Rancho Road System
Storm Drain - Elkhorn

Preliminary Design Report

Prepared for:

CITY OF Las Vegas

Prepared by:

MWH now part of Stantec

July 11, 2017

MWH now part of Stantec
3010 West Charleston Boulevard, Suite 100
Las Vegas, NV 89102

July 11, 2017

Attention: Lorrie Linnert Dunford, PE, CEM
City of Las Vegas
Capital Project Management
333 North Rancho Drive, 9th floor
Las Vegas, NV 89106

Dear Ms. Dunford,

Reference: Rancho Road System Storm Drain – Elkhorn, Preliminary Design Report

We are pleased to submit to you the Preliminary Design Report for the Rancho Road System Storm Drain – Elkhorn project. It is a pleasure working with the City of Las Vegas team and we look forward to your comments and feedback to move forward with the final design. To maintain the project plan and on-time delivery, we are requesting that review comments be returned by August 2, 2017 per the baseline schedule.

If you have questions or require additional information, please do not hesitate to contact this office.

Sincerely,

Raul Valdez
FOR:

Jarah Parke, PE, PMP, CFM
Project Manager
Phone: 702.878.8010
Fax: 702.878.7833
jarah.parke@stantec.com

Enclosure: Rancho Road System Storm Drain – Elkhorn, Preliminary Design Report

Sign-Off Sheet

This document entitled Rancho Road Storm Drain – Elkhorn Preliminary Design Report was prepared by MWH, now part of Stantec for the account of the City of Las Vegas. Any reliance on this document by any third party is strictly prohibited. The material in it reflects MWH, now part of Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between MWH, now part of Stantec and the City of Las Vegas. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, MWH, now part of Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that MWH, now part of Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by _____ (signature)

Raul Valdez, PE, CFM

Reviewed by _____ (signature)

Charles Kajkowski Jr., PE

Table of Contents

EXECUTIVE SUMMARY i

1.0 EXISTING CONDITIONS **1.1**
1.1 RIGHT-OF-WAY 1.2
1.2 EXISTING UTILITIES 1.2
1.3 ADJACENT FLOOD CONTROL FACILITIES 1.6
1.4 PROJECT CORRIDOR EXISTING CONDITION PHOTOGRAPHS 1.7

2.0 DESIGN CRITERIA **2.1**

3.0 DRAINAGE AND HYDRAULICS DESIGN **3.1**
3.1 PROJECT OVERVIEW AND STUDY PURPOSE 3.1
3.2 SITE DESCRIPTION 3.1
3.3 FEMA FLOOD ZONE 3.2
3.4 CCRFCD MASTER PLAN AND CITY OF LAS VEGAS NEIGHBORHOOD STUDY INFORMATION 3.2
3.5 REFERENCED DRAINAGE STUDIES AND DESIGN REPORTS 3.2
3.6 HYDROLOGIC METHODOLOGY AND PARAMETERS 3.3
3.7 HYDROLOGIC ANALYSIS 3.5
3.8 HYDRAULICS 3.9
3.9 FINAL RECOMMENDATION 3.12

4.0 STORM DRAIN IMPROVEMENTS **4.1**

5.0 RECORD OF SURVEY **5.1**

6.0 ENVIRONMENTAL PERMITTING **6.1**
6.1 CHAPTER 8 PROJECT-SPECIFIC ENVIRONMENTAL ANALYSIS 6.5

7.0 GEOTECHNICAL **7.1**

8.0 PROJECT COST ESTIMATE **8.1**

9.0 CONCLUSION **9.1**

LIST OF FIGURES

Figure 1.1 Site Vicinity Map 1.1
Figure 1.2 Project Location Street Level Overview 1.7
Figure 1.3 Elkhorn Road at N. Grand Canyon Drive Intersection (Looking West) 1.8
Figure 1.4 Elkhorn Road at Jensen Street Intersection (Looking West) 1.8
Figure 1.5 Elkhorn Road at Rhinehart Way Intersection (Looking West) 1.9
Figure 1.6 Elkhorn Road atConquistador Street Intersection (Looking West) 1.9
Figure 1.7 Elkhorn Road at Eula Street Intersection (Looking West) 1.10
Figure 1.8 Elkhorn Road at Eula Street Intersection (Looking East) 1.10

Figure 1.9 Elkhorn Road at N. Hualapai Way Intersection (Looking East)..... 1.11
Figure 1.10 Elkhorn Road at N. Hualapai Way Intersection (Looking West)..... 1.11
Figure 1.11 Elkhorn Road (West of N. Hualapai Way), Looking North at Overflow Weir Structure..... 1.12
Figure 1.12 Overflow Weir Structure (Looking West)..... 1.12

LIST OF TABLES

Table 2.1 Drainage Design Criteria..... 2.1

Table 3.1 Soil HSG Breakdown Comparison Summary..... 3.4
Table 3.2 Soil Composition and Curve Numbers..... 3.5
Table 3.3 100-Year Peak Flow Comparison..... 3.6
Table 3.4 Sub-Basin Local Flow Analysis - Ultimate Condition..... 3.8
Table 3.5 Combination Point Local Hydrologic Analysis - Ultimate Condition..... 3.9
Table 3.6 Hydraulic Section Calculations Summary 100-Year Flows..... 3.10
Table 3.7 Hydraulic Section Calculations Summary 10-Year Flows..... 3.10
Table 3.8 Drop Inlet Summary..... 3.11

Table 6.1 Summary Matrix of Potential Required Permits..... 6.2

LIST OF APPENDICES

APPENDIX A RIGHT-OF-WAY..... A.1
A.1 Right-of-Way Figures
A.2 Patent Easement Legal Descriptions

APPENDIX B EXISTING UTILITIES..... B.1
B.1 Utility Crossing Matrix
B.2 Utility Potholes
B.3 Utility SUE Drawings

APPENDIX C ADJACENT FLOOD CONTROL FACILITIES..... C.1
C.1 Downstream Storm Drain Facility Record Drawings
C.2 Upstream Storm Drain Facility Record Drawings
C.3 Hualapai Way Local Storm Drain Facility Record Drawings

APPENDIX D DRAINAGE AND HYDRAULICS..... D.1
D.1 Drainage Figures
D.2 Soils Data
D.3 Louis Berger Group Reference Material
D.4 Slater Hanifan Group Reference Material
D.5 Triton Reference Material
D.6 VTN Reference Material
D.7 Standard Form 4 Calculations
D.8 HEC-1 Hydrologic Model
D.9 Rainfall Calculations

D.10 Curve Number Calculations
D.11 Street Hydraulic Section Calculations Continued
D.12 Drop Inlet Section Calculations
D.13 Mainline WSPG Hydraulic Analyses (n=0.013)
D.14 Mainline WSPG Hydraulic Analyses (n=0.015)
D.15 Lateral WSPG Hydraulic Analyses

APPENDIX E PRELIMINARY 30% DESIGN DRAWINGS E.1

APPENDIX F RECORD OF SURVEY F.1

APPENDIX G PERMITTING G.1
G.1 Chapter 8 Project-Specific Environmental Analysis
G.2 Chapter 8 Project-Specific Environmental Analysis Approval Correspondence

APPENDIX H GEOTECHNICAL REPORT H.1

APPENDIX I OPINION OF PROBABLE CONSTRUCTION COST I.1

Executive Summary

EXECUTIVE SUMMARY

The Rancho Road System Storm Drain - Elkhorn Project objective is to design and construct a storm drain system designated in the 2013 Clark County Regional Flood Control District (CCRFCD) Master Plan as regional facility RCHB 0295. The regional facility spans approximately 2,900 linear feet (LF) extending from the intersection of Elkhorn Road and N. Hualapai Way to an existing storm drain located 150 feet west of the intersection of Elkhorn Road and N. Grand Canyon Drive. The associated work will construct a new main line storm drain, drop inlets, laterals, and other necessary appurtenances to make a complete, serviceable, and functional flood control system.

MWH, now part of Stantec is responsible for Project management and the preparation of design reports and construction documents, including preparation of the Chapter 8 Project-Specific Environmental Analysis. Several sub consultants are also providing support with the preparation of the design report and construction documents. Sub consultants and their responsibilities are summarized as follows: VTN is conducting field survey mapping services and providing the record of survey; Ninyo & Moore is providing geotechnical support services and preparation of the geotechnical report; and KCI Engineering is providing subsurface utility exploration and utility subsurface potholing services.

Section 1.0 – Existing Conditions documents the existing storm drain facilities, utilities, above ground features, and other considerations used in developing the 30% Preliminary Design of the storm drain system. Key topics are summarized below:

- Right-of-Way – All work is expected to be within the public right-of-way and existing patent easements. However, additional temporary construction easements are anticipated in three parcels for the purpose of providing additional space for construction activities.

- Existing crossing and proximal utilities have been identified. Preliminary design took into account the locations of existing utilities that may have an impact on the design alignment of the main storm drain and laterals. The utility issues and conflicts summary includes a list of the key issues which may impact design and construction activities.

- Adjacent Project data was used to determine the upstream and downstream facility connection points and structure type and sizing.

Section 2.0 – Design Criteria summarizes the agency criteria used in drainage study and storm drain facility design, as indicated in the CCRFCD *Hydrologic Criteria and Drainage Design Manual* (HCDDM).

Section 3.0 – Drainage Design documents the methodology used for the calculation of design flows and facility sizing. Reference data from previous design studies that were reviewed and incorporated into the hydrologic and hydraulic design is included in **Appendix D** of this report.

Section 4.0 – Storm Drain Improvements summarizes the size and configuration of proposed storm drain facilities including the main alignment and associated laterals. The 30% Preliminary Design Drawings, including General and Civil plans, are provided in **Appendix E** of this report.

Section 5.0 – Record of Survey includes a summary of the required survey monumentation and mapping documents. The submitted Record of Survey is included in **Appendix F** of this report.

Section 6.0 – Permitting includes a summary matrix of potential required permits to be obtained during the design and construction of the Project. A Chapter 8 Project-Specific Environmental Analysis was also performed, submitted, and approved by CCRFCD as part of the design permitting process. The Chapter 8 Project-Specific Environmental Analysis and related acceptance correspondence are provided in **Appendix G.1** and **Appendix G.2**, respectively.

Section 7.0 – Geotechnical provides a summary of the geotechnical data and considerations that are pertinent to the design and construction of the Project. The geotechnical analysis documents are provided in **Appendix H** of this report.

Section 8.0 – Preliminary Cost Estimate summarizes the Class IV Opinion of Probable Construction Cost (OPCC) estimate per the AACE International guidelines. The anticipated cost to construct this Project is between $2,861,000 and $4,040,000. The complete quantity and cost breakdown is provided in **Appendix I** of this report.

Section 9.0 – Conclusion provides a summary of the findings of this Preliminary Design Report.

Section 1

1.0 EXISTING CONDITIONS

The Rancho Road System Storm Drain - Elkhorn Project objective is to design and construct a storm drain system designated in the 2013 Clark County Regional Flood Control District (CCRFCD) Master Plan as facility RCHB 0295. The regional facility spans approximately 2,900 linear feet (LF) extending from the intersection of Elkhorn Road and N. Hualapai Way to an existing storm drain located 150 feet west of the Elkhorn Road and N. Grand Canyon Drive intersection (**Figure 1**). The associated work will construct a new main line storm drain, drop inlets, laterals, and other necessary appurtenances to make a complete, serviceable, and functional flood control system. To assist in the development of the Project design, an assessment of the existing conditions, including an examination of potential right-of-way and utility conflicts, in the Project vicinity was conducted.

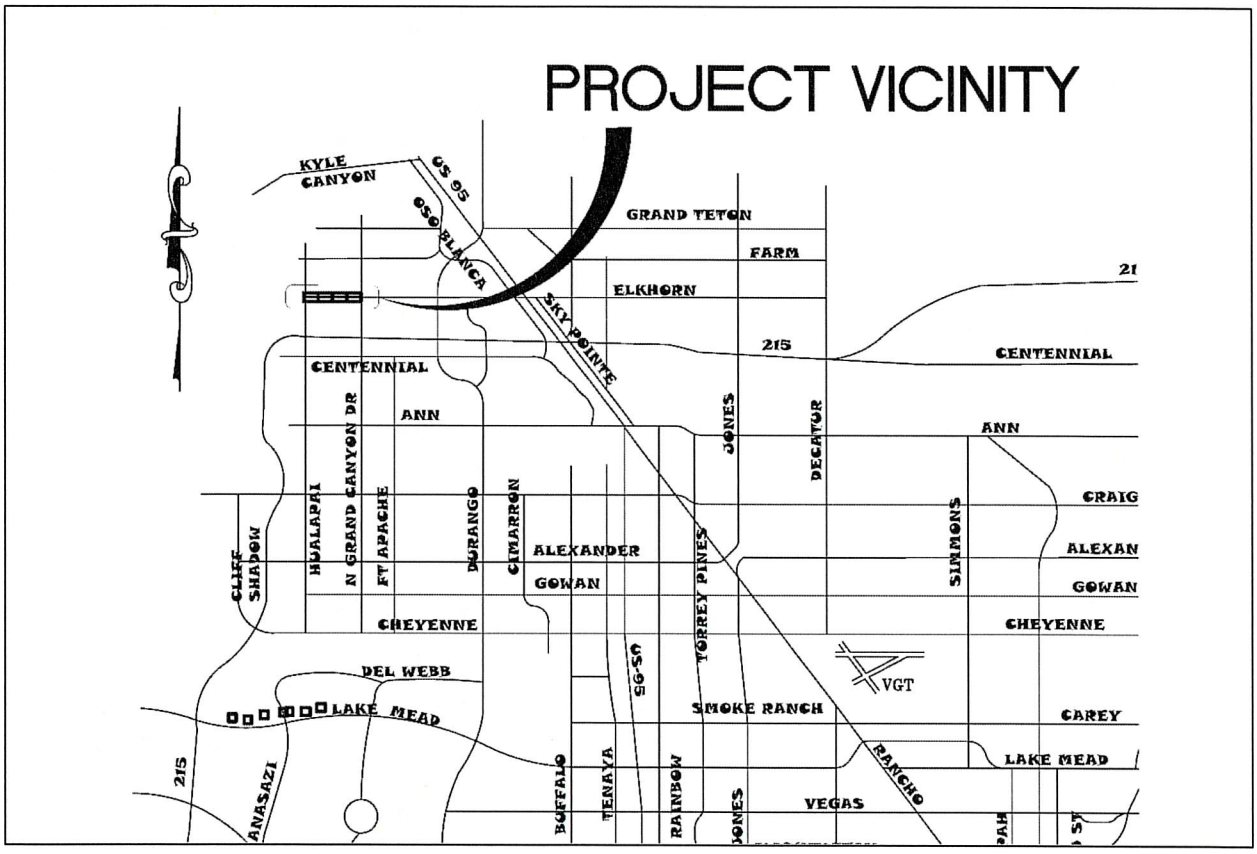


Figure 1 Site Vicinity Map

1.1 RIGHT-OF-WAY

The Rancho Road System Storm Drain – Elkhorn Project alignment runs through a corridor that consists of a combination of areas that are designated as public right-of-way and patent easements along Elkhorn Road. The upstream corridor segment of the Project, from N. Hualapai Way to Eula Street, consists of a 55-foot wide public right-of-way on the north side of the centerline and an existing 33-foot wide patent easement on the south side of the centerline of Elkhorn Road. Beginning at Eula Street and ending at approximately 240 feet west of Jensen Street, the Project corridor consists of 100-foot wide right-of-way centered on the Elkhorn Road centerline. The downstream corridor segment of the Project, west of Grand Canyon Drive, consists of a 45-foot wide public right-of-way on the south side of the centerline, and an existing 33-foot wide patent easement on the north side of the centerline of Elkhorn Road. Discussions have been held with the City of Las Vegas with respect to the patent easements located where full right-of-way is absent along Elkhorn Road. According to the City, the 33-foot wide patent easements along the project corridor can be utilized for placement of utilities (inclusive of storm drain). Based on these discussions, segments of the storm drain alignment have been situated within the patent easements in order to avoid excessive utility conflicts.

Existing right-of-way, along with patent easement limits are depicted in the right-of-way figures, which can be found in **Appendix A**. Three 15-foot wide temporary construction easements (TCEs) are recommended to be obtained within the limits of parcels 125-19-101-010, 125-19-102-002, and 125-18-403-003, to give the contractor additional working space during construction and to facilitate traffic control in this area. Patent easement legal descriptions can been found in **Appendix A**. The approximate location of TCEs are also depicted on the right-of-way figures in **Appendix A**.

1.2 EXISTING UTILITIES

Utility record drawings and as-built information was requested for existing facilities located along the Project alignment. Specifically, the following agencies were contacted:

- City of Las Vegas – Flood Control and Sanitary Sewer Divisions
- Kinder Morgan Petroleum and Kern River Gas
- Southwest Gas Corporation
- NV Energy Transmission and Distribution
- Southern Nevada Water Authority
- Las Vegas Valley Water District
- Century Link
- Cox Cable
- AT&T Communications

- Zayo Group

Several utilities identified along the Project alignment have been determined to be of critical nature, which impact the proposed storm drain improvements. To determine the exact location of the existing critical utilities, KCI, Inc., a sub-surface utility engineering (SUE) consultant, was sub-contracted to perform ten subsurface pothole investigations along the main alignment. Based on the extensive number of existing facilities along the Project corridor, it is recommended that additional potholes be performed during the final design phase to locate the utilities that were not captured in the original pothole investigations.

A set of SUE drawings has been prepared depicting the various existing utilities and the level of investigation (A through D) for the Project corridor. A utilities conflict matrix has also been prepared that summarizes all the utility crossings along the main line storm drain, as well as laterals. The SUE drawings, utilities conflict matrix, pothole data sheets, and list of additional recommended potholes are provided in **Appendix B.** A summary of the major utilities and their impact to the proposed improvements is provided as follows.

1.2.1 ELECTRICAL DISTRIBUTION DUCTBANKS

According the record drawing information received by NV Energy, major electrical distribution facilities are located within Elkhorn Road. These facilities are denoted as buried conduits with conductors. Major distribution conduit runs are typically concrete encased for protection. The electrical distribution facilities impacting the Project corridor are summarized as follows:

- Elkhorn Road – west of N. Hualapai Way: Electrical conduit is shown on both the north and south sides of Elkhorn Road, within the sidewalk limits. These conduits could impact proposed drop inlets located on the north and south side of Elkhorn Road.

- Elkhorn Road – between N. Hualapai Way and Eula Street: Three major electrical conduit runs shown in the middle of the street (near the street centerline) are labeled as *"6-1000MCM IN 2 of 2-6" C."* These three conduit runs will impact the proposed main storm drain alignment near N. Hualapai Way as they are located directly over top of the facility. Coordination with NV Energy in the final design phase will be required to relocate these facilities.

- Elkhorn Road – at the Eula Street intersection: The three major electrical conduit runs *(6-1000MCM IN 2 of 2-6" C)* are shown to traverse from the middle of the street to the south side of the road. These three conduit runs will impact the proposed main storm drain alignment as they cross diagonally over top of the facility. Coordination with NV Energy will be required to relocate these facilities or potentially support in place as they span the trench.

- Elkhorn Road – between Eula Street and N. Grand Canyon Drive: The three major electrical conduit runs (6-1000MCM IN 2 of 2-6" C) are shown on the south side of the street for approximately 650-feet, then one conduit run traverses the road and is shown on the north side, while the two remaining conduit runs remain on the south side to the intersection with N. Grand

Canyon Drive. These conduits could impact proposed drop inlets located on the north and south side of Elkhorn Road.

- N. Hualapai Way – southwest corner at the intersection with Elkhorn Road: The three major electrical conduit runs (6-1000MCM IN 2 of 2-6" C) are shown on the west side of the street near the sidewalk or curb line. These conduits could impact a proposed drop inlet and lateral proposed at this specific corner of the intersection.

1.2.2 LARGE DIAMETER WATER TRANSMISSION MAINS

Record drawing information received by the Las Vegas Valley Water District indicates that a major potable water transmission main entitled *Hualapai 2975 Zone North Pipeline* is located within the east half of N. Hualapai Way. The *2975 Zone North Pipeline* consists of a 42-inch diameter steel mortar lined and coated pipe (MLCP) to the south side of the Elkhorn Road intersection. At the intersection, the pipeline transitions to 36-inch diameter MLCP to the north of Elkhorn Road. A 42-inch diameter, 90-degree branch tees off from the *2975 North Pipeline* at the intersection and extends west in Elkhorn Road on the south side of the road. The *Hualapai 2975 Zone North Pipeline* potential impacts to the Project corridor are summarized as follows:

- The *Hualapai 2975 Zone North Pipeline* was designed with a vertical deflection at the intersection with Elkhorn Road. This vertical deflection lowers the pipeline profile to accommodate extension of the drainage improvements within Elkhorn Road. Due to the existing vertical deflection, a conflict with the proposed Project is not anticipated as the main line drainage improvements can be constructed above transmission pipeline. Overall, the proposed drainage facility is not anticipated to have any horizontal conflicts with the transmission pipeline since adequate separation is available.

- A proposed drop inlet and lateral located on the south side of Elkhorn Road to the west of N. Hualapai Way will cross the 42-inch diameter pipeline branch that tees off at the intersection. The lateral will cross above the existing pipeline, therefore a conflict is not anticipated.

1.2.3 WATER DISTRIBUTION PIPELINES

Record drawing information received by the Las Vegas Valley Water District indicates the presence of water distribution pipelines within Elkhorn Road and N. Hualapai Way. These water distribution pipelines range in size from 6 to 12-inches in diameter and traverse both the main line and lateral drainage improvements at various locations throughout the Project corridor.

Two water distribution pipelines are anticipated to require removal and relocation to mitigate a conflict. The location of the removal and relocation is at a proposed drop inlet (DI#2) lateral located on the south side of Elkhorn Road, 400-feet west of the N. Hualapai Way intersection. The conflict mitigation will require removal, relocation, and lowering of two existing 12-inch diameter mains located within the south half of Elkhorn Road, since the lateral profile is constricted by the existing 42-inch branch water transmission main

teeing off from the intersection of N. Hualapai Way. Relocation of these two water distribution pipelines will be detailed in subsequent design stages.

1.2.4 SANITARY SEWER

Record drawing information received by the City of Las Vegas indicates the presence of gravity sanitary sewer pipelines and manholes along the Project corridor. Survey manhole dip measurements have been performed along the Project corridor to determine the existing depth of the sanitary sewer system. The proposed main line drainage improvements will parallel the sewer for large segments of the alignment in close proximity, due to other various utility horizontal constraints. In addition, the sanitary sewer will be crossed by the proposed main line drainage improvements at three separation locations. The main line drainage improvements will cross sufficiently deep beneath the sanitary sewer, therefore conflicts should not be present. Several drop inlets laterals located on both the north and south sides of Elkhorn Road will also cross below the sanitary sewer, thereby eliminating conflicts.

1.2.5 NATURAL GAS

According to the record drawing information received by Southwest Gas Corporation, both normal distribution and high pressure steel transmission pipelines (6-inches in diameter) exist along Elkhorn Road. In addition, smaller distribution service pipelines (2 to 4-inches in diameter) branch into the side streets along the corridor. It is anticipated that the main line drainage improvements will cross sufficiently deep beneath the smaller distribution piping, therefore conflicts will be minimized to the maximum extent possible. Based on pothole information, one 4-inch polyethylene (PE) gas line appears to be in conflict with the main storm drain; this conflict is subsequently summarized. It is recommended that all small diameter gas line crossings be potholed during subsequent design phases. The existing normal distribution and high pressure transmission pipeline potential for impacting the Project corridor is summarized as follows:

- Elkhorn Road at N. Hualapai Way intersection: An existing 4-inch diameter PE gas line was potholed and located at a depth exceeding 10-feet on the east half of Hualapai. The gas line traverses the main storm drain alignment. Since the reinforced concrete box (RCB) main is tying into an existing 54-inch RCP side connection, it is recommended that the gas line be relocated above the storm drain to avoid making the side connection steeper than necessary.

- Elkhorn Road – west of N. Hualapai Way: Existing dual 6-inch diameter gas pipelines are located on the north half of the road. Both gas lines will be crossed by a proposed drop inlet (DI#1) lateral. It is anticipated that the lateral will cross below the existing pipelines and therefore a conflict is not anticipated. During subsequent design phases, additional potholes are recommended at all gas pipeline crossing locations to confirm conflicts are not an issue. The main storm drain line is located in the middle of the road, therefore, sufficient horizontal separation exists from the gas lines.

- Elkhorn Road – N. Hualapai Way to Conquistador Road: Existing dual 6-inch diameter gas pipelines are located on the north half of the road. Both gas lines will be crossed by several proposed drop inlets located on the north side of the road. It is anticipated that the lateral will cross

below the existing pipelines and therefore conflicts are not anticipated. During subsequent design phases, additional potholes are recommended at all gas pipeline crossing locations to confirm conflicts are not an issue. The main storm drain line is generally located in the south half of the road, therefore, sufficient horizontal separation exists from the gas lines.

- Elkhorn Road – Conquistador Road to N. Grand Canyon Drive: Existing dual 6-inch diameter gas pipelines are located on the north half of the road. Both gas lines will be crossed by several proposed drop inlets located on the north side of the road. It is anticipated that the lateral will cross below the existing pipelines, therefore, conflicts are not anticipated. During subsequent design phases, additional potholes are recommended at all gas pipeline crossing locations to confirm conflicts are not an issue. The main storm drain line is generally located both in the center and south half of the road; sufficient horizontal separation appears to exist from the gas lines.

1.3 ADJACENT FLOOD CONTROL FACILITIES

The Project is bounded by and will connect on both the east and west ends to existing flood control facilities, which are part of the Rancho Road System Storm Drain – Elkhorn master planned facility RHCB 0295. In addition, a local facility (54-inch diameter storm drain) in N. Hualapai Way runs through Elkhorn Road and crosses the proposed Project alignment. Record drawings for the Elkhorn Road existing upstream and downstream facilities, along with the local 54-inch diameter storm drain facility within Hualapai Way are included in **Appendix C.**

1.3.1 EXISTING DOWNSTREAM FACILITY

The existing connection point on the downstream east end consists of a 7-foot x 6-foot RCB storm drain, which is located in the eastbound travel lanes of Elkhorn Road approximately 150-feet west of N. Grand Canyon Drive. This specific facility was designed by the Slater Hanifan Group (SHG) in 2015 and subsequently constructed in 2016. The terminus of the RCB is currently capped and plugged. Two drop inlets were constructed along with the RCB and are sited on both the north and south sides of Elkhorn Road west of N. Grand Canyon Road.

1.3.2 EXISTING UPTREAM FACILITY

UPSTREAM

The existing connection point on the upstream west end consists of an existing 6-foot by 4-foot reinforced concrete arch culvert (RCA), which runs in the center of Elkhorn Road. At the west side of the Elkhorn Road and N. Hualapai Way intersection, the existing RCA culvert alignment crosses to the north side of the street where it outfalls into an existing concrete overflow weir structure. The overflow weir structure is located on the northwest side of the intersection within a 25-foot wide landscape easement. The overflow structure has a sloping invert slab that begins at existing grade on the east side and slopes down to the RCA outlet invert (low point) on the west side. The overflow weir structure was designed by VTN Nevada in 2005 as part of the Providence Master Planned Community flood control infrastructure. The overflow weir is an interim condition structure, which is designed to discharge flows onto the street during the 100-year storm

event. The low point of the overflow weir structure is drained to an existing local storm drain described below.

1.3.3 EXISTING N. HUALAPAI WAY LOCAL STORM DRAIN FACILITY

To drain the low point located within the overflow structure, a 24-inch storm drain connects to the low point and conveys flow in an east direction towards N. Hualapai Way. The 24-inch storm drain connects to an existing 54-inch diameter storm drain, which runs from north to south in the west travel lanes of N. Hualapai Way. The existing 54-inch storm drain was designed by VTN Nevada in 2005 as part of the Providence Master Planned Community flood control infrastructure. Several existing drop inlets located within N. Hualapai Way (located both north and south of Elkhorn Road) collect street flows and tie into the existing 54-inch diameter facility.

1.4 PROJECT CORRIDOR EXISTING CONDITION PHOTOGRAPHS

Several site field walks were performed to document existing conditions and surface features that may impact the proposed drainage improvements. The existing conditions have been documented in several field photographs included in this section. All references to intersections concern Elkhorn Road. A Project location street level overview of Elkhorn Road from N. Hualapai Way to N. Grand Canyon Drive can be seen in **Figure 2** for reference.



Figure 2 **Project Location Street Level Overview**

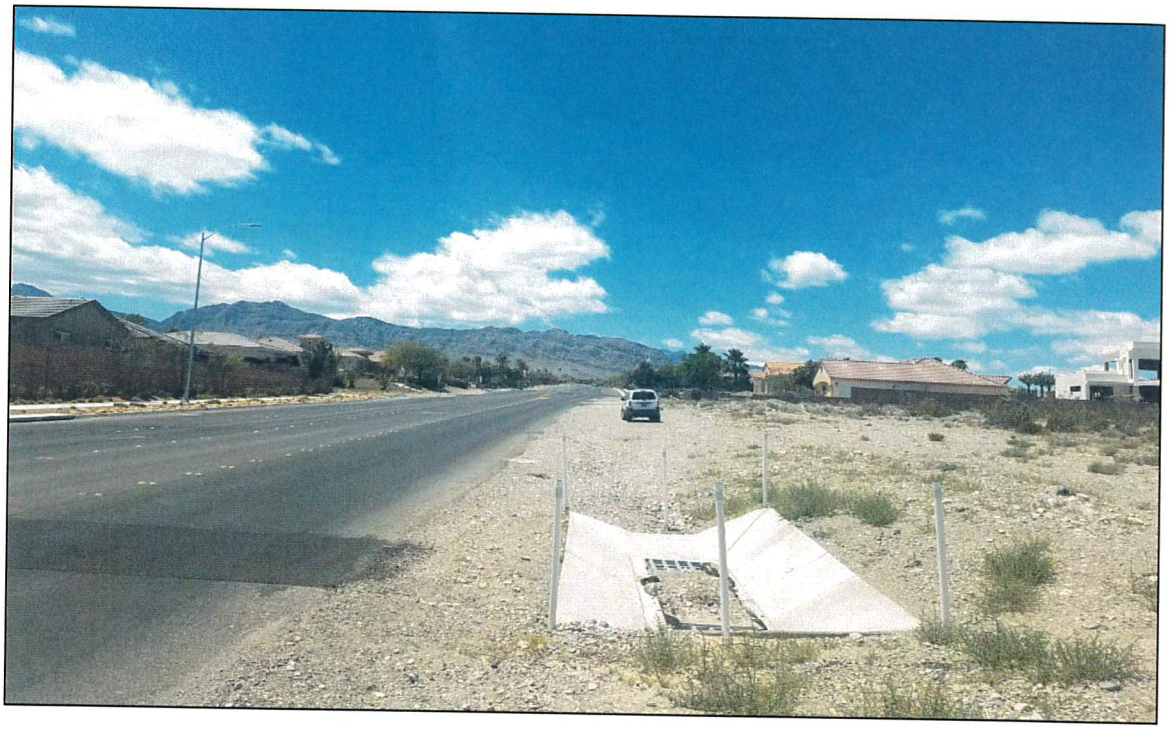


Figure 3 Elkhorn Road at N. Grand Canyon Drive Intersection (Looking West)

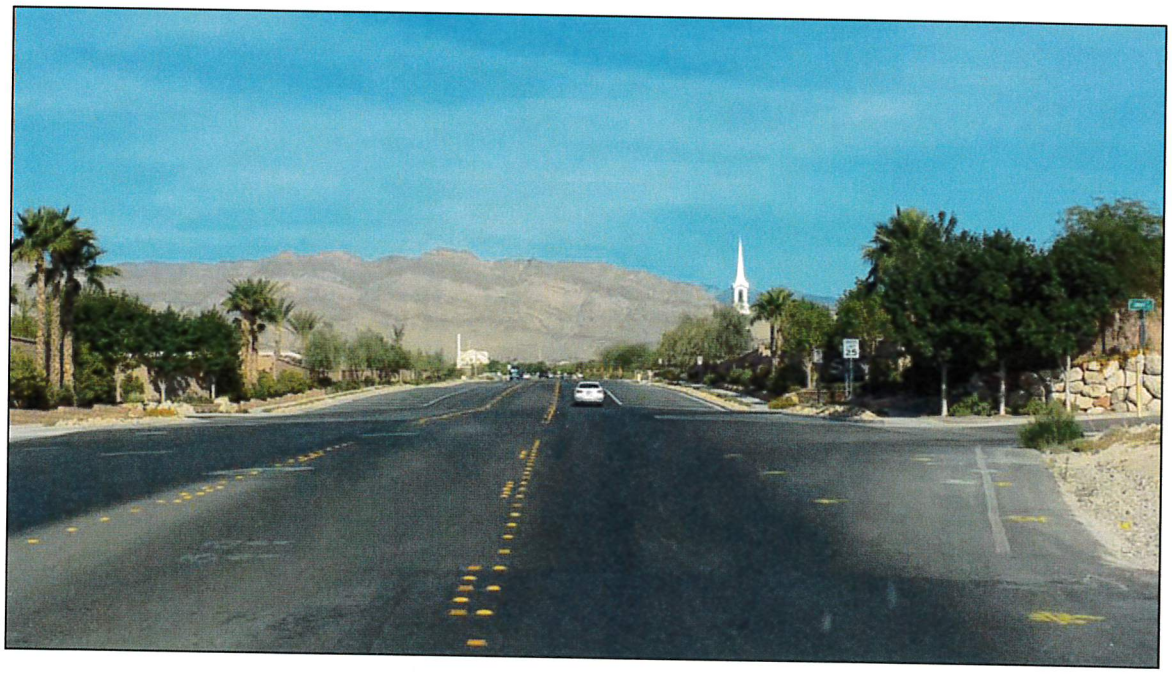


Figure 4 Elkhorn Road at Jensen Street Intersection (Looking West)



Figure 5 Elkhorn Road at Rhinehart Way Intersection (Looking West)



Figure 6 Elkhorn Road at Conquistador Street Intersection (Looking West)

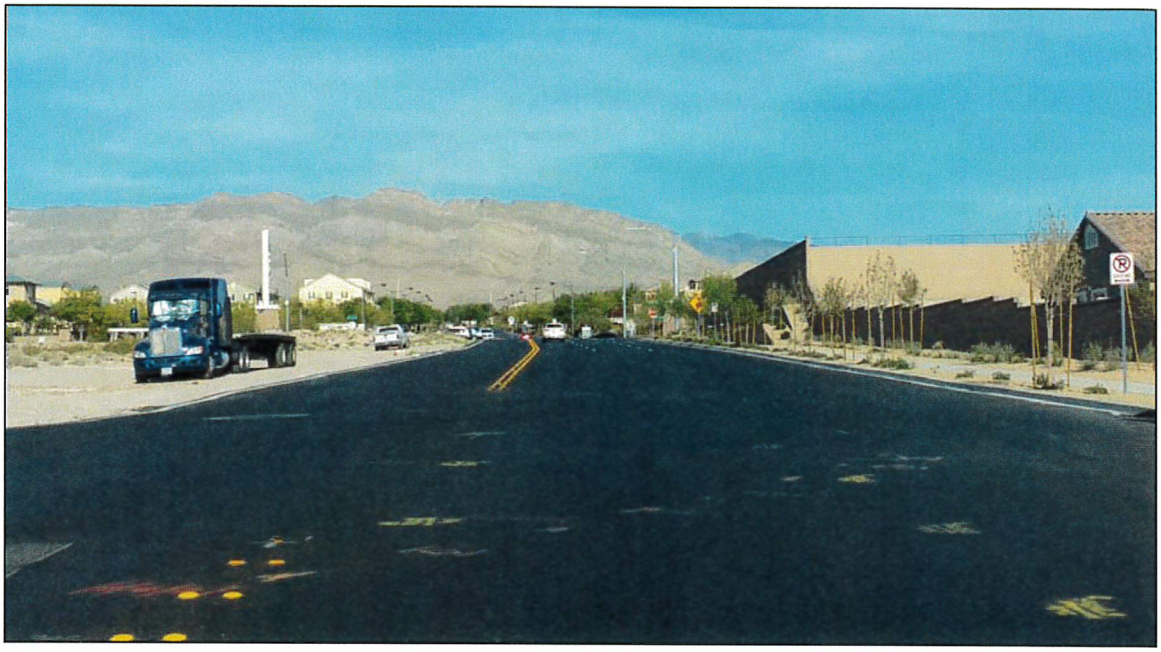


Figure 7 Elkhorn Road at Eula Street Intersection (Looking West)

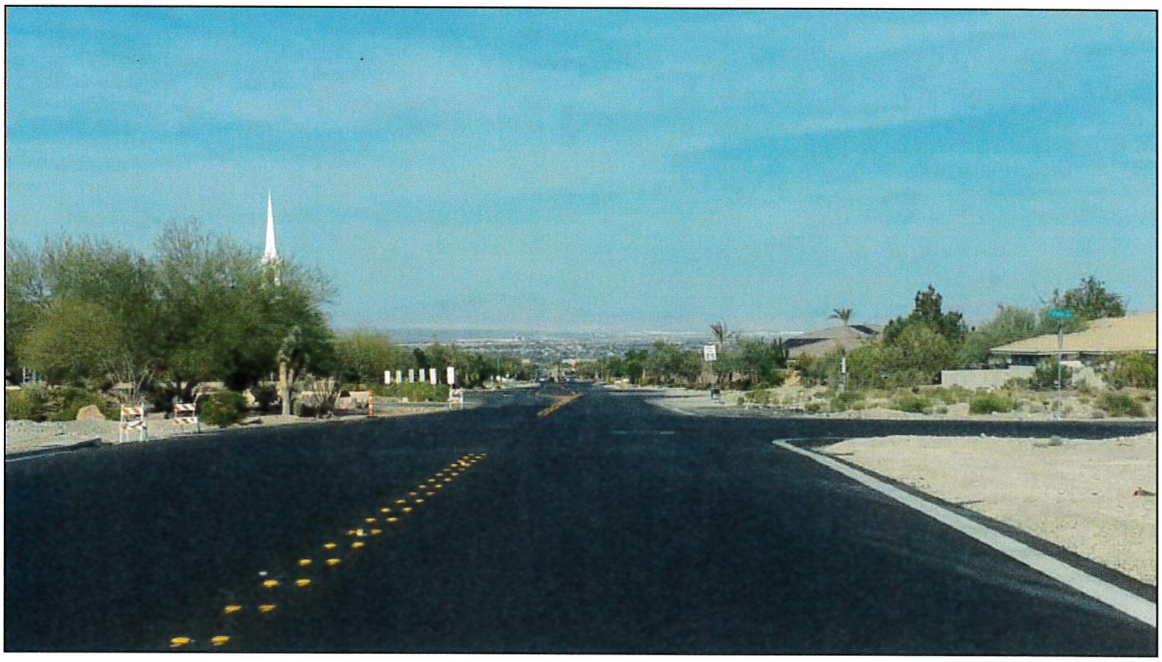


Figure 8 Elkhorn Road at Eula Street Intersection (Looking East)



Figure 9 Elkhorn Road at N. Hualapai Way Intersection (Looking East)

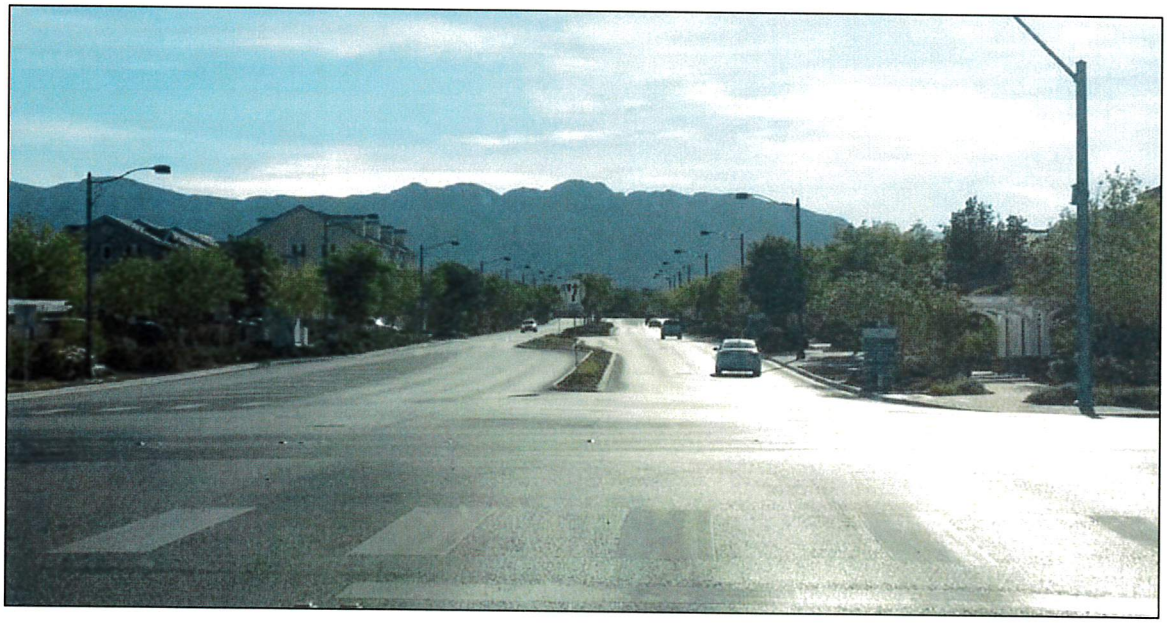


Figure 10 Elkhorn Road at N. Hualapai Way Intersection (Looking West)

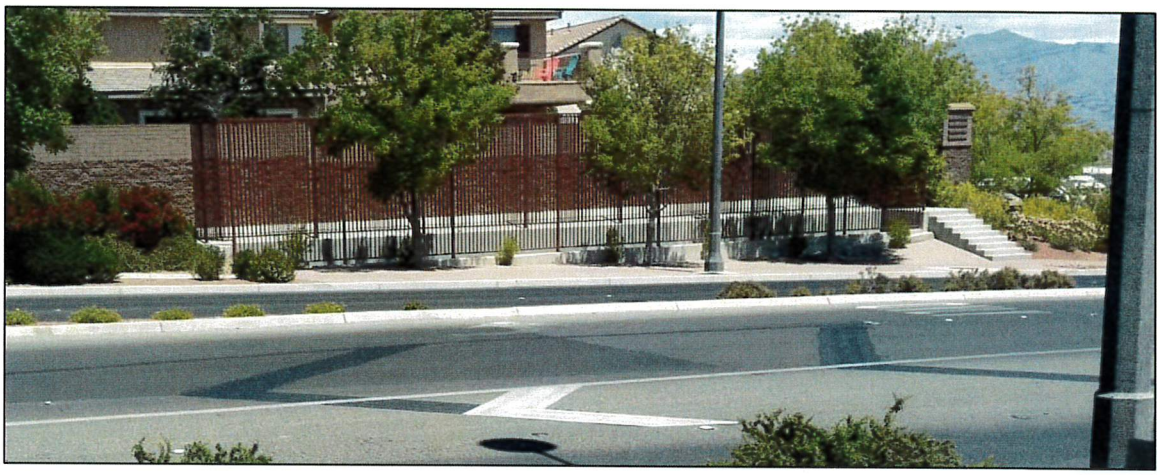


Figure 11 Elkhorn Road (West of N. Hualapai Way), Looking North at Overflow Weir Structure



Figure 12 Overflow Weir Structure (Looking West)

Section 2

2.0 DESIGN CRITERIA

The following storm drain design criteria were taken from the CCRFCD *Hydrologic Criteria and Drainage Design Manual* (HCDDM). The criteria implemented for the Rancho Road System Storm Drain – Elkhorn Project is presented in **Table 2.1**.

Table 2.1 Drainage Design Criteria

Design Criteria	Parameter
Storm Drain	• Storm sewer system shall be designed to convey all of the minor and major design storm. • Maximum level of surcharging for the capacity analysis shall be limited to maintaining the hydraulic grade line (HGL) to 1 ft. below the final grade at all top of manholes and drop inlet top of grates. • Maximum velocity in all storm sewers shall be limited to 25 feet per second (fps) to the maximum extent possible. Velocity is dependent on slope, therefore, given the tie in elevations upstream and downstream of the project alignment, the target velocity may not be achievable. Maintain a minimum velocity of 3 fps at slopes less than 0.25%. • Per Section 802.4.1.2 – Maximum spacing between manholes for various pipe sizes shall be 400 ft. • Per Section 803.1.1 - Minimum pipe size for storm inlet laterals to the storm sewer mains and for storm sewer mains shall be 18 inches in diameter for round pipe or shall have a minimum flow area of 2.2 ft.^{2} for other pipe shapes.
100-Year Street Hydraulics	• Velocity (V) [fps] x Depth (D) [feet] < 8; Depth of flow in flowline < 2 ft. • Through intersections: VxD < 8; Depth of flow through traffic streets < 2 ft.
10-Year Street Hydraulics	Right-of-Way > 80 ft. • 12 ft. wide dry lane maintained in each direction. VxD < 6. • Depth of flow at intersections with other streets with Right-of-Way widths > 80 ft. shall be < 6 in. Right-of-Way < 80 ft. • Depth of flow in gutter flow line shall be < 1 ft.; VxD < 6.
Manning's "n" Value	• Per Table 801 - A Manning's n value of 0.013 was utilized for calculations for all concrete storm drain and inlets. Manning's n values of 0.013 and 0.015 were utilized to analyze the main storm sewer line.

Table 2.1 Drainage Design Criteria (continued)

Design Criteria	Parameter
Local Entity Criteria	• Hydraulic calculations must provide for a 50% clogging factor in the capacity calculations for all drop inlets. • Provide 600 ft. spacing between all inlets along alignment. • Inlets shall be designed at 2.5 ft. length increments.

Section 3

3.0 DRAINAGE AND HYDRAULICS DESIGN

3.1 PROJECT OVERVIEW AND STUDY PURPOSE

The Rancho Road System Storm Drain – Elkhorn Project is a flood control facility that extends on Elkhorn Road between N. Hualapai Way and N. Grand Canyon Road (refer to Figure 1 in **Appendix D.1**). This particular facility is located within City of Las Vegas limits, however, the facility alignment traverses across parcels that are isolated pockets of Unincorporated Clark County jurisdiction. The facility is characterized in the 2013 CCRFCD Las Vegas Valley MPU as RCHB 0295 and is designated as a 7-foot x 6-foot RCB with a design 100-year flow ranging from 631 cfs to 744 cfs.

The Project is intended to connect two existing CCRFCD regional facilities, one located upstream and one downstream, hence, it is the last missing segment to complete the CCRFCD MPU conveyance system in this particular area (Figures 2 – 4 in **Appendix D.1**). At the upstream end, the Project connects to an existing 6-foot x 4-foot reinforced concrete arch (RCA) located 300 feet west of the N. Hualapai Way and Elkhorn Road intersection, within the north side of Elkhorn Road. This particular RCA facility terminates as an open channel ramp overflow weir structure, which is intended to spill surface flows onto Elkhorn Road. At the downstream end, the Project facility connects to an existing 7-foot x 6-foot RCB located 170 feet west of the N. Grand Canyon Drive and Elkhorn Road intersection, within the south side of Elkhorn Road. The existing 7-foot x 6-foot facility was previous constructed and plugged for future connection.

Drop inlets and associated laterals are proposed along Elkhorn Road, which would connect to the Project facility. The configuration and sizing of the inlets is such that they capture both the 10- and 100-year event flows to meet the CCRFCD HCDDM criteria requirements for street flow.

3.2 SITE DESCRIPTION

The Project facility spans for approximately 2,900 LF within Elkhorn Road from west of N. Hualapai Way to just west of N. Grand Canyon Drive. This facility is located within Sections 18 and 19, Township 19 South, Range 60 East. As mentioned previously, this Project is located within both City of Las Vegas and Unincorporated Clark County jurisdiction.

In the existing condition, Elkhorn Road is partially constructed with various segments missing full width street improvements such as pavement, sidewalk, and curb and gutter. Primarily, the unimproved segments of Elkhorn Road are summarized as follows:

- 375 LFof the north half of Elkhorn Road, located immediately west of the N. Grand Canyon Drive intersection.
- 625 LF of the south half of Elkhorn Road, located immediately east of the N. Hualapai Way intersection.

3.3 FEMA FLOOD ZONE

The Project alignment is located within Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel # 1745 and Panel # 1750, effective September, 27, 2002. Specifically, the Project alignment location is located within the unshaded Zone "X". A FEMA FIRM unshaded Zone "X" is an area determined to be located outside of the 0.1% chance (100-Year) floodplain. Refer to Figures 5 and 6 provided in **Appendix D.1** for the Project FIRM Maps.

3.4 CCRFCD MASTER PLAN AND CITY OF LAS VEGAS NEIGHBORHOOD STUDY INFORMATION

According to the 2013 CCRFCD MPU, the Project is identified as RCHB 0295. This facility is classified as a Category "A" Proposed Facility with a design flow of 973 cfs originating from the MPU HEC-1 model WEST3 at node CNW66-C. According to the CCRFCD MPU, this facility has approximately 1.75 square miles of upstream tributary watershed area. The Project facility will connect to a portion of the already constructed RCHB 0295 facility. Refer to Figures 2 – 4 in **Appendix D.1** for pertinent CCRFCD referenced maps and exhibits.

In addition to the CCRFCD MPU, it is noted that the Project alignment lies within the area of study encompassed by the City of Las Vegas Northwest Neighborhood Study and the Northwest Neighborhood Study Phase 2. Both of these studies depict the Project facility conveying a total 100-year flow rate of 1,166 cfs, which is superseded by the flows established by this report. Refer to Figure 7 in **Appendix D.1** for pertinent Northwest Neighborhood Study referenced maps and exhibits.

3.5 REFERENCED DRAINAGE STUDIES AND DESIGN REPORTS

Various drainage studies, design reports, and civil improvement plans were referenced during the preparation of the Project drainage design. Specifically, the following documents were reviewed and information referenced into this report:

- *Progress Report #1 2018 Las Vegas Valley Flood Control Master Plan Update* by Atkins, North America, dated January 2017. A portion of this Progress Report provided the latest soil information pertaining to the Project vicinity. **(Appendix D.2)**

- *Final Design Report for Rancho-Fort Apache Storm Drain (FASD) Study*, by the Louis Berger Group (LBG), dated November 2012. This particular study designed the Rancho Fort Apache Storm Drain System into which the Project ultimately drains. Hydrology and drainage basin flow patterns were established in this report for the watershed draining into the Project system. **(Appendix D.3)**

- *Final Design Report for Rancho Road System – Elkhorn (Fort Apache to Grand Canyon)*, by the Slater Hanifan Group (SHG), dated March 2013. This particular study designed a portion of CCRFCD MPU RCHB 0295 within Elkhorn Road from Fort Apache Road to N. Grand Canyon Road. Hydrology and basin flow patterns were established in this referenced report for the watershed draining into the Project system. The Project will connect to this facility. **(Appendix D.4)**

- *Technical Drainage Study, Drainage Study Updates, and Improvement Plans for Hualapai and Severence Single Family Home Development*, by Triton Engineers, Inc., dated December 2015. This particular study designed the onsite and offsite drainage infrastructure for the development located northeast of the N. Hualapai Way and Elkhorn Road intersection. Sub basins and drainage flows were referenced from this study. This development also installed a culvert headwall with three parallel 20-inch diameter lateral stubs to connect to the proposed facility. **(Appendix D.5)**

- *Master Drainage Study for Cliff's Edge/Providence*, designed by VTN, dated 2005. The drainage map from this study was referenced to confirm previously established flow rates and drainage patterns. **(Appendix D.6)**

3.6 HYDROLOGIC METHODOLOGY AND PARAMETERS

3.6.1. Hydrologic Modeling

Two separate hydrologic analyses were performed for this study: a regional wide analysis (which references MPU basins modified by the LBG and SHG studies) for the purpose of confirming the main conveyance facility, as well as a local analysis for the purpose of analyzing street flow hydraulics on Elkhorn Road and sizing individual drop inlets and laterals tying into the main line. The local analysis subdivides the larger regional MPU basins to follow field-verified drainage patterns, as well as established patterns through approved drainage studies and development. Since the Project is a CCRFCD MPU facility, fully developed (ultimate build-out only) conditions are assumed in all drainage analyses presented.

The rainfall-runoff hydrologic modeling analysis put forth for the Project was prepared using USACE HEC-1 Version 4.1. This software utilizes the Soil Conservation Service (SCS) Dimensionless Unit Hydrograph method which is accepted throughout Southern Nevada. This HEC-1 model was used to generate the 6-hour, 10- and 100-year storm runoff flow rates. The calculations and HEC-1 model output are attached in **Appendix D.7** and **D.8**, respectively.

3.6.2. Storm Distribution

The design storm distribution for the hydrologic analysis for the Project was referenced from Table 503 of the CCRFCD HCDDM, which is provided in **Appendix D.9**. This storm is characterized as a 6-hour, 100-year recurrence interval rainfall event. A 100-year recurrence interval is defined as having a 1 in 100 chance of rainfall being equal or exceeding the design storm in any given year. For the Project vicinity, Storm Distribution Number 3 (SDN3) was used for hydrologic modeling, as the total drainage area of the sub basins modeled are less than 8 square miles in total.

3.6.3. Design Precipitation

Precipitation depths that were used for design were referenced from the National Oceanic and Atmospheric Administration (NOAA) Atlas Map (*Figures 503* and *506*, and *Table 501* of the HCDDM). The sub basins delineated for the local hydrology analysis reside outside the McCarran Airport Rainfall Area, so the precipitation adjustment ratio (*Table 501* of the HCDDM) was applied to both the 10- and 100-year storms. The tables used to determine the precipitation depths are attached in **Appendix D.9** as reference material.

The design precipitation depths for the 6-hour storm are 1.61 and 2.85 inches for the 10- and 100-year events, respectively.

3.6.4. Soils

The U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) publishes soil information for the Las Vegas Valley. Specifically, Soil Survey # NV788 entitled *Soil Survey of Las Vegas Valley Area, Nevada* was referenced for preparation of curve numbers, as this survey area geographically encompasses the watershed boundaries for the Project limits. NRCS divides the soil into four hydrologic soil groups (HSG): (A) High infiltration rate, low runoff potential, well drained to excessively drained sands or gravelly sands; (B) Moderate infiltration rate, moderately low runoff potential, moderately to well drained soils with moderately fine texture to moderately coarse texture; (C) Slow infiltration rate, soils consist of moderate to fine texture; and (D) Very slow infiltration rate, soils consist of mainly clays and high shrink-swell potential.

The CCRFCD MPU is in the process of being updated by the CCRFCD's consultant (Atkins, North America) and is expected to be released in 2018. Atkins has recently submitted *Progress Report #1*, dated January 2017, for the 2018 MPU, which incorporates the latest soils information produced by the NRCS. *Progress Report #1* also contains a summary of the major changes occurring to the hydrologic group type reclassification for soils throughout the limits of the CCRFCD MPU.

According to latest soils information from *Progress Report #1*, the tributary watershed sub basins draining into the Project alignment are located within soil groups: Soil #191, Soil #155, and Soil #400. The soils boundary within the Project area is depicted on Figure 8 in **Appendix D.1**. This is consistent with the 2008 CCRFCD MPU soil mapping classification, hence the soil boundaries remain unchanged between the 2008 and 2018 MPU. During research into Soils #191, #155, and #400 it was noticed that the HSG type breakdown has changed from what is reported in the 2008 CCRFCD MPU to what is currently depicted in *Progress Report #1*. **Table 3.1** summarizes the change in soil type #191, #155, and #400.

Table 3.1 Soil HSG Breakdown Comparison Summary

HSG	Soil #155		Soil #191		Soil #400	
	2008 MPU (% of HSG)	2018 MPU (% of HSG)	2008 MPU (% of HSG)	2018 MPU (% of HSG)	2008 MPU (% of HSG)	2018 MPU (% of HSG)
A	5	0	5	100	0	0
B	5	0	85	0	10	0
C	0	0	0	0	0	0
D	90	100	10	0	90	100

As depicted in **Table 3.1**, the breakdown of Soil Type #191 has dramatically changed between 2008 and 2018. Re-allotment of the HSG to 100% "A" type reduces the curve number. The impact to flow from the HSG relationship to the curve number is summarized in a subsequent section.

3.6.5. Runoff Curve Number Computations

Soil Conservation Service curve numbers (CNs) were calculated for offsite delineated basins tributary to the Project. Pertinent CN values were referenced from Table 602 of the CCRFCD HCDDM, according to different land uses located within each basin (**Appendix D.10**). The basin land use was determined from examination of current aerial photography depicting existing developments, current zoning for undeveloped land, and comparison to the land use depicted on the Las Vegas Valley 2008 MPU basin exhibits (Figure 4 in **Appendix D.1**). In general, the land use depicted on the Las Vegas Valley 2008 MPU basin exhibits matches the current conditions. Composite calculations are attached in **Appendix D.10**.

3.7 HYDROLOGIC ANALYSIS

3.7.1. Regional Hydrologic Analysis

The regional (overall) hydrologic analysis performed to size the main Project conveyance system was previously prepared by the LBG in the referenced *FASD Study* (**Appendix D.3**). This hydrologic analysis was subsequently adopted and referenced by the SHG during design of the 7-foot x 6-foot RCB storm drain known as Rancho Road System – Elkhorn (Fort Apache to Grand Canyon). According to the LBG Study, there are three sub basins draining to the intersection of Elkhorn Road and N. Hualapai Way: NW27-C, NW26-C, and NW53-CC. A flow split (FS1) has been designated at the point where these three basins combine. The regional analysis sets the starting 100-year flow rates at the intersection of Elkhorn Road and N. Hualapai Way (FS1) as depicted on Figure 10 in **Appendix D.1**.

A review has been performed of the previously adopted LBG storm drain study, associated HEC-1 analyses, allotted sub basin land uses, and drainage patterns. MWH, now part of Stantec concurs with the established drainage basin delineation, land use classifications, and basin routing. The curve numbers assigned to these specific basins were recalculated based on updated soils information to determine impacts to the previously established flow rates at flow split FS1.

The three aforementioned sub basins tributary to flow split FS1 lie within Soils #155, #191, and #400. Specifically, the soil compositions for these basins and their respective curve numbers, based on the 2008 MPU (utilized by the LBG) and the revised soils data, per *Progress Report #1* are summarized in **Table 3.2**. Pertinent curve number calculations are provided in **Appendix D.10**.

Table 3.2 Soil Composition and Curve Numbers

Sub Basin	Soil Composition			2008 Soils Curve Number	2017 Soils Curve Number
	Soil #155 (%)	Soil #191 (%)	Soil #400 (%)		
NW26-C	0	0	100	90.30	85.60
NW27-C	1.6	76.3	21.8	90.00	85.86
NW53-CC	0	100	0	87.22	80.39

As demonstrated in **Table 3.2**, reclassification of the HSG for the sub basin soils decreases the composite curve numbers for all three sub basins tributary to flow split FS1, based on the latest available soils information. Decreasing the overall curve number for all three sub basins decreases the tributary flow rate to the flow split FS1 and ultimately the Project design flow. This was confirmed by performing an additional HEC-1 hydrologic model of the three basins tributary to flow split FS1 (included in **Appendix D.8**). Flow comparisons based on updated composite CN to the *FASD* and Project are illustrated in **Table 3.3**.

Table 3.3 100-Year Peak Flow Comparison

Sub Basin	Q100 (cfs)	
	FASD **(2008 Soils)**	**Project (2017 Soils)**
NW26-C	456	382
NW27-C	207	177
NW53-CC	121	87
CNW53-CC[1]	733	610

1. HEC-1 node immediately before flow split FS1

To remain consistent with the LBG and SHG Studies and because the CCRFCD MPU update is not currently complete, MWH, now part of Stantec proposes to conservatively maintain the curve numbers based on the 2008 soils HSG breakdown for the sub basins tributary to flow split FS1. CCRFCD is currently evaluating land use impervious percentage breakdowns, which could offset the decrease in flows attributed to the revised soil data. Therefore, this report adopts the design 100-yr peak flows at flow split FS1 at the intersection of Elkhorn Road and N. Hualapai Way. The configuration of the existing drainage infrastructure and the proposed improvements located west of N. Hualapai Way within Elkhorn Road at flow split FS1 is depicted on Figure 11 in **Appendix D.1** and is subsequently described.

The existing 6-foot x 4-foot RCA terminates approximately 250 feet west of the Elkhorn Road and N. Hualapai Way intersection and was designed to convey a 100-year peak flow rate of 419 cfs. As a regional facility did not exist in Elkhorn Road at the time of construction of the 6-foot x 4-foot RCA, an interim condition 70 foot long overflow structure was constructed to discharge the flows onto the street surface. The Project is proposed to extend towards the west in Elkhorn Road, past N. Hualapai Way and connect to the existing 6-foot x 4-foot RCA, thereby eliminating the need for the interim overflow structure.

The referenced hydrology by LBG quantified a total combined 100-year flow rate of 638 cfs traveling east bound on Elkhorn Road up to the N. Hualapai Way intersection. Of the total 638 cfs, 219 cfs is characterized as surface flow, while the remaining 419 cfs is characterized as storm drain flow. In addition, approximately 121 cfs is conveyed southbound in N. Hualapai Way within an existing 54-inch diameter storm drain to the intersection of Elkhorn Road.

Flow split FS1 allots a total storm drain flow east in Elkhorn Road of 631 cfs past N. Hualapai Way within the Project facility and 102 cfs of storm drain flow south in Hualapai Way past Elkhorn Road in the existing

54-inch diameter facility. Based on the flow routing pattern established in the LBG study, 219 cfs must be captured within Elkhorn Road, immediately west of N. Hualapai Way.

To capture the required 100-year peak flows established at flow split FS1, two drop inlets (DI#s 1 and 2) are proposed in Elkhorn Road (on both the north and south sides) approximately 300 feet west of N. Hualapai Way to capture a total of 91 cfs. The street section on the north half of Elkhorn Road at this location transitions from a crowned section to a north/south cross slope due to the need to convey street flows from the existing interim overflow structure at the northwest corner of Elkhorn Road and N. Hualapai Way. Therefore, the drop inlet on the north side (DI# 1) is located further west within the crowned section to assist in capturing flow. These drop inlets connect to the Project main facility. Of the 128 cfs (219 cfs minus 91 cfs) bypass flow, a total of 102 cfs is proposed to be captured by two additional drop inlets (DI#s 3 and 4). Drop inlet #3 is located on the south side of Elkhorn Road (175 feet west of the intersection with N. Hualapai Way) and DI #4 is located on the west side of N. Hualapai Way, immediately south of the intersection. Both DIs #3 and 4 do not tie in to the Project main facility, but rather, tie in to the existing 54-inch diameter storm drain located within N. Hualapai Way. While the remaining bypass flow of 26 cfs (128 cfs minus 102 cfs) is conveyed south on N. Hualapai Way due to existing roadway conditions and will be captured in downstream drop inlets.

The segment of 54-inch diameter storm drain pipe located north of the Project facility is proposed to be cut and tied to the RCB conveyance facility. The tied in portion of the 54-inch storm drain will discharge 121 cfs for a grand total flow within the Project facility of 631 cfs (419 cfs originally in storm drain + 91 cfs captured by inlets + 121 cfs from tying 54-inch storm drain) in accordance with the establish drainage patterns in the LBG analysis.

3.7.2. Local Hydrologic Analysis

The local basin analysis was prepared to quantify runoff flow tributary to Elkhorn Road between N. Hualapai Way and N. Grand Canyon Drive and excludes any flows directly from flow split FS1, as these will be already captured by upstream proposed drop inlets. The flow rate information from the local analysis was subsequently used to perform street hydraulic calculations for Elkhorn Road between N. Hualapai Way and N. Grand Canyon Drive. This analysis assumes fully developed basin conditions and does take into account the revised soil HSG reclassification based on the latest information from *Progress Report #1*. The analysis also assumes that Elkhorn Road will be completely built out to RTC standards for a 100-foot right-of-way street section.

The area draining into Elkhorn Road was delineated into thirteen separate sub-basins (refer to Figure 9 in **Appendix D.1**). This watershed was analyzed for both the 10-year and 100-year flows. Sub basins and combination points DN1, DN2, DN3, ELK, CP1, CP2, and CPELK were directly referenced from City of Las Vegas (CLV) drainage study #DS4745A (reference information provided in **Appendix D.5**). This particular drainage study corresponds to a housing development located at the northeast corner of N. Hualapai Way and Elkhorn Road. Constructed drainage improvements consists of a dedicated drainage easement and associated headwall with three parallel 20-inch diameter pipes. The pipes tie into an existing curb inlet on the north half of Elkhorn Road and subsequently extend to the centerline of the street, where they are capped. The headwall and pipes are currently plugged with backfill, however, this system is proposed to tie

into the Project facility, and therefore all surface flows from the subdivision will be intercepted and conveyed below grade. The combined flows from the sub-division are characterized at combination point CPELK.

Moving eastward towards delineated sub basins ON2A1 and ON2A2, flow is conveyed south, while sub basin ON3A flows north over residential and commercial terrain until it is channelized on Elkhorn Road. This flow is combined at combination point (CP) 3. Precipitation from ON2B sheet flow over residential terrain, then channeled south to Elkhorn Road combining with CP3 to form CP3A. ON2C flow is conveyed over residential and impervious terrain, towards combination point CP4.

Sub basin ON1A runoff sheet flows are conveyed southeast over residential and impervious terrain, where it is channelized at Solar Avenue. ON1A flow is combined with flow moving south from flow split FS1 at CP5A. Sub basin ON1B sheet flow travels southeast towards N. Grand Canyon Drive, combined with CP5A to create CP5. Sub basin ON3B flow is conveyed north towards Elkhorn Road with CP5 and XCP2 to become CP6. CP6 is comprised of all thirteen sub-basins with a peak flows of 87 cfs and 29 cfs for the 100-year and 10-year, respectively.

Table 3.4 Sub-Basin Local Flow Analysis – Ultimate Condition

Sub Basin	Area (Ac)	Q100 (cfs)	Q10 (cfs)
ON1A	32.12	11	1
ON1B	7.01	2	0
ON2A1	4.78	0	0
ON2A2	4.74	11	5
ON2B	9.06	4	0
ON2C	3.56	0	0
ON3A	3.14	2	0
ON3B	3.71	6	2
DN1[1]	7.78	20	8
DN2[1]	4.75	12	5
DN3[1]	4.5	11	5
ELK[1]	1.39	6	3
NW53-CA[2]	38.4	56	16

1. Referenced from Triton Engineering Hydrology Report CLV Drainage Study #DS4745A. (**Appendix D.5**)
2. Referenced from *FASD* prepared by the LBG. (**Appendix D.3**)

Table 3.5 Combination Point Local Hydrologic Analysis – Ultimate Condition

Combination Point	Q100 (cfs)	Q10 (cfs)
CP1[1]	32	13
CP2[1]	43	18
CP3	17	7
CP3A	20	7
CP4	20	7
CP5	22	3
CP5A	19	3
CP6	87	29
CPELK[1]	6	3

1. Referenced from Triton Engineering Hydrology Report CLV Drainage Study #DS4745A. (**Appendix D.5**)

3.8 HYDRAULICS

3.8.1. Street Hydraulics

Bentley FlowMaster V8i was utilized to perform the street flow hydraulic calculations for sections of Elkhorn Road (**Appendix D.11**). Each street section calculation was performed for both the 100- and 10-year flows calculated from the **Local Hydrologic Analysis** to verify the velocity multiplied by depth (VxD) criteria in conformance with the CCRFCD HCDDM, as provided in **Section 2.0** of this Preliminary Design Report. Specifically, for major storm events:

1. The depth in the gutter flow line times the average velocity (fps) shall be less than or equal to 8.
2. Depth in the gutter flow line shall be less than or equal to 2 ft.
3. The traverse street flow on through traffic streets shall be at a depth less than or equal to 1 ft. and a depth times velocity less than or equal to 8.

Eleven hydraulic cross section calculations were performed along Elkhorn Road. Cross sections A1 and A2 represent the hydraulic conditions upstream of any proposed drop inlets. The location of cross section calculations, as well as proposed drop inlets are depicted in Figure 11 of **Appendix D.1**. **Tables 3.6** and **3.7** summarize the results of the hydraulic calculations for both the 100- and 10-year events.

Table 3.6 Hydraulic Section Calculations Summary 100-Year Flows

Section Label	Slope (%)	Q100 (cfs)	Depth (ft.)	Velocity (fps)	VxD
A1	3.33	109.5	0.55	9.48	5.21
A2	2.86	109.5	0.84	10.23	8.59
B	3.80	128	0.84	9.99	8.39
C	3.90	6	0.26	4.39	1.14
D1	3.83	8.5	0.32	5.05	1.62
D2	3.89	8.5	0.32	5.20	1.66
E	4.05	6.86	0.28	4.44	1.24
F1	2.67	3.48	0.28	3.89	1.09
F2	2.37	3.38	0.28	3.72	1.04
G	3.28	1	0.19	2.79	0.53
H	3.45	87	0.58	7.98	4.63

Table 3.7 Hydraulic Section Calculations Summary 10-Year Flows

Section Label	Slope (%)	Q10 (cfs)	Depth (ft.)	Velocity (fps)	VxD
A1	3.33	N/A	--	--	--
A2	2.86	N/A	--	--	--
B	3.80	N/A	--	--	--
C	3.90	3	0.22	3.78	0.83
D1	3.83	3.5	0.26	4.10	1.07
D2	3.89	3.5	0.26	4.21	1.09
E	4.05	1.71	0.20	3.35	0.67
F1	2.67	0.90	0.20	2.89	0.58
F2	2.37	0.81	0.20	2.72	0.54
G	3.28	0	0.25	0.19	0.05
H	3.45	29	0.42	6.15	2.58

Elkhorn Road from N. Hualapai Way to N. Grand Canyon Drive meets all major and minor street capacity limitations set forth by the HCDDM. The major limitations, associated with the 100-year peak flow, that are being met are as follows: VxD less than 8 (with the exception of cross sections A2 and B representing the upstream hydraulic conditions), depth in flowline less than 2 ft., and the transverse street flow on through traffic streets are less than 1 ft. The minor limitations, associated with the 10-year peak flow, that are being met include: 12 ft. wide dry lane maintained in each direction, depth of flow at intersections with other streets with right-of-way widths greater than or equal to 80 ft. are curb height of less than 6 inches, and VxD less than 6.

3.8.2. Drop Inlets

Although all criteria is met for major and minor storm street flow hydraulics, the CLV has local entity criteria (Section 1602 of the HCDDM) that must be adhered to as well. In conformance with the CLV Minimum Drainage Study Criteria Standard Form 2 Checklist Supplement, "on-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners." As such, drop inlets have been spaced along Elkhorn Road at intervals close to 600 feet in order to collect nuisance flows.

Table 3.8 illustrates the drop inlet summary with corresponding calculations attached in **Appendix D.12**. All inlets were sized using Bentley FlowMaster software. Each inlet grate used a 50% clogging factor, in accordance with the CLV local entity criteria in Section 1602 of the HCDDM.

Table 3.8 Drop Inlet Summary

Rancho-Elkhorn Storm Drain 100-Year Drop Inlet Characteristics						
DI#	Curb Opening (ft.)	Grate length (ft.)	Incoming Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)	Lateral Pipe Size (in)
1	20	17.5	109.5	44.85	64.65	30
2	20	17.5	109.5	46.30	63.20	30
3	17.5	15	127.85	41.11	86.74	30
4	17.5	15	86.74	61.9	24.84	30
5	12.5	10	8.50	5.02	3.48	18
6	12.5	10	8.50	5.12	3.38	18
7	10	10	3.48	2.87	0.61	18
8	10	10	3.38	2.78	0.60	18

3.8.3. Mainline and Lateral Pipe Hydraulic Analyses

The Water Surface and Pressure Gradient (WSPG) Hydraulic Analysis System software was used to perform an analysis of flow conveyed through the Project main line facility, as well as lateral storm drain lines to obtain the Hydraulic Grade Line (HGL). Using the 100-year peak flows as input values for WSPG, the Project facility size was analyzed to confirm it has the capacity to convey ultimate condition flows. Two analyses were conducted for the Project mainline facility: Manning's "n" set at 0.013 and 0.015. The results of the two analyses are attached in **Appendix D.13** and **D.14**, respectively. WSPG analysis results for the drop inlet laterals are provided in **Appendix D.15**. These results illustrate a total flow of 690 cfs that would be transferred to the existing downstream storm drain facility.

3.9 FINAL RECOMMENDATION

This design report verifies that the Project proposed 7-foot x 6-foot RCB will accommodate the 100-year flows of 631 cfs to 744 cfs as previously established in the *FASD* preliminary design report. With the proposed improvements along Elkhorn Road, the calculated 100-year flow of 690 cfs would be conveyed into the existing downstream storm drain. Overall, the 2018 MPU reclassification of soils decreases the flows tributary to the system, however, MWH, now part of Stantec recommends conservatively adopting the previously established flow rates since the CCRFCD MPU is not completely updated at this point in time. A total of eight (8) drop inlets of various sizes are proposed along the alignment. Four of the eight inlets are located west of N. Hualapai Way and intercept all tributary flows at the intersection with Elkhorn Road. The additional drop inlets along Elkhorn Road are spaced close to 600 foot intervals to intercept flows. In addition, the drainage infrastructure previously installed by the housing development located at the northeast corner of N. Hualapai Way and Elkhorn is proposed to be tied into the main Project conveyance line, thereby eliminating any flows from this subdivision from spilling onto Elkhorn Road.

Section 4

4.0 STORM DRAIN IMPROVEMENTS

The Rancho Road System Storm Drain – Elkhorn Project will construct a new 7-foot wide x 6-foot high RCB storm drain beneath Elkhorn Road between N. Hualapai Way and N. Grand Canyon Drive, approximately 2,900 LF in length. This improvement connects the two previously constructed storm drain sewers, to complete CCRFCD MPU facility RCHB 0295. Portions of existing interim condition infrastructure require demolition and removal to accommodate the proposed storm drain system. Specifically, this Project starts at station STA 9+62 and ends at STA 39+59.33 Refer to **Appendix E** for the 30% Preliminary Design Drawings. The specific segments of the design are summarized as follows:

Demolition Items:

- Elkhorn Road: STA 10+62.22, Offset 00.00-feet to STA 11+57.88, Offset 54.52-feet Left – Demolish and backfill existing 6-foot x 4-foot RCA culvert
- Elkhorn Road: STA 9+59.53, Offset 00.00-feet to STA 9+64.58, Offset 00.00-feet – Demolish and remove existing 6-foot x 4-foot RCA culvert
- North half of Elkhorn Road (within Landscaping Easement): STA 11+57.88, Offset 54.52-feet Left to STA 12+31.82, Offset 55.13-feet Left – Demolish and backfill existing concrete overflow weir structure
- North half of Elkhorn Road: STA 11+70.11, Offset 54.46-feet Left to STA 13+93.27, Offset 45.04-feet Right – Demolish and remove existing 24-inch reinforced concrete pipe (RCP) low point drain and associated manholes.
- Hualapai Way: STA 13+91.75, Offset 107.80-feet Right to STA 13+94.47, Offset 35.53-feet Left – Demolish and backfill segment of existing 54-inch RCP and associated manholes.
- West half of Hualapai Way: STA 13+75.04, Offset 89.67-feet Right to STA 13+91.75, Offset 107.80-feet Right – Demolish and remove existing curb drop inlet and associated 18-inch RCP lateral.
- Public Drainage Easement north of Elkhorn Road: STA 20+93.12, Offset 63.41-feet Left – Excavate and unplug buried headwall and triple 20-inch PVC culverts.

Proposed Storm Drain System Items:

- STA 9+62.00, Offset 29.01-feet Left– Construct drop inlet (DI) #1 Type "CM" in northern curb and gutter.
- STA 9+62.06, Cut existing 6-foot x 4-foot reinforced concrete arched box storm drain, construct cast in place junction structure, and connect DI #1 to with 30-inch RCP lateral.
- STA 10+62.25 – Cut existing 6-foot x 4-foot reinforced concrete arched box storm drain, construct cast in place junction / transition structure and connect to 7-foot x 6-foot RCB; connect DI#2 lateral.

- STA 10+20.38, Offset 49.03' Right – Construct DI #2 Type "CM" in the southern curb and gutter.
- STA 10+69.50 – Connect DI #2 to the 7-foot x 6-foot RCB with 30-inch RCP.
- STA 12+34.20, Offset 55.07-feet Right – Construct DI #3 Type "CM" in southern curb and gutter.
- STA 13+73.28, Offset 99.47-feet Right – Construct DI #4 Type "C-D" in southwestern curb and gutter at the corner of N. Hualapai Way.
- STA 13+74.21 Offset 52.12-feet Right – Install 60-inch storm drain manhole (SDMH) #1 to connect to DI #3 with a 30-inch RCP.
- STA 13+92.71, Offset 69.98-feet Right – Install 60-inch SDMH #2 to the existing 54-inch RCP storm drain located in N. Hualapai Way.
- STA 13+91.768, Offset 107.85-feet Right – Install 60-inch SDMH #3 to the existing 54-inch RCP storm drain to connect DI #4 with a 30-inch RCP.
- Connect SDMH #2 to SDMH #1 with a 30-inch RCP.
- STA 13+94.46, Offset 15.21-feet Left – Install new 60-inch Type III SDMH #4 on existing 54-inch storm drain.
- STA 14+10.46 – Connect SMDH #4 to the 7-foot x 6-foot RCB with 54-inch RCP.
- STA 21+12.49 – Begin connection of three (3) – 20-inch PVC C905 storm drains to the 7-foot x 6-foot RCB from DR Horton storm drain stubs.
- STA 28+77.60, Offset 52.61-feet Right – Construct DI #6 Type "C-D" in southern curb and gutter.
- STA 29+30.88 – Connect DI #6 to the new 7-foot x 6-foot RCB storm drain with an 18-inch RCP.
- STA 29+32.79, Offset 38.35-feet Left – Construct DI #5 Type "CM" in northern curb and gutter.
- STA 29+71.37 – Connect DI #5 to the new 7-foot x 6-foot RCB storm drain with an 18-inch RCP.
- STA 33+41.34, Offset 53.48-feet Right – Construct DI #8 Type "CM" in southern curb and gutter.
- STA 33+42.87, Offset 37.61-feet Left – Construct DI #7 Type "C-D" in northern curb and gutter.
- STA 33+80.48 – Connect DI #7 to the new 7-foot x 6-foot RCB storm drain with an 18-inch RCP.
- STA 33+95.01 – Connect DI #8 to the new 7-foot x 6-foot RCB storm drain with an 18-inch RCP.
- STA 39+59.33 – Connect the proposed 7-foot x 6-foot RCB storm drain to the existing 7-foot x 6-foot RCB storm drain approximately 150-feet west of the intersection of Elkhorn Road and N. Grand Canyon Drive.

Section 5

5.0 RECORD OF SURVEY

A Record of Survey was performed for the Rancho Road System Storm Drain – Elkhorn Project by VTN Nevada in May 2017. This Record of Survey documents the land surveyed along the Project alignment. The land located along the Project alignment is located within Sections 18 and 19, Township 19 South, Range 63 East within the City of Las Vegas. All monuments discovered during the survey have been mapped, identified, and annotated with pertinent Section, Township, and Range references. The Draft Record of Survey has been submitted to the City of Las Vegas Survey Department for review and pending approval. After approval, the Record of Survey will be recorded at the Clark County Recorder's Office. Refer to **Appendix F** for the Draft Record of Survey.

Section 6

6.0 ENVIRONMENTAL PERMITTING

Construction of the Rancho Road System Storm Drain – Elkhorn Project may potentially require reviews or select permits, from federal, state, or local agencies. If a review or permit is deemed necessary, the responsible party for obtaining them (e.g., the CLV, the Contractor) is required to comply with all applicable federal, state, and local agency codes and is advised to consult current requirements and practices established by each governing agency before the review is conducted or the permit is obtained. A summary of potential agency reviews and permits that may be required for completion of the Project are included in **Table 6.1**.

Table 6.1 Summary Matrix of Potential Required Permits

Agency	Permit / Review	Reason for Obtaining	Party Responsible for Obtaining	Project Phase to Obtain	Approximate Processing Time
Federal Permits / Reviews					
U.S. Army Corps of Engineers with oversight from the U.S. Environmental Protection Agency 300 Booth Street, Suite 3050 Reno, NV 89509 775-784-5304	Section 404 of the Clean Water Act Permit	Discharging dredge or fill materials into "waters of the United States"	**Not anticipated to be needed**		
State Permits / Reviews					
Nevada Division of Environmental Protection Bureau of Water Pollution Control 901 South Stewart Street, Suite 4001 Carson City, NV 89701 775-687-9418	General Stormwater Permit at Construction Sites	Applies to projects disturbing at least 1 acre that will discharge runoff into municipal storm drain system	Contractor	After Conditional Notice to Proceed / Prior to Construction	7 – 14 days
Nevada Division of Environmental Protection Bureau of Water Pollution Control 901 South Stewart Street, Suite 4001 Carson City, NV 89701 775-687-9418	NPDES Temporary Discharge Permit	Covers point source discharges of a temporary nature to channels, roadways, or storm drains for less than 6 months	**Not anticipated to be needed**		
Nevada Division of Environmental Protection Bureau of Water Pollution Control 901 South Stewart Street, Suite 4001 Carson City, NV 89701 775-687-9418	Groundwater Discharge Permit	Covers potential discharges resulting from construction and excavation (e.g., dewatering activities)	**Not anticipated to be needed**		

Table 6.1 Summary Matrix of Potential Required Permits (continued)

Agency	Permit / Review	Reason for Obtaining	Party Responsible for Obtaining	Project Phase to Obtain	Approximate Processing Time
Local Permits / Reviews					
City of Las Vegas Public Works 333 North Rancho Drive Las Vegas, NV 89106 702-229-6272	Encroachment Permit	Required for construction, excavation, installation, or occupancy within CLV Right of Way (ROW)	Contractor	After Conditional Notice to Proceed	2 – 3 business days
City of Las Vegas Public Works 333 North Rancho Drive Las Vegas, NV 89106 702-229-6272	Temporary Stockpile Permit	Required for temporary stockpiles of excavated material	Contractor	Construction	14 days
City of Las Vegas Public Works – Transportation Division 333 North Rancho Drive Las Vegas, NV 89106 702-229-6327	Traffic Barricade Plan Approval	Required for traffic control in City of Las Vegas public ROW	Contractor	After Conditional Notice to Proceed	14 days
Clark County Department of Air Quality 4701 West Russell Road, Suite 200 Las Vegas, Nevada 89118 702-455-5942	Dust Control Permit	Disturbing soil or construction projects greater than or equal to 0.25 acres; trenching operation greater than or equal to 100 feet in length	Contractor	After Conditional Notice to Proceed	7 days
Clark County Department of Air Quality 4701 West Russell Road, Suite 200 Las Vegas, NV 89118 702-455-5942	Asbestos Abatement NESHAPS Permit	Required for removal and disposal of any asbestos-containing material	**Not anticipated to be needed**		

Table 6.1 Summary Matrix of Potential Required Permits (continued)

Agency	Permit / Review	Reason for Obtaining	Party Responsible for Obtaining	Project Phase to Obtain	Approximate Processing Time
Local Permits / Reviews (continued)					
Clark County Department of Building & Fire Prevention 4701 West Russell Road, Suite 200 Las Vegas, NV 89118 702-455-3000	Conditional Grading Permit	Required for temporary stockpiles of excavated material	Contractor	Construction	7 – 14 days
Clark County Public Works 500 South Grand Central Parkway Las Vegas, NV 89155 702-455-6000	Encroachment Permit	Required for minor construction, modification, or maintenance of existing improvements or installation of new facilities in Clark County ROW	Engineer	90% Design	14 days
Clark County Public Works 500 South Grand Central Parkway Las Vegas, NV 89155 702-455-6000	Off-Site Construction Permit	Required for construction, excavation, installation, or occupancy within Clark County ROW	City of Las Vegas	Planning	1 – 3 weeks
Clark County Public Works 500 South Grand Central Parkway Las Vegas, NV 89155 702-455-6000	Traffic Control Plan Approval	Required for traffic control in Clark County public ROW	Contractor	After Conditional Notice to Proceed	14 – 30 days

6.1 CHAPTER 8 PROJECT-SPECIFIC ENVIRONMENTAL ANALYSIS

The CCRFCD *Supplemental Environmental Impact Statement (SEIS): Flood Control Master Plan* requires a preliminary analysis of the potential environmental impacts related to the construction of regional facilities. An initial screening was conducted, according to the guidelines established in Chapter 8 of the SEIS, to determine the potential impacts on the Project or created by the Project, in the areas of: geology and soils; paleontology; surface water; groundwater; biological resources; cultural resources; air quality; visual resources; recreation; hazardous materials; land use; transportation; noise; socioeconomics; and environmental justice. In general, the initial screening suggested that the Project will not significantly impact any of the environmental resources evaluated. In select instances, standard Best Management Practices (BMPs) and engineering protocols should mitigate any potential minor impacts to an acceptable level. The complete Chapter 8 Project-Specific Environmental Analysis is available in **Appendix G.1**. The report was provided to the CCRFCD for review and concurrence was reached regarding the absence of need for further environmental documentation. The CCRFCD approval correspondence regarding the Chapter 8 Project-Specific Environmental Analysis can be found in **Appendix G.2**.

Section 7

7.0 GEOTECHNICAL

A geotechnical sub-surface investigation has been performed for the Rancho Road System Storm Drain – Elkhorn Project by Ninyo & Moore. The sub-surface investigation consisted of performing four geotechnical borings equally spaced along the Elkhorn Road alignment at a depth of 25 feet below grade (approximately 5 to 10 feet below the invert of the Project facility). Additionally, geotechnical investigations from adjacent projects were referenced for additional substantiation. Soil boring log information obtained along the Project alignment indicates that groundwater is not expected to be encountered during this project, as it was not detected during the geotechnical investigation. Furthermore, reference information cited by Ninyo & Moore indicates that groundwater levels may be as deep as 250-feet below grade in this area. The boring logs did detect relatively thin, slightly cemented soil layers throughout soil samples, leading to the conclusion that there is a high probability caliche may be present throughout the Project alignment. Based on the sampled soils engineering properties, pertinent trench, backfill, and pavement recommendations are incorporated within the 30% Preliminary Design Drawings details provided in **Appendix E**. Refer to **Appendix H** for the complete Ninyo & Moore draft geotechnical report text with accompanying boring log and sample test results.

Section 8

8.0 PROJECT COST ESTIMATE

An Opinion of Probable Construction Cost (OPCC) was prepared for the Rancho Road System Storm Drain – Elkhorn Project based on 30% Preliminary Design Plans. Based on the level of design effort, a Class IV OPCC was prepared. Recent contractor bid prices for comparable projects within the Las Vegas Valley were referenced during the preparation of the OPCC to account for current market conditions. As described in AACE International Recommended Practice # 18R-97, the expected accuracy range variations of a Class IV OPCC are: low: -15% to -30% and high:+20% to +50%. The OPCC for the Project is $3,366,217, inclusive of a 20% contingency, with a range of $2,861,000 to $4,040,000. An OPCC break down is provided in **Appendix I**. The OPCC values described in this report are in present values and do not account for future escalation and inflation.

MWH, now part of Stantec has no control over costs of labor, materials, competitive bidding, environments, unidentified field conditions, financial and/or commodity market conditions, or any other factors likely to affect the OPCC of this Project. All of these factors are and will unavoidably remain in a state of change, especially in light of high market volatility attributable to Acts of God and other market forces or events beyond the control of the parties. This OPCC deliverable is based on normal market conditions defined by stable resource supply/demand relationships, and does not account for extreme inflationary or deflationary market cycles. Furthermore, this OPCC is a "snapshot in time" and the reliability of this OPCC will degrade over time. MWH, now part of Stantec cannot and does not make any warranty, promise, guarantee or representation, either expressed or implied that proposals, bids, project construction costs, or cost of operation and maintenance functions will not vary significantly from MWH, now part of Stantec's good faith Class IV OPCC.

Section 9

9.0 CONCLUSION

The Rancho Road System Storm Drain – Elkhorn Project is a proposed regional flood control facility on Elkhorn Road between N. Hualapai Way and N. Grand Canyon Drive. The purpose for constructing this Project is to complete the regional RCHB 0295 facility. Hydraulic analyses and calculations provided in this report support the facility design to accommodate the 100-year flows previously established.

The improvements proposed for the Project include:

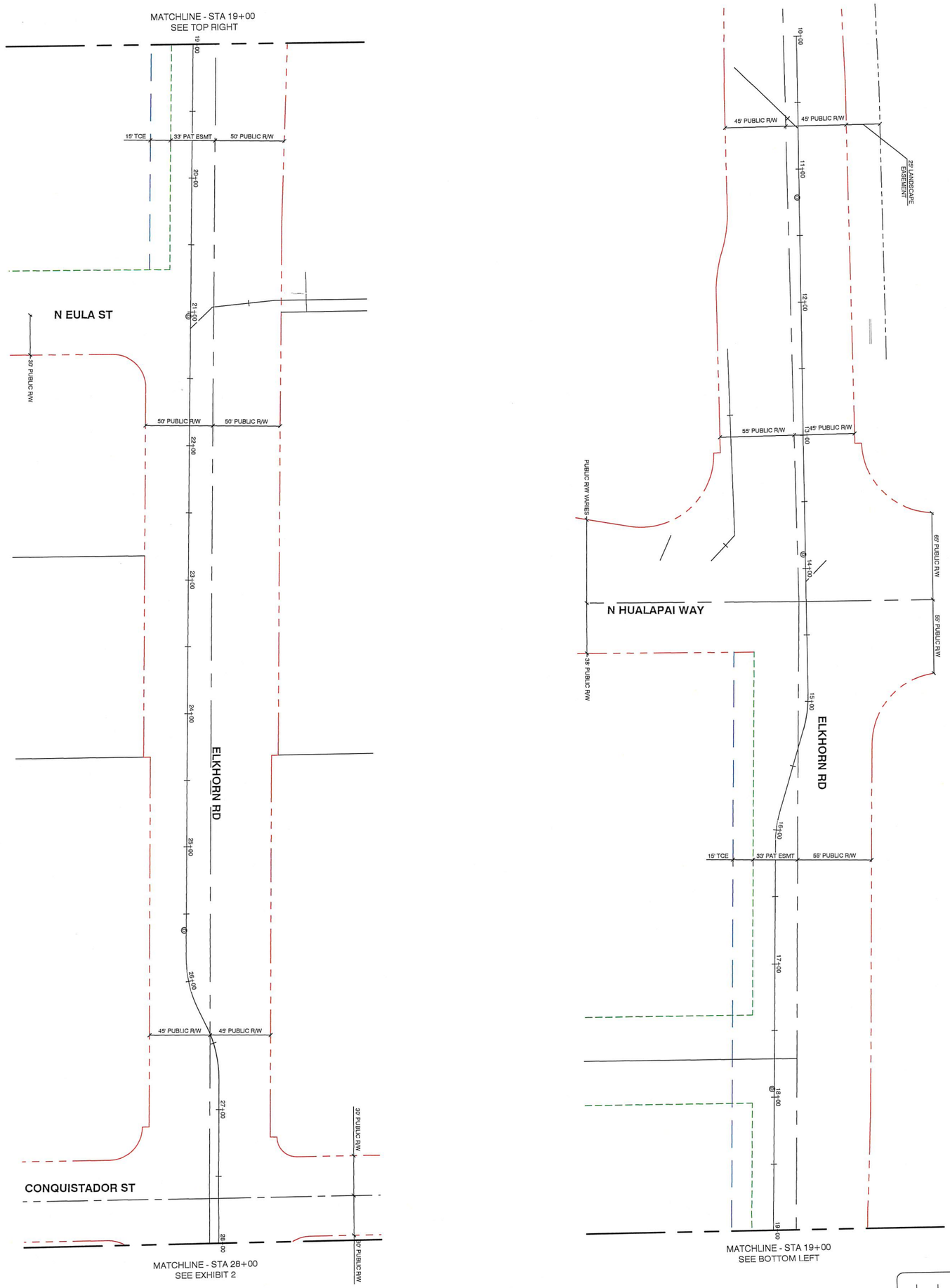
- Demolition and removal of an interim condition overflow drainage structure and existing segment of storm drain west of N. Hualapai Way.
- One junction structure connection connecting a proposed lateral and drop inlet to the existing 6-foot x 4-foot RCA culvert west of N. Hualapai Way.
- One junction / transition structure at the existing 6-foot x 4-foot arch culvert connection to the 7-foot x 6-foot RCB storm drain west of N. Hualapai Way.
- Eight drop inlets.
- Approximately 1000 LF of 7-foot x 6-foot RCB storm drain.
- Approximately 20 LF of 54-inch RCP storm drain.
- Approximately 260 LF of 30-inch RCP storm drain lateral.
- Approximately 200 LF of 18-inch RCP storm drain lateral.
- Approximately 30 LF of triple 20-inch PVC storm drain lateral.

Further utility coordination will be required with both NV Energy and the Las Vegas Valley Water District to relocate facilities (distribution duct banks and two 12-inch diameter water lines) that appear to be in conflict with the proposed improvements. Additional utility sub-surface potholes are recommended to augment the potholes performed and presented in this report. Utility conflicts and relocations will be further investigated (and designed) during later design stages of this Project.

Completion of the Rancho Road System Storm Drain – Elkhorn Project will eliminate interim condition overflows onto Elkhorn Road at the intersection with N. Hualapai Way. This Project will also complete the regional facility by constructing the missing segment, thereby providing the capability to alleviate flooding of downstream areas. The anticipated cost to construct this Project (**Appendix I**), based on the Preliminary 30% Design Plans (**Appendix E**), is between $2,861,000 and $4,040,000. Further modifications to the design and OPCC will be performed as the Project schedule progresses.

Appendix A

APPENDIX A.1
RIGHT-OF-WAY FIGURES



LEGEND

- EXISTING RIGHT-OF-WAY
- EXISTING PATENT EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- PROPERTY LINE
- LANDSCAPE EASEMENT

GRAPHIC SCALE (IN FEET)
20 0 10 20 40

NORTH

APPROVED FOR CONSTRUCTION
SOUTHWEST GAS CORPORATION
DATE:

NOT FOR CONSTRUCTION

SHEET 1 OF 2

DRAWING NO. XXX-XXXX

TITLE
RANCHO ROAD SYSTEM STORM DRAIN - ELKHORN

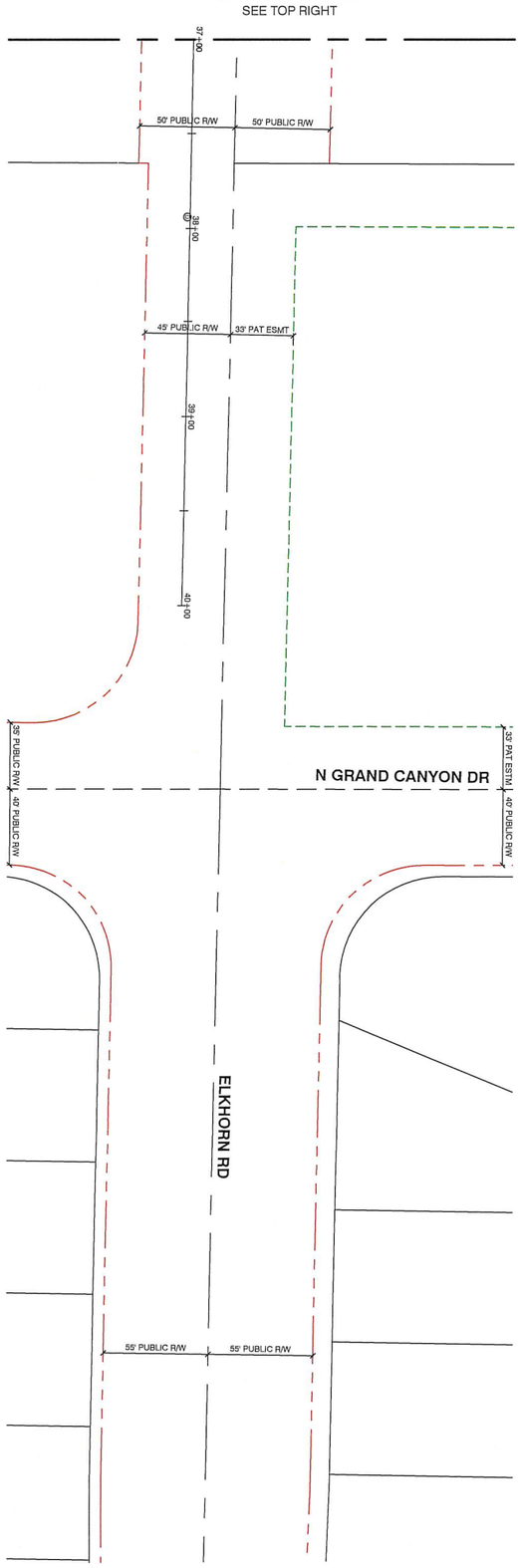
SHEET
RIGHT-OF-WAY EXHIBIT - 1
ELKHORN - HAULAPAI TO GRAND CANYON

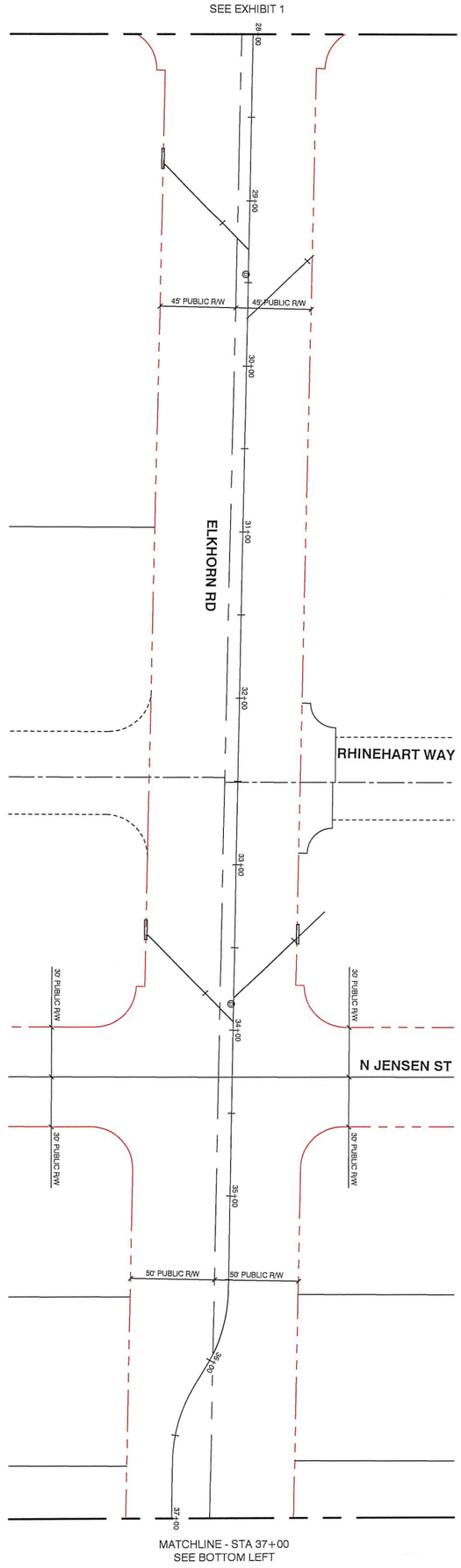
PREPARED FOR
CITY OF LAS VEGAS

H# 170149	BID# XX.XXXXX
DATE: JULY 2017	DESIGNED BY: XXX
SUBMITTAL STAGE: 30% - PRELIMINARY	DRAWN BY: XXX
	CHECKED BY: XXX

PREPARED BY
Stantec
3010 W. CHARLESTON BLVD.
SUITE 100
LAS VEGAS, NV 89102

NO.	DATE	REVISIONS





LEGEND

- EXISTING RIGHT-OF-WAY
- EXISTING PATENT EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- PROPERTY LINE
- LANDSCAPE EASEMENT

GRAPHIC SCALE
20 0 10 20 40
(IN FEET)

NORTH

APPROVED FOR CONSTRUCTION
SOUTHWEST GAS CORPORATION
DATE:

NOT FOR CONSTRUCTION

SHEET 2
2 OF 2
DRAWING NO. XXX-XXXX

TITLE
RANCHO ROAD SYSTEM
STORM DRAIN - ELKHORN

SHEET
RIGHT-OF-WAY EXHIBIT - 2
ELKHORN - HAULAPAI TO GRAND CANYON

PREPARED FOR
CITY OF LAS VEGAS

H# 170149	BID# XX.XXXXX
DATE: JULY 2017	DESIGNED BY: XXX
SUBMITTAL STAGE: 30% - PRELIMINARY	DRAWN BY: XXX
	CHECKED BY: XXX

PREPARED BY
Stantec
3010 W. CHARLESTON BLVD.
SUITE 100
LAS VEGAS, NV 89102

NO.	DATE	REVISIONS

NOTES

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

No liability is assumed for the accuracy of the data deliniated 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

0 100 200 400 600 800

MAP LEGEND

ASSESSOR'S PARCELS - CLARK CO., NV.
Michele W. Shafe - Assessor

PARCEL BOUNDARY
SUB BOUNDARY
PM/LD BOUNDARY
ROAD EASEMENT
MATCH / LEADER LINE
HISTORIC LOT LINE
HISTORIC SUB BOUNDARY
HISTORIC PM/LD BOUNDARY
SECTION LINE

CONDOMINIUM UNIT
AIR SPACE PCL
RIGHT OF WAY PCL
SUB-SURFACE PCL

001 ROAD PARCEL NUMBER
001 PARCEL NUMER
1.00 ACREAGE
202 PARCEL SUB/SEQ NUMBER
PB 24-45 PLAT RECORDING NUMBER
5 BLOCK NUMBER
5 LOT NUMBER
GL5 GOV. LOT NUMBER

BOOK T19S R59E

SEC. 13

MAP S 2 SE 4

126-13-8

099 100
126 125
137 138

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: 6/26/2013

CLARK COUNTY ASSESSOR MAPPING DIVISION NEVADA

SEVERENCE LN
BURKEHAVEN AVE
HIGHBRIDGE CT
WALWORTH AVE
CLIFF'S EDGE POD 115, 116 AND 117 UNIT 2B
CLIFF'S EDGE POD 115, 116 AND 117 UNIT 4B MODEL
CLIFF'S EDGE POD 115, 116 AND 117 UNIT 2A MODEL
RUMNEY ST
JUNIPER BRUSH AVE
SCOTCH ELM AVE
LILAC SQUARE AVE
YEW BLOSSOM AVE
POPLAR PARK AVE
RAVENS CROFT AVE
ELMWOOD GLEN AVE
JOLLY HILL AVE
CLIFF'S EDGE POD 115, 116 AND 117
UNIT 3B
PROVIDENCE POD 118 PHASE 1
PB 132-53
PB 132-76
PB 132-75
PB 130-74
PB 130-79
PB 131-9
PT 126-24-113-052
DUCHESS OF YORK AVE
WOLFEBORO AVE
NEW BOSTON AVE
BLACK FRIAR CT
DOVE ROW AVE
CLIFF'S EDGE POD 115, 116 AND 117 UNIT 1B
POD 121 AT PROVIDENCE UNIT 1
TARBELL GROVE AVE
BULL RUN GROVE AVE
MERIWEATHER GROVE AVE PB 145-53
PROVIDENCE PHASE 3
ROYAL MINT AVE
MADISON GROVE AT
CHESAPEAKE COVE ST
PERKINS HILL ST
MILLSFIELD ST
PICNIC HILL ST
RUMNEY ST
PUDDLE DUCK ST
MULBERRY FOREST ST
ALDER BEECH ST
REGENT POND ST
CREST ST
BREAKFAST HILL ST
BEACHWOOD
WILLOW BRUSH ST
DUCHESS OF YORK AVE
PUCKERSHIRE ST
AT DOVER ST
NGRE AT DOVER
MERIMACK OAKS ST
NEW HAMPTON ST
QUEENS CRESCENT ST
MARBURY ST
EGAN CREST DR
ELKHORN RD
HUALAPAI WAY
Project Alignment
TAX DIST 200

Figure 2

NOTES

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

No liability is assumed for the accuracy of the data deliniated 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

0 100 200 400 600 800

MAP LEGEND

- PARCEL BOUNDARY
- SUB BOUNDARY
- PM/LD BOUNDARY
- ROAD EASEMENT
- MATCH / LEADER LINE
- HISTORIC LOT LINE
- HISTORIC SUB BOUNDARY
- HISTORIC PM/LD BOUNDARY
- SECTION LINE
- CONDOMINIUM UNIT
- AIR SPACE PCL
- RIGHT OF WAY PCL
- SUB-SURFACE PCL

001 ROAD PARCEL NUMBER
001 PARCEL NUMER
1.00 ACREAGE
202 PARCEL SUB/SEQ NUMBER
PB 24-45 PLAT RECORDING NUMBER
5 BLOCK NUMBER
5 LOT NUMBER
GL5 GOV. LOT NUMBER

ASSESSOR'S PARCELS - CLARK CO., NV.
Michele W. Shafe - Assessor

BOOK	SEC.	MAP
T19S R59E	24	N 2 NE 4

098	099	100	101
127	126	125	124
136	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

126-24-5

Scale: 1" = 200' Rev: 03/25/2011

CLARK COUNTY ASSESSOR MAPPING DIVISION NEVADA

PROJECT ALIGNMENT

TAX DIST 200

Figure 3

NOTES

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

No liability is assumed for the accuracy of the data deliniated 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

0 100 200 400 600 800

MAP LEGEND

PARCEL BOUNDARY
SUB BOUNDARY
PM/LD BOUNDARY
ROAD EASEMENT
MATCH / LEADER LINE
HISTORIC LOT LINE
HISTORIC SUB BOUNDARY
HISTORIC PM/LD BOUNDARY
SECTION LINE

CONDOMINIUM UNIT
AIR SPACE PCL
RIGHT OF WAY PCL
SUB-SURFACE PCL

001 ROAD PARCEL NUMBER
001 PARCEL NUMER
1.00 ACREAGE
202 PARCEL SUB/SEQ NUMBER
PB 24-45 PLAT RECORDING NUMBER
5 BLOCK NUMBER
5 LOT NUMBER
GL5 GOV. LOT NUMBER

ASSESSOR'S PARCELS - CLARK CO., NV.
Michele W. Shafe - Assessor

BOOK T19S R60E

98 099	100 101
27 126	125 124
36 137	138 139

SEC. 18

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

MAP S 2 SW 4

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

125-18-4

CLARK COUNTY ASSESSOR MAPPING DIVISION NEVADA

Scale: 1" = 200' Rev: 5/26/2016

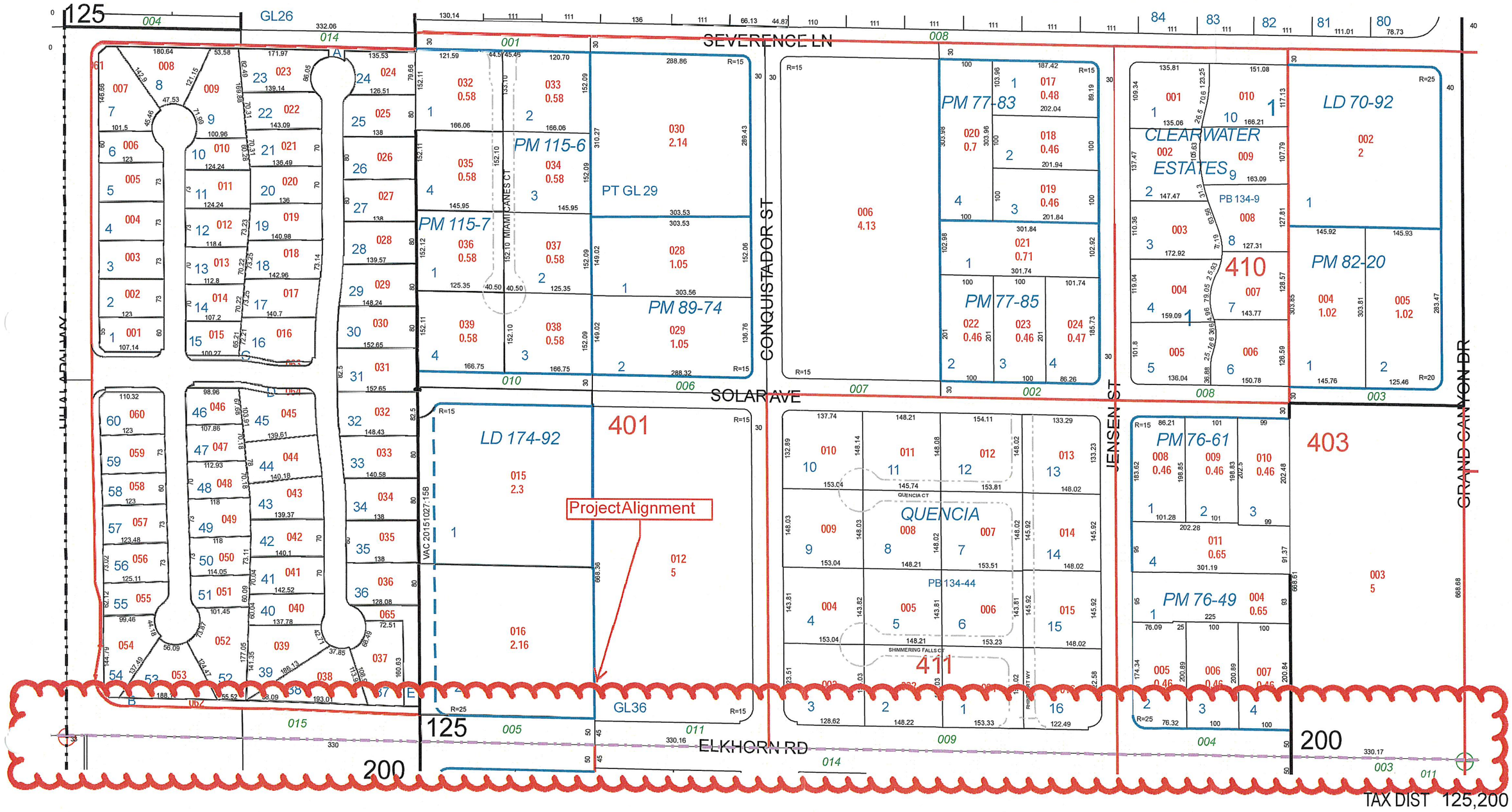


Figure 4

NOTES

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

No liability is assumed for the accuracy of the data deliniated 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

0 100 200 400 600 800

MAP LEGEND

ASSESSOR'S PARCELS - CLARK CO., NV.
Michele W. Shafe - Assessor

PARCEL BOUNDARY
SUB BOUNDARY
PM/LD BOUNDARY
ROAD EASEMENT
MATCH / LEADER LINE
HISTORIC LOT LINE
HISTORIC SUB BOUNDARY
HISTORIC PM/LD BOUNDARY
SECTION LINE

CONDOMINIUM UNIT
AIR SPACE PCL
RIGHT OF WAY PCL
SUB-SURFACE PCL

001 ROAD PARCEL NUMBER
001 PARCEL NUMER
1.00 ACREAGE
202 PARCEL SUB/SEQ NUMBER
PB 24-45 PLAT RECORDING NUMBER
5 BLOCK NUMBER
5 LOT NUMBER
GL# GOV. LOT NUMBER

BOOK T19S R60E

9 8 099	100 101
2 7 126	125 124
3 6 137	138 139

SEC. 19

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

MAP N 2 NW 4

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

125-19-1

CLARK COUNTY ASSESSOR MAPPING DIVISION NEVADA

Scale: 1" = 200' Rev: 2/10/2016

ELKHORN RD
WITTIG AVE
DORRELL LN
HUALAPAI WAY
EULA ST
CONQUISTADOR ST
JENSEN ST
GRAND CANYON DR
MESSARA CIR
ROCK PARTRIDGE CT
RHINEHART WY
ADDIE MEADOW CT
PORCUPINE HILLS CT
ROYAL ANTELOPE ST
BLUE CRANE AVE
WIDGEON CT

PM 80-59
PM 82-25
PM 76-42
PM 84-3
PM 77-10
PM 103-31
PM 86-46
PM 76-36
PM 74-96
PB 146-17
PB 147-90
SAVONA UNIT 2
SAVONA UNIT 3
LD 77-91
LD 114-92
LD 57-83

Project Alignment

TAX DIST 125,200

Figure 5

APPENDIX A.2
PATENT EASEMENT
LEGAL DESCRIPTIONS

4-1222
(Aug. 1956)

Nevada 040213

The United States of America,

To all whom these presents shall come, Greeting:

WHEREAS, a Certificate of the Land Office at **Reno, Nevada,**
has been issued showing that full payment has been made by the claimant
Anton Slogar,
pursuant to the provisions of the Act of Congress approved June 1, 1938 (52 Stat. 609), entitled "An Act to provide for the purchase of public lands for home and other sites," and the acts supplemental thereto, for the following-described land:

Mount Diablo Meridian, Nevada.

T. 19 S., R. 60 E.,

Sec. 18, E½SE¼SE¼SW¼.

The area described contains **5.00** acres, according to the Official Plat of the Survey of the said Land, on file in the Bureau of Land Management:

NOW KNOW YE, That the UNITED STATES OF AMERICA, in consideration of the premises, and in conformity with the several Acts of Congress in such case made and provided, HAS GIVEN AND GRANTED, and by these presents DOES GIVE AND GRANT unto the said claimant and to the heirs of the said claimant the Tract above described; TO HAVE AND TO HOLD the same, together with all the rights, privileges, immunities, and appurtenances, of whatsoever nature, thereunto belonging, unto the said claimant and to the heirs and assigns of the said claimant forever; subject to any vested and accrued water rights for mining, agricultural, manufacturing, or other purposes, and rights to ditches and reservoirs used in connection with such water rights, as may be recognized and acknowledged by the local customs, laws, and decisions of courts; and there is reserved from the lands hereby granted, a right-of-way thereon for ditches or canals constructed by the authority of the United States. Excepting and reserving, also, to the United States, all coal, oil, gas, and other mineral deposits, in the land so patented, together with the right to prospect for, mine, and remove the same according to the provisions of said Act of June 1, 1938. This patent is subject to a right-of-way not exceeding **33** feet in width, for roadway and public utilities purposes, to be located **along the boundaries of said land.**

IN TESTIMONY WHEREOF, the undersigned authorized officer of the Bureau of Land Management, in accordance with the provisions of the Act of June 17, 1948 (62 Stat., 476), has, in the name of the United States, caused these letters to be made Patent, and the Seal of the Bureau to be hereunto affixed.

GIVEN under my hand, in the District of Columbia, the **TWENTY-FOURTH** day of **JULY** in the year of our Lord one thousand nine hundred and **FIFTY-SEVEN** and of the Independence of the United States the one hundred and **EIGHTY-SECOND.**

[SEAL]

For the Director, Bureau of Land Management.

By Rose M. Beall
Chief, Patents Section.

Patent Number 1173602

U. S. GOVERNMENT PRINTING OFFICE 16--68764-4

4-1222
(Aug. 1957)

Nevada 060958

The United States of America,

To all whom these presents shall come, Greeting:

WHEREAS, a Certificate of the Land Office at **Reno, Nevada,**
has been issued showing that full payment has been made by the claimant
George E. Fakehany
pursuant to the provisions of the Act of Congress approved June 1, 1938 (52 Stat. 609), entitled "An Act to provide for the purchase of public lands for home and other sites," and the acts supplemental thereto, for the following-described land:

Mount Diablo Meridian, Nevada.

T. 19 S., R. 60 E.,

Sec. 19, Lot 7.

The area described contains **5.00** acres, according to the Official Plat of the Survey of the said Land, on file in the Bureau of Land Management:

NOW KNOW YE, That the UNITED STATES OF AMERICA, in consideration of the premises, and in conformity with the several Acts of Congress in such case made and provided, HAS GIVEN AND GRANTED, and by these presents DOES GIVE AND GRANT unto the said claimant and to the heirs of the said claimant the Tract above described; TO HAVE AND TO HOLD the same, together with all the rights, privileges, immunities, and appurtenances, of whatsoever nature, thereunto belonging, unto the said claimant and to the heirs and assigns of the said claimant forever; subject to any vested and accrued water rights for mining, agricultural, manufacturing, or other purposes, and rights to ditches and reservoirs used in connection with such water rights, as may be recognized and acknowledged by the local customs, laws, and decisions of courts; and there is reserved from the lands hereby granted, a right-of-way thereon for ditches or canals constructed by the authority of the United States. Excepting and reserving, also, to the United States all oil, gas and other mineral deposits, in the land so patented, together with the right to prospect for, mine, and remove the same according to the provisions of said Act of June 1, 1938. This patent is subject to a right-of-way not exceeding **33** feet in width, for roadway and public utilities purposes, to be located **along the boundaries of said land.**

IN TESTIMONY WHEREOF, the undersigned authorized officer of the Bureau of Land Management, in accordance with the provisions of the Act of June 17, 1948 (62 Stat., 476), has, in the name of the United States, caused these letters to be made Patent, and the Seal of the Bureau to be hereunto affixed.

GIVEN under my hand, in the District of Columbia, the **THIRTEENTH** day of **AUGUST** in the year of our Lord one thousand nine hundred and **SIXTY-THREE** and of the Independence of the United States the one hundred and **EIGHTY-EIGHTH.**

[SEAL]

For the Director, Bureau of Land Management.

By Elizabeth B. Hucks
Chief, Patents Section.

Patent Number 1232970

U. S. GOVERNMENT PRINTING OFFICE 16—68704-5

4-1223
(Aug. 1957)

Nevada 060959

The United States of America,

To all whom these presents shall come, Greeting:

WHEREAS, a Certificate of the Land Office at **Reno, Nevada,**
has been issued showing that full payment has been made by the claimant
Helen K. Fakehany
pursuant to the provisions of the Act of Congress approved June 1, 1938 (52 Stat. 609), entitled "An Act to provide for the purchase of public lands for home and other sites," and the acts supplemental thereto, for the following-described land:

Mount Diablo Meridian, Nevada.

T. 19 S., R. 60 E.,

Sec. 19, Lot 8.

The area described contains **5.20** acres, according to the Official Plat of the Survey of the said Land, on file in the Bureau of Land Management:

NOW KNOW YE, That the UNITED STATES OF AMERICA, in consideration of the premises, and in conformity with the several Acts of Congress in such case made and provided, HAS GIVEN AND GRANTED, and by these presents DOES GIVE AND GRANT unto the said claimant and to the heirs of the said claimant the Tract above described; TO HAVE AND TO HOLD the same, together with all the rights, privileges, immunities, and appurtenances, of whatsoever nature, thereunto belonging, unto the said claimant and to the heirs and assigns of the said claimant forever; subject to any vested and accrued water rights for mining, agricultural, manufacturing, or other purposes, and rights to ditches and reservoirs used in connection with such water rights, as may be recognized and acknowledged by the local customs, laws, and decisions of courts; and there is reserved from the lands hereby granted, a right-of-way thereon for ditches or canals constructed by the authority of the United States. Excepting and reserving, also, to the United States all oil, gas and other mineral deposits, in the land so patented, together with the right to prospect for, mine, and remove the same according to the provisions of said Act of June 1, 1938. This patent is subject to a right-of-way not exceeding **33** feet in width, for roadway and public utilities purposes, to be located **along the boundaries of said land.**

IN TESTIMONY WHEREOF, the undersigned authorized officer of the Bureau of Land Management, in accordance with the provisions of the Act of June 17, 1948 (62 Stat., 476), has, in the name of the United States, caused these letters to be made Patent, and the Seal of the Bureau to be hereunto affixed.

GIVEN under my hand, in the District of Columbia, the **TENTH** day of **SEPTEMBER** in the year of our Lord one thousand nine hundred and **SIXTY-THREE** and of the Independence of the United States the one hundred and **EIGHTY-EIGHTH.**

[SEAL]

For the Director, Bureau of Land Management.

By Elizabeth B. Bucks

Chief, Patents Section.

