

**FINAL DESIGN REPORT FOR  
Ann Road Channel West – Rainbow Boulevard  
CLV Hansen No. 36801**

**Prepared for:**



**The City of Las Vegas Nevada  
400 Stewart Ave.  
Las Vegas, NV 89101**

**Prepared by:**

**JACOBS**  
319 E. Warm Springs Rd., Ste. 200  
Las Vegas, NV 89119  
Office: (702) 938-5400  
Fax: (702) 938-5454

**December 2011  
Jacobs Project No. W4X53700**

---





December 15, 2011  
CLV Hansen No. 36801  
Jacobs Project No. W4X53700

Randy McConnell  
Engineering Project Manager  
City of Las Vegas  
333 N. Rancho Drive  
Las Vegas, NV 89107

Subject: Ann Road Channel West – Rainbow Boulevard Final Design Report

Dear Mr. McConnell:

Submitted for your records is a copy of the subject Final Design Report as required by agreement between the City of Las Vegas and Jacobs Engineering Group, Inc. Included in the submittal is an updated comment matrix from the 30%, 70% and 90% submittal (See Appendix G). The final design report incorporates all figures and exhibits under one comprehensive report. An electronic copy of the input and output design files has also been provided.

If you have any questions or require additional information, please do not hesitate to contact this office at (702) 938-5400.

Sincerely,  
Jacobs Engineering Group, Inc.



Tara T. Alexander, P.E.  
Project Manager



# HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

## DRAINAGE STUDY INFORMATION FORM

Name of Development: ANN ROAD CHANNEL WEST – RAINBOW BOULEVARD Date: December 2011

Location of Development: a) Descriptive (Cross Streets): North/South Rainbow Boulevard  
East/West Ann Road

b) Section: 27 Township: 19S Range: 60E

c) APN: 125-27-899-043 & 045, 125-27-899-004, 006, 007, 049, 125-27-799-003, 125-27-699-009  
125-26-299-002, 125-26-399-001, 004, 125-26-499-001, 019, 028

Name of Owner: City of Las Vegas, NV

Telephone Number: (702) 229-2186 Fax No.: (702) 382-3232 E-mail Address: rmcconnell@lasvegasnevada.gov

Address: 333 N. Rancho Drive, Las Vegas, NV 89107

Contact Person - Name: Tara Alexander, P.E.

Telephone Number: (702) 938-5400

\*E-mail Address: tara.alexander@jacobs.com

Firm: JACOBS Engineering Group

Address: 319 E. Warm Springs Rd., Ste. 200, Las Vegas, NV 89119

Type of Land Development/Land Disturbance Process:

|                          |                  |                          |                          |                                     |                              |
|--------------------------|------------------|--------------------------|--------------------------|-------------------------------------|------------------------------|
| <input type="checkbox"/> | Rezoning         | <input type="checkbox"/> | Subdivision Map          | <input type="checkbox"/>            | Clearing and Grading Only    |
| <input type="checkbox"/> | Parcel Map       | <input type="checkbox"/> | Planned Unit Development | <input checked="" type="checkbox"/> | Other (Please specify below) |
| <input type="checkbox"/> | Large Parcel Map | <input type="checkbox"/> | Building Permit          | <input type="checkbox"/>            | Regional Drainage Facility   |

- Total Owned Land Area: At site: ±5 acres Being Developed/Disturbed: ±5 acres
- Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? YES\*\* NO
- Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control Master Plan Facility? YES\*\* NO
- Proposed type of development (Residential, Commercial, Etc.): Public Facility
- Approximate upstream land area which drains to the subject site: ±400 acres
- Has the site drainage been evaluated in the past? YES NO If yes, please identify documentation:  
2008 Las Vegas Valley Flood Control Master Plan Update, ANRB0000: Ann Road Improvements, US95 to Ferrell Street by VTN, Nevada
- If known, please identify the proposed point(s) of runoff from the site: Underground Tie-In at Ann and Rainbow
- Briefly describe your proposed schedule for the subject project: ASAP



Engineer's Seal

Submit this form as part of the required drainage study to the local entity which has jurisdiction over the subject property. This form may provide sufficient information to serve as the Conceptual Drainage Study.

\*New Required Field

\*\*Review and concurrence of the Clark County Regional Flood Control District is required.

|  | Revision | Date |
|--|----------|------|
|  |          |      |
|  |          |      |
|  |          |      |

Local Entity File Number

REFERENCE:

STANDARD FORM 1



|             |                                                                                                                                                                                      |              |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>I.</b>   | <b>INTRODUCTION.....</b>                                                                                                                                                             | <b>3</b>     |
| 1.          | EXECUTIVE SUMMARY .....                                                                                                                                                              | 3            |
| 2.          | LOCATION OF PROPERTY .....                                                                                                                                                           | 3            |
| 3.          | EXISTING CONDITIONS .....                                                                                                                                                            | 4            |
| 4.          | SURVEY SUMMARY.....                                                                                                                                                                  | 4            |
| 5.          | UTILITIES .....                                                                                                                                                                      | 4            |
| 6.          | SUMMARY OF PERMITS.....                                                                                                                                                              | 6            |
| 7.          | GEOTECHNICAL REPORT.....                                                                                                                                                             | 7            |
| 8.          | QUANTITY AND COST ESTIMATE .....                                                                                                                                                     | 7            |
| <b>II.</b>  | <b>DRAINAGE DESIGN ANALYSIS .....</b>                                                                                                                                                | <b>7</b>     |
| 1.          | MASTER PLANNING INFORMATION .....                                                                                                                                                    | 7            |
| 2.          | FLOODPLAIN INFORMATION .....                                                                                                                                                         | 7            |
| 3.          | REFERENCED STUDIES .....                                                                                                                                                             | 8            |
| 4.          | HYDROLOGIC CRITERIA .....                                                                                                                                                            | 9            |
| 1.          | Precipitation .....                                                                                                                                                                  | 9            |
| 2.          | Soils Classification .....                                                                                                                                                           | 9            |
| 3.          | Methodology.....                                                                                                                                                                     | 9            |
| <b>III.</b> | <b>HYDROLOGIC ANALYSIS.....</b>                                                                                                                                                      | <b>9</b>     |
| 1.          | METHODOLOGY .....                                                                                                                                                                    | 9            |
| 2.          | DESCRIPTION .....                                                                                                                                                                    | 10           |
| 3.          | COMPARISON WITH 2008 MASTER PLAN UPDATE .....                                                                                                                                        | 12           |
| <b>IV.</b>  | <b>PROPOSED DRAINAGE FACILITIES.....</b>                                                                                                                                             | <b>12</b>    |
| 1.          | GENERAL DESCRIPTION .....                                                                                                                                                            | 12           |
| 2.          | FACILITY CALCULATIONS.....                                                                                                                                                           | 13           |
| 1.          | Preliminary Drop Inlet Analysis.....                                                                                                                                                 | 13           |
| 2.          | Technical Drop Inlet Analysis – 70%.....                                                                                                                                             | 15           |
| 3.          | Rio Vista Estates Drainage Easement – 90%.....                                                                                                                                       | 17           |
| 4.          | Preliminary Storm Sewers Analysis .....                                                                                                                                              | 17           |
| 5.          | Technical Storm Sewer Analysis.....                                                                                                                                                  | 18           |
| <b>V.</b>   | <b>CONCLUSION.....</b>                                                                                                                                                               | <b>19</b>    |
| 1.          | COMPLIANCE WITH DRAINAGE LAWS, MASTER PLANS AND REQUIREMENTS .....                                                                                                                   | 19           |
| <b>VI.</b>  | <b>TECHNICAL REFERENCES .....</b>                                                                                                                                                    | <b>20</b>    |
| 1.          | TECHNICAL MANUALS AND SOFTWARE REFERENCES .....                                                                                                                                      | 20           |
| 1.          | Hydrologic Criteria and Drainage Design Manual, Prepared by WRC Engineering, Inc., Updated by Montgomery Watson, for Clark County Regional Flood Control District, August 1999. .... | 20           |
| 2.          | Las Vegas Valley Flood Control Master Plan Update, PBS&J, for Clark County Regional Flood Control District, 2008.....                                                                | 20           |
| 3.          | Flood Insurance Rate Map, Federal Emergency Management Agency, Clark County, Nevada and Incorporated Areas. ....                                                                     | 20           |
| 4.          | HEC-1 Flood Hydrograph Package, User's Manual, U.S. Army Corps of Engineers, June 1998 Version 4.1.20                                                                                | 20           |
| 5.          | FLOWMASTER, Pipe and Canal Sizing Software, HAESTAD Methods Inc., November 2009 Version 8i                                                                                           | 20           |
| 6.          | HEC-RAS, River Analysis System, U.S. Army Corps of Engineers, May 2003 Version 3.1.1 .....                                                                                           | 20           |
| 7.          | WSPGW, Water Analysis System Program, Civil Design, Corp., Version 14.06 .....                                                                                                       | 20           |
| <b>VII.</b> | <b>APPENDIX .....</b>                                                                                                                                                                | <b>VII-A</b> |
| 1.          | APPENDIX A – EXISTING CONDITIONS .....                                                                                                                                               | VII-B        |
| 1.          | FIGURE A-1 PHOTO LIBRARY .....                                                                                                                                                       | VII-B        |
| 2.          | FIGURE A-2 RECORD OF SURVEY (2 TOTAL).....                                                                                                                                           | VII-B        |
| 3.          | FIGURE A-3 UTILITY CONFLICTS LOCATION EXHIBIT .....                                                                                                                                  | VII-B        |



|     |                                                                                         |       |
|-----|-----------------------------------------------------------------------------------------|-------|
| 4.  | FIGURE A-4 UTILITY CONFLICTS MATRIX (2 TOTAL) .....                                     | VII-B |
| 5.  | FIGURE A-5 PERMIT MATRIX (3 TOTAL).....                                                 | VII-B |
| 6.  | FIGURE A-6 COST ESTIMATE.....                                                           | VII-B |
| 7.  | FIGURE A-7 POTHOLE DATA BY AZTEC.....                                                   | VII-B |
| 8.  | FIGURE A-8 AUTHORIZATION TO ENTER PROPERTY.....                                         | VII-B |
| 2.  | APPENDIX B - EXHIBITS.....                                                              | VII-C |
| 1.  | FIGURE B-1 VICINITY MAP .....                                                           | VII-C |
| 2.  | FIGURE B-2 LOCATION MAP.....                                                            | VII-C |
| 3.  | FIGURE B-3 2008 MPU – UPPER NORTHERN LAS VEGAS WATERSHED.....                           | VII-C |
| 4.  | FIGURE B-4 2008 MPU – HYDROLOGIC SUMMARY (2 TOTAL) .....                                | VII-C |
| 5.  | FIGURE B-5 2008 MPU – FLOOD CONTROL FACILITIES.....                                     | VII-C |
| 6.  | FIGURE B-6 2008 MPU – FACILITY INVENTORY.....                                           | VII-C |
| 7.  | FIGURE B-7 FLOOD INSURANCE RATE MAP .....                                               | VII-C |
| 8.  | FIGURE B-8 CLARK COUNTY ZONING.....                                                     | VII-C |
| 9.  | FIGURE B-9 CITY OF LAS VEGAS ZONING.....                                                | VII-C |
| 10. | FIGURE B-10 ASSESSOR'S PARCEL MAPS (6 TOTAL).....                                       | VII-C |
| 3.  | APPENDIX C - HYDROLOGY .....                                                            | VII-E |
| 1.  | FIGURE C-1 HCDDM McCARRAN AIRPORT RAINFALL AREA .....                                   | VII-E |
| 2.  | FIGURE C-2 HCDDM DEPTH-DURATION-FREQUENCY VALUES .....                                  | VII-E |
| 3.  | FIGURE C-3 HCDDM SIX-HOUR STORM DISTRIBUTIONS (SDN3).....                               | VII-E |
| 4.  | FIGURE C-4 HCDDM RUNOFF CURVE NUMBERS – URBAN AREAS.....                                | VII-E |
| 5.  | FIGURE C-5 HCDDM RUNOFF CURVE NUMBERS – RESIDENTIAL.....                                | VII-E |
| 6.  | FIGURE C-6 COMPOSITE CURVE NUMBER CALCULATIONS .....                                    | VII-E |
| 7.  | FIGURE C-7 TIME OF CONCENTRATION – STANDARD FORM 4 .....                                | VII-E |
| 8.  | FIGURE C-8 10-YEAR HEC-1 .....                                                          | VII-E |
| 9.  | FIGURE C-9 100-YEAR HEC-1 .....                                                         | VII-E |
| 10. | FIGURE C-10 OFF-SITE DRAINAGE EXHIBIT.....                                              | VII-E |
| 4.  | APPENDIX D – HYDRAULICS.....                                                            | VII-F |
| 1.  | FIGURE D-1 TYPE C-D MODIFIED INLET .....                                                | VII-F |
| 2.  | FIGURE D-2 STORM SEWER MAINS (4 TOTAL).....                                             | VII-F |
| 3.  | FIGURE D-3 INLET OPTIONS.....                                                           | VII-F |
| 4.  | FIGURE D-4 STORM DRAIN EXHIBIT.....                                                     | VII-F |
| 5.  | FIGURE D-5 HYDRAULIC SECTION SUMMARY (2 TOTAL) .....                                    | VII-F |
| 6.  | FIGURE D-6a ANN ROAD TO EXISTING SD STATION COORDINATION.....                           | VII-F |
| 7.  | FIGURE D-6 WSPGW ANN ROAD TO EASEMENT (ANRCH1).....                                     | VII-F |
| 8.  | FIGURE D-7 WSPGW ANN ROAD TO TROPICAL PKWY (ANR115).....                                | VII-F |
| 9.  | FIGURE D-8 RIO VISTA NOMOGRAPH.....                                                     | VII-F |
| 10. | FIGURE D-9 STANDARD FORM 6 .....                                                        | VII-F |
| 11. | FIGURE D-10 DROP INLET CALCULATIONS .....                                               | VII-F |
| 12. | FIGURE D-11 HYDRAULIC SECTIONS.....                                                     | VII-F |
| 13. | FIGURE D-12 DRY LANE SUMMARY.....                                                       | VII-F |
| 14. | FIGURE D-13 WEIR AT RIO VISTA ESTATES EASEMENT.....                                     | VII-F |
| 5.  | APPENDIX E – REFERENCES .....                                                           | VII-G |
| 1.  | Las Vegas Valley Flood Control Master Plan Update by PBS&J, 2008.....                   | VII-G |
| 2.  | Ann Road Improvements – US95 to Ferrell Street by VTN Nevada, 2000 .....                | VII-G |
| 3.  | Tenaya Way/Azure Dr. Roadway Improvements by Primas & Assoc. Consulting Eng., 2000..... | VII-G |
| 4.  | Grand Entries Estates by VTN Nevada, 1993.....                                          | VII-G |
| 5.  | Rio Vista Estates by VTN Nevada, 1993.....                                              | VII-G |
| 6.  | Tropical Meadows by VTN Nevada, 1994.....                                               | VII-G |
| 7.  | Toscana by Thomason Consulting Engineers, 2005 .....                                    | VII-G |
| 8.  | Ann and Rio Vista by Zone Engineering, 2006.....                                        | VII-G |
| 9.  | Ann and Balsam (Ann & Rainbow II) by Thomas Consulting Engineers, 2005.....             | VII-G |
| 10. | Ann & Rainbow by Thomas Consulting Engineers, 2005.....                                 | VII-G |
| 11. | Rite Aid at Ann & Rainbow (Walgreens), 1998.....                                        | VII-G |
| 6.  | APPENDIX F – GEOTECHNICAL REPORT BY TERRACON .....                                      | VII-H |
| 1.  | FIGURE F-1 GEOTECHNICAL UPDATE LETTER.....                                              | VII-H |
| 2.  | FIGURE F-2 ORIGINAL GEOTECHNICAL REPORT.....                                            | VII-H |





|     |                                                                    |              |
|-----|--------------------------------------------------------------------|--------------|
| 7.  | APPENDIX G – FINAL MEETING NOTES .....                             | VII-I        |
| 1.  | <i>FEBRUARY 10, 2010</i> .....                                     | <i>VII-I</i> |
| 2.  | <i>JANUARY 6, 2011</i> .....                                       | <i>VII-I</i> |
| 3.  | <i>FEBRUARY 15, 2011</i> .....                                     | <i>VII-I</i> |
| 4.  | <i>MARCH 15, 2011</i> .....                                        | <i>VII-I</i> |
| 5.  | <i>APRIL 25, 2011</i> .....                                        | <i>VII-I</i> |
| 6.  | <i>JUNE 1, 2011</i> .....                                          | <i>VII-I</i> |
| 7.  | <i>JUNE 7, 2011</i> .....                                          | <i>VII-I</i> |
| 8.  | <i>JULY 7, 2011</i> .....                                          | <i>VII-I</i> |
| 9.  | <i>OCTOBER 6, 2011</i> .....                                       | <i>VII-I</i> |
| 10. | <i>OCTOBER 18, 2011</i> .....                                      | <i>VII-I</i> |
| 8.  | APPENDIX H – COMMENTS MATRIX FOR 30%, 70% AND 90% SUBMITTALS ..... | VII-J        |



## **I. INTRODUCTION**

### **1. EXECUTIVE SUMMARY**

The purpose of this study is to provide a hydrologic and hydraulic analysis for the proposed storm drain system located within Rainbow Boulevard from Ann Road to Tropical Parkway. For the 30% submittal, the hydrologic condition of the site will be the focus; hydraulic analysis is added to the design in the 70% submittal. Hydrologic and hydraulic analyses are incorporated together in the final report. The proposed Rainbow Boulevard drainage system will convey the 100-year storm flows from all offsite areas that drain into Rainbow Boulevard. The proposed facility in Rainbow Boulevard is delineated in the 2008 Clark County Flood Control Master Plan Update (MPU) as facility ANRB0000. Facility ANRB0000 is listed as being a 1320-lf 10' x 7' RCB storm drain which conveys 721 cfs per the MPU and is located between Ann Road to just north of El Campo Grande Avenue. This proposed facility will extend the ANRB000 system approximately 950-lf north to Tropical Parkway.

This proposed storm drain system will tie into an existing Regional Flood Control facility located in Ann Road. This existing system is designated as ANWE0327 on the west side of Rainbow Boulevard and ANWE0290 on the east side of Rainbow Boulevard. The Ann Road drainage study was initially designed by VTN Nevada for City of Las Vegas (*Ann Road Improvements – US95 to Ferrell Street, 2000*). The VTN project plans provides a 9' x 6' RCB stub out located in the west side of Rainbow Boulevard, north of Ann Road which will be utilized as the downstream section for this project.

This Design Report will serve as a record of existing conditions and will provide recommendations on improvements necessary to meet all requirements established by Clark County Regional Flood Control District (CCRFCD) and The City of Las Vegas Flood Control.

A record of the project meeting notes has been included in this report under Appendix G, *Final Meeting Notes*. All notes which have been included have been reviewed by the City of Las Vegas Project Manager, Randy McConnell before final distribution to meeting attendees.

### **2. LOCATION OF PROPERTY**

The proposed improvements are within Rainbow Boulevard from Ann Road north to Tropical Parkway, and within Tropical Parkway on the west side of Rainbow Boulevard (see Figure B-1, Appendix B, *Vicinity Map* and Figure B-2, Appendix B, *Location Map*). The project lies within the jurisdiction of both the City of Las Vegas and Clark County, Nevada (see Figure B-8, Appendix B, Clark County Zoning and Figure B-9, Appendix B, City of Las Vegas Zoning).



The entire project is located within several different parcel numbers which span six (6) separate parcel maps. All parcel maps can be referenced in Figure B-10, Appendix B of this report.

### 3. EXISTING CONDITIONS

The majority of the parcels adjacent to this site have been developed by businesses, single residence or residential developments. There are five (5) parcels adjacent to Rainbow Boulevard which are not developed. These parcels are located at the north east intersection of Rainbow Boulevard and El Campo Grande. All of these parcels are owned by Valken Development, LLC and current zoning is for Residential Estates District (R-E). Currently, two abandoned homes are located across the parcels with the rest being graded desert. These properties are located on parcels 126-26-301-005, 006, 007 and 125-26-401-001 and 002. The easement information for these parcels is included on the plans. (See Figure A-1, Appendix A, *Photo Library*).

### 4. SURVEY SUMMARY

A Record of Survey (ROS) map was submitted to the City of Las Vegas Surveyor, Alan R. Riecki, on January 27, 2011 for review and approval. A copy of the signed ROS and approval that was submitted for recordation has been included in this report (see Figure A-2, Appendix A, *Record of Survey*).

Three (3) of the undeveloped parcels owned by Valken Development, LLC (126-26-301-005, 006, and 007) currently extend to the centerline of Rainbow Boulevard. Jacobs has submitted an “Authorization to Enter Property Description” to the City dated July 11, 2011 (See Figure A-8, Appendix A, *Authorization to Enter Property*). The City will need to obtain an Authorization to Enter Property (AEP) for these parcels prior to construction.

### 5. UTILITIES

There are several locations along the corridor of this project where the proposed storm drain alignment will conflict with existing utilities owned by other agencies. An exhibit illustrating all of the potential conflicts along with a spreadsheet has been provided in the appendix of this report (see Figure A-3, Appendix A, *Utilities Conflict Location Exhibit* and Figure A-4, Appendix A, *Utilities Conflict Matrix*). A discussion of the specific entities impacted by the construction of this project follows.

#### Water

All water lines for this project are owned by Las Vegas Valley Water District (LVVWD). It will be the responsibility of the City of Las Vegas to pay for the relocation of any water appurtenances associated with the construction of this project. During the design process, Steven Jackson (702.258.3249, [steve.jackson@LVVWD.com](mailto:steve.jackson@LVVWD.com)) from the LVVWD performed review and coordination.

1

2

3

There are several areas where the waterline will need to be relocated in order to accommodate construction of the storm drain. An 8" DIP water lateral will be moved at station 152+15. An 8" DIP water main and attaching lateral will be lowered at approximately station 154+00 on Rainbow Boulevard. The 10' X 3' RCB box crosses a 36" water main in two locations on Rainbow Boulevard (stations 159+30 and 168+40) which will remain untouched; however, specialized crossing protection for shallow crossing will be provided at these locations. At the locations where the storm drain laterals cross the 36" water line in Rainbow Boulevard, an LVVWD approved encasement will be provided on the storm drain lateral. Also in Rainbow Boulevard at the 18" lateral to drop inlet RB01, a 12" PVC water line will need to be lowered.

There are several storm drain locations where the waterline must be moved near the intersection of Tropical Parkway and Rainbow Boulevard. An existing 12" PVC waterline will need to be lowered under the 10' X 3' main in two locations at station 170+00 in the intersection. In Tropical Parkway at the 30" laterals to both drop inlets TP01 and TP02, the 12" water lined will need to be moved.

### Electric

Electrical lines which cross or are adjacent to the project site are owned by Nevada Energy (NVE). It will be the responsibility of the City of Las Vegas to pay for all energy line relocations associated with the construction of this project. It will be the responsibility of NVE to provide the design for any appurtenances needing to be moved. During the design process, the primary contact for NVE Distribution was James Brown (702.402.6808, jamesbrown@nvenergy.com) and the primary contact for NVE Transmission was Lisa Harvey (702.402.5327, LHarvey@nvenergy.com).

The construction of this project will not impact any NVE Transmission lines; however, the NVE Distribution line is impacted at the intersection of Tropical Parkway / Rainbow Boulevard and at the intersection of Ann Road / Rainbow Boulevard. The NVE distribution line crossed the proposed 10' X 3' RCB in Tropical Parkway, this line will have to be relocated to cross over the RCB. Also, at the south west intersection of Tropical Parkway and Ann Road, there are two inlets proposed in the sidewalk which will impact the distribution lines, these are shown as drop inlets TP-01 and TP-03 on the design plans. At the intersection of Ann and Rainbow, the distribution line is close to a proposed sewer manhole which is specified as SSMH-01 on sheet SS-01. Nevada Energy will determine if this line will need to be moved during construction.

### Gas

Gas lines that cross or are adjacent to the project site are owned by Southwest Gas (SWG). It will be the responsibility of SWG to pay for all gas line relocations associated with the construction of this project. It will also be the responsibility of SWG to provide the design for any appurtenances needing to be moved. During the design process, Danny Byrd (702.365.2126) from SWG performed review and coordination.





There is an existing gas line which runs within the drainage easement in discharging from the Rio Vista Estates (Rainbow Plans Station 159+00). According to SWG, this line can be abandoned and will not impact the construction of this project. Along Rainbow Boulevard, the gas lines will need to be re-routed in order to avoid the laterals. At the intersection of Tropical Parkway and Rainbow Boulevard, the gas line will need to be re-routed in order to avoid crossing the 10' x 3' RCB main and the laterals to the proposed inlets.

#### Telephone

The telephone lines adjacent to or that cross the project construction area are owned by Century Link. It will be the responsibility of Century Link to pay for all telephone line relocations associated with the construction of this project. Century Link will send their personnel to the site during construction when a line needs to be moved or adjusted. During the design process, Kristine Kretschmar (702.244.7979, kristine.d.kretschmar@centurylink.com) was the primary contact for plans submittals and Scott Gifford (702.244.7290, elton.s.gifford@centurylink.com) was the reviewing engineer.

#### Cable Television/Internet

The cable lines adjacent to or that cross the project construction area are owned by Cox Communications (Cox). It will be the responsibility of Cox to pay for all cable line relocations associated with the construction of this project. Cox does not anticipate moving any appurtenances; however, Cox will send their personnel to the site during construction when something needs to be moved or adjusted. During the design process, Doney Villareal (702.545.1679) was the primary contact and plans reviewer.

The existing utilities for this site were located by obtaining the as-built drawings from the utility companies and then subsequently matching that information with the field information obtained by both survey and pothole data (see Figure A-7, Appendix A, *Pothole Data by Aztec*). The existing utilities can be found on the design plans. It will be the responsibility of the construction contractor to verify all sizes and determine the exact horizontal and vertical locations of all existing utilities.

## **6. SUMMARY OF PERMITS**

According to Todd Myers at the Clark County Regional Flood Control District, “A facility-specific environmental analysis in accordance with Chapter 8 of District’s Supplemental Programmatic Environmental Impact Statement, Clark County Regional Flood Control District, 2002 Master Plan Update, September 2004 was accepted by District on February 18, 2011. The District’s Policies and Procedures regarding environmental permitting as a pre-requisite for construction funding eligibility have been satisfied.”



A summary of all anticipated permits for this project along with the Section 8 approval can be found in the appendix of this report (see Figure A-5, Appendix A, *Permit Matrix*).

## **7. GEOTECHNICAL REPORT**

This site was originally studied in a Geotechnical Report by Terracon. The original study is dated for August 31, 2000 with a revision date of June 30, 2010. A copy of the geotechnical study along with an update letter dated February 2, 2011 is included in the Appendix of this report (see Appendix F, *Geotechnical Report by Terracon*).

The original pavement section proposed for this project was obtained from this geotechnical report and proposed on the 90% plans submittal as a 6" AC pavement over a 22" Type II aggregate base. According to a meeting with the City and Regional Flood Control on October 6, 2011, this section is too large and Regional Flood wants to replace this section with what is exists in the field. This geotechnical report was not utilized for this roadway section and is provided herein for information purposes only.

## **8. QUANTITY AND COST ESTIMATE**

A cost estimate for the construction of this project has been performed for this submittal. The cost estimate includes the quantities of the hydraulic analysis provided with this submittal (see Figure A-6, Appendix A, *Cost Estimate*).

# **II. DRAINAGE DESIGN ANALYSIS**

## **1. MASTER PLANNING INFORMATION**

The proposed facility in Rainbow Boulevard is delineated in the 2008 Clark County Flood Control Master Plan Update (MPU) as facility ANRB0000. Facility ANRB0000 is listed as being a 1320-lf 10' x 7' RCB storm drain which conveys 721 cfs per the MPU and is located between Ann Road to just north of El Campo Grande Avenue. This proposed facility will extend the ANRB000 system an approximately an additional 950-lf north to Tropical Parkway. For further explanation of the runoff analyzed for this storm system as compared to the Master Plan Update analysis, refer to the Hydrologic Analysis discussion below. Refer to Figures B-3 through B-6, Appendix B, for the 2008 MPU Maps used for this report.

## **2. FLOODPLAIN INFORMATION**

The site is located on Flood Insurance Rate Map (FIRM) Number 32003C1765E Clark County, Nevada and Incorporated Areas dated September 27, 2002. Review of panel 1795 shows that the site is located primarily within Zone X. Zone X is an area determined to be outside of the 500-year flood plain (see Figure B-7, Appendix B, *Firm Map*).



### 3. REFERENCED STUDIES

Several drainage studies were used in the preparation of this report. Many of these drainage studies were used to establish flow patterns and discharge point for the upstream drainage basins. For excerpts from each of these studies, refer to Appendix E, *References*:

- 1) *Las Vegas Valley Flood Control Master Plan Update* by PBS&J for Clark County Regional Flood Control District, 2008 – The output file for CWEST3.out is included to illustrate the three basins which combine at facility ANRB000 (Q100=721 cfs).
- 2) *Ann Road Improvements – US95 to Ferrell Street* by VTN Nevada for City of Las Vegas Nevada, 2000 – This study provided the design for the Regional Facility within Ann Road and for the 9' x 6' RCB stub in Rainbow Boulevard which ANRB0000 will tie in to.
- 3) *Tenaya Way / Azure Drive Roadway Improvements* by Primas and Associates Consulting Engineers for City of Las Vegas Nevada, 2000 – This study was used to reference point flows into the HEC-1 model at Tropical Parkway east and Grand Palace Avenue East at Tenaya Way. This was also used to reference the underground runoff in Tenaya Way at Ann Road (199 cfs).
- 4) *Grand Entries Estates* by VTN Nevada for Inco Homes, 1993 – This study was used to establish flow pattern for basins OFF-5 and OFF-6.
- 5) *Rio Vista Estates* by VTN Nevada for Stanpark Construction, Co., 1993 – This study was used to establish flow pattern for basins OFF-7 and OFF-10.
- 6) *Tropical Meadows* by VTN Nevada for Stanpark Homes of Nevada, 1994 – This study was used to establish flow pattern for basins OFF-2 and OFF-3.
- 7) *Toscana* by Thomason Consulting Engineers for Silver Dollar Land Co., 2005 – This study was used to establish flow pattern for basin OFF-9.
- 8) *Ann and Rio Vista* by Zone Engineering for Dr. Ted Trimmer, 2006 – This study was used to establish flow pattern for basin OFF-9.
- 9) *Ann and Balsam (Ann & Rainbow II)* by Thomas Consulting Engineers for Richmond American Homes, 2005 – This study was used to establish flow pattern for basin OFF-10.
- 10) *Ann & Rainbow* by Thomas Consulting Engineers for Richmond American Homes, 2005 – This study was used to establish flow pattern for basin OFF-10.
- 11) *Rite Aid at Ann & Rainbow (Walgreens)* by Tetra for Rite Aid, Inc., 1998 – This study was used to establish flow pattern for basin OFF-14 and OFF-15.



#### **4. HYDROLOGIC CRITERIA**

##### **1. Precipitation**

The Clark County Regional Flood Control, Hydrologic Criteria and Drainage Design Manual, (CCRFC Manual) was used to determine the point precipitation values from rainfall distribution SDN3. The subject site lies inside the McCarran International Airport rainfall area. The rainfall depths of 1.58 and 2.77 inches were used for the six (6) hour ten (10) year and one hundred (100) year storms, respectively (see Figure C-1, Appendix C, *McCarran Airport Rainfall Area* and Figure C-2, Appendix C, *Depth-Duration-Frequency Values for McCarran Airport Rainfall Area*).

##### **2. Soils Classification**

The soil information for the project watershed was obtained from the *Master Plan Update of the Las Vegas Valley – 2008*, Figure H-19 (2 total sheets). The first sheet of Figure H-19 is the MPU map and the second sheet of H-19 illustrates a close up of the basins on the map and where the soil delineations are along with the composite curve numbers used for the hydrologic analysis. An examination of this map indicates the presence of type “B” and type “D” soils within the basins (See Figures C-4 and C-5, Appendix C, Runoff Curve Numbers and Figure C-6, Appendix C, Composite Curve Numbers).

##### **3. Methodology**

The criteria and methodology set forth in the Clark County Regional Flood Control, Hydrologic Criteria and Drainage Design Manual, and (CCRFC Manual) were utilized as the technical guidelines for this study.

The HEC-1 Flood Hydrograph Package, developed by the United States Corps of Engineers as revised June 1998 version 4.1, performed on an IBM compatible computer was used to model the existing and proposed basins. The HEC-1 package calculated the design flows using a six (6)-hour, ten (10)-year and one-hundred (100)-year design storms per the CCRFC Manual. The flow rates determined for this study can be found on the HEC-1 output on Figures C-8 and C-9, Appendix C. The SCS Unit Hydrograph method was applied to compute peak flow rates. The time of concentration was determined according to section 602 of the CCRFC Manual.

### **III. HYDROLOGIC ANALYSIS**

#### **1. METHODOLOGY**

For an illustration of the developed hydrology for this project, refer to Figure C-10, Appendix C, *Offsite Drainage Exhibit*. Not every upstream basin for this analysis has been developed; however, these basins are treated as developed basins. For areas that are undeveloped, the Assessors Zoning classification was used to establish future land use and curve number. The existing condition analysis is also representative of the future developed condition analysis.





## 2. DESCRIPTION

Offsite runoff from the west side of Tenaya Way (TEN1 and TEN2) was referenced from the Tenaya Way Study; refer to Reference No. 3 in Appendix E of this study. All upstream basins and concentration points were routed through the downstream basins via surface roadway.

There were two locations in the HEC-1 analysis where the runoff was introduced into the model, TEN1:  $Q_{100}=96$  cfs and TEN2:  $Q_{100}=69$  cfs, the total 10-year runoff at this location is underground in the Tenaya Way storm drain system.

Offsite TEN1 combines with basins OFF1, OFF5, OFF2, OFF3, and OFF4 at the intersection of Tropical Parkway and Rainbow Boulevard. Offsite TEN2 is routed through OFF6 and combined with OFF8 and OFF7 at the outlet of the drainage easement in the Rio Vista Estates subdivision onto Rainbow Boulevard. Basin OFF9 is routed through basin OFF10 and combined at the outlet of the drainage easement in the Ann and Rainbow subdivision onto Rainbow Boulevard. Basins OFF11, OFF12, OFF13, OFF14 and OFF15 discharge directly to Rainbow Boulevard. Rainbow Boulevard is comprised of three onsite basins, RB1, RB2 and RB3. All onsite and offsite basins combine at the intersection of Ann Road and Rainbow Boulevard.



The following table summarizes the overall runoff for this analysis. Also refer to Figure C-10, *Offsite Drainage Exhibit*, in this report.

| <b>Basin Runoff in HEC-1 Combination Format</b> |                             |                              |                                                                       |
|-------------------------------------------------|-----------------------------|------------------------------|-----------------------------------------------------------------------|
| <b>Basin</b>                                    | <b>Q<sub>10</sub> (cfs)</b> | <b>Q<sub>100</sub> (cfs)</b> | <b>Source Runoff</b>                                                  |
| <b>OFF5</b>                                     | 14                          | 30                           | Offsite Basin                                                         |
| <b>TEN1</b>                                     | 0                           | 96                           | Tenaya Way Improvements Drainage Study                                |
| <b>OFF1</b>                                     | 8                           | 30                           | Offsite Basin                                                         |
| <b>CP1</b>                                      | 20                          | 154                          | Combine OFF1, OFF5 and TEN1                                           |
| <b>OFF2</b>                                     | 9                           | 23                           | Offsite Basin                                                         |
| <b>CP2</b>                                      | 27                          | 170                          | Combine CP-1 and OFF2                                                 |
| <b>OFF3</b>                                     | 12                          | 33                           | Offsite Basin                                                         |
| <b>CP3</b>                                      | 33                          | 182                          | Combine CP2 and OFF3                                                  |
| <b>OFF4</b>                                     | 1                           | 5                            | Offsite Basin                                                         |
| <b>CP4</b>                                      | 34                          | 183                          | Combine CP3 and OFF4                                                  |
| <b>TEN2</b>                                     | 0                           | 69                           | Tenaya Way Improvements Drainage Study                                |
| <b>OFF6</b>                                     | 45                          | 96                           | Offsite Basin                                                         |
| <b>OFF8</b>                                     | 4                           | 8                            | Offsite Basin                                                         |
| <b>CP5</b>                                      | 48                          | 172                          | Combine OFF6, OFF8 and TEN2                                           |
| <b>OFF7</b>                                     | 32                          | 69                           | Offsite Basin                                                         |
| <b>CP6</b>                                      | 79                          | 239                          | Combine CP-5 and OFF7                                                 |
| <b>RB1</b>                                      | 5                           | 9                            | Onsite Basin                                                          |
| <b>CP7</b>                                      | 82                          | 348                          | Combine CP6 and RB1                                                   |
| <b>OFF11</b>                                    | 2                           | 5                            | Offsite Basin                                                         |
| <b>OFF12</b>                                    | 1                           | 2                            | Offsite Basin                                                         |
| <b>OFF13</b>                                    | 1                           | 3                            | Offsite Basin                                                         |
| <b>RB2</b>                                      | 2                           | 4                            | Onsite Basin                                                          |
| <b>CP8</b>                                      | 6                           | 13                           | Combine OFF11, OFF12, OFF13 and RB2                                   |
| <b>CP9</b>                                      | 86                          | 355                          | Combine CP7 and CP8                                                   |
| <b>OFF9</b>                                     | 18                          | 34                           | Offsite Basin                                                         |
| <b>OFF10</b>                                    | 14                          | 27                           | Offsite Basin                                                         |
| <b>CP10</b>                                     | 0                           | 26                           | Combine OFF9 and OFF10 minus Balsam Street Storm Drain flows = 33 cfs |
| <b>RB3</b>                                      | 2                           | 4                            | Onsite Basin                                                          |
| <b>OFF14</b>                                    | 1                           | 2                            | Offsite Basin                                                         |
| <b>OFF15</b>                                    | 1                           | 1                            | Offsite Basin                                                         |
| <b>CP11</b>                                     | 4                           | 30                           | Combine CP-10, RB3, OFF14 and OFF15                                   |
| <b>CP12</b>                                     | 88                          | 383                          | Combine CP9 and CP11                                                  |



### 3. COMPARISON WITH 2008 MASTER PLAN UPDATE

The proposed facility in Rainbow Boulevard is delineated in the 2008 Clark County Flood Control Master Plan Update (MPU) as facility ANRB0000. The referenced drainage studies located in Appendix E and Figure B-3, Appendix B, *2008 MPU – Upper Northern Las Vegas Watershed* illustrate the basin delineations used to derive the runoff for the ANRB000 design. According to Figure B-1, ANRB0000 is sized in order to capture the runoff in offsite basins NW2A1-C, NW2A3-C, and NW2B5-C. The total runoff at this location is 721 cfs. Rainbow Boulevard is the downstream boundary condition for these basins; therefore, all drainage appurtenances for this project will be designed to capture all 100-year runoff entering Rainbow Boulevard.

For an illustration of the following discussion reference Figure C-10, Appendix C, Offsite Drainage Exhibit. For this project, the ultimate surface concentration point at the intersection of Ann Road and Rainbow Boulevard (CP12) is 383 cfs. The runoff computed for this study compared to the runoff in the MPU (721 cfs) is different due to several factors. First, storm runoff has been diverted away from the concentration point via existing underground facilities at Tenaya Way (199 cfs) and Balsam Street (33 cfs). This runoff has been placed in the Regional Facility in Ann Road upstream rather than reaching the facility at Ann Road and Rainbow Boulevard. Additionally, the upstream calculated hydrology for this report lie within the MPU basins NW2A1-C, NW2A3-C, and NW2B5-C. A portion of basin NW2A1-C and NW2A3-C are routed north towards the CC215 Beltway away from the concentration point at CP12 due to the high points located within various roadways, including Tenaya Way, Rio Vista Street, and Rainbow Boulevard.

According to the VTN Ann Road Improvements (Reference 2, Appendix E), the amount of runoff expected at the existing 9' X 6' RCB is 460 cfs. Based upon the detailed hydrology presented in this report, with the slightly less area draining south in Rainbow Boulevard, the concentration point, CP12=383 cfs is an appropriate runoff.

Overall, the detailed analysis shows that the proposed MPU facility conveys about 615 cfs at the Ann and Rainbow intersection: proposed system 383 cfs, Tenaya Way 199 cfs and Balsam Street 33 cfs. This compares favorably with the overall intent of the 2008 MPU. It is recommended that the system and MPU basins should be updated within the next MPU update in order to account for the existing split of MPU basins NW2A1-C and NW2A3-C.

## IV. PROPOSED DRAINAGE FACILITIES

### 1. GENERAL DESCRIPTION

The drainage facilities proposed with this project include an underground storm system in Rainbow Boulevard which ties into an existing 9' x 6' RCB stub out located in the west side of Rainbow Boulevard, north of Ann Road. The underground facility will begin at this stub out and continue north to the intersection of Ann Road and Tropical Parkway. There is an existing bubbler system at Ann Road and Tropical Parkway



which will be removed and replaced with this project. In addition, there will be a lateral system located west on Tropical Parkway which will be utilized to capture all of the 100-year runoff. There will be a system of laterals attached to inlets at each side of Rainbow Boulevard along the corridor of the project which will be used to capture the 100-year runoff and/or alleviate ponding on low spots along the corridor. At the downstream end of the project tying into the existing 9' x 6' RCB stub out, approximately 600 LF of 24" RCP storm drain will be removed and three storm lateral tie-ins will have to be reconnected to the proposed box. Also, approximately 200 LF of 18" RCP storm drain at El Campo Grande at the proposed alignment will be removed and replaced with the proposed laterals.

Historically, there have been problems with flooding through the channel which outlets onto Rainbow Boulevard via the drainage easement from the Rio Vista Estates Residential Subdivision located at the south west of the intersection of Tropical Parkway and Rainbow Boulevard. This study determines the amount of runoff at this location and a facility has been designed in order to capture the 100-year runoff underground rather than on the surface. This facility is designed so as not to adversely impact the homeowners adjacent to or downstream of this easement.

## **2. FACILITY CALCULATIONS**

### **1. Preliminary Drop Inlet Analysis**

Technical facilities analyses will be performed beginning with the 70% design submittal. For the 30% study, the facility sizes were estimated for planning purposes. Per the City's direction, the preferred inlets to use are the NDOT Type 2B drop inlets and the Clark County Type C-D modified inlets (Dwg. No. 412A). The type C-D inlets will be used to capture the 100-year storm flows in areas on grade and in low point along the curb. A specialized system of inlets will be used at the drainage easement which drains the runoff at the outlet of Rio Vista Estates. The NDOT Type 2B inlets will be utilized in low spots to drain nuisance flows that tend to pond within existing right-of-way adjacent to homeowners' property along the corridor as shown in the following illustration:







**Standing Water at Low Spot in Roadway**

Refer to Figure D-1, *Type C-D Modified Inlet*, for a rating curve used for preliminarily sizing the drop inlets. The Type C-D inlets which will be utilized increase in increments of 2.5 feet with both a curb opening and grate inlet. For inlets which are 7.5 feet and greater, an additional 2.5 feet curb opening on the upstream end of the inlet with a solid grate opening will be utilized. The maximum overall length to be used for each inlet is 20-lf which includes (7)-2.5 foot grate and curb opening sections (17.5-lf) and one curb opening only section. The calculations for the inlets will only incorporate equal grate and curb opening section only with a 50% clogging factor applies.



The following table summarizes the anticipated 100-year runoff amounts to be captured at each location and the source runoff. Reference Figure C-10, *Offsite Drainage Exhibit* for the locations of the concentration points shown in this table.

| <b>Preliminary Drop Inlet Analysis Provided at 30% Submittal</b> |                                           |                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------------------------------------------|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Runoff Location                                                  | Concentration Point / 100-year Runoff     | Preliminary Facility Estimate                                                                                                                                                                                                                                                                                                                                                                           |
| West of intersection at Tropical Parkway and Rainbow Boulevard   | CP3 = 182 cfs                             | On the north side of Tropical, 91 cfs total will be captured with a series of three inlets: 412A-7 grates, 412A-(5) grates and 412A-(2) grates. On the south side of Tropical, the majority of the 100-year flow will be captured with two inlets while the remaining runoff will bypass and turn south in Rainbow where it will be captured by downstream inlets: 412A-(5) grates and 412A-(2) grates. |
| North of intersection at Tropical Parkway and Rainbow Boulevard  | OFF4 = 5 cfs                              | The existing inlet on the west side of Rainbow and the existing beehive inlet on the east side of Rainbow will be removed and replaced: 412A-(2) grates on west side and NDOT Type 2B on east.                                                                                                                                                                                                          |
| Outlet of Rio Vista Estates                                      | CP6 = 239 cfs                             | Specialized inlet, technical design is forthcoming beginning at 70% submittal. Have shown a 75-lf series of inlets for 30% submittal.                                                                                                                                                                                                                                                                   |
| Locations along West side of Rainbow                             | Varies with street flows and bypass flows | These will all be designed with Type C-D modified inlets at curb and gutters                                                                                                                                                                                                                                                                                                                            |
| Locations along East side of Rainbow                             | Varies with street flows and bypass flows | These will all be design with Type C-D modified inlets at curb and gutters and NDOT Type 2B Inlets for nuisance in low points.                                                                                                                                                                                                                                                                          |

## 2. Technical Drop Inlet Analysis – 70%

There are two areas in which the design of drop inlets were considered for the 70% submittal. The first consideration for drop inlets is at the downstream end of the drainage easement at Rio Vista estates which outlets onto Rainbow Boulevard. The other locations drop inlets are used are along Rainbow Boulevard and Tropical Parkway to intercept surface runoff. The inlets are designed to capture all of the 100-year runoff.

For an illustration of the drop inlets at the outlet of Rio Vista Estates, please reference Figure D-3, *Inlet Options*. According to the hydrologic analysis for this report, there is a 100-year runoff total of 239 cfs exiting from this location. As part of the original intent in this easement, a specialized set of inlets in a series at the downstream end of the easement were anticipated (See Option 2 of Figure D-3). As part of the original set of comments from the City of Las Vegas Flood control department, this system would also need one heavy duty grated structure with a minimum size of 10' X 7' which would



serve to provide maintenance access into the storm drain system. The grated structure would need to be mechanically lifted out of the way and then accessed by a maintenance crew. During the design process, an alternative solution for gaining access into the storm system while still allowing capacity for 239 cfs was considered (See Option 1 of Figure D-3). Option 1 will eliminate all inlets and the drainage structure channel will be graded to direct flow into headwall at a 9'x5' RCB. This was found to make gaining access into the storm drain much more efficient and eliminated the need for space to maneuver a heavy duty grate structure to access underground facilities. It was determined for this submittal that Option 1 will be utilized in the storm drain design.

The following table illustrates a comparison between the two options considered:

| Appurtenance            | Option 1 - Headwall                                                        | Option 2 – Inlets                                                                              | Comments                                                                                                                                                                         |
|-------------------------|----------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Drainage Easement       | Replace all Concrete                                                       | Replace all Concrete                                                                           | Residents complained of standing water in the easement, existing channel slopes not sufficient to allow nuisance flows to positively drain out. More soil removal with Option 1. |
| Runoff Intake           | Concrete Headwall                                                          | ~14 NDOT 2B inlets and a 10'x7 Heavy Duty Inlet                                                | Easier access with Option 1 along with eliminating all underground structures associated with monolithic inlet configuration.                                                    |
| Water Surface Elevation | Inlet designed to top of RCB which is flush with existing easement surface | Water will pond on top of inlet grates at existing easement surface.                           | Runoff will more efficiently enter into system when allowed to free-flow into RCB. See Figure D-8, <i>Nomograph</i> .                                                            |
| Underground Storm Drain | 9' x 5' RCB                                                                | 9' x 5' RCB                                                                                    | RCB will tie into junction structure in Rainbow Boulevard                                                                                                                        |
| Existing Sewer Manhole  | Lower and add sealed and locked manhole                                    | Lower and add sealed and locked manhole                                                        | Will be lower with Option 1                                                                                                                                                      |
| Wrought Iron Gates      | Access gate upstream, non-access block wall with access downstream         | Access gate upstream and wrought iron gate downstream                                          | Pedestrian access restricted in both alternatives.                                                                                                                               |
| Retaining Walls         | Retaining necessary at downstream end of channel.                          | Retaining not added, concrete walls at downstream of channel anticipated for flood protection. | Channel will be lowered in Option 1.                                                                                                                                             |

The other locations drop inlets are used are along Rainbow Boulevard and Tropical Parkway to intercept surface runoff. For an illustration of the inlet system, reference Figure D-4, *Storm Drain Exhibit*. The source runoff utilized for every hydraulic surface section and every inlet calculation on the *Storm Drain Exhibit* can be found on Figure D-5, *Hydraulic Section Summary*. For Per the City's direction, the preferred inlets to use are the NDOT Type 2B drop inlets and the Clark County Type C-D modified inlets (Dwg. No. 412A). The type C-D inlets are used to capture the 100-year storm flows in areas on grade and in low point along the curb. The NDOT Type 2B inlets are utilized



in low spots at non-improved areas to collect both storm 100-year storm flows and nuisance flows. Supporting calculations for the hydraulic analyses can be found in Appendix D, Figure D-10, *Drop Inlet Calculations* and Figure D-11, *Hydraulic Sections*. The 10-year dry-land criteria downstream of all proposed drainage inlets have been satisfied for this project. For all dry-lane calculations, reference Figure D-12, *Dry Lane Summary*.

### 3. Rio Vista Estates Drainage Easement – 90% and Final Design

At the Rio Vista Estates Drainage Easement, a runoff of 239 cfs enters into Rainbow Boulevard via surface runoff. For the design, a combination of both a headwall structure and a surface inlet is proposed. The existing channel extends at the upstream end from the sidewalk on Kane Holly Street in the easement to the downstream end in Rainbow Boulevard. The channel improvements are designed to not impact the existing retaining walls at the easement or the adjacent property owners.

At the upstream end of the easement, there is existing curb, gutter and sidewalk which will remain untouched. A weir calculation at the entrance into the easement is included in the Appendix D, Figure D-13. The existing weir elevation is at 2.29'.

From the upstream end of the channel at the back of the depressed sidewalk to the approximately 475 downstream, the majority of the channel will remain untouched, excluding a 2' portion of concrete at the centerline, which will be removed and replaced with a concrete "U" channel to direct nuisance runoff to the storm drain system in Rainbow Boulevard.

The downstream portion of the drainage easement adjacent to Rainbow Boulevard will be completely removed and replaced from the sanitary sewer manhole to the back of sidewalk adjacent to Rainbow Boulevard. An interior channel is proposed which directs the runoff from the low flow "U" channel to a 14' x 3' headwall under the sidewalk adjacent to Rainbow Boulevard. On top of this headwall is a set of grates measuring 5' x 20' along with a stem wall adjacent to Rainbow Boulevard back of walk and along the south end of the grates. The stem wall elevation was chosen to allow for emergency overflow above the 100-year storm elevation. There is an inlet placed directly downstream of the stem wall which will capture overflow from the channel.

The 14' x 3' headwall was sized utilizing Figure 1004 from the Clark County Drainage Manual and is included in this report as Figure D-8. A height of 3' was chosen to keep the water surface down within easement. Additionally, the box width was limited to avoid impacts to the subsurface of the existing retaining wall behind it.

### 4. Preliminary Storm Sewers Analysis

Per directive from the City of Las Vegas, the preferred method of storm sewer design is to incorporate pre-cast storm sewer and manholes where practical. The use of cast-in-place storm sewer and manholes will be limited when necessary in order to alleviate road closure times, decrease construction time, and decrease open trench time.





Refer to Figure D-2, *Storm Sewers*, for a rating curve used to preliminarily size the main line storm sewers. These were sized in order to determine the potential impact to existing facilities and utilities in order to determine the magnitude of conflicts.

The following table summarizes the anticipated 100-year runoff amounts to be captured at each location and the source runoff. Reference Figure C-10, *Offsite Drainage Exhibit* for the locations of the concentration points shown in this table.

| <b>Preliminary Storm Sewer Analysis Provided at 30% Submittal</b> |                                              |                                                                                                                     |
|-------------------------------------------------------------------|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| Storm Sewer Main Location                                         | Concentration Point / 100-year Runoff        | Preliminary Facility Estimate                                                                                       |
| West of intersection at Tropical Parkway and Rainbow Boulevard    | CP3 = 182 cfs                                | Full flow capacity for a 5' X 4' RCB at Rainbow Tie-In then assume size can decrease to 5' X 3' upstream of 5' X 4' |
| Main Line Upstream of Rio Vista Estates Outlet                    | CP4 = 183 CFS plus Basin RB1 = 9 cfs         | Full flow capacity for a 6' X 4' RCB                                                                                |
| Main Line Downstream of Rio Vista Estates Outlet                  | CP6 = 239 cfs plus upstream runoff = 192 cfs | Full flow capacity for a 9' x 5' RCB                                                                                |

##### 5. Technical Storm Sewer Analysis

For the Final submittal, the underground storm sewer sizing has been refined and updated from the storm sewer sizing which was shown on the 90% plans. The proposed storm system will tie in-to an existing 9' X 5' RCB stub out provided with the Ann Road Improvements, US 95 to Ferrell Street, see Appendix E, Reference 2. The amount of runoff anticipated at this location is 460 cfs, in this analysis; it is assumed that 383 cfs will enter into the system at this location. Reference Figure D-4, *Storm Drain Exhibit* and Figure D-5, *Hydraulic Section Summary* for an illustration of how the 383 cfs was determined in order to size the underground facilities and for a summary of the pipe and inlet sizes utilized for this project.

The HGL versus pipes sizes for the main underground drainage facility in Ann Road and Tropical Parkway was analyzed using WSPGW and the lateral hydraulics were analyzed with Standard Form 6 from the Clark County Manual (See Figure D6a Ann Road to Existing Storm Drain Station Coordination, See Figure D-6, *WSPGW Ann Road to Easement*, Figure D-7, *WSPGW Junction to Tropical Parkway* and Figure D-9, *Standard Form 6*). The main storm system was analyzed in two parts. Figure D-6 shows the hydraulic analysis from the existing tie-in point in Ann Road up to the headworks in Tropical Parkway. Figure D-7 shows the hydraulic analysis from the existing tie-in point in Ann Road up to the headwall in Rio Vista Estates. The starting HGL in Figure D-6 and Figure D-7 was set 6.6' above the top of the box as shown in



the US95 to Ferrell WSPG analysis. All referenced material is included in Figure D-6a which shows the WSPG analysis for the existing system within Ann Road.

## **V. CONCLUSION**

### **1. COMPLIANCE with DRAINAGE LAWS, MASTER PLANS and REQUIREMENTS**

The purpose of this facility is to greatly decrease any adverse effects on upstream or downstream properties. This drainage facility attempts to preserve the overall existing drainage pattern of the site and vicinity.

This Design Report will serve as a record of existing conditions and will follow all requirements established by Clark County Regional Flood Control District (CCRFCD) and The City of Las Vegas Flood Control.



## **VI. TECHNICAL REFERENCES**

### **1. Technical Manuals and Software References**

1. Hydrologic Criteria and Drainage Design Manual, Prepared by WRC Engineering, Inc., Updated by Montgomery Watson, for Clark County Regional Flood Control District, August 1999.
2. Las Vegas Valley Flood Control Master Plan Update, PBS&J, for Clark County Regional Flood Control District, 2008.
3. Flood Insurance Rate Map, Federal Emergency Management Agency, Clark County, Nevada and Incorporated Areas.
4. HEC-1 Flood Hydrograph Package, User's Manual, U.S. Army Corps of Engineers, June 1998 Version 4.1.
5. FLOWMASTER, Pipe and Canal Sizing Software, HAESTAD Methods Inc., November 2009 Version 8i
6. HEC-RAS, River Analysis System, U.S. Army Corps of Engineers, May 2003 Version 3.1.1
7. WSPGW, Water Analysis System Program, Civil Design, Corp., Version 14.06



## **VII. APPENDIX**





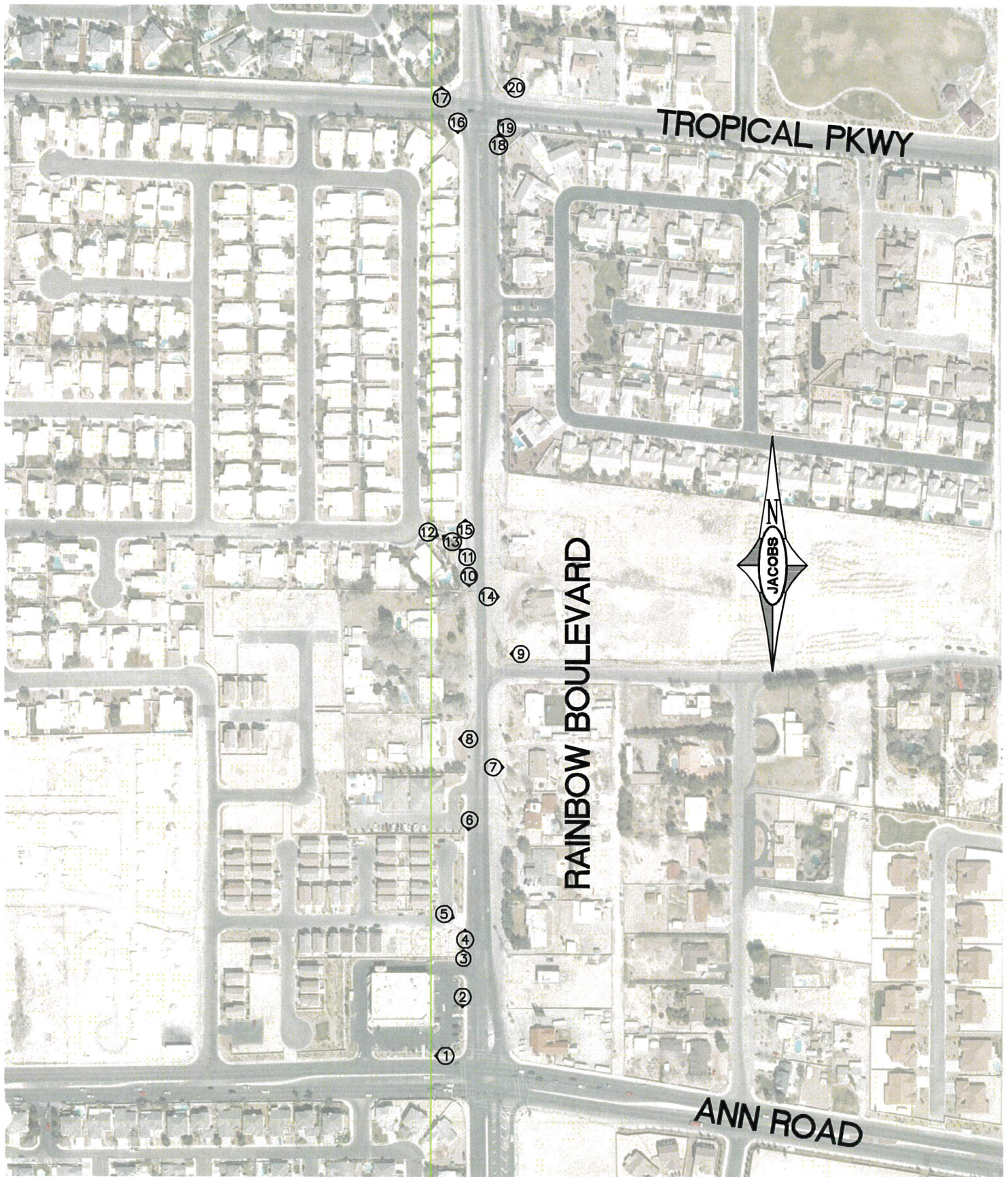
**1. APPENDIX A – EXISTING CONDITIONS**

1. FIGURE A-1 PHOTO LIBRARY
2. FIGURE A-2 RECORD OF SURVEY (2 TOTAL)
3. FIGURE A-3 UTILITY CONFLICTS MATRIX EXHIBIT
4. FIGURE A-4 UTILITY CONFLICTS MATRIX (2 TOTAL)
5. FIGURE A-5 PERMIT MATRIX (3 TOTAL)
6. FIGURE A-6 COST ESTIMATE
7. FIGURE A-7 POTHOLE DATA BY AZTEC
8. FIGURE A-8 AUTHORIZATION TO ENTER PROPERTY



# ANN ROAD WEST - RAINBOW BOULEVARD PHOTO LIBRARY LOCATIONS

NTS



① PHOTO NUMBER WITH DIRECTION TAKEN

FIGURE A-1





**Photo 1**



**Photo 2**





**Photo 3**



**Photo 4**





Photo 5



Photo 6





**Photo 7**



**Photo 8**





Photo 9



Photo 10





**Photo 11**



**Photo 12**





**Photo 13**



**Photo 14**





**Photo 15**



**Photo 16**





Photo 17



Photo 18





**Photo 19**

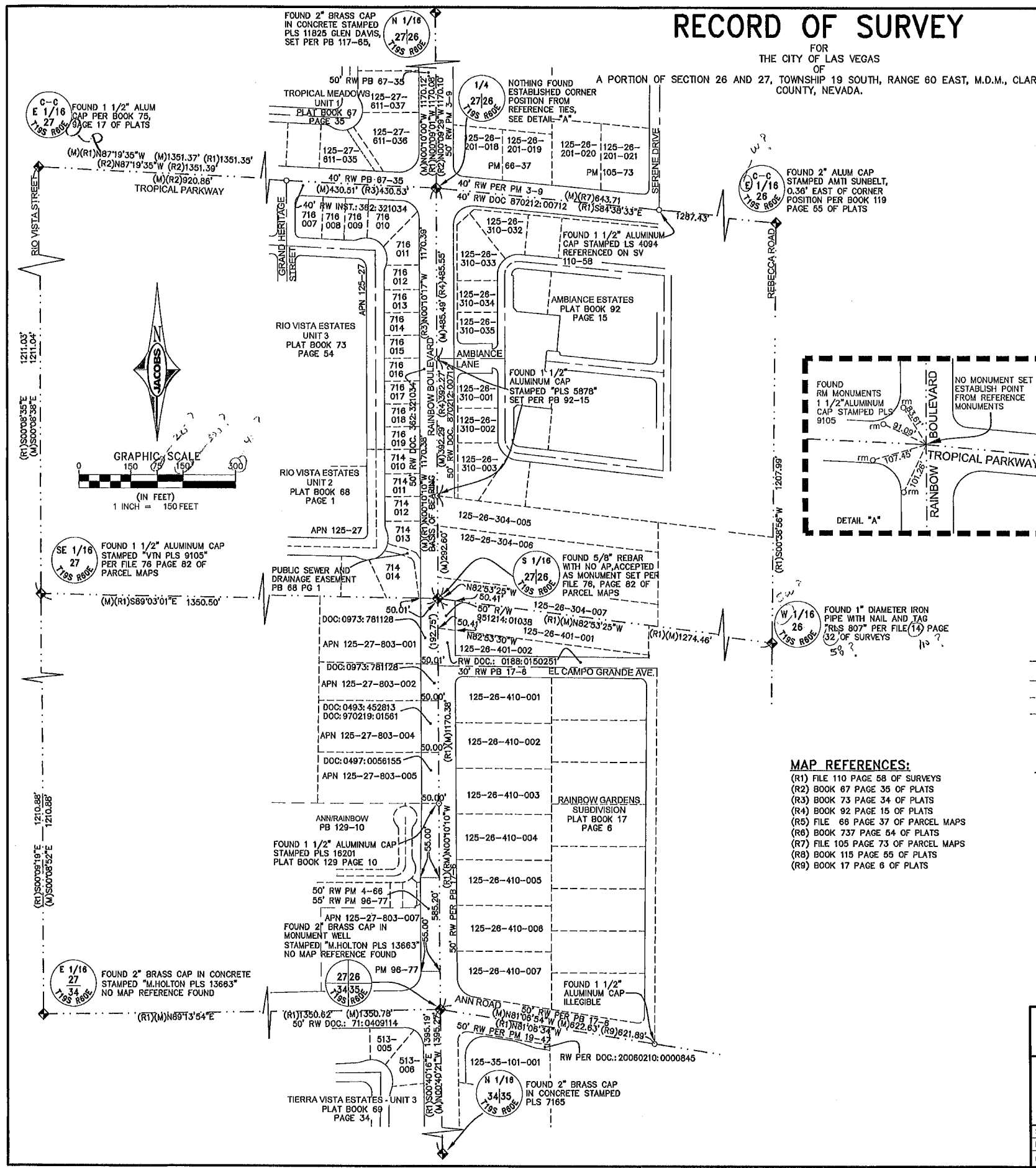


**Photo 20**



# RECORD OF SURVEY

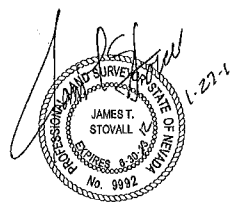
FOR  
THE CITY OF LAS VEGAS  
OF  
A PORTION OF SECTION 26 AND 27, TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.D.M., CLARK COUNTY, NEVADA.



## SURVEYOR'S CERTIFICATE:

- I, JAMES TODD STOVALL, A PROFESSIONAL LAND SURVEYOR, LICENSED IN THE STATE OF NEVADA, AS AN AGENT FOR JACOBS ENGINEERING GROUP INC., DO HEREBY CERTIFY THAT:
1. THIS PLAT REPRESENTS THE RESULTS OF A SURVEY CONDUCTED UNDER MY DIRECT SUPERVISION AT THE INSTANCE OF THE CITY OF LAS VEGAS.
  2. THE LANDS SURVEYED LIE WITHIN THE SECTION 26 AND 27, TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.D.M., CLARK COUNTY, NEVADA. THIS SURVEY WAS COMPLETED ON JANUARY 23, 2010.
  3. THIS PLAT COMPLIES WITH APPLICABLE STATUTES OF THIS STATE AND ANY LOCAL ORDINANCES IN EFFECT ON THE DATE THAT THE SURVEY WAS COMPLETED, AND THE SURVEY WAS PERFORMED IN ACCORDANCE WITH THE NEVADA ADMINISTRATIVE CODE STANDARDS OF PRACTICE FOR PROFESSIONAL LAND SURVEYORS.
  4. THE MONUMENTS DEPICTED ON THE PLAT ARE OF THE CHARACTER SHOWN, OCCUPY THE POSITIONS INDICATED AND ARE SUFFICIENT NUMBER AND DURABILITY.
  5. THIS PLAT AND THE SURVEY ON WHICH IT IS BASED MEET POSITIONAL CERTAINTY ACCURACY REQUIREMENTS FOR A LOW URBAN LAND BOUNDARY SURVEY AS DEFINED BY N.A.C. 625.666 AND N.A.C. 625.740.

JAMES TODD STOVALL  
PROFESSIONAL LAND SURVEYOR  
NEVADA CERTIFICATE NO. 9992



## LEGEND

- FOUND MONUMENT AS DESCRIBED
- ◆ FOUND ALIQUOT SECTION CORNER
- (M) MEASURED BEARING AND DISTANCE
- (R#) RECORD BEARING AND DISTANCE PER MAP REFERENCE
- rm○ REFERENCE MONUMENTS
- SECTION LINE
- RIGHT OF WAY LINE
- LOT OR PARCEL LINE
- CENTER LINE

## MAP REFERENCES:

- (R1) FILE 110 PAGE 58 OF SURVEYS
- (R2) BOOK 67 PAGE 35 OF PLATS
- (R3) BOOK 73 PAGE 34 OF PLATS
- (R4) BOOK 92 PAGE 15 OF PLATS
- (R5) FILE 68 PAGE 37 OF PARCEL MAPS
- (R6) BOOK 737 PAGE 54 OF PLATS
- (R7) FILE 105 PAGE 73 OF PARCEL MAPS
- (R8) BOOK 115 PAGE 55 OF PLATS
- (R9) BOOK 17 PAGE 6 OF PLATS

## BASIS OF BEARINGS:

NORTH 00°10'10"W, BEING THE WEST LINE OF THE NORTHWEST QUARTER (NW 1/4) OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 26, T.19S., R.60E., M.D.M., CLARK COUNTY, NEVADA. AS SHOWN ON SURVEY RECORDED IN FILE 110, PAGE 58 OF SURVEYS, OFFICIAL RECORDS OF CLARK COUNTY, NEVADA.

## COUNTY RECORDER'S NOTE:

ANY SUBSEQUENT CHANGES TO THIS MAP SHOULD BE EXAMINED AND MAY BE DETERMINED BY REFERENCE TO THE COUNTY RECORDER'S CUMULATIVE MAP INDEX. (PER NRS 278.5695)

|                                                                  |  |                                                                                              |                      |
|------------------------------------------------------------------|--|----------------------------------------------------------------------------------------------|----------------------|
| <b>JACOBS</b>                                                    |  | 319 E. WARM SPRINGS STE 200<br>LAS VEGAS, NEVADA 89119<br>(702)938-5400<br>(702)938-5454 FAX |                      |
| FILED AT THE REQUEST OF:<br><b>JACOBS ENGINEERING GROUP INC.</b> |  |                                                                                              |                      |
| DATED _____ AT _____                                             |  |                                                                                              |                      |
| FILE _____ PAGE _____                                            |  |                                                                                              |                      |
| SURVEYS                                                          |  |                                                                                              |                      |
| BOOK NO. _____                                                   |  |                                                                                              |                      |
| INSTRUMENT NO. _____                                             |  |                                                                                              |                      |
| OFFICIAL RECORDS                                                 |  |                                                                                              |                      |
| CLARK COUNTY, NEVADA RECORDS<br>DEBBIE CONWAY, RECORDER          |  |                                                                                              |                      |
| FEE \$ _____ DEPUTY _____                                        |  |                                                                                              |                      |
| SCALE: _____ NTS                                                 |  | JOB NO.: W4X53700                                                                            | SHEET _____ OF _____ |
| DWG FILE: _____                                                  |  | DRAWN BY: _____                                                                              | 1 1                  |
| DATE: 1-23-11                                                    |  | CHECKED BY: _____                                                                            |                      |



# RECORD OF SURVEY

FOR  
THE CITY OF LAS VEGAS  
OF

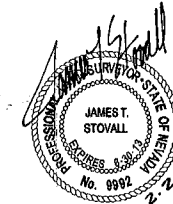
A PORTION OF SECTION 26 AND 27, TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.D.M., CLARK COUNTY, NEVADA.

## SURVEYOR'S CERTIFICATE:

I, JAMES TODD STOVALL, A PROFESSIONAL LAND SURVEYOR, LICENSED IN THE STATE OF NEVADA, AS AN AGENT FOR JACOBS ENGINEERING GROUP INC., DO HEREBY CERTIFY THAT:

1. THIS PLAT REPRESENTS THE RESULTS OF A SURVEY CONDUCTED UNDER MY DIRECT SUPERVISION AT THE INSTANCE OF THE CITY OF LAS VEGAS..
2. THE LANDS SURVEYED LIE WITHIN THE SECTION 26 AND 27, TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.D.M., CLARK COUNTY, NEVADA. THIS SURVEY WAS COMPLETED ON JANUARY 23, 2010.
3. THIS PLAT COMPLIES WITH APPLICABLE STATUTES OF THIS STATE AND ANY LOCAL ORDINANCES IN EFFECT ON THE DATE THAT THE SURVEY WAS COMPLETED, AND THE SURVEY WAS PERFORMED IN ACCORDANCE WITH THE NEVADA ADMINISTRATIVE CODE STANDARDS OF PRACTICE FOR PROFESSIONAL LAND SURVEYORS.
4. THE MONUMENTS DEPICTED ON THE PLAT ARE OF THE CHARACTER SHOWN, OCCUPY THE POSITIONS INDICATED AND ARE SUFFICIENT NUMBER AND DURABILITY.
5. THIS PLAT AND THE SURVEY ON WHICH IT IS BASED MEET POSITIONAL CERTAINTY ACCURACY REQUIREMENTS FOR A LOW URBAN LAND BOUNDARY SURVEY AS DEFINED BY N.A.C. 625.666 AND N.A.C. 625.740.

JAMES TODD STOVALL  
PROFESSIONAL LAND SURVEYOR  
NEVADA CERTIFICATE NO. 9992



## LEGEND

- FOUND MONUMENT AS DESCRIBED
- ◆ FOUND ALIQUOT SECTION CORNER
- (M) MEASURED BEARING AND DISTANCE
- (R#) RECORD BEARING AND DISTANCE PER MAP REFERENCE
- rm ○ REFERENCE MONUMENTS
- SECTION LINE
- RIGHT OF WAY LINE
- LOT OR PARCEL LINE
- CENTER LINE

## MAP REFERENCES:

- (R1) FILE 110 PAGE 58 OF SURVEYS
- (R2) BOOK 67 PAGE 35 OF PLATS
- (R3) BOOK 73 PAGE 34 OF PLATS
- (R4) BOOK 92 PAGE 15 OF PLATS
- (R5) FILE 66 PAGE 37 OF PARCEL MAPS
- (R6) BOOK 737 PAGE 54 OF PLATS
- (R7) FILE 105 PAGE 73 OF PARCEL MAPS
- (R8) BOOK 115 PAGE 55 OF PLATS
- (R9) BOOK 17 PAGE 6 OF PLATS

## BASIS OF BEARINGS:

NORTH 00°10'10" WEST, BEING THE WEST LINE OF THE NORTHWEST QUARTER (NW 1/4) OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 26, T.19S., R.60E., M.D.M., CLARK COUNTY, NEVADA. AS SHOWN ON SURVEY RECORDED IN FILE 110, PAGE 58 OF SURVEYS, OFFICIAL RECORDS OF CLARK COUNTY, NEVADA.

## COUNTY RECORDER'S NOTE:

ANY SUBSEQUENT CHANGES TO THIS MAP SHOULD BE EXAMINED AND MAY BE DETERMINED BY REFERENCE TO THE COUNTY RECORDER'S CUMULATIVE MAP INDEX. (PER NRS 278.5695)

**JACOBS**

318 E. WARM SPRINGS STE 200  
LAS VEGAS, NEVADA 89119  
(702) 838-5400  
(702) 838-5454 FAX

FILED AT THE REQUEST OF:  
**JACOBS ENGINEERING GROUP INC.**

DATED **2-2-11** AT **8:23**

FILE **183** PAGE **42**

SURVEYS

BOOK NO. **201102020000336**

INSTRUMENT NO. **0000886**

OFFICIAL RECORDS

CLARK COUNTY, NEVADA RECORDS

DEBBIE CONWAY, RECORDER

FEE \$ **21.00** DEPUTY **NGM**

## RECORD OF SURVEY

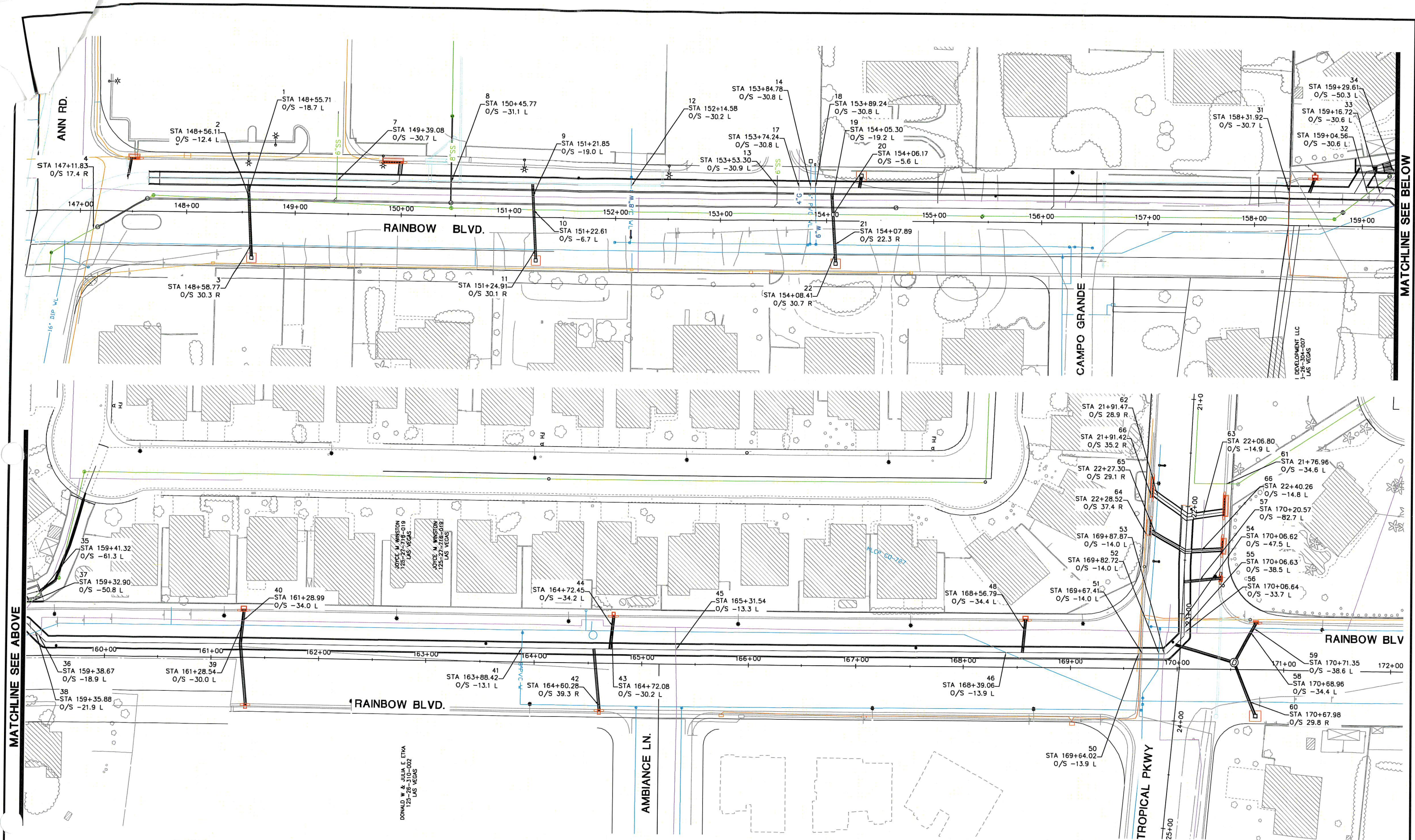
FOR  
CITY OF LAS VEGAS  
OF

A PORTION OF SECTION 26 AND 27, TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.D.M., CLARK COUNTY, NEVADA.

|           |         |             |          |       |    |
|-----------|---------|-------------|----------|-------|----|
| SCALE:    | NTS     | JOB NO.:    | W4X53700 | SHEET | OF |
| DWG FILE: |         | DRAWN BY:   |          | 1     | 1  |
| DATE:     | 1-23-11 | CHECKED BY: |          |       |    |

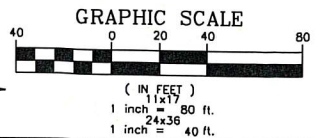
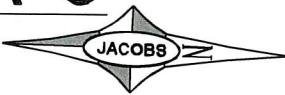
FILE **183** PAGE **42**





ANN AND RAINBOW CONFLICT LOCATION EXHIBIT FIGURE A-3

REFERENCE FIGURE A-4 FOR CONFLICT DESCRIPTION





# RAINBOW BLVD: TROPICAL PKWY TO ANN R

## UTILITY CONFLICT MATRIX

| LOCATION OF PROPOSED IMPROVEMENT CONFLICT (STATION AND |           | CONFLICTING UTILITY | BASIS FOR INFORMATION (POTHOLE INFORMATION (SEE PLANS FOR POTHOLE LOCATIONS), AS-BUILTS, ESTIMATE, FIELD INVESTIGATION, ETC.) | PROPOSED IMPROVEMENT | CONFLICT (YES, NO or POTENTIAL) |                                            |
|--------------------------------------------------------|-----------|---------------------|-------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------------------------|--------------------------------------------|
| NO                                                     | APPOX STA | SIZE AND TYPE       |                                                                                                                               | SIZE AND PIPE        |                                 |                                            |
| 1                                                      | 148+55    | 4" PE GAS           | POTHOLE INFORMATION                                                                                                           | 18" RCP LATERAL      | YES                             | TO BE RELOCATE                             |
| 2                                                      | 148+56    | 12" PVC SWR         | SURVEY                                                                                                                        | 18" RCP LATERAL      | NO                              | NOT A CONFLICT                             |
| 3                                                      | 148+59    | 36" MLCP WATER      | POTHOLE INFORMATION                                                                                                           | 18" RCP LATERAL      | YES                             | CONCRETE ENCASE                            |
| 4                                                      | 147+12    | TELEPHONE           | AS-BUILT INFORMATION                                                                                                          | SEWER MANHOLE        | POTENTIAL                       | WILL MOVE IN                               |
| 4                                                      | 147+12    | ELECTRIC            | AS-BUILT INFORMATION                                                                                                          | SEWER MANHOLE        | POTENTIAL                       | OBTAIN ADDITIONAL POT                      |
| 5 & 6 NOT USED                                         |           |                     |                                                                                                                               |                      |                                 |                                            |
| 7                                                      | 149+39    | 6" SS LATERAL       | AS-BUILT INFORMATION                                                                                                          | 11' X5' RCB          | YES                             | RELOCATE UNDER RCB                         |
| 8                                                      | 150+46    | 8" PVC SS           | SURVEY                                                                                                                        | 11' X5' RCB          | YES                             | PROVIDE CONCRETE CROSS                     |
| 9                                                      | 151+22    | 4" PE GAS           | POTHOLE INFORMATION                                                                                                           | 18" RCP LATERAL      | YES                             | TO BE RELOCATED BY SW                      |
| 10                                                     | 151+23    | 12" PVC SWR         | SURVEY                                                                                                                        | 18" RCP LATERAL      | NO                              | NOT A CONFLICT, CITY IS MO                 |
| 11                                                     | 151+24    | 36" MLCP WATER      | POTHOLE INFORMATION                                                                                                           | 18" RCP LATERAL      | YES                             | CONCRETE ENCASE LATERA                     |
| 12                                                     | 152+15    | 8" DIP WATER        | POTHOLE INFORMATION                                                                                                           | 11' X5' RCB          | YES                             | RELOCATE UNDER RCB BOX                     |
| 13                                                     | 153+53    | 6" SS LATERAL       | AS-BUILT INFORMATION                                                                                                          | 11' X5' RCB          | YES                             | RELOCATE UNDER RCB BOX                     |
| 14                                                     | 153+85    | 6" DIP WATER        | POTHOLE INFORMATION                                                                                                           | 11' X5' RCB          | YES                             | RELOCATE UNDER RCB BOX                     |
| 15 & 16 NOT USED                                       |           |                     |                                                                                                                               |                      |                                 |                                            |
| 17                                                     | 153+74    | 4" PE GAS           | POTHOLE INFORMATION                                                                                                           | 11' X5' RCB          | YES                             | TO BE RELOCATED BY SWG                     |
| 18                                                     | 153+89    | WTR SRVC            | POTHOLE INFORMATION                                                                                                           | 11' X5' RCB          | YES                             | RELOCATE UNDER RCB BOX                     |
| 19                                                     | 154+05    | 4" PE GAS           | POTHOLE INFORMATION                                                                                                           | 18" RCP LATERAL      | YES                             | TO BE RELOCATED BY SWG                     |
| 20                                                     | 154+06    | 12" PVC SWR         | SURVEY                                                                                                                        | 18" RCP LATERAL      | NO                              | NOT A CONFLICT, CITY IS MOVING             |
| 21                                                     | 154+08    | 8" PVC WATER        | POTHOLE INFORMATION                                                                                                           | 18" RCP LATERAL      | YES                             | RELOCATE UNDER RCB BOX                     |
| 22                                                     | 154+08    | 36" MLCP WATER      | POTHOLE INFORMATION                                                                                                           | 18" RCP LATERAL      | YES                             | CONCRETE ENCASE LATERAL                    |
| 23-30 NOT USED                                         |           |                     |                                                                                                                               |                      |                                 |                                            |
| 31                                                     | 158+32    | 2" PVC TV           | POTHOLE INFORMATION                                                                                                           | 11' X5' RCB          | YES                             | UTIL COMPANY WILL MOVE IN                  |
| 32                                                     | 159+05    | 12" PVC SWR         | SURVEY                                                                                                                        | 11' X5' RCB          | YES                             | CONCRETE CROSSING PROTECTION               |
| 33                                                     | 159+17    | 2" PE GAS           | POTHOLE INFORMATION                                                                                                           | 11' X5' RCB          | NO                              | TO BE ABANDONED BY SWG                     |
| 34                                                     | 159+30    | 12" PVC SWR         | SURVEY                                                                                                                        | SD CHANNEL           | POTENTIAL                       | PROTECT IN PLACE DURING CONSTRUCTION       |
| 35                                                     | 159+41    | 2" PE GAS           | POTHOLE INFORMATION                                                                                                           | SD CHANNEL           | NO                              | TO BE ABANDONED BY SWG                     |
| 36                                                     | 159+39    | 4" PE GAS           | POTHOLE INFORMATION                                                                                                           | 10' X3' RCB          | YES                             | TO BE RELOCATED BY SWG                     |
| 37                                                     | 159+33    | 12" PVC SWR         | SURVEY                                                                                                                        | SD-CHANNEL           | POTENTIAL                       | PROTECT IN PLACE                           |
| 38                                                     | 159+36    | 36" MLCP WATER      | POTHOLE INFORMATION                                                                                                           | 10' X 3' RCB         | YES                             | SPECIAL SHALLOW CROSSING DESIGN OVER WATER |



# RAINBOW BLVD: TROPICAL PKWY TO ANN ROAD

## UTILITY CONFLICT MATRIX

| LOCATION OF PROPOSED IMPROVEMENT CONFLICT (STATION AND) |           | CONFLICTING UTILITY | BASIS FOR INFORMATION (POTHOLE INFORMATION (SEE PLANS FOR POTHOLE LOCATIONS), AS-BUILTS, ESTIMATE, FIELD INVESTIGATION, ETC.) | PROPOSED IMPROVEMENT | CONFLICT (YES, NO or POTENTIAL) | RESOLUTION                                 |
|---------------------------------------------------------|-----------|---------------------|-------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------------------------|--------------------------------------------|
| NO                                                      | APPOX STA | SIZE AND TYPE       |                                                                                                                               | SIZE AND PIPE        |                                 |                                            |
| 39                                                      | 161+29    | 36" MLCP WATER      | POTHOLE INFORMATION                                                                                                           | 18" RCP LATERAL      | YES                             | CONCRETE ENCASE LATERAL                    |
| 40                                                      | 161+29    | 4" PE GAS           | POTHOLE INFORMATION                                                                                                           | 18" RCP LATERAL      | YES                             | TO BE RELOCATED BY SWG                     |
| 41                                                      | 163+89    | 8" PVC WATER        | POTHOLE INFORMATION                                                                                                           | 10' X3' RCB          | NO                              | SUBSTANTIAL CLEARANCE AT THIS LOCATION     |
| 42                                                      | 164+60    | 8" PVC WATER        | AS-BUILT INFORMATION                                                                                                          | SD LAT               | YES                             | CONCRETE CROSSING PROTECTION               |
| 43                                                      | 164+72    | 36" MLCP WATER      | POTHOLE INFORMATION                                                                                                           | 18" RCP LATERAL      | YES                             | CONCRETE ENCASE LATERAL                    |
| 44                                                      | 164+72    | 4" PE GAS           | POTHOLE INFORMATION                                                                                                           | 18" RCP LATERAL      | YES                             | TO BE RELOCATED BY SWG                     |
| 45                                                      | 165+32    | 2" PE GAS           | POTHOLE INFORMATION                                                                                                           | 10' X 3' RCB         | YES                             | TO BE RELOCATED BY SWG                     |
| 46                                                      | 168+39    | 36" MLCP WATER      | POTHOLE INFORMATION                                                                                                           | 10' X3' RCB          | YES                             | SPECIAL SHALLOW CROSSING DESIGN OVER WATER |
| 47 NOT USED                                             |           |                     |                                                                                                                               |                      |                                 |                                            |
| 48                                                      | 168+57    | 4" PE GAS           | POTHOLE INFORMATION                                                                                                           | 18" RCP LATERAL      | YES                             | TO BE RELOCATED BY SWG                     |
| 50                                                      | 169+64    | 3" & 4" PVC UGE     | POTHOLE INFORMATION                                                                                                           | 10' X3' RCB          | YES                             | TO BE RELOCATED BY CLV, DESIGN BY NVE      |
| 51                                                      | 169+67    | 2" PVC TV           | POTHOLE INFORMATION                                                                                                           | 10' X 3' RCB         | YES                             | UTIL COMPANY WILL MOVE IN FIELD            |
| 52                                                      | 169+83    | 12" PVC WTR         | POTHOLE INFORMATION                                                                                                           | 10' X 3' RCB         | YES                             | RELOCATE UNDER RCB BOX                     |
| 53                                                      | 169+88    | 4" PE GAS           | POTHOLE INFORMATION                                                                                                           | 10' X 3' RCB         | YES                             | TO BE RELOCATED BY SWG                     |
| 54                                                      | 170+06    | 1.5" & 2" PVC TV    | POTHOLE INFORMATION                                                                                                           | 10' X 3' RCB         | YES                             | UTIL COMPANY WILL MOVE IN FIELD            |
| 55                                                      | 170+07    | 12" PVC WTR         | POTHOLE INFORMATION                                                                                                           | 10' X 3' RCB         | YES                             | RELOCATE UNDER RCB BOX                     |
| 56                                                      | 170+07    | 4" PE GAS           | POTHOLE INFORMATION                                                                                                           | 10' X 3' RCB         | YES                             | TO BE RELOCATED BY SWG                     |
| 57                                                      | 170+21    | 4" PE GAS           | POTHOLE INFORMATION                                                                                                           | 18" RCP LATERAL      | YES                             | TO BE RELOCATED BY SWG                     |
| 58                                                      | 170+69    | 4" PE GAS           | POTHOLE INFORMATION                                                                                                           | 18" RCP LATERAL      | YES                             | TO BE RELOCATED BY SWG                     |
| 59                                                      | 170+71    | 12" PVC WTR         | POTHOLE INFORMATION                                                                                                           | 18" RCP LATERAL      | YES                             | CONCRETE CROSSING PROTECTION               |
| 60                                                      | 170+68    | 36" MLCP WATER      | POTHOLE INFORMATION                                                                                                           | 18" RCP LATERAL      | YES                             | CONCRETE ENCASE LATERAL                    |
| 61                                                      | 21+78     | 10" PVC SWR         | AS-BUILT INFORMATION                                                                                                          | INLET DI-TP02        | POTENTIAL                       | PROTECT IN PLACE                           |
| 62                                                      | 21+91     | 10" PVC WTR         | POTHOLE INFORMATION                                                                                                           | 30" RCP LATERAL      | YES                             | RELOCATE UNDER RCB BOX                     |
| 63                                                      | 22+07     | 4" PE GAS           | POTHOLE INFORMATION                                                                                                           | 30" RCP LATERAL      | YES                             | TO BE RELOCATED BY SWG                     |
| 64                                                      | 22+29     | (7) 3" PVC UGE      | POTHOLE INFORMATION                                                                                                           | INLET DI-TP03        | YES                             | TO BE RELOCATED BY CLV, DESIGN BY NVE      |
| 64                                                      | 22+29     | UGTV                | AS-BUILT INFORMATION                                                                                                          | INLET DI-TP03        | POTENTIAL                       | UTIL COMPANY WILL MOVE IN FIELD            |
| 65                                                      | 22+27     | 10" PVC WTR         | POTHOLE INFORMATION                                                                                                           | 30" RCP LATERAL      | YES                             | RELOCATE UNDER RCB BOX                     |
| 66                                                      | 21+91     | (7) 3" PVC UGE      | POTHOLE INFORMATION                                                                                                           | INLET DI-TP01        | YES                             | TO BE RELOCATED BY CLV, DESIGN BY NVE      |
| 66                                                      | 21+91     | UGTV                | AS-BUILT INFORMATION                                                                                                          | INLET DI-TP01        | POTENTIAL                       | UTIL COMPANY WILL MOVE IN FIELD            |

17





## ANN ROAD CHANNEL WEST-RAINBOW BOULEVARD PERMIT MATRIX

| Category                  | Permit Name                           | Issuing Agency                                                                                                                                                               |
|---------------------------|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| City of Las Vegas Permits | Construction Permit                   | City of Las Vegas Department of Building and Safety, Land Development Services, 333 N. Rancho Drive, Las Vegas, NV 89107                                                     |
| City of Las Vegas Permits | Drainage Study Review/Approval        | City of Las Vegas Department of Public Works, Flood Control Section, 333 N. Rancho Drive, Las Vegas, NV 89107                                                                |
| City of Las Vegas Permits | Excavation Permit                     | City of Las Vegas Department of Building and Safety, Land Development Services, 333 N. Rancho Drive, Las Vegas, NV 89107                                                     |
| City of Las Vegas Permits | Grading Permit                        | City of Las Vegas Department of Building and Safety, 333 N. Rancho Drive, Las Vegas, NV 89107                                                                                |
| City of Las Vegas Permits | Plans check                           | City of Las Vegas Department of Building and Safety, Land Development Services, 333 N. Rancho Drive, Las Vegas, NV 89107                                                     |
| City of Las Vegas Permits | Soils Report Submittal                | City of Las Vegas Department of Building and Safety, Land Development Services, 333 N. Rancho Drive, Las Vegas, NV 89107                                                     |
| City of Las Vegas Permits | Traffic Barricade Plan Approval       | City of Las Vegas Construction Services, 333 N. Rancho Drive, Las Vegas, NV 89107                                                                                            |
| Clark County Permits      | Drainage Study Approval               | Clark County Department of Public Works Community Development Division, 500 S. Grand Central Parkway, P.O. Box 554000, Las Vegas, NV 89155-4000 General Number: 702-455-6000 |
| Clark County Permits      | Dust Control Permit                   | Clark County Department of Air Quality Management (DAQM), 500 S. Grand Central Pkwy, P.O. Box 551776, Las Vegas, NV 89155-1776                                               |
| Clark County Permits      | Encroachment Permit                   | Clark County Department of Public Works Community Development Division, 500 S. Grand Central Parkway, P.O. Box 554000, Las Vegas, NV 89155-4000 General Number: 702-455-6000 |
| Clark County Permits      | Encroachment Permit (Discharge Water) | Clark County Department of Public Works Community Development Division, 500 S. Grand Central Parkway, P.O. Box 554000, Las Vegas, NV 89155-4000 General Number: 702-455-6000 |

FIGURE A-5 (1 OF 3)



# ANN ROAD CHANNEL WEST-RAINBOW BOULEVARD PERMIT MATRIX

| Category                                     | Permit Name                                             | Issuing Agency                                                                                                                                                               |
|----------------------------------------------|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Clark County Permits                         | Grading Permit                                          | Clark County Department of Building, 500 S. Grand Central Parkway, Las Vegas, NV 89155                                                                                       |
| Clark County Permits                         | Off-site Construction Permit                            | Clark County Department of Public Works Community Development Division, 500 S. Grand Central Parkway, P.O. Box 554000, Las Vegas, NV 89155-4000 General Number: 702-455-6000 |
| Clark County Permits                         | Soils Report Submittal                                  | Clark County Department of Building, 500 S. Grand Central Parkway, Las Vegas, NV 89155                                                                                       |
| Clark County Permits                         | Temporary Sign Permit                                   | Clark County Department of Building, 500 S. Grand Central Parkway, Las Vegas, NV 89155                                                                                       |
| Clark County Permits                         | Traffic Barricade Plan Approval                         | Clark County Department of Public Works Traffic Operations 5821 E. Flamingo Road, Las Vegas, NV 89122                                                                        |
| Nevada State Permits                         | NPDES General Stormwater Permit for Construction        | NDEP Bureau of Water Pollution Control 901S Stewart St., Suite 4001, Carson City, NV 89701-5249                                                                              |
| Nevada State Permits                         | NPDES Temporary Discharge Permit                        | NDEP Bureau of Water Pollution Control, 333 West Nye Lane, Suite 129, Carson City, NV 89710                                                                                  |
| Other Permits\Coordination                   | Encroachment and occupancy approval from Private Owners | Private Owner                                                                                                                                                                |
| Federal Permits                              | Section 8 and Section 404 Permit                        | Reference following e-mail by Tim Sutko dated February 18, 2011                                                                                                              |
| Clark County Regional Flood Control District | Drainage Study Review/Approval                          | Regional Flood Control District, 600 S. Grand Central Parkway, Suite 300, Las Vegas, NV 89106                                                                                |

FIGURE A-5 (2 OF 3)





**exander, Tara T.**

**From:** Tim Sutko [TSutko@regionalflood.org]

**Sent:** Friday, February 18, 2011 9:31 AM

**To:** Alexander, Tara T.

**Cc:** Randy McConnell; Todd L. Myers; Kevin Eubanks; Steve Parrish

**Subject:** Ann Road Channel West - Rainbow Boulevard Regional Project for the City of Las Vegas - ANRB0000

The City of Las Vegas is planning and proposing to construct Master Plan facility ANRB0000. The proposed facility is an RCB with varying dimensions in the Rainbow Blvd alignment extending from Ann Road to Tropical Parkway, and west in the Tropical Parkway alignment for roughly 130 ft. This facility is being designed to safely convey 100-year design discharges ranging from 130 cfs to 475 cfs (estimated). The proposed facility will connect at the downstream end to MPU facility ANWE0290.

The proposed facility will be located in a heavily disturbed, urbanized residential area; the RCB will be constructed under Rainbow Blvd, an existing paved roadway. The facility will be wholly located within public ROW.

Given the degree of disturbance on the site as well as the amount of development on neighboring sites, coupled with a review of the District's SEIS, it is my belief that there are no sensitive resources that would be impacted by the proposed project. Therefore I have determined that there is no need to prepare a Section 8 analysis for this project. Further, because the project will not include the placement of fill material in "waters of the US" with bed and bank, no 404 permit is required.

At the same time, please be mindful of the following:

**Air Quality** - The construction contractor will be required to comply with all mitigation measures stipulated on ground disturbance/grading permits obtained from the Clark County Department of Air Quality and Environmental Management.

**Surface Water** - Best Management Practices to control storm water quality exiting the construction site should be developed and included in the construction specifications.

The District's environmental requirements as a prerequisite for qualifying for construction funding have been satisfied.

Please don't hesitate to contact me if you have any questions or require additional information.

Thanks

Timothy E. Sutko  
Environmental Mitigation Manager  
Clark County Regional Flood Control District  
600 South Grand Central Parkway  
Suite 300  
Las Vegas, NV 89106-4511

702 685-0000  
702 685-0001 (FAX)  
TSutko@regionalflood.org





99% Construction Cost Estimate for  
ANN ROAD CHANNEL WEST

| ITEM NO. | ITEM DESCRIPTION                                            | Quantity | UOM | Unit Price   | Extended Price |
|----------|-------------------------------------------------------------|----------|-----|--------------|----------------|
| 109.01   | OWNER CAUSED DELAY ALLOWANCE                                | 10       | DAY | \$500.00     | \$5,000.00     |
| 109.02   | OWNER CAUSED DELAY AMOUNT IN ADDITION TO                    | 10       | DAY | \$500.00     | \$5,000.00     |
| 200.01   | MOBILIZATION AND DEMOBILIZATION                             | 1        | LS  | \$201,300.00 | \$201,300.00   |
| 201.01   | TREE TRIMMING WITHIN DRAINAGE EASEMENT                      | 1        | LS  | \$1,000.00   | \$1,000.00     |
| 202.01   | REMOVAL OF WROUGHT IRON FENCE                               | 1        | LS  | \$700.00     | \$700.00       |
| 202.02   | REMOVAL OF BEEHIVE DROP INLET                               | 2        | EA  | \$780.00     | \$1,560.00     |
| 202.03   | REMOVAL OF BOLLARDS                                         | 3        | EA  | \$220.00     | \$660.00       |
| 202.04   | REMOVAL OF DROP INLET                                       | 3        | EA  | \$900.00     | \$2,700.00     |
| 202.05   | REMOVAL OF STORM DRAIN MANHOLE                              | 4        | EA  | \$730.00     | \$2,920.00     |
| 202.06   | REMOVAL OF RCP STORM DRAIN PIPE                             | 886      | LF  | \$17.00      | \$15,062.00    |
| 202.07   | REMOVAL AND RECONNECTION OF EXISTING SD LATERAL             | 3        | EA  | \$200.00     | \$600.00       |
| 202.08   | REMOVAL OF EXISTING SANITARY SEWER MANHOLE                  | 6        | EA  | \$800.00     | \$4,800.00     |
| 202.09   | REMOVAL OF SANITARY SEWER PIPE                              | 1,318    | LF  | \$30.00      | \$39,540.00    |
| 202.10   | REMOVAL OF CURB, GUTTER AND SIDEWALK                        | 3,110    | SF  | \$5.00       | \$15,550.00    |
| 202.11   | REMOVAL OF CONCRETE DRAINAGE CHANNEL                        | 1,368    | SF  | \$4.00       | \$5,472.00     |
| 202.12   | REMOVAL OF ASPHALT PAVEMENT                                 | 14,131   | SY  | \$5.00       | \$70,655.00    |
| 202.13   | REMOVAL OF SD HEADWALL                                      | 1        | EA  | \$500.00     | \$500.00       |
| 202.14   | REMOVAL/SALVAGE OF SIGN AND POST                            | 17       | EA  | \$40.00      | \$680.00       |
| 202.15   | REMOVAL/SALVAGE OF STREETLIGHT                              | 1        | EA  | \$450.00     | \$450.00       |
| 203.01   | ROADWAY EXCAVATION / EMBANKMENT                             | 375      | CY  | \$20.00      | \$7,500.00     |
| 203.02   | DRAINAGE EASEMENT EXCAVATION / EMBANKMENT                   | 140      | CY  | \$20.00      | \$2,800.00     |
| 203.03   | SCARIFY AND RECOMPACT                                       | 8,650    | CY  | \$10.00      | \$86,500.00    |
| 203.04   | SWALE REGRADE IN SHOULDER                                   | 1,657    | CY  | \$10.00      | \$16,570.00    |
| 302.01   | TYPE II AGGREGATE BASE                                      | 4,915    | CY  | \$30.00      | \$147,450.00   |
| 402.01   | 5-INCH PLANTMIX BITUMINOUS SURFACE                          | 14,745   | SY  | \$20.00      | \$294,900.00   |
| 502.01   | 14' X 3' REINFORCED CONCRETE BOX CULVERT                    | 23       | LF  | \$1,450.00   | \$33,350.00    |
| 502.02   | 11' X 5' REINFORCED CONCRETE BOX CULVERT                    | 1,145    | LF  | \$900.00     | \$1,030,500.00 |
| 502.03   | 10' X 3' REINFORCED CONCRETE BOX CULVERT                    | 1,225    | LF  | \$575.00     | \$704,375.00   |
| 502.04   | DRAINAGE EASEMENT UPGRADES                                  | 1        | LS  | \$45,000.00  | \$45,000.00    |
| 502.05   | 11' X 5' TO 9' X 6' RCB TRANSITION STRUCTURE                | 1        | EA  | \$8,200.00   | \$8,200.00     |
| 502.06   | 10' X 3' RCB END CAP                                        | 1        | EA  | \$980.00     | \$980.00       |
| 603.01   | 18-INCH REINFORCED CONCRETE PIPE (CLASS III)                | 665      | LF  | \$150.00     | \$99,750.00    |
| 603.02   | 30-INCH REINFORCED CONCRETE PIPE (CLASS III)                | 161      | LF  | \$180.00     | \$28,980.00    |
| 603.03   | 18-INCH CHECK VALVE                                         | 9        | EA  | \$3,785.00   | \$34,065.00    |
| 603.04   | 30-INCH CHECK VALVE                                         | 1        | EA  | \$8,095.00   | \$8,095.00     |
| 609.01   | 30-INCH STORM DRAIN ACCESS MANHOLE W/CONCRETE CASING        | 7        | EA  | \$1,700.00   | \$11,900.00    |
| 609.02   | 60-INCH TYPE IA STORM DRAIN MANHOLE                         | 1        | EA  | \$6,400.00   | \$6,400.00     |
| 609.03   | 2-FOOT NDOT TYPE 2B DROP INLET W/CONCRETE APRON             | 5        | EA  | \$3,900.00   | \$19,500.00    |
| 609.04   | 2.5-FOOT TYPE CM2 DROP INLET                                | 3        | EA  | \$3,800.00   | \$11,400.00    |
| 609.05   | 5-FOOT TYPE CM2 DROP INLET                                  | 4        | EA  | \$5,900.00   | \$23,600.00    |
| 609.06   | 10-FOOT TYPE CM2 DROP INLET                                 | 1        | EA  | \$10,000.00  | \$10,000.00    |
| 609.07   | 15-FOOT TYPE CM2 DROP INLET                                 | 1        | EA  | \$12,200.00  | \$12,200.00    |
| 609.08   | 15-FOOT TYPE DM2 DROP INLET                                 | 1        | EA  | \$11,500.00  | \$11,500.00    |
| 609.09   | 20-FOOT TYPE DM2 DROP INLET                                 | 1        | EA  | \$16,500.00  | \$16,500.00    |
| 609.10   | 5-FOOT TYPE CM2 DROP INLET W/ SIDEWALK UNDERDRAIN           | 1        | EA  | \$7,400.00   | \$7,400.00     |
| 609.11   | 20-FOOT TYPE CM2 DROP INLET W/ SIDEWALK                     | 2        | EA  | \$18,000.00  | \$36,000.00    |
| 613.01   | TYPE L CURB AND GUTTER (24-INCH)                            | 275      | LF  | \$17.00      | \$4,675.00     |
| 613.02   | CONCRETE SIDEWALK                                           | 1,793    | SF  | \$5.00       | \$8,965.00     |
| 613.03   | CONCRETE LOW FLOW U-CHANNEL                                 | 97       | LF  | \$40.00      | \$3,880.00     |
| 616.01   | 6-FOOT WROUGHT IRON FENCE                                   | 54       | LF  | \$65.00      | \$3,510.00     |
| 616.02   | 16-FOOT WIDE WROUGHT IRON VEHICLE ACCESS GATE               | 2        | EA  | \$1,250.00   | \$2,500.00     |
| 619.01   | K71 SELF RE-ERECTING MARKER POST                            | 1        | EA  | \$200.00     | \$200.00       |
| 622.01   | CONSTRUCTION SURVEYING                                      | 1        | LS  | \$50,000.00  | \$50,000.00    |
| 623.01   | TRAFFIC SIGNAL MODIFICATION AT ANN/RAINBOW                  | 1        | LS  | \$13,000.00  | \$13,000.00    |
| 623.02   | TRAFFIC SIGNAL UNDERGROUND MODIFICATION AT RAINBOW/TROPICAL | 1        | LS  | \$25,000.00  | \$25,000.00    |
| 623.03   | STREET LIGHT ASSEMBLY AND FOUNDATION (250W)                 | 1        | EA  | \$2,100.00   | \$2,100.00     |
| 623.04   | 2-INCH PVC STREET LIGHT CONDUIT                             | 100      | LF  | \$14.00      | \$1,400.00     |
| 624.01   | TRAFFIC CONTROL & MAINTENANCE                               | 1        | LS  | \$100,000.00 | \$100,000.00   |
| 625.01   | PORTABLE CHANGEABLE MESSAGE SIGN                            | 0        | DAY | \$60.00      | \$0.00         |
| 625.02   | ARROW DISPLAY                                               | 0        | DAY | \$30.00      | \$0.00         |
| 627.01   | PERMANENT SIGN (POLE MOUNTED)                               | 1        | EA  | \$150.00     | \$150.00       |
| 627.02   | PERMANENT SIGN (GROUND MOUNTED)                             | 14       | EA  | \$200.00     | \$2,800.00     |
| 628.01   | PAINT (6-INCH SOLID WHITE LINE)                             | 2,175    | LF  | \$1.00       | \$2,175.00     |
| 628.02   | REFLECTIVE YELLOW MEDIAN PAINT                              | 475      | SF  | \$1.00       | \$475.00       |
| 628.03   | TYPE 2 FILM "ARROW"                                         | 9        | EA  | \$150.00     | \$1,350.00     |
| 628.04   | TYPE 2 FILM "ONLY"                                          | 5        | EA  | \$150.00     | \$750.00       |



# **FIGURE A-7**



Testhole Data Summary

Date: 1/13/2011  
Project Number: NVU1004-009  
Project Name: Rainbow Boulevard

| ANRB<br>Plans # | TH # | Location                             | Date of Excavation | Utility Owner                   | Utility Size     | Utility Size  | Utility<br>Description | Pipe<br>Thickness (in) | Coordinates |         | Stationing |        | Ground Elevation | Top Elevation | Bottom Invert<br>Elevation | Center of Pipe | Difference | Depth of Cover | Comments                                                           |
|-----------------|------|--------------------------------------|--------------------|---------------------------------|------------------|---------------|------------------------|------------------------|-------------|---------|------------|--------|------------------|---------------|----------------------------|----------------|------------|----------------|--------------------------------------------------------------------|
|                 |      |                                      |                    |                                 |                  |               |                        |                        | Northing    | Easting | Stationing | Offset |                  |               |                            |                |            |                |                                                                    |
| 1               | 3    | El Campo Grande & Rainbow Boulevard  | 1/6/2011           | Southwest Gas                   | 4"               | 4.00 in       | PE                     | 0.25 in                | None        | None    | None       | None   | 2326.08          | 2321.38       | 2321.02                    | 2321.19        | 0.17       | 4.70           |                                                                    |
| 2               | 4    | El Campo Grande & Rainbow Boulevard  | 1/6/2011           | Southwest Gas                   | 4"               | 4.00 in       | PE                     | 0.25 in                | None        | None    | None       | None   | 2326.71          | 2323.31       | 2322.95                    | 2323.12        | 0.17       | 3.40           |                                                                    |
| 3               | 5    | El Campo Grande & Rainbow Boulevard  | 1/6/2011           | Las Vegas Valley Water District | 36"              | 36.00 in      | RCP                    | 4.00 in                | None        | None    | None       | None   | 2326.40          | 2319.50       | 2316.17                    | 2317.67        | 1.50       | 6.90           |                                                                    |
| 4               | 6    | El Campo Grande & Rainbow Boulevard  | 1/6/2011           | City of Las Vegas               | 12"              | 12.00 in      | PVC                    | 0.40 in                | None        | None    | None       | None   | 2326.30          | 2318.10       | -                          | -              | -          | 8.20           | Node 5684, USE DIPPED MANHOLES                                     |
| 5               | 6A   | El Campo Grande & Rainbow Boulevard  | 1/6/2011           | Southwest Gas                   | 4"               | 4.00 in       | PE                     | 0.25 in                | None        | None    | None       | None   | 2326.29          | 2322.99       | 2322.64                    | 2322.80        | 0.17       | 3.30           |                                                                    |
| 6               | 7    | El Campo Grande & Rainbow Boulevard  | 1/6/2011           | Las Vegas Valley Water District | 36"              | 36.00 in      | RCP                    | 4.00 in                | None        | None    | None       | None   | 2326.45          | 2319.75       | 2316.42                    | 2317.92        | 1.50       | 6.70           |                                                                    |
| 7               | 8    | El Campo Grande & Rainbow Boulevard  | 1/6/2011           | Southwest Gas                   | 2"               | 2.00 in       | PE                     | 0.22 in                | None        | None    | None       | None   | 2326.23          | 2322.83       | 2322.65                    | 2322.73        | 0.08       | 3.40           |                                                                    |
| 8               | 9    | El Campo Grande & Rainbow Boulevard  | 1/6/2011           | Southwest Gas                   | 4"               | 4.00 in       | PE                     | 0.25 in                | None        | None    | None       | None   | 2326.53          | 2323.23       | 2322.87                    | 2323.04        | 0.17       | 3.30           |                                                                    |
| 9               | 10   | El Campo Grande & Rainbow Boulevard  | 1/6/2011           | Las Vegas Valley Water District | 36"              | 36.00 in      | RCP                    | 4.00 in                | None        | None    | None       | None   | 2326.41          | 2319.81       | 2316.48                    | 2317.98        | 1.50       | 6.60           |                                                                    |
| 10              | 11   | Ambiance Lane & Rainbow Boulevard    | 1/10/2011          | Las Vegas Valley Water District | 8"               | 8.00 in       | PVC                    | 0.32 in                | None        | None    | None       | None   | 2328.43          | 2319.73       | 2319.03                    | 2319.37        | 0.33       | 8.70           |                                                                    |
| 11              | 12   | Ambiance Lane & Rainbow Boulevard    | 1/10/2011          | Southwest Gas                   | 2"               | 2.00 in       | PE                     | 0.22 in                | None        | None    | None       | None   | 2328.95          | 2325.15       | 2324.97                    | 2325.05        | 0.08       | 3.80           |                                                                    |
| 12              | 13   | Tropical Parkway & Rainbow Boulevard | 1/10/2011          | Las Vegas Valley Water District | 36"              | 36.00 in      | RCP                    | 4.00 in                | None        | None    | None       | None   | 2330.17          | 2322.87       | 2319.53                    | 2321.03        | 1.50       | 7.30           |                                                                    |
| 13              | 14   | Tropical Parkway & Rainbow Boulevard | 1/7/2011           | Southwest Gas                   | 4"               | 4.00 in       | PE                     | 0.25 in                | None        | None    | None       | None   | 2330.60          | 2326.80       | 2326.45                    | 2326.62        | 0.17       | 3.80           |                                                                    |
| 14              | 14A  | Tropical Parkway & Rainbow Boulevard | 1/7/2011           | Nevada Energy                   | Four 3" & Six 4" | SEE WORKSHEET | PVC                    | 0.34 in                | None        | None    | None       | None   | 2330.61          | 2327.60       | SEE WORKSHEET              | -              | -          | 3.01           | FOR PLAN, THE BOTTOM OF TWO BANKS USE AS INV 8" Wide               |
| 15              | 14B  | Tropical Parkway & Rainbow Boulevard | 1/7/2011           | Cox Communications              | Two 2"           | 2.00 in       | PVC                    | 0.20 in                | None        | None    | None       | None   | 2330.62          | 2327.82       | 2327.63                    | 2327.72        | 0.08       | 2.80           |                                                                    |
| 16              | 15   | Tropical Parkway & Rainbow Boulevard | 1/7/2011           | Southwest Gas                   | 4"               | 4.00 in       | PE                     | 0.25 in                | None        | None    | None       | None   | 2330.76          | 2326.91       | 2326.55                    | 2326.72        | 0.17       | 3.85           |                                                                    |
| 17              | 16   | Tropical Parkway & Rainbow Boulevard | 1/7/2011           | Nevada Energy                   | Four 3" & Six 4" | SEE WORKSHEET | PVC                    | 0.25 in                | None        | None    | None       | None   | 2330.56          | 2327.45       | SEE WORKSHEET              | -              | -          | 3.11           | FOR PLAN, THE BOTTOM OF TWO BANKS USE AS INV 8" Wide               |
| 18              | 16A  | Tropical Parkway & Rainbow Boulevard | 1/7/2011           | Cox Communications              | Two 2"           | 2.00 in       | PVC                    | 0.20 in                | None        | None    | None       | None   | 2330.55          | 2327.65       | 2327.47                    | 2327.55        | 0.08       | 2.90           |                                                                    |
| 19              | 17   | Tropical Parkway & Rainbow Boulevard | 1/7/2011           | Las Vegas Valley Water District | 18"              | 12.00 in      | PVC                    | 0.40 in                | None        | None    | None       | None   | 2330.73          | 2326.43       | 2325.40                    | 2325.90        | 0.50       | 4.30           | 12" IN PLANS, KEPT AS 12 IN PLANS-aztec had 18" shown - 12" calc'd |
| 20              | 18   | Tropical Parkway & Rainbow Boulevard | 1/7/2011           | Southwest Gas                   | 4"               | 4.00 in       | PE                     | 0.25 in                | None        | None    | None       | None   | 2330.71          | 2327.01       | 2326.65                    | 2326.82        | 0.17       | 3.70           |                                                                    |
| 21              | 19   | Tropical Parkway & Rainbow Boulevard | 1/7/2011           | Southwest Gas                   | 4"               | 4.00 in       | PE                     | 0.25 in                | None        | None    | None       | None   | 2329.83          | 2326.63       | 2326.28                    | 2326.45        | 0.17       | 3.20           |                                                                    |
| 22              | 20   | Tropical Parkway & Rainbow Boulevard | 1/7/2011           | City of North Las Vegas         | 18"              | 18.00 in      | RCP                    | 2.50 in                | None        | None    | None       | None   | 2321.91          | 2319.61       | 2317.90                    | 2318.65        | 0.75       | 2.30           | Do not need, we are refiguring storm drain                         |
| 23              | 21   | Tropical Parkway & Rainbow Boulevard | 1/10/2011          | Las Vegas Valley Water District | 36"              | 36.00 in      | RCP                    | 4.00 in                | None        | None    | None       | None   | 2330.82          | 2323.62       | 2320.28                    | 2321.78        | 1.50       | 7.20           |                                                                    |
| 24              | 22   | El Campo Grande & Rainbow Boulevard  | 1/10/2011          | Cox Communications              | 2"               | 2.00 in       | PVC                    | 0.22 in                | None        | None    | None       | None   | 2326.23          | 2325.03       | 2324.85                    | 2324.93        | 0.08       | 1.20           |                                                                    |

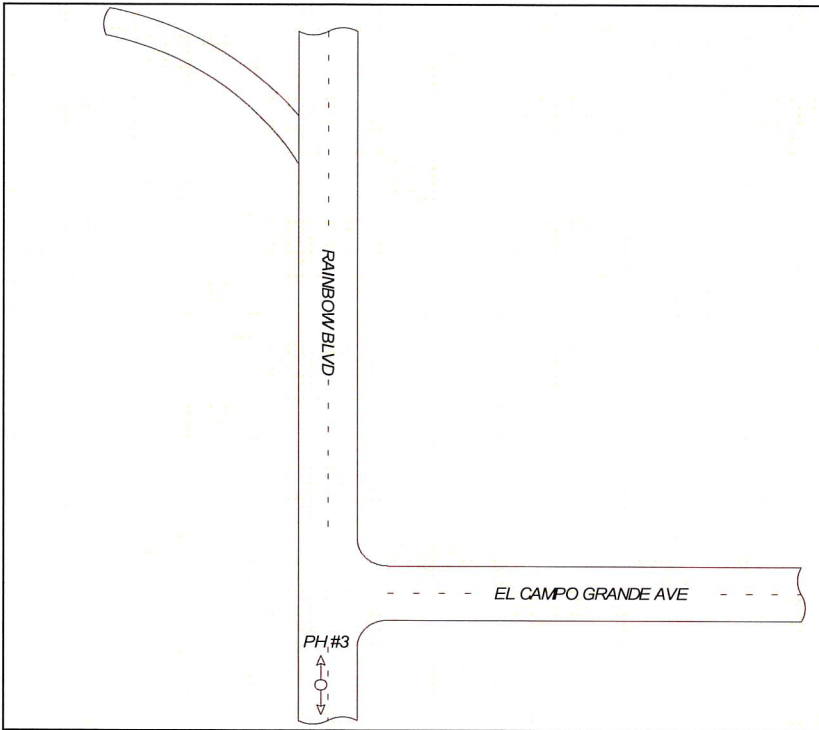
FIGURE A-7



# TEST HOLE DATA REPORT

|                                                                                                     |                                                |                                                                                                                               |          |                        |
|-----------------------------------------------------------------------------------------------------|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|----------|------------------------|
| Test Hole #                                                                                         | <u>3</u>                                       | <br><small>www.aztec.us TYPESA group</small> | SUE Crew | <u>J. Martinez</u>     |
| Date Dug                                                                                            | <u>1/6/2011</u>                                |                                                                                                                               | Truck #  | <u>9247</u>            |
| Project #                                                                                           | <u>NVU1004-009</u>                             |                                                                                                                               | City     | <u>North Las Vegas</u> |
| Phase #                                                                                             | <u>009</u>                                     |                                                                                                                               | County   | <u>Clark</u>           |
| Location                                                                                            | <u>El Campo Grande &amp; Rainbow Boulevard</u> |                                                                                                                               |          |                        |
| 3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129<br>Tel. (702) 396-3426 Fax. (702) 396-3758 |                                                |                                                                                                                               |          |                        |

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

|              |  |                   |                |                       |
|--------------|--|-------------------|----------------|-----------------------|
|              |  | FACING            | <u>North</u>   |                       |
|              |  | SURFACE ELEVATION | <u>2326.08</u> |                       |
|              |  | TOP ELEVATION     | <u>2321.38</u> | 4.70 TOP DEPTH (FEET) |
|              |  | BOTTOM ELEVATION  | <u>2321.00</u> | 5.08 BOTTOM (FEET)    |
| RIBBON COLOR |  | <u>Yellow</u>     |                |                       |

|                       |             |                |                      |
|-----------------------|-------------|----------------|----------------------|
| COORDINATES: NORTHING | <u>None</u> | EASTING        | <u>None</u>          |
| STATIONING: STATION   | <u>None</u> | OFFSET         | <u>None</u>          |
| PAVING THICKNESS      | <u>5"</u>   | PAVING TYPE    | <u>Asphalt</u>       |
| SIZE                  | <u>4"</u>   | TYPE           | <u>PE</u>            |
|                       |             | SOIL CONDITION | <u>Dirt</u>          |
|                       |             | FACILITY OWNER | <u>Southwest Gas</u> |

COMMENTS:

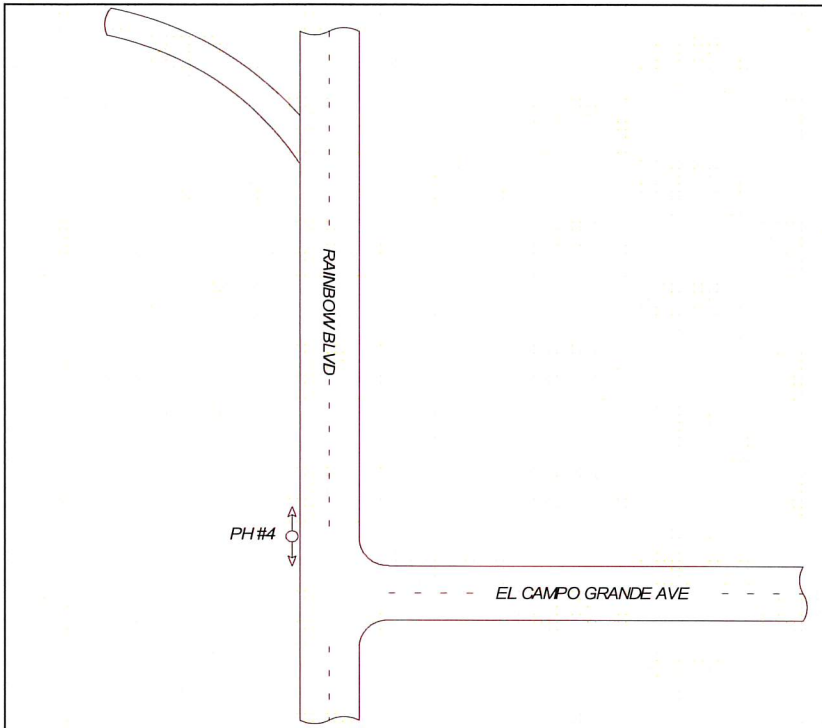
PREPARED BY: M. Huber

CHECKED BY: W. Morales

# TEST HOLE DATA REPORT

|                                                                                                     |                                                |                                                                                                                |          |                        |
|-----------------------------------------------------------------------------------------------------|------------------------------------------------|----------------------------------------------------------------------------------------------------------------|----------|------------------------|
| Test Hole #                                                                                         | <u>4</u>                                       | <br>www.aztec.us TYPESA group | SUE Crew | <u>J. Martinez</u>     |
| Date Dug                                                                                            | <u>1/6/2011</u>                                |                                                                                                                | Truck #  | <u>9247</u>            |
| Project #                                                                                           | <u>NVU1004-009</u>                             |                                                                                                                | City     | <u>North Las Vegas</u> |
| Phase #                                                                                             | <u>009</u>                                     |                                                                                                                | County   | <u>Clark</u>           |
| Location                                                                                            | <u>El Campo Grande &amp; Rainbow Boulevard</u> |                                                                                                                |          |                        |
| 3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129<br>Tel. (702) 396-3426 Fax. (702) 396-3758 |                                                |                                                                                                                |          |                        |

## LOCATION PLAN - NOT TO SCALE



### SITE BENCHMARK

### CROSS SECTION - NOT TO SCALE

|              |                     |                |  |                       |
|--------------|---------------------|----------------|--|-----------------------|
|              | FACING <u>North</u> |                |  |                       |
|              | SURFACE ELEVATION   | <u>2326.71</u> |  |                       |
|              | TOP ELEVATION       | <u>2323.31</u> |  | 3.40 TOP DEPTH (FEET) |
|              | BOTTOM ELEVATION    | <u>2322.93</u> |  | 3.78 BOTTOM (FEET)    |
| RIBBON COLOR |                     | <u>Yellow</u>  |  |                       |

|                       |             |                |                      |
|-----------------------|-------------|----------------|----------------------|
| COORDINATES: NORTHING | <u>None</u> | EASTING        | <u>None</u>          |
| STATIONING: STATION   | <u>None</u> | OFFSET         | <u>None</u>          |
| PAVING THICKNESS      | <u>None</u> | PAVING TYPE    | <u>None</u>          |
| SIZE                  | <u>4"</u>   | TYPE           | <u>PE</u>            |
|                       |             | SOIL CONDITION | <u>Dirt</u>          |
|                       |             | FACILITY OWNER | <u>Southwest Gas</u> |

COMMENTS:

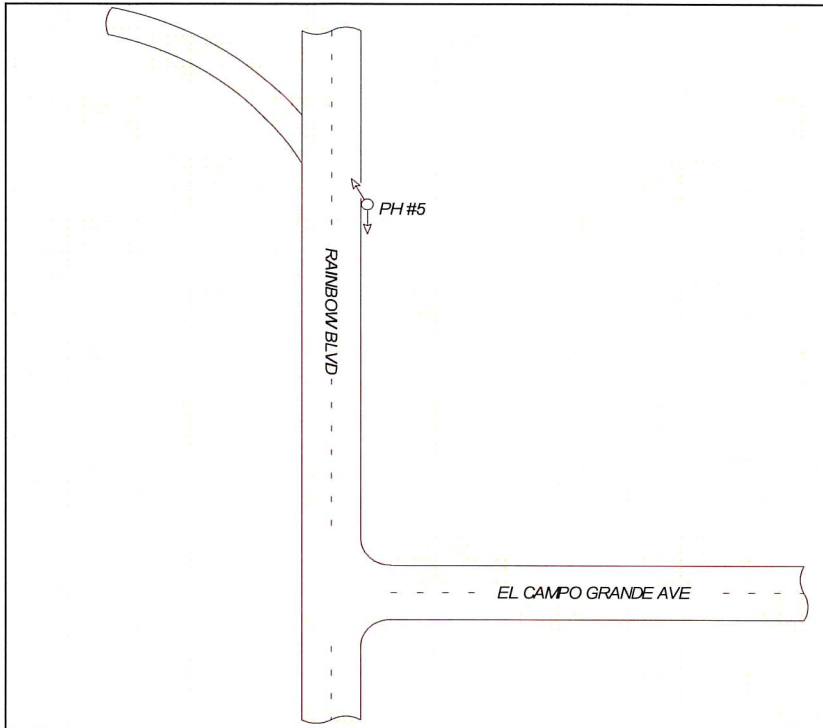
PREPARED BY: M. Huber

CHECKED BY: W. Morales

# TEST HOLE DATA REPORT

|                                                                                                     |                                     |                                                                                                                               |          |                 |
|-----------------------------------------------------------------------------------------------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|----------|-----------------|
| Test Hole #                                                                                         | 5                                   | <br><small>www.aztec.us TYPISA group</small> | SUE Crew | J. Martinez     |
| Date Dug                                                                                            | 1/6/2011                            |                                                                                                                               | Truck #  | 9247            |
| Project #                                                                                           | NVU1004-009                         |                                                                                                                               | City     | North Las Vegas |
| Phase #                                                                                             | 009                                 |                                                                                                                               | County   | Clark           |
| Location                                                                                            | El Campo Grande & Rainbow Boulevard |                                                                                                                               |          |                 |
| 3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129<br>Tel. (702) 396-3426 Fax. (702) 396-3758 |                                     |                                                                                                                               |          |                 |

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

|                          |  |                                                                                                                |                       |
|--------------------------|--|----------------------------------------------------------------------------------------------------------------|-----------------------|
|                          |  | FACING <u>North</u>                                                                                            |                       |
|                          |  | SURFACE ELEVATION <u>2326.40</u>                                                                               |                       |
|                          |  | TOP ELEVATION <u>2319.50</u>                                                                                   | 6.90 TOP DEPTH (FEET) |
|                          |  | BOTTOM ELEVATION <u>2315.83</u>                                                                                | 10.57 BOTTOM (FEET)   |
| RIBBON COLOR <u>Blue</u> |  | WIDTH/O.D. <u>44"</u><br> |                       |

|                       |             |                |                                        |
|-----------------------|-------------|----------------|----------------------------------------|
| COORDINATES: NORTHING | <u>None</u> | EASTING        | <u>None</u>                            |
| STATIONING: STATION   | <u>None</u> | OFFSET         | <u>None</u>                            |
| PAVING THICKNESS      | <u>None</u> | PAVING TYPE    | <u>None</u>                            |
| SIZE                  | <u>36"</u>  | SOIL CONDITION | <u>Dirt</u>                            |
| TYPE                  | <u>RCP</u>  | FACILITY OWNER | <u>Las Vegas Valley Water District</u> |

## COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

# TEST HOLE DATA REPORT



Test Hole # 6

Date Dug 1/6/2011

Project # NVU1004-009

Phase # 009

Location El Campo Grande & Rainbow Boulevard

3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129

Tel. (702) 396-3426 Fax. (702) 396-3758

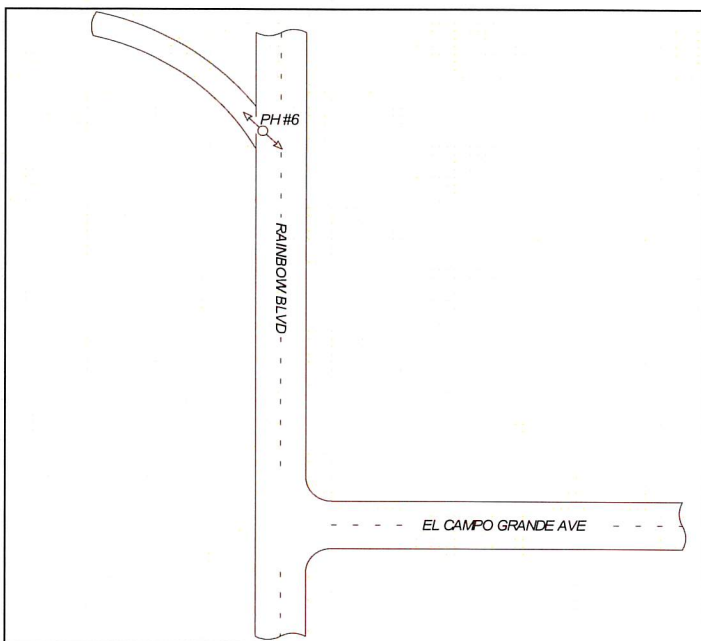
SUE Crew J. Martinez

Truck # 9247

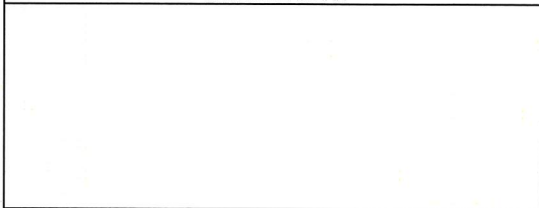
City North Las Vegas

County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK



## CROSS SECTION - NOT TO SCALE

FACING West

|                   |           |            |               |                              |
|-------------------|-----------|------------|---------------|------------------------------|
| SURFACE ELEVATION | <u>NA</u> | WIDTH/O.D. | <u>12.75"</u> |                              |
| TOP ELEVATION     |           |            |               | <u>8.20</u> TOP DEPTH (FEET) |
| BOTTOM ELEVATION  |           |            |               | <u>9.26</u> BOTTOM (FEET)    |

RIBBON COLOR Green

COORDINATES: NORTHING None

EASTING None

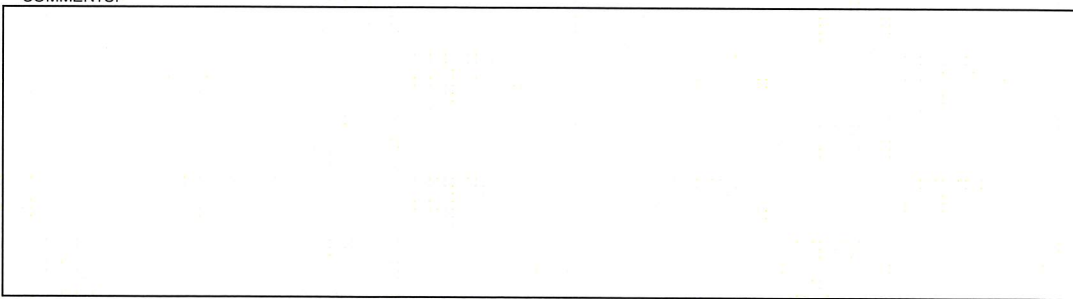
STATIONING: STATION None

OFFSET None

PAVING THICKNESS 5" PAVING TYPE Asphalt SOIL CONDITION Dirt

SIZE 12" TYPE PVC FACILITY OWNER City of Las Vegas

COMMENTS:



PREPARED BY: M. Huber

CHECKED BY: W. Morales



# TEST HOLE DATA REPORT

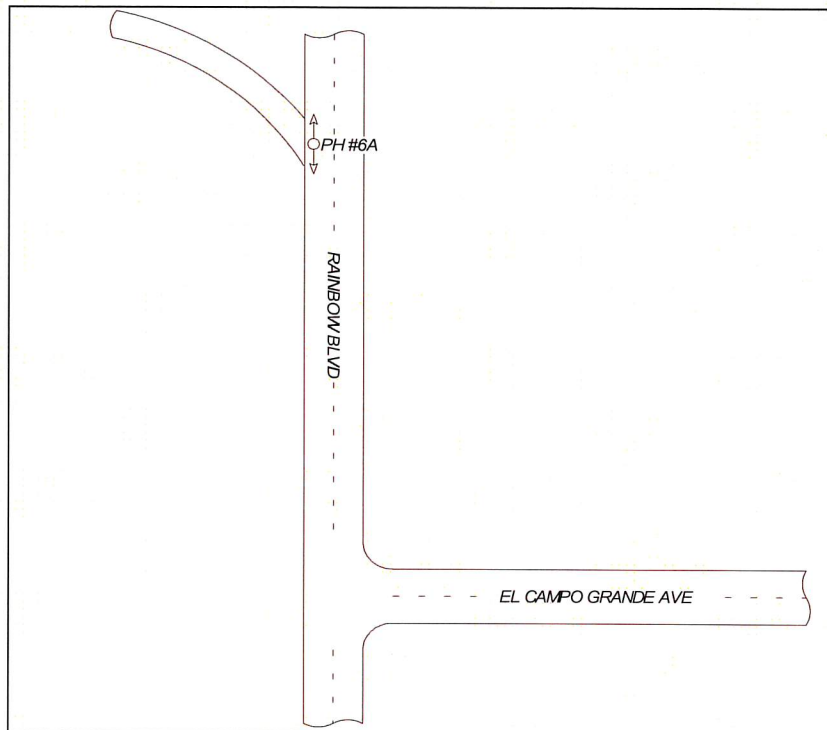
Test Hole # 6A  
 Date Dug 1/6/2011  
 Project # NVU1004-009  
 Phase # 009  
 Location El Campo Grande & Rainbow Boulevard



3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J. Martinez  
 Truck # 9247  
 City North Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

Blank area for site benchmark data.

## CROSS SECTION - NOT TO SCALE

|                     |                |                                                                 |                              |
|---------------------|----------------|-----------------------------------------------------------------|------------------------------|
| FACING <u>North</u> |                |                                                                 |                              |
| SURFACE ELEVATION   | <u>2326.29</u> | <div> <div>WIDTH/O.D.</div> <div>4.5"</div> <div>○</div> </div> |                              |
| TOP ELEVATION       | <u>2322.99</u> |                                                                 | <u>3.30</u> TOP DEPTH (FEET) |
| BOTTOM ELEVATION    | <u>2322.61</u> |                                                                 | <u>3.68</u> BOTTOM (FEET)    |

RIBBON COLOR Yellow

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS 5"

PAVING TYPE Asphalt

SOIL CONDITION Dirt

SIZE 4"

TYPE PE

FACILITY OWNER Southwest Gas

COMMENTS:

Blank area for comments.

PREPARED BY: M. Huber

CHECKED BY: W. Morales

# TEST HOLE DATA REPORT

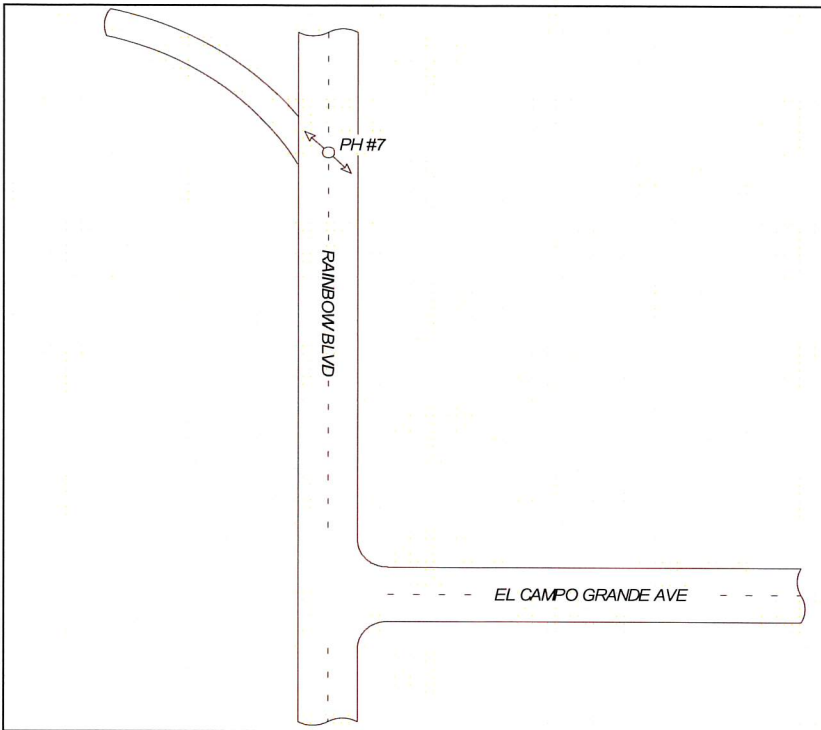
Test Hole # 7  
 Date Dug 1/6/2011  
 Project # NVU1004-009  
 Phase # 009  
 Location El Campo Grande & Rainbow Boulevard



3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J. Martinez  
 Truck # 9247  
 City North Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

RIBBON COLOR Blue

|                                  |                                                                              |
|----------------------------------|------------------------------------------------------------------------------|
| FACING <u>North</u>              |                                                                              |
| SURFACE ELEVATION <u>2326.45</u> | <div style="text-align: center;"> <p>WIDTH/O.D.<br/>44"</p> </div>           |
| TOP ELEVATION <u>2319.75</u>     |                                                                              |
| BOTTOM ELEVATION <u>2316.08</u>  |                                                                              |
|                                  | <div> <div>6.70 TOP DEPTH (FEET)</div> <div>10.37 BOTTOM (FEET)</div> </div> |

COORDINATES: NORTHING None EASTING None  
 STATIONING: STATION None OFFSET None  
 PAVING THICKNESS 4" PAVING TYPE Asphalt SOIL CONDITION Dirt  
 SIZE 36" TYPE RCP FACILITY OWNER Las Vegas Valley Water District

## COMMENTS:

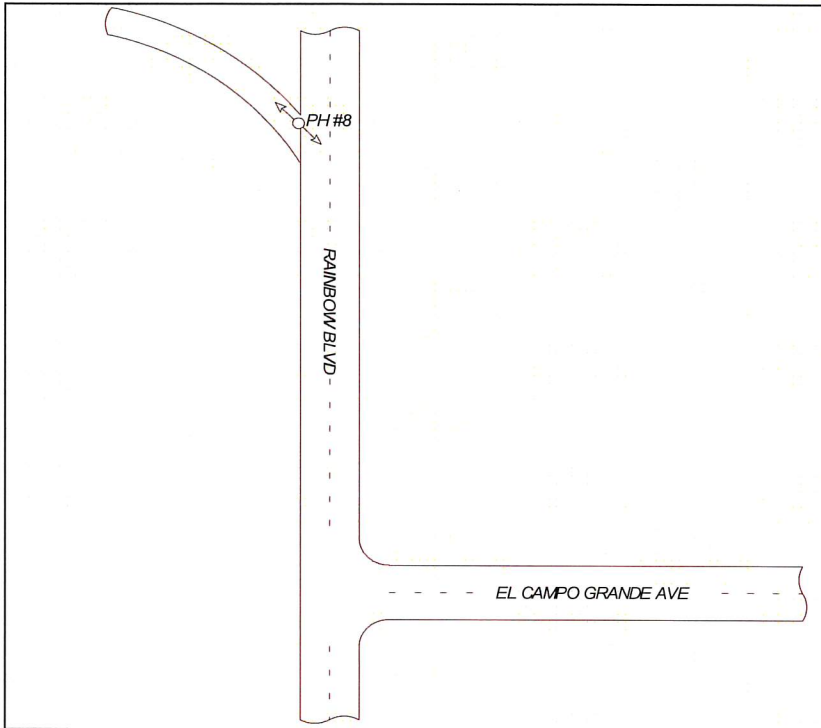
PREPARED BY: M. Huber

CHECKED BY: W. Morales

# TEST HOLE DATA REPORT

|                                                                                                     |                                     |                                                                                                                               |          |                 |
|-----------------------------------------------------------------------------------------------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|----------|-----------------|
| Test Hole #                                                                                         | 8                                   | <br><small>www.aztec.us TYPESA group</small> | SUE Crew | J. Martinez     |
| Date Dug                                                                                            | 1/6/2011                            |                                                                                                                               | Truck #  | 9247            |
| Project #                                                                                           | NVU1004-009                         |                                                                                                                               | City     | North Las Vegas |
| Phase #                                                                                             | 009                                 |                                                                                                                               | County   | Clark           |
| Location                                                                                            | El Campo Grande & Rainbow Boulevard |                                                                                                                               |          |                 |
| 3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129<br>Tel. (702) 396-3426 Fax. (702) 396-3758 |                                     |                                                                                                                               |          |                 |

## LOCATION PLAN - NOT TO SCALE



### SITE BENCHMARK

### CROSS SECTION - NOT TO SCALE

|                            |  |                                  |                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------|--|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                            |  | FACING <u>West</u>               |                                                                                                                                                                                                                                                                                                                                                                          |
|                            |  | SURFACE ELEVATION <u>2326.23</u> | <div style="display: flex; align-items: center; justify-content: center;"> <div style="text-align: center;"> <div style="width: 20px; height: 20px; border: 1px solid black; border-radius: 50%;"></div> <p>WIDTH/O.D.<br/>2.38"</p> </div> <div style="margin: 0 10px;">←</div> <div style="text-align: center;"> <p>3.40</p> <p>TOP DEPTH<br/>(FEET)</p> </div> </div> |
|                            |  | TOP ELEVATION <u>2322.83</u>     |                                                                                                                                                                                                                                                                                                                                                                          |
|                            |  | BOTTOM ELEVATION <u>2322.63</u>  |                                                                                                                                                                                                                                                                                                                                                                          |
| RIBBON COLOR <u>Yellow</u> |  |                                  | 3.60<br>BOTTOM<br>(FEET)                                                                                                                                                                                                                                                                                                                                                 |

|                       |                      |             |                |
|-----------------------|----------------------|-------------|----------------|
| COORDINATES: NORTHING | <u>None</u>          | EASTING     | <u>None</u>    |
| STATIONING: STATION   | <u>None</u>          | OFFSET      | <u>None</u>    |
| PAVING THICKNESS      | <u>3"</u>            | PAVING TYPE | <u>Asphalt</u> |
| SOIL CONDITION        | <u>Dirt</u>          |             |                |
| SIZE                  | <u>2"</u>            | TYPE        | <u>PE</u>      |
| FACILITY OWNER        | <u>Southwest Gas</u> |             |                |

COMMENTS:

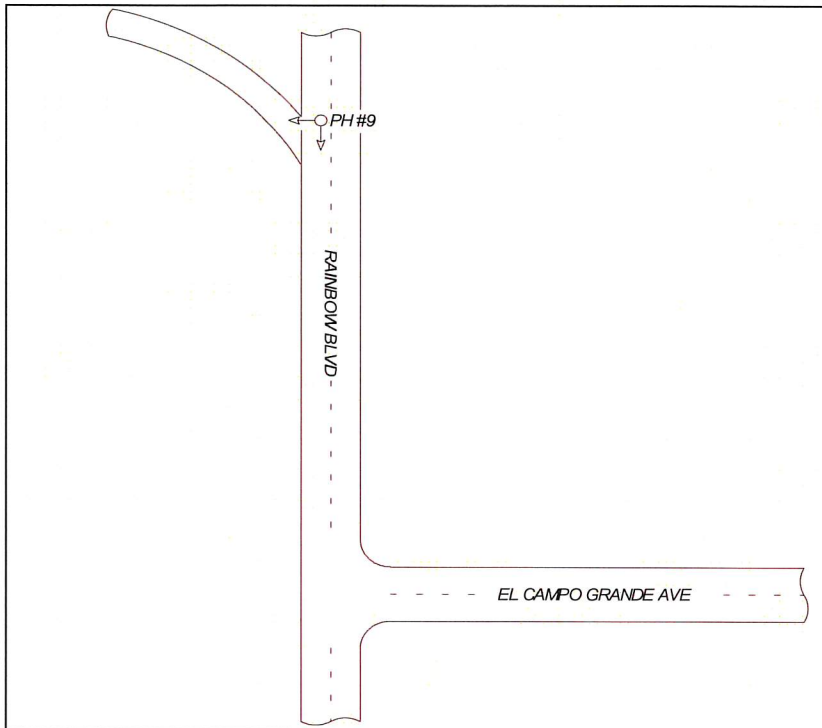
|              |          |             |            |
|--------------|----------|-------------|------------|
| PREPARED BY: | M. Huber | CHECKED BY: | W. Morales |
|--------------|----------|-------------|------------|

FIGURE A-7

# TEST HOLE DATA REPORT

|                                                                                                     |                                     |                                                                                                                |          |                 |
|-----------------------------------------------------------------------------------------------------|-------------------------------------|----------------------------------------------------------------------------------------------------------------|----------|-----------------|
| Test Hole #                                                                                         | 9                                   | <br>www.aztec.us TYPESA group | SUE Crew | J. Martinez     |
| Date Dug                                                                                            | 1/6/2011                            |                                                                                                                | Truck #  | 9247            |
| Project #                                                                                           | NVU1004-009                         |                                                                                                                | City     | North Las Vegas |
| Phase #                                                                                             | 009                                 |                                                                                                                | County   | Clark           |
| Location                                                                                            | El Campo Grande & Rainbow Boulevard |                                                                                                                |          |                 |
| 3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129<br>Tel. (702) 396-3426 Fax. (702) 396-3758 |                                     |                                                                                                                |          |                 |

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

|              |                    |                |                                                                   |                          |
|--------------|--------------------|----------------|-------------------------------------------------------------------|--------------------------|
|              | FACING <u>West</u> |                |                                                                   |                          |
|              | SURFACE ELEVATION  | <u>2326.53</u> | <div><div>←</div><div>WIDTH/O.D.<br/>4.5"</div><div>→</div></div> |                          |
|              | TOP ELEVATION      | <u>2323.23</u> |                                                                   | 3.30 TOP DEPTH<br>(FEET) |
|              | BOTTOM ELEVATION   | <u>2322.85</u> |                                                                   | 3.68 BOTTOM<br>(FEET)    |
| RIBBON COLOR | <u>Yellow</u>      |                |                                                                   |                          |

|                       |                      |             |                |
|-----------------------|----------------------|-------------|----------------|
| COORDINATES: NORTHING | <u>None</u>          | EASTING     | <u>None</u>    |
| STATIONING: STATION   | <u>None</u>          | OFFSET      | <u>None</u>    |
| PAVING THICKNESS      | <u>3"</u>            | PAVING TYPE | <u>Asphalt</u> |
| SOIL CONDITION        | <u>Dirt</u>          |             |                |
| SIZE                  | <u>4"</u>            | TYPE        | <u>PE</u>      |
| FACILITY OWNER        | <u>Southwest Gas</u> |             |                |

## COMMENTS:

PREPARED BY: M. Huber

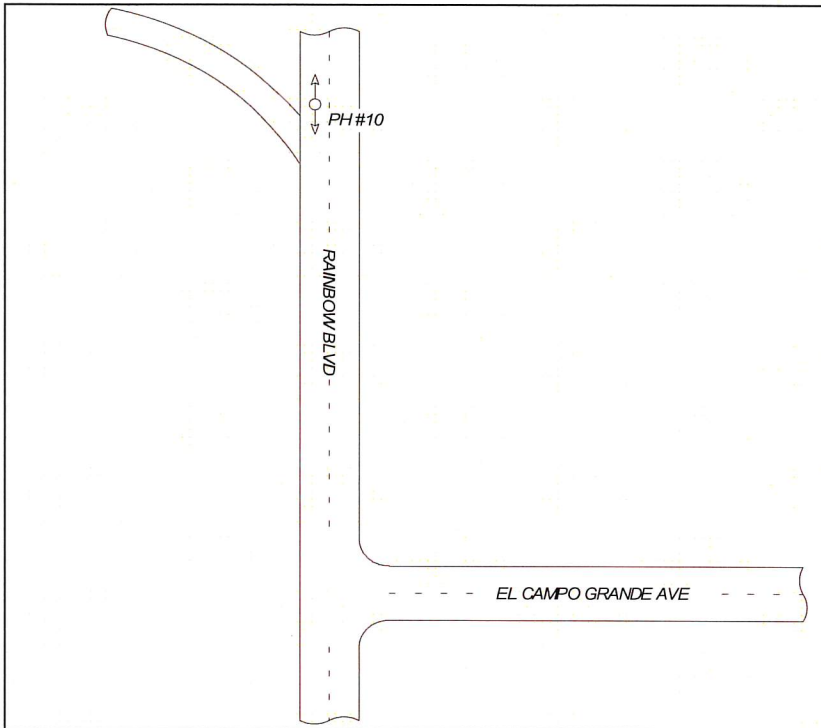
CHECKED BY: W. Morales



# TEST HOLE DATA REPORT

|                                                                                                     |                                     |                                                                                                                               |          |                 |
|-----------------------------------------------------------------------------------------------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|----------|-----------------|
| Test Hole #                                                                                         | 10                                  | <br><small>www.aztec.us TYPESA group</small> | SUE Crew | J. Martinez     |
| Date Dug                                                                                            | 1/6/2011                            |                                                                                                                               | Truck #  | 9247            |
| Project #                                                                                           | NVU1004-009                         |                                                                                                                               | City     | North Las Vegas |
| Phase #                                                                                             | 009                                 |                                                                                                                               | County   | Clark           |
| Location                                                                                            | El Campo Grande & Rainbow Boulevard |                                                                                                                               |          |                 |
| 3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129<br>Tel. (702) 396-3426 Fax. (702) 396-3758 |                                     |                                                                                                                               |          |                 |

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

|              |  |                   |         |                       |
|--------------|--|-------------------|---------|-----------------------|
|              |  | FACING            | North   |                       |
|              |  | SURFACE ELEVATION | 2326.41 |                       |
|              |  | TOP ELEVATION     | 2319.81 | 6.60 TOP DEPTH (FEET) |
|              |  | BOTTOM ELEVATION  | 2316.14 | 10.27 BOTTOM (FEET)   |
| RIBBON COLOR |  | Blue              |         |                       |

|                       |      |                |                                 |
|-----------------------|------|----------------|---------------------------------|
| COORDINATES: NORTHING | None | EASTING        | None                            |
| STATIONING: STATION   | None | OFFSET         | None                            |
| PAVING THICKNESS      | 3"   | PAVING TYPE    | Asphalt                         |
| SIZE                  | 36"  | TYPE           | RCP                             |
|                       |      | SOIL CONDITION | Dirt                            |
|                       |      | FACILITY OWNER | Las Vegas Valley Water District |

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

# TEST HOLE DATA REPORT

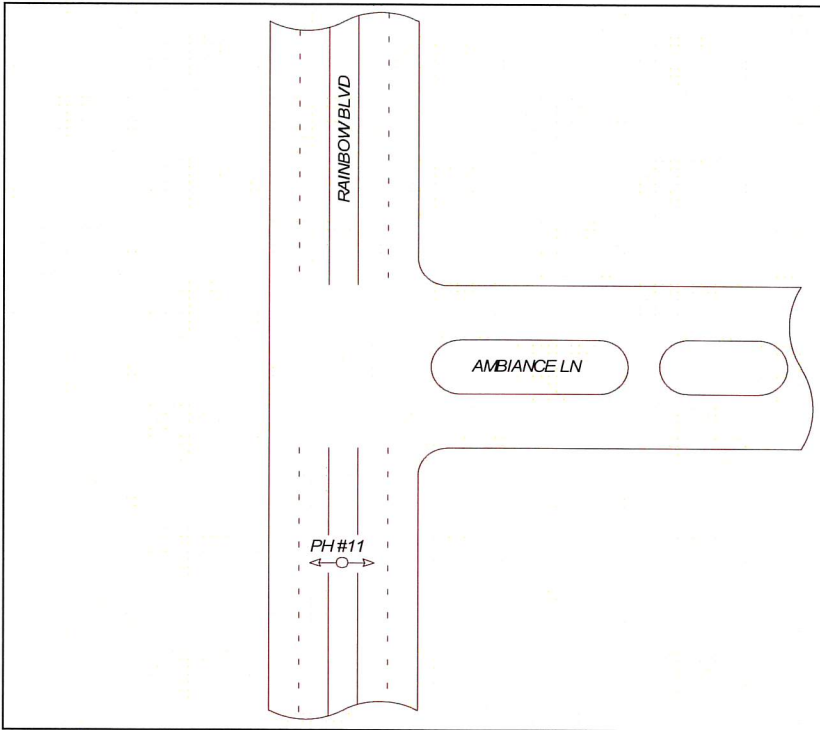
Test Hole # 11  
 Date Dug 1/10/2011  
 Project # NVU1004-009  
 Phase # 009  
 Location Ambiance Lane & Rainbow Boulevard



3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J. Martinez  
 Truck # 9247  
 City North Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

Site benchmark area for notes or drawings.

|                                  |                                              |
|----------------------------------|----------------------------------------------|
| FACING <u>West</u>               |                                              |
| SURFACE ELEVATION <u>2328.43</u> | <div> <div>WIDTH/O.D.<br/>8.63"</div> </div> |
| TOP ELEVATION <u>2319.73</u>     |                                              |
| BOTTOM ELEVATION <u>2319.01</u>  |                                              |
|                                  | 8.70 TOP DEPTH (FEET)                        |
|                                  | 9.42 BOTTOM (FEET)                           |

RIBBON COLOR Blue

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS 4" PAVING TYPE Asphalt SOIL CONDITION Dirt

SIZE 8" TYPE PVC FACILITY OWNER Las Vegas Valley Water District

COMMENTS:

Large area for handwritten or typed comments.

PREPARED BY: M. Huber

CHECKED BY: W. Morales

# TEST HOLE DATA REPORT

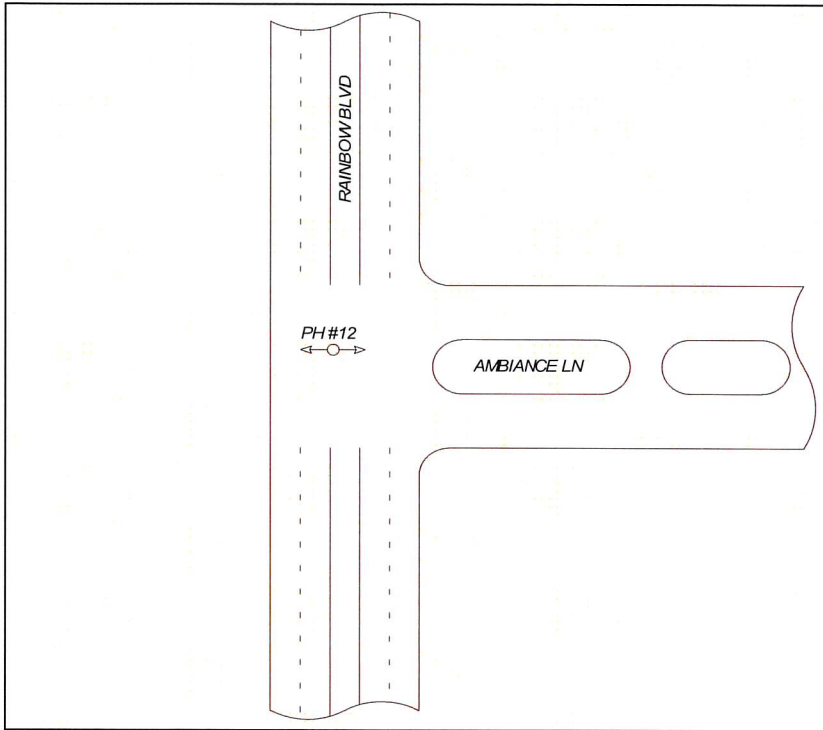
Test Hole # 12  
 Date Dug 1/10/2011  
 Project # NVU1004-009  
 Phase # 009  
 Location Ambiance Lane & Rainbow Boulevard



3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J. Martinez  
 Truck # 9247  
 City North Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

Blank area for site benchmark data.

## CROSS SECTION - NOT TO SCALE

|                    |                |                                                           |                       |
|--------------------|----------------|-----------------------------------------------------------|-----------------------|
| FACING <u>West</u> |                |                                                           |                       |
| SURFACE ELEVATION  | <u>2328.95</u> | <div> <div>WIDTH/O.D.<br/>2.38"</div> <div>○</div> </div> |                       |
| TOP ELEVATION      | <u>2325.15</u> |                                                           | 3.80 TOP DEPTH (FEET) |
| BOTTOM ELEVATION   | <u>2324.95</u> |                                                           | 4.00 BOTTOM (FEET)    |

RIBBON COLOR Yellow

COORDINATES: NORTHING None EASTING None  
 STATIONING: STATION None OFFSET None  
 PAVING THICKNESS 4" PAVING TYPE Asphalt SOIL CONDITION Dirt  
 SIZE 2" TYPE PE FACILITY OWNER Southwest Gas

COMMENTS:

Blank area for comments.

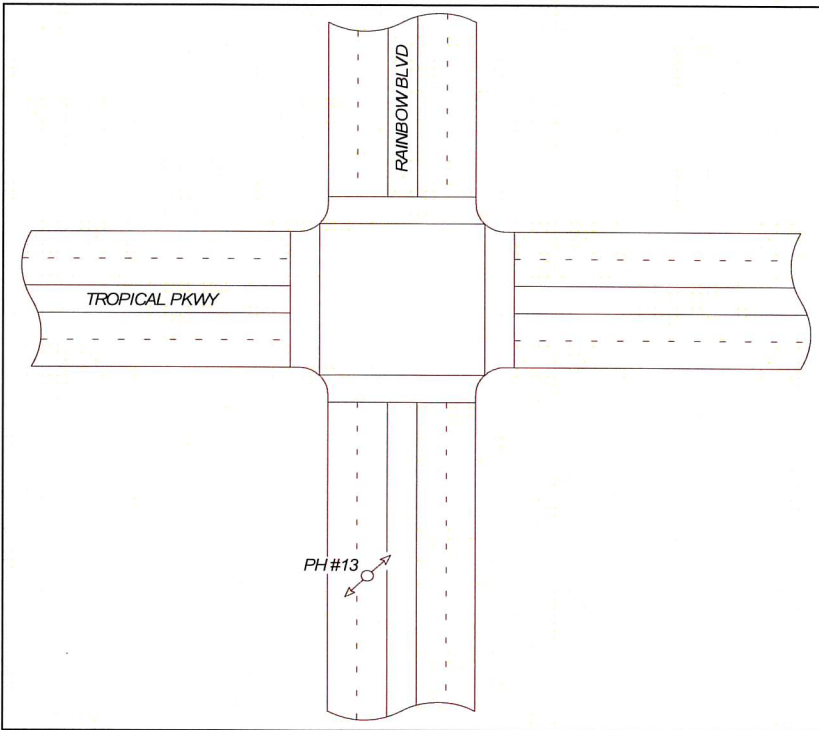
PREPARED BY: M. Huber

CHECKED BY: W. Morales

# TEST HOLE DATA REPORT

|                                                                                                     |                                      |                                                                                                                               |          |                 |
|-----------------------------------------------------------------------------------------------------|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|----------|-----------------|
| Test Hole #                                                                                         | 13                                   | <br><small>www.aztec.us TYPESA group</small> | SUE Crew | J. Martinez     |
| Date Dug                                                                                            | 1/10/2011                            |                                                                                                                               | Truck #  | 9247            |
| Project #                                                                                           | NVU1004-009                          |                                                                                                                               | City     | North Las Vegas |
| Phase #                                                                                             | 009                                  |                                                                                                                               | County   | Clark           |
| Location                                                                                            | Tropical Parkway & Rainbow Boulevard |                                                                                                                               |          |                 |
| 3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129<br>Tel. (702) 396-3426 Fax. (702) 396-3758 |                                      |                                                                                                                               |          |                 |

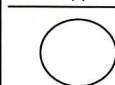
## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

|  |  |
|--|--|
|  |  |
|--|--|

## CROSS SECTION - NOT TO SCALE

|                   |         |                                                                                       |                       |
|-------------------|---------|---------------------------------------------------------------------------------------|-----------------------|
| FACING            |         | North                                                                                 |                       |
| SURFACE ELEVATION | 2330.17 |  |                       |
| TOP ELEVATION     | 2322.87 |                                                                                       | 7.30 TOP DEPTH (FEET) |
| BOTTOM ELEVATION  | 2319.20 |                                                                                       | 10.97 BOTTOM (FEET)   |

RIBBON COLOR Blue

|                       |             |                |                                        |
|-----------------------|-------------|----------------|----------------------------------------|
| COORDINATES: NORTHING | <u>None</u> | EASTING        | <u>None</u>                            |
| STATIONING: STATION   | <u>None</u> | OFFSET         | <u>None</u>                            |
| PAVING THICKNESS      | <u>4"</u>   | PAVING TYPE    | <u>Asphalt</u>                         |
| SIZE                  | <u>36"</u>  | TYPE           | <u>RCP</u>                             |
|                       |             | SOIL CONDITION | <u>Dirt</u>                            |
|                       |             | FACILITY OWNER | <u>Las Vegas Valley Water District</u> |

COMMENTS:

|  |
|--|
|  |
|--|

PREPARED BY: M. Huber

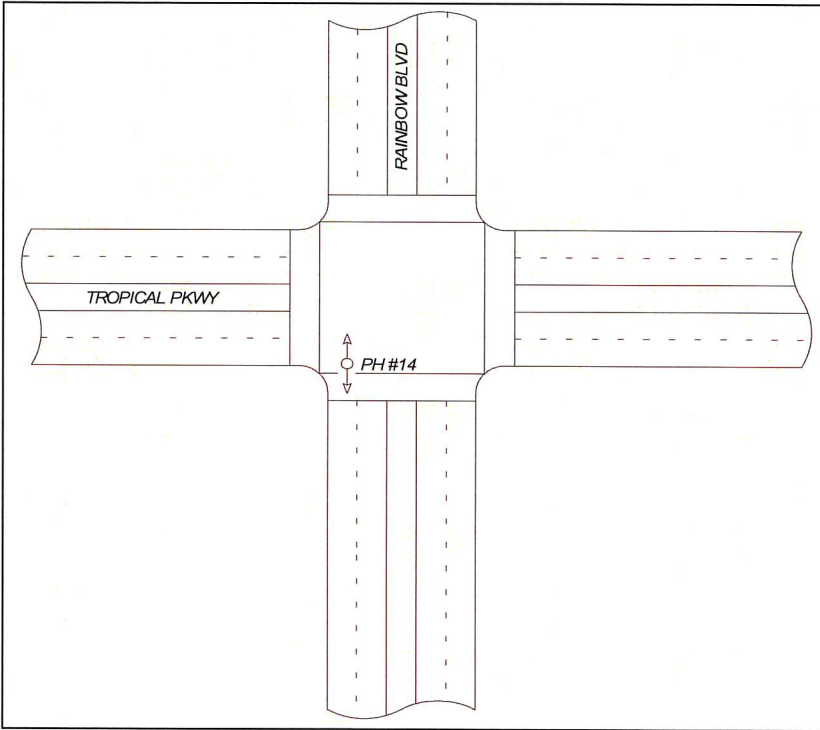
CHECKED BY: W. Morales



# TEST HOLE DATA REPORT

|                                                          |                                      |                                                                                                                               |          |                 |
|----------------------------------------------------------|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|----------|-----------------|
| Test Hole #                                              | 14                                   | <br><small>www.aztec.us TYPESA group</small> | SUE Crew | J. Martinez     |
| Date Dug                                                 | 1/7/2011                             |                                                                                                                               | Truck #  | 9247            |
| Project #                                                | NVU1004-009                          |                                                                                                                               | City     | North Las Vegas |
| Phase #                                                  | 009                                  |                                                                                                                               | County   | Clark           |
| Location                                                 | Tropical Parkway & Rainbow Boulevard |                                                                                                                               |          |                 |
| 3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129 |                                      | Tel. (702) 396-3426 Fax. (702) 396-3758                                                                                       |          |                 |

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

|  |
|--|
|  |
|--|

## CROSS SECTION - NOT TO SCALE

|                     |                |                                                                 |                       |
|---------------------|----------------|-----------------------------------------------------------------|-----------------------|
| FACING <u>North</u> |                |                                                                 |                       |
| SURFACE ELEVATION   | <u>2330.60</u> | <div> <div>WIDTH/O.D.</div> <div>4.5"</div> <div>○</div> </div> |                       |
| TOP ELEVATION       | <u>2326.80</u> |                                                                 | 3.80 TOP DEPTH (FEET) |
| BOTTOM ELEVATION    | <u>2326.42</u> |                                                                 | 4.18 BOTTOM (FEET)    |

RIBBON COLOR Yellow

|                       |             |                |                      |
|-----------------------|-------------|----------------|----------------------|
| COORDINATES: NORTHING | <u>None</u> | EASTING        | <u>None</u>          |
| STATIONING: STATION   | <u>None</u> | OFFSET         | <u>None</u>          |
| PAVING THICKNESS      | <u>4"</u>   | PAVING TYPE    | <u>Asphalt</u>       |
| SIZE                  | <u>4"</u>   | TYPE           | <u>PE</u>            |
|                       |             | SOIL CONDITION | <u>Dirt</u>          |
|                       |             | FACILITY OWNER | <u>Southwest Gas</u> |

COMMENTS:

|  |
|--|
|  |
|--|

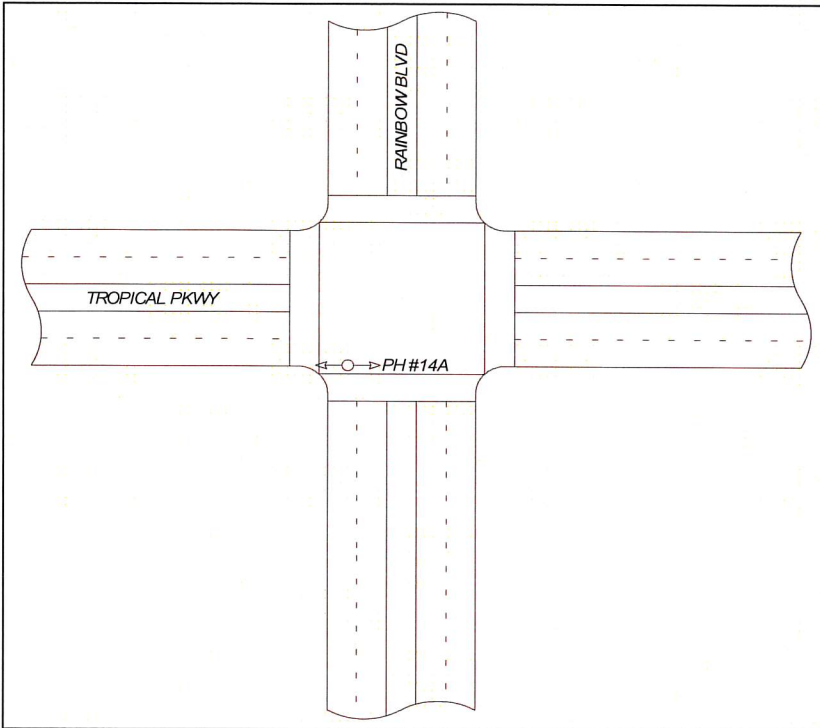
PREPARED BY: M. Huber

CHECKED BY: W. Morales

# TEST HOLE DATA REPORT

|                                                                                                     |                                      |                                                                                                                               |          |                 |
|-----------------------------------------------------------------------------------------------------|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|----------|-----------------|
| Test Hole #                                                                                         | 14A                                  | <br><small>www.aztec.us TYPESA group</small> | SUE Crew | J. Martinez     |
| Date Dug                                                                                            | 1/7/2011                             |                                                                                                                               | Truck #  | 9247            |
| Project #                                                                                           | NVU1004-009                          |                                                                                                                               | City     | North Las Vegas |
| Phase #                                                                                             | 009                                  |                                                                                                                               | County   | Clark           |
| Location                                                                                            | Tropical Parkway & Rainbow Boulevard |                                                                                                                               |          |                 |
| 3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129<br>Tel. (702) 396-3426 Fax. (702) 396-3758 |                                      |                                                                                                                               |          |                 |

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

|  |  |                   |                       |
|--|--|-------------------|-----------------------|
|  |  | FACING            | West                  |
|  |  | SURFACE ELEVATION | 2330.61               |
|  |  | TOP ELEVATION     | 2327.60               |
|  |  | BOTTOM ELEVATION  | 2326.81               |
|  |  | WIDTH/O.D.        | 36"                   |
|  |  |                   | 3.01 TOP DEPTH (FEET) |
|  |  |                   | 3.80 BOTTOM (FEET)    |

|                       |                  |
|-----------------------|------------------|
| RIBBON COLOR          | Red              |
| COORDINATES: NORTHING | None             |
| STATIONING: STATION   | None             |
| PAVING THICKNESS      | 4"               |
| PAVING TYPE           | Asphalt          |
| SOIL CONDITION        | Dirt             |
| SIZE                  | Four 3" & Six 4" |
| TYPE                  | PVC              |
| FACILITY OWNER        | Nevada Energy    |

## COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

FIGURE A-7

# TEST HOLE DATA REPORT

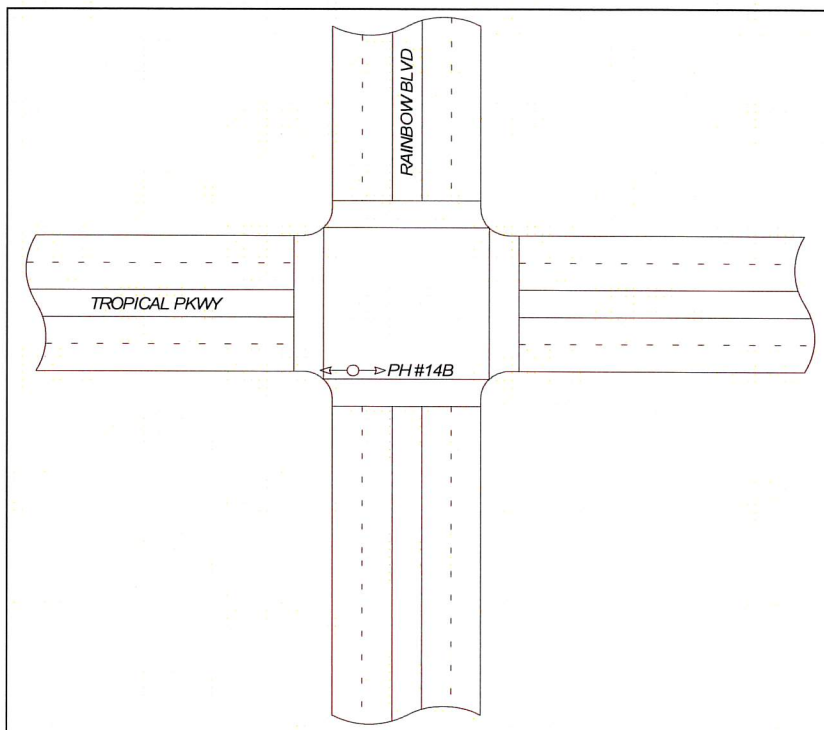
Test Hole # 14B  
 Date Dug 1/7/2011  
 Project # NVU1004-009  
 Phase # 009  
 Location Tropical Parkway & Rainbow Boulevard



3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J. Martinez  
 Truck # 9247  
 City North Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

RIBBON COLOR Orange

## CROSS SECTION - NOT TO SCALE

|                   |                    |                       |
|-------------------|--------------------|-----------------------|
|                   | FACING <u>West</u> |                       |
| SURFACE ELEVATION | <u>2330.62</u>     |                       |
| TOP ELEVATION     | <u>2327.82</u>     | 2.80 TOP DEPTH (FEET) |
| BOTTOM ELEVATION  | <u>2327.62</u>     | 3.00 BOTTOM (FEET)    |

COORDINATES: NORTHING None EASTING None  
 STATIONING: STATION None OFFSET None  
 PAVING THICKNESS 4" PAVING TYPE Asphalt SOIL CONDITION Dirt  
 SIZE Two 2" TYPE PVC FACILITY OWNER Cox Communications

## COMMENTS:

PREPARED BY: M. Huber

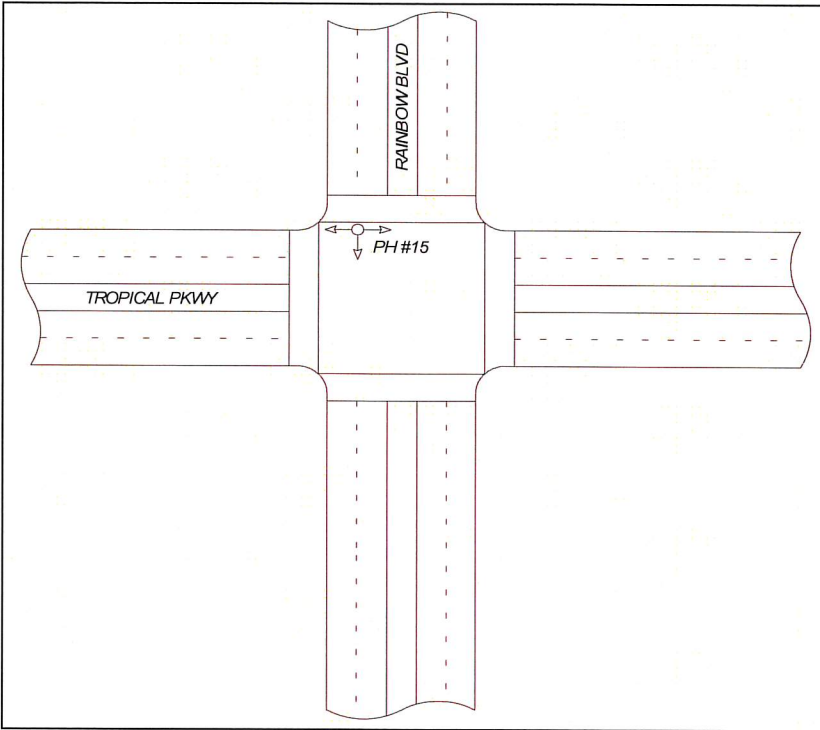
CHECKED BY: W. Morales

# TEST HOLE DATA REPORT

|             |                                      |                                                                                                               |          |                 |
|-------------|--------------------------------------|---------------------------------------------------------------------------------------------------------------|----------|-----------------|
| Test Hole # | 15                                   | <br>www.aztec.us TYP5A group | SUE Crew | J. Martinez     |
| Date Dug    | 1/7/2011                             |                                                                                                               | Truck #  | 9247            |
| Project #   | NVU1004-009                          |                                                                                                               | City     | North Las Vegas |
| Phase #     | 009                                  |                                                                                                               | County   | Clark           |
| Location    | Tropical Parkway & Rainbow Boulevard |                                                                                                               |          |                 |

3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129  
Tel. (702) 396-3426 Fax. (702) 396-3758

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

|              |  |                   |         |                       |
|--------------|--|-------------------|---------|-----------------------|
|              |  | FACING            | North   |                       |
|              |  | SURFACE ELEVATION | 2330.76 |                       |
|              |  | TOP ELEVATION     | 2326.91 | 3.85 TOP DEPTH (FEET) |
|              |  | BOTTOM ELEVATION  | 2326.53 | 4.23 BOTTOM (FEET)    |
| RIBBON COLOR |  | Yellow            |         |                       |

|                       |      |                |               |
|-----------------------|------|----------------|---------------|
| COORDINATES: NORTHING | None | EASTING        | None          |
| STATIONING: STATION   | None | OFFSET         | None          |
| PAVING THICKNESS      | 4"   | PAVING TYPE    | Asphalt       |
| SIZE                  | 4"   | SOIL CONDITION | Dirt          |
| TYPE                  | PE   | FACILITY OWNER | Southwest Gas |

COMMENTS:

PREPARED BY: M. Huber

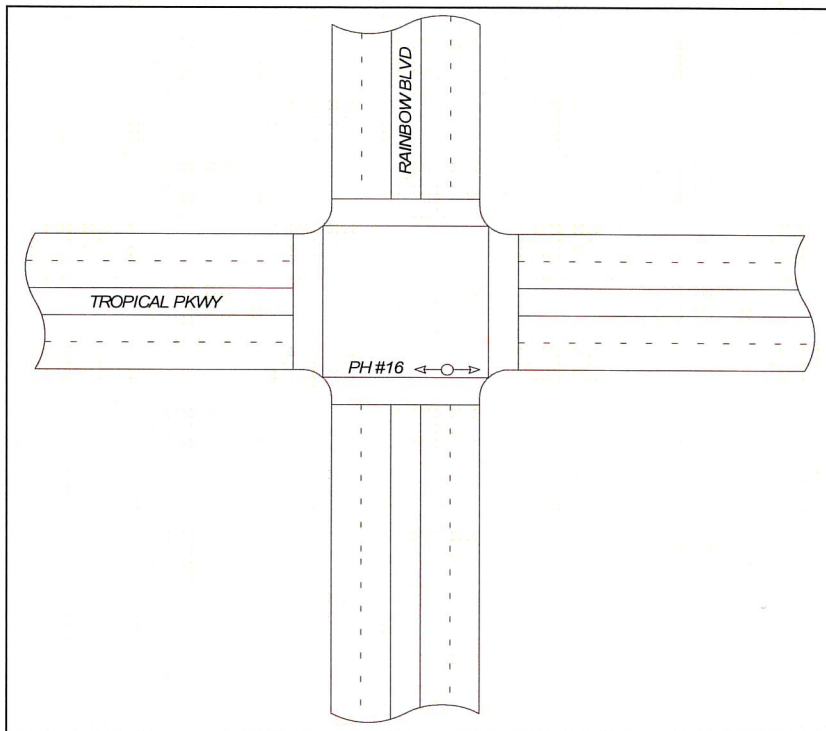
CHECKED BY: W. Morales



# TEST HOLE DATA REPORT

|                                                          |                                      |                                                                                                                |          |                 |
|----------------------------------------------------------|--------------------------------------|----------------------------------------------------------------------------------------------------------------|----------|-----------------|
| Test Hole #                                              | 16                                   | <br>www.aztec.us TYPESA group | SUE Crew | J. Martinez     |
| Date Dug                                                 | 1/7/2011                             |                                                                                                                | Truck #  | 9247            |
| Project #                                                | NVU1004-009                          |                                                                                                                | City     | North Las Vegas |
| Phase #                                                  | 009                                  |                                                                                                                | County   | Clark           |
| Location                                                 | Tropical Parkway & Rainbow Boulevard |                                                                                                                |          |                 |
| 3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129 |                                      | Tel. (702) 396-3426 Fax. (702) 396-3758                                                                        |          |                 |

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

|              |     |                   |                       |
|--------------|-----|-------------------|-----------------------|
|              |     | FACING            | West                  |
|              |     | SURFACE ELEVATION | 2330.56               |
|              |     | TOP ELEVATION     | 2327.45               |
|              |     | BOTTOM ELEVATION  | 2326.76               |
|              |     | WIDTH/O.D.        | 36"                   |
|              |     |                   | 3.11 TOP DEPTH (FEET) |
|              |     |                   | 3.80 BOTTOM (FEET)    |
| RIBBON COLOR | Red |                   |                       |

|                       |                  |                |               |
|-----------------------|------------------|----------------|---------------|
| COORDINATES: NORTHING | None             | EASTING        | None          |
| STATIONING: STATION   | None             | OFFSET         | None          |
| PAVING THICKNESS      | 4"               | PAVING TYPE    | Asphalt       |
| SIZE                  | Four 3" & Six 4" | SOIL CONDITION | Dirt          |
| TYPE                  | PVC              | FACILITY OWNER | Nevada Energy |

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

# TEST HOLE DATA REPORT

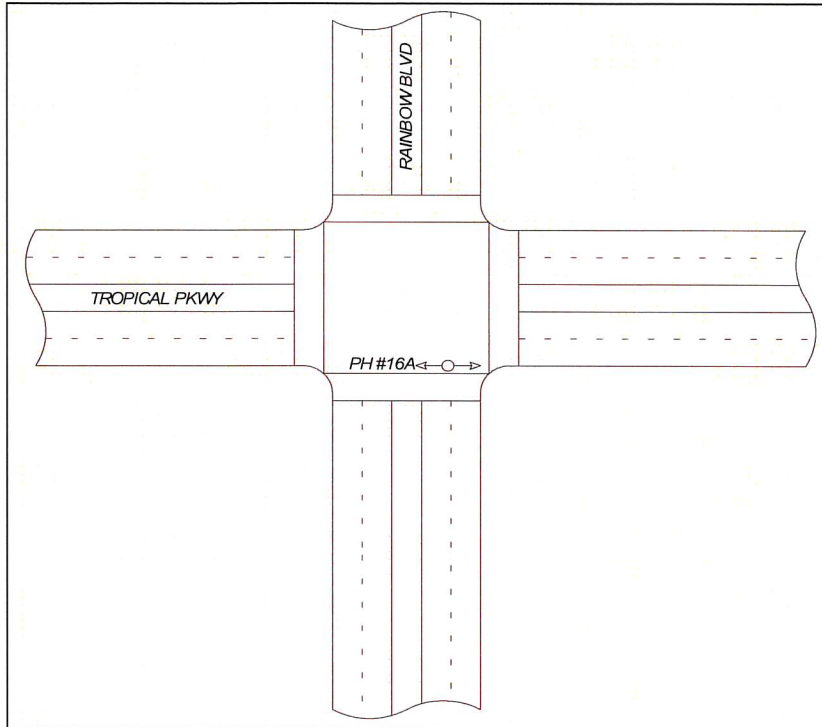
Test Hole # 16A  
 Date Dug 1/7/2011  
 Project # NVU1004-009  
 Phase # 009  
 Location Tropical Parkway & Rainbow Boulevard



3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J. Martinez  
 Truck # 9247  
 City North Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

|                            |  |                                  |                       |
|----------------------------|--|----------------------------------|-----------------------|
|                            |  | FACING <u>West</u>               |                       |
|                            |  | SURFACE ELEVATION <u>2330.55</u> |                       |
|                            |  | TOP ELEVATION <u>2327.65</u>     | 2.90 TOP DEPTH (FEET) |
|                            |  | BOTTOM ELEVATION <u>2327.41</u>  | 3.14 BOTTOM (FEET)    |
| RIBBON COLOR <u>Orange</u> |  | WIDTH/O.D. <u>8"</u>             |                       |

COORDINATES: NORTHING None EASTING None  
 STATIONING: STATION None OFFSET None  
 PAVING THICKNESS 4" PAVING TYPE Asphalt SOIL CONDITION Dirt  
 SIZE Two 2" TYPE PVC FACILITY OWNER Cox Communications

COMMENTS:

PREPARED BY: M. Huber

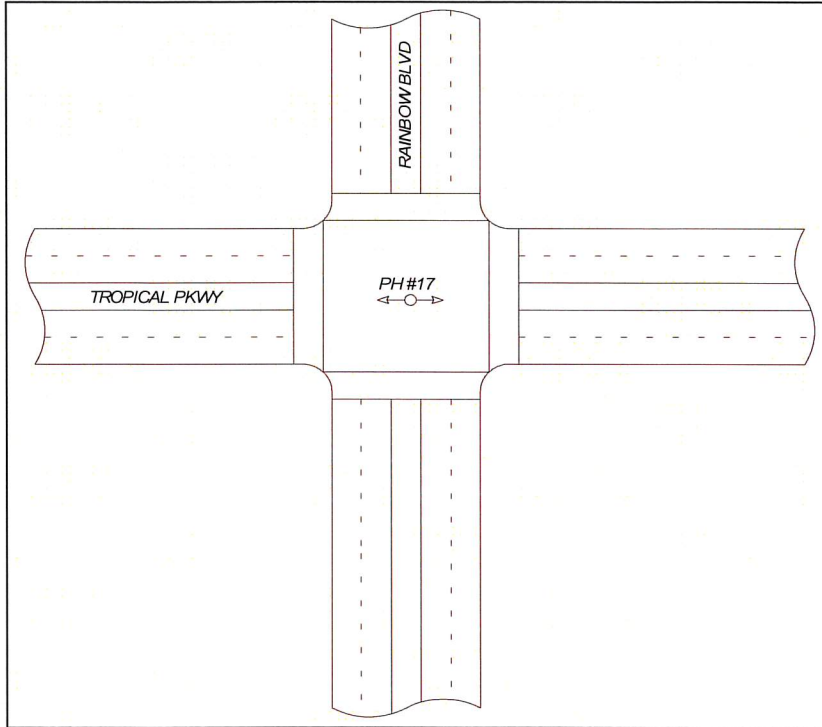
CHECKED BY: W. Morales

FIGURE A-7

# TEST HOLE DATA REPORT

|                                                                                                     |                                      |                                                                                                                               |          |                 |
|-----------------------------------------------------------------------------------------------------|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|----------|-----------------|
| Test Hole #                                                                                         | 17                                   | <br><small>www.aztec.us TYPASA group</small> | SUE Crew | J. Martinez     |
| Date Dug                                                                                            | 1/7/2011                             |                                                                                                                               | Truck #  | 9247            |
| Project #                                                                                           | NVU1004-009                          |                                                                                                                               | City     | North Las Vegas |
| Phase #                                                                                             | 009                                  |                                                                                                                               | County   | Clark           |
| Location                                                                                            | Tropical Parkway & Rainbow Boulevard |                                                                                                                               |          |                 |
| 3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129<br>Tel. (702) 396-3426 Fax. (702) 396-3758 |                                      |                                                                                                                               |          |                 |

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

|              |      |                   |                       |
|--------------|------|-------------------|-----------------------|
|              |      | FACING            | West                  |
|              |      | SURFACE ELEVATION | 2330.73               |
|              |      | TOP ELEVATION     | 2326.43               |
|              |      | BOTTOM ELEVATION  | 2324.93               |
|              |      | WIDTH/O.D.        | 18"                   |
|              |      |                   | 4.30 TOP DEPTH (FEET) |
|              |      |                   | 5.80 BOTTOM (FEET)    |
| RIBBON COLOR | Blue |                   |                       |

|                       |      |                |                                 |
|-----------------------|------|----------------|---------------------------------|
| COORDINATES: NORTHING | None | EASTING        | None                            |
| STATIONING: STATION   | None | OFFSET         | None                            |
| PAVING THICKNESS      | 4"   | PAVING TYPE    | Asphalt                         |
| SIZE                  | 18"  | TYPE           | PVC                             |
|                       |      | SOIL CONDITION | Dirt                            |
|                       |      | FACILITY OWNER | Las Vegas Valley Water District |

## COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

# TEST HOLE DATA REPORT

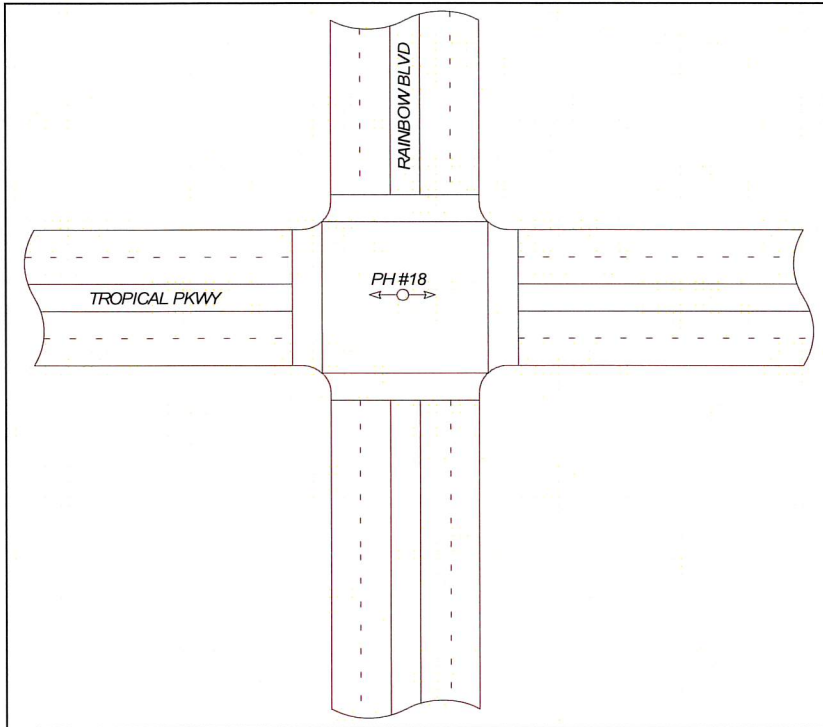
Test Hole # 18  
 Date Dug 1/7/2011  
 Project # NVU1004-009  
 Phase # 009  
 Location Tropical Parkway & Rainbow Boulevard



3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J. Martinez  
 Truck # 9247  
 City North Las Vegas  
 County Clark

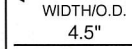
## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

Blank area for site benchmark details.

