

**70% PRELIMINARY DESIGN REPORT FOR
Ann Road Channel West – Rainbow Boulevard
CLV Hansen No. 36801**

Prepared for:



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

Prepared by:

JACOBS

**319 E. Warm Springs Rd., Ste. 200
Las Vegas, NV 89119
Office: (702) 938-5400
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**April 2011
Jacobs Project No. W4X53700**

April 14, 2011
CLV Hansen No. 36801
Jacobs Project No. W4X53700

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

Subject: Ann Road Channel West – Rainbow Boulevard Preliminary Design Report
(70%)

Dear Mr. McConnell:

Submitted for your review is a copy of the subject Preliminary Design Report as required by agreement between the City of Las Vegas and Jacobs Engineering Group, Inc. This report stands as the 70% design submittal and any comments or subsequent design is included herein. All new or revised figures and exhibits are included in the Appendix; anything that is unchanged from the initial submittal has not been resubmitted at this time. The final design report will incorporate all figures and exhibits under one comprehensive report.

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

Sincerely,
Jacobs Engineering Group, Inc.



Tara T. Alexander, P.E.
Project Manager

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: ANN ROAD CHANNEL WEST – RAINBOW BOULEVARD Date: April 14, 2011

Location of Development: a) Descriptive (Cross Streets): North/South Placid Street

East/West Arby Avenue

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

c) APN: 125-27-899-043 & 045, 125-27-899-004, 006, 007, 049, 125-27-799-003, 125-27-699-009

125-26-299-002, 125-26-399-001, 004, 125-26-499-001, 019, 028

Name of Owner: City of Las Vegas, NV

Telephone Number: (702) 229-2186 Fax No.: (702) 382-3232

E-mail Address: rmccconnell@lasvegasnevada.gov

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

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

Telephone Number: (702) 938-5400

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

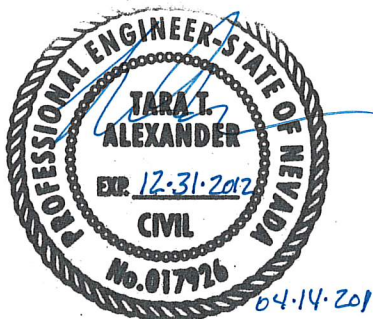
Firm: JACOBS Engineering Group

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

Type of Land Development/Land Disturbance Process:

☐	Rezoning	☐	Subdivision Map	☐	Clearing and Grading Only
☐	Parcel Map	☐	Planned Unit Development	☒	Other (Please specify below) Regional Drainage Facility
☐	Large Parcel Map	☐	Building Permit	☐	

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



Engineer's Seal

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

*New Required Field

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

	Revision	Date
Local Entity File Number		

REFERENCE:

STANDARD FORM 1





**City of Las Vegas
Hansen No. 36801
Ann Road Channel West – Rainbow Boulevard**

**Design Memorandum
To Accompany The 70% Submittal
14 April 2011**

Work Accomplished

General:

- Comments have been received from the following entities: Regional Flood Control District, CLV Flood Control, CLV Project Manager, CLV Traffic, CLV Sanitary Sewer, Clark County Public Works, Las Vegas Valley Water District, Southwest Gas, Century Link, COX, and NVE Transmission. All comments have been compiled into a comment matrix and are addressed within.
- An updated overall PDR is not requested with this submittal; however, the narrative at the beginning of the report is provided in this submittal. Additional description of the drainage system is provided in the narrative along with the addressed PDR comments by Regional Flood Control and CLV Flood Control. An updated Figure A-5, *Permit Matrix*, is also included as it has been updated per a comment by Peter Jackson from CLV Flood Control.
- A copy of all final approved progress meeting notes will be added to Appendix G of the PDR. The approved meeting notes thus far are included in this memorandum.
- An unbound preliminary copy of the Special Provisions is provided in a hardcopy version and copy is provided on the CD.
- An updated cost estimate is included in this memorandum and excel version is provided on the CD.

Hydraulic Design:

- Hydraulic models using WSPGW was performed for the sizing of the main storm drain line in Ann Road and Tropical Parkway.
- All tie-in laterals have been analyzed using Standard Form 6 from the Clark County Drainage Manual.
- A storm drain exhibit which illustrates the proposed storm system has been created.
- All hydraulic calculations for surface flow and the drop inlets have been incorporated.

- The following additional Figures will be incorporated into the final Design Report and are included herein:
 - FIGURE D-3 INLET OPTIONS
 - FIGURE D-4 STORM DRAIN EXHIBIT
 - FIGURE D-5 HYDRAULIC SECTION SUMMARY (2 TOTAL)
 - FIGURE D-6 WSPGW ANN ROAD TO EASEMENT
 - FIGURE D-7 WSPGW JUNCTION TO TROPICAL PKWY
 - FIGURE D-8 NOMOGRAPH
 - FIGURE D-9 STANDARD FORM 6
 - FIGURE D-10 DROP INLET CALCULATIONS
 - FIGURE D-11 HYDRAULIC SECTIONS
 - FIGURE D-12 DRY LANE SUMMARY

Improvement Plans:

- Further refinements of the 30% design plans are included.
- The plan/profiles and lateral sections for the proposed storm drain have been included.
- Details and trenching for preliminary storm drain have been included.
- All tie-in laterals have been analyzed using Standard Form 6 from the Clark County Drainage Manual.
- Existing utilities have been located and conflicts are shown.
- Changes to the sanitary sewer north of the Ann Road intersection have been added.

Objectives for Next Submittal (90%)

General:

- Traffic control plans will be included based on the school route and on obtaining an Authorization to Enter Property (AEP) for parcels 125-26-304-005, 006 & 007.
- An updated Utility Conflict Matrix and Exhibit based on acceptance of submitted design.

Design:

- Refinement and updates on the storm system design will be included.
- Coordination with Southwest Gas on the franchise agreement for the impacted roadways and drainage easement in order to determine bid items.
- Coordination with NVE transmission on existing power pole north of Ann Road.
- Coordination with all other utilities on conflicts and relocates as shown in the 70% plans.

Improvement Plans:

- Grading sheets for the drainage easement, existing grading and nuisance inlet locations.
- Striping Plans.
- Utility relocations plans and details.
- Structural design and details.

No.	Design Phase	Reviewer/Source	Sheet/Location	Subject	Comment	Jacobs Action/Response
1	30% Submittal	Peter Jackson, CLV Flood Control	No. 1 - Comment Letter	Drainage Memorandum	Flood Control takes no exception to the overall Hydrology presented as it complies with the overall drainage parameters. Flood Control recommends that the Design Report expand upon the MPU and facility flow information. See attached report comments to assist in the revisions to the report narrative. Review Figure C-10 to verify the Q100 @CP9. Revise and update the text and Tables accordingly. Provide an electronic copy of the HEC-1 analysis including both input and output files with the Final Design Report.	All changes to the design report and Figure C-10 will be addressed and incorporated in the final design report. Also, an electronic HEC-1 analysis will be provided with the Final Design Report.
2	30% Submittal	Peter Jackson, CLV Flood Control	No. 2 - Comment Letter	Drainage Memorandum	Provide a WSPG analysis for the proposed storm drain system based upon the HEC-1 flow data. The WSPG and the HEC-1 data need to match the proposed system parameters.	The WSPG analysis will be included in the 70% submittal.
3	30% Submittal	Peter Jackson, CLV Flood Control	No. 3 - Comment Letter	Drainage Memorandum	The Final Design Report needs to include an expanded discussion on the utility conflicts along the RCB alignment and the impacts on the project construction. Plans must reflect the existing sewer system, including the residential lateral facility connections. The sewer laterals need to be shown on the plans to verify that the sewer laterals are able to be connected into either a new sewer main or another existing sewer. Provide alignment recommendations that minimize utility relocations where practical, as the utility concerns to the constructability of this project appear to be a significant cost to this project. Update the Utility matrix information to include the new City address.	All comments will be incorporated within the final design report.
4	30% Submittal	Peter Jackson, CLV Flood Control	No. 4 - Comment Letter	Drainage Memorandum	The Design Report needs an Exhibit that shows the recommended storm drain system and labels the key concentration points with associated flows. The summary should include collected storm drain flows and the remaining street surface flows within Rainbow Boulevard.	A storm drain exhibit will be incorporated in the 70% submittal and a copy will be incorporated in the final design report.
5	30% Submittal	Peter Jackson, CLV Flood Control	No. 5 - Comment Letter	Drainage Memorandum	Show the RCB angle points by station location and angle change. This information is needed to allow for the use of precast RCB's as well as cast in place construction.	RCB angle points and angle changes have been incorporated in the Improvement plans.
6	30% Submittal	Peter Jackson, CLV Flood Control	No. 6 - Comment Letter	Drainage Memorandum	Provide details for the RCB construction. System design needs to accommodate the construction option of pre-cast or cast-in-place improvements. Verify that the Specifications and schedule accommodate the construction methods.	Details for the RCB construction will be included in the 70% submittal, further structural design will be developed in the 90% and 100% submittals.
7	30% Submittal	Peter Jackson, CLV Flood Control	No. 7 - Comment Letter	Drainage Memorandum	Provide a grated access structure within the existing Rio Vista Estates Drainage Easement for system access and maintenance. Refer to concept information shown on Sheet SD-02.	A grated access structure will not be incorporated into the 70% plans, a headwall is proposed at this location instead. Please refer to report for discussion.
8	30% Submittal	Peter Jackson, CLV Flood Control	No. 8 - Comment Letter	Drainage Memorandum	The storm drain system must be refined to provide for a transition structure for collecting the flows from the Rio Vista Estates development per the Manual requirements.	The storm drain system will be further refined for collecting the flows per the Manual requirements.
9	30% Submittal	Peter Jackson, CLV Flood Control	No. 9 - Comment Letter	Drainage Memorandum	Provide a detailed grading plan for the storm drain collection system at the Rio Vista Estates development. Provide details and sections of the proposed collection system.	Details and sections for the storm drain collection system at Rio Vista Estates will be provided.
10	30% Submittal	Peter Jackson, CLV Flood Control	No. 10 - Comment Letter	Drainage Memorandum	Provide Access Manholes along the RCB at 400-foot spacing. Adjust spacing to include Manholes near the junction structures for maintenance consideration. Consider using Manhole openings that are cast with the RCB's to reduce costs.	Manhole spacing has been adjusted to accommodate the 400-ft spacing requirements.
11	30% Submittal	Peter Jackson, CLV Flood Control	No. 11 - Comment Letter	Drainage Memorandum	The engineer must review the pipe hydraulics to verify system design to keep the HGL 18-inches below the finish grade.	In utilizing the existing information while running the WSPG analysis for the storm drain, it should be noted that the starting HGL in Ann Road at the beginning of the 9' x 6' RCB is 8.071 feet above the invert. The box is began as pressurized in the existing condition. Because of the geometry and the depth restrictions of this site, the box is proposed in many places to be right at 1' below the existing surface. When modeling the system, the progressively bigger downstream box sizes were utilized until bigger box sizes did not produce a significant drop in the HGL. The boxes were upsized greatly to what was originally proposed in the 30 % submittal. Starting at the downstream end, the boxes were upsized accordingly: 9'x5' to 12'x6', 9'x5' to 11'x5', 6'x4' to 9'x3' and 5'x4' to 9'x3'. The whole system is pressurized primarily because the downstream section is not able to flow like an open channel. Under the current conditions for the 70% submittal, it is not possible to obtain an HGL which is 1.5' below finish grade.
12	30% Submittal	Peter Jackson, CLV Flood Control	No. 12 - Comment Letter	Drainage Memorandum	Provide Plan and Profiles of the entire storm drain facility including laterals with the next submittal.	All profiles are provided on the 70% submittal.
13	30% Submittal	Peter Jackson, CLV Flood Control	No. 13 - Comment Letter	Drainage Memorandum	Provide updated storm drain design plans with the next submittal that include the design data and the complete construction notes. Include the inlet type, lengths, depth, number of grates, etc.	All Inlet data will be included in the next submittal.
14	30% Submittal	Peter Jackson, CLV Flood Control	No. 14 - Comment Letter	Drainage Memorandum	Provide detail sheets showing the drop inlet details for the proposed trench drain inlet, NDOT Type 2B and 412A inlets. Other inlet designs will be reviewed on a case by case basis.	Detail sheets will be provided on the next submittal.
15	30% Submittal	Peter Jackson, CLV Flood Control	No. 15 - Comment Letter	Drainage Memorandum	The Engineer should acquire and verify utility pothole information as soon as practical to determine additional constraints on the storm drain system design based upon the proposed design information. Consideration on utility relocations and impacts must be identified.	Pothole information has been acquired and verified. All utility relocations and impacts will be identified on the 70% drawing and further refined in the 90% and 100% drawings. Pothole data is included in the design report as Figure A-7.
16	30% Submittal	Peter Jackson, CLV Flood Control	No. 16 - Comment Letter	Drainage Memorandum	Provide Inlet calculations based upon system design with the next submittal. Review the grate type on the FlowMaster calculations to show vaned grates instead of the P-50 mm grates for the CM-DM / 412A Inlets.	Inlet calculations are provided with the next submittal. The use of vaned grates will be incorporated for the CM-DM / 412 inlets.

City of Las Vegas Department of Public Works
ANN ROAD CHANNEL WEST RAINBOW BOULEVARD - HANSEN NO. 36801

Review of 30% Submittal Dated 02/08/11

No.	Design Phase	Reviewer/Source	Sheet/Location	Subject	Comment	Jacob's Action/Response
17	30% Submittal	Peter Jackson, CLV Flood Control	No. 17 - Comment Letter	Drainage Memorandum	Provide details for the RCB structure connection to the existing box near the Ann Road and Rainbow Boulevard intersection.	The plan and profile view of the structure has been provided with the 70% plans, further refinement of the structural details and concrete sizes will be provided with the 90% submittal.
18	30% Submittal	Peter Jackson, CLV Flood Control	No. 18 - Comment Letter	Drainage Memorandum	Provide the lateral and inlet design information with the next submittal.	Lateral and Inlet design will be provided on next submittal.
19	30% Submittal	Peter Jackson, CLV Flood Control	No. 19 - Comment Letter	Drainage Memorandum	The existing and proposed utility crossings of the storm drain must be shown on the storm drain plan and profiles sheets and on the lateral profiles.	The existing utility crossings are shown on the 70% design plans. The proposed utility crossing will be refined with input from various utilities.
20	30% Submittal	Peter Jackson, CLV Flood Control	No. 20 - Comment Letter	Drainage Memorandum	Provide detail sheets showing typical details needed for the construction, connection and any special transition structure details. Structural details, if required, must be submitted by the 90% submittal.	Details will be provided for the transition section on the 70% submittal with structural details to be provided on the 90% submittal.
21	30% Submittal	Peter Jackson, CLV Flood Control	No. 21 - Comment Letter	Drainage Memorandum	Provide a concrete collar detail for the NDOT Type 2B inlets.	A concrete collar detail for NDOT 2B Inlets has been provided.
22	30% Submittal	Peter Jackson, CLV Flood Control	No. 22 - Comment Letter	Drainage Memorandum	Provide grading design information to collect the flows at the NDOT Type 2B area inlets.	Detailed grading design information will be provided in the next submittal.
23	30% Submittal	Peter Jackson, CLV Flood Control	No. 23 - Comment Letter	Drainage Memorandum	Provide preliminary plan and profiles for relocated sewer and/or water lines as necessary with the next submittal.	Preliminary plan and profile details will be provided with next submittal.
24	30% Submittal	Peter Jackson, CLV Flood Control	No. 24 - Comment Letter	Drainage Memorandum	A review of the Design Report shows minor comment revisions to the text to help refine how the information is presented. See attached comments for incorporation.	Attached comments are addressed and will be provided within the Final Design Report.
25	30% Submittal	Peter Jackson, CLV Flood Control	No. 25 - Comment Letter	Drainage Memorandum	Provide an updated detailed cost estimate with the next submittal for review. The cost estimate must be refined prior to the 90% submittal and request for construction funding to assure that the requested and allocated storm drain funds are sufficient for construction.	An updated detailed cost estimate has been provided with the next submittal.
26	30% Submittal	Peter Jackson, CLV Flood Control	No. 26 - Comment Letter	Drainage Memorandum	The Final Design report needs to include an electronic copy of the entire report with the input and output files for the hydraulics and hydrology.	The Final Design report will incorporate all input and output files for hydraulics and hydrology.
27	30% Submittal	Peter Jackson, CLV Flood Control	No. 27 - Comment Letter	Drainage Memorandum	Update the Permit matrix information to include the CCRFCD, the new City address and remove NDOT.	The permit matrix information is updated to include the CCRFCD, the new City address and removal of NDOT.
28	30% Submittal	Peter Jackson, CLV Flood Control	No. 28 - Comment Letter	Drainage Memorandum	Discuss and show any Traffic Signal Impacts to the existing Traffic Signal at the Ann Road and Rainbow Boulevard Intersection.	Traffic signal Impacts will be discussed for the Ann Road and Rainbow Boulevard Intersection.
29	30% Submittal	Peter Jackson, CLV Flood Control	No. 29 - Comment Letter	Drainage Memorandum	Discuss and show any Traffic Signal underground Impacts to the existing Tropical Parkway and Rainbow Boulevard Intersection.	Underground traffic signal impacts are show and construction notes have been added to the plans which address these concerns.
30	30% Submittal	Peter Jackson, CLV Flood Control	No. 30 - Comment Letter	Drainage Memorandum	Add a note for all storm drain drop inlets that references the newly adopted USDOCA Drawing No. 421 (Stormwater Quality Management Stamp and Sign Detail).	A construction note has been added to the plans which references Drawing No. 421.
31	30% Submittal	Peter Jackson, CLV Flood Control	No. 31 - Comment Letter	Drainage Memorandum	Additional comments are shown on the attached 30% storm drain plans.	Additional comments are addressed. Plans comments listed here from Peter are those not incorporated into the Drainage Memorandum Comments 1 through 31.
32	30% Submittal	Peter Jackson, CLV Flood Control	HC-01	Improvement Plans	±STA 147+75 - Move manhole in new section of pipe.	The manhole shown here is part of the existing system to be protected in place.
33	30% Submittal	Peter Jackson, CLV Flood Control	HC-02	Improvement Plans	±STA 148+00 - Locate inlet outside of pavement.	This is addressed on plans.
34	30% Submittal	Peter Jackson, CLV Flood Control	Typ. All Sheets	Improvement Plans	Show right-of-way.	This is addressed on plans.
35	30% Submittal	Peter Jackson, CLV Flood Control	SD/HC-03	Improvement Plans	±STA 164+55 - Recommend moving inlet to north side of Ambulance St. if possible.	This was considered; however, there are too many conflicts with underground electrical and underground cable. We avoid all conflict with inlet in current location.
36	30% Submittal	Peter Jackson, CLV Flood Control	RM-01	Improvement Plans	±STA 147+75 - Check clearance on SSMH.	This is addressed on plans.
37	30% Submittal	Peter Jackson, CLV Flood Control	SD Sheets (Typ.)	Improvement Plans	Verify grading to see if DI's are needed every 150'	This is addressed on plans.
38	30% Submittal	Peter Jackson, CLV Flood Control	SD-02	Improvement Plans	Provide detailed grading plan for easement area.	Detail grading plans will be provided with the next submittal.
39	30% Submittal	Peter Jackson, CLV Flood Control	SD TYP. All Sheets	Improvement Plans	Provide lengths of curb openings on all storm drain call-outs.	Actual lengths will vary based on final grate selected by contractor. Will show approximate whole lengths on plans.
40	30% Submittal	Peter Jackson, CLV Flood Control	SD-04	Improvement Plans	±STA 21+87 - If possible connect under drain into back of inlet.	This is addressed on plans.
41	30% Submittal	Todd L. Myers, RFCD	Comment 1	General	The PDR and supporting documentation was well organized, well written and provides an excellent basis as project moves to final design.	Comment noted, thank you.
42	30% Submittal	Todd L. Myers, RFCD	Comment 2	General	A facility-specific environmental analysis in accordance with Chapter 8 of District's Supplemental Programmatic Environmental Impact Statement, Clark County Regional Flood Control District, 2002 Master Plan Update, September 2004 was accepted by District	A copy of this approval by Tim Sutko will be provided in the final PDR.
43	30% Submittal	Todd L. Myers, RFCD	Comment 3	General	Identify all right-of-way (ROW) and easement acquisition requirements for this project. All ROW/easements must be acquired prior to City's request for construction funding.	Currently, there are three possible locations where an AEP for construction will likely be required, these are on parcels: 125-26-304-005, 006 & 007 locate north of El Campo Grande Avenue on Rainbow Boulevard.
44	30% Submittal	Todd L. Myers, RFCD	Comment 4	General	Provide draft copy of Special Provisions with all remaining submittals.	A draft copy of the Special Provisions will be provided.
45	30% Submittal	Todd L. Myers, RFCD	Comment 5	Report	The report refers to El Campo Grande as El Cortez at a few locations. Revise accordingly.	All references to El Cortez have been changed to El Campo Grande.
46	30% Submittal	Todd L. Myers, RFCD	Comment 6	Report	Update status of ROW with each phase of project submittals.	The ROW status will be updated with each submittal.
47	30% Submittal	Todd L. Myers, RFCD	Comment 7a	Report	Item 402.00: According geotechnical report, the existing AC is 5-inch maximum. Revise to match existing.	Item 402.00 has been revised to reflect 5-inch AC replacement.
48	30% Submittal	Todd L. Myers, RFCD	Comment 7b	Report	Reduce contingency to 10% in next submittal	Contingency has been adjusted accordingly.
49	30% Submittal	Todd L. Myers, RFCD	Comment 7c	Report	Are Items 202.00 (2-inch and 4-inch gas relocations) covered under City's Franchise agreement? If so, remove from cost estimate.	In progress, SWG is currently under investigation of this issue.
50	30% Submittal	Todd L. Myers, RFCD	Comment 8	Hydrology	District takes no exceptions to hydrologic analysis presented in PDR.	Noted, hydrologic analysis will not be revised.
51	30% Submittal	Todd L. Myers, RFCD	Comment 9	Hydrology	Provide an exhibit to indicate computed 100-year event flow rate capture requirements at proposed drop inlet (DI) locations.	A drop inlet exhibit has been provided, reference Figure D-4, Storm Drain Exhibit.
52	30% Submittal	Todd L. Myers, RFCD	Comment 10	Hydraulics	Provide WSPG analysis of mainline facility with 70% submittal.	The WSPG analysis will be provided with the 70% submittal.

City of Las Vegas Department of Public Works
ANN ROAD CHANNEL WEST RAINBOW BOULEVARD - HANSEN NO. 36801

Review of 30% Submittal Dated 02/08/11

No.	Design Phase	Reviewer/Source	Sheet/Location	Subject	Comment	Jacobs Action/Response
53	30% Submittal	Todd L. Myers, RFCD	Comment 11	Hydraulics	Provide detailed DI and lateral calculations with 70% submittal.	The detailed DI and lateral locations will be provided with the 70% submittal.
54	30% Submittal	Todd L. Myers, RFCD	Comment 12	Plans	Provide complete (preliminary) plan set that includes plan & profile, construction details, roadway removal and replacement, and utility sheets with 70% submittal.	Preliminary plan and profile details will be provided with next submittal.
55	30% Submittal	Todd L. Myers, RFCD	Comment 13	Plans	District prefers that contract documents for a long reach of RCB be structured to allow the contractor the option of using precast RCB or cast-in-place when practical. The market can then decide the lower price and the contractor can bid accordingly.	The opportunity to utilize pre-case storm drain will be used where practical.
56	30% Submittal	Todd L. Myers, RFCD	Comment 14	Plans	Provide pothole information for 36" waterline and sanitary sewer (SS) laterals crossing mainline facility with 70% submittal. Once final DI locations are determined on east side of Rainbow Blvd, provide pothole information for 36" waterline at storm drain (SD) lateral crossings.	All pothole information is provided in the PDR under Appendix A.
57	30% Submittal	Todd L. Myers, RFCD	Comment 15	Plans	Provide pipe materials for all utilities.	Pipe materials for utilities are provided.
58	30% Submittal	Todd L. Myers, RFCD	Comment 16	Plans	Evaluate DI locations on east side of Rainbow Blvd. District supports capturing nuisance flow. However, the numbers of area drains shown on SD sheets are excessive. If topography allows, consider providing fewer DI's and grading to drain.	The nuisance inlet on the north side of El Campo Grande Avenue has been removed and we will replace with grading in that area. The nuisance drain directly south of El Campo Grande Avenue has also been removed. Upon further investigation, it has been determined that the remainder of inlets on the east side of Rainbow have been left on the plans because the low points are surrounded by residential driveways and to grade to drain in these areas would require removal of the existing driveways and replacing with new driveways and culverts.
59	30% Submittal	Todd L. Myers, RFCD	Comment 17	Plans	Evaluate pavement replacement limits. City will require replacement to lane line along Rainbow Blvd. Full width replacement will likely be required for inlet trees on Rainbow north of Tropical Pkwy, and on Tropical Pkwy west of Rainbow. Revise accordingly.	This has been evaluated and addressed on the removal sheets.
60	30% Submittal	Randy McConnell, CLV PM	G-01	General	Add "Acting" to City Engineer title and check Acting Engineer Registration Number	This is addressed on plans.
61	30% Submittal	Randy McConnell, CLV PM	G-01	General	Revise title block to show "Acting City Engineer: David Bowers, P.E."	This is addressed on plans.
62	30% Submittal	Randy McConnell, CLV PM	G-01	General	Add LVVWD Project Number to signature block	This is addressed on plans.
63	30% Submittal	Randy McConnell, CLV PM	G-01	General	Replace Randy McConnell with Mark Sorensen, P.E. as Program Manager in Title Block. All Sheets Typical	This is addressed on plans.
64	30% Submittal	Randy McConnell, CLV PM	G-01	General	Add CLV Drawing Number 731-88 to all sheets.	This is addressed on plans.
65	30% Submittal	Randy McConnell, CLV PM	G-02	General	Sheet index needs to match sheet description.	This is addressed on plans.
66	30% Submittal	Randy McConnell, CLV PM	HC-01	Horizontal Control	Label right-of-way width on Rainbow Boulevard south of Ann Road.	This is addressed on plans.
67	30% Submittal	Randy McConnell, CLV PM	HC-01	Horizontal Control	Label right-of-way width on Ann Road.	This is addressed on plans.
68	30% Submittal	Randy McConnell, CLV PM	HC-01	Horizontal Control	Label centerline intersection point of Ann and Rainbow.	This is addressed on plans.
69	30% Submittal	Randy McConnell, CLV PM	HC-01	Horizontal Control	Label bearing and distance for the Ann Road centerline on both sides of the intersection.	This is addressed on plans.
70	30% Submittal	Randy McConnell, CLV PM	HC-01	Horizontal Control	Label right-of-way width on Rainbow Boulevard north of Ann Road.	This is addressed on plans.
71	30% Submittal	Randy McConnell, CLV PM	HC-01	Horizontal Control	Clarify the meaning of "R" when labeling alignment. All sheets typical.	This has been addressed, refer to sheet G-02 Location Map, "R" is for the Rainbow Blvd. alignment and "T" is for the Tropical Pkwy. alignment.
72	30% Submittal	Randy McConnell, CLV PM	HC-01	Horizontal Control	Can you fit more view ports on this sheet (e.g. 154+00 to 163+00)	Table for HC will be provided at the bottom of the sheet.
73	30% Submittal	Randy McConnell, CLV PM	HC-02	Horizontal Control	Label right-of-way width on Rainbow Boulevard.	This is addressed on plans.
74	30% Submittal	Randy McConnell, CLV PM	HC-02	Horizontal Control	Label right-of-way width for El Campo Grande Avenue.	This is addressed on plans.
75	30% Submittal	Randy McConnell, CLV PM	HC-02	Horizontal Control	Add centerline to El Campo Grande.	This is addressed on plans.
76	30% Submittal	Randy McConnell, CLV PM	HC-02	Horizontal Control	Add "Ave." to El Campo Grande Label	This is addressed on plans.
77	30% Submittal	Randy McConnell, CLV PM	HC-02	Horizontal Control	Add bearing and distance to El Campo Grande centerline.	This is addressed on plans.
78	30% Submittal	Randy McConnell, CLV PM	HC-02	Horizontal Control	Label centerline intersection point of El Campo Grande and Rainbow.	This is addressed on plans.
79	30% Submittal	Randy McConnell, CLV PM	HC-02	Horizontal Control	Can you fit more view ports on this sheet (e.g. 163+00 to 169+00)	Table for HC will be provided at the bottom of the sheet.
80	30% Submittal	Randy McConnell, CLV PM	HC-03	Horizontal Control	Label right-of-way width on Rainbow Boulevard.	This is addressed on plans.
81	30% Submittal	Randy McConnell, CLV PM	HC-03	Horizontal Control	Label right-of-way width for Ambiance Lane.	This is addressed on plans.
82	30% Submittal	Randy McConnell, CLV PM	HC-03	Horizontal Control	Add centerline to Ambiance Lane.	This is addressed on plans.
83	30% Submittal	Randy McConnell, CLV PM	HC-03	Horizontal Control	Add bearing and distance to Ambiance Lane centerline.	This is addressed on plans.
84	30% Submittal	Randy McConnell, CLV PM	HC-03	Horizontal Control	Label centerline intersection point of Ambiance and Rainbow.	This is addressed on plans.
85	30% Submittal	Randy McConnell, CLV PM	HC-04	Horizontal Control	Label right-of-way width on Tropical Parkway west of Rainbow Boulevard/	This is addressed on plans.
86	30% Submittal	Randy McConnell, CLV PM	HC-04	Horizontal Control	Label right-of-way width on Tropical Parkway east of rainbow Boulevard.	This is addressed on plans.
87	30% Submittal	Randy McConnell, CLV PM	HC-04	Horizontal Control	Label right-of way width on Rainbow Boulevard.	This is addressed on plans.
88	30% Submittal	Randy McConnell, CLV PM	RM-01	Removal	Any way to add view port to this sheet? (e.g. 159+00 to 163+00)	This is addressed on plans, two sheets were left with blank spaces for details in the future.
89	30% Submittal	Randy McConnell, CLV PM	RM-01	Removal	Label centerline intersection point of Ann and Rainbow.	This is addressed on plans.
90	30% Submittal	Randy McConnell, CLV PM	RM-01	Removal	Show/Label the limits of Island being removed.	This is addressed, it is assumed that the full Island will be removed and replaced.
91	30% Submittal	Randy McConnell, CLV PM	RM-01	Removal	Pavement markings designated for removal at Station 148+50± need to be replaced.	This is revised and addressed on plans.
92	30% Submittal	Randy McConnell, CLV PM	RM-01	Removal	Station limits of removal (all).	This is addressed on plans.

City of Las Vegas Department of Public Works
ANN ROAD CHANNEL WEST RAINBOW BOULEVARD - HANSEN NO. 36801

Review of 30% Submittal Dated 02/08/11

No.	Design Phase	Reviewer/Source	Sheet/Location	Subject	Comment	Jacobs Action/Response
93	30% Submittal	Randy McConnell, CLV PM	RM-01	Removal	Station 150+00± - Any reason removing pavement to DI?	This is revised and addressed on plans.
94	30% Submittal	Randy McConnell, CLV PM	RM-01	Removal	Electrical easement - Where are poles? Near trenching require special provisions be made.	Power poles are shown in plans, NVE has provided comments regarding power poles.
95	30% Submittal	Randy McConnell, CLV PM	RM-01	Removal	Add removal note for "protect in place". All RM sheets typical.	This is addressed on plans.
96	30% Submittal	Randy McConnell, CLV PM	RM-01	Removal	Protect in place fire hydrant at Station 152+00±.	Station 152+00 is a water valve which will be impacted with the construction of this storm drain.
97	30% Submittal	Randy McConnell, CLV PM	RM-01	Removal	Shade back or remove proposed improvement, cannot see 24" removal.	This is addressed on plans.
98	30% Submittal	Randy McConnell, CLV PM	RM-01	Removal	Add "AC Pavement" to the end of Removal Note #1. All RM sheets typical.	This is addressed on plans.
99	30% Submittal	Randy McConnell, CLV PM	RM-01	Removal	Add "Call Before You Dig" note. All RM sheets typical.	This is addressed on plans.
100	30% Submittal	Randy McConnell, CLV PM	RM-01	Removal	Add "Call Before You Overhead" note. All RM sheets typical.	This is addressed on plans.
101	30% Submittal	Randy McConnell, CLV PM	RM-01	Removal	Provide LVVWD Signature Block.	This is addressed on plans.
102	30% Submittal	Randy McConnell, CLV PM	RM-01	Removal	Clarify the meaning of "R" when labeling alignment. All sheets typical.	This has been addressed, refer to sheet G-02 Location Map, "R" is for the Rainbow Blvd. alignment and "T" is for the Tropical Pkwy. alignment.
103	30% Submittal	Randy McConnell, CLV PM	RM-02	Removal	Label limits of AC removal.	This is addressed on plans.
104	30% Submittal	Randy McConnell, CLV PM	RM-02	Removal	Label centerline intersection of El Campo Grande and Rainbow Boulevard.	This is addressed on plans.
105	30% Submittal	Randy McConnell, CLV PM	RM-02	Removal	Shade back or remove proposed improvement, cannot see removals.	This is addressed on plans.
106	30% Submittal	Randy McConnell, CLV PM	RM-02	Removal	Any way to add view port to this sheet?	This is addressed on plans, two sheets were left with blank spaces for details in the future.
107	30% Submittal	Randy McConnell, CLV PM	RM-03	Removal	Any way to add view port to this sheet?	This is addressed on plans, two sheets were left with blank spaces for details in the future.
108	30% Submittal	Randy McConnell, CLV PM	RM-03	Removal	Label centerline intersection of Rainbow Boulevard and Ambulance Lane.	This is addressed on plans.
109	30% Submittal	Randy McConnell, CLV PM	RM-03	Removal	Label limits of removal and station for AC.	This is addressed on plans.
110	30% Submittal	Randy McConnell, CLV PM	RM-04	Removal	Station the limits of removal.	This is addressed on plans.
111	30% Submittal	Randy McConnell, CLV PM	RM-04	Removal	Label centerline intersection of Rainbow Boulevard and Tropical Parkway.	This is addressed on plans.
112	30% Submittal	Randy McConnell, CLV PM	SD-01	Storm Drain	Show centerline for Ann Road.	This is addressed on plans.
113	30% Submittal	Randy McConnell, CLV PM	SD-01	Storm Drain	Label centerline intersection of Ann Road and Rainbow Boulevard.	This is addressed on plans.
114	30% Submittal	Randy McConnell, CLV PM	SD-01	Storm Drain	Add construction note for reconstruct median island and show on plans.	This is addressed on plans.
115	30% Submittal	Randy McConnell, CLV PM	SD-01	Storm Drain	Profile?	This is addressed on plans.
116	30% Submittal	Randy McConnell, CLV PM	SD-01	Storm Drain	Fill in correct detail sheet numbers for Storm Drain Detail Sheets in Construction Notes. All sheets typical.	This is addressed on plans.
117	30% Submittal	Randy McConnell, CLV PM	SD-01	Storm Drain	Add construction note for replace striping.	This is addressed on plans.
118	30% Submittal	Randy McConnell, CLV PM	SD-01	Storm Drain	Clarify the meaning of "R" when labeling alignment. All sheets typical.	This is addressed on plans.
119	30% Submittal	Randy McConnell, CLV PM	SD-01	Storm Drain	Add "Call Before You Dig" note. All RM sheets typical.	This is addressed on plans.
120	30% Submittal	Randy McConnell, CLV PM	SD-01	Storm Drain	Add "Call Before You Overhead" note. All RM sheets typical.	This is addressed on plans.
121	30% Submittal	Randy McConnell, CLV PM	SD-02	Storm Drain	Profile.	This is addressed on plans.
122	30% Submittal	Randy McConnell, CLV PM	SD-02	Storm Drain	Show El Campo Grande centerline.	This is addressed on plans.
123	30% Submittal	Randy McConnell, CLV PM	SD-02	Storm Drain	Label centerline intersection of El Campo Grande and Rainbow Boulevard.	This is addressed on plans.
124	30% Submittal	Randy McConnell, CLV PM	SD-03	Storm Drain	Show centerline for Ambulance Lane.	This is addressed on plans.
125	30% Submittal	Randy McConnell, CLV PM	SD-03	Storm Drain	Profile.	This is addressed on plans.
126	30% Submittal	Randy McConnell, CLV PM	SD-04	Storm Drain	Profile.	This is addressed on plans.
127	30% Submittal	Diane Phomlinh, CLV Traffic	General	Traffic	Need to identify all pavement to be replaced in kind. (Tape and raised pavement markers).	This is addressed on plans. A striping plan will be provided with the next submittal.
128	30% Submittal	Diane Phomlinh, CLV Traffic	General	Traffic	All sawcut lines for patches shall be parallel or perpendicular to a travel lane, and on a lane line OR if within 4' of curb and gutter, extend removal to curb and gutter.	This is addressed on plans.
129	30% Submittal	Diane Phomlinh, CLV Traffic	General	Traffic	Show all street lighting and traffic signal conduit, must be protected in place. See attached plans.	Traffic conduits and traffic plans will be provided with the 90% submittal.
130	30% Submittal	Diane Phomlinh, CLV Traffic	General	Traffic	Work is also in Clark County Jurisdiction.	Note, a Clark County encroachment permit will be needed for this project.
131	30% Submittal	Diane Phomlinh, CLV Traffic	General	Traffic	Look at safe route to school.	This has been addressed in the specifications.
132	30% Submittal	Sanitary Sewer Planning	G-03	General Notes	Use the revised CLV general notes.	This is addressed on plans.
133	30% Submittal	Sanitary Sewer Planning	Plans	Sewer	Show all sanitary sewer manholes as "protect in place" on RM plans.	This is addressed on plans.
134	30% Submittal	Sanitary Sewer Planning	SD-01	Sewer	Provide a minimum 5 feet of clearance between the outside wall of existing sanitary sewer manhole and outside wall of proposed 18" RCP for Type 2B area drain located in Rainbow at station 147+90.16	This is addressed on plans.
135	30% Submittal	Sanitary Sewer Planning	SD-02	Sewer	Raise existing sewer manhole located in drainage channel to final grade and provide a sanitary sewer manhole sealed locking lid.	Sewer rim to be lowered to new grade. A note will be added to provide sealed locking lid.
136	30% Submittal	Jim Von Tobel, CLV Survey	HC-1 - HC-4	Horizontal Control	Benchmark on plans has the wrong elevation. Should be 2326.07, not 2226.31. Did the topo for the plans use this elevation?	This is addressed on plans.
137	30% Submittal	Jim Von Tobel, CLV Survey	All Sheets	Horizontal Control	Not necessary to list distances to 3 decimal places, nor bearings to tenth's of seconds.	This is addressed on plans.
138	30% Submittal	Layne Weber, Clark County Public Works	SD-01	General	Show entity boundaries. (All sheets typical).	This is addressed on plans.
139	30% Submittal	Layne Weber, Clark County Public Works	SD-01	General	Show existing A/C grades. (All SD sheets typical).	Grading plans will be provided in the next submittal.

City of Las Vegas Department of Public Works
ANN ROAD CHANNEL WEST RAINBOW BOULEVARD - HANSEN NO. 36801

Review of 30% Submittal Dated 02/08/11

No.	Design Phase	Reviewer/Source	Sheet Location	Subject	Comment	Action/Response
140	30% Submittal	Layne Weber, Clark County Public Works	SD-01	General	Provide hydrology. (All SD sheets typical).	Q100 and hydraulic grade line will be provided on plan and profile sheets
141	30% Submittal	Layne Weber, Clark County Public Works	SD-01	General	Provide hydraulics - after 30% (All SD sheets typical).	All hydraulics will be provided after 30%.
142	30% Submittal	Layne Weber, Clark County Public Works	SD-01	General	Offsite permit will be required.	Noted an offsite permit will be obtain for this project.
143	30% Submittal	Layne Weber, Clark County Public Works	SD-01	General	Show right-of-way. Make sure proposed inlets are in right-of-way and not in the driveway of the homes.	This is addressed on plans.
144	30% Submittal	Layne Weber, Clark County Public Works	SD-01	Storm Drain	Laterals on east side of Rainbow Boulevard - Maybe you could put these in a sump and use half as many inlets and a larger lateral.	The nuisance inlet on the north side of El Campo Grande Avenue has been removed and we will replace with grading in that area. The nuisance drain directly south of El Campo Grande Avenue has also been removed. Upon further investigation, it has been determined that the remainder of inlets on the east side of Rainbow have been left on the plans because the low points are surrounded by residential driveways and to grade to drain in these areas would require removal of the existing driveways and replacing with new driveways and culverts.
145	30% Submittal	Layne Weber, Clark County Public Works	SD-01	Storm Drain	Call out existing facility.	This is addressed on plans.
146	30% Submittal	Layne Weber, Clark County Public Works	SD-01	Storm Drain	36" x 42", 1-ft high. Weir = 36 CFS.	Hydraulic calculations to be included in 70% submittal.
147	30% Submittal	Layne Weber, Clark County Public Works	SD-02	Storm Drain	El Campo Grande - Sort of a low spot here where you might want to move one of the proposed inlets to.	This inlet has been remove and the are north of El Campo Grande will be re-graded.
148	30% Submittal	Layne Weber, Clark County Public Works	SD-02	General	Show El Campo Grande centerline.	This is addressed on plans.
149	30% Submittal	Layne Weber, Clark County Public Works	SD-02	General	Label the APN and show parcel lines for parcels that own to the centerline.	This is addressed on plans.
150	30% Submittal	Layne Weber, Clark County Public Works	SD-04	General	Show right of way.	This is addressed on plans.
151	30% Submittal	Layne Weber, Clark County Public Works	SD-04	Storm Drain	Drop inlet on Rainbow, north of Tropical Parkway - Is this a low point?	Yes, this inlet is at a low point.
152	30% Submittal	Jason Ghadery, P.E., LVVWD	Comment Letter	Utilities	A copy of the water plan with the required revisions is attached. Please complete the revisions and return the check print of the water plan to the Engineering Services Division at the time of next submittal.	The plans have been address and re-submitted accordingly.
153	30% Submittal	Jason Ghadery, P.E., LVVWD	Comment Letter	Utilities	This property is located in the District's 2538 Pressure Zone and will have static water pressure in excess of 80 psi. The Uniform Plumbing Code requires individual pressure reducing valves be installed whenever static pressure exceeds 80 psi.	It is not the intent with this project to provide any new water services. In any case where a PRV is impacted with construction, a new PRV will replace the old PRV.
154	30% Submittal	Jason Ghadery, P.E., LVVWD	Comment Letter	Utilities	The subject project provides for storm drain improvements only and does not imply any new water commitment.	Correct, there are no new water commitments for this project.
155	30% Submittal	Jason Ghadery, P.E., LVVWD	G-01	Utilities	LVVWD project number is 116370.	This is addressed on plans.
156	30% Submittal	Jason Ghadery, P.E., LVVWD	G-01	Utilities	List all sheets under signature block that are to be signed by LVVWD. G-01, G-02, G-03, SD-01, SD-02, SD-03, SD-04.	This is addressed on plans.
157	30% Submittal	Jason Ghadery, P.E., LVVWD	G-02	Utilities	Add LVVWD signature block to this sheet.	This is addressed on plans.
158	30% Submittal	Jason Ghadery, P.E., LVVWD	G-03	Utilities	LVVWD Notes - Update, see below.	This is addressed on plans.
159	30% Submittal	Jason Ghadery, P.E., LVVWD	SD-01	Utilities	Label existing 8" PVC water line at Station 152±25.	This is addressed on plans.
160	30% Submittal	Jason Ghadery, P.E., LVVWD	SD-01	Utilities	Label existing 6" PVC water line at Station 154±00.	This is addressed on plans.
161	30% Submittal	Jason Ghadery, P.E., LVVWD	SD-01	Utilities	Label existing 3/4" meter with 1" RPPA at Station 154±00.	This is addressed on plans.
162	30% Submittal	Jason Ghadery, P.E., LVVWD	SD-01	Utilities	Label existing 1" copper water lateral at Station 154±00.	Not require to show small diameter pipe. We will note service lateral in the area to be restored.
163	30% Submittal	Jason Ghadery, P.E., LVVWD	SD-01	Utilities	Label existing 8" DCDA at Station 154±00.	This is addressed on plans.
164	30% Submittal	Jason Ghadery, P.E., LVVWD	SD-01	General	Label C/L Intersection of Ann Road and Rainbow Boulevard.	This is addressed on plans.
165	30% Submittal	Jason Ghadery, P.E., LVVWD	SD-01	General	Provide parcel numbers.	This is addressed on plans.
166	30% Submittal	Jason Ghadery, P.E., LVVWD	SD-01	Utilities	Provide profile of proposed storm drain at all water line crossings.	This is addressed on plans.
167	30% Submittal	Jason Ghadery, P.E., LVVWD	SD-01	Utilities	Label existing 36" water as MLCP CO-727.	This is addressed on plans.
168	30% Submittal	Jason Ghadery, P.E., LVVWD	SD-01	Utilities	Label existing 12" water as PVC XC-9534.	This is addressed on plans.
169	30% Submittal	Jason Ghadery, P.E., LVVWD	SD-01	Utilities	Station location of 8" lateral at station 154±00.	This is addressed on plans.
170	30% Submittal	Jason Ghadery, P.E., LVVWD	SD-01	Utilities	Add note: All Lots/Lots ____ This property may have static pressure in excess of 80 psi. The Uniform Plumbing Code requires that individual, on-site (private), pressure reducing valves be installed whenever the pressure exceeds 80 psi. PRV's are	This is addressed on plans.
171	30% Submittal	Jason Ghadery, P.E., LVVWD	SD-01	Horizontal Control	Provide benchmark data.	This is addressed on plans.
172	30% Submittal	Jason Ghadery, P.E., LVVWD	SD-01	General	Add LVVWD signature block to this sheet.	This is addressed on plans.
173	30% Submittal	Jason Ghadery, P.E., LVVWD	SD-02	General	Add LVVWD signature block to this sheet.	This is addressed on plans.
174	30% Submittal	Jason Ghadery, P.E., LVVWD	SD-02	General	Provide profile of proposed storm drain at all water line crossings.	This is addressed on plans.
175	30% Submittal	Jason Ghadery, P.E., LVVWD	SD-02	General	Provide parcel numbers.	This is addressed on plans.

