

FINAL DESIGN REPORT

RANCHO-FORT APACHE STORM DRAIN

PREPARED FOR:

**CITY OF LAS VEGAS
DEPARTMENT OF PUBLIC WORKS
333 NORTH RANCHO
LAS VEGAS, NV 89101**



PREPARED BY:

**THE LOUIS BERGER GROUP, INC.
500 E. AMIGO COURT, SUITE 100
LAS VEGAS, NV 89119**



April 2013

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TABLE OF CONTENTS

1.0	INTRODUCTION	- 1 -
1.1	Project Overview	- 1 -
1.2	Report Organization	- 3 -
2.0	PREVIOUS STUDIES	- 4 -
2.1	Las Vegas Valley Flood Control Facilities Master Plan Update	- 4 -
2.2	FEMA Flood Insurance Rate Map	- 4 -
3.0	DESIGN CRITERIA	- 9 -
3.1	General Criteria	- 9 -
4.0	HYDROLOGIC METHODS AND ANALYSIS	- 10 -
4.1	Design Storm	- 10 -
4.2	Rainfall-Runoff Model	- 10 -
4.3	Modeling Parameters	- 10 -
4.4	Flow Patterns	- 11 -
4.4.1	Master Plan Amendment Recommendation	- 11 -
4.4.2	Revisions to the 2008 MPU HEC-1 Model	- 12 -
5.0	HYDRAULICS	- 18 -
5.1	Fort Apache Storm Drain and Channel	- 18 -
5.1.1	FASD Alternatives	- 20 -
5.1.2	FASD Horizontal Layout	- 21 -
5.1.3	FASD Hydraulic Modeling	- 22 -
5.2	Lateral Storm Drains and Inlets	- 24 -
5.2.1	Street Capacity Analysis	- 24 -
5.2.2	Drop Inlet and Pipe Sizing	- 25 -
5.2.3	Existing Storm Drain System	- 26 -
5.2.4	Fort Apache Collection System	- 27 -
5.2.5	Severence Collection System	- 34 -
5.2.6	Deer Springs Collection System	- 36 -
5.2.7	Echelon Point Collection System	- 38 -
6.0	UTILITY COORDINATION AND RELOCATIONS	- 40 -
6.1	Utility Coordination	- 40 -
6.2	Utility Relocations	- 41 -



7.0	RIGHT-OF-WAY.....	- 42 -
8.0	PERMITTING	- 43 -
9.0	COST ESTIMATE	- 45 -
10.0	RECOMMENDATIONS AND CONCLUSIONS	- 50 -
11.0	REFERENCES	- 52 -



APPENDICES

APPENDIX A HYDROLOGIC PARAMETERS AND ANALYSIS

A.1 **Modified MPU 2008 HEC-1 Model**

- A.1.1 Standard Form 4
- A.1.2 Curve Number Calculations
- A.1.3 Intersection Flow Split Calculations
- A.1.4 Modified MPU 2008 HEC-1 Model – SDN3 Series A Model

APPENDIX B HYDRAULIC DESIGN AND ANALYSIS

B.1 **Main Storm Drain**

- B.1.1 Normal Depth Calculations
- B.1.2 Main Storm Drain WSPG Model ($n = 0.013$)
- B.1.3 Main Storm Drain WSPG Model ($n = 0.015$)

B.2 **Fort Apache Collection System**

- B.2.1 Street Capacity Calculations
- B.2.2 Lateral Calculations

B.3 **Severence Lane Collection System**

- B.3.1 Street Capacity Calculations
- B.3.2 Severence Lateral WSPG Model
- B.3.3 Lateral Calculations

B.4 **Deer Springs Collection System**

- B.4.1 Street Capacity Calculations
- B.4.2 Deer Springs Lateral WSPG Model
- B.4.3 Lateral Calculations

B.5 **Echelon Point Collection System**

- B.5.1 Street Capacity Calculations
- B.5.2 Echelon Point Lateral WSPG Model
- B.5.3 Lateral Calculations



APPENDIX C 90% DESIGN PLANS

APPENDIX D RECORD OF SURVEY PLANS

APPENDIX E DATA CD

- Final Design Report (PDF)
- 90% Design Plans (24x36 and 11x17 PDFs)
- Hydrologic Design Files
 - Standard Form 4 (Excel)
 - Curve Number Calculations (Excel)
 - Flow Split Calculations (Excel)
 - HEC-1 Input and Output files
- Hydraulic Design Files
 - Street Capacity Calculations (FlowMaster)
 - WSPG Input and Output files
 - Drop Inlet Depth Calculations (Excel)
 - Drop Inlet Capacity Calculations (FlowMaster)
 - Pipe Capacity Calculations (FlowMaster)
- Cost Estimate (Excel)



LIST OF FIGURES

Figure 1.1 - Project Location Map	- 2 -
Figure 2.1 - 2008 MPU Regional Facilities - F Map 13.....	- 5 -
Figure 2.2 - 2008 MPU Regional Facilities - F Table 13.....	- 6 -
Figure 2.3 - 2008 MPU Hydrologic Summary - H Map 13	- 7 -
Figure 2.4 - FEMA Floodplain Map	- 8 -
Figure 4.1 - Future Conditions Hydrology.....	- 17 -
Figure 5.1 - Storm Drain Layout	- 19 -
Figure 5.2 - Fort Apache Collection System.....	- 28 -
Figure 5.3 - Fort Apache Collection System.....	- 29 -
Figure 5.4 - Fort Apache Collection System.....	- 30 -
Figure 5.5 - Fort Apache Collection System.....	- 31 -
Figure 5.6 - Fort Apache Collection System.....	- 32 -
Figure 5.7 - Fort Apache Collection System.....	- 33 -
Figure 5.8 - Severence Lateral System	- 35 -
Figure 5.9 - Deer Springs Lateral System	- 37 -
Figure 5.10 - Echelon Point Lateral System	- 39 -

LIST OF TABLES

Table 3.1 - Conformance with CCRFCD Design Criteria.....	- 9 -
Table 4.1 - Summary of Flows - Conveyance Facilities.....	- 15 -
Table 4.2 - Summary of Detention Basin Stages	- 16 -
Table 5.1 - Alternative 1 Cost Estimate	- 20 -
Table 5.2 - Alternative 2 Cost Estimate	- 20 -
Table 5.3 - Manning's 'n' Values used in WSPG Models.....	- 22 -
Table 5.4 - Street Capacity Results.....	- 25 -
Table 6.1 - Main Storm Drain Utility Conflicts.....	- 41 -
Table 8.1 - Permit Matrix	- 44 -
Table 9.1 - Construction Cost Estimate.....	- 46 -



1.0 INTRODUCTION

1.1 Project Overview

The Rancho-Fort Apache Storm Drain (FASD) is a proposed flood control conveyance facility located in the City of Las Vegas (see Figure 1.1). The project will construct a 12 ft x 6 ft reinforced concrete box (RCB) under Fort Apache Road from Elkhorn Road to the CC 215 Beltway. The project includes approximately 1 mile of 12 ft x 6 ft RCB under Fort Apache Road between Elkhorn Road and the Clark County 215 (CC 215) Beltway.

Two major lateral storm drains are proposed to connect to the FASD:

- 1) Deer Springs Way Lateral consisting of a 48-inch reinforced concrete pipe (RCP) at the upstream end and 4 ft x 4 ft RCB at the downstream end.
- 2) Echelon Point Drive Lateral consisting of a 24-inch RCP and 36-inch RCP at the upstream and downstream ends, respectively.

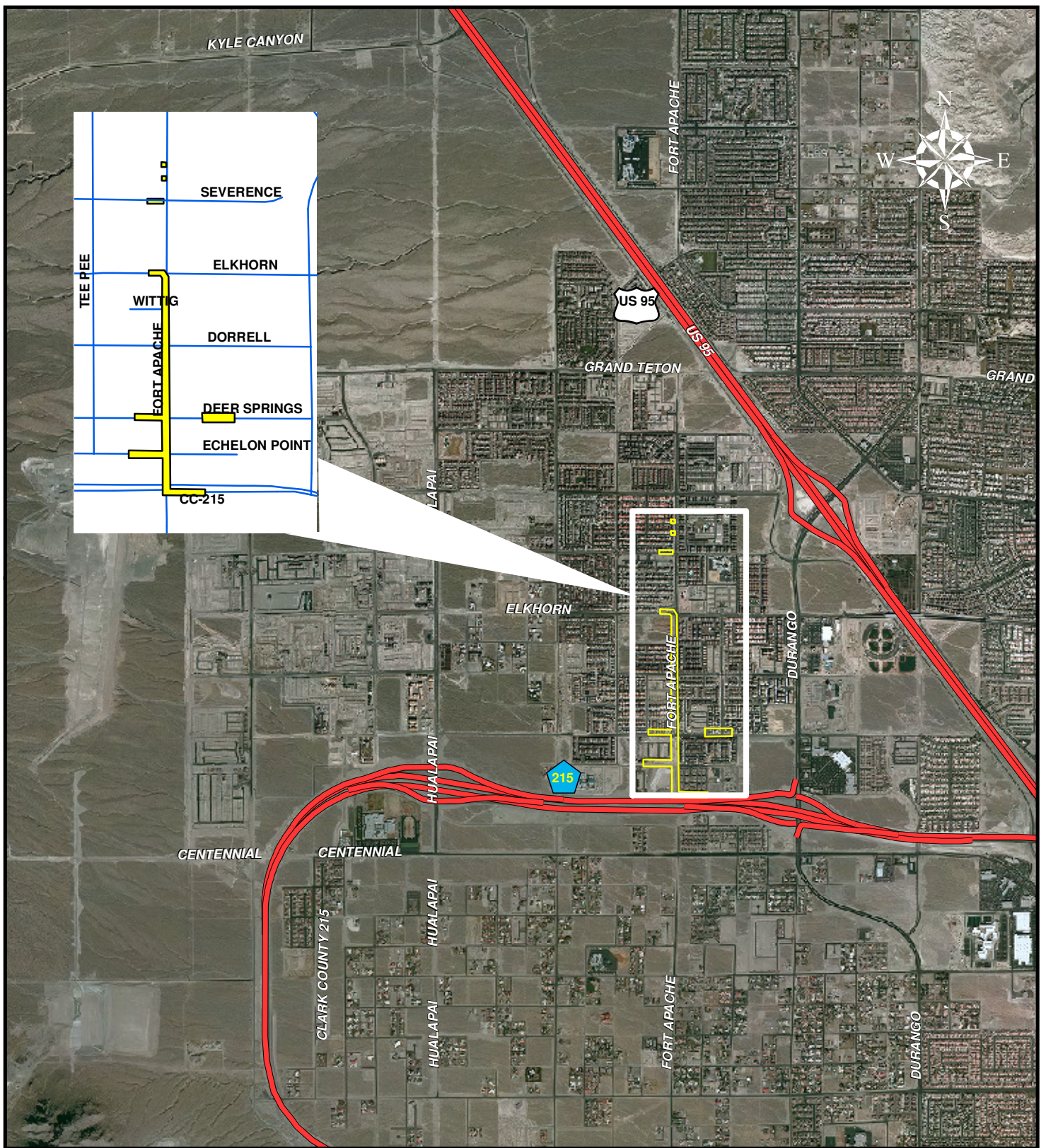
A separate lateral storm drain is proposed on Severence Lane. The Severence Lane Lateral consists of an 18-inch RCP and a 48-inch RCP at the upstream and downstream ends, respectively, and will connect to the existing 60-inch RCP in Fort Apache Road.

At CC 215, the 12 ft x 6 ft RCB turns east and continues within the CC 215 Right-of-Way. The 12 ft x 6 ft RCB will replace an existing riprap channel and connect to an existing concrete channel along the north side of the CC 215.

This project also includes utility relocations and pavement replacement as necessary for the installation of the storm drain facilities.

As the prime engineering consultant for the design of the FASD project, LBG was responsible for project management and preparation of design reports and construction documents. Subconsultants in the fields of geotechnical engineering, subsurface utility engineering, and surveying assisted LBG. Converse Consultants was responsible for the geotechnical exploration and report; Cardno TBE was responsible for the utility designating and potholing; and Tri State Surveying, Ltd. conducted the survey and right-of-way mapping.





Rancho - Fort Apache Storm Drain Project Location Map



The Louis Berger Group, Inc.

Figure 1.1



City of Las Vegas
Department of Public Works

1.2 Report Organization

This Final Design Report (FDR) is a comprehensive document presenting alternatives considered as well as details of the final design alternative.

Three reports were prepared by LBG as part of the FASD design:

- The first report was the Preliminary Design Report prepared as part of the 30% design submittal.
- The second report was a Draft of the Final Design Report prepared as part of the 70% design submittal.
- This third and Final Design Report is a comprehensive document containing all information from the previous reports as well as input from the City and CCRFCD.

This report is organized as follows:

- Section 1 - general project background
- Section 2 - previous studies related to the project area
- Section 3 - design criteria
- Section 4 - hydrologic analysis
- Section 5 - hydraulic design and alternatives
- Section 6 - utility coordination and relocations
- Section 7 - right of way mapping and required easements or acquisitions
- Section 8 - permits required for the project
- Section 9 - cost estimate
- Section 10 - conclusions
- Section 11 - references



2.0 PREVIOUS STUDIES

This section summarizes the previous studies that have been reviewed and have provided beneficial information to the FASD Project.

2.1 Las Vegas Valley Flood Control Facilities Master Plan Update

In 1985, the Nevada Legislature passed legislation allowing local entities the opportunity to create the Clark County Regional Flood Control District (CCRFCD). The CCRFCD is responsible for developing and implementing a comprehensive flood control master plan to alleviate flooding. In 1986, the original flood control master plan was developed in accordance with Nevada state law that covered the entire CCRFCD service area, Clark County. The Master Plan has been updated several times since, with the most recent update occurring in 2008. The 2008 Las Vegas Valley Master Plan Update (MPU) includes information on existing and planned flood control facilities within the entire valley.

Figure 2.1 shows the existing and proposed MPU flood control facilities in the project area. Facilities that will be constructed as part of this project include RCHB 0227, RCHB 0250 and a portion of RCHB 0295 which are described on Figure 2.2 as 11 ft x 8 ft RCB and 7 ft x 6 ft RCB.

Figure 2.3 shows the basin boundaries and land use utilized in the 2008 MPU hydrologic modeling. The 2008 MPU hydrologic modeling was used as the basis for the hydrologic analysis in this report.

2.2 FEMA Flood Insurance Rate Map

The Federal Emergency Management Agency (FEMA) publishes Flood Insurance Rate Maps (FIRM) showing areas subject to inundation during the 100-year flood event. Figure 2.4 is a reproduction of the FIRM for Clark County, Nevada and Incorporated Areas (Community 320003) Panel 1745, effective September 27, 2002. The project is located in an area designated as Zone X which is defined by FEMA as an area outside of the 0.2% annual chance floodplain (500-year floodplain).



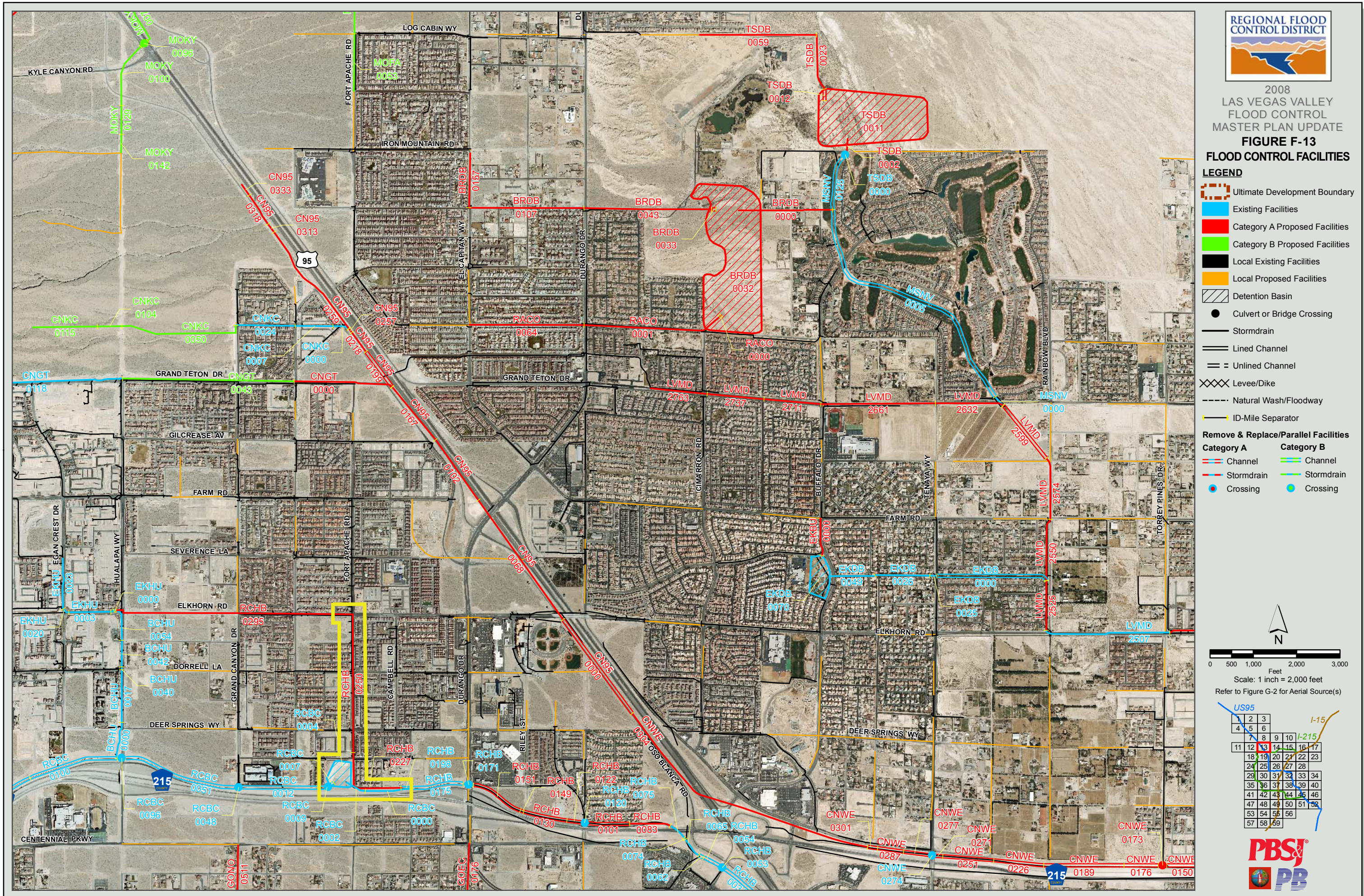


Figure 2.1

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
BCHU		BELTWAY CHANNEL - HUALAPAI						
0000	E	12' X 5' RCAP	853	501	CBA3-C	WEST3	0.84	1.11
0017	E	8' X 5' RCAP	1216	501	CBA3-C	WEST3	0.84	1.33
0040	E	66" RCP	60	222	DNW26-C	WEST3	0.51	1.04
0042	E	60" RCP	615	222	DNW26-C	WEST3	0.51	1.42
0054	E	54" RCP	770	222	DNW26-C	WEST3	0.51	1.23
BRDB		BRENT DRAINAGE SYSTEM						
0000	P3	36" RCP with 18" Orifice Plate	2170	37	BRDB	WEST3	2.48	0.40
0031	P3	45,080 cfs PMF Spillway		45080	CBRDB	WEST3	2.48	
0032	P3	450 ac-ft South Environmental Enhancement Area		1902	CBRDB	WEST3	2.48	
0033	P3	Energy Dissipator	100	957	CNW113-C	WEST3	1.58	
0043	P1	8' X 6' RCB	2920	957	CNW113-C	WEST3	1.58	2.10
0107	P1	8' X 6' RCB	2660	957	CNW113-C	WEST3	1.58	2.40
0157	P1	12' X 6' RCB	1260	741	CNW96-C	WEST3	0.95	0.25
CN95		CENTENNIAL PKWY CHANNEL WEST / U.S 95 BRANCH						
0000	P2	Conc Chnl 22"W 10"D 0:1 SS	2690	3340	CNWBB3-C	WEST3	3.36	2.17
0068	P1	3: 8' X 7" RCB	3380	3216	CNW103-C	WEST3	3.05	2.12
0102	P1	3: 8' X 6' RCB	1710	2888	2CNW89-C	WEST3	2.66	2.09
0167	P1	2: 10' X 6' RCB	1580	2160	2CNW71-E	WEST3	1.64	1.50
0199	P3	Conc Chnl 15"W 11"D 0:1 SS	1015	1609	2CNW72-C	WEST3	1.17	0.82
0218	P3	16" X 8' RCB	556	1609	2CNW72-C	WEST3	1.17	0.77
0257	P3	Transition Structure	100	1609	2CNW72-C	WEST3	1.17	0.77
0259	P3	16" X 8' RCB	2848	674	CNW74-C	WEST3	0.45	2.06
0313	P3	Transition Structure	240	674	CNW74-C	WEST3	0.45	1.50
0318	P3	14' X 6' RCB	797	333	NW62-S	WEST3	0.21	1.47
0333	P3	12' X 6' RCB	300	333	NW62-S	WEST3	0.21	5.50
CNGT		CENTENNIAL PKWY CHANNEL WEST / GRAND TETON BRANCH						
0000	P3	10' X 5' RCB	2290	600	CNW71-E	WEST3	0.47	2.63
0043	P0	6' X 6' RCB	3980	600	CNW71-E	WEST3	0.47	3.00
0118	E	6' X 5' RCAP	5472	363	KYLEDET*	KYLEDB	57.73	3.72
CNKC		CENTENNIAL PKWY CHANNEL WEST / KYLE CANYON BRANCH						
0000	E	12' X 4' RCB	377	999	CNW72-C	WEST3	0.71	4.58
0007	E	10' X 5' RCB	874	999	CNW72-C	WEST3	0.71	3.28
0024	E	8' X 5' RCB	1385	999	CNW72-C	WEST3	0.71	2.40
0050	P0	6' X 6' RCB	2830	999	CNW72-C	WEST3	0.71	3.00
0104	P0	6' X 5' RCB	565	452	NW45-S	WEST3	0.27	3.00
0115	P0	72" RCP	1513	452	NW45-S	WEST3	0.27	3.00
CNWE		CENTENNIAL PKWY CHANNEL WEST						
0150	P2	Conc Chnl 42"W 10"D 0:1 SS	720	4233	CNW3B3-C	WEST3	5.64	0.40
0173	P2	42' X 10' RCBC @ Torrey Pines	190	4233	CNW3B3-C	WEST3	5.64	0.40
0176	P2	Conc Chnl 32"W 12"D 0:1 SS	795	4233	CNW3B3-C	WEST3	5.64	0.40
0189	P2	Conc Chnl 32"W 10"D 0:1 SS	1845	4067	CNW2D4-C	WEST3	5.15	0.54
0226	P2	Conc Chnl 12"W 12"D 2:1 SS	1165	4067	CNW2D4-C	WEST3	5.15	1.00
0251	P2	Conc Chnl 12"W 12"D 2:1 SS	1135	3951	CNW2D3-C	WEST3	4.65	0.59
0271	P2	Conc Chnl 32"W 10"D 0:1 SS	185	3951	CNW2D3-C	WEST3	4.65	0.59
0274	E	32' X 10' RCBC @ Tenaya	130	3951	CNW2D3-C	WEST3	4.65	0.45
0277	P2	Conc Chnl 13"W 10"D 2:1 SS	590	3951	CNW2D3-C	WEST3	4.65	0.45
0287	P2	Conc Chnl 13"W 10"D 2:1 SS	605	3593	CNW2B2-C	WEST3	3.84	1.19
0301	P2	Conc Chnl 32"W 10"D 0:1 SS	235	3593	CNW2B2-C	WEST3	3.84	1.19
0304	P2	32' X 10' RCB	6510	3593	CNW2B2-C	WEST3	3.84	1.75
EKBU		ELKHORN SPRINGS AND BUFFALO						
0000	P1	78" RCP	860	375	NW134-C	WEST3	0.46	1.00
EKDB		ELKHORN SPRINGS DETENTION BASIN						
0000	E	Grass Chnl 15"W 5.8"D 3.5:1 SS	2575	238	CNW150-C	WEST3	1.41	0.39
0025	E	4' X 3' RCB	160	120	ELKBASIN	WEST3	0.84	0.50
0026	E	48" RCP	1270	120	ELKBASIN	WEST3	0.84	1.23
0049	E	60" RCP	1095	120	ELKBASIN	WEST3	0.84	0.13
0070	E	48 ac-ft Elkhorn Springs Detention Basin		629	CNW133-C	WEST3	0.84	
EKHU		ELKHORN AND HUALAPAI						
0000	E	6' X 5' RCB Overflow Structure	48	638	CNW26-C	WEST3	0.51	0.91
0001	E	6' X 5' RCAP	72	638	CNW26-C	WEST3	0.51	0.91
ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
EKHU		ELKHORN AND HUALAPAI						
0003	E	6' X 4' RCAP	980	638	CNW26-C	WEST3	0.51	3.61
0020	E	6' X 5' RCAP	150	638	CNW26-C	WEST3	0.51	3.61
0023	E	8' X 5' RCAP	1200	638	CNW26-C	WEST3	0.51	0.90
GOEC		GOWAN NORTH - EL CAPITAN BRANCH						
0176	P1	78" RCP	1320	363	CCPFR-C	ALLGOW3	0.46	1.15
GONO		GOWAN NORTH SYSTEM						
0511	P1	7' X 6' RCB	1320	546	CCPHW-C	ALLGOW3	0.60	1.14
LVMD		LAS VEGAS WASH - MIDDLE						
2490	P2	2: 13' X 7" RCB	2555	2278	CNW168-C	CWEST3	4.69	0.40
2507	E	2: 13' X 9" RCB	2831	2278	CNW168-C	CWEST3	4.69	0.36
2525	P1	21' X 6' RCB	1140	1913	CNW159-C	CWEST3	3.91	0.40
2550	P1	21' X 6' RCB	1445	1664	CD161-C	CWEST3	3.41	0.40
2574	P1	21' X 6' RCB	1430	1664	CD161-C	CWEST3	3.41	0.60
2599	P1	Conc Chnl 30"W 5"D 2:1 SS	1577	1585	CNW162-C	CWEST3	3.08	0.40
2632	P1	13' X 5' RCB	1580	968	CNW138-C	WEST3	1.16	0.59
2661	P1	11' X 5' RCB	2640	968	CNW138-C	WEST3	1.16	1.00
2711	P1	8' X 5' RCB	1320	968	CNW138-C	WEST3	1.16	1.80
2737	P1	8' X 5' RCB	1320	818	CNW139-C	WEST3	0.93	1.81
2763	P1	78" RCP	1320	818	CNW139-C	WEST3	0.93	2.40
MOFA		MOCCASIN - FORT APACHE						
0024	P0	12' X 6' RCB	1520	394	DNW100-W	LOWER3	0.46	0.25
0053	P0	10' X 6' RCB	1345	258	DNW78-C	LOWER3	0.24	0.25
MOKY		MOCCASIN - KYLE CANYON BRANCH						
0078	P0	2: 13' X 7" RCB	965	1205	CNW50-E	LOWER3	1.06	0.40
0096	P0	2: 13' X 7" RCBC @ US 95	210	1066	CNW35-C	LOWER3	0.89	1.70
0100	P0	2: 13' X 7" RCB	1515	1066	CNW35-C	LOWER3	0.89	0.40
0129	P0	2: 11' X 7" RCB	675	779	CNW33-C	LOWER3	0.64	0.40
0142	P0	2: 9' X 7" RCB	430	779	CNW33-C	LOWER3	0.64	0.40
MSNV		MOUNTAIN SPA/VISTA RANCH						
0000	E	6: 12' X 5' RCBC @ Grand Teton	273	679	CNW163-C	CWEST3	1.67	0.40
0005	E	Grass Chnl 100"W 4.5"D 10:1 SS	6325	679	CNW163-C	CWEST3	1.67	0.40
0125	E	Grass Chnl 100"W 4.5"D 10:1 SS	1300	116	CNW147E	WEST3	1.54	0.40
RACO		RACEL STREET COLLECTOR						
0000	P3	96" RCP Baffled Energy Dissipator	54	497	CNW111S	WEST3	0.55	4.20
0001	P3	78" RCP	3245	497	CNW111S	WEST3	0.55	2.46
0064	P3	78" RCP	2650	423	DNW111S	WEST3	0.44	2.09
RCBC		RANCHO ROAD SYSTEM - BELTWAY CHANNEL						
0000	E	6' X 5' RCB	1062	222	FADB	WEST3	1.60	1.04
0002	E	54" RCP Outlet with 41" Orifice	503	222	FADB	WEST3	1.60	2.38
0003	E	2,341 cfs PMF Spillway		2341	FADBIN	WEST3	1.60	
0004	E	76 ac-ft Fort Apache Detention Basin		1255	FADBIN	WEST3	1.60	
0007	E	Energy Dissipator	100	1255	FADBIN	WEST3	1.60	
0009	E	12' X 6' RCBC @ Fort Apache Detention Basin	133	1255	FADBIN	WEST3	1.60	1.79
0012	E	Conc Chnl 12"W 6'-7"D 0:1 SS	1937	1255	FADBIN	WEST3	1.60	3.15
0048	E	12' X 6' RCBC @ Grand Canyon	140	1040	CMNA1	WEST3	1.32	3.15
0051	E	Conc Chnl 12"W 6'-8"D 0:1 SS	2660	1040	CMNA1	WEST3	1.32	3.44
0096	E	1: 10' X 6' and 1: 6' X 6' RCBC @ Hualapai Way	190	1040	CMNA1	WEST3	1.32	1.93
0100	E	Conc Chnl 12"W 5.5"D 0:1 SS	2085	598	CDMNA1	WEST3	0.48	2.88
0140	E	Conc Chnl 10"W 5"D 0:1 SS	2155	598	CDMNA1	WEST3	0.48	1.65
RCHB		RANCHO ROAD SYSTEM - BELTWAY						
0034	E	Conc Chnl 21"W 8"D 0:1 SS	1000	2631	CNW1C-W	WEST3	4.68	1.19
0053	E	2: 12' X 8' RCBC @ South Ramp Connector	85	2304	CDW1C1	WEST3	4.31	1.40
0054	E	Conc Chnl 21"W 8"D 0:1 SS	432	2304	CDW1C1	WEST3	4.31	1.51
0062	E	Transition Structure	130	2304	CDW1C1	WEST3	4.31	1.51
0065	E	24' X 7" RCB	480	2304	CDW1C1	WEST3	4.31	0.30
0074	E	24' X 6' RCB	50	2226	CNWBC6-C	WEST3	4.17	0.30
0075	E	20' X 6' RCBC @ Beltway	428	2226	CNWBC6-C	WEST3	4.17	2.81
0083	P2	20' X 6' RCB	950	2226	CNWBC6-C	WEST3	4.17	2.49
0101	P2	Conc Chnl 20"W 7"D 0:1 SS	980	2226	CNWBC6-C	WEST3	4.17	2.38
0120	E	20' X 6' RCBC @ Grand Montecito	120	2226	CNWBC6-C	WEST3	4.17	1.00
ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
RCHB		RANCHO ROAD SYSTEM - BELTWAY						
0122	P2	Conc Chnl 16'-20"W 6"D 0:1 SS	350	2226	CNWBC6-C	WEST3	4.17	1.84
0130	P2	Conc Chnl 16"W 6"D 0:1 SS	1012	2226	CNWBC6-C	WEST3	4.17	2.67
0149	P2	Conc Chnl 16"W 6'-7"D 0:1 SS	87	1888	CNWBC3	WEST3	3.75	2.27
0151	P2	Conc Chnl 16"W 7"D 0:1 SS	1255	1888	CNWBC3	WEST3	3.75	2.65
0171	E	16' X 6' RCBC @ El Capitan Way	234	1888	CNWBC3	WEST3	3.75	1.75
0175	E	Conc Chnl 14"W 7"D 0:1 SS	1220	1888	CNWBC3	WEST3	3.75	2.93
0198	E	Conc Chnl 14"W 7"D 0:1 SS	225	1402	CNWBA6-C	WEST3	3.61	2.93
0227	P1	11' X 8' RCB	1885	1402	CNWBA6-C	WEST3	3.61	2.17
0250	P1	11' X 8' RCB	3200	1402	CNWBA6-C	WEST3	3.61	1.06
0295	P1	7' X 6' RCB	5525	973	CNW66-C	WEST3	1.75	3.30
TSDB		TULE SPRINGS DRAINAGE SYSTEM						
0000	E	2: 10' X 4' RCBC @ Echo Grande	100	26	TULEDB	WEST3	1.35	1.04
0002	P3	36" RCP with 22" Orifice Plate	320	26	TULEDB	WEST3	1.35	0.33
0010	P3	14,013 cfs PMF Spillway		14013	CTULEDB	WEST3	1.35	
0011	P3	117 ac-ft North Environmental Enhancement Area		804	CTULEDB	WEST3	1.35	
0012	P3	Energy Dissipator	260	376	CNW148-C	WEST3	0.52	
0023	P1	84" RCP	1320	376	CNW148-C	WEST3	0.52	0.80
0059	P1	78" RCP	2640	376	CNW148-C	WEST3	0.52	1.03

* The HEC-1 node shown identifies the controlling concentration point for the associated facility and is located upstream of this facility due to decreasing peak flow with increasing tributary area caused by storm distribution transitions, depth area reduction factors, or attenuation of flow from routing.

** As-built or design slopes were used when available. All other slopes are based on existing topography. The user should verify the facility slope listed prior to performing any facility specific analysis.

▲ For parallel facilities, the existing facility flow equals its normal depth capacity, and the proposed parallel facility flow equals the remaining flow (i.e., HEC-1 Node flow = existing facility normal depth capacity + proposed parallel facility flow).



2008 LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

FACILITY INVENTORY
FIGURE F - 13

L
E
G
E
N
D

ID (Facility Identifier)

Parent Stream Name

Stream Name

River Mile

Distance Above Confluence
with Parent Stream (Miles)

Miles in Hundredths

AA BB

00 00

Existing Facility..... E

Proposed or Modified Facility... .. P

Contingency Level

Category B..... P0

Master Plan..... P1

Preliminary Design..... P2

Design..... P3

Bottom Width..... W

Depth..... D

Side Slope, H:V... .. SS

Construction Features

Cast in Place Concrete Pipe..... CIPCP

Corrugated Metal Arch Pipe Culvert..... CMAP

Corrugated Metal Pipe Culvert..... CMPC

High Density Polyethylene..... HDPE

Horizontal Elliptical Reinforced Concrete Pipe..... HERCP

Reinforced Concrete Arch Pipe..... RCAP

Reinforced Concrete Arch Culvert..... RCAC

Reinforced Concrete Box..... RCB

Reinforced Concrete Box Culvert..... RCBC

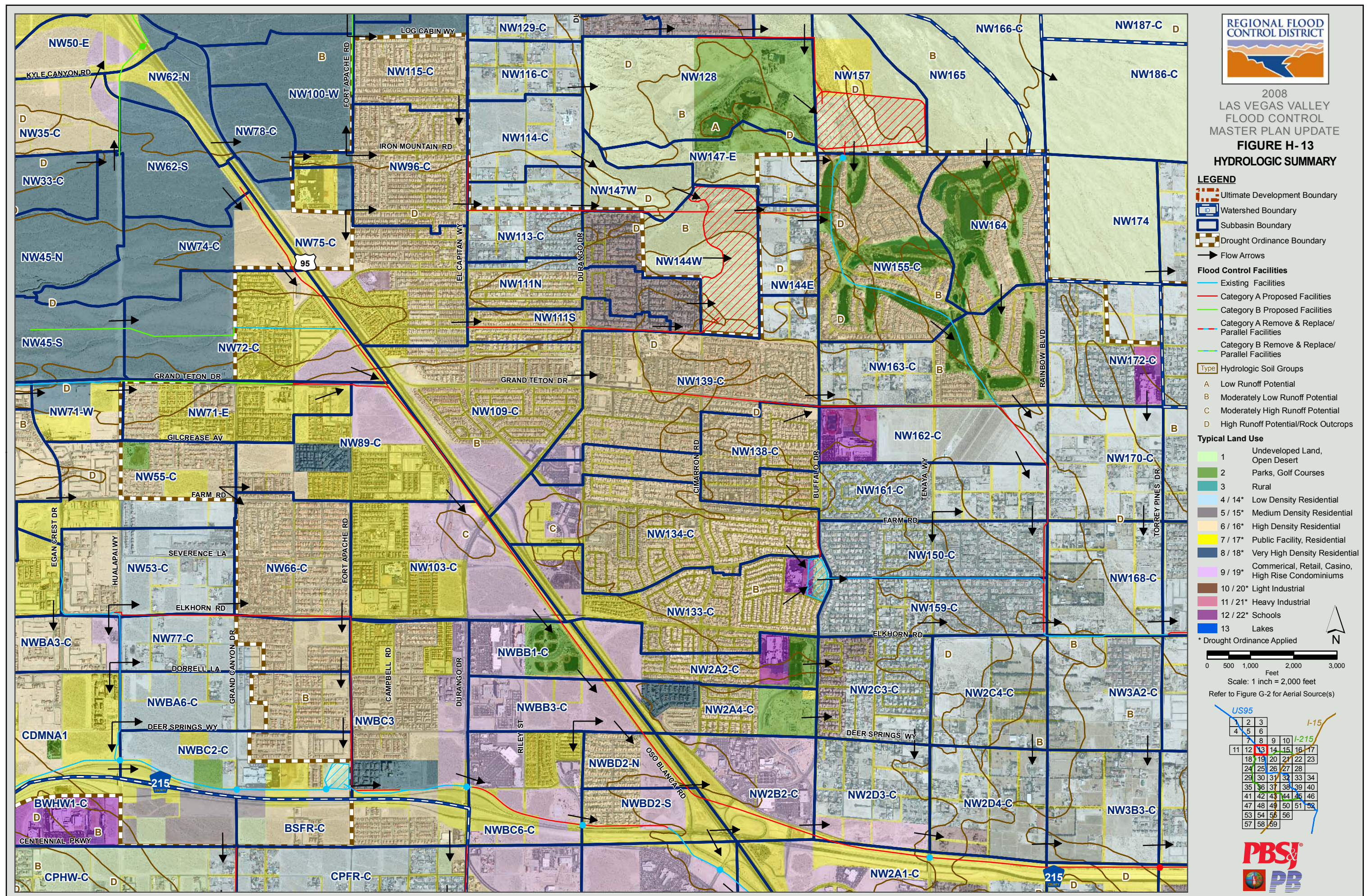
Reinforced Concrete Pipe..... RCP

Reinforced Concrete Pipe Culvert..... RCPC

Storm Sewer Pipe..... SSP



Figure 2.2



3.0 DESIGN CRITERIA

3.1 General Criteria

The project was designed in conformance with the applicable criteria established by CCRFCD in 1999 and documented in the Hydrologic Criteria and Drainage Design Manual (Manual). The design criteria related to the proposed project are summarized in Table 3.1.

Table 3.1 - Conformance with CCRFCD Design Criteria

Topic	Manual Section	Manual Page	Comments
Design Storm	304.2	315	The storm drains were designed to collect and convey the major (100-year frequency) storm event.
Rainfall	500	501 - 506	Rainfall depth, duration and distribution were applied as outlined in Section 500.
Time of Concentration and Runoff Curve Number	601 and 602	603 – 610	Time of concentration and precipitation losses were developed using procedures outlined in these sections as applicable to the SCS Unit Hydrograph method.
Hydrology	600	610 – 625	Rainfall-runoff modeling was performed primarily using HEC-1 Flood Hydrograph Package SCS Unit Hydrograph procedure. Methods and equations used were consistent with the Manual.
Maximum Permissible Velocities	703	711	Maximum permissible channel velocities from Table 703 were adhered to.
Expanding Transitions	706	772	The length of the expanding transition exceeds the minimum required by Equation 745 in the Manual.
Storm Drain Design Parameters	802	804 - 809	Storm drain design parameters were consistent with the requirements of the manual.
Storm Drain Hydraulics	804	811	Storm drain hydraulic grade line (HGL) was evaluated using Water Surface Pressure Gradient (WSPG) hydraulic model.
Storm Inlet Hydraulics	805	815	Drop inlet capacities will be determined using the Bentley's FlowMaster V8i software program. The program utilizes the HEC-22 procedures for calculating the inlet capacity.
Storm Inlet Hydraulics	1602	1607	A 50-percent clogging factor was applied to all drop inlets within the City of Las Vegas's jurisdiction.



4.0 HYDROLOGIC METHODS AND ANALYSIS

The 2008 MPU was used as a base for hydrologic modeling. LBG subdivided the 2008 MPU drainage basins to create more concentration points as necessary to quantify flows for the FASD detailed design. This section summarizes the design storm, model, modeling parameters, and revisions to the 2008 MPU model made by LBG.

4.1 Design Storm

The 100-year, 6-hour storm was used as the basis of design for all facilities evaluated in the study.

4.2 Rainfall-Runoff Model

The 2008 MPU employed the SCS unit hydrograph option in the U.S. Army Corps of Engineers' Flood Hydrograph HEC-1 computer software to develop the 100-year peak flows. The model is based on future conditions, which assumes full development of the upstream drainage area and construction of all MPU drainage facilities.

4.3 Modeling Parameters

Curve Numbers

Runoff curve numbers developed in the 2008 MPU (given on the LS line of the HEC-1 model) were not revised in this study.

Rainfall Distribution

In the 2008 MPU, a SDN3 rainfall distribution was used because the FASD watershed is less than 8 square miles (2.7 square miles at the project's downstream end). Total rainfall developed in the 2008 MPU (given on the PB line of the HEC-1 model) was not revised in this study.

Time of Concentration and Lag Time

Time of concentration and lag time were calculated for all subdivided drainage basins using Standard Form 4 in Appendix A.1.1. TLAG values are input into the HEC-1 model on the UD line.



4.4 Flow Patterns

Figure 4.1 shows the drainage basin boundaries, topographic contours, HEC-1 flow rates, concentration points, flow splits, 100-year flow rates, existing and proposed 2008 MPU drainage. The colored subbasins drain to Fort Apache Road. They are color coded according to the reach along Fort Apache Road to which they drain.

There is an existing regional storm drain system along Hualapai Way that diverts all flow to an existing concrete channel along the CC 215 Beltway. In addition, there are existing local storm drains along Fort Apache Road, Severence Lane, Elkhorn Road, Dorrell Lane, Deer Springs Way, Echelon Point Drive and Grand Canyon Drive. This project will replace the local storm drain along Fort Apache Road between Elkhorn Road and CC215, and upsize portions of the local storm drains at Severence Lane, Dorrell Lane, Deer Springs Way, and Echelon Point Drive.

4.4.1 Master Plan Amendment Recommendation

A review of the 2008 MPU hydrology for the Fort Apache Storm Drain and surrounding area indicated that the 100-year flow along Farm Road warranted the addition of a new proposed MPU facility. The proposed facility would extend along Farm Road between Hualapai Way to US 95. The advantage to adding a regional storm drain along Farm Road is that it would cutoff flow that would otherwise turn south toward the FASD.

Of particular concern was surface flow that travels east in Severence Lane and crosses over Fort Apache Road. A facility in Farm Road would reduce flow in the existing local storm drain under Fort Apache Road between Farm Road and Elkhorn Road and provide the needed capacity to capture flow in Severence Lane.

At the direction of the City and CCRFCD, it was assumed that the MPU would be amended to include the Farm Road facility. A new storm drain lateral was designed as part of the FASD project to intercept flow in Severence Lane and connect to the existing local storm drain under Fort Apache Road. The Severence Lane lateral facility will collect flow that currently continues east across Fort Apache Road to the low point in Osa Blanca Road. Additional drop inlets were also included along Fort Apache Road between Farm Road and Elkhorn Road.



4.4.2 Revisions to the 2008 MPU HEC-1 Model

The HEC-1 model developed in this report was based on the 2008 MPU and the recommended revisions discussed in Section 4.41. Several revisions were made to the MPU HEC-1 model for the purposes of this report in order to quantify flows in the east-west streets for the lateral storm drains and FASD drop inlet designs. The following revisions were made (see Figure 4.1):

- Basin NW53-C was divided into subbasins NW53-CA and NW53-CB.
- Basin NW66-C was divided into subbasins NW66-CA through NW66-CG, NW66-CJ and NW66-CI. Subbasin NW66-CJ was further subdivided into subbasins NW66-CI1 through NW66-CI3. Subbasin NW66-CJ was further subdivided into subbasins NW66-CJ1 through NW66-CJ6.
- Basin NW77-C was divided into subbasins NW77-CA through NW77-CH.
- Basin NWBA6-C was divided into subbasins NWBA6-CA through NWBA6-CH.
- Basin NWBC2-C was divided into subbasins NWBC2-CA and NWBC2-D.
- Basin NWBC3 was divided into subbasins NWBC3A and NWBC3B.
- Street flow split rating curves were added at the intersections of:
 - 1) Dorrell Lane and Tee Pee Lane
 - 2) Deer Springs Way and Grand Canyon Drive
 - 3) Deer Springs Way and Tee Pee Lane; and,
 - 4) Severence Lane and Grand Canyon Drive
- A diversion was added to divert flow into the Dorrell Lane storm drain drop inlet at Grand Canyon Drive.
- The flow split at the intersection of Fort Apache Road and Farm Road associated with the pipe flow contained in the existing 42" RCP was removed.



- With the exception of the Elkhorn Road 7 ft x 6 ft RCB, Hualapai Way was assumed to be a cutoff in the future. Flow splits to the east were eliminated at the intersection of Hualapai Way with Dorrell Lane and Deer Springs Way.
- The flow split rating curve at Hualapai Way and Elkhorn Road was revised to divert the first 631 cfs (bottom portion of the hydrograph) east within the Elkhorn Road 7 ft x 6 ft RCB. The remaining peak flow of 102 cfs flows south in the Hualapai Way 54" RCP.

The City requested that LBG develop rating curves for the above listed intersections using the method outlined in the Standards Manual for Drainage Design and Flood Plain Management in Tucson, Arizona, also known as the Pima County Method (Tucson, 1990). The equations used to develop the rating curve are described below.

$$Q_L = 0.042 (Q_M^{0.93} W_{SS}^{0.85}) / (S_M^{0.41} W_M^{0.79}) \quad (1.0)$$

where:

Q_L = Lateral Flow into the Side Street (cfs)

Q_M = Main Street Flow Measured Between the Curbs (cfs)

S_M = Longitudinal Slope of the Main Street (ft / ft)

W_M = Width of the Main Street (ft)

W_{SS} = Width of the Side Street (ft)

$$Q_M = Q - (2 Q_{OB}) \quad (2.0)$$

where:

Q = Flow in the Main Street before the Split (cfs)

Q_{OB} = Main Street Overbank flow (cfs)

$$Q_{OB} = V \times A \quad (3.0)$$

where:

V = Average Flow Velocity Flow in the Main Street before the Split (cfs)

A = Overbank Flow Area (sq ft)



$$Q_O = 46.8 Y_O W_{SS} S_s^{0.5} - Q_L \quad (4.0)$$

where:

Q_O = Maximum Overbank Flow Intercepted by the Side Street (cfs)

Y_O = Average Depth of Overbank Flow Intercepted by the Side Street (cfs)

S_s = Longitudinal Slope of the Side Street (ft / ft)

The result of Equation 4.0 is the maximum amount of flow that can be intercepted by the side street. When the result of Equation 4.0 was equal to or larger than Equation 3.0, it was assumed that all of the overbank flow is intercepted by the side street. When the result of Equation 4.0 was negative, it was assumed that no flow was intercepted by the side street.

The predominant flow direction in the study area is from west to east, therefore it was assumed that the east-west streets were the main street, and the north-south streets were the side streets intercepting flow.

The rating curve for the Dorrell Lane storm drain diversion was determined using FlowMaster.

The flow split and FlowMaster diversion calculations are included in Appendix A.1.3 and the HEC-1 input and output are included in Appendix A.1.4. Additionally the HEC-1 input and output files for the Rancho-Fort Apache Storm Drain model and the modified 2008 MPU model are included on the Data CD in Appendix E. Tables 4.1 and 4.2 summarize the conveyance facility flows and detention basins stages in the 2008 MPU model and the Updated HEC-1 model, respectively.



Table 4.1 - Summary of Flows - Conveyance Facilities

ID / River Mile	2008 MPU HEC-1 Node	2008 MPU Flow (cfs)	Updated HEC-1 Node	Updated HEC-1 Flow (cfs)	Difference (cfs)
EKHU 0000 ⁽¹⁾	CNW26-C	638	CNW26-C	638	0
EKHU 0003	CNW26-C	638	CNW26-C	638	0
EKHU 0020	CNW26-C	638	CNW26-C	638	0
BCHU 0000	CBA3-C	501	CBA3-C	500	-1
BCHU 0017	CBA3-C	501	CBA3-C	500	-1
BCHU 0040	DNW26-C	222	DNW26-C	102	-120
BCHU 0042	DNW26-C	222	DNW26-C	102	-120
BCHU 0054	DNW26-C	222	DNW26-C	102	-120
RCBC 0000	FADB	222	FADB	211	-11
RCBC 0002	FADB	222	FADB	211	-11
RCBC 0007	FADBIN	1,255	FADBIN	1,178	-77
RCBC 0009	FADBIN	1,255	FADBIN	1,178	-77
RCBC 0012	FADBIN	1,255	FADBIN	1,178	-77
RCBC 0048	CMNA1	1,040	CMNA1	1,021	-19
RCBC 0051	CMNA1	1,040	CMNA1	1,021	-19
RCBC 0096	CMNA1	1,040	CMNA1	1,021	-19
RCBC 0100	CDMNA1	598	CDMNA1	598	0
RCBC 0140	CDMNA1	598	CDMNA1	598	0
RCHB 0000	CNW1C-W	2,631	CNW1C-W	2,644	13
RCHB 0034	CNW1C-W	2,631	CNW1C-W	2,644	13
RCHB 0053	CDW1C1	2,304	CDW1C1	2,319	15
RCHB 0062	CDW1C1	2,304	CDW1C1	2,319	15
RCHB 0065	CDW1C1	2,304	CDW1C1	2,319	15
RCHB 0074	CNWBC6-C	2,226	CNWBC6-C	2,334	108
RCHB 0075	CNWBC6-C	2,226	CNWBC6-C	2,334	108
RCHB 0083	CNWBC6-C	2,226	CNWBC6-C	2,334	108
RCHB 0101	CNWBC6-C	2,226	CNWBC6-C	2,334	108



ID / River Mile	2008 MPU HEC-1 Node	2008 MPU Flow (cfs)	Updated HEC-1 Node	Updated HEC-1 Flow (cfs)	Difference (cfs)
RCHB 0101	CNWBC6-C	2,226	CNWBC6-C	2,334	108
RCHB 0120	CNWBC6-C	2,226	CNWBC6-C	2,334	108
RCHB 0122	CNWBC6-C	2,226	CNWBC6-C	2,334	108
RCHB 0130	CNWBC6-C	2,226	CNWBC6-C	2,334	108
RCHB 0149	CNWBC3	1,888	CNWBC3	1,873	-15
RCHB 0151	CNWBC3	1,888	CNWBC3	1,873	-15
RCHB 0171	CNWBC3	1,888	CNWBC3	1,873	-15
RCHB 0175	CNWBC3	1,888	CNWBC3	1,897	-15
RCHB 0198	CNWBA6-C	1,402	CPT1A	1,365	-37
RCHB 0227	CNWBA6-C	1,402	BLTWY2	1,471	69
RCHB 0250	CNWBA6-C	1,402	BLTWY2	1,471	69
RCHB 0295	CNW66-C	973	CFTELKS	1000	27
RCHO 0000	RCHODB	161	RCHODB	156	-5

- (1) The overflow structure at EKHU 0000 is connected to RCHB 0295 per the Master Plan Amendment recommendations in Section 4.4.1.

Table 4.2 - Summary of Detention Basin Stages

Detention Basin	HEC-1 Node	2008 MPU Peak Stage (ft)	Updated Peak Stage (ft)	Difference (ft)
Fort Apache Detention Basin	FADB	2634.29	2632.23	-1.96
Rancho Detention Basin	RCHODB	2390.14	2389.04	-1.10



5.0 HYDRAULICS

The hydraulic analyses performed in this study were grouped into two classifications: 1) FASD; and 2) laterals.

The laterals include:

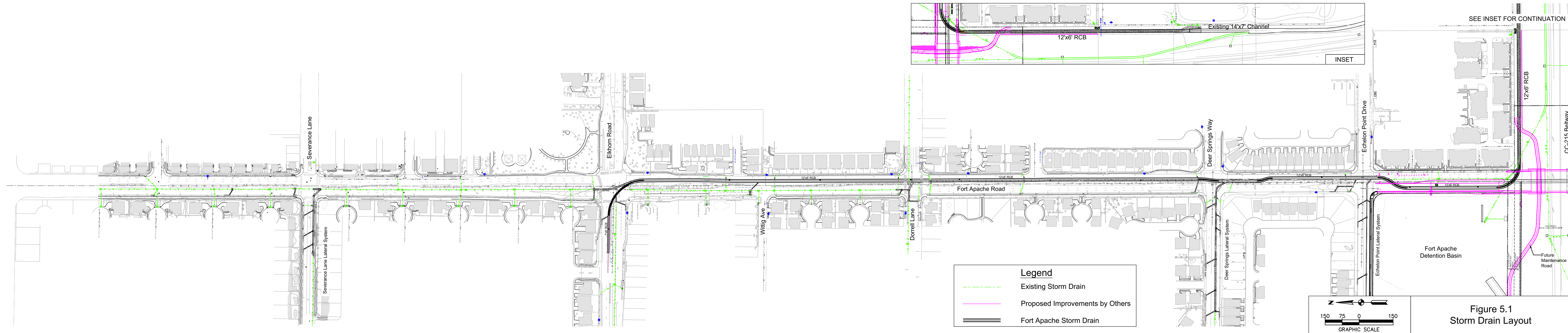
- Severence Lane,
- Deer Springs Way,
- Echelon Point Drive,
- Other miscellaneous inlets along Fort Apache Road.

5.1 Fort Apache Storm Drain and Channel

The FASD storm drain consists of the following facilities from downstream to upstream (see Figure 5.1):

- 14 ft wide, 7 ft deep rectangular channel to 12 ft wide x 6 ft RCB transition
- 12 ft x 6 ft RCB
- 7 ft x 6 ft RCB
- Junction structures at lateral confluences locations





5.1.1 FASD Alternatives

Under Fort Apache Road, the FASD will consist of a 12 ft x 6 ft RCB. Because the storm drain is under a city street, an RCB is appropriate for the design and, therefore, other alternatives were not explored.

During the Preliminary Design, two alternatives were evaluated for the reach along CC 215, two alternatives for the FASD were considered.

Alternative 1 - a 12 ft x 6 ft RCB facility

Alternative 2 - a 12 ft wide x 7 ft deep rectangular channel

The additional height required for the channel alternative is needed for freeboard.

Tables 5.1 and 5.2 present the estimated costs associated with Alternatives 1 and 2.