## CROSS SECTION - NOT TO SCALE

|                   |         |                                                                                       |  |
|-------------------|---------|---------------------------------------------------------------------------------------|--|
| FACING            |         | West                                                                                  |  |
| SURFACE ELEVATION | 2330.71 |  |  |
| TOP ELEVATION     | 2327.01 |                                                                                       |  |
| BOTTOM ELEVATION  | 2326.63 |                                                                                       |  |
|                   |         |                                                                                       |  |

RIBBON COLOR Yellow

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS 4" PAVING TYPE Asphalt SOIL CONDITION Dirt

SIZE 4" TYPE PE FACILITY OWNER Southwest Gas

COMMENTS:

Blank area for comments.

PREPARED BY: M. Huber

CHECKED BY: W. Morales

FIGURE A-7



# TEST HOLE DATA REPORT

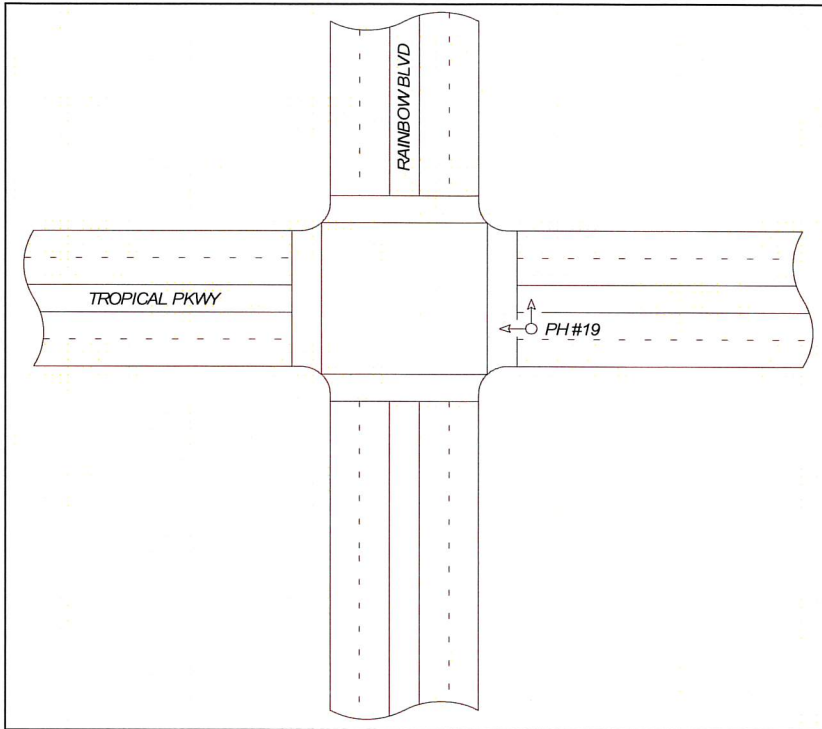
Test Hole # 19  
 Date Dug 1/7/2011  
 Project # NVU1004-009  
 Phase # 009  
 Location Tropical Parkway & Rainbow Boulevard



3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J. Martinez  
 Truck # 9247  
 City North Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

RIBBON COLOR Yellow

|                                  |                        |
|----------------------------------|------------------------|
| FACING <u>North</u>              |                        |
| SURFACE ELEVATION <u>2329.83</u> | WIDTH/O.D. <u>4.5"</u> |
| TOP ELEVATION <u>2326.63</u>     | 3.20 TOP DEPTH (FEET)  |
| BOTTOM ELEVATION <u>2326.25</u>  | 3.58 BOTTOM (FEET)     |

COORDINATES: NORTHING None EASTING None  
 STATIONING: STATION None OFFSET None  
 PAVING THICKNESS 3" PAVING TYPE Asphalt SOIL CONDITION Dirt  
 SIZE 4" TYPE PE FACILITY OWNER Southwest Gas

COMMENTS:

PREPARED BY: M. Huber

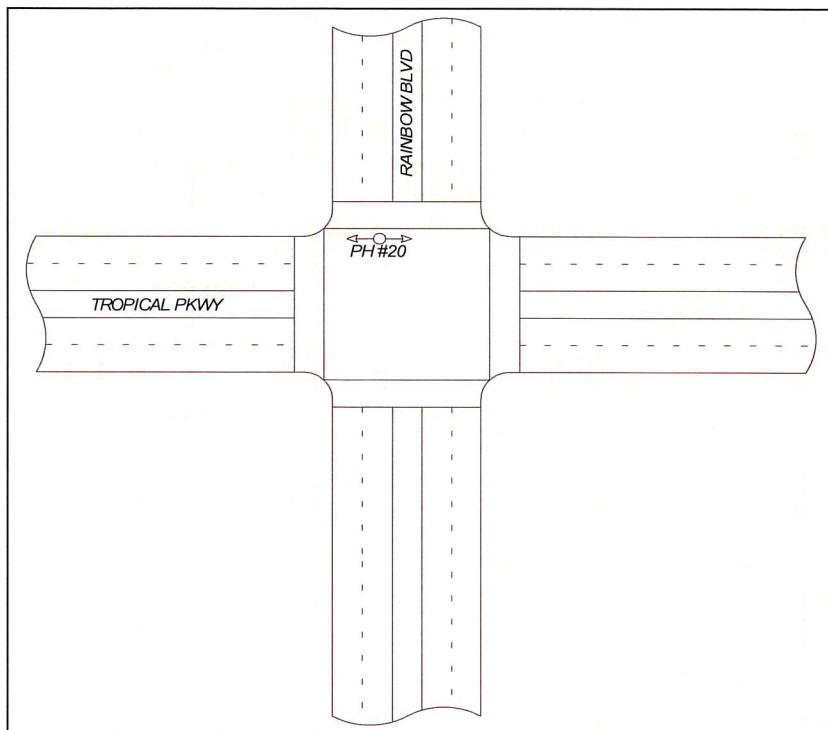
CHECKED BY: W. Morales

FIGURE A-7

# TEST HOLE DATA REPORT

|                                                                                                     |                                      |                                                                                                                               |          |                 |
|-----------------------------------------------------------------------------------------------------|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|----------|-----------------|
| Test Hole #                                                                                         | 20                                   | <br><small>www.aztec.us TYPESA group</small> | SUE Crew | J. Martinez     |
| Date Dug                                                                                            | 1/7/2011                             |                                                                                                                               | Truck #  | 9247            |
| Project #                                                                                           | NVU1004-009                          |                                                                                                                               | City     | North Las Vegas |
| Phase #                                                                                             | 009                                  |                                                                                                                               | County   | Clark           |
| Location                                                                                            | Tropical Parkway & Rainbow Boulevard |                                                                                                                               |          |                 |
| 3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129<br>Tel. (702) 396-3426 Fax. (702) 396-3758 |                                      |                                                                                                                               |          |                 |

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

|                           |  |                                                                                                                |                       |
|---------------------------|--|----------------------------------------------------------------------------------------------------------------|-----------------------|
|                           |  | FACING <u>West</u>                                                                                             |                       |
|                           |  | SURFACE ELEVATION <u>2321.91</u>                                                                               |                       |
|                           |  | TOP ELEVATION <u>2319.61</u>                                                                                   | 2.30 TOP DEPTH (FEET) |
|                           |  | BOTTOM ELEVATION <u>2317.69</u>                                                                                | 4.22 BOTTOM (FEET)    |
| RIBBON COLOR <u>Green</u> |  | WIDTH/O.D. <u>23"</u><br> |                       |

|                       |             |                |                                |
|-----------------------|-------------|----------------|--------------------------------|
| COORDINATES: NORTHING | <u>None</u> | EASTING        | <u>None</u>                    |
| STATIONING: STATION   | <u>None</u> | OFFSET         | <u>None</u>                    |
| PAVING THICKNESS      | <u>4"</u>   | PAVING TYPE    | <u>Asphalt</u>                 |
| SIZE                  | <u>18"</u>  | TYPE           | <u>RCP</u>                     |
|                       |             | SOIL CONDITION | <u>Dirt</u>                    |
|                       |             | FACILITY OWNER | <u>City of North Las Vegas</u> |

## COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

# TEST HOLE DATA REPORT

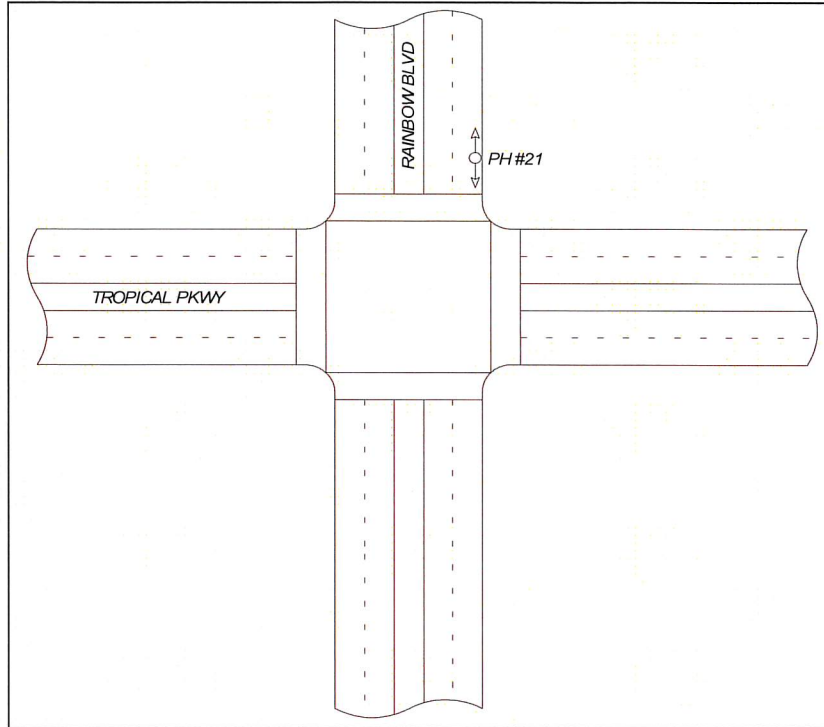
Test Hole # 21  
 Date Dug 1/10/2011  
 Project # NVU1004-009  
 Phase # 009  
 Location Tropical Parkway & Rainbow Boulevard



3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J. Martinez  
 Truck # 9247  
 City North Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

|                          |  |                                  |                       |
|--------------------------|--|----------------------------------|-----------------------|
|                          |  | FACING <u>North</u>              |                       |
|                          |  | SURFACE ELEVATION <u>2330.82</u> |                       |
|                          |  | TOP ELEVATION <u>2323.62</u>     | 7.20 TOP DEPTH (FEET) |
|                          |  | BOTTOM ELEVATION <u>2319.95</u>  | 10.87 BOTTOM (FEET)   |
| RIBBON COLOR <u>Blue</u> |  | WIDTH/O.D. <u>44"</u>            |                       |

COORDINATES: NORTHING None EASTING None  
 STATIONING: STATION None OFFSET None  
 PAVING THICKNESS None PAVING TYPE None SOIL CONDITION Dirt  
 SIZE 36" TYPE RCP FACILITY OWNER Las Vegas Valley Water District

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

# TEST HOLE DATA REPORT

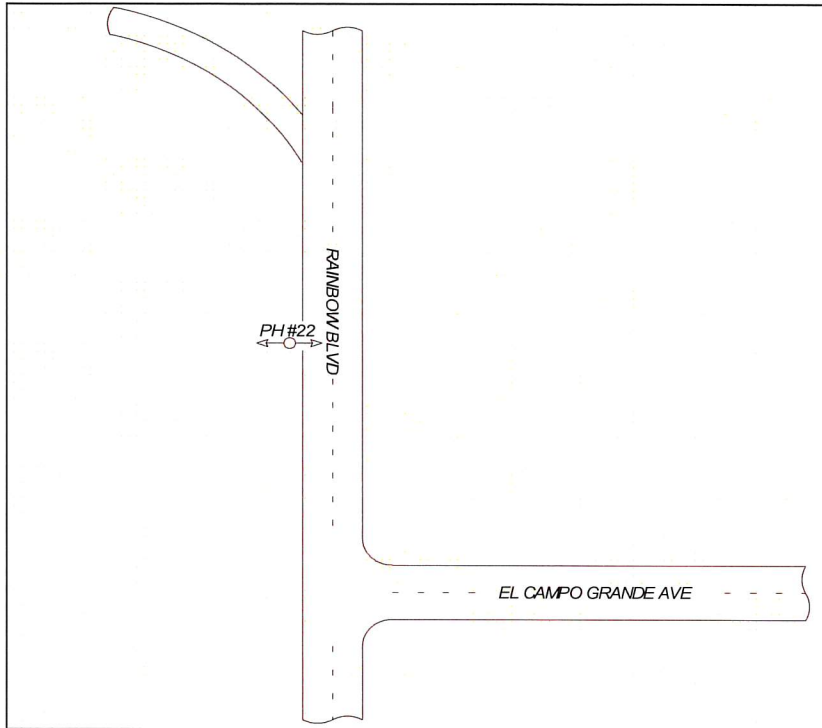
Test Hole # 22  
 Date Dug 1/10/2011  
 Project # NVU1004-009  
 Phase # 009  
 Location El Campo Grande & Rainbow Boulevard



3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J. Martinez  
 Truck # 9247  
 City North Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

Blank area for site benchmark data.

## CROSS SECTION - NOT TO SCALE

|                    |                |                                                           |                              |
|--------------------|----------------|-----------------------------------------------------------|------------------------------|
| FACING <u>West</u> |                |                                                           |                              |
| SURFACE ELEVATION  | <u>2326.23</u> | <div> <div>WIDTH/O.D.<br/>2.38"</div> <div>○</div> </div> |                              |
| TOP ELEVATION      | <u>2325.03</u> |                                                           | <u>1.20</u> TOP DEPTH (FEET) |
| BOTTOM ELEVATION   | <u>2324.83</u> |                                                           | <u>1.40</u> BOTTOM (FEET)    |

RIBBON COLOR Orange

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS 4"

PAVING TYPE Asphalt

SOIL CONDITION Dirt

SIZE 2"

TYPE PVC

FACILITY OWNER Cox Communications

COMMENTS:

Blank area for comments.

PREPARED BY: M. Huber

CHECKED BY: W. Morales



Testhole Data Summary



Date: 3/7/2011  
Project Number: NVU1105-001  
Project Name: Ann Road & Rainbow Boulevard

| ANRB<br>PLANS # | TH #  | Location                                                | Date of Excavation | Utility Owner                      | Utility Size      | Utility Size     | Utility<br>Description | Pipe Thickness<br>(in) | Ground Elevation | Top Elevation | Bottom Invert<br>Elevation | Center of Pipe | Difference | Depth of Cover | Comments                                           |
|-----------------|-------|---------------------------------------------------------|--------------------|------------------------------------|-------------------|------------------|------------------------|------------------------|------------------|---------------|----------------------------|----------------|------------|----------------|----------------------------------------------------|
| 25              | AE-1  | Rainbow Boulevard<br>& Tropical Parkway                 | 2/21/2011          | Telephone                          | One 1.5" & One 2" | SEE<br>WORKSHEET | PVC                    | 0.22 in                | 2330.86          | 2326.91       | SEE<br>WORKSHEET           | -              | -          | 3.95           | FOR PLAN, THE<br>BOTTOM OF TWO<br>BANKS USE AS INV |
| 26              | AG-1  | Rainbow Boulevard<br>& Ann Road                         | 2/23/2011          | Southwest Gas                      | 4"                | 4.00 in          | PE                     | 0.25 in                | 2324.12          | 2320.44       | 2320.08                    | 2320.25        | 0.17       | 3.68           |                                                    |
| 27              | AG-4  | Rainbow Boulevard<br>south of El Campo<br>Grande Avenue | 2/23/2011          | Southwest Gas                      | 4"                | 4.00 in          | PE                     | 0.25 in                | 2326.41          | 2322.21       | 2321.86                    | 2322.02        | 0.17       | 4.20           |                                                    |
| 28              | AG-7  | Rainbow Boulevard<br>south of Ambiance<br>Lane          | 2/21/2011          | Southwest Gas                      | 4"                | 4.00 in          | PE                     | 0.25 in                | 2326.95          | 2323.85       | 2323.50                    | 2323.67        | 0.17       | 3.10           |                                                    |
| 29              | AG-10 | Rainbow Boulevard<br>& Tropical Parkway                 | 2/21/2011          | Southwest Gas                      | 4"                | 4.00 in          | PE                     | 0.25 in                | 2331.35          | 2327.33       | 2326.98                    | 2327.14        | 0.17       | 4.02           |                                                    |
| 30              | AW-1  | Rainbow Boulevard<br>& Ann Road                         | 2/22/2011          | Las Vegas Valley<br>Water District | 36"               | 36.00 in         | MLCP                   | 4.00 in                | 2324.03          | 2314.30       | 2310.96                    | 2312.46        | 1.50       | 9.73           |                                                    |
| 31              | AW-4  | Rainbow Boulevard<br>south of El Campo<br>Grande Avenue | 2/23/2011          | Las Vegas Valley<br>Water District | 8"                | 8.00 in          | PVC                    | 0.32 in                | 2326.29          | 2322.33       | 2321.63                    | 2321.97        | 0.33       | 3.96           |                                                    |
| 32              | AW-5  | Rainbow Boulevard<br>south of El Campo<br>Grande Avenue | 2/22/2011          | Las Vegas Valley<br>Water District | 12"               | 12.00 in         | PVC                    | 0.40 in                | 2325.85          | 2322.39       | 2321.36                    | 2321.86        | 0.50       | 3.46           |                                                    |
| 33              | AW-6  | Rainbow Boulevard<br>south of El Campo<br>Grande Avenue | 2/22/2011          | Las Vegas Valley<br>Water District | 36"               | 36.00 in         | MLCP                   | 4.00 in                | 2325.57          | 2318.01       | 2314.68                    | 2316.18        | 1.50       | 7.56           |                                                    |
| 34              | AW-7  | Rainbow Boulevard<br>south of El Campo<br>Grande Avenue | 2/22/2011          | Las Vegas Valley<br>Water District | 8"                | 8.00 in          | PVC                    | 0.32 in                | 2325.52          | 2321.00       | 2320.31                    | 2320.64        | 0.33       | 4.52           |                                                    |
| 35              | AW-8  | Rainbow Boulevard<br>south of El Campo<br>Grande Avenue | 2/22/2011          | Las Vegas Valley<br>Water District | 36"               | 36.00 in         | MLCP                   | 4.00 in                | 2325.64          | 2318.59       | 2315.25                    | 2316.75        | 1.50       | 7.05           |                                                    |
| 36              | AW-9  | Rainbow Boulevard<br>& El Campo<br>Grande Avenue        | 2/23/2011          | Las Vegas Valley<br>Water District | 8"                | 8.00 in          | PVC                    | 0.32 in                | 2325.84          | 2321.89       | 2321.20                    | 2321.53        | 0.33       | 3.95           |                                                    |
| 37              | AW-10 | Rainbow Boulevard<br>& El Campo<br>Grande Avenue        | 2/23/2011          | Las Vegas Valley<br>Water District | 36"               | 36.00 in         | MLCP                   | 4.00 in                | 2325.98          | 2318.65       | 2315.31                    | 2316.81        | 1.50       | 7.33           |                                                    |
| 38              | AW-11 | Rainbow Boulevard<br>& Ambiance Lane                    | 2/23/2011          | Las Vegas Valley<br>Water District | 8"                | 8.00 in          | PVC                    | 0.32 in                | 2328.14          | 2320.76       | 2320.07                    | 2320.40        | 0.33       | 7.38           |                                                    |
| 39              | AW-13 | Rainbow Boulevard<br>& Tropical Parkway                 | 2/21/2011          | Las Vegas Valley<br>Water District | 10"               | 10.00 in         | PVC                    | 0.38 in                | 2331.15          | 2327.32       | 2326.46                    | 2326.87        | 0.42       | 3.83           |                                                    |
| 40              | AW-14 | Rainbow Boulevard<br>& Tropical Parkway                 | 2/21/2011          | Las Vegas Valley<br>Water District | 10"               | 10.00 in         | PVC                    | 0.38 in                | 2330.96          | 2326.77       | 2325.91                    | 2326.32        | 0.42       | 4.19           |                                                    |

FIGURE A-7



# TEST HOLE DATA REPORT

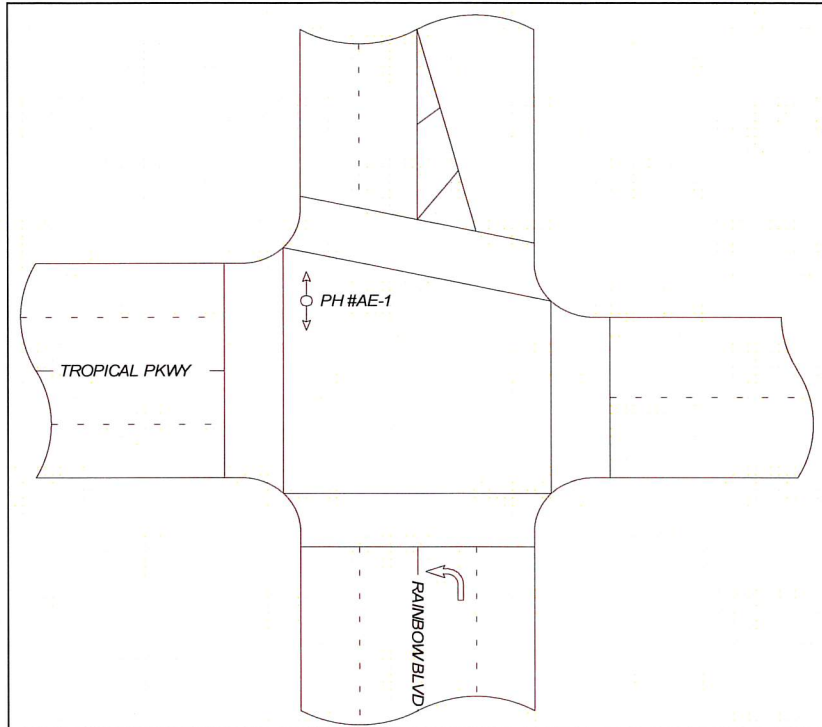
Test Hole # AE-1  
 Date Dug 2/21/2011  
 Project # NVU1105  
 Phase # 001  
 Location Rainbow Boulevard & Tropical Parkway



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J. McCarty  
 Truck # 9247  
 City Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

|              |  |                   |         |                       |
|--------------|--|-------------------|---------|-----------------------|
|              |  | FACING            | North   |                       |
|              |  | SURFACE ELEVATION | 2330.86 |                       |
|              |  | TOP ELEVATION     | 2326.91 | 3.95 TOP DEPTH (FEET) |
|              |  | BOTTOM ELEVATION  | 2325.96 | 4.90 BOTTOM (FEET)    |
| RIBBON COLOR |  | Orange            |         |                       |

COORDINATES: NORTHING None EASTING None  
 STATIONING: STATION None OFFSET None  
 PAVING THICKNESS 6" PAVING TYPE Asphalt SOIL CONDITION Dirt / Rock  
 SIZE One 1.5" & One 2" TYPE PVC FACILITY OWNER Telephone

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

# TEST HOLE DATA REPORT

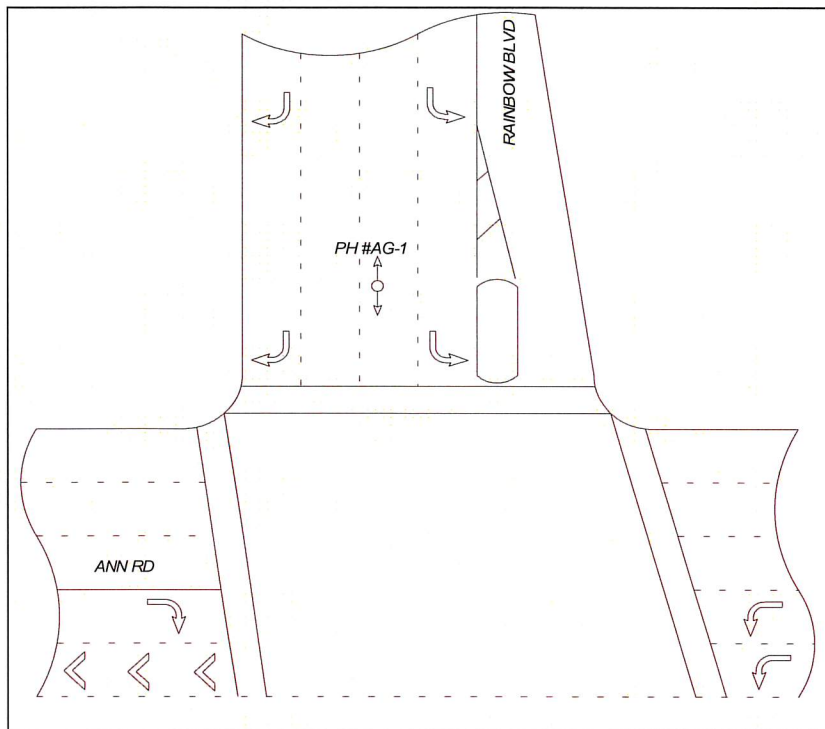
Test Hole # AG-1  
 Date Dug 2/23/2011  
 Project # NVU1105  
 Phase # 001  
 Location Rainbow Boulevard & Ann Road



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J. McCarty  
 Truck # 9247  
 City Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

Blank area for site benchmark notes.

## CROSS SECTION - NOT TO SCALE

|                                  |                       |
|----------------------------------|-----------------------|
| FACING <u>North</u>              |                       |
| SURFACE ELEVATION <u>2324.12</u> | ← WIDTH/O.D. 4.5" →   |
| TOP ELEVATION <u>2320.44</u>     | 3.68 TOP DEPTH (FEET) |
| BOTTOM ELEVATION <u>2320.06</u>  | 4.06 BOTTOM (FEET)    |

RIBBON COLOR Yellow

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS 7"

PAVING TYPE Asphalt

SOIL CONDITION Dirt / Rock

SIZE 4"

TYPE PE

FACILITY OWNER Southwest Gas

COMMENTS:

Blank area for comments.

PREPARED BY: M. Huber

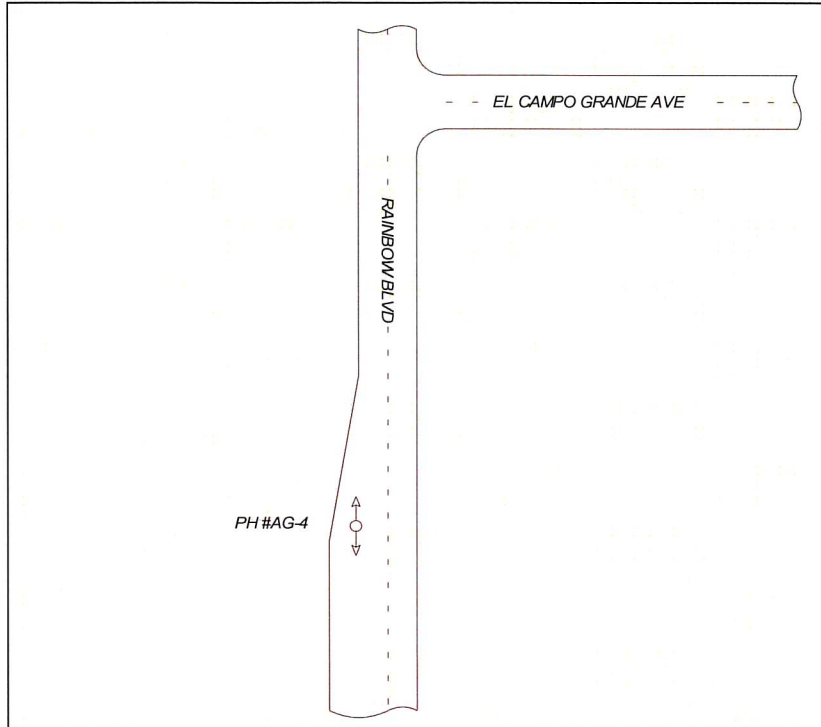
CHECKED BY: W. Morales

FIGURE A-7

# TEST HOLE DATA REPORT

|             |                                                   |                                                                                                                               |                                                             |            |           |
|-------------|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|------------|-----------|
| Test Hole # | AG-4                                              | <br><small>www.aztec.us TYPESA group</small> | SUE Crew                                                    | J. McCarty |           |
| Date Dug    | 2/23/2011                                         |                                                                                                                               | Truck #                                                     | 9247       |           |
| Project #   | NVU1105                                           |                                                                                                                               | 720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030 | City       | Las Vegas |
| Phase #     | 001                                               |                                                                                                                               | Tel. (702) 396-3426 Fax. (702) 396-3758                     | County     | Clark     |
| Location    | Rainbow Boulevard south of El Campo Grande Avenue |                                                                                                                               |                                                             |            |           |

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

|              |  |                   |         |                       |
|--------------|--|-------------------|---------|-----------------------|
|              |  | FACING            | North   |                       |
|              |  | SURFACE ELEVATION | 2326.41 |                       |
|              |  | TOP ELEVATION     | 2322.21 | 4.20 TOP DEPTH (FEET) |
|              |  | BOTTOM ELEVATION  | 2321.83 | 4.58 BOTTOM (FEET)    |
| RIBBON COLOR |  | Yellow            |         |                       |

|                       |      |                |               |
|-----------------------|------|----------------|---------------|
| COORDINATES: NORTHING | None | EASTING        | None          |
| STATIONING: STATION   | None | OFFSET         | None          |
| PAVING THICKNESS      | 6"   | PAVING TYPE    | Asphalt       |
| SIZE                  | 4"   | TYPE           | PE            |
|                       |      | SOIL CONDITION | Dirt / Rock   |
|                       |      | FACILITY OWNER | Southwest Gas |

## COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

# TEST HOLE DATA REPORT

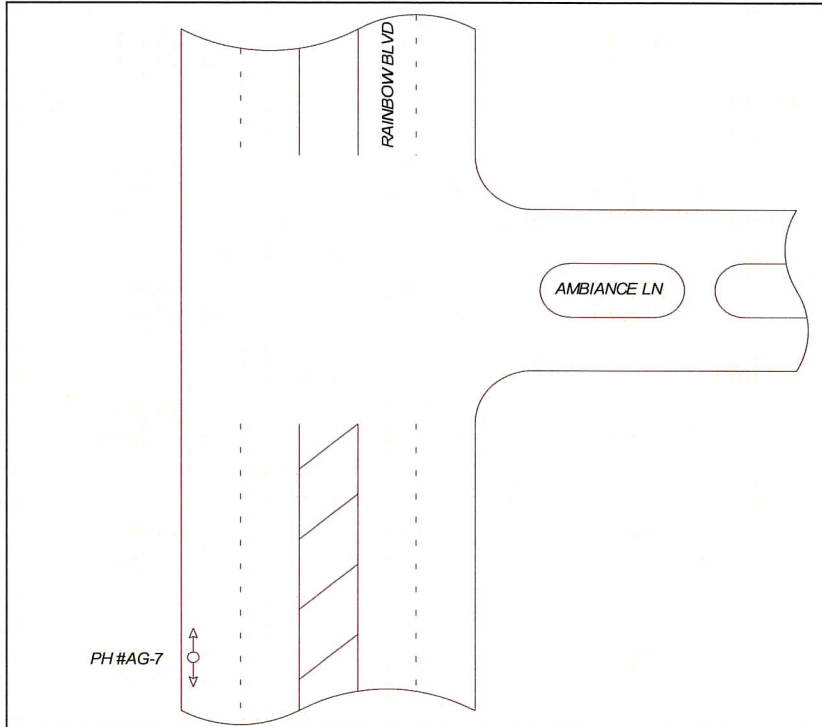
Test Hole # AG-7  
 Date Dug 2/21/2011  
 Project # NVU1105  
 Phase # 001  
 Location Rainbow Boulevard south of Ambiance Lane



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J. McCarty  
 Truck # 9247  
 City Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



### SITE BENCHMARK

### CROSS SECTION - NOT TO SCALE

|                            |  |                                  |                                                                   |                                                           |
|----------------------------|--|----------------------------------|-------------------------------------------------------------------|-----------------------------------------------------------|
|                            |  | FACING <u>North</u>              |                                                                   |                                                           |
|                            |  | SURFACE ELEVATION <u>2326.95</u> | <div><div>←</div><div>WIDTH/O.D.<br/>4.5"</div><div>→</div></div> | <div><div>3.10</div><div>TOP DEPTH<br/>(FEET)</div></div> |
|                            |  | TOP ELEVATION <u>2323.85</u>     |                                                                   |                                                           |
|                            |  | BOTTOM ELEVATION <u>2323.47</u>  |                                                                   |                                                           |
| RIBBON COLOR <u>Yellow</u> |  | <div><div>○</div></div>          | <div><div>3.48</div><div>BOTTOM<br/>(FEET)</div></div>            |                                                           |

COORDINATES: NORTHING None EASTING None  
 STATIONING: STATION None OFFSET None  
 PAVING THICKNESS 7" PAVING TYPE Asphalt SOIL CONDITION Dirt / Rock  
 SIZE 4" TYPE PE FACILITY OWNER Southwest Gas

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

FIGURE A-7



# TEST HOLE DATA REPORT

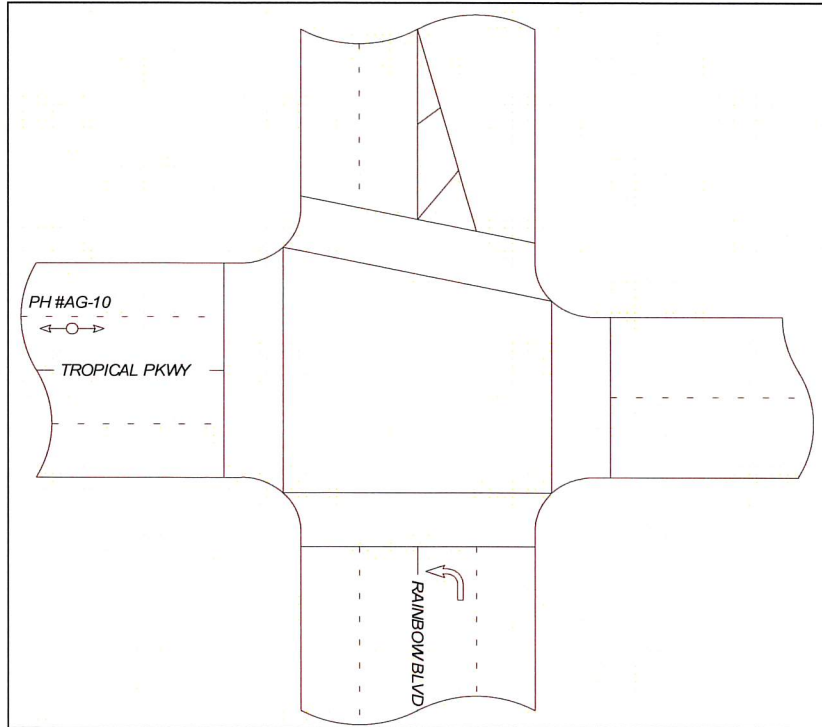
Test Hole # AG-10  
 Date Dug 2/21/2011  
 Project # NVU1105  
 Phase # 001  
 Location Rainbow Boulevard & Tropical Parkway



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J. McCarty  
 Truck # 9247  
 City Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

|                            |  |                                  |                                                                                                                                                                                                                                                      |
|----------------------------|--|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                            |  | FACING <u>East</u>               |                                                                                                                                                                                                                                                      |
|                            |  | SURFACE ELEVATION <u>2331.35</u> | <div style="display: flex; align-items: center; justify-content: center;"><div style="width: 100px; height: 100px; border: 1px solid black; border-radius: 50%; margin: 0 auto;"></div><div style="margin: 0 10px;">TOP DEPTH<br/>(FEET)</div></div> |
|                            |  | TOP ELEVATION <u>2327.33</u>     |                                                                                                                                                                                                                                                      |
|                            |  | BOTTOM ELEVATION <u>2326.95</u>  |                                                                                                                                                                                                                                                      |
| RIBBON COLOR <u>Yellow</u> |  | TOP DEPTH<br>(FEET)              |                                                                                                                                                                                                                                                      |

COORDINATES: NORTHING None EASTING None  
 STATIONING: STATION None OFFSET None  
 PAVING THICKNESS 6" PAVING TYPE Asphalt SOIL CONDITION Dirt / Rock  
 SIZE 4" TYPE PE FACILITY OWNER Southwest Gas

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

# TEST HOLE DATA REPORT

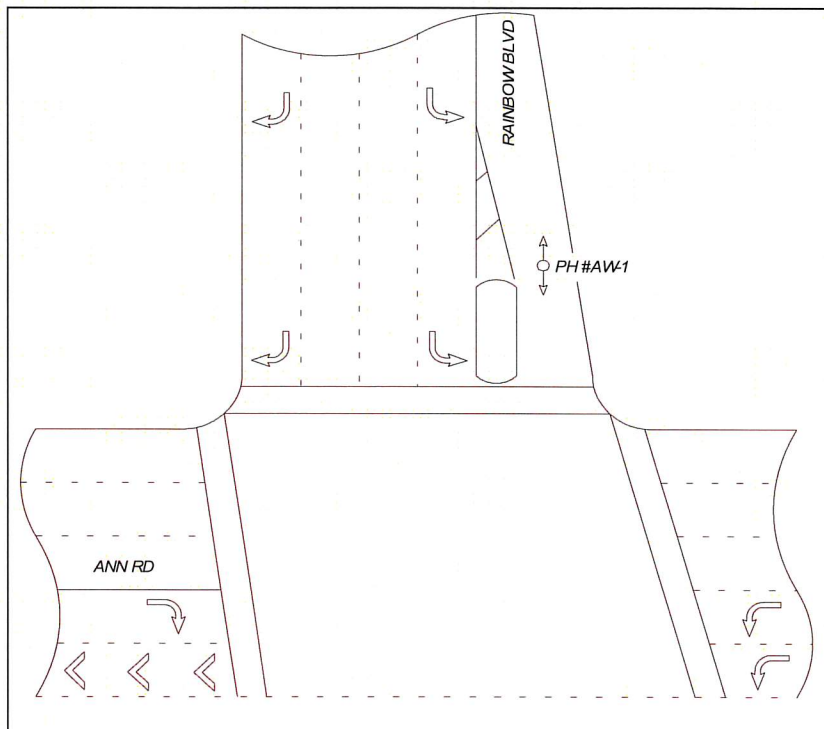
Test Hole # AW-1  
 Date Dug 2/22/2011  
 Project # NVU1105  
 Phase # 001  
 Location Rainbow Boulevard & Ann Road



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J. McCarty  
 Truck # 9247  
 City Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

RIBBON COLOR Blue

## CROSS SECTION - NOT TO SCALE

|                       |                |
|-----------------------|----------------|
| FACING <u>North</u>   |                |
| SURFACE ELEVATION     | <u>2324.03</u> |
| TOP ELEVATION         | <u>2314.30</u> |
| BOTTOM ELEVATION      | <u>2310.63</u> |
| WIDTH/O.D. <u>44"</u> |                |
|                       |                |
| 9.73 TOP DEPTH (FEET) |                |
| 13.40 BOTTOM (FEET)   |                |

COORDINATES: NORTHING None EASTING None  
 STATIONING: STATION None OFFSET None  
 PAVING THICKNESS 7" PAVING TYPE Asphalt SOIL CONDITION Dirt / Rock  
 SIZE 36" TYPE MLCP FACILITY OWNER Las Vegas Valley Water District

## COMMENTS:

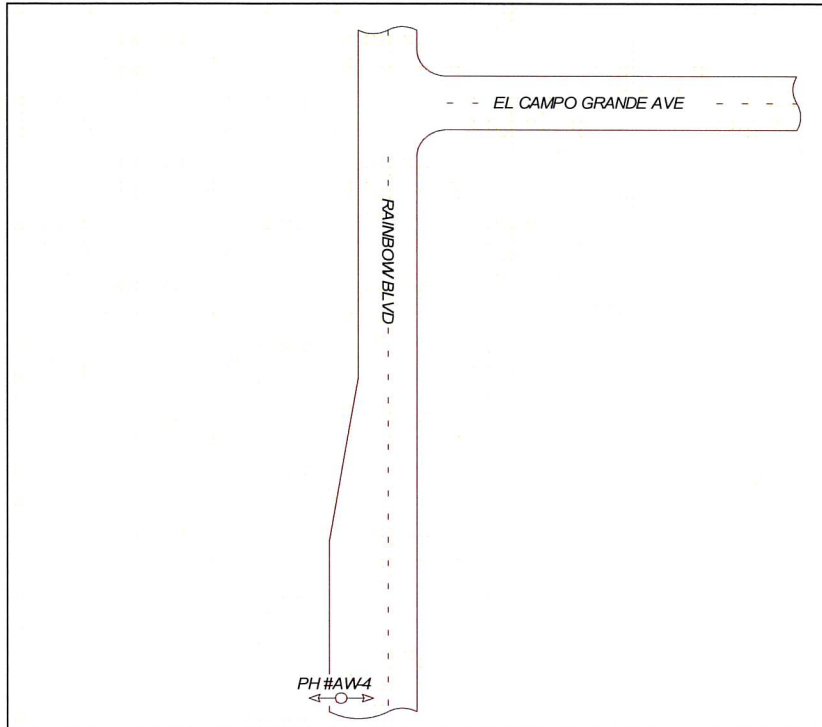
PREPARED BY: M. Huber

CHECKED BY: W. Morales

# TEST HOLE DATA REPORT

|             |                                                   |                                                                                                                               |          |            |
|-------------|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|----------|------------|
| Test Hole # | AW-4                                              | <br><small>www.aztec.us TYPESA group</small> | SUE Crew | J. McCarty |
| Date Dug    | 2/23/2011                                         |                                                                                                                               | Truck #  | 9247       |
| Project #   | NVU1105                                           |                                                                                                                               | City     | Las Vegas  |
| Phase #     | 001                                               |                                                                                                                               | County   | Clark      |
| Location    | Rainbow Boulevard south of El Campo Grande Avenue |                                                                                                                               |          |            |

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

|              |  |      |
|--------------|--|------|
| RIBBON COLOR |  | Blue |
|--------------|--|------|

## CROSS SECTION - NOT TO SCALE

|                   |         |                                                     |                       |
|-------------------|---------|-----------------------------------------------------|-----------------------|
| FACING            |         | East                                                |                       |
| SURFACE ELEVATION | 2326.29 | <div> <div>WIDTH/O.D.</div> <div>8.63"</div> </div> |                       |
| TOP ELEVATION     | 2322.33 |                                                     | 3.96 TOP DEPTH (FEET) |
| BOTTOM ELEVATION  | 2321.61 |                                                     | 4.68 BOTTOM (FEET)    |

|                       |      |                |                                 |
|-----------------------|------|----------------|---------------------------------|
| COORDINATES: NORTHING | None | EASTING        | None                            |
| STATIONING: STATION   | None | OFFSET         | None                            |
| PAVING THICKNESS      | 6"   | PAVING TYPE    | Asphalt                         |
| SIZE                  | 8"   | TYPE           | PVC                             |
|                       |      | SOIL CONDITION | Dirt / Rock                     |
|                       |      | FACILITY OWNER | Las Vegas Valley Water District |

COMMENTS:

|  |
|--|
|  |
|--|

PREPARED BY: M. Huber

CHECKED BY: W. Morales

FIGURE A-7

# TEST HOLE DATA REPORT

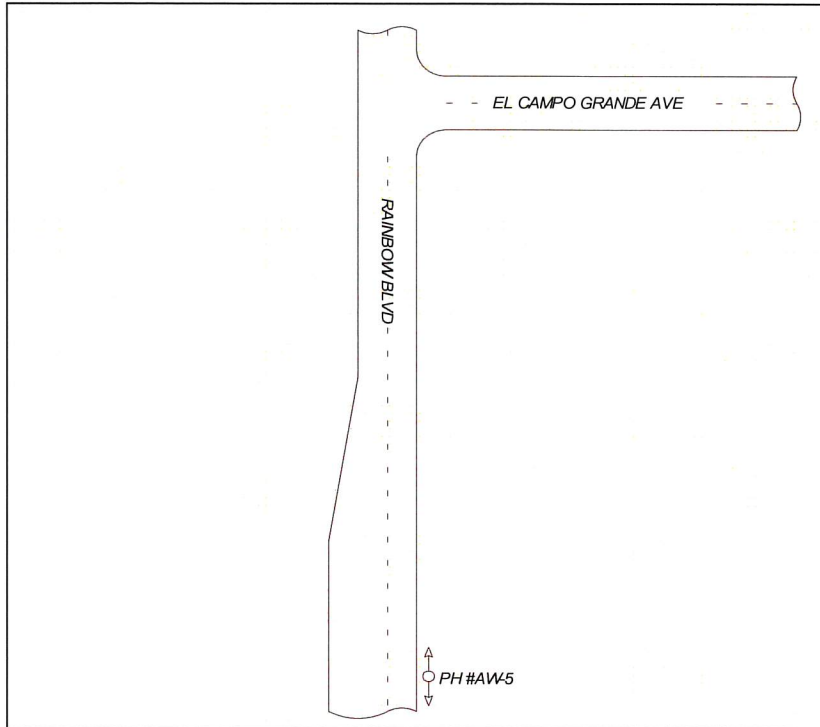
Test Hole # AW-5  
 Date Dug 2/22/2011  
 Project # NVU1105  
 Phase # 001  
 Location Rainbow Boulevard south of El Campo Grande Avenue



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J. McCarty  
 Truck # 9247  
 City Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

|                          |  |                                                                                                                   |                       |
|--------------------------|--|-------------------------------------------------------------------------------------------------------------------|-----------------------|
|                          |  | FACING <u>North</u>                                                                                               |                       |
|                          |  | SURFACE ELEVATION <u>2325.85</u>                                                                                  |                       |
|                          |  | TOP ELEVATION <u>2322.39</u>                                                                                      | 3.46 TOP DEPTH (FEET) |
|                          |  | BOTTOM ELEVATION <u>2321.33</u>                                                                                   | 4.52 BOTTOM (FEET)    |
| RIBBON COLOR <u>Blue</u> |  | WIDTH/O.D. <u>12.75"</u><br> |                       |

COORDINATES: NORTHING None EASTING None  
 STATIONING: STATION None OFFSET None  
 PAVING THICKNESS None PAVING TYPE None SOIL CONDITION Dirt / Rock  
 SIZE 12" TYPE PVC FACILITY OWNER Las Vegas Valley Water District

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

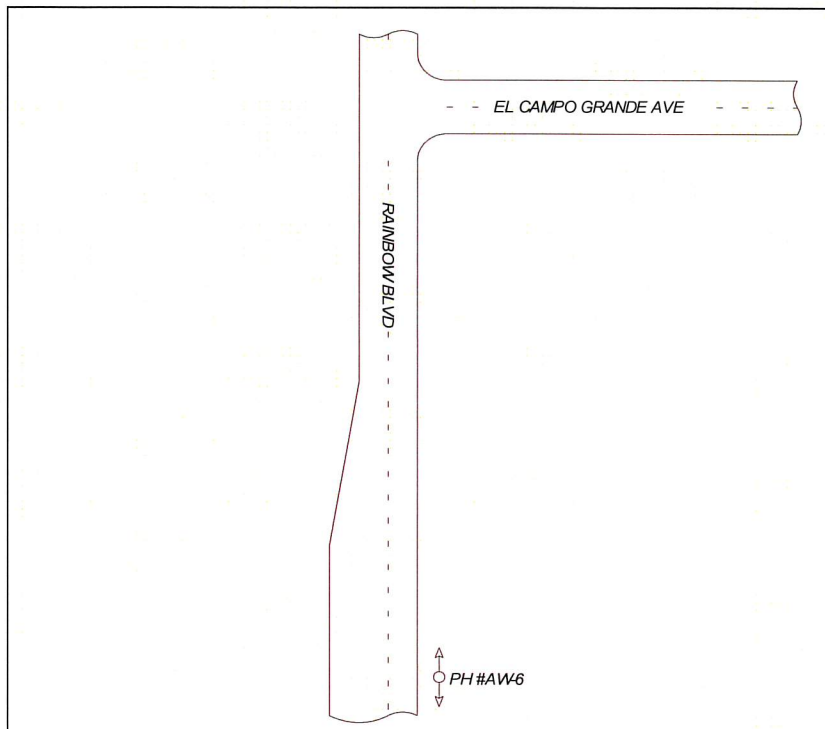
FIGURE A-7



# TEST HOLE DATA REPORT

|                                                             |           |                                                                                                                               |          |            |
|-------------------------------------------------------------|-----------|-------------------------------------------------------------------------------------------------------------------------------|----------|------------|
| Test Hole #                                                 | AW-6      | <br><small>www.aztec.us TYPESA group</small> | SUE Crew | J. McCarty |
| Date Dug                                                    | 2/22/2011 |                                                                                                                               | Truck #  | 9247       |
| Project #                                                   | NVU1105   |                                                                                                                               | City     | Las Vegas  |
| Phase #                                                     | 001       |                                                                                                                               | County   | Clark      |
| Location                                                    |           | Rainbow Boulevard south of El Campo Grande Avenue                                                                             |          |            |
| 720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030 |           | Tel. (702) 396-3426 Fax. (702) 396-3758                                                                                       |          |            |

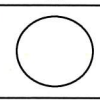
## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

|              |  |      |
|--------------|--|------|
| RIBBON COLOR |  | Blue |
|--------------|--|------|

## CROSS SECTION - NOT TO SCALE

|                   |         |                                                                                                                                         |                       |
|-------------------|---------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| FACING            |         | North                                                                                                                                   |                       |
| SURFACE ELEVATION | 2325.57 | <div> <div>WIDTH/O.D.</div> <div>44"</div>  </div> |                       |
| TOP ELEVATION     | 2318.01 |                                                                                                                                         | 7.56 TOP DEPTH (FEET) |
| BOTTOM ELEVATION  | 2314.34 |                                                                                                                                         | 11.23 BOTTOM (FEET)   |

|                       |      |                |                                 |
|-----------------------|------|----------------|---------------------------------|
| COORDINATES: NORTHING | None | EASTING        | None                            |
| STATIONING: STATION   | None | OFFSET         | None                            |
| PAVING THICKNESS      | None | PAVING TYPE    | None                            |
| SIZE                  | 36"  | TYPE           | MLCP                            |
|                       |      | SOIL CONDITION | Dirt / Rock                     |
|                       |      | FACILITY OWNER | Las Vegas Valley Water District |

COMMENTS:

|  |
|--|
|  |
|--|

PREPARED BY: M. Huber

CHECKED BY: W. Morales

# TEST HOLE DATA REPORT

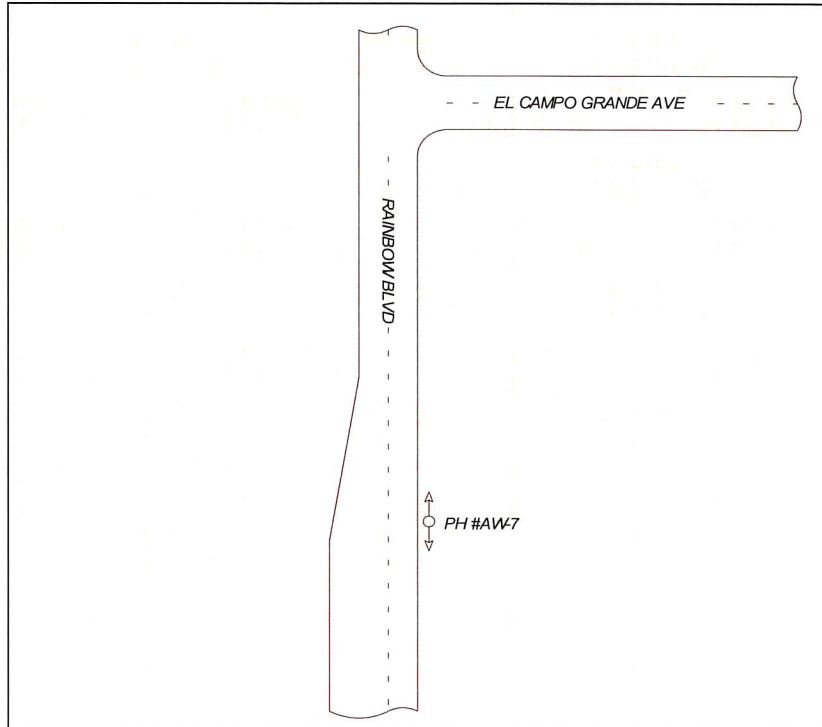
Test Hole # AW-7  
 Date Dug 2/22/2011  
 Project # NVU1105  
 Phase # 001  
 Location Rainbow Boulevard south of El Campo Grande Avenue



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J. McCarty  
 Truck # 9247  
 City Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

|                          |  |                                  |                       |
|--------------------------|--|----------------------------------|-----------------------|
|                          |  | FACING <u>North</u>              |                       |
|                          |  | SURFACE ELEVATION <u>2325.52</u> |                       |
|                          |  | TOP ELEVATION <u>2321.00</u>     | 4.52 TOP DEPTH (FEET) |
|                          |  | BOTTOM ELEVATION <u>2320.28</u>  | 5.24 BOTTOM (FEET)    |
| RIBBON COLOR <u>Blue</u> |  | WIDTH/O.D. <u>8.63"</u>          |                       |

COORDINATES: NORTHING None EASTING None  
 STATIONING: STATION None OFFSET None  
 PAVING THICKNESS None PAVING TYPE None SOIL CONDITION Dirt  
 SIZE 8" TYPE PVC FACILITY OWNER Las Vegas Valley Water District

## COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

# TEST HOLE DATA REPORT

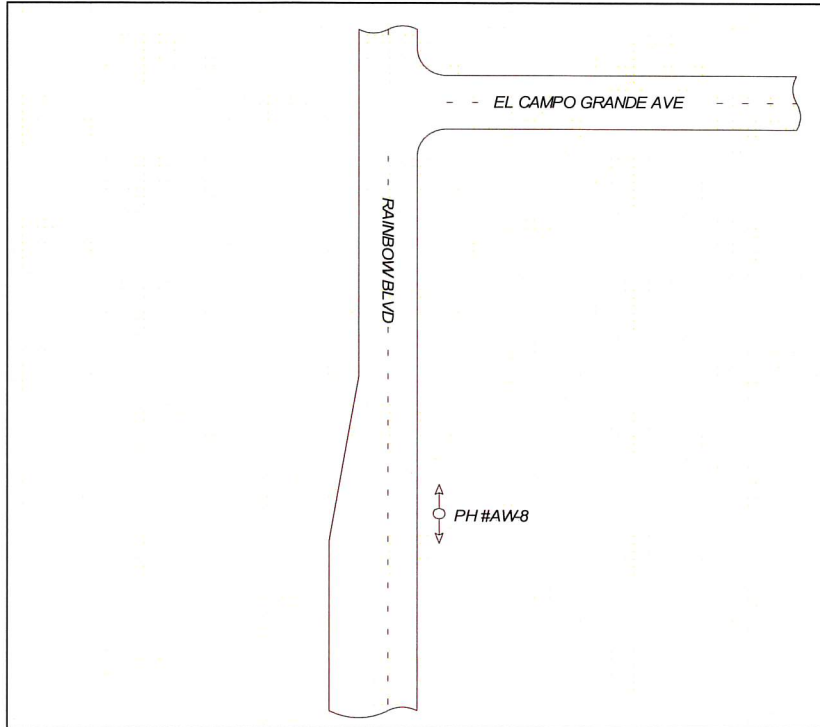
Test Hole # AW-8  
 Date Dug 2/22/2011  
 Project # NVU1105  
 Phase # 001  
 Location Rainbow Boulevard south of El Campo Grande Avenue



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J. McCarty  
 Truck # 9247  
 City Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

RIBBON COLOR Blue

## CROSS SECTION - NOT TO SCALE

|                                  |                       |
|----------------------------------|-----------------------|
| FACING <u>North</u>              |                       |
| SURFACE ELEVATION <u>2325.64</u> | WIDTH/O.D. <u>44"</u> |
| TOP ELEVATION <u>2318.59</u>     | 7.05 TOP DEPTH (FEET) |
| BOTTOM ELEVATION <u>2314.92</u>  | 10.72 BOTTOM (FEET)   |

COORDINATES: NORTHING None EASTING None  
 STATIONING: STATION None OFFSET None  
 PAVING THICKNESS None PAVING TYPE None SOIL CONDITION Dirt / Rock  
 SIZE 36" TYPE MLCP FACILITY OWNER Las Vegas Valley Water District

## COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

FIGURE A-7

# TEST HOLE DATA REPORT

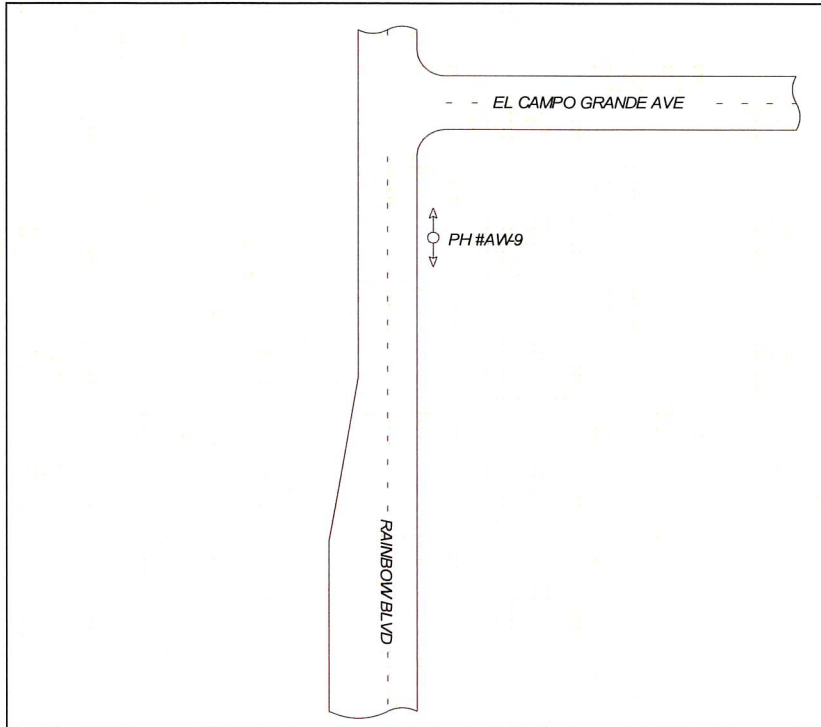
Test Hole # AW-9  
 Date Dug 2/23/2011  
 Project # NVU1105  
 Phase # 001  
 Location Rainbow Boulevard & El Campo Grande Avenue



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J. McCarty  
 Truck # 9247  
 City Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

RIBBON COLOR Blue

## CROSS SECTION - NOT TO SCALE

|                                  |                         |
|----------------------------------|-------------------------|
| FACING <u>North</u>              |                         |
| SURFACE ELEVATION <u>2325.84</u> | WIDTH/O.D. <u>8.63"</u> |
| TOP ELEVATION <u>2321.89</u>     | 3.95 TOP DEPTH (FEET)   |
| BOTTOM ELEVATION <u>2321.17</u>  | 4.67 BOTTOM (FEET)      |

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS None

PAVING TYPE None

SOIL CONDITION Dirt / Rock

SIZE 8"

TYPE PVC

FACILITY OWNER Las Vegas Valley Water District

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

FIGURE A-7

# TEST HOLE DATA REPORT

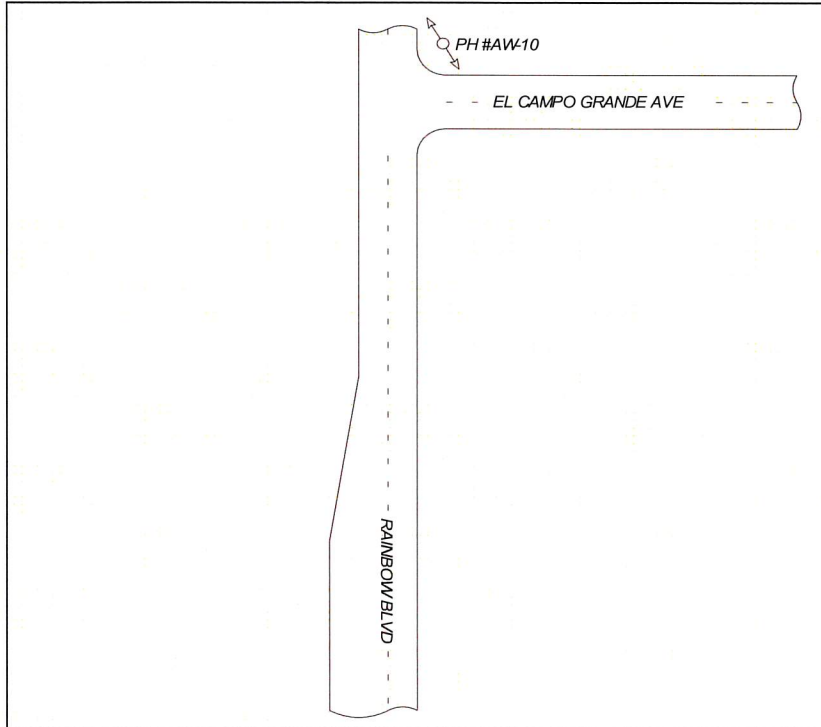
Test Hole # AW-10  
 Date Dug 2/23/2011  
 Project # NVU1105  
 Phase # 001  
 Location Rainbow Boulevard & El Campo Grande Avenue



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J. McCarty  
 Truck # 9247  
 City Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

RIBBON COLOR Blue

## CROSS SECTION - NOT TO SCALE

|                                  |                       |
|----------------------------------|-----------------------|
| FACING <u>Northwest</u>          |                       |
| SURFACE ELEVATION <u>2325.98</u> | WIDTH/O.D. <u>44"</u> |
| TOP ELEVATION <u>2318.65</u>     | 7.33 TOP DEPTH (FEET) |
| BOTTOM ELEVATION <u>2314.98</u>  | 11.00 BOTTOM (FEET)   |

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS None PAVING TYPE None SOIL CONDITION Dirt / Rock

SIZE 36" TYPE MLCP FACILITY OWNER Las Vegas Valley Water District

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

FIGURE A-7



# TEST HOLE DATA REPORT

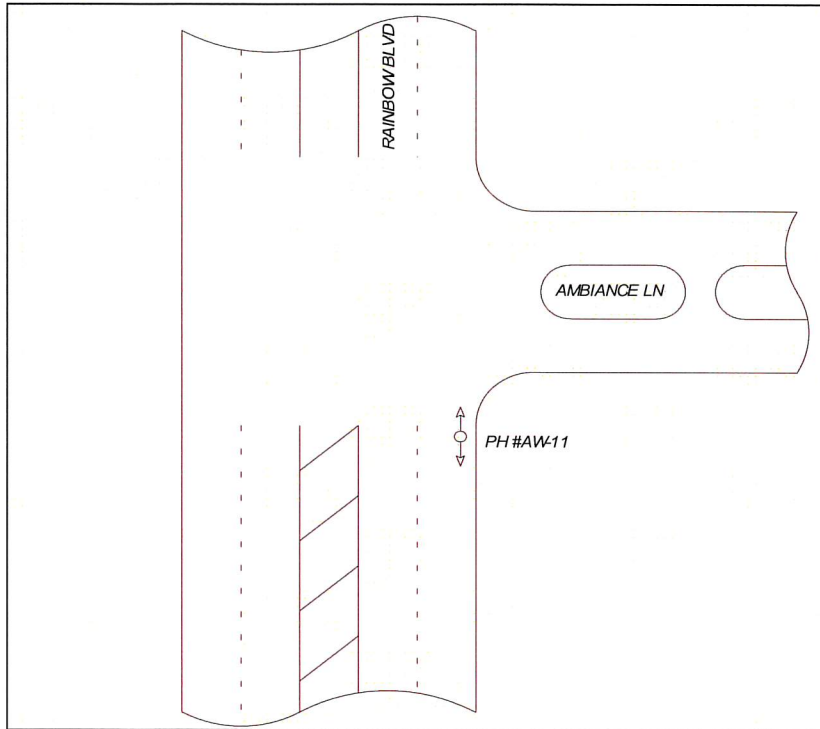
Test Hole # AW-11  
 Date Dug 2/23/2011  
 Project # NVU1105  
 Phase # 001  
 Location Rainbow Boulevard & Ambiance Lane



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J. McCarty  
 Truck # 9247  
 City Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

RIBBON COLOR Blue

|                                  |                         |
|----------------------------------|-------------------------|
| FACING <u>North</u>              |                         |
| SURFACE ELEVATION <u>2328.14</u> | WIDTH/O.D. <u>8.63"</u> |
| TOP ELEVATION <u>2320.76</u>     | 7.38 TOP DEPTH (FEET)   |
| BOTTOM ELEVATION <u>2320.04</u>  | 8.10 BOTTOM (FEET)      |

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS 6"

PAVING TYPE Asphalt

SOIL CONDITION Dirt / Rock

SIZE 8"

TYPE PVC

FACILITY OWNER Las Vegas Valley Water District

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

# TEST HOLE DATA REPORT

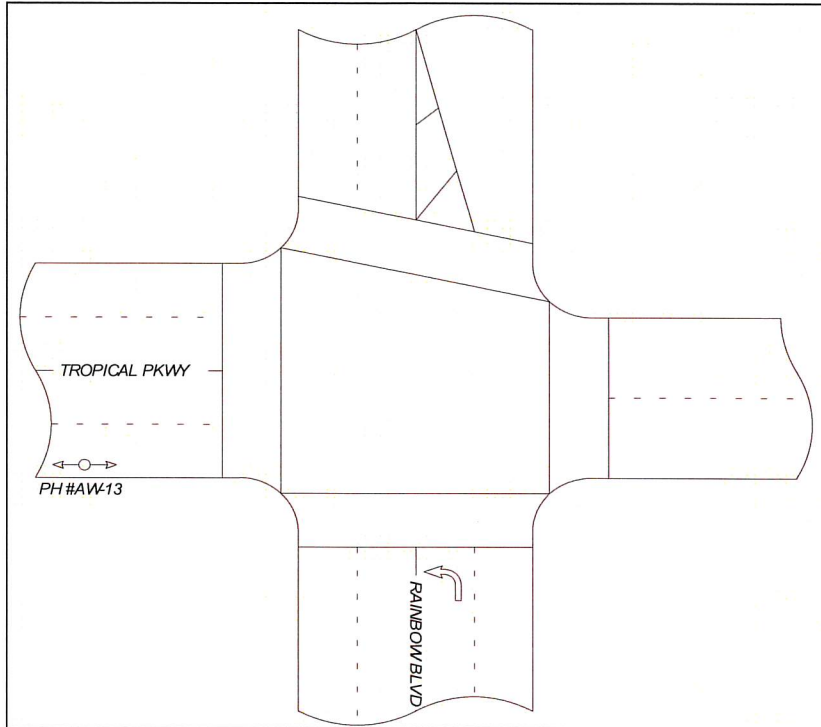
Test Hole # AW-13  
 Date Dug 2/21/2011  
 Project # NVU1105  
 Phase # 001  
 Location Rainbow Boulevard & Tropical Parkway



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J. McCarty  
 Truck # 9247  
 City Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

Blank area for site benchmark details.

## CROSS SECTION - NOT TO SCALE

|                   |         |                       |                       |
|-------------------|---------|-----------------------|-----------------------|
|                   | FACING  | East                  |                       |
| SURFACE ELEVATION | 2331.15 | ← WIDTH/O.D. 10.75" → |                       |
| TOP ELEVATION     | 2327.32 |                       | 3.83 TOP DEPTH (FEET) |
| BOTTOM ELEVATION  | 2326.42 |                       | 4.73 BOTTOM (FEET)    |

RIBBON COLOR Blue

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS 6"

PAVING TYPE Asphalt

SOIL CONDITION Dirt / Rock

SIZE 10"

TYPE PVC

FACILITY OWNER Las Vegas Valley Water District

COMMENTS:

Blank area for comments.

PREPARED BY: M. Huber

CHECKED BY: W. Morales

# TEST HOLE DATA REPORT

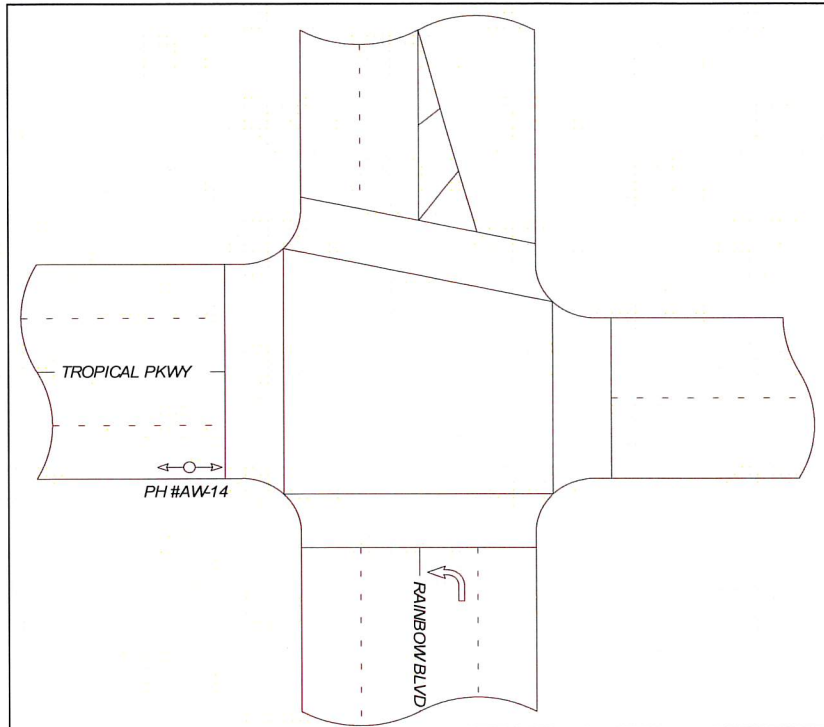
Test Hole # AW-14  
 Date Dug 2/21/2011  
 Project # NVU1105  
 Phase # 001  
 Location Rainbow Boulevard & Tropical Parkway



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J. McCarty  
 Truck # 9247  
 City Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

COORDINATES: NORTHING None  
 STATIONING: STATION None  
 PAVING THICKNESS 6" PAVING TYPE Asphalt  
 SIZE 10" TYPE PVC

|                                  |                          |
|----------------------------------|--------------------------|
| FACING <u>East</u>               |                          |
| SURFACE ELEVATION <u>2330.96</u> | WIDTH/O.D. <u>10.75"</u> |
| TOP ELEVATION <u>2326.77</u>     | 4.19 TOP DEPTH (FEET)    |
| BOTTOM ELEVATION <u>2325.87</u>  | 5.09 BOTTOM (FEET)       |

RIBBON COLOR Blue  
 COORDINATES: NORTHING None EASTING None  
 STATIONING: STATION None OFFSET None  
 PAVING THICKNESS 6" PAVING TYPE Asphalt SOIL CONDITION Dirt / Rock  
 SIZE 10" TYPE PVC FACILITY OWNER Las Vegas Valley Water District

## COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

FIGURE A-7



Testhole Data Summary

Date: 6/7/2011

Project Number: NVU1105-001- Phase 2

Project Name: Ann Road Channel West

| ANRB<br>PLANS # | TH # | Location                     | Date of Excavation | Utility Owner                   | Utility Size | Utility Description | Coordinates |         | Stationing |        | Ground Elevation | Top Elevation | Bottom Elevation | Invert Elevation | Depth of Cover | Comments                                             |
|-----------------|------|------------------------------|--------------------|---------------------------------|--------------|---------------------|-------------|---------|------------|--------|------------------|---------------|------------------|------------------|----------------|------------------------------------------------------|
|                 |      |                              |                    |                                 |              |                     | Northing    | Easting | Stationing | Offset |                  |               |                  |                  |                |                                                      |
| 41              | 1    | Rainbow Boulevard & Ann Road | 6/7/2011           | Las Vegas Valley Water District | 36"          | MLCP                | None        | None    | None       | None   | 2323.82          | 2311.62       | 2307.95          | 2308.28          | 12.20          |                                                      |
| 42              | 2    | Rainbow Boulevard & Ann Road | 6/2/2011           | None                            | N/A          | Wall Footing        | None        | None    | None       | None   | 2326.25          | 2325.67       | 2323.95          | NA               | 0.58           | Per client's request top and bottom of wall footing. |
| 43              | 3    | Rainbow Boulevard & Ann Road | 6/2/2011           | None                            | N/A          | Wall Footing        | None        | None    | None       | None   | 2326.00          | 2325.42       | 2323.80          | NA               | 0.58           | Per Client's request top and bottom of wall footing. |
| 44              | 4    | Rainbow Boulevard & Ann Road | 6/2/2011           | None                            | N/A          | Wall Footing        | None        | None    | None       | None   | 2326.20          | 2325.62       | 2323.90          | NA               | 0.58           | Per client's request top and bottom of wall footing. |
| 45              | 5    | Rainbow Boulevard & Ann Road | 6/2/2011           | None                            | N/A          | Wall Footing        | None        | None    | None       | None   | 2325.94          | 2325.36       | 2323.74          | NA               | 0.58           | Per client request top and bottom of wall footing.   |
| 46              | 6    | Rainbow Boulevard & Ann Road | 6/2/2011           | None                            | N/A          | Wall Footing        | None        | None    | None       | None   | 2326.00          | 2325.42       | 2323.70          | NA               | 0.58           | Per client request top and bottom of wall footing.   |



# TEST HOLE DATA REPORT

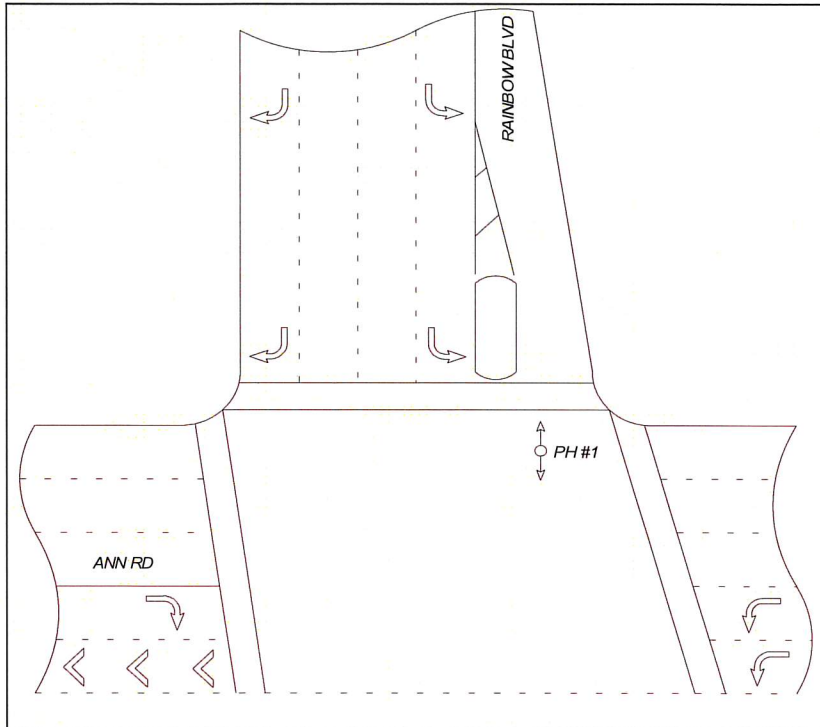
Test Hole # 1  
 Date Dug 6/7/2011  
 Project # NVU1105-001  
 Phase # 002  
 Location Rainbow Boulevard & Ann Road



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew Jose Martinez  
 Truck # 9247  
 City Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

|                          |  |                                  |                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------------|--|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                          |  | FACING <u>North</u>              |                                                                                                                                                                                                                                                                                                                                                                    |
|                          |  | SURFACE ELEVATION <u>2323.82</u> | <div style="display: flex; align-items: center; justify-content: center;"> <div style="text-align: center; margin-right: 10px;"> <math>\longleftrightarrow</math><br/>                     WIDTH/O.D.<br/> <u>44"</u> </div> <div style="text-align: center;">  </div> </div> |
|                          |  | TOP ELEVATION <u>2311.62</u>     |                                                                                                                                                                                                                                                                                                                                                                    |
|                          |  | BOTTOM ELEVATION <u>2307.95</u>  |                                                                                                                                                                                                                                                                                                                                                                    |
| RIBBON COLOR <u>Blue</u> |  |                                  | <div style="display: flex; justify-content: space-between;"> <div>12.20 TOP DEPTH (FEET)</div> <div>15.87 BOTTOM (FEET)</div> </div>                                                                                                                                                                                                                               |

COORDINATES: NORTHING None EASTING None  
 STATIONING: STATION None OFFSET None  
 PAVING THICKNESS 7" PAVING TYPE Asphalt SOIL CONDITION Dirt  
 SIZE 36" TYPE MLCP FACILITY OWNER Las Vegas Valley Water District

COMMENTS:

PREPARED BY: W. Morales

CHECKED BY: M. Huber



# TEST HOLE DATA REPORT

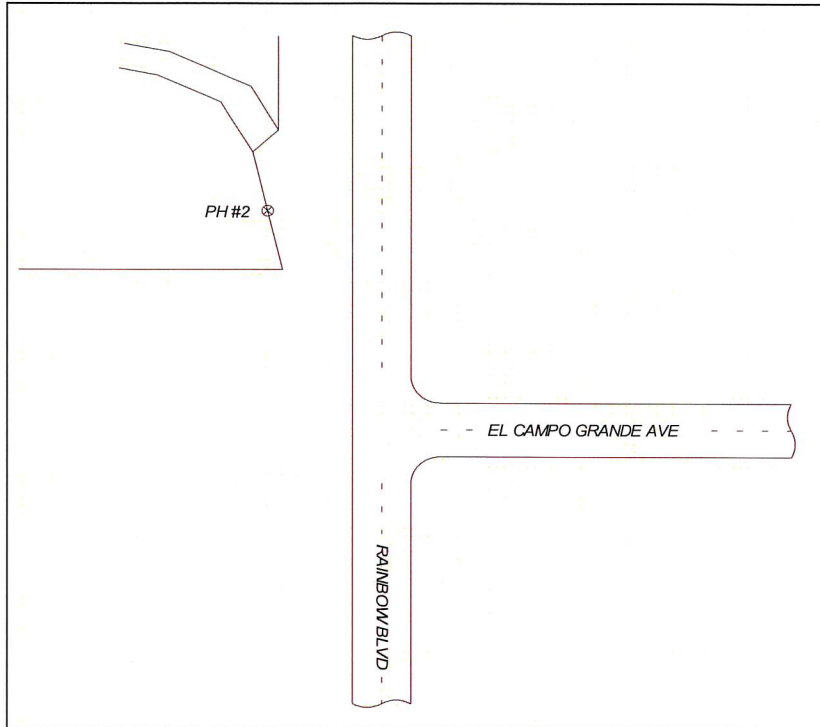
Test Hole # 2  
 Date Dug 6/2/2011  
 Project # NVU1105-001  
 Phase # 002  
 Location Rainbow Boulevard & Ann Road



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew Jose Martinez  
 Truck # 9247  
 City Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

RIBBON COLOR None

## CROSS SECTION - NOT TO SCALE

|                                  |                              |
|----------------------------------|------------------------------|
| FACING <u>North</u>              |                              |
| SURFACE ELEVATION <u>2326.25</u> | ← WIDTH/O.D. →               |
| TOP ELEVATION <u>2325.67</u>     | <u>0.58</u> TOP DEPTH (FEET) |
| BOTTOM ELEVATION <u>2323.95</u>  | <u>2.30</u> BOTTOM (FEET)    |

COORDINATES: NORTHING None EASTING None  
 STATIONING: STATION None OFFSET None  
 PAVING THICKNESS 4" PAVING TYPE Concrete SOIL CONDITION Dirt  
 SIZE N/A TYPE Wall Footing FACILITY OWNER None

## COMMENTS:

Per client's request top and bottom of wall footing.

PREPARED BY: W. Morales

CHECKED BY: M. Huber

# TEST HOLE DATA REPORT

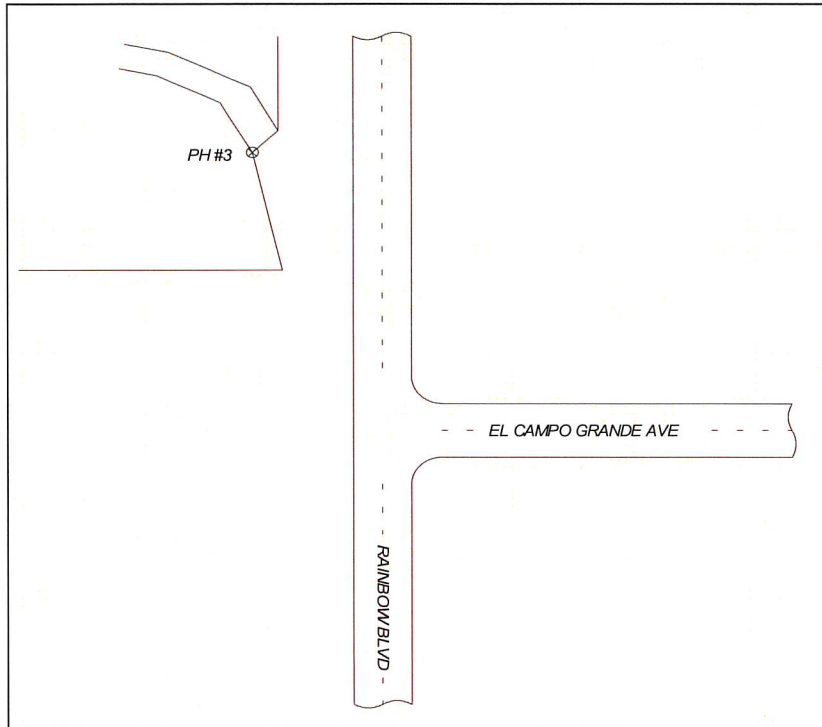
Test Hole # 3  
 Date Dug 6/2/2011  
 Project # NVU1105-001  
 Phase # 002  
 Location Rainbow Boulevard & Ann Road



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew Jose Martinez  
 Truck # 9247  
 City Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

|                          |  |                                  |                       |
|--------------------------|--|----------------------------------|-----------------------|
|                          |  | FACING <u>North</u>              |                       |
|                          |  | SURFACE ELEVATION <u>2326.00</u> | ← WIDTH/O.D. →        |
|                          |  | TOP ELEVATION <u>2325.42</u>     | 0.58 TOP DEPTH (FEET) |
|                          |  | BOTTOM ELEVATION <u>2323.80</u>  | 2.20 BOTTOM (FEET)    |
| RIBBON COLOR <u>None</u> |  |                                  |                       |

COORDINATES: NORTHING None EASTING None  
 STATIONING: STATION None OFFSET None  
 PAVING THICKNESS 4" PAVING TYPE Concrete SOIL CONDITION Dirt  
 SIZE N/A TYPE Wall Footing FACILITY OWNER None

## COMMENTS:

Per Client's request top and bottom of wall footing.

PREPARED BY: W. Morales

CHECKED BY: M. Huber

# TEST HOLE DATA REPORT

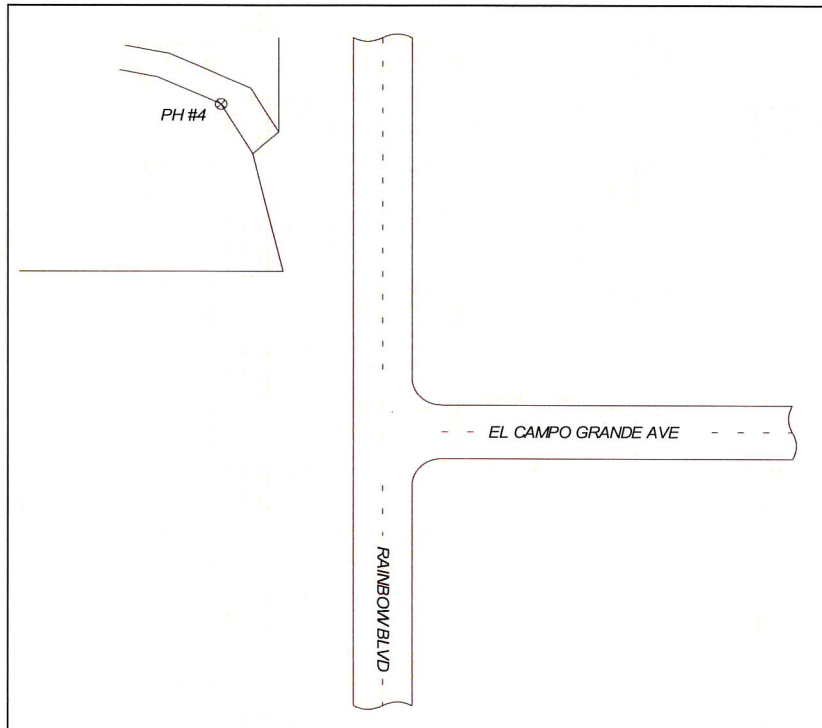
Test Hole # 4  
 Date Dug 6/2/2011  
 Project # NVU1105-001  
 Phase # 002  
 Location Rainbow Boulevard & Ann Road



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew Jose Martinez  
 Truck # 9247  
 City Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

RIBBON COLOR None

|                                  |                                        |
|----------------------------------|----------------------------------------|
| FACING <u>North/West</u>         |                                        |
| SURFACE ELEVATION <u>2326.20</u> | WIDTH/O.D. <u>                    </u> |
| TOP ELEVATION <u>2325.62</u>     | 0.58 TOP DEPTH (FEET)                  |
| BOTTOM ELEVATION <u>2323.90</u>  | 2.30 BOTTOM (FEET)                     |

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS 4"

PAVING TYPE Concrete

SOIL CONDITION Dirt

SIZE N/A

TYPE Wall Footing

FACILITY OWNER None

## COMMENTS:

Per client's request top and bottom of wall footing.

PREPARED BY: W. Morales

CHECKED BY: M. Huber

# TEST HOLE DATA REPORT

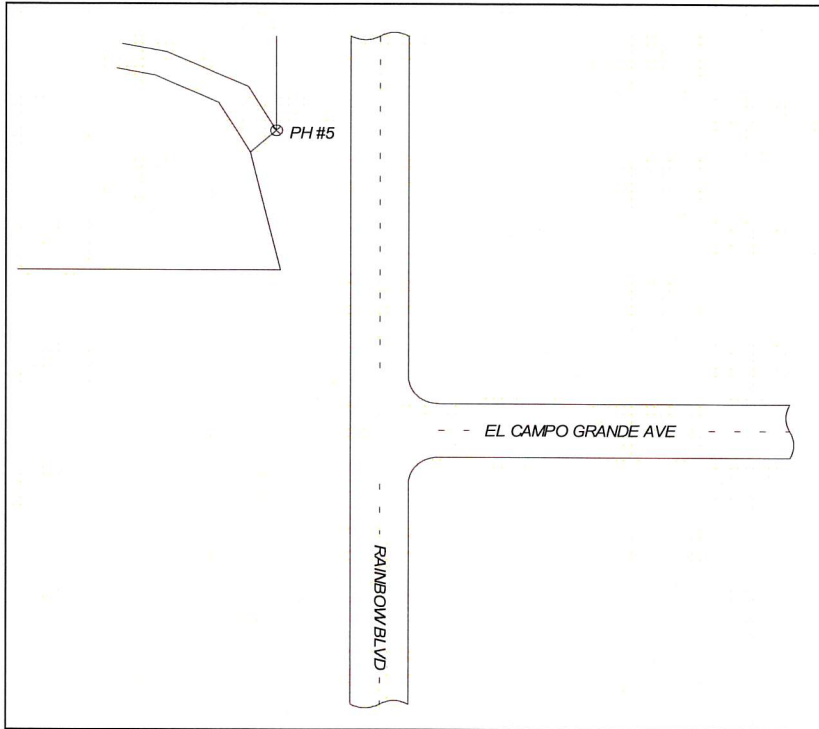
Test Hole # 5  
 Date Dug 6/2/2011  
 Project # NVU1105-001  
 Phase # 002  
 Location Rainbow Boulevard & Ann Road



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew Jose Martinez  
 Truck # 9247  
 City Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

RIBBON COLOR None

|                     |                  |
|---------------------|------------------|
| FACING <u>North</u> |                  |
| SURFACE ELEVATION   | <u>2325.94</u>   |
| TOP ELEVATION       | <u>2325.36</u>   |
| BOTTOM ELEVATION    | <u>2323.74</u>   |
| WIDTH/O.D.          |                  |
| 0.58                | TOP DEPTH (FEET) |
| 2.20                | BOTTOM (FEET)    |

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS 4"

PAVING TYPE Concrete

SOIL CONDITION Dirt

SIZE N/A

TYPE Wall Footing

FACILITY OWNER None

## COMMENTS:

Per client request top and bottom of wall footing.

PREPARED BY: W. Morales

CHECKED BY: M. Huber

# TEST HOLE DATA REPORT

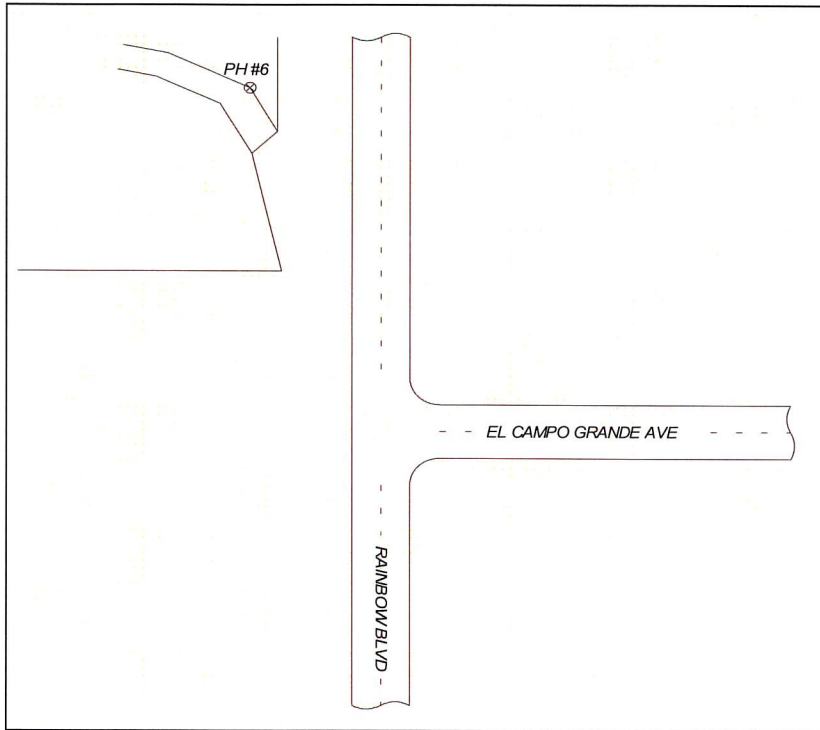
Test Hole # 6  
 Date Dug 6/2/2011  
 Project # NVU1105-001  
 Phase # 002  
 Location Rainbow Boulevard & Ann Road



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew Jose Martinez  
 Truck # 9247  
 City Las Vegas  
 County Clark

## LOCATION PLAN - NOT TO SCALE



| SITE BENCHMARK |  | CROSS SECTION - NOT TO SCALE |  |         |  |
|----------------|--|------------------------------|--|---------|--|
|                |  | FACING                       |  | North   |  |
|                |  | SURFACE ELEVATION            |  | 2326.00 |  |
|                |  | TOP ELEVATION                |  | 2325.42 |  |
|                |  | BOTTOM ELEVATION             |  | 2323.70 |  |
| RIBBON COLOR   |  | None                         |  |         |  |

COORDINATES: NORTHING None EASTING None  
 STATIONING: STATION None OFFSET None  
 PAVING THICKNESS 4" PAVING TYPE Concrete SOIL CONDITION Dirt  
 SIZE N/A TYPE Wall Footing FACILITY OWNER None

### COMMENTS:

Per client request top and bottom of wall footing.

PREPARED BY: W. Morales

CHECKED BY: M. Huber



Testhole Data Summary



Date: 7/20/2011  
Project Number: NVU1105-003  
Project Name: Ann Road Channel West

| ANRB<br>PLANS # | TH # | Location                                | Date of Excavation | Utility Owner                      | Utility Size | Utility<br>Description | Coordinates |         | Stationing |        | Ground Elevation | Top Elevation | Bottom Elevation | Invert Elevation | Depth of Cover | Comments                                                                                |
|-----------------|------|-----------------------------------------|--------------------|------------------------------------|--------------|------------------------|-------------|---------|------------|--------|------------------|---------------|------------------|------------------|----------------|-----------------------------------------------------------------------------------------|
|                 |      |                                         |                    |                                    |              |                        | Northing    | Easting | Stationing | Offset |                  |               |                  |                  |                |                                                                                         |
| 47              | 1    | Rainbow Boulevard<br>& Ann Road         | 7/19/2011          | Southwest Gas                      | 4"           | PE                     | None        | None    | None       | None   | 2325.53          | 2321.11       | 2320.74          | 2320.76          | 4.42           |                                                                                         |
| 48              | 2    | Rainbow Boulevard<br>& Ann Road         | 7/19/2011          | Las Vegas Valley<br>Water District | 36"          | RCP                    | None        | None    | None       | None   | 2325.19          | 2318.29       | 2314.63          | 2314.96          | 6.90           |                                                                                         |
| 49              | 3    | Rainbow Boulevard<br>& El Campo Grande  | 7/19/2011          | Las Vegas Valley<br>Water District | 6"           | PVC                    | None        | None    | None       | None   | 2326.56          | 2321.46       | 2320.91          | 2320.93          | 5.10           |                                                                                         |
| 50              | 4    | Rainbow Boulevard<br>& Ambiance Lane    | 7/18/2011          | Las Vegas Valley<br>Water District | 36"          | RCP                    | None        | None    | None       | None   | 2327.14          | 2320.34       | 2316.68          | 2317.01          | 6.80           |                                                                                         |
| 51              | 5    | Rainbow Boulevard<br>& Ambiance Lane    | 7/18/2011          | Las Vegas Valley<br>Water District | 36"          | RCP                    | None        | None    | None       | None   | 2328.60          | 2321.86       | 2318.20          | 2318.54          | 6.74           |                                                                                         |
| 52              | 6    | Rainbow Boulevard<br>& Tropical Parkway | 7/19/2011          | Las Vegas Valley<br>Water District | 12"          | DIP                    | None        | None    | None       | None   | 2330.39          | 2321.79       | 2320.69          | 2320.74          | 8.60           | NOTE: 12" WATER LINE<br>CONNECTS WITH 36"<br>WATER LINE AS<br>INDICATED ON FORM 6-<br>A |
| 53              | 6-A  | Rainbow Boulevard<br>& Tropical Parkway | 7/18/2011          | Las Vegas Valley<br>Water District | 36"          | RCP                    | None        | None    | None       | None   | 2330.41          | 2323.71       | 2320.05          | 2320.38          | 6.70           |                                                                                         |
| 54              | 6-B  | Rainbow Boulevard<br>& Tropical Parkway | 7/18/2011          | Las Vegas Valley<br>Water District | 1"           | PVC                    | None        | None    | None       | None   | 2330.39          | 2324.69       | 2324.58          | 2324.59          | 5.70           |                                                                                         |
| 55              | 7    | Rainbow Boulevard<br>& Tropical Parkway | 7/18/2011          | Las Vegas Valley<br>Water District | 12"          | PVC                    | None        | None    | None       | None   | 2330.93          | 2327.28       | 2326.22          | 2326.25          | 3.65           |                                                                                         |
| 56              | 8    | Rainbow Boulevard<br>& Tropical Parkway | 7/18/2011          | Nevada Energy                      | Seven-3"     | PVC                    | None        | None    | None       | None   | 2331.48          | 2328.50       | 2326.93          | NA               | 2.98           | FOR PLAN, THE BOTTOM<br>OF TWO BANKS USE AS<br>INV                                      |
| 57              | 8-A  | Rainbow Boulevard<br>& Tropical Parkway | 7/18/2011          | Century Link                       | Six-2"       | PVC                    | None        | None    | None       | None   | 2331.57          | 2329.02       | 2327.02          | NA               | 2.55           | 8A and 8B are same point<br>FOR PLAN, THE BOTTOM<br>OF TWO BANKS USE AS                 |
| 58              | 8B   | Rainbow Boulevard<br>& Tropical Parkway | 7/18/2011          | City of Las Vegas<br>Street Light  | 2"           | PVC                    | None        | None    | None       | None   | 2331.57          | 2328.99       | 2328.80          | NA               | 2.58           | 8A and 8B are same point<br>FOR PLAN, THE BOTTOM<br>OF TWO BANKS USE AS                 |

FIGURE A-7

# TEST HOLE DATA REPORT

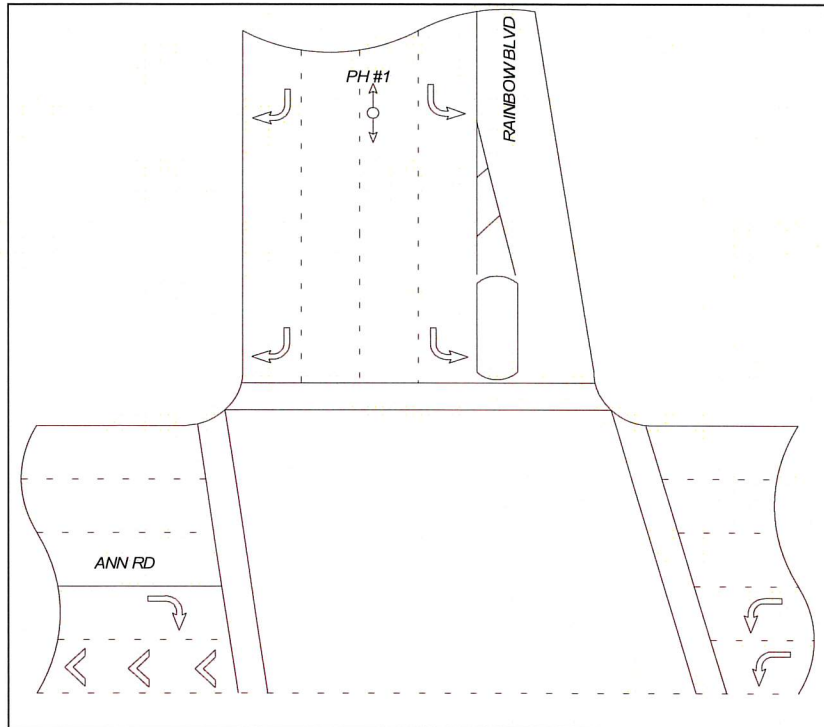
Test Hole # 1  
 Date Dug 7/19/2011  
 Project # NVU1105-003  
 Phase # 003  
 Location Rainbow Boulevard & Ann Road



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J. Martinez  
 Truck # 9247  
 City LAS VEGAS  
 County CLARK

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

|              |  |                   |                |                       |
|--------------|--|-------------------|----------------|-----------------------|
|              |  | FACING            | <u>North</u>   |                       |
|              |  | SURFACE ELEVATION | <u>2325.53</u> |                       |
|              |  | TOP ELEVATION     | <u>2321.11</u> | 4.42 TOP DEPTH (FEET) |
|              |  | BOTTOM ELEVATION  | <u>2320.74</u> | 4.79 BOTTOM (FEET)    |
| RIBBON COLOR |  | Yellow            |                |                       |

COORDINATES: NORTHING None EASTING None  
 STATIONING: STATION None OFFSET None  
 PAVING THICKNESS 6" PAVING TYPE Asphalt SOIL CONDITION Dirt  
 SIZE 4" TYPE PE FACILITY OWNER Southwestgas

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

FIGURE A-7

# TEST HOLE DATA REPORT

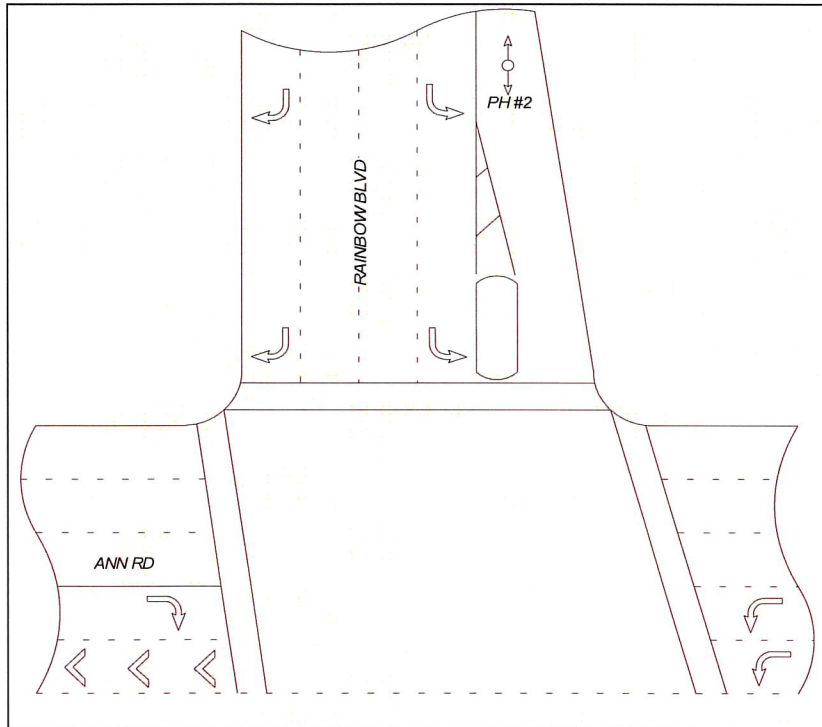
Test Hole # 2  
 Date Dug 7/19/2011  
 Project # NVU1105-003  
 Phase # 003  
 Location Rainbow Boulevard & Ann Road



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J. Martinez  
 Truck # 9247  
 City LAS VEGAS  
 County CLARK

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

|                          |  |                                  |                       |
|--------------------------|--|----------------------------------|-----------------------|
|                          |  | FACING <u>NORTH</u>              |                       |
|                          |  | SURFACE ELEVATION <u>2325.19</u> |                       |
|                          |  | TOP ELEVATION <u>2318.29</u>     | 6.90 TOP DEPTH (FEET) |
|                          |  | BOTTOM ELEVATION <u>2314.63</u>  | 10.56 BOTTOM (FEET)   |
| RIBBON COLOR <u>Blue</u> |  |                                  |                       |

COORDINATES: NORTHING None EASTING None  
 STATIONING: STATION None OFFSET None  
 PAVING THICKNESS Dirt PAVING TYPE Dirt SOIL CONDITION Dirt  
 SIZE 36" TYPE RCP FACILITY OWNER Las Vegas Valley Water District

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

FIGURE A-7

# TEST HOLE DATA REPORT

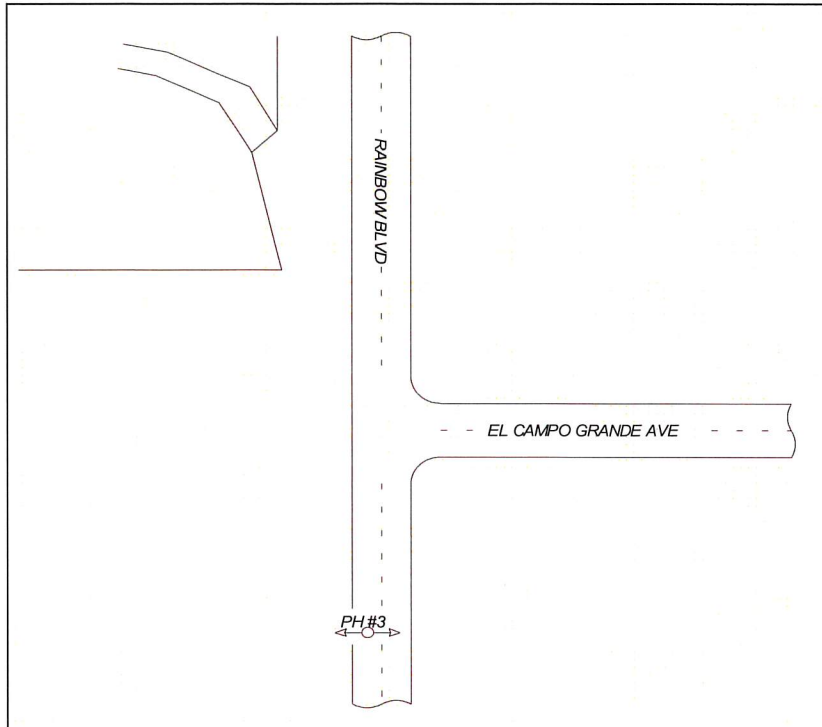
Test Hole # 3  
 Date Dug 7/19/2011  
 Project # NVU1105-003  
 Phase # 003  
 Location Rainbow Boulevard & El Campo Grande



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J. Martinez  
 Truck # 9247  
 City LAS VEGAS  
 County CLARK

## LOCATION PLAN - NOT TO SCALE



| SITE BENCHMARK |      | CROSS SECTION - NOT TO SCALE |                |                                                                  |             |                     |
|----------------|------|------------------------------|----------------|------------------------------------------------------------------|-------------|---------------------|
|                |      | FACING <u>EAST</u>           |                |                                                                  |             |                     |
|                |      | SURFACE ELEVATION            | <u>2326.56</u> | <div><div></div><div>WIDTH/O.D.<br/>6.63"</div><div></div></div> |             |                     |
|                |      | TOP ELEVATION                | <u>2321.46</u> |                                                                  | <u>5.10</u> | TOP DEPTH<br>(FEET) |
|                |      | BOTTOM ELEVATION             | <u>2320.91</u> |                                                                  | <u>5.65</u> | BOTTOM<br>(FEET)    |
| RIBBON COLOR   | Blue |                              |                |                                                                  |             |                     |

COORDINATES: NORTHING None EASTING None  
 STATIONING: STATION None OFFSET None  
 PAVING THICKNESS 6" PAVING TYPE Asphalt SOIL CONDITION Dirt  
 SIZE 6" TYPE PVC FACILITY OWNER Las Vegas Valley Water District

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

FIGURE A-7



# TEST HOLE DATA REPORT

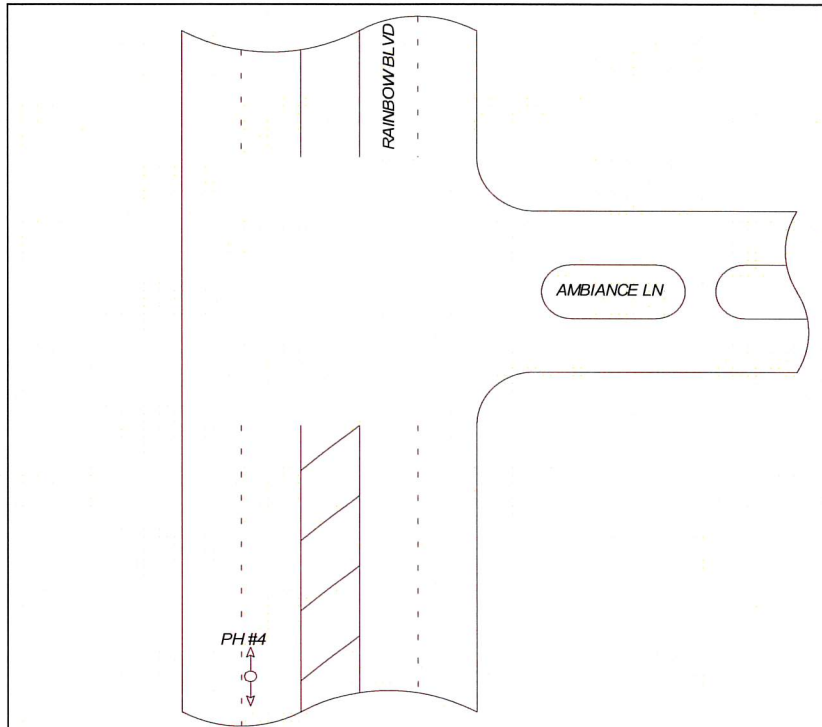
Test Hole # 4  
 Date Dug 7/18/2011  
 Project # NVU1105-003  
 Phase # 003  
 Location Rainbow Boulevard & Ambiance Lane



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J.Martinez  
 Truck # 9247  
 City LAS VEGAS  
 County CLARK

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

RIBBON COLOR Blue

## CROSS SECTION - NOT TO SCALE

|                                  |                       |
|----------------------------------|-----------------------|
| FACING <u>NORTH</u>              |                       |
| SURFACE ELEVATION <u>2327.14</u> | WIDTH/O.D. <u>44"</u> |
| TOP ELEVATION <u>2320.34</u>     | 6.80 TOP DEPTH (FEET) |
| BOTTOM ELEVATION <u>2316.68</u>  | 10.46 BOTTOM (FEET)   |

COORDINATES: NORTHING None EASTING None  
 STATIONING: STATION None OFFSET None  
 PAVING THICKNESS 6" PAVING TYPE Asphalt SOIL CONDITION Dirt  
 SIZE 36" TYPE RCP FACILITY OWNER Las Vegas Valley Water District

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales



# TEST HOLE DATA REPORT

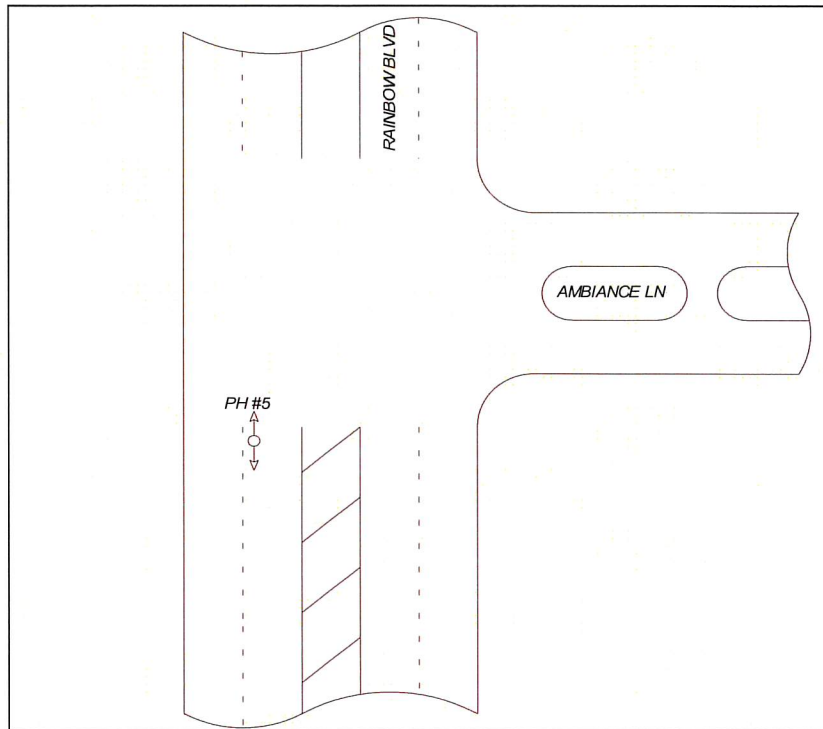
Test Hole # 5  
 Date Dug 7/18/2011  
 Project # NVU1105-003  
 Phase # 003  
 Location Rainbow Boulevard & Ambiance Lane



SUE Crew J.Martinez  
 Truck # 9247  
 City LAS VEGAS  
 County CLARK

720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

RIBBON COLOR Blue

## CROSS SECTION - NOT TO SCALE

|                                  |                       |
|----------------------------------|-----------------------|
| FACING <u>NORTH</u>              |                       |
| SURFACE ELEVATION <u>2328.60</u> | WIDTH/O.D. <u>44"</u> |
| TOP ELEVATION <u>2321.86</u>     | 6.74 TOP DEPTH (FEET) |
| BOTTOM ELEVATION <u>2318.20</u>  | 10.40 BOTTOM (FEET)   |

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS 6"

PAVING TYPE Asphalt

SOIL CONDITION Dirt

SIZE 36"

TYPE RCP

FACILITY OWNER Las Vegas Valley Water District

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

FIGURE A-7

# TEST HOLE DATA REPORT

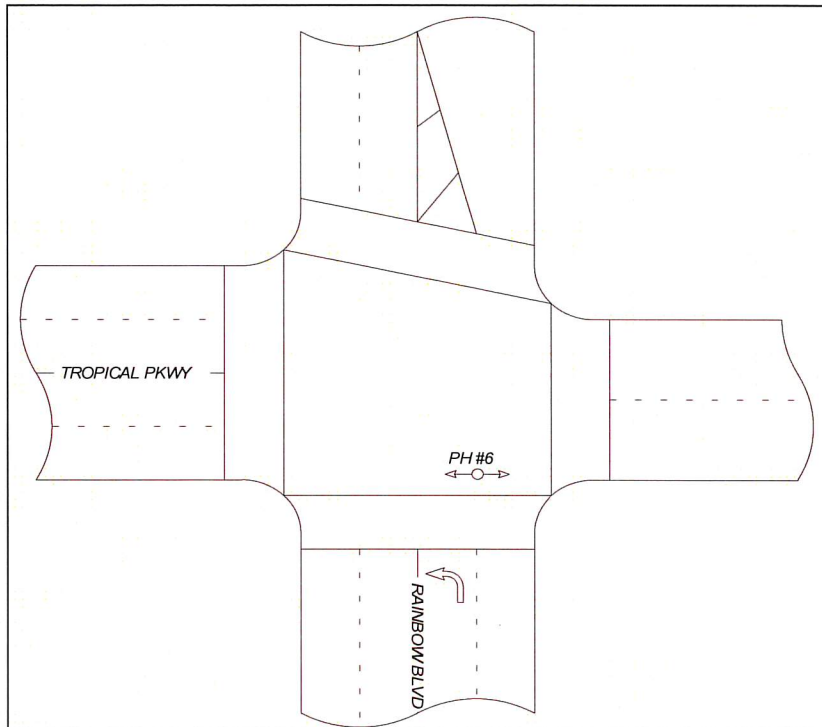
Test Hole # 6  
 Date Dug 7/19/2011  
 Project # NVU1105-003  
 Phase # 003  
 Location Rainbow Boulevard & Tropical Parkway



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J.Martinez  
 Truck # 9247  
 City LAS VEGAS  
 County CLARK

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

RIBBON COLOR Blue

|                                  |                         |
|----------------------------------|-------------------------|
| FACING <u>WEST</u>               |                         |
| SURFACE ELEVATION <u>2330.39</u> | WIDTH/O.D. <u>13.2"</u> |
| TOP ELEVATION <u>2321.79</u>     | 8.60 TOP DEPTH (FEET)   |
| BOTTOM ELEVATION <u>2320.69</u>  | 9.70 BOTTOM (FEET)      |

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS 4"

PAVING TYPE Asphalt

SOIL CONDITION Dirt

SIZE 12" TYPE DIP

FACILITY OWNER Las Vegas Valley Water District

## COMMENTS:

NOTE: 12" WATER LINE CONNECTS WITH 36" WATER LINE AS INDICATED ON FORM 6-A

PREPARED BY: M. Huber

CHECKED BY: W. Morales

# TEST HOLE DATA REPORT

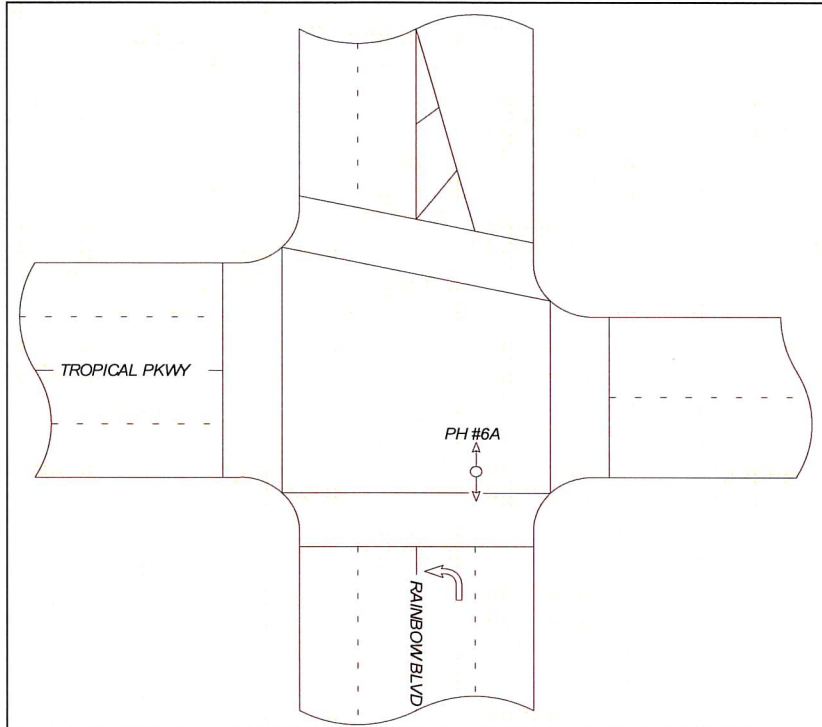
Test Hole # 6-A  
 Date Dug 7/18/2011  
 Project # NVU1105-003  
 Phase # 003  
 Location Rainbow Boulevard & Tropical Parkway



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J.Martinez  
 Truck # 9247  
 City LAS VEGAS  
 County CLARK

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

RIBBON COLOR Blue

## CROSS SECTION - NOT TO SCALE

|                                  |                       |
|----------------------------------|-----------------------|
| FACING <u>NORTH</u>              |                       |
| SURFACE ELEVATION <u>2330.41</u> | WIDTH/O.D. <u>44"</u> |
| TOP ELEVATION <u>2323.71</u>     | 6.70 TOP DEPTH (FEET) |
| BOTTOM ELEVATION <u>2320.05</u>  | 10.36 BOTTOM (FEET)   |

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS 4"

PAVING TYPE Asphalt

SOIL CONDITION Dirt

SIZE 36"

TYPE RCP

FACILITY OWNER Las Vegas Valley Water District

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

# TEST HOLE DATA REPORT

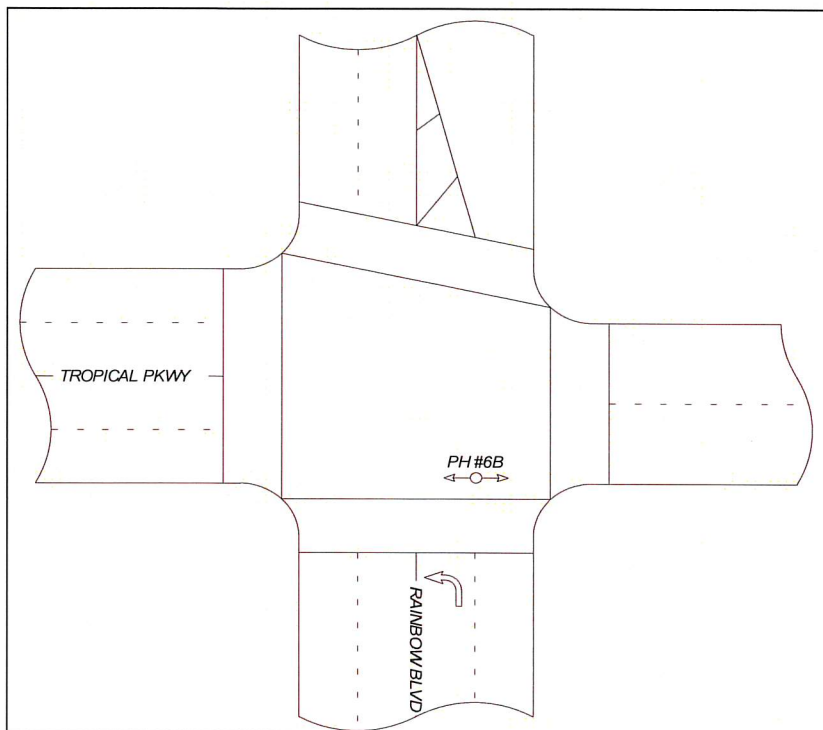
Test Hole # 6-B  
 Date Dug 7/18/2011  
 Project # NVU1105-003  
 Phase # 003  
 Location Rainbow Boulevard & Tropical Parkway



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J.Martinez  
 Truck # 9247  
 City LAS VEGAS  
 County CLARK

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

|                          |  |                                  |                       |
|--------------------------|--|----------------------------------|-----------------------|
|                          |  | FACING <u>NORTH</u>              |                       |
|                          |  | SURFACE ELEVATION <u>2330.39</u> |                       |
|                          |  | TOP ELEVATION <u>2324.69</u>     | 5.70 TOP DEPTH (FEET) |
|                          |  | BOTTOM ELEVATION <u>2324.58</u>  | 5.81 BOTTOM (FEET)    |
| RIBBON COLOR <u>Blue</u> |  | WIDTH/O.D. <u>1.32"</u>          |                       |

COORDINATES: NORTHING None EASTING None  
 STATIONING: STATION None OFFSET None  
 PAVING THICKNESS 4" PAVING TYPE Asphalt SOIL CONDITION Dirt  
 SIZE 1" TYPE PVC FACILITY OWNER Las Vegas Valley Water District

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

# TEST HOLE DATA REPORT

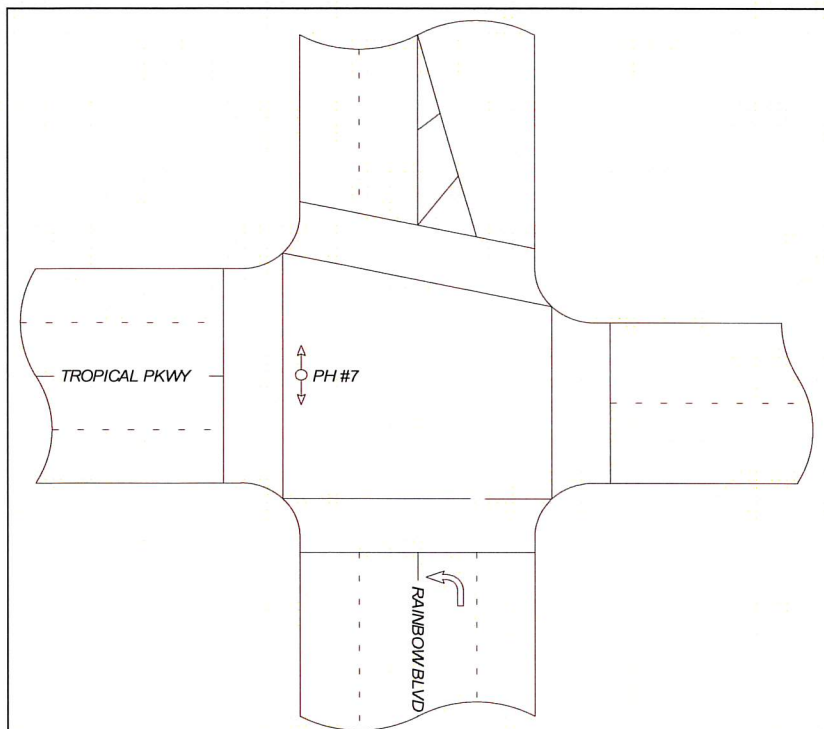
Test Hole # 7  
 Date Dug 7/18/2011  
 Project # NVU1105-003  
 Phase # 003  
 Location Rainbow Boulevard & Tropical Parkway



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J.Martinez  
 Truck # 9247  
 City LAS VEGAS  
 County CLARK

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

RIBBON COLOR Blue

## CROSS SECTION - NOT TO SCALE

|                          |                |
|--------------------------|----------------|
| FACING <u>NORTH</u>      |                |
| SURFACE ELEVATION        | <u>2330.93</u> |
| TOP ELEVATION            | <u>2327.28</u> |
| BOTTOM ELEVATION         | <u>2326.22</u> |
| WIDTH/O.D. <u>12.75"</u> |                |
|                          |                |
| TOP DEPTH (FEET)         | <u>3.65</u>    |
| BOTTOM (FEET)            | <u>4.71</u>    |

COORDINATES: NORTHING None EASTING None  
 STATIONING: STATION None OFFSET None  
 PAVING THICKNESS 4" PAVING TYPE Asphalt SOIL CONDITION Dirt  
 SIZE 12" TYPE PVC FACILITY OWNER Las Vegas Valley Water District

## COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales



# TEST HOLE DATA REPORT

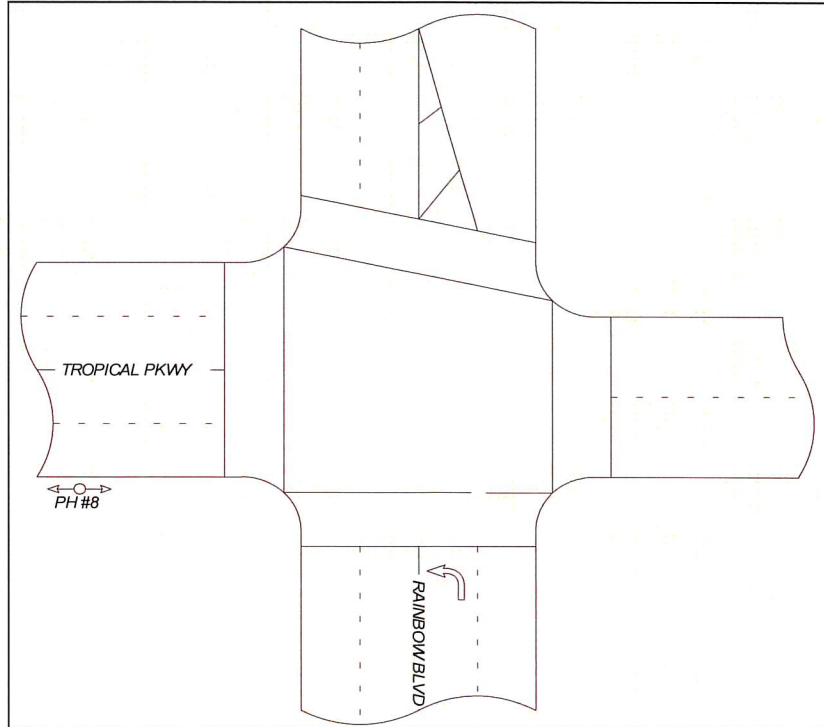
Test Hole # 8  
 Date Dug 7/18/2011  
 Project # NVU1105-003  
 Phase # 003  
 Location Rainbow Boulevard & Tropical Parkway



SUE Crew J.Martinez  
 Truck # 9247  
 City LAS VEGAS  
 County CLARK

720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

|              |  |                   |         |                       |
|--------------|--|-------------------|---------|-----------------------|
|              |  | FACING            | WEST    |                       |
|              |  | SURFACE ELEVATION | 2331.48 |                       |
|              |  | TOP ELEVATION     | 2328.50 | 2.98 TOP DEPTH (FEET) |
|              |  | BOTTOM ELEVATION  | 2326.93 | 4.55 BOTTOM (FEET)    |
| RIBBON COLOR |  | Red               |         |                       |

COORDINATES: NORTHING None EASTING None  
 STATIONING: STATION None OFFSET None  
 PAVING THICKNESS 3" PAVING TYPE Concrete SOIL CONDITION Dirt  
 SIZE Seven-3" TYPE PVC FACILITY OWNER Nevada Energy

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

# TEST HOLE DATA REPORT

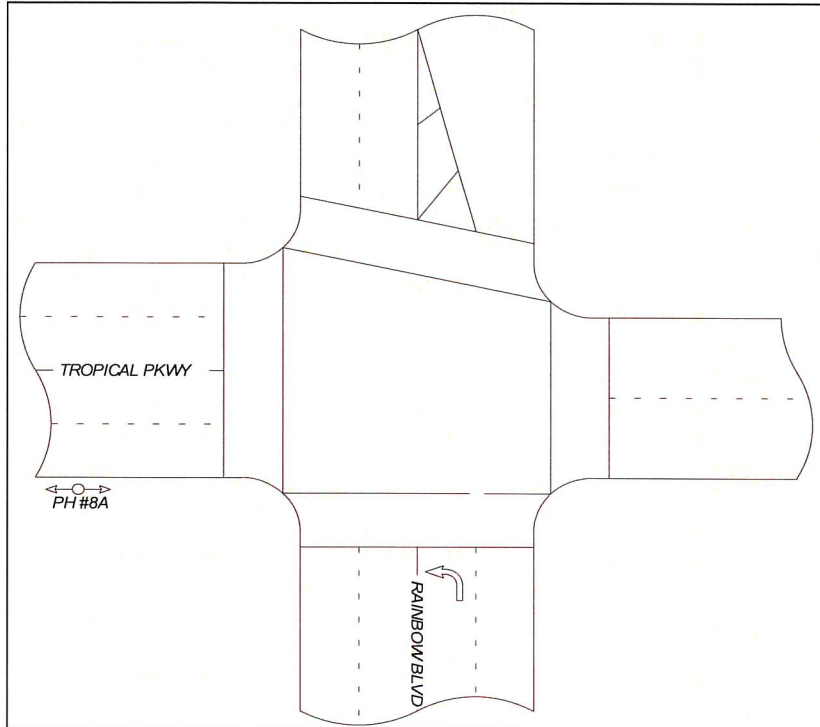
Test Hole # 8-A  
 Date Dug 7/18/2011  
 Project # NVU1105-003  
 Phase # 003  
 Location Rainbow Boulevard & Tropical Parkway



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J.Martinez  
 Truck # 9247  
 City LAS VEGAS  
 County CLARK

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

|                            |  |                                  |                       |
|----------------------------|--|----------------------------------|-----------------------|
|                            |  | FACING <u>WEST</u>               |                       |
|                            |  | SURFACE ELEVATION <u>2331.57</u> |                       |
|                            |  | TOP ELEVATION <u>2329.02</u>     | 2.55 TOP DEPTH (FEET) |
|                            |  | BOTTOM ELEVATION <u>2327.02</u>  | 4.55 BOTTOM (FEET)    |
| RIBBON COLOR <u>Orange</u> |  | WIDTH/O.D. <u>40"</u><br>        |                       |

COORDINATES: NORTHING None EASTING None  
 STATIONING: STATION None OFFSET None  
 PAVING THICKNESS 3" PAVING TYPE Concrete SOIL CONDITION Dirt  
 SIZE Six-2" TYPE PVC FACILITY OWNER Century Link

## COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

FIGURE A-7

# TEST HOLE DATA REPORT

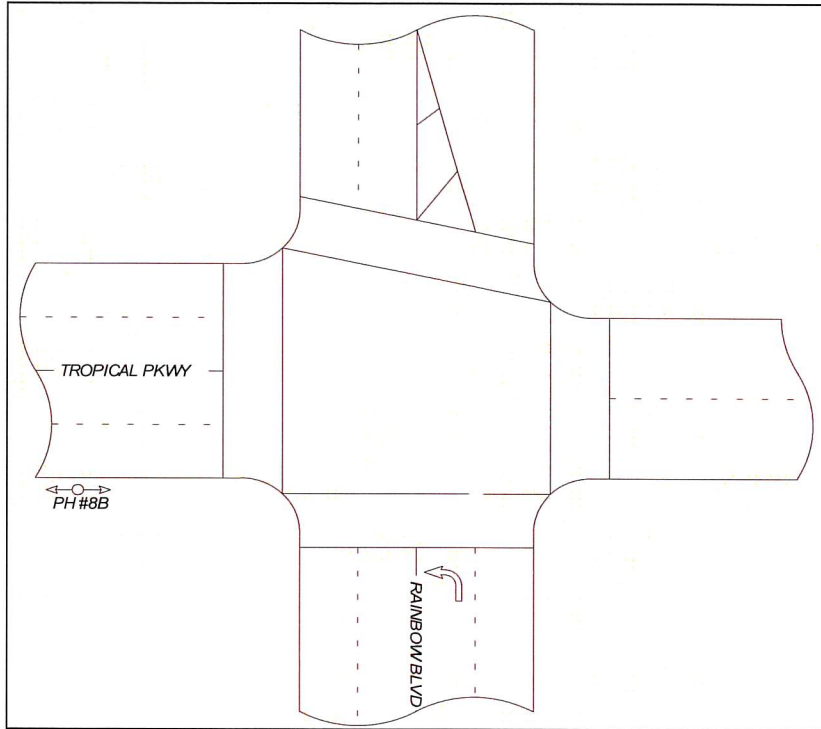
Test Hole # 8B  
 Date Dug 7/18/2011  
 Project # NVU1105-003  
 Phase # 003  
 Location Rainbow Boulevard & Tropical Parkway



720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030  
 Tel. (702) 396-3426 Fax. (702) 396-3758

SUE Crew J.Martinez  
 Truck # 9247  
 City LAS VEGAS  
 County CLARK

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

Blank area for site benchmark details.

## CROSS SECTION - NOT TO SCALE

|                   |         |            |                  |
|-------------------|---------|------------|------------------|
|                   | FACING  | WEST       |                  |
| SURFACE ELEVATION | 2331.57 | WIDTH/O.D. | 2.38             |
| TOP ELEVATION     | 2328.99 | 2.58       | TOP DEPTH (FEET) |
| BOTTOM ELEVATION  | 2328.80 | 2.77       | BOTTOM (FEET)    |

RIBBON COLOR Red

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS 3"

PAVING TYPE Concrete

SOIL CONDITION Dirt

SIZE 2"

TYPE PVC

FACILITY OWNER City of Las Vegas Street Light

COMMENTS:

Blank area for comments.

PREPARED BY: M. Huber

CHECKED BY: W. Morales

## Testhole Data Summary



Date: 11/22/2011  
 Project Number: NVU1105-004  
 Project Name: Ann Rd and Rainbow Storm Drain Project

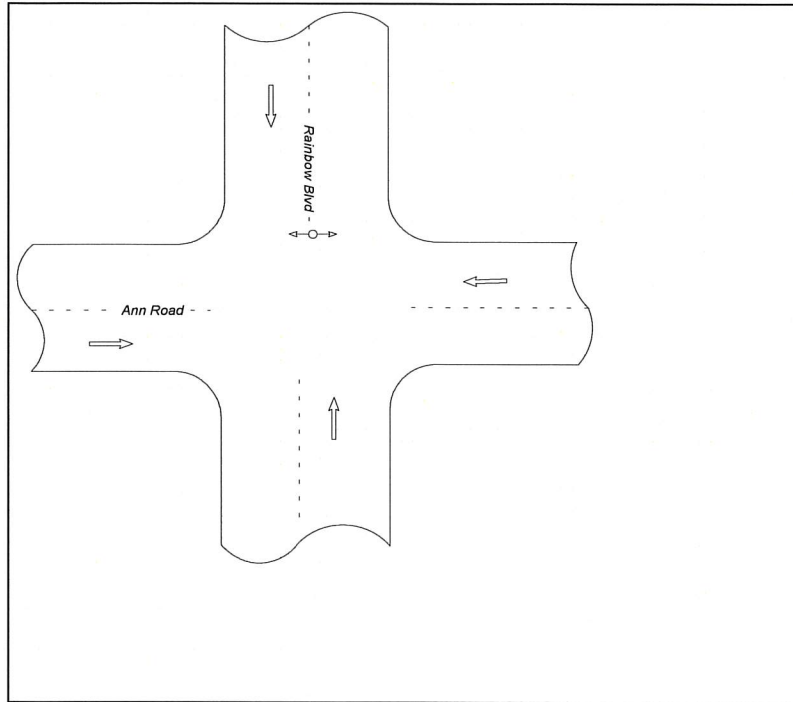
| ANRB<br>Plan # | TH # | Location                          | Date of<br>Excavation | Utility Owner | Utility Size      | Utility<br>Description | Coordinates |         | Stationing |        | Ground Elevation | Top Elevation | Bottom Elevation | Depth of Cover | Comments |
|----------------|------|-----------------------------------|-----------------------|---------------|-------------------|------------------------|-------------|---------|------------|--------|------------------|---------------|------------------|----------------|----------|
|                |      |                                   |                       |               |                   |                        | Northing    | Easting | Stationing | Offset |                  |               |                  |                |          |
| 59             | 1    | Ann Road and<br>Rainbow Boulevard | 11/22/2011            | Nevada Energy | Two-3" and One-2" | PVC                    | None        | None    | None       | None   | 2323.90          | 2321.00       | 2319.80          | 2.90           |          |

Figure A-7

# TEST HOLE DATA REPORT

|             |                                       |                                                                                                                               |                                                             |                   |                  |
|-------------|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|-------------------|------------------|
| Test Hole # | <u>1</u>                              | <br><small>www.aztec.us TYPESA group</small> | SUE Crew                                                    | <u>J.Martinez</u> |                  |
| Date Dug    | <u>11/22/2011</u>                     |                                                                                                                               | Truck #                                                     | <u>9247</u>       |                  |
| Project #   | <u>NVU1105</u>                        |                                                                                                                               | 720 W Cheyenne Avenue, Suite 110, North Las Vegas, NV 89030 | City              | <u>Las Vegas</u> |
| Phase #     | <u>004</u>                            |                                                                                                                               | Tel. (702) 396-3426 Fax. (702) 396-3758                     | County            | <u>Clark</u>     |
| Location    | <u>Ann Road and Rainbow Boulevard</u> |                                                                                                                               |                                                             |                   |                  |

## LOCATION PLAN - NOT TO SCALE



## SITE BENCHMARK

## CROSS SECTION - NOT TO SCALE

|              |            |                   |                                                                                       |
|--------------|------------|-------------------|---------------------------------------------------------------------------------------|
|              |            | FACING            | <u>West</u>                                                                           |
|              |            | SURFACE ELEVATION | <u>2323.90</u>                                                                        |
|              |            | TOP ELEVATION     | <u>2321.00</u>                                                                        |
|              |            | BOTTOM ELEVATION  | <u>2319.80</u>                                                                        |
|              |            | WIDTH/O.D.        | <u>12"</u>                                                                            |
|              |            |                   |  |
|              |            |                   | <u>2.90</u> TOP DEPTH (FEET)                                                          |
|              |            |                   | <u>4.10</u> BOTTOM (FEET)                                                             |
| RIBBON COLOR | <u>Red</u> |                   |                                                                                       |

|                       |                          |             |                |
|-----------------------|--------------------------|-------------|----------------|
| COORDINATES: NORTHING | <u>None</u>              | EASTING     | <u>None</u>    |
| STATIONING: STATION   | <u>None</u>              | OFFSET      | <u>None</u>    |
| PAVING THICKNESS      | <u>4"</u>                | PAVING TYPE | <u>Asphalt</u> |
| SOIL CONDITION        | <u>Dirt</u>              |             |                |
| SIZE                  | <u>Two-3" and One-2"</u> | TYPE        | <u>PVC</u>     |
| FACILITY OWNER        | <u>Nevada Energy</u>     |             |                |

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales



**APN 125-26-304-005**  
**VALKEN DEVELOPMENT LLC**

DATE PREPARED;  
JULY 11, 2011

**EXHIBIT "A"**

**AUTHORIZATION TO ENTER PROPERTY .**  
**.DESCRIPTION**

BEING A PORTION OF **PARCEL I** AS RECORDED IN DOCUMENT 2008052903604, OFFICIAL RECORDS OF CLARK COUNTY, NEVADA, LYING WITHIN THE SOUTH HALF (S 1/2) OF THE SOUTH HALF (S 1/2) OF THE NORTHWEST QUARTER (NW 1/4) OF THE SOUTHWEST QUARTER (SW 1/4) OF SECTION 26, TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.D.M., CLARK COUNTY, NEVADA. MORE PARTICULARLY DESCRIBED AS FOLLOWS;

COMMENCING AT THE SOUTHWEST CORNER OF THE NORTHWEST QUARTER (NW 1/4) OF THE SOUTHWEST QUARTER (SW 1/4) OF SAID SECTION 26; THENCE NORTH 00°10'10" WEST, A DISTANCE OF 206.99 FEET ALONG THE WEST LINE OF SAID NORTHWEST QUARTER (NW 1/4) TO THE SOUTHWEST CORNER OF SAID PARCEL I, SAID POINT BEING THE **POINT OF BEGINNING**

THENCE CONTINUING NORTH 00°10'10" WEST, A DISTANCE OF 85.61 FEET ALONG SAID WEST LINE, AND THE WEST LINE OF SAID PARCEL I TO THE NORTHWEST CORNER OF SAID PARCEL I; THENCE LEAVING SAID WEST LINE SOUTH 83°19'54" EAST, A DISTANCE OF 50.36 FEET ALONG THE NORTH LINE OF SAID PARCEL I; THENCE LEAVING SAID NORTH LINE SOUTH 00°10'10" EAST, A DISTANCE OF 85.61 FEET TO THE SOUTH LINE OF SAID PARCEL I; THENCE NORTH 83°19'54" WEST, A DISTANCE OF 50.36 FEET ALONG THE SOUTH LINE OF SAID PARCEL I TO THE **POINT OF BEGINNING**.

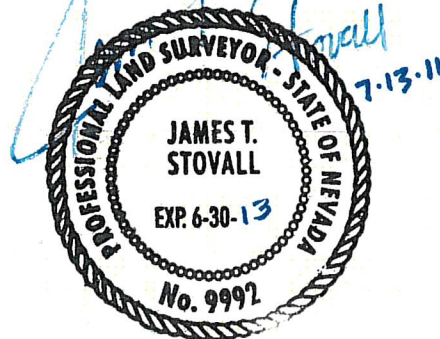
THE ABOVE DESCRIPTION CONTAINS 4,281 SQUARE FEET MORE OR LESS AND ATTACHED HERETO IS A MAP LABELED EXHIBIT B AND BY THIS REFERENCE IS MADE A PART HEREOF.

**BASIS OF BEARING**

N00°10'10"W BEING THE WEST LINE OF THE NORTHWEST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 26, TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.D.M., PER A RECORD OF SURVEY RECORDED IN FILE 183 PAGE 42, OFFICIAL RECORDS OF CLARK COUNTY, NEVADA.

**PREPARED BY;**

JAMES TODD STOVALL PLS  
NEVADA LICENSE NUMBER 9992  
JACOBS ENGINEERING GROUP  
319 EAST WARM SPRINGS ROAD STE. 200  
LAS VEGAS, NEVADA 89119  
(702)938-5400



APN 125-26-304-005  
VALKEN DEVELOPMENT LLC

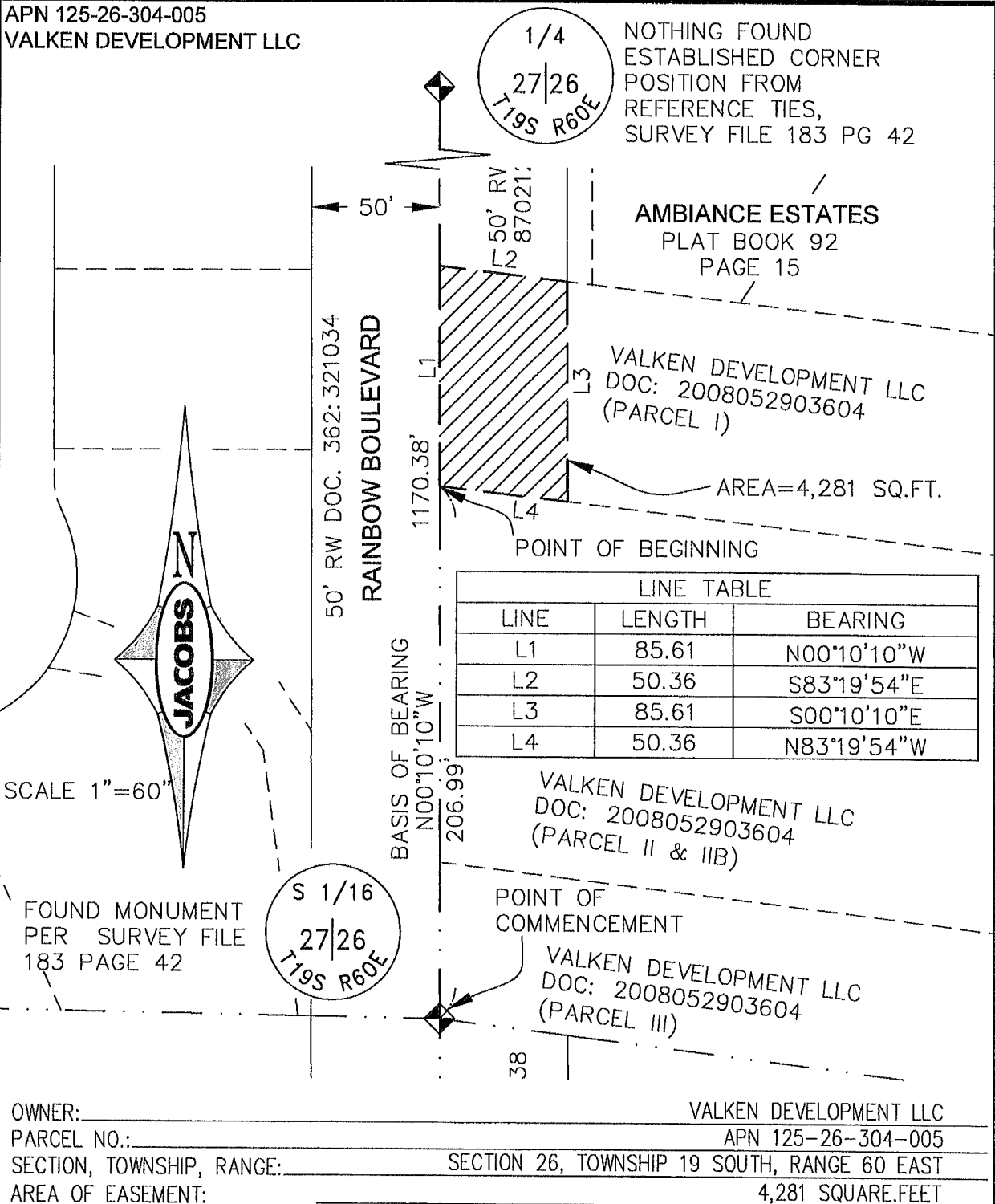


EXHIBIT "B"  
AUTHORIZATION TO ENTER PROPERTY

JOB NO: W4X53700

DATE: 7-11-11

DRAWN BY: JTS

CHECKED BY: DJR

**JACOBS**

319 WARM SPRINGS Rd  
Las Vegas, Nevada 89119  
(702) 938-5400

**APN 125-26-304-006**  
**VALKEN DEVELOPMENT LLC**

DATE PREPARED;  
JULY 11, 2011

**EXHIBIT "A"**

**AUTHORIZATION TO ENTER PROPERTY .**  
**DESCRIPTION**

BEING A PORTION OF A PARCEL II & IIB PER A DEED RECORDED AS DOCUMENT 2008052903604, OFFICIAL RECORDS OF CLARK COUNTY, NEVADA, LYING WITHIN THE SOUTH HALF (S 1/2) OF THE SOUTH HALF (S 1/2) OF THE NORTHWEST QUARTER (NW 1/4) OF THE SOUTHWEST QUARTER (SW 1/4) OF SECTION 26, TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.D.M., CLARK COUNTY, NEVADA. MORE PARTICULARLY DESCRIBED AS FOLLOWS;

COMMENCING AT THE SOUTHWEST CORNER OF THE NORTHWEST QUARTER (NW 1/4) OF THE SOUTHWEST QUARTER (SW 1/4) OF SAID SECTION 26; THENCE NORTH 00°10'10" WEST, A DISTANCE OF 60.65 FEET ALONG THE WEST LINE OF SAID NORTHWEST QUARTER (NW 1/4) TO THE SOUTHWEST CORNER OF SAID PARCEL IIB, SAID POINT BEING THE **POINT OF BEGINNING**

THENCE CONTINUING NORTH 00°10'10" WEST, A DISTANCE OF 146.34 FEET ALONG SAID WEST LINE TO THE NORTHWEST CORNER OF SAID PARCEL II; THENCE LEAVING SAID WEST LINE SOUTH 83°19'54" EAST, A DISTANCE OF 50.36 FEET ALONG THE NORTH LINE OF SAID PARCEL II; THENCE LEAVING SAID NORTH LINE SOUTH 00°10'10" EAST, A DISTANCE OF 146.53 FEET TO THE SOUTH LINE OF SAID PARCEL IIB ; THENCE NORTH 83°06'40" WEST, A DISTANCE OF 50.38 FEET ALONG SAID SOUTH LINE TO THE **POINT OF BEGINNING**.

THE ABOVE DESCRIPTION CONTAINS 7,322 SQUARE FEET MORE OR LESS AND ATTACHED HERETO IS A MAP LABELED EXHIBIT B AND BY THIS REFERENCE IS MADE A PART HEREOF.

**BASIS OF BEARING**

N00°10'10"W BEING THE WEST LINE OF THE NORTHWEST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 26, TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.D.M., PER A RECORD OF SURVEY RECORDED IN FILE 183 PAGE 42, OFFICIAL RECORDS OF CLARK COUNTY, NEVADA.

**PREPARED BY;**

JAMES TODD STOVALL PLS  
NEVADA REGISTRATION NUMBER 9992  
JACOBS ENGINEERING GROUP  
319 EAST WARM SPRINGS ROAD STE. 200  
LAS VEGAS, NEVADA 89119  
(702)938-5400

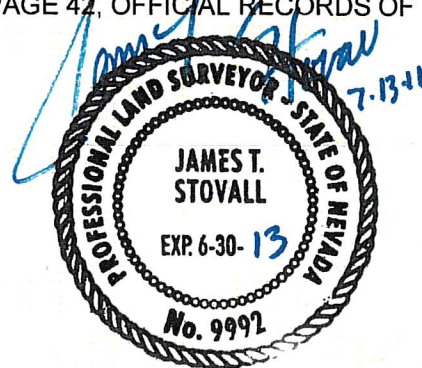


FIGURE A-8



**APN 125-26-304-007**  
**VALKEN DEVELOPMENT LLC**

DATE PREPARED;  
JULY 11, 2011

**EXHIBIT "A"**

**AUTHORIZATION TO ENTER PROPERTY.**

**DESCRIPTION**

A PORTION OF **PARCEL III** PER THE DEED RECORDED IN DOCUMENT 2008052903604, OFFICIAL RECORDS OF CLARK COUNTY, NEVADA, LYING WITHIN THE SOUTH HALF (S 1/2) OF THE SOUTH HALF (S 1/2) OF THE NORTHWEST QUARTER (NW 1/4) OF THE SOUTHWEST QUARTER (SW 1/4) OF SECTION 26, TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.D.M., CLARK COUNTY, NEVADA. MORE PARTICULARLY DESCRIBED AS FOLLOWS

**BEGINNING** AT THE SOUTHWEST CORNER OF THE NORTHWEST QUARTER (NW 1/4) OF THE SOUTHWEST QUARTER (SW 1/4) OF SAID SECTION 26, ALSO BEING THE SOUTHWEST CORNER OF SAID PARCEL III; THENCE NORTH 00°10'10" WEST, A DISTANCE OF 60.65 FEET, ALONG THE WEST LINE OF SAID NORTHWEST QUARTER (NW 1/4) TO THE NORTHWEST CORNER OF SAID PARCEL III; THENCE LEAVING SAID WEST LINE SOUTH 83°06'40" EAST, A DISTANCE OF 50.38 FEET ALONG THE NORTH LINE OF SAID PARCEL III; THENCE LEAVING SAID NORTH LINE SOUTH 00°10'10" EAST, A DISTANCE OF 60.84 FEET TO THE SOUTH LINE OF SAID PARCEL III ; THENCE NORTH 82°53'25" WEST, A DISTANCE OF 50.41 FEET ALONG SAID SOUTH LINE TO THE **POINT OF BEGINNING**.

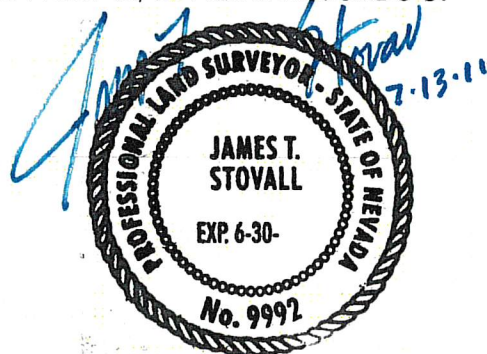
THE ABOVE DESCRIPTION CONTAINS 3,037 SQUARE FEET MORE OR LESS AND ATTACHED HERETO IS A MAP LABELED EXHIBIT B AND BY THIS REFERENCE IS MADE A PART HEREOF.

**BASIS OF BEARING**

N00°10'10"W BEING THE WEST LINE OF THE NORTHWEST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 26, TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.D.M., PER A RECORD OF SURVEY RECORDED IN FILE 183 PAGE 42, OFFICIAL RECORDS OF CLARK COUNTY, NEVADA.

**PREPARED BY;**

JAMES TODD STOVALL PLS  
NEVADA REGISTRATION NUMBER 9992  
JACOBS ENGINEERING GROUP  
319 EAST WARM SPRINGS ROAD STE. 200  
LAS VEGAS, NEVADA 89119  
(702)938-5400

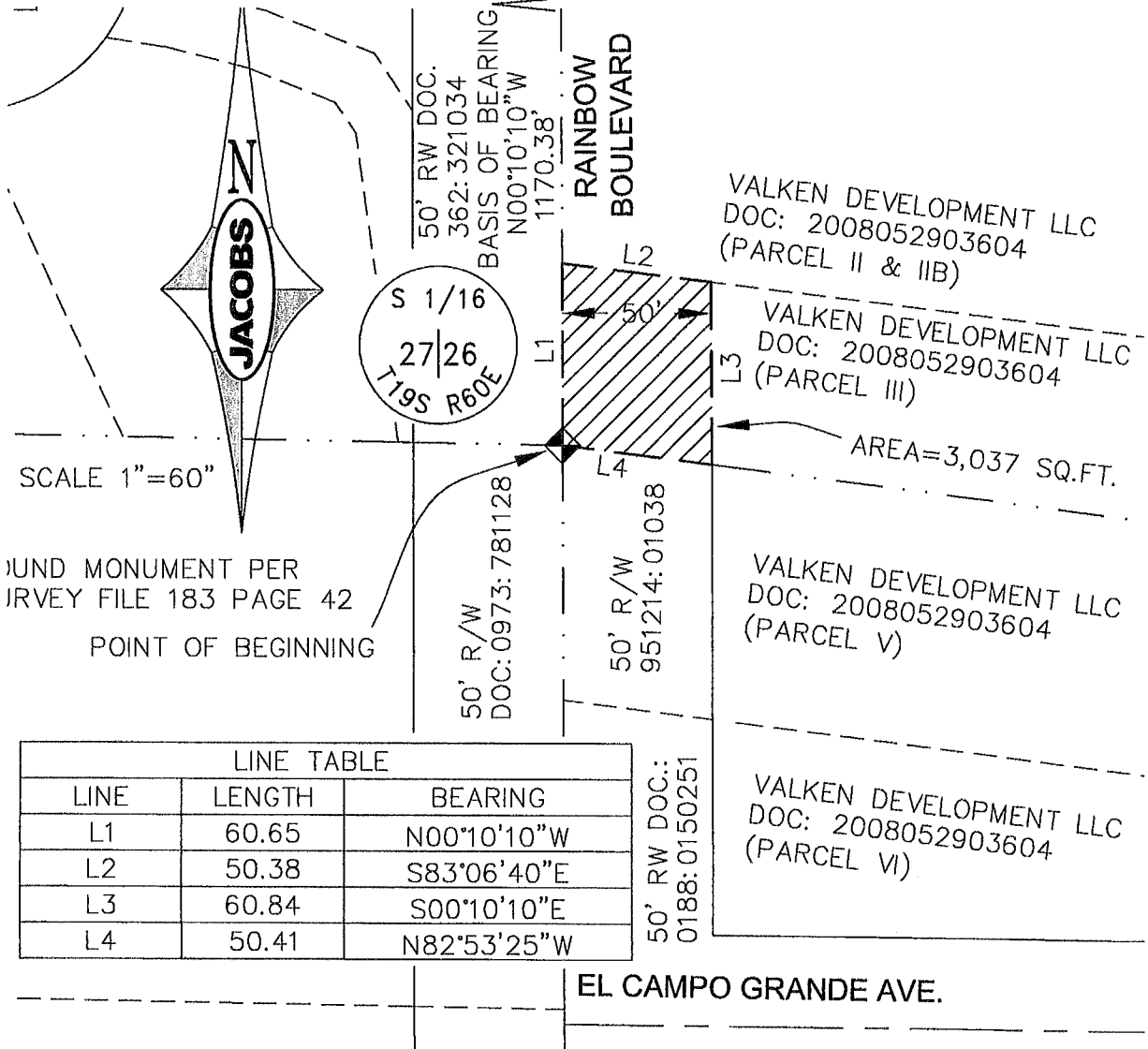




APN 125-26-304-007  
VALKEN DEVELOPMENT LLC

1/4  
27/26  
T19S R60E

NOTHING FOUND  
ESTABLISHED CORNER  
POSITION FROM  
REFERENCE TIES,  
SURVEY FILE 183 PG 42



| LINE TABLE |        |             |
|------------|--------|-------------|
| LINE       | LENGTH | BEARING     |
| L1         | 60.65  | N00°10'10"W |
| L2         | 50.38  | S83°06'40"E |
| L3         | 60.84  | S00°10'10"E |
| L4         | 50.41  | N82°53'25"W |

OWNER: VALKEN DEVELOPMENT LLC  
PARCEL NO.: APN 125-26-304-007  
SECTION, TOWNSHIP, RANGE: SECTION 26, TOWNSHIP 19 SOUTH, RANGE 60 EAST  
AREA OF EASEMENT: 3,037 SQUARE FEET 0.01 ACRES

EXHIBIT "B"  
AUTHORIZATION TO ENTER PROPERTY

JOB NO: W4X53700  
DATE: 7-11-11  
DRAWN BY: JTS  
CHECKED BY: DJR

**JACOBS**  
319 Warm Springs Rd.  
Las Vegas, Nevada 89119  
(702) 938-5400

## **2. APPENDIX B - EXHIBITS**

1. FIGURE B-1 VICINITY MAP
2. FIGURE B-2 LOCATION MAP
3. FIGURE B-3 2008 MPU – UPPER NORTHERN LAS VEGAS WATERSHED
4. FIGURE B-4 2008 MPU – HYDROLOGIC SUMMARY (2 TOTAL)
5. FIGURE B-5 2008 MPU – FLOOD CONTROL FACILITIES
6. FIGURE B-6 2008 MPU – FACILITY INVENTORY
7. FIGURE B-7 FLOOD INSURANCE RATE MAP
8. FIGURE B-8 CLARK COUNTY ZONING
9. FIGURE B-9 CITY OF LAS VEGAS ZONING
10. FIGURE B-10 ASSESOR'S PARCEL MAPS (6 TOTAL)

# ANN ROAD WEST - RAINBOW BOULEVARD VICINITY MAP

NTS

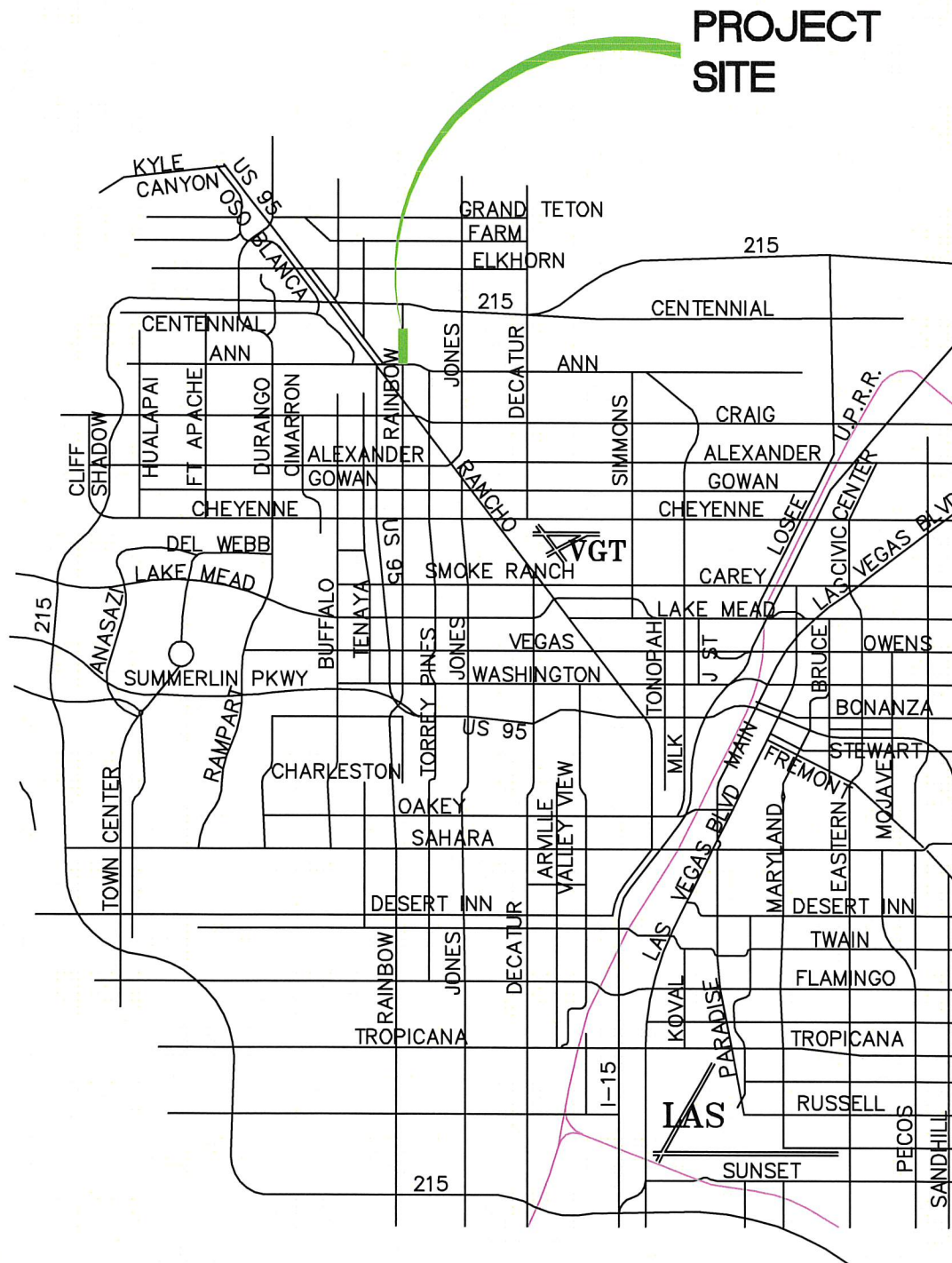


FIGURE B-1



# ANN ROAD WEST - RAINBOW BOULEVARD LOCATION MAP

NTS

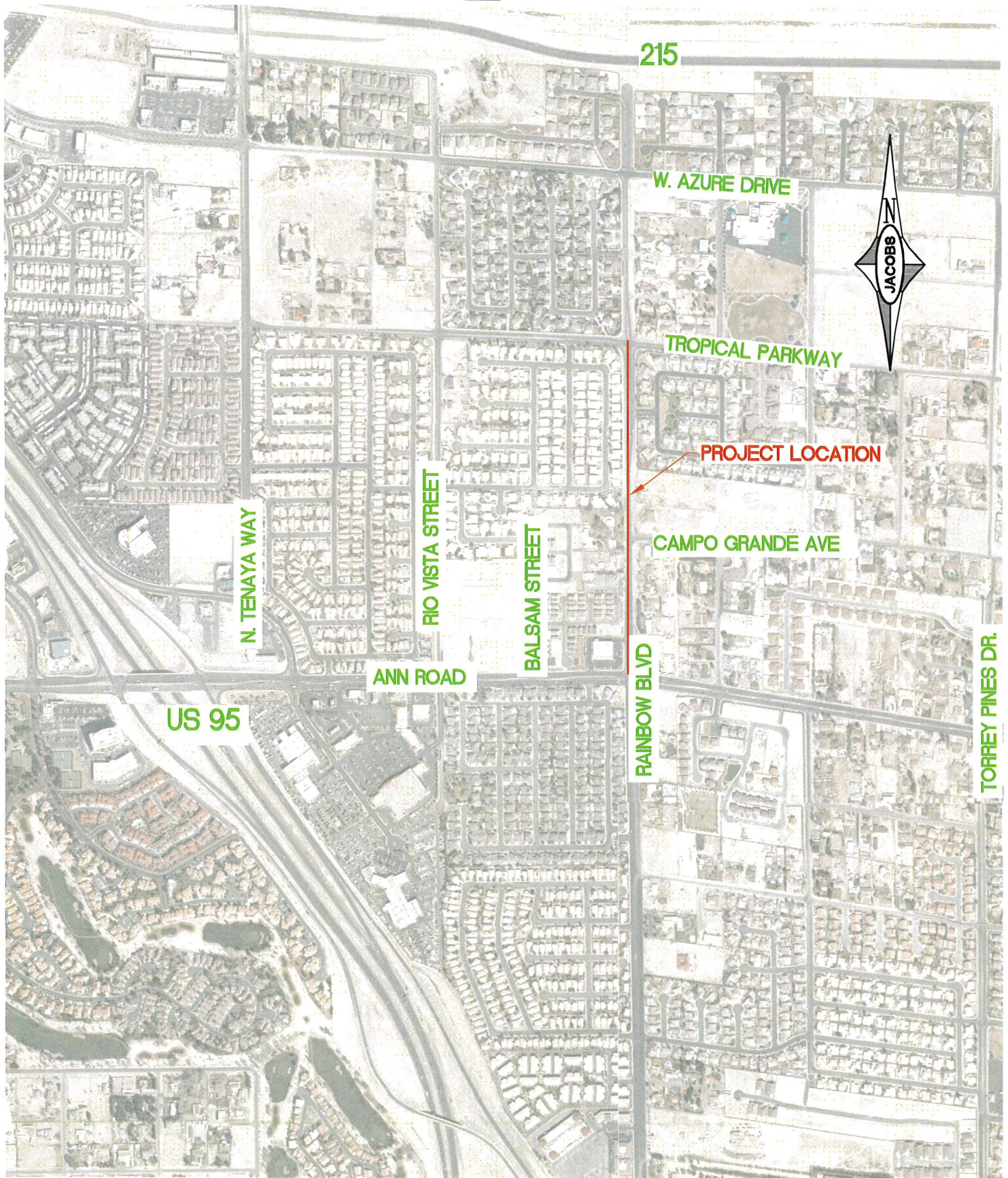


FIGURE B-2



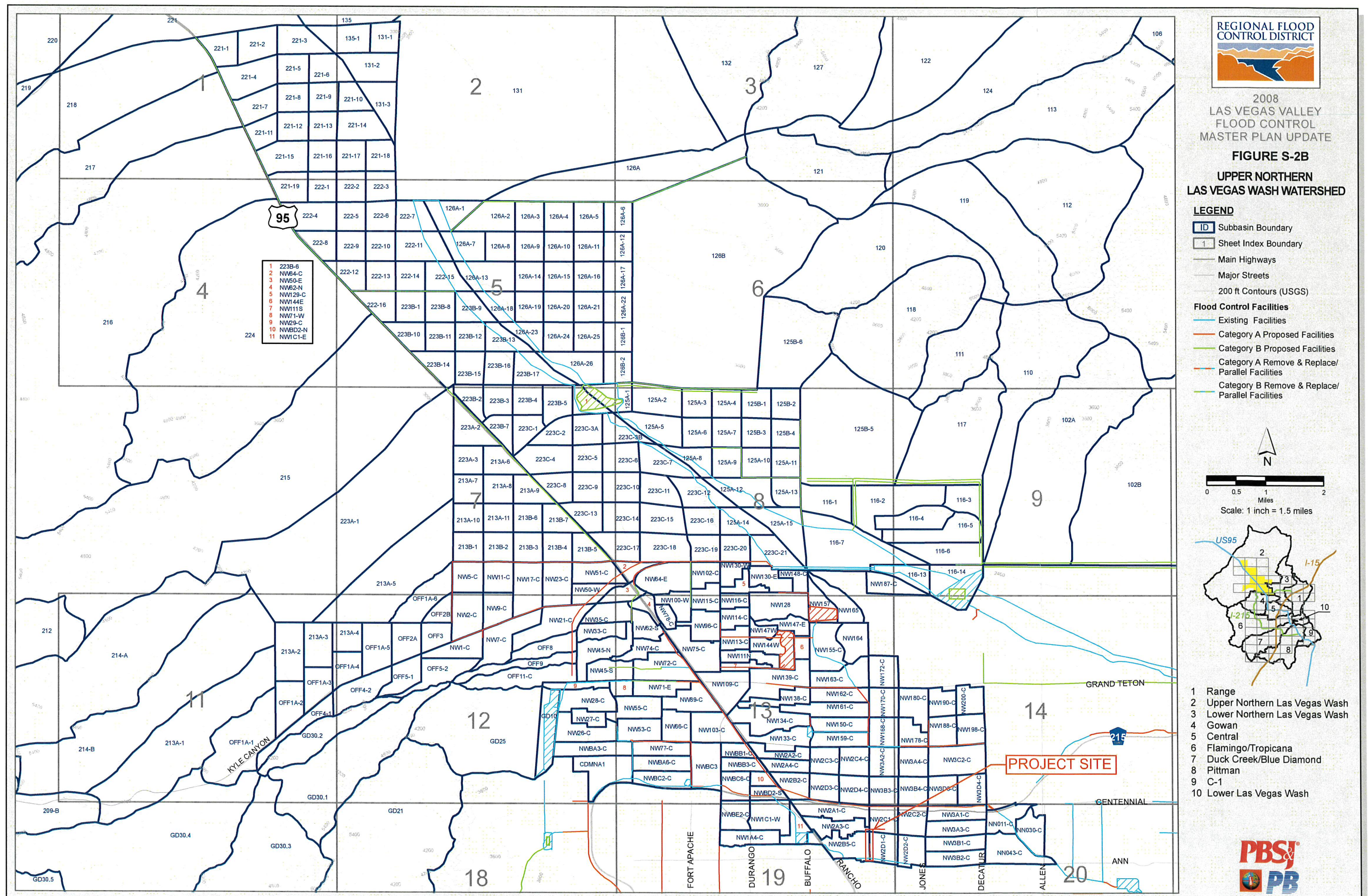
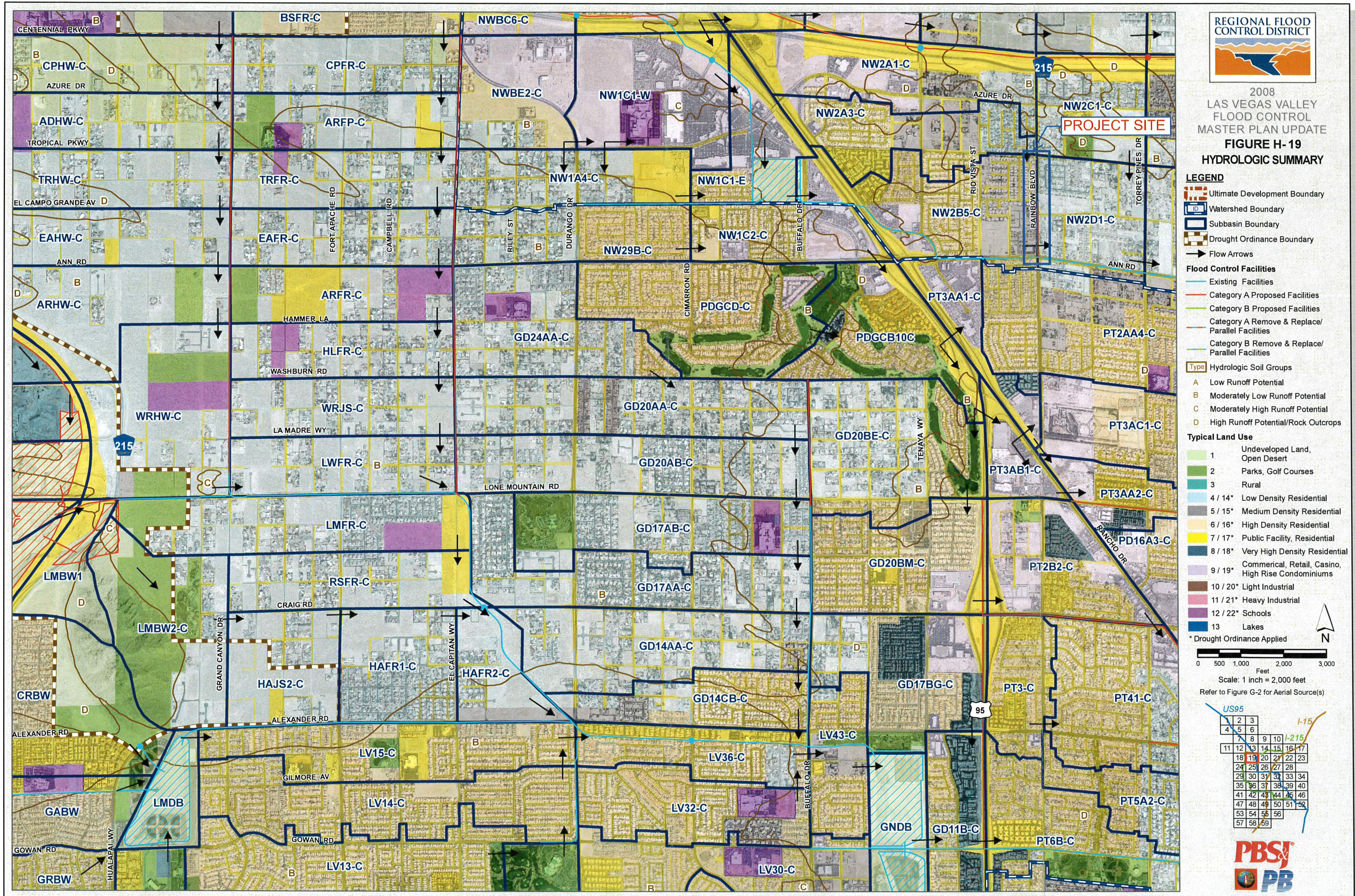


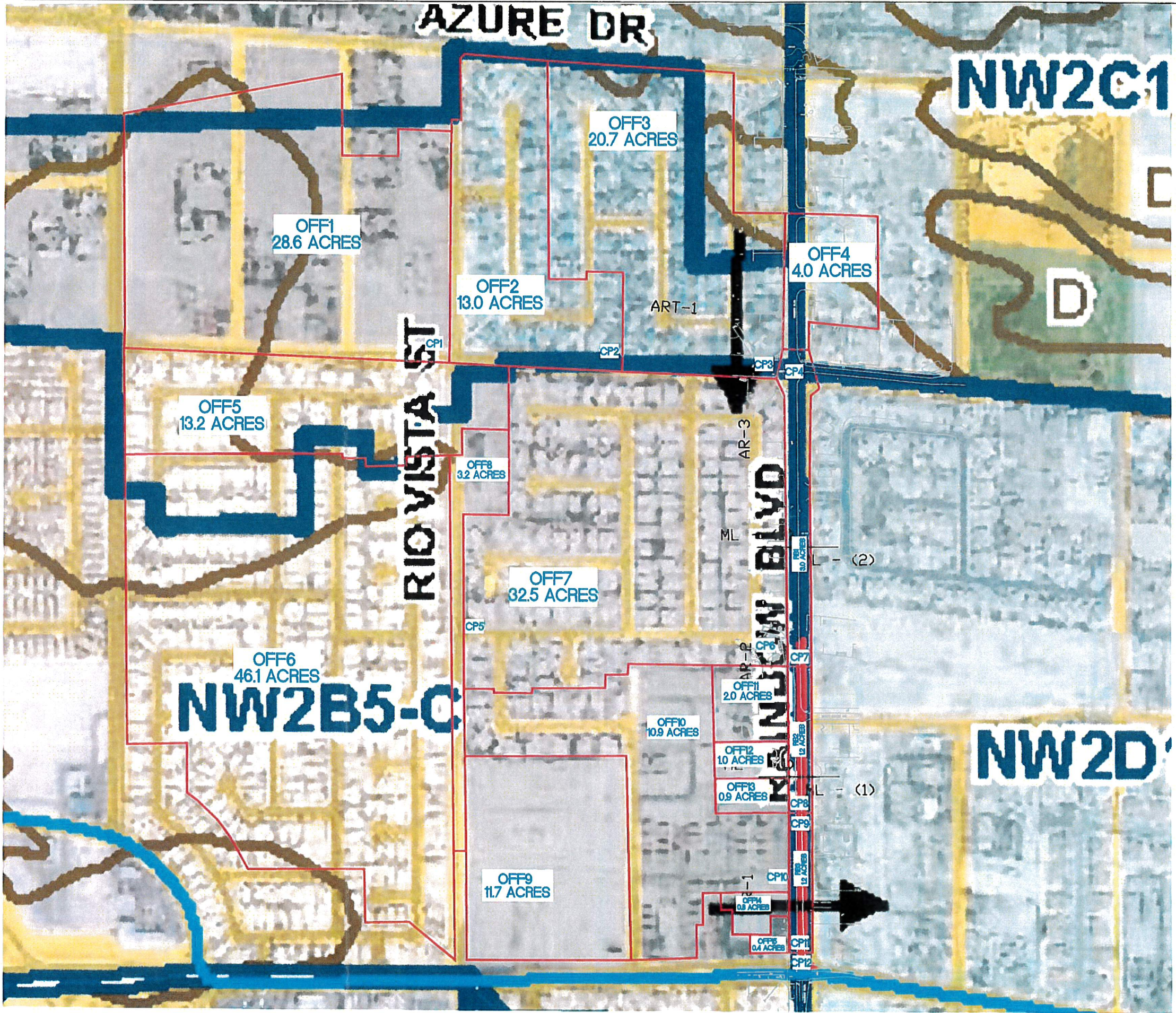
FIGURE B-3







| BASIN | %B Soil | CN B | %D Soil | CN D | Composite CN | Comments                                    |
|-------|---------|------|---------|------|--------------|---------------------------------------------|
| OFF1  | 50%     | 70   | 50%     | 85   | 77.5         | 20,000 SF Lots (2 units/acre)               |
| OFF2  | 0%      | 72   | 100%    | 86   | 86.0         | 14,000 SF Lots AVG                          |
| OFF3  | 10%     | 72   | 90%     | 86   | 84.6         | 14,000 SF Lots AVG                          |
| OFF4  | 70%     | 72   | 30%     | 86   | 76.2         | 14,000 SF Lots AVG                          |
| OFF5  | 30%     | 88   | 70%     | 93   | 91.5         | Less than 6000 use indust                   |
| OFF6  | 20%     | 88   | 80%     | 93   | 92.0         | Less than 6000 use indust                   |
| OFF7  | 0%      | 87   | 100%    | 92   | 92.0         | Average 6000 sf lot                         |
| OFF8  | 0%      | 0    | 100%    | 94   | 94.0         | 65% Paved, 35% 10,000 sf lots (3.5 DU/Acre) |
| OFF9  | 0%      | 92   | 100%    | 95   | 95.0         | Less than 6000 use commercial               |
| OFF10 | 0%      | 92   | 100%    | 95   | 95.0         | Less than 6000 use commercial               |
| OFF11 | 0%      | 75   | 100%    | 87   | 87.0         | 10,000 sf lots (3.5 DU/Acre)                |
| OFF12 | 0%      | 75   | 100%    | 87   | 87.0         | 10,000 sf lots (3.5 DU/Acre)                |
| OFF13 | 0%      | 92   | 100%    | 95   | 95.0         | Commercial Site                             |
| OFF14 | 0%      | 92   | 100%    | 95   | 95.0         | Commercial Site                             |
| OFF15 | 0%      | 92   | 100%    | 95   | 95.0         | Commercial Site                             |
| RB1   | 0%      | 98   | 100%    | 98   | 98.0         | Paved Road                                  |
| RB2   | 0%      | 98   | 100%    | 98   | 98.0         | Paved Road                                  |
| RB3   | 0%      | 98   | 100%    | 98   | 98.0         | Paved Road                                  |



ANN ROAD AND RAINBOW BOULEVARD OFF-SITE SOILS EXHIBIT

SCALE 1:400







| ID / River Mile | Status | Facility Description                                         | Length (ft.) | Flow (cfs) | HEC-1 Node | HEC-1 Model | Tributary Area (sq.mi.) | Channel Slope (%) ** |
|-----------------|--------|--------------------------------------------------------------|--------------|------------|------------|-------------|-------------------------|----------------------|
| ANRB<br>0000    | P1     | ANN ROAD CHANNEL WEST - RAINBOW<br>10' X 7' RCB              | 1320         | 721        | CNW2B5-C   | WEST3       | 0.99                    | 0.40                 |
| ANWE<br>0245    | E      | ANN ROAD CHANNEL WEST<br>10' X 9' RCB                        | 1721         | 993        | CNW2D1-C   | WEST3       | 6.84                    | 0.80                 |
| 0279            | E      | 10' X 9' RCB                                                 | 553          | 743        | 2CNW2B5C   | WEST3       | 6.37                    | 0.80                 |
| 0290            | E      | 8' X 8' RCB                                                  | 2050         | 743        | 2CNW2B5C   | WEST3       | 6.37                    | 0.70                 |
| 0327            | E      | 6' X 6' RCB                                                  | 2360         | 161        | RCHOOT     | WEST3       | 5.38                    | 0.87                 |
| 0371            | E      | 6' X 6' RCB                                                  | 760          | 161        | RCHOOT     | WEST3       | 5.38                    | 0.34                 |
| 0385            | E      | 54" RCP                                                      | 1950         | 161        | RCHOOT     | WEST3       | 5.38                    | 1.17                 |
| CNWE<br>0150    | P2     | CENTENNIAL PKWY CHANNEL WEST<br>Conc Chnl 42"W 10"D 0:1 SS   | 720          | 4233       | CNW3B3-C   | WEST3       | 5.64                    | 0.40                 |
| 0173            | P2     | 42' X 10' RCBC @ Torrey Pines                                | 190          | 4233       | CNW3B3-C   | WEST3       | 5.64                    | 0.40                 |
| 0176            | P2     | Conc Chnl 32"W 12"D 0:1 SS                                   | 795          | 4233       | CNW3B3-C   | WEST3       | 5.64                    | 0.40                 |
| 0189            | P2     | Conc Chnl 32"W 10"D 0:1 SS                                   | 1845         | 4067       | CNW2D4-C   | WEST3       | 5.15                    | 0.54                 |
| 0226            | P2     | Conc Chnl 12"W 12"D 2:1 SS                                   | 1165         | 4067       | CNW2D4-C   | WEST3       | 5.15                    | 1.00                 |
| 0251            | P2     | Conc Chnl 12"W 12"D 2:1 SS                                   | 1135         | 3951       | CNW2D3-C   | WEST3       | 4.65                    | 0.59                 |
| 0271            | P2     | Conc Chnl 32"W 10"D 0:1 SS                                   | 185          | 3951       | CNW2D3-C   | WEST3       | 4.65                    | 0.59                 |
| 0274            | E      | 32' X 10' RCBC @ Tenaya                                      | 130          | 3951       | CNW2D3-C   | WEST3       | 4.65                    | 0.45                 |
| 0277            | P2     | Conc Chnl 13"W 10"D 2:1 SS                                   | 590          | 3951       | CNW2D3-C   | WEST3       | 4.65                    | 0.45                 |
| 0287            | P2     | Conc Chnl 13"W 10"D 2:1 SS                                   | 605          | 3593       | CNW2B2-C   | WEST3       | 3.84                    | 1.19                 |
| 0301            | P2     | Conc Chnl 32"W 10"D 0:1 SS                                   | 235          | 3593       | CNW2B2-C   | WEST3       | 3.84                    | 1.19                 |
| 0304            | P2     | 32' X 10' RCB                                                | 6510         | 3593       | CNW2B2-C   | WEST3       | 3.84                    | 1.75                 |
| GO95<br>0000    | P1     | GOWAN OUTFALL - U.S. 95 CHANNEL<br>Conc Chnl 12"W 4"D 2:1 SS | 2640         | 299        | GD17BG-C   | ALLGOW3     | 0.36                    | 0.30                 |
| 0050            | P1     | Conc Chnl 12"W 4"D 2:1 SS                                    | 2450         | 299        | GD17BG-C   | ALLGOW3     | 0.36                    | 0.30                 |
| GOA2<br>0000    | P1     | GOWAN OUTFALL - ALEXANDER BRANCH<br>8' X 5' RCB              | 2281         | 523        | CPT41-C    | ALLGOW3     | 0.61                    | 0.90                 |
| GOAL<br>0111    | P1     | GOWAN OUTFALL - ALEXANDER ROAD FACILITIES<br>10' X 8' RCB    | 3000         | 880        | CPT2B2     | ALLGOW3     | 2.28                    | 0.83                 |
| 0168            | P1     | 10' X 8' RCB                                                 | 4200         | 880        | CPT2B2     | ALLGOW3     | 2.28                    | 0.50                 |
| 0247            | P1     | Conc Chnl 12"W 5.5"D 2:1 SS                                  | 2640         | 757        | CGD20BMC   | ALLGOW3     | 1.98                    | 0.30                 |
| GOBU<br>0000    | E      | GOWAN NORTH - BUFFALO BRANCH<br>2: 12' X 6' RCB              | 1705         | 961        | CGD14CBC   | ALLGOW3     | 2.53                    | 0.20                 |
| 0032            | E      | 2: 12' X 5' RCB                                              | 1248         | 850        | CGD14AAC   | ALLGOW3     | 2.30                    | 0.25                 |
| 0058            | E      | 2: 11' X 4' RCB                                              | 1398         | 745        | CGD17AAC   | ALLGOW3     | 1.90                    | 0.25                 |
| 0085            | E      | 11' X 5' RCB                                                 | 1266         | 614        | CGD17ABC   | ALLGOW3     | 1.52                    | 0.25                 |
| 0112            | P1     | 8' X 6' RCB                                                  | 1535         | 484        | CGD20ABC   | ALLGOW3     | 1.15                    | 0.54                 |
| 0136            | P1     | 7' X 6' RCB                                                  | 1400         | 344        | CGD20AAC   | ALLGOW3     | 0.76                    | 0.36                 |
| GOBW<br>0000    | E      | GOWAN BELTWAY WEST<br>48" RCP                                | 2527         | 116        | LMBWDB     | ALLGOW4     | 10.68                   | 4.37                 |
| 0048            | E      | 72" RCP                                                      | 131          | 116        | LMBWDB     | ALLGOW4     | 10.68                   | 2.21                 |
| 0051            | P2     | 72" RCP Outlet                                               | 1508         | 116        | LMBWDB     | ALLGOW4     | 10.68                   | 0.30                 |
| 0052            | P2     | 589 ac-ft Lone Mountain-Beltway Detention Basin              |              | 5140       | CLMBW1     | GW3SC       | 3.50                    |                      |
| 0082            | P2     | 51,400 cfs PMF Spillway                                      |              | 51400      | CLMBW1     | GW3SC       | 3.50                    |                      |
| 0096            | P1     | 8' X 8' RCB Connector Pipe Under Beltway                     | 839          | 5140       | CLMBW1     | GW3SC       | 3.50                    | 0.30                 |
| 0097            | P2     | 54" RCP                                                      | 394          | 525        | UVB1-2     | ALLGOW3     | 0.34                    | 8.09                 |
| 0106            | P2     | 8' X 8' RCB Connector Pipe Under Lone Mountain               | 697          | 5140       | CLMBW1     | GW3SC       | 3.50                    | 0.30                 |
| 0128            | P2     | Conc Chnl 20"W 10"D 0:1 SS                                   | 190          | 3429       | CWRBW1     | ALLGOW3     | 6.06                    | 25.00                |
| 0132            | P2     | Conc Chnl 14"W 10"D 0:1 SS                                   | 1286         | 2869       | CHLBW1-C   | GW3SC       | 1.84                    | 5.00                 |
| 0156            | P2     | Conc Chnl 16"W 10"D 0:1 SS                                   | 221          | 2869       | CHLBW1-C   | GW3SC       | 1.84                    | 1.05                 |
| 0160            | P2     | 16' X 8' RCB                                                 | 1230         | 2869       | CHLBW1-C   | GW3SC       | 1.84                    | 1.05                 |
| GOBX<br>0000    | P2     | GOWAN BOX CANYON<br>66" RCP                                  | 794          | 753        | LWBW1      | ALLGOW3     | 0.48                    | 9.45                 |
| GODU<br>0000    | E      | GOWAN NORTH - DURANGO BRANCH<br>12' X 6' RCB                 | 2629         | 1150       | CLV14-C    | ALLGOW3     | 1.40                    | 0.91                 |
| 0050            | E      | 9' X 6' RCB                                                  | 865          | 835        | CLV20-C    | ALLGOW3     | 0.97                    | 1.50                 |
| GOEC<br>0000    | P1     | GOWAN NORTH - EL CAPITAN BRANCH<br>10' X 7' RCB              | 1445         | 1233       | CLWFR-C    | ALLGOW3     | 2.20                    | 1.36                 |
| 0026            | P1     | 10' X 8' RCB                                                 | 1320         | 1162       | CWRJS-C    | ALLGOW3     | 1.95                    | 0.91                 |
| 0051            | P1     | 10' X 7' RCB                                                 | 1320         | 1027       | CHLFR-C    | ALLGOW3     | 1.69                    | 1.06                 |
| 0076            | P1     | 10' X 6' RCB                                                 | 1320         | 894        | CARFR-C    | ALLGOW3     | 1.45                    | 1.06                 |
| GOEC<br>0100    | P1     | GOWAN NORTH - EL CAPITAN BRANCH<br>10' X 6' RCB              | 1320         | 745        | CEAFR-C    | ALLGOW3     | 1.21                    | 0.76                 |
| 0126            | P1     | 10' X 7' RCB                                                 | 1320         | 635        | CTFRFR-C   | ALLGOW3     | 0.96                    | 0.38                 |
| 0152            | P1     | 7' X 6' RCB                                                  | 1320         | 485        | CARFP-C    | ALLGOW3     | 0.70                    | 0.77                 |
| 0176            | P1     | 78" RCP                                                      | 1320         | 363        | CCPFR-C    | ALLGOW3     | 0.46                    | 1.15                 |
| GOL2<br>0000    | E      | GOWAN LONE MOUNTAIN SYSTEM-BRANCH 2<br>5' X 4' RCB           | 150          | 461        | CRBW       | ALLGOW3     | 0.44                    | 14.60                |
| 0003            | E      | 66" RCP                                                      | 607          | 461        | CRBW       | ALLGOW3     | 0.44                    | 1.97                 |
| 0014            | E      | 84" RCPC @ Alexander                                         | 125          | 461        | CRBW       | ALLGOW3     | 0.44                    | 4.00                 |
| GOLM<br>0000    | E      | GOWAN LONE MOUNTAIN SYSTEM<br>78" RCP                        | 2590         | 345        | CLV15-C    | ALLGOW4     | 11.88                   | 1.80                 |
| 0049            | E      | 6' X 5' RCB                                                  | 585          | 345        | CLV15-C    | ALLGOW4     | 11.88                   | 1.87                 |
| 0060            | E      | 66" RCP                                                      | 817          | 345        | CLV15-C    | ALLGOW4     | 11.88                   | 2.40                 |
| 0075            | E      | 60" RCP                                                      | 1385         | 345        | CLV15-C    | ALLGOW4     | 11.88                   | 2.55                 |
| 0101            | E      | 54" RCP                                                      | 701          | 190        | LMTNDB     | ALLGOW4     | 11.52                   | 1.74                 |
| 0115            | E      | 48" RCP                                                      | 1799         | 190        | LMTNDB     | ALLGOW4     | 11.52                   | 3.08                 |
| 0140            | E      | 42" RCP                                                      | 439          | 190        | LMTNDB     | ALLGOW4     | 11.52                   | 1.60                 |
| 0142            | E      | 48" RCP                                                      | 348          | 190        | LMTNDB     | ALLGOW4     | 11.52                   | 2.14                 |
| 0144            | E      | 66" RCP                                                      | 196          | 190        | LMTNDB     | ALLGOW4     | 11.52                   | 5.44                 |
| 0145            | E      | 66" RCP Outlet                                               | 378          | 190        | LMTNDB     | ALLGOW4     | 11.52                   | 0.90                 |
| 0146            | E      | 888 ac-ft Lone Mountain Detention Basin                      |              | 7252       | LMTNIN     | GW3SC       | 6.13                    |                      |
| 0147            | E      | 36,000 cfs PMF Spillway                                      |              | 36000      | LMTNIN     | GW3SC       | 6.13                    |                      |
| 0150            | E      | Drop Structure                                               | 481          | 6323       | CGABW      | GW3SC       | 5.12                    |                      |
| 0162            | E      | 28' X 8' RCBC @ Hualapai                                     | 625          | 6323       | CGABW      | GW3SC       | 5.12                    | 1.86                 |
| 0174            | E      | Conc Chnl 28"W 8"D 0:1 SS                                    | 2715         | 6173       | CCLMT5     | GW3SC       | 4.92                    | 3.20                 |
| GOLO<br>0275    | P1     | GOWAN OUTFALL - LONE MTN. ROAD BRANCH<br>8' X 6' RCB         | 3000         | 590        | CPT3AA2    | ALLGOW3     | 1.16                    | 0.77                 |
| GONO<br>0000    | E      | GOWAN NORTH SYSTEM<br>8' X 8' RCB Outlet                     | 184          | 558        | GWNNDB     | ALLGOW5     | 68.49                   | 0.51                 |
| 0001            | E      | 8' X 8' RCB Outlet                                           | 156          | 558        | GWNNDB     | ALLGOW5     | 68.49                   | 0.63                 |
| 0006            | E      | 30,780 cfs PMF Spillway                                      |              | 30780      | GWNNDB     | ALLGOW5     | 68.49                   |                      |
| 0008            | E      | 921 ac-ft Gowan North Detention Basin                        |              | 4937       | CCLV43-C*  | GW4SC       | 11.93                   |                      |
| 0009            | E      | 3: 13' X 8' RCB                                              |              | 4937       | CCLV43-C   | GW4SC       | 11.93                   | 0.62                 |
| 0012            | E      | Conc Chnl 30"W 8"-9.5"D 0:1 SS                               | 2665         | 4117       | CCLV36-C   | GW4SC       | 8.54                    | 1.18                 |
| 0062            | E      | Bridge 30"W 8.5"D @ Cimarron                                 | 80           | 3844       | CCLV15-C   | GW4SC       | 8.03                    | 0.30                 |
| 0063            | E      | Conc Chnl 30"W 8.5"-10"D 0:1 SS                              | 2302         | 3844       | CCLV15-C   | GW4SC       | 8.03                    | 1.00                 |
| 0110            | E      | 2: 12' X 8' RCAC @ Alexander                                 | 547          | 3352       | CCRSFR-C*  | GW3SC       | 6.10                    | 1.00                 |
| 0117            | E      | 2: 12' X 8' RCAP                                             | 424          | 3352       | CCRSFR-C*  | GW3SC       | 6.10                    | 1.10                 |
| 0124            | E      | Conc Chnl 24"W 9"D 0:1 SS                                    | 887          | 3352       | CCRSFR-C*  | GW3SC       | 6.10                    | 1.36                 |
| 0141            | E      | Conc Chnl 24"W 9"-10.5"D 0:1 SS                              | 2064         | 3352       | CCRSFR-C   | GW3SC       | 6.10                    | 0.59                 |
| 0181            | E      | Bridge 30"W 7"D @ Craig                                      | 142          | 2846       | CRSFR-C    | GW3SC       | 5.20                    | 0.65                 |
| 0183            | E      | Conc Chnl 22"W 8"-10.6"D 0:1 SS                              | 2193         | 2846       | CRSFR-C    | GW3SC       | 5.20                    | 0.72                 |
| 0225            | E      | Conc Chnl Width Varies Depth Varies 0:1 SS                   | 508          | 2605       | CCLWFR-C   | GW3SC       | 4.54                    | 1.05                 |
| 0230            | E      | 13' X 5' RCB                                                 | 258          | 1486       | CCWRHW-C   | GW3SC       | 2.34                    | 2.78                 |
| 0234            | E      | 12' X 6' RCB                                                 | 2010         | 1486       | CCWRHW-C   | GW3SC       | 2.34                    | 1.67                 |
| 0272            | E      | 10' X 6' RCB                                                 | 2797         | 1486       | CCWRHW-C   | GW3SC       | 2.34                    | 3.15                 |
| 0325            | E      | 15' X 7' RCB                                                 | 291          | 1486       | CCWRHW-C   | GW3SC       | 2.34                    | 1.79                 |
| 0335            | E      | 15' X 7' RCB                                                 | 529          | 1486       | CWRHW-C    | ALLGOW3     | 2.34                    | 1.79                 |
| 0350            | P1     | 10' X 9' RCB                                                 | 3473         | 1486       | CWRHW-C    | ALLGOW3     | 2.34                    | 0.88                 |
| 0411            | P1     | 10' X 9' RCB                                                 | 1320         | 1404       | CARHW-C    | ALLGOW3     | 1.89                    | 0.76                 |
| 0436            | P1     | 10' X 7' RCB                                                 | 1320         | 1173       | CEAHW-C    | ALLGOW3     | 1.53                    | 1.14                 |
| 0461            | P1     | 10' X 9' RCB                                                 | 1320         | 959        | CTRHW-C    | ALLGOW3     | 1.22                    | 0.38                 |
| 0486            | P1     | 8' X 7' RCB                                                  | 1320         | 747        | CADHW-C    | ALLGOW3     | 0.90                    | 0.76                 |
| 0511            | P1     | 7' X 6' RCB                                                  | 1320         | 546        | CCPHW-C    | ALLGOW3     | 0.60                    | 1.14                 |
| GOOF<br>0511    | E      | GOWAN OUTFALL FACILITIES<br>8' X 5' RCB                      | 8390         | 699        | CPT6B-C    | GW3SC       | 1.08                    | 0.50                 |
| 0531            | E      | 8' X 5' RCB                                                  | 1300         | 558        | GWNNDB     | ALLGOW5     | 68.49                   | 0.50                 |
| 0551            | E      | 72" RCP                                                      | 524          | 558        | GWNNDB     | ALLGOW5     | 68.49                   | 0.62                 |
| 0773            | E      | 60" RCP                                                      | 803          | 286        | LV30-C     | ALLGOW3     | 0.42                    | 1.40                 |
| 0775            | E      | 60" RCP                                                      | 1300         | 286        | LV30-C     | ALLGOW3     | 0.42                    | 1.00                 |
| RCHB<br>0000    | E      | RANCHO ROAD SYSTEM - BELTWAY<br>2: 12' X 8.5' RCAP           | 1700         | 2631       | CNW1C-W    | WEST3       | 4.68                    | 0.63                 |
| 0034            | E      | Conc Chnl 21"W 8"D 0:1 SS                                    | 1000         | 2631       | CNW1C-W    | WEST3       | 4.68                    | 1.19                 |
| 0053            | E      | 2: 12' X 8' RCBC @ South Ramp Connector                      | 85           | 2304       | CDW1C1     | WEST3       | 4.31                    | 1.40                 |
| 0054            | E      | Conc Chnl 21"W 8"D 0:1 SS                                    | 432          | 2304       | CDW1C1     | WEST3       | 4.31                    | 1.51                 |
| 0062            | E      | Transition Structure                                         | 130          | 2304       | CDW1C1     | WEST3       | 4.31                    | 1.51                 |
| 0065            | E      | 24' X 7' RCB                                                 | 480          | 2304       | CDW1C1     | WEST3       | 4.31                    | 0.30                 |
| 0074            | E      | 24' X 6' RCB                                                 | 50           | 2226       | CNWBC6-C   | WEST3       | 4.17                    | 0.30                 |
| 0075            | E      | 20' X 6' RCBC @ Beltway                                      | 428          | 2226       | CNWBC6-C   | WEST3       | 4.17                    | 2.81                 |
| 0083            | P2     | 20' X 6' RCB                                                 | 950          | 2226       | CNWBC6-C   | WEST3       | 4.17                    | 2.49                 |
| 0101            | P2     | Conc Chnl 20"W 7"D 0:1 SS                                    | 980          | 2226       | CNWBC6-C   | WEST3       | 4.17                    | 2.38                 |
| 0120            | E      | 20' X 6' RCBC @ Grand Montecito                              | 120          | 2226       | CNWBC6-C   | WEST3       | 4.17                    | 1.00                 |
| 0122            | P2     | Conc Chnl 16"-20"W 6"D 0:1 SS                                | 350          | 2226       | CNWBC6-C   | WEST3       | 4.17                    | 1.84                 |
| 0130            | P2     | Conc Chnl 16"W 6"D 0:1 SS                                    | 1012         | 2226       | CNWBC6-C   | WEST3       | 4.17                    | 2.67                 |
| RCHO<br>0000    | E      | RANCHO ROAD SYSTEM<br>60" RCP with 36" Orifice Plate         | 1183         | 161        | RCHODB     | WEST3       | 5.38                    | 0.74                 |
| 0025            | E      | 321 ac-ft Rancho Road Detention Basin                        |              | 3115       | RCHOIN     | WEST3       | 5.38                    |                      |
| 0027            | E      | 18,000 cfs PMF Spillway                                      |              | 18000      | RCHOIN     | WEST3       | 5.38                    |                      |
| 0050            | E      | Energy Dissipator                                            | 90           | 402        | CNW1A4-C   | WEST3       | 0.51                    |                      |
| 0052            | E      | Conc Chnl 10"W 10"D 0:1 SS                                   | 115          | 402        | CNW1A4-C   | WEST3       | 0.51                    | 11.43                |
| 0054            | E      | 10' X 5' RCB                                                 | 128          | 402        | CNW1A4-C   | WEST3       | 0.51                    | 0.50                 |
| 0056            | E      | 10' X 5' RCB                                                 | 815          | 402        | CNW1A4-C   | WEST3       | 0.51                    | 0.47                 |
| 0071            | E      | 72" RCP                                                      | 3140         | 402        | CNW1A4-C   | WEST3       | 0.51                    | 1.80                 |

\* The HEC-1 node shown identifies the controlling concentration point for the associated facility and is located upstream of this facility due to decreasing peak flow with increasing tributary area caused by storm distribution transitions, depth area reduction factors, or attenuation of flow from routing.  
\*\* As-built or design slopes were used when available. All other slopes are based on existing topography. The user should verify the facility slope listed prior to performing any facility specific analysis.  
^ For parallel facilities, the existing facility flow equals its normal depth capacity, and the proposed parallel facility flow equals the remaining flow (i.e., HEC-1 Node flow = existing facility normal depth capacity + proposed parallel facility flow).