Patent Number 1233374

U. S. GOVERNMENT PRINTING OFFICE 16—68764-5

Appendix B

APPENDIX B.1
UTILITY CROSSING MATRIX

UTILITY CONFLICT SCHEDULE

Station	Type of Utility
9+62.02	Existing 6" PE GAS Line Crossing Proposed DI Lateral #1
9+62.04	Existing 6" HP STL GAS Line Crossing Proposed DI Lateral #1
10+23.95	Existing 12 PVC WATER Line Crossing Proposed DI Lateral #2
10+28.77	Existing 12 PVC WATER Line Crossing Proposed DI Lateral #2
10+40.25	Existing 48" MLCP WATER Line Crossing Proposed DI Lateral #2
10+55.19	Existing 8" PVC SS Line Crossing Proposed DI Lateral #2
12+96.09	Existing UG CATV Line Crossing Primary Alignment
13+04.95	Existing UG CATV Line Crossing DI Lateral #3
13+31.77	Existing UG ELECTRICAL Line Crossing DI Lateral #3
13+40.46	Existing 4" ELECTRICAL Line Crossing Primary Alignment
13+43.17	Existing 24" RCP SD Line Crossing Primary Alignment
13+53.46	Existing 6" ELECTRICAL Line Crossing Primary Alignment
13+53.98	Existing UG ELECTRICAL Lines Crossing Proposed DI Lateral #3
13+57.78	Existing 6" ELECTRICAL Line Crossing Primary Alignment
13+93.86	Existing 54" RCP SD Line Crossing Primary Alignment
14+02.12	Existing 54" RCP SD Line Intercepting Primary Alignment
14+03.75	Existing ELECTRICAL DUCTBANK Crossing 54" Lateral
14+27.23	Existing 12" PVC WATER Line Crossing Primary Alignment
14+39.88	Existing 42" MLCP WATER Line Crossing Primary Alignment
14+69.55	Existing 4" PE GAS Line Crossing Primary Alignment
14+73.05	Existing 6" ELECTRICAL Line Crossing Primary Alignment
14+87.23	Existing UG CATV Line Crossing Primary Alignment
15+55.67	Existing 16" C905 SS Line Crossing Primary Alignment
18+02.31	Existing 2" PE GAS Line Crossing Primary Alignment
20+82.79	Existing 2" PE GAS in 6" STL SLV Crossing Primary Alignment
21+00.15	Existing 12" PVC SS Crossing (3)-20" PVC C905 Laterals
21+06.81	Existing 2" ELECTRICAL Conduit Crossing Primary Alignment
21+07.29	Existing 2" ELECTRICAL Conduit Crossing (3)-20" Laterals
21+08.46	Existing 20" C905 SD Lateral Intercepting Primary Alignment
21+25.08	Existing 4" TEL Line Crossing Primary Alignment
21+31.51	Existing ELECTRICAL Duct bank Crossing Primary Alignment
21+32.24	Existing ELECTRICAL Duct bank Crossing Primary Alignment
21+33.12	Existing ELECTRICAL Duct bank Crossing Primary Alignment
21+93.81	Existing (4)-4" TEL Line Crossing Primary Alignment
22+00.91	Existing (2)-3" Fiber Optic Lines Crossing Primary Alignment
23+91.97	Existing UG CATV Line Crossing Primary Alignment
24+21.87	Existing (2)-6" ELECTRICAL Conduits Crossing Primary Alignment
24+30.57	Existing 6" PVC WATER Line Crossing Primary Alignment
25+28.57	Existing (4)-4" TEL Lines Crossing Primary Alignment
25+48.03	Existing 4" ELECTRICAL Conduit Crossing Primary Alignment
26+29.86	Existing 12" PVC SS Line Crossing Primary Alignment
27+39.05	Existing 4" ELECTRICAL Conduit Crossing Primary Alignment
27+51.18	Existing 2" PE GAS in 6" STL SLV Crossing Primary Alignment
27+86.63	Existing 8" PVC WATER Crossing Primary Alignment
28+78.28	Existing UG ELECTRICAL Ductbank Crossing DI Lateral #6
28+81.39	Existing UG ELECTRICAL Ductbank Crossing DI Lateral #6
28+84.44	Existing UG ELECTRICAL Ductbank Crossing DI Lateral #6

28+91.08	Existing 12" PVC WATER Line Crossing DI Lateral #6
29+03.72	Existing UG CATV Line Crossing DI Lateral #6
29+17.49	Existing 12" PVC SS Line Crossing DI Lateral #6
29+45.53	Existing 6" PE GAS Line Crossing DI Lateral #5
29+57.04	Existing 6" STL HP GAS Line Crossing DI Lateral #5
30+28.27	Existing UG CATV Line Crossing Primary Alignment
32+36.02	Existing 8" PVC SS Line Crossing Primary Alignment
32+45.80	Existing 2" PE GAS in 6" STL SLV Crossing Primary Alignment
32+63.74	Existing 8" PVC WATER Crossing Primary Alignment
33+44.43	Existing ELECTRICAL DUCTBANK Crossing DI Lateral #8
33+52.51	Existing 6" PE Gas Line Crossing DI Lateral #7
33+55.22	Existing 12" PVC WATER Crossing DI Lateral #8
33+65.70	Existing 6" STL HP Gas Line Crossing DI Lateral #7
33+67.42	Existing 12" PVC SS Crossing DI Lateral #8
34+34.18	Existing 8" PVC SS Crossing Primary Alignment
34+42.17	Existing 12" PVC WATER Line Crossing Primary Alignment
34+44.43	Existing 2" PE GAS in 6" STL SLV Crossing Primary Alignment
34+53.98	Existing 4" TEL Line Crossing Primary Alignment
34+57.51	Existing ELECTRICAL Line Crossing Primary Alignment
35+71.39	Existing 1" PE GAS Line Crossing Primary Alignment
36+07.40	Existing 12" PVC SS Line Crossing Primary Alignment
36+23.02	Existing UG CATV Line Crossing Primary Alignment
38+37.47	Existing ELECTRICAL Duct bank Crossing Primary Alignment
38+48.42	Existing ELECTRICAL Duct bank Crossing Primary Alignment

PRIMARY POTHOLE SCHEDULE

The Primary Pothole Matrix, shown below in **Table 2.1** summarizes potholes obtained during the 30% design phase. After additional field investigation and record drawing research it was determined that additional potholes would be required. The additional potholes are recommended to be added to the scope in order to ensure accurate depiction of critical crossing utilities. The recommended additional potholes are summarized in **Table 2.2** the Secondary Pothole Matrix.

Table 2.1 – Primary Pothole Matrix (30% Design)

Pothole Number	Station	Utility Type
PH-1	13+63.25	Existing 12" PVC WATER Line Crossing Primary Alignment
PH-2	13+78.66	Existing 42" MLCP WATER Line Crossing Primary Alignment
PH-3	13+95.68	Existing 4" PE GAS Line Crossing Primary Alignment
PH-4	21+02.42	Existing ELECTRIC Duct bank Crossing Primary Alignment
PH-5	21+00.08	Existing 2" PE GAS Line in 6" STL Sleeve Crossing Primary Alignment
PH-6	21+30.85	Existing ELECTRIC Duct bank Parallel to Primary Alignment
PH-7	14+26.01	Existing 2" PE GAS inside 6" STL SLV Line Crossing Primary Alignment
PH-8	17+37.82	Existing 8" PVC WATER Line Crossing Primary Alignment
PH-9	20+56.70	Existing 8" PVC WATER Line Crossing Primary Alignment
PH-10	15+05.02	Existing ELECTRIC Duct bank Crossing Primary Alignment

SECONDARY POTHOLE SCHEDULE

The Secondary Pothole Matrix, **Table 2.2** summarizes additional potholes recommended to be obtained during subsequent design phases of the project. These secondary potholes will encompass existing utilities that could not be captured with the original scope, and include the existing utilities crossing the proposed lateral storm drain connections.

Table 2.2 – Secondary Pothole Matrix (Recommended Potholes Pending Additional Scope Approval)

Station	Offset	Relation	Utility Type
9+62.03	-20.031	DI#1	Existing 6" PE Gas
9+62.03	-17.479	DI#1	Existing 6" Steel High Pressure Gas
10+23.31	45.500	DI#2	Existing 12" PVC Water
10+28.30	40.556	DI#2	Existing 12" PVC Water
10+39.59	29.241	DI#2	Existing 48" MLCP Water
14+67.58	-14.118	Mainline	Existing 6" Steel High Pressure Gas
18+03.91	0.000	Mainline	Existing 2" PE Gas
24+32.18	0.000	Mainline	Existing 6" PVC Water
28+84.82	47.528	DI#6	Existing Electric Duct bank
28+93.19	39.131	DI#6	Existing 12" PVC Water
29+47.66	-25.606	DI#5	Existing 6" PE Gas
29+59.77	-13.499	DI#5	Existing 6" Steel High Pressure Gas
32+47.93	0.000	Mainline	Existing 2" PE Gas
33+54.64	-28.018	DI#7	Existing 6" PE Gas
33+57.38	39.598	DI#8	Existing 12" PVC Water
33+67.88	-14.724	DI#7	Existing 6" Steel High Pressure Gas
34+46.56	0.000	Mainline	Existing 2" PE Gas
35+73.52	0.000	Mainline	Existing 2" PE Gas

APPENDIX B.2
UTILITY POTHOLES

KCI
UTILITY TEST HOLE REPORT

TEST HOLE NO: 1

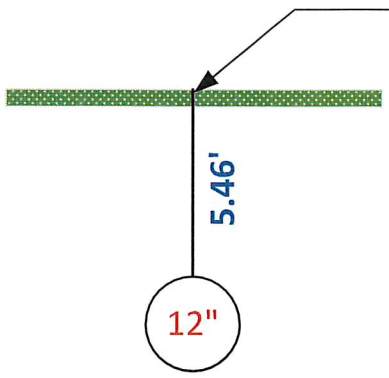
TEST HOLE DATE: 6-19-17

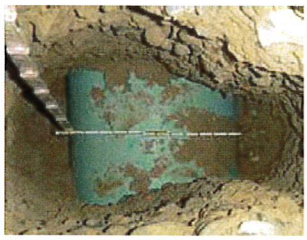
KCI JOB NO: 041702438-A

CLIENT JOB NO: 170149

PROJECT LOCATION: Elkhorn/Hualapai

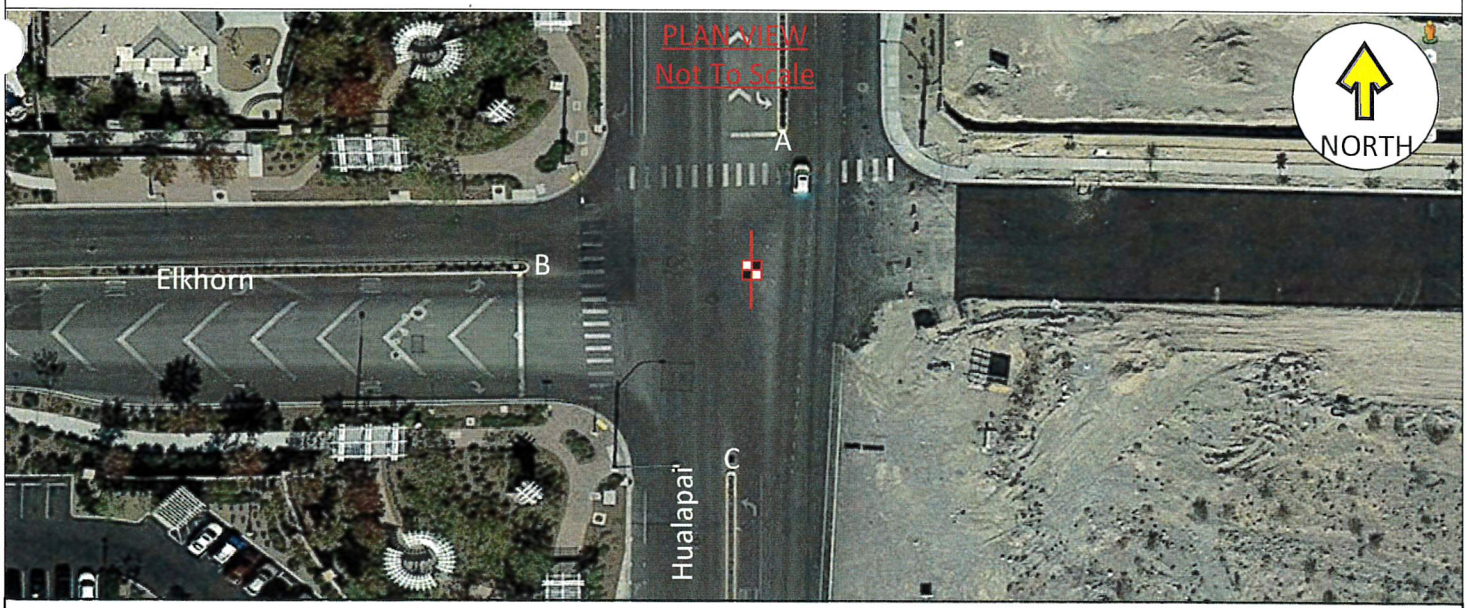
UTILITY TYPE: Water UTILITY SIZE (NOMINAL): 12" UTILITY MATERIAL: Plastic





Field Calcs. (ft)	
Rod-Top Util.	10.44'
Rod-Ref. Pt.	4.98'
Util. Top Cover	**5.46'**
Hand Measure	5.45'
Rod-Bottom Util.	.
Rod-Ref. Pt.	.
Util. Bot. Cover	.
Hand Measure	.

■ Test Hole Location



SWING TIE DATA

	DESCRIPTION	DIST (FT)		DESCRIPTION	DIST (FT)		DESCRIPTION	DIST (FT)
A	Nose of Median	63'	B	Nose of Median	90'	C	Nose of Median	87'

NOTES:

Quality Control Checks:
Field Check DS (Initials)
Office Check RT (Initials)

KCI
UTILITY SERVICES
SUBSURFACE UTILITY ENGINEERING
UTILITY COORDINATION
5940 S. Rainbow Blvd.
Las Vegas, NV 89118
T: 702.832.0729
F: 702.835.9301
Lic # NV0081727

KCI
UTILITY TEST HOLE REPORT

TEST HOLE NO: 2

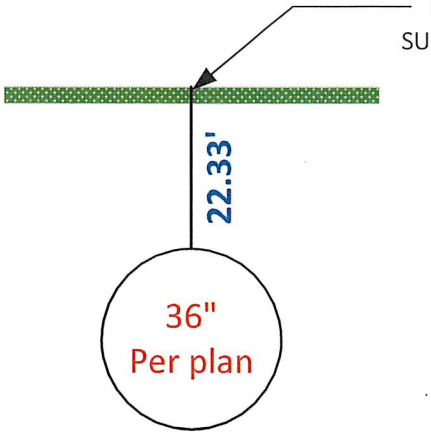
TEST HOLE DATE: 6-22-17

KCI JOB NO: 041702438-A

CLIENT JOB NO: 170149

PROJECT LOCATION: Elkhorn/Hualapai

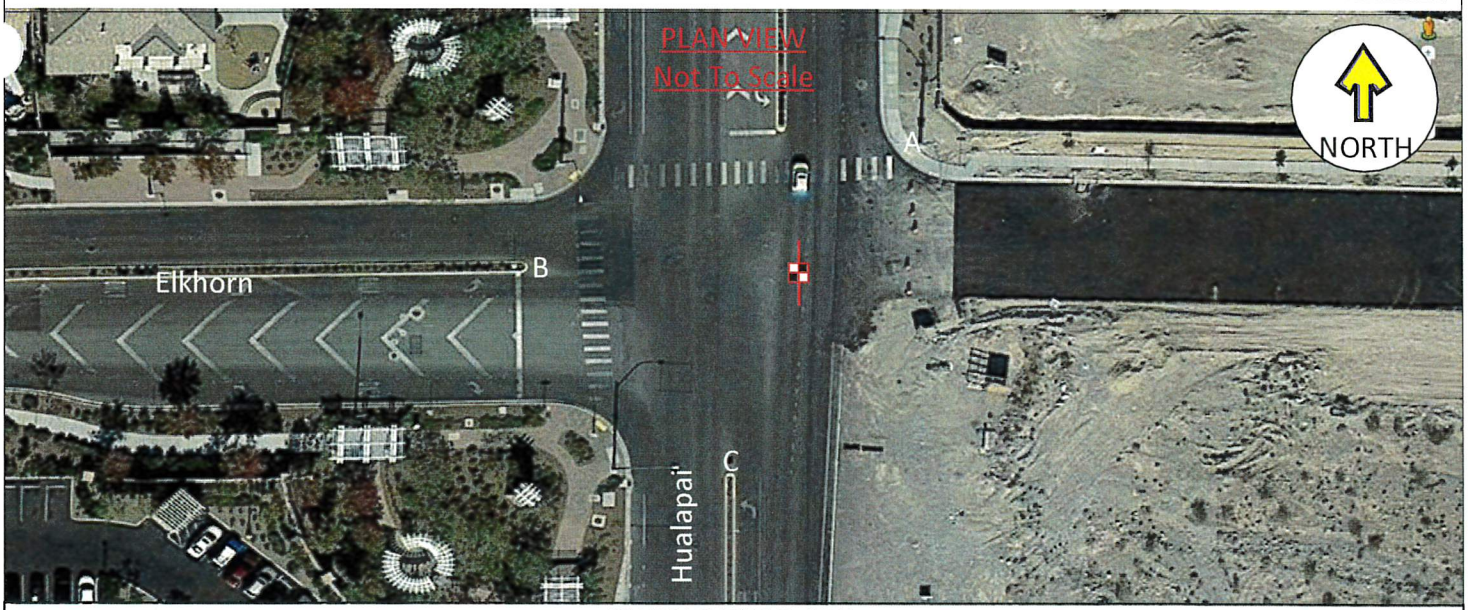
UTILITY TYPE: Water UTILITY SIZE (NOMINAL): 36" per plan UTILITY MATERIAL: MLCP per plan





Field Calcs. (ft)	
Rod-Top Util.	.
Rod-Ref. Pt.	.
Util. Top Cover	**22.33'**
Hand Measure	22.33'
Rod-Bottom Util.	.
Rod-Ref. Pt.	.
Util. Bot. Cover	.
Hand Measure	.

■ Test Hole Location



SWING TIE DATA

	DESCRIPTION	DIST (FT)		DESCRIPTION	DIST (FT)		DESCRIPTION	DIST (FT)
A	St. Light	75'	B	Nose of Median	103'	C	Nose of Median	90'

NOTES:

Quality Control Checks:
Field Check DS (Initials)
Office Check RT (Initials)

KCI
UTILITY SERVICES
SUBSURFACE UTILITY ENGINEERING
UTILITY COORDINATION
5940 S. Rainbow Blvd.
Las Vegas, NV 89118
T: 702.832.0729
F: 702.835.9301
Lic # NV0081727

KCI
UTILITY TEST HOLE REPORT

TEST HOLE NO: 3

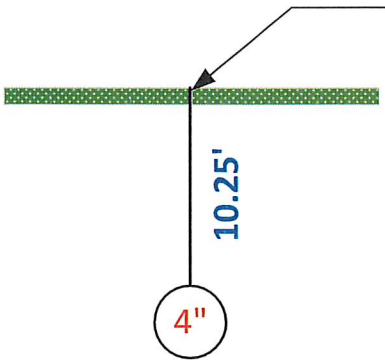
TEST HOLE DATE: 6-19-17

KCI JOB NO: 041702438-A

CLIENT JOB NO: 170149

PROJECT LOCATION: Elkhorn/Hualapai

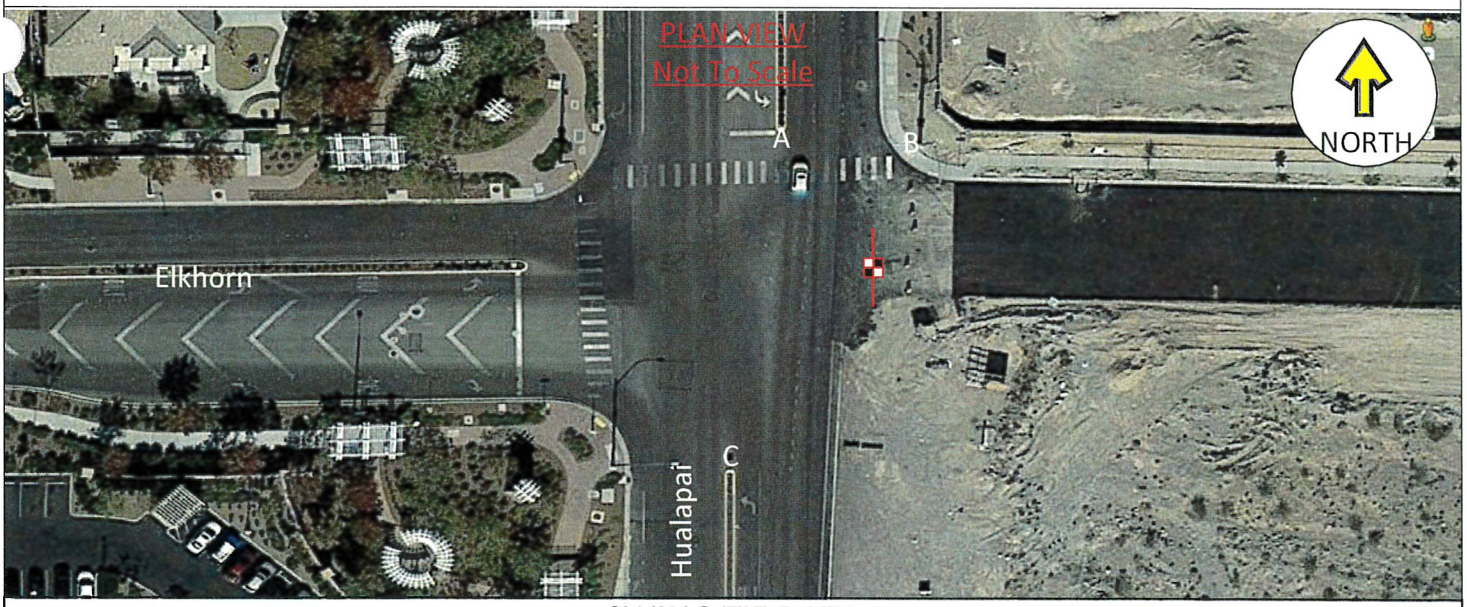
UTILITY TYPE: Gas UTILITY SIZE (NOMINAL): 4" UTILITY MATERIAL: Plastic





Field Calcs. (ft)	
Rod-Top Util.	15.58'
Rod-Ref. Pt.	5.33'
Util. Top Cover	**10.25'**
Hand Measure	10.27'
Rod-Bottom Util.	.
Rod-Ref. Pt.	.
Util. Bot. Cover	.
Hand Measure	.

■ Test Hole Location



SWING TIE DATA

	DESCRIPTION	DIST (FT)		DESCRIPTION	DIST (FT)		DESCRIPTION	DIST (FT)
A	Nose of Median	71'	B	St Light	59'	C	Nose of Median	103'

NOTES:

Quality Control Checks:
Field Check DS (Initials)
Office Check RT (Initials)

KCI
UTILITY SERVICES
SUBSURFACE UTILITY ENGINEERING
UTILITY COORDINATION
5940 S. Rainbow Blvd.
Las Vegas, NV 89118
T: 702.832.0729
F: 702.835.9301
Lic # NV0081727

KCI
UTILITY TEST HOLE REPORT

TEST HOLE NO: 4

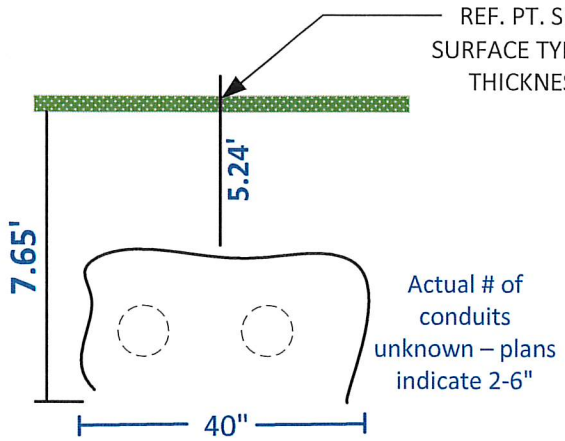
TEST HOLE DATE: 6-20-17

KCI JOB NO: 041702438-A

CLIENT JOB NO: 170149

PROJECT LOCATION: Elkhorn / Eula

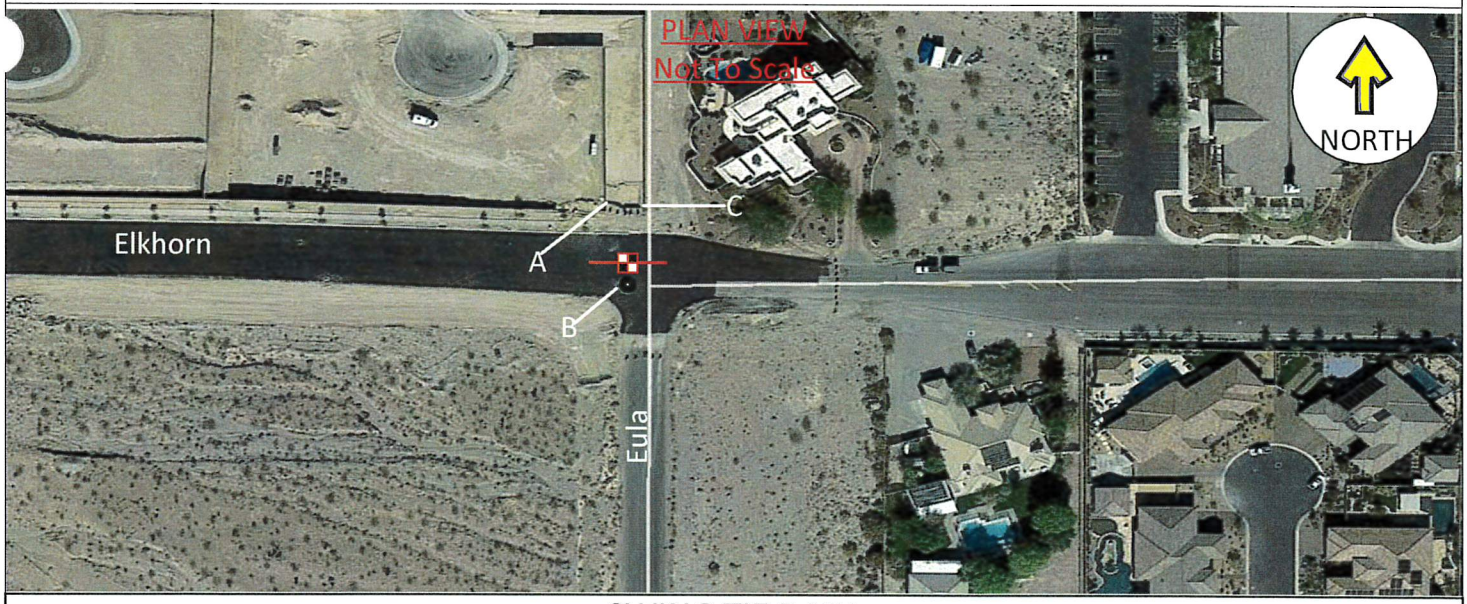
UTILITY TYPE: Electric UTILITY SIZE (NOMINAL): 40" Wide UTILITY MATERIAL: Slurry Encasement





■ Test Hole Location

Field Calcs. (ft)	
Rod-Top Util.	10.43'
Rod-Ref. Pt.	5.19'
Util. Top Cover	**5.24'**
Hand Measure	5.22'
Rod-Bottom Util.	12.84'
Rod-Ref. Pt.	5.19'
Util. Bot. Cover	**7.65'**
Hand Measure	7.64'



SWING TIE DATA

	DESCRIPTION	DIST (FT)		DESCRIPTION	DIST (FT)		DESCRIPTION	DIST (FT)
A	Corner of Wall	56'	B	SS MH	12'	C	End of Wall	58'

NOTES:

Red tear tape at 3.30'

Quality Control Checks:

Field Check SS (Initials)

Office Check RT (Initials)

KCI

UTILITY SERVICES

SUBSURFACE UTILITY ENGINEERING

UTILITY COORDINATION

5940 S. Rainbow Blvd.

Las Vegas, NV 89118

T: 702.832.0729

F: 702.835.9301

Lic # NV0081727

KCI
UTILITY TEST HOLE REPORT

TEST HOLE NO: 4-A

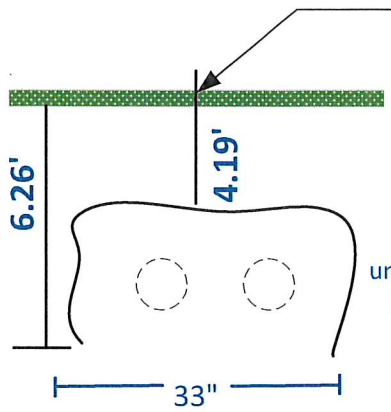
TEST HOLE DATE: 6-22-17

KCI JOB NO: 041702438-A

CLIENT JOB NO: 170149

PROJECT LOCATION: Elkhorn / Eula

UTILITY TYPE: Electric UTILITY SIZE (NOMINAL): 33" Wide UTILITY MATERIAL: Slurry Encasement

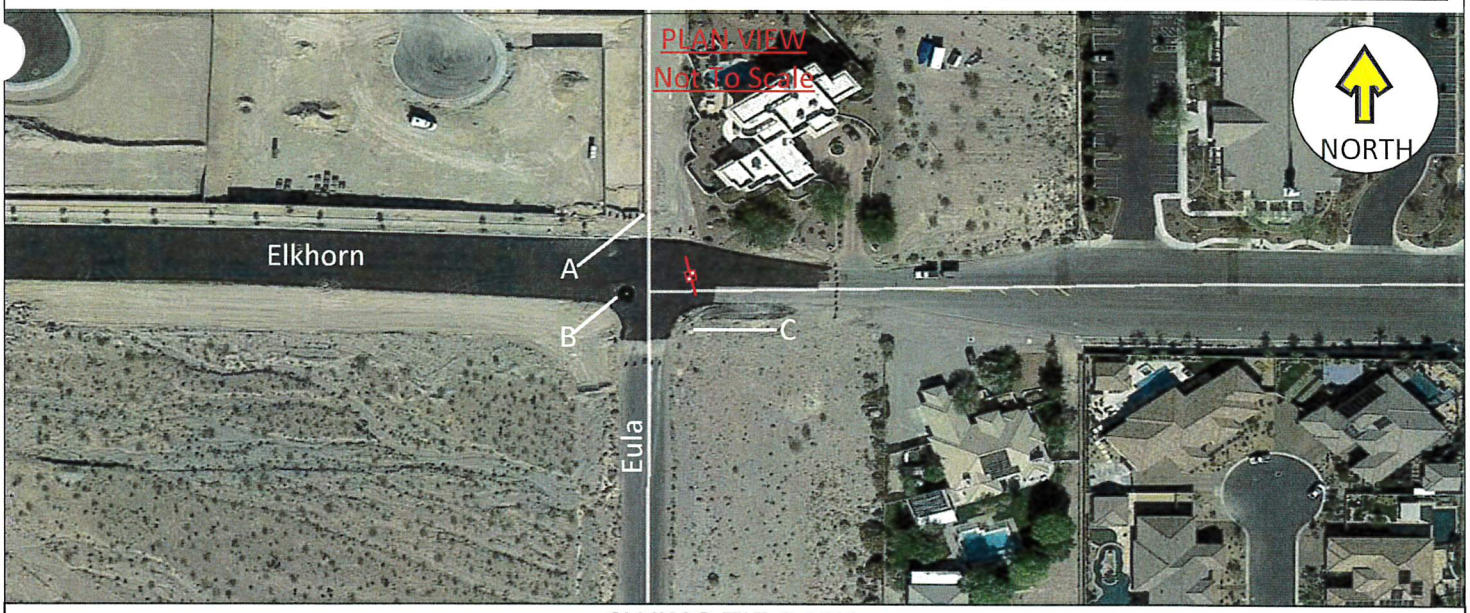


Actual # of conduits unknown – plans indicate 2-6"



Test Hole Location

Field Calcs. (ft)	
Rod-Top Util.	8.82'
Rod-Ref. Pt.	4.63'
Util. Top Cover	**4.19'**
Hand Measure	4.16'
Rod-Bottom Util.	10.89'
Rod-Ref. Pt.	4.63'
Util. Bot. Cover	**6.26'**
Hand Measure	6.23'



SWING TIE DATA

	DESCRIPTION	DIST (FT)		DESCRIPTION	DIST (FT)		DESCRIPTION	DIST (FT)
A	End of Wall	66'	B	SS MH	44'	C	TV Pull Box	47'

NOTES:

Potholed 4A added after re-designation of electric line. Exposed encasement running south.

Quality Control Checks:
Field Check DS (Initials)
Office Check RT (Initials)

KCI
UTILITY SERVICES
SUBSURFACE UTILITY ENGINEERING
UTILITY COORDINATION
5940 S. Rainbow Blvd.
Las Vegas, NV 89118
T: 702.832.0729
F: 702.835.9301
Lic # NV0081727

KCI
UTILITY TEST HOLE REPORT

TEST HOLE NO: 5

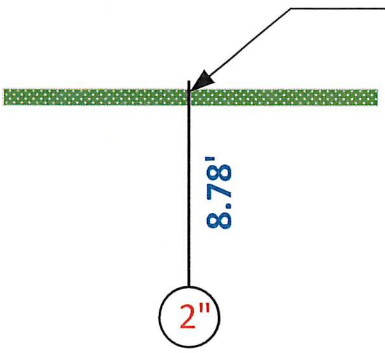
TEST HOLE DATE: 6-21-17

KCI JOB NO: 041702438-A

CLIENT JOB NO: 170149

PROJECT LOCATION: Elkhorn / Eula

UTILITY TYPE: Gas UTILITY SIZE (NOMINAL): 2" UTILITY MATERIAL: Plastic

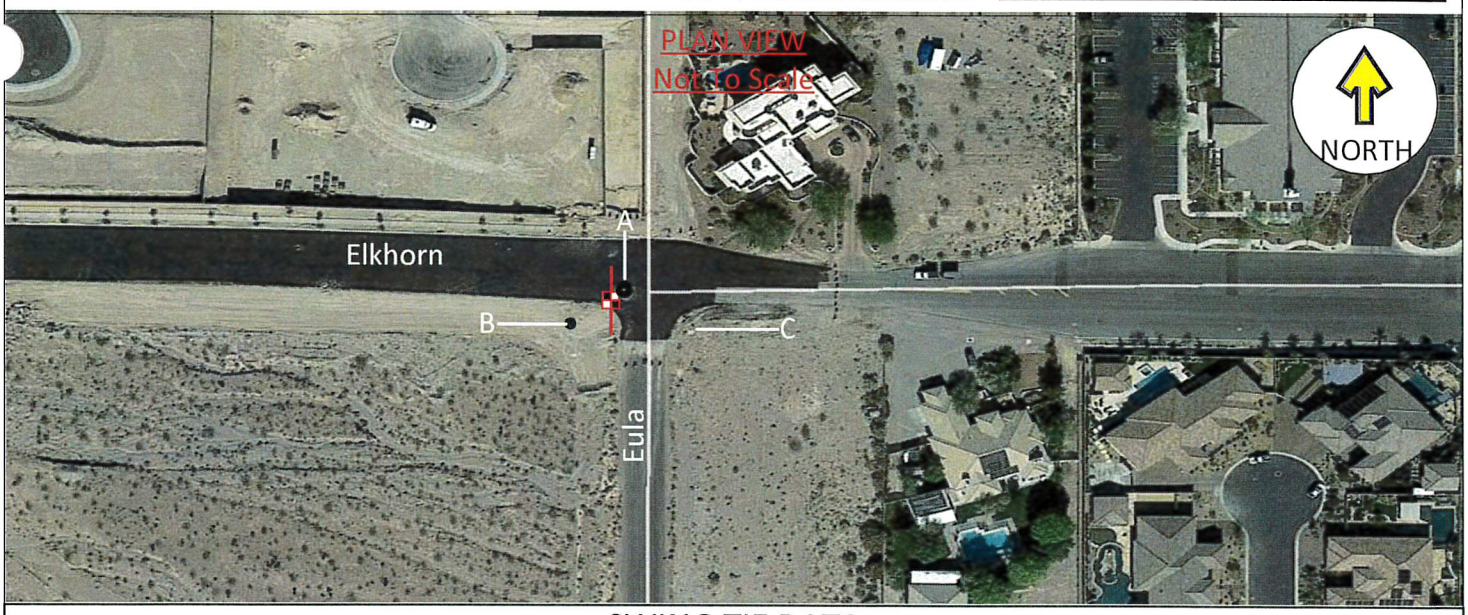


REF. PT. SET: NAIL/DISC
SURFACE TYPE: ASPHALT
THICKNESS: 4"



Field Calcs. (ft)	
Rod-Top Util.	13.70'
Rod-Ref. Pt.	4.92'
Util. Top Cover	**8.78'**
Hand Measure	8.79'
Rod-Bottom Util.	
Rod-Ref. Pt.	
Util. Bot. Cover	
Hand Measure	

Test Hole Location



SWING TIE DATA

	DESCRIPTION	DIST (FT)		DESCRIPTION	DIST (FT)		DESCRIPTION	DIST (FT)
A	SS MH	16'	B	Water Valve	28'	C	CATV Pull box	58'

NOTES:

Trace wire running along pipe

Quality Control Checks:
Field Check SS (Initials)
Office Check RT (Initials)

KCI
UTILITY SERVICES
SUBSURFACE UTILITY ENGINEERING
UTILITY COORDINATION
5940 S. Rainbow Blvd.
Las Vegas, NV 89118
T: 702.832.0729
F: 702.835.9301
Lic # NV0081727

KCI
UTILITY TEST HOLE REPORT

TEST HOLE NO: 6

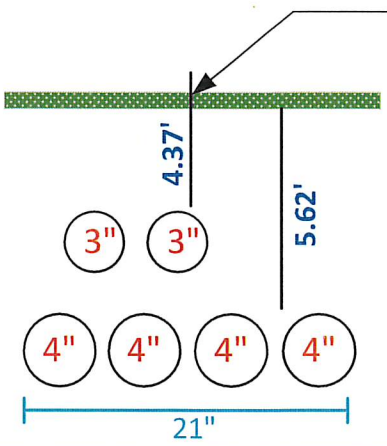
TEST HOLE DATE: 6-21-17

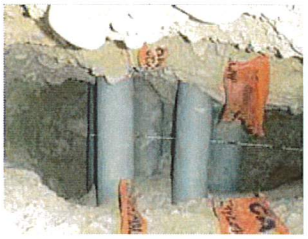
KCI JOB NO: 041702438-A

CLIENT JOB NO: 170149

PROJECT LOCATION: Elkhorn / Eula

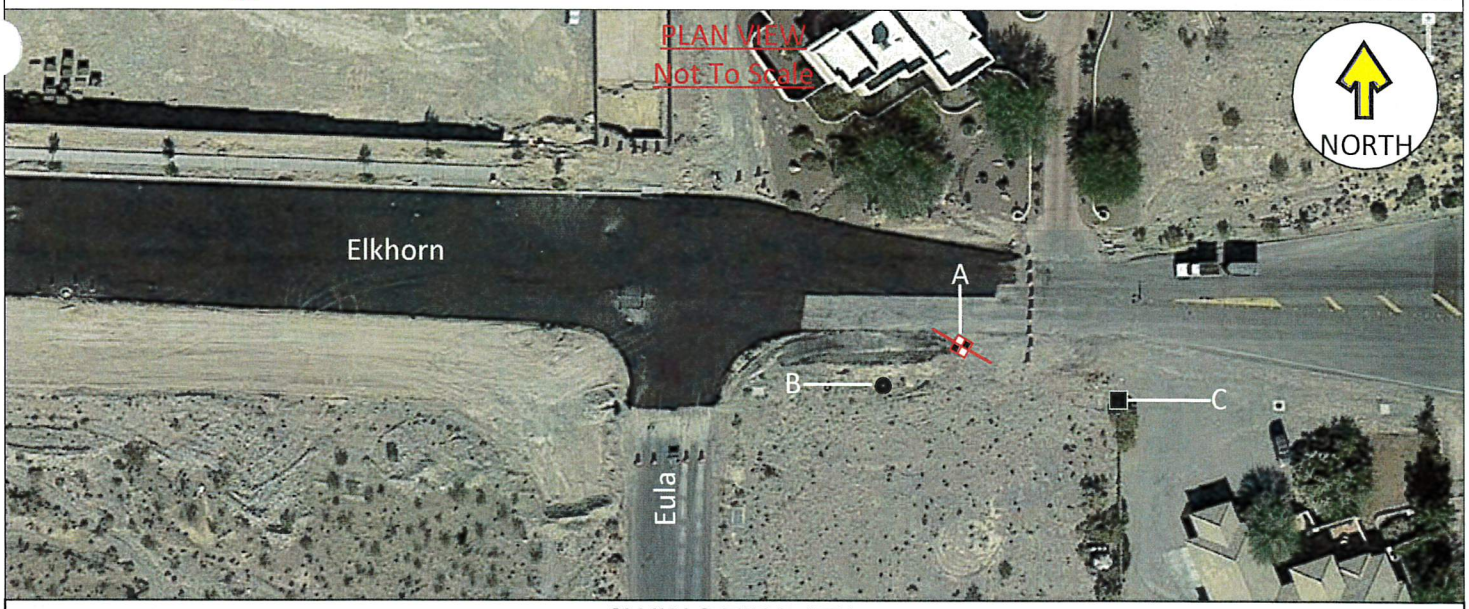
UTILITY TYPE: F.O. / Tele UTILITY SIZE (NOMINAL): 2-3" / 4-4" UTILITY MATERIAL: Plastic





Field Calcs. (ft)	
Rod-Top Util.	9.48'
Rod-Ref. Pt.	5.11'
Util. Top Cover	**4.37'**
Hand Measure	4.39'
Rod-Top Bot Util.	10.73'
Rod-Ref. Pt.	5.11'
Util. Top Bot. Cover	**5.62'**
Hand Measure	5.62'

■ Test Hole Location



SWING TIE DATA

	DESCRIPTION	DIST (FT)		DESCRIPTION	DIST (FT)		DESCRIPTION	DIST (FT)
A	Edge of Pvmt.	6'	B	Elec. MH	24'	C	Elec. Trans.	70'

NOTES:

Potholed at anticipated location of electric based on field markings – Only found Communication conduit. See TH 6A for electric data.

Quality Control Checks:

Field Check DS (Initials)

Office Check RT (Initials)

KCI
UTILITY SERVICES
SUBSURFACE UTILITY ENGINEERING
UTILITY COORDINATION
5940 S. Rainbow Blvd.
Las Vegas, NV 89118
T: 702.832.0729
F: 702.835.9301
Lic # NV0081727

KCI
UTILITY TEST HOLE REPORT

TEST HOLE NO: 6-A

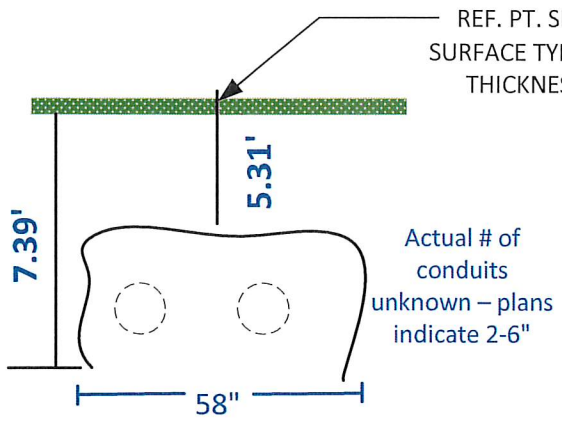
TEST HOLE DATE: 6-22-17

KCI JOB NO: 041702438-A

CLIENT JOB NO: 170149

PROJECT LOCATION: Elkhorn / Eula

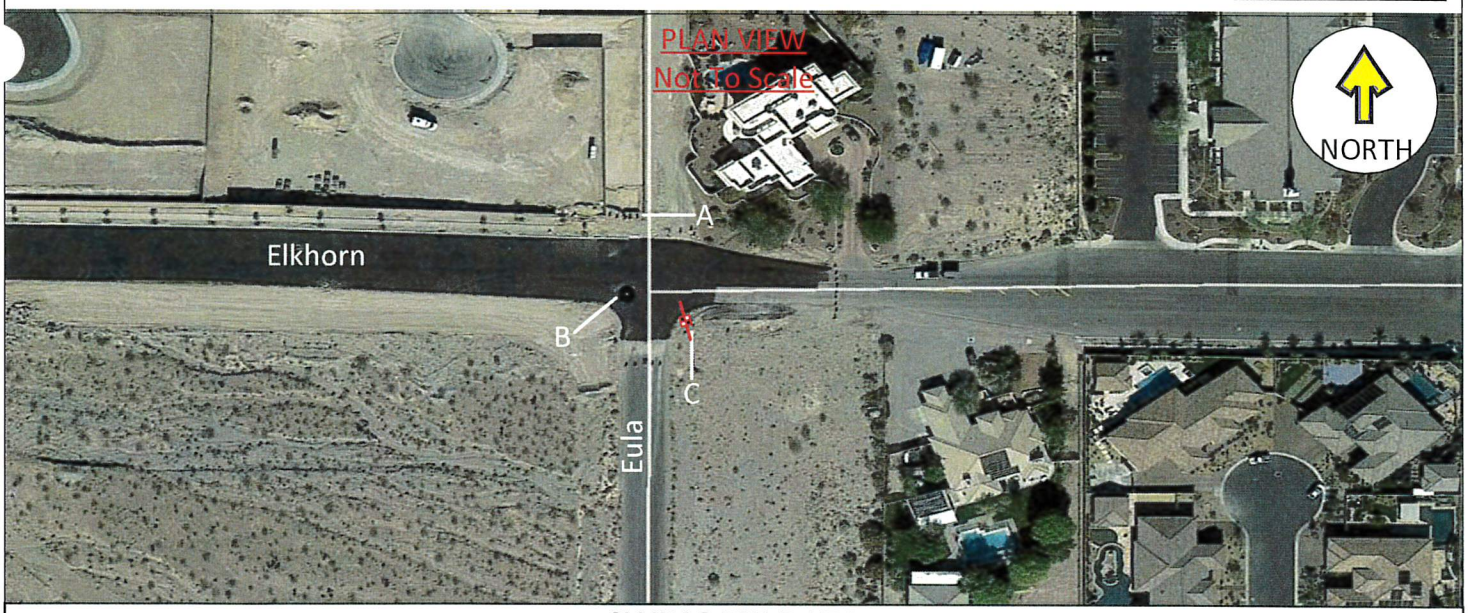
UTILITY TYPE: Electric UTILITY SIZE (NOMINAL): 58" Wide UTILITY MATERIAL: Slurry Encasement





Field Calcs. (ft)	
Rod-Top Util.	9.78'
Rod-Ref. Pt.	4.47'
Util. Top Cover	**5.31'**
Hand Measure	5.30'
Rod-Bottom Util.	11.86'
Rod-Ref. Pt.	4.47'
Util. Bot. Cover	**7.39'**
Hand Measure	7.39'

■ Test Hole Location



SWING TIE DATA

	DESCRIPTION	DIST (FT)		DESCRIPTION	DIST (FT)		DESCRIPTION	DIST (FT)
A	End of Wall	109'	B	SS MH	59'	C	TV Pull Box	5'

NOTES:

Added pothole 6A on southern most angle point of electric duct after re-designation.

Quality Control Checks:
Field Check DS (Initials)
Office Check RT (Initials)

KCI
UTILITY SERVICES
SUBSURFACE UTILITY ENGINEERING
UTILITY COORDINATION
5940 S. Rainbow Blvd.
Las Vegas, NV 89118
T: 702.832.0729
F: 702.835.9301
Lic # NV0081727

KCI
UTILITY TEST HOLE REPORT

TEST HOLE NO: 7

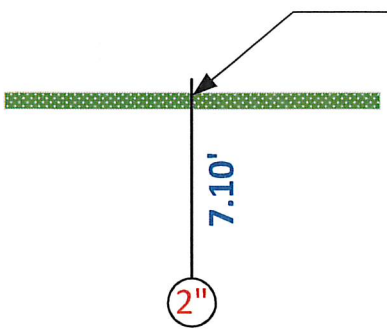
TEST HOLE DATE: 6-20-17

KCI JOB NO: 041702438-A

CLIENT JOB NO: 170149

PROJECT LOCATION: Elkhorn / Conquistador

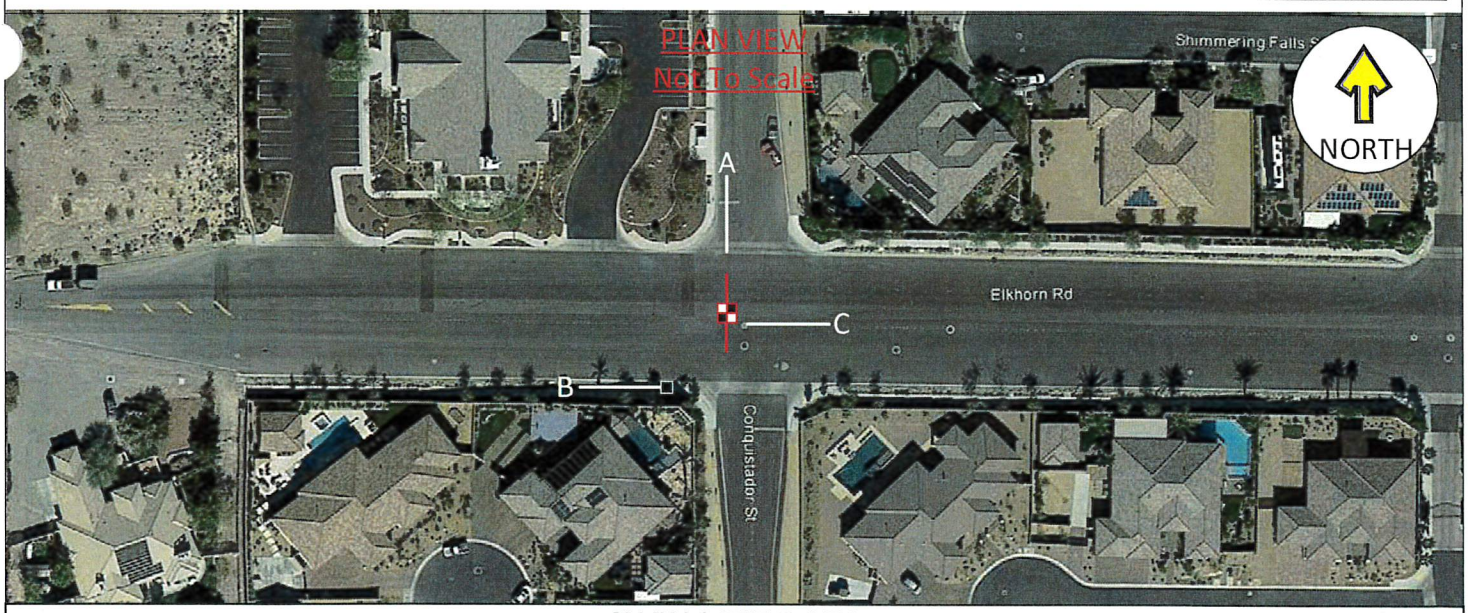
UTILITY TYPE: Gas UTILITY SIZE (NOMINAL): 2" UTILITY MATERIAL: Plastic





Field Calcs. (ft)	
Rod-Top Util.	13.46'
Rod-Ref. Pt.	6.36'
Util. Top Cover	**7.10'**
Hand Measure	7.09'
Rod-Bottom Util.	.
Rod-Ref. Pt.	.
Util. Bot. Cover	.
Hand Measure	.

■ Test Hole Location



SWING TIE DATA

	DESCRIPTION	DIST (FT)		DESCRIPTION	DIST (FT)		DESCRIPTION	DIST (FT)
A	Edge of Drain Curtain	40'	B	SL Pull Box	65'	C	SS MH	11'

NOTES:

Quality Control Checks:
Field Check DS (Initials)
Office Check RT (Initials)

KCI
UTILITY SERVICES
SUBSURFACE UTILITY ENGINEERING
UTILITY COORDINATION
5940 S. Rainbow Blvd.
Las Vegas, NV 89118
T: 702.832.0729
F: 702.835.9301
Lic # NV0081727

KCI
UTILITY TEST HOLE REPORT

TEST HOLE NO: 8

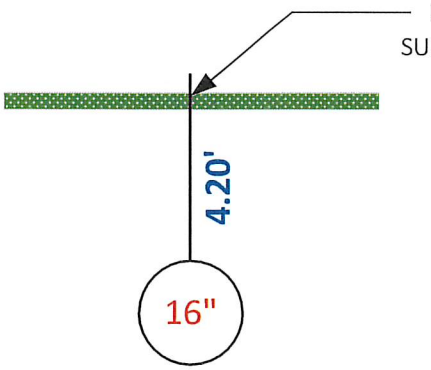
TEST HOLE DATE: 6/20/17

KCI JOB NO: 041702438-A

CLIENT JOB NO: 170149

PROJECT LOCATION: Elkorn / Conquistador

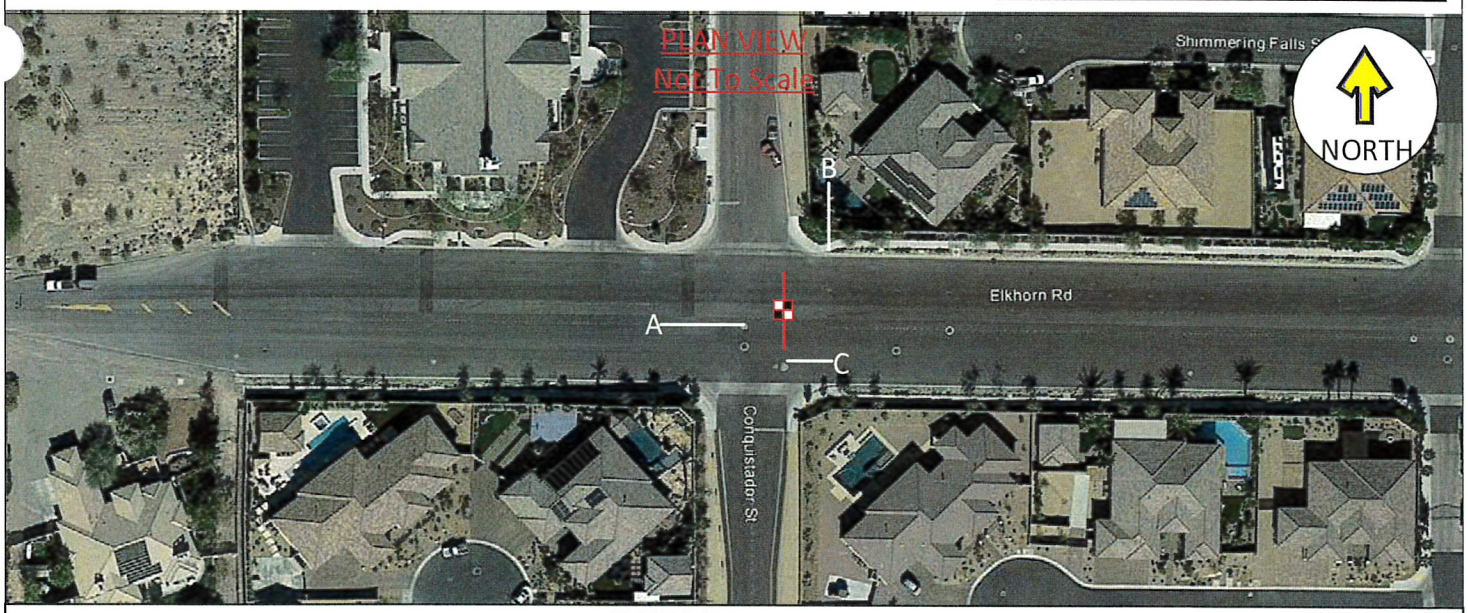
UTILITY TYPE: Water UTILITY SIZE (NOMINAL): 16" casing UTILITY MATERIAL: Metal



8" water inside steel casing per plan



Field Calcs. (ft)	
Rod-Top Util.	9.06'
Rod-Ref. Pt.	4.86'
Util. Top Cover	**4.20'**
Hand Measure	4.22'
Rod-Bottom Util.	.
Rod-Ref. Pt.	.
Util. Bot. Cover	.
Hand Measure	.



Test Hole Location

SWING TIE DATA

	DESCRIPTION	DIST (FT)	DESCRIPTION	DIST (FT)	DESCRIPTION	DIST (FT)
A	SS MH	27'	B	Curb Return	49'	C	Water Valve	33'

NOTES:

8" PVC per plan / one calls
18" casing per one calls. Found 16" casing
Blue metallic tear tape at 3.50'

Quality Control Checks:
Field Check SS (Initials)
Office Check RT (Initials)

KCI
UTILITY SERVICES
SUBSURFACE UTILITY ENGINEERING
UTILITY COORDINATION
5940 S. Rainbow Blvd.
Las Vegas, NV 89118
T: 702.832.0729
F: 702.835.9301
Lic # NV0081727

KCI
UTILITY TEST HOLE REPORT

TEST HOLE NO: 9

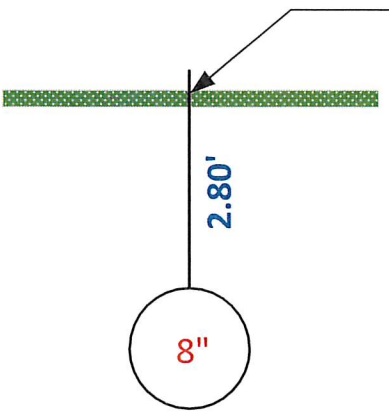
TEST HOLE DATE: 6/20/17

KCI JOB NO: 041702438-A

CLIENT JOB NO: 170149

PROJECT LOCATION: Elkhorn / Rhinehart

UTILITY TYPE: Water UTILITY SIZE (NOMINAL): 8" UTILITY MATERIAL: Plastic





Test Hole Location

Field Calcs. (ft)	
Rod-Top Util.	7.75'
Rod-Ref. Pt.	4.95'
Util. Top Cover	**2.80'**
Hand Measure	2.79'
Rod-Bottom Util.	.
Rod-Ref. Pt.	.
Util. Bot. Cover	.
Hand Measure	.



SWING TIE DATA

	DESCRIPTION	DIST (FT)		DESCRIPTION	DIST (FT)		DESCRIPTION	DIST (FT)
A	Nose of Median	63'	B	SS MH	29'	C	Water Valve	33'

NOTES:

Blue Metallic tear tape at 2.15'

Quality Control Checks:

Field Check SS (Initials)

Office Check RT (Initials)

KCI

UTILITY SERVICES

SUBSURFACE UTILITY ENGINEERING

UTILITY COORDINATION

5940 S. Rainbow Blvd.

Las Vegas, NV 89118

T: 702.832.0729

F: 702.835.9301

Lic # NV0081727

KCI
UTILITY TEST HOLE REPORT

TEST HOLE NO: 10

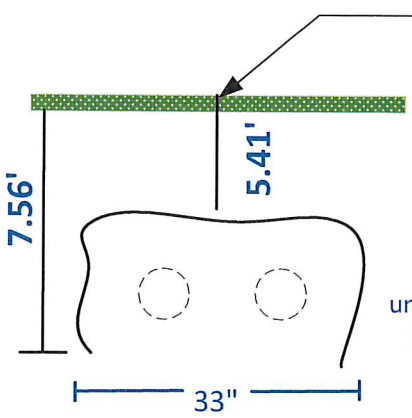
TEST HOLE DATE: 6-21-17

KCI JOB NO: 041702438-A

CLIENT JOB NO: 170149

PROJECT LOCATION: Elkhorn / Hualapai

UTILITY TYPE: Electric UTILITY SIZE (NOMINAL): 33" Wide UTILITY MATERIAL: Slurry Encasement

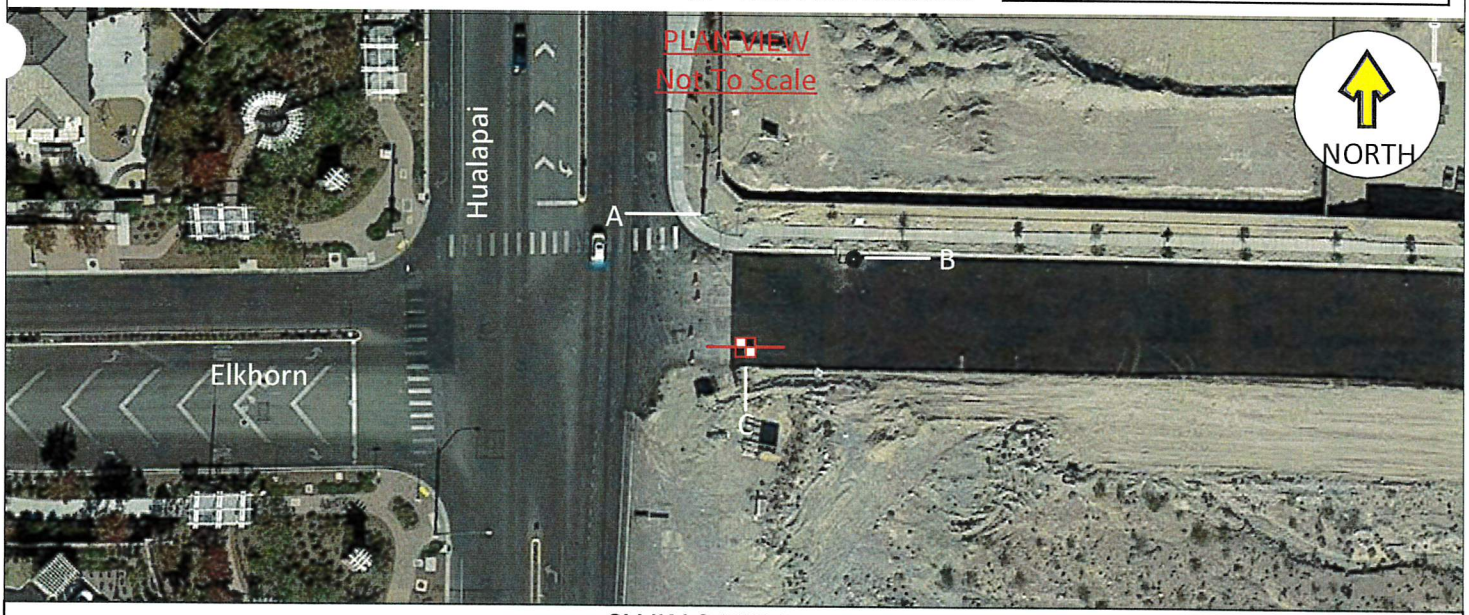


Actual # of conduits unknown – plans indicate 2-6"



Test Hole Location

Field Calcs. (ft)	
Rod-Top Util.	9.91'
Rod-Ref. Pt.	4.50'
Util. Top Cover	**5.41'**
Hand Measure	5.40'
Rod-Bottom Util.	12.06'
Rod-Ref. Pt.	4.50'
Util. Bot. Cover	**7.56'**
Hand Measure	7.57'



SWING TIE DATA

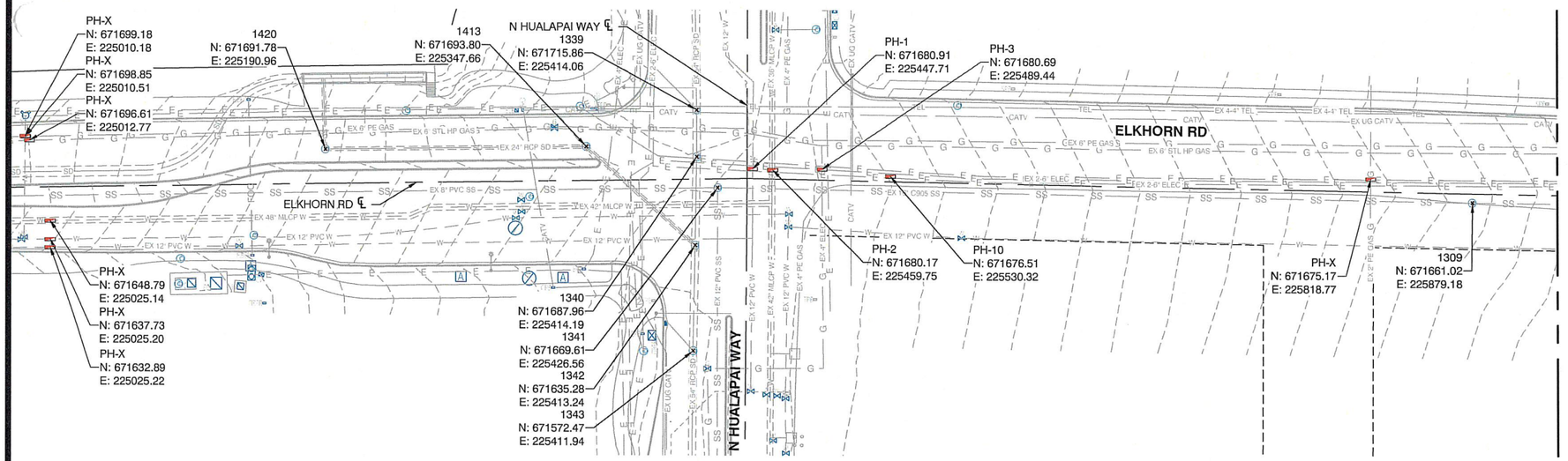
	DESCRIPTION	DIST (FT)		DESCRIPTION	DIST (FT)		DESCRIPTION	DIST (FT)
A	St Light	63'	B	Tele MH	58'	C	Edge of Pvmt.	7'

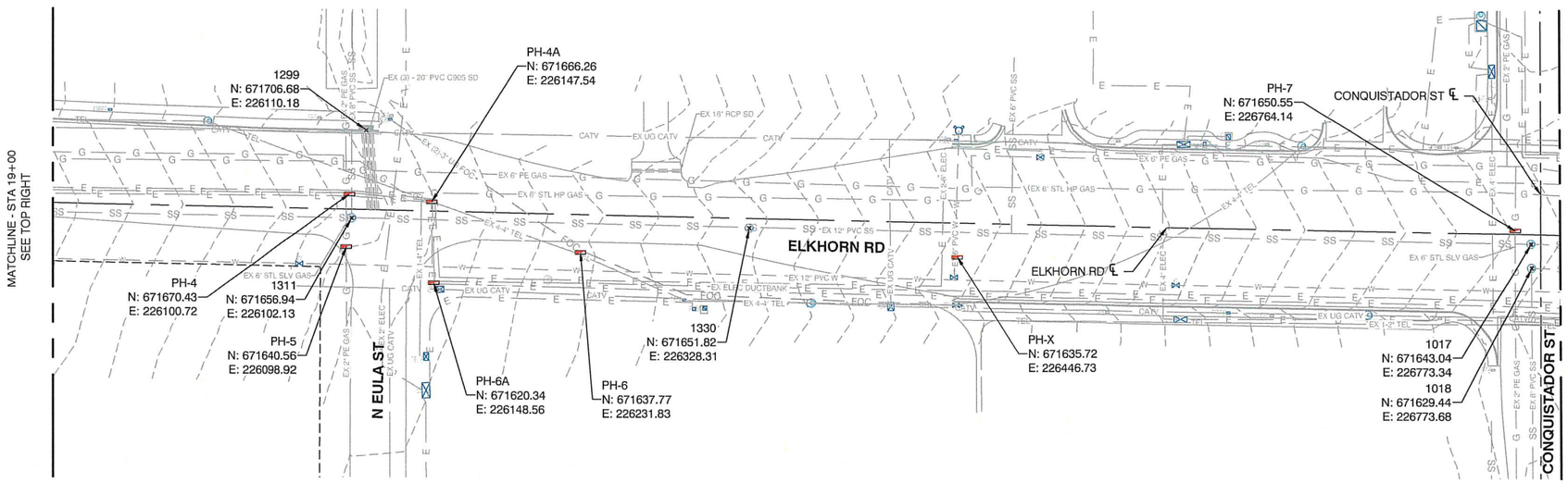
NOTES:

Quality Control Checks:
Field Check DS (Initials)
Office Check RT (Initials)

UTILITY SERVICES
SUBSURFACE UTILITY ENGINEERING
UTILITY COORDINATION
5940 S. Rainbow Blvd.
Las Vegas, NV 89118
T: 702.832.0729
F: 702.835.9301
Lic # NV0081727

APPENDIX B.3
UTILITY SUE DRAWINGS





NORTH

GRAPHIC SCALE
20 0 10 20 40
(IN FEET)

CALL BEFORE CONSTRUCTION

BEFORE YOU DIG	USA NORTH	811 OR 800-227-2600
BEFORE YOU UNDERGROUND	F.A.S.T.	702-432-5300
	CLARK COUNTY TRAFFIC OPERATIONS	702-455-7511
	CITY OF LAS VEGAS T.E.F.O.	702-229-6811
BEFORE YOU OVERHEAD	NV ENERGY	702-227-2929

GENERAL NOTES

1. UNLESS OTHERWISE NOTED, ALL UTILITIES SHOWN HEREIN ARE SUE QL-D.
2. THIS SHEET IS INTENDED TO BE PRINTED IN COLOR.
3. ALL LOCATIONS LABELED AS "PH-X" ARE INCLUDED IN THE SECONDARY POTHOLE SCHEDULE.

POTHOLE TABLE

PH #	UTILITY TYPE	SIZE (IN)	MATERIAL	GROUND ELEV	DEPTH [TOP] / [BOTTOM] (FT)
PH-1	WATER	12"	PVC	2850.16'	5.46'
PH-2	WATER	36"	MLCP	2849.92'	22.33'
PH-3	GAS	4"	PE	2849.33'	10.25'
PH-4	ELEC	40" WIDE	SLURRY	2828.91'	5.24' / 7.65'
PH-4A	ELEC	33" WIDE	SLURRY	2827.45'	4.19' / 6.26'
PH-5	GAS	2"	PE	2828.35'	8.78'
PH-6	FO / TEL	(2)-3"/(4)-4"	PVC	2824.17'	4.37',5.62'
PH-6A	ELEC	58" WIDE	SLURRY	2827.06'	5.31' / 7.39'
PH-7	GAS	2"	PE	2804.97'	7.10'
PH-10	ELEC	33" WIDE	SLURRY	2848.31'	5.41' / 7.56'

MANHOLE TABLE

POINT #	DESCRIPTION	RIM	INVERT
1017	SSMH	2804.18	2797.26
1018	SSMH	2804.36	2794.33
1299	SD-DI	2828.17	NA-DEBRIS
1309	SSMH	2836.39	2815.44
1311	SSMH	2828.52	2813.99
1330	SSMH	2821.24	2812.92
1339	SDMH	2849.78	2841.95
1340	SDMH	2850.25	2841.72
1341	SSMH	2850.08	2818.08
1342	SDMH	2849.62	2840.91
1343	SDMH	2848.93	2840.19
1413	SDMH	2851.02	2844.35
1420	SDMH	2856.30	2848.27

LEGEND

- SUE QL-A
- SUE QL-B
- SUE QL-C
- SUE QL-D

NO.	DATE	REVISIONS

PREPARED BY
Stantec
5510 W. CHARLESTON BLVD.
SUITE B
LAS VEGAS, NV 89102

PREPARED FOR
CITY OF LAS VEGAS

H# 170149 | BID# XX.XXXXX | DESIGNED BY: XXX | DRAWN BY: XXX | CHECKED BY: XXX

DATE: JULY 2017

SUBMITTAL STAGE: **30% - PRELIMINARY**

TITLE
RANCHO ROAD SYSTEM STORM DRAIN - ELKHORN

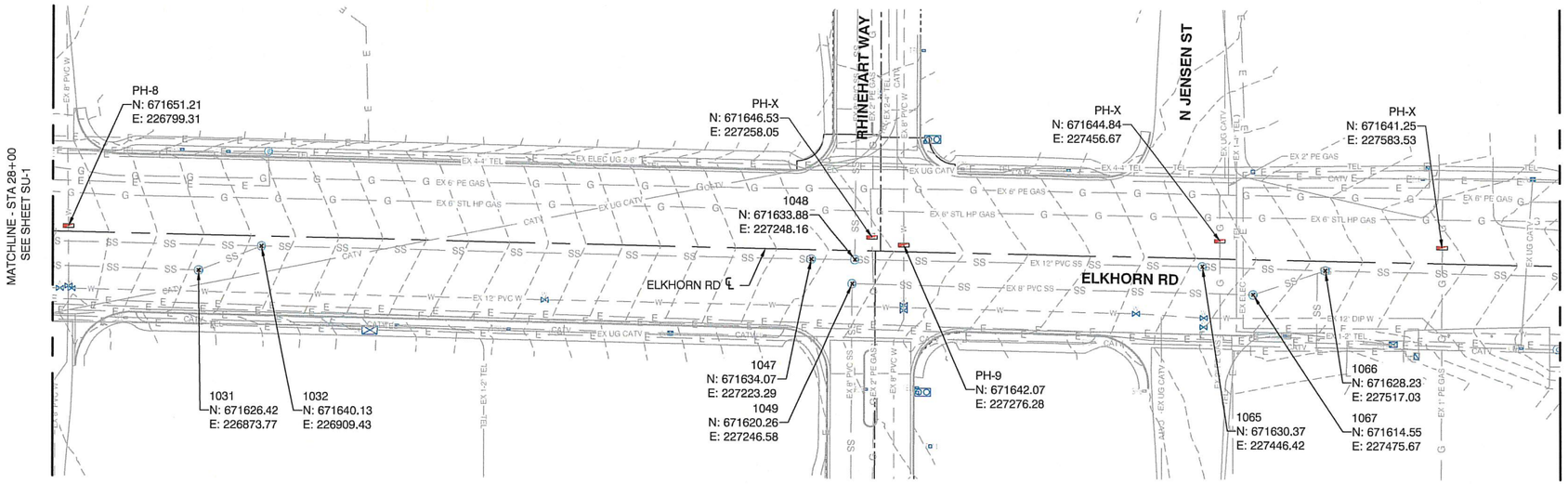
SHEET
STORM DRAIN PLAN AND PROFILE STA 10+00 TO 28+00

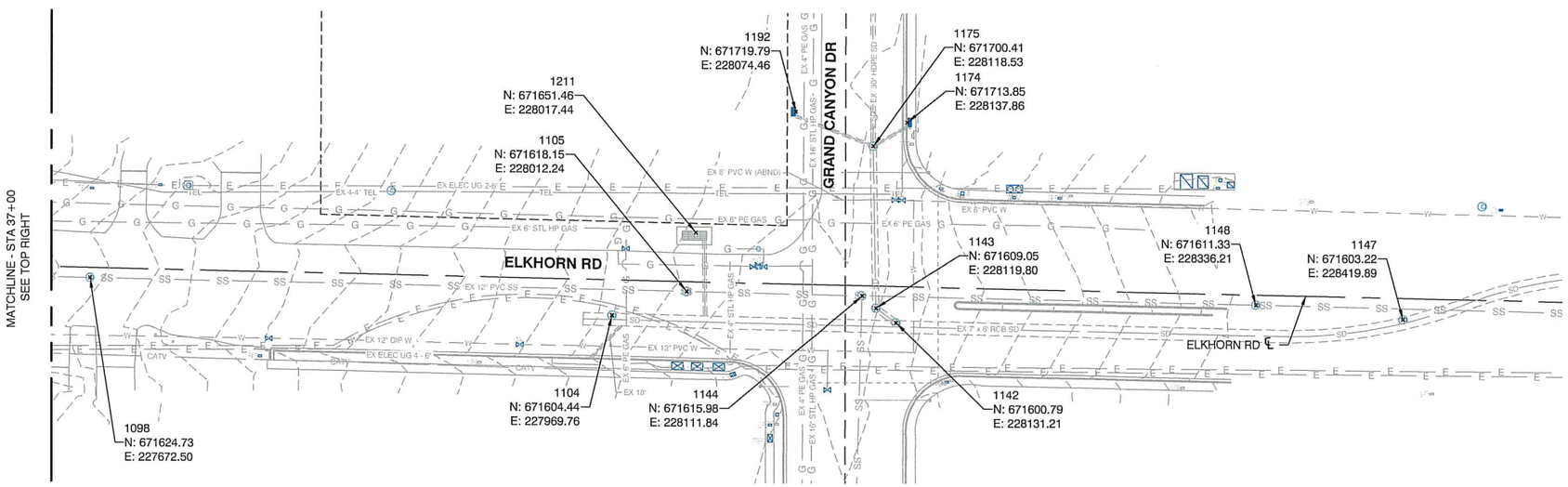
NOT FOR CONSTRUCTION

SHEET
SU-1
1 OF 2

DRAWING NO.
XXX-XXXX

6/30/17 C:\PWWORKDIR\D0324248\JH170149-SU-01-SU-02.DWG





NORTH

GRAPHIC SCALE
20 0 10 20 40
(IN FEET)

CALL BEFORE CONSTRUCTION ⚠

BEFORE YOU DIG	USA NORTH	811 OR 800-227-2600
BEFORE YOU UNDERGROUND	F.A.S.T.	702-432-5300
	CLARK COUNTY TRAFFIC OPERATIONS	702-455-7511
	CITY OF LAS VEGAS T.E.F.O.	702-229-6011
BEFORE YOU OVERHEAD	NV ENERGY	702-227-2929

GENERAL NOTES

1. UNLESS OTHERWISE NOTED, ALL UTILITIES SHOWN HEREIN ARE SUE QL-D.
2. THIS SHEET IS INTENDED TO BE PRINTED IN COLOR.
3. ALL LOCATIONS LABELED AS "PH-X" ARE INCLUDED IN THE SECONDARY POTHOLE SCHEDULE.

POTHOLE TABLE

PH #	UTILITY TYPE	SIZE (IN)	MATERIAL	GROUND ELEV	DEPTH [TOP] / [BOTTOM] (FT)
PH-8	WATER	16" CASING	DI	2803.84'	4.20'
PH-9	WATER	8"	PVC	2784.90'	2.80'

MANHOLE TABLE

POINT #	DESCRIPTION	RIM	INVERT
1031	SSMH	2800.73	2793.31
1032	SSMH	2799.50	2792.45
1047	SSMH	2786.06	2781.51
1048	SSMH	2785.41	2780.37
1049	SSMH	2785.14	2772.42
1065	SSMH	2779.69	2772.67
1066	SSMH	2777.38	2769.87
1067	SSMH	2778.38	2771.03
1098	SSMH	2772.10	BLOCKED
1104	SDMH	2761.44	2745.73
1105	SSMH	2760.44	2755.54
1142	SDMH	2758.26	2740.56
1143	SDMH	2758.79	2744.14
1147	SDMH	2748.04	2731.72
1148	SSMH	2751.20	2744.20
1174	SDMH	2759.44	2751.83
1175	SDMH	2759.66	2747.26
1192	SDMH	2757.78	2752.08
1211	SD-DI	2758.97	2751.56

LEGEND

- SUE QL-A
- SUE QL-B
- SUE QL-C
- SUE QL-D

NO.	DATE	REVISIONS

PREPARED BY
Stantec
3010 W. CHARLESTON BLVD.
SUITE 100
LAS VEGAS, NV 89102

PREPARED FOR
CITY OF LAS VEGAS

H# 170149 | BID# XX.XXXXX | DESIGNED BY: XXX | DRAWN BY: XXX | CHECKED BY: XXX
DATE: JULY 2017 | SUBMITTAL STAGE: 30% - PRELIMINARY

TITLE
RANCHO ROAD SYSTEM
STORM DRAIN - ELKHORN

SHEET
STORM DRAIN PLAN AND PROFILE
STA 28+00 TO 39+60

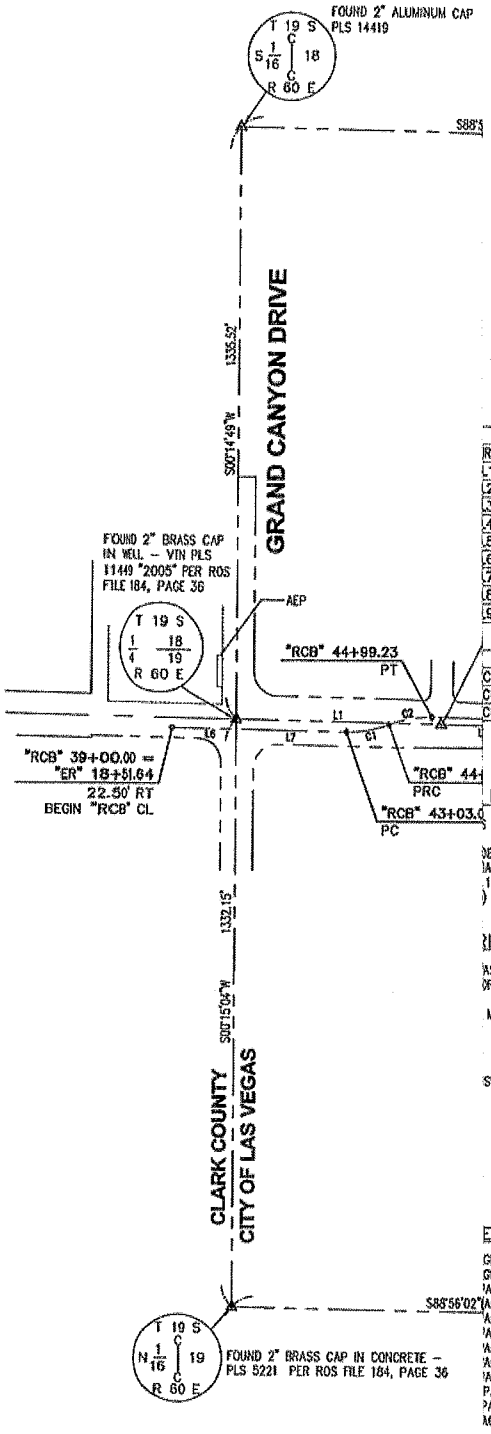
NOT FOR CONSTRUCTION

SHEET
SU-2
2 OF 2
DRAWING NO.
XXX-XXXX

6/30/17 C:\PWWORKDIR\D0332424\JH170149-SU-01-SU-02.DWG

Appendix C

APPENDIX C.1
DOWNSTREAM STORM DRAIN FACILITY RECORD DRAWINGS



LINE TABLE			
RVE	DESCRIPTION	LENGTH	BEARING
L1	"ER" CL	466.74'	S88°47'53"E
L2	"ER" CL	192.98'	S88°47'53"E
L3	"ER" CL	659.80'	S88°47'53"E
L4	"ER" CL	939.27'	S88°49'55"E
L5	"ER" CL	381.93'	S88°49'55"E
L6	"RCB" CL	148.36'	S88°51'29"E
L7	"RCB" CL	254.69'	S88°47'53"E
L8	"RCB" CL	873.62'	S88°47'53"E
L9	"RCB" CL	1027.16	S88°49'55"E

CURVE TABLE				
CRIPTION	LENGTH	RADIUS	TANGENT	DELTA
CB" CL	98.10'	250.00'	49.69	22°28'55"
CB" CL	98.10'	250.00'	49.69	22°28'55"

BEARINGS

ZONE, NAD 83 (CORS96) EPOCH 2002.0

DEFINED BY THE CENTRAL MERIDIAN OF THE NEVADA COORDINATE REFERENCE
AS ZONE, NORTH AMERICAN DATUM OF 1983; SAID MERIDIAN BEING
114°58' WEST OF THE GREENWICH MERIDIAN. THE REFERENCE FRAME BEING
) EPOCH 2002.0.

K

AS BENCHMARK #GLV9018SSE6, BEING A RIVET AND PLATE IN THE TOP OF
ORTHWEST CORNER OF TEE PEE LANE AND ELKHORN ROAD

METERS = 2715.19 FEET (NAVD88)

SURVEY FILE 167 PAGE 17 OF SURVEYS

ES

GE 36 OF SURVEYS
GE 57 OF SURVEYS
AGE 70 OF PLATS
AGE 11 OF PLATS
AGE 98 OF PLATS
AGE 38 OF PLATS
AGE 98 OF PLATS
AGE 55 OF PLATS
AGE 48 OF PLATS
PAGE 25 OF PLATS
PAGE 69 OF PLATS
AGE 89 OF SURVEYS

LEGEND

- ▲ MONUMENTATION AS DESCRIBED
- SECTION LINE –
- CLV RIGHT–OF–
- CLARK COUNTY
- ALIQUOT PART L
- PATENT EASEME
- ⟨1⟩ DOCUMENT REFE

REVISIONS

NO.	DATE:	DESCRIPTION	APP'D

DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECT MANAGEMENT

CITY ENGINEER: ALLEN E. PAVELKA, P.E.
PROGRAM MANAGER: MARK SORENSEN, P.E.

DESIGNED BY: AD
DRAWN BY: AD
CHECKED BY: MJF

DATE: 1/30/15

RANCHO ROAD SYSTEM (ELKHORN – FT APACHE TO GRAND CANYON)

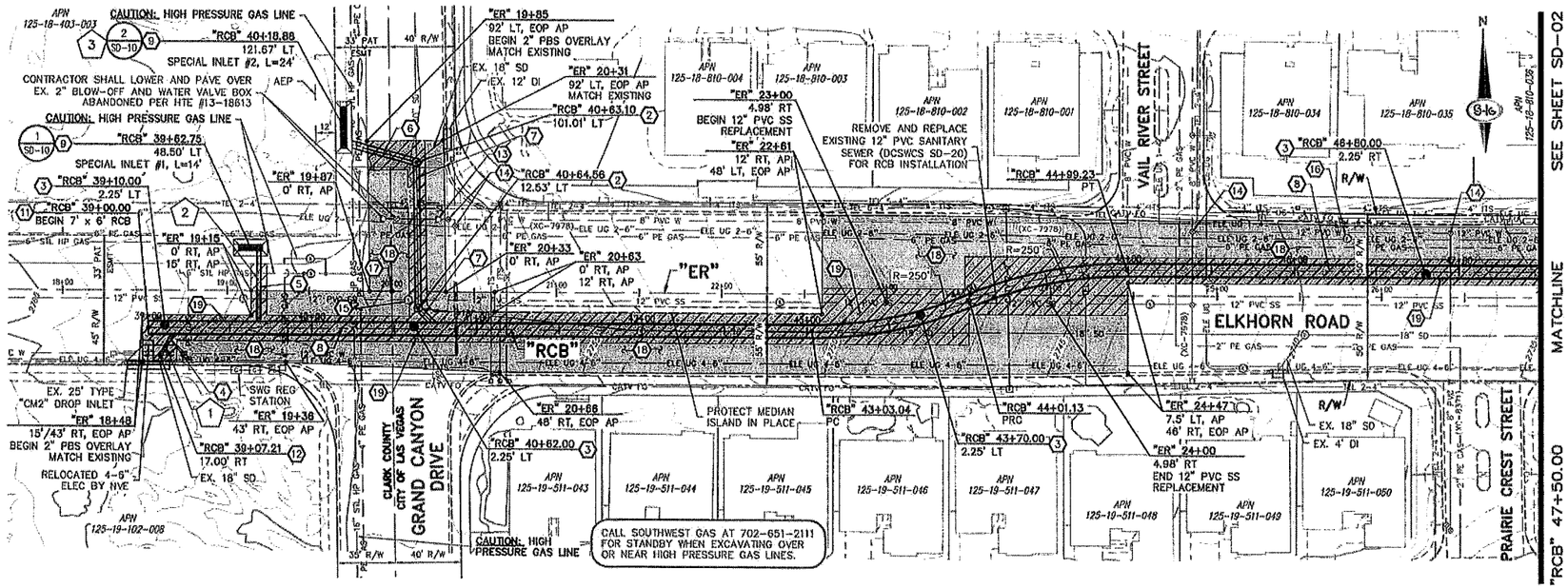
TITLE: RANCHO ROAD SYSTEM
ELKHORN – FT APACHE TO GRAND CANYON

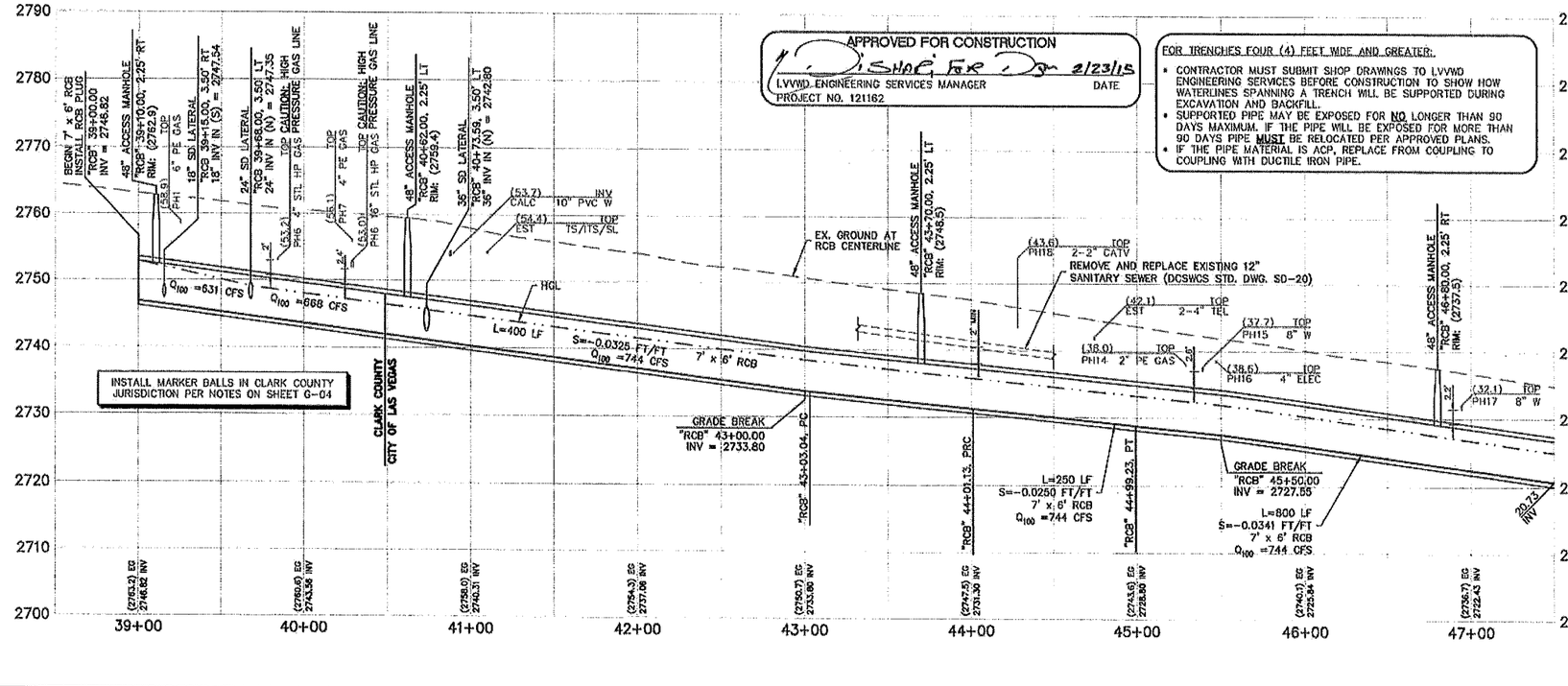
SHEET: MONUMENTATION AND
HORIZONTAL CONTROL PLAN

SEAL
ALAN W. DILL
Expl 12/31/16
No. 7808
2-17-15

Sheet
G-05
5 of 22

DRAWING NO.
327V290





CONSTRUCTION NOTES

1. CONSTRUCT 60" TYPE III MANHOLE WITH TYPE IA RISER (USDCCA STD. DWG. NO. 406.1 AND 404.1)
2. CONSTRUCT 60" TYPE III MANHOLE (USDCCA STD. DWG. NO. 406.1)
3. CONSTRUCT 48" ACCESS MANHOLE (SEE DETAIL 2, SHEET SD-08)
4. INSTALL 18" RCP (USDCCA STD. DWG. NO. 503.2 AND DETAILS ON SHEET SD-06)
5. INSTALL 24" RCP (USDCCA STD. DWG. NO. 503.2 AND DETAILS ON SHEET SD-06)
6. INSTALL 29" X 45" HERCP (USDCCA STD. DWG. NO. 503.2 AND DETAILS ON SHEET SD-06)
7. INSTALL 36" RCP (USDCCA STD. DWG. NO. 503.2 AND DETAILS ON SHEET SD-06)
8. CONSTRUCT 7' X 6' PRECAST RCB (SEE DETAILS ON SHEET SD-06)
9. CONSTRUCT SPECIAL DROP INLET W/ CONCRETE APRON (SEE DETAIL 1, SHEET SD-07 AND SHEET SD-09)
10. CONSTRUCT MODIFIED TYPE DM2 DROP INLET (SEE DETAIL 1, SHEET SD-11)
11. CONSTRUCT RCB PLUG (SEE DETAIL 4, SHEET SD-08)
12. CONSTRUCT CONCRETE COLLAR (SEE DETAIL 3, SHEET SD-08)
13. ADJUST 2" MANUAL BLOW-OFF TO FINISHED GRADE (UDACS PLATE NO. 36)
14. ADJUST WATER VALVE BOX TO FINISHED GRADE (UDACS PLATE NO. 39) VALVE SHALL BE ACCESSIBLE AT ALL TIMES
15. ADJUST SANITARY SEWER MANHOLE TO FINISHED GRADE (DCSWCS STD. DWG. SD-5)
16. ADJUST ELECTRIC MANHOLE TO FINISHED GRADE
17. SET TYPE I WELL MONUMENT
18. CONSTRUCT 2" PBS OVERLAY
19. CONSTRUCT 5" PBS OVER 4" TYPE II AGGREGATE BASE

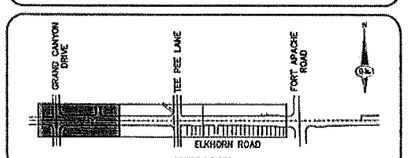
STORM DRAIN GENERAL NOTES:

1. ALL PIPE LENGTHS MEASURED ALONG PIPE CENTERLINE TO CENTER OF MANHOLE OR GRADE BREAK OR TO INSIDE EDGE OF DI, RCB, OR STRUCTURE.
2. ALL DROP INLETS AND CONCRETE APRONS SHALL INCLUDE STORM WATER MANAGEMENT STAMP AND DETAIL PER USDCCA STD. DWG. NO. 421.
3. ALL STORM DRAIN SHALL BE CLASS III UNLESS OTHERWISE NOTED.
4. NV ENERGY, CENTURYLINK TELEPHONE, AND SOUTHWEST GAS SHOWN FOR INFORMATIONAL ONLY. REFERENCE NV ENERGY, CENTURYLINK TELEPHONE, AND SOUTHWEST GAS DRAWINGS FOR CONSTRUCTION DETAILS. CONTRACTOR TO COORDINATE WITH UTILITIES FOR REMOVAL AND INSTALLATION OF FACILITIES.
5. ALL EXISTING UTILITY LOCATIONS SHOWN HEREON ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO DETERMINE THE EXACT VERTICAL AND HORIZONTAL LOCATION OF ALL EXISTING UNDERGROUND UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL UTILITIES ARE SHOWN HEREON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN IN THEIR PROPER LOCATION. THE DEPTH BELOW GRADE OF THE VARIOUS UTILITIES DEPICTED ON THE PLANS VARIES THROUGHOUT THE PROJECT AREA. THE CONTRACTOR SHALL EXERCISE EXTREME CARE WHERE EXCAVATING AND GRADING THE SUBBASE IN THE VICINITY OF UTILITIES TO AVOID DAMAGE TO THE LATTER.
6. ALL EXISTING UTILITIES SHALL BE PROTECTED IN PLACE UNLESS OTHERWISE NOTED.
7. SEE G-05 FOR RCB GEOMETRY AND R-SHEETS FOR REMOVAL INFORMATION.

LEGEND

2" PBS OVERLAY — 5" PBS OVER 4" TYPE II AGGREGATE BASE

LATERAL RUN PROFILE INDEX	
LATERAL RUN NO	SEE SHEET
1 THRU 5	SD-04
6 THRU 8	SD-05



KEY MAP

SCALE 40 0 40 80 FEET

FAST. Call before you UnderGround. 1-702-432-5300 (OUTSIDE AND INTERIOR STATES OF NEVADA)

Call before you Dig Avoid cutting underground utility lines. It's easy. Call 811 or 1-800-227-2600

CALL BEFORE YOU DO OVERHEAD 1-702-227-2929

REVISIONS

NO.	DATE:	DESCRIPTION	APP'D

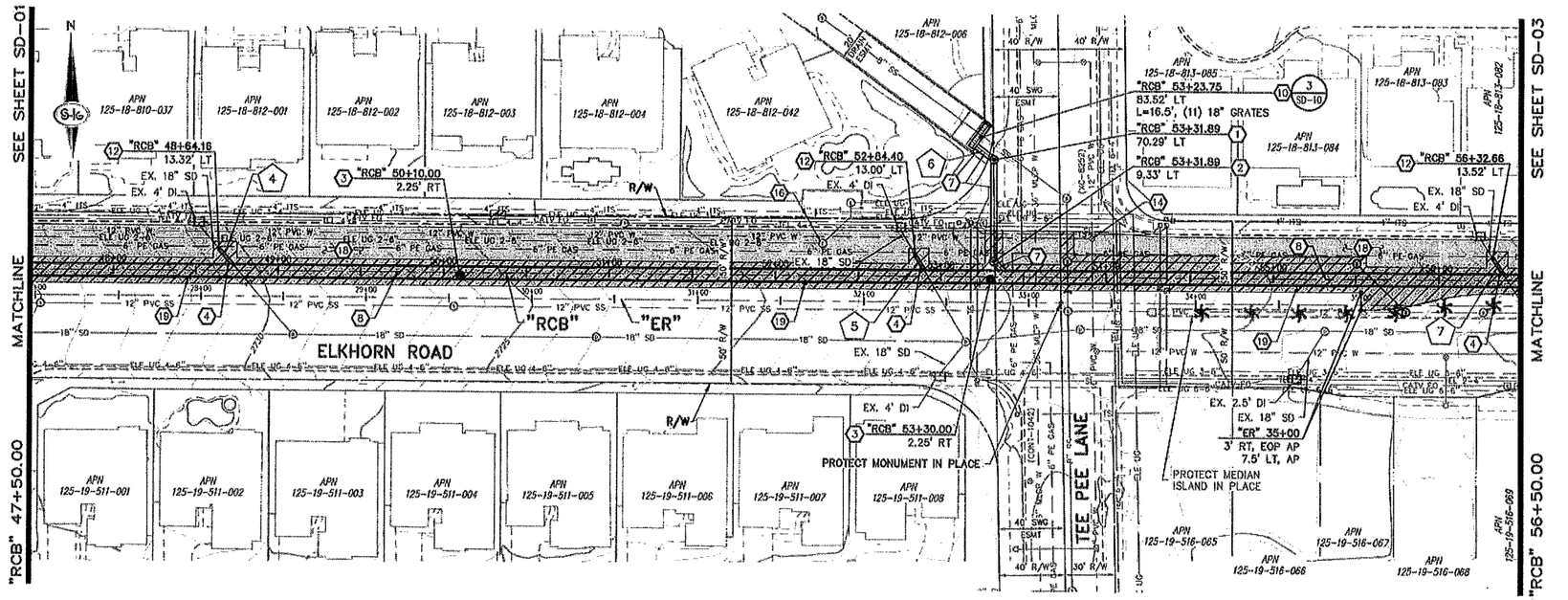
DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECT MANAGEMENT
CITY ENGINEER: ALLEN E. PANKEY, P.E.
PROGRAM MANAGER: MARK SORENSEN, P.E.
DESIGNED BY: JSR
DRAWN BY: JSR
CHECKED BY: MJF
DATE: 1/30/15

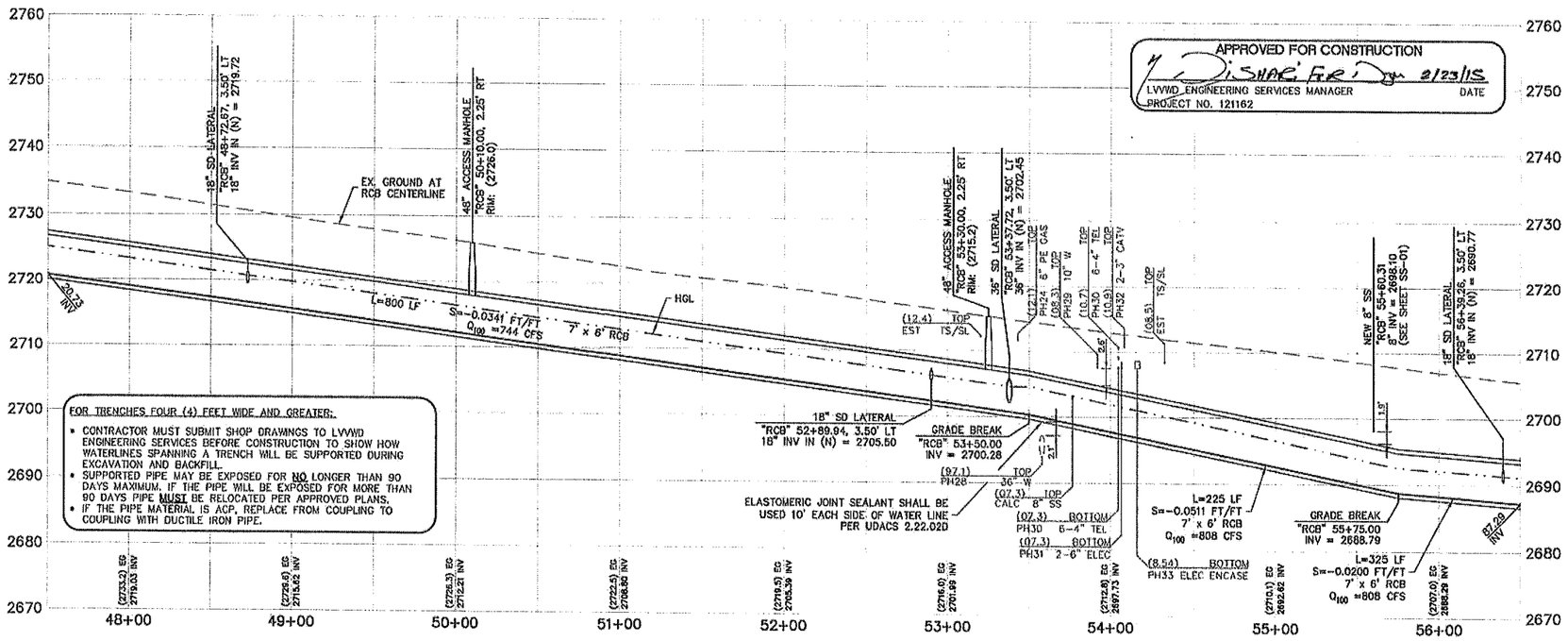
RANCHO ROAD SYSTEM (ELKHORN - FT APACHE TO GRAND CANYON)

TITLE: RANCHO ROAD SYSTEM
ELKHORN - FT APACHE TO GRAND CANYON
SHEET: STORM DRAIN PLAN AND PROFILE
"RCB" 38+50.00 TO "RCB" 47+50.00

SEAL
NEVADA ENGINEER — STATE OF
No. 14566
MARK J. FAILLA
Exp. 06/30/2015
CIVIL
11/14/14

Sheet SD-01
9 of 22
DRAWING NO. 327V290





APPROVED FOR CONSTRUCTION
LVVWD ENGINEERING SERVICES MANAGER — DATE 2/23/15
PROJECT NO. 121162

CONSTRUCTION NOTES

1. CONSTRUCT 60" TYPE III MANHOLE WITH TYPE IA RISER (USDCCA STD. DWG. NO. 406.1 AND 404.1)
2. CONSTRUCT 60" TYPE III MANHOLE (USDCCA STD. DWG. NO. 406.1)
3. CONSTRUCT 48" ACCESS MANHOLE (SEE DETAIL 2, SHEET SD-08)
4. INSTALL 18" RCP (USDCCA STD. DWG. NO. 503.2 AND DETAILS ON SHEET SD-06)
5. INSTALL 24" RCP (USDCCA STD. DWG. NO. 503.2 AND DETAILS ON SHEET SD-06)
6. INSTALL 29" X 45" HERCP (USDCCA STD. DWG. NO. 503.2 AND DETAILS ON SHEET SD-06)
7. INSTALL 36" RCP (USDCCA STD. DWG. NO. 503.2 AND DETAILS ON SHEET SD-06)
8. CONSTRUCT 7' X 6' PRECAST RCB (SEE DETAILS ON SHEET SD-06)
9. CONSTRUCT SPECIAL DROP INLET W/ CONCRETE APRON (SEE DETAIL 1, SHEET SD-07 AND SHEET SD-09)
10. CONSTRUCT MODIFIED TYPE DM2 DROP INLET (SEE DETAIL 1, SHEET SD-11)
11. CONSTRUCT RCB PLUG (SEE DETAIL 4, SHEET SD-08)
12. CONSTRUCT CONCRETE COLLAR (SEE DETAIL 3, SHEET SD-08)
13. ADJUST 2" MANUAL BLOW-OFF TO FINISHED GRADE (UDACS PLATE NO. 36)
14. ADJUST WATER VALVE BOX TO FINISHED GRADE (UDACS PLATE NO. 39) VALVE SHALL BE ACCESSIBLE AT ALL TIMES
15. ADJUST SANITARY SEWER MANHOLE TO FINISHED GRADE (DCSWCS STD. DWG. SD-5)
16. ADJUST ELECTRIC MANHOLE TO FINISHED GRADE
17. SET TYPE I WELL MONUMENT
18. CONSTRUCT 2" PBS OVERLAY
19. CONSTRUCT 5" PBS OVER 4" TYPE II AGGREGATE BASE

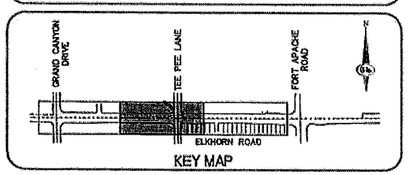
STORM DRAIN GENERAL NOTES:

1. ALL PIPE LENGTHS MEASURED ALONG PIPE CENTERLINE TO CENTER OF MANHOLE OR GRADE BREAK OR TO INSIDE EDGE OF DI, RCB, OR STRUCTURE.
2. ALL DROP INLETS AND CONCRETE APRONS SHALL INCLUDE STORM WATER MANAGEMENT STAMP AND DETAIL PER USDCCA STD. DWG. NO. 421.
3. ALL STORM DRAIN SHALL BE CLASS III UNLESS OTHERWISE NOTED.
4. NV ENERGY, CENTURYLINK TELEPHONE, AND SOUTHWEST GAS SHOWN FOR INFORMATIONAL ONLY. REFERENCE NV ENERGY, CENTURYLINK TELEPHONE, AND SOUTHWEST GAS DRAWINGS FOR CONSTRUCTION DETAILS. CONTRACTOR TO COORDINATE WITH UTILITIES FOR REMOVAL AND INSTALLATION OF FACILITIES.
5. ALL EXISTING UTILITY LOCATIONS SHOWN HEREON ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO DETERMINE THE EXACT VERTICAL AND HORIZONTAL LOCATION OF ALL EXISTING UNDERGROUND UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL UTILITIES ARE SHOWN HEREON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN IN THEIR PROPER LOCATION. THE DEPTH BELOW GRADE OF THE VARIOUS UTILITIES DEPICTED ON THE PLANS VARIES THROUGHOUT THE PROJECT AREA. THE CONTRACTOR SHALL EXERCISE EXTREME CARE WHERE EXCAVATING AND GRADING THE SUBBASE IN THE VICINITY OF UTILITIES TO AVOID DAMAGE TO THE LATTER.
6. ALL EXISTING UTILITIES SHALL BE PROTECTED IN PLACE UNLESS OTHERWISE NOTED.
7. SEE G-05 FOR RCB GEOMETRY AND R-SHEETS FOR REMOVAL INFORMATION.

LEGEND
2" PBS OVERLAY
5" PBS OVER 4" TYPE II AGGREGATE BASE

LATERAL RUN PROFILE INDEX

LATERAL RUN NO	SEE SHEET
1 THRU 5	SD-04
6 THRU 8	SD-05



KEY MAP

SCALE 40 0 40 80 FEET

FAST
Call before you UnderGround.
1-702-432-5500
Call before you Dig
Call 811
or
1-800-227-2600
CALL BEFORE YOU DIG OVERHEAD
1-702-227-2929

NO.	DATE:	DESCRIPTION	APP'D
		REVISIONS	

DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECT MANAGEMENT

CITY ENGINEER: ALLEN E. PAYELKA, P.E.
PROGRAM MANAGER: MARK SORENSEN, P.E.

DESIGNED BY: JSR
DRAWN BY: JAS
CHECKED BY: MJF
DATE: 1/30/15

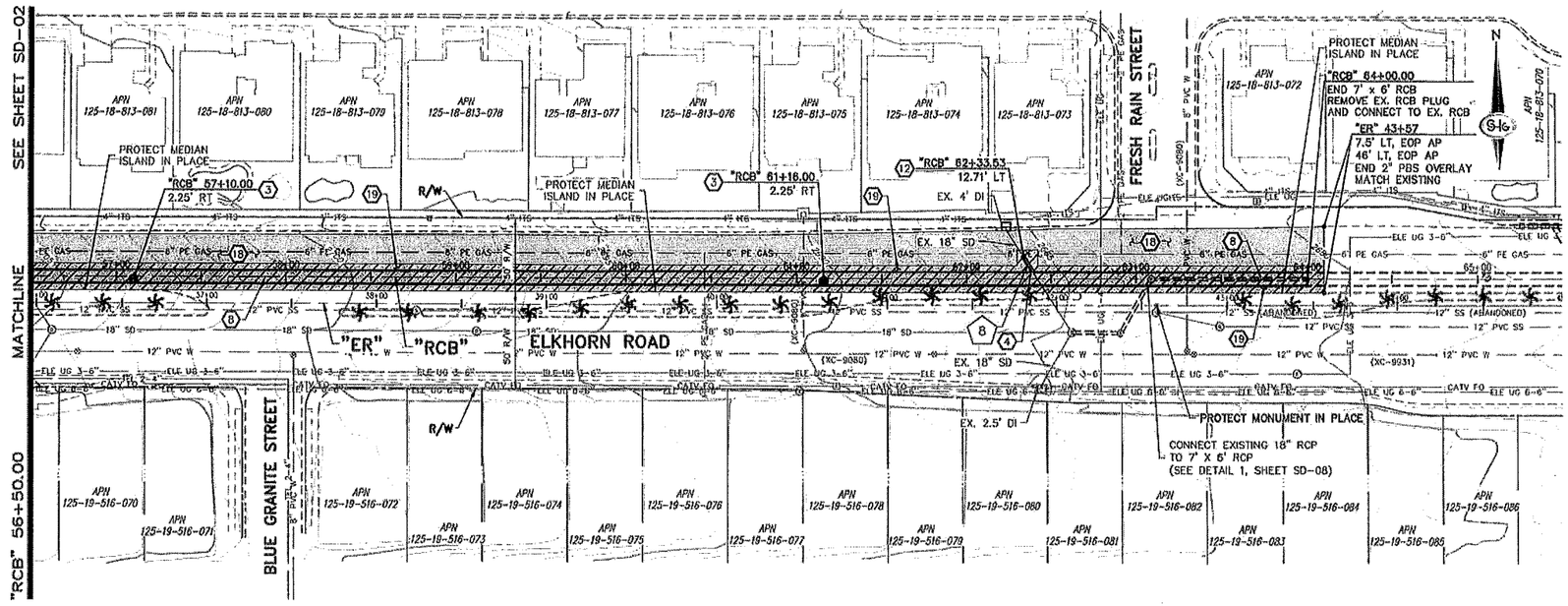
RANCHO ROAD SYSTEM (ELKHORN – FT APACHE TO GRAND CANYON)

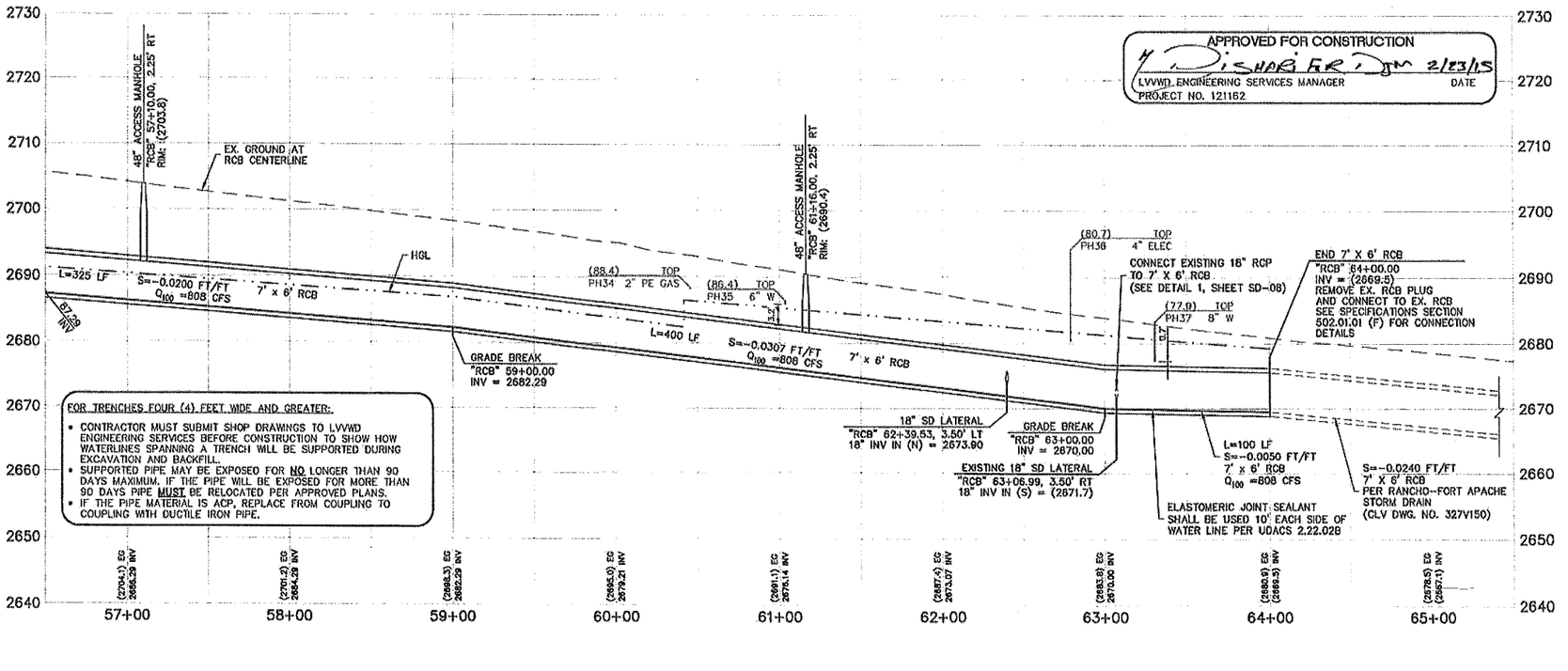
TITLE: RANCHO ROAD SYSTEM
ELKHORN - FT APACHE TO GRAND CANYON

SHEET: STORM DRAIN PLAN AND PROFILE
"RCB" 47+50.00 TO "RCB" 56+50.00

SEAL
PROFESSIONAL ENGINEER - STATE OF NEVADA
MARK J. FAILLA
No. 14566
CIVIL
Exp. 06/30/2015
2/23/15

Sheet SD-02
10 of 22
DRAWING NO. 327V290





FOR TRENCHES FOUR (4) FEET WIDE AND GREATER:

- CONTRACTOR MUST SUBMIT SHOP DRAWINGS TO LVVWD ENGINEERING SERVICES BEFORE CONSTRUCTION TO SHOW HOW WATERLINES SPANNING A TRENCH WILL BE SUPPORTED DURING EXCAVATION AND BACKFILL.
- SUPPORTED PIPE MAY BE EXPOSED FOR NO LONGER THAN 90 DAYS MAXIMUM. IF THE PIPE WILL BE EXPOSED FOR MORE THAN 90 DAYS PIPE MUST BE RELOCATED PER APPROVED PLANS.
- IF THE PIPE MATERIAL IS ACP, REPLACE FROM COUPLING TO COUPLING WITH DUCTILE IRON PIPE.

CONSTRUCTION NOTES

1. CONSTRUCT 60" TYPE III MANHOLE WITH TYPE IA RISER (USDCCA STD. DWG. NO. 406.1 AND 404.1)
2. CONSTRUCT 60" TYPE III MANHOLE (USDCCA STD. DWG. NO. 406.1)
3. CONSTRUCT 48" ACCESS MANHOLE (SEE DETAIL 2, SHEET SD-08)
4. INSTALL 18" RCP (USDCCA STD. DWG. NO. 503.2 AND DETAILS ON SHEET SD-06)
5. INSTALL 24" RCP (USDCCA STD. DWG. NO. 503.2 AND DETAILS ON SHEET SD-06)
6. INSTALL 29" X 45" HERCP (USDCCA STD. DWG. NO. 503.2 AND DETAILS ON SHEET SD-06)
7. INSTALL 36" RCP (USDCCA STD. DWG. NO. 503.2 AND DETAILS ON SHEET SD-06)
8. CONSTRUCT 7' X 6' PRECAST RCB (SEE DETAILS ON SHEET SD-06)
9. CONSTRUCT SPECIAL DROP INLET W/ CONCRETE APRON (SEE DETAIL 1, SHEET SD-07 AND SHEET SD-09)
10. CONSTRUCT MODIFIED TYPE DM2 DROP INLET (SEE DETAIL 1, SHEET SD-11)
11. CONSTRUCT RCB PLUG (SEE DETAIL 4, SHEET SD-08)
12. CONSTRUCT CONCRETE COLLAR (SEE DETAIL 3, SHEET SD-08)
13. ADJUST 2" MANUAL BLOW-OFF TO FINISHED GRADE (UDACS PLATE NO. 36)
14. ADJUST WATER VALVE BOX TO FINISHED GRADE (UDACS PLATE NO. 39) VALVE SHALL BE ACCESSIBLE AT ALL TIMES
15. ADJUST SANITARY SEWER MANHOLE TO FINISHED GRADE (DCSWCS STD. DWG. SD-5)
16. ADJUST ELECTRIC MANHOLE TO FINISHED GRADE
17. SET TYPE I WELL MONUMENT
18. CONSTRUCT 2" PBS OVERLAY
19. CONSTRUCT 5" PBS OVER 4" TYPE II AGGREGATE BASE

STORM DRAIN GENERAL NOTES:

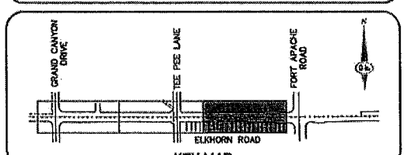
1. ALL PIPE LENGTHS MEASURED ALONG PIPE CENTERLINE TO CENTER OF MANHOLE OR GRADE BREAK OR TO INSIDE EDGE OF DI, RCB, OR STRUCTURE.
2. ALL DROP INLETS AND CONCRETE APRONS SHALL INCLUDE STORM WATER MANAGEMENT STAMP AND DETAIL PER USDCCA STD. DWG. NO. 421.
3. ALL STORM DRAIN SHALL BE CLASS III UNLESS OTHERWISE NOTED.
4. NV ENERGY, CENTURYLINK TELEPHONE, AND SOUTHWEST GAS SHOWN FOR INFORMATIONAL ONLY. REFERENCE NV ENERGY, CENTURYLINK TELEPHONE, AND SOUTHWEST GAS DRAWINGS FOR CONSTRUCTION DETAILS. CONTRACTOR TO COORDINATE WITH UTILITIES FOR REMOVAL AND INSTALLATION OF FACILITIES.
5. ALL EXISTING UTILITY LOCATIONS SHOWN HEREON ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO DETERMINE THE EXACT VERTICAL AND HORIZONTAL LOCATION OF ALL EXISTING UNDERGROUND UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL UTILITIES ARE SHOWN HEREON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN IN THEIR PROPER LOCATION. THE DEPTH BELOW GRADE OF THE VARIOUS UTILITIES DEPICTED ON THE PLANS VARIES THROUGHOUT THE PROJECT AREA. THE CONTRACTOR SHALL EXERCISE EXTREME CARE WHERE EXCAVATING AND GRADING THE SUBBASE IN THE VICINITY OF UTILITIES TO AVOID DAMAGE TO THE LATTER.
6. ALL EXISTING UTILITIES SHALL BE PROTECTED IN PLACE UNLESS OTHERWISE NOTED.
7. SEE G-05 FOR RCB GEOMETRY AND R-SHEETS FOR REMOVAL INFORMATION.

LEGEND

2" PBS OVERLAY

5" PBS OVER 4" TYPE II AGGREGATE BASE

LATERAL RUN PROFILE INDEX	
LATERAL RUN NO	SEE SHEET
1 THRU 5	SD-04
6 THRU 8	SD-05



KEY MAP

SCALE: 40 0 40 80 FEET

Call before you Dig
Call 811
1-800-227-2600

CALL BEFORE YOU DO OVERHEAD
1-702-227-2929

Call before you UnderGround.
1-702-432-5300

NO.	DATE:	DESCRIPTION	APP'D
		REVISIONS	

DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECT MANAGEMENT

CITY ENGINEER: ALLEN E. PAVELKA, P.E.
PROGRAM MANAGER: MARK SORENSEN, P.E.