Table 5.1 - Alternative 1 Cost Estimate

Description	Unit	Quantity	Unit Cost	Cost
12 ft x 6 ft RCB	LF	720	\$1,000.00	\$720,000.00
RCB Manhole	EA	2	\$4,000.00	\$8,000.00
RCB to Channel Transition	LS	1	\$60,000.00	\$60,000.00
Total				\$788,000.00

Table 5.2 - Alternative 2 Cost Estimate

Description	Unit	Quantity	Unit Cost	Cost
Remove ROW Fence	LF	840	\$ 5.00	\$ 4,200.00
12 ft Channel	LF	720	\$ 850.00	\$ 612,000.00
Channel Transition	LS	1	\$ 60,000.00	\$ 60,000.00
2-Cable Fence	LF	720	\$ 40.00	\$ 28,800.00
54-inch Chain Link Fence	LF	720	\$ 50.00	\$ 36,000.00
72-inch Chain Link ROW Fence	LF	840	\$ 25.00	\$ 21,000.00
Total				\$762,000.00

The above estimates show that Alternative 2 has a cost savings of \$26,000 or approximately \$36 per linear foot.



The two alternatives were discussed with the City, CCPW and the CCRFCD and it was determined that Alternative 1 is the preferred alternative. While slightly more expensive, Alternative 1 provides adequate space for the City's future multi-use trail planned along the CC 215 without encroaching into the Control of Access along the CC 215.

5.1.2 FASD Horizontal Layout

At the downstream end, the FASD connects to an existing 14 ft wide x 7 ft deep rectangular channel (MPU facility ID RCHB 0198) and extends west as a 12 ft x 6 ft RCB for 788 feet along the northern ROW for the CC 215. The section of the FASD within the CC 215 ROW is located within Clark County jurisdiction. All other sections of the project are located within the jurisdiction of the City of Las Vegas.

At Fort Apache Road, the storm drain turns northward under the western half of the roadway. The storm drain is located under the western half of Fort Apache Road because: 1) the western half of Fort Apache is currently an unpaved road; and, 2) the storm drain radius of curvature will be larger turning from the west side which is better for hydraulics and constructability.

Just south of the intersection of Fort Apache and Echelon Point, the FASD shifts to the eastern half of Fort Apache Road to minimize conflicts with the existing water, sewer and gas lines on the west side of the street. To the maximum extent feasible, the following separation distances were maintained:

- Waterlines: 10 feet, measured from the outside edge to outside edge.
- Gas lines: 5 feet, measured from the outside edge to outside edge.
- Sewer lines: 10 feet, measured from the outside edge to outside edge.
- Existing Median Islands: 5 feet, measures for the outside edge of the RCB to the existing curb line

The storm drain continues north in the eastern half of Fort Apache Road as a 12 ft x 6 ft RCB. The layout shifts east and west slightly between Echelon Point Road and Deer Springs Way to avoid conflicts with the existing gas line. North of Deer Springs Way, the horizontal layout is fairly straight within the eastern half of Fort Apache Road. Just south of Elkhorn Road, the storm drain turns west and transitions to a 7 ft x 6 ft RCB located in the northern half of Elkhorn Road.



The 7 ft x 6 ft RCB stops just west of the intersection of Fort Apache Road and Elkhorn Road. The extension of the storm drain along Elkhorn Road to Hualapai Way (MPU facility RCHB 0295) will be constructed in the future as a separate project. Until this storm drain extension is constructed, the flow within Elkhorn Road (815 cfs) will bypass the system and continue east.

5.1.3 FASD Hydraulic Modeling

The FASD was modeled using WSPG Water Surface Pressure Gradient program Civil Design Software. Input and parameters used in the models are discussed in the following subsections. The model input and output are provided in Appendices B.1.2 (Manning's 'n' = 0.013) and B.1.3 (Manning's 'n' = 0.015) as well as on the data CD in Appendix E. Results of the hydraulic models are presented in Section 5.1.3.2 of this report.

5.1.3.1 Water Surface Pressure Gradient Model

WSPG uses the standard step method for calculating gradually varied water surface profiles which requires boundary conditions for the computations. One boundary condition is friction. The friction slope is estimated from Manning's equation which estimates losses using based on a roughness coefficient, Manning's 'n'. Table 5.3 lists the Manning's 'n' values used for various materials/linings evaluated in this study.

Table 5.3 - Manning's 'n' Values used in WSPG Models

Material/Lining	Manning's 'n'
Concrete Channel / RCB	0.013 and 0.015
RCP	0.013

The second boundary condition is the water surface elevation at the upstream system headworks (SH) or downstream system outlet (SO). Depending on the flow regime, subcritical or supercritical, the program requires an upstream system headworks (SH) or downstream system outlet (SO) water surface elevation from which to begin the standard step calculations. The SH and SO are calculated externally and input by the user. The SH and SO were set to the normal depth calculated by FlowMaster (see Appendix B.1.1).

5.1.3.2 Results

The WSPG modeling results indicate that the storm drain will function under open channel flow and pressurized conditions. In the pressurized sections, the hydraulic grade line is at least 15 inches below grade.

In the downstream portion of the open channel flow section, station 10+12 to station 28+46, flow velocities are between 25 fps and 30 fps. These velocities are below the maximum permissible mean velocity of 35 feet per second for concrete lining (Table 703 in the Manual). However, the minimum concrete strength for the main storm drain will be increased from 4,500 psi to 6,000 psi to mitigate the high flow velocities in the system.

The WSPG models are included in Appendix B.1.2, and Appendix B.1.3 and on the Data CD in Appendix E.



5.2 Lateral Storm Drains and Inlets

Runoff enters the project area from the west at Severence Lane, Elkhorn Road, Wittig Avenue, Dorrell Lane, Deer Springs Way and Echelon Point Drive as well as from the north in Fort Apache Road. There is an existing storm drain in Fort Apache Road with lateral storm drains to the west. These facilities were not sized to convey 100-year storm flows. Therefore, additional drop inlets and lateral storm drains will be constructed as part to this project to collect surface flows and convey them into the FASD. Analysis of these collection systems was separated into the Fort Apache Collection System, Severence Collection System, Deer Springs Collection System and Echelon Point Collection System. The design and layout of these systems along with the existing drainage system are discussed in the following subsections.

5.2.1 Street Capacity Analysis

Street flow calculations were performed using FlowMaster V8i which utilizes the Manning's equation to determine the flow depth and average velocity for user defined sections. A Manning's 'n' of 0.016 was used in the street flow calculations per Section 906 of the Manual. The results of the street flow calculations were used to determine how the flow was distributed across the road (i.e., within half the street). The distribution of flow for the various streets is discussed further in Sections 5.2.4 through 5.2.7.

The results of the street flow calculations were also utilized to determine the product of the flow depth and average velocity. In all cases, the flow depth was less than 2 feet and the product of the flow depth and average velocity was less than 8. Therefore the street flow does not exceed CCRDCD's street capacity criteria as outlined in Section 304.4 of the Manual. Table 5.4 on the following page summarizes the results of the street flow calculations which are included Appendix B.

Table 5.4 - Street Capacity Results

Street	Flow (Q) (cfs)	Depth (D) (ft)	Velocity (V) (ft/s)	D x V
Fort Apache Road (West Half)	39	0.6	6.2	3.7
Severence Lane	86	0.6	6.2	3.7
Wittig Avenue (North Half)	11	0.4	4.7	1.9
Dorrell Lane	84	0.6	6.2	3.7
Deer Springs Way (North Half)	80	0.7	7.1	5.0
Echelon Point Drive (North Half)	41	0.6	5.8	3.5

5.2.2 Drop Inlet and Pipe Sizing

Interception capacity calculations for drop inlets were performed using FlowMaster V8i which utilizes procedures developed by the Federal Highway Administration (FHWA) HEC-22. A Manning's 'n' of 0.016 was used per HCDDM Section 906. A 50-percent clogging factor was applied to all drop inlets in accordance with the City of Las Vegas's criteria for drop inlet hydraulics (Section 1602 in the Manual).

The main lateral pipes along Severence Lane, Dorrell Lane, Deer Springs Way and Echelon Point Drive were modeled using WSPG Water Surface Pressure Gradient program Civil Design Software. The upstream and downstream boundary conditions for the lateral storm drain models are discussed in subsections 5.2.5 through 5.2.7.

Flow depth and velocity for lateral pipes along were evaluated using FlowMaster based on a Manning's 'n' of 0.013 (Table 702 of the Manual).

5.2.3 Existing Storm Drain System

Throughout the project corridor, there is existing drainage infrastructure that was constructed as part of various subdivisions. These systems were designed to collect runoff from within the existing development and local surface flows for a 10-year storm - they were not intended to collect or convey flows from the 100-year storm. However, where practical, the existing drainage systems were utilized in the FASD design to convey a portion of the 100-year storm flows into the main storm drain.

The existing drainage infrastructure between Severence Lane and Dorrell Lane will be modified as part of the Fort Apache Collection System which is discussed further in Section 5.2.4.

Between Dorrell Lane and Echelon Point Drive, the main storm drain layout follows the alignment of the existing 24-inch RCP storm drain. The existing 24-inch RCP storm drain and manholes will be removed. All of the existing drop inlets on the east side of Fort Apache will be left in place and connected to the main storm drain. Along the west side of Fort Apache, the existing drop inlets will either be left in place and connected to the main storm drain or modified as part of the collection systems discussed in the following subsections.

South of Echelon Point Drive and the CC 215 there is an existing 24-inch RCP storm drain. This storm drain originally collected flow from the north as well as from the low point in Fort Apache Road located approximately half way between Echelon Point Drive and the CC 215 right-of-way and daylights into a riprap channel along the northern boundary of the CC 215 right-of-way. Flow from the north and the western low points will be cut off by the construction of the main storm drain. Flow to the eastern low point will be collected by the existing drop inlet and conveyed into the main storm drain via the existing drainage system. The existing storm drain upstream of the low point that is in conflict with the FASD will be removed and the remaining storm drain will be abandoned.

5.2.4 Fort Apache Collection System

Figures 5.2 through 5.7 present the flow rates used for the design and layout of the Fort Apache Collection System which consists of existing and proposed drop inlets.

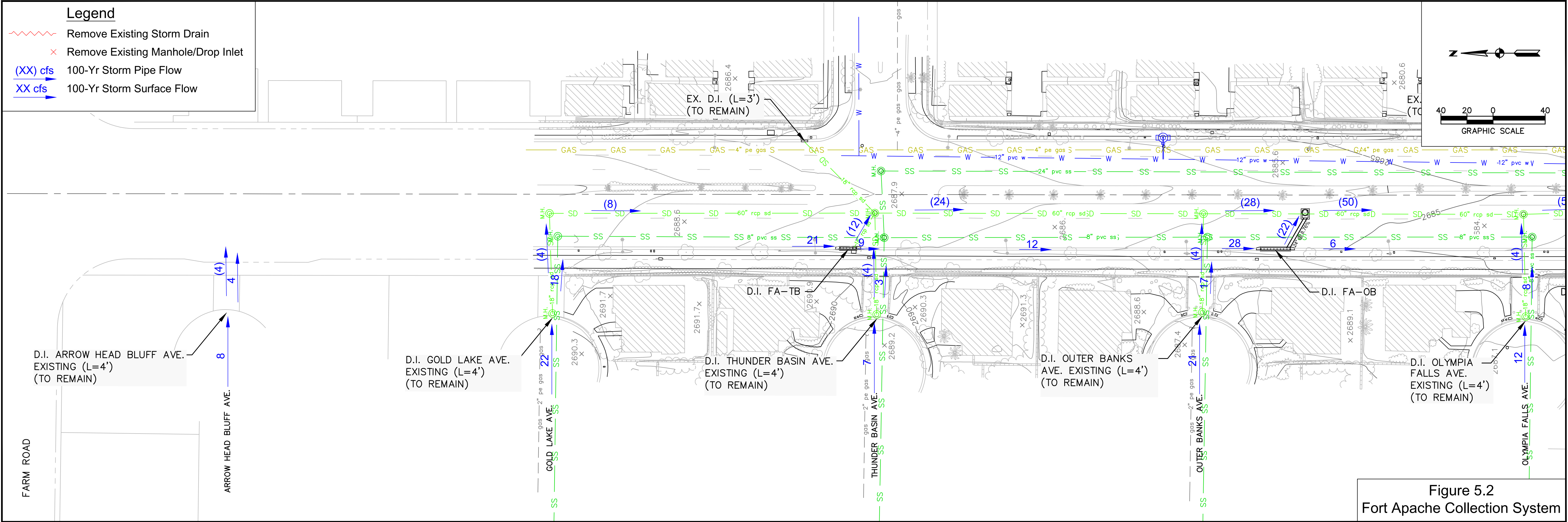
The existing storm drain north of Elkhorn Road is discussed as part of the Severence Lane Collection system in section 5.2.5.

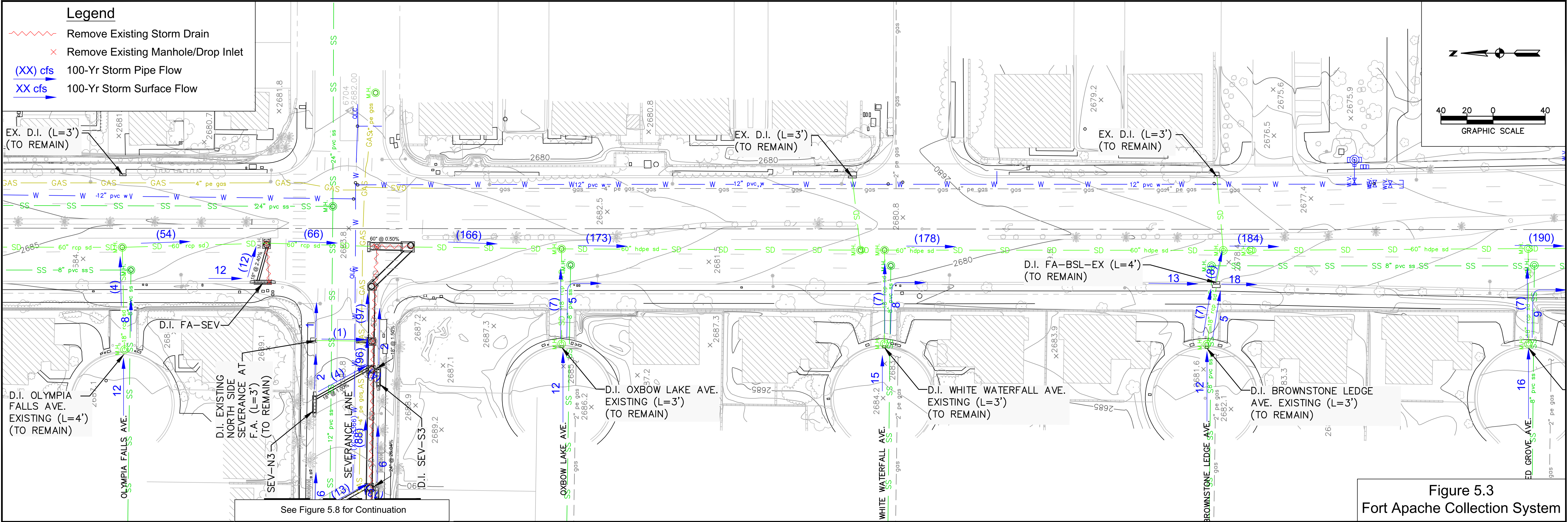
Two inlets are proposed on the northwest and southwest corners at the intersection of Fort Apache Road and Elkhorn Road. The northwest inlet is located between the bus turn out and Elkhorn Road. The southwest is located just upstream of the right hand turn lane onto Fort Apache Road. LBG will coordinate the design of these inlets with the Slater Hanifan Group, who is currently designing the proposed Rancho System along Elkhorn Road between Fort Apache Road and Grand Canyon Drive.

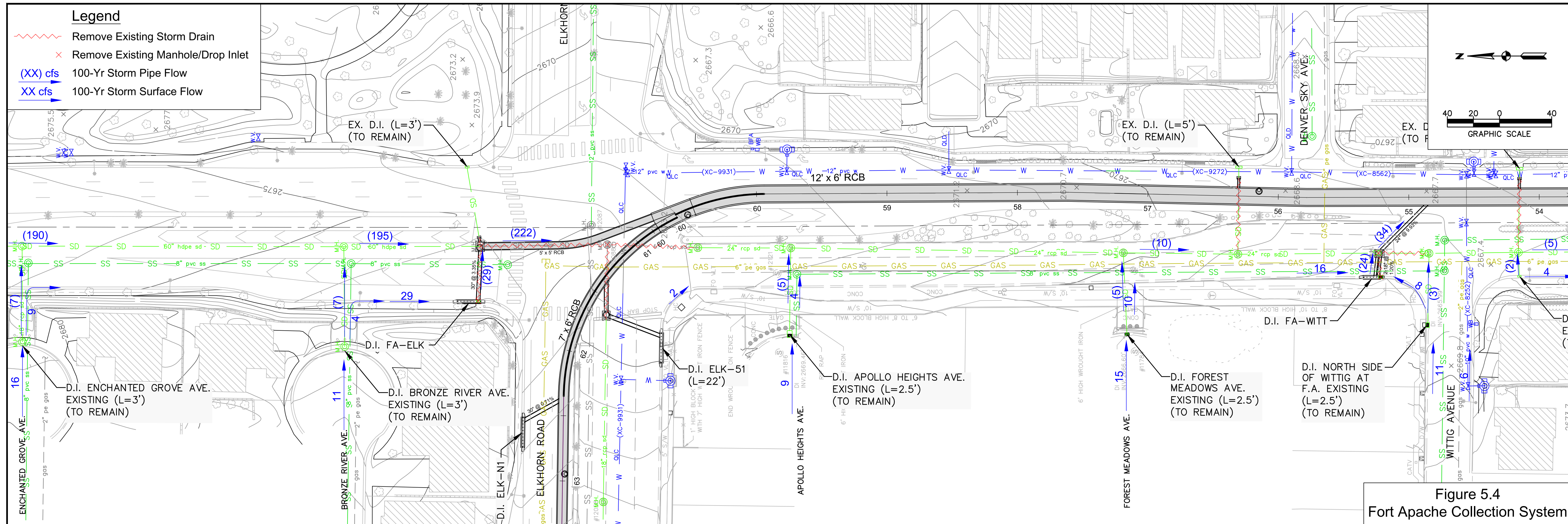
The existing storm drain in Dorrell Lane was designed to convey 40 cfs (GCWa, 2003). The 100-year flow on Dorrell Lane was determined in this study to be 124 cfs. The difference between the 124 cfs and 40 cfs (84 cfs) is conveyed as surface flow in Dorrell Lane. A street flow calculation for Dorrell Lane determined that 84 cfs will be above the crown of the road. Therefore, it is assumed that the street flow is distributed equally between either side of the road. A series of drop inlets along Dorrell Lane was not practical due to the closely spaced driveways and utility services. Therefore a trench drain is proposed to collect surface flow in Dorrell Lane before it enters Fort Apache Road.

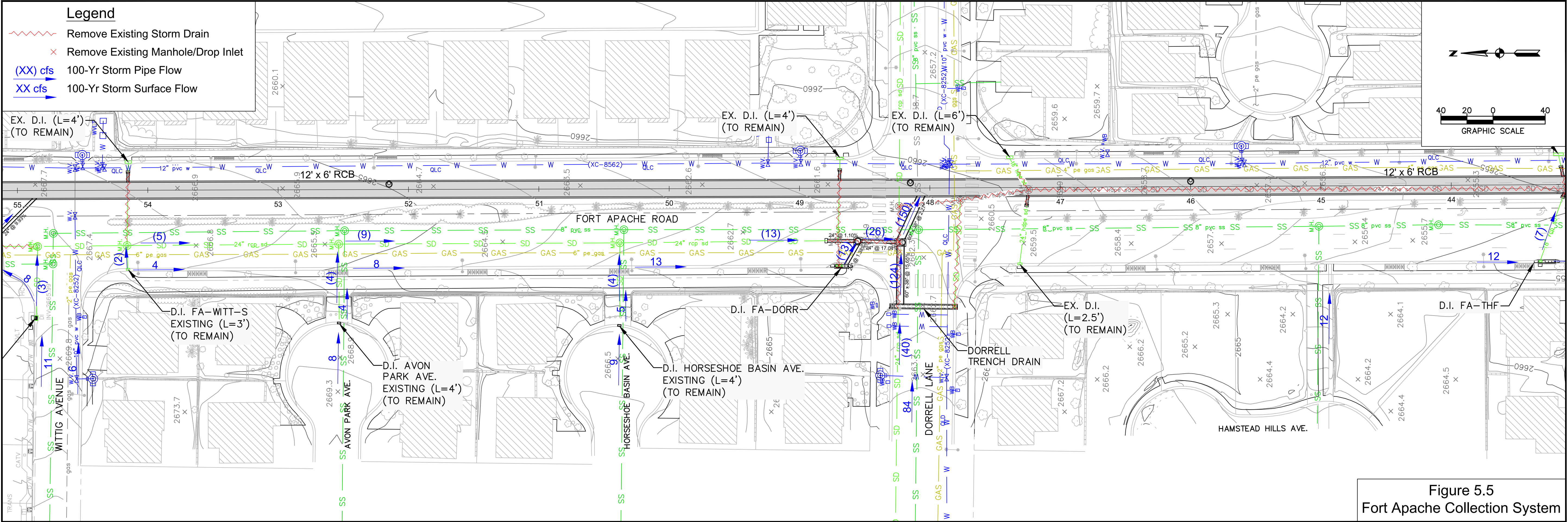
The remaining street flows were determined by subdividing HEC-1 basins as discussed in Section 4.4.2. The inflow and bypass flow at each inlet is presented on Figures 5.2 through 5.7.

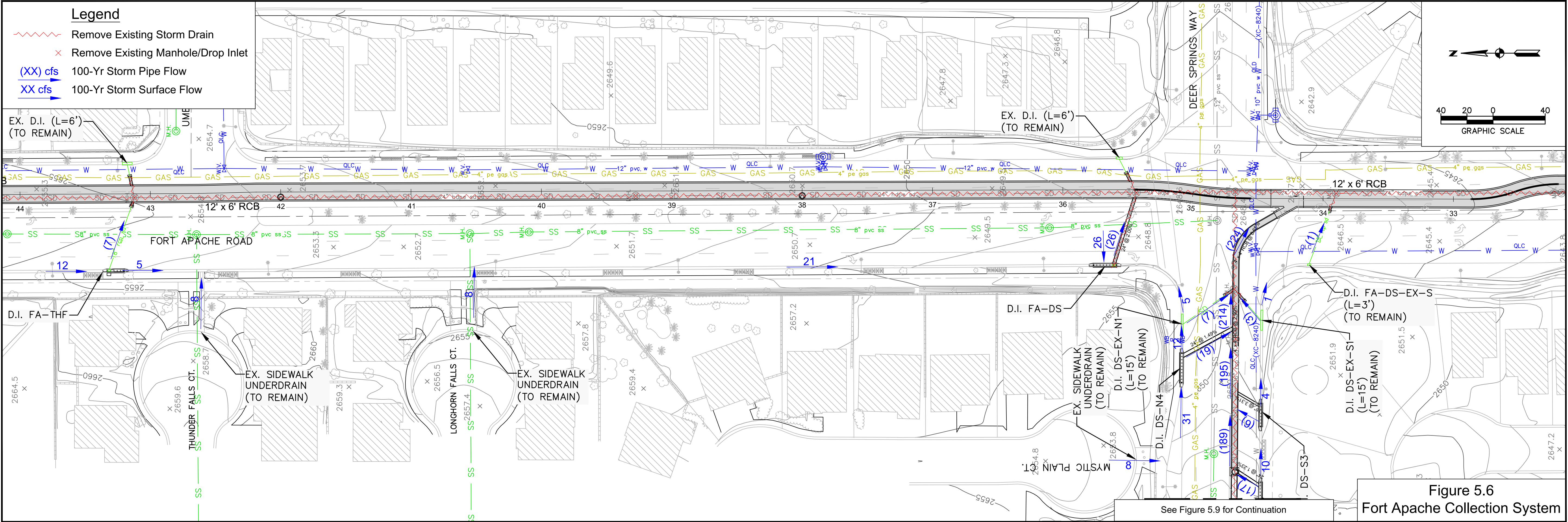
The street capacity calculations for Fort Apache Road and Dorrell Lane are included in Appendix B.2.1. The drop inlet depth calculations, drop inlet interception calculations and lateral pipe sizing calculations are included in Appendix B.2.2.

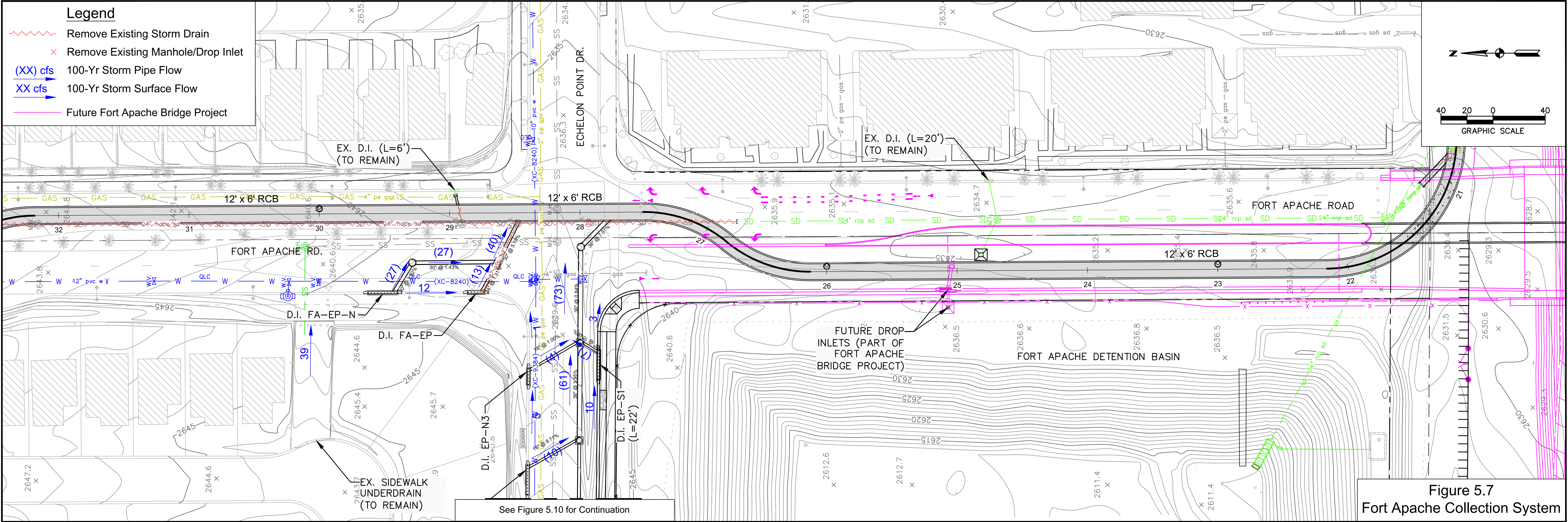












5.2.5 Severence Collection System

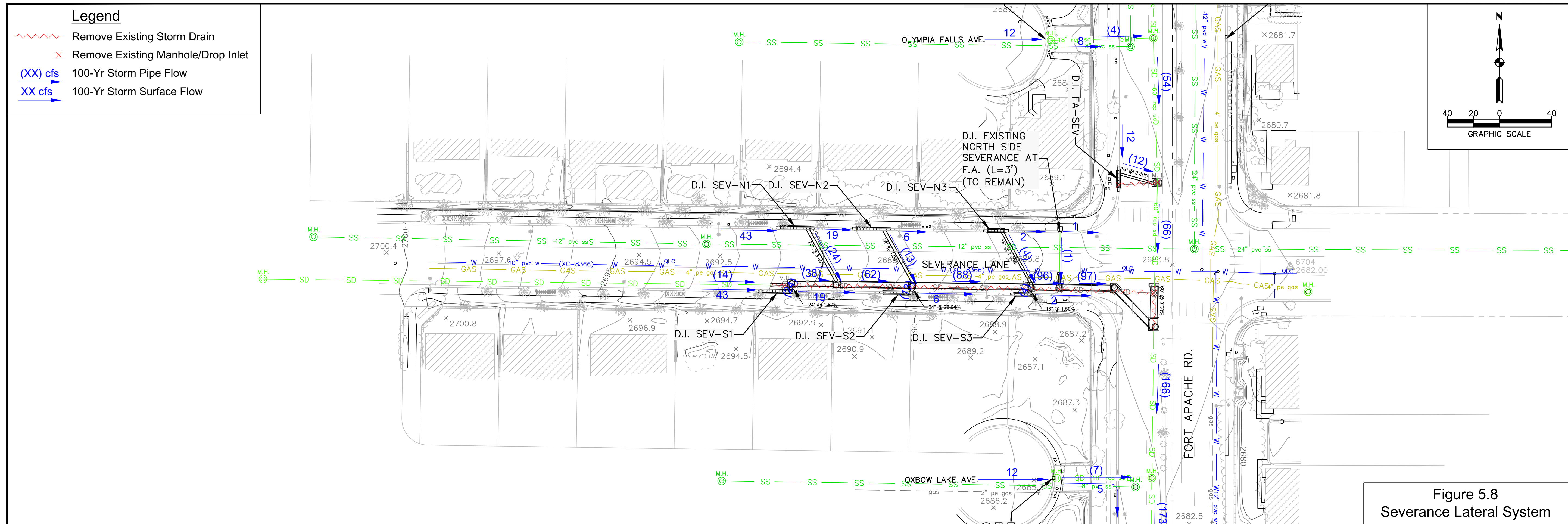
Figure 5.8 presents the flow rates used for the design and layout of the Severence Collection System which consists of existing and proposed drop inlets.

The existing 18-inch storm drain in Severence Lane conveys 14 cfs and connects to an existing 60" RCP storm drain in Fort Apache. The 100-year flow on Severence Lane was determined to be 100 cfs. The difference between the 100 cfs and 14 cfs (86 cfs) is conveyed as surface flow in Severence Lane. A street flow calculation for Severence Lane determined that 86 cfs will be above the crown of the road. Therefore, it is assumed that the street flow is distributed equally between either side of the road.

A series of six drop inlets is proposed to collect surface flow before it reaches Fort Apache Road. Layout of the drop inlets was controlled by existing light poles and decorative panels.

The existing 18-inch RCP storm drain in Severence Lane will be removed and replaced with a storm drain varying from a 42-inch RCP to a 48-inch RCP. The existing 60-RCP along Fort Apache was designed to convey 120 cfs (GCWb, 2003). The flows collected along Fort Apache Road and Severence Lane pressurize the 60-inch pipe during the 100-year storm. Therefore, the WSPG analysis for the Severence Collection System includes the 60-inch RCP storm drain in Fort Apache from the proposed confluence structure at Elkhorn Road to the existing 18-inch RCP in Severence Lane. Initial analysis of the system indicated that the hydraulic grade line (HGL) would be above the manhole cover elevations. A 5-foot x 5-foot RCB (see Figure 5.4) is proposed between the existing manhole just north of Elkhorn Road and the proposed confluence structure. The 5-foot x 5-foot RCB reduces the HGL to at least 18-inches below manhole cover elevations except at the manhole just upstream of the Elkhorn Road Confluence (SDMH-19) road where the HGL is 10-inches below the manhole cover elevation.

The street capacity calculations for Severence Lane are included in Appendix B.3.1. The WSPG analysis of the Severence Collection System is included in Appendix B.3.2 and the drop inlet depth calculations, drop inlet interception calculations and lateral pipe sizing calculations are included in Appendix B.3.3.



5.2.6 Deer Springs Collection System

Figure 5.9 presents the flow rates used for the design and layout of the Deer Springs Lateral System which consists of existing and proposed drop inlets.

The existing 36-inch RCP storm drain in Deer Springs Way was designed to convey 58 cfs (VTN, 2004). The 100-year flow on Deer Springs Way was determined in this study to be 226 cfs. The difference between the 226 cfs and 58 cfs (168 cfs) is conveyed as surface flow in Deer Springs Way. A street flow calculation for Deer Springs Way determined that 168 cfs will be above the crown of the road. Therefore, it is assumed that the street flow is distributed equally between either side of the road.

A series of four drop inlets on the north half of Deer Springs Way and three drop inlets on the south half of Deer Springs Way are proposed to collect surface flow before it reaches Fort Apache Road. Layout of the drop inlets was controlled by an existing bus turn out lane and the Mansion Oaks Street intersection.

The existing 36-inch RCP storm drain in Deer Springs Way will be removed and replaced with a storm drain varying from a 48-inch RCP (or equivalent Horizontal Elliptical RCP) to a 4-foot x 4-foot RCB. A RCB storm drain was chosen instead of a pipe and manhole layout to minimize losses caused by manholes.

The street capacity calculations for Deer Springs Way are included in Appendix B.4.1. The WSPG analysis of the Deer Springs Collection System is included in Appendix B.4.2 and the drop inlet depth calculations, drop inlet interception calculations and lateral pipe sizing calculations are included in Appendix B.4.3.

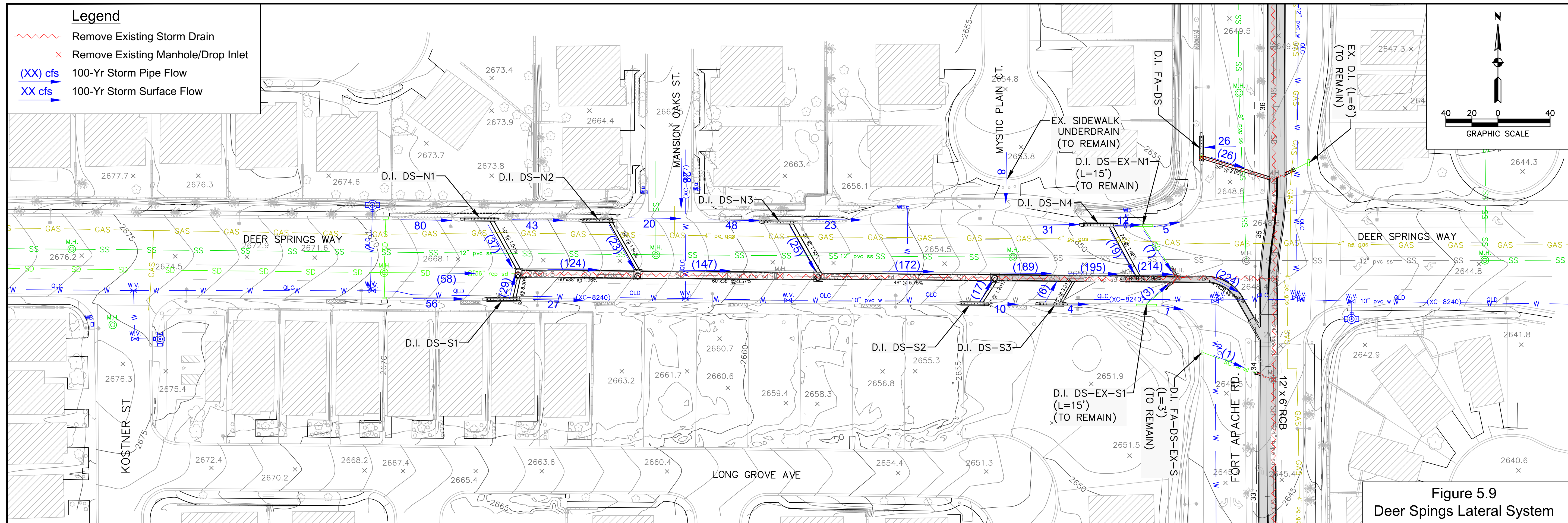


Figure 5.9
Deer Springs Lateral System

5.2.7 Echelon Point Collection System

Figure 5.10 presents the flow rates used for the design and layout of the Echelon Point Collection System which consists of proposed drop inlets.

The existing 24-inch storm drain in Echelon Point Drive conveys 29 cfs. The storm drain discharges into an earthen channel that drains into the Fort Apache Detention Basin. Currently, flow into the detention basin is eroding the earthen channel which requires frequent maintenance. As part of this project, the 24-inch RCP storm drain will be connected to the new Echelon Point Collection System.

Currently the south half of Echelon Point Drive between Hinoki Cypress Street and Fort Apache Road is unpaved. This section of road is adjacent to the existing Fort Apache Detention Basin, a regional flood control detention basin owned by the City of Las Vegas. As part of this project, the south half street section of Echelon Point Drive will be constructed along with the Echelon Point Collection System.

The 100-year flow on Echelon Point Drive was determined to be 75 cfs. The difference between the 75 cfs and 29 cfs (46 cfs) is conveyed as surface flow in Echelon Point Drive. A street flow calculation for Echelon Point Drive determined that 46 cfs will be below the crown of the road. The hydrologic analysis determined that 41 cfs will be entering Echelon Point Drive from the north, therefore it was assumed that the flow will be contained in the north half of the street and the flow from sub-basin NWBC2-CD, 10 cfs, will be in the south half of the street.

A series of three drop inlets on the north and one inlet on the south are proposed to collect surface flows before they reach Fort Apache Road. The drop inlets on the north half of the street were located between existing light poles and decorative sidewalk panels. The inlet on the south half of the street was located just west of the intersection with Fort Apache Road to collect flow before it enters Fort Apache.

The street capacity calculations for Echelon Point Drive are included in Appendix B.5.1. The WSPG analysis of the Echelon Point Lateral is included in Appendix B.5.2 and the drop inlet depth calculations, drop inlet interception calculations and lateral pipe sizing calculations are included in Appendix B.5.3.



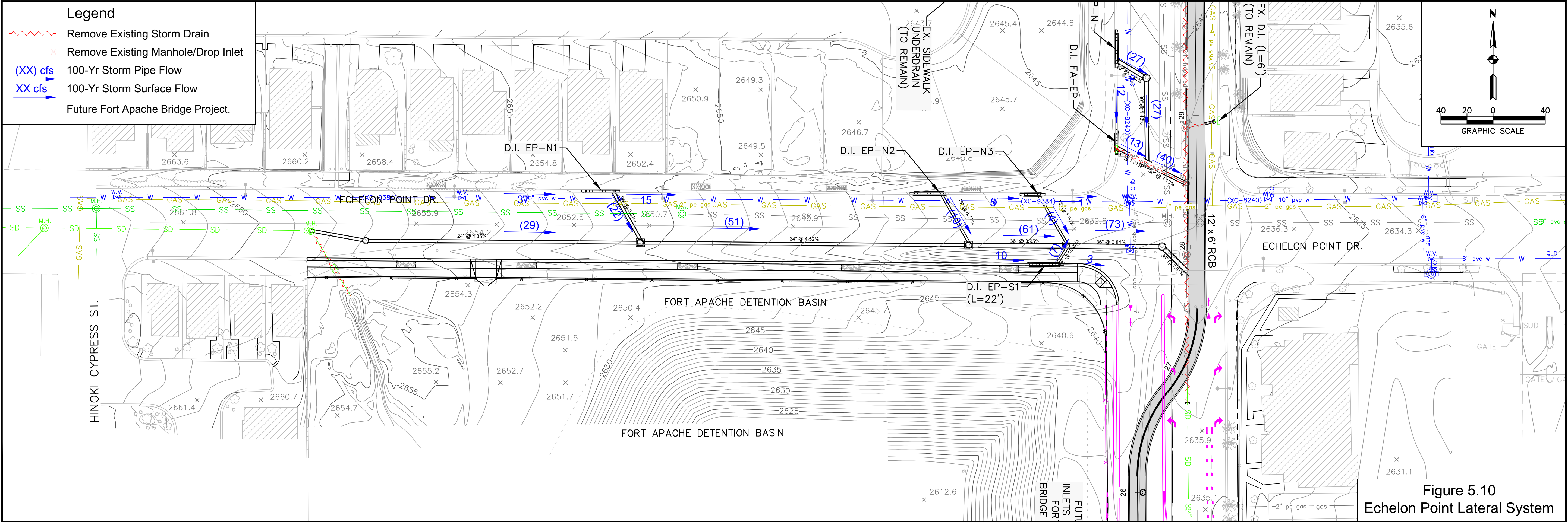


Figure 5.10
Echelon Point Lateral System

6.0 UTILITY COORDINATION AND RELOCATIONS

As part of the survey conducted for this project, Cardno TBE (TBE) was responsible for the utility designating and potholing that was conducted in two phases. The designating phase provided the approximate horizontal location of existing utilities through electronic geophysical prospecting. The potholing phase provided the exact horizontal and vertical location by means of non-destructive methods (i.e., vacuum excavation).

For the preliminary design submission, utility designating was conducted for the entire project corridor. Then, potential utility conflicts with the main storm drain were identified and a total of 58 potholes were excavated. For the 70% submittal, an additional 53 potholes were excavated for the utility conflicts with the proposed drop inlet and storm drain laterals. Lastly, for the 90% submittal an additional 18 potholes were excavated for utility conflicts with the Severence Lane lateral, Deer Springs Way sewer relocation and other miscellaneous locations identified between the 70% and 90% submissions. The pothole locations and utility locations are included on the utility sheets (U-1 through U-15) in Appendix C.

After the preliminary design submission additional utility designation was conducted along Severence Lane. Utility conflicts with the proposed drop inlet and storm drain laterals along Severence Lane were identified as part of the 90% design.

6.1 Utility Coordination

During the 30% design LBG met with the City Collections Department (sewer), Las Vegas Valley Water District, Southwest Gas, NV Energy, and Century Link to discuss the project's impacts to the existing utilities. LBG also contacted COX Communications, however, they requested that a meeting take place at a later time.

LBG provided the above mentioned utility companies with copies of the 30% design plans and received redlined plans from Las Vegas Valley Water District, Southwest Gas and Century Link. Their comments were incorporated in the to 70% design plans.

The utility agencies were provided with a copy of the 70% design plans for further coordination. LBG received redline plans from the Las Vegas Valley Water District, Cox Communications, Century Link, Southwest Gas and NV Energy. LBG attended a coordination meeting with the Las Vegas Valley Water District to discuss their comments on the 70% plans and subsequently incorporated their comments into the



90% plans. LBG will provide the affected utility agencies with copies of the 90% plans for further coordination.

6.2 Utility Relocations

Table 6.1 summarizes the known utilities that are in conflict with the main storm drain. Existing utility crossings that do not appear to be in conflict with the proposed storm drain system are not included in the table and are to be protected in place. Utility relocation designs for the water and sewer were incorporated in the 90% design plans and will be constructed by the prime contractor. Relocation of the gas, CATV, electric, telephone, and fiber optic will be coordinated with the utility agencies as part of the subsequent design phases.

Table 6.1 - Main Storm Drain Utility Conflicts

Alignment	Station	Utility	Action
"SD"	63+70	CATV	To be Relocated by COX Communications
"SD"	63+70	Electric	To be Relocated by NV Energy
"SD"	61+95	CATV	To be Relocated by COX Communications
"SD"	61+95	Electric	To be Relocated by NV Energy
"SD"	61+49	Fiber Optic	To be Relocated by Contractor
"SD"	61+49	Telephone	To be Relocated by Century Link
"SD"	61+25	Gas	To be Relocated by Southwest Gas
"SD"	61+25	Sewer	To be Relocated by Contractor
"SD"	61+10	Water	To be Relocated by Contractor
"SD"	54+55	Water	To be Relocated by Contractor
"SD"	48+37	Telephone	To be Relocated by Century Link
"SD"	48+37	Fiber Optic	To be Relocated by Contractor
"SD"	48+10	Sewer	To be Removed by Contractor
"SD"	47+81	Gas	To be Relocated by Southwest Gas
"SD"	28+18	Sewer	To be Relocated by Contractor
"SD"	20+50	CATV	To be Relocated COX Communications
"DS"	76+02	Water	To be Relocated by Contractor
"DS"	73+08	Water	To be Relocated by Contractor
"DS"	70+80	Electric	To be Relocated by NV Energy
"SL"	40+30	CATV / Electric	To be Relocated by COX / NV Energy
"SL"	41+10	CATV	To be Relocated by COX Communications
"SL"	42+15	CATV	To be Relocated by COX Communications
"SL"	42+89	CATV	To be Relocated by COX Communications



7.0 RIGHT-OF-WAY

Tri State Surveying, Ltd. conducted three topographic surveys and right-of-way mappings for this project. The first portion included the topographic mapping and right-of-way for the main storm drain and side streets between Elkhorn Road and CC 215. The second portion included the topographic mapping and right-of-way along Fort Apache Road and Severence Lane. The third portion included additional topographic mapping and right-of-way along Deer Springs Way east of Fort Apache Road.

The Record of Survey associated with the first portion was submitted to the City for review and minor comments were received on May 5, 2011. The comments were addressed and the Record of Survey was recorded on June 27, 2011 as File 184, Page 36 in Book Number 20110627. The Record of Survey associated with the second portion was reviewed as part of the 70% submittal and minor comments were received. The Record of Survey associated with the third portion is being submitted to the City for review as part of the 90% submittal. The Record of Survey for the second and third portions will be finalized and recorded between the 90% and 100% submittals.

Reduced copies of the Record of Survey plans are included in Appendix D.

There was an existing privately owned parcel (APN 125-20-401-008) along the northern boundary of the CC 215 right-of-way. This parcel should have been acquired as part of the CC 215 Beltway project; however, it was not and was vacated back to a private party. LBG presented this information during a coordination meeting with Clark Public Works (CCPW). The parcel was purchased by CCPW in November 2012 and is now public right of way.

No Authorizations to Enter Property (AEP) will be required for this project.



8.0 PERMITTING

Construction of the Rancho-Fort Apache Storm Project will require various permits from the City, County and State. Table 8.1 presents a matrix of permits that will be required for the project.



Table 8.1 - Permit Matrix

Entity	Permit	Issuing Agency	Address	Contact	When to Submit	Who Submits
Clark County Regional Flood Control District	Drainage Review	Clark County Regional Flood Control District	Clark County Regional Flood Control District 600 S. Grand Central Pkwy Suite 300 Las Vegas, NV 89106-4511	(702) 685-0000	Design phase	Consultant
NV Div. of Env. Protection	Temporary Discharge Permit	Bureau of Water Pollution Control	Nevada Division of Environmental Protection Bureau of Water Pollution Control 2030 E. Flamingo Road, Ste. 230 Las Vegas, NV 89119-0837	(702) 486-2850	Prior to discharge	City
NV Div. of Env. Protection	Groundwater Discharge Permit	Bureau of Water Pollution Control	Nevada Division of Environmental Protection Bureau of Water Pollution Control 2030 E. Flamingo Road, Ste. 230 Las Vegas, NV 89119-0837	(702) 486-2850	Prior to discharge	City
City of Las Vegas	Traffic Control Plan	Department of Public Works Traffic Engineering Division	City of Las Vegas Department of Public Works Traffic Engineering Division 333 N. Rancho Drive Las Vegas, NV 89106	(702) 229-6327	After Conditional Notice to Proceed	Contractor
City of Las Vegas	Temporary Stock Pile Permit	Development Services Center Dept. of Building and Safety	City of Las Vegas Development Services Center Dept. of Building and Safety 333 N. Rancho Drive Las Vegas, NV 89106	(702) 229-6251	Construction phase	Contractor
Clark County	Dust Control Permit	Department of Air Quality and Environmental Management	Clark County Department of Air Quality & Environmental Management 500 South Grand Central Parkway 1st Floor Box 555210 Las Vegas, NV 89155-5210	Lewis Wallenmeyer, Director (702) 455-5942	Construction phase	Contractor

9.0 COST ESTIMATE

Table 9.1 is a breakdown of the items and preliminary cost estimate for the Rancho-Fort Apache Storm Drain Project. Construction of this project will be funded by the CCRFCD, except for the half street improvements on Echelon Point Drive, which will be funded by the Regional Transportation Commission of Southern Nevada (RTCSNV). The costs presented in Table 9.1 are itemized by description and funding source. The total cost of the proposed improvements was estimated to be \$10.97 million of which \$10.77 million will be funded by the CCRFCD and \$198,000 will be funded by the RTCSNV.