2008 LAS VEGAS VALLEY  
FLOOD CONTROL  
MASTER PLAN UPDATE  
  
FACILITY INVENTORY  
FIGURE F - 19

|                                                     |                                                      |                                            |
|-----------------------------------------------------|------------------------------------------------------|--------------------------------------------|
| LEGEND                                              | ID (Facility Identifier)                             | AABB                                       |
|                                                     | Parent Stream Name                                   |                                            |
|                                                     | Stream Name                                          |                                            |
|                                                     | River Mile                                           | 0000                                       |
|                                                     | Distance Above Confluence with Parent Stream (Miles) |                                            |
|                                                     | Miles in Hundredths                                  |                                            |
| Existing Facility.....                              | E                                                    |                                            |
| Proposed or Modified Facility.....                  | P                                                    | Bottom Width..... W                        |
| Contingency Level                                   |                                                      |                                            |
| Category B.....                                     | P0                                                   | Depth..... D                               |
| Master Plan.....                                    | P1                                                   |                                            |
| Preliminary Design.....                             | P2                                                   | Side Slope, H:V..... SS                    |
| Design.....                                         | P3                                                   |                                            |
| Construction Features                               |                                                      |                                            |
| Cast in Place Concrete Pipe.....                    | CIPCP                                                | Reinforced Concrete Arch Culvert..... RCAC |
| Corrugated Metal Arch Pipe Culvert.....             | CMAF                                                 | Reinforced Concrete Box..... RCB           |
| Corrugated Metal Pipe Culvert.....                  | CMPC                                                 | Reinforced Concrete Box Culvert..... RCBC  |
| High Density Polyethylene.....                      | HDPE                                                 | Reinforced Concrete Pipe..... RCP          |
| Horizontal Elliptical Reinforced Concrete Pipe..... | HERCP                                                | Reinforced Concrete Pipe Culvert..... RCP  |
| Reinforced Concrete Arch Pipe.....                  | RCAP                                                 | Storm Sewer Pipe..... SSP                  |



FIGURE B - 6



NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where Base Flood Elevation (BFE) and/or floodways have been determined, users are encouraged to consult the Flood Profiles and Floodway Data tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

**Coastal Base Flood Elevation (BFEs)** shown on this map apply only landward of 0.0' North American Vertical Datum (NAVD). Users of this FIRM should be aware that coastal flood elevations may also be provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this community. Elevations shown in the Summary of Stillwater Elevations table should be used for construction, and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures in this jurisdiction.

The projection used in the preparation of this map is Universal Transverse Mercator (UTM) Zone 11. The horizontal datum is NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at [www.ngs.noaa.gov](http://www.ngs.noaa.gov) or contact the National Geodetic Survey at the following address:

Vertical Network Branch, N/C/G13  
National Geodetic Survey, NOAA  
Silver Spring Metro Center 3  
1315 East-West Highway  
Silver Spring, Maryland 20910  
(301) 713-3191

To obtain current elevation, description, and/or location information for bench marks shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit their website at [www.ngs.noaa.gov](http://www.ngs.noaa.gov).

**Base map** information shown on this FIRM was provided in digital format by Clark County Regional Flood Control District. This information was converted using Orthophotography, dated 1998 or newer, and GBR/DIME data. Segments were digitized off of the orthophotography based on center of pavement.

**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or dis-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

An accompanying Flood Insurance Study report, Letters of Map Revision or Letters of Map Amendment revising portions of this panel, and digital versions of this PANEL, may be available. Contact the **FEMA Map Service Center** at the following phone numbers and Internet address for information on all related products available from FEMA:

Phone: 800-358-9616  
FAX: 800-358-9620  
[www.fema.gov/fmsc](http://www.fema.gov/fmsc)

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at [www.fema.gov](http://www.fema.gov).

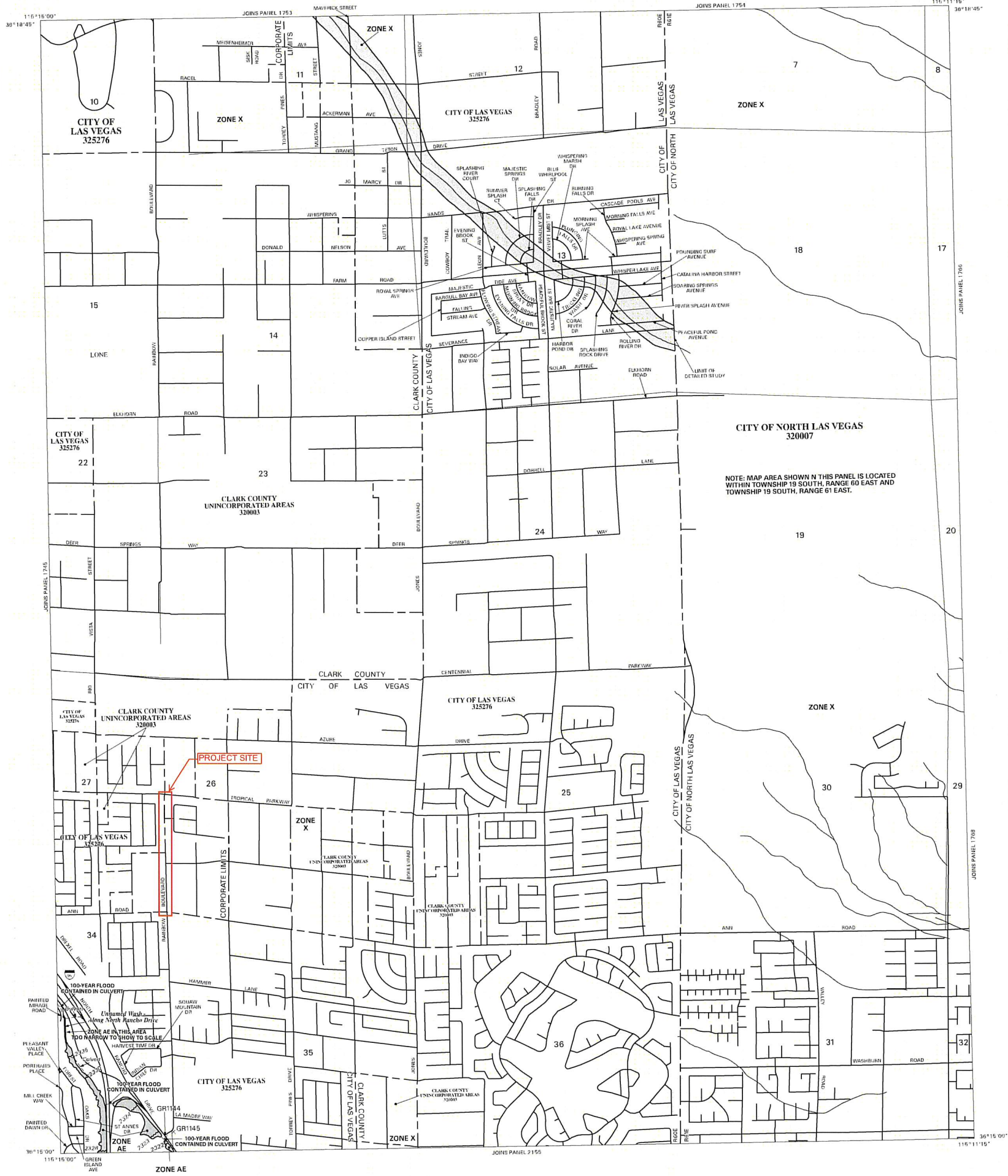
This map reflects more detailed and up-to-date stream channel configurations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report may reflect stream channel distances that differ from what is shown on this map.

This Digital Flood Insurance Rate Map (DFIRM) was produced through a unique partnership between Clark County and the Federal Emergency Management Agency (FEMA). Clark County has developed a long-term approach of floodplain management to decrease the costs associated with flooding. This is demonstrated by the Clark County commitment to share and maintain floodplain layers within their Geographic Information System Management Office (GISMO).

This DFIRM reflects several innovative features. These include:  
- Southern Nevada GIS - Cooperation among local governmental agencies throughout Clark County. The foundation of cooperation is the GIS Interlocal Agreements formed between fourteen regional participants. In part, the agreements specify that the Clark County GIS Management Office (GISMO) will be responsible for maintaining a GIS data warehouse and associated Southern Nevada GIS Metadata.

The GISMO's responsibilities go beyond maintaining the GIS data warehouse. GISMO also maintains the Street Centerline Database used by 911 dispatch services. This centerline database serves as the base map for this DFIRM.

DIGITAL DATA AVAILABILITY: <http://www.co.clark.nv.us/cgit/gismo/gismo.htm>



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD EVENT

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water surface elevation of the 1% annual chance flood.

- ZONE A** No base flood elevations determined.
- ZONE AE** Base flood elevations determined.
- ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE AR** Area of special flood hazard formerly protected from the 1% annual chance flood event by a flood control system that was subsequently deteriorated. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood event.
- ZONE A99** Area to be protected from 1% annual chance flood event by a Federal flood protection system under construction; no base flood elevations determined.
- ZONE V** Coastal flood zone with velocity hazard (wave action); no base flood elevations determined.
- ZONE VE** Coastal flood zone with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

**ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than one square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

**ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.

**ZONE D** Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- Floodplain Boundary
- Floodway Boundary
- Zone D Boundary
- Coastal Barrier Boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or velocities.
- Base Flood Elevation line and value: elevation in feet
- Base Flood Elevation value where uniform within zone; elevation in feet

\*Referenced to the North American Vertical Datum of 1988

A Cross Section Line

25 Transsect Line

97° 07' 30", 32° 22' 30"

4276990M Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)

1000-meter Universal Transverse Mercator grid values, zone 11

600000 FT 5000-foot grid ticks

DX5519 Bench mark (see explanation in Notes to Users section of this FIRM panel).

M1.5 River Mile

**MAP REPOSITORY**

Refer to Repository Listing on Index Map

**EFFECTIVE DATE OF COUNTY-WIDE FLOOD INSURANCE RATE MAP**

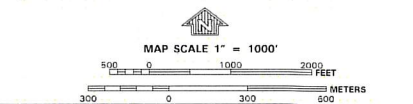
AUGUST 16, 1995

**EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL**

September 27, 2002: to update corporate limits, to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to change special flood hazard areas, to delete special flood hazard areas, to change zone designations, to add codes and road names, to incorporate previously issued letters of map revision, to incorporate previously issued letters of map amendment, and to change floodway.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at (800) 635-8620.



**FIRM**  
FLOOD INSURANCE RATE MAP  
CLARK COUNTY,  
NEVADA AND  
INCORPORATED AREAS

**PANEL 1765 OF 4090**  
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

| COMMUNITY               | NUMBER | PANEL | SUFFIX |
|-------------------------|--------|-------|--------|
| NORTH LAS VEGAS CITY OF | 32003  | 1765  | E      |
| LAS VEGAS CITY OF       | 32027  | 1765  | E      |
| CLARK COUNTY            | 32061  | 1765  | E      |
| UNINCORPORATED AREAS    | 32061  | 1765  | E      |

Notice to User: The Map Number shown above should be used when placing map orders. The Community Number shown above should be used on insurance applications for the subject community.

**MAP NUMBER**  
32003C1765 E  
**MAP REVISED:**  
SEPTEMBER 27, 2002

Federal Emergency Management Agency

FIGURE B-7



CLARK COUNTY ZONING

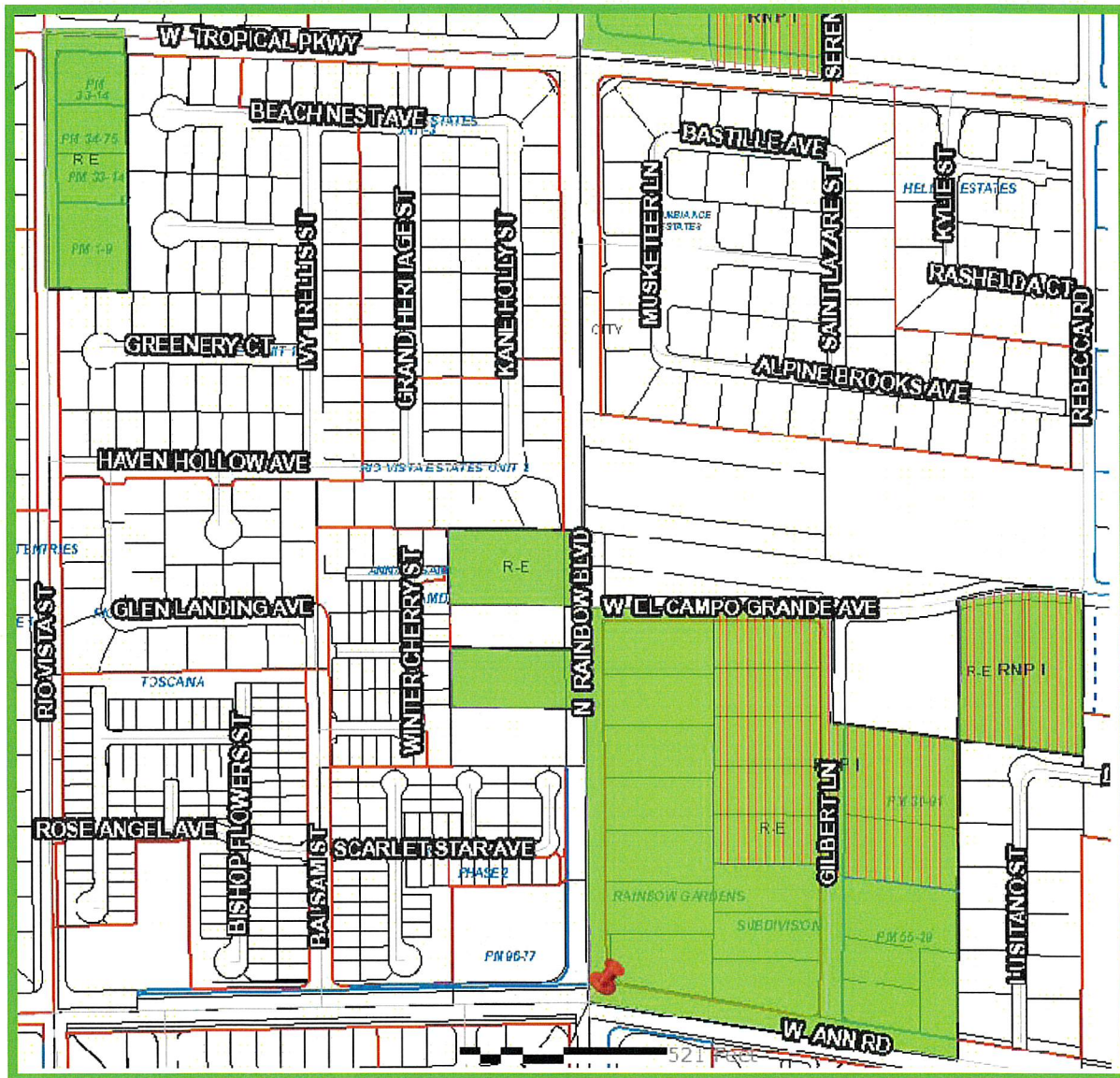


FIGURE B-8



# CITY OF LAS VEGAS ZONING



FIGURE B-9



NOTES

This map is for assessment use only and does NOT represent a survey.

No liability is assumed for the accuracy of the data delineated herein. Information on roads and other non-assessed parcels may be obtained from the Road Document Listing in the Assessor's Office.

This map is compiled from official records, including surveys and deeds, but only contains the information required for assessment. See the recorded documents for more detailed legal information.

USE THIS SCALE(Feet) WHEN MAP REDUCED FROM 11x17 ORIGINAL

0

50

100

200

400

600

800

AVERAGE  
QA VALUE  
35

MAP LEGEND

—

 PARCEL BOUNDARY

—

 SUBD BOUNDARY

---

 ROAD EASEMENT

—

 PM/LD BOUNDARY

---

 NON-PARCEL LOT LINE

---

 MATCH LINE / LEADER LINE

---

 ROAD ID NUMBER

001

ASSESSOR'S PARCELS - CLARK CO., NV.

M. W. Schofield, Assessor

001

 PARCEL NUMBER

1.00

 ACREAGE

202

 PARCEL SUB/SEQ NUMBER

PB 25-45

 PLAT RECORDING NUMBER

5

 BLOCK NUMBER

5

 LOT NUMBER

GL5

 GOV. LOT NUMBER

BOOK

T19S R60E

R59E

R60E

R61E

T18S

T19S

T20S

99

126

137

100

125

138

101

124

139

Scale:1"=200'

Rev:12/26/07

SEC.

27

6

5

4

3

2

1

18

17

16

15

14

13

19

20

21

22

23

24

30

29

28

27

26

25

31

32

33

34

35

36

MAP

S 2 SE 4

8

4

8

4

5

1

5

1

125-27-8



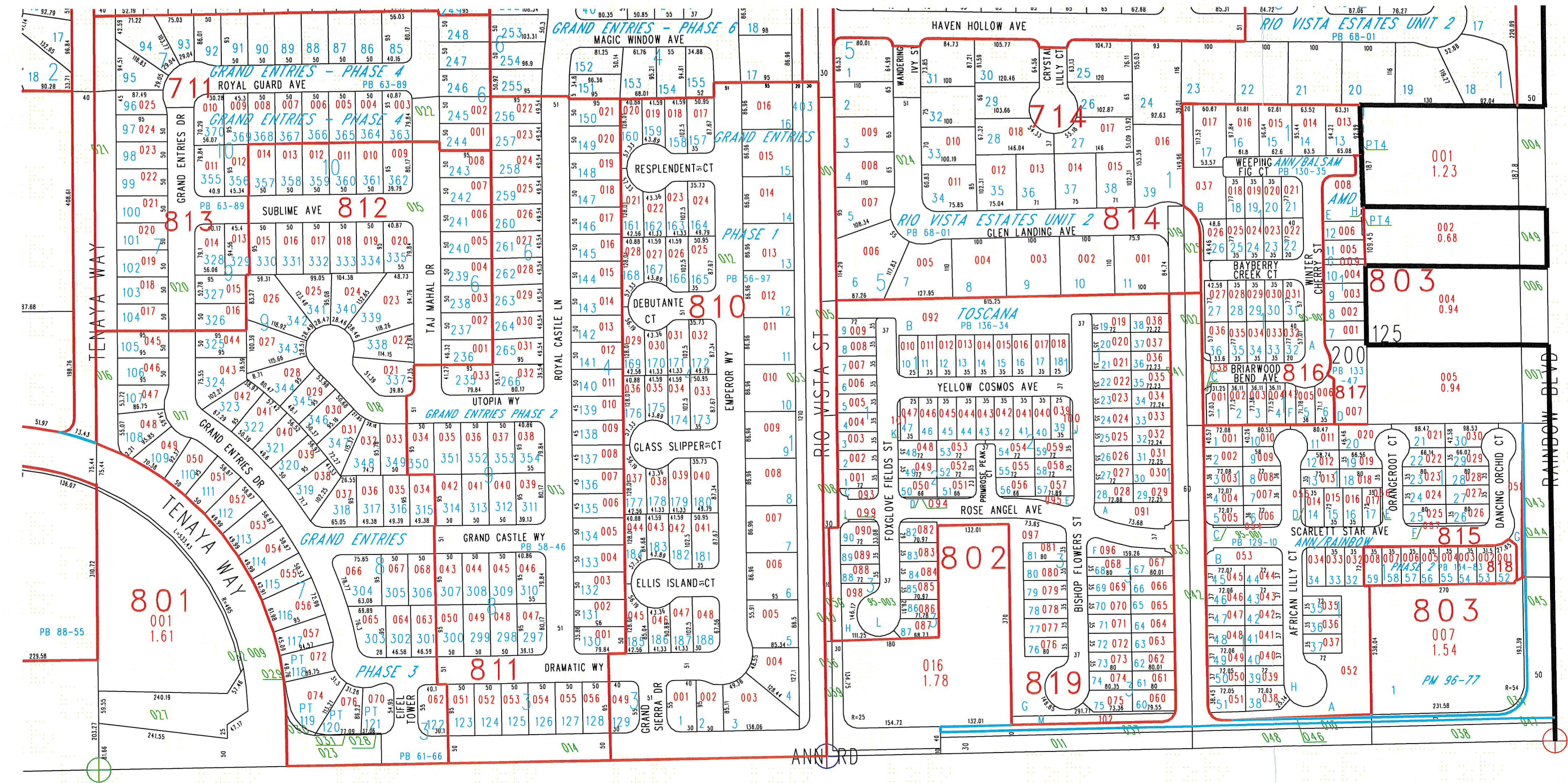


FIGURE B-10 (1 OF 6)



NOTES

This map is for assessment use only and does NOT represent a survey. No liability is assumed for the accuracy of the data delineated herein. Information on roads and other non-assessed parcels may be obtained from the Road Document Listing in the Assessor's Office.

This map is compiled from official records, including surveys and deeds, but only contains the information required for assessment. See the recorded documents for more detailed legal information.

USE THIS SCALE(Feet) WHEN MAP REDUCED FROM 11X17 ORIGINAL

0

50

100

200

400

600

800

AVERAGE  
QA VALUE  
45

MAP LEGEND

—

 PARCEL BOUNDARY

—

 SUBD BOUNDARY

---

 ROAD EASEMENT

—

 PM/LD BOUNDARY

---

 NON-PARCEL LOT LINE

---

 MATCH LINE / LEADER LINE

---

 ROAD ID NUMBER

ASSESSOR'S PARCELS - CLARK CO., NV.

M. W. Schofield, Assessor

BOOK

T19S R60E

SEC.

26

MAP

S 2 SW 4

125-26-4

001

1.00

PARCEL NUMBER

202

0.57

PARCEL ACREAGE

5

0.80

PARCEL SUB/SEQ NUMBER

5

0.54

PLAT RECORDING NUMBER

5

0.48

BLOCK NUMBER

5

0.48

LOT NUMBER

GL5

0.48

GOV. LOT NUMBER

Scale: 1"=200'

Rev: 04/18/07

|      |      |      |
|------|------|------|
| R59E | R60E | R61E |
| 99   | 100  | 101  |
| 126  | 125  | 124  |
| 137  | 138  | 139  |

|    |    |    |    |    |    |
|----|----|----|----|----|----|
| 6  | 5  | 4  | 3  | 2  | 1  |
| 7  | 8  | 9  | 10 | 11 | 12 |
| 18 | 17 | 16 | 15 | 14 | 13 |
| 19 | 20 | 21 | 22 | 23 | 24 |
| 30 | 29 | 28 | 27 | 26 | 25 |
| 31 | 32 | 33 | 34 | 35 | 36 |

|   |   |   |   |
|---|---|---|---|
| 8 | 4 | 8 | 4 |
| 5 | 1 | 5 | 1 |
| 6 | 2 | 6 | 2 |
| 7 | 3 | 7 | 3 |
| 8 | 4 | 8 | 4 |
| 5 | 1 | 5 | 1 |

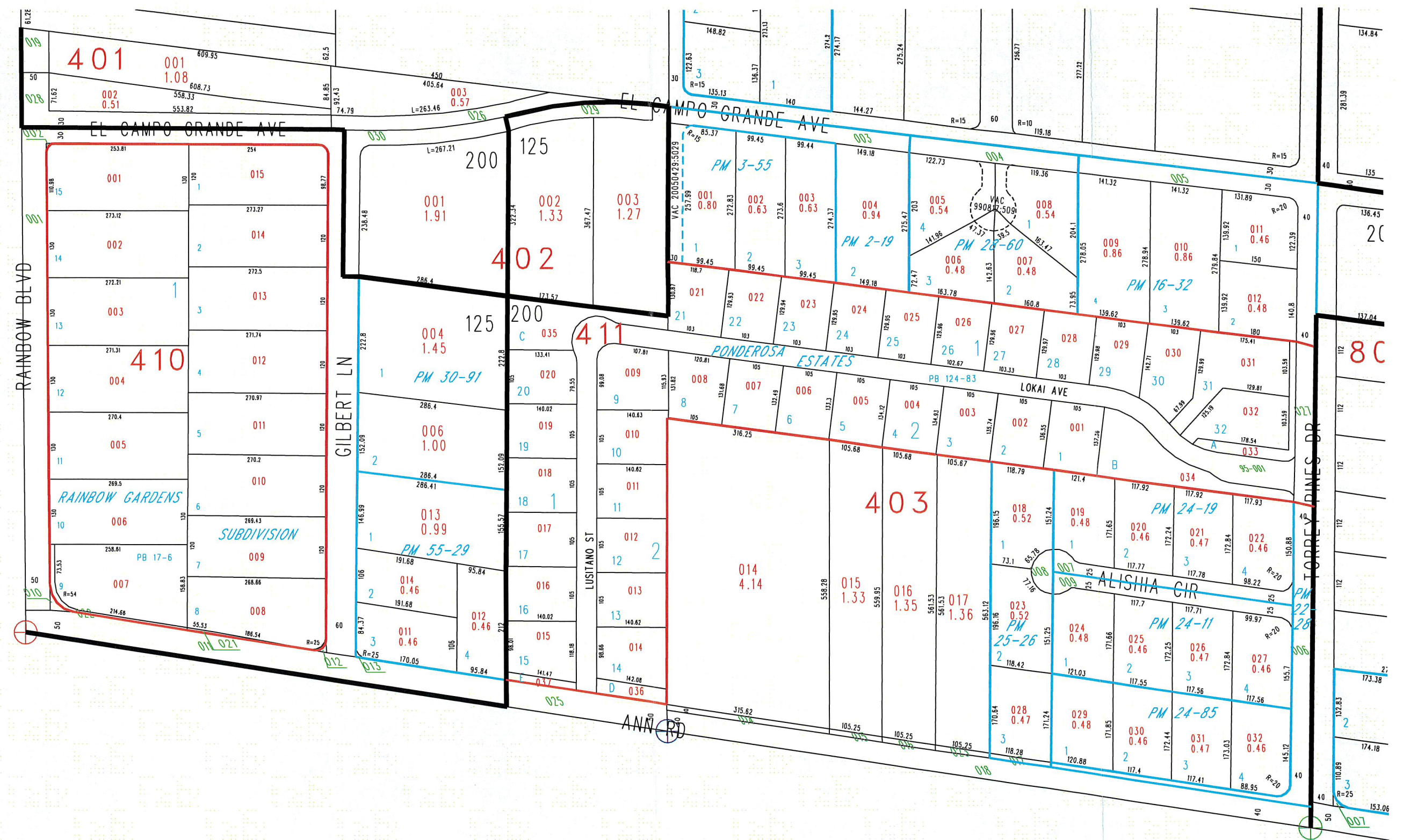


FIGURE B-10 (2 OF 6) TAX DIST 125,200



NOTES

This map is for assessment use only and does NOT represent a survey.  
No liability is assumed for the accuracy of the data delineated herein.  
Information on roads and other non-assessed parcels may be obtained from the Road Document Listing in the Assessor's Office.  
  
This map is compiled from official records, including surveys and deeds, but only contains the information required for assessment. See the recorded documents for more detailed legal information.

USE THIS SCALE(Feet) WHEN MAP REDUCED FROM 11x17 ORIGINAL

0

50

100

200

400

600

800

AVERAGE  
QA VALUE  
35

MAP LEGEND

—

PARCEL BOUNDARY

—

SUBD BOUNDARY

---

ROAD EASEMENT

---

PM/LD BOUNDARY

---

NON-PARCEL LOT LINE

---

MATCH LINE / LEADER LINE

---

ROAD ID NUMBER

ASSESSOR'S PARCELS - CLARK CO., NV.

M. W. Schofield, Assessor

001

PARCEL NUMBER

1.00

ACREAGE

202

PARCEL SUB/SEQ NUMBER

PB 25-45

PLAT RECORDING NUMBER

5

BLOCK NUMBER

5

LOT NUMBER

GL5

GOV. LOT NUMBER

T19S R60E

R59E

99

R60E

100

R61E

101

T18S

126

T19S

125

T20S

137

T18S

124

T19S

124

T20S

138

T18S

124

T19S

124

T20S

139

Scale:1"=200'

Rev:06/11/08

SEC. 27

6

5

7

8

18

17

19

20

30

29

31

32

4

3

9

10

16

15

21

22

28

27

33

34

3

2

10

11

17

18

24

23

31

30

4

1

11

12

18

19

25

26

32

33

8

4

5

1

6

2

7

3

8

4

5

1

MAP N 2 SE 4

8

4

5

1

6

2

7

3

8

4

5

1

125-27-7



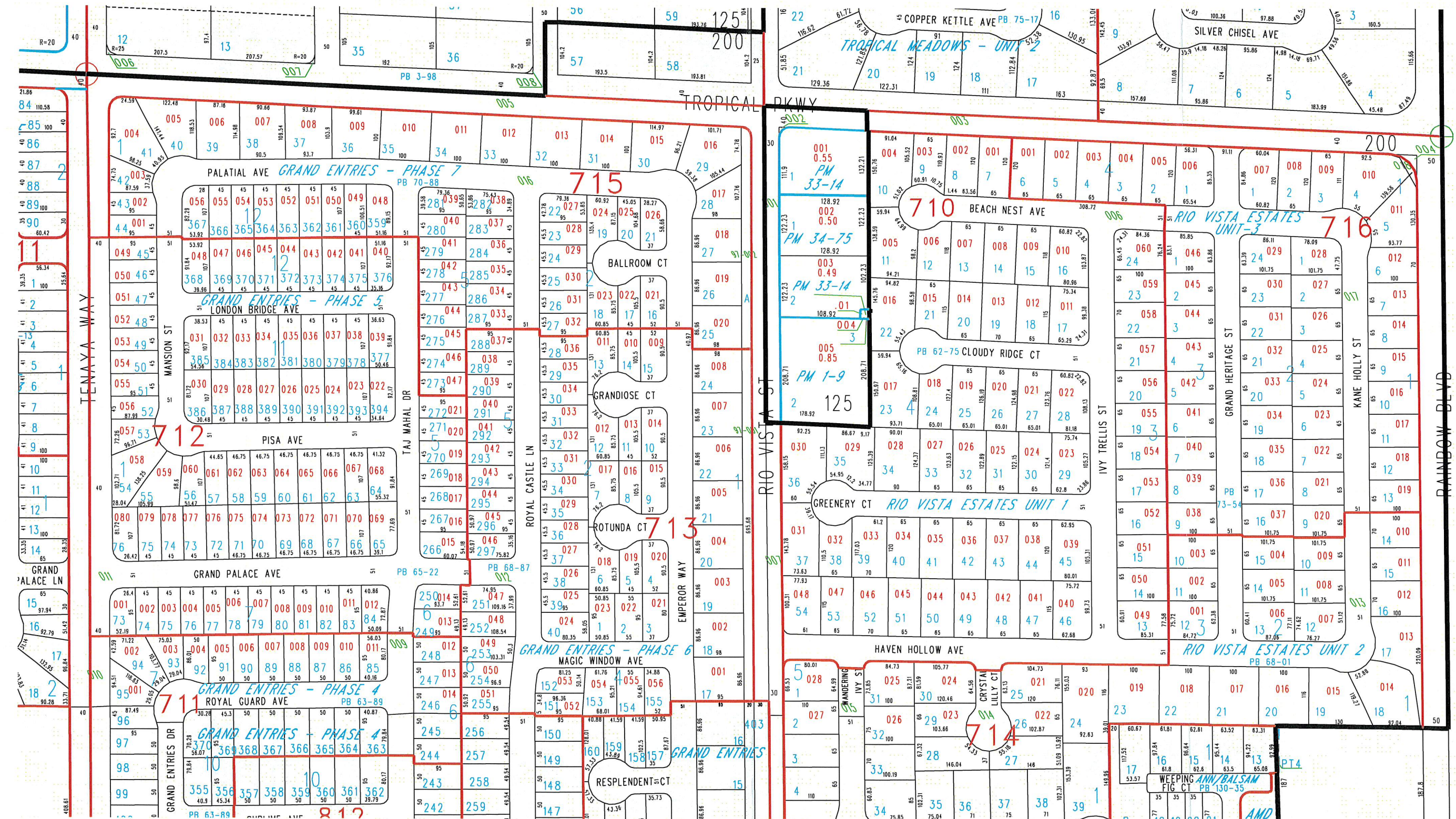


FIGURE B-10 (3 OF 6) TAX DIST 125,200



NOTES

This map is for assessment use only and does NOT represent a survey.

No liability is assumed for the accuracy of the data delineated herein.

Information on roads and other non-assessed parcels may be obtained from the Road Document Listing in the Assessor's Office.

This map is compiled from official records, including surveys and deeds, but only contains the information required for assessment. See the recorded documents for more detailed legal information.

USE THIS SCALE(Feet) WHEN MAP REDUCED FROM 11x17 ORIGINAL

0

50

100

200

400

600

800

AVERAGE  
QA VALUE  
45

MAP LEGEND

—

 PARCEL BOUNDARY

—

 SUBD BOUNDARY

---

 ROAD EASEMENT

—

 PM/LD BOUNDARY

---

 NON-PARCEL LOT LINE

---

 MATCH LINE / LEADER LINE

---

 ROAD ID NUMBER

001

 PARCEL NUMBER

1.00

 ACREAGE

202

 PARCEL SUB/SEQ NUMBER

PB 25-45

 PLAT RECORDING NUMBER

5

 BLOCK NUMBER

5

 LOT NUMBER

GL5

 GOV. LOT NUMBER

ASSESSOR'S PARCELS - CLARK CO., NV.  
M. W. Schofield, Assessor

BOOK

 T19S R60E

SEC.

 26

MAP

 N 2 SW 4

125-26-3

T18S

 99 100 101

T19S

 126 125 124

T20S

 137 138 139

R59E

 6 5 4 3 2 1

R60E

 7 8 9 10 11 12

R61E

 18 17 16 15 14 13

19 20 21 22 23 24

30 29 28 27 26 25

31 32 33 34 35 36

Scale:1"=200'

Rev:02/04/08

8

 4 8 4

5

 1 5 1

6

 2 6 2

7

 3 7 3

8

 4 8 4

5

 1 5 1

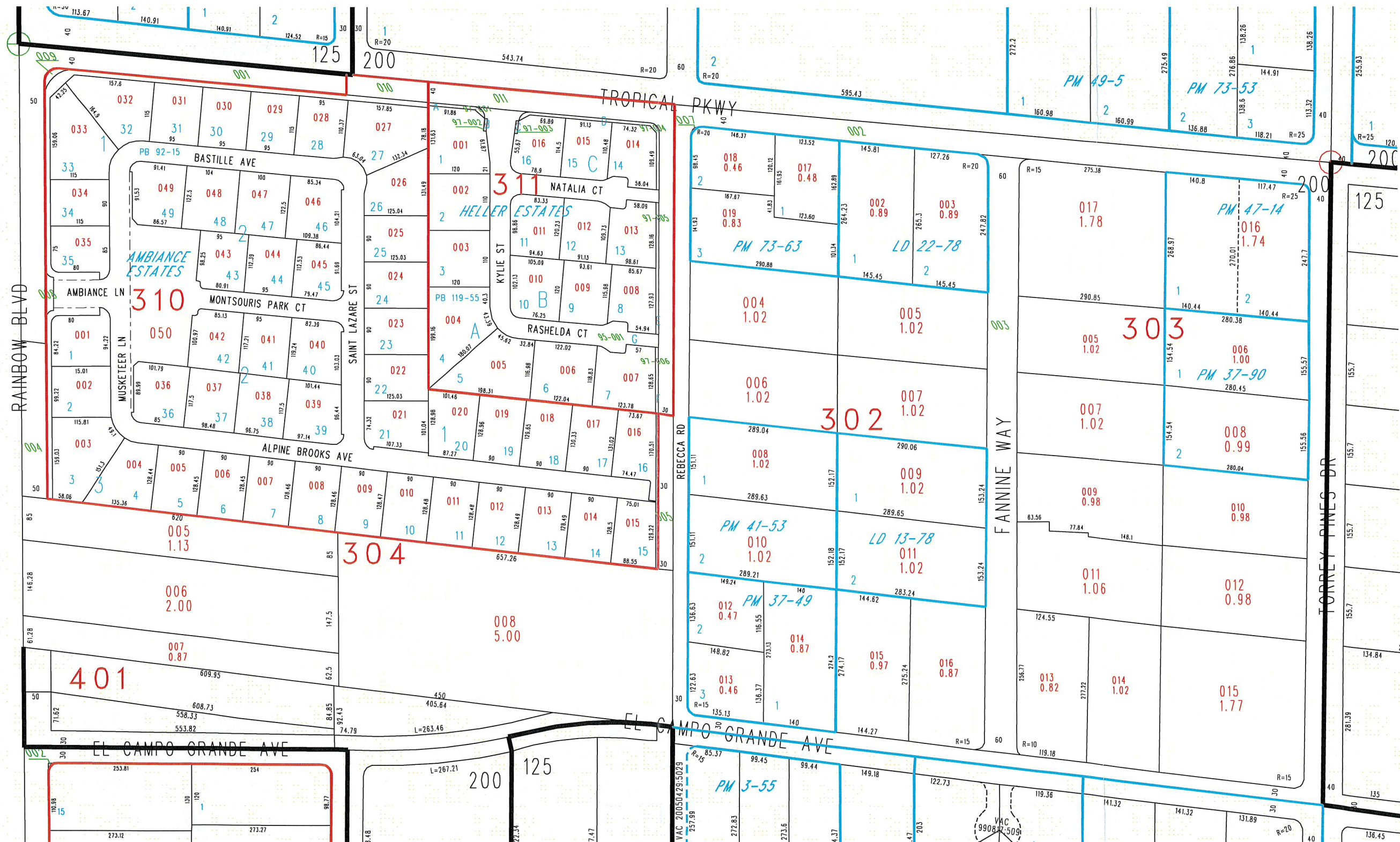


FIGURE B-10 (4 OF 6) TAX DIST 200



NOTES

This map is for assessment use only and does NOT represent a survey.  
No liability is assumed for the accuracy of the data delineated herein.  
Information on roads and other non-assessed parcels may be obtained from the Road Document Listing in the Assessor's Office.  
  
This map is compiled from official records, including surveys and deeds, but only contains the information required for assessment. See the recorded documents for more detailed legal information.

USE THIS SCALE(Feet) WHEN MAP REDUCED FROM 11x17 ORIGINAL

050100200400600800

AVERAGE  
QA VALUE  
45

MAP LEGEND

—

 PARCEL BOUNDARY

—

 SUBD BOUNDARY

---

 ROAD EASEMENT

—

 PM/LD BOUNDARY

---

 NON-PARCEL LOT LINE

---

 MATCH LINE / LEADER LINE

---

 ROAD ID NUMBER

001

 PARCEL NUMBER

1.00

 ACREAGE

202

 PARCEL SUB/SEQ NUMBER

PB 25-45

 PLAT RECORDING NUMBER

5

 BLOCK NUMBER

5

 LOT NUMBER

GL5

 GOV. LOT NUMBER

ASSESSOR'S PARCELS - CLARK CO., NV.

M. W. Schofield, Assessor

BOOK

T19S R60E

SEC.

27

MAP

S 2 NE 4

125-27-6

R59E

R60E

R61E

T18S

T19S

T20S

99

100

101

126

125

124

137

138

139

6

5

4

3

2

1

18

17

16

15

14

13

19

20

21

22

23

24

30

29

28

27

26

25

31

32

33

34

35

36

8

4

8

4

5

1

5

1

6

2

6

2

7

3

7

3

8

4

8

4

5

1

5

1

Scale:1"=200'

Rev:09/19/07

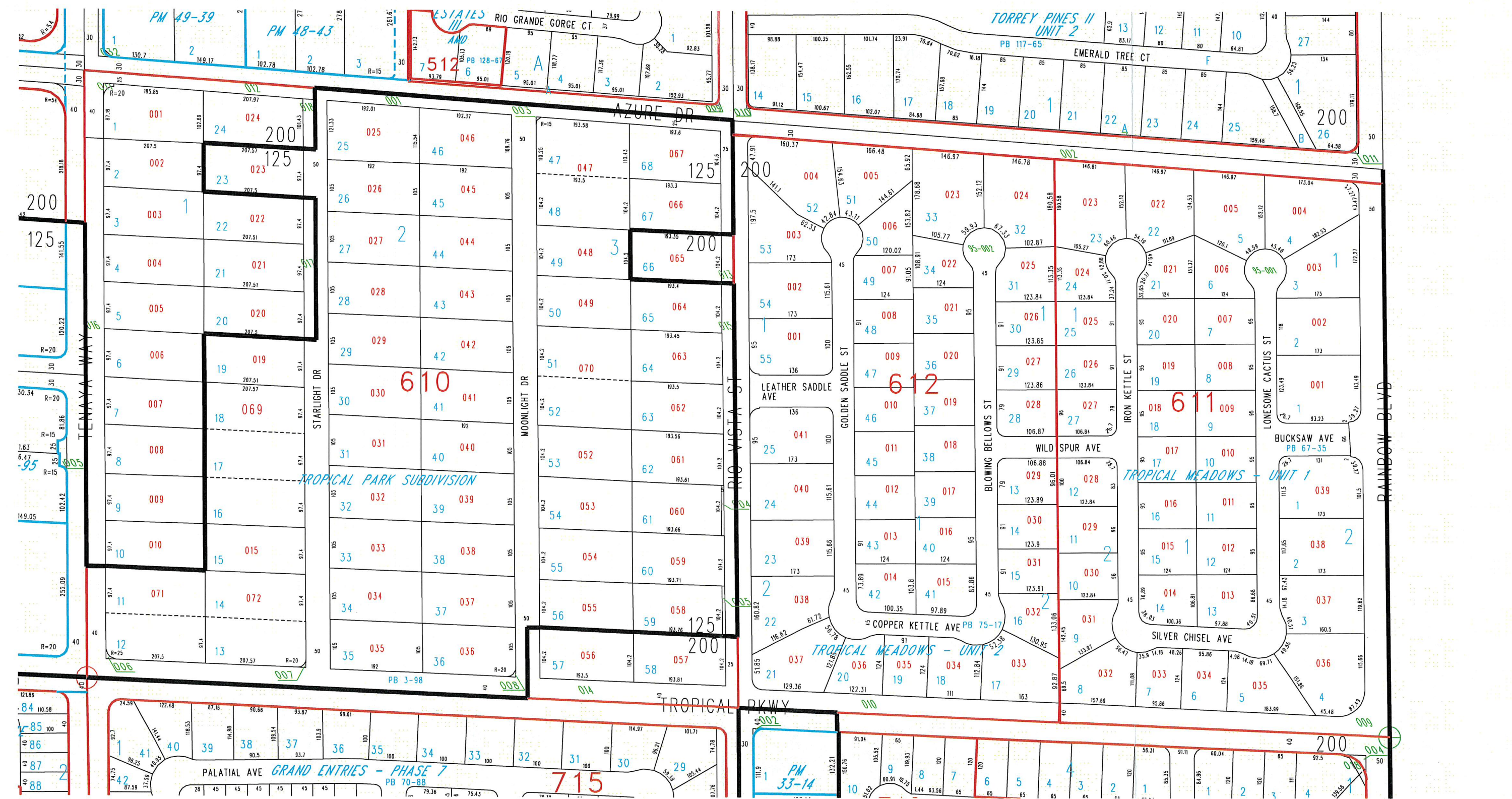


FIGURE B-10 (5 OF 6) TAX DIST 125,200



NOTES

This map is for assessment use only and does NOT represent a survey.

No liability is assumed for the accuracy of the data delineated herein.

Information on roads and other non-assessed parcels may be obtained from the Road Document Listing in the Assessor's Office.

This map is compiled from official records, including surveys and deeds, but only contains the information required for assessment. See the recorded documents for more detailed legal information.

USE THIS SCALE(Feet) WHEN MAP REDUCED FROM 11x17 ORIGINAL

0

50

100

200

400

600

800

AVERAGE  
QA VALUE  
45

MAP LEGEND

—

 PARCEL BOUNDARY

—

 SUBD BOUNDARY

---

 ROAD EASEMENT

—

 PM/LD BOUNDARY

---

 NON-PARCEL LOT LINE

---

 MATCH LINE / LEADER LINE

---

 ROAD ID NUMBER

001

 PARCEL NUMBER

1.00

 ACREAGE

202

 PARCEL SUB/SEQ NUMBER

PB 25-45

 PLAT RECORDING NUMBER

5

 BLOCK NUMBER

5

 LOT NUMBER

CL5

 GOV. LOT NUMBER

ASSESSOR'S PARCELS - CLARK CO., NV.  
M. W. Schofield, Assessor

BOOK

 T19S R60E

SEC.

 26

MAP

 S 2 NW 4

125-26-2

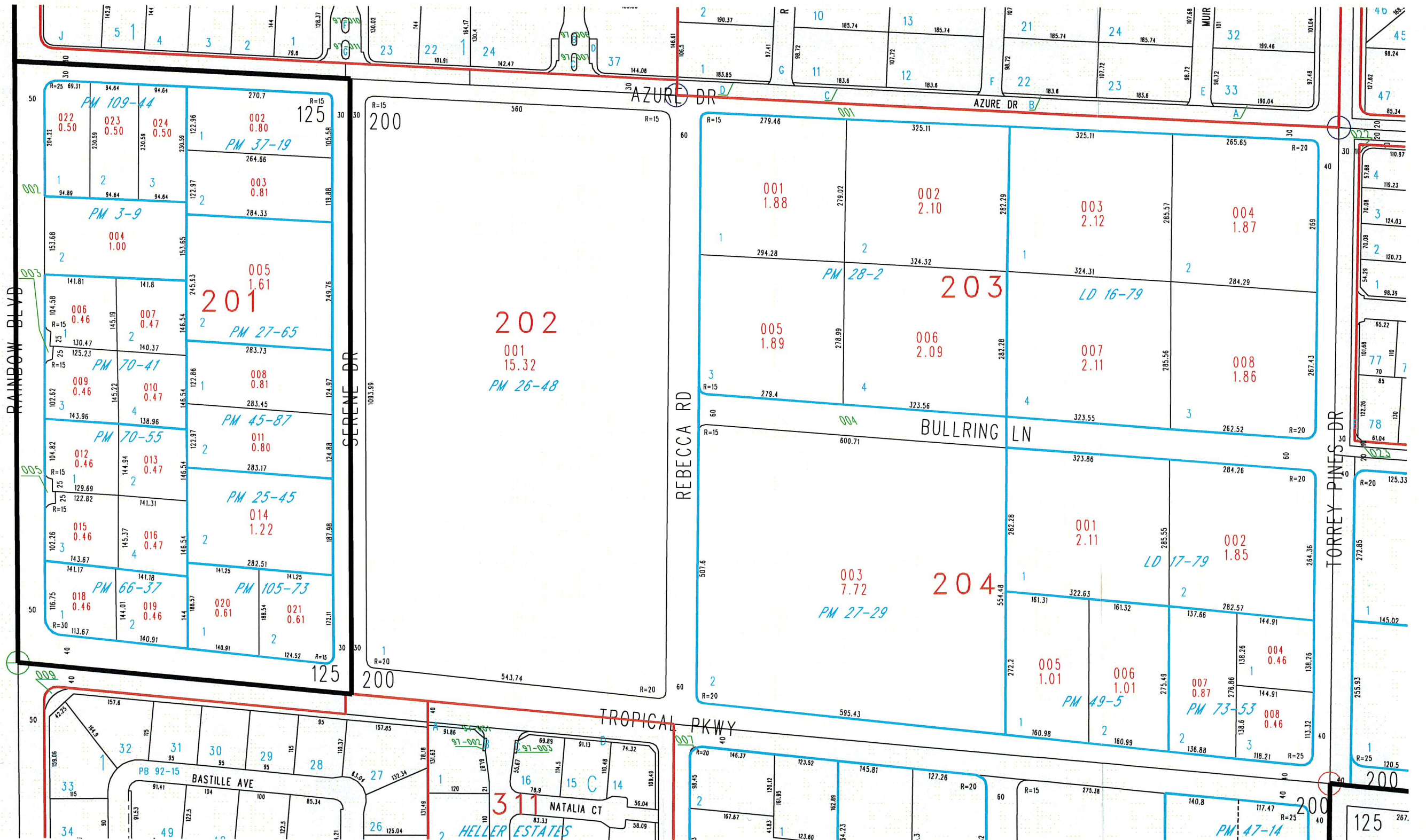
|      |      |      |      |
|------|------|------|------|
|      | R59E | R60E | R61E |
| T18S | 99   | 100  | 101  |
| T19S | 126  | 125  | 124  |
| T20S | 137  | 138  | 139  |

|    |    |    |    |    |    |
|----|----|----|----|----|----|
| 6  | 5  | 4  | 3  | 2  | 1  |
| 7  | 8  | 9  | 10 | 11 | 12 |
| 18 | 17 | 16 | 15 | 14 | 13 |
| 19 | 20 | 21 | 22 | 23 | 24 |
| 30 | 29 | 28 | 27 | 26 | 25 |
| 31 | 32 | 33 | 34 | 35 | 36 |

|   |   |   |   |
|---|---|---|---|
| 8 | 4 | 8 | 4 |
| 5 | 1 | 5 | 1 |
| 6 | 2 | 6 | 2 |
| 7 | 3 | 7 | 3 |
| 8 | 4 | 8 | 4 |
| 5 | 1 | 5 | 1 |

Scale:1"=200'

Rev:05/10/05





**21. APPENDIX C - HYDROLOGY**

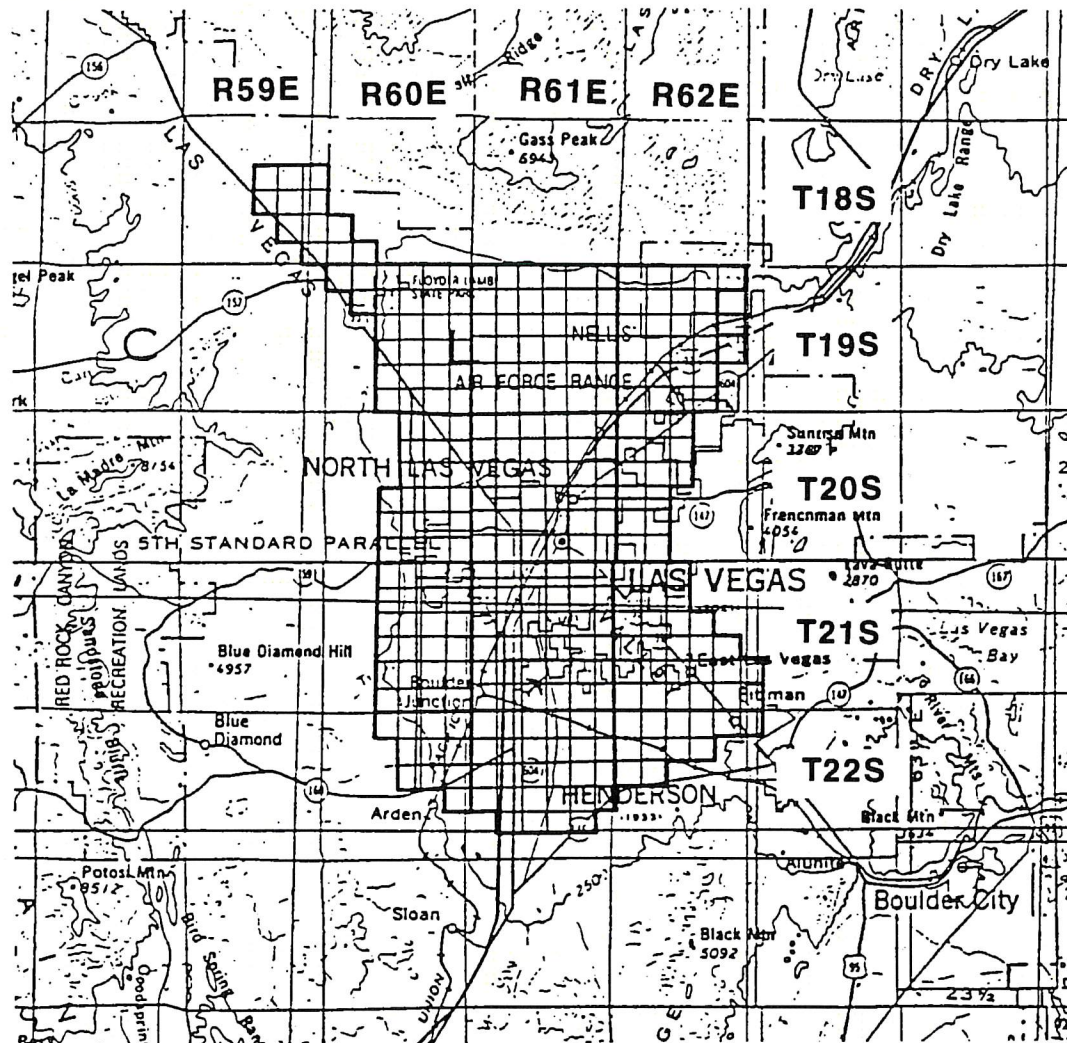
1. FIGURE C-1 HCDDM McCARRAN AIRPORT RAINFALL AREA
2. FIGURE C-2 HCDDM DEPTH-DURATION-FREQUENCY VALUES
3. FIGURE C-3 HCDDM SIX-HOUR STORM DISTRIBUTIONS (SDN3)
4. FIGURE C-4 HCDDM RUNOFF CURVE NUMBERS – URBAN AREAS
5. FIGURE C-5 HCDDM RUNOFF CURVE NUMBERS – RESIDENTIAL
6. FIGURE C-6 COMPOSITE CURVE NUMBER CALCULATIONS
7. FIGURE C-7 TIME OF CONCENTRATION – STANDARD FORM 4
8. FIGURE C-8 10-YEAR HEC-1
9. FIGURE C-9 100-YEAR HEC-1
10. FIGURE C-10 OFF-SITE DRAINAGE EXHIBIT

**21. APPENDIX C - HYDROLOGY**

1. FIGURE C-1 HCDDM McCARRAN AIRPORT RAINFALL AREA
2. FIGURE C-2 HCDDM DEPTH-DURATION-FREQUENCY VALUES
3. FIGURE C-3 HCDDM SIX-HOUR STORM DISTRIBUTIONS (SDN3)
4. FIGURE C-4 HCDDM RUNOFF CURVE NUMBERS – URBAN AREAS
5. FIGURE C-5 HCDDM RUNOFF CURVE NUMBERS – RESIDENTIAL
6. FIGURE C-6 COMPOSITE CURVE NUMBER CALCULATIONS
7. FIGURE C-7 TIME OF CONCENTRATION – STANDARD FORM 4
8. FIGURE C-8 10-YEAR HEC-1
9. FIGURE C-9 100-YEAR HEC-1
10. FIGURE C-10 OFF-SITE DRAINAGE EXHIBIT

# HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

## McCARRAN AIRPORT RAINFALL AREA



| TOWNSHIP | RANGE   | SECTIONS              | TOWNSHIP | RANGE   | SECTIONS             |
|----------|---------|-----------------------|----------|---------|----------------------|
| 18 South | 59 East | 13-15,22-26,36        | 20 South | 62 East | 4-9,16-20,29-32      |
| 18 South | 60 East | 30-32                 | 21 South | 60 East | 1-4,9-16,21-28,33-36 |
| 19 South | 60 East | 1-6,8-16,21-28,33-36  | 21 South | 61 East | ALL SECTIONS         |
| 19 South | 61 East | ALL SECTIONS          | 21 South | 62 East | 4-9,15-23, 25-36     |
| 19 South | 62 East | 2-11,14-23,27-34      | 22 South | 60 East | 1-4,10-15,24         |
| 20 South | 60 East | 1-3,10-15,21-28,33-36 | 22 South | 61 East | 1-24,26-29           |
| 20 South | 61 East | ALL SECTIONS          | 22 South | 62 East | 1-10,17-18           |

### Notes:

1. Refer to Table 505 and Figure 516 Depth-Duration-Frequency values in the McCarran Airport Rainfall Area.
2. Refer to Table 506 and Figure 517 for Time-Intensity-Frequency values on the McCarran Airport Rainfall Area.

| Revision | Date |
|----------|------|
|          |      |
|          |      |
|          |      |



# HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

## DEPTH-DURATION-FREQUENCY VALUES FOR McCARRAN AIRPORT RAINFALL AREA (IN INCHES)

| TIME            | RECURRENCE INTERVAL |      |       |       |       |        |
|-----------------|---------------------|------|-------|-------|-------|--------|
|                 | 2-YR                | 5-YR | 10-YR | 25-YR | 50-YR | 100-YR |
| 5 min.          | 0.15                | 0.27 | 0.35  | 0.46  | 0.54  | 0.63   |
| 10 min.         | 0.25                | 0.44 | 0.57  | 0.74  | 0.89  | 1.02   |
| 15 min.         | 0.33                | 0.57 | 0.74  | 0.97  | 1.15  | 1.32   |
| 30 min.         | 0.44                | 0.78 | 1.01  | 1.31  | 1.55  | 1.79   |
| 1 hour          | 0.52                | 0.89 | 1.15  | 1.50  | 1.78  | 2.06   |
| 2 hour          | 0.59                | 1.01 | 1.30  | 1.70  | 2.01  | 2.30   |
| 3 hour          | 0.64                | 1.08 | 1.39  | 1.82  | 2.15  | 2.48   |
| 6 hour          | 0.72                | 1.22 | 1.58  | 2.05  | 2.41  | 2.77   |
| 24 hour (TR-55) | 1.20                | 1.60 | 1.80  | 2.40  | 2.70  | 2.96   |

- NOTE: 1. Refer to Figure 513 for a description and drawing of the area included in the McCarran Airport Rainfall Area.
2. The 24 hour values presented above are for use with TR-55 only.
3. Table 501 adjustments not required.

| Revision | Date |
|----------|------|
|          |      |
|          |      |
|          |      |
|          |      |

**WRC  
ENGINEERING**

**REFERENCE:**

USACE, Los Angeles District, 1988

**TABLE 505**

# HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

## SIX-HOUR STORM DISTRIBUTIONS

| Percent of<br>Total Storm Depth |      |      |      | Percent of<br>Total Storm Depth |       |       |       |
|---------------------------------|------|------|------|---------------------------------|-------|-------|-------|
| Storm Time<br>(In Minutes)      | SDN3 | SDN4 | SDN5 | Storm Time<br>(In Minutes)      | SDN3  | SDN4  | SDN5  |
| 0                               | 0.0  | 0.0  | 0.0  | 185                             | 32.2  | 37.6  | 43.0  |
| 5                               | 2.0  | 2.0  | 2.0  | 190                             | 35.2  | 41.5  | 47.7  |
| 10                              | 5.7  | 5.8  | 5.9  | 195                             | 40.9  | 46.2  | 51.4  |
| 15                              | 7.0  | 7.5  | 8.0  | 200                             | 49.9  | 53.0  | 56.1  |
| 20                              | 8.7  | 9.9  | 11.0 | 205                             | 59.0  | 61.0  | 63.0  |
| 25                              | 10.8 | 12.6 | 14.4 | 210                             | 71.0  | 71.0  | 71.0  |
| 30                              | 12.4 | 13.7 | 15.0 | 215                             | 74.4  | 73.2  | 72.0  |
| 35                              | 13.0 | 14.5 | 16.0 | 220                             | 78.1  | 75.6  | 73.1  |
| 40                              | 13.0 | 14.9 | 16.8 | 225                             | 81.2  | 78.2  | 75.2  |
| 45                              | 13.0 | 15.1 | 17.1 | 230                             | 81.9  | 79.9  | 77.9  |
| 50                              | 13.0 | 15.5 | 18.0 | 235                             | 83.5  | 81.3  | 79.0  |
| 55                              | 13.0 | 15.6 | 18.2 | 240                             | 85.1  | 82.3  | 79.5  |
| 60                              | 13.0 | 15.9 | 18.7 | 245                             | 85.6  | 83.0  | 80.4  |
| 65                              | 13.3 | 16.2 | 19.0 | 250                             | 86.0  | 83.5  | 81.0  |
| 70                              | 14.0 | 16.9 | 19.7 | 255                             | 86.8  | 84.4  | 82.0  |
| 75                              | 14.2 | 17.2 | 20.2 | 260                             | 87.6  | 85.1  | 82.6  |
| 80                              | 14.8 | 17.9 | 21.0 | 265                             | 88.8  | 86.4  | 84.0  |
| 85                              | 15.8 | 18.9 | 22.0 | 270                             | 91.0  | 88.5  | 85.9  |
| 90                              | 17.2 | 20.1 | 23.0 | 275                             | 92.6  | 90.8  | 88.9  |
| 95                              | 18.1 | 21.1 | 24.1 | 280                             | 93.7  | 92.4  | 91.0  |
| 100                             | 19.0 | 22.0 | 25.0 | 285                             | 95.0  | 94.4  | 93.8  |
| 105                             | 19.7 | 22.8 | 25.9 | 290                             | 97.0  | 96.8  | 96.6  |
| 110                             | 19.9 | 23.2 | 26.5 | 295                             | 97.6  | 97.3  | 97.0  |
| 115                             | 20.0 | 24.0 | 28.0 | 300                             | 98.2  | 97.8  | 97.4  |
| 120                             | 20.1 | 24.6 | 29.0 | 305                             | 98.5  | 98.2  | 97.9  |
| 125                             | 20.4 | 25.2 | 30.0 | 310                             | 98.7  | 98.4  | 98.1  |
| 130                             | 21.4 | 26.0 | 30.5 | 315                             | 98.9  | 98.6  | 98.3  |
| 135                             | 22.9 | 26.9 | 30.9 | 320                             | 99.0  | 98.8  | 98.5  |
| 140                             | 24.1 | 27.6 | 31.0 | 325                             | 99.3  | 99.1  | 98.9  |
| 145                             | 24.9 | 28.3 | 31.7 | 330                             | 99.3  | 99.2  | 99.0  |
| 150                             | 25.1 | 28.6 | 32.1 | 335                             | 99.4  | 99.3  | 99.2  |
| 155                             | 25.6 | 29.2 | 32.7 | 340                             | 99.5  | 99.4  | 99.3  |
| 160                             | 27.0 | 30.2 | 33.3 | 345                             | 99.8  | 99.7  | 99.6  |
| 165                             | 27.8 | 31.2 | 34.6 | 350                             | 99.8  | 99.8  | 99.7  |
| 170                             | 28.1 | 32.1 | 36.1 | 355                             | 99.9  | 99.9  | 99.9  |
| 175                             | 28.3 | 33.2 | 38.1 | 360                             | 100.0 | 100.0 | 100.0 |
| 180                             | 29.5 | 35.2 | 40.8 |                                 |       |       |       |

- Notes: 1. For drainage areas less than 8 square miles in size, use SDN 3.  
 2. For drainage areas greater than or equal to 8 square miles and less than 12 square miles in size, use SDN 4.  
 3. For drainage areas greater than or equal to 12 square miles, use SDN 5.  
 4. A graphical representation of these values is presented on **Figure 515**.

| Revision | Date |
|----------|------|
|          |      |
|          |      |
|          |      |
|          |      |

REFERENCE:

TABLE 503

# HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

## RUNOFF CURVE NUMBERS (URBAN AREAS<sup>1</sup>)

| Cover description                                                                                                                    |                                              | Curve numbers for hydrologic soil group— |    |    |    |
|--------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|------------------------------------------|----|----|----|
| Cover type and hydrologic condition                                                                                                  | Average percent impervious area <sup>2</sup> | A                                        | B  | C  | D  |
| <i>Fully developed urban areas (vegetation established)</i>                                                                          |                                              |                                          |    |    |    |
| Open space (lawns, parks, golf courses, cemeteries, etc.) <sup>3</sup> :                                                             |                                              |                                          |    |    |    |
| Poor condition (grass cover < 50%) .....                                                                                             |                                              | 68                                       | 79 | 86 | 89 |
| Fair condition (grass cover 50% to 75%) .....                                                                                        |                                              | 49                                       | 69 | 79 | 84 |
| Good condition (grass cover > 75%) .....                                                                                             |                                              | 39                                       | 61 | 74 | 80 |
| Impervious areas:                                                                                                                    |                                              |                                          |    |    |    |
| Paved parking lots, roofs, driveways, etc. (excluding right-of-way) .....                                                            |                                              | 98                                       | 98 | 98 | 98 |
| Streets and roads:                                                                                                                   |                                              |                                          |    |    |    |
| Paved; curbs and storm sewers (excluding right-of-way) .....                                                                         |                                              | 98                                       | 98 | 98 | 98 |
| Paved; open ditches (including right-of-way) .....                                                                                   |                                              | 83                                       | 89 | 92 | 93 |
| Gravel (including right-of-way) .....                                                                                                |                                              | 76                                       | 85 | 89 | 91 |
| Dirt (including right-of-way) .....                                                                                                  |                                              | 72                                       | 82 | 87 | 89 |
| Western desert urban areas:                                                                                                          |                                              |                                          |    |    |    |
| Natural desert landscaping (pervious areas only) <sup>4</sup> ...                                                                    |                                              | 63                                       | 77 | 85 | 88 |
| Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders) ..... |                                              | 96                                       | 96 | 96 | 96 |
| Urban districts:                                                                                                                     |                                              |                                          |    |    |    |
| Commercial and business .....                                                                                                        | 85                                           | 89                                       | 92 | 94 | 95 |
| Industrial .....                                                                                                                     | 72                                           | 81                                       | 88 | 91 | 93 |
| Residential districts by average lot size:                                                                                           |                                              |                                          |    |    |    |

**See Table 602A**

### Developing urban areas

|                                                                            |    |    |    |    |
|----------------------------------------------------------------------------|----|----|----|----|
| Newly graded areas (pervious areas only, no vegetation) <sup>5</sup> ..... | 77 | 86 | 91 | 94 |
|----------------------------------------------------------------------------|----|----|----|----|

1 Average runoff condition, and  $I_p = 0.2S$ .

2 The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system. Impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using Figure 603.

3 CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

4 Composite CN's for natural desert landscaping should be computed using Figure 603 based on the impervious area percentage (CN #98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

5 Composite CN's to use for the design of temporary measures during grading and construction should be computed using Figure 603 based on the degree of development impervious area percentage) and the CN's for the newly graded pervious areas.

| Revision | Date |
|----------|------|
|          |      |
|          |      |
|          |      |
|          |      |

**WRC  
ENGINEERING**

**REFERENCE:**  
SCS TR-55, USDA, June 1986.

**TABLE 602  
1 of 4**



# HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

## RUNOFF CURVE NUMBERS - RESIDENTIAL DISTRICTS

| Average Lot Size<br>or Usage <sup>1</sup>        | Percent<br>Impervious <sup>2</sup> | Curve Number for Hydrologic Soil Groups |    |    |    |
|--------------------------------------------------|------------------------------------|-----------------------------------------|----|----|----|
|                                                  |                                    | A                                       | B  | C  | D  |
| Apartments/Condos                                | 72                                 | 81                                      | 88 | 91 | 93 |
| Townhouses/6,000 sq ft lots or less <sup>3</sup> | 69                                 | 80                                      | 87 | 90 | 92 |
| 7,000 sq ft lots                                 | 63                                 | 76                                      | 84 | 89 | 91 |
| 8,000 sq ft lots                                 | 58                                 | 73                                      | 82 | 88 | 90 |
| 10,000 sq ft lots                                | 38                                 | 61                                      | 75 | 83 | 87 |
| 14,000 sq ft lots                                | 30                                 | 57                                      | 72 | 81 | 86 |
| 20,000 sq ft lots                                | 25                                 | 54                                      | 70 | 80 | 85 |
| 40,000 sq ft lots                                | 20                                 | 51                                      | 68 | 79 | 84 |
| 80,000 sq ft lots                                | 12                                 | 46                                      | 65 | 77 | 82 |

- 1 Lot size should represent the size of the average lot and not the gross acreage divided by the number of lots.
- 2 Actual percent impervious value should be compared to selected land use type.
- 3 In cases where average residential lots are smaller than 6,000 sq ft, commercial/business/industrial land use should be used.

| Revision | Date |
|----------|------|
|          |      |
|          |      |
|          |      |
|          |      |

REFERENCE:

**TABLE 602A**

# COMPOSITE CURVE NUMBER CALCULATIONS

| BASIN | %B Soil | CN B | %D Soil | CN D | Composite<br>CN | Comments                                    |
|-------|---------|------|---------|------|-----------------|---------------------------------------------|
| OFF1  | 50%     | 70   | 50%     | 85   | 77.5            | 20,000 SF Lots (2 units/acre)               |
| OFF2  | 0%      | 72   | 100%    | 86   | 86.0            | 14,000 SF Lots AVG                          |
| OFF3  | 10%     | 72   | 90%     | 86   | 84.6            | 14,000 SF Lots AVG                          |
| OFF4  | 70%     | 72   | 30%     | 86   | 76.2            | 14,000 SF Lots AVG                          |
| OFF5  | 30%     | 88   | 70%     | 93   | 91.5            | Less than 6000 use indust                   |
| OFF6  | 20%     | 88   | 80%     | 93   | 92.0            | Less than 6000 use indust                   |
| OFF7  | 0%      | 87   | 100%    | 92   | 92.0            | Average 6000 sf lot                         |
| OFF8  | 0%      | 0    | 100%    | 94   | 94.0            | 65% Paved, 35% 10,000 sf lots (3.5 DU/Acre) |
| OFF9  | 0%      | 92   | 100%    | 95   | 95.0            | Less than 6000 use commercial               |
| OFF10 | 0%      | 92   | 100%    | 95   | 95.0            | Less than 6000 use commercial               |
| OFF11 | 0%      | 75   | 100%    | 87   | 87.0            | 10,000 sf lots (3.5 DU/Acre)                |
| OFF12 | 0%      | 75   | 100%    | 87   | 87.0            | 10,000 sf lots (3.5 DU/Acre)                |
| OFF13 | 0%      | 92   | 100%    | 95   | 95.0            | Commercial Site                             |
| OFF14 | 0%      | 92   | 100%    | 95   | 95.0            | Commercial Site                             |
| OFF15 | 0%      | 92   | 100%    | 95   | 95.0            | Commercial Site                             |
| RB1   | 0%      | 98   | 100%    | 98   | 98.0            | Paved Road                                  |
| RB2   | 0%      | 98   | 100%    | 98   | 98.0            | Paved Road                                  |
| RB3   | 0%      | 98   | 100%    | 98   | 98.0            | Paved Road                                  |

FIGURE C-6

| ANN ROAD CHANNEL WEST - RAINBOW BOULEVARD<br>CLV HANSEN NO. 36801                                                                                                                                                                                                                                  |                       |                 |       |              |                         |                        |           |      |                      | JACOBS<br>319 E. Warm Springs Rd., Ste. 200<br>Las Vegas, Nevada 89119                                                                                                                                                                                                                                                                                                                               |           |                      |                      |                      |                                                   |                   |                      |                    |                        |                                                                                                                                                |  |                                            |  |                               |  |                               |  |         |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------|-------|--------------|-------------------------|------------------------|-----------|------|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------------------|----------------------|----------------------|---------------------------------------------------|-------------------|----------------------|--------------------|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------|--|-------------------------------|--|-------------------------------|--|---------|--|
| TIME OF CONCENTRATION - FUTURE CONDITION                                                                                                                                                                                                                                                           |                       |                 |       |              |                         |                        |           |      |                      | PROJECT No.: W4X53700<br>DATE: 17-Jan-11                                                                                                                                                                                                                                                                                                                                                             |           |                      |                      |                      |                                                   |                   |                      |                    |                        |                                                                                                                                                |  |                                            |  |                               |  |                               |  |         |  |
| PROJECT:<br>CALCULATED BY: Ann and Rainbow<br>Tara Alexander, PE                                                                                                                                                                                                                                   |                       |                 |       |              | Sub-Basin Data          |                        |           |      |                      | Initial/Overland Time<br>(T <sub>i</sub> )                                                                                                                                                                                                                                                                                                                                                           |           |                      |                      |                      | Travel Time <sup>2,3,4</sup><br>(T <sub>t</sub> ) |                   |                      |                    |                        | T <sub>c</sub><br>(T <sub>i</sub> + T <sub>t</sub> )                                                                                           |  | T <sub>c</sub> Check<br>(Urbanized Basins) |  | Final T <sub>c</sub><br>(min) |  | T <sub>lag</sub> <sup>5</sup> |  | Remarks |  |
| DESIGN                                                                                                                                                                                                                                                                                             | PAVED / UNPAVED BASIN | CN <sup>1</sup> | K     | AREA (acres) | AREA (mi <sup>2</sup> ) | LENGTH (500' MAX) (ft) | SLOPE (%) |      | T <sub>i</sub> (min) | LENGTH (ft)                                                                                                                                                                                                                                                                                                                                                                                          | SLOPE (%) | V <sub>1</sub> (fps) | V <sub>2</sub> (fps) | T <sub>i</sub> (min) | T <sub>t</sub> (min)                              | TOTAL LENGTH (ft) | T <sub>c</sub> (min) | T <sub>c</sub> ... | T <sub>lag</sub> (hrs) | Remarks                                                                                                                                        |  |                                            |  |                               |  |                               |  |         |  |
| (1)                                                                                                                                                                                                                                                                                                | (2)                   | (3)             | (4)   | (5)          | (6)                     | (7)                    | (8)       | (9)  | (10)                 | (11)                                                                                                                                                                                                                                                                                                                                                                                                 | (12)      | (13)                 | (14)                 | (15)                 | (16)                                              | (17)              | (18)                 | (19)               | (20)                   |                                                                                                                                                |  |                                            |  |                               |  |                               |  |         |  |
| OFF1                                                                                                                                                                                                                                                                                               | P                     | 77.5            | 0.633 | 28.6         | 0.0447                  | 240                    | 1.0       | 13.0 | 2200                 | 0.6                                                                                                                                                                                                                                                                                                                                                                                                  | 1.56      | 2.37                 | 17.3                 | 30.3                 | 2440                                              | 23.6              | 23.6                 | 0.236              |                        |                                                                                                                                                |  |                                            |  |                               |  |                               |  |         |  |
| OFF2                                                                                                                                                                                                                                                                                               | P                     | 86.0            | 0.745 | 13.0         | 0.0203                  | 200                    | 1.0       | 9.0  | 1400                 | 0.4                                                                                                                                                                                                                                                                                                                                                                                                  | 1.28      | 1.94                 | 14.3                 | 23.3                 | 1600                                              | 18.9              | 18.9                 | 0.189              |                        |                                                                                                                                                |  |                                            |  |                               |  |                               |  |         |  |
| OFF3                                                                                                                                                                                                                                                                                               | P                     | 84.6            | 0.727 | 20.7         | 0.0323                  | 165                    | 1.0       | 8.6  | 1680                 | 0.5                                                                                                                                                                                                                                                                                                                                                                                                  | 1.43      | 2.16                 | 14.9                 | 23.6                 | 1845                                              | 20.3              | 20.3                 | 0.203              |                        |                                                                                                                                                |  |                                            |  |                               |  |                               |  |         |  |
| OFF4                                                                                                                                                                                                                                                                                               | P                     | 76.2            | 0.616 | 4.0          | 0.0062                  | 190                    | 1.0       | 12.0 | 500                  | 0.4                                                                                                                                                                                                                                                                                                                                                                                                  | 1.28      | N/A                  | 6.5                  | 18.5                 | 690                                               | 13.8              | 13.8                 | 0.138              |                        |                                                                                                                                                |  |                                            |  |                               |  |                               |  |         |  |
| OFF5                                                                                                                                                                                                                                                                                               | P                     | 91.5            | 0.818 | 13.2         | 0.0205                  | 150                    | 1.0       | 6.2  | 1500                 | 0.7                                                                                                                                                                                                                                                                                                                                                                                                  | 1.69      | 2.56                 | 11.4                 | 17.7                 | 1650                                              | 19.2              | 17.7                 | 0.177              |                        |                                                                                                                                                |  |                                            |  |                               |  |                               |  |         |  |
| OFF6                                                                                                                                                                                                                                                                                               | P                     | 92.0            | 0.824 | 46.1         | 0.0721                  | 150                    | 1.0       | 6.1  | 2300                 | 0.5                                                                                                                                                                                                                                                                                                                                                                                                  | 1.43      | 2.16                 | 19.7                 | 25.8                 | 2450                                              | 23.6              | 23.6                 | 0.236              |                        |                                                                                                                                                |  |                                            |  |                               |  |                               |  |         |  |
| OFF7                                                                                                                                                                                                                                                                                               | P                     | 92.0            | 0.824 | 32.5         | 0.0508                  | 140                    | 1.0       | 5.9  | 1880                 | 0.4                                                                                                                                                                                                                                                                                                                                                                                                  | 1.28      | 1.94                 | 18.4                 | 24.3                 | 2020                                              | 21.2              | 21.2                 | 0.212              |                        |                                                                                                                                                |  |                                            |  |                               |  |                               |  |         |  |
| OFF8                                                                                                                                                                                                                                                                                               | P                     | 94.0            | 0.851 | 3.2          | 0.0050                  | 185                    | 1.0       | 6.1  | 660                  | 0.4                                                                                                                                                                                                                                                                                                                                                                                                  | 1.28      | 1.94                 | 7.9                  | 14.0                 | 845                                               | 14.7              | 14.0                 | 0.140              |                        |                                                                                                                                                |  |                                            |  |                               |  |                               |  |         |  |
| OFF9                                                                                                                                                                                                                                                                                               | P                     | 95.0            | 0.864 | 11.7         | 0.0182                  | 100                    | 1.0       | 4.2  | 925                  | 1.5                                                                                                                                                                                                                                                                                                                                                                                                  | 2.47      | 3.75                 | 5.3                  | 9.5                  | 1025                                              | 15.7              | 9.5                  | 0.095              |                        |                                                                                                                                                |  |                                            |  |                               |  |                               |  |         |  |
| OFF10                                                                                                                                                                                                                                                                                              | P                     | 95.0            | 0.864 | 10.9         | 0.0170                  | 150                    | 1.0       | 5.2  | 1795                 | 0.7                                                                                                                                                                                                                                                                                                                                                                                                  | 1.69      | 2.56                 | 13.4                 | 18.6                 | 1945                                              | 20.8              | 18.6                 | 0.186              |                        |                                                                                                                                                |  |                                            |  |                               |  |                               |  |         |  |
| OFF11                                                                                                                                                                                                                                                                                              | P                     | 87.0            | 0.758 | 2.0          | 0.0032                  | 85                     | 1.0       | 5.7  | 370                  | 0.7                                                                                                                                                                                                                                                                                                                                                                                                  | 1.69      | N/A                  | N/A                  | 3.6                  | 9.3                                               | 455               | 12.5                 | 9.3                | 0.093                  |                                                                                                                                                |  |                                            |  |                               |  |                               |  |         |  |
| OFF12                                                                                                                                                                                                                                                                                              | P                     | 87.0            | 0.758 | 1.0          | 0.0015                  | 100                    | 1.0       | 6.1  | 285                  | 0.6                                                                                                                                                                                                                                                                                                                                                                                                  | 1.56      | N/A                  | N/A                  | 3.0                  | 9.2                                               | 385               | 12.1                 | 9.2                | 0.092                  |                                                                                                                                                |  |                                            |  |                               |  |                               |  |         |  |
| OFF13                                                                                                                                                                                                                                                                                              | P                     | 95.0            | 0.864 | 0.9          | 0.0014                  | 110                    | 1.0       | 4.5  | 285                  | 0.7                                                                                                                                                                                                                                                                                                                                                                                                  | 1.69      | N/A                  | N/A                  | 2.8                  | 7.3                                               | 395               | 12.2                 | 7.3                | 0.073                  | **0.083                                                                                                                                        |  |                                            |  |                               |  |                               |  |         |  |
| OFF14                                                                                                                                                                                                                                                                                              | P                     | 95.0            | 0.864 | 0.8          | 0.0012                  | 115                    | 1.0       | 4.6  | 295                  | 0.5                                                                                                                                                                                                                                                                                                                                                                                                  | 1.43      | N/A                  | N/A                  | 3.4                  | 8.0                                               | 410               | 12.3                 | 8.0                | 0.080                  | **0.083                                                                                                                                        |  |                                            |  |                               |  |                               |  |         |  |
| OFF15                                                                                                                                                                                                                                                                                              | P                     | 95.0            | 0.864 | 0.4          | 0.0006                  | 50                     | 1.0       | 3.0  | 185                  | 0.5                                                                                                                                                                                                                                                                                                                                                                                                  | 1.43      | N/A                  | N/A                  | 2.2                  | 5.2                                               | 235               | 11.3                 | 5.2                | 0.052                  | **0.083                                                                                                                                        |  |                                            |  |                               |  |                               |  |         |  |
| RB1                                                                                                                                                                                                                                                                                                | P                     | 98.0            | 0.904 | 3.0          | 0.0047                  | 30                     | 2.0       | 1.5  | 1240                 | 0.4                                                                                                                                                                                                                                                                                                                                                                                                  | 1.28      | 1.94                 | 12.9                 | 14.4                 | 1270                                              | 17.1              | 14.4                 | 0.144              |                        |                                                                                                                                                |  |                                            |  |                               |  |                               |  |         |  |
| RB2                                                                                                                                                                                                                                                                                                | P                     | 98.0            | 0.904 | 1.2          | 0.0019                  | 30                     | 2.0       | 1.5  | 570                  | 0.4                                                                                                                                                                                                                                                                                                                                                                                                  | 1.28      | 1.94                 | 7.1                  | 8.7                  | 600                                               | 13.3              | 8.7                  | 0.087              |                        |                                                                                                                                                |  |                                            |  |                               |  |                               |  |         |  |
| RB3                                                                                                                                                                                                                                                                                                | P                     | 98.0            | 0.904 | 1.2          | 0.0018                  | 30                     | 2.0       | 1.5  | 540                  | 0.4                                                                                                                                                                                                                                                                                                                                                                                                  | 1.28      | 1.94                 | 6.9                  | 8.4                  | 570                                               | 13.2              | 8.4                  | 0.084              |                        |                                                                                                                                                |  |                                            |  |                               |  |                               |  |         |  |
| Notes:<br>1.) Curve Number Calculations based on future build out per zoning<br>2.) $T_i = (1.8(1.1 - R)(L^{0.12}) / (S^{0.13})$<br>$T_c = T_i + T_t$<br>$K = 0.0132(CN)^{-39}$<br>$T_{lag} = 0.6T_c$<br>**Minimum T <sub>c</sub> = 5 min. (paved)<br>Minimum T <sub>c</sub> = 10 min. (landscape) |                       |                 |       |              |                         |                        |           |      |                      | 3.) For the travel time (T <sub>t</sub> ) calculations,<br>V <sub>1</sub> applies to the first 500 feet of travel distance;<br>V <sub>2</sub> applies to the remaining travel distance.<br>4.) Travel Time Velocity Formulas<br>Unpaved<br>$V_1 = 14.8 \cdot (S/100)^{0.12}$<br>$V_2 = 29.4 \cdot (S/100)^{0.12}$<br>Paved<br>$V_1 = 20.2 \cdot (S/100)^{0.12}$<br>$V_2 = 30.6 \cdot (S/100)^{0.12}$ |           |                      |                      |                      |                                                   |                   |                      |                    |                        | 5.) All basins over one square mile are calculated by the equation:<br>$T_{lag} = 20Kn(L \cdot L_0 S^{0.5})^{0.33}$ and denoted by shaded gray |  |                                            |  |                               |  |                               |  |         |  |
| REFERENCE:                                                                                                                                                                                                                                                                                         |                       |                 |       |              |                         |                        |           |      |                      | STANDARD FORM 4                                                                                                                                                                                                                                                                                                                                                                                      |           |                      |                      |                      |                                                   |                   |                      |                    |                        | FIGURE C-7                                                                                                                                     |  |                                            |  |                               |  |                               |  |         |  |

FIGURE C-7



```

*****
FLOOD HYDROGRAPH PACKAGE (HEC-1)
JUN 1998
VERSION 4.1
RUN DATE 24JAN11 TIME 17:03:29
*****

```

```

* U.S. ARMY CORPS OF ENGINEERS
* HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET
* DAVIS, CALIFORNIA 95616
* (916) 756-1104

```

```

X X XXXXXXX XXXX X
X X X X X XX
X X X X X
XXXXXXX XXXX X XXXXX X
X X X X X
X X X X X
X X XXXXXXX XXXXX XXX

```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE, SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY, DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1

HEC-1 INPUT

PAGE 1

```

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
*DIAGRAM
1 ID *****
2 ID *
3 ID *
4 ID *
5 ID *
6 ID *
7 ID *
8 ID *
9 ID *
10 ID *
11 ID *
12 ID *
13 ID *
14 ID *
15 ID *
16 ID *
17 ID *
18 ID *
19 ID *
20 ID
21 ID
22 ID
23 ID
24 ID
25 ID
26 ID
27 ID
28 ID
29 IT 5 0 0 300
30 IO 5
31 IN 5 0 0
32 JR PREC 1.0
*****
DEPTH-AREA REDUCTION FACTORS (DARF)
ID AREA (MI) DARF
23 0.00-0.49 1.00
24 0.50-0.99 0.98
25 1.00-1.99 0.97
26
27
28
29
30
31
32
33 KK OFF5
34 BA .0205
35 PB 1.58
36 PC .000 .020 .057 .070 .087 .108 .124 .130 .130 .130
37 PC .130 .130 .130 .133 .140 .142 .148 .158 .172 .181
38 PC .190 .197 .199 .200 .201 .204 .214 .229 .241 .249
39 PC .251 .256 .270 .278 .281 .283 .295 .322 .352 .409
40 PC .499 .590 .710 .744 .781 .812 .819 .835 .851 .856
41 PC .860 .868 .876 .888 .910 .926 .937 .950 .970 .976
42 PC .982 .985 .987 .989 .990 .993 .993 .994 .995 .998
43 PC .998 .999 1.00
44 LS 0 91.5
45 UD .177

```

1

HEC-1 INPUT

PAGE 2

```

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
46 KK TEN1
47 KM RUNOFF FROM TENEYA STUDY AT TROPICAL
48 KM PARKWAY AND N. TENEYA WAY TO EAST
49 QI 0 0
50 BA .14

```

```

51      KK      RTEN1
52      KM      ROUTE TEN1 THROUGH OFF1 TO CP1
53      RD      1280 .0094 .016 0 TRAP 40 0
      *

54      KK      OFF1
55      BA      .0447
56      LS      0 77.5
57      UD      .236
      *

58      KK      CP1
59      KM      OFF1, TEN1 AND OFF5
60      HC      3
      *

61      KK      RCP1
62      KM      ROUTE CP1 THROUGH OFF2 TO CP2
63      RD      680 .0096 .016 0 TRAP 60 0
      *

64      KK      OFF2
65      BA      .0203
66      LS      0 86
67      UD      .189
      *

68      KK      CP2
69      KM      CP1 AND OFF2
70      HC      2
      *

71      KK      RCP2
72      KM      ROUTE CP2 THROUGH OFF3 TO CP3
73      RD      625 .0094 .016 0 TRAP 60 0
      *

74      KK      OFF3
75      BA      .0323
76      LS      0 84.6
77      UD      .203
      *

```

1

HEC-1 INPUT

PAGE 3

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

```

78      KK      CP3
79      KM      CP2 AND OFF3
80      HC      2
      *

81      KK      OFF4
82      BA      .0062
83      LS      0 76.2
84      UD      .138
      *

85      KK      CP4
86      KM      CP3 AND OFF4
87      HC      2
      *

88      KK      RCP4
89      KM      ROUTE CP4 THROUGH RB1 TO CP7
90      RD      1240 .0040 .016 0 TRAP 60 0
      *

91      KK      TEN2
92      KM      RUNOFF FROM TENEYA STUDY AT GRAND
93      KM      PALACE AND N. TENEYA WAY TO EAST
94      QI      0 0
95      BA      .02
      *

96      KK      RTEN2
97      KM      ROUTE TEN2 THROUGH OFF6 TO CP5
98      RD      1460 .0050 .016 0 TRAP 40 0
      *

99      KK      OFF6
100     BA      .0721
101     LS      0 92
102     UD      .236
      *

103     KK      OFF8
104     BA      .0050
105     LS      0 94
106     UD      .140
      *

107     KK      CP5
108     KM      TEN2, OFF6 AND OFF8
109     HC      3
      *

```

K

1

HEC-1 INPUT

PAGE 4

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

```

110     KK      RCP5
111     KM      ROUTE CP5 THROUGH OFF7 TO CP6
112     RD      1315 .004 .016 0 TRAP 40 0
      *

113     KK      OFF7
114     BA      .0508

```

```

115      LS      0      92
116      UD      .212
      *
117      KK      CP6
118      KM      CP5 AND OFF7
119      HC      2
      *
120      KK      RB1
121      BA      .0047
122      LS      0      98
123      UD      .144
      *
124      KK      CP7
125      KM      CP4, CP6 AND RB1
126      HC      3
      *
127      KK      OFF11
128      BA      .0032
129      LS      0      87
130      UD      .093
      *
131      KK      OFF12
132      BA      .0015
133      LS      0      87
134      UD      .092
      *
135      KK      OFF13
136      BA      .0014
137      LS      0      95
138      UD      .083
      *
139      KK      RB2
140      BA      .0019
141      LS      0      98
142      UD      .087
      *

```

1

HEC-1 INPUT

PAGE 5

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

```

143      KK      CP8
144      KM      OFF11, OFF12, OFF13 AND RB2
145      HC      4
      *
146      KK      CP9
147      KM      CP7 AND CP8
148      HC      2
      *
149      KK      OFF9
150      BA      .0182
151      LS      0      95
152      UD      .095
      *
153      KK      RCP9
154      KM      ROUTE OFF9 THROUGH OFF10 TO CP10
155      RD      225 .004 .016 0 TRAP 60 0
      *
156      KK      OFF10
157      BA      .0170
158      LS      0      95
159      UD      .186
      *
160      KK      CP10SD
161      KM      OFF9 AND OFF10 BEFORE 33 CFS BEGIN DIVERTED INTO SD
162      HC      2
      *
163      KK      CP10
164      KM      REMAINING FLOW AFTER Q100=33 CFS INTO STORM DRAIN IN BALSAM
165      DT      BALSSD
166      DI      0      33      60
167      DQ      0      33      33
      *
168      KK      RCP10
169      KM      ROUTE CP10 THROUGH RB3 TO CP11
170      RD      315 .004 .016 0 TRAP 60 0
      *
171      KK      RB3
172      BA      .0018
173      LS      0      98
174      UD      .084
      *

```

1

HEC-1 INPUT

PAGE 6

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

```

175      KK      OFF14
176      BA      .0012
177      LS      0      95
178      UD      .083
      *

```



```

179      KK  OFF15
180      BA  .0006
181      LS   0      95
182      UD  .083
      .

183      KK  CP11
184      KM  CP10, OFF14, OFF15 AND RB3
185      HC   4
      .

186      KK  CP12
187      KM  CP9  AND CP11
188      HC   2
      .

189      ZZ

```

1

## SCHEMATIC DIAGRAM OF STREAM NETWORK

```

INPUT LINE      (V) ROUTING      (--->) DIVERSION OR PUMP FLOW
NO.             (.) CONNECTOR    (<---) RETURN OF DIVERTED OR PUMPED FLOW

33      OFF5
      .
46      .      TEN1
      .      V
      .      V
51      .      RTEN1
      .
54      .      .      OFF1
      .      .
58      .      CP1-----
      .      V
61      .      RCP1
      .
64      .      OFF2
      .
68      .      CP2-----
      .      V
71      .      RCP2
      .
74      .      OFF3
      .
78      .      CP3-----
      .
81      .      OFF4
      .
85      .      CP4-----
      .      V
88      .      RCP4
      .
91      .      TEN2
      .      V
96      .      RTEN2
      .
99      .      .      OFF6
      .      .
103     .      .      OFF8
      .      .
107     .      CP5-----
      .      V
110     .      RCP5
      .
113     .      .      OFF7
      .      .
117     .      CP6-----
      .
120     .      .      RB1
      .
124     .      CP7-----
      .
127     .      OFF11
      .
131     .      .      OFF12
      .      .
135     .      .      OFF13
      .      .
139     .      .      .      RB2
      .      .
143     .      CP8-----

```

FIGURE C-8

```

146 CP9.....
149 . OFF9
153 . V
156 . RCP9
160 . OFF10
165 . CP10.....
163 . CP10-----> BALSSD
168 . V
171 . RCP10
175 . RB3
179 . OFF14
183 . OFF15
186 . CP11.....
186 CP12.....

```

(\*\*\*) RUNOFF ALSO COMPUTED AT THIS LOCATION

```

1*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* JUN 1998 *
* VERSION 4.1 *
* RUN DATE 24JAN11 TIME 17:03:29 *
*****

```

```

* U.S. ARMY CORPS OF ENGINEERS
* HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET
* DAVIS, CALIFORNIA 95616
* (916) 756-1104

```

```

*****
* TECHNICAL DRAINAGE STUDY
* FOR
* ANN ROAD CHANNEL WEST RAINBOW BLVD
* PROPOSED CONDITIONS
*
* RETURN PERIOD - 10-YEAR
* DISTRIBUTION - 6-HOUR SDN3
* PROJECT NO - W4X53700
* FILENAME - ANRB10.HC1
* DATE - 01/17/11
* MODELED BY - T.ALEXANDER P.E.
*****

```

1

```

*****
DEPTH-AREA REDUCTION FACTORES (DARF)
AREA (MI) DARF
0.00-0.49 1.00
0.50-0.99 0.98
1.00-1.99 0.97

```

```

30 IO OUTPUT CONTROL VARIABLES
      IPRNT 5 PRINT CONTROL
      IPLOT 0 PLOT CONTROL
      QSCAL 0. HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA
   NMIN 5 MINUTES IN COMPUTATION INTERVAL
   IDATE 1 0 STARTING DATE
   ITIME 0000 STARTING TIME
   NQ 300 NUMBER OF HYDROGRAPH ORDINATES
   NDDATE 2 0 ENDING DATE
   NDTIME 0055 ENDING TIME
   ICENT 19 CENTURY MARK

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 24.92 HOURS

```

ENGLISH UNITS  
 DRAINAGE AREA SQUARE MILES  
 PRECIPITATION DEPTH INCHES  
 LENGTH, ELEVATION FEET  
 FLOW CUBIC FEET PER SECOND  
 STORAGE VOLUME ACRE-Feet  
 SURFACE AREA ACRES  
 TEMPERATURE DEGREES FAHRENHEIT

JP MULTI-PLAN OPTION  
 NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION  
 RATIOS OF PRECIPITATION  
 1.00

1

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS  
 FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES  
 TIME TO PEAK IN HOURS

| OPERATION     | STATION | AREA | PLAN         | RATIOS APPLIED TO PRECIPITATION<br>RATIO 1<br>1.00 |
|---------------|---------|------|--------------|----------------------------------------------------|
| HYDROGRAPH AT |         |      |              |                                                    |
| + OFF5        | .02     | 1    | FLOW<br>TIME | 14.<br>3.58                                        |
| HYDROGRAPH AT |         |      |              |                                                    |
| + TEN1        | .14     | 1    | FLOW<br>TIME | 0.<br>.00                                          |
| ROUTED TO     |         |      |              |                                                    |
| + RTEN1       | .14     | 1    | FLOW<br>TIME | 0.<br>.00                                          |
| HYDROGRAPH AT |         |      |              |                                                    |
| + OFF1        | .04     | 1    | FLOW<br>TIME | 8.<br>3.75                                         |
| 3 COMBINED AT |         |      |              |                                                    |
| + CP1         | .21     | 1    | FLOW<br>TIME | 20.<br>3.67                                        |
| ROUTED TO     |         |      |              |                                                    |
| + RCP1        | .21     | 1    | FLOW<br>TIME | 26.<br>4.25                                        |
| HYDROGRAPH AT |         |      |              |                                                    |
| + OFF2        | .02     | 1    | FLOW<br>TIME | 9.<br>3.67                                         |
| 2 COMBINED AT |         |      |              |                                                    |
| + CP2         | .23     | 1    | FLOW<br>TIME | 27.<br>4.25                                        |
| ROUTED TO     |         |      |              |                                                    |
| + RCP2        | .23     | 1    | FLOW<br>TIME | 30.<br>4.75                                        |
| HYDROGRAPH AT |         |      |              |                                                    |
| + OFF3        | .03     | 1    | FLOW<br>TIME | 12.<br>3.67                                        |
| 2 COMBINED AT |         |      |              |                                                    |
| + CP3         | .26     | 1    | FLOW<br>TIME | 33.<br>4.75                                        |
| HYDROGRAPH AT |         |      |              |                                                    |
| + OFF4        | .01     | 1    | FLOW<br>TIME | 1.<br>3.58                                         |
| 2 COMBINED AT |         |      |              |                                                    |
| + CP4         | .26     | 1    | FLOW<br>TIME | 34.<br>4.75                                        |
| ROUTED TO     |         |      |              |                                                    |
| + RCP4        | .26     | 1    | FLOW<br>TIME | 27.<br>5.92                                        |
| HYDROGRAPH AT |         |      |              |                                                    |
| + TEN2        | .02     | 1    | FLOW<br>TIME | 0.<br>.00                                          |
| ROUTED TO     |         |      |              |                                                    |
| + RTEN2       | .02     | 1    | FLOW<br>TIME | 0.<br>.00                                          |
| HYDROGRAPH AT |         |      |              |                                                    |
| + OFF6        | .07     | 1    | FLOW<br>TIME | 45.<br>3.67                                        |
| HYDROGRAPH AT |         |      |              |                                                    |
| + OFF8        | .00     | 1    | FLOW<br>TIME | 4.<br>3.58                                         |
| 3 COMBINED AT |         |      |              |                                                    |
| + CP5         | .10     | 1    | FLOW<br>TIME | 48.<br>3.67                                        |
| ROUTED TO     |         |      |              |                                                    |
| + RCP5        | .10     | 1    | FLOW<br>TIME | 48.<br>3.75                                        |
| HYDROGRAPH AT |         |      |              |                                                    |
| + OFF7        | .05     | 1    | FLOW         | 32.                                                |



|               |        |     |   | TIME | 1.67 |
|---------------|--------|-----|---|------|------|
| 2 COMBINED AT | CP6    | .15 | 1 | FLOW | 79.  |
| +             |        |     |   | TIME | 3.67 |
| HYDROGRAPH AT | RB1    | .00 | 1 | FLOW | 5.   |
| +             |        |     |   | TIME | 3.58 |
| 3 COMBINED AT | CP7    | .42 | 1 | FLOW | 82.  |
| +             |        |     |   | TIME | 3.67 |
| HYDROGRAPH AT | OFF11  | .00 | 1 | FLOW | 2.   |
| +             |        |     |   | TIME | 3.50 |
| HYDROGRAPH AT | OFF12  | .30 | 1 | FLOW | 1.   |
| +             |        |     |   | TIME | 3.50 |
| HYDROGRAPH AT | OFF13  | .60 | 1 | FLOW | 1.   |
| +             |        |     |   | TIME | 3.50 |
| HYDROGRAPH AT | RB2    | .00 | 1 | FLOW | 2.   |
| +             |        |     |   | TIME | 3.50 |
| 4 COMBINED AT | CP8    | .01 | 1 | FLOW | 6.   |
| +             |        |     |   | TIME | 3.50 |
| 2 COMBINED AT | CP9    | .42 | 1 | FLOW | 86.  |
| +             |        |     |   | TIME | 3.67 |
| HYDROGRAPH AT | OFF9   | .02 | 1 | FLOW | 18.  |
| +             |        |     |   | TIME | 3.50 |
| ROUTED TO     | RCP9   | .02 | 1 | FLOW | 17.  |
| +             |        |     |   | TIME | 3.58 |
| HYDROGRAPH AT | OFF10  | .02 | 1 | FLOW | 14.  |
| +             |        |     |   | TIME | 3.58 |
| 2 COMBINED AT | CP10   | .04 | 1 | FLOW | 31.  |
| +             |        |     |   | TIME | 3.58 |
| DIVERSION TO  | BALSSD | .04 | 1 | FLOW | 31.  |
| +             |        |     |   | TIME | 3.58 |
| HYDROGRAPH AT | CP10   | .04 | 1 | FLOW | 0.   |
| +             |        |     |   | TIME | .00  |
| ROUTED TO     | RCP10  | .04 | 1 | FLOW | 0.   |
| +             |        |     |   | TIME | .00  |
| HYDROGRAPH AT | RB3    | .00 | 1 | FLOW | 2.   |
| +             |        |     |   | TIME | 3.50 |
| HYDROGRAPH AT | OFF14  | .00 | 1 | FLOW | 1.   |
| +             |        |     |   | TIME | 3.50 |
| HYDROGRAPH AT | OFF15  | .00 | 1 | FLOW | 1.   |
| +             |        |     |   | TIME | 3.50 |
| 4 COMBINED AT | CP11   | .04 | 1 | FLOW | 4.   |
| +             |        |     |   | TIME | 3.50 |
| 2 COMBINED AT | CP12   | .46 | 1 | FLOW | 88.  |
| +             |        |     |   | TIME | 3.67 |

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING  
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

| ISTAQ        | ELEMENT | DT    | PEAK  | TIME TO<br>PEAK | VOLUME | INTERPOLATED TO<br>COMPUTATION INTERVAL |                 | VOLUME |      |
|--------------|---------|-------|-------|-----------------|--------|-----------------------------------------|-----------------|--------|------|
|              |         |       |       |                 |        | PEAK                                    | TIME TO<br>PEAK |        |      |
|              |         | (MIN) | (CFS) | (MIN)           | (IN)   | (MIN)                                   | (CFS)           | (MIN)  | (IN) |
| FOR PLAN = 1 | RATIO=  | .00   |       |                 |        |                                         |                 |        |      |
| RTEN1        | MANE    | 5.00  | .00   | .00             | .00    | 5.00                                    | .00             | .00    | .00  |
| FOR PLAN = 1 | RATIO=  | .00   |       |                 |        |                                         |                 |        |      |
| RCP1         | MANE    | 5.00  | 25.64 | 255.00          | .14    | 5.00                                    | 25.64           | 255.00 | .14  |

CONTINUITY SUMMARY (AC-FT) -- INFLOW= .1525E+01 EXCESS= .0000E+00 OUTFLOW= .1567E+01 BASIN STORAGE= .1457E-01 PERCENT ERROR= -3.7

FOR PLAN = 1 RATIO= .00  
RCP2 MANE 5.00 29.87 285.00 .18 5.00 29.87 285.00 .18

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2158E+01 EXCESS= .0000E+00 OUTFLOW= .2177E+01 BASIN STORAGE= .1399E-01 PERCENT ERROR= -1.5

FOR PLAN = 1 RATIO= .00  
RCP4 MANE 5.00 26.86 355.00 .22 5.00 26.86 355.00 .22

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3089E+01 EXCESS= .0000E+00 OUTFLOW= .3145E+01 BASIN STORAGE= .4053E-01 PERCENT ERROR= -3.1

FOR PLAN = 1 RATIO= .00  
RTEN2 MANE 5.00 .00 .00 .00 5.00 .00 355.00 .00

FOR PLAN = 1 RATIO= .00  
RCP5 MANE 5.00 48.15 225.00 .70 5.00 48.15 225.00 .70

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3610E+01 EXCESS= .0000E+00 OUTFLOW= .3613E+01 BASIN STORAGE= .3137E-02 PERCENT ERROR= -.2

FOR PLAN = 1 RATIO= .00  
RCP9 MANE 3.50 17.36 213.50 1.09 5.00 17.12 215.00 1.09

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1056E+01 EXCESS= .0000E+00 OUTFLOW= .1059E+01 BASIN STORAGE= .2025E-02 PERCENT ERROR= -.4

FOR PLAN = 1 RATIO= .00  
RCP10 MANE .25 .00 505.25 .00 5.00 .00 505.00 .00

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4557E-25 EXCESS= .0000E+00 OUTFLOW= .4557E-25 BASIN STORAGE= .2632E-15 PERCENT ERROR=\*\*\*\*\*

\*\*\* NORMAL END OF HEC-1 \*\*\*

```

1*****
*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
*
* JUN 1998 *
*
* VERSION 4.1 *
*
* RUN DATE 20JAN11 TIME 13:22:12 *
*
*****
*****

```

```

*
* U.S. ARMY CORPS OF ENGINEERS
*
* HYDROLOGIC ENGINEERING CENTER
*
* 609 SECOND STREET
*
* DAVIS, CALIFORNIA 95616
*
* (916) 756-1104
*

```

```

X X XXXXXXX XXXXX X
X X X X X XX
X X X X X X
XXXXXXX XXXX X XXXXX X
X X X X X X
X X X X X X
X X XXXXXXX XXXXX XXX

```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE, SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY, DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1

HEC-1 INPUT

PAGE 1

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

```

*DIAGRAM
1 ID *****
2 ID *
3 ID * :
4 ID * :
5 ID * :
6 ID * :
7 ID * :
8 ID * :
9 ID * :
10 ID * :
11 ID * :
12 ID * :
13 ID * :
14 ID * :
15 ID * :
16 ID * :
17 ID * :
18 ID * :
19 ID * :
20 ID *****
21 ID
22 ID
23 ID
24 IT 5 0 0 300
25 IO 5
26 IN 5 0 0
27 JR PREC 1.0
*
28 KK OFF5
29 BA .0205
30 PB 2.77
31 PC .000 .020 .057 .070 .087 .108 .124 .130 .130 .130
32 PC .130 .130 .130 .133 .140 .142 .148 .158 .172 .181
33 PC .190 .197 .199 .200 .201 .204 .214 .229 .241 .249
34 PC .251 .256 .270 .278 .281 .283 .295 .322 .352 .409
35 PC .499 .590 .710 .744 .781 .812 .819 .835 .851 .856
36 PC .860 .868 .876 .888 .910 .926 .937 .950 .970 .976
37 PC .982 .985 .987 .989 .990 .993 .993 .994 .995 .998
38 PC .998 .999 1.00
39 LS 0 91.5
40 UD .177
*
41 KK TEN1
42 KM RUNOFF FROM TENEYA STUDY AT TROPICAL
43 KM PARKWAY AND N. TENEYA WAY TO EAST
44 Q1 0 10 20 30 40 50 60 70 80 96
45 BA .14

```

1

HEC-1 INPUT

PAGE 2

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

```

46 KK RTEN1
47 KM ROUTE TEN1 THROUGH OFF1 TO CP1
48 RD 1280 .0094 .016 0 TRAP 40 0
*

```



```

49      KK      OFF1
50      BA      .0447
51      LS      0      77.5
52      UD      .236
      *

53      KK      CP1
54      KM      OFF1, TEN1 AND OFF5
55      HC      3
      *

56      KK      RCP1
57      KM      ROUTE CP1 THROUGH OFF2 TO CP2
58      RD      680      .0096      .016      0      TRAP      60      0
      *

59      KK      OFF2
60      BA      .0203
61      LS      0      86
62      UD      .189
      *

63      KK      CP2
64      KM      CP1 AND OFF2
65      HC      2
      *

66      KK      RCP2
67      KM      ROUTE CP2 THROUGH OFF3 TO CP3
68      RD      625      .0094      .016      0      TRAP      60      0
      *

69      KK      OFF3
70      BA      .0323
71      LS      0      84.6
72      UD      .203
      *

73      KK      CP3
74      KM      CP2 AND OFF3
75      HC      2
      *

76      KK      OFF4
77      BA      .0062
78      LS      0      76.2
79      UD      .138
      *

```

1

HEC-1 INPUT

PAGE 3

```

LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

80      KK      CP4
81      KM      CP3 AND OFF4
82      HC      2
      *

83      KK      RCP4
84      KM      ROUTE CP4 THROUGH RB1 TO CP7
85      RD      1240      .0040      .016      0      TRAP      60      0
      *

86      KK      TEN2
87      KM      RUNOFF FROM TENEYA STUDY AT GRAND
88      KM      PALACE AND N. TENEYA WAY TO EAST
89      QI      0      10      20      30      40      50      60      69      69      69
90      BA      .02
      *

91      KK      RTEN2
92      KM      ROUTE TEN2 THROUGH OFF6 TO CP5
93      RD      1460      .0050      .016      0      TRAP      40      0
      *

94      KK      OFF6
95      BA      .0721
96      LS      0      92
97      UD      .236
      *

98      KK      OFF8
99      BA      .0050
100     LS      0      94
101     UD      .140
      *

102     KK      CP5
103     KM      TEN2, OFF6 AND OFF8
104     HC      3
      *

105     KK      RCP5
106     KM      ROUTE CP5 THROUGH OFF7 TO CP6
107     RD      1315      .004      .016      0      TRAP      40      0
      *

108     KK      OFF7
109     BA      .0508
110     LS      0      92
111     UD      .212
      *

```

1

HEC-1 INPUT

PAGE 4

```

LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

112     KK      CP6

```

```

178      KK      CP11
179      KM      CP10, OFF14, OFF15 AND RB3
180      HC      4
      *
181      KK      CP12
182      KM      CP9 AND CP11
183      HC      2
      *
184      ZZ

```

1

## SCHEMATIC DIAGRAM OF STREAM NETWORK

```

INPUT LINE      (V) ROUTING      {--->} DIVERSION OR PUMP FLOW
NO.             (.) CONNECTOR    (<---) RETURN OF DIVERTED OR PUMPED FLOW
28      OFF5
      .
41      .      TEN1
      .      V
      .      V
46      .      RTEN1
      .
49      .      .      OFF1
      .      .
53      CP1.....
      V
      V
56      RCP1
      .
59      .      OFF2
      .
63      CP2.....
      V
      V
66      RCP2
      .
69      .      OFF3
      .
73      CP3.....
      .
76      .      OFF4
      .
80      CP4.....
      V
      V
83      RCP4
      .
86      .      TEN2
      .      V
      .      V
91      .      RTEN2
      .
94      .      .      OFF6
      .      .
98      .      .      OFF8
      .      .
102     .      CP5.....
      .      V
      .      V
105     .      RCP5
      .
108     .      .      OFF7
      .      .
112     .      CP6.....
      .
115     .      .      RB1
      .      .
119     CP7.....
      .
122     .      OFF11
      .
126     .      .      OFF12
      .      .
130     .      .      OFF13
      .      .
134     .      .      .      RB2
      .      .
138     .      CP8.....
      .
141     CP9.....
      .

```

```

144      .      OFF9
      .      V
      .      V
148      .      RCP9
      .      .
151      .      .      OFF10
      .      .
155      .      CP10SD.....
      .      .
160      .      .-----> BALSSD
158      .      CP10
      .      V
      .      V
163      .      RCP10
      .      .
166      .      .      RB3
      .      .
170      .      .      .      OFF14
      .      .      .
174      .      .      .      OFF15
      .      .      .
178      .      CP11.....
      .      .
181      .      CP12.....

```

(\*\*\*) RUNOFF ALSO COMPUTED AT THIS LOCATION

```

*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
*
* JUN 1998 *
*
* VERSION 4.1 *
*
* RUN DATE 20JAN11 TIME 13:22:12 *
*
*****

```

```

*
* U.S. ARMY CORPS OF ENGINEERS
*
* HYDROLOGIC ENGINEERING CENTER
*
* 609 SECOND STREET
*
* DAVIS, CALIFORNIA 95616
*
* (916) 756-1104
*

```

```

*****
*
* TECHNICAL DRAINAGE STUDY
* FOR
* ANN ROAD CHANNEL WEST RAINBOW BLVD
* PROPOSED CONDITIONS
*
*
* RETURN PERIOD _ _ _ _ 100-YEAR
* DISTRIBUTUION _ _ _ _ 6-HOUR SDN3
* PROJECT NO _ _ _ _ W4X53700
* FILENAME _ _ _ _ ANRB100.HC1
* DATE _ _ _ _ 01/17/11
* MODELED BY _ _ _ _ T.ALEXANDER P.E.
*
*****

```

I

```

25 IO      OUTPUT CONTROL VARIABLES
          IPRNT      5 PRINT CONTROL
          IPLOT      0 PLOT CONTROL
          QSCAL      0. HYDROGRAPH PLOT SCALE

17          HYDROGRAPH TIME DATA
          NMIN      5 MINUTES IN COMPUTATION INTERVAL
          IDATE      1 0 STARTING DATE
          ITIME      0000 STARTING TIME
          NQ      300 NUMBER OF HYDROGRAPH ORDINATES
          NDDATE      2 0 ENDING DATE
          NDTIME      0055 ENDING TIME
          ICENT      19 CENTURY MARK

          COMPUTATION INTERVAL .08 HOURS
          TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS
DRAINAGE AREA SQUARE MILES
PRECIPITATION DEPTH INCHES
LENGTH, ELEVATION FEET
FLOW CUBIC FEET PER SECOND
STORAGE VOLUME ACRE-Feet
SURFACE AREA ACRES
TEMPERATURE DEGREES FAHRENHEIT

JP          MULTI-PLAN OPTION

```



```

113      KM    CP5 AND OFF7
114      HC      2
      *

115      KK    RB1
116      BA    .0047
117      LS      0      98
118      UD    .144
      *

119      KK    CP7
120      KM    CP4, CP6 AND RB1
121      HC      3
      *

122      KK    OFF11
123      BA    .0032
124      LS      0      87
125      UD    .093
      *

126      KK    OFF12
127      BA    .0015
128      LS      0      87
129      UD    .092
      *

130      KK    OFF13
131      BA    .0014
132      LS      0      95
133      UD    .083
      *

134      KK    RB2
135      BA    .0019
136      LS      0      98
137      UD    .087
      *

138      KK    CP8
139      KM    OFF11, OFF12, OFF13 AND RB2
140      HC      4
      *

141      KK    CP9
142      KM    CP7 AND CP8
143      HC      2
      *

```

1

HEC-1 INPUT

PAGE 5

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

```

144      KK    OFF9
145      BA    .0182
146      LS      0      95
147      UD    .095
      *

148      KK    RCP9
149      KM    ROUTE OFF9 THROUGH OFF10 TO CP10
150      RD    225 .004 .016 0 TRAP 60 0
      *

151      KK    OFF10
152      BA    .0170
153      LS      0      95
154      UD    .186
      *

155      KK    CP10SD
156      KM    OFF9 AND OFF10 BEFORE 35 CFS BEGIN DIVERTED INTO SD
157      HC      2
      *

158      KK    CP10
159      KM    REMAINING FLOW AFTER Q100=35 CFS INTO STORM DRAIN IN BALSAM
160      DT    BALSSD
161      DI      0      33      60
162      DQ      0      33      33
      *

163      KK    RCP10
164      KM    ROUTE CP10 THROUGH RB3 TO CP11
165      RD    315 .004 .016 0 TRAP 60 0
      *

166      KK    RB3
167      BA    .0018
168      LS      0      98
169      UD    .084
      *

170      KK    OFF14
171      BA    .0012
172      LS      0      95
173      UD    .083
      *

174      KK    OFF15
175      BA    .0006
176      LS      0      95
177      UD    .083
      *

```

1

HEC-1 INPUT

PAGE 6

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

```

3 COMBINED AT
+          CP7      .42      1  FLOW      348.
                                TIME      3.67

HYDROGRAPH AT
+          OFF11     .00      1  FLOW      5.
                                TIME      3.50

HYDROGRAPH AT
+          OFF12     .00      1  FLOW      2.
                                TIME      3.50

HYDROGRAPH AT
+          OFF13     .00      1  FLOW      3.
                                TIME      3.50

HYDROGRAPH AT
+          RB2       .00      1  FLOW      4.
                                TIME      3.50

4 COMBINED AT
+          CP8       .01      1  FLOW      13.
                                TIME      3.50

2 COMBINED AT
+          CP9       .42      1  FLOW      355.
                                TIME      3.67

HYDROGRAPH AT
+          OFF9      .02      1  FLOW      34.
                                TIME      3.50

ROUTED TO
+          RCP9      .02      1  FLOW      33.
                                TIME      3.50

HYDROGRAPH AT
+          OFF10     .02      1  FLOW      27.
                                TIME      3.58

2 COMBINED AT
+          CP10SD    .04      1  FLOW      59.
                                TIME      3.58

DIVERSION TO
+          BALSSD    .04      1  FLOW      33.
                                TIME      3.42

HYDROGRAPH AT
+          CP10      .04      1  FLOW      26.
                                TIME      3.58

ROUTED TO
+          RCP10     .04      1  FLOW      24.
                                TIME      3.58

HYDROGRAPH AT
+          RB3       .00      1  FLOW      4.
                                TIME      3.50

HYDROGRAPH AT
+          OFF14     .00      1  FLOW      2.
                                TIME      3.50

HYDROGRAPH AT
+          OFF15     .00      1  FLOW      1.
                                TIME      3.50

4 COMBINED AT
+          CP11      .04      1  FLOW      30.
                                TIME      3.58

2 COMBINED AT
+          CP12      .46      1  FLOW      383.
                                TIME      3.67

1

```

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING  
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

| ISTAQ                   | ELEMENT | DT    | PEAK  | TIME TO<br>PEAK | VOLUME | INTERPOLATED TO<br>COMPUTATION INTERVAL |       |                 |        |
|-------------------------|---------|-------|-------|-----------------|--------|-----------------------------------------|-------|-----------------|--------|
|                         |         |       |       |                 |        | DT                                      | PEAK  | TIME TO<br>PEAK | VOLUME |
|                         |         | (MIN) | (CFS) | (MIN)           | (IN)   | (MIN)                                   | (CFS) | (MIN)           | (IN)   |
| FOR PLAN = 1 RATIO= .00 |         |       |       |                 |        |                                         |       |                 |        |
| RTEN1                   | MANE    | 2.25  | 97.39 | 49.50           | 25.97  | 5.00                                    | 97.00 | 50.00           | 25.99  |

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1946E+03 EXCESS= .0000E+00 OUTFLOW= .1941E+03 BASIN STORAGE= .5308E+00 PERCENT ERROR= .0

|                                                             |
|-------------------------------------------------------------|
| FOR PLAN = 1 RATIO= .00                                     |
| RCP1 MANE 5.00 154.79 230.00 17.87 5.00 154.79 230.00 17.87 |

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1987E+03 EXCESS= .0000E+00 OUTFLOW= .1959E+03 BASIN STORAGE= .3296E+01 PERCENT ERROR= -.2

|                                                             |
|-------------------------------------------------------------|
| FOR PLAN = 1 RATIO= .00                                     |
| RCP2 MANE 5.00 168.28 240.00 16.17 5.00 168.28 240.00 16.17 |

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1975E+03 EXCESS= .0000E+00 OUTFLOW= .1948E+03 BASIN STORAGE= .3048E+01 PERCENT ERROR= -.2

FOR PLAN = 1 RATIO= .00  
RCP4 MANE 4.75 180.37 266.00 13.50 5.00 179.92 270.00 13.53

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1970E+03 EXCESS= .0000E+00 OUTFLOW= .1904E+03 BASIN STORAGE= .7814E+01 PERCENT ERROR= -.6

FOR PLAN = 1 RATIO= .00  
RTEN2 MANE 1.75 69.43 40.25 131.12 5.00 69.22 40.00 131.16

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1405E+03 EXCESS= .0000E+00 OUTFLOW= .1399E+03 BASIN STORAGE= .6002E+00 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00  
RCP5 MANE 3.34 170.73 220.59 28.46 5.00 169.85 220.00 28.47

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1480E+03 EXCESS= .0000E+00 OUTFLOW= .1475E+03 BASIN STORAGE= .5780E+00 PERCENT ERROR= -.1

FOR PLAN = 1 RATIO= .00  
RCP9 MANE 1.28 34.03 211.08 2.23 5.00 33.02 210.00 2.23

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2160E+01 EXCESS= .0000E+00 OUTFLOW= .2161E+01 BASIN STORAGE= .6157E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00  
RCP10 MANE .75 25.19 218.25 .29 5.00 23.98 215.00 .27

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5410E+00 EXCESS= .0000E+00 OUTFLOW= .5434E+00 BASIN STORAGE= .2516E-02 PERCENT ERROR= -.9

\*\*\* NORMAL END OF HEC-1 \*\*\*



| Basin Summary |              |           |            |
|---------------|--------------|-----------|------------|
| Basin         | Area (acres) | Q10 (cfs) | Q100 (cfs) |
| OFF1          | 28.6         | 8         | 30         |
| OFF2          | 13.0         | 9         | 23         |
| OFF3          | 20.7         | 12        | 33         |
| OFF4          | 4.0          | 1         | 5          |
| OFF5          | 13.2         | 14        | 30         |
| OFF6          | 46.1         | 45        | 96         |
| OFF7          | 32.5         | 32        | 69         |
| OFF8          | 3.2          | 4         | 8          |
| OFF9          | 11.7         | 18        | 34         |
| OFF10         | 10.9         | 14        | 27         |
| OFF11         | 2.0          | 2         | 5          |
| OFF12         | 1.0          | 1         | 2          |
| OFF13         | 0.9          | 1         | 3          |
| OFF14         | 0.8          | 1         | 2          |
| OFF15         | 0.4          | 1         | 1          |
| RB1           | 3.0          | 5         | 9          |
| RB2           | 1.2          | 2         | 4          |
| RB3           | 1.2          | 2         | 4          |

| Concentration/Reference Point Summary |           |            |
|---------------------------------------|-----------|------------|
| Point                                 | Q10 (cfs) | Q100 (cfs) |
| CP1                                   | 20        | 154        |
| CP2                                   | 27        | 170        |
| CP3                                   | 33        | 182        |
| CP4                                   | 34        | 183        |
| CP5                                   | 48        | 172        |
| CP6                                   | 79        | 239        |
| CP7                                   | 82        | 348        |
| CP8                                   | 6         | 13         |
| CP9                                   | 86        | 355        |
| CP10                                  | 0         | 26         |
| CP11                                  | 4         | 30         |
| CP12                                  | 88        | 383        |
| TEN1                                  | 0         | 96         |
| TEN2                                  | 0         | 69         |

ANN BALSAM STUDY (2005)

OFF1

CP1

OFF2

(Q10/100P=378 CFS) US95 TO FERRELL

REFERENCE DRAINAGE STUDY WITH YEAR STUDIED

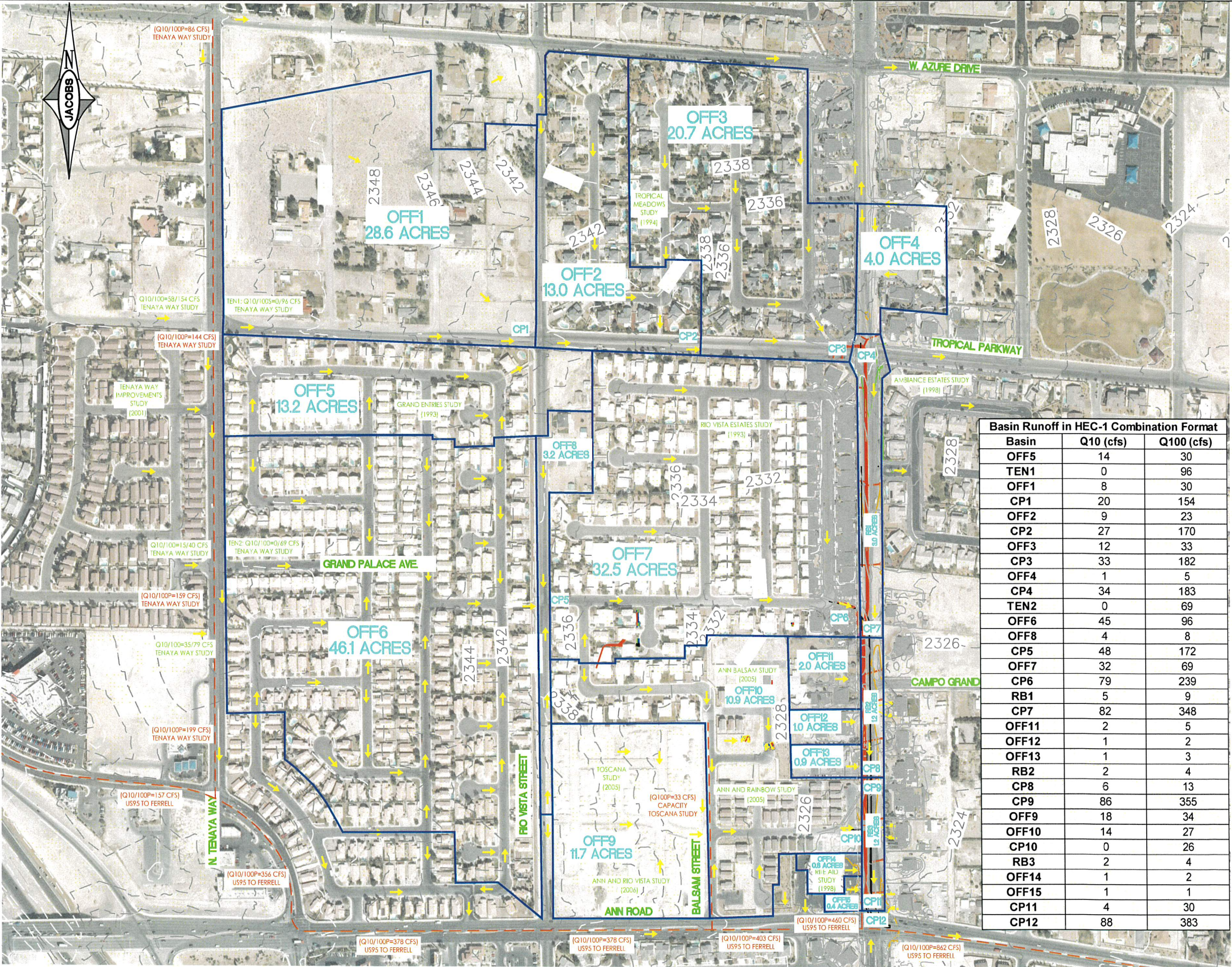
BASIN NAME

CONCENTRATION POINT

BASIN DELINEATION

FLOW DIRECTION

EXISTING STORMDRAIN WITH FLOW DATA



| Basin Runoff in HEC-1 Combination Format |           |            |
|------------------------------------------|-----------|------------|
| Basin                                    | Q10 (cfs) | Q100 (cfs) |
| OFF5                                     | 14        | 30         |
| TEN1                                     | 0         | 96         |
| OFF1                                     | 8         | 30         |
| CP1                                      | 20        | 154        |
| OFF2                                     | 9         | 23         |
| CP2                                      | 27        | 170        |
| OFF3                                     | 12        | 33         |
| CP3                                      | 33        | 182        |
| OFF4                                     | 1         | 5          |
| CP4                                      | 34        | 183        |
| TEN2                                     | 0         | 69         |
| OFF6                                     | 45        | 96         |
| OFF8                                     | 4         | 8          |
| CP5                                      | 48        | 172        |
| OFF7                                     | 32        | 69         |
| CP6                                      | 79        | 239        |
| RB1                                      | 5         | 9          |
| CP7                                      | 82        | 348        |
| OFF11                                    | 2         | 5          |
| OFF12                                    | 1         | 2          |
| OFF13                                    | 1         | 3          |
| RB2                                      | 2         | 4          |
| CP8                                      | 6         | 13         |
| CP9                                      | 86        | 355        |
| OFF9                                     | 18        | 34         |
| OFF10                                    | 14        | 27         |
| CP10                                     | 0         | 26         |
| RB3                                      | 2         | 4          |
| OFF14                                    | 1         | 2          |
| OFF15                                    | 1         | 1          |
| CP11                                     | 4         | 30         |
| CP12                                     | 88        | 383        |

ANN ROAD AND RAINBOW BOULEVARD OFF-SITE DRAINAGE EXHIBIT

SCALE 1:400

FIGURE C-10



**4. APPENDIX D -- HYDRAULICS**

1. FIGURE D-1 TYPE C-D MODIFIED INLET
2. FIGURE D-2 STORM SEWER MAINS (4 TOTAL)
3. FIGURE D-3 INLET OPTIONS
4. FIGURE D-4 STORM DRAIN EXHIBIT
5. FIGURE D-5 HYDRAULIC SECTION SUMMARY (2 TOTAL)
6. FIGURE D-6a ANN ROAD TO EXISTING SD STATION COORDINATION
7. FIGURE D-6 WSPGW ANN ROAD TO EASEMENT (ANRCH1)
8. FIGURE D-7 WSPGW ANN ROAD TO TROPICAL PKWY (ANR115)
9. FIGURE D-8 RIO VISTA NOMOGRAPH
10. FIGURE D-9 STANDARD FORM 6
11. FIGURE D-10 DROP INLET CALCULATIONS
12. FIGURE D-11 HYDRAULIC SECTIONS
13. FIGURE D-12 DRY LANE SUMMARY
14. FIGURE D-13 WEIR AT RIO VISTA ESTATES EASEMENT





## Type C-D Modified Inlet

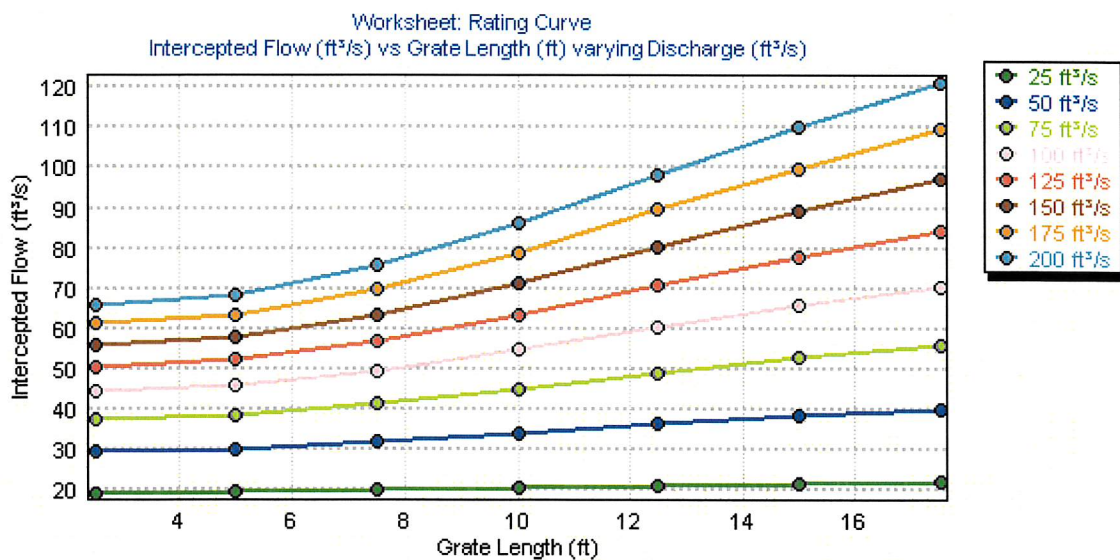
### Project Description

Solve For Efficiency

### Input Data

|                        |                    |                    |
|------------------------|--------------------|--------------------|
| Discharge              | 91.00              | ft <sup>3</sup> /s |
| Slope                  | 0.40               | %                  |
| Gutter Width           | 1.50               | ft                 |
| Gutter Cross Slope     | 8.67               | %                  |
| Road Cross Slope       | 2.00               | %                  |
| Roughness Coefficient  | 0.015              |                    |
| Local Depression       | 2.00               | in                 |
| Local Depression Width | 1.50               | ft                 |
| Grate Width            | 1.50               | ft                 |
| Grate Length           | 17.50              | ft                 |
| Grate Type             | P-50 mm (P-1-7/8") |                    |
| Clogging               | 50.00              | %                  |
| Curb Opening Length    | 17.50              | ft                 |

### Rating Curve Plot





---

## SEWER MAINS - 5' X 3'

---

### Project Description

Friction Method                      Manning Formula  
Solve For                              Full Flow Capacity

### Input Data

|                       |        |                    |
|-----------------------|--------|--------------------|
| Roughness Coefficient | 0.013  |                    |
| Channel Slope         | 0.40   | %                  |
| Normal Depth          | 3.00   | ft                 |
| Height                | 3.00   | ft                 |
| Bottom Width          | 5.00   | ft                 |
| Discharge             | 103.87 | ft <sup>3</sup> /s |

### Results

|                  |             |                    |
|------------------|-------------|--------------------|
| Flow Area        | 15.00       | ft <sup>2</sup>    |
| Wetted Perimeter | 16.00       | ft                 |
| Hydraulic Radius | 0.94        | ft                 |
| Top Width        | 5.00        | ft                 |
| Critical Depth   | 2.38        | ft                 |
| Percent Full     | 100.0       | %                  |
| Critical Slope   | 0.00450     | ft/ft              |
| Velocity         | 6.92        | ft/s               |
| Velocity Head    | 0.75        | ft                 |
| Specific Energy  | 3.75        | ft                 |
| Froude Number    | 0.70        |                    |
| Discharge Full   | 103.87      | ft <sup>3</sup> /s |
| Slope Full       | 0.00400     | ft/ft              |
| Flow Type        | Subcritical |                    |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                             |          |      |
|-----------------------------|----------|------|
| Upstream Depth              | 0.00     | ft   |
| Profile Description         |          |      |
| Profile Headloss            | 0.00     | ft   |
| Average End Depth Over Rise | 0.00     | %    |
| Normal Depth Over Rise      | 100.00   | %    |
| Downstream Velocity         | Infinity | ft/s |

---





---

## SEWER MAINS - 5' X 3'

---

### GVF Output Data

|                   |          |       |
|-------------------|----------|-------|
| Upstream Velocity | Infinity | ft/s  |
| Normal Depth      | 3.00     | ft    |
| Critical Depth    | 2.38     | ft    |
| Channel Slope     | 0.40     | %     |
| Critical Slope    | 0.00450  | ft/ft |





## Worksheet for SEWER MAINS - 5' X 4'

### Project Description

Friction Method                      Manning Formula  
Solve For                              Full Flow Capacity

### Input Data

|                       |        |                    |
|-----------------------|--------|--------------------|
| Roughness Coefficient | 0.013  |                    |
| Channel Slope         | 0.40   | %                  |
| Normal Depth          | 4.00   | ft                 |
| Height                | 4.00   | ft                 |
| Bottom Width          | 5.00   | ft                 |
| Discharge             | 155.10 | ft <sup>3</sup> /s |

### Results

|                  |             |                    |
|------------------|-------------|--------------------|
| Flow Area        | 20.00       | ft <sup>2</sup>    |
| Wetted Perimeter | 18.00       | ft                 |
| Hydraulic Radius | 1.11        | ft                 |
| Top Width        | 5.00        | ft                 |
| Critical Depth   | 3.10        | ft                 |
| Percent Full     | 100.0       | %                  |
| Critical Slope   | 0.00495     | ft/ft              |
| Velocity         | 7.76        | ft/s               |
| Velocity Head    | 0.93        | ft                 |
| Specific Energy  | 4.93        | ft                 |
| Froude Number    | 0.68        |                    |
| Discharge Full   | 155.10      | ft <sup>3</sup> /s |
| Slope Full       | 0.00400     | ft/ft              |
| Flow Type        | Subcritical |                    |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                             |          |      |
|-----------------------------|----------|------|
| Upstream Depth              | 0.00     | ft   |
| Profile Description         |          |      |
| Profile Headloss            | 0.00     | ft   |
| Average End Depth Over Rise | 0.00     | %    |
| Normal Depth Over Rise      | 100.00   | %    |
| Downstream Velocity         | Infinity | ft/s |



---

## Worksheet for SEWER MAINS - 5' X 4'

---

### GVF Output Data

|                   |          |       |
|-------------------|----------|-------|
| Upstream Velocity | Infinity | ft/s  |
| Normal Depth      | 4.00     | ft    |
| Critical Depth    | 3.10     | ft    |
| Channel Slope     | 0.40     | %     |
| Critical Slope    | 0.00495  | ft/ft |





---

## SEWER MAINS 6' X 4'

---

### Project Description

Friction Method                      Manning Formula  
Solve For                              Full Flow Capacity

### Input Data

|                       |        |                    |
|-----------------------|--------|--------------------|
| Roughness Coefficient | 0.013  |                    |
| Channel Slope         | 0.40   | %                  |
| Normal Depth          | 4.00   | ft                 |
| Height                | 4.00   | ft                 |
| Bottom Width          | 6.00   | ft                 |
| Discharge             | 195.92 | ft <sup>3</sup> /s |

### Results

|                  |             |                    |
|------------------|-------------|--------------------|
| Flow Area        | 24.00       | ft <sup>2</sup>    |
| Wetted Perimeter | 20.00       | ft                 |
| Hydraulic Radius | 1.20        | ft                 |
| Top Width        | 6.00        | ft                 |
| Critical Depth   | 3.21        | ft                 |
| Percent Full     | 100.0       | %                  |
| Critical Slope   | 0.00441     | ft/ft              |
| Velocity         | 8.16        | ft/s               |
| Velocity Head    | 1.04        | ft                 |
| Specific Energy  | 5.04        | ft                 |
| Froude Number    | 0.72        |                    |
| Discharge Full   | 195.92      | ft <sup>3</sup> /s |
| Slope Full       | 0.00400     | ft/ft              |
| Flow Type        | Subcritical |                    |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                             |          |      |
|-----------------------------|----------|------|
| Upstream Depth              | 0.00     | ft   |
| Profile Description         |          |      |
| Profile Headloss            | 0.00     | ft   |
| Average End Depth Over Rise | 0.00     | %    |
| Normal Depth Over Rise      | 100.00   | %    |
| Downstream Velocity         | Infinity | ft/s |

---





---

## SEWER MAINS 6' X 4'

---

### GVF Output Data

|                   |          |       |
|-------------------|----------|-------|
| Upstream Velocity | Infinity | ft/s  |
| Normal Depth      | 4.00     | ft    |
| Critical Depth    | 3.21     | ft    |
| Channel Slope     | 0.40     | %     |
| Critical Slope    | 0.00441  | ft/ft |



---

## SEWER MAINS 9' X 5'

---

### Project Description

Friction Method                      Manning Formula  
Solve For                              Full Flow Capacity

### Input Data

|                       |        |                    |
|-----------------------|--------|--------------------|
| Roughness Coefficient | 0.013  |                    |
| Channel Slope         | 0.40   | %                  |
| Normal Depth          | 5.00   | ft                 |
| Height                | 5.00   | ft                 |
| Bottom Width          | 9.00   | ft                 |
| Discharge             | 446.34 | ft <sup>3</sup> /s |

### Results

|                  |             |                    |
|------------------|-------------|--------------------|
| Flow Area        | 45.00       | ft <sup>2</sup>    |
| Wetted Perimeter | 28.00       | ft                 |
| Hydraulic Radius | 1.61        | ft                 |
| Top Width        | 9.00        | ft                 |
| Critical Depth   | 4.24        | ft                 |
| Percent Full     | 100.0       | %                  |
| Critical Slope   | 0.00369     | ft/ft              |
| Velocity         | 9.92        | ft/s               |
| Velocity Head    | 1.53        | ft                 |
| Specific Energy  | 6.53        | ft                 |
| Froude Number    | 0.78        |                    |
| Discharge Full   | 446.34      | ft <sup>3</sup> /s |
| Slope Full       | 0.00400     | ft/ft              |
| Flow Type        | Subcritical |                    |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                             |          |      |
|-----------------------------|----------|------|
| Upstream Depth              | 0.00     | ft   |
| Profile Description         |          |      |
| Profile Headloss            | 0.00     | ft   |
| Average End Depth Over Rise | 0.00     | %    |
| Normal Depth Over Rise      | 100.00   | %    |
| Downstream Velocity         | Infinity | ft/s |

---





---

## SEWER MAINS 9' X 5'

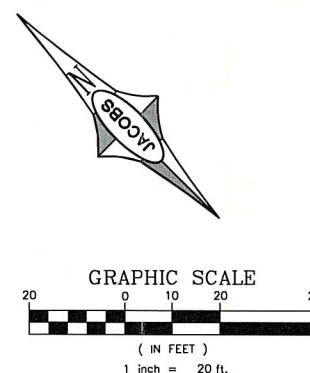
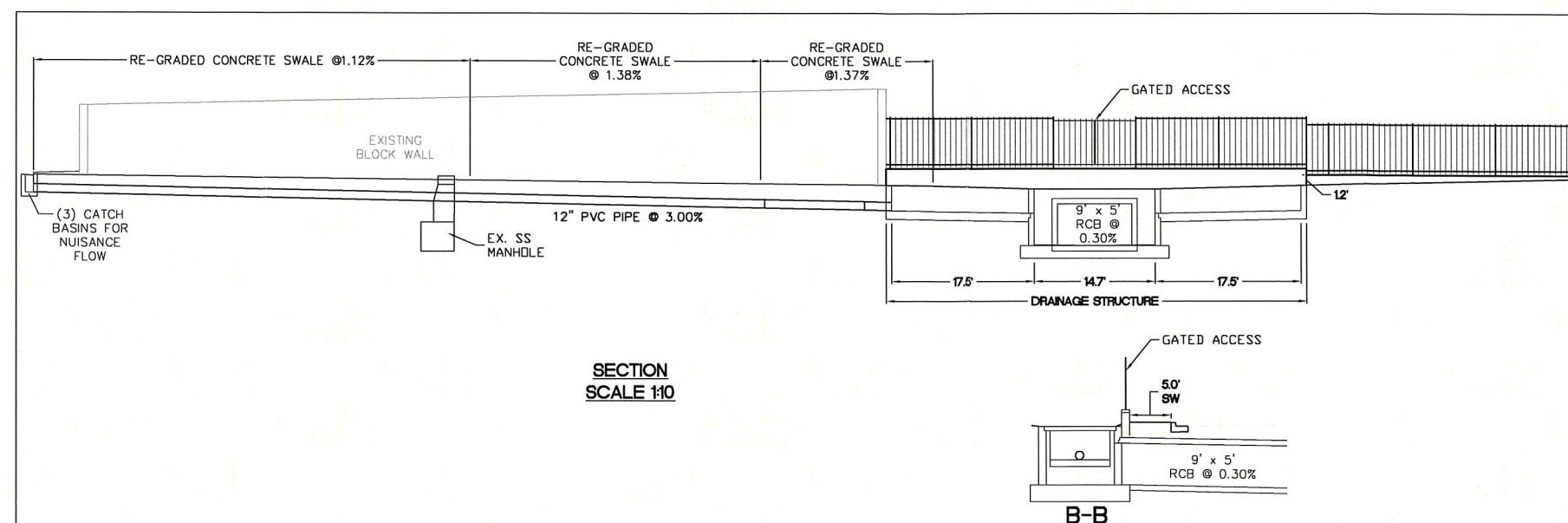
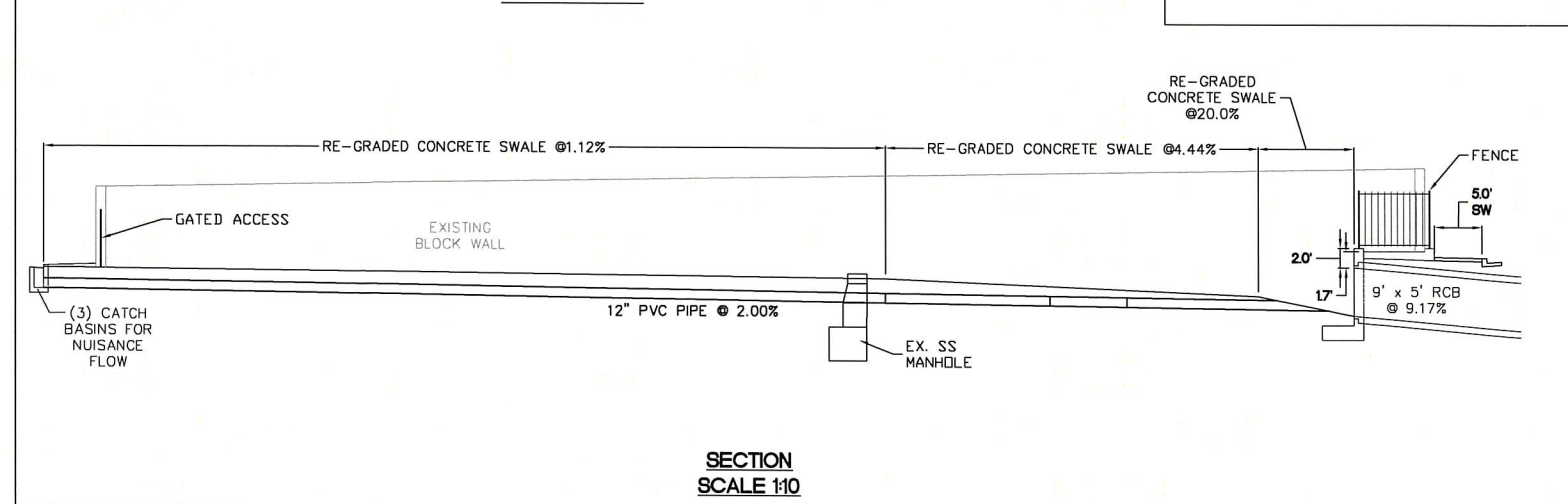
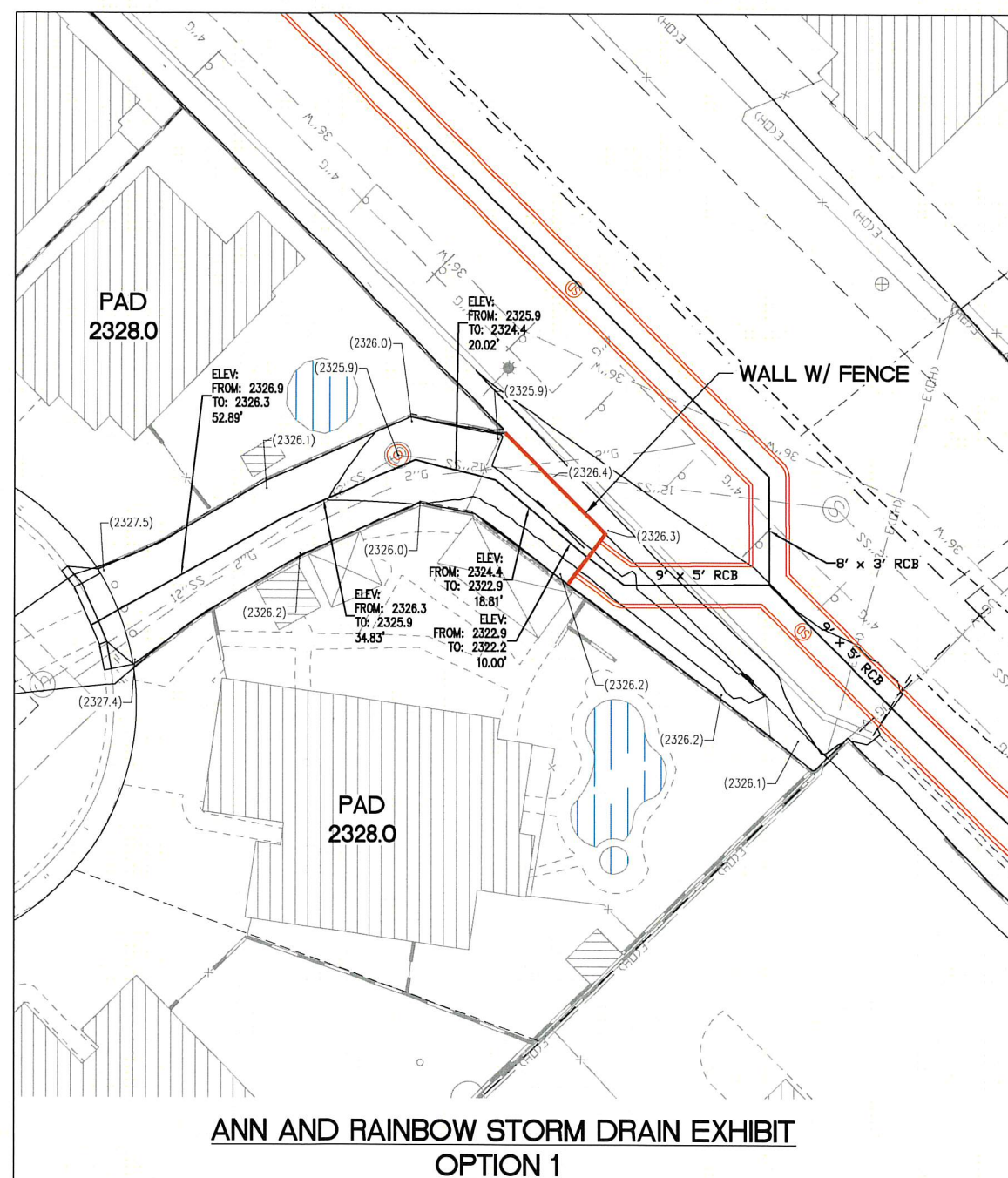
---

### GVF Output Data

|                   |          |       |
|-------------------|----------|-------|
| Upstream Velocity | Infinity | ft/s  |
| Normal Depth      | 5.00     | ft    |
| Critical Depth    | 4.24     | ft    |
| Channel Slope     | 0.40     | %     |
| Critical Slope    | 0.00369  | ft/ft |







### ANN AND RAINBOW STORM DRAIN EXHIBIT OPTION 2

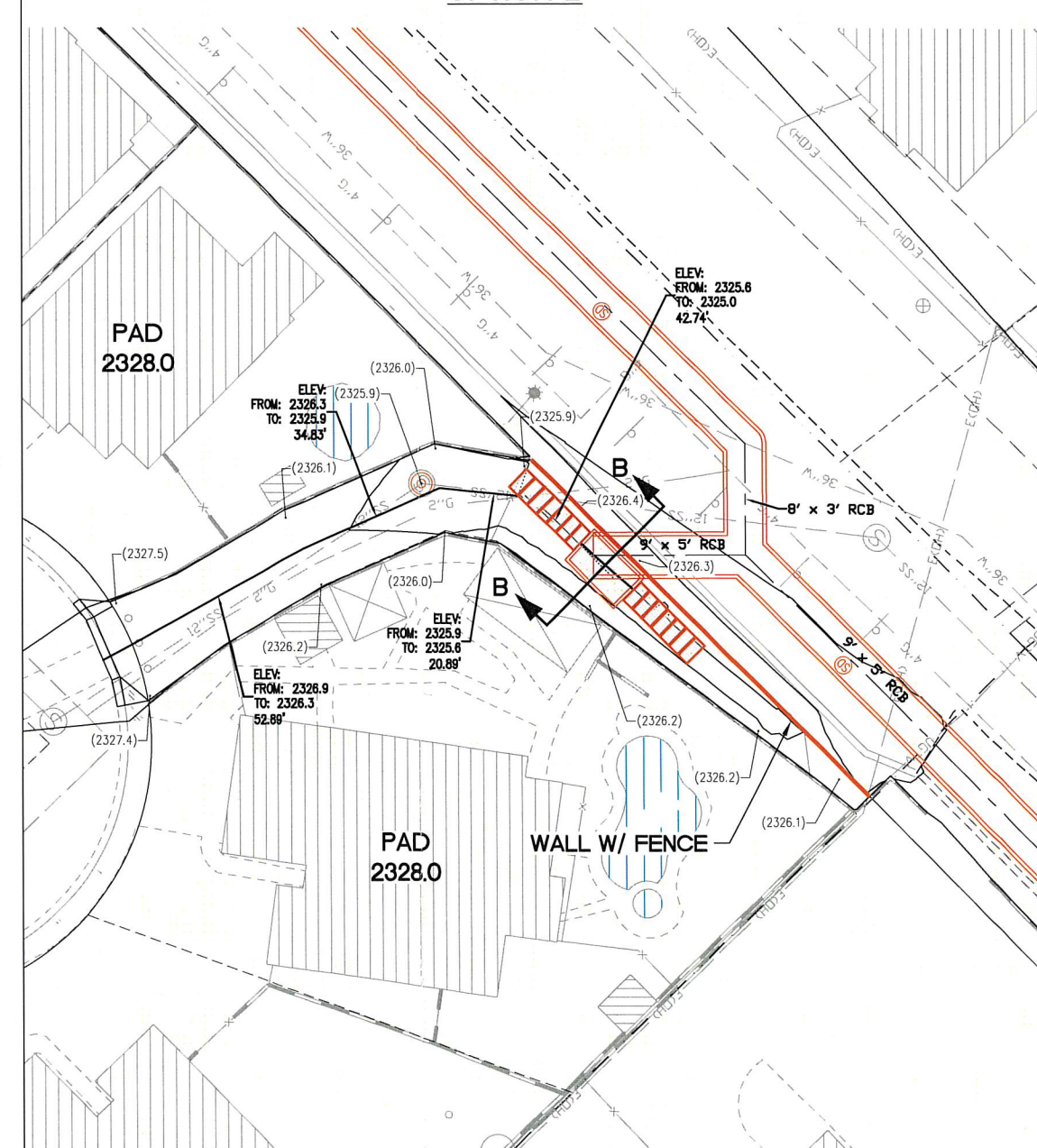
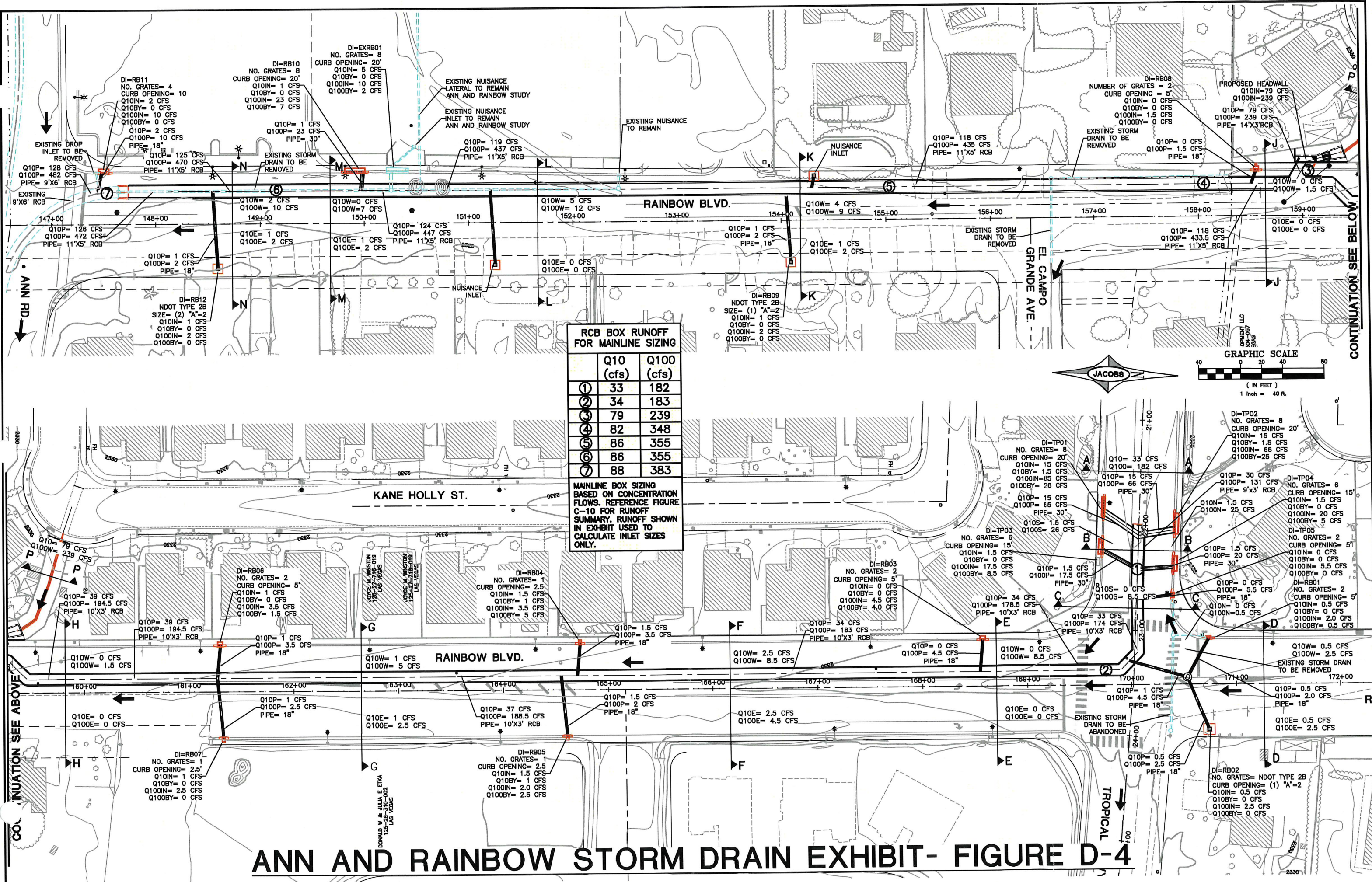


FIGURE D-3











| Hydraulic Section | Q <sub>10</sub> (cfs) | Q <sub>100</sub> (cfs) | Source Runoff                                  |
|-------------------|-----------------------|------------------------|------------------------------------------------|
| A-South           | 16.5                  | 91                     | 1/2 CP3                                        |
| A-North           | 16.5                  | 91                     | 1/2 CP3                                        |
| B-South           | 1.5                   | 26                     | Runoff Bypass from TP01                        |
| B-North           | 1.5                   | 25                     | Runoff Bypass from TP02                        |
| C-South           | 0                     | 8.5                    | Runoff Bypass from TP03                        |
| C-North           | 0                     | 0.5                    | Runoff Bypass from RB01                        |
| D-West            | 0.5                   | 2.5                    | 1/2 OFF4                                       |
| D-East            | 0.5                   | 2.5                    | 1/2 OFF4                                       |
| E-West            | 0                     | 8.5                    | QBY TP03                                       |
| E-East            | 0                     | 0                      | Top of Basin                                   |
| F-West            | 2.5                   | 8.5                    | 1/2 Basin RB1 Plus QBY RB03                    |
| F-East            | 2.5                   | 4.5                    | 1/2 Basin RB1                                  |
| G-West            | 1                     | 5                      | Runoff Bypass from RB04                        |
| G-East            | 1                     | 2.5                    | Runoff Bypass from RB05                        |
| H-West            | 0                     | 1.5                    | Runoff Bypass from RB06                        |
| H-East            | 0                     | 0                      | Runoff Bypass from RB07                        |
| J-West            | 0                     | 1.5                    | Runoff Bypass from RB06                        |
| J-East            | 0                     | 0                      | Runoff Bypass from RB07                        |
| K-West            | 4                     | 9                      | OFF11 Plus OFF12 Plus 1/2 Basin RB2            |
| K-East            | 1                     | 2                      | 1/2 BASIN RB2                                  |
| L-West            | 5                     | 12                     | OFF11 Plus OFF12 Plus 1/2 Basin RB2 Plus OFF13 |
| L-East            | 0                     | 0                      | Runoff Bypass from RB09                        |
| M-West            | 0                     | 7                      | Runoff Bypass from RB10                        |
| M-East            | 1                     | 2                      | 1/2 Basin RB3                                  |
| N-West            | 2                     | 10                     | Runoff Bypass from RB10 Plus OFF14 Plus OFF15  |
| N-East            | 1                     | 2                      | 1/2 Basin RB2 Plus 1/2 Basin RB3               |
| P-ESMT            | 79                    | 239                    | CP6                                            |

FIGURE D-5 (1 OF 2)

| Drop Inlet | Q <sub>10 IN</sub><br>(cfs) | Q <sub>10 BY</sub><br>(cfs) | Q <sub>100 IN</sub><br>(cfs) | Q <sub>100 BY</sub><br>(cfs) | Source Runoff                                          |
|------------|-----------------------------|-----------------------------|------------------------------|------------------------------|--------------------------------------------------------|
| TP01       | 15                          | 1.5                         | 65                           | 26                           | 1/2 CP3                                                |
| TP02       | 15                          | 1.5                         | 66                           | 25                           | 1/2 CP3                                                |
| TP03       | 1.5                         | 0                           | 17.5                         | 8.5                          | Runoff Bypass from TP01                                |
| TP04       | 1.5                         | 0                           | 20                           | 5                            | Runoff Bypass from TP02                                |
| TP05*      | 0                           | 0                           | 5.5                          | 0                            | Runoff Bypass from TP04 and RB01                       |
| RB01       | 0.5                         | 0                           | 2                            | 0.5                          | 1/2 Basin OFF4                                         |
| RB02*      | 0.5                         | 0                           | 2.5                          | 0                            | 1/2 Basin OFF4                                         |
| RB03       | 0                           | 0                           | 4.5                          | 4                            | QBY TP03                                               |
| RB04       | 1.5                         | 1                           | 3.5                          | 5                            | 1/2 Basin RB1 Plus QBY RB03                            |
| RB05       | 1.5                         | 1                           | 2                            | 2.5                          | 1/2 Basin RB1                                          |
| RB06       | 1                           | 0                           | 3.5                          | 1.5                          | Runoff Bypass from RB04                                |
| RB07*      | 1                           | 0                           | 2.5                          | 0                            | Runoff Bypass from RB05                                |
| RB08*      | 0                           | 0                           | 1.5                          | 0                            | Runoff Bypass from RB06                                |
| RB09*      | 1                           | 0                           | 2                            | 0                            | 1/2 Basin RB2                                          |
| EXRB01     | 5                           | 0                           | 10                           | 2                            | OFF11 Plus OFF12 Plus 1/2 Basin RB2 Plus OFF13         |
| RB10       | 1                           | 0                           | 23                           | 7                            | Runoff Bypass from EXRB01 Plus CP10 Plus 1/2 Basin RB3 |
| RB11*      | 2                           | 0                           | 10                           | 0                            | Runoff Bypass from RB10 Plus OFF14 Plus OFF15          |
| RB12*      | 1                           | 0                           | 2                            | 0                            | 1/2 RB2 Plus 1/2 Basin RB3                             |

\*Inlet in sump condition



| <b>US 95 to Ferrell<br/>WSPG Stations</b> | <b>US 95 to Ferrell<br/>Plans Stations</b> | <b>ANRB WSPG<br/>Station</b> | <b>ANRB INVERT</b> |
|-------------------------------------------|--------------------------------------------|------------------------------|--------------------|
| 425+19.58                                 | 39+85.87                                   | 140+68.76                    | 2309.58            |
| 427+00.00                                 | 38+05.45                                   | 142+49.18                    | 2310.84            |
| 427+98.83                                 | 37+06.62                                   | 143+48.01                    | 2311.53            |
| 429+59.04                                 | 35+46.41                                   | 145+08.22                    | 2312.65            |
| 429+89.31                                 | 35+16.14                                   | 145+38.49                    | 2312.86            |
| 430+28.64                                 | 34+76.81                                   | 145+77.82                    | 2313.72            |
| 430+48.06                                 | 34+57.39                                   | 145+97.24                    | 2314.13*           |

\*Tie in ANRB storm drain to existing storm drain at this location

| <b>ANRB PLANS*</b> | <b>ANRB ANR115<br/>WSPG</b> |
|--------------------|-----------------------------|
| 159+27.12          | 159+27.12                   |
| 159+45.22          | 159+52.71                   |
| 161+27.01          | 161+34.50                   |
| 164+55.05          | 164+62.54                   |
| 164+70.39          | 164+77.88                   |
| 168+54.77          | 168+62.26                   |
| 169+89.79          | 169+97.28                   |
| 169+98.22          | 170+09.22                   |
| 23+20.26           | 170+21.16                   |
| 22+70.04           | 170+71.45                   |
| 22+53.94           | 170+87.56                   |
| 22+41.84           | 170+99.67                   |
| 22+09.77           | 171+31.74                   |
| 21+98.95           | 171+42.55                   |

\*Plans station = WSPG Station from  
145+97.24 to 159+27.12

| <b>ANRB PLANS*</b> | <b>ANRB ANRCH1<br/>WSPG</b> |
|--------------------|-----------------------------|
| 158+92.13          | 158+92.13                   |
| 159+03.89          | 159+15.66                   |

\*Plans station = WSPG Station from  
145+97.24 to 158+92.13

## WATER SURFACE PROFILE LISTING

ANN ROAD MPU FACILITY  
(PEAK @ MAIN SYSTEM ) WSPG FILE: ANN5.DAT  
BY: LS, VTN, 02/13/01 UPDATED

| STATION                                            | INVERT<br>ELEV | DEPTH<br>OF FLOW | W.S.<br>ELEV | Q     | VEL   | VEL<br>HEAD | ENERGY<br>GRD.EL. | SUPER<br>ELEV | CRITICAL<br>DEPTH | HGT/<br>DIA | BASE/<br>ID NO. | ZL   | NO<br>PIER | AVBPR |
|----------------------------------------------------|----------------|------------------|--------------|-------|-------|-------------|-------------------|---------------|-------------------|-------------|-----------------|------|------------|-------|
| L/ELEM                                             | SO             |                  |              |       |       | SF AVE      | HF                |               |                   | NORM DEPTH  |                 | ZR   |            |       |
| 41116.97                                           | 2300.04        | 8.176            | 2308.216     | 862.0 | 13.52 | 2.839       | 2311.055          | 0.00          | 7.119             | 8.00        | 8.00            | 0.00 | 0          | 0.00  |
| 283.03                                             | 0.00700        |                  |              |       |       | .006474     | 1.83              |               |                   | 6.604       |                 | 0.00 |            |       |
| 41400.00                                           | 2302.02        | 8.170            | 2310.190     | 862.0 | 13.52 | 2.839       | 2313.029          | 0.00          | 7.119             | 8.00        | 8.00            | 0.00 | 0          | 0.00  |
| 400.00                                             | 0.00700        |                  |              |       |       | .006474     | 2.59              |               |                   | 6.603       |                 | 0.00 |            |       |
| 41800.00                                           | 2304.82        | 8.102            | 2312.922     | 862.0 | 13.52 | 2.839       | 2315.761          | 0.00          | 7.119             | 8.00        | 8.00            | 0.00 | 0          | 0.00  |
| 400.00                                             | 0.00700        |                  |              |       |       | .006474     | 2.59              |               |                   | 6.603       |                 | 0.00 |            |       |
| 42200.00                                           | 2307.62        | 8.033            | 2315.653     | 862.0 | 13.52 | 2.839       | 2318.492          | 0.00          | 7.119             | 8.00        | 8.00            | 0.00 | 0          | 0.00  |
| 136.50                                             | 0.00700        |                  |              |       |       | .006474     | 0.88              |               |                   | 6.603       |                 | 0.00 |            |       |
| 42336.50                                           | 2308.58        | 8.000            | 2316.576     | 862.0 | 13.52 | 2.839       | 2319.415          | 0.00          | 7.119             | 8.00        | 8.00            | 0.00 | 0          | 0.00  |
| 36.15                                              | 0.00700        |                  |              |       |       | .004627     | 0.17              |               |                   | 6.603       |                 | 0.00 |            |       |
| 42372.65                                           | 2308.83        | 7.661            | 2316.490     | 862.0 | 14.07 | 3.072       | 2319.562          | 0.00          | 7.119             | 8.00        | 8.00            | 0.00 | 0          | 0.00  |
| HYDRAULIC JUMP                                     |                |                  |              |       |       |             |                   |               |                   |             |                 | 0.00 |            |       |
| 42372.65                                           | 2308.83        | 6.603            | 2315.432     | 862.0 | 16.32 | 4.135       | 2319.567          | 0.00          | 7.119             | 8.00        | 8.00            | 0.00 | 0          | 0.00  |
| 146.93                                             | 0.00700        | ANRB WSE=2316.17 |              |       |       | .007000     | 1.03              |               |                   | 6.603       |                 | 0.00 |            |       |
| 42519.58                                           | 2309.86        | 6.603            | 2316.460     | 862.0 | 16.32 | 4.135       | 2320.595          | 0.00          | 7.119             | 8.00        | 8.00            | 0.00 | 0          | 0.00  |
| VTN PLANS STA: 39+85.87 = ANRB WSPG STA: 140+68.76 | 180.42         | 0.00700          |              |       |       | .006992     | 1.26              |               |                   | 6.603       |                 | 0.00 |            |       |
| 42700.00                                           | 2311.12        | 6.609            | 2317.729     | 862.0 | 16.30 | 4.127       | 2321.856          | 0.00          | 7.119             | 8.00        | 8.00            | 0.00 | 0          | 0.00  |
| VTN PLANS STA: 38+05.45 = ANRB WSPG STA: 142+49.18 | 98.83          | 0.00698          |              |       |       | .006984     | 0.69              |               |                   | 6.609       |                 | 0.00 |            |       |
| 42798.83                                           | 2311.81        | 6.609            | 2318.419     | 862.0 | 16.30 | 4.127       | 2322.546          | 0.00          | 7.119             | 8.00        | 8.00            | 0.00 | 0          | 0.00  |
| VTN PLANS STA: 37+06.62 = ANRB WSPG STA: 142+54.63 | 160.21         | 0.00698          |              |       |       | .006760     | 1.08              |               |                   | 6.609       |                 | 0.00 |            |       |
| 42959.04                                           | 2312.93        | 6.787            | 2319.716     | 862.0 | 15.88 | 3.914       | 2323.630          | 0.00          | 7.119             | 8.00        | 8.00            | 0.00 | 0          | 0.00  |
| VTN PLANS STA: 35+46.41 = ANRB WSPG STA: 143+48.01 | 30.27          | 0.00698          |              |       |       | .006169     | 0.19              |               |                   | 6.609       |                 | 0.00 |            |       |

INVERT ELEVATIONS IN ANRB WSPG STUDY LOWERED BY 0.28' IN COMPARISON TO VTN STUDY BASED ON SURVEY OF PHYSICAL TIE IN POINT ON RAINBOW BOULEVARD AT ANRB STA:147+64.04. VTN PLANS SHOW INVERT AT 2314.91, SURVEY DATA SHOW INVERT AT SAME LOCATION AT 2314.63.