No	Design Phase	Reviewer/Source	Sheet/Location	Subject	Comment	Jacobs Action/Response
176	30% Submittal	Jason Ghadery, P.E., LVWD	SD-02	Utilities	Label existing 36" water as MLCP CO-727.	This is addressed on plans.
177	30% Submittal	Jason Ghadery, P.E., LVWD	SD-02	Utilities	Label existing 8" water as PVC CO-1007.	This is addressed on plans.
178	30% Submittal	Jason Ghadery, P.E., LVWD	SD-02	Utilities	Label station of existing test station at Station 160±50.	Test station doesn't exist on sidewalk as shown on red line plans, test station in sidewalk at sta 159+90.
179	30% Submittal	Jason Ghadery, P.E., LVWD	SD-03	General	Add LVWD signature block to this sheet.	This is addressed on plans.
180	30% Submittal	Jason Ghadery, P.E., LVWD	SD-03	General	Provide profile of proposed storm drain at all water line crossings.	This is addressed on plans.
181	30% Submittal	Jason Ghadery, P.E., LVWD	SD-03	General	Provide parcel numbers.	This is addressed on plans.
182	30% Submittal	Jason Ghadery, P.E., LVWD	SD-03	Utilities	Label existing 36" water as MLCP CO-727.	This is addressed on plans.
183	30% Submittal	Jason Ghadery, P.E., LVWD	SD-03	Utilities	Label existing 8" water as PVC XC-6726.	This is addressed on plans.
184	30% Submittal	Jason Ghadery, P.E., LVWD	SD-04	Utilities	Label existing 12" water as PVC CO-864.	This is addressed on plans.
185	30% Submittal	Jason Ghadery, P.E., LVWD	SD-04	Utilities	Show existing 12" water as PVC XC-5109.	This is addressed on plans.
186	30% Submittal	Jason Ghadery, P.E., LVWD	SD-04	Utilities	Label existing 36" water as MLCP CO-727.	This is addressed on plans.
187	30% Submittal	Jason Ghadery, P.E., LVWD	SD-04	Utilities	Show Existing water line 10" PVC XC-5106.	This is addressed on plans.
188	30% Submittal	Jason Ghadery, P.E., LVWD	SD-04	Utilities	Rainbow Boulevard Station 170+75 - ? Separation distance between DI and existing 12" water line.	Existing utilities provided on lateral profiles.
189	30% Submittal	Jason Ghadery, P.E., LVWD	SD-04	Utilities	Tropical Parkway Station 23±25 - ? Separation distance between manhole and existing 12" water line.	Waterline will need to be located under box culvert, this manhole in an access manhole into the top of the box.
190	30% Submittal	Jason Ghadery, P.E., LVWD	SD-04	General	Label centerline intersection of Rainbow Boulevards and Tropical Parkway.	This is addressed on plans.
191	30% Submittal	Jason Ghadery, P.E., LVWD	SD-04	Utilities	Tropical Parkway Station 23±25 - show existing 10" water line and gate valve.	This is addressed on plans.
192	30% Submittal	Jason Ghadery, P.E., LVWD	SD-04	General	Add LVWD signature block to this sheet.	This is addressed on plans.
193	30% Submittal	Jason Ghadery, P.E., LVWD	SD-04	General	Provide profile of proposed storm drain at all water line crossings.	This is addressed on plans.
194	30% Submittal	Jason Ghadery, P.E., LVWD	SD-04	General	Provide parcel numbers.	This is addressed on plans.
195	30% Submittal	Dan Byrd, SW Gas	Comment Letter	Utilities	The Civil Plans have been "red-lined" to indicate the approximate location of existing SWG Facilities. Please transfer the Information to the updated Civil Plans.	This is addressed on plans.
196	30% Submittal	Dan Byrd, SW Gas	Comment Letter	Utilities	These plans are not ready for signature. 100% Civil Plans must be submitted for review.	Noted. 100% submittal plans will be submitted for review.
197	30% Submittal	Dan Byrd, SW Gas	Comment Letter	Utilities	When requesting signatures, bring the most recent Transmittal, Redlines, all SWG Maps & As-builts listed above, and a complete set of the 100% Civil Plans no later than August 30, 2011.	Noted, a complete set will be provided by August 30, 2011. According to the project schedule as of April 12, 2011, the final submittal date for these plans to the City of Las Vegas is July 14, 2011.
198	30% Submittal	Dan Byrd, SW Gas	Comment Letter	Utilities	Please label all pipelines per SWG Plan Signing Requirements Section 1.9.	This is addressed on plans.
199	30% Submittal	Dan Byrd, SW Gas	Comment Letter	Utilities	Please pothole areas in green to determine depth of pipeline.	All potholes information is provided as Figure A-7 of this report.
200	30% Submittal	Dan Byrd, SW Gas	Comment Letter	Utilities	SWG is concerned about the constructability of storm drain running in close proximity parallel to our gas line.	The design of the width of the proposed boxes is based upon the limiting depth restrictions for the storm drain at the capacity required. It may be necessary to move the parallel gas line in order to accommodate the proposed storm drain.
201	30% Submittal	Dan Byrd, SW Gas	HC-01	Utilities	Show 4" PE gas line and label per section 1.9 of SWG plan signing requirements.	This is addressed on plans.
202	30% Submittal	Dan Byrd, SW Gas	HC-02	Utilities	Show jog in gas line.	Per field markings the actual jog location is adjacent to parcels 125-27-716-016 and 125-27-716-017. This shown on HC-03.
203	30% Submittal	Dan Byrd, SW Gas	HC-02	Utilities	Show 4" PE gas line and label per section 1.9 of SWG plan signing requirements.	This is addressed on plans.
204	30% Submittal	Dan Byrd, SW Gas	HC-02	Utilities	Please clarify drainage easement area. Difficult to determine where pipe is.	Profiles and crossings for this area are further detail in the 70% plans. The gas line is this easement will be impacted.
205	30% Submittal	Dan Byrd, SW Gas	HC-03	Utilities	Show 4" PE gas line and label.	This is addressed on plans.
206	30% Submittal	Dan Byrd, SW Gas	HC-04	Utilities	Show gas line and label.	This is addressed on plans.
207	30% Submittal	Dan Byrd, SW Gas	RM-02	Utilities	Please pothole drainage easement to determine depth of gas line.	The depth of the 2" gas has been pothole and determine to be 3' deep adjacent to the easement. The entire drainage easement is to be removed and replaced.
208	30% Submittal	Dan Byrd, SW Gas	RM-02	Utilities	Removal and relocation of 2" gas line is to be determined.	Relocation of gas line will be determine as design progresses.
209	30% Submittal	Dan Byrd, SW Gas	SD-01	Utilities	Please determine depth of pipe and provide construction details to give adequate time for preparation in case of conflicts. Lateral locations: 147+90, 149+24, 150+92, 152+60.	Lateral profiles are provided with this submittal.
210	30% Submittal	Dan Byrd, SW Gas	SD-02	Utilities	Please determine depth of pipe and provide construction details to give adequate time for preparation in case of conflicts. Lateral locations: 155+78, 156+89, 161+27; main line: 159+00.	Lateral profiles are provided with this submittal.
211	30% Submittal	Dan Byrd, SW Gas	SD_03	Utilities	Please determine depth of pipe and provide construction details to give adequate time for preparation in case of conflicts. Lateral locations: 164+73, 168+58.	Lateral profiles are provided with this submittal.
212	30% Submittal	Century Link	HC-01	Utilities	Show additional red-lined Century Link Facilities in Ann Road.	Provided with 30% plans
213	30% Submittal	Century Link	HC-01	Utilities	Show additional red-lined Century Link Facilities in Rainbow Boulevard.	This is addressed on plans.
214	30% Submittal	Century Link	HC-04	Utilities	Show additional red-lined Century Link Facilities in Rainbow Boulevard.	Provided with 30% plans, crossings will be shown on profiles.
215	30% Submittal	Century Link	HC-04	Utilities	Show additional red-lined Century Link Facilities in Tropical Parkway.	Provided with 30% plans, crossings will be shown on profiles.
216	30% Submittal	Doney Villareal, COX	HC-02	Utilities	Possible relocation, underground coaxial and F/O, possible relocation at easement in station 158+50 in easement.	Relocation noted, reference 70% plans for new storm drain layout.
217	30% Submittal	Doney Villareal, COX	HC-04	Utilities	Underground conflict on Tropical Parkway at inlets at station 22+00 and 22+50 on south side of street.	Relocation noted, reference 70% plans for new storm drain layout.
218	30% Submittal	NVE Transmission	General	Utilities	Also there are two locations (x3788) north of Ann road and (x3788) north of El Campo Grande where the drains are closer than the required 20' and the structure may require bracing or shoring.	The structure located north of El Campo Grande has been removed from the plans. The structure (x3788) will be reviewed for location conflicts in subsequent submittals.
219	30% Submittal	NVE Transmission	General	Utilities	Also need for them to send detail sheet SD-X	We will be submitting 70% drawings on April 14th to the City of Las Vegas. At that time all details and profiles will be available.

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I. INTRODUCTION

1. EXECUTIVE SUMMARY

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

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

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

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

2. LOCATION OF PROPERTY

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

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

3. EXISTING CONDITIONS

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

4. SURVEY SUMMARY

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

5. UTILITIES

The existing utilities for this site were located by obtaining the as-built drawings from the utility companies and then subsequently matching that information with the field information obtained by both survey and pothole data. The existing utilities can be found on the design plans.

There are several locations along the corridor of this project which the proposed storm drain alignment will potentially conflict with existing utilities. Further detail of the utility conflicts will be provided as the design of the underground appurtenances progress. An exhibit illustrating all of the potential conflicts along with a spreadsheet has been provided in the appendix of this report (see Figure A-3, Appendix A, *Utilities Conflict Matrix Exhibit* and Figure A-4, Appendix A, *Utilities Conflict Matrix*).

6. SUMMARY OF PERMITS

A Clark County Regional Flood Control District Section 8 analysis will be performed for this project at the 90% design level effort. If the initial screening concludes that no potential environments impacts are to be expected, then a letter documenting the review process will be submitted to the CCRFCD. If the initial screening concludes that potential impacts are expected, then a facility specific environmental review is necessary per CCRFCD requirements.

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

7. GEOTECHNICAL REPORT

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

8. QUANTITY AND COST ESTIMATE

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

II. DRAINAGE DESIGN ANALYSIS

1. MASTER PLANNING INFORMATION

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

2. FLOODPLAIN INFORMATION

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

3. REFERENCED STUDIES

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

- 1) *Las Vegas Valley Flood Control Master Plan Update* by PBS&J for Clark County Regional Flood Control District, 2008 – The output file for

CWEST3.out is included to illustrates the three basins which combine at facility ANRB000 (Q100=721 cfs).

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

4. **HYDROLOGIC CRITERIA**

1. Precipitation

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

Appendix C, *McCarran Airport Rainfall Area* and Figure C-2, Appendix C, *Depth-Duration-Frequency Values for McCarran Airport Rainfall Area*).

2. Soils Classification

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

3. Methodology

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

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

III. HYDROLOGIC ANALYSIS

1. **METHODOLOGY**

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

2. **DESCRIPTION**

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

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

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

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

Basin Runoff in HEC-1 Combination Format			
Basin	Q₁₀ (cfs)	Q₁₀₀ (cfs)	Source Runoff
OFF5	14	30	Offsite Basin
TEN1	0	96	Tenaya Way Improvements Drainage Study
OFF1	8	30	Offsite Basin
CP1	20	154	Combine OFF1, OFF5 and TEN1
OFF2	9	23	Offsite Basin
CP2	27	170	Combine CP-1 and OFF2
OFF3	12	33	Offsite Basin
CP3	33	182	Combine CP2 and OFF3
OFF4	1	5	Offsite Basin
CP4	34	183	Combine CP3 and OFF4
TEN2	0	69	Tenaya Way Improvements Drainage Study
OFF6	45	96	Offsite Basin
OFF8	4	8	Offsite Basin
CP5	48	172	Combine OFF6, OFF8 and TEN2
OFF7	32	69	Offsite Basin
CP6	79	239	Combine CP-5 and OFF7
RB1	5	9	Onsite Basin
CP7	82	348	Combine CP6 and RB1
OFF11	2	5	Offsite Basin
OFF12	1	2	Offsite Basin
OFF13	1	3	Offsite Basin
RB2	2	4	Onsite Basin
CP8	6	13	Combine OFF11, OFF12, OFF13 and RB2
CP9	86	355	Combine CP7 and CP8
OFF9	18	34	Offsite Basin
OFF10	14	27	Offsite Basin
CP10	0	26	Combine OFF9 and OFF10 minus Balsam Street Storm Drain flows = 33 cfs
RB3	2	4	Onsite Basin
OFF14	1	2	Offsite Basin
OFF15	1	1	Offsite Basin
CP11	4	30	Combine CP-10, RB3, OFF14 and OFF15
CP12	88	383	Combine CP9 and CP11

3. COMPARISON WITH 2008 MASTER PLAN UPDATE

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

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

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

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

IV. PROPOSED DRAINAGE FACILITIES

1. GENERAL DESCRIPTION

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

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

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

2. FACILITY CALCULATIONS

1. Preliminary Drop Inlet Analysis

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



Standing Water at Low Spot in Roadway

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

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

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

2. Technical Drop Inlet Analysis – 70%

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

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

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

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

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

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

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

3. Preliminary Storm Sewers Analysis

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

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

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

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

4. Technical Storm Sewer Analysis

For the 70% submittal, the underground storm sewer sizing has been refined and updated from the storm sewer sizing which was shown on the 30% plans. In all cases, the storm sewer had to be upsized in order to accommodate the shallow slopes available in the roadway, the starting pressurized flow in the existing tie-in location and the limited cover over the storm sewer.

The proposed storm system will tie in-to an existing 9' X 5' RCB stub out provided with the Ann Road Improvements, US 95 to Ferrell Street, see Appendix E, Reference 2. The amount of runoff anticipated at this location is 460 cfs, in this analysis; it is assumed that 472 cfs will enter into the system at this location. Reference Figure D-4, *Storm Drain Exhibit* and Figure D-5, *Hydraulic Section Summary* for an illustration of how the 472 cfs was determined in order to size the underground facilities.

The HGL versus pipes sizes for the main underground drainage facility in Ann Road and Tropical Parkway was analyzed using WSPGW and the lateral hydraulics were analyzed with Standard Form 6 from the Clark County Manual (See Figure D-6, *WSPGW Ann Road to Easement*, Figure D-7, *WSPGW Junction to Tropical Parkway* and Figure D-9, *Standard Form 6*). The main storm system was analyzed in two parts. Figure D-6 shows the hydraulic analysis from the existing tie-in point in Ann Road up through the easement in Rio Vista Estates. The starting HGL was set 8.1' above the top of the box in order duplicate the pressurized analysis as shown on the Ann Road Improvements Plans. Additional information is included in Appendix E, Reference 2 which shows the WSPG analysis for the existing 9'X6' stub. Figure D-7 shows the remainder of the main line that was analyzed starting at the existing junction structure in Ann Road and continuing upstream to the headworks. The starting HGL from Figure D-7 was obtained from the HGL shown on Figure D-6 at the same location.

It was concluded through design progress meetings that for this project, due to the lack of heavy traffic along Rainbow Boulevard, that there would be no preference between cast-in-place or pre-cast facilities. (Refer to *Final Meeting Notes*, March 15, 2011.)

V. CONCLUSION

1. COMPLIANCE with DRAINAGE LAWS, MASTER PLANS and REQUIREMENTS

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

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

VI. TECHNICAL REFERENCES

1. Technical Manuals and Software References

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

VII. APPENDIX

1. APPENDIX A – EXISTING CONDITIONS

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

ANN ROAD CHANNEL WEST-RAINBOW BOULEVARD PERMIT MATRIX

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

ANN ROAD CHANNEL WEST-RAINBOW BOULEVARD PERMIT MATRIX

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

Alexander, Tara T.

From: Tim Sutko [TSutko@regionalflood.org]

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

To: Alexander, Tara T.

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

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

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

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

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

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

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

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

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

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

Thanks

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

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

ITEM NO.	ITEM DESCRIPTION	Sheet No.	Quantity	UOM	Unit Price	Extended Price
109.01	OWNER CAUSED DELAY ALLOWANCE		10	DAY	\$500.00	\$5,000.00
109.02	OWNER CAUSED DELAY AMOUNT IN ADDITION TO		10	DAY	\$700.00	\$7,000.00
200.01	MOBILIZATION AND DEMOBILIZATION		1	LS	\$170,000.00	\$170,000.00
202.01	REMOVAL OF FENCE		1	LS	\$250.00	\$250.00
202.02	REMOVAL OF BEEHIVE DROP INLET		2	EA	\$800.00	\$1,600.00
202.03	REMOVAL OF BOLLARDS		3	EA	\$200.00	\$600.00
202.04	REMOVAL OF DROP INLET		3	EA	\$1,300.00	\$3,900.00
202.05	REMOVAL OF STORM DRAIN MANHOLE		3	EA	\$1,200.00	\$3,600.00
202.06	REMOVAL OF 18-INCH STORM DRAIN PIPE		15	LF	\$25.00	\$375.00
202.07	REMOVAL OF 24-INCH STORM DRAIN PIPE		760	LF	\$35.00	\$26,600.00
202.08	REMOVE & RECONNECT EXISTING SD LATERAL		5	EA	\$550.00	\$2,750.00
202.09	REMOVAL OF EXISTING SANITARY SEWER MANHOLE		2	EA	\$1,000.00	\$2,000.00
202.10	REMOVAL OF SANITARY SEWER PIPE LESS THAN 15		525	LF	\$40.00	\$21,000.00
202.11	REMOVAL OF CURB AND GUTTER		320	LF	\$5.00	\$1,600.00
202.12	REMOVAL OF CONCRETE DRAINAGE CHANNEL		2,430	SF	\$5.00	\$12,150.00
202.13	REMOVAL OF CONCRETE SIDEWALK		1,955	SF	\$5.00	\$9,775.00
202.14	REMOVAL OF MEDIAN ISLAND		475	SF	\$5.00	\$2,375.00
202.15	REMOVAL OF ASPHALT PAVEMENT		26,075	SY	\$5.00	\$130,375.00
202.16	REMOVE AND REPLACEMENT OF UTILITY BOX		1	EA	\$1,250.00	\$1,250.00
	TRENCH OVEREXCAVATION AND COMPACTED IMPORT					
208.01	AGGREGATE BACKFILL		3,400	CY	\$20.00	\$68,000.00
302.01	TYPE II AGGREGATE BASE		7,101	CY	\$25.00	\$177,525.00
402.01	5-INCH PLANTMIX BITUMINOUS SURFACE		8,690	SY	\$20.00	\$173,800.00
502.01	2' X 5' REINFORCED CONCRETE BOX CULVERT		69	LF	\$320.00	\$22,080.00
502.02	9' X 3' REINFORCED CONCRETE BOX CULVERT		1,290	LF	\$660.00	\$851,400.00
502.03	9' X 5' REINFORCED CONCRETE BOX CULVERT		46	LF	\$770.00	\$35,420.00
502.04	11' X 5' REINFORCED CONCRETE BOX CULVERT		203	LF	\$880.00	\$178,640.00
502.05	12' X 6' REINFORCED CONCRETE BOX CULVERT		873	LF	\$990.00	\$864,270.00
502.06	TRANSITION STRUCTURE, 12'X6' RCB TO 9'X6' RCB		1	EA	\$11,500.00	\$11,500.00
502.07	TRANSITION STRUCTURE, 11'X5' RCB TO 12'X6' RCB		1	EA	\$12,000.00	\$12,000.00
502.08	SPECIAL JUNCTION STRUCTURE		1	EA	\$21,000.00	\$21,000.00
502.09	SPECIAL BRIDGE STRUCTURE OVER WATERLINE		2	EA	\$2,500.00	\$5,000.00
502.10	HEADWALL AND CHANNEL IMPROVEMENTS		1	LS	\$50,000.00	\$50,000.00
570.01	CMU WALL		35	LF	\$250.00	\$8,750.00
603.01	18-INCH REINFORCED CONCRETE PIPE (CLASS III)		742	LF	\$95.00	\$70,490.00
603.02	24-INCH REINFORCED CONCRETE PIPE (CLASS III)		19	LF	\$125.00	\$2,375.00
603.03	30-INCH REINFORCED CONCRETE PIPE (CLASS III)		84	LF	\$135.00	\$11,340.00
609.01	30-INCH STORM DRAIN ACCESS MANHOLE		8	EA	\$2,300.00	\$18,400.00
609.02	48-INCH TYPE IA STORM DRAIN MANHOLE		1	EA	\$4,200.00	\$4,200.00
609.03	2-FOOT NDOT TYPE 2B DROP INLET		8	EA	\$4,000.00	\$32,000.00
609.04	2.5-FOOT TYPE CM2 DROP INLET		4	EA	\$3,000.00	\$12,000.00
609.05	5-FOOT TYPE CM2 DROP INLET		3	EA	\$5,000.00	\$15,000.00
609.06	7.5-FOOT TYPE CM2 DROP INLET		1	EA	\$7,600.00	\$7,600.00
609.07	12.5-FOOT TYPE CM2 DROP INLET		1	EA	\$11,900.00	\$11,900.00
609.08	17.5-FOOT TYPE CM2 DROP INLET		3	EA	\$16,000.00	\$48,000.00
613.01	TYPE I CURB AND GUTTER (24-INCH)		320	LF	\$20.00	\$6,400.00
613.02	CONCRETE SIDEWALK		1,955	SF	\$10.00	\$19,550.00
616.01	6' WROUGHT IRON FENCE		40	LF	\$65.00	\$2,600.00
616.02	12' VEHICLE ACCESS GATE		1	EA	\$900.00	\$900.00
622.01	CONSTRUCTION SURVEYING		1	LS	\$40,000.00	\$40,000.00
624.01	TRAFFIC CONTROL & MAINTENANCE		1	LS	\$75,000.00	\$75,000.00
625.01	PORTABLE CHANGEABLE MESSAGE SIGN		40	DAY	\$70.00	\$2,800.00
625.02	ARROW DISPLAY		120	DAY	\$30.00	\$3,600.00
627.01	REMOVE EXISTING SIGN AND RELOCATE TO NEW POST		10	EA	\$150.00	\$1,500.00
628.01	TYPE II FILM "ONLY"		3	EA	\$160.00	\$480.00
628.02	TYPE II FILM FOR ARROWS		6	EA	\$130.00	\$780.00
628.03	TYPE II FILM - 24" SOLID WHITE		937	LF	\$7.00	\$6,559.00
628.04	TYPE 1 CENTERLINE (YELLOW)		175	LF	\$2.00	\$350.00
628.05	4-INCH EDGE LINE (WHITE)		1,635	LF	\$1.00	\$1,635.00
630.01	8-INCH PVC PS-46, SDR 35 SANITARY SEWER PIPE		36	LF	\$100.00	\$3,600.00
630.02	12-INCH PVC PS-46, SDR 35 SANITARY SEWER PIPE		482	LF	\$110.00	\$53,020.00
630.03	48-INCH SANITARY SEWER MANHOLE		1	EA	\$3,200.00	\$3,200.00
630.04	60-INCH SANITARY SEWER MANHOLE		2	EA	\$5,000.00	\$10,000.00
630.05	VERTICALLY ADJUST SANITARY SEWER MANHOLE		1	EA	\$650.00	\$650.00
633.01	REFLECTIVE RAISED PAVEMENT MARKERS		120	EA	\$3.00	\$360.00
633.02	NON-REFLECTIVE RAISED PAVEMENT MARKERS		360	EA	\$2.00	\$720.00
637.01	DUST CONTROL		1	LS	\$50,000.00	\$50,000.00
637.02	NPDES DISCHARGE PERMIT		1	LS	\$10,000.00	\$10,000.00

SUBTOTAL \$3,408,594.00
10% CONTINGENCY \$340,859.40
SUBTOTAL CONSTRUCTION \$3,749,453.40
7% CONSTRUCTION MANAGEMENT \$262,462.00
TOTAL \$4,011,915.40

202.17*	REMOVAL & RELOCATION OF 2-INCH STEEL GAS LINE		150	LF	\$25.00	\$3,750.00
202.18*	REMOVAL & RELOCATION 4-INCH GAS MAIN		1,200	LF	\$125.00	\$150,000.00

* These items are included until the terms of Franchise Agreement with SWG are determined.

SUBTOTAL \$153,750.00
10% CONTINGENCY \$15,375.00
TOTAL UTILITIES \$169,125.00

TOTAL CONSTRUCTION AND UTILITIES \$4,181,040.40

FIGURE A-7

Testhole Data Summary



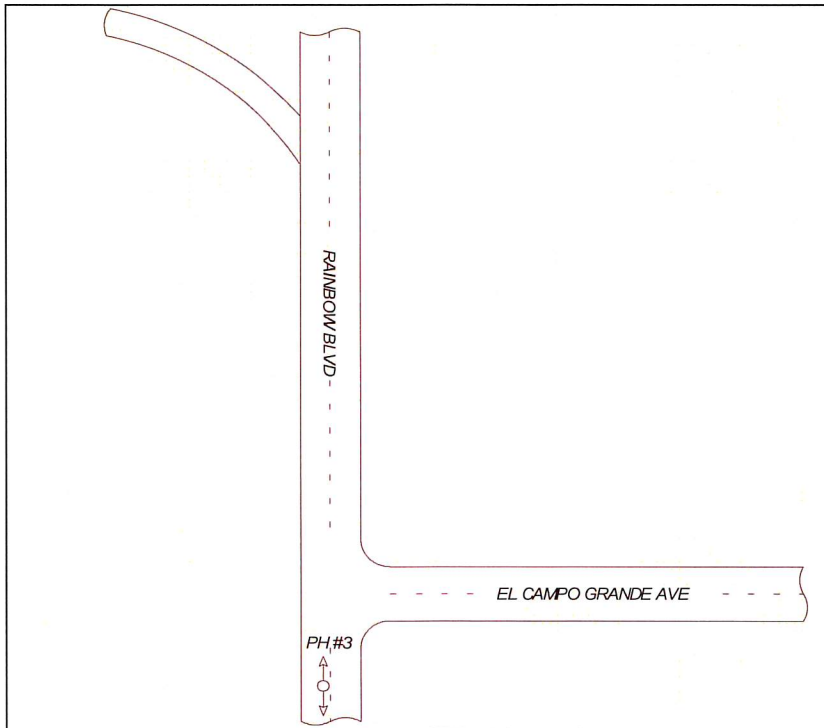
Date: 1/13/2011
Project Number: NVU1004-009
Project Name: Rainbow Boulevard

TH #	Location	Date of Excavation	Utility Owner	Utility Size	Utility Size	Utility Description	Pipe Thickness (in)	Ground Elevation	Top Elevation	Bottom Invert Elevation	Center of Pipe	Difference	Depth of Cover	Comments
3	El Campo Grande & Rainbow Boulevard	1/6/2011	Southwest Gas	4"	4.00 in	PE	0.25 in	2326.08	2321.38	2321.02	2321.19	0.17	4.70	
4	El Campo Grande & Rainbow Boulevard	1/6/2011	Southwest Gas	4"	4.00 in	PE	0.25 in	2326.71	2323.31	2322.95	2323.12	0.17	3.40	
5	El Campo Grande & Rainbow Boulevard	1/6/2011	Las Vegas Valley Water District	36"	36.00 in	RCP	4.00 in	2326.40	2319.50	2316.17	2317.67	1.50	6.90	
6	El Campo Grande & Rainbow Boulevard	1/6/2011	City of Las Vegas	12"	12.00 in	PVC	0.40 in	2326.30	2318.10	-	-	-	8.20	Node 5684, USE DIPPED MANHOLES
6A	El Campo Grande & Rainbow Boulevard	1/6/2011	Southwest Gas	4"	4.00 in	PE	0.25 in	2326.29	2322.99	2322.64	2322.80	0.17	3.30	
7	El Campo Grande & Rainbow Boulevard	1/6/2011	Las Vegas Valley Water District	36"	36.00 in	RCP	4.00 in	2326.45	2319.75	2316.42	2317.92	1.50	6.70	
8	El Campo Grande & Rainbow Boulevard	1/6/2011	Southwest Gas	2"	2.00 in	PE	0.22 in	2326.23	2322.83	2322.65	2322.73	0.08	3.40	
9	El Campo Grande & Rainbow Boulevard	1/6/2011	Southwest Gas	4"	4.00 in	PE	0.25 in	2326.53	2323.23	2322.87	2323.04	0.17	3.30	
10	El Campo Grande & Rainbow Boulevard	1/6/2011	Las Vegas Valley Water District	36"	36.00 in	RCP	4.00 in	2326.41	2319.81	2316.48	2317.98	1.50	6.60	
11	Ambiance Lane & Rainbow Boulevard	1/10/2011	Las Vegas Valley Water District	8"	8.00 in	PVC	0.32 in	2328.43	2319.73	2319.03	2319.37	0.33	8.70	
12	Ambiance Lane & Rainbow Boulevard	1/10/2011	Southwest Gas	2"	2.00 in	PE	0.22 in	NO SURVEY	-	-	-	-	3.80	
13	Tropical Parkway & Rainbow Boulevard	1/10/2011	Las Vegas Valley Water District	36"	36.00 in	RCP	4.00 in	2330.17	2322.87	2319.53	2321.03	1.50	7.30	
14	Tropical Parkway & Rainbow Boulevard	1/7/2011	Southwest Gas	4"	4.00 in	PE	0.25 in	2330.60	2326.80	2326.45	2326.62	0.17	3.80	
14A	Tropical Parkway & Rainbow Boulevard	1/7/2011	Nevada Energy	Four 3" & Six 4"	SEE WORKSHEET	PVC	0.34 in	2330.61	2327.60	SEE WORKSHEET	-	-	3.01	FOR PLAN, THE BOTTOM OF TWO BANKS USE AS INV 8" Wide
14B	Tropical Parkway & Rainbow Boulevard	1/7/2011	Cox Communications	Two 2"	2.00 in	PVC	0.20 in	2330.62	2327.82	2327.63	2327.72	0.08	2.80	
15	Tropical Parkway & Rainbow Boulevard	1/7/2011	Southwest Gas	4"	4.00 in	PE	0.25 in	2330.76	2326.91	2326.55	2326.72	0.17	3.85	
16	Tropical Parkway & Rainbow Boulevard	1/7/2011	Nevada Energy	Four 3" & Six 4"	SEE WORKSHEET	PVC	0.25 in	2330.56	2327.45	SEE WORKSHEET	-	-	3.11	FOR PLAN, THE BOTTOM OF TWO BANKS USE AS INV 8" Wide
16A	Tropical Parkway & Rainbow Boulevard	1/7/2011	Cox Communications	Two 2"	2.00 in	PVC	0.20 in	2330.55	2327.65	2327.47	2327.55	0.08	2.90	
17	Tropical Parkway & Rainbow Boulevard	1/7/2011	Las Vegas Valley Water District	18"	12.00 in	PVC	0.40 in	2330.73	2326.43	2325.40	2325.90	0.50	4.30	12" IN PLANS, KEPT AS 12" IN PLANS-aztec had 18" shown - 12" calc'd
18	Tropical Parkway & Rainbow Boulevard	1/7/2011	Southwest Gas	4"	4.00 in	PE	0.25 in	2330.71	2327.01	2326.65	2326.82	0.17	3.70	
19	Tropical Parkway & Rainbow Boulevard	1/7/2011	Southwest Gas	4"	4.00 in	PE	0.25 in	2329.83	2326.63	2326.28	2326.45	0.17	3.20	
20	Tropical Parkway & Rainbow Boulevard	1/7/2011	City of North Las Vegas	18"	18.00 in	RCP	2.50 in	NO SURVEY	-	-	-	-	2.30	Do not need, we are refiguring storm drain
21	Tropical Parkway & Rainbow Boulevard	1/10/2011	Las Vegas Valley Water District	36"	36.00 in	RCP	4.00 in	2330.82	2323.62	2320.28	2321.78	1.50	7.20	
22	El Campo Grande & Rainbow Boulevard	1/10/2011	Cox Communications	2"	2.00 in	PVC	0.22 in	2326.23	2325.03	2324.85	2324.93	0.08	1.20	

TEST HOLE DATA REPORT

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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

CROSS SECTION - NOT TO SCALE

		FACING	North	
		SURFACE ELEVATION	2326.08	
		TOP ELEVATION	2321.38	4.70 TOP DEPTH (FEET)
		BOTTOM ELEVATION	2321.00	5.08 BOTTOM (FEET)
RIBBON COLOR		Yellow		

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

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

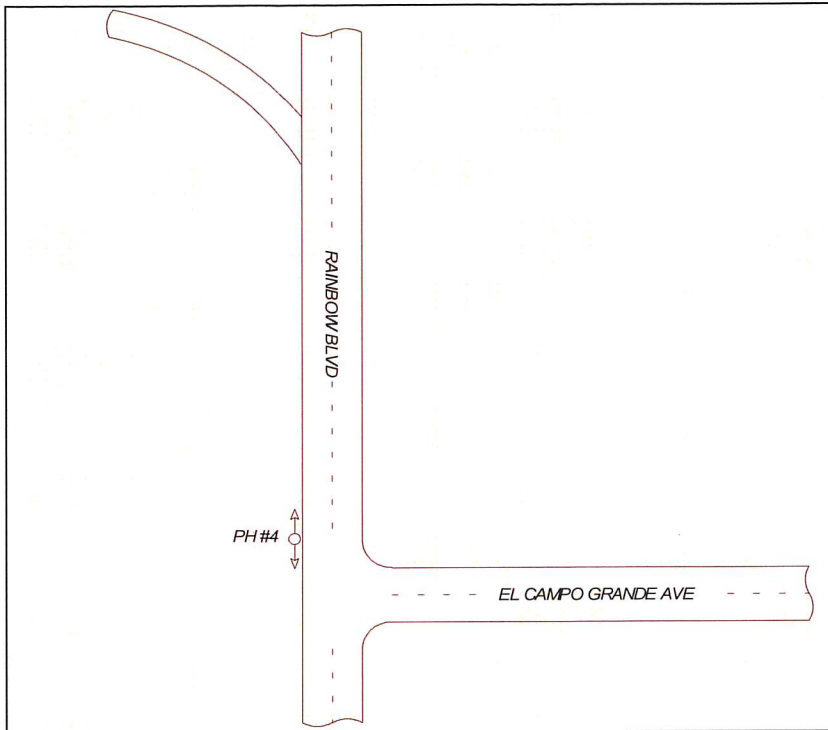
Test Hole # 4
 Date Dug 1/6/2011
 Project # NVU1004-009
 Phase # 009
 Location El Campo Grande & Rainbow Boulevard

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



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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

CROSS SECTION - NOT TO SCALE

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

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

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

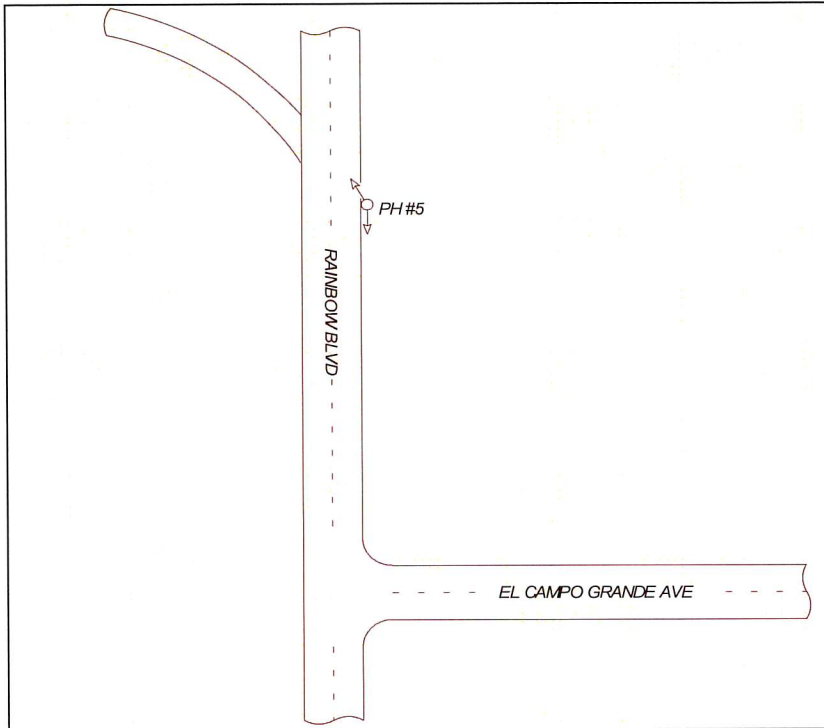
Test Hole # 5
 Date Dug 1/6/2011
 Project # NVU1004-009
 Phase # 009
 Location El Campo Grande & Rainbow Boulevard



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

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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

CROSS SECTION - NOT TO SCALE

Blank area for site benchmark notes.

FACING <u>North</u>	
SURFACE ELEVATION <u>2326.40</u>	← WIDTH/O.D. →
TOP ELEVATION <u>2319.50</u>	<u>44"</u>
BOTTOM ELEVATION <u>2315.83</u>	6.90 TOP DEPTH (FEET)
	10.57 BOTTOM (FEET)

RIBBON COLOR Blue

COORDINATES: NORTHING None EASTING None

STATIONING: STATION None OFFSET None

PAVING THICKNESS None PAVING TYPE None SOIL CONDITION Dirt

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

COMMENTS:

Blank area for comments.

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

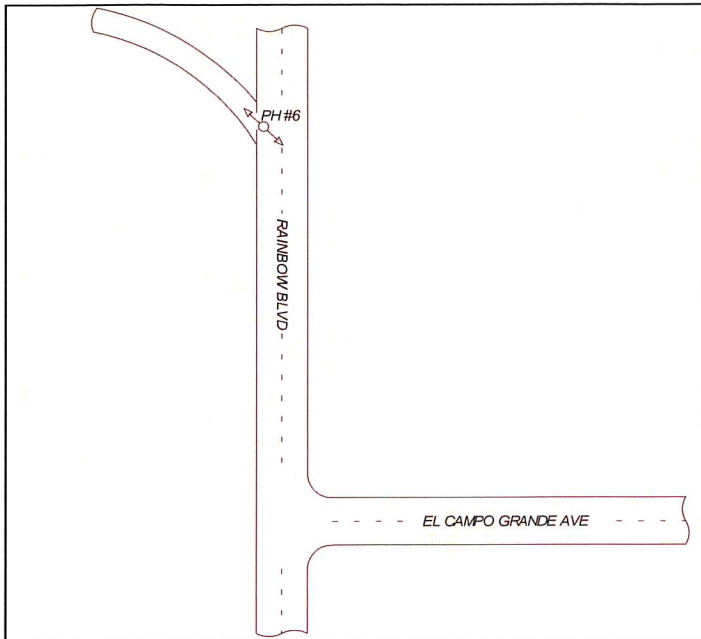


Test Hole # 6
 Date Dug 1/6/2011
 Project # NVU1004-009
 Phase # 009
 Location El Campo Grande & Rainbow Boulevard

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

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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

Blank area for site benchmark data.

CROSS SECTION - NOT TO SCALE

FACING <u>West</u>	
SURFACE ELEVATION <u>NA</u>	
TOP ELEVATION _____	
BOTTOM ELEVATION _____	
WIDTH/OD <u>12.75"</u> TOP DEPTH (FEET) <u>8.20</u> BOTTOM (FEET) <u>9.26</u>	

RIBBON COLOR Green

COORDINATES: NORTHING None EASTING None
 STATIONING: STATION None OFFSET None
 PAVING THICKNESS 5" PAVING TYPE Asphalt SOIL CONDITION Dirt
 SIZE 12" TYPE PVC FACILITY OWNER City of Las Vegas

COMMENTS:

Blank area for comments.

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

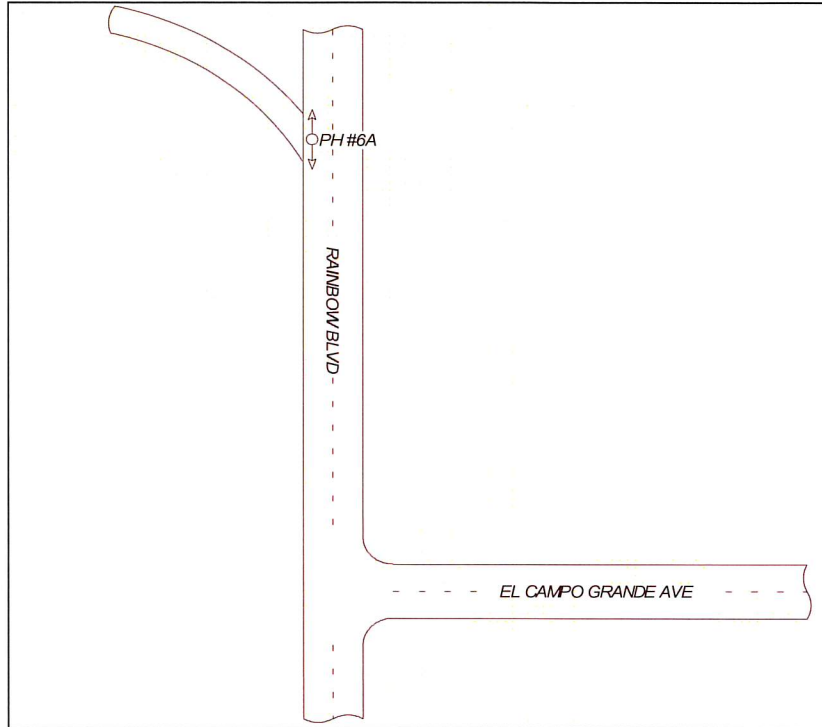
Test Hole # 6A
 Date Dug 1/6/2011
 Project # NVU1004-009
 Phase # 009
 Location El Campo Grande & Rainbow Boulevard



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

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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

CROSS SECTION - NOT TO SCALE

		FACING	<u>North</u>	
		SURFACE ELEVATION	<u>2326.29</u>	
		TOP ELEVATION	<u>2322.99</u>	3.30 TOP DEPTH (FEET)
		BOTTOM ELEVATION	<u>2322.61</u>	3.68 BOTTOM (FEET)
RIBBON COLOR		<u>Yellow</u>		

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

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

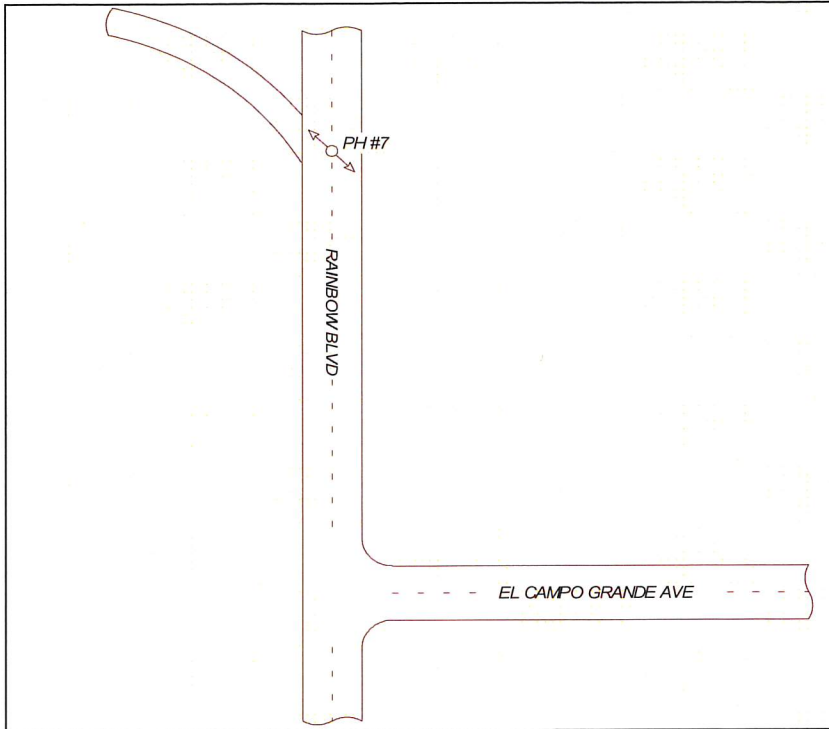
Test Hole # 7
 Date Dug 1/6/2011
 Project # NVU1004-009
 Phase # 009
 Location El Campo Grande & Rainbow Boulevard



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

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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

CROSS SECTION - NOT TO SCALE

RIBBON COLOR Blue

FACING <u>North</u>	
SURFACE ELEVATION <u>2326.45</u>	WIDTH/O.D. <u>44"</u>
TOP ELEVATION <u>2319.75</u>	6.70 TOP DEPTH (FEET)
BOTTOM ELEVATION <u>2316.08</u>	10.37 BOTTOM (FEET)

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

COMMENTS:

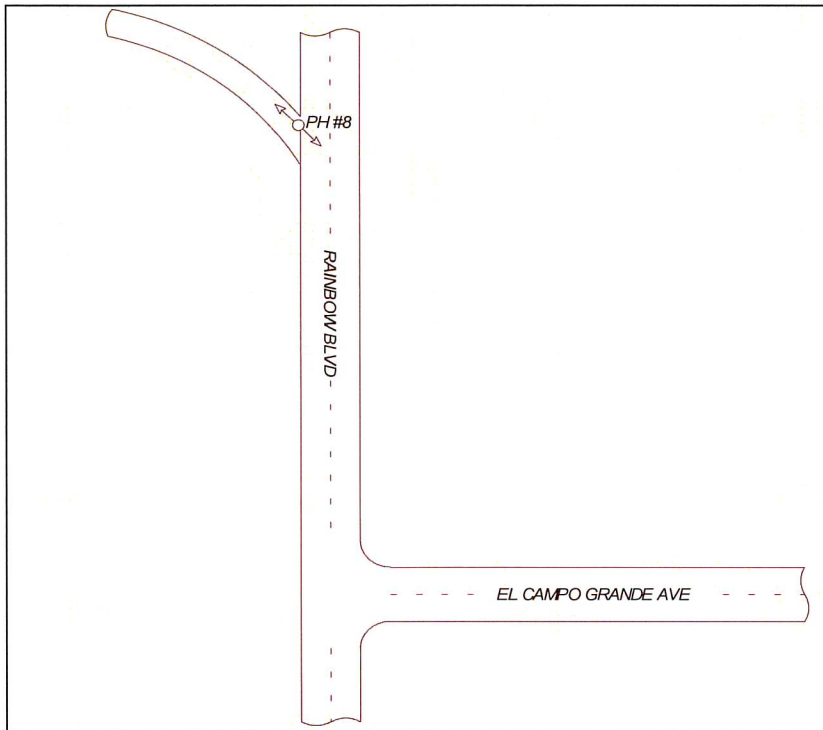
PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

CROSS SECTION - NOT TO SCALE

	FACING <u>West</u>			
	SURFACE ELEVATION	<u>2326.23</u>	← WIDTH/O.D. 2.38" → ○	
	TOP ELEVATION	<u>2322.83</u>		3.40 TOP DEPTH (FEET)
	BOTTOM ELEVATION	<u>2322.63</u>		3.60 BOTTOM (FEET)
RIBBON COLOR	Yellow			

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

COMMENTS:

PREPARED BY:	M. Huber	CHECKED BY:	W. Morales
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TEST HOLE DATA REPORT

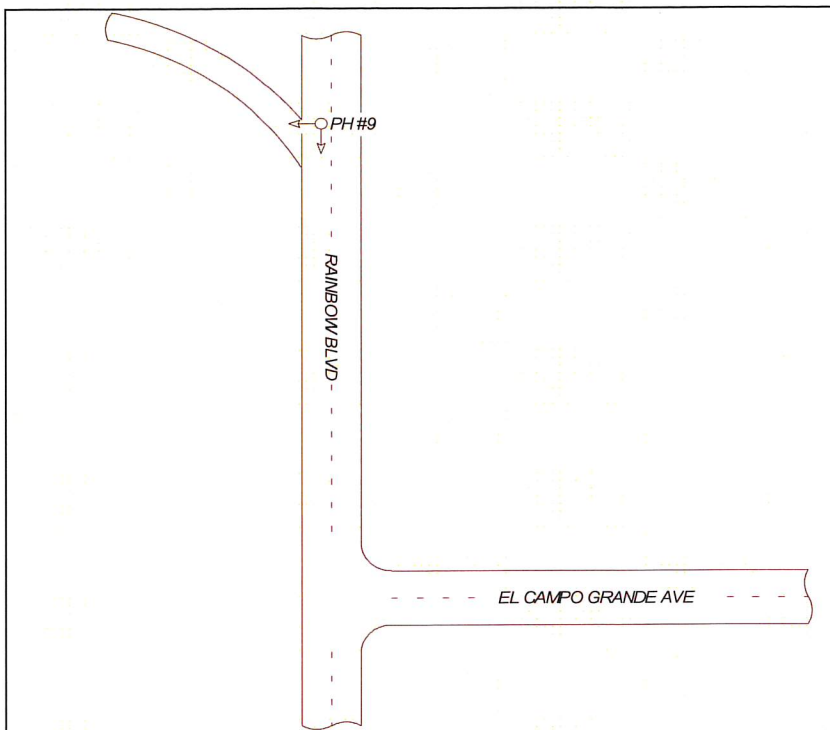
Test Hole # 9
 Date Dug 1/6/2011
 Project # NVU1004-009
 Phase # 009
 Location El Campo Grande & Rainbow Boulevard



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

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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

CROSS SECTION - NOT TO SCALE

Site benchmark area for notes or drawings.

FACING <u>West</u>	
SURFACE ELEVATION <u>2326.53</u>	WIDTH/O.D. <u>4.5"</u>
TOP ELEVATION <u>2323.23</u>	3.30 TOP DEPTH (FEET)
BOTTOM ELEVATION <u>2322.85</u>	3.68 BOTTOM (FEET)

RIBBON COLOR Yellow

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS 3" PAVING TYPE Asphalt SOIL CONDITION Dirt

SIZE 4" TYPE PE FACILITY OWNER Southwest Gas

COMMENTS:

Large area for handwritten comments.