DESIGNED BY: JSR
DRAWN BY: JAS
CHECKED BY: MJF

DATE: 1/30/15

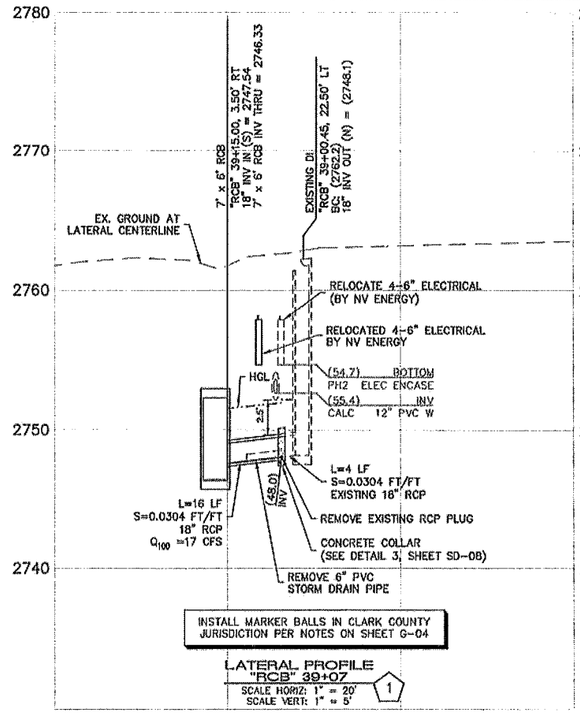
RANCHO ROAD SYSTEM (ELKHORN - FT APACHE TO GRAND CANYON)

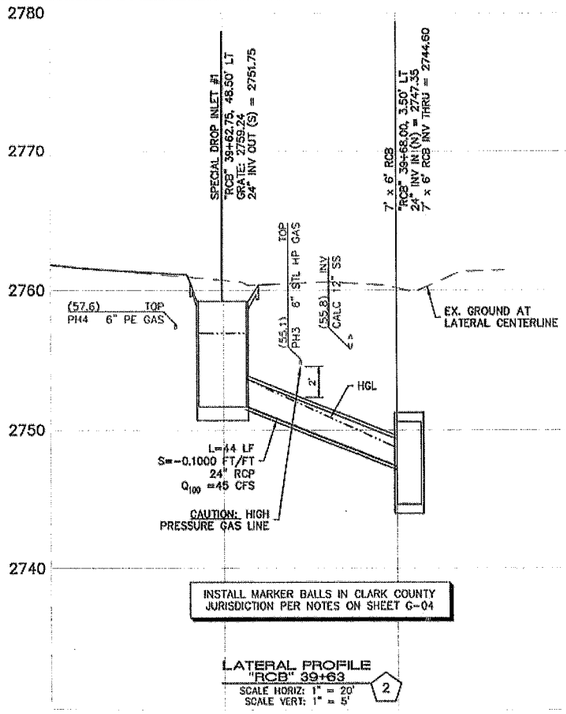
TITLE: RANCHO ROAD SYSTEM
ELKHORN - FT APACHE TO GRAND CANYON

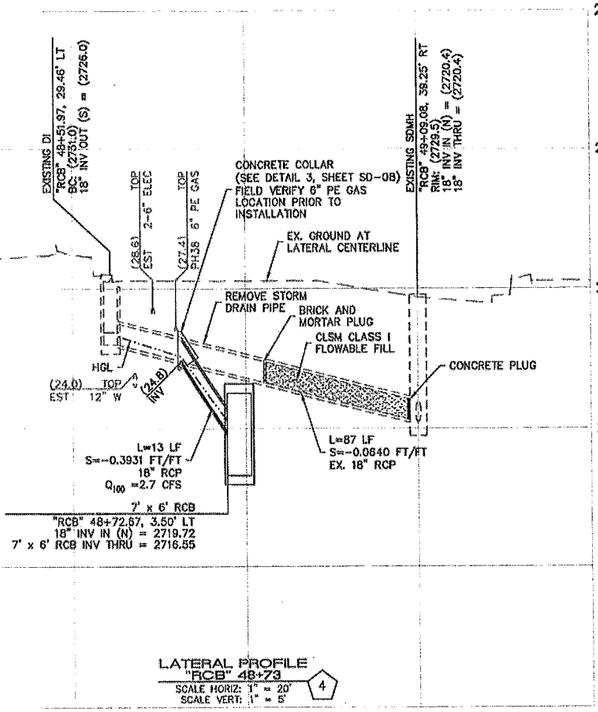
SHEET: STORM DRAIN PLAN AND PROFILE
"RCB" 56+50.00 TO "RCB" 65+50.00

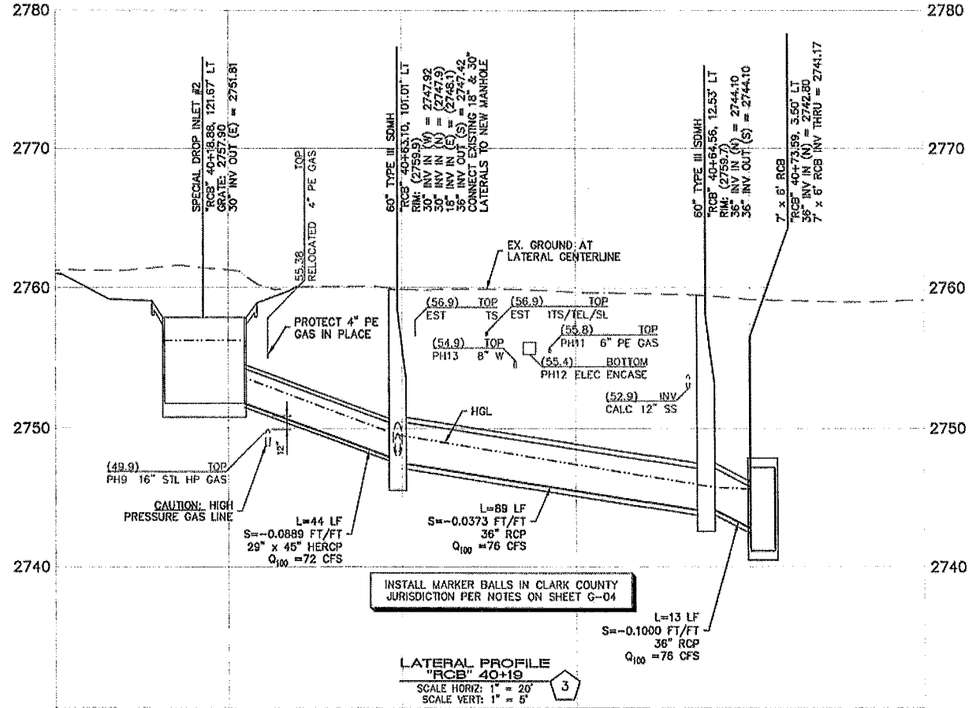
SEAL
REGISTERED ENGINEER - STATE OF NEVADA
MARK J. FAILLA
Exp. 06/30/2015
CIVIL
No. 14566

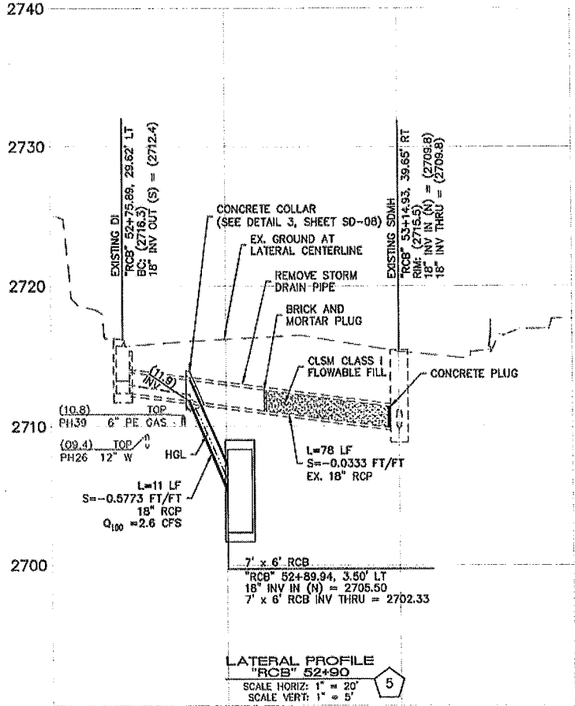
Sheet
SD-03
11 of 22
DRAWING NO.
327V290











CALL SOUTHWEST GAS AT 702-651-2111 FOR STANDBY WHEN EXCAVATING OVER OR NEAR HIGH PRESSURE GAS LINES.

FOR TRENCHES FOUR (4) FEET WIDE AND GREATER:

- CONTRACTOR MUST SUBMIT SHOP DRAWINGS TO LVVWD ENGINEERING SERVICES BEFORE CONSTRUCTION TO SHOW HOW WATERLINES SPANNING A TRENCH WILL BE SUPPORTED DURING EXCAVATION AND BACKFILL.
- SUPPORTED PIPE MAY BE EXPOSED FOR NO LONGER THAN 90 DAYS MAXIMUM. IF THE PIPE WILL BE EXPOSED FOR MORE THAN 90 DAYS PIPE MUST BE RELOCATED PER APPROVED PLANS.
- IF THE PIPE MATERIAL IS ACP, REPLACE FROM COUPLING TO COUPLING WITH DUCTILE IRON PIPE.

APPROVED FOR CONSTRUCTION

LVVWD ENGINEERING SERVICES MANAGER — DATE 2/23/15

PROJECT NO. 121162

REVISIONS

NO.	DATE:	DESCRIPTION	APP'D

DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECT MANAGEMENT

CITY ENGINEER: ALLEN E. PAVELKA, P.E.
PROGRAM MANAGER: MARK SORENSEN, P.E.

DESIGNED BY: JSR
DRAWN BY: JAS
CHECKED BY: MJF

DATE: 1/30/15

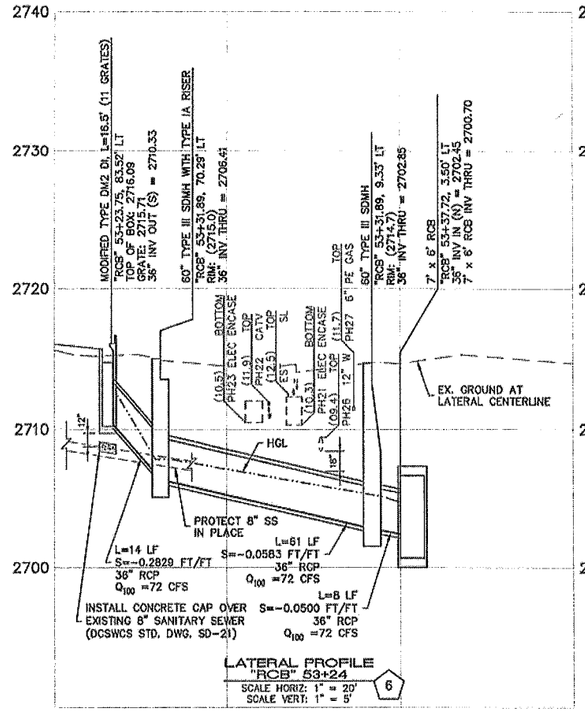
RANCHO ROAD SYSTEM (ELKHORN - FT APACHE TO GRAND CANYON)

TITLE: RANCHO ROAD SYSTEM
ELKHORN - FT APACHE TO GRAND CANYON

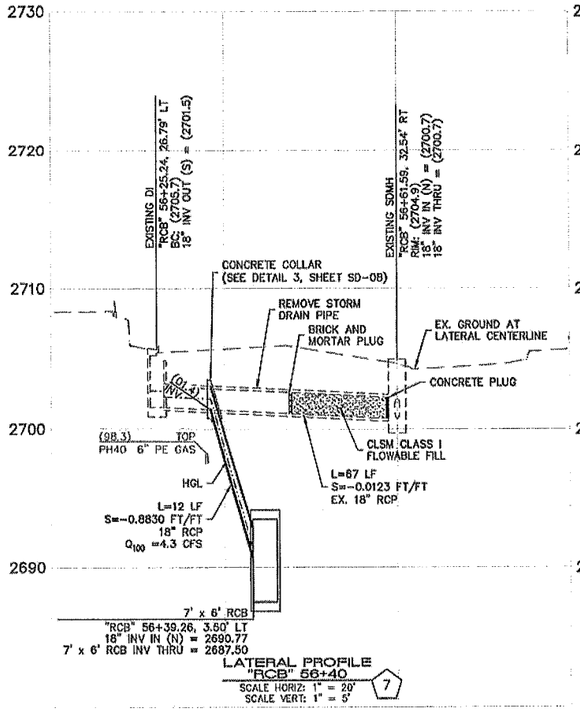
SHEET: STORM DRAIN LATERAL PROFILES

SEAL
MARK J. FAILLA
Exp. 06/30/2015
CIVIL
No. 14566
STATE OF NEVADA
PROFESSIONAL ENGINEER
2/24/15

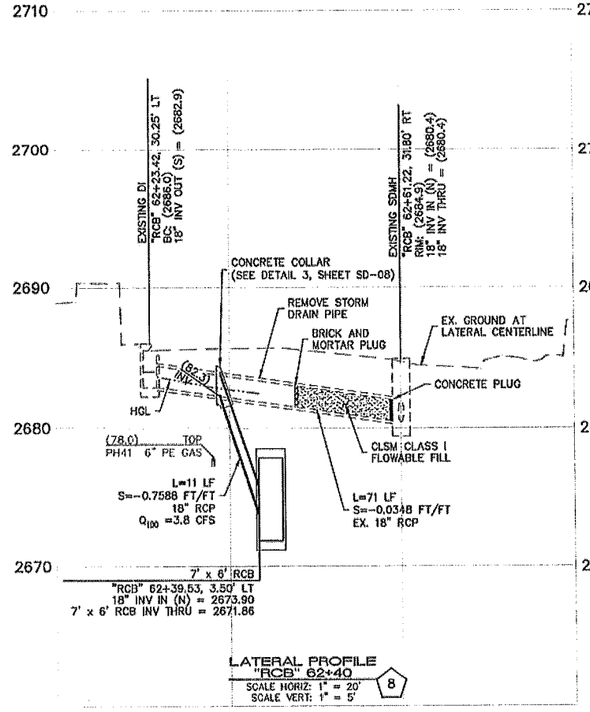
Sheet
SD-04
12 of 22
DRAWING NO.
327V290



LATERAL PROFILE
"RCB" 53+24 (6)
SCALE HORIZ: 1" = 20'
SCALE VERT: 1" = 5'



LATERAL PROFILE
"RCB" 56+40 (7)
SCALE HORIZ: 1" = 20'
SCALE VERT: 1" = 5'



LATERAL PROFILE
"RCB" 62+40 (8)
SCALE HORIZ: 1" = 20'
SCALE VERT: 1" = 5'

FOR TRENCHES FOUR (4) FEET WIDE AND GREATER:

- CONTRACTOR MUST SUBMIT SHOP DRAWINGS TO LVVWD ENGINEERING SERVICES BEFORE CONSTRUCTION TO SHOW HOW WATERLINES SPANNING A TRENCH WILL BE SUPPORTED DURING EXCAVATION AND BACKFILL.
- SUPPORTED PIPE MAY BE EXPOSED FOR NO LONGER THAN 90 DAYS MAXIMUM. IF THE PIPE WILL BE EXPOSED FOR MORE THAN 90 DAYS PIPE MUST BE RELOCATED PER APPROVED PLANS.
- IF THE PIPE MATERIAL IS ACP, REPLACE FROM COUPLING TO COUPLING WITH DUCTILE IRON PIPE.

APPROVED FOR CONSTRUCTION

LVVWD ENGINEERING SERVICES MANAGER — DATE 2/23/15

PROJECT NO. 121162

NO.	DATE	DESCRIPTION	APP'D
		REVISIONS	

DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECT MANAGEMENT

CITY ENGINEER: ALLEN E. PAVELKA, P.E.
PROGRAM MANAGER: MARK SORENSEN, P.E.

DESIGNED BY: JSR
DRAWN BY: JAS
CHECKED BY: MJF

DATE: 1/30/15

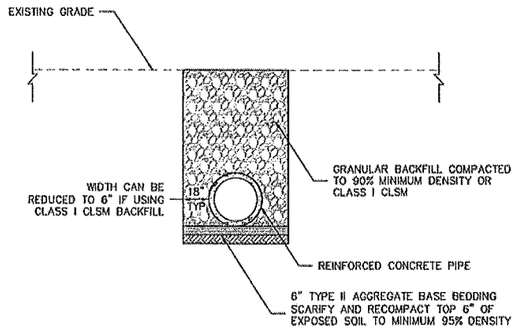
RANCHO ROAD SYSTEM (ELKHORN – FT APACHE TO GRAND CANYON)

TITLE: RANCHO ROAD SYSTEM
ELKHORN - FT APACHE TO GRAND CANYON

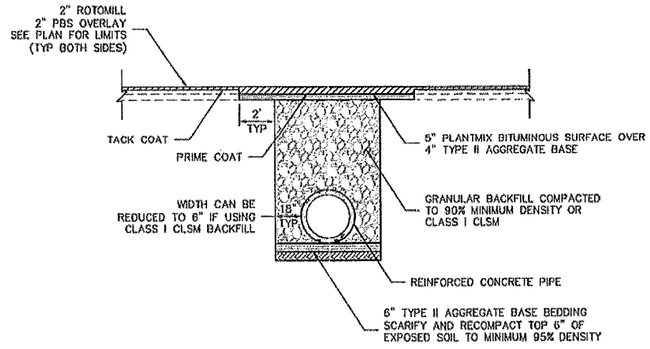
SHEET: STORM DRAIN LATERAL PROFILES

SEAL
MARK J. FAILLA
Exp. 06/30/2015
CIVIL
STATE OF NEVADA No. 14566
PROFESSIONAL ENGINEER
2/23/15

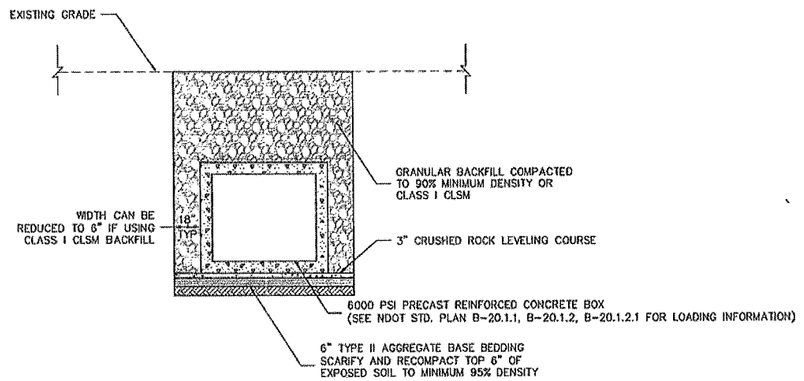
Sheet
SD-05
13 of 22
DRAWING NO.
327V290



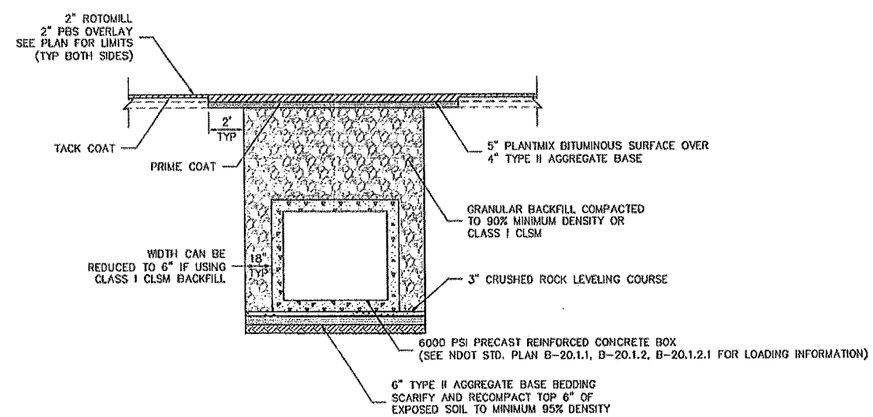
REINFORCED CONCRETE PIPE SECTION (UNPAVED AREAS)



REINFORCED CONCRETE PIPE SECTION (PAVED AREAS)



PRECAST REINFORCED CONCRETE BOX SECTION (UNPAVED AREAS)



PRECAST REINFORCED CONCRETE BOX SECTION (PAVED AREAS)

NOTES:

1. SEE REMOVAL PLANS FOR LIMITS OF PAVEMENT REPLACEMENT AND MILL/OVERLAY.
2. THE SAWCUT AND PAVEMENT RESTORATION LIMITS SHOWN ARE BASED ON VERTICAL WALL TRENCHES. NO ADDITIONAL PAYMENT WILL BE MADE FOR DAMAGED PAVEMENT OR PAVEMENT REMOVED TO LAY BACK TRENCH SLOPES. FINAL SAWCUT LIMITS SHALL BE APPROVED BY FIELD INSPECTOR.
3. TRENCH WALLS SHALL BE SHORED PER OSHA REQUIREMENTS.
4. SEE USDCCA STD. DWG. NO. 503.2 FOR ADDITIONAL INFORMATION.

REVISIONS

NO.	DATE:	DESCRIPTION	APP'D

DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECT MANAGEMENT

CITY ENGINEER: ALLEN E. PAVELKA, P.E.
PROGRAM MANAGER: MARK SORENSEN, P.E.
DESIGNED BY: JSR
DRAWN BY: JAS
CHECKED BY: MJF
DATE: 1/30/15

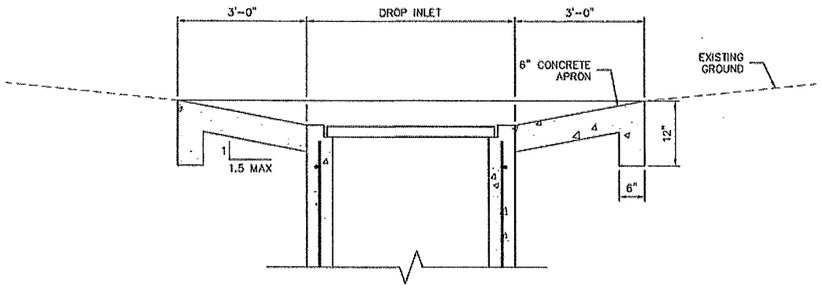
RANCHO ROAD SYSTEM (ELKHORN - FT APACHE TO GRAND CANYON)

TITLE: RANCHO ROAD SYSTEM
ELKHORN - FT APACHE TO GRAND CANYON

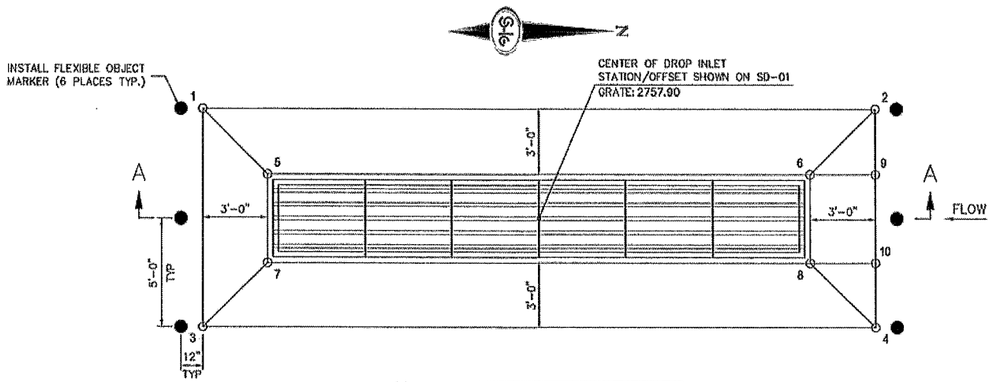
SHEET: STORM DRAIN DETAILS

SEAL
PROFESSIONAL ENGINEER - STATE OF NEVADA
MARK J. FAILLA
Exp. 06/30/2015
CIVIL
No. 14566
1/30/15

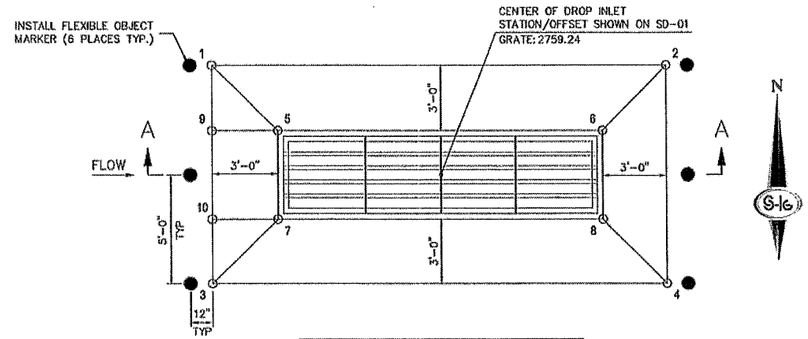
Sheet
SD-06
14 of 22
DRAWING NO.
327V290



SECTION A



APRON ELEVATION TABLE SPECIAL DROP INLET #2	
POINT	ELEVATION
1	2758.95
2	2759.10
3	2758.90
4	2759.05
5	2757.90
6	2757.90
7	2757.90
8	2757.90
9	2758.40
10	2758.40



APRON ELEVATION TABLE SPECIAL DROP INLET #1	
POINT	ELEVATION
1	2761.43
2	2760.89
3	2760.78
4	2760.24
5	2759.24
6	2759.24
7	2759.24
8	2759.24
9	2759.75
10	2759.75

NOTES:

1. ALL DROP INLETS AND CONCRETE APRONS SHALL INCLUDE STORM WATER MANAGEMENT STAMP AND DETAIL PER USDCCA STD. DWG. NO. 421.

CONCRETE APRONS
NOT TO SCALE

1
SD-07

REVISIONS

NO.	DATE:	DESCRIPTION	APP'D

DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECT MANAGEMENT

CITY ENGINEER: ALLEN E. PAVELKA, P.E.
PROGRAM MANAGER: MARK SORENSEN, P.E.
DESIGNED BY: JSR
DRAWN BY: JAS
CHECKED BY: MJF
DATE: 1/30/15

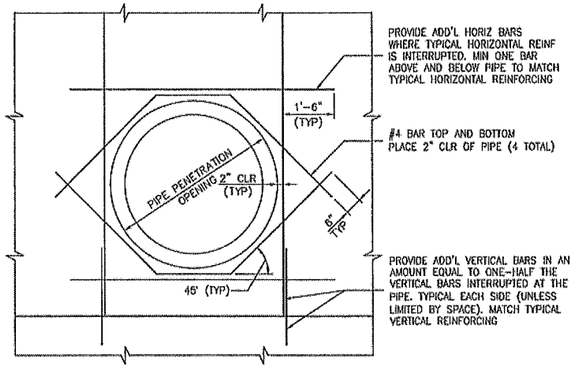
RANCHO ROAD SYSTEM (ELKHORN – FT. APACHE TO GRAND CANYON)

TITLE: RANCHO ROAD SYSTEM
ELKHORN - FT APACHE TO GRAND CANYON

SHEET: STORM DRAIN DETAILS

SEAL
PROFESSIONAL ENGINEER - STATE OF NEVADA
MARK J. FAILLA
Exp. 06/30/2015
CIVIL
No. 14565
12/9/14

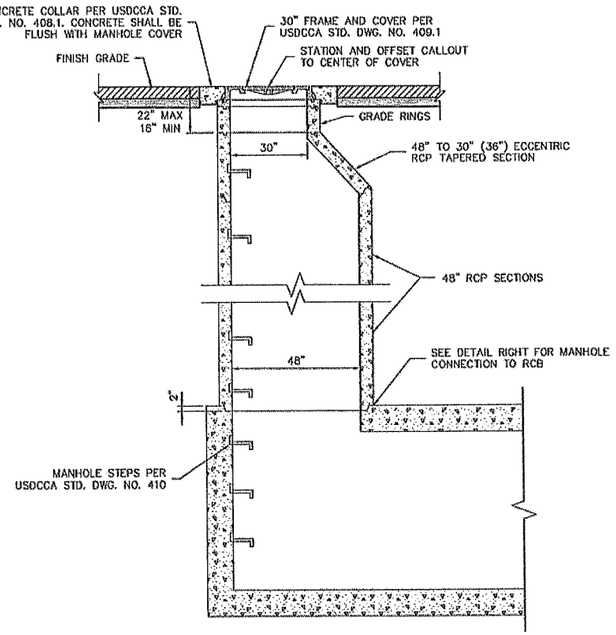
Sheet
SD-07
15 of 22
DRAWING NO.
327V290



NOTES:

1. TYPICAL WALL REINFORCING NOT SHOWN FOR CLARITY.
2. FIELD CUT TYPICAL WALL REINFORCING 2" CLEAR OF PIPE.

RCB PIPE PENETRATION (1 / SD-08)
NOT TO SCALE

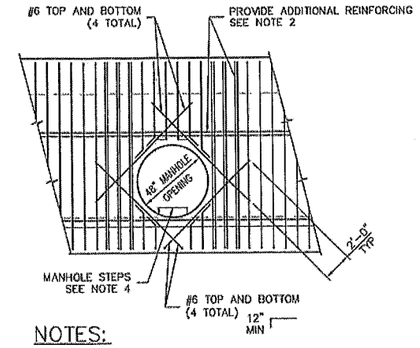


NOTES:

1. SEE USDCCA STD. DWG. NO. 403.1 FOR ADDITIONAL MANHOLE CONSTRUCTION NOTES AND DETAILS.

SECTION

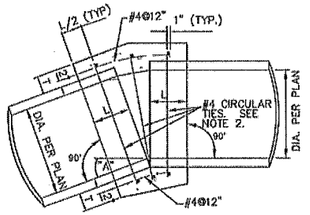
48" ACCESS MANHOLE (2 / SD-08)
NOT TO SCALE



NOTES:

1. FIELD BEND OR CUT ALL REINFORCING 2" CLR OF OPENINGS.
2. EVERY REBAR DISCONTINUED AT OPENING SHALL BE REPLACED BY AN EXTRA REBAR PLACED AT THE SIDE OF THE OPENING AS SHOWN. THE LENGTH OF THE EXTRA REBARS SHALL EQUAL THE LENGTH OF THE SCHEDULE REBARS THAT ARE NOT DISCONTINUED AT THE OPENING.
3. PROVIDE MINIMUM 2" CLEARANCE BETWEEN ALL REINFORCING BARS.
4. MANHOLE STEPS SHALL BE PER USDCCA STD. DWG. NO. 410.

CONNECTION TO RCB



PLAN

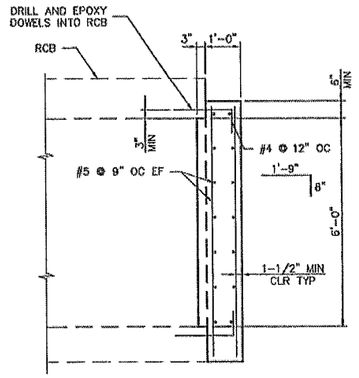
NOTES:

1. WHERE THE SLOPE OF THE UPSTREAM PIPE IS GREATER THAN THE SLOPE OF THE DOWNSTREAM PIPE, JOIN SOFFITS. WHERE THE SLOPE OF THE UPSTREAM PIPE IS LESS THAN THE SLOPE OF THE DOWNSTREAM PIPE, JOIN INVERTS.
2. WHERE THE SPACE BETWEEN THE PIPE EXTREMITIES EXCEEDS 2 1/2 INCHES, THE NUMBER OF CIRCULAR TIES SHALL BE INCREASED TO MAINTAIN A MAXIMUM SPACING OF 6 INCHES CENTER TO CENTER. CIRCULAR TIES SHALL HAVE A DIAMETER 5 INCHES GREATER THAN THE OUTSIDE DIAMETER OF THE LARGER PIPE.

CIRCULAR TIES

PIPE DIAMETER	SPACE BETWEEN PIPE EXTREMITIES	NO. OF CIRCULAR TIES	L	T
18"	2 1/2"	3	12"	5"
24"	2 1/2"	3	12"	6"
30"	2 1/2"	3	12"	7"
36"	2 1/2" or less	4	18"	9"
60"	2 1/2" or less	5	21"	11"

CONCRETE COLLAR (3 / SD-08)
NOT TO SCALE



NOTES:

1. PRECAST RCB PLUG IS AN ACCEPTABLE ALTERNATIVE TO A CAST-IN-PLACE PLUG. PRECAST PLUG SHALL BE APPROVED BY ENGINEER PRIOR TO INSTALLATION.
2. EPOXY SHALL BE SIMPSON SET ANCHORING ADHESIVE PER ICC ESR-1772 OR EQUAL.

RCB PLUG (4 / SD-08)
NOT TO SCALE

GENERAL STRUCTURAL NOTES

1. DESIGN SPECIFICATIONS: AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 2002". REINFORCED CONCRETE DESIGN BASED ON LOAD FACTOR DESIGN.
2. CONSTRUCTION SPECIFICATIONS: UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA, NEVADA.
3. EXISTING UTILITIES: THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING ALL EXISTING UTILITIES WITHIN THE WORK AREA, AND PROVIDING PROTECTION FOR THE VARIOUS UTILITIES AFFECTED PRIOR TO PROCEEDING WITH THE WORK.
4. CONCRETE: CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH AT 28 DAYS OF f'c=4,500 PSI AND A MAXIMUM WATER TO CEMENT RATIO, BY WEIGHT, OF 0.45. USE TYPE V CEMENT PER ASTM C-150. ALL EXPOSED EDGES OF CONCRETE SHALL BE CHAMFERED 3/4", UNLESS NOTED OTHERWISE.
5. REINFORCING STEEL: ALL REINFORCING STEEL SHALL BE ASTM A615 GRADE 60. DIMENSIONS ARE FROM OUT TO OUT OF BARS. MINIMUM CLEARANCE TO REINFORCING STEEL SHALL BE 2" UNLESS NOTED OTHERWISE. HOOKS MAY BE ROTATED OR TILTED AS NECESSARY TO PROVIDE THE PROPER CLEARANCES.
6. BEDDING MATERIAL: BEDDING MATERIAL SHALL BE MINIMUM OF 6-INCHES OF CLARK COUNTY TYPE II AGGREGATE BASE COMPACTED TO AT LEAST 95% OF THE MAXIMUM DRY DENSITY AS ESTABLISHED BY ASTM TEST METHOD D-1557. EXPOSED NATIVE SOILS IN BOTTOMS OF EXCAVATIONS SHALL BE SCARIFIED TO A DEPTH OF 6-INCHES, MOISTURE-CONDITIONED TO WITHIN 2% OF OPTIMUM MOISTURE CONTENT AND COMPACTED TO 95% PER ASTM D-1557.
7. STRUCTURAL STEEL: WIDE FLANGE SHAPES SHALL CONFORM TO ASTM A992. ALL MISCELLANEOUS STEEL SHALL CONFORM TO ASTM A36 UNLESS NOTED OTHERWISE.
8. GALVANIZING: ALL EXPOSED METAL PARTS SHALL BE GALVANIZED. GALVANIZING DAMAGED BY FABRICATION SHALL RECEIVE TWO COATS OF ZINC RICH PAINT (GALVANOX OR EQUAL).
9. THIS IS A TYPICAL DETAIL. PIPE SIZES, INVERT ELEVATIONS, INLET LENGTH, AND TOP OF GRATE ELEVATION SHALL BE PER CIVIL DRAWINGS.
10. CONTRACTOR SHALL PROVIDE SLOPE STABILIZATION, SHEETING, BRACING, AND/OR SHORING AS REQUIRED TO PROTECT EXISTING EMBANKMENTS, STRUCTURES, AND UNDERGROUND ITEMS.

REVISIONS

NO.	DATE:	DESCRIPTION	APP'D

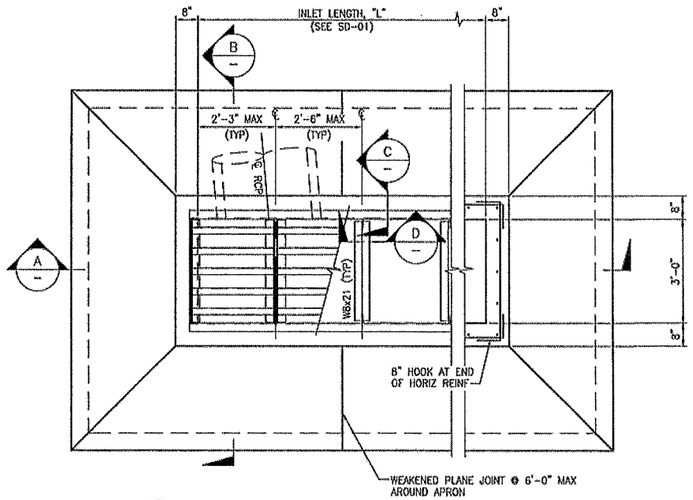
DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECT MANAGEMENT
CITY ENGINEER: ALLEN E. PAVELKA, P.E.
PROGRAM MANAGER: MARK SORENSEN, P.E.
DESIGNED BY: JSR
DRAWN BY: MJS
CHECKED BY: MJF
DATE: 1/30/15

RANCHO ROAD SYSTEM (ELKHORN - FT APACHE TO GRAND CANYON)

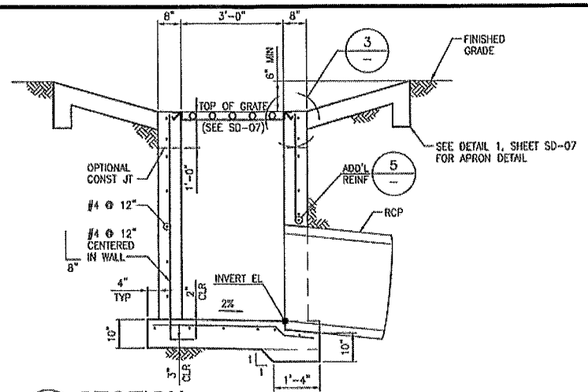
TITLE: RANCHO ROAD SYSTEM
ELKHORN - FT APACHE TO GRAND CANYON
SHEET: STORM DRAIN DETAILS

SEAL
PROFESSIONAL ENGINEER STATE OF NEVADA
DAVID A. TURNER
Exp. 06/30/2016
CIVIL
No. 18919
1/17/15

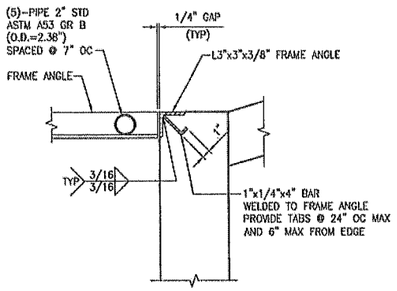
Sheet
SD-08
16 of 22
DRAWING NO.
327V290



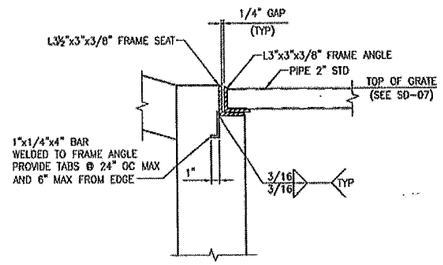
1 PLAN
SCALE: 1/2" = 1'-0"



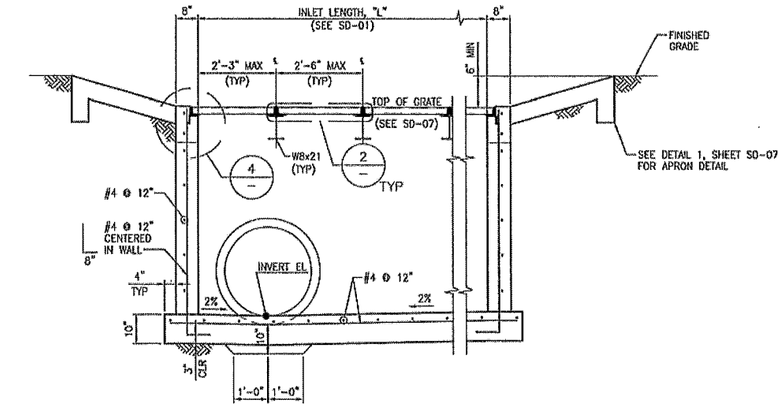
B SECTION
SCALE: 1/2" = 1'-0"



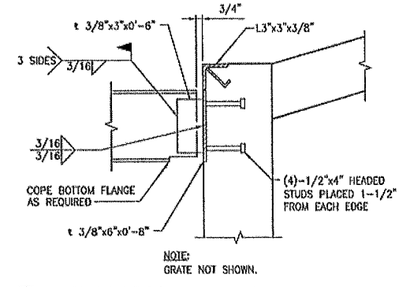
3 DETAIL
SCALE: 1 1/2" = 1'-0"



4 DETAIL
SCALE: 1 1/2" = 1'-0"

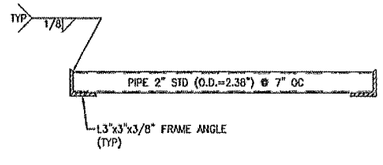


A SECTION
SCALE: 1/2" = 1'-0"

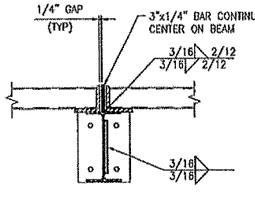


NOTE:
GRATE NOT SHOWN.

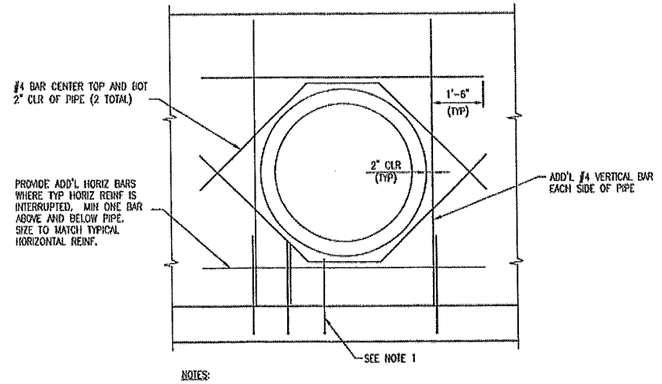
C SECTION
SCALE: 1 1/2" = 1'-0"



2 TYPICAL GRATE DETAIL
SCALE: 1 1/2" = 1'-0"



D SECTION
SCALE: 1 1/2" = 1'-0"



NOTES:
1. FIELD CUT TYPICAL WALL REINFORCING 2" CLR OF PIPE.
2. IF BARS CANNOT EXTEND BEYOND PIPE AS SHOWN, EXTEND AS FAR AS POSSIBLE AND PROVIDE STANDARD HOOK AT END.

5 PIPE PENETRATION DETAIL
SCALE: NONE

GENERAL STRUCTURAL NOTES

1. DESIGN SPECIFICATIONS: AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 2002". REINFORCED CONCRETE DESIGN BASED ON LOAD FACTOR DESIGN.
2. CONSTRUCTION SPECIFICATIONS: UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA, NEVADA.
3. EXISTING UTILITIES: THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING ALL EXISTING UTILITIES WITHIN THE WORK AREA, AND PROVIDING PROTECTION FOR THE VARIOUS UTILITIES AFFECTED PRIOR TO PROCEEDING WITH THE WORK.
4. CONCRETE: CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH AT 28 DAYS OF f'c=4,500 PSI AND A MAXIMUM WATER TO CEMENT RATIO, BY WEIGHT, OF 0.45. USE TYPE V CEMENT PER ASTM C-150. ALL EXPOSED EDGES OF CONCRETE SHALL BE CHAMFERED 3/4", UNLESS NOTED OTHERWISE.
5. REINFORCING STEEL: ALL REINFORCING STEEL SHALL BE ASTM A615 GRADE 60. DIMENSIONS ARE FROM OUT TO OUT OF BARS. MINIMUM CLEARANCE TO REINFORCING STEEL SHALL BE 2" UNLESS NOTED OTHERWISE. HOOKS MAY BE ROTATED OR TILTED AS NECESSARY TO PROVIDE THE PROPER CLEARANCES.
6. BEDDING MATERIAL: BEDDING MATERIAL SHALL BE MINIMUM OF 6-INCHES OF CLARK COUNTY TYPE II AGGREGATE BASE COMPACTED TO AT LEAST 95% OF THE MAXIMUM DRY DENSITY AS ESTABLISHED BY ASTM TEST METHOD D-1557. EXPOSED NATIVE SOILS IN BOTTOMS OF EXCAVATIONS SHALL BE SCARIFIED TO A DEPTH OF 6-INCHES, MOISTURE-CONDITIONED TO WITHIN 2% OF OPTIMUM MOISTURE CONTENT AND COMPACTED TO 95% PER ASTM D-1557.
7. STRUCTURAL STEEL: WIDE FLANGE SHAPES SHALL CONFORM TO ASTM A992. ALL MISCELLANEOUS STEEL SHALL CONFORM TO ASTM A36 UNLESS NOTED OTHERWISE.
8. GALVANIZING: ALL EXPOSED METAL PARTS SHALL BE GALVANIZED. GALVANIZING DAMAGED BY FABRICATION SHALL RECEIVE TWO COATS OF ZINC RICH PAINT (GALVANOX OR EQUAL).
9. THIS IS A TYPICAL DETAIL. PIPE SIZES, INVERT ELEVATIONS, INLET LENGTH, AND TOP OF GRATE ELEVATION SHALL BE PER CIVIL DRAWINGS.
10. CONTRACTOR SHALL PROVIDE SLOPE STABILIZATION, SHEETING, BRACING, AND/OR SHORING AS REQUIRED TO PROTECT EXISTING EMBANKMENTS, STRUCTURES, AND UNDERGROUND ITEMS.

REVISIONS

NO.	DATE:	DESCRIPTION	APP'D

DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECT MANAGEMENT

CITY ENGINEER: ALLEN E. PAVELKA, P.E.
PROGRAM MANAGER: MARK SORENSEN, P.E.
DESIGNED BY: JSR
DRAWN BY: JAS
CHECKED BY: MJF
DATE: 1/30/15

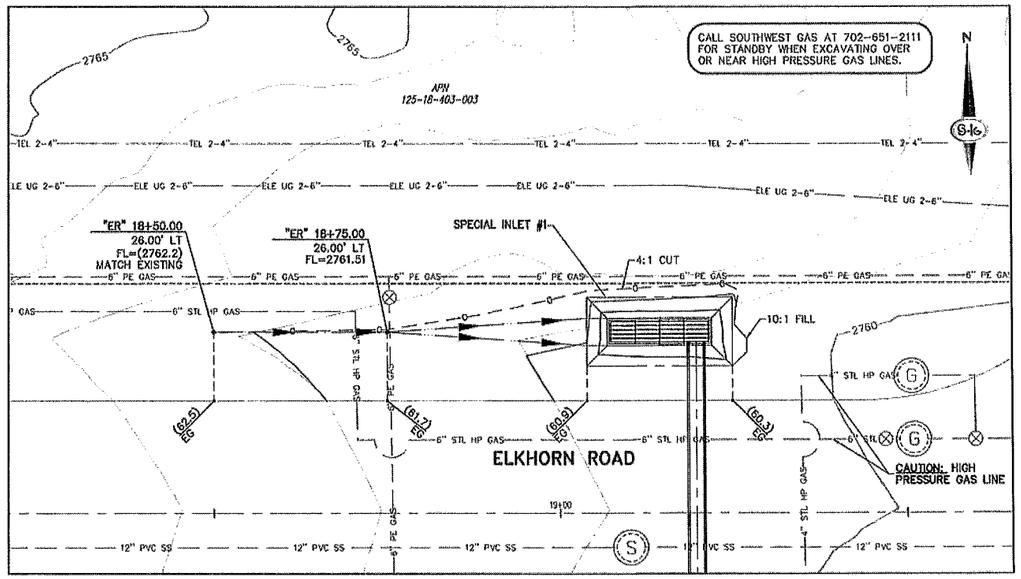
RANCHO ROAD SYSTEM (ELKHORN - FT APACHE TO GRAND CANYON)

TITLE: RANCHO ROAD SYSTEM
ELKHORN - FT APACHE TO GRAND CANYON

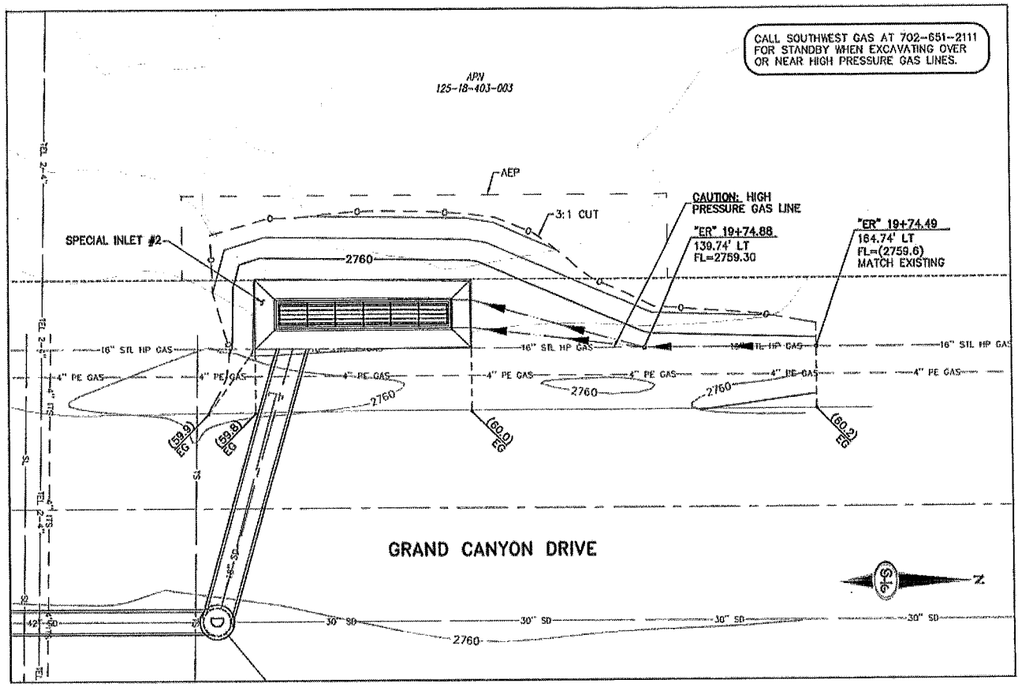
SHEET: STORM DRAIN DETAILS

SEAL
PROFESSIONAL ENGINEER - STATE OF NEVADA
DAVID A. TURNER
Exp. 06/30/2016
CIVIL
No. 18979
2/17/15

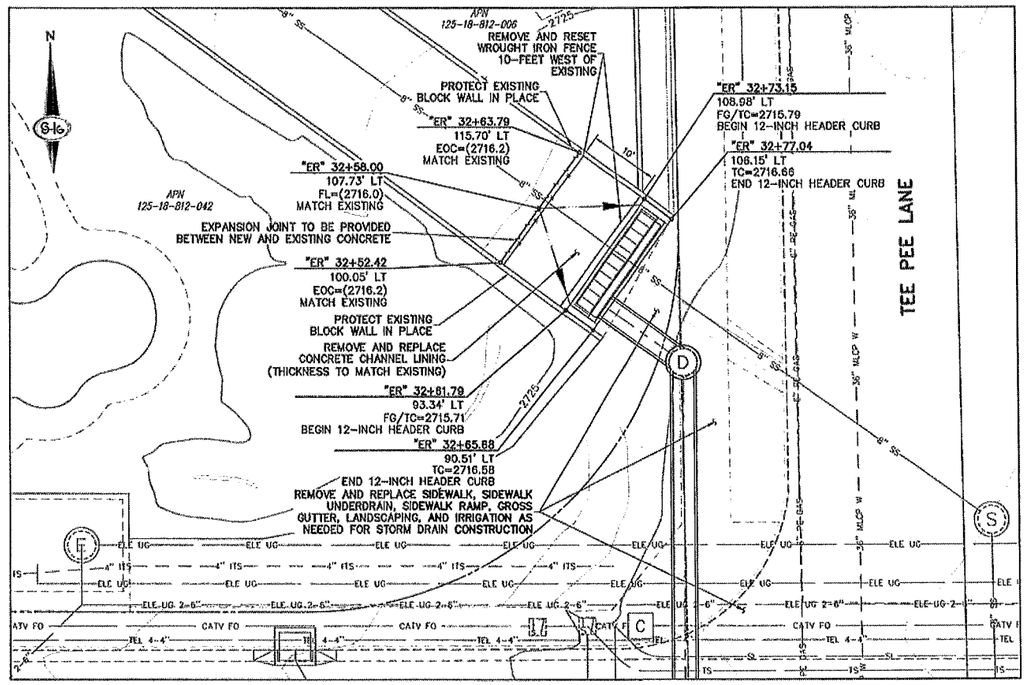
Sheet
SD-09
17 of 22
DRAWING NO.
327V290



DROP INLET GRADING DETAIL (1 / SD-10)
SCALE: 1" = 10'-0"



DROP INLET GRADING DETAIL (2 / SD-10)
SCALE: 1" = 10'-0"



DROP INLET GRADING DETAIL (3 / SD-10)
SCALE: 1" = 10'-0"

REVISIONS

NO.	DATE:	DESCRIPTION	APP'D

RANCHO ROAD SYSTEM (ELKHORN - FT APACHE TO GRAND CANYON)

DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECT MANAGEMENT

CITY ENGINEER: ALLEN E. PAVELKA, P.E.
PROGRAM MANAGER: MARK SORENSEN, P.E.

DESIGNED BY: JSR
DRAWN BY: JAS
CHECKED BY: MJF

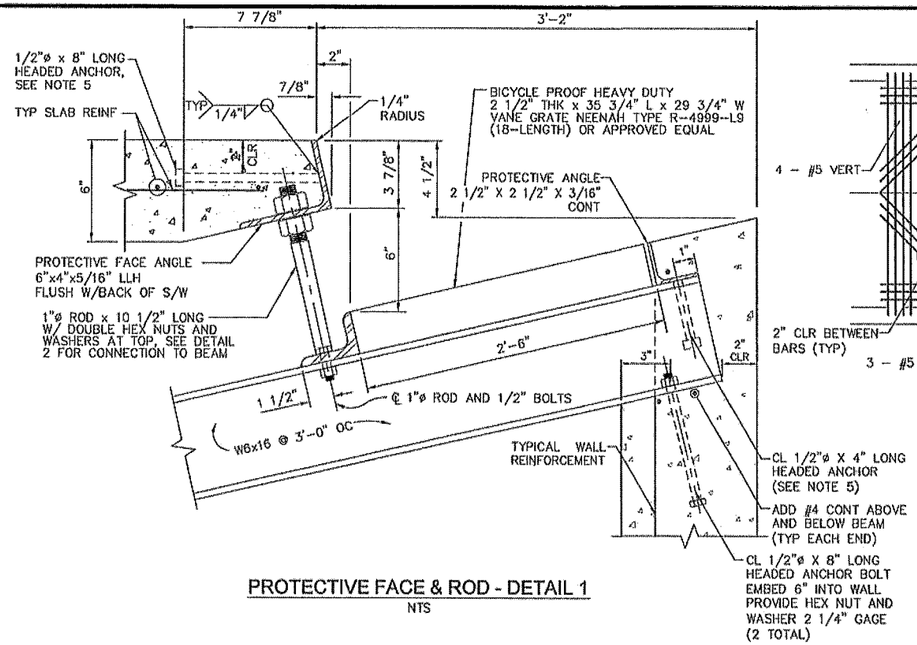
DATE: 1/30/15

TITLE: RANCHO ROAD SYSTEM
ELKHORN - FT APACHE TO GRAND CANYON

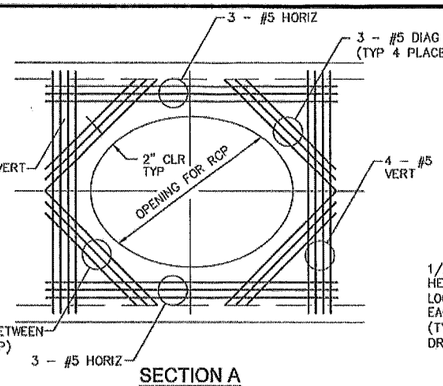
SHEET: DROP INLET GRADING DETAILS

SEAL
MARK J. FAILLA
Exp. 06/30/2015
CIVIL
No. 14566
STATE OF NEVADA
PROFESSIONAL ENGINEER

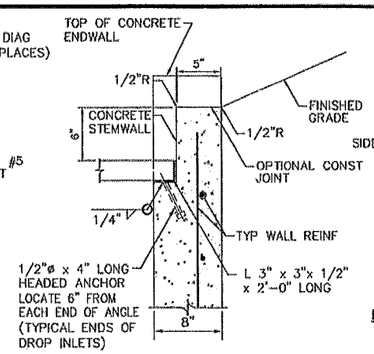
Sheet
SD-10
18 of 22
DRAWING NO.
327V290



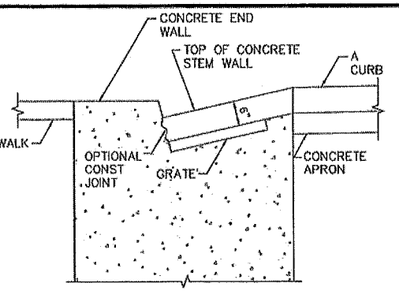
PROTECTIVE FACE & ROD - DETAIL 1
NTS



SECTION A
NTS

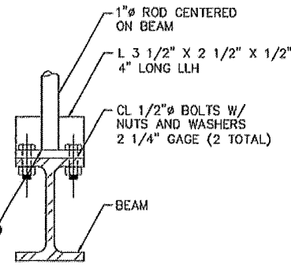


SECTION B
NTS



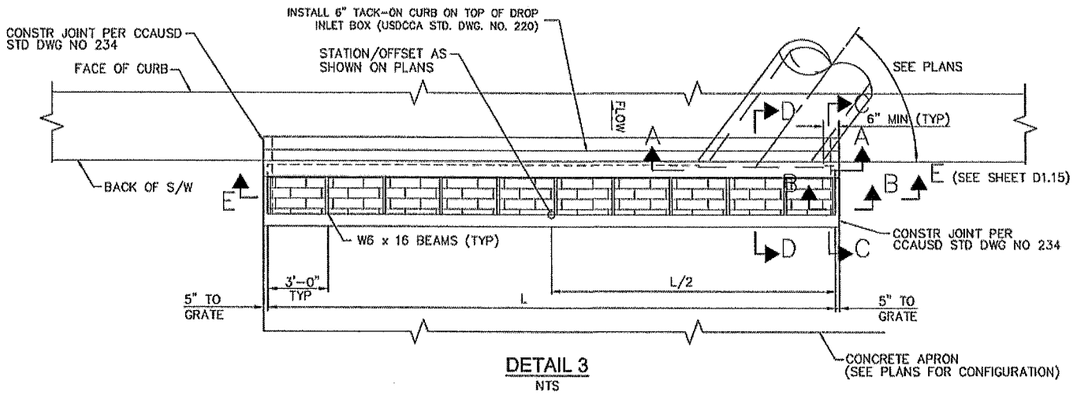
NOTE:
1. SEE SECTIONS B AND D FOR TYPICAL WALL REINFORCMENT.

SECTION C
NTS

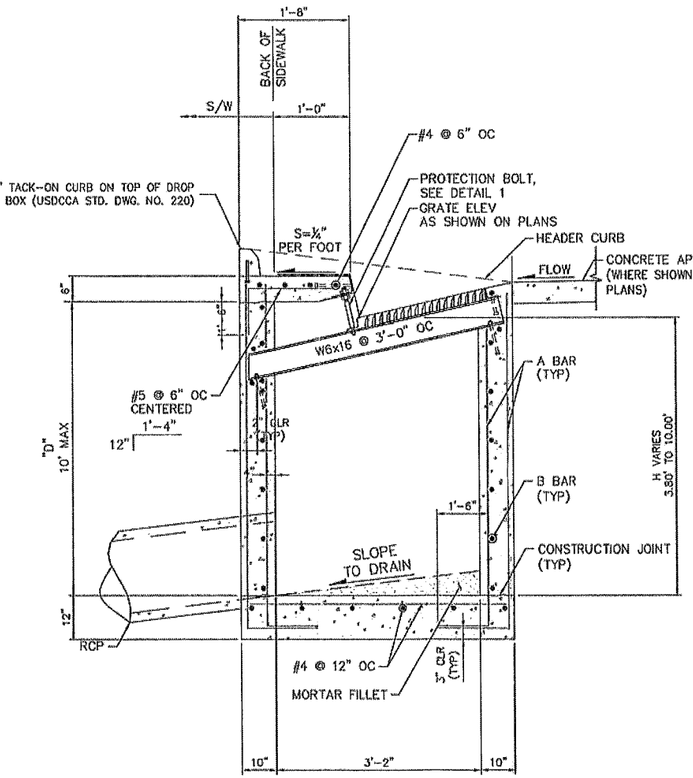


DETAIL 2
NTS

NOTES:
1. ALL EXPOSED METALS SHALL BE HOT DIP GALVANIZED AFTER FABRICATION.
2. PROVIDE 1/2" (MIN) CLEARANCE ALL AROUND THE STEEL BEAM, DRY PACK AFTER INSTALLATION.
3. WHEN REQUIRED BY LENGTH OF OPENING, PLATE ANGLE MAY BE DELIVERED IN SECTIONS AND BUTT WELDED IN PLACE.
4. ALL GALVANIZING DAMAGED BY WELDING SHALL RECEIVE TWO COATS OF GALVALLOY OR APPROVED EQUAL.
5. ANGLE ANCHORS SHALL BE EMBEDDED MIDPOINT IN EACH ENDWALL AND EVENLY SPACED (MAXIMUM SPACING OF 2').
6. BEDDING FOR DROP INLET SHALL BE 6" MIN. TYPE II AGGREGATE BASE COMPACTED TO 90% MAXIMUM DENSITY.
7. GRATING SHALL SUPPORT HS25 LIVE LOAD.



DETAIL 3
NTS



"D"	A BAR	B BAR
< 6'	#5 @ 12" OC	#5 @ 12" OC
6'-8'	#5 @ 12" OC	#5 @ 12" OC
8'-10'	#5 @ 6" OC	#5 @ 12" OC

SECTION D
NTS

MODIFIED TYPE DM2 DROP INLET
NOT TO SCALE

1
SD-11

REVISIONS

NO.	DATE:	DESCRIPTION	APP'D

DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECT MANAGEMENT

CITY ENGINEER: ALLEN E. PAVELKA, P.E.
PROGRAM MANAGER: MARK SORENSEN, P.E.

DESIGNED BY: JSR
DRAWN BY: JAS
CHECKED BY: MJF

DATE: 1/30/15

RANCHO ROAD SYSTEM (ELKHORN - FT. APACHE TO GRAND CANYON)

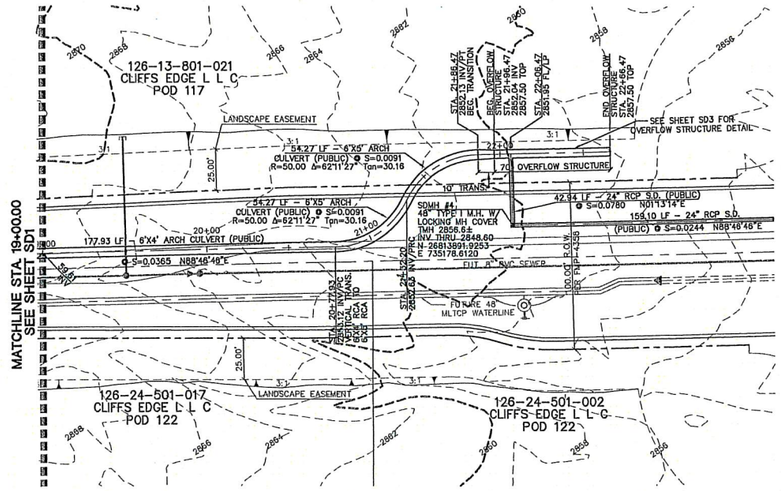
TITLE: RANCHO ROAD SYSTEM
ELKHORN - FT APACHE TO GRAND CANYON

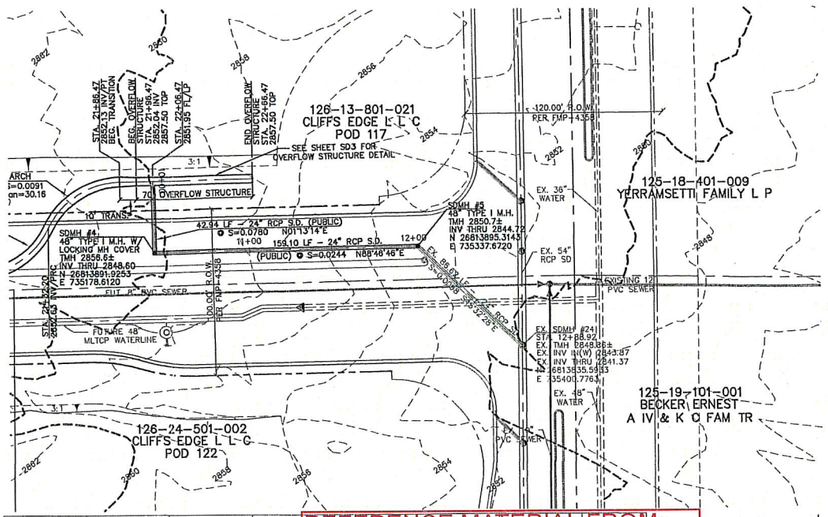
SHEET: STORM DRAIN DETAILS

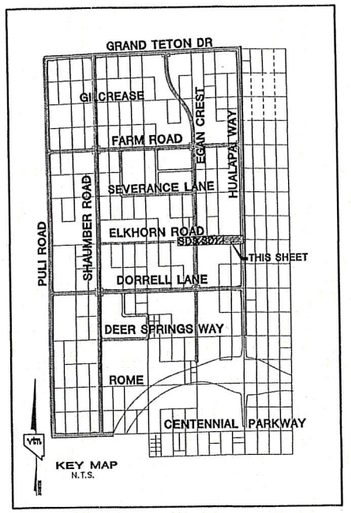
SEAL
REGISTERED PROFESSIONAL ENGINEER
MARK J. FAILLA
Exp. 06/30/2015
CIVIL
STATE OF NEVADA
No. 14566

Sheet
SD-11
19 of 22
DRAWING NO.
327V290

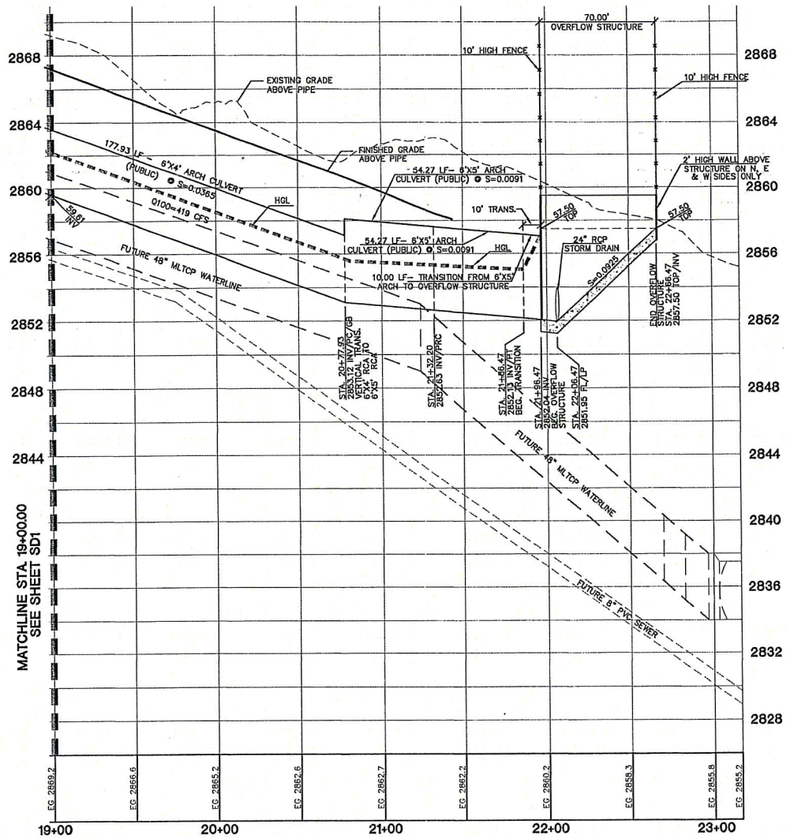
APPENDIX C.2
UPSTREAM STORM DRAIN FACILITY RECORD DRAWINGS

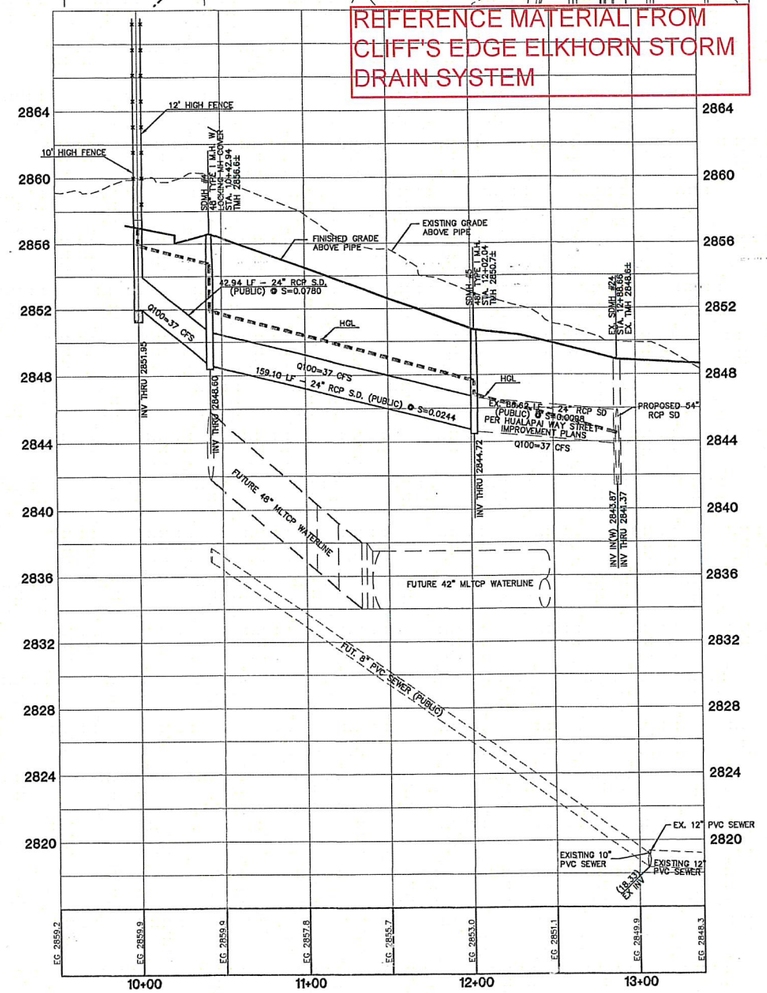






ELKHORN ROAD (PUBLIC)





REFERENCE MATERIAL FROM CLIFF'S EDGE ELKHORN STORM DRAIN SYSTEM

CONTRACTOR NOTE:
CONTRACTOR SHALL VERIFY HORIZONTAL AND VERTICAL LOCATION OF EXISTING UTILITIES AND NOTIFY THE DESIGN ENGINEER IMMEDIATELY OF ANY DISCREPANCIES PRIOR TO CONSTRUCTION.

NOTE :
STRUCTURAL CALCULATIONS FOR ALL NON-STANDARD DRAINAGE FACILITIES, SUCH AS JUNCTION BOXES AND OVERFLOW STRUCTURES, WILL BE PROVIDED WITH THE STRUCTURAL CALCULATIONS FOR THE RCA STORM DRAINS.

GRAPHIC SCALE
40 0 20 40 80
1" = 40'

Call before you Underground 1-702-455-7511 CLARK COUNTY TRAFFIC OPERATIONS AND 1-702-229-6611 LAS VEGAS AREA COMPUTERIZED TRAFFIC SYSTEM
Avoid hitting underground traffic signal systems and street light system circuits it's costly
Call before you Dig 1-800-227-2600
Avoid cutting underground utility lines. It's costly.
Call before you Overhead 1-702-227-2929
Avoid overhead power line contact. It's costly.

BASIS OF BEARINGS
THE BASIS OF BEARINGS FOR THIS PROJECT IS NORTH 00°08'16" EAST BEING THE EAST LINE OF THE NORTHWEST QUARTER (NE 1/4) OF THE SECTION 24, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M., CLARK COUNTY, NEVADA, AS SHOWN ON A RECORD OF SURVEY ON FILE IN THE CLARK COUNTY, NEVADA, RECORDER'S OFFICE IN FILE 123 AT PAGE 32.

PROJECT BENCHMARK
PROJECT DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

CLARK COUNTY VERTICAL CONTROL: 1C00:6N8
NAVD88 ELEVATION: 787.794 METERS (2584.62 FEET)

RIVET AND SQUARE ALUMINUM PLATE IN A CONCRETE CYLINDER, LOCATED 25' SOUTH & 50' EAST OF GRAND CANYON DRIVE AND RED COACH AVENUE, 1' WEST OF ELECTRICAL VAULT.

CITY OF LAS VEGAS BENCHMARK
DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

CITY OF LAS VEGAS BENCHMARK: BLV99:13SE5
NAVD88 ELEVATION: 869.606 METERS (2853.03 FEET)

RIVET AND PLATE IN CONCRETE UNDER NW CORNER OF HUALAPAI AND ELKHORN

NOTE: ADD 0.341 TO ABOVE CITY OF LAS VEGAS BENCHMARK BLV99:13SE5 TO MATCH ORIGINAL PROJECT BENCHMARK: CLARK COUNTY BENCHMARK 1C00:6N9 (2584.62 FEET) AS SHOWN ON RECORD OF SURVEY FILE 124 PAGE 94.

This plan is a part of drainage study which was received on 2/4/05 and C.A. 3/24/05. Page 1 Of 8.

"I CERTIFY THAT THIS PLAN IS IN CONFORMANCE WITH THE APPROVED DRAINAGE STUDY (#052376) ON FILE AT THE CITY OF LAS VEGAS FOR THIS PROJECT."

DANIEL J. HOOD NO. 12811 DATE

REV	DATE	BY	REVISION
1			
2			
3			
4			
5			
6			
7			

CLIFFS EDGE LLC
3455 CLIFF SHADOWS PARKWAY, SUITE 290
LAS VEGAS, NEVADA 89129
(702) 777-1221

CITY OF LAS VEGAS, NEVADA

nevada CONSULTING ENGINEERS ● PLANNERS ● LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD LAS VEGAS, NEVADA 89146-5148
PH. (702) 873-7550 FAX (702) 362-2597

STORM DRAIN PLAN & PROFILE
STA. 19+00.00 TO STA. 24+48.01

CLIFFS EDGE / PROVIDENCE
ELKHORN ROAD
STREET IMPROVEMENTS

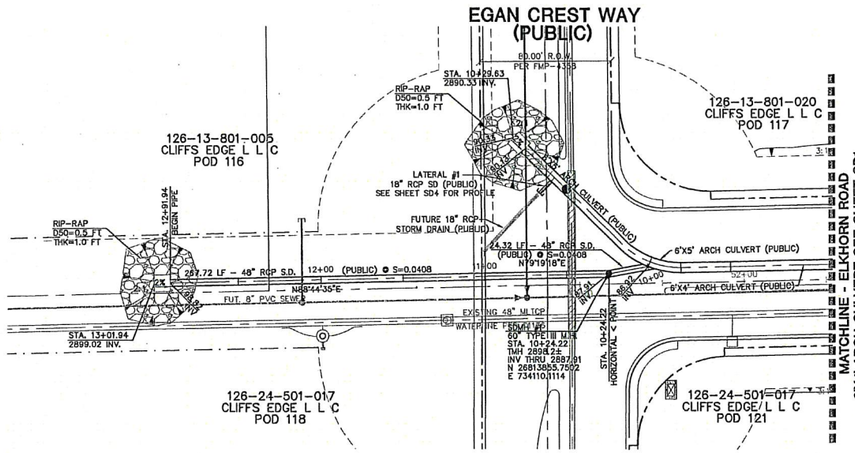
DRAWN BY: S.P./MG — APR.-04
DESIGNED BY: MH — APR.-04
CHECKED BY: DJH — APR.-04
PROJECT NO: 5969
SCALE: HORIZ. 1"=40' VERT. 1"=4'

EXPIRES 06-30-05
PROFESSIONAL ENGINEER DANIEL J. HOOD No. 12811 CIVIL STATE OF NEVADA

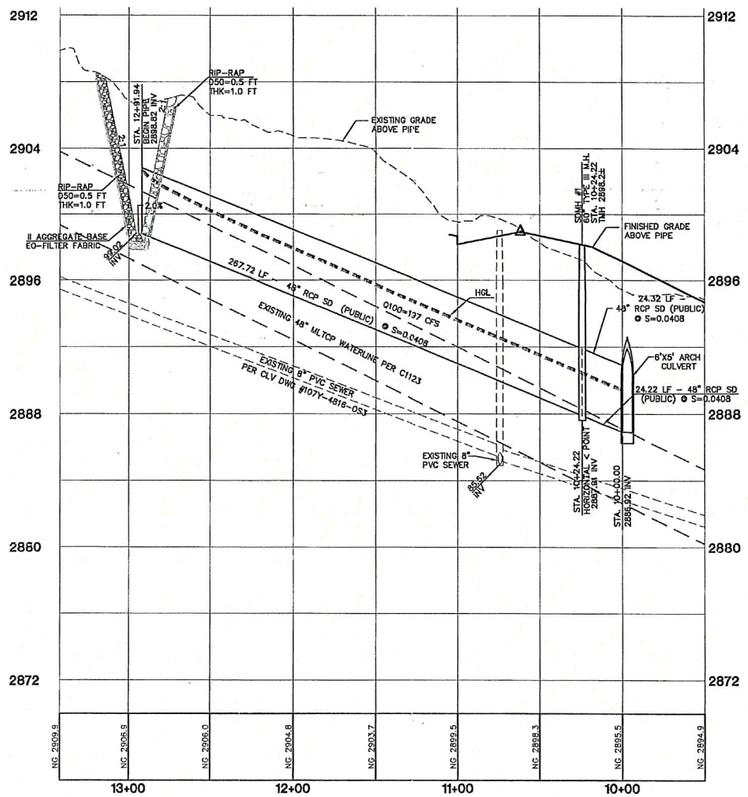
SHEET
SD2
7 OF 11 SHEETS
DRAWING NO.

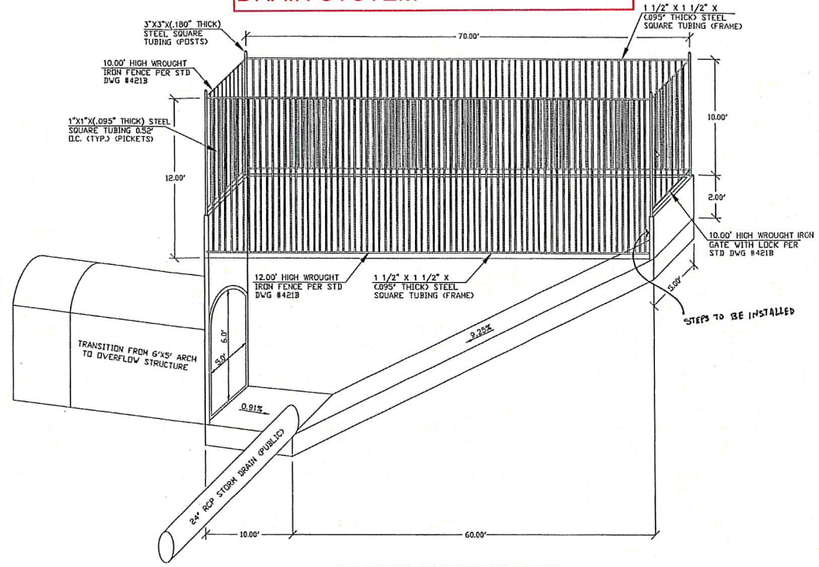
H:\5969\ELKHORN\STORM DRAIN\5969SD-ELKHORN.DWG

REFERENCE MATERIAL FROM CLIFF'S EDGE ELKHORN STORM DRAIN SYSTEM

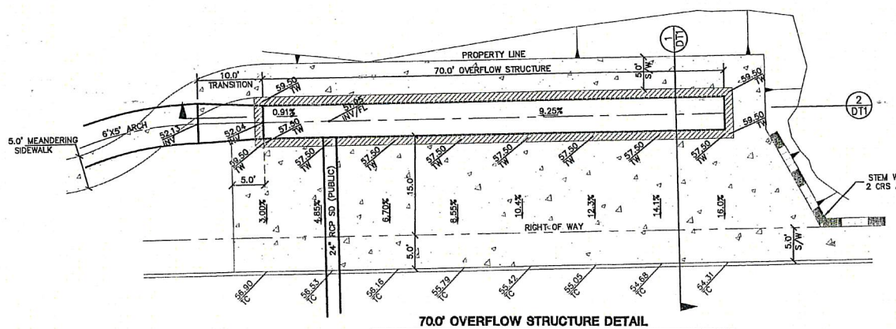


ELKHORN ROAD

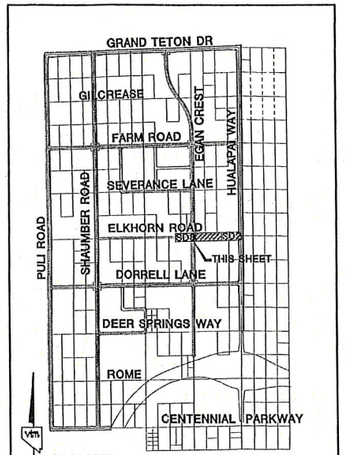


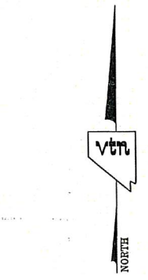


70.0' OVERFLOW STRUCTURE DETAIL
N.T.S.



70.0' OVERFLOW STRUCTURE DETAIL
SCALE: 1"=10'





GRAPHIC SCALE
40 0 20 40 80
1" = 40'

CONTRACTOR NOTE:
CONTRACTOR SHALL VERIFY HORIZONTAL AND VERTICAL LOCATION OF EXISTING UTILITIES AND NOTIFY THE DESIGN ENGINEER IMMEDIATELY OF ANY DISCREPANCIES PRIOR TO CONSTRUCTION.

NOTE :
STRUCTURAL CALCULATIONS FOR ALL NON-STANDARD DRAINAGE FACILITIES, SUCH AS JUNCTION BOXES AND OVERFLOW STRUCTURES, WILL BE PROVIDED WITH THE STRUCTURAL CALCULATIONS FOR THE RCA STORM DRAINS.

NOTE :
ADJUST SEWER MANHOLES TO DESIGN GRADE.

BASIS OF BEARINGS
THE BASIS OF BEARINGS FOR THIS PROJECT IS NORTH 00°08'16" EAST BEING THE EAST LINE OF THE NORTHWEST QUARTER (NE 1/4)' OF THE SECTION 24, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M., CLARK COUNTY, NEVADA, AS SHOWN ON A RECORD OF SURVEY ON FILE IN THE CLARK COUNTY, NEVADA, RECORDER'S OFFICE IN FILE 123 AT PAGE 32.

PROJECT BENCHMARK
PROJECT DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

CLARK COUNTY VERTICAL CONTROL: 1C00:6N8
NAVD88 ELEVATION: 787.794 METERS (2584.62 FEET)

RIVET AND SQUARE ALUMINUM PLATE IN A CONCRETE CYLINDER, LOCATED 25' SOUTH & 50' EAST OF GRAND CANYON DRIVE AND RED COACH AVENUE, 1' WEST OF ELECTRICAL VAULT.

CITY OF LAS VEGAS BENCHMARK
DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

CITY OF LAS VEGAS BENCHMARK: BLV99:13SES
NAVD88 ELEVATION: 869.606 METERS (2853.03 FEET)

RIVET AND PLATE IN CONCRETE CYLINDER NW CORNER OF HUALAPAI AND ELKHORN

NOTE: ADD 0.34' TO ABOVE CITY OF LAS VEGAS BENCHMARK BLV99:13SES TO MATCH ORIGINAL PROJECT BENCHMARK. CLARK COUNTY BENCHMARK 1C00-6N8 (2584.62 FEET) AS SHOWN ON RECORD OF SURVEY FILE 124 PAGE 94.



Avoid cutting underground utility lines. It's costly.
Call before you Dig
1-800-227-2600

Avoid overhead power line contact. It's costly.
Call before you Overhead
1-702-227-2929

This grading plan is a part of drainage study # 3576 which was received on 2/4/05 and C.A. on 3/24/05. Page 8 Of 8,

"I CERTIFY THAT THIS PLAN IS IN CONFORMANCE WITH THE APPROVED DRAINAGE STUDY (#DS3576) ON FILE AT THE CITY OF LAS VEGAS FOR THIS PROJECT."

DANIEL J. HOOD NO. 12811 DATE

REVISION	DATE	BY
1		
2		
3		
4		
5		
6		
7		

CLIFFS EDGE LLC
3455 CLIFF SHADOWS PARKWAY, SUITE 280
LAS VEGAS, NEVADA 89129
(702) 777-1221

CITY OF LAS VEGAS, NEVADA

2727 SOUTH RAINBOW BOULEVARD LAS VEGAS, NEVADA 89146-5148
PH. (702) 870-7555 FAX (702) 362-2597
nevada CONSULTING ENGINEERS ● PLANNERS ● LAND SURVEYORS

STORM DRAIN PLAN & PROFILE STA 10+00.00 TO STA. 12+91.94

CLIFFS EDGE / PROVIDENCE ELKHORN ROAD STREET IMPROVEMENTS

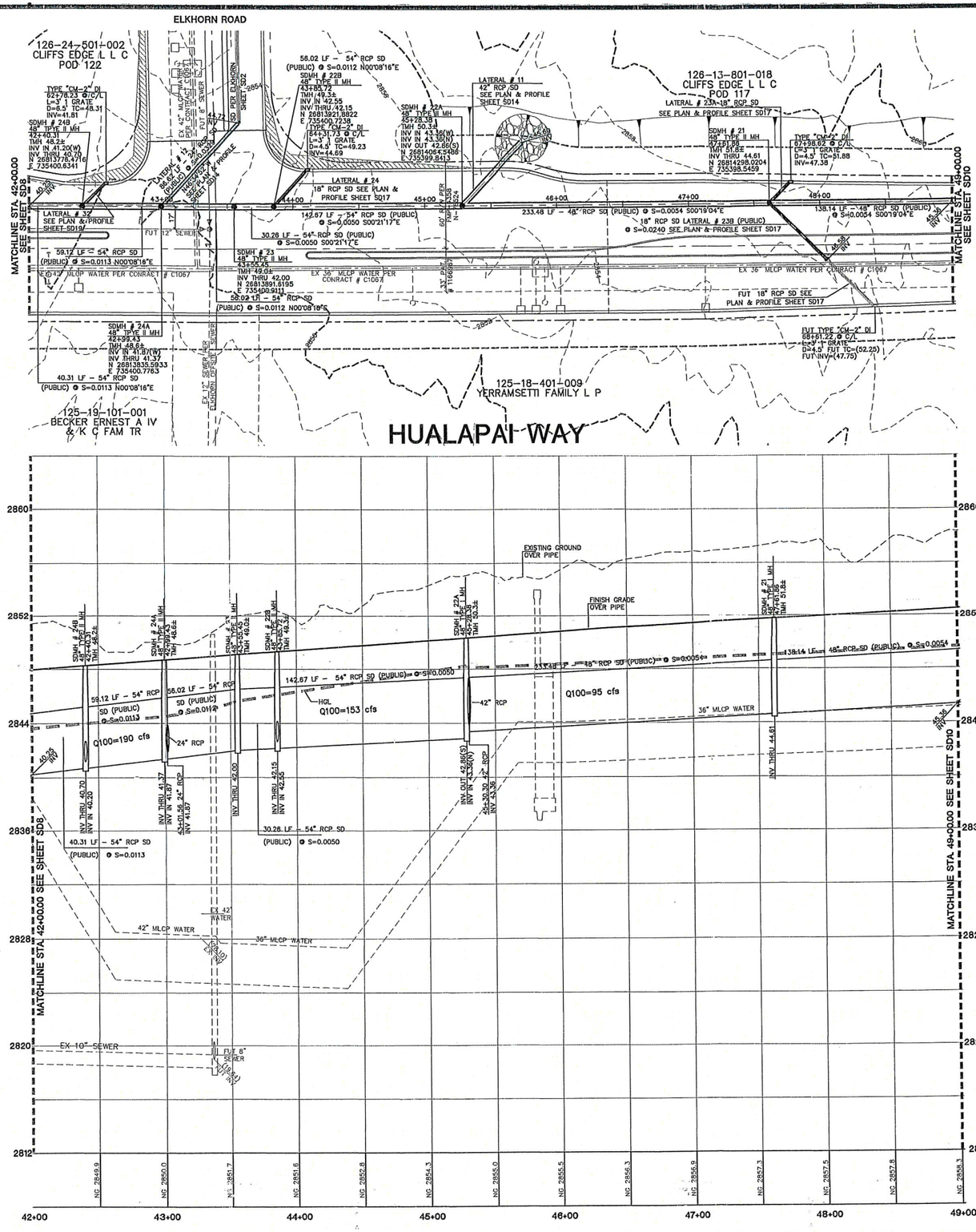
DRAWN BY: SJ/AG — APR.,04'
DESIGNED BY: NH — APR.,04'
CHECKED BY: LM — APR.,04'
PROJECT NO: 2969
SCALE: 1"=40' HORIZ. 1"=4' VERT.

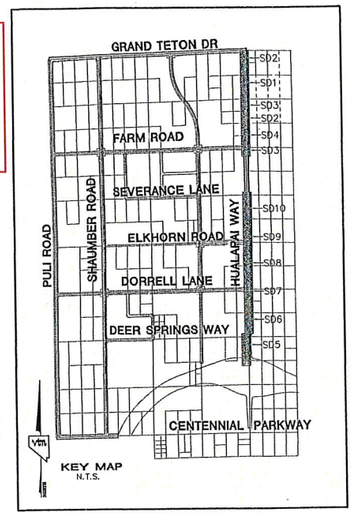
EXPIRES 06-30-05
PROFESSIONAL ENGINEER STATE OF NEVADA DANIEL J. HOOD No. 12811

SHEET SD3
8 OF 11 SHEETS
DRAWING NO.

H:\2969\ELKHORN\STORM DRAIN\2969SD-ELKHORN.DWG

REFERENCE MATERIAL FROM CLIFF'S EDGE IMPROVEMENT PLANS (HUALAPAI WAY STORM DRAIN)





NORTH

GRAPHIC SCALE

40 0 20 40 80

1" = 40'

CONTRACTOR NOTE:

CONTRACTOR SHALL VERIFY HORIZONTAL AND VERTICAL LOCATION OF EXISTING UTILITIES AND NOTIFY THE DESIGN ENGINEER IMMEDIATELY OF ANY DISCREPANCIES PRIOR TO CONSTRUCTION.

NOTE :

STRUCTURAL CALCULATIONS FOR ALL NON-STANDARD DRAINAGE FACILITIES; SUCH AS JUNCTION BOXES AND OVERFLOW STRUCTURES, WILL BE PROVIDED WITH THE STRUCTURAL CALCULATIONS FOR THE RCA STORM DRAINS.

Call before you Underground 1-702-455-7511 CLARK COUNTY TRAFFIC OPERATIONS AND 1-702-229-6611 LAS VEGAS AREA COMPUTERIZED TRAFFIC SYSTEM

Call before you Dig 1-800-227-2600

Call before you Overhead 1-702-227-2929

BASIS OF BEARINGS

THE BASIS OF BEARINGS FOR THIS PROJECT IS NORTH 00°08'16" EAST BEING THE EAST LINE OF THE NORTHWEST QUARTER (NE 1/4)' OF THE SECTION 24, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M., CLARK COUNTY, NEVADA, AS SHOWN ON A RECORD OF SURVEY ON FILE IN THE CLARK COUNTY, NEVADA, RECORDER'S OFFICE IN FILE 123 AT PAGE 32.

PROJECT BENCHMARK

PROJECT DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

CLARK COUNTY VERTICAL CONTROL: 1C00:6N6
NAVD88 ELEVATION: 787.794 METERS (2584.62 FEET)

RIVET AND SQUARE ALUMINUM PLATE IN A CONCRETE CYLINDER, LOCATED 25' SOUTH & 50' EAST OF GRAND CANYON DRIVE AND RED COACH AVENUE, 1' WEST OF ELECTRICAL VAULT.

CITY OF LAS VEGAS BENCHMARK

DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

CITY OF LAS VEGAS BENCHMARK: BLV99:135ES
NAVD88 ELEVATION: 869.606 METERS (2853.03 FEET)

RIVET AND PLATE IN CONCRETE CYLINDER NW CORNER OF HUALAPAI AND ELKHORN

NOTE: ADD 0.34' TO ABOVE CITY OF LAS VEGAS, BENCHMARK ELEVATIONS TO MATCH ORIGINAL PROJECT BENCHMARK, CLARK COUNTY BENCHMARK 1C00:6N6 (2584.62 FEET) AS SHOWN ON RECORD OF SURVEY FILE 123 PAGE 32.

This grading plan is part of drainage study ... was received on 1/8/04 and Rejected 1/21/04. Page 9 of

REVISION	DATE	BY
1		
2		
3		
4		
5		
6		
7		

CLIFFS EDGE LLC
3455 CLIFF SHADOWS PARKWAY, SUITE 290
LAS VEGAS, NEVADA 89129
(702) 777-1221

CITY OF LAS VEGAS, NEVADA

2727 SOUTH RAINBOW BOULEVARD LAS VEGAS, NEVADA 89146-5148
PH. (702) 873-7550 FAX (702) 362-2597

nevada CONSULTING ENGINEERS ● PLANNERS ● LAND SURVEYORS

STORM DRAIN PLAN & PROFILE
HUALAPAI WAY
STA 42+00.00 TO 49+00.00

CLIFFS EDGE / PROVIDENCE
HUALAPAI WAY
DEER SPRINGS TO GRAND TETON

DRAWN BY:	MAR. '04'
RSM	
DESIGNED BY:	MAR. '04'
NJHALL	
CHECKED BY:	MAR. '04'
LM	
PROJECT NO:	SCALE: 1"=40' HORIZ. 1"=4' VERT.
5969	

EXPIRES 06-30-05

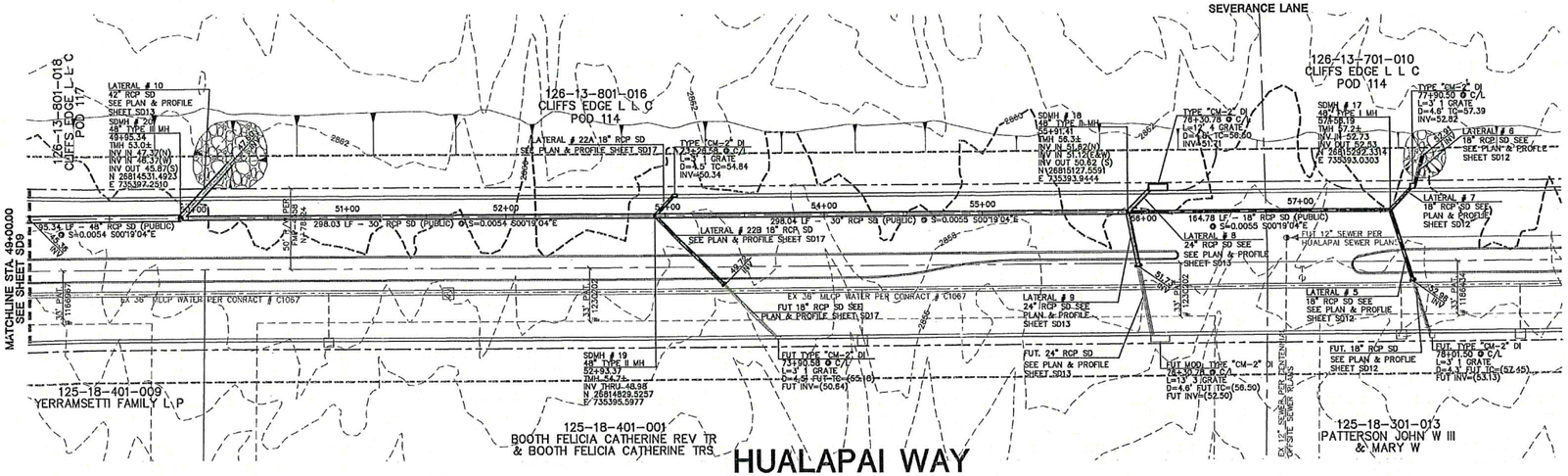
PROFESSIONAL ENGINEER STATE OF NEVADA DANIEL J. HOOD No. 12811 CIVIL

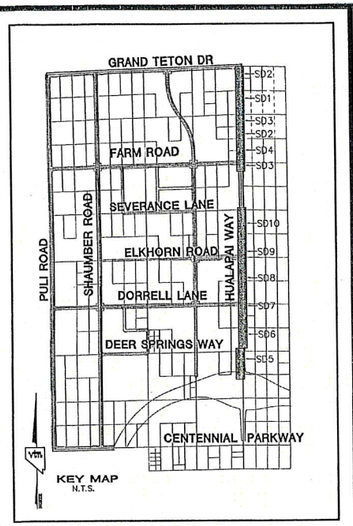
SHEET SD9
21 OF 33 SHEETS
DRAWING NO. 19
HTE #

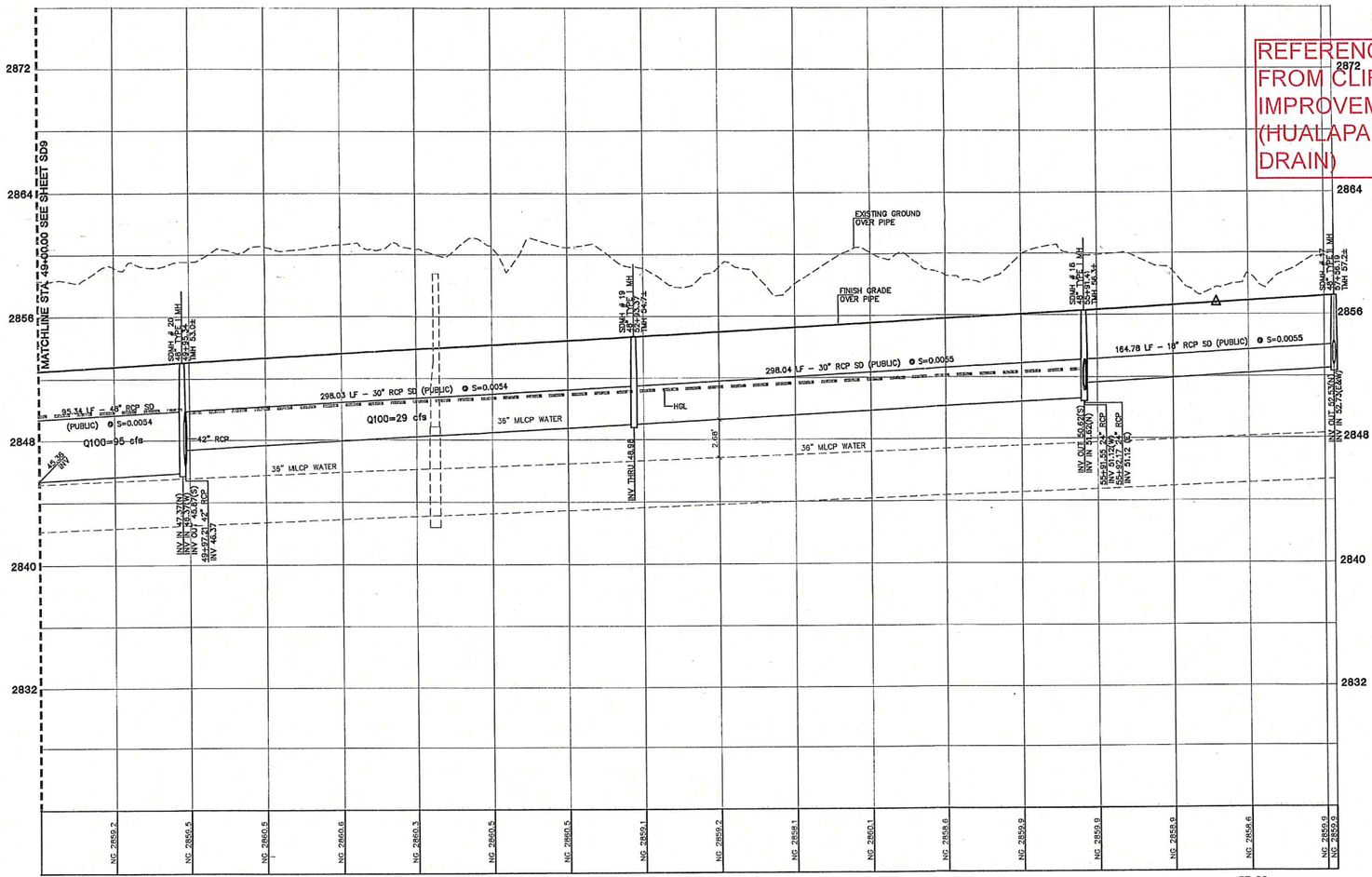
H:\5969\HUALAPAI\5969ST-HUALAPAI

APPENDIX C.3
HUALAPAI WAY
LOCAL STORM DRAIN
FACILITY RECORD DRAWINGS

MWH now part of Stantec







REFERENCE MATERIAL FROM CLIFF'S EDGE IMPROVEMENT PLANS (HUALAPAI WAY STORM DRAIN)

NORTH

GRAPHIC SCALE

40 0 20 40 80

1" = 40'

CONTRACTOR NOTE:

CONTRACTOR SHALL VERIFY HORIZONTAL AND VERTICAL LOCATION OF EXISTING UTILITIES AND NOTIFY THE DESIGN ENGINEER IMMEDIATELY OF ANY DISCREPANCIES PRIOR TO CONSTRUCTION.

NOTE :

STRUCTURAL CALCULATIONS FOR ALL NON-STANDARD DRAINAGE FACILITIES, SUCH AS JUNCTION BOXES AND OVERFLOW STRUCTURES, WILL BE PROVIDED WITH THE STRUCTURAL CALCULATIONS FOR THE RCA STORM DRAINS.

Call before you Underground 1-702-455-7511 CLARK COUNTY TRAFFIC OPERATIONS AND 1-702-229-6611 LAS VEGAS AREA COMPUTERIZED TRAFFIC SYSTEM

Avoid cutting underground utility lines. It's costly. Call before you Dig 1-800-227-2600

Avoid overhead power line contact. It's costly. Call before you Overhead 1-702-227-2929

BASIS OF BEARINGS

THE BASIS OF BEARINGS FOR THIS PROJECT IS NORTH 00°08'16" EAST BEING THE EAST LINE OF THE NORTHWEST QUARTER (NE 1/4)' OF THE SECTION 24, TOWNSHIP 19 SOUTH, RANGE 59 EAST, M.D.M., CLARK COUNTY, NEVADA, AS SHOWN ON A RECORD OF SURVEY ON FILE IN THE CLARK COUNTY, NEVADA, RECORDER'S OFFICE IN FILE 123 AT PAGE 32.

PROJECT BENCHMARK

PROJECT DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

CLARK COUNTY VERTICAL CONTROL: 1C00:6N6
NAVD88 ELEVATION: 787.794 METERS (2584.62 FEET)

RIVET AND SQUARE ALUMINUM PLATE IN A CONCRETE CYLINDER, LOCATED 29' SOUTH & 50' EAST OF GRAND CANYON DRIVE AND RED COACH AVENUE, 1' WEST OF ELECTRICAL VAULT.

CITY OF LAS VEGAS BENCHMARK

DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

CITY OF LAS VEGAS BENCHMARK: BLV99:13SES
NAVD88 ELEVATION: 869.608 METERS (2853.03 FEET)

RIVET AND PLATE IN CONCRETE CYLINDER NW OF SAHARA AND EL DORADO

NOTE: ADD 0.34' TO ABOVE CITY OF LAS VEGAS BENCHMARK BLV99:13SES TO MATCH ORIGINAL PROJECT BENCHMARK, CLARK COUNTY BENCHMARK 1C00-6N6 (2584.62 FEET) AS SHOWN ON RECORD OF SURVEY FILE 123 PAGE 32.

This grading plan is part of drainage study # 851 which was received on 7/8/04 and Rejected on 7/20/04 Page 16 of

REV	DATE	BY	REVISION
1			
2			
3			
4			
5			
6			
7			

CLIFFS EDGE LLC
3455 CLIFF SHADOWS PARKWAY, SUITE 290
LAS VEGAS, NEVADA 89129
(702) 777-1221

CITY OF LAS VEGAS, NEVADA

2727 SOUTH RAINBOW BOULEVARD LAS VEGAS, NEVADA 89146-5146
PH. (702) 873-7550 FAX (702) 362-2597
nevada CONSULTING ENGINEERS ● PLANNERS ● LAND SURVEYORS

STORM DRAIN PLAN & PROFILE
HUALAPAI WAY
STA. 49+00.00 TO 57+56.19

CLIFFS EDGE / PROVIDENCE
HUALAPAI WAY
DEER SPRINGS TO GRAND TETON

DRAWN BY: RDM — MAR. '04
DESIGNED BY: N. HALL — MAR. '04
CHECKED BY: J.L. — MAR. '04
PROJECT NO: 2569
SCALE: HORIZ. 1"=40' VERT. 1"=4'

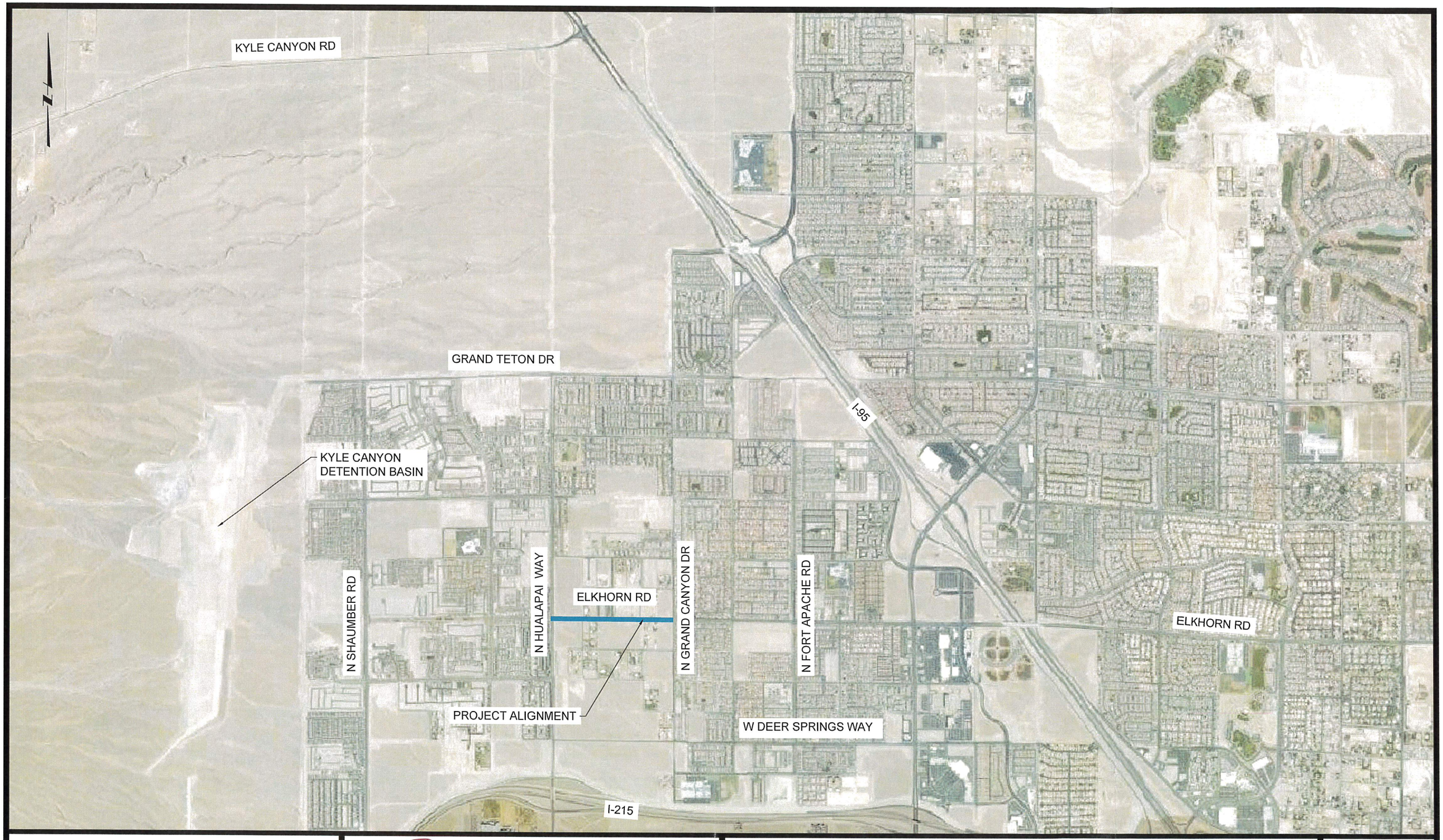
EXPIRES 06-30-05
PROFESSIONAL ENGINEER - STATE OF NEVADA - DANIEL J. HOOD - No. 12811 - CIVIL

SHEET SD10
22 OF 33 SHEETS
DRAWING NO. 14
HTE #

H:\2569\HUALAPAI\2569ST-HUALAPAI

Appendix D

APPENDIX D.1
DRAINAGE FIGURES



CITY OF Las Vegas

MWH now part of Stantec

RANCHO ROAD SYSTEM STORM DRAIN - ELKHORN

PROJECT LOCATION MAP

FIGURE

1

SCALE: 1" = 1000'

REGIONAL FLOOD CONTROL DISTRICT

2013*

LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE

FLOOD CONTROL FACILITIES

LEGEND

- Ultimate Development Boundary
- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Local Existing Facilities
- Local Proposed Facilities
- Detention Basin

- Stormdrain
- Lined Channel
- Unlined Channel
- Levee/Dike
- Natural Wash/Floodway
- ID-Mile Separator

Remove & Replace/Parallel Facilities

Category A	Category B
Channel	Channel
Stormdrain	Stormdrain

* KYLE CANYON/SKYE CANYON MPA NOT ADOPTED BY CITY OF LAS VEGAS. REFER TO 2008 MPU FOR THIS AREA.

N

0 500 1,000 2,000 3,000

Feet

Scale: 1 inch = 2,000 feet

Refer to Figure G-2 for Aerial Source(s)

US95 I-15 I-215

1	2	3			A1	A2	
4	5	6			A3	A4	
	7	8	9	10	A5	A6	
11	12	13	14	15	16	17	
	18	19	20	21	22	23	
	24	25	26	27	28		
	29	30	31	32	33	34	
	35	36	37	38	39	40	
	41	42	43	44	45	46	
	47	48	49	50	51	52	
	53	54	55	56			
	57	58	59				

PROJECT LOCATION

Figure 2

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
BCHU		BELTWAY CHANNEL - HUALAPAI						
0000	E	12' X 5' RCAP	853	501	CBA3-C	WEST3	0.84	1.11
0017	E	8' X 5' RCAP	1216	501	CBA3-C	WEST3	0.84	1.33
0040	E	66" RCP	60	222	DNW26-C	WEST3	0.51	1.04
0042	E	60" RCP	615	222	DNW26-C	WEST3	0.51	1.42
0054	E	54" RCP	770	222	DNW26-C	WEST3	0.51	1.23
BRDB		BRENT DRAINAGE SYSTEM						
0000	E	36" RCP with 18" Orifice Plate	2170	37	BRDB	WEST3	2.48	0.40
0031	E	45,080 cfs PMF Spillway		45080	CBRDB	WEST3	2.48	
0032	E	450 ac-ft South Environmental Enhancement Area		1902	CBRDB	WEST3	2.48	
0033	E	Energy Dissipator	100	957	CNW113-C	WEST3	1.58	
0043	P1	8' X 6' RCB	2920	957	CNW113-C	WEST3	1.58	2.10
0107	P1	8' X 6' RCB	2660	957	CNW113-C	WEST3	1.58	2.40
0157	P1	12' X 6' RCB	1260	741	CNW96-C	WEST3	0.95	0.25
CN95		CENTENNIAL PKWY CHANNEL WEST / U.S 95 BRANCH						
0000	P1	Conc Chnl 22'W 10'D 0:1 SS	2690	3340	CNWBB3-C	WEST3	3.36	2.17
0068	P1	3: 8' X 7' RCB	3380	3216	CNW103-C	WEST3	3.05	2.12
0102	P1	3: 8' X 6' RCB	1710	2888	2CNW89-C	WEST3	2.66	2.09
0167	P1	2: 10' X 6' RCB	1580	2160	2CNW71-E	WEST3	1.64	1.50
0199	E	2: 10' X 6' RCB	320	1423	2CNW72-C	WEST3	1.14	0.82
0218	E	15' X 9' RCB	1127	1423	2CNW72-C	WEST3	1.14	0.82
0257	E	Transition Structure	59	1423	2CNW72-C	WEST3	1.14	0.77
0259	E	15' X 9' RCB	290	653	CNW74-C	WEST3	0.44	0.77
0313	E	10' X 6' RCB	2680	653	CNW74-C	WEST3	0.44	2.50
0318	E	Transition Structure	60	653	CNW74-C	WEST3	0.44	1.50
0333	E	5' X 5' RCB	670	339	NW62-S	WEST3	0.22	1.50
CNGT		CENTENNIAL PKWY CHANNEL WEST / GRAND TETON BRANCH						
0000	E	10' X 5' RCB	2376	600	CNW71-E	WEST3	0.47	2.58
0043	P0	6' X 6' RCB	3980	600	CNW71-E	WEST3	0.47	3.00
0118	E	6' X 5' RCAP	5472	363	KYLEDET*	KYLEDB	57.73	3.72
CNKC		CENTENNIAL PKWY CHANNEL WEST / KYLE CANYON BRANCH						
0000	E	12' X 4' RCB	377	999	CNW72-C	WEST3	0.71	4.58
0007	E	10' X 5' RCB	874	999	CNW72-C	WEST3	0.71	3.28
0024	E	8' X 5' RCB	1385	999	CNW72-C	WEST3	0.71	2.40
0050	P0	84" RCP	2610	854	CNW72-C	WEST3	0.71	3.60
CNWE		CENTENNIAL PKWY CHANNEL WEST						
0150	E	Conc Chnl 40'W 9.5'D 0:1 SS	2279	4233	CNW3B3-C	WEST3	5.64	0.42
0173	E	3: 18' X 8' RCBC @ Torrey Pines	200	4233	CNW3B3-C	WEST3	5.64	0.42
0176	E	Conc Chnl 40'W 9'D 0:1 SS	150	4233	CNW3B3-C	WEST3	5.64	0.41
0189	E	Conc Chnl 36'W 10'D 0:1 SS	1200	4067	CNW2D4-C	WEST3	5.15	0.42
0200	E	Conc Chnl 36'W 9'D 0:1 SS	2470	4067	CNW2D4-C	WEST3	5.15	1.00
0226	E	2: 18' X 8.5' RCBC @ Rio Vista	100	4067	CNW2D4-C	WEST3	5.15	0.51
0241	E	Conc Chnl 36'W 9.5'D 0:1 SS	405	3951	CNW2D3-C	WEST3	4.65	0.51
0251	E	Conc Chnl 36'W 9'D 0:1 SS	575	3951	CNW2D3-C	WEST3	4.65	0.51
0271	E	Conc Chnl 32'W 10'D 0:1 SS	229	3951	CNW2D3-C	WEST3	4.65	0.51
0274	E	32' X 10' RCBC @ Tenaya	142	3951	CNW2D3-C	WEST3	4.65	0.51
0277	E	Conc Chnl 32'W 9'D 0:1 SS	579	3951	CNW2D3-C	WEST3	4.65	0.64
0287	E	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	3259	3593	CNW2B2-C	WEST3	3.84	1.79
0314	E	22' X 7' RCB	785	3593	CNW2B2-C	WEST3	3.84	1.79
0325	P1	32' X 10' RCB	2200	3593	CNW2B2-C	WEST3	3.84	1.75
EKBU		ELKHORN SPRINGS AND BUFFALO						
0000	E	60" RCP	1046	375	NW134-C	WEST3	0.46	1.00
EKDB		ELKHORN SPRINGS DETENTION BASIN						
0000	E	Grass Chnl 15'W 5.8'D 3.5:1 SS	2575	238	CNW150-C	WEST3	1.41	0.39
0025	E	4' X 3' RCB	160	120	ELKBASIN	WEST3	0.84	0.50
0026	E	48" RCP	1270	120	ELKBASIN	WEST3	0.84	1.23
0049	E	60" RCP	1095	120	ELKBASIN	WEST3	0.84	0.13
0070	E	48 ac-ft Elkhorn Springs Detention Basin		629	CNW133-C	WEST3	0.84	

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
EKHU		ELKHORN AND HUALAPAI						
0000	E	6' X 5' RCB Overflow Structure	48	638	CNW26-C	WEST3	0.51	0.91
0001	E	6' X 5' RCAP	72	638	CNW26-C	WEST3	0.51	0.91
0003	E	6' X 4' RCAP	980	638	CNW26-C	WEST3	0.51	3.61
0020	E	6' X 5' RCAP	150	638	CNW26-C	WEST3	0.51	3.61
0023	E	8' X 5' RCAP	1200	638	CNW26-C	WEST3	0.51	0.90
GOEC		GOWAN NORTH - EL CAPITAN BRANCH						
0176	P1	78" RCP	1320	363	CCPFR-C	ALLGOW3	0.46	1.15
GONO		GOWAN NORTH SYSTEM						
0511	P1	7' X 6' RCB	1320	546	CCPHW-C	ALLGOW3	0.60	1.14
LVMD		LAS VEGAS WASH - MIDDLE						
2490	E	2: 13' X 7' RCB	2555	2278	CNW168-C	CWEST3	4.69	0.40
2507	E	2: 13' X 9' RCB	2831	2278	CNW168-C	CWEST3	4.69	0.36
2525	E	24' X 8' RCB	1140	1913	CNW159-C	CWEST3	3.91	0.40
2550	E	24' X 8' RCB	1445	1664	CD161-C	CWEST3	3.41	0.40
2574	E	24' X 8' RCB	1430	1664	CD161-C	CWEST3	3.41	0.40
2599	E	Conc Chnl 24'W 7'D 2:1 SS	1577	1585	CNW162-C	CWEST3	3.08	0.50
2632	E	18' X 5' RCB	1580	968	CNW138-C	WEST3	1.16	0.46
2661	E	18' X 5' RCB	2640	968	CNW138-C	WEST3	1.16	0.46
2711	E	10' X 5' RCB	1320	968	CNW138-C	WEST3	1.16	1.54
2737	E	10' X 5' RCB	1320	818	CNW139-C	WEST3	0.93	2.22
2763	E	6' X 5' RCB	1320	818	CNW139-C	WEST3	0.93	1.79
2789	E	6' X 5' RCB	1470	818	CNW139-C	WEST3	0.93	2.17
MOHU		MOCCASIN - HUALAPAI BRANCH						
0000	P0	14' X 8' RCB	1920	761	2CNW45-N	LOWER3	2.10	0.50
0036	P0	10' X 8' RCB	2590	368	CNW45-N	LOWER3	1.15	0.50
0085	P0	72" RCP	790	368	CNW45-N	LOWER3	1.15	3.00
0100	P0	Natural Wash	850	65	DMODB1	LOWER3	0.81	3.00
0116	P0	60" RCPC	12	65	DMODB1	LOWER3	0.81	3.00
0118	P0	Natural Wash	3485	65	DMODB1	LOWER3	0.81	3.00
MOIR		MOCCASIN - IRON MOUNTAIN BRANCH						
0000	P0	66" RCP	2770	446	2CNW33-C	LOWER3	1.76	3.60
MOKC		MOCCASIN AND KYLE CANYON						
0000	P1	11' X 8' RCB	5450	2662	CNW35-C	LOWER3	2.69	3.40
MOSM		MOCCASIN AND SHEEP MOUNTAIN PARKWAY						
0000	P0	14' X 9' RCB	3370	3778	CNW64-C	LOWER3	5.32	2.40
0064	P0	14' X 8' RCB	880	3505	CNW50-C	LOWER3	4.99	3.00
0080	P0	14' X 8' RCB	710	3325	2CNW35-C	LOWER3	4.80	3.00
MSNV		MOUNTAIN SPA/VISTA RANCH						
0000	E	6: 12' X 5' RCBC @ Grand Teton	273	679	CNW163-C	CWEST3	1.67	0.40
0005	E	Grass Chnl 100'W 4.5'D 10:1 SS	6325	679	CNW163-C	CWEST3	1.67	0.40
0125	E	Grass Chnl 100'W 4.5'D 10:1 SS	1300	116	CNW147E	WEST3	1.54	0.40
RACO		RACEL STREET COLLECTOR						
0000	E	96" RCP Baffled Energy Dissipator	54	497	CNW111S	WEST3	0.55	4.20
0001	E	78" RCP	3245	497	CNW111S	WEST3	0.55	2.46
0064	E	78" RCP	2650	423	DNW111S	WEST3	0.44	2.09
RCBC		RANCHO ROAD SYSTEM - BELTWAY CHANNEL						
0000	E	6' X 5' RCB	1062	222	FADB	WEST3	1.60	1.04
0002	E	54" RCP Outlet with 41" Orifice	503	222	FADB	WEST3	1.60	2.38
0003	E	2,341 cfs PMF Spillway		2341	FADBIN	WEST3	1.60	
0004	E	76 ac-ft Fort Apache Detention Basin		1255	FADBIN	WEST3	1.60	
0007	E	Energy Dissipator	100	1255	FADBIN	WEST3	1.60	
0009	E	12' X 6' RCBC @ Fort Apache Detention Basin	133	1255	FADBIN	WEST3	1.60	1.79
0012	E	Conc Chnl 12'W 6'-7'D 0:1 SS	1937	1255	FADBIN	WEST3	1.60	3.15
0048	E	12' X 6' RCBC @ Grand Canyon	140	1040	CMNA1	WEST3	1.32	3.15
0051	E	Conc Chnl 12'W 6'-8'D 0:1 SS	2660	1040	CMNA1	WEST3	1.32	3.44
0096	E	1: 10' X 6' and 1: 6' X 6' RCBC @ Hualapai Way	190	1040	CMNA1	WEST3	1.32	1.93
0100	E	Conc Chnl 12'W 5.5'D 0:1 SS	2085	598	CDMNA1	WEST3	0.48	2.88
0140	E	Conc Chnl 10'W 5'D 0:1 SS	2155	598	CDMNA1	WEST3	0.48	1.65

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
RCHB		RANCHO ROAD SYSTEM - BELTWAY						
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	P1	20' X 6' RCB	950	2226	CNWBC6-C	WEST3	4.17	2.49
0101	P1	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	P1	Conc Chnl 16'-20'W 6'D 0:1 SS	350	2226	CNWBC6-C	WEST3	4.17	1.84
0130	P1	Conc Chnl 16'W 6'D 0:1 SS	1012	2226	CNWBC6-C	WEST3	4.17	2.67
0149	P1	Conc Chnl 16'W 6'-7'D 0:1 SS	87	1888	CNWBC3	WEST3	3.75	2.27
0151	P1	Conc Chnl 16'W 7'D 0:1 SS	1255	1888	CNWBC3	WEST3	3.75	2.65
0171	E	16' X 6' RCBC @ El Capitan Way	234	1888	CNWBC3	WEST3	3.75	1.75
0175	E	Conc Chnl 14'W 7'D 0:1 SS	1220	1888	CNWBC3	WEST3	3.75	2.93
0198	E	Conc Chnl 14'W 7'D 0:1 SS	225	1402	CNWBA6-C	WEST3	3.61	2.93
0227	E	12' X 6' RCB	1885	1402	CNWBA6-C	WEST3	3.61	1.02
0250	E	12' X 6' RCB	3200	1402	CNWBA6-C	WEST3	3.61	1.00
0275	P1	7' X 6' RCB	2650	973	CNW66-C	WEST3	1.75	3.30
0295	P1	7' X 6' RCB	2875	973	CNW66-C	WEST3	1.75	3.30
TSDB		TULE SPRINGS DRAINAGE SYSTEM						
0000	E	2: 10' X 4' RCBC @ Echo Grande	100	26	TULEDB	WEST3	1.35	1.04
0002	E	36" RCP with 22" Orifice Plate	320	26	TULEDB	WEST3	1.35	0.33
0010	E	14,013 cfs PMF Spillway		14013	CTULEDB	WEST3	1.35	
0011	E	117 ac-ft North Environmental Enhancement Area		804	CTULEDB	WEST3	1.35	
0012	E	Energy Dissipator	260	376	CNW148-C	WEST3	0.52	
0023	P1	84" RCP	1320	376	CNW148-C	WEST3	0.52	0.80
0059	P1	78" RCP	2640	376	CNW148-C	WEST3	0.52	1.03

* KYLE CANYON/SKYE CANYON MPA NOT ADOPTED BY CITY OF LAS VEGAS. REFER TO 2008 MPU FOR THIS AREA.