ANN ROAD MPU FACILITY  
(PEAK @ MAIN SYSTEM ) WSPG FILE: ANN5.DAT  
BY: LS, VTN, 02/13/01 UPDATED

| SECTION                                            | INVERT<br>ELEV | DEPTH<br>OF FLOW | W.S.<br>ELEV | Q     | VEL   | VEL<br>HEAD | ENERGY<br>GRD.EL. | SUPER<br>ELEV | CRITICAL<br>DEPTH | HGT/<br>DIA | BASE/<br>ID NO. | ZL   | NO<br>PIER | AVBPR |
|----------------------------------------------------|----------------|------------------|--------------|-------|-------|-------------|-------------------|---------------|-------------------|-------------|-----------------|------|------------|-------|
| L/ELEM                                             | SO             |                  |              |       |       |             |                   |               |                   |             |                 |      |            |       |
| *****                                              |                |                  |              |       |       |             |                   |               |                   |             |                 |      |            |       |
| 42989.31                                           | 2313.14        | 7.119            | 2320.259     | 862.0 | 15.14 | 3.557       | 2323.816          | 0.00          | 7.119             | 8.00        | 8.00            | 0.00 | 0          | 0.00  |
| VTN PLANS STA: 35+16.14 = ANRB WSPG STA: 145+38.49 |                |                  |              |       |       |             |                   |               |                   |             |                 |      |            |       |
| TRANS STR                                          | 0.02187        |                  |              |       |       | .004177     | 0.16              |               |                   |             |                 | 0.00 |            |       |
| 43028.64                                           | 2314.00        | 8.952            | 2322.952     | 862.0 | 9.00  | 1.258       | 2324.210          | 0.00          | 4.485             | 6.00        | 16.00           | 0.00 | 0          | 0.00  |
| VTN PLANS STA: 34+76.81 = ANRB WSPG STA: 145+77.82 |                |                  |              |       |       |             |                   |               |                   |             |                 |      |            |       |
| JUNCT STR                                          | 0.02111        |                  |              |       |       | .004525     | 0.09              |               |                   |             |                 | 0.00 |            |       |
| 43048.06                                           | 2314.41        | 8.071            | 2322.481     | 399.0 | 11.16 | 1.934       | 2324.415          | 0.00          | 5.161             | 6.00        | 6.00            | 0.00 | 0          | 0.00  |
| VTN PLANS STA: 34+57.39 = ANRB WSPG STA: 145+97.24 |                |                  |              |       |       |             |                   |               |                   |             |                 |      |            |       |
| 0.33                                               | 0.00000        |                  |              |       |       | .006499     | 0.00              |               |                   | 0.000       |                 | 0.00 |            |       |
| 43048.39                                           | 2314.41        | 8.073            | 2322.483     | 399.0 | 11.16 | 1.934       | 2324.417          | 0.00          | 5.161             | 6.00        | 6.00            | 0.00 | 0          | 0.00  |
| 86.87                                              | 0.02153        |                  |              |       |       | .006499     | 0.56              |               |                   | 3.193       |                 | 0.00 |            |       |
| 43135.26                                           | 2316.28        | 6.865            | 2323.145     | 399.0 | 11.16 | 1.934       | 2325.079          | 0.00          | 5.161             | 6.00        | 6.00            | 0.00 | 0          | 0.00  |
| 62.04                                              | 0.00661        |                  |              |       |       | .006499     | 0.40              |               |                   | 5.055       |                 | 0.00 |            |       |
| 43197.30                                           | 2316.69        | 6.890            | 2323.580     | 399.0 | 11.16 | 1.934       | 2325.514          | 0.00          | 5.161             | 6.00        | 6.00            | 0.00 | 0          | 0.00  |
| 430.73                                             | 0.00652        |                  |              |       |       | .006499     | 2.80              |               |                   | 5.081       |                 | 0.00 |            |       |
| 43628.03                                           | 2319.50        | 6.976            | 2326.476     | 399.0 | 11.16 | 1.934       | 2328.410          | 0.00          | 5.161             | 6.00        | 6.00            | 0.00 | 0          | 0.00  |
| 83.66                                              | 0.01410        |                  |              |       |       | .006499     | 0.54              |               |                   | 3.752       |                 | 0.00 |            |       |
| 43711.69                                           | 2320.68        | 6.352            | 2327.032     | 399.0 | 11.16 | 1.934       | 2328.966          | 0.00          | 5.161             | 6.00        | 6.00            | 0.00 | 0          | 0.00  |
| HYDRAULIC JUMP                                     |                |                  |              |       |       |             |                   |               |                   |             |                 |      |            |       |
| 11.69                                              | 2320.68        | 3.829            | 2324.509     | 399.0 | 17.37 | 4.684       | 2329.193          | 0.00          | 5.161             | 6.00        | 6.00            | 0.00 | 0          | 0.00  |
| 141.94                                             | 0.01410        |                  |              |       |       | .013003     | 1.85              |               |                   | 3.752       |                 | 0.00 |            |       |
| 43853.63                                           | 2322.68        | 3.917            | 2326.598     | 399.0 | 16.98 | 4.476       | 2331.074          | 0.00          | 5.161             | 6.00        | 6.00            | 0.00 | 0          | 0.00  |
| 97.65                                              | 0.01410        |                  |              |       |       | .011893     | 1.16              |               |                   | 3.752       |                 | 0.00 |            |       |
| 43951.28                                           | 2324.06        | 4.108            | 2328.166     | 399.0 | 16.19 | 4.068       | 2332.234          | 0.00          | 5.161             | 6.00        | 6.00            | 0.00 | 0          | 0.00  |
| 47.36                                              | 0.01410        |                  |              |       |       | .010525     | 0.50              |               |                   | 3.752       |                 | 0.00 |            |       |

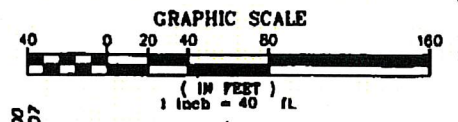
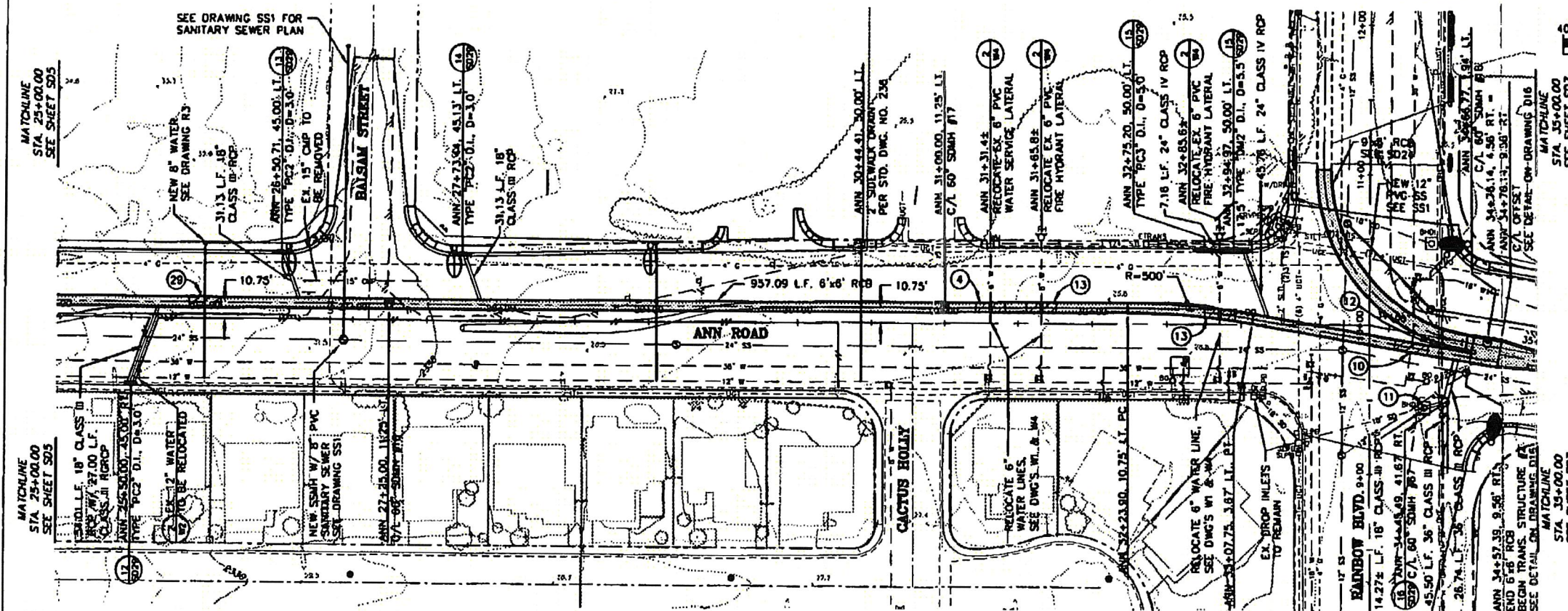
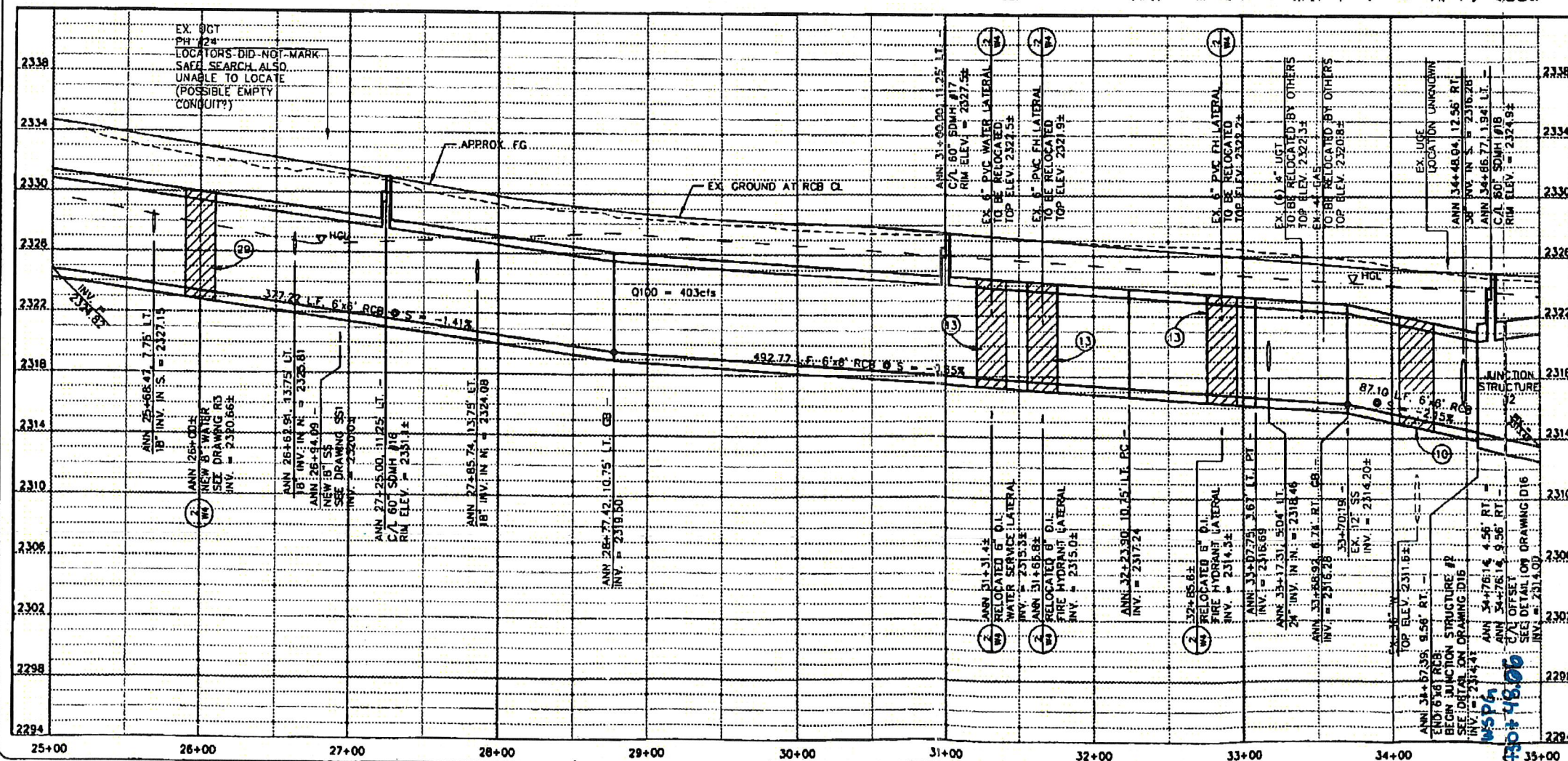


**ANN ROAD IMPROVEMENTS**  
**W.O. #5546**

| CHANNEL STATION         | WSPG STATION | DESIGN FLOW (cfs) | SEGMENT LENGTH (ft) | CHANNEL TYPE                          | INVERT ELEV. (ft) | INVERT SLOPE |
|-------------------------|--------------|-------------------|---------------------|---------------------------------------|-------------------|--------------|
| 300+02.52               | 481+02.34    | 157               | 8                   | TRANSITION                            | 2360.13           | 1.00%        |
| 300+10.52               | 480+94.34    |                   |                     |                                       | 2360.05           |              |
| 300+10.52               | 480+94.34    | 157               | 32.66               | 54" RCP                               | 2360.05           | 1.00%        |
| 300+43.18               | 480+61.68    |                   |                     |                                       | 2359.72           |              |
| 300+43.18               | 480+61.68    | 157               | 406.82              | 54" RCP W/ CASING<br>U.S.-95 CROSSING | 2359.72           | 1.57%        |
| 304+50.00               | 476+54.86    |                   |                     |                                       | 2353.34           |              |
| 304+50.00               | 476+54.86    | 157               | 377.66              | 54" RCP                               | 2353.34           | 0.84%        |
| 308+27.66               | 472+77.20    |                   |                     |                                       | 2350.17           |              |
| 308+27.66               | 472+77.20    | 157               | 435.62              | 54" RCP                               | 2350.17           | 1.45%        |
| 312+63.28               | 468+41.58    |                   |                     |                                       | 2343.85           |              |
| 312+63.28               | 468+41.58    | 157               | 751.83              | 54" RCP                               | 2343.85           | 0.92%        |
| 320+15.11               | 460+89.75    |                   |                     |                                       | 2336.93           |              |
| 320+15.11               | 460+89.75    | 356               | 53.85               | TENAYA CONFLUENCE                     | 2336.93           | 0.34%        |
| 320+68.96               | 460+35.90    |                   |                     |                                       | 2336.75           |              |
| 320+68.96               | 460+35.90    | 378               | 671.17              | 6' X 6' RCB                           | 2336.75           | 0.34%        |
| 327+40.13 =<br>11+40.72 | 453+64.73    |                   |                     |                                       | 2334.49           |              |
| 11+40.72                | 453+64.73    | 378               | 1318.29             | 6' X 6' RCB                           | 2334.49           | 0.69%        |
| 24+59.01                | 440+46.44    |                   |                     |                                       | 2325.40           |              |
| 24+59.01                | 440+46.44    | 378               | 418.41              | 6' X 6' RCB                           | 2325.40           | 1.41%        |
| 28+77.42                | 436+28.03    |                   |                     |                                       | 2319.50           |              |
| 28+77.42                | 436+28.03    | 378               | 492.77              | 6' X 6' RCB                           | 2319.50           | 0.65%        |
| 33+70.19                | 431+35.26    |                   |                     |                                       | 2316.28           |              |
| 33+70.19                | 431+35.26    | 378               | 87.20               | 6' X 6' RCB                           | 2316.28           | 2.15%        |
| 34+57.39                | 430+48.06    |                   |                     |                                       | 2314.41           |              |
| 34+57.39                | 430+48.06    | 862               | 58.75               | RAINBOW CONFLUENCE                    | 2314.41           | 2.15%        |
| 35+16.14                | 429+89.31    |                   |                     |                                       | 2313.14           |              |
| 35+16.14                | 429+89.31    | 862               | 1872.34             | 8' X 8' RCB                           | 2313.14           | 0.70%        |
| 53+88.48                | 411+16.97    |                   |                     |                                       | 2300.04           |              |
| 53+88.48                | 411+16.97    | 862               | 36.52               | 8' X 8' RCB                           | 2300.04           | 0.80%        |
| 54+25.00                | 410+80.45    |                   |                     |                                       | 2299.76           |              |

Rainbow  
lateral





## NOTES

- SEE DRAWING D7 FOR STORM DRAIN MANHOLE SCHEDULE AND DROP INLET SCHEDULE.
- SEE DRAWINGS D8 & D9 FOR DROP INLET DETAILS.
- SEE NOTE 2 ON DRAWING I2 FOR EXISTING UTILITY RELOCATION.

### CONSTRUCTION NOTES

- (10) EXISTING 36" WATER LINE, EPOXY SEAL RCB JOINTS 10' EACH WAY.
- (11) EXISTING BEEHIVE INLET TO BE REMOVED, SEE 
- (12) CEMENT SLURRY BACKFILL TO BE PLACED BETWEEN RCB's WHEN CLEARANCE BETWEEN IS LESS THAN 3'-0".
- (13) EPOXY SEAL RCB JOINTS 10' EACH WAY OF RELOCATED 6" WATER LINE.
- (29) NEW 8" WATER LINE, EPOXY SEAL RCB JOINTS 10' EACH WAY.

## VTN PROJECT BENCHMARK

PROJECT DATA: MAY088  
CITY OF LAS VEGAS BENCHMARK 11V90-3615  
MAY088 ELEVATION: 681.303 METERS (2235.24 FEET)  
RIVER AND PLATE IN TOP OF CURB, SW CORNER OF ANN  
ROAD AND DECATUR BLVD.

## SVERDRUP PROJECT BENCHMARK

CITY OF LAS VEGAS BENCHMARK STATION 11VBO-26M4  
A 1-INCH IRON PIPE IN THE GROUND NEXT TO A  
WOODEN FENCE POST AT CENTENNIAL PARKWAY AND  
TORREY PINES DRIVE  
ELEVATION = 708.1522 METERS (NAVD88 PUBLISHED)  
ELEVATION = 2323.53 U.S. SURVEY FEET (NAVD88)

**APPROVED**

LAS VEGAS VALLEY WATER DISTRICT

Avoid adding underground utility lines. It's costly.  
 I'm saving **Call**  
 before you **Dig**  
**1-800-227-2800**  
 Underground Service Alert (U.S.A.)

Add another page  
 in seconds  
 1 writing  
 tip **Call**  
 before you  
**Overhead**  
 1-702-583-6111  
 South Park Business &

STORM DRAIN PLAN & PROFILE  
STA. 25+00.00 TO STA. 35+00.00  
ANN ROAD

ANN ROAD IMPROVEMENTS  
US 95 TO FERRELL STREET

ANN ROAD IMPROVEMENTS  
US 95 TO FERRELL STREET

DEPARTMENT OF PUBLIC WORKS  
CITY OF LAS VEGAS

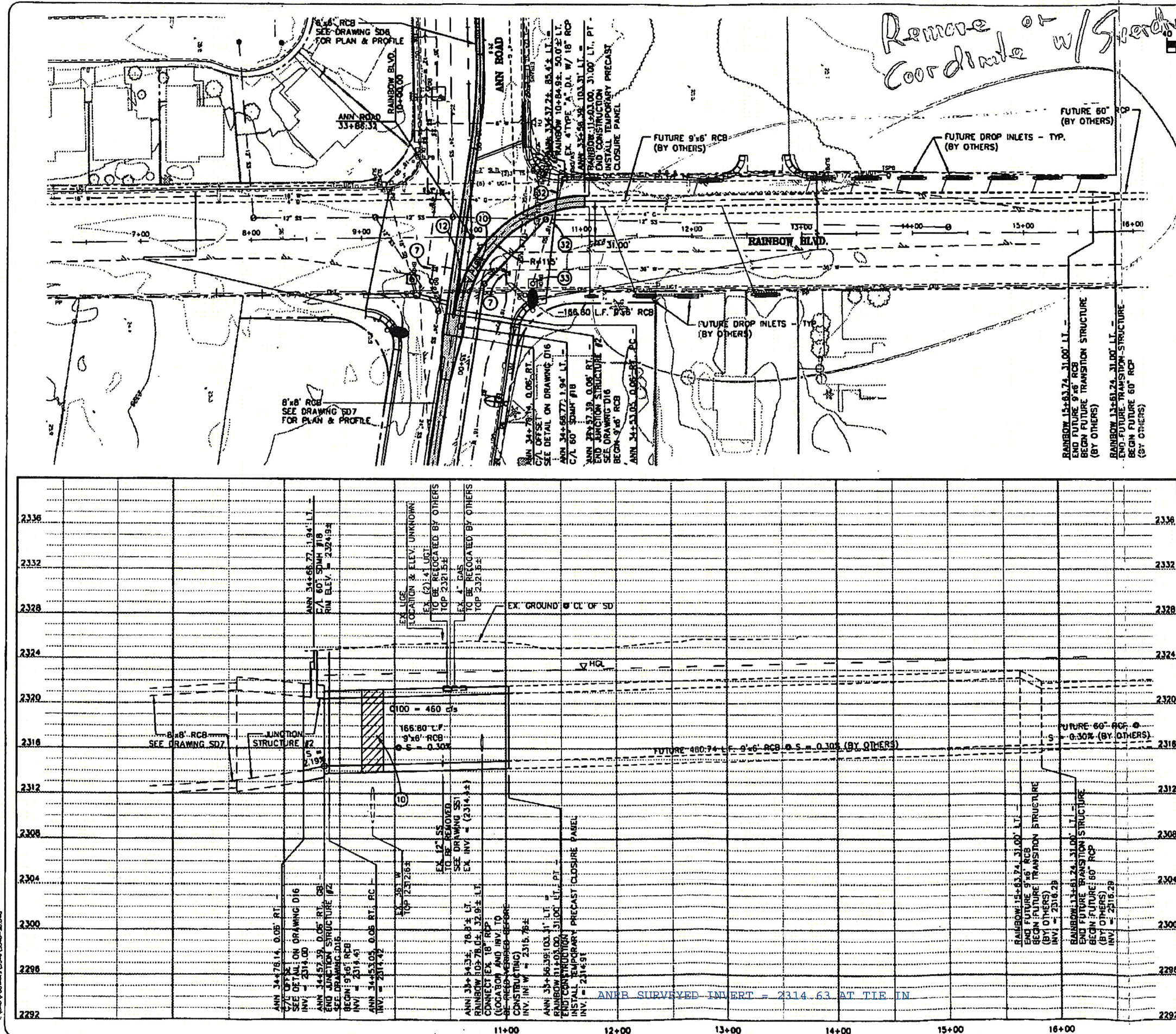
|                                                                                                                                                                                |    |          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----------|
| DATE                                                                                                                                                                           | BY | REVISION |
| <p><b>CONSULTING ENGINEERS • PLANNERS • LAND SURVEYORS</b></p> <p>2727 SOUTH RAINBOW BOULEVARD</p> <p>LAS VEGAS, NEVADA 89146-5148 PHONE (702) 873-7550 FAX (702) 362-2597</p> |    |          |

**UTN** university technology network











# **FIGURE D-6**

T1 ANN ROAD CHANNEL WEST - RAINBOW BOULEVARD  
 T2 MODEL EXISTING ANN SYSTEM THROUGH RIO VIST EASEMENT  
 T3 BY TARA ALEXANDER, PE 11/09/2011  
 SO 14068.7602309.580 1 2316.170  
 R 14249.1802310.840 1 .013 .000 .000 0  
 R 14348.0102311.530 1 .013 .000 .000 1  
 R 14508.2202312.650 1 .013 .000 .000 0  
 R 14538.4902312.860 1 .013 .000 .000 0  
 TS 14577.8202313.720 2 .013 .000  
 JX 14597.2402314.130 4 3 .013 403.000 2314.130 .0 .000  
 R 14744.3802314.530 4 .013 73.264 .000 0  
 JX 14744.3902314.530 6 8 .013 10.000 2316.790 -69.0 .000  
 R 14764.0402314.620 6 .013 .000 .000 1  
 TS 14774.0402314.810 7 .013 .000  
 R 14854.9502316.300 7 .013 .000 .000 0  
 JX 14854.9602316.300 7 8 .013 2.000 2317.790 86.0 .000  
 R 14900.0102317.030 7 .013 .000 .000 0  
 R 14997.4002317.350 9 .013 .000 .000 0  
 JX 14997.4102317.350 11 10 .013 23.000 2318.370 -85.0 .000  
 R 15026.2302317.420 11 .013 .000 .000 0  
 JX 15026.2402317.420 13 12 .013 10.000 2317.640 -90.0 .000  
 R 15402.2402318.260 13 .013 .000 .000 1  
 JX 15402.2502318.260 15 14 .013 2.000 2319.190 86.0 .000  
 R 15850.4702319.300 15 .013 .000 .000 1  
 JX 15850.4802319.300 15 16 .013 1.500 2321.070 -80.0 .000  
 R 15892.1202319.400 15 .013 .000 .000 0  
 JX 15892.1302319.400 13 13 .013 95.500 2321.170 .0 .000  
 R 15892.1402320.380 18 .013 .000 .000 0  
 R 15915.6602321.000 18 .013 -60.000 .000 0  
 SH 15915.6602321.000 18 2324.700  
 CD 1 3 0 .000 8.000 8.000 .000 .000 .00  
 CD 2 3 0 .000 6.000 16.000 .000 .000 .00  
 CD 3 3 0 .000 6.000 6.000 .000 .000 .00  
 CD 4 3 0 .000 6.000 9.000 .000 .000 .00  
 CD 6 3 0 .000 6.000 9.000 .000 .000 .00  
 CD 7 3 0 .000 5.000 11.000 .000 .000 .00  
 CD 8 4 1 .000 1.500 .000 .000 .000 .00  
 CD 9 3 0 .000 5.000 11.000 .000 .000 .00  
 CD 10 4 1 .000 2.500 .000 .000 .000 .00  
 CD 11 3 0 .000 5.000 11.000 .000 .000 .00  
 CD 12 4 1 .000 2.500 .000 .000 .000 .00  
 CD 13 3 0 .000 5.000 11.000 .000 .000 .00  
 CD 14 4 1 .000 1.500 .000 .000 .000 .00  
 CD 15 3 0 .000 5.000 11.000 .000 .000 .00  
 CD 16 4 1 .000 1.500 .000 .000 .000 .00  
 CD 17 3 0 .000 5.000 11.000 .000 .000 .00  
 CD 18 3 0 .000 3.000 14.000 .000 .000 .00  
 Q 239.000 .0



FILE: anrch1.WSW

W S P G W - CIVILDESIGN Version 14.06

PAGE 1

Program Package Serial Number: 1267

WATER SURFACE PROFILE LISTING

Date: 11- 9-2011 Time: 10:37: 2

ANN ROAD CHANNEL WEST - RAINBOW BOULEVARD

MODEL EXISTING ANN SYSTEM THROUGH RIO VIST EASEMENT

BY TARA ALEXANDER, PE 11/09/2011

```

*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height | Base Wt | | No Wth
        | Elev   | (FT)  | Elev   | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | I.D. | ZL | Prs/Pip
L/Elem | Ch Slope |
***** |
14068.760 | 2309.580 | 5.812 | 2315.392 | 786.00 | 16.91 | 4.44 | 2319.83 | .00 | 6.69 | 8.00 | 8.000 | 8.000 | .00 | 0 | .0
        | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -
180.420 | .0070 | - | - | - | - | - | - | - | - | - | - | - | .00 | - | BOX
14249.180 | 2310.840 | 5.855 | 2316.695 | 786.00 | 16.78 | 4.37 | 2321.07 | .00 | 6.69 | 8.00 | 8.000 | 8.000 | .00 | 0 | .0
        | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -
98.830 | .0070 | - | - | - | - | - | - | - | - | - | - | - | .00 | - | BOX
14348.010 | 2311.530 | 5.910 | 2317.440 | 786.00 | 16.62 | 4.29 | 2321.73 | .00 | 6.69 | 8.00 | 8.000 | 8.000 | .00 | 0 | .0
        | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -
56.462 | .0070 | - | - | - | - | - | - | - | - | - | - | - | .00 | - | BOX
14404.470 | 2311.925 | 5.967 | 2317.892 | 786.00 | 16.47 | 4.21 | 2322.10 | .00 | 6.69 | 8.00 | 8.000 | 8.000 | .00 | 0 | .0
        | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -
103.748 | .0070 | - | - | - | - | - | - | - | - | - | - | - | .00 | - | BOX
14508.220 | 2312.650 | 6.258 | 2318.908 | 786.00 | 15.70 | 3.83 | 2322.74 | .00 | 6.69 | 8.00 | 8.000 | 8.000 | .00 | 0 | .0
        | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -
17.335 | .0069 | - | - | - | - | - | - | - | - | - | - | - | .00 | - | BOX
14525.550 | 2312.770 | 6.382 | 2319.152 | 786.00 | 15.40 | 3.68 | 2322.83 | .00 | 6.69 | 8.00 | 8.000 | 8.000 | .00 | 0 | .0
        | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -
12.936 | .0069 | - | - | - | - | - | - | - | - | - | - | - | .00 | - | BOX
14538.490 | 2312.860 | 6.694 | 2319.554 | 786.00 | 14.68 | 3.34 | 2322.90 | .00 | 6.69 | 8.00 | 8.000 | 8.000 | .00 | 0 | .0
        | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -
TRANS STR | .0219 | - | - | - | - | - | - | - | - | - | - | - | .00 | - | BOX
14577.820 | 2313.720 | 8.517 | 2322.237 | 786.00 | 8.19 | 1.04 | 2323.28 | .00 | 4.22 | 16.00 | 6.000 | 16.000 | .00 | 0 | .0
        | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -
JUNCT STR | .0211 | - | - | - | - | - | - | - | - | - | - | - | .00 | - | BOX
14597.240 | 2314.130 | 8.402 | 2322.532 | 383.00 | 7.09 | .78 | 2323.31 | .00 | 3.83 | 9.00 | 6.000 | 9.000 | .00 | 0 | .0
        | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -
147.140 | .0027 | - | - | - | - | - | - | - | - | - | - | - | .00 | - | BOX
*****

```

FILE: anrch1.WSW

W S P G W - CIVILDESIGN Version 14.06  
Program Package Serial Number: 1267

PAGE 2

WATER SURFACE PROFILE LISTING  
ANN ROAD CHANNEL WEST - RAINBOW BOULEVARD  
MODEL EXISTING ANN SYSTEM THROUGH RIO VIST EASEMENT  
BY TARA ALEXANDER, PE 11/09/2011

Date: 11- 9-2011 Time: 10:37: 2

```

*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height | Base Wt | No Wth |
| Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip |
L/Elem | Ch Slope |
*****
14744.380 | 2314.530 | 8.401 | 2322.931 | 383.00 | 7.09 | .78 | 2323.71 | .00 | 3.83 | 9.00 | 6.000 | 9.000 | .00 | 0 | .0
JUNCT STR | .0000 | | | | | .0017 | .00 | 8.40 | .51 | .013 | .00 | .00 | BOX
14744.390 | 2314.530 | 8.470 | 2323.000 | 373.00 | 6.91 | .74 | 2323.74 | .00 | 3.76 | 9.00 | 6.000 | 9.000 | .00 | 0 | .0
19.650 | .0046 | | | | | .0017 | .03 | 8.47 | .50 | 3.43 | .013 | .00 | .00 | BOX
14764.040 | 2314.620 | 8.450 | 2323.070 | 373.00 | 6.91 | .74 | 2323.81 | .00 | 3.76 | 9.00 | 6.000 | 9.000 | .00 | 0 | .0
TRANS STR | .0190 | | | | | .0017 | .02 | 8.45 | .50 | .013 | .00 | .00 | BOX
14774.040 | 2314.810 | 8.306 | 2323.116 | 373.00 | 6.78 | .71 | 2323.83 | .00 | 3.29 | 11.00 | 5.000 | 11.000 | .00 | 0 | .0
80.910 | .0184 | | | | | .0017 | .14 | 8.31 | .53 | 1.79 | .013 | .00 | .00 | BOX
14854.950 | 2316.300 | 6.954 | 2323.255 | 373.00 | 6.78 | .71 | 2323.97 | .00 | 3.29 | 11.00 | 5.000 | 11.000 | .00 | 0 | .0
JUNCT STR | .0000 | | | | | .0017 | .00 | 6.95 | .53 | .013 | .00 | .00 | BOX
14854.960 | 2316.300 | 6.970 | 2323.270 | 371.00 | 6.75 | .71 | 2323.98 | .00 | 3.28 | 11.00 | 5.000 | 11.000 | .00 | 0 | .0
45.050 | .0162 | | | | | .0017 | .08 | 6.97 | .53 | 1.86 | .013 | .00 | .00 | BOX
14900.010 | 2317.030 | 6.316 | 2323.346 | 371.00 | 6.75 | .71 | 2324.05 | .00 | 3.28 | 11.00 | 5.000 | 11.000 | .00 | 0 | .0
97.391 | .0033 | | | | | .0017 | .16 | 6.32 | .53 | 3.21 | .013 | .00 | .00 | BOX
14997.400 | 2317.350 | 6.161 | 2323.511 | 371.00 | 6.75 | .71 | 2324.22 | .00 | 3.28 | 11.00 | 5.000 | 11.000 | .00 | 0 | .0
JUNCT STR | .0000 | | | | | .0015 | .00 | 6.16 | .53 | .013 | .00 | .00 | BOX
14997.410 | 2317.350 | 6.325 | 2323.675 | 348.00 | 6.33 | .62 | 2324.30 | .00 | 3.14 | 11.00 | 5.000 | 11.000 | .00 | 0 | .0
28.820 | .0024 | | | | | .0015 | .04 | 6.33 | .50 | 3.42 | .013 | .00 | .00 | BOX

```

FILE: anrch1.WSW

W S P G W - CIVILDESIGN Version 14.06

PAGE 3

Program Package Serial Number: 1267

WATER SURFACE PROFILE LISTING

Date: 11- 9-2011 Time: 10:37: 2

ANN ROAD CHANNEL WEST - RAINBOW BOULEVARD

MODEL EXISTING ANN SYSTEM THROUGH RIO VIST EASEMENT

BY TARA ALEXANDER, PE 11/09/2011

| Station   | Invert Elev | Depth (FT) | Water Elev | Q (CFS) | Vel (FPS) | Vel Head | Energy Grd.El. | Super Elev | Critical Depth | Flow Top Width | Height/Dia. | Base Wt/ I.D. | ZL  | No Wth Prs/Pip |
|-----------|-------------|------------|------------|---------|-----------|----------|----------------|------------|----------------|----------------|-------------|---------------|-----|----------------|
| L/Elem    | Ch Slope    |            |            |         |           | SF Ave   | HF             | SE Dpth    | Froude N       | Norm Dp        | "N"         | X-Fall        | ZR  | Type Ch        |
| 15026.230 | 2317.420    | 6.298      | 2323.718   | 348.00  | 6.33      | .62      | 2324.34        | .00        | 3.14           | 11.00          | 5.000       | 11.000        | .00 | 0 .0           |
| JUNCT STR | .0000       |            |            |         |           | .0014    | .00            | 6.30       | .50            |                | .013        | .00           | .00 | BOX            |
| 15026.240 | 2317.420    | 6.368      | 2323.788   | 338.00  | 6.15      | .59      | 2324.37        | .00        | 3.08           | 11.00          | 5.000       | 11.000        | .00 | 0 .0           |
| 376.000   | .0022       |            |            |         |           | .0014    | .53            | 6.37       | .48            | 3.45           | .013        | .00           | .00 | BOX            |
| 15402.240 | 2318.260    | 6.086      | 2324.345   | 338.00  | 6.15      | .59      | 2324.93        | .00        | 3.08           | 11.00          | 5.000       | 11.000        | .00 | 0 .0           |
| JUNCT STR | .0000       |            |            |         |           | .0014    | .00            | 6.09       | .48            |                | .013        | .00           | .00 | BOX            |
| 15402.250 | 2318.260    | 6.099      | 2324.359   | 336.00  | 6.11      | .58      | 2324.94        | .00        | 3.07           | 11.00          | 5.000       | 11.000        | .00 | 0 .0           |
| 448.220   | .0023       |            |            |         |           | .0014    | .62            | 6.10       | .48            | 3.39           | .013        | .00           | .00 | BOX            |
| 15850.470 | 2319.300    | 5.710      | 2325.010   | 336.00  | 6.11      | .58      | 2325.59        | .00        | 3.07           | 11.00          | 5.000       | 11.000        | .00 | 0 .0           |
| JUNCT STR | .0000       |            |            |         |           | .0014    | .00            | 5.71       | .48            |                | .013        | .00           | .00 | BOX            |
| 15850.480 | 2319.300    | 5.720      | 2325.021   | 334.50  | 6.08      | .57      | 2325.59        | .00        | 3.06           | 11.00          | 5.000       | 11.000        | .00 | 0 .0           |
| 41.640    | .0024       |            |            |         |           | .0014    | .06            | 5.72       | .48            | 3.34           | .013        | .00           | .00 | BOX            |
| 15892.120 | 2319.400    | 5.678      | 2325.078   | 334.50  | 6.08      | .57      | 2325.65        | .00        | 3.06           | 11.00          | 5.000       | 11.000        | .00 | 0 .0           |
| JUNCT STR | .0000       |            |            |         |           | .0007    | .00            | 5.68       | .48            |                | .013        | .00           | .00 | BOX            |
| 15892.130 | 2319.400    | 6.147      | 2325.546   | 239.00  | 5.69      | .50      | 2326.05        | .00        | 2.08           | 14.00          | 3.000       | 14.000        | .00 | 0 .0           |
| 15892.140 | 2320.380    | 5.167      | 2325.546   | 239.00  | 5.69      | .50      | 2326.05        | .00        | 2.08           | 14.00          | 3.000       | 14.000        | .00 | 0 .0           |
| 23.521    | .0264       |            |            |         |           | .0019    | .04            | .00        | .58            | 1.00           | .013        | .00           | .00 | BOX            |
| 15915.660 | 2321.000    | 4.672      | 2325.672   | 239.00  | 5.69      | .50      | 2326.18        | .00        | 2.08           | 14.00          | 3.000       | 14.000        | .00 | 0 .0           |



# FIGURE D-7

T1 ANN ROAD CHANNEL WEST - RAINBOW BOULEVARD  
 T2 MODEL EXISTING ANN SYSTEM THROUGH TROPICAL PARKWAY  
 T3 BY TARA ALAEXANDER, PE 07/20/2011  
 SO 14068.7602309.580 1 2316.170  
 R 14249.1802310.840 1 .013 .000 .000 0  
 R 14348.0102311.530 1 .013 .000 .000 1  
 R 14508.2202312.650 1 .013 .000 .000 0  
 R 14538.4902312.860 1 .013 .000 .000 0  
 TS 14577.8202313.720 2 .013 .000  
 JX 14597.2402314.130 4 3 .013 403.000 2314.130 .0 .000  
 R 14744.3802314.530 4 .013 73.264 .000 0  
 JX 14744.3902314.530 6 8 .013 10.000 2316.790 -69.0 .000  
 R 14764.0402314.620 6 .013 .000 .000 1  
 TS 14774.0402314.810 7 .013 .000  
 R 14854.9502316.300 7 .013 .000 .000 0  
 JX 14854.9602316.300 7 8 .013 2.000 2317.790 86.0 .000  
 R 14900.0102317.030 7 .013 .000 .000 0  
 R 14997.4002317.350 9 .013 .000 .000 0  
 JX 14997.4102317.350 11 10 .013 23.000 2318.370 -85.0 .000  
 R 15026.2302317.420 11 .013 .000 .000 0  
 JX 15026.2402317.420 13 12 .013 10.000 2317.640 -90.0 .000  
 R 15402.2402318.260 13 .013 .000 .000 1  
 JX 15402.2502318.260 15 14 .013 2.000 2319.190 86.0 .000  
 R 15850.4702319.300 15 .013 .000 .000 1  
 JX 15850.4802319.300 15 16 .013 1.500 2321.0710 -80.0 .000  
 R 15892.1202319.400 21 .013 .000 .000 0  
 JX 15892.1302319.400 23 22 .013 140.000 2320.380 -45.0 .000  
 R 15918.2002319.460 23 .013 .000 .000 0  
 R 15918.2102321.170 24 .013 .000 .000 0  
 R 15927.1202321.400 24 .013 .000 45.000 0  
 R 15952.7102321.490 24 .013 .000 -45.000 0  
 R 16134.5002322.110 24 .013 .000 .000 1  
 JX 16134.5102322.110 27 25 26 .013 3.500 2.5002322.9602322.960 -85.0 84.0 .000  
 R 16462.5402323.270 27 .013 .000 .000 1  
 JX 16462.5502323.270 29 28 .013 2.000 2324.910 84.0 .000  
 R 16477.8802323.330 27 .013 .000 .000 0  
 JX 16477.8902323.330 27 30 .013 3.500 2323.680 -84.0 .000  
 R 16862.2602324.670 27 .013 .000 .000 1  
 JX 16862.2702324.670 31 30 .013 4.500 2325.420 -84.0 .000  
 R 16997.2802325.150 32 .013 .000 -45.000 0  
 R 17009.2202325.190 33 .013 .000 .000 1  
 JX 17009.2302325.190 29 28 .013 4.500 2325.760 70.0 .000  
 R 17021.1602325.230 27 .013 .000 -45.000 0  
 R 17071.4502325.380 29 .013 .000 .000 0  
 JX 17071.4602325.380 29 28 .013 5.500 2326.170 74.0 .000  
 R 17087.5602325.380 29 .013 .000 3.000 0  
 R 17099.6702325.460 29 .013 .000 .000 0  
 JX 17099.6802325.460 27 34 34 .013 17.500 20.0002325.7102325.710 -63.0 84.0 .000  
 R 17131.7402325.560 29 .013 .000 .000 0  
 JX 17131.7402325.560 37 35 36 .013 65.000 66.0002326.0602326.060 -58.0 79.0 .000  
 R 17142.5502325.590 32 .013 .000 .000 1  
 SH 17142.5502325.590 32 2325.590  
 CD 1 3 0 .000 8.000 8.000 .000 .000 .00  
 CD 2 3 0 .000 6.000 16.000 .000 .000 .00  
 CD 3 3 0 .000 6.000 6.000 .000 .000 .00  
 CD 4 3 0 .000 6.000 9.000 .000 .000 .00  
 CD 5 4 1 .000 2.000 .000 .000 .000 .00  
 CD 6 3 0 .000 6.000 9.000 .000 .000 .00  
 CD 7 3 0 .000 5.000 11.000 .000 .000 .00  
 CD 8 4 1 .000 1.500 .000 .000 .000 .00  
 CD 9 3 0 .000 5.000 11.000 .000 .000 .00  
 CD 10 4 1 .000 2.500 .000 .000 .000 .00  
 CD 11 3 0 .000 5.000 11.000 .000 .000 .00  
 CD 12 4 1 .000 2.500 .000 .000 .000 .00  
 CD 13 3 0 .000 5.000 11.000 .000 .000 .00  
 CD 14 4 1 .000 1.500 .000 .000 .000 .00  
 CD 15 3 0 .000 5.000 11.000 .000 .000 .00  
 CD 16 4 1 .000 1.500 .000 .000 .000 .00  
 CD 19 4 1 .000 1.500 .000 .000 .000 .00  
 CD 20 3 0 .000 5.000 11.000 .000 .000 .00  
 CD 21 3 0 .000 5.000 11.000 .000 .000 .00  
 CD 22 3 0 .000 3.000 14.000 .000 .000 .00  
 CD 23 3 0 .000 5.000 11.000 .000 .000 .00  
 CD 24 3 0 .000 3.000 10.000 .000 .000 .00  
 CD 25 4 1 .000 1.500 .000 .000 .000 .00  
 CD 26 4 1 .000 1.500 .000 .000 .000 .00  
 CD 27 3 0 .000 3.000 10.000 .000 .000 .00  
 CD 28 4 1 .000 1.500 .000 .000 .000 .00  
 CD 29 3 0 .000 3.000 10.000 .000 .000 .00  
 CD 30 4 1 .000 1.500 .000 .000 .000 .00  
 CD 31 3 0 .000 3.000 10.000 .000 .000 .00  
 CD 32 3 0 .000 3.000 10.000 .000 .000 .00  
 CD 33 3 0 .000 3.000 10.000 .000 .000 .00  
 CD 34 4 1 .000 2.500 .000 .000 .000 .00  
 CD 35 3 0 .000 2.000 5.000 .000 .000 .00  
 CD 36 3 0 .000 2.000 5.000 .000 .000 .00  
 CD 37 3 0 .000 3.000 10.000 .000 .000 .00  
 CD 38 3 0 .000 3.000 10.000 .000 .000 .00  
 Q .010 .0

NOTE: HIGHLIGHTED TEXT USED AS STARTING HGL FOR  
 LATERALS IN STANDARD FORM 6

FILE: ANR115.WSW

W S P G W - CIVILDESIGN Version 14.06  
Program Package Serial Number: 1267

PAGE 1

WATER SURFACE PROFILE LISTING  
ANN ROAD CHANNEL WEST - RAINBOW BOULEVARD  
MODEL EXISTING ANN SYSTEM THROUGH TROPICAL PARKWAY  
BY TARA ALAEXANDER, PE 07/20/2011

Date: 11- 9-2011 Time: 10:48: 8

```

*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height | Base Wt | No Wth |
| Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip |
L/Elem | Ch Slope |
*****
14068.760 | 2309.580 | 5.812 | 2315.392 | 786.01 | 16.91 | 4.44 | 2319.83 | .00 | 6.69 | 8.00 | 8.000 | 8.000 | .00 | 0 | .0
| | | | | | | | | | | | | | | |
180.420 | .0070 | | | | | | | | | | | | | | |
14249.180 | 2310.840 | 5.855 | 2316.695 | 786.01 | 16.78 | 4.37 | 2321.07 | .00 | 6.69 | 8.00 | 8.000 | 8.000 | .00 | 0 | .0
| | | | | | | | | | | | | | | |
98.830 | .0070 | | | | | | | | | | | | | | |
14348.010 | 2311.530 | 5.910 | 2317.440 | 786.01 | 16.62 | 4.29 | 2321.73 | .00 | 6.69 | 8.00 | 8.000 | 8.000 | .00 | 0 | .0
| | | | | | | | | | | | | | | |
56.390 | .0070 | | | | | | | | | | | | | | |
14404.400 | 2311.924 | 5.967 | 2317.891 | 786.01 | 16.47 | 4.21 | 2322.10 | .00 | 6.69 | 8.00 | 8.000 | 8.000 | .00 | 0 | .0
| | | | | | | | | | | | | | | |
103.820 | .0070 | | | | | | | | | | | | | | |
14508.220 | 2312.650 | 6.258 | 2318.908 | 786.01 | 15.70 | 3.83 | 2322.74 | .00 | 6.69 | 8.00 | 8.000 | 8.000 | .00 | 0 | .0
| | | | | | | | | | | | | | | |
17.242 | .0069 | | | | | | | | | | | | | | |
14525.460 | 2312.770 | 6.381 | 2319.150 | 786.01 | 15.40 | 3.68 | 2322.83 | .00 | 6.69 | 8.00 | 8.000 | 8.000 | .00 | 0 | .0
| | | | | | | | | | | | | | | |
13.028 | .0069 | | | | | | | | | | | | | | |
14538.490 | 2312.860 | 6.693 | 2319.553 | 786.01 | 14.68 | 3.35 | 2322.90 | .00 | 6.69 | 8.00 | 8.000 | 8.000 | .00 | 0 | .0
| | | | | | | | | | | | | | | |
TRANS STR | .0219 | | | | | | | | | | | | | | |
14577.820 | 2313.720 | 8.518 | 2322.238 | 786.01 | 8.19 | 1.04 | 2323.28 | .00 | 4.22 | 16.00 | 6.000 | 16.000 | .00 | 0 | .0
| | | | | | | | | | | | | | | |
JUNCT STR | .0211 | | | | | | | | | | | | | | |
14597.240 | 2314.130 | 8.402 | 2322.532 | 383.01 | 7.09 | .78 | 2323.31 | .00 | 3.83 | 9.00 | 6.000 | 9.000 | .00 | 0 | .0
| | | | | | | | | | | | | | | |
147.140 | .0027 | | | | | | | | | | | | | | |
*****

```



FILE: ANR115.WSW

W S P G W - CIVILDESIGN Version 14.06  
Program Package Serial Number: 1267

PAGE 2

WATER SURFACE PROFILE LISTING  
ANN ROAD CHANNEL WEST - RAINBOW BOULEVARD  
MODEL EXISTING ANN SYSTEM THROUGH TROPICAL PARKWAY  
BY TARA ALAEXANDER, PE 07/20/2011

Date: 11- 9-2011 Time: 10:48: 8

```

*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height | Base Wt | | No Wth
| Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip
L/Elem | Ch Slope | | | | | | | | | | | | | ZR | Type Ch
*****
14744.380 | 2314.530 | 8.402 | 2322.932 | 383.01 | 7.09 | .78 | 2323.71 | .00 | 3.83 | 9.00 | 6.000 | 9.000 | .00 | 0 | .0
JUNCT STR | .0000 | | | | | | | | | | | | | .00 | BOX
14744.390 | 2314.530 | 8.471 | 2323.000 | 373.01 | 6.91 | .74 | 2323.74 | .00 | 3.76 | 9.00 | 6.000 | 9.000 | .00 | 0 | .0
19.650 | .0046 | | | | | | | | | | | | | .00 | BOX
14764.040 | 2314.620 | 8.450 | 2323.070 | 373.01 | 6.91 | .74 | 2323.81 | .00 | 3.76 | 9.00 | 6.000 | 9.000 | .00 | 0 | .0
TRANS STR | .0190 | | | | | | | | | | | | | .00 | BOX
14774.040 | 2314.810 | 8.307 | 2323.116 | 373.01 | 6.78 | .71 | 2323.83 | .00 | 3.29 | 11.00 | 5.000 | 11.000 | .00 | 0 | .0
80.910 | .0184 | | | | | | | | | | | | | .00 | BOX
14854.950 | 2316.300 | 6.955 | 2323.255 | 373.01 | 6.78 | .71 | 2323.97 | .00 | 3.29 | 11.00 | 5.000 | 11.000 | .00 | 0 | .0
JUNCT STR | .0000 | | | | | | | | | | | | | .00 | BOX
14854.960 | 2316.300 | 6.970 | 2323.270 | 371.01 | 6.75 | .71 | 2323.98 | .00 | 3.28 | 11.00 | 5.000 | 11.000 | .00 | 0 | .0
45.050 | .0162 | | | | | | | | | | | | | .00 | BOX
14900.010 | 2317.030 | 6.316 | 2323.346 | 371.01 | 6.75 | .71 | 2324.05 | .00 | 3.28 | 11.00 | 5.000 | 11.000 | .00 | 0 | .0
97.391 | .0033 | | | | | | | | | | | | | .00 | BOX
14997.400 | 2317.350 | 6.161 | 2323.511 | 371.01 | 6.75 | .71 | 2324.22 | .00 | 3.28 | 11.00 | 5.000 | 11.000 | .00 | 0 | .0
JUNCT STR | .0000 | | | | | | | | | | | | | .00 | BOX
14997.410 | 2317.350 | 6.325 | 2323.676 | 348.01 | 6.33 | .62 | 2324.30 | .00 | 3.14 | 11.00 | 5.000 | 11.000 | .00 | 0 | .0
28.820 | .0024 | | | | | | | | | | | | | .00 | BOX

```

FILE: ANR115.WSW

W S P G W - CIVILDESIGN Version 14.06

PAGE 3

Program Package Serial Number: 1267

WATER SURFACE PROFILE LISTING

Date: 11- 9-2011 Time: 10:48: 8

ANN ROAD CHANNEL WEST - RAINBOW BOULEVARD

MODEL EXISTING ANN SYSTEM THROUGH TROPICAL PARKWAY

BY TARA ALAEXANDER, PE 07/20/2011

| Station   | Invert Elev | Depth (FT) | Water Elev | Q (CFS) | Vel (FPS) | Vel Head | Energy Grd.El. | Super Elev | Critical Depth | Flow Top Width | Height/Dia.-FT | Base Wt/I.D. | ZL  | No Wth Prs/Pip |
|-----------|-------------|------------|------------|---------|-----------|----------|----------------|------------|----------------|----------------|----------------|--------------|-----|----------------|
| L/Elem    | Ch Slope    |            |            |         |           | SF Ave   | HF             | SE Dpth    | Froude N       | Norm Dp        | "N"            | X-Fall       | ZR  | Type Ch        |
| 15026.230 | 2317.420    | 6.299      | 2323.719   | 348.01  | 6.33      | .62      | 2324.34        | .00        | 3.14           | 11.00          | 5.000          | 11.000       | .00 | 0 .0           |
| JUNCT STR | .0000       |            |            |         |           | .0014    | .00            | 6.30       | .50            |                | .013           | .00          | .00 | BOX            |
| 15026.240 | 2317.420    | 6.369      | 2323.789   | 338.01  | 6.15      | .59      | 2324.38        | .00        | 3.08           | 11.00          | 5.000          | 11.000       | .00 | 0 .0           |
| 376.000   | .0022       |            |            |         |           | .0014    | .53            | 6.37       | .48            | 3.45           | .013           | .00          | .00 | BOX            |
| 15402.240 | 2318.260    | 6.086      | 2324.346   | 338.01  | 6.15      | .59      | 2324.93        | .00        | 3.08           | 11.00          | 5.000          | 11.000       | .00 | 0 .0           |
| JUNCT STR | .0000       |            |            |         |           | .0014    | .00            | 6.09       | .48            |                | .013           | .00          | .00 | BOX            |
| 15402.250 | 2318.260    | 6.100      | 2324.360   | 336.01  | 6.11      | .58      | 2324.94        | .00        | 3.07           | 11.00          | 5.000          | 11.000       | .00 | 0 .0           |
| 448.220   | .0023       |            |            |         |           | .0014    | .62            | 6.10       | .48            | 3.39           | .013           | .00          | .00 | BOX            |
| 15850.470 | 2319.300    | 5.711      | 2325.011   | 336.01  | 6.11      | .58      | 2325.59        | .00        | 3.07           | 11.00          | 5.000          | 11.000       | .00 | 0 .0           |
| JUNCT STR | .0000       |            |            |         |           | .0014    | .00            | 5.71       | .48            |                | .013           | .00          | .00 | BOX            |
| 15850.480 | 2319.300    | 5.721      | 2325.021   | 334.51  | 6.08      | .57      | 2325.60        | .00        | 3.06           | 11.00          | 5.000          | 11.000       | .00 | 0 .0           |
| 41.640    | .0024       |            |            |         |           | .0014    | .06            | 5.72       | .48            | 3.34           | .013           | .00          | .00 | BOX            |
| 15892.120 | 2319.400    | 5.678      | 2325.078   | 334.51  | 6.08      | .57      | 2325.65        | .00        | 3.06           | 11.00          | 5.000          | 11.000       | .00 | 0 .0           |
| JUNCT STR | .0000       |            |            |         |           | .0005    | .00            | 5.68       | .48            |                | .013           | .00          | .00 | BOX            |
| 15892.130 | 2319.400    | 6.252      | 2325.652   | 194.51  | 3.54      | .19      | 2325.85        | .00        | 2.13           | 11.00          | 5.000          | 11.000       | .00 | 0 .0           |
| 26.070    | .0023       |            |            |         |           | .0005    | .01            | 6.25       | .28            | 2.32           | .013           | .00          | .00 | BOX            |
| 15918.200 | 2319.460    | 6.205      | 2325.665   | 194.51  | 6.48      | .65      | 2326.32        | .00        | 2.27           | 10.00          | 3.000          | 10.000       | .00 | 0 .0           |
| 15918.210 | 2321.170    | 4.495      | 2325.665   | 194.51  | 6.48      | .65      | 2326.32        | .00        | 2.27           | 10.00          | 3.000          | 10.000       | .00 | 0 .0           |
| 8.910     | .0258       |            |            |         |           | .0027    | .02            | 4.49       | .66            | 1.12           | .013           | .00          | .00 | BOX            |

FILE: ANR115.WSW

W S P G W - CIVILDESIGN Version 14.06

PAGE 4

Program Package Serial Number: 1267

WATER SURFACE PROFILE LISTING

Date: 11- 9-2011 Time: 10:48: 8

ANN ROAD CHANNEL WEST - RAINBOW BOULEVARD

MODEL EXISTING ANN SYSTEM THROUGH TROPICAL PARKWAY

BY TARA ALAEXANDER, PE 07/20/2011

| Station   | Invert Elev | Depth (FT) | Water Elev | Q (CFS) | Vel (FPS) | Vel Head | Energy Grd.El. | Super Elev | Critical Depth | Flow Top Width | Height/Dia.-FT | Base Wt I.D. | ZL  | No Wth Prs/Pip |
|-----------|-------------|------------|------------|---------|-----------|----------|----------------|------------|----------------|----------------|----------------|--------------|-----|----------------|
| L/Elem    | Ch Slope    |            |            |         |           | SF Ave   | HF             | SE Dpth    | Froude N       | Norm Dp        | "N"            | X-Fall       | ZR  | Type Ch        |
| 15927.120 | 2321.400    | 4.385      | 2325.785   | 194.51  | 6.48      | .65      | 2326.44        | .00        | 2.27           | 10.00          | 3.000          | 10.000       | .00 | 0 .0           |
| 25.590    | .0035       |            |            |         |           | .0027    | .07            | 4.39       | .66            | 2.17           | .013           | .00          | .00 | BOX            |
| 15952.710 | 2321.490    | 4.460      | 2325.950   | 194.51  | 6.48      | .65      | 2326.60        | .00        | 2.27           | 10.00          | 3.000          | 10.000       | .00 | 0 .0           |
| 181.790   | .0034       |            |            |         |           | .0027    | .48            | 4.46       | .66            | 2.20           | .013           | .00          | .00 | BOX            |
| 16134.500 | 2322.110    | 4.356      | 2326.466   | 194.51  | 6.48      | .65      | 2327.12        | .00        | 2.27           | 10.00          | 3.000          | 10.000       | .00 | 0 .0           |
| JUNCT STR | .0000       |            |            |         |           | .0025    | .00            | 4.36       | .66            |                | .013           | .00          | .00 | BOX            |
| 16134.510 | 2322.110    | 4.434      | 2326.544   | 188.51  | 6.28      | .61      | 2327.16        | .00        | 2.23           | 10.00          | 3.000          | 10.000       | .00 | 0 .0           |
| 328.029   | .0035       |            |            |         |           | .0025    | .82            | 4.43       | .64            | 2.12           | .013           | .00          | .00 | BOX            |
| 16462.540 | 2323.270    | 4.124      | 2327.394   | 188.51  | 6.28      | .61      | 2328.01        | .00        | 2.23           | 10.00          | 3.000          | 10.000       | .00 | 0 .0           |
| JUNCT STR | .0000       |            |            |         |           | .0024    | .00            | 4.12       | .64            |                | .013           | .00          | .00 | BOX            |
| 16462.550 | 2323.270    | 4.150      | 2327.420   | 186.51  | 6.22      | .60      | 2328.02        | .00        | 2.21           | 10.00          | 3.000          | 10.000       | .00 | 0 .0           |
| 15.330    | .0039       |            |            |         |           | .0024    | .04            | 4.15       | .63            | 2.04           | .013           | .00          | .00 | BOX            |
| 16477.880 | 2323.330    | 4.127      | 2327.457   | 186.51  | 6.22      | .60      | 2328.06        | .00        | 2.21           | 10.00          | 3.000          | 10.000       | .00 | 0 .0           |
| JUNCT STR | .0000       |            |            |         |           | .0024    | .00            | 4.13       | .63            |                | .013           | .00          | .00 | BOX            |
| 16477.890 | 2323.330    | 4.171      | 2327.501   | 183.01  | 6.10      | .58      | 2328.08        | .00        | 2.18           | 10.00          | 3.000          | 10.000       | .00 | 0 .0           |
| 384.369   | .0035       |            |            |         |           | .0024    | .90            | 4.17       | .62            | 2.09           | .013           | .00          | .00 | BOX            |
| 16862.260 | 2324.670    | 3.765      | 2328.435   | 183.01  | 6.10      | .58      | 2329.01        | .00        | 2.18           | 10.00          | 3.000          | 10.000       | .00 | 0 .0           |
| JUNCT STR | .0000       |            |            |         |           | .0022    | .00            | 3.76       | .62            |                | .013           | .00          | .00 | BOX            |



FILE: ANR115.WSW

W S P G W - CIVILDESIGN Version 14.06  
Program Package Serial Number: 1267

PAGE 5

WATER SURFACE PROFILE LISTING  
ANN ROAD CHANNEL WEST - RAINBOW BOULEVARD  
MODEL EXISTING ANN SYSTEM THROUGH TROPICAL PARKWAY  
BY TARA ALAEXANDER, PE 07/20/2011

Date: 11- 9-2011 Time: 10:48: 8

| Station   | Invert Elev | Depth (FT) | Water Elev | Q (CFS) | Vel (FPS) | Vel Head | Energy Grd.El. | Super Elev | Critical Depth | Flow Top Width | Height/Dia.-FT | Base Wt/I.D. | ZL  | No Wth Prs/Pip |
|-----------|-------------|------------|------------|---------|-----------|----------|----------------|------------|----------------|----------------|----------------|--------------|-----|----------------|
| L/Elem    | Ch Slope    |            |            |         |           | SF Ave   | HF             | SE Dpth    | Froude N       | Norm Dp        | "N"            | X-Fall       | ZR  | Type Ch        |
| 16862.270 | 2324.670    | 3.820      | 2328.490   | 178.51  | 5.95      | .55      | 2329.04        | .00        | 2.15           | 10.00          | 3.000          | 10.000       | .00 | 0 .0           |
| 135.010   | .0036       |            |            |         |           | .0022    | .30            | 3.82       | .61            | 2.04           | .013           | .00          | .00 | BOX            |
| 16997.280 | 2325.150    | 3.724      | 2328.874   | 178.51  | 5.95      | .55      | 2329.42        | .00        | 2.15           | 10.00          | 3.000          | 10.000       | .00 | 0 .0           |
| 11.941    | .0034       |            |            |         |           | .0022    | .03            | 3.72       | .61            | 2.08           | .013           | .00          | .00 | BOX            |
| 17009.220 | 2325.190    | 3.738      | 2328.928   | 178.51  | 5.95      | .55      | 2329.48        | .00        | 2.15           | 10.00          | 3.000          | 10.000       | .00 | 0 .0           |
| JUNCT STR | .0000       |            |            |         |           | .0021    | .00            | 3.74       | .61            |                | .013           | .00          | .00 | BOX            |
| 17009.230 | 2325.190    | 3.789      | 2328.979   | 174.01  | 5.80      | .52      | 2329.50        | .00        | 2.11           | 10.00          | 3.000          | 10.000       | .00 | 0 .0           |
| 11.930    | .0034       |            |            |         |           | .0021    | .03            | 3.79       | .59            | 2.05           | .013           | .00          | .00 | BOX            |
| 17021.160 | 2325.230    | 3.851      | 2329.082   | 174.01  | 5.80      | .52      | 2329.60        | .00        | 2.11           | 10.00          | 3.000          | 10.000       | .00 | 0 .0           |
| 50.289    | .0030       |            |            |         |           | .0021    | .11            | 3.85       | .59            | 2.13           | .013           | .00          | .00 | BOX            |
| 17071.450 | 2325.380    | 3.809      | 2329.188   | 174.01  | 5.80      | .52      | 2329.71        | .00        | 2.11           | 10.00          | 3.000          | 10.000       | .00 | 0 .0           |
| JUNCT STR | .0000       |            |            |         |           | .0020    | .00            | 3.81       | .59            |                | .013           | .00          | .00 | BOX            |
| 17071.460 | 2325.380    | 3.869      | 2329.249   | 168.51  | 5.62      | .49      | 2329.74        | .00        | 2.07           | 10.00          | 3.000          | 10.000       | .00 | 0 .0           |
| 16.100    | .0000       |            |            |         |           | .0020    | .03            | 3.87       | .57            | .00            | .013           | .00          | .00 | BOX            |
| 17087.560 | 2325.380    | 3.906      | 2329.286   | 168.51  | 5.62      | .49      | 2329.78        | .00        | 2.07           | 10.00          | 3.000          | 10.000       | .00 | 0 .0           |
| 12.109    | .0066       |            |            |         |           | .0020    | .02            | 3.91       | .57            | 1.60           | .013           | .00          | .00 | BOX            |
| 17099.670 | 2325.460    | 3.850      | 2329.310   | 168.51  | 5.62      | .49      | 2329.80        | .00        | 2.07           | 10.00          | 3.000          | 10.000       | .00 | 0 .0           |
| JUNCT STR | .0000       |            |            |         |           | .0012    | .00            | 3.85       | .57            |                | .013           | .00          | .00 | BOX            |

FILE: ANR115.WSW

W S P G W - CIVILDESIGN Version 14.06  
Program Package Serial Number: 1267

PAGE 6

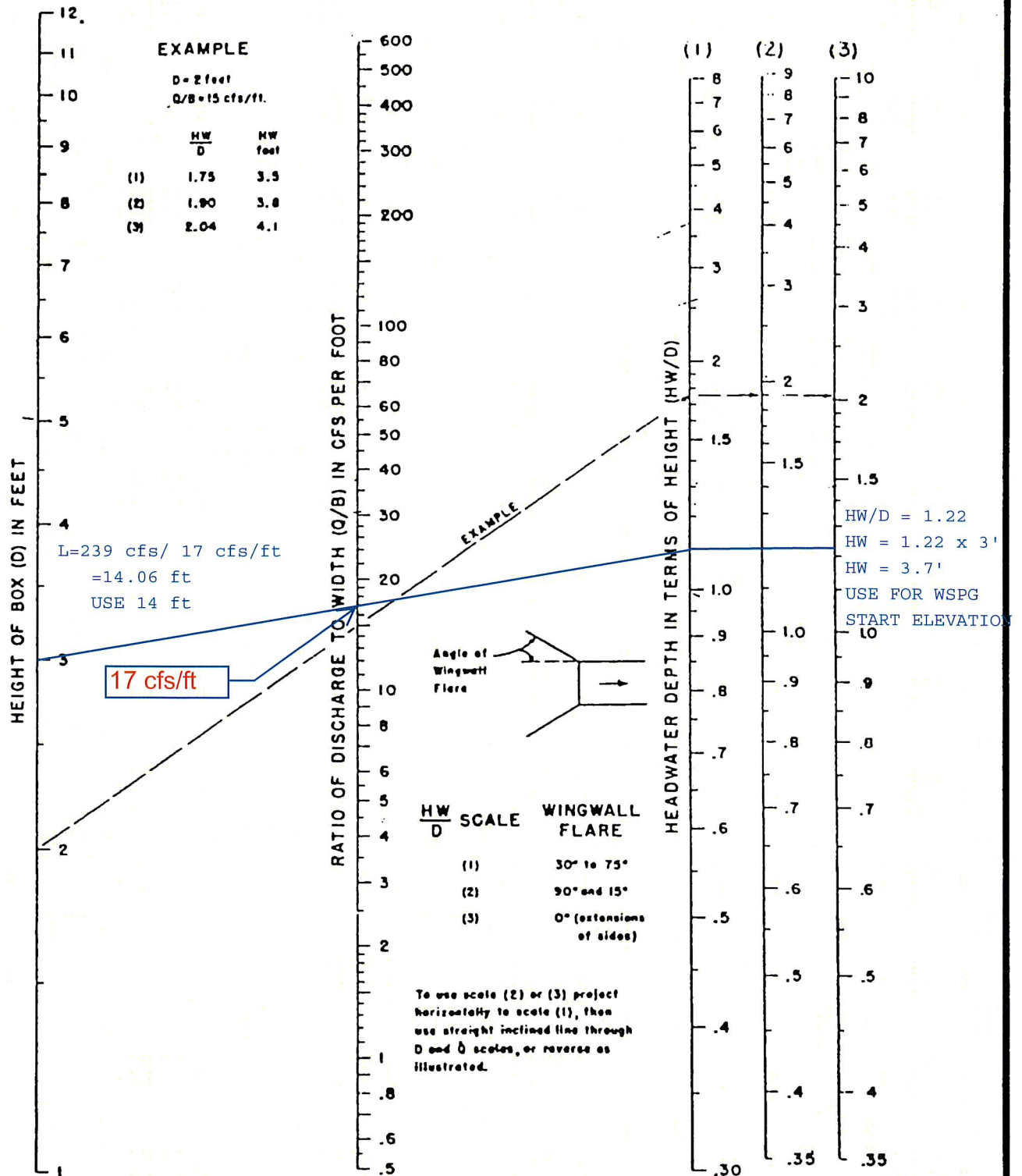
WATER SURFACE PROFILE LISTING  
ANN ROAD CHANNEL WEST - RAINBOW BOULEVARD  
MODEL EXISTING ANN SYSTEM THROUGH TROPICAL PARKWAY  
BY TARA ALAEXANDER, PE 07/20/2011

Date: 11- 9-2011 Time: 10:48: 8

| Station   | Invert Elev | Depth (FT) | Water Elev | Q (CFS) | Vel (FPS) | Vel Head | Energy Grd.El. | Super Elev | Critical Depth | Flow Top Width | Height/Dia.-FT | Base Wt/I.D. | ZL  | No Wth  |
|-----------|-------------|------------|------------|---------|-----------|----------|----------------|------------|----------------|----------------|----------------|--------------|-----|---------|
| L/Elem    | Ch Slope    |            |            |         |           | SF Ave   | HF             | SE Dpth    | Froude N       | Norm Dp        | "N"            | X-Fall       | ZR  | Type Ch |
| 17099.680 | 2325.460    | 4.199      | 2329.659   | 131.01  | 4.37      | .30      | 2329.96        | .00        | 1.75           | 10.00          | 3.000          | 10.000       | .00 | 0 .0    |
| 32.061    | .0031       |            |            |         |           | .0012    | .04            | 4.20       | .44            | 1.73           | .013           | .00          | .00 | BOX     |
| 17131.740 | 2325.560    | 4.138      | 2329.698   | 131.01  | 4.37      | .30      | 2329.99        | .00        | 1.75           | 10.00          | 3.000          | 10.000       | .00 | 0 .0    |
| JUNCT STR | .0000       |            |            |         |           | .0000    | .00            | 4.14       | .44            |                | .013           | .00          | .00 | BOX     |
| 17131.740 | 2325.560    | 4.412      | 2329.972   | .01     | .00       | .00      | 2329.97        | .00        | .00            | 10.00          | 3.000          | 10.000       | .00 | 0 .0    |
| 10.811    | .0028       |            |            |         |           | .0000    | .00            | 4.41       | .00            | .01            | .013           | .00          | .00 | BOX     |
| 17142.550 | 2325.590    | 4.382      | 2329.972   | .01     | .00       | .00      | 2329.97        | .00        | .00            | 10.00          | 3.000          | 10.000       | .00 | 0 .0    |

# HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

## NOMOGRAPH - INLET CONTROL BOX CULVERT



| Revision | Date |
|----------|------|
|          |      |
|          |      |
|          |      |
|          |      |

WRC  
ENGINEERING

REFERENCE:  
USDOT, FHWA, HDS No.5, 1985

FIGURE 1004

FIGURE D-8



| STANDARD FORM 6 - STORM DRAIN HYDRAULIC CALCULATIONS   |           |                |        |         |         |                  |              |       |        |              |              |                             |                             |                                   |                            |                |                |                |                |                |                 |                           |         |            |         |         |          |         |     |                      |
|--------------------------------------------------------|-----------|----------------|--------|---------|---------|------------------|--------------|-------|--------|--------------|--------------|-----------------------------|-----------------------------|-----------------------------------|----------------------------|----------------|----------------|----------------|----------------|----------------|-----------------|---------------------------|---------|------------|---------|---------|----------|---------|-----|----------------------|
| Location: Rainbow Blvd. from Tropical Pkwy. to Ann Rd. |           |                |        |         |         |                  |              |       |        |              |              |                             |                             | Calculated By: Tara Alexander, PE |                            |                |                |                |                |                | Date: 12-Nov-11 |                           |         |            |         |         |          |         |     |                      |
| Conduit Data                                           |           |                |        |         |         |                  | Flow Data    |       |        |              |              |                             |                             |                                   | Energy Loss Data           |                |                |                |                |                |                 | Energy and Hydraulic Data |         |            |         |         | Comments |         |     |                      |
| From<br><br>To                                         |           | Size<br><br>Ft |        | Inverts |         | Length<br><br>Ft | A<br><br>Ft² | n     | ψ      | Q<br><br>CFS | V<br><br>F/S | H <sub>v</sub><br><br>V²/2g | S <sub>f</sub><br><br>FT/FT | AVG<br><br>S <sub>f</sub>         | Pipe<br><br>H <sub>f</sub> | Transitions    |                |                |                |                |                 | Pipe                      |         | Transition |         | Press   |          |         |     |                      |
|                                                        |           |                |        | D/S     | U/S     |                  |              |       |        |              |              |                             |                             |                                   |                            | H <sub>f</sub> | H <sub>j</sub> | H <sub>m</sub> | H <sub>o</sub> | H <sub>e</sub> | Total           | U/S EGL                   | U/S HGL | U/S EGL    | U/S HGL | Flow ?  |          |         |     |                      |
|                                                        |           | Width          | Height |         |         |                  |              |       |        |              |              |                             |                             |                                   |                            |                |                |                |                |                |                 |                           |         |            |         |         |          |         |     |                      |
| 147+44                                                 | DI-RB11   |                | 1.50   | 2316.79 | 2318.32 | 19.25            | 1.77         | 0.013 | 0.0049 | 10.0         | 5.66         | 0.50                        | 0.009                       | 0.009                             | 0.17                       | Starting       | Downstream     | HGL            |                |                |                 |                           |         | 0.17       | 2323.60 | 2323.10 | 2320.32  | 2319.82 | Yes | FL Surface = 2324.16 |
| 148+55                                                 | DI-RB12   |                | 1.50   | 2317.79 | 2319.37 | 73.44            | 1.77         | 0.013 | 0.0049 | 2.0          | 1.13         | 0.02                        | 0.000                       | 0.000                             | 0.03                       | Starting       | Downstream     | HGL            |                |                |                 |                           |         | 0.03       | 2319.17 | 2323.30 | 2320.89  | 2320.87 | Yes | FL Surface = 2323.62 |
| 149+97                                                 | DI-RB10   |                | 2.50   | 2318.37 | 2318.88 | 17.13            | 4.91         | 0.013 | 0.0049 | 23.0         | 4.69         | 0.34                        | 0.003                       | 0.003                             | 0.05                       | Starting       | Downstream     | HGL            |                |                |                 |                           |         | 0.05       | 2324.06 | 2323.72 | 2321.72  | 2321.38 | Yes | FL Surface = 2324.79 |
| 150+26                                                 | DI-EXRB01 |                | 2.50   | 2317.64 | 2320.04 | 16.62            | 4.91         | 0.013 | 0.0049 | 10.0         | 2.04         | 0.06                        | 0.001                       | 0.001                             | 0.01                       | Starting       | Downstream     | HGL            |                |                |                 |                           |         | 0.01       | 2323.86 | 2323.80 | 2322.60  | 2322.54 | Yes | FL Surface = 2324.43 |
| 154+02                                                 | DI-RB09   |                | 1.50   | 2319.19 | 2321.31 | 70.75            | 1.77         | 0.013 | 0.0049 | 2.0          | 1.13         | 0.02                        | 0.000                       | 0.000                             | 0.03                       | Starting       | Downstream     | HGL            |                |                |                 |                           |         | 0.03       | 2324.41 | 2324.39 | 2322.83  | 2322.81 | Yes | FL Surface = 2325.22 |
| 158+51                                                 | DI-RB08   |                | 1.50   | 2321.07 | 2321.50 | 14.56            | 1.77         | 0.013 | 0.0049 | 1.5          | 0.85         | 0.01                        | 0.000                       | 0.000                             | 0.00                       | Starting       | Downstream     | HGL            |                |                |                 |                           |         | 0.00       | 2325.03 | 2325.02 | 2323.01  | 2323.00 | Yes | FL Surface = 2326.32 |
| 161+27                                                 | DI-RB07   |                | 1.50   | 2322.96 | 2324.25 | 56.11            | 1.77         | 0.013 | 0.0049 | 2.5          | 1.41         | 0.03                        | 0.001                       | 0.001                             | 0.03                       | Starting       | Downstream     | HGL            |                |                |                 |                           |         | 0.03       | 2326.60 | 2326.57 | 2325.78  | 2325.75 | Yes | FL Surface = 2326.80 |
| 161+27                                                 | DI-RB06   |                | 1.50   | 2322.96 | 2324.23 | 30.01            | 1.77         | 0.013 | 0.0049 | 3.5          | 1.98         | 0.06                        | 0.001                       | 0.001                             | 0.03                       | Starting       | Downstream     | HGL            |                |                |                 |                           |         | 0.03       | 2326.63 | 2326.57 | 2325.79  | 2325.73 | Yes | FL Surface = 2326.77 |
| 164+55                                                 | DI-RB05   |                | 1.50   | 2323.78 | 2324.91 | 56.54            | 1.77         | 0.013 | 0.0049 | 2.0          | 1.13         | 0.02                        | 0.000                       | 0.000                             | 0.02                       | Starting       | Downstream     | HGL            |                |                |                 |                           |         | 0.02       | 2327.46 | 2327.44 | 2326.43  | 2326.41 | Yes | FL Surface = 2328.11 |
| 164+70                                                 | DI-RB04   |                | 1.50   | 2323.68 | 2324.13 | 30.12            | 1.77         | 0.013 | 0.0049 | 3.5          | 1.98         | 0.06                        | 0.001                       | 0.001                             | 0.03                       | Starting       | Downstream     | HGL            |                |                |                 |                           |         | 0.03       | 2327.59 | 2327.53 | 2325.69  | 2325.63 | Yes | FL Surface = 2328.13 |
| 168+58                                                 | DI-RB03   |                | 1.50   | 2325.42 | 2326.02 | 29.63            | 1.77         | 0.013 | 0.0049 | 4.5          | 2.55         | 0.10                        | 0.002                       | 0.002                             | 0.05                       | Starting       | Downstream     | HGL            |                |                |                 |                           |         | 0.05       | 2328.64 | 2328.54 | 2327.62  | 2327.52 | Yes | FL Surface = 2329.61 |
| 169+98                                                 | SDMH-RT1  |                | 1.50   | 2325.76 | 2325.94 | 57.23            | 1.77         | 0.013 | 0.0049 | 4.5          | 2.55         | 0.10                        | 0.002                       | 0.001                             | 0.07                       | Starting       | Downstream     | HGL            |                |                | 0.360           |                           |         | 0.43       | 2329.51 | 2329.41 | 2327.54  | 2327.44 | Yes | Rim = 2331.49        |
| SDMH-RT1                                               | DI-RB-02  |                | 1.50   | 2325.94 | 2327.01 | 53.54            | 1.77         | 0.013 | 0.0049 | 2.5          | 1.41         | 0.03                        | 0.001                       | 0.001                             | 0.03                       | Starting       | Downstream     | HGL            |                |                |                 |                           |         | 0.03       | 2329.47 | 2329.44 | 2328.54  | 2328.51 | Yes | FL Surface = 2329.90 |
| SDMH-RT1                                               | DI-RB01   |                | 1.50   | 2326.94 | 2327.48 | 41.51            | 1.77         | 0.013 | 0.0049 | 2.0          | 1.13         | 0.02                        | 0.000                       | 0.000                             | 0.01                       | Starting       | Downstream     | HGL            |                |                |                 |                           |         | 0.01       | 2329.44 | 2329.42 | 2329.00  | 2328.98 | Yes | FL Surface = 2330.94 |
| 22+70                                                  | DI-TP05   |                | 1.50   | 2326.17 | 2326.43 | 32.63            | 1.77         | 0.013 | 0.0049 | 5.5          | 3.11         | 0.15                        | 0.003                       | 0.003                             | 0.09                       | Starting       | Downstream     | HGL            |                |                |                 |                           |         | 0.09       | 2329.49 | 2329.34 | 2328.08  | 2327.93 | Yes | FL Surface = 2330.52 |
| 22+42                                                  | DI-TP04   |                | 2.50   | 2325.71 | 2326.21 | 33.39            | 4.91         | 0.013 | 0.0049 | 20.0         | 4.07         | 0.26                        | 0.002                       | 0.002                             | 0.08                       | Starting       | Downstream     | HGL            |                |                |                 |                           |         | 0.08       | 2330.00 | 2329.74 | 2328.97  | 2328.71 | Yes | FL Surface = 2330.82 |
| 22+42                                                  | DI-TP03   |                | 2.50   | 2325.71 | 2326.21 | 37.25            | 4.91         | 0.013 | 0.0049 | 17.5         | 3.57         | 0.20                        | 0.002                       | 0.002                             | 0.07                       | Starting       | Downstream     | HGL            |                |                |                 |                           |         | 0.07       | 2329.93 | 2329.73 | 2328.91  | 2328.71 | Yes | FL Surface = 2330.92 |
| 22+09                                                  | DI-TP02   |                | 2.50   | 2326.06 | 2326.31 | 33.85            | 4.91         | 0.013 | 0.0049 | 66.0         | 13.45        | 2.81                        | 0.026                       | 0.026                             | 0.87                       | Starting       | Downstream     | HGL            |                |                |                 |                           |         | 0.87       | 2333.65 | 2330.84 | 2331.62  | 2328.81 | Yes | FL Surface = 2330.94 |
| 22+09                                                  | DI-TP01   |                | 2.50   | 2326.06 | 2326.40 | 39.28            | 4.91         | 0.013 | 0.0049 | 65.0         | 13.24        | 2.72                        | 0.025                       | 0.025                             | 0.98                       | Starting       | Downstream     | HGL            |                |                |                 |                           |         | 0.98       | 2333.68 | 2330.95 | 2331.62  | 2328.90 | Yes | FL Surface = 2331.05 |

FIGURE D-9

# FIGURE D-10

---

## Worksheet for DI#TP01-Q10

---

### Project Description

Solve For                      Efficiency

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 16.50        | ft <sup>3</sup> /s |
| Slope                  | 0.38         | %                  |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.67         | %                  |
| Road Cross Slope       | 1.90         | %                  |
| Roughness Coefficient  | 0.015        |                    |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 17.50        | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 17.50        | ft                 |

### Options

|                    |              |
|--------------------|--------------|
| Calculation Option | Use Both     |
| Grate Flow Option  | Exclude None |

### Results

|                           |         |                    |
|---------------------------|---------|--------------------|
| Efficiency                | 92.31   | %                  |
| Intercepted Flow          | 15.23   | ft <sup>3</sup> /s |
| Bypass Flow               | 1.27    | ft <sup>3</sup> /s |
| Spread                    | 24.67   | ft                 |
| Depth                     | 0.57    | ft                 |
| Flow Area                 | 5.86    | ft <sup>2</sup>    |
| Gutter Depression         | 0.10    | ft                 |
| Total Depression          | 0.27    | ft                 |
| Velocity                  | 2.82    | ft/s               |
| Splash Over Velocity      | 44.17   | ft/s               |
| Frontal Flow Factor       | 1.00    |                    |
| Side Flow Factor          | 0.74    |                    |
| Grate Flow Ratio          | 0.18    |                    |
| Equivalent Cross Slope    | 0.05099 | ft/ft              |
| Active Grate Length       | 8.75    | ft                 |
| Length Factor             | 0.32    |                    |
| Total Interception Length | 27.12   | ft                 |

---



---

## Worksheet for DI#TP01-Q10

---

### Messages

#### Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

## Worksheet for DI#TP01-Q100

### Project Description

Solve For

Efficiency

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 91.00        | ft <sup>3</sup> /s |
| Slope                  | 0.38         | %                  |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.67         | %                  |
| Road Cross Slope       | 1.90         | %                  |
| Roughness Coefficient  | 0.015        |                    |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 17.50        | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 17.50        | ft                 |

### Options

Calculation Option

Use Both

Grate Flow Option

Exclude None

### Results

|                           |         |                    |
|---------------------------|---------|--------------------|
| Efficiency                | 71.75   | %                  |
| Intercepted Flow          | 65.30   | ft <sup>3</sup> /s |
| Bypass Flow               | 25.70   | ft <sup>3</sup> /s |
| Spread                    | 47.14   | ft                 |
| Depth                     | 1.00    | ft                 |
| Flow Area                 | 21.19   | ft <sup>2</sup>    |
| Gutter Depression         | 0.10    | ft                 |
| Total Depression          | 0.27    | ft                 |
| Velocity                  | 4.29    | ft/s               |
| Splash Over Velocity      | 44.17   | ft/s               |
| Frontal Flow Factor       | 1.00    |                    |
| Side Flow Factor          | 0.57    |                    |
| Grate Flow Ratio          | 0.09    |                    |
| Equivalent Cross Slope    | 0.03510 | ft/ft              |
| Active Grate Length       | 8.75    | ft                 |
| Length Factor             | 0.13    |                    |
| Total Interception Length | 69.51   | ft                 |

---

## Worksheet for DI#TP01-Q100

---

### Messages

#### Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).



## Worksheet for DI#TP02-Q10

### Project Description

Solve For

Efficiency

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 16.50        | ft <sup>3</sup> /s |
| Slope                  | 0.38         | %                  |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.67         | %                  |
| Road Cross Slope       | 2.00         | %                  |
| Roughness Coefficient  | 0.015        |                    |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 17.50        | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 17.50        | ft                 |

### Options

Calculation Option

Use Both

Grate Flow Option

Exclude None

### Results

|                           |         |                    |
|---------------------------|---------|--------------------|
| Efficiency                | 92.71   | %                  |
| Intercepted Flow          | 15.30   | ft <sup>3</sup> /s |
| Bypass Flow               | 1.20    | ft <sup>3</sup> /s |
| Spread                    | 23.89   | ft                 |
| Depth                     | 0.58    | ft                 |
| Flow Area                 | 5.78    | ft <sup>2</sup>    |
| Gutter Depression         | 0.10    | ft                 |
| Total Depression          | 0.27    | ft                 |
| Velocity                  | 2.85    | ft/s               |
| Splash Over Velocity      | 44.17   | ft/s               |
| Frontal Flow Factor       | 1.00    |                    |
| Side Flow Factor          | 0.75    |                    |
| Grate Flow Ratio          | 0.18    |                    |
| Equivalent Cross Slope    | 0.05261 | ft/ft              |
| Active Grate Length       | 8.75    | ft                 |
| Length Factor             | 0.33    |                    |
| Total Interception Length | 26.61   | ft                 |

---

## Worksheet for DI#TP02-Q10

---

### Messages

#### Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

## Worksheet for DI#TP02-Q100

### Project Description

Solve For

Efficiency

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 91.00        | ft <sup>3</sup> /s |
| Slope                  | 0.38         | %                  |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.67         | %                  |
| Road Cross Slope       | 2.00         | %                  |
| Roughness Coefficient  | 0.015        |                    |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 17.50        | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 17.50        | ft                 |

### Options

Calculation Option

Use Both

Grate Flow Option

Exclude None

### Results

|                           |         |                    |
|---------------------------|---------|--------------------|
| Efficiency                | 72.54   | %                  |
| Intercepted Flow          | 66.01   | ft <sup>3</sup> /s |
| Bypass Flow               | 24.99   | ft <sup>3</sup> /s |
| Spread                    | 45.65   | ft                 |
| Depth                     | 1.01    | ft                 |
| Flow Area                 | 20.92   | ft <sup>2</sup>    |
| Gutter Depression         | 0.10    | ft                 |
| Total Depression          | 0.27    | ft                 |
| Velocity                  | 4.35    | ft/s               |
| Splash Over Velocity      | 44.17   | ft/s               |
| Frontal Flow Factor       | 1.00    |                    |
| Side Flow Factor          | 0.58    |                    |
| Grate Flow Ratio          | 0.09    |                    |
| Equivalent Cross Slope    | 0.03647 | ft/ft              |
| Active Grate Length       | 8.75    | ft                 |
| Length Factor             | 0.13    |                    |
| Total Interception Length | 67.93   | ft                 |



---

## Worksheet for DI#TP02-Q100

---

### Messages

#### Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

---

## Worksheet for DI #TP03-Q10

---

### Project Description

Solve For

Efficiency

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 1.50         | ft <sup>3</sup> /s |
| Slope                  | 0.48         | %                  |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.67         | %                  |
| Road Cross Slope       | 1.60         | %                  |
| Roughness Coefficient  | 0.015        |                    |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 12.50        | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 12.50        | ft                 |

### Options

Calculation Option

Use Both

Grate Flow Option

Exclude None

### Results

|                           |         |                    |
|---------------------------|---------|--------------------|
| Efficiency                | 100.00  | %                  |
| Intercepted Flow          | 1.50    | ft <sup>3</sup> /s |
| Bypass Flow               | 0.00    | ft <sup>3</sup> /s |
| Spread                    | 9.97    | ft                 |
| Depth                     | 0.27    | ft                 |
| Flow Area                 | 0.87    | ft <sup>2</sup>    |
| Gutter Depression         | 0.11    | ft                 |
| Total Depression          | 0.27    | ft                 |
| Velocity                  | 1.71    | ft/s               |
| Splash Over Velocity      | 16.48   | ft/s               |
| Frontal Flow Factor       | 1.00    |                    |
| Side Flow Factor          | 0.73    |                    |
| Grate Flow Ratio          | 0.48    |                    |
| Equivalent Cross Slope    | 0.10338 | ft/ft              |
| Active Grate Length       | 6.25    | ft                 |
| Length Factor             | 0.90    |                    |
| Total Interception Length | 6.95    | ft                 |

---

---

## Worksheet for DI #TP03-Q10

---

### Messages

#### Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).



## Worksheet for DI #TP03-Q100

### Project Description

Solve For

Efficiency

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 26.00        | ft <sup>3</sup> /s |
| Slope                  | 0.48         | %                  |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.67         | %                  |
| Road Cross Slope       | 1.60         | %                  |
| Roughness Coefficient  | 0.015        |                    |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 12.50        | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 12.50        | ft                 |

### Options

Calculation Option

Use Both

Grate Flow Option

Exclude None

### Results

|                           |         |                    |
|---------------------------|---------|--------------------|
| Efficiency                | 68.77   | %                  |
| Intercepted Flow          | 17.88   | ft <sup>3</sup> /s |
| Bypass Flow               | 8.12    | ft <sup>3</sup> /s |
| Spread                    | 31.25   | ft                 |
| Depth                     | 0.61    | ft                 |
| Flow Area                 | 7.89    | ft <sup>2</sup>    |
| Gutter Depression         | 0.11    | ft                 |
| Total Depression          | 0.27    | ft                 |
| Velocity                  | 3.29    | ft/s               |
| Splash Over Velocity      | 16.48   | ft/s               |
| Frontal Flow Factor       | 1.00    |                    |
| Side Flow Factor          | 0.46    |                    |
| Grate Flow Ratio          | 0.14    |                    |
| Equivalent Cross Slope    | 0.04200 | ft/ft              |
| Active Grate Length       | 6.25    | ft                 |
| Length Factor             | 0.16    |                    |
| Total Interception Length | 39.55   | ft                 |

---

## Worksheet for DI #TP03-Q100

---

### Messages

#### Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

## Worksheet for DI #TP04-Q10

### Project Description

Solve For

Efficiency

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 1.50         | ft <sup>3</sup> /s |
| Slope                  | 0.25         | %                  |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.67         | %                  |
| Road Cross Slope       | 1.80         | %                  |
| Roughness Coefficient  | 0.016        |                    |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 12.50        | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 12.50        | ft                 |

### Options

Calculation Option

Use Both

Grate Flow Option

Exclude None

### Results

|                           |         |                    |
|---------------------------|---------|--------------------|
| Efficiency                | 100.00  | %                  |
| Intercepted Flow          | 1.50    | ft <sup>3</sup> /s |
| Bypass Flow               | 0.00    | ft <sup>3</sup> /s |
| Spread                    | 10.97   | ft                 |
| Depth                     | 0.30    | ft                 |
| Flow Area                 | 1.16    | ft <sup>2</sup>    |
| Gutter Depression         | 0.10    | ft                 |
| Total Depression          | 0.27    | ft                 |
| Velocity                  | 1.29    | ft/s               |
| Splash Over Velocity      | 16.48   | ft/s               |
| Frontal Flow Factor       | 1.00    |                    |
| Side Flow Factor          | 0.84    |                    |
| Grate Flow Ratio          | 0.42    |                    |
| Equivalent Cross Slope    | 0.09409 | ft/ft              |
| Active Grate Length       | 6.25    | ft                 |
| Length Factor             | 1.07    |                    |
| Total Interception Length | 5.82    | ft                 |



---

## Worksheet for DI #TP04-Q10

---

### Messages

#### Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

## Worksheet for DI #TP04-Q100

### Project Description

Solve For Efficiency

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 25.00        | ft <sup>3</sup> /s |
| Slope                  | 0.25         | %                  |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.67         | %                  |
| Road Cross Slope       | 1.80         | %                  |
| Roughness Coefficient  | 0.016        |                    |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 12.50        | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 12.50        | ft                 |

### Options

Calculation Option Use Both  
Grate Flow Option Exclude None

### Results

|                           |         |                    |
|---------------------------|---------|--------------------|
| Efficiency                | 80.35   | %                  |
| Intercepted Flow          | 20.09   | ft <sup>3</sup> /s |
| Bypass Flow               | 4.91    | ft <sup>3</sup> /s |
| Spread                    | 33.18   | ft                 |
| Depth                     | 0.70    | ft                 |
| Flow Area                 | 9.99    | ft <sup>2</sup>    |
| Gutter Depression         | 0.10    | ft                 |
| Total Depression          | 0.27    | ft                 |
| Velocity                  | 2.50    | ft/s               |
| Splash Over Velocity      | 16.48   | ft/s               |
| Frontal Flow Factor       | 1.00    |                    |
| Side Flow Factor          | 0.61    |                    |
| Grate Flow Ratio          | 0.13    |                    |
| Equivalent Cross Slope    | 0.04165 | ft/ft              |
| Active Grate Length       | 6.25    | ft                 |
| Length Factor             | 0.20    |                    |
| Total Interception Length | 30.93   | ft                 |

---

## Worksheet for DI #TP04-Q100

---

### Messages

#### Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).



## Worksheet for DI#RB01-Q10

### Project Description

Solve For

Efficiency

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 0.50         | ft <sup>3</sup> /s |
| Slope                  | 0.46         | %                  |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.67         | %                  |
| Road Cross Slope       | 1.40         | %                  |
| Roughness Coefficient  | 0.015        |                    |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 5.00         | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 5.00         | ft                 |

### Options

Calculation Option

Use Both

Grate Flow Option

Exclude None

### Results

|                           |         |                    |
|---------------------------|---------|--------------------|
| Efficiency                | 100.00  | %                  |
| Intercepted Flow          | 0.50    | ft <sup>3</sup> /s |
| Bypass Flow               | 0.00    | ft <sup>3</sup> /s |
| Spread                    | 6.34    | ft                 |
| Depth                     | 0.20    | ft                 |
| Flow Area                 | 0.36    | ft <sup>2</sup>    |
| Gutter Depression         | 0.11    | ft                 |
| Total Depression          | 0.28    | ft                 |
| Velocity                  | 1.38    | ft/s               |
| Splash Over Velocity      | 6.60    | ft/s               |
| Frontal Flow Factor       | 1.00    |                    |
| Side Flow Factor          | 0.30    |                    |
| Grate Flow Ratio          | 0.73    |                    |
| Equivalent Cross Slope    | 0.14750 | ft/ft              |
| Active Grate Length       | 2.50    | ft                 |
| Length Factor             | 0.72    |                    |
| Total Interception Length | 3.50    | ft                 |

---

## Worksheet for DI#RB01-Q10

---

Messages

Messages

Grate Length should be within the  
defined range of HEC-22's Chart 5  
(approx. 0.5-4.5 ft / 0.15-1.35 m).

## Worksheet for DI#RB01-Q100

### Project Description

Solve For

Efficiency

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 2.50         | ft <sup>3</sup> /s |
| Slope                  | 0.46         | %                  |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.67         | %                  |
| Road Cross Slope       | 1.40         | %                  |
| Roughness Coefficient  | 0.015        |                    |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 5.00         | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 5.00         | ft                 |

### Options

Calculation Option

Use Both

Grate Flow Option

Exclude None

### Results

|                           |         |                    |
|---------------------------|---------|--------------------|
| Efficiency                | 75.89   | %                  |
| Intercepted Flow          | 1.90    | ft <sup>3</sup> /s |
| Bypass Flow               | 0.60    | ft <sup>3</sup> /s |
| Spread                    | 13.62   | ft                 |
| Depth                     | 0.30    | ft                 |
| Flow Area                 | 1.38    | ft <sup>2</sup>    |
| Gutter Depression         | 0.11    | ft                 |
| Total Depression          | 0.28    | ft                 |
| Velocity                  | 1.81    | ft/s               |
| Splash Over Velocity      | 6.60    | ft/s               |
| Frontal Flow Factor       | 1.00    |                    |
| Side Flow Factor          | 0.21    |                    |
| Grate Flow Ratio          | 0.37    |                    |
| Equivalent Cross Slope    | 0.08110 | ft/ft              |
| Active Grate Length       | 2.50    | ft                 |
| Length Factor             | 0.25    |                    |
| Total Interception Length | 9.84    | ft                 |



---

## Worksheet for DI#RB01-Q100

---

### Messages

#### Messages

Grate Length should be within the  
defined range of HEC-22's Chart 5  
(approx. 0.5-4.5 ft / 0.15-1.35 m).

## Worksheet for DI#RB03-Q10

### Project Description

Solve For

Efficiency

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 0.00         | ft <sup>3</sup> /s |
| Slope                  | 0.35         | %                  |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.67         | %                  |
| Road Cross Slope       | 1.60         | %                  |
| Roughness Coefficient  | 0.015        |                    |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 5.00         | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 5.00         | ft                 |

### Options

Calculation Option

Use Both

Grate Flow Option

Exclude None

### Results

|                           |         |                    |
|---------------------------|---------|--------------------|
| Efficiency                | 100.00  | %                  |
| Intercepted Flow          | 0.00    | ft <sup>3</sup> /s |
| Bypass Flow               | 0.00    | ft <sup>3</sup> /s |
| Spread                    | 0.26    | ft                 |
| Depth                     | 0.02    | ft                 |
| Flow Area                 | 0.00    | ft <sup>2</sup>    |
| Gutter Depression         | 0.11    | ft                 |
| Total Depression          | 0.27    | ft                 |
| Velocity                  | 0.35    | ft/s               |
| Splash Over Velocity      | 6.60    | ft/s               |
| Frontal Flow Factor       | 1.00    |                    |
| Side Flow Factor          | 0.86    |                    |
| Grate Flow Ratio          | 1.00    |                    |
| Equivalent Cross Slope    | 0.19781 | ft/ft              |
| Active Grate Length       | 2.50    | ft                 |
| Length Factor             | 12.59   |                    |
| Total Interception Length | 0.20    | ft                 |

---

## Worksheet for DI#RB03-Q10

---

### Messages

#### Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).



## Worksheet for DI#RB03-Q100

### Project Description

Solve For

Efficiency

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 8.50         | ft <sup>3</sup> /s |
| Slope                  | 0.35         | %                  |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.67         | %                  |
| Road Cross Slope       | 1.60         | %                  |
| Roughness Coefficient  | 0.015        |                    |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 5.00         | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 5.00         | ft                 |

### Options

Calculation Option

Use Both

Grate Flow Option

Exclude None

### Results

|                           |         |                    |
|---------------------------|---------|--------------------|
| Efficiency                | 51.85   | %                  |
| Intercepted Flow          | 4.41    | ft <sup>3</sup> /s |
| Bypass Flow               | 4.09    | ft <sup>3</sup> /s |
| Spread                    | 21.60   | ft                 |
| Depth                     | 0.45    | ft                 |
| Flow Area                 | 3.81    | ft <sup>2</sup>    |
| Gutter Depression         | 0.11    | ft                 |
| Total Depression          | 0.27    | ft                 |
| Velocity                  | 2.23    | ft/s               |
| Splash Over Velocity      | 6.60    | ft/s               |
| Frontal Flow Factor       | 1.00    |                    |
| Side Flow Factor          | 0.17    |                    |
| Grate Flow Ratio          | 0.21    |                    |
| Equivalent Cross Slope    | 0.05486 | ft/ft              |
| Active Grate Length       | 2.50    | ft                 |
| Length Factor             | 0.13    |                    |
| Total Interception Length | 19.17   | ft                 |

---

## Worksheet for DI#RB03-Q100

---

### Messages

#### Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

---

## Worksheet for DI#RB04-Q10

---

### Project Description

Solve For

Efficiency

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 2.50         | ft <sup>3</sup> /s |
| Slope                  | 0.45         | %                  |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.67         | %                  |
| Road Cross Slope       | 3.00         | %                  |
| Roughness Coefficient  | 0.015        |                    |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 2.50         | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 2.50         | ft                 |

### Options

Calculation Option

Use Both

Grate Flow Option

Exclude None

### Results

|                           |         |                    |
|---------------------------|---------|--------------------|
| Efficiency                | 67.98   | %                  |
| Intercepted Flow          | 1.70    | ft <sup>3</sup> /s |
| Bypass Flow               | 0.80    | ft <sup>3</sup> /s |
| Spread                    | 8.55    | ft                 |
| Depth                     | 0.34    | ft                 |
| Flow Area                 | 1.16    | ft <sup>2</sup>    |
| Gutter Depression         | 0.09    | ft                 |
| Total Depression          | 0.25    | ft                 |
| Velocity                  | 2.16    | ft/s               |
| Splash Over Velocity      | 4.61    | ft/s               |
| Frontal Flow Factor       | 1.00    |                    |
| Side Flow Factor          | 0.08    |                    |
| Grate Flow Ratio          | 0.47    |                    |
| Equivalent Cross Slope    | 0.10934 | ft/ft              |
| Active Grate Length       | 1.25    | ft                 |
| Length Factor             | 0.15    |                    |
| Total Interception Length | 8.17    | ft                 |

---

---

## Worksheet for DI#RB04-Q10

---

### Messages

#### Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).



## Worksheet for DI#RB04-Q100

### Project Description

Solve For Efficiency

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 8.50         | ft <sup>3</sup> /s |
| Slope                  | 0.45         | %                  |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.67         | %                  |
| Road Cross Slope       | 3.00         | %                  |
| Roughness Coefficient  | 0.015        |                    |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 2.50         | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 2.50         | ft                 |

### Options

|                    |              |
|--------------------|--------------|
| Calculation Option | Use Both     |
| Grate Flow Option  | Exclude None |

### Results

|                           |         |                    |
|---------------------------|---------|--------------------|
| Efficiency                | 43.49   | %                  |
| Intercepted Flow          | 3.70    | ft <sup>3</sup> /s |
| Bypass Flow               | 4.80    | ft <sup>3</sup> /s |
| Spread                    | 13.91   | ft                 |
| Depth                     | 0.50    | ft                 |
| Flow Area                 | 2.97    | ft <sup>2</sup>    |
| Gutter Depression         | 0.09    | ft                 |
| Total Depression          | 0.25    | ft                 |
| Velocity                  | 2.87    | ft/s               |
| Splash Over Velocity      | 4.61    | ft/s               |
| Frontal Flow Factor       | 1.00    |                    |
| Side Flow Factor          | 0.05    |                    |
| Grate Flow Ratio          | 0.30    |                    |
| Equivalent Cross Slope    | 0.07990 | ft/ft              |
| Active Grate Length       | 1.25    | ft                 |
| Length Factor             | 0.08    |                    |
| Total Interception Length | 16.49   | ft                 |

---

## Worksheet for DI#RB04-Q100

---

### Messages

#### Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

---

## Worksheet for DI#RB05-Q10

---

### Project Description

Solve For

Efficiency

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 2.50         | ft <sup>3</sup> /s |
| Slope                  | 0.30         | %                  |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.67         | %                  |
| Road Cross Slope       | 1.80         | %                  |
| Roughness Coefficient  | 0.016        |                    |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 2.50         | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 2.50         | ft                 |

### Options

Calculation Option

Use Both

Grate Flow Option

Exclude None

### Results

|                           |         |                    |
|---------------------------|---------|--------------------|
| Efficiency                | 59.55   | %                  |
| Intercepted Flow          | 1.49    | ft <sup>3</sup> /s |
| Bypass Flow               | 1.01    | ft <sup>3</sup> /s |
| Spread                    | 13.06   | ft                 |
| Depth                     | 0.34    | ft                 |
| Flow Area                 | 1.61    | ft <sup>2</sup>    |
| Gutter Depression         | 0.10    | ft                 |
| Total Depression          | 0.27    | ft                 |
| Velocity                  | 1.55    | ft/s               |
| Splash Over Velocity      | 4.61    | ft/s               |
| Frontal Flow Factor       | 1.00    |                    |
| Side Flow Factor          | 0.08    |                    |
| Grate Flow Ratio          | 0.35    |                    |
| Equivalent Cross Slope    | 0.08180 | ft/ft              |
| Active Grate Length       | 1.25    | ft                 |
| Length Factor             | 0.15    |                    |
| Total Interception Length | 8.28    | ft                 |

---

---

## Worksheet for DI#RB05-Q10

---

### Messages

#### Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).



## Worksheet for DI#RB05-Q100

### Project Description

Solve For

Efficiency

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 4.50         | ft <sup>3</sup> /s |
| Slope                  | 0.30         | %                  |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.67         | %                  |
| Road Cross Slope       | 1.80         | %                  |
| Roughness Coefficient  | 0.016        |                    |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 2.50         | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 2.50         | ft                 |

### Options

Calculation Option

Use Both

Grate Flow Option

Exclude None

### Results

|                           |         |                    |
|---------------------------|---------|--------------------|
| Efficiency                | 46.96   | %                  |
| Intercepted Flow          | 2.11    | ft <sup>3</sup> /s |
| Bypass Flow               | 2.39    | ft <sup>3</sup> /s |
| Spread                    | 16.54   | ft                 |
| Depth                     | 0.40    | ft                 |
| Flow Area                 | 2.54    | ft <sup>2</sup>    |
| Gutter Depression         | 0.10    | ft                 |
| Total Depression          | 0.27    | ft                 |
| Velocity                  | 1.77    | ft/s               |
| Splash Over Velocity      | 4.61    | ft/s               |
| Frontal Flow Factor       | 1.00    |                    |
| Side Flow Factor          | 0.07    |                    |
| Grate Flow Ratio          | 0.28    |                    |
| Equivalent Cross Slope    | 0.06784 | ft/ft              |
| Active Grate Length       | 1.25    | ft                 |
| Length Factor             | 0.11    |                    |
| Total Interception Length | 11.87   | ft                 |

---

## Worksheet for DI#RB05-Q100

---

### Messages

#### Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

## Worksheet for DI#RB06-Q10

### Project Description

Solve For

Efficiency

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 1.00         | ft <sup>3</sup> /s |
| Slope                  | 0.35         | %                  |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.67         | %                  |
| Road Cross Slope       | 2.30         | %                  |
| Roughness Coefficient  | 0.016        |                    |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 5.00         | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 5.00         | ft                 |

### Options

Calculation Option

Use Both

Grate Flow Option

Exclude None

### Results

|                           |         |                    |
|---------------------------|---------|--------------------|
| Efficiency                | 98.80   | %                  |
| Intercepted Flow          | 0.99    | ft <sup>3</sup> /s |
| Bypass Flow               | 0.01    | ft <sup>3</sup> /s |
| Spread                    | 7.36    | ft                 |
| Depth                     | 0.26    | ft                 |
| Flow Area                 | 0.69    | ft <sup>2</sup>    |
| Gutter Depression         | 0.10    | ft                 |
| Total Depression          | 0.26    | ft                 |
| Velocity                  | 1.44    | ft/s               |
| Splash Over Velocity      | 6.60    | ft/s               |
| Frontal Flow Factor       | 1.00    |                    |
| Side Flow Factor          | 0.40    |                    |
| Grate Flow Ratio          | 0.57    |                    |
| Equivalent Cross Slope    | 0.12321 | ft/ft              |
| Active Grate Length       | 2.50    | ft                 |
| Length Factor             | 0.54    |                    |
| Total Interception Length | 4.62    | ft                 |

---

## Worksheet for DI#RB06-Q10

---

### Messages

#### Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).



## Worksheet for DI#RB06-Q100

### Project Description

Solve For

Efficiency

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 5.00         | ft <sup>3</sup> /s |
| Slope                  | 0.35         | %                  |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.67         | %                  |
| Road Cross Slope       | 2.30         | %                  |
| Roughness Coefficient  | 0.016        |                    |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 5.00         | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 5.00         | ft                 |

### Options

Calculation Option

Use Both

Grate Flow Option

Exclude None

### Results

|                           |         |                    |
|---------------------------|---------|--------------------|
| Efficiency                | 70.05   | %                  |
| Intercepted Flow          | 3.50    | ft <sup>3</sup> /s |
| Bypass Flow               | 1.50    | ft <sup>3</sup> /s |
| Spread                    | 14.36   | ft                 |
| Depth                     | 0.43    | ft                 |
| Flow Area                 | 2.44    | ft <sup>2</sup>    |
| Gutter Depression         | 0.10    | ft                 |
| Total Depression          | 0.26    | ft                 |
| Velocity                  | 2.05    | ft/s               |
| Splash Over Velocity      | 6.60    | ft/s               |
| Frontal Flow Factor       | 1.00    |                    |
| Side Flow Factor          | 0.26    |                    |
| Grate Flow Ratio          | 0.30    |                    |
| Equivalent Cross Slope    | 0.07607 | ft/ft              |
| Active Grate Length       | 2.50    | ft                 |
| Length Factor             | 0.21    |                    |
| Total Interception Length | 12.13   | ft                 |

---

## Worksheet for DI#RB06-Q100

---

### Messages

#### Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

---

## Worksheet for DI#EXRB01-Q10

---

### Project Description

Solve For

Efficiency

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 5.00         | ft <sup>3</sup> /s |
| Slope                  | 0.80         | %                  |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.67         | %                  |
| Road Cross Slope       | 1.10         | %                  |
| Roughness Coefficient  | 0.015        |                    |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 17.50        | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 17.50        | ft                 |

### Options

Calculation Option

Use Both

Grate Flow Option

Exclude None

### Results

|                           |         |                    |
|---------------------------|---------|--------------------|
| Efficiency                | 96.26   | %                  |
| Intercepted Flow          | 4.81    | ft <sup>3</sup> /s |
| Bypass Flow               | 0.19    | ft <sup>3</sup> /s |
| Spread                    | 18.80   | ft                 |
| Depth                     | 0.32    | ft                 |
| Flow Area                 | 2.03    | ft <sup>2</sup>    |
| Gutter Depression         | 0.11    | ft                 |
| Total Depression          | 0.28    | ft                 |
| Velocity                  | 2.46    | ft/s               |
| Splash Over Velocity      | 44.17   | ft/s               |
| Frontal Flow Factor       | 1.00    |                    |
| Side Flow Factor          | 0.68    |                    |
| Grate Flow Ratio          | 0.28    |                    |
| Equivalent Cross Slope    | 0.06264 | ft/ft              |
| Active Grate Length       | 8.75    | ft                 |
| Length Factor             | 0.48    |                    |
| Total Interception Length | 18.15   | ft                 |

---

---

## Worksheet for DI#EXRB01-Q10

---

### Messages

#### Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).



## Worksheet for DI#EXRB01-Q100

### Project Description

Solve For Efficiency

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 12.00        | ft <sup>3</sup> /s |
| Slope                  | 0.80         | %                  |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.67         | %                  |
| Road Cross Slope       | 1.10         | %                  |
| Roughness Coefficient  | 0.015        |                    |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 17.50        | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 17.50        | ft                 |

### Options

|                    |              |
|--------------------|--------------|
| Calculation Option | Use Both     |
| Grate Flow Option  | Exclude None |

### Results

|                           |         |                    |
|---------------------------|---------|--------------------|
| Efficiency                | 85.30   | %                  |
| Intercepted Flow          | 10.24   | ft <sup>3</sup> /s |
| Bypass Flow               | 1.76    | ft <sup>3</sup> /s |
| Spread                    | 26.60   | ft                 |
| Depth                     | 0.41    | ft                 |
| Flow Area                 | 3.98    | ft <sup>2</sup>    |
| Gutter Depression         | 0.11    | ft                 |
| Total Depression          | 0.28    | ft                 |
| Velocity                  | 3.02    | ft/s               |
| Splash Over Velocity      | 44.17   | ft/s               |
| Frontal Flow Factor       | 1.00    |                    |
| Side Flow Factor          | 0.60    |                    |
| Grate Flow Ratio          | 0.19    |                    |
| Equivalent Cross Slope    | 0.04572 | ft/ft              |
| Active Grate Length       | 8.75    | ft                 |
| Length Factor             | 0.28    |                    |
| Total Interception Length | 31.67   | ft                 |

---

## Worksheet for DI#EXRB01-Q100

---

### Messages

#### Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

## Worksheet for DI#RB10-Q10

### Project Description

Solve For Efficiency

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 1.00         | ft <sup>3</sup> /s |
| Slope                  | 0.50         | %                  |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.67         | %                  |
| Road Cross Slope       | 1.10         | %                  |
| Roughness Coefficient  | 0.015        |                    |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 17.50        | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 17.50        | ft                 |

### Options

|                    |              |
|--------------------|--------------|
| Calculation Option | Use Both     |
| Grate Flow Option  | Exclude None |

### Results

|                           |         |                    |
|---------------------------|---------|--------------------|
| Efficiency                | 100.00  | %                  |
| Intercepted Flow          | 1.00    | ft <sup>3</sup> /s |
| Bypass Flow               | 0.00    | ft <sup>3</sup> /s |
| Spread                    | 10.35   | ft                 |
| Depth                     | 0.23    | ft                 |
| Flow Area                 | 0.67    | ft <sup>2</sup>    |
| Gutter Depression         | 0.11    | ft                 |
| Total Depression          | 0.28    | ft                 |
| Velocity                  | 1.48    | ft/s               |
| Splash Over Velocity      | 44.17   | ft/s               |
| Frontal Flow Factor       | 1.00    |                    |
| Side Flow Factor          | 0.84    |                    |
| Grate Flow Ratio          | 0.52    |                    |
| Equivalent Cross Slope    | 0.10854 | ft/ft              |
| Active Grate Length       | 8.75    | ft                 |
| Length Factor             | 1.52    |                    |
| Total Interception Length | 5.77    | ft                 |

---

## Worksheet for DI#RB10-Q10

---

### Messages

#### Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).



## Worksheet for DI#RB10-Q100

### Project Description

Solve For

Efficiency

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 30.00        | ft <sup>3</sup> /s |
| Slope                  | 0.50         | %                  |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.67         | %                  |
| Road Cross Slope       | 1.10         | %                  |
| Roughness Coefficient  | 0.015        |                    |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 17.50        | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 17.50        | ft                 |

### Options

Calculation Option

Use Both

Grate Flow Option

Exclude None

### Results

|                           |         |                    |
|---------------------------|---------|--------------------|
| Efficiency                | 76.20   | %                  |
| Intercepted Flow          | 22.86   | ft <sup>3</sup> /s |
| Bypass Flow               | 7.14    | ft <sup>3</sup> /s |
| Spread                    | 41.40   | ft                 |
| Depth                     | 0.57    | ft                 |
| Flow Area                 | 9.51    | ft <sup>2</sup>    |
| Gutter Depression         | 0.11    | ft                 |
| Total Depression          | 0.28    | ft                 |
| Velocity                  | 3.15    | ft/s               |
| Splash Over Velocity      | 44.17   | ft/s               |
| Frontal Flow Factor       | 1.00    |                    |
| Side Flow Factor          | 0.58    |                    |
| Grate Flow Ratio          | 0.11    |                    |
| Equivalent Cross Slope    | 0.03199 | ft/ft              |
| Active Grate Length       | 8.75    | ft                 |
| Length Factor             | 0.17    |                    |
| Total Interception Length | 50.07   | ft                 |

---

## Worksheet for DI#RB10-Q100

---

### Messages

#### Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

**TP05**  
**Drop Inlet Orifice Calculation**  
**SOLVE FOR REQUIRED**  
**OPENING AREA**

$$Q=CA(2gh)^{0.5}$$

Inputs:

|                              |             |
|------------------------------|-------------|
| C = Discharge Coefficient=   | <b>0.62</b> |
| Q = Discharge (cfs) =        | <b>5.5</b>  |
| g = Gravity Constant (ft/s)= | <b>32.2</b> |
| h = height of water=         | <b>0.5</b>  |

Result:

|                                               |                    |
|-----------------------------------------------|--------------------|
| A = Required Opening Area (ft <sup>2</sup> )= | <b>1.56</b>        |
| ( area doubled for 50% clogging)              | <b><u>3.13</u></b> |

**SOLVE FOR ACTUAL**  
**GRATE OPENING AREA (GOA)**

$$GOA = (NOG \times OAG) + (COH \times COL)$$

Inputs:

|                                            |             |
|--------------------------------------------|-------------|
| Number of Grates (NOG) =                   | <b>2</b>    |
| Open Area/Grate (OAG) (ft <sup>2</sup> )*= | <b>2.25</b> |
| Curb Opening Height (COH) (ft)=            | <b>0.5</b>  |
| Curb Opening Length (COL) (ft)=            | <b>2.5</b>  |

\*\*The effective Open Area/Grate is  
assumed to be 60% for overall inlet size  
(1.5x2.5)

Result:

|                                               |                    |
|-----------------------------------------------|--------------------|
| Actual Grate Opening Area (ft <sup>2</sup> )= | <b><u>5.75</u></b> |
|-----------------------------------------------|--------------------|

## Worksheet for DI#TP05-Q10

### Project Description

Solve For

Spread

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 0.00         | ft <sup>3</sup> /s |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.97         | %                  |
| Road Cross Slope       | 2.00         | %                  |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 5.00         | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 5.00         | ft                 |
| Opening Height         | 0.50         | ft                 |
| Curb Throat Type       | Horizontal   |                    |
| Throat Incline Angle   | 90.00        | degrees            |

### Options

Calculation Option

Use Both

### Results

|                          |       |                 |
|--------------------------|-------|-----------------|
| Spread                   | 0.75  | ft              |
| Depth                    | -0.02 | ft              |
| Gutter Depression        | 0.10  | ft              |
| Total Depression         | 0.27  | ft              |
| Open Grate Area          | 1.31  | ft <sup>2</sup> |
| Active Grate Weir Length | 6.50  | ft              |



## Worksheet for DI#TP05-Q100

### Project Description

Solve For

Spread

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 5.50         | ft <sup>3</sup> /s |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.97         | %                  |
| Road Cross Slope       | 2.00         | %                  |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 5.00         | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 5.00         | ft                 |
| Opening Height         | 0.50         | ft                 |
| Curb Throat Type       | Horizontal   |                    |
| Throat Incline Angle   | 90.00        | degrees            |

### Options

Calculation Option

Use Both

### Results

|                          |       |                 |
|--------------------------|-------|-----------------|
| Spread                   | 14.65 | ft              |
| Depth                    | 0.40  | ft              |
| Gutter Depression        | 0.10  | ft              |
| Total Depression         | 0.27  | ft              |
| Open Grate Area          | 1.31  | ft <sup>2</sup> |
| Active Grate Weir Length | 6.50  | ft              |

**RB07**  
**Drop Inlet Orifice Calculation**  
**SOLVE FOR REQUIRED**  
**OPENING AREA**

$$Q = CA(2gh)^{0.5}$$

Inputs:

|                                            |      |
|--------------------------------------------|------|
| C = Discharge Coefficient=                 | 0.62 |
| Q = Discharge (cfs) =                      | 2.5  |
| g = Gravity Constant (ft <sup>2</sup> /s)= | 32.2 |
| h = height of water=                       | 0.5  |

Result:

|                                               |             |
|-----------------------------------------------|-------------|
| A = Required Opening Area (ft <sup>2</sup> )= | 0.71        |
| ( area doubled for 50% clogging)              | <u>1.42</u> |

**SOLVE FOR ACTUAL**  
**GRATE OPENING AREA (GOA)**

$$GOA = (NOG \times OAG) + (COH \times COL)$$

Inputs:

|                                            |      |
|--------------------------------------------|------|
| Number of Grates (NOG) =                   | 1    |
| Open Area/Grate (OAG) (ft <sup>2</sup> )*= | 2.25 |
| Curb Opening Height (COH) (ft)=            | 0.5  |
| Curb Opening Length (COL) (ft)=            | 2.5  |

\*\*The effective Open Area/Grate is  
assumed to be 60% for overall inlet size  
(1.5x2.5)

Result:

|                                               |             |
|-----------------------------------------------|-------------|
| Actual Grate Opening Area (ft <sup>2</sup> )= | <u>3.50</u> |
|-----------------------------------------------|-------------|

---

## Worksheet for DI#RB07-Q10

---

### Project Description

Solve For Spread

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 1.00         | ft <sup>3</sup> /s |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.97         | %                  |
| Road Cross Slope       | 2.00         | %                  |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 2.50         | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 2.50         | ft                 |
| Opening Height         | 0.50         | ft                 |
| Curb Throat Type       | Horizontal   |                    |
| Throat Incline Angle   | 90.00        | degrees            |

### Options

Calculation Option Use Both

### Results

|                          |      |                 |
|--------------------------|------|-----------------|
| Spread                   | 5.50 | ft              |
| Depth                    | 0.21 | ft              |
| Gutter Depression        | 0.10 | ft              |
| Total Depression         | 0.27 | ft              |
| Open Grate Area          | 0.66 | ft <sup>2</sup> |
| Active Grate Weir Length | 4.00 | ft              |

---

## Worksheet for DI#RB07-Q100

---

### Project Description

Solve For Spread

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 2.50         | ft <sup>3</sup> /s |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.97         | %                  |
| Road Cross Slope       | 2.00         | %                  |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 2.50         | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 2.50         | ft                 |
| Opening Height         | 0.50         | ft                 |
| Curb Throat Type       | Horizontal   |                    |
| Throat Incline Angle   | 90.00        | degrees            |

### Options

Calculation Option Use Both

### Results

|                          |       |                 |
|--------------------------|-------|-----------------|
| Spread                   | 10.74 | ft              |
| Depth                    | 0.32  | ft              |
| Gutter Depression        | 0.10  | ft              |
| Total Depression         | 0.27  | ft              |
| Open Grate Area          | 0.66  | ft <sup>2</sup> |
| Active Grate Weir Length | 4.00  | ft              |



**RB11**  
**Drop Inlet Orifice Calculation**  
**SOLVE FOR REQUIRED**  
**OPENING AREA**

$$Q=CA(2gh)^{0.5}$$

Inputs:

|                              |      |
|------------------------------|------|
| C = Discharge Coefficient=   | 0.62 |
| Q = Discharge (cfs) =        | 10   |
| g = Gravity Constant (ft/s)= | 32.2 |
| h = height of water=         | 0.5  |

Result:

|                                               |             |
|-----------------------------------------------|-------------|
| A = Required Opening Area (ft <sup>2</sup> )= | 2.84        |
| ( area doubled for 50% clogging)              | <u>5.68</u> |

**SOLVE FOR ACTUAL**  
**GRATE OPENING AREA (GOA)**

$$GOA = (NOG \times OAG) + (COH \times COL)$$

Inputs:

|                                             |      |
|---------------------------------------------|------|
| Number of Grates (NOG) =                    | 3    |
| Open Area/Grate (OAG) (ft <sup>2</sup> )**= | 2.25 |
| Curb Opening Height (COH) (ft)=             | 0.5  |
| Curb Opening Length (COL) (ft)=             | 5    |

\*\*The effective Open Area/Grate is  
assumed to be 60% for overall inlet size  
(1.5x2.5)

Result:

|                                               |             |
|-----------------------------------------------|-------------|
| Actual Grate Opening Area (ft <sup>2</sup> )= | <u>9.25</u> |
|-----------------------------------------------|-------------|

---

## Worksheet for DI#RB11-Q10

---

### Project Description

Solve For

Spread

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 2.00         | ft <sup>3</sup> /s |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.97         | %                  |
| Road Cross Slope       | 2.00         | %                  |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 7.50         | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 7.50         | ft                 |
| Opening Height         | 0.50         | ft                 |
| Curb Throat Type       | Horizontal   |                    |
| Throat Incline Angle   | 90.00        | degrees            |

### Options

Calculation Option

Use Both

### Results

|                          |      |                 |
|--------------------------|------|-----------------|
| Spread                   | 6.56 | ft              |
| Depth                    | 0.24 | ft              |
| Gutter Depression        | 0.10 | ft              |
| Total Depression         | 0.27 | ft              |
| Open Grate Area          | 1.97 | ft <sup>2</sup> |
| Active Grate Weir Length | 9.00 | ft              |

---

## Worksheet for DI#RB11-Q100

---

### Project Description

Solve For

Spread

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 10.00        | ft <sup>3</sup> /s |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.97         | %                  |
| Road Cross Slope       | 2.00         | %                  |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 7.50         | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 7.50         | ft                 |
| Opening Height         | 0.50         | ft                 |
| Curb Throat Type       | Horizontal   |                    |
| Throat Incline Angle   | 90.00        | degrees            |

### Options

Calculation Option

Use Both

### Results

|                          |       |                 |
|--------------------------|-------|-----------------|
| Spread                   | 17.97 | ft              |
| Depth                    | 0.46  | ft              |
| Gutter Depression        | 0.10  | ft              |
| Total Depression         | 0.27  | ft              |
| Open Grate Area          | 1.97  | ft <sup>2</sup> |
| Active Grate Weir Length | 9.00  | ft              |

NDOT Type 2B Calcs  
REQUIRED OPEN AREA VERSUS RUNOFF

$$Q=CA(2gh)^{0.5}$$

Inputs:

C = Discharge Coefficient= **0.62**  
 Q = Discharge (cfs) = **SEE CHART**  
 g = Gravity Constant (ft/s)= **32.2**  
 h = height of water= **SEE CHART**

| Inlet    | Q (cfs) | h (ft) | Open Area (ft <sup>2</sup> ) | Required Open Area (ft <sup>2</sup> ) 1.5Xs for 50% clogging | Notes     |
|----------|---------|--------|------------------------------|--------------------------------------------------------------|-----------|
| NUISANCE | 4       | 0.4    | 1.3                          | 1.9                                                          | Use "A"=2 |
| RB02     | 2.5     | 0.4    | 0.8                          | 1.6                                                          | Use "A"=2 |
| RB08     | 1.5     | 0.4    | 0.5                          | 1.0                                                          | Use "A"=2 |
| RB09     | 2       | 0.4    | 0.6                          | 1.0                                                          | Use "A"=2 |
| RB12     | 4       | 0.4    | 1.3                          | 1.9                                                          | Use "A"=2 |

| Actual Open Areas for NDOT Type 2B<br>Drop Inlet - Assume inlets are 64% open and all Widths = |                         |           |                |
|------------------------------------------------------------------------------------------------|-------------------------|-----------|----------------|
| Length                                                                                         | Area (ft <sup>2</sup> ) | Open Area | Pipe Size (in) |
| 2                                                                                              | 4                       | 2.6       | 15             |
| 2.5                                                                                            | 5                       | 3.2       | 18             |
| 3                                                                                              | 6                       | 3.8       | 24             |
| 3.5                                                                                            | 7                       | 4.5       | 30             |
| 4                                                                                              | 8                       | 5.1       | 36             |
| 4.5                                                                                            | 9                       | 5.8       | 42             |
| 5                                                                                              | 10                      | 6.4       | 48             |



---

## Worksheet for DI#RB02-Q10

---

### Project Description

Solve For

Spread

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 0.50         | ft <sup>3</sup> /s |
| Left Side Slope        | 10.00        | ft/ft (H:V)        |
| Right Side Slope       | 10.00        | ft/ft (H:V)        |
| Bottom Width           | 2.00         | ft                 |
| Grate Width            | 2.00         | ft                 |
| Grate Length           | 2.00         | ft                 |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 3.00         | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |

### Results

|                          |       |                 |
|--------------------------|-------|-----------------|
| Spread                   | 3.00  | ft              |
| Depth                    | -0.07 | ft              |
| Wetted Perimeter         | 0.49  | ft              |
| Top Width                | 0.50  | ft              |
| Open Grate Area          | 0.70  | ft <sup>2</sup> |
| Active Grate Weir Length | 6.00  | ft              |

---

## Worksheet for DI#RB02-Q100

---

### Project Description

Solve For

Spread

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 2.50         | ft <sup>3</sup> /s |
| Left Side Slope        | 10.00        | ft/ft (H:V)        |
| Right Side Slope       | 10.00        | ft/ft (H:V)        |
| Bottom Width           | 2.00         | ft                 |
| Grate Width            | 2.00         | ft                 |
| Grate Length           | 2.00         | ft                 |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 3.00         | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |

### Results

|                          |      |                 |
|--------------------------|------|-----------------|
| Spread                   | 7.50 | ft              |
| Depth                    | 0.27 | ft              |
| Wetted Perimeter         | 7.53 | ft              |
| Top Width                | 7.50 | ft              |
| Open Grate Area          | 0.70 | ft <sup>2</sup> |
| Active Grate Weir Length | 6.00 | ft              |

---

## Worksheet for DI#RB08

---

### Project Description

Solve For

Spread

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 1.50         | ft <sup>3</sup> /s |
| Gutter Width           | 1.50         | ft                 |
| Gutter Cross Slope     | 8.97         | %                  |
| Road Cross Slope       | 2.00         | %                  |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 1.50         | ft                 |
| Grate Width            | 1.50         | ft                 |
| Grate Length           | 5.00         | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |
| Curb Opening Length    | 5.00         | ft                 |
| Opening Height         | 0.50         | ft                 |
| Curb Throat Type       | Horizontal   |                    |
| Throat Incline Angle   | 90.00        | degrees            |

### Options

Calculation Option

Use Both

### Results

|                          |      |                 |
|--------------------------|------|-----------------|
| Spread                   | 6.20 | ft              |
| Depth                    | 0.23 | ft              |
| Gutter Depression        | 0.10 | ft              |
| Total Depression         | 0.27 | ft              |
| Open Grate Area          | 1.31 | ft <sup>2</sup> |
| Active Grate Weir Length | 6.50 | ft              |

## Worksheet for DI#RB09-Q10

### Project Description

Solve For

Spread

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 1.00         | ft <sup>3</sup> /s |
| Left Side Slope        | 10.00        | ft/ft (H:V)        |
| Right Side Slope       | 10.00        | ft/ft (H:V)        |
| Bottom Width           | 2.00         | ft                 |
| Grate Width            | 2.00         | ft                 |
| Grate Length           | 2.00         | ft                 |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 3.00         | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |

### Results

|                          |       |                 |
|--------------------------|-------|-----------------|
| Spread                   | 3.00  | ft              |
| Depth                    | -0.02 | ft              |
| Wetted Perimeter         | 1.58  | ft              |
| Top Width                | 1.58  | ft              |
| Open Grate Area          | 0.70  | ft <sup>2</sup> |
| Active Grate Weir Length | 6.00  | ft              |



## Worksheet for DI#RB09-Q100

### Project Description

Solve For

Spread

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 2.00         | ft <sup>3</sup> /s |
| Left Side Slope        | 10.00        | ft/ft (H:V)        |
| Right Side Slope       | 10.00        | ft/ft (H:V)        |
| Bottom Width           | 2.00         | ft                 |
| Grate Width            | 2.00         | ft                 |
| Grate Length           | 2.00         | ft                 |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 3.00         | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |

### Results

|                          |      |                 |
|--------------------------|------|-----------------|
| Spread                   | 4.32 | ft              |
| Depth                    | 0.12 | ft              |
| Wetted Perimeter         | 4.33 | ft              |
| Top Width                | 4.32 | ft              |
| Open Grate Area          | 0.70 | ft <sup>2</sup> |
| Active Grate Weir Length | 6.00 | ft              |

---

## Worksheet for DI#RB12-Q10

---

### Project Description

Solve For

Spread

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 1.00         | ft <sup>3</sup> /s |
| Left Side Slope        | 10.00        | ft/ft (H:V)        |
| Right Side Slope       | 10.00        | ft/ft (H:V)        |
| Bottom Width           | 2.00         | ft                 |
| Grate Width            | 2.00         | ft                 |
| Grate Length           | 2.00         | ft                 |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 3.00         | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |

### Results

|                          |       |                 |
|--------------------------|-------|-----------------|
| Spread                   | 3.00  | ft              |
| Depth                    | -0.02 | ft              |
| Wetted Perimeter         | 1.58  | ft              |
| Top Width                | 1.58  | ft              |
| Open Grate Area          | 0.70  | ft <sup>2</sup> |
| Active Grate Weir Length | 6.00  | ft              |

## Worksheet for DI#RB12-Q100

### Project Description

Solve For

Spread

### Input Data

|                        |              |                    |
|------------------------|--------------|--------------------|
| Discharge              | 2.00         | ft <sup>3</sup> /s |
| Left Side Slope        | 10.00        | ft/ft (H:V)        |
| Right Side Slope       | 10.00        | ft/ft (H:V)        |
| Bottom Width           | 2.00         | ft                 |
| Grate Width            | 2.00         | ft                 |
| Grate Length           | 2.00         | ft                 |
| Local Depression       | 2.00         | in                 |
| Local Depression Width | 3.00         | ft                 |
| Grate Type             | Curved Vaned |                    |
| Clogging               | 50.00        | %                  |

### Results

|                          |      |                 |
|--------------------------|------|-----------------|
| Spread                   | 4.32 | ft              |
| Depth                    | 0.12 | ft              |
| Wetted Perimeter         | 4.33 | ft              |
| Top Width                | 4.32 | ft              |
| Open Grate Area          | 0.70 | ft <sup>2</sup> |
| Active Grate Weir Length | 6.00 | ft              |

# FIGURE D-11



## Worksheet for Section A-Q10

### Project Description

Friction Method

Manning Formula

Solve For

Normal Depth

### Input Data

Channel Slope

0.38 %

Discharge

33.00 ft<sup>3</sup>/s

### Section Definitions

Station (ft)

Elevation (ft)

|        |      |
|--------|------|
| 0+00.0 | 0.59 |
| 0+05.0 | 0.54 |
| 0+05.5 | 0.54 |
| 0+05.5 | 0.04 |
| 0+07.0 | 0.17 |
| 0+07.0 | 0.21 |
| 0+40.0 | 0.84 |
| 0+73.0 | 0.17 |
| 0+73.0 | 0.13 |
| 0+74.5 | 0.00 |
| 0+74.5 | 0.50 |
| 0+75.0 | 0.50 |
| 0+80.0 | 0.55 |

### Roughness Segment Definitions

Start Station

Ending Station

Roughness Coefficient

|                |                |       |
|----------------|----------------|-------|
| (0+00.0, 0.59) | (0+07.0, 0.17) | 0.013 |
| (0+07.0, 0.17) | (0+73.0, 0.13) | 0.016 |
| (0+73.0, 0.13) | (0+80.0, 0.55) | 0.013 |

### Options

Current Roughness Weighted Method

Pavlovskii's Method

Open Channel Weighting Method

Pavlovskii's Method

Closed Channel Weighting Method

Pavlovskii's Method

## Worksheet for Section A-Q10

### Results

|                  |                 |                 |
|------------------|-----------------|-----------------|
| Normal Depth     | 0.67            | ft              |
| Elevation Range  | 0.00 to 0.84 ft |                 |
| Flow Area        | 14.70           | ft <sup>2</sup> |
| Wetted Perimeter | 63.78           | ft              |
| Hydraulic Radius | 0.23            | ft              |
| Top Width        | 62.48           | ft              |
| Normal Depth     | 0.67            | ft              |
| Critical Depth   | 0.63            | ft              |
| Critical Slope   | 0.00590         | ft/ft           |
| Velocity         | 2.24            | ft/s            |
| Velocity Head    | 0.08            | ft              |
| Specific Energy  | 0.75            | ft              |
| Froude Number    | 0.82            |                 |
| Flow Type        | Subcritical     |                 |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.67     | ft    |
| Critical Depth      | 0.63     | ft    |
| Channel Slope       | 0.38     | %     |
| Critical Slope      | 0.00590  | ft/ft |

## Cross Section for Section A-Q10

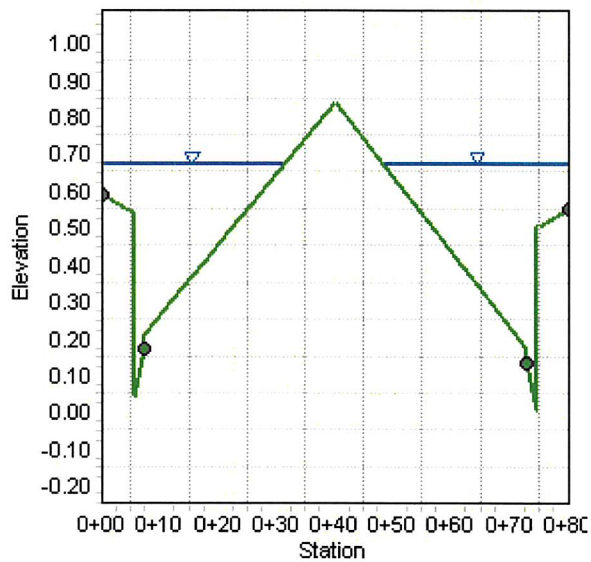
### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                              0.38 %  
Normal Depth                              0.67 ft  
Discharge                                  33.00 ft<sup>3</sup>/s

### Cross Section Image



## Worksheet for Section A-Q100

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                                              0.38    %  
Discharge                                              182.00    ft<sup>3</sup>/s

### Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.0       | 0.59           |
| 0+05.0       | 0.54           |
| 0+05.5       | 0.54           |
| 0+05.5       | 0.04           |
| 0+07.0       | 0.17           |
| 0+07.0       | 0.21           |
| 0+40.0       | 0.84           |
| 0+73.0       | 0.17           |
| 0+73.0       | 0.13           |
| 0+74.5       | 0.00           |
| 0+74.5       | 0.50           |
| 0+75.0       | 0.50           |
| 0+80.0       | 0.55           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+00.0, 0.59) | (0+07.0, 0.17) | 0.013                 |
| (0+07.0, 0.17) | (0+73.0, 0.13) | 0.016                 |
| (0+73.0, 0.13) | (0+80.0, 0.55) | 0.013                 |

### Options

Current Roughness Weighted Method                      Pavlovskii's Method  
Open Channel Weighting Method                      Pavlovskii's Method  
Closed Channel Weighting Method                      Pavlovskii's Method



---

## Worksheet for Section A-Q100

---

### Results

|                  |                 |                 |
|------------------|-----------------|-----------------|
| Normal Depth     | 1.07            | ft              |
| Elevation Range  | 0.00 to 0.84 ft |                 |
| Flow Area        | 45.51           | ft <sup>2</sup> |
| Wetted Perimeter | 82.11           | ft              |
| Hydraulic Radius | 0.55            | ft              |
| Top Width        | 80.00           | ft              |
| Normal Depth     | 1.07            | ft              |
| Critical Depth   | 1.05            | ft              |
| Critical Slope   | 0.00441         | ft/ft           |
| Velocity         | 4.00            | ft/s            |
| Velocity Head    | 0.25            | ft              |
| Specific Energy  | 1.32            | ft              |
| Froude Number    | 0.93            |                 |
| Flow Type        | Subcritical     |                 |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 1.07     | ft    |
| Critical Depth      | 1.05     | ft    |
| Channel Slope       | 0.38     | %     |
| Critical Slope      | 0.00441  | ft/ft |

## Cross Section for Section A-Q100

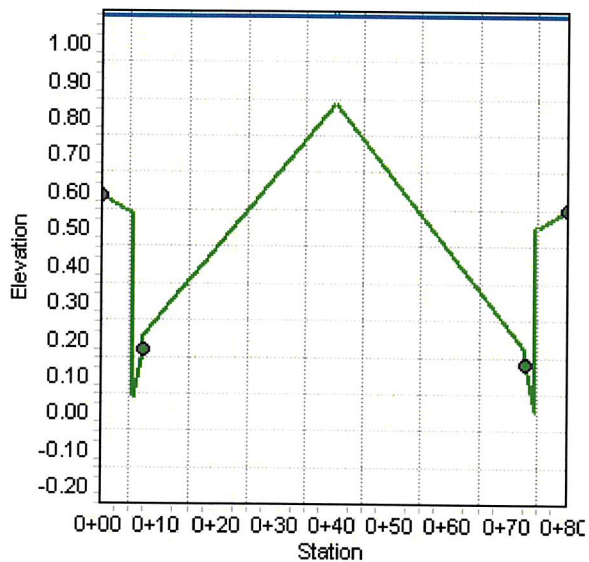
### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|               |        |                    |
|---------------|--------|--------------------|
| Channel Slope | 0.38   | %                  |
| Normal Depth  | 1.07   | ft                 |
| Discharge     | 182.00 | ft <sup>3</sup> /s |

### Cross Section Image



## Worksheet for Section B-North-Q10

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                                              0.25    %  
Discharge                                                1.50    ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+40.0       | 0.76           |
| 0+73.0       | 0.17           |
| 0+73.0       | 0.13           |
| 0+74.5       | 0.00           |
| 0+74.5       | 0.50           |
| 0+75.0       | 0.50           |
| 0+80.0       | 0.55           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+40.0, 0.76) | (0+73.0, 0.17) | 0.016                 |
| (0+73.0, 0.17) | (0+80.0, 0.55) | 0.013                 |

### Options

Current Roughness Weighted Method                      Pavlovskii's Method  
Open Channel Weighting Method                      Pavlovskii's Method  
Closed Channel Weighting Method                      Pavlovskii's Method

### Results

Normal Depth                                              0.35    ft  
Elevation Range                                              0.00 to 0.76 ft  
Flow Area                                                      1.35    ft<sup>2</sup>  
Wetted Perimeter                                              12.06    ft  
Hydraulic Radius                                              0.11    ft

---

## Worksheet for Section B-North-Q10

---

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Top Width       | 11.66       | ft    |
| Normal Depth    | 0.35        | ft    |
| Critical Depth  | 0.30        | ft    |
| Critical Slope  | 0.00813     | ft/ft |
| Velocity        | 1.11        | ft/s  |
| Velocity Head   | 0.02        | ft    |
| Specific Energy | 0.37        | ft    |
| Froude Number   | 0.57        |       |
| Flow Type       | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.35     | ft    |
| Critical Depth      | 0.30     | ft    |
| Channel Slope       | 0.25     | %     |
| Critical Slope      | 0.00813  | ft/ft |



## Cross Section for Section B-North-Q10

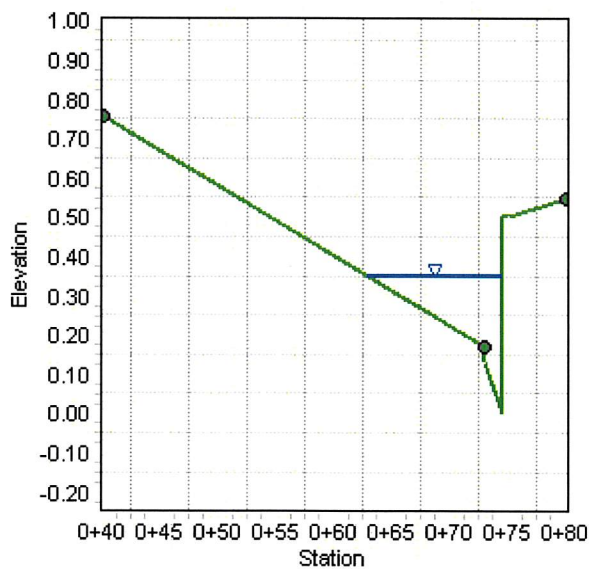
### Project Description

Friction Method                      Manning Formula  
Solve For                                Normal Depth

### Input Data

|               |      |                    |
|---------------|------|--------------------|
| Channel Slope | 0.25 | %                  |
| Normal Depth  | 0.35 | ft                 |
| Discharge     | 1.50 | ft <sup>3</sup> /s |

### Cross Section Image



## Worksheet for Section B-North-Q100

### Project Description

Friction Method                      Manning Formula  
Solve For                                Normal Depth

### Input Data

Channel Slope                                              0.25    %  
Discharge                                                25.00   ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+40.0       | 0.76           |
| 0+73.0       | 0.17           |
| 0+73.0       | 0.13           |
| 0+74.5       | 0.00           |
| 0+74.5       | 0.50           |
| 0+75.0       | 0.50           |
| 0+80.0       | 0.55           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+40.0, 0.76) | (0+73.0, 0.17) | 0.016                 |
| (0+73.0, 0.17) | (0+80.0, 0.55) | 0.013                 |

### Options

Current Roughness Weighted Method                      Pavlovskii's Method  
Open Channel Weighting Method                      Pavlovskii's Method  
Closed Channel Weighting Method                      Pavlovskii's Method

### Results

Normal Depth                                              0.75    ft  
Elevation Range                                              0.00 to 0.76 ft  
Flow Area                                                      11.81   ft<sup>2</sup>  
Wetted Perimeter                                              40.37   ft  
Hydraulic Radius                                              0.29    ft

---

## Worksheet for Section B-North-Q100

---

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Top Width       | 39.62       | ft    |
| Normal Depth    | 0.75        | ft    |
| Critical Depth  | 0.67        | ft    |
| Critical Slope  | 0.00567     | ft/ft |
| Velocity        | 2.12        | ft/s  |
| Velocity Head   | 0.07        | ft    |
| Specific Energy | 0.82        | ft    |
| Froude Number   | 0.68        |       |
| Flow Type       | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.75     | ft    |
| Critical Depth      | 0.67     | ft    |
| Channel Slope       | 0.25     | %     |
| Critical Slope      | 0.00567  | ft/ft |

## Project Description

### Manning Formula

Normal Depth

## Channel Slope

0.25 %

0.75 ft

25.00 ft<sup>3</sup>/s

FIGURE D-11



## Worksheet for Section B-South-Q10

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                                              0.48    %  
Discharge                                                1.50    ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.0       | 0.60           |
| 0+05.0       | 0.55           |
| 0+05.5       | 0.55           |
| 0+05.5       | 0.05           |
| 0+07.0       | 0.18           |
| 0+07.0       | 0.22           |
| 0+40.0       | 0.76           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+00.0, 0.60) | (0+07.0, 0.18) | 0.013                 |
| (0+07.0, 0.18) | (0+40.0, 0.76) | 0.016                 |

### Options

Current Roughness Weighted Method                      Pavlovskii's Method  
Open Channel Weighting Method                      Pavlovskii's Method  
Closed Channel Weighting Method                      Pavlovskii's Method

### Results

Normal Depth                                              0.32    ft  
Elevation Range                                              0.05 to 0.76 ft  
Flow Area                                                      1.07    ft<sup>2</sup>  
Wetted Perimeter                                              11.03    ft  
Hydraulic Radius                                              0.10    ft

---

## Worksheet for Section B-South-Q10

---

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Top Width       | 10.67       | ft    |
| Normal Depth    | 0.32        | ft    |
| Critical Depth  | 0.30        | ft    |
| Critical Slope  | 0.00818     | ft/ft |
| Velocity        | 1.40        | ft/s  |
| Velocity Head   | 0.03        | ft    |
| Specific Energy | 0.35        | ft    |
| Froude Number   | 0.78        |       |
| Flow Type       | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.32     | ft    |
| Critical Depth      | 0.30     | ft    |
| Channel Slope       | 0.48     | %     |
| Critical Slope      | 0.00818  | ft/ft |

## Cross Section for Section B-South-Q10

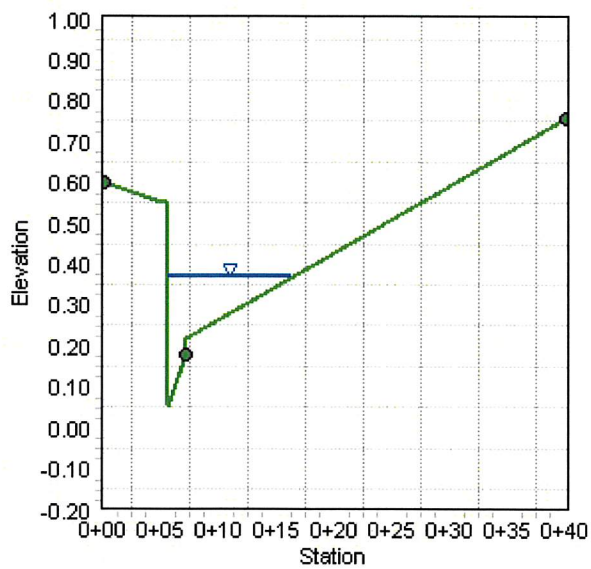
### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                              0.48 %  
Normal Depth                              0.32 ft  
Discharge                                  1.50 ft<sup>3</sup>/s

### Cross Section Image



## Worksheet for Section B-South-100

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                              0.48    %  
Discharge                                  26.00   ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.0       | 0.60           |
| 0+05.0       | 0.55           |
| 0+05.5       | 0.55           |
| 0+05.5       | 0.05           |
| 0+07.0       | 0.18           |
| 0+07.0       | 0.22           |
| 0+40.0       | 0.76           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+00.0, 0.60) | (0+07.0, 0.18) | 0.013                 |
| (0+07.0, 0.18) | (0+40.0, 0.76) | 0.016                 |

### Options

Current Roughness Weighted Method                      Pavlovskii's Method  
Open Channel Weighting Method                      Pavlovskii's Method  
Closed Channel Weighting Method                      Pavlovskii's Method

### Results

Normal Depth                              0.68    ft  
Elevation Range                              0.05 to 0.76 ft  
Flow Area                                      9.79    ft<sup>2</sup>  
Wetted Perimeter                              38.93    ft  
Hydraulic Radius                              0.25    ft



---

## Worksheet for Section B-South-100

---

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Top Width       | 38.25       | ft    |
| Normal Depth    | 0.68        | ft    |
| Critical Depth  | 0.67        | ft    |
| Critical Slope  | 0.00568     | ft/ft |
| Velocity        | 2.66        | ft/s  |
| Velocity Head   | 0.11        | ft    |
| Specific Energy | 0.79        | ft    |
| Froude Number   | 0.93        |       |
| Flow Type       | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.68     | ft    |
| Critical Depth      | 0.67     | ft    |
| Channel Slope       | 0.48     | %     |
| Critical Slope      | 0.00568  | ft/ft |

---

## Cross Section for Section B-South-Q100

---

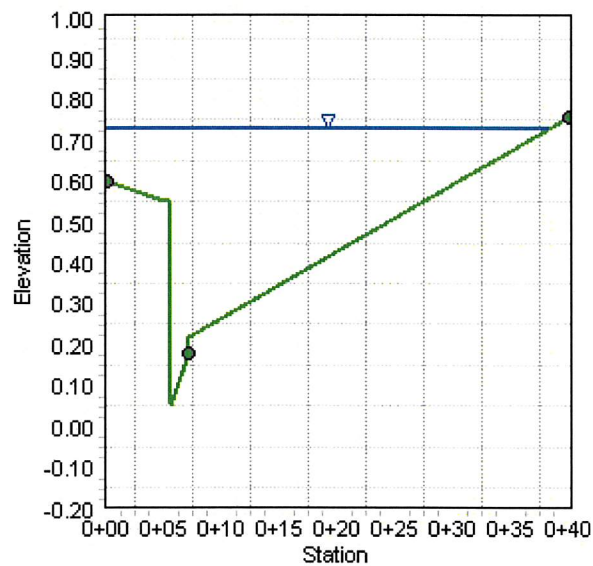
### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|               |       |                    |
|---------------|-------|--------------------|
| Channel Slope | 0.48  | %                  |
| Normal Depth  | 0.68  | ft                 |
| Discharge     | 26.00 | ft <sup>3</sup> /s |

### Cross Section Image



## Worksheet for Section C-North-Q10

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                              0.30    %  
Discharge                                  0.00    ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+59.0       | 0.94           |
| 0+92.0       | 0.24           |
| 0+92.0       | 0.20           |
| 0+93.5       | 0.07           |
| 0+93.5       | 0.57           |
| 0+94.0       | 0.57           |
| 0+99.0       | 0.62           |
| 1+12.0       | 1.39           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+59.0, 0.94) | (0+92.0, 0.20) | 0.016                 |
| (0+92.0, 0.20) | (1+12.0, 1.39) | 0.013                 |

### Options

Current Roughness Weighted Method                      Pavlovskii's Method  
Open Channel Weighting Method                      Pavlovskii's Method  
Closed Channel Weighting Method                      Pavlovskii's Method

### Results

Normal Depth                              0.02    ft  
Elevation Range                              0.07 to 1.39 ft  
Flow Area                                      0.00    ft<sup>2</sup>  
Wetted Perimeter                              0.30    ft

---

## Worksheet for Section C-North-Q10

---

### Results

|                  |             |       |
|------------------|-------------|-------|
| Hydraulic Radius | 0.01        | ft    |
| Top Width        | 0.28        | ft    |
| Normal Depth     | 0.02        | ft    |
| Critical Depth   | 0.02        | ft    |
| Critical Slope   | 0.01335     | ft/ft |
| Velocity         | 0.30        | ft/s  |
| Velocity Head    | 0.00        | ft    |
| Specific Energy  | 0.03        | ft    |
| Froude Number    | 0.48        |       |
| Flow Type        | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.02     | ft    |
| Critical Depth      | 0.02     | ft    |
| Channel Slope       | 0.30     | %     |
| Critical Slope      | 0.01335  | ft/ft |



---

## Cross Section for Section C-North-Q10

---

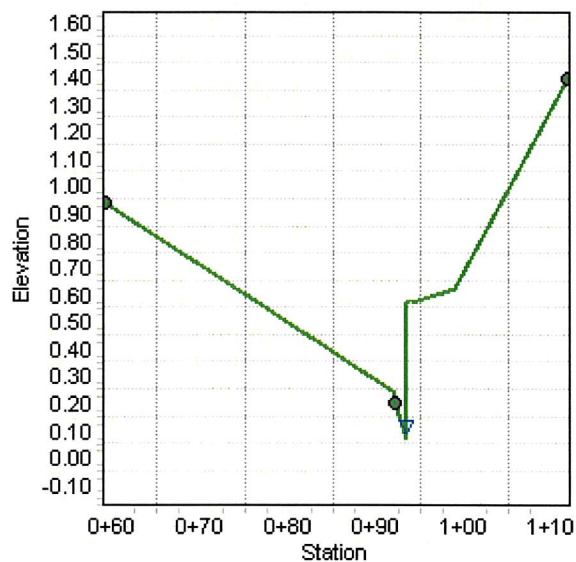
### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|               |      |                    |
|---------------|------|--------------------|
| Channel Slope | 0.30 | %                  |
| Normal Depth  | 0.02 | ft                 |
| Discharge     | 0.00 | ft <sup>3</sup> /s |

### Cross Section Image



## Worksheet for Section C-North-Q100

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                              0.30    %  
Discharge                                0.50    ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+59.0       | 0.94           |
| 0+92.0       | 0.24           |
| 0+92.0       | 0.20           |
| 0+93.5       | 0.07           |
| 0+93.5       | 0.57           |
| 0+94.0       | 0.57           |
| 0+99.0       | 0.62           |
| 1+12.0       | 1.39           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+59.0, 0.94) | (0+92.0, 0.20) | 0.016                 |
| (0+92.0, 0.20) | (1+12.0, 1.39) | 0.013                 |

### Options

Current Roughness weighted Method                      Pavlovskii's Method  
Open Channel Weighting Method                      Pavlovskii's Method  
Closed Channel Weighting Method                      Pavlovskii's Method

### Results

Normal Depth                              0.26    ft  
Elevation Range                              0.07 to 1.39 ft  
Flow Area                                0.50    ft<sup>2</sup>  
Wetted Perimeter                              6.18    ft

---

## Worksheet for Section C-North-Q100

---

### Results

|                  |             |       |
|------------------|-------------|-------|
| Hydraulic Radius | 0.08        | ft    |
| Top Width        | 5.87        | ft    |
| Normal Depth     | 0.26        | ft    |
| Critical Depth   | 0.23        | ft    |
| Critical Slope   | 0.00864     | ft/ft |
| Velocity         | 1.00        | ft/s  |
| Velocity Head    | 0.02        | ft    |
| Specific Energy  | 0.28        | ft    |
| Froude Number    | 0.61        |       |
| Flow Type        | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.26     | ft    |
| Critical Depth      | 0.23     | ft    |
| Channel Slope       | 0.30     | %     |
| Critical Slope      | 0.00864  | ft/ft |





## Worksheet for Section C-South-Q10

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                              0.30    %  
Discharge                                  0.00    ft<sup>3</sup>/s

### Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.0       | 0.90           |
| 0+12.0       | 0.55           |
| 0+17.0       | 0.50           |
| 0+17.5       | 0.50           |
| 0+17.5       | 0.00           |
| 0+19.0       | 0.13           |
| 0+19.0       | 0.17           |
| 0+59.0       | 0.94           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+00.0, 0.90) | (0+19.0, 0.13) | 0.013                 |
| (0+19.0, 0.13) | (0+59.0, 0.94) | 0.016                 |

### Options

Current Roughness Weighted Method                      Pavlovskii's Method  
Open Channel Weighting Method                      Pavlovskii's Method  
Closed Channel Weighting Method                      Pavlovskii's Method

### Results

Normal Depth                              0.02    ft  
Elevation Range                              0.00 to 0.94 ft  
Flow Area                                      0.00    ft<sup>2</sup>  
Wetted Perimeter                              0.30    ft

## Worksheet for Section C-South-Q10

### Results

|                  |             |       |
|------------------|-------------|-------|
| Hydraulic Radius | 0.01        | ft    |
| Top Width        | 0.27        | ft    |
| Normal Depth     | 0.02        | ft    |
| Critical Depth   | 0.02        | ft    |
| Critical Slope   | 0.01332     | ft/ft |
| Velocity         | 0.31        | ft/s  |
| Velocity Head    | 0.00        | ft    |
| Specific Energy  | 0.03        | ft    |
| Froude Number    | 0.51        |       |
| Flow Type        | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.02     | ft    |
| Critical Depth      | 0.02     | ft    |
| Channel Slope       | 0.30     | %     |
| Critical Slope      | 0.01332  | ft/ft |

## Project Description

### Manning Formula

Normal Depth

0.00 ft<sup>3</sup>/s

## Worksheet for Section C-South-Q100

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                              0.30 %  
Discharge                                  8.50 ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.0       | 0.90           |
| 0+12.0       | 0.55           |
| 0+17.0       | 0.50           |
| 0+17.5       | 0.50           |
| 0+17.5       | 0.00           |
| 0+19.0       | 0.13           |
| 0+19.0       | 0.17           |
| 0+59.0       | 0.94           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+00.0, 0.90) | (0+19.0, 0.13) | 0.013                 |
| (0+19.0, 0.13) | (0+59.0, 0.94) | 0.016                 |

### Options

Current Roughness Weighted Method                      Pavlovskii's Method  
Open Channel Weighting Method                      Pavlovskii's Method  
Closed Channel Weighting Method                      Pavlovskii's Method

### Results

Normal Depth                              0.57 ft  
Elevation Range                              0.00 to 0.94 ft  
Flow Area                                  5.05 ft<sup>2</sup>  
Wetted Perimeter                              28.62 ft



---

## Worksheet for Section C-South-Q100

---

### Results

|                  |             |       |
|------------------|-------------|-------|
| Hydraulic Radius | 0.18        | ft    |
| Top Width        | 28.07       | ft    |
| Normal Depth     | 0.57        | ft    |
| Critical Depth   | 0.50        | ft    |
| Critical Slope   | 0.00619     | ft/ft |
| Velocity         | 1.68        | ft/s  |
| Velocity Head    | 0.04        | ft    |
| Specific Energy  | 0.61        | ft    |
| Froude Number    | 0.70        |       |
| Flow Type        | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.57     | ft    |
| Critical Depth      | 0.50     | ft    |
| Channel Slope       | 0.30     | %     |
| Critical Slope      | 0.00619  | ft/ft |

## Project Description

### Manning Formula

Normal Depth

0.30 %

0.57 ft

8.50 ft<sup>3</sup>/s

FIGURE D-11



---

### Worksheet for Section D-East-Q10

---

#### Results

|                 |             |       |
|-----------------|-------------|-------|
| Critical Depth  | 0.16        | ft    |
| Critical Slope  | 0.03247     | ft/ft |
| Velocity        | 0.92        | ft/s  |
| Velocity Head   | 0.01        | ft    |
| Specific Energy | 0.23        | ft    |
| Froude Number   | 0.49        |       |
| Flow Type       | Subcritical |       |

#### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

#### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.22     | ft    |
| Critical Depth      | 0.16     | ft    |
| Channel Slope       | 0.70     | %     |
| Critical Slope      | 0.03247  | ft/ft |



---

## Cross Section for Section D-East-Q10

---

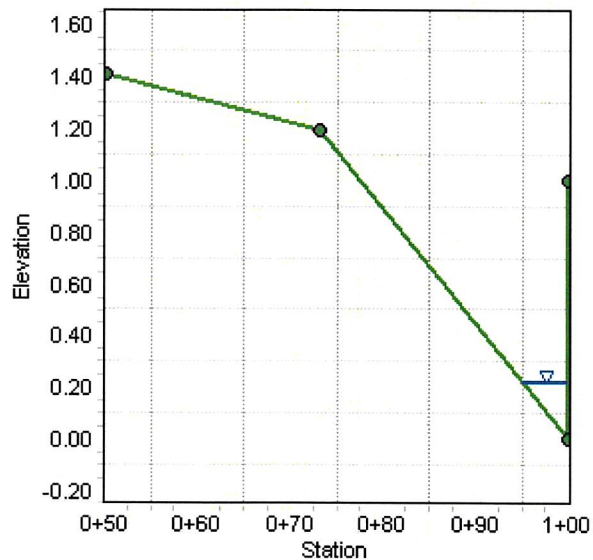
### Project Description

Friction Method                      Manning Formula  
Solve For                                Normal Depth

### Input Data

|               |      |                    |
|---------------|------|--------------------|
| Channel Slope | 0.70 | %                  |
| Normal Depth  | 0.22 | ft                 |
| Discharge     | 0.50 | ft <sup>3</sup> /s |

### Cross Section Image



## Worksheet for Section D-East-Q100

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                              0.70 %  
Discharge                                  2.50 ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+50.0       | 1.41           |
| 0+73.0       | 1.19           |
| 1+00.0       | 0.00           |
| 1+00.0       | 1.00           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+50.0, 1.41) | (0+73.0, 1.19) | 0.160                 |
| (0+73.0, 1.19) | (1+00.0, 0.00) | 0.030                 |
| (1+00.0, 0.00) | (1+00.0, 1.00) | 0.035                 |

### Options

Current Roughness vweighted Method                      Pavlovskii's Method  
Open Channel Weighting Method                      Pavlovskii's Method  
Closed Channel Weighting Method                      Pavlovskii's Method

### Results

|                  |                      |
|------------------|----------------------|
| Normal Depth     | 0.40 ft              |
| Elevation Range  | 0.00 to 1.41 ft      |
| Flow Area        | 1.83 ft <sup>2</sup> |
| Wetted Perimeter | 9.51 ft              |
| Hydraulic Radius | 0.19 ft              |
| Top Width        | 9.10 ft              |
| Normal Depth     | 0.40 ft              |

---

## Worksheet for Section D-East-Q100

---

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Critical Depth  | 0.31        | ft    |
| Critical Slope  | 0.02619     | ft/ft |
| Velocity        | 1.37        | ft/s  |
| Velocity Head   | 0.03        | ft    |
| Specific Energy | 0.43        | ft    |
| Froude Number   | 0.54        |       |
| Flow Type       | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.40     | ft    |
| Critical Depth      | 0.31     | ft    |
| Channel Slope       | 0.70     | %     |
| Critical Slope      | 0.02619  | ft/ft |

## Cross Section for Section D-East-Q100

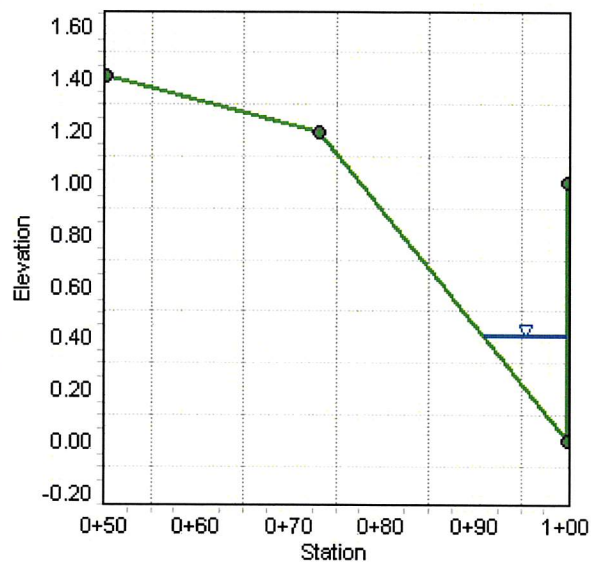
### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|               |      |                    |
|---------------|------|--------------------|
| Channel Slope | 0.70 | %                  |
| Normal Depth  | 0.40 | ft                 |
| Discharge     | 2.50 | ft <sup>3</sup> /s |

### Cross Section Image





## Worksheet for Section D-West-Q10

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                              0.46    %  
Discharge                                  0.50    ft<sup>3</sup>/s

### Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.0       | 1.17           |
| 0+05.0       | 1.12           |
| 0+05.5       | 1.12           |
| 0+05.5       | 0.62           |
| 0+07.0       | 0.75           |
| 0+07.0       | 0.79           |
| 0+50.0       | 1.41           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+00.0, 1.17) | (0+07.0, 0.75) | 0.013                 |
| (0+07.0, 0.75) | (0+50.0, 1.41) | 0.016                 |

### Options

Current Roughness Weighted Method                      Pavlovskii's Method  
Open Channel Weighting Method                      Pavlovskii's Method  
Closed Channel Weighting Method                      Pavlovskii's Method

### Results

Normal Depth                              0.24    ft  
Elevation Range                              0.62 to 1.41 ft  
Flow Area                                      0.46    ft<sup>2</sup>  
Wetted Perimeter                              6.97    ft  
Hydraulic Radius                              0.07    ft

## Worksheet for Section D-West-Q10

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Top Width       | 6.68        | ft    |
| Normal Depth    | 0.24        | ft    |
| Critical Depth  | 0.23        | ft    |
| Critical Slope  | 0.00907     | ft/ft |
| Velocity        | 1.08        | ft/s  |
| Velocity Head   | 0.02        | ft    |
| Specific Energy | 0.26        | ft    |
| Froude Number   | 0.72        |       |
| Flow Type       | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.24     | ft    |
| Critical Depth      | 0.23     | ft    |
| Channel Slope       | 0.46     | %     |
| Critical Slope      | 0.00907  | ft/ft |

FIGURE D-11

## Project Description

### Friction Method

### Manning Formula

Solve For

Normal Depth

## Input Data

### Channel Slope

0.46 %

Discharge

2.50 ft<sup>3</sup>/s

## Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.0       | 1.17           |
| 0+05.0       | 1.12           |
| 0+05.5       | 1.12           |
| 0+05.5       | 0.62           |
| 0+07.0       | 0.75           |
| 0+07.0       | 0.79           |
| 0+50.0       | 1.41           |

## Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+00.0, 1.17) | (0+07.0, 0.75) | 0.013                 |
| (0+07.0, 0.75) | (0+50.0, 1.41) | 0.016                 |

## Options

### Current Roughness Weighted Method

### Pavlovskii's Method

### Open Channel Weighting Method

### Pavlovskii's Method

### Closed Channel Weighting Method

### Pavlovskii's Method

## Results

### Normal Depth

0.36 ft

### Elevation Range

0.62 to 1.41 ft

Flow Area

1.67 ft<sup>2</sup>

### Wetted Perimeter

14.99 ft

### Hydraulic Radius

0.11 ft



## Worksheet for Section D-West-Q100

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Top Width       | 14.58       | ft    |
| Normal Depth    | 0.36        | ft    |
| Critical Depth  | 0.34        | ft    |
| Critical Slope  | 0.00788     | ft/ft |
| Velocity        | 1.49        | ft/s  |
| Velocity Head   | 0.03        | ft    |
| Specific Energy | 0.39        | ft    |
| Froude Number   | 0.78        |       |
| Flow Type       | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.36     | ft    |
| Critical Depth      | 0.34     | ft    |
| Channel Slope       | 0.46     | %     |
| Critical Slope      | 0.00788  | ft/ft |



## Worksheet for Section E - East-Q10

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                              0.35 %  
Discharge                                  0.00 ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+50.0       | 1.10           |
| 0+93.0       | 0.17           |
| 0+93.0       | 0.13           |
| 0+94.5       | 0.00           |
| 0+94.5       | 0.50           |
| 0+95.0       | 0.50           |
| 1+00.0       | 0.55           |
| 1+10.0       | 1.55           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+50.0, 1.10) | (0+93.0, 0.13) | 0.016                 |
| (0+93.0, 0.13) | (1+00.0, 0.55) | 0.013                 |
| (1+00.0, 0.55) | (1+10.0, 1.55) | 0.030                 |

### Options

Current Roughness Weighted Method                      Pavlovskii's Method  
Open Channel Weighting Method                      Pavlovskii's Method  
Closed Channel Weighting Method                      Pavlovskii's Method

### Results

Normal Depth                              0.02 ft  
Elevation Range                              0.00 to 1.55 ft  
Flow Area                                  0.00 ft<sup>2</sup>

## Worksheet for Section E - East-Q10

### Results

|                  |             |       |
|------------------|-------------|-------|
| Wetted Perimeter | 0.29        | ft    |
| Hydraulic Radius | 0.01        | ft    |
| Top Width        | 0.27        | ft    |
| Normal Depth     | 0.02        | ft    |
| Critical Depth   | 0.02        | ft    |
| Critical Slope   | 0.01329     | ft/ft |
| Velocity         | 0.33        | ft/s  |
| Velocity Head    | 0.00        | ft    |
| Specific Energy  | 0.02        | ft    |
| Froude Number    | 0.54        |       |
| Flow Type        | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.02     | ft    |
| Critical Depth      | 0.02     | ft    |
| Channel Slope       | 0.35     | %     |
| Critical Slope      | 0.01329  | ft/ft |

FIGURE D-11



## Worksheet for Section E - East-100

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                              0.35    %  
Discharge                                  0.00    ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+50.0       | 1.10           |
| 0+93.0       | 0.17           |
| 0+93.0       | 0.13           |
| 0+94.5       | 0.00           |
| 0+94.5       | 0.50           |
| 0+95.0       | 0.50           |
| 1+00.0       | 0.55           |
| 1+10.0       | 1.55           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+50.0, 1.10) | (0+93.0, 0.13) | 0.016                 |
| (0+93.0, 0.13) | (1+00.0, 0.55) | 0.013                 |
| (1+00.0, 0.55) | (1+10.0, 1.55) | 0.030                 |

### Options

Current Roughness Weighted Method                      Pavlovskii's Method  
Open Channel Weighting Method                      Pavlovskii's Method  
Closed Channel Weighting Method                      Pavlovskii's Method

### Results

Normal Depth                              0.02    ft  
Elevation Range                              0.00 to 1.55 ft  
Flow Area                                      0.00    ft<sup>2</sup>

## Worksheet for Section E - East-100

### Results

|                  |             |       |
|------------------|-------------|-------|
| Wetted Perimeter | 0.29        | ft    |
| Hydraulic Radius | 0.01        | ft    |
| Top Width        | 0.27        | ft    |
| Normal Depth     | 0.02        | ft    |
| Critical Depth   | 0.02        | ft    |
| Critical Slope   | 0.01329     | ft/ft |
| Velocity         | 0.33        | ft/s  |
| Velocity Head    | 0.00        | ft    |
| Specific Energy  | 0.02        | ft    |
| Froude Number    | 0.54        |       |
| Flow Type        | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.02     | ft    |
| Critical Depth      | 0.02     | ft    |
| Channel Slope       | 0.35     | %     |
| Critical Slope      | 0.01329  | ft/ft |

## Project Description

### Manning Formula

Normal Depth

### Channel Slope

0.35 %

0.02 ft

0.00 ft<sup>3</sup>/s

FIGURE D-11

## Worksheet for Section E-West-Q10

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                                              0.35    %  
Discharge                                                0.00    ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.0       | 0.79           |
| 0+05.0       | 0.74           |
| 0+05.5       | 0.74           |
| 0+05.5       | 0.24           |
| 0+07.0       | 0.37           |
| 0+07.0       | 0.41           |
| 0+50.0       | 1.10           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+00.0, 0.79) | (0+07.0, 0.37) | 0.013                 |
| (0+07.0, 0.37) | (0+50.0, 1.10) | 0.016                 |

### Options

Current Roughness Weighted Method                      Pavlovskii's Method  
Open Channel Weighting Method                      Pavlovskii's Method  
Closed Channel Weighting Method                      Pavlovskii's Method

### Results

Normal Depth                                              0.02    ft  
Elevation Range                                              0.24 to 1.10 ft  
Flow Area                                                      0.00    ft<sup>2</sup>  
Wetted Perimeter                                              0.29    ft  
Hydraulic Radius                                              0.01    ft

---

## Worksheet for Section E-West-Q10

---

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Top Width       | 0.27        | ft    |
| Normal Depth    | 0.02        | ft    |
| Critical Depth  | 0.02        | ft    |
| Critical Slope  | 0.01325     | ft/ft |
| Velocity        | 0.32        | ft/s  |
| Velocity Head   | 0.00        | ft    |
| Specific Energy | 0.02        | ft    |
| Froude Number   | 0.53        |       |
| Flow Type       | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.02     | ft    |
| Critical Depth      | 0.02     | ft    |
| Channel Slope       | 0.35     | %     |
| Critical Slope      | 0.01325  | ft/ft |



---

## Cross Section for Section E-West-Q10

---

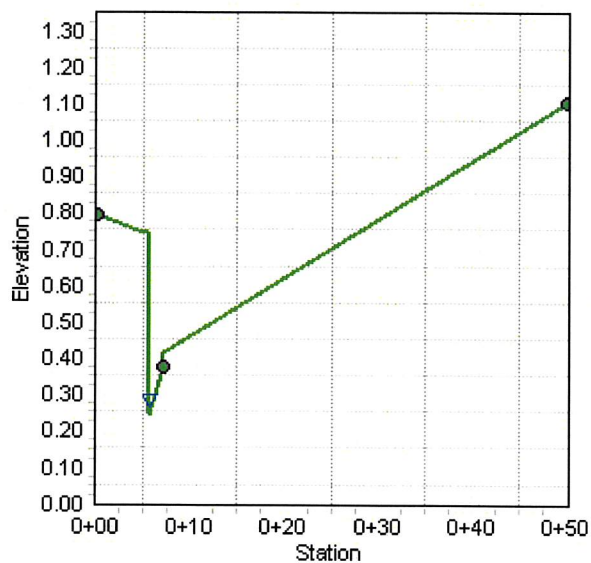
### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|               |      |                    |
|---------------|------|--------------------|
| Channel Slope | 0.35 | %                  |
| Normal Depth  | 0.02 | ft                 |
| Discharge     | 0.00 | ft <sup>3</sup> /s |

### Cross Section Image



## Project Description

### Manning Formula

### Normal Depth

## Input Data

0.35 %

8.50 ft<sup>3</sup>/s

## Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.0       | 0.79           |
| 0+05.0       | 0.74           |
| 0+05.5       | 0.74           |
| 0+05.5       | 0.24           |
| 0+07.0       | 0.37           |
| 0+07.0       | 0.41           |
| 0+50.0       | 1.10           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+00.0, 0.79) | (0+07.0, 0.37) | 0.013                 |
| (0+07.0, 0.37) | (0+50.0, 1.10) | 0.016                 |

## Options

### Pavlovskii's Method

### Pavlovskii's Method

### Pavlovskii's Method

## Results

0.53 ft

0.24 to 1.10 ft

4.84 ft<sup>2</sup>

28.24 ft

0.17 ft

---

## Worksheet for Section E-West-Q100

---

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Top Width       | 27.69       | ft    |
| Normal Depth    | 0.53        | ft    |
| Critical Depth  | 0.48        | ft    |
| Critical Slope  | 0.00645     | ft/ft |
| Velocity        | 1.76        | ft/s  |
| Velocity Head   | 0.05        | ft    |
| Specific Energy | 0.58        | ft    |
| Froude Number   | 0.74        |       |
| Flow Type       | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.53     | ft    |
| Critical Depth      | 0.48     | ft    |
| Channel Slope       | 0.35     | %     |
| Critical Slope      | 0.00645  | ft/ft |

## Cross Section for Section E-West-Q100

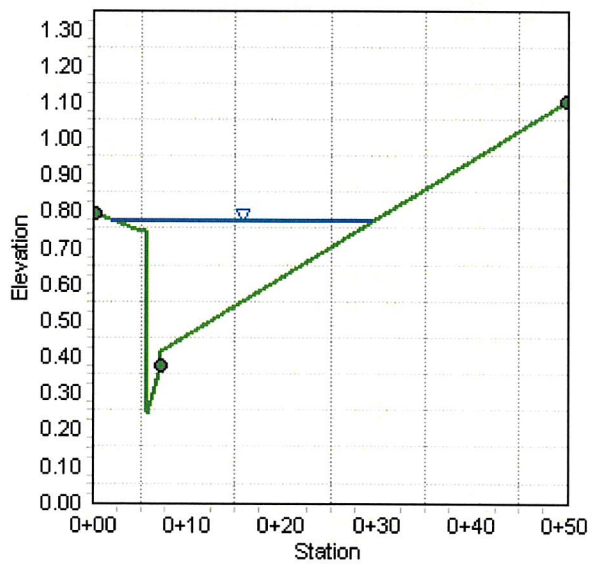
### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                              0.35    %  
Normal Depth                              0.53    ft  
Discharge                                  8.50    ft<sup>3</sup>/s

### Cross Section Image



## Worksheet for Section F-East-Q10

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                              0.30    %  
Discharge                                2.50    ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+50.0       | 1.02           |
| 0+93.0       | 0.25           |
| 0+93.0       | 0.21           |
| 0+94.5       | 0.08           |
| 0+94.5       | 0.58           |
| 0+95.0       | 0.58           |
| 1+00.0       | 0.63           |
| 1+10.0       | 1.63           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+50.0, 1.02) | (0+93.0, 0.21) | 0.016                 |
| (0+93.0, 0.21) | (1+00.0, 0.63) | 0.013                 |
| (1+00.0, 0.63) | (1+10.0, 1.63) | 0.030                 |

### Options

Current Roughness weighted      Pavlovskii's Method  
Method  
Open Channel Weighting Method      Pavlovskii's Method  
Closed Channel Weighting Method      Pavlovskii's Method

### Results

Normal Depth                              0.39    ft  
Elevation Range                          0.08 to 1.63 ft  
Flow Area                                  1.87    ft<sup>2</sup>



---

## Worksheet for Section F-East-Q10

---

### Results

|                  |             |       |
|------------------|-------------|-------|
| Wetted Perimeter | 14.33       | ft    |
| Hydraulic Radius | 0.13        | ft    |
| Top Width        | 13.89       | ft    |
| Normal Depth     | 0.39        | ft    |
| Critical Depth   | 0.35        | ft    |
| Critical Slope   | 0.00768     | ft/ft |
| Velocity         | 1.34        | ft/s  |
| Velocity Head    | 0.03        | ft    |
| Specific Energy  | 0.42        | ft    |
| Froude Number    | 0.64        |       |
| Flow Type        | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.39     | ft    |
| Critical Depth      | 0.35     | ft    |
| Channel Slope       | 0.30     | %     |
| Critical Slope      | 0.00768  | ft/ft |

---

## Cross Section for Section F-East-Q10

---

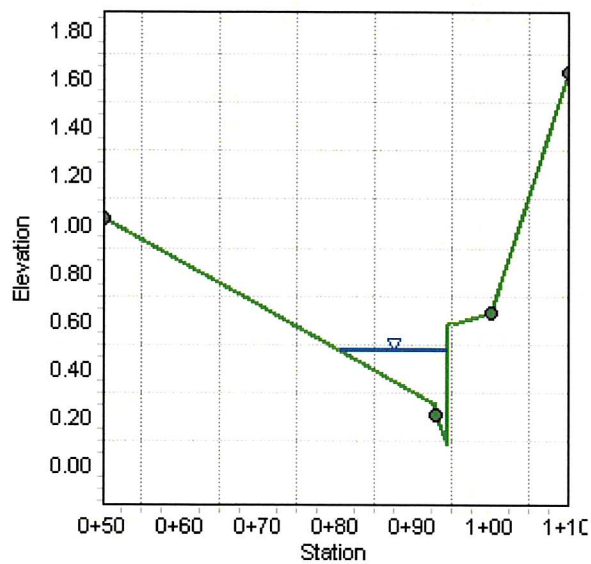
### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|               |      |                    |
|---------------|------|--------------------|
| Channel Slope | 0.30 | %                  |
| Normal Depth  | 0.39 | ft                 |
| Discharge     | 2.50 | ft <sup>3</sup> /s |

### Cross Section Image



## Worksheet for Section F-East-Q100

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                              0.30    %  
Discharge                                  4.50    ft<sup>3</sup>/s

### Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+50.0       | 1.02           |
| 0+93.0       | 0.25           |
| 0+93.0       | 0.21           |
| 0+94.5       | 0.08           |
| 0+94.5       | 0.58           |
| 0+95.0       | 0.58           |
| 1+00.0       | 0.63           |
| 1+10.0       | 1.63           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+50.0, 1.02) | (0+93.0, 0.21) | 0.016                 |
| (0+93.0, 0.21) | (1+00.0, 0.63) | 0.013                 |
| (1+00.0, 0.63) | (1+10.0, 1.63) | 0.030                 |

### Options

Current Roughness weighted Method                      Pavlovskii's Method  
Open Channel Weighting Method                      Pavlovskii's Method  
Closed Channel Weighting Method                      Pavlovskii's Method

### Results

Normal Depth                              0.46    ft  
Elevation Range                              0.08 to 1.63 ft  
Flow Area                                      2.93    ft<sup>2</sup>

---

## Worksheet for Section F-East-Q100

---

### Results

|                  |             |       |
|------------------|-------------|-------|
| Wetted Perimeter | 18.17       | ft    |
| Hydraulic Radius | 0.16        | ft    |
| Top Width        | 17.66       | ft    |
| Normal Depth     | 0.46        | ft    |
| Critical Depth   | 0.41        | ft    |
| Critical Slope   | 0.00717     | ft/ft |
| Velocity         | 1.54        | ft/s  |
| Velocity Head    | 0.04        | ft    |
| Specific Energy  | 0.50        | ft    |
| Froude Number    | 0.66        |       |
| Flow Type        | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.46     | ft    |
| Critical Depth      | 0.41     | ft    |
| Channel Slope       | 0.30     | %     |
| Critical Slope      | 0.00717  | ft/ft |

---

## Cross Section for Section F-East-Q100

---

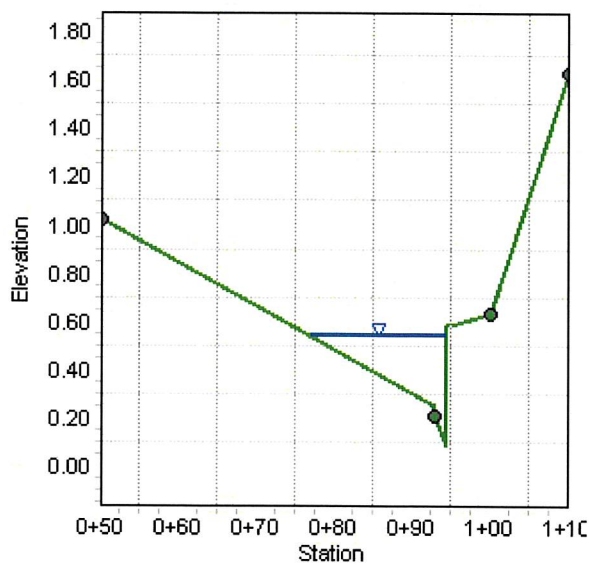
### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|               |      |                    |
|---------------|------|--------------------|
| Channel Slope | 0.30 | %                  |
| Normal Depth  | 0.46 | ft                 |
| Discharge     | 4.50 | ft <sup>3</sup> /s |

### Cross Section Image





## Worksheet for Section F-West-Q10

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                              0.45    %  
Discharge                                  4.50    ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.0       | 0.55           |
| 0+05.0       | 0.50           |
| 0+05.5       | 0.50           |
| 0+05.5       | 0.00           |
| 0+07.0       | 0.13           |
| 0+07.0       | 0.17           |
| 0+50.0       | 1.02           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+00.0, 0.55) | (0+07.0, 0.13) | 0.013                 |
| (0+07.0, 0.13) | (0+50.0, 1.02) | 0.016                 |

### Options

Current Roughness Weighted Method              Pavlovskii's Method  
Open Channel Weighting Method                  Pavlovskii's Method  
Closed Channel Weighting Method                Pavlovskii's Method

### Results

Normal Depth                              0.44    ft  
Elevation Range                          0.00 to 1.02 ft  
Flow Area                                  2.45    ft<sup>2</sup>  
Wetted Perimeter                          15.80    ft  
Hydraulic Radius                          0.16    ft

## Worksheet for Section F-West-Q10

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Top Width       | 15.31       | ft    |
| Normal Depth    | 0.44        | ft    |
| Critical Depth  | 0.42        | ft    |
| Critical Slope  | 0.00706     | ft/ft |
| Velocity        | 1.84        | ft/s  |
| Velocity Head   | 0.05        | ft    |
| Specific Energy | 0.50        | ft    |
| Froude Number   | 0.81        |       |
| Flow Type       | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.44     | ft    |
| Critical Depth      | 0.42     | ft    |
| Channel Slope       | 0.45     | %     |
| Critical Slope      | 0.00706  | ft/ft |

## Cross Section for Section F-West-Q10

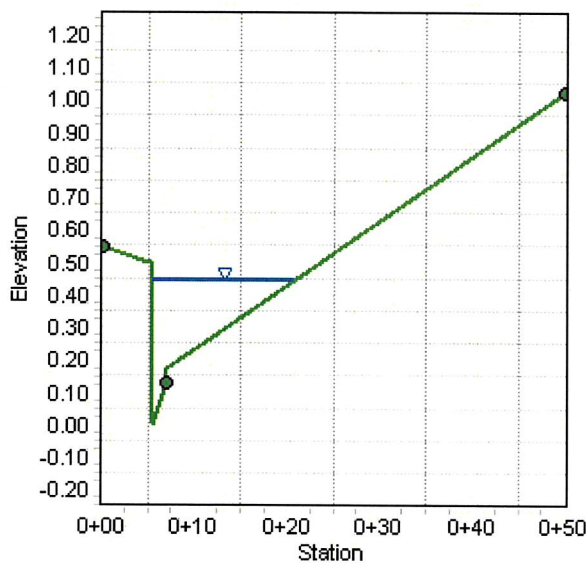
### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|               |                         |
|---------------|-------------------------|
| Channel Slope | 0.45 %                  |
| Normal Depth  | 0.44 ft                 |
| Discharge     | 4.50 ft <sup>3</sup> /s |

### Cross Section Image



## Worksheet for Section F-West-Q100

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                              0.45 %  
Discharge                                  8.50 ft<sup>3</sup>/s

### Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.0       | 0.55           |
| 0+05.0       | 0.50           |
| 0+05.5       | 0.50           |
| 0+05.5       | 0.00           |
| 0+07.0       | 0.13           |
| 0+07.0       | 0.17           |
| 0+50.0       | 1.02           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+00.0, 0.55) | (0+07.0, 0.13) | 0.013                 |
| (0+07.0, 0.13) | (0+50.0, 1.02) | 0.016                 |

### Options

Current Roughness Weighted Method      Pavlovskii's Method  
Open Channel Weighting Method      Pavlovskii's Method  
Closed Channel Weighting Method      Pavlovskii's Method

### Results

Normal Depth                              0.54 ft  
Elevation Range                      0.00 to 1.02 ft  
Flow Area                                  4.26 ft<sup>2</sup>  
Wetted Perimeter                      25.16 ft  
Hydraulic Radius                      0.17 ft

---

## Worksheet for Section F-West-Q100

---

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Top Width       | 24.61       | ft    |
| Normal Depth    | 0.54        | ft    |
| Critical Depth  | 0.51        | ft    |
| Critical Slope  | 0.00626     | ft/ft |
| Velocity        | 2.00        | ft/s  |
| Velocity Head   | 0.06        | ft    |
| Specific Energy | 0.60        | ft    |
| Froude Number   | 0.85        |       |
| Flow Type       | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.54     | ft    |
| Critical Depth      | 0.51     | ft    |
| Channel Slope       | 0.45     | %     |
| Critical Slope      | 0.00626  | ft/ft |



## Cross Section for Section F-West-Q100

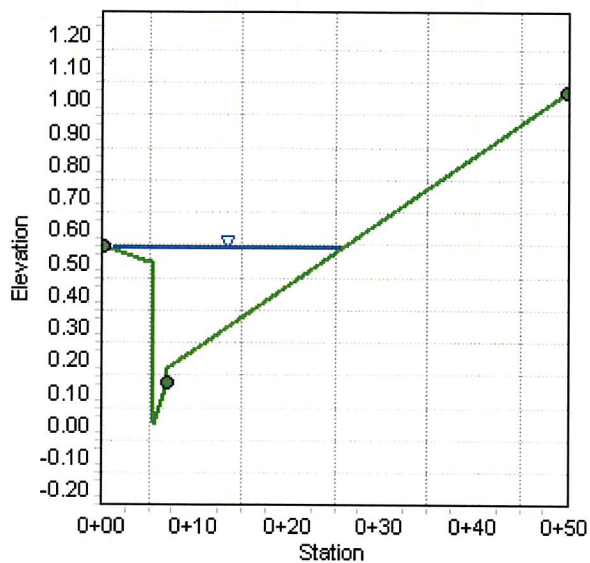
### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|               |                         |
|---------------|-------------------------|
| Channel Slope | 0.45 %                  |
| Normal Depth  | 0.54 ft                 |
| Discharge     | 8.50 ft <sup>3</sup> /s |

### Cross Section Image



## Project Description

### Manning Formula

Normal Depth

## Input Data

0.40 %

1.00 ft<sup>3</sup>/s

## Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+50.0       | 1.16           |
| 0+93.0       | 0.20           |
| 0+93.0       | 0.16           |
| 0+94.5       | 0.03           |
| 0+94.5       | 0.53           |
| 0+95.0       | 0.53           |
| 1+00.0       | 0.58           |
| 1+10.0       | 1.58           |

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+50.0, 1.16) | (0+93.0, 0.16) | 0.016                 |
| (0+93.0, 0.16) | (1+00.0, 0.58) | 0.013                 |
| (1+00.0, 0.58) | (1+10.0, 1.58) | 0.030                 |

|                                   |                     |
|-----------------------------------|---------------------|
| Current Roughness weighted Method | Pavlovskii's Method |
| Open Channel Weighting Method     | Pavlovskii's Method |
| Closed Channel Weighting Method   | Pavlovskii's Method |

|                 |                 |      |                 |
|-----------------|-----------------|------|-----------------|
| Normal Depth    |                 | 0.31 | ft              |
| Elevation Range | 0.03 to 1.58 ft |      |                 |
| Flow Area       |                 | 0.77 | ft <sup>2</sup> |

---

## Worksheet for Section G-East-Q10

---

### Results

|                  |             |       |
|------------------|-------------|-------|
| Wetted Perimeter | 7.92        | ft    |
| Hydraulic Radius | 0.10        | ft    |
| Top Width        | 7.57        | ft    |
| Normal Depth     | 0.31        | ft    |
| Critical Depth   | 0.28        | ft    |
| Critical Slope   | 0.00816     | ft/ft |
| Velocity         | 1.30        | ft/s  |
| Velocity Head    | 0.03        | ft    |
| Specific Energy  | 0.33        | ft    |
| Froude Number    | 0.71        |       |
| Flow Type        | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.31     | ft    |
| Critical Depth      | 0.28     | ft    |
| Channel Slope       | 0.40     | %     |
| Critical Slope      | 0.00816  | ft/ft |

---

## Cross Section for Section G-East-Q10

---

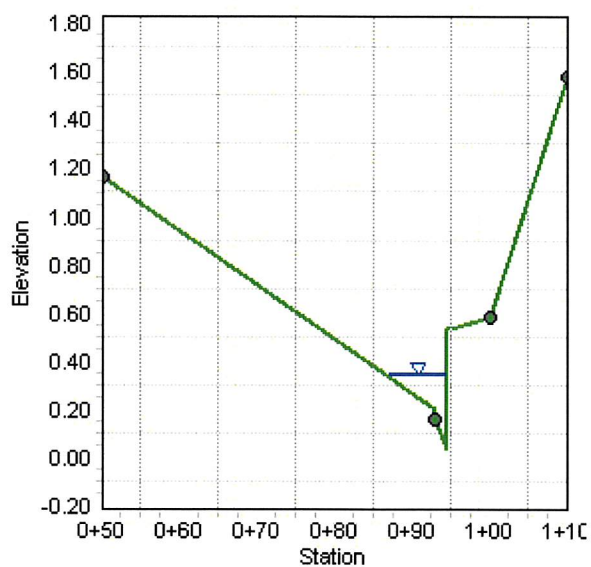
### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|               |      |                    |
|---------------|------|--------------------|
| Channel Slope | 0.40 | %                  |
| Normal Depth  | 0.31 | ft                 |
| Discharge     | 1.00 | ft <sup>3</sup> /s |