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

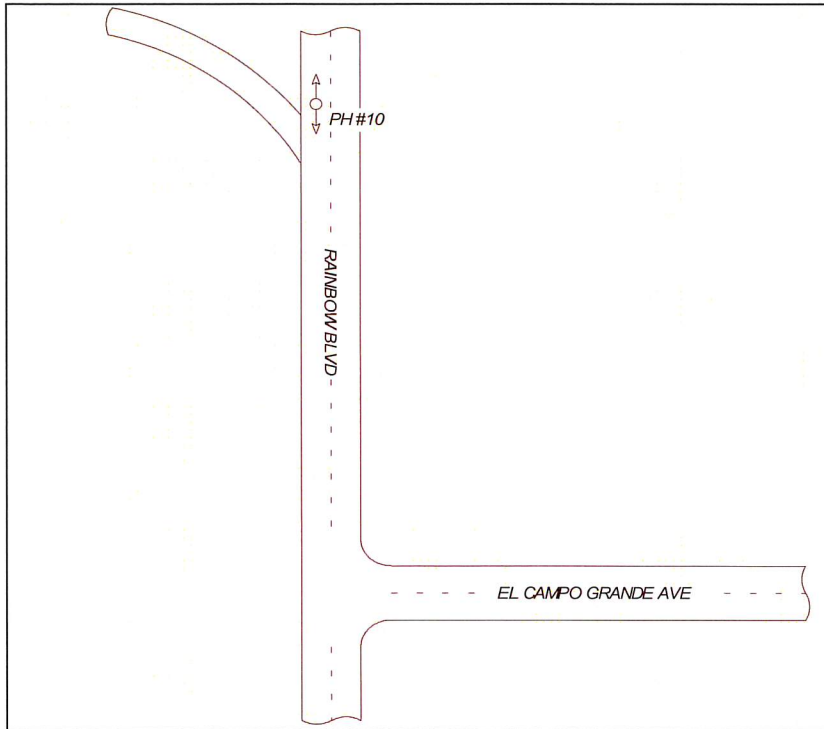
Test Hole # 10
 Date Dug 1/6/2011
 Project # NVU1004-009
 Phase # 009
 Location El Campo Grande & Rainbow Boulevard



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

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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

CROSS SECTION - NOT TO SCALE

RIBBON COLOR Blue

FACING <u>North</u>	
SURFACE ELEVATION <u>2326.41</u>	WIDTH/O.D. <u>44"</u>
TOP ELEVATION <u>2319.81</u>	6.60 TOP DEPTH (FEET)
BOTTOM ELEVATION <u>2316.14</u>	10.27 BOTTOM (FEET)

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

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

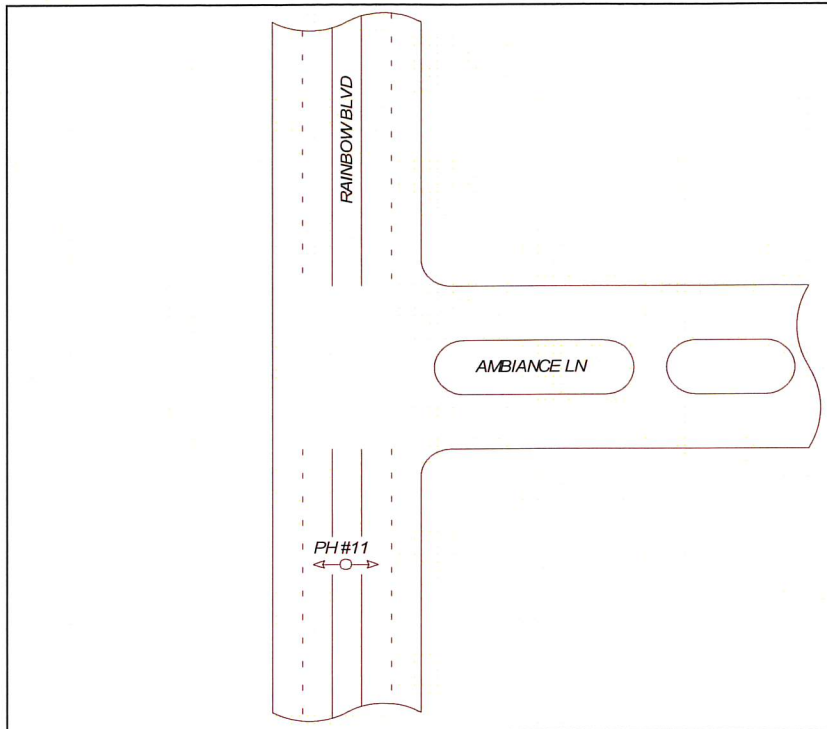
TEST HOLE DATA REPORT

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

AZTEC
www.aztec.us TYPSA group
 3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129
 Tel. (702) 396-3426 Fax. (702) 396-3758

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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

CROSS SECTION - NOT TO SCALE

RIBBON COLOR Blue

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

COORDINATES: NORTHING None EASTING None
 STATIONING: STATION None OFFSET None
 PAVING THICKNESS 4" PAVING TYPE Asphalt SOIL CONDITION Dirt
 SIZE 8" TYPE PVC FACILITY OWNER Las Vegas Valley Water District

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

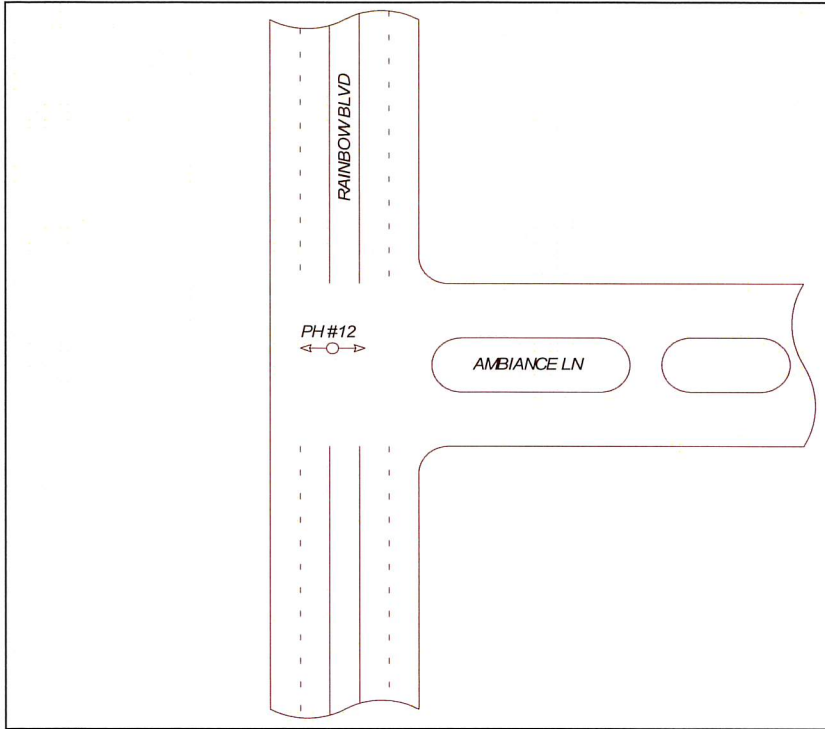
Test Hole # 12
 Date Dug 1/10/2011
 Project # NVU1004-009
 Phase # 009
 Location Ambiance Lane & Rainbow Boulevard



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

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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

Blank area for site benchmark data.

CROSS SECTION - NOT TO SCALE

FACING West

SURFACE ELEVATION	NO SURVEY	← WIDTH/O.D. 2.38" →	
TOP ELEVATION			3.80 TOP DEPTH (FEET)
BOTTOM ELEVATION			4.00 BOTTOM (FEET)

RIBBON COLOR Yellow

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS 4" PAVING TYPE Asphalt SOIL CONDITION Dirt

SIZE 2" TYPE PE FACILITY OWNER Southwest Gas

COMMENTS:

Blank area for comments.

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

Test Hole # 13
 Date Dug 1/10/2011
 Project # NVU1004-009
 Phase # 009
 Location Tropical Parkway & Rainbow Boulevard

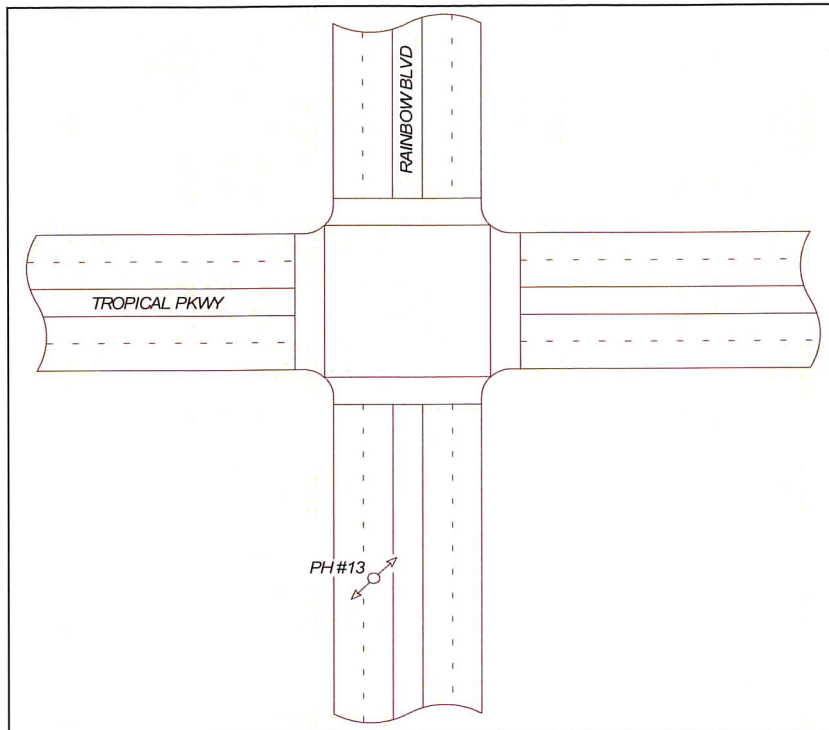
3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129

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



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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

CROSS SECTION - NOT TO SCALE

		FACING	<u>North</u>	
		SURFACE ELEVATION	<u>2330.17</u>	
		TOP ELEVATION	<u>2322.87</u>	
		BOTTOM ELEVATION	<u>2319.20</u>	
		WIDTH/O.D.		
		<u>44"</u>		
				<u>7.30</u> TOP DEPTH (FEET)
				<u>10.97</u> BOTTOM (FEET)

RIBBON COLOR Blue

COORDINATES: NORTHING None EASTING None

STATIONING: STATION None OFFSET None

PAVING THICKNESS 4" PAVING TYPE Asphalt SOIL CONDITION Dirt

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

COMMENTS:

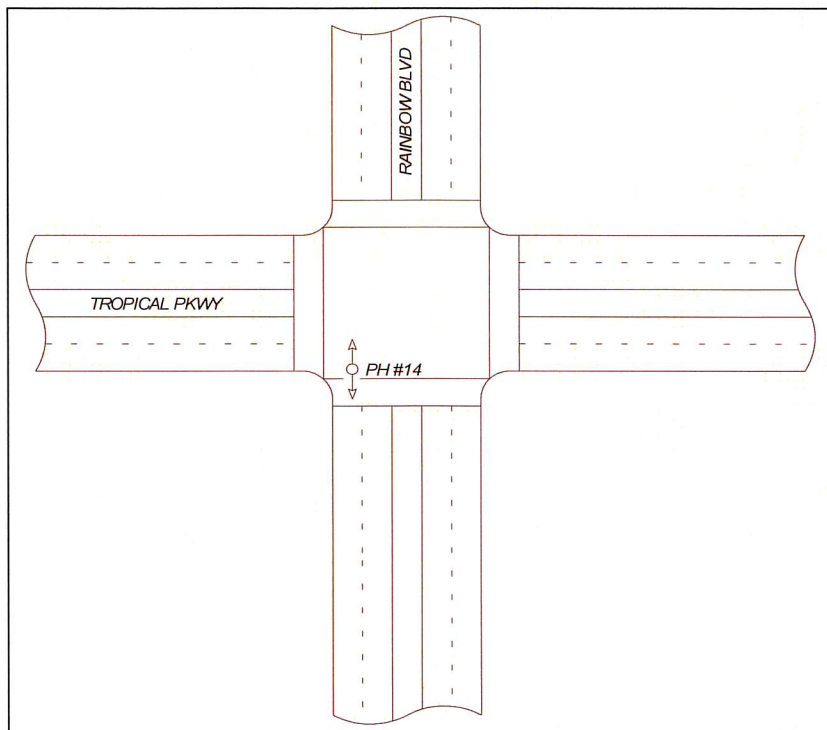
PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

CROSS SECTION - NOT TO SCALE

		FACING	North
		SURFACE ELEVATION	2330.60
		TOP ELEVATION	2326.80
		BOTTOM ELEVATION	2326.42
		WIDTH/O.D.	4.5"
		TOP DEPTH (FEET)	3.80
		BOTTOM (FEET)	4.18
RIBBON COLOR	Yellow		

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

COMMENTS:

PREPARED BY:	M. Huber	CHECKED BY:	W. Morales
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TEST HOLE DATA REPORT

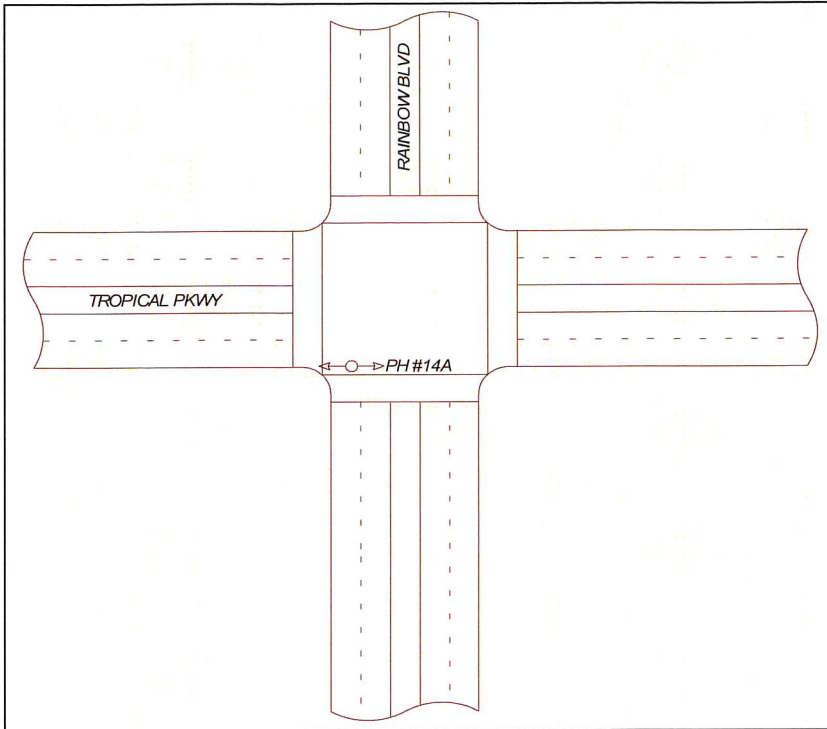
Test Hole # 14A
 Date Dug 1/7/2011
 Project # NVU1004-009
 Phase # 009
 Location Tropical Parkway & Rainbow Boulevard

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



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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

CROSS SECTION - NOT TO SCALE

		FACING	<u>West</u>	
		SURFACE ELEVATION	<u>2330.61</u>	
		TOP ELEVATION	<u>2327.60</u>	3.01 TOP DEPTH (FEET)
		BOTTOM ELEVATION	<u>2326.81</u>	3.80 BOTTOM (FEET)
RIBBON COLOR		<u>Red</u>		

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

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

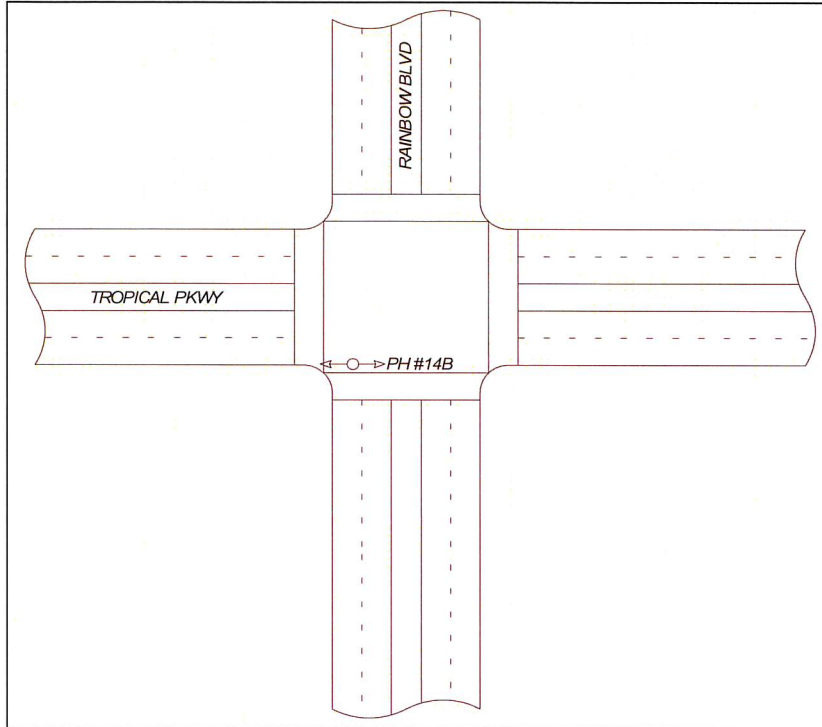
Test Hole # 14B
 Date Dug 1/7/2011
 Project # NVU1004-009
 Phase # 009
 Location Tropical Parkway & Rainbow Boulevard



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

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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

Blank area for site benchmark details.

CROSS SECTION - NOT TO SCALE

FACING <u>West</u>	
SURFACE ELEVATION <u>2330.62</u>	WIDTH/O.D. <u>8"</u>
TOP ELEVATION <u>2327.82</u>	2.80 TOP DEPTH (FEET)
BOTTOM ELEVATION <u>2327.62</u>	3.00 BOTTOM (FEET)

RIBBON COLOR Orange

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS 4"

PAVING TYPE Asphalt

SOIL CONDITION Dirt

SIZE Two 2"

TYPE PVC

FACILITY OWNER Cox Communications

COMMENTS:

Blank area for comments.

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

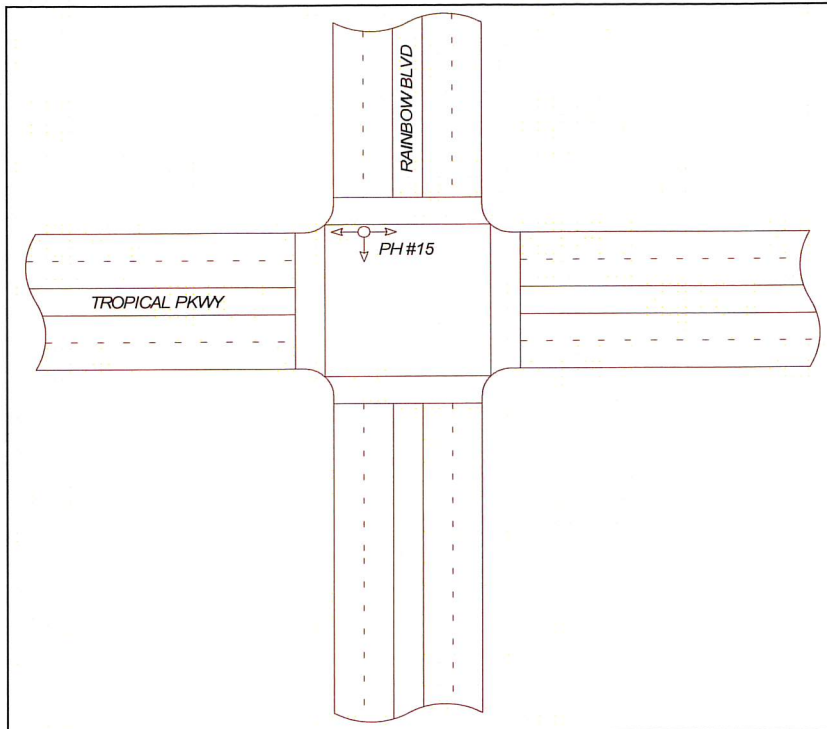
Test Hole # 15
 Date Dug 1/7/2011
 Project # NVU1004-009
 Phase # 009
 Location Tropical Parkway & Rainbow Boulevard



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

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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

CROSS SECTION - NOT TO SCALE

RIBBON COLOR Yellow

FACING		North		
SURFACE ELEVATION	2330.76	← WIDTH/O.D. 4.5" → 		
TOP ELEVATION	2326.91		3.85	TOP DEPTH (FEET)
BOTTOM ELEVATION	2326.53		4.23	BOTTOM (FEET)

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

COMMENTS:

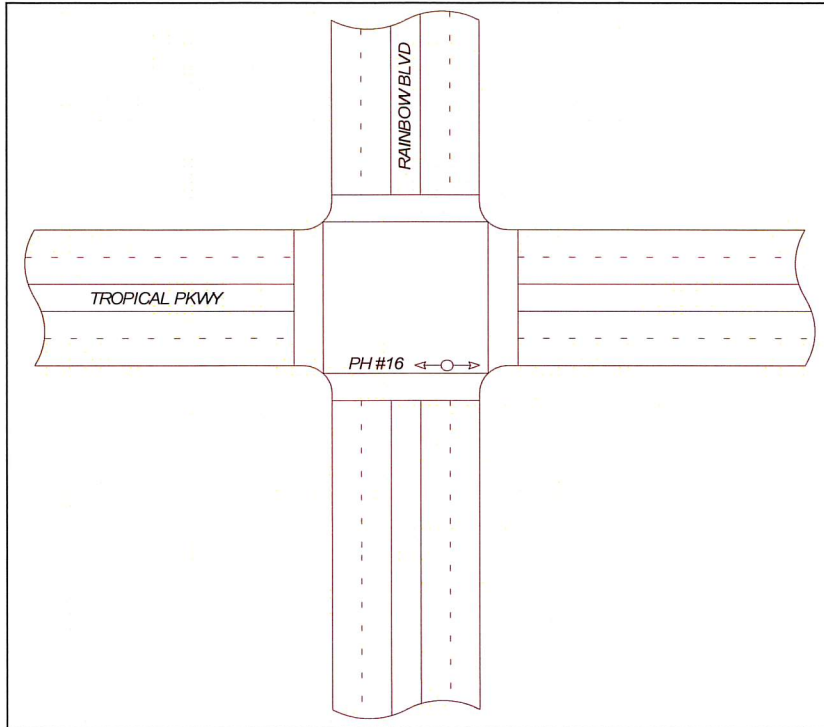
PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

CROSS SECTION - NOT TO SCALE

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

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

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

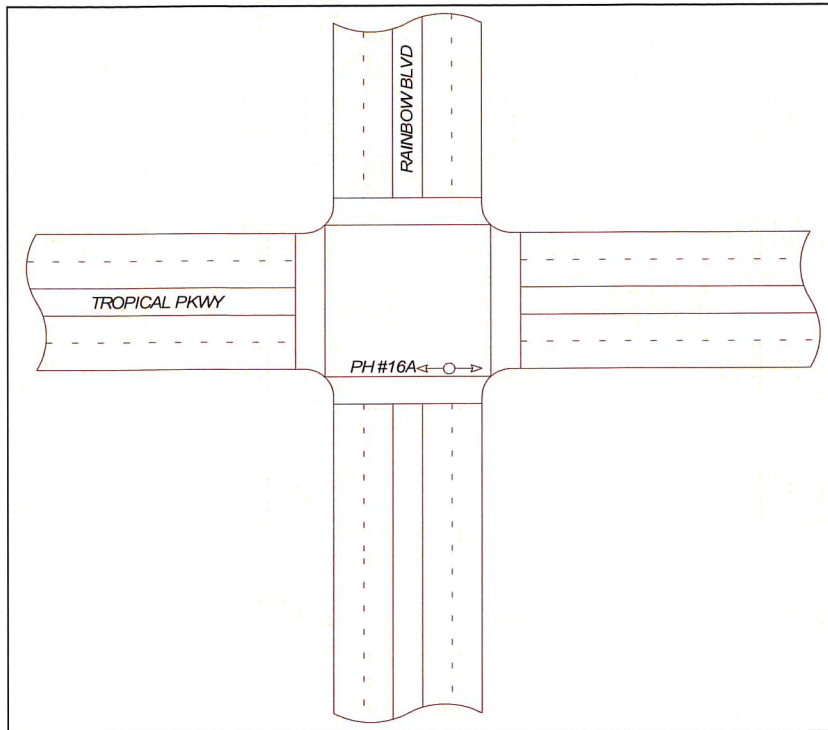
Test Hole # 16A
 Date Dug 1/7/2011
 Project # NVU1004-009
 Phase # 009
 Location Tropical Parkway & Rainbow Boulevard



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

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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

Blank area for site benchmark notes.

CROSS SECTION - NOT TO SCALE

FACING <u>West</u>			
SURFACE ELEVATION	<u>2330.55</u>	← WIDTH/O.D. → 8" ○ ○	
TOP ELEVATION	<u>2327.65</u>		2.90 TOP DEPTH (FEET)
BOTTOM ELEVATION	<u>2327.41</u>		3.14 BOTTOM (FEET)

RIBBON COLOR Orange

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS 4"

PAVING TYPE Asphalt

SOIL CONDITION Dirt

SIZE Two 2"

TYPE PVC

FACILITY OWNER Cox Communications

COMMENTS:

Blank area for comments.

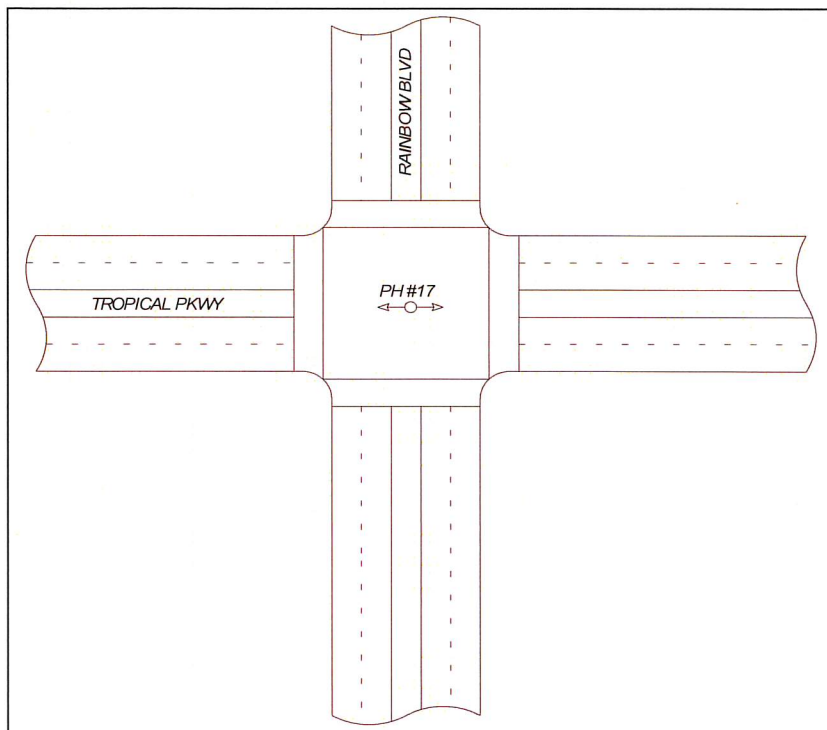
PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

CROSS SECTION - NOT TO SCALE

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

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

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

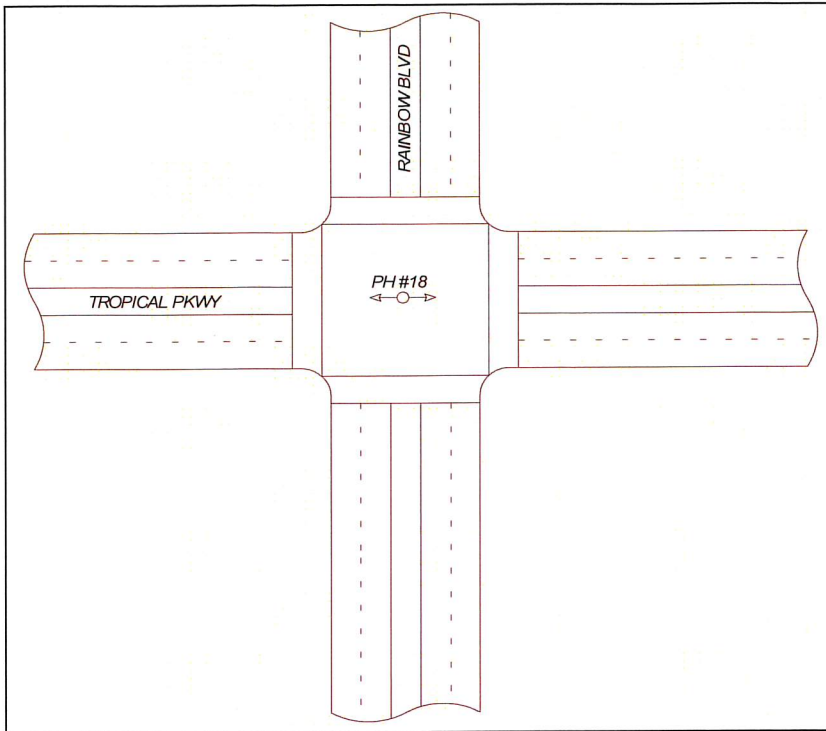
Test Hole # 18
 Date Dug 1/7/2011
 Project # NVU1004-009
 Phase # 009
 Location Tropical Parkway & Rainbow Boulevard



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

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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

RIBBON COLOR Yellow

CROSS SECTION - NOT TO SCALE

FACING West

SURFACE ELEVATION	<u>2330.71</u>		
TOP ELEVATION	<u>2327.01</u>		<u>3.70</u> TOP DEPTH (FEET)
BOTTOM ELEVATION	<u>2326.63</u>		<u>4.08</u> BOTTOM (FEET)

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

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

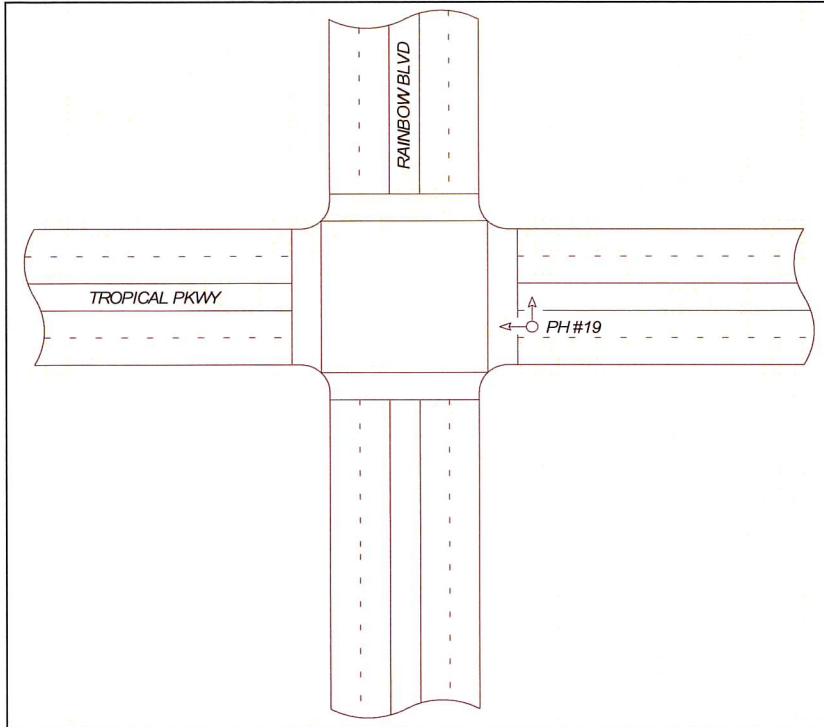
Test Hole # 19
 Date Dug 1/7/2011
 Project # NVU1004-009
 Phase # 009
 Location Tropical Parkway & Rainbow Boulevard



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 City North Las Vegas
 County Clark

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

CROSS SECTION - NOT TO SCALE

RIBBON COLOR Yellow

FACING <u>North</u>	
SURFACE ELEVATION <u>2329.83</u>	
TOP ELEVATION <u>2326.63</u>	
BOTTOM ELEVATION <u>2326.25</u>	
	<u>3.20</u> TOP DEPTH (FEET) <u>3.58</u> BOTTOM (FEET)

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

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

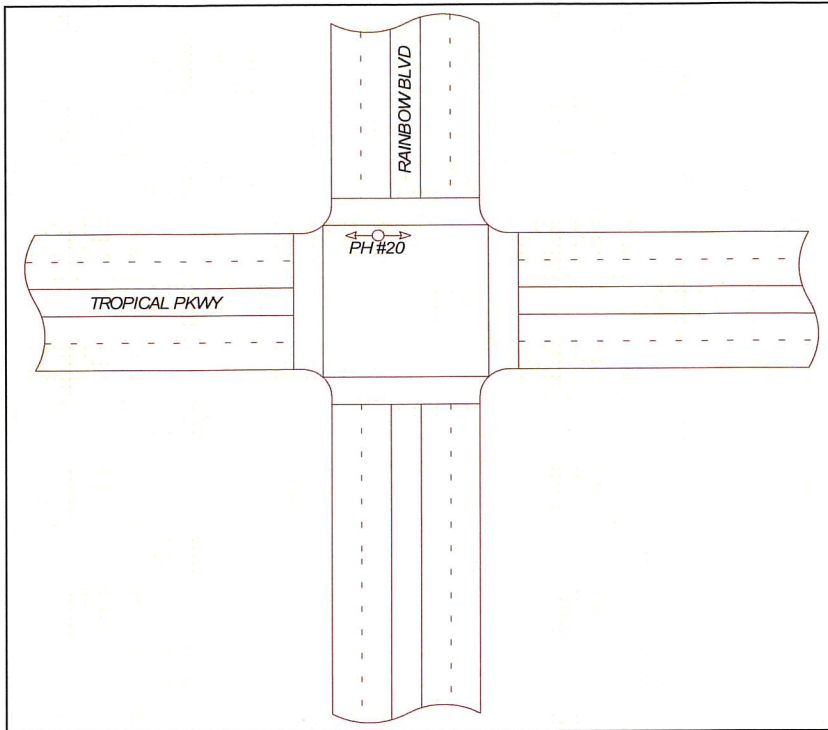
Test Hole # 20
 Date Dug 1/7/2011
 Project # NVU1004-009
 Phase # 009
 Location Tropical Parkway & Rainbow Boulevard

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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

RIBBON COLOR Green

CROSS SECTION - NOT TO SCALE

FACING West

SURFACE ELEVATION NO SURVEY

TOP ELEVATION 2.30 TOP DEPTH (FEET)

BOTTOM ELEVATION 4.22 BOTTOM (FEET)

WIDTH/O.D. 23"

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

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

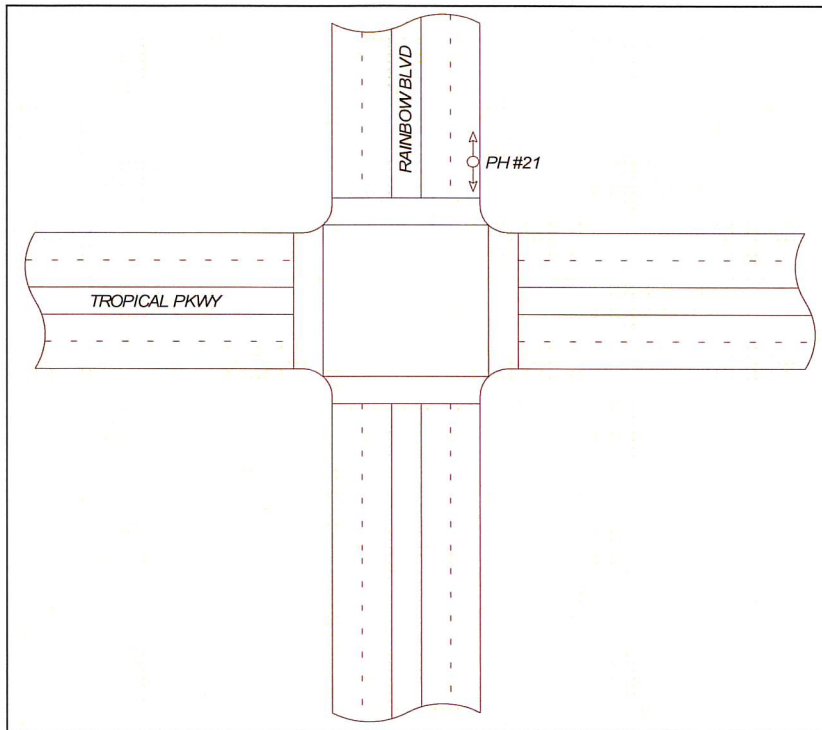
Test Hole # 21
 Date Dug 1/10/2011
 Project # NVU1004-009
 Phase # 009
 Location Tropical Parkway & Rainbow Boulevard



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 Truck # 9247
 City North Las Vegas
 County Clark

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

Blank area for site benchmark data.

CROSS SECTION - NOT TO SCALE

FACING <u>North</u>	
SURFACE ELEVATION <u>2330.82</u>	← WIDTH/O.D. 44" →
TOP ELEVATION <u>2323.62</u>	7.20 TOP DEPTH (FEET)
BOTTOM ELEVATION <u>2319.95</u>	10.87 BOTTOM (FEET)

RIBBON COLOR Blue

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS None

PAVING TYPE None

SOIL CONDITION Dirt

SIZE 36"

TYPE RCP

FACILITY OWNER Las Vegas Valley Water District

COMMENTS:

Blank area for comments.

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

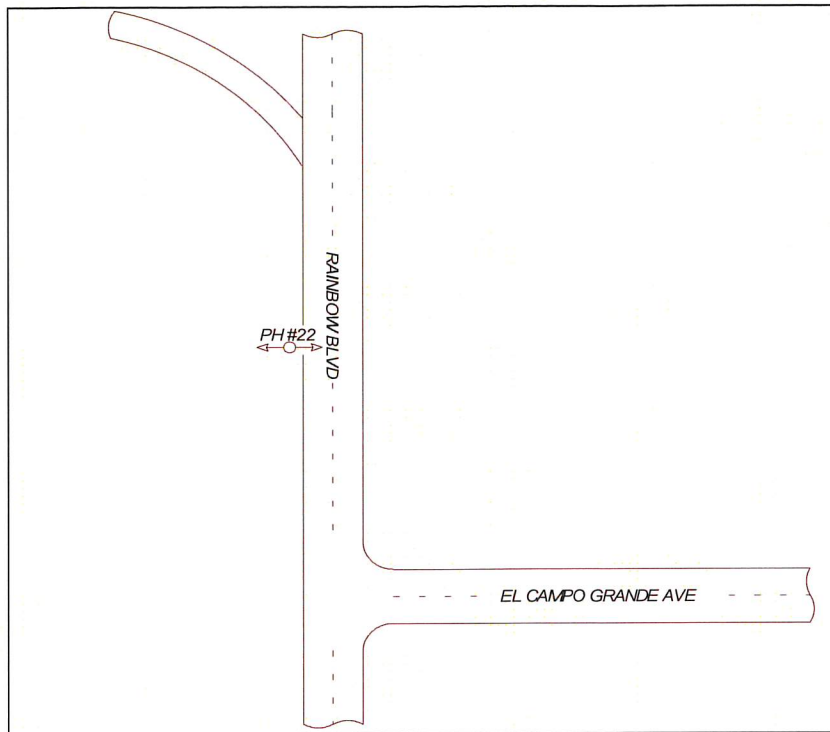
Test Hole # 22
 Date Dug 1/10/2011
 Project # NVU1004-009
 Phase # 009
 Location El Campo Grande & Rainbow Boulevard



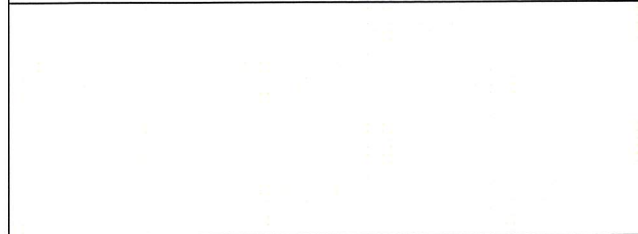
3320 North Buffalo Drive, Suite 106, Las Vegas, NV 89129
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SUE Crew J. Martinez
 Truck # 9247
 City North Las Vegas
 County Clark

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK



CROSS SECTION - NOT TO SCALE

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

RIBBON COLOR Orange

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS 4"

PAVING TYPE Asphalt

SOIL CONDITION Dirt

SIZE 2"

TYPE PVC

FACILITY OWNER Cox Communications

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

Testhole Data Summary



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

TH #	Location	Date of Excavation	Utility Owner	Utility Size	Utility Size	Utility Description	Pipe Thickness (in)	Ground Elevation	Top Elevation	Bottom Invert Elevation	Center of Pipe	Difference	Depth of Cover	Comments
AE-1	Rainbow Boulevard & Tropical Parkway	2/21/2011	Telephone	One 1.5" & One 2"	SEE WORKSHEET	PVC	0.22 in	2330.85	2326.90	SEE WORKSHEET	-	-	3.95	FOR PLAN, THE BOTTOM OF TWO BANKS USE AS INV
AG-1	Rainbow Boulevard & Ann Road	2/23/2011	Southwest Gas	4"	4.00 in	PE	0.25 in	2324.12	2320.44	2320.08	2320.25	0.17	3.68	
AG-4	Rainbow Boulevard south of El Campo Grande Avenue	2/23/2011	Southwest Gas	4"	4.00 in	PE	0.25 in	2326.41	2322.21	2321.86	2322.02	0.17	4.20	
AG-7	Rainbow Boulevard south of Ambiance Lane	2/21/2011	Southwest Gas	4"	4.00 in	PE	0.25 in	2326.95	2323.85	2323.50	2323.67	0.17	3.10	
AG-10	Rainbow Boulevard & Tropical Parkway	2/21/2011	Southwest Gas	4"	4.00 in	PE	0.25 in	2331.40	2327.38	2327.03	2327.19	0.17	4.02	
AW-1	Rainbow Boulevard & Ann Road	2/22/2011	Las Vegas Valley Water District	36"	36.00 in	MLCP	4.00 in	2324.03	2314.30	2310.96	2312.46	1.50	9.73	
AW-4	Rainbow Boulevard south of El Campo Grande Avenue	2/23/2011	Las Vegas Valley Water District	8"	8.00 in	PVC	0.32 in	2326.29	2322.33	2321.63	2321.97	0.33	3.96	
AW-5	Rainbow Boulevard south of El Campo Grande Avenue	2/22/2011	Las Vegas Valley Water District	12"	12.00 in	PVC	0.40 in	2324.85	2321.39	2320.35	2320.85	0.50	3.46	
AW-6	Rainbow Boulevard south of El Campo Grande Avenue	2/22/2011	Las Vegas Valley Water District	36"	36.00 in	MLCP	4.00 in	2325.57	2318.01	2314.68	2316.18	1.50	7.56	
AW-7	Rainbow Boulevard south of El Campo Grande Avenue	2/22/2011	Las Vegas Valley Water District	8"	8.00 in	PVC	0.32 in	2325.52	2321.00	2320.31	2320.64	0.33	4.52	
AW-8	Rainbow Boulevard south of El Campo Grande Avenue	2/22/2011	Las Vegas Valley Water District	36"	36.00 in	MLCP	4.00 in	2325.64	2318.59	2315.25	2316.75	1.50	7.05	
AW-9	Rainbow Boulevard & El Campo Grande Avenue	2/23/2011	Las Vegas Valley Water District	8"	8.00 in	PVC	0.32 in	2325.84	2321.89	2321.20	2321.53	0.33	3.95	
AW-10	Rainbow Boulevard & El Campo Grande Avenue	2/23/2011	Las Vegas Valley Water District	36"	36.00 in	MLCP	4.00 in	2325.98	2318.65	2315.31	2316.81	1.50	7.33	
AW-11	Rainbow Boulevard & Ambiance Lane	2/23/2011	Las Vegas Valley Water District	8"	8.00 in	PVC	0.32 in	2328.14	2320.76	2320.07	2320.40	0.33	7.38	
AW-13	Rainbow Boulevard & Tropical Parkway	2/21/2011	Las Vegas Valley Water District	10"	10.00 in	PVC	0.38 in	2331.15	2327.32	2326.46	2326.87	0.42	3.83	
AW-14	Rainbow Boulevard & Tropical Parkway	2/21/2011	Las Vegas Valley Water District	10"	10.00 in	PVC	0.38 in	2330.97	2326.78	2325.91	2326.33	0.42	4.19	

TEST HOLE DATA REPORT

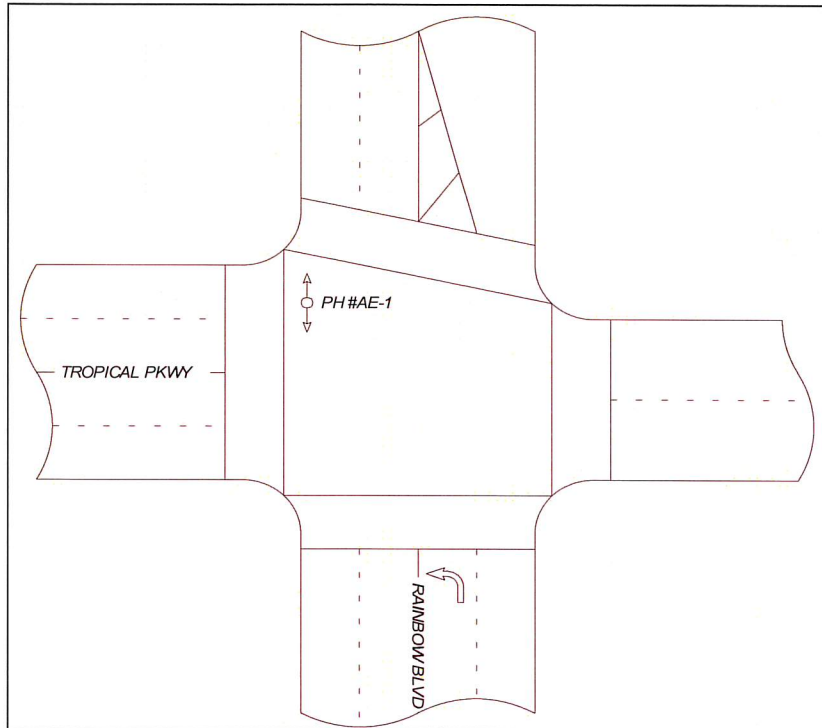
Test Hole # AE-1
 Date Dug 2/21/2011
 Project # NVU1105
 Phase # 001
 Location Rainbow Boulevard & Tropical Parkway



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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

RIBBON COLOR Orange

CROSS SECTION - NOT TO SCALE

FACING <u>North</u>	
SURFACE ELEVATION <u>2330.85</u>	WIDTH/O.D. <u>3"</u>
TOP ELEVATION <u>2326.90</u>	3.95 TOP DEPTH (FEET)
BOTTOM ELEVATION <u>2325.95</u>	4.90 BOTTOM (FEET)

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

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

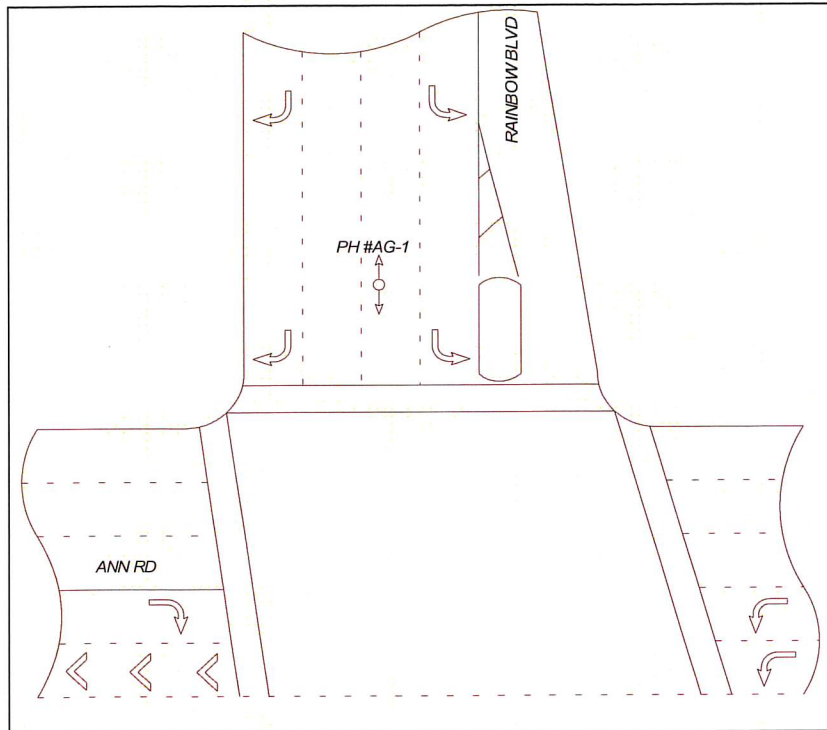
Test Hole # AG-1
 Date Dug 2/23/2011
 Project # NVU1105
 Phase # 001
 Location Rainbow Boulevard & Ann Road



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LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

Blank area for site benchmark details.

CROSS SECTION - NOT TO SCALE

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

RIBBON COLOR Yellow

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS 7"

PAVING TYPE Asphalt

SOIL CONDITION Dirt / Rock

SIZE 4"

TYPE PE

FACILITY OWNER Southwest Gas

COMMENTS:

Blank area for comments.

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

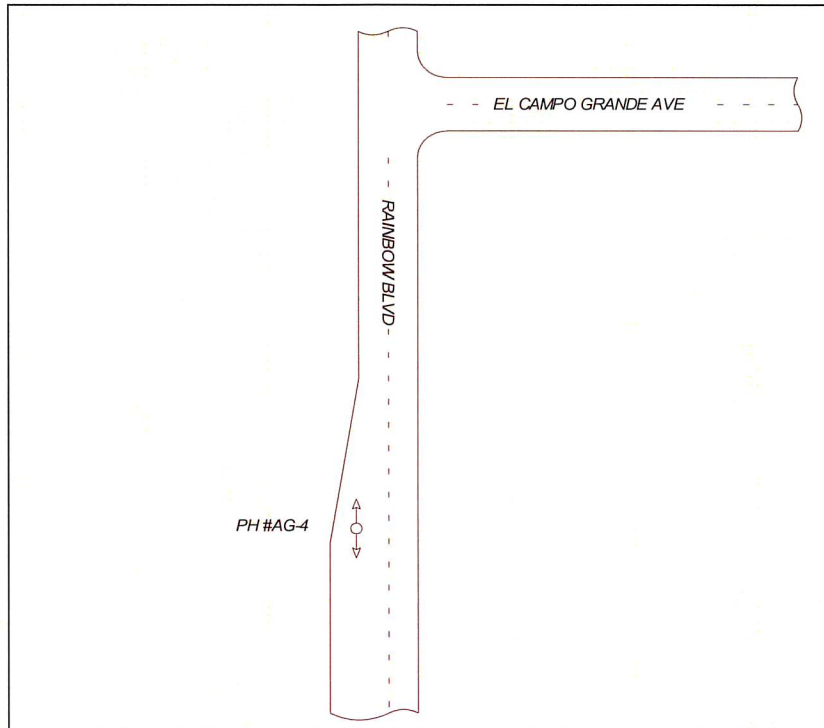
Test Hole # AG-4
 Date Dug 2/23/2011
 Project # NVU1105
 Phase # 001
 Location Rainbow Boulevard south of El Campo Grande Avenue



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 City Las Vegas
 County Clark

LOCATION PLAN - NOT TO SCALE



PH#AG-4

SITE BENCHMARK

CROSS SECTION - NOT TO SCALE

		FACING	<u>North</u>	
		SURFACE ELEVATION	<u>2326.41</u>	
		TOP ELEVATION	<u>2322.21</u>	4.20 TOP DEPTH (FEET)
		BOTTOM ELEVATION	<u>2321.83</u>	4.58 BOTTOM (FEET)
RIBBON COLOR		<u>Yellow</u>		

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

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

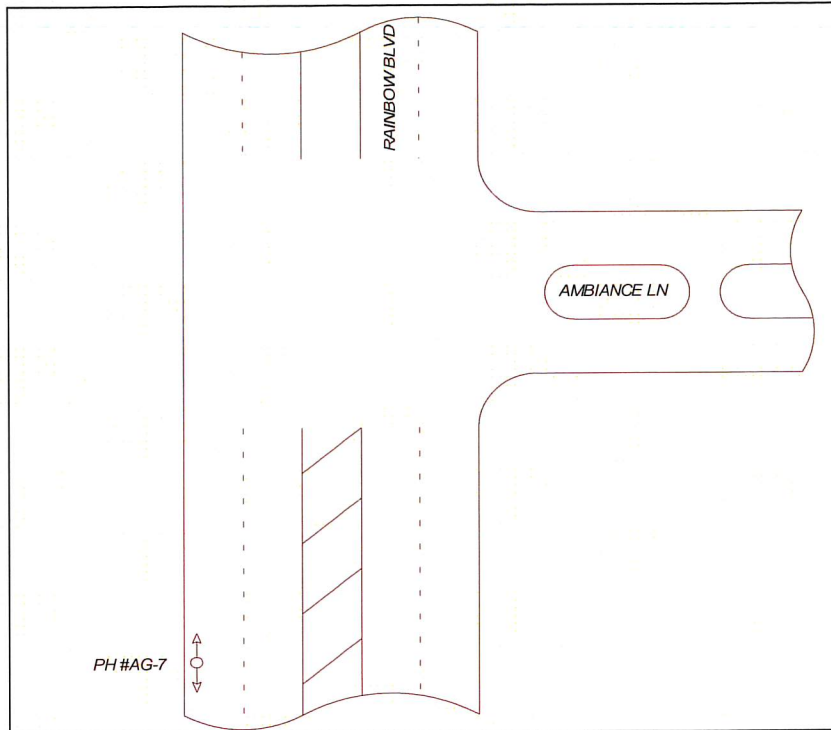
Test Hole # AG-7
 Date Dug 2/21/2011
 Project # NVU1105
 Phase # 001
 Location Rainbow Boulevard south of Ambiance Lane



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 City Las Vegas
 County Clark

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

Blank area for site benchmark data.