** 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).

REGIONAL FLOOD CONTROL DISTRICT

2013 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE

FACILITY INVENTORY

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
Contingency Level
Category B..... P0
Master Plan..... P1
Preliminary Design..... P2
Design..... P3

Bottom Width..... W
Depth..... D
Side Slope, H:V..... SS

Construction Features

Cast in Place Concrete Pipe..... CIPCP
Corrugated Metal Arch Pipe Culvert..... CMAP
Corrugated Metal Pipe Culvert..... CMPC
High Density Polyethylene..... HDPE
Horizontal Elliptical Reinforced Concrete Pipe..... HERCP
Reinforced Concrete Arch Pipe..... RCAP
Reinforced Concrete Arch Culvert..... RCAC
Reinforced Concrete Box..... RCB
Reinforced Concrete Box Culvert..... RCBC
Reinforced Concrete Pipe..... RCP
Reinforced Concrete Pipe Culvert..... RCPC
Storm Sewer Pipe..... SSP

Figure 3

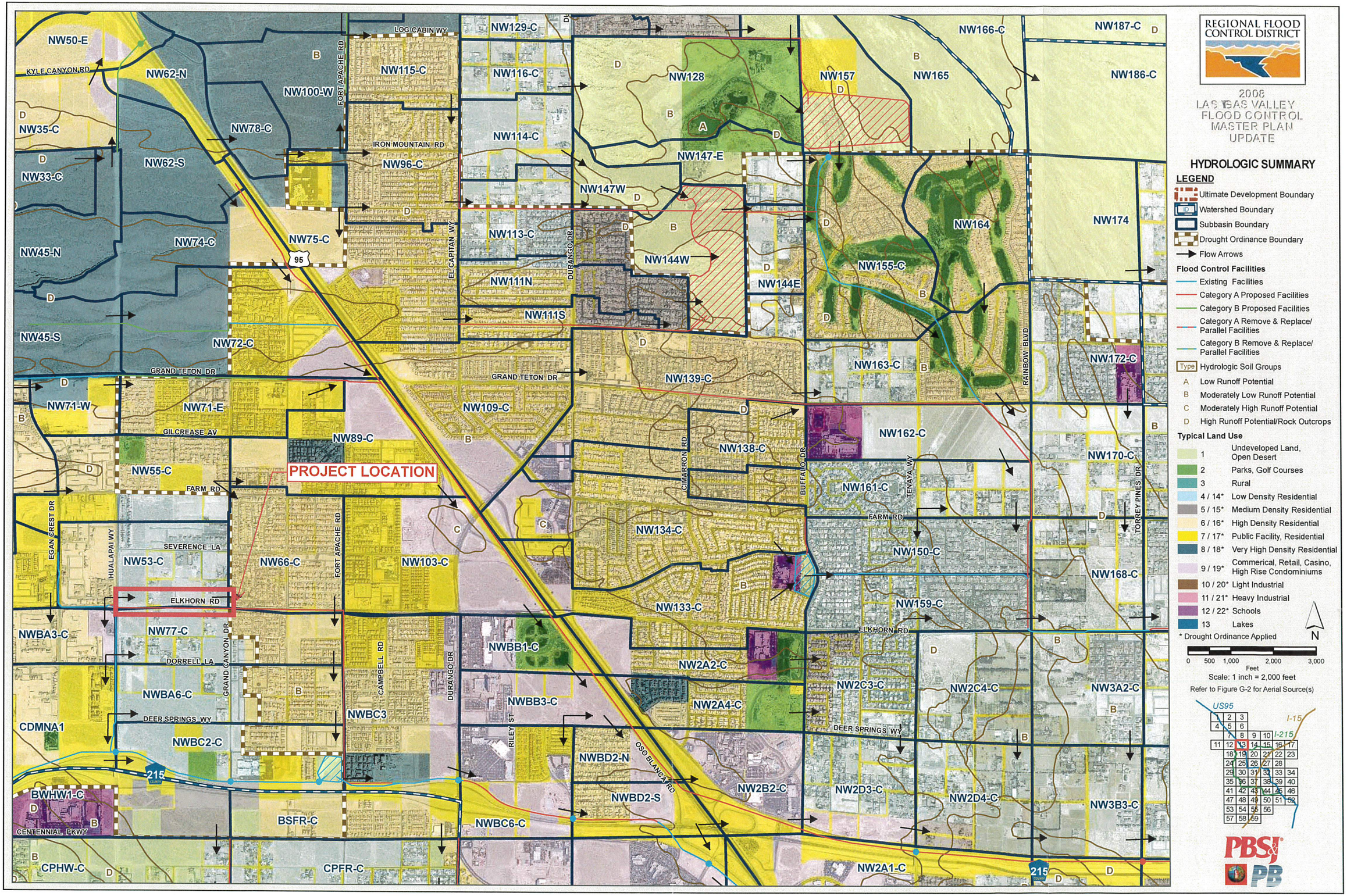

REGIONAL FLOOD CONTROL DISTRICT
2008 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE
HYDROLOGIC SUMMARY
LEGEND
Ultimate Development Boundary
Watershed Boundary
Subbasin Boundary
Drought Ordinance Boundary
Flow Arrows
Flood Control Facilities
Existing Facilities
Category A Proposed Facilities
Category B Proposed Facilities
Category A Remove & Replace/ Parallel Facilities
Category B Remove & Replace/ Parallel Facilities
Type Hydrologic Soil Groups
A Low Runoff Potential
B Moderately Low Runoff Potential
C Moderately High Runoff Potential
D High Runoff Potential/Rock Outcrops
Typical Land Use
1 Undeveloped Land, Open Desert
2 Parks, Golf Courses
3 Rural
4 / 14* Low Density Residential
5 / 15* Medium Density Residential
6 / 16* High Density Residential
7 / 17* Public Facility, Residential
8 / 18* Very High Density Residential
9 / 19* Commerical, Retail, Casino, High Rise Condominiums
10 / 20* Light Industrial
11 / 21* Heavy Industrial
12 / 22* Schools
13 Lakes
* Drought Ordinance Applied
N
0 500 1,000 2,000 3,000
Feet
Scale: 1 inch = 2,000 feet
Refer to Figure G-2 for Aerial Source(s)
US95
I-15
I-215
PROJECT LOCATION
NW50-E
NW62-N
NW100-W
NW35-C
NW78-C
NW62-S
NW33-C
NW74-C
NW75-C
NW45-N
NW45-S
NW72-C
NW71-W
NW71-E
NW89-C
NW55-C
NW53-C
NW66-C
NW103-C
NW77-C
NWBA3-C
NWBA6-C
CDMNA1
NWBC2-C
NWBC3
BWHW1-C
BSFR-C
CPHW-C
CPFR-C
NWBC6-C
NW115-C
NW96-C
NW116-C
NW114-C
NW129-C
NW128
NW147-E
NW147W
NW113-C
NW111N
NW111S
NW144W
NW144E
NW139-C
NW109-C
NW138-C
NW134-C
NW133-C
NWBB1-C
NWBB3-C
NWBD2-N
NWBD2-S
NW2A2-C
NW2A4-C
NW2B2-C
NW2A1-C
NW157
NW165
NW166-C
NW187-C
NW186-C
NW164
NW174
NW155-C
NW163-C
NW172-C
NW162-C
NW170-C
NW161-C
NW150-C
NW168-C
NW159-C
NW2C3-C
NW2C4-C
NW3A2-C
NW2D3-C
NW2D4-C
NW3B3-C
LOG CABIN WY
FORT APACHE RD
KYLE CANYON RD
IRON MOUNTAIN RD
EL CAPITAN WY
DURANGO DR
GRAND TETON DR
GILCREASE AV
FARM RD
SEVERENCE LA
ELKHORN RD
DORRELL LA
DEER SPRINGS WY
CENTENNIAL PKWY
EGAN CREST DR
HUALAPAI WY
GRAND CANYON DR
CAMPBELL RD
RILEY ST
OSO BLANCA RD
CIMARRON RD
BUFFALO DR
TENAYA WY
RAINBOW BLVD
TORREY PINES DR
95
215

Figure 4

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 (BFEs)** 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 or contact the National Geodetic Survey at the following address:

Vertical Network Branch, N/CG13
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 **benchmarks** 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.

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 1999 or newer, and GBF/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 de 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/msc

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.

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/ceit/gisms/gismo.htm

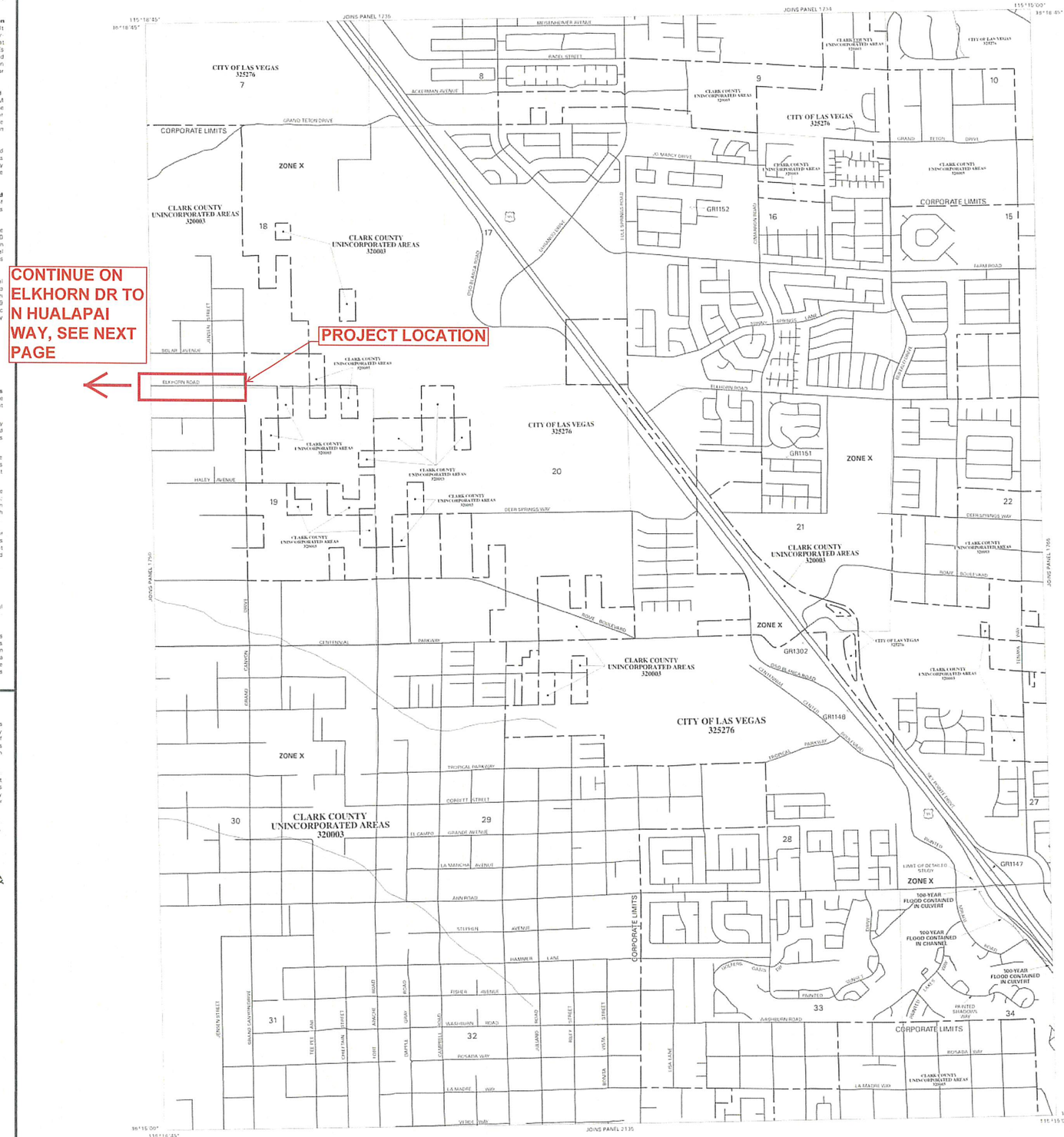


Figure 5

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 decertified. 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 1 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.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

- (A)—(A) Cross Section Line
- (23)—(23) Transect Line
- 97°07'30", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4276000mN — 1000-meter Universal Transverse Mercator grid values, zone 11
- 600000 FT — 5000-foot grid ticks
- DX5510 — 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 COUNTYWIDE 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 roads 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) 638-6620.

MAP SCALE 1" = 1000'
500 0 1000 2000 FEET
300 0 300 600 METERS

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1745 E

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

PANEL 1745 OF 4090

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
LAS VEGAS, CITY OF	325276	1745	E
CLARK COUNTY UNINCORPORATED AREAS	320003	1745	E

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

MAP NUMBER 32003C1745 E

MAP REVISED: SEPTEMBER 27, 2002

Federal Emergency Management Agency

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** (BFEs) 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 or contact the National Geodetic Survey at the following address:

Vertical Network Branch, N/CG13
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.

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 1999 or newer, and GBF/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 de-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/msc

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.

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/cert/gismo/gismo.htm



THIS AREA IS SHOWN ON MAP NUMBER 32003C1735

THIS AREA IS SHOWN ON MAP NUMBER 32003C1734

PROJECT LOCATION

CONTINUE ON ELKHORN DR TO N GRAND CANYON DR, SEE PREVIOUS PAGE

THIS AREA IS SHOWN ON MAP NUMBER 32003C1745

Figure 6

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 decertified. 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 1 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.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

- (A)—(A) Cross Section Line
- (23)—(23) Transect Line
- 97°07'30", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4276000M — 1000-meter Universal Transverse Mercator grid values, zone 11
- 600000 FT — 5000-foot grid ticks
- DX5510 — 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 COUNTYWIDE 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 roads 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) 638-6620.

MAP SCALE 1" = 2000'
1000 0 2000 4000 FEET
300 0 600 1200 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1750 E

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

PANEL 1750 OF 4090
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:

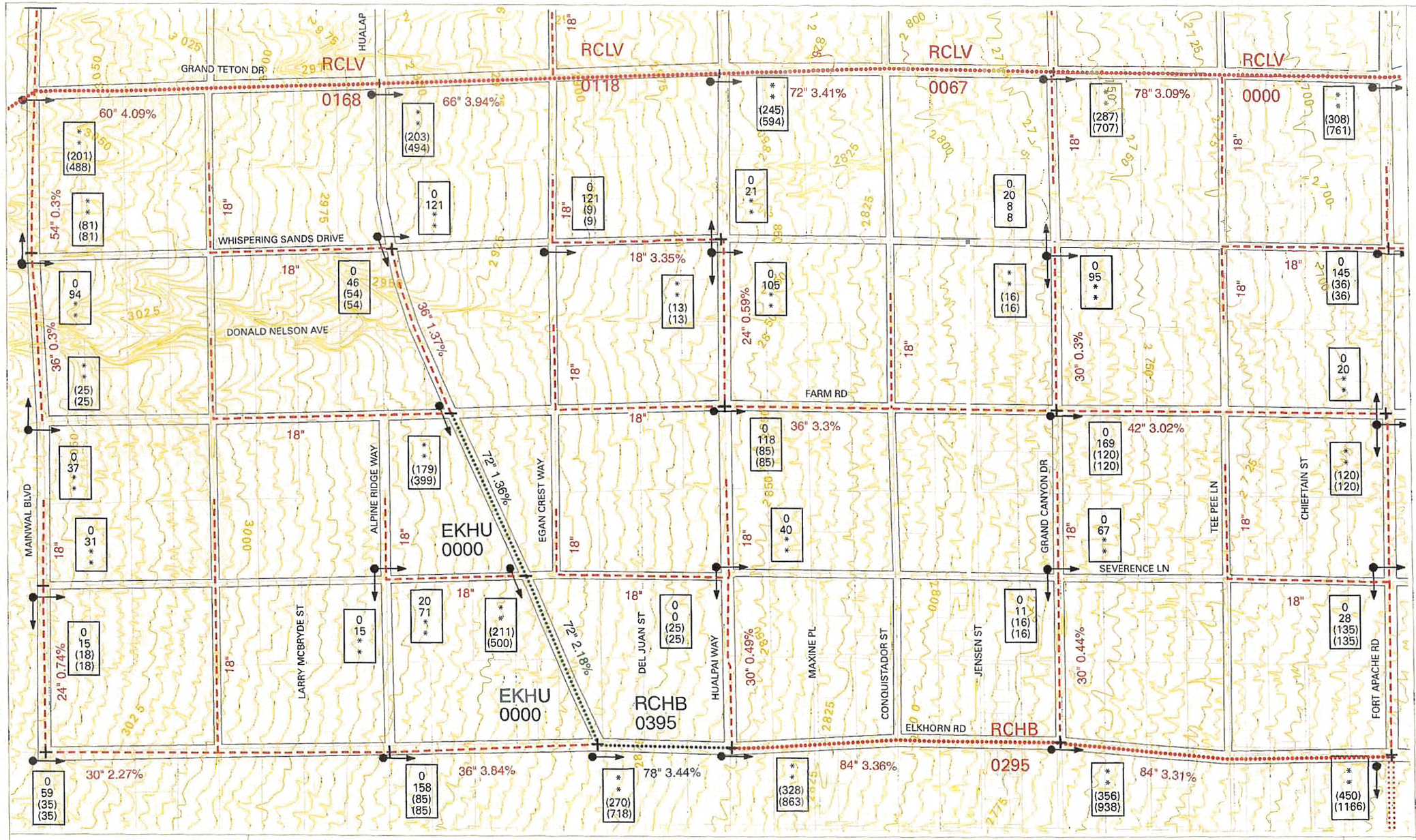
COMMUNITY	NUMBER	PANEL	SUFFIX
LAS VEGAS, CITY OF	320276	1750	E
CLARK COUNTY, UNINCORPORATED AREAS	320003	1750	E

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

MAP NUMBER 32003C1750 E

MAP REVISED: SEPTEMBER 27, 2002

Federal Emergency Management Agency



CITY OF LAS VEGAS NEVADA

NORTHWEST NEIGHBORHOOD STUDY PHASE 2

LEGEND

- EXISTING REGIONAL DETENTION BASINS
- PROPOSED REGIONAL DETENTION BASINS (Not included in 1996 MPU)
- EXISTING REGIONAL BRIDGES
- PROPOSED REGIONAL BRIDGES
- PROPOSED REGIONAL BRIDGES (Not included in 1996 MPU)
- EXISTING LOCAL BRIDGES
- PROPOSED REGIONAL CULVERT
- EXISTING REGIONAL CULVERT
- EXISTING LOCAL CULVERT
- EXISTING REGIONAL PIPELINE
- PROPOSED REGIONAL PIPELINE
- PROPOSED REGIONAL PIPELINE (Not included in 1996 MPU)
- EXISTING LOCAL P PELINE
- PROPOSED LOCAL PIPELINE
- EXISTING REGIONAL CHANNEL
- PROPOSED REGIONAL CHANNEL
- EXISTING LOCAL CHANNEL
- PROPOSED LOCAL CHANNEL
- PROPOSED REGIONAL CHANNEL (Not included in 1996 MPU)
- EXISTING REGIONAL DIKE/LEVEE
- PROPOSED REGIONAL DIKE/LEVEE
- PROPOSED REGIONAL DIKE/LEVEE (Not included in 1996 MPU)
- PROPOSED LOCAL DIKE/LEVEE

N W E S

0 200 0 400 800

(IN FEET)
CALE: 1 INCH = 800 FEET

FLOW ARROW

250 10-YEAR STREET FLOW
500 100-YEAR STREET FLOW
(300) 10-YEAR FACILITY FLOW
(800) 100-YEAR FACILITY FLOW

(FLOWS IN CFS)

NOTE:

Ultimate drainage conditions are based on future CN values with all flood control facilities in place.
Regional facility identifiers were established based on the methodology used in the "1996 Clark County Regional Flood Control Master Plan Update for the Las Vegas Valley."

NOTE:

All regional facilities proposed in the "1996 Clark County Regional Flood Control Master Plan Update for the Las Vegas Valley" have been resized based on the flows developed in this study. In addition, many of these facilities have been changed from channels to reinforced concrete box culverts.

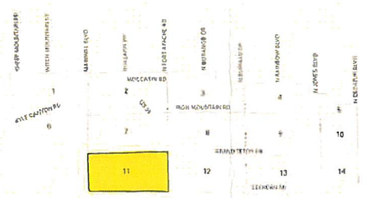


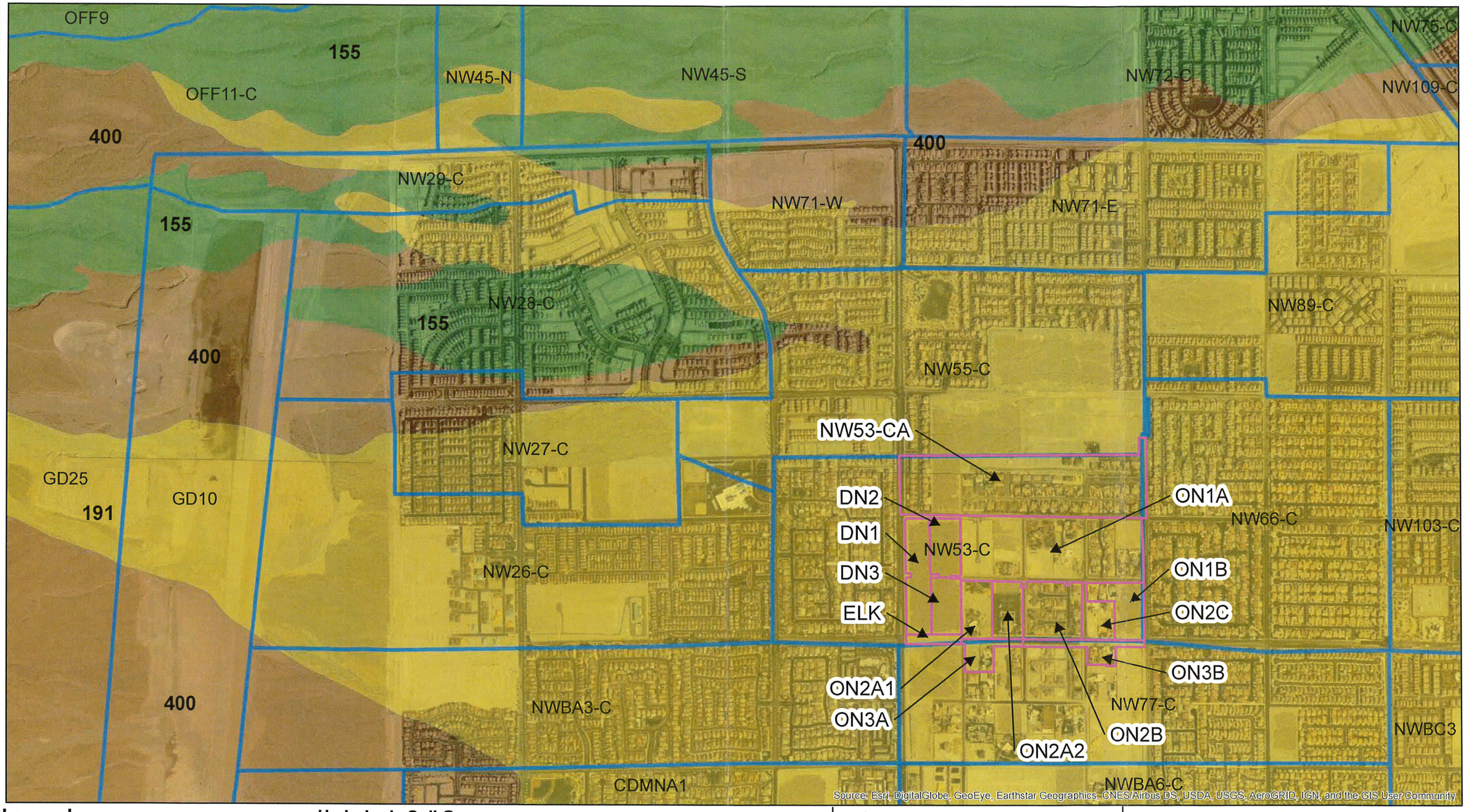
FIGURE F-11

FUTURE DRAINAGE CONDITIONS

PBSJ
901 North Green Valley Parkway, Suite 100
Henderson, Nevada 89014-6139
Phone: 702/263-7275
Fax: 702/263-7200
ENGINEERING PLANNING GIS SURVEYING CONSTRUCTION SERVICES

Figure 7

/F7/NW/F11.MAP



Legend

- LOCAL BASIN MAP
- REGIONAL BASIN BOUNDARIES

Hydrologic Soil Group

- 155
- 191
- 400

NORTH

0 500 1,000 2,000 Feet

Document: \\Uspas1netapp1\muni\Clients\Client Name\14 Electronic Files - Modeling\GIS\Projects\GIS Project Name.mxd

Date: 6/30/2017

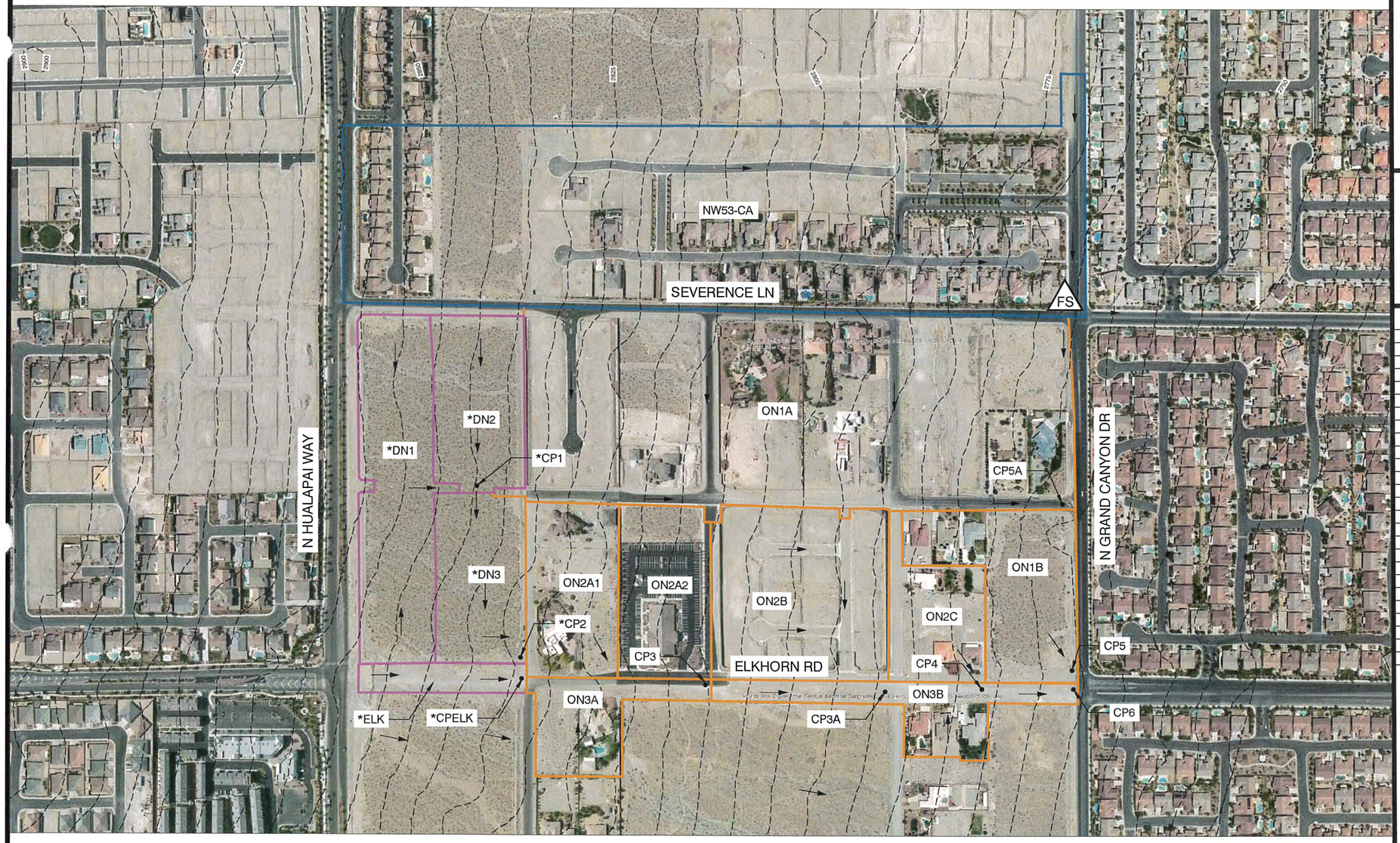
HYRDOLOGIC SOILS GROUP MAP

MWH now part of Stantec

Figure 8

City of Las Vegas

This map has been designed to print size 11'' by 17''.



LEGEND

- SUB-BASIN BOUNDARY
- REFERENCED BASINS - SEE NOTE 1
- REFERENCED BASINS - SEE NOTE 2
- FLOW COMBINATION POINT
- FLOW DIRECTION
- EXISTING DRAINAGE FACILITY
- PROPOSED DRAINAGE FACILITY
- FUTURE DRAINAGE FACILITY
- FLOW SPLIT

NORTH

GRAPHIC SCALE
200 0 100 200 400
(IN FEET)

CALL BEFORE CONSTRUCTION

BEFORE YOU DIG	USA NORTH	811 OR 800-227-2600
BEFORE YOU UNDERGROUND	F.A.S.T.	702-432-5300
	CLARK COUNTY TRAFFIC OPERATIONS	702-455-7511
	CITY OF LAS VEGAS T.E.F.O.	702-229-6611
BEFORE YOU OVERHEAD	NV ENERGY	702-227-2929

GENERAL NOTES

1. REFERENCED FROM TECHNICAL DRAINAGE STUDY FOR HUALAPAI AND SEVERENCE RESIDENTIAL DEVELOPMENT (ORIGINAL STUDY: DS4745A) CONDUCTED BY TRITON ENGINEERING IN 2015.
2. REFERENCED FROM RANCHO ROAD SYSTEM - ELKHORN (FORT APACHE TO GRAND CANYON) PROJECT SLATER HANIFAN GROUP HYDROLOGY REPORT IN 2013.

LOCAL HYDROLOGIC ANALYSIS

BASIN AND COMBINATION POINT FLOW SUMMARY TABLE

SUB BASIN	AREA (AC)	Q100 (CFS)	Q10 (CFS)
ON1A	32.12	11	1
ON1B	7.01	2	0
ON2A1	4.78	0	0
ON2A2	4.74	11	5
ON2B	9.06	4	0
ON2C	3.56	0	0
ON3A	3.14	2	0
ON3B	3.71	6	2
DN1[1]	7.78	20	8
DN2[1]	4.75	12	5
DN3[1]	4.5	11	5
ELK[1]	1.39	6	3
NW53-CA[2]	38.4	56	16

COMBINATION POINT	AREA (AC)	Q100 (CFS)	Q10 (CFS)
CP1[1]		32	13
CP2[1]		43	18
CP3		17	7
CP3A		20	7
CP4		20	7
CP5		22	3
CP5A		19	3
CP6		87	29
CPELK[1]		6	3

NO.	DATE	REVISIONS

PREPARED BY
Stantec
3010 W. CHARLESTON BLVD. SUITE 100 LAS VEGAS, NV 89102

PREPARED FOR
CITY OF LAS VEGAS

BID# XX-XXXXX
DESIGNED BY: RV
DRAWN BY: TB
CHECKED BY: CP

H# 170149
DATE: JULY 2017
SUBMITTAL STAGE:
30% - PRELIMINARY

TITLE
RANCHO ROAD SYSTEM
STORM DRAIN - ELKHORN

SHEET
ULTIMATE CONDITION
LOCAL BASIN MAP

NOT FOR CONSTRUCTION

SHEET
FIG 9
1 OF 1
DRAWING NO.

C:\DIR\D0384973\BASINMAP_LOCAL.DWG
6/30/17



NORTH

GRAPHIC SCALE
20 0 10 20 40
(IN FEET)

CALL BEFORE CONSTRUCTION

BEFORE YOU DIG	USA NORTH	811 OR 800-227-2600
BEFORE YOU UNDERGROUND	F.A.S.T.	702-432-5300
	CLARK COUNTY TRAFFIC OPERATIONS	702-455-7511
	CITY OF LAS VEGAS T.E.F.O.	702-229-6611
BEFORE YOU OVERHEAD	NV ENERGY	702-227-2929

LEGEND

- SUBBASIN BOUNDARY
- ID — SUBBASIN ID
- PTI — CONCENTRATION POINT
- FLOW DIRECTION
- EXISTING DRAINAGE FACILITY
- PROPOSED DRAINAGE FACILITY
- FUTURE DRAINAGE FACILITY
- FLOW SPLIT

NO.	DATE	REVISIONS

PREPARED BY
Stantec
3010 W. CHARLESTON BLVD.
SUITE 100
LAS VEGAS, NV 89102

PREPARED FOR
CITY OF LAS VEGAS

H# 170149 | BID# XX-XXXXX
DATE: JULY 2017 | DESIGNED BY: RV
SUBMITTAL STAGE: **30% - PRELIMINARY** | DRAWN BY: TB | CHECKED BY: CP

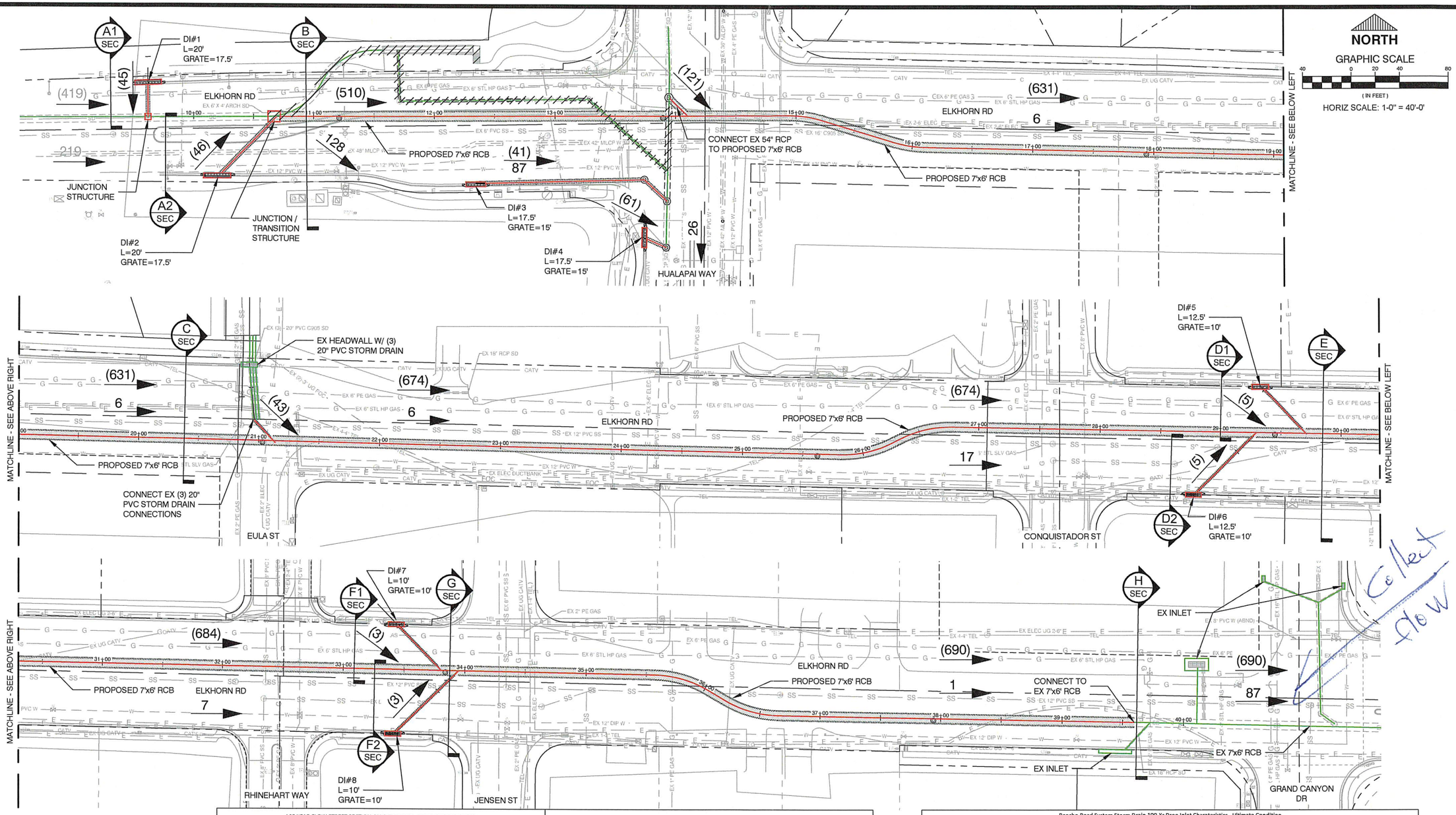
TITLE
RANCHO ROAD SYSTEM STORM DRAIN - ELKHORN

SHEET
ULTIMATE CONDITION REGIONAL BASIN MAP

NOT FOR CONSTRUCTION

SHEET
FIG. 10
1 OF 1
DRAWING NO.

C:\PROJECTS\RD0338497\3\BASINMAP_REGIONAL_V2.DWG
7/5/17



LEGEND

- (CFS) — 100-YR STORM DRAIN FLOW IN CFS
- CFS — 100-YR SURFACE FLOW IN CFS
- EXISTING DRAINAGE FACILITY
- PROPOSED DRAINAGE FACILITY
- A SEC — HYDRAULIC CROSS SECTION CALCULATION
- DEMOLISH AND REMOVE EXISTING DRAINAGE FACILITY

100 YEAR FLOW STREET SECTION CALCULATIONS - ULTIMATE CONDITION

SECTION LABEL	100-YR Q (CFS)	SLOPE (%)	FLOW DEPTH (ft)	VELOCITY (ft/s)	V x D	FLOW EXPLANATION
A1	109.5	3.33	0.55	9.48	5.21	EXISITING FLOW CONDITION
A2	109.5	2.86	0.84	10.23	8.59	EXISTING FLOW CONDITION
B	128	3.8	0.84	9.99	8.39	BYPASS DI#1 & DI#2
C	6	3.9	0.26	4.39	1.14	CONQUISTADOR ST ELKHORN ROAD INTERSECTION FLOW
D1	8.5	3.83	0.32	5.05	1.62	NORTH HALF STREET FLOW DI#5
D2	8.5	3.89	0.32	5.2	1.66	SOUTH HALF STREET FLOW DI#6
E	6.86	4.05	0.28	4.44	1.24	BYPASS DI#5 & DI#6
F1	3.48	2.67	0.28	3.89	1.09	NORTH HALF STREET FLOW DI#7
F2	3.38	2.37	0.28	3.72	1.04	SOUTH HALF STREET FLOW DI#8
G	1	3.28	0.19	2.79	0.53	BYPASS DI#7 & DI#8
H	87	3.45	0.58	7.98	4.63	CP6 BYPASS

10 YEAR FLOW STREET SECTION CALCULATIONS - ULTIMATE CONDITION

SECTION LABEL	10-YR Q (CFS)	SLOPE (%)	FLOW DEPTH (FT)	VELOCITY (ft/s)	V x D	FLOW EXPLANATION
A1	N/A	-	-	-	-	EXISITING FLOW CONDITION
A2	N/A	-	-	-	-	EXISTING FLOW CONDITION
B	N/A	-	-	-	-	BYPASS DI#1 & DI#2
C	3	3.9	0.22	3.78	0.83	CONQUISTADOR ST ELKHORN ROAD INTERSECTION FLOW
D1	3.5	3.83	0.26	4.1	1.07	NORTH HALF STREET FLOW DI#5
D2	3.5	3.89	0.26	4.21	1.09	SOUTH HALF STREET FLOW DI#6
E	1.71	4.05	0.20	3.35	0.67	BYPASS DI#5 & DI#6
F1	0.90	2.67	0.20	2.89	0.58	NORTH HALF STREET FLOW DI#7
F2	0.81	2.37	0.20	2.72	0.54	SOUTH HALF STREET FLOW DI#8
G	0	3.28	0.25	0.19	0.05	BYPASS DI#7 & DI#8
H	29	3.45	0.42	6.15	2.58	CP6 BYPASS

Rancho Road System Storm Drain 100-Yr Drop Inlet Charateristics - Ultimate Condition

DI#	Curb Opening Length (ft)	Grate Length (ft)	Incoming Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)	Pipe Size (in)	LOCATION	STREET FLOW EXPLANATION
1	20	17.5	109.50	44.85	64.65	30.00	Northeast of RRSSD Alignment	Half Street Flow from Existing Conditions on Elkhorn Rd
2	20	17.5	109.50	46.30	63.20	30.00	Southeast of RRSSD Alignment	Half Street Flow from Existing Conditions on Elkhorn Rd
3	17.5	15	127.85	41.11	86.74	30.00	Southeast Corner of Elkhorn Rd and Hualapai Way	Half Street Flow from Existing Conditions on Elkhorn Rd
4	17.5	15	86.74	61.90	24.84	30.00	Southeast Corner of Elkhorn Rd and Hualapai Way	Half Street Flow from Existing Conditions on Elkhorn Rd
5	12.5	10	8.50	5.02	3.48	18.00	Northwest Corner of Elkhorn & Conquistador	North Half Street Flow
6	12.5	10	8.50	5.12	3.38	18.00	Southwest Corner of Elkhorn & Conquistador	South Half Street Flow
7	10	10	3.48	2.87	0.61	18.00	Northeast Corner of Elkhorn & Jensen	North Half Street Flow
8	10	10	3.38	2.78	0.60	18.00	Southeast Corner of eElkhorn & Jensen	South Half Street Flow

Collect flow

NO.	DATE	REVISIONS

PREPARED BY
Stantec
3010 W. CHARLESTON BLVD. SUITE 100
LAS VEGAS, NV 89102

PREPARED FOR
CITY OF LAS VEGAS

BID# XX-XXXXX	
H# 170149	DESIGNED BY: RV
DATE: JULY 2017	DRAWN BY: TB
SUBMITTAL STAGE: 30% - PRELIMINARY	CHECKED BY: CP

TITLE
RANCHO ROAD SYSTEM
STORM DRAIN - ELKHORN

SHEET
PROPOSED STORM DRAIN FACILITIES

NOT FOR CONSTRUCTION

SHEET
FIG. 11
1 OF 1
DRAWING NO.

APPENDIX D.2
SOILS DATA

THIS PAGE WAS INTENTIONALLY LEFT BLANK

Reference Material - 2018 Las Vegas Valley Flood Control Master Plan Update by Atkins (January 9, 2017)

Appendix B

Soils Data

THIS PAGE WAS INTENTIONALLY LEFT BLANK

REFERENCE MATERIAL

MAP UNIT	HYDROLOGIC SOIL GROUP				
	%A	%B	%C	%D	%ROCK
100	6	0	0	59	35
105	55	40	0	5	0
107	0	100	0	0	0
112	100	0	0	0	0
113	100	0	0	0	0
117	100	0	0	0	0
120	100	0	0	0	0
127	100	0	0	0	0
129	100	0	0	0	0
130	65	0	25	10	0
132	100	0	0	0	0
133	70	0	10	0	20
134	100	0	0	0	0
135	84	0	0	16	0
140	0	0	100	0	0
141	8	0	2	70	20
150	0	0	0	100	0
151	41	0	0	59	0
152	0	0	0	100	0
155	0	0	0	100	0
156	1	10	0	89	0
160	0	0	100	0	0
160dn	46	1	0	53	0
165	32	40	15	13	0
181	100	0	0	0	0
182	95	0	5	0	0
183	100	0	0	0	0
184	100	0	0	0	0
187	100	0	0	0	0
190	100	0	0	0	0
191	100	0	0	0	0
192	55	35	0	10	0
200	0	0	100	0	0
206	0	0	100	0	0
207	3	85	5	7	0
222	0	0	100	0	0
225	9	20	50	21	0
230	54	0	0	46	0
235	66	25	0	9	0
236	0	0	100	0	0
237	0	0	100	0	0
240	0	0	0	100	0
252	0	100	0	0	0
255	0	100	0	0	0
260	100	0	0	0	0
262	75	0	0	25	0
263	95	0	0	5	0
264	100	0	0	0	0
270	0	0	100	0	0
278	0	0	100	0	0
282	0	0	100	0	0
300	0	0	0	100	0
301	0	0	0	100	0
302	35	20	0	45	0
305	5	0	35	60	0
307	10	0	30	60	0
313	8	68	0	24	0
314	80	5	0	15	0
320	0	2	0	83	15

Revised Soil Group # 191
Hydrologic Soil Group
Composition Breakdown

REFERENCE MATERIAL

3. Hydrologic Parameters

3.1. General

Data collection and a review of the previous MPU hydrologic analysis is underway to finalize input parameters and ensure the MPU analysis will be based on the best available, current information and data. Analysis for the 2018 MPU will be performed to update the previous MPU hydrologic models and determine 100-year peak flows and volumes in the study area based on the latest RFCD Hydrologic Criteria and Drainage Design Manual.

The sections below describe information and assumptions that have been compiled to date for the soils data, land use data, curve number calculations, and drought ordinance. These parameters will be finalized based on feedback on this report and incorporated into the 2018 MPU hydrologic analysis.

3.2. Soils

The consultant team collected the latest soil survey data, from the Natural Resources Conservation Service (NRCS). The soil data used in the 2018 MPU is a composite of the following soil survey data sources (refer to **Figure 3-1**):

Source 1: U.S. Department of Agriculture, NRCS, Soil Survey of Las Vegas Valley Area, Nevada, Part of Clark County, dated August 2014 (SSA Symbol: NV788)

Source 2: U.S. Department of Agriculture, NRCS, Soil Survey of Clark County Area, Nevada, dated August 2014 (SSA Symbol: NV755)

Source 3: U.S. Department of Agriculture, NRCS, Soil Survey of Desert National Wildlife Refuge Area, Nevada, South Part, dated August 2014 (SSA Symbol: NV757)

Source 4: U.S. Department of Agriculture, NRCS, Soil Survey of Virgin River Area, Nevada and Arizona, Nevada, dated August 2014 (SSA Symbol: NV608)

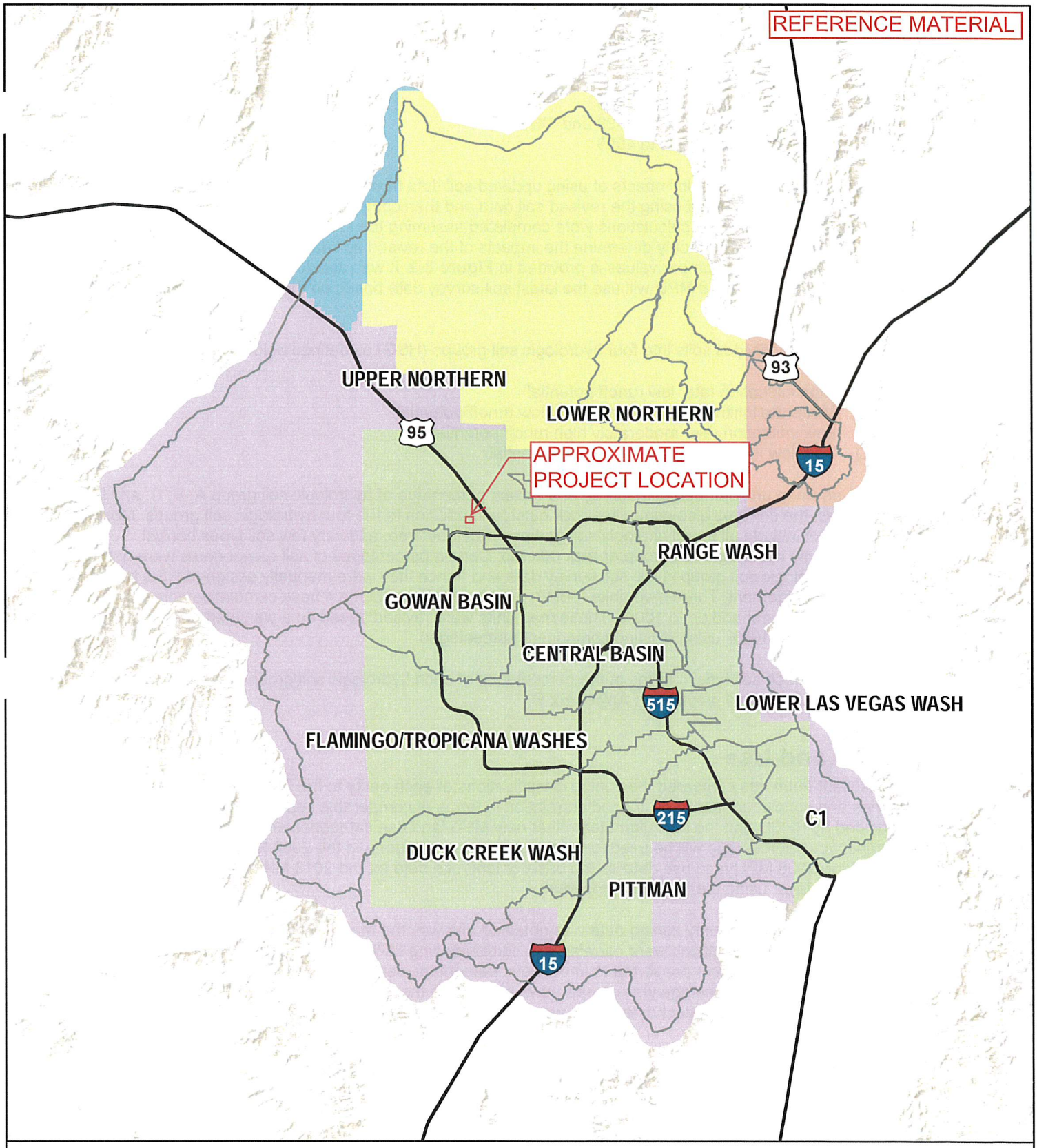
Source 5: U.S. Department of Agriculture, NRCS, Soil Survey of Energy and Defense Area, Nevada, Parts of Clark, Lincoln and Nye Counties, dated December 2013 (SSA Symbol: NV786)

The soil survey data described above was downloaded in GIS layers from the NRCS website. The GIS data delineates each soil map unit area and has a corresponding map unit number. Since several soil survey areas are combined in the 2018 MPU, these original map unit numbers were modified in order to have unique identifiers for each soil type in the study area.

For Source 1, the original map unit number was used with no modification. Generally, for Sources 2 and 3, a preceding number of 1 or 2, respectively, was added to the original map unit number. For example, for Source 3, if the original map unit number was 112, it became 2112. For Source 4, some of the original map unit numbers are letters. For example, one soil map unit number used was RTF which became 3RTF in the composite GIS layer. For Source 5, there are no delineated map units because a detailed soil survey was not performed in the Department of Defense and Department of Energy area. Instead, the soil data used in the Source 5 area is the same as the 2008 MPU map unit numbers with a preceding number, 4, added to the remaining last three digits of the 2008 MPU soil map unit numbers. For example, if the 2008 MPU map unit number was 3385, it became 4385.

Thus, the source of the soils information can be identified by the map unit number as follows:

Source 1: Map unit numbers 0 to 999
Source 2: Map unit numbers 1000 to 1999



N

0 2 4 8

Miles

1 in = 8 miles

2018 LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

FIGURE 3-1
SOIL DATA SOURCE

Soil Data Source

- Source 1 - NV788
- Source 2 - NV755
- Source 3 - NV757
- Source 4 - NV608
- Source 5 - NV786

REGIONAL FLOOD CONTROL DISTRICT

ATKINS

REFERENCE MATERIAL

Source 3: Map unit numbers 2000 to 2999
Source 4: Map unit numbers 3000 to 3999 and 3XXX
Source 5: Map unit numbers 4000 to 4999

To show the potential hydrologic impacts of using updated soil data from the 2008 MPU, composite subbasin curve numbers were calculated using the revised soil data and then compared to curve numbers from the 2008 MPU. The curve number calculations were completed assuming the same land use and subbasin data from the 2008 MPU in order to only determine the impacts of the revised soil data. The comparison results of composite subbasin curve number values is provided in **Figure 3-2**. It was decided by RFCD and the consultant team that the 2018 MPU will use the latest soil survey data based on the discussion in the kick-off meeting.

NRCS methodology divides soils into four hydrologic soil groups (HSG) as defined below:

A High infiltration rate, low runoff potential
B Moderate infiltration rate, moderately low runoff potential
C Low infiltration rate, moderately high runoff potential
D Very low infiltration rate, high runoff potential

Each soil type (map unit number) is made up of a certain percentage of hydrologic soil group A, B, C, and D. In some cases, the soil type also comprises rock outcrop in addition to the four hydrologic soil groups. Most soil types do not include all four hydrologic soil groups or rock outcrop, and very few soil types consist entirely of a single hydrologic soil group or rock outcrop. Certain percentages of soil components were not assigned a hydrologic soil group in the soil survey data and hence they were manually assigned HSG based on engineering judgement. Three map units (3BRB, 3CTC, 3RTF) in Source 4 have cumulative component percentages that do not add up to 100%. These map units were revised based on a weighted percentages with a summation of 100% using existing component percentages.

The make-up of each soil type in terms of the percentages of each hydrologic soil group (A, B, C, D, & rock outcrop) are tabulated and provided in **Appendix B**.

3.3. Land Use

The consultant team has compared the zoning classifications of each entity to the 2008 MPU land use categories and concluded that there is good correlation in terms of comparable impervious percentages. It was decided by RFCD and the consultant team that new MPU land use categories are not needed and the same impervious percentage will be used for each category as was done in the 2008 MPU. The consultant team used the 2008 MPU land use data as the basis of land use data for the 2018 MPU and proceeded to update the GIS layer using the following procedure:

1. GIS city and county zoning data was obtained and was the main source of land use updates. Zoning classifications were correlated to corresponding MPU land use categories. Then the zoning areas were converted to impervious percentages spatially in GIS and the converted impervious percentage was compared with that from the 2008 MPU land use GIS layer. The areas with the greatest differences were identified and looked at in more detail on a case by case basis.

2. GIS parcel data, planned land use, National Land Cover Database 2011 (NLCD 2011) and the Spring 2016 aerial imagery were used to review the overall land use update and the areas with large impervious percentage differences, especially in developed areas.

3. Major land development land use plans were collected throughout the valley and reviewed in order to incorporate relevant plans and information into the 2018 MPU land use data.

4.3.9. Soils

The soil data used in the 2008 MPU (and the 2002 MPU) is a conglomeration of the following soil survey data sources (please refer to **Figure 4-2**):

Source 1: U.S. Department of Agriculture, National Resource Conservation Service[3] (NRCS), Soil Survey of Las Vegas Valley Area, July 1985
Source 2: U.S. Department of Agriculture, NRCS, Supplemental Soil Survey of the Las Vegas Valley Area, December 1995
Source 3: U.S. Department of Agriculture, NRCS, unpublished soils data for outlying areas of the Las Vegas Valley, obtained 2001
Source 4: U.S. Department of Agriculture, NRCS, State Soil Geographic (STATSGO) Data Base, September 1995
Source 5: U.S. Department of Agriculture, NRCS, Soil Survey of Virgin River Area, July 1980

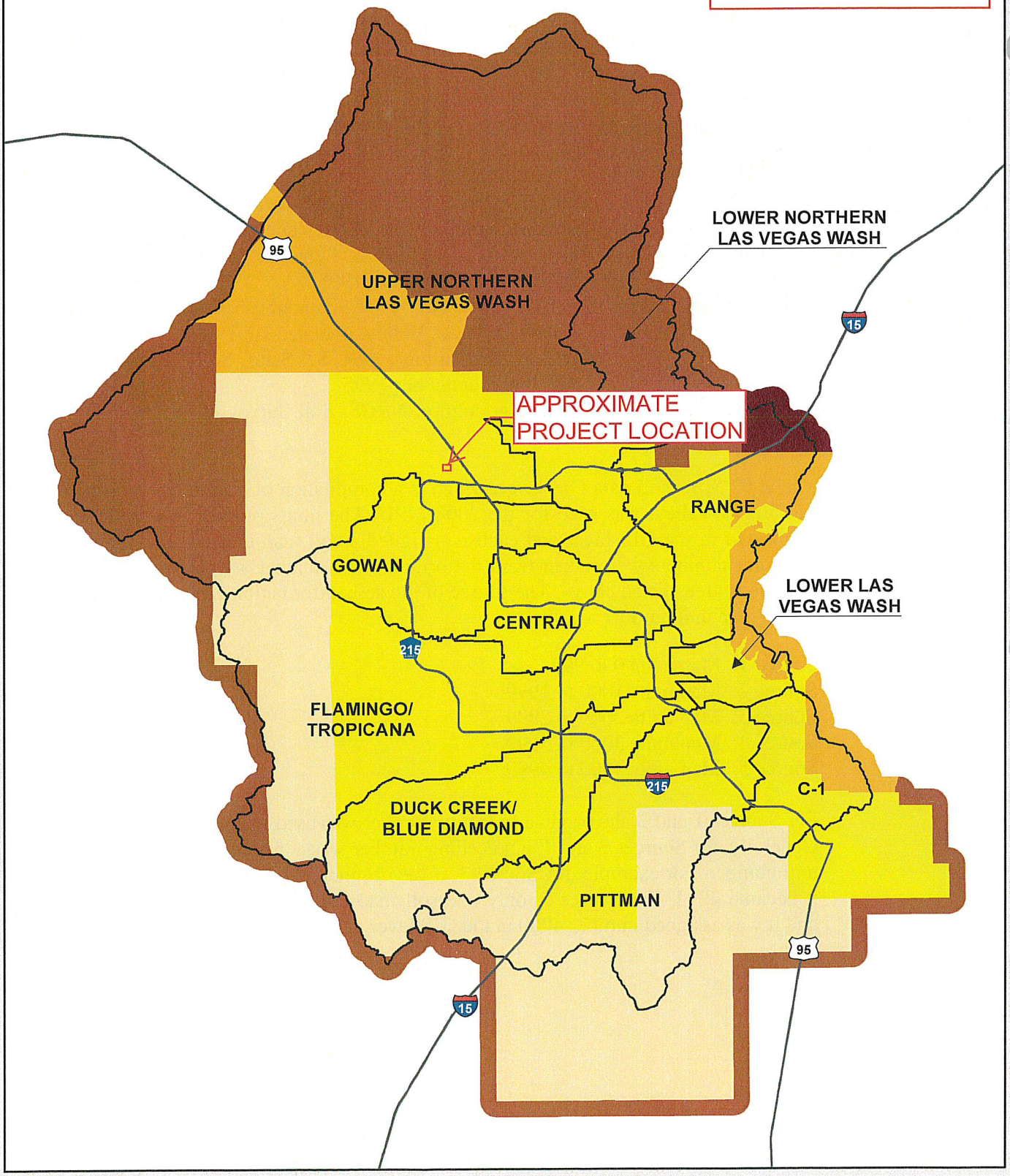
The 2002 MPU soil data GIS layer, which is a compilation of all soil types in the Las Vegas Valley, was used for the 2008 MPU. The limits of each soil type are delineated in the GIS layer and each is assigned a soil map unit number. These map unit numbers were taken from the original unit number assigned to it from the five sources listed above. The source of the soils information can be identified by the map unit number as follows:

Source 1: Map units 0 to 999
Source 2: Map units 1000 to 1999
Source 3: Map units 2000 to 2999
Source 4: Map units 3000 to 3999
Source 5: Map units 4000 to 4999

For Sources 1 and 2, the original map unit number was used with no modification. Generally, for Sources 3 and 4, a preceding number was added to the original map unit number. For example, for Source 3, if the original map unit number was 212, it became 3212. For Source 5, only one soil map unit number was used (RTF), and it was assigned number 4000 in the GIS layer.

[3] Note: The organization named above as the National Resource Conservation Service was formerly known as the Soil Conservation Service (SCS).

REFERENCE MATERIAL



N

0 4 8
Miles

Scale: 1 inch = 8 miles

2008
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

FIGURE 4-2
SOIL DATA SOURCE

Soil Data Source
- Source 1
- Source 2
- Source 3
- Source 4
- Source 5

REGIONAL FLOOD CONTROL DISTRICT

PBS&J
PB

REFERENCE MATERIAL

NRCS methodology divides soils into four hydrologic soil groups as defined below:

A High infiltration rate, low runoff potential
B Moderate infiltration rate, moderately low runoff potential
C Low infiltration rate, moderately high runoff potential
D Very low infiltration rate, high runoff potential

Each soil type (map unit number) is made up of a certain percentage of hydrologic soil group A, B, C, and D. In some cases, the soil type also comprises rock outcrop in addition to the four hydrologic soil groups. Most soil types do not include all four hydrologic soil groups or rock outcrop, and very few soil types consist entirely of a single hydrologic soil group or rock outcrop. The H-Maps of Volume 2 display the delineation for each soil type and identify each map unit by the predominant Hydrologic Soil Group (either A, B, C, or D). Actual curve number calculations for each of the subbasins were based on the individual breakdown of each soil type into the percentages of the minor Hydrologic Soil Group components (A, B, C, or D) or rock outcrop. Therefore, the Hydrologic Soil Groups displayed on the figures are for general reference only and should not be used to calculate hydrologic input parameters.

The make-up of each soil type in terms of the Hydrologic Soil Group (A, B, C, or D) or rock outcrop is tabulated in **Appendix G**.

In 2006, NRCS updated and made revisions to the soil data available for Las Vegas Valley and the outlying areas. The major differences between the new soil data and the data used with this MPU are as follows:

1. NRCS recently completed a more detailed survey for the outlying areas (outside the Las Vegas Valley). The new soil surveys completed by NRCS for the outlying areas are titled:

    a. Survey Area Symbol and Name: NV 755 Clark County Area, Nevada
    b. Survey Area Symbol and Name: NV 608 Virgin River Area, Nevada and Arizona

2. NRCS did not update the soil delineation and soil type for the interior of the Las Vegas Valley (Soil Survey Symbol: NV788) except at the perimeter to match the soil type and delineation associated with the Clark County Soil Survey (NV 755) and Virgin River Soil Survey (NV 608)

3. In previous MPUs and the 2008 MPU, the minor components for the soils and associated hydrologic groups (A, B, C, D, and Rock Outcrop) were interpreted from "Map Unit Descriptions" published in the soil survey books. In 2006, the minor components and associated hydrologic groups

were specifically identified by NRCS for each soil type. This resulted in some differences between the hydrologic soil groups used in the MPU and the new 2006 soil data; these differences occurred even for areas where soil delineation/type was not modified.

The above-mentioned changes resulted in differences between hydrologic parameters calculated with the MPU soil data and the new 2006 soil data. To show the potential hydrologic impact of these differences, curve number values were calculated using the MPU soil data and the new 2006 soil data. The different curve numbers for each soil data coverage were then compared. Curve number calculations were completed assuming that the entire study area is comprised of grass in good condition to eliminate skewing the comparison due to the influence of impervious area, which does not vary due to soil type. The differences in curve numbers are more prominent when using the above-mentioned assumption (grass land cover). The figure showing the difference in curve number values (geographically) is provided in **Appendix G**.

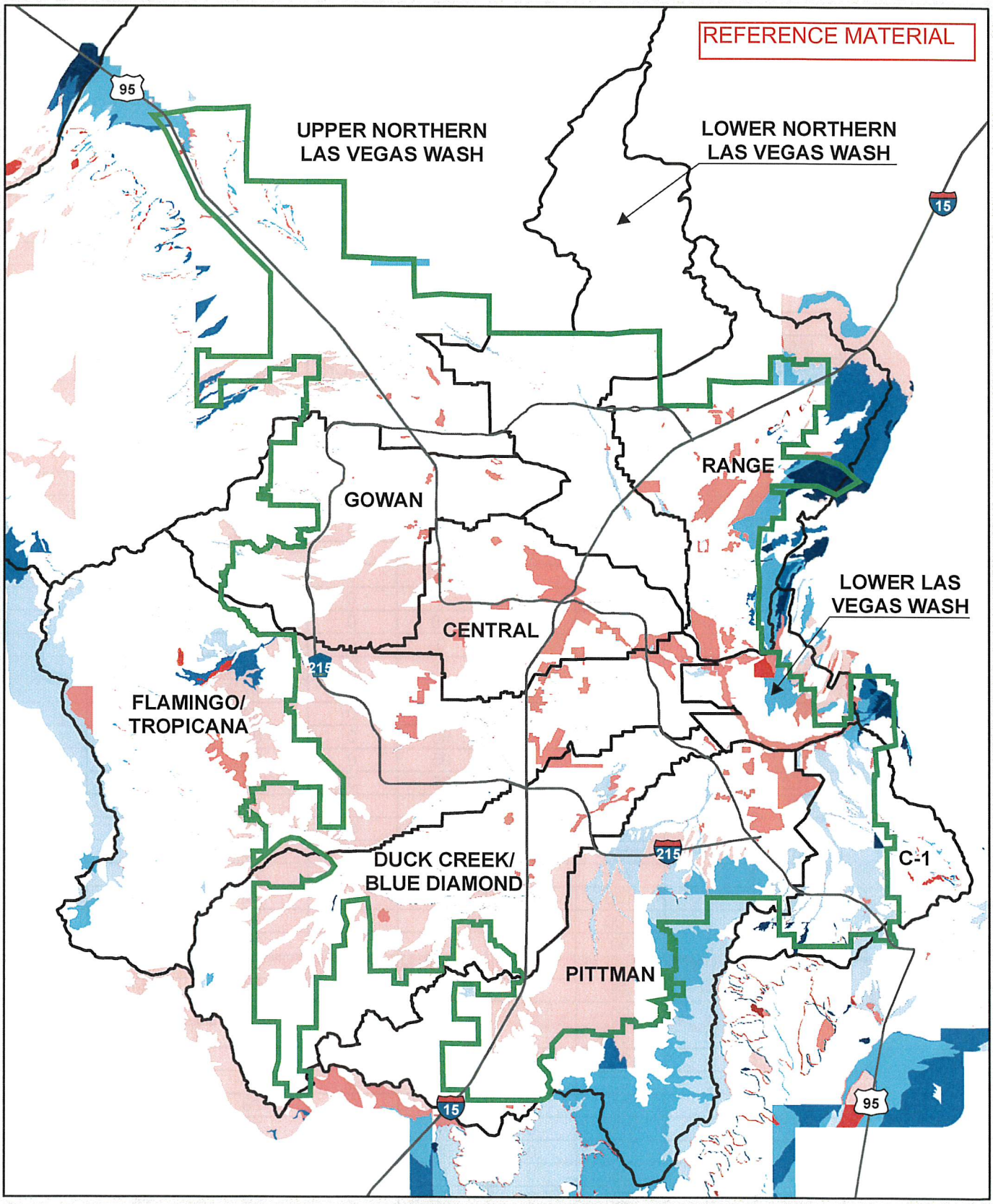
CCRFCD is aware of the basis of change between the MPU soil data and the new 2006 soil data. It was decided that these differences in the soil data will be addressed outside the MPU process. In addition, a detailed analysis was performed to verify the hydrologic response of the Gowan South Detention Basin watershed using August 19, 2003 storm event in conjunction with other hydrologic scenarios. One of the scenarios included using the new 2006 soil data, which showed that the new 2006 soil data overestimates flow rates and runoff volumes for the watershed tributary to Gowan South Detention Basin. The memorandum prepared by Parsons Brinckerhoff dated April 18, 2007, describing this analysis is included in **Appendix E**.

4.3.10. Curve Numbers

Rainfall losses due to soil infiltration, depression storage, and other factors were calculated using the NRCS curve number method, which is a function of soil type, land cover, and antecedent moisture condition. Based on the CCRFCD Design Manual, the average antecedent moisture condition (AMC II) is used for computing losses.

Curve number information was compiled using GIS polygon processing of subbasin delineations, soil map unit delineations, and land use layers. To calculate a curve number for a given subbasin, the procedure described below was used.

1. Base curve numbers are taken from the CCRFCD Design Manual for the three assumed land cover conditions shown in **Table 4-2** (directly connected impervious area, open landscaped area in good condition, open desert shrub in poor condition) for each of the four Hydrologic Soil Groups. In addition, a curve number of 90 is assumed for rock outcrop



N

0 2.75 5.5
Miles

Scale: 1 inch = 5.5 miles

2008
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

FIGURE G-1
CHANGE IN SOILS

2008 Ultimate Development Boundary
Watershed Boundaries

Change in soils between the new soils data and 2008 MPU soil coverage in terms of CN values assuming that the entire watershed is comprised of grass. The CNs associated with the 2008 MPU soils were subtracted from the CNs associated with the new soils.

Difference in CN
- < -25
- -25 - -15
- -15 - -5
- -5 - -2.5
- -2.5 - 2.5
- 2.5 - 5
- 5 - 15
- 15 - 25
- > 25

REGIONAL FLOOD CONTROL DISTRICT

PBS&J
PB

PERVIOUS AREA CURVE NUMBERS

REFERENCE MATERIAL

CONDITION 1: ----------> DESERT SHRUB POOR HYDROLOGIC CONDITION

CONDITION 2: ----------> LANDSCAPED, LAWNS, TREES, GOOD HYDROLOGIC CONDITION

CN VALUES

		HYDROLOGIC SOIL GROUP				
CONDITION		A	B	C	D	ROCK
1	---------->	63	77	85	88	90
2	---------->	39	61	74	80	90

MAP	HYDROLOGIC SOIL GROUP					CONDITION 1	CONDITION 2
UNIT	%A	%B	%C	%D	%ROCK	CN	CN
105	50	45	0	5	0	71	51
107	90	5	0	5	0	65	42
112	85	10	0	5	0	66	43
113	85	10	0	5	0	66	43
117	90	5	5	0	0	65	42
120	95	5	0	0	0	64	40
127	90	10	0	0	0	64	41
128	90	10	0	0	0	64	41
129	85	5	5	5	0	66	44
130	0	90	0	10	0	78	63
132	0	100	0	0	0	77	61
133	5	75	0	0	20	79	66
134	0	100	0	0	0	77	61
140	0	15	85	0	0	84	72
150	5	5	0	90	0	86	77
151	5	0	0	95	0	87	78
152	5	10	0	85	0	86	76
155	5	5	0	90	0	86	77
160	0	90	0	10	0	78	63
181	10	50	40	0	0	79	64
182	15	65	20	0	0	77	60
183	0	100	0	0	0	77	61
184	0	100	0	0	0	77	61
187	5	90	5	0	0	77	61
190	10	85	0	5	0	76	60
191	5	85	0	10	0	77	62
192	0	90	0	10	0	78	63
200	3	88	9	0	0	77	62
206	0	95	5	0	0	77	62
222	5	90	5	0	0	77	61
236	0	90	10	0	0	78	62
237	0	100	0	0	0	77	61
240	5	0	0	95	0	87	78
252	0	95	0	5	0	78	62
255	0	95	0	5	0	78	62
260	95	0	0	5	0	64	41
262	75	0	0	25	0	69	49
263	95	0	0	5	0	64	41

APPENDIX D.3
LOUIS BERGER GROUP
REFERENCE MATERIAL

MWH now part of Stantec

THIS PAGE WAS INTENTIONALLY LEFT BLANK

REFERENCE MATERIAL - FROM RANCHO FORT APACHE STORM DRAIN FINAL DESIGN REPORT BY LOUIS BERGER GROUP

Rancho - Fort Apache Storm Drain

N
W E
S

0 200 400 800 1,200
Scale (in feet)

Legend

- (XXX) Storm Drain Flow (cfs)
- XXX Street Flow (cfs)
- LBG Subbasin
- MPU Basins
- Severance Watershed
- Elkhorn Watershed
- Deer Springs Watershed
- Echelon Watershed
- Dorrell Watershed
- Beltway Watershed
- Fort Apache Detention Basin
- Existing Regional Facilities
- Proposed Regional Facilities
- Proposed Local Facilities
- Local Facilities
- 10 Foot Contours
- CP1 Concentration Point
- FS1 Flow Split

Flow Split Summary Table

Number	HEC-1 Node	Area (sq mi)
FS1	DOUTFLOW	0.61
FS2	DSGC	0.06
FS3	GC	0.13
FS4	DDORTP	0.19
FS5	GC2	0.26
FS6	DDSTP	0.39

Subbasin Summary Table

Sub-basin	Area (sq mi)	100 yr Peak Flow (cfs)
CDMNA1	0.48	598
NW26-C	0.37	456
NW27-C	0.15	207
NW53-CA	0.06	55
NW53-CB	0.13	107
NW53-CC	0.10	121
NW66-CI2	0.02	28
NW66-CI3	0.02	28
NW66-CA	0.07	79
NW66-CB	0.01	9
NW66-CJ6	0.01	8
NW66-CJ2	0.02	22
NW66-CJ4	0.01	7
NW66-CJ3	0.02	21
NW66-CJ5	0.01	12
NW66-CG	0.01	12
NW66-CF	0.01	15
NW66-CE	0.01	12
NW66-CD	0.01	16
NW66-CC	0.01	11
NW77-CC	0.01	9
NW77-CD	0.01	15
NW77-CE	0.01	17
NW77-CF	0.01	8
NW77-CG	0.01	9
NW77-CA	0.13	115
NW77-CB	0.07	77
NWBA6-CB	0.005	6
NW77-CH	0.01	21
NWBA3-C	0.33	407
NWBA6-CD	0.01	12
NWBA6-CG	0.005	8
NWBA6-CH	0.01	8
NWBA6-CA	0.13	114
NWBA6-CF	0.06	70
NWBA6-CC	0.03	40
NWBA6-CE	0.01	8
NWBC2-CB	0.03	39
NWBC2-CA	0.03	37
NWBC2-CD	0.01	10
NWBC3A	0.015	17
NWBC3B	0.009	17

Concentration Point Summary Table

Number	HEC-1 Node	Area (sq mi)	Facility	100-yr Peak Flow (cfs)
C1	C66-CB	0.93	Ft Apache Storm Drain	815
C2	C66CJ5	0.06	Ex. 60" HDPE Storm Drain	66
C3	DSEV	0.11	Severance Lateral	100
C4	CFA&SV	0.17	Ex. 60" HDPE Storm Drain	166
C5	CRC66CC	0.22	Severance / Ft Apache 5'x5' RCB	222
C6	CFTELKS	1.04	Ft Apache Storm Drain	1000
C7	CNW77-CG	1.08	Ft Apache Storm Drain	1034
C8	CPT2A	0.21	Dorrell Trench Drain	124
C9	CBA6-CB	1.29	Ft Apache Storm Drain	1149
C10	CBA6-CD	1.31	Ft Apache Storm Drain	1155
C11	CBA6-CE	0.42	Deer Springs Lateral	226
C12	CPT1A	1.54	Ft Apache Storm Drain	1365
C13	FTAP	1.57	Ft Apache Storm Drain	1390
C14	CP-EPL	0.42	Echelon Lateral	75
C15	FTAP2	1.61	Ft Apache Storm Drain	1460
C16	BLTWY1	1.63	Ft Apache Storm Drain	1465
C17	BLTWY2	1.63	Ft Apache Storm Drain	1471
C18	CFADB	2.66	Freeway Channel	1538

Rancho - Fort Apache Storm Drain
Future Conditions Hydrology

REFERENCE MATERIAL - FROM RANCHO FORT APACHE STORM DRAIN FINAL DESIGN REPORT BY LOUIS BERGER GROUP

```
1*****************************************
*                                       *
*    FLOOD HYDROGRAPH PACKAGE (HEC-1)   *
*                JUN  1998              *
*             VERSION 4.1               *
*                                       *
*  RUN DATE   07NOV12  TIME  16:01:57   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    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
XXXXXXX  XXXX     X        XXXXX  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
*** FREE ***
               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 = WEST8.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 = WEST TRIBUTARY
              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
              14        ID    REFERENCED HYDROLOGIC MODELS:
              15        ID    REVISED FINAL DESIGN REPORT FOR THE RANCHO DETENTION BASIN
              16        ID    PHASE II (VTN 2006)
              17        ID    RESPONSE TO COMMENTS ON THE CONCEPTUAL DRAINAGE STUDY FOR
              18        ID    NORTH LAS VEGAS 600-ACRE SITE (GC WALLACE 2006)
```

```
19          ID    SECOND RESPONSE TO COMMENTS OF THE CONCEPTUAL DRAINAGE STUDY
20          ID    FOR NORTH LAS VEGAS 2074-ACRE SITE (GC WALLACE 2006)
21          ID    BASIN MAPS FOR SUPPLEMENT #2 TO ADDENDUM #2 TO THE MASTER
22          ID    DRAINAGE STUDY FOR CLIFF'S EDGE/ PROVIDENCE (VTN 2004)
23          ID    MASTER DRAINAGE STUDY FOR KYLE CANYON (GC WALLACE 2006)
24          ID    TECHNICAL DRAINAGE STUDY FOR GRAND TETON DRIVE STROM DRAIN
25          ID    AND AREA 1 ROADWAY IMPROVEMENTS  (GC WALLACE 2006)
26          ID    90% FINAL DESIGN REPORT FOR RANCHO ROAD SYSTEM - EL CAMPO
27          ID    GRANDE STORM DRAIN PROJECT (PBS&J 2007)
28          ID    MPA FOR RACEL STREET COLLECTOR (LOUIS BERGER JANUARY 2007)
29          ID    HYDROLOGIC MODEL FOR FLOYD LAMB NORTH AND SOUTH ENVIRONMENTAL
30          ID    ENHANCEMENT AREAS (LOUIS BERGER  DECEMBER 7, 2007)
31          ID
32          ID    UPDATED BY THE LOUIS BERGER GROUP INC FOR THE RANCHO-FORT
33          ID    APACHE STORM DRAIN PROJECT.  MODEL WAS NOT TRUNCATED IN ORDER TO
34          ID    VERFITY THAT THE RANCHO DETENTION BASIN (RCHODB) WAS NOT AFFECTED.
35          ID    INPUT FILE = FASD.DAT
36          ID    INPUT FILE DATE = JUNE 2012
37          ID    MODELED BY LBG (RUFIN INOS, E.I. AND FRED RETZLAFF, P.E.)
38          ID    CHECKED BY LBG (JEFFREY, S DOUGLAS, P.E., CFM)
39          ID
40          ID
41          ID    JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:
42          ID
43          ID    AREA (SQUARE MILES)          DARF
44          ID          0 - 0.5                0.99
45          ID          0.5 - 1                0.975
46          ID          1 - 2                  0.95
47          ID          2 - 3                  0.925
48          ID          3 - 4                  0.915
49          ID          4 - 5                  0.908
50          ID          5 - 6                  0.903
51          ID          6 - 7                  0.895
52          ID          7 - 8                  0.885
53          ID
```


1

HEC-1 INPUT

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

54          IT      5       0       0     200
55          IO      5       0       0
56          IN      5       0       0
57          JR   PREC    0.99   0.975    0.95   0.925   0.915   0.908   0.903   0.895   0.885
            *

58          KK  NW62-S
59          BA   0.208
60          PB    2.77
61          PC   0.000   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
62          PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
63          PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
64          PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
65          PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
66          PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
67          PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
68          PC   0.998   0.999   1.000
69          LS       0    95.6
70          UD   0.190
```

```
1191          KKCNN011-C
1192          KM  COMBINE NN011-C AND RC3D4-C
1193          KM  LAS VEGAS WASH MIDDLE @ TROPICAL
1194          HC       2
              *

1195          KK RC011-C
1196          KM  ROUTE CNN011-C TO CNN030-C
1197          KM  FACILITY = LAS VEGAS WASH MIDDLE
1198          KM  FACILITY ID-MILE = LVMD 2192,2197,2223,2228
1199          KM  LINING = CONCRETE
1200          RD    3370   0.018   0.015       0    TRAP      50       0
              *

1201          KK NN030-C
1202          BA   0.288
1203          PB    2.77
1204          LS       0    90.0
1205          UD   0.287
              *

1206          KKCNN030-C
1207          KM  COMBINE NN030-C AND RC011-C
1208          HC       2
              *

1209          KK RC030-C
1210          KM  ROUTE CNN030-C TO 2C043-C
1211          KM  FACILITY = LAS VEGAS WASH MIDDLE
1212          KM  FACILITY ID-MILE = LVMD 2170,2172
1213          KM  LINING = CONCRETE
1214          RD    1789   0.012   0.015       0    TRAP      50       0
              *
              * ************************************************************
              * AREA CONTRIBUTING TO RANCHO DETENTION BASIN
              * ************************************************************
              *

1215          KK  NW27-C
1216          BA   0.148
1217          PB    3.06
1218          LS       0    90.0
1219          UD   0.234
              *

1220          KK  RN27-C
1221          KM  ROUTE NW27-C TO CNW26-C
1222          KM  FACILITY = ELKHORN AND HUALAPAI
1223          KM  FACILITY ID-MILE = EKHU 0023
1224          KM  LINING = RCAP
1225          RD    2300   0.009   0.015       0    TRAP       8       0
              *
```

```
KK  NW26-C
BA   0.367
PB    3.09
LS       0     90.3
UD   0.325
*

KK CNW26-C
KM  COMBINE NW26-C AND RN27-C
HC       2
*

KK  RN26-C
KM  ROUTE CN26-C TO DNW26-C
KM  FACILITY = ELKHORN AND HUALAPAI
KM  FACILITY ID-MILE = EKHU 0000,0001,0003,0020
KM  LINING = RCAP
KM   419 CFS IN EXISTING 6'X4' RCA AND 219 AS SURFACE FLOW
RD    1250   0.036   0.015       0     TRAP       6       0
*

KK NW53-CC
KM   NEW BASIN FOR FLOW IN HUALAPAI LOCAL STORM DRAIN
BA   0.099
PB    2.85
LS       0     87.2
UD   0.191
*

KKCNW53-CC
KM   COMBINE FLOWS AT ELKHORN & HUALAPAI
KM   ADDED BY LBG FOR RANCHO-FT APACHE STORM DRAIN
HC       2
*

KK DNW26-C
KM    INTERSECTION OF HUALAPAI AND ELKHORN
KM    FIRST 631 GOES EAST IN RCBH 0295
KM    REMAINING FLOW GOES SOUTH IN BCHU 0054
DTDOUTFLOW
DI       0     631     733    7102
DQ       0     631     631    7000
*
*
* KKDNW26-C
* KM190 CFS IN FACILITY AND 132 CFS SURFACE FLOW
* KMGO SOUTH ON HUALAPAI AND REMAINING FLOW GOES EAST
* KMPER "SUPPLEMENT #2 TO ADDENDUM #2 TO THE TDS FOR
* KMCLIFFS EDGE" PREPARED BY VTN (FIGURE 5-N AND 5-S)
* KMTHE FLOW GOING SOUTH WAS REDUCED BY 100 CFS TO
* KMKEEP THE FORT APACHE DB FROM OVERTOPPING
* DTDOUTFLOW
* DI0       222     500     1000    5000
* DQ0       0       278     778     4778
*
```

```
1317          HC       2
              *
1318          KKDFADBIN1
1319          KM   DIVERT OUT FLOW INTO DETENTION BASIN.  RETRIEVE AFTER
1320          KM   FLOW SPLIT AT GRAND CANYON AND DEER SPRINGS IS CALCULATED.
1321          DT   DFADB
1322          DI       0  9000.1
1323          DQ       0  9000.0
              *
1324          KK NW53-CA
1325          BA   0.064
1326          PB    2.85
1327          LS       0    79.1
1328          UD   0.176
              *
1329          KK     SEV
1330          KM   FLOW SPLIT AT SEVERENCE & GRAND CANYON
1331          KM   REMAINING FLOW GOES EAST ON SEVERENCE
1332          KM   PIMA COUNTY METHOD
1333          DT    DSGC
1334          DI       0      50     100     150     200     250     350     500     750
1335          DQ       0       9      16      23      29      38      60      80     129
              *
              *
              *
              * ***************
              * NEW BASIN
              * ***************
              * _
1336          KKNW66-CI2
1337          BA   0.024
1338          PB    2.85
1339          LS       0    84.0
1340          UD   0.162
              *
1341          KK    CCI2
1342          HC       2
              *
              *
              * ***************
              * NEW BASIN
              * ***************
              *
1             HEC-1 INPUT                                                PAGE 37

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

1343          KKNW66-CI3
1344          BA   0.024
1345          PB    2.85
1346          LS       0    84.1
1347          UD   0.163
```

```
                *
1348            KK    CCI3
1349            HC       2
                *
1350            KK     SGC
1351            KM   FLOW AT INTERSECTION OF TEE PEE AND SEVERANCE
1352            KM   NO FLOW SPLIT, ALL FLOW CONTINUES EAST ALONG
1353            KM   SEVERANCE.
1354            DT    DSEV
1355            DI       0  3000.1
1356            DQ       0  3000.0
                *
1357            KKDOUTFLOW
1358            KM   RETIREVE DOUTFLOW FLOWING EAST ON ELKHORN
1359            DRDOUTFLOW
                *
1360            KKRDOUTFLW
1361            KM   ROUTE DOUTFLOW TO CNW53-C
1362            KM   FACILITY = RANCHO ROAD SYSTEM - BELTWAY
1363            KM   FACILITY # = RCHB 0295
1364            KM   LINING = RCB
1365            RD    2925   0.033   0.015       0    TRAP       7       0
                *
                * ***************
                * REVISE BASIN
                * ***************
                *
1366            KK NW53-CB
1367            BA   0.128
1368            PB    2.85
1369            LS       0    79.8
1370            UD   0.210
                *
1371            KK    DSGC
1372            KM   RETRIEVE DSGC FLOWING SOUTH ON GRAND CANYON
1373            DR    DSGC
                *
1                                        HEC-1 INPUT                                    PAGE 38

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

1374            KK CNW53-C
1375            KM   COMBINE FLOWS AT ELKHORN AND GRAND CANYON
1376            HC       4
                *
1377            KKRCNW53-C
1378            KM   ROUTE CNW53-C TO CNW66-C
1379            KM   ROUTE ELK AND GC TO ELK AND FT APACHE
1380            KM   FACILITY = RANCHO ROAD SYSTEM - BELTWAY
1381            KM   FACILITY # = RCHB 0295
```

```
1382          KM   LINING = RCB
1383          RD    2600   0.033   0.015       0    TRAP       7       0
              *

1384          KK NW66-CA
1385          BA   0.067
1386          PB    2.91
1387          LS       0    84.0
1388          UD   0.166
              *

1389          KK  C66-CA
1390          HC       2
              *

1391          KK NW66-CB
1392          BA   0.010
1393          PB    2.91
1394          LS       0    77.5
1395          UD   0.129
              *

1396          KK  C66-CB
1397          KM   FLOW IN RCHB 0295 JUST WEST OF INTERSECTION
1398          KM   OF ELKHORN AND FORT APACHE
1399          HC       2
              *

1400          KKNW66-CJ6
1401          BA   0.006
1402          PB    2.85
1403          LS       0    84.0
1404          UD   0.101
              *

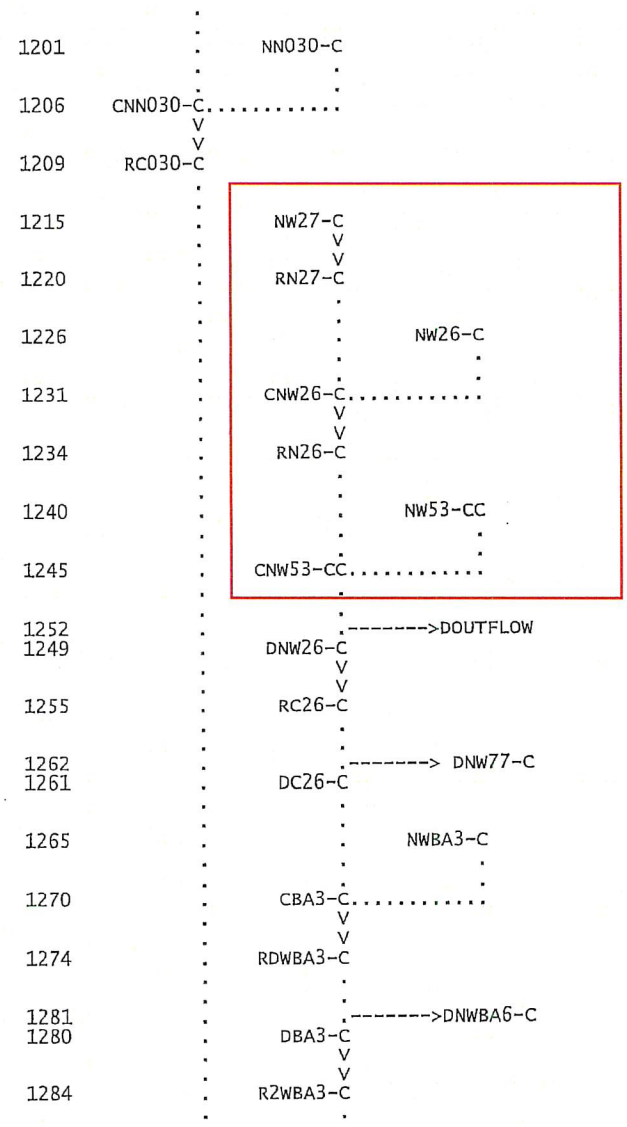
1405          KK  D66CJ6
1406          KM   PART OF FLOW GOES INTO 60" STORM DRAIN
1407          KM   THE REMAINDER TRAVELS IN THE STREET SOUTH ON FT APACHE
1408          DT  S66CJ6
1409          DI       0       4    1004
1410          DQ       0       0    1000
              *
```

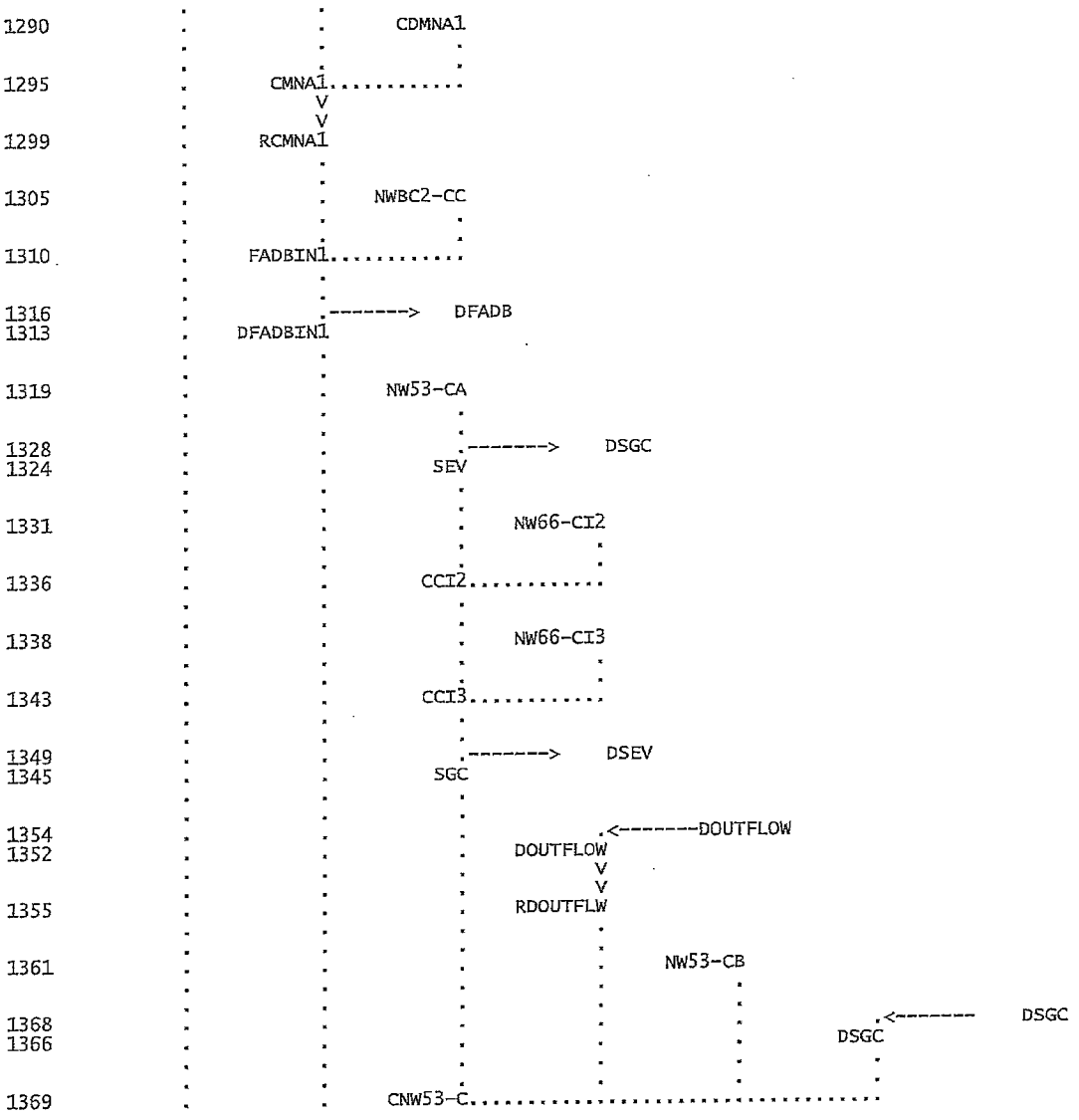


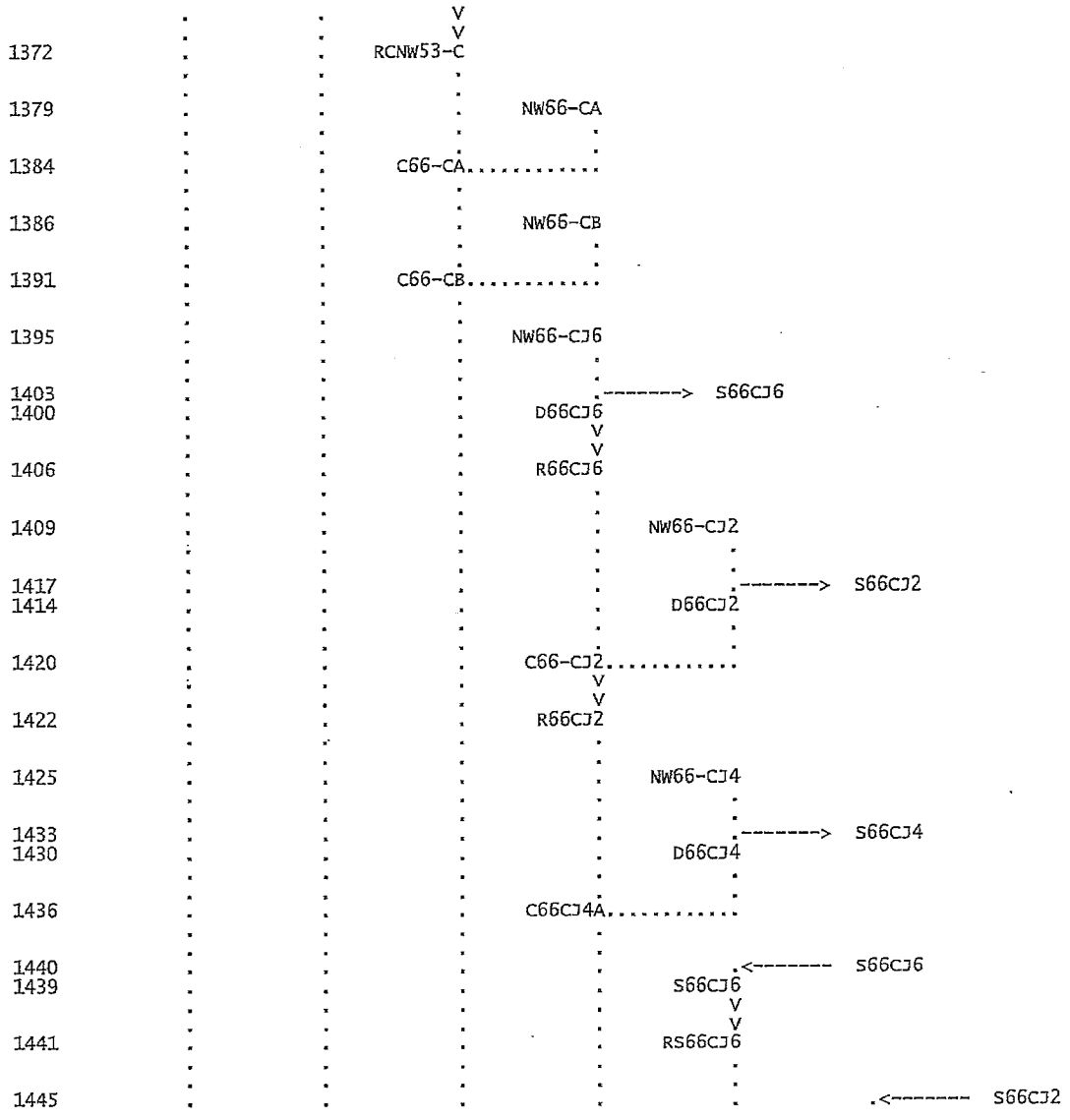
```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

1411          KK  R66CJ6
1412          KM   ROUTE STORM DRAIN FLOWS TO GOLD LAKE AVE
1413          RD     243  0.0050   0.013       0    CIRC       5       0
              *

1414          KKNW66-CJ2
1415          BA   0.018
1416          PB    2.85
1417          LS       0    84.0
1418          UD   0.128
              *
```


1201
NN030-C
1206
CNN030-C
1209
RC030-C
1215
NW27-C
1220
RN27-C
1226
NW26-C
1231
CNW26-C
1234
RN26-C
1240
NW53-CC
1245
CNW53-CC
1252
DOUTFLOW
1249
DNW26-C
1255
RC26-C
1262
DNW77-C
1261
DC26-C
1265
NWBA3-C
1270
CBA3-C
1274
RDWBA3-C
1281
DNWBA6-C
1280
DBA3-C
1284
R2WBA3-C


1290
CDMNA1
1295
CMNA1
1299
RCMNA1
1305
NWBC2-CC
1310
FADBIN1
1316
DFADB
1313
DFADBIN1
1319
NW53-CA
1328
DSGC
1324
SEV
1331
NW66-CI2
1336
CCI2
1338
NW66-CI3
1343
CCI3
1349
DSEV
1345
SGC
1354
DOUTFLOW
1352
DOUTFLOW
1355
RDOUTFLW
1361
NW53-CB
1368
DSGC
1366
DSGC
1369
CNW53-C


1372
RCNW53-C
1379
NW66-CA
1384
C66-CA
1386
NW66-CB
1391
C66-CB
1395
NW66-CJ6
1403
S66CJ6
1400
D66CJ6
1406
R66CJ6
1409
NW66-CJ2
1417
S66CJ2
1414
D66CJ2
1420
C66-CJ2
1422
R66CJ2
1425
NW66-CJ4
1433
S66CJ4
1430
D66CJ4
1436
C66CJ4A
1440
S66CJ6
1439
S66CJ6
1441
RS66CJ6
1445
S66CJ2

HYDROGRAPH AT													
+	NW27-C	.15	1	FLOW	207.	203.	196.	189.	186.	185.	183.	181.	178.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
ROUTED TO													
+	RN27-C	.15	1	FLOW	203.	199.	193.	185.	183.	181.	179.	178.	175.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT													
+	NW26-C	.37	1	FLOW	456.	447.	432.	417.	411.	407.	404.	399.	393.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
2 COMBINED AT													
+	CNW26-C	.51	1	FLOW	650.	638.	617.	596.	587.	582.	577.	571.	562.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
ROUTED TO													
+	RN26-C	.51	1	FLOW	649.	636.	616.	595.	586.	581.	576.	570.	560.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
HYDROGRAPH AT													
+	NW53-CC	.10	1	FLOW	121.	118.	114.	109.	107.	106.	105.	104.	102.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT													
+	CNW53-CC	.61	1	FLOW	748.	733.	709.	685.	675.	668.	662.	655.	645.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
DIVERSION TO													
+	DOUTFLOW	.61	1	FLOW	646.	631.	631.	631.	631.	631.	631.	631.	631.
				TIME	3.75	3.75	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT													
+	DNW26-C	.61	1	FLOW	102.	102.	78.	54.	44.	37.	31.	24.	14.
				TIME	3.67	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
ROUTED TO													
+	RC26-C	.61	1	FLOW	103.	100.	78.	53.	43.	36.	30.	23.	12.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
DIVERSION TO													
+	DNW77-C	.61	1	FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.
				TIME	.00	.00	.00	.00	.00	.00	.00	.00	.00
HYDROGRAPH AT													
+	DC26-C	.61	1	FLOW	103.	100.	78.	53.	43.	36.	30.	23.	12.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
HYDROGRAPH AT													
+	NWBA3-C	.33	1	FLOW	407.	399.	386.	372.	367.	363.	360.	356.	351.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
2 COMBINED AT													
+	CBA3-C	.94	1	FLOW	510.	500.	464.	425.	410.	399.	390.	379.	363.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
ROUTED TO													

+	RDWBA3-C	.94	1	FLOW TIME	505. 3.75	495. 3.75	459. 3.75	420. 3.75	406. 3.75	395. 3.75	386. 3.75	375. 3.75	359. 3.75
DIVERSION TO +	DNWBA6-C	.94	1	FLOW TIME	0. .00	0. .00	0. .00	0. .00	0. .00	0. .00	0. .00	0. .00	0. .00
HYDROGRAPH AT +	DBA3-C	.94	1	FLOW TIME	505. 3.75	495. 3.75	459. 3.75	420. 3.75	406. 3.75	395. 3.75	386. 3.75	375. 3.75	359. 3.75
ROUTED TO +	R2WBA3-C	.94	1	FLOW TIME	500. 3.75	490. 3.75	453. 3.75	416. 3.75	401. 3.75	391. 3.75	383. 3.75	372. 3.75	356. 3.75
HYDROGRAPH AT +	CDMNA1	.48	1	FLOW TIME	598. 3.75	587. 3.75	567. 3.75	548. 3.75	540. 3.75	535. 3.75	531. 3.75	525. 3.75	517. 3.75
2 COMBINED AT +	CMNA1	1.42	1	FLOW TIME	1099. 3.75	1076. 3.75	1021. 3.75	964. 3.75	942. 3.75	926. 3.75	914. 3.75	897. 3.75	874. 3.75
ROUTED TO +	RCMNA1	1.42	1	FLOW TIME	1068. 3.75	1044. 3.75	990. 3.75	935. 3.75	915. 3.75	899. 3.83	891. 3.75	874. 3.75	854. 3.83
HYDROGRAPH AT +	NWBC2-CC	.20	1	FLOW TIME	191. 3.67	187. 3.67	178. 3.67	170. 3.67	167. 3.67	165. 3.67	163. 3.67	160. 3.67	157. 3.67
2 COMBINED AT +	FADBIN1	1.63	1	FLOW TIME	1257. 3.75	1228. 3.75	1166. 3.75	1104. 3.75	1080. 3.75	1061. 3.75	1052. 3.75	1033. 3.75	1008. 3.75
DIVERSION TO +	DFADB	1.63	1	FLOW TIME	1257. 3.75	1228. 3.75	1166. 3.75	1104. 3.75	1080. 3.75	1061. 3.75	1052. 3.75	1033. 3.75	1008. 3.75
HYDROGRAPH AT +	DFADBIN1	1.63	1	FLOW TIME	0. 3.75	0. 3.75	0. 3.75	0. 3.75	0. 3.75	0. 3.75	0. 3.75	0. 3.75	0. 3.75
HYDROGRAPH AT +	NW53-CA	.06	1	FLOW TIME	55. 3.58	53. 3.58	51. 3.58	48. 3.58	47. 3.58	46. 3.58	46. 3.58	45. 3.58	44. 3.58
DIVERSION TO +	DSGC	.06	1	FLOW TIME	10. 3.58	9. 3.58	9. 3.58	9. 3.58	8. 3.58	8. 3.58	8. 3.58	8. 3.58	8. 3.58
HYDROGRAPH AT +	SEV	.06	1	FLOW TIME	45. 3.58	44. 3.58	42. 3.58	39. 3.58	39. 3.58	38. 3.58	38. 3.58	37. 3.58	36. 3.58
HYDROGRAPH AT +	NW66-CI2	.02	1	FLOW TIME	28. 3.58	27. 3.58	26. 3.58	25. 3.58	24. 3.58	24. 3.58	24. 3.58	23. 3.58	23. 3.58

+ 2 COMBINED AT	CCI2	.09	1	FLOW	73.	71.	67.	64.	63.	62.	61.	60.	59.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
+ HYDROGRAPH AT	NW66-CI3	.02	1	FLOW	28.	27.	26.	25.	24.	24.	24.	23.	23.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
+ 2 COMBINED AT	CCI3	.11	1	FLOW	100.	98.	93.	89.	87.	86.	85.	84.	82.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
+ DIVERSION TO	DSEV	.11	1	FLOW	100.	98.	93.	89.	87.	86.	85.	84.	82.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
+ HYDROGRAPH AT	SGC	.11	1	FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.
				TIME	3.50	3.50	3.58	3.58	3.58	3.58	3.58	3.58	3.58
+ HYDROGRAPH AT	DOUTFLOW	.00	1	FLOW	646.	631.	631.	631.	631.	631.	631.	631.	631.
				TIME	3.75	3.75	3.67	3.67	3.67	3.67	3.67	3.67	3.67
+ ROUTED TO	RDOUTFLW	.00	1	FLOW	646.	631.	631.	631.	631.	631.	631.	631.	631.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
+ HYDROGRAPH AT	NW53-CB	.13	1	FLOW	107.	104.	99.	94.	92.	91.	90.	88.	86.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
+ HYDROGRAPH AT	DSGC	.00	1	FLOW	10.	9.	9.	9.	8.	8.	8.	8.	8.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
+ 4 COMBINED AT	CNW53-C	.24	1	FLOW	759.	744.	736.	726.	723.	720.	719.	718.	716.
				TIME	3.67	3.67	3.67	3.67	3.67	3.75	3.75	3.75	3.75
+ ROUTED TO	RCNW53-C	.24	1	FLOW	753.	738.	729.	723.	722.	720.	719.	717.	715.
				TIME	3.67	3.67	3.75	3.75	3.75	3.75	3.75	3.75	3.75
+ HYDROGRAPH AT	NW66-CA	.07	1	FLOW	79.	77.	74.	70.	69.	68.	68.	67.	65.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
+ 2 COMBINED AT	C66-CA	.31	1	FLOW	824.	808.	795.	781.	774.	770.	768.	766.	763.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.75	3.75	3.75
+ HYDROGRAPH AT	NW66-CB	.01	1	FLOW	9.	9.	9.	8.	8.	8.	8.	8.	7.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT													

+	C66-CB	.32	1	FLOW TIME	832. 3.67	815. 3.67	802. 3.67	787. 3.67	781. 3.67	776. 3.67	774. 3.67	771. 3.75	768. 3.75
HYDROGRAPH AT +	NW66-CJ6	.01	1	FLOW TIME	8. 3.50	7. 3.50	7. 3.50	7. 3.50	7. 3.50	7. 3.50	6. 3.50	6. 3.50	6. 3.50
DIVERSION TO +	S66CJ6	.01	1	FLOW TIME	4. 3.50	3. 3.50	3. 3.50	3. 3.50	3. 3.50	3. 3.50	2. 3.50	2. 3.50	2. 3.50
HYDROGRAPH AT +	D66CJ6	.01	1	FLOW TIME	4. 3.42	4. 3.42	4. 3.42	4. 3.42	4. 3.42	4. 3.42	4. 3.42	4. 3.42	4. 3.42
ROUTED TO +	R66CJ6	.01	1	FLOW TIME	4. 3.50	4. 3.50	4. 3.50	4. 3.50	4. 3.50	4. 3.50	4. 3.50	4. 3.50	4. 3.50
HYDROGRAPH AT +	NW66-CJ2	.02	1	FLOW TIME	22. 3.58	21. 3.58	21. 3.58	20. 3.58	19. 3.58	19. 3.58	19. 3.58	19. 3.58	18. 3.58
DIVERSION TO +	S66CJ2	.02	1	FLOW TIME	18. 3.58	17. 3.58	17. 3.58	16. 3.58	15. 3.58	15. 3.58	15. 3.58	15. 3.58	14. 3.58
HYDROGRAPH AT +	D66CJ2	.02	1	FLOW TIME	4. 3.25	4. 3.25	4. 3.25	4. 3.25	4. 3.25	4. 3.33	4. 3.33	4. 3.33	4. 3.33
2 COMBINED AT +	C66-CJ2	.02	1	FLOW TIME	8. 3.50	8. 3.50	8. 3.50	8. 3.50	8. 3.50	8. 3.50	8. 3.50	8. 3.50	8. 3.50
ROUTED TO +	R66CJ2	.02	1	FLOW TIME	8. 3.58	8. 3.58	8. 3.58	8. 3.58	8. 3.58	8. 3.58	8. 3.58	8. 3.58	8. 3.58
HYDROGRAPH AT +	NW66-CJ4	.01	1	FLOW TIME	7. 3.50	7. 3.50	7. 3.50	7. 3.50	7. 3.50	6. 3.50	6. 3.50	6. 3.50	6. 3.50
DIVERSION TO +	S66CJ4	.01	1	FLOW TIME	3. 3.50	3. 3.50	3. 3.50	3. 3.50	3. 3.50	2. 3.50	2. 3.50	2. 3.50	2. 3.50
HYDROGRAPH AT +	D66CJ4	.01	1	FLOW TIME	4. 3.42	4. 3.42	4. 3.42	4. 3.42	4. 3.42	4. 3.42	4. 3.42	4. 3.42	4. 3.42
2 COMBINED AT +	C66CJ4A	.03	1	FLOW TIME	12. 3.58	12. 3.58	12. 3.58	12. 3.58	12. 3.58	12. 3.58	12. 3.58	12. 3.58	12. 3.58
HYDROGRAPH AT +	S66CJ6	.00	1	FLOW TIME	4. 3.50	3. 3.50	3. 3.50	3. 3.50	3. 3.50	3. 3.50	2. 3.50	2. 3.50	2. 3.50

APPENDIX D.4
SLATER HANIFAN GROUP
REFERENCE MATERIAL

MWH now part of Stantec

THIS PAGE WAS INTENTIONALLY LEFT BLANK

REFERENCE MATERIAL FROM RANCHO ROAD SYSTEM - ELKHORN (FORT APACHE TO GRAND CANYON) - BY SLATER HANIFAN GROUP

HUALAPAI

SOLAR AVE

*SD FLOW = 121 CFS (M9SCC)

*TOTAL FLOW = 638 CFS
(419 CFS SD FLOW + 219 CFS SURFACE FLOW)

*SD FLOW = 419 CFS (RN26-C)

*SD FLOW = 631 CFS (DOUTFLOW)

FS1

*SURFACE FLOW = 219 CFS (CNW28-C)

*SD FLOW = 102 CFS (DW9SCC)

ELKHORN RD

MDI1

MDI2

MDI3

MDI4

*SD FLOW = 744 CFS (CNW53-C)

*SD FLOW = 808 CFS (C66-CA)

*SD FLOW = 815 CFS (C66-CB)

18BD14

18BD15

TEE PEE LN

FORT APACHE RD

SEVERANCE LN

WITTIG AVE

GRAND CANYON DR

CONQUISTADOR ST

DORRELL LN

REGIONAL DRAINAGE ANALYSIS UTILIZED FOR DESIGN OF MAINLINE STORM DRAIN.

Elkhorn Proposed Mainline Storm Drain Flow Summary - North Side
Regional Analysis - Ultimate Condition

Segment and Segment ID	*Referenced HEC-1 Flow Q_{100} (cfs)
Hualapai to Grand Canyon	631 DOUTFLOW
Grand Canyon to Tee Pee	744 CNW53-C
Tee Pee to Fort Apache	808/815 C66-CA/C66-CB

LEGEND

- SUBBASIN BOUNDARY
- ID — SUBBASIN ID
- PT1 — CONCENTRATION POINT
- FLOW DIRECTION
- EXISTING DRAINAGE FACILITY
- PROPOSED DRAINAGE FACILITY
- FUTURE DRAINAGE FACILITY
- Q=00 CFS / PT1 / Q=00 CFS — FLOW SPLIT

0 200 400
SCALE – 1" = 200' FEET

N

NOTE:
*REFERENCED FROM THE RANCHO–FORT APACHE STORM DRAIN PROJECT PREPARED BY LOUIS BERGER GROUP AS A SUPPLEMENTAL ANALYSIS AND INCLUDED AS HEC–1 MODEL FASD–SDN3.OUT RUN DATE 07NOV12

NO.	DESCRIPTION	DATE	BY	DATE APP.

SLATER HANIFAN GROUP
CONSULTING ENGINEERS & PLANNERS
5740 S. ARVILLE STREET #216, LAS VEGAS, NV 89118
PHONE (702) 284-5359 FAX (702) 284-5399

CITY OF LAS VEGAS

RANCHO RD SYSTEM - ELKHORN (FT APACHE TO GRAND CANYON)

REGIONAL HYDROLOGIC ANALYSIS - ULTIMATE CONDITIONS

DATE: MAR 2013
DRAFTER: KC
DESIGNER: KC
CHECKED: MJF
PROJECT NO.
CLV1201-000

EXHIBIT H
SHEET 1 OF 1

K:\clv1201\drawings\RDS design\exhibits\clv1201 exhibit a ultimate drainage map1.dwg Plotted on May 3, 2013 - 10:48 AM by Peterman

REFERENCE MATERIAL FROM RANCHO ROAD SYSTEM - ELKHORN (FORT APACHE TO GRAND CANYON) - BY SLATER HANIFAN GROUP

HUALAPAI

*NW53-CA

*SURFACE FLOW = 55 CFS (NW53-CA)

FS2

*SURFACE FLOW = 45 CFS (SEV)

TEEPEE LN

FORT APACHE RD

SEVERANCE LN

*SURFACE FLOW = 10 CFS (DSGC)

MDI3

MDI4

MDI7

SOLAR AVE

MDI2

MDI8

MDI10

MDI5

MDI6

MDI9

CPMDI3

ELKHORN RD

MDI1

18DI1

18DI2

18DI3

18DI4

18DI5

CONQUISTADOR ST

GRAND CANYON DR

WITTIG AVE

DORRELL LN

LOCAL DRAINAGE ANALYSIS UTILIZED FOR DESIGN OF DROP INLETS, DESIGN OF LATERAL STORM DRAINS AND ESTABLISHMENT OF DESIGN FLOWS IN EXISTING 18-INCH PARALLEL STORM DRAIN SYSTEM (SOUTH SIDE OF ELKHORN)

LEGEND

- SUBBASIN BOUNDARY
- ID — SUBBASIN ID
- PT1 — CONCENTRATION POINT
- FLOW DIRECTION
- EXISTING DRAINAGE FACILITY
- PROPOSED DRAINAGE FACILITY
- FUTURE DRAINAGE FACILITY
- PT1 Q=00 CFS / Q=00 CFS — FLOW SPLIT

0 200 400 SCALE – 1" = 200' FEET

N

NOTE:
*REFERENCED FROM THE RANCHO-FORT APACHE STORM DRAIN PROJECT PREPARED BY LOUIS BERGER GROUP AS A SUPPLEMENTAL ANALYSIS AND INCLUDED AS HEC-1 MODEL FASD-SDN3.OUT RUN DATE 07NOV12

Lateral Storm Drain Flow Summary

Local Analysis - Ultimate Condition

Subbasin	Area (acres)	Q100 (cfs)	Q10 (cfs)
*NW53-CA	41.15	55	16
*DSGC	N/A	10	3
*SEV	N/A	45	13
MDI3	48.93	64	18
CPMDI3 DSGC + MDI3	N/A	72	21
MDI1	7.75	15	6
MDI2	31.76	45	13
MDI4	1.37	4	2
MDI5	1.12	4	2
MDI6	0.56	2	1
MDI7	34.60	72	29
MDI8	2.60	8	4
MDI9	0.72	3	1
MDI10	3.33	8	3
18DI1	1.00	4	2
18DI2	1.05	4	2
18DI3	4.05	9	3
18DI4	2.03	7	4
18DI5	0.57	2	1

SLATER HANIFAN GROUP
CONSULTING ENGINEERS & PLANNERS
8740 S. ARVILLE STREET #216, LAS VEGAS, NV 89118
PHONE (702) 284-5300 FAX (702) 284-5339

NO.	DESCRIPTION	DATE	BY	APP.	APP. DATE

CITY OF LAS VEGAS

RANCHO RD SYSTEM - ELKHORN (FT APACHE TO GRAND CANYON)

LOCAL HYDROLOGIC ANALYSIS - ULTIMATE CONDITIONS

DATE: MAR 2013
DRAFTER: KC
DESIGNER: KC
CHECKED: MJF
PROJECT NO. CLV1201-000

EXHIBIT I
SHEET 1 OF 1

J:\clv1201\drainage\VDS design\exhibits\clv1201 exhibit a ultimate drainage mms local.dwg 3/7/2013 10:48 AM Amy Poeckman

REFERENCE MATERIAL FROM RANCHO ROAD SYSTEM - ELKHORN (FORT APACHE TO GRAND CANYON) - BY SLATER HANIFAN GROUP

NOTE: DESIGN FLOWS IDENTIFIED FOR ELKHORN PROPOSED MAINLINE FACILITY ARE BASED ON REGIONAL HYDROLOGIC ANALYSIS. DESIGN FLOWS IDENTIFIED FOR ELKHORN EXISTING FACILITY, DROP INLET/SURFACE FLOW, AND PROPOSED STORM DRAIN LATERALS ARE BASED ON LOCAL HYDROLOGIC ANALYSIS.

LEGEND

- CFS — 100-YR SURFACE FLOW (CFS) - ELKHORN EXISTING FACILITY
- (CFS) — 100-YR DRAINAGE FACILITY FLOW (CFS) - ELKHORN EXISTING FACILITY
- CFS — 100-YR SURFACE FLOW (CFS) - ELKHORN PROPOSED FACILITY
- (CFS) — 100-YR DRAINAGE FACILITY FLOW (CFS) - ELKHORN PROPOSED FACILITY
- CFS — 100-YR SURFACE FLOW (CFS) - ELKHORN PROPOSED FACILITY (BY OTHERS)
- (CFS) — 100-YR DRAINAGE FACILITY FLOW (CFS) - ELKHORN PROPOSED FACILITY (BY OTHERS)
- EXISTING DRAINAGE FACILITY
- PROPOSED DRAINAGE FACILITY
- PROPOSED DRAINAGE FACILITY (BY OTHERS)
- REMOVE EXISTING DRAINAGE FACILITY
- (ID) — STREET SECTION

N

SCALE — 1" = 60' FEET (0, 60, 120)

GRAND CANYON DR

TEE PEE LN

ELKHORN RD

FORT APACHE RD

SEE MATCH LINE A

SEE MATCH LINE A

MDI1 SPECIAL DROP INLET "RCB" 39+07

MDI2 SPECIAL DROP INLET "RCB" 39+63

MDI3 SPECIAL DROP INLET "RCB" 40+19

MDI4 12-FT DROP INLET "RCB" 40+82

MDI5 4-FT DI "RCB" 48+52

MDI6 4-FT DI "RCB" 52+78

MDI7 17.5' MOD DM2 "RCB" 53+24

MDI8 4-FT DI "RCB" 56+25

MDI9 4-FT DI "RCB" 62+23

MDI10 22.5-FT DI "RCB" 65+36

18DI1 4-FT DI "RCB" 45+90

18DI2 4-FT DI "RCB" 53+00

18DI3 2.5-FT DI "RCB" 55+14

18DI4 2.5-FT DI "RCB" 62+44

18DI5 22.5-FT DI "RCB" 66+33

LIMIT OF ANALYSIS. TIE TO 7'X6' RCB DESIGN BY OTHERS

PLUG

SLATER HANIFAN GROUP
CONSULTING ENGINEERS & PLANNERS
5740 S. ARVILLE STREET #216, LAS VEGAS, NV 89118
PHONE (702) 284-5300 FAX (702) 284-5399

NO.	DESCRIPTION	DATE	BY	APP. PAT. APP.

CITY OF LAS VEGAS

RANCHO RD SYSTEM - ELKHORN (FT APACHE TO GRAND CANYON)
STORM DRAIN FACILITIES EXHIBIT

DATE: MAR 2013
DRAFTER: KC
DESIGNER: KC
CHECKED: MJF
PROJECT NO. CLV1201-000

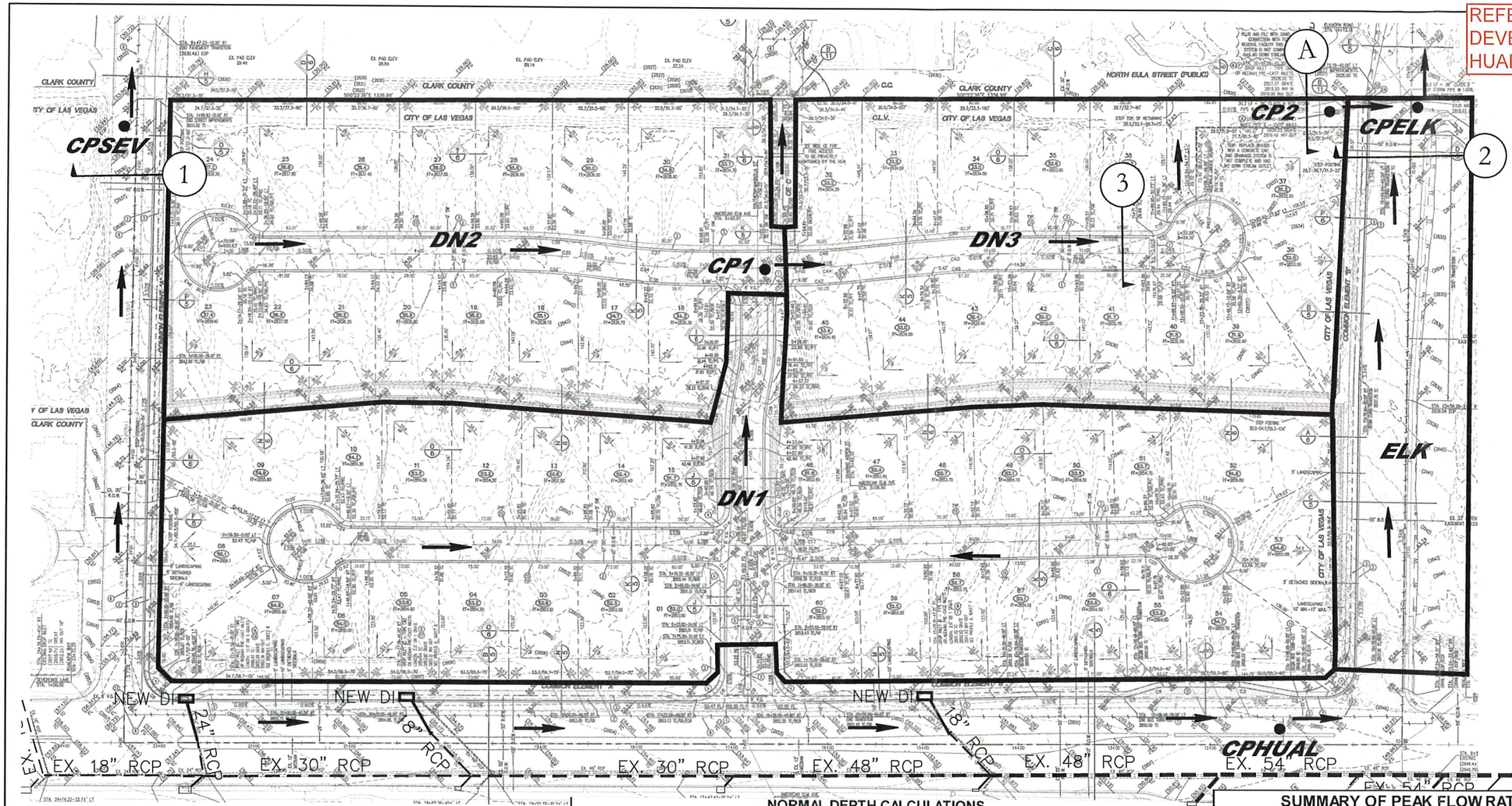
EXHIBIT J
SHEET 1 OF 1

K:\clv\1201\drainage\LTDS_exhibit\clv1201_exhibit_h_facilities_mod.dwg 3/7/2013 10:47 AM Jimmy Pederson

APPENDIX D.5
TRITON REFERENCE MATERIAL

MWH now part of Stantec

REFERENCE MATERIAL FROM HOUSING DEVELOPMENT AT CORNER OF HUALAPAI AND ELKHORN (DS#XXXXX)



DRAINAGE LEGEND

XT32	BASIN IDENTIFICATION
	BASIN BOUNDARY
CPT4	CONCENTRATION POINT
→	FLOW PATH

NOTE: 1. HYDROLOGIC SOILS GROUPS ARE NOT MAPPED, SINCE THE ENTIRE AREA STUDIED HAS HSG="B".
2. ONSITE AREA WILL EVENTUALLY HAVE LOTS AS SHOWN. HYDRAULIC CALCULATIONS AT SECTIONS A, 2, AND 3 ASSUME FUTURE BUILD-OUT CONDITIONS.

120' 0 60' 120' 240'

1 INCH = 120 FEET
CONTOUR INTERVAL = 1 FOOT

NORMAL DEPTH CALCULATIONS
DEVELOPED CONDITIONS

HYDRAULIC SECTION LABEL	DESCRIPTION	SLOPE, PERCENT	Q_{100} CFS	D_{100} NORMAL FEET	V_{100} NORMAL FEET/SEC	Weir Head FEET
A**	30-FT Drainage Esmt	0.50	43	0.45	3.8	0.61

NORMAL DEPTH FLOW CALCULATIONS

HYDRAULIC SECTION	SLOPE, %	Q_{10} / Q_{100} CFS	D_{10} / D_{100}, FEET	V_{10} / V_{100}, FPS	$V_{10} * D_{10}$ / $V_{100} * D_{100}$
1 - Severence Lane*	3.53	12 / 27	0.37 / 0.46	4.3 / 5.2	1.6 / 2.4
2 - Elkhorn Road**	3.32	19 / 47	0.42 / 0.54	4.6 / 5.5	1.9 / 3.0
3 - Onsite worst case 37' B/C**	0.50	17 / 43	0.52 / 0.67	2.2 / 3.0	1.1 / 2.0

12/3/2015

* Referenced from Technical Drainage Study for Capriana (DS3704)by Slater Hanifan Group, 2004.
**Assumes full buildout of site including 60 residential lots and onsite streets.

SUMMARY OF PEAK FLOW RATES 12/3/2015

CONC. POINT/ DRAINAGE AREA	AREA, ACRES	PEAK FLOW, CFS 10-YR	PEAK FLOW, CFS 100-YR	NOTES
DN1	7.78	8	20	3
DN2	4.75	5	12	3
CP1		12	32	3
DN3	4.50	4	11	3
CP2		17	43	3
ELK	1.39	3	6	
CPELK		19	47	3
CPSEV		12	27	1
CPHUAL		0	0	2

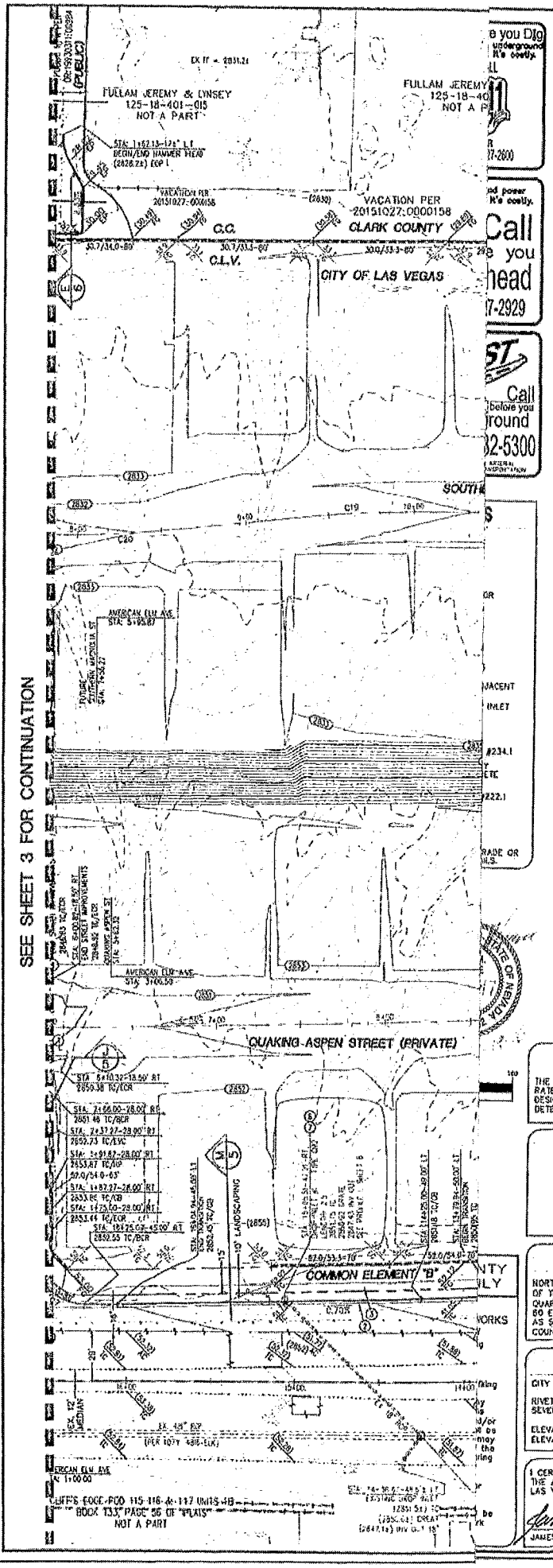
1. Referenced from Technical Drainage Study for Capriana (DS3704) by Slater Hanifan Group, 2004.
2. All flow less than the 100-year storm event is contained in the underground storm drain pipe (Q100=153 cfs). Referenced from the Master Drainage Study for Cliffs Edge, by VTN Nevada, 2004.
3. Assumes future buildout conditions of all 60 lots.

FIGURE 4

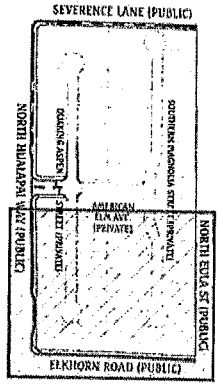
Technical Drainage Study for Hualapai & Severence

DEVELOPED CONDITIONS DRAINAGE BASINS

Triton Engineering



KEY MAP



GRADING LEGEND

- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- BOUNDARY LINE
- STREET CENTERLINE
- EDGE OF PAVEMENT
- EXISING CURB, GUTTER, & SIDEWALK
- PROPOSED CURB, GUTTER, & SIDEWALK
- PROPOSED AC PAVING
- EX. FENCE
- EX. BLOCK WALL
- PROPOSED RETAINING WALL
- 37.3/38.7-12' — TOP OF FOOTING / APPROX. WALL LENGTH / TOP OF RETAINING WALL
- PROPOSED SCARP

GRADING NOTES

1. ALL PROPOSED PAD ELEVATIONS AND SWALE ELEVATIONS ARE ROUGH GRADES. ALL OTHER PROPOSED ELEVATIONS ARE FINISHED GRADES.
2. THE GRADING PLANS SHALL BE AT THE PROJECT SITE THROUGHOUT THE COURSE OF CONSTRUCTION.
3. ALL GRADING SHALL BE PERFORMED IN CONFORMANCE WITH THE LINES, GRADES AND DETAILS AS SHOWN ON THESE PLANS. ANY DEVIATION FROM THESE PLANS WILL ONLY BE PERMITTED UPON WRITTEN APPROVAL FROM THE ENGINEER.
4. ALL PADS ARE TO BE GRADED WITHIN ±0.3' OF THE ELEVATIONS AS SHOWN ON THE PLANS. GRADING IS NOT COMPLETE UNTIL THE ENGINEER HAS CERTIFIED THAT THE PADS HAVE BEEN GRADED IN SUBSTANTIAL CONFORMANCE TO THE PLANS.
5. ALL PLACEMENT OF OVERSIZED MATERIALS AND/OR FILL MATERIALS SHALL BE PER THE SOILS REPORT REFERENCED ON THIS PLAN.
6. ADD 2700 TO ALL SPOT GRADES AND TOP OF CURB, FLOW LINE AND FINISH GRADE ELEVATIONS.
7. ALL PRIVATE STREETS ARE P.U.E., PUBLIC SEWER EASEMENTS AND PUBLIC DRAINAGE EASEMENTS TO BE PRIVATELY MAINTAINED BY THE HOA.
8. ANY CURVED CURB LESS THAN 1% MUST BE WATER TESTED BY CONTRACTOR AS REQUIRED BY CITY INSPECTOR.

FLOOD ZONE NOTE

THE PROJECT SITE IS LOCATED ON FEMA FLOOD INSURANCE RATE MAP #32003C2145 F. THE SITE IS LOCATED WITHIN DESIGNATED FLOOD HAZARD ZONE 'X' BEING AN AREA DETERMINED TO BE OUTSIDE THE 100 YEAR FLOOD PLAIN.

SOILS INFORMATION

1. SOILS REPORT BY: GEOTEK RESIDENTIAL, LLC
   PROJECT No. 12163-LVR
   DATED: 12/11/14
2. CUT TOTAL: 73,384 C.Y.
   FILL TOTAL: 54,096 C.Y.
   NET: 19,288 C.Y. (CUT)

BASIS OF BEARING

NORTH 89°07'00" WEST, BEING THE BEARING OF THE SOUTH LINE OF THE SOUTHWEST QUARTER (SW 1/4) OF THE SOUTHWEST QUARTER (SW 1/4) OF SECTION 18, TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.D.M., CITY OF LAS VEGAS, CLARK COUNTY, NEVADA, AS SHOWN ON THAT CERTAIN MAP ON FILE IN THE CLARK COUNTY RECORDER'S OFFICE IN BOOK 146, PAGE 17 OF PLATS.

BENCHMARK

CITY OF LAS VEGAS BENCHMARK STATION: 6LV90 105WW6

RIVET & PLATE ON TOP OF CURB AT THE NORTHEAST CORNER OF SEVERENCE LANE AND HUALAPAI WAY.

ELEVATION=870.872 Meters (NAVD'88)
ELEVATION=2857.19 U.S. Survey Feet (NAVD'88)

I CERTIFY THAT THIS GRADING PLAN IS IN CONFORMANCE WITH THE APPROVED DRAINAGE STUDY ON FILE AT THE CITY OF LAS VEGAS FOR THIS PROJECT. #DS4745 & HTE #15-64198

James M. Pearce 1-27-16
JAMES M. PEARCE, PE No. 9552 DATE: 1/27/2016

NO	DESCRIPTION	DATE	APP'D
1	PER CITY AND TRI-STATE COMMENTS	1/27/16	

DATE 10/29/2015
PM J. PEARCE
DRAWN BY
DESIGNED BY
CHECKED BY
ADA CHECKED
JOB NO 107.026
SCALE 1" = 30'

Triton Engineering
6757 W. Charleston Blvd.
Suite B
Las Vegas, Nevada 89146
Office (702) 254-1480
Fax (702) 254-3062
www.tritoneng.com

DR HORTON
HUALAPAI / SEVERENCE
GRADING PLAN II

PROFESSIONAL ENGINEER - STATE OF NEVADA
JAMES M. PEARCE
Exp. 12-31-17
CIVIL
No. 9552
1-27-16

SHEET 4 OF 28
C.L.V. DWG.# 107V6546

G:\Triton Drawings\107.026 Hualapai-Farm\Drawings\Improvements\01_Grading_107.026_Imp.dwg plotted: Wed, 27 Jan 2016 - 4:26pm

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL - STANDARD FORM 4

Momentum Engineers, Ltd.
6101 Kings Brook Ct.
Las Vegas NV 89149

Sub-Basin Data					Initial/Overland Time (T_i)			Travel Time (T_t)					T_c	T_c Check (Urbanized Basins)		Final T_c	T_{lag}	Remarks
DESIG	CN	K	AREA (acres)	AREA (mi^2)	LENGTH (ft)	SLOPE (%)	T_i (min)	LENGTH (ft)	SLOPE (%)	V_1 (fps)	V_2 (fps)	T_t (min)	$T_c=T_i+T_t$ (min)	TOTAL (ft)	T_c (min)	T_c (min)	T_{lag} (hrs)	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
DEVELOPED CONDITION																		
DN1	87	0.758	7.78	0.0122	110	1.0	6.4	720	1.2	2.2	3.3	5.0	11.4	830	14.6	11.4	0.114	
DN2	87	0.758	4.75	0.0074	110	1.0	6.4	570	0.5	1.0	2.2	8.9	15.3	680	13.8	13.8	0.138	
DN3	87	0.758	4.50	0.0070	110	1.0	6.4	440	0.5	1.4	N/A	5.1	11.6	550	13.1	11.6	0.116	
ELK	98	0.904	1.39	0.0022	44	2.0	1.9	600	3.3	3.7	5.6	2.6	4.4	644	13.6	4.4	0.050	
UNDEVELOPED CONDITION																		
EN1	77	0.63	11.29	0.0176	200	3.9	7.7	550	3.9	2.9	5.8	3.0	10.7	N/A	N/A	10.7	0.107	
EN2	77	0.63	9.30	0.0145	200	4.1	7.5	550	4.1	3.0	6.0	2.9	10.5	N/A	N/A	10.5	0.105	

$T_i=(1.8(1.1-K)L^{1/2})/(S^{1/3})$

$T_c=T_i+T_t$

$K=0.0132(CN)-.39$

$T_{lag}=0.6T_c$

For the travel time (T_t) calculations,
V_1 applies to the first 500 feet of travel distance;
V_2 applies to the remaining travel distance.

Travel Time Velocity Formulas

Existing	Developed
$V_1 = 14.8*(S/100)^{1/2}$	$V_1 = 20.2*(S/100)^{1/2}$
$V_2 = 29.4*(S/100)^{1/2}$	$V_2 = 30.6*(S/100)^{1/2}$

All basins over one square mile are calculated by the equation
$T_{lag}=20Kn(L*L_c/S^{0.5})^{0.33}$
(SEE SEPARATE SPREADSHEET)

REFERENCE: CCRFCD HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

STANDARD FORM 4

CURVE NUMBER DETERMINATION*

HUALAPAI & SEVERENCE

7/23/2015 BY B.BROWN

BASIN	HYDROLOGIC SOIL GROUP	LAND USE	CURVE NUMBER	PERCENT OF TOTAL	FINAL CN	REMARKS
DN1, DN2, DN3	B	20,000 SF LOTS RESIDENTIAL	87	100	87	TABLE 602A,
EN1 EN2	B	DESERT SHRUB	77	100	77	Table 602, 4 of 4 Semiarid Rangeland
ELK	ANY	PAVED AREAS	98	100	98	Table 602, 1 of 4 Urban districts

*Based on Clark County Regional Flood Control District Hydrologic Criteria and Drainage Design Manual, Latest update.