### Cross Section Image



## Worksheet for Section G-East-Q100

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                              0.40    %  
Discharge                                  2.50    ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+50.0       | 1.16           |
| 0+93.0       | 0.20           |
| 0+93.0       | 0.16           |
| 0+94.5       | 0.03           |
| 0+94.5       | 0.53           |
| 0+95.0       | 0.53           |
| 1+00.0       | 0.58           |
| 1+10.0       | 1.58           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+50.0, 1.16) | (0+93.0, 0.16) | 0.016                 |
| (0+93.0, 0.16) | (1+00.0, 0.58) | 0.013                 |
| (1+00.0, 0.58) | (1+10.0, 1.58) | 0.030                 |

### Options

Current Roughness Weighted Method                      Pavlovskii's Method  
Open Channel Weighting Method                      Pavlovskii's Method  
Closed Channel Weighting Method                      Pavlovskii's Method

### Results

Normal Depth                              0.39    ft  
Elevation Range                              0.03 to 1.58 ft  
Flow Area                                      1.58    ft<sup>2</sup>



---

## Worksheet for Section G-East-Q100

---

### Results

|                  |             |       |
|------------------|-------------|-------|
| Wetted Perimeter | 11.84       | ft    |
| Hydraulic Radius | 0.13        | ft    |
| Top Width        | 11.40       | ft    |
| Normal Depth     | 0.39        | ft    |
| Critical Depth   | 0.36        | ft    |
| Critical Slope   | 0.00744     | ft/ft |
| Velocity         | 1.58        | ft/s  |
| Velocity Head    | 0.04        | ft    |
| Specific Energy  | 0.43        | ft    |
| Froude Number    | 0.75        |       |
| Flow Type        | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.39     | ft    |
| Critical Depth      | 0.36     | ft    |
| Channel Slope       | 0.40     | %     |
| Critical Slope      | 0.00744  | ft/ft |

FIGURE D-11

## Worksheet for Section G-West-Q10

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                                              0.35    %  
Discharge                                                1.00   ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.0       | 0.55           |
| 0+05.0       | 0.50           |
| 0+05.5       | 0.50           |
| 0+05.5       | 0.00           |
| 0+07.0       | 0.13           |
| 0+07.0       | 0.17           |
| 0+50.0       | 1.16           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+00.0, 0.55) | (0+07.0, 0.13) | 0.013                 |
| (0+07.0, 0.13) | (0+50.0, 1.16) | 0.016                 |

### Options

Current Roughness Weighted Method                      Pavlovskii's Method  
Open Channel Weighting Method                      Pavlovskii's Method  
Closed Channel Weighting Method                      Pavlovskii's Method

### Results

Normal Depth                                              0.31    ft  
Elevation Range                                              0.00 to 1.16 ft  
Flow Area                                                      0.81    ft<sup>2</sup>  
Wetted Perimeter                                              8.02    ft  
Hydraulic Radius                                              0.10    ft

---

## Worksheet for Section G-West-Q10

---

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Top Width       | 7.66        | ft    |
| Normal Depth    | 0.31        | ft    |
| Critical Depth  | 0.28        | ft    |
| Critical Slope  | 0.00814     | ft/ft |
| Velocity        | 1.24        | ft/s  |
| Velocity Head   | 0.02        | ft    |
| Specific Energy | 0.34        | ft    |
| Froude Number   | 0.67        |       |
| Flow Type       | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.31     | ft    |
| Critical Depth      | 0.28     | ft    |
| Channel Slope       | 0.35     | %     |
| Critical Slope      | 0.00814  | ft/ft |

## Cross Section for Section G-West-Q10

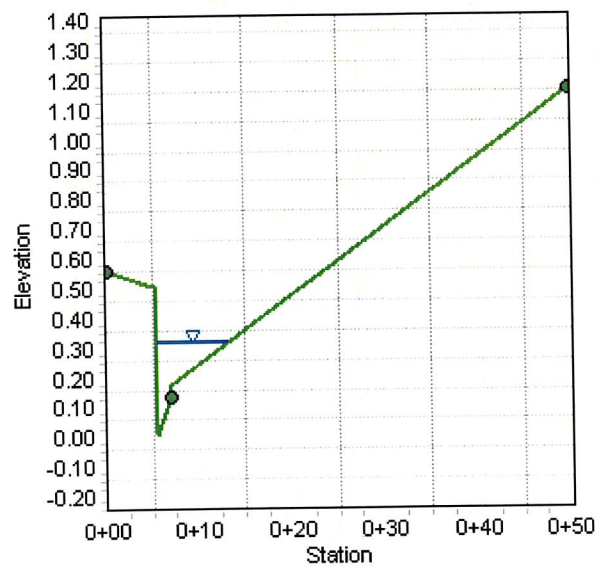
### Project Description

Friction Method                      Manning Formula  
Solve For                                Normal Depth

### Input Data

|               |      |                    |
|---------------|------|--------------------|
| Channel Slope | 0.35 | %                  |
| Normal Depth  | 0.31 | ft                 |
| Discharge     | 1.00 | ft <sup>3</sup> /s |

### Cross Section Image





## Worksheet for Section G-West-Q100

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                                              0.35    %  
Discharge                                                5.00    ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.0       | 0.55           |
| 0+05.0       | 0.50           |
| 0+05.5       | 0.50           |
| 0+05.5       | 0.00           |
| 0+07.0       | 0.13           |
| 0+07.0       | 0.17           |
| 0+50.0       | 1.16           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+00.0, 0.55) | (0+07.0, 0.13) | 0.013                 |
| (0+07.0, 0.13) | (0+50.0, 1.16) | 0.016                 |

### Options

Current Roughness Weighted Method                      Pavlovskii's Method  
Open Channel Weighting Method                      Pavlovskii's Method  
Closed Channel Weighting Method                      Pavlovskii's Method

### Results

Normal Depth                                              0.49    ft  
Elevation Range                                              0.00 to 1.16 ft  
Flow Area                                                      2.82    ft<sup>2</sup>  
Wetted Perimeter                                              15.81    ft  
Hydraulic Radius                                              0.18    ft

---

## Worksheet for Section G-West-Q100

---

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Top Width       | 15.27       | ft    |
| Normal Depth    | 0.49        | ft    |
| Critical Depth  | 0.44        | ft    |
| Critical Slope  | 0.00685     | ft/ft |
| Velocity        | 1.78        | ft/s  |
| Velocity Head   | 0.05        | ft    |
| Specific Energy | 0.54        | ft    |
| Froude Number   | 0.73        |       |
| Flow Type       | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.49     | ft    |
| Critical Depth      | 0.44     | ft    |
| Channel Slope       | 0.35     | %     |
| Critical Slope      | 0.00685  | ft/ft |

## Project Description

### Manning Formula

Normal Depth

### Input Data

0.35 %

0.49 ft

5.00 ft<sup>3</sup>/s

### Cross Section Image

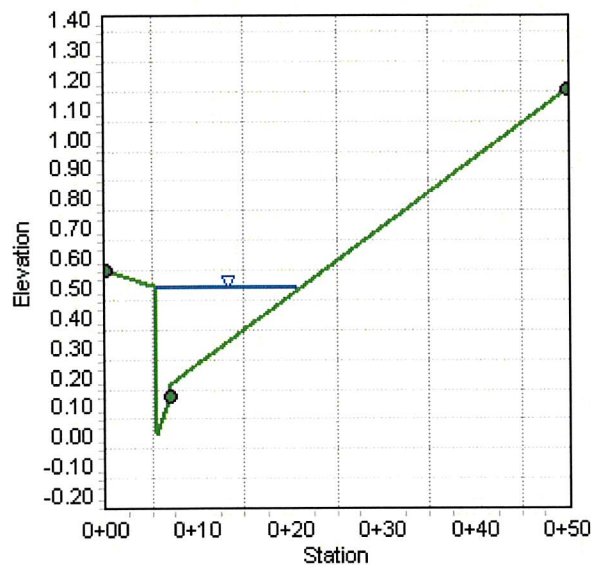


FIGURE D-11

## Worksheet for Section H-East-Q10

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                              0.10    %  
Discharge                                  0.00    ft<sup>3</sup>/s

### Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+52.0       | 0.99           |
| 0+78.0       | 0.95           |
| 0+93.0       | 1.21           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+52.0, 0.99) | (0+93.0, 1.21) | 0.030                 |

### Options

|                                   |                     |
|-----------------------------------|---------------------|
| Current Roughness Weighted Method | Pavlovskii's Method |
| Open Channel Weighting Method     | Pavlovskii's Method |
| Closed Channel Weighting Method   | Pavlovskii's Method |

### Results

|                  |                         |
|------------------|-------------------------|
| Normal Depth     | 0.00    ft              |
| Elevation Range  | 0.95 to 1.21 ft         |
| Flow Area        | 0.00    ft <sup>2</sup> |
| Wetted Perimeter | 2.55    ft              |
| Hydraulic Radius | 0.00    ft              |
| Top Width        | 2.55    ft              |
| Normal Depth     | 0.00    ft              |
| Critical Depth   | 0.00    ft              |
| Critical Slope   | 0.14885    ft/ft        |
| Velocity         | 0.02    ft/s            |

---

## Worksheet for Section H-East-Q10

---

### Results

|                 |             |    |
|-----------------|-------------|----|
| Velocity Head   | 0.00        | ft |
| Specific Energy | 0.00        | ft |
| Froude Number   | 0.09        |    |
| Flow Type       | Subcritical |    |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.00     | ft    |
| Critical Depth      | 0.00     | ft    |
| Channel Slope       | 0.10     | %     |
| Critical Slope      | 0.14885  | ft/ft |



---

## Cross Section for Section H-East-Q10

---

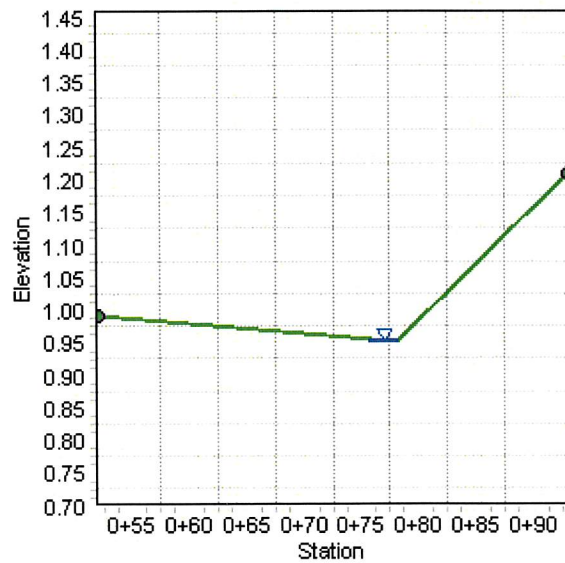
### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|               |      |                    |
|---------------|------|--------------------|
| Channel Slope | 0.10 | %                  |
| Normal Depth  | 0.00 | ft                 |
| Discharge     | 0.00 | ft <sup>3</sup> /s |

### Cross Section Image



## Worksheet for Section H-East-Q100

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                              0.10    %  
Discharge                                  0.00    ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+52.0       | 0.99           |
| 0+78.0       | 0.95           |
| 0+93.0       | 1.21           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+52.0, 0.99) | (0+93.0, 1.21) | 0.030                 |

### Options

|                                   |                     |
|-----------------------------------|---------------------|
| Current Roughness Weighted Method | Pavlovskii's Method |
| Open Channel Weighting Method     | Pavlovskii's Method |
| Closed Channel Weighting Method   | Pavlovskii's Method |

### Results

|                  |              |                 |
|------------------|--------------|-----------------|
| Normal Depth     | 0.00         | ft              |
| Elevation Range  | 0.95 to 1.21 | ft              |
| Flow Area        | 0.00         | ft <sup>2</sup> |
| Wetted Perimeter | 2.55         | ft              |
| Hydraulic Radius | 0.00         | ft              |
| Top Width        | 2.55         | ft              |
| Normal Depth     | 0.00         | ft              |
| Critical Depth   | 0.00         | ft              |
| Critical Slope   | 0.14885      | ft/ft           |
| Velocity         | 0.02         | ft/s            |

---

## Worksheet for Section H-East-Q100

---

### Results

|                 |             |    |
|-----------------|-------------|----|
| Velocity Head   | 0.00        | ft |
| Specific Energy | 0.00        | ft |
| Froude Number   | 0.09        |    |
| Flow Type       | Subcritical |    |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.00     | ft    |
| Critical Depth      | 0.00     | ft    |
| Channel Slope       | 0.10     | %     |
| Critical Slope      | 0.14885  | ft/ft |

## Project Description

### Manning Formula

Normal Depth

## Channel Slope

0.10 %

0.00 ft

0.00 ft<sup>3</sup>/s

The profile view graph displays the elevation of a road surface relative to a datum. The vertical axis represents Elevation, ranging from 0.70 to 1.45. The horizontal axis represents Stationing, with labels at 0+55, 0+60, 0+65, 0+70, 0+75, 0+80, 0+85, and 0+90. The profile line starts at an elevation of 1.00 at station 0+55, gradually descends to a minimum elevation of 0.95 at station 0+75, and then ascends to an elevation of 1.20 at station 0+90. A blue arrow points to the minimum elevation at station 0+75.

| Station | Elevation |
|---------|-----------|
| 0+55    | 1.00      |
| 0+60    | 0.98      |
| 0+65    | 0.97      |
| 0+70    | 0.96      |
| 0+75    | 0.95      |
| 0+80    | 0.95      |
| 0+85    | 1.05      |
| 0+90    | 1.20      |

## Project Description

### Manning Formula

### Normal Depth

0.50 %

0.00 ft<sup>3</sup>/s

## Station (ft)

Elevation (ft)

0.55

0.50

0.50

0.00

0.13

0.17

0.95

0.99

**Start Station**

Ending Station

### Roughness Coefficient

(0+07.0, 0.13)

0.013

(0+52.0, 0.99)

0.016

### Pavlovskii's Method

### Pavlovskii's Method

### Pavlovskii's Method

## 0.02 ft

0.00 to 0.99 ft

0.00 ft<sup>2</sup>

0.27 ft



---

## Worksheet for Section H-West-Q10

---

### Results

|                  |             |       |
|------------------|-------------|-------|
| Hydraulic Radius | 0.01        | ft    |
| Top Width        | 0.25        | ft    |
| Normal Depth     | 0.02        | ft    |
| Critical Depth   | 0.02        | ft    |
| Critical Slope   | 0.01331     | ft/ft |
| Velocity         | 0.37        | ft/s  |
| Velocity Head    | 0.00        | ft    |
| Specific Energy  | 0.02        | ft    |
| Froude Number    | 0.64        |       |
| Flow Type        | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.02     | ft    |
| Critical Depth      | 0.02     | ft    |
| Channel Slope       | 0.50     | %     |
| Critical Slope      | 0.01331  | ft/ft |

---

## Cross Section for Section H-West-Q10

---

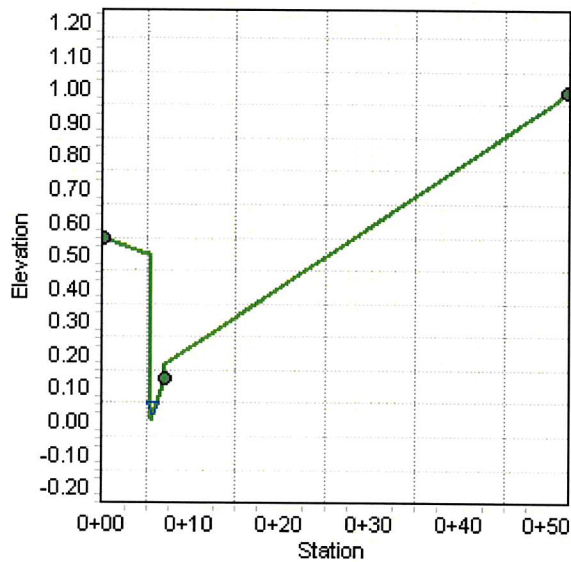
### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|               |      |                    |
|---------------|------|--------------------|
| Channel Slope | 0.50 | %                  |
| Normal Depth  | 0.02 | ft                 |
| Discharge     | 0.00 | ft <sup>3</sup> /s |

### Cross Section Image



## Worksheet for Section H-West-Q100

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                                              0.50 %  
Discharge                                                 1.50 ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.0       | 0.55           |
| 0+05.0       | 0.50           |
| 0+05.5       | 0.50           |
| 0+05.5       | 0.00           |
| 0+07.0       | 0.13           |
| 0+07.0       | 0.17           |
| 0+50.0       | 0.95           |
| 0+52.0       | 0.99           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+00.0, 0.55) | (0+07.0, 0.13) | 0.013                 |
| (0+07.0, 0.13) | (0+52.0, 0.99) | 0.016                 |

### Options

Current Roughness Weighted Method                      Pavlovskii's Method  
Open Channel Weighting Method                      Pavlovskii's Method  
Closed Channel Weighting Method                      Pavlovskii's Method

### Results

Normal Depth                                              0.32 ft  
Elevation Range                                              0.00 to 0.99 ft  
Flow Area                                                      1.03 ft<sup>2</sup>  
Wetted Perimeter                                              10.28 ft

---

## Worksheet for Section H-West-Q100

---

### Results

|                  |             |       |
|------------------|-------------|-------|
| Hydraulic Radius | 0.10        | ft    |
| Top Width        | 9.91        | ft    |
| Normal Depth     | 0.32        | ft    |
| Critical Depth   | 0.30        | ft    |
| Critical Slope   | 0.00806     | ft/ft |
| Velocity         | 1.46        | ft/s  |
| Velocity Head    | 0.03        | ft    |
| Specific Energy  | 0.36        | ft    |
| Froude Number    | 0.80        |       |
| Flow Type        | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.32     | ft    |
| Critical Depth      | 0.30     | ft    |
| Channel Slope       | 0.50     | %     |
| Critical Slope      | 0.00806  | ft/ft |

## Cross Section for Section H-West-Q100

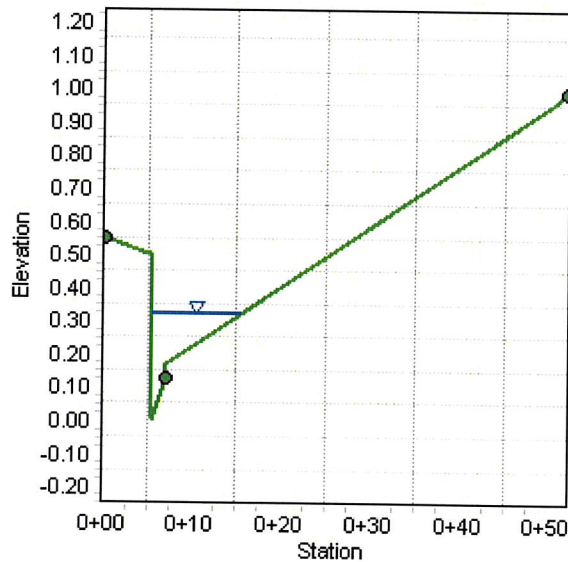
### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                                              0.50 %  
Normal Depth                                              0.32 ft  
Discharge                                                  1.50 ft<sup>3</sup>/s

### Cross Section Image





## Worksheet for Section J

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                              0.30 %  
Discharge                                      1.50 ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.0       | 0.55           |
| 0+05.0       | 0.50           |
| 0+05.5       | 0.50           |
| 0+05.5       | 0.00           |
| 0+07.0       | 0.13           |
| 0+07.0       | 0.17           |
| 0+50.0       | 0.95           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+00.0, 0.55) | (0+07.0, 0.13) | 0.013                 |
| (0+07.0, 0.13) | (0+50.0, 0.95) | 0.016                 |

### Options

Current Roughness Weighted Method              Pavlovskii's Method  
Open Channel Weighting Method              Pavlovskii's Method  
Closed Channel Weighting Method              Pavlovskii's Method

### Results

Normal Depth                              0.34 ft  
Elevation Range                              0.00 to 0.95 ft  
Flow Area                                      1.26 ft<sup>2</sup>  
Wetted Perimeter                              11.49 ft  
Hydraulic Radius                              0.11 ft

## Worksheet for Section J

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Top Width       | 11.10       | ft    |
| Normal Depth    | 0.34        | ft    |
| Critical Depth  | 0.30        | ft    |
| Critical Slope  | 0.00811     | ft/ft |
| Velocity        | 1.20        | ft/s  |
| Velocity Head   | 0.02        | ft    |
| Specific Energy | 0.37        | ft    |
| Froude Number   | 0.63        |       |
| Flow Type       | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.34     | ft    |
| Critical Depth      | 0.30     | ft    |
| Channel Slope       | 0.30     | %     |
| Critical Slope      | 0.00811  | ft/ft |

## Project Description

### Manning Formula

Normal Depth

0.30 %

0.34 ft

1.50 ft<sup>3</sup>/s

The graph shows a profile with the following approximate data points:

| Station | Elevation |
|---------|-----------|
| 0+00    | 0.55      |
| 0+05    | 0.50      |
| 0+05    | 0.00      |
| 0+06    | 0.15      |
| 0+10    | 0.30      |
| 0+15    | 0.35      |
| 0+50    | 0.95      |

## Worksheet for Section K-East-Q10

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                                              0.20    %  
Discharge                                                1.00    ft<sup>3</sup>/s

### Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+58.0       | 1.67           |
| 0+90.0       | 0.00           |
| 0+99.0       | 0.31           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+58.0, 1.67) | (0+99.0, 0.31) | 0.030                 |

### Options

Current Roughness weighted Method                      Pavlovskii's Method  
Open Channel Weighting Method                      Pavlovskii's Method  
Closed Channel Weighting Method                      Pavlovskii's Method

### Results

|                  |              |                 |
|------------------|--------------|-----------------|
| Normal Depth     | 0.27         | ft              |
| Elevation Range  | 0.00 to 1.67 | ft              |
| Flow Area        | 1.73         | ft <sup>2</sup> |
| Wetted Perimeter | 12.91        | ft              |
| Hydraulic Radius | 0.13         | ft              |
| Top Width        | 12.90        | ft              |
| Normal Depth     | 0.27         | ft              |
| Critical Depth   | 0.16         | ft              |
| Critical Slope   | 0.03043      | ft/ft           |
| Velocity         | 0.58         | ft/s            |

## Worksheet for Section K-East-Q10

### Results

|                 |             |    |
|-----------------|-------------|----|
| Velocity Head   | 0.01        | ft |
| Specific Energy | 0.27        | ft |
| Froude Number   | 0.28        |    |
| Flow Type       | Subcritical |    |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.27     | ft    |
| Critical Depth      | 0.16     | ft    |
| Channel Slope       | 0.20     | %     |
| Critical Slope      | 0.03043  | ft/ft |



## Cross Section for Section K-East-Q10

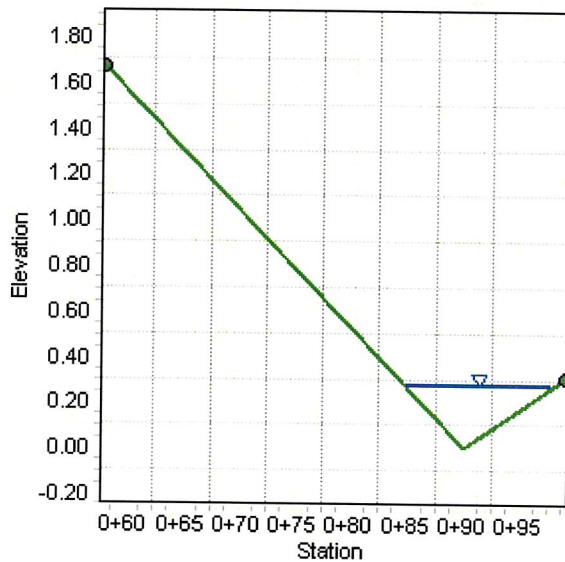
### Project Description

Friction Method                      Manning Formula  
Solve For                                Normal Depth

### Input Data

Channel Slope                                              0.20 %  
Normal Depth                                              0.27 ft  
Discharge                                                  1.00 ft<sup>3</sup>/s

### Cross Section Image



## Project Description

### Manning Formula

Normal Depth

### Channel Slope

0.20 %

2.00 ft<sup>3</sup>/s

## Station (ft)

Elevation (ft)

0+58.0

1.67

0+90.0

0.00

0+99.0

0.31

**Start Station**

Ending Station

### Roughness Coefficient

(0+58.0, 1.67)

(0+99.0, 0.31)

0.030

### Current Roughness Weighted Method

### Pavlovskii's Method

### Open Channel Weighting Method

### Pavlovskii's Method

### Closed Channel Weighting Method

### Pavlovskii's Method

Normal Depth

0.34 ft

### Elevation Range

0.00 to 1.67 ft

Flow Area

2.82 ft<sup>2</sup>

### Wetted Perimeter

15.63 ft

### Hydraulic Radius

0.18 ft

Top Width

15.58 ft

### Normal Depth

0.34 ft

### Critical Depth

0.21 ft

### Critical Slope

0.02774 ft/ft

## Velocity

0.71 ft/s

## Worksheet for Section K-East-Q100

### Results

|                 |             |    |
|-----------------|-------------|----|
| Velocity Head   | 0.01        | ft |
| Specific Energy | 0.35        | ft |
| Froude Number   | 0.29        |    |
| Flow Type       | Subcritical |    |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.34     | ft    |
| Critical Depth      | 0.21     | ft    |
| Channel Slope       | 0.20     | %     |
| Critical Slope      | 0.02774  | ft/ft |

## Cross Section for Section K-East-Q100

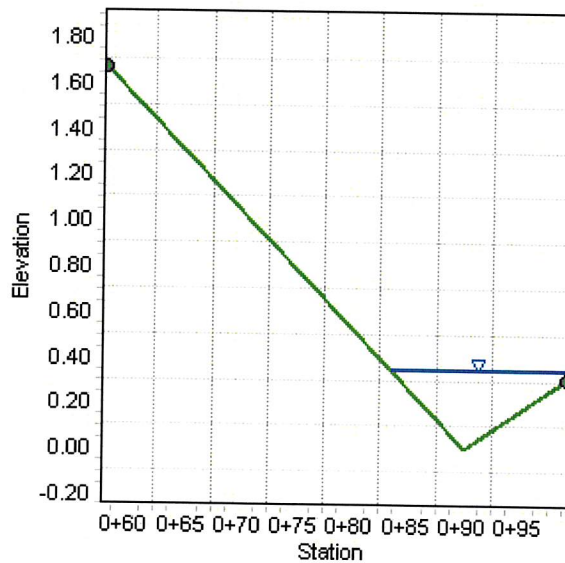
### Project Description

Friction Method                      Manning Formula  
Solve For                                Normal Depth

### Input Data

|               |      |                    |
|---------------|------|--------------------|
| Channel Slope | 0.20 | %                  |
| Normal Depth  | 0.34 | ft                 |
| Discharge     | 2.00 | ft <sup>3</sup> /s |

### Cross Section Image



## Worksheet for Section K-West-Q10

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                                              0.50 %  
Discharge                                                 4.00 ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.0       | 1.53           |
| 0+05.0       | 1.48           |
| 0+05.5       | 1.48           |
| 0+05.5       | 0.98           |
| 0+07.0       | 1.11           |
| 0+07.0       | 1.15           |
| 0+25.0       | 1.28           |
| 0+50.0       | 1.58           |
| 0+58.0       | 1.67           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+00.0, 1.53) | (0+07.0, 1.11) | 0.013                 |
| (0+07.0, 1.11) | (0+58.0, 1.67) | 0.016                 |

### Options

Current Roughness Weighted Method                      Pavlovskii's Method  
Open Channel Weighting Method                      Pavlovskii's Method  
Closed Channel Weighting Method                      Pavlovskii's Method

### Results

Normal Depth                                              0.35 ft  
Elevation Range                                              0.98 to 1.67 ft  
Flow Area                                                      2.63 ft<sup>2</sup>



## Worksheet for Section K-West-Q10

### Results

|                  |             |       |
|------------------|-------------|-------|
| Wetted Perimeter | 24.18       | ft    |
| Hydraulic Radius | 0.11        | ft    |
| Top Width        | 23.78       | ft    |
| Normal Depth     | 0.35        | ft    |
| Critical Depth   | 0.33        | ft    |
| Critical Slope   | 0.00801     | ft/ft |
| Velocity         | 1.52        | ft/s  |
| Velocity Head    | 0.04        | ft    |
| Specific Energy  | 0.39        | ft    |
| Froude Number    | 0.80        |       |
| Flow Type        | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.35     | ft    |
| Critical Depth      | 0.33     | ft    |
| Channel Slope       | 0.50     | %     |
| Critical Slope      | 0.00801  | ft/ft |

## Project Description

### Manning Formula

Normal Depth

0.50 %

0.35 ft

4.00 ft<sup>3</sup>/s

The graph shows a vertical curve profile. The y-axis is labeled 'Elevation' and ranges from 0.80 to 1.90. The x-axis is labeled 'Station' and ranges from 0+00 to 0+55. The profile line starts at (0+00, 1.54), drops to a minimum of (0+05, 0.98), and then rises to (0+10, 1.12). From station 0+10, the curve continues to rise, passing through (0+20, 1.22) and (0+30, 1.32), and ending at (0+55, 1.66). A horizontal sight line is drawn at an elevation of 1.34, starting from station 0+05 and ending at station 0+30. A sight triangle symbol is placed on this line at station 0+20.

| Station | Elevation |
|---------|-----------|
| 0+00    | 1.54      |
| 0+05    | 0.98      |
| 0+10    | 1.12      |
| 0+20    | 1.22      |
| 0+30    | 1.32      |
| 0+55    | 1.66      |

## Worksheet for Section K-West-Q100

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                                              0.50    %  
Discharge                                                 9.00    ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.0       | 1.53           |
| 0+05.0       | 1.48           |
| 0+05.5       | 1.48           |
| 0+05.5       | 0.98           |
| 0+07.0       | 1.11           |
| 0+07.0       | 1.15           |
| 0+25.0       | 1.28           |
| 0+50.0       | 1.58           |
| 0+58.0       | 1.67           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+00.0, 1.53) | (0+07.0, 1.11) | 0.013                 |
| (0+07.0, 1.11) | (0+58.0, 1.67) | 0.016                 |

### Options

Current Roughness Weighted Method                      Pavlovskii's Method  
Open Channel Weighting Method                      Pavlovskii's Method  
Closed Channel Weighting Method                      Pavlovskii's Method

### Results

Normal Depth                                              0.43    ft  
Elevation Range                                              0.98 to 1.67 ft  
Flow Area                                                      4.72    ft<sup>2</sup>

## Worksheet for Section K-West-Q100

### Results

|                  |             |       |
|------------------|-------------|-------|
| Wetted Perimeter | 30.70       | ft    |
| Hydraulic Radius | 0.15        | ft    |
| Top Width        | 30.22       | ft    |
| Normal Depth     | 0.43        | ft    |
| Critical Depth   | 0.41        | ft    |
| Critical Slope   | 0.00709     | ft/ft |
| Velocity         | 1.91        | ft/s  |
| Velocity Head    | 0.06        | ft    |
| Specific Energy  | 0.49        | ft    |
| Froude Number    | 0.85        |       |
| Flow Type        | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.43     | ft    |
| Critical Depth      | 0.41     | ft    |
| Channel Slope       | 0.50     | %     |
| Critical Slope      | 0.00709  | ft/ft |

## Project Description

### Manning Formula

Normal Depth

## Channel Slope

0.50 %

0.43 ft

9.00 ft<sup>3</sup>/s



## Project Description

### Manning Formula

Normal Depth

## Input Data

0.60 %

0.00 ft<sup>3</sup>/s

## Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+34.0       | 1.24           |
| 0+52.0       | 1.12           |
| 0+67.0       | 1.05           |
| 1+02.0       | 0.00           |
| 1+02.0       | 1.00           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+34.0, 1.24) | (0+67.0, 1.05) | 0.016                 |
| (0+67.0, 1.05) | (1+02.0, 0.00) | 0.030                 |
| (1+02.0, 0.00) | (1+02.0, 1.00) | 0.035                 |

## Options

### Pavlovskii's Method

### Pavlovskii's Method

### Pavlovskii's Method

## Results

Normal Depth 0.02 ft

Elevation Range 0.00 to 1.24 ft

|           |      |                 |
|-----------|------|-----------------|
| Flow Area | 0.01 | ft <sup>2</sup> |
|-----------|------|-----------------|

|                  |      |    |
|------------------|------|----|
| Wetted Perimeter | 0.65 | ft |
|------------------|------|----|

|                  |      |    |
|------------------|------|----|
| Hydraulic Radius | 0.01 | ft |
|------------------|------|----|

|           |      |    |
|-----------|------|----|
| Top Width | 0.63 | ft |
|-----------|------|----|

## Worksheet for Section L-East-Q10

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Normal Depth    | 0.02        | ft    |
| Critical Depth  | 0.01        | ft    |
| Critical Slope  | 0.07655     | ft/ft |
| Velocity        | 0.17        | ft/s  |
| Velocity Head   | 0.00        | ft    |
| Specific Energy | 0.02        | ft    |
| Froude Number   | 0.30        |       |
| Flow Type       | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.02     | ft    |
| Critical Depth      | 0.01     | ft    |
| Channel Slope       | 0.60     | %     |
| Critical Slope      | 0.07655  | ft/ft |

## Project Description

### Manning Formula

Normal Depth

### Channel Slope

0.60 %

0.02 ft

0.00 ft<sup>3</sup>/s

## Project Description

## Input Data

## Section Definitions

### Roughness Segment Definitions

## Options

## Results

3/31/2011 4:09:56 PM Bentley Systems, Inc. Haestad Methods Software Center Master V8i (SELECTseries 1) [08.11.01.03]  
 27 Siemons Company Drive Suite 200 W Watertown, CT 06795 USA +1-203-755-1666 Page 1 of 2

## Worksheet for Section L-East-Q100

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Normal Depth    | 0.02        | ft    |
| Critical Depth  | 0.01        | ft    |
| Critical Slope  | 0.07655     | ft/ft |
| Velocity        | 0.17        | ft/s  |
| Velocity Head   | 0.00        | ft    |
| Specific Energy | 0.02        | ft    |
| Froude Number   | 0.30        |       |
| Flow Type       | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.02     | ft    |
| Critical Depth      | 0.01     | ft    |
| Channel Slope       | 0.60     | %     |
| Critical Slope      | 0.07655  | ft/ft |



## Cross Section for Section L-East-Q100

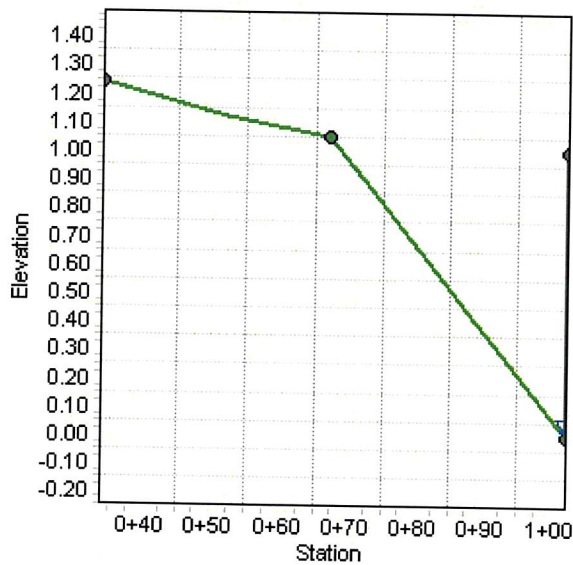
### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|               |      |                    |
|---------------|------|--------------------|
| Channel Slope | 0.60 | %                  |
| Normal Depth  | 0.02 | ft                 |
| Discharge     | 0.00 | ft <sup>3</sup> /s |

### Cross Section Image



## Worksheet for Section L-West-Q10

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                                              0.35 %  
Discharge                                                      5.00 ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.0       | 1.14           |
| 0+05.0       | 1.09           |
| 0+05.5       | 1.09           |
| 0+05.5       | 0.59           |
| 0+07.0       | 0.72           |
| 0+07.0       | 0.76           |
| 0+34.0       | 1.24           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+00.0, 1.14) | (0+07.0, 0.72) | 0.013                 |
| (0+07.0, 0.72) | (0+34.0, 1.24) | 0.016                 |

### Options

Current Roughness Weighted Method                      Pavlovskii's Method  
Open Channel Weighting Method                      Pavlovskii's Method  
Closed Channel Weighting Method                      Pavlovskii's Method

### Results

Normal Depth                                              0.46 ft  
Elevation Range                                              0.59 to 1.24 ft  
Flow Area                                                      3.00 ft<sup>2</sup>  
Wetted Perimeter                                              18.45 ft  
Hydraulic Radius                                              0.16 ft

## Worksheet for Section L-West-Q10

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Top Width       | 17.94       | ft    |
| Normal Depth    | 0.46        | ft    |
| Critical Depth  | 0.42        | ft    |
| Critical Slope  | 0.00708     | ft/ft |
| Velocity        | 1.67        | ft/s  |
| Velocity Head   | 0.04        | ft    |
| Specific Energy | 0.51        | ft    |
| Froude Number   | 0.72        |       |
| Flow Type       | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.46     | ft    |
| Critical Depth      | 0.42     | ft    |
| Channel Slope       | 0.35     | %     |
| Critical Slope      | 0.00708  | ft/ft |

## Project Description

### Manning Formula

Normal Depth

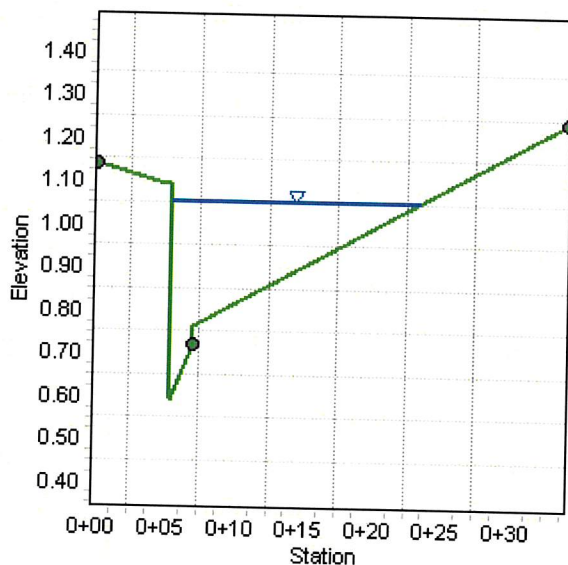
### Input Data

0.35 %

0.46 ft

5.00 ft<sup>3</sup>/s

### Cross Section Image







## Worksheet for Section L-West-Q100

### Results

|                 |         |       |
|-----------------|---------|-------|
| Top Width       | 30.73   | ft    |
| Normal Depth    | 0.59    | ft    |
| Critical Depth  | 0.55    | ft    |
| Critical Slope  | 0.00627 | ft/ft |
| Velocity        | 1.94    | ft/s  |
| Velocity Head   | 0.06    | ft    |
| Specific Energy | 0.65    | ft    |
| Froude Number   | 0.76    |       |

Flow Type Subcritical

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.59     | ft    |
| Critical Depth      | 0.55     | ft    |
| Channel Slope       | 0.35     | %     |
| Critical Slope      | 0.00627  | ft/ft |

## Project Description

### Manning Formula

Normal Depth

### Channel Slope

0.35 %

0.59 ft

12.00 ft<sup>3</sup>/s

The graph shows a cross-section profile with Elevation on the y-axis (ranging from 0.40 to 1.40) and Station on the x-axis (ranging from 0+00 to 0+30+). A blue line represents the existing ground surface, which is relatively flat at an elevation of about 1.18. A green line represents the proposed profile, which starts at station 0+00 with an elevation of 1.15, drops sharply to a minimum of 0.60 at station 0+06, and then rises to meet the existing profile at station 0+30 with an elevation of 1.20. A blue triangle symbol is located on the existing profile line at station 0+15.

| Station | Existing Elevation (Blue) | Proposed Elevation (Green) |
|---------|---------------------------|----------------------------|
| 0+00    | 1.18                      | 1.15                       |
| 0+05    | 1.10                      | 1.10                       |
| 0+06    | 1.10                      | 0.60                       |
| 0+07    | 1.10                      | 0.72                       |
| 0+15    | 1.18                      | 0.85                       |
| 0+20    | 1.18                      | 1.00                       |
| 0+25    | 1.18                      | 1.10                       |
| 0+30    | 1.18                      | 1.20                       |



## Worksheet for Section M-East-Q10

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Critical Depth  | 0.14        | ft    |
| Critical Slope  | 0.03178     | ft/ft |
| Velocity        | 1.01        | ft/s  |
| Velocity Head   | 0.02        | ft    |
| Specific Energy | 0.19        | ft    |
| Froude Number   | 0.61        |       |
| Flow Type       | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.17     | ft    |
| Critical Depth      | 0.14     | ft    |
| Channel Slope       | 1.10     | %     |
| Critical Slope      | 0.03178  | ft/ft |

## Project Description

### Manning Formula

Normal Depth

## Channel Slope

1.10 %

0.17 ft

1.00 ft<sup>3</sup>/s

FIGURE D-11





## Worksheet for Section M-East-Q100

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Critical Depth  | 0.19        | ft    |
| Critical Slope  | 0.02896     | ft/ft |
| Velocity        | 1.21        | ft/s  |
| Velocity Head   | 0.02        | ft    |
| Specific Energy | 0.25        | ft    |
| Froude Number   | 0.64        |       |
| Flow Type       | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.22     | ft    |
| Critical Depth      | 0.19     | ft    |
| Channel Slope       | 1.10     | %     |
| Critical Slope      | 0.02896  | ft/ft |

## Project Description

### Manning Formula

Normal Depth

1.10 %

0.22 ft

2.00 ft<sup>3</sup>/s

FIGURE D-11

## Project Description

### Manning Formula

Normal Depth

## Input Data

0.80 %

0.00 ft<sup>3</sup>/s

## Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.0       | 0.67           |
| 0+05.0       | 0.62           |
| 0+05.5       | 0.62           |
| 0+05.5       | 0.12           |
| 0+07.0       | 0.25           |
| 0+07.0       | 0.29           |
| 0+40.0       | 0.60           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+00.0, 0.67) | (0+07.0, 0.25) | 0.013                 |
| (0+07.0, 0.25) | (0+40.0, 0.60) | 0.016                 |

## Options

### Pavlovskii's Method

### Pavlovskii's Method

### Pavlovskii's Method

## Results

0.02 ft

0.12 to 0.67 ft

0.00 ft<sup>2</sup>

0.25 ft

0.01 ft

## Worksheet for Section M-West-Q10

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Top Width       | 0.23        | ft    |
| Normal Depth    | 0.02        | ft    |
| Critical Depth  | 0.02        | ft    |
| Critical Slope  | 0.01331     | ft/ft |
| Velocity        | 0.44        | ft/s  |
| Velocity Head   | 0.00        | ft    |
| Specific Energy | 0.02        | ft    |
| Froude Number   | 0.78        |       |
| Flow Type       | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.02     | ft    |
| Critical Depth      | 0.02     | ft    |
| Channel Slope       | 0.80     | %     |
| Critical Slope      | 0.01331  | ft/ft |



## Project Description

### Manning Formula

Normal Depth

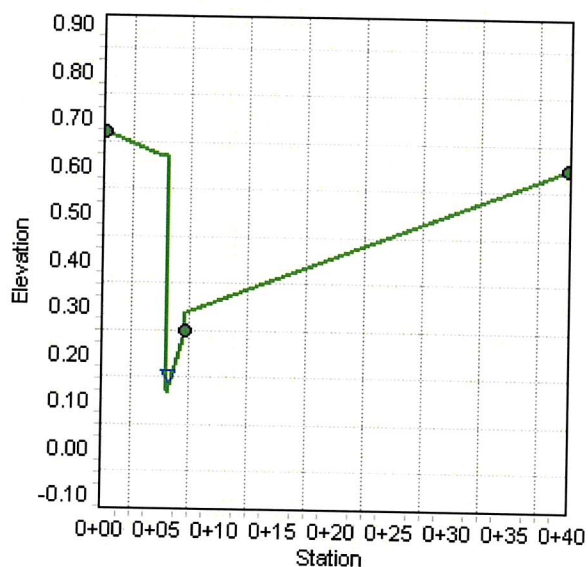
## Input Data

0.80 %

0.02 ft

0.00 ft<sup>3</sup>/s

### Cross Section Image



## Project Description

### Manning Formula

Normal Depth

## Input Data

0.80 %

7.00 ft<sup>3</sup>/s

## Section Definitions

Elevation (ft)

|        |      |
|--------|------|
| 0+00.0 | 0.67 |
| 0+05.0 | 0.62 |
| 0+05.5 | 0.62 |
| 0+05.5 | 0.12 |
| 0+07.0 | 0.25 |
| 0+07.0 | 0.29 |
| 0+40.0 | 0.60 |

### Roughness Segment Definitions

### Roughness Coefficient

|                |                |       |
|----------------|----------------|-------|
| (0+00.0, 0.67) | (0+07.0, 0.25) | 0.013 |
| (0+07.0, 0.25) | (0+40.0, 0.60) | 0.016 |

## Options

### Pavlovskii's Method

### Pavlovskii's Method

### Pavlovskii's Method

## Results

|                  |                 |       |                 |
|------------------|-----------------|-------|-----------------|
| Normal Depth     |                 | 0.40  | ft              |
| Elevation Range  | 0.12 to 0.67 ft |       |                 |
| Flow Area        |                 | 3.33  | ft <sup>2</sup> |
| Wetted Perimeter |                 | 26.46 | ft              |
| Hydraulic Radius |                 | 0.13  | ft              |

## Worksheet for Section M-West-Q100

### Results

|                 |               |       |
|-----------------|---------------|-------|
| Top Width       | 26.01         | ft    |
| Normal Depth    | 0.40          | ft    |
| Critical Depth  | 0.40          | ft    |
| Critical Slope  | 0.00735       | ft/ft |
| Velocity        | 2.11          | ft/s  |
| Velocity Head   | 0.07          | ft    |
| Specific Energy | 0.47          | ft    |
| Froude Number   | 1.04          |       |
| Flow Type       | Supercritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.40     | ft    |
| Critical Depth      | 0.40     | ft    |
| Channel Slope       | 0.80     | %     |
| Critical Slope      | 0.00735  | ft/ft |

## Project Description

### Manning Formula

Normal Depth

### Input Data

0.80 %

0.40 ft

7.00 ft<sup>3</sup>/s

### Cross Section Image

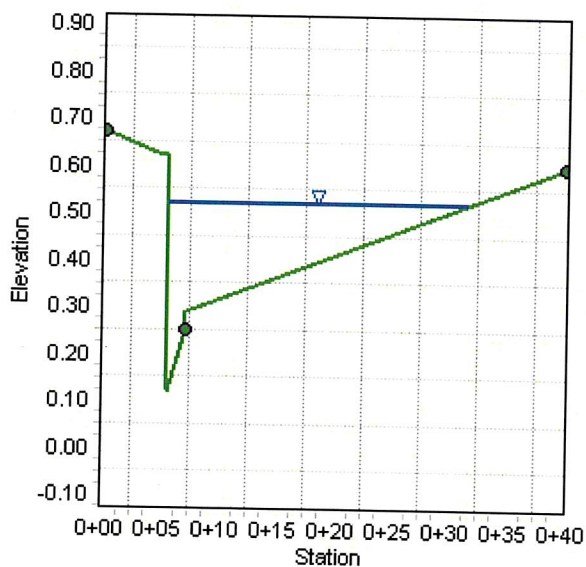


FIGURE D-11





## Worksheet for Section N-East-Q10

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Critical Slope  | 0.01801     | ft/ft |
| Velocity        | 0.81        | ft/s  |
| Velocity Head   | 0.01        | ft    |
| Specific Energy | 0.15        | ft    |
| Froude Number   | 0.55        |       |
| Flow Type       | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.14     | ft    |
| Critical Depth      | 0.11     | ft    |
| Channel Slope       | 0.50     | %     |
| Critical Slope      | 0.01801  | ft/ft |



## Project Description

### Manning Formula

Normal Depth

## Input Data

0.50 %

2.00 ft<sup>3</sup>/s

## Section Definitions

Elevation (ft)

0.65

0.43

0.00

0.28

### Roughness Segment Definitions

### Ending Station

### Roughness Coefficient

(0+93.0, 0.00)

(1+05.0, 0.28)

0.016

0.030

## Options

### Pavlovskii's Method

### Pavlovskii's Method

### Pavlovskii's Method

## Results

0.18 ft

0.00 to 0.65 ft

2.06 ft<sup>2</sup>

23.28 ft

0.09 ft

23.28 ft

0.18 ft

0.14 ft

## Worksheet for Section N-East-Q100

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Critical Slope  | 0.01641     | ft/ft |
| Velocity        | 0.97        | ft/s  |
| Velocity Head   | 0.01        | ft    |
| Specific Energy | 0.19        | ft    |
| Froude Number   | 0.57        |       |
| Flow Type       | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.18     | ft    |
| Critical Depth      | 0.14     | ft    |
| Channel Slope       | 0.50     | %     |
| Critical Slope      | 0.01641  | ft/ft |

## Project Description

### Manning Formula

Normal Depth

0.50 %

0.18 ft

2.00 ft<sup>3</sup>/s

FIGURE D-11



## Project Description

### Manning Formula

Normal Depth

## Section Definitions

## Worksheet for Section N-West-Q10

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Critical Depth  | 0.56        | ft    |
| Critical Slope  | 0.00567     | ft/ft |
| Velocity        | 1.53        | ft/s  |
| Velocity Head   | 0.04        | ft    |
| Specific Energy | 0.65        | ft    |
| Froude Number   | 0.62        |       |
| Flow Type       | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.61     | ft    |
| Critical Depth      | 0.56     | ft    |
| Channel Slope       | 0.20     | %     |
| Critical Slope      | 0.00567  | ft/ft |

## Project Description

### Manning Formula

Normal Depth

0.20 %

0.61 ft

2.00 ft<sup>3</sup>/s

| Station | Ground Elevation (m) | Proposed Road Grade (m) |
|---------|----------------------|-------------------------|
| 0+00    | 1.03                 | 1.10                    |
| 0+01    | 1.02                 | 1.098                   |
| 0+02    | 1.01                 | 1.096                   |
| 0+03    | 1.00                 | 1.094                   |
| 0+04    | 0.99                 | 1.092                   |
| 0+05    | 0.97                 | 1.09                    |
| 0+06    | 0.48                 | 1.088                   |
| 0+07    | 0.63                 | 1.08                    |

FIGURE D-11

## Project Description

Solve For Normal Depth

## Input Data

|               |       |                    |
|---------------|-------|--------------------|
| Channel Slope | 0.20  | %                  |
| Discharge     | 10.00 | ft <sup>3</sup> /s |

## Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.0       | 1.03           |
| 0+05.0       | 0.98           |
| 0+05.5       | 0.98           |
| 0+05.5       | 0.48           |
| 0+07.0       | 0.61           |
| 0+07.0       | 0.65           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+00.0, 1.03) | (0+07.0, 0.65) | 0.013                 |

## Options

|                                   |                     |
|-----------------------------------|---------------------|
| Current Roughness weighted Method | Pavlovskii's Method |
| Open Channel Weighting Method     | Pavlovskii's Method |
| Closed Channel Weighting Method   | Pavlovskii's Method |

## Results

|                  |                 |      |     |
|------------------|-----------------|------|-----|
| Normal Depth     |                 | 0.93 | ft  |
| Elevation Range  | 0.48 to 1.03 ft |      |     |
| Flow Area        |                 | 3.55 | ft² |
| Wetted Perimeter |                 | 8.69 | ft  |
| Hydraulic Radius |                 | 0.41 | ft  |
| Top Width        |                 | 7.00 | ft  |
| Normal Depth     |                 | 0.93 | ft  |

## Worksheet for Section N-West-Q100

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Critical Depth  | 0.82        | ft    |
| Critical Slope  | 0.00432     | ft/ft |
| Velocity        | 2.82        | ft/s  |
| Velocity Head   | 0.12        | ft    |
| Specific Energy | 1.06        | ft    |
| Froude Number   | 0.70        |       |
| Flow Type       | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.93     | ft    |
| Critical Depth      | 0.82     | ft    |
| Channel Slope       | 0.20     | %     |
| Critical Slope      | 0.00432  | ft/ft |



## Project Description

### Manning Formula

Normal Depth

0.20 %

0.93 ft

10.00 ft<sup>3</sup>/s

| Station | Elevation |
|---------|-----------|
| 0+00    | 1.03      |
| 0+01    | 1.02      |
| 0+02    | 1.01      |
| 0+03    | 1.00      |
| 0+04    | 0.99      |
| 0+05    | 0.98      |
| 0+06    | 0.97      |
| 0+07    | 0.63      |

FIGURE D-11

## Project Description

### Manning Formula

Normal Depth

## Input Data

0.50 %

79.00 ft<sup>3</sup>/s

## Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.0       | 1.00           |
| 0+00.0       | 0.15           |
| 0+10.0       | 0.00           |
| 0+20.0       | 0.02           |
| 0+20.0       | 1.00           |

### Roughness Segment Definitions

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+00.0, 1.00) | (0+00.0, 0.15) | 0.035                 |
| (0+00.0, 0.15) | (0+20.0, 0.02) | 0.016                 |
| (0+20.0, 0.02) | (0+20.0, 1.00) | 0.035                 |

## Options

### Pavlovskii's Method

### Pavlovskii's Method

### Pavlovskii's Method

## Results

0.86 ft

0.00 to 1.00 ft

16.32 ft<sup>2</sup>

21.55 ft

0.76 ft

20.00 ft

## Worksheet for Section P-Q10

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Normal Depth    | 0.86        | ft    |
| Critical Depth  | 0.83        | ft    |
| Critical Slope  | 0.00566     | ft/ft |
| Velocity        | 4.84        | ft/s  |
| Velocity Head   | 0.36        | ft    |
| Specific Energy | 1.22        | ft    |
| Froude Number   | 0.94        |       |
| Flow Type       | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 0.86     | ft    |
| Critical Depth      | 0.83     | ft    |
| Channel Slope       | 0.50     | %     |
| Critical Slope      | 0.00566  | ft/ft |

## Project Description

### Manning Formula

Normal Depth

79.00 ft<sup>3</sup>/s

FIGURE D-11

## Project Description

Solve For Normal Depth

|               |        |                    |
|---------------|--------|--------------------|
| Channel Slope | 0.50   | %                  |
| Discharge     | 239.00 | ft <sup>3</sup> /s |

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.0       | 1.00           |
| 0+00.0       | 0.15           |
| 0+10.0       | 0.00           |
| 0+20.0       | 0.02           |
| 0+20.0       | 1.00           |

| Start Station  | Ending Station | Roughness Coefficient |
|----------------|----------------|-----------------------|
| (0+00.0, 1.00) | (0+00.0, 0.15) | 0.035                 |
| (0+00.0, 0.15) | (0+20.0, 0.02) | 0.016                 |
| (0+20.0, 0.02) | (0+20.0, 1.00) | 0.035                 |

|                                   |                     |
|-----------------------------------|---------------------|
| Current Roughness weighted Method | Pavlovskii's Method |
| Open Channel Weighting Method     | Pavlovskii's Method |
| Closed Channel Weighting Method   | Pavlovskii's Method |

|                  |                 |       |     |
|------------------|-----------------|-------|-----|
| Normal Depth     |                 | 1.78  | ft  |
| Elevation Range  | 0.00 to 1.00 ft |       |     |
| Flow Area        |                 | 34.77 | ft² |
| Wetted Perimeter |                 | 23.39 | ft  |
| Hydraulic Radius |                 | 1.49  | ft  |
| Top Width        |                 | 20.00 | ft  |



## Worksheet for Section P-Q100

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Normal Depth    | 1.78        | ft    |
| Critical Depth  | 1.69        | ft    |
| Critical Slope  | 0.00597     | ft/ft |
| Velocity        | 6.87        | ft/s  |
| Velocity Head   | 0.73        | ft    |
| Specific Energy | 2.52        | ft    |
| Froude Number   | 0.92        |       |
| Flow Type       | Subcritical |       |

### GVF Input Data

|                  |      |    |
|------------------|------|----|
| Downstream Depth | 0.00 | ft |
| Length           | 0.00 | ft |
| Number Of Steps  | 0    |    |

### GVF Output Data

|                     |          |       |
|---------------------|----------|-------|
| Upstream Depth      | 0.00     | ft    |
| Profile Description |          |       |
| Profile Headloss    | 0.00     | ft    |
| Downstream Velocity | Infinity | ft/s  |
| Upstream Velocity   | Infinity | ft/s  |
| Normal Depth        | 1.78     | ft    |
| Critical Depth      | 1.69     | ft    |
| Channel Slope       | 0.50     | %     |
| Critical Slope      | 0.00597  | ft/ft |

## Project Description

### Manning Formula

Normal Depth

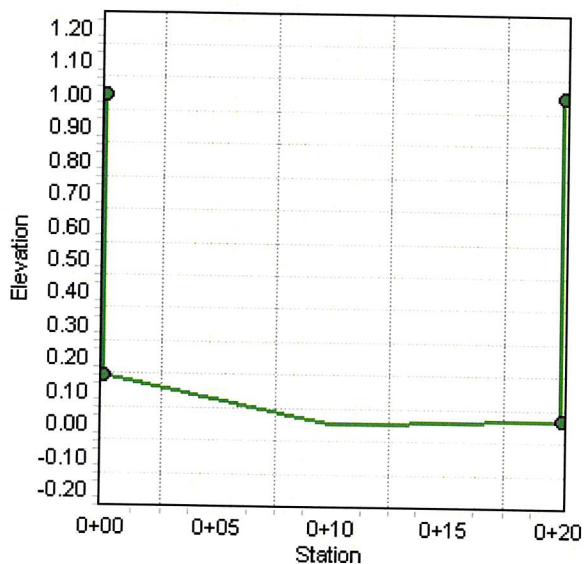
## Input Data

0.50 %

1.78 ft

239.00 ft<sup>3</sup>/s

### Cross Section Image

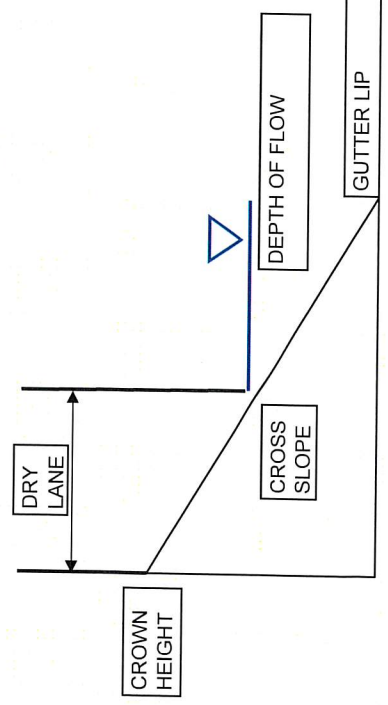


# **FIGURE D-12**

# 10 Year Event Dry Travel Depth Calculation

| Hydraulic Section | Side of 1/2 Street | Crown Height (ft) | Cross Slope (ft/ft) | Dry Lane (ft) | Maximum Depth of Flow* (ft) | Datum Elevation (ft) | 10-Year Calculated Hydraulic Depth (ft) | Datum Adjusted Normal Depth (ft) | Dry Lane Criteria Met | Notes                                                                                  |
|-------------------|--------------------|-------------------|---------------------|---------------|-----------------------------|----------------------|-----------------------------------------|----------------------------------|-----------------------|----------------------------------------------------------------------------------------|
| Section A - TP    | NORTH              | 0.84              | 0.020               | 12.00         | 0.60                        | 0.00                 | 0.67                                    | 0.67                             | NO                    | This is existing condition before proposed inlet.                                      |
| Section A - TP    | SOUTH              | 0.84              | 0.019               | 12.00         | 0.61                        | 0.00                 | 0.67                                    | 0.67                             | NO                    | This is existing condition before proposed inlet.                                      |
| Section B - TP    | NORTH              | 0.76              | 0.018               | 12.00         | 0.54                        | 0.00                 | 0.35                                    | 0.35                             | YES                   |                                                                                        |
| Section B - TP    | SOUTH              | 0.76              | 0.016               | 12.00         | 0.57                        | 0.05                 | 0.32                                    | 0.37                             | YES                   |                                                                                        |
| Section C - TP    | NORTH              | 0.94              | 0.021               | 12.00         | 0.69                        | NA                   | NA                                      | NA                               | *                     | 10-year is 0 cfs                                                                       |
| Section C - TP    | SOUTH              | 0.94              | 0.019               | 12.00         | 0.71                        | NA                   | NA                                      | NA                               | *                     | 10-year is 0 cfs                                                                       |
| Section D - RB    | EAST               | 1.41              | 0.010               | 12.00         | 1.29                        | 0.00                 | 0.22                                    | 0.22                             | YES                   | This is existing condition before proposed inlet.                                      |
| Section D - RB    | WEST               | 1.41              | 0.014               | 12.00         | 1.24                        | 0.62                 | 0.24                                    | 0.86                             | YES                   | This is existing condition before proposed inlet.                                      |
| Section E - RB    | EAST               | 1.10              | 0.022               | 12.00         | 0.84                        | NA                   | NA                                      | NA                               | *                     | 10-year is 0 cfs                                                                       |
| Section E - RB    | WEST               | 1.10              | 0.015               | 12.00         | 0.92                        | NA                   | NA                                      | NA                               | *                     | 10-year is 0 cfs                                                                       |
| Section F - RB    | EAST               | 1.02              | 0.018               | 12.00         | 0.80                        | 0.08                 | 0.39                                    | 0.47                             | YES                   |                                                                                        |
| Section F - RB    | WEST               | 1.02              | 0.020               | 12.00         | 0.78                        | 0.00                 | 0.44                                    | 0.44                             | YES                   |                                                                                        |
| Section G - RB    | EAST               | 1.16              | 0.022               | 12.00         | 0.90                        | 0.03                 | 0.31                                    | 0.34                             | YES                   |                                                                                        |
| Section G - RB    | WEST               | 1.16              | 0.023               | 12.00         | 0.88                        | 0.00                 | 0.31                                    | 0.31                             | YES                   |                                                                                        |
| Section H - RB    | WEST               | 0.99              | 0.018               | 24.00         | 0.56                        | NA                   | NA                                      | NA                               | *                     | Crown at east EOP, 2 dry lanes from crown required.                                    |
| Section J - RB    | EAST               | 0.90              | 0.020               | 24.00         | 0.42                        | NA                   | NA                                      | NA                               | *                     | Crown at west EOP, 2 dry lanes required.                                               |
| Section K - RB    | WEST               | 1.67              | 0.010               | 24.00         | 1.43                        | 0.98                 | 0.35                                    | 1.33                             | YES                   | Crown at east EOP, 2 dry lanes from crown required.                                    |
| Section L - RB    | EAST               | 1.24              | 0.005               | 12.00         | 1.18                        | NA                   | NA                                      | NA                               | *                     | 10-year is 0 cfs                                                                       |
| Section L - RB    | WEST               | 1.24              | 0.008               | 12.00         | 1.14                        | 0.59                 | 0.46                                    | 1.05                             | YES                   |                                                                                        |
| Section M - RB    | EAST               | 0.60              | 0.005               | 12.00         | 0.54                        | 0.01                 | 0.17                                    | 0.18                             | YES                   |                                                                                        |
| Section M - RB    | WEST               | 0.60              | 0.011               | 12.00         | 0.47                        | NA                   | NA                                      | NA                               | *                     | 10-year is 0 cfs                                                                       |
| Section N - RB    | EAST               | 0.65              | 0.011               | 24.00         | 0.39                        | 0.00                 | 0.14                                    | 0.14                             | YES                   | Crown in on lip of west gutter, 2 dry lanes needed on east side (drive lane) of crown. |

\*If depth of flow calculation <= 0.1 then, "No Travel Lane"



$$\text{Dry Lane} = (\text{Crown Height} - \text{Depth Of Flow}) / \text{Cross Slope}$$

FIGURE D-12

Wier onto Rio Vista Estates  
**SOLVE FOR HEIGHT OF WATER**

$$Q = CLh^{1.5}$$

Inputs:

C = Discharge Coefficient= 3  
Q = Discharge (cfs)\*\* = 239  
L = length of weir (ft) = 23

Result:

h = height of water (ft) = 2.29



## 23. APPENDIX E – REFERENCES

1. Las Vegas Valley Flood Control Master Plan Update by PBS&J, 2008
2. Ann Road Improvements – US95 to Ferrell Street by VTN Nevada, 2000
3. Tenaya Way/Azure Dr. Roadway Improvements by Primas & Assoc. Consulting Eng., 2000
4. Grand Entries Estates by VTN Nevada, 1993
5. Rio Vista Estates by VTN Nevada, 1993
6. Tropical Meadows by VTN Nevada, 1994
7. Toscana by Thomason Consulting Engineers, 2005
8. Ann and Rio Vista by Zone Engineering, 2006
9. Ann and Balsam (Ann & Rainbow II) by Thomas Consulting Engineers, 2005
10. Ann & Rainbow by Thomas Consulting Engineers, 2005
11. Rite Aid at Ann & Rainbow (Walgreens), 1998

# REFERENCE 1

```

1.....
.....
FLOOD HYDROGRAPH PACKAGE (HEC-1)
JUN 1998
VERSION 4.1
RUN DATE 24JUN08 TIME 08:53:10
.....
U.S. ARMY CORPS OF ENGINEERS
HYDROLOGIC ENGINEERING CENTER
609 SECOND STREET
DAVIS, CALIFORNIA 95616
(916) 756-1104

```

```

X X XXXXXXX XXXXX X
X X X X X XX
X X X X X X
XXXXXX XXXX X XXXXX X
X X X X X X
X X X X X X
X X XXXXXXX XXXXX XXX

```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE, SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY, DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
*** FREE ***
*DIAGRAM
1 ID CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT 2008 MASTER PLAN UPDATE
2 ID UPPER AND LOWER NORTHERN LAS VEGAS WASH WATERSHEDS
3 ID RECOMMENDED DRAINAGE SYSTEM WITH ULTIMATE DEVELOPMENT
4 ID INPUT FILE = CWEST3.DAT
5 ID INPUT FILE DATE = MAY 2008
6 ID DESIGN STORM = 100-YEAR 6-HOUR STORM
7 ID STORM DISTRIBUTION = SDN3
8 ID MODELED BY PBS&J (KRYSTLE PEMBERTON, E.I., CFM)
9 ID CHECKED BY PBS&J (HARSHAL B. DESAI, P.E., CFM)
10 ID STORM CENTERING = REMOVED DETENTION BASIN OUTFLOWS
11 ID DOWNSTREAM OF THE UPPER LAS VEGAS WASH DETENTION BASIN TO THE MOST
12 ID DOWNSTREAM POINT IN THE LOWER NORTHERN LAS VEGAS WASH WATERSHED
13 ID COMBINATION POINT DOWNSTREAM OF LOWER LAS VEGAS WASH DETENTION BASIN
14 ID WAS MODIFIED TO SIMULATE NECESSARY STORM CENTERINGS
15 ID
16 ID
17 ID REFERENCED HYDROLOGIC MODELS:
18 ID REVISED FINAL DESIGN REPORT FOR THE RANCHO DETENTION BASIN
19 ID PHASE II (VTN 2006)
20 ID RESPONSE TO COMMENTS ON THE CONCEPTUAL DRAINAGE STUDY FOR
21 ID NORTH LAS VEGAS 600-ACRE SITE (GC WALLACE 2006)
22 ID SECOND RESPONSE TO COMMENTS OF THE CONCEPTUAL DRAINAGE STUDY
23 ID FOR NORTH LAS VEGAS 2074-ACRE SITE (GC WALLACE 2006)
24 ID BASIN MAPS FOR SUPPLEMENT #2 TO ADDENDUM #2 TO THE MASTER
25 ID DRAINAGE STUDY FOR CLIFF'S EDGE/ PROVIDENCE (VTN 2004)
26 ID MASTER DRAINAGE STUDY FOR KYLE CANYON (GC WALLACE 2006)
27 ID TECHNICAL DRAINAGE STUDY FOR GRAND TETON DRIVE STROM DRAIN
28 ID AND AREA 1 ROADWAY IMPROVEMENTS (GC WALLACE 2006)
29 ID 90% FINAL DESIGN REPORT FOR RANCHO ROAD SYSTEM - EL CAMPO
30 ID GRANDE STORM DRAIN PROJECT (PBS&J 2007)
31 ID MPA FOR RACEL STREET COLLECTOR (LOUIS BERGER JANUARY 2007)
32 ID HYDROLOGIC MODEL FOR FLOYD LAMB NORTH AND SOUTH ENVIRONMENTAL
33 ID ENHANCEMENT AREAS (LOUIS BERGER DECEMBER 7, 2007)
34 ID
35 ID
36 ID
37 ID JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:
38 ID
39 ID AREA (SQUARE MILES) DARF
40 ID 0 - 0.5 0.99
41 ID 0.5 - 1 0.975
42 ID 1 - 2 0.95
43 ID 2 - 3 0.925
44 ID 3 - 4 0.915
45 ID 4 - 5 0.908
46 ID 5 - 6 0.903
47 ID 6 - 7 0.895
48 ID 7 - 8 0.885
49 ID
50 ID 5 0 0 300
51 ID 5 0 0
52 ID 5 0 0
53 ID JR PREC 0.99 0.975 0.95 0.925 0.915 0.908 0.903 0.895 0.885

```

1 HEC-1 INPUT PAGE 2

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

1572 BA 0.261  
 1573 PB 2.80  
 1574 LS 0 80.0  
 1575 UD 0.377  
 \*

1576 KKCNW1A4-C  
 1577 KM COMBINE NW1A4-C, RD1A4-2 AND RD1A4-1  
 1578 HC 3  
 \*

1579 KKRCW1A4-C  
 1580 KM ROUTE CNW1A4-C TO RCHOIN  
 1581 KM FACILITY = RANCHO ROAD SYSTEM  
 1582 KM FACILITY ID-MILE = RCHO 0071,0056,0054,0052,0050  
 1583 KM LINING = RCB  
 1584 RD 1800 0.005 0.015 0 TRAP 10 0  
 \*

1585 KK NW1C1-E  
 1586 BA 0.189  
 1587 PB 2.77  
 1588 LS 0 88.0  
 1589 UD 0.256  
 \*

1

## HEC-1 INPUT

PAGE 43

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

1590 KK RCHOIN  
 1591 KM COMBINE NW1C1-E, RCW1A4-C AND 2CNW1C-W  
 1592 KO 1  
 1593 HC 3  
 \*

1594 KK RCHODB  
 1595 KM FACILITY = RANCHO DETENTION BASIN  
 1596 KM FACILITY ID-MILE = RCHO 0025  
 1597 KM REFERENCED FROM "REVISED FINAL DESIGN REPORT -  
 1598 KM RANCHO DETENTION BASIN PHASE II" PREPARED BY VTN (JUNE 2006)  
 1599 KM STORAGE VOLUME = 321 ACRE-Feet  
 1600 KM OUTLET = 60" RCP WITH 36" ORIFICE PLATE  
 1601 KM 100-YEAR DISCHARGE = 156 CFS  
 1602 KM SPILLWAY LENGTH = 550'  
 1603 KM SPILLWAY CREST ELEVATION = 2390.84'  
 1604 KM SPILLWAY TYPE = BROAD CRESTED WEIR  
 1605 KM PMF DISCHARGE = 18,000 CFS  
 1606 KM TOP OF EMBANKMENT ELEVATION = 2396.44'  
 1607 KO 1  
 1608 RS 1 STOR 0  
 1609 SV 0.0 0.1 3.1 16.3 42.1 74.8 109.6 145.7 183.0 221.70  
 1610 SV 261.8 303.2 321.1 346.1 390.3 446.1  
 1611 SE 2368.8 2370.0 2372.0 2374.0 2376.0 2378.0 2380.0 2382.0 2384.0 2386.0  
 1612 SE 2388.0 2390.0 2390.8 2392.0 2394.0 2396.4  
 1613 SQ 0.0 18.6 36.5 63.7 82.3 94.4 110.5 122.2 132.8 142.70  
 1614 SQ 151.9 160.6 164.2 3085.2 10575.3 20673.0  
 \*

1615 KK RCHOOT  
 1616 KM ROUTE RCHODB TO CNW2B5-C  
 1617 KM FACILITY = ANN ROAD CHANNEL WEST  
 1618 KM FACILITY ID-MILE = ANWE 0327,0371,0385; RCHO 0000  
 1619 KM LINING = RCB  
 1620 RD 6253 0.009 0.015 0 TRAP 6 0  
 \*

1621 KKDRRCHODB  
 1622 KM DIVERT RANCHO DETENTION BASIN DISCHARGE OUT OF MODEL  
 1623 KM FOR STORM CENTERING  
 1624 DTRANCHODB  
 1625 DI 1 5000 10000  
 1626 DQ 1 5000 10000

1627 KK NW2A1-C  
 1628 BA 0.361  
 1629 PB 2.77  
 1630 LS 0 88.2  
 1631 UD 0.519  
 \*

NORTH OF SITE

1

## HEC-1 INPUT

PAGE 44

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

1632 KK NW2A3-C  
 1633 BA 0.265  
 1634 PB 2.77  
 1635 LS 0 84.8  
 1636 UD 0.443  
 \*

1637 KKCNW2A3-C  
 1638 KM COMBINE NW2A3-C AND NW2A1-C  
 1639 KM TROPICAL AND RAINBOW  
 1640 HC 2  
 \*

1641 KK RC2A3-C  
 1642 KM ROUTE CNW2A3-C TO CNW2B5-C  
 1643 KM FACILITY = ANN ROAD CHANNEL WEST-RAINBOW  
 1644 KM FACILITY ID-MILE = ANRB 0000  
 1645 KM LINING = RCB  
 1646 RD 2400 0.004 0.015 0 TRAP 10 0  
 \*

1647 KK NW2B5-C

1648 BA 0.368  
 1649 PB 2.77  
 1650 LS 0 87.1  
 1651 UD 0.489  
 \*

1652 KKCWNW2B5-C  
 1653 KM COMBINE NW2B5-C AND RC2A3-C  
 1654 KM ANN ROAD WEST @ RAINBOW  
 1655 HC 2  
 \*

1656 KK2CNW2B5C  
 1657 KM COMBINE RCHOOT AND CNW2B5-C  
 1658 KM ANN ROAD WEST @ RAINBOW  
 1659 HC 2  
 \*

1660 KK RC2B5-C  
 1661 KM ROUTE CNW2B5-C TO CNW2D1-C  
 1662 KM FACILITY = ANN ROAD CHANNEL WEST  
 1663 KM FACILITY ID-MILE = ANWE 0279,0290  
 1664 KM LINING = RCB  
 1665 RD 2603 0.007 0.015 0 TRAP 8 3  
 \*

1666 KK NW2C1-C  
 1667 BA 0.226  
 1668 PB 2.77  
 1669 LS 0 82.4  
 1670 UD 0.397  
 \*

1

## HEC-1 INPUT

PAGE 45

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

1671 KKRNNW2C1-C  
 1672 KM ROUTE NW2C1-C TO NW2D1-C  
 1673 KM TORREY PINES  
 1674 RD 2500 0.002 0.016 0 TRAP 0 50  
 \*

1675 KK NW2D1-C  
 1676 BA 0.243  
 1677 PB 2.77  
 1678 LS 0 83.2  
 1679 UD 0.389  
 \*

1680 KKCWNW2D1-C  
 1681 KM COMBINE NW2D1-C, RNW2C1-C AND RC2B5-C  
 1682 KM ANN ROAD WEST @ TORREY PINES  
 1683 HC 3  
 \*

1684 KK RC2D1-C  
 1685 KM ROUTE CNW2D1-C TO CNW2D2-C  
 1686 KM FACILITY = ANN ROAD CHANNEL WEST  
 1687 KM FACILITY ID-MILE = ANWE 0232,0245  
 1688 KM LINING = RCB  
 1689 RD 2435 0.008 0.015 0 TRAP 10 0  
 \*

1690 KK NW2C2-C  
 1691 BA 0.243  
 1692 PB 2.77  
 1693 LS 0 81.8  
 1694 UD 0.414  
 \*

1695 KKRNNW2C2-C  
 1696 KM ROUTE NW2C2-C TO NW2D2-C  
 1697 KM JONES  
 1698 RD 2600 0.004 0.016 0 TRAP 0 50  
 \*

1699 KK NW2D2-C  
 1700 BA 0.243  
 1701 PB 2.77  
 1702 LS 0 83.0  
 1703 UD 0.394  
 \*

1704 KKCWNW2D2-C  
 1705 KM COMBINE NW2D2-C, RNW2C2-C AND RC2D1-C  
 1706 KM ANN ROAD WEST @ JONES  
 1707 HC 3  
 \*

1

## HEC-1 INPUT

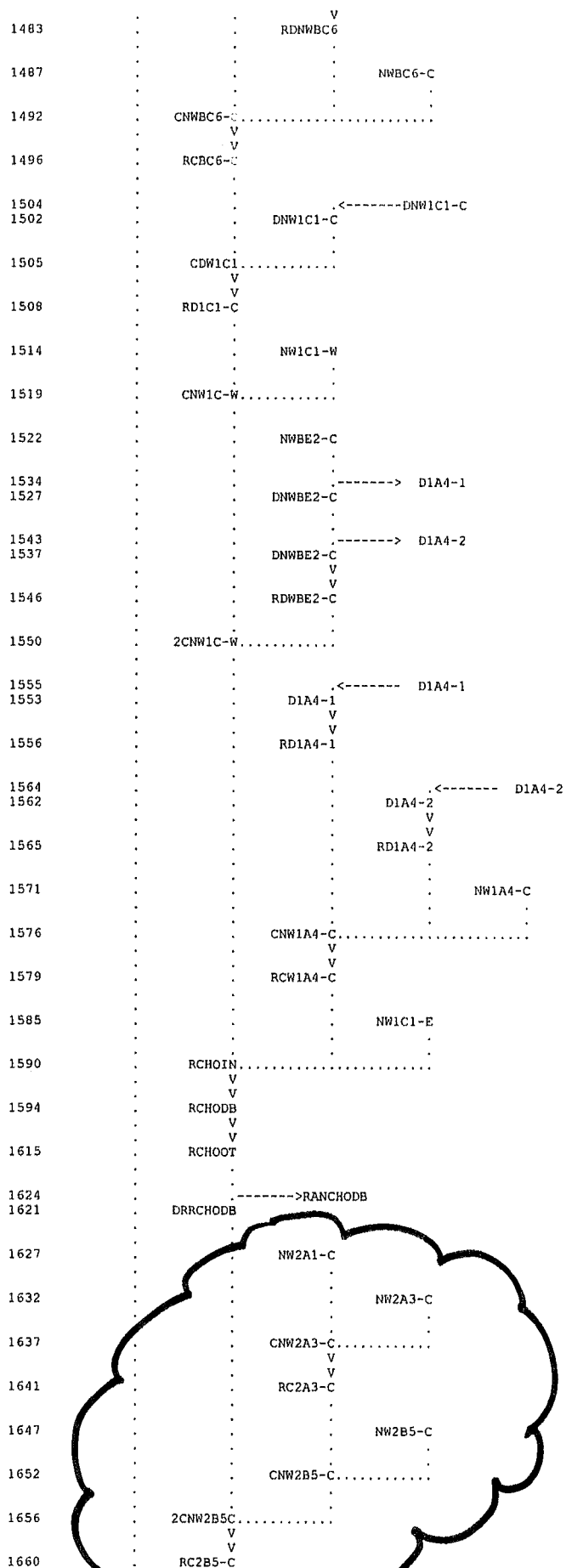
PAGE 46

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

1708 KK RC2D2-C  
 1709 KM ROUTE CNW2D2-C TO CNW3B2-C  
 1710 KM FACILITY = ANN ROAD CHANNEL WEST  
 1711 KM FACILITY ID-MILE = ANWE 0127,0157,0177  
 1712 KM LINING = RCB  
 1713 RD 5359 0.004 0.015 0 TRAP 12  
 \*

1714 KK NW3A1-C  
 1715 BA 0.258  
 1716 PB 2.77  
 1717 LS 0 90.2  
 1718 UD 0.483  
 \*





|      |         |          |          |         |
|------|---------|----------|----------|---------|
| 1666 | .       | .        | NW2C1-C  | .       |
|      | .       | .        | V        | .       |
|      | .       | .        | V        | .       |
| 1671 | .       | .        | RNW2C1-C | .       |
|      | .       | .        | .        | .       |
| 1675 | .       | .        | .        | NW2D1-C |
|      | .       | .        | .        | .       |
| 1680 | .       | CNW2D1-C | .        | .       |
|      | .       | .        | V        | .       |
|      | .       | .        | V        | .       |
| 1684 | .       | RC2D1-C  | .        | .       |
|      | .       | .        | .        | .       |
| 1690 | .       | .        | NW2C2-C  | .       |
|      | .       | .        | V        | .       |
|      | .       | .        | V        | .       |
| 1695 | .       | .        | RNW2C2-C | .       |
|      | .       | .        | .        | .       |
| 1699 | .       | .        | .        | NW2D2-C |
|      | .       | .        | .        | .       |
| 1704 | .       | CNW2D2-C | .        | .       |
|      | .       | .        | V        | .       |
|      | .       | .        | V        | .       |
| 1708 | .       | RC2D2-C  | .        | .       |
|      | .       | .        | .        | .       |
| 1714 | .       | .        | NW3A1-C  | .       |
|      | .       | .        | V        | .       |
|      | .       | .        | V        | .       |
| 1719 | .       | .        | RNW3A1-C | .       |
|      | .       | .        | .        | .       |
| 1723 | .       | .        | .        | NW3A3-C |
|      | .       | .        | .        | .       |
| 1728 | .       | .        | CNW3A3-C | .       |
|      | .       | .        | V        | .       |
|      | .       | .        | V        | .       |
| 1732 | .       | .        | RC3A3-C  | .       |
|      | .       | .        | .        | .       |
| 1736 | .       | .        | .        | NW3B1-C |
|      | .       | .        | .        | .       |
| 1741 | .       | .        | CNW3B1-C | .       |
|      | .       | .        | V        | .       |
|      | .       | .        | V        | .       |
| 1745 | .       | .        | RC3B1-C  | .       |
|      | .       | .        | .        | .       |
| 1749 | .       | .        | .        | NW3B2-C |
|      | .       | .        | .        | .       |
| 1754 | .       | CNW3B2-C | .        | .       |
|      | .       | .        | V        | .       |
|      | .       | .        | V        | .       |
| 1758 | .       | RC3B2-C  | .        | .       |
|      | .       | .        | .        | .       |
| 1764 | .       | .        | NN043-C  | .       |
|      | .       | .        | .        | .       |
| 1769 | .       | CNN043-C | .        | .       |
|      | .       | .        | .        | .       |
| 1773 | 2C043-C | .        | .        | .       |
|      | .       | .        | V        | .       |
|      | .       | .        | V        | .       |
| 1777 | RC043-C | .        | .        | .       |
|      | .       | .        | .        | .       |
| 1783 | .       | .        | NN038-C  | .       |
|      | .       | .        | V        | .       |
|      | .       | .        | V        | .       |
| 1788 | .       | .        | RNW038-C | .       |
|      | .       | .        | .        | .       |
| 1794 | .       | .        | .        | NN040-C |
|      | .       | .        | .        | .       |
| 1799 | .       | .        | CNN040-C | .       |
|      | .       | .        | V        | .       |
|      | .       | .        | V        | .       |
| 1803 | .       | .        | RC040-C  | .       |
|      | .       | .        | .        | .       |
| 1809 | .       | .        | .        | NN044-C |
|      | .       | .        | .        | .       |
| 1814 | .       | .        | CNN044-C | .       |
|      | .       | .        | .        | .       |
| 1818 | 2C044-C | .        | .        | .       |
|      | .       | .        | V        | .       |
|      | .       | .        | V        | .       |
| 1822 | RC044-C | .        | .        | .       |
|      | .       | .        | .        | .       |
| 1828 | .       | .        | NN052-C  | .       |
|      | .       | .        | V        | .       |
|      | .       | .        | V        | .       |
| 1833 | .       | .        | RNW052-C | .       |
|      | .       | .        | .        | .       |

|                           |          |      |   | TIME    | 3.75    | 3.75    | 3.75    | 3.75    | 3.75    | 3.75    | 3.75    | 3.75    |
|---------------------------|----------|------|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| HYDROGRAPH AT             |          |      |   | 3.75    |         |         |         |         |         |         |         |         |
| + 0.                      | DNWBE2-C | .25  | 1 | FLOW    | 0.      | 0.      | 0.      | 0.      | 0.      | 0.      | 0.      | 0.      |
|                           |          |      |   | TIME    | .00     | .00     | .00     | .00     | .00     | .00     | .00     | .00     |
|                           |          |      |   | .00     |         |         |         |         |         |         |         |         |
| ROUTED TO                 |          |      |   |         |         |         |         |         |         |         |         |         |
| + 0.                      | RDWBE2-C | .75  | 1 | FLOW    | 0.      | 0.      | 0.      | 0.      | 0.      | 0.      | 0.      | 0.      |
|                           |          |      |   | TIME    | .00     | .00     | .00     | .00     | .00     | .00     | .00     | .00     |
|                           |          |      |   | .00     |         |         |         |         |         |         |         |         |
| 2 COMBINED AT             |          |      |   |         |         |         |         |         |         |         |         |         |
| + 2391.                   | 2CNW1C-W | 3.94 | 1 | FLOW    | 2799.   | 2741.   | 2644.   | 2546.   | 2507.   | 2481.   | 2461.   | 2432.   |
|                           |          |      |   | TIME    | 3.83    | 3.83    | 3.83    | 3.83    | 3.83    | 3.83    | 3.83    | 3.83    |
|                           |          |      |   | 3.83    |         |         |         |         |         |         |         |         |
| HYDROGRAPH AT             |          |      |   |         |         |         |         |         |         |         |         |         |
| + 130.                    | D1A4-1   | .00  | 1 | FLOW    | 130.    | 130.    | 130.    | 130.    | 130.    | 130.    | 130.    | 130.    |
|                           |          |      |   | TIME    | 3.50    | 3.50    | 3.50    | 3.50    | 3.50    | 3.50    | 3.50    | 3.50    |
|                           |          |      |   | 3.50    |         |         |         |         |         |         |         |         |
| ROUTED TO                 |          |      |   |         |         |         |         |         |         |         |         |         |
| + 130.                    | RD1A4-1  | .00  | 1 | FLOW    | 131.    | 131.    | 132.    | 131.    | 130.    | 130.    | 130.    | 130.    |
|                           |          |      |   | TIME    | 3.58    | 3.58    | 3.58    | 3.58    | 3.75    | 3.75    | 3.75    | 3.75    |
|                           |          |      |   | 3.67    |         |         |         |         |         |         |         |         |
| HYDROGRAPH AT             |          |      |   |         |         |         |         |         |         |         |         |         |
| + 86.                     | D1A4-2   | .00  | 1 | FLOW    | 124.    | 119.    | 109.    | 100.    | 97.     | 94.     | 92.     | 89.     |
|                           |          |      |   | TIME    | 3.75    | 3.75    | 3.75    | 3.75    | 3.75    | 3.75    | 3.75    | 3.75    |
|                           |          |      |   | 3.75    |         |         |         |         |         |         |         |         |
| ROUTED TO                 |          |      |   |         |         |         |         |         |         |         |         |         |
| + 81.                     | RD1A4-2  | .00  | 1 | FLOW    | 117.    | 113.    | 103.    | 95.     | 91.     | 89.     | 87.     | 84.     |
|                           |          |      |   | TIME    | 3.83    | 3.83    | 3.83    | 3.83    | 3.83    | 3.83    | 3.83    | 3.83    |
|                           |          |      |   | 3.83    |         |         |         |         |         |         |         |         |
| HYDROGRAPH AT             |          |      |   |         |         |         |         |         |         |         |         |         |
| + 132.                    | NW1A4-C  | .26  | 1 | FLOW    | 164.    | 160.    | 152.    | 144.    | 141.    | 139.    | 138.    | 135.    |
|                           |          |      |   | TIME    | 3.83    | 3.83    | 3.83    | 3.83    | 3.83    | 3.83    | 3.83    | 3.83    |
|                           |          |      |   | 3.83    |         |         |         |         |         |         |         |         |
| 3 COMBINED AT             |          |      |   |         |         |         |         |         |         |         |         |         |
| + 343.                    | CNW1A4-C | .26  | 1 | FLOW    | 411.    | 402.    | 385.    | 369.    | 363.    | 358.    | 355.    | 350.    |
|                           |          |      |   | TIME    | 3.83    | 3.83    | 3.83    | 3.83    | 3.83    | 3.83    | 3.83    | 3.83    |
|                           |          |      |   | 3.83    |         |         |         |         |         |         |         |         |
| ROUTED TO                 |          |      |   |         |         |         |         |         |         |         |         |         |
| + 340.                    | RCW1A4-C | .26  | 1 | FLOW    | 409.    | 400.    | 383.    | 367.    | 360.    | 355.    | 352.    | 347.    |
|                           |          |      |   | TIME    | 3.83    | 3.83    | 3.83    | 3.83    | 3.83    | 3.83    | 3.83    | 3.83    |
|                           |          |      |   | 3.83    |         |         |         |         |         |         |         |         |
| HYDROGRAPH AT             |          |      |   |         |         |         |         |         |         |         |         |         |
| + 174.                    | NW1C1-E  | .19  | 1 | FLOW    | 206.    | 202.    | 194.    | 186.    | 183.    | 181.    | 180.    | 177.    |
|                           |          |      |   | TIME    | 3.67    | 3.67    | 3.67    | 3.67    | 3.67    | 3.67    | 3.67    | 3.67    |
|                           |          |      |   | 3.67    |         |         |         |         |         |         |         |         |
| 3 COMBINED AT             |          |      |   |         |         |         |         |         |         |         |         |         |
| + 2877.                   | RCHOIN   | 4.39 | 1 | FLOW    | 3380.   | 3308.   | 3189.   | 3068.   | 3020.   | 2988.   | 2964.   | 2928.   |
|                           |          |      |   | TIME    | 3.83    | 3.83    | 3.83    | 3.83    | 3.83    | 3.83    | 3.83    | 3.83    |
|                           |          |      |   | 3.83    |         |         |         |         |         |         |         |         |
| ROUTED TO                 |          |      |   |         |         |         |         |         |         |         |         |         |
| + 148.                    | RCHODB   | 4.39 | 1 | FLOW    | 158.    | 156.    | 154.    | 152.    | 151.    | 150.    | 150.    | 149.    |
|                           |          |      |   | TIME    | 6.17    | 6.17    | 6.17    | 6.17    | 6.17    | 6.17    | 6.17    | 6.17    |
|                           |          |      |   | 6.17    |         |         |         |         |         |         |         |         |
| ** PEAK STAGES IN FEET ** |          |      |   |         |         |         |         |         |         |         |         |         |
|                           |          |      |   | 1 STAGE | 2389.33 | 2389.02 | 2388.50 | 2387.98 | 2387.77 | 2387.62 | 2387.51 | 2387.34 |
|                           |          |      |   | 2387.13 |         |         |         |         |         |         |         |         |
|                           |          |      |   | TIME    | 6.17    | 6.17    | 6.17    | 6.17    | 6.17    | 6.17    | 6.17    | 6.17    |
|                           |          |      |   | 6.17    |         |         |         |         |         |         |         |         |
| ROUTED TO                 |          |      |   |         |         |         |         |         |         |         |         |         |
| + 148.                    | RCHOOT   | 4.39 | 1 | FLOW    | 158.    | 156.    | 154.    | 152.    | 151.    | 150.    | 150.    | 149.    |
|                           |          |      |   | TIME    | 6.25    | 6.25    | 6.25    | 6.25    | 6.25    | 6.25    | 6.25    | 6.25    |
|                           |          |      |   | 6.17    |         |         |         |         |         |         |         |         |
| DIVERSION TO              |          |      |   |         |         |         |         |         |         |         |         |         |
| + 148.                    | RANCHODB | 4.39 | 1 | FLOW    | 158.    | 156.    | 154.    | 152.    | 151.    | 150.    | 150.    | 149.    |
|                           |          |      |   | TIME    | 6.25    | 6.25    | 6.25    | 6.25    | 6.25    | 6.25    | 6.25    | 6.25    |
|                           |          |      |   | 6.17    |         |         |         |         |         |         |         |         |
| HYDROGRAPH AT             |          |      |   |         |         |         |         |         |         |         |         |         |
| + 0.                      | DRRCHODB | 4.39 | 1 | FLOW    | 0.      | 0.      | 0.      | 0.      | 0.      | 0.      | 0.      | 0.      |
|                           |          |      |   | TIME    | .00     | .00     | .00     | .00     | .00     | .00     | .00     | .00     |
|                           |          |      |   | .00     |         |         |         |         |         |         |         |         |
| HYDROGRAPH AT             |          |      |   |         |         |         |         |         |         |         |         |         |
| + 234.                    | NW2A1-C  | .36  | 1 | FLOW    | 276.    | 270.    | 260.    | 250.    | 246.    | 243.    | 241.    | 238.    |

|               |          |      |   | TIME | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  |
|---------------|----------|------|---|------|-------|-------|-------|-------|-------|-------|-------|-------|
|               |          |      |   | 4.00 |       |       |       |       |       |       |       |       |
| HYDROGRAPH AT |          |      |   |      |       |       |       |       |       |       |       |       |
| + 159.        | NW2A3-C  | .26  | 1 | FLOW | 191.  | 186.  | 178.  | 171.  | 168.  | 166.  | 164.  | 162.  |
|               |          |      |   | TIME | 3.92  | 3.92  | 3.92  | 3.92  | 3.92  | 3.92  | 3.92  | 3.92  |
|               |          |      |   | 3.92 |       |       |       |       |       |       |       |       |
| 2 COMBINED AT |          |      |   |      |       |       |       |       |       |       |       |       |
| + 391.        | CNW2A3-C | .63  | 1 | FLOW | 466.  | 455.  | 437.  | 420.  | 413.  | 408.  | 404.  | 398.  |
|               |          |      |   | TIME | 3.92  | 3.92  | 3.92  | 3.92  | 3.92  | 3.92  | 3.92  | 3.92  |
|               |          |      |   | 3.92 |       |       |       |       |       |       |       |       |
| ROUTED TO     |          |      |   |      |       |       |       |       |       |       |       |       |
| + 389.        | RC2A3-C  | .63  | 1 | FLOW | 461.  | 450.  | 432.  | 415.  | 409.  | 403.  | 400.  | 394.  |
|               |          |      |   | TIME | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  |
|               |          |      |   | 4.00 |       |       |       |       |       |       |       |       |
| HYDROGRAPH AT |          |      |   |      |       |       |       |       |       |       |       |       |
| + 235.        | NW2B5-C  | .37  | 1 | FLOW | 279.  | 272.  | 262.  | 251.  | 247.  | 244.  | 242.  | 239.  |
|               |          |      |   | TIME | 3.92  | 3.92  | 3.92  | 3.92  | 3.92  | 3.92  | 3.92  | 3.92  |
|               |          |      |   | 3.92 |       |       |       |       |       |       |       |       |
| 2 COMBINED AT |          |      |   |      |       |       |       |       |       |       |       |       |
| + 621.        | CNW2B5-C | .99  | 1 | FLOW | 738.  | 721.  | 693.  | 664.  | 654.  | 645.  | 640.  | 631.  |
|               |          |      |   | TIME | 3.92  | 3.92  | 3.92  | 3.92  | 3.92  | 3.92  | 3.92  | 3.92  |
|               |          |      |   | 4.00 |       |       |       |       |       |       |       |       |
| 2 COMBINED AT |          |      |   |      |       |       |       |       |       |       |       |       |
| + 621.        | 2CNW2B5C | 5.38 | 1 | FLOW | 738.  | 721.  | 693.  | 664.  | 654.  | 645.  | 640.  | 631.  |
|               |          |      |   | TIME | 3.92  | 3.92  | 3.92  | 3.92  | 3.92  | 3.92  | 3.92  | 3.92  |
|               |          |      |   | 4.00 |       |       |       |       |       |       |       |       |
| ROUTED TO     |          |      |   |      |       |       |       |       |       |       |       |       |
| + 620.        | RC2B5-C  | 5.38 | 1 | FLOW | 735.  | 719.  | 690.  | 663.  | 653.  | 644.  | 639.  | 630.  |
|               |          |      |   | TIME | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  |
|               |          |      |   | 4.00 |       |       |       |       |       |       |       |       |
| HYDROGRAPH AT |          |      |   |      |       |       |       |       |       |       |       |       |
| + 126.        | NW2C1-C  | .23  | 1 | FLOW | 154.  | 150.  | 143.  | 136.  | 134.  | 132.  | 130.  | 128.  |
|               |          |      |   | TIME | 3.83  | 3.83  | 3.83  | 3.83  | 3.83  | 3.83  | 3.83  | 3.83  |
|               |          |      |   | 3.83 |       |       |       |       |       |       |       |       |
| ROUTED TO     |          |      |   |      |       |       |       |       |       |       |       |       |
| + 124.        | RNW2C1-C | .23  | 1 | FLOW | 151.  | 147.  | 141.  | 134.  | 132.  | 130.  | 129.  | 127.  |
|               |          |      |   | TIME | 4.08  | 4.08  | 4.08  | 4.08  | 4.08  | 4.08  | 4.08  | 4.08  |
|               |          |      |   | 4.08 |       |       |       |       |       |       |       |       |
| HYDROGRAPH AT |          |      |   |      |       |       |       |       |       |       |       |       |
| + 143.        | NW2D1-C  | .24  | 1 | FLOW | 174.  | 170.  | 162.  | 155.  | 152.  | 150.  | 148.  | 146.  |
|               |          |      |   | TIME | 3.83  | 3.83  | 3.83  | 3.83  | 3.83  | 3.83  | 3.83  | 3.83  |
|               |          |      |   | 3.83 |       |       |       |       |       |       |       |       |
| 3 COMBINED AT |          |      |   |      |       |       |       |       |       |       |       |       |
| + 868.        | CNW2D1-C | 5.85 | 1 | FLOW | 1036. | 1013. | 972.  | 931.  | 916.  | 904.  | 896.  | 883.  |
|               |          |      |   | TIME | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  |
|               |          |      |   | 4.00 |       |       |       |       |       |       |       |       |
| ROUTED TO     |          |      |   |      |       |       |       |       |       |       |       |       |
| + 864.        | RC2D1-C  | 5.85 | 1 | FLOW | 1035. | 1011. | 970.  | 929.  | 913.  | 901.  | 893.  | 879.  |
|               |          |      |   | TIME | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  |
|               |          |      |   | 4.00 |       |       |       |       |       |       |       |       |
| HYDROGRAPH AT |          |      |   |      |       |       |       |       |       |       |       |       |
| + 127.        | NW2C2-C  | .24  | 1 | FLOW | 156.  | 152.  | 145.  | 138.  | 135.  | 133.  | 132.  | 130.  |
|               |          |      |   | TIME | 3.83  | 3.83  | 3.83  | 3.83  | 3.92  | 3.92  | 3.92  | 3.92  |
|               |          |      |   | 3.92 |       |       |       |       |       |       |       |       |
| ROUTED TO     |          |      |   |      |       |       |       |       |       |       |       |       |
| + 127.        | RNW2C2-C | .24  | 1 | FLOW | 157.  | 152.  | 145.  | 138.  | 136.  | 134.  | 132.  | 130.  |
|               |          |      |   | TIME | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  |
|               |          |      |   | 4.00 |       |       |       |       |       |       |       |       |
| HYDROGRAPH AT |          |      |   |      |       |       |       |       |       |       |       |       |
| + 141.        | NW2D2-C  | .24  | 1 | FLOW | 171.  | 167.  | 159.  | 152.  | 149.  | 147.  | 146.  | 143.  |
|               |          |      |   | TIME | 3.83  | 3.83  | 3.83  | 3.83  | 3.83  | 3.83  | 3.83  | 3.83  |
|               |          |      |   | 3.83 |       |       |       |       |       |       |       |       |
| 3 COMBINED AT |          |      |   |      |       |       |       |       |       |       |       |       |
| + 1117.       | CNW2D2-C | 6.34 | 1 | FLOW | 1343. | 1311. | 1257. | 1203. | 1182. | 1166. | 1155. | 1137. |
|               |          |      |   | TIME | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  |
|               |          |      |   | 4.00 |       |       |       |       |       |       |       |       |
| ROUTED TO     |          |      |   |      |       |       |       |       |       |       |       |       |
| + 1101.       | RC2D2-C  | 6.34 | 1 | FLOW | 1332. | 1297. | 1239. | 1184. | 1170. | 1147. | 1137. | 1125. |
|               |          |      |   | TIME | 4.00  | 4.00  | 4.00  | 4.00  | 4.00  | 4.08  | 4.00  | 4.00  |
|               |          |      |   | 4.08 |       |       |       |       |       |       |       |       |
| HYDROGRAPH AT |          |      |   |      |       |       |       |       |       |       |       |       |
| + 192.        | NW3A1-C  | .26  | 1 | FLOW | 224.  | 220.  | 212.  | 204.  | 201.  | 199.  | 198.  | 195.  |

## REFERENCE 2

**ANN ROAD IMPROVEMENTS**  
**W.O. #5546**

| CHANNEL STATION         | WSPG STATION | DESIGN FLOW (cfs) | SEGMENT LENGTH (ft) | CHANNEL TYPE                          | INVERT ELEV. (ft) | INVERT SLOPE |
|-------------------------|--------------|-------------------|---------------------|---------------------------------------|-------------------|--------------|
| 300+02.52               | 481+02.34    | 157               | 8                   | TRANSITION                            | 2360.13           | 1.00%        |
| 300+10.52               | 480+94.34    |                   |                     |                                       | 2360.05           |              |
| 300+10.52               | 480+94.34    | 157               | 32.66               | 54" RCP                               | 2360.05           | 1.00%        |
| 300+43.18               | 480+61.68    |                   |                     |                                       | 2359.72           |              |
| 300+43.18               | 480+61.68    | 157               | 406.82              | 54" RCP W/ CASING<br>U.S.-95 CROSSING | 2359.72           | 1.57%        |
| 304+50.00               | 476+54.86    |                   |                     |                                       | 2353.34           |              |
| 304+50.00               | 476+54.86    | 157               | 377.66              | 54" RCP                               | 2353.34           | 0.84%        |
| 308+27.66               | 472+77.20    |                   |                     |                                       | 2350.17           |              |
| 308+27.66               | 472+77.20    | 157               | 435.62              | 54" RCP                               | 2350.17           | 1.45%        |
| 312+63.28               | 468+41.58    |                   |                     |                                       | 2343.85           |              |
| 312+63.28               | 468+41.58    | 157               | 751.83              | 54" RCP                               | 2343.85           | 0.92%        |
| 320+15.11               | 460+89.75    |                   |                     |                                       | 2336.93           |              |
| 320+15.11               | 460+89.75    | 356               | 53.85               | TENAYA CONFLUENCE                     | 2336.93           | 0.34%        |
| 320+68.96               | 460+35.90    |                   |                     |                                       | 2336.75           |              |
| 320+68.96               | 460+35.90    | 378               | 671.17              | 6' X 6' RCB                           | 2336.75           | 0.34%        |
| 327+40.13 =<br>11+40.72 | 453+64.73    |                   |                     |                                       | 2334.49           |              |
| 11+40.72                | 453+64.73    | 378               | 1318.29             | 6' X 6' RCB                           | 2334.49           | 0.69%        |
| 24+59.01                | 440+46.44    |                   |                     |                                       | 2325.40           |              |
| 24+59.01                | 440+46.44    | 378               | 418.41              | 6' X 6' RCB                           | 2325.40           | 1.41%        |
| 28+77.42                | 436+28.03    |                   |                     |                                       | 2319.50           |              |
| 28+77.42                | 436+28.03    | 378               | 492.77              | 6' X 6' RCB                           | 2319.50           | 0.65%        |
| 33+70.19                | 431+35.26    |                   |                     |                                       | 2316.28           |              |
| 33+70.19                | 431+35.26    | 378               | 87.20               | 6' X 6' RCB                           | 2316.28           | 2.15%        |
| 34+57.39                | 430+48.06    |                   |                     |                                       | 2314.41           |              |
| 34+57.39                | 430+48.06    | 862               | 58.75               | RAINBOW CONFLUENCE                    | 2314.41           | 2.15%        |
| 35+16.14                | 429+89.31    |                   |                     |                                       | 2313.14           |              |
| 35+16.14                | 429+89.31    | 862               | 1872.34             | 8' X 8' RCB                           | 2313.14           | 0.70%        |
| 53+88.48                | 411+16.97    |                   |                     |                                       | 2300.04           |              |
| 53+88.48                | 411+16.97    | 862               | 36.52               | 8' X 8' RCB                           | 2300.04           | 0.80%        |
| 54+25.00                | 410+80.45    |                   |                     |                                       | 2299.76           |              |

Rainbow  
lateral

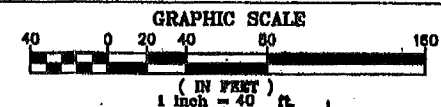
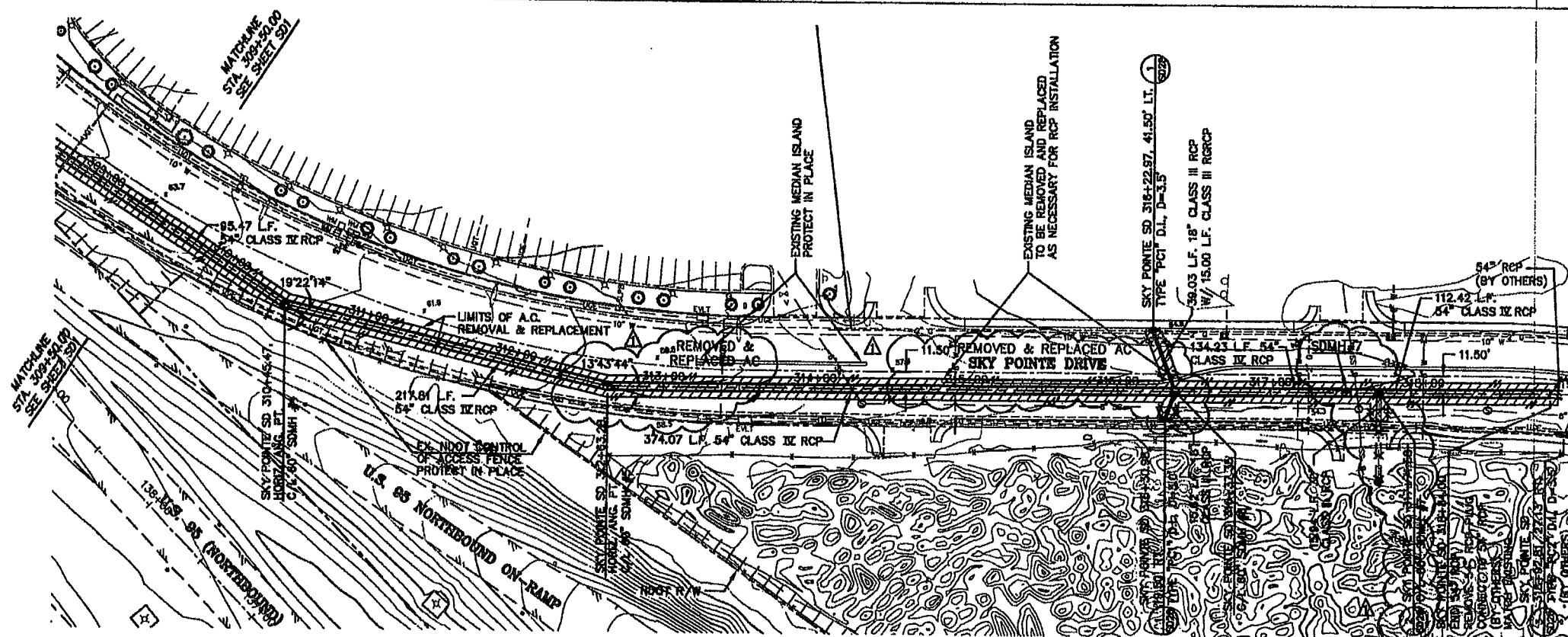
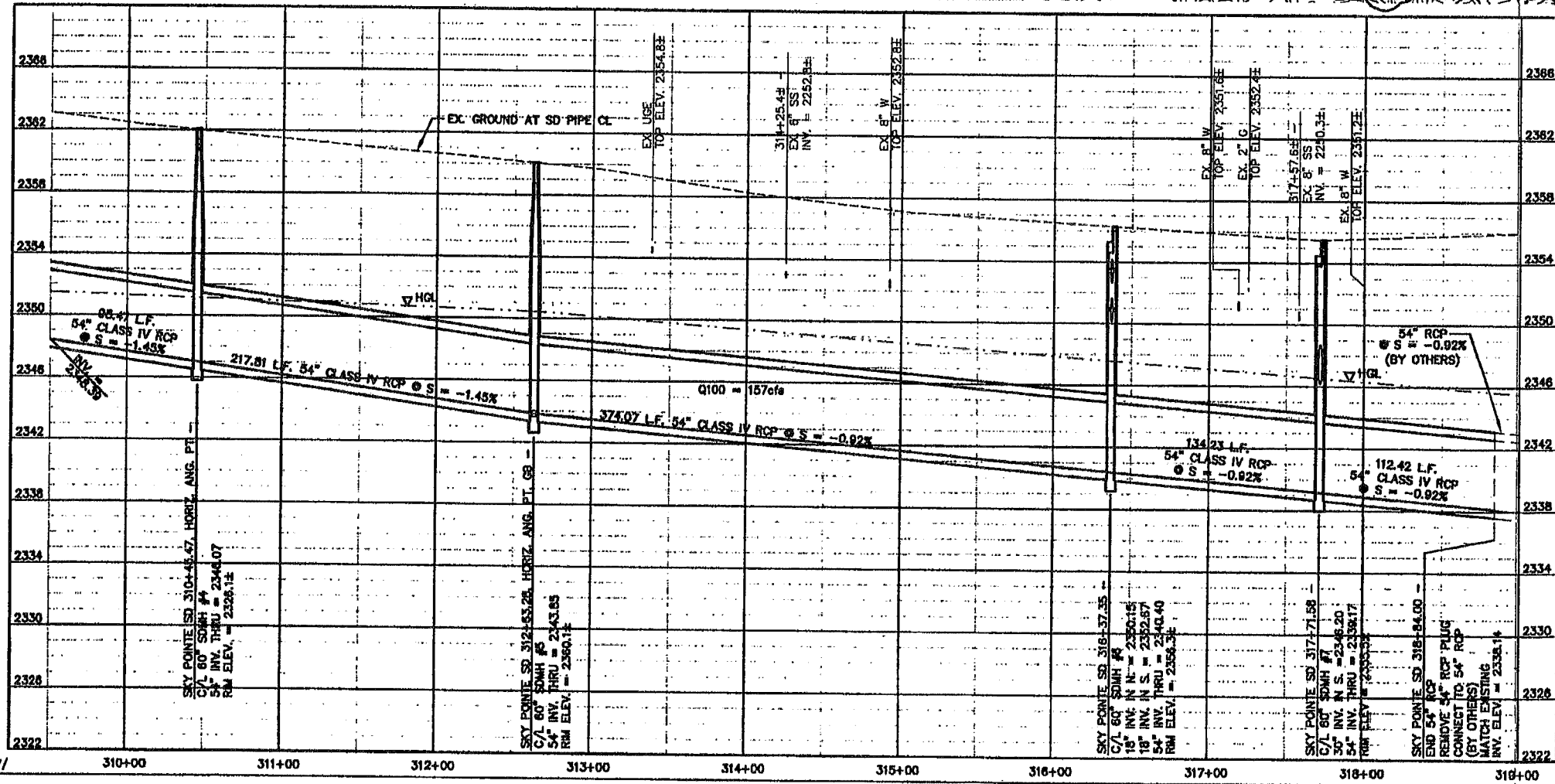


ANN ROAD MPU FACILITY  
(PEAK @ MAIN SYSTEM ) WSPG FILE: ANN5.DAT  
BY: LS, VTN, 02/13/01 UPDATED

| STATION        | INVERT<br>ELEV | DEPTH<br>OF FLOW | W.S.<br>ELEV | Q     | VEL   | VEL<br>HEAD | ENERGY<br>GRD.EL. | SUPER<br>ELEV | CRITICAL<br>DEPTH | HGT/<br>DIA | BASE/<br>ID NO. | ZL    | NO<br>PIER | AVBPR |
|----------------|----------------|------------------|--------------|-------|-------|-------------|-------------------|---------------|-------------------|-------------|-----------------|-------|------------|-------|
| L/ELEM         | SD             |                  |              |       |       | SF AVE      | HF                |               |                   | NORM DEPTH  |                 | ZR    |            |       |
| *****          | *****          | *****            | *****        | ***** | ***** | *****       | *****             | *****         | *****             | *****       | *****           | ***** | *****      | ***** |
| 42989.31       | 2313.14        | 7.119            | 2320.259     | 862.0 | 15.14 | 3.557       | 2323.816          | 0.00          | 7.119             | 8.00        | 8.00            | 0.00  | 0          | 0.00  |
| TRANS STR      | 0.02187        |                  |              |       |       | .004177     | 0.16              |               |                   |             |                 | 0.00  |            |       |
| 43028.64       | 2314.00        | 8.952            | 2322.952     | 862.0 | 9.00  | 1.258       | 2324.210          | 0.00          | 4.485             | 6.00        | 16.00           | 0.00  | 0          | 0.00  |
| JUNCT STR      | 0.02111        |                  |              |       |       | .004525     | 0.09              |               |                   |             |                 | 0.00  |            |       |
| 43048.06       | 2314.41        | 8.071            | 2322.481     | 399.0 | 11.16 | 1.934       | 2324.415          | 0.00          | 5.161             | 6.00        | 6.00            | 0.00  | 0          | 0.00  |
| 0.33           | 0.00000        |                  |              |       |       | .006499     | 0.00              |               |                   | 0.000       |                 | 0.00  |            |       |
| 43048.39       | 2314.41        | 8.073            | 2322.483     | 399.0 | 11.16 | 1.934       | 2324.417          | 0.00          | 5.161             | 6.00        | 6.00            | 0.00  | 0          | 0.00  |
| 86.87          | 0.02153        |                  |              |       |       | .006499     | 0.56              |               |                   | 3.193       |                 | 0.00  |            |       |
| 43135.26       | 2316.28        | 6.865            | 2323.145     | 399.0 | 11.16 | 1.934       | 2325.079          | 0.00          | 5.161             | 6.00        | 6.00            | 0.00  | 0          | 0.00  |
| 62.04          | 0.00661        |                  |              |       |       | .006499     | 0.40              |               |                   | 5.055       |                 | 0.00  |            |       |
| 43197.30       | 2316.69        | 6.890            | 2323.580     | 399.0 | 11.16 | 1.934       | 2325.514          | 0.00          | 5.161             | 6.00        | 6.00            | 0.00  | 0          | 0.00  |
| 430.73         | 0.00652        |                  |              |       |       | .006499     | 2.80              |               |                   | 5.081       |                 | 0.00  |            |       |
| 43628.03       | 2319.50        | 6.976            | 2326.476     | 399.0 | 11.16 | 1.934       | 2328.410          | 0.00          | 5.161             | 6.00        | 6.00            | 0.00  | 0          | 0.00  |
| 83.66          | 0.01410        |                  |              |       |       | .006499     | 0.54              |               |                   | 3.752       |                 | 0.00  |            |       |
| 43711.69       | 2320.68        | 6.352            | 2327.032     | 399.0 | 11.16 | 1.934       | 2328.966          | 0.00          | 5.161             | 6.00        | 6.00            | 0.00  | 0          | 0.00  |
| HYDRAULIC JUMP |                |                  |              |       |       |             |                   |               |                   |             |                 | 0.00  |            |       |
| 11.69          | 2320.68        | 3.829            | 2324.509     | 399.0 | 17.37 | 4.684       | 2329.193          | 0.00          | 5.161             | 6.00        | 6.00            | 0.00  | 0          | 0.00  |
| 141.94         | 0.01410        |                  |              |       |       | .013003     | 1.85              |               |                   | 3.752       |                 | 0.00  |            |       |
| 43853.63       | 2322.68        | 3.917            | 2326.598     | 399.0 | 16.98 | 4.476       | 2331.074          | 0.00          | 5.161             | 6.00        | 6.00            | 0.00  | 0          | 0.00  |
| 97.65          | 0.01410        |                  |              |       |       | .011893     | 1.16              |               |                   | 3.752       |                 | 0.00  |            |       |
| 43951.28       | 2324.06        | 4.108            | 2328.166     | 399.0 | 16.19 | 4.068       | 2332.234          | 0.00          | 5.161             | 6.00        | 6.00            | 0.00  | 0          | 0.00  |
| 47.36          | 0.01410        |                  |              |       |       | .010525     | 0.50              |               |                   | 3.752       |                 | 0.00  |            |       |



46311



MATCHLINE  
STA 319+00.00  
SEE SHEET SD3

MATCHLINE  
STA 319+00.00  
SEE SHEET SD3

- NOTES:
- SEE DRAWING D7 FOR STORM DRAIN MANHOLE SCHEDULE AND DROP INLET SCHEDULE.
  - SEE DRAWINGS D8 & D9 FOR DROP INLET DETAILS.
  - SEE NOTE 2 ON DRAWING I2 FOR EXISTING UTILITY RELOCATION.
  - SEE DRAWING D11 FOR TRENCH DETAILS.

LEGEND

- NEW STORM DRAIN MAIN LINE
- EXISTING A.C. PAVEMENT TO BE REMOVED AND REPLACED

APPROVED

LAS VEGAS VALLEY WATER DISTRICT

DATE

Call before you Dig

1-800-227-2800

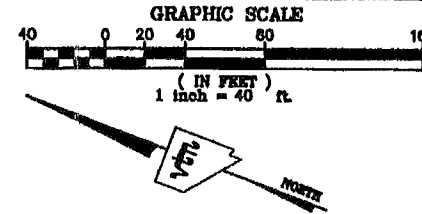
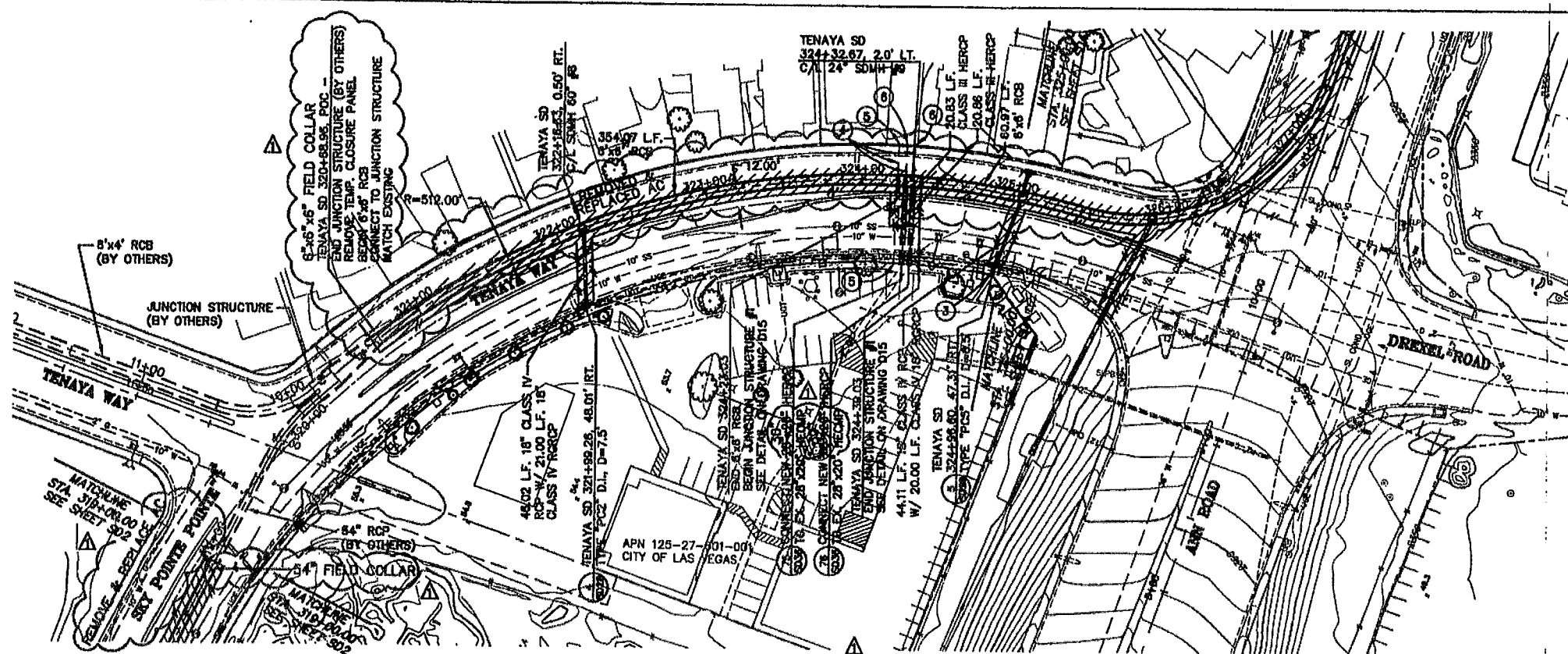
Call before you Overhead

1-702-593-4111

|                                                                                    |                              |
|------------------------------------------------------------------------------------|------------------------------|
| STORM DRAIN PLAN & PROFILE<br>STA. 309+50.00 TO STA. 391+00.00<br>SKY POINTE DRIVE |                              |
| ANN ROAD IMPROVEMENTS<br>US 95 TO FERRELL STREET                                   |                              |
| PROJECT                                                                            |                              |
| SEAL                                                                               |                              |
| ORIGINAL CONSTRUCTION<br>DRAWINGS ARE ON FILE WITH<br>THE CITY OF LAS VEGAS.       |                              |
| THE DOCUMENTS WILL BE SEALS ON<br>10/14/01                                         |                              |
| BY<br>KEN D. GILBERT<br>UNDER LICENSE NO.<br>9177                                  |                              |
| NO. NO.                                                                            | 5546                         |
| BY                                                                                 | TMM                          |
| DATE                                                                               | 10/05/01                     |
| SCALE                                                                              | HORIZ. 1"=40'<br>VERT. 1"=4' |
| DRAWING                                                                            | SHEET                        |
| SD2                                                                                | 92                           |
| 169 SHEETS                                                                         |                              |

|                                                                                                                                                          |          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| DEPARTMENT OF PUBLIC WORKS<br>CITY OF LAS VEGAS                                                                                                          |          |
| CONSULTING ENGINEERS • PLANNERS • LAND SURVEYORS<br>2727 SOUTH RAINBOW BOULEVARD<br>LAS VEGAS, NEVADA 89146-3148 PHONE (702) 873-7550 FAX (702) 362-2587 |          |
| DATE                                                                                                                                                     | 05/14/04 |
| REV                                                                                                                                                      | BY       |
| 1                                                                                                                                                        | BY       |
| 2                                                                                                                                                        | BY       |
| 3                                                                                                                                                        | BY       |
| 4                                                                                                                                                        | BY       |
| 5                                                                                                                                                        | BY       |
| 6                                                                                                                                                        | BY       |
| 7                                                                                                                                                        | BY       |
| 8                                                                                                                                                        | BY       |
| 9                                                                                                                                                        | BY       |
| 10                                                                                                                                                       | BY       |
| 11                                                                                                                                                       | BY       |
| 12                                                                                                                                                       | BY       |
| 13                                                                                                                                                       | BY       |
| 14                                                                                                                                                       | BY       |
| 15                                                                                                                                                       | BY       |
| 16                                                                                                                                                       | BY       |
| 17                                                                                                                                                       | BY       |
| 18                                                                                                                                                       | BY       |
| 19                                                                                                                                                       | BY       |
| 20                                                                                                                                                       | BY       |
| 21                                                                                                                                                       | BY       |
| 22                                                                                                                                                       | BY       |
| 23                                                                                                                                                       | BY       |
| 24                                                                                                                                                       | BY       |
| 25                                                                                                                                                       | BY       |
| 26                                                                                                                                                       | BY       |
| 27                                                                                                                                                       | BY       |
| 28                                                                                                                                                       | BY       |
| 29                                                                                                                                                       | BY       |
| 30                                                                                                                                                       | BY       |
| 31                                                                                                                                                       | BY       |
| 32                                                                                                                                                       | BY       |
| 33                                                                                                                                                       | BY       |
| 34                                                                                                                                                       | BY       |
| 35                                                                                                                                                       | BY       |
| 36                                                                                                                                                       | BY       |
| 37                                                                                                                                                       | BY       |
| 38                                                                                                                                                       | BY       |
| 39                                                                                                                                                       | BY       |
| 40                                                                                                                                                       | BY       |
| 41                                                                                                                                                       | BY       |
| 42                                                                                                                                                       | BY       |
| 43                                                                                                                                                       | BY       |
| 44                                                                                                                                                       | BY       |
| 45                                                                                                                                                       | BY       |
| 46                                                                                                                                                       | BY       |
| 47                                                                                                                                                       | BY       |
| 48                                                                                                                                                       | BY       |
| 49                                                                                                                                                       | BY       |
| 50                                                                                                                                                       | BY       |
| 51                                                                                                                                                       | BY       |
| 52                                                                                                                                                       | BY       |
| 53                                                                                                                                                       | BY       |
| 54                                                                                                                                                       | BY       |
| 55                                                                                                                                                       | BY       |
| 56                                                                                                                                                       | BY       |
| 57                                                                                                                                                       | BY       |
| 58                                                                                                                                                       | BY       |
| 59                                                                                                                                                       | BY       |
| 60                                                                                                                                                       | BY       |
| 61                                                                                                                                                       | BY       |
| 62                                                                                                                                                       | BY       |
| 63                                                                                                                                                       | BY       |
| 64                                                                                                                                                       | BY       |
| 65                                                                                                                                                       | BY       |
| 66                                                                                                                                                       | BY       |
| 67                                                                                                                                                       | BY       |
| 68                                                                                                                                                       | BY       |
| 69                                                                                                                                                       | BY       |
| 70                                                                                                                                                       | BY       |
| 71                                                                                                                                                       | BY       |
| 72                                                                                                                                                       | BY       |
| 73                                                                                                                                                       | BY       |
| 74                                                                                                                                                       | BY       |
| 75                                                                                                                                                       | BY       |
| 76                                                                                                                                                       | BY       |
| 77                                                                                                                                                       | BY       |
| 78                                                                                                                                                       | BY       |
| 79                                                                                                                                                       | BY       |
| 80                                                                                                                                                       | BY       |
| 81                                                                                                                                                       | BY       |
| 82                                                                                                                                                       | BY       |
| 83                                                                                                                                                       | BY       |
| 84                                                                                                                                                       | BY       |
| 85                                                                                                                                                       | BY       |
| 86                                                                                                                                                       | BY       |
| 87                                                                                                                                                       | BY       |
| 88                                                                                                                                                       | BY       |
| 89                                                                                                                                                       | BY       |
| 90                                                                                                                                                       | BY       |
| 91                                                                                                                                                       | BY       |
| 92                                                                                                                                                       | BY       |
| 93                                                                                                                                                       | BY       |
| 94                                                                                                                                                       | BY       |
| 95                                                                                                                                                       | BY       |
| 96                                                                                                                                                       | BY       |
| 97                                                                                                                                                       | BY       |
| 98                                                                                                                                                       | BY       |
| 99                                                                                                                                                       | BY       |
| 100                                                                                                                                                      | BY       |

RECORD DRAWINGS INFORMATION SUPPLIED BY CONTRACTOR - NOVEMBER 2003



#### NOTES:

- SEE DRAWING D7 FOR STORM DRAIN MANHOLE SCHEDULE AND DROP INLET SCHEDULE.
- SEE DRAWINGS D8 & D9 FOR DROP INLET DETAILS.
- SEE NOTE 2 ON DRAWING I2 FOR EXISTING UTILITY RELOCATION.
- SEE DRAWING D11 FOR TRENCH DETAILS.

#### LEGEND

- NEW STORM DRAIN MAIN LINE
- EXISTING A.C. PAVEMENT TO BE REMOVED AND REPLACED

#### CONSTRUCTION NOTES

- EXISTING SIDEWALK DRAIN TO BE REMOVED
- EXISTING (3) 28"x20" HECMP's
- EXISTING 28"x20" HECMP (NORTH PIPE) TO BE REMOVED AS NECESSARY FOR JUNCTION STRUCTURE #1 INSTALLATION. ABANDON AND PLUG REMAINING PIPE WITH CONCRETE.
- EXISTING 28"x20" HECMP TO BE CONNECTED TO NEW 28"x20" HECMP. SEE LATERAL PROFILES 75 AND 76 ON DRAWING S036.

#### VIN PROJECT BENCHMARK

PROJECT DATUM: NAVD83  
CITY OF LAS VEGAS BENCHMARK 1LV90-38NES  
NAVD83 ELEVATION: 881.303 METERS (2235.24 FEET)  
(PRIMAS AND ASSOCIATES - 2234.85 FEET)  
RIVET AND PLATE IN TOP OF CURB, SW CORNER OF ANN ROAD AND DECATUR BLVD.

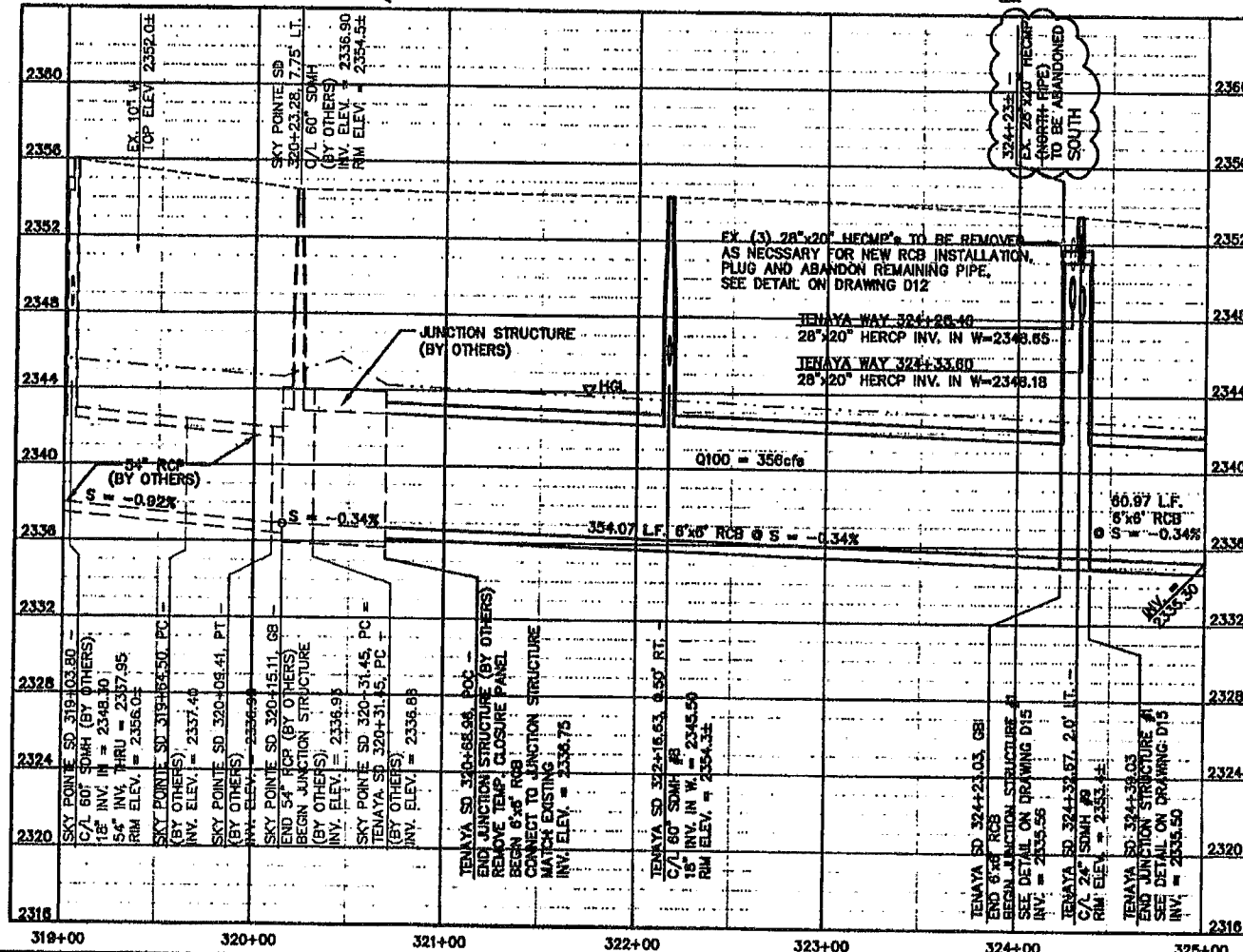
#### PRIMAS AND ASSOCIATES PROJECT BENCHMARK

1LV90/27W4, CLV, PLS 2050 AL CAP W1/4 SEC.27  
ELEV. 2301.17 NAVD 83  
1LV90/27W4, CLV, AL CAP, PLS 2984  
CENTENNIAL PKWY. & TENAYA WAY  
ELEV. 2350.41 NAVD 83  
(VIN NEVADA = 2350.695 FEET)

#### APPROVED

LAS VEGAS VALLEY WATER DISTRICT DATE

Call before you Dig  
1-800-227-2600  
Call before you Overhead  
1-702-583-0711



STORM DRAIN PLAN & PROFILE  
STA. 319+00.00 TO STA. 325+00.00  
SKY POINTE DRIVE / TENAYA WAY  
ANN ROAD IMPROVEMENTS  
US 95 TO FERRELL STREET

SEAL  
ORIGINAL CONSTRUCTION  
DRAWINGS ARE ON FILE WITH  
THE CITY OF LAS VEGAS.  
THESE DOCUMENTS WERE SEALED ON  
10/05/01  
KEN D. GILBERT  
UNDER LICENSE NO.  
9177

NO. 5546  
BY IS  
DATE 10/05/01  
SCALE HORIZ. 1"=40'  
VERT. 1"=4'  
DRAWING SHEET  
SD3 93 OF 163  
SHEETS

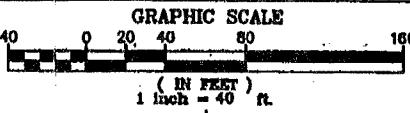
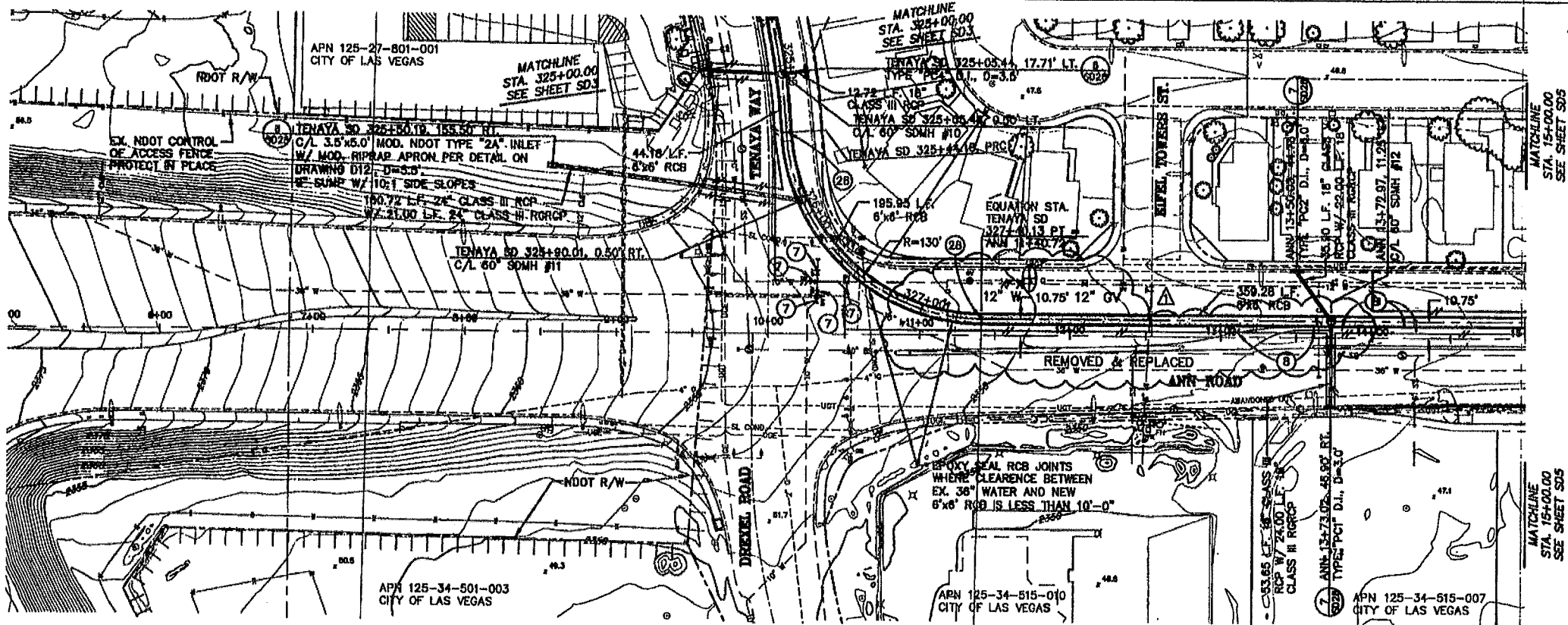
CONSULTING ENGINEERS • PLANNERS • LAND SURVEYORS  
2737 SOUTH RAINBOW BOULEVARD  
LAS VEGAS, NEVADA 89146-5148 PHONE (702) 873-7550 FAX (702) 362-2587

vtm nevada

DEPARTMENT OF PUBLIC WORKS  
CITY OF LAS VEGAS

RECORD DRAWINGS INFORMATION SUPPLIED BY CONTRACTOR - NOVEMBER 2003

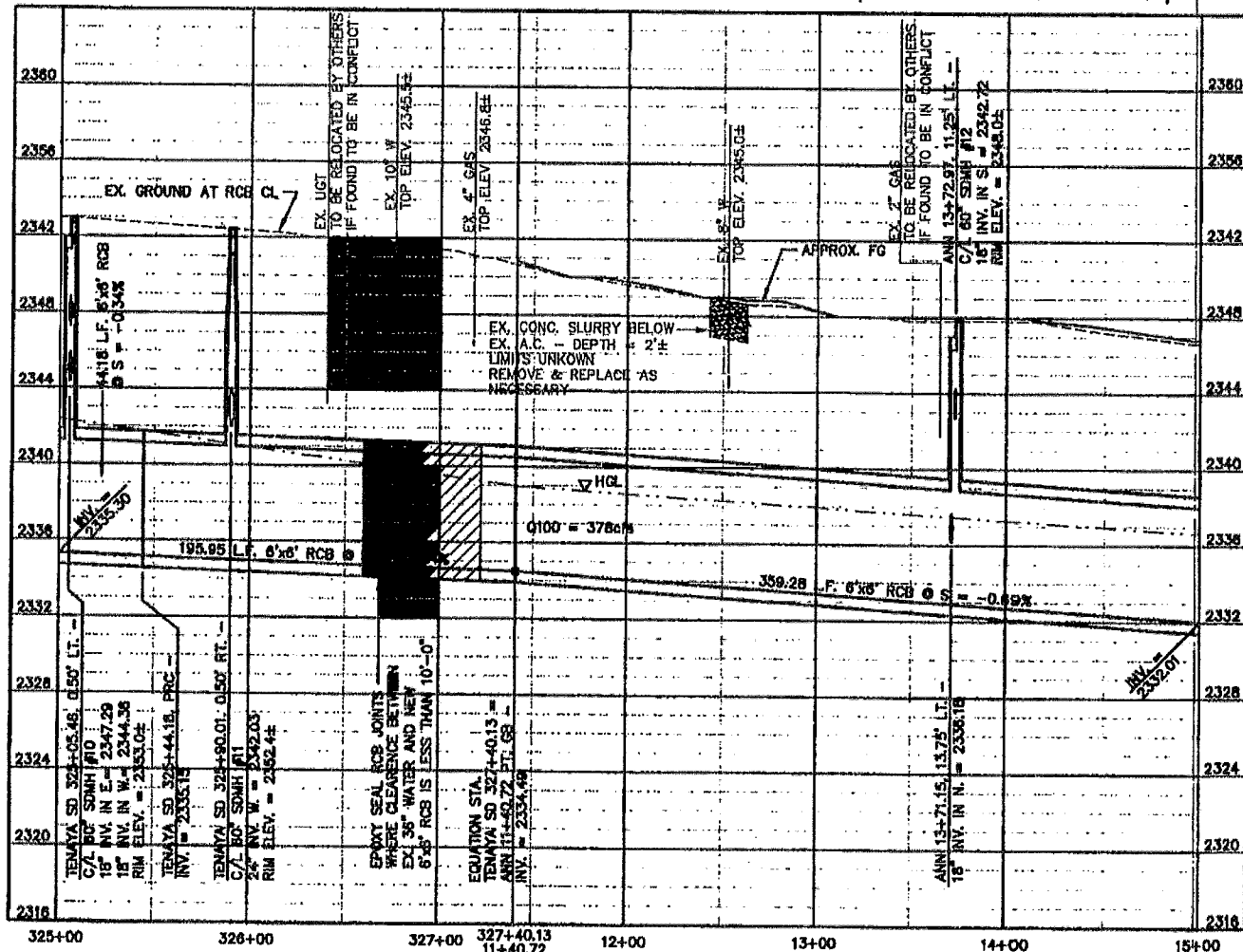




**LEGEND**  
 NEW STORM DRAIN MAIN LINE

**CONSTRUCTION NOTES**

- ⑦ EXISTING WATER VALVE - PROTECT IN PLACE. MUST BE ACCESSIBLE AT ALL TIMES.
- ⑧ EXISTING MEDIAN ISLAND SURFACE WITH TACK ON CURB TO BE REMOVED AND REPLACED, SEE DRAWING R28.
- ②⑧ TRENCH SHORING FROM TENAYA SD 325+44.18, PC TO TENAYA SD 327+40.13, PT. PROTECT IN PLACE ALL EXISTING TRAFFIC SIGNAL FACILITIES, 10' W, 38' W, 4' G, CURB, GUTTER & SIDEWALK. CONTRACTOR TO REPAIR ALL DAMAGES AT CONTRACTOR'S EXPENSE.



**APPROVED**  
 LAS VEGAS VALLEY WATER DISTRICT  
 DATE \_\_\_\_\_

**Call before you Dig**  
 1-800-227-2800  
**Call before you Overhead**  
 1-702-583-6111

DEPARTMENT OF PUBLIC WORKS  
 CITY OF LAS VEGAS

CONSULTING ENGINEERS • PLANNERS • LAND SURVEYORS  
 2727 SOUTH RAINBOW BOULEVARD  
 LAS VEGAS, NEVADA 89146-5146 PHONE (702) 873-7550 FAX (702) 362-2587

**vtm** Nevada

**STORM DRAIN PLAN & PROFILE**  
 STA. 325+00.00 TO STA. 327+40.13  
 TENAYA WAY / ANN ROAD  
 ANN ROAD IMPROVEMENTS  
 US 95 TO FERRELL STREET

SEAL  
 ORIGINAL CONSTRUCTION DRAWINGS ARE ON FILE WITH THE CITY OF LAS VEGAS.  
 THE DOCUMENTS WERE SEALED ON 10/15/01 BY KEN D. GILBRETH UNDER LICENSE NO. 9177

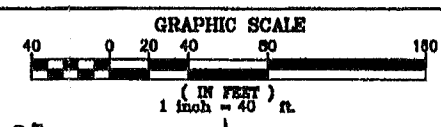
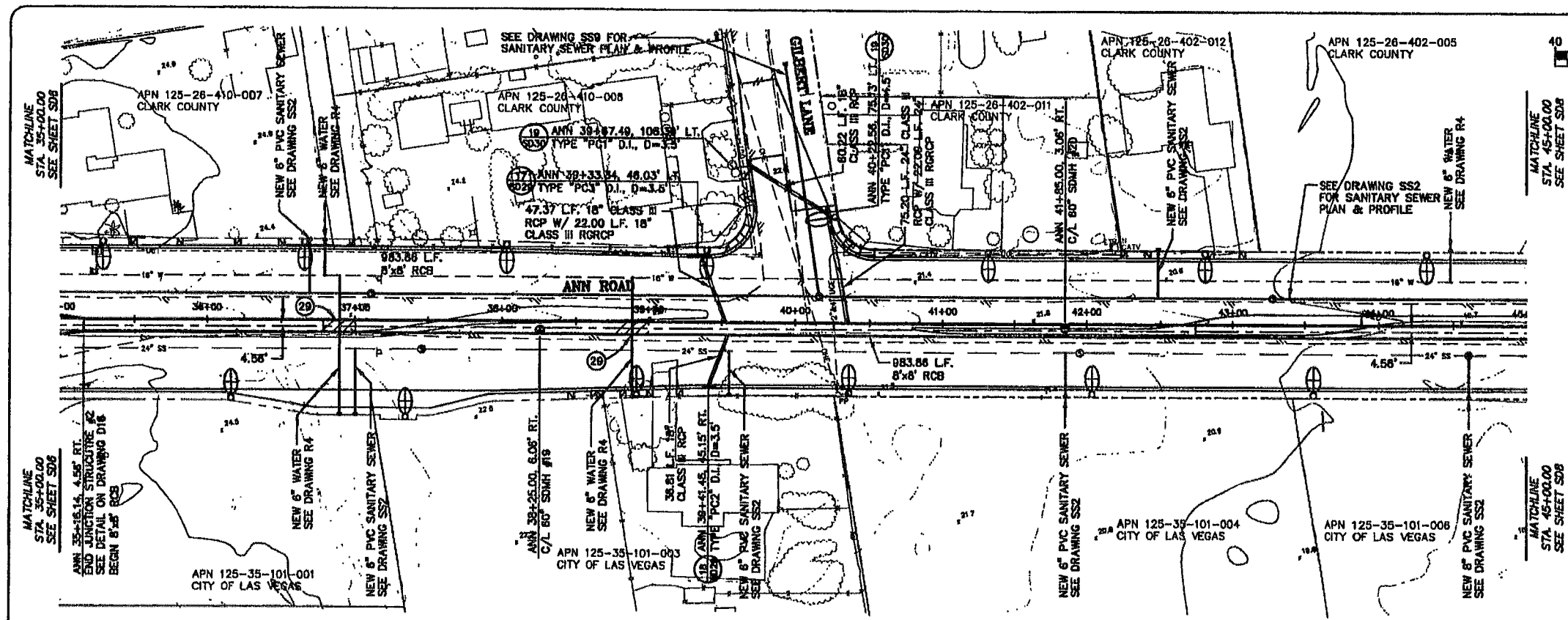
NO. 5546  
 BY TMM  
 DATE  
 SCALE HORIZ. 1"=40' VERT. 1"=4'  
 DRAWING SHEET SD4 94 OF 163

RECORD DRAWINGS INFORMATION SUPPLIED BY CONTRACTOR - NOVEMBER 2003









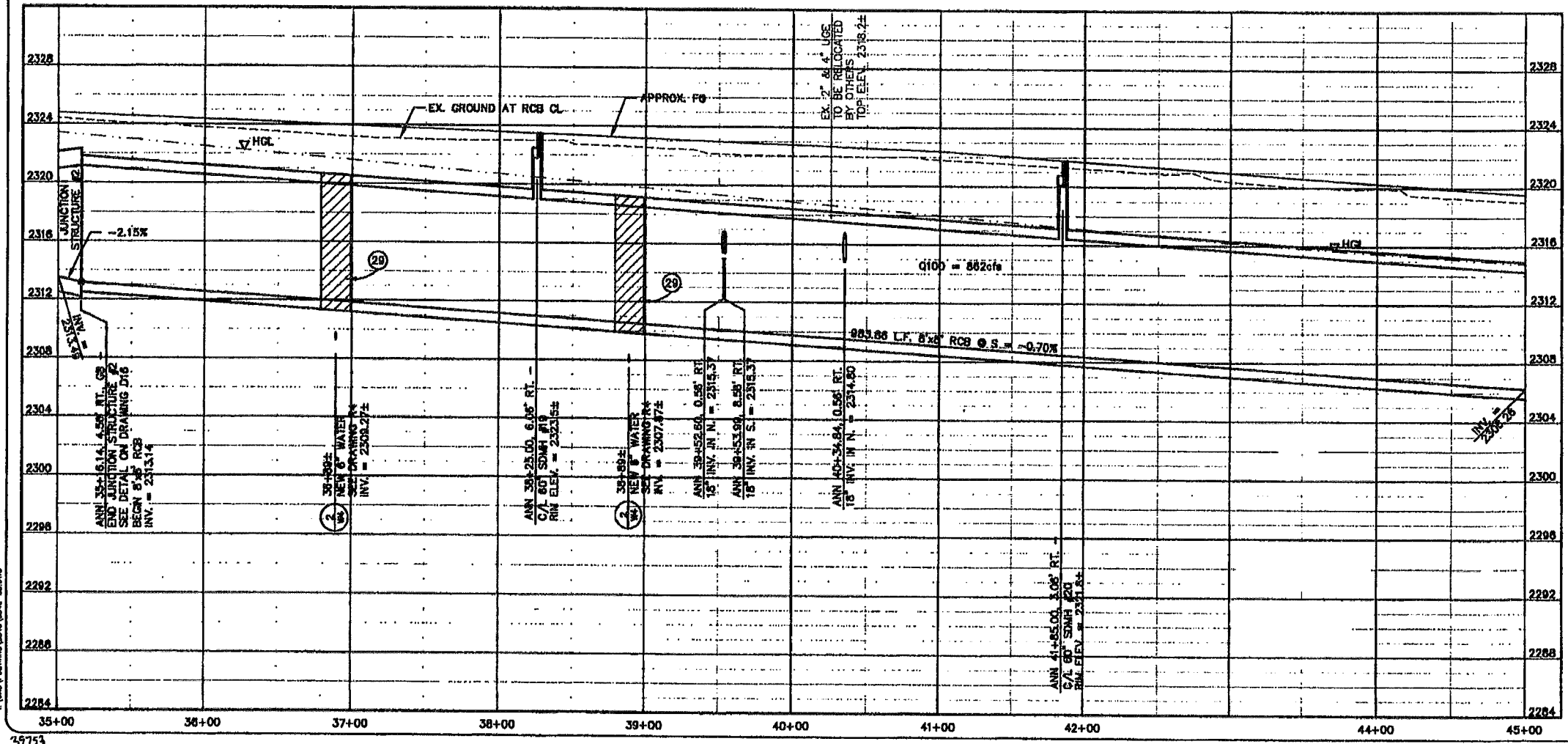
- NOTES:
- SEE DRAWING D7 FOR STORM DRAIN MANHOLE SCHEDULE AND DROP INLET SCHEDULE.
  - SEE DRAWINGS D8 & D9 FOR DROP INLET DETAILS.
  - SEE NOTE 2 ON DRAWING I2 FOR EXISTING UTILITY RELOCATION.
  - SEE DRAWING D11 FOR TRENCH DETAILS.

LEGEND

NEW STORM DRAIN MAIN LINE

CONSTRUCTION NOTES

- (29) NEW WATER LINE, EPOXY SEAL RCB JOINTS 10' EACH WAY.



APPROVED

10/24/01

DATE

Call before you Dig

1-800-227-2800

Call before you Overhead

1-702-881-9711

CONSULTING ENGINEERS • PLANNERS • LAND SURVEYORS

2727 SOUTH RAINBOW BOULEVARD

LAS VEGAS, NEVADA 89146-5148 PHONE (702) 875-7590 FAX (702) 382-2597

DEPARTMENT OF PUBLIC WORKS

CITY OF LAS VEGAS

vtm nevada

STORM DRAIN PLAN & PROFILE

STA. 35+00.00 TO STA. 45+00.00

ANN ROAD

US 95 TO FERRELL STREET

NO. 5546

IS

DATE 10/05/01

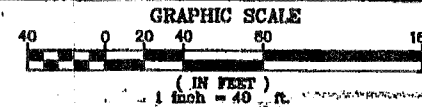
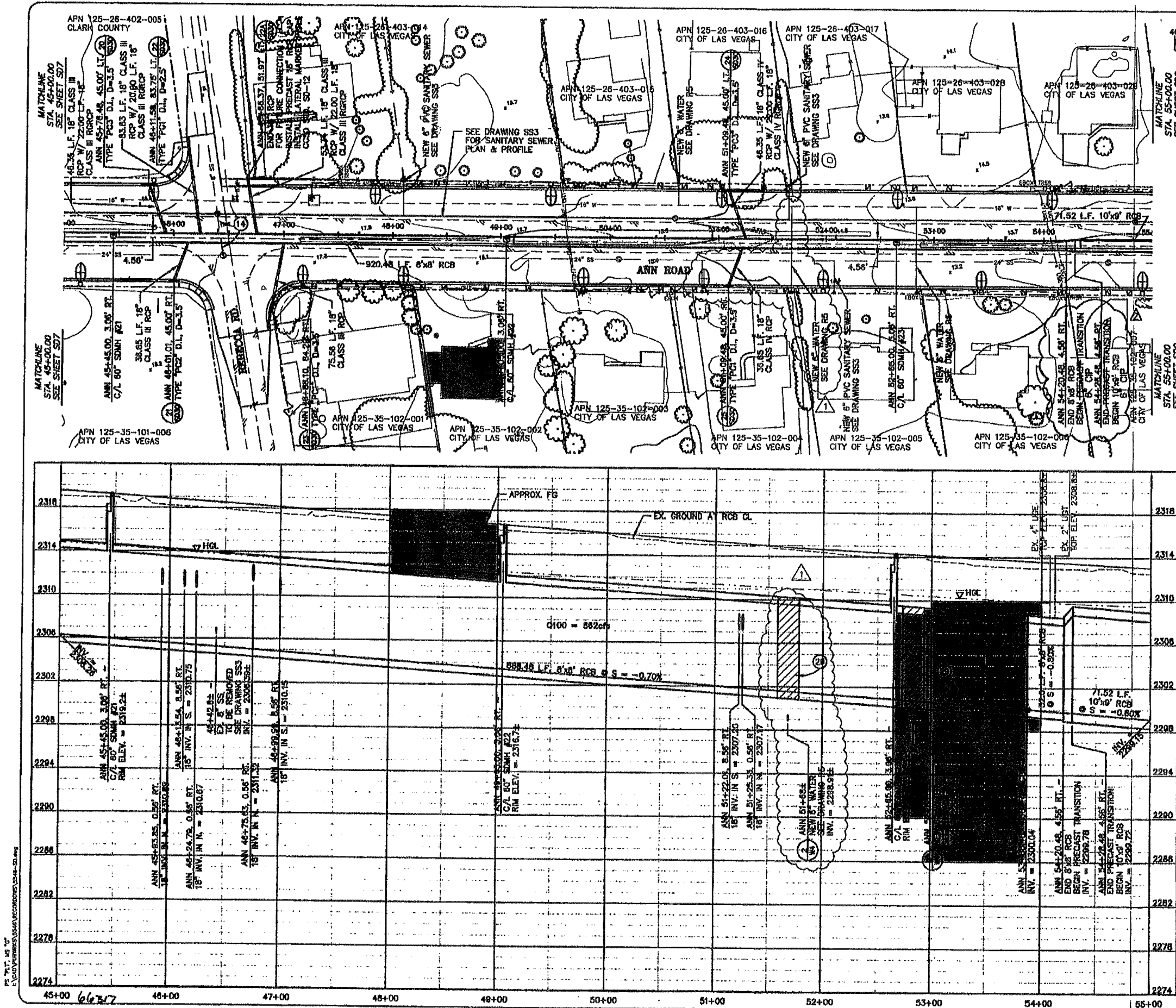
SCALE HORIZ. 1"=40'

VERT. 1"=4'

DRAWING SD7

SHEET 97 OF 163

39753



#### NOTES:

- SEE DRAWING D7 FOR STORM DRAIN MANHOLE SCHEDULE AND DROP INLET SCHEDULE.
- SEE DRAWINGS D8 & D9 FOR DROP INLET DETAILS.
- SEE NOTE 2 ON DRAWING I2 FOR EXISTING UTILITY RELOCATION.
- SEE DRAWING D11 FOR TRENCH DETAILS.

#### LEGEND

NEW STORM DRAIN MAIN LINE

#### CONSTRUCTION NOTES

- EXISTING 8" SANITARY SEWER TO BE REMOVED, SEE DRAWING SS3.
- NEW WATER LINE, EPOXY SEAL RCB JOINTS 10' EACH WAY.

#### APPROVED

LAS VEGAS VALLEY WATER DISTRICT DATE

Call before you Dig  
1-800-227-2800  
Call before you Overhead  
1-702-933-4111

STORM DRAIN PLAN & PROFILE  
STA. 45+00.00 TO STA. 55+00.00  
ANN ROAD

ANN ROAD IMPROVEMENTS  
US 95 TO FERRELL STREET

ORIGINAL CONSTRUCTION DRAWING ARE ON FILE WITH THE CITY OF LAS VEGAS. THE DOCUMENTS WERE SEALED ON 10/10/01 BY KEN D. GILBERT UNDER LICENSE NO. 9177

NO. 13 5546  
BY TMM  
DATE 10/05/01  
SCALE HORIZ. 1"=40'  
VERT. 1"=4'  
DRAWING SD8  
SHEET 98 OF 163 SHEETS

DEPARTMENT OF PUBLIC WORKS  
CITY OF LAS VEGAS

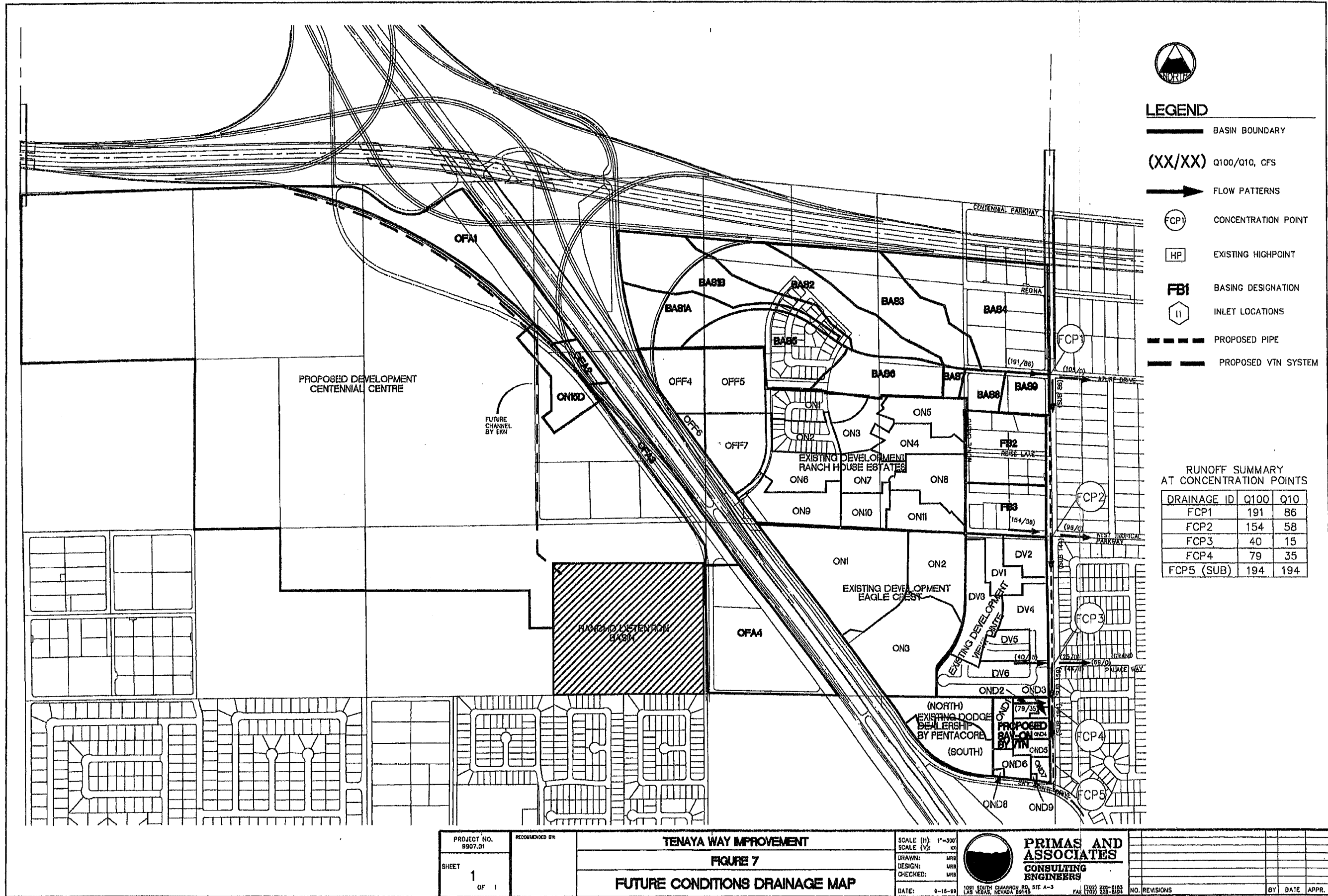
vtm nevada

CONSULTING ENGINEERS • PLANNERS • LAND SURVEYORS  
2727 SOUTH RAINBOW BOULEVARD  
LAS VEGAS, NEVADA 89146-5148 PHONE (702) 875-7550 FAX (702) 382-2567

RECORD DRAWINGS INFORMATION SUPPLIED BY CONTRACTOR - NOVEMBER 2003

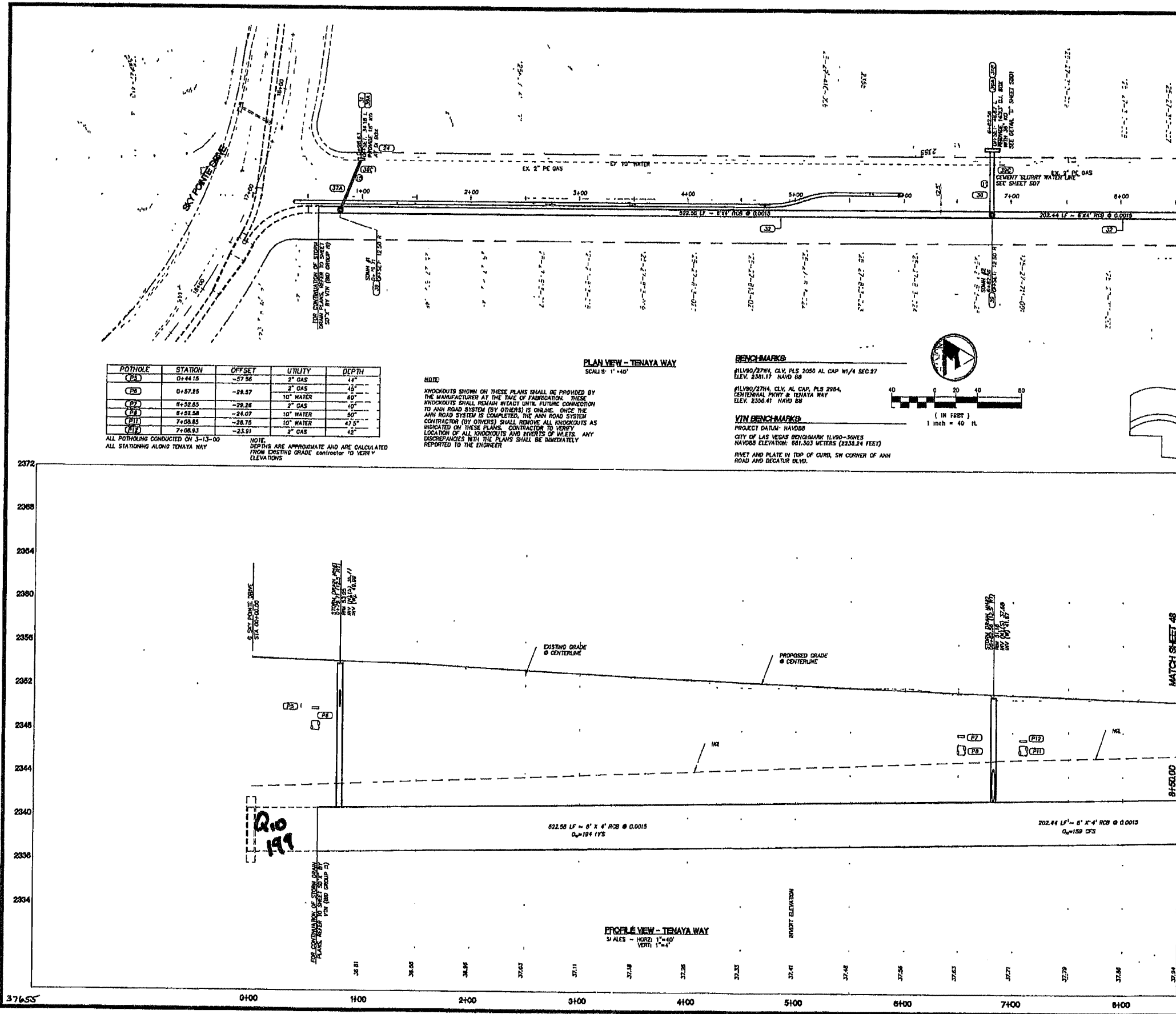
# REFERENCE 3





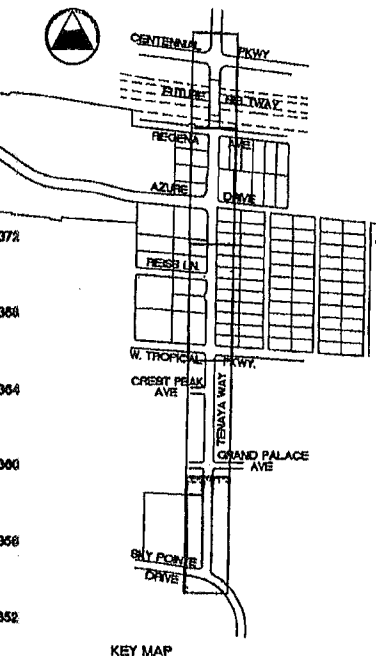
(Ref DS 44405)

1" VERTICAL SCALE  
1" HORIZONTAL SCALE  
10/01/2001 07:23:44 AM PWT



**CONSTRUCTION NOTES**  
**RELOCATIONS**  
(R1) RELOCATE DRY UTILITY (BY OTHERS)  
**STORM DRAIN IMPROVEMENTS**  
(S1) CONST. WATER TIGHT PIPE (UDS SEC. 2.18.01 PAR. "D" SUB. "3C")  
(S2) CONSTRUCT DROP INLET TYPE "CMI" (SHEET S001)  
(S3) CONSTRUCT DROP INLET TYPE "PC" (SHEET S002)  
(S4) CONSTRUCT DROP INLET TYPE "PC" (SHEET S002)  
(S5) CONSTRUCT 14" X3" DROP DALET (SHEET S001)  
(S6) CONSTRUCT 6" X4" RCB  
(S7) CONSTRUCT 48" SMOOTH LINED HOPE  
(S8) CONSTRUCT 27" SMOOTH LINED HOPE  
(S9) CONSTRUCT 6" X4" 45" REND (SHEET S001)  
(S10) CONSTRUCT 36" SMOOTH LINED HOPE  
(S11) CONSTRUCT 24" SMOOTH LINED HOPE  
(S12) CONSTRUCT 18" SMOOTH LINED HOPE  
(S13) CONSTRUCT 48" MANHOLE (CCSD STD DMO SD-1)  
(S14) CONSTRUCT 60" MANHOLE (CCSD STD DMO SD-1)  
(S15) PROVIDE KNOCKOUT PER DETAIL SHEET S002  
(S16) PROVIDE 36" KNOCKOUT PER WH DETAIL (SHEET S001)  
(S17) CONCRETE ENCASE STORM DRAIN 10' EACH SIDE OF WATER  
(S18) INDICATES STORM DRAIN LATERAL NUMBER  
SEE SHEET S07 - STORM DRAIN LATERAL PROFILES

**BASE OF BEARING**  
NORTH AMERICAN DATUM - 1983 (NAD83), NEVADA COORDINATE SYSTEM - 1983 (NCS83), EAST ZONE (2701), MODIFIED AS SHOWN BY A MAP ON FILE IN THE OFFICE OF THE COUNTY RECORDER, CLARK COUNTY, NEVADA IN FILE 89 OF RECORDS OF SURVEYS, PAGE 3



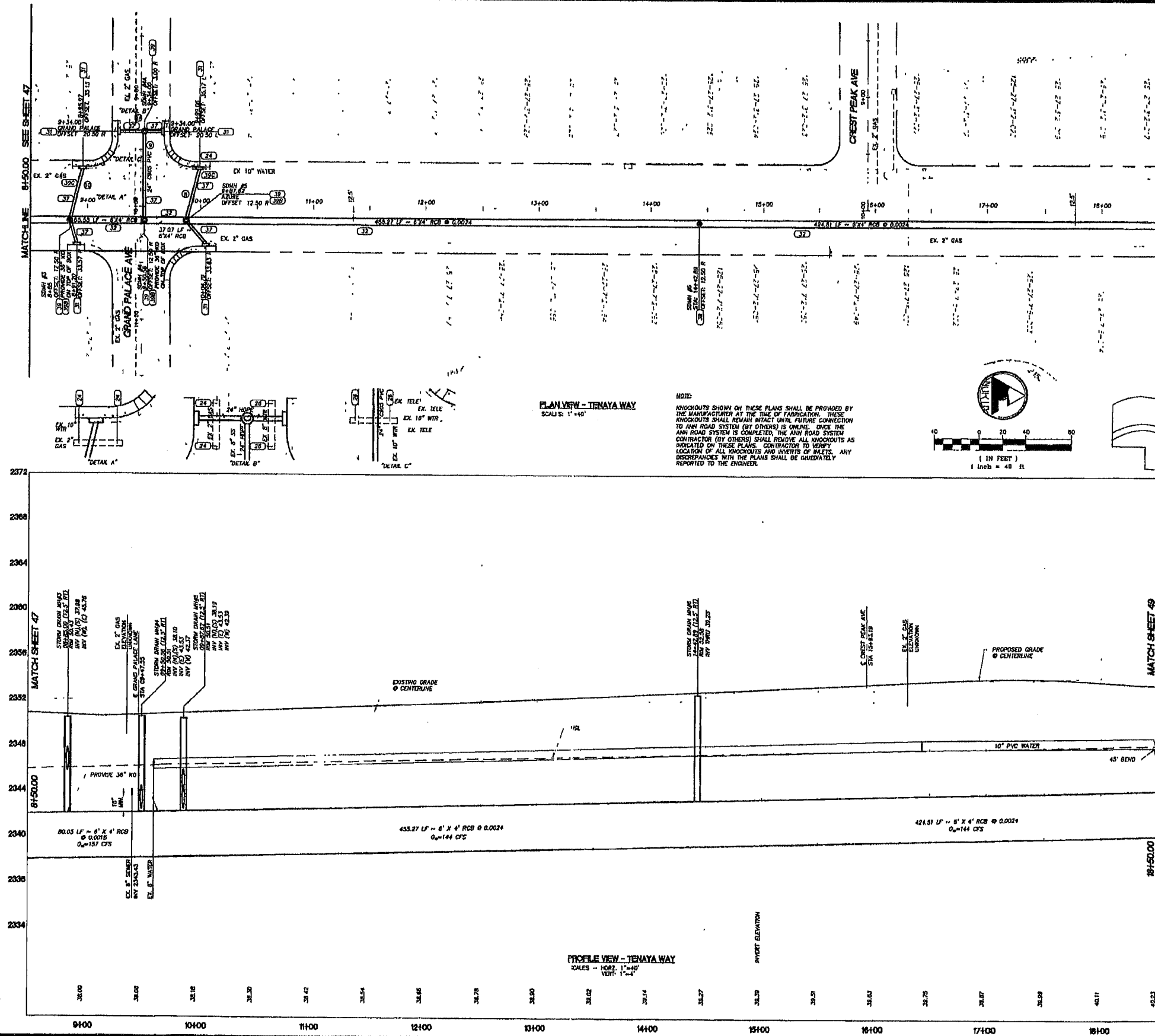
APPROVED FOR CONSTRUCTION  
LAS VEGAS VALLEY WATER DISTRICT  
DATE

**DISCLAIMER NOTE**  
UTILITY LOCATIONS SHOWN HEREIN ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT HORIZONTAL AND VERTICAL LOCATION OF ALL EXISTING UNDERGROUND UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HEREON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATION.

|                                                       |                                           |
|-------------------------------------------------------|-------------------------------------------|
| ENGINEERING DESIGN SECTION                            |                                           |
| CITY ENGINEER: CHARLES KALONOSKI, JR., P.E.           | PROJECT MANAGER: TERESA M. HANNAHAN, P.E. |
| PRIMAS AND ASSOCIATES<br>CONSULTING ENGINEERS         |                                           |
| SHEET 8D1<br>47 OF 70 SHEETS<br>DRAWING NO. 107-V3145 |                                           |



37656



CONSTRUCTION NOTES  
RELOCATIONS  
(1) RELOCATE DRY UTILITIES (BY OTHERS)  
(2) RELOCATE WATER (PER DETAIL SHEET WS)  
STORM DRAIN IMPROVEMENTS  
(3) CONSTRUCT DROP INLET TYPE "DM" (SHEET SDD1)  
(4) CONSTRUCT DROP INLET TYPE "PC" (SHEET SDD2)  
(5) CONSTRUCT DROP INLET TYPE "PC" (SHEET SDD3)  
(6) CONSTRUCT 6" DIA. RIB  
(7) CONSTRUCT 48" SMOOTH UNLINED HOPE  
(8) CONSTRUCT 24" SMOOTH UNLINED HOPE  
(9) CONSTRUCT 18" SMOOTH UNLINED HOPE  
(10) CONSTRUCT 12" SMOOTH UNLINED HOPE  
(11) CONSTRUCT 8" DIA. 45° BEND (SHEET SDD1)  
(12) CONSTRUCT 24" SMOOTH UNLINED HOPE  
(13) CONSTRUCT 18" SMOOTH UNLINED HOPE  
(14) CONSTRUCT 48" MANHOLE (COST STD DWG 80-1)  
(15) CONSTRUCT 60" MANHOLE (COST STD DWG 80-1)  
(16) PROVIDE KNOCKOUT PER DETAIL SHEET SDD2  
(17) PROVIDE 36" KNOCKOUT PER WH DETAIL (SHEET SDD1)  
(18) CONCRETE ENCASE STORM DRAIN 10' EACH SIDE OF WATER  
(19) INDICATE STORM DRAIN LATERAL NUMBER  
(20) SEE SHEET SDD2 - STORM DRAIN LATERAL PROFILES  
BASIS OF BEARING  
NORTH AMERICAN DATUM - 1983 (NAD83), NEVADA COORDINATE SYSTEM - 1983 (NCS83), EAST ZONE (270), ADJUSTED AS SHOWN BY A MAP ON FILE IN THE OFFICE OF THE COUNTY RECORDS, CLARK COUNTY, NEVADA IN FILE 89 OF RECORDS ON SURVEYS, PAGE 3  
BENCHMARKS  
#1150/2714, C.V. PLS 2030 AL CAP W/1/4 SEC 27  
ELEV. 2381.17 NAVD 88  
#1150/2714, C.V. AL CAP, PLS 2884  
CENTENNIAL PKWY & TENAYA WAY  
ELEV. 2358.41 NAVD 88

KEY MAP

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT

DATE

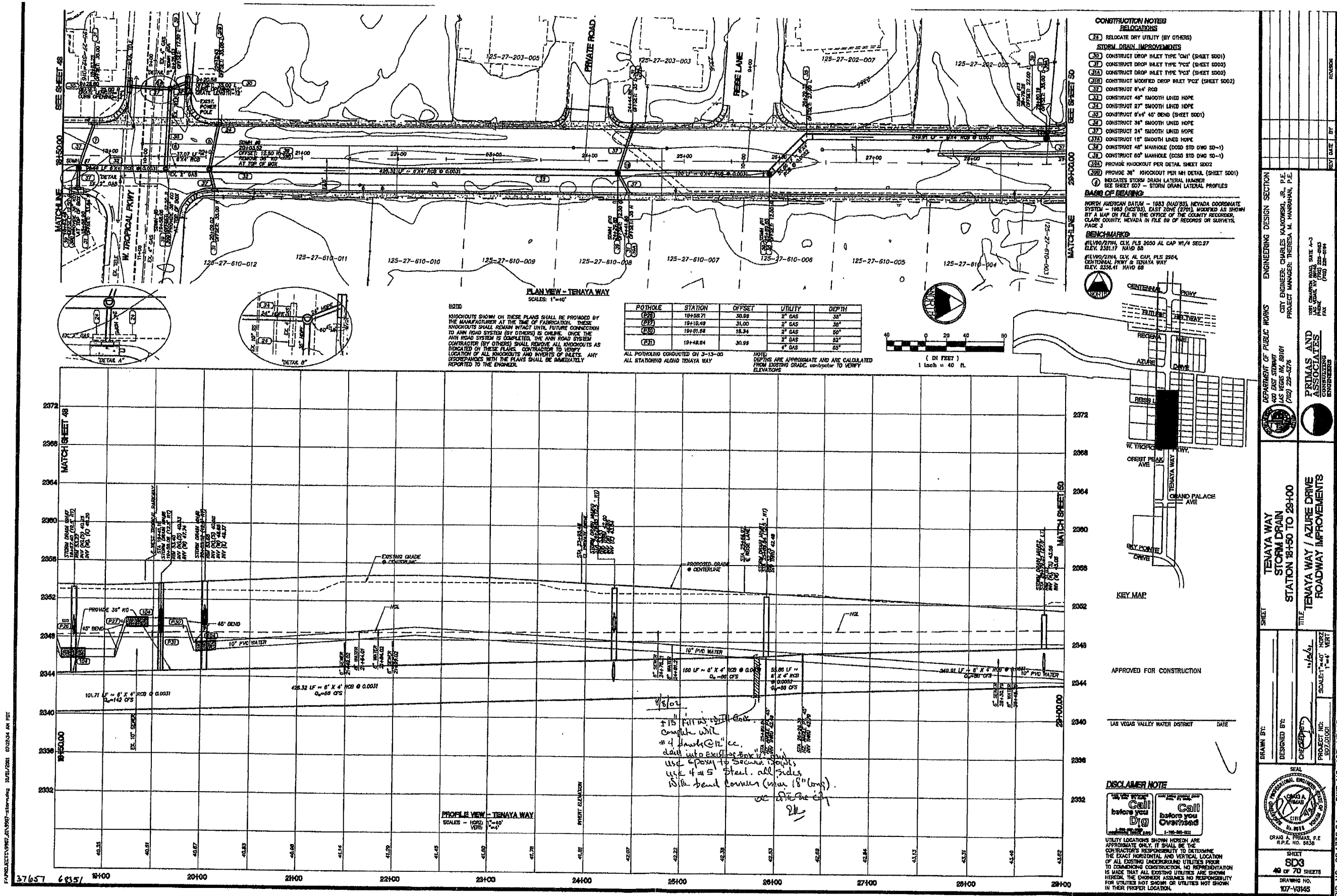
DISCLAIMER NOTE

Call before you Dig  
Call before you Overhead

UTILITIES LOCATIONS SHOWN HEREON ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT HORIZONTAL AND VERTICAL LOCATION OF ALL EXISTING UNDERGROUND UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HEREON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATION.

DRAWN BY: \_\_\_\_\_  
DESIGNED BY: \_\_\_\_\_  
CHECKED BY: \_\_\_\_\_  
PROJECT NO. 902 01001  
SHEET 48 OF 70 SHEETS  
107-0345

DEPARTMENT OF PUBLIC WORKS  
ENGINEERING DESIGN SECTION  
CITY ENGINEER: CHARLES KAPROWSKI, JR., P.E.  
PROJECT MANAGER: THERESA M. HANSMAN, P.E.  
PRIMAS AND ASSOCIATES  
REGISTERED PROFESSIONAL ENGINEERS  
1000 S. LAS VEGAS BLVD. SUITE 4-3  
LAS VEGAS, NV 89101  
PHONE: (702) 238-8883  
FAX: (702) 238-8884



# HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

## TIME OF CONCENTRATION

PRIMAS AND ASSOCIATES

PROJECT NO.

FILE:

DEVELOPMENT: TENAYA WAY / AZURE DRIVE

CALCULATED BY: Manny Belen

DATE: 6/5/00

Urbanized Basin (Y/N) ☒ Y

| SUB-BASIN DATA |      |      |           | INITIAL/OVERLAND TIME (H) |             |           |                      | TRAVEL TIME (H) |           |                 |                      | CHECK (URBANIZED BASINS) |                      | LAG TIME |
|----------------|------|------|-----------|---------------------------|-------------|-----------|----------------------|-----------------|-----------|-----------------|----------------------|--------------------------|----------------------|----------|
| Design (ID)    | CN   | K    | Area (ac) | Area (mi <sup>2</sup> )   | Length (ft) | Slope (%) | t <sub>i</sub> (min) | Length (ft)     | Slope (%) | Velocity (ft/s) | t <sub>e</sub> (min) | Total Length (ft)        | t <sub>e</sub> (min) |          |
| BAS1a          | 92.0 | 0.82 | 10.10     | 0.0158                    | 450         | 2.00      | 8.4                  | 846             | 1.70      | 3.96            | 3.6                  | 1296                     | 17.2                 | 0.120    |
| BAS1b          | 92.0 | 0.82 | 7.14      | 0.0102                    | 905         | 2.00      | 11.8                 | 1296            | 1.70      | 3.96            | 5.5                  | 2201                     | 22.2                 | 0.173    |
| BAS2           | 92.0 | 0.82 | 10.75     | 0.0168                    | 0           | 2.00      | 0.0                  | 718             | 1.25      | 3.26            | 3.7                  | 2919                     | 26.2                 | 0.210    |
| BAS3           | 92.0 | 0.82 | 11.82     | 0.0185                    | 0           | 2.00      | 0.0                  | 311             | 0.61      | 2.36            | 2.2                  | 3230                     | 27.9                 | 0.232    |
| BAS4           | 92.0 | 0.82 | 16.56     | 0.0259                    | 0           | 2.00      | 0.0                  | 513             | 0.61      | 2.48            | 3.4                  | 3743                     | 30.8                 | 0.266    |
| BAS5           | 92.0 | 0.82 | 9.30      | 0.0145                    | 905         | 2.00      | 11.8                 | 1296            | 1.70      | 3.96            | 5.5                  | 2201                     | 22.2                 | 0.173    |
| BAS6           | 92.0 | 0.82 | 6.15      | 0.0096                    | 0           | 2.00      | 0.0                  | 718             | 1.25      | 3.26            | 3.7                  | 2919                     | 26.2                 | 0.210    |
| BAS7           | 92.0 | 0.82 | 0.81      | 0.0013                    | 0           | 2.00      | 0.0                  | 162             | 0.61      | 1.43            | 1.9                  | 3081                     | 27.1                 | 0.229    |
| BAS8           | 92.0 | 0.82 | 2.19      | 0.0034                    | 0           | 2.00      | 0.0                  | 306             | 0.61      | 1.67            | 3.1                  | 3387                     | 28.8                 | 0.259    |
| BAS9           | 92.0 | 0.82 | 2.65      | 0.0041                    | 0           | 2.00      | 0.0                  | 513             | 0.61      | 2.48            | 3.4                  | 3900                     | 31.7                 | 0.266    |
| FB2            | 92.0 | 0.82 | 38.02     | 0.0125                    | 400         | 1.00      | 9.9                  | 600             | 2.00      | 1.23            | 8.1                  | 1000                     | 15.6                 | 0.156    |
| FB3            | 92.0 | 0.82 | 5.74      | 0.0090                    | 375         | 1.00      | 9.6                  | 600             | 2.00      | 1.12            | 8.9                  | 975                      | 15.4                 | 0.154    |
|                |      |      |           |                           |             |           |                      |                 |           |                 |                      |                          |                      |          |
|                |      |      |           |                           |             |           |                      |                 |           |                 |                      |                          |                      |          |
|                |      |      |           |                           |             |           |                      |                 |           |                 |                      |                          |                      |          |
|                |      |      |           |                           |             |           |                      |                 |           |                 |                      |                          |                      |          |
|                |      |      |           |                           |             |           |                      |                 |           |                 |                      |                          |                      |          |
|                |      |      |           |                           |             |           |                      |                 |           |                 |                      |                          |                      |          |
|                |      |      |           |                           |             |           |                      |                 |           |                 |                      |                          |                      |          |
|                |      |      |           |                           |             |           |                      |                 |           |                 |                      |                          |                      |          |

$K = 0.0132(CN) - 0.39$   
 $t_i = 1.8(1.1-K)L^{1/2}$   
 $S^{1/3}$

$t_c = t_i + t_e$   
 $t_L = 0.6 * t_c / 60$

REFERENCE: STANDARD FORM 4

```

1 .....
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* SEPTEMBER 1990
* VERSION 4.0
* RUN DATE 03/28/2000 TIME 08:31:59
* .....

```

```

* .....
* U.S. ARMY CORPS OF ENGINEERS
* HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET
* DAVIS, CALIFORNIA 95616
* (916) 756-1104
* .....

```

```

X X XXXXXX XXXX X
X X X X X XX
X X X X X
XXXXXX XXXX X XXXXX X
X X X X X
X X X X X
X X XXXXXX XXXX XXX

```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION  
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE, SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,  
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION  
 KINEMATIC WAVE; NEW FINITE DIFFERENCE ALGORITHM

```

1
HEC-1 INPUT
PAGE 1

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
1 ID .....
2 ID .....
3 ID ..
4 ID ..
5 ID .. PRIMAS AND ASSOCIATES ..
6 ID .. TENAYA WAY/AZURE DRIVE IMPROVEMENTS ..
7 ID .. FUTURE CONDITIONS ..
8 ID ..
9 ID .. PROJECT NO. 9907.01 ..
10 ID ..
11 ID .. MARCHJ 28, 2000 ..
12 ID ..
13 ID .....
14 ID ..
15 ID .. INPUT FILE : 9907RFUT.IH1 ..
16 ID .. STORM EVENT: 100 year (10 year), 6 Hour ..
17 ID .. STORM DISTRIBUTION NUMBER (SDN) = SDN3 ..
18 ID .. PRECIPITATION: 100-yr (10-yr) ..
19 ID .. BASIN BRAKEDOWN REFER TO STANDARD FORM 4 ..
20 ID .. DEPTH AREA REDUCTION FACTOR (DARF)....= 1.00 ( 1.00) ..
21 ID .. DEPTH DURATION FREQUENCY VALUES ..
22 ID .. FOR MCCARRAN AIRPORT RAINFALL AREA...= 2.77 ( 1.58) ..
23 ID ..
24 ID .....
25 ID .....
26 ID .....
27 ID IT 5 0 0 300
28 ID IO 5 0 0
29 ID IN 5 0 0
30 ID JR PREC 1.0 0.566
31 KK BAS1A
32 KM RUNOFF PRODUCED BY BAS1A
33 BA 0.0158
34 PB 2.77
35 PC 0.000 0.020 0.057 0.070 0.087 0.108 0.124 0.130 0.130 0.130
36 PC 0.130 0.130 0.130 0.133 0.140 0.142 0.148 0.158 0.172 0.181
37 PC 0.190 0.197 0.199 0.200 0.201 0.204 0.214 0.229 0.241 0.249
38 PC 0.251 0.256 0.270 0.278 0.281 0.283 0.295 0.322 0.352 0.409
39 PC 0.499 0.590 0.710 0.744 0.781 0.812 0.819 0.835 0.851 0.856
40 PC 0.860 0.868 0.876 0.888 0.910 0.926 0.937 0.950 0.970 0.976
41 PC 0.982 0.985 0.987 0.989 0.990 0.993 0.993 0.994 0.995 0.998
42 PC 0.998 0.999 1.000
43 LS 0 92
44 UD 0.120
45 KK BAS1B
46 KM RUNOFF PRODUCED BY BAS1B
47 BA 0.0112
48 LS 0 92
49 UD 0.173

```