CROSS SECTION - NOT TO SCALE

FACING <u>North</u>	
SURFACE ELEVATION <u>2326.95</u>	← WIDTH/O.D. →
TOP ELEVATION <u>2323.85</u>	<u>4.5"</u>
BOTTOM ELEVATION <u>2323.47</u>	<u>3.10</u> TOP DEPTH (FEET)
	<u>3.48</u> BOTTOM (FEET)

RIBBON COLOR Yellow

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS 7"

PAVING TYPE Asphalt

SOIL CONDITION Dirt / Rock

SIZE 4"

TYPE PE

FACILITY OWNER Southwest Gas

COMMENTS:

Blank area for comments.

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

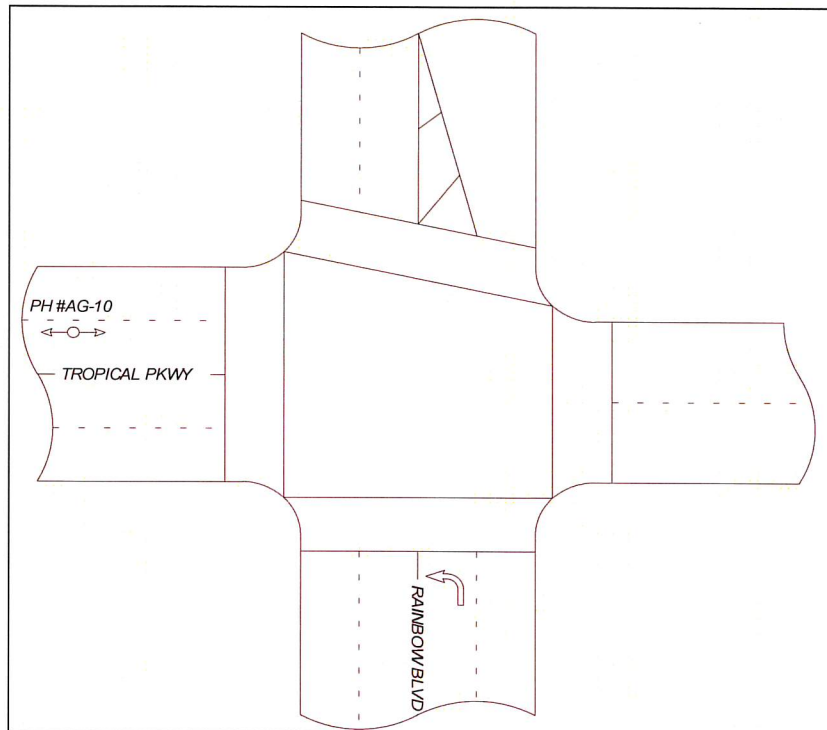
Test Hole # AG-10
 Date Dug 2/21/2011
 Project # NVU1105
 Phase # 001
 Location Rainbow Boulevard & Tropical Parkway



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 County Clark

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

RIBBON COLOR Yellow

CROSS SECTION - NOT TO SCALE

FACING <u>East</u>	
SURFACE ELEVATION <u>2331.40</u>	WIDTH/O.D. <u>4.5"</u>
TOP ELEVATION <u>2327.38</u>	4.02 TOP DEPTH (FEET)
BOTTOM ELEVATION <u>2327.00</u>	4.40 BOTTOM (FEET)

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS 6"

PAVING TYPE Asphalt

SOIL CONDITION Dirt / Rock

SIZE 4"

TYPE PE

FACILITY OWNER Southwest Gas

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

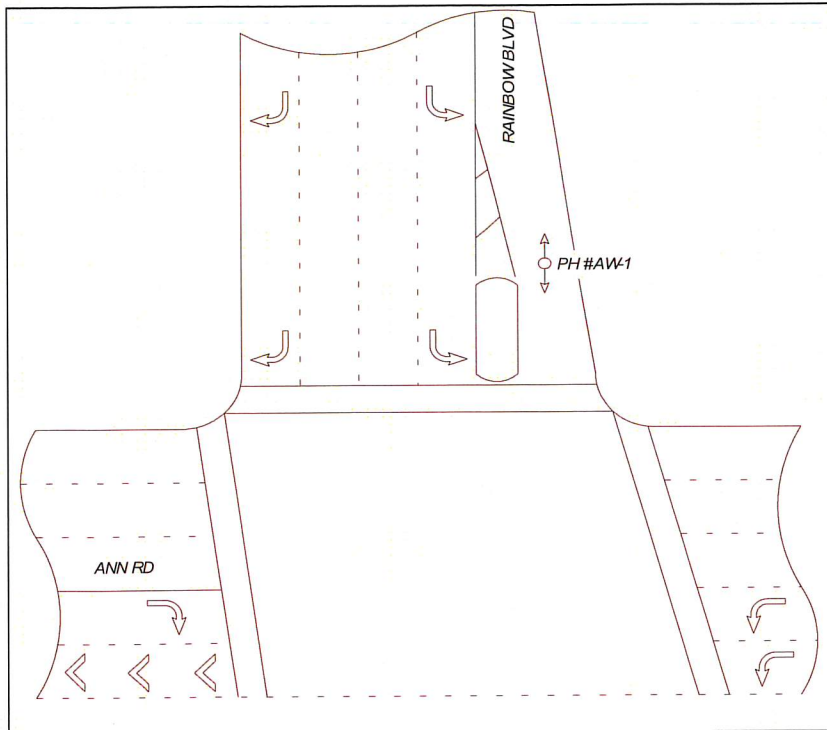
Test Hole # AW-1
 Date Dug 2/22/2011
 Project # NVU1105
 Phase # 001
 Location Rainbow Boulevard & Ann Road



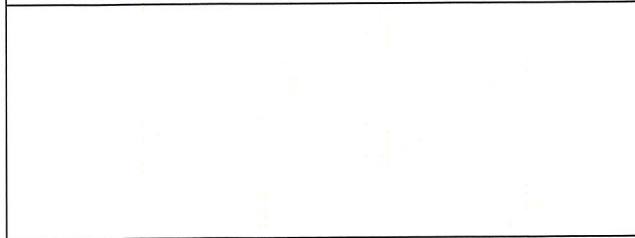
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 Truck # 9247
 City Las Vegas
 County Clark

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK



CROSS SECTION - NOT TO SCALE

FACING	<u>North</u>		
SURFACE ELEVATION	<u>2324.03</u>		
TOP ELEVATION	<u>2314.30</u>		<u>9.73</u> TOP DEPTH (FEET)
BOTTOM ELEVATION	<u>2310.63</u>		<u>13.40</u> BOTTOM (FEET)

RIBBON COLOR Blue

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS 7"

PAVING TYPE Asphalt

SOIL CONDITION Dirt / Rock

SIZE 36"

TYPE MLCP

FACILITY OWNER Las Vegas Valley Water District

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

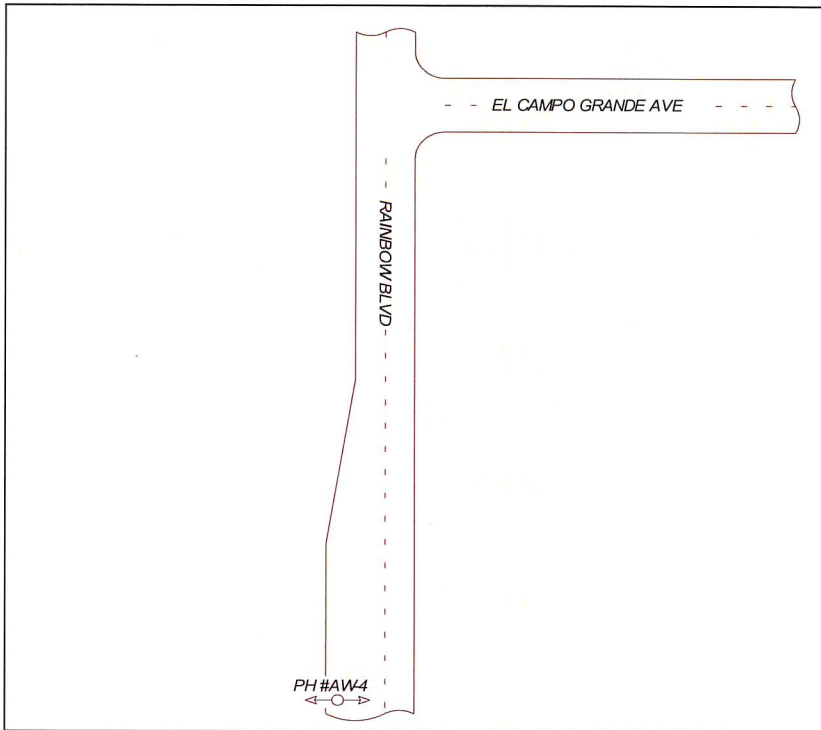
Test Hole # AW-4
 Date Dug 2/23/2011
 Project # NVU1105
 Phase # 001
 Location Rainbow Boulevard south of El Campo Grande Avenue



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 City Las Vegas
 County Clark

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

Blank area for site benchmark details.

CROSS SECTION - NOT TO SCALE

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

RIBBON COLOR Blue

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS 6"

PAVING TYPE Asphalt

SOIL CONDITION Dirt / Rock

SIZE 8"

TYPE PVC

FACILITY OWNER Las Vegas Valley Water District

COMMENTS:

Blank area for comments.

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

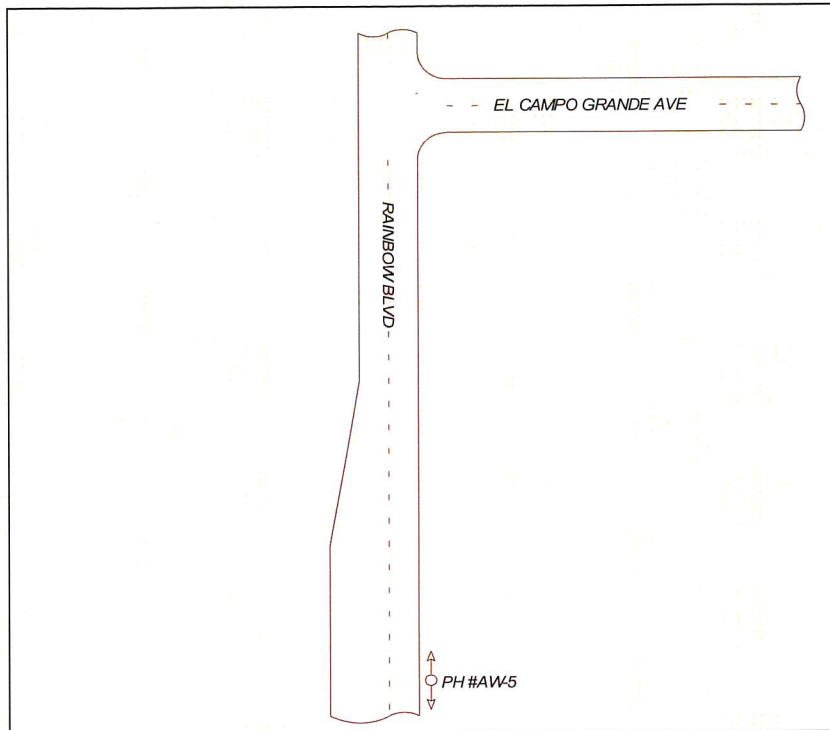
Test Hole # AW-5
 Date Dug 2/22/2011
 Project # NVU1105
 Phase # 001
 Location Rainbow Boulevard south of El Campo Grande Avenue



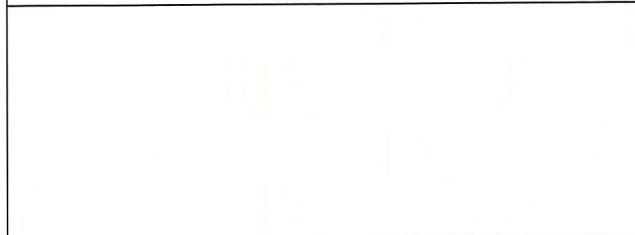
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 City Las Vegas
 County Clark

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK



CROSS SECTION - NOT TO SCALE

FACING <u>North</u>	
SURFACE ELEVATION <u>2324.85</u>	WIDTH/O.D. <u>12.75"</u>
TOP ELEVATION <u>2321.39</u>	3.46 TOP DEPTH (FEET)
BOTTOM ELEVATION <u>2320.33</u>	4.52 BOTTOM (FEET)

RIBBON COLOR Blue

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS None

PAVING TYPE None

SOIL CONDITION Dirt / Rock

SIZE 12"

TYPE PVC

FACILITY OWNER Las Vegas Valley Water District

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

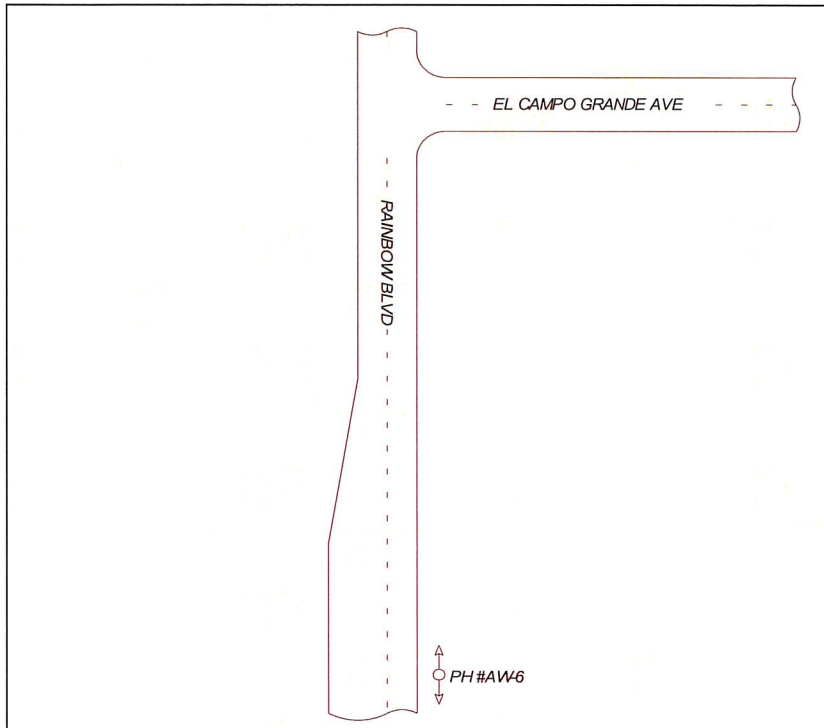
Test Hole # AW-6
 Date Dug 2/22/2011
 Project # NVU1105
 Phase # 001
 Location Rainbow Boulevard south of El Campo Grande Avenue



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LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

Blank area for site benchmark data.

CROSS SECTION - NOT TO SCALE

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

RIBBON COLOR Blue

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS None

PAVING TYPE None

SOIL CONDITION Dirt / Rock

SIZE 36"

TYPE MLCP

FACILITY OWNER Las Vegas Valley Water District

COMMENTS:

Blank area for comments.

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

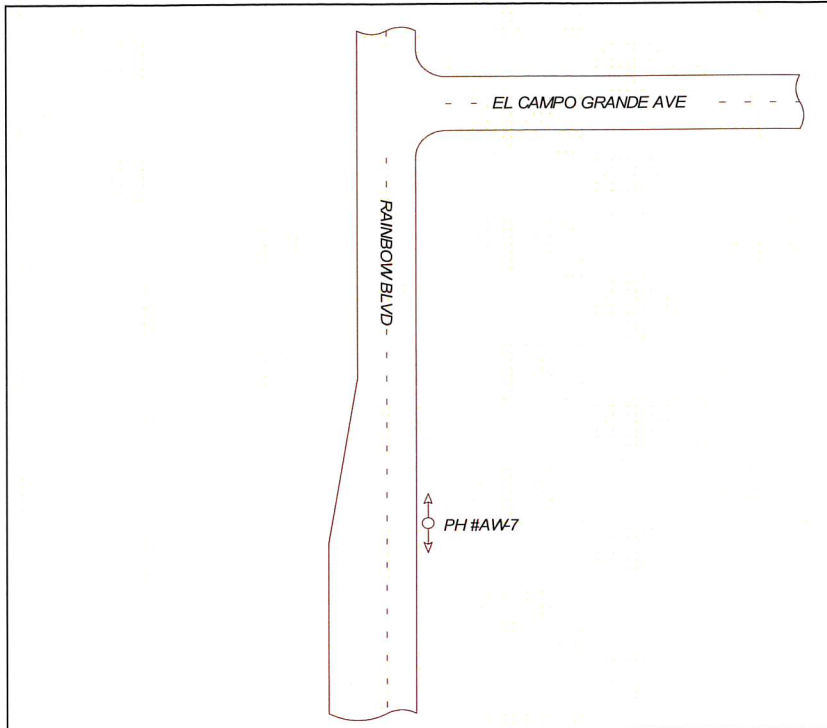
Test Hole # AW-7
 Date Dug 2/22/2011
 Project # NVU1105
 Phase # 001
 Location Rainbow Boulevard south of El Campo Grande Avenue



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LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

Blank area for site benchmark data.

CROSS SECTION - NOT TO SCALE

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

RIBBON COLOR Blue

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS None

PAVING TYPE None

SOIL CONDITION Dirt

SIZE 8" TYPE PVC

FACILITY OWNER Las Vegas Valley Water District

COMMENTS:

Blank area for comments.

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

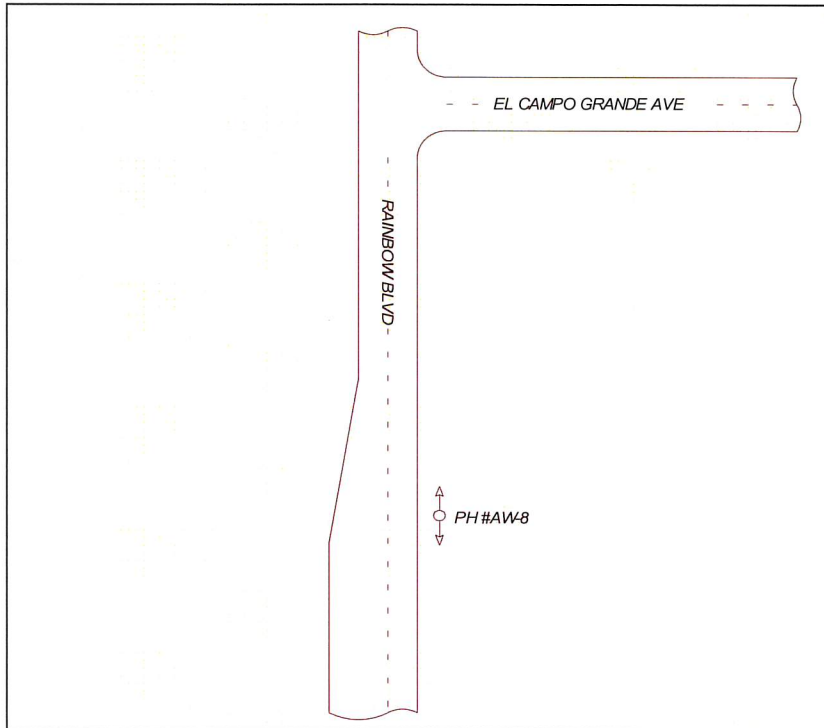
Test Hole # AW-8
 Date Dug 2/22/2011
 Project # NVU1105
 Phase # 001
 Location Rainbow Boulevard south of El Campo Grande Avenue



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

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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

Blank area for site benchmark data.

CROSS SECTION - NOT TO SCALE

FACING <u>North</u>			
SURFACE ELEVATION	<u>2325.64</u>		
TOP ELEVATION	<u>2318.59</u>		<u>7.05</u> TOP DEPTH (FEET)
BOTTOM ELEVATION	<u>2314.92</u>		<u>10.72</u> BOTTOM (FEET)

RIBBON COLOR Blue

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS None

PAVING TYPE None

SOIL CONDITION Dirt / Rock

SIZE 36"

TYPE MLCP

FACILITY OWNER Las Vegas Valley Water District

COMMENTS:

Blank area for comments.

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

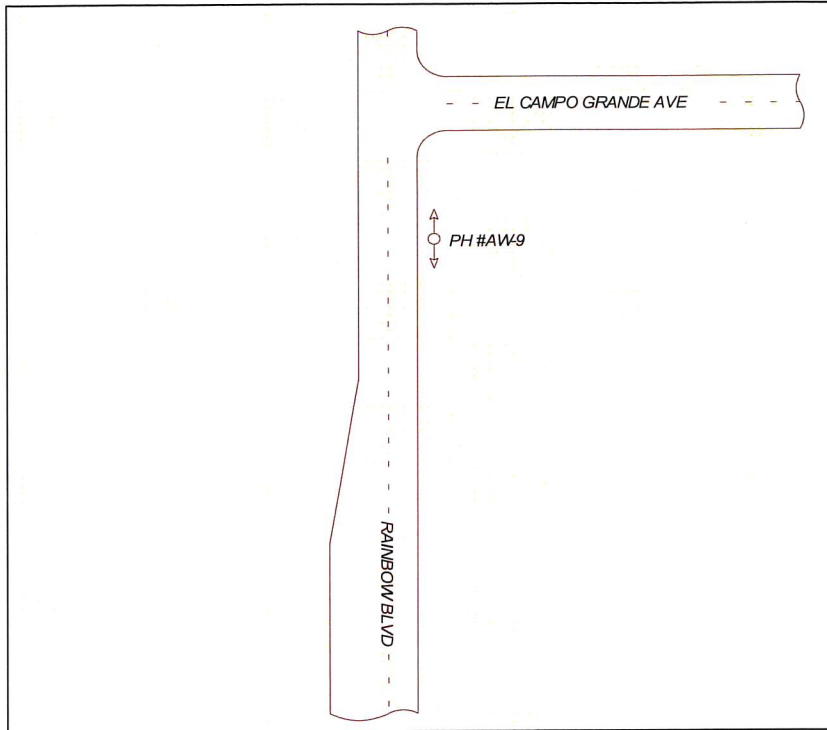
Test Hole # AW-9
 Date Dug 2/23/2011
 Project # NVU1105
 Phase # 001
 Location Rainbow Boulevard & El Campo Grande Avenue



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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

Blank area for site benchmark details.

CROSS SECTION - NOT TO SCALE

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

RIBBON COLOR Blue

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS None

PAVING TYPE None

SOIL CONDITION Dirt / Rock

SIZE 8"

TYPE PVC

FACILITY OWNER Las Vegas Valley Water District

COMMENTS:

Blank area for comments.

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

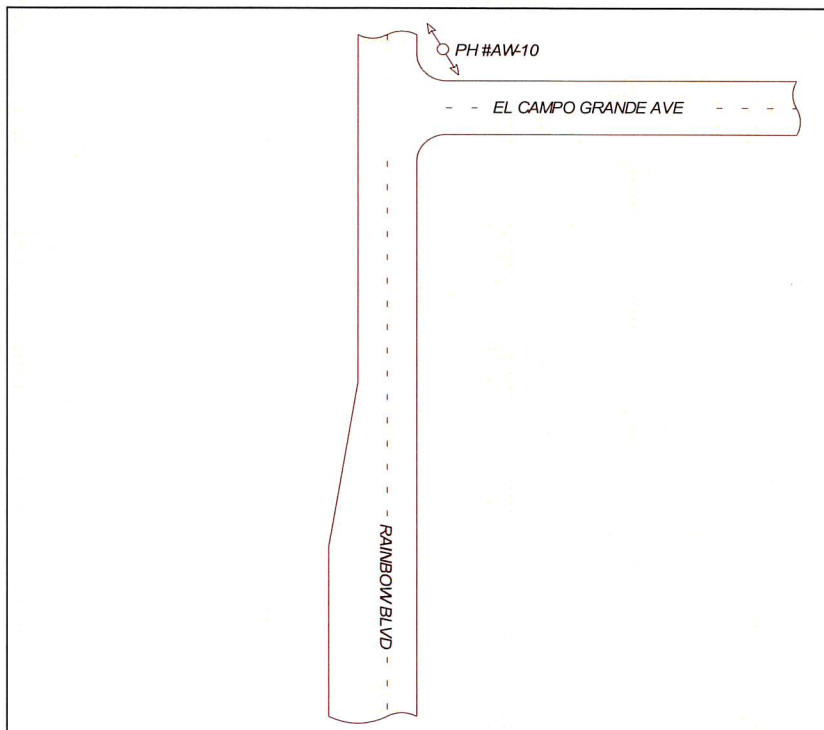
Test Hole # AW-10
 Date Dug 2/23/2011
 Project # NVU1105
 Phase # 001
 Location Rainbow Boulevard & El Campo Grande Avenue



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

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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

RIBBON COLOR Blue

CROSS SECTION - NOT TO SCALE

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

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS None

PAVING TYPE None

SOIL CONDITION Dirt / Rock

SIZE 36"

TYPE MLCP

FACILITY OWNER Las Vegas Valley Water District

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

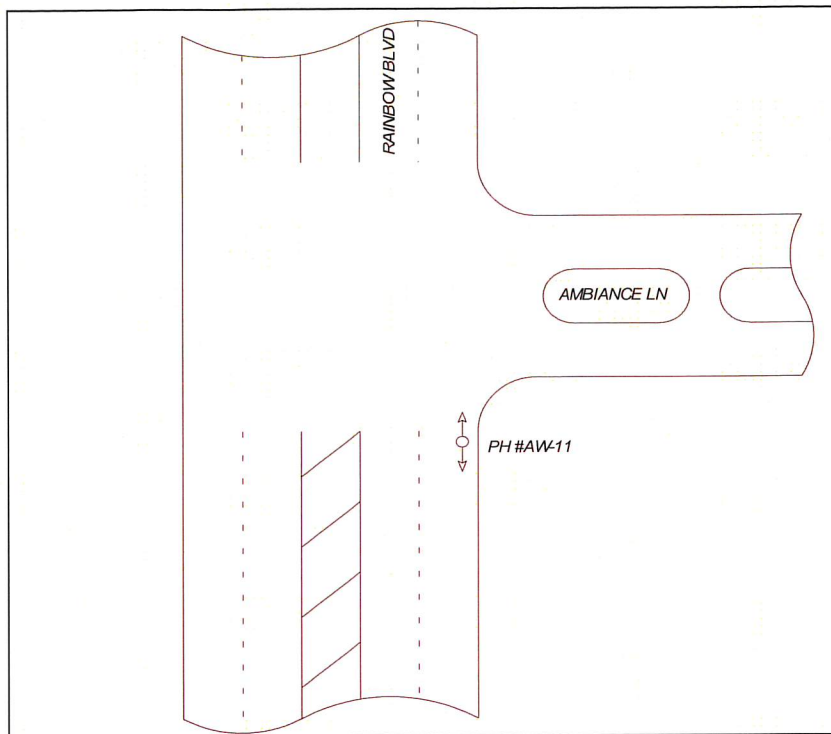
Test Hole # AW-11
 Date Dug 2/23/2011
 Project # NVU1105
 Phase # 001
 Location Rainbow Boulevard & Ambiance Lane



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

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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

RIBBON COLOR Blue

CROSS SECTION - NOT TO SCALE

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

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS 6"

PAVING TYPE Asphalt

SOIL CONDITION Dirt / Rock

SIZE 8" TYPE PVC

FACILITY OWNER Las Vegas Valley Water District

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

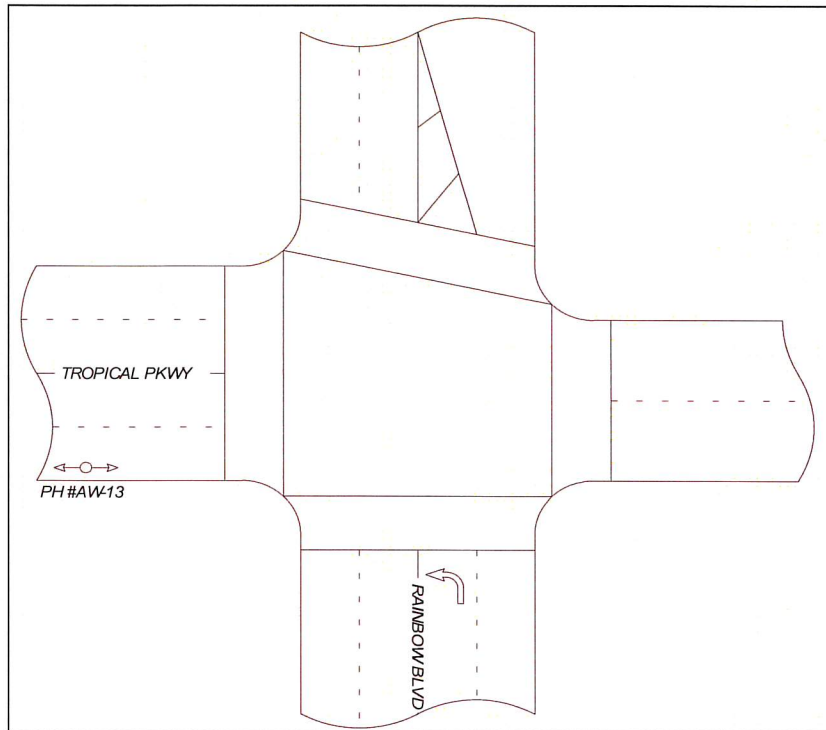
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 Date Dug 2/21/2011
 Project # NVU1105
 Phase # 001
 Location Rainbow Boulevard & Tropical Parkway



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

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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

RIBBON COLOR Blue

CROSS SECTION - NOT TO SCALE

	FACING <u>East</u>	
SURFACE ELEVATION	<u>2331.15</u>	
TOP ELEVATION	<u>2327.32</u>	<u>3.83</u> TOP DEPTH (FEET)
BOTTOM ELEVATION	<u>2326.42</u>	<u>4.73</u> BOTTOM (FEET)

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

COMMENTS:

PREPARED BY: M. Huber

CHECKED BY: W. Morales

TEST HOLE DATA REPORT

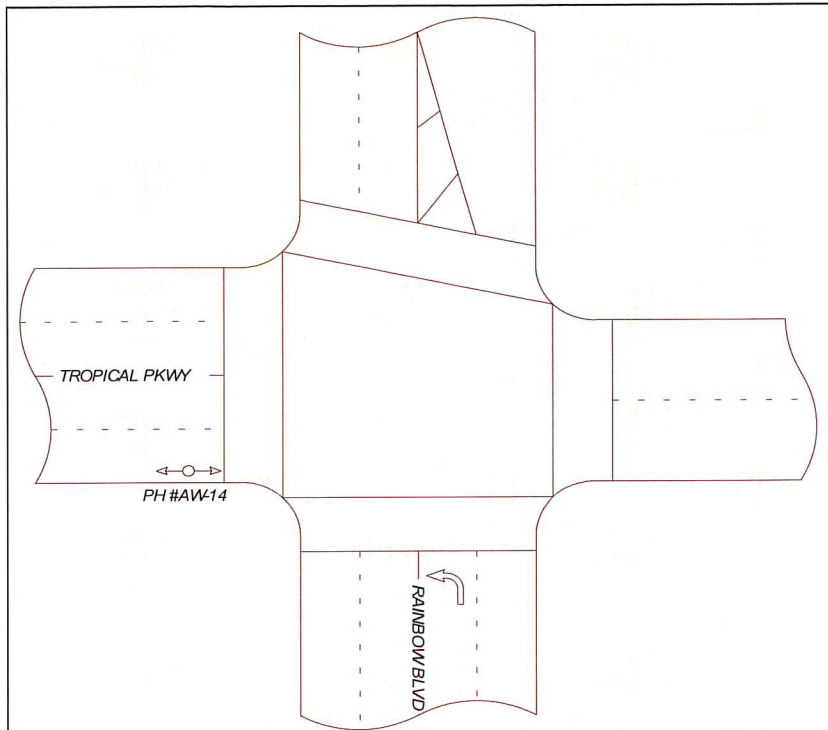
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 Date Dug 2/21/2011
 Project # NVU1105
 Phase # 001
 Location Rainbow Boulevard & Tropical Parkway



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

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

LOCATION PLAN - NOT TO SCALE



SITE BENCHMARK

Blank area for site benchmark data.

CROSS SECTION - NOT TO SCALE

FACING <u>East</u>			
SURFACE ELEVATION	<u>2330.97</u>	WIDTH/O.D. 10.75"	
TOP ELEVATION	<u>2326.78</u>		<u>4.19</u> TOP DEPTH (FEET)
BOTTOM ELEVATION	<u>2325.88</u>		<u>5.09</u> BOTTOM (FEET)

RIBBON COLOR Blue

COORDINATES: NORTHING None

EASTING None

STATIONING: STATION None

OFFSET None

PAVING THICKNESS 6"

PAVING TYPE Asphalt

SOIL CONDITION Dirt / Rock

SIZE 10"

TYPE PVC

FACILITY OWNER Las Vegas Valley Water District

COMMENTS:

Blank area for comments.

PREPARED BY: M. Huber

CHECKED BY: W. Morales

2. APPENDIX B - EXHIBITS

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

3. APPENDIX C - HYDROLOGY

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

1

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

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

LEGEND

ANN BALSAM STUDY (2005)

OFF10 10.9 ACRES

CP1

REFERENCE DRAINAGE STUDY WITH YEAR STUDIED

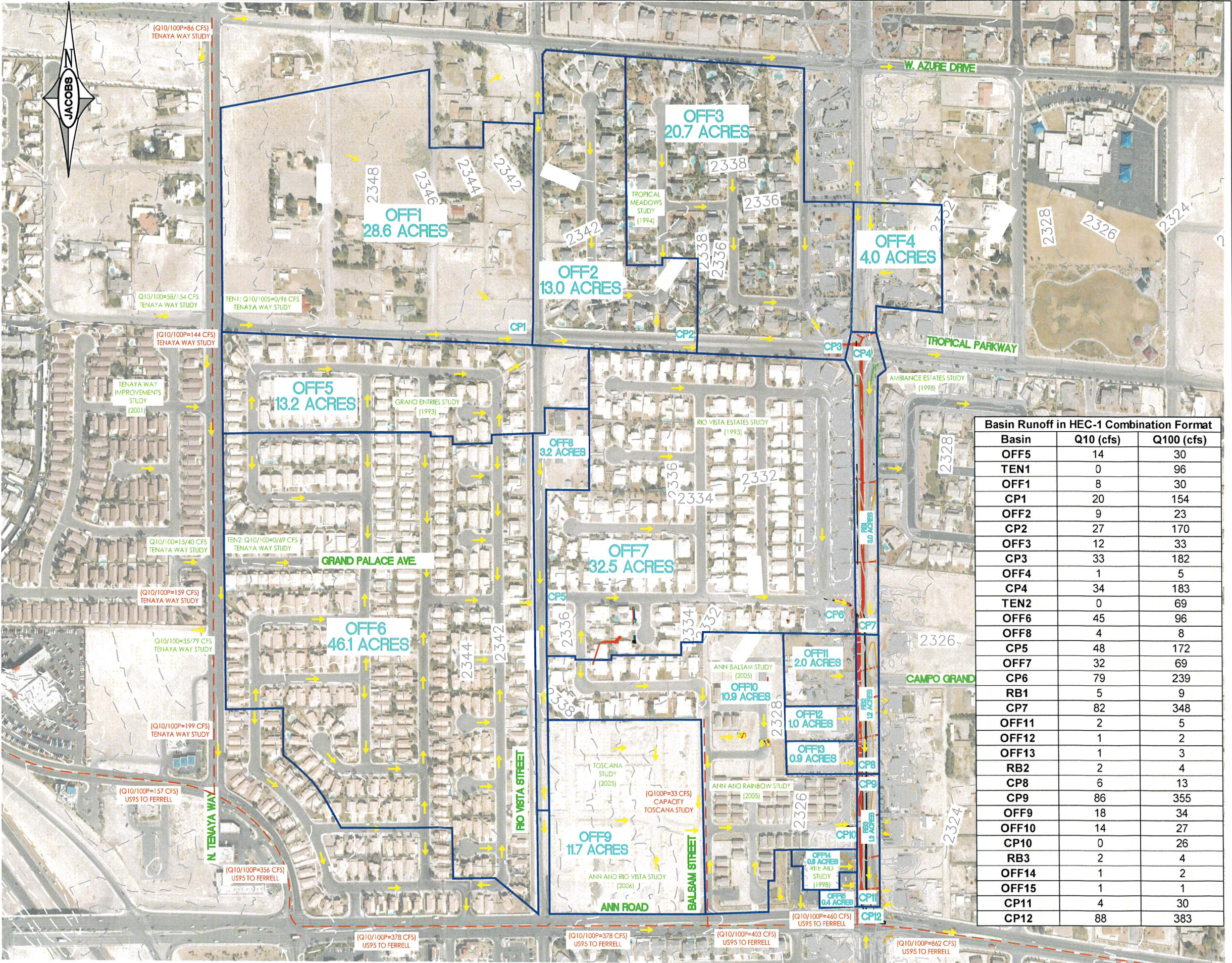
BASIN NAME

CONCENTRATION POINT

BASIN DELINEATION

FLOW DIRECTION

EXISTING STORMDRAIN WITH FLOW DATA



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

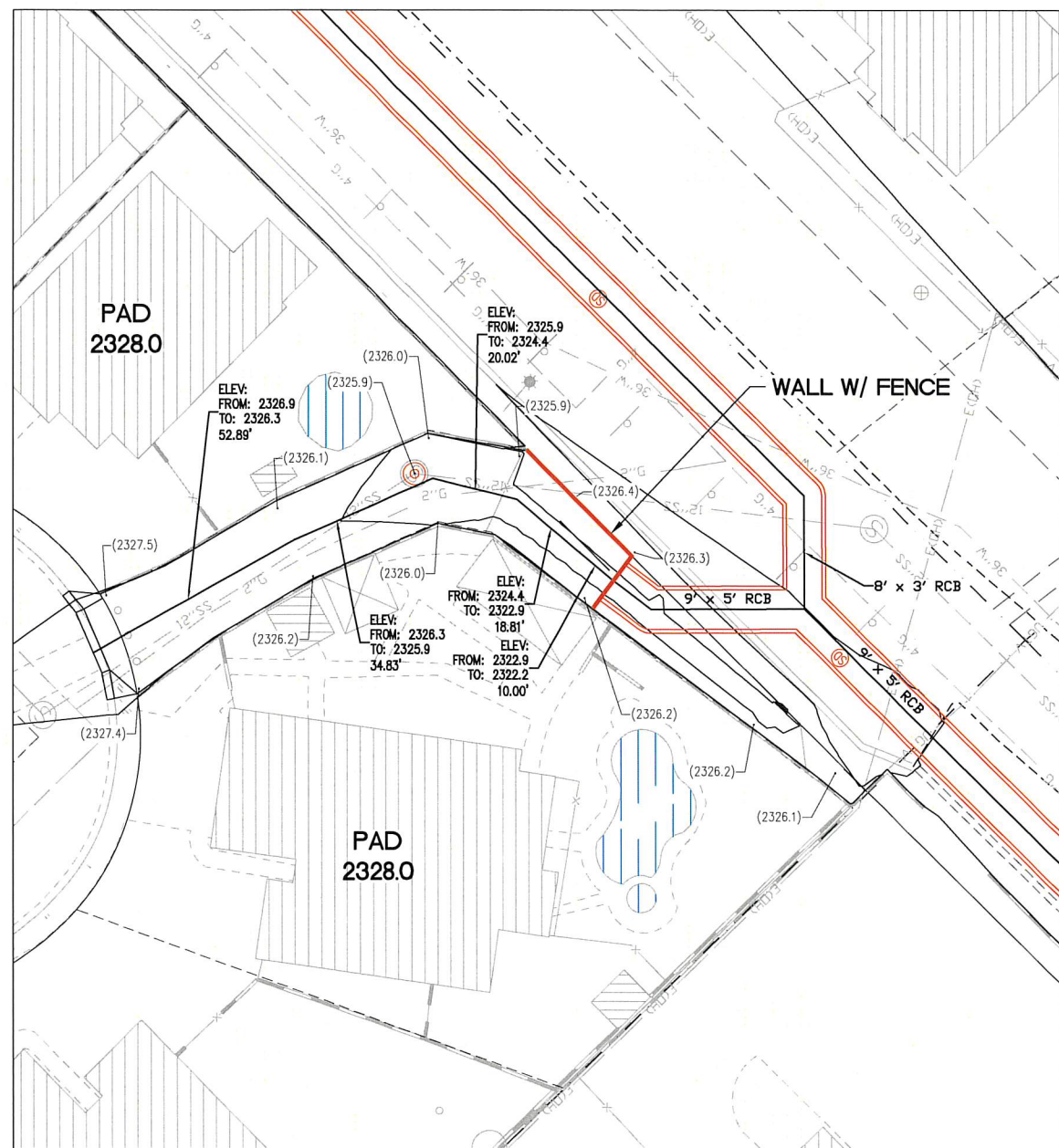
ANN ROAD AND RAINBOW BOULEVARD OFF-SITE DRAINAGE EXHIBIT

SCALE 1:400

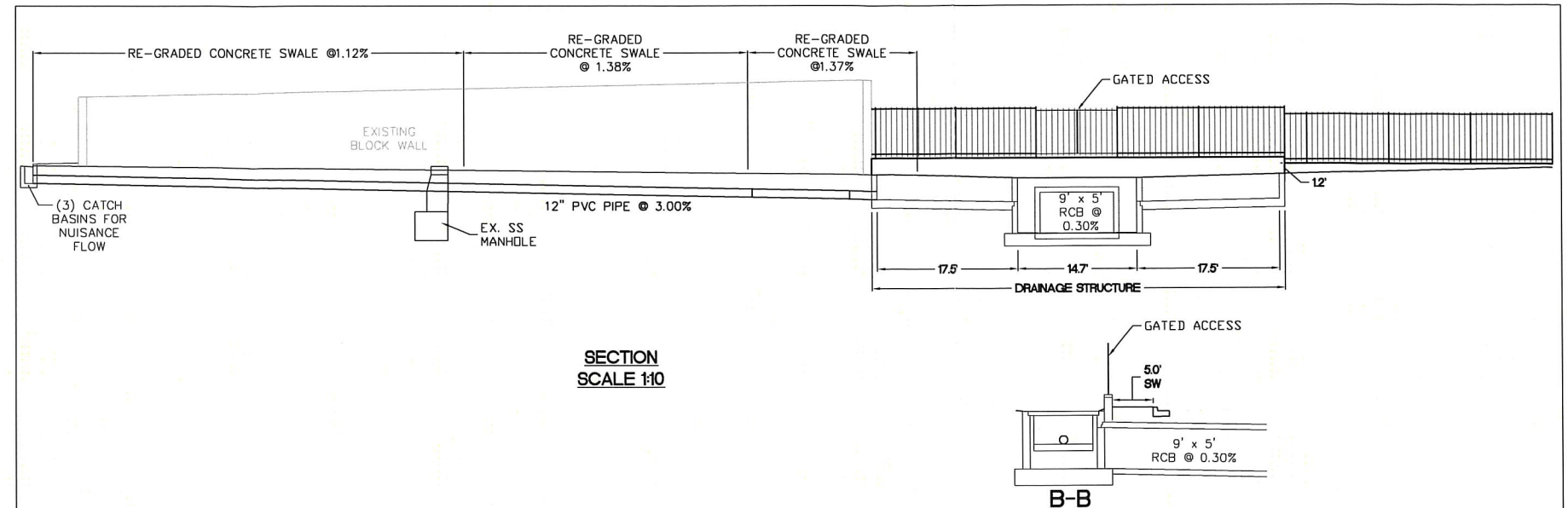
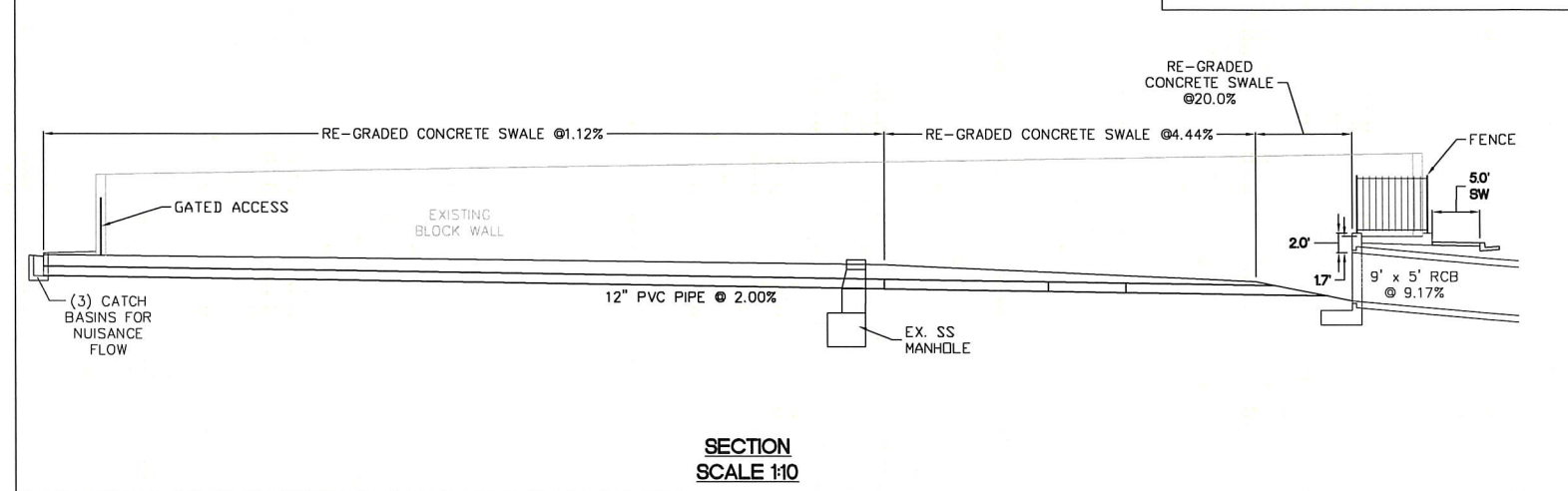
FIGURE C-10

4. APPENDIX D – HYDRAULICS

1. FIGURE D-1 TYPE C-D MODIFIED INLET
2. FIGURE D-2 STORM SEWER MAINS (4 TOTAL)
3. FIGURE D-3 INLET OPTIONS
4. FIGURE D-4 STORM DRAIN EXHIBIT
5. FIGURE D-5 HYDRAULIC SECTION SUMMARY (2 TOTAL)
6. FIGURE D-6 WSPGW ANN ROAD TO EASEMENT
7. FIGURE D-7 WSPGW JUNCTION TO TROPICAL PKWY
8. FIGURE D-8 NOMOGRAPH
9. FIGURE D-9 STANDARD FORM 6
10. FIGURE D-10 DROP INLET CALCULATIONS
11. FIGURE D-11 HYDRAULIC SECTIONS
12. FIGURE D-12 DRY LANE SUMMARY