```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *               JUN  1998               *
 *            VERSION 4.1                *
 *                                       *
 *  RUN DATE   23JUL15  TIME  13:03:55   *
 *                                       *
 *****************************************
```

```
*****************************************
*                                       *
*    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
XXXXXXX  XXXX     X        XXXXX  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     EXISTING AND DEVELOPED CONDITIONS MODEL
    3         ID     HUALAPAI SEVERENCE
    4         ID     MOMENTUM ENGINEERS FOR TRITON ENG - B BROWN
    5         ID
    6         ID
    7         ID     6-HOUR STORM DISTRIBUTION #3
    8         ID     10- AND 100-YEAR STORM EVENTS
    9         ID     NO REDUCTION FOR DEPTH AREA
   10         ID     NO HYDROGRAPH ROUTING LOSSES
   11         ID
   12         IT       5       0       0     300
   13         IO       5       0       0
   14         IN       5       0       0
   15         JR    PREC    0.55       1

   16         KK     EN1
   17         KM              <<<<<<<<<<<<<<EXISTING CONDITIONS>>>>>>>>>>>>>>>>>>>
   18         BA    .0176
   19         PB    3.15
   20         KM             SDN #3
```

```
 21          PC   0.000   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
 22          PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
 23          PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
 24          PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
 25          PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
 26          PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
 27          PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
 28          PC   0.998   0.999   1.000
 29          LS      0      77
 30          UD   0.107
             *

 31          KK     EN2
 32          BA   .0145
 33          LS      0      77
 34          UD   0.105
             *

 35          KK     DN1
 36          KM           <<<<<<<<<<<<<<DEVELOPED CONDITIONS>>>>>>>>>>>>>>>>>>
 37          BA   .0122
 38          LS      0      87
 39          UD   0.114
             *

 40          KK     DN2
 41          BA   .0074
 42          LS      0      87
 43          UD   0.138
             *
```

1 HEC-1 INPUT PAGE 2

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

 44          KK     CP1
 45          HC       2
             *

 46          KK     DN3
 47          BA   .0070
 48          LS      0      87
 49          UD   0.116
             *

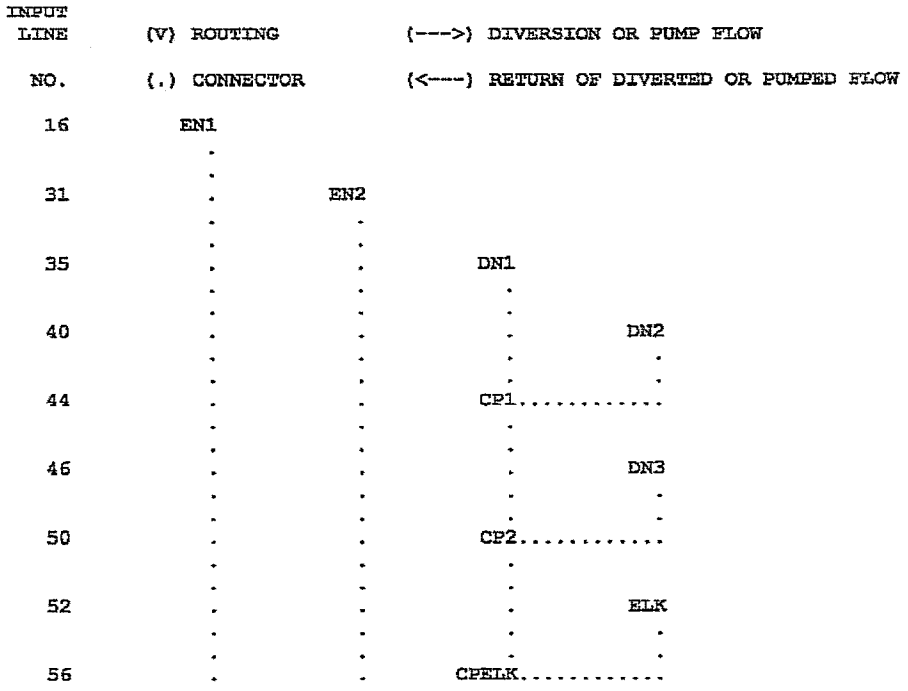
 50          KK     CP2
 51          HC       2
             *

 52          KK     ELK
 53          BA   .0022
 54          LS      0      98
 55          UD   0.050
             *

 56          KK   CPELK
 57          HC       2
             *
 58          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               JUN  1998               *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   23JUL15  TIME  13:03:55   *
*                                       *
*****************************************
```

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

EXISTING AND DEVELOPED CONDITIONS MODEL
HUALAPAI SEVERENCE
MOMENTUM ENGINEERS FOR TRITON ENG - B BROWN

6-HOUR STORM DISTRIBUTION #3
10- AND 100-YEAR STORM EVENTS
NO REDUCTION FOR DEPTH AREA
NO HYDROGRAPH ROUTING LOSSES

13 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
                .55      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

                                                                RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION      AREA    PLAN                 RATIO 1  RATIO 2
                                                              .55      1.00

  HYDROGRAPH AT
+                   EN1        .02     1   FLOW              5.       19.
                                           TIME            3.58     3.58

  HYDROGRAPH AT
+                   EN2        .01     1   FLOW              4.       16.
                                           TIME            3.58     3.58

  HYDROGRAPH AT
+                   DN1        .01     1   FLOW              8.       20.
                                           TIME            3.58     3.58

  HYDROGRAPH AT
+                   DN2        .01     1   FLOW              5.       12.
                                           TIME            3.58     3.58