Table 9.1 - Construction Cost Estimate

Item Number	Description	Unit	Total Quantity	Unit Price	CCRFCD FUNDING		RTC FUNDING		Total Cost
					Quantity	Cost	Quantity	Cost	
109.01	Owner Initiated Time Extension Allowance	DAY	50	\$500.00	50	\$25,000.00	0	\$0.00	\$25,000.00
109.02	Owner Initiated Time Extension Amount In Addition To Allowance	DAY	50	\$500.00	50	\$25,000.00	0	\$0.00	\$25,000.00
200.01	Mobilization And Demobilization	LS	1	\$440,000.00	1	\$440,000.00	0	\$0.00	\$440,000.00
202.01	Cold Planing (1-inch)	SY	31,680	\$2.00	31,680	\$63,360.00	0	\$0.00	\$63,360.00
202.02	Removal of Concrete Channel Transition	LS	1	\$5,000.00	1	\$5,000.00	0	\$0.00	\$5,000.00
202.03	Removal of Stone Wall	LS	1	\$2,000.00	1	\$2,000.00	0	\$0.00	\$2,000.00
202.04	Removal of End Section	EA	3	\$200.00	3	\$600.00	0	\$0.00	\$600.00
202.05	Abandon Storm Drain Pipe	LF	491	\$50.00	491	\$24,550.00	0	\$0.00	\$24,550.00
202.06	Removal of Storm Drain Pipe	LF	3,913	\$50.00	3,913	\$195,650.00	0	\$0.00	\$195,650.00
202.07	Removal of Drop Inlet	EA	10	\$1,000.00	10	\$10,000.00	0	\$0.00	\$10,000.00
202.08	Removal of Storm Drain Manhole	EA	25	\$1,250.00	25	\$31,250.00	0	\$0.00	\$31,250.00
202.09	Removal of Riprap	SY	1,970	\$10.00	1,970	\$19,700.00	0	\$0.00	\$19,700.00
202.10	Remove and Salvage Chain Link Fence	LF	640	\$2.00	640	\$1,280.00	0	\$0.00	\$1,280.00
202.11	Removal of Water Line	LF	281	\$25.00	281	\$7,025.00	0	\$0.00	\$7,025.00
202.12	Removal of Sewer Line	LF	1,801	\$30.00	1,801	\$54,030.00	0	\$0.00	\$54,030.00
202.13	Abandon Sewer Line	LF	242	\$50.00	242	\$12,100.00	0	\$0.00	\$12,100.00
202.14	Removal of Sewer Manhole	EA	4	\$1,250.00	4	\$5,000.00	0	\$0.00	\$5,000.00
203.01	Roadway Excavation	CY	5,300	\$3.00	3,890	\$11,670.00	1,410	\$4,230.00	\$15,900.00
212.01	Site Preparation	SF	2,585	\$0.10	0	\$0.00	2,585	\$258.50	\$258.50
212.02	Plants, Group A	EA	81	\$15.00	0	\$0.00	81	\$1,215.00	\$1,215.00
212.03	Plants, Group B	EA	20	\$480.00	0	\$0.00	20	\$9,600.00	\$9,600.00
212.04	Root Guard	LF	1,085	\$6.40	0	\$0.00	1,085	\$6,944.00	\$6,944.00
212.05	Rock Mulch	SF	2,585	\$0.90	0	\$0.00	2,585	\$2,326.50	\$2,326.50
212.06	Landscape Boulder, 2' Dia.	EA	3	\$40.00	0	\$0.00	3	\$120.00	\$120.00
212.07	Landscape Boulder, 3' Dia.	EA	2	\$85.00	0	\$0.00	2	\$170.00	\$170.00
212.08	Landscape Boulder, 4' Dia.	EA	2	\$170.00	0	\$0.00	2	\$340.00	\$340.00
213.01	1-inch Valve	EA	1	\$270.00	0	\$0.00	1	\$270.00	\$270.00
213.02	1-inch Irrigation Line (SCH 40)	LF	580	\$1.60	0	\$0.00	580	\$928.00	\$928.00
213.03	2" PVC Sleeve (SCH 40)	LF	300	\$1.90	0	\$0.00	300	\$570.00	\$570.00
213.04	3/4-inch Irrigation Line (Class 200)	LF	1,100	\$1.50	0	\$0.00	1,100	\$1,650.00	\$1,650.00
213.05	Field Transmitter	EA	1	\$250.00	0	\$0.00	1	\$250.00	\$250.00
213.06	3/4-inch Drip Valve Assembly	EA	4	\$290.00	0	\$0.00	4	\$1,160.00	\$1,160.00



Item Number	Description	Unit	Total Quantity	Unit Price	CCRFCD FUNDING		RTC FUNDING		Total Cost
					Quantity	Cost	Quantity	Cost	
213.07	Quick Coupling Valve	EA	3	\$125.00	0	\$0.00	3	\$375.00	\$375.00
213.08	Emitters	EA	241	\$5.40	0	\$0.00	241	\$1,301.40	\$1,301.40
302.01	Type II Aggregate Base	CY	2,430	\$20.00	2,200	\$44,000.00	230	\$4,600.00	\$48,600.00
402.01	4-Inch Plantmix Bituminous Surface	SY	1,810	\$15.00	190	\$2,850.00	1,620	\$24,300.00	\$27,150.00
402.02	5-Inch Plantmix Bituminous Surface	SY	13,660	\$18.00	13,660	\$245,880.00	0	\$0.00	\$245,880.00
413.01	1-Inch UTACS Bonded With A PMM, S3 Gradation	SY	33,490	\$8.00	31,870	\$254,960.00	1,620	\$12,960.00	\$267,920.00
502.01	Precast 4-foot x 4-foot Reinforced Concrete Box	LF	209	\$400.00	209	\$83,600.00	0	\$0.00	\$83,600.00
502.02	Precast 5 x 5-foot Reinforced Concrete Box	LF	133	\$500.00	133	\$66,500.00	0	\$0.00	\$66,500.00
502.03	Precast 7-foot x 6-foot Reinforced Concrete Box	LF	319	\$600.00	319	\$191,400.00	0	\$0.00	\$191,400.00
502.04	Precast 12-foot x 6-foot Reinforced Concrete Box	LF	3,274	\$1,000.00	3,274	\$3,274,000.00	0	\$0.00	\$3,274,000.00
502.05	12-foot x 6-foot Reinforced Concrete Box	LF	1,690	\$900.00	1,690	\$1,521,000.00	0	\$0.00	\$1,521,000.00
502.06	Confluence Structure (Elkhorn Road)	LS	1	\$50,000.00	1	\$50,000.00	0	\$0.00	\$50,000.00
502.07	Confluence Structure (Deer Springs Way)	LS	1	\$20,000.00	1	\$20,000.00	0	\$0.00	\$20,000.00
502.08	RCB to Channel Transition	LS	1	\$60,000.00	1	\$60,000.00	0	\$0.00	\$60,000.00
603.01	18-inch Reinforced Concrete Pipe (Class III)	LF	325	\$80.00	325	\$26,000.00	0	\$0.00	\$26,000.00
603.02	24-inch Reinforced Concrete Pipe (Class III)	LF	943	\$90.00	943	\$84,870.00	0	\$0.00	\$84,870.00
603.03	30-inch Reinforced Concrete Pipe (Class III)	LF	366	\$100.00	366	\$36,600.00	0	\$0.00	\$36,600.00
603.04	36-inch Reinforced Concrete Pipe (Class III)	LF	166	\$110.00	166	\$18,260.00	0	\$0.00	\$18,260.00
603.05	42-inch Reinforced Concrete Pipe (Class III)	LF	29	\$120.00	29	\$3,480.00	0	\$0.00	\$3,480.00
603.06	48-inch Reinforced Concrete Pipe (Class III)	LF	360	\$130.00	360	\$46,800.00	0	\$0.00	\$46,800.00
603.07	60-inch Reinforced Concrete Pipe (Class III)	LF	25	\$180.00	25	\$4,500.00	0	\$0.00	\$4,500.00
603.08	30-inch x 19-inch Reinforced Concrete Pipe (Class III)	LF	43	\$125.00	43	\$5,375.00	0	\$0.00	\$5,375.00
603.09	45-inch x 29-inch Reinforced Concrete Pipe (Class III)	LF	8	\$150.00	8	\$1,200.00	0	\$0.00	\$1,200.00
603.10	60-inch x 38-inch Reinforced Concrete Pipe (Class III)	LF	319	\$200.00	319	\$63,800.00	0	\$0.00	\$63,800.00
609.01	RCB Manhole	EA	13	\$4,000.00	13	\$52,000.00	0	\$0.00	\$52,000.00
609.02	48-inch Type I Storm Drain Manhole	EA	1	\$4,000.00	1	\$4,000.00	0	\$0.00	\$4,000.00
609.03	60-inch Type I Storm Drain Manhole	EA	2	\$4,500.00	2	\$9,000.00	0	\$0.00	\$9,000.00
609.04	60-inch Type Iii Storm Drain Manhole	EA	1	\$5,000.00	1	\$5,000.00	0	\$0.00	\$5,000.00
609.05	NDOT Type 4 Storm Drain Manhole	EA	21	\$7,000.00	21	\$147,000.00	0	\$0.00	\$147,000.00
609.06	NDOT Type 2 Drop Inlet with Concrete Apron	EA	2	\$7,500.00	2	\$15,000.00	0	\$0.00	\$15,000.00
609.07	9.5-foot Type DM Drop Inlet	EA	1	\$10,000.00	1	\$10,000.00	0	\$0.00	\$10,000.00
609.08	12-foot Type DM Drop Inlet	EA	8	\$12,000.00	8	\$96,000.00	0	\$0.00	\$96,000.00



Item Number	Description	Unit	Total Quantity	Unit Price	CCRFCD FUNDING		RTC FUNDING		Total Cost
					Quantity	Cost	Quantity	Cost	
609.09	17-foot Type DM Drop Inlet	EA	4	\$17,000.00	4	\$68,000.00	0	\$0.00	\$68,000.00
609.10	22-foot Type DM Drop Inlet	EA	16	\$22,000.00	16	\$352,000.00	0	\$0.00	\$352,000.00
609.11	Trench Drain	EA	1	\$30,000.00	1	\$30,000.00	0	\$0.00	\$30,000.00
613.01	Type L Curb and Gutter	LF	591	\$20.00	0	\$0.00	591	\$11,820.00	\$11,820.00
613.02	Concrete Sidewalk	SF	4,140	\$4.00	0	\$0.00	4,140	\$16,560.00	\$16,560.00
613.03	Decorative Sidewalk Panel	EA	5	\$400.00	0	\$0.00	5	\$2,000.00	\$2,000.00
613.04	16-foot Industrial Driveway (Option A)	EA	1	\$3,500.00	0	\$0.00	1	\$3,500.00	\$3,500.00
613.05	Sidewalk Ramp, Modified Case II	EA	1	\$3,000.00	0	\$0.00	1	\$3,000.00	\$3,000.00
616.01	2-Cable Fence	LF	114	\$40.00	114	\$4,560.00	0	\$0.00	\$4,560.00
616.02	72-inch Chain Link Fence	LF	635	\$15.00	635	\$9,525.00	0	\$0.00	\$9,525.00
616.03	16-Foot Swing Gate (Double)	EA	1	\$3,500.00	0	\$0.00	1	\$3,500.00	\$3,500.00
622.01	Construction Surveying	LS	1	\$173,000.00	1	\$173,000.00	0	\$0.00	\$173,000.00
623.01	160 Watt Street Light Assembly and Foundation	EA	4	\$8,000.00	0	\$0.00	4	\$32,000.00	\$32,000.00
623.02	No. 3-1/2 Pullbox	EA	1	\$600.00	0	\$0.00	1	\$600.00	\$600.00
623.03	2-inch Streetlight Conduit w/ 2-#4 And 1-#8 Conductors	LF	840	\$19.00	0	\$0.00	840	\$15,960.00	\$15,960.00
623.04	2-inch Streetlight Conduit w/ 1-#8 Bare Tracer Wire And Pullstring	LF	90	\$16.50	0	\$0.00	90	\$1,485.00	\$1,485.00
623.05	Modify Existing Service Pedestal	EA	1	\$1,200.00	0	\$0.00	1	\$1,200.00	\$1,200.00
624.01	Traffic Control And Maintenance	LS	1	\$566,000.00	1	\$566,000.00	0	\$0.00	\$566,000.00
627.01	Ground Mounted Signs	LS	1	\$1,000.00	1	\$1,000.00	0	\$0.00	\$1,000.00
628.01	Type 2 Film for Arrows	EA	33	\$200.00	33	\$6,600.00	0	\$0.00	\$6,600.00
628.02	Type 2 Film for Crosswalks and Stop Bars	SF	2,152	\$4.00	2,152	\$8,608.00	0	\$0.00	\$8,608.00
628.03	Type 1 Film for Bike Legends	EA	2	\$180.00	2	\$360.00	0	\$0.00	\$360.00
628.04	Type 2 Film for Chevrons	SF	264	\$4.00	264	\$1,056.00	0	\$0.00	\$1,056.00
628.05	Type 2 Film 6-inch Solid White	LF	298	\$1.50	298	\$447.00	0	\$0.00	\$447.00
628.06	Type 2 Film 6-inch Skip White	LF	112	\$1.50	112	\$168.00	0	\$0.00	\$168.00
628.07	Type 1 White 8-inch Marking	LF	102	\$2.00	102	\$204.00	0	\$0.00	\$204.00
629.01	10-inch Dip Water Pipe	LF	190	\$65.00	190	\$12,350.00	0	\$0.00	\$12,350.00
629.02	12-inch Dip Water Pipe	LF	68	\$80.00	68	\$5,440.00	0	\$0.00	\$5,440.00
629.03	Vertical Adjust Water Valve Cover	EA	30	\$400.00	30	\$12,000.00	0	\$0.00	\$12,000.00
629.04	20-inch Steel Casing	LF	51	\$110.00	51	\$5,610.00	0	\$0.00	\$5,610.00
629.05	24-inch Steel Casing	LF	50	\$165.00	50	\$8,250.00	0	\$0.00	\$8,250.00
629.06	Tapping Sleeve and Valve	EA	7	\$500.00	7	\$3,500.00	0	\$0.00	\$3,500.00



Item Number	Description	Unit	Total Quantity	Unit Price	CCRFCD FUNDING		RTC FUNDING		Total Cost
					Quantity	Cost	Quantity	Cost	
629.07	3/4-inch Water Meter	EA	1	\$1,200.00	0	\$0.00	1	\$1,200.00	\$1,200.00
629.08	1-inch RPPA	EA	1	\$1,500.00	0	\$0.00	1	\$1,500.00	\$1,500.00
630.01	8-inch PVC Sewer Pipe	LF	900	\$110.00	900	\$99,000.00	0	\$0.00	\$99,000.00
630.02	12-inch PVC Sewer Pipe	LF	643	\$160.00	643	\$102,880.00	0	\$0.00	\$102,880.00
630.03	15-inch PVC Sewer Pipe	LF	351	\$180.00	351	\$63,180.00	0	\$0.00	\$63,180.00
630.04	18-inch PVC Sewer Pipe	LF	138	\$200.00	138	\$27,600.00	0	\$0.00	\$27,600.00
630.05	60-inch Sanitary Sewer Manhole	EA	8	\$9,700.00	8	\$77,600.00	0	\$0.00	\$77,600.00
630.06	72-inch Sanitary Sewer Manhole	EA	1	\$12,000.00	1	\$12,000.00	0	\$0.00	\$12,000.00
630.07	Vertically Adjust Manhole Cover	EA	19	\$1,250.00	19	\$23,750.00	0	\$0.00	\$23,750.00
633.01	Reflective Raised Pavement Markers	EA	634	\$3.00	589	\$1,767.00	45	\$135.00	\$1,902.00
633.02	Non-Reflective Raised Pavement Markers	EA	1,499	\$2.50	1,379	\$3,447.50	120	\$300.00	\$3,747.50
633.03	Blue Reflective Raised Fire Hydrant Id Pavement Markers	EA	5	\$3.00	5	\$15.00	0	\$0.00	\$15.00
637.01	Dust Control	LS	1	\$87,000.00	1	\$87,000.00	0	\$0.00	\$87,000.00
637.02	NPDES Discharge Permit	LS	1	\$10,000.00	1	\$10,000.00	0	\$0.00	\$10,000.00

SUBTOTAL	\$9,153,207.50	\$168,328.40	\$9,321,535.90
CONTINGENCY (10%)	\$915,320.75	\$16,832.84	\$932,153.59
SUBTOTAL CONSTRUCTION	\$10,068,528.25	\$185,161.24	\$10,253,689.49
CONSTRUCTION MANAGEMENT (7%)	\$704,796.98	\$12,961.29	\$717,758.26
TOTAL	\$10,773,325.23	\$198,122.53	\$10,971,447.75



10.0 RECOMMENDATIONS AND CONCLUSIONS

This report presents the 90% design of the Rancho-Fort Apache Storm Drain Project. The Rancho-Fort Apache Storm Drain is a regional flood control conveyance facility located in Fort Apache Road between Elkhorn Road and the CC 215. The project also includes lateral collection systems in Severence Lane, Deer Springs Way and Echelon Point Drive. This study presents a discussion of the previous studies related to the project, design criteria, and analysis of the recommended design.

The 2008 MPU hydrologic modeling was used as the basis for the hydrologic modeling in this report. As part of this project, LBG reviewed the MPU hydrology and proposed the following recommendations:

- Amend the MPU to include a 100-year conveyance facility along Farm Road
- Add a local lateral facility along Severence Lane
- Revise the flow split at Elkhorn Road and Hualapai Way
- Eliminate the flow splits at the intersection of Hualapai Way with Dorrell Lane and Deer Springs Way. Add additional drop inlets along Fort Apache Road between Elkhorn Road and Farm Road

In addition, further revisions to the MPU basin boundaries were required to quantify flows in local streets and model flow splits at the following intersections:

- Dorrell Lane and Tee Pee Lane
- Deer Springs Way and Grand Canyon Drive
- Deer Springs Way and Tee Pee Lane
- Severence Lane and Grand Canyon Drive

These flow splits in the model collectively increased design flows at the south end of the project and decreased design flows at the north end.

Two alternatives were evaluated for the project along the CC 215 right-of-way.

Alternative 1 - 12 ft x 6 ft RCB, \$788,000 construction cost.

Alternative 2 - 12 ft x 7 ft rectangular channel, \$762,000 construction cost.

The two alternatives were discussed with the City and CCRFCD and it was decided to incorporate Alternative 1 into the final design. While slightly more expensive, Alternative 1 provided adequate space for the City's future multi-use trail planned along the CC 215 without encroaching into the Control of Access along the CC 215.



Lateral storm drains along Severence Lane, Deer Springs Way and Echelon Point Road are proposed to collect surface flows before they reach Fort Apache Road. These lateral storm drains along with main storm drain are included as an excerpt of the 90% Design Plans in Appendix C a complete copy of the 90% design plans is included on the Data CD in Appendix E.

The total cost of the proposed improvements was estimated to be \$10.97 million of which \$10.77 million will be funded by the CCRFCD and \$198,000 will be funded by the RTCSNV.



11.0 REFERENCES

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3. CLV, 1999. *Northwest Neighborhood Flood Control Master Plan Phase 2*. Prepared by PBS&J, Inc., for City of Las Vegas Department of Public Works
4. COE, 1998. Flood Hydrograph Package (HEC-1) Computer Program and Users Manual, Version 4.1, prepared by U.S. Army Corps of Engineers Hydrologic Engineering Center, 1998.
5. FEMA, 2002. Flood Insurance Rate Map, Clark County, Nevada and Incorporated Areas, Panel 1745 of 4090, prepared by the Federal Emergency Management Agency, September 27, 2002, available at <http://www.ccrfcd.org>.
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7. GCWa, 2003. Technical Drainage Study for Town Center Assemblege L-TC 55 #2. Prepared by GC Wallace, Inc, January 2003.
8. GCWb, 2003. Development Plans, Town Center Assemblege L-TC 60/75 #2. Prepared by GC Wallace, Inc, October 2003.
9. Tucson, 1990. Standards Manual for Drainage Design and Floodplain Management in Tucson, Arizona, prepared by Simons, Li and Associates, Inc., 1990.
10. VTN, 2004. Technical Drainage Study for Day Dawn Vista. Prepared by VTN, June 2004.
11. WSPG, 2002. Water Surface Pressure Gradient Computer Program, Version 14.05, distributed by Civil Design Software Corporation, prepared originally by the Los Angeles Flood Control District.



APPENDIX A HYDROLOGIC PARAMETERS AND CALCULATIONS

A.1 Modified MPU 2008 HEC-1 Model

Table A.1.1

Rancho-Fort Apache Storm Drain

LBG Project No.: CCB 1126

STANDARD FORM 4

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME OF CONCENTRATION

FUTURE CONDITIONS

BY: EPF / FKR

DATE: 3/21/2013

CHKD BY: JSD

DATE: 4/26/2013

SUB-BASIN DATA						INITIAL / OVERLAND TIME (Ti)			TRAVEL TIME (Tt)					Tc	Tc Check	Tlag	REMARKS
BASIN	DEV./UN. (D or U)	CN	K	AREA Ac (3)	AREA (mi2)	Lo INITIAL LENGTH (ft)	S SLOPE %	Ti (min)	TRAVEL LENGTH (ft)	SLOPE %	V1 VELOCITY (ft/s)	V2 VELOCITY (ft/s)	Tt (min)	(min)	(min)	Tlag= 0.6Tc/60 (hours)	
(1)			(2)	(3)		(4)	(5)	(6)	(7)	(8)	(9a)	(9b)	(10)	(13)	(14)		
NW53-CA	D	79.1	0.6545	41.2	0.064	125	2.0	7.1	3000	2.9	3.4	5.2	10.5	17.6	27.4	0.176	PB = 2.85"
NW53-CB	D	79.8	0.6628	81.7	0.128	125	2.0	7.0	3825	2.5	3.2	4.9	14.0	21.0	31.9	0.210	PB = 2.85"
NW53-CC	D	87.2	0.7615	63.5	0.099	125	2.0	5.4	3055	1.7	2.7	4.0	13.7	19.1	27.7	0.191	PB = 2.85"
NW66-CA	D	84.0	0.7188	4.1	0.006	125	2.0	6.1	2500	2.0	2.9	4.4	10.5	16.6	24.6	0.166	PB = 2.91"
NW66-CB	D	77.5	0.6335	6.5	0.010	125	2.0	7.5	1416	2.8	3.4	5.1	5.5	12.9	18.6	0.129	PB = 2.91"
NW66-CC	D	84.1	0.7197	6.0	0.009	125	2.0	6.1	1504	2.7	3.3	5.0	5.9	12.0	19.1	0.120	PB = 2.87"
NW66-CD	D	84.1	0.7201	8.4	0.013	125	2.0	6.1	1511	2.6	3.3	4.9	6.0	12.1	19.1	0.121	PB = 2.87"
NW66-CE	D	84.0	0.7188	6.6	0.010	125	2.0	6.1	1524	2.6	3.3	4.9	6.0	12.1	19.2	0.121	PB = 2.86"
NW66-CF	D	84.0	0.7188	7.9	0.012	125	2.0	6.1	1493	2.5	3.2	4.9	6.0	12.1	19.0	0.121	PB = 2.86"
NW66-CG	D	84.1	0.7196	6.7	0.010	125	2.0	6.1	1273	2.8	3.4	5.1	5.0	11.0	17.8	0.110	PB = 2.86"
NW66-CI1	D	84.1	0.7197	16.7	0.026	125	2.0	6.1	1551	2.5	3.2	4.9	6.2	12.3	19.3	0.123	PB = 2.85"
NW66-CI2	D	84.0	0.7188	15.4	0.024	125	2.0	6.1	1878	1.3	2.3	3.5	10.1	16.2	21.1	0.162	PB = 2.85"
NW66-CI3	D	84.1	0.7198	15.4	0.024	125	2.0	6.1	2570	2.3	3.0	4.6	10.3	16.3	25.0	0.163	PB = 2.85"
NW66-CJ1	D	86.4	0.7500	2.2	0.003	125	2.0	5.6	1267	2.1	2.9	4.4	5.7	11.3	17.7	0.113	PB = 2.85"
NW66-CJ2	D	84.0	0.7193	11.2	0.018	125	2.0	6.1	1623	2.3	3.1	4.7	6.7	12.8	19.7	0.128	PB = 2.85"
NW66-CJ3	D	84.3	0.7222	11.0	0.017	125	2.0	6.0	1610	2.4	3.1	4.7	6.6	12.7	19.6	0.127	PB = 2.85"
NW66-CJ4	D	84.0	0.7188	3.8	0.006	125	2.0	6.1	875	2.3	3.1	4.6	4.1	10.2	15.6	0.102	PB = 2.85"
NW66-CJ5	D	84.1	0.7205	6.4	0.010	125	2.0	6.1	1375	2.5	3.2	4.8	5.7	11.7	18.3	0.117	PB = 2.85"
NW66-CJ6	D	84.0	0.7188	3.8	0.006	125	2.0	6.1	851	2.2	3.0	4.6	4.0	10.1	15.4	0.101	PB = 2.85"
NW77-CA	D	80.1	0.6672	80.3	0.125	125	2.0	6.9	3864	2.7	3.3	5.0	13.7	20.6	32.2	0.206	PB = 2.98"
NW77-CB	D	83.7	0.7152	42.3	0.066	125	2.0	6.1	2611	2.2	3.0	4.6	10.5	16.6	25.2	0.166	PB = 2.91"
NW77-CC	D	84.6	0.7268	4.6	0.007	125	2.0	6.0	1135	2.8	3.4	5.1	4.5	10.5	17.0	0.105	PB = 2.90"
NW77-CD	D	86.0	0.7456	7.3	0.011	125	2.0	5.7	1637	2.6	3.3	5.0	6.4	12.0	19.8	0.120	PB = 2.90"
NW77-CE	D	82.5	0.6991	9.1	0.014	125	2.0	6.4	1441	2.8	3.4	5.2	5.5	11.9	18.7	0.119	PB = 2.91"
NW77-CF	D	84.0	0.7188	3.7	0.006	125	2.0	6.1	1090	2.8	3.4	5.1	4.4	10.5	16.8	0.105	PB = 2.90"
NW77-CG	D	84.0	0.7188	4.3	0.007	125	2.0	6.1	1250	2.5	3.2	4.8	5.2	11.3	17.6	0.113	PB = 2.90"
NW77-CH	D	88.0	0.7716	8.9	0.014	125	2.0	5.2	1762	2.7	3.3	5.1	6.7	11.9	20.5	0.119	PB = 2.90"

Table A.1.1

Rancho-Fort Apache Storm Drain
LBG Project No.: CCB 1126

STANDARD FORM 4
HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL
TIME OF CONCENTRATION
FUTURE CONDITIONS

BY: EPF / FKR

DATE: 3/21/2013

CHKD BY: JSD

DATE: 4/26/2013

SUB-BASIN DATA						INITIAL / OVERLAND TIME (Ti)			TRAVEL TIME (Tt)					Tc	Tc Check	Tlag	REMARKS
BASIN	DEV./UN. (D or U)	CN	K	AREA Ac (mi2)	AREA (mi2)	Lo INITIAL LENGTH (ft)	S SLOPE %	Ti (min)	TRAVEL LENGTH (ft)	SLOPE %	V1 VELOCITY (ft/s)	V2 VELOCITY (ft/s)	Tt (min)	(min)	(min)	Tlag= 0.6Tc/60 (hours)	
(1)			(2)	(3)		(4)	(5)	(6)	(7)	(8)	(9a)	(9b)	(10)	(13)	(14)		
NWBA6-CA	D	80.0	0.6659	84.7	0.132	300	2.0	10.7	3700	2.8	3.4	5.1	12.9	23.6	32.2	0.236	PB = 2.95"
NWBA6-CB	D	84.3	0.7233	3.5	0.005	125	2.0	6.0	1281	3.4	3.7	5.6	4.6	10.6	17.8	0.106	PB = 2.91"
NWBA6-CC	D	84.3	0.7230	21.3	0.033	125	2.0	6.0	2200	1.9	2.8	4.2	9.7	15.7	22.9	0.157	PB = 2.91"
NWBA6-CD	D	84.0	0.7188	4.8	0.008	25	2.0	2.7	840	3.1	3.6	5.4	3.4	6.1	14.8	0.061	PB = 2.91"
NWBA6-CE	D	84.1	0.7202	3.9	0.006	125	2.0	6.1	1146	2.1	2.9	4.4	5.3	11.4	17.1	0.114	PB = 2.93"
NWBA6-CF	D	83.1	0.7070	38.9	0.061	125	2.0	6.3	2587	2.1	2.9	4.4	10.7	17.0	25.1	0.170	PB = 2.95"
NWBA6-CG	D	84.0	0.7188	3.2	0.005	25	2.0	2.7	708	3.3	3.7	5.6	2.9	5.6	14.1	0.056	PB = 2.91"
NWBA6-CH	D	84.0	0.7188	3.9	0.006	25	2.0	2.7	1217	2.2	3.0	4.6	5.4	8.1	16.9	0.081	PB = 2.91"
NWBC3A	D	93.0	0.8376	9.5	0.015	125	2.0	4.2	1075	1.5	2.5	3.7	5.9	10.1	16.7	0.101	PB = 2.87"
NWBC3B	D	93.0	0.8376	6.0	0.009	125	2.0	4.2	855	1.7	2.7	4.0	4.6	8.8	15.4	0.088	PB = 2.87"
NWBC2-CA	D	82.7	0.7017	19.3	0.030	120	2.0	6.2	1465	2.5	3.2	4.8	5.9	12.1	18.8	0.121	PB = 2.95"
NWBC2-CB	D	84.0	0.7188	20.0	0.031	125	2.0	6.1	1909	2.5	3.2	4.8	7.5	13.6	21.3	0.136	PB = 2.93"
NWBC2-CC	D	81.8	0.6894	131.4	0.205	125	2.0	6.6	5601	2.6	3.3	4.9	19.8	26.3	41.8	0.263	PB = 3.03"
NWBC2-CD	D	82.4	0.6982	6.2	0.010	320	1.5	11.3	2321	3.1	3.5	5.4	8.0	19.3	24.7	0.193	PB = 2.95"

For Developed basins $V1 = 20.2 \text{ (Slope/100)}^{0.5}$ and $V2 = 30.6 \text{ (Slope/100)}^{0.5}$

For Existing basins $V1 = 14.8 \text{ (Slope/100)}^{0.5}$ and $V2 = 29.4 \text{ (Slope/100)}^{0.5}$

If the Travel Length is greater than 500 ft then $Tt = 500/(60 V1) + (\text{Travel Length} - 500)/(60 V2)$

If the Travel Length is less than 500 ft then $Tt = \text{Travel Length}/(60 V2)$

$Tc = Ti + Tt$

Table A.1.2**Fort Apache Storm Drain
Curve Number Calculations**

By: FKR/RBI / EPF Date: 3/21/2013

Chkd By: JSD Date: 4/26/2013

BASIN ID	LAND USE INDEX NUMBER	SOIL MAP UNIT #	SUBREGION CN	ACRES	Subbasin Area (ac)	PERCENT OF SUBBASIN	CUMULATIVE PERCENT	AREAL WEIGHTED CN	CUMULATIVE CN	COMPOSITE CN
NW53-CA	4	191	76	0.008	41.21	0.0%	0.0%	0.01	0.01	
NW53-CA	17	191	90	0.119	41.21	0.3%	0.3%	0.26	0.27	
NW53-CA	6	191	84	0.827	41.21	2.0%	2.3%	1.69	1.96	
NW53-CA	14	191	79	40.215	41.21	97.6%	99.9%	77.10	79.06	
NW53-CA	17	191	90	0.001	41.21	0.0%	99.9%	0.00	79.06	
NW53-CA	14	191	79	0.034	41.21	0.1%	100.0%	0.07	79.13	
NW53-CA	17	191	90	0.002	41.21	0.0%	100.0%	0.00	79.13	79.13
NW53-CB	17	191	90	0.002	81.66	0.0%	0.0%	0.00	0.00	
NW53-CB	14	191	79	0.034	81.66	0.0%	0.0%	0.03	0.03	
NW53-CB	19	191	96	0.055	81.66	0.1%	0.1%	0.06	0.10	
NW53-CB	16	191	87	0.436	81.66	0.5%	0.6%	0.46	0.56	
NW53-CB	17	191	90	0.446	81.66	0.5%	1.2%	0.49	1.06	
NW53-CB	17	191	90	0.906	81.66	1.1%	2.3%	1.00	2.06	
NW53-CB	17	191	90	0.925	81.66	1.1%	3.4%	1.02	3.08	
NW53-CB	17	191	90	2.937	81.66	3.6%	7.0%	3.24	6.31	
NW53-CB	14	191	79	8.264	81.66	10.1%	17.2%	8.00	14.31	
NW53-CB	14	191	79	8.539	81.66	10.5%	27.6%	8.26	22.57	
NW53-CB	14	191	79	59.114	81.66	72.4%	100.0%	57.19	79.76	79.76
NW53-CC	19	191	96	0.003	63.50	0.0%	0.0%	0.00	0.00	
NW53-CC	16	191	87	0.004	63.50	0.0%	0.0%	0.01	0.01	
NW53-CC	14	191	79	0.089	63.50	0.1%	0.2%	0.11	0.12	
NW53-CC	16	191	87	0.363	63.50	0.6%	0.7%	0.50	0.62	
NW53-CC	19	191	96	0.803	63.50	1.3%	2.0%	1.21	1.83	
NW53-CC	17	191	90	0.837	63.50	1.3%	3.3%	1.19	3.02	
NW53-CC	17	191	90	2.010	63.50	3.2%	6.5%	2.85	5.87	
NW53-CC	16	191	87	59.389	63.50	93.5%	100.0%	81.37	87.24	87.24
NW66-CI2	6	191	84	15.400	15.40	100.0%	100.0%	84.00	84.00	84.00
NW66-CI1	6	191	84	7.100	16.70	42.5%	42.5%	35.71	35.71	
NW66-CI1	7	191	88	0.100	16.70	0.6%	43.1%	0.53	36.24	
NW66-CI1	7	191	88	0.200	16.70	1.2%	44.3%	1.05	37.29	
NW66-CI1	6	191	84	9.300	16.70	55.7%	100.0%	46.78	84.07	84.07
NW66-CJ3	6	191	84	10.300	11.00	93.6%	93.6%	78.65	78.65	
NW66-CJ3	7	191	88	0.200	11.00	1.8%	95.5%	1.60	80.25	
NW66-CJ3	7	191	88	0.500	11.00	4.5%	100.0%	4.00	84.25	
NW66-CJ3	7	191	88	0.000	11.00	0.0%	100.0%	0.00	84.25	84.25

Table A.1.2**Fort Apache Storm Drain
Curve Number Calculations**

By: FKR/RBI / EPF Date: 3/21/2013

Chkd By: JSD Date: 4/26/2013

BASIN ID	LAND USE INDEX NUMBER	SOIL MAP UNIT #	SUBREGION CN	ACRES	Subbasin Area (ac)	PERCENT OF SUBBASIN	CUMULATIVE PERCENT	AREAL WEIGHTED CN	CUMULATIVE CN	COMPOSITE CN
NW66-CJ2	6	191	84	11.100	11.20	99.1%	99.1%	83.25	83.25	
NW66-CJ2	7	191	88	0.100	11.20	0.9%	100.0%	0.79	84.04	84.04
NW66-CJ4	6	191	84	3.800	3.80	100.0%	100.0%	84.00	84.00	84.00
NW66-CJ5	6	191	84	6.200	6.40	96.9%	96.9%	81.37	81.37	
NW66-CJ5	7	191	88	0.200	6.40	3.1%	100.0%	2.75	84.13	84.13
NW66-CI3	6	191	84	9.800	15.40	63.6%	63.6%	53.45	53.45	
NW66-CI3	7	191	88	0.200	15.40	1.3%	64.9%	1.14	54.60	
NW66-CI3	7	191	88	0.100	15.40	0.6%	65.6%	0.57	55.17	
NW66-CI3	6	191	84	5.300	15.40	34.4%	100.0%	28.91	84.08	84.08
NW66-CJ6	6	191	84	3.800	3.80	100.0%	100.0%	84.00	84.00	84.00
NW66-CJ1	6	191	84	0.900	2.20	40.9%	40.9%	34.36	34.36	
NW66-CJ1	7	191	88	0.200	2.20	9.1%	50.0%	8.00	42.36	
NW66-CJ1	7	191	88	1.100	2.20	50.0%	100.0%	44.00	86.36	86.36
NW77-CA	17	191	90	4.700	80.30	5.9%	5.9%	5.27	5.27	
NW77-CA	17	191	90	1.900	80.30	2.4%	8.2%	2.13	7.40	
NW77-CA	14	191	79	8.500	80.30	10.6%	18.8%	8.36	15.76	
NW77-CA	14	191	79	8.200	80.30	10.2%	29.0%	8.07	23.83	
NW77-CA	14	191	79	56.100	80.30	69.9%	98.9%	55.19	79.02	
NW77-CA	19	191	96	0.900	80.30	1.1%	100.0%	1.08	80.09	80.09
NWBA6-CA	16	191	87	0.041	84.68	0.0%	0.0%	0.04	0.04	
NWBA6-CA	14	191	79	0.089	84.68	0.1%	0.2%	0.08	0.13	
NWBA6-CA	17	191	90	0.135	84.68	0.2%	0.3%	0.14	0.27	
NWBA6-CA	17	191	90	0.798	84.68	0.9%	1.3%	0.85	1.12	
NWBA6-CA	17	191	90	1.059	84.68	1.3%	2.5%	1.13	2.24	
NWBA6-CA	17	191	90	5.608	84.68	6.6%	9.1%	5.96	8.20	
NWBA6-CA	14	191	79	8.427	84.68	10.0%	19.1%	7.86	16.06	
NWBA6-CA	14	191	79	68.527	84.68	80.9%	100.0%	63.93	79.99	79.99
NW77-CD	7	191	88	3.700	7.30	50.7%	50.7%	44.60	44.60	
NW77-CD	6	191	84	0.200	7.30	2.7%	53.4%	2.30	46.90	
NW77-CD	6	191	84	0.400	7.30	5.5%	58.9%	4.60	51.51	
NW77-CD	6	191	84	3.000	7.30	41.1%	100.0%	34.52	86.03	86.03
NW77-CF	6	191	84	3.700	3.70	100.0%	100.0%	84.00	84.00	84.00

Table A.1.2**Fort Apache Storm Drain
Curve Number Calculations**

By: FKR/RBI / EPF Date: 3/21/2013

Chkd By: JSD Date: 4/26/2013

BASIN ID	LAND USE INDEX NUMBER	SOIL MAP UNIT #	SUBREGION CN	ACRES	Subbasin Area (ac)	PERCENT OF SUBBASIN	CUMULATIVE PERCENT	AREAL WEIGHTED CN	CUMULATIVE CN	COMPOSITE CN
NW77-CB	4	191	76	0.035	42.35	0.1%	0.1%	0.06	0.06	
NW77-CB	6	191	84	0.047	42.35	0.1%	0.2%	0.09	0.16	
NW77-CB	4	191	76	0.065	42.35	0.2%	0.3%	0.12	0.27	
NW77-CB	17	191	90	0.138	42.35	0.3%	0.7%	0.29	0.57	
NW77-CB	16	191	87	4.487	42.35	10.6%	11.3%	9.22	9.79	
NW77-CB	14	191	79	4.997	42.35	11.8%	23.1%	9.32	19.11	
NW77-CB	6	191	84	9.861	42.35	23.3%	46.4%	19.56	38.67	
NW77-CB	6	191	84	22.715	42.35	53.6%	100.0%	45.06	83.73	83.73
NWBA6-CF	4	191	76	0.208	38.88	0.5%	0.5%	0.41	0.41	
NWBA6-CF	7	191	88	0.696	38.88	1.8%	2.3%	1.58	1.98	
NWBA6-CF	6	191	84	4.062	38.88	10.4%	12.8%	8.77	10.76	
NWBA6-CF	6	191	84	4.714	38.88	12.1%	24.9%	10.18	20.94	
NWBA6-CF	16	191	87	5.488	38.88	14.1%	39.0%	12.28	33.22	
NWBA6-CF	14	191	79	10.488	38.88	27.0%	66.0%	21.31	54.53	
NWBA6-CF	6	191	84	13.229	38.88	34.0%	100.0%	28.58	83.10	83.10
NW77-CC	6	191	84	1.100	4.60	23.9%	23.9%	20.09	20.09	
NW77-CC	7	191	88	0.700	4.60	15.2%	39.1%	13.39	33.48	
NW77-CC	6	191	84	2.800	4.60	60.9%	100.0%	51.13	84.61	84.61
NW77-CE	6	191	84	6.400	9.10	70.3%	70.3%	59.08	59.08	
NW77-CE	7	191	88	0.200	9.10	2.2%	72.5%	1.93	61.01	
NW77-CE	6	191	84	0.700	9.10	7.7%	80.2%	6.46	67.47	
NW77-CE	4	191	76	1.800	9.10	19.8%	100.0%	15.03	82.51	82.51
NWBA6-CD	6	191	84	4.000	4.80	83.3%	83.3%	70.00	70.00	
NWBA6-CD	6	191	84	0.800	4.80	16.7%	100.0%	14.00	84.00	84.00
NWBA6-CG	6	191	84	3.200	3.20	100.0%	100.0%	84.00	84.00	84.00
NWBA6-CH	6	191	84	3.900	3.90	100.0%	100.0%	84.00	84.00	84.00
NWBC2-CA	6	191	84	9.910	19.30	51.3%	51.3%	43.13	43.13	
NWBC2-CA	4	191	76	0.520	19.30	2.7%	54.0%	2.05	45.18	
NWBC2-CA	4	191	76	0.190	19.30	1.0%	55.0%	0.75	45.93	
NWBC2-CA	16	191	87	0.080	19.30	0.4%	55.4%	0.36	46.29	
NWBC2-CA	14	191	79	3.920	19.30	20.3%	75.8%	16.05	62.33	
NWBC2-CA	6	191	84	4.680	19.30	24.2%	100.0%	20.37	82.70	82.70

Table A.1.2**Fort Apache Storm Drain
Curve Number Calculations**

By: FKR/RBI / EPF Date: 3/21/2013

Chkd By: JSD Date: 4/26/2013

BASIN ID	LAND USE INDEX NUMBER	SOIL MAP UNIT #	SUBREGION CN	ACRES	Subbasin Area (ac)	PERCENT OF SUBBASIN	CUMULATIVE PERCENT	AREAL WEIGHTED CN	CUMULATIVE CN	COMPOSITE CN
NWBC2-CC	16	191	87	0.014	131.42	0.0%	0.0%	0.01	0.01	
NWBC2-CC	15	191	78	0.019	131.42	0.0%	0.0%	0.01	0.02	
NWBC2-CC	7	191	88	0.036	131.42	0.0%	0.1%	0.02	0.04	
NWBC2-CC	15	191	78	0.037	131.42	0.0%	0.1%	0.02	0.07	
NWBC2-CC	15	191	78	0.076	131.42	0.1%	0.1%	0.05	0.11	
NWBC2-CC	15	191	78	0.120	131.42	0.1%	0.2%	0.07	0.18	
NWBC2-CC	15	191	78	0.152	131.42	0.1%	0.3%	0.09	0.27	
NWBC2-CC	8	191	93	0.161	131.42	0.1%	0.5%	0.11	0.39	
NWBC2-CC	17	191	90	0.334	131.42	0.3%	0.7%	0.23	0.62	
NWBC2-CC	15	191	78	0.360	131.42	0.3%	1.0%	0.21	0.83	
NWBC2-CC	15	191	78	0.371	131.42	0.3%	1.3%	0.22	1.05	
NWBC2-CC	15	191	78	0.506	131.42	0.4%	1.7%	0.30	1.35	
NWBC2-CC	15	191	78	0.508	131.42	0.4%	2.1%	0.30	1.65	
NWBC2-CC	15	191	78	0.514	131.42	0.4%	2.4%	0.31	1.96	
NWBC2-CC	15	191	78	0.525	131.42	0.4%	2.8%	0.31	2.27	
NWBC2-CC	17	191	90	0.632	131.42	0.5%	3.3%	0.43	2.70	
NWBC2-CC	17	191	90	0.776	131.42	0.6%	3.9%	0.53	3.23	
NWBC2-CC	17	191	90	0.880	131.42	0.7%	4.6%	0.60	3.84	
NWBC2-CC	17	191	90	0.883	131.42	0.7%	5.3%	0.60	4.44	
NWBC2-CC	17	191	90	1.072	131.42	0.8%	6.1%	0.73	5.18	
NWBC2-CC	17	191	90	1.789	131.42	1.4%	7.4%	1.23	6.40	
NWBC2-CC	17	191	90	2.066	131.42	1.6%	9.0%	1.42	7.82	
NWBC2-CC	15	191	78	3.220	131.42	2.5%	11.5%	1.91	9.73	
NWBC2-CC	16	191	87	3.461	131.42	2.6%	14.1%	2.29	12.02	
NWBC2-CC	14	191	79	3.971	131.42	3.0%	17.1%	2.39	14.41	
NWBC2-CC	16	191	87	5.196	131.42	4.0%	21.1%	3.44	17.85	
NWBC2-CC	17	191	90	8.253	131.42	6.3%	27.3%	5.65	23.50	
NWBC2-CC	1	191	77	9.765	131.42	7.4%	34.8%	5.72	29.22	
NWBC2-CC	17	191	90	9.925	131.42	7.6%	42.3%	6.80	36.02	
NWBC2-CC	2	191	65	9.985	131.42	7.6%	49.9%	4.94	40.96	
NWBC2-CC	17	191	90	15.046	131.42	11.4%	61.4%	10.30	51.26	
NWBC2-CC	14	191	79	50.758	131.42	38.6%	100.0%	30.51	81.77	81.8

Table A.1.2**Fort Apache Storm Drain
Curve Number Calculations**

By: FKR/RBI / EPF Date: 3/21/2013

Chkd By: JSD Date: 4/26/2013

BASIN ID	LAND USE INDEX NUMBER	SOIL MAP UNIT #	SUBREGION CN	ACRES	Subbasin Area (ac)	PERCENT OF SUBBASIN	CUMULATIVE PERCENT	AREAL WEIGHTED CN	CUMULATIVE CN	COMPOSITE CN
NWBC2-CD	6	191	84	0.13	6.19	2.1%	2.1%	1.76	1.76	
NWBC2-CD	16	191	87	0.37	6.19	6.0%	8.1%	5.20	6.96	
NWBC2-CD	17	191	90	1.03	6.19	16.6%	24.7%	14.98	21.94	
NWBC2-CD	16	191	87	0.00	6.19	0.0%	24.7%	0.00	21.94	
NWBC2-CD	1	191	77	0.27	6.19	4.4%	29.1%	3.36	25.30	
NWBC2-CD	1	191	77	0.08	6.19	1.3%	30.4%	1.00	26.29	
NWBC2-CD	8	191	93	0.01	6.19	0.2%	30.5%	0.15	26.44	
NWBC2-CD	7	191	88	0.53	6.19	8.6%	39.1%	7.53	33.98	
NWBC2-CD	7	191	88	0.01	6.19	0.2%	39.3%	0.14	34.12	
NWBC2-CD	4	191	76	0.28	6.19	4.5%	43.8%	3.44	37.56	
NWBC2-CD	4	191	76	0.02	6.19	0.3%	44.1%	0.25	37.80	
NWBC2-CD	14	191	79	2.87	6.19	46.4%	90.5%	36.63	74.43	
NWBC2-CD	6	191	84	0.59	6.19	9.5%	100.0%	8.01	82.44	82.4
NW66-CH	6	191	84	5.700	42.60	13.4%	13.4%	11.24	11.24	
NW66-CH	7	191	88	0.600	42.60	1.4%	14.8%	1.24	12.48	
NW66-CH	7	191	88	0.900	42.60	2.1%	16.9%	1.86	14.34	
NW66-CH	6	191	84	4.200	42.60	9.9%	26.8%	8.28	22.62	
NW66-CH	4	191	76	0.600	42.60	1.4%	28.2%	1.07	23.69	
NW66-CH	6	191	84	30.600	42.60	71.8%	100.0%	60.34	84.03	84.0
NWBA6-CB	6	191	84	3.100	3.50	88.6%	88.6%	74.40	74.40	
NWBA6-CB	7	191	88	0.300	3.50	8.6%	97.1%	7.54	81.94	
NWBA6-CB	6	191	84	0.100	3.50	2.9%	100.0%	2.40	84.34	84.3
NWBA6-CC	6	191	84	19.600	21.30	92.0%	92.0%	77.30	77.30	
NWBA6-CC	7	191	88	0.500	21.30	2.3%	94.4%	2.07	79.36	
NWBA6-CC	7	191	88	1.200	21.30	5.6%	100.0%	4.96	84.32	84.3
NWBA6-CE	6	191	84	3.800	3.90	97.4%	97.4%	81.85	81.85	
NWBA6-CE	7	191	88	0.100	3.90	2.6%	100.0%	2.26	84.10	84.1
NW66-CC	6	191	84	5.900	6.00	98.3%	98.3%	82.60	82.60	
NW66-CC	7	191	88	0.100	6.00	1.7%	100.0%	1.47	84.07	84.1
NW66-CD	6	191	84	8.200	8.40	97.6%	97.6%	82.00	82.00	
NW66-CD	7	191	88	0.200	8.40	2.4%	100.0%	2.10	84.10	84.1
NW66-CE	6	191	84	6.600	6.60	100.0%	100.0%	84	84.00	84.0
NW66-CF	6	191	84	7.900	7.90	100.0%	100.0%	84.00	84.00	84.0
NW66-CG	6	191	84	6.600	6.70	98.5%	98.5%	82.75	82.75	
NW66-CG	7	191	88	0.100	6.70	1.5%	100.0%	1.31	84.06	84.1
NWBC2-CB	6	191	84	20.000	20.00	100.0%	100.0%	84	84.00	84.0

Table A.1.2**Fort Apache Storm Drain
Curve Number Calculations**By: FKR/RBI / EPF Date: 3/21/2013
Chkd By: JSD Date: 4/26/2013

BASIN ID	LAND USE INDEX NUMBER	SOIL MAP UNIT #	SUBREGION CN	ACRES	Subbasin Area (ac)	PERCENT OF SUBBASIN	CUMULATIVE PERCENT	AREAL WEIGHTED CN	CUMULATIVE CN	COMPOSITE CN
NW66-CA	6	191	84	4.100	4.10	100.0%	100.0%	84.00	84.00	84.0
NW66-CB	4	191	76	5.100	6.50	78.5%	78.5%	59.63	59.63	
NW66-CB	6	191	84	0.500	6.50	7.7%	86.2%	6.46	66.09	
NW66-CB	7	191	88	0.500	6.50	7.7%	93.8%	6.77	72.86	
NW66-CB	4	191	76	0.400	6.50	6.2%	100.0%	4.68	77.54	77.5
NW77-CG	6	191	84	4.300	4.30	100.0%	100.0%	84.00	84.00	84.0
NW77-CH	7	191	88	8.800	8.90	98.9%	98.9%	87.01	87.01	
NW77-CH	7	191	88	0.100	8.90	1.1%	100.0%	0.99	88.00	88.0
NWBC3A	8	191	93	1.740	9.51	18.3%	18.3%	17.02	17.02	
NWBC3A	8	191	93	7.770	9.51	81.7%	100.0%	75.98	93.00	93.0
NWBC3B	8	191	93	5.970	5.97	100.0%	100.0%	93.00	93.00	93.0

Table A.1.3: Summary of Intersection Flow Split Calculations

Street 1 (Main)	Street 2 (Side)	Total Flow at Intersection (cfs)	Street 1 Flow (cfs)	Street 2 Flow (cfs)
Dorrell Lane	Tee Pee Lane	50	42	8
		100	83	17
		150	125	25
		200	166	34
		250	207	43
Deer Springs Way	Grand Canyon Drive	50	39	11
		100	80	20
		150	120	30
		200	160	40
		250	202	48
		350	279	71
Deer Springs Way	Tee Pee Lane	50	43	7
		100	84	16
		150	126	24
		200	167	33
		250	209	41
		350	293	57
Severence Lane	Grand Canyon Drive	50	41	9
		100	84	16
		150	127	23
		200	171	29
		250	212	38
		350	290	60
		500	412	88
		750	621	129

THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF DORRELL LANE (MAIN) AND TEE PEE LANE (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q = 50 cfs Q_{OB} = 1.7 cfs Q_m = 47 cfs (See Cross Section on Sheet 2) W_m = 49.5 ft Measured between Face of Curbs S_m = 0.032 W_{ss} = 49.5 ft Measured between Face of Curbs S_s = 0.01 Y_o = 0.020 ft		
OUTPUT		
Q_L = 8 cfs Q_o = -3 cfs		
FLOW INTERCEPTED BY TEE PEE LANE		
Q _{INT} = 8 cfs		
TOTAL FLOW IN DORRELL LANE = TOTAL FLOW IN TEE PEE LANE = 42 cfs 8 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

DORRELL LANE OVERBANK FLOW CALCULATION

$A_t = 0.31 \text{ sqft}$

$V = 5.6 \text{ ft/s}$ (See FlowMaster Calculation)

$Q_{OB} = 1.7 \text{ cfs}$

Flow Depth = 0.52 ft (See FlowMaster Calculation)

Curb Height (CH) = 0.5 ft

Curb Width (CW) = 0.5 ft

Sidewalk Width (SW) = 15 ft

Top of Curb Elev (TC) = 0.5 ft

Back Walk Elev (BW) = 0.8 ft

$A_1 = 0.3 \text{ sqft}$ $A_1 = (WS - BW) \times SW$

$A_2 = 0.01 \text{ sqft}$ $A_2 = (WS - CH) \times CW$

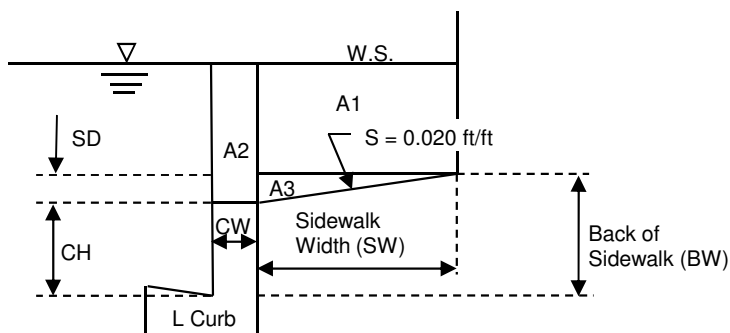
$A_3 = 0 \text{ sqft}$ (if $WS < BW$) $A_3 = \frac{SD \times (SD / 0.020)}{2}$ $SD = WS - CH$

$A_{\text{total}} (A_T) = 0.31 \text{ sqft}$ (if $WS > BW$) $A_3 = \frac{SW \times SD}{2}$ $SD = SW \times 0.020$

Top Width = 15.5 ft

$A_T = A_1 + A_2 + A_3$

$Q_{ob} = V \times A_T$



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF DORRELL LANE (MAIN) AND TEE PEE LANE (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q= 100 cfs Q_{OB}= 3.6 cfs Q_m= 93 cfs (See Cross Section on Sheet 2) W_m= 49.5 ft Measured between Face of Curbs S_m= 0.032 W_{ss}= 49.5 ft Measured between Face of Curbs S_s= 0.01 Y_o= 0.075 ft		
OUTPUT		
Q_L= 15 cfs Q_o= 3 cfs		
FLOW INTERCEPTED BY TEE PEE LANE		
Q_{INT}= 17 cfs		
TOTAL FLOW IN DORRELL LANE = 83 cfs TOTAL FLOW IN TEE PEE LANE = 17 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

DORRELL LANE OVERBANK FLOW CALCULATION

At = 0.56 sqft

V = 6.42 ft/s (See FlowMaster Calculation)

Qob = 3.6 cfs

Flow Depth = 0.64 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

15 ft

0.5 ft

0.8 ft

A1 = 0 sqft

A1 = (WS - BW) x SW

A2 = 0.07 sqft

A2 = (WS - CH) x CW

A3 = 0.49 sqft

(if WS < BW) $A3 = \frac{SD \times (SD / 0.020)}{2}$

SD = WS - CH

A total = 0.56 sqft

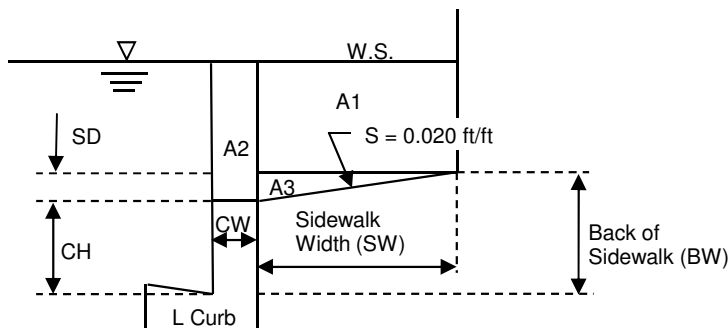
(if WS > BW) $A3 = \frac{SW \times SD}{2}$

SD = SW x 0.020

Top Width = 7.5 ft

AT = A1 + A2 + A3

Qob = V x AT



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF DORRELL LANE (MAIN) AND TEE PEE LANE (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q= 150 cfs Q_{OB}= 8.7 cfs Q_m= 133 cfs (See Cross Section on Sheet 2) W_m= 49.5 ft Measured between Face of Curbs S_m= 0.032 W_{ss}= 49.5 ft Measured between Face of Curbs S_s= 0.01 Y_o= 0.110 ft		
OUTPUT		
Q_L= 20 cfs Q_o= 5 cfs		
FLOW INTERCEPTED BY TEE PEE LANE		
Q_{INT}= 25 cfs		
TOTAL FLOW IN DORRELL LANE = 125 cfs TOTAL FLOW IN TEE PEE LANE = 25 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

DORRELL LANE OVERBANK FLOW CALCULATION

At = 1.21 sqft

V = 7.23 ft/s (See FlowMaster Calculation)

Qob = 8.7 cfs

Flow Depth = 0.71 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

15 ft

0.5 ft

0.8 ft

A1 = 0 sqft A1 = (WS - BW) x SW

A2 = 0.105 sqft A2 = (WS - CH) x CW

A3 = 1.1025 sqft (if WS < BW) A3 = $\frac{SD \times (SD / 0.020)}{2}$ SD = WS - CH

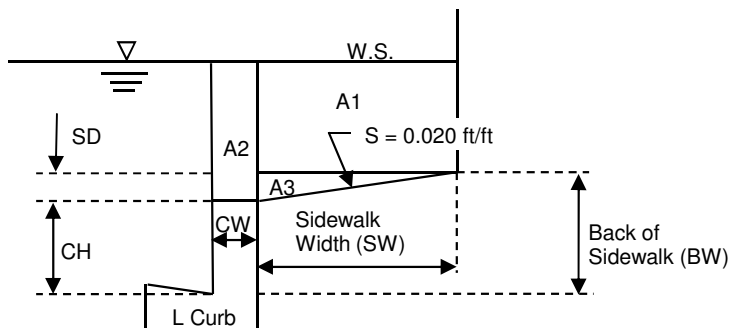
A total = 1.21 sqft

(if WS > BW) A3 = $\frac{SW \times SD}{2}$ SD = SW x 0.020

Top Width = 11 ft

AT = A1 + A2 + A3

Qob = V x AT



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF DORRELL LANE (MAIN) AND TEE PEE LANE (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q= 200 cfs Q_{OB}= 16.5 cfs Q_m= 167 cfs (See Cross Section on Sheet 2) W_m= 49.5 ft Measured between Face of Curbs S_m= 0.032 W_{ss}= 49.5 ft Measured between Face of Curbs S_s= 0.01 Y_o= 0.145 ft		
OUTPUT		
Q_L= 25 cfs Q_o= 8 cfs		
FLOW INTERCEPTED BY TEE PEE LANE		
Q_{INT}= 34 cfs		
TOTAL FLOW IN DORRELL LANE = 166 cfs TOTAL FLOW IN TEE PEE LANE = 34 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

DORRELL LANE OVERBANK FLOW CALCULATION

At = 2.10 sqft

V = 7.84 ft/s (See FlowMaster Calculation)

Qob = 16.5 cfs

Flow Depth = 0.78 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

15 ft

0.5 ft

0.8 ft

A1 = 0 sqft

A1 = (WS - BW) x SW

A2 = 0.14 sqft

A2 = (WS - CH) x CW

A3 = 1.96 sqft

(if WS < BW) A3 = $\frac{SD \times (SD / 0.020)}{2}$

SD = WS - CH

A total = 2.10 sqft

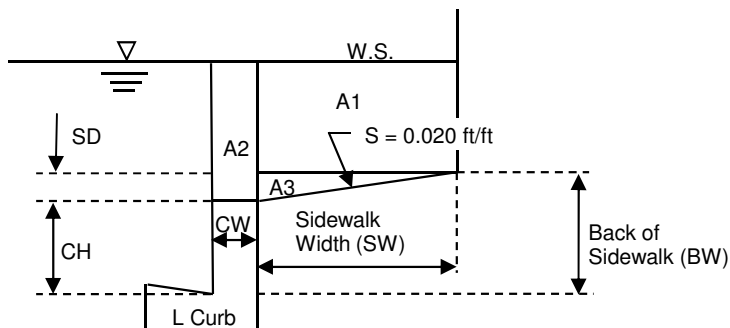
(if WS > BW) A3 = $\frac{SW \times SD}{2}$

SD = SW x 0.020

Top Width = 14.5 ft

AT = A1 + A2 + A3

Qob = V x AT



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF DORRELL LANE (MAIN) AND TEE PEE LANE (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q= 250 cfs Q_{OB}= 24.3 cfs Q_m= 201 cfs (See Cross Section on Sheet 2) W_m= 49.5 ft Measured between Face of Curbs S_m= 0.032 W_{ss}= 49.5 ft Measured between Face of Curbs S_s= 0.01 Y_o= 0.185 ft		
OUTPUT		
Q_L= 30 cfs Q_o= 13 cfs		
FLOW INTERCEPTED BY TEE PEE LANE		
Q_{INT}= 43 cfs		
TOTAL FLOW IN DORRELL LANE = 207 cfs TOTAL FLOW IN TEE PEE LANE = 43 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

DORRELL LANE OVERBANK FLOW CALCULATION

At = 2.87 sqft

V = 8.48 ft/s (See FlowMaster Calculation)