```

1
HEC-1 INPUT
PAGE 2

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

```

|               |        |     |   |              |              |             |
|---------------|--------|-----|---|--------------|--------------|-------------|
|               |        |     |   | TIME         | 3.58         | 3.67        |
| HYDROGRAPH AT |        |     |   |              |              |             |
| +             | RHON7  | .00 | 1 | FLOW<br>TIME | 6.<br>3.50   | 2.<br>3.58  |
| 2 COMBINED AT |        |     |   |              |              |             |
| +             | COMBI  | .02 | 1 | FLOW<br>TIME | 22.<br>3.58  | 8.<br>3.58  |
| ROUTED TO     |        |     |   |              |              |             |
| +             | ROUTE  | .02 | 1 | FLOW<br>TIME | 22.<br>3.58  | 8.<br>3.67  |
| HYDROGRAPH AT |        |     |   |              |              |             |
| +             | RHON8  | .01 | 1 | FLOW<br>TIME | 8.<br>3.58   | 3.<br>3.58  |
| 2 COMBINED AT |        |     |   |              |              |             |
| +             | COMBI  | .03 | 1 | FLOW<br>TIME | 29.<br>3.58  | 10.<br>3.58 |
| HYDROGRAPH AT |        |     |   |              |              |             |
| +             | RETR1  | .00 | 1 | FLOW<br>TIME | 10.<br>3.58  | 3.<br>3.67  |
| HYDROGRAPH AT |        |     |   |              |              |             |
| +             | RHON9  | .01 | 1 | FLOW<br>TIME | 9.<br>3.50   | 4.<br>3.58  |
| 2 COMBINED AT |        |     |   |              |              |             |
| +             | COMBI  | .01 | 1 | FLOW<br>TIME | 19.<br>3.58  | 7.<br>3.58  |
| ROUTED TO     |        |     |   |              |              |             |
| +             | ROUTE  | .01 | 1 | FLOW<br>TIME | 19.<br>3.58  | 6.<br>3.58  |
| HYDROGRAPH AT |        |     |   |              |              |             |
| +             | RHON10 | .00 | 1 | FLOW<br>TIME | 5.<br>3.50   | 2.<br>3.58  |
| 2 COMBINED AT |        |     |   |              |              |             |
| +             | COMBI  | .01 | 1 | FLOW<br>TIME | 24.<br>3.58  | 8.<br>3.58  |
| ROUTED TO     |        |     |   |              |              |             |
| +             | ROUTE  | .01 | 1 | FLOW<br>TIME | 23.<br>3.58  | 8.<br>3.67  |
| HYDROGRAPH AT |        |     |   |              |              |             |
| +             | RHON11 | .00 | 1 | FLOW<br>TIME | 4.<br>3.58   | 2.<br>3.58  |
| 3 COMBINED AT |        |     |   |              |              |             |
| +             | COMBI  | .04 | 1 | FLOW<br>TIME | 57.<br>3.58  | 19.<br>3.58 |
| HYDROGRAPH AT |        |     |   |              |              |             |
| +             | MONTE  | .00 | 1 | FLOW<br>TIME | 2.<br>3.58   | 1.<br>3.58  |
| 4 COMBINED AT |        |     |   |              |              |             |
| +             | COMBI  | .13 | 1 | FLOW<br>TIME | 142.<br>3.58 | 52.<br>3.58 |
| ROUTED TO     |        |     |   |              |              |             |
| +             | R1     | .13 | 1 | FLOW<br>TIME | 140.<br>3.58 | 50.<br>3.58 |
| HYDROGRAPH AT |        |     |   |              |              |             |
| +             | FB3    | .01 | 1 | FLOW<br>TIME | 14.<br>3.58  | 6.<br>3.58  |
| 2 COMBINED AT |        |     |   |              |              |             |
| +             | FCP2   | .14 | 1 | FLOW<br>TIME | 154.<br>3.58 | 57.<br>3.58 |
| DIVERSION TO  |        |     |   |              |              |             |
| +             | D2     | .14 | 1 | FLOW<br>TIME | 58.<br>3.42  | 57.<br>3.58 |
| HYDROGRAPH AT |        |     |   |              |              |             |
| +             | D2     | .14 | 1 | FLOW<br>TIME | 96.<br>3.58  | 0.<br>.08   |
| HYDROGRAPH AT |        |     |   |              |              |             |
| +             | VPDV1  | .00 | 1 | FLOW<br>TIME | 6.<br>3.58   | 2.<br>3.58  |
| HYDROGRAPH AT |        |     |   |              |              |             |
| +             | VPDV2  | .00 | 1 | FLOW<br>TIME | 4.<br>3.50   | 1.<br>3.50  |
| 2 COMBINED AT |        |     |   |              |              |             |

-TEN1

|               |        |     |   |              |             |             |
|---------------|--------|-----|---|--------------|-------------|-------------|
| +             | VPC4   | .01 | 1 | FLOW<br>TIME | 10.<br>3.58 | 4.<br>3.58  |
| ROUTED TO     |        |     |   |              |             |             |
| +             | VPR1   | .01 | 1 | FLOW<br>TIME | 10.<br>3.58 | 4.<br>3.67  |
| HYDROGRAPH AT |        |     |   |              |             |             |
| +             | VPDV3  | .01 | 1 | FLOW<br>TIME | 7.<br>3.58  | 3.<br>3.58  |
| ROUTED TO     |        |     |   |              |             |             |
| +             | VPR2   | .01 | 1 | FLOW<br>TIME | 7.<br>3.58  | 3.<br>3.67  |
| HYDROGRAPH AT |        |     |   |              |             |             |
| +             | VPDV4  | .01 | 1 | FLOW<br>TIME | 8.<br>3.58  | 3.<br>3.58  |
| HYDROGRAPH AT |        |     |   |              |             |             |
| +             | VPDV5  | .00 | 1 | FLOW<br>TIME | 4.<br>3.50  | 2.<br>3.50  |
| ROUTED TO     |        |     |   |              |             |             |
| +             | VPR3   | .00 | 1 | FLOW<br>TIME | 4.<br>3.58  | 2.<br>3.58  |
| 3 COMBINED AT |        |     |   |              |             |             |
| +             | VPC5   | .01 | 1 | FLOW<br>TIME | 19.<br>3.58 | 7.<br>3.58  |
| HYDROGRAPH AT |        |     |   |              |             |             |
| +             | VPDV6  | .01 | 1 | FLOW<br>TIME | 11.<br>3.58 | 5.<br>3.58  |
| 3 COMBINED AT |        |     |   |              |             |             |
| +             | FCP3   | .03 | 1 | FLOW<br>TIME | 40.<br>3.58 | 15.<br>3.58 |
| DIVERSION TO  |        |     |   |              |             |             |
| +             | D3     | .03 | 1 | FLOW<br>TIME | 15.<br>3.42 | 15.<br>3.58 |
| HYDROGRAPH AT |        |     |   |              |             |             |
| +             | D3     | .03 | 1 | FLOW<br>TIME | 25.<br>3.58 | 0.<br>3.58  |
| HYDROGRAPH AT |        |     |   |              |             |             |
| +             | CCOFA3 | .01 | 1 | FLOW<br>TIME | 11.<br>3.75 | 5.<br>3.75  |
| HYDROGRAPH AT |        |     |   |              |             |             |
| +             | CCON15 | .01 | 1 | FLOW<br>TIME | 11.<br>3.50 | 5.<br>3.50  |
| 2 COMBINED AT |        |     |   |              |             |             |
| +             | CP19   | .02 | 1 | FLOW<br>TIME | 18.<br>3.58 | 8.<br>3.58  |
| ROUTED TO     |        |     |   |              |             |             |
| +             | R2     | .02 | 1 | FLOW<br>TIME | 18.<br>3.58 | 8.<br>3.58  |
| HYDROGRAPH AT |        |     |   |              |             |             |
| +             | CCOFA4 | .02 | 1 | FLOW<br>TIME | 27.<br>3.67 | 13.<br>3.67 |
| 2 COMBINED AT |        |     |   |              |             |             |
| +             | VPC2   | .04 | 1 | FLOW<br>TIME | 44.<br>3.67 | 20.<br>3.67 |
| ROUTED TO     |        |     |   |              |             |             |
| +             | VPR2   | .04 | 1 | FLOW<br>TIME | 44.<br>3.67 | 20.<br>3.67 |
| HYDROGRAPH AT |        |     |   |              |             |             |
| +             | VPON3  | .01 | 1 | FLOW<br>TIME | 17.<br>3.58 | 6.<br>3.58  |
| 2 COMBINED AT |        |     |   |              |             |             |
| +             | VPC3   | .05 | 1 | FLOW<br>TIME | 59.<br>3.67 | 26.<br>3.67 |
| ROUTED TO     |        |     |   |              |             |             |
| +             | R1     | .05 | 1 | FLOW<br>TIME | 59.<br>3.67 | 26.<br>3.67 |
| HYDROGRAPH AT |        |     |   |              |             |             |
| +             | DDNRTH | .01 | 1 | FLOW<br>TIME | 9.<br>3.58  | 4.<br>3.58  |
| HYDROGRAPH AT |        |     |   |              |             |             |
| +             | SVOND6 | .00 | 1 | FLOW<br>TIME | 4.<br>3.50  | 2.<br>3.50  |

TEN2

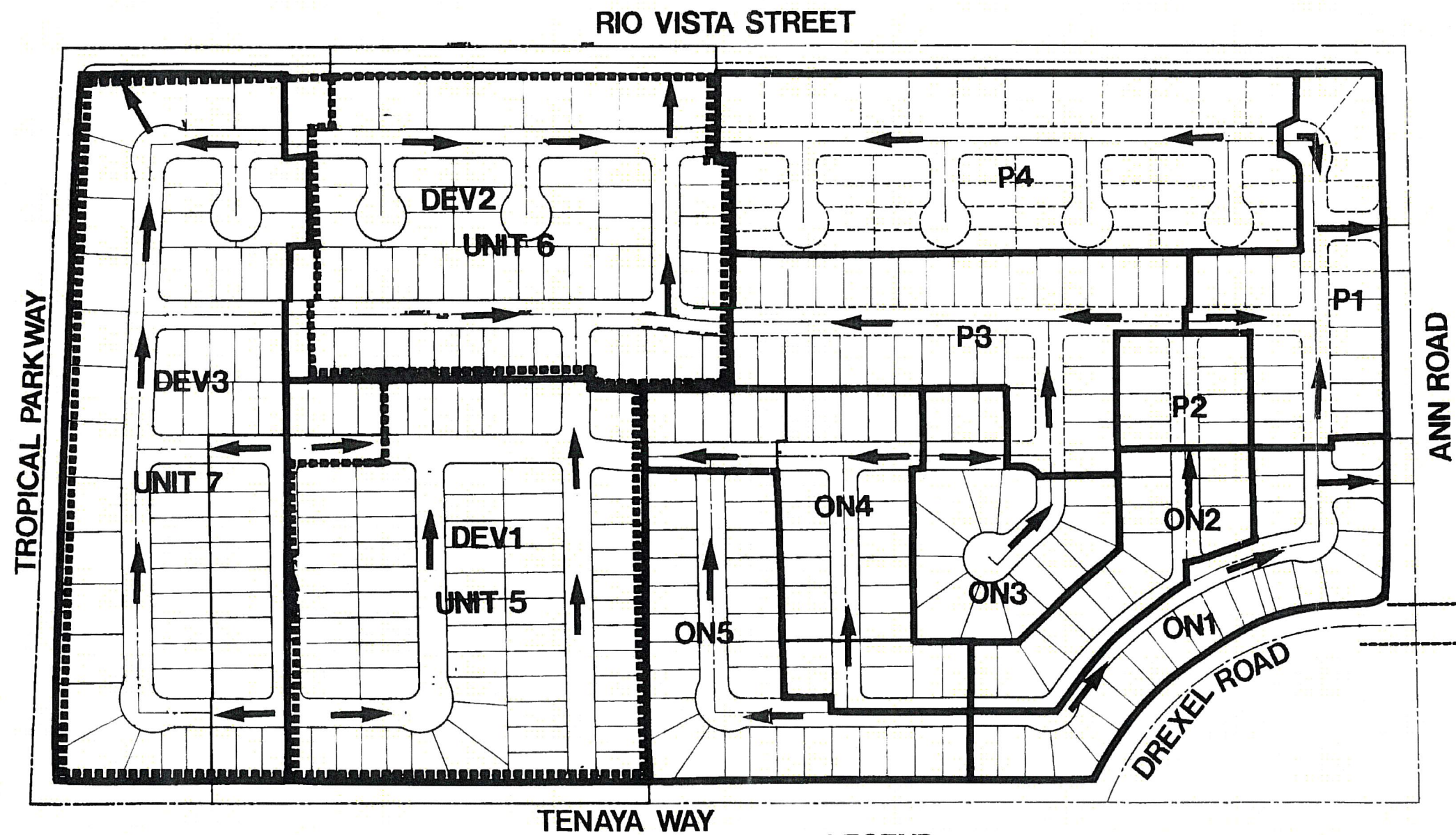


|               |        |     |   |      |      |      |  |  |
|---------------|--------|-----|---|------|------|------|--|--|
| ROUTED TO     |        |     |   |      |      |      |  |  |
| +             | ROUT1  | .00 | 1 | FLOW | 4.   | 2.   |  |  |
|               |        |     |   | TIME | 3.50 | 3.50 |  |  |
| HYDROGRAPH AT |        |     |   |      |      |      |  |  |
| +             | SVOND7 | .00 | 1 | FLOW | 2.   | 1.   |  |  |
|               |        |     |   | TIME | 3.50 | 3.50 |  |  |
| 2 COMBINED AT |        |     |   |      |      |      |  |  |
| +             | CMBN1  | .00 | 1 | FLOW | 7.   | 3.   |  |  |
|               |        |     |   | TIME | 3.50 | 3.50 |  |  |
| HYDROGRAPH AT |        |     |   |      |      |      |  |  |
| +             | SVOND5 | .00 | 1 | FLOW | 3.   | 1.   |  |  |
|               |        |     |   | TIME | 3.50 | 3.50 |  |  |
| 2 COMBINED AT |        |     |   |      |      |      |  |  |
| +             | CMBN2  | .00 | 1 | FLOW | 9.   | 5.   |  |  |
|               |        |     |   | TIME | 3.50 | 3.50 |  |  |
| HYDROGRAPH AT |        |     |   |      |      |      |  |  |
| +             | SVOND4 | .00 | 1 | FLOW | 3.   | 1.   |  |  |
|               |        |     |   | TIME | 3.50 | 3.50 |  |  |
| 2 COMBINED AT |        |     |   |      |      |      |  |  |
| +             | CMBN3  | .01 | 1 | FLOW | 12.  | 6.   |  |  |
|               |        |     |   | TIME | 3.50 | 3.50 |  |  |
| HYDROGRAPH AT |        |     |   |      |      |      |  |  |
| +             | SVOND3 | .00 | 1 | FLOW | 1.   | 0.   |  |  |
|               |        |     |   | TIME | 3.50 | 3.50 |  |  |
| 2 COMBINED AT |        |     |   |      |      |      |  |  |
| +             | CMBN4  | .01 | 1 | FLOW | 13.  | 6.   |  |  |
|               |        |     |   | TIME | 3.50 | 3.50 |  |  |
| HYDROGRAPH AT |        |     |   |      |      |      |  |  |
| +             | SVOND1 | .00 | 1 | FLOW | 5.   | 3.   |  |  |
|               |        |     |   | TIME | 3.50 | 3.50 |  |  |
| ROUTED TO     |        |     |   |      |      |      |  |  |
| +             | ROUT2  | .00 | 1 | FLOW | 5.   | 2.   |  |  |
|               |        |     |   | TIME | 3.50 | 3.50 |  |  |
| HYDROGRAPH AT |        |     |   |      |      |      |  |  |
| +             | SVOND2 | .00 | 1 | FLOW | 4.   | 2.   |  |  |
|               |        |     |   | TIME | 3.50 | 3.50 |  |  |
| 2 COMBINED AT |        |     |   |      |      |      |  |  |
| +             | CMBN5  | .00 | 1 | FLOW | 9.   | 4.   |  |  |
|               |        |     |   | TIME | 3.50 | 3.50 |  |  |
| 2 COMBINED AT |        |     |   |      |      |      |  |  |
| +             | CMBN6  | .01 | 1 | FLOW | 22.  | 11.  |  |  |
|               |        |     |   | TIME | 3.50 | 3.50 |  |  |
| 3 COMBINED AT |        |     |   |      |      |      |  |  |
| +             | FCP4   | .07 | 1 | FLOW | 79.  | 35.  |  |  |
|               |        |     |   | TIME | 3.58 | 3.58 |  |  |
| DIVERSION TO  |        |     |   |      |      |      |  |  |
| +             | D4     | .07 | 1 | FLOW | 35.  | 35.  |  |  |
|               |        |     |   | TIME | 3.33 | 3.58 |  |  |
| HYDROGRAPH AT |        |     |   |      |      |      |  |  |
| +             | D4     | .07 | 1 | FLOW | 44.  | 0.   |  |  |
|               |        |     |   | TIME | 3.58 | .08  |  |  |
| HYDROGRAPH AT |        |     |   |      |      |      |  |  |
| +             | D1     | .00 | 1 | FLOW | 86.  | 86.  |  |  |
|               |        |     |   | TIME | 3.42 | 3.67 |  |  |
| HYDROGRAPH AT |        |     |   |      |      |      |  |  |
| +             | D2     | .00 | 1 | FLOW | 58.  | 57.  |  |  |
|               |        |     |   | TIME | 3.42 | 3.58 |  |  |
| HYDROGRAPH AT |        |     |   |      |      |      |  |  |
| +             | D3     | .00 | 1 | FLOW | 15.  | 15.  |  |  |
|               |        |     |   | TIME | 3.42 | 3.58 |  |  |
| HYDROGRAPH AT |        |     |   |      |      |      |  |  |
| +             | D4     | .00 | 1 | FLOW | 35.  | 35.  |  |  |
|               |        |     |   | TIME | 3.33 | 3.58 |  |  |
| 4 COMBINED AT |        |     |   |      |      |      |  |  |
| +             | FCPS   | .00 | 1 | FLOW | 194. | 190. |  |  |
|               |        |     |   | TIME | 3.42 | 3.58 |  |  |

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING  
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

| ISTAQ | ELEMENT | DT | PEAK | TIME TO<br>PEAK | VOLUME | DT | INTERPOLATED TO<br>COMPUTATION INTERVAL |                 | VOLUME |
|-------|---------|----|------|-----------------|--------|----|-----------------------------------------|-----------------|--------|
|       |         |    |      |                 |        |    | PEAK                                    | TIME TO<br>PEAK |        |

# REFERENCE 4

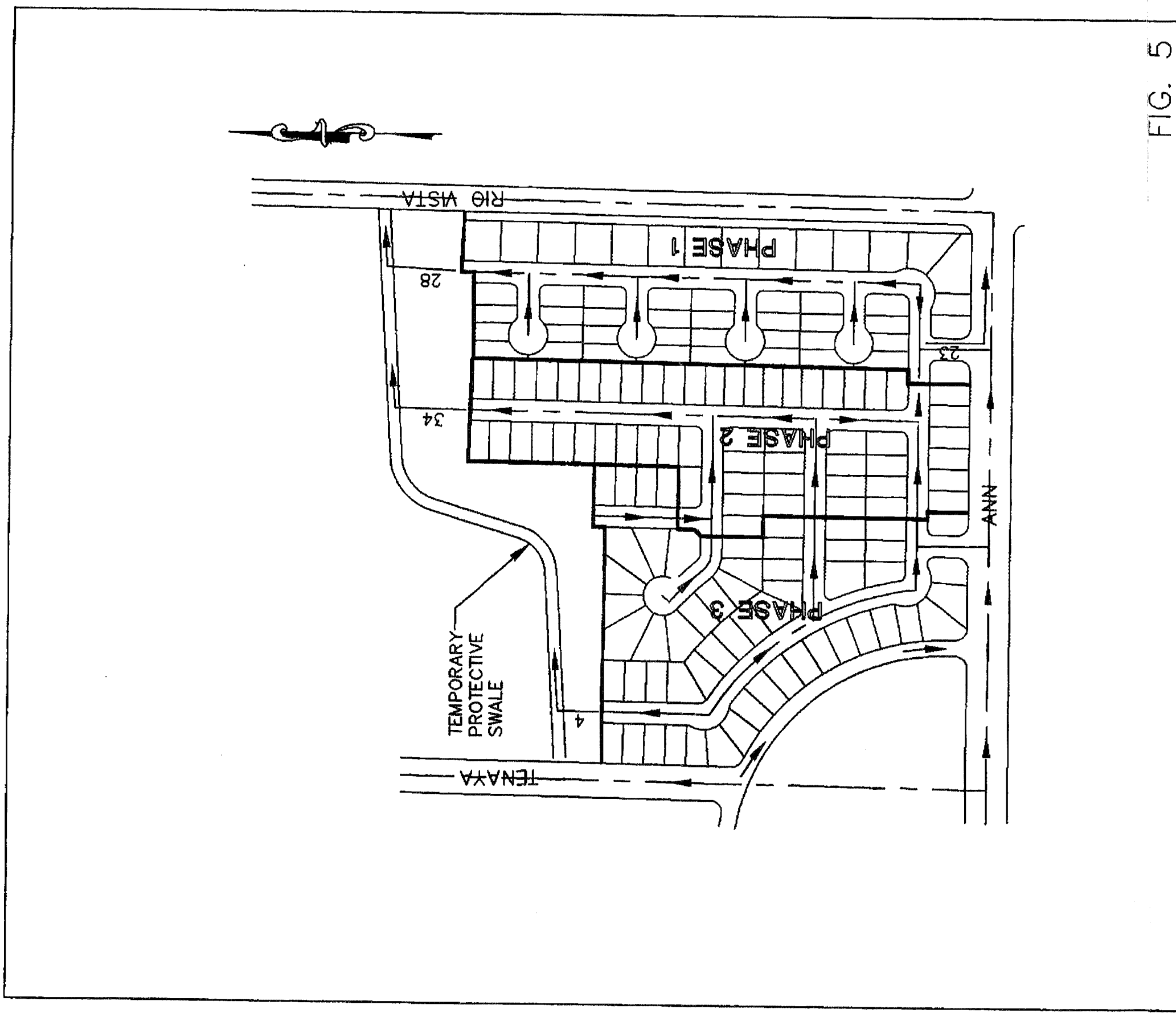


LEGEND:  
 ----- UNIT BOUNDARY  
 ————— BASIN BOUNDARY

FIGURE 7

Basin MAP FOR SUBMITTAL DATED July 1994

|                                                                                                                                                            |  |                                  |  |       |  |    |  |        |  |          |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------------------------------|--|-------|--|----|--|--------|--|----------|--|
| TITLE                                                                                                                                                      |  | PROJECT                          |  | DATE  |  | BY |  | REV    |  | REVISION |  |
| ONSITE DRAINAGE MAP                                                                                                                                        |  | GRAND ENTRIES<br>UNITS 5, 6, & 7 |  |       |  |    |  |        |  |          |  |
| SCALE                                                                                                                                                      |  | HORIZ. VERT.                     |  | SHEET |  | OF |  | SHEETS |  |          |  |
|                                                                                                                                                            |  |                                  |  |       |  |    |  |        |  |          |  |
| CONSULTING ENGINEERS & PLANNERS & LAND SURVEYORS<br>2727 SOUTH HAWTHORNE BOULEVARD<br>LAS VEGAS, NEVADA 89102-5148 PHONE (702) 873-7860 FAX (702) 382-2867 |  |                                  |  |       |  |    |  |        |  |          |  |
|                                                                                                                                                            |  |                                  |  |       |  |    |  |        |  |          |  |

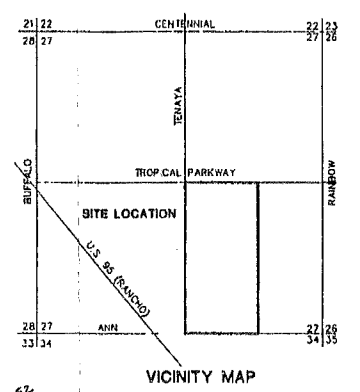
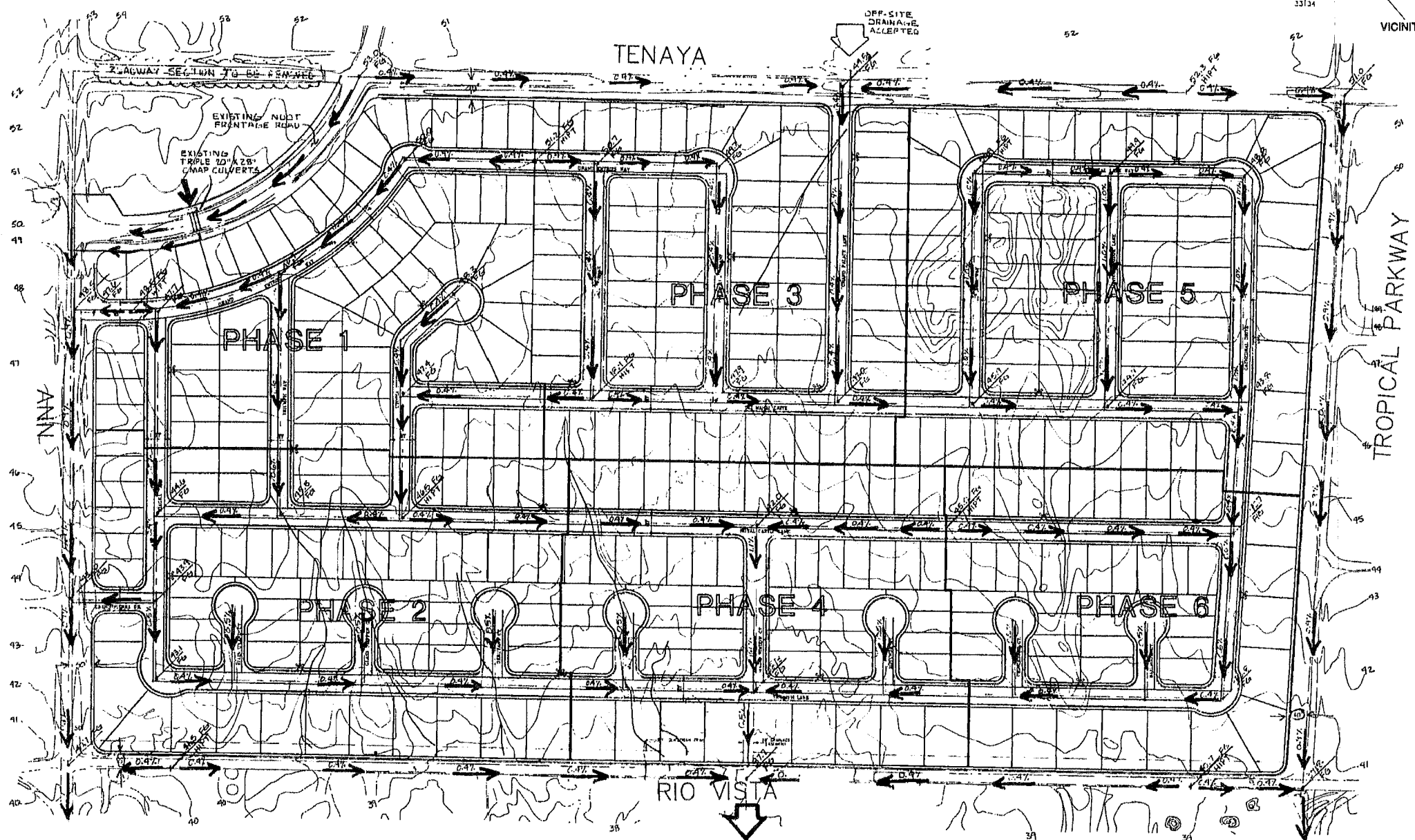


|                                |  |                                                                                                                                                          |
|--------------------------------|--|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| GRAND ENTRIES PHASE 3          |  | <br>SOUTHWEST<br>ENGINEERING<br>LAND PLANNING • MAPPING • DEVELOPMENT |
| ON-SITE DEVELOPED DRAINAGE MAP |  |                                                                                                                                                          |

SCALE: 1" = 300'

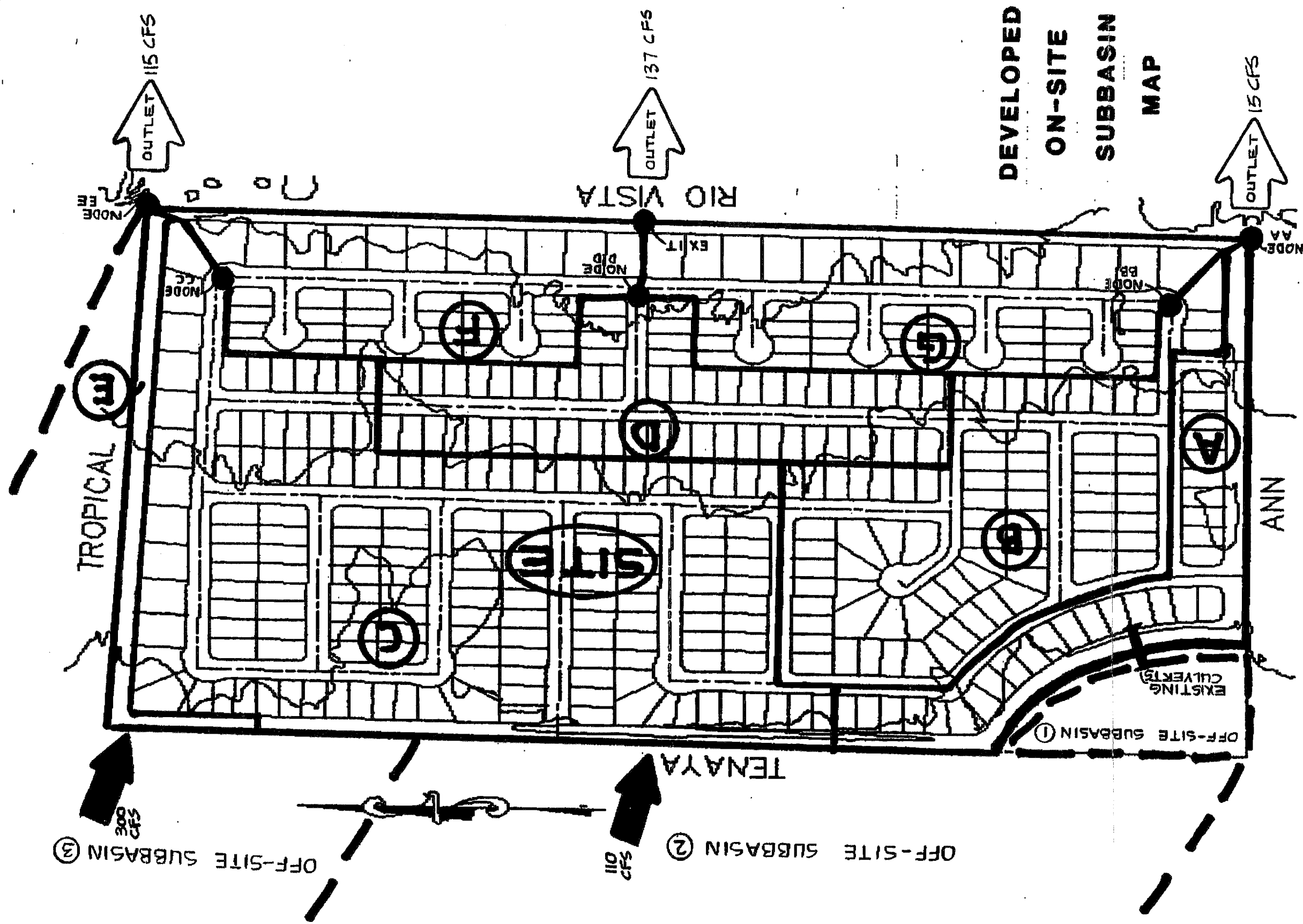
SCALE: 1" = 300'





|                       |             |
|-----------------------|-------------|
| REVISIONS             |             |
| NO.                   | DESCRIPTION |
| 1                     | DATE        |
| 2                     | BY          |
| 3                     | DATE        |
| 4                     | BY          |
| PROJECT               |             |
| DRAINAGE PLAN         |             |
| GRAND ENTRIES         |             |
| SHEET 1 OF 1          |             |
| DATE: 9/92            |             |
| SCALE: 1" = 120'      |             |
| DRAWN BY: B. PETERS   |             |
| PROJECT NO: 923215    |             |
| SHEET 1 OF 1          |             |
| CAD FILE: GRDRAIN.DWG |             |

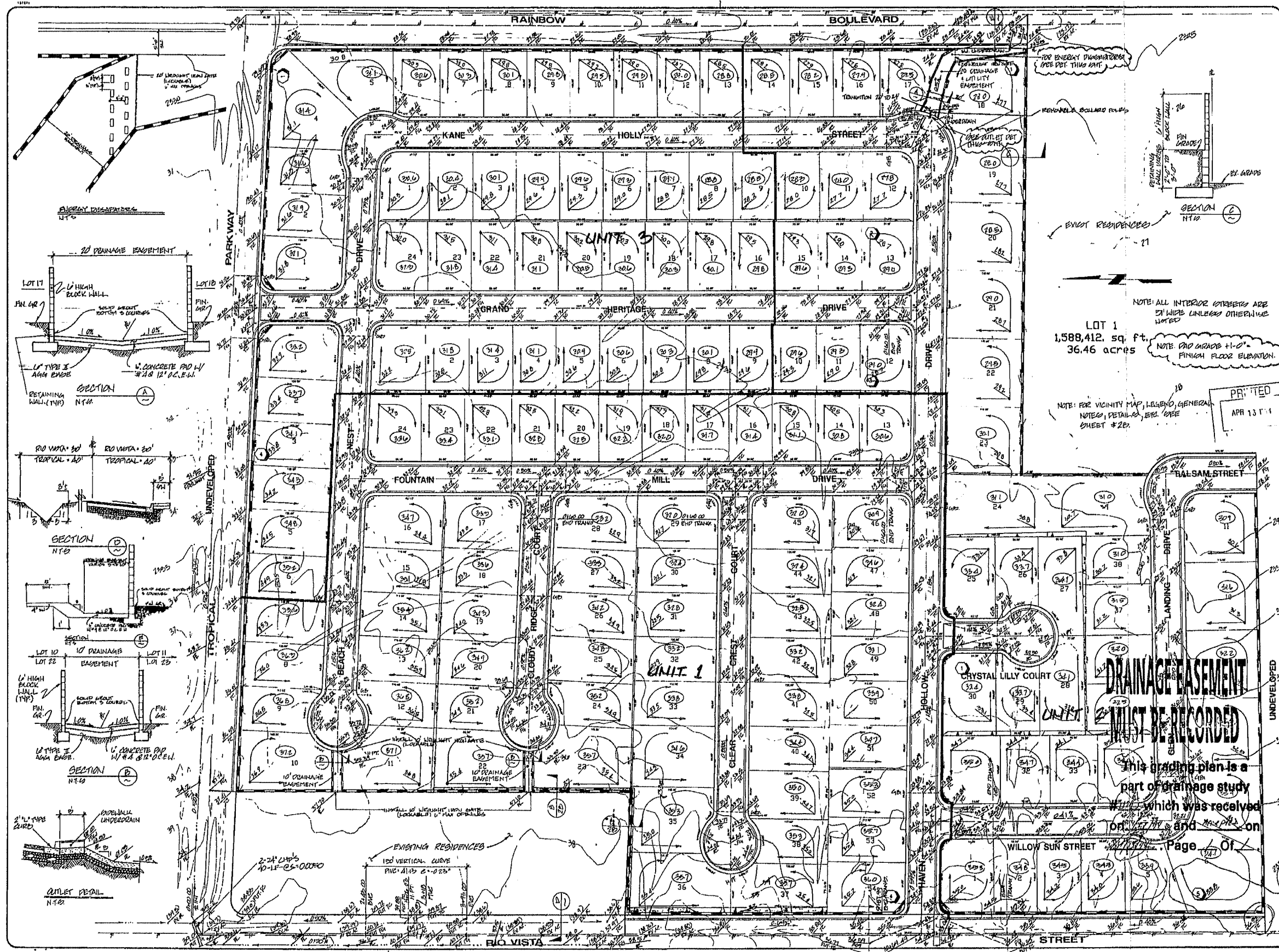
**SOUTHWEST ENGINEERING**  
 LAND PLANNING/MAPPING/DEVELOPMENT  
 6541 W. LAS VEGAS BLVD.  
 LAS VEGAS, NEVADA 89119  
 PHONE: (702) 444-3300





# REFERENCE 5





|                                     |                                                  |
|-------------------------------------|--------------------------------------------------|
| U.S. HOME CITY OF LAS VEGAS, NEVADA | CONSULTING ENGINEERS • PLANNERS • LAND SURVEYORS |
| 2727 SOUTH RAINBOW BOULEVARD        | LAS VEGAS, NEVADA 89102-5148                     |
| PHONE (702) 873-7550                | FAX (702) 362-2587                               |

|                            |                   |
|----------------------------|-------------------|
| OVERALL ROUGH GRADING PLAN | RIO VISTA ESTATES |
| UNIT 1                     | UNIT 1            |
| DATE: 9/93                 | BY: TEN, NLR      |
| DATE: 9/93                 | SCALE: 1" = 60'   |
| SHEET: 2A                  | OF 19 SHEETS      |

# REFERENCE 6

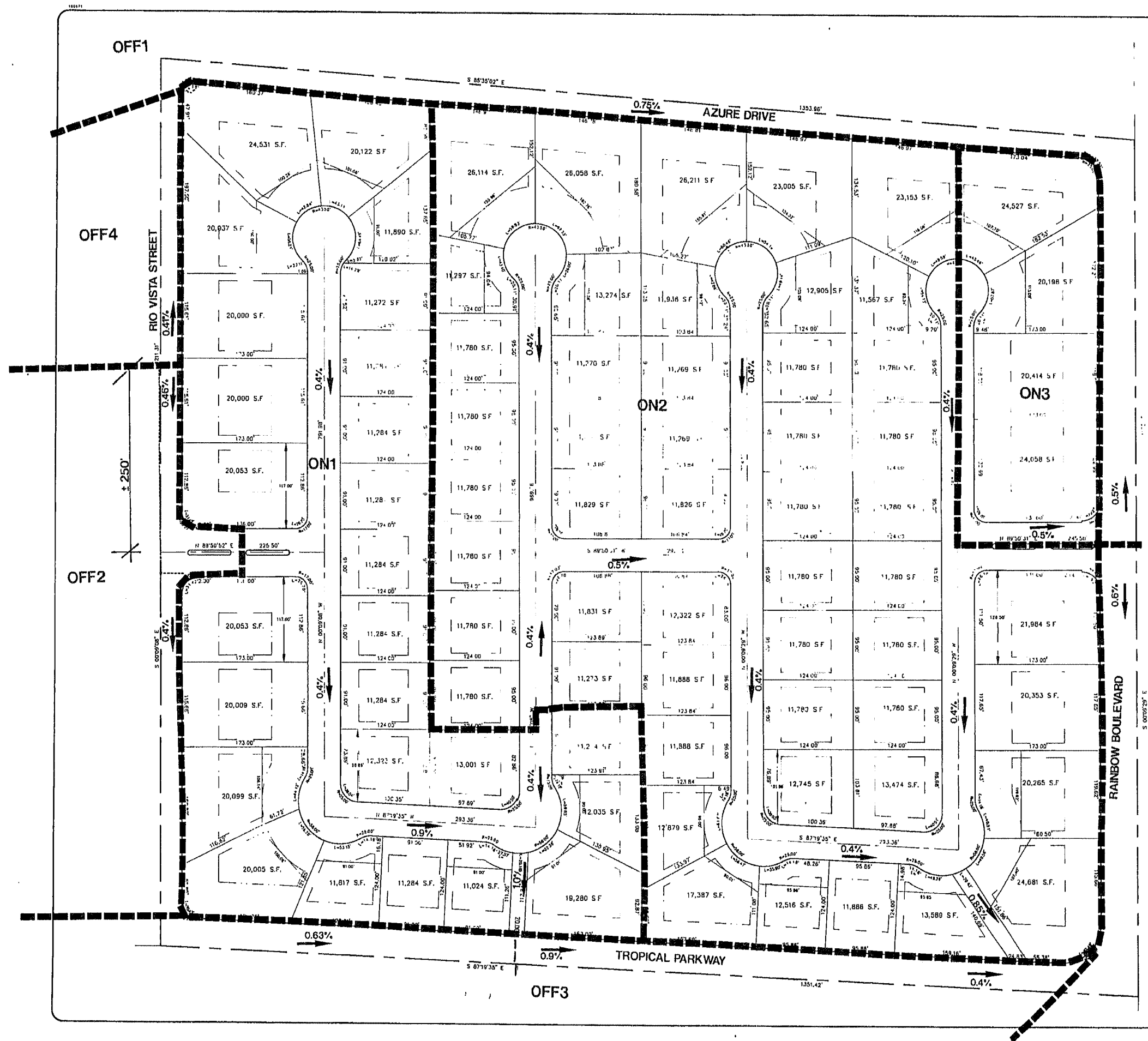
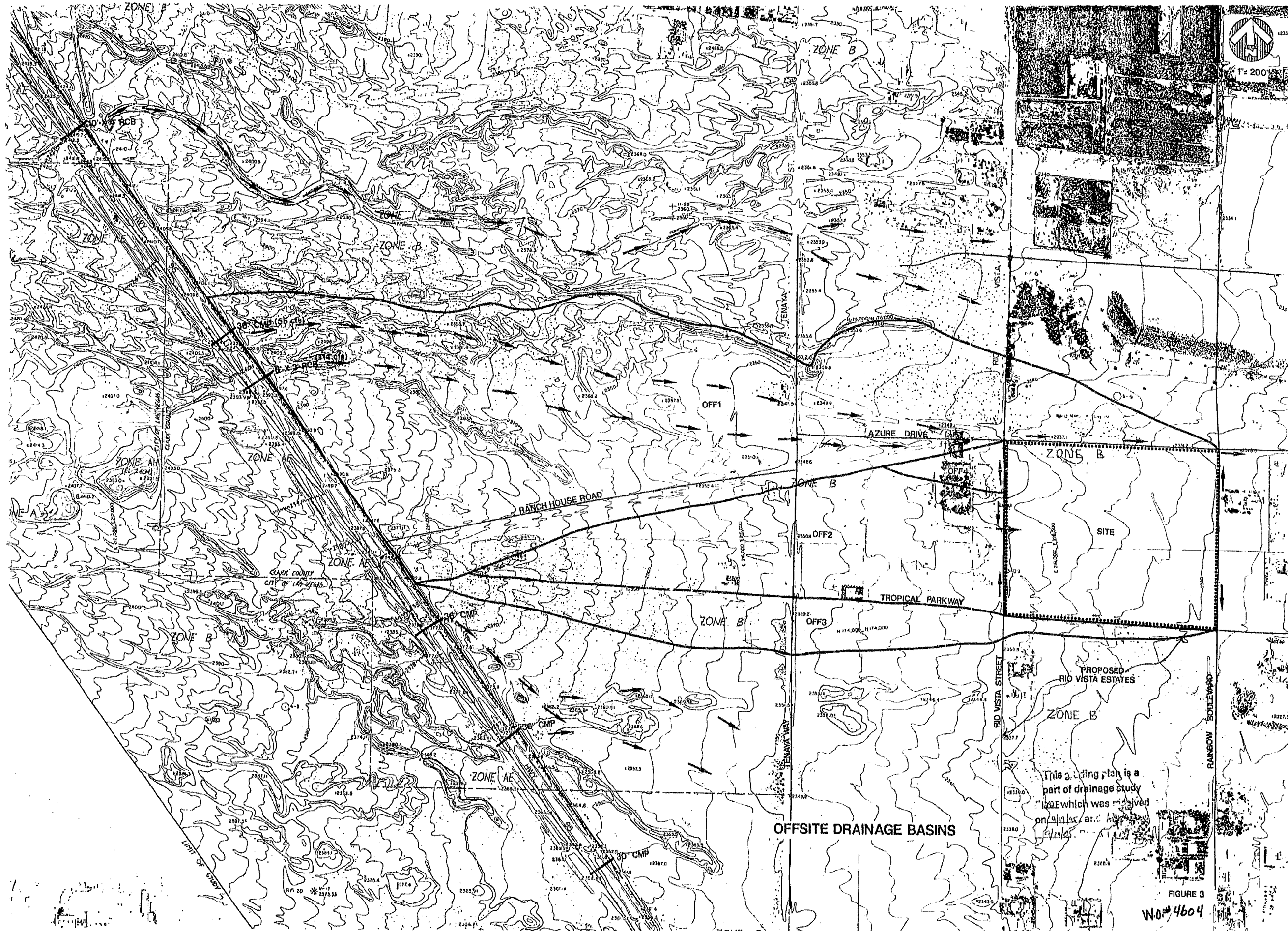


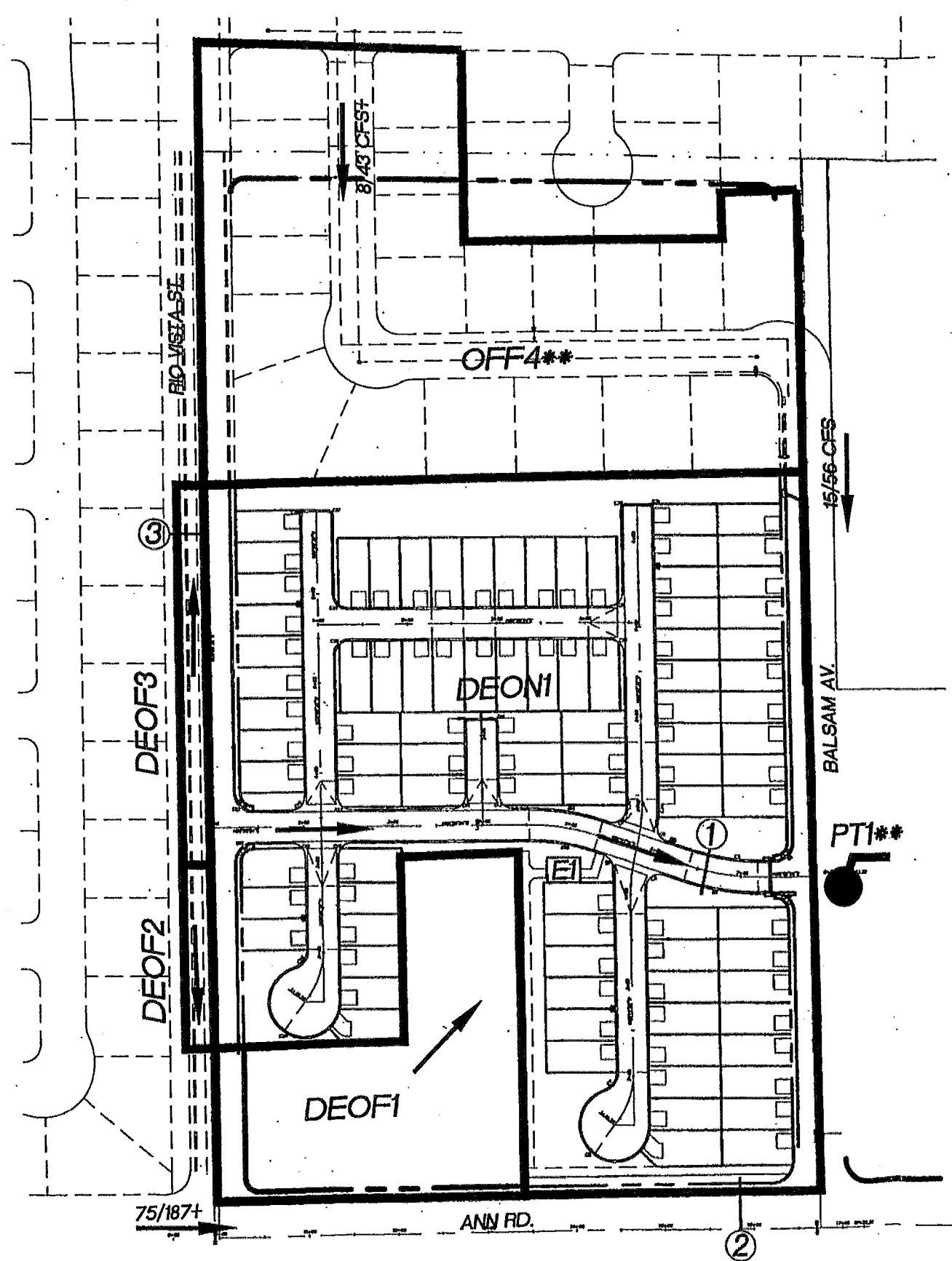
FIGURE 5

|                                     |  |                                                                                                                                                          |  |
|-------------------------------------|--|----------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| CITY OF LAS VEGAS, NEVADA           |  | CONSULTING ENGINEERS • PLANNERS • LAND SURVEYORS<br>2727 SOUTH RAINBOW BOULEVARD<br>LAS VEGAS, NEVADA 89102-5148 PHONE (702) 873-7550 FAX (702) 873-7551 |  |
| TITLE<br>DEVELOPED ONSITE BASIN MAP |  | PROJECT<br>TROPICAL MEADOWS                                                                                                                              |  |
| BY<br>RJ                            |  | DATE<br>APRIL 7, 1994                                                                                                                                    |  |
| SCALE<br>1" = 60'                   |  | SHEET<br>1 OF 1 SHEETS                                                                                                                                   |  |
| SEAL                                |  | APPENDIX E                                                                                                                                               |  |

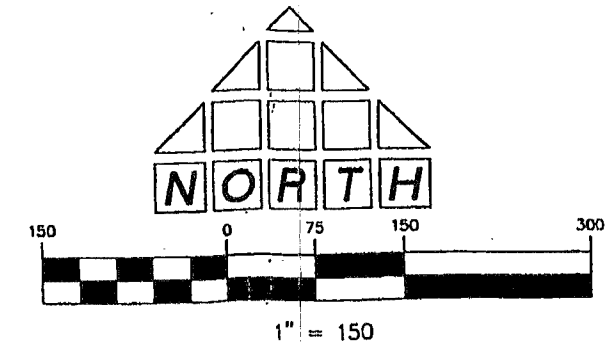




# REFERENCE 7



+ FLOWS AFTER FLOW SPLIT PER CITY OF LAS VEGAS NORTHWEST NEIGHBORHOOD STUDY



### LEGEND

- DEON1 BASIN NAME
- BASIN BOUNDARY
- FLOW ARROW
- ① STREET SECTION
- E1 DRAINAGE EASEMENT
- PT1 CONCENTRATION POINT

| BASIN / CONCENTRATION POINT | 10-YEAR FLOW<br>(cfs) | 100-YEAR FLOW<br>(cfs) |
|-----------------------------|-----------------------|------------------------|
| DEON1                       | 17                    | 33                     |
| DEOF1                       | 3                     | 7                      |
| DEOF2                       | <1                    | <1                     |
| DEOF3                       | <1                    | 1                      |
| OFF4                        | 7                     | 13                     |
| PT1**                       | 20                    | 67                     |

\*\*ADDED FLOWS PER THE ANN/RAINBOW TDS. THESE FLOWS ACCOUNT FOR FLOWSPLIT ON HEAVEN HOLLOW AND GLEN LANDING INTERSECTION. MINUS WHAT IS INTERCEPTED BY DROP INLET #4 AT BALSAM AV PER SAME STUDY AND DROP INLE D.I.#3 PROPOSED ON THIS ADDENDUM.

| Street Section   | Q <sub>10</sub> /Q <sub>100</sub><br>cfs | D <sub>10</sub> /D <sub>100</sub><br>ft | V <sub>10</sub> /V <sub>100</sub><br>Ft/s | V x D     |
|------------------|------------------------------------------|-----------------------------------------|-------------------------------------------|-----------|
| 1- Red Clover Rd | 20/40                                    | .44/.54                                 | 4.29/4.95                                 | 1.88/2.67 |
| 2- Ann Rd*       | 75/187                                   | .77/1.02                                | 3.29/4.24                                 | 2.53/4.32 |
| 3- Rio Vista St  | -/1                                      | -./0.25                                 | -./2.34                                   | -./0.58   |

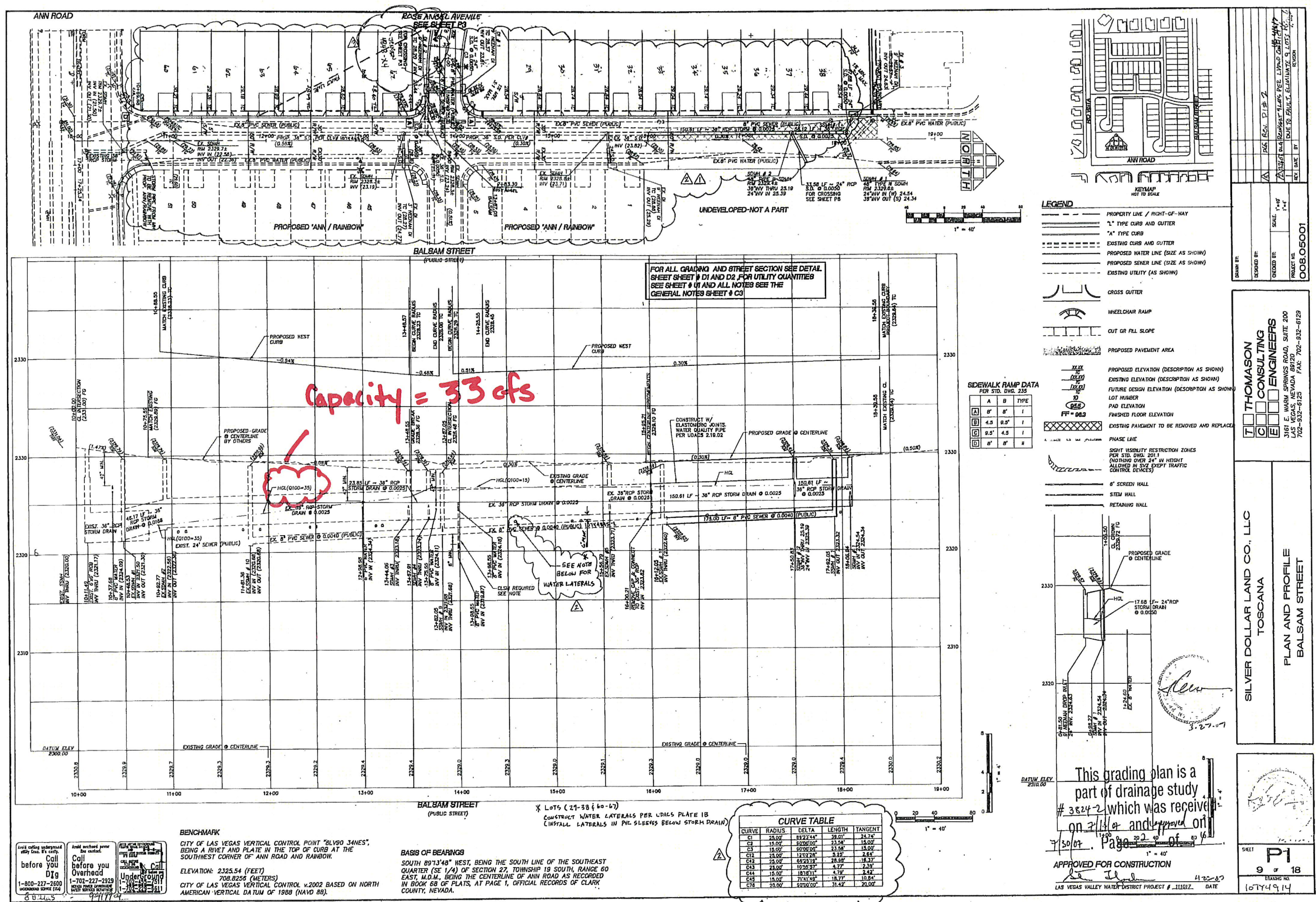
\* FLOWS PER CITY OF LAS VEGAS NORTHWEST NEIGHBORHOOD STUDY

**THOMASON CONSULTING ENGINEERS**  
 3161 E. WARM SPRINGS ROAD, SUITE 200  
 LAS VEGAS, NEVADA 89120  
 702-932-6125 FAX: 702-932-6129

SILVER DOLLAR LAND CO  
 TOSCANA  
 FIGURE 7  
 DEVELOPED DRAINAGE BASINS

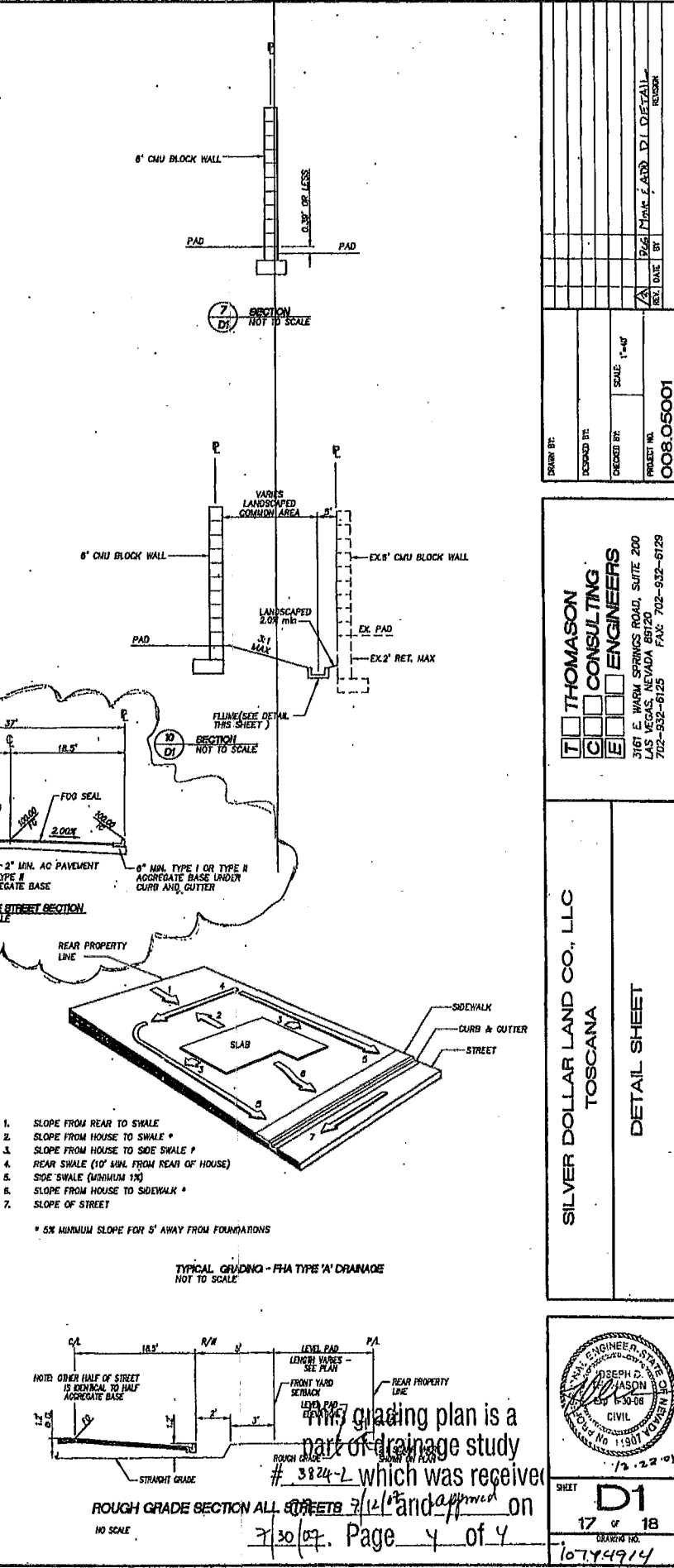
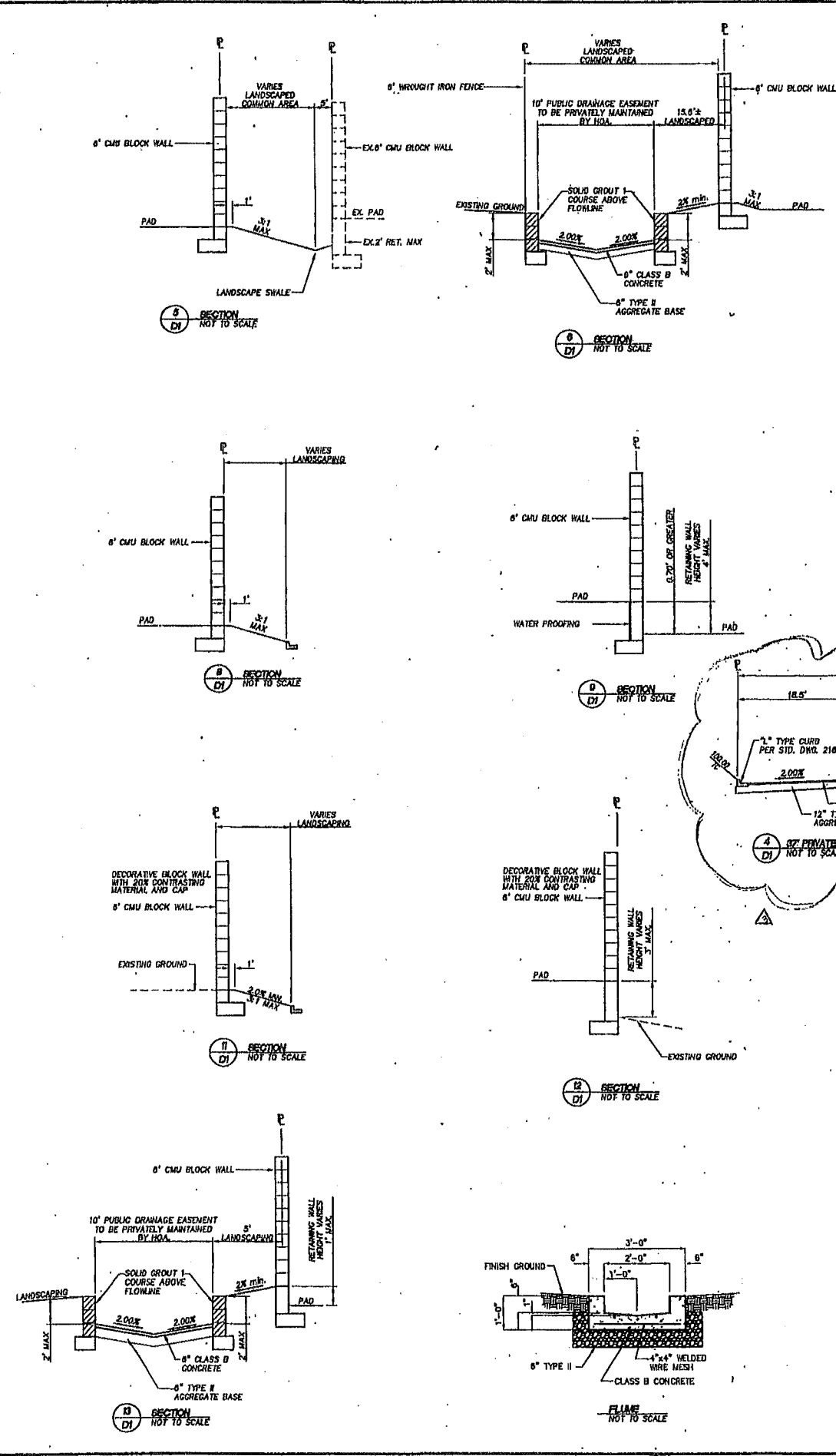
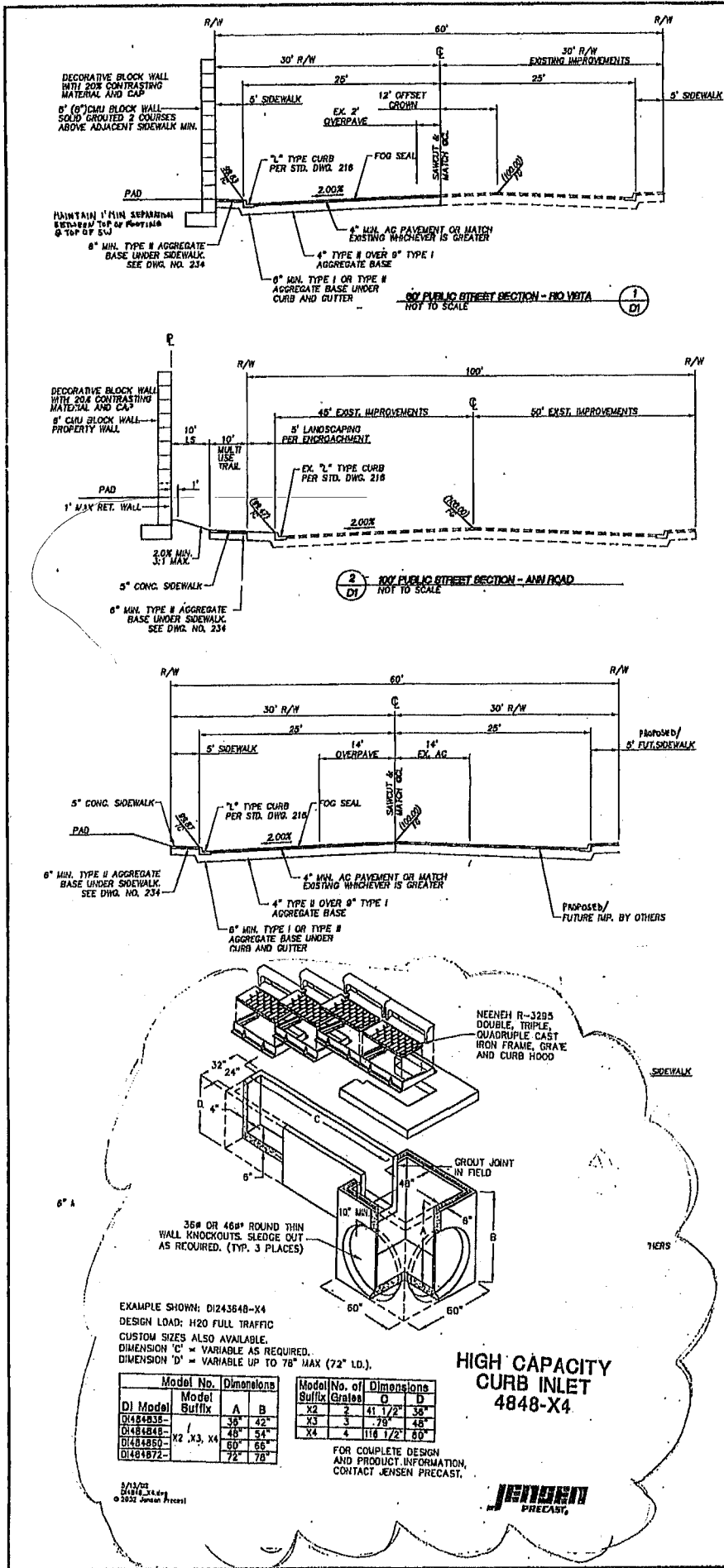












THOMSON CONSULTING ENGINEERS

3161 E. WARM SPRINGS ROAD, SUITE 200  
LAS VEGAS, NEVADA 89120  
702-932-6125

008.05001

SCALE: 1"=4'

DATE: 12/14/2005

SILVER DOLLAR LAND CO., LLC

TOSCANA

DETAIL SHEET

Model No. Dimensions

| Model    | Dimensions |
|----------|------------|
| D1 Model | 30' x 42'  |
| D1 Model | 48' x 54'  |
| D1 Model | 60' x 66'  |
| D1 Model | 72' x 78'  |

Model No. Dimensions

| Model | Dimensions      |
|-------|-----------------|
| X2    | 41' 1/2" x 38"  |
| X3    | 78" x 48"       |
| X4    | 116' 1/2" x 80" |

**HIGH CAPACITY CURB INLET 4848-X4**

FOR COMPLETE DESIGN AND PRODUCT INFORMATION, CONTACT JENSEN PRECAST.

**JENSEN PRECAST**

Model No. Dimensions

| Model    | Dimensions |
|----------|------------|
| D1 Model | 30' x 42'  |
| D1 Model | 48' x 54'  |
| D1 Model | 60' x 66'  |
| D1 Model | 72' x 78'  |

Model No. Dimensions

| Model | Dimensions      |
|-------|-----------------|
| X2    | 41' 1/2" x 38"  |
| X3    | 78" x 48"       |
| X4    | 116' 1/2" x 80" |

**HIGH CAPACITY CURB INLET 4848-X4**

FOR COMPLETE DESIGN AND PRODUCT INFORMATION, CONTACT JENSEN PRECAST.

**JENSEN PRECAST**

Model No. Dimensions

| Model    | Dimensions |
|----------|------------|
| D1 Model | 30' x 42'  |
| D1 Model | 48' x 54'  |
| D1 Model | 60' x 66'  |
| D1 Model | 72' x 78'  |

Model No. Dimensions

| Model | Dimensions      |
|-------|-----------------|
| X2    | 41' 1/2" x 38"  |
| X3    | 78" x 48"       |
| X4    | 116' 1/2" x 80" |

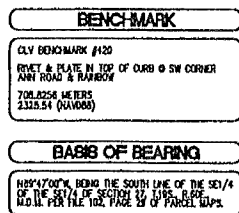
**HIGH CAPACITY CURB INLET 4848-X4**

FOR COMPLETE DESIGN AND PRODUCT INFORMATION, CONTACT JENSEN PRECAST.

**JENSEN PRECAST**



# REFERENCE 8



**NOTE:**

ZONE ENGINEERING INC. ASSUMES NO RESPONSIBILITY FOR EXISTING UTILITY LOCATIONS & ELEVATIONS. THE UTILITIES SHOWN ON THIS DRAWING HAVE BEEN PLOTTED FROM THE BEST AVAILABLE INFORMATION. IT IS, HOWEVER, THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY THE LOCATION AND ELEVATION OF ALL UTILITIES PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION. CONTRACTOR TO FIELD VERIFY ALL EXISTING SITE CONDITIONS PRIOR TO CONSTRUCTION. IF A CONFLICT EXISTS BETWEEN WHAT IS SHOWN ON THESE DRAWINGS AND WHAT EXIST IN THE FIELD, THE CONTRACTOR IS TO NOTIFY THE ARCHITECT, OWNER'S REPRESENTATIVE OR ENGINEER IMMEDIATELY.

# SOILS REPORT NOTE

**FLOODPLAIN INFORMATION**

THE SUBJECT SITE IS LOCATED WITHIN FEMA ZONE X AS SHOWN ON THE FLOODPLAIN MAP. THE SUBJECT SITE IS LOCATED WITHIN FEMA ZONE X AS SHOWN ON THE FLOODPLAIN MAP. THE SUBJECT SITE IS LOCATED WITHIN FEMA ZONE X AS SHOWN ON THE FLOODPLAIN MAP.

| RAMP NO. | GRADE (X)<br>"B" TO "A" | "A" (FT) MIN. | "B" (FT) MIN. |
|----------|-------------------------|---------------|---------------|
| H1       | -6 TO -5.0              | 4.5           | 21.5          |
| H2       | -5 TO -4.71             | 4.5           | 15.0 #        |
| H3       | -4 TO -3.0              | 4.5           | 12.0          |
| H4       | -3 TO -2.0              | 4.5           | 8.5           |
| H5       | -2 TO 2                 | 8.0           | 8.0           |
| H6       | 2.01 TO 3               | 9.5           | 4.5           |
| H7       | 3.01 TO 4               | 12.0          | 4.5           |
| H8       | 4.01 TO 5               | 15.0          | 4.5           |
| H9       | 5.01 TO 6               | 21.5          | 4.5           |

This grading plan is a part of drainage study 4080 which was received on 12/24/00 and CA <sup>correspondence</sup> on 12/24/00. Page 2 of 3

1/3/01

I CERTIFY THAT THIS GRADING PLAN CONFORMS TO THE APPROVED DRAINAGE STUDY ON FILE WITH THE CITY OF LAS VEGAS (4080-00).

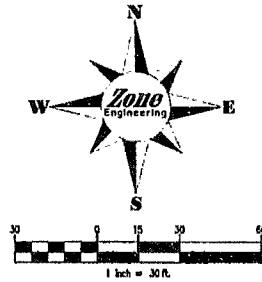
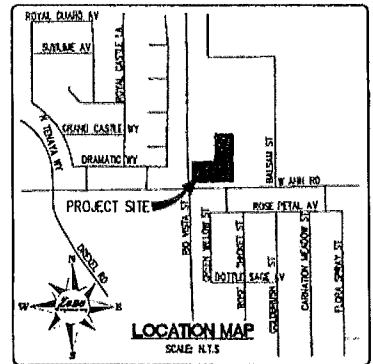
DEBORAH KALLS, P.E. 207485 DATE \_\_\_\_\_

## GRADING LEGEND

|                                                     |  |                            |                              |
|-----------------------------------------------------|--|----------------------------|------------------------------|
| CENTER LINE & STATION                               |  | FINISHED GRADE             | FG                           |
| RIGHT-OF-WAY                                        |  | GRADE BREAK                | GB                           |
| PARCEL LINE                                         |  | FLOW LINE                  | FL                           |
| EXISTING WATER MAIN                                 |  | HIGH POINT                 | HP                           |
| EXISTING GAS MAIN                                   |  | TOP OF CURB                | TC                           |
| EXISTING SEWER MAIN                                 |  | TOP OF ROLL CURB           | TRC                          |
| EXISTING STORM DRAIN                                |  | ADA ACCESS ROUTE           | <small>MIN. 5' CLEAR</small> |
| BLACK OF CURB                                       |  | PROPOSED PAD ELEVATION     | <b>(24)</b>                  |
| FACE OF CURB                                        |  | BASE FLOOD ELEVATION       | <b>5'-11.00'</b>             |
| UP OF CUTTER                                        |  | DRAINAGE EASEMENT          |                              |
| SIDEWALK                                            |  | RETAINING WALL             |                              |
| DRAINAGE SWALE & DIRECTION                          |  | SCREEN WALL                |                              |
| SCARP W/DIRECTION                                   |  | GRADE BREAK/A.C. FLOW LINE |                              |
| 1' CONTOURS & ELEVATION                             |  | SAWTOOTH LINE              |                              |
| 5' CONTOURS & ELEVATION                             |  | NEW AC PAVEMENT            |                              |
| SIGHT VISIBILITY ZONE<br>NO OBJECT ABOVE 24" IN SVZ |  |                            |                              |

### CONSTRUCTION NOTES

- 11 CONSTRUCT TYPE "I" CURB PER C.C.A.U.S.D. #218
- 12 CONSTRUCT TYPE "I" CURB PER C.C.A.U.S.D. #219
- 13 CONSTRUCT 2' U-CURB PER DETAIL "I" ON SHEET 4
- 14 CONSTRUCT 2' VALLEY GUTTER PER DETAIL "I" ON SHEET 4
- 15 CONSTRUCT CROSS GUTTER PER C.C.A.U.S.D. #228
- 16 CONSTRUCT HANDCAP RAMP C.C.A.U.S.D. #235
- 17 CONSTRUCT TRASH ENCLOSURE PER ARCHITECTURAL PLANS
- 18 SAWCUT AND REMOVE EXISTING CROSS GUTTER, CURB AND SIDEWALK
- 19 CONSTRUCT BLOCK WALL, CAPPING PER DETAIL "I" ON SHEET 4
- 20 CONTINUE W/ WALL CAPPING TO EXISTING CONTINUE OF U-CURB
- 21 CONSTRUCT SIDEWALK PER C.C.A.U.S.D. #234



**Zong Engineering**  
CIVIL ENGINEERING & LAND PLANNING

GRADING PLAN

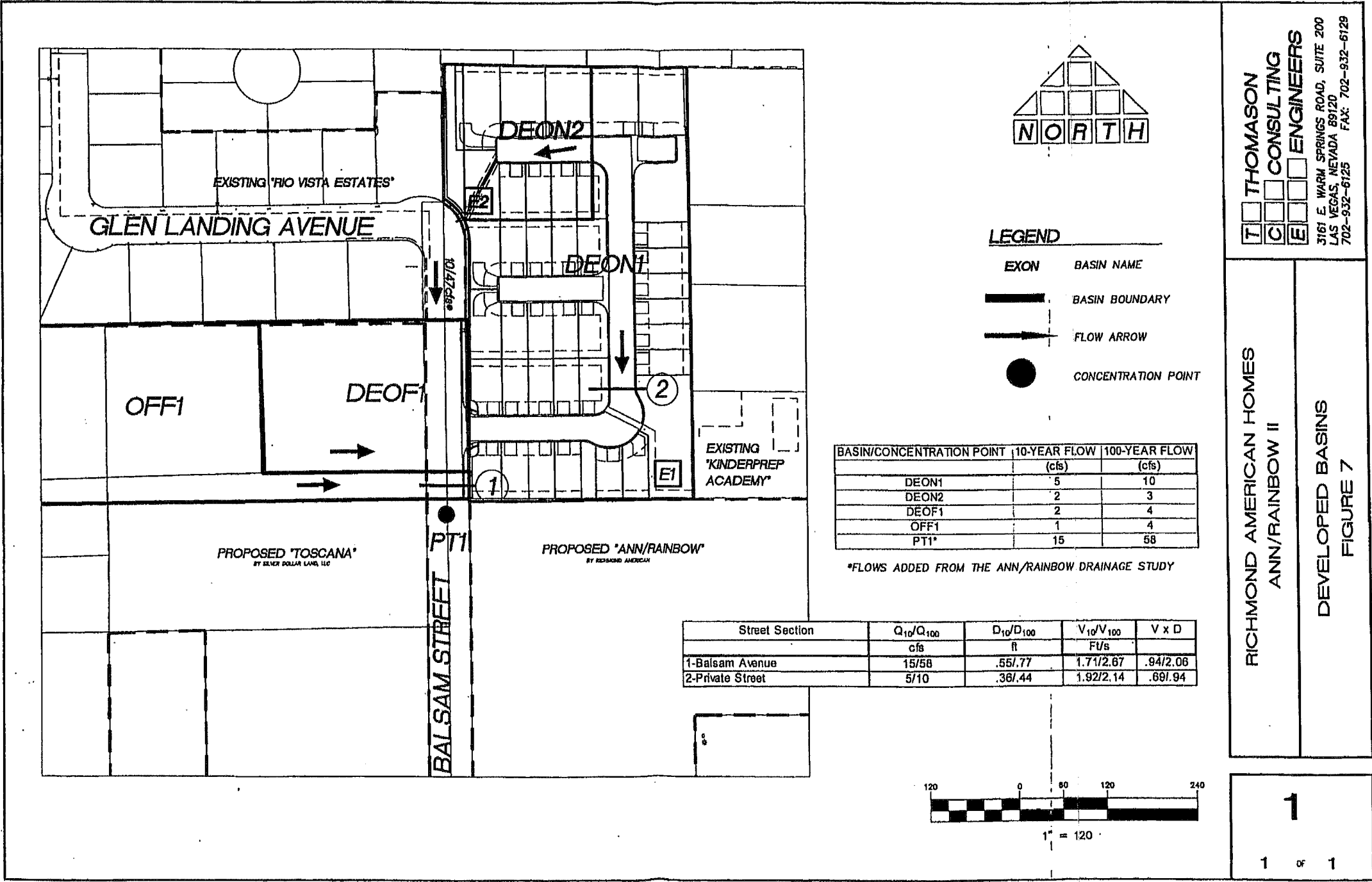
|              |       |        |
|--------------|-------|--------|
| DRAWN BY:    | DATE: | SHEET: |
| DESIGNED BY: | DATE: |        |
| CHECKED BY:  | DATE: | TITLE: |
| PROJECT NO.: |       |        |

Professional Engineer - State of Louisiana  
 No. 014993  
 Exp. 12-31-06  
 CIVIL  
 10-23-06

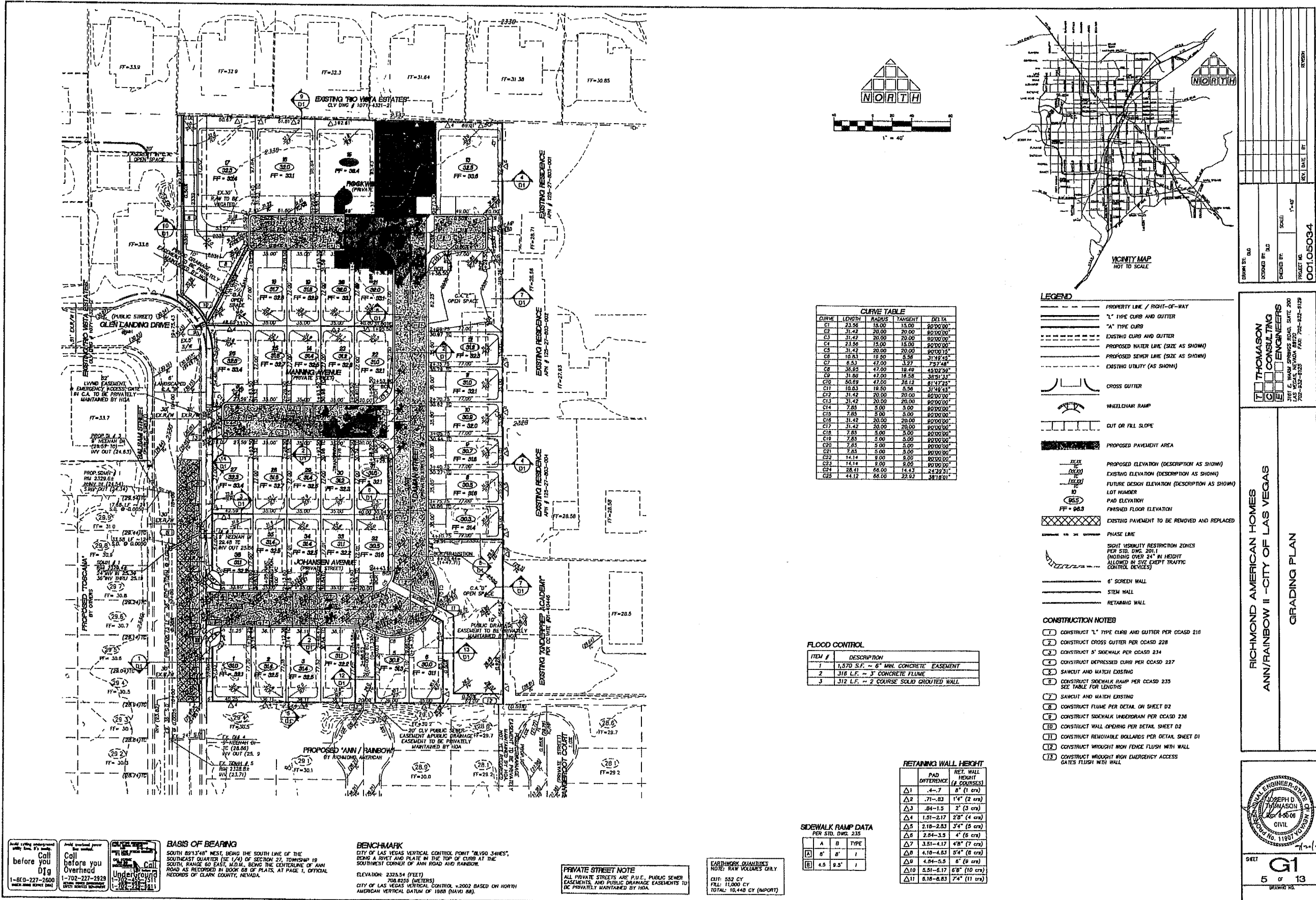
SHEET No. **3** of 7

CLV #

# REFERENCE 9



AKA Ann + Balsam



16:29:42

05-55848 ADD1

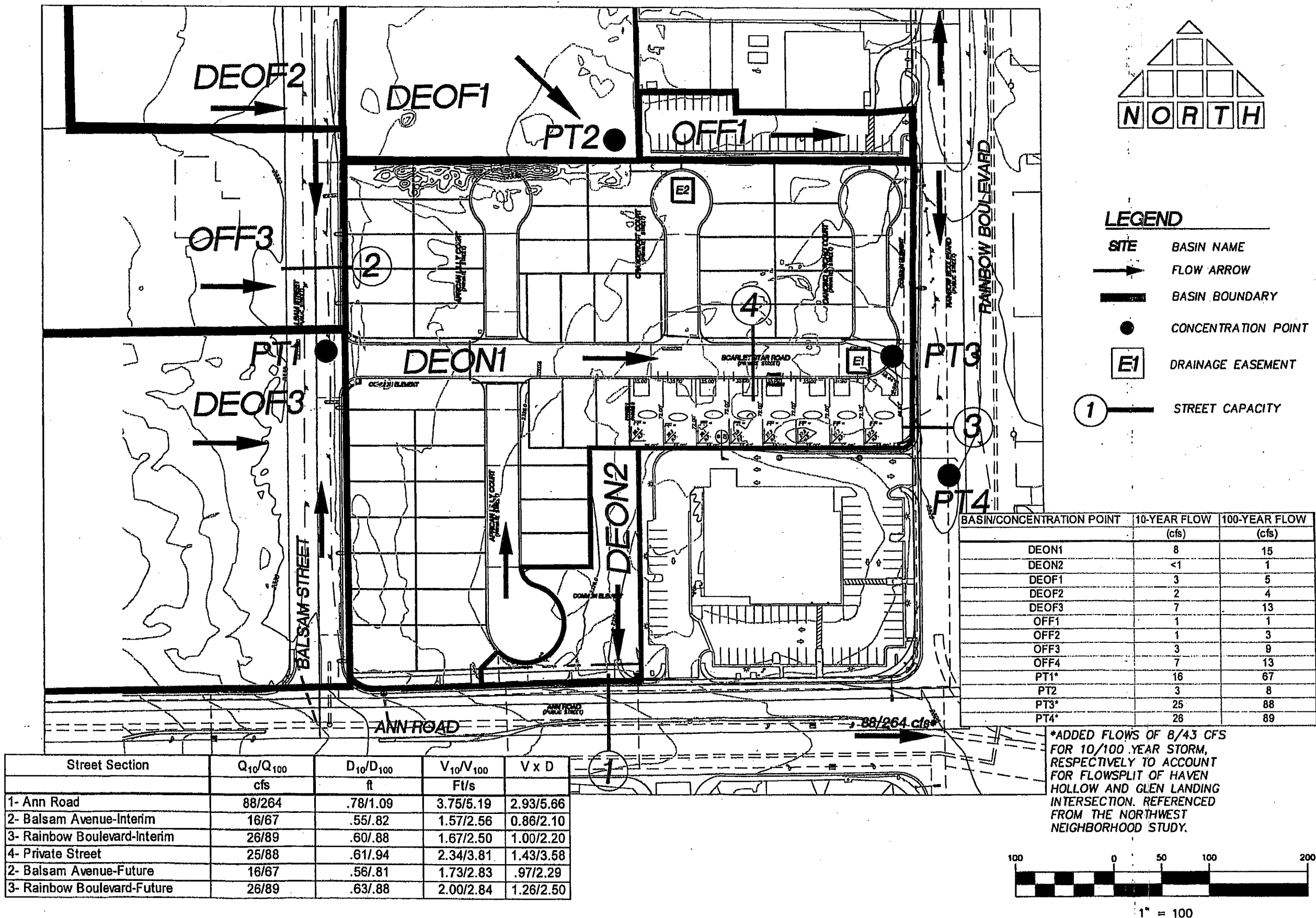


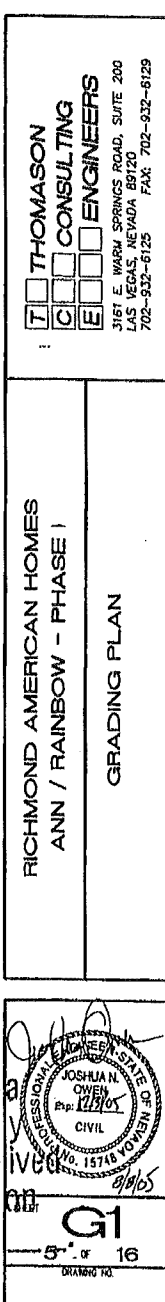
# REFERENCE 10

**T** THOMASON  
**C** CONSULTING  
**E** ENGINEERS  
3161 E. WARM SPRINGS ROAD, SUITE 200  
LAS VEGAS, NEVADA 89120  
702-932-6125 FAX: 702-932-6129

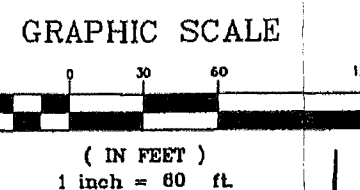
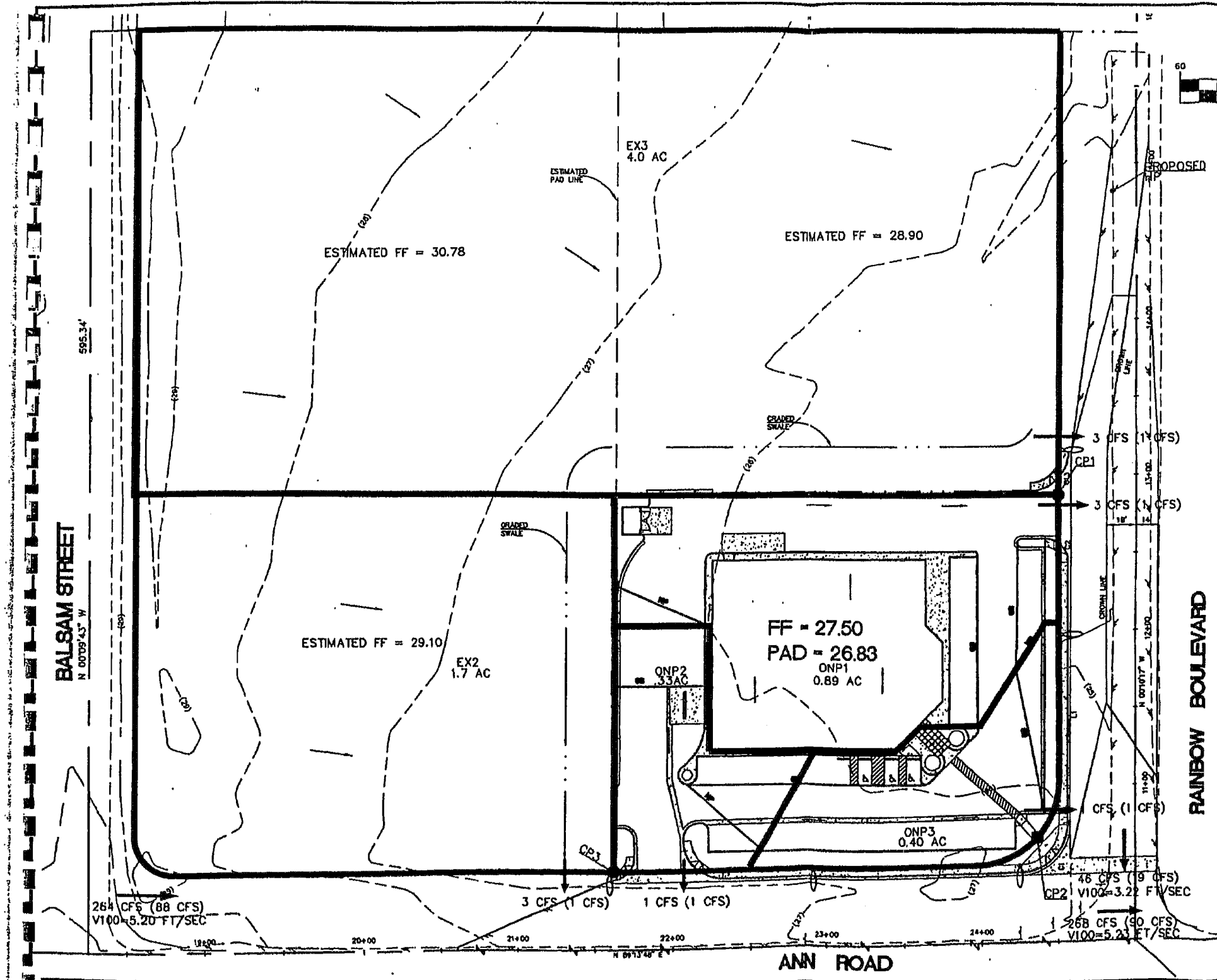
RICHMOND AMERICAN  
ANN/RAINBOW

DEVELOPED BASINS  
FIGURE 7





# REFERENCE 11



**LEGEND**

100 YEAR FLOW (10 YEAR FLOW)

→ = DIRECTION OF FLOW

HP = HIGH POINT

— = PROPOSED PAD LINE

**RAINBOW BOULEVARD**

**FLOW SUMMARY**

| BASIN | Q10 (CFS) | Q100 (CFS) |
|-------|-----------|------------|
| ONP1  | 1         | 3          |
| ONP2  | 1         | 1          |
| ONP3  | 1         | 1          |
| CP1   | 19        | 46         |
| CP2   | 19        | 46         |
| CP3   | 1         | 4          |

**FIGURE 7**

**SCALE: 1" = 80'**

**DATE: 2-10-98**

**DRAFTER: KBN**

**DEVELOPED CONDITIONS ONSITE DRAINAGE MAP**

**RITE AID AT**

**ANN AND RAINBOW**

**TETRA**

Civil Engineering • Land Planning

9001 S. Valley View Blvd.

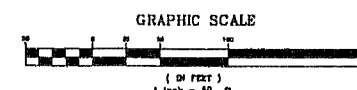
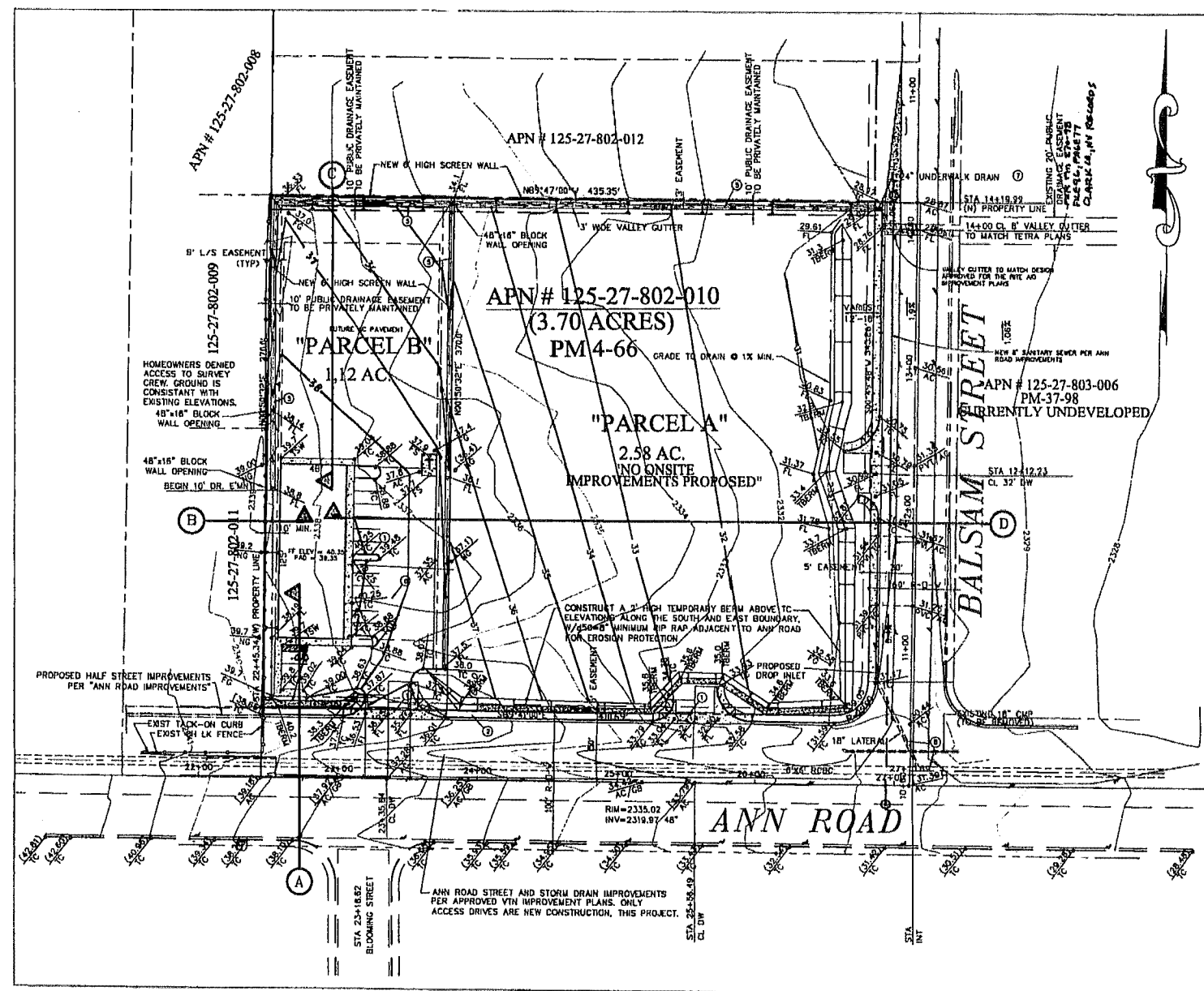
Las Vegas, Nevada 89122

Phone: (702) 885-6010

Fax: (702) 885-6020

000412





ASSESSOR'S PARCEL NUMBER

125-27-802-010

## ENGINEER

ROBERT L. LUCERO, P.E.  
6711 SHELTER LANE  
LAS VEGAS, NV. 89103  
PHONE: (702) 362-7952  
FAX (702) 362-7952

## OWNER/SUBDIVIDER

THE BORSACK GROUP, INC.  
9555 DEL WEBB BLVD.  
LAS VEGAS, NV. 89134  
PHONE: (702) 257-1188  
FAX (702) 257-1681

## BENCHMARK

CITY OF LAS VEGAS BM # 1LV9035NNW6  
5/8" REBAR, 2' FROM WALL, CENTER OF RETURN  
SE CORNER OF REBECCA AND ANN ROAD  
ELEV. = 2318.27 (NAD83 88)

## BASIS OF BEARINGS

N 89°47'00" W BEING THE BEARING OF THE SOUTH  
LINE OF THE SE QUARTER SEC. 27, T 19 S  
R 80 E M.D.M. CLARK COUNTY, NEVADA AS SHOWN  
ON FILE 4, PAGE 66 OF RECORD OF SURVEY PLATS.

### LEGAL DESCRIPTION

SITUATE IN THE COUNTY OF CLARK, STATE OF NEVADA, FURTHER DESCRIBED AS FOLLOWS:

THAT PORTION OF THE SOUTHEAST QUARTER (SE1/4) OF THE SOUTHEAST QUARTER (SE 1/4) OF RANGE 27 NORTH, RANGE 50 EAST, M.D.B. & M., MORE PARTICULARLY DESCRIBED AS PARCEL 2 SHOWN BY PARCEL MAP IN FILE 4, PAGE 66, RECORDED JANUARY 20, 1976, AS DOCUMENT NO. 448001 IN BOOK 489 IF OFFICIAL RECORDS, CLARK COUNTY, NEVADA.

### LEGEND

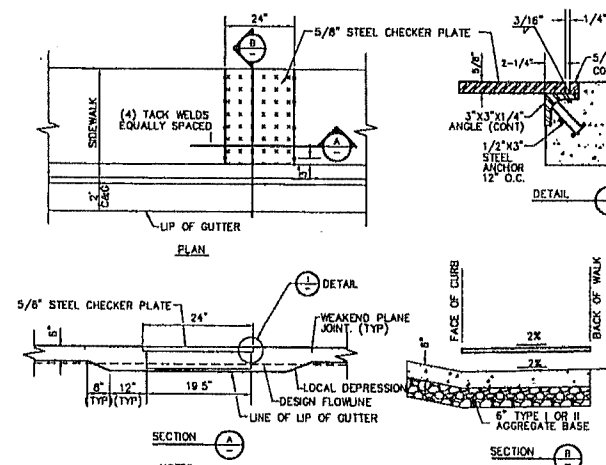
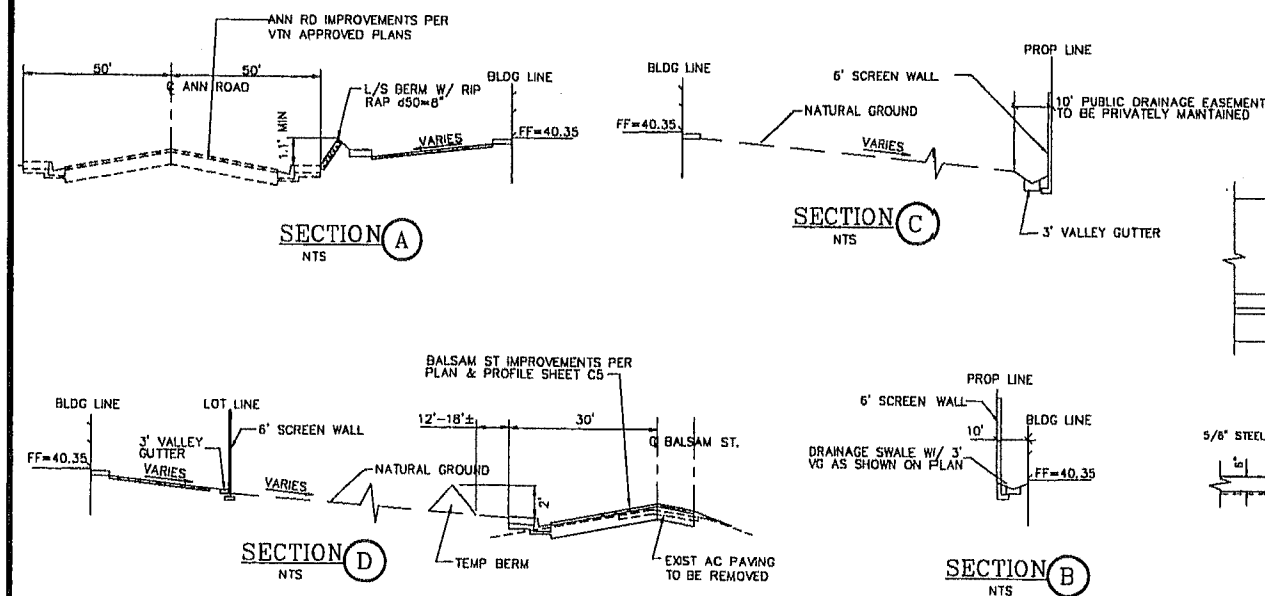
|                             |                                         |                                                   |
|-----------------------------|-----------------------------------------|---------------------------------------------------|
| BOUNDARY LINE               | TELEPHONE PEDASTAL                      | NOTE:<br>N 88°47'<br>LINE OF<br>R 60 E<br>ON FILE |
| FOUND POINT AS NOTED        | SEWER CLEAN OUT                         |                                                   |
| MANHOLE                     | CONDUIT                                 |                                                   |
| POWER POLE                  | WATER VALVE                             |                                                   |
| GUY WIRE                    | MONITOR WELL                            |                                                   |
| EDGE OF PAVEMENT            | TRAFFIC SIGNAL BOX                      |                                                   |
| CURB & GUTTER               | STREET LIGHT PULL BOX                   |                                                   |
| BLOCK WALL                  | WATER METER                             |                                                   |
| DRAINAGE INLET              | PVC                                     |                                                   |
| HYDRANT                     | HANDICAP ACCESS RAMP                    |                                                   |
| STREET LIGHT                | CONCRETE AREAS                          |                                                   |
| STORM DRAIN MANHOLE         | BUILDING                                |                                                   |
| CONCRETE PADS               | 1 FT ROUND LIDS(COVERS) ON CONCRETE PAD |                                                   |
| SINGLE POLE SIGN            | SOUTH AND EAST OF SERVICE ISLAND        |                                                   |
| MISCELLANEOUS UTILITY COVER |                                         |                                                   |
| FINISH CONTOUR              | 1" O PROTECTION BAR, SEE DETAIL BELOW   | ANGLE IRON TOP & EACH SIDE<br>SEE DETAIL BELOW    |
| EXISTING CONTOUR            |                                         |                                                   |

### CONSTRUCTION NOTES

- ① 8' VALLEY GUTTER PER USD # 228
- ② 5' SIDEWALK PER USD # 235
- ③ A-TYPE CURB
- ④ L-TYPE CURB PER USD # 216
- ⑤ 3' WIDE CONCRETE VALLEY GUTTER
- ⑥ NEW AC PAVEMENT
- ⑦ UNDERWALK DRAIN PER DETAILS THIS SHEET
- ⑧ PROPOSED VTN STORM DRAIN

## NOTES

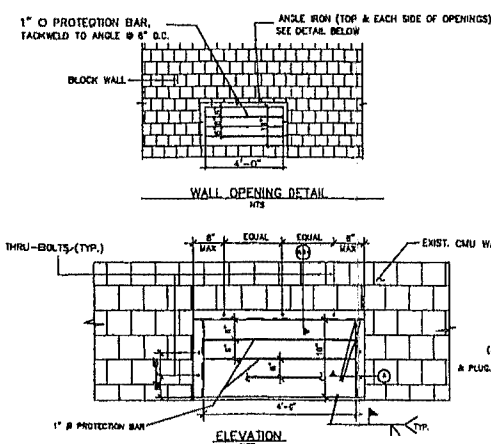
N 89°47'00" W BEING THE BEARING OF THE SOUTH  
LINE OF THE SE QUARTER SEC. 27, T 19 S  
R 60 E M.D.M. CLARK COUNTY, NEVADA AS SHOWN  
ON FILE 4, PAGE 66 OF RECORD OF SURVEY PLATS.



NOTES:

1. IF WIDTH OF PLATE IS GREATER THAN 24", A SPECIAL DESIGN IS REQUIRED
2. ALL EXPOSED METAL PARTS SHALL BE GALVANIZED AND ALL GALVANIZED DAMAGED BY FABRICATION OR INSTALLATION SHALL RECEIVE TWO COATS OF ALUMINUM PAINT (KALNIDON OR EQUIV.)

**SIDEWALK DRAIN**



This grading plan is part of drainage study

Avoid overhead power line contact. It's costly. **Call before you Overhead.** **1-702-593-6111** **USA 1-800-226-0600** **1-800-226-0600** **1-800-226-0600**

**ROBERT L. LUCERO, P.E.**  
CONSULTING ENGINEERING - PLANNING - DESIGN

6711 SHELTER LANE  
LAS VEGAS, NV 89103

PHONE: 702-277-4937  
FAX: 702-382-7952

**THE BORSACK GROUP, INC.**  
A NEVADA CORPORATION  
7111 PILOT ROAD, SUITE F  
LAS VEGAS, NV 89119-429  
PHONE: (702) 897-5660  
FAX: (702) 897-2993

PM42-2000/ANIMAL HOSPITAL  
NW CONIER ANN AND BALSAM  
GRADING PLAN  
CLARK COUNTY NEVADA

[illegible]



**6. APPENDIX F – GEOTECHNICAL REPORT BY TERRACON**

1. FIGURE F-1 GEOTECHNICAL UPDATE LETTER
2. FIGURE F-2 ORIGINAL GEOTECHNICAL REPORT

February 2, 2011

Jacobs Engineering Group, Inc  
319 Warm Springs Road, Suite 200  
Las Vegas, Nevada 89119

Attn: Ms Tara Taylor Alexander, P.E.  
Project Manager

Re: Geotechnical Report Update Letter  
Rainbow Boulevard Improvements  
Las Vegas, Nevada  
Terracon Project No. 64995240U

Dear Ms Alexander:

Terracon Consultants, Inc. (Terracon) appreciates the opportunity to submit this update letter. According to the 2009 Southern Nevada Building Code Amendments (SNBCA) to the 2009 International Building Code (IBC), geotechnical exploration reports must be current within a period of twelve months after the exploration was completed. The recommendations presented in our Geotechnical Engineering Report (Project No.64995240, dated June 30, 2000) and any addendum's are still valid and remain applicable as long as there have not been significant changes in structural loading, foundation type or floor level. We do not know of, or anticipate, any changes; therefore, the recommendations presented in the report remain valid.

If fill has been placed and the site has been graded since the geotechnical report was issued, the fill would be considered uncontrolled fill unless observation and testing was performed during placement. All uncontrolled fill should be removed and replaced with properly placed and compacted fill as recommended in the geotechnical report. All fill placed in structure areas of the site should be properly placed, compacted and tested as recommended in the geotechnical report.

Site Class D should be used in accordance with Section 1613.5.2, Site Class Definitions of the 2009 IBC. Although the project is divided into northern and southern segments, the ground accelerations are nearly identical. Design parameters are provided for both segments.

We have determined the following approximate latitude and longitude of the site, along with the spectral response accelerations:

|                | Northern Segment | Southern Segment |
|----------------|------------------|------------------|
| Latitude       | 36.2630°         | 36.1885°         |
| Longitude      | -115.2423°       | -115.2423°       |
| S <sub>s</sub> | 0.521            | 0.528            |

FIGURE F-1



**Geotechnical Report Update Letter**

Rainbow Boulevard Improvements ■ Las Vegas, Nevada  
 February 2, 2011 ■ Terracon Project No. 64995240U

**Terracon**

|          | Northern Segment | Southern Segment |
|----------|------------------|------------------|
| $S_1$    | 0.168            | 0.169            |
| $S_{DS}$ | 0.481            | 0.485            |
| $S_{D1}$ | 0.239            | 0.239            |

The seismic load due to lateral earth pressure may be defined in accordance with Section 1610.1.1 of the 2009 SNBCA. The dynamic component for yielding walls,  $\Delta P_{AE} = \frac{3}{8}(k_h)H^2\gamma$ ; and the dynamic component for non-yielding walls is  $\Delta P_E = k_h H^2 \gamma$

- $k_h$  is equal to  $S_{DS}/2.5$
- $H$  is the height of the wall in feet
- $\gamma$  is equal to the unit weight of the backfill material in pcf

The resultant dynamic force acts at a distance of  $0.6H$  above the base of the wall.

|                                          | Northern Segment | Southern Segment |
|------------------------------------------|------------------|------------------|
| $k_h$ (g)                                | 0.192            | 0.194            |
| $\gamma$ (pcf)                           | 130              | 130              |
| $\Delta P_{AE}$ (lb/linear foot of wall) | $9.36 \cdot H^2$ | $9.46 \cdot H^2$ |
| $\Delta P_E$ (lb/linear foot of wall)    | $25 \cdot H^2$   | $25.2 \cdot H^2$ |

The dynamic forces are considered a short-term loading condition; therefore, a one-third increase in the bearing pressure and passive resistance may be allowed for dynamic analysis.

Laboratory testing, observation and inspection of backfill materials should be carried out in accordance with the guidelines provided in Table 1704.7 of the SNBCA to the 2009 IBC. Based on the subsurface soil conditions encountered in the borings and the results of the laboratory tests performed for the project, we recommend that continuous special inspections be carried out during grading operations that consist of fill placement and compaction in accordance with Item 4b of Table 1704.7.

Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers practicing in this or similar localities. No warranties, either express or implied, are intended or made. Should you have any questions, please do not hesitate to call.

Sincerely,  
**Terracon Consultants, Inc.**

*J. La Putt*

Jennifer T. La Putt, E.I.  
 Staff Engineer

*Michael E. McGettigan*

Michael E. McGettigan, P.E.  
 Senior Associate / Office Manager





August 30, 2000

Sverdrup Civil, Inc.  
5450 West Sahara Avenue  
Suite 150  
Las Vegas, Nevada 89146

Attention: Mr. David Potter

Re: **Comment Response**  
**Rainbow Boulevard Improvements**  
**Centennial Parkway to Rancho Drive**  
**Smoke Ranch Road to Silverstream Avenue**  
**Las Vegas, Nevada**  
**Project No. 64995240**

Dear Mr. Potter:

This letter is offered as a response to comments received from ACEP regarding the referenced project. The comments concerned traffic along the northern section of the alignment and the use of US Climate Region 5 in our overlay design.

- The traffic data for the northern segment was revised by an addendum originally issued June 6, 2000. The addendum has further been revised to show that there will be 2-lanes in each direction of the northern section of the project. In addition, the original report will be revised and re-issued.
- Figure 4.1 of the AASHTO design manual contains a map of the climatic regions of the US, which indicates this project to be in Region 5.

Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers practicing in this or similar localities. No warranties, either express or implied, are intended or made. Should you have any questions, please do not hesitate to call.

Sincerely,  
TERRACON

Reviewed by:

Frank L. Blackett, P.E.  
Project Manager

Mark J. Owens  
Principal

August 30, 2000

Sverdrup Civil, Inc.  
5450 West Sahara Avenue  
Suite 150  
Las Vegas, Nevada 89146

Attention: Mr. David Potter

Re: **Addendum**  
**Rainbow Boulevard Improvements**  
**Centennial Parkway to Rancho Drive**  
**Las Vegas, Nevada**  
**Project No. 64995240**

Dear Mr. Potter:

It has come to our attention that the traffic values used in our design for the referenced section of Rainbow Boulevard were incorrect. In addition, we understand the northern section will consist of two lanes in each direction. These values have been revised and our design reviewed. Detailed below are the revisions to the traffic values and pavement sections.

The new traffic data used for the design is as follows:

| Rainbow Blvd                        | Design ADT | DESIGN ESAL* | TRAFFIC INDEX |
|-------------------------------------|------------|--------------|---------------|
| Rancho Road to Centennial Parkway   | 6700       | 3,700,000    | 10.5          |
| *ESAL – Equivalent Single Axle Load |            |              |               |

The following overlay sections resulted from the revised traffic data.

| Overlay Recommendations<br>Northern Segment |                 |                            |                 |                        |
|---------------------------------------------|-----------------|----------------------------|-----------------|------------------------|
| From Station (ft)                           | To Station (ft) | Existing AC Thickness (in) | Mill Depth (in) | Overlay Thickness (in) |
| 0+00                                        | 46+00           | 3.7                        | 1.5             | 5.0                    |
| 60+00                                       | 82+00           | 3.5                        | 1.5             | 3.5                    |

An overlay from Station 0+00 to 46+00 will result in approximately 3 ½ inches of asphalt above current grades. The overlay from Station 60+00 to 82+00 will result in a finished grade approximately 2 inches above existing grades. If these final grades are not acceptable, then

Sverdrup  
Addendum  
Rainbow Boulevard  
Project No. 64995240

reconstruction will be required. The alignment between Station 46+00 to 60+00 was not evaluated because of the poor quality of the pavement and the inability to overlay the section.

| Recommended Layer Thickness for New Construction – Northern Segment |                                |                 |                           |                                   |
|---------------------------------------------------------------------|--------------------------------|-----------------|---------------------------|-----------------------------------|
| Street Segment                                                      | Design Resilient Modulus (psi) | SN <sub>r</sub> | AC Surface Thickness (in) | Type II Base Layer Thickness (in) |
| 0+00 to 53+00                                                       | 8050                           | 4.26            | 6.0                       | 18.0                              |
| 53+00 to 93+00                                                      | 5740                           | 4.74            | 6.0                       | 22.0                              |

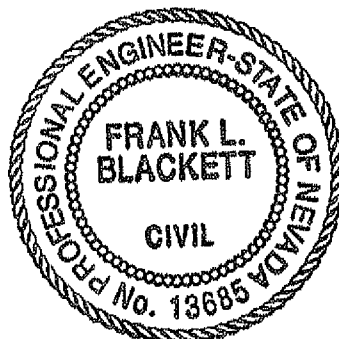
Our original report is currently being revised to show these changes and will be re-issued with these changes incorporated into the report.

Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers practicing in this or similar localities. No warranties, either express or implied, are intended or made. Should you have any questions, please do not hesitate to call.

Sincerely,  
TERRACON  
Frank L. Blackett, P.E.  
Project Manager

Reviewed by:

Mark J. Owens  
Principal



**GEOTECHNICAL EXPLORATION REPORT  
RAINBOW BOULEVARD IMPROVEMENTS**

**SMOKE RANCH ROAD TO SILVERSTREAM AVENUE  
CENTENNIAL PKWY. TO RANCHO DR.**

**LAS VEGAS, NEVADA**

**PROJECT NO. 64995240**

**June 30, 2000**

**REVISED**

**August 31, 2000**

*Prepared for:*

**Sverdrup Civil, Inc.**

*Prepared by:*

**TERRACON  
4343 SOUTH POLARIS AVENUE  
LAS VEGAS, NEVADA 89103**

**Phone: (702) 597-9393**

**Fax: (702) 597-9009**

**Terracon**

## TABLE OF CONTENTS

|                                                                 | Page No. |
|-----------------------------------------------------------------|----------|
| <b>1.0 INTRODUCTION .....</b>                                   | <b>1</b> |
| <b>2.0 PROJECT INFORMATION .....</b>                            | <b>2</b> |
| <b>3.0 ALIGNMENT EXPLORATION .....</b>                          | <b>2</b> |
| <b>4.0 ALIGNMENT CONDITIONS .....</b>                           | <b>3</b> |
| 4.1 Surface.....                                                | 3        |
| 4.1.1 Northern Segment .....                                    | 3        |
| 4.1.2 Southern Segment.....                                     | 3        |
| 4.2 Subsurface.....                                             | 4        |
| 4.2.1 Northern Segment .....                                    | 4        |
| 4.2.2 Southern Segment.....                                     | 6        |
| <b>5.0 GEOLOGIC INFORMATION .....</b>                           | <b>7</b> |
| 5.1 General .....                                               | 7        |
| 5.2 Subsidence .....                                            | 8        |
| <b>6.0 PAVEMENT EVALUATION .....</b>                            | <b>9</b> |
| 6.1 INTRODUCTION.....                                           | 9        |
| 6.2 FIELD DATA COLLECTION.....                                  | 9        |
| 6.2.1 Visual Distress Survey .....                              | 9        |
| 6.2.2 Ground Penetrating Radar Survey.....                      | 10       |
| 6.2.3 Nondestructive Deflection Testing .....                   | 10       |
| 6.3 STRUCTURAL EVALUATION.....                                  | 11       |
| 6.3.1 Identification of Uniform Sections .....                  | 11       |
| 6.3.2 Evaluation of Existing Pavement Structural Capacity ..... | 12       |
| 6.4 REHABILITATION OF AC PAVEMENT USING AC OVERLAYS .....       | 14       |
| 6.4.1 Projection Of Design Traffic Volumes .....                | 14       |
| 6.4.2 Evaluation of Design Roadbed Soil Resilient Modulus ..... | 15       |
| 6.4.3 Determination of Required Structural Number .....         | 16       |
| 6.4.4 Determination of AC Overlay Thickness .....               | 16       |



## TABLE OF CONTENTS (Cont'd)

|                                                  |    |
|--------------------------------------------------|----|
| 6.5 PAVEMENT RECOMMENDATIONS .....               | 18 |
| 6.5.1 General .....                              | 18 |
| 6.5.2 Overlay of Northern Segment .....          | 18 |
| 6.5.3 Overlay of Southern Segment .....          | 19 |
| 6.5.4 New Pavement Sections .....                | 20 |
| 6.5.4.1 General .....                            | 20 |
| 6.5.4.2 Northern Segment .....                   | 20 |
| 6.5.4.3 Southern Segment .....                   | 21 |
| 7.0 RECOMMENDATIONS .....                        | 21 |
| 7.1 General .....                                | 21 |
| 7.2 Soil Profile Type .....                      | 22 |
| 7.3 Soil Design Parameters .....                 | 22 |
| 7.4 Earthwork .....                              | 24 |
| 7.4.1 Alignment Clearing .....                   | 24 |
| 7.4.2 Excavation .....                           | 25 |
| 7.4.3 Overexcavation .....                       | 25 |
| 7.4.4 Fill Materials .....                       | 26 |
| 7.4.5 Fill Placement and Compaction .....        | 26 |
| 7.4.6 Material Volume Changes .....              | 27 |
| 7.5 Utility Trenches .....                       | 28 |
| 7.5.1 Subgrade, Pipe Bedding and Pipe Zone ..... | 28 |
| 7.5.2 Trench Backfill .....                      | 28 |
| 7.6 Drainage and Moisture Protection .....       | 29 |
| 7.7 Corrosivity .....                            | 29 |
| 8.0 OTHER SERVICES .....                         | 29 |
| 9.0 CLOSURE .....                                | 30 |

## TABLE OF CONTENTS (Cont'd)

|                        | Plate No. |
|------------------------|-----------|
| Vicinity Map .....     | 1A and 1B |
| Alignment Plans.....   | 2A and 2B |
| Geologic Hazards ..... | 3         |
| Subsidence .....       | 4         |
| Photographs .....      | 5A and 5B |

### APPENDIX A

|                                               |                  |
|-----------------------------------------------|------------------|
| Boring Logs .....                             | A-1 through A-72 |
| Explanation of Material Classifications ..... | B                |
| Sieve Analysis Test Results .....             | C                |
| Expansion Test Results.....                   | D                |
| Consolidation Test Results .....              | E-1 through E-5  |
| Chemical Test Results.....                    | F                |

### APPENDIX B

GPR Layer Profile Plots  
Design Mr Profiles

**GEOTECHNICAL EXPLORATION REPORT  
RAINBOW BOULEVARD IMPROVEMENTS  
SMOKE RANCH ROAD TO SILVERSTREAM AVENUE  
CENTENNIAL PKWY. TO RANCHO DR.  
LAS VEGAS, NEVADA**

**PROJECT NO. 64995240**

## **1.0 INTRODUCTION**

This report presents the results of our geotechnical exploration for roadway improvements to Rainbow Boulevard. The northern segment of the alignment extends from Centennial Parkway south to Rancho Drive, and the southern segment of the alignment extends from Smoke Ranch Road to Silverstream Avenue. The alignment from Centennial Parkway to Ann Road is in Clark County, Nevada. The remaining portion of the alignments are in Las Vegas, Nevada. The general location of the site is shown on Plates 1A and 1B, Vicinity Map.

The purpose of our services was to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- General geology of the area
- Soil design parameters
- Retaining wall design and construction
- Pavement design and construction
- Earthwork
- Utility trench backfill

This report is for the purpose of providing geotechnical engineering and/or testing information and requirements. The scope of our services for this project did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic material in structures, soil, surface water, groundwater or air, below or around this site.

The analyses and recommendations presented in this report are based upon the data obtained from the limited visual condition survey, ground penetrating radar (GPR) and deflection testing, and from other information discussed in this report. This report has been prepared for the exclusive use of the client for specific application to the project discussed and has been prepared in accordance with generally accepted pavement engineering practices. No warranty, express or implied, is provided. In the event that any information furnished to us, as outlined in this report, is inaccurate or changes, the conclusions contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report modified or verified in writing by the pavement engineer.

## 2.0 PROJECT INFORMATION

The project consists of the improvement of two separate sections of Rainbow Boulevard. The northern segment extends from Centennial Parkway south to Rancho Drive, a distance of approximately  $1\frac{3}{4}$  miles; and the southern segment extends from Smoke Ranch Road south to Silverstream Avenue, a distance of approximately  $1\frac{5}{8}$  miles. The major improvements generally include asphalt pavement, storm drain, sanitary sewer, signals and pavement markings. We assume the storm drain invert will be approximately 10 feet below existing alignment grades. If the Special Improvement District (SID) is formed, curb, gutter, sidewalk and lighting will also be constructed. The existing pavement was evaluated for complete reconstruction, overlayment or a combination of both.

Traffic data for the project was provided by the City of Las Vegas. For the northern segment of the alignment, an average daily traffic (ADT) value of 6,700 was used, which represented the maximum, directional ADT presented for the northern segment. An annual growth rate of 6% was applied to determine the 20 year traffic value and design equivalent single-axle load (ESAL). For the southern segment of the alignment, an ADT of 15,332 was used with an annual growth rate of 4%. This ADT was calculated from directional data provided at several different intersections along the alignment, and represents the maximum ADT. The final alignment is projected to be 4 lanes in width along both the northern and southern segments.

## 3.0 ALIGNMENT EXPLORATION

The scope of our services for this project included a subsurface exploration program. The subsurface exploration program consisted of drilling 19 borings in the northern segment of the alignment, and 17 borings in the southern segment of the alignment (approximately 500 foot intervals) to depths of approximately 20 feet below existing alignment grades. The borings were logged by a geologist during drilling and samples were obtained to aid in material classification and for possible laboratory testing. The approximate locations of the borings are shown on Plates 2A and 2B, Alignment Plan. Results of the borings are presented in Appendix A.

In addition, an evaluation of the existing pavements was performed. The existing pavements were evaluated using a falling heavy deflectometer (FWD) and ground penetrating radar (GPR). Deflection tests were performed along the entire lengths of the northern and southern segments of the alignment with the exception of that portion of the northern segment, from approximate stations 46+50 to 60+50. This 2-lane section consisted of temporary pavement in poor condition, which, in our opinion, would require complete replacement. The existing 4-lane sections were tested at 200 foot spacings, but staggered to provide 100 foot coverage along the centerline of the street in both the northbound and southbound directions. The 2-lane sections were tested at

200 foot spacings but staggered between the northbound and southbound lanes, also providing 100 foot coverage along the centerline of the street.

#### **4.0 ALIGNMENT CONDITIONS**

##### **4.1 Surface**

###### **4.1.1 Northern Segment**

The alignment between Centennial Parkway and Azure Avenue consisted of native desert with sparse vegetation. The area was relatively flat with minor amounts of fill associated with the existing streets. From Azure Avenue to Tropical Parkway, the alignment consisted of a 2-lane paved street, fully developed on the western edge only. The eastern one-half consisted of a gravel area approximately 3 to 4 feet lower in elevation than the existing, paved portion. The pavement was in good to excellent condition, with no cracking or visual distress.

The eastern one-half of the alignment between Tropical Parkway and El Campo Grande was being improved during our exploration with the construction of curb, gutter and sidewalk. It appeared that pavement was also to be placed to a final width of 6-lanes (approximately 100 feet). The western one-half of the alignment was fully improved. The existing pavement from Azure Avenue to El Campo Grande was in excellent condition with no cracking or visual distress.

From El Campo Grande to Ann Road, the alignment consisted of a 2-lane paved street with no additional improvements. The western one-half of the pavement appeared to be newer than the eastern one-half, which had extensive longitudinal and transverse cracking. The pavement was generally in poor condition.

The remaining portion of the northern alignment, extending from Ann Road to Rancho Drive consisted of a 4-lane street with center turn lane. The western edge of the alignment was fully improved with curb, gutter and sidewalk. Two sections of the eastern edge of the alignment were fully improved with curb, gutter and sidewalk. One section extended approximately 400 feet north and 100 feet south of Rancho Santa Fe Drive. The other section was the last, approximate 200 feet of the alignment extending north from Rancho Drive. The pavement between Ann Road and Rancho Drive was in excellent condition.

###### **4.1.2 Southern Segment**

The alignment, approximately from Smoke Ranch Road to Gazelle Drive consisted of a paved, 4-lane street with a center turn lane. This section was fully developed on both sides with the exception of approximately 550 feet of the western edge between Lake Mead Boulevard and the



on-ramp to northbound I-95. The pavement was generally in good condition with occasional cracks and utility excavation patches.

The alignment between Gazelle Drive and Vegas Drive consisted of a paved 2-lane street with no additional improvements on the western edge. The eastern edge along this section was fully developed with the exception of approximately 350 feet between the commercial development at Vegas Drive and the residential development at Escalon Drive. The pavement along this section was generally in fair to poor condition, especially the section with no improvements along either side.

The remaining portion of the alignment extending from Vegas Drive to Silverstream Avenue consisted of a 4-lane street with a center turn lane. Both sides were fully developed with curb, gutter and sidewalk, with the exception of approximately 625 feet along the eastern edge immediately south of Vegas Drive, which had curb and gutter only. The condition of the pavement was generally in good to fair condition with minor, intermittent areas of utility excavation patches, bleeding and cracking.

## **4.2 Subsurface**

### **4.2.1 Northern Segment**

As previously mentioned, the entire alignment was paved, with the exception of the portion between Centennial Parkway and Azure Drive. The asphalt pavement encountered in the explorations ranged in thickness from approximately 3 to 5 inches. Aggregate base course below the asphalt ranged in thickness from approximately 8 to 18 inches. Table 1A contains a summary of the thickness of asphalt and aggregate base encountered in the borings. Fill below the aggregate base course was encountered in 10 of the explorations and ranged in thickness from approximately ½ to 6½ feet and generally consisted of clayey sand, clayey gravel and sandy gravel.

Natural soils along the alignment generally consisted of loose to moderately hard clayey sand, silty sand, clayey gravel and silty gravel and firm to very stiff clayey silt, sandy silt, clay, silty clay, sandy clay and gravelly clay. Moderately hard to very hard caliche was encountered in 13 of the 19 borings. The caliche was first encountered at depths ranging from approximately 4½ to 18½ feet below existing alignment grades. The caliche layers ranged in thickness from approximately ½ to 5½ feet. The depth to caliche and thickness of the layers are also summarized in Table 1A.

Chemical test results indicate that the soils contain sufficient quantities of sodium sulfate to be susceptible to chemical expansion. Laboratory test results indicate the clay soils along the alignment have a low to critical expansion potential. Consolidation test results on the silty soils along the alignment indicate the soils are porous (hydro-collapsible) and become weaker and more compressible with an increase in moisture content. Groundwater was not encountered

within the depths explored. The boring logs (B-1 through B-19) and laboratory test results presented in Appendix A should be referred to for more detailed information.

| TABLE 1A. SUMMARY OF ASPHALT, BASE COURSE AND CALICHE CONDITIONS |                           |                                  |                       |                           |
|------------------------------------------------------------------|---------------------------|----------------------------------|-----------------------|---------------------------|
| Northern Segment                                                 |                           |                                  |                       |                           |
| Boring Number                                                    | Thickness of Asphalt (in) | Thickness of Aggregate Base (in) | Depth to Caliche (ft) | Thickness of Caliche (ft) |
| 1                                                                | N/A                       | N/A                              | NE                    | N/A                       |
| 2                                                                | N/A                       | N/A                              | NE                    | N/A                       |
| 3                                                                | N/A                       | N/A                              | NE                    | N/A                       |
| 4                                                                | 4 1/8                     | 12                               | 4 1/2                 | 1                         |
| 5                                                                | 3 7/8                     | 12                               | 16                    | 1/2                       |
| 6                                                                | 4                         | 13                               | NE                    | N/A                       |
| 7                                                                | 5                         | 18                               | NE                    | N/A                       |
| 8                                                                | 4 1/2                     | 13                               | 10                    | 1                         |
| 9                                                                | N/A                       | N/A                              | NE                    | N/A                       |
| 10                                                               | N/A                       | N/A                              | 17                    | 1 1/2                     |
| 11                                                               | 3                         | 9                                | 6                     | 5 1/2                     |
| 12                                                               | 4 1/2                     | 8                                | 17                    | 2                         |
| 13                                                               | 3 1/8                     | 12                               | 7                     | 1                         |
|                                                                  |                           |                                  | 10 1/2                | 1                         |
|                                                                  |                           |                                  | 18 1/2                | 1 1/2                     |
| 14                                                               | 3 1/2                     | 10                               | 8                     | 1/2                       |
|                                                                  |                           |                                  | 10                    | 1                         |
| 15                                                               | 4 1/4                     | 12                               | 12                    | 1/2                       |
|                                                                  |                           |                                  | 13                    | 2 1/2                     |
| 16                                                               | 4 3/8                     | 18                               | 11 1/2                | 4 1/2                     |
| 17                                                               | 3 1/4                     | 9                                | 14                    | 4                         |
|                                                                  |                           |                                  | 19 1/2                | 1/2                       |
| 18                                                               | 4 1/4                     | 12                               | 13                    | 4                         |
| 19                                                               | 4 3/8                     | 12                               | 13                    | 2                         |
|                                                                  |                           |                                  | 15                    | 1/2                       |

N/A = Not Applicable  
NE = Not Encountered

#### 4.2.2 Southern Segment

As previously mentioned, the entire alignment was paved. The asphalt pavement encountered in the explorations ranged in thickness from approximately 3 to 5½ inches in thickness. Aggregate base course below the asphalt ranged in thickness from approximately 6 to 13½ inches. Table 1B contains a summary of the thickness of asphalt and aggregate base encountered in the borings. Fill beyond the aggregate base course was encountered in 10 of the explorations and ranged in thickness from approximately ½ to 2 feet and generally consisted of clayey sand and sandy gravel.

Natural soils along the alignment generally consisted of stiff clayey silt and sandy silt and loose to moderately hard clayey sand, silty sand, gravelly sand, clayey gravel, silty gravel and sandy gravel. Moderately hard to very hard caliche was encountered in 12 of the 17 borings. The caliche was first encountered at depths ranging from approximately 4 to 19 feet below existing alignment grades. The caliche layers ranged in thickness from approximately 1 to 14 feet. The depth to caliche and thickness of the layers are also summarized in Table 1B. Groundwater was not encountered within the depths explored. The boring logs (B-20 through B-36) and laboratory test results presented in Appendix A should be referred to for more detailed information.

| TABLE 1B. SUMMARY OF ASPHALT, BASE COURSE AND CALICHE CONDITIONS |                           |                                  |                       |                           |
|------------------------------------------------------------------|---------------------------|----------------------------------|-----------------------|---------------------------|
| Southern Segment                                                 |                           |                                  |                       |                           |
| Boring Number                                                    | Thickness of Asphalt (in) | Thickness of Aggregate Base (in) | Depth to Caliche (ft) | Thickness of Caliche (ft) |
| 20                                                               | 4 ⅜                       | 8                                | 4 ½                   | 12                        |
| 21                                                               | 3 ⅜                       | 13 ½                             | 5 ½                   | 9 ½                       |
|                                                                  |                           |                                  | 16                    | 4                         |
| 22                                                               | 5                         | 6                                | 6                     | 1 ½                       |
|                                                                  |                           |                                  | 11 ½                  | 8 ½                       |
| 23                                                               | 4 ⅛                       | 12                               | 5                     | 5 ½                       |
|                                                                  |                           |                                  | 11 ½                  | 4 ½                       |
| 24                                                               | 5 ½                       | 12                               | 6                     | 4                         |
|                                                                  |                           |                                  | 11 ½                  | 2                         |
| 25                                                               | 5 ½                       | 13                               | NE                    | N/A                       |
| 26                                                               | 3                         | 13                               | NE                    | N/A                       |
| 27                                                               | 3                         | 12                               | NE                    | N/A                       |
| 28                                                               | N/A                       | N/A                              | NE                    | N/A                       |
| 29                                                               | N/A                       | N/A                              | NE                    | N/A                       |
| 30                                                               | 3 ½ *                     | N/A                              | 13 ½                  | 1                         |

| TABLE 1B. SUMMARY OF ASPHALT, BASE COURSE AND CALICHE CONDITIONS |                           |                                  |                       |                           |
|------------------------------------------------------------------|---------------------------|----------------------------------|-----------------------|---------------------------|
| Southern Segment                                                 |                           |                                  |                       |                           |
| Boring Number                                                    | Thickness of Asphalt (in) | Thickness of Aggregate Base (in) | Depth to Caliche (ft) | Thickness of Caliche (ft) |
|                                                                  |                           |                                  | 17 1/2                | 2 1/2                     |
| 31                                                               | 4                         | 8                                | 6                     | 12                        |
|                                                                  |                           |                                  | 19                    | 1                         |
| 32                                                               | 3 5/8                     | 10                               | 5                     | 3 1/2                     |
|                                                                  |                           |                                  | 15                    | 5                         |
| 33                                                               | 5 1/8                     | 7                                | 4                     | 6                         |
|                                                                  |                           |                                  | 12 1/2                | 6                         |
| 34                                                               | 4 3/4                     | 10                               | 4                     | 12 1/2                    |
| 35                                                               | 3                         | 12                               | 4                     | 14                        |
| 36                                                               | 3 1/2                     | 10 1/2                           | 4                     | 10                        |
|                                                                  |                           |                                  | 15                    | 5                         |

\* Measured on edge of roadway

N/A = Not Applicable

NE = Not Encountered

## 5.0 GEOLOGIC INFORMATION

### 5.1 General

The alignments are located in the north-central portion of the Las Vegas Valley. This location places the site in an area underlain by thick alluvial deposits (hundreds of feet).

The nearest mapped fissure zone is approximately 1 1/2 miles east of the southern end of the northern alignment (See Plate 3).<sup>1</sup> The cumulative evidence indicates that fissures are the result of a subsurface erosional process. The erosional process occurs in tensional fractures at or near the surface in uncemented, relatively fine-grained soils.

The nearest mapped compaction fault scarp is approximately 500 feet west of Rainbow Boulevard at Ann Road.<sup>1</sup> Compaction faults are generally accepted as a phenomena resulting from deep-seated differential consolidation of alluvial materials with dissimilar grain size and compressibility characteristics. The origin of compaction faults is uncertain. One theory indicates compaction faults are a phenomena resulting from deep-seated differential consolidation of alluvial materials,

<sup>1</sup> Bell, John W. and Jonathan G. Price, 1991, "Subsidence in Las Vegas Valley, 1980-91, Final Project Report", Nevada Bureau of Mines and Geology, Plate 2.

with dissimilar grain size and compressibility characteristics, due to prehistoric large scale reductions in groundwater levels. Another theory is that they may have originated from tectonic processes and are part of a valley wide fault system. It is also possible that a combination of these factors could have resulted in these features. However, no historic earthquakes have been attributed to any compaction fault in the Las Vegas Valley.<sup>2</sup>

The alignments are located within Zone 2B as defined by the Uniform Building Code (1997 edition) on Figure 16-2 entitled Seismic Zone Map of the United States. Numerous seismic events, most of which are a probable result of underground blasting at the Nevada Test Site (about 90 miles north of Las Vegas), have been felt in and around the Las Vegas area. There is a noticeable lack of earthquakes which have epicenters in the Southern Nevada area and are directly attributable to deep-seated tectonic movement. A few events recorded in the Henderson area and in Lincoln County registered between 5.0 and 6.0 Richter magnitude. Most of the recorded events in the area range between 4.0 and 4.9.

## 5.2 Subsidence

Land subsidence has occurred in portions of Las Vegas Valley because groundwater withdrawal has exceeded groundwater recharge. The subsidence is manifested by a large principal subsidence bowl, punctuated by three secondary bowls. The most active and deepest of the three secondary bowls is located in the north-central portion of the valley, and is the result of high capacity wells that are concentrated in this area. The northern alignment crosses the northwestern portion of this subsidence bowl,<sup>3</sup> (See Plate 4). Studies performed by several researchers and summarized by the Nevada Bureau of Mines and Geology estimate that a maximum of 3.0 feet of subsidence has occurred along the alignment.<sup>3</sup>

Based on available information regarding the location of high production wells, subsurface geologic information, and survey leveling data, ground movements due to subsidence within the Las Vegas Valley as well as the project alignment are expected to continue with ongoing depletion of the groundwater. Therefore, it is our opinion that the alignment will be subject to the potential effects of subsidence. Prediction of future subsidence along the project alignment is beyond the scope of this investigation. However, based on past subsidence in the area, subsidence should be moderate. It is our opinion that there is no practical way to design the storm drain or pavement to account for future subsidence.

---

<sup>2</sup> Slemmons, Burt, 1990 "Earthquakes in Las Vegas", Address to first meeting of Southwestern Section of Association of Engineering Geologists, Las Vegas, Nevada, October 1990.

<sup>3</sup> Bell, John W. and Jonathan G. Price, 1991, "Subsidence in Las Vegas Valley, 1980-91, Final Project Report", Nevada Bureau of Mines and Geology, Plate 4.

## **6.0 PAVEMENT EVALUATION**

### **6.1 INTRODUCTION**

Part of the scope of this project was to evaluate the existing pavement condition and structural capacity, and to provide recommendations concerning rehabilitation alternatives for the existing pavement. The project alignment was an urban arterial, which varied in width from two to four travel lanes at the time of our evaluation. The roadway was constructed of asphaltic concrete (AC) over a granular base course and untreated subgrade.

The structural capacity of the northern segment was evaluated from analyses of GPR data and load-deflection testing with a FWD. Stationing used in the nondestructive testing began with station 1+00 at Rancho Drive and increased north to Azure Drive for the northern segment and began with station 1+00 at Silverstream Avenue and increased north to Smoke Ranch Road for the southern segment. As previously mentioned, a subsurface exploration program was also conducted as part of the geotechnical exploration. Pavement and base thicknesses were determined from the boring locations along the project length (see Tables 1A and 1B). These values were used for calibrating the GPR data and identifying uniform pavement sections.

This section of the report discusses the testing methods applied to the existing pavement structure, describes the data analysis procedures used, presents the results of those analyses, and discusses our rehabilitation and new construction recommendations.

### **6.2 FIELD DATA COLLECTION**

#### **6.2.1 Visual Distress Survey**

A limited visual pavement condition survey was conducted by the field engineer during the nondestructive pavement evaluation to assess the surface conditions along the route segments. The survey was an abbreviated form of the Federal Highway Administration's Strategic Highway Research Program (SHRP) pavement condition survey. The visual distress survey included observation of distress types, severities, and extents for use in our analysis.

The pavement surface along the route segments was generally in good condition. The exceptions were the 2-lane portion extending between Ann Road and El Campo Grande in the northern segment (approximate stations 46+50 to 60+50), and the 2-lane section between Gazelle Drive and Vegas Drive (approximate stations 36+50 to 54+00) in the southern segment.



### 6.2.2 Ground Penetrating Radar Survey

The data obtained from the GPR survey allowed identification of the thickness of each layer of this multi-layer pavement system and provided a measure of the pavement system's uniformity along the length of the route segment. The GPR survey of each lane was conducted using a Pulse Radar 1.0 GHz, air-coupled radar system. The antenna/transceiver assembly contained a short-pulse transmitter and a sampler connected to the antenna. The system emitted and captured 50 pulses per second to obtain nearly continuous subsurface information to depths up to 24 inches. Since the pulse rate of the system was a constant, the spacing of individual data pulses was a direct function of the traveling speed during data acquisition. For this project, where the GPR data was used to develop a general overview of pavement thickness, GPR data was collected at, or near, posted speed limits in the outside wheel paths of each travel lane. A sample of the raw GPR data is included as Plate B-1 in Appendix B.

### 6.2.3 Nondestructive Deflection Testing

The deflection tests were performed using a Dynatest Model 8081 FWD meeting the requirements of ASTM D 4694. The FWD, an impulse loading device applied a load to the pavement simulating a moving wheel load and measures the pavement's response (deflection) due to the applied load. A test consisted of:

- lowering a circular steel loading plate and a bar holding a series of seven seismic deflection transducers, or surface deflection measurement devices, to the pavement surface;
- applying a load by raising and dropping a set of "falling weights" onto the load plate; and
- measuring and recording the impulse load and deflection response of the pavement at each sensor location.

The load magnitude and characteristics could be varied by changing the drop height, the number of weights or the load plate size. The load plate used for this project was 11.8 inches in diameter. Two tests targeted to produce nominal loads of approximately 9,000 pounds were performed at each test location. The deflection sensors were spaced at distances of 0, 8, 12, 18, 24, 36 and 60 inches from the center of the load plate. The seven measured deflections, and their distances from the applied load defined a deflection basin, from which the structural characteristics of the pavement section were evaluated.

As the tests were performed, the FWD operator observed and made a preliminary evaluation of the load and deflection data and recorded it on disk with the on-board computer. An electronic digital distance measuring device, which is accurate to the nearest 1.0 foot, recorded the distance of each test from the initial starting point (station 1+00). At each test location, an infrared sensing unit measured the temperature on the surface of the pavement which, at the

time of testing, ranged between 84°F and 111°F. Deflection tests were performed as described previously to provide approximately 100 foot centerline spacing.

## 6.3 STRUCTURAL EVALUATION

### 6.3.1 Identification of Uniform Sections

The analysis of a pavement's structural capacity must be accomplished for each individual "uniform" pavement section identified along the alignment. A uniform section is a contiguous section of pavement unit that is assumed to have the same cross-section, construction and maintenance history, traffic history, and approximate overall condition.

Since construction records were not available, the visual survey, GPR layer profiles and FWD deflection data were used to identify the uniform sections within the project. The visual survey and GPR thickness profiles provided a preliminary breakdown of the alignment into uniform sections, while the FWD data was used to finalize the uniform sections by using the impulse stiffness modulus (ISM). The ISM is calculated by dividing the load at each FWD test point by the deflection under the load plate and is expressed in units of pounds per mil. The ISM results were then subjected to a cumulative difference analysis, as described in Appendix J of the 1993 American Association of State Highway and Transportation Officials (AASHTO) Guide for the Design of Pavement Structures, to delineate uniform sections.

The GPR data indicated the presence of one AC layer above a base course of varying thickness throughout the project length. Plates B-2 and B-3 located in Appendix B, are plots of the layers along the alignment. Table 2 presents a summary of the uniform sections identified for the project and their average layer thicknesses.

| Table 2. Summary of Uniform Sections |                   |                 |                        |         |                        |         |
|--------------------------------------|-------------------|-----------------|------------------------|---------|------------------------|---------|
| Section                              | From Station (ft) | To Station (ft) | Mean AC Thickness (in) | COV (%) | Mean BC Thickness (in) | COV (%) |
| Northern Segment                     |                   |                 |                        |         |                        |         |
| SB1                                  | 68+50             | 82+50           | 2.5                    | 11.4    | 11.6                   | 12.8    |
| SB2                                  | 46+50             | 68+50           | 4.1                    | 4.0     | 12.3                   | 8.4     |
| SB3                                  | 38+50             | 46+50           | 4.0                    | 4.4     | 10.5                   | 11.1    |
| SB4                                  | 22+50             | 38+50           | 4.1                    | 10.9    | 11.3                   | 8.5     |
| SB5                                  | 1+00              | 22+50           | 4.2                    | 10.8    | 10.3                   | 12.2    |
| NB1                                  | 60+50             | 82+50           | 3.6                    | 17.9    | 11.5                   | 10.9    |
| NB2                                  | 37+50             | 46+50           | 3.3                    | 15.3    | 12.9                   | 9.3     |
| NB3                                  | 27+50             | 37+50           | 3.3                    | 16.0    | 12.5                   | 11.4    |
| NB4                                  | 24+50             | 27+50           | 3.4                    | 9.9     | 12.8                   | 5.2     |
| NB5                                  | 1+00              | 24+50           | 3.6                    | 12.4    | 12.3                   | 16.8    |

| Table 2. Summary of Uniform Sections |                   |                 |                        |         |                        |         |
|--------------------------------------|-------------------|-----------------|------------------------|---------|------------------------|---------|
| Section                              | From Station (ft) | To Station (ft) | Mean AC Thickness (in) | COV (%) | Mean BC Thickness (in) | COV (%) |
| Southern Segment                     |                   |                 |                        |         |                        |         |
| SBIL1                                | 1+00              | 28+00           | 4.9                    | 13.2    | 8.5                    | 28.0    |
| SBIL2                                | 28+00             | 52+00           | 3.8                    | 21.2    | 9.8                    | 24.7    |
| SBIL3                                | 52+00             | 64+00           | 4.2                    | 23.5    | 9.3                    | 21.2    |
| SBIL4                                | 64+00             | 90+50           | 5.0                    | 29.9    | 9.2                    | 16.1    |
| SBOL1                                | 1+00              | 28+00           | 4.8                    | 8.5     | 11.9                   | 4.5     |
| SBOL2                                | 28+00             | 52+00           | 4.7                    | 9.1     | 11.8                   | 3.1     |
| SBOL3                                | 52+00             | 64+00           | 4.8                    | 16.8    | 11.8                   | 7.9     |
| SBOL4                                | 64+00             | 82+00           | 5.2                    | 27.6    | 11.3                   | 9.8     |
| SBOL5                                | 82+00             | 90+50           | 4.9                    | 29.3    | 11.4                   | 3.1     |
| NBIL1                                | 1+00              | 11+00           | 3.9                    | 26.8    | 12.6                   | 8.7     |
| NBIL2                                | 11+00             | 38+00           | 3.3                    | 9.3     | 13.2                   | 4.9     |
| NBIL3                                | 38+00             | 77+00           | 4.6                    | 31.0    | 12.2                   | 12.9    |
| NBIL4                                | 77+00             | 90+50           | 4.3                    | 9.4     | 12.5                   | 8.0     |
| NBOL1                                | 1+00              | 11+00           | 3.5                    | 30.6    | 12.6                   | 6.6     |
| NBOL2                                | 11+00             | 38+00           | 3.9                    | 20.1    | 12.6                   | 7.4     |
| NBOL3                                | 38+00             | 77+00           | 4.2                    | 17.5    | 13.1                   | 7.9     |
| NBOL4                                | 77+00             | 90+50           | 4.6                    | 15.8    | 13.0                   | 5.1     |

Note: SB = Southbound NB = Northbound  
IL = Inside Lane OL = Outside Lane  
COV = Coefficient of Variation = standard deviation divided by the mean

### 6.3.2 Evaluation of Existing Pavement Structural Capacity

The structural capacity of the AC pavement sections was evaluated in terms of an effective structural number ( $SN_{eff}$ ) using the nondestructive deflection testing approach outlined in the 1993 AASHTO Guide. This method is based on the equivalent stiffness approach described in Appendix NN of the 1986 AASHTO Guide.  $SN_{eff}$  is calculated using the following equation:

$$SN_{eff} = 0.0045 \times D_{Total} \times \sqrt[3]{E_p}$$

Where:

- $SN_{eff}$  = Effective Structural Number
- $D_{Total}$  = Total pavement thickness above the subgrade (in)
- $E_p$  = Effective pavement modulus (psi)

The overall stiffness for the pavement structure ( $E_p$ ) is determined using deflection data. The theoretical relations used in this method were developed from elastic theory analyses of the AASHO (now known as AASHTO) road test data and the representative layer structural

coefficients developed at the AASHO road test. This procedure is completed for each FWD test location, then average values are determined for each uniform section. Table 3 contains the  $D_{Total}$ ,  $E_p$ , and  $SN_{eff}$  values for each uniform section.

| Table 3. Existing Pavement Structural Capacities |                 |                  |            |            |            |
|--------------------------------------------------|-----------------|------------------|------------|------------|------------|
| Section                                          | $D_{Total}$     | $E_p$            |            | $SN_{eff}$ |            |
|                                                  | Average<br>(in) | Average<br>(psi) | COV<br>(%) | Average    | COV<br>(%) |
| Northern Segment                                 |                 |                  |            |            |            |
| SB1                                              | 14.1            | 152,940          | 19.3       | 3.35       | 12.5       |
| SB2                                              | 16.4            | 108,817          | 17.9       | 3.51       | 6.6        |
| SB3                                              | 14.5            | 165,758          | 23.8       | 3.54       | 9.1        |
| SB4                                              | 15.4            | 123,284          | 24.2       | 3.43       | 10.1       |
| SB5                                              | 14.5            | 140,068          | 28.5       | 3.36       | 11.4       |
| NB1                                              | 15.1            | 164,099          | 39.5       | 3.65       | 14.7       |
| NB2                                              | 16.2            | 122,276          | 35.5       | 3.56       | 16.6       |
| NB3                                              | 15.8            | 107,167          | 78.6       | 3.26       | 26.3       |
| NB4                                              | 16.2            | 76,772           | 13.1       | 3.09       | 3.2        |
| NB5                                              | 15.9            | 162,407          | 59.9       | 3.74       | 19.9       |
| Southern Segment                                 |                 |                  |            |            |            |
| SBIL1                                            | 13.4            | 178,923          | 31.2       | 3.30       | 6.8        |
| SBIL2                                            | 13.6            | 187,121          | 36.2       | 3.41       | 13.9       |
| SBIL3                                            | 13.6            | 218,673          | 42.4       | 3.52       | 9.5        |
| SBIL4                                            | 14.2            | 270,622          | 27.8       | 4.14       | 27.1       |
| SBOL1                                            | 16.7            | 126,667          | 14.0       | 3.76       | 7.2        |
| SBOL2                                            | 16.5            | 183,116          | 22.2       | 4.19       | 9.9        |
| SBOL3                                            | 16.6            | 116,460          | 21.5       | 3.64       | 7.6        |
| SBOL4                                            | 16.5            | 193,080          | 23.8       | 4.27       | 10.7       |
| SBOL5                                            | 16.3            | 150,518          | 43.6       | 3.85       | 20.7       |
| NBIL1                                            | 16.5            | 119,360          | 28.5       | 3.62       | 9.7        |
| NBIL2                                            | 16.5            | 167,554          | 25.4       | 4.05       | 10.7       |
| NBIL3                                            | 16.8            | 177,583          | 57.0       | 4.09       | 21.7       |
| NBIL4                                            | 16.8            | 170,162          | 16.5       | 4.15       | 2.8        |
| NBOL1                                            | 16.1            | 114,886          | 41.0       | 3.48       | 24.2       |
| NBOL2                                            | 16.5            | 187,071          | 23.2       | 4.18       | 7.2        |
| NBOL3                                            | 17.3            | 170,495          | 22.6       | 4.28       | 9.8        |
| NBOL4                                            | 17.6            | 103,524          | 25.8       | 3.67       | 10.5       |

## 6.4 REHABILITATION OF AC PAVEMENT USING AC OVERLAYS

### 6.4.1 Projection Of Design Traffic Volumes

As mentioned previously, traffic data for the project was provided by the City of Las Vegas. The maximum ADT for the respective northern or southern segment was used in our design, with the percent mix and ESAL factors shown in Table 4.

| Table 4. Percent Trucks<br>And ESAL Factors |                |            |
|---------------------------------------------|----------------|------------|
| Vehicle Type                                | ESAL<br>Factor | Mix<br>(%) |
| PASSENGER<br>CAR                            | 0.0004         | 94.1       |
| BUS                                         | 0.722          | 0.4897     |
| SINGLE UNIT                                 |                |            |
| 2-AXLE, 6 TIRE                              | 0.253          | 3.363      |
| 3-AXLE OR<br>MORE                           | 1.044          | 0.1121     |
| SINGLE<br>TRAILER                           |                |            |
| 4-AXLE OR<br>LESS                           | 1.285          | 1.3039     |
| 5-AXLE                                      | 2.426          | 0.1003     |
| 6-AXLE OR<br>MORE                           | 1.766          | 0.2537     |
| MULTI<br>TRAILER                            |                |            |
| 5-AXLE OR<br>LESS                           | 2.080          | 0.0826     |
| 6-AXLE                                      | 0.815          | 0.0295     |
| 7-AXLE OR<br>MORE                           | 2.693          | 0.1711     |
| TOTALS                                      | ----           | 100        |

Utilizing the above ADT information and NDOT conversion factors for the given truck types, the design 18-kip equivalent single axle loads (ESALs) in the design lane for the project alignment was computed. The computed 20 year total and design ESALs are presented in Table 5.

| Table 5. Total and Design ESALs |            |                             |                          |              |               |
|---------------------------------|------------|-----------------------------|--------------------------|--------------|---------------|
| Segment                         | Total ESAL | No. of Lanes Each Direction | % Traffic In Design Lane | Design ESALs | Traffic Index |
| Northern                        | 4,111,000  | 2                           | 90                       | 3,700,000    | 10.5          |
| Southern                        | 7,303,269  | 2                           | 90                       | 6,572,942    | 11.3          |

#### 6.4.2 Evaluation of Design Roadbed Soil Resilient Modulus

The AASHTO design procedure for rehabilitation using AC overlays requires the evaluation of a design roadbed soil resilient modulus ( $M_r$ ) for each uniform section. Field roadbed soil  $M_r$  values for each FWD test location were calculated from the deflection data using procedures outlined in the 1993 AASHTO Guide. Next, the field  $M_r$  results must be converted to an equivalent laboratory measured value, because the design procedure is based on lab-measured moduli. Using guidance found in the September 1997 FHWA pamphlet RD-97-083, a C-value of 0.35 was applied to each back-calculated  $M_r$  to determine the corrected resilient modulus,  $M_{r,corr}$ .

Finally,  $M_{r,corr}$  is seasonally adjusted using the relative damage approach described in the 1993 AASHTO Guide. This procedure allocates a seasonal modulus, based on the calculated modulus, for a specific number of months in each season. This project is located in US Climatic Region 5 with 1.0 month of winter (roadbed frozen), 0.5 month of spring melt (roadbed saturated), 3.0 months of spring/fall (roadbed wet), and 7.5 months of summer (roadbed dry). The resulting design  $M_r$ , determined at each FWD test location, is averaged to determine the Design  $M_r$  for each uniform section. Table 6 summarizes the average calculated Field  $M_r$  values and Design  $M_r$  values for each uniform section. Profiles of the calculated Design  $M_r$  values for the entire project length are presented as Plates B-4 and B-5 in Appendix B.

| Table 6. Resilient Modulus Results |               |         |               |         |
|------------------------------------|---------------|---------|---------------|---------|
| Section                            | Field $M_r$   |         | Design $M_r$  |         |
|                                    | Average (psi) | COV (%) | Average (psi) | COV (%) |
| Northern Segment                   |               |         |               |         |
| SB1                                | 44,481        | 29.7    | 9,371         | 29.2    |
| SB2                                | 35,622        | 27.7    | 7,530         | 27.5    |
| SB3                                | 42,578        | 22.3    | 8,984         | 22.1    |
| SB4                                | 33,856        | 23.4    | 7,161         | 23.2    |
| SB5                                | 35,034        | 24.8    | 7,407         | 24.6    |
| NB1                                | 46,485        | 25.6    | 9,790         | 25.2    |
| NB2                                | 38,706        | 18.5    | 8,179         | 18.4    |
| NB3                                | 29,598        | 29.2    | 6,285         | 28.5    |
| NB4                                | 34,807        | 7.2     | 7,366         | 7.1     |
| NB5                                | 31,952        | 34.4    | 6,758         | 34.0    |



| Table 6. Resilient Modulus Results |                  |            |                  |            |
|------------------------------------|------------------|------------|------------------|------------|
| Section                            | Field $M_r$      |            | Design $M_r$     |            |
|                                    | Average<br>(psi) | COV<br>(%) | Average<br>(psi) | COV<br>(%) |
| Southern Segment                   |                  |            |                  |            |
| SBIL1                              | 54,038           | 23.4       | 11,345           | 22.8       |
| SBIL2                              | 65,093           | 26.0       | 13,574           | 25.1       |
| SBIL3                              | 49,436           | 15.7       | 10,410           | 15.4       |
| SBIL4                              | 62,974           | 35.0       | 13,115           | 33.5       |
| SBOL1                              | 49,870           | 21.9       | 10,491           | 21.4       |
| SBOL2                              | 56,871           | 39.4       | 11,896           | 38.9       |
| SBOL3                              | 45,097           | 25.9       | 9,506            | 25.6       |
| SBOL4                              | 42,121           | 21.4       | 8,889            | 21.0       |
| SBOL5                              | 36,091           | 31.6       | 7,627            | 31.4       |
| NBIL1                              | 46,819           | 35.2       | 9,847            | 34.5       |
| NBIL2                              | 89,769           | 34.8       | 18,260           | 31.9       |
| NBIL3                              | 61,950           | 32.8       | 12,911           | 31.2       |
| NBIL4                              | 69,486           | 8.7        | 14,500           | 8.4        |
| NBOL1                              | 43,234           | 32.9       | 9,112            | 32.6       |
| NBOL2                              | 101,966          | 37.8       | 20,404           | 33.8       |
| NBOL3                              | 48,923           | 22.2       | 10,297           | 21.9       |
| NBOL4                              | 36,187           | 23.8       | 7,650            | 23.6       |

#### 6.4.3 Determination of Required Structural Number

In addition to the projected traffic and Design  $M_r$ , four other design parameters were needed for the determination of a required structural number ( $SN_r$ ) for each uniform section. A reliability level ( $R$ ) of 90 percent, an overall standard deviation ( $D$ ) of 0.49, an initial serviceability index ( $P_i$ ) of 4.2, and a terminal serviceability index ( $P_t$ ) of 2.2 were selected for this project. A 90 percent reliability is reasonable for the traffic conditions present and the arterial classification of the alignment. The 0.49 standard deviation is generally recommended for AC overlay pavement designs, and the initial and terminal serviceability levels are recommended by AASHTO to provide some remaining structural life when the design traffic has been accumulated.

#### 6.4.4 Determination of AC Overlay Thickness

Thicknesses of AC overlays required to support anticipated traffic levels for each uniform section were computed from the following equation.

$$D_{ol} = \frac{SN_f - SN_{eff}}{a_{ol} m_{ol}} = \frac{SN_f - [0.0045(D_{total} - D_{mill}) \sqrt{E_p}]}{a_{ol} m_{ol}}$$

Where:

- $D_{ol}$  = required AC overlay thickness (in)
- $D_{total}$  = existing pavement thickness (in)
- $D_{mill}$  = depth of AC removed by milling (in)
- $a_{ol}$  = layer coefficient for the AC overlay
- $m_{ol}$  = drainage coefficient for AC overlay

If the  $SN_f$  is less than or equal to the  $SN_{eff}$ , the pavement system is adequate to support the anticipated traffic volumes. If  $SN_f$  is greater than  $SN_{eff}$ , additional AC thickness and surface repairs are required to support the anticipated traffic volumes. An  $a_{ol}$  value of 0.35, an  $m_{ol}$  value of 1.0 and a  $D_{mill}$  of 1.5 inches were used to calculate the minimum required AC overlay thicknesses shown in Table 7.

| Table 7. Minimum Required AC Overlay Thicknesses |                |                    |                       |
|--------------------------------------------------|----------------|--------------------|-----------------------|
| Section                                          | Average $SN_f$ | Average $SN_{eff}$ | Minimum $D_{ol}$ (in) |
| Northern Segment                                 |                |                    |                       |
| SB1                                              | 4.54           | 3.35               | 3.4                   |
| SB2                                              | 4.87           | 3.51               | 3.9                   |
| SB3                                              | 4.59           | 3.54               | 3.0                   |
| SB4                                              | 4.94           | 3.43               | 4.3                   |
| SB5                                              | 4.89           | 3.36               | 4.4                   |
| NB1                                              | 4.47           | 3.65               | 2.3                   |
| NB2                                              | 4.72           | 3.56               | 3.3                   |
| NB3                                              | 5.17           | 3.26               | 5.5                   |
| NB4                                              | 4.85           | 3.09               | 5.0                   |
| NB5                                              | 5.08           | 3.74               | 3.8                   |
| Southern Segment                                 |                |                    |                       |
| SBIL1                                            | 3.93           | 3.30               | 1.8                   |
| SBIL2                                            | 3.70           | 3.41               | 0.8                   |
| SBIL3                                            | 4.02           | 3.52               | 1.4                   |
| SBIL4                                            | 3.77           | 4.14               | -1.1                  |
| SBOL1                                            | 4.02           | 3.76               | 0.7                   |
| SBOL2                                            | 3.96           | 4.19               | -0.7                  |
| SBOL3                                            | 4.18           | 3.64               | 1.6                   |
| SBOL4                                            | 4.25           | 4.27               | -0.1                  |
| SBOL5                                            | 4.52           | 3.85               | 1.9                   |
| NBIL1                                            | 4.16           | 3.62               | 1.5                   |
| NBIL2                                            | 3.36           | 4.05               | -2.0                  |
| NBIL3                                            | 3.78           | 4.09               | -0.9                  |
| NBIL4                                            | 3.57           | 4.15               | -1.7                  |
| NBOL1                                            | 4.27           | 3.48               | 2.3                   |
| NBOL2                                            | 3.24           | 4.18               | -2.7                  |

| Table 7. Minimum Required AC Overlay Thicknesses |                            |                              |                                 |
|--------------------------------------------------|----------------------------|------------------------------|---------------------------------|
| Section                                          | Average<br>SN <sub>f</sub> | Average<br>SN <sub>eff</sub> | Minimum D <sub>01</sub><br>(in) |
| NBOL3                                            | 4.06                       | 4.28                         | -0.6                            |
| NBOL4                                            | 4.49                       | 3.67                         | 2.4                             |

## 6.5 PAVEMENT RECOMMENDATIONS

### 6.5.1 General

The analyses and recommendations presented in this report are based upon the data obtained from the limited visual condition survey, GPR and deflection testing, subsurface explorations and other information discussed in this report.

The pavement area subgrade should be properly prepared as outlined in the Earthwork section of this report before placing any asphalt or base materials. Proper drainage of the paved areas should be provided to increase the pavement life. In addition, pavements must be maintained for durability and integrity during their life. Therefore, periodic seal coating, crack sealing, and/or patching may be required.

Asphalt and base course materials and compaction should meet the criteria set forth in the Uniform Standard Specifications for Public Works' Construction, Off-Site Improvements, Clark County Area, Nevada. Field and laboratory testing of asphalt and base materials should be performed to determine whether specified requirements have been met.

In areas where poor utility cut patches and joints between differing ages of asphalt exist, we recommend these areas be cutout and properly repaired before the overlay is applied. These areas are intermittent throughout the alignment.

As previously discussed, the alignment crosses a subsidence bowl. Movement across this feature cannot be prevented or predicted. It should be understood that future movement may cause the pavement to crack.

### 6.5.2 Overlay of Northern Segment

It is typically most economical to rehabilitate a pavement using AC overlays due to their reduced cost of materials, their relative speed of construction, and their limited disruption of traffic. A 1 to 2 inch deep milling of the AC surface can help to retard reflection cracking through

the new AC surface, improve the bond between the old and new AC surfaces, and can be desirable when trying to match existing gutter elevations.

Table 8 summarizes the recommended AC overlay thicknesses for the northern segment between Rancho Road and Azure Drive. The recommended overlay between stations 0+00 and 46+00 will result in a net increase of approximately 3½ inches in final grade from existing grade. The net increase in final grade between stations 60+00 to 82+00 will be approximately 2 inches. If the increase between existing grade and final grade is not acceptable, then reconstruction will be required. The alignment between stations 46+00 and 60+00 is temporary pavement and was not evaluated for an overlay. This section should be reconstructed.

| Table 8. Summary of Overlay Recommendations<br>Northern Segment |                 |                            |                 |                        |
|-----------------------------------------------------------------|-----------------|----------------------------|-----------------|------------------------|
| From Station (ft)                                               | To Station (ft) | Existing AC Thickness (in) | Mill Depth (in) | Overlay Thickness (in) |
| 0+00                                                            | 46+00           | 3.7                        | 1.5             | 5.0                    |
| 46+00                                                           | 60+00           | Reconstruct                |                 |                        |
| 60+00                                                           | 82+00           | 3.5                        | 1.5             | 3.5                    |

### 6.5.3 Overlay of Southern Segment

Because this segment requires only small structural increases, we recommend a mill and overlay rehabilitation. After milling, but prior to paving, any localized failures, alligator cracking, or deteriorated patches should be repaired with full depth patching consisting of an AC patch to match the milled pavement cross-section. Reflection crack control measures such as crack filling and synthetic fabrics should also be considered to retard the development of future cracks in the pavement surface. Overlay thicknesses should be the same for all lanes of a section to ensure a matching, uniform grade across the entire pavement width. Wedge milling may be required to meet existing curb profiles and utility protrusions through the pavement (manholes, shut off valves, etc.) which are surrounded by Portland cement concrete (PCC) collars. Longitudinal tapering of the overlays may also be required to obtain smooth transitions to and from cross streets if they are not overlaid.

Table 9 summarizes the recommended AC overlay thicknesses for the southern segment between Silverstream Avenue and Smoke Ranch Road. These recommendations represent the controlling lane's required AC overlay thickness from Table 7 rounded to the nearest 0.5 inch and increased by the mill depth. The overlay thicknesses may need to be increased to meet local standards for minimum thicknesses of AC overlays based on the mix design.

| Table 9. Summary of Overlay Recommendations<br>Southern Segment |                       |                                  |                       |                              |
|-----------------------------------------------------------------|-----------------------|----------------------------------|-----------------------|------------------------------|
| From<br>Station<br>(ft)                                         | To<br>Station<br>(ft) | Existing AC<br>Thickness<br>(in) | Rehabilitation        |                              |
|                                                                 |                       |                                  | Mill<br>Depth<br>(in) | Overlay<br>Thickness<br>(in) |
| 1+00                                                            | 28+00                 | 4.3                              | 1.5                   | 4.0                          |
| 28+00                                                           | 82+00                 | 4.4                              | 1.5                   | 3.0                          |
| 82+00                                                           | 90+50                 | 4.7                              | 1.5                   | 4.0                          |

#### 6.5.4 New Pavement Sections

##### 6.5.4.1 General

The recommendations for construction of new pavement sections are presented for those portions of the alignment where the existing pavement will be replaced or the existing alignment widened. New pavement sections were designed in accordance with guidelines presented in the 1993 AASHTO Guide for Design of Pavement Structures.

R-values were determined for selected samples taken from the explorations along the alignment. The R-values were correlated to resilient modulus ( $M_r$ ) values. The design  $M_r$  values, determined from R-value test results, are presented in Table 10 for the different street segments.

The  $SN_r$  for each street segment was determined in accordance with AASHTO procedures. The design parameters used for new construction were identical to those used in the rehabilitation design, with two exceptions. The standard deviation was decreased from 0.49 to 0.45 to give credit for the new construction, and the terminal service index was increased from 2.2 to 2.5. Eighty percent of the total ESAL's was used in the design to account for multiple traffic lanes.

##### 6.5.4.2 Northern Segment

Based upon our exploration, assessment of the existing pavement and the projected traffic along the northern segment, we recommend complete reconstruction of the pavement between Ann Road and north of El Campo Grande (approximate stations 46+00 to 60+00) in conjunction with the new construction between Centennial Parkway and Azure Drive. Additional reconstruction is dependent upon the acceptance of final grades after the placement of an overlay. Table 10 contains the recommended pavement sections for the northern segment of the alignment. The design resilient modulus was determined from our laboratory testing.

| Table 10. Recommended Layer Thicknesses for New Construction<br>Northern Segment |                                         |                 |                                 |                                            |
|----------------------------------------------------------------------------------|-----------------------------------------|-----------------|---------------------------------|--------------------------------------------|
| Street Segment                                                                   | Design<br>Resilient<br>Modulus<br>(psi) | SN <sub>r</sub> | AC Surface<br>Thickness<br>(in) | Type II Base<br>Layer<br>Thickness<br>(in) |
| 0+00 to 53+00                                                                    | 8050                                    | 4.26            | 6.0                             | 18                                         |
| 53+00 to 93+00                                                                   | 5740                                    | 4.74            | 6.0                             | 22                                         |

#### 6.5.4.3 Southern Segment

Based upon our assessment of the existing pavement, subsurface exploration and visual assessment, we recommend complete reconstruction of only one section of the southern segment. That portion consisting of 2-lanes between approximate stations 37+00 and 53+00, is recommended to be reconstructed. All other sections of the southern segment of the alignment could be overlaid. Table 11 contains the recommended minimum section for the portion to be reconstructed, as well as all portions to be widened or otherwise elected to be reconstructed rather than receive an overlay.

| Table 11. Recommended Layer Thicknesses for New Construction – Southern Segment |                 |                                 |                                            |
|---------------------------------------------------------------------------------|-----------------|---------------------------------|--------------------------------------------|
| Design<br>Resilient<br>Modulus<br>(psi)                                         | SN <sub>r</sub> | AC Surface<br>Thickness<br>(in) | Type II Base<br>Layer<br>Thickness<br>(in) |
| 18,765                                                                          | 3.42            | 6                               | 11                                         |

## 7.0 RECOMMENDATIONS

### 7.1 General

Our recommendations are based on the assumption that the soil conditions are similar to those disclosed by the explorations. If variations are noted during construction or if changes are made in alignment plan, we should be notified so we can supplement our recommendations, as applicable.

As previously indicated, the on-site soils along the northern segment are porous (hydro-collapsible) and become considerably weaker and more compressible with increased moisture content. The porous soils are not suitable for support of paving in their present state. The natural



soils within 2 feet of the subgrade or of existing grade, whichever is lower, should be overexcavated and recompacted. In addition, the clay soils along the northern segment of the alignment ranged from having a low to critical expansion potential. The highly to critically expansive clays have the potential to undergo relatively large movements due to increases in moisture contents. However, it appeared the highly to critically expansive soils were generally encountered at depth. The clay soils should be tested during grading, and any clay soils with an expansion potential of 10% or greater should be overexcavated and replaced with approved imported soils.

Projected invert depths (approximately 10 feet below existing grade) along the alignment between Tropical Parkway and Rancho Santa Fe had loose and firm soils, and caliche. Where loose and firm soils are encountered at the invert depth, these soils should be overexcavated and recompacted within 2½ feet below the invert depth.

As indicated, there was some fill along the northern and southern segments of the alignment. This fill would be considered uncontrolled fill unless observation and testing was performed during placement. In pavement reconstruction areas. All uncontrolled fill should be removed and replaced with properly compacted fill. The uncontrolled fill soils can be re-used for controlled fill provided all oversize material, unsuitable material (as determined by the geotechnical engineer), vegetation and debris is removed.

## 7.2 Soil Profile Type

The soil profile type was determined using the generalized soil characteristic given in Table 16-J of the 1997 Uniform Building Code. Based on our knowledge of the alignment, the soil profile type is S<sub>D</sub> for the northern segment and S<sub>C</sub> for the southern segment.

## 7.3 Soil Design Parameters

If grading recommendations presented in the Earthwork section of this report are complied with, any proposed storm drain (box culverts) may be established on 6 inches of compacted Type II aggregate supported on at least medium dense or stiff native soils properly compacted fill and/or caliche. If practical, portions of the storm drain should not be partially supported on caliche and partially on properly compacted fill and/or natural soils. A net dead- plus live-load bearing pressure of 4000 pounds per square foot may be used for design of the culvert.

Any proposed foundations for street lights, retaining walls, screen walls, utility vaults, etc., may be supported by conventional foundations established on at least medium dense or stiff native soils, properly compacted fill and/or caliche. Foundations should be at least 12 inches wide and should be established at least 18 inches below the lowest adjacent final compacted subgrade. Foundations established as recommended, may be designed to impose a net dead- plus live-load

pressure of 1500 pounds per square foot (psf). The bearing value may be increased by 500 psf for each additional 12 inches of embedment. However, the maximum net bearing value should not exceed 3000 psf. A one-third increase may be used for wind or seismic loads.

The following soil design parameters may be used, where applicable, for design of the proposed storm drain and utility lines:

- Coefficient of Friction (between pipe and fill).....0.40<sup>(1)</sup>
- Modulus of Soil Reaction (E') (native granular soil) ..... 2000 psi<sup>(2)</sup>  
 Modulus of Soil Reaction (E') (native fine-grained soils) ..... 1000 psi<sup>(2)</sup>  
 Modulus of Soil Reaction (E') (Type II) ..... 1500 psi<sup>(2)</sup>
- Modulus of Subgrade Reaction (k) (native soil)..... 125 pci  
 Modulus of Subgrade Reaction (k) (6 in. Type II)..... 150 pci
- Unit Weight of Compacted fill ..... 125 to 135 psf

<sup>1</sup>Assumes granular backfill

<sup>2</sup>Bureau of Reclamation E' for Iowa Formula

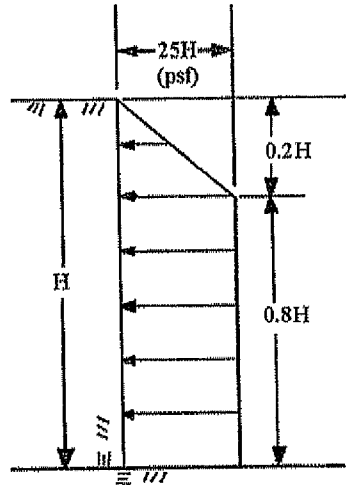
For soils, with level backfill and no surcharge loads, we recommend the following equivalent fluid pressures and coefficient of friction.

- Active..... 35 pcf
- Passive ..... 250 pcf
- At-Rest..... 50 pcf
- Coefficient of Friction (northern segment) ..... 0.30
- Coefficient of Friction (southern segment) ..... 0.40

Notes:

1. Active pressure assumes unrestrained (cantilever) wall and assumes no loading from heavy compaction equipment.
2. Passive pressure should not exceed a maximum of 3000 psf for the northern segment and 4000 for the southern segment. A one-third increase may be used for wind or seismic loads.
3. The passive pressure and the frictional resistance of the soils may be combined without reduction in determining the total lateral resistance.

Where the design includes restrained (braced) walls, with level backfill and no surcharge loads, we recommend the wall be designed to resist an earth pressure with the distribution shown below:



Any surcharge from adjacent loadings should be added to the above pressures using a factor of 0.30. Surcharge loads would include any loading that falls within a zone measured from the back of the wall that is equal to the height of the wall. As indicated, the aforementioned pressures assume that there will be no build-up of hydrostatic pressure. Therefore, if walls will be subject to saturated conditions, we recommend that weep holes (if practical) or a wall drainage system be provided, and that the structural fill behind retaining walls be granular and free draining. All walls, below grade, should be waterproofed or at least dampproofed.

Fill against foundations, grade beams and retaining walls should be properly placed and compacted. Backfill should be mechanically compacted in layers (6 to 8 inches maximum thickness); flooding should not be permitted. Backfill, within 3 feet behind the walls, should be compacted to at least 90 percent of the maximum dry density obtainable by the ASTM D1557 method. Care should be taken when placing backfill so as not to damage the walls. Compaction of each lift adjacent to walls should be accomplished with hand-operated tampers or other lightweight compactors. Overcompaction may cause excessive lateral earth pressures which could result in wall movements.

## 7.4 Earthwork

### 7.4.1 Alignment Clearing

- Strip and remove existing vegetation, debris, uncontrolled fill, all existing pavement in areas to be reconstructed, all loose or disturbed natural soils, and other deleterious materials from the

project right-of-way. Uncontrolled fill is defined as any existing fill that was not properly placed, observed and tested.

- All exposed surfaces should be free of mounds and depressions which could prevent uniform compaction.
- If unexpected fills or underground facilities are encountered during alignment clearing, such features should be removed and the excavation thoroughly cleaned and backfilled. All excavations should be observed by the geotechnical engineer prior to backfill placement.

#### **7.4.2 Excavation**

- It is anticipated that excavation of the on-site natural non-cemented deposits for the proposed project can be accomplished with conventional earthmoving equipment.
- Excavations penetrating moderately hard or relatively thin (less than one foot) hard layers of caliche should be able to be excavated using heavy-duty equipment.
- Excavations penetrating hard or very hard caliche will require special consideration where they are to be performed.
- Contractors, especially those digging utilities, should satisfy themselves as to the hardness of materials and equipment required.
- Underpinning may be required to protect adjacent structures, such as manholes, vaults or utility lines, if excavations will be deeper than existing improvements.
- Trenching and shoring operations should be conducted in accordance with Section 10 Nos. 1926.650 through 1926.652 of the State of Nevada Occupational Safety and Health Standards for the Construction Industry (with amendments as of August, 1991) and in accordance with 29 CFR Part 1926, Occupational Safety and Health Standards - Excavations; Final Rule (October 31, 1989). Safety of construction personnel is the responsibility of the contractor.

#### **7.4.3 Overexcavation**

- The soils along the northern segment are porous and become considerably weaker and more compressible with increased moisture content. These soils are not suitable for support of paving in their present state. To provide improved support for miscellaneous foundations and paving, it will be necessary to overexcavate and recompact the 2 feet of native soils below existing grade or final subgrade, whichever is lower.

- The on-site clay soils are low to critically expansive. The highly to critically expansive soils are not suitable for support of miscellaneous foundations or paving. To provide improved support for miscellaneous foundations or paving, it will be necessary to test these soils during grading and overexcavate and replace all soils with an expansion potential greater than 10% within 2 feet of final subgrade.

#### 7.4.4 Fill Materials

- On-site soils, minus any debris, oversized material (greater than 3 inches) or organic matter, may be used in required fills. However, highly and critically expansive soils should not be used as fill.
- Imported soils should conform to the following:

- | <u>Gradation (ASTM C136):</u> | <u>Percent Finer by Weight:</u> |
|-------------------------------|---------------------------------|
| 6" .....                      | 100                             |
| 3" .....                      | 70-100                          |
| No. 4 Sieve .....             | 50-100                          |
| No. 200 Sieve .....           | 30 (max)                        |
- Northern Segment
  - Maximum Sulfate Content (%).....0.20
  - Minimum R-value.....30
  - Liquid Limit .....30
  - Plasticity Index.....15
  - Expansion Potential (% w/60 psf surcharge)..... <10%
- Southern Segment
  - Maximum Sulfate Content (%).....0.10
  - Minimum R-value.....60
  - Liquid Limit .....Non-plastic
  - Plasticity Index.....Non-expansive

- Select free draining granular materials should be used as backfill behind retaining walls.

#### 7.4.5 Fill Placement and Compaction

- After performing required excavations, the exposed soils should be carefully observed to verify removal of all unsuitable deposits. Exposed soils should then be scarified to a depth of 6

inches (not necessary if caliche exposed), watered as necessary, and compacted as recommended.

- Fill materials should be placed on a horizontal plane unless otherwise accepted by the geotechnical engineer.
- All required fill should be placed in loose lifts not over 8 inches in thickness.
- Materials should be compacted to the following:

| MATERIAL       | PERCENT DENSITY (ASTM D1557) | MOISTURE CONTENT                  |
|----------------|------------------------------|-----------------------------------|
| Fine – grained | 90 minimum                   | +2 percent over optimum (minimum) |
| Granular       | 95 minimum                   | -2 percent of optimum (minimum)   |

Note: For the purpose of compaction, fine-grained soils are soils with at least 30 percent passing the No. 200 sieve and/or soils having an expansion greater than 4 percent.

All fill placed deeper than 5 feet below final grade should be compacted to a minimum of 95 percent.

- Clay soils should not be allowed to dry out and crack. Any dried or cracked soils could be wetted until they reach acceptable moisture contents or they could be excavated and replaced with acceptable properly compacted fill.

#### 7.4.6 Material Volume Changes

- Clearing and grubbing operations will result in some loss of material. Excavation and recompaction of the on-site soils will result in shrinkage losses.
- Based on our experience in the area, a shrinkage factor of approximately 15 to 25 percent would be applicable for the upper natural soils when excavated and recompacted along the northern segment of the alignment and approximately 10 to 20 percent would be applicable to the southern segment. As an example, a shrinkage factor of 10 percent would mean it would require 1.10 cubic yards of excavated material to equal 1.0 cubic yard of properly compacted fill.
- Caliche may have some bulkage where it is excavated and recompacted.



- Scarification and compaction of surface soils will cause additional shrinkage. We estimate that this shrinkage will be on the order of 0.1 foot lowering in site grade.

## **7.5 Utility Trenches**

### **7.5.1 Subgrade, Pipe Bedding and Pipe Zone**

Medium dense to moderately hard, and stiff to very stiff natural soils, and caliche will provide good support for any proposed utility lines. However, overexcavation will be required if oversized material (greater than 6 inches in size) is encountered at invert elevations, and where soft, firm or loose soils are encountered at invert elevations. Overexcavation, if required, should extend to competent acceptable material or to a depth of approximately 2½ feet below invert depth, whichever occurs first. The overexcavation should be backfilled with fill as recommended in this report.

Six inches of Type II aggregate base or sand should be placed directly below the pipes to provide uniform support. Any fill placed beneath pipes and within the pipe zone of utility lines should be compacted to at least 90 percent of the maximum density obtainable by the ASTM D1557 laboratory method of compaction.

### **7.5.2 Trench Backfill**

Trench backfill may consist of "Selected Backfill", "Granular Backfill" or "Type II" (Uniform Standard Specifications for Clark County, Nevada - Sections 207 and 204). The soils along the northern segment of the alignment will not meet the aforementioned requirements for "Selected Backfill" however, most of the soils along the southern segment of the alignment will meet the requirements. Imported material should meet the requirements for "Selected Backfill" and should be compatible with the native soils along the alignment.

Backfill materials compacted by mechanical means should be placed in loose lifts not over 8 inches in thickness and compacted to at least 90 percent of the maximum density obtainable by the ASTM D1557 method of compaction. Moisture content at the time of compaction should be at or near optimum. Ponding and jetting are not an acceptable means of compaction. The upper 24 inches of backfill (below street subgrade) should consist of slurry cement backfill or Type II aggregate base, compacted to at least 95%.

Precautions should be taken during backfilling to avoid damage to utilities. Field and laboratory testing of backfill material should be performed to determine whether applicable requirements have been met.

## **7.6 Drainage and Moisture Protection**

Foundation soils should not be allowed to become saturated during or after construction. Infiltration of water into subgrade or utility excavations should be prevented during construction. Utility lines should be properly installed and the backfill properly compacted to avoid possible sources for subsurface saturation.

## **7.7 Corrosivity**

Based on test results and Table 19-A-4 of the 1997 UBC, the on-site soils along the northern segment classify as having a severe sulfate exposure. The on-site soils along the southern segment of the alignment classify as having a negligible sulfate exposure. We recommend that Type V cement or equivalent sulfate resistant cement be used in all concrete. Consideration should be given to providing protection to buried metal pipes or use of nonmetallic pipe where permitted by local building codes.

## **8.0 OTHER SERVICES**

It is recommended that Terracon be retained to provide a general review of final design plans and specifications in order that grading and foundation recommendations may be interpreted and implemented. In the event that any changes of the proposed project are planned, the conclusions and recommendations contained in this report should be reviewed and the report modified or supplemented as necessary.

Terracon should also be retained to provide services during excavation, grading, paving and construction phases of work. Observation of excavations should be performed prior to placement of fill to confirm that satisfactory materials are present. Field and laboratory testing of concrete, asphalt and soils should be performed to determine whether applicable requirements have been met.

The analyses and recommendations in this report are based in part upon data obtained from the field exploration. The nature and extent of variations beyond the locations of the explorations may not become evident until construction. If variations then appear evident, it may be necessary to re-evaluate the recommendations of this report.

## 9.0 CLOSURE

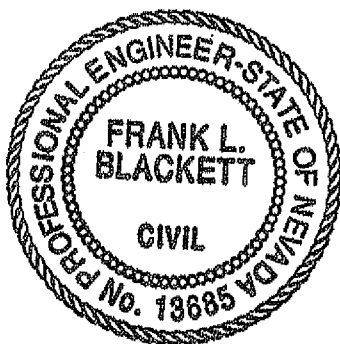
Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers practicing in this or similar report as an aid in design of the proposed project. This report is not a bidding document. Any contractor reviewing this report must draw his own conclusions regarding site conditions and specific construction techniques to be used on this project.

### TERRACON

Frank L. Blackett, P.E.  
Project Manager

Reviewed by:

Mark J. Owens, P.E.  
Principal





## NORTHERN SEGMENT



NOT TO SCALE

CLIENT: SVERDRUP CIVIL, INC.

PROJECT: RAINBOW BOULEVARD  
IMPROVEMENTS

**Terracon**

**VICINITY MAP**

PROJECT NO.:

64995240

PLATE:

FIGURE F-2 1A



## SOUTHERN SEGMENT



NOT TO SCALE

CLIENT:

SVERDRUP CIVIL, INC.

PROJECT: RAINBOW BOULEVARD  
IMPROVEMENTS

**Terracon**

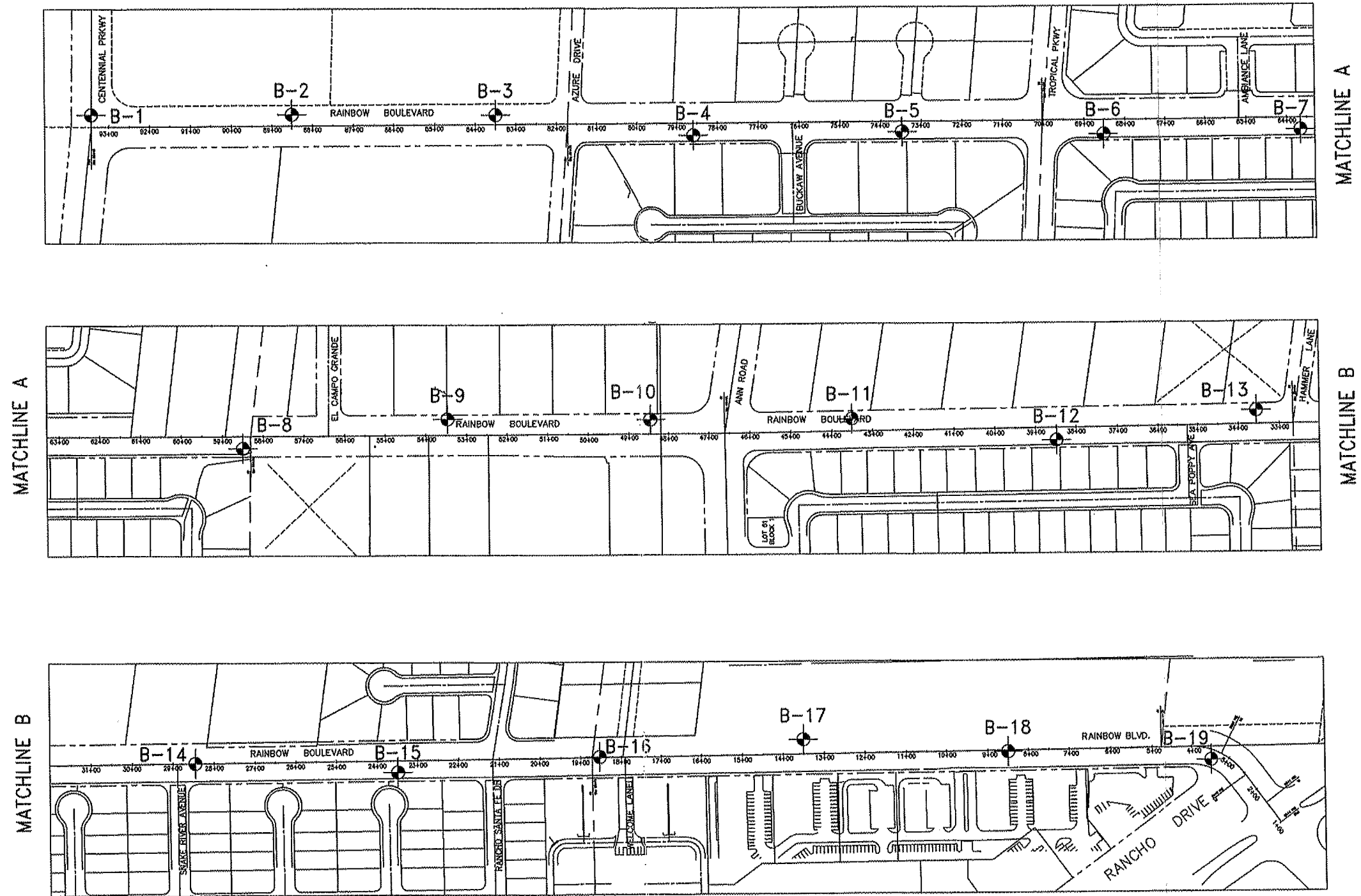
**VICINITY MAP**

PROJECT NO.:

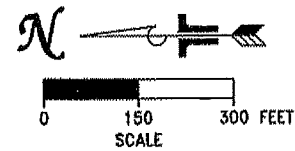
64995240

PLATE:

FIGURE F-2 1B



# NORTHERN SEGMENT



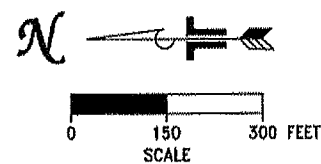
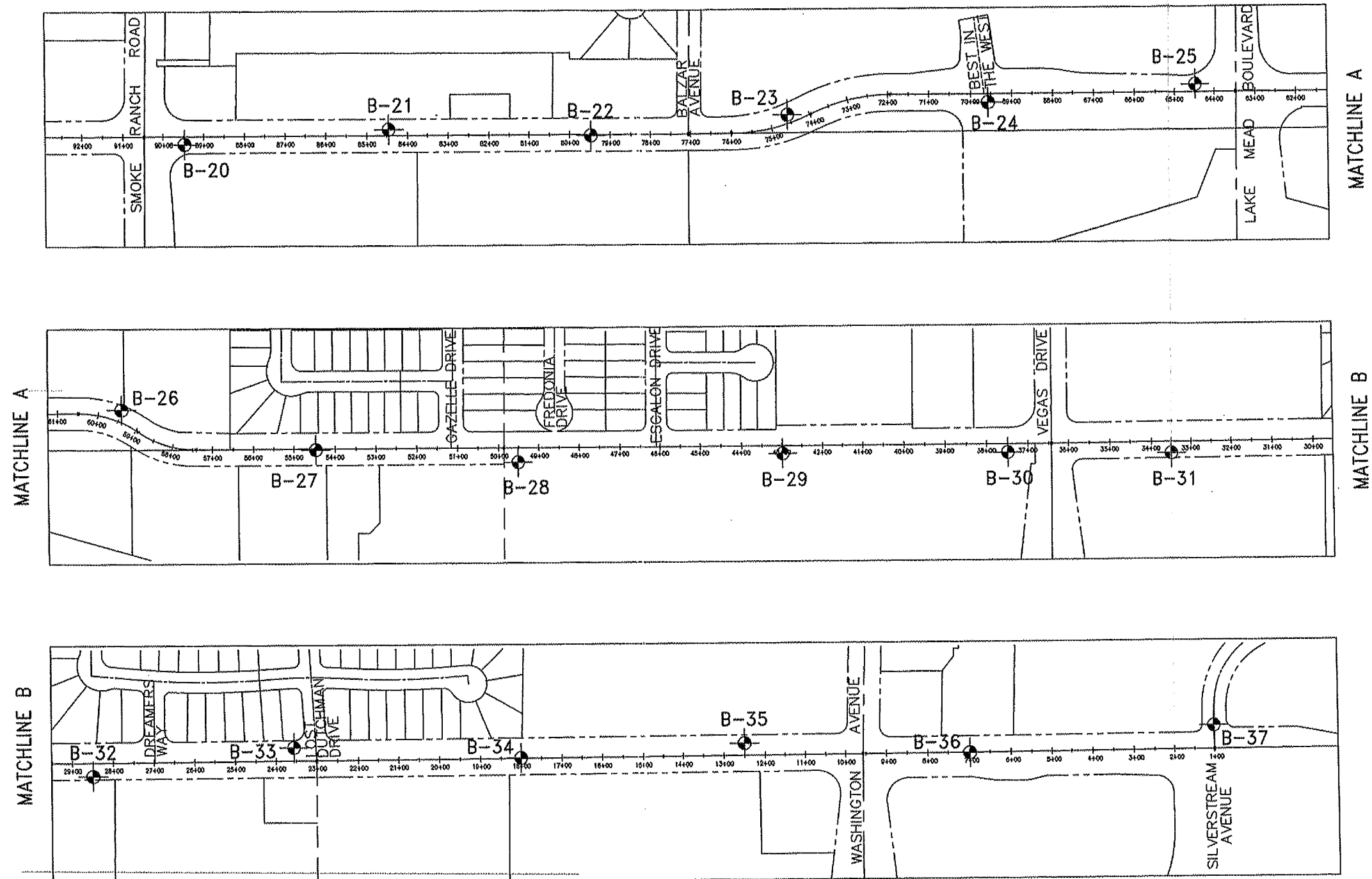
LEGEND:  
 ⦿ - APPROXIMATE BORING LOCATION

CLIENT: SVERDRUP CIVIL, INC.  
 PROJECT: RAINBOW BOULEVARD IMPROVEMENTS

**Terracon**

**ALIGNMENT PLAN**  
 PROJECT NO.: 64995240  
 PLATE: FIGURE F-2 2A



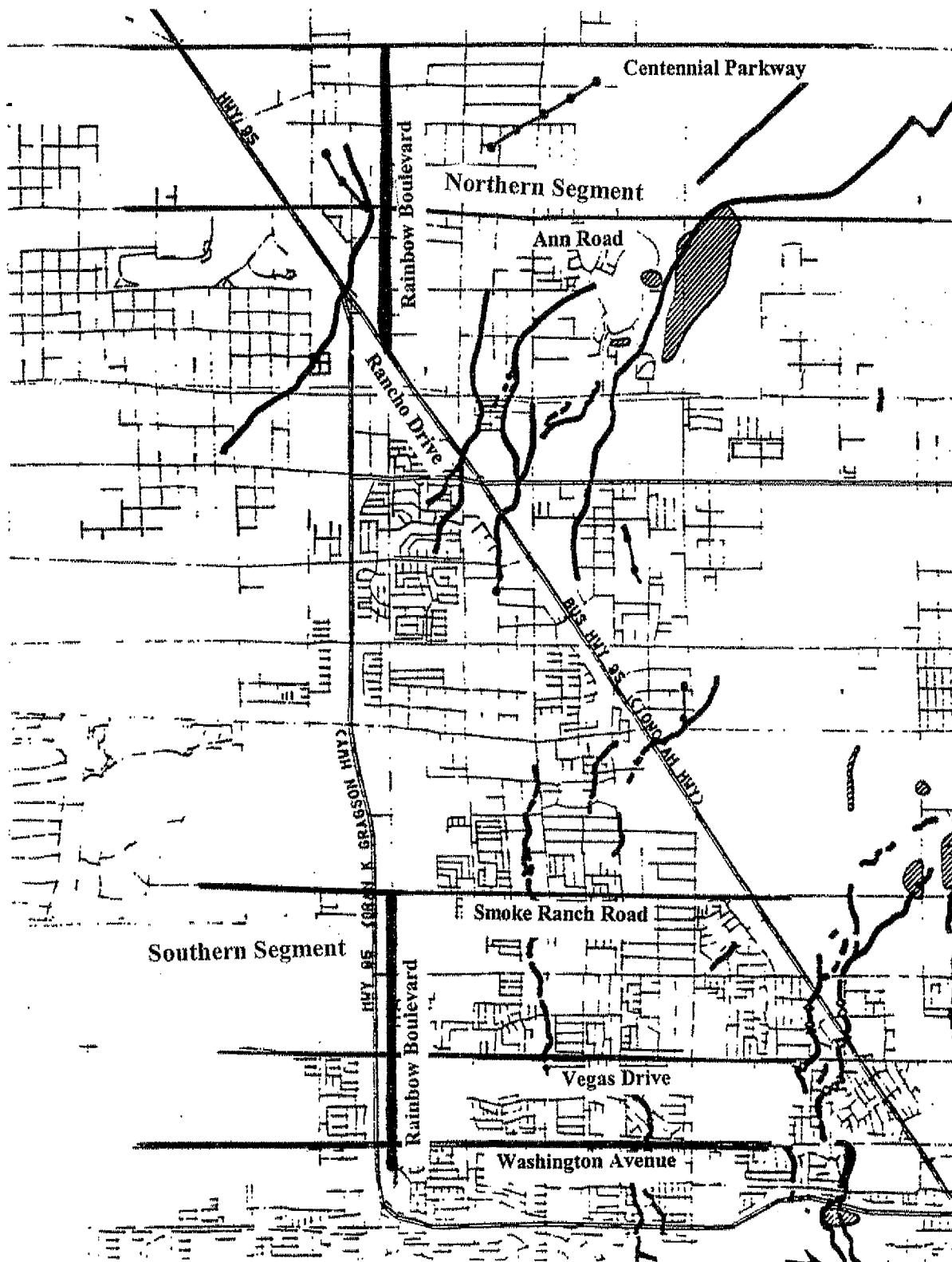


**LEGEND:**  
 - - - - - APPROXIMATE BORING LOCATION

CLIENT: SVERDRUP CIVIL, INC.  
 PROJECT: RAINBOW BOULEVARD IMPROVEMENTS

**Terracon**

**ALIGNMENT PLAN**  
 PROJECT NO.: 64995240  
 PLATE: 2B  
 FIGURE F-2



Subsidence - Related Faults and Fissures of the Las Vegas Valley

Bell, John W. and Jonathan G. Price, 1991, "Subsidence in Las Vegas Valley, 1980-91, Final Project Report", Nevada Bureau of Mines and Geology, Plate 2

CLIENT:

SVERDRUP CIVIL, INC.

PROJECT:

RAINBOW BOULEVARD  
IMPROVEMENT

**Terracon**

**GEOLOGIC HAZARDS**

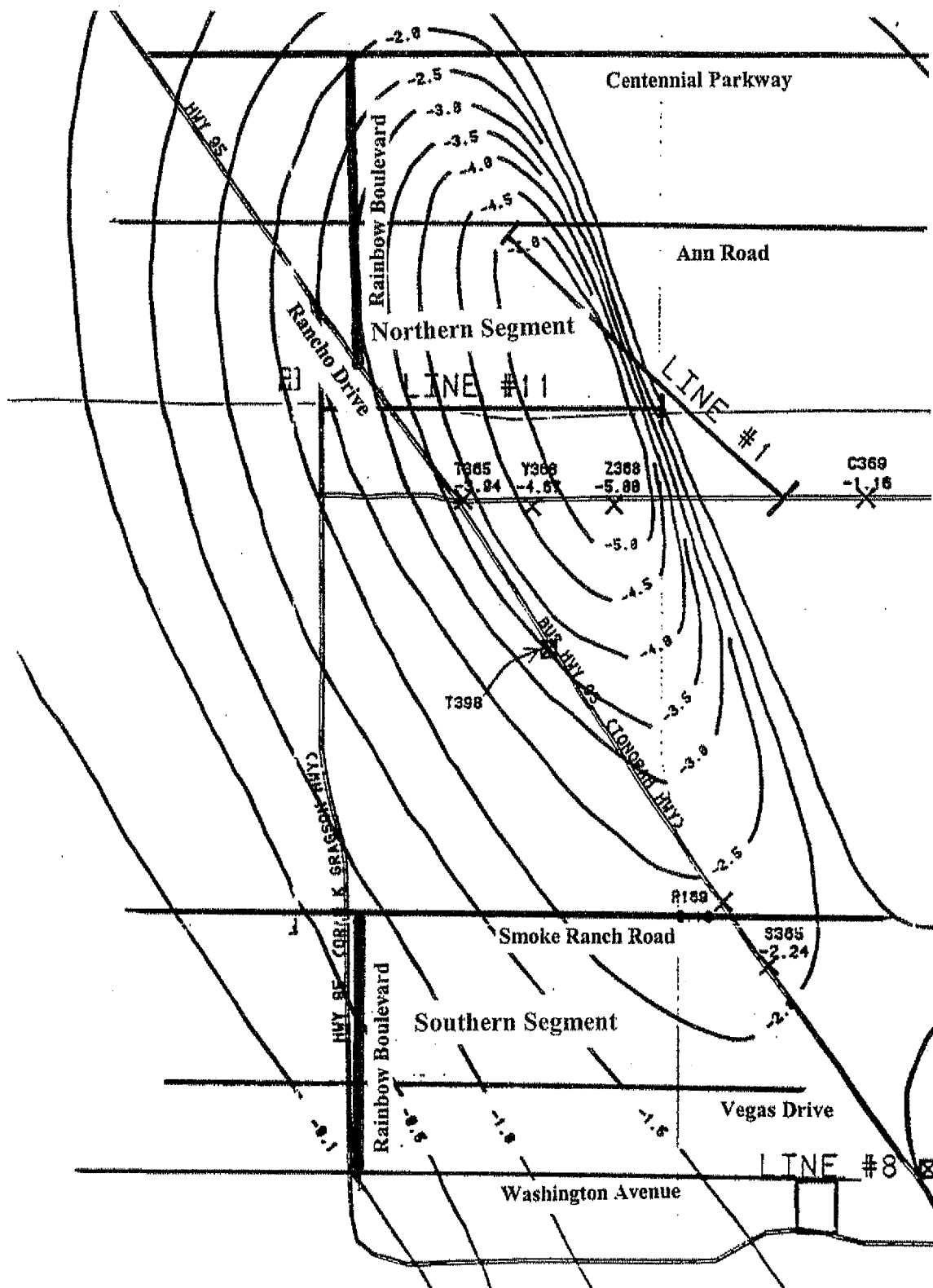
PROJECT NO.:

64995240

PLATE:

3

FIGURE F-2



Subsidence in the Las Vegas Valley 1963 through 1986/87

Bell, John W. and Jonathan G. Price, 1991, "Subsidence in Las Vegas Valley, 1980-91, Final Project Report", Nevada Bureau of Mines and Geology, Plate 4

CLIENT:

SVERDRUP CIVIL, INC.

PROJECT:

RAINBOW BOULEVARD  
IMPROVEMENT

**Terracon**

**SUBSIDENCE**

PROJECT NO.:

64995240

PLATE:

4

FIGURE F-2

## **APPENDIX A**

### **Alignment Explorations**

The subsurface conditions of the alignment were explored by drilling 36 borings to depths of approximately 20 feet below existing site grades. Borings were drilled using an auger-type drill rig (Diedrich D-120) with a 6-inch diameter continuous flight auger.

Soils were logged during drilling and samples were obtained to aid in material classification and for possible laboratory testing. Boring logs are presented on Plates A-1 through A-72. The number of blows required to drive a 2½ inch diameter sampler 12 inches are shown on the logs. The soils are generally classified by the Unified Soil Classification System. Plate B presents an explanation of material classifications used in this report.

### **Laboratory Testing**

Laboratory testing was performed on selected samples of on-site soils. Tests were performed in general accordance with applicable ASTM or local standards.

Field moisture content and dry density determinations were performed on undisturbed samples. Results of these tests are presented on the boring logs.

Sieve analyses were performed to determine the grain-size distribution of representative materials, including Atterberg Limits (Liquid Limit and Plastic Limit). The tests were performed in general accordance with ASTM C117 and C136 and the results are presented on Plates C-1 and C-2.

Expansion tests were performed on remolded samples of the clay soils. The tests were performed from oven-dried moisture content to near saturated condition with a 60 psf surcharge load. Plate D presents the test results.

Consolidation tests were performed on representative samples to illustrate the compressibility of on-site soils. Water was added during testing to illustrate the influence of moisture on compressibility. The test results are presented on Plates E-1 through E-4.

R-value tests were performed on representative samples. The test results are presented below:

| SAMPLE         | PLASTICITY<br>INDEX | % PASSING<br>NO. 200 | R-VALUE |
|----------------|---------------------|----------------------|---------|
| B-1 @ 0-5 ft.  | 12                  | 58                   | 30      |
| B-11 @ 2-7 ft. | Non-Plastic         | Non-Plastic          | 40      |
| B-14 @ 2-7 ft. | 12                  | 41                   | 43      |
| B-17 @ 2-7 ft. | 7                   | 57                   | 42      |
| B-27 @ 3-8 ft. | Non-Plastic         | Non-Plastic          | 79      |

Chemical tests were performed on representative samples by Atlas Chemical Testing Laboratories, Inc. Tests were performed to determine the percent water soluble sodium sulfate and sodium sulfate. Test results are presented on Plate F.

# LOG OF BORING NO. 1

|                                       |                                |                                                        |
|---------------------------------------|--------------------------------|--------------------------------------------------------|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |

| SOIL DESCRIPTION                                  | CONSISTENCY | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |                 |
|---------------------------------------------------|-------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                                   |             |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| SILTY SAND -dry, lt. brown                        | loose       |         | SM          |             |         |           | B     |            |                 |
| SANDY SILT -porous, sl. moist, lt. brown          | firm        |         | ML          | 1           |         | 8         | R     |            |                 |
| CLAYEY SILT -porous, sl. moist, lt. brown         | firm-stiff  |         |             | 2           |         |           | B     |            |                 |
| SILTY CLAY -w/trace sand, sl. moist, white        |             |         | CL          | 3           |         |           |       |            |                 |
| w/sand                                            |             |         |             | 4           |         |           |       |            |                 |
|                                                   |             |         |             | 5           |         | 46        | R     | 5.3        | 91              |
|                                                   |             |         |             | 6           |         |           |       |            |                 |
| CLAY -desiccated, sl. moist to moist, green brown |             |         | CH          | 7           |         |           |       |            |                 |
| GRAVELLY CLAY -sl. moist, white                   | very stiff  |         | CL          | 8           |         |           |       |            |                 |
| SANDY CLAY -sl. moist, white to lt. green         |             |         |             | 9           |         |           |       |            |                 |
|                                                   |             |         |             | 10          |         | 41        | R     |            |                 |
| SILTY CLAY -w/sand, sl. moist, lt. green          |             |         |             | 11          |         |           | B     |            |                 |
|                                                   |             |         |             | 12          |         |           |       |            |                 |
|                                                   |             |         |             | 13          |         |           |       |            |                 |
|                                                   |             |         |             | 14          |         |           |       |            |                 |
|                                                   |             |         |             | 15          |         |           |       |            |                 |

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:

1-20-00

PAGE NUMBER:

Page 1 of 2

PROJECT NO.:

64995240

PLATE:

FIGURE F-2 A-1

DRIVING WEIGHT (lbs.): 140

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.



# LOG OF BORING NO. 1

|                                       |                                |                                                        |
|---------------------------------------|--------------------------------|--------------------------------------------------------|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                                                                                    | CONSISTENCY | GRAPHIC                                                                           | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           |       | TESTS      |                 |
|-----------------------------------------------------------------------------------------------------|-------------|-----------------------------------------------------------------------------------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                                                                                     |             |                                                                                   |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| <b>SILTY CLAY -w/trace sand, sl. moist, brown to lt. green-brown</b><br><br><b>w/occ. CH lenses</b> | very stiff  |  | CL          | 16          |         | 65        | R     |            |                 |
|                                                                                                     |             |                                                                                   |             | 17          |         |           |       |            |                 |
| <b>Bottom at 20 feet</b>                                                                            |             |                                                                                   |             | 18          |         |           |       |            |                 |
|                                                                                                     |             |                                                                                   |             | 19          |         |           |       |            |                 |
|                                                                                                     |             |                                                                                   |             | 20          |         |           |       |            |                 |
|                                                                                                     |             |                                                                                   |             | 21          |         |           |       |            |                 |
|                                                                                                     |             |                                                                                   |             | 22          |         |           |       |            |                 |
|                                                                                                     |             |                                                                                   |             | 23          |         |           |       |            |                 |
|                                                                                                     |             |                                                                                   |             | 24          |         |           |       |            |                 |
|                                                                                                     |             |                                                                                   |             | 25          |         |           |       |            |                 |
|                                                                                                     |             |                                                                                   |             | 26          |         |           |       |            |                 |
|                                                                                                     |             |                                                                                   |             | 27          |         |           |       |            |                 |
|                                                                                                     |             |                                                                                   |             | 28          |         |           |       |            |                 |
|                                                                                                     |             |                                                                                   |             | 29          |         |           |       |            |                 |
|                                                                                                     |             |                                                                                   |             | 30          |         |           |       |            |                 |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
**Groundwater not encountered.**

DRIVING WEIGHT (lbs.): **140**

**Terracon**

DATE DRILLED:  
**1-20-00**

PROJECT NO.:  
**64995240**

PAGE NUMBER:  
**Page 2 of 2**

PLATE:  
**FIGURE F-2 A-2**

# LOG OF BORING NO. 2

|                                       |                                |                                                        |
|---------------------------------------|--------------------------------|--------------------------------------------------------|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                          | CONSISTENCY         | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           |       | TESTS      |                 |
|-------------------------------------------|---------------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                           |                     |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| SILTY SAND -dry, lt. brown                | loose-m.dense       |         | SM          | 1           |         |           |       |            |                 |
| SANDY SILT -porous, sl. moist, lt. brown  | firm                |         | ML          | 2           |         | 8         | R     |            |                 |
| CLAYEY SILT -porous, sl. moist, lt. brown | firm-stiff          |         |             | 3           |         |           |       |            |                 |
| SILTY CLAY -w/sand, sl. moist, white      | stiff               |         | CL          | 4           |         |           |       |            |                 |
| w/gravel                                  |                     |         |             | 5           |         |           | B     | 1.1        |                 |
|                                           | very stiff          |         |             | 6           |         |           |       |            |                 |
|                                           |                     |         |             | 7           |         | 53        | R     |            |                 |
|                                           |                     |         |             | 8           |         |           | B     |            |                 |
| CLAYEY GRAVEL -w/sand, sl. moist, white   | very dense          |         | GC          | 9           |         |           |       |            |                 |
| w/caliche lenses                          |                     |         |             | 10          |         |           |       |            |                 |
| SILTY CLAY -w/sand, sl. moist, lt. green  | stiff to very stiff |         | CL          | 11          |         |           |       |            |                 |
|                                           |                     |         |             | 12          |         | 24        | R     |            |                 |
| w/trace caliche gravel                    |                     |         |             | 13          |         |           |       |            |                 |
|                                           |                     |         |             | 14          |         |           |       |            |                 |
|                                           |                     |         |             | 15          |         |           |       |            |                 |

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:

1-20-00

PAGE NUMBER:

Page 1 of 2

PROJECT NO.:  
64995240

PLATE:

FIGURE F-2 A-3

DRIVING WEIGHT (lbs.): 140

# LOG OF BORING NO. 2

|                                          |                                   |                                                           |  |
|------------------------------------------|-----------------------------------|-----------------------------------------------------------|--|
| CLIENT:<br><b>Sverdrup Civil, Inc.</b>   |                                   | PROJECT:<br><b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION:<br><b>See Plot Plan</b> | ELEVATION:<br><b>Not Measured</b> | SITE:<br><b>Centennial Parkway to Silverstream Avenue</b> |  |

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                                                                 | CONSISTENCY | GRAPHIC                                                                           | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           |       | TESTS      |                 |  |
|----------------------------------------------------------------------------------|-------------|-----------------------------------------------------------------------------------|-------------|-------------|---------|-----------|-------|------------|-----------------|--|
|                                                                                  |             |                                                                                   |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |  |
| <b>SILTY CLAY -w/sand, sl. moist, lt. green</b><br><br><b>white to lt. brown</b> | very stiff  |  | CL          | 16          |         |           | B     |            |                 |  |
|                                                                                  |             |                                                                                   |             | 17          |         | 46        | R     |            |                 |  |
|                                                                                  |             |                                                                                   |             | 18          |         |           | B     |            |                 |  |
|                                                                                  |             |                                                                                   |             | 19          |         |           |       |            |                 |  |
|                                                                                  |             |                                                                                   |             | 20          |         |           |       |            |                 |  |
| <b>Bottom at 20 feet</b>                                                         |             |                                                                                   |             | 21          |         |           |       |            |                 |  |
|                                                                                  |             |                                                                                   |             | 22          |         |           |       |            |                 |  |
|                                                                                  |             |                                                                                   |             | 23          |         |           |       |            |                 |  |
|                                                                                  |             |                                                                                   |             | 24          |         |           |       |            |                 |  |
|                                                                                  |             |                                                                                   |             | 25          |         |           |       |            |                 |  |
|                                                                                  |             |                                                                                   |             | 26          |         |           |       |            |                 |  |
|                                                                                  |             |                                                                                   |             | 27          |         |           |       |            |                 |  |
|                                                                                  |             |                                                                                   |             | 28          |         |           |       |            |                 |  |
|                                                                                  |             |                                                                                   |             | 29          |         |           |       |            |                 |  |
|                                                                                  |             |                                                                                   |             | 30          |         |           |       |            |                 |  |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
**Groundwater not encountered.**

**Terracon**

DATE DRILLED:  
**1-20-00**

PAGE NUMBER:  
**Page 2 of 2**

DRIVING WEIGHT (lbs.): **140**

PROJECT NO.:  
**64995240**

PLATE:  
**FIGURE F-2 A-4**

# LOG OF BORING NO. 3

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                                              | CONSISTENCY | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |
|---------------------------------------------------------------|-------------|---------|-------------|-------------|---------|-----------|-------|------------|
|                                                               |             |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % |
| SILTY SAND -dry, lt. brown                                    | med. dense  |         | SM          | 1           | 27      | R         | B     |            |
| CLAYEY GRAVEL -w/caliche, gravel, dry to sl. moist, lt. brown |             |         | GC          | 2           |         |           |       |            |
| CLAYEY SAND -w/trace gravel, sl. moist, white                 |             |         | SC          | 3           |         |           |       |            |
| SANDY CLAY -sl. moist, white                                  | stiff       |         | CL          | 4           |         | B         |       |            |
|                                                               |             |         |             | 5           |         |           |       |            |
| SILTY CLAY -w/trace sand, sl. moist, white                    | very stiff  |         |             | 6           | 22      | R         | B     |            |
| w/CH lenses                                                   |             |         |             | 7           |         |           |       |            |
| w/no CH lenses                                                |             |         |             | 8           |         |           |       |            |
|                                                               |             |         |             | 9           |         |           |       |            |
| white to lt. green                                            |             |         |             | 10          |         |           |       |            |
|                                                               |             |         |             | 11          |         |           |       |            |
| w/green CH lenses, lt. green                                  |             |         |             | 12          |         |           |       |            |
|                                                               |             |         |             | 13          |         |           |       |            |
|                                                               |             |         |             | 14          |         |           |       |            |
|                                                               |             |         |             | 15          |         |           |       |            |

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test. C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:  
1-20-00

PAGE NUMBER:  
Page 1 of 2

DRIVING WEIGHT (lbs.): 140

PROJECT NO.:  
64995240

PLATE:  
**FIGURE F-2 A-5**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 3

|                                          |                                   |                                                           |
|------------------------------------------|-----------------------------------|-----------------------------------------------------------|
| CLIENT:<br><b>Sverdrup Civil, Inc.</b>   |                                   | PROJECT:<br><b>Rainbow Boulevard Improvements</b>         |
| BORING LOCATION:<br><b>See Plot Plan</b> | ELEVATION:<br><b>Not Measured</b> | SITE:<br><b>Centennial Parkway to Silverstream Avenue</b> |

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                                    | CONSISTENCY | GRAPHIC                                                                           | USCS SYMBOL | DEPTH (FT.) | SAMPLES                                                                             |           |       | TESTS      |                 |  |
|-----------------------------------------------------|-------------|-----------------------------------------------------------------------------------|-------------|-------------|-------------------------------------------------------------------------------------|-----------|-------|------------|-----------------|--|
|                                                     |             |                                                                                   |             |             | SAMPLE                                                                              | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |  |
| SILTY CLAY -w/green CH lenses, sl. moist, lt. green | very stiff  |  | CL          | 16          |                                                                                     |           |       |            |                 |  |
| CLAY -w/sand, sl. moist to moist, green             |             |                                                                                   | CH          | 17          |                                                                                     |           |       |            |                 |  |
|                                                     |             |                                                                                   |             | 18          |  | 45        | R     |            |                 |  |
| Bottom at 20 feet                                   |             |                                                                                   |             | 19          |                                                                                     |           |       |            |                 |  |
|                                                     |             |                                                                                   |             | 20          |                                                                                     |           |       |            |                 |  |
|                                                     |             |                                                                                   |             | 21          |                                                                                     |           |       |            |                 |  |
|                                                     |             |                                                                                   |             | 22          |                                                                                     |           |       |            |                 |  |
|                                                     |             |                                                                                   |             | 23          |                                                                                     |           |       |            |                 |  |
|                                                     |             |                                                                                   |             | 24          |                                                                                     |           |       |            |                 |  |
|                                                     |             |                                                                                   |             | 25          |                                                                                     |           |       |            |                 |  |
|                                                     |             |                                                                                   |             | 26          |                                                                                     |           |       |            |                 |  |
|                                                     |             |                                                                                   |             | 27          |                                                                                     |           |       |            |                 |  |
|                                                     |             |                                                                                   |             | 28          |                                                                                     |           |       |            |                 |  |
|                                                     |             |                                                                                   |             | 29          |                                                                                     |           |       |            |                 |  |
|                                                     |             |                                                                                   |             | 30          |                                                                                     |           |       |            |                 |  |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:

1-20-00

PAGE NUMBER:

Page 2 of 2

PROJECT NO.:  
64995240

PLATE:

FIGURE F-2 A-6

DRIVING WEIGHT (lbs.): 140

# LOG OF BORING NO. 4

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                                                 | CONSISTENCY   | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |                 |
|------------------------------------------------------------------|---------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                                                  |               |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| FILL-4 1/8" A.C. over 12" Agg. base, sl. moist, brown            |               |         | FILL        | 1           |         | 17        | R     |            |                 |
| FILL-CLAYEY GRAVEL -w/sand, very moist to wet, white to lt. gray |               |         |             | 2           |         |           |       |            |                 |
| CLAYEY GRAVEL -dry to sl. moist, white                           | v.dense       |         | GC          | 4           |         |           |       |            |                 |
| CALICHE -dry, white                                              | m.hard        |         |             | 5           |         | 50/0"     | R     |            |                 |
| CLAYEY GRAVEL -moist, lt. green                                  | med. dense    |         | GC          | 6           |         |           | B     |            |                 |
| SANDY CLAY -w/caliche gravel, moist, lt. green                   | stiff         |         | CL          | 7           |         |           |       |            |                 |
| SILTY SAND -moist, green to lt. green                            | med. dense    |         | SM          | 8           |         |           |       |            |                 |
| CLAY -w/trace sand, moist, green                                 |               |         | CH          | 9           |         |           |       |            |                 |
| w/trace caliche gravel                                           | stiff         |         |             | 10          |         | 25        | R     | 19.1       | 99              |
| CLAYEY SAND -w/gravel, moist, green                              | m.dense-dense |         | SC          | 14          |         |           |       |            |                 |
| Continued Next Page                                              |               |         |             |             |         |           |       |            |                 |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:  
**1-20-00**

PAGE NUMBER:  
**Page 1 of 2**

DRIVING WEIGHT (lbs.): **140**

PROJECT NO.:  
**64995240**

PLATE:  
**FIGURE F-2 A-7**

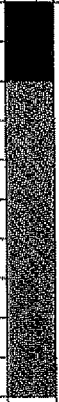
THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.



# LOG OF BORING NO. 4

|                                          |                                   |                                                           |
|------------------------------------------|-----------------------------------|-----------------------------------------------------------|
| CLIENT:<br><b>Sverdrup Civil, Inc.</b>   |                                   | PROJECT:<br><b>Rainbow Boulevard Improvements</b>         |
| BORING LOCATION:<br><b>See Plot Plan</b> | ELEVATION:<br><b>Not Measured</b> | SITE:<br><b>Centennial Parkway to Silverstream Avenue</b> |

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                    | CONSISTENCY         | GRAPHIC                                                                           | USCS SYMBOL | DEPTH (FT.) | SAMPLES                                                                             |           |       | TESTS      |                 |
|-------------------------------------|---------------------|-----------------------------------------------------------------------------------|-------------|-------------|-------------------------------------------------------------------------------------|-----------|-------|------------|-----------------|
|                                     |                     |                                                                                   |             |             | SAMPLE                                                                              | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| CLAYEY SAND -w/gravel, moist, green | med. dense to dense |  | SC          | 16          |  | 35        | R     |            |                 |
| CLAYEY GRAVEL -w/sand, moist, green |                     |                                                                                   | GC          | 17          |                                                                                     |           | B     |            |                 |
| CLAYEY SAND -sl. moist, lt. green   | dense               |  | SC          | 18          |                                                                                     |           |       |            |                 |
| Bottom at 20 feet                   |                     |                                                                                   |             | 19          |                                                                                     |           |       |            |                 |
|                                     |                     |                                                                                   |             | 20          |                                                                                     |           |       |            |                 |
|                                     |                     |                                                                                   |             | 21          |                                                                                     |           |       |            |                 |
|                                     |                     |                                                                                   |             | 22          |                                                                                     |           |       |            |                 |
|                                     |                     |                                                                                   |             | 23          |                                                                                     |           |       |            |                 |
|                                     |                     |                                                                                   |             | 24          |                                                                                     |           |       |            |                 |
|                                     |                     |                                                                                   |             | 25          |                                                                                     |           |       |            |                 |
|                                     |                     |                                                                                   |             | 26          |                                                                                     |           |       |            |                 |
|                                     |                     |                                                                                   |             | 27          |                                                                                     |           |       |            |                 |
|                                     |                     |                                                                                   |             | 28          |                                                                                     |           |       |            |                 |
|                                     |                     |                                                                                   |             | 29          |                                                                                     |           |       |            |                 |
|                                     |                     |                                                                                   |             | 30          |                                                                                     |           |       |            |                 |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
**Groundwater not encountered.**

**Terracon**

DATE DRILLED:  
**1-20-00**

PAGE NUMBER:  
**Page 2 of 2**

DRIVING WEIGHT (lbs.): **140**

PROJECT NO.:  
**64995240**

PLATE:  
**FIGURE F-2 A-8**

# LOG OF BORING NO. 5

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                                                    | CONSISTENCY | GRAPHIC                                                                             | USCS SYMBOL | DEPTH (FT.)                                                                         | SAMPLES                                                                               |           |        | TESTS      |                 |  |
|---------------------------------------------------------------------|-------------|-------------------------------------------------------------------------------------|-------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-----------|--------|------------|-----------------|--|
|                                                                     |             |                                                                                     |             |                                                                                     | SAMPLE                                                                                | BLOWS/FT. | TYPE*  | MOISTURE % | DRY DENSITY PCF |  |
| FILL-3 7/8" A.C. over 12" Agg. base, moist, brown                   |             |    | FILL        |                                                                                     |                                                                                       |           |        |            |                 |  |
| FILL-CLAYEY SAND -w/trace caliche gravel, sl. moist to moist, brown |             |                                                                                     |             | 1                                                                                   |    | 6         | B<br>R |            |                 |  |
|                                                                     |             |                                                                                     | 2           |  |                                                                                       |           |        |            |                 |  |
|                                                                     |             |                                                                                     | 3           |                                                                                     |                                                                                       |           |        |            |                 |  |
|                                                                     |             |                                                                                     | 4           |  | B                                                                                     |           |        |            |                 |  |
|                                                                     |             |                                                                                     | 5           |                                                                                     |                                                                                       |           |        |            |                 |  |
|                                                                     |             |                                                                                     | 6           |                                                                                     |                                                                                       |           |        |            |                 |  |
|                                                                     | 7           |                                                                                     |             |                                                                                     |                                                                                       |           |        |            |                 |  |
| SILTY CLAY -w/trace CH lenses, sl. moist, white to lt. green        | very stiff  |  | CL          | 7                                                                                   |                                                                                       | 36        | R      |            |                 |  |
| CLAY -w/trace sand, moist, green                                    |             |                                                                                     |             | 8                                                                                   |                                                                                       |           |        |            |                 |  |
|                                                                     |             |                                                                                     |             | 9                                                                                   |                                                                                       |           |        |            |                 |  |
|                                                                     |             |                                                                                     |             | 10                                                                                  |  | B         |        |            |                 |  |
| SANDY CLAY -sl. moist to moist, lt. green                           |             |                                                                                     |             | 11                                                                                  |                                                                                       |           |        |            |                 |  |
| w/trace caliche gravel                                              |             |                                                                                     |             | 12                                                                                  |  | 43        | R      |            |                 |  |
|                                                                     |             |                                                                                     |             | 13                                                                                  |  | B         |        |            |                 |  |
|                                                                     |             | 14                                                                                  |             |                                                                                     |                                                                                       |           |        |            |                 |  |
|                                                                     |             | 15                                                                                  |             |                                                                                     |                                                                                       |           |        |            |                 |  |
| Continued Next Page                                                 |             |                                                                                     |             |                                                                                     |                                                                                       |           |        |            |                 |  |

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:  
1-21-00

PAGE NUMBER:  
Page 1 of 2

DRIVING WEIGHT (lbs.): 140

PROJECT NO.:  
64995240

PLATE:  
**FIGURE F-2 A-9**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 5

CLIENT: **Sverdrup Civil, Inc.** PROJECT: **Rainbow Boulevard Improvements**  
 BORING LOCATION: **See Plot Plan** ELEVATION: **Not Measured** SITE: **Centennial Parkway to Silverstream Avenue**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                                  | CONSISTENCY | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |                               |
|---------------------------------------------------|-------------|---------|-------------|-------------|---------|-----------|-------|-------------------------------|
|                                                   |             |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE %<br>DRY DENSITY PCF |
| CLAYEY GRAVEL -sl. moist, lt. brown               | dense       |         | GC          | 16          |         |           |       |                               |
| CALICHE -dry, white to lt. brown                  | m.hard      |         |             | 17          |         |           |       |                               |
| CLAYEY GRAVEL -sl. moist, lt. green               | dense       |         | GC          | 17          |         | 55        | R     |                               |
| SILTY CLAY -w/sand, sl. moist, white to lt. green | very stiff  |         | CL          | 18          |         |           |       |                               |
| Bottom at 20 feet                                 |             |         |             | 19          |         |           |       |                               |
|                                                   |             |         |             | 20          |         |           |       |                               |
|                                                   |             |         |             | 21          |         |           |       |                               |
|                                                   |             |         |             | 22          |         |           |       |                               |
|                                                   |             |         |             | 23          |         |           |       |                               |
|                                                   |             |         |             | 24          |         |           |       |                               |
|                                                   |             |         |             | 25          |         |           |       |                               |
|                                                   |             |         |             | 26          |         |           |       |                               |
|                                                   |             |         |             | 27          |         |           |       |                               |
|                                                   |             |         |             | 28          |         |           |       |                               |
|                                                   |             |         |             | 29          |         |           |       |                               |
|                                                   |             |         |             | 30          |         |           |       |                               |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:  
1-21-00

PAGE NUMBER:  
Page 2 of 2

DRIVING WEIGHT (lbs.): 140

PROJECT NO.:  
64995240

PLATE:  
FIGURE F-2 A-10

# LOG OF BORING NO. 6

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                                                   | CONSISTENCY         | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           |       | TESTS      |                 |
|--------------------------------------------------------------------|---------------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                                                    |                     |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| FILL-4" A.C. over 13" Agg. base, moist, lt. brown                  |                     |         | FILL        | 1           |         |           |       |            |                 |
| FILL-CLAYEY GRAVEL -w/sand, moist to very moist, white to lt. gray |                     |         |             | 2           |         |           |       |            |                 |
| SILTY GRAVEL -w/sand, sl. moist, white                             |                     |         | GM          | 3           |         | 65        | R     |            |                 |
|                                                                    | dense               |         |             | 4           |         |           |       |            |                 |
| w/caliche lenses                                                   | very dense          |         |             | 5           |         |           | B     |            |                 |
|                                                                    |                     |         |             | 6           |         |           |       |            |                 |
| CLAYEY GRAVEL -w/sand, very moist, lt. brown                       |                     |         | GC          | 7           |         |           |       |            |                 |
|                                                                    | loose to med. dense |         |             | 8           |         |           |       |            |                 |
|                                                                    |                     |         |             | 9           |         | 7         | R     |            |                 |
| SANDY CLAY -w/gravel, very moist, lt. brown                        |                     |         | CL          | 10          |         |           | B     |            |                 |
|                                                                    | firm                |         |             | 11          |         |           |       |            |                 |
|                                                                    |                     |         |             | 12          |         |           |       |            |                 |
| GRAVELLY CLAY -w/sand, moist, lt. brown to green                   |                     |         |             | 13          |         | 16        | R     |            |                 |
| w/occ. thin CH lenses                                              | firm to stiff       |         |             | 14          |         |           |       |            |                 |
|                                                                    |                     |         |             | 15          |         |           |       |            |                 |

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

DRIVING WEIGHT (lbs.): 140

**Terracon**

DATE DRILLED:

1-21-00

PAGE NUMBER:

Page 1 of 2

PROJECT NO.:

64995240

PLATE:

FIGURE F-2 A-11

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 6

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                                  | CONSISTENCY   | GRAPHIC                                                                            | USCS SYMBOL | DEPTH (FT.) | SAMPLES                                                                              |           | TESTS |                               |
|---------------------------------------------------|---------------|------------------------------------------------------------------------------------|-------------|-------------|--------------------------------------------------------------------------------------|-----------|-------|-------------------------------|
|                                                   |               |                                                                                    |             |             | SAMPLE                                                                               | BLOWS/FT. | TYPE* | MOISTURE %<br>DRY DENSITY PCF |
| CLAY -w/caliche gravel, moist, green              | firm to stiff |   | CH          | 16          |  | 23/<br>6" | B     |                               |
| SILTY CLAY -w/sand, sl. moist, white to lt. green | very stiff    |  | CL          | 17          |                                                                                      |           |       |                               |
|                                                   |               |                                                                                    |             | 18          |                                                                                      |           | R     |                               |
|                                                   |               |                                                                                    |             | 19          |                                                                                      |           | B     |                               |
| Bottom at 20 feet                                 |               |                                                                                    |             | 20          |                                                                                      |           |       |                               |
|                                                   |               |                                                                                    |             | 21          |                                                                                      |           |       |                               |
|                                                   |               |                                                                                    |             | 22          |                                                                                      |           |       |                               |
|                                                   |               |                                                                                    |             | 23          |                                                                                      |           |       |                               |
|                                                   |               |                                                                                    |             | 24          |                                                                                      |           |       |                               |
|                                                   |               |                                                                                    |             | 25          |                                                                                      |           |       |                               |
|                                                   |               |                                                                                    |             | 26          |                                                                                      |           |       |                               |
|                                                   |               |                                                                                    |             | 27          |                                                                                      |           |       |                               |
|                                                   |               |                                                                                    |             | 28          |                                                                                      |           |       |                               |
|                                                   |               |                                                                                    |             | 29          |                                                                                      |           |       |                               |
|                                                   |               |                                                                                    |             | 30          |                                                                                      |           |       |                               |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

DRIVING WEIGHT (lbs.): 140

**Terracon**

DATE DRILLED:  
1-21-00

PROJECT NO.:  
64995240

PAGE NUMBER:  
Page 2 of 2

PLATE:  
FIGURE F-2 A-12

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 7

CLIENT: **Sverdrup Civil, Inc.** PROJECT: **Rainbow Boulevard Improvements**  
 BORING LOCATION: **See Plot Plan** ELEVATION: **Not Measured** SITE: **Centennial Parkway to Silverstream Avenue**

| SOIL DESCRIPTION                                  | CONSISTENCY         | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |                 |
|---------------------------------------------------|---------------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                                   |                     |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| FILL-5" A.C. over 18" Agg. base, moist, brown     |                     |         | FILL        | 1           |         | 23        | R     |            |                 |
| CLAYEY SILT -very moist, brown                    | soft-firm           |         | ML          | 2           |         |           | B     |            |                 |
| SILTY CLAY -w/sand, gravel, very moist, white     | firm                |         | CL          | 3           |         |           |       |            |                 |
|                                                   |                     |         |             | 4           |         |           |       |            |                 |
|                                                   |                     |         |             | 5           |         | 12        | R     |            |                 |
|                                                   | firm to stiff       |         |             | 6           |         |           |       |            |                 |
|                                                   |                     |         |             | 7           |         |           |       |            |                 |
| w/caliche gravel                                  |                     |         |             | 8           |         |           |       |            |                 |
| CLAYEY SAND -moist, green                         | loose to med. dense |         | SC          | 9           |         |           |       |            |                 |
| CLAYEY GRAVEL -sl. moist, white                   |                     |         | GC          | 10          |         | 15        | R     |            |                 |
| w/occ. caliche lense                              | m.dense             |         |             | 11          |         |           | B     |            |                 |
| CLAYEY SAND -w/trace gravel, sl. moist, lt. green | m.dense-dense       |         | SC          | 12          |         |           |       |            |                 |
|                                                   |                     |         |             | 13          |         |           |       |            |                 |
| SANDY CLAY -sl. moist, lt. green                  | very stiff          |         | CL          | 14          |         |           |       |            |                 |
|                                                   |                     |         |             | 15          |         |           |       |            |                 |

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:  
1-21-00

PAGE NUMBER:  
Page 1 of 2

DRIVING WEIGHT (lbs.): 140

PROJECT NO.:  
64995240

PLATE:  
**FIGURE F-2 A-13**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.



# LOG OF BORING NO. 7

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                                                | CONSISTENCY | GRAPHIC                                                                           | USCS SYMBOL | DEPTH (FT.) | SAMPLES                                                                             |           |       | TESTS      |                 |
|-----------------------------------------------------------------|-------------|-----------------------------------------------------------------------------------|-------------|-------------|-------------------------------------------------------------------------------------|-----------|-------|------------|-----------------|
|                                                                 |             |                                                                                   |             |             | SAMPLE                                                                              | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| <b>SANDY CLAY -w/trace caliche gravel, sl. moist, lt. green</b> | very stiff  |  | CL          | 16          |  | 55        | R     |            |                 |
| <b>CLAY -w/sand, sl. moist, green</b>                           |             |                                                                                   | CH          | 17          |                                                                                     |           |       |            |                 |
| <b>SILTY CLAY -w/sand, sl. moist, lt. green</b>                 |             |                                                                                   | CL          | 18          |                                                                                     |           |       |            |                 |
| <b>Bottom at 20 feet</b>                                        |             |                                                                                   |             | 19          |                                                                                     |           |       |            |                 |
|                                                                 |             |                                                                                   |             | 20          |                                                                                     |           |       |            |                 |
|                                                                 |             |                                                                                   |             | 21          |                                                                                     |           |       |            |                 |
|                                                                 |             |                                                                                   |             | 22          |                                                                                     |           |       |            |                 |
|                                                                 |             |                                                                                   |             | 23          |                                                                                     |           |       |            |                 |
|                                                                 |             |                                                                                   |             | 24          |                                                                                     |           |       |            |                 |
|                                                                 |             |                                                                                   |             | 25          |                                                                                     |           |       |            |                 |
|                                                                 |             |                                                                                   |             | 26          |                                                                                     |           |       |            |                 |
|                                                                 |             |                                                                                   |             | 27          |                                                                                     |           |       |            |                 |
|                                                                 |             |                                                                                   |             | 28          |                                                                                     |           |       |            |                 |
|                                                                 |             |                                                                                   |             | 29          |                                                                                     |           |       |            |                 |
|                                                                 |             |                                                                                   |             | 30          |                                                                                     |           |       |            |                 |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
**Groundwater not encountered.**

DRIVING WEIGHT (lbs.): **140**

**Terracon**

DATE DRILLED:  
**1-21-00**

PROJECT NO.:  
**64995240**

PAGE NUMBER:  
**Page 2 of 2**

PLATE:  
**FIGURE F-2 A-14**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 8

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                                             | CONSISTENCY | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |
|--------------------------------------------------------------|-------------|---------|-------------|-------------|---------|-----------|-------|------------|
|                                                              |             |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % |
| FILL-4 1/2" A.C. over 13" Agg. base, sl. moist, brown        |             |         | FILL        | 1           |         |           |       |            |
| CLAYEY SILT -w/sand, very moist to wet, lt. brown            | firm        |         | ML          | 2           |         | 9         | R     |            |
|                                                              |             |         |             | 3           |         |           |       |            |
|                                                              |             |         |             | 4           |         |           |       |            |
| CLAYEY GRAVEL -w/sand, very moist to wet, white to lt. brown | loose       |         | GC          | 5           |         |           | B     |            |
|                                                              |             |         |             | 6           |         |           |       |            |
|                                                              |             |         |             | 7           |         |           |       |            |
| w/clay lenses                                                |             |         |             | 8           |         | 6         | R     |            |
|                                                              |             |         |             | 9           |         |           | B     |            |
|                                                              |             |         |             | 10          |         |           |       |            |
| CALICHE -dry, white to lt. brown                             | mod. hard   |         |             | 11          |         |           |       |            |
| CLAYEY GRAVEL -w/sand, moist, lt. brown                      | loose       |         | GC          | 12          |         |           |       |            |
| SANDY CLAY -w/gravel, moist, lt. green                       | firm        |         | CL          | 13          |         | 9         | R     |            |
|                                                              |             |         |             | 14          |         |           |       |            |
|                                                              |             |         |             | 15          |         |           |       |            |
| Continued Next Page                                          |             |         |             |             |         |           |       |            |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:

1-24-00

PAGE NUMBER:

Page 1 of 2

PROJECT NO.:  
64995240

PLATE:

FIGURE F-2 A-15

DRIVING WEIGHT (lbs.): 140

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 8

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                                                      | CONSISTENCY             | GRAPHIC                                                                           | USCS SYMBOL | DEPTH (FT.) | SAMPLES                                                                              |           | TESTS |            |
|-----------------------------------------------------------------------|-------------------------|-----------------------------------------------------------------------------------|-------------|-------------|--------------------------------------------------------------------------------------|-----------|-------|------------|
|                                                                       |                         |                                                                                   |             |             | SAMPLE                                                                               | BLOWS/FT. | TYPE* | MOISTURE % |
| SANDY CLAY -w/caliche gravel, moist, lt. gray<br><br>w/occ. CH lenses | stiff                   |  | CL          | 16          |  | 65/<br>9" | B     |            |
|                                                                       |                         |                                                                                   |             | 17          |                                                                                      |           | R     |            |
| CLAYEY SAND -partially cemented, dry to sl. moist, white              | very dense to mod. hard |  | SC          | 18          |                                                                                      |           | B     |            |
|                                                                       |                         |                                                                                   |             | 19          |                                                                                      |           |       |            |
|                                                                       |                         |                                                                                   |             | 20          |                                                                                      |           |       |            |
| Bottom at 20 feet                                                     |                         |                                                                                   |             | 21          |                                                                                      |           |       |            |
|                                                                       |                         |                                                                                   |             | 22          |                                                                                      |           |       |            |
|                                                                       |                         |                                                                                   |             | 23          |                                                                                      |           |       |            |
|                                                                       |                         |                                                                                   |             | 24          |                                                                                      |           |       |            |
|                                                                       |                         |                                                                                   |             | 25          |                                                                                      |           |       |            |
|                                                                       |                         |                                                                                   |             | 26          |                                                                                      |           |       |            |
|                                                                       |                         |                                                                                   |             | 27          |                                                                                      |           |       |            |
|                                                                       |                         |                                                                                   |             | 28          |                                                                                      |           |       |            |
|                                                                       |                         |                                                                                   |             | 29          |                                                                                      |           |       |            |
|                                                                       |                         |                                                                                   |             | 30          |                                                                                      |           |       |            |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

DRIVING WEIGHT (lbs.): 140

**Terracon**

DATE DRILLED:  
1-24-00

PROJECT NO.:  
64995240

PAGE NUMBER:  
Page 2 of 2

PLATE:  
FIGURE F-2 A-16

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 9

|                                       |                                |                                                        |
|---------------------------------------|--------------------------------|--------------------------------------------------------|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |

| SOIL DESCRIPTION                                               | CONSISTENCY         | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |                               |
|----------------------------------------------------------------|---------------------|---------|-------------|-------------|---------|-----------|-------|-------------------------------|
|                                                                |                     |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE %<br>DRY DENSITY PCF |
| FILL-SANDY GRAVEL -w/clay, dry, lt. brown                      |                     |         | FILL        |             |         |           |       |                               |
| SANDY CLAY -sl. moist, lt. brown                               |                     |         | CL          | 1           |         |           |       |                               |
| w/trace gravel                                                 | stiff               |         | CL          | 2           |         | 40        | R     | 14.9 93                       |
| CLAYEY GRAVEL -moist, lt. brown                                | med. dense          |         | GC          | 3           |         |           |       |                               |
| SILTY CLAY -w/sand, sl. porous, moist to very moist, lt. brown |                     |         | CL          | 4           |         |           |       |                               |
|                                                                | firm to stiff       |         | CL          | 5           |         |           | B     |                               |
|                                                                |                     |         | CL          | 6           |         | 6         | R     |                               |
|                                                                |                     |         | CL          | 7           |         |           | B     |                               |
| w/thin CH lenses, sl. moist to moist, green brown              |                     |         | CL          | 8           |         |           |       |                               |
| CLAY -w/sand, sl. moist to moist, green                        |                     |         | CH          | 9           |         |           |       |                               |
| w/trace caliche gravel                                         | very stiff          |         | CH          | 10          |         | 23        | R     |                               |
| SANDY CLAY -w/gravel, sl. moist, white                         |                     |         | CL          | 11          |         |           |       |                               |
| CLAYEY GRAVEL -sl. moist, white                                |                     |         | GC          | 12          |         |           |       |                               |
| CLAYEY SAND -w/gravel, sl. moist, white                        | med. dense to dense |         | SC          | 13          |         |           |       |                               |
|                                                                |                     |         | SC          | 14          |         |           |       |                               |
|                                                                |                     |         | SC          | 15          |         |           |       |                               |

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

DRIVING WEIGHT (lbs.): 140

**Terracon**

DATE DRILLED:  
1-20-00

PROJECT NO.:  
64995240

PAGE NUMBER:  
Page 1 of 2

PLATE:  
FIGURE F-2 A-17

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 9

|                                          |                                   |                                                           |  |
|------------------------------------------|-----------------------------------|-----------------------------------------------------------|--|
| CLIENT:<br><b>Sverdrup Civil, Inc.</b>   |                                   | PROJECT:<br><b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION:<br><b>See Plot Plan</b> | ELEVATION:<br><b>Not Measured</b> | SITE:<br><b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                                | CONSISTENCY | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |                               |
|-------------------------------------------------|-------------|---------|-------------|-------------|---------|-----------|-------|-------------------------------|
|                                                 |             |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE %<br>DRY DENSITY PCF |
| CLAYEY SAND -w/caliche gravel, sl. moist, white |             |         | SC          |             |         | 66        | R     |                               |
| w/occ. clay lenses                              | dense       |         |             | 16          |         |           | B     |                               |
|                                                 |             |         |             | 17          |         |           |       |                               |
|                                                 |             |         |             | 18          |         |           |       |                               |
|                                                 |             |         |             | 19          |         |           |       |                               |
|                                                 |             |         |             | 20          |         |           |       |                               |
| Bottom at 20 feet                               |             |         |             | 21          |         |           |       |                               |
|                                                 |             |         |             | 22          |         |           |       |                               |
|                                                 |             |         |             | 23          |         |           |       |                               |
|                                                 |             |         |             | 24          |         |           |       |                               |
|                                                 |             |         |             | 25          |         |           |       |                               |
|                                                 |             |         |             | 26          |         |           |       |                               |
|                                                 |             |         |             | 27          |         |           |       |                               |
|                                                 |             |         |             | 28          |         |           |       |                               |
|                                                 |             |         |             | 29          |         |           |       |                               |
|                                                 |             |         |             | 30          |         |           |       |                               |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring, B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

DRIVING WEIGHT (lbs.): 140

**Terracon**

DATE DRILLED:  
1-20-00

PROJECT NO.:  
64995240

PAGE NUMBER:  
Page 2 of 2

PLATE:  
FIGURE F-2 A-18

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 10

CLIENT: **Sverdrup Civil, Inc.** PROJECT: **Rainbow Boulevard Improvements**  
 BORING LOCATION: **See Plot Plan** ELEVATION: **Not Measured** SITE: **Centennial Parkway to Silverstream Avenue**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                                         | CONSISTENCY         | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |                 |
|----------------------------------------------------------|---------------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                                          |                     |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| FILL-SANDY GRAVEL -w/silt, dry, lt. brown                |                     |         | FILL        |             |         |           |       |            |                 |
| SILTY SAND -moist, brown                                 | loose               |         | SM          | 1           |         |           |       |            |                 |
| GRAVELLY CLAY -w/sand, sl. moist, lt. brown              | stiff               |         | CL          | 2           |         | 14        | B     |            |                 |
| CLAYEY GRAVEL -w/sand, sl. moist, lt. brown              |                     |         | GC          | 3           |         |           | R     |            |                 |
|                                                          |                     |         |             | 4           |         |           | B     |            |                 |
| CLAYEY SAND -w/caliche gravel, moist, white to lt. brown | loose to med. dense |         | SC          | 5           |         |           |       |            |                 |
|                                                          |                     |         |             | 6           |         |           |       |            |                 |
| CLAYEY GRAVEL -w/sand, moist, white to lt. brown         |                     |         | GC          | 7           |         |           | R     |            |                 |
| w/caliche lenses                                         |                     |         |             | 8           |         |           |       |            |                 |
|                                                          | dense               |         |             | 9           |         |           |       |            |                 |
|                                                          | med. dense          |         |             | 10          |         |           | B     |            |                 |
| SILTY CLAY -w/sand, trace gravel, moist, lt. brown       |                     |         | CL          | 11          |         |           |       |            |                 |
|                                                          |                     |         |             | 12          |         | 14        | R     |            |                 |
| w/occ. GC lenses                                         | stiff               |         |             | 13          |         |           | B     |            |                 |
|                                                          |                     |         |             | 14          |         |           |       |            |                 |
|                                                          |                     |         |             | 15          |         |           |       |            |                 |

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES. IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test .C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:  
1-20-00

PAGE NUMBER:  
Page 1 of 2

DRIVING WEIGHT (lbs.): 140

PROJECT NO.:  
64995240

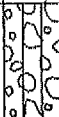
PLATE:  
**FIGURE F-2 A-19**



# LOG OF BORING NO. 10

|                                       |                                |                                                        |
|---------------------------------------|--------------------------------|--------------------------------------------------------|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                                   | CONSISTENCY   | GRAPHIC                                                                           | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           |       | TESTS      |                 |  |
|----------------------------------------------------|---------------|-----------------------------------------------------------------------------------|-------------|-------------|---------|-----------|-------|------------|-----------------|--|
|                                                    |               |                                                                                   |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |  |
| SILTY CLAY -w/sand, trace gravel, moist, lt. brown | stiff         |  | CL          |             |         |           |       |            |                 |  |
| CLAYEY GRAVEL -w/sand, moist, lt. brown            | med. dense    |  | GC          | 16          |         |           |       |            |                 |  |
| CALICHE -dry, white to lt. brown                   | mod. hard     |  |             | 17          |         | 50/1"     | R     |            |                 |  |
| SILTY GRAVEL -w/sand, sl. moist, white             | m.dense-dense |  | GM          | 18          |         |           |       |            |                 |  |
| Bottom at 20 feet                                  |               |                                                                                   |             | 19          |         |           |       |            |                 |  |
|                                                    |               |                                                                                   |             | 20          |         |           |       |            |                 |  |
|                                                    |               |                                                                                   |             | 21          |         |           |       |            |                 |  |
|                                                    |               |                                                                                   |             | 22          |         |           |       |            |                 |  |
|                                                    |               |                                                                                   |             | 23          |         |           |       |            |                 |  |
|                                                    |               |                                                                                   |             | 24          |         |           |       |            |                 |  |
|                                                    |               |                                                                                   |             | 25          |         |           |       |            |                 |  |
|                                                    |               |                                                                                   |             | 26          |         |           |       |            |                 |  |
|                                                    |               |                                                                                   |             | 27          |         |           |       |            |                 |  |
|                                                    |               |                                                                                   |             | 28          |         |           |       |            |                 |  |
|                                                    |               |                                                                                   |             | 29          |         |           |       |            |                 |  |
|                                                    |               |                                                                                   |             | 30          |         |           |       |            |                 |  |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:

1-20-00

PAGE NUMBER:

Page 2 of 2

PROJECT NO.:

64995240

PLATE:

FIGURE F-2 A-20

DRIVING WEIGHT (lbs.): 140

# LOG OF BORING NO. 11

CLIENT: **Sverdrup Civil, Inc.** PROJECT: **Rainbow Boulevard Improvements**  
 BORING LOCATION: **See Plot Plan** ELEVATION: **Not Measured** SITE: **Centennial Parkway to Silverstream Avenue**

| SOIL DESCRIPTION                                                  | CONSISTENCY         | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |
|-------------------------------------------------------------------|---------------------|---------|-------------|-------------|---------|-----------|-------|------------|
|                                                                   |                     |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % |
| FILL-3" A.C. over 9" Agg. base, sl. moist, brown                  |                     |         | FILL        |             |         |           |       |            |
| FILL-SANDY GRAVEL -w/silt, sl. moist, lt. brown                   |                     |         |             | 1           |         |           |       |            |
| SILTY SAND -sl. moist, lt. brown                                  | med. dense          |         | SM          | 2           | 19      |           | R     |            |
| SANDY SILT -porous, sl. moist, lt. brown                          | firm to stiff       |         | ML          | 3           |         |           | B     |            |
| CLAYEY SILT -porous, sl. moist, lt. brown                         |                     |         |             | 4           |         |           |       |            |
| SILTY GRAVEL -sl. moist, lt. brown                                | m.dense-dense       |         | GM          | 5           |         |           |       |            |
| CALICHE -dry, lt. brown                                           | very hard           |         |             | 6           |         |           |       |            |
| w/popcorn lenses                                                  | hard                |         |             | 7           | 50/0"   |           | R     |            |
|                                                                   |                     |         |             | 8           |         |           |       |            |
|                                                                   | mod. hard           |         |             | 9           |         |           |       |            |
| CLAYEY SAND -w/caliche gravel, sl. moist, lt. brown               | med. dense to dense |         | SC          | 10          |         |           |       |            |
|                                                                   |                     |         |             | 11          |         |           |       |            |
|                                                                   |                     |         |             | 12          | 39      |           | R     |            |
|                                                                   |                     |         |             | 13          |         |           | B     |            |
| SANDY CLAY -w/trace caliche gravel, sl. moist, lt. green to white | very stiff          |         | CL          | 14          |         |           |       |            |
|                                                                   |                     |         |             | 15          |         |           |       |            |
| Continued Next Page                                               |                     |         |             |             |         |           |       |            |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES. IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
 SPT = Standard Penetration Test C = Core

NOTES:  
 Groundwater not encountered.

**Terracon**

DATE DRILLED:  
 1-26-00

PAGE NUMBER:  
 Page 1 of 2

DRIVING WEIGHT (lbs.): 140

PROJECT NO.:  
 64995240

PLATE:  
 FIGURE F-2 A-21

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 11

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                            | CONSISTENCY | GRAPHIC                                                                           | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |                               |
|---------------------------------------------|-------------|-----------------------------------------------------------------------------------|-------------|-------------|---------|-----------|-------|-------------------------------|
|                                             |             |                                                                                   |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE %<br>DRY DENSITY PCF |
| CLAY -w/sand, sl. moist, green to lt. green |             |                                                                                   | CH          | 16          |         |           | B     |                               |
| w/trace caliche gravel                      | very stiff  |  | CH          | 17          |         | 34        | R     | 17.3 105                      |
| w/caliche gravel                            |             |                                                                                   |             | 18          |         |           |       |                               |
|                                             |             |                                                                                   |             | 19          |         |           |       |                               |
| Bottom at 20 feet                           |             |                                                                                   |             | 20          |         |           |       |                               |
|                                             |             |                                                                                   |             | 21          |         |           |       |                               |
|                                             |             |                                                                                   |             | 22          |         |           |       |                               |
|                                             |             |                                                                                   |             | 23          |         |           |       |                               |
|                                             |             |                                                                                   |             | 24          |         |           |       |                               |
|                                             |             |                                                                                   |             | 25          |         |           |       |                               |
|                                             |             |                                                                                   |             | 26          |         |           |       |                               |
|                                             |             |                                                                                   |             | 27          |         |           |       |                               |
|                                             |             |                                                                                   |             | 28          |         |           |       |                               |
|                                             |             |                                                                                   |             | 29          |         |           |       |                               |
|                                             |             |                                                                                   |             | 30          |         |           |       |                               |

|                                                                                                                                        |                                                                                      |                                                                             |                             |
|----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|-----------------------------|
| THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL. |                                                                                      | *SAMPLE TYPES: R = Ring B = Bag<br>SPT = Standard Penetration Test C = Core |                             |
| NOTES:<br>Groundwater not encountered.                                                                                                 |  | DATE DRILLED:<br>1-26-00                                                    | PAGE NUMBER:<br>Page 2 of 2 |
| DRIVING WEIGHT (lbs.): 140                                                                                                             |                                                                                      | PROJECT NO.:<br>64995240                                                    | PLATE:<br>FIGURE F-2 A-22   |

# LOG OF BORING NO. 12

CLIENT: **Sverdrup Civil, Inc.** PROJECT: **Rainbow Boulevard Improvements**  
 BORING LOCATION: **See Plot Plan** ELEVATION: **Not Measured** SITE: **Centennial Parkway to Silverstream Avenue**

| SOIL DESCRIPTION                                                | CONSISTENCY   | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |                 |
|-----------------------------------------------------------------|---------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                                                 |               |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| FILL-4 1/2" A.C. over 8" Agg. base, sl. moist, lt. brown        |               |         | FILL        | 1           |         |           |       |            |                 |
| FILL-SANDY GRAVEL -w/silt, sl. moist, lt. brown                 |               |         |             | 2           |         |           |       |            |                 |
| SILTY SAND -sl. moist, brown                                    | m.dense-dense |         | SM          | 3           |         |           |       |            |                 |
| SILTY CLAY -w/sand, sl. moist, white to lt. gray                | very stiff    |         | CL          | 4           |         | 56        | R     | 13.7       | 82              |
| w/trace caliche gravel                                          |               |         |             | 5           |         |           |       |            |                 |
| CLAYEY GRAVEL -sl. moist, white                                 |               |         |             | 6           |         |           |       |            |                 |
| CLAYEY SAND -w/caliche gravel, sl. moist, lt. green             | m.dense-dense |         | GC          | 7           |         |           |       |            |                 |
| SANDY CLAY -w/trace caliche gravel, sl. moist, lt. brown        | very stiff    |         | CL          | 8           |         | 12        | R     |            |                 |
| SILTY CLAY -w/sand, trace gravel, sl. moist, white to lt. green |               |         |             | 9           |         |           | B     |            |                 |
|                                                                 |               |         |             | 10          |         |           |       |            |                 |
|                                                                 |               |         |             | 11          |         |           |       |            |                 |
|                                                                 |               |         |             | 12          |         |           |       |            |                 |
|                                                                 |               |         |             | 13          |         | 50        | R     |            |                 |
|                                                                 |               |         |             | 14          |         |           | B     |            |                 |
|                                                                 |               |         |             | 15          |         |           |       |            |                 |

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
 SPT = Standard Penetration Test C = Core

NOTES:  
 Groundwater not encountered.

**Terracon**

DATE DRILLED:  
 1-26-00

PAGE NUMBER:  
 Page 1 of 2

DRIVING WEIGHT (lbs.): 140

PROJECT NO.:  
 64995240

PLATE:  
 FIGURE F-2 A-23

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 12

|                                       |                                |                                                        |
|---------------------------------------|--------------------------------|--------------------------------------------------------|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |

| SOIL DESCRIPTION                         | CONSISTENCY   | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |                 |
|------------------------------------------|---------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                          |               |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| CLAYEY GRAVEL -w/sand, sl. moist, white  | m.dense-dense |         | GC          | 16          |         | 50/0"     | R     |            |                 |
| w/occ. caliche lenses                    | dense-v.dense |         |             | 17          |         |           |       |            |                 |
| CALICHE -dry, white                      | hard          |         |             | 18          |         |           |       |            |                 |
|                                          | mod. hard     |         |             | 19          |         |           |       |            |                 |
| CLAYEY GRAVEL -sl. moist to moist, brown | dense         |         | GC          | 20          |         |           |       |            |                 |
| Bottom at 20 feet                        |               |         |             | 21          |         |           |       |            |                 |
|                                          |               |         |             | 22          |         |           |       |            |                 |
|                                          |               |         |             | 23          |         |           |       |            |                 |
|                                          |               |         |             | 24          |         |           |       |            |                 |
|                                          |               |         |             | 25          |         |           |       |            |                 |
|                                          |               |         |             | 26          |         |           |       |            |                 |
|                                          |               |         |             | 27          |         |           |       |            |                 |
|                                          |               |         |             | 28          |         |           |       |            |                 |
|                                          |               |         |             | 29          |         |           |       |            |                 |
|                                          |               |         |             | 30          |         |           |       |            |                 |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:  
1-26-00

PAGE NUMBER:  
Page 2 of 2

DRIVING WEIGHT (lbs.): 140

PROJECT NO.:  
64995240

PLATE:  
**FIGURE F-2** A-24

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 13

|                                          |                                   |                                                           |
|------------------------------------------|-----------------------------------|-----------------------------------------------------------|
| CLIENT:<br><b>Sverdrup Civil, Inc.</b>   |                                   | PROJECT:<br><b>Rainbow Boulevard Improvements</b>         |
| BORING LOCATION:<br><b>See Plot Plan</b> | ELEVATION:<br><b>Not Measured</b> | SITE:<br><b>Centennial Parkway to Silverstream Avenue</b> |

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                                                   | CONSISTENCY         | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |                 |
|--------------------------------------------------------------------|---------------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                                                    |                     |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| FILL-3 1/8" A.C. over 12" Agg. base, sl. moist, lt. brown          |                     |         | FILL        | 1           |         | 24        | R     |            |                 |
| SILTY SAND -w/trace gravel, sl. moist, brown                       |                     |         | SM          | 2           |         |           | B     |            |                 |
| CLAYEY SAND -w/caliche gravel, sl. moist, lt. brown                | med. dense          |         | SC          | 3           |         |           |       |            |                 |
| CLAYEY GRAVEL -w/sand, sl. moist to moist, white to lt. brown      |                     |         | GC          | 4           |         |           |       |            |                 |
| CLAYEY SAND -w/trace caliche gravel, sl. moist to moist, lt. brown | loose to med. dense |         | SC          | 5           |         | 13        | R     |            |                 |
| w/caliche gravel                                                   |                     |         |             | 6           |         |           |       |            |                 |
| CALICHE -dry, white to lt. brown                                   | hard                |         |             | 7           |         |           |       |            |                 |
| CLAYEY GRAVEL -w/thin occ. caliche lenses, sl. moist, lt. brown    | dense               |         | GC          | 8           |         |           |       |            |                 |
| w/caliche lenses                                                   | very dense          |         |             | 9           |         |           |       |            |                 |
| CALICHE -dry, lt. brown                                            | hard                |         |             | 10          |         | 76/7"     | R     |            |                 |
| SANDY CLAY -w/trace caliche gravel, sl. moist to moist, lt. brown  |                     |         | CL          | 11          |         |           | B     |            |                 |
|                                                                    | stiff               |         |             | 12          |         |           |       |            |                 |
| CLAYEY GRAVEL -w/sand, sl. moist, brown                            |                     |         | GC          | 13          |         |           |       |            |                 |
| w/caliche lenses                                                   | dense               |         |             | 14          |         |           |       |            |                 |
| Continued Next Page                                                |                     |         |             | 15          |         |           |       |            |                 |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:  
**1-26-00**

PAGE NUMBER:  
**Page 1 of 2**

PROJECT NO.:  
**64995240**

PLATE:  
**FIGURE F-2 A-25**

DRIVING WEIGHT (lbs.): **140**



# LOG OF BORING NO. 13

|                                          |                                   |                                                           |  |
|------------------------------------------|-----------------------------------|-----------------------------------------------------------|--|
| CLIENT:<br><b>Sverdrup Civil, Inc.</b>   |                                   | PROJECT:<br><b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION:<br><b>See Plot Plan</b> | ELEVATION:<br><b>Not Measured</b> | SITE:<br><b>Centennial Parkway to Silverstream Avenue</b> |  |

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                                      | CONSISTENCY | GRAPHIC                                                                           | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |
|-------------------------------------------------------|-------------|-----------------------------------------------------------------------------------|-------------|-------------|---------|-----------|-------|------------|
|                                                       |             |                                                                                   |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % |
| CLAYEY SAND -w/gravel, sl. moist, lt. brown           | dense       |  | SC          |             |         | 46        | R     |            |
| SANDY CLAY -w/trace gravel, sl. moist to moist, brown |             |  | CL          | 16          |         |           |       |            |
| w/CH lenses                                           | very stiff  |  |             | 17          |         |           |       |            |
| w/caliche gravel                                      |             |  |             | 18          |         |           |       |            |
| CALICHE -dry, lt. brown                               | mod. hard   |  |             | 19          |         |           |       |            |
| Bottom at 20 feet                                     |             |                                                                                   |             | 20          |         |           |       |            |
|                                                       |             |                                                                                   |             | 21          |         |           |       |            |
|                                                       |             |                                                                                   |             | 22          |         |           |       |            |
|                                                       |             |                                                                                   |             | 23          |         |           |       |            |
|                                                       |             |                                                                                   |             | 24          |         |           |       |            |
|                                                       |             |                                                                                   |             | 25          |         |           |       |            |
|                                                       |             |                                                                                   |             | 26          |         |           |       |            |
|                                                       |             |                                                                                   |             | 27          |         |           |       |            |
|                                                       |             |                                                                                   |             | 28          |         |           |       |            |
|                                                       |             |                                                                                   |             | 29          |         |           |       |            |
|                                                       |             |                                                                                   |             | 30          |         |           |       |            |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
**Groundwater not encountered.**

**Terracon**

DATE DRILLED:  
**1-26-00**

PAGE NUMBER:  
**Page 2 of 2**

DRIVING WEIGHT (lbs.): **140**

PROJECT NO.:  
**64995240**

PLATE:  
**A-26**

**FIGURE F-2**

# LOG OF BORING NO. 14

CLIENT: **Sverdrup Civil, Inc.** PROJECT: **Rainbow Boulevard Improvements**  
 BORING LOCATION: **See Plot Plan** ELEVATION: **Not Measured** SITE: **Centennial Parkway to Silverstream Avenue**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                                                  | CONSISTENCY   | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           |       | TESTS      |                 |  |
|-------------------------------------------------------------------|---------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|--|
|                                                                   |               |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |  |
| FILL-3 1/2" A.C. over 10" Agg. base, sl. moist to moist, brown    |               |         | FILL        | 1           |         |           |       |            |                 |  |
| FILL-SANDY GRAVEL -w/silt, sl. moist to moist, brown to lt. brown |               |         |             | 2           |         | 35        | R     |            |                 |  |
| FILL-CLAYEY SAND -w/gravel, sl. moist, lt. brown white            |               |         |             | 3           |         |           | B     |            |                 |  |
| CLAYEY GRAVEL -w/sand, sl. moist to moist, lt. brown              | med. dense    |         | GC          | 4           |         |           |       |            |                 |  |
| CLAYEY SAND -w/gravel, moist, brown                               |               |         | SC          | 6           |         |           |       |            |                 |  |
| CLAYEY GRAVEL -sl. moist, white                                   |               |         | GC          | 7           |         | 28        | R     |            |                 |  |
| CALICHE -dry, white                                               | m.hard        |         |             | 8           |         |           |       |            |                 |  |
| CLAYEY GRAVEL -sl. moist, white                                   | m.dense-dense |         | GC          | 9           |         |           |       |            |                 |  |
| CALICHE -dry, white                                               | hard-v.hard   |         |             | 10          |         |           |       |            |                 |  |
| CLAY -w/sand, moist, brown                                        | firm-stiff    |         | CH          | 11          |         |           |       |            |                 |  |
| w/trace gravel                                                    |               |         |             | 12          |         | 56/10"    | R     |            |                 |  |
| CLAYEY GRAVEL -w/occ. caliche lenses, moist, lt. brown            | very dense    |         | GC          | 13          |         |           | B     |            |                 |  |
| SANDY CLAY -w/trace gravel, moist, brown                          | firm-stiff    |         | CL          | 14          |         |           |       |            |                 |  |
| Continued Next Page                                               |               |         |             |             | 15      |           |       |            |                 |  |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
 SPT = Standard Penetration Test C = Core

NOTES:  
 Groundwater not encountered.

**Terracon**

DATE DRILLED:

1-24-00

PAGE NUMBER:

Page 1 of 2

PROJECT NO.:  
 64995240

PLATE:

FIGURE F-2 A-27

DRIVING WEIGHT (lbs.): 140