    2 COMBINED AT
+                   CP1        .02     1   FLOW             12.       32.
```

				TIME	3.58	3.58
HYDROGRAPH AT						
+	DN3	.01	1	FLOW	4.	11.
				TIME	3.58	3.58
2 COMBINED AT						
+	CP2	.03	1	FLOW	17.	43.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	ELK	.00	1	FLOW	3.	6.
				TIME	3.50	3.50
2 COMBINED AT						
+	CPELK	.03	1	FLOW	19.	47.
				TIME	3.58	3.50

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

HYDRAULICS

Worksheet for 36" pipe normal depth at 43 cfs

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.014	
Channel Slope	1.00	%
Diameter	3.00	ft
Discharge	43.00	ft³/s

Results

Normal Depth	1.84	ft
Flow Area	4.54	ft²
Wetted Perimeter	5.40	ft
Hydraulic Radius	0.84	ft
Top Width	2.92	ft
Critical Depth	2.14	ft
Percent Full	61.3	%
Critical Slope	0.00658	ft/ft
Velocity	9.46	ft/s
Velocity Head	1.39	ft
Specific Energy	3.23	ft
Froude Number	1.34	
Maximum Discharge	66.62	ft³/s
Discharge Full	61.93	ft³/s
Slope Full	0.00482	ft/ft
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
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	61.32	%
Downstream Velocity	Infinity	ft/s

Worksheet for Sec 2 - Elkhorn Road 10yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03320	ft/ft
Discharge	19.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+50.00	1.03
0+93.00	0.17
0+93.00	0.13
0+94.50	0.00
0+94.50	0.50
0+95.00	0.50
1+00.00	0.60

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(1+00.00, 0.60)	0.016

Options

Current Roughness Weighted Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Worksheet for Sec 2 - Elkhorn Road 10yr

Results

Normal Depth		0.42	ft
Elevation Range	0.00 to 1.03 ft		
Flow Area		4.11	ft²
Wetted Perimeter		28.63	ft
Hydraulic Radius		0.14	ft
Top Width		27.70	ft
Normal Depth		0.42	ft
Critical Depth		0.53	ft
Critical Slope		0.00678	ft/ft
Velocity		4.63	ft/s
Velocity Head		0.33	ft
Specific Energy		0.75	ft
Froude Number		2.12	
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	0.42	ft
Critical Depth	0.53	ft
Channel Slope	0.03320	ft/ft
Critical Slope	0.00678	ft/ft

Cross Section for Sec 2 - Elkhorn Road 10yr

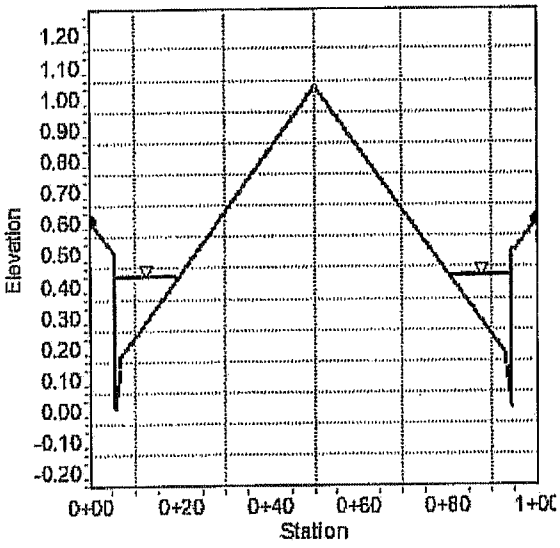
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03320	ft/ft
Normal Depth	0.42	ft
Discharge	19.00	ft³/s

Cross Section Image



Worksheet for Sec 2 - Elkhorn Road 100yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03320	ft/ft
Discharge	47.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+50.00	1.03
0+93.00	0.17
0+93.00	0.13
0+94.50	0.00
0+94.50	0.50
0+95.00	0.50
1+00.00	0.60

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(1+00.00, 0.60)	0.016

Options

Current Roughness Weighted Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Cross Section for Sec 2 - Elkhorn Road 100yr

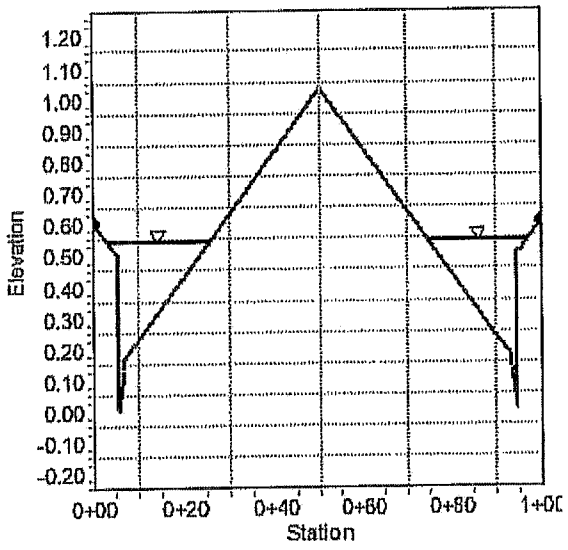
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03320	ft/ft
Normal Depth	0.54	ft
Discharge	47.00	ft³/s

Cross Section Image

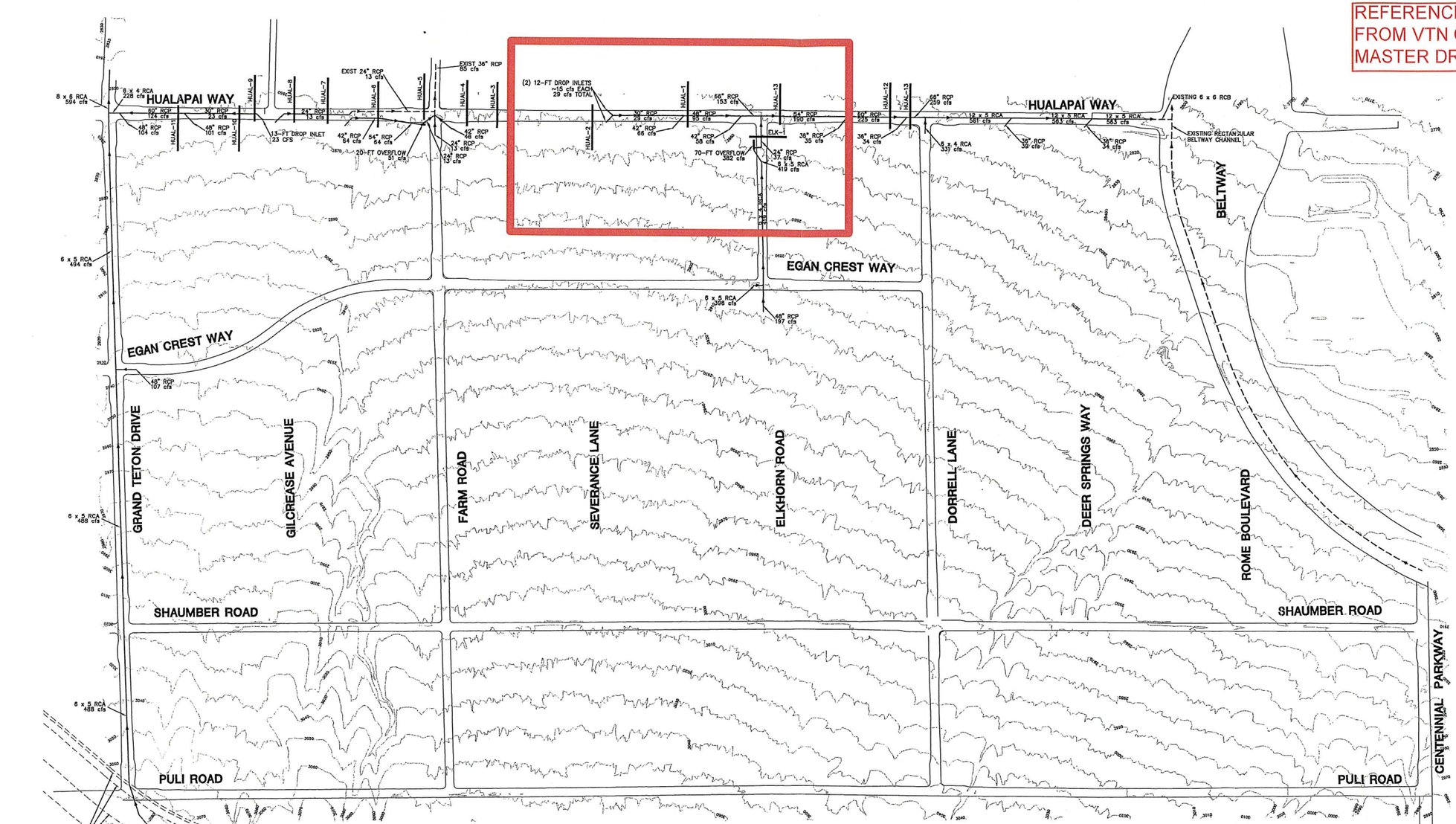


APPENDIX D.6
VTN REFERENCE MATERIAL

MWH now part of Stantec

THIS PAGE WAS INTENTIONALLY LEFT BLANK

REFERENCE MATERIAL
FROM VTN CLIFF'S EDGE
MASTER DRAINAGE STUDY



PHASE 1 FLOWMASTER SECTIONS

DESCRIPTION			ROW	SLOPE	FLOW		DEPTH		VELOCITY		V * D		Q10 Dry Lane
LABEL	BEG	END	(ft)	(%)	Q10	Q100	D10	D100	V10	V100	10-YR	100-YR	(ft)
HUAL-1	63+61.	76+98.	100	0.55	0	15	0.00	0.49	0.00	2.40	0.0	1.2	50
HUAL-2	76+98.	83+70.	100	0.57	0	15	0.00	0.48	0.00	2.43	0.0	1.2	50
HUAL-3	83+70.	88+00.	100	0.50	0	15	0.00	0.49	0.00	2.31	0.0	1.1	50
HUAL-4	88+00.	89+15.	100	1.01	0	15	0.00	0.44	0.00	3.07	0.0	1.4	50
HUAL-5	91+55.	93+16.	100	1.27	0	66	0.00	0.67	0.00	4.22	0.0	2.8	50
HUAL-6	93+16.	98+66.	100	0.50	0	15	0.00	0.49	0.00	2.31	0.0	1.1	50
HUAL-7	98+66.	102+00.	100	1.36	0	15	0.00	0.42	0.00	3.47	0.0	1.5	50
HUAL-8	102+00.	104+50.	100	1.28	0	37	0.00	0.58	0.00	3.63	0.0	2.1	50
HUAL-9	104+50.	106+70.	100	1.28	0	14	0.00	0.42	0.00	3.35	0.0	1.4	50
HUAL-10	106+70.	109+17.	100	0.60	0	14	0.00	0.47	0.00	2.45	0.0	1.2	50
HUAL-11	109+17.	115+00.	100	0.40	0	14	0.00	0.51	0.00	1.96	0.0	1.0	50
HUAL-12	50+54.	61+79.	100	1.40	0	132	0.00	0.80	0.00	5.34	0.0	4.3	50
HUAL-13	61+79.	62+79.	100	0.73	0	132	0.00	0.88	0.00	4.22	0.0	3.7	50
ELK-1	61+00.	64+00.	100	3.68	100	382	0.62	0.88	6.53	9.77	4.0	8.6	21

LEGEND

36" RCP.....36-INCH DIAMETER REINFORCED CONCRETE PIPE
8 x 6 RCB.....8-ft SPAN by 6-ft RISE REINFORCED CONCRETE BOX
6 x 4 RCA.....6-ft SPAN by 4-ft RISE REINFORCED CONCRETE ARCH
190 CFS.....FLOW CONVEYED BY STORM DRAIN DURING 100-YEAR STORM
STORM DRAIN LOCATION AND FLOW DIRECTION
HUAL-1 FLOWMASTER SECTION LOCATION AND DESCRIPTION

HLMON

GRAPHIC SCALE
0 100 200 400 800

This grading plan is a part of drainage study # 3576 which was received on 7/8/04 and rejected on 7/21/04. Page 5 of 6

CLIFFS EDGE
STORM DRAIN AND FLOWMASTER EXHIBIT
PHASE 1

J:\5969-CLIFFS EDGE\5969-SD-EXHIBIT.dwg, 06/25/2004 11:15:02 AM, TDS6000BOND.pc3

DEPARTMENT OF PUBLIC WORKS

Mayor:
CAROLYN G. GOODMAN

City Council:
STEVEN D. ROSS (Mayor Pro-Tem)
LOIS TARKANIAN
RICKI Y. BARLOW
STAVROS S. ANTHONY
BOB COFFIN
BOB BEERS

City Manager:
SCOTT ADAMS

Director of Public Works:
DAVID N. BOWERS, P.E., P.T.O.E.

City Engineer:
ALLEN E. PAVELKA, P.E.

Funded By:
CLARK COUNTY REGIONAL
FLOOD CONTROL DISTRICT

RANCHO ROAD SYSTEM STORM DRAIN - ELKHORN

30% DESIGN SUBMITTAL (NOT FOR CONSTRUCTION)

Reviewed By:

CLV CITY ENGINEER DATE

CLV PROJECT MANAGER DATE

CLV CITY TRAFFIC ENGINEER DATE

CLV CONSTRUCTION MANAGER DATE

CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT DATE

REGIONAL TRANSPORTATION COMMISSION OF SOUTHERN NEVADA DATE

SOUTHWEST GAS CORPORATION DATE

CENTRAL TELEPHONE COMPANY d/b/a CENTURYLINK DATE
THE AFFIXED CENTURYLINK NEVADA APPROVAL DOES NOT ASSUME OR GUARANTEE LIABILITY FOR KNOWN OR UNKNOWN CONFLICTS WITH EXISTING OR PROPOSED IMPROVEMENTS. RESOLUTION OF ANY CONFLICT WILL BE ACCOMPLISHED PURSUANT TO LOCAL ORDINANCES, NEVADA REVISED STATUTES AND/OR PUBLIC UTILITY COMMISSION STANDARD REGULATIONS.

COX COMMUNICATIONS LAS VEGAS, INC. DATE

NV ENERGY – DISTRIBUTION DATE
NV ENERGY ACKNOWLEDGES THAT WE HAVE RECEIVED YOUR PLANS AND WILL PROVIDE SERVICE TO ALL ELECTRICAL NEEDS ASSOCIATED WITH THIS PROJECT. NV ENERGY RESERVES THE RIGHT TO ADDRESS ANY EXISTING OR FUTURE CONFLICTS ONCE THE FINAL DESIGN IS COMPLETED. THE NEW SERVICE AND THE RESOLUTION OF ANY CONFLICTS WILL BE ACCOMPLISHED PURSUANT TO THE NEVADA PUBLIC UTILITY COMMISSION'S RULES AND REGULATIONS.

NV ENERGY - TRANSMISSION DATE

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
DATE: PROJECT# XXXXX
SHEETS: CV, GN, ...

THE SIGNATURE ABOVE ACKNOWLEDGES THAT THE UTILITY COMPANY REPRESENTATIVE HAS REVIEWED THE PLANS, AND THAT TO THE BEST OF HIS OR HER KNOWLEDGE THE UTILITY LINES ARE SHOWN IN THE CORRECT LOCATIONS AND ARE THE CORRECT SIZES. WHILE SUCH DATA HAS BEEN COLLECTED WITH REASONABLE CARE, THERE IS NO EXPRESSED OR IMPLIED GUARANTEE THAT THE LOCATIONS ARE EXACT. THE CONTRACTOR SHALL BEAR THE RESPONSIBILITY OF OBTAINING THE ACTUAL FIELD LOCATIONS.

THE SIGNATURE ABOVE FURTHER ACKNOWLEDGES THAT THE UTILITY COMPANY DOES NOT ANTICIPATE CONSTRUCTION OR MAINTENANCE IN THE PROJECT AREA FOR FIVE (5) YEARS IN CONFORMANCE WITH THE CLV NO-CUT POLICY.

NO.	DATE	SHEET	REVISIONS

PREPARED BY
Stantec
3010 W. CHARLESTON BLVD.
SUITE 100
LAS VEGAS, NV 89102

PREPARED FOR
CITY OF LAS VEGAS

H# 170149 | BID# XX-XXXXX | DESIGNED BY: RVV
DATE: JULY 2017 | DRAWN BY: ED
SUBMITTAL STAGE: 30% - PRELIMINARY | CHECKED BY: XXX

TITLE
RANCHO ROAD SYSTEM
STORM DRAIN - ELKHORN

SHEET
GENERAL
COVER SHEET

NOT FOR CONSTRUCTION

SHEET
CV
1 OF 22
DRAWING NO.
XXX-XXXX

C:\PWWORKDIR\D0324288\JH170149-CV.DWG
7/5/17

CITY OF LAS VEGAS GENERAL NOTES

1. ALL CONSTRUCTION AND MATERIALS SHALL BE IN ACCORDANCE WITH THE "UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA NEVADA", LATEST ISSUE; THE "UNIFORM STANDARD DRAWINGS FOR PUBLIC WORKS CONSTRUCTION, CLARK COUNTY AREA NEVADA", LATEST REVISED EDITION; THE "SUMMERLIN IMPROVEMENT STANDARDS" FOR WORK IN THE SUMMERLIN AREA; AND OTHER APPLICABLE APPROVED STANDARDS ISSUED BY THE CONTROLLING AGENCY; THE UNIFORM BUILDING CODE; AND ALL LOCAL CITY CODES AND ORDINANCES APPLICABLE, EXCEPT AS NOTED ON THIS SHEET AS "DEVIATIONS FROM STANDARDS".

   THE EXISTENCE AND LOCATION OF ANY OVERHEAD OR UNDERGROUND UTILITY LINES, PIPES, OR STRUCTURES SHOWN ON THESE PLANS ARE OBTAINED BY A RESEARCH OF THE AVAILABLE RECORDS. EXISTING UTILITIES AS SHOWN FROM CLV PLANS LIBRARY ARE APPROXIMATE AND FOR RECORD PURPOSES. EXISTING UTILITIES ARE LOCATED ON PLANS ONLY FOR THE CONVENIENCE OF THE CONTRACTOR. EXISTING UTILITY SERVICE LATERALS MAY NOT BE SHOWN ON THE PLANS. THE CONTRACTOR SHALL, AT HIS OWN EXPENSE, LOCATE ALL UNDERGROUND AND OVERHEAD INTERFERENCE WHICH MAY AFFECT HIS OPERATION DURING CONSTRUCTION AND SHALL TAKE ALL NECESSARY PRECAUTIONS TO AVOID DAMAGE TO SAME. THE CONTRACTOR SHALL USE EXTREME CAUTION WHEN WORKING NEAR OVERHEAD UTILITIES SO AS TO SAFELY PROTECT ALL PERSONNEL AND EQUIPMENT, AND SHALL BE RESPONSIBLE FOR ALL COST AND LIABILITY IN CONNECTION THEREWITH.

3. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT EXISTING UTILITY LINES, STRUCTURES AND STREET IMPROVEMENTS WHICH ARE TO REMAIN IN PLACE, FROM DAMAGE, AND ALL SUCH IMPROVEMENTS OR STRUCTURES DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED OR REPLACED SATISFACTORY TO THE CITY ENGINEER OR OWNING UTILITY COMPANY AT THE EXPENSE OF THE CONTRACTOR.

4. ALL CONSTRUCTION SHALL BE AS SHOWN ON THESE PLANS, ANY REVISIONS SHALL HAVE THE PRIOR WRITTEN APPROVAL OF THE CITY ENGINEER.

5. TYPE V CEMENT SHALL BE USED IN ALL OFF-SITE CONCRETE WORK. CONCRETE TO BE 3000 P.S.I. MINIMUM @ 28 DAYS. MIX DESIGN TO BE APPROVED BY THE QUALITY CONTROL DIVISION, PRIOR TO THE USE ON THE PROJECT.

6. PERMITS ARE REQUIRED FOR ANY WORK IN THE PUBLIC RIGHT-OF-WAY. THE CONTRACTOR SHALL SECURE ALL PERMITS AND INSPECTIONS REQUIRED FOR THIS CONSTRUCTION.

7. EXPANSION JOINTS REQUIRED, MAXIMUM EVERY 300' IN EXTRUDED-TYPE CURB.

8. AC PAVEMENT TO BE 1/2" ABOVE LIP OF ALL GUTTERS AFTER COMPACTION, EXCEPT AT SIDEWALK RAMPS.

9. CURB AND GUTTER WITH A GRADE OF LESS THAN FOUR-TENTHS OF ONE PERCENT SHALL BE WATER-TESTED AS SOON AS POSSIBLE AFTER CONSTRUCTION. ANY CURB AND GUTTER FOUND TO BE UNACCEPTABLE TO THE CITY SHALL BE REMOVED AND REPLACED PER USD 216.

10. SIDEWALK RAMPS SHALL BE CONSTRUCTED IN EACH QUADRANT OF AN INTERSECTION PER USD 235, CASE I. EXACT LOCATION OF RAMPS MAY BE ADJUSTED IN THE FIELD BY A CITY PROJECT REPRESENTATIVE.

11. CONTRACTOR SHALL PROVIDE ALL NECESSARY HORIZONTAL AND VERTICAL TRANSITIONS BETWEEN NEW CONSTRUCTION AND EXISTING SURFACES TO PROVIDE FOR PROPER DRAINAGE AND FOR INGRESS AND EGRESS TO NEW CONSTRUCTION. THE EXTENT OF TRANSITIONS TO BE AS SHOWN ON PLANS, OR AS DESIGNATED IN THE FIELD BY CITY PROJECT REPRESENTATIVE.

    EXACT LOCATION OF ALL SAWCUT LINES MAY BE DETERMINED IN THE FIELD BY A CITY PROJECT REPRESENTATIVE IF LOCATION ON PLANS IS NOT CLEARLY SHOWN, OR EXISTING PAVEMENT CONDITION REQUIRES RELOCATIONS.

13. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY TO PROTECT EXISTING PERMANENT SURVEY MONUMENTS. ANY MONUMENTS DISTURBED SHALL BE REPLACED, AND SHALL BE DONE ONLY BY A NEVADA PROFESSIONAL LAND SURVEYOR IN ACCORDANCE WITH THE UNIFORM STANDARD DRAWINGS - CLARK COUNTY AREA. A RECORD-OF-SURVEY FOR REPLACEMENT OF PERMANENT SURVEY MONUMENTS SHALL BE SUBMITTED TO THE CITY ENGINEER FOR APPROVAL PRIOR TO RECORDING. THE RECORD-OF-SURVEY SHALL BE PREPARED IN ACCORDANCE WITH NEVADA REVISED STATUTES 625.350.

14. UTILITY COMPANY METER BOXES, MANHOLE LIDS, VALVE COVERS, ETC., SHALL BE LOCATED OUT OF DRIVEWAYS, DRIVEWAY APRONS, FLOWLINES, AND CROSS GUTTERS UNLESS WRITTEN APPROVAL IS GRANTED BY THE AFFECTED UTILITY COMPANY AND THE CITY ENGINEER.

15. ALL WALLS, NEW OR EXISTING, ARE ONLY SHOWN ON CIVIL PLANS FOR THE PURPOSE OF REVIEWING GRADING RELATIONSHIPS; FLOOD CONTROL AND SIGHT DISTANCE AT INTERSECTIONS. NEW WALLS REQUIRE A SEPARATE PERMIT AND INSPECTION BY THE CLV BUILDING DEPARTMENT.

16. ASPHALT MIX DESIGN MUST BE SUBMITTED AND APPROVED BY THE CITY ENGINEER PRIOR TO THE PLACEMENT OF ASPHALT WITHIN CITY RIGHTS OF WAY.

17. CONTRACTOR SHALL ADJUST ALL NEW AND EXISTING INLETS, VALVE BOXES, MANHOLE RIMS, SEWER CLEANOUTS, ETC. TO FINISH GRADE AS APPLICABLE WHETHER OR NOT THEY ARE SHOWN ON THE PLANS.

18. MATERIALS, HANDLING AND PLACEMENT OF PORTLAND CEMENT CONCRETE SHALL BE IN ACCORDANCE WITH APPLICABLE SECTIONS OF NDOT AND CLARK COUNTY AREA SPECIFICATIONS (AS APPLICABLE) AND THE PLANS AND DETAILS SHOWN HEREON.

19. WHEN INSTALLING UNDERGROUND FACILITIES THAT REQUIRE UNDERGROUND LOCATING DEVICES SUCH AS MARKER BALLS, LOCATING RIBBON, ETC, THE CONTRACTOR SHALL PROVIDE WRITTEN DOCUMENTATION TO THE ENGINEER CERTIFYING THAT ALL DEVICES HAVE BEEN PLACED AND VERIFIED TO BE IN GOOD WORKING CONDITION PRIOR TO THE CONSTRUCTION OF ANY ROAD BASE.

20. NEWLY INSTALLED AND EXISTING UTILITIES EXPOSED DURING CONSTRUCTION SHALL BE SURVEYED AND DOCUMENTED PER SECTION 622 OF THE SPECIAL PROVISIONS.

21. CCTV VIDEO INSPECTION IS REQUIRED FOR ALL SEWER AND STORM DRAINS. THE CCTV VIDEO INSPECTIONS NEED TO BE PERFORMED PER THE DESIGN AND CONSTRUCTION STANDARDS FOR WASTEWATER COLLECTION SYSTEMS LATEST ADDITION.

22. A SEPARATE BORING PERMIT IS REQUIRED FOR ALL BORING ACTIVITIES.

:D JULY 23, 2015 (CPM VERSION)

RTC/FAST NOTES

1. CONTRACTOR IS TO MAINTAIN AND KEEP OPERATIONAL ALL EXISTING ITS INFRASTRUCTURE WITHIN THE CONSTRUCTION LIMITS. IF ANY EXISTING ITS INFRASTRUCTURE IS DAMAGED DUE TO CONSTRUCTION, WITHIN THE PROJECT LIMITS, THE CONTRACTOR SHALL IMMEDIATELY CONTACT MR. JESUS "CHUY" MARMOLEJO (RTC/FAST MANAGER TRAFFIC SYSTEMS MAINTENANCE) AT (702) 804-7078.

ABBREVIATIONS

@	AT	IRR	IRRIGATION
AB	ABANDONED	L	LENGTH
AC	ASPHALTIC CONCRETE	LF	LINEAL FOOT, LINEAR FEET
ACP	ASBESTOS CEMENT PIPE	LT	LEFT
AEP	AUTHORIZATION TO ENTER PROPERTY	LVWD	LAS VEGAS VALLEY WATER DISTRICT
APPROX	APPROXIMATE	MH	MANHOLE
AVAR	AIR VALVE ASSEMBLY	MLCP	MULTI-LAYER COMPOSITE PIPE
B/C, BC	BACK OF CURB	MTR	METER
BCR	BACK OF CURB RADIUS	NDOT	NEVADA DEPT OF TRANSPORTATION
BM	BENCHMARK	NTS	NOT TO SCALE
BOT	BOTTOM	NVE	NV ENERGY
BR	BACK OF RAMP	OHP	OVERHEAD POWER LINE
C & G	CURB AND GUTTER	OHU	OVERHEAD UTILITIES
CALCD	CALCULATED	PB	PULL BOX
CATV, TV	CABLE TELEVISION	PC	POINT OF CURVATURE
CC	CLARK COUNTY	P.I.P.	PROTECT IN PLACE
CCPW	CLARK COUNTY PUBLIC WORKS	PP	POWER POLE
CIPP	CURED-IN-PLACE PIPE	PRC	POINT OF REVERSE CURVE
℄, CL	CENTERLINE	PT	POINT OF TANGENCY
CLSM	CONTROLLED LOW STRENGTH MATERIAL	ℙ, PL	PROPERTY LINE
CLV	CITY OF LAS VEGAS	R RADIUS	RT RIGHT
CMP	CORRUGATED METAL PIPE	R/W, R.O.W.	RIGHT OF WAY
CONC	CONCRETE	SCCP	STEEL CYLINDER CONCRETE PIPE
COND	CONDUCTOR	SD	STORM DRAIN
CPM	CAPITAL PROJECT MANAGEMENT	SF	SQUARE FOOT
D, DIA	DIAMETER	SP	SPECIAL PROVISIONS
DCSWCS	DESIGN & CONSTRUCTION STDS FOR WASTEWATER COLLECTION SYSTEMS	SS	SANITARY SEWER
		STA.	STATION
DG	DECOMPOSED GRANITE	STD	STANDARD
DI	DROP INLET	STL	STREET LIGHT
DIP	DUCTILE IRON PIPE	SV	SPRINKLER VALVE
DRH	DR HORTON	S/W	SIDEWALK
D/W	DRIVEWAY	SWG	SOUTHWEST GAS
DWG	DRAWING	SY	SQUARE YARD
ECR	END OF CURB RETURN (AT B/C)	T, TEL	TELEPHONE
ELEC	ELECTRIC	TC	TOP OF CURB
ELEV	ELEVATION	TCE	TEMP. CONSTRUCTION EASEMENT
EOP, EP	EDGE OF PAVEMENT	TEMP.	TEMPORARY
EX.	EXISTING	TRANS.	TRANSITION
FAST	FREEWAY & ARTERIAL SYSTEM OF TRANSPORTATION (INTERCONNECT)	TRC	TOP OF RAMP CURB
		TS	TRAFFIC SIGNAL
FC	FACE OF CURB	TYP.	TYPICAL
FD	FOUND	UDACS	UNIFORM DESIGN & CONSTRUCTION STDS FOR POTABLE WATER DISTRIBUTION SYSTEMS
FG	FINISHED GRADE		
FH, HYD	FIRE HYDRANT		
FT	FOOT, FEET	USD	UNIFORM STANDARD DRAWING
G	GAS	USS	UNIFORM STD SPECIFICATIONS
GM	GAS METER	W	WATER LINE
GV	GAS VALVE	WC	WHEEL CHAIR
GW	GUY WIRE	WM	WATER METER
HP	HIGH PRESSURE	WV	WATER VALVE
INT	INTERSECTION	W/	WITH
		Δ	INCLUDED DELTA ANGLE

RTC NOTES

1. THE CONTRACTOR SHALL NOT BE ALLOWED TO CLOSE MORE THAN ONE CONSECUTIVE BUS STOP ON THE SAME SIDE OF THE STREET, TEMPORARY CLOSURES SHALL BE PWD (PERSONS WITH DISABILITY) ACCESSIBLE BEFORE ANY BUS STOP CAN BE CLOSED. THE CONTRACTOR SHALL NOTIFY CARL SCARBROUGH AT (702) 676-1609 OR ERIC TRAASDAHL AT (702) 676-1633, AT LEAST SEVEN WORKING DAYS IN ADVANCE.

2. THE CONTRACTOR SHALL SUBMIT A BUS STOP CLOSURES SCHEDULE WITH THE TRAFFIC CONTROL PLAN. THE BUS STOP CLOSURE SCHEDULE SHALL IDENTIFY SPECIFIC DURATIONS AND TIMES OF THE DAY FOR ALL PROPOSED BUS STOP CLOSURES. BUS STOP CLOSURES ARE NOT TO EXCEED TWO CONSECUTIVE STOPS AT ONE TIME, OR MORE THAN 1,000 FEET AT A TIME. PERSONS WITH DISABILITIES SHALL HAVE ACCESS TO BUS STOPS. THE CONTRACTOR SHALL PROVIDE A 100 FOOT LONG BY 10 FEET WIDE GRAVELED TURN OUT AT TEMPORARY BUS STOPS.

REVISED FEBRUARY 14, 2013

BASIS OF BEARINGS

GRID NORTH AS DEFINED BY THE CENTRAL MERIDIAN OF THE NEVADA COORDINATE REFERENCE SYSTEM (NCRS), LAS VEGAS ZONE, NORTH AMERICAN DATUM OF 1983; SAID MERIDIAN BEING COINCIDENT WITH 114°58' WEST OF THE GREENWICH MERIDIAN.

LINEAR UNIT: US SURVEY FOOT (FTUS)

DATUM (REFERENCE FRAME): NAD 83 (2011) EPOCH 2010.00

SYSTEM: NEVADA COORDINATE REFERENCE SYSTEM (NCRS)

ZONE: LAS VEGAS

PROJECTION: TRANSVERSE MERCATOR

STANDARD PARALLEL: (AND LATITUDE OF GRID ORIGIN): 36°15'00"N

LONGITUDE OF CENTRAL MERIDIAN: 114°58'00"W

NORTHING AT GRID ORIGIN: 200,000,000 M (656,168.6667 FTUS)

EASTING AT CENTRAL MERIDIAN: 100,000,000 M (328,083.3333 FTUS)

SCALE FACTOR ON CENTRAL MERIDIAN: 1.0001 (EXACT)

BENCHMARK

NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) (REVISED 2014)

-

CITY OF LAS VEGAS BENCHMARK: 119019-NW6LV
NAVD88 ELEVATION: 649.227 METERS (2786.17 FEET)

-

RIVET AND PLATE IN CONCRETE TRANFORMER PAD, NORTH SIDE DORRELL 175' EAST OF CONQUISTADOR.

CITY OF LAS VEGAS GRADING NOTES

1. IN THE EVENT THAT ANY UNFORESEEN CONDITIONS NOT COVERED BY THESE NOTES ARE ENCOUNTERED DURING GRADING OPERATIONS, THE OWNER/ENGINEER SHALL BE IMMEDIATELY NOTIFIED FOR DIRECTION.

2. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO PERFORM ALL NECESSARY CUTS AND FILLS WITHIN THE LIMITS OF THIS PROJECT AND THE RELATED OFF-SITE WORK, SO AS TO GENERATE THE DESIRED SUBGRADE, FINISH GRADES AND SLOPES SHOWN.

3. CONTRACTOR SHALL TAKE FULL RESPONSIBILITY FOR ALL EXCAVATION, ADEQUATE SHORING SHALL BE DESIGNED AND PROVIDED BY THE CONTRACTOR TO PREVENT UNDERMINING OF ANY ADJACENT FEATURES OR FACILITIES AND/OR CAVING OF THE EXCAVATION.

4. THE GRADING CONTRACTOR IS RESPONSIBLE TO COORDINATE WITH THE OWNER TO PROVIDE FOR THE REQUIREMENTS OF THE PROJECT STORM WATER POLLUTION PREVENTION PLAN (SWPPP) AND ASSOCIATED PERMIT.

5. ALL CUT AND FILL SLOPES SHALL BE PROTECTED UNTIL EFFECTIVE EROSION CONTROL HAS BEEN ESTABLISHED.

6. THE USE OF POTABLE WATER WITHOUT A SPECIAL PERMIT FOR BUILDING OR CONSTRUCTION PURPOSES INCLUDING CONSOLIDATION OF BACKFILL OR DUST CONTROL IS PROHIBITED. THE CONTRACTOR SHALL OBTAIN ALL NECESSARY PERMITS FOR CONSTRUCTION WATER.

7. THE CONTRACTOR SHALL MAINTAIN THE STREETS, SIDEWALKS AND ALL OTHER PUBLIC RIGHT- OF-WAY IN A CLEAN, SAFE AND USABLE CONDITION. ALL SPILLS OF SOIL, ROCK OR CONSTRUCTION DEBRIS SHALL BE PROMPTLY REMOVED FROM THE PUBLICLY OWNED PROPERTY DURING CONSTRUCTION AND UPON COMPLETION OF THE PROJECT, ALL ADJACENT PROPERTY, PRIVATE OR PUBLIC SHALL BE MAINTAINED IN A CLEAN, SAFE AND USABLE CONDITION.

8. IN THE EVENT THAT ANY TEMPORARY CONSTRUCTION ITEM IS REQUIRED THAT IS NOT SHOWN ON THESE DRAWINGS, SUCH ITEM SHALL BE PROVIDED, AS DIRECTED BY THE CITY ENGINEER, AT NO EXPENSE TO THE CITY OF LAS VEGAS. TEMPORARY CONSTRUCTION INCLUDES DITCHES, BERMS, ROAD SIGNS AND BARRICADES, ETC.

REVISED APRIL 13, 2015 (CPM VERSION)

CITY OF LAS VEGAS TRAFFIC NOTES

1. ALL CONSTRUCTION SIGNING, BARRICADING, AND TRAFFIC DELINEATION SHALL CONFORM TO THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES", LATEST EDITION.

2. THE STREET SIGN CONTRACTOR SHALL OBTAIN STREET NAMES AND BLOCK NUMBERING FROM THE PLANNING DEPARTMENT PRIOR TO CONSTRUCTION.

3. BEFORE ANY WORK IS STARTED IN THE RIGHT-OF-WAY, THE CONTRACTOR SHALL INSTALL ALL ADVANCE WARNING SIGNS FOR THE CONSTRUCTION ZONE. THE CONTRACTOR SHALL INSTALL TEMPORARY STOP SIGNS AT ALL NEW STREET ENCROACHMENTS INTO EXISTING CITY STREETS WHERE WARRANTED IMMEDIATELY AFTER FIRST GRADING WORK IS ACCOMPLISHED, AND SHALL MAINTAIN SAID SIGNS UNTIL PERMANENT SIGNS ARE INSTALLED.

4. WHEN A DESIGNATED "SUGGESTED ROUTE TO SCHOOL" IS ENCROACHED UPON BY A CONSTRUCTION WORK ZONE AND PUBLIC WORKS STAFF IDENTIFIES A NEED FOR STUDENTS TO BE ASSISTED IN THE SAFE CROSSING THROUGH THAT WORK ZONE, THE CONTRACTOR SHALL BE REQUIRED TO PROVIDE A QUALIFIED "CROSSING GUARD". THE GUARD SHALL BE PRESENT FOR THE FULL DURATION OF TIME THAT CHILDREN ARE LIKELY TO BE PRESENT.

5. IF THE IMPROVEMENTS NECESSITATE THE OBLITERATION, TEMPORARY OBSTRUCTION, TEMPORARY REMOVAL OR RELOCATION OF ANY EXISTING TRAFFIC PAVEMENT MARKING, SUCH PAVEMENT MARKINGS SHALL BE RESTORED OR REPLACED WITH LIKE MATERIALS TO THE SATISFACTION OF THE CITY TRAFFIC ENGINEER.

6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AND INSTALLING ALL PERMANENT SIGNS SHOWN ON THE PLANS. ALL NEW TRAFFIC SIGNS SHALL UTILIZE TYPE XI RETROREFLECTIVE SHEETING IN ACCORDANCE WITH CAUSS 627 AND 716 AND SHALL HAVE AN ANTI-GRAFFITI PROTECTIVE OVERLAY FILM THAT IS A MATCHING COMPONENT TO, AND OF THE SAME MANUFACTURER AS THE RETROREFLECTIVE SHEETING TO WHICH IT IS APPLIED. STREET NAME SIGNS SHALL CONFORM IN THEIR ENTIRETY TO CURRENT CITY STANDARDS. ALL OTHER SIGNS SHALL BE STANDARD SIZE UNLESS OTHERWISE SPECIFIED ON THE PLANS. ALL SIGN POSTS SHALL BE INSTALLED IN ACCORDANCE WITH THE CURRENT CITY STANDARDS.

7. WHEN A PROPOSED STREET LIGHT STANDARD IS LOCATED WITHIN FIVE (5) FEET OF ANY PROPOSED SIGN SHOWN ON THE PLANS TO BE MOUNTED ON A SIGNPOST, THE SIGN SHALL BE MOUNTED ON THE STREET LIGHT STANDARD AND THE SIGNPOST SHALL BE ELIMINATED.

8. ALL PERMANENT TRAFFIC CONTROL DEVICES CALLED FOR HEREON SHALL BE IN PLACE AND IN FINAL POSITION PRIOR TO ALLOWING ANY PUBLIC TRAFFIC ONTO THE PORTIONS OF THE ROAD(S) BEING IMPROVED HERE UNDER, REGARDLESS OF THE STATUS OF COMPLETION OF PAVING OR OTHER OFF-SITE IMPROVEMENTS CALLED FOR BY THESE PLANS.

9. STREET SIGNS AND STOP SIGNS SHALL BE INSTALLED PER CITY STANDARD SPECIFICATIONS FOR PLACEMENT OF STREET NAME SIGNS.

10. THE CONTRACTOR SHALL PROVIDE ALL NECESSARY TRAFFIC CONTROL DEVICES AND FLAGGERS TO INSURE THE SAFETY OF THE PUBLIC IN OR AROUND THE WORK AREA. THE CONTRACTOR SHALL HAVE A CERTIFIED ATSSA TRAFFIC CONTROL TECHNICIAN OR IMSA WORK ZONE SAFETY SPECIALIST SET UP, MAINTAIN AND/OR REMOVE ALL TRAFFIC CONTROL DEVICES IN THE CITY OF LAS VEGAS RIGHT OF WAY.

11. WORK IN PUBLIC STREETS, ONCE BEGUN, SHALL BE EXPEDITED TO COMPLETION SO AS TO PROVIDE MINIMUM INCONVENIENCE TO ADJACENT PROPERTY OWNERS AND TO THE TRAVELING PUBLIC.

12. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING RTC TRANSIT IF THE CONSTRUCTION INTERRUPTS OR RELOCATES A BUS STOP OR HAS AN ADVERSE EFFECT ON BUS SERVICE ON THAT STREET TO ARRANGE FOR TEMPORARY RELOCATION OF STOP.

13. GUARDS SHALL BE OBTAINED BY CONTACTING THE METROPOLITAN POLICE DEPARTMENT SPECIAL EVENTS UNIT (PHONE # 828-3442) WHO WILL PROVIDE OFFICERS PROPERLY TRAINED IN TRAFFIC CONTROL. FEES FOR THE USE OF THESE OFFICERS SHALL BE SET BY METRO AND WILL BE PAID BY THE CONTRACTOR. THE CONTRACTOR IS RESPONSIBLE FOR ALL ARRANGEMENTS WITH METRO.

14. ANY WORK WITHIN 300' OF A SIGNALIZED INTERSECTION WILL BE NIGHT WORK, UNLESS DIRECTED BY THE CITY OF LAS VEGAS TRAFFIC ENGINEER.

15. THE CONTRACTOR SHALL CONTACT THE TRAFFIC ENGINEERING DIVISION (TRANSPORTATION SECTION) THROUGH THE PROJECTS OFFSITE INSPECTOR PRIOR TO INITIATING PAVING TO RECEIVE DIRECTION FOR ANY PERMANENT OR TEMPORARY MODIFICATIONS TO THE APPROVED DRAWINGS REGARDING FINAL PAVEMENT TRANSITIONS, MARKINGS AND SIGNING THAT ARE REQUIRED TO MATCH ADJACENT ROADWAY SEGMENTS. THE CONTRACTOR SHALL PROVIDE A DRAWING FOR APPROVAL BY THE TRAFFIC ENGINEERING DIVISION DEPICTING ANY ADJUSTMENTS TO THE FINAL PAVEMENT MARKINGS AND SIGNAGE, WHICH MAY INCLUDE OMITTING, ADDING OR MODIFYING PAVEMENT MARKINGS AND TRAFFIC CONTROL SIGNS SUCH THAT ADEQUATE TRANSITIONS AND LANE TERMINATIONS BETWEEN ADJACENT ROADWAY SEGMENTS ARE CONSTRUCTED.

REVISED JULY 13, 2013

CITY OF LAS VEGAS SEWER NOTES

1. ALL CONSTRUCTION AND MATERIALS SHALL BE IN ACCORDANCE WITH THE LATEST EDITION OF THE DESIGN AND CONSTRUCTION STANDARDS FOR WASTEWATER COLLECTION SYSTEMS AND THE UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS' CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA, NEVADA, AS AMENDED. IT WILL BE THE RESPONSIBILITY OF THE CONTRACTOR TO BE AWARE OF THE CONTENTS OF THE ABOVE SPECIFICATIONS.

2. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO PERFORM CONSTRUCTION AS PER PLANS, ANY ADDITIONS, DELETIONS, OR CHANGES SHALL FIRST MEET WITH THE APPROVAL OF THE CITY ENGINEER.

3. CHISEL "S" OR "G" IN CURBS WHERE SEWER OR GAS LATERALS PASS UNDER THE CURB.

4. POLYVINYL (PVC) SEWER PIPE SHALL MEET ASTM D-3034 SDR 35 SPECIFICATIONS. INSTALLED WITH SAND BEDDING AND BACKFILL OF TYPE II AGGREGATE BASE.

5. ALL MANHOLES PAVED IN STREETS EIGHTY (80') FOOT R/W AND LARGER SHALL HAVE CONCRETE COLLARS. STREETS LESS THAN EIGHTY (80') FOOT R/W WILL REQUIRE RETROFIT IF PAVING DOES NOT CONFORM TO CITY STANDARDS AT THE MANHOLE.

6. TEE SADDLES SHALL BE USED TO CONNECT SEWER LATERALS TO EXISTING MAIN LINES UP TO TWELVE INCH (12") DIAMETER. CONNECTIONS TO FIFTEEN INCH (15") OR LARGER MAINS SHALL REQUIRE SPECIAL PROCEDURES. IN LINE "Y" IS SHALL BE USED ON LINES TWELVE INCHES (12") OR ABOVE.

7. WATER MAINS SHALL BE PROTECTED IN ACCORDANCE WITH LVVWD STANDARDS WHENEVER A SEWER MAIN CROSSES OVER A WATER MAIN OR THE SEWER IS LESS THAN EIGHTEEN INCH (18") UNDER A WATER MAIN.

8. ALL CONTRACTORS INSTALLING SEWER MAINS THAT WILL BE UNDER THE JURISDICTION OF THE CITY OF LAS VEGAS MUST BE STATE OF NEVADA CLASS "A" CONTRACTORS.

9. THE CITY OF LAS VEGAS WILL NOT ACCEPT ANY SEWER MAINS WHICH HAVE A VERTICAL DEFLECTION OF MORE THAN ONE TENTH (0.1) OF A FOOT FROM THE APPROVED CONSTRUCTION PLANS AT ANY LOCATION. SEWER MAINS FOUND TO EXCEED THIS TOLERANCE WILL HAVE TO BE REPAIRED OR REMOVED OR REPLACED TO THE SATISFACTION OF THE CITY ENGINEER PRIOR TO ACCEPTANCE BY THE CITY OF LAS VEGAS.

10. INSTALLATION OF CURVED SEWERS REQUIRES THE USE OF C-900 PVC PIPE WHICH ALLOWS FOR PIPE DEFLECTION AT THE JOINTS.

REVISED JANUARY 13, 2015

LVVWD STANDARD NOTES

LVVWD PROJECT # XXXXX

1. NO WORK SHALL BEGIN UNTIL THE WATER PLANS HAVE BEEN APPROVED FOR CONSTRUCTION BY THE LVVWD. FOLLOWING WATER PLAN APPROVAL, NOTICE SHALL BE GIVEN TO THE LVVWD COMMUNICATION SUPPORT CENTER (258-7171) TWO (2) WORKING DAYS PRIOR TO THE START OF CONSTRUCTION. FOR FUTURE INSPECTIONS, NOTICE MUST BE GIVEN BY 2:00 P.M. THE BUSINESS DAY PRIOR TO THE REQUESTED LVVWD INSPECTION. WHEN REQUESTING INSPECTIONS, PLEASE REFER TO THE PROJECT# IDENTIFIED ABOVE.

2. ALL WORK SHALL CONFORM TO LVVWD STANDARD PLATES, DRAWINGS, AND SPECIFICATIONS, AND TO THE 2010 EDITION OF THE UNIFORM DESIGN AND CONSTRUCTION STANDARDS FOR POTABLE WATER SYSTEMS (UDACS), THE LATEST EDITION OF UDACS SHALL SUPERSEDE ANY CONFLICTS CONTAINED IN THE APPROVED DRAWINGS AND/OR SPECIFICATIONS.

3. ALL WORK, EXCEPT AS MODIFIED BY THESE PLANS OR BY NOTE 2 ABOVE, SHALL BE DONE IN ACCORDANCE WITH THE MOST RECENT DRAFT OR EDITION OF THE UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION OFFSITE IMPROVEMENT, CLARK COUNTY AREA.

4. A SINGLE PIPE MATERIAL SHALL BE USED THROUGHOUT THE PROJECT UNLESS OTHERWISE APPROVED BY THE LVVWD.

5. ALL SERVICE LATERALS TWO (2) INCHES IN DIAMETER AND SMALLER SHALL BE TYPE K COPPER TUBING WITH LVVWD APPROVED SERVICE SADDLES.

6. ALL WATER METER BOXES SHALL BE LOCATED OUTSIDE OF DRIVEWAY AREAS.

7. ALL VALVES SHALL BE LOCATED OUTSIDE OF DRIVEWAYS, VALLEY AND CURB GUTTERS.

8. ALL WATER AND STORM DRAIN OR SANITARY SEWER CROSSINGS SHALL CONFORM TO SECTION 2.22 OF THE 2010 EDITION OF THE UDACS.

9. ALL WATER FACILITIES SHALL BE FILLED, DISINFECTED, PRESSURE TESTED, FLUSHED, FILLED AND AN ACCEPTABLE WATER SAMPLE OBTAINED, PRIOR TO CONNECTION TO THE LVVWD DISTRIBUTION SYSTEM.

10. THE CONTRACTOR MUST OBTAIN ALL METERS TWO (2) INCHES AND SMALLER FROM LVVWD CENTRAL STORES. TELEPHONE 258-3152 OR 258-3802. TWO (2) WORKING DAYS PRIOR TO METER PICKUP.

11. ANY INTERRUPTION OF SERVICE MUST BE PERFORMED IN ACCORDANCE WITH UDACS SECTION 3.14.01, AND APPROVED BY THE LVVWD INSPECTION DIVISION PRIOR TO SHUTDOWN. PROPER WRITTEN NOTIFICATION MUST BE GIVEN TO ALL AFFECTED CUSTOMERS.

12. ALL WATER FACILITY CONSTRUCTION MATERIALS USED MUST BE AS LISTED ON THE LVVWD PRE-APPROVED MATERIALS AND MANUFACTURER'S LISTING FOR NEW FACILITIES, LATEST REVISION, OR SPECIFICALLY APPROVED ON THESE PLANS.

13. TELEPHONE "CALL BEFORE YOU DIG" AT "811" OR 1-800-227-2600

14. THE INSTALLATION OF LAS VEGAS VALLEY WATER DISTRICT (LVVWD) MUNICIPAL WATER FACILITIES WITHIN ALL STREETS IS ASSUMED TO BE IN COMPLIANCE WITH THE UNIFORM STANDARDS, INCLUDING THE PLACEMENT OF ASPHALT PAVING STREET SURFACES. ANY REPAIR WORK DONE BY THE LVVWD TO THE MUNICIPAL FACILITIES WILL INCLUDE THE PLACEMENT OF ANY APPROPRIATELY SIZED ASPHALT REPAIR PATCH ON THE STREET SURFACE.

15. ANY DECORATIVE PAVING SURFACE WITHIN THE STREET IS THE RESPONSIBILITY OF THE OWNERS ASSOCIATION, OR THE INDIVIDUAL PROPERTY OWNERS IF NO OWNERS ASSOCIATION IS IN EXISTENCE, OR THE AGENCY HAVING JURISDICTION. DECORATIVE SURFACE MATERIALS PLACED WITHIN THE TEN FOOT EASEMENT ABUTTING A PUBLIC OR PRIVATE STREET, IF DISTURBED BY THE LVVWD DURING THE REPAIR OR OPERATION OF ITS FACILITIES, WILL BE REPLACED BY LVVWD WITH AN APPROPRIATELY SIZED PLAIN FINISH CONCRETE PATCH. THE LVVWD WILL NOT RESTORE, AND WILL NOT BE RESPONSIBLE FOR THE RESTORATION OF, ANY DECORATIVE PAVING SURFACE WITHIN THE STREET. THE LVVWD WILL NOT ATTEMPT TO MATCH COLOR OR FINISH OF ANY ADJACENT MATERIALS.

APPROVED FOR CONSTRUCTION	
LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER	
DATE:	PROJECT# XXXXX

CITY OF LAS VEGAS STREET LIGHT NOTES

1. ALL STREET LIGHTING INSTALLATIONS SHALL BE IN ACCORDANCE WITH THE STREET LIGHTING PLANS, THE "UNIFORM STANDARD SPECIFICATION FOR PUBLIC WORKS CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA, NEVADA", LATEST REVISION (USS), AND THE "UNIFORM STANDARD DRAWINGS FOR PUBLIC WORKS CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA, NEVADA" (USD), LATEST REVISION.

2. NO DEVIATION OF STREET LIGHT, PULL BOX, CONDUITS (ETC.) LOCATIONS SHALL BE PERMITTED WITHOUT WRITTEN APPROVAL OF THE TRAFFIC AND CITY ENGINEER. ANY DEVIATION FROM THE PLAN LOCATION WILL REQUIRE COMPLIANCE WITH SECTION 623 OF THE USS.

3. ALL EXISTING STREET LIGHTING SHALL REMAIN OPERATIONAL DURING CONSTRUCTION IN ACCORDANCE WITH SECTION 623 G.03.01 OF THE USS.

4. ALL EMPTY CONDUIT SHALL HAVE AT LEAST ONE GREEN No. #6 AWG WIRE INSTALLED AS TRACER WIRE IN ACCORDANCE WITH SECTION 623 G.02.01 OF THE USS PRIOR TO BACKFILLING AND FINAL INSPECTION.

5. ANY STRUCTURE SUCH AS BLOCK WALLS, CHAIN LINK FENCES, RETAINING WALLS, ETC., SHALL LEAVE A MINIMUM CLEARANCE I

CITY OF LAS VEGAS FIRE AND RESCUE NOTES

1. ALL WORK SHALL BE DONE IN STRICT ACCORDANCE WITH THE LAS VEGAS FIRE AND RESCUE ADOPTED FIRE CODE ORDINANCE #6325 FOR HYDRANT SPECIFICATIONS AND HYDRANT INSTALLATION SPECIFICATIONS.
2. ONLY FIRE HYDRANTS THAT ARE ON THE LAS VEGAS VALLEY WATER DISTRICT'S APPROVED PRODUCTS LIST ARE ALLOWED TO BE INSTALLED.
3. A PERMIT IS REQUIRED FROM LAS VEGAS FIRE AND RESCUE FOR THE INSTALLATION OF ON-SITE WATER LINES AND FIRE HYDRANTS. THE PERMIT AND CONTRACTORS MATERIAL TEST CERTIFICATE FOR UNDERGROUND PIPING FORM SHALL BE OBTAINED FROM THE FIRE PROTECTION ENGINEER BEFORE COMMENCEMENT OF WORK. IFC § 105.7.12
4. ON ANY RESIDENTIAL OR COMMERCIAL INSTALLATIONS, FIRE HYDRANTS SHALL BE INSTALLED AND FIRE APPARATUS ACCESS ROADS SHALL BE MAINTAINED BEFORE COMMENCEMENT OF ANY COMBUSTIBLE CONSTRUCTION. ALL FIRE HYDRANTS SHALL BE IN GOOD WORKING ORDER AND SHALL BE CAPABLE OF DELIVERING THE REQUIRED FIRE FLOW. IFC § 3310, § 3312
5. TO IDENTIFY THE FIRE HYDRANT LOCATIONS, THE CONTRACTOR SHALL PLACE A BLUE REFLECTIVE MARKER AT THE CENTER LINE OF THE STREET ADJACENT TO THE FIRE HYDRANTS. IFC § 507.5.7.3
6. ALL UNDERGROUND INSPECTIONS, PRESSURE AND FLUSH VERIFICATIONS OF ALL FIRE HYDRANTS AND FIRE LINES, SHALL BE CONDUCTED BEFORE COVERING THE LINES. CENTER LOADING IS ACCEPTABLE FOR THE HYDRO TESTS WITH PRIOR FIRE PREVENTION APPROVAL. IFC § 106.3
7. ALL ON-SITE UNDERGROUND WATER MAINS AND MATERIALS SHALL BE U.L. LISTED, A.W.W.A APPROVED AND SHALL BE RATED FOR THE APPROPRIATE WORKING PRESSURE. IFC § 507.2.1, NFPA 24
8. PAINTING OF CURBS, FIRE HYDRANTS, PADS, PROTECTION OF FIRE HYDRANTS FROM PHYSICAL DAMAGE, AND ALL OTHER WORK NECESSARY PER PLANS SHALL BE COMPLETED BEFORE APPROVAL BY LAS VEGAS FIRE AND RESCUE, FIRE PREVENTION DIVISION. IFC § 507
9. PRIVATE HYDRANTS SHALL BE PAINTED RED. IFC § 507.5.7.1
10. PRIOR TO THE FINAL OCCUPANCY, A FIRE FLOW TEST SHALL BE WITNESSED BY LAS VEGAS FIRE AND RESCUE, FIRE PREVENTION DIVISION TO VERIFY AVAILABILITY OF THE REQUIRED FIRE FLOW. IFC § 507
11. FIRE HYDRANT SPACING SHALL BE AS FOLLOWS: IFC § C102
    - RESIDENTIAL - 500 FT UNSPRINKLERED; 600 FT SPRINKLERED.
    - COMMERCIAL - 300 FT UNSPRINKLERED; 400 FT SPRINKLERED.
12. WHERE THE WATER MAINS ARE EXTENDED ALONG STREETS OR NEW STREETS ARE INSTALLED WHERE FIRE HYDRANTS ARE NOT NEEDED FOR PROTECTION OF THE STRUCTURES, FIRE HYDRANTS SHALL BE INSTALLED AT A MAXIMUM OF 1000 FT SPACING, TO PROVIDE FOR TRANSPORTATION HAZARDS. WHERE STREETS ARE PROVIDED WITH MEDIAN DIVIDERS OR HAVE FOUR (4) OR MORE TRAFFIC LANES AND HAVE A TRAFFIC COUNT OF MORE THAN 30,000 PER DAY, HYDRANTS ARE REQUIRED ON EACH SIDE OF THE STREET SPACED AT 500 FT ON AN ALTERNATING BASIS. IFC § C102.8
13. NO FIRE HYDRANTS SHALL BE LOCATED WITHIN THE RADIUS OF A CUL-DE-SAC OR WITHIN 20 FT OF THE PERIMETER OF THE RADIUS OF THE CUL-DE-SAC.
14. NO FIRE HYDRANTS SHALL BE LOCATED WITHIN 6 FT OF ANY CURB RETURN, DRIVEWAY, POWER POLE, STREETLIGHT OR ANY OTHER OBSTRUCTION. IFC § C102.12
15. A MAXIMUM DISTANCE FROM A FIRE HYDRANT TO A ONE-TWO FAMILY DWELLING SHALL NOT EXCEED 300 FT, AS MEASURED BY AN APPROVED ROUTE. IFC § 102.4

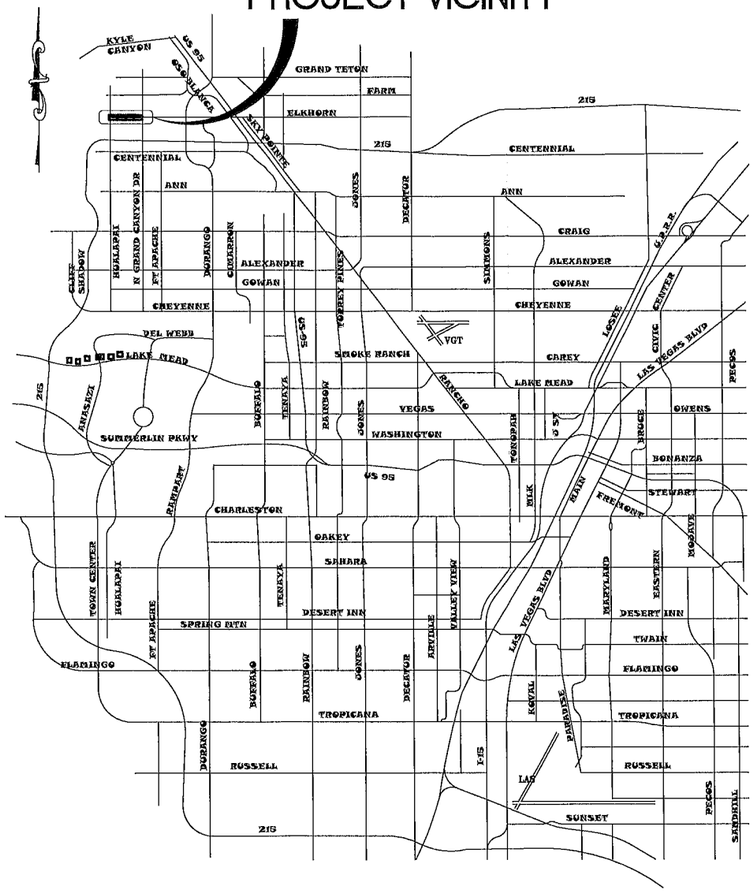
    THE MAXIMUM DISTANCE FROM A FIRE HYDRANT TO A FIRE DEPARTMENT CONNECTION (FDC) SHALL NOT EXCEED 100 FT, AS MEASURED BY AN APPROVED ROUTE. IFC § C102.7
17. THE MAXIMUM DISTANCE FROM A HYDRANT TO THE END OF A DEAD-END STREET SHALL NOT EXCEED 200 FT. IFC § C102.6
18. TWO (2) SOURCES OF SUPPLY ARE REQUIRED WHENEVER THERE IS 4 OR MORE FIRE HYDRANTS/SPRINKLER LEAD-INS ARE INSTALLED ON A SINGLE SYSTEM. SECTIONAL CONTROL VALVES SHALL BE INSTALLED SO THAT NO MORE THAN 2 FIRE HYDRANTS CAN BE OUT OF SERVICE DUE TO A BREAK IN A WATER MAIN. IFC § C104
19. ALL FIRE APPARATUS ACCESS ROADS SHALL BE PAVED TO PROVIDE ALL-WEATHER DRIVING CAPABILITIES, AND SHALL BE DESIGNED AND MAINTAINED TO SUPPORT THE IMPOSED LOADS OF THE FIRE APPARATUS. IFC § 503.2.3
20. THE GRADIENT FOR THE FIRE APPARATUS ACCESS ROADS SHALL NOT EXCEED 12%. ANGLES OF APPROACH AND ANGLES OF DEPARTURE SHALL NOT EXCEED 6% FOR 25 FT PRIOR TO OR AFTER THE GRADE CHANGE. ADJACENT TO THE STRUCTURES GRADIENT SHALL NOT EXCEED 6%. IFC § 503.2.7; 503.2.8
21. THE TURNING RADIUS OF THE FIRE APPARATUS ACCESS ROADS SHALL BE NO LESS THAN 52 FT OUTSIDE AND 28 FT INSIDE TURNING RADIUS. IFC § 503.2.4
22. VERTICAL CLEARANCE OF ALL FIRE APPARATUS ACCESS ROADS SHALL NOT BE LESS THAN 13FT 6 INS. IFC § 503.2.1
23. FIRE DEPARTMENT ACCESS ROADS SHALL HAVE A MINIMUM UNOBSTRUCTED WIDTH OF NOT LESS THAN 40 FT FLOW LINE TO FLOW LINE WITH PARALLEL PARKING PERMITTED ON BOTH SIDES. NOT LESS THAN 32 FT WIDE, FLOW LINE TO FLOW LINE, WHERE PARKING IS PERMITTED ONLY ON ONE SIDE OF THE FIRE APPARATUS ACCESS ROAD. NOT LESS THAN 24FT WIDE, FLOW LINE TO FLOW LINE, WHERE NO PARKING IS PERMITTED ON EITHER SIDE. FIRE LANES THROUGH PARKING LOTS SHALL BE NOT LESS THAN 24 FT. IFC § 503.2.1.1
24. A FIRE APPARATUS ACCESS ROAD SHALL BE REQUIRED WHEN ANY PORTION OF AN EXTERIOR WALL OF THE FIRST STORY IS LOCATED MORE THAN 150 FT FROM A FIRE DEPARTMENT VEHICLE ACCESS. THIS DISTANCE COULD BE INCREASED TO 250 FT IF THE BUILDING IS SPRINKLERED. IFC § 503.1.1
25. APPROVED SECONDARY FIRE APPARATUS ACCESS SHALL BE PROVIDED FOR 100 OR MORE DWELLING UNITS, ROAD(S) WITH DEAD-ENDS OR WITH A SINGLE POINT OF ACCESS IN EXCESS OF 600 FT, COMMERCIAL AND INDUSTRIAL DEVELOPMENTS WHERE BUILDINGS EXCEED 2 STORIES OR 30 FEET IN HEIGHT, OR EXCEEDING 62,000 SQUARE FEET IN AREA. IFC § 503.1.2
26. ALL DEAD-END FIRE APPARATUS ROADS AND/OR FIRE LANES, PUBLIC OR PRIVATE, IN EXCESS OF 150 FT IN LENGTH SHALL BE PROVIDED WITH AN APPROVED TURN AROUND HAVING A MINIMUM DIAMETER OF 81 FT. IFC § 503.2.5
27. ALL FIRE APPARATUS ACCESS ROADS SHALL BE MARKED BY PLACING APPROVED SIGNS AT THE START OF THE DESIGNATED FIRE LANE, ONE SIGN AT THE END OF THE FIRE LANE AND WITH SIGNS AT INTERVALS OF 100 FT ALONG THE DESIGNATED FIRE LANES. SIGNS TO BE PLACED ON BOTH SIDES OF AN ACCESS ROADWAY IF NEEDED TO PREVENT PARKING ON EITHER SIDE. SIGNS TO BE INSTALLED NO HIGHER THAN 10 FT OR LESS THAN 6 FT FROM THE ROADWAY LEVEL. THE CURB ALONG OR ON THE PAVEMENT OR CEMENT (IF NO CURB IS PROVIDED) SHALL BE PAINTED WITH A RED WEATHER RESISTANT PAINT IN ADDITION TO THE SIGNS. IFC § 503.3
28. ELECTRICALLY CONTROLLED ACCESS GATES SHALL BE PROVIDED WITH AN APPROVED EMERGENCY VEHICLE DETECTOR/RECEIVER SYSTEM. SAID SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE IFC § 503.6 AND IFC APPENDIX M.

REVISED MARCH 1, 2016

SHEET INDEX

SHEET	TITLE I	TITLE II
CV	GENERAL	COVER SHEET
GN-1	GENERAL	NOTES, LEGEND, AND ABBREVIATIONS
GN-2	GENERAL	GENERAL NOTES AND SHEET INDEX
GN-3	GENERAL	KEY MAP
SC-1	SURVEY CONTROL	
DR-1	DEMOLITION AND REMOVAL PLAN	
DR-2	DEMOLITION AND REMOVAL DETAILS	
DR-3	DEMOLITION AND REMOVAL SECTIONS	
PP-1	STORM DARIN PLAN AND PROFILE	STA 9+50 TO 19+00
PP-2	STORM DRAIN PLAN AND PROFILE	STA 19+00 TO 28+00
PP-3	STORM DRAIN PLAN AND PROFILE	STA 28+00 TO 37+00
PP-4	STORM DRAIN PLAN AND PROFILE	STA 37+00 TO 40+00
PP-5	STORM DRAIN LATERALS	PLAN AND PROFILE I
PP-6	STORM DRAIN LATERALS	PLAN AND PROFILE II
PP-7	STORM DRAIN LATERALS	PLAN AND PROFILE III
PP-8	STORM DRAIN LATERALS	PLAN AND PROFILE IV
PP-9	STORM DRAIN LATERALS	PLAN AND PROFILE V
RD-1	PAVING PLAN	STA 9+50 TO 28+00
RD-2	PAVING PLAN	STA 28+00 TO 40+00
GR-1	GRADING RESTORATION PLAN	
DT-1	CIVIL DETAILS I	
DT-2	CIVIL DETAILS II	

PROJECT VICINITY



VICINITY MAP

NOT TO SCALE

NOTE: SEE KEY MAP ON GN-3.

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER

DATE: PROJECT# XXXXX

NO.	DATE	REVISIONS

PREPARED BY: Stantec, 3010 W. CHARLESTON BLVD. SUITE 100, LAS VEGAS, NV 89102

PREPARED FOR: CITY OF LAS VEGAS

H# 170149 | BID# XX-XXXXX | DESIGNED BY: RW | DATE: JULY 2017 | DRAWN BY: ED | SUBMITTAL STAGE: 30% - PRELIMINARY | CHECKED BY: XXX

TITLE: RANCHO ROAD SYSTEM STORM DRAIN - ELKHORN

SHEET: GENERAL NOTES AND SHEET INDEX

NOT FOR CONSTRUCTION

SHEET GN-2

3 OF 22

DRAWING NO. XXX-XXXX

C:\PWWORKDIR\D0324288\JH170149-GN01-GN-02.DWG

7/6/17

NORTH

NOT TO SCALE

SEVERENCE LN

HUALAPAI WAY

CONQUISTADOR ST

JENSEN ST

GRAND CANYON DR

EULA ST

RHINEHART WAY

PP-1

PP-2

PP-3

PP-4

PP-5

PP-6

PP-7

PP-8

PP-9

ELKHORN RD

WITTIG AVE

DORRELL LN

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER

DATE: PROJECT# XXXXX

NO.	DATE	REVISIONS

PREPARED BY

Stantec

3010 W. CHARLESTON BLVD.
SUITE 100
LAS VEGAS, NV 89102

PREPARED FOR
CITY OF LAS VEGAS

H# 170149 | BID# XX-XXXXX | DESIGNED BY: RW | DRAWN BY: ED | CHECKED BY: XXX

DATE: JULY 2017

SUBMITTAL STAGE:
30% - PRELIMINARY

TITLE
RANCHO ROAD SYSTEM STORM DRAIN - ELKHORN

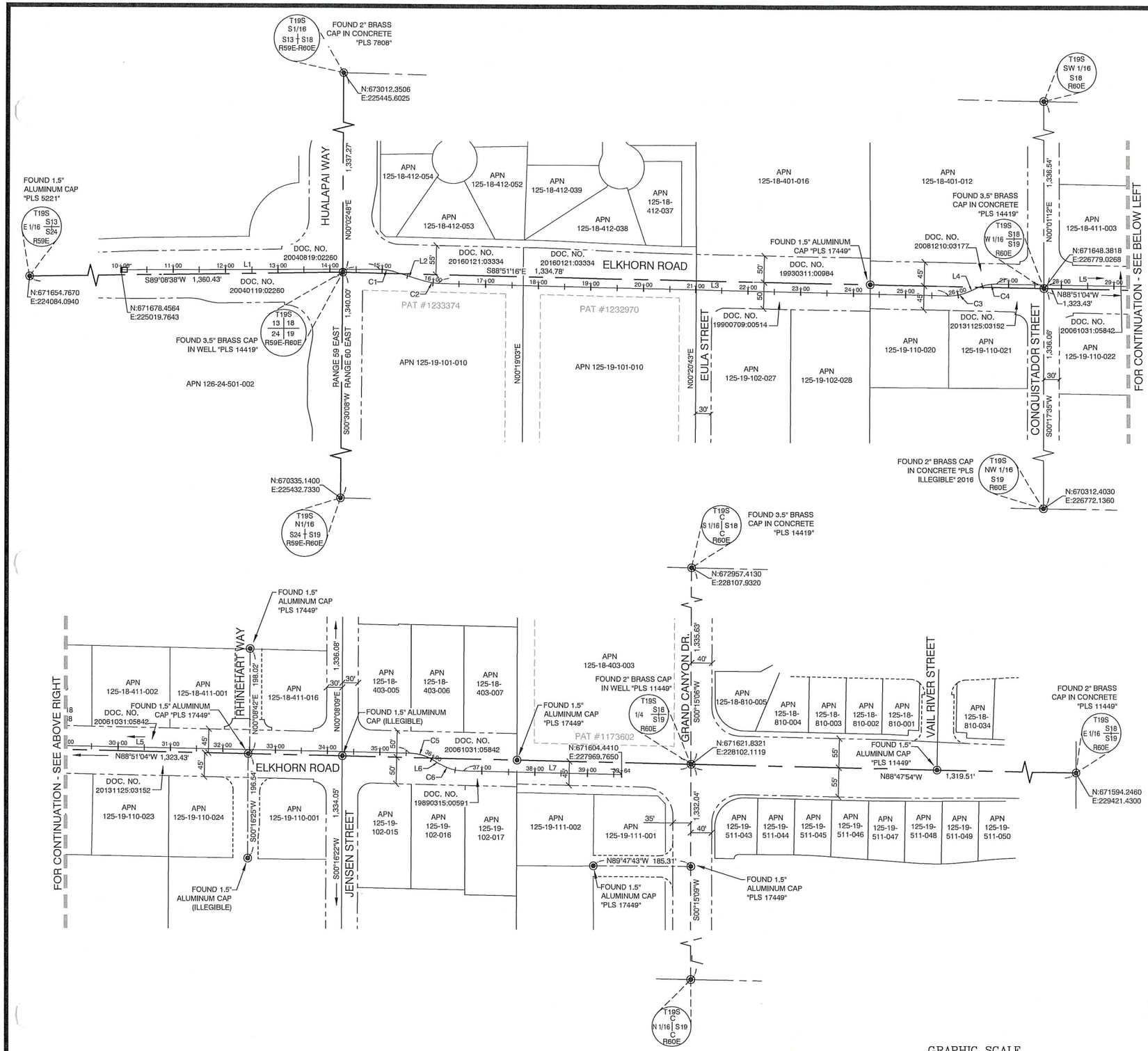
SHEET
GENERAL KEY MAP

NOT FOR CONSTRUCTION

SHEET
GN-3
4 OF 22

DRAWING NO.
XXX-XXXX

7/5/17 C:\PWWORKDIR\D0324288\JH170149-GN-03.DWG



CONSULTING ENGINEERS
PLANNERS - LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA, 89146-5148
(702) 873-7550 FAX (702) 362-2597

NORTH

BASIS OF BEARINGS AND COORDINATES:

GRID NORTH AS DEFINED BY THE CENTRAL MERIDIAN OF THE NEVADA COORDINATE REFERENCE SYSTEM (NCRS), LAS VEGAS ZONE, NORTH AMERICAN DATUM OF 1983; SAID MERIDIAN BEING COINCIDENT WITH 114°58' WEST OF THE GREENWICH MERIDIAN.

LINEAR UNIT: US SURVEY FOOT (FTUS)

DATUM (REFERENCE FRAME): NAD 83 (2011) EPOCH 2010.00
SYSTEM:NEVADA COORDINATE REFERENCE SYSTEM (NCRS)

ZONE: LAS VEGAS

PROJECTION: TRANSVERSE MERCATOR
STANDARD PARALLEL (AND LATITUDE OF GRID ORGIN):36°15'00"N
LONGITUDE OF CENTRAL MERIDIAN:114°58'00"W
NORTHING AT GRID ORIGIN: 200,000.000 M (656,166.6667 FTUS)
EASTING AT CENTRAL MERIDIAN: 100,000.000 M (328,083.3333 FTUS)
SCALE FACTOR ON CENTRAL MERIDIAN; 1.0001 (EXACT)

NOTES:
1. ALL DISTANCES AND BEARINGS SHOWN HEREON ARE PROJECTED (GRID) VALUES BASED ON THE PRECEDING PROJECTION DEFINITION. THE PROJECTION WAS DEFINED SUCH THAT PROJECTED (GRID) DISTANCES ARE EQUIVALENT TO "GROUND" DISTANCES IN THE PROJECT AREA.
2. GRID BEARINGS SHOWN HEREON (OR IMPLIED BY GRID COORDINATES) DO NOT EQUAL GEODETIC BEARINGS DUE TO MERIDIAN CONVERGENCE.

LEGEND:

———	SECTION LINE
— — —	QUARTER SECTION LINE
———	RIGHT-OF-WAY LINE
———	STREET CENTERLINE
———	MATCH LINE
———	PATENT EASEMENT LINE
◉	FOUND MONUMENT AS DESCRIBED
APN	ASSESSOR'S PARCEL NUMBER

BENCHMARK:

NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) (REVISED 2014)

CITY OF LAS VEGAS BENCHMARK: 119019-NW6LV
NAVD88 ELEVATION: 849.227 METERS (2786.17 FEET)

RIVET AND PLATE IN CONCRETE TRANSFORMER PAD, NORTH SIDE DORRELL 175' EAST OF CONQUISTADOR.

COURSE TABLE

NO.	BEARING	LENGTH
L1	N89°43'48"E	494.79'
L2	S73°22'58"E	64.26'
L3	S88°46'37"E	971.84'
L4	N64°51'13"E	13.17'
L5	S88°57'56"E	879.10'
L6	S58°57'56"E	14.58'
L7	S88°55'59"E	299.14'

CURVE TABLE

CURVE	RADIUS	DELTA	LENGTH	TANGENT
C1	90.00'	16°52'56"	26.52'	13.36'
C2	90.00'	15°23'39"	24.18'	12.16'
C3	90.00'	26°22'10"	41.42'	21.08'
C4	90.00'	26°10'51"	41.12'	20.93'
C5	90.00'	30°00'00"	47.12'	24.12'
C6	90.00'	29°58'03"	47.07'	24.09'

REFERENCE MAP:

RECORD OF SURVEY:

FILE 199, PAGE 91

APPROVED FOR CONSTRUCTION	
LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER	
DATE:	PROJECT# XXXXX

CALL BEFORE CONSTRUCTION

BEFORE YOU DIG	USA NORTH	811 OR 800-227-2600
BEFORE YOU UNDERGROUND	F.A.S.T.	702-432-5300
	CLARK COUNTY TRAFFIC OPERATIONS	702-455-7511
	CITY OF LAS VEGAS T.E.F.O.	702-229-6611
BEFORE YOU OVERHEAD	NV ENERGY	702-227-2929

NO.	DATE	REVISIONS

PREPARED FOR
CITY OF LAS VEGAS

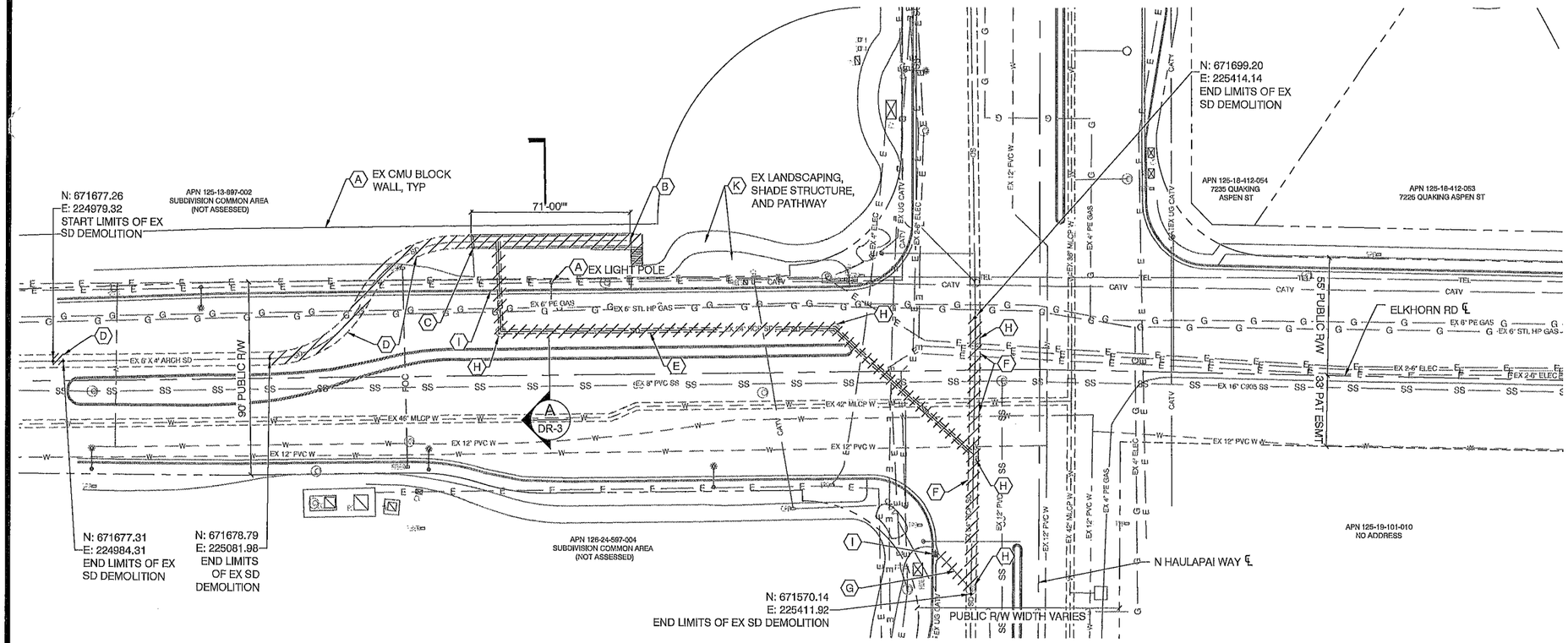
BID# XX.XXXXX
H# 170149
DESIGNED BY:
DRAWN BY: KAC
DATE: JULY 2017
SUBMITTAL STAGE:
30% - PRELIMINARY
CHECKED BY: RAJ

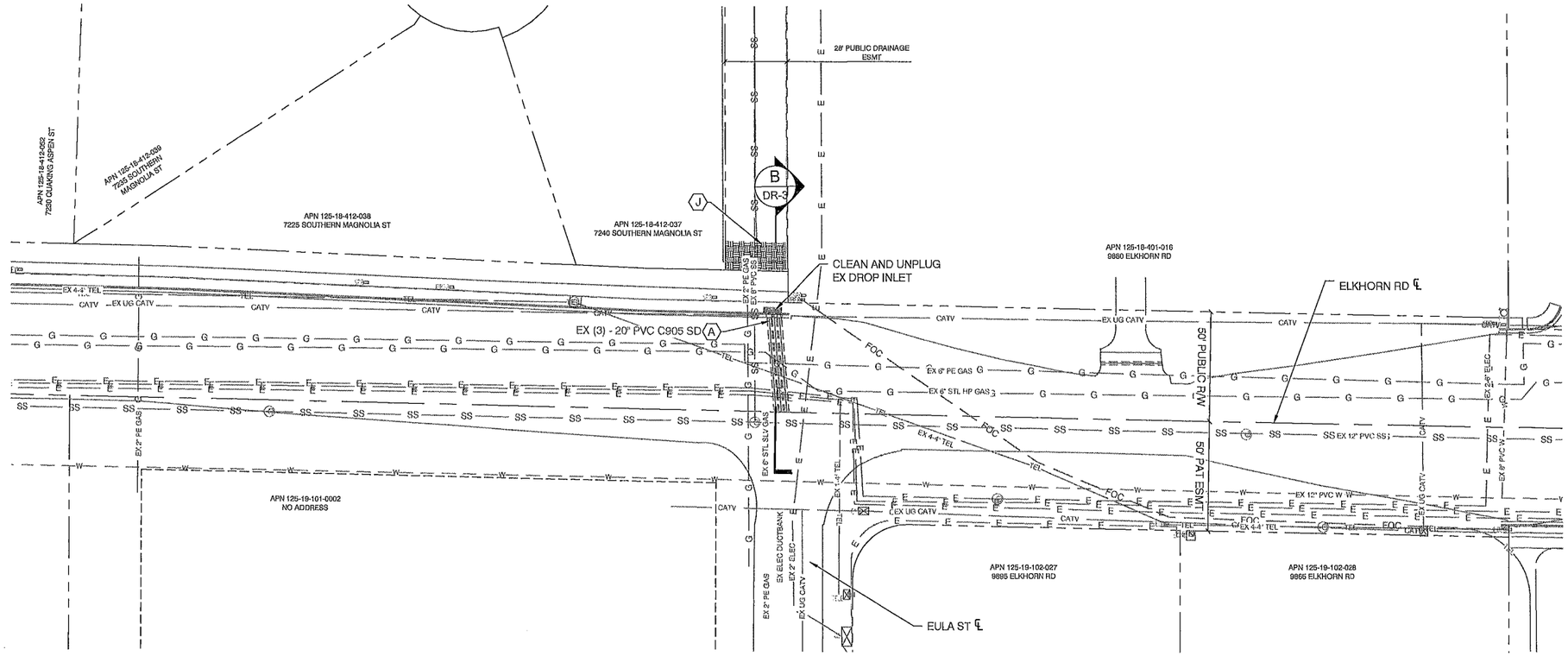
TITLE
RANCHO ROAD SYSTEM
STORM DRAIN - ELKHORN
HORIZONTAL CONTROL

SHEET

PROFESSIONAL LAND SURVEYOR - STATE OF NEVADA
RAYMOND A JOHNSON
EXP. 06-30-19
No. 18983

SHEET
SC-1
5 OF 22
DRAWING NO.
XXX-XXXX





NORTH

GRAPHIC SCALE
30 0 15 30 60
(IN FEET)

HORIZONTAL SCALE: 1" = 30'

CALL BEFORE CONSTRUCTION

BEFORE YOU DIG	USA NORTH	811 OR 800-227-2600
BEFORE YOU UNDERGROUND	F.A.S.T.	702-432-5300
	CLARK COUNTY TRAFFIC OPERATIONS	702-455-7611
	CITY OF LAS VEGAS T.E.F.O.	702-229-6611
BEFORE YOU OVERHEAD	NV ENERGY	702-227-2929

GENERAL NOTES

1. REFER TO SHEET GN-2 FOR OVERALL SHEET INDEX LIST.
2. ALL UTILITIES DEPICTED THROUGHOUT DRAWINGS ARE APPROXIMATE ONLY AND ALL UTILITIES MAY NOT BE SHOWN. CONTRACTOR MUST FIELD VERIFY AND PERFORM POTHOLES PRIOR TO CONSTRUCTION.
3. ALL EXISTING UTILITIES SHALL BE PROTECTED IN PLACE UNLESS SHOWN OTHERWISE.
4. REFER TO USDCCA DWG # 501.1 FOR TYPICAL UNDERGROUND UTILITY LOCATIONS, IF RESIDENTIAL SERVICE LATERALS ARE NOT SHOWN.
5. REPLACE ALL TRAFFIC CONTROL DEVICES (SIGNALS, LOOPS, CONDUITS, SIGNS, AND PAVEMENT MARKINGS), UNDER CITY OF LAS VEGAS AND NDOT JURISDICTION THAT ARE DISTURBED DURING CONSTRUCTION.
6. REFER TO RD SHEETS FOR LIMITS OF SAWCUT PAVEMENT REPLACEMENT.
7. RESTORE EXISTING GRADES TO ORIGINAL CONDITIONS.
8. SEE ADDITIONAL LVVWD PROJECT SPECIFIC NOTES ON SHEET GN-1.
9. CONTACT NV ENERGY BEFORE EXCAVATING NEAR POWER POLES FOR TEMPORARY POLE SUPPORT.

DEMOLITION KEY NOTES

A. PROTECT IN PLACE.
B. DEMOLISH AND REMOVE EX CONCRETE OVERFLOW WEIR STRUCTURE AND PERIMETER WROUGHT IRON FENCING; SEE DETAILS 1,2, AND 3, SHEET DR-2.
C. DEMOLISH AND REMOVE EX CONCRETE HEADWALL STRUCTURE AND TRANSITION STRUCTURE PER DETAIL 2, SHEET DR-2..
D. DEMOLISH AND REMOVE 123-LF OF EX 6'x4' CONCRETE ARCH CULVERT.
E. DEMOLISH AND REMOVE 289-LF OF EX 24" DIAM RCP STORM DRAIN.
F. SAW CUT AND REMOVE 133-LF OF EX 54" DIAM RCP STORM DRAIN.
G. DEMOLISH AND REMOVE 25-LF OF EX 18" DIAM RCP STORM DRAIN.
H. DEMOLISH AND REMOVE EX STORM DRAIN MANHOLE AND BASE.
I. DEMOLISH AND REMOVE EX CURB AND GUTTER DROP INLET.
J. EXCAVATE AND REMOVE TEMPORARY FILL, UNCOVER EX CONCRETE HEADWALL AND CLEAN DRAINAGE PIPING.
K. PROTECT IN PLACE EXISTING LANDSCAPING, SHADE STRUCTURE, AND PATHWAY. REFER TO DR-2 FOR DEMOLITION AND REMOVAL DETAILS.

APPROVED FOR CONSTRUCTION
SOUTHWEST GAS CORPORATION
DATE:

APPROVED FOR CONSTRUCTION
LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
DATE: PROJECT# XXXXX

NO.	DATE	REVISIONS

PREPARED BY
Stantec
3010 W. CHARLESTON BLVD.
SUITE 100
LAS VEGAS, NV 89102

PREPARED FOR
CITY OF LAS VEGAS

H# 170149 | BID# XX-XXXXX | DESIGNED BY: RW | DRAWN BY: ED | CHECKED BY: XXX

DATE: JULY 2017

SUBMITTAL STAGE:
30% - PRELIMINARY

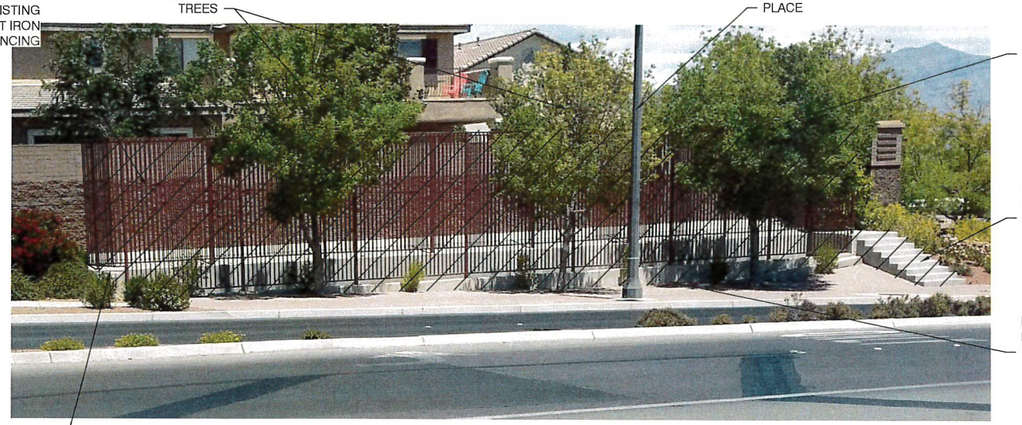
TITLE
RANCHO ROAD SYSTEM
STORM DRAIN - ELKHORN

SHEET
DEMOLITION AND REMOVAL PLAN

NOT FOR CONSTRUCTION

SHEET
DR-1
6 OF 22
DRAWING NO.
XXX-XXXX

C:\PWWORKDIR\D0322\2\48\JH170149-DR-01-DR-03.DWG
7/7/17



1 DR-1 DEMOLITION AND REMOVAL DETAIL I - OUTLET WEIR STRUCTURE
(NTS)



2 DR-1 DEMOLITION AND REMOVAL DETAIL II - OUTLET WEIR STRUCTURE
(NTS)



3 DR-1 DEMOLITION AND REMOVAL DETAIL III - OUTLET WEIR STRUCTURE
(NTS)



4 DR-1 DEMOLITION AND REMOVAL DETAIL IV - EXISTING LANDSCAPE FEATURES
(NTS)

NORTH

CALL BEFORE CONSTRUCTION

BEFORE YOU DIG	USA NORTH	811 OR 800-227-2600
BEFORE YOU UNDERGROUND	F.A.S.T.	702-432-5300
	CLARK COUNTY TRAFFIC OPERATIONS	702-455-7511
	CITY OF LAS VEGAS T.E.F.O.	702-229-6611
BEFORE YOU OVERHEAD	NV ENERGY	702-227-2929

GENERAL NOTES

1. REFER TO SHEET GN-2 FOR OVERALL SHEET INDEX LIST.
2. ALL UTILITIES DEPICTED THROUGHOUT DRAWINGS ARE APPROXIMATE ONLY AND ALL UTILITIES MAY NOT BE SHOWN. CONTRACTOR MUST FIELD VERIFY AND PERFORM POTHOLES PRIOR TO CONSTRUCTION.
3. ALL EXISTING UTILITIES SHALL BE PROTECTED IN PLACE UNLESS SHOWN OTHERWISE.
4. REFER TO USDCCA DWG # 501.1 FOR TYPICAL UNDERGROUND UTILITY LOCATIONS, IF RESIDENTIAL SERVICE LATERALS ARE NOT SHOWN.
5. REPLACE ALL TRAFFIC CONTROL DEVICES (SIGNALS, LOOPS, CONDUITS, SIGNS, AND PAVEMENT MARKINGS), UNDER CITY OF LAS VEGAS AND NDOT JURISDICTION THAT ARE DISTURBED DURING CONSTRUCTION.
6. REFER TO RD SHEETS FOR LIMITS OF SAWCUT PAVEMENT REPLACEMENT.
7. RESTORE EXISTING GRADES TO ORIGINAL CONDITIONS.
8. SEE ADDITIONAL LVVWD PROJECT SPECIFIC NOTES ON SHEET GN-1.
9. CONTACT NV ENERGY BEFORE EXCAVATING NEAR POWER POLES FOR TEMPORARY POLE SUPPORT.

APPROVED FOR CONSTRUCTION
SOUTHWEST GAS CORPORATION
DATE:

APPROVED FOR CONSTRUCTION
LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
DATE: PROJECT# XXXXX

NO.	DATE	REVISIONS

PREPARED BY Stantec
3010 W. CHARLESTON BLVD. SUITE 100
LAS VEGAS, NV 89102

PREPARED FOR CITY OF LAS VEGAS

H# 170149 | BID# XX-XXXXX | DESIGNED BY: RVV | DRAWN BY: ED | CHECKED BY: XXX

DATE: JULY 2017 | SUBMITTAL STAGE: 30% - PRELIMINARY

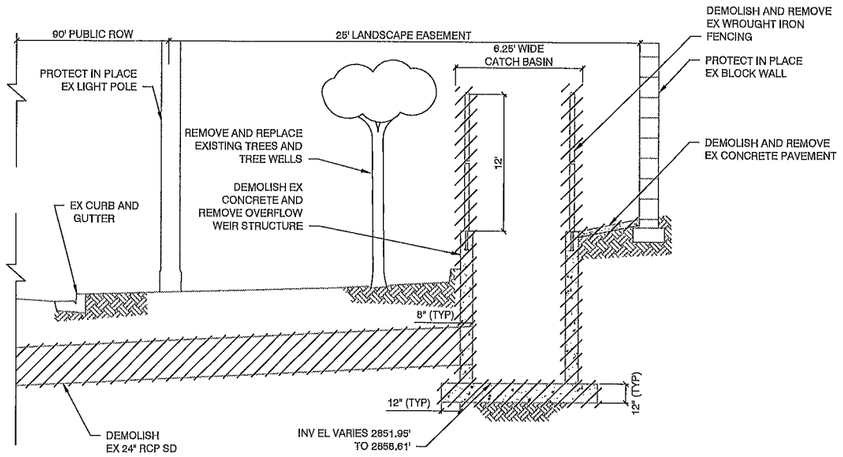
TITLE: RANCHO ROAD SYSTEM STORM DRAIN - ELKHORN

SHEET: DEMOLITION AND REMOVAL DETAILS

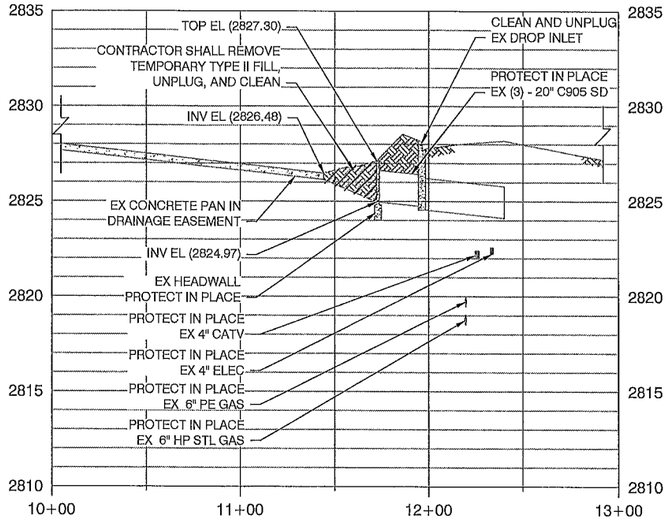
NOT FOR CONSTRUCTION

SHEET DR-2
7 OF 22
DRAWING NO. XXX-XXXX

C:\PWWORKDIR\D0032248\JH170149-DR-01-DR-03.DWG
7/7/17



A DR-1 DEMOLITION AND REMOVAL SECTION 1
SCALE: 1/4" = 1'-0"



B DR-1 DEMOLITION AND REMOVAL SECTION 2
SCALE: 1" = 40' H
1" = 4' V

NORTH

CALL BEFORE CONSTRUCTION

BEFORE YOU DIG	USA NORTH	811 OR 800-227-2600
BEFORE YOU UNDERGROUND	F.A.S.T.	702-432-5300
	CLARK COUNTY TRAFFIC OPERATIONS	702-455-7511
	CITY OF LAS VEGAS T.E.F.O.	702-229-6811
BEFORE YOU OVERHEAD	NV ENERGY	702-227-2929

GENERAL NOTES

1. REFER TO SHEET GN-2 FOR OVERALL SHEET INDEX LIST.
2. ALL UTILITIES DEPICTED THROUGHOUT DRAWINGS ARE APPROXIMATE ONLY AND ALL UTILITIES MAY NOT BE SHOWN. CONTRACTOR MUST FIELD VERIFY AND PERFORM POTHOLES PRIOR TO CONSTRUCTION.
3. ALL EXISTING UTILITIES SHALL BE PROTECTED IN PLACE UNLESS SHOWN OTHERWISE.
4. REFER TO USDCCA DWG # 501.1 FOR TYPICAL UNDERGROUND UTILITY LOCATIONS, IF RESIDENTIAL SERVICE LATERALS ARE NOT SHOWN.
5. REPLACE ALL TRAFFIC CONTROL DEVICES (SIGNALS, LOOPS, CONDUITS, SIGNS, AND PAVEMENT MARKINGS), UNDER CITY OF LAS VEGAS AND NDOT JURISDICTION THAT ARE DISTURBED DURING CONSTRUCTION.
6. REFER TO RD SHEETS FOR LIMITS OF SAWCUT PAVEMENT REPLACEMENT.
7. RESTORE EXISTING GRADES TO ORIGINAL CONDITIONS.
8. SEE ADDITIONAL LVVWD PROJECT SPECIFIC NOTES ON SHEET GN-1.
9. CONTACT NV ENERGY BEFORE EXCAVATING NEAR POWER POLES FOR TEMPORARY POLE SUPPORT.

APPROVED FOR CONSTRUCTION
SOUTHWEST GAS CORPORATION
DATE:

APPROVED FOR CONSTRUCTION
LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
DATE: PROJECT# XXXXX

NO.	DATE	REVISIONS

PREPARED BY
Stantec
5010 W. CHARLESTON BLVD.
SUITE 230
LAS VEGAS, NV 89102

PREPARED FOR
CITY OF LAS VEGAS

I-#: 170149	BID#: XX-XXXXX	DESIGNED BY: RVV	DRAWN BY: ED	CHECKED BY: XXX
DATE: JULY 2017	SUBMITTAL STAGE: 30% - PRELIMINARY			

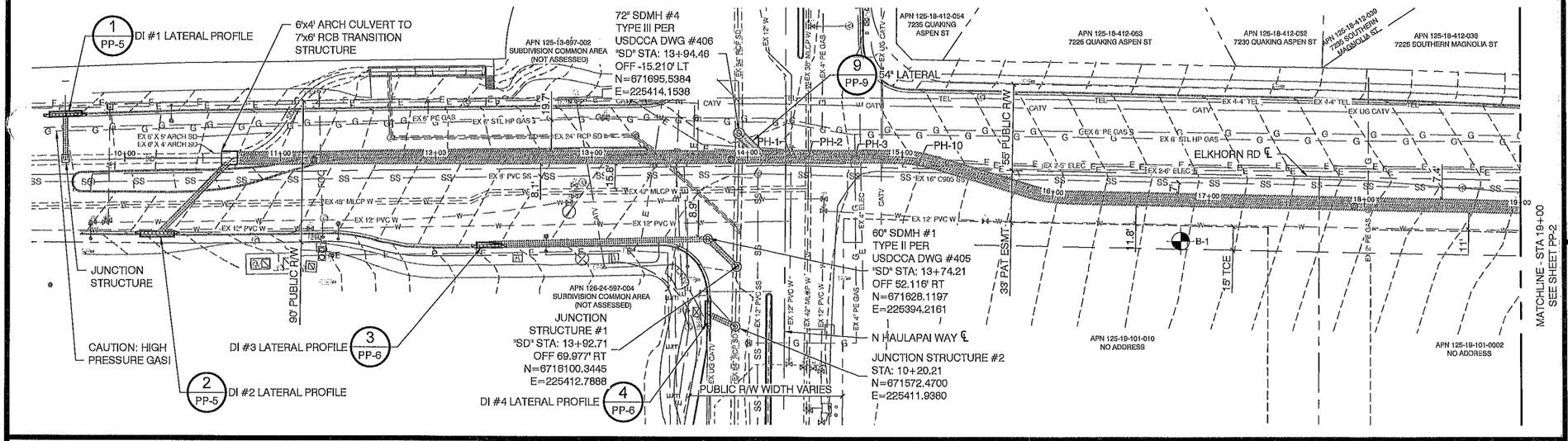
TITLE
RANCHO ROAD SYSTEM
STORM DRAIN - ELKHORN

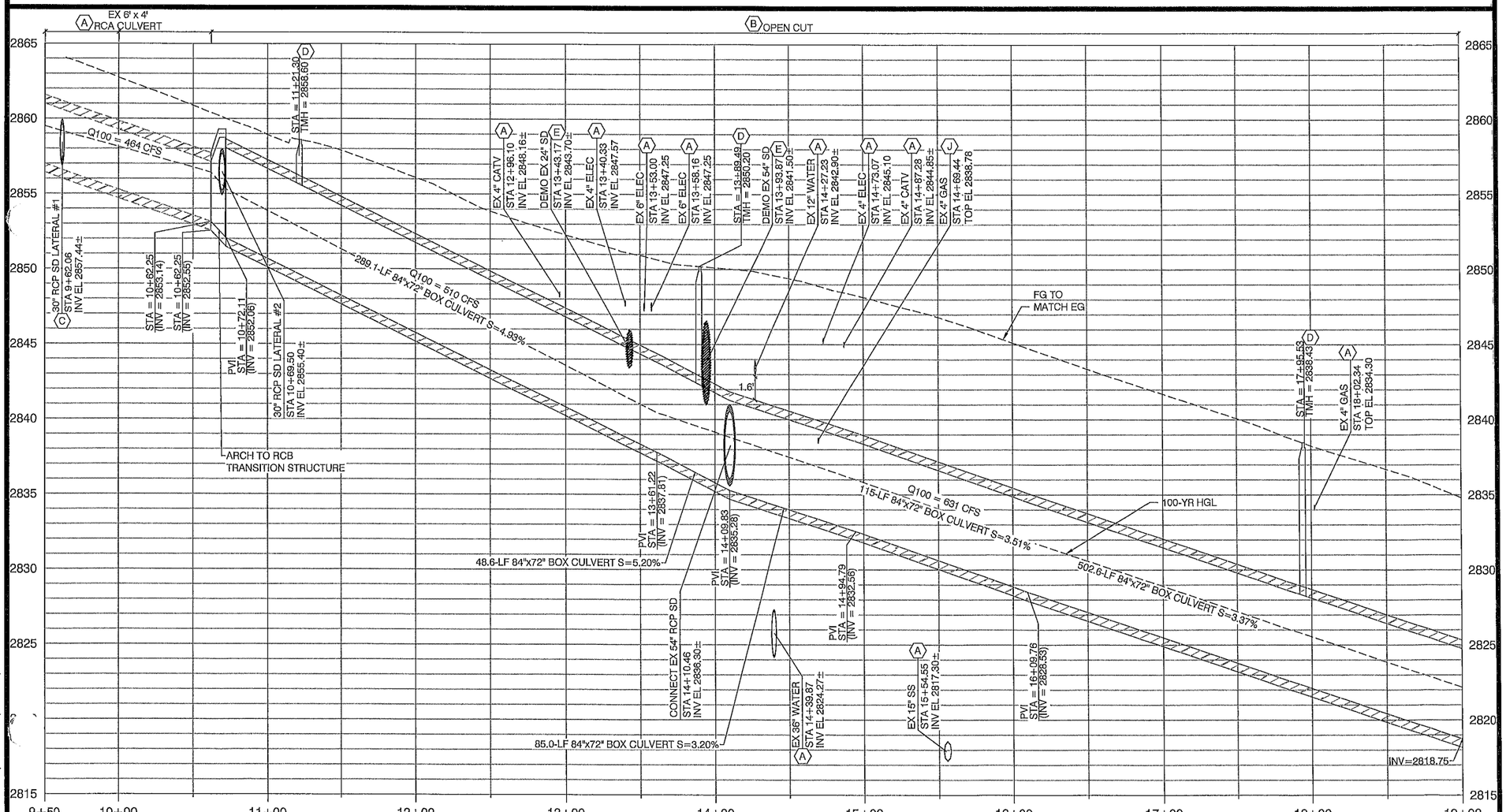
SHEET
DEMOLITION AND REMOVAL SECTIONS

NOT FOR CONSTRUCTION

SHEET
DR-3
8 OF 22
DRAWING NO.
XXX-XXXX

7/7/17 C:\PWWORK\DIR\D0324248\JH170149-DR-01-DR-03.DWG





GRAPHIC SCALE

NORTH

40 0 20 40 80

(IN FEET)

HORIZONTAL SCALE: 1" = 40'
VERTICAL SCALE: 1" = 4'

CALL BEFORE CONSTRUCTION

BEFORE YOU DIG	USA NORTH	811 OR 800-227-2600
BEFORE YOU UNDERGROUND	F.A.S.T.	702-132-5300
	CLARK COUNTY TRAFFIC OPERATIONS	702-455-7511
	CITY OF LAS VEGAS T.E.F.O.	702-229-6611
BEFORE YOU OVERHEAD	NV ENERGY	702-227-2929

GENERAL NOTES

1. REFER TO SHEET GN-2 FOR OVERALL SHEET INDEX LIST.
2. ALL UTILITIES DEPICTED THROUGHOUT DRAWINGS ARE APPROXIMATE ONLY AND ALL UTILITIES MAY NOT BE SHOWN. CONTRACTOR MUST FIELD VERIFY AND PERFORM POTHOLES PRIOR TO CONSTRUCTION.
3. ALL EXISTING UTILITIES SHALL BE PROTECTED IN PLACE UNLESS SHOWN OTHERWISE.
4. REFER TO USDCCA DWG # 501.1 FOR TYPICAL UNDERGROUND UTILITY LOCATIONS, IF RESIDENTIAL SERVICE LATERALS ARE NOT SHOWN.
5. REPLACE ALL TRAFFIC CONTROL DEVICES (SIGNALS, LOOPS, CONDUITS, SIGNS, AND PAVEMENT MARKINGS), UNDER CITY OF LAS VEGAS AND NDOT JURISDICTION THAT ARE DISTURBED DURING CONSTRUCTION.
6. REFER TO RD SHEETS FOR LIMITS OF SAWCUT PAVEMENT REPLACEMENT.
7. RESTORE EXISTING GRADES TO ORIGINAL CONDITIONS.
8. SEE ADDITIONAL LVVWD PROJECT SPECIFIC NOTES ON SHEET GN-1.
9. CONTACT NV ENERGY BEFORE EXCAVATING NEAR POWER POLES FOR TEMPORARY POLE SUPPORT.

CONSTRUCTION KEY NOTES

A. PROTECT IN PLACE.
B. INSTALL RCB STORM DRAIN PER TRENCH DETAIL C-901 / SHEET DT-1.
C. CONNECT TO EXISTING STORM DRAIN WITH JUNCTION BOX.
D. INSTALL 48" DIAMETER RISER TYPE MANHOLE ON RCB MAIN STORM DRAIN PER DETAIL C-905 / SHEET DT-2.
E. DEMOLISH AND REMOVE EX SD LINE, REFER TO DEMOLITION AND REMOVAL (DR) SHEETS FOR LIMITS.
J. CONTRACTOR SHALL COORDINATE WITH DRY UTILITY COMPANIES TO ADJUST EXISTING UTILITY LINE AROUND IMPROVEMENTS.

CALL SOUTHWEST GAS CORPORATION AT 702-400-1789 FOR STANDBY WHEN EXCAVATING OVER OR NEAR HIGH PRESSURE GAS LINES 48 HOURS PRIOR TO CONSTRUCTION.

APPROVED FOR CONSTRUCTION
SOUTHWEST GAS CORPORATION
DATE:

APPROVED FOR CONSTRUCTION
LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
DATE: PROJECT# XXXXX

NO.	DATE	REVISIONS

PREPARED BY Stantec
5010 W. CHARLESTON BLVD. SUITE 150 LAS VEGAS, NV 89102

PREPARED FOR
CITY OF LAS VEGAS

I-Ⅱ# 170149	BID# XX-XXXXX
DATE: JULY 2017	DESIGNED BY: RVV
SUBMITTAL STAGE: 30% - PRELIMINARY	DRAWN BY: ED
	CHECKED BY: XXX

TITLE
RANCHO ROAD SYSTEM
STORM DRAIN - ELKHORN

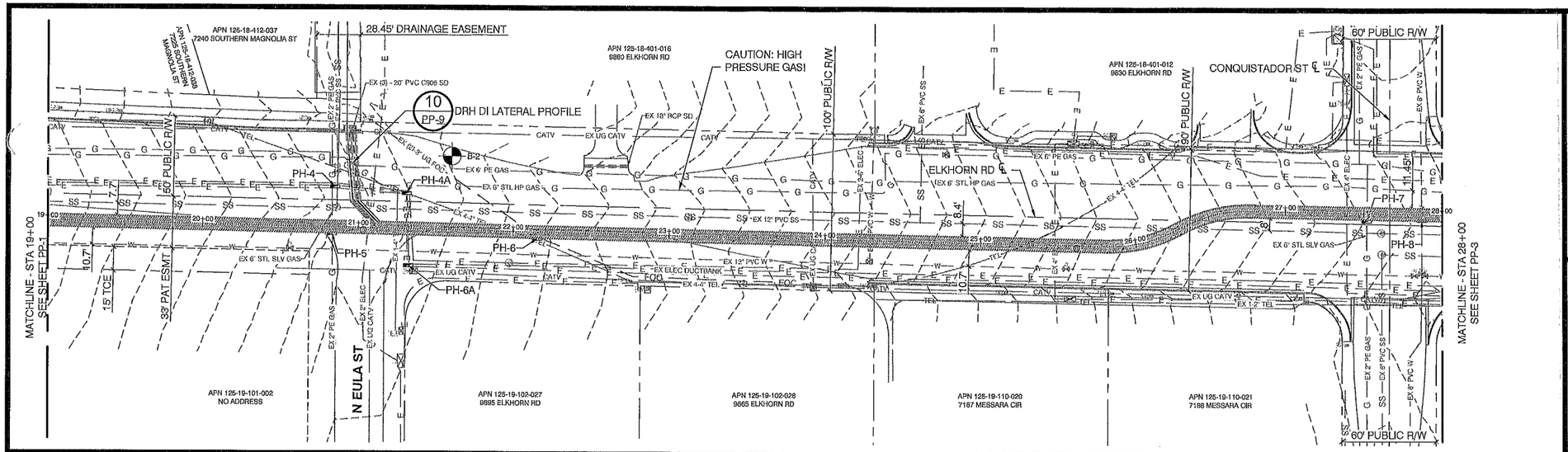
SHEET
STORM DRAIN PLAN AND PROFILE
STA 9+50 TO 19+00

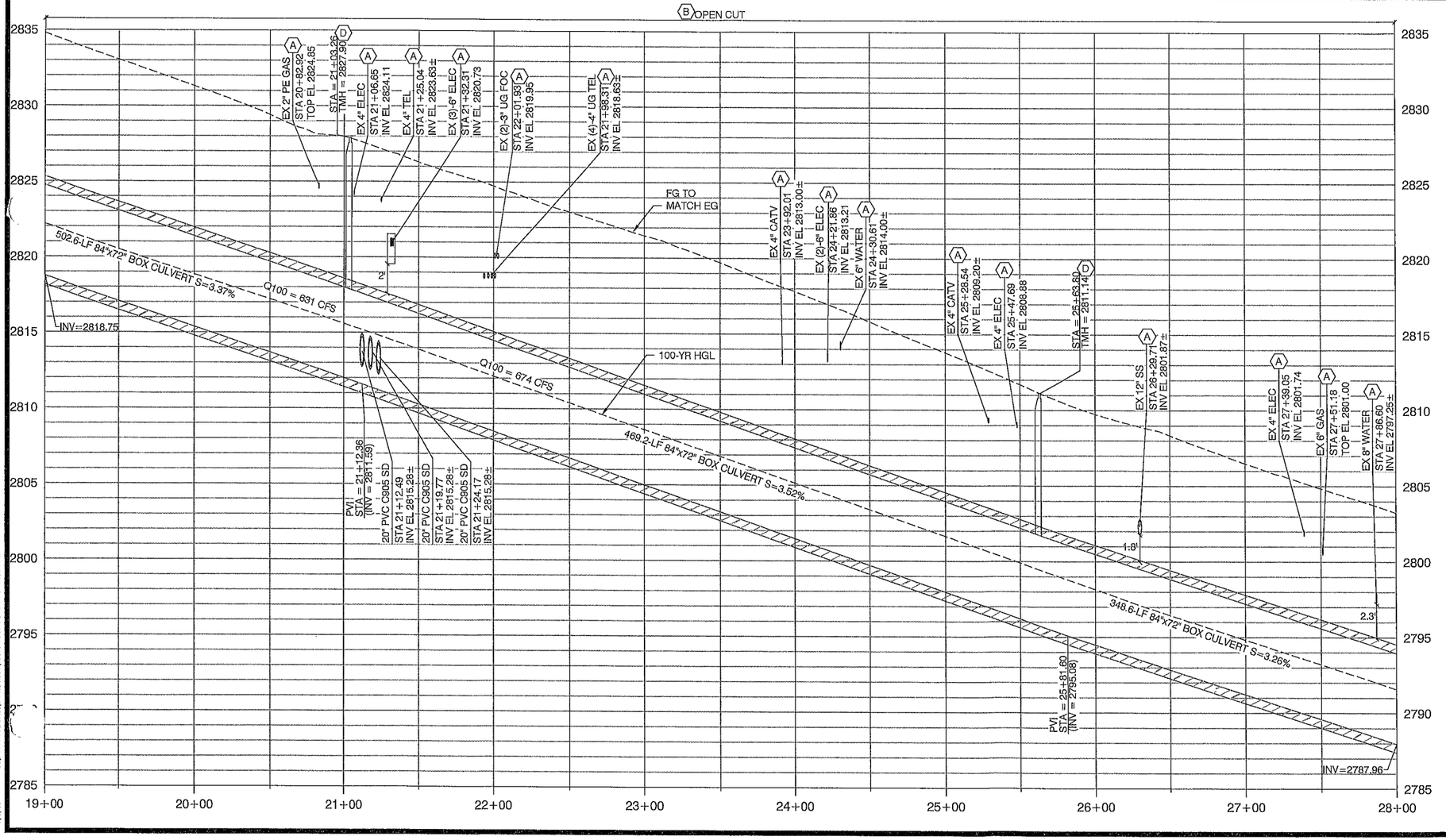
NOT FOR CONSTRUCTION

SHEET
PP-1
9 OF 22

DRAWING NO.
XXX-XXXX

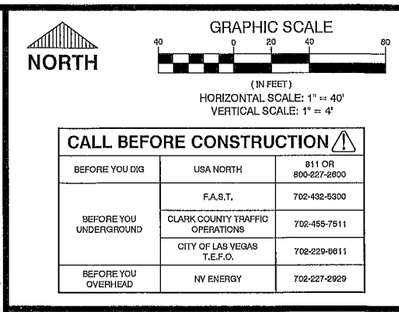
C:\PWWORK\DIR\D0324248\JH170149-PP-01-FP-09.DWG
7/6/17





C:\PW\WORK\DI\D0382448\JH170148-PP-01-PP-09.DWG

7/6/17



CALL BEFORE CONSTRUCTION

BEFORE YOU DIG	USA NORTH	811 OR 800-227-2600
BEFORE YOU UNDERGROUND	F.A.S.T.	702-432-5300
	CLARK COUNTY TRAFFIC OPERATIONS	702-455-7511
	CITY OF LAS VEGAS T.E.F.O.	702-229-6611
BEFORE YOU OVERHEAD	NV ENERGY	702-227-2929

GENERAL NOTES

1. REFER TO SHEET GN-2 FOR OVERALL SHEET INDEX LIST.
2. ALL UTILITIES DEPICTED THROUGHOUT DRAWINGS ARE APPROXIMATE ONLY AND ALL UTILITIES MAY NOT BE SHOWN. CONTRACTOR MUST FIELD VERIFY AND PERFORM POTHOLES PRIOR TO CONSTRUCTION.
3. ALL EXISTING UTILITIES SHALL BE PROTECTED IN PLACE UNLESS SHOWN OTHERWISE.
4. REFER TO USDCCA DWG # 501.1 FOR TYPICAL UNDERGROUND UTILITY LOCATIONS, IF RESIDENTIAL SERVICE LATERALS ARE NOT SHOWN.
5. REPLACE ALL TRAFFIC CONTROL DEVICES (SIGNALS, LOOPS, CONDUITS, SIGNS, AND PAVEMENT MARKINGS), UNDER CITY OF LAS VEGAS AND NDOT JURISDICTION THAT ARE DISTURBED DURING CONSTRUCTION.
6. REFER TO RD SHEETS FOR LIMITS OF SAWCUT PAVEMENT REPLACEMENT.
7. RESTORE EXISTING GRADES TO ORIGINAL CONDITIONS.
8. SEE ADDITIONAL LVVWD PROJECT SPECIFIC NOTES ON SHEET GN-1.
9. CONTACT NV ENERGY BEFORE EXCAVATING NEAR POWER POLES FOR TEMPORARY POLE SUPPORT.

CONSTRUCTION KEY NOTES

A. PROTECT IN PLACE.
B. INSTALL RCB STORM DRAIN PER TRENCH DETAIL C-901 / SHEET DT-1.
D. INSTALL 48" DIAMETER RISER TYPE MANHOLE ON RCB MAIN STORM DRAIN PER DETAIL C-905 / SHEET DT-2.

CALL SOUTHWEST GAS CORPORATION AT 702-400-1789 FOR STANDBY WHEN EXCAVATING OVER OR NEAR HIGH PRESSURE GAS LINES 48 HOURS PRIOR TO CONSTRUCTION.

APPROVED FOR CONSTRUCTION
SOUTHWEST GAS CORPORATION
DATE:

APPROVED FOR CONSTRUCTION
LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
DATE: PROJECT# XXXXX

NO.	DATE	REVISIONS

PREPARED BY
Stantec
3010 W. CHARLESTON BLVD.
SUITE 100
LAS VEGAS, NV 89102

PREPARED FOR
CITY OF LAS VEGAS

H# 170149

DATE: JULY 2017

SUBMITTAL STAGE:
30% - PRELIMINARY

DESIGNED BY: RW
DRAWN BY: ED
CHECKED BY: XXX

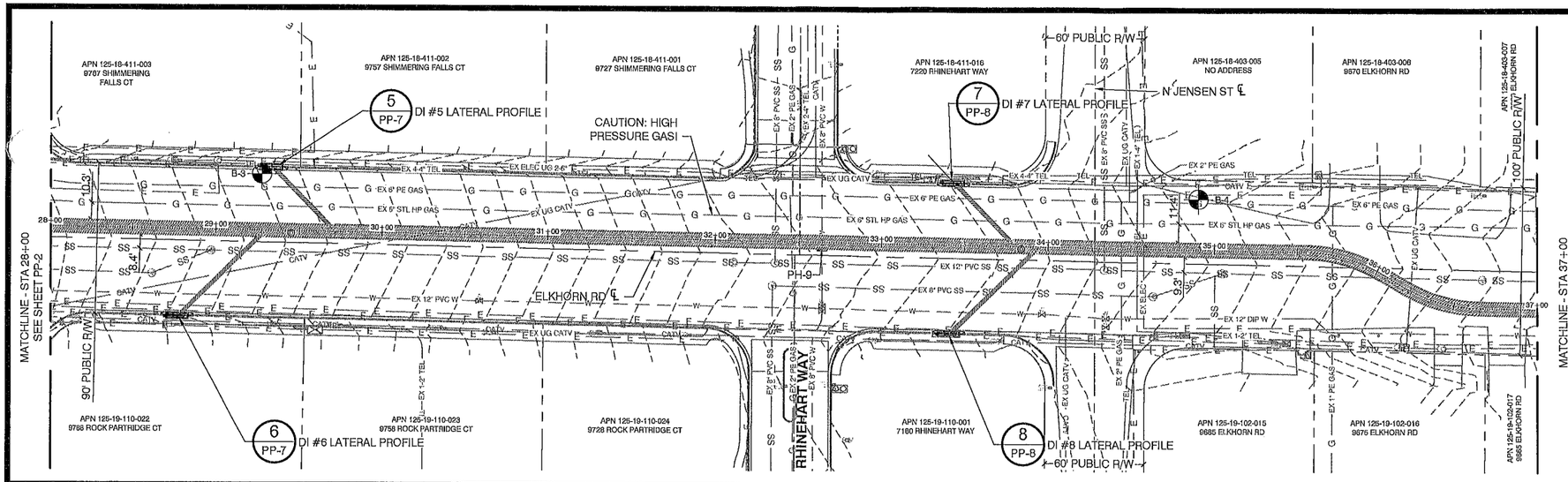
BID# XX.XXXXX

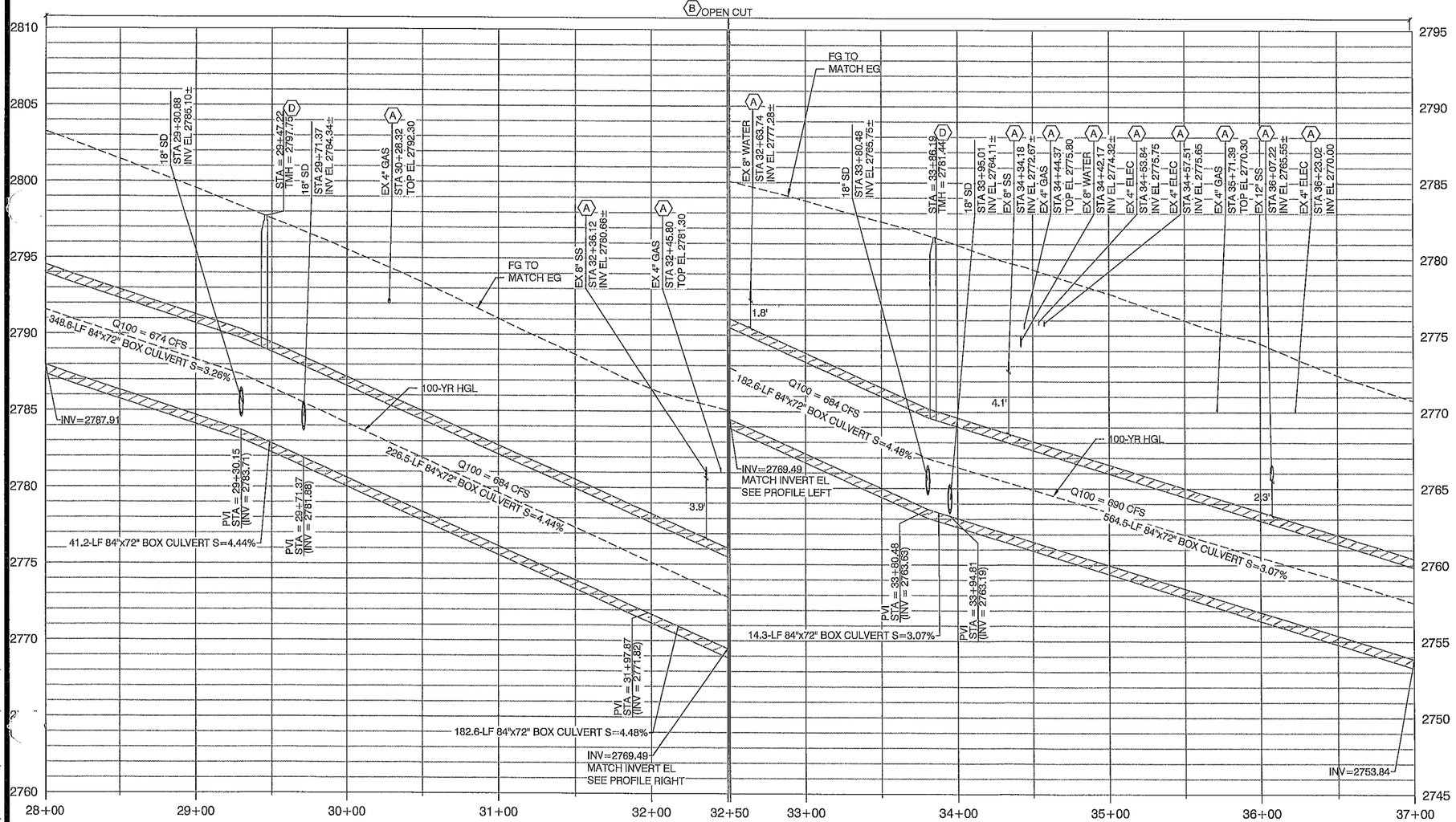
TITLE
RANCHO ROAD SYSTEM
STORM DRAIN - ELKHORN

SHEET
STORM DRAIN PLAN AND PROFILE
STA 19+00 TO 28+00

NOT FOR CONSTRUCTION

SHEET
PP-2
10 OF 22
DRAWING NO.
XXX-XXXX





C:\PW\WORK\DIR\D0324248\JH170149-PP-01-PP-09.DWG

7/6/17

GRAPHIC SCALE

NORTH

40 0 20 40 80

(IN FEET)

HORIZONTAL SCALE: 1" = 40'

VERTICAL SCALE: 1" = 4'

CALL BEFORE CONSTRUCTION

BEFORE YOU DIG	USA NORTH	811 OR 800-227-2600
BEFORE YOU UNDERGROUND	F.A.S.T.	702-432-5300
	CLARK COUNTY TRAFFIC OPERATIONS	702-455-7511
	CITY OF LAS VEGAS T.E.F.O.	702-229-6611
BEFORE YOU OVERHEAD	NV ENERGY	702-227-2929

GENERAL NOTES

1. REFER TO SHEET GN-2 FOR OVERALL SHEET INDEX LIST.
2. ALL UTILITIES DEPICTED THROUGHOUT DRAWINGS ARE APPROXIMATE ONLY AND ALL UTILITIES MAY NOT BE SHOWN. CONTRACTOR MUST FIELD VERIFY AND PERFORM POTHOLES PRIOR TO CONSTRUCTION.
3. ALL EXISTING UTILITIES SHALL BE PROTECTED IN PLACE UNLESS SHOWN OTHERWISE.
4. REFER TO USDCCA DWG # 501.1 FOR TYPICAL UNDERGROUND UTILITY LOCATIONS, IF RESIDENTIAL SERVICE LATERALS ARE NOT SHOWN.
5. REPLACE ALL TRAFFIC CONTROL DEVICES (SIGNALS, LOOPS, CONDUITS, SIGNS, AND PAVEMENT MARKINGS), UNDER CITY OF LAS VEGAS AND NDOT JURISDICTION THAT ARE DISTURBED DURING CONSTRUCTION.
6. REFER TO RD SHEETS FOR LIMITS OF SAWCUT PAVEMENT REPLACEMENT.
7. RESTORE EXISTING GRADES TO ORIGINAL CONDITIONS.
8. SEE ADDITIONAL LVVWD PROJECT SPECIFIC NOTES ON SHEET GN-1.
9. CONTACT NV ENERGY BEFORE EXCAVATING NEAR POWER POLES FOR TEMPORARY POLE SUPPORT.

CONSTRUCTION KEY NOTES

A. PROTECT IN PLACE.
B. INSTALL RCB STORM DRAIN PER TRENCH DETAIL C-901 / SHEET DT-1.
D. INSTALL 48" DIAMETER RISER TYPE MANHOLE ON RCB MAIN STORM DRAIN PER DETAIL C-905 / SHEET DT-2.

CALL SOUTHWEST GAS CORPORATION AT 702-400-1789 FOR STANDBY WHEN EXCAVATING OVER OR NEAR HIGH PRESSURE GAS LINES 48 HOURS PRIOR TO CONSTRUCTION.

APPROVED FOR CONSTRUCTION
SOUTHWEST GAS CORPORATION
DATE:

APPROVED FOR CONSTRUCTION
LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
DATE: PROJECT# XXXXX

NO.	DATE	REVISIONS

PREPARED BY
Stantec
3010 W. CHARLESTON BLVD. SUITE 100
LAS VEGAS, NV 89102

PREPARED FOR
CITY OF LAS VEGAS

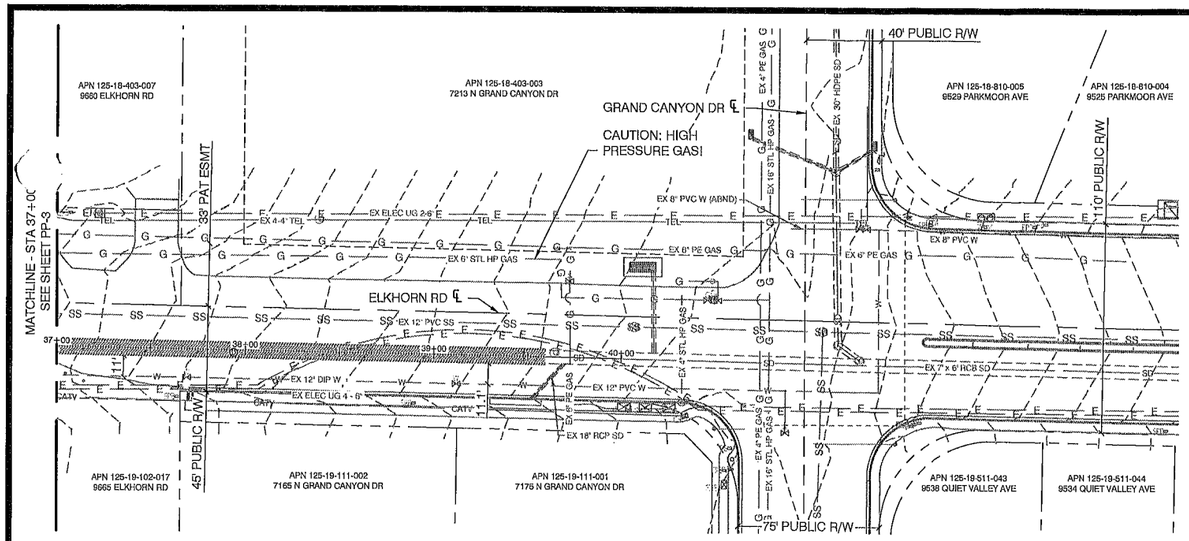
H# 170149 | BID# XX-XXXXX | DESIGNED BY: RVV
DATE: JULY 2017 | SUBMITTAL STAGE: 30% - PRELIMINARY | DRAWN BY: ED | CHECKED BY: XXX

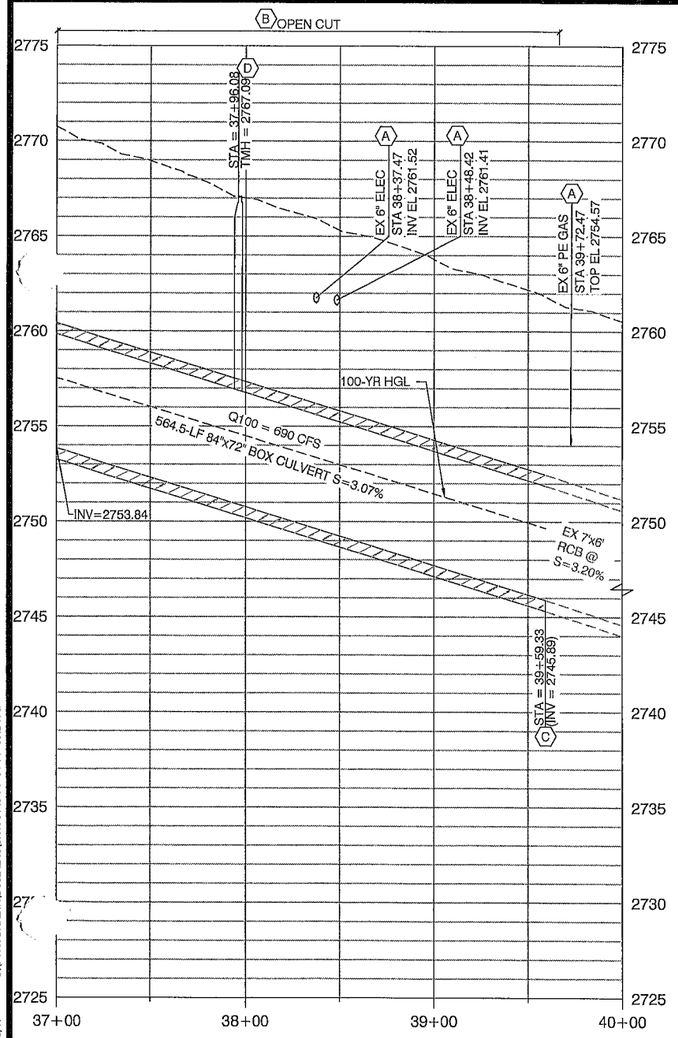
TITLE
RANCHO ROAD SYSTEM
STORM DRAIN - ELKHORN

SHEET
STORM DRAIN PLAN AND PROFILE
STA 28+00 TO 37+00

NOT FOR CONSTRUCTION

SHEET
PP-3
11 OF 22
DRAWING NO.
XXX-XXXX





NORTH

GRAPHIC SCALE
40 0 20 40 80
(IN FEET)
HORIZONTAL SCALE: 1" = 40'
VERTICAL SCALE: 1" = 4'

CALL BEFORE CONSTRUCTION

BEFORE YOU DIG	USA NORTH	811 OR 800-227-2600
BEFORE YOU UNDERGROUND	F.A.S.T.	702-432-5300
	CLARK COUNTY TRAFFIC OPERATIONS	702-455-7511
	CITY OF LAS VEGAS T.E.F.O.	702-229-6611
BEFORE YOU OVERHEAD	NV ENERGY	702-227-2929

GENERAL NOTES

1. REFER TO SHEET GN-2 FOR OVERALL SHEET INDEX LIST.
2. ALL UTILITIES DEPICTED THROUGHOUT DRAWINGS ARE APPROXIMATE ONLY AND ALL UTILITIES MAY NOT BE SHOWN. CONTRACTOR MUST FIELD VERIFY AND PERFORM POTHOLES PRIOR TO CONSTRUCTION.
3. ALL EXISTING UTILITIES SHALL BE PROTECTED IN PLACE UNLESS SHOWN OTHERWISE.
4. REFER TO USDCCA DWG # 501.1 FOR TYPICAL UNDERGROUND UTILITY LOCATIONS, IF RESIDENTIAL SERVICE LATERALS ARE NOT SHOWN.
5. REPLACE ALL TRAFFIC CONTROL DEVICES (SIGNALS, LOOPS, CONDUITS, SIGNS, AND PAVEMENT MARKINGS), UNDER CITY OF LAS VEGAS AND NDOT JURISDICTION THAT ARE DISTURBED DURING CONSTRUCTION.
6. REFER TO RD SHEETS FOR LIMITS OF SAWCUT PAVEMENT REPLACEMENT.
7. RESTORE EXISTING GRADES TO ORIGINAL CONDITIONS.
8. SEE ADDITIONAL LVVWD PROJECT SPECIFIC NOTES ON SHEET GN-1.
9. CONTACT NV ENERGY BEFORE EXCAVATING NEAR POWER POLES FOR TEMPORARY POLE SUPPORT.

CONSTRUCTION KEY NOTES

A. PROTECT IN PLACE.
B. INSTALL RCB STORM DRAIN PER TRENCH DETAIL C-901 / SHEET DT-1.
C. CONNECT TO EX STORM DRAIN WITH JUNCTION BOX.
D. INSTALL 48" DIAMETER RISER TYPE MANHOLE ON RCB MAIN STORM DRAIN PER DETAIL C-905 / SHEET DT-2.

CALL SOUTHWEST GAS CORPORATION AT 702-400-1789 FOR STANDBY WHEN EXCAVATING OVER OR NEAR HIGH PRESSURE GAS LINES 48 HOURS PRIOR TO CONSTRUCTION.

APPROVED FOR CONSTRUCTION
SOUTHWEST GAS CORPORATION
DATE:

APPROVED FOR CONSTRUCTION
LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
DATE: PROJECT# XXXXX

NO.	DATE	REVISIONS

PREPARED BY
Stantec
3010 W. CHARLESTON BLVD. SUITE 100
LAS VEGAS, NV 89102

PREPARED FOR
CITY OF LAS VEGAS

H.# 170149 | BID# XX.XXXX | DESIGNED BY: RW
DATE: JULY 2017 | DRAWN BY: ED
SUBMITTAL STAGE: 30% - PRELIMINARY | CHECKED BY: XXX

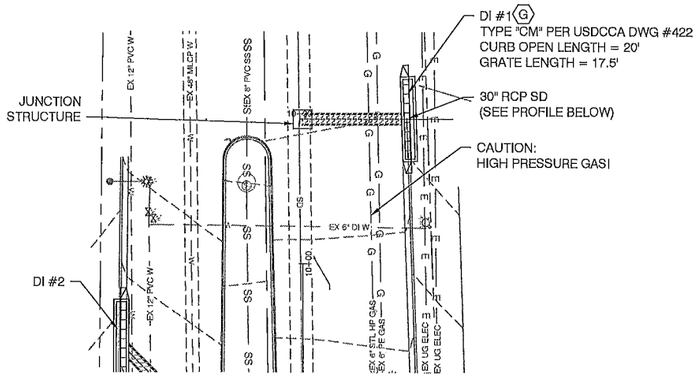
TITLE
RANCHO ROAD SYSTEM
STORM DRAIN - ELKHORN

SHEET
STORM DRAIN PLAN AND PROFILE
STA 37+00 TO 40+00

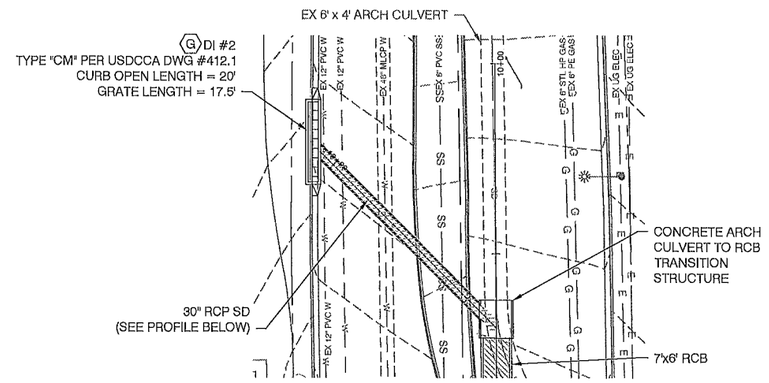
NOT FOR CONSTRUCTION

SHEET
PP-4
12 OF 22
DRAWING NO.
XXX-XXXX

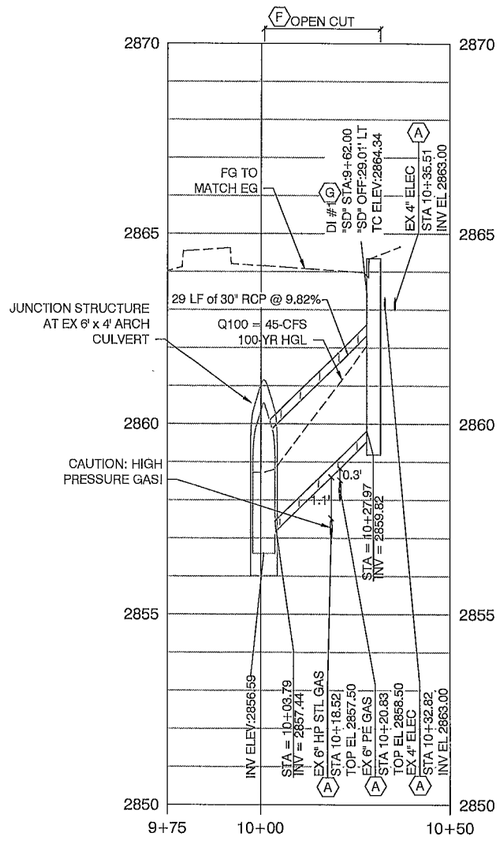
C:\PWWORKDIR\D0324248\JH170149-PP-01-PP-09.DWG
7/6/17



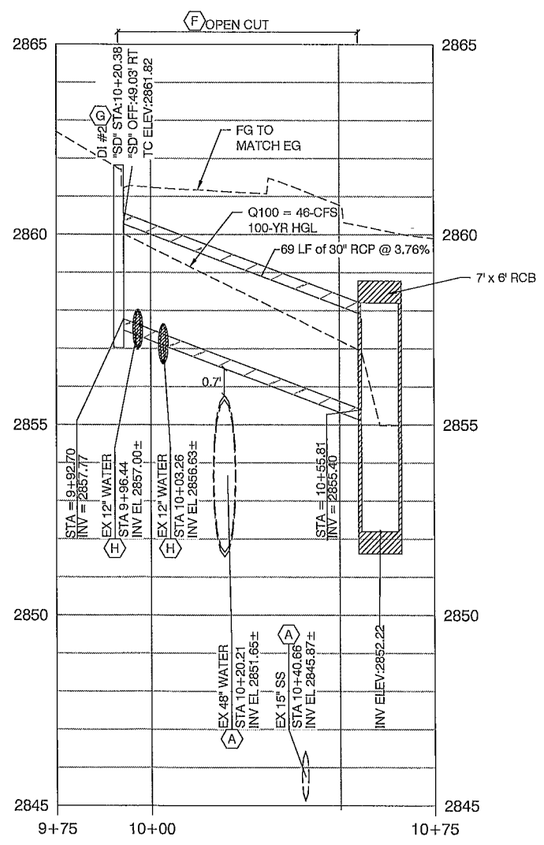
1 PP-1 DI #1 PLAN
SCALE: 1" = 20'-0"



2 PP-1 DI #2 PLAN
SCALE: 1" = 20'-0"



1 - DI #1 LATERAL PROFILE
SCALE: 1" = 20'-0" H
SCALE: 1" = 2'-0" V



2 - DI #2 LATERAL PROFILE
SCALE: 1" = 20'-0" H
SCALE: 1" = 2'-0" V

NORTH

GRAPHIC SCALE
20 0 10 20 40
(IN FEET)
HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 2'

CALL BEFORE CONSTRUCTION

BEFORE YOU DIG	USA NORTH	811 OR 800-227-2600
BEFORE YOU UNDERGROUND	F.A.S.T.	702-432-5300
	CLARK COUNTY TRAFFIC OPERATIONS	702-455-7511
	CITY OF LAS VEGAS T.E.F.O.	702-229-6611
BEFORE YOU OVERHEAD	NV ENERGY	702-227-2929

GENERAL NOTES

1. REFER TO SHEET GN-2 FOR OVERALL SHEET INDEX LIST.
2. ALL UTILITIES DEPICTED THROUGHOUT DRAWINGS ARE APPROXIMATE ONLY AND ALL UTILITIES MAY NOT BE SHOWN. CONTRACTOR MUST FIELD VERIFY AND PERFORM POTHOLES PRIOR TO CONSTRUCTION.
3. ALL EXISTING UTILITIES SHALL BE PROTECTED IN PLACE UNLESS SHOWN OTHERWISE.
4. REFER TO USDCCA DWG # 501.1 FOR TYPICAL UNDERGROUND UTILITY LOCATIONS, IF RESIDENTIAL SERVICE LATERALS ARE NOT SHOWN.
5. REPLACE ALL TRAFFIC CONTROL DEVICES (SIGNALS, LOOPS, CONDUITS, SIGNS, AND PAVEMENT MARKINGS), UNDER CITY OF LAS VEGAS AND NDOT JURISDICTION THAT ARE DISTURBED DURING CONSTRUCTION.
6. REFER TO RD SHEETS FOR LIMITS OF SAWCUT PAVEMENT REPLACEMENT.
7. RESTORE EXISTING GRADES TO ORIGINAL CONDITIONS.
8. SEE ADDITIONAL LVVWD PROJECT SPECIFIC NOTES ON SHEET GN-1.
9. CONTACT NV ENERGY BEFORE EXCAVATING NEAR POWER POLES FOR TEMPORARY POLE SUPPORT.

CONSTRUCTION KEY NOTES

A. PROTECT IN PLACE.
F. INSTALL STORM DRAIN LATERAL, PER TRENCH DETAIL C-900 / SHEET DT-1.
G. INSTALL DROP INLET, TYPE AND SIZE AS INDICATED.
H. DEMOLISH AND RELOCATE UTILITY IN CONFLICT. SEE DR DRAWINGS FOR LIMITS.

CALL SOUTHWEST GAS CORPORATION AT 702-400-1789 FOR STANDBY WHEN EXCAVATING OVER OR NEAR HIGH PRESSURE GAS LINES 48 HOURS PRIOR TO CONSTRUCTION.

APPROVED FOR CONSTRUCTION
SOUTHWEST GAS CORPORATION
DATE:

APPROVED FOR CONSTRUCTION
LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
DATE: PROJECT# XXXXX

NO.	DATE	REVISIONS

PREPARED BY
Stantec
3010 W. CHARLESTON BLVD.
SUITE 100
LAS VEGAS, NV 89102

PREPARED FOR
CITY OF LAS VEGAS

H# 170149 | BID# XX-XXXXX | DESIGNED BY: RW | DRAWN BY: ED | CHECKED BY: XXX
DATE: JULY 2017 | SUBMITTAL STAGE: 30% - PRELIMINARY

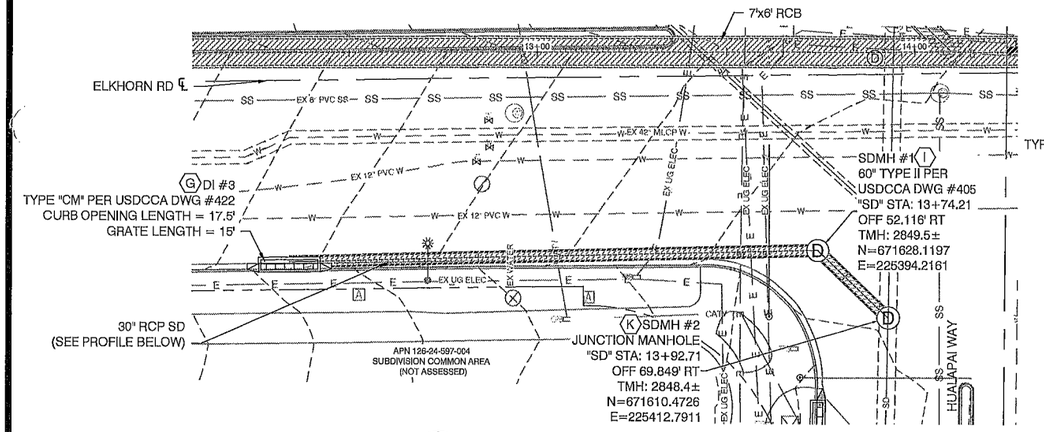
TITLE
RANCHO ROAD SYSTEM
STORM DRAIN - ELKHORN

SHEET
STORM DRAIN LATERALS
PLAN AND PROFILE I

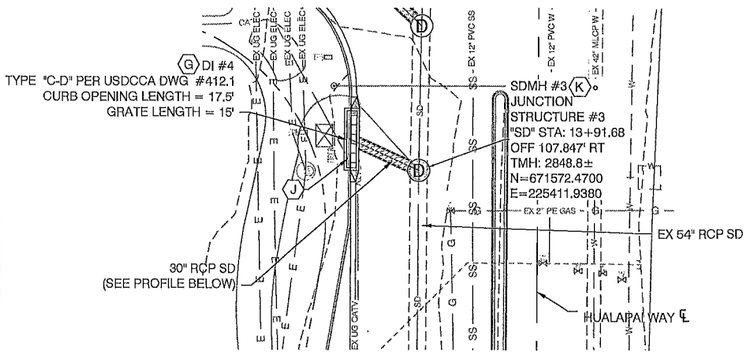
NOT FOR CONSTRUCTION

SHEET
PP-5
13 OF 22
DRAWING NO.
XXX-XXXX

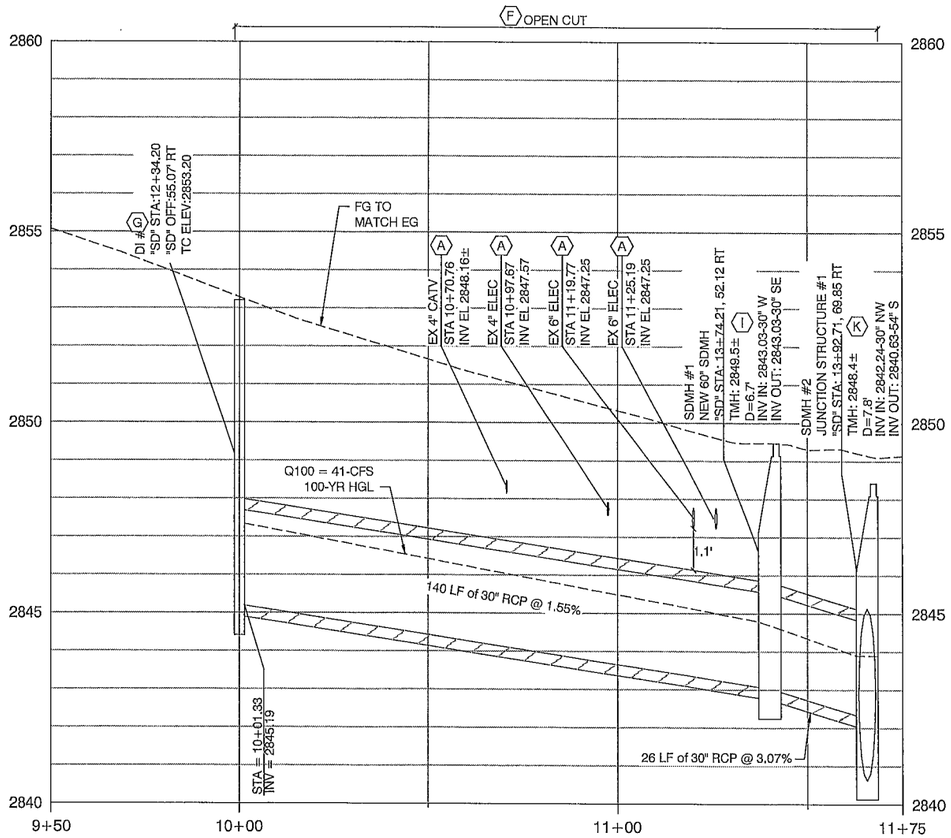
C:\PWWORKDIR\D0302\e248\JH170149-PP-01-PP-08.DWG
7/6/17



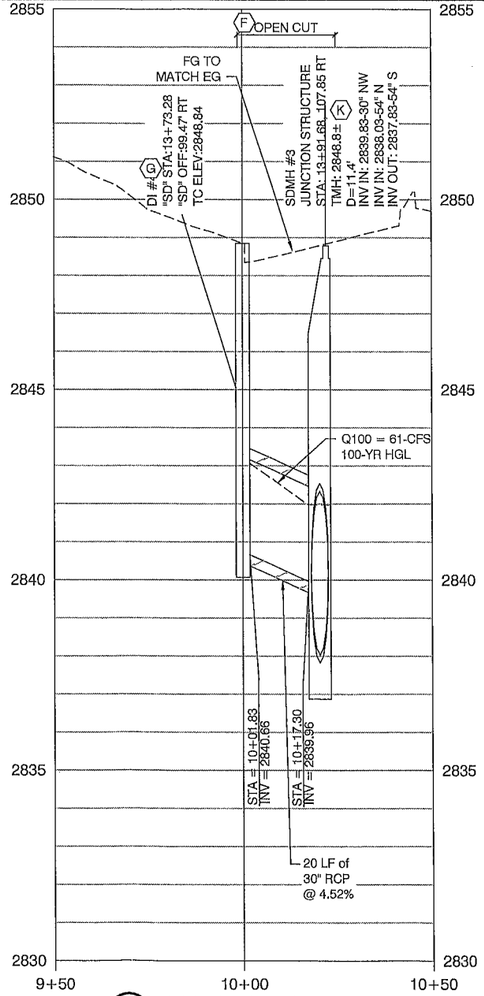
3 PP-1 **DI #3 PLAN**
SCALE: 1" = 20'-0"



4 PP-1 **DI #4 PLAN**
SCALE: 1" = 20'-0"



3 - **DI #3 LATERAL PROFILE**
SCALE: 1" = 20'-0" H
SCALE: 1" = 2'-0" V



4 - **DI #4 LATERAL PROFILE**
SCALE: 1" = 20'-0" H
SCALE: 1" = 2'-0" V

NORTH

GRAPHIC SCALE
20 0 10 20 40
(IN FEET)
HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 2'

CALL BEFORE CONSTRUCTION

BEFORE YOU DIG	USA NORTH	811 OR 800-227-2600
BEFORE YOU UNDERGROUND	F.A.S.T.	702-432-5300
	CLARK COUNTY TRAFFIC OPERATIONS	702-455-7511
	CITY OF LAS VEGAS T.E.F.O.	702-229-6611
BEFORE YOU OVERHEAD	NV ENERGY	702-227-2929

GENERAL NOTES

1. REFER TO SHEET GN-2 FOR OVERALL SHEET INDEX LIST.
2. ALL UTILITIES DEPICTED THROUGHOUT DRAWINGS ARE APPROXIMATE ONLY AND ALL UTILITIES MAY NOT BE SHOWN. CONTRACTOR MUST FIELD VERIFY AND PERFORM POTHOLES PRIOR TO CONSTRUCTION.
3. ALL EXISTING UTILITIES SHALL BE PROTECTED IN PLACE UNLESS SHOWN OTHERWISE.
4. REFER TO USDCCA DWG # 501.1 FOR TYPICAL UNDERGROUND UTILITY LOCATIONS, IF RESIDENTIAL SERVICE LATERALS ARE NOT SHOWN.
5. REPLACE ALL TRAFFIC CONTROL DEVICES (SIGNALS, LOOPS, CONDUITS, SIGNS, AND PAVEMENT MARKINGS), UNDER CITY OF LAS VEGAS AND NDOT JURISDICTION THAT ARE DISTURBED DURING CONSTRUCTION.
6. REFER TO RD SHEETS FOR LIMITS OF SAWCUT PAVEMENT REPLACEMENT.
7. RESTORE EXISTING GRADES TO ORIGINAL CONDITIONS.
8. SEE ADDITIONAL LVVWD PROJECT SPECIFIC NOTES ON SHEET GN-1.
9. CONTACT NV ENERGY BEFORE EXCAVATING NEAR POWER POLES FOR TEMPORARY POLE SUPPORT.

CONSTRUCTION KEY NOTES

A. PROTECT IN PLACE.
F. INSTALL STORM DRAIN LATERAL, PER TRENCH DETAIL C-900 / SHEET DT-1.
G. INSTALL DROP INLET, TYPE AND SIZE AS INDICATED.
I. INSTALL STORM DRAIN MANHOLE, TYPE AND SIZE AS INDICATED.
J. CONTRACTOR SHALL COORDINATE WITH DRY UTILITY COMPANIES TO ADJUST EXISTING UTILITY LINES AROUND DROP INLET.
K. INSTALL JUNCTION STRUCTURE MANHOLE.

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
DATE: PROJECT# XXXXX

NO.	DATE	REVISIONS

PREPARED BY
Stantec
3010 W. CHARLESTON BLVD.
SUITE 100
LAS VEGAS, NV 89102

PREPARED FOR
CITY OF LAS VEGAS

H# 170149 | BID# XX-XXXXX | DESIGNED BY: RVV
DATE: JULY 2017 | SUBMITTAL STAGE: **30% - PRELIMINARY** | DRAWN BY: ED | CHECKED BY: XXX

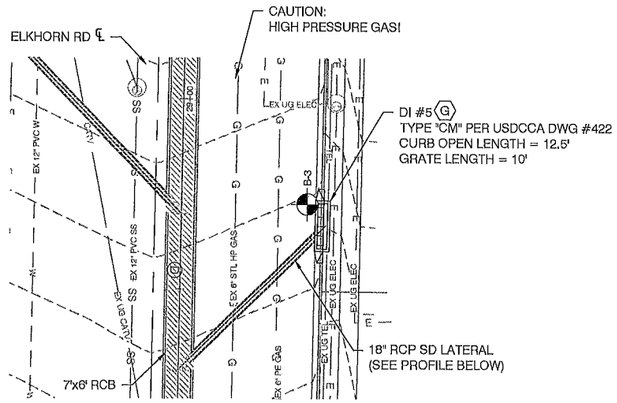
TITLE: **RANCHO ROAD SYSTEM STORM DRAIN - ELKHORN**

SHEET: **STORM DRAIN LATERALS PLAN AND PROFILE II**

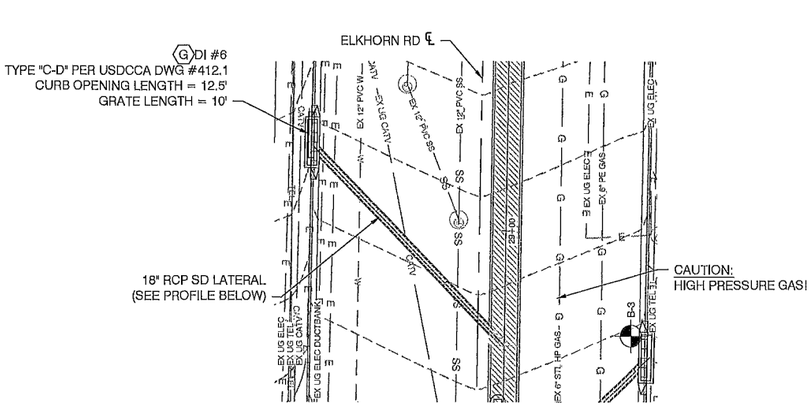
NOT FOR CONSTRUCTION

SHEET **PP-6**
14 OF 22
DRAWING NO. XXX-XXXX

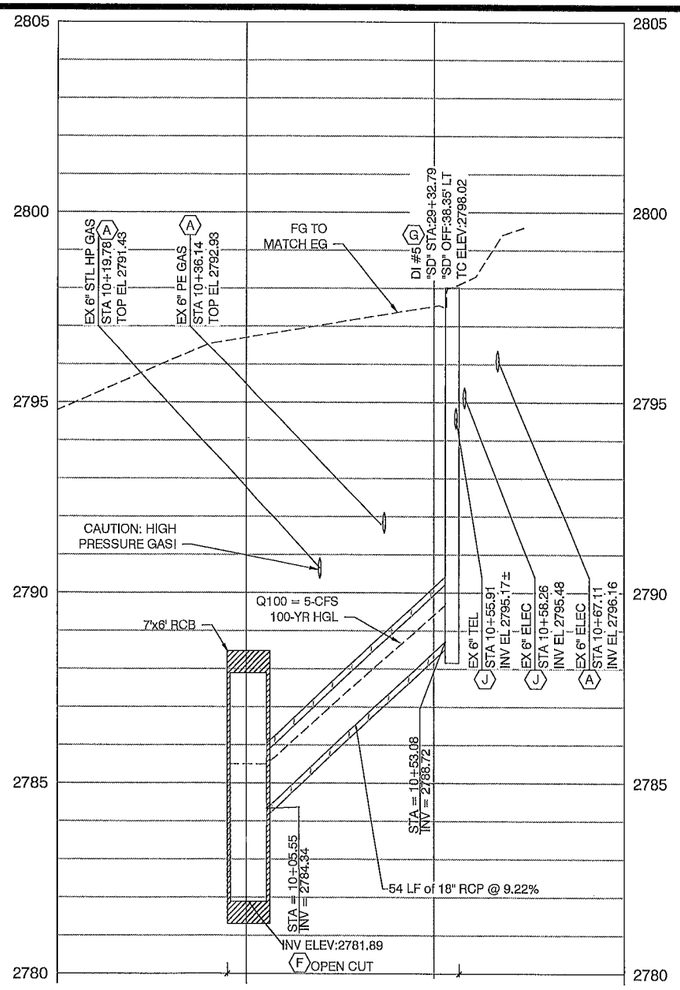
C:\PWWORKDIR\D0328248\JH170149-PP-01-PP-09.DWG
7/6/17



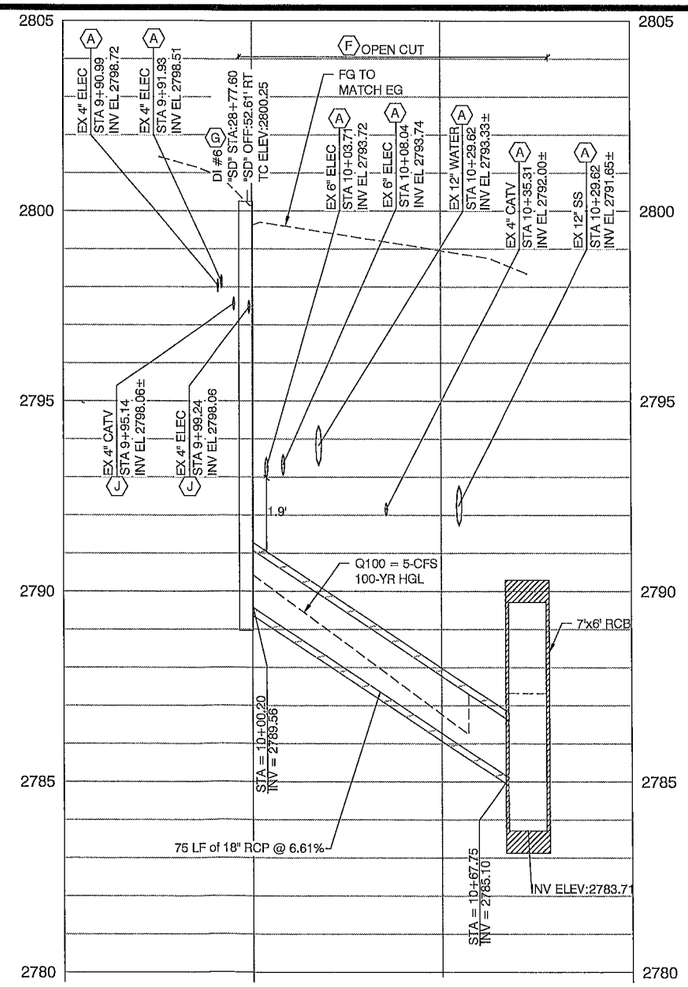
5 PP-3 DI #5 PLAN
SCALE: 1" = 20'-0"



6 PP-3 DI #6 PLAN
SCALE: 1" = 20'-0"



5 - DI #5 LATERAL PROFILE
SCALE: 1" = 20'-0" H
SCALE: 1" = 2'-0" V



6 - DI #6 LATERAL PROFILE
SCALE: 1" = 20'-0" H
SCALE: 1" = 2'-0" V

GRAPHIC SCALE
20 0 10 20 40
(IN FEET)
HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 2'

NORTH

CALL BEFORE CONSTRUCTION

BEFORE YOU DIG	USA NORTH	811 OR 800-227-2600
BEFORE YOU UNDERGROUND	F.A.S.T.	702-432-5300
	CLARK COUNTY TRAFFIC OPERATIONS	702-455-7511
	CITY OF LAS VEGAS T.E.F.O.	702-229-6611
BEFORE YOU OVERHEAD	NV ENERGY	702-227-2929

GENERAL NOTES

1. REFER TO SHEET GN-2 FOR OVERALL SHEET INDEX LIST.
2. ALL UTILITIES DEPICTED THROUGHOUT DRAWINGS ARE APPROXIMATE ONLY AND ALL UTILITIES MAY NOT BE SHOWN. CONTRACTOR MUST FIELD VERIFY AND PERFORM POTHOLES PRIOR TO CONSTRUCTION.
3. ALL EXISTING UTILITIES SHALL BE PROTECTED IN PLACE UNLESS SHOWN OTHERWISE.
4. REFER TO USDCCA DWG # 501.1 FOR TYPICAL UNDERGROUND UTILITY LOCATIONS, IF RESIDENTIAL SERVICE LATERALS ARE NOT SHOWN.
5. REPLACE ALL TRAFFIC CONTROL DEVICES (SIGNALS, LOOPS, CONDUITS, SIGNS, AND PAVEMENT MARKINGS), UNDER CITY OF LAS VEGAS AND NDOT JURISDICTION THAT ARE DISTURBED DURING CONSTRUCTION.
6. REFER TO RD SHEETS FOR LIMITS OF SAWCUT PAVEMENT REPLACEMENT.
7. RESTORE EXISTING GRADES TO ORIGINAL CONDITIONS.
8. SEE ADDITIONAL LVVWD PROJECT SPECIFIC NOTES ON SHEET GN-1.
9. CONTACT NV ENERGY BEFORE EXCAVATING NEAR POWER POLES FOR TEMPORARY POLE SUPPORT.

CONSTRUCTION KEY NOTES

A. PROTECT IN PLACE.
F. INSTALL STORM DRAIN LATERAL, PER TRENCH DETAIL C-900 / SHEET DT-1.
G. INSTALL DROP INLET, TYPE AND SIZE AS INDICATED.
J. CONTRACTOR SHALL COORDINATE WITH DRY UTILITY COMPANIES TO ADJUST EXISTING UTILITY LINE AROUND IMPROVEMENTS.

CALL SOUTHWEST GAS CORPORATION AT 702-400-1789 FOR STANDBY WHEN EXCAVATING OVER OR NEAR HIGH PRESSURE GAS LINES 48 HOURS PRIOR TO CONSTRUCTION.

APPROVED FOR CONSTRUCTION
SOUTHWEST GAS CORPORATION
DATE:

APPROVED FOR CONSTRUCTION
LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
DATE: PROJECT# XXXXX

NO.	DATE	REVISIONS

PREPARED BY
Stantec
3010 W. CHARLESTON BLVD.
SUITE 200
LAS VEGAS, NV 89102

PREPARED FOR
CITY OF LAS VEGAS

BID# XX-XXXXX	DESIGNED BY: RW		
H# 170149	DRAWN BY: ED		
DATE: JULY 2017	CHECKED BY: XXX		
SUBMITTAL STAGE: 30% - PRELIMINARY			

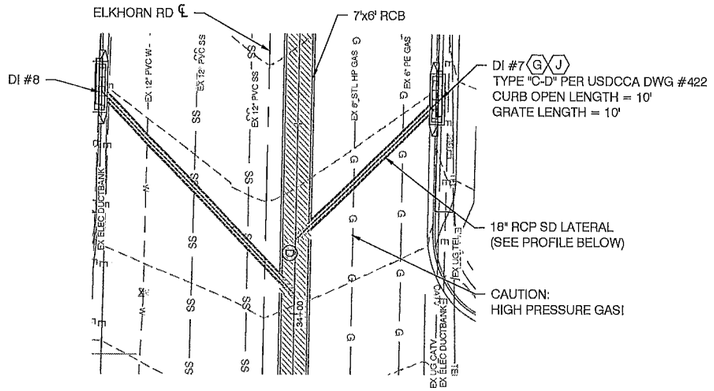
TITLE
RANCHO ROAD SYSTEM
STORM DRAIN - ELKHORN

SHEET
STORM DRAIN LATERALS
PLAN AND PROFILE III

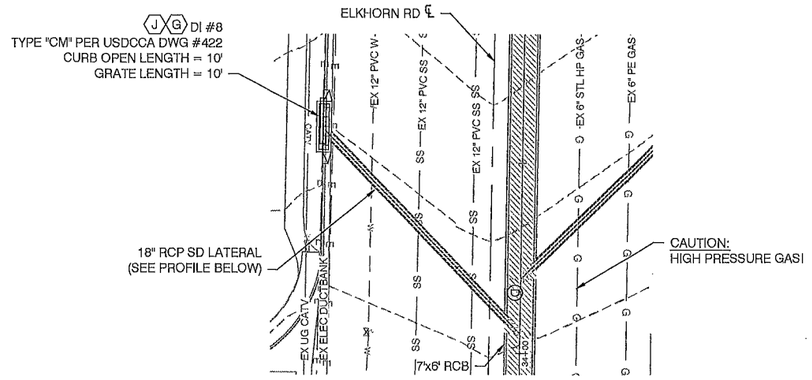
NOT FOR CONSTRUCTION

SHEET
PP-7
15 OF 22
DRAWING NO.
XXX-XXXX

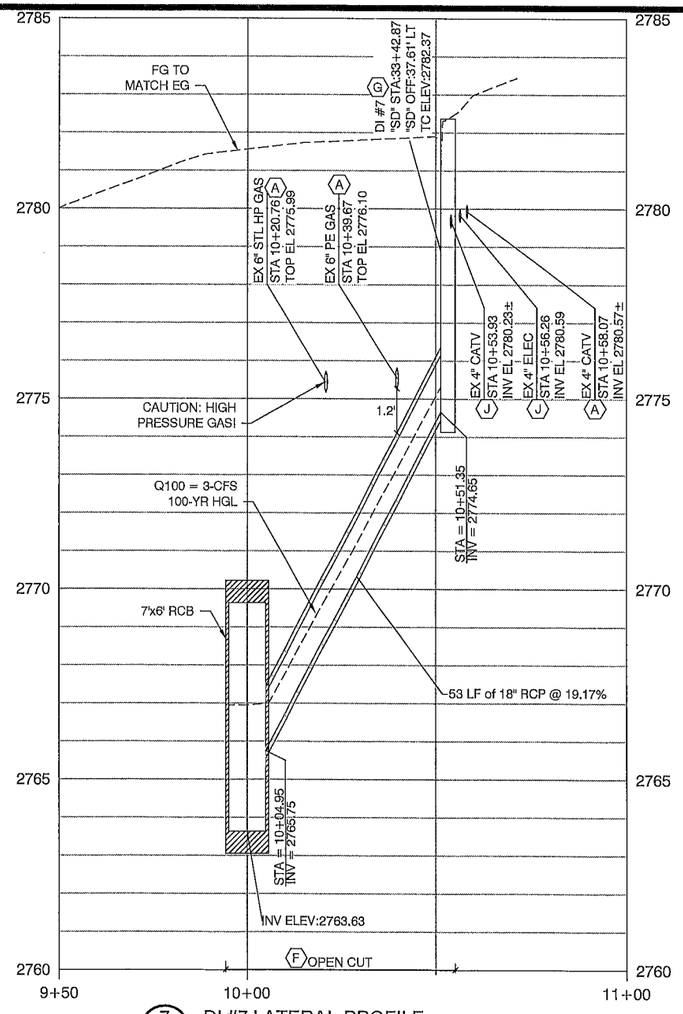
C:\PWWORKDIR\D0324248\UH170149-PP-01-PP-09.DWG
7/6/17



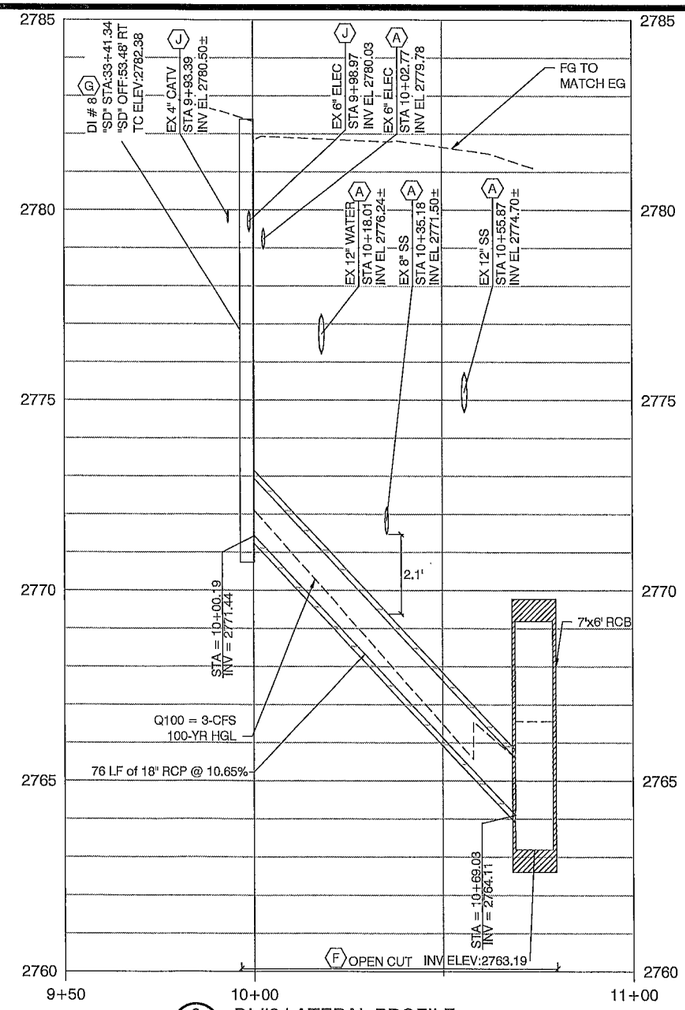
7 PP-3 DI #7 PLAN
SCALE: 1" = 20'-0"



8 PP-3 DI #8 PLAN
SCALE: 1" = 20'-0"



7 - DI #7 LATERAL PROFILE
SCALE: 1" = 20'-0" H
SCALE: 1" = 2'-0" V



8 - DI #8 LATERAL PROFILE
SCALE: 1" = 20'-0" H
SCALE: 1" = 2'-0" V

NORTH

GRAPHIC SCALE
20 0 10 20 40
(IN FEET)
HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 2'

CALL BEFORE CONSTRUCTION

BEFORE YOU DIG	USA NORTH	811 OR 800-227-2600
BEFORE YOU UNDERGROUND	F.A.S.T.	702-432-5300
	CLARK COUNTY TRAFFIC OPERATIONS	702-455-7511
	CITY OF LAS VEGAS T.E.F.O.	702-229-6011
BEFORE YOU OVERHEAD	NV ENERGY	702-227-2929

GENERAL NOTES

1. REFER TO SHEET GN-2 FOR OVERALL SHEET INDEX LIST.
2. ALL UTILITIES DEPICTED THROUGHOUT DRAWINGS ARE APPROXIMATE ONLY AND ALL UTILITIES MAY NOT BE SHOWN. CONTRACTOR MUST FIELD VERIFY AND PERFORM POTHOLES PRIOR TO CONSTRUCTION.
3. ALL EXISTING UTILITIES SHALL BE PROTECTED IN PLACE UNLESS SHOWN OTHERWISE.
4. REFER TO USDCCA DWG # 501.1 FOR TYPICAL UNDERGROUND UTILITY LOCATIONS, IF RESIDENTIAL SERVICE LATERALS ARE NOT SHOWN.
5. REPLACE ALL TRAFFIC CONTROL DEVICES (SIGNALS, LOOPS, CONDUITS, SIGNS, AND PAVEMENT MARKINGS), UNDER CITY OF LAS VEGAS AND NDOT JURISDICTION THAT ARE DISTURBED DURING CONSTRUCTION.
6. REFER TO RD SHEETS FOR LIMITS OF SAWCUT PAVEMENT REPLACEMENT.
7. RESTORE EXISTING GRADES TO ORIGINAL CONDITIONS.
8. SEE ADDITIONAL LVVWD PROJECT SPECIFIC NOTES ON SHEET GN-1.
9. CONTACT NV ENERGY BEFORE EXCAVATING NEAR POWER POLES FOR TEMPORARY POLE SUPPORT.

CONSTRUCTION KEY NOTES

A. PROTECT IN PLACE.
F. INSTALL STORM DRAIN LATERAL, PER TRENCH DETAIL C-900 / SHEET DT-1.
G. INSTALL DROP INLET, TYPE AND SIZE AS INDICATED.
J. CONTRACTOR SHALL COORDINATE WITH DRY UTILITY COMPANIES TO ADJUST EXISTING UTILITY LINE AROUND DROP INLET.

CALL SOUTHWEST GAS CORPORATION AT 702-400-1789 FOR STANDBY WHEN EXCAVATING OVER OR NEAR HIGH PRESSURE GAS LINES 48 HOURS PRIOR TO CONSTRUCTION.

APPROVED FOR CONSTRUCTION
SOUTHWEST GAS CORPORATION
DATE:

APPROVED FOR CONSTRUCTION
LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
DATE: PROJECT# XXXXX

NO.	DATE	REVISIONS

PREPARED BY
Stantec
3010 W. CHARLESTON BLVD.
SUITE 100
LAS VEGAS, NV 89102

PREPARED FOR
CITY OF LAS VEGAS

H# 170149 | BID# XX-XXXXX | DESIGNED BY: RW
DATE: JULY 2017 | DRAWN BY: ED
SUBMITTAL STAGE: 30% - PRELIMINARY | CHECKED BY: XXX

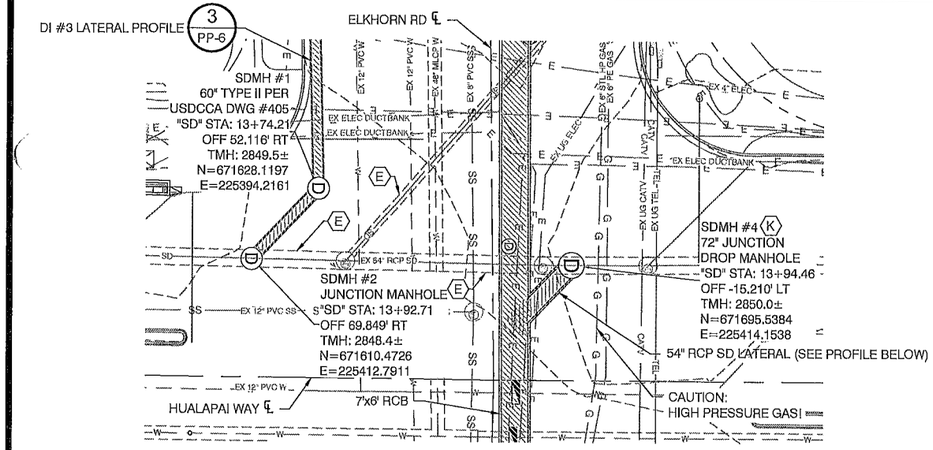
TITLE
RANCHO ROAD SYSTEM
STORM DRAIN - ELKHORN

SHEET
STORM DRAIN LATERALS
PLAN AND PROFILE IV

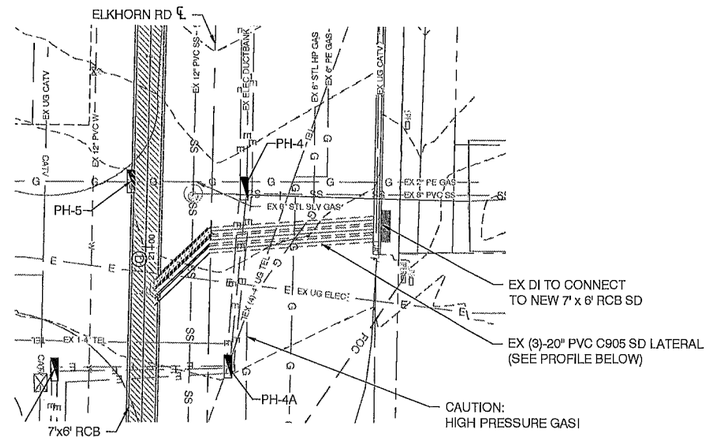
NOT FOR CONSTRUCTION

SHEET
PP-8
16 OF 22
DRAWING NO.
XXX-XXXX

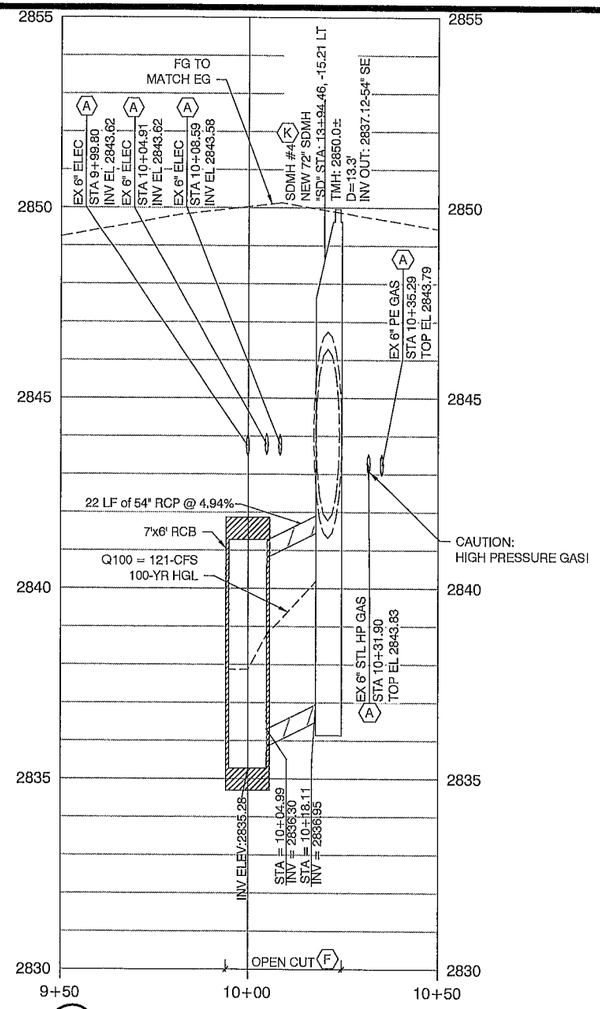
C:\PWWORKDIR\D0324248\JH170149-PP-01-PP-09.DWG
7/6/17



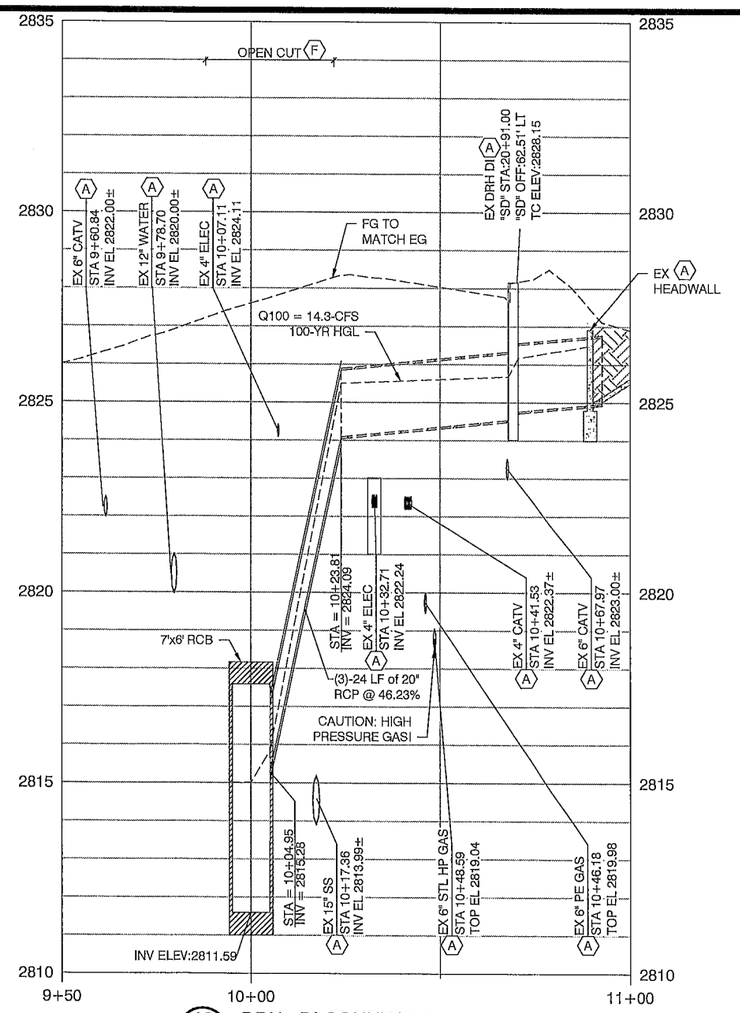
9 PP-1 54" CONNECTION
SCALE: 1" = 20'-0"



10 PP-2 DRH - DI PLAN
SCALE: 1" = 20'-0"



9 - 54" CONNECTION
SCALE: 1" = 20'-0" H
SCALE: 1" = 2'-0" V



10 - DRH - DI CONNECTION
SCALE: 1" = 20'-0" H
SCALE: 1" = 2'-0" V

NORTH

GRAPHIC SCALE
20 0 10 20 40
(IN FEET)
HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 2'

CALL BEFORE CONSTRUCTION

BEFORE YOU DIG	USA NORTH	811 OR 800-227-2600
BEFORE YOU UNDERGROUND	F.A.S.T.	702-432-5300
	CLARK COUNTY TRAFFIC OPERATIONS	702-455-7511
	CITY OF LAS VEGAS T.E.F.O.	702-229-6611
BEFORE YOU OVERHEAD	NV ENERGY	702-227-2929

GENERAL NOTES

1. REFER TO SHEET GN-2 FOR OVERALL SHEET INDEX LIST.
2. ALL UTILITIES DEPICTED THROUGHOUT DRAWINGS ARE APPROXIMATE ONLY AND ALL UTILITIES MAY NOT BE SHOWN. CONTRACTOR MUST FIELD VERIFY AND PERFORM POTHOLES PRIOR TO CONSTRUCTION.
3. ALL EXISTING UTILITIES SHALL BE PROTECTED IN PLACE UNLESS SHOWN OTHERWISE.
4. REFER TO USDCCA DWG # 501.1 FOR TYPICAL UNDERGROUND UTILITY LOCATIONS, IF RESIDENTIAL SERVICE LATERALS ARE NOT SHOWN.
5. REPLACE ALL TRAFFIC CONTROL DEVICES (SIGNALS, LOOPS, CONDUITS, SIGNS, AND PAVEMENT MARKINGS), UNDER CITY OF LAS VEGAS AND NDOT JURISDICTION THAT ARE DISTURBED DURING CONSTRUCTION.
6. REFER TO RD SHEETS FOR LIMITS OF SAWCUT PAVEMENT REPLACEMENT.
7. RESTORE EXISTING GRADES TO ORIGINAL CONDITIONS.
8. SEE ADDITIONAL LVVWD PROJECT SPECIFIC NOTES ON SHEET GN-1.
9. CONTACT NV ENERGY BEFORE EXCAVATING NEAR POWER POLES FOR TEMPORARY POLE SUPPORT.

CONSTRUCTION KEY NOTES

A. PROTECT IN PLACE.
E. DEMOLISH AND REMOVE EX SD LINE, REFER TO DEMOLITION AND REMOVAL (DR) SHEETS FOR LIMITS.
F. INSTALL STORM DRAIN LATERAL, PER TRENCH DETAIL C-900 / SHEET DT-1.
K. INSTALL JUNCTION STRUCTURE DROP MANHOLE.

CALL SOUTHWEST GAS CORPORATION AT 702-400-1789 FOR STANDBY WHEN EXCAVATING OVER OR NEAR HIGH PRESSURE GAS LINES 48 HOURS PRIOR TO CONSTRUCTION.

APPROVED FOR CONSTRUCTION
SOUTHWEST GAS CORPORATION
DATE:

APPROVED FOR CONSTRUCTION
LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
DATE: PROJECT# XXXXX

NO.	DATE	REVISIONS

PREPARED BY: Stantec
3010 W. CHARLESTON BLVD.
LAS VEGAS, NV 89102

PREPARED FOR
CITY OF LAS VEGAS

BID# XX-XXXXX	DESIGNED BY: RVV
H# 170149	DRAWN BY: ED
DATE: JULY 2017	CHECKED BY: XXX
SUBMITTAL STAGE: 30% - PRELIMINARY	

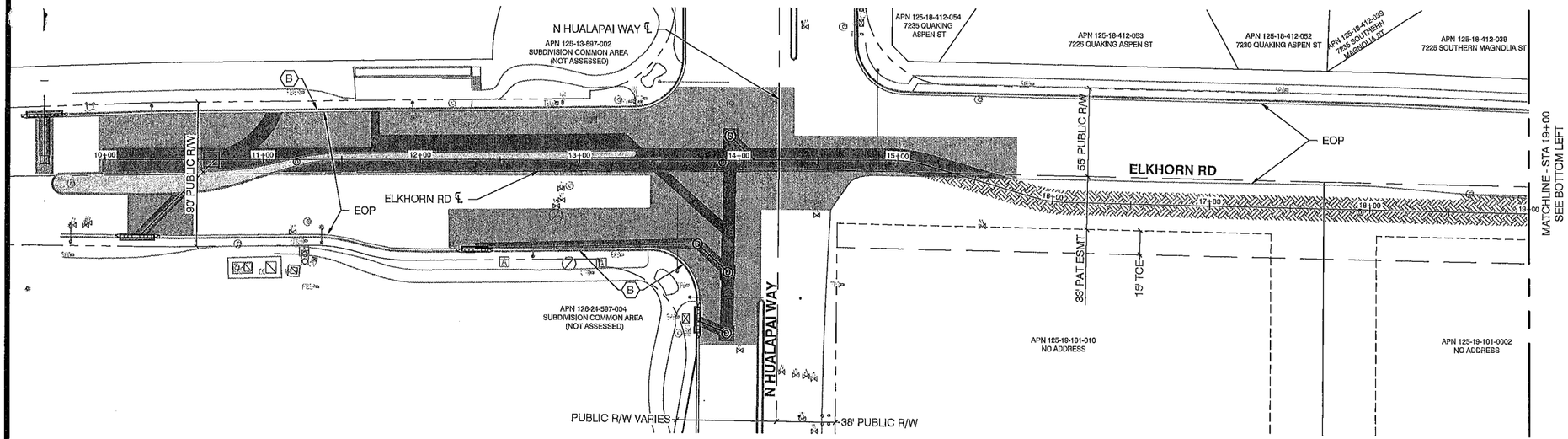
TITLE: RANCHO ROAD SYSTEM
STORM DRAIN - ELKHORN

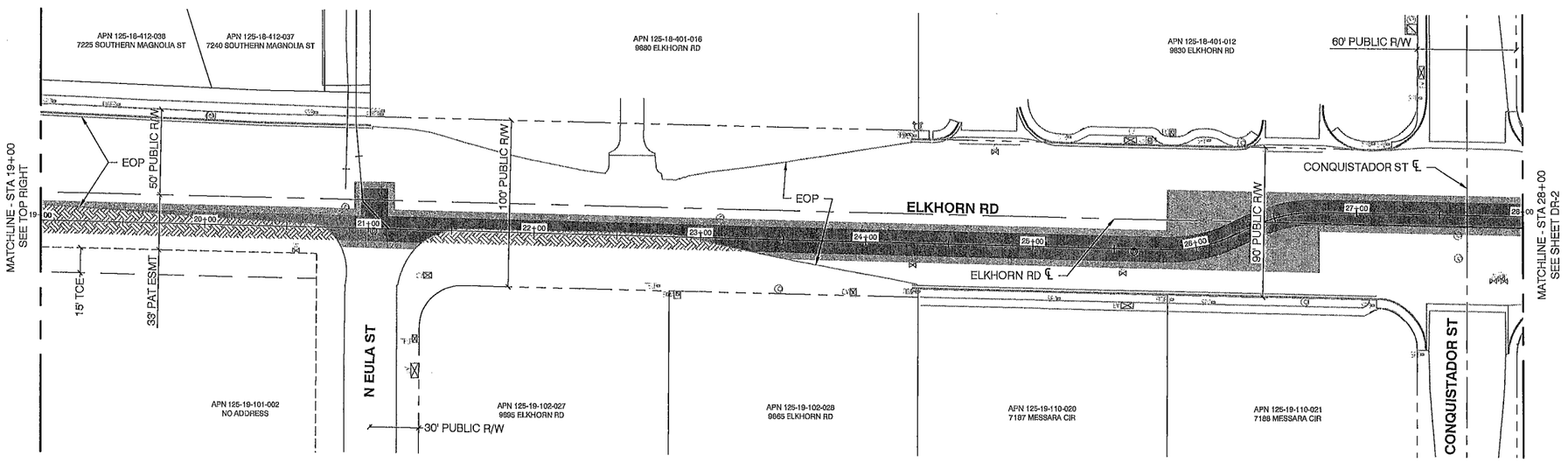
SHEET: STORM DRAIN LATERALS
PLAN AND PROFILE V

NOT FOR CONSTRUCTION

SHEET
PP-9
17 OF 22
DRAWING NO.
XXX-XXXX

C:\PWWORKDIR\D0332424\8\H170149-PP-01-PP-09.DWG
7/5/17





NORTH

GRAPHIC SCALE
40 0 20 40 80
(IN FEET)

HORIZONTAL SCALE: 1" = 40'

CALL BEFORE CONSTRUCTION

BEFORE YOU DIG	USA NORTH	811 OR 800-227-2600
BEFORE YOU UNDERGROUND	F.A.S.T.	702-432-5300
	CLARK COUNTY TRAFFIC OPERATIONS	702-455-7511
	CITY OF LAS VEGAS T.E.F.O.	702-229-6611
BEFORE YOU OVERHEAD	NV ENERGY	702-227-2929

GENERAL NOTES

1. REFER TO SHEET GN-2 FOR OVERALL SHEET INDEX LIST.
2. SAWCUT EXISTING ASPHALT TO THE LIMITS SHOWN. FINAL LIMITS SHALL BE DETERMINED IN THE FIELD BY A CITY INSPECTOR.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR RESTORING ALL DAMAGED EXISTING STREET IMPROVEMENTS TO ORIGINAL CONDITIONS.
4. CONTRACTOR SHALL BE RESPONSIBLE FOR REPLACING PAVEMENT DAMAGED OUTSIDE OF LIMITS DEPICTED ON DRAWINGS.
5. REPLACE DAMAGED VALVE BOX CONCRETE COLLARS AND ADJUST WATER VALVE BOX TO FINISHED GRADE PER UDACS PLATE 39. VALVES SHALL BE ACCESSIBLE AT ALL TIMES. PROTECT IN PLACE AND ADJUST LVVWD FACILITIES TO FINISHED GRADE. ALL LVVWD FACILITIES SHALL BE ACCESSIBLE AT ALL TIMES.
6. REPLACE ALL TRAFFIC CONTROL DEVICES (SIGNALS, LOOPS, CONDUITS, SIGNS, AND PAVEMENT MARKINGS), IN CITY OF LAS VEGAS AND NDOT JURISDICTION THAT ARE DISTURBED, DESTROYED, MOVED, OR MODIFIED BY TRENCHING ACTIVITY TO ORIGINAL CONDITIONS.
7. ALL STREET IMPROVEMENTS SHALL BE PROTECTED IN PLACE UNLESS SHOWN OTHERWISE.
8. MEDIANS, PAVEMENT MARKINGS, AND ALL OTHER TRAFFIC CONTROL DEVICES REMOVED AND OR REPLACED OR ADJUSTED DUE TO THE CONTRACTORS TRAFFIC CONTROL PLANS SHALL BE RETURNED TO PRE-EXISTING CONDITIONS AND WILL BE PAID FOR UNDER ITEM 624.01.
9. PROTECT IN PLACE AND ADJUST LVVWD FACILITIES TO FINISHED GRADE. ALL LVVWD FACILITIES SHALL BE ACCESSIBLE AT ALL TIMES.

CONSTRUCTION KEY NOTES

A. PROTECT IN PLACE.

B. RESTORE EXISTING CURB AND GUTTER TO PRE-EXISTING CONDITIONS IF DAMAGED DURING CONSTRUCTION.

LEGEND

- DENOTES LIMITS OF FULL DEPTH EXISTING AC PAVEMENT RESTORATION PER C-902/DT-1.
- DENOTES LIMITS OF MILL AND OVERLAY EXISTING AC PAVEMENT RESTORATION PER C-902/DT-1.
- DENOTES LIMITS OF EXISTING AC PAVEMENT MEDIAN ISLAND WITH CONCRETE CURB RESTORATION PER DETAIL C-904/DT-1.
- DENOTES LIMITS OF EXISTING UNPAVED AREA RESTORATION PER DETAIL C-903/DT-1.

APPROVED FOR CONSTRUCTION
SOUTHWEST GAS CORPORATION
DATE:

APPROVED FOR CONSTRUCTION
LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
DATE: PROJECT# XXXXX

NO.	DATE	REVISIONS

PREPARED BY
Stantec
3010 W. CHARLESTON BLVD.
SUITE 100
LAS VEGAS, NV 89102

PREPARED FOR
CITY OF LAS VEGAS

I:# 170149	BID# XX-XXXXX
DATE: JULY 2017	DESIGNED BY: RW
SUBMITTAL STAGE: 30% - PRELIMINARY	DRAWN BY: ED
	CHECKED BY: XXX

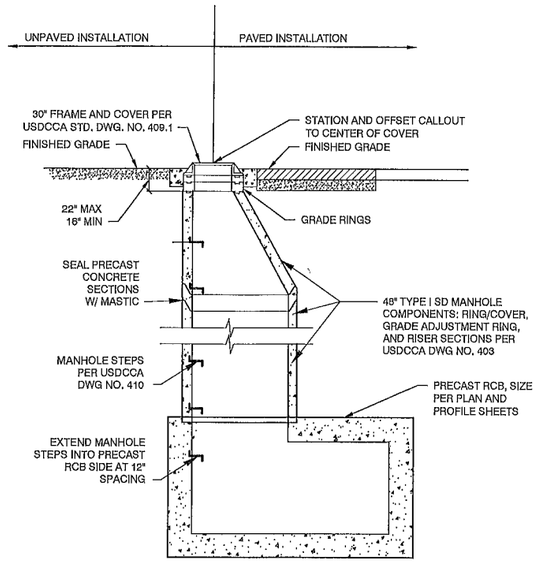
TITLE
RANCHO ROAD SYSTEM
STORM DRAIN - ELKHORN

SHEET
PAVING PLAN
STA 9+50 TO 28+00

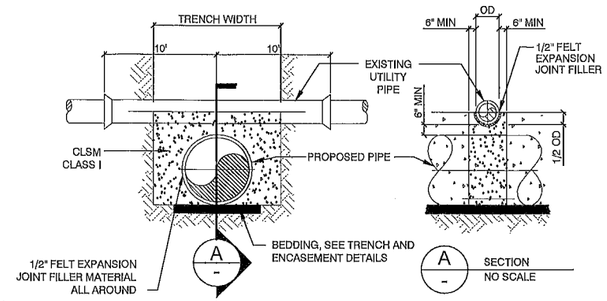
NOT FOR CONSTRUCTION

SHEET
RD-1
18 OF 22
DRAWING NO.
XXX-XXXX

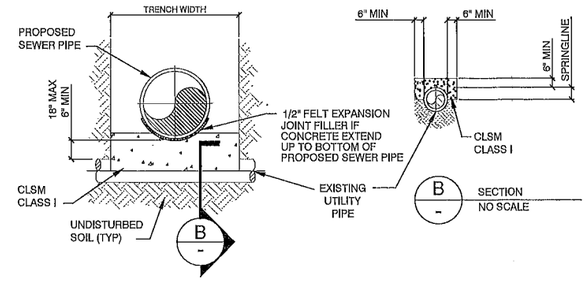
C:\PWWORKDIR\D0282424\UH170149-RD-01-RD-02.DWG
7/6/17



RCB MANHOLE RISER C-905



EXISTING PIPE UNDER NEW PIPE



EXISTING UTILITY STRUCTURAL SUPPORT AT CROSSINGS C-906

NOTES

1. REPLACE CLSM WITH 3,000 PSI CONCRETE WHEN CLEARANCE BETWEEN EXISTING UTILITY OUTER DIAMETER (OD) AND PROPOSED SS PIPE OD IS ONE FOOT OR LESS.
2. INSTALL #15 FELT OR NEOPRENE WATERSTOP AROUND WATER PIPE PRIOR TO THE POUR OF CLSM OR CONCRETE ENCASEMENT TO PREVENT BONDING.
3. IF VERTICAL CLEARANCE IS LESS THAN 6" CONTACT ENGINEER.
4. REFER TO SHEET G-2 AND G-3 FOR ADDITIONAL CNLV UTILITIES DEPARTMENT REQUIREMENTS.

NO.	DATE	REVISIONS

PREPARED BY
Stantec
3010 W. CHARLESTON BLVD.
SUITE 100
LAS VEGAS, NV 89102

PREPARED FOR
CITY OF LAS VEGAS

H# 170149
BID# XX-XXXXX
DATE: JULY 2017
SUBMITTAL STAGE: 30% - PRELIMINARY
DESIGNED BY: RW
DRAWN BY: ED
CHECKED BY: XXX

TITLE
RANCHO ROAD SYSTEM
STORM DRAIN - ELKHORN

SHEET
CIVIL DETAILS II

NOT FOR CONSTRUCTION

SHEET
DT-2
22 OF 22
DRAWING NO.
XXX-XXXX

APPROVED FOR CONSTRUCTION
SOUTHWEST GAS CORPORATION
DATE:

APPROVED FOR CONSTRUCTION
LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
DATE:
PROJECT# XXXXX

APPENDIX D.7
STANDARD FORM 4 CALCULATIONS

MWH now part of Stantec

THIS PAGE WAS INTENTIONALLY LEFT BLANK

STANDARD FORM 4

PROJECT: Elkhorn

JOB # _____ CALCULATED BY: TB

V1 applies to the first 500 feet of travel distance V2 applies to the remaining travel distance	
Existing:	Developed
$V1=148*S^{1/2}$ $V2=294*S^{1/2}$	$V1=202*S^{1/2}$ $V2=306*S^{1/2}$

$$T_i = \frac{1.8(1.1-k)L^{1/2}}{S^{1/3}} \qquad T_t = \frac{L}{60V}$$

$$k = 0.0132C_n - 0.39 \qquad T_c = T_i + T_t$$

SUB-BASIN DATA					INITIAL/OVERLAND TIME (Ti)			TRAVEL TIME (Tt)					Tc CHECK (URBANIZED BASINS)		FINAL Tc	LAG TIME	REMARKS
DESIG. (1)	Cn	K (2)	AREA Ac. (3)	AREA Mi^2	LENGTH Ft (4)	SLOPE % (5)	Ti Min. (6)	LENGTH Ft. (7)	SLOPE % (8)	V1 fps (9a)	V2 fps (9b)	Tt Min. (10)	TOTAL LENGTH (11)	Tc Min. (12)	Min.	TLAG Hr.	
ON1A	62.7	0.437	32.1	0.0502	700	0.7	36.24	1965	3.6	3.8	5.8	6.37	2665	24.81	24.81	0.248	Developed
ON1B	61.0	0.416	7.0	0.0110	620	4.0	19.32	637	0.2	0.9	1.4	10.39	1257	16.98	16.98	0.170	Developed
ON2A1	51.0	0.283	4.8	0.0075	335	4.0	16.97	623.62	0.1	0.7	1.0	14.47	958.92	15.33	15.33	0.153	Developed
ON2A2	89.0	0.785	4.7	0.0074	332	3.8	6.60	564.11	0.2	0.9	1.4	10.01	895.81	14.98	14.98	0.150	Developed
ON2B	63.1	0.443	9.1	0.0142	350	3.2	14.98	584.34	0.1	0.5	0.7	18.72	934.34	15.19	15.19	0.152	Developed
ON2C	54.0	0.323	3.6	0.0056	310	3.5	16.22	612.22	0.1	0.6	0.9	15.79	922.22	15.12	15.12	0.151	Developed
ON3A	68.7	0.516	3.1	0.0049	324	0.8	20.29	665.25	3.5	3.8	5.7	2.69	989.25	15.50	15.50	0.155	Developed
ON3B	81.3	0.683	3.7	0.0058	217	0.6	13.19	1329.92	3.4	3.7	5.6	4.72	1546.92	18.59	17.91	0.179	Developed

TRAVEL TIME CALCULATIONS

PROJECT: Elkhorn
JOB #:

CALCULATED BY: TB

$$Velocity = CS^{1/2}$$

C1 applies to the first 500 feet of travel distance
C2 applies to the remaining travel distance

Existing:		Developed	
C1=14.8	C2=29.4	C1=20.2	C2=30.6

Basin	Length (ft)	High Elev (ft)	Low Elev (ft)	Slope (ft/ft)	First 500 feet C1	First 500 feet V1 (fps)	Remaining Travel Distance C2	Remaining Travel Distance V2 (fps)
ON1A	1965	2831.59	2760.56	0.036	20.2	3.8	30.6	5.8
ON1B	637	2781.63	2761.2	0.002	20.2	0.9	30.6	1.4
ON2A1	624	2318.68	2817.79	0.001	20.2	0.7	30.6	1.0
ON2A2	564	2807.35	2805.78	0.002	20.2	0.9	30.6	1.4
ON2B	584	2789.59	2789.23	0.001	20.2	0.5	30.6	0.7
ON2C	612	2783.46	2782.94	0.001	20.2	0.6	30.6	0.9
ON3A	665	2827.84	2804.62	0.035	20.2	3.8	30.6	5.7
ON3B	1330	2804.62	2760.49	0.034	20.2	3.7	30.6	5.6

APPENDIX D.8
HEC-1 HYDROLOGIC MODEL

MWH now part of Stantec

THIS PAGE WAS INTENTIONALLY LEFT BLANK

REGIONAL BASIN HEC-1 MODEL (WITH 2017 UPDATED SOILS CURVE NUMBER)

MWH now part of Stantec

THIS PAGE WAS INTENTIONALLY LEFT BLANK

```
1*****************************************
 *                                       *
 *    FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *                JUN  1998              *
 *             VERSION 4.1               *
 *                                       *
 *  RUN DATE   29JUN17  TIME  16:28:42   *
 *                                       *
 *****************************************
```

```
*****************************************
*                                       *
*    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
XXXXXXX  XXXX     X        XXXXX  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
*** FREE ***
               1    ID   ---------------------------------------------------------------------------
               2    ID   Project: RANCHO ROAD SYSTEM STORM DRAIN - ELKHORN

               3    ID   Model: UTLIMATE Model - REGIONAL BASIN ANALYSIS W/2017 SOILS/CN (LBG BASINS O
               4    ID   Design Storm: 100-YR AND 10-YR 6-Hr, SDN3 Distribution
               5    ID   Precipitation:  CCRFCD-HCDDM Of Rainfall Depth-Duration-Frequency
               6    ID
               7    ID   DARF VALUES USED : CCRFCD HCDDM
               8    ID
               9    ID   ---------------------------------------------------------------------------
              10    ID    JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:
              11    ID
              12    ID    AREA (SQUARE MILES)            DARF
              13    ID          0 - 0.5                  0.99
              14    ID          0.5 - 1                  0.975
              15    ID          1 - 2                    0.95
              16    ID          2 - 3                    0.925
              17    ID          3 - 4                    0.915
              18    ID          4 - 5                    0.908
              19    ID          5 - 6                    0.903
              20    ID          6 - 7                    0.895
              21    ID          7 - 8                    0.885
              22    ID
              23    IT       5       0       0     300
              24    IO       5       0       0
              25    IN       5       0       0
              26    JR    PREC    0.99   0.975    0.95   0.925   0.915   0.908   0.903   0.895   0.885
                    *
              27    KK  NW27-C
              28    KM   SUB-BASINS REFERENCED FROM RANCHO-FORT APACHE STORM DRAIN PROJECT
              29    KM   PREPARED BY LOUIS BERGER GROUP AS SUPPLEMENTAL ANALYSIS AND
              30    KM   INCLUDED AS HEC-1 MODEL FASD-TR.DAT MAY 2013
              31    BA   0.148
              32    PB    3.06
              33    PC   0.000   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
              34    PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
              35    PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
              36    PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
              37    PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
              38    PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
              39    PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
              40    PC   0.998   0.999   1.000
              41    LS    0.00    85.8
              42    UD   0.234
                    *
              43    KK  RN27-C
              44    KM   ROUTE NW27-C TO CNW26-C
              45    KM   FACILITY = ELKHORN AND HUALAPAI
              46    KM   FACILITY ID-MILE = EKHU 0023
              47    KM   LINING = RCAP
              48    RD    2300   0.009   0.015       0    TRAP       8       0
                    *
```

CN Number based on 2017 Soils Revised HSG Breakdown

1 HEC-1 INPUT PAGE 2

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

              49    KK  NW26-C
              50    BA   0.367
              51    PB    3.09
              52    LS       0    85.6
              53    UD   0.325
                    *
```

CN Number based on 2017 Soils Revised HSG Breakdown

```
54          KK CNW26-C
55          KM  COMBINE NW26-C AND RN27-C
56          HC       2
            *

57          KK  RN26-C
58          KM  ROUTE CN26-C TO DNW26-C
59          KM  FACILITY = ELKHORN AND HUALAPAI
60          KM  FACILITY ID-MILE = EKHU 0000,0001,0003,0020
61          KM  LINING = RCAP
62          KM  419 CFS IN EXISTING 6'x4' RCA AND 219 AS SURFACE FLOW
63          RD    1250   0.036   0.015       0    TRAP       6       0
            *

64          KK NW53-CC
65          KM   NEW BASIN FOR FLOW IN HUALAPAI LOCAL STORM DRAIN
66          BA   0.099
67          PB    2.85
68          LS       0   80.4
69          UD   0.191
            *

70          KKCNW53-CC
71          KM   COMBINE FLOWS AT ELKHORN & HUALAPAI
72          KM   ADDED BY LBG FOR RANCHO-FT APACHE STORM DRAIN
73          HC       2
            *

74          KK DNW26-C
75          KM   INTERSECTION OF HUALAPAI AND ELKHORN
76          KM   FIRST 631 GOES EAST IN RCBH 0295
77          KM   REMAINING FLOW GOES SOUTH IN BCHU 0054
78          DTDOUTFLOW
79          DI       0     631     733    7102
80          DQ       0     631     631    7000
            *

81          ZZ
```

CN Number based on 2017 Soils Revised HSG Breakdown

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    27      NW27-C
              V
              V
    43      RN27-C
              .
              .
    49        .       NW26-C
              .           .
              .           .
    54     CNW26-C.............
              V
              V
    57      RN26-C
              .
              .
    64        .      NW53-CC
              .           .
              .           .
    70    CNW53-CC.............
              .
              .
    78        .-------->DOUTFLOW
    74     DNW26-C

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
 *                                       *
 *    FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *              JUN  1998                *
 *           VERSION 4.1                 *
 *                                       *
 *  RUN DATE   29JUN17  TIME  16:28:42   *
 *                                       *
 *****************************************
```

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

Project: RANCHO ROAD SYSTEM STORM DRAIN - ELKHORN

Model: UTLIMATE Model - REGIONAL BASIN ANALYSIS W/2017 SOILS/CN (LBG BASINS O
Design Storm: 100-YR AND 10-YR 6-Hr, SDN3 Distribution
Precipitation: CCRFCD-HCDDM Of Rainfall Depth-Duration-Frequency

DARF VALUES USED : CCRFCD HCDDM

JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:

AREA (SQUARE MILES)	DARF
0 - 0.5	0.99
0.5 - 1	0.975
1 - 2	0.95
2 - 3	0.925
3 - 4	0.915
4 - 5	0.908
5 - 6	0.903
6 - 7	0.895
7 - 8	0.885

24 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
.99 .98 .95 .93 .92 .91 .90 .89 .88

1

FOR CONSERVATISM, DEFAULT TO PREVIOUSLY ESTABLISHED FLOWS UPSTREAM OF FS1 ESTABLISHED BY LOUIS BERGER GROUP STUDY

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 RATIO 1 .99	RATIO 2 .98	RATIO 3 .95	RATIO 4 .93	RATIO 5 .92	RATIO 6 .91	RATIO 7 .90	RATIO 8 .89	RATIO 9 .88
HYDROGRAPH AT													
+	NW27-C	.15	1	FLOW	177.	173.	166.	160.	157.	155.	154.	152.	149.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
ROUTED TO													
+	RN27-C	.15	1	FLOW	173.	169.	162.	156.	153.	151.	150.	147.	145.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT													
+	NW26-C	.37	1	FLOW	382.	373.	359.	345.	339.	335.	332.	327.	322.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
2 COMBINED AT													
+	CNW26-C	.51	1	FLOW	551.	538.	518.	497.	489.	483.	480.	472.	465.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
ROUTED TO													
+	RN26-C	.51	1	FLOW	549.	537.	516.	496.	487.	482.	478.	471.	463.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
HYDROGRAPH AT													
+	NW53-CC	.10	1	FLOW	87.	85.	81.	77.	75.	74.	73.	72.	71.
				TIME	3.58	3.58	3.67	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT													
+	CNW53-CC	.61	1	FLOW	624.	610.	586.	562.	552.	546.	542.	533.	524.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
DIVERSION TO													
+	DOUTFLOW	.61	1	FLOW	624.	610.	586.	562.	552.	546.	542.	533.	524.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
HYDROGRAPH AT													
+	DNW26-C	.61	1	FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.
				TIME	.00	.00	.00	.00	.00	.00	.00	.00	.00

1

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

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	INTERPOLATED TO COMPUTATION INTERVAL DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
FOR PLAN = 1 RATIO= .00									
RN27-C	MANE	2.29	174.40	222.07	1.67	5.00	173.35	220.00	1.67

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1320E+02 EXCESS= .0000E+00 OUTFLOW= .1321E+02 BASIN STORAGE= .2215E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RN27-C	MANE	2.31	170.02	221.80	1.63	5.00	169.00	220.00	1.63

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1290E+02 EXCESS= .0000E+00 OUTFLOW= .1290E+02 BASIN STORAGE= .2390E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RN27-C	MANE	2.35	163.46	222.95	1.57	5.00	161.97	220.00	1.57

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1238E+02 EXCESS= .0000E+00 OUTFLOW= .1238E+02 BASIN STORAGE= .2413E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RN27-C	MANE	2.39	157.05	221.83	1.50	5.00	155.71	220.00	1.50

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1187E+02 EXCESS= .0000E+00 OUTFLOW= .1187E+02 BASIN STORAGE= .2416E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RN27-C	MANE	2.40	154.17	220.91	1.48	5.00	152.60	220.00	1.48

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1166E+02 EXCESS= .0000E+00 OUTFLOW= .1167E+02 BASIN STORAGE= .2248E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RN27-C	MANE	2.41	152.71	221.96	1.46	5.00	151.39	220.00	1.46

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1153E+02 EXCESS= .0000E+00 OUTFLOW= .1153E+02 BASIN STORAGE= .2384E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RN27-C	MANE	2.42	151.52	222.71	1.45	5.00	150.17	220.00	1.45

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1143E+02 EXCESS= .0000E+00 OUTFLOW= .1143E+02 BASIN STORAGE= .2069E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RN27-C	MANE	2.43	149.20	221.51	1.43	5.00	147.45	220.00	1.42

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1126E+02 EXCESS= .0000E+00 OUTFLOW= .1126E+02 BASIN STORAGE= .2072E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RN27-C	MANE	2.45	146.47	223.06	1.40	5.00	145.05	220.00	1.40

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1106E+02 EXCESS= .0000E+00 OUTFLOW= .1106E+02 BASIN STORAGE= .2456E-02 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RN26-C	MANE	.46	549.96	225.29	1.68	5.00	549.24	225.00	1.68

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4614E+02 EXCESS= .0000E+00 OUTFLOW= .4614E+02 BASIN STORAGE= .6606E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RN26-C	MANE	.47	537.13	225.53	1.64	5.00	536.63	225.00	1.64

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4506E+02 EXCESS= .0000E+00 OUTFLOW= .4506E+02 BASIN STORAGE= .6458E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RN26-C	MANE	.48	516.79	225.22	1.58	5.00	516.12	225.00	1.58

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4326E+02 EXCESS= .0000E+00 OUTFLOW= .4326E+02 BASIN STORAGE= .6381E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RN26-C	MANE	.48	496.16	225.55	1.51	5.00	495.54	225.00	1.51

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4147E+02 EXCESS= .0000E+00 OUTFLOW= .4147E+02 BASIN STORAGE= .6374E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RN26-C	MANE	.49	487.49	225.14	1.48	5.00	487.00	225.00	1.49

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4076E+02 EXCESS= .0000E+00 OUTFLOW= .4076E+02 BASIN STORAGE= .6457E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RN26-C	MANE	.49	482.20	225.15	1.47	5.00	481.70	225.00	1.47

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4026E+02 EXCESS= .0000E+00 OUTFLOW= .4026E+02 BASIN STORAGE= .6413E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RN26-C	MANE	.49	478.98	225.32	1.45	5.00	478.13	225.00	1.46

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3994E+02 EXCESS= .0000E+00 OUTFLOW= .3994E+02 BASIN STORAGE= .6449E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RN26-C	MANE	.49	471.32	225.28	1.43	5.00	470.54	225.00	1.43

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3934E+02 EXCESS= .0000E+00 OUTFLOW= .3934E+02 BASIN STORAGE= .6429E-03 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .00									
RN26-C	MANE	.50	463.58	225.28	1.41	5.00	462.79	225.00	1.41

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3865E+02 EXCESS= .0000E+00 ELKHORN_REG OUTFLOW= .3865E+02 BASIN STORAGE= .6373E-03 PERCENT ERROR= .0

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

THIS PAGE WAS INTENTIONALLY LEFT BLANK

LOCAL (ELKHORN ROAD) BASIN HEC-1 MODEL (WITH 2017 UPDATED SOILS CURVE NUMBERS)

MWH now part of Stantec

ELKHORN_LOC

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN  1998                 *
*           VERSION 4.1                 *
*                                       *
*  RUN DATE   29JUN17  TIME  17:31:43   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    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
XXXXXXX  XXXX           X  XXXXX  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

HEC-1 INPUT

```
1
      LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
                    *DIAGRAM
*** FREE ***
         1          ID   ------------------------------------------------------------------------
         2          ID   Project: RANCHO ROAD SYSTEM STORM DRAIN - ELKHORN
         3          ID   Model: UTLIMATE COND Model - LOOCAL BASINS ALONG ELKHORN RD
         4          ID   Design Storm: 100-YR AND 10-YR 6-Hr, SDN3 Distribution
         5          ID   Precipitation:  CCRFCD-HCDDM Of Rainfall Depth-Duration-Frequency
         6          ID
         7          ID   DARF VALUES USED : CCRFCD HCDDM
         8          ID
         9          ID   ------------------------------------------------------------------------
                    *
        10          IT       5       0       0     300
        11          IO       5       0       0
        12          IN       5       0       0
        13          JR    PREC       1    0.57
                    *

        14          KK NW53-CA
        15          KM   NW53-CA REFERENCED FROM RANCHO-FORT APACHE STORM DRAIN PROJECT
        16          KM   PREPARED BY LOUIS BERGER GROUP AS SUPPLEMENTAL ANALYSIS AND
        17          KM   INCLUDED AS HEC-1 MODEL FASD_SDN3.OUT RUN DATE 07NOV12
        18          BA  0.0640
        19          PC   0.000   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
        20          PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
        21          PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
        22          PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
        23          PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
        24          PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
        25          PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
        26          PC   0.998   0.999   1.000
        27          PB    2.85
        28          LS    0.00    79.1
        29          UD   0.176
                    *

        30          KK     SEV
        31          KM   FLOW SLPIT AT SEVERENCE AND GRAND CANYON
        32          KM   REMAINING FLOW GOES EAST ON SEVERENCE
        33          KM   PIMA COUNTY METHOD
        34          KM   FLOW SPLIT REFERENCED FROM RANCHO-FORT APACHE STORM DRAIN PROJECT
        35          KM   PREPARED BY LOUIS BERGER GROUP AS SUPPLEMENTAL ANALYSIS AND
        36          KM   INCLUDED AS HEC-1 MODEL FASD_SDN3.OUT RUN DAT 07NOV12
        37          KM   REFERENCE TABLE A.1.3 APPENDIX A FOR VALUES
        38          DT    DSGC
        39          DI       0      50     100     150     200     250     350     500     750
        40          DQ       0       9      16      23      29      38      60      80     129
                    *

        41          KK     DN1
        42          KM   REFERENCED BASIN FROM TRITON ENGINEERING HYDROLOGY REPORT
        43          KM   CLV DRAINAGE STUDY #DS4745A
        44          BA  0.0122
        45          LS    0.00    87.0
        46          PB    3.15
```


HEC-1 INPUT

```
1
      LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
        47          UD   0.114
                    *

        48          KK     DN2
        49          KM   REFERENCED BASIN FROM TRITON ENGINEERING HYDROLOGY REPORT
        50          KM   CLV DRAINAGE STUDY #DS4745A
        51          BA  0.0074
        52          LS    0.00    87.0
```

```
53          PB    3.15
54          UD   0.138
            *

55          KK     CP1
56          KM   REFERENCED COMBINATION POINT FROM TRITON ENGINEERING HYDROLOGY REPORT
57          KM   CLV DRAINAGE STUDY #DS4745A
58          HC        2
            *

59          KK     DN3
60          KM   REFERENCED BASIN FROM TRITON ENGINEERING HYDROLOGY REPORT
61          KM   CLV DRAINAGE STUDY #DS4745A
62          BA  0.0070
63          LS    0.00    87.0
64          PB    3.15
65          UD   0.116
            *

66          KK     CP2
67          KM   REFERENCED COMBINATION POINT FROM TRITON ENGINEERING HYDROLOGY REPORT
68          KM   CLV DRAINAGE STUDY #DS4745A
69          HC        2
            *

70          KK    DCP2
71          KM   FLOW COLLECTED FROM CLV DRAINAGE STUDY #DS4745A WILL BE CONVEYED
72          KM   DIRECTLY TO RRSSD
73          DT    XCP2
74          DI    43.0    18.0
75          DQ    43.0    18.0
            *

76          KK     ELK
77          KM   REFERENCED BASIN FROM TRITON ENGINEERING HYDROLOGY REPORT
78          KM   CLV DRAINAGE STUDY #DS4745A
79          BA  0.0022
80          LS    0.00    98.0
81          PB    3.15
82          UD   0.050
            *
```



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

83          KK   CPELK
84          KM   REFERENCED COMBINATION POINT FROM TRITON ENGINEERING HYDROLOGY REPORT
85          KM   CLV DRAINAGE STUDY #DS4745A
86          HC        2
            *

87          KK   ON2A1
88          KM   ONSITE BASIN BY STANTEC
89          BA  0.0075
90          LS    0.00    51.0
91          PB    2.85
92          UD   0.153
            *

93          KK   ON2A2
94          KM   ONSITE BASIN BY STANTEC
95          BA  0.0074
96          LS    0.00    89.0
97          UD   0.150
            *

98          KK    ON3A
99          KM   ONSITE BASIN BY STANTEC
100         BA  0.0049
101         LS    0.00    68.7
102         UD   0.155
            *

103         KK     CP3
104         KM   COMBINATION POINT BY STANTEC
105         HC        4
            *

106         KK    ON2B
107         KM   ONSITE BASIN BY STANTEC
108         BA  0.0142
109         LS    0.00    63.1
110         UD   0.152
            *

111         KK    CP3A
112         KM   COMBINATION POINT BY STANTEC
113         HC        2
            *

114         KK    ON2C
115         KM   ONSITE BASIN BY STANTEC
116         BA  0.0056
117         LS    0.00    54.0
118         UD   0.151
            *
```



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

119         KK     CP4
120         KM   COMBINATION POINT BY STANTEC
121         HC        2
            *
```

```
122           KK    ON3B
123           KM   ONSITE BASIN BY STANTEC
124           BA  0.0058
125           LS    0.00     81.3
126           UD   0.179
              *

127           KK    ON1A
128           KM   ONSITE BASIN BY STANTEC
129           BA  0.0502
130           LS    0.00     62.7
131           UD   0.248
              *

132           KK    DSGC
133           KM   FLOW SPLIT REFERENCED FROM RANCHO-FORT APACHE STORM DRAIN PROJECT
134           KM   PREPARED BY LOUIS BERGER GROUP AS SUPPLEMENTAL ANALYSIS AND
135           KM   INCLUDED AS HEC-1 MODEL FASD_SDN3.OUT RUN DAT 07NOV12
136           DR    DSGC
              *

137           KK    CP5A
138           KM   COMBINATION POINT BY STANTEC
139           HC       2
              *

140           KK    ON1B
141           KM   ONSITE BASIN BY STANTEC
142           BA  0.0110
143           LS    0.00     61.0
144           UD   0.170
              *