Qob = 24.3 cfs

Flow Depth = 0.83 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

15 ft

0.5 ft

0.8 ft

A1 = 0.45 sqft A1 = (WS - BW) x SW

A2 = 0.165 sqft A2 = (WS - CH) x CW

A3 = 2.25 sqft (if WS < BW) A3 = $\frac{SD \times (SD / 0.020)}{2}$ SD = WS - CH

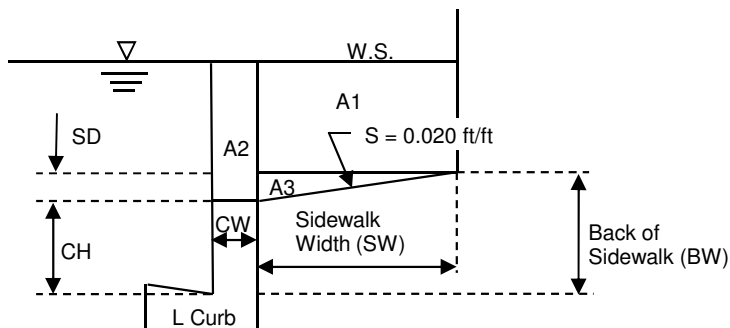
A total = 2.87 sqft

(if WS > BW) A3 = $\frac{SW \times SD}{2}$ SD = SW x 0.020

Top Width = 15.5 ft

AT = A1 + A2 + A3

Qob = V x AT



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF DEER SPRINGS WAY (MAIN) AND GRAND CANYON DRIVE (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q= 50 cfs Q_{OB}= 0.0 cfs Q_m= 50 cfs (See Cross Section on Sheet 2) W_m= 49.5 ft Measured between Face of Curbs S_m= 0.0155 W_{ss}= 49.5 ft Measured between Face of Curbs S_s= 0.0155 Y_o= 0.008 ft		
OUTPUT		
Q_L= 11 cfs Q_o= -9 cfs		
FLOW INTERCEPTED BY GRAND CANYON DRIVE		
Q_{INT}= 11 cfs		
TOTAL FLOW IN DEER SPRINGS WAY = 39 cfs TOTAL FLOW IN GRAND CANYON DRIVE = 11 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

GRAND CANYON DRIVE OVERBANK FLOW CALCULATION

$A_t = 0.01 \text{ sqft}$

$V = 5.89 \text{ ft/s}$ (See FlowMaster Calculation)

$Q_{ob} = 0.0 \text{ cfs}$ $Q_{ob} = V \times A_t$

Flow Depth = 0.51 ft (See FlowMaster Calculation)

0.8 ft

0.5 ft

15 ft

0.5 ft

0.5 ft

$A_1 = 0 \text{ sqft}$ $A_1 = (WS - BW) \times SW$

$A_2 = 0.005 \text{ sqft}$ $A_2 = (WS - CH) \times CW$

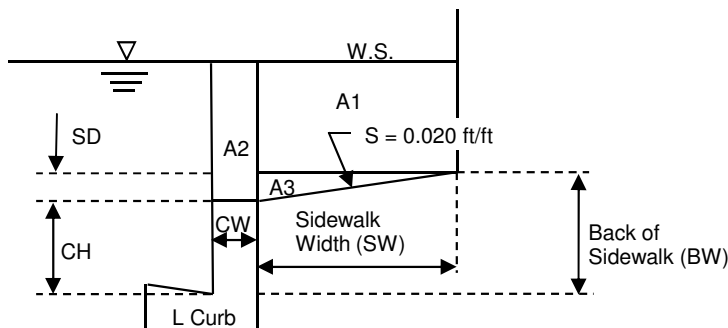
$A_3 = 0.0025 \text{ sqft}$ (if $WS < BW$) $A_3 = \frac{SD \times (SD / 0.020)}{2}$ $SD = WS - CH$

$A_{\text{total}} (A_t) = 0.01 \text{ sqft}$ (if $WS > BW$) $A_3 = \frac{SW \times SD}{2}$ $SD = SW \times 0.020$

Top Width = 1 ft

$A_t = A_1 + A_2 + A_3$

$Q_{ob} = V \times A_t$



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF DEER SPRINGS WAY (MAIN) AND GRAND CANYON DRIVE (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q = 100 cfs Q_{OB} = 3.2 cfs Q_m = 94 cfs (See Cross Section on Sheet 2) W_m = 49.5 ft Measured between Face of Curbs S_m = 0.0155 W_{ss} = 49.5 ft Measured between Face of Curbs S_s = 0.0155 Y_o = 0.070 ft		
OUTPUT		
Q_L = 20 cfs Q_o = 0 cfs		
FLOW INTERCEPTED BY GRAND CANYON DRIVE		
Q _{INT} = 20 cfs		
TOTAL FLOW IN DEER SPRINGS WAY = 80 cfs TOTAL FLOW IN GRAND CANYON DRIVE = 20 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

GRAND CANYON DRIVE OVERBANK FLOW CALCULATION

$A_t = 0.49 \text{ sqft}$

$V = 6.62 \text{ ft/s}$ (See FlowMaster Calculation)

$Q_{ob} = 3.2 \text{ cfs}$ $Q_{ob} = V \times A_t$

Flow Depth = 0.63 ft (See FlowMaster Calculation)

0.8 ft

0.5 ft

15 ft

0.5 ft

0.5 ft

$A_1 = 0 \text{ sqft}$ $A_1 = (WS - BW) \times SW$

$A_2 = 0.065 \text{ sqft}$ $A_2 = (WS - CH) \times CW$

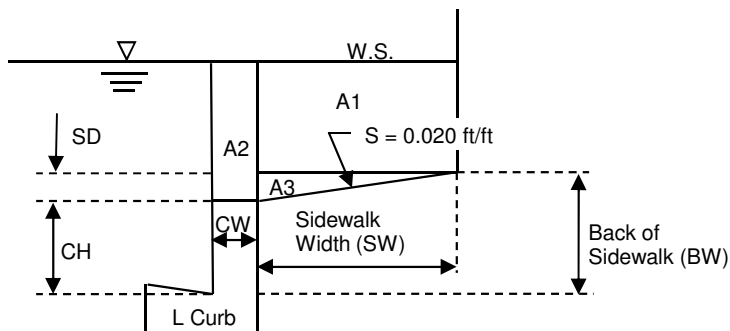
$A_3 = 0.4225 \text{ sqft}$ (if $WS < BW$) $A_3 = \frac{SD \times (SD / 0.020)}{2}$ $SD = WS - CH$

$A_{\text{total}} (A_t) = 0.49 \text{ sqft}$ (if $WS > BW$) $A_3 = \frac{SW \times SD}{2}$ $SD = SW \times 0.020$

Top Width = 7 ft

$A_t = A_1 + A_2 + A_3$

$Q_{ob} = V \times A_t$



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF DEER SPRINGS WAY (MAIN) AND GRAND CANYON DRIVE (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q = 150 cfs Q_{OB} = 8.2 cfs Q_m = 134 cfs (See Cross Section on Sheet 2) W_m = 49.5 ft Measured between Face of Curbs S_m = 0.0155 W_{ss} = 49.5 ft Measured between Face of Curbs S_s = 0.0155 Y_o = 0.105 ft		
OUTPUT		
Q_L = 28 cfs Q_o = 2 cfs		
FLOW INTERCEPTED BY GRAND CANYON DRIVE		
Q _{INT} = 30 cfs		
TOTAL FLOW IN DEER SPRINGS WAY = 120 cfs TOTAL FLOW IN GRAND CANYON DRIVE = 30 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

GRAND CANYON DRIVE OVERBANK FLOW CALCULATION

$A_t = 1.10 \text{ sqft}$

$V = 7.46 \text{ ft/s}$ (See FlowMaster Calculation)

$Q_{ob} = 8.2 \text{ cfs}$ $Q_{ob} = V \times A_t$

Flow Depth = 0.7 ft (See FlowMaster Calculation)

0.8 ft

0.5 ft

15 ft

0.5 ft

0.5 ft

$A_1 = 0 \text{ sqft}$ $A_1 = (WS - BW) \times SW$

$A_2 = 0.1 \text{ sqft}$ $A_2 = (WS - CH) \times CW$

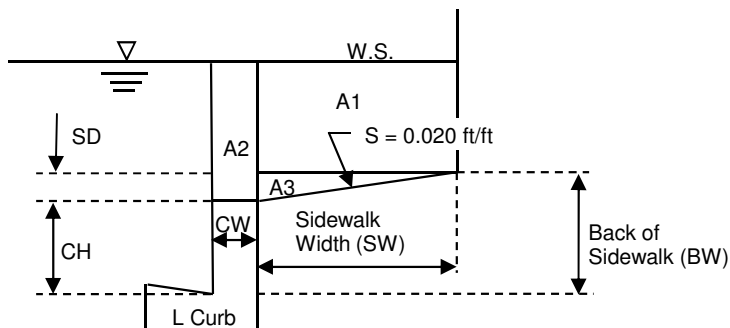
$A_3 = 1 \text{ sqft}$ (if $WS < BW$) $A_3 = \frac{SD \times (SD / 0.020)}{2}$ $SD = WS - CH$

$A_{\text{total}} (A_t) = 1.10 \text{ sqft}$ (if $WS > BW$) $A_3 = \frac{SW \times SD}{2}$ $SD = SW \times 0.020$

Top Width = 10.5 ft

$A_t = A_1 + A_2 + A_3$

$Q_{ob} = V \times A_t$



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF DEER SPRINGS WAY (MAIN) AND GRAND CANYON DRIVE (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q = 200 cfs Q_{OB} = 15.9 cfs Q_m = 168 cfs (See Cross Section on Sheet 2) W_m = 49.5 ft Measured between Face of Curbs S_m = 0.0155 W_{ss} = 49.5 ft Measured between Face of Curbs S_s = 0.0155 Y_o = 0.140 ft		
OUTPUT		
Q_L = 34 cfs Q_o = 6 cfs		
FLOW INTERCEPTED BY GRAND CANYON DRIVE		
Q _{INT} = 40 cfs		
TOTAL FLOW IN DEER SPRINGS WAY = 160 cfs TOTAL FLOW IN GRAND CANYON DRIVE = 40 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

GRAND CANYON DRIVE OVERBANK FLOW CALCULATION

$A_t = 1.96 \text{ sqft}$

$V = 8.1 \text{ ft/s}$ (See FlowMaster Calculation)

$Q_{ob} = 15.9 \text{ cfs}$ $Q_{ob} = V \times A_t$

Flow Depth = 0.77 ft (See FlowMaster Calculation)

0.8 ft

0.5 ft

15 ft

0.5 ft

0.5 ft

$A_1 = 0 \text{ sqft}$ $A_1 = (WS - BW) \times SW$

$A_2 = 0.135 \text{ sqft}$ $A_2 = (WS - CH) \times CW$

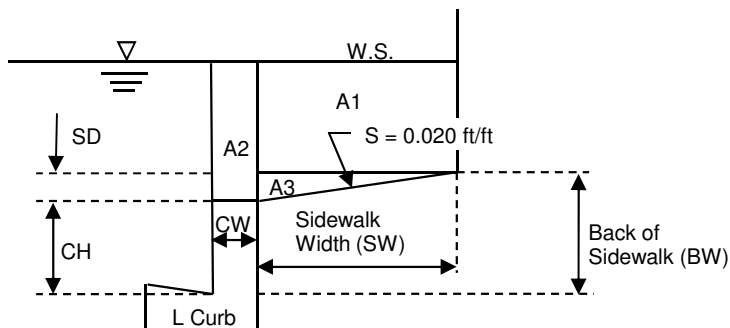
$A_3 = 1.8225 \text{ sqft}$ (if $WS < BW$) $A_3 = \frac{SD \times (SD / 0.020)}{2}$ $SD = WS - CH$

$A_{\text{total}} (A_t) = 1.96 \text{ sqft}$ (if $WS > BW$) $A_3 = \frac{SW \times SD}{2}$ $SD = SW \times 0.020$

Top Width = 14 ft

$A_t = A_1 + A_2 + A_3$

$Q_{ob} = V \times A_t$



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF DEER SPRINGS WAY (MAIN) AND GRAND CANYON DRIVE (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q = 250 cfs Q_{OB} = 22.3 cfs Q_m = 205 cfs (See Cross Section on Sheet 2) W_m = 49.5 ft Measured between Face of Curbs S_m = 0.0155 W_{ss} = 49.5 ft Measured between Face of Curbs S_s = 0.0155 Y_o = 0.165 ft		
OUTPUT		
Q_L = 41 cfs Q_o = 6 cfs		
FLOW INTERCEPTED BY GRAND CANYON DRIVE		
Q _{INT} = 48 cfs		
TOTAL FLOW IN DEER SPRINGS WAY = 202 cfs TOTAL FLOW IN GRAND CANYON DRIVE = 48 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

GRAND CANYON DRIVE OVERBANK FLOW CALCULATION

$A_t = 2.56 \text{ sqft}$

$V = 8.74 \text{ ft/s}$ (See FlowMaster Calculation)

$Q_{ob} = 22.3 \text{ cfs}$ $Q_{ob} = V \times A_t$

Flow Depth = 0.81 ft (See FlowMaster Calculation)

0.8 ft

0.5 ft

15 ft

0.5 ft

0.5 ft

$A_1 = 0.15 \text{ sqft}$ $A_1 = (WS - BW) \times SW$

$A_2 = 0.155 \text{ sqft}$ $A_2 = (WS - CH) \times CW$

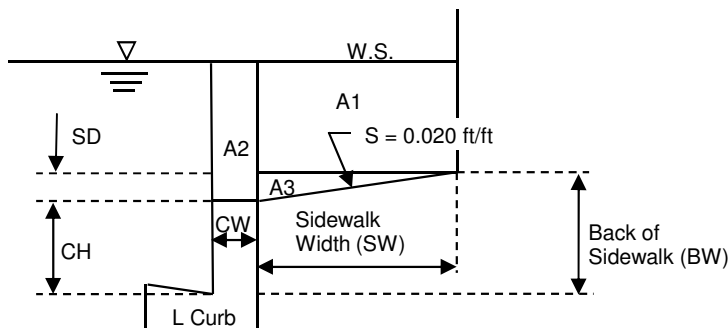
$A_3 = 2.25 \text{ sqft}$ (if $WS < BW$) $A_3 = \frac{SD \times (SD / 0.020)}{2}$ $SD = WS - CH$

$A_{\text{total}} (A_t) = 2.56 \text{ sqft}$ (if $WS > BW$) $A_3 = \frac{SW \times SD}{2}$ $SD = SW \times 0.020$

Top Width = 15.5 ft

$A_t = A_1 + A_2 + A_3$

$Q_{ob} = V \times A_t$



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF DEER SPRINGS WAY (MAIN) AND GRAND CANYON DRIVE (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q = 350 cfs Q_{OB} = 37.9 cfs Q_m = 274 cfs (See Cross Section on Sheet 2) W_m = 49.5 ft Measured between Face of Curbs S_m = 0.0155 W_{ss} = 49.5 ft Measured between Face of Curbs S_s = 0.0155 Y_o = 0.245 ft		
OUTPUT		
Q_L = 54 cfs Q_o = 16 cfs		
FLOW INTERCEPTED BY GRAND CANYON DRIVE		
Q _{INT} = 71 cfs		
TOTAL FLOW IN DEER SPRINGS WAY = 279 cfs TOTAL FLOW IN GRAND CANYON DRIVE = 71 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

GRAND CANYON DRIVE OVERBANK FLOW CALCULATION

At = 3.80 sqft

V = 9.99 ft/s (See FlowMaster Calculation)

Qob = 37.9 cfs Qob = V x AT

Flow Depth = 0.89 ft (See FlowMaster Calculation)

0.8 ft

0.5 ft

15 ft

0.5 ft

0.5 ft

A1 = 1.35 sqft A1 = (WS - BW) x SW

A2 = 0.195 sqft A2 = (WS - CH) x CW

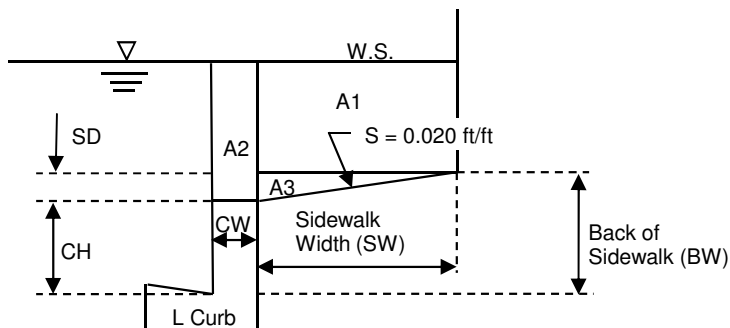
A3 = 2.25 sqft (if WS < BW) A3 = $\frac{SD \times (SD / 0.020)}{2}$ SD = WS - CH

A total (AT) = 3.80 sqft (if WS > BW) A3 = $\frac{SW \times SD}{2}$ SD = SW x 0.020

Top Width = 15.5 ft

AT = A1 + A2 + A3

Qob = V x AT



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF DEER SPRINGS WAY (MAIN) AND TEE PEE LANE (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q = 50 cfs Q_{OB} = 0.3 cfs Q_m = 49 cfs (See Cross Section on Sheet 2) W_m = 69 ft Measured between Face of Curbs S_m = 0.0264 W_{ss} = 49.5 ft Measured between Face of Curbs S_s = 0.012 Y_o = 0.024 ft		
OUTPUT		
Q_L = 7 cfs Q_o = -1 cfs		
FLOW INTERCEPTED BY TEE PEE LANE		
Q_{INT} = 7 cfs		
TOTAL FLOW IN DEER SPRINGS WAY = 43 cfs TOTAL FLOW IN TEE PEE LANE = 7 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

DEER SPRINGS WAY OVERBANK FLOW CALCULATION

At = 0.06 sqft

V = 5.13 ft/s (See FlowMaster Calculation)

Qob = 0.3 cfs

Flow Depth = 0.54 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

5 ft

0.5 ft

0.6 ft

A1 = 0 sqft

A1 = (WS - BW) x SW

A2 = 0.02 sqft

A2 = (WS - CH) x CW

A3 = 0.04 sqft

(if WS < BW) A3 = $\frac{SD \times (SD / 0.020)}{2}$

SD = WS - CH

A total = 0.06 sqft

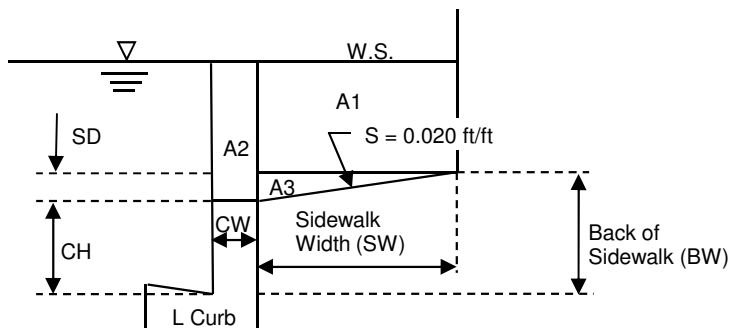
(if WS > BW) A3 = $\frac{SW \times SD}{2}$

SD = SW x 0.020

Top Width = 2.5 ft

AT = A1 + A2 + A3

Qob = V x AT



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF DEER SPRINGS WAY (MAIN) AND TEE PEE LANE (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q= 100 cfs Q_{OB}= 3.7 cfs Q_m= 93 cfs (See Cross Section on Sheet 2) W_m= 69 ft Measured between Face of Curbs S_m= 0.0264 W_{ss}= 49.5 ft Measured between Face of Curbs S_s= 0.012 Y_o= 0.115 ft		
OUTPUT		
Q_L= 12 cfs Q_o= 17 cfs		
FLOW INTERCEPTED BY TEE PEE LANE		
Q_{INT}= 16 cfs		
TOTAL FLOW IN DEER SPRINGS WAY = 84 cfs TOTAL FLOW IN TEE PEE LANE = 16 cfs		

THE Louis Berger Group, INC.			
By:	FKR	Date: 5/30/2012	Sheet #: 2 of 2
Chkd By:	JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations			

Date: 5/30/2012

Sheet #: 2 of 2

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

DEER SPRINGS WAY OVERBANK FLOW CALCULATION

At = 0.63 sqft

V = 5.95 ft/s (See FlowMaster Calculation)

Qob = 3.7 cfs

Flow Depth = 0.66 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

5 ft

0.5 ft

0.6 ft

A1 =	0.3 sqft	$A1 = (WS - BW) \times SW$	
A2 =	0.08 sqft	$A2 = (WS - CH) \times CW$	
A3 =	0.25 sqft	(if $WS < BW$) $A3 = \frac{SD \times (SD / 0.020)}{2}$	SD = WS - CH
A total =	0.63 sqft	(if $WS > BW$) $A3 = \frac{SW \times SD}{2}$	SD = SW x 0.020

Top Width = 5.5 ft

$AT = A1 + A2 + A3$

$Qob = V \times AT$

The diagram illustrates a cross-section of a road and sidewalk. The road surface is labeled 'W.S.' (Water Surface). The sidewalk is labeled 'Back of Sidewalk (BW)'. The curb is labeled 'L Curb'. The flow area is divided into three sections: A1 (roadway), A2 (curb area), and A3 (sidewalk area). The slope of the roadway is indicated as S = 0.020 ft/ft. The width of the sidewalk is labeled 'Sidewalk Width (SW)'. The depth of the flow is labeled 'SD'. The height of the curb is labeled 'CH'. The width of the curb is labeled 'CW'.

At = 0.63 sqft

V = 5.95 ft/s (See FlowMaster Calculation)

Qob = 3.7 cfs

Flow Depth = 0.66 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

5 ft

0.5 ft

0.6 ft

$$A1 = 0.3 \text{ sqft} \quad A1 = (WS - BW) \times SW$$

$$A2 = 0.08 \text{ sqft} \quad A2 = (WS - CH) \times CW$$

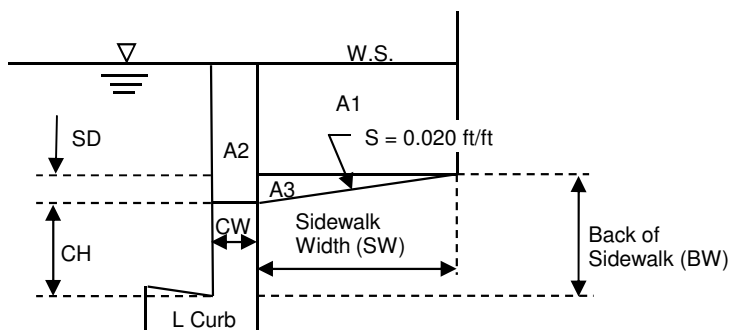
$$A3 = 0.25 \text{ sqft} \quad (\text{if } WS < BW) \quad A3 = \frac{SD \times (SD / 0.020)}{2} \quad SD = WS - CH$$

A total = 0.63 sqft (if WS > BW) $A3 = \frac{SW \times SD}{2}$ SD = SW x 0.020

Top Width = 5.5 ft

$$AT = A1 + A2 + A3$$

$$Q_{ob} = V \times AT$$



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF DEER SPRINGS WAY (MAIN) AND TEE PEE LANE (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q= 150 cfs Q_{OB}= 6.8 cfs Q_m= 136 cfs (See Cross Section on Sheet 2) W_m= 69 ft Measured between Face of Curbs S_m= 0.0264 W_{ss}= 49.5 ft Measured between Face of Curbs S_s= 0.012 Y_o= 0.185 ft		
OUTPUT		
Q_L= 18 cfs Q_o= 29 cfs		
FLOW INTERCEPTED BY TEE PEE LANE		
Q_{INT}= 24 cfs		
TOTAL FLOW IN DEER SPRINGS WAY = 126 cfs TOTAL FLOW IN TEE PEE LANE = 24 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

DEER SPRINGS WAY OVERBANK FLOW CALCULATION

At = 1.02 sqft

V = 6.7 ft/s (See FlowMaster Calculation)

Qob = 6.8 cfs

Flow Depth = 0.73 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

5 ft

0.5 ft

0.6 ft

A1 = 0.65 sqft A1 = (WS - BW) x SW

A2 = 0.115 sqft A2 = (WS - CH) x CW

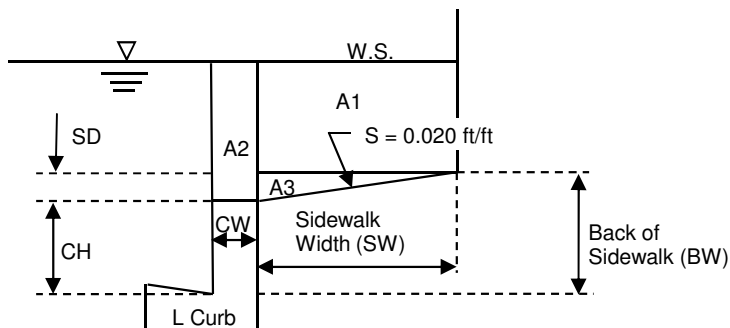
A3 = 0.25 sqft (if WS < BW) A3 = $\frac{SD \times (SD / 0.020)}{2}$ SD = WS - CH

A total = 1.02 sqft (if WS > BW) A3 = $\frac{SW \times SD}{2}$ SD = SW x 0.020

Top Width = 5.5 ft

AT = A1 + A2 + A3

Qob = V x AT



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF DEER SPRINGS WAY (MAIN) AND TEE PEE LANE (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q = 200 cfs Q_{OB} = 10.2 cfs Q_m = 180 cfs (See Cross Section on Sheet 2) W_m = 69 ft Measured between Face of Curbs S_m = 0.0264 W_{ss} = 49.5 ft Measured between Face of Curbs S_s = 0.012 Y_o = 0.255 ft		
OUTPUT		
Q_L = 23 cfs Q_o = 42 cfs		
FLOW INTERCEPTED BY TEE PEE LANE		
Q_{INT} = 33 cfs		
TOTAL FLOW IN DEER SPRINGS WAY = 167 cfs TOTAL FLOW IN TEE PEE LANE = 33 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

DEER SPRINGS WAY OVERBANK FLOW CALCULATION

At = 1.40 sqft

V = 7.3 ft/s (See FlowMaster Calculation)

Qob = 10.2 cfs

Flow Depth = 0.8 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

5 ft

0.5 ft

0.6 ft

A1 = 1 sqft A1 = (WS - BW) x SW

A2 = 0.15 sqft A2 = (WS - CH) x CW

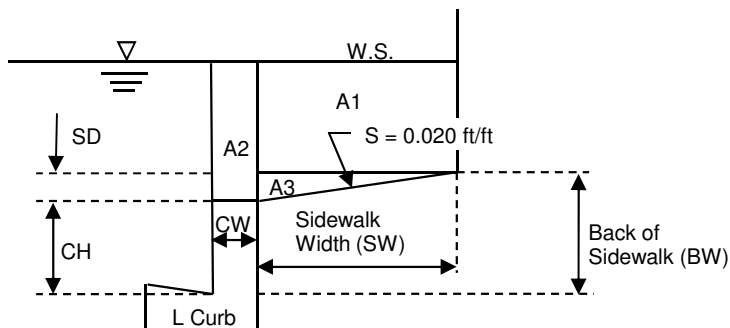
A3 = 0.25 sqft (if WS < BW) A3 = $\frac{SD \times (SD / 0.020)}{2}$ SD = WS - CH

A total = 1.40 sqft (if WS > BW) A3 = $\frac{SW \times SD}{2}$ SD = SW x 0.020

Top Width = 5.5 ft

AT = A1 + A2 + A3

Qob = V x AT



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF DEER SPRINGS WAY (MAIN) AND TEE PEE LANE (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q = 250 cfs Q_{OB} = 13.4 cfs Q_m = 223 cfs (See Cross Section on Sheet 2) W_m = 69 ft Measured between Face of Curbs S_m = 0.0264 W_{ss} = 49.5 ft Measured between Face of Curbs S_s = 0.012 Y_o = 0.305 ft		
OUTPUT		
Q_L = 28 cfs Q_o = 50 cfs		
FLOW INTERCEPTED BY TEE PEE LANE		
Q_{INT} = 41 cfs		
TOTAL FLOW IN DEER SPRINGS WAY = 209 cfs TOTAL FLOW IN TEE PEE LANE = 41 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

DEER SPRINGS WAY OVERBANK FLOW CALCULATION

At = 1.68 sqft

V = 7.98 ft/s (See FlowMaster Calculation)

Qob = 13.4 cfs

Flow Depth = 0.85 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

5 ft

0.5 ft

0.6 ft

A1 = 1.25 sqft A1 = (WS - BW) x SW

A2 = 0.175 sqft A2 = (WS - CH) x CW

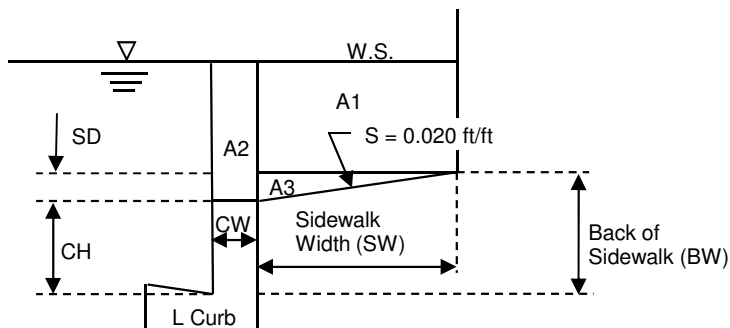
A3 = 0.25 sqft (if WS < BW) A3 = $\frac{SD \times (SD / 0.020)}{2}$ SD = WS - CH

A total = 1.68 sqft (if WS > BW) A3 = $\frac{SW \times SD}{2}$ SD = SW x 0.020

Top Width = 5.5 ft

AT = A1 + A2 + A3

Qob = V x AT



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF DEER SPRINGS WAY (MAIN) AND TEE PEE LANE (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q = 350 cfs Q_{OB} = 19.8 cfs Q_m = 310 cfs (See Cross Section on Sheet 2) W_m = 69 ft Measured between Face of Curbs S_m = 0.0264 W_{ss} = 49.5 ft Measured between Face of Curbs S_s = 0.012 Y_o = 0.395 ft		
OUTPUT		
Q_L = 38 cfs Q_o = 62 cfs		
FLOW INTERCEPTED BY TEE PEE LANE		
Q_{INT} = 57 cfs		
TOTAL FLOW IN DEER SPRINGS WAY = 293 cfs TOTAL FLOW IN TEE PEE LANE = 57 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

DEER SPRINGS WAY OVERBANK FLOW CALCULATION

At = 2.17 sqft

V = 9.12 ft/s (See FlowMaster Calculation)

Qob = 19.8 cfs

Flow Depth = 0.94 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

5 ft

0.5 ft

0.6 ft

A1 = 1.7 sqft A1 = (WS - BW) x SW

A2 = 0.22 sqft A2 = (WS - CH) x CW

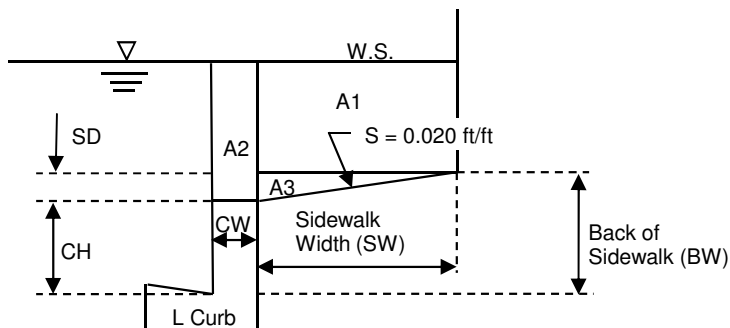
A3 = 0.25 sqft (if WS < BW) A3 = $\frac{SD \times (SD / 0.020)}{2}$ SD = WS - CH

A total = 2.17 sqft (if WS > BW) A3 = $\frac{SW \times SD}{2}$ SD = SW x 0.020

Top Width = 5.5 ft

AT = A1 + A2 + A3

Qob = V x AT



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF SEVERANCE LANE (MAIN) AND GRAND CANYON DRIVE (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q = 50 cfs Q_{OB} = 0.1 cfs Q_m = 50 cfs (See Cross Section on Sheet 2) W_m = 46 ft Measured between Face of Curbs S_m = 0.0320 W_{ss} = 49.5 ft Measured between Face of Curbs S_s = 0.0088 Y_o = 0.013 ft		
OUTPUT		
Q_L = 9 cfs Q_o = -6 cfs		
FLOW INTERCEPTED BY GRAND CANYON DRIVE		
Q_{INT} = 9 cfs		
TOTAL FLOW IN SEVERANCE LANE = 41 cfs TOTAL FLOW IN GRAND CANYON DRIVE = 9 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

SEVERANCE LANE OVERBANK FLOW CALCULATION

At = 0.02 sqft

V = 5.6 ft/s (See FlowMaster Calculation)

Qob = 0.1 cfs

Flow Depth = 0.52 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

15 ft

0.5 ft

0.8 ft

A1 = 0 sqft A1 = (WS - BW) x SW

A2 = 0.01 sqft A2 = (WS - CH) x CW

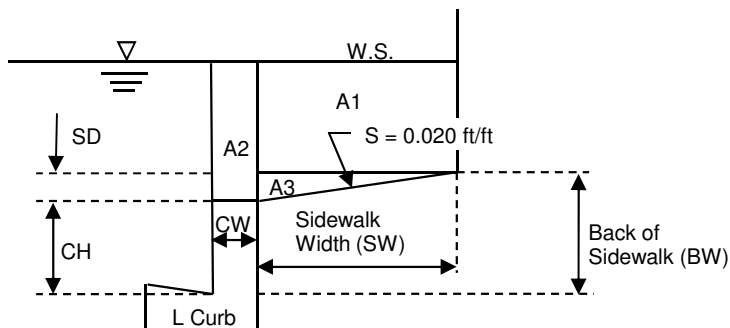
A3 = 0.01 sqft (if WS < BW) A3 = $\frac{SD \times (SD / 0.020)}{2}$ SD = WS - CH

A total = 0.02 sqft (if WS > BW) A3 = $\frac{SW \times SD}{2}$ SD = SW x 0.020

Top Width = 1.5 ft

AT = A1 + A2 + A3

Qob = V x AT



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF SEVERANCE LANE (MAIN) AND GRAND CANYON DRIVE (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q= 100 cfs Q_{OB}= 3.2 cfs Q_m= 94 cfs (See Cross Section on Sheet 2) W_m= 46 ft Measured between Face of Curbs S_m= 0.0320 W_{ss}= 49.5 ft Measured between Face of Curbs S_s= 0.0088 Y_o= 0.070 ft		
OUTPUT		
Q_L= 16 cfs Q_o= -1 cfs		
FLOW INTERCEPTED BY GRAND CANYON DRIVE		
Q_{INT}= 16 cfs		
TOTAL FLOW IN SEVERANCE LANE = 84 cfs TOTAL FLOW IN GRAND CANYON DRIVE = 16 cfs		

THE Louis Berger Group, INC.			
By:	FKR	Date: 5/30/2012	Sheet #: 2 of 2
Chkd By:	JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations			

Date: 5/30/2012

Sheet #: 2 of 2

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

SEVERANCE LANE OVERBANK FLOW CALCULATION

At = 0.49 sqft

V = 6.58 ft/s (See FlowMaster Calculation)

Qob = 3.2 cfs

Flow Depth = 0.63 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

15 ft

0.5 ft

0.8 ft

A1 = 0 sqft A1 = (WS - BW) x SW

A2 = 0.065 sqft A2 = (WS - CH) x CW

A3 = 0.4225 sqft (if WS < BW) A3 = $\frac{SD \times (SD / 0.020)}{2}$ SD = WS - CH

A total = 0.49 sqft

(if WS > BW) A3 = $\frac{SW \times SD}{2}$ SD = SW x 0.020

Top Width = 7 ft

AT = A1 + A2 + A3

Qob = V x AT

The diagram illustrates a cross-section of a road and sidewalk. The water surface (WS) is at the top. The sidewalk width (SW) is the distance from the curb to the back of the sidewalk (BW). The curb height (CH) is the vertical distance from the sidewalk to the curb. The curb width (CW) is the horizontal distance from the curb to the back of the sidewalk. The side depth (SD) is the vertical distance from the sidewalk to the water surface. The area A1 is the area above the sidewalk. The area A2 is the area between the curb and the sidewalk. The area A3 is the area between the curb and the back of the sidewalk. The slope S is given as 0.020 ft/ft.

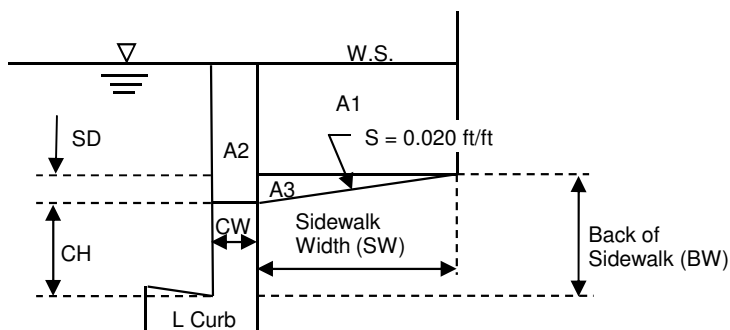
V = 6.58 ft/s (See FlowMaster Calculation)

Flow Depth = 0.63 ft (See FlowMaster Calculation)

0.8 ft

Top Width = 7 ft

$$Q_{ob} = V \times AT$$



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF SEVERANCE LANE (MAIN) AND GRAND CANYON DRIVE (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q = 150 cfs Q_{OB} = 8.5 cfs Q_m = 133 cfs (See Cross Section on Sheet 2) W_m = 46 ft Measured between Face of Curbs S_m = 0.0320 W_{ss} = 49.5 ft Measured between Face of Curbs S_s = 0.0088 Y_o = 0.105 ft		
OUTPUT		
Q_L = 22 cfs Q_o = 1 cfs		
FLOW INTERCEPTED BY GRAND CANYON DRIVE		
Q_{INT} = 23 cfs		
TOTAL FLOW IN SEVERANCE LANE = 127 cfs TOTAL FLOW IN GRAND CANYON DRIVE = 23 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

SEVERANCE LANE OVERBANK FLOW CALCULATION

At = 1.10 sqft

V = 7.73 ft/s (See FlowMaster Calculation)

Qob = 8.5 cfs

Flow Depth = 0.7 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

15 ft

0.5 ft

0.8 ft

A1 = 0 sqft A1 = (WS - BW) x SW

A2 = 0.1 sqft A2 = (WS - CH) x CW

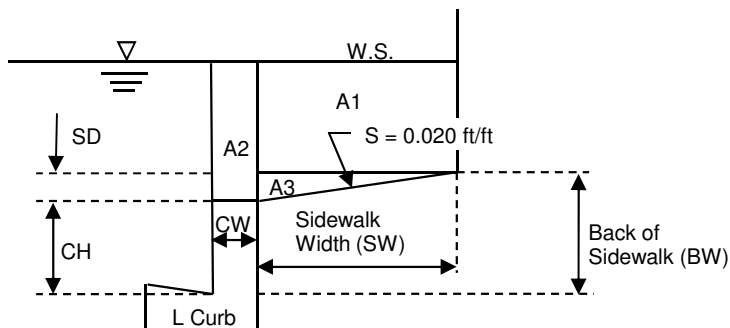
A3 = 1 sqft (if WS < BW) A3 = $\frac{SD \times (SD / 0.020)}{2}$ SD = WS - CH

A total = 1.10 sqft (if WS > BW) A3 = $\frac{SW \times SD}{2}$ SD = SW x 0.020

Top Width = 10.5 ft

AT = A1 + A2 + A3

Qob = V x AT



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF SEVERANCE LANE (MAIN) AND GRAND CANYON DRIVE (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q = 200 cfs Q_{OB} = 15.8 cfs Q_m = 168 cfs (See Cross Section on Sheet 2) W_m = 46 ft Measured between Face of Curbs S_m = 0.0320 W_{ss} = 49.5 ft Measured between Face of Curbs S_s = 0.0088 Y_o = 0.135 ft		
OUTPUT		
Q_L = 27 cfs Q_o = 2 cfs		
FLOW INTERCEPTED BY GRAND CANYON DRIVE		
Q _{INT} = 29 cfs		
TOTAL FLOW IN SEVERANCE LANE = 171 cfs TOTAL FLOW IN GRAND CANYON DRIVE = 29 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

SEVERANCE LANE OVERBANK FLOW CALCULATION

At = 1.82 sqft

V = 8.66 ft/s (See FlowMaster Calculation)

Qob = 15.8 cfs

Flow Depth = 0.76 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

15 ft

0.5 ft

0.8 ft

A1 = 0 sqft A1 = (WS - BW) x SW

A2 = 0.13 sqft A2 = (WS - CH) x CW

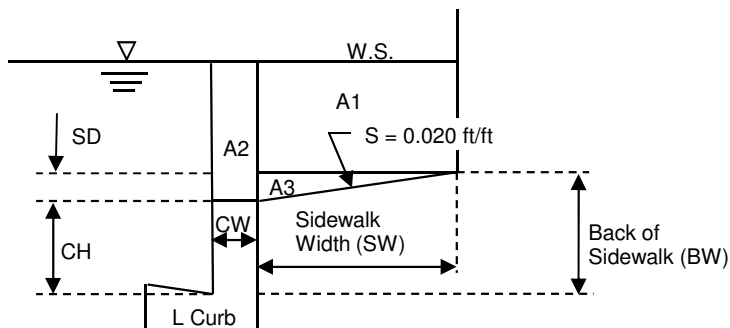
A3 = 1.69 sqft (if WS < BW) A3 = $\frac{SD \times (SD / 0.020)}{2}$ SD = WS - CH

A total = 1.82 sqft (if WS > BW) A3 = $\frac{SW \times SD}{2}$ SD = SW x 0.020

Top Width = 13.5 ft

AT = A1 + A2 + A3

Qob = V x AT



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF SEVERANCE LANE (MAIN) AND GRAND CANYON DRIVE (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q = 250 cfs Q_{OB} = 25.6 cfs Q_m = 199 cfs (See Cross Section on Sheet 2) W_m = 46 ft Measured between Face of Curbs S_m = 0.0320 W_{ss} = 49.5 ft Measured between Face of Curbs S_s = 0.0088 Y_o = 0.175 ft		
OUTPUT		
Q_L = 32 cfs Q_o = 6 cfs		
FLOW INTERCEPTED BY GRAND CANYON DRIVE		
Q_{INT} = 38 cfs		
TOTAL FLOW IN SEVERANCE LANE = 212 cfs TOTAL FLOW IN GRAND CANYON DRIVE = 38 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

SEVERANCE LANE OVERBANK FLOW CALCULATION

At = 2.71 sqft

V = 9.46 ft/s (See FlowMaster Calculation)

Qob = 25.6 cfs

Flow Depth = 0.82 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

15 ft

0.5 ft

0.8 ft

A1 = 0.3 sqft A1 = (WS - BW) x SW

A2 = 0.16 sqft A2 = (WS - CH) x CW

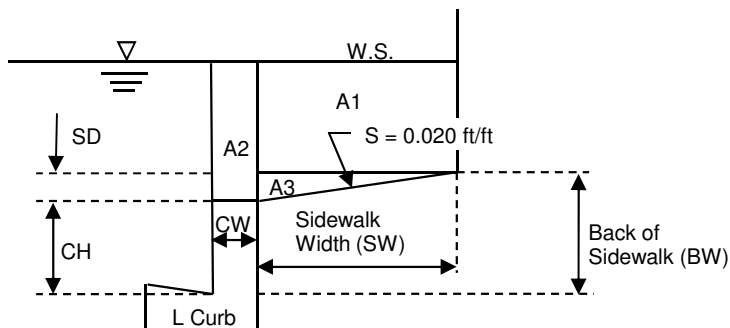
A3 = 2.25 sqft (if WS < BW) A3 = $\frac{SD \times (SD / 0.020)}{2}$ SD = WS - CH

A total = 2.71 sqft (if WS > BW) A3 = $\frac{SW \times SD}{2}$ SD = SW x 0.020

Top Width = 15.5 ft

AT = A1 + A2 + A3

Qob = V x AT



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF SEVERANCE LANE (MAIN) AND GRAND CANYON DRIVE (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q = 350 cfs Q_{OB} = 46.1 cfs Q_m = 258 cfs (See Cross Section on Sheet 2) W_m = 46 ft Measured between Face of Curbs S_m = 0.0320 W_{ss} = 49.5 ft Measured between Face of Curbs S_s = 0.0088 Y_o = 0.275 ft		
OUTPUT		
Q_L = 40 cfs Q_o = 19 cfs		
FLOW INTERCEPTED BY GRAND CANYON DRIVE		
Q _{INT} = 60 cfs		
TOTAL FLOW IN SEVERANCE LANE = TOTAL FLOW IN GRAND CANYON DRIVE = 290 cfs 60 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

SEVERANCE LANE OVERBANK FLOW CALCULATION

At = 4.26 sqft

V = 10.81 ft/s (See FlowMaster Calculation)

Qob = 46.1 cfs

Flow Depth = 0.92 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

15 ft

0.5 ft

0.8 ft

A1 = 1.8 sqft

A1 = (WS - BW) x SW

A2 = 0.21 sqft

A2 = (WS - CH) x CW

A3 = 2.25 sqft

(if WS < BW) A3 = $\frac{SD \times (SD / 0.020)}{2}$

SD = WS - CH

A total = 4.26 sqft

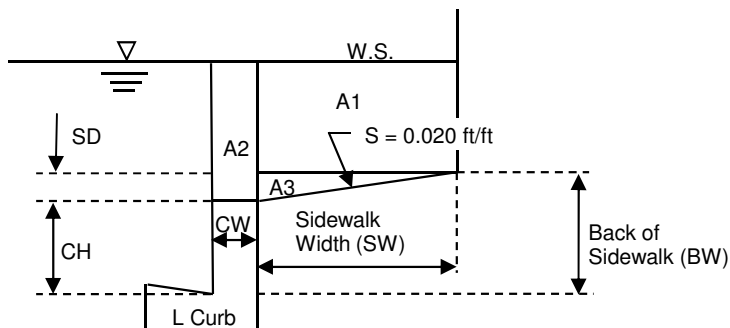
(if WS > BW) A3 = $\frac{SW \times SD}{2}$

SD = SW x 0.020

Top Width = 15.5 ft

AT = A1 + A2 + A3

Qob = V x AT



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF SEVERANCE LANE (MAIN) AND GRAND CANYON DRIVE (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q = 500 cfs Q_{OB} = 78.1 cfs Q_m = 344 cfs (See Cross Section on Sheet 2) W_m = 46 ft Measured between Face of Curbs S_m = 0.0320 W_{ss} = 49.5 ft Measured between Face of Curbs S_s = 0.0088 Y_o = 0.405 ft		
OUTPUT		
Q_L = 53 cfs Q_o = 35 cfs		
FLOW INTERCEPTED BY GRAND CANYON DRIVE		
Q _{INT} = 88 cfs		
TOTAL FLOW IN SEVERANCE LANE = TOTAL FLOW IN GRAND CANYON DRIVE = 412 cfs 88 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

SEVERANCE LANE OVERBANK FLOW CALCULATION

At = 6.28 sqft

V = 12.45 ft/s (See FlowMaster Calculation)

Qob = 78.1 cfs

Flow Depth = 1.05 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

15 ft

0.5 ft

0.8 ft

A1 = 3.75 sqft A1 = (WS - BW) x SW

A2 = 0.275 sqft A2 = (WS - CH) x CW

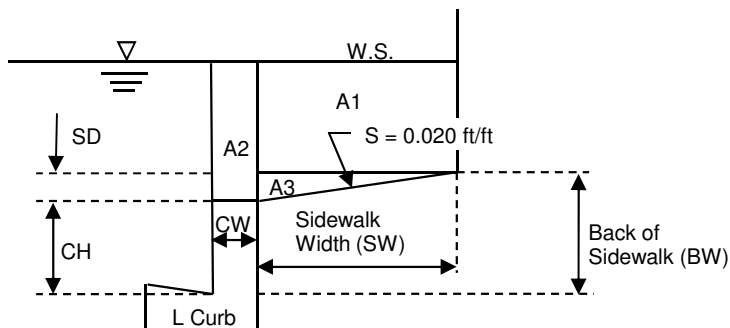
A3 = 2.25 sqft (if WS < BW) A3 = $\frac{SD \times (SD / 0.020)}{2}$ SD = WS - CH

A total = 6.28 sqft (if WS > BW) A3 = $\frac{SW \times SD}{2}$ SD = SW x 0.020

Top Width = 15.5 ft

AT = A1 + A2 + A3

Qob = V x AT



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF SEVERANCE LANE (MAIN) AND GRAND CANYON DRIVE (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q= 750 cfs Q_{OB}= 134.6 cfs Q_m= 481 cfs (See Cross Section on Sheet 2) W_m= 46 ft Measured between Face of Curbs S_m= 0.0320 W_{ss}= 49.5 ft Measured between Face of Curbs S_s= 0.0088 Y_o= 0.595 ft		
OUTPUT		
Q_L= 72 cfs Q_o= 57 cfs		
FLOW INTERCEPTED BY GRAND CANYON DRIVE		
Q_{INT}= 129 cfs		
TOTAL FLOW IN SEVERANCE LANE = 621 cfs TOTAL FLOW IN GRAND CANYON DRIVE = 129 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

SEVERANCE LANE OVERBANK FLOW CALCULATION

At = 9.22 sqft

V = 14.6 ft/s (See FlowMaster Calculation)

Qob = 134.6 cfs

Flow Depth = 1.24 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

15 ft

0.5 ft

0.8 ft

A1 = 6.6 sqft A1 = (WS - BW) x SW

A2 = 0.37 sqft A2 = (WS - CH) x CW

A3 = 2.25 sqft (if WS < BW) A3 = $\frac{SD \times (SD / 0.020)}{2}$ SD = WS - CH

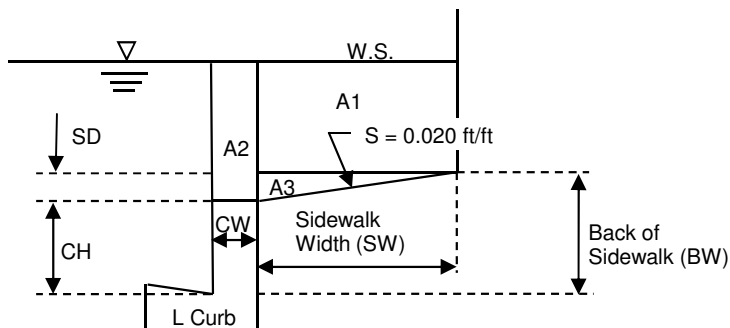
A total = 9.22 sqft

(if WS > BW) A3 = $\frac{SW \times SD}{2}$ SD = SW x 0.020

Top Width = 15.5 ft

AT = A1 + A2 + A3

Qob = V x AT



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF SEVERANCE LANE (MAIN) AND FORT APACHE ROAD (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q = 50 cfs Q_{OB} = 0.1 cfs Q_m = 50 cfs (See Cross Section on Sheet 2) W_m = 46 ft Measured between Face of Curbs S_m = 0.0320 W_{ss} = 49.5 ft Measured between Face of Curbs S_s = 0.0050 Y_o = 0.013 ft		
OUTPUT		
Q_L = 9 cfs Q_o = -7 cfs		
FLOW INTERCEPTED BY FORT APACHE ROAD		
Q _{INT} = 9 cfs		
TOTAL FLOW IN SEVERANCE LANE = TOTAL FLOW IN FORT APACHE ROAD = 41 cfs 9 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

SEVERANCE LANE OVERBANK FLOW CALCULATION

At = 0.02 sqft

V = 5.6 ft/s (See FlowMaster Calculation)

Qob = 0.1 cfs

Flow Depth = 0.52 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

15 ft

0.5 ft

0.80 ft

A1 = 0 sqft A1 = (WS - BW) x SW

A2 = 0.01 sqft A2 = (WS - CH) x CW

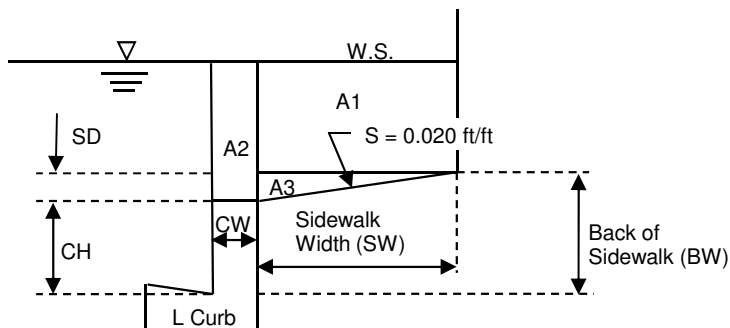
A3 = 0.01 sqft (if WS < BW) A3 = $\frac{SD \times (SD / 0.020)}{2}$ SD = WS - CH

A total = 0.02 sqft (if WS > BW) A3 = $\frac{SW \times SD}{2}$ SD = SW x 0.020

Top Width = 1.5 ft

AT = A1 + A2 + A3

Qob = V x AT



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF SEVERANCE LANE (MAIN) AND FORT APACHE ROAD (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q= 100 cfs Q_{OB}= 3.2 cfs Q_m= 94 cfs (See Cross Section on Sheet 2) W_m= 46 ft Measured between Face of Curbs S_m= 0.0320 W_{ss}= 49.5 ft Measured between Face of Curbs S_s= 0.0050 Y_o= 0.070 ft		
OUTPUT		
Q_L= 16 cfs Q_o= -4 cfs		
FLOW INTERCEPTED BY FORT APACHE ROAD		
Q_{INT}= 16 cfs		
TOTAL FLOW IN SEVERANCE LANE = 84 cfs TOTAL FLOW IN FORT APACHE ROAD = 16 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

SEVERANCE LANE OVERBANK FLOW CALCULATION

At = 0.49 sqft

V = 6.58 ft/s (See FlowMaster Calculation)

Qob = 3.2 cfs

Flow Depth = 0.63 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

15 ft

0.5 ft

0.80 ft

A1 = 0 sqft

A1 = (WS - BW) x SW

A2 = 0.065 sqft

A2 = (WS - CH) x CW

A3 = 0.4225 sqft

(if WS < BW) A3 = $\frac{SD \times (SD / 0.020)}{2}$

SD = WS - CH

A total = 0.49 sqft

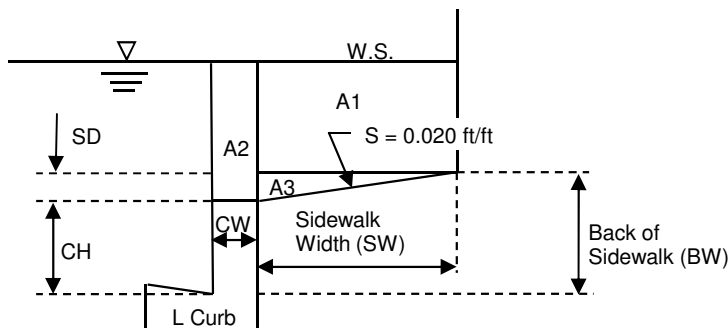
(if WS > BW) A3 = $\frac{SW \times SD}{2}$

SD = SW x 0.020

Top Width = 7 ft

AT = A1 + A2 + A3

Qob = V x AT



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF SEVERANCE LANE (MAIN) AND FORT APACHE ROAD (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q= 150 cfs Q_{OB}= 8.5 cfs Q_m= 133 cfs (See Cross Section on Sheet 2) W_m= 46 ft Measured between Face of Curbs S_m= 0.0320 W_{ss}= 49.5 ft Measured between Face of Curbs S_s= 0.0050 Y_o= 0.105 ft		
OUTPUT		
Q_L= 22 cfs Q_o= -5 cfs		
FLOW INTERCEPTED BY FORT APACHE ROAD		
Q_{INT}= 22 cfs		
TOTAL FLOW IN SEVERANCE LANE = 128 cfs TOTAL FLOW IN FORT APACHE ROAD = 22 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

SEVERANCE LANE OVERBANK FLOW CALCULATION

At = 1.10 sqft

V = 7.73 ft/s (See FlowMaster Calculation)