ANN AND RAINBOW STORM DRAIN EXHIBIT
OPTION 1



ANN AND RAINBOW STORM DRAIN EXHIBIT
OPTION 2

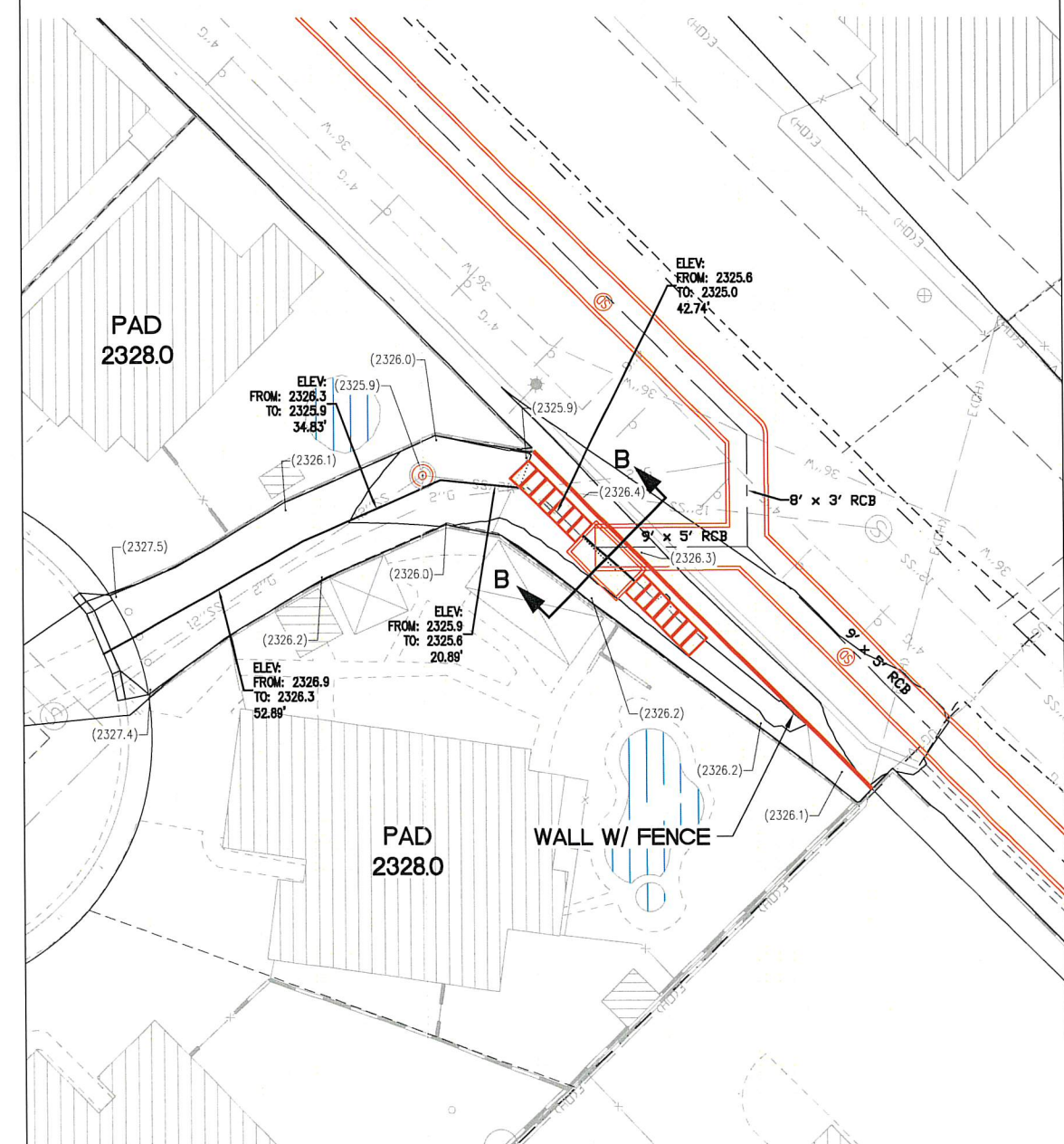


FIGURE D-3

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

FIGURE D-5 (1 OF 2)

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

*Inlet in sump condition

FIGURE D-6



T1 ANN ROAD CHANNEL WEST - RAINBOW BOULEVARD
 T2 HANSEN NO. 36801 - APRIL 5, 2011 BY TARA ALEXANDER, PE
 T3 MAIN CHANNEL RUN TO TIE IN AT EASEMENT

SO	833.2002314.120	1			2322.220															
R	980.2502314.560	1	.013																	
JX	980.2602314.560	15	10	.013	10.000	2316.790														
R	1000.0002314.620	15		.013																
TS	1000.0102314.620	5		.013																
R	1010.0002314.650	5		.013																
R	1021.7402314.690	3		.013																
JX	1021.7502314.690	3	2	.013	2.000	2317.000														
R	1233.3602315.320	3		.013																
JX	1233.3702315.320	5	4	.013	23.000	2317.580														
R	1262.1902315.410	5		.013																
JX	1262.2002315.410	7	6	.013	10.000	2317.640														
R	1463.0902316.010	7		.013																
JX	1463.1002316.010	9	8	.013	2.000	2317.520														
R	1894.8602317.300	9		.013																
JX	1894.8702317.300	11	10	.013	1.500	2320.390														
TS	1900.0002317.320	16		.013																
R	1910.0002317.350	18		.013																
R	2108.0802317.940	11		.013																
JX	2108.0902317.940	13	12	.013	194.500	2319.940														
R	2143.1802319.900	13		.013																
R	2153.9502320.500	13		.013																
WE	2153.9502320.500	14		.500																
R	2186.3702323.700	14		.013																
R	2202.4102324.600	14		.013																
R	2237.2402326.650	14		.013																
R	2282.5802326.840	14		.013																
SH	2282.5802326.840	14				2326.840														
CD	1 3 0	.000	6.000	.000	.000	.000	.00													
CD	2 4 1	.000	1.500	.000	.000	.000	.00													
CD	3 3 0	.000	6.000	12.000	.000	.000	.00													
CD	4 4 1	.000	2.500	.000	.000	.000	.00													
CD	5 3 0	.000	6.000	12.000	.000	.000	.00													
CD	6 4 1	.000	2.500	.000	.000	.000	.00													
CD	7 3 0	.000	6.000	12.000	.000	.000	.00													
CD	8 4 1	.000	1.500	.000	.000	.000	.00													
CD	9 3 0	.000	6.000	12.000	.000	.000	.00													
CD	10 4 1	.000	1.500	.000	.000	.000	.00													
CD	11 3 0	.000	5.000	11.000	.000	.000	.00													
CD	12 3 0	.000	3.000	9.000	.000	.000	.00													
CD	13 3 0	.000	5.000	9.000	.000	.000	.00													
CD	15 3 0	.000	6.000	9.000	.000	.000	.00													
CD	16 3 0	.000	5.000	11.000	.000	.000	.00													
CD	17 3 0	.000	6.000	12.000	.000	.000	.00													
CD	18 3 0	.000	5.000	11.000	.000	.000	.00													
CD	14 5 0	.000	.00	.00	.00	.00	.00													
PTS	14 5 10.000	5.560	10.010	.560	17.560	.000	29.000	.560	29.010	5.560										
Q	239.000	.0																		

Extended
 info
 WSPG
 ANN

FILE: anrb12.WSW

W S P G W - CIVILDESIGN Version 14.06

PAGE

1

 Program Package Serial Number: 1267
 WATER SURFACE PROFILE LISTING
 7:11:50

Date: 4-12-2011 Time:

 ANN ROAD CHANNEL WEST - RAINBOW BOULEVARD
 HANSEN NO. 36801 - APRIL 5, 2011 BY TARA ALEXANDER, PE
 MAIN CHANNEL RUN TO TIE IN AT EASEMENT

*****	Invert	Depth	Water	Q	Vel	Vel	Energy	Super	Critical	Flow Top	Height	Base Wt	No	
Station	Elev	(FT)	Elev	(CFS)	(FPS)	Head	Grd.El.	Elev	Depth	Width	Dia.-FT	or I.D.	ZL	
Prs/Pip	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type
L/Elem	Ch													
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****

833.200	2314.120	8.100	2322.220	482.00	8.93	1.24	2323.46	.00	4.47	9.00	6.000	9.000	.00	0
.0														
147.050	.0030					.0028	.41	.00	.64	4.86	.013	.00	.00	BOX
980.250	2314.560	8.293	2322.853	482.00	8.93	1.24	2324.09	.00	4.47	9.00	6.000	9.000	.00	0
.0														
JUNCT STR	.0000		RB11			.0027	.00	.00	.64		.013	.00	.00	BOX
980.260	2314.560	8.371	2322.931	472.00	8.74	1.19	2324.12	.00	4.40	9.00	6.000	9.000	.00	0
.0														
19.740	.0030					.0027	.05	.00	.63	4.76	.013	.00	.00	BOX
1000.000	2314.620	8.502	2323.122	472.00	8.74	1.19	2324.31	.00	4.40	9.00	6.000	9.000	.00	0
.0														
TRANS STR	.0000					.0013	.00	8.50	.63		.013	.00	.00	BOX
1000.010	2314.620	9.151	2323.771	472.00	6.56	.67	2324.44	.00	3.64	12.00	6.000	12.000	.00	0
.0														
9.990	.0030					.0013	.01	9.15	.47	3.65	.013	.00	.00	BOX
1010.000	2314.650	9.134	2323.784	472.00	6.56	.67	2324.45	.00	3.64	12.00	6.000	12.000	.00	0
.0														
11.740	.0034					.0013	.02	9.13	.47	3.48	.013	.00	.00	BOX
1021.740	2314.690	9.142	2323.832	472.00	6.56	.67	2324.50	.00	3.64	12.00	6.000	12.000	.00	0
.0														
JUNCT STR	.0000		RB12			.0013	.00	9.14	.47		.013	.00	.00	BOX
1021.750	2314.690	9.154	2323.844	470.00	6.53	.66	2324.51	.00	3.63	12.00	6.000	12.000	.00	0
.0														
211.610	.0030					.0013	.27	9.15	.47	3.64	.013	.00	.00	BOX
1233.360	2315.320	8.797	2324.117	470.00	6.53	.66	2324.78	.00	3.63	12.00	6.000	12.000	.00	0
.0														
JUNCT STR	.0000					.0012	.00	8.80	.47		.013	.00	.00	BOX

FILE: anrb12.WSW

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PAGE

2

Program Package Serial Number: 1267

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Date: 4-12-2011 Time:

7:11:50

ANN ROAD CHANNEL WEST - RAINBOW BOULEVARD

HANSEN NO. 36801 - APRIL 5, 2011 BY TARA ALEXANDER, PE

MAIN CHANNEL RUN TO TIE IN AT EASEMENT

Station	Invert	Depth	Water	Q	Vel	Vel	Energy	Super	Critical	Flow Top	Height	Base Wt	No		
Prs/Pip	Wth	Elev	(FT)	Elev	(CFS)	(FPS)	Head	Grd.El.	Elev	Depth	Width	Dia.-FT	or I.D.	ZL	
L/Elem	Ch Slope						SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type
Ch															

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Program Package Serial Number: 1267
 WATER SURFACE PROFILE LISTING
 7:11:50

Date: 4-12-2011 Time:

ANN ROAD CHANNEL WEST - RAINBOW BOULEVARD
 HANSEN NO. 36801 - APRIL 5, 2011 BY TARA ALEXANDER, PE
 MAIN CHANNEL RUN TO TIE IN AT EASEMENT

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top	Height	Base Wt	No
Prs/Pip	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR
L/Elem	Ch												Type
2108.080	2317.940	7.275	2325.215	433.50	7.88	.96	2326.18	.00	3.64	11.00	5.000	11.000	.00
.0													0
JUNCT STR	.0000		antp9.wsw			.0011	.00	7.27	.62		.013	.00	.00
2108.090	2317.940	7.993	2325.933	239.00	5.31	.44	2326.37	.00	2.80	9.00	5.000	9.000	.00
.0													0
35.090	.0559					.0011	.04	7.99	.42	1.08	.013	.00	.00
2143.180	2319.900	6.138	2326.038	239.00	5.31	.44	2326.48	.00	2.80	9.00	5.000	9.000	.00
.0													0
10.770	.0557					.0011	.01	6.14	.42	1.08	.013	.00	.00
2153.950	2320.500	5.551	2326.051	239.00	5.31	.44	2326.49	.00	2.80	9.00	5.000	9.000	.00
.0													0
WALL ENTRANCE													
2153.950	2320.500	6.099	2326.599	239.00	2.16	.07	2326.67	.00	1.98	19.01		14	.00
.0													0
2.671	.0987					.0001	.00	6.10	.16	.819	.013		
IR-OPEN													
2156.621	2320.764	5.829	2326.592	239.00	2.27	.08	2326.67	.00	1.98	19.01		14	.00
.0													0
2.536	.0987					.0001	.00	5.83	.17	.819	.013		
IR-OPEN													
2159.157	2321.014	5.570	2326.584	239.00	2.38	.09	2326.67	.00	1.98	19.01		14	.00
.0													0
2.406	.0987					.0001	.00	5.57	.18	.819	.013		
IR-OPEN													
2161.563	2321.251	5.324	2326.576	239.00	2.49	.10	2326.67	.00	1.98	19.01		14	.00
.0													0
2.281	.0987					.0001	.00	5.32	.20	.819	.013		
IR-OPEN													
2163.845	2321.477	5.090	2326.566	239.00	2.62	.11	2326.67	.00	1.98	19.01		14	.00
.0													0
2.161	.0987					.0001	.00	5.09	.21	.819	.013		
IR-OPEN													

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WATER SURFACE PROFILE LISTING
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Date: 4-12-2011 Time:

ANN ROAD CHANNEL WEST - RAINBOW BOULEVARD
HANSEN NO. 36801 - APRIL 5, 2011 BY TARA ALEXANDER, PE
MAIN CHANNEL RUN TO TIE IN AT EASEMENT

Station	Invert Wth Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Froude N	Height/ Dia.-FT	Base Wt/ or I.D.	No ZL
Prs/Pip	Ch Slope					Sf Ave	HF	SE Dpth			"N"	X-Fall	ZR
L/Elem Ch													Type
2166.006	2321.690	4.866	2326.556	239.00	2.74	.12	2326.67	.00	1.98	19.01		14	0
.0													
2.046	.0987					.0001	.00	4.87	.23	.819	.013		
IR-OPEN													
2168.052	2321.892	4.653	2326.544	239.00	2.88	.13	2326.67	.00	1.98	19.01		14	0
.0													
1.934	.0987					.0002	.00	4.65	.24	.819	.013		
IR-OPEN													
2169.986	2322.083	4.449	2326.532	239.00	3.02	.14	2326.67	.00	1.98	19.01		14	0
.0													
1.824	.0987					.0002	.00	4.45	.26	.819	.013		
IR-OPEN													
2171.811	2322.263	4.255	2326.518	239.00	3.16	.16	2326.67	.00	1.98	19.00		14	0
.0													
1.719	.0987					.0002	.00	4.26	.28	.819	.013		
IR-OPEN													
2173.530	2322.433	4.070	2326.503	239.00	3.32	.17	2326.67	.00	1.98	19.00		14	0
.0													
1.618	.0987					.0002	.00	4.07	.30	.819	.013		
IR-OPEN													
2175.147	2322.592	3.894	2326.486	239.00	3.48	.19	2326.67	.00	1.98	19.00		14	0
.0													
1.517	.0987					.0003	.00	3.89	.32	.819	.013		
IR-OPEN													
2176.664	2322.742	3.726	2326.468	239.00	3.65	.21	2326.67	.00	1.98	19.00		14	0
.0													
1.329	.0987					.0003	.00	3.73	.35	.819	.013		
IR-OPEN													
2177.993	2322.873	3.575	2326.448	239.00	3.82	.23	2326.67	.00	1.98	19.00		14	0
.0													
HYDRAULIC JUMP													
2177.993	2322.873	1.018	2323.891	239.00	17.06	4.52	2328.41	.00	1.98	18.99		14	0
.0													
3.242	.0987					.0341	.11	1.02	3.50	.819	.013		
IR-OPEN													

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WATER SURFACE PROFILE LISTING

Date: 4-12-2011 Time:

7:11:50

ANN ROAD CHANNEL WEST - RAINBOW BOULEVARD

HANSEN NO. 36801 - APRIL 5, 2011 BY TARA ALEXANDER, PE

MAIN CHANNEL RUN TO TIE IN AT EASEMENT

```

*****
*****
| Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height | Base Wt | | No
| Station | Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL
| Prs/Pip | | | | | | | | | | | | | | |
| L/Elem | Ch Slope | | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type
| Ch | | | | | | | | | | | | | | |
*****
*****
| 2181.235 | 2323.193 | 1.039 | 2324.232 | 239.00 | 16.59 | 4.27 | 2328.51 | .00 | 1.98 | 18.99 | | | 14 | 0
|.0 | | | | | | | | | | | | | | | |
| 5.135 | .0987 | | | | | | .0303 | .16 | 1.04 | 3.36 | .819 | .013 | | | |
| IR-OPEN | | | | | | | | | | | | | | |
| 2186.370 | 2323.700 | 1.076 | 2324.776 | 239.00 | 15.82 | 3.89 | 2328.66 | 4.80 | 1.98 | 18.99 | | | 14 | 0
|.0 | | | | | | | | | | | | | | | |
| 7.100 | .0561 | | | | | | .0266 | .19 | 5.88 | 3.13 | .921 | .013 | | | |
| IR-OPEN | | | | | | | | | | | | | | |
| 2193.470 | 2324.098 | 1.101 | 2325.199 | 239.00 | 15.33 | 3.65 | 2328.85 | 4.51 | 1.98 | 18.99 | | | 14 | 0
|.0 | | | | | | | | | | | | | | | |
| 8.940 | .0561 | | | | | | .0235 | .21 | 5.61 | 2.98 | .921 | .013 | | | |
| IR-OPEN | | | | | | | | | | | | | | |
| 2202.410 | 2324.600 | 1.141 | 2325.741 | 239.00 | 14.62 | 3.32 | 2329.06 | .00 | 1.98 | 18.99 | | | 14 | 0
|.0 | | | | | | | | | | | | | | | |
| 4.838 | .0589 | | | | | | .0206 | .10 | 1.14 | 2.78 | .912 | .013 | | | |
| IR-OPEN | | | | | | | | | | | | | | |
| 2207.248 | 2324.885 | 1.170 | 2326.054 | 239.00 | 14.14 | 3.11 | 2329.16 | .00 | 1.98 | 18.99 | | | 14 | 0
|.0 | | | | | | | | | | | | | | | |
| 5.860 | .0589 | | | | | | .0181 | .11 | 1.17 | 2.64 | .912 | .013 | | | |
| IR-OPEN | | | | | | | | | | | | | | |
| 2213.108 | 2325.229 | 1.213 | 2326.443 | 239.00 | 13.48 | 2.82 | 2329.27 | .00 | 1.98 | 18.99 | | | 14 | 0
|.0 | | | | | | | | | | | | | | | |
| 4.870 | .0589 | | | | | | .0155 | .08 | 1.21 | 2.46 | .912 | .013 | | | |
| IR-OPEN | | | | | | | | | | | | | | |
| 2217.978 | 2325.516 | 1.259 | 2326.775 | 239.00 | 12.86 | 2.57 | 2329.34 | .00 | 1.98 | 18.99 | | | 14 | 0
|.0 | | | | | | | | | | | | | | | |
| 4.074 | .0589 | | | | | | .0133 | .05 | 1.26 | 2.29 | .912 | .013 | | | |
| IR-OPEN | | | | | | | | | | | | | | |
| 2222.052 | 2325.756 | 1.307 | 2327.063 | 239.00 | 12.26 | 2.33 | 2329.40 | .00 | 1.98 | 18.99 | | | 14 | 0
|.0 | | | | | | | | | | | | | | | |
| 3.417 | .0589 | | | | | | .0114 | .04 | 1.31 | 2.13 | .912 | .013 | | | |
| IR-OPEN | | | | | | | | | | | | | | |
| 2225.469 | 2325.957 | 1.357 | 2327.314 | 239.00 | 11.69 | 2.12 | 2329.43 | .00 | 1.98 | 18.99 | | | 14 | 0
|.0 | | | | | | | | | | | | | | | |
| 2.862 | .0589 | | | | | | .0098 | .03 | 1.36 | 1.98 | .912 | .013 | | | |
| IR-OPEN | | | | | | | | | | | | | | |

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ANN ROAD CHANNEL WEST - RAINBOW BOULEVARD

HANSEN NO. 36801 - APRIL 5, 2011 BY TARA ALEXANDER, PE

MAIN CHANNEL RUN TO TIE IN AT EASEMENT

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top	Height/	Base Wt	No
Prs/Pip	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR
L/Elem	Ch												Type
2228.330	2326.125	1.409	2327.535	239.00	11.14	1.93	2329.46	.00	1.98	18.99		14	0
.0													
2.382	.0589					.0084	.02	1.41	1.85	.912	.013		
IR-OPEN													
2230.712	2326.266	1.465	2327.730	239.00	10.62	1.75	2329.48	.00	1.98	18.99		14	0
.0													
1.968	.0589					.0073	.01	1.46	1.72	.912	.013		
IR-OPEN													
2232.680	2326.381	1.522	2327.904	239.00	10.13	1.59	2329.50	.00	1.98	18.99		14	0
.0													
1.601	.0589					.0062	.01	1.52	1.60	.912	.013		
IR-OPEN													
2234.281	2326.476	1.583	2328.059	239.00	9.66	1.45	2329.51	.00	1.98	18.99		14	0
.0													
1.273	.0589					.0054	.01	1.58	1.49	.912	.013		
IR-OPEN													
2235.554	2326.551	1.647	2328.197	239.00	9.21	1.32	2329.51	.00	1.98	18.99		14	0
.0													
.977	.0589					.0046	.00	1.65	1.39	.912	.013		
IR-OPEN													
2236.531	2326.608	1.713	2328.321	239.00	8.78	1.20	2329.52	.00	1.98	18.99		14	0
.0													
.708	.0589					.0040	.00	1.71	1.29	.912	.013		
IR-OPEN													
2237.240	2326.650	1.783	2328.433	239.00	8.37	1.09	2329.52	.12	1.98	18.99		14	0
.0													
24.224	.0042					.0035	.09	1.91	1.20	1.721	.013		
IR-OPEN													
2261.464	2326.751	1.825	2328.577	239.00	8.14	1.03	2329.61	.12	1.98	19.00		14	0
.0													
17.118	.0042					.0031	.05	1.94	1.15	1.721	.013		
IR-OPEN													
2278.583	2326.823	1.901	2328.724	239.00	7.76	.94	2329.66	.11	1.98	19.00		14	0
.0													
3.997	.0042					.0027	.01	2.01	1.07	1.721	.013		
IR-OPEN													

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WATER SURFACE PROFILE LISTING

Date: 4-12-2011 Time:

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ANN ROAD CHANNEL WEST - RAINBOW BOULEVARD

HANSEN NO. 36801 - APRIL 5, 2011 BY TARA ALEXANDER, PE

MAIN CHANNEL RUN TO TIE IN AT EASEMENT

```

*****
| Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height | Base Wt | | No
| Station | Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL
| Prs/Pip |
| L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type
| Ch
*****
|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****
|*****|
2282.580 | 2326.840 | 1.981 | 2328.821 | 239.00 | 7.40 | .85 | 2329.67 | .10 | 1.98 | 19.00 | | | 14 | 0
.0
| - | - | - | - | - | - | - | - | - | - | - | - | - | - | -

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FIGURE D-7

T1 ANN ROAD CHANNEL WEST - RAINBOW BOULEVARD
 T2 HANSEN NO. 36801 - APRIL 5, 2011 BY TARA ALEXANDER, PE
 T3 TIE IN AT JUNCTION STRUCTURE TO UPSTREAM IN TROPICAL PKWY
 SO 2108.0802319.940 2 2325.930
 R 2133.8102321.300 2 .013 .000 .000 0
 R 2370.5502322.130 2 .013 .000 -45.000 0
 JX 2370.5602322.130 5 3 4.013 3.500 2.5002323.5302323.580-80.0 80.0 .000
 R 2698.1102323.270 5 .013 .000 .000 1
 JX 2698.1202323.270 7 6 .013 2.000 2324.780 75.0 .000
 R 2713.8802323.330 2 .000 .000 .000 0
 JX 2713.8902323.330 9 8 .013 3.500 2324.830 -75.0 .000
 R 3098.2602324.670 2 .000 .000 .000 0
 JX 3098.2702324.670 9 8 .013 4.500 2326.170 -75.0 .000
 R 3255.0002325.220 10 .013 .000 .000 0
 R 3266.2702325.260 11 .013 .000 -45.000 0
 JX 3266.2802325.260 7 6 .013 4.500 2325.940 75.0 .000
 R 3277.0002325.290 2 .013 .000 .000 0
 R 3328.4402325.440 7 .013 .000 -45.000 1
 JX 3328.4502325.440 7 6 .013 5.500 2326.500 75.0 .000
 R 3355.6102325.520 7 .013 .000 .000 0
 JX 3355.6202325.520 5 12 4.013 17.500 20.0002326.0202326.020-80.0 80.0 .000
 R 3387.6802325.620 7 .013 .000 .000 0
 JX 3387.6902325.620 15 13 14.013 65.000 66.0002325.8802325.910-80.0 70.0 .000
 R 3398.4902325.650 10 .013 .000 .000 0
 SH 3398.4902325.650 10 2323.270
 CD 2 3 0 .000 3.000 9.000 .000 .000 .00
 CD 3 4 1 .000 1.500 .000 .000 .000 .00
 CD 4 4 1 .000 1.500 .000 .000 .000 .00
 CD 5 3 0 .000 3.000 9.000 .000 .000 .00
 CD 6 4 1 .000 1.500 .000 .000 .000 .00
 CD 7 3 0 .000 3.000 9.000 .000 .000 .00
 CD 8 4 1 .000 1.500 .000 .000 .000 .00
 CD 9 3 0 .000 3.000 9.000 .000 .000 .00
 CD 10 3 0 .000 3.000 9.000 .000 .000 .00
 CD 11 3 0 .000 3.000 9.000 .000 .000 .00
 CD 12 4 1 .000 2.500 .000 .000 .000 .00
 CD 13 3 0 .000 2.000 5.000 .000 .000 .00
 CD 14 3 0 .000 2.000 5.000 .000 .000 .00
 CD 15 3 0 .000 3.000 9.000 .000 .000 .00
 CD 18 3 0 .000 3.000 9.000 .000 .000 .00
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WATER SURFACE PROFILE LISTING
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Date: 4-12-2011 Time:

ANN ROAD CHANNEL WEST - RAINBOW BOULEVARD
HANSEN NO. 36801 - APRIL 5, 2011 BY TARA ALEXANDER, PE
TIE IN AT JUNCTION STRUCTURE TO UPSTREAM IN TROPICAL PKWY

Station	Invert Wth Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt/ or I.D.	No ZL
L/Elem Ch	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR Type
2108.080	2319.940	5.990	2325.930	194.51	7.20	.81	2326.74	.00	2.44	9.00	3.000	9.000	.00 0
25.730	.0529					.0034	.09	5.99	.73	.96	.013	.00	.00 BOX
2133.810	2321.300	4.717	2326.017	194.51	7.20	.81	2326.82	.00	2.44	9.00	3.000	9.000	.00 0
236.740	.0035					.0034	.80	4.72	.73	2.38	.013	.00	.00 BOX
2370.550	2322.130	4.811	2326.941	194.51	7.20	.81	2327.75	.00	2.44	9.00	3.000	9.000	.00 0
JUNCT STR	.0000		RB06 & RB07			.0032	.00	4.81	.73		.013	.00	.00 BOX
2370.560	2322.130	4.907	2327.037	188.51	6.98	.76	2327.79	.00	2.39	9.00	3.000	9.000	.00 0
327.550	.0035					.0032	1.04	4.91	.71	2.33	.013	.00	.00 BOX
2698.110	2323.270	4.811	2328.081	188.51	6.98	.76	2328.84	.00	2.39	9.00	3.000	9.000	.00 0
JUNCT STR	.0000		RB05			.0031	.00	4.81	.71		.013	.00	.00 BOX
2698.120	2323.270	4.842	2328.112	186.51	6.91	.74	2328.85	.00	2.37	9.00	3.000	9.000	.00 0
15.760	.0038					.0036	.06	4.84	.70	2.36	.014	.00	.00 BOX
2713.880	2323.330	4.839	2328.169	186.51	6.91	.74	2328.91	.00	2.37	9.00	3.000	9.000	.00 0
JUNCT STR	.0000		RB04			.0030	.00	4.84	.70		.013	.00	.00 BOX
2713.890	2323.330	4.892	2328.222	183.01	6.78	.71	2328.94	.00	2.34	9.00	3.000	9.000	.00 0
384.370	.0035					.0035	1.34	4.89	.69	2.40	.014	.00	.00 BOX
3098.260	2324.670	4.892	2329.562	183.01	6.78	.71	2330.28	.00	2.34	9.00	3.000	9.000	.00 0
JUNCT STR	.0000					.0029	.00	4.89	.69		.013	.00	.00 BOX

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WATER SURFACE PROFILE LISTING

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ANN ROAD CHANNEL WEST - RAINBOW BOULEVARD

HANSEN NO. 36801 - APRIL 5, 2011 BY TARA ALEXANDER, PE

TIE IN AT JUNCTION STRUCTURE TO UPSTREAM IN TROPICAL PKWY

	Invert	Depth	Water	Q	Vel	Vel	Energy	Super	Critical	Flow Top	Height/	Base Wt		No	
Station	Wth Elev	(FT)	Elev	(CFS)	(FPS)	Head	Grd.El.	Elev	Depth	Width	Dia.-FT	or I.D.	ZL		
Prs/Pip															
L/Elem	Ch Slope					SF Ave	HF	SE	Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR Type	
Ch															

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7:37:36

Date: 4-12-2011 Time:

ANN ROAD CHANNEL WEST - RAINBOW BOULEVARD
HANSEN NO. 36801 - APRIL 5, 2011 BY TARA ALEXANDER, PE
TIE IN AT JUNCTION STRUCTURE TO UPSTREAM IN TROPICAL PKWY

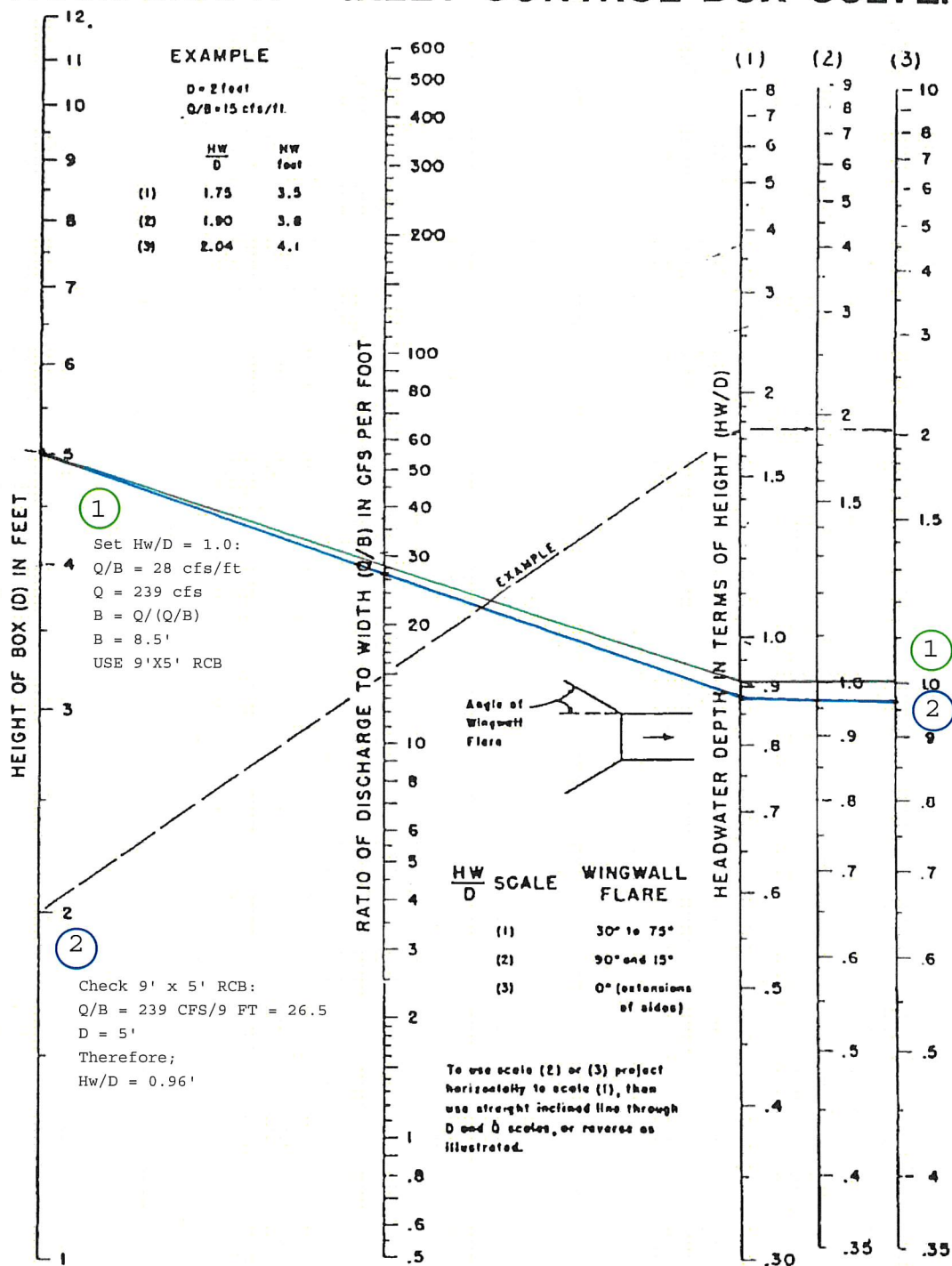
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*****
| Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height | Base Wt | | No
| Station | Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL
| Prs/Pip | | | | | | | | | | | | | |
| L/Elem | Ch Slope | | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type
| Ch | | | | | | | | | | | | | |
*****
|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|
|*****|
3387.680 | 2325.620 | 5.565 | 2331.185 | 131.01 | 4.85 | .37 | 2331.55 | .00 | 1.87 | 9.00 | 3.000 | 9.000 | .00 | 0
.0
| - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
JUNCT STR .0000 | TP01 & TP02
3387.690 | 2325.620 | 6.040 | 2331.660 | .01 | .00 | .00 | 2331.66 | .00 | .00 | 9.00 | 3.000 | 9.000 | .00 | 0
.0
| - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
10.800 | .0028 | | | | | .0000 | .00 | 6.04 | .00 | .01 | .013 | .00 | .00 | BOX
3398.490 | 2325.650 | 6.010 | 2331.660 | .01 | .00 | .00 | 2331.66 | | | | | | | |

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HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

NOMOGRAPH - INLET CONTROL BOX CULVERT



Revision	Date

WRC
ENGINEERING

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

FIGURE 1004

FIGURE D-8

Locir-11							
Conduit Data				Energy and Hydraulic Data			Comments
Station		Size		Pipe		Press	
From	To	Ft/dia		U/S EGL	U/S HGL	Flow ?	
		Width	Depth		2322.93		
DI-RB11	8+32		17	2323.60	2323.10	Yes	Surface = 2324.16
				2323.84			
DI-RB12	10+22		13	2323.89	2323.87	Yes	Surface = 2323.90
				2324.23			
DI-RB10	12+34		15	2324.62	2324.28	Yes	Surface = 2324.79
				2324.31			
DI-EXRB01	12+62		11	2324.38	2324.32	Yes	Surface = 2325.03
				2324.55			
DI-RB09	14+63		13	2324.60	2324.58	Yes	Surface = 2325.31
				2325.06			
DI-RB08	18+95		10	2325.07	2325.06	Yes	Surface = 2326.6
				2327.03			
DI-RB07	23+71		13	2327.09	2327.06	Yes	Surface = 2326.80
				2327.03			
DI-RB06	23+71		13	2327.12	2327.06	Yes	Surface = 2326.77
				2328.11			
DI-RB05	26+98		12	2328.15	2328.13	Yes	Surface = 2328.11
				2328.22			
DI-RB04	27+14		13	2328.31	2328.25	Yes	Surface = 2328.13
				2329.62			
DI-RB03	30+98		15	2329.77	2329.67	Yes	Surface = 2329.61
				2330.27			
SDMH-RT1	32+67		10	2330.78	2330.67	Yes	Surface = 2331.49
DI-RB-02	SDMH-RT1		13	2330.74	2330.70	Yes	Surface = 2330.41
				2330.67			
DI-RB01	SDMH-RT1		11	2330.71	2330.69	Yes	Surface = 2330.94
				2330.65			
DI-TP05	33+28		13	2330.83	2330.68	Yes	Surface = 2330.52
				2331.14			
DI-TP04	33+55		13	2331.43	2331.17	Yes	Surface = 2330.82
				2331.14			
DI-TP03	33+55		10	2331.43	2331.24	Yes	Surface = 2330.85
				2331.66			
DI-TP02	33+87	5.00	17	2332.41	2331.73	Yes	Surface = 2330.94
				2331.66			
DI-TP01	33+87	5.00	17	2332.59	2331.93	Yes	Surface = 2331.02

Flap on Inlets
Reference
Rainbow Project
by Rosa Cortez

FIGURE D-9

FIGURE D-10

Worksheet for DI#TP01-Q10

Project Description

Solve For Efficiency

Input Data

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

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	92.31	%
Intercepted Flow	15.23	ft ³ /s
Bypass Flow	1.27	ft ³ /s
Spread	24.67	ft
Depth	0.57	ft
Flow Area	5.86	ft ²
Gutter Depression	0.10	ft
Total Depression	0.27	ft
Velocity	2.82	ft/s
Splash Over Velocity	44.17	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.74	
Grate Flow Ratio	0.18	
Equivalent Cross Slope	0.05099	ft/ft
Active Grate Length	8.75	ft
Length Factor	0.32	
Total Interception Length	27.12	ft

Worksheet for DI#TP01-Q10

Messages

Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for DI#TP01-Q100

Project Description

Solve For Efficiency

Input Data

Discharge	91.00	ft ³ /s
Slope	0.38	%
Gutter Width	1.50	ft
Gutter Cross Slope	8.67	%
Road Cross Slope	1.90	%
Roughness Coefficient	0.015	
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	17.50	ft
Grate Type	Curved Vaned	
Clogging	50.00	%
Curb Opening Length	17.50	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	71.75	%
Intercepted Flow	65.30	ft ³ /s
Bypass Flow	25.70	ft ³ /s
Spread	47.14	ft
Depth	1.00	ft
Flow Area	21.19	ft ²
Gutter Depression	0.10	ft
Total Depression	0.27	ft
Velocity	4.29	ft/s
Splash Over Velocity	44.17	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.57	
Grate Flow Ratio	0.09	
Equivalent Cross Slope	0.03510	ft/ft
Active Grate Length	8.75	ft
Length Factor	0.13	
Total Interception Length	69.51	ft

Worksheet for DI#TP01-Q100

Messages

Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for DI#TP02-Q10

Project Description

Solve For Efficiency

Input Data

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

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	92.71	%
Intercepted Flow	15.30	ft ³ /s
Bypass Flow	1.20	ft ³ /s
Spread	23.89	ft
Depth	0.58	ft
Flow Area	5.78	ft ²
Gutter Depression	0.10	ft
Total Depression	0.27	ft
Velocity	2.85	ft/s
Splash Over Velocity	44.17	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.75	
Grate Flow Ratio	0.18	
Equivalent Cross Slope	0.05261	ft/ft
Active Grate Length	8.75	ft
Length Factor	0.33	
Total Interception Length	26.61	ft

Worksheet for DI#TP02-Q10

Messages

Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for DI#TP02-Q100

Project Description

Solve For Efficiency

Input Data

Discharge	91.00	ft ³ /s
Slope	0.38	%
Gutter Width	1.50	ft
Gutter Cross Slope	8.67	%
Road Cross Slope	2.00	%
Roughness Coefficient	0.015	
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	17.50	ft
Grate Type	Curved Vaned	
Clogging	50.00	%
Curb Opening Length	17.50	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	72.54	%
Intercepted Flow	66.01	ft ³ /s
Bypass Flow	24.99	ft ³ /s
Spread	45.65	ft
Depth	1.01	ft
Flow Area	20.92	ft ²
Gutter Depression	0.10	ft
Total Depression	0.27	ft
Velocity	4.35	ft/s
Splash Over Velocity	44.17	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.58	
Grate Flow Ratio	0.09	
Equivalent Cross Slope	0.03647	ft/ft
Active Grate Length	8.75	ft
Length Factor	0.13	
Total Interception Length	67.93	ft

Worksheet for DI#TP02-Q100

Messages

Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for DI #TP03-Q10

Project Description

Solve For Efficiency

Input Data

Discharge	1.50	ft ³ /s
Slope	0.48	%
Gutter Width	1.50	ft
Gutter Cross Slope	8.67	%
Road Cross Slope	1.60	%
Roughness Coefficient	0.015	
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	12.50	ft
Grate Type	Curved Vaned	
Clogging	50.00	%
Curb Opening Length	12.50	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	100.00	%
Intercepted Flow	1.50	ft ³ /s
Bypass Flow	0.00	ft ³ /s
Spread	9.97	ft
Depth	0.27	ft
Flow Area	0.87	ft ²
Gutter Depression	0.11	ft
Total Depression	0.27	ft
Velocity	1.71	ft/s
Splash Over Velocity	16.48	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.73	
Grate Flow Ratio	0.48	
Equivalent Cross Slope	0.10338	ft/ft
Active Grate Length	6.25	ft
Length Factor	0.90	
Total Interception Length	6.95	ft

Worksheet for DI #TP03-Q10

Messages

Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for DI #TP03-Q100

Project Description

Solve For Efficiency

Input Data

Discharge	26.00	ft ³ /s
Slope	0.48	%
Gutter Width	1.50	ft
Gutter Cross Slope	8.67	%
Road Cross Slope	1.60	%
Roughness Coefficient	0.015	
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	12.50	ft
Grate Type	Curved Vaned	
Clogging	50.00	%
Curb Opening Length	12.50	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	68.77	%
Intercepted Flow	17.88	ft ³ /s
Bypass Flow	8.12	ft ³ /s
Spread	31.25	ft
Depth	0.61	ft
Flow Area	7.89	ft ²
Gutter Depression	0.11	ft
Total Depression	0.27	ft
Velocity	3.29	ft/s
Splash Over Velocity	16.48	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.46	
Grate Flow Ratio	0.14	
Equivalent Cross Slope	0.04200	ft/ft
Active Grate Length	6.25	ft
Length Factor	0.16	
Total Interception Length	39.55	ft

Worksheet for DI #TP03-Q100

Messages

Messages

Grate Length should be within the
defined range of HEC-22's Chart 5
(approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for DI #TP04-Q10

Project Description

Solve For Efficiency

Input Data

Discharge	1.50	ft ³ /s
Slope	0.25	%
Gutter Width	1.50	ft
Gutter Cross Slope	8.67	%
Road Cross Slope	1.80	%
Roughness Coefficient	0.016	
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	12.50	ft
Grate Type	Curved Vaned	
Clogging	50.00	%
Curb Opening Length	12.50	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	100.00	%
Intercepted Flow	1.50	ft ³ /s
Bypass Flow	0.00	ft ³ /s
Spread	10.97	ft
Depth	0.30	ft
Flow Area	1.16	ft ²
Gutter Depression	0.10	ft
Total Depression	0.27	ft
Velocity	1.29	ft/s
Splash Over Velocity	16.48	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.84	
Grate Flow Ratio	0.42	
Equivalent Cross Slope	0.09409	ft/ft
Active Grate Length	6.25	ft
Length Factor	1.07	
Total Interception Length	5.82	ft

Worksheet for DI #TP04-Q10

Messages

Messages

Grate Length should be within the
defined range of HEC-22's Chart 5
(approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for DI #TP04-Q100

Project Description

Solve For

Efficiency

Input Data

Discharge	25.00	ft ³ /s
Slope	0.25	%
Gutter Width	1.50	ft
Gutter Cross Slope	8.67	%
Road Cross Slope	1.80	%
Roughness Coefficient	0.016	
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	12.50	ft
Grate Type	Curved Vaned	
Clogging	50.00	%
Curb Opening Length	12.50	ft

Options

Calculation Option

Use Both

Grate Flow Option

Exclude None

Results

Efficiency	80.35	%
Intercepted Flow	20.09	ft ³ /s
Bypass Flow	4.91	ft ³ /s
Spread	33.18	ft
Depth	0.70	ft
Flow Area	9.99	ft ²
Gutter Depression	0.10	ft
Total Depression	0.27	ft
Velocity	2.50	ft/s
Splash Over Velocity	16.48	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.61	
Grate Flow Ratio	0.13	
Equivalent Cross Slope	0.04165	ft/ft
Active Grate Length	6.25	ft
Length Factor	0.20	
Total Interception Length	30.93	ft

Worksheet for DI #TP04-Q100

Messages

Messages

Grate Length should be within the
defined range of HEC-22's Chart 5
(approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for DI#RB01-Q10

Project Description

Solve For Efficiency

Input Data

Discharge	0.50	ft³/s
Slope	0.46	%
Gutter Width	1.50	ft
Gutter Cross Slope	8.67	%
Road Cross Slope	1.40	%
Roughness Coefficient	0.015	
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	5.00	ft
Grate Type	Curved Vaned	
Clogging	50.00	%
Curb Opening Length	5.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	100.00	%
Intercepted Flow	0.50	ft³/s
Bypass Flow	0.00	ft³/s
Spread	6.34	ft
Depth	0.20	ft
Flow Area	0.36	ft²
Gutter Depression	0.11	ft
Total Depression	0.28	ft
Velocity	1.38	ft/s
Splash Over Velocity	6.60	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.30	
Grate Flow Ratio	0.73	
Equivalent Cross Slope	0.14750	ft/ft
Active Grate Length	2.50	ft
Length Factor	0.72	
Total Interception Length	3.50	ft

Worksheet for DI#RB01-Q10

Messages

Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for DI#RB01-Q100

Project Description

Solve For Efficiency

Input Data

Discharge	2.50	ft ³ /s
Slope	0.46	%
Gutter Width	1.50	ft
Gutter Cross Slope	8.67	%
Road Cross Slope	1.40	%
Roughness Coefficient	0.015	
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	5.00	ft
Grate Type	Curved Vaned	
Clogging	50.00	%
Curb Opening Length	5.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	75.89	%
Intercepted Flow	1.90	ft ³ /s
Bypass Flow	0.60	ft ³ /s
Spread	13.62	ft
Depth	0.30	ft
Flow Area	1.38	ft ²
Gutter Depression	0.11	ft
Total Depression	0.28	ft
Velocity	1.81	ft/s
Splash Over Velocity	6.60	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.21	
Grate Flow Ratio	0.37	
Equivalent Cross Slope	0.08110	ft/ft
Active Grate Length	2.50	ft
Length Factor	0.25	
Total Interception Length	9.84	ft

Worksheet for DI#RB01-Q100

Messages

Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for DI#RB03-Q10

Project Description

Solve For Efficiency

Input Data

Discharge	0.00	ft ³ /s
Slope	0.35	%
Gutter Width	1.50	ft
Gutter Cross Slope	8.67	%
Road Cross Slope	1.60	%
Roughness Coefficient	0.015	
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	5.00	ft
Grate Type	Curved Vaned	
Clogging	50.00	%
Curb Opening Length	5.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	100.00	%
Intercepted Flow	0.00	ft ³ /s
Bypass Flow	0.00	ft ³ /s
Spread	0.26	ft
Depth	0.02	ft
Flow Area	0.00	ft ²
Gutter Depression	0.11	ft
Total Depression	0.27	ft
Velocity	0.35	ft/s
Splash Over Velocity	6.60	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.86	
Grate Flow Ratio	1.00	
Equivalent Cross Slope	0.19781	ft/ft
Active Grate Length	2.50	ft
Length Factor	12.59	
Total Interception Length	0.20	ft

Worksheet for DI#RB03-Q10

Messages

Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for DI#RB03-Q100

Project Description

Solve For Efficiency

Input Data

Discharge	8.50	ft ³ /s
Slope	0.35	%
Gutter Width	1.50	ft
Gutter Cross Slope	8.67	%
Road Cross Slope	1.60	%
Roughness Coefficient	0.015	
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	5.00	ft
Grate Type	Curved Vaned	
Clogging	50.00	%
Curb Opening Length	5.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	51.85	%
Intercepted Flow	4.41	ft ³ /s
Bypass Flow	4.09	ft ³ /s
Spread	21.60	ft
Depth	0.45	ft
Flow Area	3.81	ft ²
Gutter Depression	0.11	ft
Total Depression	0.27	ft
Velocity	2.23	ft/s
Splash Over Velocity	6.60	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.17	
Grate Flow Ratio	0.21	
Equivalent Cross Slope	0.05486	ft/ft
Active Grate Length	2.50	ft
Length Factor	0.13	
Total Interception Length	19.17	ft

Worksheet for DI#RB03-Q100

Messages

Messages

Grate Length should be within the
defined range of HEC-22's Chart 5
(approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for DI#RB04-Q10

Project Description

Solve For

Efficiency

Input Data

Discharge	2.50	ft ³ /s
Slope	0.45	%
Gutter Width	1.50	ft
Gutter Cross Slope	8.67	%
Road Cross Slope	3.00	%
Roughness Coefficient	0.015	
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	2.50	ft
Grate Type	Curved Vaned	
Clogging	50.00	%
Curb Opening Length	2.50	ft

Options

Calculation Option

Use Both

Grate Flow Option

Exclude None

Results

Efficiency	67.98	%
Intercepted Flow	1.70	ft ³ /s
Bypass Flow	0.80	ft ³ /s
Spread	8.55	ft
Depth	0.34	ft
Flow Area	1.16	ft ²
Gutter Depression	0.09	ft
Total Depression	0.25	ft
Velocity	2.16	ft/s
Splash Over Velocity	4.61	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.08	
Grate Flow Ratio	0.47	
Equivalent Cross Slope	0.10934	ft/ft
Active Grate Length	1.25	ft
Length Factor	0.15	
Total Interception Length	8.17	ft

Worksheet for DI#RB04-Q10

Messages

Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for DI#RB04-Q100

Project Description

Solve For Efficiency

Input Data

Discharge	8.50	ft ³ /s
Slope	0.45	%
Gutter Width	1.50	ft
Gutter Cross Slope	8.67	%
Road Cross Slope	3.00	%
Roughness Coefficient	0.015	
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	2.50	ft
Grate Type	Curved Vaned	
Clogging	50.00	%
Curb Opening Length	2.50	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	43.49	%
Intercepted Flow	3.70	ft ³ /s
Bypass Flow	4.80	ft ³ /s
Spread	13.91	ft
Depth	0.50	ft
Flow Area	2.97	ft ²
Gutter Depression	0.09	ft
Total Depression	0.25	ft
Velocity	2.87	ft/s
Splash Over Velocity	4.61	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.05	
Grate Flow Ratio	0.30	
Equivalent Cross Slope	0.07990	ft/ft
Active Grate Length	1.25	ft
Length Factor	0.08	
Total Interception Length	16.49	ft