# LOG OF BORING NO. 14

|                                       |                                |                                                        |
|---------------------------------------|--------------------------------|--------------------------------------------------------|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                                     | CONSISTENCY | GRAPHIC                                                                           | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           |       | TESTS      |                 |  |
|------------------------------------------------------|-------------|-----------------------------------------------------------------------------------|-------------|-------------|---------|-----------|-------|------------|-----------------|--|
|                                                      |             |                                                                                   |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |  |
| SANDY CLAY -w/trace gravel, moist, brown             | firm-stiff  |  | CL          | 16          |         |           | B     |            |                 |  |
| CLAYEY GRAVEL -sl. moist, lt. brown                  | med. dense  |  | GC          | 17          |         | 20        | R     |            |                 |  |
| CLAYEY SAND -w/gravel, sl. moist, white to lt. brown | dense       |  | SC          | 18          |         |           |       |            |                 |  |
| Bottom at 20 feet                                    |             |                                                                                   |             | 19          |         |           |       |            |                 |  |
|                                                      |             |                                                                                   |             | 20          |         |           |       |            |                 |  |
|                                                      |             |                                                                                   |             | 21          |         |           |       |            |                 |  |
|                                                      |             |                                                                                   |             | 22          |         |           |       |            |                 |  |
|                                                      |             |                                                                                   |             | 23          |         |           |       |            |                 |  |
|                                                      |             |                                                                                   |             | 24          |         |           |       |            |                 |  |
|                                                      |             |                                                                                   |             | 25          |         |           |       |            |                 |  |
|                                                      |             |                                                                                   |             | 26          |         |           |       |            |                 |  |
|                                                      |             |                                                                                   |             | 27          |         |           |       |            |                 |  |
|                                                      |             |                                                                                   |             | 28          |         |           |       |            |                 |  |
|                                                      |             |                                                                                   |             | 29          |         |           |       |            |                 |  |
|                                                      |             |                                                                                   |             | 30          |         |           |       |            |                 |  |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:  
1-24-00

PAGE NUMBER:  
Page 2 of 2

DRIVING WEIGHT (lbs.): 140

PROJECT NO.:  
64995240

PLATE:  
FIGURE F-2 A-28

# LOG OF BORING NO. 15

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                                             | CONSISTENCY   | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS  |            |                 |
|--------------------------------------------------------------|---------------|---------|-------------|-------------|---------|-----------|--------|------------|-----------------|
|                                                              |               |         |             |             | SAMPLE  | BLOWS/FT. | TYPE*  | MOISTURE % | DRY DENSITY PCF |
| FILL-4 1/4" A.C. over 12" Agg. base, sl. moist, lt. brown    |               |         | FILL        | 1           |         |           |        |            |                 |
| FILL-SANDY GRAVEL -w/silt, sl. moist, lt. brown              |               |         |             | 2           |         |           |        |            |                 |
| CLAYEY SAND -sl. moist to moist, brown                       | med. dense    |         | SC          | 3           |         | 30        | R      | 22.9       | 85              |
| SILTY CLAY -w/sand, sl. moist to moist, white                | very stiff    |         | CL          | 4           |         |           | B      |            |                 |
| w/sandy silt lenses, moist, lt. gray                         | firm-stiff    |         |             | 5           |         |           |        |            |                 |
| w/cal. gravel, moist to very moist<br>lt. yellow brown       | firm          |         |             | 6           |         |           |        |            |                 |
|                                                              |               |         |             | 7           |         |           |        |            |                 |
|                                                              |               |         |             | 8           |         |           |        |            |                 |
|                                                              |               |         |             | 9           |         | 6         | R      |            |                 |
|                                                              |               |         |             | 10          |         |           |        |            |                 |
| CLAYEY GRAVEL -w/sand, moist to very moist, lt. yellow brown | loose-m.dense |         | GC          | 11          |         |           |        |            |                 |
| CALICHE -dry, lt. brown                                      | hard          |         |             | 12          |         |           |        |            |                 |
| CLAYEY GRAVEL -sl. moist, lt. brown                          | v.dense       |         | GC          | 13          |         |           |        |            |                 |
| CALICHE -dry, lt. brown                                      | hard          |         |             | 14          |         | 50/0"     | R<br>B |            |                 |
| w/popcorn lenses                                             | mod. hard     |         |             | 15          |         |           |        |            |                 |
| Continued Next Page                                          |               |         |             |             |         |           |        |            |                 |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:

1-26-00

PAGE NUMBER:

Page 1 of 2

PROJECT NO.:

64995240

PLATE:

FIGURE F-2 A-29

DRIVING WEIGHT (lbs.): 140

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 15

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                               | CONSISTENCY | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           |       | TESTS      |                 |  |  |
|------------------------------------------------|-------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|--|--|
|                                                |             |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |  |  |
| CALICHE -dry, lt. brown                        | m.h.-h.     |         | CL          |             |         | 14        | R     |            |                 |  |  |
| SILTY CLAY -w/sand, moist, brown               | med. dense  |         |             | 16          |         |           |       |            |                 |  |  |
| SANDY CLAY -w/caliche gravel, moist, lt. green | firm        |         |             | 17          |         |           |       |            |                 |  |  |
| w/clayey sand and clayey gravel lenses         |             |         |             | 18          |         |           |       |            |                 |  |  |
|                                                | hard        |         | 19          |             |         |           |       |            |                 |  |  |
| Bottom at 20 feet                              |             |         |             | 20          |         |           |       |            |                 |  |  |
|                                                |             |         |             | 21          |         |           |       |            |                 |  |  |
|                                                |             |         |             | 22          |         |           |       |            |                 |  |  |
|                                                |             |         |             | 23          |         |           |       |            |                 |  |  |
|                                                |             |         |             | 24          |         |           |       |            |                 |  |  |
|                                                |             |         |             | 25          |         |           |       |            |                 |  |  |
|                                                |             |         |             | 26          |         |           |       |            |                 |  |  |
|                                                |             |         |             | 27          |         |           |       |            |                 |  |  |
|                                                |             |         |             | 28          |         |           |       |            |                 |  |  |
|                                                |             |         |             | 29          |         |           |       |            |                 |  |  |
|                                                |             |         |             | 30          |         |           |       |            |                 |  |  |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

DRIVING WEIGHT (lbs.): 140

**Terracon**

DATE DRILLED:  
1-26-00

PROJECT NO.:  
64995240

PAGE NUMBER:  
Page 2 of 2

PLATE:  
FIGURE F-2 A-30

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 16

CLIENT: **Sverdrup Civil, Inc.** PROJECT: **Rainbow Boulevard Improvements**  
 BORING LOCATION: **See Plot Plan** ELEVATION: **Not Measured** SITE: **Centennial Parkway to Silverstream Avenue**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                                               | CONSISTENCY         | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           |       | TESTS      |                 |
|----------------------------------------------------------------|---------------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                                                |                     |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| FILL-4 3/8" A.C. over 18" Agg. base, sl. moist to moist, brown |                     |         | FILL        | 1           |         | 39        | R     |            |                 |
| FILL-CLAYEY SAND -w/gravel, sl. moist, lt. brown               |                     |         |             | 2           |         |           |       |            |                 |
|                                                                |                     |         |             | 3           |         |           |       |            |                 |
| CLAYEY SAND -w/caliche gravel, sl. moist, lt. brown            |                     |         | SC          | 4           |         |           |       |            |                 |
|                                                                |                     |         |             | 5           |         | 38        | R     |            |                 |
|                                                                |                     |         |             | 6           |         |           | B     |            |                 |
| CLAYEY GRAVEL -w/sand, sl. moist to moist, white to lt. brown  | med. dense to dense |         | GC          | 7           |         |           |       |            |                 |
|                                                                |                     |         |             | 8           |         |           |       |            |                 |
|                                                                |                     |         |             | 9           |         |           |       |            |                 |
| CLAYEY SAND -w/gravel, sl. moist to moist, lt. brown           | med. dense          |         | SC          | 10          |         | 20        | R     |            |                 |
|                                                                |                     |         |             | 11          |         |           |       |            |                 |
|                                                                |                     |         |             | 12          |         |           |       |            |                 |
| CALICHE -dry, white                                            | m.hard              |         |             | 13          |         |           |       |            |                 |
| w/thin uncemented lense                                        | hard                |         |             | 14          |         |           |       |            |                 |
| w/occ. uncemented lenses                                       | m.hard              |         |             | 15          |         |           |       |            |                 |

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:  
1-24-00

PAGE NUMBER:  
Page 1 of 2

PROJECT NO.:  
64995240

PLATE:  
FIGURE F-2 A-31

DRIVING WEIGHT (lbs.): 140



# LOG OF BORING NO. 16

CLIENT: **Sverdrup Civil, Inc.** PROJECT: **Rainbow Boulevard Improvements**  
 BORING LOCATION: **See Plot Plan** ELEVATION: **Not Measured** SITE: **Centennial Parkway to Silverstream Avenue**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                                                    | CONSISTENCY | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           |        | TESTS      |                 |
|---------------------------------------------------------------------|-------------|---------|-------------|-------------|---------|-----------|--------|------------|-----------------|
|                                                                     |             |         |             |             | SAMPLE  | BLOWS/FT. | TYPE*  | MOISTURE % | DRY DENSITY PCF |
| CALICHE -w/uncemented lenses, dry, white to lt. brown               | mod. hard   |         |             | 16          |         | 50/0"     | R<br>B |            |                 |
| CLAYEY SAND -w/trace gravel, sl. moist to moist, lt. brown to brown | dense       |         | SC          | 17          |         |           |        |            |                 |
| CLAYEY GRAVEL -w/caliche lenses, sl. moist to moist, lt. brown      | very dense  |         | GC          | 18          |         |           |        |            |                 |
| CLAYEY SAND -w/caliche gravel, sl. moist to moist, lt. brown        | dense       |         | SC          | 19          |         |           |        |            |                 |
| Bottom at 20 feet                                                   |             |         |             | 20          |         |           |        |            |                 |
|                                                                     |             |         |             | 21          |         |           |        |            |                 |
|                                                                     |             |         |             | 22          |         |           |        |            |                 |
|                                                                     |             |         |             | 23          |         |           |        |            |                 |
|                                                                     |             |         |             | 24          |         |           |        |            |                 |
|                                                                     |             |         |             | 25          |         |           |        |            |                 |
|                                                                     |             |         |             | 26          |         |           |        |            |                 |
|                                                                     |             |         |             | 27          |         |           |        |            |                 |
|                                                                     |             |         |             | 28          |         |           |        |            |                 |
|                                                                     |             |         |             | 29          |         |           |        |            |                 |
|                                                                     |             |         |             | 30          |         |           |        |            |                 |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES. IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
 SPT = Standard Penetration Test C = Core

NOTES:  
 Groundwater not encountered.

**Terracon**

DATE DRILLED:  
 1-24-00

PAGE NUMBER:  
 Page 2 of 2

DRIVING WEIGHT (lbs.): 140

PROJECT NO.:  
 64995240

PLATE:  
 FIGURE F-2 A-32

# LOG OF BORING NO. 17

|                                       |                                |                                                        |
|---------------------------------------|--------------------------------|--------------------------------------------------------|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                                                | CONSISTENCY         | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |                 |
|-----------------------------------------------------------------|---------------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                                                 |                     |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| FILL-3 1/4" A.C. over 9" Agg. base, sl. moist, lt. brown        |                     |         | FILL        | 1           |         |           |       |            |                 |
| FILL-SANDY GRAVEL -w/silt, sl. moist, lt. brown                 |                     |         |             | 2           |         | 56        | R     |            |                 |
|                                                                 |                     |         |             | 3           |         |           | B     |            |                 |
| SANDY SILT -w/gravel, porous, sl. moist, lt. brown              | firm-stiff          |         | ML          | 4           |         |           |       |            |                 |
| CLAYEY SILT -porous, sl. moist, lt. brown                       | stiff               |         |             | 5           |         |           |       |            |                 |
|                                                                 |                     |         |             | 6           |         |           |       |            |                 |
| CLAYEY GRAVEL -w/sand, sl. moist, green brown                   | med. dense          |         | GC          | 7           |         | 18        | R     |            |                 |
|                                                                 |                     |         |             | 8           |         |           |       |            |                 |
| SANDY CLAY -w/silt, trace gravel, sl. moist, white to lt. green | stiff to very stiff |         | CL          | 9           |         |           |       |            |                 |
|                                                                 |                     |         |             | 10          |         |           |       |            |                 |
| w/caliche gravel                                                |                     |         |             | 11          |         |           |       |            |                 |
|                                                                 |                     |         |             | 12          |         | 39        | R     |            |                 |
|                                                                 |                     |         |             | 13          |         |           | B     |            |                 |
| CLAYEY GRAVEL -w/sand, sl. moist, lt. green brown               | v.dense             |         | GC          | 14          |         |           |       |            |                 |
| CALICHE -dry, lt. brown                                         | hard                |         |             | 15          |         |           |       |            |                 |
| Continued Next Page                                             |                     |         |             |             |         |           |       |            |                 |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

DRIVING WEIGHT (lbs.): 140

**Terracon**

DATE DRILLED:

1-26-00

PAGE NUMBER:

Page 1 of 2

PROJECT NO.:

64995240

PLATE:

FIGURE F-2 A-33

# LOG OF BORING NO. 17

|                                       |                                |                                                        |
|---------------------------------------|--------------------------------|--------------------------------------------------------|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                        | CONSISTENCY         | GRAPHIC                                                                           | USCS SYMBOL | DEPTH (FT.) | SAMPLES                                                                             |           | TESTS |            |                 |
|-----------------------------------------|---------------------|-----------------------------------------------------------------------------------|-------------|-------------|-------------------------------------------------------------------------------------|-----------|-------|------------|-----------------|
|                                         |                     |                                                                                   |             |             | SAMPLE                                                                              | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| CALICHE -dry, lt. brown                 | hard                |  |             | 16          |  | 50/0"     | B     |            |                 |
|                                         |                     |                                                                                   |             | 17          |                                                                                     |           | R     |            |                 |
| CLAYEY GRAVEL -w/sand, sl. moist, brown | med. dense to dense |  | GC          | 18          |                                                                                     |           |       |            |                 |
|                                         |                     |                                                                                   |             | 19          |                                                                                     |           |       |            |                 |
| CALICHE -sl. moist, brown               | hard                |  |             | 20          |                                                                                     |           |       |            |                 |
| Bottom at 20 feet                       |                     |                                                                                   |             | 21          |                                                                                     |           |       |            |                 |
|                                         |                     |                                                                                   |             | 22          |                                                                                     |           |       |            |                 |
|                                         |                     |                                                                                   |             | 23          |                                                                                     |           |       |            |                 |
|                                         |                     |                                                                                   |             | 24          |                                                                                     |           |       |            |                 |
|                                         |                     |                                                                                   |             | 25          |                                                                                     |           |       |            |                 |
|                                         |                     |                                                                                   |             | 26          |                                                                                     |           |       |            |                 |
|                                         |                     |                                                                                   |             | 27          |                                                                                     |           |       |            |                 |
|                                         |                     |                                                                                   |             | 28          |                                                                                     |           |       |            |                 |
|                                         |                     |                                                                                   |             | 29          |                                                                                     |           |       |            |                 |
|                                         |                     |                                                                                   |             | 30          |                                                                                     |           |       |            |                 |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:  
1-26-00

PAGE NUMBER:  
Page 2 of 2

DRIVING WEIGHT (lbs.): 140

PROJECT NO.:  
64995240

PLATE:  
**FIGURE F-2** A-34

# LOG OF BORING NO. 18

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                                          | CONSISTENCY   | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |                 |
|-----------------------------------------------------------|---------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                                           |               |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| FILL-4 1/4" A.C. over 12" Agg. base, sl. moist, lt. brown |               |         | FILL        | 1           |         |           |       |            |                 |
| FILL-SANDY GRAVEL -w/silt, sl. moist, lt. brown           |               |         |             | 2           |         |           |       |            |                 |
| CLAYEY GRAVEL -w/sand, sl. moist, white                   | med. dense    |         | GC          | 3           |         | 24        | R     |            |                 |
|                                                           |               |         |             | 4           |         |           | B     |            |                 |
|                                                           |               |         |             | 5           |         |           |       |            |                 |
| SILTY CLAY -w/gravel, sl. moist to moist, lt. brown       | firm to stiff |         | CL          | 6           |         |           |       |            |                 |
| w/occ. gravel lenses                                      |               |         |             | 7           |         |           |       |            |                 |
|                                                           |               |         |             | 8           |         | 13        | R     | 22.8       | 88              |
| SANDY CLAY -w/gravel, sl. moist to moist, lt. green brown | stiff         |         |             | 9           |         |           |       |            |                 |
|                                                           |               |         |             | 10          |         |           |       |            |                 |
|                                                           |               |         |             | 11          |         |           |       |            |                 |
| CALICHE -dry, white to lt. brown                          | mod. hard     |         |             | 12          |         |           |       |            |                 |
|                                                           |               |         |             | 13          |         | 50/2"     | R     |            |                 |
|                                                           | hard          |         |             | 14          |         |           | B     |            |                 |
|                                                           |               |         |             | 15          |         |           |       |            |                 |

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:

1-24-00

PAGE NUMBER:

Page 1 of 2

PROJECT NO.:

64995240

PLATE:

FIGURE F-2 A-35

DRIVING WEIGHT (lbs.): 140

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 18

|                                       |                                |                                                        |
|---------------------------------------|--------------------------------|--------------------------------------------------------|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                    | CONSISTENCY | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           |       | TESTS      |                 |
|-------------------------------------|-------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                     |             |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| CALICHE -dry, white to lt. brown    | hard        |         |             | 16          |         |           | B     |            |                 |
|                                     | m.hard      |         |             | 17          |         |           |       |            |                 |
| CLAYEY GRAVEL -w/sand, moist, brown | med. dense  |         | GC          | 18          |         |           |       |            |                 |
| SANDY CLAY -w/gravel, moist, brown  | stiff       |         | CL          | 19          |         | 16        | R     |            |                 |
| Bottom at 20 feet                   |             |         |             | 20          |         |           |       |            |                 |
|                                     |             |         |             | 21          |         |           |       |            |                 |
|                                     |             |         |             | 22          |         |           |       |            |                 |
|                                     |             |         |             | 23          |         |           |       |            |                 |
|                                     |             |         |             | 24          |         |           |       |            |                 |
|                                     |             |         |             | 25          |         |           |       |            |                 |
|                                     |             |         |             | 26          |         |           |       |            |                 |
|                                     |             |         |             | 27          |         |           |       |            |                 |
|                                     |             |         |             | 28          |         |           |       |            |                 |
|                                     |             |         |             | 29          |         |           |       |            |                 |
|                                     |             |         |             | 30          |         |           |       |            |                 |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:  
**1-24-00**

PAGE NUMBER:  
**Page 2 of 2**

DRIVING WEIGHT (lbs.): **140**

PROJECT NO.:  
**64995240**

PLATE:  
**FIGURE F-2 A-36**

# LOG OF BORING NO. 19

CLIENT: **Sverdrup Civil, Inc.** PROJECT: **Rainbow Boulevard Improvements**

BORING LOCATION: **See Plot Plan** ELEVATION: **Not Measured** SITE: **Centennial Parkway to Silverstream Avenue**

| SOIL DESCRIPTION                                          | CONSISTENCY         | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           |       | TESTS      |                 |
|-----------------------------------------------------------|---------------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                                           |                     |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| FILL-4 3/8" A.C. over 12" Agg. base, sl. moist, lt. brown |                     |         | FILL        | 1           |         | 28        | R     | 7.4        | 117             |
| SILTY CLAY -w/sand, sl. moist, lt. brown                  | stiff               |         | CL          | 2           |         |           |       |            |                 |
| w/caliche gravel                                          |                     |         |             | 3           |         |           |       |            |                 |
| CLAYEY GRAVEL -w/sand, sl. moist, white to lt. brown      |                     |         |             | 4           |         |           |       |            |                 |
|                                                           | loose to med. dense |         | GC          | 5           |         | 8         | R     |            |                 |
|                                                           |                     |         |             | 6           |         |           | B     |            |                 |
|                                                           |                     |         |             | 7           |         |           |       |            |                 |
| CLAYEY SAND -w/caliche gravel, moist, lt. brown           |                     |         |             | 8           |         |           |       |            |                 |
|                                                           |                     |         |             | 9           |         |           |       |            |                 |
|                                                           |                     |         |             | 10          |         | 43        | R     |            |                 |
| w/thin caliche lenses                                     | dense               |         | SC          | 11          |         |           |       |            |                 |
| CLAYEY GRAVEL -w/sand, moist, lt. brown                   | med. dense          |         | GC          | 12          |         |           |       |            |                 |
| CALICHE -dry, lt. brown                                   | m.hard-hard         |         |             | 13          |         |           |       |            |                 |
| w/occ. uncemented lenses                                  | mod. hard           |         |             | 14          |         |           |       |            |                 |
|                                                           |                     |         |             | 15          |         |           |       |            |                 |

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

DRIVING WEIGHT (lbs.): 140

**Terracon**

DATE DRILLED:

1-26-00

PAGE NUMBER:

Page 1 of 2

PROJECT NO.:

64995240

PLATE:

FIGURE F-2 A-37

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.



# LOG OF BORING NO. 19

CLIENT: **Sverdrup Civil, Inc.** PROJECT: **Rainbow Boulevard Improvements**  
 BORING LOCATION: **See Plot Plan** ELEVATION: **Not Measured** SITE: **Centennial Parkway to Silverstream Avenue**

| SOIL DESCRIPTION                                | CONSISTENCY   | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |                 |
|-------------------------------------------------|---------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                                 |               |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| CLAYEY GRAVEL -dry, lt. brown                   | v.dense       |         | GC          | 15          |         | 50/2"     | R     |            |                 |
| CALICHE -dry, lt. brown                         | m.hard        |         |             | 16          |         |           | B     |            |                 |
| CLAYEY GRAVEL -moist, brown                     | m.dense-dense |         | GC          | 17          |         |           |       |            |                 |
| SANDY CLAY -w/gravel, sl. moist to moist, brown | very stiff    |         | CL          | 18          |         |           |       |            |                 |
| CLAYEY SAND -w/caliche gravel, sl. moist, brown | m.dense-dense |         | SC          | 19          |         |           |       |            |                 |
| Bottom at 20 feet                               |               |         |             | 20          |         |           |       |            |                 |
|                                                 |               |         |             | 21          |         |           |       |            |                 |
|                                                 |               |         |             | 22          |         |           |       |            |                 |
|                                                 |               |         |             | 23          |         |           |       |            |                 |
|                                                 |               |         |             | 24          |         |           |       |            |                 |
|                                                 |               |         |             | 25          |         |           |       |            |                 |
|                                                 |               |         |             | 26          |         |           |       |            |                 |
|                                                 |               |         |             | 27          |         |           |       |            |                 |
|                                                 |               |         |             | 28          |         |           |       |            |                 |
|                                                 |               |         |             | 29          |         |           |       |            |                 |
|                                                 |               |         |             | 30          |         |           |       |            |                 |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
 SPT = Standard Penetration Test C = Core

NOTES:  
 Groundwater not encountered.

DRIVING WEIGHT (lbs.): 140

**Terracon**

DATE DRILLED:

1-26-00

PAGE NUMBER:

Page 2 of 2

PROJECT NO.:

64995240

PLATE:

FIGURE F-2 A-38

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 20

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                                                                                         | CONSISTENCY             | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |                 |
|----------------------------------------------------------------------------------------------------------|-------------------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                                                                                          |                         |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| FILL-4 3/8" A.C. over 8" Agg. base, sl. moist, brown                                                     |                         |         | FILL        | 1           |         |           |       |            |                 |
| FILL-SANDY GRAVEL -w/silt, sl. moist, brown                                                              |                         |         |             | 2           |         |           |       |            |                 |
| SANDY GRAVEL -w/silt, cobbles, partially cemented, dry to sl. moist, lt. brown<br>w/occ. cemented lenses | very dense to mod. hard |         | GM          | 3           |         |           |       |            |                 |
|                                                                                                          |                         |         |             | 4           |         |           |       |            |                 |
| CALICHE (Cemented SAND & GRAVEL) -w/cobbles, dry, lt. brown                                              | m.hard-hard             |         |             | 5           |         |           |       |            |                 |
|                                                                                                          | hard                    |         |             | 6           |         |           |       |            |                 |
|                                                                                                          | m.hard-hard             |         |             | 7           |         |           |       |            |                 |
|                                                                                                          |                         |         |             | 8           |         |           |       |            |                 |
| w/partially cemented lenses                                                                              | mod. hard               |         |             | 9           |         |           |       |            |                 |
|                                                                                                          |                         |         |             | 10          |         |           |       |            |                 |
|                                                                                                          |                         |         |             | 11          |         |           |       |            |                 |
|                                                                                                          |                         |         |             | 12          |         |           |       |            |                 |
|                                                                                                          |                         |         |             | 13          |         |           |       |            |                 |
|                                                                                                          |                         |         |             | 14          |         |           |       |            |                 |
|                                                                                                          |                         |         |             | 15          |         |           |       |            |                 |
|                                                                                                          |                         |         |             |             |         |           |       |            |                 |

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

DRIVING WEIGHT (lbs.): 140

**Terracon**

DATE DRILLED:

1-31-00

PAGE NUMBER:

Page 1 of 2

PROJECT NO.:

64995240

PLATE:

FIGURE F-2 A-39

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 20

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                                                                      | CONSISTENCY             | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |
|---------------------------------------------------------------------------------------|-------------------------|---------|-------------|-------------|---------|-----------|-------|------------|
|                                                                                       |                         |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % |
| <b>CALICHE (Cemented SAND &amp; GRAVEL) -dry, lt. brown</b>                           | mod. hard               |         |             | 16          |         |           | B     |            |
| <b>SANDY GRAVEL -w/silt, cobbles, partially cemented, dry to sl. moist, lt. brown</b> | very dense to mod. hard |         | GM          | 17          |         | 50/2"     | SPT   |            |
| <b>sl. moist</b>                                                                      | very dense              |         |             | 18          |         |           |       |            |
|                                                                                       |                         |         |             | 19          |         |           |       |            |
|                                                                                       |                         |         |             | 20          |         |           |       |            |
| <b>Bottom at 20 feet</b>                                                              |                         |         |             | 21          |         |           |       |            |
|                                                                                       |                         |         |             | 22          |         |           |       |            |
|                                                                                       |                         |         |             | 23          |         |           |       |            |
|                                                                                       |                         |         |             | 24          |         |           |       |            |
|                                                                                       |                         |         |             | 25          |         |           |       |            |
|                                                                                       |                         |         |             | 26          |         |           |       |            |
|                                                                                       |                         |         |             | 27          |         |           |       |            |
|                                                                                       |                         |         |             | 28          |         |           |       |            |
|                                                                                       |                         |         |             | 29          |         |           |       |            |
|                                                                                       |                         |         |             | 30          |         |           |       |            |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
**Groundwater not encountered.**

DRIVING WEIGHT (lbs.): **140**

**Terracon**

DATE DRILLED:

**1-31-00**

PAGE NUMBER:

**Page 2 of 2**

PROJECT NO.:

**64995240**

PLATE:

**FIGURE F-2 A-40**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 21

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                                              | CONSISTENCY             | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |
|---------------------------------------------------------------|-------------------------|---------|-------------|-------------|---------|-----------|-------|------------|
|                                                               |                         |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % |
| FILL-3 3/8" A.C. over 13 1/2" Agg. base, sl. moist, lt. brown |                         |         | FILL        | 1           |         |           |       |            |
| FILL-SANDY GRAVEL -w/silt, sl. moist, lt. brown               |                         |         |             | 2           |         |           |       |            |
| SANDY GRAVEL -w/silt, cobbles, sl. moist, lt. brown           | very dense              |         | GM          | 3           |         | 71        | SPT   |            |
| partially cemented, dry to sl. moist                          | very dense to mod. hard |         |             | 4           |         |           | B     |            |
| CALICHE (Cemented SAND & GRAVEL) -w/cobbles, dry, lt. brown   |                         |         |             | 5           |         |           |       |            |
|                                                               |                         |         |             | 6           |         |           |       |            |
|                                                               |                         |         |             | 7           |         |           |       |            |
|                                                               |                         |         |             | 8           |         | 50/0"     | SPT   |            |
|                                                               |                         |         |             | 9           |         |           |       |            |
|                                                               |                         |         |             | 10          |         |           |       |            |
|                                                               |                         |         |             | 11          |         |           |       |            |
|                                                               |                         |         |             | 12          |         |           |       |            |
|                                                               |                         |         |             | 13          |         | 50/1.5"   | SPT   |            |
|                                                               |                         |         |             | 14          |         |           | B     |            |
|                                                               |                         |         |             | 15          |         |           |       |            |

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test .C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:

1-30-00

PAGE NUMBER:

Page 1 of 2

PROJECT NO.:  
64995240

PLATE:

FIGURE F-2 A-41

DRIVING WEIGHT (lbs.): 140

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 21

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                                                        | CONSISTENCY    | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |                 |
|-------------------------------------------------------------------------|----------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                                                         |                |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| <b>SANDY GRAVEL w/silt, cobbles, partially cemented, dry, lt. brown</b> | v.dense-m.hard |         | GM          | 16          |         |           | B     |            |                 |
| <b>CALICHE (Cemented SAND &amp; GRAVEL) -w/cobbles, dry, lt. brown</b>  | hard           |         |             | 17          |         |           |       |            |                 |
| <b>w/partially cemented</b>                                             |                |         |             | 18          |         | 50/0"     | SPT   |            |                 |
| <b>w/occ. partially cemented lenses</b>                                 | mod. hard      |         |             | 19          |         |           |       |            |                 |
| <b>Bottom at 20 feet</b>                                                |                |         |             | 20          |         |           |       |            |                 |
|                                                                         |                |         |             | 21          |         |           |       |            |                 |
|                                                                         |                |         |             | 22          |         |           |       |            |                 |
|                                                                         |                |         |             | 23          |         |           |       |            |                 |
|                                                                         |                |         |             | 24          |         |           |       |            |                 |
|                                                                         |                |         |             | 25          |         |           |       |            |                 |
|                                                                         |                |         |             | 26          |         |           |       |            |                 |
|                                                                         |                |         |             | 27          |         |           |       |            |                 |
|                                                                         |                |         |             | 28          |         |           |       |            |                 |
|                                                                         |                |         |             | 29          |         |           |       |            |                 |
|                                                                         |                |         |             | 30          |         |           |       |            |                 |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
**Groundwater not encountered.**

DRIVING WEIGHT (lbs.): 140

**Terracon**

DATE DRILLED:

**1-30-00**

PAGE NUMBER:

**Page 2 of 2**

PROJECT NO.:

**64995240**

PLATE:

**FIGURE F-2 A-42**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 22

CLIENT: **Sverdrup Civil, Inc.** PROJECT: **Rainbow Boulevard Improvements**  
 BORING LOCATION: **See Plot Plan** ELEVATION: **Not Measured** SITE: **Centennial Parkway to Silverstream Avenue**

| SOIL DESCRIPTION                                                               | CONSISTENCY             | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |
|--------------------------------------------------------------------------------|-------------------------|---------|-------------|-------------|---------|-----------|-------|------------|
|                                                                                |                         |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % |
| FILL-5" A.C. over 6" Agg. base, sl. moist, brown                               |                         |         | FILL        | 1           |         |           |       |            |
| FILL-SANDY GRAVEL -w/silt, cobbles, sl. moist, brown                           |                         |         |             | 2           |         | 54        | SPT   |            |
| SANDY GRAVEL -w/silt, cobbles, sl. moist, lt. brown                            | very dense              |         | GM          | 3           |         |           |       |            |
| part. cem., dry to sl. moist, lt. brown                                        | very dense to mod. hard |         |             | 4           |         |           |       |            |
| w/occ. cemented lenses                                                         |                         |         |             | 5           |         | 50/5"     | SPT B |            |
| CALICHE (Cemented SAND & GRAVEL) -w/cobbles, dry, lt. brown                    | mod. hard               |         |             | 6           |         |           |       |            |
| SANDY GRAVEL -w/silt, cobbles, partially cemented, dry to sl. moist, lt. brown | very dense to mod. hard |         | GM          | 7           |         |           |       |            |
|                                                                                |                         |         |             | 8           |         |           |       |            |
|                                                                                |                         |         |             | 9           |         |           |       |            |
|                                                                                |                         |         |             | 10          |         |           |       |            |
|                                                                                |                         |         |             | 11          |         | 50/5"     | SPT   |            |
| CALICHE (Cemented SAND & GRAVEL) -w/cobbles, dry, lt. brown                    | mod. hard               |         |             | 12          |         |           |       |            |
| w/part. cem. lenses                                                            |                         |         |             | 13          |         |           |       |            |
|                                                                                |                         |         |             | 14          |         |           |       |            |
|                                                                                |                         |         |             | 15          |         |           |       |            |

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
 SPT = Standard Penetration Test C = Core

NOTES:  
 Groundwater not encountered.

DRIVING WEIGHT (lbs.): 140

**Terracon**

DATE DRILLED:

1-27-00

PAGE NUMBER:

Page 1 of 2

PROJECT NO.:

64995240

PLATE:

FIGURE F-2 A-43

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.



# LOG OF BORING NO. 22

|                                       |                                |                                                        |
|---------------------------------------|--------------------------------|--------------------------------------------------------|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |

| SOIL DESCRIPTION                                                       | CONSISTENCY | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |                 |
|------------------------------------------------------------------------|-------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                                                        |             |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| <b>CALICHE (Cemented SAND &amp; GRAVEL) -w/cobbles, dry, lt. brown</b> | m.hard-hard |         |             | 16          |         | 50/0"     | SPT B |            |                 |
|                                                                        | hard        |         |             | 17          |         |           |       |            |                 |
|                                                                        |             |         |             | 18          |         |           |       |            |                 |
|                                                                        | very hard   |         |             | 19          |         |           |       |            |                 |
| <b>Bottom at 20 feet</b>                                               |             |         |             | 20          |         |           |       |            |                 |
|                                                                        |             |         |             | 21          |         |           |       |            |                 |
|                                                                        |             |         |             | 22          |         |           |       |            |                 |
|                                                                        |             |         |             | 23          |         |           |       |            |                 |
|                                                                        |             |         |             | 24          |         |           |       |            |                 |
|                                                                        |             |         |             | 25          |         |           |       |            |                 |
|                                                                        |             |         |             | 26          |         |           |       |            |                 |
|                                                                        |             |         |             | 27          |         |           |       |            |                 |
|                                                                        |             |         |             | 28          |         |           |       |            |                 |
|                                                                        |             |         |             | 29          |         |           |       |            |                 |
|                                                                        |             |         |             | 30          |         |           |       |            |                 |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES. IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
**Groundwater not encountered.**

DRIVING WEIGHT (lbs.): **140**

**Terracon**

DATE DRILLED:

**1-27-00**

PAGE NUMBER:

**Page 2 of 2**

PROJECT NO.:

**64995240**

PLATE:

**FIGURE F-2 A-44**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 23

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                                                                    | CONSISTENCY             | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |                 |
|-------------------------------------------------------------------------------------|-------------------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                                                                     |                         |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| FILL-4 1/8" A.C. over 12" Agg. base, sl. moist, lt. brown                           |                         |         | FILL        | 1           |         |           |       |            |                 |
| FILL-SANDY GRAVEL -w/silt, cob., sl. moist, lt. brown                               |                         |         |             | 2           |         |           |       |            |                 |
| SANDY GRAVEL -w/silt, occ. cobbles, partially cemented, dry to sl. moist, lt. brown | very dense to mod. hard |         | GM          | 3           |         | 50/5"     | SPT B |            |                 |
| w/cobbles                                                                           |                         |         |             | 4           |         |           |       |            |                 |
| CALICHE (Cemented SAND & GRAVEL) -w/cobbles, dry, lt. brown                         | mod. hard               |         |             | 5           |         | 50/2"     | SPT   |            |                 |
|                                                                                     |                         |         |             | 6           |         |           |       |            |                 |
|                                                                                     |                         |         |             | 7           |         |           |       |            |                 |
|                                                                                     |                         |         |             | 8           |         |           |       |            |                 |
| w/partially cemented lenses                                                         |                         |         |             | 9           |         |           |       |            |                 |
|                                                                                     |                         |         |             | 10          |         |           |       |            |                 |
| SANDY GRAVEL -w/silt, partially cemented, dry to sl. moist, lt. brown               | v.dense-m.hard          |         | GM          | 11          |         |           |       |            |                 |
| CALICHE (Cemented SAND & GRAVEL) -w/cobbles, dry, lt. brown                         | mod. hard               |         |             | 12          |         | 50/0"     | SPT B |            |                 |
|                                                                                     |                         |         |             | 13          |         |           |       |            |                 |
|                                                                                     |                         |         |             | 14          |         |           |       |            |                 |
|                                                                                     |                         |         |             | 15          |         |           |       |            |                 |
| w/partially cemented lenses                                                         |                         |         |             |             |         |           |       |            |                 |
| Continued Next Page                                                                 |                         |         |             |             |         |           |       |            |                 |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:

1-30-00

PAGE NUMBER:

Page 1 of 2

PROJECT NO.:

64995240

PLATE:

FIGURE F-2 A-45

DRIVING WEIGHT (lbs.): 140

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 23

|                                       |                                |                                                        |
|---------------------------------------|--------------------------------|--------------------------------------------------------|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |

| SOIL DESCRIPTION                                            | CONSISTENCY             | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |
|-------------------------------------------------------------|-------------------------|---------|-------------|-------------|---------|-----------|-------|------------|
|                                                             |                         |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % |
| CALICHE (Cemented SAND & GRAVEL) -w/cobbles, dry, lt. brown | mod. hard               |         |             | 16          |         |           | B     |            |
| SANDY GRAVEL -w/silt, cobbles, dry to sl. moist, lt. brown  | very dense to mod. hard |         | GM          | 17          |         | 50/3"     | SPT   |            |
|                                                             |                         |         |             | 18          |         |           |       |            |
|                                                             |                         |         |             | 19          |         |           |       |            |
|                                                             |                         |         |             | 20          |         |           |       |            |
| w/occ. silty sand lenses                                    |                         |         |             | 21          |         |           |       |            |
|                                                             |                         |         |             | 22          |         |           |       |            |
|                                                             |                         |         |             | 23          |         |           |       |            |
|                                                             |                         |         |             | 24          |         |           |       |            |
|                                                             |                         |         |             | 25          |         |           |       |            |
|                                                             |                         |         |             | 26          |         |           |       |            |
|                                                             |                         |         |             | 27          |         |           |       |            |
|                                                             |                         |         |             | 28          |         |           |       |            |
|                                                             |                         |         |             | 29          |         |           |       |            |
|                                                             |                         |         |             | 30          |         |           |       |            |
| Bottom at 20 feet                                           |                         |         |             |             |         |           |       |            |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
**Groundwater not encountered.**

**Terracon**

DATE DRILLED:  
**1-30-00**

PAGE NUMBER:  
**Page 2 of 2**

PROJECT NO.:  
**64995240**

PLATE:  
**FIGURE F-2 A-46**

DRIVING WEIGHT (lbs.): **140**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 24

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                                                               | CONSISTENCY    | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           |       | TESTS      |                 |
|--------------------------------------------------------------------------------|----------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                                                                |                |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| FILL-5 1/2" A.C. over 12" Agg. base, sl. moist, brown                          |                |         | FILL        | 1           |         |           |       |            |                 |
| FILL-SANDY GRAVEL -w/silt, occ. cobbles, sl. moist, lt. brown                  |                |         |             | 2           |         |           |       |            |                 |
| SANDY GRAVEL -w/silt, cobbles, sl. moist, lt. brown                            | very dense     |         | GM          | 3           |         |           |       |            |                 |
|                                                                                |                |         |             | 4           |         | 54        | B SPT |            |                 |
| part. cem., dry to sl. moist                                                   | v.dense-m.hard |         |             | 5           |         |           | B     |            |                 |
| CALICHE (Cemented SAND & GRAVEL) -w/cobbles, dry, lt. brown                    | hard           |         |             | 6           |         |           |       |            |                 |
| w/partially cemented lenses                                                    | mod. hard      |         |             | 7           |         |           |       |            |                 |
|                                                                                |                |         |             | 8           |         | 50/1"     | SPT   |            |                 |
| SANDY GRAVEL -w/silt, cobbles, partially cemented, dry to sl. moist, lt. brown | v.dense-m.hard |         | GM          | 9           |         |           |       |            |                 |
|                                                                                |                |         |             | 10          |         |           |       |            |                 |
| CALICHE (Cemented SAND & GRAVEL) -w/cobbles, dry, lt. brown                    | hard           |         |             | 11          |         |           |       |            |                 |
|                                                                                |                |         |             | 12          |         |           |       |            |                 |
|                                                                                |                |         |             | 13          |         | 50/0"     | SPT   |            |                 |
| SANDY GRAVEL -w/silt, cobbles, partially cemented, dry to sl. moist, lt. brown | v.dense-m.hard |         | GM          | 14          |         |           | B     |            |                 |
|                                                                                |                |         |             | 15          |         |           |       |            |                 |
| Continued Next Page                                                            |                |         |             |             |         |           |       |            |                 |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:

1-27-00

PAGE NUMBER:

Page 1 of 2

PROJECT NO.:

64995240

PLATE:

FIGURE F-2 A-47

DRIVING WEIGHT (lbs.): 140

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 24

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                                                                                                                            | CONSISTENCY        | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           |       | TESTS      |                 |  |
|---------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|--|
|                                                                                                                                             |                    |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |  |
| SANDY GRAVEL -w/silt, cobbles, part. cem., dry to sl. moist, lt. brown<br><br>sl. moist, white to lt. brown<br><br>w/occ. part. cem. lenses | v.dense-<br>m.hard |         | GM          | 16          |         | 50/<br>5" | B     |            |                 |  |
|                                                                                                                                             | very<br>dense      |         |             | 17          |         |           |       |            |                 |  |
|                                                                                                                                             |                    |         |             | 18          |         |           |       |            |                 |  |
|                                                                                                                                             |                    |         |             | 19          |         |           |       |            |                 |  |
| Bottom at 20 feet                                                                                                                           |                    |         |             | 20          |         |           | SPT   |            |                 |  |
|                                                                                                                                             |                    |         |             | 21          |         |           |       |            |                 |  |
|                                                                                                                                             |                    |         |             | 22          |         |           |       |            |                 |  |
|                                                                                                                                             |                    |         |             | 23          |         |           |       |            |                 |  |
|                                                                                                                                             |                    |         |             | 24          |         |           |       |            |                 |  |
|                                                                                                                                             |                    |         |             | 25          |         |           |       |            |                 |  |
|                                                                                                                                             |                    |         |             | 26          |         |           |       |            |                 |  |
|                                                                                                                                             |                    |         |             | 27          |         |           |       |            |                 |  |
|                                                                                                                                             |                    |         |             | 28          |         |           |       |            |                 |  |
|                                                                                                                                             |                    |         |             | 29          |         |           |       |            |                 |  |
|                                                                                                                                             |                    |         |             | 30          |         |           |       |            |                 |  |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
**Groundwater not encountered.**

**Terracon**

|                                 |                                    |
|---------------------------------|------------------------------------|
| DATE DRILLED:<br><b>1-27-00</b> | PAGE NUMBER:<br><b>Page 2 of 2</b> |
| PROJECT NO.:<br><b>64995240</b> | PLATE:<br><b>FIGURE F-2 A-48</b>   |

DRIVING WEIGHT (lbs.): **140**

# LOG OF BORING NO. 25

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                                                                                                                    | CONSISTENCY             | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |
|-------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------|-------------|-------------|---------|-----------|-------|------------|
|                                                                                                                                     |                         |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % |
| FILL-5 1/2" A.C. over 13" Agg. base, sl. moist, lt. brown                                                                           |                         |         | FILL        | 1           |         |           |       |            |
| SANDY GRAVEL -w/silt, occ. cobbles, sl. moist, lt. brown<br><br>w/cobbles<br><br>w/occ. part. cem. lenses<br><br>partially cemented |                         |         |             | 2           |         | 19        | B SPT |            |
|                                                                                                                                     | med. dense              |         | GM          | 3           |         |           | B     |            |
|                                                                                                                                     |                         |         |             | 4           |         |           |       |            |
|                                                                                                                                     |                         |         |             | 5           |         |           |       |            |
|                                                                                                                                     | med. dense to dense     |         |             | 6           |         | 28        | SPT   |            |
|                                                                                                                                     |                         |         |             | 7           |         |           |       |            |
|                                                                                                                                     |                         |         |             | 8           |         |           |       |            |
|                                                                                                                                     | dense                   |         |             | 9           |         |           |       |            |
|                                                                                                                                     |                         |         |             | 10          |         |           | B     |            |
|                                                                                                                                     |                         |         |             | 11          |         | 39        | SPT   |            |
|                                                                                                                                     | very dense              |         |             | 12          |         |           | B     |            |
|                                                                                                                                     |                         |         |             | 13          |         |           |       |            |
|                                                                                                                                     | very dense to mod. hard |         |             | 14          |         |           |       |            |
|                                                                                                                                     |                         |         |             | 15          |         |           |       |            |

Continued Next Page

|                                                                                                                                        |                 |                                                                             |                                    |
|----------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------------------------------------------------------------------------|------------------------------------|
| THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL. |                 | *SAMPLE TYPES: R = Ring B = Bag<br>SPT = Standard Penetration Test C = Core |                                    |
| NOTES:<br><b>Groundwater not encountered.</b>                                                                                          | <b>Terracon</b> | DATE DRILLED:<br><b>1-30-00</b>                                             | PAGE NUMBER:<br><b>Page 1 of 2</b> |
| DRIVING WEIGHT (lbs.): <b>140</b>                                                                                                      |                 | PROJECT NO.:<br><b>64995240</b>                                             | PLATE:<br><b>FIGURE F-2 A-49</b>   |

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.



# LOG OF BORING NO. 25

|                                          |                                   |                                                           |
|------------------------------------------|-----------------------------------|-----------------------------------------------------------|
| CLIENT:<br><b>Sverdrup Civil, Inc.</b>   |                                   | PROJECT:<br><b>Rainbow Boulevard Improvements</b>         |
| BORING LOCATION:<br><b>See Plot Plan</b> | ELEVATION:<br><b>Not Measured</b> | SITE:<br><b>Centennial Parkway to Silverstream Avenue</b> |

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                                                                                                                         | CONSISTENCY             | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |
|------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------|-------------|-------------|---------|-----------|-------|------------|
|                                                                                                                                          |                         |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % |
| <b>SANDY GRAVEL -w/silt, part. cem., dry to sl. moist, lt. brown w/cobbles</b><br><br><b>sl. moist</b><br><br><b>w/silty sand lenses</b> | very dense to mod. hard |         | GM          | 16          | X       | 50/5"     | R     |            |
|                                                                                                                                          |                         |         |             | 17          |         |           |       |            |
|                                                                                                                                          |                         |         |             | 18          |         |           |       |            |
|                                                                                                                                          | very dense              |         |             | 19          |         |           |       |            |
| <b>Bottom at 20 feet</b>                                                                                                                 |                         |         |             | 20          |         |           |       |            |
|                                                                                                                                          |                         |         |             | 21          |         |           |       |            |
|                                                                                                                                          |                         |         |             | 22          |         |           |       |            |
|                                                                                                                                          |                         |         |             | 23          |         |           |       |            |
|                                                                                                                                          |                         |         |             | 24          |         |           |       |            |
|                                                                                                                                          |                         |         |             | 25          |         |           |       |            |
|                                                                                                                                          |                         |         |             | 26          |         |           |       |            |
|                                                                                                                                          |                         |         |             | 27          |         |           |       |            |
|                                                                                                                                          |                         |         |             | 28          |         |           |       |            |
|                                                                                                                                          |                         |         |             | 29          |         |           |       |            |
|                                                                                                                                          |                         |         |             | 30          |         |           |       |            |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
**Groundwater not encountered.**

**Terracon**

DATE DRILLED:  
**1-30-00**

PAGE NUMBER:  
**Page 2 of 2**

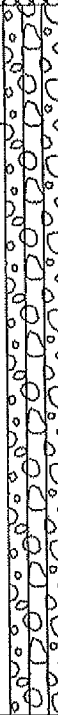
DRIVING WEIGHT (lbs.): **140**

PROJECT NO.:  
**64995240**

PLATE:  
**FIGURE F-2 A-50**

# LOG OF BORING NO. 26

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                                         | CONSISTENCY                                       | GRAPHIC                                                                             | USCS SYMBOL | DEPTH (FT.)         | SAMPLES                                                                             |           |       | TESTS      |                 |  |
|----------------------------------------------------------|---------------------------------------------------|-------------------------------------------------------------------------------------|-------------|---------------------|-------------------------------------------------------------------------------------|-----------|-------|------------|-----------------|--|
|                                                          |                                                   |                                                                                     |             |                     | SAMPLE                                                                              | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |  |
| FILL-3" A.C. over 13" Agg. base, sl. moist, lt. brown    |                                                   |    | FILL        | 1                   |                                                                                     |           |       |            |                 |  |
| SANDY GRAVEL -w/silt, occ. cobbles, sl. moist, lt. brown | m.dense-dense                                     |   | GM          | 2                   |                                                                                     |           |       |            |                 |  |
|                                                          | dense                                             |                                                                                     |             | 3                   | X                                                                                   | 31        | SPT   |            |                 |  |
|                                                          |                                                   |                                                                                     |             | 4                   |                                                                                     |           |       |            |                 |  |
|                                                          |                                                   |                                                                                     |             | 5                   |                                                                                     |           |       |            |                 |  |
|                                                          |                                                   |                                                                                     |             | 6                   |                                                                                     |           |       |            |                 |  |
|                                                          |                                                   |                                                                                     |             | 7                   |                                                                                     |           |       |            |                 |  |
|                                                          |                                                   |                                                                                     |             | 8                   | X                                                                                   | 78        | B SPT |            |                 |  |
|                                                          |                                                   |                                                                                     |             | 9                   |                                                                                     |           | B     |            |                 |  |
|                                                          |                                                   |                                                                                     |             | 10                  |                                                                                     |           |       |            |                 |  |
|                                                          | CLAYEY SAND -w/trace gravel, sl. moist, lt. brown |                                                                                     |             | med. dense to dense |  | SC        | 11    |            |                 |  |
| CLAYEY SILT -w/sand, gravel, sl. moist, lt. brown        | stiff                                             |  | ML          | 12                  |                                                                                     |           |       |            |                 |  |
|                                                          |                                                   |                                                                                     |             | 13                  | X                                                                                   | 30        | SPT   |            |                 |  |
|                                                          |                                                   |                                                                                     |             | 14                  |                                                                                     |           | B     |            |                 |  |
| Continued Next Page                                      |                                                   |                                                                                     |             | 15                  |                                                                                     |           |       |            |                 |  |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:  
1-30-00

PAGE NUMBER:  
Page 1 of 2

DRIVING WEIGHT (lbs.): 140

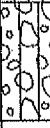
PROJECT NO.:  
64995240

PLATE:  
**FIGURE F-2 A-51**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 26

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                                 | CONSISTENCY         | GRAPHIC                                                                           | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |
|--------------------------------------------------|---------------------|-----------------------------------------------------------------------------------|-------------|-------------|---------|-----------|-------|------------|
|                                                  |                     |                                                                                   |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % |
| SANDY SILT -w/clay, gravel, sl. moist, lt. brown | stiff to very stiff |  | ML          | 16          |         |           | B     |            |
|                                                  |                     |                                                                                   |             | 17          |         | 29        | R     |            |
|                                                  |                     |                                                                                   |             | 18          |         |           |       |            |
| SILTY GRAVEL -w/sand, sl. moist, lt. brown       | m.dense-dense       |  | GM          | 19          |         |           |       |            |
| Bottom at 20 feet                                |                     |                                                                                   |             | 20          |         |           |       |            |
|                                                  |                     |                                                                                   |             | 21          |         |           |       |            |
|                                                  |                     |                                                                                   |             | 22          |         |           |       |            |
|                                                  |                     |                                                                                   |             | 23          |         |           |       |            |
|                                                  |                     |                                                                                   |             | 24          |         |           |       |            |
|                                                  |                     |                                                                                   |             | 25          |         |           |       |            |
|                                                  |                     |                                                                                   |             | 26          |         |           |       |            |
|                                                  |                     |                                                                                   |             | 27          |         |           |       |            |
|                                                  |                     |                                                                                   |             | 28          |         |           |       |            |
|                                                  |                     |                                                                                   |             | 29          |         |           |       |            |
|                                                  |                     |                                                                                   |             | 30          |         |           |       |            |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:  
1-30-00

PAGE NUMBER:  
Page 2 of 2

DRIVING WEIGHT (lbs.): 140

PROJECT NO.:  
64995240

PLATE:  
FIGURE F-2 A-52

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 27

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                                         | CONSISTENCY             | GRAPHIC                                                                            | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS         |            |
|----------------------------------------------------------|-------------------------|------------------------------------------------------------------------------------|-------------|-------------|---------|-----------|---------------|------------|
|                                                          |                         |                                                                                    |             |             | SAMPLE  | BLOWS/FT. | TYPE*         | MOISTURE % |
| FILL-3" A.C. over 12" Agg. base, sl. moist, lt. brown    |                         |   | FILL        | 1           |         |           |               |            |
| FILL-SANDY GRAVEL -w/silt, cobbles, sl. moist, lt. brown |                         |                                                                                    |             | 2           |         |           |               |            |
| SANDY GRAVEL -w/silt, cobbles, sl. moist, lt. brown      |                         |  | GM          | 3           |         |           |               |            |
| w/part. cem. lenses                                      | very dense              |                                                                                    |             | 4           |         | 50/5.5"   | B<br>SPT<br>B |            |
| partially cemented, dry to sl. moist                     | v.dense-m.hard          |                                                                                    |             | 5           |         |           |               |            |
| SILTY GRAVEL -w/sand, sl. moist, white                   |                         |                                                                                    |             | 6           |         |           |               |            |
| w/occ. thin CLAYEY SILT lenses                           | very dense              |                                                                                    |             | 7           |         |           |               |            |
| partially cemented, dry to sl. moist                     | very dense to mod. hard |                                                                                    |             | 8           |         |           |               |            |
|                                                          |                         |                                                                                    |             | 9           |         | 77/11"    | SPT<br>B      |            |
| SANDY GRAVEL -w/silt, sl. moist, white to lt. brown      |                         |                                                                                    |             | 10          |         |           |               |            |
|                                                          | very dense              |                                                                                    |             | 11          |         |           |               |            |
|                                                          |                         |                                                                                    |             | 12          |         |           |               |            |
|                                                          |                         |                                                                                    |             | 13          |         |           |               |            |
|                                                          |                         |                                                                                    |             | 14          |         | 72        | SPT           |            |
|                                                          |                         |                                                                                    |             | 15          |         |           |               |            |

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

## NOTES:

Groundwater not encountered.

**Terracon**

DATE DRILLED:

1-27-00

PAGE NUMBER:

Page 1 of 2

PROJECT NO.:

64995240

PLATE:

FIGURE F-2 A-53

DRIVING WEIGHT (lbs.): 140

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 27

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                                               | CONSISTENCY    | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |                 |
|----------------------------------------------------------------|----------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                                                |                |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| SANDY GRAVEL -w/silt, cobbles, sl. moist, lt. brown            | very dense     |         | GM          | 16          |         | 50/3.5"   | SPT   |            |                 |
| CLAYEY SAND -w/gravel, sl. moist, lt. brown                    |                |         | SC          | 17          |         |           |       |            |                 |
| CLAYEY GRAVEL -w/sand, part. cem., dry to sl. moist, lt. brown | v.dense-m.hard |         | GC          | 18          |         |           |       |            |                 |
| CLAYEY SAND -w/trace gravel, sl. moist, lt. brown              | very dense     |         | SC          | 19          |         |           |       |            |                 |
| Bottom at 20 feet                                              |                |         |             | 20          |         |           |       |            |                 |
|                                                                |                |         |             | 21          |         |           |       |            |                 |
|                                                                |                |         |             | 22          |         |           |       |            |                 |
|                                                                |                |         |             | 23          |         |           |       |            |                 |
|                                                                |                |         |             | 24          |         |           |       |            |                 |
|                                                                |                |         |             | 25          |         |           |       |            |                 |
|                                                                |                |         |             | 26          |         |           |       |            |                 |
|                                                                |                |         |             | 27          |         |           |       |            |                 |
|                                                                |                |         |             | 28          |         |           |       |            |                 |
|                                                                |                |         |             | 29          |         |           |       |            |                 |
|                                                                |                |         |             | 30          |         |           |       |            |                 |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:  
1-27-00

PAGE NUMBER:  
Page 2 of 2

DRIVING WEIGHT (lbs.): 140

PROJECT NO.:  
64995240

PLATE:  
**FIGURE F-2 A-54**

# LOG OF BORING NO. 28

|                                       |                                |                                                        |
|---------------------------------------|--------------------------------|--------------------------------------------------------|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                                                      | CONSISTENCY             | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |
|-----------------------------------------------------------------------|-------------------------|---------|-------------|-------------|---------|-----------|-------|------------|
|                                                                       |                         |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % |
| <b>FILL-SANDY GRAVEL -w/silt, dry, lt. brown</b>                      |                         |         | FILL        |             |         |           |       |            |
| <b>SANDY GRAVEL -w/silt, cobbles, dry to sl. moist, lt. red brown</b> | very dense              |         | GM          | 1           |         |           |       |            |
|                                                                       |                         |         |             | 2           | X       | 76        | SPT   |            |
| <b>partially cemented, dry</b>                                        |                         |         |             | 3           |         |           |       |            |
|                                                                       |                         |         |             | 4           |         |           |       |            |
| <b>w/occ. cemented lenses</b>                                         | very dense to mod. hard |         |             | 5           |         | 50/1"     | SPT B |            |
|                                                                       |                         |         |             | 6           |         |           |       |            |
|                                                                       |                         |         |             | 7           |         |           |       |            |
| <b>sl. moist</b>                                                      |                         |         |             | 8           |         |           |       |            |
|                                                                       |                         |         |             | 9           |         |           |       |            |
|                                                                       | very dense              |         |             | 10          | X       | 50/6"     | SPT   |            |
| <b>CLAYEY SAND -sl. moist, white to lt. brown</b>                     |                         |         | SC          | 11          |         |           |       |            |
|                                                                       |                         |         |             | 12          |         |           |       |            |
|                                                                       | dense                   |         |             | 13          |         |           |       |            |
| <b>GRAVELLY SAND -w/clay, sl. moist, red brown</b>                    |                         |         |             | 14          |         |           |       |            |
|                                                                       |                         |         |             | 15          |         |           |       |            |
| Continued Next Page                                                   |                         |         |             |             |         |           |       |            |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
**Groundwater not encountered.**

# Terracon

DATE DRILLED:  
**1-20-00**

PAGE NUMBER:  
**Page 1 of 2**

DRIVING WEIGHT (lbs.): **140**

PROJECT NO.:  
**64995240**

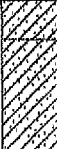
PLATE:  
**FIGURE F-2 A-55**



# LOG OF BORING NO. 28

|                                       |                                |                                                        |
|---------------------------------------|--------------------------------|--------------------------------------------------------|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                                             | CONSISTENCY | GRAPHIC                                                                           | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |
|--------------------------------------------------------------|-------------|-----------------------------------------------------------------------------------|-------------|-------------|---------|-----------|-------|------------|
|                                                              |             |                                                                                   |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % |
| GRAVELLY SAND -w/clay, dry to sl. moist, red brown           | very dense  |  | SC          | 16          | X       | 71/6"     | SPT   |            |
| CLAYEY SAND -dry to sl. moist, white                         |             |                                                                                   |             | 17          |         |           | B     |            |
| SANDY GRAVEL -w/silt, cobbles, sl. moist, lt. brown to white |             |                                                                                   |             | 18          |         |           |       |            |
|                                                              |             |                                                                                   |             | 19          |         |           |       |            |
|                                                              |             |                                                                                   |             | 20          |         |           |       |            |
| Bottom at 20 feet                                            |             |                                                                                   |             | 21          |         |           |       |            |
|                                                              |             |                                                                                   |             | 22          |         |           |       |            |
|                                                              |             |                                                                                   |             | 23          |         |           |       |            |
|                                                              |             |                                                                                   |             | 24          |         |           |       |            |
|                                                              |             |                                                                                   |             | 25          |         |           |       |            |
|                                                              |             |                                                                                   |             | 26          |         |           |       |            |
|                                                              |             |                                                                                   |             | 27          |         |           |       |            |
|                                                              |             |                                                                                   |             | 28          |         |           |       |            |
|                                                              |             |                                                                                   |             | 29          |         |           |       |            |
|                                                              |             |                                                                                   |             | 30          |         |           |       |            |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:  
1-20-00

PAGE NUMBER:  
Page 2 of 2

DRIVING WEIGHT (lbs.): 140

PROJECT NO.:  
64995240

PLATE:  
FIGURE F-2 A-56

# LOG OF BORING NO. 29

CLIENT: **Sverdrup Civil, Inc.** PROJECT: **Rainbow Boulevard Improvements**  
 BORING LOCATION: **See Plot Plan** ELEVATION: **Not Measured** SITE: **Centennial Parkway to Silverstream Avenue**

| SOIL DESCRIPTION                                               | CONSISTENCY             | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |                 |
|----------------------------------------------------------------|-------------------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                                                |                         |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| <b>FILL-SANDY GRAVEL -w/silt, dry, lt. brown</b>               |                         |         | FILL        |             |         |           |       |            |                 |
| <b>SANDY GRAVEL -w/silt, cobbles, sl. moist, lt. red brown</b> | very dense              |         | GM          | 1           |         | 58        | B     |            |                 |
|                                                                |                         |         |             | 2           |         |           |       |            |                 |
|                                                                |                         |         |             | 3           |         |           | SPT   |            |                 |
| <b>partially cemented, dry to sl. moist</b>                    | very dense to mod. hard |         |             | 4           |         |           | B     |            |                 |
| <b>w/cemented lenses</b>                                       |                         |         |             | 5           |         |           |       |            |                 |
|                                                                |                         |         |             | 6           |         |           |       |            |                 |
|                                                                |                         |         |             | 7           |         | 50/2"     | SPT   |            |                 |
| <b>SANDY GRAVEL -w/clay, sl. moist, lt. brown to white</b>     | very dense              |         | GC          | 8           |         |           |       |            |                 |
|                                                                |                         |         |             | 9           |         |           |       |            |                 |
| <b>CLAYEY SAND -w/trace gravel, sl. moist, white</b>           | very dense              |         | SC          | 10          |         |           | B     |            |                 |
|                                                                |                         |         |             | 11          |         |           |       |            |                 |
| <b>GRAVELLY SAND -w/clay, sl. moist, white to lt. brown</b>    | very dense              |         |             | 12          |         | 62        | SPT   |            |                 |
|                                                                |                         |         |             | 13          |         |           |       |            |                 |
| <b>SANDY GRAVEL -w/silt, cobbles, sl. moist, lt. brown</b>     |                         |         | GM          | 14          |         |           | B     |            |                 |
|                                                                |                         |         |             | 15          |         |           |       |            |                 |

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:  
1-24-00

PAGE NUMBER:  
Page 1 of 2

DRIVING WEIGHT (lbs.): 140

PROJECT NO.:  
64995240

PLATE:  
FIGURE F-2 A-57

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 29

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                                                    | CONSISTENCY | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           |       | TESTS      |                 |
|---------------------------------------------------------------------|-------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                                                     |             |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| <b>SANDY GRAVEL -w/silt, cobbles, sl. moist, white to lt. brown</b> | very dense  |         | GM          | 16          |         |           |       |            |                 |
| <b>SILTY SAND -w/trace gravel, sl. moist, white to lt. brown</b>    |             |         | SM          | 17          |         |           |       |            |                 |
| <b>SANDY GRAVEL -w/silt, cobbles, sl. moist, white to lt. brown</b> |             |         | GM          | 18          |         |           |       |            |                 |
| <b>Bottom at 20 feet</b>                                            |             |         |             | 19          |         |           |       |            |                 |
|                                                                     |             |         |             | 20          |         |           |       |            |                 |
|                                                                     |             |         |             | 21          |         |           |       |            |                 |
|                                                                     |             |         |             | 22          |         |           |       |            |                 |
|                                                                     |             |         |             | 23          |         |           |       |            |                 |
|                                                                     |             |         |             | 24          |         |           |       |            |                 |
|                                                                     |             |         |             | 25          |         |           |       |            |                 |
|                                                                     |             |         |             | 26          |         |           |       |            |                 |
|                                                                     |             |         |             | 27          |         |           |       |            |                 |
|                                                                     |             |         |             | 28          |         |           |       |            |                 |
|                                                                     |             |         |             | 29          |         |           |       |            |                 |
|                                                                     |             |         |             | 30          |         |           |       |            |                 |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
**Groundwater not encountered.**

**Terracon**

DATE DRILLED:  
**1-24-00**

PAGE NUMBER:  
**Page 2 of 2**

DRIVING WEIGHT (lbs.): **140**

PROJECT NO.:  
**64995240**

PLATE:  
**FIGURE F-2 A-58**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 30

|                                          |                                   |                                                           |  |
|------------------------------------------|-----------------------------------|-----------------------------------------------------------|--|
| CLIENT:<br><b>Sverdrup Civil, Inc.</b>   |                                   | PROJECT:<br><b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION:<br><b>See Plot Plan</b> | ELEVATION:<br><b>Not Measured</b> | SITE:<br><b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                                                                                                   | CONSISTENCY             | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |
|--------------------------------------------------------------------------------------------------------------------|-------------------------|---------|-------------|-------------|---------|-----------|-------|------------|
|                                                                                                                    |                         |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % |
| <b>FILL-3 1/2" A.C. on edge of pavement SANDY GRAVEL</b><br>-w/silt, occ. cobbles, dry, lt. brown<br><br>sl. moist |                         |         | FILL        | 1           |         |           |       |            |
| <b>SANDY GRAVEL</b> -w/silt, occ. cobbles, sl. moist, lt. brown                                                    |                         |         | GM          | 2           |         |           |       |            |
|                                                                                                                    | very dense              |         |             | 3           |         |           |       |            |
|                                                                                                                    |                         |         |             | 4           |         | 76        | SPT   |            |
| partially cemented, dry to sl. moist, lt. brown                                                                    |                         |         |             | 5           |         |           |       |            |
| w/non-cemented lenses                                                                                              | very dense to mod. hard |         |             | 6           |         |           |       |            |
|                                                                                                                    |                         |         |             | 7           |         |           |       |            |
| w/no cementation                                                                                                   |                         |         |             | 8           |         |           | B     |            |
|                                                                                                                    |                         |         |             | 9           |         | 50/2.5"   | SPT B |            |
|                                                                                                                    |                         |         |             | 10          |         |           |       |            |
|                                                                                                                    | very dense              |         |             | 11          |         |           |       |            |
|                                                                                                                    |                         |         |             | 12          |         |           |       |            |
| partially cemented, dry to sl. moist                                                                               | v.dense-m.hard          |         |             | 13          |         | 50/1.5"   | SPT B |            |
| <b>CALICHE (Cemented SAND &amp; GRAVEL)</b> -w/cobbles, dry, lt. brown                                             | mod. hard               |         |             | 14          |         |           |       |            |
| <b>SILTY SAND</b> -w/gravel, sl. moist, red brown                                                                  | m.d.-d.                 |         | SM          | 15          |         |           |       |            |

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:  
**1-30-00**

PAGE NUMBER:  
**Page 1 of 2**

PROJECT NO.:  
**64995240**

PLATE:  
**FIGURE F-2 A-59**

DRIVING WEIGHT (lbs.): **140**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 30

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                                                               | CONSISTENCY    | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |
|--------------------------------------------------------------------------------|----------------|---------|-------------|-------------|---------|-----------|-------|------------|
|                                                                                |                |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % |
| SILTY SAND -w/gravel, sl. moist, lt. brown                                     | m.dense-dense  |         | SM          | 16          |         |           | B     |            |
| SANDY GRAVEL -w/silt, cobbles, partially cemented, dry to sl. moist, lt. brown | v.dense-m.hard |         | GM          | 17          |         |           |       |            |
| CALICHE (Cemented SAND & GRAVEL) -w/cobbles, dry, lt. brown                    | hard           |         |             | 18          |         |           |       |            |
| w/occ. SM lenses                                                               | mod. hard      |         |             | 19          |         |           |       |            |
| Bottom at 20 feet                                                              |                |         |             | 20          |         |           |       |            |
|                                                                                |                |         |             | 21          |         |           |       |            |
|                                                                                |                |         |             | 22          |         |           |       |            |
|                                                                                |                |         |             | 23          |         |           |       |            |
|                                                                                |                |         |             | 24          |         |           |       |            |
|                                                                                |                |         |             | 25          |         |           |       |            |
|                                                                                |                |         |             | 26          |         |           |       |            |
|                                                                                |                |         |             | 27          |         |           |       |            |
|                                                                                |                |         |             | 28          |         |           |       |            |
|                                                                                |                |         |             | 29          |         |           |       |            |
|                                                                                |                |         |             | 30          |         |           |       |            |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:  
1-30-00

PAGE NUMBER:  
Page 2 of 2

PROJECT NO.:  
64995240

PLATE:  
FIGURE F-2 A-60

DRIVING WEIGHT (lbs.): 140

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 31

|                                |                         |                                                 |  |
|--------------------------------|-------------------------|-------------------------------------------------|--|
| CLIENT: Sverdrup Civil, Inc.   |                         | PROJECT: Rainbow Boulevard Improvements         |  |
| BORING LOCATION: See Plot Plan | ELEVATION: Not Measured | SITE: Centennial Parkway to Silverstream Avenue |  |

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                                              | CONSISTENCY             | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |
|---------------------------------------------------------------|-------------------------|---------|-------------|-------------|---------|-----------|-------|------------|
|                                                               |                         |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % |
| FILL-4" A.C. over 8" Agg. base, sl. moist, lt. brown          |                         |         | FILL        | 1           |         | 50/3"     | SPT B |            |
| FILL-SANDY GRAVEL -w/silt, occ. cobbles, sl. moist, lt. brown |                         |         |             | 2           |         |           |       |            |
| SANDY GRAVEL -w/silt, cobbles, sl. moist, lt. brown           | very dense              |         | GM          | 3           |         |           |       |            |
| part. cem., dry to sl. moist, lt. brown                       | very dense to mod. hard |         |             | 4           |         |           |       |            |
|                                                               |                         |         |             | 5           |         | 50/5"     | SPT   |            |
| CALICHE (Cemented SAND & GRAVEL) -w/cobbles, dry, lt. brown   | mod. hard               |         |             | 6           |         |           |       |            |
|                                                               | hard                    |         |             | 7           |         |           |       |            |
| w/part. cem. lenses                                           | mod. hard               |         |             | 8           |         |           |       |            |
|                                                               | hard to very hard       |         |             | 9           |         |           |       |            |
|                                                               | mod. hard               |         |             | 10          |         | 50/0"     | SPT B |            |
| w/part. cem. lenses                                           |                         |         |             | 11          |         |           |       |            |
|                                                               |                         |         |             | 12          |         |           |       |            |
|                                                               |                         |         |             | 13          |         |           |       |            |
|                                                               |                         |         |             | 14          |         |           |       |            |
|                                                               |                         |         |             | 15          |         |           |       |            |

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:  
1-27-00

PAGE NUMBER:  
Page 1 of 2

PROJECT NO.:  
64995240

PLATE:  
FIGURE F-2 A-61

DRIVING WEIGHT (lbs.): 140



# LOG OF BORING NO. 31

|                                       |                                |                                                        |
|---------------------------------------|--------------------------------|--------------------------------------------------------|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                                                                       | CONSISTENCY    | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           |       | TESTS      |                 |
|----------------------------------------------------------------------------------------|----------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                                                                        |                |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| CALICHE (Cemented SAND & GRAVEL) -w/cobbles, dry, lt. brown<br><br>w/part. cem. lenses | m.hard         |         |             | 16          |         | 50/5"     | SPT   |            |                 |
|                                                                                        | very hard      |         |             | 17          |         |           |       |            |                 |
|                                                                                        | mod. hard      |         |             | 18          |         |           |       |            |                 |
| SANDY GRAVEL -w/clay, dry to sl. moist, white to lt. brown                             | v.dense-m.hard |         | GC          | 19          |         |           |       |            |                 |
| CALICHE (Cemented SAND & GRAVEL) -w/cobbles, dry, white to lt. brown                   | mod. hard      |         |             | 20          |         |           |       |            |                 |
| Bottom at 20 feet                                                                      |                |         |             | 21          |         |           |       |            |                 |
|                                                                                        |                |         |             | 22          |         |           |       |            |                 |
|                                                                                        |                |         |             | 23          |         |           |       |            |                 |
|                                                                                        |                |         |             | 24          |         |           |       |            |                 |
|                                                                                        |                |         |             | 25          |         |           |       |            |                 |
|                                                                                        |                |         |             | 26          |         |           |       |            |                 |
|                                                                                        |                |         |             | 27          |         |           |       |            |                 |
|                                                                                        |                |         |             | 28          |         |           |       |            |                 |
|                                                                                        |                |         |             | 29          |         |           |       |            |                 |
|                                                                                        |                |         |             | 30          |         |           |       |            |                 |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:  
1-27-00

PAGE NUMBER:  
Page 2 of 2

PROJECT NO.:  
64995240

PLATE:  
FIGURE F-2 A-62

DRIVING WEIGHT (lbs.): 140

# LOG OF BORING NO. 32

|                                |                         |                                                 |
|--------------------------------|-------------------------|-------------------------------------------------|
| CLIENT: Sverdrup Civil, Inc.   |                         | PROJECT: Rainbow Boulevard Improvements         |
| BORING LOCATION: See Plot Plan | ELEVATION: Not Measured | SITE: Centennial Parkway to Silverstream Avenue |

| SOIL DESCRIPTION                                                               | CONSISTENCY             | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |                 |
|--------------------------------------------------------------------------------|-------------------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                                                                |                         |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| FILL-3 5/8" A.C. over 10" Agg. base, sl. moist, lt. brown                      |                         |         | FILL        | 1           |         |           |       |            |                 |
| SANDY GRAVEL -w/silt, cobbles, sl. moist, lt. brown                            | very dense              |         | GM          | 2           |         |           |       |            |                 |
| partially cemented, dry to sl. moist                                           |                         |         |             | 3           | X       | 50/4.5"   | SPT   |            |                 |
| w/cemented lenses                                                              | very dense to mod. hard |         |             | 4           |         |           |       |            |                 |
| CALICHE (Cemented SAND & GRAVEL) -w/cobbles, dry, lt. brown                    | mod. hard               |         |             | 5           |         |           |       |            |                 |
|                                                                                | hard                    |         |             | 6           |         |           |       |            |                 |
|                                                                                |                         |         |             | 7           |         | 50/1"     | SPT B |            |                 |
| SANDY GRAVEL -w/silt, cobbles, partially cemented, dry to sl. moist, lt. brown |                         |         | GM          | 8           |         |           |       |            |                 |
| w/cemented lenses                                                              | very dense to mod. hard |         |             | 9           |         |           |       |            |                 |
|                                                                                |                         |         |             | 10          |         |           |       |            |                 |
|                                                                                |                         |         |             | 11          |         |           |       |            |                 |
|                                                                                |                         |         |             | 12          | X       | 50/4.5"   | SPT B |            |                 |
|                                                                                |                         |         |             | 13          |         |           |       |            |                 |
|                                                                                |                         |         |             | 14          |         |           |       |            |                 |
|                                                                                |                         |         |             | 15          |         |           |       |            |                 |

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:

1-31-00

PAGE NUMBER:

Page 1 of 2

PROJECT NO.:

64995240

PLATE:

FIGURE F-2 A-63

DRIVING WEIGHT (lbs.): 140

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 32

|                                          |                                   |                                                           |
|------------------------------------------|-----------------------------------|-----------------------------------------------------------|
| CLIENT:<br><b>Sverdrup Civil, Inc.</b>   |                                   | PROJECT:<br><b>Rainbow Boulevard Improvements</b>         |
| BORING LOCATION:<br><b>See Plot Plan</b> | ELEVATION:<br><b>Not Measured</b> | SITE:<br><b>Centennial Parkway to Silverstream Avenue</b> |

| SOIL DESCRIPTION                                                                                                                                 | CONSISTENCY       | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS        |            |                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------|-------------|-------------|---------|-----------|--------------|------------|-----------------|
|                                                                                                                                                  |                   |         |             |             | SAMPLE  | BLOWS/FT. | TYPE*        | MOISTURE % | DRY DENSITY PCF |
| <b>CALICHE (Cemented SAND &amp; GRAVEL) -w/cobbles, dry, lt. brown</b><br><br><br><br><br><br><br><br><br><br><b>w/partially cemented lenses</b> | mod. hard         |         |             | 16          |         | 50/.5"    | B<br><br>SPT |            |                 |
|                                                                                                                                                  |                   |         |             | 17          |         |           |              |            |                 |
|                                                                                                                                                  | mod. hard to hard |         |             | 18          |         |           |              |            |                 |
|                                                                                                                                                  |                   |         |             | 19          |         |           |              |            |                 |
| <b>Bottom at 20 feet</b>                                                                                                                         | mod. hard         |         |             | 20          |         |           |              |            |                 |
|                                                                                                                                                  |                   |         |             | 21          |         |           |              |            |                 |
|                                                                                                                                                  |                   |         |             | 22          |         |           |              |            |                 |
|                                                                                                                                                  |                   |         |             | 23          |         |           |              |            |                 |
|                                                                                                                                                  |                   |         |             | 24          |         |           |              |            |                 |
|                                                                                                                                                  |                   |         |             | 25          |         |           |              |            |                 |
|                                                                                                                                                  |                   |         |             | 26          |         |           |              |            |                 |
|                                                                                                                                                  |                   |         |             | 27          |         |           |              |            |                 |
|                                                                                                                                                  |                   |         |             | 28          |         |           |              |            |                 |
|                                                                                                                                                  |                   |         |             | 29          |         |           |              |            |                 |
|                                                                                                                                                  |                   |         |             | 30          |         |           |              |            |                 |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
**Groundwater not encountered.**

**Terracon**

DATE DRILLED:  
**1-31-00**

PAGE NUMBER:  
**Page 2 of 2**

DRIVING WEIGHT (lbs.): **140**

PROJECT NO.:  
**64995240**

PLATE:  
**FIGURE F-2 A-64**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 33

|                                |                         |                                                 |  |
|--------------------------------|-------------------------|-------------------------------------------------|--|
| CLIENT: Sverdrup Civil, Inc.   |                         | PROJECT: Rainbow Boulevard Improvements         |  |
| BORING LOCATION: See Plot Plan | ELEVATION: Not Measured | SITE: Centennial Parkway to Silverstream Avenue |  |

| SOIL DESCRIPTION                                                               | CONSISTENCY             | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |
|--------------------------------------------------------------------------------|-------------------------|---------|-------------|-------------|---------|-----------|-------|------------|
|                                                                                |                         |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % |
| FILL-5 1/8" A.C. over 7" Agg. base, sl. moist, brown                           |                         |         | FILL        | 1           |         |           |       |            |
| FILL-SANDY GRAVEL -w/silt, cobbles, sl. moist, lt. brown                       |                         |         |             | 2           |         |           |       |            |
| SANDY GRAVEL -w/silt, cobbles, partially cemented, dry to sl. moist, lt. brown | very dense to mod. hard |         | GM          | 3           | 50/5.5" |           | SPT B |            |
| CALICHE (Cemented SAND & GRAVEL) -w/cobbles, dry, lt. brown                    | mod. hard               |         |             | 4           |         |           |       |            |
|                                                                                | hard                    |         |             | 5           |         |           |       |            |
| w/part. cem. lenses                                                            | mod. hard               |         |             | 6           |         |           |       |            |
|                                                                                | hard                    |         |             | 7           |         |           |       |            |
| w/occ. part. cem. lenses                                                       | m.hard-hard             |         |             | 8           | 50/0"   |           | SPT   |            |
| SANDY GRAVEL -w/silt, cobbles, partially cemented, dry to sl. moist, lt. brown | very dense to mod. hard |         | GM          | 9           |         |           |       |            |
| w/occ. cemented lenses                                                         |                         |         |             | 10          |         |           |       |            |
| CALICHE (Cemented SAND & GRAVEL) -w/cobbles, dry, lt. brown                    | hard                    |         |             | 11          |         |           |       |            |
|                                                                                | very hard               |         |             | 12          |         |           |       |            |
|                                                                                |                         |         |             | 13          | 50/0"   |           | SPT B |            |
|                                                                                |                         |         |             | 14          |         |           |       |            |
|                                                                                |                         |         |             | 15          |         |           |       |            |

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:

1-27-00

PAGE NUMBER:

Page 1 of 2

PROJECT NO.:

64995240

PLATE:

FIGURE F-2 A-65

DRIVING WEIGHT (lbs.): 140

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 33

|                                       |                                |                                                        |
|---------------------------------------|--------------------------------|--------------------------------------------------------|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                                                               | CONSISTENCY    | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |                 |
|--------------------------------------------------------------------------------|----------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                                                                |                |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| CALICHE (Cemented SAND & GRAVEL) -w/cobbles, dry, lt. brown                    | very hard      |         |             | 16          |         | 50/1.5"   | B     |            |                 |
|                                                                                | hard           |         |             | 17          |         |           |       |            |                 |
|                                                                                | mod. hard      |         |             | 18          |         |           |       |            |                 |
| SANDY GRAVEL -w/silt, cobbles, partially cemented, dry to sl. moist, lt. brown | v.dense-m.hard |         | GM          | 19          |         |           |       |            |                 |
| Bottom at 20 feet                                                              |                |         |             | 20          |         |           |       |            |                 |
|                                                                                |                |         |             | 21          |         |           |       |            |                 |
|                                                                                |                |         |             | 22          |         |           |       |            |                 |
|                                                                                |                |         |             | 23          |         |           |       |            |                 |
|                                                                                |                |         |             | 24          |         |           |       |            |                 |
|                                                                                |                |         |             | 25          |         |           |       |            |                 |
|                                                                                |                |         |             | 26          |         |           |       |            |                 |
|                                                                                |                |         |             | 27          |         |           |       |            |                 |
|                                                                                |                |         |             | 28          |         |           |       |            |                 |
|                                                                                |                |         |             | 29          |         |           |       |            |                 |
|                                                                                |                |         |             | 30          |         |           |       |            |                 |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

DRIVING WEIGHT (lbs.): 140

**Terracon**

DATE DRILLED:

1-27-00

PAGE NUMBER:

Page 2 of 2

PROJECT NO.:

64995240

PLATE:

**FIGURE F-2** A-66

# LOG OF BORING NO. 34

|                                          |                                   |                                                           |  |
|------------------------------------------|-----------------------------------|-----------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>      |                                   | PROJECT: <b>Rainbow Boulevard Improvements</b>            |  |
| BORING LOCATION:<br><b>See Plot Plan</b> | ELEVATION:<br><b>Not Measured</b> | SITE:<br><b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                                                       | CONSISTENCY    | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |
|------------------------------------------------------------------------|----------------|---------|-------------|-------------|---------|-----------|-------|------------|
|                                                                        |                |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % |
| <b>FILL-4 3/4" A.C. over 10" Agg. base, sl. moist, lt. brown</b>       |                |         | <b>FILL</b> | 1           |         |           |       |            |
| <b>SANDY GRAVEL -w/silt, cobbles, sl. moist, lt. brown</b>             | very dense     |         | <b>GM</b>   | 2           |         | 84        | SPT   |            |
| <b>partially cemented, dry to sl. moist</b>                            | v.dense-m.hard |         |             | 3           |         |           |       |            |
| <b>CALICHE (Cemented SAND &amp; GRAVEL) -w/cobbles, dry, lt. brown</b> | mod. hard      |         |             | 4           |         |           |       |            |
|                                                                        |                |         |             | 5           |         |           |       |            |
|                                                                        |                |         |             | 6           |         | 50/0"     | SPT B |            |
|                                                                        |                |         |             | 7           |         |           |       |            |
|                                                                        |                |         |             | 8           |         |           |       |            |
|                                                                        |                |         |             | 9           |         |           |       |            |
|                                                                        |                |         |             | 10          |         | 50/0"     | SPT   |            |
|                                                                        |                |         |             | 11          |         |           |       |            |
| <b>w/partially cemented lenses</b>                                     | mod. hard      |         |             | 12          |         |           |       |            |
|                                                                        | m.hard-hard    |         |             | 13          |         |           |       |            |
|                                                                        | hard           |         |             | 14          |         |           |       |            |
| <b>w/partially cemented lenses</b>                                     | mod. hard      |         |             | 15          |         |           |       |            |

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
**Groundwater not encountered.**

**Terracon**

DATE DRILLED:  
**1-31-00**

PAGE NUMBER:  
**Page 1 of 2**

DRIVING WEIGHT (lbs.): **140**

PROJECT NO.:  
**64995240**

PLATE:  
**FIGURE F-2 A-67**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.



# LOG OF BORING NO. 34

|                                       |                                |                                                        |  |
|---------------------------------------|--------------------------------|--------------------------------------------------------|--|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |  |

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                                                                | CONSISTENCY    | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |
|---------------------------------------------------------------------------------|----------------|---------|-------------|-------------|---------|-----------|-------|------------|
|                                                                                 |                |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % |
| <b>CALICHE (Cemented SAND &amp; GRAVEL) -w/cobbles, dry, lt. brown</b>          | mod. hard      |         |             | 16          |         | 50/0"     | SPT B |            |
| <b>SANDY GRAVEL -w/silt, occ. cob., part. cem., dry to sl. moist, lt. brown</b> | v.dense-m.hard |         | GM          | 17          |         |           |       |            |
| <b>sl. moist</b>                                                                |                |         |             | 18          |         |           |       |            |
| <b>w/occ. silty sand lenses</b>                                                 | very dense     |         |             | 19          |         |           |       |            |
| <b>Bottom at 20 feet</b>                                                        |                |         |             | 20          |         |           |       |            |
|                                                                                 |                |         |             | 21          |         |           |       |            |
|                                                                                 |                |         |             | 22          |         |           |       |            |
|                                                                                 |                |         |             | 23          |         |           |       |            |
|                                                                                 |                |         |             | 24          |         |           |       |            |
|                                                                                 |                |         |             | 25          |         |           |       |            |
|                                                                                 |                |         |             | 26          |         |           |       |            |
|                                                                                 |                |         |             | 27          |         |           |       |            |
|                                                                                 |                |         |             | 28          |         |           |       |            |
|                                                                                 |                |         |             | 29          |         |           |       |            |
|                                                                                 |                |         |             | 30          |         |           |       |            |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
**Groundwater not encountered.**

# Terracon

DATE DRILLED:  
**1-31-00**

PAGE NUMBER:  
**Page 2 of 2**

PROJECT NO.:  
**64995240**

PLATE:  
**FIGURE F-2 A-68**

DRIVING WEIGHT (lbs.): **140**

# LOG OF BORING NO. 35

|                                       |                                |                                                        |
|---------------------------------------|--------------------------------|--------------------------------------------------------|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |

| SOIL DESCRIPTION                                                               | CONSISTENCY    | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |                 |
|--------------------------------------------------------------------------------|----------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|
|                                                                                |                |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |
| FILL-3" A.C. over 12" Agg. base, sl. moist, lt. brown                          |                |         | FILL        | 1           |         |           |       |            |                 |
| FILL-SANDY GRAVEL -w/silt, cobbles, sl. moist, lt. brown                       |                |         |             | 2           |         |           | B     |            |                 |
| SANDY GRAVEL -w/silt, cobbles, partially cemented, dry to sl. moist, lt. brown | v.dense-m.hard |         | GM          | 3           |         | 50/4"     | SPT B |            |                 |
| CALICHE (Cemented SAND & GRAVEL) -w/cobbles, dry, lt. brown                    | hard           |         |             | 4           |         |           |       |            |                 |
|                                                                                | hard-v.hard    |         |             | 5           |         |           |       |            |                 |
|                                                                                | very hard      |         |             | 6           |         |           |       |            |                 |
|                                                                                | hard           |         |             | 7           |         | 50/0"     | SPT   |            |                 |
|                                                                                | m.hard-hard    |         |             | 8           |         |           |       |            |                 |
|                                                                                | mod. hard      |         |             | 9           |         |           |       |            |                 |
| w/part. cem. lenses                                                            | hard           |         |             | 10          |         |           |       |            |                 |
|                                                                                | mod. hard      |         |             | 11          |         |           |       |            |                 |
|                                                                                | hard           |         |             | 12          |         | 50/0"     | SPT B |            |                 |
|                                                                                | mod. hard      |         |             | 13          |         |           |       |            |                 |
| w/part. cem. lenses                                                            |                |         |             | 14          |         |           |       |            |                 |
|                                                                                |                |         |             | 15          |         |           |       |            |                 |

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

**Terracon**

DATE DRILLED:  
1-27-00

PAGE NUMBER:  
Page 1 of 2

PROJECT NO.:  
64995240

PLATE:  
FIGURE F-2 A-69

DRIVING WEIGHT (lbs.): 140

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 35

|                                       |                                |                                                        |
|---------------------------------------|--------------------------------|--------------------------------------------------------|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| SOIL DESCRIPTION                                                                       | CONSISTENCY             | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |
|----------------------------------------------------------------------------------------|-------------------------|---------|-------------|-------------|---------|-----------|-------|------------|
|                                                                                        |                         |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % |
| CALICHE (Cemented SAND & GRAVEL) -w/cobbles, dry, lt. brown<br><br>w/part. cem. lenses | hard                    |         |             | 16          |         | 50/.5"    | B     |            |
|                                                                                        | mod. hard               |         |             | 17          |         |           | SPT   |            |
| SANDY GRAVEL -w/silt, cobbles, partially cemented, dry to sl. moist, lt. brown         | very dense to mod. hard |         | GM          | 18          |         |           |       |            |
| Bottom at 20 feet                                                                      |                         |         |             | 19          |         |           |       |            |
|                                                                                        |                         |         |             | 20          |         |           |       |            |
|                                                                                        |                         |         |             | 21          |         |           |       |            |
|                                                                                        |                         |         |             | 22          |         |           |       |            |
|                                                                                        |                         |         |             | 23          |         |           |       |            |
|                                                                                        |                         |         |             | 24          |         |           |       |            |
|                                                                                        |                         |         |             | 25          |         |           |       |            |
|                                                                                        |                         |         |             | 26          |         |           |       |            |
|                                                                                        |                         |         |             | 27          |         |           |       |            |
|                                                                                        |                         |         |             | 28          |         |           |       |            |
|                                                                                        |                         |         |             | 29          |         |           |       |            |
|                                                                                        |                         |         |             | 30          |         |           |       |            |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

DRIVING WEIGHT (lbs.): 140

**Terracon**

DATE DRILLED:

1-27-00

PROJECT NO.:

64995240

PAGE NUMBER:

Page 2 of 2

PLATE:

FIGURE F-2 A-70

# LOG OF BORING NO. 36

|                                       |                                |                                                        |
|---------------------------------------|--------------------------------|--------------------------------------------------------|
| CLIENT: <b>Sverdrup Civil, Inc.</b>   |                                | PROJECT: <b>Rainbow Boulevard Improvements</b>         |
| BORING LOCATION: <b>See Plot Plan</b> | ELEVATION: <b>Not Measured</b> | SITE: <b>Centennial Parkway to Silverstream Avenue</b> |

| SOIL DESCRIPTION                                                               | CONSISTENCY       | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           | TESTS |            |
|--------------------------------------------------------------------------------|-------------------|---------|-------------|-------------|---------|-----------|-------|------------|
|                                                                                |                   |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % |
| FILL-3 1/2" A.C. over 10 1/2" Agg. base, dry, lt. brown                        |                   |         | FILL        | 1           |         |           |       |            |
| FILL-SANDY GRAVEL -w/silt, occ. cobbles, sl. moist, brown                      |                   |         |             | 2           |         |           |       |            |
| SANDY GRAVEL -w/silt, cobbles, dry to sl. moist, lt. brown                     | v.dense-m.hard    |         | GM          | 3           |         | 50/2"     | SPT   |            |
| CALICHE (Cemented SAND & GRAVEL) -w/cobbles, dry, lt. brown                    | mod. hard to hard |         |             | 4           |         |           |       |            |
|                                                                                | hard              |         |             | 5           |         |           |       |            |
|                                                                                |                   |         |             | 6           |         |           |       |            |
|                                                                                |                   |         |             | 7           |         |           |       |            |
|                                                                                |                   |         |             | 8           |         | 50/0"     | SPT B |            |
|                                                                                |                   |         |             | 9           |         |           |       |            |
|                                                                                |                   |         |             | 10          |         |           |       |            |
|                                                                                |                   |         |             | 11          |         |           |       |            |
|                                                                                |                   |         |             | 12          |         |           |       |            |
|                                                                                |                   |         |             | 13          |         | 50/0.5"   | SPT B |            |
|                                                                                |                   |         |             | 14          |         |           |       |            |
| SANDY GRAVEL -w/silt, cobbles, partially cemented, dry to sl. moist, lt. brown | v.dense-m.hard    |         | GM          | 15          |         |           |       |            |

Continued Next Page

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

NOTES:  
Groundwater not encountered.

DRIVING WEIGHT (lbs.): 140

**Terracon**

DATE DRILLED:

1-30-00

PAGE NUMBER:

Page 1 of 2

PROJECT NO.:

64995240

PLATE:

FIGURE F-2 A-71

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

# LOG OF BORING NO. 36

|                                          |                                   |                                                           |  |
|------------------------------------------|-----------------------------------|-----------------------------------------------------------|--|
| CLIENT:<br><b>Sverdrup Civil, Inc.</b>   |                                   | PROJECT:<br><b>Rainbow Boulevard Improvements</b>         |  |
| BORING LOCATION:<br><b>See Plot Plan</b> | ELEVATION:<br><b>Not Measured</b> | SITE:<br><b>Centennial Parkway to Silverstream Avenue</b> |  |

| SOIL DESCRIPTION                                                                                                      | CONSISTENCY | GRAPHIC | USCS SYMBOL | DEPTH (FT.) | SAMPLES |           |       | TESTS      |                 |  |
|-----------------------------------------------------------------------------------------------------------------------|-------------|---------|-------------|-------------|---------|-----------|-------|------------|-----------------|--|
|                                                                                                                       |             |         |             |             | SAMPLE  | BLOWS/FT. | TYPE* | MOISTURE % | DRY DENSITY PCF |  |
| <b>CALICHE (Cemented SAND &amp; GRAVEL) -w/cobbles, dry, lt. brown</b><br><br><b>w/occ. partially cemented lenses</b> | mod. hard   |         |             | 16          |         | 50/0"     | SPT   |            |                 |  |
|                                                                                                                       |             |         |             | 17          |         |           |       |            |                 |  |
|                                                                                                                       | m.hard-hard |         |             | 18          |         |           |       |            |                 |  |
|                                                                                                                       | hard        |         |             | 19          |         |           |       |            |                 |  |
| Bottom at 20 feet                                                                                                     |             |         |             | 20          |         |           |       |            |                 |  |
|                                                                                                                       |             |         |             | 21          |         |           |       |            |                 |  |
|                                                                                                                       |             |         |             | 22          |         |           |       |            |                 |  |
|                                                                                                                       |             |         |             | 23          |         |           |       |            |                 |  |
|                                                                                                                       |             |         |             | 24          |         |           |       |            |                 |  |
|                                                                                                                       |             |         |             | 25          |         |           |       |            |                 |  |
|                                                                                                                       |             |         |             | 26          |         |           |       |            |                 |  |
|                                                                                                                       |             |         |             | 27          |         |           |       |            |                 |  |
|                                                                                                                       |             |         |             | 28          |         |           |       |            |                 |  |
|                                                                                                                       |             |         |             | 29          |         |           |       |            |                 |  |
|                                                                                                                       |             |         |             | 30          |         |           |       |            |                 |  |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

\*SAMPLE TYPES: R = Ring B = Bag  
SPT = Standard Penetration Test C = Core

## NOTES:

Groundwater not encountered.

**Terracon**

DATE DRILLED:

1-30-00

PAGE NUMBER:

Page 2 of 2

PROJECT NO.:

64995240

PLATE:

FIGURE F-2 A-72

DRIVING WEIGHT (lbs.): 140

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER WITH TIME OR AT OTHER LOCATIONS.

| Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests <sup>A</sup> |                                                                     |                                                        |                                                    | Soil Classification |                                    |
|------------------------------------------------------------------------------------------|---------------------------------------------------------------------|--------------------------------------------------------|----------------------------------------------------|---------------------|------------------------------------|
|                                                                                          |                                                                     |                                                        |                                                    | Group Symbol        | Group Name <sup>B</sup>            |
| Coarse-Grained Soils, more than 50% retained on No. 200 sieve                            | Gravels<br>More than 50% of coarse fraction retained on No. 4 sieve | Clean Gravels<br>Less than 5% fines <sup>C</sup>       | $Cu > 4$ and $1 < Cc < 3^E$                        | GW                  | Well-graded gravel <sup>F</sup>    |
|                                                                                          |                                                                     |                                                        | $Cu < 4$ and/or $1 > Cc > 3^E$                     | GP                  | Poorly graded gravel <sup>F</sup>  |
|                                                                                          |                                                                     | Gravels with Fines<br>More than 12% fines <sup>G</sup> | Fines classify as ML or MH                         | GM                  | Silty gravel <sup>F, G, H</sup>    |
|                                                                                          |                                                                     |                                                        | Fines classify as CL or CH                         | GC                  | Clayey gravel <sup>F, G, H</sup>   |
|                                                                                          | Sands<br>50% or more of coarse fraction passes No. 4 sieve          | Clean sands<br>Less than 5% fines <sup>E</sup>         | $Cu > 6$ and $1 < Cc < 3^E$                        | SW                  | Well-graded sand <sup>I</sup>      |
|                                                                                          |                                                                     |                                                        | $Cu < 6$ and/or $1 > Cc > 3^E$                     | SP                  | Poorly graded sand <sup>I</sup>    |
|                                                                                          |                                                                     | Sands with Fines<br>More than 12% fines <sup>G</sup>   | Fines classify as ML or MH                         | SM                  | Silty sand <sup>G, H, I</sup>      |
|                                                                                          |                                                                     |                                                        | Fines classify as CL or CH                         | SC                  | Clayey sand <sup>G, H, I</sup>     |
| Fine-Grained Soils 50% or more passes the No. 200 sieve                                  | Sils and Clays<br>Liquid limit less than 50                         | inorganic                                              | $PI > 7$ & plots on or above "A" line <sup>J</sup> | CL                  | Lean clay <sup>K, L, M</sup>       |
|                                                                                          |                                                                     |                                                        | $PI < 4$ or plots below "A" line <sup>J</sup>      | ML                  | Silt <sup>K, L, M</sup>            |
|                                                                                          |                                                                     | organic                                                | Liquid limit - oven dried $< 0.75$                 | OL                  | Organic clay <sup>K, L, M, N</sup> |
|                                                                                          |                                                                     |                                                        | Liquid limit - not dried                           |                     | Organic silt <sup>K, L, M, O</sup> |
|                                                                                          | Sils and Clays<br>Liquid limit 50 or more                           | inorganic                                              | $PI$ plots on or above "A" line                    | CH                  | Fat clay <sup>K, L, M</sup>        |
|                                                                                          |                                                                     |                                                        | $PI$ plots below "A" line                          | MH                  | Elastic silt <sup>K, L, M</sup>    |
|                                                                                          |                                                                     | organic                                                | Liquid limit - oven dried $< 0.75$                 | OL                  | Organic clay <sup>K, L, M, P</sup> |
|                                                                                          |                                                                     |                                                        | Liquid limit - not dried                           |                     | Organic silt <sup>K, L, M, Q</sup> |
|                                                                                          |                                                                     |                                                        |                                                    | PT                  | Peat                               |
|                                                                                          |                                                                     |                                                        |                                                    |                     |                                    |

<sup>A</sup>Based on the material passing the 3-in. (75-mm) sieve.

<sup>B</sup>If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

<sup>C</sup>Gravels with 5 to 12% fines require dual symbols:  
GW-GM well-graded gravel with silt  
GW-GC well-graded gravel with clay  
GP-GM poorly graded gravel with silt  
GP-GC poorly graded gravel with clay

<sup>D</sup>Sands with 5 to 12% fines require dual symbols:  
SW-SM well-graded sand with silt  
SW-SC well-graded sand with clay  
SP-SM poorly graded sand with silt  
SP-SC poorly graded sand with clay

$$^E Cu = D_{60} / D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

<sup>F</sup>If soil contains  $\geq 15\%$  sand, add "with sand" to group name.

<sup>G</sup>If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

<sup>H</sup>If fines are organic, add "with organic fines" to group name.

<sup>I</sup>If soil contains  $\geq 15\%$  gravel, add "with gravel" to group name.

<sup>J</sup>If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

<sup>K</sup>If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel", whichever is predominant

<sup>L</sup>If soil contains  $\geq 30\%$  plus, No. 200 predominantly sand, add "sandy" to group name.

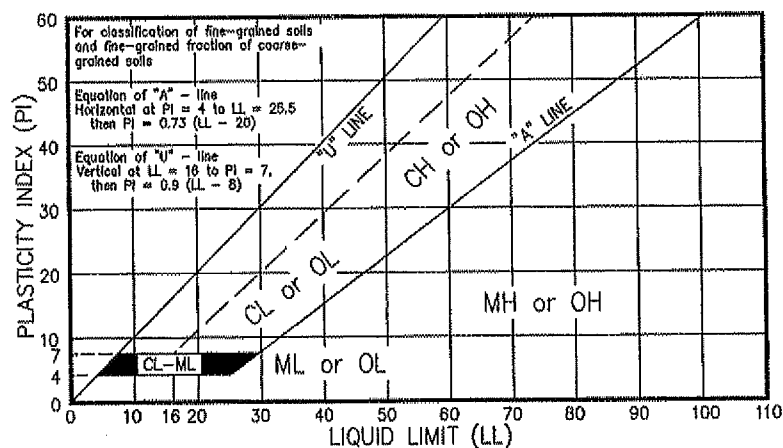
<sup>M</sup>If soil contains  $\geq 30\%$  plus No. 200, predominantly gravel, add "gravelly" to group name.

<sup>N</sup> $PI > 4$  and plots on or above "A" line.

<sup>O</sup> $PI < 4$  or plots below "A" line.

<sup>P</sup> $PI$  plots on or above "A" line.

<sup>Q</sup> $PI$  plots below "A" line.



UNIFIED SOIL  
CLASSIFICATION SYSTEM

Terracon

PLATE:

B

FIGURE E-2



**7. APPENDIX G – FINAL MEETING NOTES**

1. FEBRUARY 10, 2010
2. JANUARY 6, 2011
3. FEBRUARY 15, 2011
4. MARCH 15, 2011
5. APRIL 25, 2011
6. JUNE 1, 2011
7. JUNE 7, 2011
8. JULY 7, 2011
9. OCTOBER 6, 2011
10. OCTOBER 18, 2011

**Location:** City of Las Vegas (420 N. 4th)

**Attendees:**

Randy McConnell, CLV  
Tim Parks, CLV  
Mark Sorensen, CLV  
Eric Meyer, CLV  
Peter Jackson, CLV  
Nancy Almanzan, CLV  
Tara Alexander, Jacobs  
Ken Lambert, Jacobs  
Joe Jensen, Jacobs

**Notes Prepared By:**

Joe Jensen, Jacobs

The meeting was held to review scope items and costs for the project. The meeting began with an overview of project history beginning with the Sverdrup plans dating from the 1990's. A conceptual layout was shown with both Regional Flood Control and local drainage facilities identified. Discussion of the concept included the following points:

- One task will be to intercept drainage flowing from the Rio Vista Estates subdivision to Rainbow Boulevard. This will require a special inlet structure.
- The work will include removal of an existing storm drain in Ann south of El Campo Grande, and tying laterals to the new storm drain.
- The existing 24" storm drain near the Ann/Rainbow subdivision easement will be removed.
- Relocation of an existing 4-inch gas line may be required for the segment south of El Campo Grande adjacent to the proposed 10' x 7' box.
- The area near the drainage easement at Rio Vista Estates is challenging due to the number of utilities in the area. A potential solution is to use a shallow box in lieu of large diameter pipe to aid in crossing existing utilities.
- Three parcels near El Campo Grande on the east side of Rainbow extend to the roadway centerline. If traffic is to be maintained, TCE's would be required for these parcels to allow traffic to be diverted away from the construction zone onto temporary pavement. A discussion regarding easements followed. During this discussion, the following points were raised by the City:
  - The City dislikes relying on patent easements.
  - The size of the main facility is a 10-foot by 7-foot box.
  - The City prefers the use of pre-cast box segments, and dislikes the cast-in-place option.

- The size of the box is an issue. New Q values were given in 2008 which increased over the 2002 numbers.
- All email or other correspondence regarding this project should clearly identify Ann Road and provide the City Hansen number.
- The project must accommodate all flows from Tropical.
- Plans should show all facilities in the road, such a conduit for future signals.
- If obtaining Temporary Construction Easements (TCE) for the three parcels is not feasible, partial road closure is another option. It was noted traffic is light through this area.
- No future master plan sewers are shown in this area. Sewer rehabilitation is not expected to be an issue.
- There is some concern that the drainage structure may impact the existing sewer.
- Sleeves across the RCB may be needed for future sewer connections.

A general discussion of scope and cost followed. A sheet by sheet examination of scope tasks led to the following points:

- The City like the breakout of the various meetings with different entities.
- Problems involving utility companies were discussed under the Data Collection item. The number of submittals to utilities was questioned, and the decision was made to eliminate the 70% submittal to the utilities.
- It was noted that delays due to utilities were a common problem, and that it was necessary to closely follow up any submittal made to a utility.
- This is a lump sum by task job. If a major task is not performed, it will not be paid for.
- Utility relocation letters will be added to the task list.
- Pre-design tasks include potholing, survey, and geotechnical studies.
- Some topo is missing from the available mapping.
- It was noted that another project to the south experienced an elevation bust of approximately 1-foot. It was recommended that elevations be spot checked throughout the project limits.

- Peter Jackson from the City Flood Control wants to have pdf files of the conceptual layout used in the meeting.
- An approved Record of Survey must be recorded prior to the 30% submittal.
- Geotechnical work will consist of an update letter to the original report.
- Jacobs requested a copy of the Permit Matrix. City does not know if they have a copy of such, but will look. City may modify language regarding penalties for permit matrix error. There was considerable discussion on this, with the City indicating they considered this language too severe.
- The Performance Schedule will be prepared in cooperation with the City.
- No specifications will be required at the 30% submittal. Only a single unbound copy of specifications will be required at the 70% submittal.
- City requests Excel spreadsheet showing rates and hours. This is intended for them to do some "what if" analysis only.
- The structural and hydraulic effort will be minimal at 30%.
- The number of PDR copies required was discussed. It was decided that six, not eight, copies would be required.
- The 24 X 36 exhibits and two (2) plan sets will be required as shown in the scope.
- At the 70% level, the hydraulic design will be more refined.
- No reinforcing will be shown for the structural design at the 70% level.
- There was a general discussion of what the plans will show, QA/QC, and deliverables.
- It was reiterated that no submittals to the utilities would be made at 70%.
- The 70% field walk-through was eliminated from the task list.
- There was significant discussion relating to the Draft Final Design Report and the Final Design Report. It was decided that Jacobs should provide a simplified document to be labeled as a Design Memo. This memo would document entity comments and project decisions.
- The 90% submittal would follow the same formats as the others.

# Meeting Notes

(Continued)

Page 4 of 4

- The completed drainage report will be submitted at the Pre-Final (99%) submittal, until then the City does not want a complete study shown at each submittal phase, only new and/or modified hydraulic and hydrologic information.
- Put the sheet count (proposed plan sheets) into Exhibit A.
- Jacobs should anticipate that there will be minor increases or decreases to the scope as part of the design effort. Jacobs was place a contingency suitable to anticipated changes into the estimate. City does not want to consider extras for minor changes, only if there is a major scope change affecting costs.
- Overhead rates were briefly discussed. City will further investigate the details for the "Consultant Overhead Cost Worksheet". This is something new to them as well.
- The City requested an electronic copy of the Excel Spreadsheet showing the task breakdown and hours per task along with the overall cost for each task and individuals billing rate.

## ACTION ITEMS

City will:

- Review submitted scope and cost details.
- Provide Hansen number to Jacobs for this project.
- Schedule additional meeting.

Jacobs will:

- Provide pdf of conceptual layout to City.
- Provide back up for Audited Overhead Rate multiplier to City.
- Provide Excel spreadsheet of Exhibit DEF to City.
- Modify scope and task costs per this meeting's decisions.





Ann Road Channel West – Rainbow Boulevard  
CLV Hansen No. 36801  
Jacobs Project No. W4X53700

**JACOBS**

**Sign-In-Sheet**

Meeting Subject: Kick-Off Meeting  
Date/Day: 06JAN2011 / Thursday  
Time: 9:00 AM  
Location: CE Large Conference Room

| Name                             | Organization           | Present Signature                             | Phone           | Email                                                                                |
|----------------------------------|------------------------|-----------------------------------------------|-----------------|--------------------------------------------------------------------------------------|
| Randy McConnell                  | CLV                    | <i>R.M.</i>                                   | 229.2186        | <a href="mailto:rmcconnell@lasvegasnevada.gov">rmcconnell@lasvegasnevada.gov</a>     |
| Mark Sorensen                    | CLV                    | Mark was present, did not sign form. -Tara A. | 229.2203        | <a href="mailto:msorensen@lasvegasnevada.gov">msorensen@lasvegasnevada.gov</a>       |
| Mike Janssen - <i>Eric Meyer</i> | CLV                    | <i>Diane for Eric</i>                         | 229.4866        | <a href="mailto:mjanssen@lasvegasnevada.gov">mjanssen@lasvegasnevada.gov</a>         |
| Peter Jackson                    | CLV                    | <i>Peter Jackson</i>                          | 229.5266        | <a href="mailto:pjackson@lasvegasnevada.gov">pjackson@lasvegasnevada.gov</a>         |
| Rob Welch                        | CLV                    | <i>Rob Welch</i>                              | 229.2177        | <a href="mailto:rwelch@lasvegasnevada.gov">rwelch@lasvegasnevada.gov</a>             |
| Tim Parks                        | CLV                    | <i>Tim Parks</i>                              | 229.2178        | <a href="mailto:tparks@lasvegasnevada.gov">tparks@lasvegasnevada.gov</a>             |
| David Bowers                     | CLV                    | <i>David Bowers</i>                           | 229-2324        | <a href="mailto:dbowers@lasvegasnevada.gov">dbowers@lasvegasnevada.gov</a>           |
| Tara Alexander                   | Jacobs                 | <i>Tara Alexander</i>                         | 938.5475        | <a href="mailto:tara.alexander@jacobs.com">tara.alexander@jacobs.com</a>             |
| Matt Sackschewsky                | Jacobs                 | <i>Matt Sackschewsky</i>                      | 938.5491        | <a href="mailto:matthew.sackschewsky@jacobs.com">matthew.sackschewsky@jacobs.com</a> |
| Alan Thomas                      | Jacobs                 | <i>Alan Thomas</i>                            | 938-5447        | <a href="mailto:alan.thomas@jacobs.com">alan.thomas@jacobs.com</a>                   |
| Todd Myers                       | RFCD                   | <i>Todd Myers</i>                             | 625-0000        | <a href="mailto:Tmyers@regionalflood.org">Tmyers@regionalflood.org</a>               |
| <i>Diane Phommavith</i>          | <i>CLV-TRAFFIC REP</i> |                                               | <i>229-2199</i> | <i>dphommavith@lasvegasnevada.gov</i>                                                |
|                                  |                        |                                               |                 |                                                                                      |
|                                  |                        |                                               |                 |                                                                                      |
|                                  |                        |                                               |                 |                                                                                      |
|                                  |                        |                                               |                 |                                                                                      |
|                                  |                        |                                               |                 |                                                                                      |
|                                  |                        |                                               |                 |                                                                                      |

**Attendees:**

|                        |                           |                     |
|------------------------|---------------------------|---------------------|
| Randy McConnell, CLV   | Mark Sorensen, CLV        | Peter Jackson, CLV  |
| Tim Parks, CLV         | David Bowers, CLV         | Diane Phomnin, CLV  |
| Tara Alexander, Jacobs | Matt Sackschewsky, Jacobs | Alan Thomas, Jacobs |
| Todd Myers, CCRFCD     |                           |                     |

**Notes Prepared By:**

Tara Alexander, Jacobs

The meeting was held at the City of Las Vegas to kick off the Ann and Rainbow project. The introductions were made along with a project overview. A project schedule, project exhibit and an offsite drainage exhibit were issued to all attendees.

Discussion of the Project included the following points:

- All correspondence is to go through Randy McConnell at the city. Make sure Mark Sorensen is CC'd on e-mail. Jacobs may discuss directly with Peter Jackson & Tim Parks on design issues, Randy McConnell is to be invited to all meetings.
- Preliminary meeting minutes will be provided to Randy M. for review and approval before sending out the final draft to all meeting attendees.
- Jacobs is to invite Randy to all meetings with the utilities regarding the project.
- Do not contact any homeowners with any issues regarding right-of-way, all correspondence is to go through the City of Las Vegas right-of-way department.
- E-mail Tim regarding sewer lateral crossing at the frontage of all homes.
- An updated project schedule is to be given at the monthly progress meeting.
- Delays in the schedule need to be documented on the schedule via a bar chart; make all important deadline dates stand out on the schedule. Changes to critical path items need to be documented and shown on the schedule, along with brief explanation for delays to critical path item.
- The City's new work schedule will be 7 am – 5:30 pm, Monday-Thursday. The City understands that communication with Jacobs will be limited between 5 pm and 5:30 pm.
- The City will provide feedback on service to the consultant via a new formal process at the 70-90% stage. They will provide Jacobs a blank form to review.
- The paint lines for the utility companies need to be surveyed.

Discussion regarding lessons learned by other City projects included the following points:

- Either an independent engineering firm or an in-house bid ability and constructability review will be performed with the plans at the ~90% design level.
- Keep in mind the time called out for the contractors and the time constraints for cast-in-place concrete versus ready-cast products. The issues regarding construction time in the past did not consider such things as traffic control and open trench length.
- Potholes coordination with the pothole sub-contractor is very important. Make sure we are in the field with them and can clearly communicate what needs to be performed for the project.

# Meeting Notes

(Continued)

Page 2 of 2

## ACTION ITEMS

City will:

- Set up a field visit with Jacobs to the project site.
- Provide Jacobs with the sewer lateral and sewer plans at the project limits.
- Provide Jacobs with at blank feed back form the City will use at the 70-90% level.

Jacobs will:

- Set up a design meeting with Peter Jackson.



Ann Road Channel West – Rainbow Boulevard  
CLV Hansen No. 36801  
Jacobs Project No. W4X53700

**JACOBS**

**Sign-In-Sheet**

**Meeting Subject:** Progress Meeting

**Date/Day:** 15FEB2011 / Tuesday

**Time:** 8:00 AM

**Location:** PW Boulder Room (333 N. Rancho, 9th floor)

| Name              | Organization | Present Signature                           | Phone    | Email                                                                                |
|-------------------|--------------|---------------------------------------------|----------|--------------------------------------------------------------------------------------|
| Randy McConnell   | CLV          | <i>RM</i>                                   | 229.2186 | <a href="mailto:rmcconnell@lasvegasnevada.gov">rmcconnell@lasvegasnevada.gov</a>     |
| Mark Sorensen     | CLV          | <i>No Signature<br/>Arrived towards End</i> | 229.2203 | <a href="mailto:msorensen@lasvegasnevada.gov">msorensen@lasvegasnevada.gov</a>       |
| Mike Janssen      | CLV          |                                             | 229.4866 | <a href="mailto:mjanssen@lasvegasnevada.gov">mjanssen@lasvegasnevada.gov</a>         |
| Peter Jackson     | CLV          | <i>PJ</i>                                   | 229.5266 | <a href="mailto:pjackson@lasvegasnevada.gov">pjackson@lasvegasnevada.gov</a>         |
| Rob Welch         | CLV          |                                             | 229.2177 | <a href="mailto:rwelch@lasvegasnevada.gov">rwelch@lasvegasnevada.gov</a>             |
| Tim Parks         | CLV          |                                             | 229.2178 | <a href="mailto:tparks@lasvegasnevada.gov">tparks@lasvegasnevada.gov</a>             |
| David Bowers      | CLV          |                                             | 229-2324 | <a href="mailto:dbowers@lasvegasnevada.gov">dbowers@lasvegasnevada.gov</a>           |
| Tara Alexander    | Jacobs       | <i>TA</i>                                   | 938.5475 | <a href="mailto:tara.alexander@jacobs.com">tara.alexander@jacobs.com</a>             |
| Matt Sackschewsky | Jacobs       | <i>MS</i>                                   | 938.5491 | <a href="mailto:matthew.sackschewsky@jacobs.com">matthew.sackschewsky@jacobs.com</a> |
| Alan Thomas       | Jacobs       | <i>AT</i>                                   | 938.5447 | <a href="mailto:alan.thomas@jacobs.com">alan.thomas@jacobs.com</a>                   |
| Todd Myers        | RFCD         | <i>TM</i>                                   | 685.0000 | <a href="mailto:Tmyers@regionalflood.org">Tmyers@regionalflood.org</a>               |
|                   |              |                                             |          |                                                                                      |
|                   |              |                                             |          |                                                                                      |
|                   |              |                                             |          |                                                                                      |
|                   |              |                                             |          |                                                                                      |
|                   |              |                                             |          |                                                                                      |
|                   |              |                                             |          |                                                                                      |
|                   |              |                                             |          |                                                                                      |
|                   |              |                                             |          |                                                                                      |

**Attendees:**

|                        |                           |                     |
|------------------------|---------------------------|---------------------|
| Randy McConnell, CLV   | Mark Sorensen, CLV        | Peter Jackson, CLV  |
| Tara Alexander, Jacobs | Matt Sackschewsky, Jacobs | Alan Thomas, Jacobs |
| Todd Myers, CCRFCD     |                           |                     |

**Notes Prepared By:**

Tara Alexander, Jacobs

The meeting was held at the City of Las Vegas to discuss progress for the Ann and Rainbow project. The introductions were made along with a project overview. A revised project schedule was issued to all attendees.

Discussion of the Project included the following points:

- Review comments from the 30% submittal will be discussed at the next CLV progress meeting scheduled for March 15, 2011.
- Jacobs needs further as-built plans for residential and commercial subdivisions adjacent to the project.
- Tim Sutko is the Regional Flood Control contact regarding the 404 permit and the section 8 screening. These need to begin after the 70% submittal and be completed by the 90% submittal.
- Lane Weber at Clark County public works will be responsible for approving the Clark County encroachment permit.
- There will be no NDOT coordination or permit required for this project, remove all NDOT references from schedule.
- Jacobs is in the process of completing the contracting and permitting with Aztec to obtain additional potholes.
- Project presentations will be scheduled after the 90% submittal, Technical Advisory Committee is July 28, 2011; Citizens Advisory Committee with MJ Harvey as chairman is August 1, 2011 and the Board presentations are scheduled for August 11, 2011. Jacobs will show a power point presentation summarizing the project at these meetings. Todd Myers will provide a format for the presentation to use as a template.
- There will be no walk-through with all stakeholders for this 30% submittal; the walk-through will take place after the 70% submittal.
- All future submittals will be incorporated into the 30% submittal in order to have one cohesive report with all calculations included.
- Only one CD to the City with the PFD plans and design report are required to submit to the city until the 100% submittal when they will need 2 CD's.
- The final submittal is to include hydraulic input files. Todd would like a copy of the HEC-1 models via e-mail.

# Meeting Notes

(Continued)

Page 2 of 2

## ACTION ITEMS

City will:

- Provide as-built sewer as-built improvement plans for developed areas adjacent to the project including all grading and utility sheets.
- Provide Jacobs with the 30% review comments if available prior to the next progress meeting on March 15, 2011.

CCRFCD will:

- Provide Jacobs with a formatted example of the project presentations to use as a template.

Jacobs will:

- Contact Lane Weber at Clark County public works to see if he would like a copy of the design submittal for the 30% and how to proceed with subsequent submittals.
- Contact Tim Sutko regarding 404 permit and section 8 screening.
- Take the NDOT encroachment permit off the schedule.
- Update the project schedule and submit a copy to Randy McConnell before next progress meeting.
- Send Todd Myers the 30% HEC-1 models via e-mail.





Ann Road Channel West – Rainbow Boulevard  
CLV Hansen No. 36801  
Jacobs Project No. W4X53700

**JACOBS**

**Sign-In-Sheet**

**Meeting Subject:** Progress Meeting

**Date/Day:** 15MAR2011 / Tuesday

**Time:** 8:00 AM

**Location:** PW Boulder Room (333 N. Rancho, 9th floor)

| Name              | Organization | Present Signature | Phone    | Email                                                                                |
|-------------------|--------------|-------------------|----------|--------------------------------------------------------------------------------------|
| Randy McConnell   | CLV          |                   | 229.2186 | <a href="mailto:rmccconnell@lasvegasnevada.gov">rmccconnell@lasvegasnevada.gov</a>   |
| Mark Sorensen     | CLV          |                   | 229.2203 | <a href="mailto:msorensen@lasvegasnevada.gov">msorensen@lasvegasnevada.gov</a>       |
| Mike Janssen      | CLV          |                   | 229.4866 | <a href="mailto:mjanssen@lasvegasnevada.gov">mjanssen@lasvegasnevada.gov</a>         |
| Peter Jackson     | CLV          |                   | 229.5266 | <a href="mailto:pjackson@lasvegasnevada.gov">pjackson@lasvegasnevada.gov</a>         |
| Rob Welch         | CLV          |                   | 229.2177 | <a href="mailto:rwelch@lasvegasnevada.gov">rwelch@lasvegasnevada.gov</a>             |
| Tim Parks         | CLV          |                   | 229.2178 | <a href="mailto:tparks@lasvegasnevada.gov">tparks@lasvegasnevada.gov</a>             |
| David Bowers      | CLV          |                   | 229.2324 | <a href="mailto:dbowers@lasvegasnevada.gov">dbowers@lasvegasnevada.gov</a>           |
| Tara Alexander    | Jacobs       |                   | 938.5475 | <a href="mailto:tara.alexander@jacobs.com">tara.alexander@jacobs.com</a>             |
| Matt Sackschewsky | Jacobs       |                   | 938.5491 | <a href="mailto:matthew.sackschewsky@jacobs.com">matthew.sackschewsky@jacobs.com</a> |
| Joe Jensen        | Jacobs       |                   | 938.5475 | <a href="mailto:joseph.jensen@jacobs.com">joseph.jensen@jacobs.com</a>               |
| Alan Thomas       | Jacobs       |                   | 938.5448 | <a href="mailto:alan.thomas@jacobs.com">alan.thomas@jacobs.com</a>                   |
| Todd Myers        | RFCD         |                   | 685.0000 | <a href="mailto:Tmyers@regionalflood.org">Tmyers@regionalflood.org</a>               |
| DIANE PHOMNINH    | CLV          |                   | 229-2199 | <a href="mailto:dphomninh@lasvegasnevada.gov">dphomninh@lasvegasnevada.gov</a>       |
| JOE PENA          | CLV          |                   | 229-2180 | <a href="mailto:jpena@lasvegasnevada.gov">jpena@lasvegasnevada.gov</a>               |
|                   |              |                   |          |                                                                                      |
|                   |              |                   |          |                                                                                      |
|                   |              |                   |          |                                                                                      |
|                   |              |                   |          |                                                                                      |
|                   |              |                   |          |                                                                                      |

# Meeting Notes

(Continued)

Page 2 of 2

- Diane requested that all pavement saw cut lines be perpendicular or parallel to the roadway. Also, if a saw cut line comes within 4 feet of the lip of a gutter, go ahead and replace all the way to the lip.
- Diane also requested that in the location of the traffic conduit at Tropical Parkway and Rainbow Boulevard that the plans read for the contractor to replace any conduit that has been removed during construction and to provide all stub outs for conduit outside of the pavement areas.
- Diane reported that the existing conduit in the intersection currently has breaks in it. She has requested that during construction of drainage facilities, a note will be added to the plans for the conduits to be repaired via splicing where necessary.
- Diane requested that the entire intersection at Rainbow & Tropical be repaved.

## ACTION ITEMS

City will:

- Set up a meeting with LVVWD to discuss the 36" MLCP crossing mains.
- Verify the revised sewer main in Rainbow just north of Ann Road is at proper slope for the 12" capacity and if not, recommend a size of replacement sewer which will provide proper capacity for a 0.20% slope.
- Have the proposed sewer manhole that is paved over at approximately STA 151+00 raised to grade. Joe will contact Jacobs when that is complete.
- Provide Jacobs with fencing and bollard details to use at the drainage easement for Rio Vista Estates.
- Provide Jacobs with information on the large grate used for access inlet structure example from the Flood Control plans comments.

CCRFCD will:

- Provide Jacobs with 30% submittal comments.

Jacobs will:

- Send estimates to Randy regarding getting a video of the sewer line from Ann Road to the cul-de-sac (Kane Holly St. and Haven Hollow Ave.) upstream of the easement on Rio Vista Estates.



Ann Road Channel West – Rainbow Boulevard  
CLV Hansen No. 36801  
Jacobs Project No. W4X53700

**JACOBS**

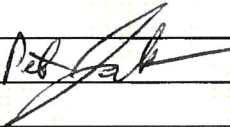
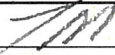
**Sign-In-Sheet**

**Meeting Subject:** Progress Design Meeting

**Date/Day:** 26APR2011 / Tuesday

**Time:** 3:30 PM

**Location:** PW Boulder Room (333 N. Rancho, 9th floor)

| Name              | Organization | Present Signature                                                                 | Phone    | Email                                                                                |
|-------------------|--------------|-----------------------------------------------------------------------------------|----------|--------------------------------------------------------------------------------------|
| Randy McConnell   | CLV          |  | 229.2186 | <a href="mailto:rmccconnell@lasvegasnevada.gov">rmccconnell@lasvegasnevada.gov</a>   |
| Mark Sorensen     | CLV          |                                                                                   | 229.2203 | <a href="mailto:msorensen@lasvegasnevada.gov">msorensen@lasvegasnevada.gov</a>       |
| Mike Janssen      | CLV          |                                                                                   | 229.4866 | <a href="mailto:mjanssen@lasvegasnevada.gov">mjanssen@lasvegasnevada.gov</a>         |
| Peter Jackson     | CLV          |  | 229.5266 | <a href="mailto:pjackson@lasvegasnevada.gov">pjackson@lasvegasnevada.gov</a>         |
| Rob Welch         | CLV          |                                                                                   | 229.2177 | <a href="mailto:rwelch@lasvegasnevada.gov">rwelch@lasvegasnevada.gov</a>             |
| Tim Parks         | CLV          |                                                                                   | 229.2178 | <a href="mailto:tparks@lasvegasnevada.gov">tparks@lasvegasnevada.gov</a>             |
| David Bowers      | CLV          |                                                                                   | 229-2324 | <a href="mailto:dbowers@lasvegasnevada.gov">dbowers@lasvegasnevada.gov</a>           |
| Tara Alexander    | Jacobs       |  | 938.5475 | <a href="mailto:tara.alexander@jacobs.com">tara.alexander@jacobs.com</a>             |
| Matt Sackschewsky | Jacobs       |  | 938.5491 | <a href="mailto:matthew.sackschewsky@jacobs.com">matthew.sackschewsky@jacobs.com</a> |
| Joe Jensen        | Jacobs       |                                                                                   | 938.5475 | <a href="mailto:joseph.jensen@jacobs.com">joseph.jensen@jacobs.com</a>               |
| Alan Thomas       | Jacobs       |                                                                                   | 938.5448 | <a href="mailto:alan.thomas@jacobs.com">alan.thomas@jacobs.com</a>                   |
| Todd Myers        | RFCD         |  | 685.0000 | <a href="mailto:Tmyers@regionalflood.org">Tmyers@regionalflood.org</a>               |
|                   |              |                                                                                   |          |                                                                                      |
|                   |              |                                                                                   |          |                                                                                      |
|                   |              |                                                                                   |          |                                                                                      |
|                   |              |                                                                                   |          |                                                                                      |
|                   |              |                                                                                   |          |                                                                                      |
|                   |              |                                                                                   |          |                                                                                      |
|                   |              |                                                                                   |          |                                                                                      |

**Attendees:**

|                        |                           |                    |
|------------------------|---------------------------|--------------------|
| Randy McConnell, CLV   | Peter Jackson, CLV        | Todd Myers, CCRFCD |
| Tara Alexander, Jacobs | Matt Sackschewsky, Jacobs |                    |

**Notes Prepared By:**

Tara Alexander, Jacobs

The meeting was held at the City of Las Vegas to discuss design constraints as analyzed in the 70% submittal. It was brought up that the HGL in the existing pipe is high and that the HGL translates upstream in the proposed storm drain to an HGL which is less than 1' above below ground. Also, an exhibit of the proposed grading for the Rios Vista Estates drainage channel was given to the participants.

After the meeting, Peter, Tara and Matt went to Tim Parks' office to discuss sewer line requirements for the project.

Discussion of the Project included the following points:

- The downstream end of the WSPGW analysis needs to extend several hundred feet downstream in the existing Ann Road system until the model becomes stable.
- The City and Regional indicated that the proposed height of the HGL will be acceptable with upgraded storm sewer manholes and laterals.
- For all drop inlets where the HGL is less than 1' below finish grade, provide rubber check valves in the line lateral pipe.
- For the storm drain manholes, provide concrete collars around manholes with a locking, slotted lid. The City will provide details they have used in the past.
- The biggest box size at the downstream end which showed the HGL below ground was proposed on the 70% plans; this is a 12' x 6' RCB.
- There may be an issue with the sewer lateral crossing under the 12' x 6' box at STA 150+46. The separation is minimal in this location. The alternatives discussed for this location aside from decreasing the size of the RCB are as follows: decrease proposed lateral slope from 0.4% to 0.2% or keep the 0.4% slope and decrease pipe size to 8". According to Tim Parks, a minimum of 6" clearance is to be provided.
- For the proposed sewer lateral at 150+46, the manholes on each side are to be T-Locked.
- For the 12' x 6' box sizes, verify with precast companies Rinker and Geneva to see if a box size thinner than 12" can be provided pre-cast.
- At STA 147+00, obtain a pothole for the proposed sewer line over the 36" water main at the location where the slope in the 12" PVC sanitary sewer is proposed.
- At this time, retaining walls are proposed in the drainage channel off Rio Vista Estates adjacent to the existing retaining/screen walls. The City would like to have this area potholed

# Meeting Notes

(Continued)

Page 2 of 2

in order to determine the width and depth of the existing footings. Jacobs will find out how much it will cost to get footing information in this location.

- For the channel in Rio Vista Estates, provide a pony wall which extends 1' above the adjacent HGL per the WSPGW analysis.
- According to Tim Parks, the sewer manhole in the drainage easement needs to be checked for grade rings. Typically, the City will only allow up to 18" of grade rings. City prefers that all adjustments to be made to the grade rings. If significant numbers of grade rings are not present and depth gets into bell part of the manhole, replacement of the manhole will be required.

## ACTION ITEMS

City will:

- Provide Jacobs with a detail for a concrete collar with a locking manhole and solid lid.
- Provide Jacobs with a detail for slotted lid used in past projects.
- Provide Jacobs with additional services funding for additional potholes.

Jacobs will:

- Verify configuration of sewer manhole in Rio Vista estate easement.
- Obtain vertical information for footers along the block wall in Rio Vistas channel.
- Re-analyze channel design for best design once footer information has been obtained from sub-contractor.
- Obtain pothole information for proposed sanitary sewer relocation crossing at the 36" water main in Ann Rd.
- Re-analyze sanitary sewer crossing at 156+46 to provide minimum of 6" of cover.
- Finalize pipe sizes.
- Re-analyze WSPGW further downstream in Ann Road. Provide city copy of updated analyses if a significant change occurs.
- Provide City with cost to pothole the retaining wall.



ANRB-Hansen

[illegible]



**Attendees:**

|                        |                           |                    |
|------------------------|---------------------------|--------------------|
| Randy McConnell, CLV   | Mark Sorensen, CLV        | Peter Jackson, CLV |
| Diane Phomninh, CLV    | Joe Pena, CLV             | Todd Myers, CCRFCD |
| Tara Alexander, Jacobs | Matt Sackschewsky, Jacobs |                    |

**Notes Prepared By:**

Tara Alexander, Jacobs

The meeting was held at the City of Las Vegas to discuss progress for the Ann and Rainbow project.

Discussion of the Project included the following points:

- Comments from the 70% plan submittal were discussed. Jacobs received comments from Randy, Diane, Joe and Peter. Comments were also received from John O'Connell, public works construction management. Comments from Todd are forthcoming.
- A copy of the 70% quantities takeoff and a copy of previous CLV sample storm drain projects were provided to Jacobs.
- Randy expressed his concern for the level of design received at the 70% level, he is expecting the missing traffic, structural and removal information to be worked out and complete in the next 90% submittal.
- The 90% submittal was originally scheduled for June 8, 2011. Randy and Peter will discuss moving this date for the next submittal.
- Diane pointed out that the existing pavement markings which will be impacted are not shown on the removal plans or on a traffic plan. This needs to be added in the next submittal.
- Rainbow Boulevard is a safe-route-to-school road. The specifications need to call out an alternate path to school.
- The Ann Road intersection is being impacted, Diane provided as-builts for this area and to show how any conduit will be impacted.
- Diane does not need a pothole on the Ann Road conduit, needs to be called out as protect-in-place on the plans.
- Joe discussed his portion of comments. The primary concern is to lower the sewer main further north to the easement at Rio Vista Estates in order to provide future connections for homes on septic systems and provide stubs for future use.
- There is a sanitary sewer lateral crossing the storm drain from the Walgreens parking lot. Jacobs is to verify if we need pothole information in this location.
- For all slope breaks great than 4% at a manhole, T-Lock manholes are to be provided.
- A waterproof lid in the drainage easement at Rio Vista Estates for the sanitary sewer is required.
- Todd reviewed comments he had to the plans. Todd requires all access manholes to be shown on the side of the box with stationing to center of manholes.

# Meeting Notes

(Continued)

Page 2 of 2

- Todd wants to revisit providing inlets in the easement in Rio Vista Estates versus a box. This will be discussed at the walk-through.
- Todd suggested calling out an 8" minimum side of trench width on the storm drain with the option of using CLSM rather than compacted dirt.
- Randy reviewed his comments to the 70% plans. He advised condensing the plans further and removing the SD sheets in lieu of the profile sheets.
- Peter re-iterated that grading on the new inlets is necessary in order to determine if they will work.
- All risers on the storm drain are to be concrete encased from the concrete collar to top of manhole.
- Separate Sanitary sheets with profiles are to be added to the plan set.

## ACTION ITEMS

City will:

- Set up a walk through for the following Tuesday.
- Determine new submittal date for 90% plans.

CCRFCD will:

- Provide Jacobs with 70% submittal comments.

Jacobs will:

- Address all CLV comments to plans.
- Obtain additional survey for the sewer and pavement markings.
- Verify if a pothole is needed at the sewer lateral for Walgreens.
- Coordinate meeting with the utility companies to determine franchise agreements.



Ann Road Channel West – Rainbow Boulevard  
CLV Hansen No. 36801  
Jacobs Project No. W4X53700

**JACOBS**

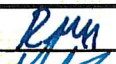
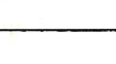
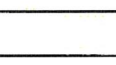
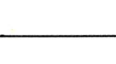
**Sign-In-Sheet**

**Meeting Subject:** Design Progress Meeting

**Date/Day:** Thursday, July 07, 2011

**Time:** 2:30 PM

**Location:** PW Gravel Room (333 N. Rancho, 9th floor)

| Name            | Organization | Present Signature                                                                   | Phone        | Email                                                                            |
|-----------------|--------------|-------------------------------------------------------------------------------------|--------------|----------------------------------------------------------------------------------|
| Randy McConnell | CLV          |    | 229.2186     | <a href="mailto:rmcconnell@lasvegasnevada.gov">rmcconnell@lasvegasnevada.gov</a> |
| Mark Sorensen   | CLV          |    | 229.2203     | <a href="mailto:msorensen@lasvegasnevada.gov">msorensen@lasvegasnevada.gov</a>   |
| Mike Janssen    | CLV          |    | 229.4866     | <a href="mailto:mjanssen@lasvegasnevada.gov">mjanssen@lasvegasnevada.gov</a>     |
| Peter Jackson   | CLV          |    | 229.5266     | <a href="mailto:pjackson@lasvegasnevada.gov">pjackson@lasvegasnevada.gov</a>     |
| Rob Welch       | CLV          |    | 229.2177     | <a href="mailto:rwelch@lasvegasnevada.gov">rwelch@lasvegasnevada.gov</a>         |
| Tim Parks       | CLV          |    | 229.2178     | <a href="mailto:tparks@lasvegasnevada.gov">tparks@lasvegasnevada.gov</a>         |
| David Bowers    | CLV          |    | 229-2324     | <a href="mailto:dbowers@lasvegasnevada.gov">dbowers@lasvegasnevada.gov</a>       |
| Tara Alexander  | Jacobs       |    | 938.5475     | <a href="mailto:tara.alexander@jacobs.com">tara.alexander@jacobs.com</a>         |
| Nathan Worker   | Jacobs       |   | 938.5538     | <a href="mailto:nathan.worker@jacobs.com">nathan.worker@jacobs.com</a>           |
| Don Tulloch     | Jacobs       |  | 775-850-5110 | <a href="mailto:don.tulloch@jacobs.com">don.tulloch@jacobs.com</a>               |
| Todd Myers      | RFCD         |  | 685.0000     | <a href="mailto:Tmyers@regionalflood.org">Tmyers@regionalflood.org</a>           |
|                 |              |                                                                                     |              |                                                                                  |
|                 |              |                                                                                     |              |                                                                                  |
|                 |              |                                                                                     |              |                                                                                  |
|                 |              |                                                                                     |              |                                                                                  |
|                 |              |                                                                                     |              |                                                                                  |
|                 |              |                                                                                     |              |                                                                                  |
|                 |              |                                                                                     |              |                                                                                  |

**Attendees:**

|                        |                     |                        |
|------------------------|---------------------|------------------------|
| Randy McConnell, CLV   | Peter Jackson, CLV  | Todd Myers, CCRFCD     |
| Tara Alexander, Jacobs | Don Tulloch, Jacobs | Anil Mudigonda, Jacobs |

**Notes Prepared By:**

Tara Alexander, Jacobs

This site walkthrough was held as a follow up to the 70% design review meeting held on June 1, 2010.

Discussion of the Project included the following points:

- Additional survey needs to be shown on the plans in order to obtain the following information: driveways, inverts of sewer manholes upstream and downstream of the project site, striping on the project corridor, grading shots adjacent to Rainbow Boulevard, existing utilities west of Rainbow Boulevard on Tropical Parkway.
- Look at alternatives for the inlet at the drainage easement in Rio Vista Estates. Todd expressed concerns about ponding heights into a 9'x5' box and wanted to revisit the inlets. Don suggested we stay out of the easement as much as possible and look at using two 9'x3' boxes at the back of the sidewalk in Rainbow Boulevard to lower the water elevation and to avoid the existing home owner's retaining walls.
- Add an inlet on Rainbow Boulevard downstream of the Rio Vista easement in order to collect any overtopping in the 100-year storm event.
- At the Rio Vista Estates drainage easement, there are many trees that overtop from home owners back yards into the easement. Randy suggested we add a note to the plans to trim the trees out of the easement.
- On the upstream end of the Rio Vista Easement, add a 4" nuisance inlet in the depressed curb and see if we can daylight into the channel in order to keep sidewalk free standing water.
- The City and Regional want to eliminate as many area inlets as possible away from the homeowners and with sufficient grading provide surface drainage for nuisance flow.
- The entire narrow roadway section needs to be repaired on Rainbow Boulevard from approximately station 156+00 to 159+00.
- For the existing property walls, verify if the trenching widths will impact the walls.
- Provide temporary pavement on the east side of Rainbow Boulevard north of El Campo Grande for construction activities. This will require an AEP.
- Look at providing a temporary asphalt patch for the school walking route along Rainbow Boulevard.



Ann Road Channel West – Rainbow Boulevard  
CLV Hansen No. 36801  
Jacobs Project No. W4X53700



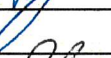
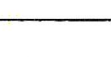
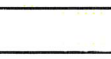
Sign-In-Sheet

Meeting Subject: Design Progress Meeting

Date/Day: Thursday, July 07, 2011

Time: 2:30 PM

Location: PW Gravel Room (333 N. Rancho, 9th floor)

| Name            | Organization | Present Signature                                                                   | Phone        | Email                                                                              |
|-----------------|--------------|-------------------------------------------------------------------------------------|--------------|------------------------------------------------------------------------------------|
| Randy McConnell | CLV          |    | 229.2186     | <a href="mailto:rmccconnell@lasvegasnevada.gov">rmccconnell@lasvegasnevada.gov</a> |
| Mark Sorensen   | CLV          |    | 229.2203     | <a href="mailto:msorensen@lasvegasnevada.gov">msorensen@lasvegasnevada.gov</a>     |
| Mike Janssen    | CLV          |    | 229.4866     | <a href="mailto:mjanssen@lasvegasnevada.gov">mjanssen@lasvegasnevada.gov</a>       |
| Peter Jackson   | CLV          |    | 229.5266     | <a href="mailto:pjackson@lasvegasnevada.gov">pjackson@lasvegasnevada.gov</a>       |
| Rob Welch       | CLV          |    | 229.2177     | <a href="mailto:rwelch@lasvegasnevada.gov">rwelch@lasvegasnevada.gov</a>           |
| Tim Parks       | CLV          |    | 229.2178     | <a href="mailto:tparks@lasvegasnevada.gov">tparks@lasvegasnevada.gov</a>           |
| David Bowers    | CLV          |    | 229-2324     | <a href="mailto:dbowers@lasvegasnevada.gov">dbowers@lasvegasnevada.gov</a>         |
| Tara Alexander  | Jacobs       |    | 938.5475     | <a href="mailto:tara.alexander@jacobs.com">tara.alexander@jacobs.com</a>           |
| Nathan Worker   | Jacobs       |    | 938.5538     | <a href="mailto:nathan.worker@jacobs.com">nathan.worker@jacobs.com</a>             |
| Don Tulloch     | Jacobs       |   | 775-850-5110 | <a href="mailto:don.tulloch@jacobs.com">don.tulloch@jacobs.com</a>                 |
| Todd Myers      | RFCD         |  | 685.0000     | <a href="mailto:Tmyers@regionalflood.org">Tmyers@regionalflood.org</a>             |
|                 |              |                                                                                     |              |                                                                                    |
|                 |              |                                                                                     |              |                                                                                    |
|                 |              |                                                                                     |              |                                                                                    |
|                 |              |                                                                                     |              |                                                                                    |
|                 |              |                                                                                     |              |                                                                                    |
|                 |              |                                                                                     |              |                                                                                    |
|                 |              |                                                                                     |              |                                                                                    |
|                 |              |                                                                                     |              |                                                                                    |

**Attendees:**

|                        |                     |                       |
|------------------------|---------------------|-----------------------|
| Randy McConnell, CLV   | Peter Jackson, CLV  | Mark Sorensen, CLV    |
| Tim Parks, CLV         | Todd Myers, CCRFCD  | Nathan Worker, Jacobs |
| Tara Alexander, Jacobs | Don Tulloch, Jacobs |                       |

**Notes Prepared By:**

Tara Alexander, Jacobs

The meeting was held at the City of Las Vegas to discuss design progress of the sewer lowering and the updated channel easement design for Rio Vista Estates. Updated profiles of the sewer design were shown to illustrate the sewer design progress. An exhibit of the revised channel design along with the updated profile view of the main storm system was provided by Jacobs to the City.

Discussion of the Project included the following points:

- There are currently homeowners to the west of Rainbow and south of Rio Vista Estates which have private septic systems. The possibility of future tie-in to the revised sewer was discussed. The City cannot pay for individual homeowners to have laterals; they can only maintain sewer mains 8" and larger. In order to prevent future disturbance under the storm drain box, the plans will provide for a 6" water quality pipe under the box, capped at both ends past the trench.
- The sewer manhole and crossing within the Rio Vista Drainage easement were discussed. Jacobs' recommendation is to not disturb the existing walls in the drainage easement by replacing the sewer manhole and 12" main line. Tim agreed that the design can provide for a sewer manhole within the sidewalk which will connect the existing sewer from the easement to the new sewer manhole within Rainbow. This manhole will have the standard 0.2' drop. Jacobs will report the clearance to the City via e-mail to gain approval for the mainline clearance less than 1-foot below the box on the portion of the line that will be replaced.
- The revised 12" sewer main in Rainbow Boulevard is currently shown at 0.20% with 0.2' drops across manholes where bends occur. Jacobs will remove the drop from manholes downstream of the drainage easement in order to gain slope in the sewer line.
- On the channel exhibit, a stem wall adjacent to the existing property walls is shown. It was discussed that the new water surface in the channel will be below the adjacent finish grade on the property side of the channel. In order to provide a stem wall, the entire 4" drainage slab would need to be replaced with a 6" slab. If the stem walls are not included in the design, the only portion of the easement that will be completely replaced is the downstream end adjacent to Rainbow Boulevard. The City agreed that the stem walls will not be necessary and will not be shown on the design plans.
- The proposed design incorporates an inlet/headwall combination. The elevation of the stem walls adjacent to Rainbow Boulevard will be set at the 100-year flood elevation in order to provide emergency overflow into Rainbow Boulevard where an emergency overflow inlet will be provided. A wrought fence will be designed on top of these stem walls with gated access to the inlets adjacent to Rainbow Boulevard. A standard gate size will be provided. A standard wrought iron gate will be provided at the upstream end of the easement.



# Meeting Notes

(Continued)

Page 2 of 2

- For the grates in the easements, look into using the grates that are utilized on the NDOT 2B grates. Lifting eyes need to be provided. Also provide a hatch as part of a portion of the grating which can be locked and lifted for access.
- The existing trees which encroach into the Rio Vista drainage easement will be trimmed per plans. The special specification shall instruct the contractor to contact the homeowners regarding this issue. Jacobs will provide a photo of the trees on the plans after ensuring that photographs on the plans are clearly reproducible, so that the contractor can determine the magnitude of the work to be performed.
- The homeowners on parcels 125-27-803-001 and 004 have existing decorative walls within the right-of way which will be impacted during construction. The City will communicate with the homeowners regarding this issue prior to construction. Both properties lie within Clark County jurisdiction.
- There are three parcels which will be impacted during construction. The City needs to obtain authorization to enter property permission for parcels: 125-26-304-005, 006 & 007.
- In order to open bidding to other pre-cast contractors, it was requested that Jacobs looks into transitioning the box size at approximately station 157+00 to 158+00 from a 16 x 5 culvert to a 14 x 5 culvert.
- The city may consider the 3 sided box construction for this project to accommodate the box sizes. The correct AASHTO and ASTM standards shall apply.

## ACTION ITEMS

City will:

- Contact homeowners regarding on parcels 125-27-803-001 and 004 existing walls.

Jacobs will:

- Run preliminary calculations on the increased slope and clearance below the box at the drainage easement and report findings via e-mail.
- Check mylar printing and photocopy reproduction of photographs on plans.
- Provide legal descriptions for authorization to enter property during construction for parcels: 125-26-304-005, 006 & 007.
- Perform WSPG analysis to transition the box size at approximately station 157+00 to 158+00 from a 16 x 5 culvert to a 14 x 5 culvert.



Ann Road Channel West – Rainbow Boulevard  
CLV Hansen No. 36801  
Jacobs Project No. W4X53700

**JACOBS**

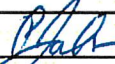
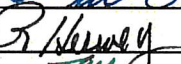
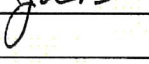
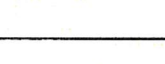
**Sign-In-Sheet**

**Meeting Subject:** 90% Design Review Meeting

**Date/Day:** Thursday, October 06, 2011

**Time:** 3:30 PM

**Location:** PW Boulder Room (333 N. Rancho, 9th floor)

| Name            | Organization | Present Signature                                                                   | Phone        | Email                                                                            |
|-----------------|--------------|-------------------------------------------------------------------------------------|--------------|----------------------------------------------------------------------------------|
| Randy McConnell | CLV          |    | 229.2186     | <a href="mailto:rmcconnell@lasvegasnevada.gov">rmcconnell@lasvegasnevada.gov</a> |
| Mark Sorensen   | CLV          |                                                                                     | 229.2203     | <a href="mailto:msorensen@lasvegasnevada.gov">msorensen@lasvegasnevada.gov</a>   |
| Mike Janssen    | CLV          |                                                                                     | 229.4866     | <a href="mailto:mjanssen@lasvegasnevada.gov">mjanssen@lasvegasnevada.gov</a>     |
| Peter Jackson   | CLV          |    | 229.5266     | <a href="mailto:pjackson@lasvegasnevada.gov">pjackson@lasvegasnevada.gov</a>     |
| Rob Welch       | CLV          |    | 229.2177     | <a href="mailto:rwelch@lasvegasnevada.gov">rwelch@lasvegasnevada.gov</a>         |
| Tim Parks       | CLV          |                                                                                     | 229.2178     | <a href="mailto:tparks@lasvegasnevada.gov">tparks@lasvegasnevada.gov</a>         |
| David Bowers    | CLV          |                                                                                     | 229.2324     | <a href="mailto:dbowers@lasvegasnevada.gov">dbowers@lasvegasnevada.gov</a>       |
| Diane Phomninh  | CLV          |                                                                                     | 229.2199     | <a href="mailto:dphomninh@lasvegasnevada.gov">dphomninh@lasvegasnevada.gov</a>   |
| Tara Alexander  | Jacobs       |    | 938.5475     | <a href="mailto:tara.alexander@jacobs.com">tara.alexander@jacobs.com</a>         |
| Nathan Worker   | Jacobs       |    | 938.5538     | <a href="mailto:nathan.worker@jacobs.com">nathan.worker@jacobs.com</a>           |
| Don Tulloch     | Jacobs       |    | 775.850.5110 | <a href="mailto:don.tulloch@jacobs.com">don.tulloch@jacobs.com</a>               |
| Raymond Herweg  | Jacobs       |   | 938.5477     | <a href="mailto:raymond.herweg@jacobs.com">raymond.herweg@jacobs.com</a>         |
| Todd Myers      | RFCD         |  | 685.0000     | <a href="mailto:Tmyers@regionalflood.org">Tmyers@regionalflood.org</a>           |
| JOE PEÑA        | CLV          |  | 229-2180     | <a href="mailto:jpena@lasvegasnevada.gov">jpena@lasvegasnevada.gov</a>           |
|                 |              |                                                                                     |              |                                                                                  |
|                 |              |                                                                                     |              |                                                                                  |
|                 |              |                                                                                     |              |                                                                                  |
|                 |              |                                                                                     |              |                                                                                  |

**Attendees:**

|                       |                     |                        |
|-----------------------|---------------------|------------------------|
| Randy McConnell, CLV  | Peter Jackson, CLV  | Robert Welch, CLV      |
| Joe Pena, CLV         | Todd Myers, CCRFCD  | Tara Alexander, Jacobs |
| Nathan Worker, Jacobs | Don Tulloch, Jacobs | Raymond Herweg, Jacobs |

**Notes Prepared By:**

Tara Alexander, Jacobs

The meeting was held at the City of Las Vegas to discuss progress for the Ann and Rainbow project.

Discussion of the Project included the following points:

- Comments from the 90% plan submittal were discussed. Jacobs received comments from Randy, Joe and from Clark County via Randy. Comments were also received from John O'Connell, public works construction management and Diane Phomninh of CLV. Comments from Todd and Peter are forthcoming.

Joe Pena discussed his comments:

- The manhole in the sidewalk was discussed. Tim Parks had previously approved it due to the lack of alternative options.
- Sewer lateral crossing detail was discussed, Joe wanted to see it connected to main and existing lateral; however, Tim Parks had previously said we can only put sleeves in due to the public funding of the project, and that such funding cannot be used to make improvements to individual lots.
- We need to show limits of the sleeves in the details (1' outside of trench) and specify that as-built shots need to be taken of both the upstream and downstream ends of the laterals. Add call-out to plans regarding the as-built shots.

Todd Myers discussed his comments:

- The asphalt section is too large. For regional projects, replace in kind (4" over 12") rather than use the recommendations from the geotechnical report.
- We need to base main sizing on regional basins due to the offset peaking of the smaller basins. Keep the inlet sizing based on peak flows and resize the main RCB box based on Regional Flows. Todd also mentioned performing an attenuation analysis to find 100-year flows within the existing VTN storm drain at the same time the ANRB runoff hits the intersection. Jacobs will submit an updated WSPG analysis and all plans corrections will take place at once as soon as a box design size is agreed upon between CLV, Regional and Jacobs.
- The amount of CLSM called out on the plans needs to be verified at the headwall easement. Don pointed out that the compaction equipment may impact the existing walls, thus CLSM was used. Jacobs will review and if possible, reduce the amount of CLSM used.
- Verify the box size in the easement at 15' X 3.5' cannot be changed to a smaller size while using hydraulic head to decrease the width.

Peter Jackson discussed his comments:

- Verify if the waterlines passing below the storm drains need to have steel casings as shown on plans and if water quality pipe on the sewer can be used to alleviate the use of steel casings. Follow up with UDACS and LVVWD if necessary.

Follow up: Per Section 2.22.02 C of UDACS: "Where a section of water main is being lowered due to a sanitary sewer, or storm drain conflict, the water main shall be constructed of ductile iron pipe, or as otherwise approved by the Agency. All pipe joints shall be restrained in accordance with the Agency's requirements. The plans shall clearly identify the length of water main to be restrained (i.e. from station "x" to station "y"). The Engineer shall also submit all calculations used to determine the required length of restrained pipe. The water main shall be placed within a steel sleeve in accordance with UDACS Plates 21 or 22, and 23." Based on this requirement, a steel sleeve is provided. Re-constructing the sewer of Water Quality Pipe will alleviate the requirement under the sewer, and we can ask about elastomeric seals on the box without a sleeve, but we can't get away without the casing when crossing under storm drains less than 24" because these cannot be elastomerically sealed.

- On the crossing detail for the 36" waterline crossing, annotate that one section of box must be centered on the large diameter waterline crossing.
- All backwater valves placed in the storm drain laterals on Tropical Parkway can be removed.
- Dimension all laterals to side of box rather than to pipe centerline.
- Verify if the 5' X 2' laterals on the upstream of the system in Tropical Parkway can be adjusted to a 30" lateral.
- Show paving transitions on grading plans and check driveway slopes to make sure they match and the homeowners will not have any issues with their driveways.
- Peter and Robert will check with the CLV streets departments to see if they can eliminate fiberglass grid in pavement section and if they can simply pave over.
- Peter will give submit all comments once the RCB box size has been finalized.

Randy McConnell discussed his comments:

- If the limits of pavement are different than the removals (as shown), we need to station /offset the angle points on the new asphalt. We also need to check edge conditions and provide a transition at El Campo Grande.
- Don't use Glass Grid. Put the pavement section right on top of the box if necessary (CCRFGD concurrence). The City will follow up with their streets division.
- Traffic commented on whether we should shut down Rainbow Boulevard for construction versus first getting an authorization to enter property for parcels: 125-26-304-005, 006 & 007.
- Traffic discussion included whether or not Ambiance Lane can be closed to the Ambiance Estates subdivision; this is the only entrance into the subdivision. Jacobs will coordinate with Clark County and CLV traffic on permits required if Rainbow Boulevard will close down during construction. Access to Kinder Care to the south can not be shut down.
- Randy wants to check status of design for the cable/gas companies. He will attend meetings to coordinate with the utility companies who are doing their own plans. Randy will send the

# Meeting Notes

(Continued)

Page 3 of 3

"Prior Rights" research received by James Brown from NV Energy to the CLV right of way department in order to determine who is responsible to pay for the relocation of the underground power crossings in Rainbow Boulevard and Tropical Parkway at the NW intersection.

## ACTION ITEMS

City will:

- Verify with streets division on how to handle the shallow RCB and what the paving sections over the box have been used in the past.
- Follow up on the usage of glass grid in the pavement section.
- Send "Prior Rights" research received by James Brown from NV Energy to the CLV right of way department in order to determine who is responsible to pay for the relocation of the underground power crossings in Rainbow Boulevard and Tropical Parkway at the NW intersection.
- Review updated WSPG analyses and attend meeting with Jacobs and CLV regarding the box size if necessary.

CCRFCD will:

- Provide Jacobs with 70% submittal comments.
- Review updated WSPG analyses and attend meeting with Jacobs and CLV regarding the box size if necessary.

Jacobs will:

- Address all CLV comments to plans.
- Follow up with UDACS and LVVWD if necessary regarding water crossings.
- Obtain and approve revised box size analysis for the RCB in Rainbow Boulevard.
- Review CLSM in drainage easement.



Ann Road Channel West – Rainbow Boulevard  