Qob = 8.5 cfs

Flow Depth = 0.70 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

15 ft

0.5 ft

0.80 ft

A1 = 0 sqft A1 = (WS - BW) x SW

A2 = 0.1 sqft A2 = (WS - CH) x CW

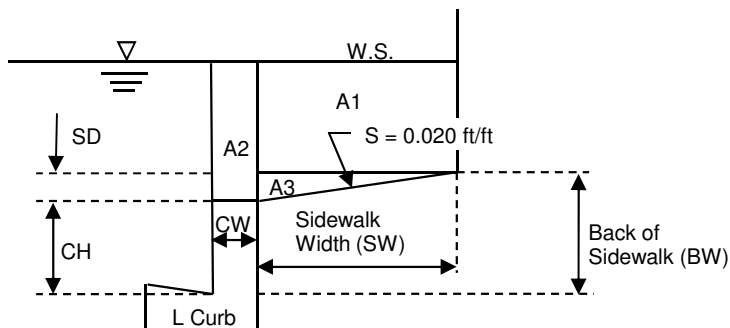
A3 = 1 sqft (if WS < BW) A3 = $\frac{SD \times (SD / 0.020)}{2}$ SD = WS - CH

A total = 1.10 sqft (if WS > BW) A3 = $\frac{SW \times SD}{2}$ SD = SW x 0.020

Top Width = 10.5 ft

AT = A1 + A2 + A3

Qob = V x AT



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF SEVERANCE LANE (MAIN) AND FORT APACHE ROAD (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q = 200 cfs Q_{OB} = 15.8 cfs Q_m = 168 cfs (See Cross Section on Sheet 2) W_m = 46 ft Measured between Face of Curbs S_m = 0.0320 W_{ss} = 49.5 ft Measured between Face of Curbs S_s = 0.0050 Y_o = 0.135 ft		
OUTPUT		
Q_L = 27 cfs Q_o = -5 cfs		
FLOW INTERCEPTED BY FORT APACHE ROAD		
Q_{INT} = 27 cfs		
TOTAL FLOW IN SEVERANCE LANE = 173 cfs TOTAL FLOW IN FORT APACHE ROAD = 27 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

SEVERANCE LANE OVERBANK FLOW CALCULATION

At = 1.82 sqft

V = 8.66 ft/s (See FlowMaster Calculation)

Qob = 15.8 cfs

Flow Depth = 0.76 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

15 ft

0.5 ft

0.80 ft

A1 = 0 sqft

A1 = (WS - BW) x SW

A2 = 0.13 sqft

A2 = (WS - CH) x CW

A3 = 1.69 sqft

(if WS < BW) A3 = $\frac{SD \times (SD / 0.020)}{2}$

SD = WS - CH

A total = 1.82 sqft

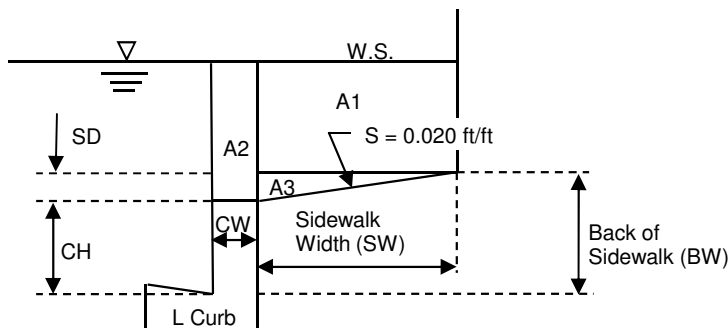
(if WS > BW) A3 = $\frac{SW \times SD}{2}$

SD = SW x 0.020

Top Width = 13.5 ft

AT = A1 + A2 + A3

Qob = V x AT



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF SEVERANCE LANE (MAIN) AND FORT APACHE ROAD (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q = 250 cfs Q_{OB} = 25.5 cfs Q_m = 199 cfs (See Cross Section on Sheet 2) W_m = 46 ft Measured between Face of Curbs S_m = 0.0320 W_{ss} = 49.5 ft Measured between Face of Curbs S_s = 0.0050 Y_o = 0.175 ft		
OUTPUT		
Q_L = 32 cfs Q_o = -3 cfs		
FLOW INTERCEPTED BY FORT APACHE ROAD		
Q _{INT} = 32 cfs		
TOTAL FLOW IN SEVERANCE LANE = 218 cfs TOTAL FLOW IN FORT APACHE ROAD = 32 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

SEVERANCE LANE OVERBANK FLOW CALCULATION

At = 2.71 sqft

V = 9.41 ft/s (See FlowMaster Calculation)

Qob = 25.5 cfs

Flow Depth = 0.82 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

15 ft

0.5 ft

0.80 ft

A1 = 0.3 sqft A1 = (WS - BW) x SW

A2 = 0.16 sqft A2 = (WS - CH) x CW

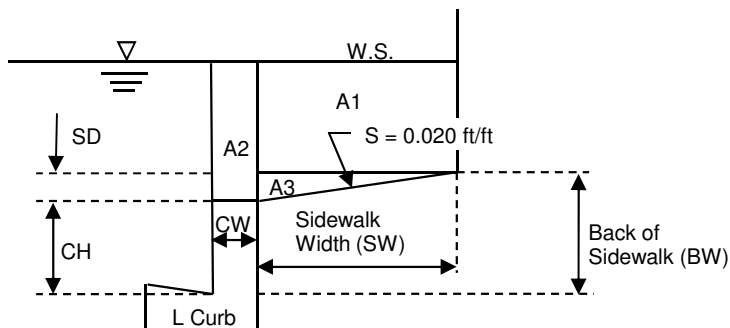
A3 = 2.25 sqft (if WS < BW) A3 = $\frac{SD \times (SD / 0.020)}{2}$ SD = WS - CH

A total = 2.71 sqft (if WS > BW) A3 = $\frac{SW \times SD}{2}$ SD = SW x 0.020

Top Width = 15.5 ft

AT = A1 + A2 + A3

Qob = V x AT



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF SEVERANCE LANE (MAIN) AND FORT APACHE ROAD (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q= 350 cfs Q_{OB}= 46.1 cfs Q_m= 258 cfs (See Cross Section on Sheet 2) W_m= 46 ft Measured between Face of Curbs S_m= 0.0320 W_{ss}= 49.5 ft Measured between Face of Curbs S_s= 0.0050 Y_o= 0.275 ft		
OUTPUT		
Q_L= 40 cfs Q_o= 5 cfs		
FLOW INTERCEPTED BY FORT APACHE ROAD		
Q_{INT}= 45 cfs		
TOTAL FLOW IN SEVERANCE LANE = 305 cfs TOTAL FLOW IN FORT APACHE ROAD = 45 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

SEVERANCE LANE OVERBANK FLOW CALCULATION

At = 4.26 sqft

V = 10.81 ft/s (See FlowMaster Calculation)

Qob = 46.1 cfs

Flow Depth = 0.92 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

15 ft

0.5 ft

0.80 ft

A1 = 1.8 sqft

A1 = (WS - BW) x SW

A2 = 0.21 sqft

A2 = (WS - CH) x CW

A3 = 2.25 sqft

(if WS < BW) A3 = $\frac{SD \times (SD / 0.020)}{2}$

SD = WS - CH

A total = 4.26 sqft

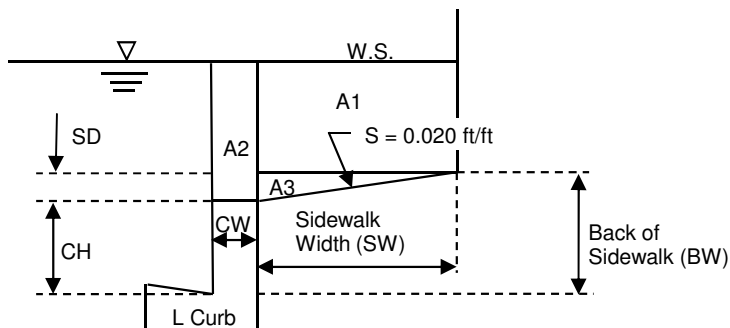
(if WS > BW) A3 = $\frac{SW \times SD}{2}$

SD = SW x 0.020

Top Width = 15.5 ft

AT = A1 + A2 + A3

Qob = V x AT



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF SEVERANCE LANE (MAIN) AND FORT APACHE ROAD (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q= 750 cfs Q_{OB}= 134.6 cfs Q_m= 481 cfs (See Cross Section on Sheet 2) W_m= 46 ft Measured between Face of Curbs S_m= 0.0320 W_{ss}= 49.5 ft Measured between Face of Curbs S_s= 0.0050 Y_o= 0.595 ft		
OUTPUT		
Q_L= 72 cfs Q_o= 25 cfs		
FLOW INTERCEPTED BY FORT APACHE ROAD		
Q_{INT}= 97 cfs		
TOTAL FLOW IN SEVERANCE LANE = 653 cfs TOTAL FLOW IN FORT APACHE ROAD = 97 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

SEVERANCE LANE OVERBANK FLOW CALCULATION

At = 9.22 sqft

V = 14.6 ft/s (See FlowMaster Calculation)

Qob = 134.6 cfs

Flow Depth = 1.24 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

15 ft

0.5 ft

0.80 ft

A1 = 6.6 sqft A1 = (WS - BW) x SW

A2 = 0.37 sqft A2 = (WS - CH) x CW

A3 = 2.25 sqft (if WS < BW) A3 = $\frac{SD \times (SD / 0.020)}{2}$ SD = WS - CH

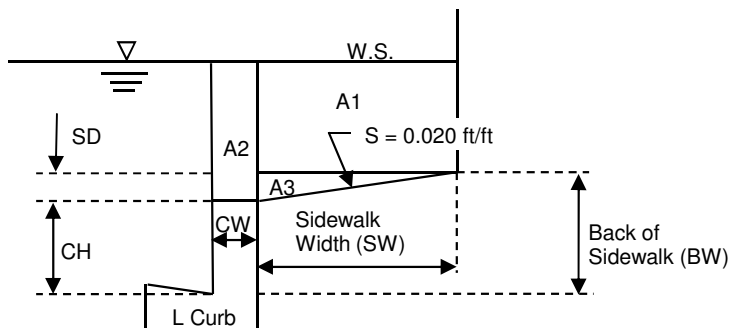
A total = 9.22 sqft

(if WS > BW) A3 = $\frac{SW \times SD}{2}$ SD = SW x 0.020

Top Width = 15.5 ft

AT = A1 + A2 + A3

Qob = V x AT



THE Louis Berger Group, INC.		
By: FKR	Date: 5/30/2012	Sheet #: 1 of 2
Chkd By: JSD	Date: 5/30/2012	LBG Project #: CCB1121
Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations		
INTERSECTION OF SEVERANCE LANE (MAIN) AND FORT APACHE ROAD (SIDE)		
Computation of Flow Split at Intersection (PIMA County's Flow Split Formula)		
$Q_L = 0.042 \left(\frac{Q_m^{0.93} \times W_{ss}^{0.85}}{S_m^{0.41} \times W_m^{0.79}} \right)$ $Q_O = 46.8 \times W_{ss} \times Y_O \times S_s^{0.5} - Q_L$ Where: - Q = Flow in Main street before split - Q_L = Lateral flow into the side street (cfs) - Q_m = Main Street flow measured between the curbs (cfs) - S_m = Longitudinal slope of the main street (feet per foot) - W_m = Width the main street (cfs) - W_{ss} = Width the side street (cfs) - Q_o = Overbank flow intercepted by the side street (cfs) - Y_o = Average depth of overbank flow intercepted by side street (ft) - S_s = Longitudinal slope of the side street (feet per foot)		
INPUT		
Q = 1000 cfs Q_{OB} = 191.4 cfs Q_m = 617 cfs (See Cross Section on Sheet 2) W_m = 46 ft Measured between Face of Curbs S_m = 0.0320 W_{ss} = 49.5 ft Measured between Face of Curbs S_s = 0.0050 Y_o = 0.755 ft		
OUTPUT		
Q_L = 91 cfs Q_o = 33 cfs		
FLOW INTERCEPTED BY SIDE STREET		
Q _{INT} = 124 cfs		
TOTAL FLOW IN SEVERANCE LANE = TOTAL FLOW IN FORT APACHE ROAD = 876 cfs 124 cfs		

THE Louis Berger Group, INC.

By: FKR

Date: 5/30/2012

Sheet #: 2 of 2

Chkd By: JSD

Date: 5/30/2012

LBG Project #: CCB1121

Subject: Rancho -Fort Apache Storm Drain: Intersection Flow Split Calculations

SEVERANCE LANE OVERBANK FLOW CALCULATION

$A_t = 11.70 \text{ sqft}$

$V = 16.36 \text{ ft/s}$ (See FlowMaster Calculation)

$Q_{ob} = 191.4 \text{ cfs}$

Flow Depth = 1.4 ft (See FlowMaster Calculation)

0.5 ft

0.5 ft

15 ft

0.5 ft

0.80 ft

$A_1 = 9 \text{ sqft}$ $A_1 = (WS - BW) \times SW$

$A_2 = 0.45 \text{ sqft}$ $A_2 = (WS - CH) \times CW$

$A_3 = 2.25 \text{ sqft}$ (if $WS < BW$) $A_3 = \frac{SD \times (SD / 0.020)}{2}$ $SD = WS - CH$

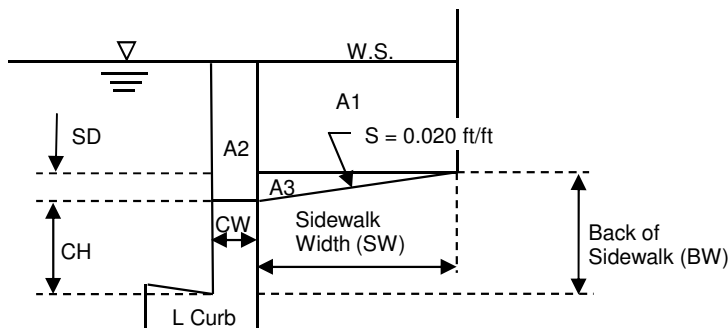
$A_{\text{total}} = 11.70 \text{ sqft}$

(if $WS > BW$) $A_3 = \frac{SW \times SD}{2}$ $SD = SW \times 0.020$

Top Width = 15.5 ft

$A_T = A_1 + A_2 + A_3$

$Q_{ob} = V \times A_T$



A.1.4 Modified MPU 2008 HEC-1 Model - SDN3 Series A Model


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1*****
*
*   FLOOD HYDROGRAPH PACKAGE (HEC-1)
*       JUN 1998
*       VERSION 4.1
*
*   RUN DATE 03MAY13 TIME 16:30:41
*
*****

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

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X   X XXXXXXX XXXX      X
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XXXXXX XXXX   X      XXXX X
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X   X XXXXXXX XXXX      XXX

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

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION

NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

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

*DIAGRAM

*** FREE ***

```

1 ID CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT 2008 MASTER PLAN UPDATE
2 ID UPPER AND LOWER NORTHERN LAS VEGAS WASH WATERSHEDS
3 ID RECOMMENDED DRAINAGE SYSTEM WITH ULTIMATE DEVELOPMENT
4 ID INPUT FILE = WEST8.DAT
5 ID INPUT FILE DATE = MAY 2008
6 ID DESIGN STORM = 100-YEAR 6-HOUR STORM
7 ID STORM DISTRIBUTION = SDN3
8 ID MODELED BY PBS&J (KRYSTLE PEMBERTON, E.I., CFM)
9 ID CHECKED BY PBS&J (HARSHAL B. DESAI, P.E., CFM)
10 ID STORM CENTERING = WEST TRIBUTARY
11 ID DOWNSTREAM OF THE UPPER LAS VEGAS WASH DETENTION BASIN TO THE MOST
12 ID DOWNSTREAM POINT IN THE LOWER NORTHERN LAS VEGAS WASH WATERSHED
13 ID
14 ID REFERENCED HYDROLOGIC MODELS:
15 ID REVISED FINAL DESIGN REPORT FOR THE RANCHO DETENTION BASIN
16 ID PHASE II (VTN 2006)
17 ID RESPONSE TO COMMENTS ON THE CONCEPTUAL DRAINAGE STUDY FOR
18 ID NORTH LAS VEGAS 600-ACRE SITE (GC WALLACE 2006)

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*
 71 KK RN27-C
 72 KM ROUTE NW27-C TO CNW26-C
 73 KM FACILITY = ELKHORN AND HUALAPAI
 74 KM FACILITY ID-MILE = EKHU 0023
 75 KM LINING = RCAP
 76 RD 2300 0.009 0.015 0 TRAP 8 0
 *

77 KK NW26-C
 78 BA 0.367
 79 PB 3.09
 80 LS 0 90.3
 81 UD 0.325
 *

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

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

1

HEC-1 INPUT

PAGE 3

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

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

98 KKC NW53-CC
 99 KM COMBINE FLOWS AT ELKHORN & HUALAPAI
 100 KM ADDED BY LBG FOR RANCHO-FT APACHE STORM DRAIN
 101 HC 2
 *

102 KK DNW26-C
 103 KM INTERSECTION OF HUALAPAI AND ELKHORN
 104 KM FIRST 631 GOES EAST IN RCBH 0295
 105 KM REMAINING FLOW GOES SOUTH IN BCHU 0054
 106 DTDOUTFLOW
 107 DI 0 631 733 7102
 108 DQ 0 631 631 7000
 *
 *

* KKDWN26-C
 * KM190 CFS IN FACILITY AND 132 CFS SURFACE FLOW
 * KMGO SOUTH ON HUALAPAI AND REMAINING FLOW GOES EAST
 * KMPER "SUPPLEMENT #2 TO ADDENDUM #2 TO THE TDS FOR
 * KMCLIFFS EDGE" PREPARED BY VTN (FIGURE 5-N AND 5-S)
 * KM THE FLOW GOING SOUTH WAS REDUCED BY 100 CFS TO
 * KM KEEP THE FORT APACHE DB FROM OVERTOPPING
 * DTDOUTFLOW
 * DI0 222 500 1000 5000
 * DQ0 0 278 778 4778
 *

109 KK RC26-C
 110 KM ROUTE DNW26-C TO CBA3-C
 111 KM FACILITY = BELTWAY CHANNEL - HUALAPAI
 112 KM FACILITY ID-MILE = BCHU 0054,0042,0040
 113 KM LINING = RCP
 114 RD 1445 0.014 0.013 0 CIRC 5 0
 *
 *

115 KK DC26-C
 116 KM ELIMINATED FLOW SPLIT AT DORRELL AND HUALAPAI BY LBG
 117 DT DNW77-C
 118 DI 0 120 150 200 500 1000 5000
 119 DQ 0 0 0 0 0 0 0
 *

*
 * KKDC26-C
 * KMDIVERT 120 CFS FROM RC26-C TO NW77-C
 * KMIN PROPOSED LOCAL FACILITY AND STREETS
 * KM REMAINING FLOW ROUTED TO CDMNA1
 * KM REFERENCED FROM "REVISED FINAL DESIGN REPORT -
 * KMRANCHO DETENTION BASIN PHASE II" PREPARED BY VTN (JUNE 2006)
 * KM REFERENCE NODE: DCE3
 * DTDNW77-C
 * DI0 120 150 200 500 1000 5000
 * DQ0 120 120 120 120 120 120
 *

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HEC-1 INPUT

PAGE 4

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

120 KK NWBA3-C
 121 BA 0.327
 122 PB 3.11
 123 LS 0 89.7
 124 UD 0.313
 *

125 KK CBA3-C
 126 KM COMBINE NWBA3-C AND DC26-C
 127 KM DORRELL AND HUALAPAI
 128 HC 2
 *

129 KKRDWBA3-C

130 KM ROUTE CBA3-C TO CMNA1
 131 KM FACILITY = BELTWAY CHANNEL - HUALAPAI
 132 KM FACILITY ID-MILE = BCHU 0017
 133 KM LINING = RCAP
 134 RD 1360 0.013 0.015 0 TRAP 8 0
 *
 *
 135 KK DBA3-C
 136 KM ELIMINATED FLOW SPLIT AT DEER SPRINGS AND HUALAPAI BY LBG
 137 DTDNWBA6-C
 138 DI 0 11 50 100 500 1000
 139 DQ 0 0 0 0 0 0
 *
 * KKDBA3-C
 * KMDIVERT 11 CFS FROM RDWBA3-C TO NWBA6-C
 * KMREMAINING FLOW COMBINES AT CMNA1
 * KMREFERENCED FROM "REVISED FINAL DESIGN REPORT -
 * KMRANCHO DETENTION BASIN PHASE II" PREPARED BY VTN (JUNE 2006)
 * KMREFERENCE NODE: DCE4
 * DTDNWBA6-C
 * DI0 11 50 100 500 1000
 * DQ0 11 11 11 11 11
 *
 140 KKR2WBA3-C
 141 KM ROUTE DBA3-C TO CMNA1
 142 KM FACILITY = BELTWAY CHANNEL - HUALAPAI
 143 KM FACILITY ID-MILE = BCHU 0000
 144 KM LINING = RCAP
 145 RD 853 0.011 0.015 0 TRAP 12 0
 *
 *
 146 KK CDMNA1
 147 BA 0.481
 148 PB 3.12
 149 LS 0 90.8
 150 UD 0.344
 *

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HEC-1 INPUT

PAGE 5

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

151 KK CMNA1
 152 KM COMBINE CDMNA1 AND R2WBA3-C
 153 KM RANCHO ROAD SYSTEM-BELTWAY @ HUALAPAI WAY
 154 HC 2
 *
 155 KK RCMNA1
 156 KM ROUTE CMNA1 TO FADBIN
 157 KM FACILITY = RANCHO ROAD SYSTEM - BELTWAY
 158 KM FACILITY # = RCBC 0096,0051,0048,0012,0009,0007
 159 KM LINING = CONCRETE
 160 RD 5160 0.034 0.015 0 TRAP 12 0
 *

161 KKNWBC2-CC
162 BA 0.205
163 PB 3.03
164 LS 0 81.8
165 UD 0.263
*

166 KK FADBIN1
167 KM COMBINE RCMNA1 AND NWBC2-C
168 HC 2
*

169 KKDFADBIN1
170 KM DIVERT OUT FLOW INTO DETENTION BASIN. RETRIEVE AFTER
171 KM FLOW SPLIT AT GRAND CANYON AND DEER SPRINGS IS CALCULATED.
172 DT DFADB
173 DI 0 9000.1
174 DQ 0 9000.0
*

175 KK NW53-CA
176 BA 0.064
177 PB 2.85
178 LS 0 79.1
179 UD 0.176
*

180 KK SEV
181 KM FLOW SPLIT AT SEVERENCE & GRAND CANYON
182 KM REMAINING FLOW GOES EAST ON SEVERENCE
183 KM PIMA COUNTY METHOD
184 DT DSGC
185 DI 0 50 100 150 200 250 350 500 750
186 DQ 0 9 16 23 29 38 60 80 129
*

*
*
* *****
* NEW BASIN
* *****
*

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HEC-1 INPUT

PAGE 6

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

187 KKNW66-CI2
188 BA 0.024
189 PB 2.85
190 LS 0 84.0
191 UD 0.162
*

192 KK CCI2
193 HC 2
*
*
* *****

* NEW BASIN
 * *****
 *

194 KKNW66-CI3
 195 BA 0.024
 196 PB 2.85
 197 LS 0 84.1
 198 UD 0.163
 *

199 KK CCI3
 200 HC 2
 *

201 KK SGC
 202 KM FLOW AT INTERSECTION OF TEE PEE AND SEVERANCE
 203 KM NO FLOW SPLIT, ALL FLOW CONTINUES EAST ALONG
 204 KM SEVERANCE.
 205 DT DSEV
 206 DI 0 3000.1
 207 DQ 0 3000.0
 *

208 KKDOUTFLOW
 209 KM RETIREVE DOUTFLOW FLOWING EAST ON ELKHORN
 210 DRDOUTFLOW
 *

211 KKRROUTFLW
 212 KM ROUTE DOUTFLOW TO CNW53-C
 213 KM FACILITY = RANCHO ROAD SYSTEM - BELTWAY
 214 KM FACILITY # = RCHB 0295
 215 KM LINING = RCB
 216 RD 2925 0.033 0.015 0 TRAP 7 0
 *

* *****
 * REVISE BASIN
 * *****
 *

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HEC-1 INPUT

PAGE 7

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

217 KK NW53-CB
 218 BA 0.128
 219 PB 2.85
 220 LS 0 79.8
 221 UD 0.210
 *

222 KK DSGC
 223 KM RETRIEVE DSGC FLOWING SOUTH ON GRAND CANYON
 224 DR DSGC
 *

225 KK CNW53-C

226	KM	COMBINE FLOWS AT ELKHORN AND GRAND CANYON						
227	HC	4						
	*							
228		KKRCNW53-C						
229	KM	ROUTE CNW53-C TO CNW66-C						
230	KM	ROUTE ELK AND GC TO ELK AND FT APACHE						
231	KM	FACILITY = RANCHO ROAD SYSTEM - BELTWAY						
232	KM	FACILITY # = RCHB 0295						
233	KM	LINING = RCB						
234	RD	2600	0.033	0.015	0	TRAP	7	0
	*							
235	KK	NW66-CA						
236	BA	0.067						
237	PB	2.91						
238	LS	0	84.0					
239	UD	0.166						
	*							
240	KK	C66-CA						
241	HC	2						
	*							
242	KK	NW66-CB						
243	BA	0.010						
244	PB	2.91						
245	LS	0	77.5					
246	UD	0.129						
	*							
247	KK	C66-CB						
248	KM	FLOW IN RCHB 0295 JUST WEST OF INTERSECTION						
249	KM	OF ELKHORN AND FORT APACHE						
250	HC	2						
	*							

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HEC-1 INPUT

PAGE 8

LINE	ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
251	KKNW66-CJ6
252	BA 0.006
253	PB 2.85
254	LS 0 84.0
255	UD 0.101
	*
256	KK D66CJ6
257	KM PART OF FLOW GOES INTO 60" STORM DRAIN
258	KM THE REMAINDER TRAVELS IN THE STREET SOUTH ON FT APACHE
259	DT S66CJ6
260	DI 0 4 1004
261	DQ 0 0 1000
	*
262	KK R66CJ6
263	KM ROUTE STORM DRAIN FLOWS TO GOLD LAKE AVE

264	RD	243	0.0050	0.013	0	CIRC	5	0
	*							
265	KKNW66-CJ2							
266	BA	0.018						
267	PB	2.85						
268	LS	0	84.0					
269	UD	0.128						
	*							
270	KK D66CJ2							
271	KM	PART OF FLOW GOES INTO 60" STORM DRAIN						
272	KM	THE REMAINDER TRAVELS IN THE STREET SOUTH ON FT APACHE						
273	DT S66CJ2							
274	DI	0	4	1004				
275	DQ	0	0	1000				
	*							
276	KK C66-CJ2							
277	HC	2						
	*							
278	KK R66CJ2							
279	KM	ROUTE STORM DRAIN FLOWS TO THUNDER BASIN AVE						
280	RD	244	0.0050	0.013	0	CIRC	5	0
	*							
281	KKNW66-CJ4							
282	BA	0.006						
283	PB	2.85						
284	LS	0	84.0					
285	UD	0.102						
	*							

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HEC-1 INPUT

PAGE 9

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

286	KK D66CJ4							
287	KM	PART OF FLOW GOES INTO 60" STORM DRAIN						
288	KM	THE REMAINDER TRAVELS IN THE STREET SOUTH ON FT APACHE						
289	DT S66CJ4							
290	DI	0	4	1004				
291	DQ	0	0	1000				
	*							
292	KK C66CJ4A							
293	KM	COMBINE STORM DRAIN FLOWS AT THUNDER BASIN						
294	HC	2						
	*							
295	KK S66CJ6							
296	DR S66CJ6							
	*							
297	KK RS66CJ6							
298	KM	ROUTE STREET FLOW TO THUNDER BASIN						
299	RD	490	0.0065	0.016	0	TRAP	0	50

```

*
300      KK  S66CJ2
301      DR  S66CJ2
302      *
302      KK  RS66CJ6
303      KM  ROUTE STREET FLOW TO THUNDER BASIN
304      RD  244 0.0065 0.016 0 TRAP 0 50
305      *
305      KK  THB
306      KM  COMBINE STREET FLOW AT THUNDER BASIN & FT APACHE
307      HC  2
308      *
308      KK  DTHB
309      KM  PART OF FLOW GOES INTO 60" STORM DRAIN
310      KM  THE REMAINDER TRAVELS IN THE STREET SOUTH ON FT APACHE
311      DT  STHB
312      DI  0 12 1012
313      DQ  0 0 1000
314      *
314      KK  C66CJ4B
315      HC  2
316      *
316      KK  R66CJ4
317      KM  ROUTE STORM DRAIN FLOWS TO OUTER BANKS AVE
318      RD  244 0.0050 0.013 0 CIRC 5 0
319      *
319      KKNW66-CJ3
320      BA  0.017
321      PB  2.85
322      LS  0 84.3
323      UD  0.127
324      *
324      KK  D66CJ3
325      KM  PART OF FLOW GOES INTO 60" STORM DRAIN
326      KM  THE REMAINDER TRAVELS IN THE STREET SOUTH ON FT APACHE
327      DT  S66CJ3
328      DI  0 4 1004
329      DQ  0 0 1000
330      *
330      KK  C66CJ3A
331      KM  COMBINE FLOWS IN STORM DRAIN AT OUTER BANKS AVE
332      HC  2
333      *
333      KK  R66CJ3A

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HEC-1 INPUT

PAGE 10

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

334	KM	ROUTE STORM DRAIN FLOWS TO OLYMPIA					
335	RD	78 0.0050 0.013 0 CIRC	5	0			
	*						
336	KK	STHB					
337	KM	RETRIEVE STREET FLOW FROM THUNDER BASIN AT OUTER BANKS AVE					
338	DR	STHB					
	*						
339	KK	S66CJ4					
340	KM	RETRIEVE STREET FLOW FROM NW66-CJ4					
341	DR	S66CJ4					
	*						
342	KK	CS66CJ4					
343	KM	COMBINE STREET FLOW AND ROUTE TO OUTER BANK					
344	HC	2					
	*						
345	KK	RS66CJ6					
346	KM	ROUTE STREET FLOW TO OUTER BANKS					
347	RD	244 0.0065 0.016 0 TRAP	0	50			
	*						
348	KK	S66CJ3					
349	DR	S66CJ3					
	*						

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HEC-1 INPUT

PAGE 11

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

350	KK	CS66CJ3					
351	KM	COMBINE STREET FLOWS JUST SOUTH OF OUTER BANKS AVE					
352	HC	2					
	*						
353	KK	DS66CJ3					
354	KM	PART OF FLOW GOES INTO 60" STORM DRAIN					
355	KM	THE REMAINDER TRAVELS IN THE STREET SOUTH ON FT APACHE					
356	DT	S66CJ3B					
357	DI	0 22 1022					
358	DQ	0 0 1000					
	*						
359	KKCS66CJ3B						
360	KM	COMBINE FLOWS IN STORM DRAIN JUST SOUTH OF OUTER BANKS AVE					
361	HC	2					
	*						
362	KK	R66CJ3					
363	KM	ROUTE STORM DRAIN FLOWS TO OLYMPIA					
364	RD	167 0.0050 0.013 0 CIRC	5	0			
	*						
365	KKNW66-CJ5						
366	BA	0.010					
367	PB	2.85					

368 LS 0 84.1
 369 UD 0.117
 *
 370 KK D66CJ5
 371 KM PART OF FLOW GOES INTO 60" STORM DRAIN
 372 KM THE REMAINDER TRAVELS IN THE STREET SOUTH ON FT APACHE
 373 DT S66CJ5
 374 DI 0 4 1004
 375 DQ 0 0 1000
 *

376 KK C66CJ5
 377 KM COMBINE FLOWS IN STORM DRAIN AT OLYMPIA
 378 HC 2
 *

379 KK R66CJ5
 380 KM ROUTE STORM DRAIN FLOWS TO SEVERENCE
 381 RD 112 0.0050 0.013 0 CIRC 5 0
 *

382 KK S66CJ3B
 383 KM RETRIEVE STREET FLOW AT OLYMPIA
 384 DR S66CJ3B
 *

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HEC-1 INPUT

PAGE 12

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

385 KK RS66CJ6
 386 KM ROUTE STREET FLOW TO OLYMPIA
 387 RD 244 0.0065 0.016 0 TRAP 0 50
 *

388 KK S66CJ5
 389 KM RETRIEVE BYPASS FLOW AT OLYMPIA CUL-DE-SAC
 390 DR S66CJ5
 *

391 KK C66CJ5
 392 KM COMBINE REMAINING STREET FLOWS INTO STORM DRAIN
 393 HC 3
 *

394 KK FAP&SEV
 395 KM RETRIEVE FLOWS FROM SEVERENCE & TEE PEE
 396 KM STREET FLOW ON SEVERANCE FROM THE WEST
 397 DR DSEV
 *

398 KK CFA&SV
 399 KM FLOW AT INTERSECTION OF SEVERANCE AND FORT APACHE
 400 HC 2
 *
 * KK RSFTAP
 * KM ROUTE FLOW IN LOCAL 60" RCP FACILITY IN FORT APACHE

* KM FROM SEVERANCE TO ELKHORN
 * RD 1300 0.005 0.013 0 CIRC 5 0
 *

401 KK NW66-CG
 402 BA 0.010
 403 PB 2.86
 404 LS 0 84.1
 405 UD 0.110
 *

406 KK D66CG
 407 KM PART OF FLOW GOES INTO 60" STORM DRAIN
 408 KM THE REMAINDER TRAVELS IN THE STREET SOUTH ON FT APACHE
 409 KM TO THE INTERSECTION WITH ELKHORN
 410 DT 66CG
 411 DI 0 7 1007
 412 DQ 0 0 1000
 *

413 KK CCG
 414 HC 2
 *

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HEC-1 INPUT

PAGE 13

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

415 KK RCG
 416 RD 248 0.0050 0.013 0 CIRC 5 0
 *

417 KK NW66-CF
 418 BA 0.012
 419 PB 2.86
 420 LS 0 84.0
 421 UD 0.121
 *

422 KK D66CF
 423 KM PART OF FLOW GOES INTO 60" STORM DRAIN
 424 KM THE REMAINDER TRAVELS IN THE STREET SOUTH ON FT APACHE
 425 KM TO THE INTERSECTION WITH ELKHORN
 426 DT 66CF
 427 DI 0 7 1007
 428 DQ 0 0 1000
 *

429 KK C66-CF
 430 HC 2
 *

431 KK R66CF
 432 RD 260 0.0072 0.013 0 CIRC 5 0
 *

433 KK NW66-CE
 434 BA 0.010

435 PB 2.86
 436 LS 0 84.0
 437 UD 0.121
 *

438 KK D66CE
 439 KM PART OF FLOW GOES INTO 60" STORM DRAIN
 440 KM THE REMAINDER TRAVELS IN THE STREET SOUTH ON FT APACHE
 441 KM TO THE INTERSECTION WITH ELKHORN
 442 DT 66CE
 443 DI 0 7 1007
 444 DQ 0 0 1000
 *

445 KK C66-CE
 446 HC 2
 *

447 KK R66CE
 448 RD 234 0.0082 0.013 0 CIRC 5 0
 *

1

HEC-1 INPUT

PAGE 14

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

449 KK NW66-CD
 450 BA 0.013
 451 PB 2.87
 452 LS 0 84.1
 453 UD 0.121
 *

454 KK D66CD
 455 KM PART OF FLOW GOES INTO 60" STORM DRAIN
 456 KM THE REMAINDER TRAVELS IN THE STREET SOUTH ON FT APACHE
 457 KM TO THE INTERSECTION WITH ELKHORN
 458 DT 66CD
 459 DI 0 7 1007
 460 DQ 0 0 1000
 *

461 KK C66-CD
 462 HC 2
 *

463 KK R66CD
 464 RD 247 0.0065 0.013 0 CIRC 5 0
 *

465 KK NW66-CC
 466 BA 0.009
 467 PB 2.87
 468 LS 0 84.1
 469 UD 0.120
 *

470 KK D66CC

471 KM PART OF FLOW GOES INTO 60" STORM DRAIN
 472 KM THE REMAINDER TRAVELS IN THE STREET SOUTH ON FT APACHE
 473 KM TO THE INTERSECTION WITH ELKHORN
 474 DT 66CC
 475 DI 0 7 1007
 476 DQ 0 0 1000
 *

477 KK C66-CC
 478 HC 2
 *

479 KK R66CC
 480 KM ROUTE FLOW TO UPSTREAM END OF 5'X5' RCB
 481 RD 105 0.0050 0.013 0 CIRC 5 0
 *

HEC-1 INPUT

PAGE 15

1

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

482 KK 66CG
 483 KM RETRIEVE STREET FLOW AT OXBOW LAKE
 484 DR 66CG
 *

485 KK R66CG
 486 KM ROUTE TO WHITE WATERFALL
 487 RD 245 0.0082 0.016 0 TRAP 0 50
 *

488 KK 66CF
 489 KM RETRIEVE STREET FLOW AT WHITE WATERFALL
 490 DR 66CF
 *

491 KK C66CF
 492 KM COMBINE FLOWS IN STREET
 493 HC 2
 *

494 KK RC66CF
 495 KM ROUTE TO BROWNSTONE LEDGE
 496 RD 245 0.0082 0.016 0 TRAP 0 50
 *

497 KK 66CE
 498 KM RETRIEVE STREET FLOW AT BROWNSTONE LEDGE
 499 DR 66CE
 *

500 KK C66CE
 501 KM COMBINE FLOWS IN STREET
 502 HC 2
 *

503 KK RC66CE
 504 KM ROUTE FLOWS TO ENCHANTED GROVE

505 RD 245 0.0082 0.016 0 TRAP 0 50
*

506 KK 66CD
507 KM RETRIEVE STREET FLOW AT ENCHANTED GROVE
508 DR 66CD
*

509 KK C66CD
510 KM COMBINE FLOWS IN STREET
511 HC 2
*

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HEC-1 INPUT

PAGE 16

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

512 KK RC66CD
513 KM ROUTE FLOWS TO BRONZE RIVER
514 RD 245 0.0082 0.016 0 TRAP 0 50
*

515 KK 66CC
516 KM RETRIEVE STREET FLOW AT BRONZE RIVER
517 DR 66CC
*

518 KK C66CC
519 KM COMBINE FLOWS IN STREET
520 HC 2
*

521 KK RC66CC
522 KM ROUTE FLOWS TO ELKHORN
523 RD 85 0.0082 0.016 0 TRAP 0 50
*

524 KK CRC66CC
525 KM COMBINE FLOWS IN 5'X5' RCB
526 HC 2
*

527 KK R5X5
528 KM ROUTE FLOWS TO RCB IN 5'X5' RCB
529 RD 235 0.04 0.016 0 TRAP 5 0
*
* KK CFTLKN
* KM CLOSED SYSTEM FLOW IN FORT APACHE NORTH OF ELKHORN
* HC 2
*

530 KK CFTLKS
531 KM CLOSED SYSTEM FLOW SOUTH OF INTERSTION OF
532 KM FORT APACHE AND ELKHORN
533 HC 2
*

534 KK RCW66-C

535 KM ROUTE CNW66-C TO CNW77-C
 536 KM ROUTE FT APACHE AND ELKHORN TO
 537 KM FORT APACHE AND WITTIG
 538 KM FACILITY = RANCHO ROAD SYSTEM - BELTWAY
 539 KM FACILITY ID-MILE = RCHB 0250
 540 KM LINING = RCB
 541 RD 650 0.01 0.013 0 TRAP 12 0
 *

1

HEC-1 INPUT

PAGE 17

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

542 KK NW77-CC
 543 BA 0.007
 544 PB 2.90
 545 LS 0 84.6
 546 UD 0.105
 *

547 KK NW77-CD
 548 BA 0.011
 549 PB 2.90
 550 LS 0 86.0
 551 UD 0.120
 *

552 KKCnw77-CD
 553 HC 3
 *

554 KK NW77-CE
 555 KM FLOW IN WITTIG FROM THE WEST
 556 BA 0.014
 557 PB 2.90
 558 LS 0 82.5
 559 UD 0.119
 *

560 KKCnw77-CE
 561 KM FLOW IN RCB AT WITTIG
 562 HC 2
 *

563 KKRCnw77-CE
 564 KM REVISED BY LBG
 565 KM ROUTE NW77-CE TO NW77-CH RCB
 566 KM FLOW IN RCB FROM WITTIG TO DORRELL
 567 RD 300 0.01 0.013 0 TRAP 12 0
 *

568 KK NW77-CF
 569 BA 0.006
 570 PB 2.90
 571 LS 0 84.0
 572 UD 0.105
 *

1

573 KKCWN77-CF
 574 HC 2
 *

HEC-1 INPUT

PAGE 18

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

575 KKRCNW77-CF
 576 KM REVISED BY LBG
 577 KM ROUTE FROM NW77-CF TO NW77-CH
 578 RD 350 0.01 0.013 0 TRAP 12 0
 *

579 KK NW77-CG
 580 BA 0.007
 581 PB 2.90
 582 LS 0 84.0
 583 UD 0.113
 *

584 KKCWN77-CG
 585 KM FLOW IN RCB NORTH OF FT APACHE AND DORRELL
 586 HC 2
 *

587 KK DNW77-C
 588 KM RETRIEVE DNW77-C
 589 DR DNW77-C
 *

590 KK RDW77-C
 591 KM REVISED BY LBG TO ROUTE DNW77-C TO CNW77-C
 592 KM DORRELL FROM HUALAPAI TO GRAND CANYON
 593 RD 2600 0.033 0.016 0 TRAP 0 50
 *

594 KK NW77-CA
 595 KM REVISED BY LBG
 596 KM WEST PART OF NW77-C
 597 BA 0.125
 598 PB 2.98
 599 LS 0 80.1
 600 UD 0.206
 *

601 KK CPT12
 602 KM ADD FLOW FROM WEST DORRELL
 603 HC 2
 *

604 KK GC-DRINT
 605 KM REVISED BY LBG TO DIVERT THE MAJORITY OF THE
 606 KM FLOW SOUTH TO GRAND CANYON THE REMAINDER TRAVELS
 607 KM EAST IN DORRELL STORM DRAIN PER INTERCEPTION
 608 KM CAPACITY OF DUAL 20' DROP INLETS
 609 DT GC
 610 DI 0 94.0 100 109.0 115.0 218 233.0 500

611 DQ 0 47.8 51 56.0 59.3 120 129.2 307
 *

HEC-1 INPUT

PAGE 19

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

612 KK RCPT12
 613 KM GRAND CANYON & DORRELL TO
 614 KM TEE PEE & DORRELL
 615 RD 1332 .0324 .016 0 TRAP 0 50
 *

616 KK NW77-CB
 617 KM REVISED BY LBG
 618 KM NW77-C BETWEEN GRAND CANYON & TEEPEE
 619 BA 0.066
 620 PB 2.91
 621 LS 0 83.7
 622 UD 0.166
 *

623 KK CDL
 624 KM REVISED BY LBG
 625 KM COMBINE FLOWS ON DORRELL LN AT TEE PEE LANE
 626 HC 2
 *

627 KK DORTP
 628 KM FLOW SPLIT AT DORRELL & TEE PEE
 629 KM PIMA COUNTY METHOD
 630 KM FLOW CONTINUTES EAST ON DORRELL
 631 KM FLOW DIVERTED OUT CONTINUES SOUTH ON TEE PEE
 632 DT DDORTP
 633 DI 0 50 100 150 200 250
 634 DQ 0 8 17 25 34 43
 *

635 KKRNW77-CB
 636 KM REVISED BY LBG
 637 KM DORRELL FROM TEE PEE LANE TO FORT APACHE RD
 638 KM ROUTES FLOW FROM NW77-CB
 639 RD 1350 0.032 .016 0 TRAP 0 50
 *

640 KKNWBA6-CB
 641 BA 0.005
 642 PB 2.91
 643 LS 0 84.3
 644 UD 0.106
 *

645 KK NW77-CH
 646 BA 0.014
 647 PB 2.90
 648 LS 0 88.0
 649 UD 0.119
 *

LINE	ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
650	KK CPT2A
651	KM COMBINE FLOW AT FT APACHE
652	KM STREET FLOW AND CLOSED SYSTEM FLOW
653	KM IN DORRELL LANE FROM THE WEST
654	HC 3
	*
655	KK CBA6-CB
656	KM FORT APACHE AND DORRELL
657	HC 2
	*
658	KK RFASD1
659	KM ROUTE NW77-CE TO NWBA6-CD
660	KM ROUTE FT APACHE AND DORRELL TO
661	KM FT APACHE AND DEER SPRINGS
662	KM FACILITY = RANCHO ROAD SYSTEM - BELTWAY
663	KM FACILITY ID-MILE = RCHB 0250
664	KM LINING = RCB
665	RD 1300 0.01 0.013 0 TRAP 12 0
	*
666	KKNWBA6-CD
667	BA 0.008
668	PB 2.91
669	LS 0 84.0
670	UD 0.061
	*
671	KKNWBA6-CG
672	BA 0.005
673	PB 2.91
674	LS 0 84.0
675	UD 0.056
	*
676	KKNWBA6-CH
677	BA 0.006
678	PB 2.91
679	LS 0 84.0
680	UD 0.081
	*
681	KK CBA6-CD
682	KM FLOW IN RCB NORTH OF
683	KM FORT APACHE AND DEER SPRINGS
684	HC 4
	*

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

685	KKNWBA6-CA								
686	BA	0.132							
687	PB	2.95							
688	LS	0	80.0						
689	UD	0.236							
	*								
690	KKDNWBA6-C								
691	KM	RETRIEVE	DNWBA6-C						
692	DRDNWBA6-C								
	*								
693	KKRDWBA6-C								
694	KM	ROUTE	DNWBA6-C TO CNWBA6-C						
695	KM	FLOW	FROM HUALAPAI & DORRELL TO						
696	KM	DEER	SPRINGS & GRAND CANYON						
697	RD	2600	0.034 0.016	0	TRAP	0	50		
	*								
698	KK	CDSW							
699	KM	FLOW	IN DEER SPRINGS FROM THE WEST						
700	HC	2							
	*								
701	KKDNWBA6C2								
702	KM	RETRIEVE	FLOW FROM DORRELL & GRAND CANYON						
703	DR	GC							
	*								
704	KKRDWBA6C2								
705	KM	REVISED	BY LBG						
706	KM	GRAND	CANYON FROM DORRELL TO DEER SPRINGS						
707	RD	1376	0.032 0.016	0	TRAP	0	50		
	*								
708	KK	CPT11A							
709	KM	REVISED	BY LBG						
710	KM	COMBINE	FLows AT GRAND CANYON & DEER SPRINGS						
711	HC	2							
	*								
712	KK	CPT11B							
713	KM	REVISED	BY LBG						
714	KM	FLOW	SPLIT AT DEER SPRINGS AND GRAND CANYON						
715	KM	FIRST	60 CFS IS COLLECTED BY LOCAL STORM DRAIN IN DEER SPRINGS						
716	KM	FLOW	DIVERTED OUT FLOWS TO FT APACHE DETENTION BASIN						
717	DT	GC2							
718	DI	0	60 110 160 210 260 310 410						
719	DQ	0	0 6 14 23 35 45 68						
	*								

1

HEC-1 INPUT

PAGE 22

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

720	KK	RCPT11B
721	KM	REVISED BY LBG TO ROUTE FLOW ON
722	KM	DEER SPRINGS FROM GRAND CANYON TO TEE PEE

723 RD 1310 0.029 0.016 0 TRAP 0 50
*

724 KK DEERSP
725 KM RETRIEVE FLOW FROM DORRELL & TEE PEE
726 DR DDORTP
*

727 KK DEERSP
728 KM REVISED BY LBG TO ROUTE FLOW ON
729 KM TEE PEE FROM DORRELL TO DEER SPRINGS
730 RD 1341 0.009 0.016 0 TRAP 0 50
*

731 KKNWBA6-CF
732 BA 0.061
733 PB 2.95
734 LS 0 83.1
735 UD 0.170
*

736 KK CTEEP
737 KM COMBINE FLOWS AT DEER SPRINGS & TEE PEE
738 HC 3
*

739 KK DSTP
740 KM FLOW SPLIT AT DEER SPRINGS & TEE TEE
741 KM PIMA COUNTY METHOD
742 KM FLOW CONTINUES EAST ALONG DEER SPRINGS
743 DT DDSTP
744 DI 0 50 100 150 200 250 350
745 DQ 0 7 16 24 33 41 57
*

746 KK RDEER
747 KM REVISED BY LBG TO ROUTE FLOW ON
748 KM DEER SRPINGS FROM TEE PEE TO FORT APACHE
749 RD 1333 0.030 0.016 0 TRAP 0 50
*

750 KKNWBA6-CC
751 BA 0.033
752 PB 2.91
753 LS 0 84.3
754 UD 0.157
*

1

HEC-1 INPUT

PAGE 23

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

755 KKNWBA6-CE
756 BA 0.006
757 PB 2.93
758 LS 0 84.1
759 UD 0.114
*

760	KK	CBA6-CE							
761	KM	FLOW IN DEER SPRINGS JUST WEST OF							
762	KM	FT APACHE (DEER SPRINGS LATERAL DESIGN FLOW)							
763	HC	3							
	*								
764	KK	CPT1A							
765	KM	COMBINE FLOWS IN FT APACHE STORM DRAIN							
766	HC	2							
	*								
767	KK	RCPT1A							
768	KM	REVISED BY LBG TO ROUTE FLOW FROM							
769	KM	FORT APACHE RCB FROM DEER SPRINGS TO ECHELON							
770	RD	656 0.0125 0.013 0 TRAP 12 0							
	*								
771	KK	NWBC2-CB							
772	BA	0.031							
773	PB	2.93							
774	LS	0 84.0							
775	UD	0.136							
	*								
776	KK	FTAP							
777	KM	COMBINE FLOWS AT FT APACHE JUST NORTH OF ECHELON							
778	HC	2							
	*								
779	KK	ECH							
780	KM	RETRIEVE FLOWS FROM DEER SPRINGS & TEE PEE							
781	DR	DDSTP							
	*								
782	KK	RECH							
783	KM	REVISED BY LBG TO ROUTE FLOW ON							
784	KM	TEE PEE FROM DEER SPRINGS TO ECHELON							
785	RD	667 0.0137 0.016 0 TRAP 0 50							
	*								
786	KK	NWBC2-CA							
787	BA	0.030							
788	PB	2.95							
789	LS	0 82.7							
790	UD	0.121							
	*								

1

HEC-1 INPUT

PAGE 24

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

791	KK	CB2-CA
792	HC	2
	*	
793	KK	RCECH
794	KM	REVISED BY LBG TO ROUTE FLOW ON

795 KM ECHELON FROM TEE PEE TO FORT APACHE
 796 RD 1317 0.0208 0.016 0 TRAP 0 50
 *

797 KKNWBC2-CD
 798 BA 0.010
 799 PB 2.95
 800 LS 0 82.4
 801 UD 0.193
 *

802 KK CP-EPL
 803 KM ECHELON POINT LATERAL
 804 HC 2
 *

805 KK FTAP2
 806 KM COMBINE FLOWS AT FT APACHE & ECHELON
 807 HC 2
 *

808 KK RFTAP2
 809 KM ADDED BY LBG
 810 KM ROUTE NWBC3A IN RANCHO-FT APACHE STORM DRAIN
 811 RD 1300 0.014 0.015 0 TRAP 12 0
 *

812 KK NWBC3A
 813 KM REVISED BY LBG
 814 BA 0.015
 815 PB 2.87
 816 LS 0 93.0
 817 UD 0.101
 *

818 KK BLTWY1
 819 KM ADDED BY LBG
 820 KM ADD FLOWS FROM THE WILLOWS AT TOWN CENTER
 821 KM COMBINE FLOWS AT FT APACHE STORM DRAIN
 822 HC 2
 *

823 KK RBLTWY1
 824 KM ADDED BY LBG
 825 KM ROUTE NWBC3B IN RANCHO-FT APACHE STORM DRAIN
 826 RD 350 0.021 0.015 0 TRAP 12 0
 *

1

HEC-1 INPUT

PAGE 25

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

827 KK NWBC3B
 828 BA 0.009
 829 PB 2.87
 830 LS 0 93.0
 831 UD 0.088
 *

832 KK BLTWY2
 833 KM ADD FLOWS FROM THE ECHELON
 834 KM COMBINE FLOWS AT BELTWAY CHANNEL
 835 HC 2
 *

836 KK RCBA6-C
 837 KM REVISED BY LBG
 838 KM ROUTE CNWBA6-C TO CFADB
 839 KM FACILITY = RANCHO ROAD SYSTEM - BELTWAY
 840 KM FACILITY ID-MILE = RCHB 0250,0227,0198
 841 KM LINING = RCB
 842 RD 1050 0.022 0.015 0 TRAP 11 0
 *

843 KK DRFADB
 844 KM RETRIEVE FLOW INTO FORT APACHE DB
 845 DR DFADB
 *

846 KK DRGC2
 847 KM RETRIEVE FLOW INTO FORT APACHE DB FROM GRAND CANYON
 848 DR GC2
 *

849 KK FADBIN
 850 KM RANCHO ROAD SYSTEM-BELTWAY @ FORT APACHE
 851 HC 2
 *

852 KK FADB
 853 KM FACILITY = FORT APACHE DETENTION BASIN
 854 KM FACILITY ID-MILE = RCBC 0004
 855 KM STORAGE VOLUME = 76 AC-FT
 856 KM OUTLET = 54 INCH RCP WITH A 41" ORIFICE
 857 KM 100-YEAR DISCHARGE =
 858 KM SPILLWAY LENGTH = 417'
 859 KM SPILLWAY HEIGHT =
 860 KM SPILLWAY CREST ELEVATION = 2636'
 861 KM SPILLWAY TYPE =
 862 KM PMF DISCHARGE = 2341 CFS
 863 KM TOP OF EMBANKMENT ELEVATION =
 864 KM REFERENCED FROM "PRELIMINARY HYDRAULIC DESIGN REPORT FOR
 865 KM WESTERN SEGMENT LAS VEGAS BELTWAY, INITIAL IMPROVEMENTS,
 866 KM ANN ROAD TO EL CAPITAN WAY" PREPARED BY LOUIS BERGER (MARCH 6, 2002)
 867 RS 1 STOR 0
 868 SV 0.0 5.8 15.6 27.0 40.0 54.7 71.2 75.6 93.6
 HEC-1 INPUT

1

PAGE 26

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
 869 SE 2611 2615 2619 2623 2627 2631 2635 2636 2640
 870 SQ 0 72 120 153 181 205 226 231 250
 *

871 KK FADBOUT
 872 KM ROUTE FABD TO CFADB

873 KM FACILITY = RANCHO ROAD SYSTEM - BELTWAY
 874 KM FACILITY ID-MILE = RCBC 0002,0000
 875 KM LINING = RCB
 876 RD 1565 0.01 0.015 0 TRAP 6 0
 *

877 KK CFADB
 878 KM COMBINE FADB AND RCBA6-C
 879 KM RANCHO ROAD SYSTEM-BELTWAY @ FORT APACHE
 880 HC 3
 *
 881 ZZ

1

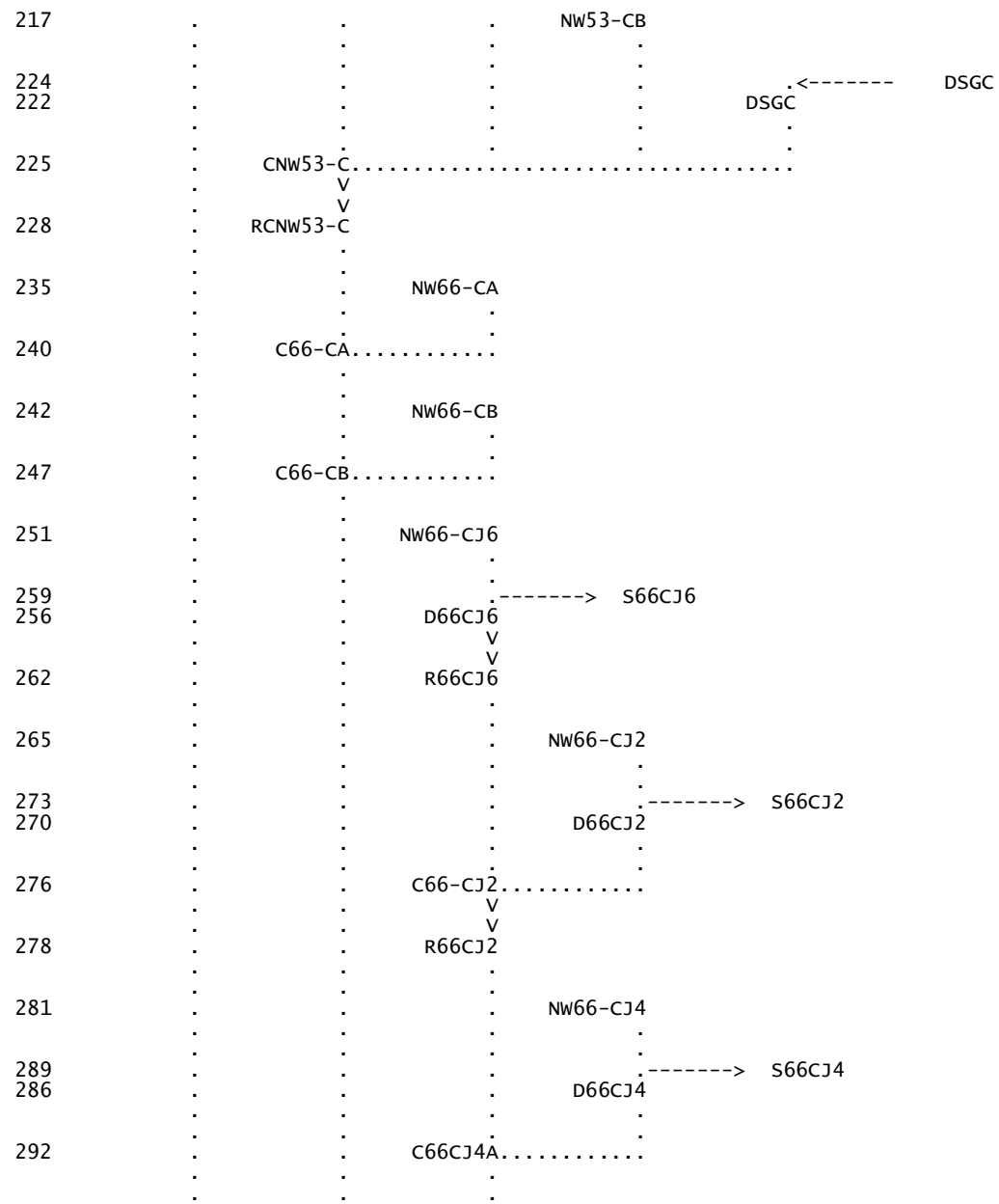
SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE	(V) ROUTING	(--->) DIVERSION OR PUMP FLOW
NO.	(.) CONNECTOR	(<---) RETURN OF DIVERTED OR PUMPED FLOW
58	NW27-C	
	V	
	V	
71	RN27-C	
	.	
77	.	NW26-C
	.	.
82	CNW26-C.....	.
	V	
	V	
85	RN26-C	
	.	
92	.	NW53-CC
	.	.
98	CNW53-CC.....	.
	.	
106	.	----->DOUTFLOW
102	DNW26-C	
	V	
	V	
109	RC26-C	
	.	
117	.	-----> DNW77-C
115	DC26-C	
	.	
120	.	NWBA3-C
	.	.
125	CBA3-C.....	.
	V	
	V	
129	RDWBA3-C	

```

137      .
135      .----->DNWBA6-C
      DBA3-C
      V
      V
140      R2WBA3-C
      .
146      .      CDMNA1
      .
151      CMNA1.....
      V
      V
155      RCMNA1
      .
161      .      NWBC2-CC
      .
166      FADBIN1.....
      .
172      .----->   DFADB
169      DFADBIN1
      .
175      .      NW53-CA
      .
184      .----->   DSGC
180      .      SEV
      .
187      .      NW66-CI2
      .
192      .      CCI2.....
      .
194      .      NW66-CI3
      .
199      .      CCI3.....
      .
205      .----->   DSEV
201      .      SGC
      .
210      .      .<-----DOUTFLOW
208      .      DOUTFLOW
      .      V
      .      V
211      .      RDOUTFLW
      .
      .