Worksheet for DI#RB04-Q100

Messages

Messages

Grate Length should be within the
defined range of HEC-22's Chart 5
(approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for DI#RB05-Q10

Project Description

Solve For Efficiency

Input Data

Discharge	2.50	ft ³ /s
Slope	0.30	%
Gutter Width	1.50	ft
Gutter Cross Slope	8.67	%
Road Cross Slope	1.80	%
Roughness Coefficient	0.016	
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	2.50	ft
Grate Type	Curved Vaned	
Clogging	50.00	%
Curb Opening Length	2.50	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	59.55	%
Intercepted Flow	1.49	ft ³ /s
Bypass Flow	1.01	ft ³ /s
Spread	13.06	ft
Depth	0.34	ft
Flow Area	1.61	ft ²
Gutter Depression	0.10	ft
Total Depression	0.27	ft
Velocity	1.55	ft/s
Splash Over Velocity	4.61	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.08	
Grate Flow Ratio	0.35	
Equivalent Cross Slope	0.08180	ft/ft
Active Grate Length	1.25	ft
Length Factor	0.15	
Total Interception Length	8.28	ft

Worksheet for DI#RB05-Q10

Messages

Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for DI#RB05-Q100

Project Description

Solve For

Efficiency

Input Data

Discharge	4.50	ft ³ /s
Slope	0.30	%
Gutter Width	1.50	ft
Gutter Cross Slope	8.67	%
Road Cross Slope	1.80	%
Roughness Coefficient	0.016	
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	2.50	ft
Grate Type	Curved Vaned	
Clogging	50.00	%
Curb Opening Length	2.50	ft

Options

Calculation Option

Use Both

Grate Flow Option

Exclude None

Results

Efficiency	46.96	%
Intercepted Flow	2.11	ft ³ /s
Bypass Flow	2.39	ft ³ /s
Spread	16.54	ft
Depth	0.40	ft
Flow Area	2.54	ft ²
Gutter Depression	0.10	ft
Total Depression	0.27	ft
Velocity	1.77	ft/s
Splash Over Velocity	4.61	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.07	
Grate Flow Ratio	0.28	
Equivalent Cross Slope	0.06784	ft/ft
Active Grate Length	1.25	ft
Length Factor	0.11	
Total Interception Length	11.87	ft

Worksheet for DI#RB05-Q100

Messages

Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for DI#RB06-Q10

Project Description

Solve For

Efficiency

Input Data

Discharge	1.00	ft ³ /s
Slope	0.35	%
Gutter Width	1.50	ft
Gutter Cross Slope	8.67	%
Road Cross Slope	2.30	%
Roughness Coefficient	0.016	
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	5.00	ft
Grate Type	Curved Vaned	
Clogging	50.00	%
Curb Opening Length	5.00	ft

Options

Calculation Option

Use Both

Grate Flow Option

Exclude None

Results

Efficiency	98.80	%
Intercepted Flow	0.99	ft ³ /s
Bypass Flow	0.01	ft ³ /s
Spread	7.36	ft
Depth	0.26	ft
Flow Area	0.69	ft ²
Gutter Depression	0.10	ft
Total Depression	0.26	ft
Velocity	1.44	ft/s
Splash Over Velocity	6.60	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.40	
Grate Flow Ratio	0.57	
Equivalent Cross Slope	0.12321	ft/ft
Active Grate Length	2.50	ft
Length Factor	0.54	
Total Interception Length	4.62	ft

Worksheet for DI#RB06-Q10

Messages

Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for DI#RB06-Q100

Project Description

Solve For Efficiency

Input Data

Discharge	5.00	ft ³ /s
Slope	0.35	%
Gutter Width	1.50	ft
Gutter Cross Slope	8.67	%
Road Cross Slope	2.30	%
Roughness Coefficient	0.016	
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	5.00	ft
Grate Type	Curved Vaned	
Clogging	50.00	%
Curb Opening Length	5.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	70.05	%
Intercepted Flow	3.50	ft ³ /s
Bypass Flow	1.50	ft ³ /s
Spread	14.36	ft
Depth	0.43	ft
Flow Area	2.44	ft ²
Gutter Depression	0.10	ft
Total Depression	0.26	ft
Velocity	2.05	ft/s
Splash Over Velocity	6.60	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.26	
Grate Flow Ratio	0.30	
Equivalent Cross Slope	0.07607	ft/ft
Active Grate Length	2.50	ft
Length Factor	0.21	
Total Interception Length	12.13	ft

Worksheet for DI#RB06-Q100

Messages

Messages

Grate Length should be within the
defined range of HEC-22's Chart 5
(approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for DI#EXRB01-Q10

Project Description

Solve For

Efficiency

Input Data

Discharge	5.00	ft ³ /s
Slope	0.80	%
Gutter Width	1.50	ft
Gutter Cross Slope	8.67	%
Road Cross Slope	1.10	%
Roughness Coefficient	0.015	
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	17.50	ft
Grate Type	Curved Vaned	
Clogging	50.00	%
Curb Opening Length	17.50	ft

Options

Calculation Option

Use Both

Grate Flow Option

Exclude None

Results

Efficiency	96.26	%
Intercepted Flow	4.81	ft ³ /s
Bypass Flow	0.19	ft ³ /s
Spread	18.80	ft
Depth	0.32	ft
Flow Area	2.03	ft ²
Gutter Depression	0.11	ft
Total Depression	0.28	ft
Velocity	2.46	ft/s
Splash Over Velocity	44.17	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.68	
Grate Flow Ratio	0.28	
Equivalent Cross Slope	0.06264	ft/ft
Active Grate Length	8.75	ft
Length Factor	0.48	
Total Interception Length	18.15	ft

Worksheet for DI#EXRB01-Q10

Messages

Messages

Grate Length should be within the
defined range of HEC-22's Chart 5
(approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for DI#EXRB01-Q100

Project Description

Solve For Efficiency

Input Data

Discharge	12.00	ft ³ /s
Slope	0.80	%
Gutter Width	1.50	ft
Gutter Cross Slope	8.67	%
Road Cross Slope	1.10	%
Roughness Coefficient	0.015	
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	17.50	ft
Grate Type	Curved Vaned	
Clogging	50.00	%
Curb Opening Length	17.50	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	85.30	%
Intercepted Flow	10.24	ft ³ /s
Bypass Flow	1.76	ft ³ /s
Spread	26.60	ft
Depth	0.41	ft
Flow Area	3.98	ft ²
Gutter Depression	0.11	ft
Total Depression	0.28	ft
Velocity	3.02	ft/s
Splash Over Velocity	44.17	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.60	
Grate Flow Ratio	0.19	
Equivalent Cross Slope	0.04572	ft/ft
Active Grate Length	8.75	ft
Length Factor	0.28	
Total Interception Length	31.67	ft

Worksheet for DI#EXRB01-Q100

Messages

Messages

Grate Length should be within the
defined range of HEC-22's Chart 5
(approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for DI#RB10-Q10

Project Description

Solve For Efficiency

Input Data

Discharge	1.00	ft ³ /s
Slope	0.50	%
Gutter Width	1.50	ft
Gutter Cross Slope	8.67	%
Road Cross Slope	1.10	%
Roughness Coefficient	0.015	
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	17.50	ft
Grate Type	Curved Vaned	
Clogging	50.00	%
Curb Opening Length	17.50	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	100.00	%
Intercepted Flow	1.00	ft ³ /s
Bypass Flow	0.00	ft ³ /s
Spread	10.35	ft
Depth	0.23	ft
Flow Area	0.67	ft ²
Gutter Depression	0.11	ft
Total Depression	0.28	ft
Velocity	1.48	ft/s
Splash Over Velocity	44.17	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.84	
Grate Flow Ratio	0.52	
Equivalent Cross Slope	0.10854	ft/ft
Active Grate Length	8.75	ft
Length Factor	1.52	
Total Interception Length	5.77	ft

Worksheet for DI#RB10-Q10

Messages

Messages

Grate Length should be within the
defined range of HEC-22's Chart 5
(approx. 0.5-4.5 ft / 0.15-1.35 m).

Worksheet for DI#RB10-Q100

Project Description

Solve For Efficiency

Input Data

Discharge	30.00	ft ³ /s
Slope	0.50	%
Gutter Width	1.50	ft
Gutter Cross Slope	8.67	%
Road Cross Slope	1.10	%
Roughness Coefficient	0.015	
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	17.50	ft
Grate Type	Curved Vaned	
Clogging	50.00	%
Curb Opening Length	17.50	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	76.20	%
Intercepted Flow	22.86	ft ³ /s
Bypass Flow	7.14	ft ³ /s
Spread	41.40	ft
Depth	0.57	ft
Flow Area	9.51	ft ²
Gutter Depression	0.11	ft
Total Depression	0.28	ft
Velocity	3.15	ft/s
Splash Over Velocity	44.17	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.58	
Grate Flow Ratio	0.11	
Equivalent Cross Slope	0.03199	ft/ft
Active Grate Length	8.75	ft
Length Factor	0.17	
Total Interception Length	50.07	ft

Worksheet for DI#RB10-Q100

Messages

Messages

Grate Length should be within the
defined range of HEC-22's Chart 5
(approx. 0.5-4.5 ft / 0.15-1.35 m).

TP05
Drop Inlet Orifice Calculation
SOLVE FOR REQUIRED
OPENING AREA

$$Q = CA(2gh)^{0.5}$$

Inputs:

C = Discharge Coefficient= **0.62**

Q = Discharge (cfs) = **5.5**

g = Gravity Constant (ft²/s)= **32.2**

h = height of water= **0.5**

Result:

A = Required Opening Area (ft²)= **1.56**

(area doubled for 50% clogging) **3.13**

SOLVE FOR ACTUAL
GRATE OPENING AREA (GOA)

$$GOA = (NOG \times OAG) + (COH \times COL)$$

Inputs:

Number of Grates (NOG) = **2**

Open Area/Grate (OAG) (ft²)*= **2.25**

Curb Opening Height (COH) (ft)= **0.5**

Curb Opening Length (COL) (ft)= **2.5**

**The effective Open Area/Grate is
assumed to be 60% for overall inlet size
(1.5x2.5)

Result:

Actual Grate Opening Area (ft²)= **5.75**

Worksheet for DI#TP05-Q10

Project Description

Solve For Spread

Input Data

Discharge	0.00	ft ³ /s
Gutter Width	1.50	ft
Gutter Cross Slope	8.97	%
Road Cross Slope	2.00	%
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	5.00	ft
Grate Type	Curved Vaned	
Clogging	50.00	%
Curb Opening Length	5.00	ft
Opening Height	0.50	ft
Curb Throat Type	Horizontal	
Throat Incline Angle	90.00	degrees

Options

Calculation Option Use Both

Results

Spread	0.75	ft
Depth	-0.02	ft
Gutter Depression	0.10	ft
Total Depression	0.27	ft
Open Grate Area	1.31	ft ²
Active Grate Weir Length	6.50	ft

Worksheet for DI#TP05-Q100

Project Description

Solve For Spread

Input Data

Discharge	5.50	ft ³ /s
Gutter Width	1.50	ft
Gutter Cross Slope	8.97	%
Road Cross Slope	2.00	%
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	5.00	ft
Grate Type	Curved Vaned	
Clogging	50.00	%
Curb Opening Length	5.00	ft
Opening Height	0.50	ft
Curb Throat Type	Horizontal	
Throat Incline Angle	90.00	degrees

Options

Calculation Option Use Both

Results

Spread	14.65	ft
Depth	0.40	ft
Gutter Depression	0.10	ft
Total Depression	0.27	ft
Open Grate Area	1.31	ft ²
Active Grate Weir Length	6.50	ft

RB07

**Drop Inlet Orifice Calculation
SOLVE FOR REQUIRED
OPENING AREA**

$$Q = CA(2gh)^{0.5}$$

Inputs:

C = Discharge Coefficient= 0.62

Q = Discharge (cfs) = 2.5

g = Gravity Constant (ft²/s)= 32.2

h = height of water= 0.5

Result:

A = Required Opening Area (ft²)= 0.71

(area doubled for 50% clogging) 1.42

**SOLVE FOR ACTUAL
GRATE OPENING AREA (GOA)**

$$GOA = (NOG \times OAG) + (COH \times COL)$$

Inputs:

Number of Grates (NOG) = 1

Open Area/Grate (OAG) (ft²)*= 2.25

Curb Opening Height (COH) (ft)= 0.5

Curb Opening Length (COL) (ft)= 2.5

****The effective Open Area/Grate is
assumed to be 60% for overall inlet size
(1.5x2.5)**

Result:

Actual Grate Opening Area (ft²)= 3.50

Worksheet for DI#RB07-Q10

Project Description

Solve For Spread

Input Data

Discharge		1.00	ft ³ /s
Gutter Width		1.50	ft
Gutter Cross Slope		8.97	%
Road Cross Slope		2.00	%
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		2.50	ft
Grate Type	Curved Vaned		
Clogging		50.00	%
Curb Opening Length		2.50	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Throat Incline Angle		90.00	degrees

Options

Calculation Option Use Both

Results

Spread	5.50	ft
Depth	0.21	ft
Gutter Depression	0.10	ft
Total Depression	0.27	ft
Open Grate Area	0.66	ft ²
Active Grate Weir Length	4.00	ft

Worksheet for DI#RB07-Q100

Project Description

Solve For Spread

Input Data

Discharge	2.50	ft ³ /s
Gutter Width	1.50	ft
Gutter Cross Slope	8.97	%
Road Cross Slope	2.00	%
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	2.50	ft
Grate Type	Curved Vaned	
Clogging	50.00	%
Curb Opening Length	2.50	ft
Opening Height	0.50	ft
Curb Throat Type	Horizontal	
Throat Incline Angle	90.00	degrees

Options

Calculation Option Use Both

Results

Spread	10.74	ft
Depth	0.32	ft
Gutter Depression	0.10	ft
Total Depression	0.27	ft
Open Grate Area	0.66	ft ²
Active Grate Weir Length	4.00	ft

RB11
Drop Inlet Orifice Calculation
SOLVE FOR REQUIRED
OPENING AREA

$$Q=CA(2gh)^{0.5}$$

Inputs:

C = Discharge Coefficient=	0.62
Q = Discharge (cfs) =	10
g = Gravity Constant (ft ² /s)=	32.2
h = height of water=	0.5

Result:

A = Required Opening Area (ft ²)=	2.84
(area doubled for 50% clogging)	<u>5.68</u>

SOLVE FOR ACTUAL
GRATE OPENING AREA (GOA)

$$GOA = (NOG \times OAG) + (COH \times COL)$$

Inputs:

Number of Grates (NOG) =	3
Open Area/Grate (OAG) (ft ²)**=	2.25
Curb Opening Height (COH) (ft)=	0.5
Curb Opening Length (COL) (ft)=	5

**The effective Open Area/Grate is
assumed to be 60% for overall inlet size
(1.5x2.5)

Result:

Actual Grate Opening Area (ft ²)=	<u>9.25</u>
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Worksheet for DI#RB11-Q10

Project Description

Solve For Spread

Input Data

Discharge	2.00	ft ³ /s
Gutter Width	1.50	ft
Gutter Cross Slope	8.97	%
Road Cross Slope	2.00	%
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	7.50	ft
Grate Type	Curved Vaned	
Clogging	50.00	%
Curb Opening Length	7.50	ft
Opening Height	0.50	ft
Curb Throat Type	Horizontal	
Throat Incline Angle	90.00	degrees

Options

Calculation Option Use Both

Results

Spread	6.56	ft
Depth	0.24	ft
Gutter Depression	0.10	ft
Total Depression	0.27	ft
Open Grate Area	1.97	ft ²
Active Grate Weir Length	9.00	ft

Worksheet for DI#RB11-Q100

Project Description

Solve For Spread

Input Data

Discharge	10.00	ft ³ /s
Gutter Width	1.50	ft
Gutter Cross Slope	8.97	%
Road Cross Slope	2.00	%
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	7.50	ft
Grate Type	Curved Vaned	
Clogging	50.00	%
Curb Opening Length	7.50	ft
Opening Height	0.50	ft
Curb Throat Type	Horizontal	
Throat Incline Angle	90.00	degrees

Options

Calculation Option Use Both

Results

Spread	17.97	ft
Depth	0.46	ft
Gutter Depression	0.10	ft
Total Depression	0.27	ft
Open Grate Area	1.97	ft ²
Active Grate Weir Length	9.00	ft

NDOT Type 2B Calcs
REQUIRED OPEN AREA VERSUS RUNOFF

$$Q=CA(2gh)^{0.5}$$

Inputs:

C = Discharge Coefficient= **0.62**
 Q = Discharge (cfs) = **SEE CHART**
 g = Gravity Constant (ft2/s)= **32.2**
 h = height of water= **SEE CHART**

Inlet	Q (cfs)	h (ft)	Open Area (ft ²)	Required Open Area (ft ²) 1.5Xs for 50% clogging	Notes
NUISANCE	4	0.4	1.3	1.9	Use "A"=2
RB02	2.5	0.4	0.8	1.6	Use "A"=2
RB08	1.5	0.4	0.5	1.0	Use "A"=2
RB09	2	0.4	0.6	1.0	Use "A"=2
RB12	4	0.4	1.3	1.9	Use "A"=2

Actual Open Areas for NDOT Type 2B Drop Inlet - Assume inlets are 64% open and all Widths =			
Length	Area (ft ²)	Open Area	Pipe Size (in)
2	4	2.6	15
2.5	5	3.2	18
3	6	3.8	24
3.5	7	4.5	30
4	8	5.1	36
4.5	9	5.8	42
5	10	6.4	48

Worksheet for DI#RB02-Q10

Project Description

Solve For Spread

Input Data

Discharge	0.50	ft ³ /s
Left Side Slope	10.00	ft/ft (H:V)
Right Side Slope	10.00	ft/ft (H:V)
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	2.00	ft
Local Depression	2.00	in
Local Depression Width	3.00	ft
Grate Type	Curved Vaned	
Clogging	50.00	%

Results

Spread	3.00	ft
Depth	-0.07	ft
Wetted Perimeter	0.49	ft
Top Width	0.50	ft
Open Grate Area	0.70	ft ²
Active Grate Weir Length	6.00	ft

Worksheet for DI#RB02-Q100

Project Description

Solve For

Spread

Input Data

Discharge	2.50	ft ³ /s
Left Side Slope	10.00	ft/ft (H:V)
Right Side Slope	10.00	ft/ft (H:V)
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	2.00	ft
Local Depression	2.00	in
Local Depression Width	3.00	ft
Grate Type	Curved Vaned	
Clogging	50.00	%

Results

Spread	7.50	ft
Depth	0.27	ft
Wetted Perimeter	7.53	ft
Top Width	7.50	ft
Open Grate Area	0.70	ft ²
Active Grate Weir Length	6.00	ft

Worksheet for DI#RB08-Q10

Project Description

Solve For Spread

Input Data

Discharge	0.00	ft ³ /s
Left Side Slope	10.00	ft/ft (H:V)
Right Side Slope	10.00	ft/ft (H:V)
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	2.00	ft
Local Depression	2.00	in
Local Depression Width	3.00	ft
Grate Type	Curved Vaned	
Clogging	50.00	%

Results

Spread	3.00	ft
Depth	-0.17	ft
Wetted Perimeter	-1.32	ft
Top Width	-1.30	ft
Open Grate Area	0.70	ft ²
Active Grate Weir Length	6.00	ft

Worksheet for DI#RB08-Q100

Project Description

Solve For

Spread

Input Data

Discharge	1.50	ft ³ /s
Left Side Slope	10.00	ft/ft (H:V)
Right Side Slope	10.00	ft/ft (H:V)
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	2.00	ft
Local Depression	2.00	in
Local Depression Width	3.00	ft
Grate Type	Curved Vaned	
Clogging	50.00	%

Results

Spread	2.48	ft
Depth	0.02	ft
Wetted Perimeter	2.48	ft
Top Width	2.48	ft
Open Grate Area	0.70	ft ²
Active Grate Weir Length	6.00	ft

Worksheet for DI#RB09-Q10

Project Description

Solve For

Spread

Input Data

Discharge	1.00	ft ³ /s
Left Side Slope	10.00	ft/ft (H:V)
Right Side Slope	10.00	ft/ft (H:V)
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	2.00	ft
Local Depression	2.00	in
Local Depression Width	3.00	ft
Grate Type	Curved Vaned	
Clogging	50.00	%

Results

Spread	3.00	ft
Depth	-0.02	ft
Wetted Perimeter	1.58	ft
Top Width	1.58	ft
Open Grate Area	0.70	ft ²
Active Grate Weir Length	6.00	ft

Worksheet for DI#RB09-Q100

Project Description

Solve For

Spread

Input Data

Discharge	2.00	ft ³ /s
Left Side Slope	10.00	ft/ft (H:V)
Right Side Slope	10.00	ft/ft (H:V)
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	2.00	ft
Local Depression	2.00	in
Local Depression Width	3.00	ft
Grate Type	Curved Vaned	
Clogging	50.00	%

Results

Spread	4.32	ft
Depth	0.12	ft
Wetted Perimeter	4.33	ft
Top Width	4.32	ft
Open Grate Area	0.70	ft ²
Active Grate Weir Length	6.00	ft

Worksheet for DI#RB12-Q10

Project Description

Solve For Spread

Input Data

Discharge	1.00	ft ³ /s
Left Side Slope	10.00	ft/ft (H:V)
Right Side Slope	10.00	ft/ft (H:V)
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	2.00	ft
Local Depression	2.00	in
Local Depression Width	3.00	ft
Grate Type	Curved Vaned	
Clogging	50.00	%

Results

Spread	3.00	ft
Depth	-0.02	ft
Wetted Perimeter	1.58	ft
Top Width	1.58	ft
Open Grate Area	0.70	ft ²
Active Grate Weir Length	6.00	ft

Worksheet for DI#RB12-Q100

Project Description

Solve For

Spread

Input Data

Discharge	2.00	ft ³ /s
Left Side Slope	10.00	ft/ft (H:V)
Right Side Slope	10.00	ft/ft (H:V)
Bottom Width	2.00	ft
Grate Width	2.00	ft
Grate Length	2.00	ft
Local Depression	2.00	in
Local Depression Width	3.00	ft
Grate Type	Curved Vaned	
Clogging	50.00	%

Results

Spread	4.32	ft
Depth	0.12	ft
Wetted Perimeter	4.33	ft
Top Width	4.32	ft
Open Grate Area	0.70	ft ²
Active Grate Weir Length	6.00	ft

FIGURE D-11

Worksheet for Section A-Q10

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.38 %
Discharge 33.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.0	0.59
0+05.0	0.54
0+05.5	0.54
0+05.5	0.04
0+07.0	0.17
0+07.0	0.21
0+40.0	0.84
0+73.0	0.17
0+73.0	0.13
0+74.5	0.00
0+74.5	0.50
0+75.0	0.50
0+80.0	0.55

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 0.59)	(0+07.0, 0.17)	0.013
(0+07.0, 0.17)	(0+73.0, 0.13)	0.016
(0+73.0, 0.13)	(0+80.0, 0.55)	0.013

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Worksheet for Section A-Q10

Results

Normal Depth	0.67	ft
Elevation Range	0.00 to 0.84 ft	
Flow Area	14.70	ft ²
Wetted Perimeter	63.78	ft
Hydraulic Radius	0.23	ft
Top Width	62.48	ft
Normal Depth	0.67	ft
Critical Depth	0.63	ft
Critical Slope	0.00590	ft/ft
Velocity	2.24	ft/s
Velocity Head	0.08	ft
Specific Energy	0.75	ft
Froude Number	0.82	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.67	ft
Critical Depth	0.63	ft
Channel Slope	0.38	%
Critical Slope	0.00590	ft/ft

Worksheet for Section A-Q100

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.38 %
Discharge 182.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.0	0.59
0+05.0	0.54
0+05.5	0.54
0+05.5	0.04
0+07.0	0.17
0+07.0	0.21
0+40.0	0.84
0+73.0	0.17
0+73.0	0.13
0+74.5	0.00
0+74.5	0.50
0+75.0	0.50
0+80.0	0.55

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 0.59)	(0+07.0, 0.17)	0.013
(0+07.0, 0.17)	(0+73.0, 0.13)	0.016
(0+73.0, 0.13)	(0+80.0, 0.55)	0.013

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Worksheet for Section A-Q100

Results

Normal Depth	1.07	ft
Elevation Range	0.00 to 0.84	ft
Flow Area	45.51	ft ²
Wetted Perimeter	82.11	ft
Hydraulic Radius	0.55	ft
Top Width	80.00	ft
Normal Depth	1.07	ft
Critical Depth	1.05	ft
Critical Slope	0.00441	ft/ft
Velocity	4.00	ft/s
Velocity Head	0.25	ft
Specific Energy	1.32	ft
Froude Number	0.93	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.07	ft
Critical Depth	1.05	ft
Channel Slope	0.38	%
Critical Slope	0.00441	ft/ft

Cross Section for Section A-Q100

Project Description

Friction Method

Manning Formula

Solve For

Normal Depth

Input Data

Channel Slope

0.38 %

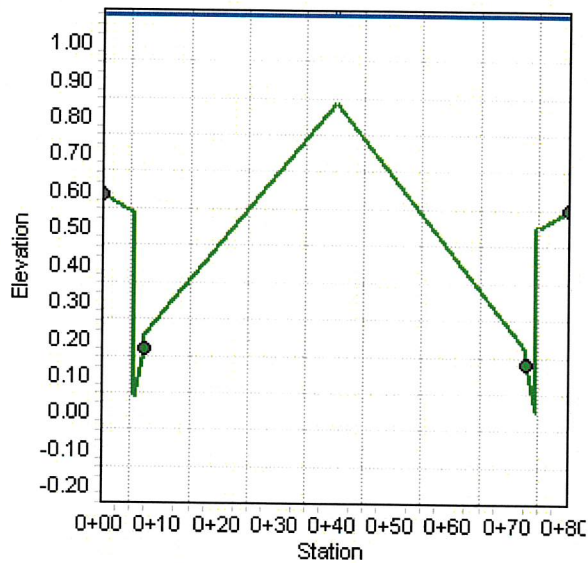
Normal Depth

1.07 ft

Discharge

182.00 ft³/s

Cross Section Image



Worksheet for Section B-North-Q10

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.25 %
Discharge 1.50 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+40.0	0.76
0+73.0	0.17
0+73.0	0.13
0+74.5	0.00
0+74.5	0.50
0+75.0	0.50
0+80.0	0.55

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+40.0, 0.76)	(0+73.0, 0.17)	0.016
(0+73.0, 0.17)	(0+80.0, 0.55)	0.013

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.35 ft
Elevation Range 0.00 to 0.76 ft
Flow Area 1.35 ft²
Wetted Perimeter 12.06 ft
Hydraulic Radius 0.11 ft

Worksheet for Section B-North-Q10

Results

Top Width	11.66	ft
Normal Depth	0.35	ft
Critical Depth	0.30	ft
Critical Slope	0.00813	ft/ft
Velocity	1.11	ft/s
Velocity Head	0.02	ft
Specific Energy	0.37	ft
Froude Number	0.57	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.35	ft
Critical Depth	0.30	ft
Channel Slope	0.25	%
Critical Slope	0.00813	ft/ft

Cross Section for Section B-North-Q10

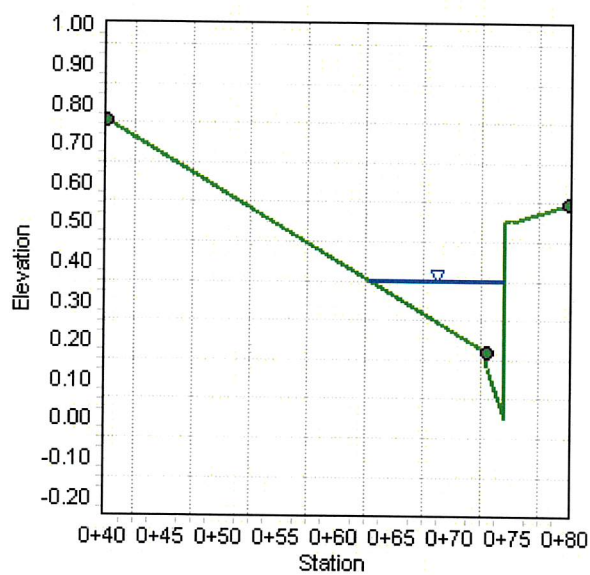
Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope	0.25 %
Normal Depth	0.35 ft
Discharge	1.50 ft ³ /s

Cross Section Image



Worksheet for Section B-North-Q100

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.25 %
Discharge 25.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+40.0	0.76
0+73.0	0.17
0+73.0	0.13
0+74.5	0.00
0+74.5	0.50
0+75.0	0.50
0+80.0	0.55

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+40.0, 0.76)	(0+73.0, 0.17)	0.016
(0+73.0, 0.17)	(0+80.0, 0.55)	0.013

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.75 ft
Elevation Range 0.00 to 0.76 ft
Flow Area 11.81 ft²
Wetted Perimeter 40.37 ft
Hydraulic Radius 0.29 ft

Worksheet for Section B-North-Q100

Results

Top Width	39.62	ft
Normal Depth	0.75	ft
Critical Depth	0.67	ft
Critical Slope	0.00567	ft/ft
Velocity	2.12	ft/s
Velocity Head	0.07	ft
Specific Energy	0.82	ft
Froude Number	0.68	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.75	ft
Critical Depth	0.67	ft
Channel Slope	0.25	%
Critical Slope	0.00567	ft/ft

Project Description

Manning Formula

Normal Depth

Channel Slope

0.48 %

1.50 ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	0.60
0+05.0	0.55
0+05.5	0.55
0+05.5	0.05
0+07.0	0.18
0+07.0	0.22
0+40.0	0.76

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 0.60)	(0+07.0, 0.18)	0.013
(0+07.0, 0.18)	(0+40.0, 0.76)	0.016

Options

Pavlovskii's Method

Pavlovskii's Method

Pavlovskii's Method

Results

0.32 ft

0.05 to 0.76 ft

1.07 ft²

11.03 ft

0.10 ft

Worksheet for Section B-South-Q10

Results

Top Width	10.67	ft
Normal Depth	0.32	ft
Critical Depth	0.30	ft
Critical Slope	0.00818	ft/ft
Velocity	1.40	ft/s
Velocity Head	0.03	ft
Specific Energy	0.35	ft
Froude Number	0.78	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.32	ft
Critical Depth	0.30	ft
Channel Slope	0.48	%
Critical Slope	0.00818	ft/ft

Cross Section for Section B-South-Q10

Project Description

Friction Method

Manning Formula

Solve For

Normal Depth

Input Data

Channel Slope

0.48 %

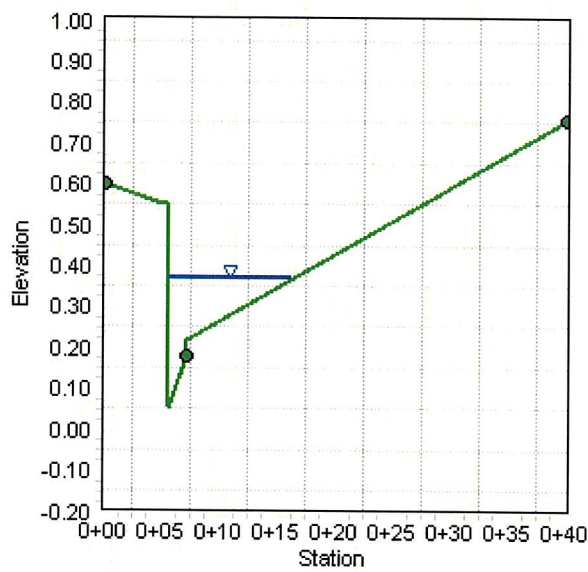
Normal Depth

0.32 ft

Discharge

1.50 ft³/s

Cross Section Image



Project Description

Manning Formula

Normal Depth

0.48 %

26.00 ft³/s

Elevation (ft)

0+00.0	0.60
0+05.0	0.55
0+05.5	0.55
0+05.5	0.05
0+07.0	0.18
0+07.0	0.22
0+40.0	0.76

Roughness Coefficient

(0+00.0, 0.60)	(0+07.0, 0.18)	0.013
(0+07.0, 0.18)	(0+40.0, 0.76)	0.016

Pavlovskii's Method

Pavlovskii's Method

Pavlovskii's Method

0.68 ft

0.05 to 0.76 ft

9.79 ft²

38.93 ft

0.25 ft

Worksheet for Section B-South-100

Results

Top Width	38.25	ft
Normal Depth	0.68	ft
Critical Depth	0.67	ft
Critical Slope	0.00568	ft/ft
Velocity	2.66	ft/s
Velocity Head	0.11	ft
Specific Energy	0.79	ft
Froude Number	0.93	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.68	ft
Critical Depth	0.67	ft
Channel Slope	0.48	%
Critical Slope	0.00568	ft/ft

Cross Section for Section B-South-Q100

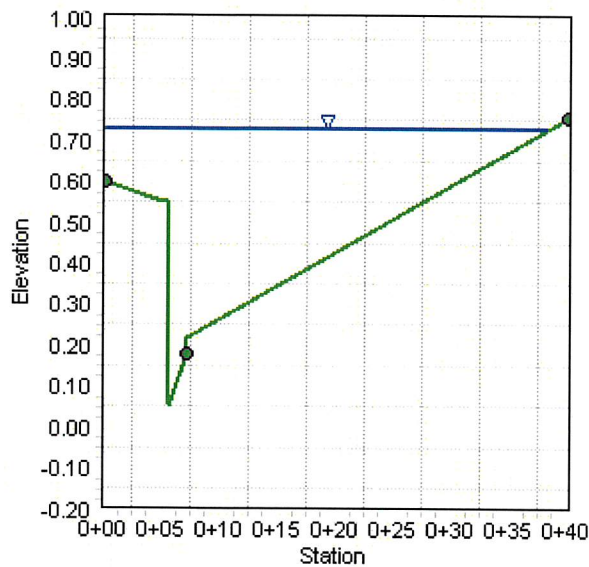
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.48 %
Normal Depth	0.68 ft
Discharge	26.00 ft ³ /s

Cross Section Image



Worksheet for Section C-North-Q10

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.30 %
Discharge 0.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+59.0	0.94
0+92.0	0.24
0+92.0	0.20
0+93.5	0.07
0+93.5	0.57
0+94.0	0.57
0+99.0	0.62
1+12.0	1.39

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+59.0, 0.94)	(0+92.0, 0.20)	0.016
(0+92.0, 0.20)	(1+12.0, 1.39)	0.013

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.02 ft
Elevation Range 0.07 to 1.39 ft
Flow Area 0.00 ft²
Wetted Perimeter 0.30 ft

Worksheet for Section C-North-Q10

Results

Hydraulic Radius	0.01	ft
Top Width	0.28	ft
Normal Depth	0.02	ft
Critical Depth	0.02	ft
Critical Slope	0.01335	ft/ft
Velocity	0.30	ft/s
Velocity Head	0.00	ft
Specific Energy	0.03	ft
Froude Number	0.48	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.02	ft
Critical Depth	0.02	ft
Channel Slope	0.30	%
Critical Slope	0.01335	ft/ft

Cross Section for Section C-North-Q10

Project Description

Friction Method

Manning Formula

Solve For

Normal Depth

Input Data

Channel Slope

0.30 %

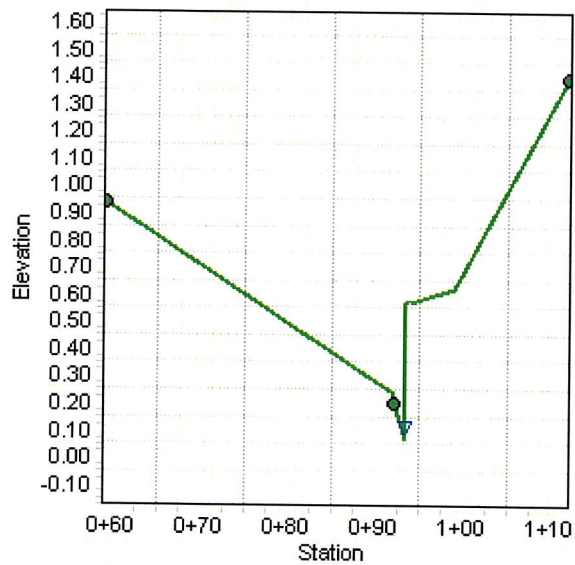
Normal Depth

0.02 ft

Discharge

0.00 ft³/s

Cross Section Image



Worksheet for Section C-North-Q100

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.30 %
Discharge 0.50 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+59.0	0.94
0+92.0	0.24
0+92.0	0.20
0+93.5	0.07
0+93.5	0.57
0+94.0	0.57
0+99.0	0.62
1+12.0	1.39

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+59.0, 0.94)	(0+92.0, 0.20)	0.016
(0+92.0, 0.20)	(1+12.0, 1.39)	0.013

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.26 ft
Elevation Range 0.07 to 1.39 ft
Flow Area 0.50 ft²
Wetted Perimeter 6.18 ft

Worksheet for Section C-North-Q100

Results

Hydraulic Radius	0.08	ft
Top Width	5.87	ft
Normal Depth	0.26	ft
Critical Depth	0.23	ft
Critical Slope	0.00864	ft/ft
Velocity	1.00	ft/s
Velocity Head	0.02	ft
Specific Energy	0.28	ft
Froude Number	0.61	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.26	ft
Critical Depth	0.23	ft
Channel Slope	0.30	%
Critical Slope	0.00864	ft/ft

Cross Section for Section C-North-Q100

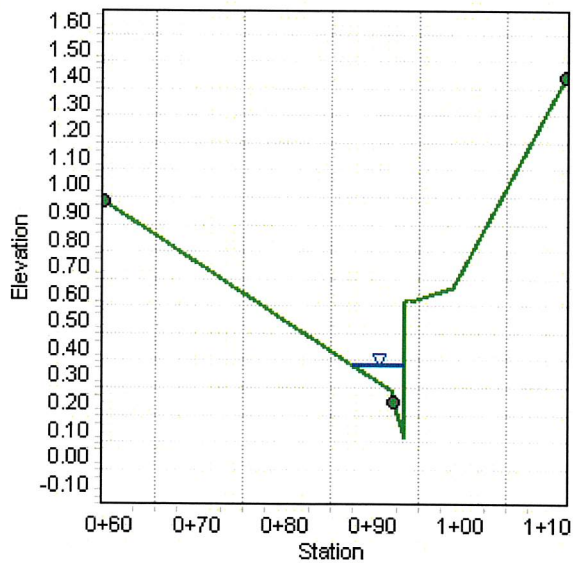
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.30 %
Normal Depth	0.26 ft
Discharge	0.50 ft ³ /s

Cross Section Image



Worksheet for Section C-South-Q10

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.30 %
Discharge 0.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.0	0.90
0+12.0	0.55
0+17.0	0.50
0+17.5	0.50
0+17.5	0.00
0+19.0	0.13
0+19.0	0.17
0+59.0	0.94

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 0.90)	(0+19.0, 0.13)	0.013
(0+19.0, 0.13)	(0+59.0, 0.94)	0.016

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.02 ft
Elevation Range 0.00 to 0.94 ft
Flow Area 0.00 ft²
Wetted Perimeter 0.30 ft

Worksheet for Section C-South-Q10

Results

Hydraulic Radius	0.01	ft
Top Width	0.27	ft
Normal Depth	0.02	ft
Critical Depth	0.02	ft
Critical Slope	0.01332	ft/ft
Velocity	0.31	ft/s
Velocity Head	0.00	ft
Specific Energy	0.03	ft
Froude Number	0.51	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.02	ft
Critical Depth	0.02	ft
Channel Slope	0.30	%
Critical Slope	0.01332	ft/ft

Cross Section for Section C-South-Q10

Project Description

Friction Method

Manning Formula

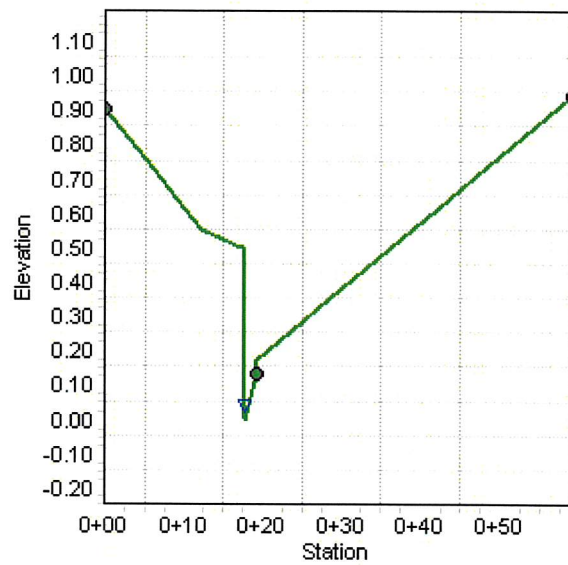
Solve For

Normal Depth

Input Data

Channel Slope	0.30 %
Normal Depth	0.02 ft
Discharge	0.00 ft ³ /s

Cross Section Image



Worksheet for Section C-South-Q100

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.30 %
Discharge 8.50 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.0	0.90
0+12.0	0.55
0+17.0	0.50
0+17.5	0.50
0+17.5	0.00
0+19.0	0.13
0+19.0	0.17
0+59.0	0.94

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 0.90)	(0+19.0, 0.13)	0.013
(0+19.0, 0.13)	(0+59.0, 0.94)	0.016

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.57 ft
Elevation Range 0.00 to 0.94 ft
Flow Area 5.05 ft²
Wetted Perimeter 28.62 ft

Worksheet for Section C-South-Q100

Results

Hydraulic Radius	0.18	ft
Top Width	28.07	ft
Normal Depth	0.57	ft
Critical Depth	0.50	ft
Critical Slope	0.00619	ft/ft
Velocity	1.68	ft/s
Velocity Head	0.04	ft
Specific Energy	0.61	ft
Froude Number	0.70	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.57	ft
Critical Depth	0.50	ft
Channel Slope	0.30	%
Critical Slope	0.00619	ft/ft

Project Description

Manning Formula

Normal Depth

0.30 %

0.57 ft

8.50 ft³/s

Worksheet for Section D-East-Q10

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.70 %
Discharge 0.50 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+50.0	1.41
0+73.0	1.19
1+00.0	0.00
1+00.0	1.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+50.0, 1.41)	(0+73.0, 1.19)	0.160
(0+73.0, 1.19)	(1+00.0, 0.00)	0.030
(1+00.0, 0.00)	(1+00.0, 1.00)	0.035

Options

Current Roughness 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 0.00 to 1.41 ft
Flow Area 0.55 ft²
Wetted Perimeter 5.20 ft
Hydraulic Radius 0.10 ft
Top Width 4.98 ft
Normal Depth 0.22 ft

Worksheet for Section D-East-Q10

Results

Critical Depth	0.16	ft
Critical Slope	0.03247	ft/ft
Velocity	0.92	ft/s
Velocity Head	0.01	ft
Specific Energy	0.23	ft
Froude Number	0.49	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.22	ft
Critical Depth	0.16	ft
Channel Slope	0.70	%
Critical Slope	0.03247	ft/ft

Cross Section for Section D-East-Q10

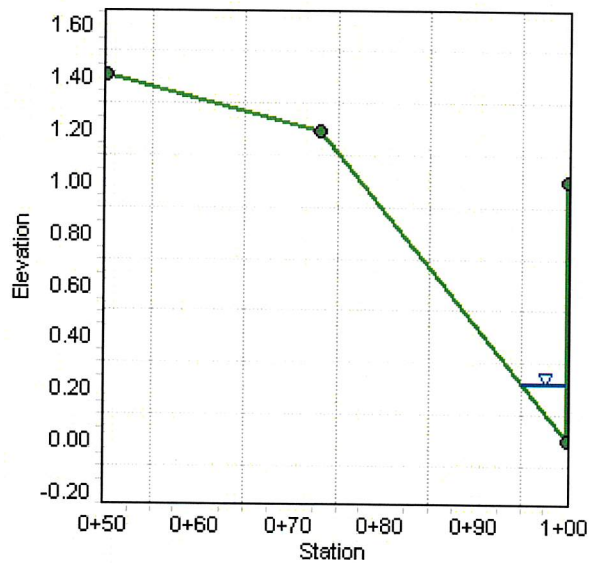
Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope	0.70 %
Normal Depth	0.22 ft
Discharge	0.50 ft ³ /s

Cross Section Image



Project Description

Manning Formula

Normal Depth

0.70 %

2.50 ft³/s

Section Definitions

Elevation (ft)

1.41

1.19

0.00

1.00

Roughness Segment Definitions

Roughness Coefficient

0.160

0.030

0.035

Pavlovskii's Method

Pavlovskii's Method

Pavlovskii's Method

0.40 ft

0.00 to 1.41 ft

1.83 ft²

9.51 ft

0.19 ft

9.10 ft

0.40 ft

Worksheet for Section D-East-Q100

Results

Critical Depth	0.31	ft
Critical Slope	0.02619	ft/ft
Velocity	1.37	ft/s
Velocity Head	0.03	ft
Specific Energy	0.43	ft
Froude Number	0.54	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.40	ft
Critical Depth	0.31	ft
Channel Slope	0.70	%
Critical Slope	0.02619	ft/ft

Cross Section for Section D-East-Q100

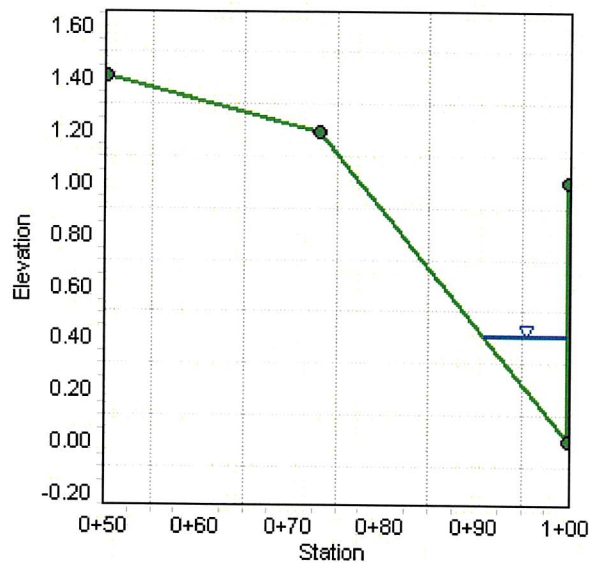
Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope	0.70	%
Normal Depth	0.40	ft
Discharge	2.50	ft ³ /s

Cross Section Image



Worksheet for Section D-West-Q10

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.46 %
Discharge 0.50 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.0	1.17
0+05.0	1.12
0+05.5	1.12
0+05.5	0.62
0+07.0	0.75
0+07.0	0.79
0+50.0	1.41

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 1.17)	(0+07.0, 0.75)	0.013
(0+07.0, 0.75)	(0+50.0, 1.41)	0.016

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.24 ft
Elevation Range 0.62 to 1.41 ft
Flow Area 0.46 ft²
Wetted Perimeter 6.97 ft
Hydraulic Radius 0.07 ft

Worksheet for Section D-West-Q10

Results

Top Width	6.68	ft
Normal Depth	0.24	ft
Critical Depth	0.23	ft
Critical Slope	0.00907	ft/ft
Velocity	1.08	ft/s
Velocity Head	0.02	ft
Specific Energy	0.26	ft
Froude Number	0.72	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.24	ft
Critical Depth	0.23	ft
Channel Slope	0.46	%
Critical Slope	0.00907	ft/ft

Cross Section for Section D-West-Q10

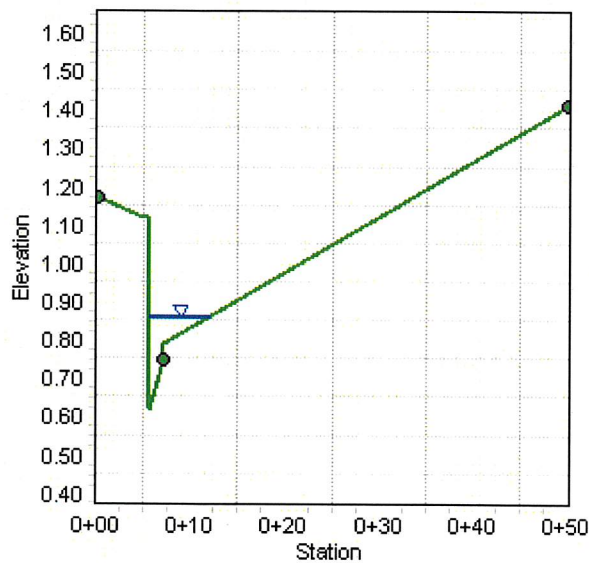
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.46 %
Normal Depth	0.24 ft
Discharge	0.50 ft ³ /s

Cross Section Image



Project Description

Input Data

Section Definitions

Roughness Segment Definitions

Options

Results

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27 Siemens Company Drive Suite 200 W Watertown, CT 06795 USA +1-203-755-1666 Page 1 of 2

Worksheet for Section D-West-Q100

Results

Top Width	14.58	ft
Normal Depth	0.36	ft
Critical Depth	0.34	ft
Critical Slope	0.00788	ft/ft
Velocity	1.49	ft/s
Velocity Head	0.03	ft
Specific Energy	0.39	ft
Froude Number	0.78	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.36	ft
Critical Depth	0.34	ft
Channel Slope	0.46	%
Critical Slope	0.00788	ft/ft