145           KK     CP5
146           KM   COMBINATION POINT BY STANTEC
147           HC       2
              *

148           KK    XCP2
149           KM   FLOW COLLECTED FROM CLV DRAINAGE STUDY #DS4745A WILL BE CONVEYED
150           KM   DIRECTLY TO RRSSD
151           DR    XCP2
              *
```

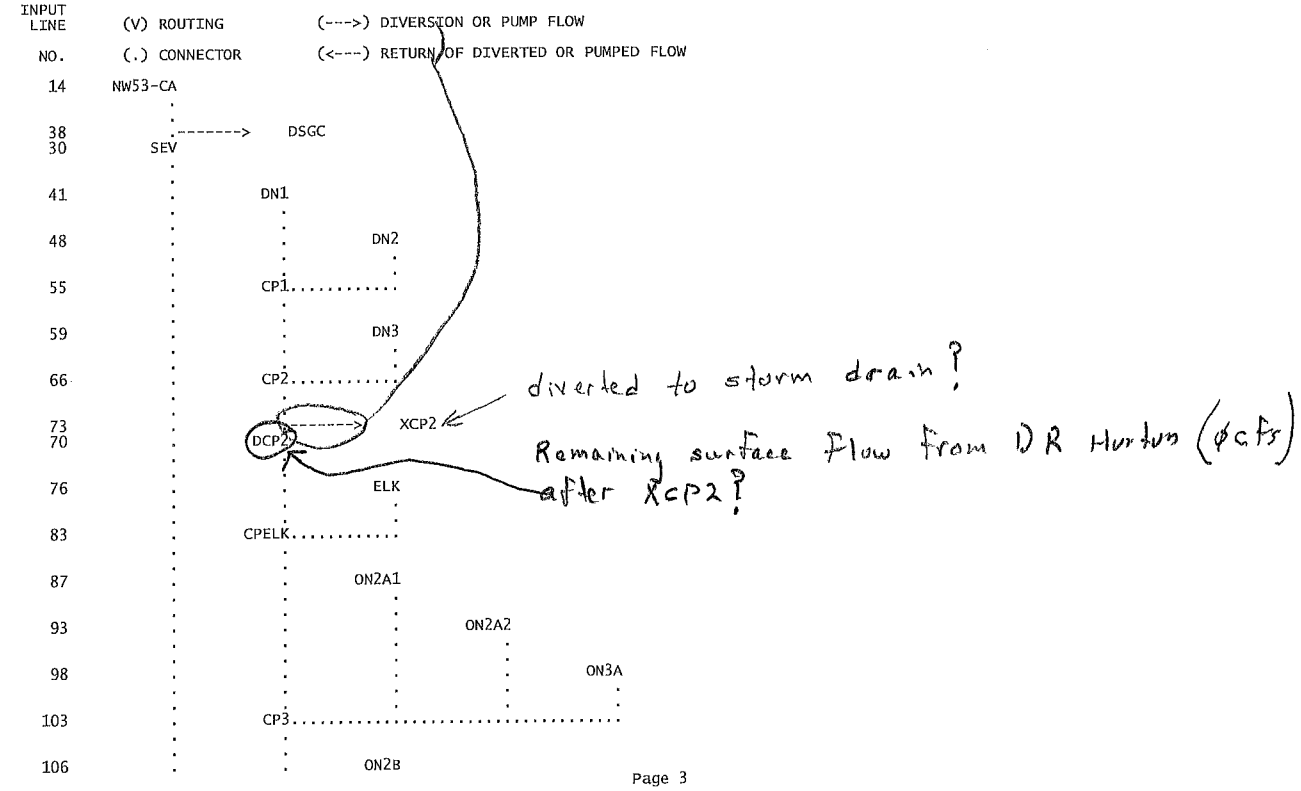


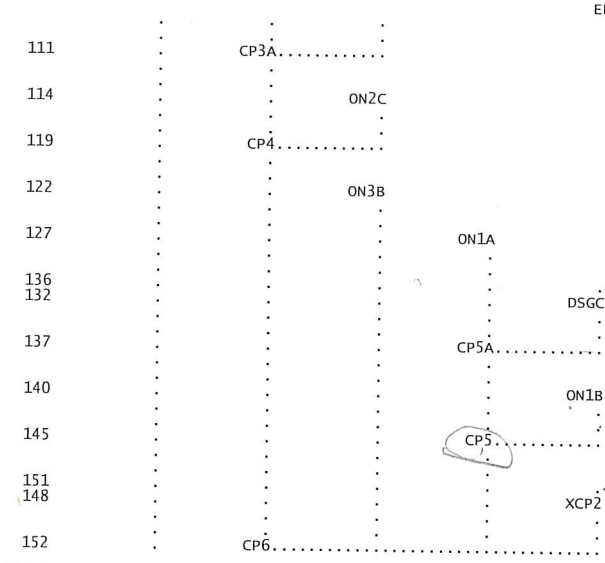
```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

152           KK     CP6
153           KM   COMBINATION POINT BY STANTEC
154           HC       4
              *
155           ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK





10cfs per output

No, per 3.7.2 in report

? Where — Flow split at Severance & Grand Canyon

From D.S. 4745A
100yr Q = 43cfs

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *             JUN  1998                 *
 *           VERSION 4.1                 *
 *                                       *
 *  RUN DATE   29JUN17  TIME  17:31:43   *
 *                                       *
 *****************************************
```

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

```
                    ------------------------------------------------------------------------
                    Project: RANCHO ROAD SYSTEM STORM DRAIN - ELKHORN

                    Model: UTLIMATE COND Model - LOOCAL BASINS ALONG ELKHORN RD
                    Design Storm: 100-YR AND 10-YR 6-Hr, SDN3 Distribution
                    Precipitation:  CCRFCD-HCDDM Of Rainfall Depth-Duration-Frequency

                    DARF VALUES USED : CCRFCD HCDDM

                    ------------------------------------------------------------------------

  11 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       .57
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


                                                                RATIOS APPLIED TO PRECIPITATION
OPERATION       STATION      AREA     PLAN                 RATIO 1  RATIO 2
                                                             1.00       .57

HYDROGRAPH AT
```

					100yr	10yr ELKHORN_LOC
+	NW53-CA	.06	1	FLOW TIME	56. 3.58	16. 3.67
DIVERSION TO +	DSGC	.06	1	FLOW TIME	10. 3.58	3. 3.67
HYDROGRAPH AT +	SEV	.06	1	FLOW TIME	46. 3.58	13. 3.67
HYDROGRAPH AT +	DN1	.01	1	FLOW TIME	~~20.~~ ok 3.58	8. 3.58
HYDROGRAPH AT +	DN2	.01	1	FLOW TIME	12. 3.58	5. 3.58
2 COMBINED AT +	CP1	.02	1	FLOW TIME	32. 3.58	13. 3.58
HYDROGRAPH AT +	DN3	.01	1	FLOW TIME	11. 3.58	5. 3.58
2 COMBINED AT +	CP2	.03	1	FLOW TIME	43. 3.58	18. 3.58
DIVERSION TO +	XCP2	.03	1	FLOW TIME	43. 3.58	18. 3.58
HYDROGRAPH AT +	DCP2	.03	1	FLOW TIME	0. .00	0. .00
HYDROGRAPH AT +	ELK	.00	1	FLOW TIME	6. 3.50	3. 3.50
2 COMBINED AT +	CPELK	.03	1	FLOW TIME	6. 3.50	3. 3.50
HYDROGRAPH AT +	ON2A1	.01	1	FLOW TIME	0. 4.92	0. .00
HYDROGRAPH AT +	ON2A2	.01	1	FLOW TIME	11. 3.58	5. 3.58
HYDROGRAPH AT +	ON3A	.00	1	FLOW TIME	2. 3.58	0. 3.75
4 COMBINED AT +	CP3	.05	1	FLOW TIME	17. 3.50	7. 3.50
HYDROGRAPH AT +	ON2B	.01	1	FLOW TIME	4. 3.67	0. 4.92
2 COMBINED AT +	CP3A	.06	1	FLOW TIME	20. 3.58	7. 3.50
HYDROGRAPH AT +	ON2C	.01	1	FLOW TIME	0. 3.83	0. .00
2 COMBINED AT +	CP4	.07	1	FLOW TIME	20. 3.58	7. 3.50
HYDROGRAPH AT +	ON3B	.01	1	FLOW TIME	6. 3.58	2. 3.67
HYDROGRAPH AT +	ON1A	.05	1	FLOW TIME	11. 3.75	1. 5.00
HYDROGRAPH AT +	DSGC	.00	1	FLOW TIME	10. 3.58	3. 3.67
2 COMBINED AT +	CP5A	.05	1	FLOW TIME	19. 3.67	3. 3.67
HYDROGRAPH AT +	ON1B	.01	1	FLOW TIME	2. 3.67	0. 4.92
2 COMBINED AT +	CP5	.06	1	FLOW TIME	22. 3.67	3. 3.67
HYDROGRAPH AT +	XCP2	.00	1	FLOW TIME	43. 3.58	18. 3.58

Southbound flow split at Grand Canyon & Severence (?)

100-yr Q

						ELKHORN_LOC
4 COMBINED AT						
+	CP6	.14	1	FLOW	87.	29.
				TIME	3.58	3.58

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

THIS PAGE WAS INTENTIONALLY LEFT BLANK

APPENDIX D.9
RAINFALL CALCULATIONS

MWH now part of Stantec

DESIGN RAINFALL

PROJECT: Rancho Road System Storm Drain -Elkhorn

JOB #:

The project site is not included in the McCarran Airport Rainfall Area as shown by Figure 513 in the Hydrologic Criteria and Drainage Design Manual. Precipitation values are taken from the NOAA ATLAS 2, then adjusted per Table 501 in the Hydrologic Criteria and Drainage Design Manual.

STREET INTERSECTION	TOWNSHIP	RANGE	SECTION
North Elkhorn (Hualapa Rochelle	*T19 South*	*R60 East*	*18* *19*

STORM EVENT	RAINFALL DEPTH (IN)	RATIO TO NOAA ATLAS 2 ADJUSTMENT RATIO	DESIGN DEPTH (IN)
10-YEAR	1.30	1.24	1.61
100-YEAR	1.99	1.43	2.85

10-YEAR/100-YEAR DESIGN RAINFALL DEPTH RATIO: **0.57**

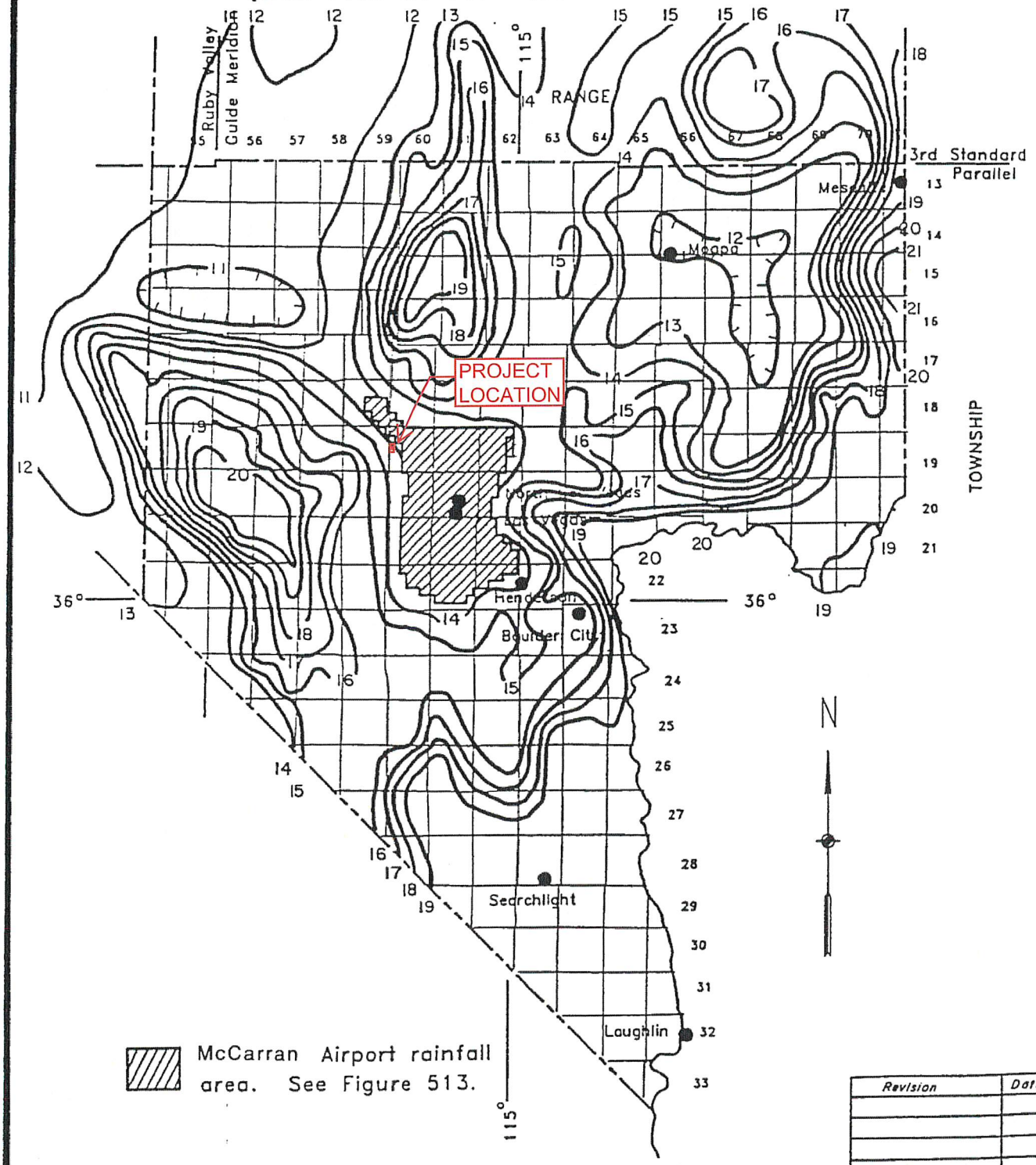
PRECIPITATION ADJUSTMENT RATIOS

Recurrence Interval	Ratio to NOAA Atlas 2
2-year	1.00
5-year	1.16
10-year	1.24
25-year	1.33
50-year	1.39
100-year	1.43

NOTE:
1. Multiply the values obtained from the NOAA Atlas 2 by the above ratios to obtain the adjusted precipitation values.
2. NOAA Atlas 2 values for use with TR-55 shall not be adjusted by the above ratios.
3. Tables 505 and 506 require no adjustments.

Revision	Date

RAINFALL DEPTH-DURATION-FREQUENCY
10-YEAR, 6-HOUR
(DEPTHS IN TENTHS OF INCHES)



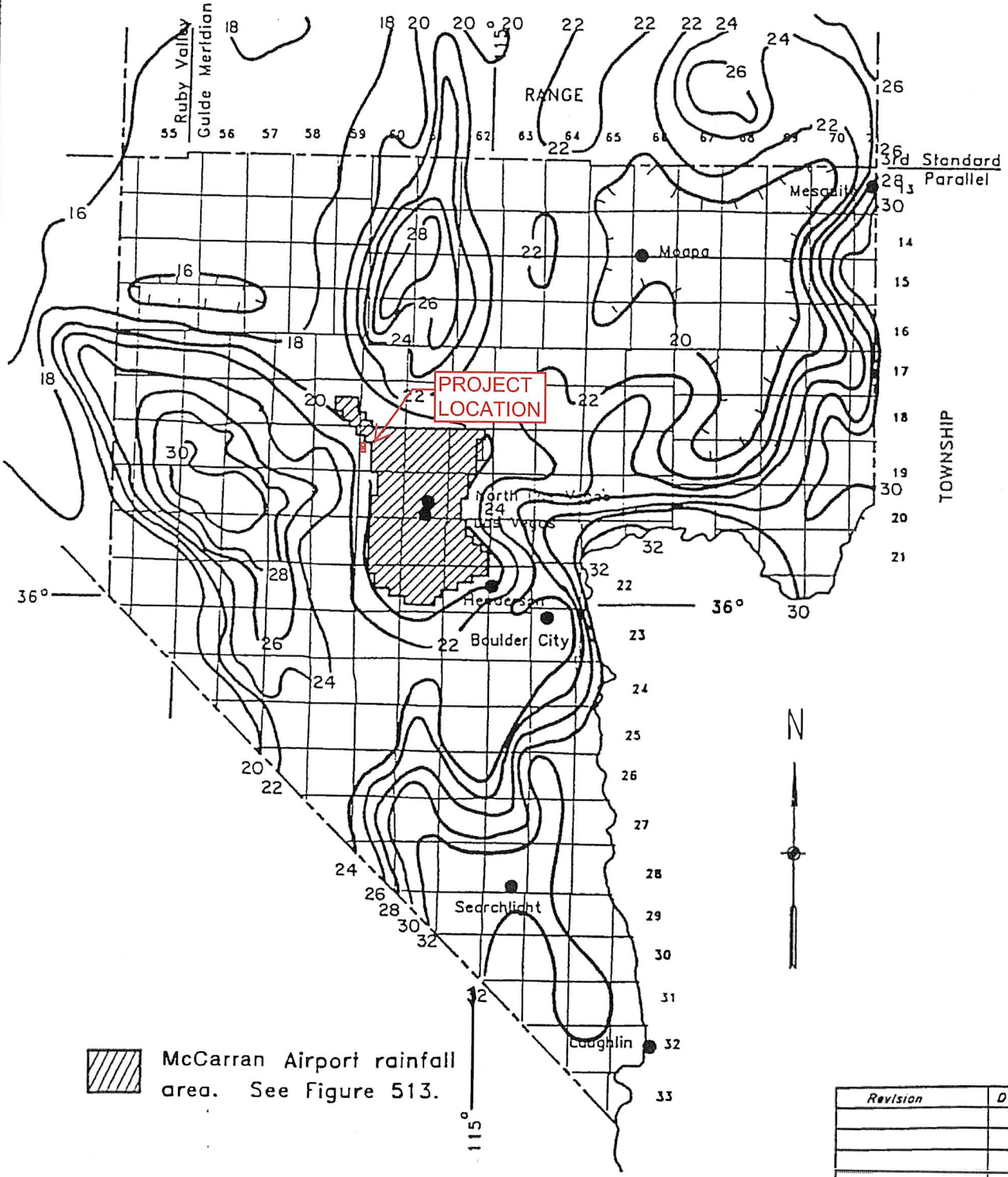
Revision	Date

WRC ENGINEERING

REFERENCE:
NOAA ATLAS 2, VOLUME VII NEVADA, 1973

FIGURE 503

RAINFALL DEPTH-DURATION-FREQUENCY
100-YEAR, 6-HOUR
(DEPTHS IN TENTHS OF INCHES)



Revision	Date

WRC ENGINEERING

REFERENCE:
NOAA ATLAS 2, VOLUME VII NEVADA, 1973

FIGURE 506

SIX-HOUR STORM DISTRIBUTIONS

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

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

APPENDIX D.10
CURVE NUMBER CALCULATIONS

MWH now part of Stantec

THIS PAGE WAS INTENTIONALLY LEFT BLANK

CURVE NUMBER CALCULATIONS AND COMPARISONS FOR REGIONAL BASINS TRIBUTARY TO FLOW SPLIT FS1

MWH now part of Stantec

THIS PAGE WAS INTENTIONALLY LEFT BLANK

REVISED CN NUMBERS BASED ON 2017 ATKINS PROGRESS REPORT #1 FOR 2018 MPU UPDATED

PERVIOUS AREA CURVE NUMBERS

CONDITION 1: ----------> DESERT SHRUB POOR HYDROLOGIC CONDITION

CONDITION 2: ----------> LANDSCAPED, LAWNS, TREES, GOOD HYDROLOGIC CONDITION

CN VALUES

		HYDROLOGIC SOIL GROUP						
CONDITION		A	B	C	D	ROCK		
1	---------->	63	77	85	88	90		
2	---------->	39	61	74	80	90		

							CONDITION	CONDITION
	MAP	HYDROLOGIC SOIL GROUP					1	2
	UNIT	%A	%B	%C	%D	%ROCK	CN	CN
	155	0	0	0	100	0	88	80
	191	100	0	0	0	0	63	39
	400	0	0	0	100	0	88	80

REVISED COMPOSITE CN NUMBERS BASED ON 2017 ATKINS PROGRESS REPORT #1 FOR 2018 MPU UPDATED

Curve Number Matrix

MAP #	COMPONENTS			LAND USE CLASSIFICATION INDEX NUMBER																				
	OPEN DESERT	OPEN GOOD	% IMP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	% --->			100	10	60	35	0	0	0	0	0	15	7	0	0	55	36	19	14	15	10	30	15	20
		% --->		0	85	20	40	71	38	28	15	10	15	8	50	0	20	35	19	14	0	0	0	0	30
			% --->	0	5	20	25	29	62	72	85	90	70	85	50	0	25	29	62	72	85	90	70	85	50
	CN	CN	CN	SOIL TYPE COMPOSITE CN FOR LAND USE TYPE																				
155	88	80	98	88.0	82.0	88.0	87.0	85.0	91.0	93.0	95.0	96.0	94.0	96.0	89.0	30.0	89.0	88.0	93.0	94.0	97.0	97.0	95.0	97.0	91.0
191	63	39	98	63.0	44.0	65.0	62.0	56.0	76.0	81.0	89.0	92.0	84.0	91.0	69.0	30.0	67.0	65.0	80.0	85.0	93.0	95.0	88.0	93.0	73.0
400	88	80	98	88.0	82.0	88.0	87.0	85.0	91.0	93.0	95.0	96.0	94.0	96.0	89.0	30.0	89.0	88.0	93.0	94.0	97.0	97.0	95.0	97.0	91.0

REVISED COMPOSITE CN NUMBERS BASED ON 2017 ATKINS PROGRESS REPORT #1 FOR 2018 MPU UPDATE

2018 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE - COMPOSITE CURVE NUMBER BREAKDOWN

WATERSHED	2008 MPU BASINID	LAND USE INDEX NUMBER	SOIL MAP UNIT #	SUBREGION CN	SUBREGION AREA (SQ FT)	SUBBASIN AREA (SQ FT)	PERCENT OF SUBBASIN	CUMULATIVE PERCENT	AREAL WEIGHTED CN	CUMULATIVE CN	COMPOSITE CN
UPPER NORTHERN	NW26-C	1	191	63	5492	10231508	0.1%	0.1%	0.03	0.03	
UPPER NORTHERN	NW26-C	1	400	88	1897	10231508	0.0%	0.1%	0.02	0.05	
UPPER NORTHERN	NW26-C	16	191	80	3404970	10231508	33.3%	33.4%	26.62	26.67	
UPPER NORTHERN	NW26-C	17	191	85	4143107	10231508	40.5%	73.8%	34.42	61.09	
UPPER NORTHERN	NW26-C	17	400	94	336042	10231508	3.3%	77.1%	3.09	64.18	
UPPER NORTHERN	NW26-C	18	191	93	1970075	10231508	19.3%	96.4%	17.91	82.09	
UPPER NORTHERN	NW26-C	18	400	97	369925	10231508	3.6%	100.0%	3.51	85.59	**85.595**
UPPER NORTHERN	NW27-C	16	155	93	11947	4125832	0.3%	0.3%	0.27	0.27	
UPPER NORTHERN	NW27-C	16	191	80	974778	4125832	23.6%	23.9%	18.90	19.17	
UPPER NORTHERN	NW27-C	16	400	93	468554	4125832	11.4%	35.3%	10.56	29.73	
UPPER NORTHERN	NW27-C	17	155	94	52585	4125832	1.3%	36.5%	1.20	30.93	
UPPER NORTHERN	NW27-C	17	191	85	2167312	4125832	52.5%	89.1%	44.65	75.58	
UPPER NORTHERN	NW27-C	17	400	94	430381	4125832	10.4%	99.5%	9.81	85.39	
UPPER NORTHERN	NW27-C	18	191	93	4961	4125832	0.1%	99.6%	0.11	85.50	
UPPER NORTHERN	NW27-C	18	400	97	15315	4125832	0.4%	100.0%	0.36	85.86	**85.858**
UPPER NORTHERN	NW53-C	14	191	67	5030485	8050712	62.5%	62.5%	41.86	41.86	
UPPER NORTHERN	NW53-C	16	191	80	2622974	8050712	32.6%	95.1%	26.06	67.93	
UPPER NORTHERN	NW53-C	17	191	85	359628	8050712	4.5%	99.5%	3.80	71.73	
UPPER NORTHERN	NW53-C	19	191	95	37625	8050712	0.5%	100.0%	0.44	72.17	**72.170**
UPPER NORTHERN	NW53-CA	4	191	62	348.48	1795108	0.0%	0.0%	0.01	0.01	
UPPER NORTHERN	NW53-CA	17	191	85	5183.64	1795108	0.3%	0.3%	0.25	0.26	
UPPER NORTHERN	NW53-CA	6	191	76	36024.12	1795108	2.0%	2.3%	1.53	1.78	
UPPER NORTHERN	NW53-CA	14	191	67	1751765.40	1795108	97.6%	99.9%	65.38	67.16	
UPPER NORTHERN	NW53-CA	17	191	85	43.56	1795108	0.0%	99.9%	0.00	67.17	
UPPER NORTHERN	NW53-CA	14	191	67	1481.04	1795108	0.1%	100.0%	0.06	67.22	
UPPER NORTHERN	NW53-CA	17	191	85	87.12	1795108	0.0%	100.0%	0.00	67.23	**67.226**
UPPER NORTHERN	NW53-CB	17	191	85	87.12	3557110	0.0%	0.0%	0.00	0.00	
UPPER NORTHERN	NW53-CB	14	191	67	1481.04	3557110	0.0%	0.0%	0.03	0.03	
UPPER NORTHERN	NW53-CB	19	191	95	2395.80	3557110	0.1%	0.1%	0.06	0.09	
UPPER NORTHERN	NW53-CB	16	191	80	18992.16	3557110	0.5%	0.6%	0.43	0.52	
UPPER NORTHERN	NW53-CB	17	191	85	19427.76	3557110	0.5%	1.2%	0.46	0.99	
UPPER NORTHERN	NW53-CB	17	191	85	39465.36	3557110	1.1%	2.3%	0.94	1.93	
UPPER NORTHERN	NW53-CB	17	191	85	40293.00	3557110	1.1%	3.4%	0.96	2.89	
UPPER NORTHERN	NW53-CB	17	191	85	127935.72	3557110	3.6%	7.0%	3.06	5.95	
UPPER NORTHERN	NW53-CB	14	191	67	359979.84	3557110	10.1%	17.2%	6.78	12.73	
UPPER NORTHERN	NW53-CB	14	191	67	371958.84	3557110	10.5%	27.6%	7.01	19.73	
UPPER NORTHERN	NW53-CB	14	191	67	2575005.84	3557110	72.4%	100.0%	48.50	68.24	**68.236**
UPPER NORTHERN	NW53-CC	19	191	95	130.68	2766060	0.0%	0.0%	0.00	0.00	
UPPER NORTHERN	NW53-CC	16	191	80	174.24	2766060	0.0%	0.0%	0.01	0.01	
UPPER NORTHERN	NW53-CC	14	191	67	3876.84	2766060	0.1%	0.2%	0.09	0.10	
UPPER NORTHERN	NW53-CC	16	191	80	15812.28	2766060	0.6%	0.7%	0.46	0.56	
UPPER NORTHERN	NW53-CC	19	191	95	34978.68	2766060	1.3%	2.0%	1.20	1.76	
UPPER NORTHERN	NW53-CC	17	191	85	36459.72	2766060	1.3%	3.3%	1.12	2.88	
UPPER NORTHERN	NW53-CC	17	191	85	87555.60	2766060	3.2%	6.5%	2.69	5.57	
UPPER NORTHERN	NW53-CC	16	191	80	2586984.84	2766060	93.5%	100.0%	74.82	80.39	**80.394**

NOTES: * Curve Numbers used in HEC-1 models referenced from Design Report for Kyle Canyon Detention Basin (Upper Northern Las Vegas Wash Watershed)

** Curve Numbers used in HEC-1 models referenced from Predesign Report for the Upper Las Vegas Wash Detention Basin (Upper Northern Las Vegas Wash Watershed)

ORIGINAL CN NUMBER MATRIX BASED ON 2008 MPU SOILS								
PERVIOUS AREA CURVE NUMBERS								
CONDITION 1:	---------->	DESERT SHRUB POOR HYDROLOGIC CONDITION						
CONDITION 2:	---------->	LANDSCAPED, LAWNS, TREES, GOOD HYDROLOGIC CONDITION						
CN VALUES								
		HYDROLOGIC SOIL GROUP						
CONDITION		A	B	C	D	ROCK		
1	---------->	63	77	85	88	90		
2	---------->	39	61	74	80	90		
							CONDITION	CONDITION
	MAP	HYDROLOGIC SOIL GROUP					1	2
	UNIT	%A	%B	%C	%D	%ROCK	CN	CN
	155	5	5	0	90	0	86	77
	191	5	85	0	10	0	77	62
	400	0	10	0	90	0	87	78

ORIGINAL CN NUMBER MATRIX BASED ON 2008 MPU SOILS

Curve Number Matrix

MAP #	COMPONENTS			LAND USE CLASSIFICATION INDEX NUMBER																				
	OPEN DESERT	OPEN GOOD	% IMP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	% --->			100	10	60	35	0	0	0	0	0	15	7	0	0	55	36	19	14	15	10	30	15	20
		% --->		0	85	20	40	71	38	28	15	10	15	8	50	0	20	35	19	14	0	0	0	0	30
			% --->	0	5	20	25	29	62	72	85	90	70	85	50	0	25	29	62	72	85	90	70	85	50
	CN	CN	CN	SOIL TYPE COMPOSITE CN FOR LAND USE TYPE																				
155	86	77	98	86.0	79.0	87.0	85.0	83.0	90.0	92.0	95.0	96.0	93.0	95.0	88.0	30.0	87.0	86.0	92.0	93.0	96.0	97.0	94.0	96.0	89.0
191	77	62	98	77.0	65.0	78.0	76.0	72.0	84.0	88.0	93.0	94.0	89.0	94.0	80.0	30.0	79.0	78.0	87.0	90.0	95.0	96.0	92.0	95.0	83.0
400	87	78	98	87.0	80.0	87.0	86.0	84.0	90.0	92.0	95.0	96.0	93.0	96.0	88.0	30.0	88.0	87.0	92.0	94.0	96.0	97.0	95.0	96.0	90.0

2008 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE - COMPOSITE CURVE NUMBER BREAKDOWN

WATERSHED	2008 MPU BASINID	LAND USE INDEX NUMBER	SOIL MAP UNIT #	SUBREGION CN	SUBREGION AREA (SQ FT)	SUBBASIN AREA (SQ FT)	PERCENT OF SUBBASIN	CUMULATIVE PERCENT	AREAL WEIGHTED CN	CUMULATIVE CN	COMPOSITE CN
UPPER NORTHERN	NW26-C	1	191	77	5492	10231508	0.1%	0.1%	0.04	0.04	
UPPER NORTHERN	NW26-C	1	400	87	1897	10231508	0.0%	0.1%	0.02	0.06	
UPPER NORTHERN	NW26-C	16	191	87	3404970	10231508	33.3%	33.4%	28.95	29.01	
UPPER NORTHERN	NW26-C	17	191	90	4143107	10231508	40.5%	73.8%	36.44	65.45	
UPPER NORTHERN	NW26-C	17	400	94	336042	10231508	3.3%	77.1%	3.09	68.54	
UPPER NORTHERN	NW26-C	18	191	95	1970075	10231508	19.3%	96.4%	18.29	86.83	
UPPER NORTHERN	NW26-C	18	400	96	369925	10231508	3.6%	100.0%	3.47	90.31	**90.305**
UPPER NORTHERN	NW27-C	16	155	92	11947	4125832	0.3%	0.3%	0.27	0.27	
UPPER NORTHERN	NW27-C	16	191	87	974778	4125832	23.6%	23.9%	20.55	20.82	
UPPER NORTHERN	NW27-C	16	400	92	468554	4125832	11.4%	35.3%	10.45	31.27	
UPPER NORTHERN	NW27-C	17	155	93	52585	4125832	1.3%	36.5%	1.19	32.45	
UPPER NORTHERN	NW27-C	17	191	90	2167312	4125832	52.5%	89.1%	47.28	79.73	
UPPER NORTHERN	NW27-C	17	400	94	430381	4125832	10.4%	99.5%	9.81	89.54	
UPPER NORTHERN	NW27-C	18	191	95	4961	4125832	0.1%	99.6%	0.11	89.65	
UPPER NORTHERN	NW27-C	18	400	96	15315	4125832	0.4%	100.0%	0.36	90.01	**90.008**
UPPER NORTHERN	NW53-C	14	191	79	5030485	8050712	62.5%	62.5%	49.36	49.36	
UPPER NORTHERN	NW53-C	16	191	87	2622974	8050712	32.6%	95.1%	28.35	77.71	
UPPER NORTHERN	NW53-C	17	191	90	359628	8050712	4.5%	99.5%	4.02	81.73	
UPPER NORTHERN	NW53-C	19	191	96	37625	8050712	0.5%	100.0%	0.45	82.18	**82.177**

CURVE NUMBER CALCULATIONS FOR LOCAL BASINS TRIBUTARY TO ELKHORN ROAD

MWH now part of Stantec

THIS PAGE WAS INTENTIONALLY LEFT BLANK

CURVE NUMBER CALCULATIONS FOR SOILS

PROJECT: Elkhorn Storm Drain

JOB # _____ CALCULATED BY: TB

Soil #: 191	Dalian, very cobbly fine sandy loam									
Soil	Percent	Hydrologic Group	Residential$_1$ 14000sq ft	Residential$_2$ 20000sq ft	Residential$_3$ 40000sq ft	Commercial$_4$	Impervious$_5$			
Dalian	100%	A	57	54	51	89	98			
Total	**100%**		**57**	**54**	**51**	**89**	**98**			

Notes:

1- Referenced from Table 602A (1 of 5), Residential 14000 sq ft
2- Referenced from Table 602A (2 of 5), Residential 20000 sq ft
3- Referenced from Table 602A (3 of 5), Residential 40000 sq ft
4- Referenced from Table 602 (4 of 5), Commercial and Business
5- Referenced from Table 602 (5 of 5), Impervious, Paved parking lots or Streets and road

CURVE NUMBER CALCULATIONS FOR BASINS

Basin	Land Use Type	Soil Type Breakdown			Land Use Breakdown						Composite CN Value
		Soil #191			Residential$_1$ 14000sq ft	Residential$_2$ 20000sq ft	Residential$_3$ 40000sq ft	Commercial$_4$	Impervious$_5$		
ON1A	Residential/Impervious	100%			11.15%	26.12%	40.97%	0.00%	21.76%		**62.7**
ON1B	Residential/Impervious	100%			20.83%	64.62%	0.00%	0.00%	14.55%		**61.0**
ON2A1	Residential	100%			0.00%	0.00%	100.00%	0.00%	0.00%		**51.0**
ON2A2	Commercial	100%			0.00%	0.00%	0.00%	100.00%	0.00%		**89.0**
ON2B	Residential/Impervious	100%			0.00%	79.25%	0.00%	0.00%	20.75%		**63.1**
ON2C	Residential	100%			0.00%	100.00%	0.00%	0.00%	0.00%		**54.0**
ON3A	Residential/Impervious	100%			0.00%	0.00%	62.42%	0.00%	37.58%		**68.7**
ON3B	Residential/Impervious	100%			0.00%	38.01%	0.00%	0.00%	61.99%		**81.3**

RUNOFF CURVE NUMBERS
(URBAN AREAS[1])

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area[2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.)[3]:					
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)[4]		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)[5]		77	86	91	94

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

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

RUNOFF CURVE NUMBERS - RESIDENTIAL DISTRICTS

Average Lot Size or Usage[1]	Percent Impervious[2]	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[3]	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

THIS PAGE WAS INTENTIONALLY LEFT BLANK

APPENDIX D.11
STREET HYDRAULIC SECTION CALCULATIONS CONTINUED

THIS PAGE WAS INTENTIONALLY LEFT BLANK

10-YR Flowmaster
Street Sections

MWH now part of Stantec

THIS PAGE WAS INTENTIONALLY LEFT BLANK

Worksheet for 10-YR section-C

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.90000	%
Discharge	3.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+09.87	2829.83
0+10.37	2829.83
0+10.43	2829.33
0+11.87	2829.46
0+54.83	2830.34
0+97.79	2829.46
0+99.20	2829.33
0+99.26	2829.83
0+99.76	2829.83

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+09.87, 2829.83)	(0+99.76, 2829.83)	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		0.22	ft
Elevation Range	2829.33 to 2830.34 ft		
Flow Area		0.79	ft²
Wetted Perimeter		11.67	ft

Worksheet for 10-YR section-C

Results

Hydraulic Radius		0.07	ft
Top Width		11.28	ft
Normal Depth		0.22	ft
Critical Depth		0.28	ft
Critical Slope		0.00556	ft/ft
Velocity		3.78	ft/s
Velocity Head		0.22	ft
Specific Energy		0.44	ft
Froude Number		2.51	
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	0.22	ft
Critical Depth	0.28	ft
Channel Slope	3.90000	%
Critical Slope	0.00556	ft/ft

Worksheet for 10-YR section-D1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.83000	%
Discharge	3.50	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+09.07	2802.20
0+09.57	2802.20
0+09.63	2801.70
0+11.07	2801.83
0+53.87	2802.41

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+09.07, 2802.20)	(0+53.87, 2802.41)	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	2801.70 to 2802.41 ft	
Flow Area	0.85	ft²
Wetted Perimeter	10.93	ft
Hydraulic Radius	0.08	ft
Top Width	10.70	ft
Normal Depth	0.26	ft
Critical Depth	0.33	ft

Worksheet for 10-YR section-D1

Results

Critical Slope		0.00521	ft/ft
Velocity		4.10	ft/s
Velocity Head		0.26	ft
Specific Energy		0.52	ft
Froude Number		2.55	
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	0.26	ft
Critical Depth	0.33	ft
Channel Slope	3.83000	%
Critical Slope	0.00521	ft/ft

Worksheet for 10-YR section-D2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.89000	%
Discharge	3.50	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+04.51	2801.19
0+47.59	2800.55
0+49.03	2800.42
0+49.09	2800.92
0+49.59	2800.92

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+04.51, 2801.19)	(0+49.59, 2800.92)	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	2800.42 to 2801.19 ft	
Flow Area	0.83	ft²
Wetted Perimeter	10.31	ft
Hydraulic Radius	0.08	ft
Top Width	10.07	ft
Normal Depth	0.26	ft
Critical Depth	0.33	ft

Worksheet for 10-YR section-D2

Results

Critical Slope		0.00515	ft/ft
Velocity		4.21	ft/s
Velocity Head		0.28	ft
Specific Energy		0.53	ft
Froude Number		2.58	
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	0.26	ft
Critical Depth	0.33	ft
Channel Slope	3.89000	%
Critical Slope	0.00515	ft/ft

Worksheet for 10-YR section-E

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	4.05000	%
Discharge	1.71	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+22.59	2798.05
0+23.09	2798.05
0+23.15	2797.55
0+24.59	2797.68
0+67.43	2798.40
1+10.59	2797.64
1+12.03	2797.51
1+12.09	2798.01
1+12.59	2798.01

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+22.59, 2798.05)	(1+12.59, 2798.01)	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		0.20	ft
Elevation Range	2797.51 to 2798.40 ft		
Flow Area		0.51	ft²
Wetted Perimeter		9.15	ft

Worksheet for 10-YR section-E

Results

Hydraulic Radius	0.06	ft
Top Width	8.81	ft
Normal Depth	0.20	ft
Critical Depth	0.25	ft
Critical Slope	0.00607	ft/ft
Velocity	3.35	ft/s
Velocity Head	0.17	ft
Specific Energy	0.38	ft
Froude Number	2.45	
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	0.20	ft
Critical Depth	0.25	ft
Channel Slope	4.05000	%
Critical Slope	0.00607	ft/ft

Worksheet for 10-YR section-F1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	2.67000	%
Discharge	0.90	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+07.29	2783.24
0+07.79	2783.24
0+07.85	2782.74
0+09.29	2782.87
0+52.23	2783.71

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+07.29, 2783.24)	(0+52.23, 2783.71)	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	0.20	ft
Elevation Range	2782.74 to 2783.71 ft	
Flow Area	0.31	ft²
Wetted Perimeter	5.11	ft
Hydraulic Radius	0.06	ft
Top Width	4.93	ft
Normal Depth	0.20	ft
Critical Depth	0.24	ft

Worksheet for 10-YR section-F1

Results

Critical Slope		0.00596	ft/ft
Velocity		2.89	ft/s
Velocity Head		0.13	ft
Specific Energy		0.33	ft
Froude Number		2.03	
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	0.20	ft
Critical Depth	0.24	ft
Channel Slope	2.67000	%
Critical Slope	0.00596	ft/ft

Worksheet for 10-YR section-F2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	2.37000	%
Discharge	0.81	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+15.28	2783.25
0+58.26	2782.39
0+59.70	2782.26
0+59.76	2782.76
0+60.26	2782.76

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+15.28, 2783.25)	(0+60.26, 2782.76)	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	0.20	ft
Elevation Range	2782.26 to 2783.25 ft	
Flow Area	0.30	ft²
Wetted Perimeter	4.93	ft
Hydraulic Radius	0.06	ft
Top Width	4.75	ft
Normal Depth	0.20	ft
Critical Depth	0.23	ft

Worksheet for 10-YR section-F2

Results

Critical Slope		0.00603	ft/ft
Velocity		2.72	ft/s
Velocity Head		0.11	ft
Specific Energy		0.31	ft
Froude Number		1.91	
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	0.20	ft
Critical Depth	0.23	ft
Channel Slope	2.37000	%
Critical Slope	0.00603	ft/ft

Worksheet for 10-YR section-G

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.28000	%
Discharge	0.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+11.77	2781.37
0+12.27	2781.37
0+12.33	2780.87
0+13.78	2781.00
0+56.97	2781.67
0+99.82	2781.10
1+02.33	2781.00
1+02.39	2781.50
1+02.91	2781.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+11.77, 2781.37)	(1+02.91, 2781.50)	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	0.25	ft
Elevation Range	2780.87 to 2781.67 ft	
Flow Area	0.96	ft²
Wetted Perimeter	13.88	ft

Worksheet for 10-YR section-G

Results

Hydraulic Radius		0.07	ft
Top Width		13.54	ft
Normal Depth		0.25	ft
Critical Depth		0.31	ft
Critical Slope		0.00563	ft/ft
Velocity		3.48	ft/s
Velocity Head		0.19	ft
Specific Energy		0.44	ft
Froude Number		2.31	
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	0.25	ft
Critical Depth	0.31	ft
Channel Slope	3.28000	%
Critical Slope	0.00563	ft/ft

Worksheet for 10-YR section-H

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.45000	%
Discharge	29.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2762.38
0+00.50	2762.38
0+00.56	2761.88
0+02.00	2762.02
0+43.61	2762.89
0+45.23	2762.91
0+48.05	2762.89
0+89.66	2762.02
0+91.10	2761.88
0+91.16	2762.38
0+91.66	2762.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2762.38)	(0+91.66, 2762.38)	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	0.42	ft
Elevation Range	2761.88 to 2762.91 ft	

Worksheet for 10-YR section-H

Results

Flow Area	4.72	ft²
Wetted Perimeter	30.32	ft
Hydraulic Radius	0.16	ft
Top Width	29.56	ft
Normal Depth	0.42	ft
Critical Depth	0.57	ft
Critical Slope	0.00413	ft/ft
Velocity	6.15	ft/s
Velocity Head	0.59	ft
Specific Energy	1.01	ft
Froude Number	2.71	
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	0.42	ft
Critical Depth	0.57	ft
Channel Slope	3.45000	%
Critical Slope	0.00413	ft/ft

10-YR Flowmaster
Street Cross Sections

MWH now part of Stantec

THIS PAGE WAS INTENTIONALLY LEFT BLANK

Cross Section for 10-YR section-C

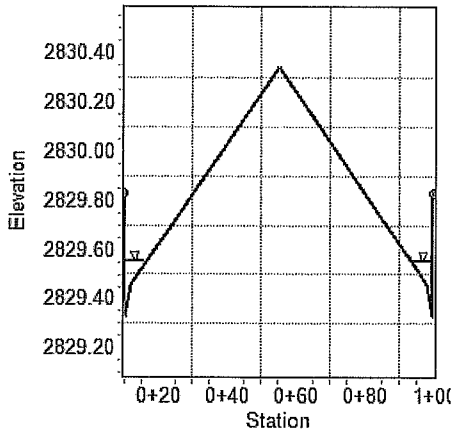
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.90000	%
Normal Depth	0.22	ft
Discharge	3.00	ft³/s

Cross Section Image



Cross Section for 10-YR section-D1

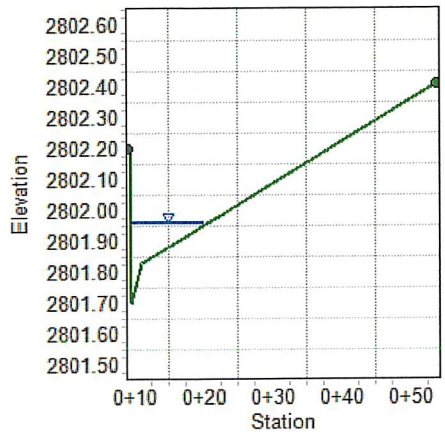
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.83000	%
Normal Depth	0.26	ft
Discharge	3.50	ft³/s

Cross Section Image



Cross Section for 10-YR section-D2

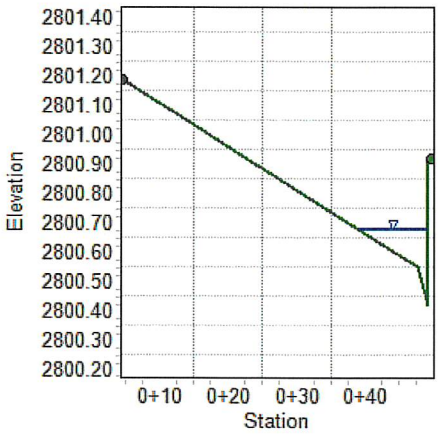
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.89000	%
Normal Depth	0.26	ft
Discharge	3.50	ft³/s

Cross Section Image



Cross Section for 10-YR section-E

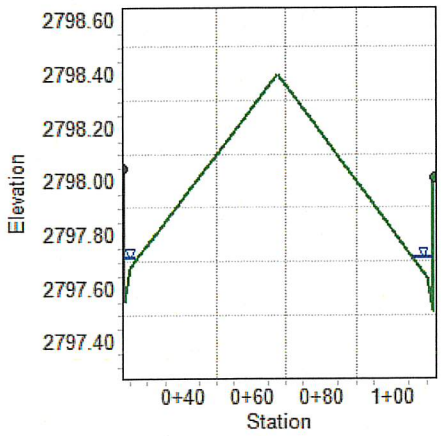
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	4.05000	%
Normal Depth	0.20	ft
Discharge	1.71	ft³/s

Cross Section Image



Cross Section for 10-YR section-F1

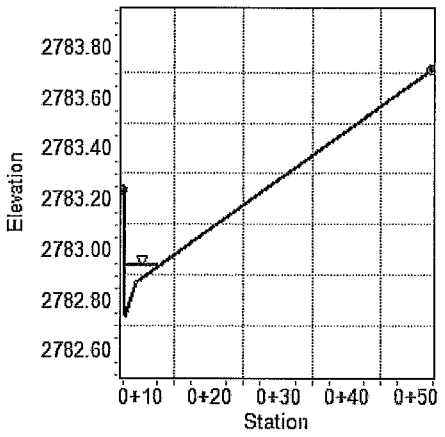
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	2.67000	%
Normal Depth	0.20	ft
Discharge	0.90	ft³/s

Cross Section Image



Cross Section for 10-YR section-F2

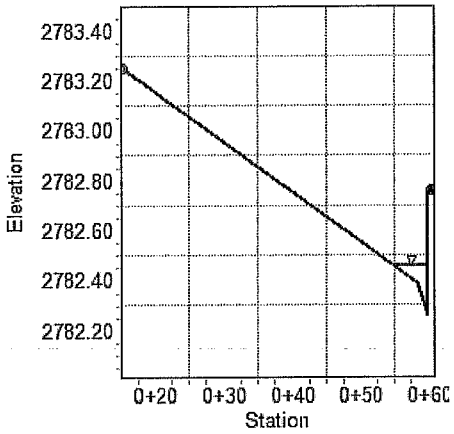
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	2.37000	%
Normal Depth	0.20	ft
Discharge	0.81	ft³/s

Cross Section Image



Cross Section for 10-YR section-G

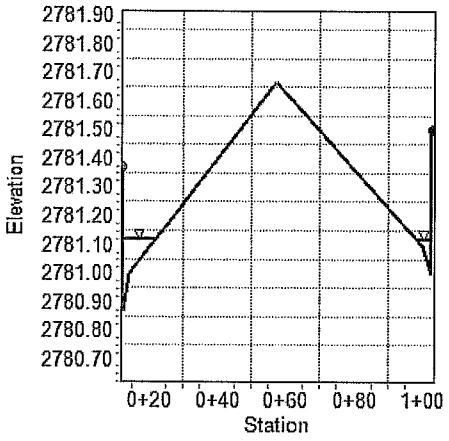
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.28000	%
Normal Depth	0.25	ft
Discharge	0.00	ft³/s

Cross Section Image



Cross Section for 10-YR section-H

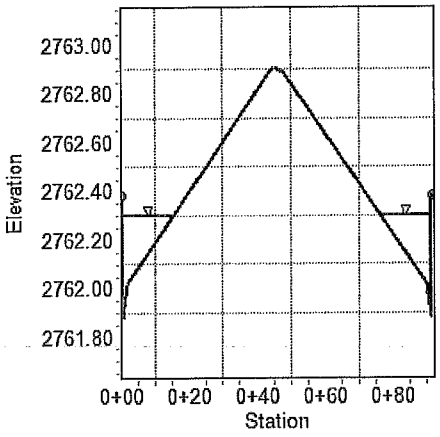
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.45000	%
Normal Depth	0.42	ft
Discharge	29.00	ft³/s

Cross Section Image



100-YR Flowmaster
Street Sections

MWH now part of Stantec

THIS PAGE WAS INTENTIONALLY LEFT BLANK

Worksheet for 100-YR section-A1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.33000	%
Discharge	109.50	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+04.45	2863.93
0+04.95	2863.93
0+05.01	2863.43
0+06.45	2863.56
0+41.49	2863.78

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+04.45, 2863.93)	(0+41.49, 2863.78)	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	0.55	ft
Elevation Range	2863.43 to 2863.93 ft	
Flow Area	11.56	ft²
Wetted Perimeter	37.74	ft
Hydraulic Radius	0.31	ft
Top Width	37.04	ft
Normal Depth	0.55	ft
Critical Depth	0.88	ft

Worksheet for 100-YR section-A1

Results

Critical Slope		0.00299	ft/ft
Velocity		9.48	ft/s
Velocity Head		1.40	ft
Specific Energy		1.94	ft
Froude Number		2.99	
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	0.55	ft
Critical Depth	0.88	ft
Channel Slope	3.33000	%
Critical Slope	0.00299	ft/ft

Worksheet for 100-YR section-A2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	2.86000	%
Discharge	109.50	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+21.65	2863.64
0+46.59	2862.97
0+48.03	2862.84
0+48.09	2863.34
0+48.59	2863.34

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+21.65, 2863.64)	(0+48.59, 2863.34)	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	0.84	ft
Elevation Range	2862.84 to 2863.64 ft	
Flow Area	10.70	ft²
Wetted Perimeter	27.78	ft
Hydraulic Radius	0.39	ft
Top Width	26.94	ft
Normal Depth	0.84	ft
Critical Depth	1.24	ft

Worksheet for 100-YR section-A2

Results

Critical Slope		0.00287	ft/ft
Velocity		10.23	ft/s
Velocity Head		1.63	ft
Specific Energy		2.47	ft
Froude Number		2.86	
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	0.84	ft
Critical Depth	1.24	ft
Channel Slope	2.86000	%
Critical Slope	0.00287	ft/ft

Worksheet for 100-YR section-B

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.80000	%
Discharge	128.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+15.49	2860.05
0+15.99	2860.05
0+16.05	2859.55
0+17.49	2859.69
0+50.85	2859.15
0+51.16	2859.57
0+51.67	2859.58
0+58.37	2859.79
0+58.89	2859.79
0+59.21	2859.38
0+93.52	2858.59
0+94.96	2858.46
0+95.02	2858.96
0+95.52	2858.96

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+15.49, 2860.05)	(0+95.52, 2858.96)	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 100-YR section-B

Results

Normal Depth		0.84	ft
Elevation Range	2858.46 to 2860.05 ft		
Flow Area		12.81	ft²
Wetted Perimeter		42.68	ft
Hydraulic Radius		0.30	ft
Top Width		41.81	ft
Normal Depth		0.84	ft
Critical Depth		1.20	ft
Critical Slope		0.00328	ft/ft
Velocity		9.99	ft/s
Velocity Head		1.55	ft
Specific Energy		2.39	ft
Froude Number		3.18	
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	0.84	ft
Critical Depth	1.20	ft
Channel Slope	3.80000	%
Critical Slope	0.00328	ft/ft

Worksheet for 100-YR section-C

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.90000	%
Discharge	6.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+09.87	2829.83
0+10.37	2829.83
0+10.43	2829.33
0+11.87	2829.46
0+54.83	2830.34
0+97.79	2829.46
0+99.20	2829.33
0+99.26	2829.83
0+99.76	2829.83

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+09.87, 2829.83)	(0+99.76, 2829.83)	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	2829.33 to 2830.34 ft	
Flow Area	1.37	ft²
Wetted Perimeter	15.94	ft

Worksheet for 100-YR section-C

Results

Hydraulic Radius		0.09	ft
Top Width		15.46	ft
Normal Depth		0.26	ft
Critical Depth		0.34	ft
Critical Slope		0.00508	ft/ft
Velocity		4.39	ft/s
Velocity Head		0.30	ft
Specific Energy		0.56	ft
Froude Number		2.60	
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	0.26	ft
Critical Depth	0.34	ft
Channel Slope	3.90000	%
Critical Slope	0.00508	ft/ft

Worksheet for 100-YR section-D1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.83000	%
Discharge	8.50	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+09.07	2802.20
0+09.57	2802.20
0+09.63	2801.70
0+11.07	2801.83
0+53.87	2802.41

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+09.07, 2802.20)	(0+53.87, 2802.41)	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	0.32	ft
Elevation Range	2801.70 to 2802.41 ft	
Flow Area	1.68	ft²
Wetted Perimeter	15.68	ft
Hydraulic Radius	0.11	ft
Top Width	15.39	ft
Normal Depth	0.32	ft
Critical Depth	0.42	ft

Worksheet for 100-YR section-D1

Results

Critical Slope		0.00463	ft/ft
Velocity		5.05	ft/s
Velocity Head		0.40	ft
Specific Energy		0.71	ft
Froude Number		2.69	
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	0.32	ft
Critical Depth	0.42	ft
Channel Slope	3.83000	%
Critical Slope	0.00463	ft/ft

Worksheet for 100-YR section-D2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.89000	%
Discharge	8.50	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+04.51	2801.19
0+47.59	2800.55
0+49.03	2800.42
0+49.09	2800.92
0+49.59	2800.92

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+04.51, 2801.19)	(0+49.59, 2800.92)	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	0.32	ft
Elevation Range	2800.42 to 2801.19 ft	
Flow Area	1.64	ft²
Wetted Perimeter	14.78	ft
Hydraulic Radius	0.11	ft
Top Width	14.49	ft
Normal Depth	0.32	ft
Critical Depth	0.43	ft

Worksheet for 100-YR section-D2

Results

Critical Slope		0.00458	ft/ft
Velocity		5.20	ft/s
Velocity Head		0.42	ft
Specific Energy		0.74	ft
Froude Number		2.73	
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	0.32	ft
Critical Depth	0.43	ft
Channel Slope	3.89000	%
Critical Slope	0.00458	ft/ft

Worksheet for 100-YR section-E

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	4.05000	%
Discharge	6.86	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+22.59	2798.05
0+23.09	2798.05
0+23.15	2797.55
0+24.59	2797.68
0+67.43	2798.40
1+10.59	2797.64
1+12.03	2797.51
1+12.09	2798.01
1+12.59	2798.01

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+22.59, 2798.05)	(1+12.59, 2798.01)	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		0.28	ft
Elevation Range	2797.51 to 2798.40 ft		
Flow Area		1.55	ft²
Wetted Perimeter		18.33	ft

Worksheet for 100-YR section-E

Results

Hydraulic Radius		0.08	ft
Top Width		17.85	ft
Normal Depth		0.28	ft
Critical Depth		0.36	ft
Critical Slope		0.00508	ft/ft
Velocity		4.44	ft/s
Velocity Head		0.31	ft
Specific Energy		0.58	ft
Froude Number		2.66	
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	0.28	ft
Critical Depth	0.36	ft
Channel Slope	4.05000	%
Critical Slope	0.00508	ft/ft

Worksheet for 100-YR section-F1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	2.67000	%
Discharge	3.48	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+07.29	2783.24
0+07.79	2783.24
0+07.85	2782.74
0+09.29	2782.87
0+52.23	2783.71

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+07.29, 2783.24)	(0+52.23, 2783.71)	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	0.28	ft
Elevation Range	2782.74 to 2783.71 ft	
Flow Area	0.90	ft²
Wetted Perimeter	9.43	ft
Hydraulic Radius	0.09	ft
Top Width	9.17	ft
Normal Depth	0.28	ft
Critical Depth	0.35	ft

Worksheet for 100-YR section-F1

Results

Critical Slope		0.00501	ft/ft
Velocity		3.89	ft/s
Velocity Head		0.23	ft
Specific Energy		0.52	ft
Froude Number		2.19	
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	0.28	ft
Critical Depth	0.35	ft
Channel Slope	2.67000	%
Critical Slope	0.00501	ft/ft

Worksheet for 100-YR section-F2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	2.37000	%
Discharge	3.38	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+15.28	2783.25
0+58.26	2782.39
0+59.70	2782.26
0+59.76	2782.76
0+60.26	2782.76

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+15.28, 2783.25)	(0+60.26, 2782.76)	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	0.28	ft
Elevation Range	2782.26 to 2783.25 ft	
Flow Area	0.91	ft²
Wetted Perimeter	9.41	ft
Hydraulic Radius	0.10	ft
Top Width	9.15	ft
Normal Depth	0.28	ft
Critical Depth	0.35	ft

Worksheet for 100-YR section-F2

Results

Critical Slope		0.00501	ft/ft
Velocity		3.72	ft/s
Velocity Head		0.21	ft
Specific Energy		0.50	ft
Froude Number		2.08	
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	0.28	ft
Critical Depth	0.35	ft
Channel Slope	2.37000	%
Critical Slope	0.00501	ft/ft

Worksheet for 100-YR section-G

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.28000	%
Discharge	1.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+11.77	2781.37
0+12.27	2781.37
0+12.33	2780.87
0+13.78	2781.00
0+56.97	2781.67
0+99.82	2781.10
1+02.33	2781.00
1+02.39	2781.50
1+02.91	2781.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+11.77, 2781.37)	(1+02.91, 2781.50)	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	0.19	ft
Elevation Range	2780.87 to 2781.67 ft	
Flow Area	0.36	ft²
Wetted Perimeter	7.27	ft

Worksheet for 100-YR section-G

Results

Hydraulic Radius	0.05	ft
Top Width	7.03	ft
Normal Depth	0.19	ft
Critical Depth	0.23	ft
Critical Slope	0.00633	ft/ft
Velocity	2.79	ft/s
Velocity Head	0.12	ft
Specific Energy	0.31	ft
Froude Number	2.18	
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	0.19	ft
Critical Depth	0.23	ft
Channel Slope	3.28000	%
Critical Slope	0.00633	ft/ft

Worksheet for 100-YR section-H

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.45000	%
Discharge	87.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2762.38
0+00.50	2762.38
0+00.56	2761.88
0+02.00	2762.02
0+43.61	2762.89
0+45.23	2762.91
0+48.05	2762.89
0+89.66	2762.02
0+91.10	2761.88
0+91.16	2762.38
0+91.66	2762.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2762.38)	(0+91.66, 2762.38)	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	0.58	ft
Elevation Range	2761.88 to 2762.91 ft	

Worksheet for 100-YR section-H

Results

Flow Area		10.91	ft²
Wetted Perimeter		47.28	ft
Hydraulic Radius		0.23	ft
Top Width		46.21	ft
Normal Depth		0.58	ft
Critical Depth		0.83	ft
Critical Slope		0.00356	ft/ft
Velocity		7.98	ft/s
Velocity Head		0.99	ft
Specific Energy		1.57	ft
Froude Number		2.89	
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	0.58	ft
Critical Depth	0.83	ft
Channel Slope	3.45000	%
Critical Slope	0.00356	ft/ft

100-YR Flowmaster
Street Cross Sections

MWH now part of Stantec

THIS PAGE WAS INTENTIONALLY LEFT BLANK

Cross Section for 100-YR section-A1

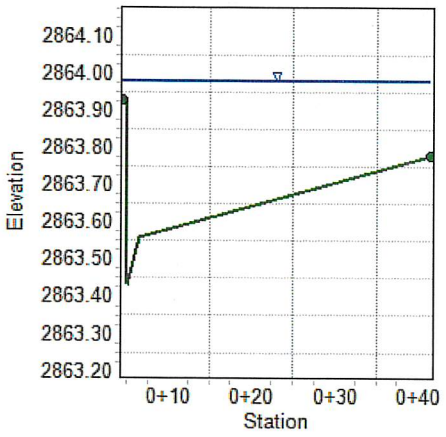
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.33000	%
Normal Depth	0.55	ft
Discharge	109.50	ft³/s

Cross Section Image



Cross Section for 100-YR section-A2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	2.86000	%
Normal Depth	0.84	ft
Discharge	109.50	ft³/s

Cross Section Image



Cross Section for 100-YR section-B

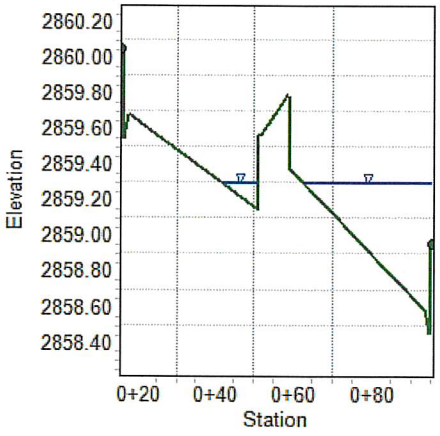
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.80000	%
Normal Depth	0.84	ft
Discharge	128.00	ft³/s

Cross Section Image



Cross Section for 100-YR section-C

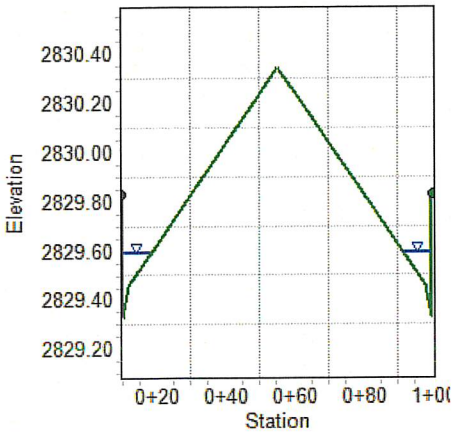
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.90000	%
Normal Depth	0.26	ft
Discharge	6.00	ft³/s

Cross Section Image



Cross Section for 100-YR section-D1

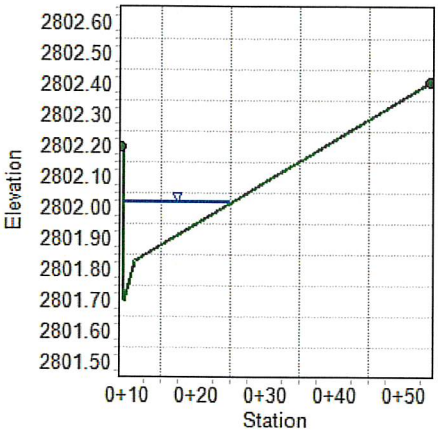
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.83000	%
Normal Depth	0.32	ft
Discharge	8.50	ft³/s

Cross Section Image



Cross Section for 100-YR section-D2

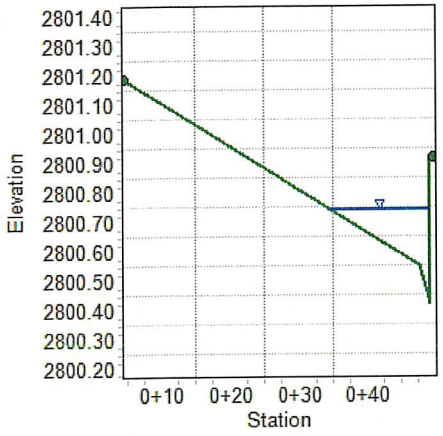
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.89000	%
Normal Depth	0.32	ft
Discharge	8.50	ft³/s

Cross Section Image



Cross Section for 100-YR section-E

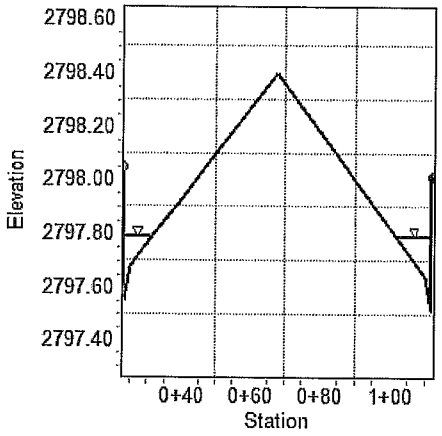
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	4.05000	%
Normal Depth	0.28	ft
Discharge	6.86	ft^3/s

Cross Section Image



Cross Section for 100-YR section-F1

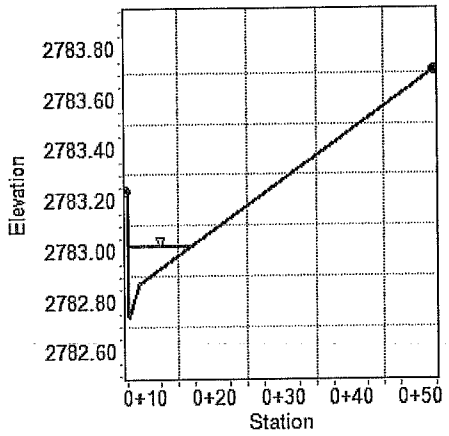
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	2.67000	%
Normal Depth	0.28	ft
Discharge	3.48	ft³/s

Cross Section Image



Cross Section for 100-YR section-F2

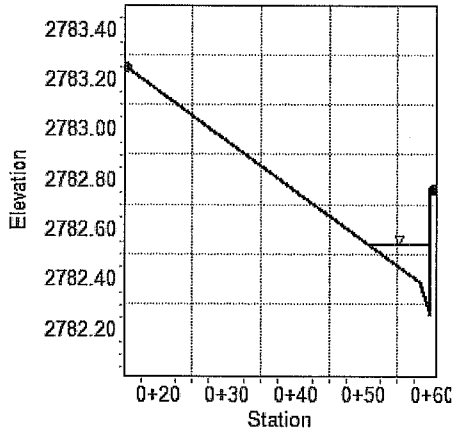
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	2.37000	%
Normal Depth	0.28	ft
Discharge	3.38	ft³/s

Cross Section Image



Cross Section for 100-YR section-G

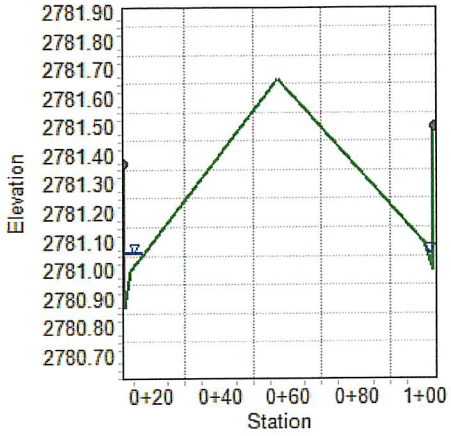
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.28000	%
Normal Depth	0.19	ft
Discharge	1.00	ft³/s

Cross Section Image



Cross Section for 100-YR section-H

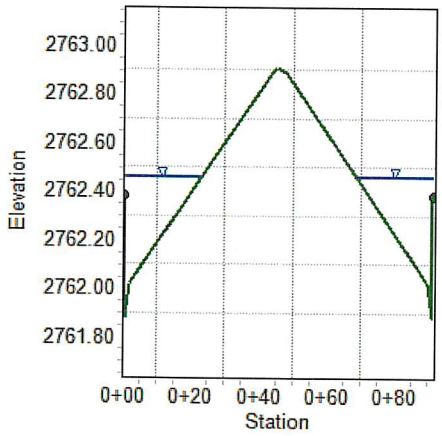
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.45000	%
Normal Depth	0.58	ft
Discharge	87.00	ft³/s

Cross Section Image



THIS PAGE WAS INTENTIONALLY LEFT BLANK

APPENDIX D.12
DROP INLET SECTION CALCULATIONS

MWH now part of Stantec

THIS PAGE WAS INTENTIONALLY LEFT BLANK

10-YR Flowmaster
Drop Inlet Sections

MWH now part of Stantec

THIS PAGE WAS INTENTIONALLY LEFT BLANK

Worksheet for 10-YR of DI-5

Project Description

Solve For	Efficiency

Input Data

Discharge		3.50	ft³/s
Slope		3.83000	%
Gutter Width		1.50	ft
Gutter Cross Slope		7.33	%
Road Cross Slope		1.51	%
Roughness Coefficient		0.013	
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Width		1.50	ft
Grate Length		10.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%
Curb Opening Length		10.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	74.26	%
Intercepted Flow	2.60	ft³/s
Bypass Flow	0.90	ft³/s
Spread	9.09	ft
Depth	0.22	ft
Flow Area	0.69	ft²
Gutter Depression	0.09	ft
Total Depression	0.09	ft
Velocity	5.07	ft/s
Splash Over Velocity	13.09	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.18	
Grate Flow Ratio	0.51	
Equivalent Cross Slope	0.04465	ft/ft
Active Grate Length	5.00	ft
Length Factor	0.15	
Total Interception Length	33.37	ft

Worksheet for 10-YR of DI-5

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 10-YR of DI-6

Project Description

Solve For	Efficiency

Input Data

Discharge		3.50	ft³/s
Slope		3.89000	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.67	%
Road Cross Slope		1.36	%
Roughness Coefficient		0.013	
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Width		1.50	ft
Grate Length		10.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%
Curb Opening Length		10.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	76.80	%
Intercepted Flow	2.69	ft³/s
Bypass Flow	0.81	ft³/s
Spread	9.43	ft
Depth	0.24	ft
Flow Area	0.69	ft²
Gutter Depression	0.11	ft
Total Depression	0.11	ft
Velocity	5.09	ft/s
Splash Over Velocity	13.09	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.16	
Grate Flow Ratio	0.53	
Equivalent Cross Slope	0.05244	ft/ft
Active Grate Length	5.00	ft
Length Factor	0.16	
Total Interception Length	30.44	ft

Worksheet for 10-YR of DI-6

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 10-YR of DI-7

Project Description

Solve For	Efficiency

Input Data

Discharge		0.90	ft³/s
Slope		2.67000	%
Gutter Width		1.50	ft
Gutter Cross Slope		9.03	%
Road Cross Slope		1.95	%
Roughness Coefficient		0.013	
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Width		1.50	ft
Grate Length		10.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%
Curb Opening Length		10.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	100.00	%
Intercepted Flow	0.90	ft³/s
Bypass Flow	0.00	ft³/s
Spread	3.88	ft
Depth	0.18	ft
Flow Area	0.23	ft²
Gutter Depression	0.11	ft
Total Depression	0.11	ft
Velocity	3.98	ft/s
Splash Over Velocity	13.09	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.30	
Grate Flow Ratio	0.89	
Equivalent Cross Slope	0.08247	ft/ft
Active Grate Length	5.00	ft
Length Factor	0.43	
Total Interception Length	11.72	ft

Worksheet for 10-YR of DI-7

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 10-YR of DI-8

Project Description

Solve For	Efficiency

Input Data

Discharge		0.81	ft³/s
Slope		2.37000	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.67	%
Road Cross Slope		1.93	%
Roughness Coefficient		0.013	
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Width		1.50	ft
Grate Length		10.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%
Curb Opening Length		10.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	100.00	%
Intercepted Flow	0.81	ft³/s
Bypass Flow	0.00	ft³/s
Spread	3.88	ft
Depth	0.18	ft
Flow Area	0.22	ft²
Gutter Depression	0.10	ft
Total Depression	0.10	ft
Velocity	3.67	ft/s
Splash Over Velocity	13.09	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.33	
Grate Flow Ratio	0.89	
Equivalent Cross Slope	0.07900	ft/ft
Active Grate Length	5.00	ft
Length Factor	0.45	
Total Interception Length	11.10	ft

Worksheet for 10-YR of DI-8

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).

10-YR Flowmaster
Drop Inlet
Cross Sections

MWH now part of Stantec

THIS PAGE WAS INTENTIONALLY LEFT BLANK

Cross Section for 10-YR of DI-5

Project Description

Solve For	Efficiency

Input Data

Discharge		3.50	ft³/s
Slope		3.83000	%
Gutter Width		1.50	ft
Gutter Cross Slope		7.33	%
Road Cross Slope		1.51	%
Roughness Coefficient		0.013	
Local Depression		0.00	in
Local Depression Width		0.00	ft
Efficiency		74.26	%
Grate Width		1.50	ft
Grate Length		10.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%
Curb Opening Length		10.00	ft

Cross Section Image



V: 1
H: 1

Cross Section for 10-YR of DI-6

Project Description

Solve For	Efficiency

Input Data

Discharge	3.50	ft³/s
Slope	3.89000	%
Gutter Width	1.50	ft
Gutter Cross Slope	8.67	%
Road Cross Slope	1.36	%
Roughness Coefficient	0.013	
Local Depression	0.00	in
Local Depression Width	0.00	ft
Efficiency	76.80	%
Grate Width	1.50	ft
Grate Length	10.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%
Curb Opening Length	10.00	ft

Cross Section Image



V: 1
H: 1

Cross Section for 10-YR of DI-7

Project Description

Solve For	Efficiency

Input Data

Discharge		0.90	ft³/s
Slope		2.67000	%
Gutter Width		1.50	ft
Gutter Cross Slope		9.03	%
Road Cross Slope		1.95	%
Roughness Coefficient		0.013	
Local Depression		0.00	in
Local Depression Width		0.00	ft
Efficiency		100.00	%
Grate Width		1.50	ft
Grate Length		10.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%
Curb Opening Length		10.00	ft

Cross Section Image



V: 1
H: 1

Cross Section for 10-YR of DI-8

Project Description

Solve For	Efficiency

Input Data

Discharge		0.81	ft³/s
Slope		2.37000	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.67	%
Road Cross Slope		1.93	%
Roughness Coefficient		0.013	
Local Depression		0.00	in
Local Depression Width		0.00	ft
Efficiency		100.00	%
Grate Width		1.50	ft
Grate Length		10.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%
Curb Opening Length		10.00	ft

Cross Section Image



V: 1
H: 1

100-YR Flowmaster
Drop Inlet Sections

MWH now part of Stantec

THIS PAGE WAS INTENTIONALLY LEFT BLANK

Worksheet for 100-YR DI-1

Project Description

Solve For	Efficiency

Input Data

Discharge		109.50	ft³/s
Slope		3.33000	%
Gutter Width		1.50	ft
Gutter Cross Slope		9.00	%
Road Cross Slope		2.42	%
Roughness Coefficient		0.013	
Local Depression		0.00	in
Local Depression Width		0.00	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

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	40.96	%
Intercepted Flow	44.85	ft³/s
Bypass Flow	64.65	ft³/s
Spread	27.29	ft
Depth	0.76	ft
Flow Area	9.10	ft²
Gutter Depression	0.10	ft
Total Depression	0.10	ft
Velocity	12.04	ft/s
Splash Over Velocity	25.03	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.21	
Grate Flow Ratio	0.16	
Equivalent Cross Slope	0.03447	ft/ft
Active Grate Length	8.75	ft
Length Factor	0.06	
Total Interception Length	158.72	ft

Worksheet for 100-YR DI-1

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 100-YR DI-2

Project Description

Solve For	Efficiency

Input Data

Discharge		109.50	ft³/s
Slope		2.86000	%
Gutter Width		1.50	ft
Gutter Cross Slope		9.00	%
Road Cross Slope		2.42	%
Roughness Coefficient		0.013	
Local Depression		0.00	in
Local Depression Width		0.00	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

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	42.28	%
Intercepted Flow	46.30	ft³/s
Bypass Flow	63.20	ft³/s
Spread	28.11	ft
Depth	0.78	ft
Flow Area	9.63	ft²
Gutter Depression	0.10	ft
Total Depression	0.10	ft
Velocity	11.37	ft/s
Splash Over Velocity	25.03	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.23	
Grate Flow Ratio	0.15	
Equivalent Cross Slope	0.03413	ft/ft
Active Grate Length	8.75	ft
Length Factor	0.06	
Total Interception Length	152.53	ft

Worksheet for 100-YR DI-2

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 100-YR DI-3

Project Description

Solve For	Efficiency

Input Data

Discharge		128.00	ft³/s
Slope		2.65000	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.67	%
Road Cross Slope		1.96	%
Roughness Coefficient		0.013	
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Width		1.50	ft
Grate Length		15.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%
Curb Opening Length		15.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	32.14	%
Intercepted Flow	41.14	ft³/s
Bypass Flow	86.86	ft³/s
Spread	34.53	ft
Depth	0.78	ft
Flow Area	11.76	ft²
Gutter Depression	0.10	ft
Total Depression	0.10	ft
Velocity	10.89	ft/s
Splash Over Velocity	19.39	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.15	
Grate Flow Ratio	0.12	
Equivalent Cross Slope	0.02795	ft/ft
Active Grate Length	7.50	ft
Length Factor	0.04	
Total Interception Length	179.44	ft

Worksheet for 100-YR DI-3

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 100-YR DI-4

Project Description

Solve For	Efficiency

Input Data

Discharge		86.74	ft³/s
Slope		0.19000	%
Gutter Width		1.50	ft
Gutter Cross Slope		2.46	%
Road Cross Slope		2.46	%
Roughness Coefficient		0.013	
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Width		1.50	ft
Grate Length		15.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%
Curb Opening Length		15.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	71.37	%
Intercepted Flow	61.90	ft³/s
Bypass Flow	24.84	ft³/s
Spread	42.65	ft
Depth	1.05	ft
Flow Area	22.37	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	3.88	ft/s
Splash Over Velocity	19.39	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.60	
Grate Flow Ratio	0.09	
Equivalent Cross Slope	0.02460	ft/ft
Active Grate Length	7.50	ft
Length Factor	0.10	
Total Interception Length	74.63	ft

Worksheet for 100-YR DI-4

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 100-YR DI-5

Project Description

Solve For	Efficiency

Input Data

Discharge		8.50	ft³/s
Slope		3.83000	%
Gutter Width		1.50	ft
Gutter Cross Slope		7.33	%
Road Cross Slope		1.51	%
Roughness Coefficient		0.013	
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Width		1.50	ft
Grate Length		10.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%
Curb Opening Length		12.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	59.04	%
Intercepted Flow	5.02	ft³/s
Bypass Flow	3.48	ft³/s
Spread	13.25	ft
Depth	0.29	ft
Flow Area	1.39	ft²
Gutter Depression	0.09	ft
Total Depression	0.09	ft
Velocity	6.11	ft/s
Splash Over Velocity	13.09	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.14	
Grate Flow Ratio	0.35	
Equivalent Cross Slope	0.03549	ft/ft
Active Grate Length	5.00	ft
Length Factor	0.13	
Total Interception Length	55.59	ft

Worksheet for 100-YR DI-5

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 100-YR DI-6

Project Description

Solve For	Efficiency

Input Data

Discharge		8.50	ft³/s
Slope		3.89000	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.67	%
Road Cross Slope		1.36	%
Roughness Coefficient		0.013	
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Width		1.50	ft
Grate Length		10.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%
Curb Opening Length		12.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	60.26	%
Intercepted Flow	5.12	ft³/s
Bypass Flow	3.38	ft³/s
Spread	13.94	ft
Depth	0.30	ft
Flow Area	1.40	ft²
Gutter Depression	0.11	ft
Total Depression	0.11	ft
Velocity	6.05	ft/s
Splash Over Velocity	13.09	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.13	
Grate Flow Ratio	0.36	
Equivalent Cross Slope	0.03984	ft/ft
Active Grate Length	5.00	ft
Length Factor	0.13	
Total Interception Length	52.11	ft

Worksheet for 100-YR DI-6

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 100-YR DI-7

Project Description

Solve For	Efficiency

Input Data

Discharge		3.48	ft³/s
Slope		2.67000	%
Gutter Width		1.50	ft
Gutter Cross Slope		9.03	%
Road Cross Slope		1.95	%
Roughness Coefficient		0.013	
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Width		1.50	ft
Grate Length		10.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%
Curb Opening Length		10.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	82.38	%
Intercepted Flow	2.87	ft³/s
Bypass Flow	0.61	ft³/s
Spread	8.17	ft
Depth	0.27	ft
Flow Area	0.73	ft²
Gutter Depression	0.11	ft
Total Depression	0.11	ft
Velocity	4.77	ft/s
Splash Over Velocity	13.09	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.24	
Grate Flow Ratio	0.55	
Equivalent Cross Slope	0.05859	ft/ft
Active Grate Length	5.00	ft
Length Factor	0.20	
Total Interception Length	25.38	ft

Worksheet for 100-YR DI-7

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 100-YR DI-8

Project Description

Solve For	Efficiency

Input Data

Discharge		3.38	ft³/s
Slope		2.37000	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.67	%
Road Cross Slope		1.93	%
Roughness Coefficient		0.013	
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Width		1.50	ft
Grate Length		10.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%
Curb Opening Length		10.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	82.12	%
Intercepted Flow	2.78	ft³/s
Bypass Flow	0.60	ft³/s
Spread	8.38	ft
Depth	0.26	ft
Flow Area	0.75	ft²
Gutter Depression	0.10	ft
Total Depression	0.10	ft
Velocity	4.48	ft/s
Splash Over Velocity	13.09	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.26	
Grate Flow Ratio	0.54	
Equivalent Cross Slope	0.05534	ft/ft
Active Grate Length	5.00	ft
Length Factor	0.20	
Total Interception Length	25.03	ft

Worksheet for 100-YR DI-8

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).

100-YR Flowmaster
Drop Inlet Cross Sections

MWH now part of Stantec

THIS PAGE WAS INTENTIONALLY LEFT BLANK

Cross Section for 100-YR DI-1

Project Description

Solve For	Efficiency

Input Data

Discharge		109.50	ft³/s
Slope		3.33000	%
Gutter Width		1.50	ft
Gutter Cross Slope		9.00	%
Road Cross Slope		2.42	%
Roughness Coefficient		0.013	
Local Depression		0.00	in
Local Depression Width		0.00	ft
Efficiency		40.96	%
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

Cross Section Image



V: 1
H: 1

Cross Section for 100-YR DI-2

Project Description

Solve For	Efficiency

Input Data

Discharge		109.50	ft³/s
Slope		2.86000	%
Gutter Width		1.50	ft
Gutter Cross Slope		9.00	%
Road Cross Slope		2.42	%
Roughness Coefficient		0.013	
Local Depression		0.00	in
Local Depression Width		0.00	ft
Efficiency		42.28	%
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

Cross Section Image



V: 1
H: 1

Cross Section for 100-YR DI-3

Project Description

Solve For	Efficiency

Input Data

Discharge		128.00	ft³/s
Slope		2.65000	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.67	%
Road Cross Slope		1.96	%
Roughness Coefficient		0.013	
Local Depression		0.00	in
Local Depression Width		0.00	ft
Efficiency		32.14	%
Grate Width		1.50	ft
Grate Length		15.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%
Curb Opening Length		15.00	ft

Cross Section Image



V: 1
H: 1

Cross Section for 100-YR DI-4

Project Description

Solve For	Efficiency

Input Data

Discharge		86.74	ft³/s
Slope		0.19000	%
Gutter Width		1.50	ft
Gutter Cross Slope		2.46	%
Road Cross Slope		2.46	%
Roughness Coefficient		0.013	
Local Depression		0.00	in
Local Depression Width		0.00	ft
Efficiency		71.37	%
Grate Width		1.50	ft
Grate Length		15.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%
Curb Opening Length		15.00	ft

Cross Section Image



V: 1
H: 1

Cross Section for 100-YR DI-5

Project Description

Solve For	Efficiency

Input Data

Discharge		8.50	ft³/s
Slope		3.83000	%
Gutter Width		1.50	ft
Gutter Cross Slope		7.33	%
Road Cross Slope		1.51	%
Roughness Coefficient		0.013	
Local Depression		0.00	in
Local Depression Width		0.00	ft
Efficiency		59.04	%
Grate Width		1.50	ft
Grate Length		10.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%
Curb Opening Length		12.00	ft

Cross Section Image



V: 1
H: 1

Cross Section for 100-YR DI-6

Project Description

Solve For	Efficiency

Input Data

Discharge		8.50	ft³/s
Slope		3.89000	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.67	%
Road Cross Slope		1.36	%
Roughness Coefficient		0.013	
Local Depression		0.00	in
Local Depression Width		0.00	ft
Efficiency		60.26	%
Grate Width		1.50	ft
Grate Length		10.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%
Curb Opening Length		12.00	ft

Cross Section Image



V: 1
H: 1

Cross Section for 100-YR DI-7

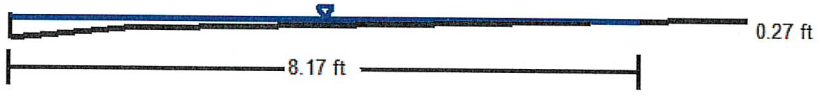
Project Description

Solve For	Efficiency

Input Data

Discharge		3.48	ft³/s
Slope		2.67000	%
Gutter Width		1.50	ft
Gutter Cross Slope		9.03	%
Road Cross Slope		1.95	%
Roughness Coefficient		0.013	
Local Depression		0.00	in
Local Depression Width		0.00	ft
Efficiency		82.38	%
Grate Width		1.50	ft
Grate Length		10.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%
Curb Opening Length		10.00	ft

Cross Section Image



V: 1
H: 1

Cross Section for 100-YR DI-8

Project Description

Solve For	Efficiency

Input Data

Discharge	3.38	ft³/s
Slope	2.37000	%
Gutter Width	1.50	ft
Gutter Cross Slope	8.67	%
Road Cross Slope	1.93	%
Roughness Coefficient	0.013	
Local Depression	0.00	in
Local Depression Width	0.00	ft
Efficiency	82.12	%
Grate Width	1.50	ft
Grate Length	10.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%
Curb Opening Length	10.00	ft

Cross Section Image



V: 1
H: 1

APPENDIX D.13
MAINLINE WSPG HYDRAULIC ANALYSES (n=0.013)

MWH now part of Stantec

THIS PAGE WAS INTENTIONALLY LEFT BLANK

STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
Portions Copyrighted by CIVILSOFT, 1986, 1987, 1989

Version 1.20
Serial Number 07010220

Jun 30, 2017 14:49:25

Input file : elkmain2.txt
Output file: elkmain2.out

INPUT FILE LISTING

```
T1 Rancho Road System Storm Drain - Elkhorn
T2 7'x6' RCB STORM DRAIN SYSTEM ELKHORN UPSTREAM EX 6'x4' RCA DOWNSTREAM EX 7'x6
T3 ULTIMATE CONDITION, 100YR, STANTEC 06/29/17
SO  -3959.332745.89  1      .013     0.0        2752.82
R   -3665.192754.91  1      .013     0.0        0000.00    90.00
R   -3618.122756.36  1      .013     0.0        0000.00          00.00
R   -3603.542756.80  1      .013     0.0        0000.00    90.00
R   -3556.422758.25  1      .013     0.0        0000.00          00.00
JX  -3395.012763.19  1  6   .013     3.0        2764.11          45.00
R   -3394.812763.19  1      .013     0.0        0000.00          00.00
JX  -3380.482763.63  1  6   .013     3.0        2765.75          45.00
R   -3380.482763.63  1      .013     0.0        0000.00          00.00
R   -3197.872771.82  1      .013     0.0        0000.00          00.00
R   -2971.372781.88  1      .013     0.0        0000.00          00.00
JX  -2971.372781.88  1  6   .013     5.0        2784.34          45.00
JX  -2930.882783.68  1  6   .013     5.0        2785.10          45.00
R   -2930.152783.71  1      .013     0.0        0000.00          00.00
R   -2680.342791.86  1      .013     0.0        0000.00    90.00
R   -2629.612793.52  1      .013     0.0        0000.00    90.00
R   -2581.602795.08  1      .013     0.0        0000.00          00.00
JX  -2124.172811.17  1  5   .013    14.3        2814.89          45.00
JX  -2119.772811.33  1  5   .013    14.3        2815.18          45.00
JX  -2112.492811.58  1  5   .013    14.3        2815.28          45.00
R   -2112.362811.59  1      .013     0.0        0000.00          00.00
R   -1609.762828.53  1      .013     0.0        0000.00    90.00
R   -1585.572829.38  1      .013     0.0        0000.00          00.00
R   -1521.312831.63  1      .013     0.0        0000.00    90.00
R   -1494.792832.56  1      .013     0.0        0000.00          00.00
JX  -1410.452835.26  1  3   .013   121.0        2836.30          45.00
R   -1409.832835.28  1      .013     0.0        0000.00          00.00
R   -1361.222837.81  1      .013     0.0        0000.00          00.00
R   -1072.112852.06  1      .013     0.0        0000.00          00.00
TS  -1072.112852.06  2      .013     0.0        0000.00          00.00
JX  -1069.502852.35  2  4   .013    46.0        2855.40          45.00
R   -1062.252853.14  2      .013     0.0        0000.00          00.00
TS  -1062.252853.14  7      .013     0.0        0000.00          00.00
R   -1002.002855.21  7      .013     0.0        0000.00          00.00
JX   -962.062856.59  2  4   .013    45.0        2857.44          90.00
TS   -962.062856.59  7      .013     0.0        0000.00          00.00
R    -950.002857.00  7      .013     0.0        0000.00          00.00
SH   -950.002857.00  7      .013     0.0        2859.50          00.00
1                                                SP
```

WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING — PAGE 1

CARD CODE	SECT NO	CHN TYPE	NO OF PIERS	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	3	0	.00	6.00	7.00	.00	.00	.00										
CD	2	3	0	.00	5.00	7.00	.00	.00	.00										
CD	3	4			4.50														
CD	4	4			2.50														
CD	5	4			1.67														
CD	6	4			1.50														
CD	7	6	0	.00															

1 SP

WATER SURFACE PROFILE - CROSS SECTION POINT LISTING — PAGE 2

CARD CODE	SECT NO	NO OF POINTS	X(1) , Y(1) X(8) , Y(8)	X(2) , Y(2) X(9) , Y(9)	X(3) , Y(3) X(10) ,Y(10)	X(4) , Y(4) X(11) ,Y(11)	X(5) , Y(5) X(N) , Y(N)	X(6) , Y(6) X(N+1),Y(N+1)	X(7) , Y(7) X(99) ,Y(99)
PTS	7	17	.00 .00	6.00 .00	6.00 1.00	6.00 2.50	5.93 2.91	5.72 3.29	5.32 3.61
PTS			5.00 3.73	4.13 3.91	3.00 4.00	1.87 3.91	1.00 3.73	.68 3.61	.28 3.29
PTS			.07 2.91	.00 2.50	.00 1.00				

1

WATER SURFACE PROFILE - TITLE CARD LISTING — PAGE NO 1

HEADING LINE NO 1 IS -
Rancho Road System Storm Drain - Elkhorn

HEADING LINE NO 2 IS -
7'x6' RCB STORM DRAIN SYSTEM ELKHORN UPSTREAM EX 6'x4' RCA DOWNSTREAM EX 7

HEADING LINE NO 3 IS -
ULTIMATE CONDITION, 100YR, STANTEC 06/29/17

1

WATER SURFACE PROFILE - ELEMENT CARD LISTING — PAGE NO 2

ELEMENT NO 1 IS A SYSTEM OUTLET

U/S DATA	STATION	INVERT	SECT	W S ELEV
	-3959.33	2745.89	1	2752.82

ELEMENT NO 2 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	-3665.19	2754.91	1	.013	90.00	.00	.00	0

ELEMENT NO 3 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	-3618.12	2756.36	1	.013	.00	.00	.00	0

ELEMENT NO 4 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	-3603.54	2756.80	1	.013	90.00	.00	.00	0

ELEMENT NO 5 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	-3556.42	2758.25	1	.013	.00	.00	.00	0

ELEMENT NO 6 IS A JUNCTION

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4

-3395.01 2763.19 1 6 0 .013 3.0 .0 2764.11 .00 45.00 .00

0 ELEMENT NO 7 IS A REACH

	STATION	INVERT	SECT			N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	-3394.81	2763.19	1			.013	.00	.00	.00	0

0 ELEMENT NO 8 IS A JUNCTION

	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
U/S DATA	-3380.48	2763.63	1	6	0	.013	3.0	.0	2765.75	.00	45.00	.00

0 ELEMENT NO 9 IS A REACH

	STATION	INVERT	SECT			N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	-3380.48	2763.63	1			.013	.00	.00	.00	0

0 ELEMENT NO 10 IS A REACH

	STATION	INVERT	SECT			N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	-3197.87	2771.82	1			.013	.00	.00	.00	0

0 ELEMENT NO 11 IS A REACH

	STATION	INVERT	SECT			N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	-2971.37	2781.88	1			.013	.00	.00	.00	0

0 ELEMENT NO 12 IS A JUNCTION

	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
U/S DATA	-2971.37	2781.88	1	6	0	.013	5.0	.0	2784.34	.00	45.00	.00

THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING
THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING

1
0 WATER SURFACE PROFILE - ELEMENT CARD LISTING

0 ELEMENT NO 13 IS A JUNCTION

	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
U/S DATA	-2930.88	2783.68	1	6	0	.013	5.0	.0	2785.10	.00	45.00	.00

0 ELEMENT NO 14 IS A REACH

	STATION	INVERT	SECT			N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	-2930.15	2783.71	1			.013	.00	.00	.00	0

0 ELEMENT NO 15 IS A REACH

	STATION	INVERT	SECT			N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	-2680.34	2791.86	1			.013	90.00	.00	.00	0

0 ELEMENT NO 16 IS A REACH

	STATION	INVERT	SECT			N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	-2629.61	2793.52	1			.013	90.00	.00	.00	0

0 ELEMENT NO 17 IS A REACH

	STATION	INVERT	SECT			N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	-2581.60	2795.08	1			.013	.00	.00	.00	0

0 ELEMENT NO 18 IS A JUNCTION

	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
U/S DATA	-2124.17	2811.17	1	5	0	.013	14.3	.0	2814.89	.00	45.00	.00

0 ELEMENT NO 19 IS A JUNCTION

	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
U/S DATA	-2119.77	2811.33	1	5	0	.013	14.3	.0	2815.18	.00	45.00	.00

0 ELEMENT NO 20 IS A JUNCTION

	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
U/S DATA	-2112.49	2811.58	1	5	0	.013	14.3	.0	2815.28	.00	45.00	.00

0 ELEMENT NO 21 IS A REACH

	STATION	INVERT	SECT			N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	-2112.36	2811.59	1			.013	.00	.00	.00	0

1
0 WATER SURFACE PROFILE - ELEMENT CARD LISTING

0 ELEMENT NO 22 IS A REACH

	STATION	INVERT	SECT			N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	-1609.76	2828.53	1			.013	90.00	.00	.00	0

0 ELEMENT NO 23 IS A REACH

	STATION	INVERT	SECT			N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	-1585.57	2829.38	1			.013	.00	.00	.00	0

0 ELEMENT NO 24 IS A REACH

	STATION	INVERT	SECT			N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	-1521.31	2831.63	1			.013	90.00	.00	.00	0

0 ELEMENT NO 25 IS A REACH

	STATION	INVERT	SECT			N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	-1494.79	2832.56	1			.013	.00	.00	.00	0

0 ELEMENT NO 26 IS A JUNCTION

	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
U/S DATA	-1410.45	2835.26	1	3	0	.013	121.0	.0	2836.30	.00	45.00	.00

0 ELEMENT NO 27 IS A REACH

	STATION	INVERT	SECT			N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	-1409.83	2835.28	1			.013	.00	.00	.00	0

0 ELEMENT NO 28 IS A REACH

	STATION	INVERT	SECT			N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	-1361.22	2837.81	1			.013	.00	.00	.00	0

0 ELEMENT NO 29 IS A REACH

	STATION	INVERT	SECT			N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	-1072.11	2852.06	1			.013	.00	.00	.00	0

0 ELEMENT NO 30 IS A TRANSITION

	STATION	INVERT	SECT			N
U/S DATA	-1072.11	2852.06	2			.013

THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING

0 ELEMENT NO 31 IS A JUNCTION

	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
U/S DATA	-1069.50	2852.35	2	4	0	.013	46.0	.0	2855.40	.00	45.00	.00

0 ELEMENT NO 32 IS A REACH

	STATION	INVERT	SECT			N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	-1062.25	2853.14	2			.013	.00	.00	.00	0

1
0 WATER SURFACE PROFILE - ELEMENT CARD LISTING

0 ELEMENT NO 33 IS A TRANSITION

	STATION	INVERT	SECT			N
U/S DATA	-1062.25	2853.14	7			.013

THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING

0 ELEMENT NO 34 IS A REACH

	STATION	INVERT	SECT			N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	-1002.00	2855.21	7			.013	.00	.00	.00	0

0 ELEMENT NO 35 IS A JUNCTION

	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
U/S DATA	-962.06	2856.59	2	4	0	.013	45.0	.0	2857.44	.00	90.00	.00

0 ELEMENT NO 36 IS A TRANSITION

	STATION	INVERT	SECT			N
U/S DATA	-962.06	2856.59	7			.013

THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING

0 ELEMENT NO 37 IS A REACH

	STATION	INVERT	SECT			N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	-950.00	2857.00	7			.013	.00	.00	.00	0

0 ELEMENT NO 38 IS A SYSTEM HEADWORKS

ELKMAIN2

U/S DATA STATION INVERT SECT W S ELEV
-950.00 2857.00 7 2859.50

NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

1

WATER SURFACE PROFILE LISTING
Rancho Road System Storm Drain - Elkhorn
7'x6' RCB STORM DRAIN SYSTEM ELKHORN UPSTREAM EX 6'x4' RCA DOWNSTREAM EX 7
ULTIMATE CONDITION, 100YR, STANTEC 06/29/17

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 -3959.33	2745.89	3.38	2749.27	689.9	29.18	13.23	2762.50	.00	6.00	6.00	7.00	.00	0	.00
0 294.14	.03067					.03280	9.65		3.42			.00		
0 -3665.19	2754.91	3.29	2758.20	689.9	29.96	13.95	2772.15	.00	6.00	6.00	7.00	.00	0	.00
0 .00	.03067					.03396	.00		3.42			.00		
0 -3665.19	2754.91	3.29	2758.20	689.9	29.96	13.95	2772.15	.00	6.00	6.00	7.00	.00	0	.00
0 47.07	.03081					.03427	1.61		3.41			.00		
0 -3618.12	2756.36	3.27	2759.63	689.9	30.16	14.13	2773.76	.00	6.00	6.00	7.00	.00	0	.00
0 14.58	.03017					.03470	.51		3.44			.00		
0 -3603.54	2756.80	3.26	2760.06	689.9	30.24	14.21	2774.27	.00	6.00	6.00	7.00	.00	0	.00
0 47.12	.03077					.03521	1.66		3.41			.00		
0 -3556.42	2758.25	3.23	2761.48	689.9	30.49	14.44	2775.93	.00	6.00	6.00	7.00	.00	0	.00
0JUNCT STR	.03060					.03828	6.18					.00		
0 -3395.01	2763.19	3.06	2766.25	686.9	32.07	15.99	2782.24	.00	6.00	6.00	7.00	.00	0	.00
0 .20	.00000					.04097	.01		.00			.00		
0 -3394.81	2763.19	3.06	2766.25	686.9	32.08	16.00	2782.24	.00	6.00	6.00	7.00	.00	0	.00
0JUNCT STR	.03070					.04163	.60					.00		
0 -3380.48	2763.63	3.01	2766.64	683.9	32.41	16.32	2782.97	.00	6.00	6.00	7.00	.00	0	.00
0 .00	.00000					.04227	.00		.00			.00		
0 -3380.48	2763.63	3.01	2766.64	683.9	32.41	16.32	2782.97	.00	6.00	6.00	7.00	.00	0	.00
0 .00	.00000					.04227	.00		.00			.00		
0 -3380.48	2763.63	3.01	2766.64	683.9	32.41	16.32	2782.97	.00	6.00	6.00	7.00	.00	0	.00
0 182.61	.04485					.04087	7.46		2.95			.00		

1

WATER SURFACE PROFILE LISTING
Rancho Road System Storm Drain - Elkhorn
7'x6' RCB STORM DRAIN SYSTEM ELKHORN UPSTREAM EX 6'x4' RCA DOWNSTREAM EX 7
ULTIMATE CONDITION, 100YR, STANTEC 06/29/17

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 -3197.87	2771.82	3.09	2774.91	683.9	31.60	15.52	2790.43	.00	6.00	6.00	7.00	.00	0	.00
0 101.01	.04441					.03830	3.87		2.96			.00		
0 -3096.86	2776.31	3.16	2779.47	683.9	30.90	14.84	2794.30	.00	6.00	6.00	7.00	.00	0	.00
0 125.49	.04441					.03490	4.38		2.96			.00		
0 -2971.37	2781.88	3.32	2785.20	683.9	29.46	13.49	2798.68	.00	6.00	6.00	7.00	.00	0	.00
0JUNCT STR	.00000					.03311	.00					.00		
0 -2971.37	2781.88	3.27	2785.15	678.9	29.70	13.71	2798.86	.00	6.00	6.00	7.00	.00	0	.00
0JUNCT STR	.04446					.03317	1.34					.00		
0 -2930.88	2783.68	3.28	2786.96	673.9	29.39	13.42	2800.38	.00	6.00	6.00	7.00	.00	0	.00
0 .73	.04114					.03276	.02		3.01			.00		
0 -2930.15	2783.71	3.28	2786.99	673.9	29.38	13.41	2800.40	.00	6.00	6.00	7.00	.00	0	.00
0 .00	.04114					.03275	.00		3.01			.00		
0 -2930.15	2783.71	3.28	2786.99	673.9	29.38	13.41	2800.40	.00	6.00	6.00	7.00	.00	0	.00
0 249.81	.03263					.03287	8.21		3.28			.00		
0 -2680.34	2791.86	3.27	2795.13	673.9	29.46	13.48	2808.61	.00	6.00	6.00	7.00	.00	0	.00
0 50.73	.03272					.03301	1.67		3.28			.00		
0 -2629.61	2793.52	3.27	2796.79	673.9	29.47	13.50	2810.29	.00	6.00	6.00	7.00	.00	0	.00
0 48.01	.03249					.03310	1.59		3.29			.00		
0 -2581.60	2795.08	3.26	2798.34	673.9	29.51	13.53	2811.88	.00	6.00	6.00	7.00	.00	0	.00
0JUNCT STR	.03517					.03066	14.02					.00		
0 -2124.17	2811.17	3.41	2814.58	659.6	27.62	11.86	2826.44	.00	6.00	6.00	7.00	.00	0	.00
0JUNCT STR	.03640					.02947	.13					.00		

1

WATER SURFACE PROFILE LISTING
Rancho Road System Storm Drain - Elkhorn
7'x6' RCB STORM DRAIN SYSTEM ELKHORN UPSTREAM EX 6'x4' RCA DOWNSTREAM EX 7
ULTIMATE CONDITION, 100YR, STANTEC 06/29/17

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 -2119.77	2811.33	3.25	2814.58	645.3	28.39	12.52	2827.10	.00	6.00	6.00	7.00	.00	0	.00
0JUNCT STR	.03434					.03223	.23					.00		
0 -2112.49	2811.58	3.09	2814.67	631.0	29.19	13.24	2827.91	.00	6.00	6.00	7.00	.00	0	.00
0 .13	.07707					.03371	.00		2.29			.00		
0 -2112.36	2811.59	3.09	2814.68	631.0	29.19	13.24	2827.92	.00	6.00	6.00	7.00	.00	0	.00
0 502.60	.03370					.03369	16.93		3.09			.00		
0 -1609.76	2828.53	3.09	2831.62	631.0	29.18	13.23	2844.85	.00	6.00	6.00	7.00	.00	0	.00
0 .00	.03370					.03368	.00		3.09			.00		
0 -1609.76	2828.53	3.09	2831.62	631.0	29.18	13.23	2844.85	.00	6.00	6.00	7.00	.00	0	.00
0 24.19	.03513					.03361	.81		3.04			.00		
0 -1585.57	2829.38	3.09	2832.47	631.0	29.14	13.19	2845.67	.00	6.00	6.00	7.00	.00	0	.00
0 .00	.03513					.03354	.00		3.04			.00		
0 -1585.57	2829.38	3.09	2832.47	631.0	29.14	13.19	2845.67	.00	6.00	6.00	7.00	.00	0	.00
0 64.26	.03501					.03334	2.14		3.05			.00		
0 -1521.31	2831.63	3.11	2834.74	631.0	29.01	13.08	2847.82	.00	6.00	6.00	7.00	.00	0	.00
0 26.52	.03507					.03304	.88		3.04			.00		
0 -1494.79	2832.56	3.11	2835.67	631.0	28.94	13.02	2848.69	.00	6.00	6.00	7.00	.00	0	.00
0JUNCT STR	.03201					.03838	3.24					.00		
0 -1410.45	2835.26	2.40	2837.66	510.0	30.31	14.27	2851.94	.00	5.49	6.00	7.00	.00	0	.00
0 .62	.03229					.04385	.03		2.68			.00		
0 -1409.83	2835.28	2.40	2837.68	510.0	30.32	14.28	2851.97	.00	5.49	6.00	7.00	.00	0	.00
0 48.61	.05205					.04284	2.08		2.26			.00		

1

WATER SURFACE PROFILE LISTING
Rancho Road System Storm Drain - Elkhorn
7'x6' RCB STORM DRAIN SYSTEM ELKHORN UPSTREAM EX 6'x4' RCA DOWNSTREAM EX 7
ULTIMATE CONDITION, 100YR, STANTEC 06/29/17

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR

ELKMAIN2

0 -1361.22	2837.81	2.45	2840.26	510.0	29.79	13.80	2854.05	.00	5.49		6.00	7.00	.00	0	.00
0 106.81	.04929					.03939	4.21			2.31			.00		
0 -1254.41	2843.07	2.56	2845.63	510.0	28.51	12.63	2858.26	.00	5.49		6.00	7.00	.00	0	.00
0 70.14	.04929					.03470	2.43			2.31			.00		
0 -1184.27	2846.53	2.68	2849.21	510.0	27.18	11.48	2860.69	.00	5.49		6.00	7.00	.00	0	.00
0 48.40	.04929					.03043	1.47			2.31			.00		
0 -1135.87	2848.92	2.81	2851.73	510.0	25.92	10.44	2862.17	.00	5.49		6.00	7.00	.00	0	.00
0 35.94	.04929					.02670	.96			2.31			.00		
0 -1099.93	2850.69	2.95	2853.64	510.0	24.71	9.49	2863.13	.00	5.49		6.00	7.00	.00	0	.00
0 27.82	.04929					.02345	.65			2.31			.00		
0 -1072.11	2852.06	3.09	2855.15	510.0	23.56	8.63	2863.78	.00	5.49		6.00	7.00	.00	0	.00
0TRANS STR	.00000					.02194	.00						.00		
0 -1072.11	2852.06	3.09	2855.15	510.0	23.56	8.63	2863.78	.00	5.00		5.00	7.00	.00	0	.00
0JUNCT STR	.11113					.02702	.07						.00		
0 -1069.50	2852.35	2.51	2854.86	464.0	26.39	10.82	2865.68	.00	5.00		5.00	7.00	.00	0	.00
0 7.25	.10894					.03079	.22			1.63			.00		
0 -1062.25	2853.14	2.59	2855.73	464.0	25.59	10.18	2865.91	.00	5.00		5.00	7.00	.00	0	.00
0TRANS STR	.00000					.02853	.00						.00		
0 -1062.25	2853.14	3.11	2856.25	464.0	25.00	9.71	2865.96		3.93			7		0	.00
0 60.25	.03436					.02658	1.60			2.84					
0 -1002.00	2855.21	3.21	2858.42	464.0	24.26	9.14	2867.56		3.93			7		0	.00
0JUNCT STR	.03455					.03387	1.35								

1

WATER SURFACE PROFILE LISTING

Rancho Road System Storm Drain - Elkhorn
7'x6' RCB STORM DRAIN SYSTEM ELKHORN UPSTREAM EX 6'x4' RCA DOWNSTREAM EX 7
ULTIMATE CONDITION, 100YR, STANTEC 06/29/17

0 STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0 L/ELEM	SO					SF AVE	HF						ZR		
**********															
0 -962.06	2856.59	2.12	2858.71	419.0	28.24	12.40	2871.11	.00	4.81		5.00	7.00	.00	0	.00
0TRANS STR	.00000					.04067	.00						.00		
0 -962.06	2856.59	2.51	2859.10	419.0	27.85	12.05	2871.15		3.92			7		0	.00
0 12.06	.03399					.03933	.47			2.64					
0 -950.00	2857.00	2.50	2859.50	419.0	27.93	12.13	2871.63		3.92			7		0	.00

1

APPENDIX D.14
MAINLINE WSPG HYDRAULIC ANALYSES (n=0.015)

MWH now part of Stantec

THIS PAGE WAS INTENTIONALLY LEFT BLANK

STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
Portions Copyrighted by CIVILSOFT, 1986, 1987, 1989

Version 1.20
Serial Number 07010220

Jun 30, 2017 14:59:18

Input file : elkmain3.txt
Output file: elkmain3.out

INPUT FILE LISTING

```
T1 Rancho Road System Storm Drain - Elkhorn
T2 7'x6' RCB STORM DRAIN SYSTEM ELKHORN UPSTREAM EX 6'x4' RCA DOWNSTREAM EX 7'x6
T3 ULTIMATE CONDITION, 100YR, STANTEC 06/29/17
SO  -3959.332745.89  1       .015      0.0        2752.82
R   -3665.192754.91  1       .015      0.0        0000.00    90.00
R   -3618.122756.36  1       .015      0.0        0000.00          00.00
R   -3603.542756.80  1       .015      0.0        0000.00    90.00
R   -3556.422758.25  1       .015      0.0        0000.00          00.00
JX  -3395.012763.19  1  6    .015      3.0        2764.11          45.00
R   -3394.812763.19  1       .015      0.0        0000.00          00.00
JX  -3380.482763.63  1  6    .015      3.0        2765.75          45.00
R   -3380.482763.63  1       .015      0.0        0000.00          00.00
R   -3197.872771.82  1       .015      0.0        0000.00          00.00
R   -2971.372781.88  1       .015      0.0        0000.00          00.00
JX  -2971.372781.88  1  6    .015      5.0        2784.34          45.00
JX  -2930.882783.68  1  6    .015      5.0        2785.10          45.00
R   -2930.152783.71  1       .015      0.0        0000.00          00.00
R   -2680.342791.86  1       .015      0.0        0000.00    90.00
R   -2629.612793.52  1       .015      0.0        0000.00    90.00
R   -2581.602795.08  1       .015      0.0        0000.00          00.00
JX  -2124.172811.17  1  5    .015     14.3        2814.89          45.00
JX  -2119.772811.33  1  5    .015     14.3        2815.18          45.00
JX  -2112.492811.58  1  5    .015     14.3        2815.28          45.00
R   -2112.362811.59  1       .015      0.0        0000.00          00.00
R   -1609.762828.53  1       .015      0.0        0000.00    90.00
R   -1585.572829.38  1       .015      0.0        0000.00          00.00
R   -1521.312831.63  1       .015      0.0        0000.00    90.00
R   -1494.792832.56  1       .015      0.0        0000.00          00.00
JX  -1410.452835.26  1  3    .015    121.0        2836.30          45.00
R   -1409.832835.28  1       .015      0.0        0000.00          00.00
R   -1361.222837.81  1       .015      0.0        0000.00          00.00
R   -1072.112852.06  1       .015      0.0        0000.00          00.00
TS  -1072.112852.06  2       .015      0.0        0000.00          00.00
JX  -1069.502852.35  2  4    .015     46.0        2855.40          45.00
R   -1062.252853.14  2       .015      0.0        0000.00          00.00
TS  -1062.252853.14  7       .015      0.0        0000.00          00.00
R   -1002.002855.21  7       .015      0.0        0000.00          00.00
JX   -962.062856.59  2  4    .015     45.0        2857.44          90.00
TS   -962.062856.59  7       .015      0.0        0000.00          00.00
R    -950.002857.00  7       .015      0.0        0000.00          00.00
SH   -950.002857.00  7       .015      0.0        2859.50          00.00
1                                                                  SP
                              WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING                                    PAGE    1
0 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
  CODE   NO   TYPE  PIERS   WIDTH    DIAMETER  WIDTH                DROP

  CD      1    3      0       .00      6.00    7.00    .00   .00   .00
  CD      2    3      0       .00      5.00    7.00    .00   .00   .00
  CD      3    4                       4.50
  CD      4    4                       2.50
  CD      5    4                       1.67
  CD      6    4                       1.50
  CD      7    6      0       .00
1                                                                  SP
                              WATER SURFACE PROFILE - CROSS SECTION POINT LISTING                                   PAGE    2
0   CARD  SECT  NO OF    X(1) , Y(1)    X(2) , Y(2)    X(3) , Y(3)    X(4) , Y(4)    X(5) , Y(5)    X(6) , Y(6)    X(7) , Y(7)
    CODE   NO   POINTS   X(8) , Y(8)    X(9) , Y(9)   X(10) ,Y(10)   X(11) ,Y(11)    X(N) , Y(N)  X(N+1),Y(N+1)  X(99) ,Y(99)

0   PTS     7    17        .00   .00    6.00   .00    6.00  1.00    6.00  2.50    5.93  2.91    5.72  3.29    5.32  3.61
    PTS                  5.00  3.73    4.13  3.91    3.00  4.00    1.87  3.91    1.00  3.73     .68  3.61     .28  3.29
    PTS                   .07  2.91     .00  2.50     .00  1.00
1
0                                                                  PAGE NO   1
                            WATER SURFACE PROFILE - TITLE CARD LISTING
0HEADING LINE NO 1 IS -
0                             Rancho Road System Storm Drain - Elkhorn
0HEADING LINE NO 2 IS -
0                             7'x6' RCB STORM DRAIN SYSTEM ELKHORN UPSTREAM EX 6'x4' RCA DOWNSTREAM EX 7
0HEADING LINE NO 3 IS -
0                             ULTIMATE CONDITION, 100YR, STANTEC 06/29/17
1
0                                                                  PAGE NO   2
                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO   1 IS A SYSTEM OUTLET          *       *       *                                                  W S ELEV
                    U/S DATA   STATION    INVERT  SECT                                                       2752.82
                                -3959.33 2745.89    1
0 ELEMENT NO   2 IS A REACH               *       *       *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                -3665.19 2754.91    1              .015                                90.00    .00     .00      0
0 ELEMENT NO   3 IS A REACH               *       *       *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                -3618.12 2756.36    1              .015                                 .00     .00     .00      0
0 ELEMENT NO   4 IS A REACH               *       *       *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                -3603.54 2756.80    1              .015                                90.00    .00     .00      0
0 ELEMENT NO   5 IS A REACH               *       *       *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                -3556.42 2758.25    1              .015                                 .00     .00     .00      0
0 ELEMENT NO   6 IS A JUNCTION            *       *       *       *       *                       *       *
                    U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N       Q3      Q4     INVERT-3 INVERT-4  PHI 3   PHI 4
```

See sheet PP-4
HGL at STA 39+59.33
≈ 2749.7

≈ 2749.8 ?