```



296	.	.	.	S66CJ6	<-----	S66CJ6
295	.	.	.	S66CJ6	V	
	.	.	.	V		
297	.	.	.	RS66CJ6		
	.	.	.			
301	.	.	.			
300	.	.	.	S66CJ2	<-----	S66CJ2
	.	.	.	V		
302	.	.	.	RS66CJ6		
	.	.	.			
305	.	.	.	THB.....		
	.	.	.			
311	.	.	.			
308	.	.	.	DTHB	----->	STHB
	.	.	.			
314	.	.	.	C66CJ4B.....		
	.	.	.	V		
316	.	.	.	R66CJ4		
	.	.	.			
319	.	.	.	NW66-CJ3		
	.	.	.			
327	.	.	.			
324	.	.	.	D66CJ3	----->	S66CJ3
	.	.	.			
330	.	.	.	C66CJ3A.....		
	.	.	.	V		
333	.	.	.	R66CJ3A		
	.	.	.			
338	.	.	.			
336	.	.	.	STHB	<-----	STHB
	.	.	.			
341	.	.	.			
339	.	.	.	S66CJ4	<-----	S66CJ4
	.	.	.			
342	.	.	.	CS66CJ4.....		
	.	.	.	V		
345	.	.	.	RS66CJ6		
	.	.	.			
349	.	.	.			
348	.	.	.	S66CJ3	<-----	S66CJ3
	.	.	.			
	.	.	.			

350	.	.	.	CS66CJ3.....	
	.	.	.	.	
356	.	.	.	.	-----> S66CJ3B
353	.	.	.	DS66CJ3	
	.	.	.	.	
359	.	.	.	CS66CJ3B.....	
	.	.	.	V	
	.	.	.	V	
362	.	.	.	R66CJ3	
	.	.	.	.	
365	.	.	.	NW66-CJ5	
	.	.	.	.	
373	.	.	.	.	-----> S66CJ5
370	.	.	.	D66CJ5	
	.	.	.	.	
376	.	.	.	C66CJ5.....	
	.	.	.	V	
	.	.	.	V	
379	.	.	.	R66CJ5	
	.	.	.	.	
384	.	.	.	.	-----< S66CJ3B
382	.	.	.	S66CJ3B	
	.	.	.	V	
	.	.	.	V	
385	.	.	.	RS66CJ6	
	.	.	.	.	
390	.	.	.	.	-----< S66CJ5
388	.	.	.	S66CJ5	
	.	.	.	.	
391	.	.	.	C66CJ5.....	
	.	.	.	.	
397	.	.	.	.	-----< DSEV
394	.	.	.	FAP&SEV	
	.	.	.	.	
398	.	.	.	CFA&SV.....	
	.	.	.	.	
401	.	.	.	NW66-CG	
	.	.	.	.	
410	.	.	.	.	-----> 66CG
406	.	.	.	D66CG	
	.	.	.	.	
413	.	.	.	CCG.....	
	.	.	.	V	
	.	.	.	V	
415	.	.	.	RCCG	

417	.	.	.	NW66-CF	.	
426	.	.	.	.	.	
422	.	.	.	D66CF	----->	66CF
	.	.	.	.	.	
429	.	.	.	C66-CF	.....	
	.	.	.	V		
431	.	.	.	R66CF		
	.	.	.	.	.	
433	.	.	.	NW66-CE	.	
	.	.	.	.	.	
442	.	.	.	.	----->	66CE
438	.	.	.	D66CE		
	.	.	.	.	.	
445	.	.	.	C66-CE	.....	
	.	.	.	V		
	.	.	.	V		
447	.	.	.	R66CE		
	.	.	.	.	.	
449	.	.	.	NW66-CD	.	
	.	.	.	.	.	
458	.	.	.	.	----->	66CD
454	.	.	.	D66CD		
	.	.	.	.	.	
461	.	.	.	C66-CD	.....	
	.	.	.	V		
	.	.	.	V		
463	.	.	.	R66CD		
	.	.	.	.	.	
465	.	.	.	NW66-CC	.	
	.	.	.	.	.	
474	.	.	.	.	----->	66CC
470	.	.	.	D66CC		
	.	.	.	.	.	
477	.	.	.	C66-CC	.....	
	.	.	.	V		
	.	.	.	V		
479	.	.	.	R66CC		
	.	.	.	.	.	
484	.	.	.	.	.	
482	.	.	.	66CG	<-----	66CG
	.	.	.	V		
	.	.	.	V		

485	.	.	.	R66CG		
	.	.	.	.	.	
490	.	.	.	.	66CF	66CF
488	.	.	.	.	.	
	.	.	.	.	.	
491	.	.	.	C66CF	.	
	.	.	.	V	.	
	.	.	.	V	.	
494	.	.	.	RC66CF	.	
	.	.	.	.	.	
499	.	.	.	.	66CE	66CE
497	.	.	.	.	.	
	.	.	.	.	.	
500	.	.	.	C66CE	.	
	.	.	.	V	.	
	.	.	.	V	.	
503	.	.	.	RC66CE	.	
	.	.	.	.	.	
508	.	.	.	.	66CD	66CD
506	.	.	.	.	.	
	.	.	.	.	.	
509	.	.	.	C66CD	.	
	.	.	.	V	.	
	.	.	.	V	.	
512	.	.	.	RC66CD	.	
	.	.	.	.	.	
517	.	.	.	.	66CC	66CC
515	.	.	.	.	.	
	.	.	.	.	.	
518	.	.	.	C66CC	.	
	.	.	.	V	.	
	.	.	.	V	.	
521	.	.	.	RC66CC	.	
	.	.	.	.	.	
524	.	.	.	CRC66CC	.	
	.	.	.	V	.	
	.	.	.	V	.	
527	.	.	.	R5X5	.	
	.	.	.	.	.	
530	.	.	.	CFTELKS	.	
	.	.	.	V	.	
	.	.	.	V	.	
534	.	.	.	RCW66-C	.	
	.	.	.	.	.	
542	.	.	.	NW77-CC	.	
	.	.	.	.	.	
	.	.	.	.	.	

547	.	.	.	NW77-CD
	.	.	.	.
552	.	CNW77-CD	.....	.
	.	.	.	.
554	.	.	NW77-CE	.
	.	.	.	.
560	.	CNW77-CE	.....	.
	.	.	V	.
	.	.	V	.
563	.	RCNW77-C		.
	.	.	.	.
568	.	.	NW77-CF	.
	.	.	.	.
573	.	CNW77-CF	.....	.
	.	.	V	.
	.	.	V	.
575	.	RCNW77-C		.
	.	.	.	.
579	.	.	NW77-CG	.
	.	.	.	.
584	.	CNW77-CG	.....	.
	.	.	.	.
589	.	.	.	<----- DNW77-C
587	.	DNW77-C		.
	.	.	V	.
	.	.	V	.
590	.	RDW77-C		.
	.	.	.	.
594	.	.	.	NW77-CA
	.	.	.	.
601	.	CPT12	.....	.
	.	.	.	.
609	.	.	.	-----> GC
604	.	GC-DR		.
	.	.	V	.
	.	.	V	.
612	.	RCPT12		.
	.	.	.	.
616	.	.	.	NW77-CB
	.	.	.	.
623	.	.	CDL	.....
	.	.	.	.
632	.	.	.	-----> DDORTP
627	.	DORTP		.

635	.	.	V	
	.	.	V	
	.	.	RNW77-CB	
640	.	.	.	NWBA6-CB
	.	.	.	.
645	.	.	.	NW77-CH
	.	.	.	.
650	.	.	CPT2A.....	.
	.	.	.	.
655	.	CBA6-CB.....	.	
	.	.	V	
	.	.	V	
658	.	.	RFASD1	
	.	.	.	
666	.	.	NWBA6-CD	
	.	.	.	
671	.	.	.	NWBA6-CG
	.	.	.	.
676	.	.	.	NWBA6-CH
	.	.	.	.
681	.	CBA6-CD.....	.	
	.	.	.	
685	.	.	NWBA6-CA	
	.	.	.	
692	.	.	.	.<-----DNWBA6-C
690	.	.	DNWBA6-C	
	.	.	V	
	.	.	V	
693	.	.	RDWBA6-C	
	.	.	.	
698	.	.	CDSW.....	
	.	.	.	
703	.	.	.	.<----- GC
701	.	.	DNWBA6C2	
	.	.	V	
	.	.	V	
704	.	.	RDWBA6C	
	.	.	.	
708	.	.	CPT11A.....	
	.	.	.	
717	.	.	.	
712	.	.	CPT11B----->	GC2
	.	.	V	

720	.	.	V	
	.	.	RCPT11B	
	.	.	.	
726	.	.	.	
724	.	.	DEERSP	.<----- DDORTP
	.	.	V	
	.	.	V	
727	.	.	DEERSP	
	.	.	.	
731	.	.	.	NWBA6-CF
	.	.	.	.
736	.	.	CTEEPEE.....	.
	.	.	.	
743	.	.	.	
739	.	.	DSTP	-----> DDSTP
	.	.	V	
	.	.	V	
746	.	.	RDEER	
	.	.	.	
750	.	.	.	NWBA6-CC
	.	.	.	.
755	.	.	.	NWBA6-CE
	.	.	.	.
760	.	.	CBA6-CE.....	.
	.	.	.	
764	.	.	CPT1A.....	
	.	.	V	
	.	.	V	
767	.	.	RCPT1A	
	.	.	.	
771	.	.	NWBC2-CB	
	.	.	.	
776	.	.	FTAP.....	
	.	.	.	
781	.	.	.	
779	.	.	ECH	.<----- DDSTP
	.	.	V	
	.	.	V	
782	.	.	RECH	
	.	.	.	
786	.	.	.	NWBC2-CA
	.	.	.	.
791	.	.	CB2-CA.....	.
	.	.	V	
	.	.	V	

```

793      .      .      RCECH
      .      .      .
797      .      .      .      NWBC2-CD
      .      .      .
802      .      .      CP-EPL.....
      .      .      .
805      .      FTAP2.....
      .      V
      .      V
808      .      RFTAP2
      .      .
812      .      .      NWBC3A
      .      .      .
818      .      BLTWY1.....
      .      V
      .      V
823      .      RBLTWY1
      .      .
827      .      .      NWBC3B
      .      .      .
832      .      BLTWY2.....
      .      V
      .      V
836      .      RCBA6-C
      .      .
845      .      .      .      <----- DFADB
843      .      .      DRFADB
      .      .      .
848      .      .      .      .      <----- GC2
846      .      .      .      DRGC2
      .      .      .
849      .      .      FADBIN.....
      .      .      V
      .      .      V
852      .      .      FADB
      .      .      V
      .      .      V
871      .      .      FADBOUT
      .      .      .
877      .      .      CFADB.....

```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1
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*
* U.S. ARMY CORPS OF ENGINEERS
* HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET
*
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*
* RUN DATE 03MAY13 TIME 16:30:41 *
*

* DAVIS, CALIFORNIA 95616 *
* (916) 756-1104 *
*

CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT 2008 MASTER PLAN UPDATE
UPPER AND LOWER NORTHERN LAS VEGAS WASH WATERSHEDS
RECOMMENDED DRAINAGE SYSTEM WITH ULTIMATE DEVELOPMENT
INPUT FILE = WEST8.DAT
INPUT FILE DATE = MAY 2008
DESIGN STORM = 100-YEAR 6-HOUR STORM
STORM DISTRIBUTION = SDN3
MODELED BY PBS&J (KRYSTLE PEMBERTON, E.I., CFM)
CHECKED BY PBS&J (HARSHAL B. DESAI, P.E., CFM)
STORM CENTERING = WEST TRIBUTARY
DOWNSTREAM OF THE UPPER LAS VEGAS WASH DETENTION BASIN TO THE MOST
DOWNSTREAM POINT IN THE LOWER NORTHERN LAS VEGAS WASH WATERSHED

REFERENCED HYDROLOGIC MODELS:
REVISED FINAL DESIGN REPORT FOR THE RANCHO DETENTION BASIN
PHASE II (VTN 2006)
RESPONSE TO COMMENTS ON THE CONCEPTUAL DRAINAGE STUDY FOR
NORTH LAS VEGAS 600-ACRE SITE (GC WALLACE 2006)
SECOND RESPONSE TO COMMENTS OF THE CONCEPTUAL DRAINAGE STUDY
FOR NORTH LAS VEGAS 2074-ACRE SITE (GC WALLACE 2006)
BASIN MAPS FOR SUPPLEMENT #2 TO ADDENDUM #2 TO THE MASTER
DRAINAGE STUDY FOR CLIFF'S EDGE/ PROVIDENCE (VTN 2004)
MASTER DRAINAGE STUDY FOR KYLE CANYON (GC WALLACE 2006)
TECHNICAL DRAINAGE STUDY FOR GRAND TETON DRIVE STROM DRAIN
AND AREA 1 ROADWAY IMPROVEMENTS (GC WALLACE 2006)
90% FINAL DESIGN REPORT FOR RANCHO ROAD SYSTEM - EL CAMPO
GRANDE STORM DRAIN PROJECT (PBS&J 2007)
MPA FOR RACEL STREET COLLECTOR (LOUIS BERGER JANUARY 2007)
HYDROLOGIC MODEL FOR FLOYD LAMB NORTH AND SOUTH ENVIRONMENTAL
ENHANCEMENT AREAS (LOUIS BERGER DECEMBER 7, 2007)

UPDATED BY THE LOUIS BERGER GROUP INC FOR THE RANCHO-FORT
APACHE STORM DRAIN PROJECT. MODEL WAS TRUNCATED TO INCLUDE ONLY
THE WATERSHEDS FOR THE FORT APACHE STORM DRAIN AND DETENTION BASIN.
INPUT FILE = FASD.DAT
INPUT FILE DATE = JUNE 2012
MODELED BY LBG (RUFIN INOS, E.I. AND FRED RETZLAFF, P.E.)
CHECKED BY LBG (JEFFREY, S DOUGLAS, P.E., CFM)

JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:

AREA (SQUARE MILES)	DARF
0 - 0.5	0.99
0.5 - 1	0.975
1 - 2	0.95
2 - 3	0.925
3 - 4	0.915
4 - 5	0.908

```

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

IT            HYDROGRAPH TIME DATA
                NMIN           5  MINUTES IN COMPUTATION INTERVAL
                IDATE          1  0  STARTING DATE
                ITIME          0000 STARTING TIME
                NQ             200  NUMBER OF HYDROGRAPH ORDINATES
                NDDATE          1  0  ENDING DATE
                NDTIME          1635 ENDING TIME
                ICENT           19  CENTURY MARK

                COMPUTATION INTERVAL .08 HOURS
                TOTAL TIME BASE      16.58 HOURS

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ENGLISH UNITS			METRIC UNITS	
DRAINAGE AREA	SQUARE MILES		HECTARES	
PRECIPITATION DEPTH	INCHES		MILLIMETERS	
LENGTH, ELEVATION	FEET		METERS	
FLOW	CUBIC FEET PER SECOND		LITERS PER SECOND	
STORAGE VOLUME	ACRE-FeET		CUBIC METERS	
SURFACE AREA	ACRES		HECTARES	
TEMPERATURE	DEGREES FAHRENHEIT		DEGREES CELSIUS	

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JP          MULTI-PLAN OPTION
           NPLAN          1  NUMBER OF PLANS

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JR	MULTI-RATIO OPTION								
	RATIOS OF PRECIPITATION								
	.99	.98	.95	.93	.92	.91	.90	.89	.88

1

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION								
				RATIO 1 .99	RATIO 2 .98	RATIO 3 .95	RATIO 4 .93	RATIO 5 .92	RATIO 6 .91	RATIO 7 .90	RATIO 8 .89	RATIO 9 .88
HYDROGRAPH AT +	NW27-C	.15	1 FLOW TIME	207. 3.67	203. 3.67	196. 3.67	189. 3.67	186. 3.67	185. 3.67	183. 3.67	181. 3.67	178. 3.67
ROUTED TO												

[illegible]

[illegible]

+	NW66-CI3	.02	1	FLOW TIME	28. 3.58	27. 3.58	26. 3.58	25. 3.58	24. 3.58	24. 3.58	24. 3.58	23. 3.58	23. 3.58
+	2 COMBINED AT CCI3	.11	1	FLOW TIME	100. 3.58	98. 3.58	93. 3.58	89. 3.58	87. 3.58	86. 3.58	85. 3.58	84. 3.58	82. 3.58
+	DIVERSION TO DSEV	.11	1	FLOW TIME	100. 3.58	98. 3.58	93. 3.58	89. 3.58	87. 3.58	86. 3.58	85. 3.58	84. 3.58	82. 3.58
+	HYDROGRAPH AT SGC	.11	1	FLOW TIME	0. 3.50	0. 3.50	0. 3.58	0. 3.58	0. 3.58	0. 3.58	0. 3.58	0. 3.58	0. 3.58
+	HYDROGRAPH AT DOUTFLOW	.00	1	FLOW TIME	646. 3.75	631. 3.75	631. 3.67	631. 3.67	631. 3.67	631. 3.67	631. 3.67	631. 3.67	631. 3.67
+	ROUTED TO RDOUTFLW	.00	1	FLOW TIME	646. 3.75	631. 3.75	631. 3.75	631. 3.75	631. 3.75	631. 3.75	631. 3.75	631. 3.75	631. 3.75
+	HYDROGRAPH AT NW53-CB	.13	1	FLOW TIME	107. 3.67	104. 3.67	99. 3.67	94. 3.67	92. 3.67	91. 3.67	90. 3.67	88. 3.67	86. 3.67
+	HYDROGRAPH AT DSGC	.00	1	FLOW TIME	10. 3.58	9. 3.58	9. 3.58	9. 3.58	8. 3.58	8. 3.58	8. 3.58	8. 3.58	8. 3.58
+	4 COMBINED AT CNW53-C	.24	1	FLOW TIME	759. 3.67	744. 3.67	736. 3.67	726. 3.67	723. 3.67	720. 3.75	719. 3.75	718. 3.75	716. 3.75
+	ROUTED TO RCNW53-C	.24	1	FLOW TIME	753. 3.67	738. 3.67	729. 3.75	723. 3.75	722. 3.75	720. 3.75	719. 3.75	717. 3.75	715. 3.75
+	HYDROGRAPH AT NW66-CA	.07	1	FLOW TIME	79. 3.58	77. 3.58	74. 3.58	70. 3.58	69. 3.58	68. 3.58	68. 3.58	67. 3.58	65. 3.58
+	2 COMBINED AT C66-CA	.31	1	FLOW TIME	824. 3.67	808. 3.67	795. 3.67	781. 3.67	774. 3.67	770. 3.67	768. 3.75	766. 3.75	763. 3.75
+	HYDROGRAPH AT NW66-CB	.01	1	FLOW TIME	9. 3.58	9. 3.58	9. 3.58	8. 3.58	8. 3.58	8. 3.58	8. 3.58	8. 3.58	7. 3.58
+	2 COMBINED AT C66-CB	.32	1	FLOW TIME	832. 3.67	815. 3.67	802. 3.67	787. 3.67	781. 3.67	776. 3.67	774. 3.67	771. 3.75	768. 3.75
+	HYDROGRAPH AT NW66-CJ6	.01	1	FLOW TIME	8. 3.50	7. 3.50	7. 3.50	7. 3.50	7. 3.50	7. 3.50	6. 3.50	6. 3.50	6. 3.50

[illegible]

+	S66CJ2	.00	1	FLOW TIME	18. 3.58	17. 3.58	17. 3.58	16. 3.58	15. 3.58	15. 3.58	15. 3.58	15. 3.58	14. 3.58
ROUTED TO +	RS66CJ6	.00	1	FLOW TIME	17. 3.58	17. 3.58	16. 3.58	15. 3.58	15. 3.58	15. 3.58	14. 3.58	14. 3.58	14. 3.58
2 COMBINED AT +	THB	.00	1	FLOW TIME	21. 3.58	20. 3.58	19. 3.58	18. 3.58	17. 3.58	17. 3.58	17. 3.58	17. 3.58	16. 3.58
DIVERSION TO +	STHB	.00	1	FLOW TIME	9. 3.58	8. 3.58	7. 3.58	6. 3.58	5. 3.58	5. 3.58	5. 3.58	5. 3.58	4. 3.58
HYDROGRAPH AT +	DTHB	.00	1	FLOW TIME	12. 3.50	12. 3.50	12. 3.50	12. 3.50	12. 3.50	12. 3.50	12. 3.50	12. 3.58	12. 3.58
2 COMBINED AT +	C66CJ4B	.03	1	FLOW TIME	24. 3.58	24. 3.58	24. 3.58	24. 3.58	24. 3.58	24. 3.58	24. 3.58	24. 3.58	24. 3.58
ROUTED TO +	R66CJ4	.03	1	FLOW TIME	24. 3.58	24. 3.58	24. 3.58	24. 3.58	24. 3.58	24. 3.58	24. 3.58	24. 3.58	24. 3.67
HYDROGRAPH AT +	NW66-CJ3	.02	1	FLOW TIME	21. 3.58	21. 3.58	20. 3.58	19. 3.58	19. 3.58	18. 3.58	18. 3.58	18. 3.58	18. 3.58
DIVERSION TO +	S66CJ3	.02	1	FLOW TIME	17. 3.58	17. 3.58	16. 3.58	15. 3.58	15. 3.58	14. 3.58	14. 3.58	14. 3.58	14. 3.58
HYDROGRAPH AT +	D66CJ3	.02	1	FLOW TIME	4. 3.25	4. 3.25	4. 3.25	4. 3.25	4. 3.33	4. 3.33	4. 3.33	4. 3.33	4. 3.33
2 COMBINED AT +	C66CJ3A	.05	1	FLOW TIME	28. 3.58	28. 3.58	28. 3.58	28. 3.58	28. 3.58	28. 3.58	28. 3.58	28. 3.58	28. 3.67
ROUTED TO +	R66CJ3A	.05	1	FLOW TIME	28. 3.67	28. 3.67	28. 3.58	28. 3.58	28. 3.58	28. 3.58	28. 3.58	28. 3.58	28. 3.67
HYDROGRAPH AT +	STHB	.00	1	FLOW TIME	9. 3.58	8. 3.58	7. 3.58	6. 3.58	5. 3.58	5. 3.58	5. 3.58	5. 3.58	4. 3.58
HYDROGRAPH AT +	S66CJ4	.00	1	FLOW TIME	3. 3.50	3. 3.50	3. 3.50	3. 3.50	3. 3.50	2. 3.50	2. 3.50	2. 3.50	2. 3.50
2 COMBINED AT +	CS66CJ4	.00	1	FLOW TIME	12. 3.58	11. 3.58	10. 3.58	8. 3.58	8. 3.58	7. 3.58	7. 3.58	7. 3.58	6. 3.58

[illegible]

+	S66CJ5	.00	1	FLOW TIME	8. 3.58	8. 3.58	8. 3.58	7. 3.58	7. 3.58	7. 3.58	7. 3.58	6. 3.58	6. 3.58
3 COMBINED AT +	C66CJ5	.06	1	FLOW TIME	66. 3.58	64. 3.58	62. 3.58	60. 3.58	59. 3.58	58. 3.58	58. 3.58	57. 3.58	56. 3.58
HYDROGRAPH AT +	FAP&SEV	.00	1	FLOW TIME	100. 3.58	98. 3.58	93. 3.58	89. 3.58	87. 3.58	86. 3.58	85. 3.58	84. 3.58	82. 3.58
2 COMBINED AT +	CFA&SV	.06	1	FLOW TIME	166. 3.58	162. 3.58	155. 3.58	149. 3.58	146. 3.58	144. 3.58	143. 3.58	141. 3.58	138. 3.58
HYDROGRAPH AT +	NW66-CG	.01	1	FLOW TIME	12. 3.58	12. 3.58	12. 3.58	11. 3.58	11. 3.58	11. 3.58	11. 3.58	11. 3.58	10. 3.58
DIVERSION TO +	66CG	.01	1	FLOW TIME	5. 3.58	5. 3.58	5. 3.58	4. 3.58	4. 3.58	4. 3.58	4. 3.58	4. 3.58	3. 3.58
HYDROGRAPH AT +	D66CG	.01	1	FLOW TIME	7. 3.42	7. 3.42	7. 3.42	7. 3.42	7. 3.42	7. 3.42	7. 3.42	7. 3.42	7. 3.42
2 COMBINED AT +	CCG	.07	1	FLOW TIME	173. 3.58	169. 3.58	162. 3.58	156. 3.58	153. 3.58	151. 3.58	150. 3.58	148. 3.58	145. 3.58
ROUTED TO +	RCCG	.07	1	FLOW TIME	171. 3.58	167. 3.58	161. 3.58	154. 3.58	151. 3.58	150. 3.58	148. 3.58	146. 3.58	143. 3.58
HYDROGRAPH AT +	NW66-CF	.01	1	FLOW TIME	15. 3.58	14. 3.58	14. 3.58	13. 3.58	13. 3.58	13. 3.58	13. 3.58	13. 3.58	12. 3.58
DIVERSION TO +	66CF	.01	1	FLOW TIME	8. 3.58	7. 3.58	7. 3.58	6. 3.58	6. 3.58	6. 3.58	6. 3.58	6. 3.58	5. 3.58
HYDROGRAPH AT +	D66CF	.01	1	FLOW TIME	7. 3.42	7. 3.42	7. 3.42	7. 3.42	7. 3.42	7. 3.42	7. 3.42	7. 3.42	7. 3.42
2 COMBINED AT +	C66-CF	.08	1	FLOW TIME	178. 3.58	174. 3.58	168. 3.58	161. 3.58	158. 3.58	157. 3.58	155. 3.58	153. 3.58	150. 3.58
ROUTED TO +	R66CF	.08	1	FLOW TIME	177. 3.58	173. 3.58	166. 3.58	160. 3.58	157. 3.58	155. 3.58	154. 3.58	151. 3.58	149. 3.58
HYDROGRAPH AT +	NW66-CE	.01	1	FLOW TIME	12. 3.58	12. 3.58	12. 3.58	11. 3.58	11. 3.58	11. 3.58	11. 3.58	10. 3.58	10. 3.58

[illegible]

+	66CG	.00	1	FLOW TIME	5. 3.58	5. 3.58	5. 3.58	4. 3.58	4. 3.58	4. 3.58	4. 3.58	4. 3.58	3. 3.58
ROUTED TO +	R66CG	.00	1	FLOW TIME	5. 3.58	5. 3.58	5. 3.58	4. 3.58	4. 3.58	4. 3.58	4. 3.58	3. 3.58	3. 3.58
HYDROGRAPH AT +	66CF	.00	1	FLOW TIME	8. 3.58	7. 3.58	7. 3.58	6. 3.58	6. 3.58	6. 3.58	6. 3.58	6. 3.58	5. 3.58
2 COMBINED AT +	C66CF	.00	1	FLOW TIME	13. 3.58	12. 3.58	11. 3.58	10. 3.58	10. 3.58	10. 3.58	9. 3.58	9. 3.58	9. 3.58
ROUTED TO +	RC66CF	.00	1	FLOW TIME	13. 3.58	12. 3.58	11. 3.58	10. 3.58	9. 3.58	9. 3.58	9. 3.58	8. 3.58	8. 3.58
HYDROGRAPH AT +	66CE	.00	1	FLOW TIME	5. 3.58	5. 3.58	5. 3.58	4. 3.58	4. 3.58	4. 3.58	4. 3.58	3. 3.58	3. 3.58
2 COMBINED AT +	C66CE	.00	1	FLOW TIME	18. 3.58	17. 3.58	15. 3.58	14. 3.58	13. 3.58	13. 3.58	12. 3.58	12. 3.58	11. 3.58
ROUTED TO +	RC66CE	.00	1	FLOW TIME	17. 3.58	16. 3.58	14. 3.58	13. 3.58	12. 3.58	12. 3.58	11. 3.58	11. 3.58	10. 3.58
HYDROGRAPH AT +	66CD	.00	1	FLOW TIME	9. 3.58	9. 3.58	8. 3.58	8. 3.58	7. 3.58	7. 3.58	7. 3.58	7. 3.58	7. 3.58
2 COMBINED AT +	C66CD	.00	1	FLOW TIME	26. 3.58	25. 3.58	22. 3.58	20. 3.58	19. 3.58	19. 3.58	18. 3.58	18. 3.58	17. 3.58
ROUTED TO +	RC66CD	.00	1	FLOW TIME	24. 3.58	23. 3.58	21. 3.58	19. 3.58	18. 3.58	17. 3.58	17. 3.58	16. 3.58	15. 3.58
HYDROGRAPH AT +	66CC	.00	1	FLOW TIME	4. 3.58	4. 3.58	3. 3.58	3. 3.58	3. 3.58	3. 3.58	3. 3.58	3. 3.58	2. 3.58
2 COMBINED AT +	C66CC	.00	1	FLOW TIME	29. 3.58	27. 3.58	24. 3.58	22. 3.58	21. 3.58	20. 3.58	19. 3.58	19. 3.58	18. 3.58
ROUTED TO +	RC66CC	.00	1	FLOW TIME	28. 3.58	26. 3.58	24. 3.58	21. 3.58	20. 3.58	19. 3.58	19. 3.58	18. 3.58	17. 3.58
2 COMBINED AT +	CRC66CC	.11	1	FLOW TIME	222. 3.58	216. 3.58	207. 3.58	198. 3.58	194. 3.58	192. 3.58	190. 3.58	187. 3.58	183. 3.58

[illegible]

+	DNW77-C	.00	1	FLOW TIME	0. .00	0. .00	0. .00	0. .00	0. .00	0. .00	0. .00	0. .00	0. .00
ROUTED TO +	RDW77-C	.00	1	FLOW TIME	0. .00	0. .00	0. .00	0. .00	0. .00	0. .00	0. .00	0. .00	0. .00
HYDROGRAPH AT +	NW77-CA	.13	1	FLOW TIME	115. 3.67	112. 3.67	107. 3.67	102. 3.67	100. 3.67	99. 3.67	98. 3.67	96. 3.67	94. 3.67
2 COMBINED AT +	CPT12	.13	1	FLOW TIME	115. 3.67	112. 3.67	107. 3.67	102. 3.67	100. 3.67	99. 3.67	98. 3.67	96. 3.67	94. 3.67
DIVERSION TO +	GC	.13	1	FLOW TIME	59. 3.67	58. 3.67	55. 3.67	52. 3.67	51. 3.67	50. 3.67	50. 3.67	49. 3.67	48. 3.67
HYDROGRAPH AT +	GC-DR	.13	1	FLOW TIME	56. 3.67	54. 3.67	52. 3.67	50. 3.67	49. 3.67	48. 3.67	48. 3.67	47. 3.67	46. 3.67
ROUTED TO +	RCPT12	.13	1	FLOW TIME	55. 3.67	54. 3.67	51. 3.67	49. 3.67	48. 3.67	47. 3.67	47. 3.67	46. 3.67	45. 3.67
HYDROGRAPH AT +	NW77-CB	.07	1	FLOW TIME	77. 3.58	75. 3.58	72. 3.58	68. 3.58	67. 3.58	66. 3.58	66. 3.58	65. 3.58	64. 3.58
2 COMBINED AT +	CDL	.19	1	FLOW TIME	125. 3.67	122. 3.67	116. 3.67	111. 3.67	109. 3.67	108. 3.67	107. 3.67	105. 3.67	103. 3.67
DIVERSION TO +	DDORTP	.19	1	FLOW TIME	21. 3.67	20. 3.67	20. 3.67	19. 3.67	18. 3.67	18. 3.67	18. 3.67	18. 3.67	17. 3.67
HYDROGRAPH AT +	DORTP	.19	1	FLOW TIME	104. 3.67	101. 3.67	97. 3.67	93. 3.67	91. 3.67	90. 3.67	89. 3.67	87. 3.67	86. 3.67
ROUTED TO +	RNW77-CB	.19	1	FLOW TIME	104. 3.67	101. 3.67	96. 3.67	92. 3.67	90. 3.67	90. 3.67	89. 3.67	87. 3.67	85. 3.67
HYDROGRAPH AT +	NWBA6-CB	.00	1	FLOW TIME	6. 3.50	6. 3.50	6. 3.50	6. 3.58	6. 3.58	6. 3.58	6. 3.58	5. 3.58	5. 3.58
HYDROGRAPH AT +	NW77-CH	.01	1	FLOW TIME	21. 3.58	20. 3.58	19. 3.58	19. 3.58	18. 3.58	18. 3.58	18. 3.58	18. 3.58	18. 3.58
3 COMBINED AT +	CPT2A	.21	1	FLOW TIME	124. 3.67	120. 3.67	115. 3.67	110. 3.67	108. 3.67	107. 3.67	106. 3.67	104. 3.67	102. 3.67

[illegible]

+	CPT11B	.13	1	FLOW TIME	156. 3.67	152. 3.67	145. 3.67	139. 3.67	136. 3.67	134. 3.67	133. 3.67	131. 3.67	128. 3.67
ROUTED TO +	RCPT11B	.13	1	FLOW TIME	152. 3.75	150. 3.75	144. 3.75	137. 3.75	134. 3.75	132. 3.75	132. 3.75	129. 3.75	126. 3.75
HYDROGRAPH AT +	DEERSP	.00	1	FLOW TIME	21. 3.67	20. 3.67	20. 3.67	19. 3.67	18. 3.67	18. 3.67	18. 3.67	18. 3.67	17. 3.67
ROUTED TO +	DEERSP	.00	1	FLOW TIME	21. 3.75	21. 3.75	20. 3.75	19. 3.75	19. 3.75	19. 3.75	19. 3.75	18. 3.75	18. 3.75
HYDROGRAPH AT +	NWBA6-CF	.06	1	FLOW TIME	70. 3.58	68. 3.58	65. 3.58	62. 3.58	61. 3.58	60. 3.58	60. 3.58	59. 3.58	58. 3.58
3 COMBINED AT +	CTEEPEE	.19	1	FLOW TIME	232. 3.67	228. 3.67	218. 3.67	208. 3.67	202. 3.67	199. 3.67	198. 3.67	195. 3.67	190. 3.67
DIVERSION TO +	DDSTP	.19	1	FLOW TIME	38. 3.67	37. 3.67	36. 3.67	34. 3.67	33. 3.67	33. 3.67	33. 3.67	32. 3.67	31. 3.67
HYDROGRAPH AT +	DSTP	.19	1	FLOW TIME	194. 3.67	190. 3.67	182. 3.67	173. 3.67	169. 3.67	167. 3.67	165. 3.67	163. 3.67	159. 3.67
ROUTED TO +	RDEER	.19	1	FLOW TIME	192. 3.75	188. 3.75	180. 3.75	172. 3.75	168. 3.75	165. 3.75	165. 3.75	164. 3.75	158. 3.75
HYDROGRAPH AT +	NWBA6-CC	.03	1	FLOW TIME	40. 3.58	39. 3.58	38. 3.58	36. 3.58	35. 3.58	35. 3.58	35. 3.58	34. 3.58	33. 3.58
HYDROGRAPH AT +	NWBA6-CE	.01	1	FLOW TIME	8. 3.58	8. 3.58	7. 3.58	7. 3.58	7. 3.58	7. 3.58	7. 3.58	7. 3.58	6. 3.58
3 COMBINED AT +	CBA6-CE	.23	1	FLOW TIME	226. 3.67	220. 3.67	210. 3.67	201. 3.75	197. 3.75	194. 3.75	193. 3.75	191. 3.75	185. 3.75
2 COMBINED AT +	CPT1A	.93	1	FLOW TIME	1439. 3.67	1408. 3.67	1365. 3.67	1322. 3.67	1303. 3.67	1291. 3.67	1283. 3.67	1271. 3.67	1250. 3.67
ROUTED TO +	RCPT1A	.93	1	FLOW TIME	1434. 3.67	1403. 3.67	1360. 3.67	1316. 3.67	1297. 3.67	1285. 3.67	1277. 3.67	1265. 3.67	1244. 3.67
HYDROGRAPH AT +	NWBC2-CB	.03	1	FLOW TIME	39. 3.58	38. 3.58	37. 3.58	35. 3.58	34. 3.58	34. 3.58	34. 3.58	33. 3.58	33. 3.58

[illegible]

+	BLTWY2	1.03	1	FLOW TIME	1554. 3.67	1522. 3.67	1471. 3.67	1420. 3.67	1398. 3.67	1386. 3.67	1376. 3.67	1361. 3.67	1337. 3.67
ROUTED TO +	RCBA6-C	1.03	1	FLOW TIME	1546. 3.67	1514. 3.67	1463. 3.67	1411. 3.67	1389. 3.67	1376. 3.67	1366. 3.67	1352. 3.75	1334. 3.75
HYDROGRAPH AT +	DRFADB	.00	1	FLOW TIME	1257. 3.75	1228. 3.75	1166. 3.75	1104. 3.75	1080. 3.75	1061. 3.75	1052. 3.75	1033. 3.75	1008. 3.75
HYDROGRAPH AT +	DRGC2	.00	1	FLOW TIME	16. 3.67	15. 3.67	14. 3.67	13. 3.67	12. 3.67	12. 3.67	11. 3.67	11. 3.67	11. 3.67
2 COMBINED AT +	FADBIN	.00	1	FLOW TIME	1271. 3.75	1242. 3.75	1178. 3.75	1115. 3.75	1091. 3.75	1072. 3.75	1063. 3.75	1043. 3.75	1018. 3.75
ROUTED TO +	FADB	.00	1	FLOW TIME	218. 5.25	215. 5.25	211. 5.25	208. 5.25	206. 5.25	205. 5.25	204. 5.25	203. 5.25	201. 5.25
				** PEAK STAGES IN FEET **									
				1 STAGE TIME	2633.44 5.25	2633.00 5.25	2632.23 5.25	2631.48 5.25	2631.20 5.25	2631.00 5.25	2630.84 5.25	2630.59 5.25	2630.27 5.25
ROUTED TO +	FADBOUT	.00	1	FLOW TIME	218. 5.25	215. 5.25	211. 5.25	208. 5.25	206. 5.25	205. 5.25	204. 5.25	203. 5.25	201. 5.25
3 COMBINED AT +	CFADB	2.66	1	FLOW TIME	1676. 3.67	1642. 3.67	1588. 3.67	1539. 3.75	1521. 3.75	1509. 3.75	1501. 3.75	1489. 3.75	1469. 3.75
1													

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

APPENDIX B HYDRAULIC DESIGN AND ANALYSIS

B.1 Main Storm Drain

B.2 Fort Apache Collection System

B.3 Severance Lane Collection System

B.4 Deer Springs Collection System

B.5 Echelon Point Collection System

B.1 Main Storm Drain

B.1.1 Normal Depth Calculations

B.1.2 Main Storm Drain WSPG Model ($n = 0.013$)

B.1.3 Main Storm Drain WSPG Model ($n = 0.015$)

SH Proposed 7'x6' RCB n=0.013

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.02400	ft/ft
Height	6.00	ft
Bottom Width	7.00	ft
Discharge	815.00	ft ³ /s

Results

Normal Depth	4.26	ft
Flow Area	29.79	ft ²
Wetted Perimeter	15.51	ft
Hydraulic Radius	1.92	ft
Top Width	7.00	ft
Critical Depth	7.50	ft
Percent Full	70.9	%
Critical Slope	0.00579	ft/ft
Velocity	27.36	ft/s
Velocity Head	11.63	ft
Specific Energy	15.89	ft
Froude Number	2.34	
Discharge Full	1023.90	ft ³ /s
Slope Full	0.03788	ft/ft
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	70.93	%
Downstream Velocity	Infinity	ft/s

SH Proposed 7'x6' RCB n=0.015

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.015	
Channel Slope	0.02400	ft/ft
Height	6.00	ft
Bottom Width	7.00	ft
Discharge	815.00	ft ³ /s

Results

Normal Depth	4.75	ft
Flow Area	33.28	ft ²
Wetted Perimeter	16.51	ft
Hydraulic Radius	2.02	ft
Top Width	7.00	ft
Critical Depth	7.50	ft
Percent Full	79.2	%
Critical Slope	0.00771	ft/ft
Velocity	24.49	ft/s
Velocity Head	9.32	ft
Specific Energy	14.07	ft
Froude Number	1.98	
Discharge Full	887.38	ft ³ /s
Slope Full	0.02845	ft/ft
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	79.24	%
Downstream Velocity	Infinity	ft/s

Downstream Boundary n = 0.013

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.02560	ft/ft
Height	7.00	ft
Bottom Width	14.00	ft
Discharge	1471.00	ft ³ /s

Results

Normal Depth	3.34	ft
Flow Area	46.71	ft ²
Wetted Perimeter	20.67	ft
Hydraulic Radius	2.26	ft
Top Width	14.00	ft
Critical Depth	7.00	ft
Percent Full	47.7	%
Critical Slope	0.00324	ft/ft
Velocity	31.49	ft/s
Velocity Head	15.41	ft
Specific Energy	18.75	ft
Froude Number	3.04	
Discharge Full	3152.94	ft ³ /s
Slope Full	0.11761	ft/ft
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	47.67	%
Downstream Velocity	Infinity	ft/s

SO Existing 14' Channel n=0.015

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.015	
Channel Slope	0.02560	ft/ft
Height	7.00	ft
Bottom Width	14.00	ft
Discharge	1471.00	ft ³ /s

Results

Normal Depth	3.68	ft
Flow Area	51.58	ft ²
Wetted Perimeter	21.37	ft
Hydraulic Radius	2.41	ft
Top Width	14.00	ft
Critical Depth	7.00	ft
Percent Full	52.6	%
Critical Slope	0.00432	ft/ft
Velocity	28.52	ft/s
Velocity Head	12.64	ft
Specific Energy	16.32	ft
Froude Number	2.62	
Discharge Full	2732.55	ft ³ /s
Slope Full	0.08834	ft/ft
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	52.63	%
Downstream Velocity	Infinity	ft/s

B.1.2 Main Storm Drain WSPG Model ($n = 0.013$)

FASD10a

T1 Ranch-Fort Apache Storm Drain Project
 T2 Main Storm Drain - Mannings's N = 0.013
 T3 By FKR, 4/23/2013 Checked By JSD, 4/28/2013

SO	800.0002588.104	1			2591.440		
R	911.1702590.528	1	.013			.000	
R	1012.1902592.730	1	.013			.000	
TS	1018.9402592.860	12	.013			.000	
JX	1018.9502592.870	12	10	.013	6.000	2593.870	80.0 .000
TS	1062.1602593.770	3	.013			.000	
JX	1465.0002602.180	3	6	.013	5.000	2603.170	80.0 .000
R	1850.0002610.200	3	.013			.000	
R	2059.3632613.390	3	.013			.000	.000 0
R	2216.3622615.790	3	.013			89.954	.000 0
R	2250.0002616.300	3	.013			.000	.000 0
R	2612.5732621.190	3	.013			.000	.000 0
R	2682.1602622.130	3	.013			39.870	.000 0
R	2751.7502623.070	3	.013			-39.870	.000 0
R	2770.0002623.360	3	.013			.000	.000 0
JX	2778.9302623.500	3	4	.013	70.000	2624.000	-45.0 .000
R	2830.0002624.300	3	.013			.000	.000 0
JX	2846.9402624.570	3	10	.013	25.000	2625.070	-63.0 .000
R	3218.4002630.400	3	.013			.000	.000 0
R	3251.9002631.070	3	.013			-19.193	.000 0
R	3286.3202631.760	3	.013			19.721	.000 0
R	3400.0002634.030	3	.013			.000	
JX	3440.0002634.830	3	5	.013	210.000	2634.830	-30.0 .000
R	3455.4902635.140	3	.013			.000	
R	3499.2802636.020	3	.013			8.364	
R	3544.8302636.400	3	.013			-8.718	
JX	3544.9302636.400	3	9	.013	6.000	2636.900	-80.0 .000
R	3600.0002636.860	3	.013			.000	
R	4000.0002640.180	3	.013			.000	
R	4400.0002643.500	3	.013			.000	
R	4803.8502646.850	3	.013			.000	
JX	4806.7802646.890	3	7	.013	123.000	2647.390	-64.0 .000
R	5470.0002655.420	3	.013			.000	
JX	5486.7002655.630	3	6	.013	26.000	2656.130	-45.0 .000
R	5578.2502656.810	3	.013			.000	.000 0
R	5994.1802660.970	3	.013			.000	.000 0
R	6064.3002661.660	3	.013			-25.611	.000 0
JX	6064.4002661.670	3	11	.013	185.000	2661.670	6.0 .000
R	6064.5002661.680	8	.013			.000	.000 0
R	6080.9602661.840	8	.013			-6.140	.000 0
R	6135.1302663.140	8	.013			-23.997	.000 0
R	6234.9902665.540	8	.013			-33.124	.000 0

R	6400.0002669.500	8	.013					FASD10a			
SH	6400.0002669.500	8					2673.760		.000	.000	0
CD	1 2 0	.000	7.000	14.000	.000	.000	.00				
CD	2 2 0	.000	7.000	12.000	.000	.000	.00				
CD	3 3 0	.000	6.000	12.000	.000	.000	.00				
CD	4 4 1	.000	3.000	.000	.000	.000	.00				
CD	5 3 0	.000	4.000	4.000	.000	.000	.00				
CD	6 4 1	.000	2.500	.000	.000	.000	.00				
CD	7 4 1	.000	4.000	.000	.000	.000	.00				
CD	8 3 0	.000	6.000	7.000	.000	.000	.00				
CD	9 4 1	.000	2.000	.000	.000	.000	.00				
CD	10 4 1	.000	1.500	.000	.000	.000	.00				
CD	11 3 0	.000	5.000	5.000	.000	.000	.00				
CD	12 2 0	.000	6.870	13.730	.000	.000	.00				
Q	815.000	.0									

WATER SURFACE PROFILE LISTING

Date: 4-29-2013 Time: 2: 6:36

Ranch-Fort Apache Storm Drain Project

Main Storm Drain - Mannings's N = 0.013

By FKR, 4/23/2013 Checked By JSD, 4/28/2013

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
800.000	2588.104	3.526	2591.630	1471.00	29.80	13.79	2605.42	.00	7.00	14.00	7.000	14.000	.00	0 .0
111.170	.0218					.0218	2.43	3.53	2.80	3.53	.013	.00	.00	RECTANG
911.170	2590.528	3.525	2594.053	1471.00	29.81	13.80	2607.85	.00	7.00	14.00	7.000	14.000	.00	0 .0
101.020	.0218					.0218	2.21	3.53	2.80	3.53	.013	.00	.00	RECTANG
1012.190	2592.730	3.524	2596.254	1471.00	29.81	13.80	2610.06	.00	7.00	14.00	7.000	14.000	.00	0 .0
TRANS STR	.0193					.0217	.15	3.52	2.80		.013	.00	.00	RECTANG
1018.940	2592.860	3.601	2596.461	1471.00	29.75	13.75	2610.21	.00	7.09	13.73	6.870	13.730	.00	0 .0
JUNCT STR	1.0000					.0217	.00	3.60	2.76		.013	.00	.00	RECTANG
1018.950	2592.870	3.570	2596.440	1465.00	29.89	13.87	2610.31	.00	7.07	13.73	6.870	13.730	.00	0 .0
TRANS STR	.0208					.0209	.90	3.57	2.79		.013	.00	.00	RECTANG
1062.160	2593.770	4.166	2597.936	1465.00	29.31	13.34	2611.27	.00	6.00	12.00	6.000	12.000	.00	0 .0
JUNCT STR	.0209					.0191	7.68	4.17	2.53		.013	.00	.00	BOX
1465.000	2602.180	4.274	2606.454	1460.00	28.47	12.58	2619.04	.00	6.00	12.00	6.000	12.000	.00	0 .0
232.543	.0208					.0173	4.03	4.27	2.43	4.08	.013	.00	.00	BOX
1697.543	2607.024	4.453	2611.477	1460.00	27.32	11.59	2623.07	.00	6.00	12.00	6.000	12.000	.00	0 .0
152.457	.0208					.0153	2.34	4.45	2.28	4.08	.013	.00	.00	BOX
1850.000	2610.200	4.670	2614.870	1460.00	26.05	10.54	2625.41	.00	6.00	12.00	6.000	12.000	.00	0 .0
209.363	.0152					.0140	2.94	4.67	2.12	4.57	.013	.00	.00	BOX

WATER SURFACE PROFILE LISTING

Date: 4-29-2013 Time: 2: 6:36

Ranch-Fort Apache Storm Drain Project

Main Storm Drain - Mannings's N = 0.013

By FKR, 4/23/2013 Checked By JSD, 4/28/2013

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
2059.363	2613.390	4.744	2618.134	1460.00	25.65	10.21	2628.35	6.00	6.00	12.00	6.000	12.000	.00	0 .0
156.999	.0153					.0134	2.10	6.00	2.08	4.56	.013	.00	.00	BOX
2216.362	2615.790	4.838	2620.628	1460.00	25.15	9.82	2630.45	.00	6.00	12.00	6.000	12.000	.00	0 .0
33.638	.0152					.0129	.43	4.84	2.01	4.58	.013	.00	.00	BOX
2250.000	2616.300	4.863	2621.163	1460.00	25.02	9.72	2630.88	.00	6.00	12.00	6.000	12.000	.00	0 .0
362.573	.0135					.0123	4.47	4.86	2.00	4.78	.013	.00	.00	BOX
2612.573	2621.190	5.011	2626.201	1460.00	24.28	9.15	2635.35	6.00	6.00	12.00	6.000	12.000	.00	0 .0
69.587	.0135					.0117	.81	6.00	1.91	4.77	.013	.00	.00	BOX
2682.160	2622.130	5.060	2627.190	1460.00	24.04	8.98	2636.17	6.00	6.00	12.00	6.000	12.000	.00	0 .0
69.590	.0135					.0113	.79	6.00	1.88	4.77	.013	.00	.00	BOX
2751.750	2623.070	5.122	2628.192	1460.00	23.76	8.76	2636.95	.00	6.00	12.00	6.000	12.000	.00	0 .0
18.250	.0159					.0110	.20	5.12	1.85	4.50	.013	.00	.00	BOX
2770.000	2623.360	5.159	2628.519	1460.00	23.59	8.64	2637.16	.00	6.00	12.00	6.000	12.000	.00	0 .0
JUNCT STR	.0157					.0122	.11	5.16	1.83		.013	.00	.00	BOX
2778.930	2623.500	4.611	2628.111	1390.00	25.12	9.80	2637.91	.00	6.00	12.00	6.000	12.000	.00	0 .0
51.070	.0157					.0133	.68	4.61	2.06	4.36	.013	.00	.00	BOX
2830.000	2624.300	4.648	2628.948	1390.00	24.92	9.64	2638.59	.00	6.00	12.00	6.000	12.000	.00	0 .0
JUNCT STR	.0159					.0136	.23	4.65	2.04		.013	.00	.00	BOX

WATER SURFACE PROFILE LISTING
Ranch-Fort Apache Storm Drain Project
Main Storm Drain - Mannings's N = 0.013
By FKR, 4/23/2013 Checked By JSD, 4/28/2013

Date: 4-29-2013 Time: 2: 6:36

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
2846.940	2624.570	4.472	2629.042	1365.00	25.43	10.04	2639.09	.00	6.00	12.00	6.000	12.000	.00	0 .0
171.832	.0157					.0137	2.35	4.47	2.12	4.30	.013	.00	.00	BOX
3018.772	2627.267	4.576	2631.843	1365.00	24.86	9.60	2641.44	.00	6.00	12.00	6.000	12.000	.00	0 .0
199.628	.0157					.0124	2.48	4.58	2.05	4.30	.013	.00	.00	BOX
3218.400	2630.400	4.799	2635.199	1365.00	23.70	8.72	2643.92	6.00	6.00	12.00	6.000	12.000	.00	0 .0
33.500	.0200					.0113	.38	6.00	1.91	3.95	.013	.00	.00	BOX
3251.900	2631.070	4.915	2635.985	1365.00	23.14	8.32	2644.30	6.00	6.00	12.00	6.000	12.000	.00	0 .0
34.420	.0200					.0105	.36	6.00	1.84	3.94	.013	.00	.00	BOX
3286.320	2631.760	5.063	2636.822	1365.00	22.47	7.84	2644.66	.00	6.00	12.00	6.000	12.000	.00	0 .0
26.403	.0200					.0097	.26	5.06	1.76	3.95	.013	.00	.00	BOX
3312.723	2632.287	5.200	2637.487	1365.00	21.88	7.43	2644.92	.00	6.00	12.00	6.000	12.000	.00	0 .0
37.689	.0200					.0088	.33	5.20	1.69	3.95	.013	.00	.00	BOX
3350.412	2633.040	5.454	2638.493	1365.00	20.86	6.76	2645.25	.00	6.00	12.00	6.000	12.000	.00	0 .0
28.404	.0200					.0077	.22	5.45	1.57	3.95	.013	.00	.00	BOX
----- WARNING - Flow depth near top of box conduit -----														
3378.816	2633.607	5.720	2639.327	1365.00	19.89	6.14	2645.47	.00	6.00	12.00	6.000	12.000	.00	0 .0
21.184	.0200					.0091	.19	5.72	1.47	3.95	.013	.00	.00	BOX
----- WARNING - Flow depth near top of box conduit -----														

WATER SURFACE PROFILE LISTING

Date: 4-29-2013 Time: 2: 6:36

Ranch-Fort Apache Storm Drain Project
Main Storm Drain - Mannings's N = 0.013
By FKR, 4/23/2013 Checked By JSD, 4/28/2013

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
3400.000	2634.030	6.000	2640.030	1365.00	18.96	5.58	2645.61	.00	6.00	12.00	6.000	12.000	.00	0 .0
JUNCT STR	.0200					.0078	.31	6.00	1.36		.013	.00	.00	BOX
3440.000	2634.830	7.715	2642.545	1155.00	16.04	4.00	2646.54	.00	6.00	12.00	6.000	12.000	.00	0 .0
15.490	.0200					.0078	.12	7.72	1.15	3.51	.013	.00	.00	BOX
3455.490	2635.140	7.527	2642.667	1155.00	16.04	4.00	2646.66	.00	6.00	12.00	6.000	12.000	.00	0 .0
43.790	.0201					.0078	.34	.00	1.15	3.50	.013	.00	.00	BOX
3499.280	2636.020	7.232	2643.252	1155.00	16.04	4.00	2647.25	.00	6.00	12.00	6.000	12.000	.00	0 .0
45.550	.0083					.0078	.36	.00	1.15	4.80	.013	.00	.00	BOX
3544.830	2636.400	7.457	2643.857	1155.00	16.04	4.00	2647.85	.00	6.00	12.00	6.000	12.000	.00	0 .0
JUNCT STR	.0000					.0077	.00	7.46	1.15		.013	.00	.00	BOX
3544.930	2636.400	7.540	2643.940	1149.00	15.96	3.95	2647.89	.00	6.00	12.00	6.000	12.000	.00	0 .0
55.070	.0084					.0077	.43	7.54	1.15	4.77	.013	.00	.00	BOX
3600.000	2636.860	7.506	2644.366	1149.00	15.96	3.95	2648.32	.00	6.00	12.00	6.000	12.000	.00	0 .0
400.000	.0083					.0077	3.09	7.51	1.15	4.79	.013	.00	.00	BOX
4000.000	2640.180	7.280	2647.460	1149.00	15.96	3.95	2651.41	.00	6.00	12.00	6.000	12.000	.00	0 .0
400.000	.0083					.0077	3.09	7.28	1.15	4.79	.013	.00	.00	BOX

WATER SURFACE PROFILE LISTING

Date: 4-29-2013 Time: 2: 6:36

Ranch-Fort Apache Storm Drain Project

Main Storm Drain - Mannings's N = 0.013

By FKR, 4/23/2013 Checked By JSD, 4/28/2013

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
4400.000	2643.500	7.054	2650.554	1149.00	15.96	3.95	2654.51	.00	6.00	12.00	6.000	12.000	.00	0 .0
403.850	.0083					.0077	3.12	7.05	1.15	4.79	.013	.00	.00	BOX
4803.850	2646.850	6.828	2653.678	1149.00	15.96	3.95	2657.63	.00	6.00	12.00	6.000	12.000	.00	0 .0
JUNCT STR	.0136					.0062	.02	6.83	1.15		.013	.00	.00	BOX
4806.780	2646.890	8.183	2655.073	1026.00	14.25	3.15	2658.23	.00	6.00	12.00	6.000	12.000	.00	0 .0
61.431	.0129					.0062	.38	8.18	1.03	3.77	.013	.00	.00	BOX
4868.210	2647.680	7.771	2655.451	1026.00	14.25	3.15	2658.60	.00	6.00	12.00	6.000	12.000	.00	0 .0
HYDRAULIC JUMP														
4868.210	2647.680	3.842	2651.522	1026.00	22.25	7.69	2659.21	.00	6.00	12.00	6.000	12.000	.00	0 .0
262.553	.0129					.0118	3.10	3.84	2.00	3.77	.013	.00	.00	BOX
5130.763	2651.057	3.930	2654.987	1026.00	21.76	7.35	2662.34	.00	6.00	12.00	6.000	12.000	.00	0 .0
222.400	.0129					.0107	2.38	3.93	1.93	3.77	.013	.00	.00	BOX
5353.163	2653.917	4.122	2658.039	1026.00	20.74	6.68	2664.72	.00	6.00	12.00	6.000	12.000	.00	0 .0
116.837	.0129					.0094	1.10	4.12	1.80	3.77	.013	.00	.00	BOX
5470.000	2655.420	4.323	2659.743	1026.00	19.78	6.07	2665.82	.00	6.00	12.00	6.000	12.000	.00	0 .0
JUNCT STR	.0126					.0093	.16	4.32	1.68		.013	.00	.00	BOX
5486.700	2655.630	4.058	2659.688	1000.00	20.54	6.55	2666.24	.00	6.00	12.00	6.000	12.000	.00	0 .0
91.550	.0129					.0094	.86	4.06	1.80	3.70	.013	.00	.00	BOX

WATER SURFACE PROFILE LISTING
Ranch-Fort Apache Storm Drain Project
Main Storm Drain - Mannings's N = 0.013
By FKR, 4/23/2013 Checked By JSD, 4/28/2013

Date: 4-29-2013 Time: 2: 6:36

*****															*****	
Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt or I.D.	ZL	No With Prs/Pip		
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch		
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****		
5578.250	2656.810	4.212	2661.022	1000.00	19.79	6.08	2667.10	.00	6.00	12.00	6.000	12.000	.00	0 .0		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
122.605	.0100					.0087	1.07	4.21	1.70	4.05	.013	.00	.00	BOX		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
5700.855	2658.036	4.300	2662.336	1000.00	19.38	5.83	2668.17	.00	6.00	12.00	6.000	12.000	.00	0 .0		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
154.424	.0100					.0079	1.22	4.30	1.65	4.05	.013	.00	.00	BOX		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
5855.279	2659.581	4.510	2664.091	1000.00	18.48	5.30	2669.39	.00	6.00	12.00	6.000	12.000	.00	0 .0		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
85.806	.0100					.0069	.60	4.51	1.53	4.05	.013	.00	.00	BOX		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
5941.085	2660.439	4.730	2665.169	1000.00	17.62	4.82	2669.99	.00	6.00	12.00	6.000	12.000	.00	0 .0		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
53.095	.0100					.0061	.32	4.73	1.43	4.05	.013	.00	.00	BOX		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
5994.181	2660.970	4.961	2665.931	1000.00	16.80	4.38	2670.31	.67	6.00	12.00	6.000	12.000	.00	0 .0		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
34.265	.0098					.0054	.18	5.63	1.33	4.07	.013	.00	.00	BOX		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
6028.446	2661.307	5.198	2666.505	1000.00	16.03	3.99	2670.50	.61	6.00	12.00	6.000	12.000	.00	0 .0		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
21.298	.0098					.0047	.10	5.81	1.24	4.07	.013	.00	.00	BOX		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
6049.744	2661.517	5.452	2666.969	1000.00	15.29	3.63	2670.60	6.00	6.00	12.00	6.000	12.000	.00	0 .0		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
11.199	.0098					.0041	.05	6.00	1.15	4.07	.013	.00	.00	BOX		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
		----- WARNING - Flow depth near top of box conduit -----														
6060.943	2661.627	5.718	2667.345	1000.00	14.57	3.30	2670.64	6.00	6.00	12.00	6.000	12.000	.00	0 .0		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
3.356	.0098					.0036	.01	6.00	1.07	4.07	.013	.00	.00	BOX		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
		----- WARNING - Flow depth near top of box conduit -----														
*****															*****	

WATER SURFACE PROFILE LISTING

Date: 4-29-2013 Time: 2: 6:36

Ranch-Fort Apache Storm Drain Project

Main Storm Drain - Mannings's N = 0.013

By FKR, 4/23/2013 Checked By JSD, 4/28/2013

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
6064.300	2661.660	5.998	2667.658	1000.00	13.89	3.00	2670.66	.00	6.00	12.00	6.000	12.000	.00	0 .0
JUNCT STR	.1000					.0039	.00	6.00	1.00		.013	.00	.00	BOX
----- WARNING - Flow depth near top of box conduit -----														
6064.400	2661.670	7.415	2669.085	815.00	11.32	1.99	2671.07	.00	5.23	12.00	6.000	12.000	.00	0 .0
6064.400	2661.670	4.308	2665.978	815.00	27.03	11.34	2677.32	.00	6.00	7.00	6.000	7.000	.00	0 .0
.100	.1000					.0232	.00	4.31	2.29	2.50	.013	.00	.00	BOX
6064.500	2661.680	4.310	2665.990	815.00	27.02	11.33	2677.32	.52	6.00	7.00	6.000	7.000	.00	0 .0
16.460	.0097					.0236	.39	4.83	2.29	6.00	.013	.00	.00	BOX
6080.960	2661.840	4.257	2666.097	815.00	27.35	11.61	2677.71	1.26	6.00	7.00	6.000	7.000	.00	0 .0
54.170	.0240					.0240	1.30	5.51	2.34	4.26	.013	.00	.00	BOX
6135.130	2663.140	4.257	2667.397	815.00	27.35	11.61	2679.01	.94	6.00	7.00	6.000	7.000	.00	0 .0
99.860	.0240					.0240	2.39	5.20	2.34	4.25	.013	.00	.00	BOX
6234.990	2665.540	4.258	2669.798	815.00	27.34	11.61	2681.41	.00	6.00	7.00	6.000	7.000	.00	0 .0
165.010	.0240					.0239	3.95	4.26	2.34	4.26	.013	.00	.00	BOX
6400.000	2669.500	4.260	2673.760	815.00	27.33	11.60	2685.36	.00	6.00	7.00	6.000	7.000	.00	0 .0

B.1.3 Main Storm Drain WSPG Model ($n = 0.015$)

FASD10b

T1 Ranch-Fort Apache Storm Drain Project
T2 Main Storm Drain - Mannings's N = 0.013
T3 By FKR, 4/23/2013 Checked By JSD, 4/28/2013

SO	800.0002588.104	1			2591.784		
R	911.1702590.528	1	.015			.000	
R	1012.1902592.730	1	.015			.000	
TS	1018.9402592.860	12	.015			.000	
JX	1018.9502592.870	12	10	.015	6.000	2593.870	80.0 .000
TS	1062.1602593.770	3	.015			.000	
JX	1465.0002602.180	3	6	.015	5.000	2603.170	80.0 .000
R	1850.0002610.200	3	.015			.000	
R	2059.3632613.390	3	.015			.000	.000 0
R	2216.3622615.790	3	.015			89.954	.000 0
R	2250.0002616.300	3	.015			.000	.000 0
R	2612.5732621.190	3	.015			.000	.000 0
R	2682.1602622.130	3	.015			39.870	.000 0
R	2751.7502623.070	3	.015			-39.870	.000 0
R	2770.0002623.360	3	.015			.000	.000 0
JX	2778.9302623.500	3	4	.015	70.000	2624.000	-45.0 .000
R	2830.0002624.300	3	.015			.000	.000 0
JX	2846.9402624.570	3	10	.015	25.000	2625.070	-63.0 .000
R	3218.4002630.400	3	.015			.000	.000 0
R	3251.9002631.070	3	.015			-19.193	.000 0
R	3286.3202631.760	3	.015			19.721	.000 0
R	3400.0002634.030	3	.015			.000	
JX	3440.0002634.830	3	5	.015	210.000	2634.830	-30.0 .000
R	3455.4902635.140	3	.015			.000	
R	3499.2802636.020	3	.015			8.364	
R	3544.8302636.400	3	.015			-8.718	
JX	3544.9302636.400	3	9	.015	6.000	2636.900	-80.0 .000
R	3600.0002636.860	3	.015			.000	
R	4000.0002640.180	3	.015			.000	
R	4400.0002643.500	3	.015			.000	
R	4803.8502646.850	3	.015			.000	
JX	4806.7802646.890	3	7	.015	123.000	2647.390	-64.0 .000
R	5470.0002655.420	3	.015			.000	
JX	5486.7002655.630	3	6	.015	26.000	2656.130	-45.0 .000
R	5578.2502656.810	3	.015			.000	.000 0
R	5994.1802660.970	3	.015			.000	.000 0
R	6064.3002661.660	3	.015			-25.611	.000 0
JX	6064.4002661.670	3	11	.015	185.000	2661.670	6.0 .000
R	6064.5002661.680	8	.015			.000	.000 0
R	6080.9602661.840	8	.015			-6.140	.000 0
R	6135.1302663.140	8	.015			-23.997	.000 0
R	6234.9902665.540	8	.015			-33.124	.000 0
R	6400.0002669.500	8	.015			.000	.000 0
SH	6400.0002669.500	8			2674.250		

									FASD10b
CD	1	2	0	.000	7.000	14.000	.000	.000	.00
CD	2	2	0	.000	7.000	12.000	.000	.000	.00
CD	3	3	0	.000	6.000	12.000	.000	.000	.00
CD	4	4	1	.000	3.000	.000	.000	.000	.00
CD	5	3	0	.000	4.000	4.000	.000	.000	.00
CD	6	4	1	.000	2.500	.000	.000	.000	.00
CD	7	4	1	.000	4.000	.000	.000	.000	.00
CD	8	3	0	.000	6.000	7.000	.000	.000	.00
CD	9	4	1	.000	2.000	.000	.000	.000	.00
CD	10	4	1	.000	1.500	.000	.000	.000	.00
CD	11	3	0	.000	5.000	5.000	.000	.000	.00
CD	12	2	0	.000	6.870	13.730	.000	.000	.00
Q				815.000	.0				

WATER SURFACE PROFILE LISTING

Date: 4-29-2013 Time: 2:25:33

Ranch-Fort Apache Storm Drain Project

Main Storm Drain - Mannings's N = 0.015

By FKR, 4/23/2013 Checked By JSD, 4/28/2013

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
800.000	2588.104	3.873	2591.977	1471.00	27.13	11.43	2603.40	.00	7.00	14.00	7.000	14.000	.00	0 .0
111.170	.0218					.0223	2.47	3.87	2.43	3.90	.015	.00	.00	RECTANG
911.170	2590.528	3.863	2594.391	1471.00	27.20	11.49	2605.88	.00	7.00	14.00	7.000	14.000	.00	0 .0
101.020	.0218					.0225	2.27	3.86	2.44	3.90	.015	.00	.00	RECTANG
1012.190	2592.730	3.849	2596.579	1471.00	27.30	11.57	2608.15	.00	7.00	14.00	7.000	14.000	.00	0 .0
TRANS STR	.0193					.0224	.15	3.85	2.45		.015	.00	.00	RECTANG
1018.940	2592.860	3.934	2596.794	1471.00	27.23	11.51	2608.31	.00	7.09	13.73	6.870	13.730	.00	0 .0
JUNCT STR	1.0000					.0225	.00	3.93	2.42		.015	.00	.00	RECTANG
1018.950	2592.870	3.899	2596.769	1465.00	27.37	11.63	2608.40	.00	7.07	13.73	6.870	13.730	.00	0 .0
TRANS STR	.0208					.0215	.93	3.90	2.44		.015	.00	.00	RECTANG
1062.160	2593.770	4.578	2598.348	1465.00	26.67	11.04	2609.39	.00	6.00	12.00	6.000	12.000	.00	0 .0
JUNCT STR	.0209					.0197	7.95	4.58	2.20		.015	.00	.00	BOX
1465.000	2602.180	4.665	2606.845	1460.00	26.08	10.56	2617.41	.00	6.00	12.00	6.000	12.000	.00	0 .0
8.753	.0208					.0191	.17	4.66	2.13	4.52	.015	.00	.00	BOX
1473.753	2602.362	4.669	2607.031	1460.00	26.06	10.54	2617.58	.00	6.00	12.00	6.000	12.000	.00	0 .0
252.008	.0208					.0179	4.52	4.67	2.13	4.52	.015	.00	.00	BOX
1725.761	2607.612	4.897	2612.509	1460.00	24.85	9.59	2622.09	.00	6.00	12.00	6.000	12.000	.00	0 .0
124.239	.0208					.0157	1.96	4.90	1.98	4.52	.015	.00	.00	BOX

WATER SURFACE PROFILE LISTING
Ranch-Fort Apache Storm Drain Project
Main Storm Drain - Mannings's N = 0.015
By FKR, 4/23/2013 Checked By JSD, 4/28/2013

Date: 4-29-2013 Time: 2:25:33

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt or I.D.	ZL	No With Prs/Pip	
L/Elem	Ch slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch	
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
1850.000	2610.200	5.136	2615.336	1460.00	23.69	8.71	2624.05	.00	6.00	12.00	6.000	12.000	.00	0 .0	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
209.363	.0152					.0145	3.03	5.14	1.84	5.07	.015	.00	.00	BOX	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
2059.363	2613.390	5.206	2618.596	1460.00	23.37	8.48	2627.08	6.00	6.00	12.00	6.000	12.000	.00	0 .0	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
156.999	.0153					.0138	2.17	6.00	1.80	5.06	.015	.00	.00	BOX	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
2216.362	2615.790	5.315	2621.105	1460.00	22.89	8.14	2629.24	.00	6.00	12.00	6.000	12.000	.00	0 .0	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
33.638	.0152					.0133	.45	5.31	1.75	5.08	.015	.00	.00	BOX	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
2250.000	2616.300	5.345	2621.645	1460.00	22.76	8.05	2629.69	.00	6.00	12.00	6.000	12.000	.00	0 .0	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
362.573	.0135					.0128	4.63	5.35	1.73	5.30	.015	.00	.00	BOX	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
2612.573	2621.190	5.481	2626.671	1460.00	22.20	7.65	2634.32	6.00	6.00	12.00	6.000	12.000	.00	0 .0	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
69.587	.0135					.0122	.85	6.00	1.67	5.30	.015	.00	.00	BOX	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
----- WARNING - Flow depth near top of box conduit -----															
2682.160	2622.130	5.533	2627.663	1460.00	21.99	7.51	2635.17	6.00	6.00	12.00	6.000	12.000	.00	0 .0	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
69.590	.0135					.0118	.82	6.00	1.65	5.30	.015	.00	.00	BOX	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
----- WARNING - Flow depth near top of box conduit -----															
2751.750	2623.070	5.603	2628.673	1460.00	21.71	7.32	2635.99	.00	6.00	12.00	6.000	12.000	.00	0 .0	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
18.250	.0159					.0115	.21	5.60	1.62	4.99	.015	.00	.00	BOX	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
----- WARNING - Flow depth near top of box conduit -----															

WATER SURFACE PROFILE LISTING

Date: 4-29-2013 Time: 2:25:33

Ranch-Fort Apache Storm Drain Project

Main Storm Drain - Mannings's N = 0.015

By FKR, 4/23/2013 Checked By JSD, 4/28/2013

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
2770.000	2623.360	5.654	2629.014	1460.00	21.52	7.19	2636.20	.00	6.00	12.00	6.000	12.000	.00	0 .0
JUNCT STR	.0157					.0129	.11	5.65	1.59		.015	.00	.00	BOX
----- WARNING - Flow depth near top of box conduit -----														
2778.930	2623.500	4.996	2628.496	1390.00	23.19	8.35	2636.84	.00	6.00	12.00	6.000	12.000	.00	0 .0
51.070	.0157					.0143	.73	5.00	1.83	4.84	.015	.00	.00	BOX
2830.000	2624.300	5.027	2629.327	1390.00	23.04	8.25	2637.57	.00	6.00	12.00	6.000	12.000	.00	0 .0
JUNCT STR	.0159					.0147	.25	5.03	1.81		.015	.00	.00	BOX
2846.940	2624.570	4.818	2629.388	1365.00	23.61	8.65	2638.04	.00	6.00	12.00	6.000	12.000	.00	0 .0
371.460	.0157					.0147	5.45	4.82	1.90	4.78	.015	.00	.00	BOX
3218.400	2630.400	4.973	2635.373	1365.00	22.87	8.12	2643.50	6.00	6.00	12.00	6.000	12.000	.00	0 .0
33.500	.0200					.0137	.46	6.00	1.81	4.37	.015	.00	.00	BOX
3251.900	2631.070	5.070	2636.140	1365.00	22.43	7.82	2643.96	6.00	6.00	12.00	6.000	12.000	.00	0 .0
34.420	.0200					.0129	.44	6.00	1.76	4.37	.015	.00	.00	BOX
3286.320	2631.760	5.195	2636.955	1365.00	21.90	7.44	2644.40	.00	6.00	12.00	6.000	12.000	.00	0 .0
1.303	.0200					.0125	.02	5.19	1.69	4.38	.015	.00	.00	BOX

WATER SURFACE PROFILE LISTING

Date: 4-29-2013 Time: 2:25:33

Ranch-Fort Apache Storm Drain Project

Main Storm Drain - Mannings's N = 0.015

By FKR, 4/23/2013 Checked By JSD, 4/28/2013

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
3287.623	2631.786	5.200	2636.986	1365.00	21.88	7.43	2644.42	.00	6.00	12.00	6.000	12.000	.00	0 .0
50.928	.0200					.0117	.60	5.20	1.69	4.38	.015	.00	.00	BOX
3338.552	2632.803	5.454	2638.257	1365.00	20.86	6.76	2645.01	.00	6.00	12.00	6.000	12.000	.00	0 .0
35.901	.0200					.0103	.37	5.45	1.57	4.38	.015	.00	.00	BOX
----- WARNING - Flow depth near top of box conduit -----														
3374.452	2633.520	5.720	2639.240	1365.00	19.89	6.14	2645.38	.00	6.00	12.00	6.000	12.000	.00	0 .0
25.548	.0200					.0121	.31	5.72	1.47	4.38	.015	.00	.00	BOX
----- WARNING - Flow depth near top of box conduit -----														
3400.000	2634.030	6.000	2640.030	1365.00	18.96	5.58	2645.61	.00	6.00	12.00	6.000	12.000	.00	0 .0
JUNCT STR	.0200					.0104	.42	6.00	1.36		.015	.00	.00	BOX
3440.000	2634.830	7.839	2642.669	1155.00	16.04	4.00	2646.67	.00	6.00	12.00	6.000	12.000	.00	0 .0
15.490	.0200					.0104	.16	7.84	1.15	3.88	.015	.00	.00	BOX
3455.490	2635.140	7.691	2642.831	1155.00	16.04	4.00	2646.83	.00	6.00	12.00	6.000	12.000	.00	0 .0
43.790	.0201					.0104	.46	.00	1.15	3.87	.015	.00	.00	BOX
3499.280	2636.020	7.510	2643.530	1155.00	16.04	4.00	2647.53	.00	6.00	12.00	6.000	12.000	.00	0 .0
45.550	.0083					.0104	.47	.00	1.15	5.33	.015	.00	.00	BOX

WATER SURFACE PROFILE LISTING

Date: 4-29-2013 Time: 2:25:33

Ranch-Fort Apache Storm Drain Project

Main Storm Drain - Mannings's N = 0.015

By FKR, 4/23/2013 Checked By JSD, 4/28/2013

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
3544.830	2636.400	7.853	2644.252	1155.00	16.04	4.00	2648.25	.00	6.00	12.00	6.000	12.000	.00	0 .0
JUNCT STR	.0000					.0103	.00	7.85	1.15		.015	.00	.00	BOX
3544.930	2636.400	7.936	2644.335	1149.00	15.96	3.95	2648.29	.00	6.00	12.00	6.000	12.000	.00	0 .0
55.070	.0084					.0103	.57	7.94	1.15	5.30	.015	.00	.00	BOX
3600.000	2636.860	8.042	2644.903	1149.00	15.96	3.95	2648.86	.00	6.00	12.00	6.000	12.000	.00	0 .0
400.000	.0083					.0103	4.12	8.04	1.15	5.32	.015	.00	.00	BOX
4000.000	2640.180	8.842	2649.022	1149.00	15.96	3.95	2652.98	.00	6.00	12.00	6.000	12.000	.00	0 .0
400.000	.0083					.0103	4.12	8.84	1.15	5.32	.015	.00	.00	BOX
4400.000	2643.500	9.641	2653.141	1149.00	15.96	3.95	2657.10	.00	6.00	12.00	6.000	12.000	.00	0 .0
403.850	.0083					.0103	4.16	9.64	1.15	5.32	.015	.00	.00	BOX
4803.850	2646.850	10.450	2657.300	1149.00	15.96	3.95	2661.25	.00	6.00	12.00	6.000	12.000	.00	0 .0
JUNCT STR	.0136					.0082	.02	10.45	1.15		.015	.00	.00	BOX
4806.780	2646.890	11.812	2658.702	1026.00	14.25	3.15	2661.85	.00	6.00	12.00	6.000	12.000	.00	0 .0
663.220	.0129					.0082	5.45	11.81	1.03	4.17	.015	.00	.00	BOX
5470.000	2655.420	8.728	2664.148	1026.00	14.25	3.15	2667.30	.00	6.00	12.00	6.000	12.000	.00	0 .0
JUNCT STR	.0126					.0078	.13	8.73	1.03		.015	.00	.00	BOX
5486.700	2655.630	8.925	2664.555	1000.00	13.89	3.00	2667.55	.00	6.00	12.00	6.000	12.000	.00	0 .0
91.550	.0129					.0078	.71	8.93	1.00	4.09	.015	.00	.00	BOX

WATER SURFACE PROFILE LISTING

Date: 4-29-2013 Time: 2:25:33

Ranch-Fort Apache Storm Drain Project

Main Storm Drain - Mannings's N = 0.015

By FKR, 4/23/2013 Checked By JSD, 4/28/2013

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
5578.250	2656.810	8.459	2665.269	1000.00	13.89	3.00	2668.26	.00	6.00	12.00	6.000	12.000	.00	0 .0
415.930	.0100					.0078	3.24	8.46	1.00	4.49	.015	.00	.00	BOX
5994.180	2660.970	7.543	2668.513	1000.00	13.89	3.00	2671.51	.00	6.00	12.00	6.000	12.000	.00	0 .0
70.120	.0098					.0078	.55	.00	1.00	4.51	.015	.00	.00	BOX
6064.300	2661.660	7.720	2669.380	1000.00	13.89	3.00	2672.38	.00	6.00	12.00	6.000	12.000	.00	0 .0
JUNCT STR	.1000					.0052	.00	7.72	1.00		.015	.00	.00	BOX
6064.400	2661.670	9.135	2670.805	815.00	19.40	5.85	2676.65	.00	6.00	7.00	6.000	7.000	.00	0 .0
.100	.1000					.0202	.00	9.13	1.40	2.78	.015	.00	.00	BOX
6064.500	2661.680	9.127	2670.807	815.00	19.40	5.85	2676.65	.00	6.00	7.00	6.000	7.000	.00	0 .0
16.460	.0097					.0202	.33	.00	1.40	6.00	.015	.00	.00	BOX
6080.960	2661.840	9.605	2671.446	815.00	19.40	5.85	2677.29	.00	6.00	7.00	6.000	7.000	.00	0 .0
54.170	.0240					.0202	1.10	.00	1.40	4.75	.015	.00	.00	BOX
6135.130	2663.140	10.006	2673.146	815.00	19.40	5.85	2678.99	.00	6.00	7.00	6.000	7.000	.00	0 .0
99.860	.0240					.0202	2.02	.00	1.40	4.75	.015	.00	.00	BOX
6234.990	2665.540	10.337	2675.877	815.00	19.40	5.85	2681.72	.00	6.00	7.00	6.000	7.000	.00	0 .0
165.010	.0240					.0202	3.34	10.34	1.40	4.75	.015	.00	.00	BOX
6400.000	2669.500	9.717	2679.217	815.00	19.40	5.85	2685.06	.00	6.00	7.00	6.000	7.000	.00	0 .0

B.2 Fort Apache Collection System

B.2.1 Street Capacity Calculations

B.2.2 Lateral Calculations

Worksheet for Fort Apache Worst Case Street Section (West Half)

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.03500 ft/ft
Discharge 39.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.80
0+15.00	0.50
0+15.01	0.00
0+16.50	0.13
0+54.00	0.88
0+54.01	1.38
0+55.00	1.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.80)	(0+55.00, 1.40)	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 0.00 to 1.40 ft
Flow Area 6.30 ft²
Wetted Perimeter 29.57 ft
Hydraulic Radius 0.21 ft
Top Width 29.07 ft

Worksheet for Fort Apache Worst Case Street Section (West Half)

Results

Normal Depth	0.59	ft
Critical Depth	0.77	ft
Critical Slope	0.00580	ft/ft
Velocity	6.19	ft/s
Velocity Head	0.60	ft
Specific Energy	1.19	ft
Froude Number	2.35	
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	0.59	ft
Critical Depth	0.77	ft
Channel Slope	0.03500	ft/ft
Critical Slope	0.00580	ft/ft

Cross Section for Fort Apache Worst Case Street Section (West Half)

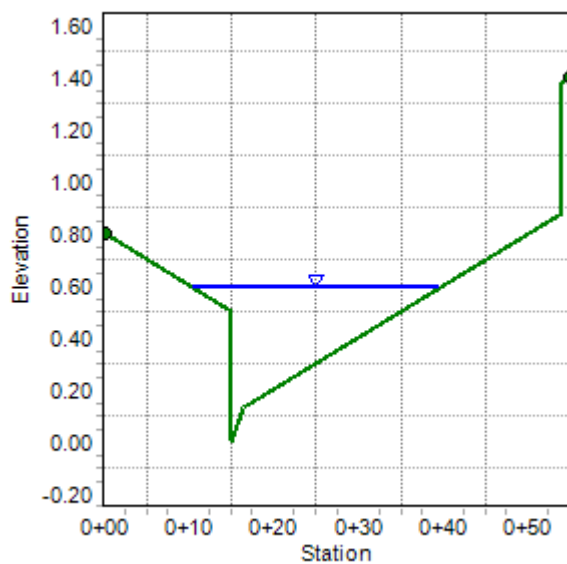
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03500	ft/ft
Normal Depth	0.59	ft
Discharge	39.00	ft ³ /s

Cross Section Image



Worksheet for Wittig North Half Street Section

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.03220 ft/ft
Discharge 11.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.50
0+00.50	0.48
0+00.58	0.00
0+02.00	0.13
0+18.50	0.46

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.50)	(0+18.50, 0.46)	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 0.00 to 0.50 ft
Flow Area 2.33 ft²
Wetted Perimeter 15.39 ft
Hydraulic Radius 0.15 ft
Top Width 15.05 ft
Normal Depth 0.40 ft
Critical Depth 0.50 ft

Worksheet for Wittig North Half Street Section

Results

Critical Slope	0.00636	ft/ft
Velocity	4.72	ft/s
Velocity Head	0.35	ft
Specific Energy	0.75	ft
Froude Number	2.12	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.40	ft
Critical Depth	0.50	ft
Channel Slope	0.03220	ft/ft
Critical Slope	0.00636	ft/ft

Cross Section for Wittig North Half Street Section

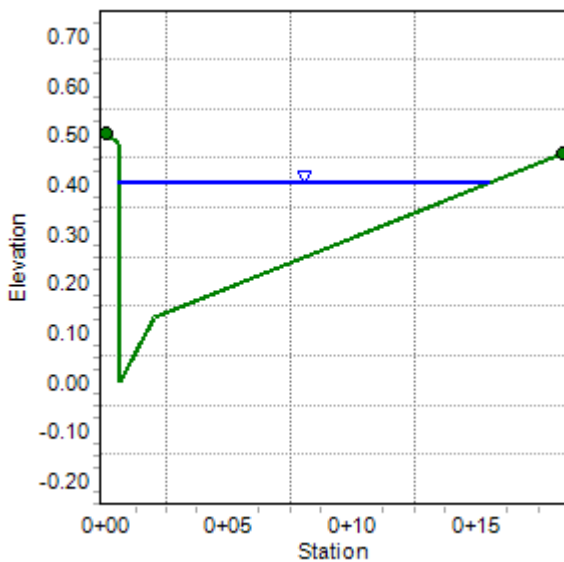
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03220	ft/ft
Normal Depth	0.40	ft
Discharge	11.00	ft ³ /s

Cross Section Image



Worksheet for Dorrell Street Section

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.03410 ft/ft
Discharge 84.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.80
0+15.00	0.50
0+15.50	0.48
0+15.58	0.00
0+17.00	0.13
0+40.00	0.59
0+63.00	0.13
0+64.42	0.00
0+64.50	0.48
0+65.00	0.50
0+80.00	0.80

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.80)	(0+80.00, 0.80)	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 0.60 ft
Elevation Range 0.00 to 0.80 ft

Worksheet for Dorrell Street Section

Results

Flow Area	13.46	ft ²
Wetted Perimeter	61.22	ft
Hydraulic Radius	0.22	ft
Top Width	60.38	ft
Normal Depth	0.60	ft
Critical Depth	0.78	ft
Critical Slope	0.00548	ft/ft
Velocity	6.24	ft/s
Velocity Head	0.61	ft
Specific Energy	1.21	ft
Froude Number	2.33	
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	0.60	ft
Critical Depth	0.78	ft
Channel Slope	0.03410	ft/ft
Critical Slope	0.00548	ft/ft

Cross Section for Dorrell Street Section

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03410	ft/ft
Normal Depth	0.60	ft
Discharge	84.00	ft ³ /s

Cross Section Image

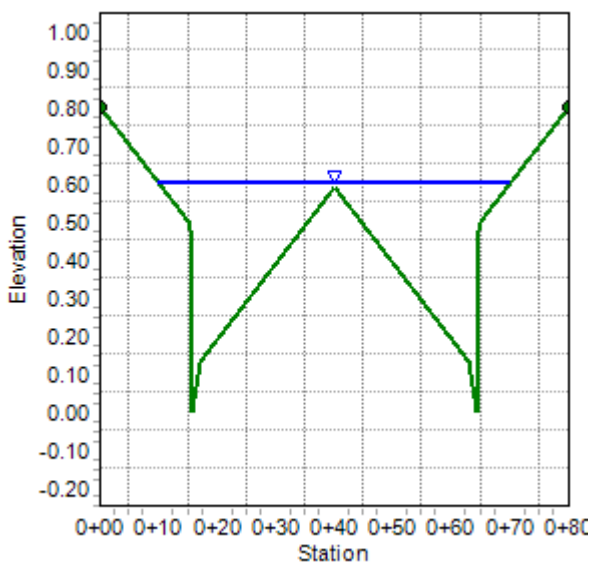


TABLE B.2.2.1: DROP INLET DEPTH CALCULATIONS
FORT APACHE STORM DRAIN -- FORT APACHE COLLECTION SYSTEM
LBG Project: CCB 1121

By: EPF
Check By: JSD
Date: 4/30/2013

Inlet Name	Station & Offset	Inlet Type	Pipe					Drop Inlet		
			Size d	Area	Slope S	Flow Q	Velocity v	Curb Height CF	Minimum Depth V	Actual Depth D
			(inches)	(sq feet)	(ft/ft)	(cfs)	(ft/s)	(feet)	(feet)	(feet)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
FA-TB	"FA" 166+74.00 42.00' LT	"DM" DROP INLET (L=12')	18	1.77	0.0350	12.0	6.8	0.83	3.69	3.50
FA-OB	"FA" 163+46.00 42.00' LT	"DM" DROP INLET (L=22')	24	3.14	0.0876	22.0	7.0	0.83	4.25	5.00
FA-SEV	"FA" 160+48.00 42.00' LT	"DM" DROP INLET (L=12')	18	1.77	0.0980	12.0	6.8	0.83	3.70	4.20
FA-ELK	"FA" 147+35.00 57.50' LT	"DM" DROP INLET (L=17')	30	4.91	0.0209	29.0	5.9	0.83	4.48	4.70
FA-WITT	"FA-SD" 55+28.00 62.00' LT	"DM" DROP INLET (L=12')	18	1.77	0.0100	12.0	6.8	0.83	3.69	3.60
FA-DORR	"FA-SD" 48+68.00 60.50' LT	"DM" DROP INLET (L=9.5')	24	3.14	0.0020	13.0	4.1	0.83	3.65	3.50
FA-THF	"FA-SD" 43+40.00 60.00' LT	"DM" DROP INLET (L=12')	18	1.77	0.0103	7.2	4.1	0.83	3.14	3.50
FA-DS	"FA-SD" 35+65.00 58.50' LT	"DM" DROP INLET (L=17')	24	3.14	0.0647	26.0	8.3	0.83	4.61	5.00
FA-EP	"FA-SD" 28+80.00 61.50' LT	"DM" DROP INLET (L=12')	24	3.14	0.0131	13.0	4.1	0.83	3.65	9.68
FA-EP-N	"FA-SD" 29+52.00 61.50' LT	"DM" DROP INLET (L=22')	30	4.91	0.0152	27	5.5	0.83	4.40	9.50
DORR-TRENCH	"FA-SD" 48+05.00 94.00' LT	DORRELL TRENCH DRAIN	60"x38"	12.90	0.1565	124	9.6	0.00	5.43	5.94

$$V = CF + 0.5 + 1.2 (v^2/2g) + d/\cos(S) \quad \text{Source: CCRFCD HCDDM Equation 801}$$

V = Depth of the catch basin from the pipe invert to the top of the curb in feet

CF = Vertical dimension of the curb face in feet.

v = Average velocity of the flow in the pipe, assuming a full pipe section in feet per second.

d = Diameter of the connector pipe in feet.

S = Slope of the connector pipe

Note: The term $1.2 (v^2/2g)$ includes an entrance loss of 0.2 of the velocity head.

$$v = Q / A$$

Q = Flow intercepted by the drop inlet, in cubic feet per second.

A = Cross sectional area of the pipe, in square feet.

Notes: 1) Inlet FA-TB connects to an existing pipe.
2) Depth of Inlets FA-WITT and FA-DORR are reduced to avoid existing gas lines.

Worksheet for DI FA-TB

Project Description

Solve For Efficiency

Input Data

Discharge	21.00	ft ³ /s
Slope	0.00650	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.09	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.016	
Local Depression	0.00	in
Local Depression Width	0.00	ft
Grate Width	1.50	ft
Grate Length	6.00	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	6.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	55.72	%
Intercepted Flow	11.70	ft ³ /s
Bypass Flow	9.30	ft ³ /s
Spread	24.22	ft
Depth	0.59	ft
Flow Area	5.94	ft ²
Gutter Depression	0.11	ft
Total Depression	0.11	ft
Velocity	3.53	ft/s
Splash Over Velocity	15.01	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.46	
Grate Flow Ratio	0.18	
Equivalent Cross Slope	0.03274	ft/ft
Active Grate Length	6.00	ft
Length Factor	0.00	
Total Interception Length	44.24	ft

Worksheet for DI FA-OB

Project Description

Solve For Efficiency

Input Data

Discharge	28.00	ft ³ /s
Slope	0.00650	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.09	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.016	
Local Depression	0.00	in
Local Depression Width	0.00	ft
Grate Width	1.50	ft
Grate Length	11.00	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	11.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	79.10	%
Intercepted Flow	22.15	ft ³ /s
Bypass Flow	5.85	ft ³ /s
Spread	27.04	ft
Depth	0.65	ft
Flow Area	7.39	ft ²
Gutter Depression	0.11	ft
Total Depression	0.11	ft
Velocity	3.79	ft/s
Splash Over Velocity	97.34	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.75	
Grate Flow Ratio	0.16	
Equivalent Cross Slope	0.03133	ft/ft
Active Grate Length	11.00	ft
Length Factor	0.00	
Total Interception Length	51.26	ft

Worksheet for DI FA-SEV

Project Description

Solve For Spread

Input Data

Discharge		12.00	ft ³ /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.09	ft/ft
Road Cross Slope		0.0200	ft/ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Width		1.50	ft
Grate Length		6.00	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		6.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Throat Incline Angle		90.00	degrees

Options

Calculation Option Use Both

Results

Spread	21.55	ft
Depth	0.54	ft
Gutter Depression	0.11	ft
Total Depression	0.11	ft
Open Grate Area	3.15	ft ²
Active Grate Weir Length	9.00	ft

Worksheet for DI FA-ELK

Project Description

Solve For Spread

Input Data

Discharge		29.00	ft ³ /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.09	ft/ft
Road Cross Slope		0.0200	ft/ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Width		1.50	ft
Grate Length		8.50	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		8.50	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Throat Incline Angle		90.00	degrees

Options

Calculation Option Use Both

Results

Spread	30.66	ft
Depth	0.72	ft
Gutter Depression	0.11	ft
Total Depression	0.11	ft
Open Grate Area	4.46	ft ²
Active Grate Weir Length	11.50	ft

Worksheet for DI FA-WITT

Project Description

Solve For Spread

Input Data

Discharge		24.00	ft ³ /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.09	ft/ft
Road Cross Slope		0.0200	ft/ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Width		1.50	ft
Grate Length		6.00	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		6.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Throat Incline Angle		90.00	degrees

Options

Calculation Option Use Both

Results

Spread	31.47	ft
Depth	0.73	ft
Gutter Depression	0.11	ft
Total Depression	0.11	ft
Open Grate Area	3.15	ft ²
Active Grate Weir Length	9.00	ft

Worksheet for DI FA-DORR

Project Description

Solve For Spread

Input Data

Discharge		13.00	ft ³ /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.09	ft/ft
Road Cross Slope		0.0200	ft/ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Width		1.50	ft
Grate Length		4.75	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		4.75	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Throat Incline Angle		90.00	degrees

Options

Calculation Option Use Both

Results

Spread	24.30	ft
Depth	0.59	ft
Gutter Depression	0.11	ft
Total Depression	0.11	ft
Open Grate Area	2.49	ft ²
Active Grate Weir Length	7.75	ft

Worksheet for DI FA-THF

Project Description

Solve For Efficiency

Input Data

Discharge	12.00	ft ³ /s
Slope	0.00840	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.09	ft/ft
Road Cross Slope	0.0200	ft/ft
Roughness Coefficient	0.016	
Local Depression	0.00	in
Local Depression Width	0.00	ft
Grate Width	1.50	ft
Grate Length	6.00	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	6.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	60.22	%
Intercepted Flow	7.23	ft ³ /s
Bypass Flow	4.77	ft ³ /s
Spread	18.57	ft
Depth	0.48	ft
Flow Area	3.53	ft ²
Gutter Depression	0.11	ft
Total Depression	0.11	ft
Velocity	3.40	ft/s
Splash Over Velocity	15.01	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.48	
Grate Flow Ratio	0.24	
Equivalent Cross Slope	0.03689	ft/ft
Active Grate Length	6.00	ft
Length Factor	0.00	
Total Interception Length	35.16	ft

Worksheet for DI FA-EP

Project Description

Solve For Spread

Input Data

Discharge		13.00	ft ³ /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.09	ft/ft
Road Cross Slope		0.0150	ft/ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Width		1.50	ft
Grate Length		6.00	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		6.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Throat Incline Angle		90.00	degrees

Options

Calculation Option Use Both

Results

Spread	29.53	ft
Depth	0.56	ft
Gutter Depression	0.11	ft
Total Depression	0.11	ft
Open Grate Area	3.15	ft ²
Active Grate Weir Length	9.00	ft

Worksheet for DI FA-EP-N

Project Description

Solve For Efficiency

Input Data

Discharge	39.00	ft ³ /s
Slope	0.01550	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.09	ft/ft
Road Cross Slope	0.0260	ft/ft
Roughness Coefficient	0.016	
Local Depression	0.00	in
Local Depression Width	0.00	ft
Grate Width	1.50	ft
Grate Length	11.00	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	11.00	ft

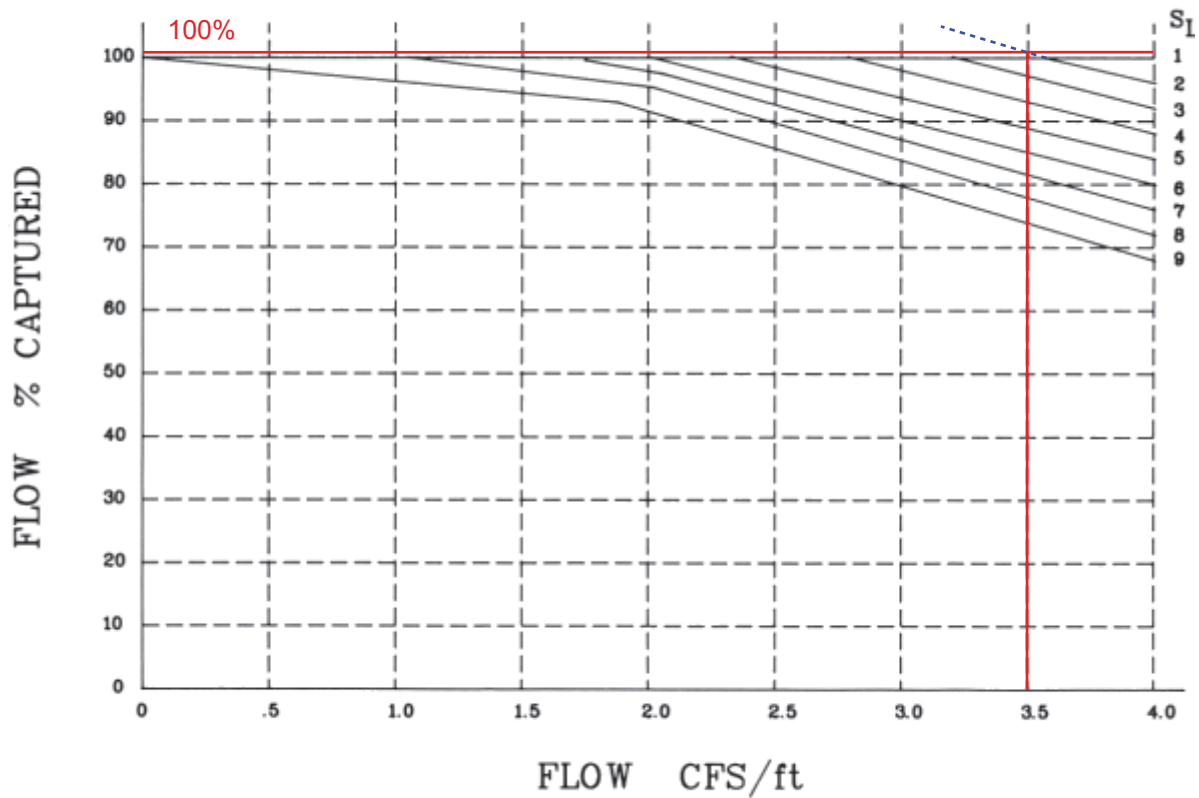
Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	69.69	%
Intercepted Flow	27.18	ft ³ /s
Bypass Flow	11.82	ft ³ /s
Spread	22.07	ft
Depth	0.67	ft
Flow Area	6.40	ft ²
Gutter Depression	0.10	ft
Total Depression	0.10	ft
Velocity	6.09	ft/s
Splash Over Velocity	97.34	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.62	
Grate Flow Ratio	0.19	
Equivalent Cross Slope	0.03829	ft/ft
Active Grate Length	11.00	ft
Length Factor	0.00	
Total Interception Length	67.79	ft

R-4999-L9

**Dorrell Trench Drain Analysis**

Street Longitudinal Slope = 2%

Street Flow = 84 cfs

Curb to Curb Width = 48 ft

Flow per Unit Width = 1.75 cfs/ft

Clogging Factor = 50%

Adjusted Flow per Unit Width = 3.5 cfs/ft

Flow Percent Captured = 100%

Flow Captured = 84 cfs

Worksheet for South Side of Inside of DORRELL TRENCH DRAIN

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.03000	ft/ft
Bottom Width	2.00	ft
Discharge	42.00	ft ³ /s

Results

Normal Depth	1.49	ft
Flow Area	2.99	ft ²
Wetted Perimeter	4.99	ft
Hydraulic Radius	0.60	ft
Top Width	2.00	ft
Critical Depth	2.39	ft
Critical Slope	0.00939	ft/ft
Velocity	14.07	ft/s
Velocity Head	3.07	ft
Specific Energy	4.57	ft
Froude Number	2.03	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.49	ft
Critical Depth	2.39	ft
Channel Slope	0.03000	ft/ft
Critical Slope	0.00939	ft/ft

Worksheet for DI Apollo Heights Existing

Project Description

Solve For Spread

Input Data

Discharge		4.51	ft ³ /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.09	ft/ft
Road Cross Slope		0.0200	ft/ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Width		1.50	ft
Grate Length		1.00	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		1.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Throat Incline Angle		90.00	degrees

Options

Calculation Option Use Both

Results

Spread	36.25	ft
Depth	0.83	ft
Gutter Depression	0.11	ft
Total Depression	0.11	ft
Open Grate Area	0.53	ft ²
Active Grate Weir Length	4.00	ft

Worksheet for DI Arrowhead Bluff Ave. Existing

Project Description

Solve For Spread

Input Data

Discharge		4.10	ft ³ /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.09	ft/ft
Road Cross Slope		0.0100	ft/ft
Curb Opening Length		2.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Local Depression		0.00	in
Local Depression Width		0.00	ft
Throat Incline Angle		90.00	degrees

Results

Spread	71.19	ft
Depth	0.83	ft
Gutter Depression	0.12	ft
Total Depression	0.12	ft

Worksheet for DI Avon Park Existing

Project Description

Solve For Spread

Input Data

Discharge		4.08	ft ³ /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.09	ft/ft
Road Cross Slope		0.0250	ft/ft
Curb Opening Length		2.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Local Depression		0.00	in
Local Depression Width		0.00	ft
Throat Incline Angle		90.00	degrees

Results

Spread	29.15	ft
Depth	0.83	ft
Gutter Depression	0.10	ft
Total Depression	0.10	ft

Worksheet for DI Bronze River Ave. Existing

Project Description

Solve For Spread

Input Data

Discharge		6.75	ft ³ /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.09	ft/ft
Road Cross Slope		0.0200	ft/ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Width		1.50	ft
Grate Length		1.50	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		1.50	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Throat Incline Angle		90.00	degrees

Options

Calculation Option Use Both

Results

Spread	36.10	ft
Depth	0.83	ft
Gutter Depression	0.11	ft
Total Depression	0.11	ft
Open Grate Area	0.79	ft ²
Active Grate Weir Length	4.50	ft

Worksheet for DI Brownstone Ledge Ave. Existing

Project Description

Solve For Spread

Input Data

Discharge		6.75	ft ³ /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.09	ft/ft
Road Cross Slope		0.0200	ft/ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Width		1.50	ft
Grate Length		1.50	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		1.50	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Throat Incline Angle		90.00	degrees

Options

Calculation Option Use Both

Results

Spread	36.10	ft
Depth	0.83	ft
Gutter Depression	0.11	ft
Total Depression	0.11	ft
Open Grate Area	0.79	ft ²
Active Grate Weir Length	4.50	ft

Worksheet for DI Enchanted Grove Ave. Existing

Project Description

Solve For Spread

Input Data

Discharge		6.75	ft ³ /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.09	ft/ft
Road Cross Slope		0.0200	ft/ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Width		1.50	ft
Grate Length		1.50	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		1.50	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Throat Incline Angle		90.00	degrees

Options

Calculation Option Use Both

Results

Spread	36.10	ft
Depth	0.83	ft
Gutter Depression	0.11	ft
Total Depression	0.11	ft
Open Grate Area	0.79	ft ²
Active Grate Weir Length	4.50	ft

Worksheet for DI Forest Meadows Existing

Project Description

Solve For Spread

Input Data

Discharge		4.51	ft ³ /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.09	ft/ft
Road Cross Slope		0.0200	ft/ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Width		1.50	ft
Grate Length		1.00	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		1.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Throat Incline Angle		90.00	degrees

Options

Calculation Option Use Both

Results

Spread	36.25	ft
Depth	0.83	ft
Gutter Depression	0.11	ft
Total Depression	0.11	ft
Open Grate Area	0.53	ft ²
Active Grate Weir Length	4.00	ft

Worksheet for DI Gold Lake Ave. Existing

Project Description

Solve For Spread

Input Data

Discharge		4.10	ft ³ /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.09	ft/ft
Road Cross Slope		0.0200	ft/ft
Curb Opening Length		2.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Local Depression		0.00	in
Local Depression Width		0.00	ft
Throat Incline Angle		90.00	degrees

Results

Spread	36.35	ft
Depth	0.83	ft
Gutter Depression	0.11	ft
Total Depression	0.11	ft

Worksheet for DI Horseshoe Basin Existing

Project Description

Solve For Spread

Input Data

Discharge		4.08	ft ³ /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.09	ft/ft
Road Cross Slope		0.0100	ft/ft
Curb Opening Length		2.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Local Depression		0.00	in
Local Depression Width		0.00	ft
Throat Incline Angle		90.00	degrees

Results

Spread	70.63	ft
Depth	0.83	ft
Gutter Depression	0.12	ft
Total Depression	0.12	ft

Project Description

Input Data

Results

5/9/2013 8:15:22 AM Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemons Company Drive Suite 200 W Watertown, CT 06795 USA +1-203-755-1666
Page 1 of 1

Project Description

Input Data

Results

5/9/2013 8:15:22 AM Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemons Company Drive Suite 200 W Watertown, CT 06795 USA +1-203-755-1666
Page 1 of 1

Worksheet for DI Oxbow Lake Ave. Existing

Project Description

Solve For Spread

Input Data

Discharge		6.75	ft ³ /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.09	ft/ft
Road Cross Slope		0.0200	ft/ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Width		1.50	ft
Grate Length		1.50	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		1.50	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Throat Incline Angle		90.00	degrees

Options

Calculation Option Use Both

Results

Spread	36.10	ft
Depth	0.83	ft
Gutter Depression	0.11	ft
Total Depression	0.11	ft
Open Grate Area	0.79	ft ²
Active Grate Weir Length	4.50	ft

Worksheet for DI Thunder Basin Ave. Existing

Project Description

Solve For Spread

Input Data

Discharge		4.10	ft ³ /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.09	ft/ft
Road Cross Slope		0.0200	ft/ft
Curb Opening Length		2.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Local Depression		0.00	in
Local Depression Width		0.00	ft
Throat Incline Angle		90.00	degrees

Results

Spread	36.35	ft
Depth	0.83	ft
Gutter Depression	0.11	ft
Total Depression	0.11	ft

Worksheet for DI White Waterfall Ave. Existing

Project Description

Solve For Spread

Input Data

Discharge		6.75	ft ³ /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.09	ft/ft
Road Cross Slope		0.0200	ft/ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Width		1.50	ft
Grate Length		1.50	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		1.50	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Throat Incline Angle		90.00	degrees

Options

Calculation Option Use Both

Results

Spread	36.10	ft
Depth	0.83	ft
Gutter Depression	0.11	ft
Total Depression	0.11	ft
Open Grate Area	0.79	ft ²
Active Grate Weir Length	4.50	ft

Worksheet for Pipe FA-TB-EX

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.03500	ft/ft
Diameter	18.00	in
Discharge	12.00	ft ³ /s

Results

Normal Depth	0.85	ft
Flow Area	1.03	ft ²
Wetted Perimeter	2.55	ft
Hydraulic Radius	0.40	ft
Top Width	1.49	ft
Critical Depth	1.31	ft
Percent Full	56.4	%
Critical Slope	0.01180	ft/ft
Velocity	11.67	ft/s
Velocity Head	2.12	ft
Specific Energy	2.96	ft
Froude Number	2.47	
Maximum Discharge	21.14	ft ³ /s
Discharge Full	19.65	ft ³ /s
Slope Full	0.01305	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	56.45	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe FA-OB

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.08760	ft/ft
Diameter	24.00	in
Discharge	24.00	ft ³ /s

Results

Normal Depth	0.83	ft
Flow Area	1.23	ft ²
Wetted Perimeter	2.80	ft
Hydraulic Radius	0.44	ft
Top Width	1.97	ft
Critical Depth	1.74	ft
Percent Full	41.4	%
Critical Slope	0.01030	ft/ft
Velocity	19.55	ft/s
Velocity Head	5.94	ft
Specific Energy	6.77	ft
Froude Number	4.37	
Maximum Discharge	72.02	ft ³ /s
Discharge Full	66.95	ft ³ /s
Slope Full	0.01126	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	41.38	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe FA-SEV

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.09800	ft/ft
Diameter	18.00	in
Discharge	12.00	ft ³ /s

Results

Normal Depth	0.63	ft
Flow Area	0.70	ft ²
Wetted Perimeter	2.11	ft
Hydraulic Radius	0.33	ft
Top Width	1.48	ft
Critical Depth	1.31	ft
Percent Full	41.8	%
Critical Slope	0.01180	ft/ft
Velocity	17.16	ft/s
Velocity Head	4.57	ft
Specific Energy	5.20	ft
Froude Number	4.40	
Maximum Discharge	35.37	ft ³ /s
Discharge Full	32.88	ft ³ /s
Slope Full	0.01305	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	41.78	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe FA-ELK

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.02090	ft/ft
Diameter	30.00	in
Discharge	29.00	ft ³ /s

Results

Normal Depth	1.23	ft
Flow Area	2.41	ft ²
Wetted Perimeter	3.89	ft
Hydraulic Radius	0.62	ft
Top Width	2.50	ft
Critical Depth	1.84	ft
Percent Full	49.4	%
Critical Slope	0.00632	ft/ft
Velocity	12.01	ft/s
Velocity Head	2.24	ft
Specific Energy	3.48	ft
Froude Number	2.15	
Maximum Discharge	63.78	ft ³ /s
Discharge Full	59.29	ft ³ /s
Slope Full	0.00500	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	49.36	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe FA-WITT

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01200	ft/ft
Diameter	18.00	in
Discharge	12.00	ft ³ /s

Results

Normal Depth	1.30	ft
Flow Area	1.62	ft ²
Wetted Perimeter	3.58	ft
Hydraulic Radius	0.45	ft
Top Width	1.03	ft
Critical Depth	1.31	ft
Percent Full	86.5	%
Critical Slope	0.01180	ft/ft
Velocity	7.39	ft/s
Velocity Head	0.85	ft
Specific Energy	2.15	ft
Froude Number	1.04	
Maximum Discharge	12.38	ft ³ /s
Discharge Full	11.51	ft ³ /s
Slope Full	0.01305	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	86.46	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe FA-WITT to RCB

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.09930	ft/ft
Diameter	24.00	in
Discharge	34.00	ft ³ /s

Results

Normal Depth	0.97	ft
Flow Area	1.52	ft ²
Wetted Perimeter	3.09	ft
Hydraulic Radius	0.49	ft
Top Width	2.00	ft
Critical Depth	1.91	ft
Percent Full	48.6	%
Critical Slope	0.01962	ft/ft
Velocity	22.42	ft/s
Velocity Head	7.81	ft
Specific Energy	8.78	ft
Froude Number	4.54	
Maximum Discharge	76.68	ft ³ /s
Discharge Full	71.28	ft ³ /s
Slope Full	0.02259	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	48.65	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe FA-DORR

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.02000	ft/ft
Diameter	24.00	in
Discharge	13.00	ft ³ /s

Results

Normal Depth	0.89	ft
Flow Area	1.35	ft ²
Wetted Perimeter	2.92	ft
Hydraulic Radius	0.46	ft
Top Width	1.99	ft
Critical Depth	1.30	ft
Percent Full	44.4	%
Critical Slope	0.00581	ft/ft
Velocity	9.66	ft/s
Velocity Head	1.45	ft
Specific Energy	2.34	ft
Froude Number	2.07	
Maximum Discharge	34.41	ft ³ /s
Discharge Full	31.99	ft ³ /s
Slope Full	0.00330	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	44.38	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe FA-DORR (MH 62 to MH 61)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.17040	ft/ft
Diameter	24.00	in
Discharge	26.00	ft ³ /s

Results

Normal Depth	0.72	ft
Flow Area	1.02	ft ²
Wetted Perimeter	2.58	ft
Hydraulic Radius	0.40	ft
Top Width	1.92	ft
Critical Depth	1.79	ft
Percent Full	36.1	%
Critical Slope	0.01171	ft/ft
Velocity	25.46	ft/s
Velocity Head	10.07	ft
Specific Energy	10.79	ft
Froude Number	6.15	
Maximum Discharge	100.45	ft ³ /s
Discharge Full	93.38	ft ³ /s
Slope Full	0.01321	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	36.08	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe FA-DORR (EX 24" to MH 62)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01100	ft/ft
Diameter	24.00	in
Discharge	13.00	ft ³ /s

Results

Normal Depth	1.06	ft
Flow Area	1.68	ft ²
Wetted Perimeter	3.25	ft
Hydraulic Radius	0.52	ft
Top Width	2.00	ft
Critical Depth	1.30	ft
Percent Full	52.8	%
Critical Slope	0.00580	ft/ft
Velocity	7.73	ft/s
Velocity Head	0.93	ft
Specific Energy	1.98	ft
Froude Number	1.48	
Maximum Discharge	25.52	ft ³ /s
Discharge Full	23.73	ft ³ /s
Slope Full	0.00330	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	52.80	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe FA-THF-EX

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01030	ft/ft
Diameter	18.00	in
Discharge	7.23	ft ³ /s

Results

Normal Depth	0.91	ft
Flow Area	1.12	ft ²
Wetted Perimeter	2.67	ft
Hydraulic Radius	0.42	ft
Top Width	1.47	ft
Critical Depth	1.04	ft
Percent Full	60.4	%
Critical Slope	0.00691	ft/ft
Velocity	6.48	ft/s
Velocity Head	0.65	ft
Specific Energy	1.56	ft
Froude Number	1.31	
Maximum Discharge	11.47	ft ³ /s
Discharge Full	10.66	ft ³ /s
Slope Full	0.00474	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	60.38	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe FA-DS

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.06470	ft/ft
Diameter	24.00	in
Discharge	26.00	ft ³ /s

Results

Normal Depth	0.94	ft
Flow Area	1.46	ft ²
Wetted Perimeter	3.03	ft
Hydraulic Radius	0.48	ft
Top Width	2.00	ft
Critical Depth	1.79	ft
Percent Full	47.1	%
Critical Slope	0.01171	ft/ft
Velocity	17.85	ft/s
Velocity Head	4.95	ft
Specific Energy	5.90	ft
Froude Number	3.69	
Maximum Discharge	61.90	ft ³ /s
Discharge Full	57.54	ft ³ /s
Slope Full	0.01321	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	47.14	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe FA-EP

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01310	ft/ft
Diameter	24.00	in
Discharge	13.00	ft ³ /s

Results

Normal Depth	1.00	ft
Flow Area	1.58	ft ²
Wetted Perimeter	3.15	ft
Hydraulic Radius	0.50	ft
Top Width	2.00	ft
Critical Depth	1.30	ft
Percent Full	50.1	%
Critical Slope	0.00581	ft/ft
Velocity	8.25	ft/s
Velocity Head	1.06	ft
Specific Energy	2.06	ft
Froude Number	1.64	
Maximum Discharge	27.85	ft ³ /s
Discharge Full	25.89	ft ³ /s
Slope Full	0.00330	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	50.14	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe FA-EP (MH 18 to MH 17)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01430	ft/ft
Diameter	30.00	in
Discharge	27.00	ft ³ /s

Results

Normal Depth	1.32	ft
Flow Area	2.64	ft ²
Wetted Perimeter	4.07	ft
Hydraulic Radius	0.65	ft
Top Width	2.50	ft
Critical Depth	1.77	ft
Percent Full	52.9	%
Critical Slope	0.00599	ft/ft
Velocity	10.23	ft/s
Velocity Head	1.63	ft
Specific Energy	2.95	ft
Froude Number	1.75	
Maximum Discharge	52.76	ft ³ /s
Discharge Full	49.05	ft ³ /s
Slope Full	0.00433	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	52.95	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe FA-EP-N

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01520	ft/ft
Diameter	30.00	in
Discharge	27.00	ft ³ /s

Results

Normal Depth	1.30	ft
Flow Area	2.58	ft ²
Wetted Perimeter	4.03	ft
Hydraulic Radius	0.64	ft
Top Width	2.50	ft
Critical Depth	1.77	ft
Percent Full	52.0	%
Critical Slope	0.00599	ft/ft
Velocity	10.47	ft/s
Velocity Head	1.70	ft
Specific Energy	3.00	ft
Froude Number	1.82	
Maximum Discharge	54.39	ft ³ /s
Discharge Full	50.57	ft ³ /s
Slope Full	0.00433	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	51.99	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe FA-EP (MH 17 to RCB)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.05180	ft/ft
Diameter	30.00	in
Discharge	40.00	ft ³ /s

Results

Normal Depth	1.14	ft
Flow Area	2.19	ft ²
Wetted Perimeter	3.71	ft
Hydraulic Radius	0.59	ft
Top Width	2.49	ft
Critical Depth	2.13	ft
Percent Full	45.7	%
Critical Slope	0.00893	ft/ft
Velocity	18.28	ft/s
Velocity Head	5.19	ft
Specific Energy	6.34	ft
Froude Number	3.44	
Maximum Discharge	100.42	ft ³ /s
Discharge Full	93.35	ft ³ /s
Slope Full	0.00951	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	45.73	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe 60" x 38" (TRENCH DRAIN to MH 61)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.15650	ft/ft
Rise	38.00	in
Span	60.00	in
Discharge	124.00	ft ³ /s

Results

Normal Depth	1.05	ft
Flow Area	3.62	ft ²
Wetted Perimeter	5.47	ft
Hydraulic Radius	0.66	ft
Top Width	4.71	ft
Critical Depth	2.79	ft
Percent Full	33.2	%
Critical Slope	0.00696	ft/ft
Velocity	34.30	ft/s
Velocity Head	18.28	ft
Specific Energy	19.34	ft
Froude Number	6.90	
Maximum Discharge	595.65	ft ³ /s
Discharge Full	546.18	ft ³ /s
Slope Full	3.03621	ft/ft
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	33.24	%

Worksheet for Pipe 60" x 38" (MH 61 to RCB)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.02270	ft/ft
Rise	38.00	in
Span	60.00	in
Discharge	150.00	ft ³ /s

Results

Normal Depth	1.96	ft
Flow Area	8.06	ft ²
Wetted Perimeter	7.18	ft
Hydraulic Radius	1.12	ft
Top Width	4.86	ft
Critical Depth	2.95	ft
Percent Full	61.7	%
Critical Slope	0.00991	ft/ft
Velocity	18.61	ft/s
Velocity Head	5.38	ft
Specific Energy	7.34	ft
Froude Number	2.55	
Maximum Discharge	226.86	ft ³ /s
Discharge Full	208.01	ft ³ /s
Slope Full	0.04367	ft/ft
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	61.75	%

B.3 Severance Lane Collection System

B.3.1 Street Capacity Calculations

B.3.2 Severance Lane Lateral WSPG Model

B.3.3 Lateral Calculations

Worksheet for Severence Lane Street Section

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.03200 ft/ft
Discharge 86.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.80
0+15.00	0.50
0+15.01	0.00
0+16.50	0.13
0+39.50	0.59
0+62.50	0.13
0+63.99	0.00
0+64.00	0.50
0+79.00	0.80

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.80)	(0+79.00, 0.80)	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 0.61 ft
Elevation Range 0.00 to 0.80 ft
Flow Area 13.92 ft²
Wetted Perimeter 61.31 ft

Worksheet for Severence Lane Street Section

Results

Hydraulic Radius	0.23	ft
Top Width	60.30	ft
Normal Depth	0.61	ft
Critical Depth	0.79	ft
Critical Slope	0.00546	ft/ft
Velocity	6.18	ft/s
Velocity Head	0.59	ft
Specific Energy	1.21	ft
Froude Number	2.27	
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	0.61	ft
Critical Depth	0.79	ft
Channel Slope	0.03200	ft/ft
Critical Slope	0.00546	ft/ft

Cross Section for Severence Lane Street Section

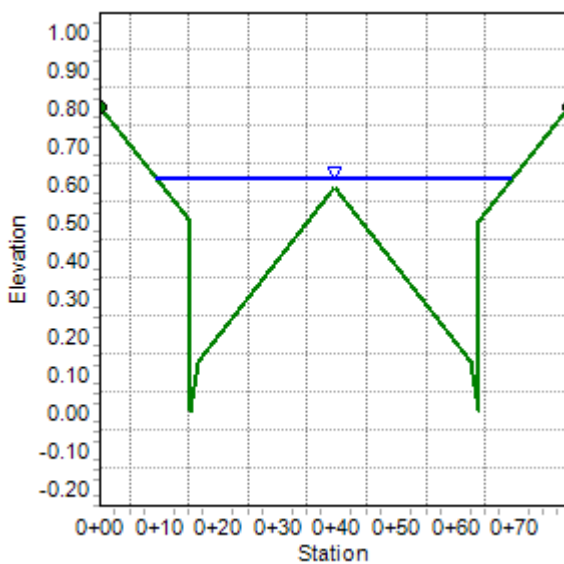
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03200	ft/ft
Normal Depth	0.61	ft
Discharge	86.00	ft ³ /s

Cross Section Image



Worksheet for SH_Severance Ex 18" RCP

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.03200	ft/ft
Diameter	1.50	ft
Discharge	11.00	ft ³ /s

Results

Normal Depth	0.82	ft
Flow Area	1.00	ft ²
Wetted Perimeter	2.51	ft
Hydraulic Radius	0.40	ft
Top Width	1.49	ft
Critical Depth	1.27	ft
Percent Full	55.0	%
Critical Slope	0.01039	ft/ft
Velocity	11.05	ft/s
Velocity Head	1.90	ft
Specific Energy	2.72	ft
Froude Number	2.39	
Maximum Discharge	20.21	ft ³ /s
Discharge Full	18.79	ft ³ /s
Slope Full	0.01097	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	54.98	%
Downstream Velocity	Infinity	ft/s

T1 Ranch-Fort Apache Storm Drain Project

T2 Severence - Add 5'x5' RCB to downstream end

T3 FKR 05/09/2013, Checked By:JSD 05/09/2013

SO	9514.7602661.670	9			2669.085				
R	9531.7402661.840	9	.013			.000	.000	0	
R	9575.5202664.570	9	.013			.000	.000	0	
R	9606.7702666.510	9	.013			19.895	.000	0	
R	9616.8902667.140	9	.013			.000	.000	0	
R	9663.1802667.300	9	.013			.000	.000	0	
WX	9663.1802667.300	1	.500						
JX	9666.9702667.320	1 5	.013	27.000	2668.630	-88.0		.000	
JX	9770.5602667.570	1 2	.013	5.000	2668.630	-90.0		.000	
R	10012.1802669.210	1	.013			.000	.000	0	
JX	10017.1802669.310	1 2	.013	6.000	2671.690	-90.0		.000	
R	10227.6002671.230	1	.013			.000	.000	1	
R	10246.0902671.340	1	.013			.000	.000	0	
JX	10251.0902671.440	1 2	.013	6.000	2673.720	-90.0		.000	
R	10505.9102672.240	1	.013			.000	.000	0	
JX	10510.9102672.440	1 2	.013	5.000	2675.740	-90.0		.000	
R	10526.8702672.590	1	.013			.000	.000	1	
R	10753.6802674.720	1	.013			.000	.000	0	
JX	10758.6802674.920	1 2	.013	7.000	2677.770	-90.0		.000	
R	10872.5202675.250	1	.013			.000	.000	0	
JX	10877.5202675.520	1 6	.013	69.000	2675.520	44.93		.000	
R	10877.6202675.520	3	.013			.000	-44.930	0	
R	10877.7202675.530	3	.013			.000	.000	0	
R	10916.0402675.860	3	.013			.000	-45.000	1	
R	10956.2102676.220	3	.013			.000	.000	0	
JX	10961.2102676.220	3 2	.013	1.000	2676.440	.000	90.000	.000	
R	10976.2102676.340	3	.013			.000	.000	0	
JX	10981.2102676.440	3 2	2.013	4.000	4.0002678.8402676.440	60.0-60.0		.000	
R	11066.8602677.980	3	.013			.000	.000	0	
JX	11071.8602678.080	3 4	4.013	13.000	13.0002678.0802678.340	60.0-60.0		.000	
R	11125.4502680.140	3	.013			.000	.000	0	
JX	11130.4502680.640	3 4	.013	24.000	2680.240	60.0		.000	
R	11159.6502683.480	7	.013			.000	.000	0	
JX	11164.6502685.480	7 4	.013	24.000	2684.980	-60.0		.000	
R	11169.6502686.950	8	.013			.000	.000	0	
SH	11169.6502686.950	8			2687.770				
CD	1 4 1	.000	5.000	.000	.000	.000	.00		
CD	2 4 1	.000	1.500	.000	.000	.000	.00		
CD	3 4 1	.000	4.000	.000	.000	.000	.00		
CD	4 4 1	.000	2.000	.000	.000	.000	.00		
CD	5 4 1	.000	2.500	.000	.000	.000	.00		
CD	6 4 1	.000	5.000	.000	.000	.000	.00		
CD	7 4 1	.000	3.500	.000	.000	.000	.00		
CD	8 4 1	.000	1.500	.000	.000	.000	.00		
CD	9 3 0	.000	5.000	5.000	.000	.000	.00		
Q	14.000	.0							

Program Package Serial Number: 1455

WATER SURFACE PROFILE LISTING

Date: 5- 9-2013 Time: 1:36:23

Ranch-Fort Apache Storm Drain Project

Severence - Add 5'x5' RCB to downstream end

FKR 05/09/2013, Checked By:JSD 05/09/2013

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
9514.760	2661.670	7.415	2669.085	222.00	8.88	1.22	2670.31	.00	3.94	5.00	5.000	5.000	.00	0 .0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
16.980	.0100					.0045	.08	7.42	.70	3.12	.013	.00	.00	BOX
9531.740	2661.840	7.321	2669.161	222.00	8.88	1.22	2670.39	.00	3.94	5.00	5.000	5.000	.00	0 .0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
18.554	.0624					.0045	.08	7.32	.70	1.59	.013	.00	.00	BOX
9550.294	2662.997	6.247	2669.244	222.00	8.88	1.22	2670.47	.00	3.94	5.00	5.000	5.000	.00	0 .0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
HYDRAULIC JUMP														
9550.294	2662.997	2.133	2665.130	222.00	20.81	6.73	2671.86	.00	3.94	5.00	5.000	5.000	.00	0 .0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
.073	.0624					.0275	.00	2.13	2.51	1.59	.013	.00	.00	BOX
9550.367	2663.002	2.133	2665.135	222.00	20.81	6.73	2671.86	.00	3.94	5.00	5.000	5.000	.00	0 .0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
13.888	.0624					.0258	.36	2.13	2.51	1.59	.013	.00	.00	BOX
9564.255	2663.868	2.237	2666.105	222.00	19.85	6.12	2672.22	.00	3.94	5.00	5.000	5.000	.00	0 .0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
11.265	.0624					.0227	.26	2.24	2.34	1.59	.013	.00	.00	BOX
9575.520	2664.570	2.347	2666.917	222.00	18.92	5.56	2672.48	.62	3.94	5.00	5.000	5.000	.00	0 .0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
6.623	.0621					.0203	.13	2.96	2.18	1.59	.013	.00	.00	BOX
9582.143	2664.981	2.425	2667.406	222.00	18.31	5.21	2672.61	.58	3.94	5.00	5.000	5.000	.00	0 .0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
8.103	.0621					.0183	.15	3.00	2.07	1.59	.013	.00	.00	BOX
9590.245	2665.484	2.543	2668.028	222.00	17.46	4.73	2672.76	.53	3.94	5.00	5.000	5.000	.00	0 .0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
6.657	.0621					.0161	.11	3.07	1.93	1.59	.013	.00	.00	BOX

Program Package Serial Number: 1455

WATER SURFACE PROFILE LISTING

Date: 5- 9-2013 Time: 1:36:23

Ranch-Fort Apache Storm Drain Project

Severence - Add 5'x5' RCB to downstream end

FKR 05/09/2013, Checked By:JSD 05/09/2013