Cross Section for Section D-West-Q100

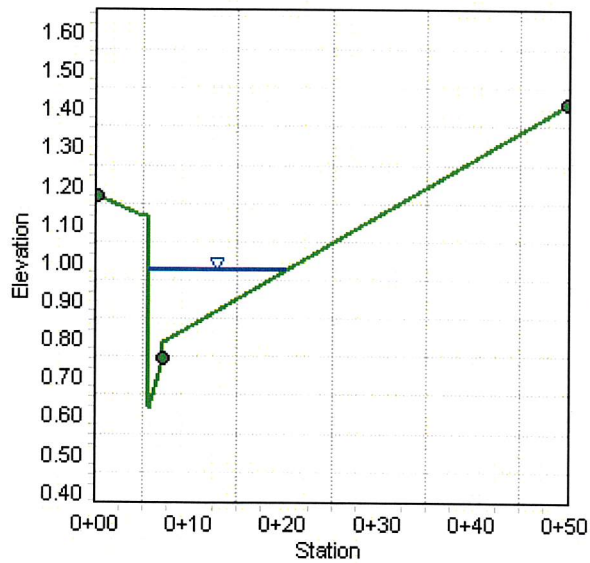
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.46 %
Normal Depth	0.36 ft
Discharge	2.50 ft ³ /s

Cross Section Image



Worksheet for Section E - East-Q10

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.35 %
Discharge 0.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+50.0	1.10
0+93.0	0.17
0+93.0	0.13
0+94.5	0.00
0+94.5	0.50
0+95.0	0.50
1+00.0	0.55
1+10.0	1.55

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+50.0, 1.10)	(0+93.0, 0.13)	0.016
(0+93.0, 0.13)	(1+00.0, 0.55)	0.013
(1+00.0, 0.55)	(1+10.0, 1.55)	0.030

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.02 ft
Elevation Range 0.00 to 1.55 ft
Flow Area 0.00 ft²

Worksheet for Section E - East-Q10

Results

Wetted Perimeter	0.29	ft
Hydraulic Radius	0.01	ft
Top Width	0.27	ft
Normal Depth	0.02	ft
Critical Depth	0.02	ft
Critical Slope	0.01329	ft/ft
Velocity	0.33	ft/s
Velocity Head	0.00	ft
Specific Energy	0.02	ft
Froude Number	0.54	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.02	ft
Critical Depth	0.02	ft
Channel Slope	0.35	%
Critical Slope	0.01329	ft/ft

Cross Section for Section E - East-Q10

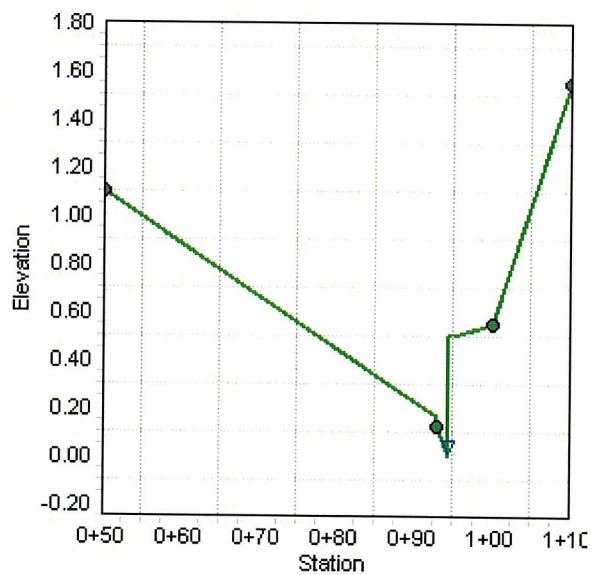
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.35 %
Normal Depth	0.02 ft
Discharge	0.00 ft ³ /s

Cross Section Image



Worksheet for Section E - East-100

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.35 %
Discharge 0.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+50.0	1.10
0+93.0	0.17
0+93.0	0.13
0+94.5	0.00
0+94.5	0.50
0+95.0	0.50
1+00.0	0.55
1+10.0	1.55

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+50.0, 1.10)	(0+93.0, 0.13)	0.016
(0+93.0, 0.13)	(1+00.0, 0.55)	0.013
(1+00.0, 0.55)	(1+10.0, 1.55)	0.030

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.02 ft
Elevation Range 0.00 to 1.55 ft
Flow Area 0.00 ft²

Worksheet for Section E - East-100

Results

Wetted Perimeter	0.29	ft
Hydraulic Radius	0.01	ft
Top Width	0.27	ft
Normal Depth	0.02	ft
Critical Depth	0.02	ft
Critical Slope	0.01329	ft/ft
Velocity	0.33	ft/s
Velocity Head	0.00	ft
Specific Energy	0.02	ft
Froude Number	0.54	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.02	ft
Critical Depth	0.02	ft
Channel Slope	0.35	%
Critical Slope	0.01329	ft/ft

Cross Section for Section E - East-Q100

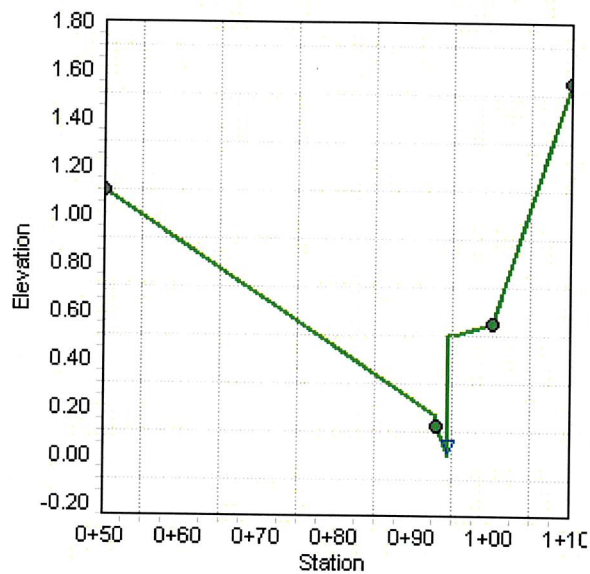
Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope	0.35	%
Normal Depth	0.02	ft
Discharge	0.00	ft ³ /s

Cross Section Image



Project Description

Input Data

Section Definitions

Roughness Segment Definitions

Options

Results

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Worksheet for Section E-West-Q10

Results

Top Width	0.27	ft
Normal Depth	0.02	ft
Critical Depth	0.02	ft
Critical Slope	0.01325	ft/ft
Velocity	0.32	ft/s
Velocity Head	0.00	ft
Specific Energy	0.02	ft
Froude Number	0.53	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.02	ft
Critical Depth	0.02	ft
Channel Slope	0.35	%
Critical Slope	0.01325	ft/ft

Cross Section for Section E-West-Q10

Project Description

Friction Method

Manning Formula

Solve For

Normal Depth

Input Data

Channel Slope

0.35 %

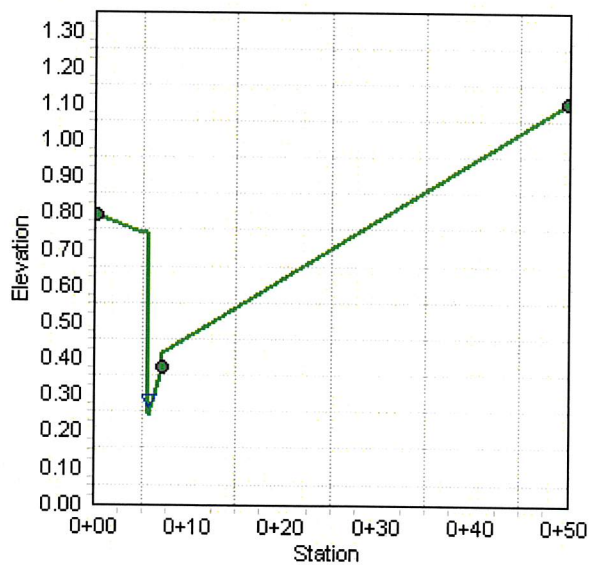
Normal Depth

0.02 ft

Discharge

0.00 ft³/s

Cross Section Image



Worksheet for Section E-West-Q100

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.35 %
Discharge 8.50 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.0	0.79
0+05.0	0.74
0+05.5	0.74
0+05.5	0.24
0+07.0	0.37
0+07.0	0.41
0+50.0	1.10

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 0.79)	(0+07.0, 0.37)	0.013
(0+07.0, 0.37)	(0+50.0, 1.10)	0.016

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.53 ft
Elevation Range 0.24 to 1.10 ft
Flow Area 4.84 ft²
Wetted Perimeter 28.24 ft
Hydraulic Radius 0.17 ft

Worksheet for Section E-West-Q100

Results

Top Width	27.69	ft
Normal Depth	0.53	ft
Critical Depth	0.48	ft
Critical Slope	0.00645	ft/ft
Velocity	1.76	ft/s
Velocity Head	0.05	ft
Specific Energy	0.58	ft
Froude Number	0.74	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.53	ft
Critical Depth	0.48	ft
Channel Slope	0.35	%
Critical Slope	0.00645	ft/ft

Cross Section for Section E-West-Q100

Project Description

Friction Method

Manning Formula

Solve For

Normal Depth

Input Data

Channel Slope

0.35 %

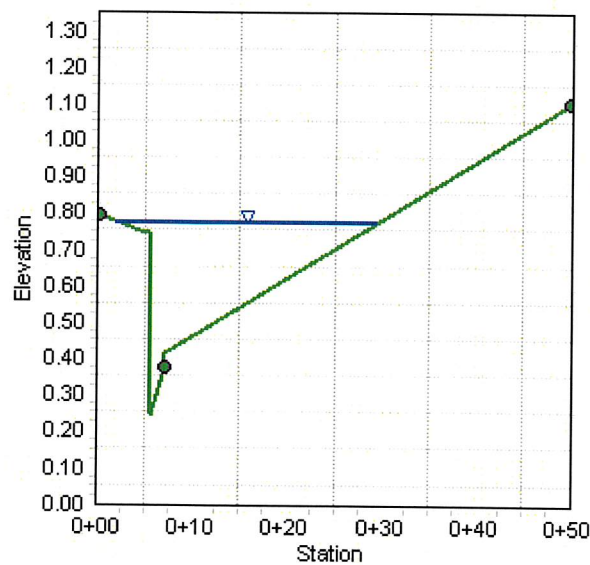
Normal Depth

0.53 ft

Discharge

8.50 ft³/s

Cross Section Image



Worksheet for Section F-East-Q10

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.30 %
Discharge 2.50 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+50.0	1.02
0+93.0	0.25
0+93.0	0.21
0+94.5	0.08
0+94.5	0.58
0+95.0	0.58
1+00.0	0.63
1+10.0	1.63

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+50.0, 1.02)	(0+93.0, 0.21)	0.016
(0+93.0, 0.21)	(1+00.0, 0.63)	0.013
(1+00.0, 0.63)	(1+10.0, 1.63)	0.030

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.39 ft
Elevation Range 0.08 to 1.63 ft
Flow Area 1.87 ft²

Worksheet for Section F-East-Q10

Results

Wetted Perimeter	14.33	ft
Hydraulic Radius	0.13	ft
Top Width	13.89	ft
Normal Depth	0.39	ft
Critical Depth	0.35	ft
Critical Slope	0.00768	ft/ft
Velocity	1.34	ft/s
Velocity Head	0.03	ft
Specific Energy	0.42	ft
Froude Number	0.64	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.39	ft
Critical Depth	0.35	ft
Channel Slope	0.30	%
Critical Slope	0.00768	ft/ft

Cross Section for Section F-East-Q10

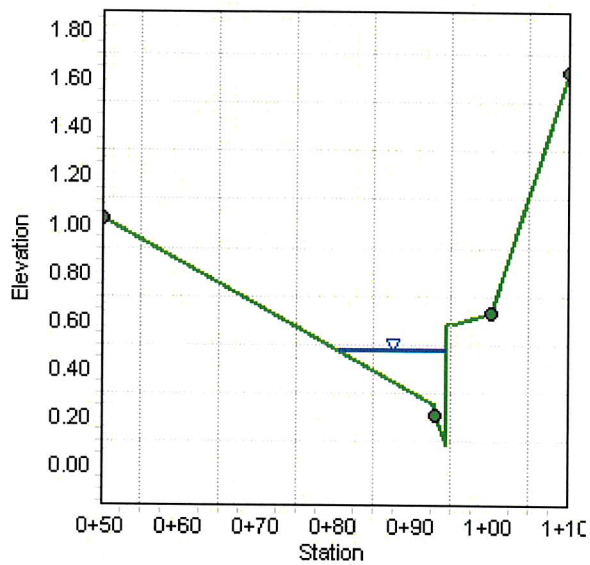
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.30 %
Normal Depth	0.39 ft
Discharge	2.50 ft ³ /s

Cross Section Image



Worksheet for Section F-East-Q100

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.30 %
Discharge 4.50 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+50.0	1.02
0+93.0	0.25
0+93.0	0.21
0+94.5	0.08
0+94.5	0.58
0+95.0	0.58
1+00.0	0.63
1+10.0	1.63

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+50.0, 1.02)	(0+93.0, 0.21)	0.016
(0+93.0, 0.21)	(1+00.0, 0.63)	0.013
(1+00.0, 0.63)	(1+10.0, 1.63)	0.030

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.46 ft
Elevation Range 0.08 to 1.63 ft
Flow Area 2.93 ft²

Worksheet for Section F-East-Q100

Results

Wetted Perimeter	18.17	ft
Hydraulic Radius	0.16	ft
Top Width	17.66	ft
Normal Depth	0.46	ft
Critical Depth	0.41	ft
Critical Slope	0.00717	ft/ft
Velocity	1.54	ft/s
Velocity Head	0.04	ft
Specific Energy	0.50	ft
Froude Number	0.66	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.46	ft
Critical Depth	0.41	ft
Channel Slope	0.30	%
Critical Slope	0.00717	ft/ft

Cross Section for Section F-East-Q100

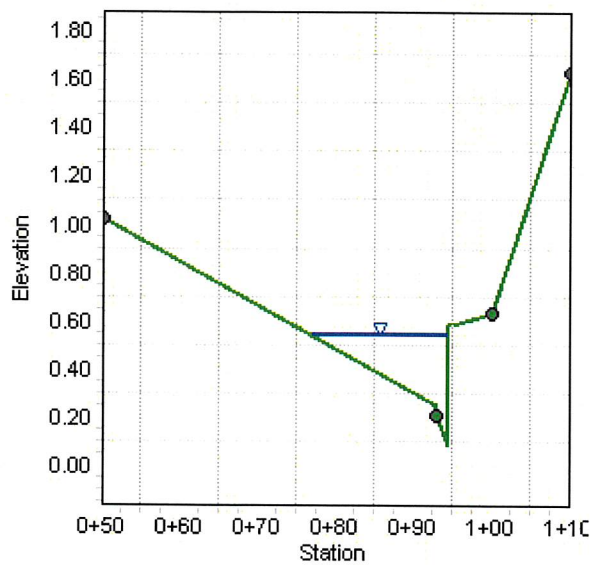
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.30 %
Normal Depth	0.46 ft
Discharge	4.50 ft ³ /s

Cross Section Image



Worksheet for Section F-West-Q10

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.45 %
Discharge 4.50 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.0	0.55
0+05.0	0.50
0+05.5	0.50
0+05.5	0.00
0+07.0	0.13
0+07.0	0.17
0+50.0	1.02

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 0.55)	(0+07.0, 0.13)	0.013
(0+07.0, 0.13)	(0+50.0, 1.02)	0.016

Options

Current Roughness vweighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.44 ft
Elevation Range 0.00 to 1.02 ft
Flow Area 2.45 ft²
Wetted Perimeter 15.80 ft
Hydraulic Radius 0.16 ft

Worksheet for Section F-West-Q10

Results

Top Width	15.31	ft
Normal Depth	0.44	ft
Critical Depth	0.42	ft
Critical Slope	0.00706	ft/ft
Velocity	1.84	ft/s
Velocity Head	0.05	ft
Specific Energy	0.50	ft
Froude Number	0.81	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.44	ft
Critical Depth	0.42	ft
Channel Slope	0.45	%
Critical Slope	0.00706	ft/ft

Cross Section for Section F-West-Q10

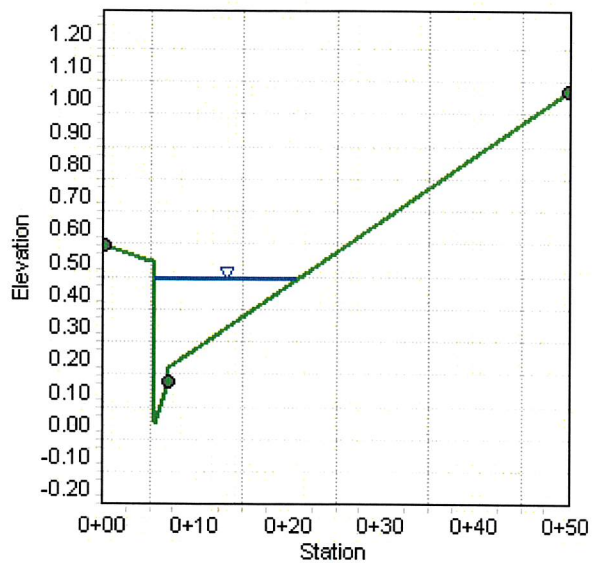
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.45 %
Normal Depth	0.44 ft
Discharge	4.50 ft ³ /s

Cross Section Image



Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.45	%
Discharge	8.50	ft ³ /s
Section Definitions		

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	0.55
0+05.0	0.50
0+05.5	0.50
0+05.5	0.00
0+07.0	0.13
0+07.0	0.17
0+50.0	1.02

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 0.55)	(0+07.0, 0.13)	0.013
(0+07.0, 0.13)	(0+50.0, 1.02)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth		0.54	ft
Elevation Range	0.00 to 1.02 ft		
Flow Area		4.26	ft²
Wetted Perimeter		25.16	ft
Hydraulic Radius		0.17	ft

Worksheet for Section F-West-Q100

Results

Top Width	24.61	ft
Normal Depth	0.54	ft
Critical Depth	0.51	ft
Critical Slope	0.00626	ft/ft
Velocity	2.00	ft/s
Velocity Head	0.06	ft
Specific Energy	0.60	ft
Froude Number	0.85	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.54	ft
Critical Depth	0.51	ft
Channel Slope	0.45	%
Critical Slope	0.00626	ft/ft

Cross Section for Section F-West-Q100

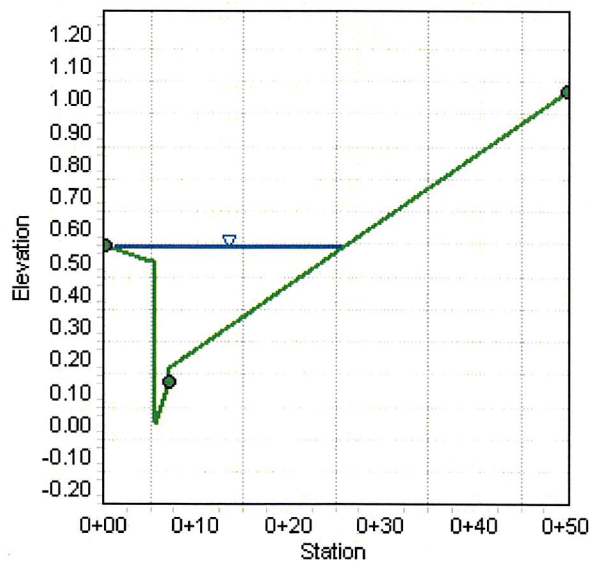
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.45 %
Normal Depth	0.54 ft
Discharge	8.50 ft ³ /s

Cross Section Image



Project Description

Manning Formula

Normal Depth

0.40 %

1.00 ft³/s

Elevation (ft)

0+50.0	1.16
0+93.0	0.20
0+93.0	0.16
0+94.5	0.03
0+94.5	0.53
0+95.0	0.53
1+00.0	0.58
1+10.0	1.58

Roughness Coefficient

(0+50.0, 1.16)	(0+93.0, 0.16)	0.016
(0+93.0, 0.16)	(1+00.0, 0.58)	0.013
(1+00.0, 0.58)	(1+10.0, 1.58)	0.030

Pavlovskii's Method

Pavlovskii's Method

Pavlovskii's Method

0.31 ft

0.03 to 1.58 ft

0.77 ft²

Worksheet for Section G-East-Q10

Results

Wetted Perimeter	7.92	ft
Hydraulic Radius	0.10	ft
Top Width	7.57	ft
Normal Depth	0.31	ft
Critical Depth	0.28	ft
Critical Slope	0.00816	ft/ft
Velocity	1.30	ft/s
Velocity Head	0.03	ft
Specific Energy	0.33	ft
Froude Number	0.71	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.31	ft
Critical Depth	0.28	ft
Channel Slope	0.40	%
Critical Slope	0.00816	ft/ft

Cross Section for Section G-East-Q10

Project Description

Friction Method

Manning Formula

Solve For

Normal Depth

Input Data

Channel Slope

0.40 %

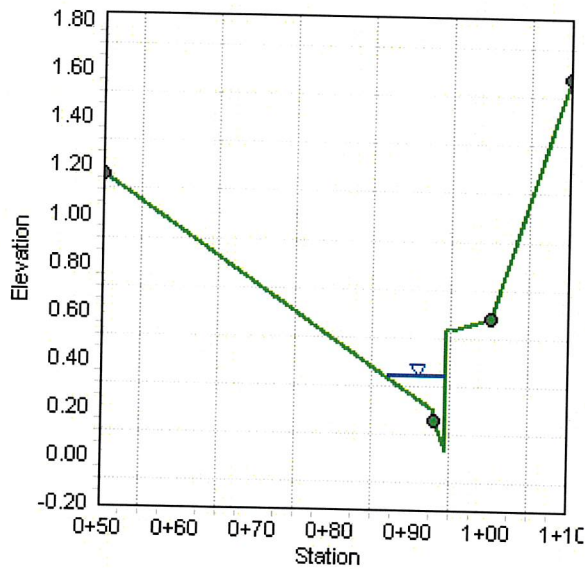
Normal Depth

0.31 ft

Discharge

1.00 ft³/s

Cross Section Image



Worksheet for Section G-East-Q100

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.40 %
Discharge 2.50 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+50.0	1.16
0+93.0	0.20
0+93.0	0.16
0+94.5	0.03
0+94.5	0.53
0+95.0	0.53
1+00.0	0.58
1+10.0	1.58

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+50.0, 1.16)	(0+93.0, 0.16)	0.016
(0+93.0, 0.16)	(1+00.0, 0.58)	0.013
(1+00.0, 0.58)	(1+10.0, 1.58)	0.030

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.39 ft
Elevation Range 0.03 to 1.58 ft
Flow Area 1.58 ft²

Worksheet for Section G-East-Q100

Results

Wetted Perimeter	11.84	ft
Hydraulic Radius	0.13	ft
Top Width	11.40	ft
Normal Depth	0.39	ft
Critical Depth	0.36	ft
Critical Slope	0.00744	ft/ft
Velocity	1.58	ft/s
Velocity Head	0.04	ft
Specific Energy	0.43	ft
Froude Number	0.75	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.39	ft
Critical Depth	0.36	ft
Channel Slope	0.40	%
Critical Slope	0.00744	ft/ft

Cross Section for Section G-East-Q100

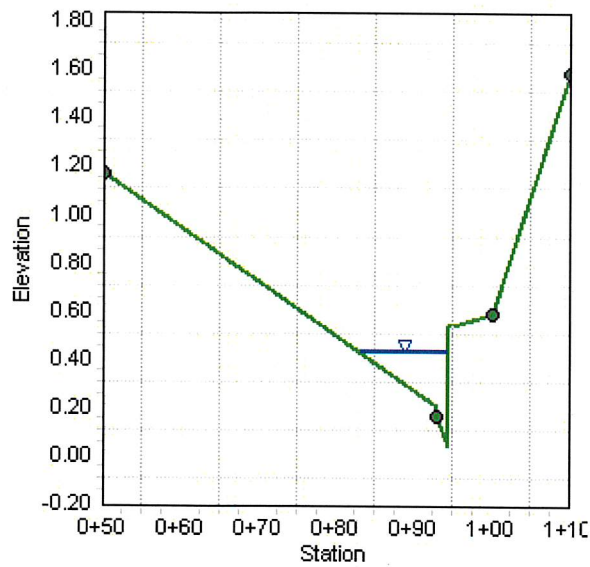
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.40 %
Normal Depth	0.39 ft
Discharge	2.50 ft ³ /s

Cross Section Image



Worksheet for Section G-West-Q10

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.35 %
Discharge 1.00 ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	0.55
0+05.0	0.50
0+05.5	0.50
0+05.5	0.00
0+07.0	0.13
0+07.0	0.17
0+50.0	1.16

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 0.55)	(0+07.0, 0.13)	0.013
(0+07.0, 0.13)	(0+50.0, 1.16)	0.016

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.31 ft
Elevation Range 0.00 to 1.16 ft
Flow Area 0.81 ft²
Wetted Perimeter 8.02 ft
Hydraulic Radius 0.10 ft

Worksheet for Section G-West-Q10

Results

Top Width	7.66	ft
Normal Depth	0.31	ft
Critical Depth	0.28	ft
Critical Slope	0.00814	ft/ft
Velocity	1.24	ft/s
Velocity Head	0.02	ft
Specific Energy	0.34	ft
Froude Number	0.67	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.31	ft
Critical Depth	0.28	ft
Channel Slope	0.35	%
Critical Slope	0.00814	ft/ft

Cross Section for Section G-West-Q10

Project Description

Friction Method

Manning Formula

Solve For

Normal Depth

Input Data

Channel Slope

0.35 %

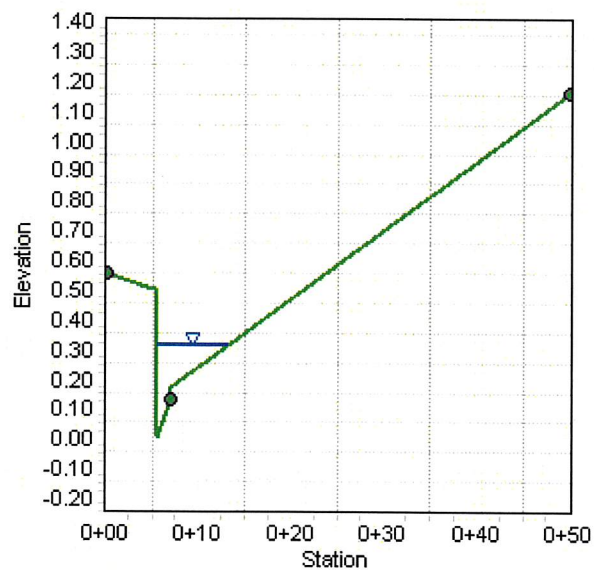
Normal Depth

0.31 ft

Discharge

1.00 ft³/s

Cross Section Image



Worksheet for Section G-West-Q100

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.35 %
Discharge 5.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.0	0.55
0+05.0	0.50
0+05.5	0.50
0+05.5	0.00
0+07.0	0.13
0+07.0	0.17
0+50.0	1.16

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 0.55)	(0+07.0, 0.13)	0.013
(0+07.0, 0.13)	(0+50.0, 1.16)	0.016

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.49 ft
Elevation Range 0.00 to 1.16 ft
Flow Area 2.82 ft²
Wetted Perimeter 15.81 ft
Hydraulic Radius 0.18 ft

Worksheet for Section G-West-Q100

Results

Top Width	15.27	ft
Normal Depth	0.49	ft
Critical Depth	0.44	ft
Critical Slope	0.00685	ft/ft
Velocity	1.78	ft/s
Velocity Head	0.05	ft
Specific Energy	0.54	ft
Froude Number	0.73	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.49	ft
Critical Depth	0.44	ft
Channel Slope	0.35	%
Critical Slope	0.00685	ft/ft

Project Description

Manning Formula

Normal Depth

0.35 %

0.49 ft

5.00 ft³/s

The graph illustrates a profile with Elevation on the Y-axis and Station on the X-axis. The Y-axis ranges from -0.20 to 1.40 in increments of 0.10. The X-axis ranges from 0+00 to 0+50 in increments of 10. A green line represents the profile, starting at (0+00, 0.55), dipping to (0+05, 0.15), and then rising to (0+50, 1.15). A blue horizontal line segment is drawn at Elevation 0.50 from Station 0+05 to 0+20, with a blue triangle symbol above it.

Station	Elevation
0+00	0.55
0+05	0.15
0+50	1.15

Worksheet for Section H-East-Q10

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.10 %
Discharge 0.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+52.0	0.99
0+78.0	0.95
0+93.0	1.21

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+52.0, 0.99)	(0+93.0, 1.21)	0.030

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth	0.00	ft
Elevation Range	0.95 to 1.21	ft
Flow Area	0.00	ft ²
Wetted Perimeter	2.55	ft
Hydraulic Radius	0.00	ft
Top Width	2.55	ft
Normal Depth	0.00	ft
Critical Depth	0.00	ft
Critical Slope	0.14885	ft/ft
Velocity	0.02	ft/s

Worksheet for Section H-East-Q10

Results

Velocity Head	0.00	ft
Specific Energy	0.00	ft
Froude Number	0.09	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.00	ft
Critical Depth	0.00	ft
Channel Slope	0.10	%
Critical Slope	0.14885	ft/ft

Cross Section for Section H-East-Q10

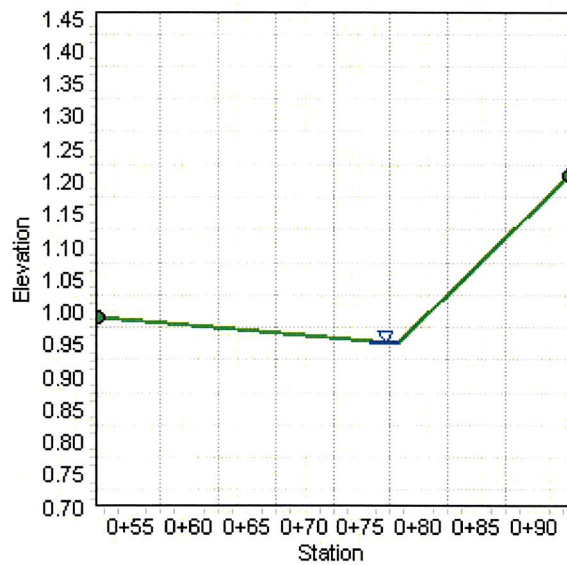
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.10	%
Normal Depth	0.00	ft
Discharge	0.00	ft ³ /s

Cross Section Image



Project Description

Manning Formula

Normal Depth

0.10 %

0.00 ft³/s

Station (ft)

Elevation (ft)

0+52.0

0.99

0+78.0

0.95

0+93.0

1.21

Start Station

Ending Station

Roughness Coefficient

(0+52.0, 0.99)

(0+93.0, 1.21)

0.030

Pavlovskii's Method

Pavlovskii's Method

Pavlovskii's Method

0.00 ft

0.95 to 1.21 ft

0.00 ft²

2.55 ft

0.00 ft

2.55 ft

0.00 ft

0.00 ft

0.14885 ft/ft

0.02 ft/s

Worksheet for Section H-East-Q100

Results

Velocity Head	0.00	ft
Specific Energy	0.00	ft
Froude Number	0.09	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.00	ft
Critical Depth	0.00	ft
Channel Slope	0.10	%
Critical Slope	0.14885	ft/ft

Cross Section for Section H-East-Q100

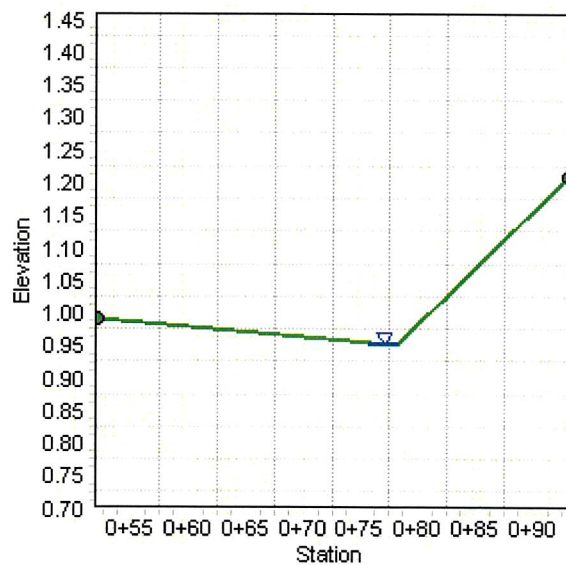
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.10	%
Normal Depth	0.00	ft
Discharge	0.00	ft ³ /s

Cross Section Image



Worksheet for Section H-West-Q10

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.50 %
Discharge 0.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.0	0.55
0+05.0	0.50
0+05.5	0.50
0+05.5	0.00
0+07.0	0.13
0+07.0	0.17
0+50.0	0.95
0+52.0	0.99

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 0.55)	(0+07.0, 0.13)	0.013
(0+07.0, 0.13)	(0+52.0, 0.99)	0.016

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.02 ft
Elevation Range 0.00 to 0.99 ft
Flow Area 0.00 ft²
Wetted Perimeter 0.27 ft

Worksheet for Section H-West-Q10

Results

Hydraulic Radius	0.01	ft
Top Width	0.25	ft
Normal Depth	0.02	ft
Critical Depth	0.02	ft
Critical Slope	0.01331	ft/ft
Velocity	0.37	ft/s
Velocity Head	0.00	ft
Specific Energy	0.02	ft
Froude Number	0.64	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.02	ft
Critical Depth	0.02	ft
Channel Slope	0.50	%
Critical Slope	0.01331	ft/ft

Cross Section for Section H-West-Q10

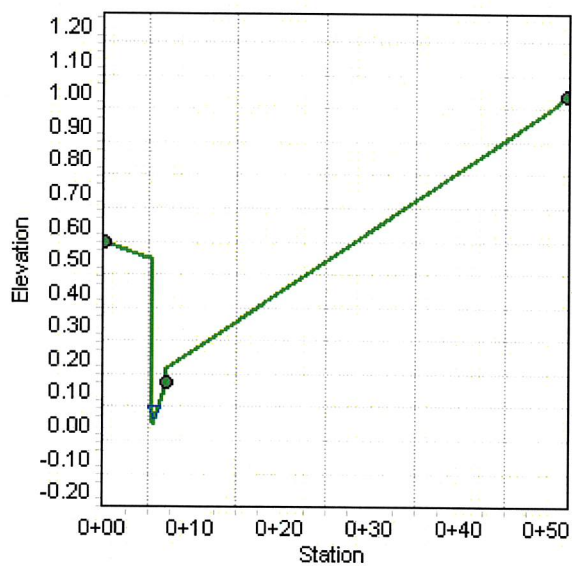
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.50 %
Normal Depth	0.02 ft
Discharge	0.00 ft ³ /s

Cross Section Image



Worksheet for Section H-West-Q100

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.50 %
Discharge 1.50 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.0	0.55
0+05.0	0.50
0+05.5	0.50
0+05.5	0.00
0+07.0	0.13
0+07.0	0.17
0+50.0	0.95
0+52.0	0.99

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 0.55)	(0+07.0, 0.13)	0.013
(0+07.0, 0.13)	(0+52.0, 0.99)	0.016

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.32 ft
Elevation Range 0.00 to 0.99 ft
Flow Area 1.03 ft²
Wetted Perimeter 10.28 ft

Worksheet for Section H-West-Q100

Results

Hydraulic Radius	0.10	ft
Top Width	9.91	ft
Normal Depth	0.32	ft
Critical Depth	0.30	ft
Critical Slope	0.00806	ft/ft
Velocity	1.46	ft/s
Velocity Head	0.03	ft
Specific Energy	0.36	ft
Froude Number	0.80	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.32	ft
Critical Depth	0.30	ft
Channel Slope	0.50	%
Critical Slope	0.00806	ft/ft

Worksheet for Section J-Q10

Results

Top Width	0.00	ft
Normal Depth	0.00	ft
Critical Depth	0.00	ft
Critical Slope	0.05212	ft/ft
Velocity	0.00	ft/s
Velocity Head	0.00	ft
Specific Energy	0.00	ft
Froude Number	0.00	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.00	ft
Critical Depth	0.00	ft
Channel Slope	0.50	%
Critical Slope	0.05212	ft/ft

Cross Section for Section J-Q10

Project Description

Friction Method

Manning Formula

Solve For

Normal Depth

Input Data

Channel Slope

0.50 %

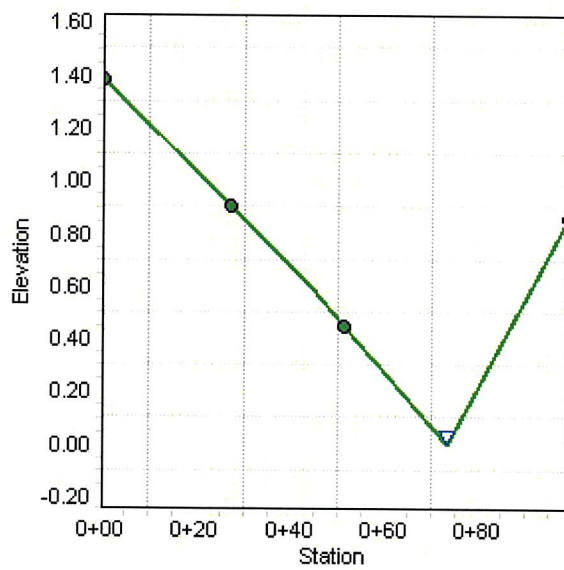
Normal Depth

0.00 ft

Discharge

0.00 ft³/s

Cross Section Image



Project Description

Manning Formula

Normal Depth

0.50 %

1.50 ft³/s

Station (ft)

Elevation (ft)

0+00.0	1.38
0+27.0	0.90
0+44.0	0.60
0+51.0	0.45
0+73.0	0.00
0+99.0	0.86

Start Station

Ending Station

Roughness Coefficient

(0+00.0, 1.38)	(0+27.0, 0.90)	0.030
(0+27.0, 0.90)	(0+51.0, 0.45)	0.016
(0+51.0, 0.45)	(0+99.0, 0.86)	0.030

Pavlovskii's Method

Pavlovskii's Method

Pavlovskii's Method

0.22 ft

0.00 to 1.38 ft

1.88 ft²

17.25 ft

0.11 ft

Worksheet for Section J-Q100

Results

Top Width	17.24	ft
Normal Depth	0.22	ft
Critical Depth	0.15	ft
Critical Slope	0.03079	ft/ft
Velocity	0.80	ft/s
Velocity Head	0.01	ft
Specific Energy	0.23	ft
Froude Number	0.43	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.22	ft
Critical Depth	0.15	ft
Channel Slope	0.50	%
Critical Slope	0.03079	ft/ft

Cross Section for Section J-Q100

Project Description

Friction Method

Manning Formula

Solve For

Normal Depth

Input Data

Channel Slope

0.50 %

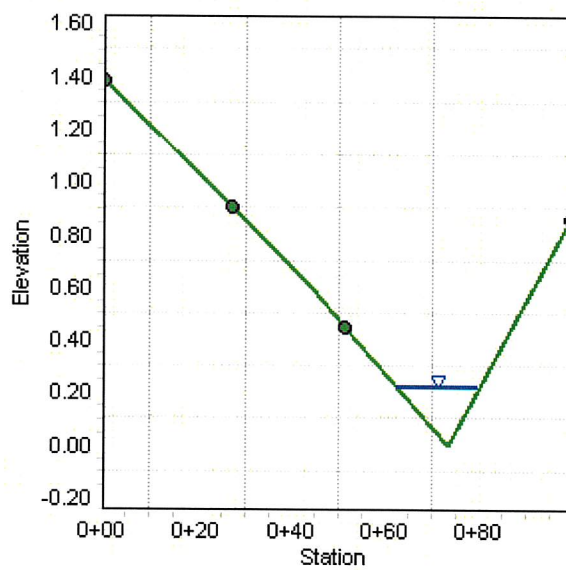
Normal Depth

0.22 ft

Discharge

1.50 ft³/s

Cross Section Image



Project Description

Input Data

Station (ft)	Elevation (ft)
0+58.0	1.67
0+90.0	0.00
0+99.0	0.31

Start Station	Ending Station	Roughness Coefficient
(0+58.0, 1.67)	(0+99.0, 0.31)	0.030

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Normal Depth		0.27	ft
Elevation Range	0.00 to 1.67 ft		
Flow Area		1.73	ft²
Wetted Perimeter		12.91	ft
Hydraulic Radius		0.13	ft
Top Width		12.90	ft
Normal Depth		0.27	ft
Critical Depth		0.16	ft
Critical Slope		0.03043	ft/ft
Velocity		0.58	ft/s

Worksheet for Section K-East-Q10

Results

Velocity Head	0.01	ft
Specific Energy	0.27	ft
Froude Number	0.28	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.27	ft
Critical Depth	0.16	ft
Channel Slope	0.20	%
Critical Slope	0.03043	ft/ft

Cross Section for Section K-East-Q10

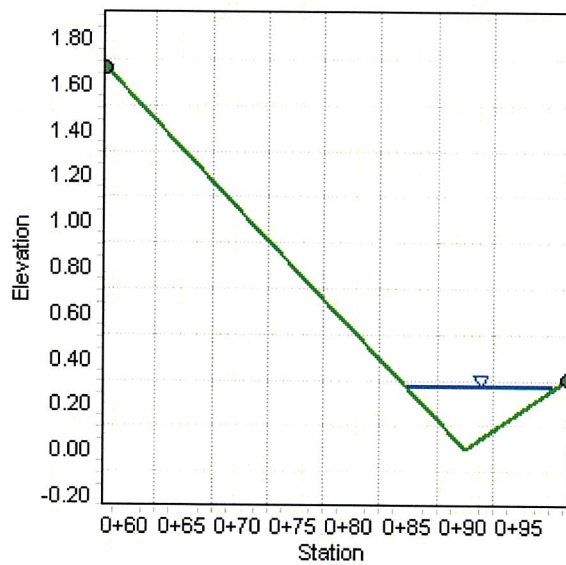
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.20 %
Normal Depth	0.27 ft
Discharge	1.00 ft ³ /s

Cross Section Image



Worksheet for Section K-East-Q100

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.20 %
Discharge 2.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+58.0	1.67
0+90.0	0.00
0+99.0	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+58.0, 1.67)	(0+99.0, 0.31)	0.030

Options

Current Roughness Vweighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth	0.34 ft
Elevation Range	0.00 to 1.67 ft
Flow Area	2.82 ft ²
Wetted Perimeter	15.63 ft
Hydraulic Radius	0.18 ft
Top Width	15.58 ft
Normal Depth	0.34 ft
Critical Depth	0.21 ft
Critical Slope	0.02774 ft/ft
Velocity	0.71 ft/s

Worksheet for Section K-East-Q100

Results

Velocity Head	0.01	ft
Specific Energy	0.35	ft
Froude Number	0.29	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.34	ft
Critical Depth	0.21	ft
Channel Slope	0.20	%
Critical Slope	0.02774	ft/ft

Cross Section for Section K-East-Q100

Project Description

Friction Method

Manning Formula

Solve For

Normal Depth

Input Data

Channel Slope

0.20 %

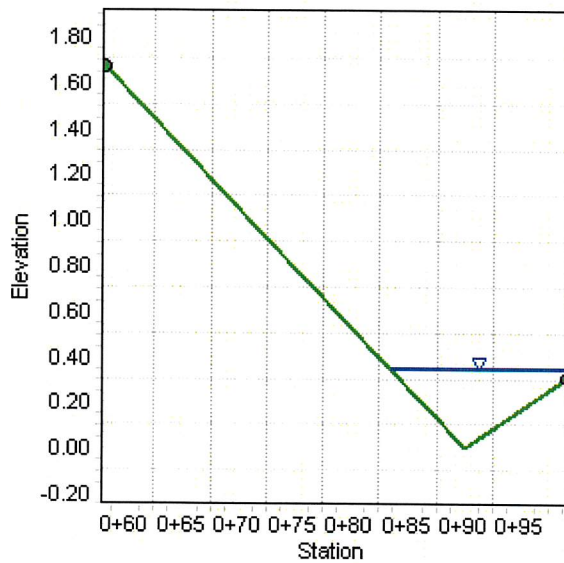
Normal Depth

0.34 ft

Discharge

2.00 ft³/s

Cross Section Image



Worksheet for Section K-West-Q10

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.50 %
Discharge 4.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.0	1.53
0+05.0	1.48
0+05.5	1.48
0+05.5	0.98
0+07.0	1.11
0+07.0	1.15
0+25.0	1.28
0+50.0	1.58
0+58.0	1.67

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 1.53)	(0+07.0, 1.11)	0.013
(0+07.0, 1.11)	(0+58.0, 1.67)	0.016

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.35 ft
Elevation Range 0.98 to 1.67 ft
Flow Area 2.63 ft²

Worksheet for Section K-West-Q10

Results

Wetted Perimeter	24.18	ft
Hydraulic Radius	0.11	ft
Top Width	23.78	ft
Normal Depth	0.35	ft
Critical Depth	0.33	ft
Critical Slope	0.00801	ft/ft
Velocity	1.52	ft/s
Velocity Head	0.04	ft
Specific Energy	0.39	ft
Froude Number	0.80	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.35	ft
Critical Depth	0.33	ft
Channel Slope	0.50	%
Critical Slope	0.00801	ft/ft

Project Description

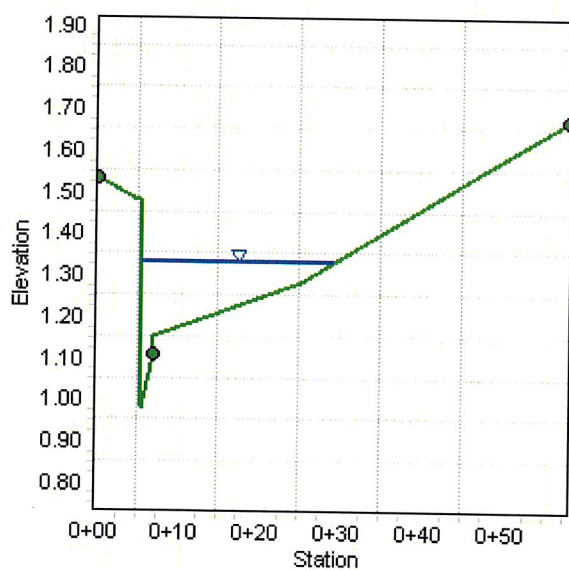
Manning Formula

Normal Depth

Input Data

Discharge 4.00 ft³/s

Cross Section Image



Worksheet for Section K-West-Q100

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.50 %
Discharge 9.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.0	1.53
0+05.0	1.48
0+05.5	1.48
0+05.5	0.98
0+07.0	1.11
0+07.0	1.15
0+25.0	1.28
0+50.0	1.58
0+58.0	1.67

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 1.53)	(0+07.0, 1.11)	0.013
(0+07.0, 1.11)	(0+58.0, 1.67)	0.016

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.43 ft
Elevation Range 0.98 to 1.67 ft
Flow Area 4.72 ft²

Worksheet for Section K-West-Q100

Results

Wetted Perimeter	30.70	ft
Hydraulic Radius	0.15	ft
Top Width	30.22	ft
Normal Depth	0.43	ft
Critical Depth	0.41	ft
Critical Slope	0.00709	ft/ft
Velocity	1.91	ft/s
Velocity Head	0.06	ft
Specific Energy	0.49	ft
Froude Number	0.85	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.43	ft
Critical Depth	0.41	ft
Channel Slope	0.50	%
Critical Slope	0.00709	ft/ft

Cross Section for Section K-WestQ-100

Project Description

Friction Method

Manning Formula

Solve For

Normal Depth

Input Data

Channel Slope

0.50 %

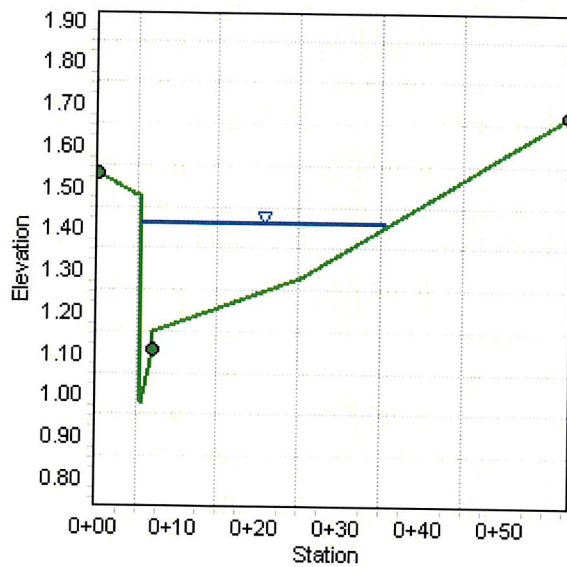
Normal Depth

0.43 ft

Discharge

9.00 ft³/s

Cross Section Image



Worksheet for Section L-East-Q10

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.60 %
Discharge 0.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+34.0	1.24
0+52.0	1.12
0+67.0	1.05
1+02.0	0.00
1+02.0	1.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+34.0, 1.24)	(0+67.0, 1.05)	0.016
(0+67.0, 1.05)	(1+02.0, 0.00)	0.030
(1+02.0, 0.00)	(1+02.0, 1.00)	0.035

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.02 ft
Elevation Range 0.00 to 1.24 ft
Flow Area 0.01 ft²
Wetted Perimeter 0.65 ft
Hydraulic Radius 0.01 ft
Top Width 0.63 ft

Worksheet for Section L-East-Q10

Results

Normal Depth	0.02	ft
Critical Depth	0.01	ft
Critical Slope	0.07655	ft/ft
Velocity	0.17	ft/s
Velocity Head	0.00	ft
Specific Energy	0.02	ft
Froude Number	0.30	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.02	ft
Critical Depth	0.01	ft
Channel Slope	0.60	%
Critical Slope	0.07655	ft/ft