CLV Hansen No. 36801  
Jacobs Project No. W4X53700

**JACOBS**

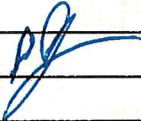
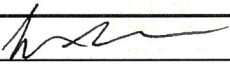
**Sign-In-Sheet**

**Meeting Subject:** RCB Box Size Main

**Date/Day:** Tuesday, October 18, 2011

**Time:** 4:00 PM

**Location:** PW Boulder Room (333 N. Rancho, 9th floor)

| Name            | Organization | Present Signature                                                                  | Phone        | Email                                                                            |
|-----------------|--------------|------------------------------------------------------------------------------------|--------------|----------------------------------------------------------------------------------|
| Randy McConnell | CLV          |   | 229.2186     | <a href="mailto:rmcconnell@lasvegasnevada.gov">rmcconnell@lasvegasnevada.gov</a> |
| Mark Sorensen   | CLV          |                                                                                    | 229.2203     | <a href="mailto:msorensen@lasvegasnevada.gov">msorensen@lasvegasnevada.gov</a>   |
| Mike Janssen    | CLV          |                                                                                    | 229.4866     | <a href="mailto:mjanssen@lasvegasnevada.gov">mjanssen@lasvegasnevada.gov</a>     |
| Peter Jackson   | CLV          |   | 229.5266     | <a href="mailto:pjackson@lasvegasnevada.gov">pjackson@lasvegasnevada.gov</a>     |
| Rob Welch       | CLV          |                                                                                    | 229.2177     | <a href="mailto:rwelch@lasvegasnevada.gov">rwelch@lasvegasnevada.gov</a>         |
| Tim Parks       | CLV          |                                                                                    | 229.2178     | <a href="mailto:tparks@lasvegasnevada.gov">tparks@lasvegasnevada.gov</a>         |
| David Bowers    | CLV          |                                                                                    | 229.2324     | <a href="mailto:dbowers@lasvegasnevada.gov">dbowers@lasvegasnevada.gov</a>       |
| Diane Phomninh  | CLV          |                                                                                    | 229.2199     | <a href="mailto:dphomninh@lasvegasnevada.gov">dphomninh@lasvegasnevada.gov</a>   |
| Tara Alexander  | Jacobs       |   | 938.5475     | <a href="mailto:tara.alexander@jacobs.com">tara.alexander@jacobs.com</a>         |
| Nathan Worker   | Jacobs       |                                                                                    | 938.5538     | <a href="mailto:nathan.worker@jacobs.com">nathan.worker@jacobs.com</a>           |
| Don Tulloch     | Jacobs       |                                                                                    | 775.850.5110 | <a href="mailto:don.tulloch@jacobs.com">don.tulloch@jacobs.com</a>               |
| Raymond Herweg  | Jacobs       |                                                                                    | 938.5477     | <a href="mailto:raymond.herweg@jacobs.com">raymond.herweg@jacobs.com</a>         |
| Todd Myers      | RFCD         |  | 685.0000     | <a href="mailto:Tmyers@regionalflood.org">Tmyers@regionalflood.org</a>           |
|                 |              |                                                                                    |              |                                                                                  |
|                 |              |                                                                                    |              |                                                                                  |
|                 |              |                                                                                    |              |                                                                                  |
|                 |              |                                                                                    |              |                                                                                  |
|                 |              |                                                                                    |              |                                                                                  |



**Attendees:**

|                        |                    |                    |
|------------------------|--------------------|--------------------|
| Randy McConnell, CLV   | Peter Jackson, CLV | Todd Myers, CCRFCD |
| Tara Alexander, Jacobs |                    |                    |

**Notes Prepared By:**

Tara Alexander, Jacobs

The meeting was held at the City of Las Vegas to discuss box hydraulics for the Ann and Rainbow project.

Discussion of the Project included the following points:

- Peter Jackson will double check with Jerry Walker at the City regarding the elimination of the trash rack in the subdivision drainage easement adjacent to station 159+00, unless otherwise directed, Jacobs can assume that the trash rack can be completely removed.
- The WSPGW model which follows the channel section in the drainage easement can begin at the headwall utilizing the water surface elevation to size the opening rather than begin at the upstream end in the open channel portion. ‘
- The City is requesting a structural tie-in section at station 158+92 in order to provide the contractor the option of tying in with a prefabricated lateral section or with a cast-in-place section. The specifications need to be modified to provide both options.
- On the plans and on Figure D-4, adjust the 100-year flow rate to be based on the concentration point flows as derived in this drainage study and illustrated on Figure C-10.

**ACTION ITEMS**

City will:

- Provide Jacobs with 90% submittal comments from the Flood Control Section.

CCRFCD will:

- Provide Jacobs with 90% submittal comments.

Jacobs will:

- Address all CLV comments to plans.

**8. APPENDIX H – COMMENTS MATRIX FOR 30%, 70% AND 90% SUBMITTALS**

City of Las Vegas Department of Public Works  
ANN ROAD CHANNEL WEST RAINBOW BOULEVARD - HANSEN NO. 36801

Comment Matrix for  
30%, 70% and 90% Submittals

| No. | Design Phase  | Reviewer/Source                  | Sheet/Location          | Subject             | Comment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Jacobs Action/Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----|---------------|----------------------------------|-------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | 30% Submittal | Peter Jackson, CLV Flood Control | No. 1 - Comment Letter  | Drainage Memorandum | Flood Control takes no exception to the overall Hydrology presented as it complies with the overall drainage parameters. Flood Control recommends that the Design Report expand upon the MPU and facility flow information. See attached report comments to assist in the revisions to the report narrative. Review Figure C-10 to verify the Q100 @CP0. Revise and update the text and Tables accordingly. Provide an electronic copy of the HEC-1 analysis including both input and output files with the Final Design Report.                                                                                                                                                                                     | All changes to the design report and Figure C-10 will be addressed and incorporated in the final design report. Also, an electronic HEC-1 analysis will be provided with the Final Design Report.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 2   | 30% Submittal | Peter Jackson, CLV Flood Control | No. 2 - Comment Letter  | Drainage Memorandum | Provide a WSPG analysis for the proposed storm drain system based upon the HEC-1 flow data. The WSPG and the HEC-1 data need to match the proposed system parameters.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | The WSPG analysis will be included in the 70% submittal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 3   | 30% Submittal | Peter Jackson, CLV Flood Control | No. 3 - Comment Letter  | Drainage Memorandum | The Final Design Report needs to include an expanded discussion on the utility conflicts along the RCB alignment and the impacts on the project construction. Plans must reflect the existing sewer system, including the residential lateral facility connections. The sewer laterals need to be shown on the plans to verify that the sewer laterals are able to be connected into either a new sewer main or another existing sewer. Provide alignment recommendations that minimize utility relocations where practical, as the utility concerns to the constructability of this project appear to be a significant cost to this project. Update the Utility matrix information to include the new City address. | All comments will be incorporated within the final design report.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 4   | 30% Submittal | Peter Jackson, CLV Flood Control | No. 4 - Comment Letter  | Drainage Memorandum | The Design Report needs an Exhibit that shows the recommended storm drain system and labels the key concentration points with associated flows. The summary should include collected storm drain flows and the remaining street surface flows within Rainbow Boulevard.                                                                                                                                                                                                                                                                                                                                                                                                                                              | A storm drain exhibit will be incorporated in the 70% submittal and a copy will be incorporated in the final design report.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 5   | 30% Submittal | Peter Jackson, CLV Flood Control | No. 5 - Comment Letter  | Drainage Memorandum | Show the RCB angle points by station location and angle change. This information is needed to allow for the use of precast RCB's as well as cast in place construction.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | RCB angle points and angle changes have been incorporated in the improvement plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 6   | 30% Submittal | Peter Jackson, CLV Flood Control | No. 6 - Comment Letter  | Drainage Memorandum | Provide details for the RCB construction. System design needs to accommodate the construction option of pre-cast or cast-in-place improvements. Verify that the Specifications and schedule accommodate the construction methods.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Details for the RCB construction will be included in the 70% submittal, further structural design will be developed in the 90% and 100% submittals.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 7   | 30% Submittal | Peter Jackson, CLV Flood Control | No. 7 - Comment Letter  | Drainage Memorandum | Provide a grated access structure within the existing Rio Vista Estates Drainage Easement for system access and maintenance. Refer to concept information shown on Sheet SD-02.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | A grated access structure will not be incorporated into the 70% plans, a headwall is proposed at this location instead. Please refer to report for discussion.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 8   | 30% Submittal | Peter Jackson, CLV Flood Control | No. 8 - Comment Letter  | Drainage Memorandum | The storm drain system must be refined to provide for a transition structure for collecting the flows from the Rio Vista Estates development per the Manual requirements.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | The storm drain system will be further refined for collecting the flows per the Manual requirements.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 9   | 30% Submittal | Peter Jackson, CLV Flood Control | No. 9 - Comment Letter  | Drainage Memorandum | Provide a detailed grading plan for the storm drain collection system at the Rio Vista Estates development. Provide details and sections of the proposed collection system.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Details and sections for the storm drain collection system at Rio Vista Estates will be provided.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 10  | 30% Submittal | Peter Jackson, CLV Flood Control | No. 10 - Comment Letter | Drainage Memorandum | Provide Access Manholes along the RCB at 400-foot spacing. Adjust spacing to include Manholes near the Junction structures for maintenance consideration. Consider using Manhole openings that are cast with the RCB's to reduce costs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Manhole spacing has been adjusted to accommodate the 400-ft spacing requirements.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 11  | 30% Submittal | Peter Jackson, CLV Flood Control | No. 11 - Comment Letter | Drainage Memorandum | The engineer must review the pipe hydraulics to verify system design to keep the HGL 18-inches below the finish grade.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | In utilizing the existing information while running the WSPG analysis for the storm drain, it should be noted that the starting HGL in Ann Road at the beginning of the 9' x 8' RCB is 8.071 feet above the invert. The box is began as pressurized in the existing condition. Because of the geometry and the depth restrictions of this site, the box is proposed in many places to be right at 1' below the existing surface. When modeling the system, the progressively bigger downstream box sizes were utilized until bigger box sizes did not produce a significant drop in the HGL. The boxes were upsized greatly to what was originally proposed in the 30% submittal. Starting at the downstream end, the boxes were upsized accordingly: 9'x5' to 12'x6', 9'x5' to 11'x5', 6'x4' to 9'x3' and 5'x4' to 5'x3'. The whole system is pressurized primarily because the downstream section is not able to flow like an open channel. Under the current conditions for the 70% submittal, it is not possible to obtain an HGL which is 1.5' below finish grade. |
| 12  | 30% Submittal | Peter Jackson, CLV Flood Control | No. 12 - Comment Letter | Drainage Memorandum | Provide Plan and Profiles of the entire storm drain facility including laterals with the next submittal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | All profiles are provided on the 70% submittal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 13  | 30% Submittal | Peter Jackson, CLV Flood Control | No. 13 - Comment Letter | Drainage Memorandum | Provide updated storm drain design plans with the next submittal that include the design data and the complete construction notes. Include the inlet type, lengths, depth, number of grates, etc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | All inlet data will be included in the next submittal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 14  | 30% Submittal | Peter Jackson, CLV Flood Control | No. 14 - Comment Letter | Drainage Memorandum | Provide detail sheets showing the drop inlet details for the proposed trench drain inlet, NDOT Type 2B and 412A inlets. Other inlet designs will be reviewed on a case by case basis.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Detail sheets will be provided on the next submittal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 15  | 30% Submittal | Peter Jackson, CLV Flood Control | No. 15 - Comment Letter | Drainage Memorandum | The Engineer should acquire and verify utility pothole information as soon as practical to determine additional constraints on the storm drain system design based upon the proposed design information. Consideration on utility relocations and impacts must be identified.                                                                                                                                                                                                                                                                                                                                                                                                                                        | Pothole information has been acquired and verified. All utility relocations and impacts will be identified on the 70% drawing and further refined in the 90% and 100% drawings. Pothole data is included in the design report as Figure A-7.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 16  | 30% Submittal | Peter Jackson, CLV Flood Control | No. 16 - Comment Letter | Drainage Memorandum | Provide inlet calculations based upon system design with the next submittal. Review the grate type on the FlowMaster calculations to show vaned grates instead of the P-50 mm grates for the CM-DM / 412A inlets.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Inlet calculations are provided with the next submittal. The use of vaned grates will be incorporated for the CM-DM / 412 inlets.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 17  | 30% Submittal | Peter Jackson, CLV Flood Control | No. 17 - Comment Letter | Drainage Memorandum | Provide details for the RCB structure connection to the existing box near the Ann Road and Rainbow Boulevard Intersection.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | The plan and profile view of the structure has been provided with the 70% plans, further refinement of the structural details and concrete sizes will be provided with the 90% submittal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 18  | 30% Submittal | Peter Jackson, CLV Flood Control | No. 18 - Comment Letter | Drainage Memorandum | Provide the lateral and inlet design information with the next submittal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Lateral and inlet design will be provided on next submittal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

City of Las Vegas Department of Public Works  
ANN ROAD CHANNEL WEST RAINBOW BOULEVARD - HANSEN NO. 36801

Comment Matrix for  
30%, 70% and 90% Submittals

| No. | Design Phase  | Reviewer Source                  | Sheet / Location        | Subject             | Comment                                                                                                                                                                                                                                                                       | JACOBS Action/Response                                                                                                                                                                                            |
|-----|---------------|----------------------------------|-------------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 19  | 30% Submittal | Peter Jackson, CLV Flood Control | No. 19 - Comment Letter | Drainage Memorandum | The existing and proposed utility crossings of the storm drain must be shown on the storm drain plan and profiles sheets and on the lateral profiles.                                                                                                                         | The existing utility crossings are shown on the 70% design plans. The proposed utility crossing will be refined with input from various utilities.                                                                |
| 20  | 30% Submittal | Peter Jackson, CLV Flood Control | No. 20 - Comment Letter | Drainage Memorandum | Provide detail sheets showing typical details needed for the construction, connection and any special transition structure details. Structural details, if required, must be submitted by the 90% submittal.                                                                  | Details will be provided for the transition section on the 70% submittal with structural details to be provided on the 90% submittal.                                                                             |
| 21  | 30% Submittal | Peter Jackson, CLV Flood Control | No. 21 - Comment Letter | Drainage Memorandum | Provide a concrete collar detail for the NDOT Type 2B Inlets.                                                                                                                                                                                                                 | A concrete collar detail for NDOT 2B Inlets has been provided.                                                                                                                                                    |
| 22  | 30% Submittal | Peter Jackson, CLV Flood Control | No. 22 - Comment Letter | Drainage Memorandum | Provide grading design information to collect the flows at the NDOT Type 2B area inlets.                                                                                                                                                                                      | Detailed grading design information will be provided in the next submittal.                                                                                                                                       |
| 23  | 30% Submittal | Peter Jackson, CLV Flood Control | No. 23 - Comment Letter | Drainage Memorandum | Provide preliminary plan and profiles for relocated sewer and/or water lines as necessary with the next submittal.                                                                                                                                                            | Preliminary plan and profile details will be provided with next submittal.                                                                                                                                        |
| 24  | 30% Submittal | Peter Jackson, CLV Flood Control | No. 24 - Comment Letter | Drainage Memorandum | A review of the Design Report shows minor comment revisions to the text to help refine how the information is presented. See attached comments for incorporation.                                                                                                             | Attached comments are addressed and will be provided within the Final Design Report.                                                                                                                              |
| 25  | 30% Submittal | Peter Jackson, CLV Flood Control | No. 25 - Comment Letter | Drainage Memorandum | Provide an updated detailed cost estimate with the next submittal for review. The cost estimate must be refined prior to the 90% submittal and request for construction funding to assure that the requested and allocated storm drain funds are sufficient for construction. | An updated detailed cost estimate has been provided with the next submittal.                                                                                                                                      |
| 26  | 30% Submittal | Peter Jackson, CLV Flood Control | No. 26 - Comment Letter | Drainage Memorandum | The Final Design report needs to include an electronic copy of the entire report with the input and output files for the hydraulics and hydrology.                                                                                                                            | The Final Design report will incorporate all input and output files for hydraulics and hydrology.                                                                                                                 |
| 27  | 30% Submittal | Peter Jackson, CLV Flood Control | No. 27 - Comment Letter | Drainage Memorandum | Update the Permit matrix information to include the CCRFCD, the new City address and remove NDOT.                                                                                                                                                                             | The permit matrix information is updated to include the CCRFCD, the new City address and removal of NDOT.                                                                                                         |
| 28  | 30% Submittal | Peter Jackson, CLV Flood Control | No. 28 - Comment Letter | Drainage Memorandum | Discuss and show any Traffic Signal Impacts to the existing Traffic Signal at the Ann Road and Rainbow Boulevard Intersection.                                                                                                                                                | Traffic signal impacts will be discussed for the Ann Road and Rainbow Boulevard Intersection.                                                                                                                     |
| 29  | 30% Submittal | Peter Jackson, CLV Flood Control | No. 29 - Comment Letter | Drainage Memorandum | Discuss and show any Traffic Signal underground impacts to the existing Tropical Parkway and Rainbow Boulevard Intersection.                                                                                                                                                  | Underground traffic signal impacts are shown and construction notes have been added to the plans which address these concerns.                                                                                    |
| 30  | 30% Submittal | Peter Jackson, CLV Flood Control | No. 30 - Comment Letter | Drainage Memorandum | Add a note for all storm drain drop inlets that references the newly adopted USDOCA Drawing No. 421 (Stormwater Quality Management Stamp and Sign Detail).                                                                                                                    | A construction note has been added to the plans which references Drawing No. 421.                                                                                                                                 |
| 31  | 30% Submittal | Peter Jackson, CLV Flood Control | No. 31 - Comment Letter | Drainage Memorandum | Additional comments are shown on the attached 30% storm drain plans.                                                                                                                                                                                                          | Additional comments are addressed. Plans comments listed here from Peter are those not incorporated into the Drainage Memorandum Comments 1 through 31.                                                           |
| 32  | 30% Submittal | Peter Jackson, CLV Flood Control | HC-01                   | Improvement Plans   | ±STA 147+75 - Move manhole in new section of pipe.                                                                                                                                                                                                                            | The manhole shown here is part of the existing system to be protected in place.                                                                                                                                   |
| 33  | 30% Submittal | Peter Jackson, CLV Flood Control | HC-02                   | Improvement Plans   | ±STA 148+00 - Locate Inlet outside of pavement.                                                                                                                                                                                                                               | This is addressed on plans.                                                                                                                                                                                       |
| 34  | 30% Submittal | Peter Jackson, CLV Flood Control | Typ. All Sheets         | Improvement Plans   | Show right-of-way.                                                                                                                                                                                                                                                            | This is addressed on plans.                                                                                                                                                                                       |
| 35  | 30% Submittal | Peter Jackson, CLV Flood Control | SD/HC-03                | Improvement Plans   | ±STA 164+55 - Recommend moving Inlet to north side of Ambiance St. if possible.                                                                                                                                                                                               | This was considered; however, there are too many conflicts with underground electrical and underground cable. We avoid all conflict with inlet in current location.                                               |
| 36  | 30% Submittal | Peter Jackson, CLV Flood Control | RM-01                   | Improvement Plans   | ±STA 147+75 - Check clearance on SSMH.                                                                                                                                                                                                                                        | This is addressed on plans.                                                                                                                                                                                       |
| 37  | 30% Submittal | Peter Jackson, CLV Flood Control | SD Sheets (Typ.)        | Improvement Plans   | Verify grading to see if DI's are needed every 150'                                                                                                                                                                                                                           | This is addressed on plans.                                                                                                                                                                                       |
| 38  | 30% Submittal | Peter Jackson, CLV Flood Control | SD-02                   | Improvement Plans   | Provide detailed grading plan for easement area.                                                                                                                                                                                                                              | Detail grading plans will be provided with the next submittal.                                                                                                                                                    |
| 39  | 30% Submittal | Peter Jackson, CLV Flood Control | SD TYP. All Sheets      | Improvement Plans   | Provide lengths of curb openings on all storm drain call-outs.                                                                                                                                                                                                                | Actual lengths will vary based on final grate selected by contractor. Will show approximate whole lengths on plans.                                                                                               |
| 40  | 30% Submittal | Peter Jackson, CLV Flood Control | SD-04                   | Improvement Plans   | ±STA 21+87 - If possible connect under drain into back of Inlet.                                                                                                                                                                                                              | This is addressed on plans.                                                                                                                                                                                       |
| 41  | 30% Submittal | Todd L. Myers, RFCD              | Comment 1               | General             | The PDR and supporting documentation was well organized, well written and provides an excellent basis as project moves to final design.                                                                                                                                       | Comment noted, thank you.                                                                                                                                                                                         |
| 42  | 30% Submittal | Todd L. Myers, RFCD              | Comment 2               | General             | A facility-specific environmental analysis in accordance with Chapter 8 of District's <i>Supplemental Programmatic Environmental Impact Statement, Clark County Regional Flood Control District, 2002 Master Plan Update, September 2004</i> was accepted by District         | A copy of this approval by Tim Sutko will be provided in the final PDR.                                                                                                                                           |
| 43  | 30% Submittal | Todd L. Myers, RFCD              | Comment 3               | General             | Identify all right-of-way (ROW) and easement acquisition requirements for this project. All ROW/easements must be acquired prior to City's request for construction funding.                                                                                                  | Currently, there are three possible locations where an AEP for construction will likely be required, these are on parcels: 125-26-304-005, 006 & 007 locate north of El Campo Grande Avenue on Rainbow Boulevard. |
| 44  | 30% Submittal | Todd L. Myers, RFCD              | Comment 4               | General             | Provide draft copy of Special Provisions with all remaining submittals.                                                                                                                                                                                                       | A draft copy of the Special Provisions will be provided.                                                                                                                                                          |
| 45  | 30% Submittal | Todd L. Myers, RFCD              | Comment 5               | Report              | The report refers to El Campo Grande as El Cortez at a few locations. Revise accordingly.                                                                                                                                                                                     | All references to El Cortez have been changed to El Campo Grande.                                                                                                                                                 |
| 46  | 30% Submittal | Todd L. Myers, RFCD              | Comment 6               | Report              | Update status of ROW with each phase of project submittals.                                                                                                                                                                                                                   | The ROW status will be updated with each submittal.                                                                                                                                                               |
| 47  | 30% Submittal | Todd L. Myers, RFCD              | Comment 7a              | Report              | Item 402.00: According to geotechnical report, the existing AC is 5-inch maximum. Revise to match existing.                                                                                                                                                                   | Item 402.00 has been revised to reflect 5-inch AC replacement.                                                                                                                                                    |
| 48  | 30% Submittal | Todd L. Myers, RFCD              | Comment 7b              | Report              | Reduce contingency to 10% in next submittal                                                                                                                                                                                                                                   | Contingency has been adjusted accordingly.                                                                                                                                                                        |
| 49  | 30% Submittal | Todd L. Myers, RFCD              | Comment 7c              | Report              | Are Items 202.00 (2-inch and 4-inch gas relocations) covered under City's Franchise agreement? If so, remove from cost estimate.                                                                                                                                              | In progress, SWG is currently under investigation of this issue.                                                                                                                                                  |
| 50  | 30% Submittal | Todd L. Myers, RFCD              | Comment 8               | Hydrology           | District takes no exceptions to hydrologic analysis presented in PDR.                                                                                                                                                                                                         | Noted, hydrologic analysis will not be revised.                                                                                                                                                                   |
| 51  | 30% Submittal | Todd L. Myers, RFCD              | Comment 9               | Hydrology           | Provide an exhibit to indicate computed 100-year event flow rate capture requirements at proposed drop Inlet (DI) locations.                                                                                                                                                  | A drop Inlet exhibit has been provided, reference Figure D-4, <i>Storm Drain Exhibit</i> .                                                                                                                        |
| 52  | 30% Submittal | Todd L. Myers, RFCD              | Comment 10              | Hydraulics          | Provide WSPG analysis of mainline facility with 70% submittal.                                                                                                                                                                                                                | The WSPG analysis will be provided with the 70% submittal.                                                                                                                                                        |
| 53  | 30% Submittal | Todd L. Myers, RFCD              | Comment 11              | Hydraulics          | Provide detailed DI and lateral calculations with 70% submittal.                                                                                                                                                                                                              | The detailed DI and lateral locations will be provided with the 70% submittal.                                                                                                                                    |
| 54  | 30% Submittal | Todd L. Myers, RFCD              | Comment 12              | Plans               | Provide complete (preliminary) plan set that includes plan & profile, construction details, roadway removal and replacement, and utility sheets with 70% submittal.                                                                                                           | Preliminary plan and profile details will be provided with next submittal.                                                                                                                                        |
| 55  | 30% Submittal | Todd L. Myers, RFCD              | Comment 13              | Plans               | District prefers that contract documents for a long reach of RCB be structured to allow the contractor the option of using precast RCB or cast-in-place when practical. The market can then decide the lower price and the contractor can bid accordingly.                    | The opportunity to utilize pre-cast storm drain will be used where practical.                                                                                                                                     |

City of Las Vegas Department of Public Works  
ANN ROAD CHANNEL WEST RAINBOW BOULEVARD - HANSEN NO. 36801

Comment Matrix for  
30%, 70% and 90% Submittals

| No. | Design Phase  | Reviewer Source         | Sheet Location | Subject            | Comment                                                                                                                                                                                                                                                                                 | Jacobs Action/Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----|---------------|-------------------------|----------------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 56  | 30% Submittal | Todd L. Myers, RFCD     | Comment 14     | Plans              | Provide pothole information for 36" waterline and sanitary sewer (SS) laterals crossing mainline facility with 70% submittal. Once final DI locations are determined on east side of Rainbow Blvd, provide pothole information for 36" waterline at storm drain (SD) lateral crossings. | All pothole information is provided in the PDR under Appendix A.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 57  | 30% Submittal | Todd L. Myers, RFCD     | Comment 15     | Plans              | Provide pipe materials for all utilities.                                                                                                                                                                                                                                               | Pipe materials for utilities are provided.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 58  | 30% Submittal | Todd L. Myers, RFCD     | Comment 16     | Plans              | Evaluate DI locations on east side of Rainbow Blvd. District supports capturing nuisance flow. However, the numbers of area drains shown on SD sheets are excessive. If topography allows, consider providing fewer DI's and grading to drain.                                          | The nuisance inlet on the north side of El Campo Grande Avenue has been removed and we will replace with grading in that area. The nuisance drain directly south of El Campo Grande Avenue has also been removed. Upon further investigation, it has been determined that the remainder of inlets on the east side of Rainbow have been left on the plans because the low points are surrounded by residential driveways and to grade to drain in these areas would require removal of the existing driveways and replacing with new driveways and culverts. |
| 59  | 30% Submittal | Todd L. Myers, RFCD     | Comment 17     | Plans              | Evaluate pavement replacement limits. City will require replacement to lane line along Rainbow Blvd. Full width replacement will likely be required for inlet trees on Rainbow north of Tropical Pkwy, and on Tropical Pkwy west of Rainbow. Revise accordingly.                        | This has been evaluated and addressed on the removal sheets.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 60  | 30% Submittal | Randy McConnell, CLV PM | G-01           | General            | Add "Acting" to City Engineer title and check Acting Engineer Registration Number                                                                                                                                                                                                       | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 61  | 30% Submittal | Randy McConnell, CLV PM | G-01           | General            | Revise title block to show "Acting City Engineer: David Bowers, P.E."                                                                                                                                                                                                                   | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 62  | 30% Submittal | Randy McConnell, CLV PM | G-01           | General            | Add LVVWD Project Number to signature block                                                                                                                                                                                                                                             | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 63  | 30% Submittal | Randy McConnell, CLV PM | G-01           | General            | Replace Randy McConnell with Mark Sorensen, P.E. as Program Manager in Title Block. All Sheets Typical                                                                                                                                                                                  | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 64  | 30% Submittal | Randy McConnell, CLV PM | G-01           | General            | Add CLV Drawing Number 731-88 to all sheets.                                                                                                                                                                                                                                            | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 65  | 30% Submittal | Randy McConnell, CLV PM | G-02           | General            | Sheet index needs to match sheet description.                                                                                                                                                                                                                                           | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 66  | 30% Submittal | Randy McConnell, CLV PM | HC-01          | Horizontal Control | Label right-of-way width on Rainbow Boulevard south of Ann Road.                                                                                                                                                                                                                        | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 67  | 30% Submittal | Randy McConnell, CLV PM | HC-01          | Horizontal Control | Label right-of-way width on Ann Road.                                                                                                                                                                                                                                                   | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 68  | 30% Submittal | Randy McConnell, CLV PM | HC-01          | Horizontal Control | Label centerline intersection point of Ann and Rainbow.                                                                                                                                                                                                                                 | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 69  | 30% Submittal | Randy McConnell, CLV PM | HC-01          | Horizontal Control | Label bearing and distance for the Ann Road centerline on both sides of the intersection.                                                                                                                                                                                               | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 70  | 30% Submittal | Randy McConnell, CLV PM | HC-01          | Horizontal Control | Label right-of-way width on Rainbow Boulevard north of Ann Road.                                                                                                                                                                                                                        | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 71  | 30% Submittal | Randy McConnell, CLV PM | HC-01          | Horizontal Control | Clarify the meaning of "R" when labeling alignment. All sheets typical.                                                                                                                                                                                                                 | This has been addressed, refer to sheet G-02 Location Map, "R" is for the Rainbow Blvd. alignment and "T" is for the Tropical Pkwy. alignment.                                                                                                                                                                                                                                                                                                                                                                                                               |
| 72  | 30% Submittal | Randy McConnell, CLV PM | HC-01          | Horizontal Control | Can you fit more view ports on this sheet (e.g. 154+00 to 163+00)                                                                                                                                                                                                                       | Table for HC will be provided at the bottom of the sheet.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 73  | 30% Submittal | Randy McConnell, CLV PM | HC-02          | Horizontal Control | Label right-of-way width on Rainbow Boulevard.                                                                                                                                                                                                                                          | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 74  | 30% Submittal | Randy McConnell, CLV PM | HC-02          | Horizontal Control | Label right-of-way width for El Campo Grande Avenue.                                                                                                                                                                                                                                    | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 75  | 30% Submittal | Randy McConnell, CLV PM | HC-02          | Horizontal Control | Add centerline to El Campo Grande.                                                                                                                                                                                                                                                      | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 76  | 30% Submittal | Randy McConnell, CLV PM | HC-02          | Horizontal Control | Add "Ave." to El Campo Grande Label                                                                                                                                                                                                                                                     | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 77  | 30% Submittal | Randy McConnell, CLV PM | HC-02          | Horizontal Control | Add bearing and distance to El Campo Grande centerline.                                                                                                                                                                                                                                 | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 78  | 30% Submittal | Randy McConnell, CLV PM | HC-02          | Horizontal Control | Label centerline intersection point of El Campo Grande and Rainbow.                                                                                                                                                                                                                     | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 79  | 30% Submittal | Randy McConnell, CLV PM | HC-02          | Horizontal Control | Can you fit more view ports on this sheet (e.g. 163+00 to 169+00)                                                                                                                                                                                                                       | Table for HC will be provided at the bottom of the sheet.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 80  | 30% Submittal | Randy McConnell, CLV PM | HC-03          | Horizontal Control | Label right-of-way width on Rainbow Boulevard.                                                                                                                                                                                                                                          | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 81  | 30% Submittal | Randy McConnell, CLV PM | HC-03          | Horizontal Control | Label right-of-way width for Ambiance Lane.                                                                                                                                                                                                                                             | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 82  | 30% Submittal | Randy McConnell, CLV PM | HC-03          | Horizontal Control | Add centerline to Ambiance Lane.                                                                                                                                                                                                                                                        | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 83  | 30% Submittal | Randy McConnell, CLV PM | HC-03          | Horizontal Control | Add bearing and distance to Ambiance Lane centerline.                                                                                                                                                                                                                                   | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 84  | 30% Submittal | Randy McConnell, CLV PM | HC-03          | Horizontal Control | Label centerline intersection point of Ambiance and Rainbow.                                                                                                                                                                                                                            | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 85  | 30% Submittal | Randy McConnell, CLV PM | HC-04          | Horizontal Control | Label right-of-way width on Tropical Parkway west of Rainbow Boulevard                                                                                                                                                                                                                  | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 86  | 30% Submittal | Randy McConnell, CLV PM | HC-04          | Horizontal Control | Label right-of-way width on Tropical Parkway east of rainbow Boulevard.                                                                                                                                                                                                                 | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 87  | 30% Submittal | Randy McConnell, CLV PM | HC-04          | Horizontal Control | Label right-of-way width on Rainbow Boulevard.                                                                                                                                                                                                                                          | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 88  | 30% Submittal | Randy McConnell, CLV PM | RM-01          | Removal            | Any way to add view port to this sheet? (e.g. 159+00 to 163+00)                                                                                                                                                                                                                         | This is addressed on plans, two sheets were left with blank spaces for details in the future.                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 89  | 30% Submittal | Randy McConnell, CLV PM | RM-01          | Removal            | Label centerline intersection point of Ann and Rainbow.                                                                                                                                                                                                                                 | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 90  | 30% Submittal | Randy McConnell, CLV PM | RM-01          | Removal            | Show/Label the limits of Island being removed.                                                                                                                                                                                                                                          | This is addressed, it is assumed that the full island will be removed and replaced.                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 91  | 30% Submittal | Randy McConnell, CLV PM | RM-01          | Removal            | Pavement markings designated for removal at Station 148+50± need to be replaced.                                                                                                                                                                                                        | This is revised and addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 92  | 30% Submittal | Randy McConnell, CLV PM | RM-01          | Removal            | Station limits of removal (all).                                                                                                                                                                                                                                                        | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 93  | 30% Submittal | Randy McConnell, CLV PM | RM-01          | Removal            | Station 150+00± - Any reason removing pavement to DI?                                                                                                                                                                                                                                   | This is revised and addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 94  | 30% Submittal | Randy McConnell, CLV PM | RM-01          | Removal            | Electrical easement - Where are poles? Near trenching require special provisions be made.                                                                                                                                                                                               | Power poles are shown in plans, NVE has provided comments regarding power poles.                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 95  | 30% Submittal | Randy McConnell, CLV PM | RM-01          | Removal            | Add removal note for "protect in place". All RM sheets typical.                                                                                                                                                                                                                         | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 96  | 30% Submittal | Randy McConnell, CLV PM | RM-01          | Removal            | Protect in place fire hydrant at Station 152+00±.                                                                                                                                                                                                                                       | Station 152+00 is a water valve which will be impacted with the construction of this storm drain.                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 97  | 30% Submittal | Randy McConnell, CLV PM | RM-01          | Removal            | Shade back or remove proposed improvement, cannot see 24" removal.                                                                                                                                                                                                                      | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 98  | 30% Submittal | Randy McConnell, CLV PM | RM-01          | Removal            | Add "AC Pavement" to the end of Removal Note #1. All RM sheets typical.                                                                                                                                                                                                                 | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 99  | 30% Submittal | Randy McConnell, CLV PM | RM-01          | Removal            | Add "Call Before You Dig" note. All RM sheets typical.                                                                                                                                                                                                                                  | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 100 | 30% Submittal | Randy McConnell, CLV PM | RM-01          | Removal            | Add "Call Before You Overhead" note. All RM sheets typical.                                                                                                                                                                                                                             | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 101 | 30% Submittal | Randy McConnell, CLV PM | RM-01          | Removal            | Provide LVVWD Signature Block.                                                                                                                                                                                                                                                          | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

APPENDIX H

City of Las Vegas Department of Public Works  
ANN ROAD CHANNEL WEST RAINBOW BOULEVARD - HANSEN NO. 36801

Comment Matrix for  
30%, 70% and 90% Submittals

| No. | Design Phase  | Reviewer/Source                        | Sheet Location | Subject            | Comment                                                                                                                                                                                               | Jacobs Action/Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----|---------------|----------------------------------------|----------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 102 | 30% Submittal | Randy McConnell, CLV PM                | RM-01          | Removal            | Clarify the meaning of "R" when labeling alignment. All sheets typical.                                                                                                                               | This has been addressed, refer to sheet G-02 Location Map, "R" is for the Rainbow Blvd. alignment and "T" is for the Tropical Pkwy. alignment.                                                                                                                                                                                                                                                                                                                                                                                                               |
| 103 | 30% Submittal | Randy McConnell, CLV PM                | RM-02          | Removal            | Label limits of AC removal.                                                                                                                                                                           | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 104 | 30% Submittal | Randy McConnell, CLV PM                | RM-02          | Removal            | Label centerline intersection of El Campo Grande and Rainbow Boulevard.                                                                                                                               | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 105 | 30% Submittal | Randy McConnell, CLV PM                | RM-02          | Removal            | Shade back or remove proposed improvement, cannot see removals.                                                                                                                                       | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 106 | 30% Submittal | Randy McConnell, CLV PM                | RM-02          | Removal            | Any way to add view port to this sheet?                                                                                                                                                               | This is addressed on plans, two sheets were left with blank spaces for details in the future.                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 107 | 30% Submittal | Randy McConnell, CLV PM                | RM-03          | Removal            | Any way to add view port to this sheet?                                                                                                                                                               | This is addressed on plans, two sheets were left with blank spaces for details in the future.                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 108 | 30% Submittal | Randy McConnell, CLV PM                | RM-03          | Removal            | Label centerline intersection of Rainbow Boulevard and Ambiance Lane.                                                                                                                                 | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 109 | 30% Submittal | Randy McConnell, CLV PM                | RM-03          | Removal            | Label limits of removal and station for AC.                                                                                                                                                           | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 110 | 30% Submittal | Randy McConnell, CLV PM                | RM-04          | Removal            | Station the limits of removal.                                                                                                                                                                        | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 111 | 30% Submittal | Randy McConnell, CLV PM                | RM-04          | Removal            | Label centerline intersection of Rainbow Boulevard and Tropical Parkway.                                                                                                                              | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 112 | 30% Submittal | Randy McConnell, CLV PM                | SD-01          | Storm Drain        | Show centerline for Ann Road.                                                                                                                                                                         | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 113 | 30% Submittal | Randy McConnell, CLV PM                | SD-01          | Storm Drain        | Label centerline intersection of Ann Road and Rainbow Boulevard.                                                                                                                                      | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 114 | 30% Submittal | Randy McConnell, CLV PM                | SD-01          | Storm Drain        | Add construction note for reconstruct median island and show on plans.                                                                                                                                | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 115 | 30% Submittal | Randy McConnell, CLV PM                | SD-01          | Storm Drain        | Profile?                                                                                                                                                                                              | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 116 | 30% Submittal | Randy McConnell, CLV PM                | SD-01          | Storm Drain        | Fill in correct detail sheet numbers for Storm Drain Detail Sheets in Construction Notes. All sheets typical.                                                                                         | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 117 | 30% Submittal | Randy McConnell, CLV PM                | SD-01          | Storm Drain        | Add construction note for replace striping.                                                                                                                                                           | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 118 | 30% Submittal | Randy McConnell, CLV PM                | SD-01          | Storm Drain        | Clarify the meaning of "R" when labeling alignment. All sheets typical.                                                                                                                               | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 119 | 30% Submittal | Randy McConnell, CLV PM                | SD-01          | Storm Drain        | Add "Call Before You Dig" note. All RM sheets typical.                                                                                                                                                | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 120 | 30% Submittal | Randy McConnell, CLV PM                | SD-01          | Storm Drain        | Add "Call Before You Overhead" note. All RM sheets typical.                                                                                                                                           | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 121 | 30% Submittal | Randy McConnell, CLV PM                | SD-02          | Storm Drain        | Profile.                                                                                                                                                                                              | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 122 | 30% Submittal | Randy McConnell, CLV PM                | SD-02          | Storm Drain        | Show El Campo Grande centerline.                                                                                                                                                                      | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 123 | 30% Submittal | Randy McConnell, CLV PM                | SD-02          | Storm Drain        | Label centerline intersection of El Campo Grande and Rainbow Boulevard.                                                                                                                               | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 124 | 30% Submittal | Randy McConnell, CLV PM                | SD-03          | Storm Drain        | Show centerline for Ambiance Lane.                                                                                                                                                                    | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 125 | 30% Submittal | Randy McConnell, CLV PM                | SD-03          | Storm Drain        | Profile.                                                                                                                                                                                              | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 126 | 30% Submittal | Randy McConnell, CLV PM                | SD-04          | Storm Drain        | Profile.                                                                                                                                                                                              | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 127 | 30% Submittal | Diane Phominh, CLV Traffic             | General        | Traffic            | Need to identify all pavement to be replaced in kind. (Tape and raised pavement markers).                                                                                                             | This is addressed on plans. A striping plan will be provided with the next submittal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 128 | 30% Submittal | Diane Phominh, CLV Traffic             | General        | Traffic            | All sawcut lines for patches shall be parallel or perpendicular to a travel lane, and on a lane line OR if within 4' of curb and gutter, extend removal to curb and gutter.                           | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 129 | 30% Submittal | Diane Phominh, CLV Traffic             | General        | Traffic            | Show all street lighting and traffic signal conduit, must be protected in place. See attached plans.                                                                                                  | Traffic conduits and traffic plans will be provided with the 90% submittal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 130 | 30% Submittal | Diane Phominh, CLV Traffic             | General        | Traffic            | Work is also in Clark County Jurisdiction.                                                                                                                                                            | Note, a Clark County encroachment permit will be needed for this project.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 131 | 30% Submittal | Diane Phominh, CLV Traffic             | General        | Traffic            | Look at safe route to school.                                                                                                                                                                         | This has been addressed in the specifications.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 132 | 30% Submittal | Sanitary Sewer Planning                | G-03           | General Notes      | Use the revised CLV general notes.                                                                                                                                                                    | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 133 | 30% Submittal | Sanitary Sewer Planning                | Plans          | Sewer              | Show all sanitary sewer manholes as "protect in place" on RM plans.                                                                                                                                   | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 134 | 30% Submittal | Sanitary Sewer Planning                | SD-01          | Sewer              | Provide a minimum 6 feet of clearance between the outside wall of existing sanitary sewer manhole and outside wall of proposed 18" RCP for Type 2B area drain located in Rainbow at station 147+90.16 | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 135 | 30% Submittal | Sanitary Sewer Planning                | SD-02          | Sewer              | Raise existing sewer manhole located in drainage channel to final grade and provide a sanitary sewer manhole sealed locking lid.                                                                      | Sewer rim to be lowered to new grade. A note will be added to provide sealed locking lid.                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 136 | 30% Submittal | Jim Von Tobel, CLV Survey              | HC-1 - HC-4    | Horizontal Control | Benchmark on plans has the wrong elevation. Should be 2326.07, not 2226.31. Did the topo for the plans use this elevation?                                                                            | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 137 | 30% Submittal | Jim Von Tobel, CLV Survey              | All Sheets     | Horizontal Control | Not necessary to list distances to 3 decimal places, nor bearings to tenths of seconds.                                                                                                               | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 138 | 30% Submittal | Layne Weber, Clark County Public Works | SD-01          | General            | Show entity boundaries. (All sheets typical).                                                                                                                                                         | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 139 | 30% Submittal | Layne Weber, Clark County Public Works | SD-01          | General            | Show existing A/C grades. (All SD sheets typical).                                                                                                                                                    | Grading plans will be provided in the next submittal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 140 | 30% Submittal | Layne Weber, Clark County Public Works | SD-01          | General            | Provide hydrology. (All SD sheets typical).                                                                                                                                                           | Q100 and hydraulic grade line will be provided on plan and profile sheets                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 141 | 30% Submittal | Layne Weber, Clark County Public Works | SD-01          | General            | Provide hydraulics - after 30% (All SD sheets typical).                                                                                                                                               | All hydraulics will be provided after 30%.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 142 | 30% Submittal | Layne Weber, Clark County Public Works | SD-01          | General            | Offsite permit will be required.                                                                                                                                                                      | Noted an offsite permit will be obtain for this project.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 143 | 30% Submittal | Layne Weber, Clark County Public Works | SD-01          | General            | Show right-of-way. Make sure proposed inlets are in right-of-way and not in the driveway of the homes.                                                                                                | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 144 | 30% Submittal | Layne Weber, Clark County Public Works | SD-01          | Storm Drain        | Laterals on east side of Rainbow Boulevard - Maybe you could put these in a sump and use half as many inlets and a larger lateral.                                                                    | The nuisance inlet on the north side of El Campo Grande Avenue has been removed and we will replace with grading in that area. The nuisance drain directly south of El Campo Grande Avenue has also been removed. Upon further investigation, it has been determined that the remainder of inlets on the east side of Rainbow have been left on the plans because the low points are surrounded by residential driveways and to grade to drain in these areas would require removal of the existing driveways and replacing with new driveways and culverts. |
| 145 | 30% Submittal | Layne Weber, Clark County Public Works | SD-01          | Storm Drain        | Call out existing facility.                                                                                                                                                                           | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |



City of Las Vegas Department of Public Works  
ANN ROAD CHANNEL WEST RAINBOW BOULEVARD - HANSEN NO. 36801

Comment Matrix for  
30%, 70% and 90% Submittals

| No. | Design Phase  | Reviewer Source                        | Sheet Location | Subject            | Comment                                                                                                                                                                                                                                               | Jacobs Action/Response                                                                                                                                               |
|-----|---------------|----------------------------------------|----------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 146 | 30% Submittal | Layne Weber, Clark County Public Works | SD-01          | Storm Drain        | 36" x 42", 1-ft high. Weir = 36 CFS.                                                                                                                                                                                                                  | Hydraulic calculations to be included in 70% submittal.                                                                                                              |
| 147 | 30% Submittal | Layne Weber, Clark County Public Works | SD-02          | Storm Drain        | El Campo Grande - Sort of a low spot here where you might want to move one of the proposed inlets to.                                                                                                                                                 | This inlet has been remove and the are north of El Campo Grande will be re-graded.                                                                                   |
| 148 | 30% Submittal | Layne Weber, Clark County Public Works | SD-02          | General            | Show El Campo Grande centerline.                                                                                                                                                                                                                      | This is addressed on plans.                                                                                                                                          |
| 149 | 30% Submittal | Layne Weber, Clark County Public Works | SD-02          | General            | Label the APN and show parcel lines for parcels that own to the centerline.                                                                                                                                                                           | This is addressed on plans.                                                                                                                                          |
| 150 | 30% Submittal | Layne Weber, Clark County Public Works | SD-04          | General            | Show right of way.                                                                                                                                                                                                                                    | This is addressed on plans.                                                                                                                                          |
| 151 | 30% Submittal | Layne Weber, Clark County Public Works | SD-04          | Storm Drain        | Drop inlet on Rainbow, north of Tropical Parkway - is this a low point?                                                                                                                                                                               | Yes, this inlet is at a low point.                                                                                                                                   |
| 152 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | Comment Letter | Utilities          | A copy of the water plan with the required revisions is attached. Please complete the revisions and return the check print of the water plan to the Engineering Services Division at the time of next submittal.                                      | The plans have been address and re-submitted accordingly.                                                                                                            |
| 153 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | Comment Letter | Utilities          | This property is located in the District's 2538 Pressure Zone and will have static water pressure in excess of 80 psi. The Uniform Plumbing Code requires individual pressure reducing valves be installed whenever static pressure exceeds 80 psi.   | It is not the intent with this project to provide any new water services. In any case where a PRV is impacted with construction, a new PRV will replace the old PRV. |
| 154 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | Comment Letter | Utilities          | The subject project provides for storm drain improvements only and does not imply any new water commitment.                                                                                                                                           | Correct, there are no new water commitments for this project.                                                                                                        |
| 155 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | G-01           | Utilities          | LVVWD project number is 116370.                                                                                                                                                                                                                       | This is addressed on plans.                                                                                                                                          |
| 156 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | G-01           | Utilities          | List all sheets under signature block that are to be signed by LVVWD. G-01, G-02, G-03, SD-01, SD-02, SD-03, SD-04.                                                                                                                                   | This is addressed on plans.                                                                                                                                          |
| 157 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | G-02           | Utilities          | Add LVVWD signature block to this sheet.                                                                                                                                                                                                              | This is addressed on plans.                                                                                                                                          |
| 158 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | G-03           | Utilities          | LVVWD Notes - Update, see below.                                                                                                                                                                                                                      | This is addressed on plans.                                                                                                                                          |
| 159 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-01          | Utilities          | Label existing 8" PVC water line at Station 152±25.                                                                                                                                                                                                   | This is addressed on plans.                                                                                                                                          |
| 160 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-01          | Utilities          | Label existing 6" PVC water line at Station 154±00.                                                                                                                                                                                                   | This is addressed on plans.                                                                                                                                          |
| 161 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-01          | Utilities          | Label existing 3/4" meter with 1" RPPA at Station 154±00.                                                                                                                                                                                             | This is addressed on plans.                                                                                                                                          |
| 162 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-01          | Utilities          | Label existing 1" copper water lateral at Station 154±00.                                                                                                                                                                                             | Not require to show small diameter pipe. We will note service lateral in the area to be restored.                                                                    |
| 163 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-01          | Utilities          | Label existing 8" DCDA at Station 154±00.                                                                                                                                                                                                             | This is addressed on plans.                                                                                                                                          |
| 164 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-01          | General            | Label C/L Intersection of Ann Road and Rainbow Boulevard.                                                                                                                                                                                             | This is addressed on plans.                                                                                                                                          |
| 165 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-01          | General            | Provide parcel numbers.                                                                                                                                                                                                                               | This is addressed on plans.                                                                                                                                          |
| 166 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-01          | Utilities          | Provide profile of proposed storm drain at all water line crossings.                                                                                                                                                                                  | This is addressed on plans.                                                                                                                                          |
| 167 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-01          | Utilities          | Label existing 36" water as MLCP CO-727.                                                                                                                                                                                                              | This is addressed on plans.                                                                                                                                          |
| 168 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-01          | Utilities          | Label existing 12" water as PVC XC-8534.                                                                                                                                                                                                              | This is addressed on plans.                                                                                                                                          |
| 169 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-01          | Utilities          | Station location of 8" lateral at station 154±00.                                                                                                                                                                                                     | This is addressed on plans.                                                                                                                                          |
| 170 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-01          | Utilities          | Add note: All Lots/Lots ____ This property may have static pressure in excess of 80 psi. The Uniform Plumbing Code requires that individual, on-site (private), pressure reducing valves be installed whenever the pressure exceeds 80 psi. PRV's are | This is addressed on plans.                                                                                                                                          |
| 171 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-01          | Horizontal Control | Provide benchmark data.                                                                                                                                                                                                                               | This is addressed on plans.                                                                                                                                          |
| 172 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-01          | General            | Add LVVWD signature block to this sheet.                                                                                                                                                                                                              | This is addressed on plans.                                                                                                                                          |
| 173 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-02          | General            | Add LVVWD signature block to this sheet.                                                                                                                                                                                                              | This is addressed on plans.                                                                                                                                          |
| 174 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-02          | General            | Provide profile of proposed storm drain at all water line crossings.                                                                                                                                                                                  | This is addressed on plans.                                                                                                                                          |
| 175 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-02          | General            | Provide parcel numbers.                                                                                                                                                                                                                               | This is addressed on plans.                                                                                                                                          |
| 176 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-02          | Utilities          | Label existing 36" water as MLCP CO-727.                                                                                                                                                                                                              | This is addressed on plans.                                                                                                                                          |
| 177 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-02          | Utilities          | Label existing 8" water as PVC CO-1007.                                                                                                                                                                                                               | This is addressed on plans.                                                                                                                                          |
| 178 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-02          | Utilities          | Label station of existing test station at Station 150±50.                                                                                                                                                                                             | Test station doesn't exist on sidewalk as shown on red line plans, test station in sidewalk at sta 150+00.                                                           |
| 179 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-03          | General            | Add LVVWD signature block to this sheet.                                                                                                                                                                                                              | This is addressed on plans.                                                                                                                                          |
| 180 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-03          | General            | Provide profile of proposed storm drain at all water line crossings.                                                                                                                                                                                  | This is addressed on plans.                                                                                                                                          |
| 181 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-03          | General            | Provide parcel numbers.                                                                                                                                                                                                                               | This is addressed on plans.                                                                                                                                          |
| 182 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-03          | Utilities          | Label existing 36" water as MLCP CO-727.                                                                                                                                                                                                              | This is addressed on plans.                                                                                                                                          |
| 183 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-03          | Utilities          | Label existing 8" water as PVC XC-6726.                                                                                                                                                                                                               | This is addressed on plans.                                                                                                                                          |
| 184 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-04          | Utilities          | Label existing 12" water as PVC CO-864.                                                                                                                                                                                                               | This is addressed on plans.                                                                                                                                          |
| 185 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-04          | Utilities          | Show existing 12" water as PVC XC-5109.                                                                                                                                                                                                               | This is addressed on plans.                                                                                                                                          |
| 186 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-04          | Utilities          | Label existing 36" water as MLCP CO-727.                                                                                                                                                                                                              | This is addressed on plans.                                                                                                                                          |
| 187 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-04          | Utilities          | Show Existing water line 10" PVC XC-5106.                                                                                                                                                                                                             | This is addressed on plans.                                                                                                                                          |
| 188 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-04          | Utilities          | Rainbow Boulevard Station 170+75 - ? Separation distance between DI and existing 12" water line.                                                                                                                                                      | Existing utilities provided on lateral profiles.                                                                                                                     |
| 189 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-04          | Utilities          | Tropical Parkway Station 23±25 - ? Separation distance between manhole and existing 12" water line.                                                                                                                                                   | Waterline will need to be located under box culvert, this manhole in an access manhole into the top of the box.                                                      |
| 190 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-04          | General            | Label centerline intersection of Rainbow Boulevards and Tropical Parkway.                                                                                                                                                                             | This is addressed on plans.                                                                                                                                          |
| 191 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-04          | Utilities          | Tropical Parkway Station 23±25 - show existing 10" water line and gate valve.                                                                                                                                                                         | This is addressed on plans.                                                                                                                                          |
| 192 | 30% Submittal | Jason Ghadery, P.E., LVVWD             | SD-04          | General            | Add LVVWD signature block to this sheet.                                                                                                                                                                                                              | This is addressed on plans.                                                                                                                                          |

City of Las Vegas Department of Public Works  
ANN ROAD CHANNEL WEST RAINBOW BOULEVARD - HANSEN NO. 36801

Comment Matrix for  
30%, 70% and 90% Submittals

| No. | Design Phase           | Reviewer/Source                                    | Sheet/Location         | Subject             | Comment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Jacobs Action/Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----|------------------------|----------------------------------------------------|------------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 193 | 30% Submittal          | Jason Ghadery, P.E., LVVWD                         | SD-04                  | General             | Provide profile of proposed storm drain at all water line crossings.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 194 | 30% Submittal          | Jason Ghadery, P.E., LVVWD                         | SD-04                  | General             | Provide parcel numbers.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 195 | 30% Submittal          | Dan Byrd, SW Gas                                   | Comment Letter         | Utilities           | The Civil Plans have been "red-lined" to indicate the approximate location of existing SWG Facilities. Please transfer the information to the updated Civil Plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 196 | 30% Submittal          | Dan Byrd, SW Gas                                   | Comment Letter         | Utilities           | These plans are not ready for signature. 100% Civil Plans must be submitted for review.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Noted. 100% submittal plans will be submitted for review.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 197 | 30% Submittal          | Dan Byrd, SW Gas                                   | Comment Letter         | Utilities           | When requesting signatures, bring the most recent Transmittal, Redlines, all SWG Maps & As-builts listed above, and a complete set of the 100% Civil Plans no later than August 30, 2011.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Noted, a complete set will be provided by August 30, 2011. According to the project schedule as of April 12, 2011, the final submittal date for these plans to the City of Las Vegas is July 14, 2011.                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 198 | 30% Submittal          | Dan Byrd, SW Gas                                   | Comment Letter         | Utilities           | Please label all pipelines per SWG Plan Signing Requirements Section 1.9.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 199 | 30% Submittal          | Dan Byrd, SW Gas                                   | Comment Letter         | Utilities           | Please pothole areas in green to determine depth of pipeline.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | All potholes information is provided as Figure A-7 of this report.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 200 | 30% Submittal          | Dan Byrd, SW Gas                                   | Comment Letter         | Utilities           | SWG is concerned about the constructability of storm drain running in close proximity parallel to our gas line.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | The design of the width of the proposed boxes is based upon the limiting depth restrictions for the storm drain at the capacity required. It may be necessary to move the parallel gas line in order to accommodate the proposed storm drain.                                                                                                                                                                                                                                                                                                                                                                                       |
| 201 | 30% Submittal          | Dan Byrd, SW Gas                                   | HC-01                  | Utilities           | Show 4" PE gas line and label per section 1.9 of SWG plan signing requirements.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 202 | 30% Submittal          | Dan Byrd, SW Gas                                   | HC-02                  | Utilities           | Show jog in gas line.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Per field markings the actual jog location is adjacent to parcels 125-27-716-016 and 125-27-716-017. This shown on HC-03.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 203 | 30% Submittal          | Dan Byrd, SW Gas                                   | HC-02                  | Utilities           | Show 4" PE gas line and label per section 1.9 of SWG plan signing requirements.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 204 | 30% Submittal          | Dan Byrd, SW Gas                                   | HC-02                  | Utilities           | Please clarify drainage easement area. Difficult to determine where pipe is.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Profiles and crossings for this area are further detail in the 70% plans. The gas line is this easement will be impacted.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 205 | 30% Submittal          | Dan Byrd, SW Gas                                   | HC-03                  | Utilities           | Show 4" PE gas line and label.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 206 | 30% Submittal          | Dan Byrd, SW Gas                                   | HC-04                  | Utilities           | Show gas line and label.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 207 | 30% Submittal          | Dan Byrd, SW Gas                                   | RM-02                  | Utilities           | Please pothole drainage easement to determine depth of gas line.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | The depth of the 2" gas has been potholed and determine to be 3' deep adjacent to the easement. The entire drainage easement is to be removed and replaced.                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 208 | 30% Submittal          | Dan Byrd, SW Gas                                   | RM-02                  | Utilities           | Removal and relocation of 2" gas line is to be determined.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Relocation of gas line will be determined as design progresses.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 209 | 30% Submittal          | Dan Byrd, SW Gas                                   | SD-01                  | Utilities           | Please determine depth of pipe and provide construction details to give adequate time for preparation in case of conflicts. Lateral locations: 147+00, 149+24, 150+02, 162+60.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Lateral profiles are provided with this submittal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 210 | 30% Submittal          | Dan Byrd, SW Gas                                   | SD-02                  | Utilities           | Please determine depth of pipe and provide construction details to give adequate time for preparation in case of conflicts. Lateral locations: 155+78, 156+09, 161+27; main line: 159+00.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Lateral profiles are provided with this submittal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 211 | 30% Submittal          | Dan Byrd, SW Gas                                   | SD_03                  | Utilities           | Please determine depth of pipe and provide construction details to give adequate time for preparation in case of conflicts. Lateral locations: 164+73, 168+58.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Lateral profiles are provided with this submittal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 212 | 30% Submittal          | Century Link                                       | HC-01                  | Utilities           | Show additional red-lined Century Link Facilities in Ann Road.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Provided with 30% plans                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 213 | 30% Submittal          | Century Link                                       | HC-01                  | Utilities           | Show additional red-lined Century Link Facilities in Rainbow Boulevard.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | This is addressed on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 214 | 30% Submittal          | Century Link                                       | HC-04                  | Utilities           | Show additional red-lined Century Link Facilities in Rainbow Boulevard.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Provided with 30% plans, crossings will be shown on profiles.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 215 | 30% Submittal          | Century Link                                       | HC-04                  | Utilities           | Show additional red-lined Century Link Facilities in Tropical Parkway.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Provided with 30% plans, crossings will be shown on profiles.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 216 | 30% Submittal          | Doney Villareal, COX                               | HC-02                  | Utilities           | Possible relocation, underground coaxial and F/O, possible relocation at easement in station 158+50 in easement.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Relocation noted, reference 70% plans for new storm drain layout.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 217 | 30% Submittal          | Doney Villareal, COX                               | HC-04                  | Utilities           | Underground conflict on Tropical Parkway at inlets at station 22+00 and 22+50 on south side of street.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Relocation noted, reference 70% plans for new storm drain layout.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 218 | 30% Submittal          | NVE Transmission                                   | General                | Utilities           | Also there are two locations (x3788) north of Ann road and (x3786) north of El Campo Grande where the drains are closer than the required 20' and the structure may require bracing or shoring.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | The structure located north of El Campo Grande has been removed from the plans. The structure (x3788) will be reviewed for location conflicts in subsequent submittals.                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 219 | 30% Submittal          | NVE Transmission                                   | General                | Utilities           | Also need for them to send detail sheet SD-X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | We will be submitting 70% drawings on April 14th to the City of Las Vegas. At that time all details and profiles will be available.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 220 | 70% Submittal          | Randy McConnell, CLV PM                            | Plans Submittal        | Reference Redlines  | See redlined plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Comments are addressed as noted.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 221 | 70% Submittal          | John O'Connell, CLV Public Works Construction Mgt. | Plans Submittal        | Reference Redlines  | See redlined plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Comments are addressed as noted.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 222 | 70% Submittal          | Diane Phommih, CLV Traffic                         | Plans Submittal        | Reference Redlines  | See redlined plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Comments are addressed as noted.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 223 | 70% Quantities Takeoff | CLV                                                | Quantities Comparison  | Quantities          | CLV Quantities Takeoff/P:\Jobs\W4X53700 Ann&Rainbow\800 DELIVERABLES\802 Submittals\802.2 70% Comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | A revised quantities list has been provided with the 90% submittal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 224 | 70% Submittal          | Peter Jackson, CLV Flood Control                   | No. 1 - Comment Letter | Drainage Memorandum | Flood Control takes no exception to the overall Hydrology presented as it complies with the overall drainage parameters. Provide an electronic copy of the HEC-1 analysis including both input and output files with the Final Design Report.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Comment Noted, and electronic copy of the HEC-1 will be provided with the Final Design Report.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 225 | 70% Submittal          | Peter Jackson, CLV Flood Control                   | No. 2 - Comment Letter | Drainage Memorandum | Revise the WSPG analysis for the proposed storm drain system based upon the flow data in the Ann Road system. Extend the WSPG sufficiently downstream of the Rainbow & Ann confluence until the flow stabilizes, using the Rainbow branch as the mainline flow for the Rainbow & Ann confluence.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | The WSPG analysis has been extended downstream of the Rainbow and Ann Confluence and is included in the 90% submittal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 226 | 70% Submittal          | Peter Jackson, CLV Flood Control                   | No. 3 - Comment Letter | Drainage Memorandum | The Final Design Report needs to include an expanded discussion on the utility conflicts along the RCB alignment and the impacts on the project construction. Update the Utility Conflict Location Exhibit, Figure A3, to reflect the updated utility information. Plans must reflect the existing sewer system, including the residential lateral facility connections. The sewer laterals need to be shown on the plans to verify that the sewer laterals are able to be connected into either a new sewer main or another existing sewer. Provide alignment recommendations that minimize utility relocations where practical, as the utility concerns to the constructability of this project appear to be a significant cost to this project. Update the Utility matrix information to show that the Land Development review is now under the Department of Building and Safety instead of the Public Works. | The Final Design report will include an expanded discussion on the utility conflicts along the project vicinity for the proposed alignment of the storm drain based on the final design. There are still potholes pending as of the submission of this report which will be included in the discussion as well as in the improvement plans. The sewer data for the plans have been updated for this submittal including new/existing sewer lateral, relocations and connections allowing laterals to connect to the relocated sewer. The Utility permit matrix information will be updated to show Land Development review updates. |
| 227 | 70% Submittal          | Peter Jackson, CLV Flood Control                   | No. 4 - Comment Letter | Drainage Memorandum | Flood Control concurs with the proposed storm drain extension with a headwall structure at the Rio Vista development drainage easement shown as Option 1 on Figure D-3. The existing drainage easement is proposed for reconstruction. It is recommended that potholing be provided along the existing retaining wall footings to determine the impacts of the concrete channel reconstruction within the existing easement. Review and revise the cross-sections accordingly.                                                                                                                                                                                                                                                                                                                                                                                                                                    | Potholing information at the existing walls have been obtained for the 90% submittal. The revised design at the inlet has been revised to show provide for a combination headwall/inlet structure. Survey data on these potholes is still pending and will be included in the final improvement set.                                                                                                                                                                                                                                                                                                                                |

City of Las Vegas Department of Public Works  
ANN ROAD CHANNEL WEST RAINBOW BOULEVARD - HANSEN NO. 36801

Comment Matrix for  
30%, 70% and 90% Submittals

| No. | Design Phase  | Reviewer/Source                  | Sheet/Location          | Subject             | Comment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Jacobs Action/Response                                                                                                                                                                                                                                                                                                                                                 |
|-----|---------------|----------------------------------|-------------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 228 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 5 - Comment Letter  | Drainage Memorandum | Provide a detailed grading plan for the storm drain collection system at the Rio Vista Estates development. The plan needs to label the adjacent finish floors and provide corresponding Water Surface Elevations for the channel to verify that the WSE is not above the retaining wall heights. Provide details and sections of the proposed collection system. Provide retaining wall details for the access ramp into the RCB. Provide headwall details that include wrought iron fencing for security and access. Provide wrought iron fencing with a 16-foot access gate at the upstream end of the easement where the existing side yard fences provide adequate height for the fence tie-in. With the proposed ramp construction, we still need a sidewalk underdrain if we are not providing a nuisance Inlet at the street knuckle. | A detailed grading and structural plan has been provided for the Rio Vista Estates drainage easement. All comments have been addressed in the 90% design set.                                                                                                                                                                                                          |
| 229 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 6 - Comment Letter  | Drainage Memorandum | The storm drain system stationing for the project is confusing. Two types of Stationing are shown and there is no clear tie between the systems. Review and revise the Stationing for the project.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | The stationing has been revised to station all improvements off the centerline of the roadway as described on the horizontal control sheets.                                                                                                                                                                                                                           |
| 230 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 7 - Comment Letter  | Drainage Memorandum | Show the RCB angle points by station location and angle change. This information is needed to allow for the use of precast RCB's as well as cast in place construction.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | The RCB angle points have been provided in the 90% Improvement plan submittal.                                                                                                                                                                                                                                                                                         |
| 231 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 8 - Comment Letter  | Drainage Memorandum | The RCB Stationing needs to label the Stationing on the profiles and include the beginning station, begin and end of transition structures, manholes, laterals, etc. The main line RCB should show Stationing between manholes, transitions and structures and label the RCB lengths accordingly based upon system sizes. Do not label the individual RCB segments between every lateral.                                                                                                                                                                                                                                                                                                                                                                                                                                                     | The RCB station and design information has been labeled accordingly.                                                                                                                                                                                                                                                                                                   |
| 232 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 9 - Comment Letter  | Drainage Memorandum | Provide details for the RCB construction. System design needs to accommodate the construction option of pre-cast or cast-in-place improvements. Verify that the Specifications and schedule accommodate the construction methods.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | The RCB details have been provided. The specification and schedule have been reviewed to accommodate construction methods.                                                                                                                                                                                                                                             |
| 233 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 10 - Comment Letter | Drainage Memorandum | The drainage easement channel section shown on Sheet CS-01 includes 6-inches of concrete with 18-inches of Type IT Base. Review the need for 18-inches of base material for this channel section as this seems excessive and revise the details accordingly.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | The base material has been reviewed. The details have been revised accordingly.                                                                                                                                                                                                                                                                                        |
| 234 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 11 - Comment Letter | Drainage Memorandum | Provide Access Manholes along the RCB at 400-foot spacing. Adjust spacing to include Manholes near the junction structures for maintenance consideration. Consider using Manhole openings that are cast with the RCB's to reduce costs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | The spacing of the access manholes have been adjusted accordingly. Access manholes are provided for maintenance consideration. Manhole openings which are cast in the RCB are part of the construction means and methods for the contractor and the design will be able to accommodate manhole openings that are cast with the RCB's to reduce cost.                   |
| 235 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 12 - Comment Letter | Drainage Memorandum | The engineer must review the pipe hydraulics to verify system design to keep the HGL 12-inches below the finish grade per the Manual requirements. If the HGL is less than 18-inches below the finish grade, slotted and bolt down manhole lids will be required. Additionally, the manhole concrete collars will need to be extended to prevent collar blow outs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | The tie-in HGL in Ann Road, existing tie-in invert in Rainbow Boulevard and the existing 36" water line crossing necessitate a shallow cover over the underground storm system. In all cases, the 100-year HGL is less than 1' below the surface grade. All manholes in the system are proposed to have slotted and bolted down manhole lids with concrete encasement. |
| 236 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 13 - Comment Letter | Drainage Memorandum | Where the HGL for the laterals is less than 12-inches below the finish grade, the laterals will require the installation of dual check valves (flapper valves) in the lateral pipe at the inlet. Flood Control recommends that you reference the Las Vegas Wash Middle Branch-Rainbow Storm Drain project (Hansen# 23161, CLV plan# 731-87-1) which included the information under Section 603 of the Specifications.                                                                                                                                                                                                                                                                                                                                                                                                                         | A check valve as specified in the Las Vegas Wash Middle Branch Rainbow Storm Drain project is included in this submittal. It is included in 603 of the specifications as a single check valve rather than a dual check valve.                                                                                                                                          |
| 237 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 14 - Comment Letter | Drainage Memorandum | Provide the complete Plan and Profiles of the entire storm drain facility including laterals with the next submittal. Provide Construction Notes on the Plan and Profile Sheets.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Plan and Profile sheets along with the corresponding laterals are provided with the 90% submittal. Construction notes are included on the plan and profile sheets.                                                                                                                                                                                                     |
| 238 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 15 - Comment Letter | Drainage Memorandum | Provide updated storm drain design plans with the next submittal that include the design data and the complete construction notes. Include the inlet type, lengths, depth, number of grates, etc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Updated storm drain design plans with design data and construction notes have been provided. The inlet type, lengths, depths and number of grates have been called out.                                                                                                                                                                                                |
| 239 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 16 - Comment Letter | Drainage Memorandum | Review the inlet design grate call-outs, as the 412A includes the solid segment in the number of grates count, while the plans only count the open grates. Verify inlet information.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | The number of total grates have been called out on the plan, including the solid grate.                                                                                                                                                                                                                                                                                |
| 240 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 17 - Comment Letter | Drainage Memorandum | The Engineer should acquire and verify utility pothole information as soon as practical to determine additional constraints on the storm drain system design based upon the proposed design information. Consideration on utility relocations and impacts must be identified. Has the existing RCB stub been potholed to verify the beginning elevation for the storm drain? How is the pothole information being incorporated into the plans?                                                                                                                                                                                                                                                                                                                                                                                                | Pothole information has been provided on the plans. The RCB stub has been surveyed in order to determine the elevation at the tie-in location. Pothole tables have been provided on the plans. For this submittal, there is pothole information pending along with the survey of these locations which will be included in the final design submittal.                 |
| 241 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 18 - Comment Letter | Drainage Memorandum | Provide updated inlet calculations as necessary based upon the final system design with the next submittal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Updated inlet calculations have been submitted with this set based on system updates.                                                                                                                                                                                                                                                                                  |
| 242 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 19 - Comment Letter | Drainage Memorandum | Provide details for the RCB structure connection to the existing box near the Ann Road and Rainbow Boulevard intersection. Call out existing plug removal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Details for the RCB structure connection to the existing box has been called out along with the existing plug removal.                                                                                                                                                                                                                                                 |
| 243 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 20 - Comment Letter | Drainage Memorandum | Provide details of the junction/confluence structure at Station 21+08.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Details for the confluence structure have been provided.                                                                                                                                                                                                                                                                                                               |
| 244 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 21 - Comment Letter | Drainage Memorandum | The design constraints keep this storm drain system at a shallow depth. The manholes need to be detailed to account for the shallow cover as standard manhole details do not apply.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | The manhole details have been reviewed and provided to show the deviation from standards.                                                                                                                                                                                                                                                                              |
| 245 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 22 - Comment Letter | Drainage Memorandum | Update the lateral and inlet design information to include water and/or sewer relocations with the next submittal. Provide the clearance between storm drain and the water & sewer lines. Provide encasement requirements and details. Crossings of the existing 36-inch water line may require special details, especially where the RCB has shallow crossings over the water line.                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Water and sewer relocations are provided with this submittal. Crossing details for the 36-inch water and sewer are included within on the UT sheets.                                                                                                                                                                                                                   |
| 246 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 23 - Comment Letter | Drainage Memorandum | The existing and proposed utility crossings of the storm drain must be shown on the storm drain plan and profiles sheets and on the lateral profiles. Indicate the type of material of water and sewer lines. ACP will require special consideration and handling and must be addressed in the specifications.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | The existing and proposed utility crossings are shown on the storm drain plan and profile sheets and on the lateral profiles. Types of materials are called out. There is no ACP removal required for this project.                                                                                                                                                    |
| 247 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 24 - Comment Letter | Drainage Memorandum | Clearly identify the required utility relocations and which relocations are incidental to and part of the storm drain work. Review the Specifications accordingly.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | The utility relocations are identified in the plans submittal. Specifications are provided accordingly.                                                                                                                                                                                                                                                                |
| 248 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 25 - Comment Letter | Drainage Memorandum | Provide separate plan and profiles for relocated sewer and/or water lines with the next submittal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Separate plan and profile for relocated sewer and water are provided with this submittal.                                                                                                                                                                                                                                                                              |
| 249 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 26 - Comment Letter | Drainage Memorandum | Provide detail sheets showing typical details needed for the construction, connection and any special transition structure details. Structural details, if required, must be submitted by the 90% submittal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Structural details are provided with the 90% submittal.                                                                                                                                                                                                                                                                                                                |
| 250 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 27 - Comment Letter | Drainage Memorandum | Add a note for all storm drain drop inlets that references the newly adopted USDCCA Drawing No. 421 (Stormwater Quality Management Stamp and Sign Detail). Include the USDCCA Drawing No. 421 (Stormwater Quality Management Stamp and Sign Detail) note to the concrete collar detail for the NDOT Type 2B inlets.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | A note referencing the newly adopted USDCCA Drawing 421 has been added to the plans for both Drawing No. 421 and the NDOT Type 2B inlets.                                                                                                                                                                                                                              |

APPENDIX H



City of Las Vegas Department of Public Works  
ANN ROAD CHANNEL WEST RAINBOW BOULEVARD - HANSEN NO. 36801

Comment Matrix for  
30%, 70% and 90% Submittals

| No. | Design Phase  | Reviewer/Source                  | Sheet/Location          | Subject             | Comment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Jacobs Action/Responses                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----|---------------|----------------------------------|-------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 251 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 28 - Comment Letter | Drainage Memorandum | Provide grading design information to collect the flows at the NDOT Type 2B area inlets.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Separate grading sheets with callouts have been provided with this submittal which show all areas of re-grading design and design information for the NDOT Type 2B area inlets.                                                                                                                                                                                                                                              |
| 252 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 29 - Comment Letter | Drainage Memorandum | The Storm Drain Plan & Profile Sheets and the Storm Drain Lateral Sheets need to continue the SD Sheet nomenclature.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | The SD nomenclature has been continued on the PP and SD lateral sheets.                                                                                                                                                                                                                                                                                                                                                      |
| 253 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 30 - Comment Letter | Drainage Memorandum | Identify the existing driveway locations and verify that the construction of the inlets will not impact these existing driveways. Provide grading information as necessary for the inlet construction.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Driveways have been identified and the construction of the inlets which impact these existing driveways is shown.                                                                                                                                                                                                                                                                                                            |
| 254 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 31 - Comment Letter | Drainage Memorandum | Flood Control recommends that the existing storm drain shown as abandoned in place be removed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | All existing storm drain on the plans being impacted is called out as removed.                                                                                                                                                                                                                                                                                                                                               |
| 255 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 32 - Comment Letter | Drainage Memorandum | Provide a copy of the referenced Updated Geotechnical Report letter under Section I, 7 of the Report.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | A copy of the Updated Geotechnical Report has been included herein.                                                                                                                                                                                                                                                                                                                                                          |
| 256 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 33 - Comment Letter | Drainage Memorandum | Provide an updated detailed cost estimate with the next submittal for review. The cost estimate must be refined prior to the 90% submittal and request for construction funding to assure that the requested and allocated storm drain funds are sufficient for construction.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | An updated detailed cost estimate is provided with this submittal.                                                                                                                                                                                                                                                                                                                                                           |
| 257 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 34 - Comment Letter | Drainage Memorandum | The Final Design report needs to include an electronic copy of the entire report with the input and output files for the hydraulics and hydrology.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | The Final Design report will incorporate all input and output files for hydraulics and hydrology.                                                                                                                                                                                                                                                                                                                            |
| 258 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 35 - Comment Letter | Drainage Memorandum | The plans show a storm drain lateral & inlet and a new sewer line construction that appears to impact the existing Traffic Signal at the Ann Road and Rainbow Boulevard intersection. Show the existing signal improvements and coordinate the need for any modifications with Traffic Engineering.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | The existing signal improvements are being shown on the plans. All modifications are being coordinated with Traffic Engineering.                                                                                                                                                                                                                                                                                             |
| 259 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 36 - Comment Letter | Drainage Memorandum | Identify the Traffic Signal undergrounds at the existing Tropical Parkway and Rainbow Boulevard intersection and show any relocations/reconnections to these facilities.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Traffic signal undergrounds and relocations/reconnections to these facilities are shown.                                                                                                                                                                                                                                                                                                                                     |
| 260 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 37 - Comment Letter | Drainage Memorandum | A copy of the Record of Survey was submitted at the 30% submittal. Obtain Survey approval prior to the 90% submittal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | The recorded Record of Survey map is included herein.                                                                                                                                                                                                                                                                                                                                                                        |
| 261 | 70% Submittal | Peter Jackson, CLV Flood Control | No. 38 - Comment Letter | Drainage Memorandum | Additional comments are shown on the attached 70% storm drain plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Additional plan comments are addressed.                                                                                                                                                                                                                                                                                                                                                                                      |
| 262 | 70% Submittal | Todd L. Myers, RFCD              | No. 1 - Comment Letter  | General             | A facility-specific environmental analysis in accordance with Chapter 8 of District's Supplemental Programmatic Environmental Impact Statement, Clark County Regional Flood Control District, 2002 Master Plan Update, September 2004 was accepted by District on February 18, 2011. The District's Policies and Procedures regarding environmental permitting as a pre-requisite for construction funding eligibility have been satisfied.                                                                                                                                                                                                                                                                                                                                            | Comment Noted.                                                                                                                                                                                                                                                                                                                                                                                                               |
| 263 | 70% Submittal | Todd L. Myers, RFCD              | No. 2 - Comment Letter  | General             | Identify all right-of-way (ROW) and easement acquisition requirements for this project. All ROW/easements must be acquired prior to City's request for construction funding.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | A temporary construction easement is required for parcels 125-23-304-005, 008 & 007. Jacobs has submitted easement descriptions dated July 11, 2011 to the City for review.                                                                                                                                                                                                                                                  |
| 264 | 70% Submittal | Todd L. Myers, RFCD              | No. 3 - Comment Letter  | General             | Provide draft copy of Special Provisions with all submittals.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | A draft copy of the Special Provisions are provided with this submittal.                                                                                                                                                                                                                                                                                                                                                     |
| 265 | 70% Submittal | Todd L. Myers, RFCD              | No. 4 - Comment Letter  | Drainage Memorandum | District takes no exceptions to information presented in report.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Comment noted.                                                                                                                                                                                                                                                                                                                                                                                                               |
| 266 | 70% Submittal | Todd L. Myers, RFCD              | No. 5 - Comment Letter  | Drainage Memorandum | Update status of ROW with each phase of project submittals.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | A temporary construction easement is required for parcels 125-23-304-005, 008 & 007. Jacobs has submitted easement descriptions dated July 11, 2011 to the City for review.                                                                                                                                                                                                                                                  |
| 267 | 70% Submittal | Todd L. Myers, RFCD              | No. 6 - Comment Letter  | Cost Estimate       | a. How are water line relocations paid? Are these incidental to RCB, or separate line item. Address, provide copy of Special Provisions to District, and provide line item under SP 105 as necessary.<br>b. Are items 202.00 (2-inch and 4-inch gas relocations) covered under City's Franchise agreement? If so, remove from cost estimate.                                                                                                                                                                                                                                                                                                                                                                                                                                           | a. A pay item has been established for this portion of the project.<br>b. Gas is removed from the cost estimate. These will be paid for by Southwest Gas.                                                                                                                                                                                                                                                                    |
| 268 | 70% Submittal | Todd L. Myers, RFCD              | No. 7 - Comment Letter  | Hydraulics          | Revise WSPG analysis of mainline to extend downstream through confluence with existing Ann Road facility. Analyze system assuming that Rainbow facility is mainline and Ann Road facility is a lateral. If, based on revised analyses, 100-year design flow is not contained in facility, determine level of protection proposed facility will provide, and if street flow criteria are satisfied.                                                                                                                                                                                                                                                                                                                                                                                     | The WSPG analysis has been extended through the confluence structure. The HCL is maintained at or less than 1' below surface grade. All of the 10-year storm is contained within the system and the dry-lane street criteria has been met.                                                                                                                                                                                   |
| 269 | 70% Submittal | Todd L. Myers, RFCD              | No. 8 - Comment Letter  | Hydraulics          | The confluence near RCB station 20+00 needs additional analyses. Consider an alternative, more efficient, geometry for this confluence. (See Comment No.21)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | The confluence at station 20+00 has been revised.                                                                                                                                                                                                                                                                                                                                                                            |
| 270 | 70% Submittal | Todd L. Myers, RFCD              | No. 9 - Comment Letter  | Hydraulics          | Provide check valves for area drain laterals, grates and bolted manhole (MH) lids, and concrete collars for MH risers if necessary as determined by revised WSPG analysis (see Comment No. 7).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | For all laterals proposed for the Ann and Rainbow storm drain system, installation of check valves, grates and bolted manhole (MH) lids, and concrete collars for MH risers are necessary.                                                                                                                                                                                                                                   |
| 271 | 70% Submittal | Todd L. Myers, RFCD              | No. 10 - Comment Letter | Plans               | Provide Striping Plan with next submittal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | The striping plan is provided with the 90% submittal.                                                                                                                                                                                                                                                                                                                                                                        |
| 272 | 70% Submittal | Todd L. Myers, RFCD              | No. 11 - Comment Letter | Plans               | Consider combining SD and PP sheets.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | The SD and PP sheets have been combined.                                                                                                                                                                                                                                                                                                                                                                                     |
| 273 | 70% Submittal | Todd L. Myers, RFCD              | No. 12 - Comment Letter | Plans               | Provide consistent stationing (Station/offset from CL or separate control) for storm drain system.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | All sheets now show stationing and offsets off the street centerline.                                                                                                                                                                                                                                                                                                                                                        |
| 274 | 70% Submittal | Todd L. Myers, RFCD              | No. 13 - Comment Letter | Plans               | Provide RCB angle point information.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | RCB angle points and angle changes have been incorporated in the improvement plans.                                                                                                                                                                                                                                                                                                                                          |
| 275 | 70% Submittal | Todd L. Myers, RFCD              | No. 14 - Comment Letter | Plans               | Provide pipe materials for all utilities.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Pipe materials have been provided for all utilities.                                                                                                                                                                                                                                                                                                                                                                         |
| 276 | 70% Submittal | Todd L. Myers, RFCD              | No. 15 - Comment Letter | Plans               | Clearly indicate who is responsible for utility relocations. Provide instructions and plans for all utility relocation to be completed under this contract.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | The removal sheets have indicated who is responsible for what relocation. All utility relocation plans for utilities to be completed under this contract are provided with the 90% submittal.                                                                                                                                                                                                                                |
| 277 | 70% Submittal | Todd L. Myers, RFCD              | No. 16 - Comment Letter | Plans               | Sheet G-03: Delete references to "Soils Report" on City of Las Vegas General Notes (No.12) and City of Las Vegas Grading Notes (No.8). The Soils Report is not a part of contract documents. Provide specifications for soils within Special Provisions and/or on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | The reference to the soils report has been left in the improvements plans. The original report is not a part of this contract documents; however, an update letter validating the original report in order to use it for this project is part of this report.                                                                                                                                                                |
| 278 | 70% Submittal | Todd L. Myers, RFCD              | No. 17 - Comment Letter | Plans               | Sheet RM-011thru -03:<br>a. Extend paving limits east to east edge of sewer trench. Contractor won't be able to save existing pavement between trenches;<br>b. Define limits of all removals by station;<br>c. Provide striping plan instead of "Remove and replace pavement markings in kind";<br>d. Removal notes call for removal and replacement of gas line. Determine if this is work for contractor or Southwest Gas under franchise agreement with City;<br>e. Plans only call for removal of waterline. What about replacement?<br>f. Address and account for work in Special Provisions and cost estimate;<br>g. Removal Note No. 18 calls for "remove or abandon" sanitary sewer (SS); Determine which, and revise note;<br>h. See other redlined comments on check prints. | Sheet RM-011thru -03:<br>a. Pavement limits have been revised.<br>b. Limits of removal are defined by station.<br>c. A striping plan has been provided.<br>d. Southwest Gas will be responsible to pay for all gas move/relocations.<br>e. The plans, cost estimate and special provisions have been revised to incorporate removals or relocations.<br>f. This has been revised.<br>g. Other comments are addressed herein. |





City of Las Vegas Department of Public Works  
ANN ROAD CHANNEL WEST RAINBOW BOULEVARD - HANSEN NO. 36801

Comment Matrix for  
30%, 70% and 90% Submittals

| No. | Design Phase  | Reviewer/Source     | Sheet/Location          | Subject    | Comment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Jacobs Action/Response                                                                                                                                                                                                                                                                                                                        |
|-----|---------------|---------------------|-------------------------|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 279 | 70% Submittal | Todd L. Myers, RFCD | No. 18 - Comment Letter | Plans      | Sheet SD-01:<br>a. Provide detailed grading for area drain locations on east side of Rainbow;<br>b. Place access MH's next to wall instead of center of RCB;<br>c. The shallow MH's will require special design. Provide and reference detail;<br>d. See other redlined comments;                                                                                                                                                                                                                  | Sheet SD-01:<br>a. Detailed grading is provided.<br>b. Access manholes are shown next to wall rather than center of RCB.<br>c. Special design for the shallow manholes have been provided and are shown on the plans.<br>d. Other redline comments are addressed herein.                                                                      |
| 280 | 70% Submittal | Todd L. Myers, RFCD | No. 19 - Comment Letter | Plans      | Sheet SD-03: Call-out and provide detail for RCB plug.                                                                                                                                                                                                                                                                                                                                                                                                                                             | The detail call out and design has been provided for the RCB plug.                                                                                                                                                                                                                                                                            |
| 281 | 70% Submittal | Todd L. Myers, RFCD | No. 20 - Comment Letter | Plans      | Sheet PP-01:<br>a. Provide detail for connection at RCB Station 10+00;<br>b. Verify with RCB fabricators that 12' x 6' to 9' x 6' transitions can be pre-casted;<br>c. Provide separate plan and profile of SS relocation;<br>d. Address SS lateral crossing RCB near RCB station 11+75;<br>e. See other redlined comments.                                                                                                                                                                        | Sheet PP-01:<br>a. The detail for the connection is provided in the plan set.<br>b. This transition has been verified to be able to be precast.<br>c. Separate plan and profiles for the SS sheets are provided herein.<br>d. The sanitary sewer lateral crossing has been addressed on the plans.<br>e. Other comments are addressed herein. |
| 282 | 70% Submittal | Todd L. Myers, RFCD | No. 21 - Comment Letter | Plans      | Sheet PP-02:<br>a. Consider a different, hydraulically efficient, geometry for RCB confluence near RCB station 21+00. I have provided two alternatives on the redlined check prints;<br>b. Provide construction details for confluence, channel walls...etc.;<br>c. Provide detail for proposed bridge over waterline;<br>d. Where possible, avoid lateral penetrations at Invert or soffit of RCB. This requires contractor to chip out haunch of precast RCB;<br>e. See other redlined comments. | Sheet PP-02:<br>a. The confluence has been revised.<br>b. Details for the revised confluence have been provided.<br>c. A detail for the crossing over the 36" water is provided.<br>d. Lateral penetrations have been revised accordingly.<br>e. Other comments are addressed herein.                                                         |
| 283 | 70% Submittal | Todd L. Myers, RFCD | No. 22 - Comment Letter | Plans      | Sheet PP-03 and -04: See redlined comments.                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Plan comments have been addressed.                                                                                                                                                                                                                                                                                                            |
| 284 | 70% Submittal | Todd L. Myers, RFCD | No. 23 - Comment Letter | Plans      | Sheet LT-01: Where possible, avoid lateral penetrations at Invert or soffit of RCB. This requires contractor to chip out haunch of precast RCB. Typical all. See other redlined comments.                                                                                                                                                                                                                                                                                                          | Revised lateral penetrations have been provided. Where possible, penetrations at Inverts and soffits are avoided.                                                                                                                                                                                                                             |
| 285 | 70% Submittal | Todd L. Myers, RFCD | No. 24 - Comment Letter | Plans      | Sheet LT-02: Consider revising LAT-10 to flatten RCB slope that will remain underground. Provide a large grate (12'x8' ±), and flood walls as necessary to capture runoff. District's concern is that the opened culvert and the 100-year level pool depth of approximately 6-feet will not only provide a safety concern, but may cause additional flooding problems in the upstream residential subdivision.                                                                                     | This area has been revised and the calculations are included.                                                                                                                                                                                                                                                                                 |
| 286 | 70% Submittal | Todd L. Myers, RFCD | No. 25 - Comment Letter | Plans      | DT Sheets: Provide all construction details required to construct RCB system including but not limited to non-standard details for RCB junction structures, transitions, connections, MH's, special D's, collars, fencing and flood walls.                                                                                                                                                                                                                                                         | Details have been provided in the plans.                                                                                                                                                                                                                                                                                                      |
| 287 | 70% Submittal | Todd L. Myers, RFCD | No. 26 - Comment Letter | Plans      | Sheet DT-01: I don't think it is necessary to include the NDOT standard details on sheet as long as plans and specifications reference the 2010 Edition of Nevada Department of Transportation - Standard Plans for Road and Bridge Construction. Verify with City and revise accordingly.                                                                                                                                                                                                         | Any standard referenced details have been removed from the plans.                                                                                                                                                                                                                                                                             |
| 288 | 70% Submittal | Todd L. Myers, RFCD | No. 27 - Comment Letter | Plans      | Sheet DT-03: If the standard DWG No 421 B will be used, it is not necessary to include in plans.                                                                                                                                                                                                                                                                                                                                                                                                   | This is left in per request by the City.                                                                                                                                                                                                                                                                                                      |
| 289 | 70% Submittal | Todd L. Myers, RFCD | No. 28 - Comment Letter | Plans      | Sheet DT-05: Remove maximum trench width requirements (shown as 24 inches on detail, and called out as 18 inches in notes). It may not be possible to meet these requirements in field based on soil conditions and OSHA requirements. I recommend allowing for a reduced trench width of 8-inches from outside of RCB to trench wall if CLSM is used in pipe zone from invert to top of RCB, and a minimum of 18" if standard backfill material is used.                                          | The trench details have been revised and are included herein. For the RCB box section, an 18" trench width with CLSM is recommended. For the laterals, 8-inch with CLSM or 18" with standard backfill is recommended.                                                                                                                         |
| 290 | 70% Submittal | Todd L. Myers, RFCD | No. 29 - Comment Letter | Plans      | Please refer to red-lined check prints for additional plan comments. Return with 90% submittal.                                                                                                                                                                                                                                                                                                                                                                                                    | Additional comments are addressed herein.                                                                                                                                                                                                                                                                                                     |
| 291 | 70% Submittal | Tim Parks, CLV      | No. 1 - Comment Matrix  | 07 / RM-01 | Protect in place and provide label on existing sewer manhole within existing concrete channel on the west side of Rainbow north of El Campo Grande. Sewer manhole shall be adjusted to final grade with the replacement of concrete in channel.                                                                                                                                                                                                                                                    | Since concrete will not be replaced in this portion of channel, grade adjustment is not necessary. A callout has been provided on the removal sheets for protection in place as well as installation of a locking manhole cover and frame.                                                                                                    |
| 292 | 70% Submittal | Tim Parks, CLV      | No. 2 - Comment Matrix  | 07 / RM-01 | Mislabeled note 18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Note 18 has been revised to call for manhole removal                                                                                                                                                                                                                                                                                          |
| 293 | 70% Submittal | Tim Parks, CLV      | No. 3 - Comment Matrix  | 07 / RM-01 | Note 18, add "per DCSWCS 3.18"                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | The reference to DCSWCS 3.18 has been added to the removal note, which has been re-numbered as removal note 3.                                                                                                                                                                                                                                |
| 294 | 70% Submittal | Tim Parks, CLV      | No. 4 - Comment Matrix  | 10 / SD-01 | Revise sewer label located north of parcels 125-27-818-001 & 002; per CLV records existing sewer is 8" not 10" as shown.                                                                                                                                                                                                                                                                                                                                                                           | This line has been downsized to an 8" line accordingly.                                                                                                                                                                                                                                                                                       |
| 295 | 70% Submittal | Tim Parks, CLV      | No. 5 - Comment Matrix  | 10 / SD-01 | Where in new paving, adjust ex smhs to grade (typ)                                                                                                                                                                                                                                                                                                                                                                                                                                                 | This issue is no longer of concern, as all manholes within the paved area will be replaced.                                                                                                                                                                                                                                                   |
| 296 | 70% Submittal | Tim Parks, CLV      | No. 6 - Comment Matrix  | 10 / SD-01 | Note 18, add "Per SD-1A of DCSWCS"                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | SD-1A is now referenced for all SSMH's.                                                                                                                                                                                                                                                                                                       |
| 297 | 70% Submittal | Tim Parks, CLV      | No. 7 - Comment Matrix  | 13 / PP-01 | Show and provide label on proposed sewer manhole to be located at the transition point of proposed 8" sewer and 12" sewer lines for the existing sewer coming from Scarlett Star Avenue.                                                                                                                                                                                                                                                                                                           | This manhole is now shown and called out on SS-03.                                                                                                                                                                                                                                                                                            |
| 298 | 70% Submittal | Tim Parks, CLV      | No. 8 - Comment Matrix  | 13 / PP-01 | Provide profile for proposed 8" and 12" sewer lines coming from Scarlett Star Avenue located on the west side of Rainbow north of Ann Road.                                                                                                                                                                                                                                                                                                                                                        | This profile is now shown on SS-03.                                                                                                                                                                                                                                                                                                           |
| 299 | 70% Submittal | Tim Parks, CLV      | No. 9 - Comment Matrix  | 13 / PP-01 | Provide profile for relocated 12" sewer at the intersection of Rainbow Boulevard and Ann Road. All relocated/proposed sewer requires Plan and Profile. (typical)                                                                                                                                                                                                                                                                                                                                   | The profile for all proposed/relocated sewer is shown on SS-01 through SS-03.                                                                                                                                                                                                                                                                 |
| 300 | 70% Submittal | Tim Parks, CLV      | No. 10 - Comment Matrix | 13 / PP-01 | Label existing ssmh-4 in profile view to match plan view.                                                                                                                                                                                                                                                                                                                                                                                                                                          | Plan views now show manhole name, station, and offset, and all manhole data is provided in profile view.                                                                                                                                                                                                                                      |
| 301 | 70% Submittal | Tim Parks, CLV      | No. 11 - Comment Matrix | 13 / PP-01 | Proposed sewer manhole SSMH-AR2 shall be "T-Lock" lined; (Required when slope change is greater than 4%)                                                                                                                                                                                                                                                                                                                                                                                           | No manholes exist in the new design with slope changes greater than 4%, therefore, T-lock has not been called out.                                                                                                                                                                                                                            |
| 302 | 70% Submittal | Tim Parks, CLV      | No. 12 - Comment Matrix | 13 / PP-01 | Apparent conflicts with existing ss laterals from west side of Rainbow at three locations. Need to be able to service two remaining septic properties on west side of Rainbow in future.                                                                                                                                                                                                                                                                                                           | Sewers have been re-designed to allow clearance below the box required to connect the existing laterals. Future laterals will be provided with a crossing below the box.                                                                                                                                                                      |
| 303 | 70% Submittal | Tim Parks, CLV      | No. 13 - Comment Matrix | 13 - PP-01 | Extend sewer profile to show entire limits (typ)                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Profiles now show entire limits of sewer re-location.                                                                                                                                                                                                                                                                                         |
| 304 | 70% Submittal | Tim Parks, CLV      | No. 14 - Comment Matrix | 14 / PP-02 | Adjustment of existing ssmh in channel may require rebuilding of cone and sections.                                                                                                                                                                                                                                                                                                                                                                                                                | In lieu of re-building this manhole, the connection to the existing system will be made in the sidewalk outside of the easement per meeting on 7/7/11.                                                                                                                                                                                        |



City of Las Vegas Department of Public Works  
ANN ROAD CHANNEL WEST RAINBOW BOULEVARD - HANSEN NO. 36801

Comment Matrix for  
30%, 70% and 90% Submittals

| No. | Design Phase  | Reviewer/Source           | Sheet/Location          | Subject    | Comment                                                                                                                                                                                                                                                                    | Jacobs Action/Response                                                                                                                                                                  |
|-----|---------------|---------------------------|-------------------------|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 305 | 70% Submittal | Tim Parks, CLV            | No. 16 - Comment Matrix | 14 / PP-02 | Protect existing sewer at storm drain lateral crossing per SD-21 Protection of sewer is required when clearance is less than 2' from top of sewer to bottom of storm drain. (typical)                                                                                      | DCSWCS SD-21 protection is called out where clearance above the sewer is less than 2'.                                                                                                  |
| 306 | 70% Submittal | Jim Von Tobel, CLV Survey | HC-01 - HC-03           | Utilities  | At this stage we will need the plans to show found monuments for horizontal control. It appears that all monuments in the intersections will be taken out as shown on the removal plans. Contractor is responsible to replace all monuments including reference monuments. | Found monuments are shown on the horizontal control plans. A note has been added to the HC plans and the specifications call for the contractor to replace any damaged monuments.       |
| 307 | 70% Submittal | Steve Jackson, LVVWD      | RM-01                   | Utilities  | Change note 19 from remove to relocate on all RM-Sheets.                                                                                                                                                                                                                   | Waterline removals are no longer addressed on the RM sheets. Since they are relocations, the UT sheets illustrate the relocations.                                                      |
| 308 | 70% Submittal | Steve Jackson, LVVWD      | SD-01                   | Utilities  | Delete LVVWD Notes block from sheet.                                                                                                                                                                                                                                       | This has been addressed on the plans.                                                                                                                                                   |
| 309 | 70% Submittal | Steve Jackson, LVVWD      | SD-01                   | Utilities  | Change notes 1-8 from DT-02 to DT-05 on all SD-Sheets.                                                                                                                                                                                                                     | This has been addressed on the plans.                                                                                                                                                   |
| 310 | 70% Submittal | Steve Jackson, LVVWD      | SD-01                   | Utilities  | Relocate 8", 6", and 1" service lateral.                                                                                                                                                                                                                                   | These services have been relocated.                                                                                                                                                     |
| 311 |               |                           |                         |            |                                                                                                                                                                                                                                                                            |                                                                                                                                                                                         |
| 312 | 70% Submittal | Steve Jackson, LVVWD      | SD-02                   | Utilities  | Delete LVVWD Notes block from sheet.                                                                                                                                                                                                                                       | These notes have been removed.                                                                                                                                                          |
| 313 | 70% Submittal | Steve Jackson, LVVWD      | SD-03                   | Utilities  | Delete LVVWD Notes block from sheet.                                                                                                                                                                                                                                       | These notes have been removed.                                                                                                                                                          |
| 314 | 70% Submittal | Steve Jackson, LVVWD      | SD-03                   | Utilities  | Relocate 10" waterline and show details.                                                                                                                                                                                                                                   | This relocation has been shown with corresponding profiles.                                                                                                                             |
| 315 | 70% Submittal | Steve Jackson, LVVWD      | SD-03                   | Utilities  | Relocate 12" waterline and show details.                                                                                                                                                                                                                                   | This relocation has been shown with corresponding profiles.                                                                                                                             |
| 316 | 70% Submittal | Steve Jackson, LVVWD      | PP-01                   | Utilities  | Add Approved For Construction signature block to this sheet.                                                                                                                                                                                                               | This has been addressed on the plans.                                                                                                                                                   |
| 317 | 70% Submittal | Steve Jackson, LVVWD      | PP-01                   | Utilities  | Add callout to 16" Dip Water.                                                                                                                                                                                                                                              | This has been addressed on the plans.                                                                                                                                                   |
| 318 | 70% Submittal | Steve Jackson, LVVWD      | PP-01                   | Utilities  | Add Sanitary Sewer and Waterline crossings to profile.                                                                                                                                                                                                                     | This has been addressed on the plans.                                                                                                                                                   |
| 319 | 70% Submittal | Steve Jackson, LVVWD      | PP-01                   | Utilities  | Re-route proposed Sanitary Sewer to deconflict with valves and thrust blocks.                                                                                                                                                                                              | Sewer connection point has been modified to avoid these conflicts.                                                                                                                      |
| 320 | 70% Submittal | Steve Jackson, LVVWD      | PP-01                   | Utilities  | Show new relocation of 8", 6" and 1" service lateral to plan and profile view.                                                                                                                                                                                             | These relocations have been shown. The 8" and 6" have been profiled on the utility plan and profile sheets. A crossing detail has been provided for the 1".                             |
| 321 | 70% Submittal | Steve Jackson, LVVWD      | PP-01                   | Utilities  | Add 6" PVC and 1"CU service laterals to profile view.                                                                                                                                                                                                                      | Crossings have been added for the 6" lateral on SD and Sewer profiles, and a profile has been shown on the UT sheets. Typically, waterlines less than 6" are not shown in profile view. |
| 322 | 70% Submittal | Steve Jackson, LVVWD      | PP-02                   | Utilities  | Add Approved For Construction signature block to this sheet.                                                                                                                                                                                                               | This block has been added.                                                                                                                                                              |
| 323 | 70% Submittal | Steve Jackson, LVVWD      | PP-02                   | Utilities  | Add callout to 8" Waterline.                                                                                                                                                                                                                                               | This has been addressed on the plans.                                                                                                                                                   |
| 324 | 70% Submittal | Steve Jackson, LVVWD      | PP-02                   | Utilities  | Fix Ex. 8" Waterline callout on profile view.                                                                                                                                                                                                                              | This has been addressed on the plans.                                                                                                                                                   |
| 325 | 70% Submittal | Steve Jackson, LVVWD      | PP-02                   | Utilities  | Need to address crossings issues per UDacs 2.22.                                                                                                                                                                                                                           | Crossings for the 36" have been addressed through a special detail. Other crossing conflicts have been addressed per UDACS 2.22.                                                        |
| 326 | 70% Submittal | Steve Jackson, LVVWD      | PP-02                   | Utilities  | Need more detail on Ex. 36" MLCP Waterline.                                                                                                                                                                                                                                | The existing 36" line is shown on the Utility Profiles at all locations where it is crossed by new construction. Elevations are based upon potholes in the vicinity of the crossing.    |
| 327 | 70% Submittal | Steve Jackson, LVVWD      | PP-03                   | Utilities  | Add Approved For Construction signature block to this sheet.                                                                                                                                                                                                               | This has been addressed on the plans.                                                                                                                                                   |
| 328 | 70% Submittal | Steve Jackson, LVVWD      | PP-03                   | Utilities  | Need more detail on Ex. 36" MLCP Waterline.                                                                                                                                                                                                                                | The existing 36" line is shown on the Utility Profiles at all locations where it is crossed by new construction. Elevations are based upon potholes in the vicinity of the crossing.    |
| 329 | 70% Submittal | Steve Jackson, LVVWD      | PP-03                   | Utilities  | Move Ex. 8" Waterline callout on profile view to PP-02.                                                                                                                                                                                                                    | This has been addressed on the plans.                                                                                                                                                   |
| 330 | 70% Submittal | Steve Jackson, LVVWD      | PP-04                   | Utilities  | Add Approved For Construction signature block to this sheet.                                                                                                                                                                                                               | This has been addressed on the plans.                                                                                                                                                   |
| 331 | 70% Submittal | Steve Jackson, LVVWD      | PP-04                   | Utilities  | Rotate North Arrow to the correct angle.                                                                                                                                                                                                                                   | This has been addressed on the plans.                                                                                                                                                   |
| 332 | 70% Submittal | Steve Jackson, LVVWD      | PP-04                   | Utilities  | Relocate 10" waterline.                                                                                                                                                                                                                                                    | This relocation has been shown with corresponding profiles.                                                                                                                             |
| 333 | 70% Submittal | Steve Jackson, LVVWD      | PP-04                   | Utilities  | Relocate 12" waterline on plan and profile view.                                                                                                                                                                                                                           | This relocation has been shown with corresponding profiles.                                                                                                                             |
| 334 | 70% Submittal | Steve Jackson, LVVWD      | LT-01                   | Utilities  | Add Approved For Construction signature block to this sheet.                                                                                                                                                                                                               | This has been addressed on the plans.                                                                                                                                                   |
| 335 | 70% Submittal | Steve Jackson, LVVWD      | LT-01                   | Utilities  | Add a Callout X to read: Slurry encase sd per udacs 2.22 10 ft either side of waterline.                                                                                                                                                                                   | This has been addressed on the plans.                                                                                                                                                   |
| 336 | 70% Submittal | Steve Jackson, LVVWD      | LT-01                   | Utilities  | Lat-02, add slurry encase and label.                                                                                                                                                                                                                                       | This has been addressed on the plans.                                                                                                                                                   |
| 337 | 70% Submittal | Steve Jackson, LVVWD      | LT-01                   | Utilities  | Lat-03, add slurry encase and label.                                                                                                                                                                                                                                       | This has been addressed on the plans.                                                                                                                                                   |
| 338 | 70% Submittal | Steve Jackson, LVVWD      | LT-01                   | Utilities  | Lat-05, add slurry encase and label.                                                                                                                                                                                                                                       | This has been addressed on the plans.                                                                                                                                                   |
| 339 | 70% Submittal | Steve Jackson, LVVWD      | LT-01                   | Utilities  | Lat-06, add slurry encase and label.                                                                                                                                                                                                                                       | This has been addressed on the plans.                                                                                                                                                   |
| 340 | 70% Submittal | Steve Jackson, LVVWD      | LT-01                   | Utilities  | Lat-06, show relocated 12" Waterline                                                                                                                                                                                                                                       | This has been addressed on the plans.                                                                                                                                                   |
| 341 | 70% Submittal | Steve Jackson, LVVWD      | LT-02                   | Utilities  | Add Approved For Construction signature block to this sheet.                                                                                                                                                                                                               | This has been addressed on the plans.                                                                                                                                                   |
| 342 | 70% Submittal | Steve Jackson, LVVWD      | LT-02                   | Utilities  | Add a Callout X to read: Slurry encase sd per udacs 2.22 10 ft either side of waterline.                                                                                                                                                                                   | This has been addressed on the plans.                                                                                                                                                   |
| 343 | 70% Submittal | Steve Jackson, LVVWD      | LT-02                   | Utilities  | Lat-07, add slurry encase and label.                                                                                                                                                                                                                                       | This has been addressed on the plans.                                                                                                                                                   |
| 344 | 70% Submittal | Steve Jackson, LVVWD      | LT-02                   | Utilities  | Lat-07, show relocated 8" Waterline                                                                                                                                                                                                                                        | This has been addressed on the plans.                                                                                                                                                   |
| 345 | 70% Submittal | Steve Jackson, LVVWD      | LT-02                   | Utilities  | Lat-07, change Ex. 12" Waterline to Ex. 8" Waterline.                                                                                                                                                                                                                      | This has been addressed on the plans.                                                                                                                                                   |
| 346 | 70% Submittal | Steve Jackson, LVVWD      | LT-02                   | Utilities  | Lat-11, add slurry encase and label.                                                                                                                                                                                                                                       | This has been addressed on the plans.                                                                                                                                                   |
| 347 | 70% Submittal | Steve Jackson, LVVWD      | LT-02                   | Utilities  | Lat-12, add slurry encase and label.                                                                                                                                                                                                                                       | This has been addressed on the plans.                                                                                                                                                   |
| 348 | 70% Submittal | Steve Jackson, LVVWD      | LT-03                   | Utilities  | Add Approved For Construction signature block to this sheet.                                                                                                                                                                                                               | This has been addressed on the plans.                                                                                                                                                   |
| 349 | 70% Submittal | Steve Jackson, LVVWD      | LT-03                   | Utilities  | Add a Callout X to read: Slurry encase sd per udacs 2.22 10 ft either side of waterline.                                                                                                                                                                                   | This has been addressed on the plans.                                                                                                                                                   |
| 350 | 70% Submittal | Steve Jackson, LVVWD      | LT-03                   | Utilities  | Lat-13, add slurry encase and label.                                                                                                                                                                                                                                       | This has been addressed on the plans.                                                                                                                                                   |
| 351 | 70% Submittal | Steve Jackson, LVVWD      | LT-03                   | Utilities  | Lat-15A, add slurry encase and label.                                                                                                                                                                                                                                      | This has been addressed on the plans.                                                                                                                                                   |
| 352 | 70% Submittal | Steve Jackson, LVVWD      | LT-03                   | Utilities  | Lat-16B, add slurry encase and label.                                                                                                                                                                                                                                      | This has been addressed on the plans.                                                                                                                                                   |
| 353 | 70% Submittal | Steve Jackson, LVVWD      | LT-03                   | Utilities  | Lat-17, show relocated 10" waterline.                                                                                                                                                                                                                                      | This has been addressed on the plans.                                                                                                                                                   |

APPENDIX H



City of Las Vegas Department of Public Works  
ANN ROAD CHANNEL WEST RAINBOW BOULEVARD - HANSEN NO. 36801

Comment Matrix for  
30%, 70% and 90% Submittals

| No. | Design Phase  | Reviewer/Source                                    | Sheet/Location          | Subject             | Comment                                                                                                                                                                                                                                       | Jacobs' Action/Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----|---------------|----------------------------------------------------|-------------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 364 | 70% Submittal | Steve Jackson, LVVWD                               | LT-04                   | Utilities           | Add Approved For Construction signature block to this sheet.                                                                                                                                                                                  | This has been addressed on the plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 365 | 70% Submittal | Steve Jackson, LVVWD                               | LT-04                   | Utilities           | Add a Callout X to read: Slurry encase sd per uduacs 2.22 10 ft either side of waterline.                                                                                                                                                     | This has been addressed on the plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 366 | 70% Submittal | Steve Jackson, LVVWD                               | LT-04                   | Utilities           | Lat-18, show relocated 10" waterline.                                                                                                                                                                                                         | This has been addressed on the plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 367 | 70% Submittal | Layne Weber, CCPW                                  | G-02                    | Utilities           | Show entity boundaries on location map.                                                                                                                                                                                                       | This has been addressed on the plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 368 | 70% Submittal | Layne Weber, CCPW                                  | HC-03                   | Utilities           | Matchline should reference HC-02                                                                                                                                                                                                              | This has been addressed on the plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 369 | 70% Submittal | Layne Weber, CCPW                                  | SD-01                   | Utilities           | Revise sheet SD-01 to callout the existing RCB size in Ann Rd east and west of rainbow.                                                                                                                                                       | This has been addressed on the plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 360 | 70% Submittal | Layne Weber, CCPW                                  | PP-01                   | Utilities           | It appears manholes should be provided at lateral location.                                                                                                                                                                                   | Manholes are provided at 400-ft intervals where practical at the request of the City of Las Vegas.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 361 | 70% Submittal | Layne Weber, CCPW                                  | PP-01                   | Utilities           | It appears manholes are out of the ground on profile.                                                                                                                                                                                         | Manholes elevations have been checked against the proposed surface on the profile.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 362 | 70% Submittal | Layne Weber, CCPW                                  | PP-01 & PP-02           | Utilities           | Show entity boundary on parcels 125-27-803-001 and 004 and property lines                                                                                                                                                                     | Entity boundaries and property lines have been provided on the plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 363 | 70% Submittal | Layne Weber, CCPW                                  | PP-01 & PP-02           | Utilities           | HGL does not appear to be 1-ft below FG.                                                                                                                                                                                                      | HGL is not 1-ft below ground. Backflow preventors at laterals and slotted manholes are provided with the system.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 364 | 70% Submittal | Layne Weber, CCPW                                  | PP-03                   | Utilities           | Appears plan and profile should extend to station 32+65.95                                                                                                                                                                                    | Stationing has been revised to match the center of the roadway.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 365 | 70% Submittal | Layne Weber, CCPW                                  | PP-04                   | Utilities           | Rotate North Arrow to the correct angle.                                                                                                                                                                                                      | This has been addressed on the plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 366 | 70% Submittal | Layne Weber, CCPW                                  | PP-04                   | Utilities           | Provide an access at the end of system.                                                                                                                                                                                                       | This has been addressed on the plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 367 | 70% Submittal | Layne Weber, CCPW                                  | DT-01                   | Utilities           | Shows PVC in Row, not allowed.                                                                                                                                                                                                                | This detail has been revised, PVC is not shown in ROW.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 368 | 70% Submittal | Layne Weber, CCPW                                  | DT-02                   | Utilities           | Appears more reinforcing is needed around pipe penetration, see section A on DT-04.                                                                                                                                                           | Detail DT-04 is a standard drawing with modifications to add water quality stamp from CCAUSD 421.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 369 | 70% Submittal | Layne Weber, CCPW                                  | DT-03                   | Utilities           | Provide manhole access detail for RCB showing ladder to invert of structure.                                                                                                                                                                  | A ladder has been provided on the details.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 370 | 70% Submittal | NVE Transmission                                   | DT-04                   | Utilities           | Identify transmission poles and easements along Rainbow as shown in the Removal Plans.                                                                                                                                                        | This has been addressed on the plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 371 | 70% Submittal | Scott Gifford, Century Link                        | General                 | Review              | Review of 70% Plans - No Conflicts noted. If during construction conflicts are found CTL will make the needed adjustments where CTL facilities are within R.O.W.                                                                              | Comment Noted                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 372 | 90% Submittal | Randy McConnell, CLV PM                            | Plans Submittal         | Reference Redlines  | See redlined plans.                                                                                                                                                                                                                           | Comments are addressed as noted.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 373 | 90% Submittal | John O'Connell, CLV Public Works Construction Mgt. | Plans Submittal         | Reference Redlines  | See redlined plans.                                                                                                                                                                                                                           | Comments are addressed as noted.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 374 | 90% Submittal | Diane Phommnh, CLV Traffic                         | Plans Submittal         | Reference Redlines  | See redlined plans.                                                                                                                                                                                                                           | Comments are addressed as noted.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 375 | 90% Submittal | Tim Parks, CLV                                     | No. 1 - Comment Matrix  | RM-01 / 10          | All sewer being removed is 12" why is "LESS THAN 15" used in label of removal item #3.                                                                                                                                                        | There is a section of sewer coming off of Scarlett Star Ave. that is 8-inches. The designation has been removed from the removal sheets, but remains in the specification.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 376 | 90% Submittal | Tim Parks, CLV                                     | No. 2 - Comment Matrix  | SD-01 / 11          | Show all sewer utility crossings. (Typical)                                                                                                                                                                                                   | Utility sewer been shown in the plan sheets.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 377 | 90% Submittal | Tim Parks, CLV                                     | No. 3 - Comment Matrix  | GR-02 / 19          | Remove sewer manhole shown in sidewalk left of approximately station 159+25.                                                                                                                                                                  | According to the Final Meeting Notes with the City of Las Vegas dated 07JUL2011, the location of this sewer manhole is necessary and alternative locations are not viable. The meeting notes read, "The sewer manhole and crossing within the Rio Vista Drainage easement were discussed. Jacobs' recommendation is to not disturb the existing walls in the drainage easement by replacing the sewer manhole and 12" main line. Tim agreed that the design can provide for a sewer manhole within the sidewalk which will connect the existing sewer from the easement to the new sewer manhole within Rainbow. This manhole will have the standard 0.2' drop. Jacobs will report the clearance to the City via e-mail to gain approval for the mainline clearance less than 1-foot below the box on the portion of the line that will be replaced." |
| 378 | 90% Submittal | Tim Parks, CLV                                     | No. 4 - Comment Matrix  | SS-01 / 27          | Label proposed sewer manhole in Scarlett Star Ave and Dancing Orchid Ct                                                                                                                                                                       | Proposed sewer manhole is labeled.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 379 | 90% Submittal | Tim Parks, CLV                                     | No. 5 - Comment Matrix  | SS-01 / 27          | Show 6" sewer lateral connection near station 153+50                                                                                                                                                                                          | The 6" lateral connection is shown.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 380 | 90% Submittal | Tim Parks, CLV                                     | No. 6 - Comment Matrix  | SS-02 / 28          | Add "Adjust ssmh to final grade" to Construction Note #40                                                                                                                                                                                     | This note has been added to the plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 381 | 90% Submittal | Tim Parks, CLV                                     | No. 7 - Comment Matrix  | SS-02 / 28          | Remove proposed manhole in sidewalk at approximate station 159+25-46.9' LT and extend proposed pipe connecting directly into existing manhole at approximate station 159+60-72' LT. (manhole not permitted in sidewalk)                       | According to the Final Meeting Notes with the City of Las Vegas dated 07JUL2011, the location of this sewer manhole is necessary and alternative locations are not viable. The meeting notes read, "The sewer manhole and crossing within the Rio Vista Drainage easement were discussed. Jacobs' recommendation is to not disturb the existing walls in the drainage easement by replacing the sewer manhole and 12" main line. Tim agreed that the design can provide for a sewer manhole within the sidewalk which will connect the existing sewer from the easement to the new sewer manhole within Rainbow. This manhole will have the standard 0.2' drop. Jacobs will report the clearance to the City via e-mail to gain approval for the mainline clearance less than 1-foot below the box on the portion of the line that will be replaced." |
| 382 | 90% Submittal | Tim Parks, CLV                                     | No. 8 - Comment Matrix  | SS-04 / 30          | Show 6" C900 lateral connection to 12" sewer main in Rainbow in RCP Crossing Detail #3                                                                                                                                                        | Per discussions with CLV staff, public funds cannot be used to improve private properties. Since the lateral connection is the responsibility of the private land owner, and laterals currently do not exist, the most that can be provided with this project is a sleeve that is not connected to the main.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 383 | 90% Submittal | Tim Parks, CLV                                     | No. 9 - Comment Matrix  | SS-04 / 30          | What does "INSTALL PERMANENT" reference mean?                                                                                                                                                                                                 | This note has been updated on plans, the intent is to provide a future location where homeowners can tie into the sewer main in Rainbow Boulevard if they choose to abandon their current septic systems.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 384 | 90% Submittal | Tim Parks, CLV                                     | No. 10 - Comment Matrix | SS-04 / 30          | 2% minimum slope required on proposed sewer laterals. (Lateral Reconnection Around SD Detail #2)                                                                                                                                              | This note has been revised to provide the minimum slope.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 385 | 90% Submittal | Peter Jackson, CLV Flood Control                   | No. 1 - Comment Letter  | Drainage Memorandum | Flood Control takes no exception to the overall Hydrology presented as it complies with the overall drainage parameters. Provide an electronic copy of the HEC-1 analysis including both input and output files with the Final Design Report. | Comment Noted, and electronic copy of the HEC-1 will be provided with the Final Design Report.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |





City of Las Vegas Department of Public Works  
ANN ROAD CHANNEL WEST RAINBOW BOULEVARD - HANSEN NO. 36801

Comment Matrix for  
30%, 70% and 90% Submittals

| No. | Design Phase  | Reviewer/Source                  | Sheet/Location          | Subject             | Comment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Jacobs Action/Response                                                                                                                                                                                                                                                                    |
|-----|---------------|----------------------------------|-------------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 386 | 90% Submittal | Peter Jackson, CLV Flood Control | No. 2 - Comment Letter  | Drainage Memorandum | The revised WSPG analysis dated 10-10-2011 has incorporated revising the main line RCB for the proposed Rainbow storm drain system. The main line RCB between the existing Ann Road stub and the drainage easement confluence north of El Campo Grande has been revised to reflect an 11' x 5' RCB. Two main line WSPG runs were provided; one using the drainage easement flow as the primary facility and the second using the flow impact from Tropical Parkway as the primary facility. The drainage easement flow WSPG analysis (File: lanrch.wsw) needs to be updated to remove the surface channel within the drainage easement and to use the culvert entrance ponding condition as the upstream control for the WSPG analysis. Include the final WSPG analysis within the electronic data included with the Final Design Report. | The revised WSPG analyses have been provided in the final report under Figure D-6 and D-7, all updates have been addressed accordingly. An electronic copy of the WSPG analysis is included with the Final Design Report.                                                                 |
| 387 | 90% Submittal | Peter Jackson, CLV Flood Control | No. 3 - Comment Letter  | Drainage Memorandum | Revise the storm drain plans and Figure D-4 to match the HEC-1 concentration point flows and illustrated on Figure C-10.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | The storm drain plans and Figure D-4 have been updated accordingly.                                                                                                                                                                                                                       |
| 388 | 90% Submittal | Peter Jackson, CLV Flood Control | No. 4 - Comment Letter  | Drainage Memorandum | Revise the storm drain plans with the 99% submittal to reflect the reduction in size of the storm drain to an 11' x 5' RCB based upon the revised WSPG analysis between the existing Ann Road stub and the drainage easement confluence north of El Campo Grande.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | The 99% submittal shows the reduced RCB box size to 11' X 5'.                                                                                                                                                                                                                             |
| 389 | 90% Submittal | Peter Jackson, CLV Flood Control | No. 5 - Comment Letter  | Drainage Memorandum | Provide an updated detailed cost estimate with the next submittal for review. The cost estimate must be refined prior to the request for construction funding to assure that the requested and allocated storm drain funds are sufficient for construction. Flood Control anticipates submitting a request for construction funding for placement on the Estimated Funding Schedule from CCRFCD upon receipt of the 99% plans.                                                                                                                                                                                                                                                                                                                                                                                                            | An updated cost estimate has been provided and can also be found in the Final Design Report under Figure A-6. Figure A-6 reflects the cost estimate as submitted with the 99% plans, any subsequent estimates will need to be obtained from the City of Las Vegas.                        |
| 390 | 90% Submittal | Peter Jackson, CLV Flood Control | No. 6 - Comment Letter  | Drainage Memorandum | Provide structural details and sections for the transition structure near Station 158+82.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Structural details of the transition structure have been provided.                                                                                                                                                                                                                        |
| 391 | 90% Submittal | Peter Jackson, CLV Flood Control | No. 7 - Comment Letter  | Drainage Memorandum | Flood Control recommends that the trash rack proposed for the drainage easement culvert entry be removed. The easement area is proposed to have wrought iron fencing and gates to limit access.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | The trash rack has been removed from the culvert entrance.                                                                                                                                                                                                                                |
| 392 | 90% Submittal | Peter Jackson, CLV Flood Control | No. 8 - Comment Letter  | Drainage Memorandum | Flood Control has reviewed the sidewalk trench drain proposed for the Street Knuckle shown on Sheet CD-01 with the Operations and maintenance Department for maintenance concerns. Based upon the maintenance review, eliminate the proposed trench drain and keep the existing sidewalk under drain for the nuisance flow at the street. Connect the u-channel into the existing sidewalk under drain.                                                                                                                                                                                                                                                                                                                                                                                                                                   | The existing sidewalk trench drain has been maintained and the U-Channel has been connected into the sidewalk under drain.                                                                                                                                                                |
| 393 | 90% Submittal | Peter Jackson, CLV Flood Control | No. 9 - Comment Letter  | Drainage Memorandum | The Final Design Report needs to include an expanded discussion on the utility conflicts along the RCB alignment and the impacts on the project construction. Update the Utility Conflict Location Exhibit, Figure A3, to reflect the additional pothole utility information.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | The Final Design Report has included and updated discussion on the utility conflict and figure A-3 has been updated to include addition information as obtained by the potholes.                                                                                                          |
| 394 | 90% Submittal | Peter Jackson, CLV Flood Control | No. 10 - Comment Letter | Drainage Memorandum | Update the storm drain profiles to reflect the proposed sewer system crossings, including the residential lateral facility connections. Where sewer lateral stubs are being placed under the new RCB storm drain, provide a plan note requiring that the ends of the stubs be as-built to verify sewer stub elevations and slopes. This information needs to also be covered within the Specifications.                                                                                                                                                                                                                                                                                                                                                                                                                                   | All comments have been incorporated onto the plans and into the specifications as noted.                                                                                                                                                                                                  |
| 395 | 90% Submittal | Peter Jackson, CLV Flood Control | No. 11 - Comment Letter | Drainage Memorandum | Provide additional detailed grading plan information for the storm drain collection system at the Rio Vista Estates development. Provide headwall details that include wrought iron fencing for security and access. Add the wrought iron fencing detail to the plans, including the wall connections.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Additional information has been provided on the plans.                                                                                                                                                                                                                                    |
| 396 | 90% Submittal | Peter Jackson, CLV Flood Control | No. 12 - Comment Letter | Drainage Memorandum | Provide details for the RCB construction. System design needs to accommodate the construction option of pre-cast or cast-in-place improvements. Verify that the Specifications and the time schedule for construction accommodate the construction methods.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Additional details have been provided for RCB construction. The specification accommodate either pre-cast or cast-in-place options. The time schedule for construction has been verified.                                                                                                 |
| 397 | 90% Submittal | Peter Jackson, CLV Flood Control | No. 13 - Comment Letter | Drainage Memorandum | The drop inlets proposed for Tropical Parkway (DI-TP01- TP05) should not include the installation of dual check valves (flapper valves) in the lateral pipe for these inlets.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | These check valves have been removed.                                                                                                                                                                                                                                                     |
| 398 | 90% Submittal | Peter Jackson, CLV Flood Control | No. 14 - Comment Letter | Drainage Memorandum | Flood Control recommends that the proposed 6' x 2' laterals for Inlets DI-TR01 & TR02 be reviewed. It appears that 30" RCP laterals at a steeper slope may be a value engineering option.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | This lateral size has been revised to 30" RCP.                                                                                                                                                                                                                                            |
| 399 | 90% Submittal | Peter Jackson, CLV Flood Control | No. 15 - Comment Letter | Drainage Memorandum | Update the lateral and inlet design information to include water and/or sewer relocations with the next submittal. Provide the clearance between storm drain and the water & sewer lines. Provide encasement requirements and details. Crossings of the existing 36-inch water line may require special details, especially where the RCB has shallow crossings over the water line. Verify that the foam layer is the only requirement from the LVVWD at the shallow RCB crossings. Recommend that the there are no joints on the RCB at the box crossing of the 36-inch water line.                                                                                                                                                                                                                                                     | All lateral and sewer relocations and details are provided on the SS sheets and the UT sheets. LVVWD has reviewed and accepted the foam layer cover on the 36" water crossing. The detail has been updated to recommend that no joints are to be over the crossing of the 36" water line. |
| 400 | 90% Submittal | Peter Jackson, CLV Flood Control | No. 16 - Comment Letter | Drainage Memorandum | The existing and proposed utility crossings of the storm drain must be shown on the storm drain plan and profiles sheets and on the lateral profiles. Indicate the type of material of water and sewer lines. ACP will require special consideration and handling and must be addressed in the specifications.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | The utility are shown on the plans and profile sheets along with the lateral profiles. There will be no ACP required for this project.                                                                                                                                                    |
| 401 | 90% Submittal | Peter Jackson, CLV Flood Control | No. 17 - Comment Letter | Drainage Memorandum | Clearly identify the required utility relocations and which relocations are incidental to and part of the storm drain work. Revise the cost estimate to remove the incidental costs. Add a note on the construction plans indicating which water line relocations are incidental to and part of the storm drain work. Verify that the Specifications cover these incidental items accordingly.                                                                                                                                                                                                                                                                                                                                                                                                                                            | Each utility relocation is called out by which utility will be moving their appurtenances. The cost estimate and specifications have been updated accordingly.                                                                                                                            |
| 402 | 90% Submittal | Peter Jackson, CLV Flood Control | No. 18 - Comment Letter | Drainage Memorandum | Provide separate plan and profiles for relocated sewer and/or water lines with the next submittal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Separate plan and profiles for sewer and water lines are provided on the SS and UT sheets.                                                                                                                                                                                                |
| 403 | 90% Submittal | Peter Jackson, CLV Flood Control | No. 19 - Comment Letter | Drainage Memorandum | Include the USDOCA Drawing No. 421 (Stormwater Quality Management Stamp and Sign Detail) note to the concrete collar detail for the NDOT Type 2B inlets.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | This note has been added to the plans.                                                                                                                                                                                                                                                    |
| 404 | 90% Submittal | Peter Jackson, CLV Flood Control | No. 20 - Comment Letter | Drainage Memorandum | Provide grading design information to collect the flows at the NDOT Type 2B area inlets.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | All grading design has been incorporated into the GR sheets.                                                                                                                                                                                                                              |
| 405 | 90% Submittal | Peter Jackson, CLV Flood Control | No. 21 - Comment Letter | Drainage Memorandum | Identify the existing driveway locations and verify that the construction of the inlets will not impact these existing driveways. Provide grading information as necessary for the inlet construction.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Grading and driveway plans are shown on the GR sheets. All driveways have been verified.                                                                                                                                                                                                  |
| 406 | 90% Submittal | Peter Jackson, CLV Flood Control | No. 22 - Comment Letter | Drainage Memorandum | Provide updated pavement sections that reflect replacement of existing roadway improvements, not full street reconstruction as identified in the Geotechnical report from original RTC roadway project.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Updated pavement sections have been provided. According the pothole information along with the Geotechnical borings, the pavement sections range from 4" to 6", a 5" sections has been provided.                                                                                          |
| 407 | 90% Submittal | Peter Jackson, CLV Flood Control | No. 23 - Comment Letter | Drainage Memorandum | Provide updated grading and paving to accommodate the intersection transition at the Rainbow and El Campo Grande intersection.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | An updated grading and pavement section has been provided at the intersection transition at Rainbow and El Campo Grande.                                                                                                                                                                  |
| 408 | 90% Submittal | Peter Jackson, CLV Flood Control | No. 24 - Comment Letter | Drainage Memorandum | Include a copy of the Updated Geotechnical Report letter under Section I, 7 of the Final Report.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | A copy of the Updated Geotechnical Report has been included in the Final Design Report, see Appendix F, Figure F-1 and F-2.                                                                                                                                                               |

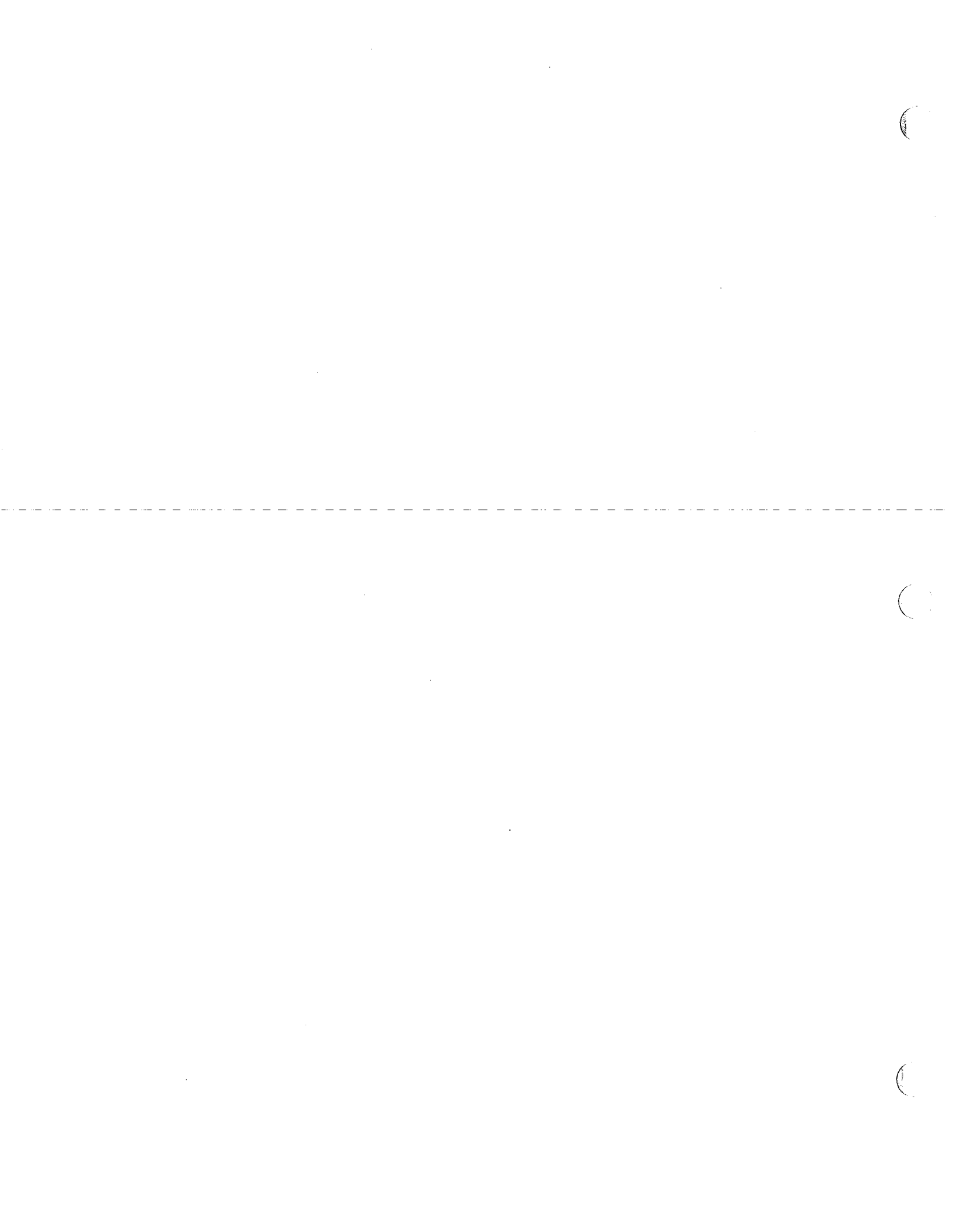


City of Las Vegas Department of Public Works  
ANN ROAD CHANNEL WEST RAINBOW BOULEVARD - HANSEN NO. 36801

Comment Matrix for  
30%, 70% and 90% Submittals

| No. | Design Phase  | Reviewer/Source                  | Sheet / Location        | Subject             | Comment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Jacobs Action/Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----|---------------|----------------------------------|-------------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 409 | 90% Submittal | Peter Jackson, CLV Flood Control | No. 25 - Comment Letter | Drainage Memorandum | The Final Design report needs to include an electronic copy of the entire report with the input and output files for the hydraulics and hydrology.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | The input and outputs files are included with the final design reports.                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 410 | 90% Submittal | Peter Jackson, CLV Flood Control | No. 26 - Comment Letter | Drainage Memorandum | Additional comments are shown on the attached 90% storm drain plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Comments are addressed as noted.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 411 | 90% Submittal | Todd L. Myers, RFCD              | No. 1 - Comment Letter  | General             | 1. As requested by District, Jacobs revised WSPG analyses for mainline MPU facility to incorporate flows established at Combination Points within hydrologic analysis presented in the project Design Report. The revised hydraulic (WSPG) analyses resulted in re-sizing the main line to an 11-ft x 5-ft RCB, from Ann Road north to the drainage easement confluence near Station 159+00.                                                                                                                                                                                                                                                                                                                                                                                                                            | The plans have been updated to illustrate the 11' x 5' box.                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 412 | 90% Submittal | Todd L. Myers, RFCD              | No. 2 - Comment Letter  | General             | 2. Please provide the following, prior to request for construction funding:<br>a. Updated plans revised to reflect results from revised WSPG analyses;<br>b. Updated engineers cost estimate revised to reflect reduced RCB size and additional comments as noted below.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Updated plans and cost estimate will be provided prior to construction funding.                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 413 | 90% Submittal | Todd L. Myers, RFCD              | No. 3 - Comment Letter  | General             | 3. A facility-specific environmental analysis in accordance with Chapter 8 of District's Supplemental Programmatic Environmental Impact Statement, Clark County Regional Flood Control District, 2002 Master Plan Update, September 2004 was accepted by District on February 18, 2011. The District's Policies and Procedures regarding environmental permitting as a pre-requisite for construction funding eligibility have been satisfied.                                                                                                                                                                                                                                                                                                                                                                          | Comment is noted.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 414 | 90% Submittal | Todd L. Myers, RFCD              | No. 4 - Comment Letter  | General             | 4. Identify all right-of-way (ROW) and easement acquisition requirements for this project. All ROW/easements must be acquired prior to City's final request for construction funding.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | A temporary construction easement is required for parcels 126-23-304-005, 006 & 007. Jacobs has submitted easement descriptions dated July 11, 2011 to the City for review.                                                                                                                                                                                                                                                                                                                                                     |
| 415 | 90% Submittal | Todd L. Myers, RFCD              | No. 5 - Comment Letter  | General             | 5. Provide draft copy of Special Provisions with all submittals.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Special provisions will be provided for all submittals.                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 416 | 90% Submittal | Todd L. Myers, RFCD              | No. 6 - Comment Letter  | Report              | 6. Please provide Final Design Report that incorporates all revisions to date, with next submittal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | The Final Design Report incorporates all revisions to date.                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 417 | 90% Submittal | Todd L. Myers, RFCD              | No. 7 - Comment Letter  | Cost Estimate       | 7. Cost Estimate: Address the following prior to funding request:<br>a. Item 302.01: The quantity of Type II Aggregate Base appears high. Please note that District's policy is to replace street "in kind". Based on Geotechnical Report, the majority of the existing structural section is 4-inch AC over 12-inch Type II. Verify and revise accordingly;<br>b. Item 402.01: See "a." above. Revise AC surface to match existing section;<br>c. Item 402.02: Delete, or only use where RCB has less than 1-ft of cover;<br>d. Items 502.01 - .07: Update based on revised RCB sizes;<br>e. Item 624.01: Based on the scope of work, and recent bids on similar projects, the unit cost appears high.<br>f. Item 630.02: Based on the scope of work, and recent bids on similar projects, the unit cost appears high. | a. Item 302.01: Updated pavement sections have been provided. According to the pothole information along with the Geotechnical borings, the pavement sections range from 4 to 6", a 5" sections has been provided;<br>b. Item 402.01: See "a." above.<br>c. Item 402.02: This has been removed from the plans.<br>d. Items 502.01 - .07: This has been updated.<br>e. Item 624.01: Unit costs have been revised.<br>f. Item 630.02: This cost likely appears high due to the inclusion of bypass pumping within the unit price. |
| 418 | 90% Submittal | Todd L. Myers, RFCD              | No. 8 - Comment Letter  | Hydraulics          | 8. District has reviewed and accepts the revised WSPG analyses dated October 10, 2011 with the following exception:<br>a. Consider revising WSPG 1a nch.wsw to remove open channel section of the drainage easement and terminate WSPG at wall entrance (downstream end of drainage easement). Provide separate culvert inlet control analysis to determine upstream water surface elevation to incorporate in WSPG.                                                                                                                                                                                                                                                                                                                                                                                                    | The WSPG has been revised as requested.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 419 | 90% Submittal | Todd L. Myers, RFCD              | No. 9 - Comment Letter  | Plans               | 9. I have provided only a cursory review of the 90% plans at this time. A complete review will be provided once the plans have been revised to incorporate changes resulting from the revised WSPG.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Comment noted.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 420 | 90% Submittal | Todd L. Myers, RFCD              | No. 10 - Comment Letter | Plans               | 10. Sheet G-03: Delete "Soils Report" note. The Soils Report is not a part of the construction contract documents. The specifications must be clear that the soils report is for informational purposes only. Provide recommendations, as necessary, within project Special Provisions and/or on plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | The soils report note has been removed and the specifications state that the soils report is for information purposes only.                                                                                                                                                                                                                                                                                                                                                                                                     |
| 421 | 90% Submittal | Todd L. Myers, RFCD              | No. 11 - Comment Letter | Plans               | 11. Sheet TY-01 and -02: Please note that District's policy is to replace street "in kind". Based on Geotechnical Report, the majority of the existing structural section is 4-inch AC over 12-inch Type II. Revise accordingly;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Updated pavement sections have been provided. According to the pothole information along with the Geotechnical borings, the pavement sections range from 4" to 6", a 5" asphalt sections has been provided.                                                                                                                                                                                                                                                                                                                     |
| 422 | 90% Submittal | Todd L. Myers, RFCD              | No. 12 - Comment Letter | Plans               | 12. Sheet RM-01: Revise relocation notes to specify who will perform work instead of "by others". Typical all.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | This has been updated with the plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 423 | 90% Submittal | Todd L. Myers, RFCD              | No. 13 - Comment Letter | Plans               | 13. Sheet SD-02: Provide details for confluence structure near Station 159+00. Clarify in Special Provisions that this structure can be constructed as pre-cast or cast-in-place construction.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | The plans and specifications have been updated accordingly.                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 424 | 90% Submittal | Todd L. Myers, RFCD              | No. 14 - Comment Letter | Plans               | 14. Sheet SD-04, SD-07: I'm unclear why 5' x 2' RCB is called out for proposed laterals from DI-TP01 and DI-TP02. If there is a conflict, show it on lateral profile. Otherwise, a 30-inch RCP at roughly 3% slope is adequate to convey flow. Revise accordingly.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | The original analysis accounted for highly pressurized flow at the upstream end. The revised WSPG analysis illustrates a lower HGL in this location; these laterals have been revised to 30".                                                                                                                                                                                                                                                                                                                                   |
| 425 | 90% Submittal | Todd L. Myers, RFCD              | No. 15 - Comment Letter | Plans               | 15. Sheet CD-01: Considering that the Drainage Easement will be fenced (wrought iron) at the upstream and downstream sections, with no public access, District recommends deleting proposed trash rack.<br>a. Section A-A calls out CLSM to fill all spaces between proposed channel wall and existing privacy/retaining wall. This will require a very large volume of CLSM. Please justify using CLSM, or consider using a typical structural backfill or crushed rock if acceptable to City.                                                                                                                                                                                                                                                                                                                         | The trash rack has been removed from the culvert entrance. The amount of CLSM has been reviewed for the 90% submittal. All CLSM called out on plans are necessary for the construction within the easement which will not impact the existing walls.                                                                                                                                                                                                                                                                            |
| 426 | 90% Submittal | Todd L. Myers, RFCD              | No. 16 - Comment Letter | Plans               | 16. DT Sheets: Provide all construction details required to construct RCB system including but not limited to non-standard details for RCB junction structures, transitions, connections, MH's, special DI's, collars, fencing and flood walls.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | All details have been provided on the plans.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 427 | 90% Submittal | Todd L. Myers, RFCD              | No. 17 - Comment Letter | Plans               | 17. Sheet DT-01: Revise "Trench Detail for Box Culvert" to require 18-inch minimum clearance from outside of RCB to trench wall if standard backfill is used, and consider allowing contractor to reduce trench width to 6- or 8-inches from outside of RCB to trench wall if CLSM is used.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | The trench details have been revised accordingly.                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

APPENDIX H



END OF REPORT