```
                                                                                                                ELKMAIN3
                                  -3395.01 2763.19   1     6     0   .015      3.0       .0  2764.11      .00  45.00      .00
0 ELEMENT NO    7 IS A REACH                                                                                                                
```

ELKMAIN3

U/S DATA STATION INVERT SECT W S ELEV
-950.00 2857.00 7 2859.50
NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

1

WATER SURFACE PROFILE LISTING
Rancho Road System Storm Drain - Elkhorn
7'x6' RCB STORM DRAIN SYSTEM ELKHORN UPSTREAM EX 6'x4' RCA DOWNSTREAM EX 7
ULTIMATE CONDITION, 100YR, STANTEC 06/29/17

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 -3959.33	2745.89	3.78	2749.67	689.9	26.05	10.54	2760.22	.00	6.00	6.00	7.00	.00	0	.00
0 294.14	.03067					.03229	9.50		3.81			.00		
0 -3665.19	2754.91	3.68	2758.59	689.9	26.75	11.12	2769.72	.00	6.00	6.00	7.00	.00	0	.00
0 .00	.03067					.03343	.00		3.81			.00		
0 -3665.19	2754.91	3.68	2758.59	689.9	26.75	11.12	2769.72	.00	6.00	6.00	7.00	.00	0	.00
0 47.07	.03081					.03376	1.59		3.80			.00		
0 -3618.12	2756.36	3.66	2760.02	689.9	26.95	11.29	2771.30	.00	6.00	6.00	7.00	.00	0	.00
0 14.58	.03017					.03424	.50		3.83			.00		
0 -3603.54	2756.80	3.65	2760.45	689.9	27.04	11.36	2771.80	.00	6.00	6.00	7.00	.00	0	.00
0 47.12	.03077					.03484	1.64		3.80			.00		
0 -3556.42	2758.25	3.61	2761.86	689.9	27.30	11.59	2773.45	.00	6.00	6.00	7.00	.00	0	.00
0JUNCT STR	.03060					.03848	6.21					.00		
0 -3395.01	2763.19	3.38	2766.57	686.9	29.03	13.09	2779.67	.00	6.00	6.00	7.00	.00	0	.00
0 .20	.00000					.04169	.01		.00			.00		
0 -3394.81	2763.19	3.38	2766.57	686.9	29.04	13.10	2779.67	.00	6.00	6.00	7.00	.00	0	.00
0JUNCT STR	.03070					.04250	.61					.00		
0 -3380.48	2763.63	3.32	2766.95	683.9	29.41	13.44	2780.39	.00	6.00	6.00	7.00	.00	0	.00
0 .00	.00000					.04328	.00		.00			.00		
0 -3380.48	2763.63	3.32	2766.95	683.9	29.41	13.44	2780.39	.00	6.00	6.00	7.00	.00	0	.00
0 .00	.00000					.04328	.00		.00			.00		
0 -3380.48	2763.63	3.32	2766.95	683.9	29.41	13.44	2780.39	.00	6.00	6.00	7.00	.00	0	.00
0 182.61	.04485					.04200	7.67		3.28			.00		

1

WATER SURFACE PROFILE LISTING
Rancho Road System Storm Drain - Elkhorn
7'x6' RCB STORM DRAIN SYSTEM ELKHORN UPSTREAM EX 6'x4' RCA DOWNSTREAM EX 7
ULTIMATE CONDITION, 100YR, STANTEC 06/29/17

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 -3197.87	2771.82	3.40	2775.22	683.9	28.75	12.84	2788.06	.00	6.00	6.00	7.00	.00	0	.00
0 125.40	.04441					.03910	4.90		3.29			.00		
0 -3072.47	2777.39	3.51	2780.90	683.9	27.87	12.07	2792.97	.00	6.00	6.00	7.00	.00	0	.00
0 101.10	.04441					.03525	3.56		3.29			.00		
0 -2971.37	2781.88	3.68	2785.56	683.9	26.57	10.97	2796.53	.00	6.00	6.00	7.00	.00	0	.00
0JUNCT STR	.00000					.03352	.00					.00		
0 -2971.37	2781.88	3.62	2785.50	678.9	26.82	11.18	2796.68	.00	6.00	6.00	7.00	.00	0	.00
0JUNCT STR	.04446					.03345	1.35					.00		
0 -2930.88	2783.68	3.64	2787.32	673.9	26.43	10.86	2798.18	.00	6.00	6.00	7.00	.00	0	.00
0 .73	.04114					.03287	.02		3.35			.00		
0 -2930.15	2783.71	3.64	2787.35	673.9	26.42	10.85	2798.20	.00	6.00	6.00	7.00	.00	0	.00
0 .00	.04114					.03285	.00		3.35			.00		
0 -2930.15	2783.71	3.64	2787.35	673.9	26.42	10.85	2798.20	.00	6.00	6.00	7.00	.00	0	.00
0 249.81	.03263					.03320	8.29		3.65			.00		
0 -2680.34	2791.86	3.61	2795.47	673.9	26.64	11.02	2806.50	.00	6.00	6.00	7.00	.00	0	.00
0 50.73	.03272					.03368	1.71		3.65			.00		
0 -2629.61	2793.52	3.60	2797.12	673.9	26.71	11.08	2808.21	.00	6.00	6.00	7.00	.00	0	.00
0 48.01	.03249					.03397	1.63		3.66			.00		
0 -2581.60	2795.08	3.59	2798.67	673.9	26.81	11.17	2809.84	.00	6.00	6.00	7.00	.00	0	.00
0JUNCT STR	.03517					.03103	14.19					.00		
0 -2124.17	2811.17	3.81	2814.98	659.6	24.71	9.49	2824.47	.00	6.00	6.00	7.00	.00	0	.00
0JUNCT STR	.03640					.02927	.13					.00		

1

WATER SURFACE PROFILE LISTING
Rancho Road System Storm Drain - Elkhorn
7'x6' RCB STORM DRAIN SYSTEM ELKHORN UPSTREAM EX 6'x4' RCA DOWNSTREAM EX 7
ULTIMATE CONDITION, 100YR, STANTEC 06/29/17

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 -2119.77	2811.33	3.62	2814.95	645.3	25.47	10.08	2825.03	.00	6.00	6.00	7.00	.00	0	.00
0JUNCT STR	.03434					.03220	.23					.00		
0 -2112.49	2811.58	3.43	2815.01	631.0	26.26	10.71	2825.73	.00	6.00	6.00	7.00	.00	0	.00
0 .13	.07707					.03373	.00		2.54			.00		
0 -2112.36	2811.59	3.43	2815.02	631.0	26.25	10.71	2825.73	.00	6.00	6.00	7.00	.00	0	.00
0 .00	.07707					.03372	.00		2.54			.00		
0 -2112.36	2811.59	3.43	2815.02	631.0	26.25	10.71	2825.73	.00	6.00	6.00	7.00	.00	0	.00
0 134.74	.03370					.03372	4.54		3.43			.00		
0 -1977.62	2816.13	3.43	2819.57	631.0	26.25	10.71	2830.27	.00	6.00	6.00	7.00	.00	0	.00
0 367.86	.03370					.03390	12.47		3.43			.00		
0 -1609.76	2828.53	3.42	2831.95	631.0	26.36	10.80	2842.75	.00	6.00	6.00	7.00	.00	0	.00
0 .00	.03370					.03409	.00		3.43			.00		
0 -1609.76	2828.53	3.42	2831.95	631.0	26.36	10.80	2842.75	.00	6.00	6.00	7.00	.00	0	.00
0 24.19	.03513					.03403	.82		3.38			.00		
0 -1585.57	2829.38	3.42	2832.80	631.0	26.32	10.77	2843.57	.00	6.00	6.00	7.00	.00	0	.00
0 .00	.03513					.03396	.00		3.38			.00		
0 -1585.57	2829.38	3.42	2832.80	631.0	26.32	10.77	2843.57	.00	6.00	6.00	7.00	.00	0	.00
0 64.26	.03501					.03377	2.17		3.39			.00		
0 -1521.31	2831.63	3.44	2835.07	631.0	26.21	10.67	2845.74	.00	6.00	6.00	7.00	.00	0	.00
0 26.52	.03507					.03347	.89		3.38			.00		
0 -1494.79	2832.56	3.45	2836.01	631.0	26.15	10.63	2846.63	.00	6.00	6.00	7.00	.00	0	.00
0JUNCT STR	.03201					.04000	3.37					.00		

1

WATER SURFACE PROFILE LISTING
Rancho Road System Storm Drain - Elkhorn
7'x6' RCB STORM DRAIN SYSTEM ELKHORN UPSTREAM EX 6'x4' RCA DOWNSTREAM EX 7
ULTIMATE CONDITION, 100YR, STANTEC 06/29/17

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR

See HGL on sheet PJP-1

ELKMAIN3

0 -1410.45	2835.26	2.61	2837.87	510.0	27.96	12.14	2850.01	.00	5.49		6.00	7.00	.00	0	.00
0 .62	.03229					.04666	.03			2.98			.00		
0 -1409.83	2835.28	2.61	2837.89	510.0	27.97	12.16	2850.04	.00	5.49		6.00	7.00	.00	0	.00
0 48.61	.05205					.04579	2.23			2.51			.00		
0 -1361.22	2837.81	2.64	2840.45	510.0	27.57	11.81	2852.27	.00	5.49		6.00	7.00	.00	0	.00
0 .00	.05205					.04488	.00			2.51			.00		
0 -1361.22	2837.81	2.64	2840.45	510.0	27.57	11.81	2852.27	.00	5.49		6.00	7.00	.00	0	.00
0 63.56	.04929					.04387	2.79			2.55			.00		
0 -1297.66	2840.94	2.69	2843.63	510.0	27.11	11.43	2855.06	.00	5.49		6.00	7.00	.00	0	.00
0 100.21	.04929					.04023	4.03			2.55			.00		
0 -1197.44	2845.88	2.82	2848.70	510.0	25.85	10.39	2859.09	.00	5.49		6.00	7.00	.00	0	.00
0 57.71	.04929					.03531	2.04			2.55			.00		
0 -1139.74	2848.73	2.96	2851.68	510.0	24.65	9.44	2861.13	.00	5.49		6.00	7.00	.00	0	.00
0 39.07	.04929					.03101	1.21			2.55			.00		
0 -1100.66	2850.65	3.10	2853.75	510.0	23.50	8.58	2862.34	.00	5.49		6.00	7.00	.00	0	.00
0 28.55	.04929					.02726	.78			2.55			.00		
0 -1072.11	2852.06	3.25	2855.31	510.0	22.41	7.80	2863.11	.00	5.49		6.00	7.00	.00	0	.00
0TRANS STR	.00000					.02551	.00						.00		
0 -1072.11	2852.06	3.25	2855.31	510.0	22.41	7.80	2863.12	.00	5.00		5.00	7.00	.00	0	.00
0JUNCT STR	.11113					.03161	.08						.00		
0 -1069.50	2852.35	2.63	2854.98	464.0	25.22	9.89	2864.86	.00	5.00		5.00	7.00	.00	0	.00
0 7.25	.10894					.03613	.26			1.80			.00		
1														PAGE	5

WATER SURFACE PROFILE LISTING

Rancho Road System Storm Drain - Elkhorn
7'x6' RCB STORM DRAIN SYSTEM ELKHORN UPSTREAM EX 6'x4' RCA DOWNSTREAM EX 7
ULTIMATE CONDITION, 100YR, STANTEC 06/29/17

0 STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL ZR	NO PIER	AVBPR
0 L/ELEM	SO					SF AVE	HF								
**********															
0 -1062.25	2853.14	2.71	2855.85	464.0	24.43	9.27	2865.13	.00	5.00		5.00	7.00	.00	0	.00
0TRANS STR	.00000					.03341	.00						.00		
0 -1062.25	2853.14	3.28	2856.42	464.0	23.74	8.76	2865.18		3.93			7		0	.00
0 60.25	.03436					.03190	1.92			3.19					
0 -1002.00	2855.21	3.32	2858.53	464.0	23.49	8.57	2867.11		3.93			7		0	.00
0JUNCT STR	.03455					.04331	1.73								
0 -962.06	2856.59	2.13	2858.72	419.0	28.06	12.23	2870.96	.00	4.81		5.00	7.00	.00	0	.00
0TRANS STR	.00000					.05312	.00						.00		
0 -962.06	2856.59	2.53	2859.12	419.0	27.65	11.88	2871.00		3.92			7		0	.00
0 12.06	.03399					.05186	.63			2.95					
0 -950.00	2857.00	2.50	2859.50	419.0	27.93	12.13	2871.63		3.92			7		0	.00
1															

APPENDIX D.15
LATERAL WSPG
HYDRAULIC ANALYSES

MWH now part of Stantec

THIS PAGE WAS INTENTIONALLY LEFT BLANK

STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
Portions Copyrighted by CIVILSOFT, 1986, 1987, 1989

Version 1.20
Serial Number 07010220

Jul 5, 2017 10:17:57

Input file : elkdi1.txt
Output file: elkdi1.out

INPUT FILE LISTING

```
T1 RESD
T2 RANCHO ELKORN STORM DRAIN - NORTHEAST ELKHORN& HUALAPAI DI#1
T3 ULTIMATE CONDITION 100-YEAR PEAK FLOWS
SO   1003.792857.44  1      .013              2858.72
R    1027.972859.82  1      .013
SH   1027.972859.82  1      .013
1                                                SP
                                  WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING                                  PAGE    1
0 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
  CODE   NO   TYPE  PIERS   WIDTH    DIAMETER  WIDTH             DROP

 CD      1    4                      2.50
 ERROR MESSAGE NUMBER  7 IN SEQUENCE CHECKING THRU CHANNEL DEFINITION DATA
 INVALID CARD CODE ENCOUNTERED WHILE PROCESSING CD AND PTS CARDS - CODE =
1                                                                                                          PAGE NO   1
0                         WATER SURFACE PROFILE - TITLE CARD LISTING
0HEADING LINE NO 1 IS -
0                           RESD
0HEADING LINE NO 2 IS -
0                           RANCHO ELKORN STORM DRAIN - NORTHEAST ELKHORN& HUALAPAI DI#1
0HEADING LINE NO 3 IS -
0                           ULTIMATE CONDITION 100-YEAR PEAK FLOWS
1                                                                                                          PAGE NO   2
0                         WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO   1 IS A SYSTEM OUTLET      *       *                                          W S ELEV
                  U/S DATA   STATION    INVERT  SECT                                      2858.72
0 ELEMENT NO   2 IS A REACH             *       *
                  U/S DATA   STATION    INVERT  SECT          N                  RADIUS  ANGLE  ANG PT  MAN H
                               1027.97 2859.82    1         .013                    .00    .00     .00      0
0 ELEMENT NO   3 IS A SYSTEM HEADWORKS                *               *
                  U/S DATA   STATION    INVERT  SECT                                      W S ELEV
                               1027.97 2859.82    1                                          .00
 NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

 ** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC
1                                                                                                          PAGE    1
                                        WATER SURFACE PROFILE LISTING
                          RESD
                          RANCHO ELKORN STORM DRAIN - NORTHEAST ELKHORN& HUALAPAI DI#1
                          ULTIMATE CONDITION 100-YEAR PEAK FLOWS
0 STATION    INVERT   DEPTH     W.S.        Q       VEL      VEL      ENERGY   SUPER  CRITICAL          HGT/   BASE/    ZL    NO  AVBPR
           ELEV   OF FLOW    ELEV                        HEAD   GRD.EL.   ELEV   DEPTH          DIA    ID NO.          PIER
0 L/ELEM      SO                                      SF AVE      HF                NORM DEPTH                ZR
*****************************************************************************************************************************
0  1003.79  2857.44     1.37   2858.81     45.0    16.29     4.13   2862.94    .00    2.23          2.50     .00    .00   0    .00
0  1003.79  2857.44     1.37   2858.81     45.0    16.29     4.13   2862.94    .00    2.23          2.50     .00    .00   0    .00
0     3.85   .09843                                       .03361      .13                1.02                      .00
0  1007.64  2857.82     1.41   2859.23     45.0    15.70     3.83   2863.07    .00    2.23          2.50     .00    .00   0    .00
0     4.27   .09843                                       .03013      .13                1.02                      .00
0  1011.90  2858.24     1.47   2859.71     45.0    14.97     3.48   2863.19    .00    2.23          2.50     .00    .00   0    .00
0     3.58   .09843                                       .02665      .10                1.02                      .00
0  1015.48  2858.59     1.53   2860.12     45.0    14.28     3.17   2863.29    .00    2.23          2.50     .00    .00   0    .00
0     2.99   .09843                                       .02361      .07                1.02                      .00
0  1018.47  2858.89     1.60   2860.48     45.0    13.61     2.88   2863.36    .00    2.23          2.50     .00    .00   0    .00
0     2.51   .09843                                       .02095      .05                1.02                      .00
0  1020.99  2859.13     1.66   2860.79     45.0    12.98     2.62   2863.41    .00    2.23          2.50     .00    .00   0    .00
0     2.07   .09843                                       .01863      .04                1.02                      .00
0  1023.05  2859.34     1.74   2861.07     45.0    12.37     2.38   2863.45    .00    2.23          2.50     .00    .00   0    .00
0     1.69   .09843                                       .01661      .03                1.02                      .00
0  1024.74  2859.50     1.81   2861.32     45.0    11.80     2.16   2863.48    .00    2.23          2.50     .00    .00   0    .00
0     1.34   .09843                                       .01487      .02                1.02                      .00
0  1026.08  2859.63     1.90   2861.53     45.0    11.25     1.97   2863.50    .00    2.23          2.50     .00    .00   0    .00
0     1.00   .09843                                       .01337      .01                1.02                      .00
0  1027.08  2859.73     1.99   2861.72     45.0    10.73     1.79   2863.51    .00    2.23          2.50     .00    .00   0    .00
0      .64   .09843                                       .01212      .01                1.02                      .00
1                                                                                                          PAGE    2
                                        WATER SURFACE PROFILE LISTING
                          RESD
                          RANCHO ELKORN STORM DRAIN - NORTHEAST ELKHORN& HUALAPAI DI#1
                          ULTIMATE CONDITION 100-YEAR PEAK FLOWS
0 STATION    INVERT   DEPTH     W.S.        Q       VEL      VEL      ENERGY   SUPER  CRITICAL          HGT/   BASE/    ZL    NO  AVBPR
           ELEV   OF FLOW    ELEV                        HEAD   GRD.EL.   ELEV   DEPTH          DIA    ID NO.          PIER
0 L/ELEM      SO                                      SF AVE      HF                NORM DEPTH                ZR
*****************************************************************************************************************************
0  1027.72  2859.80     2.10   2861.89     45.0    10.23     1.63   2863.52    .00    2.23          2.50     .00    .00   0    .00
0      .25   .09843                                       .01113      .00                1.02                      .00
0  1027.97  2859.82     2.23   2862.05     45.0     9.75     1.48   2863.52    .00    2.23          2.50     .00    .00   0    .00
1
```

STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
Portions Copyrighted by CIVILSOFT, 1986, 1987, 1989

Version 1.20
Serial Number 07010220

Jul 5, 2017 10:14:47

Input file : elkdi2.txt
Output file: elkdi2.out

INPUT FILE LISTING

```
T1 RESD
T2 RANCHO ELKORN STORM DRAIN - SOUTHEAST ELKHORN & HUALAPAI DI#2
T3 ULTIMATE CONDITION 100-YEAR PEAK FLOWS
SO  -1055.812855.40  1      .013                2854.98
R    -992.752857.77  1      .013
SH   -992.752857.77  1      .013
1                                                SP
                                  WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING                                  PAGE    1
0 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR    INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
  CODE   NO   TYPE  PIERS   WIDTH    DIAMETER  WIDTH              DROP

  CD      1    4                    2.50
 ERROR MESSAGE NUMBER  7 IN SEQUENCE CHECKING THRU CHANNEL DEFINITION DATA
 INVALID CARD CODE ENCOUNTERED WHILE PROCESSING CD AND PTS CARDS - CODE =
1                                                                                                                    PAGE NO   1
0                          WATER SURFACE PROFILE - TITLE CARD LISTING
0HEADING LINE NO 1 IS -
0                            RESD
0HEADING LINE NO 2 IS -
0                            RANCHO ELKORN STORM DRAIN - SOUTHEAST ELKHORN & HUALAPAI DI#2
0HEADING LINE NO 3 IS -
0                            ULTIMATE CONDITION 100-YEAR PEAK FLOWS
1                                                                                                                    PAGE NO   2
0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO   1 IS A SYSTEM OUTLET      *          *      *
                    U/S DATA    STATION     INVERT  SECT                                          W S ELEV
                                -1055.81 2855.40    1                                            2854.98
0 ELEMENT NO   2 IS A REACH                 *          *      *
                    U/S DATA    STATION     INVERT  SECT              N                                    RADIUS  ANGLE  ANG PT  MAN H
                                 -992.75 2857.77    1              .013                                      .00    .00     .00      0
0 ELEMENT NO   3 IS A SYSTEM HEADWORKS                    *                  *
                    U/S DATA    STATION     INVERT  SECT                                          W S ELEV
                                -992.75 2857.77    1                                                 .00
 NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

 ** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC
 ERROR MESSAGE NO. 2 - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN OTLTUS, W.S.ELEV = INV + DC
1                                                                                                                    PAGE    1
                                        WATER SURFACE PROFILE LISTING
                          RESD
                          RANCHO ELKORN STORM DRAIN - SOUTHEAST ELKHORN & HUALAPAI DI#2
                          ULTIMATE CONDITION 100-YEAR PEAK FLOWS
0 STATION    INVERT   DEPTH     W.S.        Q      VEL     VEL      ENERGY   SUPER  CRITICAL          HGT/   BASE/    ZL    NO  AVBPR
               ELEV  OF FLOW    ELEV                     HEAD    GRD.EL.   ELEV   DEPTH              DIA    ID NO.         PIER
0 L/ELEM       SO                                     SF AVE      HF                NORM DEPTH                      ZR
**********************************************************************************************************************************
0 -1055.81  2855.40     1.53   2856.93      46.0    14.64    3.33   2860.26   .00    2.24             2.50     .00   .00    0   .00
0 -1055.81  2855.40     1.53   2856.93      46.0    14.64    3.33   2860.26   .00    2.24             2.50     .00   .00    0   .00
0     3.92   .03759                                        .02609      .10                1.36                          .00
0 -1051.89  2855.55     1.54   2857.09      46.0    14.52    3.27   2860.36   .00    2.24             2.50     .00   .00    0   .00
0    17.65   .03759                                        .02434      .43                1.36                          .00
0 -1034.25  2856.21     1.60   2857.81      46.0    13.84    2.98   2860.79   .00    2.24             2.50     .00   .00    0   .00
0    12.68   .03759                                        .02160      .27                1.36                          .00
0 -1021.57  2856.69     1.67   2858.36      46.0    13.20    2.71   2861.06   .00    2.24             2.50     .00   .00    0   .00
0     9.42   .03759                                        .01921      .18                1.36                          .00
0 -1012.15  2857.04     1.74   2858.78      46.0    12.58    2.46   2861.24   .00    2.24             2.50     .00   .00    0   .00
0     7.08   .03759                                        .01714      .12                1.36                          .00
0 -1005.08  2857.31     1.82   2859.13      46.0    12.00    2.24   2861.37   .00    2.24             2.50     .00   .00    0   .00
0     5.28   .03759                                        .01535      .08                1.36                          .00
0  -999.80  2857.51     1.91   2859.41      46.0    11.44    2.03   2861.45   .00    2.24             2.50     .00   .00    0   .00
0     3.74   .03759                                        .01381      .05                1.36                          .00
0  -996.06  2857.65     2.00   2859.65      46.0    10.91    1.85   2861.50   .00    2.24             2.50     .00   .00    0   .00
0     2.40   .03759                                        .01253      .03                1.36                          .00
0  -993.67  2857.74     2.11   2859.85      46.0    10.40    1.68   2861.53   .00    2.24             2.50     .00   .00    0   .00
0      .92   .03759                                        .01153      .01                1.36                          .00
0  -992.75  2857.77     2.24   2860.01      46.0     9.91    1.53   2861.54   .00    2.24             2.50     .00   .00    0   .00
1
```

STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
Portions Copyrighted by CIVILSOFT, 1986, 1987, 1989

Version 1.20
Serial Number 07010220

Jul 5, 2017 10:25:11

Input file : elkdi3.txt
Output file: elkdi3.out

INPUT FILE LISTING

```
T1 RESD
T2 RANCHO ELKORN STORM DRAIN - SOUTHEAST CORNER ELKHORN & HUALAPAI DI#3
T3 ULTIMATE CONDITION 100-YEAR PEAK FLOWS
SO  -1162.742842.33  1      .013                0000.00
R   -1142.952842.94  1      .013
R   -1137.122843.07  1      .013
R   -1001.332845.18  1      .013
SH  -1001.332845.18  1      .013
1                                                    SP
                                  WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING                                  PAGE    1
0 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
  CODE   NO   TYPE  PIERS   WIDTH    DIAMETER  WIDTH              DROP

 CD      1    4                      2.50
 ERROR MESSAGE NUMBER  7 IN SEQUENCE CHECKING THRU CHANNEL DEFINITION DATA
 INVALID CARD CODE ENCOUNTERED WHILE PROCESSING CD AND PTS CARDS - CODE =
1                                                                                                                    PAGE NO   1
0                              WATER SURFACE PROFILE - TITLE CARD LISTING
0HEADING LINE NO 1 IS -
0                                RESD
0HEADING LINE NO 2 IS -
0                                RANCHO ELKORN STORM DRAIN - SOUTHEAST CORNER ELKHORN & HUALAPAI DI#3
0HEADING LINE NO 3 IS -
0                                ULTIMATE CONDITION 100-YEAR PEAK FLOWS
1
0                              WATER SURFACE PROFILE - ELEMENT CARD LISTING                                          PAGE NO   2
0 ELEMENT NO   1 IS A SYSTEM OUTLET          *          *          *
                     U/S DATA   STATION     INVERT  SECT                                          W S ELEV
                                -1162.74 2842.33    1                                               .00
0 ELEMENT NO   2 IS A REACH                  *          *          *
                     U/S DATA   STATION     INVERT  SECT            N                                    RADIUS  ANGLE  ANG PT  MAN H
                                -1142.95 2842.94    1             .013                                    .00     .00     .00      0
0 ELEMENT NO   3 IS A REACH                  *          *          *
                     U/S DATA   STATION     INVERT  SECT            N                                    RADIUS  ANGLE  ANG PT  MAN H
                                -1137.12 2843.07    1             .013                                    .00     .00     .00      0
0 ELEMENT NO   4 IS A REACH                  *          *          *
                     U/S DATA   STATION     INVERT  SECT            N                                    RADIUS  ANGLE  ANG PT  MAN H
                                -1001.33 2845.18    1             .013                                    .00     .00     .00      0
0 ELEMENT NO   5 IS A SYSTEM HEADWORKS                  *                    *
                     U/S DATA   STATION     INVERT  SECT                                          W S ELEV
                                -1001.33 2845.18    1                                               .00
 NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

 ** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC
1                                                                                                                    PAGE    1
                                          WATER SURFACE PROFILE LISTING
                                RESD
                                RANCHO ELKORN STORM DRAIN - SOUTHEAST CORNER ELKHORN & HUALAPAI DI#3
                                ULTIMATE CONDITION 100-YEAR PEAK FLOWS
0 STATION    INVERT   DEPTH     W.S.        Q       VEL      VEL      ENERGY   SUPER  CRITICAL          HGT/   BASE/    ZL    NO  AVBPR
  L/ELEM      ELEV    OF FLOW    ELEV                        HEAD     GRD.EL.  ELEV   DEPTH             DIA    ID NO.         PIER
0             SO                                          SF AVE      HF                 NORM DEPTH                        ZR
*****************************************************************************************************************************************
0 -1162.74  2842.33     1.57    2843.90      41.0    12.61     2.47    2846.37   .00     2.15                2.50     .00    .00    0    .00
0    10.08   .03082                                        .01836     .19                    1.35                                .00
0 -1152.66  2842.64     1.62    2844.26      41.0    12.15     2.30    2846.56   .00     2.15                2.50     .00    .00    0    .00
0     9.71   .03082                                        .01654     .16                    1.35                                .00
0 -1142.95  2842.94     1.69    2844.63      41.0    11.59     2.09    2846.72   .00     2.15                2.50     .00    .00    0    .00
0     5.83   .02232                                        .01528     .09                    1.49                                .00
0 -1137.12  2843.07     1.72    2844.79      41.0    11.40     2.02    2846.81   .00     2.15                2.50     .00    .00    0    .00
0      .00   .02232                                        .01498     .00                    1.49                                .00
0 -1137.12  2843.07     1.72    2844.79      41.0    11.40     2.02    2846.81   .00     2.15                2.50     .00    .00    0    .00
0    67.45   .01554                                        .01443     .97                    1.69                                .00
0 -1069.67  2844.12     1.77    2845.89      41.0    11.05     1.90    2847.78   .00     2.15                2.50     .00    .00    0    .00
0    38.42   .01554                                        .01316     .51                    1.69                                .00
0 -1031.25  2844.72     1.85    2846.56      41.0    10.54     1.73    2848.29   .00     2.15                2.50     .00    .00    0    .00
0    18.13   .01554                                        .01180     .21                    1.69                                .00
0 -1013.11  2845.00     1.94    2846.93      41.0    10.05     1.57    2848.50   .00     2.15                2.50     .00    .00    0    .00
0     9.10   .01554                                        .01064     .10                    1.69                                .00
0 -1004.02  2845.14     2.04    2847.17      41.0     9.58     1.43    2848.60   .00     2.15                2.50     .00    .00    0    .00
0     2.69   .01554                                        .00968     .03                    1.69                                .00
0 -1001.33  2845.18     2.15    2847.33      41.0     9.13     1.30    2848.63   .00     2.15                2.50     .00    .00    0    .00
1
```

STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
Portions Copyrighted by CIVILSOFT, 1986, 1987, 1989

Version 1.20
Serial Number 07010220

Jul 5, 2017 10:21:23

Input file : elkdi4.txt
Output file: elkdi4.out

INPUT FILE LISTING

```
T1 RESD
T2 RANCHO ELKORN STORM DRAIN - SOUTHEAST ELKHORN & HUALAPAI DI#4
T3 ULTIMATE CONDITION 100-YEAR PEAK FLOWS
SO  -1017.302839.96  1      .013                0000.00
R   -1001.832840.66  1      .013
SH  -1001.832840.66  1      .013
1                                                SP                                                                                  PAGE    1
                                  WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING
0 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL     ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
  CODE   NO   TYPE  PIERS   WIDTH    DIAMETER  WIDTH              DROP

  CD      1    4                      2.50
 ERROR MESSAGE NUMBER  7 IN SEQUENCE CHECKING THRU CHANNEL DEFINITION DATA
 INVALID CARD CODE ENCOUNTERED WHILE PROCESSING CD AND PTS CARDS - CODE =
                                                                                                                                    PAGE NO   1
1
0                          WATER SURFACE PROFILE - TITLE CARD LISTING
0HEADING LINE NO 1 IS -
0                            RESD
0HEADING LINE NO 2 IS -
0                            RANCHO ELKORN STORM DRAIN - SOUTHEAST ELKHORN & HUALAPAI DI#4
0HEADING LINE NO 3 IS -
0                            ULTIMATE CONDITION 100-YEAR PEAK FLOWS
                                                                                                                                    PAGE NO   2
1
0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO   1 IS A SYSTEM OUTLET                *      *      *
                    U/S DATA   STATION    INVERT  SECT                                                          W S ELEV
                                -1017.30 2839.96    1                                                             .00
0 ELEMENT NO   2 IS A REACH                        *      *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                -1001.83 2840.66    1             .013                                 .00     .00     .00      0
0 ELEMENT NO   3 IS A SYSTEM HEADWORKS                      *                *
                    U/S DATA   STATION    INVERT  SECT                                                          W S ELEV
                                -1001.83 2840.66    1                                                             .00
 NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

 ** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC
                                                                                                                                    PAGE    1
1                                          WATER SURFACE PROFILE LISTING
                                RESD
                                RANCHO ELKORN STORM DRAIN - SOUTHEAST ELKHORN & HUALAPAI DI#4
                                ULTIMATE CONDITION 100-YEAR PEAK FLOWS
0 STATION    INVERT   DEPTH     W.S.        Q       VEL      VEL       ENERGY   SUPER  CRITICAL          HGT/   BASE/    ZL    NO  AVBPR
               ELEV  OF FLOW    ELEV                        HEAD    GRD.EL.    ELEV   DEPTH             DIA    ID NO.         PIER
0 L/ELEM       SO                                         SF AVE      HF                NORM DEPTH                    ZR
*********************************************************************************************************************************
0 -1017.30  2839.96     2.01   2841.97      61.0    14.42     3.23   2845.20    .00    2.40                2.50     .00    .00    0    .00
0 -1017.30  2839.96     2.01   2841.97      61.0    14.42     3.23   2845.20    .00    2.40                2.50     .00    .00    0    .00
0      6.74   .04525                                        .02207      .15                 1.54                          .00
0 -1010.56  2840.27     2.10   2842.36      61.0    13.86     2.99   2845.35    .00    2.40                2.50     .00    .00    0    .00
0      5.86   .04525                                        .02044      .12                 1.54                          .00
0 -1004.69  2840.53     2.23   2842.76      61.0    13.22     2.71   2845.47    .00    2.40                2.50     .00    .00    0    .00
0      2.86   .04525                                        .01946      .06                 1.54                          .00
0 -1001.83  2840.66     2.40   2843.06      61.0    12.60     2.47   2845.53    .00    2.40                2.50     .00    .00    0    .00
1
```

STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
Portions Copyrighted by CIVILSOFT, 1986, 1987, 1989

Version 1.20
Serial Number 07010220

Jul 5, 2017 9:34:58

Input file : elkdi5.txt
Output file: elkdi5.out

INPUT FILE LISTING

```
T1 RESD
T2 RANCHO ELKORN STORM DRAIN - NORTH HALF ELKHORN & CONQUISTADOR DI#5
T3 ULTIMATE CONDITION 100-YEAR PEAK FLOWS
SO   1005.552784.34  1      .013              2785.50
R    1053.082788.82  1      .013
SH   1053.082788.82  1      .013
1                                                SP
                                  WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING                                  PAGE    1
0 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
  CODE   NO   TYPE  PIERS   WIDTH    DIAMETER  WIDTH              DROP

  CD      1    4                      1.50
 ERROR MESSAGE NUMBER  7 IN SEQUENCE CHECKING THRU CHANNEL DEFINITION DATA
 INVALID CARD CODE ENCOUNTERED WHILE PROCESSING CD AND PTS CARDS - CODE =
1                                                                                                          PAGE NO   1
0                            WATER SURFACE PROFILE - TITLE CARD LISTING
OHEADING LINE NO 1 IS -
0                              RESD
OHEADING LINE NO 2 IS -
0                              RANCHO ELKORN STORM DRAIN - NORTH HALF ELKHORN & CONQUISTADOR DI#5
OHEADING LINE NO 3 IS -
0                              ULTIMATE CONDITION 100-YEAR PEAK FLOWS
1                                                                                                          PAGE NO   2
0                            WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO   1 IS A SYSTEM OUTLET      *       *       *
                    U/S DATA   STATION    INVERT  SECT                                        W S ELEV
                                 1005.55 2784.34    1                                         2785.50
0 ELEMENT NO   2 IS A REACH              *       *       *
                    U/S DATA   STATION    INVERT  SECT            N                                    RADIUS  ANGLE  ANG PT  MAN H
                                 1053.08 2788.82    1          .013                                      .00    .00     .00      0
0 ELEMENT NO   3 IS A SYSTEM HEADWORKS                  *               *
                    U/S DATA   STATION    INVERT  SECT                                        W S ELEV
                                 1053.08 2788.82    1                                            .00
 NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

 ** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC
1                                                                                                          PAGE    1
                                        WATER SURFACE PROFILE LISTING
                          RESD
                          RANCHO ELKORN STORM DRAIN - NORTH HALF ELKHORN & CONQUISTADOR DI#5
                          ULTIMATE CONDITION 100-YEAR PEAK FLOWS
0 STATION    INVERT   DEPTH     W.S.        Q       VEL      VEL      ENERGY   SUPER  CRITICAL          HGT/   BASE/    ZL    NO  AVBPR
           ELEV    OF FLOW     ELEV                        HEAD   GRD.EL.    ELEV    DEPTH          DIA    ID NO.          PIER
0 L/ELEM      SO                                          SF AVE      HF                NORM DEPTH                      ZR
*****************************************************************************************************************************************
0  1005.55  2784.34      .41   2784.75       5.0   12.78     2.54  2787.29     .00      .86            1.50      .00   .00   0    .00
0  1005.55  2784.34      .41   2784.75       5.0   12.78     2.54  2787.29     .00      .86            1.50      .00   .00   0    .00
0    10.70   .09426                                       .08156     .87                    .40                             .00
0  1016.25  2785.35      .42   2785.77       5.0   12.39     2.39  2788.15     .00      .86            1.50      .00   .00   0    .00
0     9.58   .09426                                       .07318     .70                    .40                             .00
0  1025.83  2786.25      .43   2786.68       5.0   11.82     2.17  2788.85     .00      .86            1.50      .00   .00   0    .00
0     6.04   .09426                                       .06407     .39                    .40                             .00
0  1031.87  2786.82      .45   2787.27       5.0   11.27     1.97  2789.24     .00      .86            1.50      .00   .00   0    .00
0     4.28   .09426                                       .05610     .24                    .40                             .00
0  1036.15  2787.22      .46   2787.69       5.0   10.74     1.79  2789.48     .00      .86            1.50      .00   .00   0    .00
0     3.26   .09426                                       .04913     .16                    .40                             .00
0  1039.41  2787.53      .48   2788.01       5.0   10.24     1.63  2789.64     .00      .86            1.50      .00   .00   0    .00
0     2.56   .09426                                       .04302     .11                    .40                             .00
0  1041.97  2787.77      .50   2788.27       5.0    9.77     1.48  2789.75     .00      .86            1.50      .00   .00   0    .00
0     2.06   .09426                                       .03770     .08                    .40                             .00
0  1044.03  2787.97      .52   2788.48       5.0    9.31     1.35  2789.83     .00      .86            1.50      .00   .00   0    .00
0     1.71   .09426                                       .03304     .06                    .40                             .00
0  1045.74  2788.13      .53   2788.66       5.0    8.88     1.22  2789.89     .00      .86            1.50      .00   .00   0    .00
0     1.41   .09426                                       .02896     .04                    .40                             .00
0  1047.15  2788.26      .55   2788.81       5.0    8.46     1.11  2789.93     .00      .86            1.50      .00   .00   0    .00
0     1.18   .09426                                       .02539     .03                    .40                             .00
1                                                                                                          PAGE    2
                                        WATER SURFACE PROFILE LISTING
                          RESD
                          RANCHO ELKORN STORM DRAIN - NORTH HALF ELKHORN & CONQUISTADOR DI#5
                          ULTIMATE CONDITION 100-YEAR PEAK FLOWS
0 STATION    INVERT   DEPTH     W.S.        Q       VEL      VEL      ENERGY   SUPER  CRITICAL          HGT/   BASE/    ZL    NO  AVBPR
           ELEV    OF FLOW     ELEV                        HEAD   GRD.EL.    ELEV    DEPTH          DIA    ID NO.          PIER
0 L/ELEM      SO                                          SF AVE      HF                NORM DEPTH                      ZR
*****************************************************************************************************************************************
0  1048.33  2788.37      .57   2788.94       5.0    8.07     1.01  2789.96     .00      .86            1.50      .00   .00   0    .00
0     1.00   .09426                                       .02227     .02                    .40                             .00
0  1049.33  2788.47      .59   2789.06       5.0    7.69      .92  2789.98     .00      .86            1.50      .00   .00   0    .00
0      .83   .09426                                       .01954     .02                    .40                             .00
0  1050.16  2788.54      .61   2789.16       5.0    7.34      .84  2790.00     .00      .86            1.50      .00   .00   0    .00
0      .69   .09426                                       .01716     .01                    .40                             .00
0  1050.85  2788.61      .64   2789.25       5.0    7.00      .76  2790.01     .00      .86            1.50      .00   .00   0    .00
0      .58   .09426                                       .01508     .01                    .40                             .00
0  1051.43  2788.66      .66   2789.32       5.0    6.67      .69  2790.02     .00      .86            1.50      .00   .00   0    .00
0      .47   .09426                                       .01325     .01                    .40                             .00
0  1051.90  2788.71      .69   2789.39       5.0    6.36      .63  2790.02     .00      .86            1.50      .00   .00   0    .00
0      .39   .09426                                       .01165     .00                    .40                             .00
0  1052.29  2788.75      .71   2789.46       5.0    6.06      .57  2790.03     .00      .86            1.50      .00   .00   0    .00
```

ELKDI5

0		.30	.09426					.01024	.00			.40			.00	
0	1052.58	2788.77	.74	2789.51	5.0	5.78	.52	2790.03	.00	.86		1.50	.00	.00	0	.00
0		.23	.09426					.00902	.00			.40			.00	
0	1052.81	2788.79	.77	2789.56	5.0	5.51	.47	2790.03	.00	.86		1.50	.00	.00	0	.00
0		.15	.09426					.00795	.00			.40			.00	
0	1052.96	2788.81	.80	2789.60	5.0	5.26	.43	2790.03	.00	.86		1.50	.00	.00	0	.00
0		.09	.09426					.00701	.00			.40			.00	
0	1053.05	2788.82	.83	2789.64	5.0	5.01	.39	2790.03	.00	.86		1.50	.00	.00	0	.00
0		.03	.09426					.00618	.00			.40			.00	
1															PAGE	3

WATER SURFACE PROFILE LISTING

RESD
RANCHO ELKORN STORM DRAIN - NORTH HALF ELKHORN & CONQUISTADOR DI#5
ULTIMATE CONDITION 100-YEAR PEAK FLOWS

0 STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0 L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
0 1053.08	2788.82	.86	2789.68	5.0	4.77	.35	2790.03	.00	.86		1.50	.00	.00	0	.00
1															

STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
Portions Copyrighted by CIVILSOFT, 1986, 1987, 1989

Version 1.20
Serial Number 07010220

Jul 5, 2017 9:37:12

Input file : elkdi6.txt
Output file: elkdi6.out

INPUT FILE LISTING

```
T1 RESD
T2 RANCHO ELKORN STORM DRAIN - SOUTH HALF ELKHORN & CONQUISTADOR DI#6
T3 ULTIMATE CONDITION 100-YEAR PEAK FLOWS
SO  -1067.732785.10  1      .013                2787.32
R   -1000.202789.56  1      .013
SH  -1000.202789.56  1      .013
1                                                SP
                                  WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING                                  PAGE    1
0 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
  CODE   NO   TYPE  PIERS   WIDTH    DIAMETER  WIDTH             DROP

  CD      1    4                      1.50
 ERROR MESSAGE NUMBER  7 IN SEQUENCE CHECKING THRU CHANNEL DEFINITION DATA
 INVALID CARD CODE ENCOUNTERED WHILE PROCESSING CD AND PTS CARDS - CODE =
1                                                                                                          PAGE NO   1
0                              WATER SURFACE PROFILE - TITLE CARD LISTING
0HEADING LINE NO 1 IS -
0                                RESD
0HEADING LINE NO 2 IS -
0                                RANCHO ELKORN STORM DRAIN - SOUTH HALF ELKHORN & CONQUISTADOR DI#6
0HEADING LINE NO 3 IS -
0                                ULTIMATE CONDITION 100-YEAR PEAK FLOWS
1                                                                                                          PAGE NO   2
0                              WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO   1 IS A SYSTEM OUTLET      *         *      *
                     U/S DATA   STATION    INVERT  SECT                                        W S ELEV
                                -1067.73 2785.10    1                                         2787.32
0 ELEMENT NO   2 IS A REACH                      *       *
                     U/S DATA   STATION    INVERT  SECT          N                                    RADIUS  ANGLE  ANG PT  MAN H
                                -1000.20 2789.56    1         .013                                     .00     .00     .00      0
0 ELEMENT NO   3 IS A SYSTEM HEADWORKS                  *                 *
                     U/S DATA   STATION    INVERT  SECT                                        W S ELEV
                                -1000.20 2789.56    1                                           .00
 NO EDIT ERRORS ENCOUNTERED--COMPUTATION IS NOW BEGINNING

 ** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC
1                                                                                                          PAGE    1
                                        WATER SURFACE PROFILE LISTING
                                RESD
                                RANCHO ELKORN STORM DRAIN - SOUTH HALF ELKHORN & CONQUISTADOR DI#6
                                ULTIMATE CONDITION 100-YEAR PEAK FLOWS
0 STATION    INVERT   DEPTH     W.S.       Q      VEL      VEL      ENERGY   SUPER  CRITICAL          HGT/   BASE/    ZL   NO  AVBPR
           ELEV   OF FLOW    ELEV                       HEAD    GRD.EL.   ELEV    DEPTH              DIA    ID NO.        PIER
0 L/ELEM     SO                                       SF AVE     HF                 NORM DEPTH                 ZR
*****************************************************************************************************************************
0 -1067.73  2785.10     2.22   2787.32     5.0     2.83      .12   2787.44    .00      .86              1.50     .00   .00   0    .00
0    10.57   .06604                                        .00227      .02                    .44                          .00
0 -1057.16  2785.80     1.54   2787.34     5.0     2.83      .12   2787.47    .00      .86              1.50     .00   .00   0    .00
0HYDRAULIC JUMP                                                                                                         .00
0 -1057.16  2785.80      .45   2786.24     5.0    11.38     2.01   2788.26    .00      .86              1.50     .00   .00   0    .00
0     6.92   .06604                                        .06067      .42                    .44                          .00
0 -1050.24  2786.26      .45   2786.70     5.0    11.27     1.97   2788.68    .00      .86              1.50     .00   .00   0    .00
0    16.43   .06604                                        .05610      .92                    .44                          .00
0 -1033.81  2787.34      .46   2787.80     5.0    10.74     1.79   2789.60    .00      .86              1.50     .00   .00   0    .00
0     8.69   .06604                                        .04913      .43                    .44                          .00
0 -1025.12  2787.91      .48   2788.39     5.0    10.24     1.63   2790.02    .00      .86              1.50     .00   .00   0    .00
0     5.70   .06604                                        .04302      .25                    .44                          .00
0 -1019.43  2788.29      .50   2788.79     5.0     9.77     1.48   2790.27    .00      .86              1.50     .00   .00   0    .00
0     4.12   .06604                                        .03770      .16                    .44                          .00
0 -1015.31  2788.56      .52   2789.08     5.0     9.31     1.35   2790.42    .00      .86              1.50     .00   .00   0    .00
0     3.17   .06604                                        .03304      .10                    .44                          .00
0 -1012.14  2788.77      .53   2789.30     5.0     8.88     1.22   2790.53    .00      .86              1.50     .00   .00   0    .00
0     2.49   .06604                                        .02896      .07                    .44                          .00
0 -1009.65  2788.94      .55   2789.49     5.0     8.46     1.11   2790.60    .00      .86              1.50     .00   .00   0    .00
0     2.00   .06604                                        .02539      .05                    .44                          .00
0 -1007.65  2789.07      .57   2789.64     5.0     8.07     1.01   2790.65    .00      .86              1.50     .00   .00   0    .00
0     1.65   .06604                                        .02227      .04                    .44                          .00
1                                                                                                          PAGE    2
                                        WATER SURFACE PROFILE LISTING
                                RESD
                                RANCHO ELKORN STORM DRAIN - SOUTH HALF ELKHORN & CONQUISTADOR DI#6
                                ULTIMATE CONDITION 100-YEAR PEAK FLOWS
0 STATION    INVERT   DEPTH     W.S.       Q      VEL      VEL      ENERGY   SUPER  CRITICAL          HGT/   BASE/    ZL   NO  AVBPR
           ELEV   OF FLOW    ELEV                       HEAD    GRD.EL.   ELEV    DEPTH              DIA    ID NO.        PIER
0 L/ELEM     SO                                       SF AVE     HF                 NORM DEPTH                 ZR
*****************************************************************************************************************************
0 -1006.01  2789.18      .59   2789.77     5.0     7.69      .92   2790.69    .00      .86              1.50     .00   .00   0    .00
0     1.33   .06604                                        .01954      .03                    .44                          .00
0 -1004.68  2789.26      .61   2789.88     5.0     7.34      .84   2790.71    .00      .86              1.50     .00   .00   0    .00
0     1.09   .06604                                        .01716      .02                    .44                          .00
0 -1003.60  2789.34      .64   2789.97     5.0     7.00      .76   2790.73    .00      .86              1.50     .00   .00   0    .00
0      .91   .06604                                        .01508      .01                    .44                          .00
0 -1002.69  2789.40      .66   2790.06     5.0     6.67      .69   2790.75    .00      .86              1.50     .00   .00   0    .00
0      .72   .06604                                        .01325      .01                    .44                          .00
0 -1001.98  2789.44      .69   2790.13     5.0     6.36      .63   2790.76    .00      .86              1.50     .00   .00   0    .00
0      .59   .06604                                        .01165      .01                    .44                          .00
0 -1001.39  2789.48      .71   2790.19     5.0     6.06      .57   2790.76    .00      .86              1.50     .00   .00   0    .00
0      .45   .06604                                        .01024      .00                    .44                          .00
```

ELKDI6

```
0 -1000.94  2789.51    .74   2790.25    5.0    5.78     .52  2790.77   .00   .86          1.50   .00   .00  0   .00
0      .34    .06604                                  .00902     .00          .44                  .00
0 -1000.60  2789.53    .77   2790.30    5.0    5.51     .47  2790.77   .00   .86          1.50   .00   .00  0   .00
0      .22    .06604                                  .00795     .00          .44                  .00
0 -1000.38  2789.55    .80   2790.34    5.0    5.26     .43  2790.77   .00   .86          1.50   .00   .00  0   .00
0      .14    .06604                                  .00701     .00          .44                  .00
0 -1000.24  2789.56    .83   2790.38    5.0    5.01     .39  2790.77   .00   .86          1.50   .00   .00  0   .00
0      .04    .06604                                  .00618     .00          .44                  .00
0 -1000.20  2789.56    .86   2790.42    5.0    4.77     .35  2790.77   .00   .86          1.50   .00   .00  0   .00
1
```

STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
Portions Copyrighted by CIVILSOFT, 1986, 1987, 1989

Version 1.20
Serial Number 07010220

Jul 5, 2017 9:25:10

Input file : elkdi7.txt
Output file: elkdi7.out

INPUT FILE LISTING

```
T1 RESD
T2 RANCHO ELKORN STORM DRAIN - NORTH HALF ELKHORN & JENSEN DI#7
T3 ULTIMATE CONDITION 100-YEAR PEAK FLOWS
SO   1004.952765.75  1      .013              2766.95
R    1051.352774.65  1      .013
SH   1051.352774.65  1      .013
1                                                SP
                                  WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING                                    PAGE    1
0 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
  CODE   NO   TYPE  PIERS   WIDTH    DIAMETER  WIDTH              DROP

  CD      1    4                      1.50
 ERROR MESSAGE NUMBER  7 IN SEQUENCE CHECKING THRU CHANNEL DEFINITION DATA
 INVALID CARD CODE ENCOUNTERED WHILE PROCESSING CD AND PTS CARDS - CODE =
1                                                                                                          PAGE NO   1
0                              WATER SURFACE PROFILE - TITLE CARD LISTING
OHEADING LINE NO 1 IS -
0                                RESD
OHEADING LINE NO 2 IS -
0                                RANCHO ELKORN STORM DRAIN - NORTH HALF ELKHORN & JENSEN DI#7
OHEADING LINE NO 3 IS -
0                                ULTIMATE CONDITION 100-YEAR PEAK FLOWS
1                                                                                                          PAGE NO   2
0                              WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO   1 IS A SYSTEM OUTLET      *       *                                          W S ELEV
                    U/S DATA   STATION    INVERT  SECT                                     2766.95
0 ELEMENT NO   2 IS A REACH             *       *
                    U/S DATA   STATION    INVERT  SECT          N                                  RADIUS  ANGLE  ANG PT  MAN H
                                1051.35 2774.65    1          .013                                    .00     .00     .00      0
0 ELEMENT NO   3 IS A SYSTEM HEADWORKS                *               *
                    U/S DATA   STATION    INVERT  SECT                                     W S ELEV
                                1051.35 2774.65    1                                          .00
 NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

 ** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC
1                                                                                                          PAGE    1
                                   WATER SURFACE PROFILE LISTING
                          RESD
                          RANCHO ELKORN STORM DRAIN - NORTH HALF ELKHORN & JENSEN DI#7
                          ULTIMATE CONDITION 100-YEAR PEAK FLOWS
0 STATION    INVERT   DEPTH     W.S.        Q       VEL      VEL      ENERGY   SUPER  CRITICAL          HGT/   BASE/    ZL    NO  AVBPR
               ELEV   OF FLOW    ELEV                       HEAD    GRD.EL.   ELEV    DEPTH             DIA    ID NO.         PIER
0 L/ELEM       SO                                          SF AVE     HF                NORM DEPTH                      ZR
*****************************************************************************************************************************************
0  1004.95  2765.75      .26   2766.01      3.0    14.57     3.30   2769.31    .00     .66              1.50     .00    .00   0    .00
0  1004.95  2765.75      .26   2766.01      3.0    14.57     3.30   2769.31    .00     .66              1.50     .00    .00   0    .00
0     2.06    .19181                                        .18771      .39                  .25                              .00
0  1007.01  2766.14      .26   2766.41      3.0    14.56     3.30   2769.70    .00     .66              1.50     .00    .00   0    .00
0    17.88    .19181                                        .17550     3.14                  .25                              .00
0  1024.89  2769.57      .27   2769.84      3.0    13.88     3.00   2772.84    .00     .66              1.50     .00    .00   0    .00
0     6.81    .19181                                        .15312     1.04                  .25                              .00
0  1031.70  2770.88      .28   2771.16      3.0    13.24     2.72   2773.88    .00     .66              1.50     .00    .00   0    .00
0     4.10    .19181                                        .13384      .55                  .25                              .00
0  1035.80  2771.67      .29   2771.95      3.0    12.62     2.48   2774.43    .00     .66              1.50     .00    .00   0    .00
0     2.88    .19181                                        .11706      .34                  .25                              .00
0  1038.67  2772.22      .30   2772.52      3.0    12.03     2.25   2774.77    .00     .66              1.50     .00    .00   0    .00
0     2.17    .19181                                        .10231      .22                  .25                              .00
0  1040.85  2772.64      .31   2772.94      3.0    11.47     2.05   2774.99    .00     .66              1.50     .00    .00   0    .00
0     1.72    .19181                                        .08935      .15                  .25                              .00
0  1042.57  2772.96      .32   2773.28      3.0    10.94     1.86   2775.14    .00     .66              1.50     .00    .00   0    .00
0     1.39    .19181                                        .07806      .11                  .25                              .00
0  1043.96  2773.23      .33   2773.56      3.0    10.43     1.69   2775.25    .00     .66              1.50     .00    .00   0    .00
0     1.16    .19181                                        .06823      .08                  .25                              .00
0  1045.11  2773.45      .34   2773.79      3.0     9.95     1.54   2775.33    .00     .66              1.50     .00    .00   0    .00
0      .97    .19181                                        .05966      .06                  .25                              .00
1                                                                                                          PAGE    2
                                   WATER SURFACE PROFILE LISTING
                          RESD
                          RANCHO ELKORN STORM DRAIN - NORTH HALF ELKHORN & JENSEN DI#7
                          ULTIMATE CONDITION 100-YEAR PEAK FLOWS
0 STATION    INVERT   DEPTH     W.S.        Q       VEL      VEL      ENERGY   SUPER  CRITICAL          HGT/   BASE/    ZL    NO  AVBPR
               ELEV   OF FLOW    ELEV                       HEAD    GRD.EL.   ELEV    DEPTH             DIA    ID NO.         PIER
0 L/ELEM       SO                                          SF AVE     HF                NORM DEPTH                      ZR
*****************************************************************************************************************************************
0  1046.08  2773.64      .35   2773.99      3.0     9.48     1.40   2775.39    .00     .66              1.50     .00    .00   0    .00
0      .82    .19181                                        .05218      .04                  .25                              .00
0  1046.90  2773.80      .36   2774.16      3.0     9.04     1.27   2775.43    .00     .66              1.50     .00    .00   0    .00
0      .71    .19181                                        .04560      .03                  .25                              .00
0  1047.61  2773.93      .38   2774.31      3.0     8.62     1.16   2775.46    .00     .66              1.50     .00    .00   0    .00
0      .61    .19181                                        .03987      .02                  .25                              .00
0  1048.22  2774.05      .39   2774.44      3.0     8.22     1.05   2775.49    .00     .66              1.50     .00    .00   0    .00
0      .52    .19181                                        .03489      .02                  .25                              .00
0  1048.74  2774.15      .40   2774.55      3.0     7.84      .95   2775.51    .00     .66              1.50     .00    .00   0    .00
0      .45    .19181                                        .03054      .01                  .25                              .00
0  1049.19  2774.23      .42   2774.65      3.0     7.47      .87   2775.52    .00     .66              1.50     .00    .00   0    .00
0      .39    .19181                                        .02672      .01                  .25                              .00
0  1049.58  2774.31      .43   2774.74      3.0     7.13      .79   2775.53    .00     .66              1.50     .00    .00   0    .00
```

ELKDI7

0	.34	.19181					.02337	.01			.25			.00		
0	1049.92	2774.37	.45	2774.82	3.0	6.79	.72	2775.54	.00	.66		1.50	.00	.00	0	.00
0	.29	.19181					.02047	.01			.25			.00		
0	1050.20	2774.43	.46	2774.89	3.0	6.48	.65	2775.54	.00	.66		1.50	.00	.00	0	.00
0	.25	.19181					.01793	.00			.25			.00		
0	1050.45	2774.48	.48	2774.96	3.0	6.18	.59	2775.55	.00	.66		1.50	.00	.00	0	.00
0	.21	.19181					.01570	.00			.25			.00		
0	1050.66	2774.52	.50	2775.01	3.0	5.89	.54	2775.55	.00	.66		1.50	.00	.00	0	.00
0	.17	.19181					.01376	.00			.25			.00		
1															PAGE	3

WATER SURFACE PROFILE LISTING

RESD
RANCHO ELKORN STORM DRAIN - NORTH HALF ELKHORN & JENSEN DI#7
ULTIMATE CONDITION 100-YEAR PEAK FLOWS

0	STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0	L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
0	1050.84	2774.55	.51	2775.06	3.0	5.61	.49	2775.55	.00	.66		1.50	.00	.00	0	.00
0	.15	.19181					.01206	.00			.25			.00		
0	1050.98	2774.58	.53	2775.11	3.0	5.35	.45	2775.56	.00	.66		1.50	.00	.00	0	.00
0	.12	.19181					.01057	.00			.25			.00		
0	1051.10	2774.60	.55	2775.15	3.0	5.10	.40	2775.56	.00	.66		1.50	.00	.00	0	.00
0	.09	.19181					.00927	.00			.25			.00		
0	1051.19	2774.62	.57	2775.19	3.0	4.87	.37	2775.56	.00	.66		1.50	.00	.00	0	.00
0	.07	.19181					.00813	.00			.25			.00		
0	1051.27	2774.63	.59	2775.22	3.0	4.64	.33	2775.56	.00	.66		1.50	.00	.00	0	.00
0	.05	.19181					.00713	.00			.25			.00		
0	1051.31	2774.64	.61	2775.25	3.0	4.42	.30	2775.56	.00	.66		1.50	.00	.00	0	.00
0	.03	.19181					.00626	.00			.25			.00		
0	1051.34	2774.65	.63	2775.28	3.0	4.22	.28	2775.56	.00	.66		1.50	.00	.00	0	.00
0	.01	.19181					.00549	.00			.25			.00		
0	1051.35	2774.65	.66	2775.31	3.0	4.01	.25	2775.56	.00	.66		1.50	.00	.00	0	.00
1																

STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
Portions Copyrighted by CIVILSOFT, 1986, 1987, 1989

Version 1.20
Serial Number 07010220

Jul 5, 2017 9:27:24

Input file : elkdi8.txt
Output file: elkdi8.out

INPUT FILE LISTING

```
T1 RESD
T2 RANCHO ELKORN STORM DRAIN - SOUTH HALF ELKHORN & JENSEN DI#8
T3 ULTIMATE CONDITION 100-YEAR PEAK FLOWS
SO  -1069.032764.11  1      .013                2766.57
R   -1000.192771.44  1      .013
SH  -1000.192771.44  1      .013
1                                                SP
                                  WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING                                  PAGE    1
0 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
  CODE   NO   TYPE  PIERS   WIDTH    DIAMETER  WIDTH             DROP

  CD      1    4                        1.50
 ERROR MESSAGE NUMBER  7 IN SEQUENCE CHECKING THRU CHANNEL DEFINITION DATA
 INVALID CARD CODE ENCOUNTERED WHILE PROCESSING CD AND PTS CARDS - CODE =
1                                                                                                          PAGE NO   1
0                              WATER SURFACE PROFILE - TITLE CARD LISTING
0HEADING LINE NO 1 IS -
0                                RESD
0HEADING LINE NO 2 IS -
0                                RANCHO ELKORN STORM DRAIN - SOUTH HALF ELKHORN & JENSEN DI#8
0HEADING LINE NO 3 IS -
0                                ULTIMATE CONDITION 100-YEAR PEAK FLOWS
1                                                                                                          PAGE NO   2
0                              WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO   1 IS A SYSTEM OUTLET      *          *      *                                    W S ELEV
                    U/S DATA   STATION    INVERT  SECT                                       2766.57
0 ELEMENT NO   2 IS A REACH                *          *      *
                    U/S DATA   STATION    INVERT  SECT            N                                  RADIUS  ANGLE  ANG PT  MAN H
                                -1000.19 2771.44    1           .013                                    .00    .00     .00      0
0 ELEMENT NO   3 IS A SYSTEM HEADWORKS                    *              *
                    U/S DATA   STATION    INVERT  SECT                                       W S ELEV
                                -1000.19 2771.44    1                                          .00
 NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

 ** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC
1                                                                                                          PAGE    1
                                        WATER SURFACE PROFILE LISTING
                          RESD
                          RANCHO ELKORN STORM DRAIN - SOUTH HALF ELKHORN & JENSEN DI#8
                          ULTIMATE CONDITION 100-YEAR PEAK FLOWS
0 STATION    INVERT   DEPTH     W.S.        Q       VEL      VEL      ENERGY   SUPER  CRITICAL          HGT/   BASE/    ZL   NO  AVBPR
           ELEV   OF FLOW    ELEV                        HEAD   GRD.EL.   ELEV    DEPTH                DIA    ID NO.        PIER
0 L/ELEM      SO                                      SF AVE     HF                    NORM DEPTH                      ZR
*****************************************************************************************************************************
0 -1069.03  2764.11     2.46  2766.57       3.0     1.70      .04  2766.61    .00      .66             1.50      .00   .00   0    .00
0     9.09    .10648                                          .00081     .01                  .30                          .00
0 -1059.94  2765.08     1.50  2766.58       3.0     1.70      .04  2766.62    .00      .66             1.50      .00   .00   0    .00
0     1.27    .10648                                          .00076     .00                  .30                          .00
0 -1058.67  2765.21     1.36  2766.57       3.0     1.78      .05  2766.62    .00      .66             1.50      .00   .00   0    .00
0      .64    .10648                                          .00074     .00                  .30                          .00
0 -1058.03  2765.28     1.28  2766.56       3.0     1.87      .05  2766.62    .00      .66             1.50      .00   .00   0    .00
0HYDRAULIC JUMP                                                                                                            .00
0 -1058.03  2765.28      .30  2765.58       3.0    11.87     2.19  2767.77    .00      .66             1.50      .00   .00   0    .00
0    23.97    .10648                                          .10025     2.40                 .30                          .00
0 -1034.06  2767.83      .31  2768.14       3.0    11.47     2.05  2770.19    .00      .66             1.50      .00   .00   0    .00
0    10.28    .10648                                          .08935     .92                  .30                          .00
0 -1023.78  2768.93      .32  2769.25       3.0    10.94     1.86  2771.11    .00      .66             1.50      .00   .00   0    .00
0     5.56    .10648                                          .07806     .43                  .30                          .00
0 -1018.21  2769.52      .33  2769.85       3.0    10.43     1.69  2771.54    .00      .66             1.50      .00   .00   0    .00
0     3.73    .10648                                          .06823     .25                  .30                          .00
0 -1014.48  2769.92      .34  2770.26       3.0     9.95     1.54  2771.80    .00      .66             1.50      .00   .00   0    .00
0     2.73    .10648                                          .05966     .16                  .30                          .00
0 -1011.75  2770.21      .35  2770.56       3.0     9.48     1.40  2771.96    .00      .66             1.50      .00   .00   0    .00
0     2.12    .10648                                          .05218     .11                  .30                          .00
0 -1009.63  2770.43      .36  2770.80       3.0     9.04     1.27  2772.07    .00      .66             1.50      .00   .00   0    .00
0     1.70    .10648                                          .04560     .08                  .30                          .00
1                                                                                                          PAGE    2
                                        WATER SURFACE PROFILE LISTING
                          RESD
                          RANCHO ELKORN STORM DRAIN - SOUTH HALF ELKHORN & JENSEN DI#8
                          ULTIMATE CONDITION 100-YEAR PEAK FLOWS
0 STATION    INVERT   DEPTH     W.S.        Q       VEL      VEL      ENERGY   SUPER  CRITICAL          HGT/   BASE/    ZL   NO  AVBPR
           ELEV   OF FLOW    ELEV                        HEAD   GRD.EL.   ELEV    DEPTH                DIA    ID NO.        PIER
0 L/ELEM      SO                                      SF AVE     HF                    NORM DEPTH                      ZR
*****************************************************************************************************************************
0 -1007.93  2770.62      .38  2770.99       3.0     8.62     1.16  2772.15    .00      .66             1.50      .00   .00   0    .00
0     1.38    .10648                                          .03987     .06                  .30                          .00
0 -1006.55  2770.76      .39  2771.15       3.0     8.22     1.05  2772.20    .00      .66             1.50      .00   .00   0    .00
0     1.14    .10648                                          .03489     .04                  .30                          .00
0 -1005.41  2770.88      .40  2771.29       3.0     7.84      .95  2772.24    .00      .66             1.50      .00   .00   0    .00
0      .96    .10648                                          .03054     .03                  .30                          .00
0 -1004.46  2770.99      .42  2771.40       3.0     7.47      .87  2772.27    .00      .66             1.50      .00   .00   0    .00
0      .81    .10648                                          .02672     .02                  .30                          .00
0 -1003.64  2771.07      .43  2771.50       3.0     7.13      .79  2772.29    .00      .66             1.50      .00   .00   0    .00
0      .68    .10648                                          .02337     .02                  .30                          .00
0 -1002.96  2771.15      .45  2771.59       3.0     6.79      .72  2772.31    .00      .66             1.50      .00   .00   0    .00
0      .57    .10648                                          .02047     .01                  .30                          .00
```

ELKDI8

0 -1002.39	2771.21	.46	2771.67	3.0	6.48	.65	2772.32	.00	.66		1.50	.00	.00	0	.00
0 .49	.10648					.01793	.01			.30			.00		
0 -1001.90	2771.26	.48	2771.74	3.0	6.18	.59	2772.33	.00	.66		1.50	.00	.00	0	.00
0 .41	.10648					.01570	.01			.30			.00		
0 -1001.49	2771.30	.50	2771.80	3.0	5.89	.54	2772.33	.00	.66		1.50	.00	.00	0	.00
0 .33	.10648					.01376	.00			.30			.00		
0 -1001.16	2771.34	.51	2771.85	3.0	5.61	.49	2772.34	.00	.66		1.50	.00	.00	0	.00
0 .28	.10648					.01206	.00			.30			.00		
0 -1000.88	2771.37	.53	2771.90	3.0	5.35	.45	2772.34	.00	.66		1.50	.00	.00	0	.00
0 .22	.10648					.01057	.00			.30			.00		

1 PAGE 3

WATER SURFACE PROFILE LISTING

RESD
RANCHO ELKORN STORM DRAIN - SOUTH HALF ELKHORN & JENSEN DI#8
ULTIMATE CONDITION 100-YEAR PEAK FLOWS

0 STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0 L/ELEM	SO					SF AVE	HF		NORM DEPTH				ZR		
0 -1000.65	2771.39	.55	2771.94	3.0	5.10	.40	2772.35	.00	.66		1.50	.00	.00	0	.00
0 .17	.10648					.00927	.00			.30			.00		
0 -1000.48	2771.41	.57	2771.98	3.0	4.87	.37	2772.35	.00	.66		1.50	.00	.00	0	.00
0 .14	.10648					.00813	.00			.30			.00		
0 -1000.34	2771.42	.59	2772.01	3.0	4.64	.33	2772.35	.00	.66		1.50	.00	.00	0	.00
0 .08	.10648					.00713	.00			.30			.00		
0 -1000.26	2771.43	.61	2772.04	3.0	4.42	.30	2772.35	.00	.66		1.50	.00	.00	0	.00
0 .06	.10648					.00626	.00			.30			.00		
0 -1000.20	2771.44	.63	2772.07	3.0	4.22	.28	2772.35	.00	.66		1.50	.00	.00	0	.00
0 .01	.10648					.00549	.00			.30			.00		
0 -1000.19	2771.44	.66	2772.10	3.0	4.01	.25	2772.35	.00	.66		1.50	.00	.00	0	.00

1

STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
Portions Copyrighted by CIVILSOFT, 1986, 1987, 1989

Version 1.20
Serial Number 07010220

Jul 5, 2017 10:10:45

Input file : elkdi54.txt
Output file: elkdi54.out

INPUT FILE LISTING

```
T1 RESD
T2 RANCHO ELKORN STORM DRAIN - 54" CONNECTION AT ELKHORN & HUALAPAI
T3 ULTIMATE CONDITION 100-YEAR PEAK FLOWS
SO   1004.992836.30  1      .013                2837.87
R    1018.112836.95  1      .013
SH   1018.112836.95  1      .013
1                                                SP
                                  WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING                                  PAGE    1
0 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
  CODE   NO   TYPE  PIERS   WIDTH    DIAMETER  WIDTH             DROP

  CD      1    4                      4.50
 ERROR MESSAGE NUMBER  7 IN SEQUENCE CHECKING THRU CHANNEL DEFINITION DATA
 INVALID CARD CODE ENCOUNTERED WHILE PROCESSING CD AND PTS CARDS - CODE =
1                                                                                                          PAGE NO   1
0                              WATER SURFACE PROFILE - TITLE CARD LISTING
0HEADING LINE NO 1 IS -
0                                RESD
0HEADING LINE NO 2 IS -
0                                RANCHO ELKORN STORM DRAIN - 54" CONNECTION AT ELKHORN & HUALAPAI
0HEADING LINE NO 3 IS -
0                                ULTIMATE CONDITION 100-YEAR PEAK FLOWS
1                                                                                                          PAGE NO   2
0                              WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO   1 IS A SYSTEM OUTLET      *          *      *
                     U/S DATA   STATION     INVERT  SECT                                        W S ELEV
                                  1004.99 2836.30    1                                          2837.87
0 ELEMENT NO   2 IS A REACH              *          *      *
                     U/S DATA   STATION     INVERT  SECT              N                                    RADIUS  ANGLE  ANG PT  MAN H
                                  1018.11 2836.95    1              .013                                     .00    .00     .00     0
0 ELEMENT NO   3 IS A SYSTEM HEADWORKS                    *                 *
                     U/S DATA   STATION     INVERT  SECT                                        W S ELEV
                                  1018.11 2836.95    1                                             .00
 NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

 ** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC                *
1                                                                                                                  PAGE    1
                                                WATER SURFACE PROFILE LISTING
                                  RESD
                                  RANCHO ELKORN STORM DRAIN - 54" CONNECTION AT ELKHORN & HUALAPAI
                                  ULTIMATE CONDITION 100-YEAR PEAK FLOWS
0 STATION    INVERT   DEPTH     W.S.        Q       VEL     VEL      ENERGY   SUPER  CRITICAL          HGT/   BASE/    ZL    NO  AVBPR
            ELEV    OF FLOW    ELEV                        HEAD   GRD.EL.    ELEV   DEPTH             DIA    ID NO.          PIER
0 L/ELEM     SO                                          SF AVE     HF                  NORM DEPTH                      ZR
*****************************************************************************************************************************************
0  1004.99  2836.30     2.48   2838.78    121.0   13.44     2.81   2841.59    .00     3.24              4.50      .00   .00   0     .00
0  1004.99  2836.30     2.48   2838.78    121.0   13.44     2.81   2841.59    .00     3.24              4.50      .00   .00   0     .00
0     1.95   .04953                                       .01060      .02                  1.62                                .00
0  1006.94  2836.40     2.53   2838.92    121.0   13.15     2.69   2841.61    .00     3.24              4.50      .00   .00   0     .00
0     3.60   .04953                                       .00971      .03                  1.62                                .00
0  1010.53  2836.57     2.63   2839.20    121.0   12.54     2.44   2841.65    .00     3.24              4.50      .00   .00   0     .00
0     2.84   .04953                                       .00858      .02                  1.62                                .00
0  1013.37  2836.72     2.74   2839.45    121.0   11.95     2.22   2841.67    .00     3.24              4.50      .00   .00   0     .00
0     2.12   .04953                                       .00760      .02                  1.62                                .00
0  1015.49  2836.82     2.85   2839.67    121.0   11.40     2.02   2841.69    .00     3.24              4.50      .00   .00   0     .00
0     1.46   .04953                                       .00674      .01                  1.62                                .00
0  1016.95  2836.89     2.97   2839.86    121.0   10.87     1.84   2841.70    .00     3.24              4.50      .00   .00   0     .00
0      .87   .04953                                       .00599      .01                  1.62                                .00
0  1017.82  2836.94     3.10   2840.03    121.0   10.36     1.67   2841.70    .00     3.24              4.50      .00   .00   0     .00
0      .29   .04953                                       .00534      .00                  1.62                                .00
0  1018.11  2836.95     3.24   2840.19    121.0    9.88     1.52   2841.70    .00     3.24              4.50      .00   .00   0     .00
1
```

STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
Portions Copyrighted by CIVILSOFT, 1986, 1987, 1989

Version 1.20
Serial Number 07010220

Jul 5, 2017 10:27:27

Input file : elkdidr1.txt
Output file: elkdidr1.out

INPUT FILE LISTING

```
T1 RESD
T2 RANCHO ELKORN STORM DRAIN - 3-20" CONNECTION FROM DR HORTON DEVELOPMENT
T3 ULTIMATE CONDITION 100-YEAR PEAK FLOWS
SO    1004.952815.28  1      .013                2815.01
R     1023.812824.09  1      .013
R     1068.172824.54  1      .013
R     1070.842824.76  1      .013
R     1088.912824.93  1      .013
SH    1088.912824.93  1      .013
1                                                    SP
                                  WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING                                  PAGE    1
0 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
  CODE   NO   TYPE  PIERS   WIDTH    DIAMETER  WIDTH            DROP

  CD      1    4                      1.60
 ERROR MESSAGE NUMBER  7 IN SEQUENCE CHECKING THRU CHANNEL DEFINITION DATA
 INVALID CARD CODE ENCOUNTERED WHILE PROCESSING CD AND PTS CARDS - CODE =
1                                                                                                                  PAGE NO   1
0                              WATER SURFACE PROFILE - TITLE CARD LISTING
0HEADING LINE NO 1 IS -
0                                RESD
0HEADING LINE NO 2 IS -
0                                RANCHO ELKORN STORM DRAIN - 3-20" CONNECTION FROM DR HORTON DEVELOPMENT
0HEADING LINE NO 3 IS -
0                                ULTIMATE CONDITION 100-YEAR PEAK FLOWS
1                                                                                                                  PAGE NO   2
0                              WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO   1 IS A SYSTEM OUTLET        *          *      *                                        W S ELEV
                     U/S DATA   STATION    INVERT  SECT                                            2815.01
                                1004.95 2815.28    1
0 ELEMENT NO   2 IS A REACH               *          *      *
                     U/S DATA   STATION    INVERT  SECT          N                                 RADIUS  ANGLE  ANG PT  MAN H
                                1023.81 2824.09    1          .013                                    .00    .00     .00      0
0 ELEMENT NO   3 IS A REACH               *          *      *
                     U/S DATA   STATION    INVERT  SECT          N                                 RADIUS  ANGLE  ANG PT  MAN H
                                1068.17 2824.54    1          .013                                    .00    .00     .00      0
0 ELEMENT NO   4 IS A REACH               *          *      *
                     U/S DATA   STATION    INVERT  SECT          N                                 RADIUS  ANGLE  ANG PT  MAN H
                                1070.84 2824.76    1          .013                                    .00    .00     .00      0
0 ELEMENT NO   5 IS A REACH               *          *      *
                     U/S DATA   STATION    INVERT  SECT          N                                 RADIUS  ANGLE  ANG PT  MAN H
                                1088.91 2824.93    1          .013                                    .00    .00     .00      0
0 ELEMENT NO   6 IS A SYSTEM HEADWORKS                 *                  *
                     U/S DATA   STATION    INVERT  SECT                                            W S ELEV
                                1088.91 2824.93    1                                                  .00
 NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

 ** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC
 ERROR MESSAGE NO. 2 - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN OTLTUS, W.S.ELEV = INV + DC
1                                                                                                                  PAGE    1
                                        WATER SURFACE PROFILE LISTING
                          RESD
                          RANCHO ELKORN STORM DRAIN - 3-20" CONNECTION FROM DR HORTON DEVELOPMENT
                          ULTIMATE CONDITION 100-YEAR PEAK FLOWS
0 STATION     INVERT   DEPTH     W.S.        Q       VEL     VEL      ENERGY   SUPER  CRITICAL          HGT/   BASE/    ZL   NO  AVBPR
               ELEV   OF FLOW    ELEV                       HEAD    GRD.EL.   ELEV   DEPTH             DIA    ID NO.        PIER
0 L/ELEM       SO                                         SF AVE     HF                NORM DEPTH                      ZR
*****************************************************************************************************************************
0  1004.95  2815.28      .55   2815.83      14.3   23.39    8.50   2824.33    .00    1.41              1.60     .00   .00   0    .00
0  1004.95  2815.28      .55   2815.83      14.3   23.39    8.50   2824.33    .00    1.41              1.60     .00   .00   0    .00
0     1.40   .46713                                       .19724      .28                 .44                             .00
0  1006.35  2815.93      .56   2816.49      14.3   22.83    8.10   2824.59    .00    1.41              1.60     .00   .00   0    .00
0     2.49   .46713                                       .17892      .44                 .44                             .00
0  1008.83  2817.09      .58   2817.67      14.3   21.77    7.37   2825.04    .00    1.41              1.60     .00   .00   0    .00
0     2.09   .46713                                       .15690      .33                 .44                             .00
0  1010.92  2818.07      .60   2818.67      14.3   20.76    6.70   2825.37    .00    1.41              1.60     .00   .00   0    .00
0     1.78   .46713                                       .13758      .25                 .44                             .00
0  1012.71  2818.90      .62   2819.53      14.3   19.79    6.09   2825.61    .00    1.41              1.60     .00   .00   0    .00
0     1.53   .46713                                       .12069      .18                 .44                             .00
0  1014.24  2819.62      .64   2820.26      14.3   18.87    5.53   2825.80    .00    1.41              1.60     .00   .00   0    .00
0     1.33   .46713                                       .10594      .14                 .44                             .00
0  1015.57  2820.24      .67   2820.91      14.3   17.99    5.03   2825.94    .00    1.41              1.60     .00   .00   0    .00
0     1.16   .46713                                       .09302      .11                 .44                             .00
0  1016.72  2820.78      .69   2821.47      14.3   17.16    4.57   2826.05    .00    1.41              1.60     .00   .00   0    .00
0     1.01   .46713                                       .08172      .08                 .44                             .00
0  1017.74  2821.25      .72   2821.97      14.3   16.36    4.16   2826.13    .00    1.41              1.60     .00   .00   0    .00
0      .89   .46713                                       .07181      .06                 .44                             .00
0  1018.63  2821.67      .74   2822.41      14.3   15.60    3.78   2826.19    .00    1.41              1.60     .00   .00   0    .00
0      .78   .46713                                       .06317      .05                 .44                             .00
1                                                                                                                  PAGE    2
                                        WATER SURFACE PROFILE LISTING
                          RESD
                          RANCHO ELKORN STORM DRAIN - 3-20" CONNECTION FROM DR HORTON DEVELOPMENT
                          ULTIMATE CONDITION 100-YEAR PEAK FLOWS
0 STATION     INVERT   DEPTH     W.S.        Q       VEL     VEL      ENERGY   SUPER  CRITICAL          HGT/   BASE/    ZL   NO  AVBPR
               ELEV   OF FLOW    ELEV                       HEAD    GRD.EL.   ELEV   DEPTH             DIA    ID NO.        PIER
0 L/ELEM       SO                                         SF AVE     HF                NORM DEPTH                      ZR
*****************************************************************************************************************************
```

ELKDIDR1

0	1019.41	2822.03	.77	2822.81	14.3	14.87	3.44	2826.24	.00	1.41		1.60	.00	.00	0	.00
0	.69	.46713					.05561	.04			.44			.00		
0	1020.09	2822.35	.80	2823.16	14.3	14.18	3.12	2826.28	.00	1.41		1.60	.00	.00	0	.00
0	.61	.46713					.04898	.03			.44			.00		
0	1020.70	2822.64	.83	2823.47	14.3	13.52	2.84	2826.31	.00	1.41		1.60	.00	.00	0	.00
0	.53	.46713					.04317	.02			.44			.00		
0	1021.23	2822.89	.87	2823.75	14.3	12.89	2.58	2826.33	.00	1.41		1.60	.00	.00	0	.00
0	.47	.46713					.03809	.02			.44			.00		
0	1021.70	2823.10	.90	2824.00	14.3	12.29	2.35	2826.35	.00	1.41		1.60	.00	.00	0	.00
0	.41	.46713					.03365	.01			.44			.00		
0	1022.11	2823.30	.94	2824.23	14.3	11.72	2.13	2826.36	.00	1.41		1.60	.00	.00	0	.00
0	.36	.46713					.02974	.01			.44			.00		
0	1022.47	2823.46	.97	2824.44	14.3	11.17	1.94	2826.38	.00	1.41		1.60	.00	.00	0	.00
0	.31	.46713					.02633	.01			.44			.00		
0	1022.78	2823.61	1.01	2824.62	14.3	10.65	1.76	2826.38	.00	1.41		1.60	.00	.00	0	.00
0	.26	.46713					.02337	.01			.44			.00		
0	1023.04	2823.73	1.06	2824.79	14.3	10.16	1.60	2826.39	.00	1.41		1.60	.00	.00	0	.00
0	.23	.46713					.02077	.00			.44			.00		
0	1023.27	2823.84	1.10	2824.94	14.3	9.68	1.46	2826.39	.00	1.41		1.60	.00	.00	0	.00
0	.18	.46713					.01850	.00			.44			.00		
0	1023.45	2823.92	1.15	2825.07	14.3	9.23	1.32	2826.40	.00	1.41		1.60	.00	.00	0	.00
0	.15	.46713					.01655	.00			.44			.00		

1 PAGE 3

WATER SURFACE PROFILE LISTING

RESD
RANCHO ELKORN STORM DRAIN - 3-20" CONNECTION FROM DR HORTON DEVELOPMENT
ULTIMATE CONDITION 100-YEAR PEAK FLOWS

0	STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0	L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
0	1023.60	2823.99	1.20	2825.20	14.3	8.80	1.20	2826.40	.00	1.41		1.60	.00	.00	0	.00
0	.11	.46713					.01486	.00			.44			.00		
0	1023.71	2824.04	1.26	2825.31	14.3	8.39	1.09	2826.40	.00	1.41		1.60	.00	.00	0	.00
0	.07	.46713					.01345	.00			.44			.00		
0	1023.78	2824.08	1.33	2825.41	14.3	8.00	1.00	2826.40	.00	1.41		1.60	.00	.00	0	.00
0	.03	.46713					.01231	.00			.44			.00		
0	1023.81	2824.09	1.41	2825.50	14.3	7.63	.90	2826.40	.00	1.41		1.60	.00	.00	0	.00
0	13.18	.01014					.01158	.15			1.60			.00		
0	1036.99	2824.22	1.51	2825.73	14.3	7.27	.82	2826.56	.00	1.41		1.60	.00	.00	0	.00
0	1.16	.01014					.01135	.01			1.60			.00		
0	1038.16	2824.24	1.51	2825.75	14.3	7.27	.82	2826.57	.00	1.41		1.60	.00	.00	0	.00
0	HYDRAULIC JUMP													.00		
0	1038.16	2824.24	1.30	2825.54	14.3	8.16	1.03	2826.57	.00	1.41		1.60	.00	.00	0	.00
0	9.02	.01014					.01385	.12			1.60			.00		
0	1047.18	2824.33	1.25	2825.58	14.3	8.48	1.12	2826.70	.00	1.41		1.60	.00	.00	0	.00
0	10.62	.01014					.01520	.16			1.60			.00		
0	1057.80	2824.43	1.19	2825.63	14.3	8.89	1.23	2826.86	.00	1.41		1.60	.00	.00	0	.00
0	10.37	.01014					.01694	.18			1.60			.00		
0	1068.17	2824.54	1.14	2825.68	14.3	9.33	1.35	2827.03	.00	1.41		1.60	.00	.00	0	.00
0	.25	.08239					.01767	.00			.70			.00		
0	1068.42	2824.56	1.15	2825.71	14.3	9.23	1.32	2827.04	.00	1.41		1.60	.00	.00	0	.00
0	1.02	.08239					.01655	.02			.70			.00		

1 PAGE 4

WATER SURFACE PROFILE LISTING

RESD
RANCHO ELKORN STORM DRAIN - 3-20" CONNECTION FROM DR HORTON DEVELOPMENT
ULTIMATE CONDITION 100-YEAR PEAK FLOWS

0	STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0	L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
0	1069.44	2824.64	1.20	2825.85	14.3	8.80	1.20	2827.05	.00	1.41		1.60	.00	.00	0	.00
0	.75	.08239					.01486	.01			.70			.00		
0	1070.19	2824.71	1.26	2825.97	14.3	8.39	1.09	2827.06	.00	1.41		1.60	.00	.00	0	.00
0	.47	.08239					.01345	.01			.70			.00		
0	1070.66	2824.75	1.33	2826.08	14.3	8.00	1.00	2827.07	.00	1.41		1.60	.00	.00	0	.00
0	.18	.08239					.01231	.00			.70			.00		
0	1070.84	2824.76	1.41	2826.17	14.3	7.63	.90	2827.07	.00	1.41		1.60	.00	.00	0	.00
0	8.70	.00940					.01158	.10			1.60			.00		
0	1079.54	2824.84	1.51	2826.35	14.3	7.27	.82	2827.17	.00	1.41		1.60	.00	.00	0	.00
0	9.37	.00940					.01145	.11			1.60			.00		
0	1088.91	2824.93	1.55	2826.48	14.3	7.18	.80	2827.28	.00	1.41		1.60	.00	.00	0	.00
0	.00	.00940					.00578	.00			1.60			.00		
0	1088.91	2824.93	1.55	2826.48	14.3	7.18	.80	2827.28	.00	1.41		1.60	.00	.00	0	.00

1

STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
Portions Copyrighted by CIVILSOFT, 1986, 1987, 1989

Version 1.20
Serial Number 07010220

Jul 5, 2017 10: 4:22

Input file : elkdidr2.txt
Output file: elkdidr2.out

INPUT FILE LISTING

```
T1 RESD
T2 RANCHO ELKORN STORM DRAIN - 3-20" CONNECTION FROM DR HORTON DEVELOPMENT
T3 ULTIMATE CONDITION 100-YEAR PEAK FLOWS
SO   1004.952815.18  1      .013                2814.95
R    1023.812824.09  1      .013
R    1068.172824.54  1      .013
R    1070.842824.76  1      .013
R    1088.912824.93  1      .013
SH   1088.912824.93  1      .013
1                                                SP
                                  WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING                                  PAGE   1
0 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
  CODE   NO   TYPE  PIERS   WIDTH    DIAMETER  WIDTH              DROP

  CD      1    4                     1.60
 ERROR MESSAGE NUMBER  7 IN SEQUENCE CHECKING THRU CHANNEL DEFINITION DATA
 INVALID CARD CODE ENCOUNTERED WHILE PROCESSING CD AND PTS CARDS - CODE =
1                                                                                                                   PAGE NO   1
0                            WATER SURFACE PROFILE - TITLE CARD LISTING
0HEADING LINE NO 1 IS -
0                              RESD
0HEADING LINE NO 2 IS -
0                              RANCHO ELKORN STORM DRAIN - 3-20" CONNECTION FROM DR HORTON DEVELOPMENT
0HEADING LINE NO 3 IS -
0                              ULTIMATE CONDITION 100-YEAR PEAK FLOWS
1                                                                                                                   PAGE NO   2
0                            WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO   1 IS A SYSTEM OUTLET      *         *     *                                          W S ELEV
                    U/S DATA   STATION    INVERT  SECT                                          2814.95
                                1004.95 2815.18    1
0 ELEMENT NO   2 IS A REACH                *         *     *
                    U/S DATA   STATION    INVERT  SECT            N                                    RADIUS  ANGLE  ANG PT  MAN H
                                1023.81 2824.09    1           .013                                      .00    .00     .00      0
0 ELEMENT NO   3 IS A REACH      *         *         *     *
                    U/S DATA   STATION    INVERT  SECT            N                                    RADIUS  ANGLE  ANG PT  MAN H
                                1068.17 2824.54    1           .013                                      .00    .00     .00      0
0 ELEMENT NO   4 IS A REACH                *         *     *
                    U/S DATA   STATION    INVERT  SECT            N                                    RADIUS  ANGLE  ANG PT  MAN H
                                1070.84 2824.76    1           .013                                      .00    .00     .00      0
0 ELEMENT NO   5 IS A REACH      *         *         *     *
                    U/S DATA   STATION    INVERT  SECT            N                                    RADIUS  ANGLE  ANG PT  MAN H
                                1088.91 2824.93    1           .013                                      .00    .00     .00      0
0 ELEMENT NO   6 IS A SYSTEM HEADWORKS                 *                     *
                    U/S DATA   STATION    INVERT  SECT                                          W S ELEV
                                1088.91 2824.93    1                                               .00
 NO EDIT ERRORS ENCOUNTERED--COMPUTATION IS NOW BEGINNING

 ** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC
 ERROR MESSAGE NO. 2 - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN OTLTUS, W.S.ELEV = INV + DC
                                                                                                                    PAGE   1
1                                WATER SURFACE PROFILE LISTING
                    RESD
                    RANCHO ELKORN STORM DRAIN - 3-20" CONNECTION FROM DR HORTON DEVELOPMENT
                    ULTIMATE CONDITION 100-YEAR PEAK FLOWS
0 STATION    INVERT   DEPTH     W.S.        Q      VEL      VEL      ENERGY   SUPER  CRITICAL          HGT/   BASE/    ZL   NO  AVBPR
               ELEV   OF FLOW   ELEV                        HEAD     GRD.EL.  ELEV   DEPTH             DIA    ID NO.       PIER
0 L/ELEM      SO                                          SF AVE     HF                 NORM DEPTH                    ZR
*****************************************************************************************************************************
0  1004.95  2815.18      .55   2815.73      14.3    23.49    8.58    2824.30    .00   1.41              1.60     .00   .00   0    .00
0  1004.95  2815.18      .55   2815.73      14.3    23.49    8.58    2824.30    .00   1.41              1.60     .00   .00   0    .00
0     1.65    .47244                                        .19850      .33                 .44                          .00
0  1006.60  2815.96      .56   2816.52      14.3    22.83    8.10    2824.62    .00   1.41              1.60     .00   .00   0    .00
0     2.44    .47244                                        .17892      .44                 .44                          .00
0  1009.04  2817.11      .58   2817.69      14.3    21.77    7.37    2825.06    .00   1.41              1.60     .00   .00   0    .00
0     2.06    .47244                                        .15690      .32                 .44                          .00
0  1011.10  2818.09      .60   2818.69      14.3    20.76    6.70    2825.38    .00   1.41              1.60     .00   .00   0    .00
0     1.76    .47244                                        .13758      .24                 .44                          .00
0  1012.86  2818.92      .62   2819.54      14.3    19.79    6.09    2825.62    .00   1.41              1.60     .00   .00   0    .00
0     1.51    .47244                                        .12069      .18                 .44                          .00
0  1014.36  2819.63      .64   2820.27      14.3    18.87    5.53    2825.81    .00   1.41              1.60     .00   .00   0    .00
0     1.31    .47244                                        .10594      .14                 .44                          .00
0  1015.67  2820.25      .67   2820.91      14.3    17.99    5.03    2825.94    .00   1.41              1.60     .00   .00   0    .00
0     1.14    .47244                                        .09302      .11                 .44                          .00
0  1016.81  2820.78      .69   2821.48      14.3    17.16    4.57    2826.05    .00   1.41              1.60     .00   .00   0    .00
0     1.00    .47244                                        .08172      .08                 .44                          .00
0  1017.81  2821.26      .72   2821.97      14.3    16.36    4.16    2826.13    .00   1.41              1.60     .00   .00   0    .00
0      .88    .47244                                        .07181      .06                 .44                          .00
0  1018.69  2821.67      .74   2822.42      14.3    15.60    3.78    2826.20    .00   1.41              1.60     .00   .00   0    .00
0      .77    .47244                                        .06317      .05                 .44                          .00
1                                                                                                                   PAGE   2
                                WATER SURFACE PROFILE LISTING
                    RESD
                    RANCHO ELKORN STORM DRAIN - 3-20" CONNECTION FROM DR HORTON DEVELOPMENT
                    ULTIMATE CONDITION 100-YEAR PEAK FLOWS
0 STATION    INVERT   DEPTH     W.S.        Q      VEL      VEL      ENERGY   SUPER  CRITICAL          HGT/   BASE/    ZL   NO  AVBPR
               ELEV   OF FLOW   ELEV                        HEAD     GRD.EL.  ELEV   DEPTH             DIA    ID NO.       PIER
0 L/ELEM      SO                                          SF AVE     HF                 NORM DEPTH                    ZR
*****************************************************************************************************************************
```

ELKDIDR2

0	1019.46	2822.04	.77	2822.81	14.3	14.87	3.44	2826.24	.00	1.41		1.60	.00	.00	0	.00
0	.68	.47244					.05561	.04			.44			.00		
0	1020.14	2822.36	.80	2823.16	14.3	14.18	3.12	2826.28	.00	1.41		1.60	.00	.00	0	.00
0	.60	.47244					.04898	.03			.44			.00		
0	1020.74	2822.64	.83	2823.47	14.3	13.52	2.84	2826.31	.00	1.41		1.60	.00	.00	0	.00
0	.52	.47244					.04317	.02			.44			.00		
0	1021.26	2822.89	.87	2823.75	14.3	12.89	2.58	2826.33	.00	1.41		1.60	.00	.00	0	.00
0	.46	.47244					.03809	.02			.44			.00		
0	1021.73	2823.10	.90	2824.00	14.3	12.29	2.35	2826.35	.00	1.41		1.60	.00	.00	0	.00
0	.40	.47244					.03365	.01			.44			.00		
0	1022.13	2823.30	.94	2824.23	14.3	11.72	2.13	2826.36	.00	1.41		1.60	.00	.00	0	.00
0	.35	.47244					.02974	.01			.44			.00		
0	1022.48	2823.46	.97	2824.44	14.3	11.17	1.94	2826.38	.00	1.41		1.60	.00	.00	0	.00
0	.30	.47244					.02633	.01			.44			.00		
0	1022.79	2823.61	1.01	2824.62	14.3	10.65	1.76	2826.38	.00	1.41		1.60	.00	.00	0	.00
0	.26	.47244					.02337	.01			.44			.00		
0	1023.05	2823.73	1.06	2824.79	14.3	10.16	1.60	2826.39	.00	1.41		1.60	.00	.00	0	.00
0	.22	.47244					.02077	.00			.44			.00		
0	1023.27	2823.84	1.10	2824.94	14.3	9.68	1.46	2826.39	.00	1.41		1.60	.00	.00	0	.00
0	.18	.47244					.01850	.00			.44			.00		
0	1023.45	2823.92	1.15	2825.07	14.3	9.23	1.32	2826.40	.00	1.41		1.60	.00	.00	0	.00
0	.15	.47244					.01655	.00			.44			.00		

1 PAGE 3

WATER SURFACE PROFILE LISTING

RESD
RANCHO ELKORN STORM DRAIN - 3-20" CONNECTION FROM DR HORTON DEVELOPMENT
ULTIMATE CONDITION 100-YEAR PEAK FLOWS

0	STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0	L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
0	1023.60	2823.99	1.20	2825.20	14.3	8.80	1.20	2826.40	.00	1.41		1.60	.00	.00	0	.00
0	.11	.47244					.01486	.00			.44			.00		
0	1023.71	2824.04	1.26	2825.31	14.3	8.39	1.09	2826.40	.00	1.41		1.60	.00	.00	0	.00
0	.07	.47244					.01345	.00			.44			.00		
0	1023.78	2824.08	1.33	2825.41	14.3	8.00	1.00	2826.40	.00	1.41		1.60	.00	.00	0	.00
0	.03	.47244					.01231	.00			.44			.00		
0	1023.81	2824.09	1.41	2825.50	14.3	7.63	.90	2826.40	.00	1.41		1.60	.00	.00	0	.00
0	13.18	.01014					.01158	.15			1.60			.00		
0	1036.99	2824.22	1.51	2825.73	14.3	7.27	.82	2826.56	.00	1.41		1.60	.00	.00	0	.00
0	1.16	.01014					.01135	.01			1.60			.00		
0	1038.16	2824.24	1.51	2825.75	14.3	7.27	.82	2826.57	.00	1.41		1.60	.00	.00	0	.00
0	HYDRAULIC JUMP													.00		
0	1038.16	2824.24	1.30	2825.54	14.3	8.16	1.03	2826.57	.00	1.41		1.60	.00	.00	0	.00
0	9.02	.01014					.01385	.12			1.60			.00		
0	1047.18	2824.33	1.25	2825.58	14.3	8.48	1.12	2826.70	.00	1.41		1.60	.00	.00	0	.00
0	10.62	.01014					.01520	.16			1.60			.00		
0	1057.80	2824.43	1.19	2825.63	14.3	8.89	1.23	2826.86	.00	1.41		1.60	.00	.00	0	.00
0	10.37	.01014					.01694	.18			1.60			.00		
0	1068.17	2824.54	1.14	2825.68	14.3	9.33	1.35	2827.03	.00	1.41		1.60	.00	.00	0	.00
0	.25	.08239					.01767	.00			.70			.00		
0	1068.42	2824.56	1.15	2825.71	14.3	9.23	1.32	2827.04	.00	1.41		1.60	.00	.00	0	.00
0	1.02	.08239					.01655	.02			.70			.00		

1 PAGE 4

WATER SURFACE PROFILE LISTING

RESD
RANCHO ELKORN STORM DRAIN - 3-20" CONNECTION FROM DR HORTON DEVELOPMENT
ULTIMATE CONDITION 100-YEAR PEAK FLOWS

0	STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0	L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
0	1069.44	2824.64	1.20	2825.85	14.3	8.80	1.20	2827.05	.00	1.41		1.60	.00	.00	0	.00
0	.75	.08239					.01486	.01			.70			.00		
0	1070.19	2824.71	1.26	2825.97	14.3	8.39	1.09	2827.06	.00	1.41		1.60	.00	.00	0	.00
0	.47	.08239					.01345	.01			.70			.00		
0	1070.66	2824.75	1.33	2826.08	14.3	8.00	1.00	2827.07	.00	1.41		1.60	.00	.00	0	.00
0	.18	.08239					.01231	.00			.70			.00		
0	1070.84	2824.76	1.41	2826.17	14.3	7.63	.90	2827.07	.00	1.41		1.60	.00	.00	0	.00
0	8.70	.00940					.01158	.10			1.60			.00		
0	1079.54	2824.84	1.51	2826.35	14.3	7.27	.82	2827.17	.00	1.41		1.60	.00	.00	0	.00
0	9.37	.00940					.01145	.11			1.60			.00		
0	1088.91	2824.93	1.55	2826.48	14.3	7.18	.80	2827.28	.00	1.41		1.60	.00	.00	0	.00
0	.00	.00940					.00578	.00			1.60			.00		
0	1088.91	2824.93	1.55	2826.48	14.3	7.18	.80	2827.28	.00	1.41		1.60	.00	.00	0	.00

1

STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
Portions Copyrighted by CIVILSOFT, 1986, 1987, 1989

Version 1.20
Serial Number 07010220

Jul 5, 2017 10: 7:11

Input file : elkdidr3.txt
Output file: elkdidr3.out

INPUT FILE LISTING

```
T1 RESD
T2 RANCHO ELKORN STORM DRAIN - 3-20" CONNECTION FROM DR HORTON DEVELOPMENT
T3 ULTIMATE CONDITION 100-YEAR PEAK FLOWS
SO    1004.952814.89  1      .013                2814.98
R     1023.812824.09  1      .013
R     1068.172824.54  1      .013
R     1070.842824.76  1      .013
R     1088.912824.93  1      .013
SH    1088.912824.93  1      .013
1                                                    SP
                                  WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING                                  PAGE    1
0 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
  CODE   NO   TYPE  PIERS   WIDTH    DIAMETER  WIDTH              DROP

  CD      1    4                      1.60
 ERROR MESSAGE NUMBER  7 IN SEQUENCE CHECKING THRU CHANNEL DEFINITION DATA
 INVALID CARD CODE ENCOUNTERED WHILE PROCESSING CD AND PTS CARDS - CODE =
1                                                                                                                   PAGE NO   1
0                              WATER SURFACE PROFILE - TITLE CARD LISTING
0HEADING LINE NO 1 IS -
0                                RESD
0HEADING LINE NO 2 IS -
0                                RANCHO ELKORN STORM DRAIN - 3-20" CONNECTION FROM DR HORTON DEVELOPMENT
0HEADING LINE NO 3 IS -
0                                ULTIMATE CONDITION 100-YEAR PEAK FLOWS
1                                                                                                                   PAGE NO   2
0                              WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO   1 IS A SYSTEM OUTLET      *          *      *
                     U/S DATA    STATION    INVERT  SECT                                        W S ELEV
                                   1004.95 2814.89    1                                          2814.98
0 ELEMENT NO   2 IS A REACH                *          *      *
                     U/S DATA    STATION    INVERT  SECT              N                  RADIUS  ANGLE  ANG PT  MAN H
                                   1023.81 2824.09    1             .013                     .00    .00     .00      0
0 ELEMENT NO   3 IS A REACH                *          *      *
                     U/S DATA    STATION    INVERT  SECT              N                  RADIUS  ANGLE  ANG PT  MAN H
                                   1068.17 2824.54    1             .013                     .00    .00     .00      0
0 ELEMENT NO   4 IS A REACH                *          *      *
                     U/S DATA    STATION    INVERT  SECT              N                  RADIUS  ANGLE  ANG PT  MAN H
                                   1070.84 2824.76    1             .013                     .00    .00     .00      0
0 ELEMENT NO   5 IS A REACH                *          *      *
                     U/S DATA    STATION    INVERT  SECT              N                  RADIUS  ANGLE  ANG PT  MAN H
                                   1088.91 2824.93    1             .013                     .00    .00     .00      0
0 ELEMENT NO   6 IS A SYSTEM HEADWORKS                  *                    *
                     U/S DATA    STATION    INVERT  SECT                                        W S ELEV
                                   1088.91 2824.93    1                                            .00
 NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

 ** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC
1                                                                                                                   PAGE    1
                                        WATER SURFACE PROFILE LISTING
                          RESD
                          RANCHO ELKORN STORM DRAIN - 3-20" CONNECTION FROM DR HORTON DEVELOPMENT
                          ULTIMATE CONDITION 100-YEAR PEAK FLOWS
0 STATION    INVERT   DEPTH     W.S.        Q       VEL     VEL      ENERGY   SUPER  CRITICAL          HGT/   BASE/    ZL   NO  AVBPR
              ELEV   OF FLOW    ELEV                       HEAD    GRD.EL.   ELEV    DEPTH             DIA    ID NO.        PIER
0 L/ELEM      SO                                          SF AVE     HF                NORM DEPTH                        ZR
*****************************************************************************************************************************
0  1004.95  2814.89      .54   2815.43      14.3   23.79    8.80   2824.23    .00     1.41             1.60      .00   .00   0    .00
0  1004.95  2814.89      .54   2815.43      14.3   23.79    8.80   2824.23    .00     1.41             1.60      .00   .00   0    .00
0     2.35   .48782                                       .20224     .48                 .44                        .00
0  1007.30  2816.04      .56   2816.60      14.3   22.83    8.10   2824.70    .00     1.41             1.60      .00   .00   0    .00
0     2.32   .48782                                       .17892     .42                 .44                        .00
0  1009.62  2817.17      .58   2817.75      14.3   21.77    7.37   2825.12    .00     1.41             1.60      .00   .00   0    .00
0     1.96   .48782                                       .15690     .31                 .44                        .00
0  1011.58  2818.13      .60   2818.73      14.3   20.76    6.70   2825.42    .00     1.41             1.60      .00   .00   0    .00
0     1.68   .48782                                       .13758     .23                 .44                        .00
0  1013.26  2818.94      .62   2819.57      14.3   19.79    6.09   2825.65    .00     1.41             1.60      .00   .00   0    .00
0     1.44   .48782                                       .12069     .17                 .44                        .00
0  1014.71  2819.65      .64   2820.29      14.3   18.87    5.53   2825.83    .00     1.41             1.60      .00   .00   0    .00
0     1.26   .48782                                       .10594     .13                 .44                        .00
0  1015.96  2820.26      .67   2820.93      14.3   17.99    5.03   2825.96    .00     1.41             1.60      .00   .00   0    .00
0     1.10   .48782                                       .09302     .10                 .44                        .00
0  1017.06  2820.80      .69   2821.49      14.3   17.16    4.57   2826.06    .00     1.41             1.60      .00   .00   0    .00
0      .96   .48782                                       .08172     .08                 .44                        .00
0  1018.02  2821.27      .72   2821.98      14.3   16.36    4.16   2826.14    .00     1.41             1.60      .00   .00   0    .00
0      .84   .48782                                       .07181     .06                 .44                        .00
0  1018.87  2821.68      .74   2822.42      14.3   15.60    3.78   2826.20    .00     1.41             1.60      .00   .00   0    .00
0      .74   .48782                                       .06317     .05                 .44                        .00
1                                                                                                                   PAGE    2
                                        WATER SURFACE PROFILE LISTING
                          RESD
                          RANCHO ELKORN STORM DRAIN - 3-20" CONNECTION FROM DR HORTON DEVELOPMENT
                          ULTIMATE CONDITION 100-YEAR PEAK FLOWS
0 STATION    INVERT   DEPTH     W.S.        Q       VEL     VEL      ENERGY   SUPER  CRITICAL          HGT/   BASE/    ZL   NO  AVBPR
              ELEV   OF FLOW    ELEV                       HEAD    GRD.EL.   ELEV    DEPTH             DIA    ID NO.        PIER
0 L/ELEM      SO                                          SF AVE     HF                NORM DEPTH                        ZR
*****************************************************************************************************************************
0  1019.61  2822.04      .77   2822.81      14.3   14.87    3.44   2826.25    .00     1.41             1.60      .00   .00   0    .00
```

ELKDIDR3

0	.65	.48782					.05561	.04			.44			.00		
0	1020.26	2822.36	.80	2823.16	14.3	14.18	3.12	2826.29	.00	1.41		1.60	.00	.00	0	.00
0	.58	.48782					.04898	.03			.44			.00		
0	1020.84	2822.64	.83	2823.47	14.3	13.52	2.84	2826.31	.00	1.41		1.60	.00	.00	0	.00
0	.51	.48782					.04317	.02			.44			.00		
0	1021.35	2822.89	.87	2823.75	14.3	12.89	2.58	2826.34	.00	1.41		1.60	.00	.00	0	.00
0	.45	.48782					.03809	.02			.44			.00		
0	1021.79	2823.11	.90	2824.01	14.3	12.29	2.35	2826.35	.00	1.41		1.60	.00	.00	0	.00
0	.39	.48782					.03365	.01			.44			.00		
0	1022.18	2823.30	.94	2824.23	14.3	11.72	2.13	2826.37	.00	1.41		1.60	.00	.00	0	.00
0	.34	.48782					.02974	.01			.44			.00		
0	1022.53	2823.46	.97	2824.44	14.3	11.17	1.94	2826.38	.00	1.41		1.60	.00	.00	0	.00
0	.29	.48782					.02633	.01			.44			.00		
0	1022.82	2823.61	1.01	2824.62	14.3	10.65	1.76	2826.38	.00	1.41		1.60	.00	.00	0	.00
0	.25	.48782					.02337	.01			.44			.00		
0	1023.07	2823.73	1.06	2824.79	14.3	10.16	1.60	2826.39	.00	1.41		1.60	.00	.00	0	.00
0	.22	.48782					.02077	.00			.44			.00		
0	1023.29	2823.84	1.10	2824.94	14.3	9.68	1.46	2826.39	.00	1.41		1.60	.00	.00	0	.00
0	.18	.48782					.01850	.00			.44			.00		
0	1023.47	2823.92	1.15	2825.07	14.3	9.23	1.32	2826.40	.00	1.41		1.60	.00	.00	0	.00
0	.14	.48782					.01655	.00			.44			.00		

1 PAGE 3

WATER SURFACE PROFILE LISTING

RESD
RANCHO ELKORN STORM DRAIN - 3-20" CONNECTION FROM DR HORTON DEVELOPMENT
ULTIMATE CONDITION 100-YEAR PEAK FLOWS

0	STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0	L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
0	1023.61	2823.99	1.20	2825.20	14.3	8.80	1.20	2826.40	.00	1.41		1.60	.00	.00	0	.00
0	.11	.48782					.01486	.00			.44			.00		
0	1023.71	2824.04	1.26	2825.31	14.3	8.39	1.09	2826.40	.00	1.41		1.60	.00	.00	0	.00
0	.07	.48782					.01345	.00			.44			.00		
0	1023.78	2824.08	1.33	2825.41	14.3	8.00	1.00	2826.40	.00	1.41		1.60	.00	.00	0	.00
0	.03	.48782					.01231	.00			.44			.00		
0	1023.81	2824.09	1.41	2825.50	14.3	7.63	.90	2826.40	.00	1.41		1.60	.00	.00	0	.00
0	13.18	.01014					.01158	.15			1.60			.00		
0	1036.99	2824.22	1.51	2825.73	14.3	7.27	.82	2826.56	.00	1.41		1.60	.00	.00	0	.00
0	1.16	.01014					.01135	.01			1.60			.00		
0	1038.16	2824.24	1.51	2825.75	14.3	7.27	.82	2826.57	.00	1.41		1.60	.00	.00	0	.00
0	HYDRAULIC JUMP													.00		
0	1038.16	2824.24	1.30	2825.54	14.3	8.16	1.03	2826.57	.00	1.41		1.60	.00	.00	0	.00
0	9.02	.01014					.01385	.12			1.60			.00		
0	1047.18	2824.33	1.25	2825.58	14.3	8.48	1.12	2826.70	.00	1.41		1.60	.00	.00	0	.00
0	10.62	.01014					.01520	.16			1.60			.00		
0	1057.80	2824.43	1.19	2825.63	14.3	8.89	1.23	2826.86	.00	1.41		1.60	.00	.00	0	.00
0	10.37	.01014					.01694	.18			1.60			.00		
0	1068.17	2824.54	1.14	2825.68	14.3	9.33	1.35	2827.03	.00	1.41		1.60	.00	.00	0	.00
0	.25	.08239					.01767	.00			.70			.00		
0	1068.42	2824.56	1.15	2825.71	14.3	9.23	1.32	2827.04	.00	1.41		1.60	.00	.00	0	.00
0	1.02	.08239					.01655	.02			.70			.00		

1 PAGE 4

WATER SURFACE PROFILE LISTING

RESD
RANCHO ELKORN STORM DRAIN - 3-20" CONNECTION FROM DR HORTON DEVELOPMENT
ULTIMATE CONDITION 100-YEAR PEAK FLOWS

0	STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0	L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
0	1069.44	2824.64	1.20	2825.85	14.3	8.80	1.20	2827.05	.00	1.41		1.60	.00	.00	0	.00
0	.75	.08239					.01486	.01			.70			.00		
0	1070.19	2824.71	1.26	2825.97	14.3	8.39	1.09	2827.06	.00	1.41		1.60	.00	.00	0	.00
0	.47	.08239					.01345	.01			.70			.00		
0	1070.66	2824.75	1.33	2826.08	14.3	8.00	1.00	2827.07	.00	1.41		1.60	.00	.00	0	.00
0	.18	.08239					.01231	.00			.70			.00		
0	1070.84	2824.76	1.41	2826.17	14.3	7.63	.90	2827.07	.00	1.41		1.60	.00	.00	0	.00
0	8.70	.00940					.01158	.10			1.60			.00		
0	1079.54	2824.84	1.51	2826.35	14.3	7.27	.82	2827.17	.00	1.41		1.60	.00	.00	0	.00
0	9.37	.00940					.01145	.11			1.60			.00		
0	1088.91	2824.93	1.55	2826.48	14.3	7.18	.80	2827.28	.00	1.41		1.60	.00	.00	0	.00
0	.00	.00940					.00578	.00			1.60			.00		
0	1088.91	2824.93	1.55	2826.48	14.3	7.18	.80	2827.28	.00	1.41		1.60	.00	.00	0	.00

1

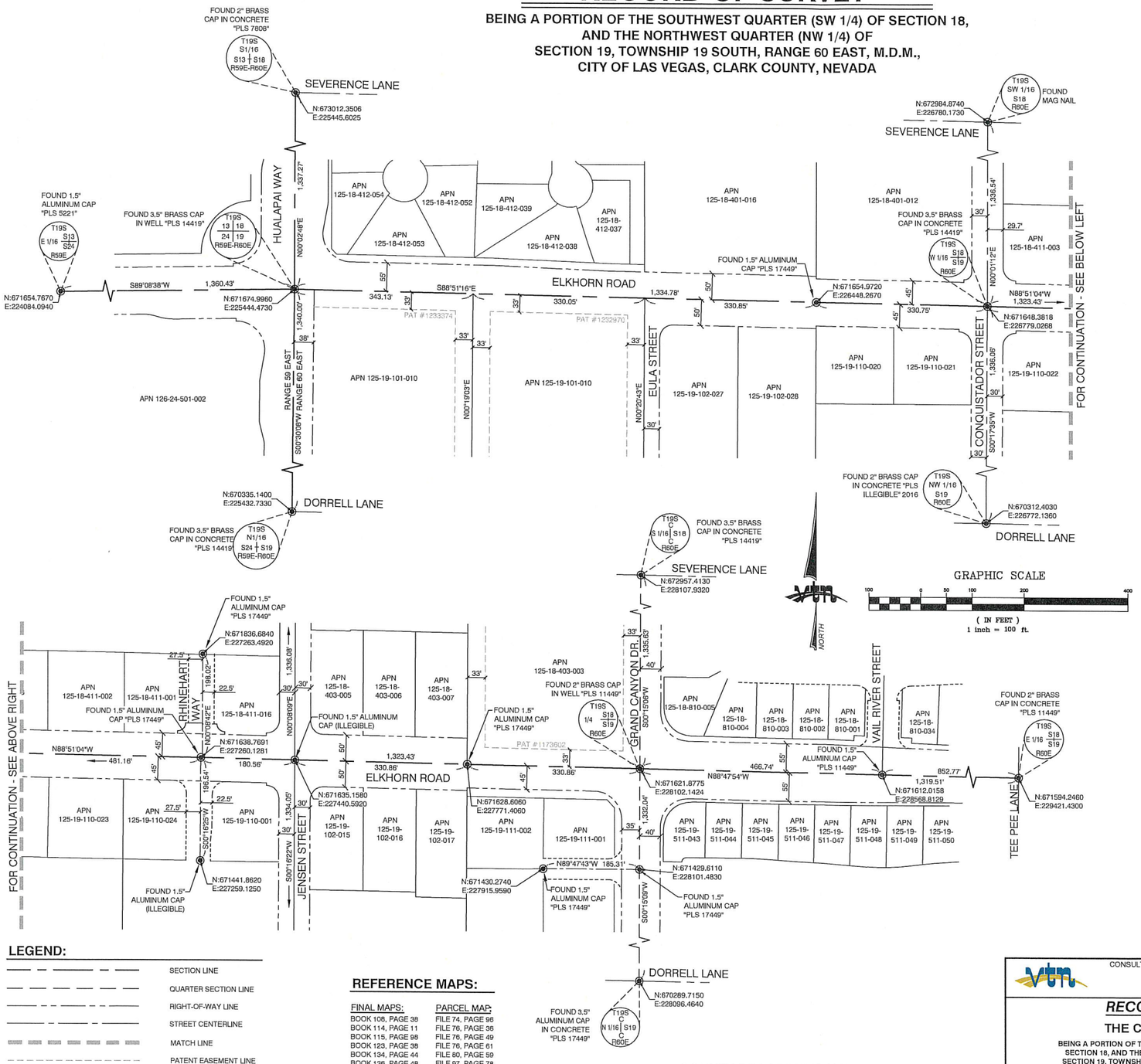
Appendix E

Appendix F

APPENDIX F.1
RECORD OF SURVEY

RECORD OF SURVEY

BEING A PORTION OF THE SOUTHWEST QUARTER (SW 1/4) OF SECTION 18, AND THE NORTHWEST QUARTER (NW 1/4) OF SECTION 19, TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.D.M., CITY OF LAS VEGAS, CLARK COUNTY, NEVADA



SURVEYOR'S CERTIFICATE:

I, RAYMOND A. JOHNSON, A PROFESSIONAL LAND SURVEYOR LICENSED IN THE STATE OF NEVADA, AS AN AGENT FOR VTN, 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 SECTIONS 18 AND 19, TOWNSHIP 19 SOUTH, RANGE 60 EAST, CITY OF LAS VEGAS, CLARK COUNTY, NEVADA, AND THE SURVEY WAS COMPLETED ON MAY 12, 2017.
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 CONDUCTED IN ACCORDANCE WITH CHAPTER 625 OF THE NEVADA ADMINISTRATIVE CODE.
4. THE MONUMENTS DEPICTED ON THE PLAT ARE OF THE CHARACTER SHOWN OCCUPY THE POSITIONS INDICATED AND ARE OF SUFFICIENT NUMBER AND DURABILITY.

RAYMOND A. JOHNSON, P.L.S.
NEVADA CERTIFICATE NO. 18983

PROFESSIONAL LAND SURVEYOR STATE OF NEVADA RAYMOND A. JOHNSON EXP. 6-30-17 CERT. NO. 18983

05/31/2017

BASIS OF BEARINGS AND COORDINATES:

GRID NORTH AS DEFINED BY THE CENTRAL MERIDIAN OF THE NEVADA COORDINATE REFERENCE SYSTEM (NCRS), LAS VEGAS ZONE, NORTH AMERICAN DATUM OF 1983; SAID MERIDIAN BEING COINCIDENT WITH 114°58' WEST OF THE GREENWICH MERIDIAN.

LINEAR UNIT: US SURVEY FOOT (FTUS)

DATUM (REFERENCE FRAME): NAD 83 (2011) EPOCH 2010.00
SYSTEM:NEVADA COORDINATE REFERENCE SYSTEM (NCRS)

ZONE: LAS VEGAS

PROJECTION: TRANSVERSE MERCATOR
STANDARD PARALLEL (AND LATITUDE OF GRID ORGIN):36°15'00"N
LONGITUDE OF CENTRAL MERIDIAN:114°58'00"W
NORTHING AT GRID ORIGIN: 200,000.000 M (656,166.6667 FTUS)
EASTING AT CENTRAL MERIDIAN: 100,000.000 M (328,083.3333 FTUS)
SCALE FACTOR ON CENTRAL MERIDIAN: 1.0001 (EXACT)

NOTES:
1. ALL DISTANCES AND BEARINGS SHOWN HEREON ARE PROJECTED (GRID) VALUES BASED ON THE PRECEDING PROJECTION DEFINITION. THE PROJECTION WAS DEFINED SUCH THAT PROJECTED (GRID) DISTANCES ARE EQUIVALENT TO "GROUND" DISTANCES IN THE PROJECT AREA.
2. GRID BEARINGS SHOWN HEREON (OR IMPLIED BY GRID COORDINATES) DO NOT EQUAL GEODETIC BEARINGS DUE TO MERIDIAN CONVERGENCE.

BENCHMARK:

NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) (REVISED 2014)

CITY OF LAS VEGAS BENCHMARK: 119019-NW6LV
NAVD88 ELEVATION: 849.227 METERS (2786.17 FEET)

RIVET AND PLATE IN CONCRETE TRANSFORMER PAD, NORTH SIDE DORRELL LANE 175' EAST OF CONQUISTADOR STREET.

SURVEYOR'S NOTES:

1) THIS FIELD SURVEY WAS PERFORMED TO ESTABLISH AND MEMORIALIZE THE LEGAL RIGHTS-OF-WAY AND/OR BOUNDARY LIMITS FOR THE CONSTRUCTION OF ROADWAY AND OFFSITE IMPROVEMENTS ON RESPECTIVE ROADWAYS AND TO PROVIDE A PLAN FOR THE MONUMENTATION OF ALL INTERSECTIONS; OTHER CONTROL POINTS WILL BE MONUMENTED IN ACCORDANCE WITH APPLICABLE STATE STATUTES AND LOCAL ORDINANCES AT THE COMPLETION OF ROADWAY CONSTRUCTION.

2) COORDINATES SHOWN HEREON ARE FOR ACTUAL MONUMENTS LOCATIONS REGARDLESS OF THEIR POSITION FROM RESOLVED CORNER LOCATIONS. INVERSES OF COORDINATES MAY PRODUCE DISCREPANCIES FROM ANNOTATION OF RESOLVED ALIGNMENTS WITHIN ACCEPTABLE TOLERANCES.

LEGEND:

- SECTION LINE
- QUARTER SECTION LINE
- RIGHT-OF-WAY LINE
- STREET CENTERLINE
- MATCH LINE
- PATENT EASEMENT LINE
- FOUND MONUMENT AS DESCRIBED
- APN — ASSESSOR'S PARCEL NUMBER

REFERENCE MAPS:

FINAL MAPS:	PARCEL MAP:
BOOK 106, PAGE 38	FILE 74, PAGE 96
BOOK 114, PAGE 11	FILE 76, PAGE 36
BOOK 115, PAGE 98	FILE 76, PAGE 49
BOOK 123, PAGE 38	FILE 76, PAGE 61
BOOK 134, PAGE 44	FILE 80, PAGE 59
BOOK 136, PAGE 48	FILE 97, PAGE 78
BOOK 146, PAGE 17	
BOOK 147, PAGE 90	
BOOK 151, PAGE 89	

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 NRS 278.5695

CONSULTING ENGINEERS • PLANNERS • LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA, 89146-5148
(702) 873-7550 FAX (702) 362-2597

RECORD OF SURVEY

THE CITY OF LAS VEGAS

BEING A PORTION OF THE SOUTHWEST QUARTER (SW 1/4) OF SECTION 18, AND THE NORTHWEST QUARTER (NW 1/4) OF SECTION 19, TOWNSHIP 19 SOUTH, RANGE 60 EAST, M.D.M., CITY OF LAS VEGAS, CLARK COUNTY, NEVADA

FILE: G:\7842\MAPPING	W.O.# 7842	DATE: 5-25-17	SHEET	OF
RECORD OF SURVEY\7842 ROS	DRN. BY: WLB	REV:	1	1
	CKD. BY: TJ			

CIP

NO. _____
FILED AT THE REQUEST OF
THE CITY OF LAS VEGAS
DATED _____ AT _____ M
FILE _____ PAGE _____
OF SURVEYS
OFFICIAL RECORDS
BOOK NO. _____
CLARK COUNTY, NEVADA RECORDS
DEBBIE CONWAY - RECORDER
FEE $_____ DEPUTY _____

MWH now part of Stantec

DC
7/10/2017

RANCHO ROAD SYSTEM STORM DRAIN - ELKHORN PROJECT
30% Design

Opinion of Probable Construction Costs (OPCC)

Currency: USD-United States-JUN 2017 Dollar

BI#	Description	Quantity	UOM	Unit Price	Final Total
Item	Description				
109.01	*Owner Initiated Time Extension Allowance*	30	DAY	500.00	*$15,000.00*
109.02	*Allowance*	30	DAY	500.00	*$15,000.00*
200.01	*Mobilization and Demobilization*	1	LS	100,000.00	*$100,000.00*
202.01	*Demolish and Remove Concrete Overflow Weir Structure*	1	LS	11,000.00	*$11,000.00*
202.02	*Demolish and Remove 6'x4' Concrete Arch Culvert*	123	LF	126.00	*$15,498.00*
202.03	*Demolish and Remove 18" RCP Storm Drain*	25	LF	82.00	*$2,009.00*
202.04	*Demolish and Remove 24" RCP Storm Drain*	289	LF	40.00	*$11,560.00*
202.05	*Demolish and Remove 54" RCP Storm Drain*	133	LF	50.00	*$6,650.00*
202.06	*Demolish and Remove Drop Inlet*	2	EA	5,000.00	*$10,000.00*
202.07	*Demolish and Remove Storm Drain Manhole*	5	EA	11,000.00	*$55,000.00*
202.08	*Excavate and Remove Temporary Fill at Drainage Easement*	31	CY	10.00	*$311.11*
212.01	*Landscape Restoration*	1	LS	40,000.00	*$40,000.00*
213.01	*Irrigation System Restoration*	1	LS	10,000.00	*$10,000.00*
302.01	*Type II Aggregate Base for Roadway*	588	CY	25.00	*$14,707.41*
402.01	*6" Plantmix Bituminous Pavement*	1,495	TON	130.00	*$194,366.25*
402.02	*2.75" Inch Mill and Overlay*	5,411	SY	20.00	*$108,222.22*
402.03	*Fog Seal*	9,841	SY	0.40	*$3,936.44*
502.01	*Precast 7'x6' Reinforced Concrete Box*	2,888	LF	550.00	*$1,588,400.00*
502.02	*Cast In Place Transition Structure STA 9+62.06*	1	LS	45,000.00	*$45,000.00*
502.03	*Cast In Place Transition Structure STA 10+69.50*	1	LS	65,000.00	*$65,000.00*
603.01	*18" Reinforced Concrete Pipe (Class III)*	258	LF	125.00	*$32,250.00*
603.02	*30" Reinforced Concrete Pipe (Class III)*	282	LF	200.00	*$56,400.00*
603.03	*54" Reinforced Concrete Pipe (Class III)*	22	LF	450.00	*$9,900.00*
605.01	*Triple 20" C905 PVC Culverts*	26	LF	345.00	*$8,970.00*
609.01	*48" RCB Riser Manhole*	8	EA	3,500.00	*$28,000.00*
609.02	*60" Storm Drain Manhole - Type II*	1	EA	11,500.00	*$11,500.00*
609.03	*72" Storm Drain Junction Structure Manhole*	3	EA	25,000.00	*$75,000.00*
609.04	*20' Type CM Drop Inlet*	2	EA	15,000.00	*$30,000.00*
609.05	*17.5' Type CM Drop Inlet*	1	EA	25,000.00	*$25,000.00*
609.06	*17.5' Type C-D Drop Inlet*	1	EA	25,000.00	*$25,000.00*
609.07	*12.5' Type CM Drop Inlet*	1	EA	17,750.00	*$17,750.00*
609.08	*12.5' Type C-D Drop Inlet*	1	EA	17,750.00	*$17,750.00*
609.09	*10' Type CM Drop Inlet*	1	EA	14,250.00	*$14,250.00*
609.1	*10' Type C-D Drop Inlet*	1	EA	14,250.00	*$14,250.00*
613.01	*Sidewalk*	50	SY	40.00	*$2,000.00*
622.01	*Construction Survey*	1	LS	9,000.00	*$9,000.00*
624.01	*Traffic Control*	1	LS	25,000.00	*$25,000.00*
628.01	*Pavement Marking Restoration*	1	LS	10,000.00	*$10,000.00*
629.01	*12" PVC Water Line Relocation*	1	LS	60,000.00	*$60,000.00*
637.01	*Dust Control*	1	LS	18,000.00	*$18,000.00*
637.02	*NPDES Permit*	1	LS	3,500.00	*$3,500.00*
	SUBTOTAL				$2,805,180.44
	30% Design Contingency	20	%		*$561,036*
	TOTAL CONSTRUCTION DIRECT AND INDIRECT OPCC				$3,366,217

Cost Range:	$2,861,284	$4,039,460

OPCC Disclaimer

The client hereby acknowledges that MWH has no control over the costs of labor, materials, competitive bidding environments, unidentified field conditions, financial and/or commodity market conditions, or any other factors likely to affect the OPCC of this project, all of which are and will unavoidably remain in a state of change, especially in light of high market volatility attributable to Acts of God and other market forces or events beyond the control of the parties. As such, Client recognizes that this OPCC deliverable is based on normal market conditions, defined by stable resources supply/demand relationships, and does not account for extreme inflationary or deflationary market cycles. Client further acknowledges that this OPCC is a "snapshot in time" and that the reliability of this OPCC will degrade over time. Client agrees that MWH cannot and does not make any warranty, promise, guarantee, or representation, either express or implied that proposals, bids, project construction costs, or cost of O&M functions will not vary significantly from MWH's food faith Class 4 OPCC.

Class 4 estimates are generally prepared based on limited information and subsequently have fairly wide accuracy ranges. Typically engineering is 10% to 40% complete. They are typically used for project screening, determination of feasibility, concept evaluation, and preliminary budget approval. Virtually all Class 4 estimates uses stochastic estimating methods such as cost curves, capacity factors, and other parametric and modelling techniques. Expected accuracy ranges are from -15% to -30% on the low side and +20% to 50% high on high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances. (AACE International Recommended Practices and Standards).