Cross Section for Section L-East-Q10

Project Description

Friction Method

Manning Formula

Solve For

Normal Depth

Input Data

Channel Slope

0.60 %

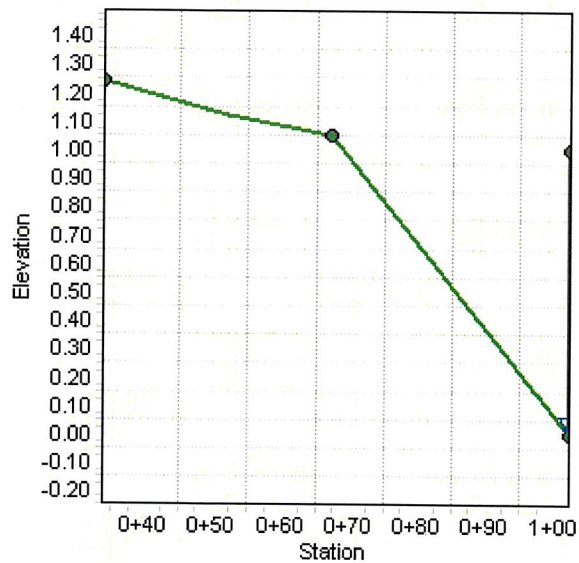
Normal Depth

0.02 ft

Discharge

0.00 ft³/s

Cross Section Image



Worksheet for Section L-East-Q100

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.60 %
Discharge 0.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+34.0	1.24
0+52.0	1.12
0+67.0	1.05
1+02.0	0.00
1+02.0	1.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+34.0, 1.24)	(0+67.0, 1.05)	0.016
(0+67.0, 1.05)	(1+02.0, 0.00)	0.030
(1+02.0, 0.00)	(1+02.0, 1.00)	0.035

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.02 ft
Elevation Range 0.00 to 1.24 ft
Flow Area 0.01 ft²
Wetted Perimeter 0.65 ft
Hydraulic Radius 0.01 ft
Top Width 0.63 ft

Worksheet for Section L-East-Q100

Results

Normal Depth	0.02	ft
Critical Depth	0.01	ft
Critical Slope	0.07655	ft/ft
Velocity	0.17	ft/s
Velocity Head	0.00	ft
Specific Energy	0.02	ft
Froude Number	0.30	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.02	ft
Critical Depth	0.01	ft
Channel Slope	0.60	%
Critical Slope	0.07655	ft/ft

Project Description

Manning Formula

Normal Depth

Channel Slope

0.60 %

0.02 ft

0.00 ft³/s

Station	Elevation
0+40	1.25
0+50	1.15
0+60	1.10
0+70	1.05
0+80	0.75
0+90	0.40
1+00	0.05

Worksheet for Section L-West-Q10

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.35 %
Discharge 5.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.0	1.14
0+05.0	1.09
0+05.5	1.09
0+05.5	0.59
0+07.0	0.72
0+07.0	0.76
0+34.0	1.24

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 1.14)	(0+07.0, 0.72)	0.013
(0+07.0, 0.72)	(0+34.0, 1.24)	0.016

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.46 ft
Elevation Range 0.59 to 1.24 ft
Flow Area 3.00 ft²
Wetted Perimeter 18.45 ft
Hydraulic Radius 0.16 ft

Worksheet for Section L-West-Q10

Results

Top Width	17.94	ft
Normal Depth	0.46	ft
Critical Depth	0.42	ft
Critical Slope	0.00708	ft/ft
Velocity	1.67	ft/s
Velocity Head	0.04	ft
Specific Energy	0.51	ft
Froude Number	0.72	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.46	ft
Critical Depth	0.42	ft
Channel Slope	0.35	%
Critical Slope	0.00708	ft/ft

Cross Section for Section L-West-Q10

Project Description

Friction Method

Manning Formula

Solve For

Normal Depth

Input Data

Channel Slope

0.35 %

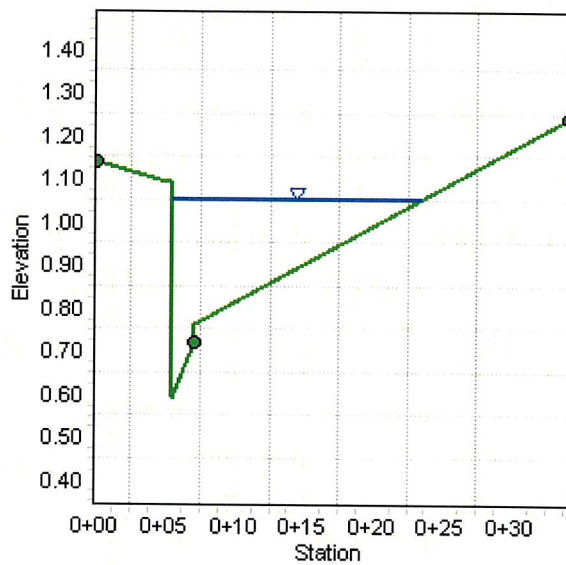
Normal Depth

0.46 ft

Discharge

5.00 ft³/s

Cross Section Image



Worksheet for Section L-West-Q100

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.35 %
Discharge 12.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.0	1.14
0+05.0	1.09
0+05.5	1.09
0+05.5	0.59
0+07.0	0.72
0+07.0	0.76
0+34.0	1.24

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 1.14)	(0+07.0, 0.72)	0.013
(0+07.0, 0.72)	(0+34.0, 1.24)	0.016

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.59 ft
Elevation Range 0.59 to 1.24 ft
Flow Area 6.18 ft²
Wetted Perimeter 31.32 ft
Hydraulic Radius 0.20 ft

Worksheet for Section L-West-Q100

Results

Top Width	30.73	ft
Normal Depth	0.59	ft
Critical Depth	0.55	ft
Critical Slope	0.00627	ft/ft
Velocity	1.94	ft/s
Velocity Head	0.06	ft
Specific Energy	0.65	ft
Froude Number	0.76	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.59	ft
Critical Depth	0.55	ft
Channel Slope	0.35	%
Critical Slope	0.00627	ft/ft

Cross Section for Section L-West-Q100

Project Description

Friction Method

Manning Formula

Solve For

Normal Depth

Input Data

Channel Slope

0.35 %

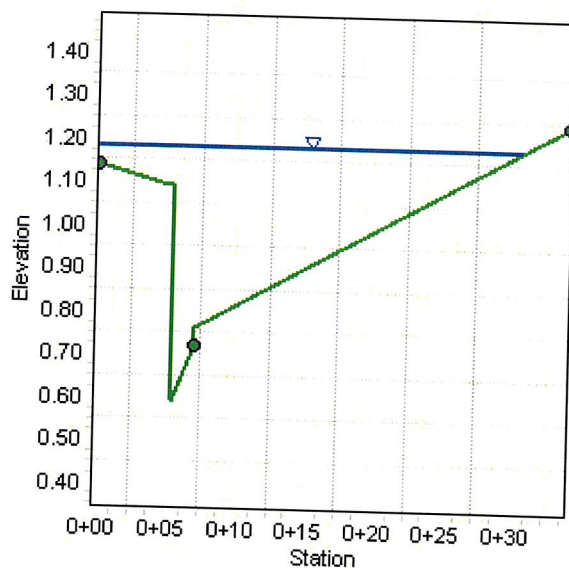
Normal Depth

0.59 ft

Discharge

12.00 ft³/s

Cross Section Image



Project Description

Manning Formula

Normal Depth

1.00 ft³/s

Station (ft)

Elevation (ft)

0+40.0	0.60
0+55.0	0.53
0+69.0	0.46
0+81.0	0.01
0+91.0	0.26

Start Station

Ending Station

Roughness Coefficient

(0+40.0, 0.60)	(0+69.0, 0.46)	0.016
(0+69.0, 0.46)	(0+91.0, 0.26)	0.030

Current Roughness Weighted Method

Pavlovskii's Method

Open Channel Weighting Method

Pavlovskii's Method

Closed Channel Weighting Method

Pavlovskii's Method

Normal Depth

0.17 ft

Elevation Range

0.01 to 0.60 ft

Flow Area

0.99 ft²

Wetted Perimeter

11.49 ft

Hydraulic Radius

0.09 ft

Top Width

11.48 ft

Normal Depth

0.17 ft

Worksheet for Section M-East-Q10

Results

Critical Depth	0.14	ft
Critical Slope	0.03178	ft/ft
Velocity	1.01	ft/s
Velocity Head	0.02	ft
Specific Energy	0.19	ft
Froude Number	0.61	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.17	ft
Critical Depth	0.14	ft
Channel Slope	1.10	%
Critical Slope	0.03178	ft/ft

Cross Section for Section M-East-Q10

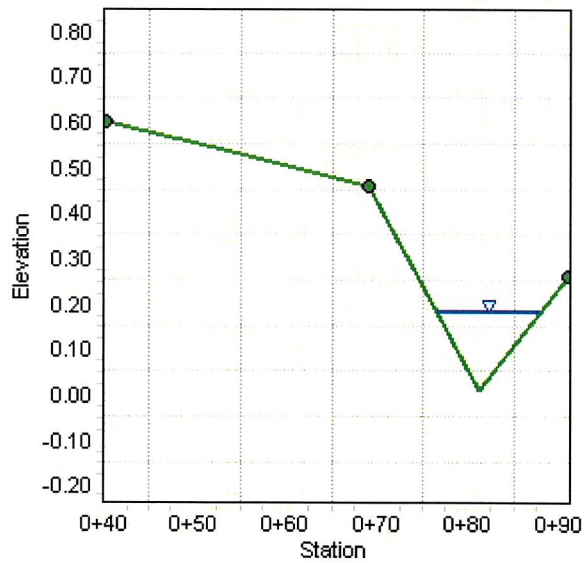
Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope	1.10	%
Normal Depth	0.17	ft
Discharge	1.00	ft ³ /s

Cross Section Image



Project Description

Manning Formula

Normal Depth

1.10 %

2.00 ft³/s

Elevation (ft)

0+40.0	0.60
0+55.0	0.53
0+69.0	0.46
0+81.0	0.01
0+91.0	0.26

Roughness Coefficient

(0+40.0, 0.60)	(0+69.0, 0.46)	0.016
(0+69.0, 0.46)	(0+91.0, 0.26)	0.030

Pavlovskii's Method

Pavlovskii's Method

Pavlovskii's Method

0.22 ft

0.01 to 0.60 ft

1.66 ft²

14.88 ft

0.11 ft

14.87 ft

0.22 ft

Worksheet for Section M-East-Q100

Results

Critical Depth	0.19	ft
Critical Slope	0.02896	ft/ft
Velocity	1.21	ft/s
Velocity Head	0.02	ft
Specific Energy	0.25	ft
Froude Number	0.64	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.22	ft
Critical Depth	0.19	ft
Channel Slope	1.10	%
Critical Slope	0.02896	ft/ft

Cross Section for Section M-East-Q100

Project Description

Friction Method

Manning Formula

Solve For

Normal Depth

Input Data

Channel Slope

1.10 %

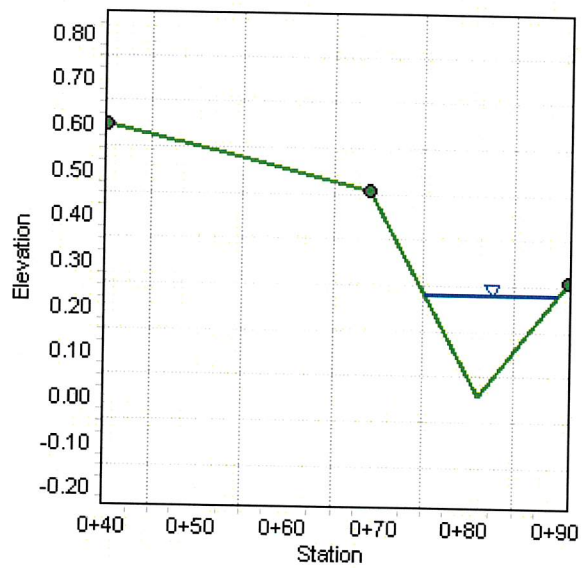
Normal Depth

0.22 ft

Discharge

2.00 ft³/s

Cross Section Image



Worksheet for Section M-West-Q10

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.80 %
Discharge 0.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.0	0.67
0+05.0	0.62
0+05.5	0.62
0+05.5	0.12
0+07.0	0.25
0+07.0	0.29
0+40.0	0.60

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 0.67)	(0+07.0, 0.25)	0.013
(0+07.0, 0.25)	(0+40.0, 0.60)	0.016

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.02 ft
Elevation Range 0.12 to 0.67 ft
Flow Area 0.00 ft²
Wetted Perimeter 0.25 ft
Hydraulic Radius 0.01 ft

Worksheet for Section M-West-Q10

Results

Top Width	0.23	ft
Normal Depth	0.02	ft
Critical Depth	0.02	ft
Critical Slope	0.01331	ft/ft
Velocity	0.44	ft/s
Velocity Head	0.00	ft
Specific Energy	0.02	ft
Froude Number	0.78	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.02	ft
Critical Depth	0.02	ft
Channel Slope	0.80	%
Critical Slope	0.01331	ft/ft

Cross Section for Section M-West-Q10

Project Description

Friction Method

Manning Formula

Solve For

Normal Depth

Input Data

Channel Slope

0.80 %

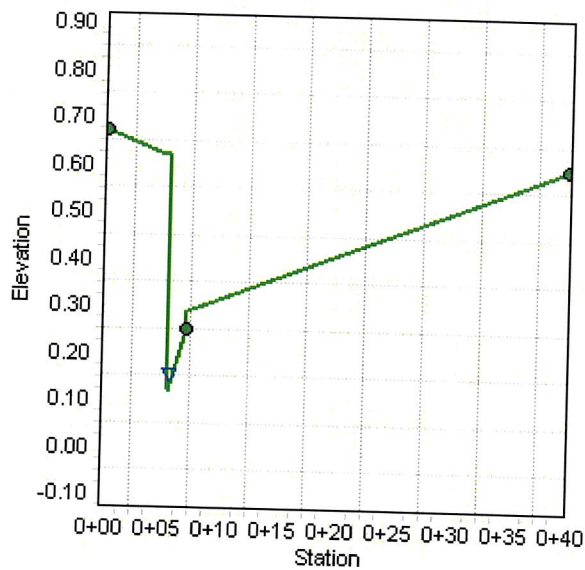
Normal Depth

0.02 ft

Discharge

0.00 ft³/s

Cross Section Image



Worksheet for Section M-West-Q100

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.80 %
Discharge 7.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.0	0.67
0+05.0	0.62
0+05.5	0.62
0+05.5	0.12
0+07.0	0.25
0+07.0	0.29
0+40.0	0.60

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 0.67)	(0+07.0, 0.25)	0.013
(0+07.0, 0.25)	(0+40.0, 0.60)	0.016

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.40 ft
Elevation Range 0.12 to 0.67 ft
Flow Area 3.33 ft²
Wetted Perimeter 26.46 ft
Hydraulic Radius 0.13 ft

Worksheet for Section M-West-Q100

Results

Top Width	26.01	ft
Normal Depth	0.40	ft
Critical Depth	0.40	ft
Critical Slope	0.00735	ft/ft
Velocity	2.11	ft/s
Velocity Head	0.07	ft
Specific Energy	0.47	ft
Froude Number	1.04	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.40	ft
Critical Depth	0.40	ft
Channel Slope	0.80	%
Critical Slope	0.00735	ft/ft

Cross Section for Section M-West-Q100

Project Description

Friction Method

Manning Formula

Solve For

Normal Depth

Input Data

Channel Slope

0.80 %

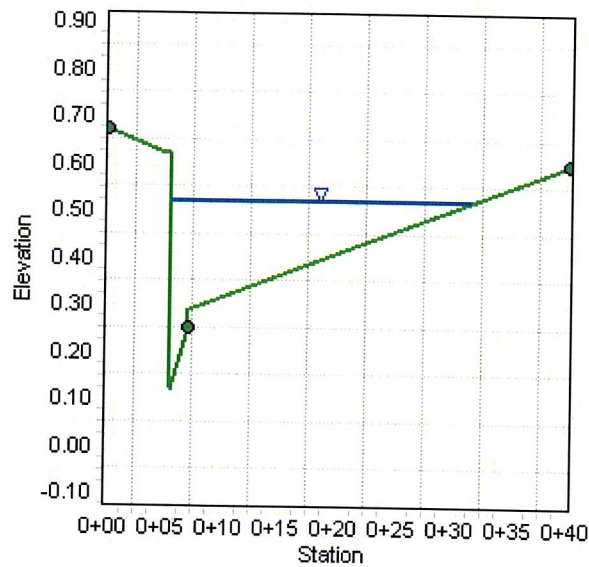
Normal Depth

0.40 ft

Discharge

7.00 ft³/s

Cross Section Image



Worksheet for Section N-East-Q10

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.50 %
Discharge 1.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+07.0	0.65
0+55.0	0.43
0+93.0	0.00
1+05.0	0.28

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+07.0, 0.65)	(0+93.0, 0.00)	0.016
(0+93.0, 0.00)	(1+05.0, 0.28)	0.030

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth	0.14 ft
Elevation Range	0.00 to 0.65 ft
Flow Area	1.23 ft ²
Wetted Perimeter	17.98 ft
Hydraulic Radius	0.07 ft
Top Width	17.97 ft
Normal Depth	0.14 ft
Critical Depth	0.11 ft

Worksheet for Section N-East-Q10

Results

Critical Slope	0.01801	ft/ft
Velocity	0.81	ft/s
Velocity Head	0.01	ft
Specific Energy	0.15	ft
Froude Number	0.55	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.14	ft
Critical Depth	0.11	ft
Channel Slope	0.50	%
Critical Slope	0.01801	ft/ft

Cross Section for Section N-East-Q10

Project Description

Friction Method

Manning Formula

Solve For

Normal Depth

Input Data

Channel Slope

0.50 %

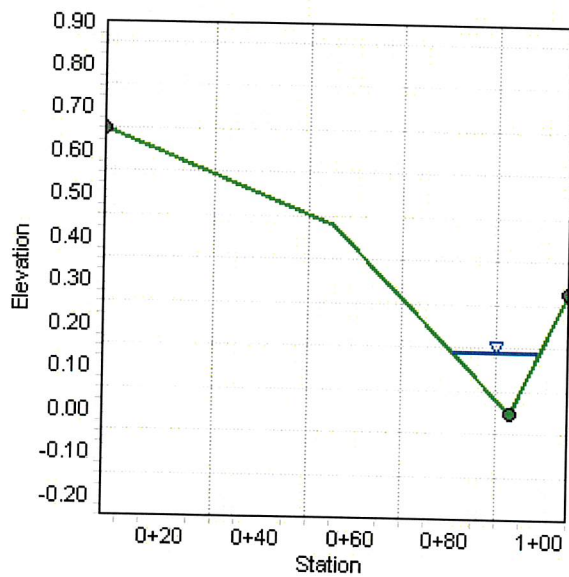
Normal Depth

0.14 ft

Discharge

1.00 ft³/s

Cross Section Image



Worksheet for Section N-East-Q100

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.50 %
Discharge 2.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+07.0	0.65
0+55.0	0.43
0+93.0	0.00
1+05.0	0.28

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+07.0, 0.65)	(0+93.0, 0.00)	0.016
(0+93.0, 0.00)	(1+05.0, 0.28)	0.030

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth	0.18 ft
Elevation Range	0.00 to 0.65 ft
Flow Area	2.06 ft ²
Wetted Perimeter	23.28 ft
Hydraulic Radius	0.09 ft
Top Width	23.28 ft
Normal Depth	0.18 ft
Critical Depth	0.14 ft

Worksheet for Section N-East-Q100

Results

Critical Slope	0.01641	ft/ft
Velocity	0.97	ft/s
Velocity Head	0.01	ft
Specific Energy	0.19	ft
Froude Number	0.57	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.18	ft
Critical Depth	0.14	ft
Channel Slope	0.50	%
Critical Slope	0.01641	ft/ft

Cross Section for Section N-East-Q100

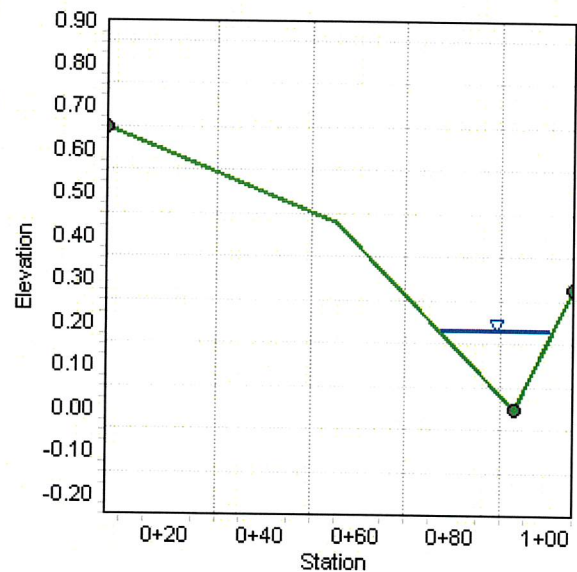
Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope	0.50	%
Normal Depth	0.18	ft
Discharge	2.00	ft³/s

Cross Section Image



Worksheet for Section N-West-Q10

Results

Critical Depth	0.56	ft
Critical Slope	0.00567	ft/ft
Velocity	1.53	ft/s
Velocity Head	0.04	ft
Specific Energy	0.65	ft
Froude Number	0.62	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.61	ft
Critical Depth	0.56	ft
Channel Slope	0.20	%
Critical Slope	0.00567	ft/ft

Cross Section for Section N-West-Q10

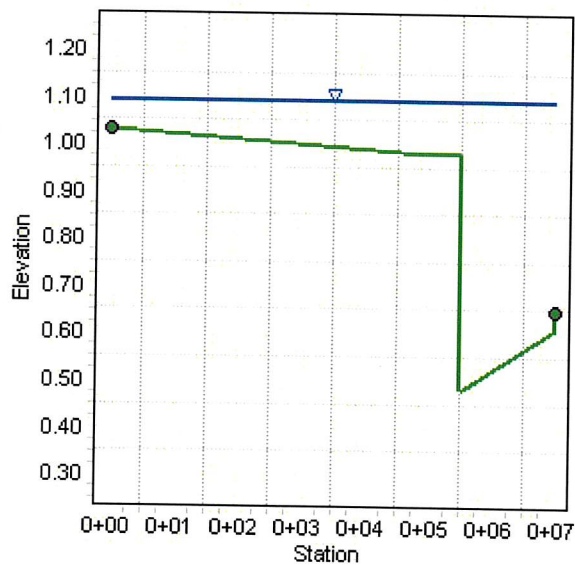
Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope	0.20	%
Normal Depth	0.61	ft
Discharge	2.00	ft ³ /s

Cross Section Image



Worksheet for Section N-West-Q100

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.20 %
Discharge 10.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.0	1.03
0+05.0	0.98
0+05.5	0.98
0+05.5	0.48
0+07.0	0.61
0+07.0	0.65

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 1.03)	(0+07.0, 0.65)	0.013

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth	0.93 ft
Elevation Range	0.48 to 1.03 ft
Flow Area	3.55 ft ²
Wetted Perimeter	8.69 ft
Hydraulic Radius	0.41 ft
Top Width	7.00 ft
Normal Depth	0.93 ft

Worksheet for Section N-West-Q100

Results

Critical Depth	0.82	ft
Critical Slope	0.00432	ft/ft
Velocity	2.82	ft/s
Velocity Head	0.12	ft
Specific Energy	1.06	ft
Froude Number	0.70	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.93	ft
Critical Depth	0.82	ft
Channel Slope	0.20	%
Critical Slope	0.00432	ft/ft

Cross Section for Section N-West-Q100

Project Description

Friction Method

Manning Formula

Solve For

Normal Depth

Input Data

Channel Slope

0.20 %

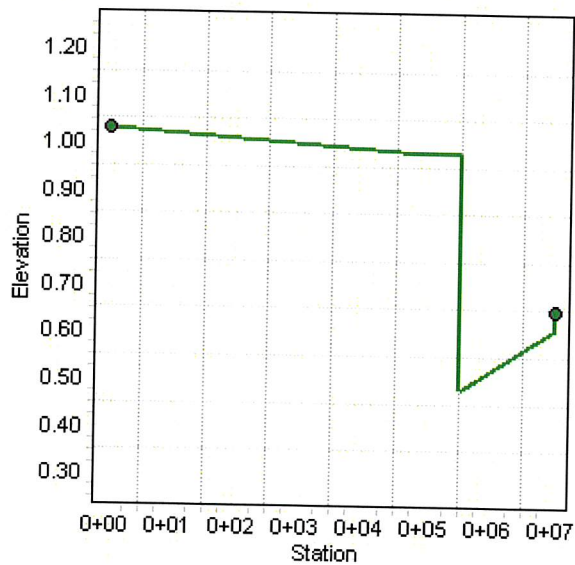
Normal Depth

0.93 ft

Discharge

10.00 ft³/s

Cross Section Image



Worksheet for Section P-Q10

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.50 %
Discharge 79.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.0	1.00
0+00.0	0.15
0+10.0	0.00
0+20.0	0.02
0+20.0	1.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 1.00)	(0+00.0, 0.15)	0.035
(0+00.0, 0.15)	(0+20.0, 0.02)	0.016
(0+20.0, 0.02)	(0+20.0, 1.00)	0.035

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth	0.86 ft
Elevation Range	0.00 to 1.00 ft
Flow Area	16.32 ft ²
Wetted Perimeter	21.55 ft
Hydraulic Radius	0.76 ft
Top Width	20.00 ft

Worksheet for Section P-Q10

Results

Normal Depth	0.86	ft
Critical Depth	0.83	ft
Critical Slope	0.00566	ft/ft
Velocity	4.84	ft/s
Velocity Head	0.36	ft
Specific Energy	1.22	ft
Froude Number	0.94	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.86	ft
Critical Depth	0.83	ft
Channel Slope	0.50	%
Critical Slope	0.00566	ft/ft

Cross Section for Section P-Q10

Project Description

Friction Method

Manning Formula

Solve For

Normal Depth

Input Data

Channel Slope

0.50 %

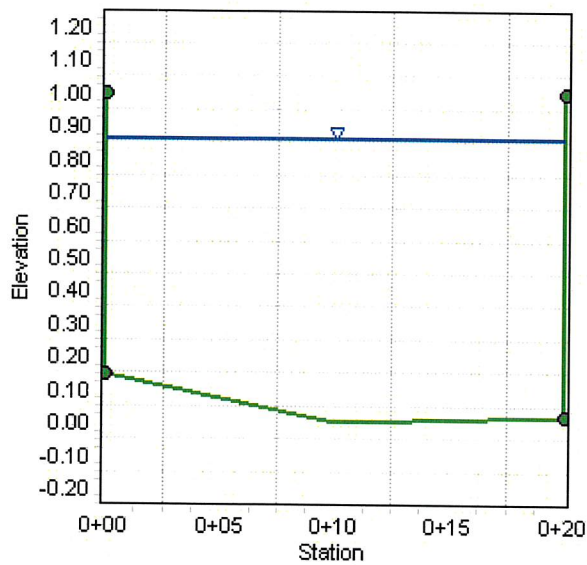
Normal Depth

0.86 ft

Discharge

79.00 ft³/s

Cross Section Image



Worksheet for Section P-Q100

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.50 %
Discharge 239.00 ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	1.00
0+00.0	0.15
0+10.0	0.00
0+20.0	0.02
0+20.0	1.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 1.00)	(0+00.0, 0.15)	0.035
(0+00.0, 0.15)	(0+20.0, 0.02)	0.016
(0+20.0, 0.02)	(0+20.0, 1.00)	0.035

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth	1.78 ft
Elevation Range	0.00 to 1.00 ft
Flow Area	34.77 ft ²
Wetted Perimeter	23.39 ft
Hydraulic Radius	1.49 ft
Top Width	20.00 ft

Worksheet for Section P-Q100

Results

Normal Depth	1.78	ft
Critical Depth	1.69	ft
Critical Slope	0.00597	ft/ft
Velocity	6.87	ft/s
Velocity Head	0.73	ft
Specific Energy	2.52	ft
Froude Number	0.92	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.78	ft
Critical Depth	1.69	ft
Channel Slope	0.50	%
Critical Slope	0.00597	ft/ft

Cross Section for Section P-100

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope	0.50	%
Normal Depth	1.78	ft
Discharge	239.00	ft ³ /s

Cross Section Image

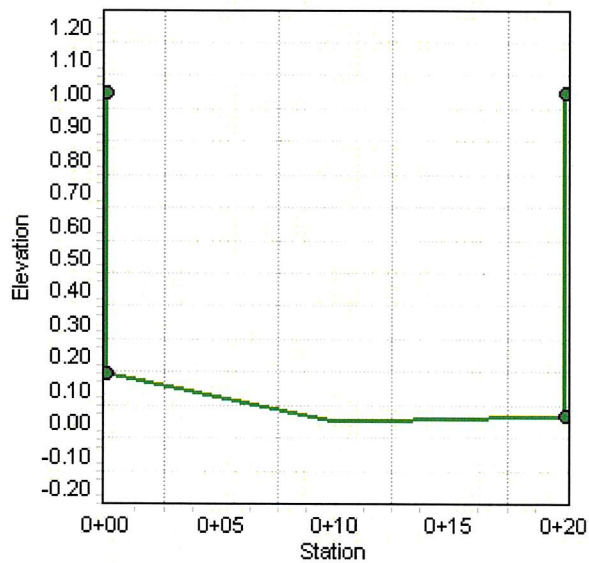
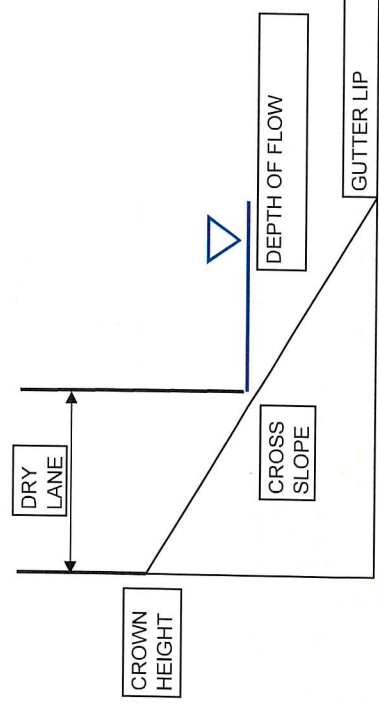


FIGURE D-12

10 Year Event Dry Travel Depth Calculation

Hydraulic Section	Side of 1/2 Street	Crown Height (ft)	Cross Slope (ft/ft)	Dry Lane (ft)	Maximum Depth of Flow* (ft)	Datum Elevation (ft)	10-Year Calculated Hydraulic Depth (ft)	Datum Adjusted Normal Depth (ft)	Dry Lane Criteria Met	Notes
Section A - TP	NORTH	0.84	0.020	12.00	0.60	0.00	0.67	0.67	NO	This is existing condition before proposed inlet.
Section A - TP	SOUTH	0.84	0.019	12.00	0.61	0.00	0.67	0.67	NO	This is existing condition before proposed inlet.
Section B - TP	NORTH	0.76	0.018	12.00	0.54	0.00	0.35	0.35	YES	
Section B - TP	SOUTH	0.76	0.016	12.00	0.57	0.05	0.32	0.37	YES	
Section C - TP	NORTH	0.94	0.021	12.00	0.69	NA	NA	NA	*	10-year is 0 cfs
Section C - TP	SOUTH	0.94	0.019	12.00	0.71	NA	NA	NA	*	10-year is 0 cfs
Section D - RB	EAST	1.41	0.010	12.00	1.29	0.00	0.22	0.22	YES	This is existing condition before proposed inlet.
Section D - RB	WEST	1.41	0.014	12.00	1.24	0.62	0.24	0.86	YES	This is existing condition before proposed inlet.
Section E - RB	EAST	1.10	0.022	12.00	0.84	NA	NA	NA	*	10-year is 0 cfs
Section E - RB	WEST	1.10	0.015	12.00	0.92	NA	NA	NA	*	10-year is 0 cfs
Section F - RB	EAST	1.02	0.018	12.00	0.80	0.08	0.39	0.47	YES	
Section F - RB	WEST	1.02	0.020	12.00	0.78	0.00	0.44	0.44	YES	
Section G - RB	EAST	1.16	0.022	12.00	0.90	0.03	0.31	0.34	YES	
Section G - RB	WEST	1.16	0.023	12.00	0.88	0.00	0.31	0.31	YES	
Section H - RB	WEST	0.99	0.018	24.00	0.56	NA	NA	NA	*	Crown at east EOP, 2 dry lanes from crown required.
Section J - RB	EAST	0.90	0.020	24.00	0.42	NA	NA	NA	*	Crown at west EOP, 2 dry lanes required.
Section K - RB	WEST	1.67	0.010	24.00	1.43	0.98	0.35	1.33	YES	Crown at east EOP, 2 dry lanes from crown required.
Section L - RB	EAST	1.24	0.005	12.00	1.18	NA	NA	NA	*	10-year is 0 cfs
Section L - RB	WEST	1.24	0.008	12.00	1.14	0.59	0.46	1.05	YES	
Section M - RB	EAST	0.60	0.005	12.00	0.54	0.01	0.17	0.18	YES	
Section M - RB	WEST	0.60	0.011	12.00	0.47	NA	NA	NA	*	10-year is 0 cfs
Section N - RB	EAST	0.65	0.011	24.00	0.39	0.00	0.14	0.14	YES	Crown in on lip of west gutter, 2 dry lanes needed on east side (drive lane) of crown.

*If depth of flow calculation <= 0.1 then, "No Travel Lane"



Dry Lane = (Crown Height - Depth Of Flow)/Cross Slope

FIGURE D-12

5. APPENDIX E – REFERENCES

1. Las Vegas Valley Flood Control Master Plan Update by PBS&J, 2008
2. Ann Road Improvements – US95 to Ferrell Street by VTN Nevada, 2000
3. Tenaya Way/Azure Dr. Roadway Improvements by Primas & Assoc. Consulting Eng., 2000
4. Grand Entries Estates by VTN Nevada, 1993
5. Rio Vista Estates by VTN Nevada, 1993
6. Tropical Meadows by VTN Nevada, 1994
7. Toscana by Thomason Consulting Engineers, 2005
8. Ann and Rio Vista by Zone Engineering, 2006
9. Ann and Balsam (Ann & Rainbow II) by Thomas Consulting Engineers, 2005
10. Ann & Rainbow by Thomas Consulting Engineers, 2005
11. Rite Aid at Ann & Rainbow (Walgreens), 1998

ANN ROAD IMPROVEMENTS
W.O. #5546

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

Rainbow
lateral

ANN
WSPG
Ext 33



WATER SURFACE PROFILE LISTING

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

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
L/ELEM	SO					SF AVE	HF			NORM DEPTH		ZR		
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
42989.31	2313.14	7.119	2320.259	862.0	15.14	3.557	2323.816	0.00	7.119	8.00	8.00	0.00	0	0.00
TRANS STR	0.02187					.004177	0.16					0.00		
43028.64	2314.00	8.952	2322.952	862.0	9.00	1.258	2324.210	0.00	4.485	6.00	16.00	0.00	0	0.00
JUNCT STR	0.02111					.004525	0.09					0.00		
43048.06	2314.41	8.071	2322.481	399.0	11.16	1.934	2324.415	0.00	5.161	6.00	6.00	0.00	0	0.00
0.33	0.00000					.006499	0.00			0.000		0.00		
43048.39	2314.41	8.073	2322.483	399.0	11.16	1.934	2324.417	0.00	5.161	6.00	6.00	0.00	0	0.00
86.87	0.02153					.006499	0.56			3.193		0.00		
43135.26	2316.28	6.865	2323.145	399.0	11.16	1.934	2325.079	0.00	5.161	6.00	6.00	0.00	0	0.00
62.04	0.00661					.006499	0.40			5.055		0.00		
43197.30	2316.69	6.890	2323.580	399.0	11.16	1.934	2325.514	0.00	5.161	6.00	6.00	0.00	0	0.00
430.73	0.00652					.006499	2.80			5.081		0.00		
43628.03	2319.50	6.976	2326.476	399.0	11.16	1.934	2328.410	0.00	5.161	6.00	6.00	0.00	0	0.00
83.66	0.01410					.006499	0.54			3.752		0.00		
43711.69	2320.68	6.352	2327.032	399.0	11.16	1.934	2328.966	0.00	5.161	6.00	6.00	0.00	0	0.00
HYDRAULIC JUMP												0.00		
11.69	2320.68	3.829	2324.509	399.0	17.37	4.684	2329.193	0.00	5.161	6.00	6.00	0.00	0	0.00
141.94	0.01410					.013003	1.85			3.752		0.00		
43853.63	2322.68	3.917	2326.598	399.0	16.98	4.476	2331.074	0.00	5.161	6.00	6.00	0.00	0	0.00
97.65	0.01410					.011893	1.16			3.752		0.00		
43951.28	2324.06	4.108	2328.166	399.0	16.19	4.068	2332.234	0.00	5.161	6.00	6.00	0.00	0	0.00
47.36	0.01410					.010525	0.50			3.752		0.00		

6. APPENDIX F – GEOTECHNICAL REPORT BY TERRACON



7. APPENDIX G – FINAL MEETING NOTES

1. FEBRUARY 10, 2010

2. JANUARY 06, 2011

3. FEBRUARY 15, 2011

4. MARCH 15, 2011

Project: CLV Regional Drainage Facility @ Ann & Rainbow

Subject: Project Scoping Meeting

Date/Day: February 10, 2010 / Wednesday

Location: City of Las Vegas (420 N. 4th)

SIGN IN SHEET

Name	Organization	Phone	Email
Tara Alexander	Jacobs	702-938-5459	tara.alexander@jacobs.com
KEN LANGRISH	"	702.610.3912	KEN.LANGRISH@JACOBS.COM
JOE JENSEN	"	702 938-5475	JOSEPH.JENSEN@JACOBS.COM
RANDY MCLENNAN	CLV	229-2186	PMcLennan@lasvegasnevada.gov
TIM PARKS	CLV	229-2178	TPARKS@" "
MARK SPOONER	CLV	" 2203	MESSENER@" "
ERIC MEYER	CLV TRAFFIC	229-6033	emeyer@lasvegasnevada.gov
PETER JACKSON	CLV Flood	229-5266	PJACKSON@" "
NANCY ALMANZAN	CLV-RW	229-6343	nalmanzan@" "

Attendees:

Randy McConnell, CLV
Tim Parks, CLV
Mark Sorensen, CLV
Eric Meyer, CLV
Peter Jackson, CLV
Nancy Almanzan, CLV
Tara Alexander, Jacobs
Ken Lambert, Jacobs
Joe Jensen, Jacobs

Notes Prepared By:

Joe Jensen, Jacobs

The meeting was held to review scope items and costs for the project. The meeting began with an overview of project history beginning with the Sverdrup plans dating from the 1990's. A conceptual layout was shown with both Regional Flood Control and local drainage facilities identified. Discussion of the concept included the following points:

- One task will be to intercept drainage flowing from the Rio Vista Estates subdivision to Rainbow Boulevard. This will require a special inlet structure.
- The work will include removal of an existing storm drain in Ann south of El Campo Grande, and tying laterals to the new storm drain.
- The existing 24" storm drain near the Ann/Rainbow subdivision easement will be removed.
- Relocation of an existing 4-inch gas line may be required for the segment south of El Campo Grande adjacent to the proposed 10' x 7' box.
- The area near the drainage easement at Rio Vista Estates is challenging due to the number of utilities in the area. A potential solution is to use a shallow box in lieu of large diameter pipe to aid in crossing existing utilities.
- Three parcels near El Campo Grande on the east side of Rainbow extend to the roadway centerline. If traffic is to be maintained, TCE's would be required for these parcels to allow traffic to be diverted away from the construction zone onto temporary pavement. A discussion regarding easements followed. During this discussion, the following points were raised by the City:
 - The City dislikes relying on patent easements.
 - The size of the main facility is a 10-foot by 7-foot box.
 - The City prefers the use of pre-cast box segments, and dislikes the cast-in-place option.

Meeting Notes

(Continued)

Page 2 of 4

- The size of the box is an issue. New Q values were given in 2008 which increased over the 2002 numbers.
- All email or other correspondence regarding this project should clearly identify Ann Road and provide the City Hansen number.
- The project must accommodate all flows from Tropical.
- Plans should show all facilities in the road, such a conduit for future signals.
- If obtaining Temporary Construction Easements (TCE) for the three parcels is not feasible, partial road closure is another option. It was noted traffic is light through this area.
- No future master plan sewers are shown in this area. Sewer rehabilitation is not expected to be an issue.
- There is some concern that the drainage structure may impact the existing sewer.
- Sleeves across the RCB may be needed for future sewer connections.

A general discussion of scope and cost followed. A sheet by sheet examination of scope tasks led to the following points:

- The City like the breakout of the various meetings with different entities.
- Problems involving utility companies were discussed under the Data Collection item. The number of submittals to utilities was questioned, and the decision was made to eliminate the 70% submittal to the utilities.
- It was noted that delays due to utilities were a common problem, and that it was necessary to closely follow up any submittal made to a utility.
- This is a lump sum by task job. If a major task is not performed, it will not be paid for.
- Utility relocation letters will be added to the task list.
- Pre-design tasks include potholing, survey, and geotechnical studies.
- Some topo is missing from the available mapping.
- It was noted that another project to the south experienced an elevation bust of approximately 1-foot. It was recommended that elevations be spot checked throughout the project limits.

Meeting Notes

(Continued)

Page 3 of 4

- Peter Jackson from the City Flood Control wants to have pdf files of the conceptual layout used in the meeting.
- An approved Record of Survey must be recorded prior to the 30% submittal.
- Geotechnical work will consist of an update letter to the original report.
- Jacobs requested a copy of the Permit Matrix. City does not know if they have a copy of such, but will look. City may modify language regarding penalties for permit matrix error. There was considerable discussion on this, with the City indicating they considered this language too severe.
- The Performance Schedule will be prepared in cooperation with the City.
- No specifications will be required at the 30% submittal. Only a single unbound copy of specifications will be required at the 70% submittal.
- City requests Excel spreadsheet showing rates and hours. This is intended for them to do some "what if" analysis only.
- The structural and hydraulic effort will be minimal at 30%.
- The number of PDR copies required was discussed. It was decided that six, not eight, copies would be required.
- The 24 X 36 exhibits and two (2) plan sets will be required as shown in the scope.
- At the 70% level, the hydraulic design will be more refined.
- No reinforcing will be shown for the structural design at the 70% level.
- There was a general discussion of what the plans will show, QA/QC, and deliverables.
- It was reiterated that no submittals to the utilities would be made at 70%.
- The 70% field walk-through was eliminated from the task list.
- There was significant discussion relating to the Draft Final Design Report and the Final Design Report. It was decided that Jacobs should provide a simplified document to be labeled as a Design Memo. This memo would document entity comments and project decisions.
- The 90% submittal would follow the same formats as the others.

Meeting Notes

(Continued)

Page 4 of 4

- The completed drainage report will be submitted at the Pre-Final (99%) submittal, until then the City does not want a complete study shown at each submittal phase, only new and/or modified hydraulic and hydrologic information.
- Put the sheet count (proposed plan sheets) into Exhibit A.
- Jacobs should anticipate that there will be minor increases or decreases to the scope as part of the design effort. Jacobs was place a contingency suitable to anticipated changes into the estimate. City does not want to consider extras for minor changes, only if there is a major scope change affecting costs.
- Overhead rates were briefly discussed. City will further investigate the details for the "Consultant Overhead Cost Worksheet". This is something new to them as well.
- The City requested an electronic copy of the Excel Spreadsheet showing the task breakdown and hours per task along with the overall cost for each task and individuals billing rate.

ACTION ITEMS

City will:

- Review submitted scope and cost details.
- Provide Hansen number to Jacobs for this project.
- Schedule additional meeting.

Jacobs will:

- Provide pdf of conceptual layout to City.
- Provide back up for Audited Overhead Rate multiplier to City.
- Provide Excel spreadsheet of Exhibit DEF to City.
- Modify scope and task costs per this meeting's decisions.

[illegible]

Attendees:

Randy McConnell, CLV	Mark Sorensen, CLV	Peter Jackson, CLV
Tim Parks, CLV	David Bowers, CLV	Diane Phomnin, CLV
Tara Alexander, Jacobs	Matt Sackschewsky, Jacobs	Alan Thomas, Jacobs
Todd Myers, CCRFCD		

Notes Prepared By:

Tara Alexander, Jacobs

The meeting was held at the City of Las Vegas to kick off the Ann and Rainbow project. The introductions were made along with a project overview. A project schedule, project exhibit and an offsite drainage exhibit were issued to all attendees.

Discussion of the Project included the following points:

- All correspondence is to go through Randy McConnell at the city. Make sure Mark Sorensen is CC'd on e-mail. Jacobs may discuss directly with Peter Jackson & Tim Parks on design issues, Randy McConnell is to be invited to all meetings.
- Preliminary meeting minutes will be provided to Randy M. for review and approval before sending out the final draft to all meeting attendees.
- Jacobs is to invite Randy to all meetings with the utilities regarding the project.
- Do not contact any homeowners with any issues regarding right-of-way, all correspondence is to go through the City of Las Vegas right-of-way department.
- E-mail Tim regarding sewer lateral crossing at the frontage of all homes.
- An updated project schedule is to be given at the monthly progress meeting.
- Delays in the schedule need to be documented on the schedule via a bar chart; make all important deadline dates stand out on the schedule. Changes to critical path items need to be documented and shown on the schedule, along with brief explanation for delays to critical path item.
- The City's new work schedule will be 7 am – 5:30 pm, Monday-Thursday. The City understands that communication with Jacobs will be limited between 5 pm and 5:30 pm.
- The City will provide feedback on service to the consultant via a new formal process at the 70-90% stage. They will provide Jacobs a blank form to review.
- The paint lines for the utility companies need to be surveyed.

Discussion regarding lessons learned by other City projects included the following points:

- Either an independent engineering firm or an in-house bid ability and constructability review will be performed with the plans at the ~90% design level.
- Keep in mind the time called out for the contractors and the time constraints for cast-in-place concrete versus ready-cast products. The issues regarding construction time in the past did not consider such things as traffic control and open trench length.
- Potholes coordination with the pothole sub-contractor is very important. Make sure we are in the field with them and can clearly communicate what needs to be performed for the project.

Meeting Notes

(Continued)

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ACTION ITEMS

City will:

- Set up a field visit with Jacobs to the project site.
- Provide Jacobs with the sewer lateral and sewer plans at the project limits.
- Provide Jacobs with at blank feed back form the City will use at the 70-90% level.

Jacobs will:

- Set up a design meeting with Peter Jackson.

[illegible]

Attendees:

Randy McConnell, CLV	Mark Sorensen, CLV	Peter Jackson, CLV
Tara Alexander, Jacobs	Matt Sackschewsky, Jacobs	Alan Thomas, Jacobs
Todd Myers, CCRFCD		

Notes Prepared By:

Tara Alexander, Jacobs

The meeting was held at the City of Las Vegas to discuss progress for the Ann and Rainbow project. The introductions were made along with a project overview. A revised project schedule was issued to all attendees.

Discussion of the Project included the following points:

- Review comments from the 30% submittal will be discussed at the next CLV progress meeting scheduled for March 15, 2011.
- Jacobs needs further as-built plans for residential and commercial subdivisions adjacent to the project.
- Tim Sutko is the Regional Flood Control contact regarding the 404 permit and the section 8 screening. These need to begin after the 70% submittal and be completed by the 90% submittal.
- Lane Weber at Clark County public works will be responsible for approving the Clark County encroachment permit.
- There will be no NDOT coordination or permit required for this project, remove all NDOT references from schedule.
- Jacobs is in the process of completing the contracting and permitting with Aztec to obtain additional potholes.
- Project presentations will be scheduled after the 90% submittal, Technical Advisory Committee is July 28, 2011; Citizens Advisory Committee with MJ Harvey as chairman is August 1, 2011 and the Board presentations are scheduled for August 11, 2011. Jacobs will show a power point presentation summarizing the project at these meetings. Todd Myers will provide a format for the presentation to use as a template.
- There will be no walk-through with all stakeholders for this 30% submittal; the walk-through will take place after the 70% submittal.
- All future submittals will be incorporated into the 30% submittal in order to have one cohesive report with all calculations included.
- Only one CD to the City with the PFD plans and design report are required to submit to the city until the 100% submittal when they will need 2 CD's.
- The final submittal is to include hydraulic input files. Todd would like a copy of the HEC-1 models via e-mail.

Meeting Notes

(Continued)

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- Diane requested that all pavement saw cut lines be perpendicular or parallel to the roadway. Also, if a saw cut line comes within 4 feet of the lip of a gutter, go ahead and replace all the way to the lip.
- Diane also requested that in the location of the traffic conduit at Tropical Parkway and Rainbow Boulevard that the plans read for the contractor to replace any conduit that has been removed during construction and to provide all stub outs for conduit outside of the pavement areas.
- Diane reported that the existing conduit in the intersection currently has breaks in it. She has requested that during construction of drainage facilities, a note will be added to the plans for the conduits to be repaired via splicing where necessary.
- Diane requested that the entire intersection at Rainbow & Tropical be repaved.

ACTION ITEMS

City will:

- Set up a meeting with LVVWD to discuss the 36" MLCP crossing mains.
- Verify the revised sewer main in Rainbow just north of Ann Road is at proper slope for the 12" capacity and if not, recommend a size of replacement sewer which will provide proper capacity for a 0.20% slope.
- Have the proposed sewer manhole that is paved over at approximately STA 151+00 raised to grade. Joe will contact Jacobs when that is complete.
- Provide Jacobs with fencing and bollard details to use at the drainage easement for Rio Vista Estates.
- Provide Jacobs with information on the large grate used for access inlet structure example from the Flood Control plans comments.

CCRFCD will:

- Provide Jacobs with 30% submittal comments.

Jacobs will:

- Send estimates to Randy regarding getting a video of the sewer line from Ann Road to the cul-de-sac (Kane Holly St. and Haven Hollow Ave.) upstream of the easement on Rio Vista Estates.

END OF REPORT

Under the terms of the agreement...

It is the policy of the Government to...
The Government of the United States...
The Government of the United States...