```

*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height | Base Wt | | No Wth
        | Elev  | (FT)  | Elev  | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip
        | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****
9596.902 | 2665.897 | 2.668 | 2668.565 | 222.00 | 16.64 | 4.30 | 2672.87 | .48 | 3.94 | 5.00 | 5.000 | 5.000 | .00 | 0 | .0
        | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-
5.448 | .0621 | | | | | .0142 | .08 | 3.15 | 1.80 | 1.59 | .013 | .00 | .00 | BOX
9602.351 | 2666.236 | 2.798 | 2669.033 | 222.00 | 15.87 | 3.91 | 2672.94 | .43 | 3.94 | 5.00 | 5.000 | 5.000 | .00 | 0 | .0
        | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-
4.419 | .0621 | | | | | .0125 | .06 | 3.23 | 1.67 | 1.59 | .013 | .00 | .00 | BOX
9606.769 | 2666.510 | 2.934 | 2669.444 | 222.00 | 15.13 | 3.56 | 2673.00 | .00 | 3.94 | 5.00 | 5.000 | 5.000 | .00 | 0 | .0
        | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-
1.480 | .0622 | | | | | .0115 | .02 | 2.93 | 1.56 | 1.59 | .013 | .00 | .00 | BOX
9608.249 | 2666.602 | 2.990 | 2669.592 | 222.00 | 14.85 | 3.42 | 2673.02 | .00 | 3.94 | 5.00 | 5.000 | 5.000 | .00 | 0 | .0
        | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-
3.199 | .0622 | | | | | .0105 | .03 | 2.99 | 1.51 | 1.59 | .013 | .00 | .00 | BOX
9611.448 | 2666.801 | 3.136 | 2669.937 | 222.00 | 14.16 | 3.11 | 2673.05 | .00 | 3.94 | 5.00 | 5.000 | 5.000 | .00 | 0 | .0
        | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-
2.456 | .0622 | | | | | .0093 | .02 | 3.14 | 1.41 | 1.59 | .013 | .00 | .00 | BOX
9613.904 | 2666.954 | 3.289 | 2670.243 | 222.00 | 13.50 | 2.83 | 2673.07 | .00 | 3.94 | 5.00 | 5.000 | 5.000 | .00 | 0 | .0
        | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-
1.792 | .0622 | | | | | .0082 | .01 | 3.29 | 1.31 | 1.59 | .013 | .00 | .00 | BOX
9615.696 | 2667.066 | 3.449 | 2670.515 | 222.00 | 12.87 | 2.57 | 2673.09 | .00 | 3.94 | 5.00 | 5.000 | 5.000 | .00 | 0 | .0
        | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-
1.193 | .0622 | | | | | .0073 | .01 | 3.45 | 1.22 | 1.59 | .013 | .00 | .00 | BOX
9616.890 | 2667.140 | 3.618 | 2670.758 | 222.00 | 12.27 | 2.34 | 2673.10 | .00 | 3.94 | 5.00 | 5.000 | 5.000 | .00 | 0 | .0
        | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-
6.506 | .0035 | | | | | .0070 | .05 | 3.62 | 1.14 | 4.75 | .013 | .00 | .00 | BOX
9623.396 | 2667.162 | 3.547 | 2670.710 | 222.00 | 12.52 | 2.43 | 2673.14 | .00 | 3.94 | 5.00 | 5.000 | 5.000 | .00 | 0 | .0
        | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-  | -|-
18.598 | .0035 | | | | | .0077 | .14 | 3.55 | 1.17 | 4.75 | .013 | .00 | .00 | BOX

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Program Package Serial Number: 1455

WATER SURFACE PROFILE LISTING

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Ranch-Fort Apache Storm Drain Project

Severence - Add 5'x5' RCB to downstream end

FKR 05/09/2013, Checked By:JSD 05/09/2013

*****																	*****	
Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt or I.D.	ZL	No Prs/Pip	Wth			
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type	Ch			
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
9641.993	2667.227	3.382	2670.609	222.00	13.13	2.68	2673.28	.00	3.94	5.00	5.000	5.000	.00	0	.0			
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -		
21.187	.0035					.0087	.18	3.38	1.26	4.75	.013	.00	.00	BOX				
9663.180	2667.300	3.225	2670.525	222.00	13.77	2.94	2673.47	.00	3.94	5.00	5.000	5.000	.00	0	.0			
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -		
WALL EXIT																		
9663.180	2667.300	4.224	2671.524	222.00	12.55	2.44	2673.97	.00	4.22	3.62	5.000	.000	.00	1	.0			
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -		
JUNCT STR	.0053					.0063	.02	4.22	1.00		.013	.00	.00	PIPE				
9666.970	2667.320	5.631	2672.951	195.00	9.93	1.53	2674.48	.00	3.99	.00	5.000	.000	.00	1	.0			
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -		
JUNCT STR	.0024					.0055	.57	5.63	.00		.013	.00	.00	PIPE				
9770.560	2667.570	6.102	2673.672	190.00	9.68	1.45	2675.13	.00	3.94	.00	5.000	.000	.00	1	.0			
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -		
241.620	.0068					.0053	1.29	6.10	.00	3.66	.013	.00	.00	PIPE				
10012.180	2669.210	5.748	2674.958	190.00	9.68	1.45	2676.41	.00	3.94	.00	5.000	.000	.00	1	.0			
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -		
JUNCT STR	.0200					.0052	.03	5.75	.00		.013	.00	.00	PIPE				
10017.180	2669.310	5.855	2675.165	184.00	9.37	1.36	2676.53	.00	3.88	.00	5.000	.000	.00	1	.0			
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -		
210.420	.0091					.0050	1.05	5.85	.00	3.20	.013	.00	.00	PIPE				
10227.600	2671.230	5.053	2676.283	184.00	9.37	1.36	2677.65	.00	3.88	.00	5.000	.000	.00	1	.0			
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -		
18.490	.0060					.0050	.09	5.05	.00	3.76	.013	.00	.00	PIPE				
10246.090	2671.340	5.035	2676.375	184.00	9.37	1.36	2677.74	.00	3.88	.00	5.000	.000	.00	1	.0			
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -		
JUNCT STR	.0200					.0048	.02	5.04	.00		.013	.00	.00	PIPE				

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Severence - Add 5'x5' RCB to downstream end

FKR 05/09/2013, Checked By:JSD 05/09/2013

*****																	*****	
Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt I.D.	ZL	No Prs/Pip	Wth			
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type	Ch			
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	
10251.090	2671.440	5.135	2676.575	178.00	9.07	1.28	2677.85	.00	3.82	.00	5.000	.000	.00	1	.0			
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -		
254.820	.0031					.0047	1.19	5.13	.00	5.00	.013	.00	.00	PIPE				
10505.910	2672.240	5.525	2677.765	178.00	9.07	1.28	2679.04	.00	3.82	.00	5.000	.000	.00	1	.0			
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -		
JUNCT STR	.0400					.0045	.02	5.52	.00		.013	.00	.00	PIPE				
10510.910	2672.440	5.489	2677.929	173.00	8.81	1.21	2679.13	.00	3.77	.00	5.000	.000	.00	1	.0			
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -		
15.960	.0094					.0044	.07	5.49	.00	3.04	.013	.00	.00	PIPE				
10526.870	2672.590	5.470	2678.060	173.00	8.81	1.21	2679.27	.00	3.77	.00	5.000	.000	.00	1	.0			
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -		
94.321	.0094					.0044	.41	5.47	.00	3.04	.013	.00	.00	PIPE				
10621.190	2673.476	5.000	2678.476	173.00	8.81	1.21	2679.68	.00	3.77	.00	5.000	.000	.00	1	.0			
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -		
64.829	.0094					.0041	.27	5.00	.00	3.04	.013	.00	.00	PIPE				
10686.020	2674.085	4.536	2678.621	173.00	9.24	1.33	2679.95	.00	3.77	2.90	5.000	.000	.00	1	.0			
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -		
25.280	.0094					.0040	.10	4.54	.64	3.04	.013	.00	.00	PIPE				
10711.300	2674.322	4.267	2678.589	173.00	9.69	1.46	2680.05	.00	3.77	3.54	5.000	.000	.00	1	.0			
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -		
3.618	.0094					.0042	.02	4.27	.76	3.04	.013	.00	.00	PIPE				
10714.920	2674.356	4.223	2678.579	173.00	9.78	1.48	2680.06	.00	3.77	3.62	5.000	.000	.00	1	.0			
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -		
HYDRAULIC JUMP																		
10714.920	2674.356	3.354	2677.710	173.00	12.36	2.37	2680.08	.00	3.77	4.70	5.000	.000	.00	1	.0			
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -		
19.420	.0094					.0068	.13	3.35	1.26	3.04	.013	.00	.00	PIPE				

Program Package Serial Number: 1455

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Ranch-Fort Apache Storm Drain Project

Severence - Add 5'x5' RCB to downstream end

FKR 05/09/2013, Checked By:JSD 05/09/2013

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt I.D.	ZL	No Prs/Pip	Wth
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type	Ch
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
10734.340	2674.538	3.445	2677.983	173.00	11.99	2.23	2680.22	.00	3.77	4.63	5.000	.000	.00	1	.0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
15.037	.0094					.0062	.09	3.45	1.20	3.04	.013	.00	.00	PIPE	
10749.380	2674.679	3.600	2678.280	173.00	11.43	2.03	2680.31	.00	3.77	4.49	5.000	.000	.00	1	.0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
4.304	.0094					.0056	.02	3.60	1.10	3.04	.013	.00	.00	PIPE	
10753.680	2674.720	3.769	2678.489	173.00	10.90	1.84	2680.33	.00	3.77	4.31	5.000	.000	.00	1	.0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
JUNCT STR	.0400					.0046	.02	3.77	1.00		.013	.00	.00	PIPE	
10758.680	2674.920	4.167	2679.087	166.00	9.49	1.40	2680.49	.00	3.69	3.73	5.000	.000	.00	1	.0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
113.840	.0029					.0038	.43	4.17	.77	5.00	.013	.00	.00	PIPE	
10872.520	2675.250	4.386	2679.636	166.00	9.09	1.28	2680.92	.00	3.69	3.28	5.000	.000	.00	1	.0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
JUNCT STR	.0540					.0025	.01	4.39	.68		.013	.00	.00	PIPE	
10877.520	2675.520	5.536	2681.056	97.00	7.72	.93	2681.98	.00	2.98	.00	4.000	.000	.00	1	.0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
.101	.0000					.0046	.00	5.54	.00	.00	.013	.00	.00	PIPE	
10877.620	2675.520	5.674	2681.194	97.00	7.72	.93	2682.12	.00	2.98	.00	4.000	.000	.00	1	.0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
.100	.1005					.0046	.00	5.67	.00	1.25	.013	.00	.00	PIPE	
10877.720	2675.530	5.664	2681.194	97.00	7.72	.93	2682.12	.00	2.98	.00	4.000	.000	.00	1	.0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
38.320	.0086					.0046	.17	5.66	.00	2.53	.013	.00	.00	PIPE	
10916.040	2675.860	5.693	2681.553	97.00	7.72	.93	2682.48	.00	2.98	.00	4.000	.000	.00	1	.0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
40.170	.0090					.0046	.18	5.69	.00	2.50	.013	.00	.00	PIPE	

Program Package Serial Number: 1455

WATER SURFACE PROFILE LISTING

Date: 5- 9-2013 Time: 1:36:23

Ranch-Fort Apache Storm Drain Project

Severence - Add 5'x5' RCB to downstream end

FKR 05/09/2013, Checked By:JSD 05/09/2013

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height | Base Wt | | No Wth
        | Elev  | (FT)  | Elev  | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|
10956.210 | 2676.220 | 5.516 | 2681.736 | 97.00 | 7.72 | .93 | 2682.66 | .00 | 2.98 | .00 | 4.000 | .000 | .00 | 1 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
JUNCT STR .0000 | | | | | .0045 | .02 | 5.52 | .00 | | .013 | .00 | .00 | PIPE
10961.210 | 2676.220 | 5.575 | 2681.795 | 96.00 | 7.64 | .91 | 2682.70 | .00 | 2.97 | .00 | 4.000 | .000 | .00 | 1 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
15.000 | .0080 | | | | .0045 | .07 | 5.58 | .00 | 2.58 | .013 | .00 | .00 | PIPE
10976.210 | 2676.340 | 5.522 | 2681.862 | 96.00 | 7.64 | .91 | 2682.77 | .00 | 2.97 | .00 | 4.000 | .000 | .00 | 1 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
JUNCT STR .0200 | | | | | .0041 | .02 | 5.52 | .00 | | .013 | .00 | .00 | PIPE
10981.210 | 2676.440 | 5.710 | 2682.150 | 88.00 | 7.00 | .76 | 2682.91 | .00 | 2.84 | .00 | 4.000 | .000 | .00 | 1 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
85.650 | .0180 | | | | .0038 | .32 | 5.71 | .00 | 1.90 | .013 | .00 | .00 | PIPE
11066.860 | 2677.980 | 4.491 | 2682.471 | 88.00 | 7.00 | .76 | 2683.23 | .00 | 2.84 | .00 | 4.000 | .000 | .00 | 1 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
JUNCT STR .0200 | | | | | .0028 | .01 | 4.49 | .00 | | .013 | .00 | .00 | PIPE
11071.860 | 2678.080 | 5.039 | 2683.119 | 62.00 | 4.93 | .38 | 2683.50 | .00 | 2.37 | .00 | 4.000 | .000 | .00 | 1 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
28.412 | .0384 | | | | .0019 | .05 | 5.04 | .00 | 1.28 | .013 | .00 | .00 | PIPE
11100.270 | 2679.172 | 4.000 | 2683.172 | 62.00 | 4.93 | .38 | 2683.55 | .00 | 2.37 | .00 | 4.000 | .000 | .00 | 1 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
9.049 | .0384 | | | | .0017 | .02 | 4.00 | .00 | 1.28 | .013 | .00 | .00 | PIPE
11109.320 | 2679.520 | 3.629 | 2683.149 | 62.00 | 5.17 | .42 | 2683.56 | .00 | 2.37 | 2.32 | 4.000 | .000 | .00 | 1 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
4.746 | .0384 | | | | .0017 | .01 | 3.63 | .40 | 1.28 | .013 | .00 | .00 | PIPE
11114.070 | 2679.702 | 3.413 | 2683.115 | 62.00 | 5.43 | .46 | 2683.57 | .00 | 2.37 | 2.83 | 4.000 | .000 | .00 | 1 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
3.585 | .0384 | | | | .0018 | .01 | 3.41 | .48 | 1.28 | .013 | .00 | .00 | PIPE

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Program Package Serial Number: 1455

WATER SURFACE PROFILE LISTING

Date: 5- 9-2013 Time: 1:36:23

Ranch-Fort Apache Storm Drain Project

Severence - Add 5'x5' RCB to downstream end

FKR 05/09/2013, Checked By:JSD 05/09/2013

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt/I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
11117.650	2679.840	3.236	2683.076	62.00	5.69	.50	2683.58	.00	2.37	3.14	4.000	.000	.00	1 .0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
2.901	.0384					.0020	.01	3.24	.54	1.28	.013	.00	.00	PIPE
11120.550	2679.952	3.080	2683.032	62.00	5.97	.55	2683.59	.00	2.37	3.37	4.000	.000	.00	1 .0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
.601	.0384					.0021	.00	3.08	.60	1.28	.013	.00	.00	PIPE
11121.150	2679.975	3.045	2683.020	62.00	6.04	.57	2683.59	.00	2.37	3.41	4.000	.000	.00	1 .0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
HYDRAULIC JUMP														
11121.150	2679.975	1.826	2681.800	62.00	11.10	1.91	2683.71	.00	2.37	3.98	4.000	.000	.00	1 .0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
.798	.0384					.0101	.01	1.83	1.65	1.28	.013	.00	.00	PIPE
11121.950	2680.005	1.838	2681.844	62.00	11.00	1.88	2683.72	.00	2.37	3.99	4.000	.000	.00	1 .0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
3.498	.0384					.0094	.03	1.84	1.63	1.28	.013	.00	.00	PIPE
11125.450	2680.140	1.907	2682.047	62.00	10.49	1.71	2683.75	.00	2.37	4.00	4.000	.000	.00	1 .0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
JUNCT STR	.1000					.0259	.13	1.91	1.52		.013	.00	.00	PIPE
11130.450	2680.640	.965	2681.605	38.00	17.61	4.82	2686.42	.00	1.92	3.13	3.500	.000	.00	1 .0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
1.509	.0973					.0512	.08	.96	3.74	.82	.013	.00	.00	PIPE
11131.960	2680.787	.970	2681.757	38.00	17.48	4.74	2686.50	.00	1.92	3.13	3.500	.000	.00	1 .0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
7.992	.0973					.0474	.38	.97	3.70	.82	.013	.00	.00	PIPE
11139.950	2681.564	1.003	2682.567	38.00	16.66	4.31	2686.88	.00	1.92	3.17	3.500	.000	.00	1 .0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
6.403	.0973					.0415	.27	1.00	3.46	.82	.013	.00	.00	PIPE

Date: 5- 9-2013 Time: 1:36:23

Severence - Add 5'x5' RCB to downstream end

FKR 05/09/2013, Checked By:JSD 05/09/2013

[illegible]

TABLE B.3.3.1: DROP INLET DEPTH CALCULATIONS
FORT APACHE STORM DRAIN -- SEVERENCE LANE COLLECTION SYSTEM
LBG Project: CCB 1121

By: TQT
Check By: JSD
Date: 4/29/2013

Inlet Name	Station & Offset	Inlet Type	Pipe					Drop Inlet		
			Size d	Area	Slope S	Flow Q	Velocity v	Curb Height CF	Minimum Depth V	Actual Depth D
			(inches)	(sq feet)	(ft/ft)	(cfs)	(ft/s)	(feet)	(feet)	(feet)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
SEV-N1	"SV" 509+60.00 25.00' RT	"DM" DROP INLET (L=22')	24	3.14	0.2245	24.0	7.6	0.83	4.47	4.50
SEV-N2	"SV" 509+02.00 25.00' RT	"DM" DROP INLET (L=22')	24	3.14	0.2438	13.0	4.1	0.83	3.71	4.00
SEV-N3	"SV" 508+11.00 25.00' RT	"DM" DROP INLET (L=12')	18	1.77	0.0100	4.0	2.3	0.83	2.93	8.70
SEV-S1	"SV" 509+73.00 25.00' LT	"DM" DROP INLET (L=22')	24	3.14	0.1214	24.0	7.6	0.83	4.44	5.00
SEV-S2	"SV" 508+80.00 25.00' LT	"DM" DROP INLET (L=22')	24	3.14	0.0219	13.0	4.1	0.83	3.65	5.00
SEV-S3	"SV" 507+90.00 25.00' LT	"DM" DROP INLET (L=12')	18	1.77	0.0300	4.5	2.5	0.83	2.95	4.50

$$V = CF + 0.5 + 1.2 (v^2/2g) + d/\cos(S) \quad \text{Source: CCRFCD HCDDM Equation 801}$$

V = Depth of the catch basin from the pipe invert to the top of the curb in feet

CF = Vertical dimension of the curb face in feet.

v = Average velocity of the flow in the pipe, assuming a full pipe section in feet per second.

d = Diameter of the connector pipe in feet.

S = Slope of the connector pipe

Note: The term $1.2 (v^2/2g)$ includes an entrance loss of 0.2 of the velocity head.

$$v = Q / A$$

Q = Flow intercepted by the drop inlet, in cubic feet per second.

A = Cross sectional area of the pipe, in square feet.

Worksheet for DI SEV-N1

Project Description

Solve For Efficiency

Input Data

Discharge	43.00	ft ³ /s
Slope	0.03310	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.083	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Local Depression	0.00	in
Local Depression Width	0.00	ft
Grate Width	1.50	ft
Grate Length	11.00	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	11.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	55.43	%
Intercepted Flow	23.83	ft ³ /s
Bypass Flow	19.17	ft ³ /s
Spread	23.36	ft
Depth	0.56	ft
Flow Area	5.53	ft ²
Gutter Depression	0.09	ft
Total Depression	0.09	ft
Velocity	7.78	ft/s
Splash Over Velocity	97.34	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.45	
Grate Flow Ratio	0.19	
Equivalent Cross Slope	0.03174	ft/ft
Active Grate Length	11.00	ft
Length Factor	0.00	
Total Interception Length	99.25	ft

Worksheet for DI SEV-N2

Project Description

Solve For Efficiency

Input Data

Discharge	19.00	ft ³ /s
Slope	0.03020	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.083	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Local Depression	0.00	in
Local Depression Width	0.00	ft
Grate Width	1.50	ft
Grate Length	11.00	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	11.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	66.93	%
Intercepted Flow	12.72	ft ³ /s
Bypass Flow	6.28	ft ³ /s
Spread	17.35	ft
Depth	0.44	ft
Flow Area	3.08	ft ²
Gutter Depression	0.09	ft
Total Depression	0.09	ft
Velocity	6.17	ft/s
Splash Over Velocity	97.34	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.56	
Grate Flow Ratio	0.25	
Equivalent Cross Slope	0.03605	ft/ft
Active Grate Length	11.00	ft
Length Factor	0.00	
Total Interception Length	63.47	ft

Worksheet for DI SEV-N3

Project Description

Solve For Efficiency

Input Data

Discharge	6.00	ft ³ /s
Slope	0.03000	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.083	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Local Depression	0.00	in
Local Depression Width	0.00	ft
Grate Width	1.50	ft
Grate Length	6.00	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	8.50	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	67.61	%
Intercepted Flow	4.06	ft ³ /s
Bypass Flow	1.94	ft ³ /s
Spread	10.96	ft
Depth	0.31	ft
Flow Area	1.27	ft ²
Gutter Depression	0.09	ft
Total Depression	0.09	ft
Velocity	4.72	ft/s
Splash Over Velocity	15.01	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.33	
Grate Flow Ratio	0.41	
Equivalent Cross Slope	0.04566	ft/ft
Active Grate Length	6.00	ft
Length Factor	0.07	
Total Interception Length	33.88	ft

Worksheet for DI SEV-S1

Project Description

Solve For Efficiency

Input Data

Discharge	43.00	ft ³ /s
Slope	0.03130	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.083	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Local Depression	0.00	in
Local Depression Width	0.00	ft
Grate Width	1.50	ft
Grate Length	11.00	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	11.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	56.09	%
Intercepted Flow	24.12	ft ³ /s
Bypass Flow	18.88	ft ³ /s
Spread	23.62	ft
Depth	0.57	ft
Flow Area	5.65	ft ²
Gutter Depression	0.09	ft
Total Depression	0.09	ft
Velocity	7.61	ft/s
Splash Over Velocity	97.34	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.46	
Grate Flow Ratio	0.18	
Equivalent Cross Slope	0.03161	ft/ft
Active Grate Length	11.00	ft
Length Factor	0.00	
Total Interception Length	97.84	ft

Worksheet for DI SEV-S2

Project Description

Solve For Efficiency

Input Data

Discharge	19.00	ft ³ /s
Slope	0.03000	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.090	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Local Depression	0.00	in
Local Depression Width	0.00	ft
Grate Width	1.50	ft
Grate Length	11.00	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	11.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	67.15	%
Intercepted Flow	12.76	ft ³ /s
Bypass Flow	6.24	ft ³ /s
Spread	17.33	ft
Depth	0.45	ft
Flow Area	3.08	ft ²
Gutter Depression	0.11	ft
Total Depression	0.11	ft
Velocity	6.16	ft/s
Splash Over Velocity	97.34	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.56	
Grate Flow Ratio	0.26	
Equivalent Cross Slope	0.03818	ft/ft
Active Grate Length	11.00	ft
Length Factor	0.00	
Total Interception Length	61.21	ft

Worksheet for DI SEV-S3

Project Description

Solve For Efficiency

Input Data

Discharge	6.00	ft ³ /s
Slope	0.03090	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.090	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Local Depression	0.00	in
Local Depression Width	0.00	ft
Grate Width	1.50	ft
Grate Length	6.00	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	11.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	74.91	%
Intercepted Flow	4.49	ft ³ /s
Bypass Flow	1.51	ft ³ /s
Spread	10.82	ft
Depth	0.32	ft
Flow Area	1.25	ft ²
Gutter Depression	0.11	ft
Total Depression	0.11	ft
Velocity	4.80	ft/s
Splash Over Velocity	15.01	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.33	
Grate Flow Ratio	0.42	
Equivalent Cross Slope	0.04948	ft/ft
Active Grate Length	6.00	ft
Length Factor	0.15	
Total Interception Length	32.57	ft

Worksheet for DI EXISTING North Side Severance at F.A.

Project Description

Solve For Efficiency

Input Data

Discharge	2.00	ft ³ /s
Slope	0.02030	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.090	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Local Depression	0.00	in
Local Depression Width	0.00	ft
Grate Width	1.50	ft
Grate Length	1.50	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	1.50	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	61.81	%
Intercepted Flow	1.24	ft ³ /s
Bypass Flow	0.76	ft ³ /s
Spread	7.30	ft
Depth	0.25	ft
Flow Area	0.61	ft ²
Gutter Depression	0.11	ft
Total Depression	0.11	ft
Velocity	3.27	ft/s
Splash Over Velocity	5.14	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.04	
Grate Flow Ratio	0.60	
Equivalent Cross Slope	0.06220	ft/ft
Active Grate Length	1.50	ft
Length Factor	0.00	
Total Interception Length	15.78	ft

Worksheet for Pipe SEV-N1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.03600	ft/ft
Diameter	24.00	in
Discharge	23.83	ft ³ /s

Results

Normal Depth	1.06	ft
Flow Area	1.70	ft ²
Wetted Perimeter	3.27	ft
Hydraulic Radius	0.52	ft
Top Width	2.00	ft
Critical Depth	1.73	ft
Percent Full	53.2	%
Critical Slope	0.01019	ft/ft
Velocity	14.02	ft/s
Velocity Head	3.05	ft
Specific Energy	4.12	ft
Froude Number	2.68	
Maximum Discharge	46.17	ft ³ /s
Discharge Full	42.92	ft ³ /s
Slope Full	0.01110	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	53.22	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe SEV-N2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	24.00	in
Discharge	12.72	ft ³ /s

Results

Normal Depth	1.07	ft
Flow Area	1.72	ft ²
Wetted Perimeter	3.29	ft
Hydraulic Radius	0.52	ft
Top Width	1.99	ft
Critical Depth	1.28	ft
Percent Full	53.6	%
Critical Slope	0.00574	ft/ft
Velocity	7.41	ft/s
Velocity Head	0.85	ft
Specific Energy	1.93	ft
Froude Number	1.41	
Maximum Discharge	24.33	ft ³ /s
Discharge Full	22.62	ft ³ /s
Slope Full	0.00316	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	53.64	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe SEV-N3

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	18.00	in
Discharge	4.06	ft ³ /s

Results

Normal Depth	0.65	ft
Flow Area	0.73	ft ²
Wetted Perimeter	2.15	ft
Hydraulic Radius	0.34	ft
Top Width	1.49	ft
Critical Depth	0.77	ft
Percent Full	43.2	%
Critical Slope	0.00543	ft/ft
Velocity	5.56	ft/s
Velocity Head	0.48	ft
Specific Energy	1.13	ft
Froude Number	1.40	
Maximum Discharge	11.30	ft ³ /s
Discharge Full	10.50	ft ³ /s
Slope Full	0.00149	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	43.16	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe SEV-S1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.12140	ft/ft
Diameter	24.00	in
Discharge	24.12	ft ³ /s

Results

Normal Depth	0.76	ft
Flow Area	1.09	ft ²
Wetted Perimeter	2.66	ft
Hydraulic Radius	0.41	ft
Top Width	1.94	ft
Critical Depth	1.74	ft
Percent Full	38.0	%
Critical Slope	0.01038	ft/ft
Velocity	22.04	ft/s
Velocity Head	7.55	ft
Specific Energy	8.31	ft
Froude Number	5.18	
Maximum Discharge	84.78	ft ³ /s
Discharge Full	78.82	ft ³ /s
Slope Full	0.01137	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	37.97	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe SEV-S2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.26040	ft/ft
Diameter	24.00	in
Discharge	12.76	ft ³ /s

Results

Normal Depth	0.45	ft
Flow Area	0.53	ft ²
Wetted Perimeter	1.97	ft
Hydraulic Radius	0.27	ft
Top Width	1.67	ft
Critical Depth	1.28	ft
Percent Full	22.4	%
Critical Slope	0.00575	ft/ft
Velocity	24.19	ft/s
Velocity Head	9.10	ft
Specific Energy	9.55	ft
Froude Number	7.59	
Maximum Discharge	124.17	ft ³ /s
Discharge Full	115.43	ft ³ /s
Slope Full	0.00318	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	22.45	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe SEV-S3

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.19310	ft/ft
Diameter	18.00	in
Discharge	4.49	ft ³ /s

Results

Normal Depth	0.32	ft
Flow Area	0.27	ft ²
Wetted Perimeter	1.43	ft
Hydraulic Radius	0.19	ft
Top Width	1.22	ft
Critical Depth	0.81	ft
Percent Full	21.1	%
Critical Slope	0.00558	ft/ft
Velocity	16.57	ft/s
Velocity Head	4.27	ft
Specific Energy	4.58	ft
Froude Number	6.21	
Maximum Discharge	49.65	ft ³ /s
Discharge Full	46.16	ft ³ /s
Slope Full	0.00183	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	21.07	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe EXISTING North Side Severance at F.A.

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	18.00	in
Discharge	1.24	ft ³ /s

Results

Normal Depth	0.35	ft
Flow Area	0.31	ft ²
Wetted Perimeter	1.51	ft
Hydraulic Radius	0.21	ft
Top Width	1.27	ft
Critical Depth	0.42	ft
Percent Full	23.2	%
Critical Slope	0.00491	ft/ft
Velocity	3.99	ft/s
Velocity Head	0.25	ft
Specific Energy	0.60	ft
Froude Number	1.42	
Maximum Discharge	11.30	ft ³ /s
Discharge Full	10.50	ft ³ /s
Slope Full	0.00014	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	23.21	%
Downstream Velocity	Infinity	ft/s

B.4 Deer Springs Collection System

B.4.1 Street Capacity Calculations

B.4.2 Deer Springs Lateral WSPG Model

B.4.3 Lateral Calculations

Worksheet for Deer Springs Street Section

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.03530 ft/ft
Discharge 136.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.66
0+08.00	0.50
0+08.50	0.48
0+08.58	0.00
0+10.00	0.13
0+40.00	0.73
0+70.00	0.13
0+71.42	0.00
0+71.50	0.48
0+72.00	0.50
0+80.00	0.66

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.66)	(0+80.00, 0.66)	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 0.69 ft
Elevation Range 0.00 to 0.73 ft

Worksheet for Deer Springs Street Section

Results

Flow Area	19.46	ft ²
Wetted Perimeter	76.87	ft
Hydraulic Radius	0.25	ft
Top Width	75.97	ft
Normal Depth	0.69	ft
Critical Depth	0.90	ft
Critical Slope	0.00498	ft/ft
Velocity	6.99	ft/s
Velocity Head	0.76	ft
Specific Energy	1.45	ft
Froude Number	2.43	
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	0.69	ft
Critical Depth	0.90	ft
Channel Slope	0.03530	ft/ft
Critical Slope	0.00498	ft/ft

Cross Section for Deer Springs Street Section

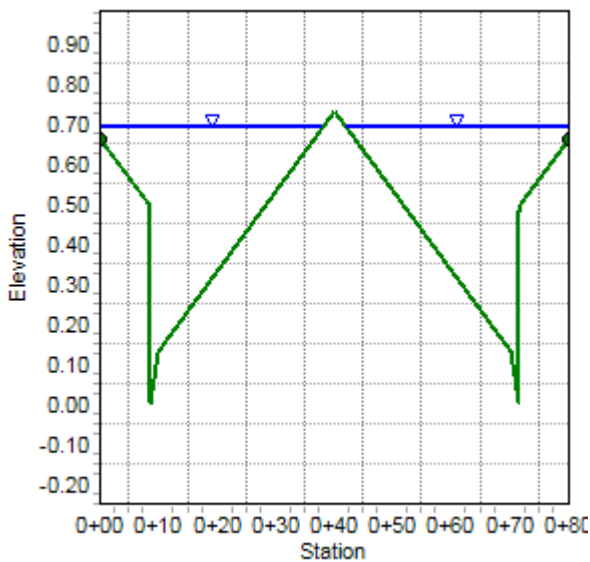
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03530	ft/ft
Normal Depth	0.69	ft
Discharge	136.00	ft ³ /s

Cross Section Image



Worksheet for Deer Springs North Half Street Section

Project Description

Friction Method Manning Formula
Solve For Discharge

Input Data

Channel Slope 0.03500 ft/ft
Normal Depth 0.73 ft
Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.80
0+15.00	0.50
0+15.01	0.00
0+16.50	0.13
0+46.50	0.73

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.80)	(0+46.50, 0.73)	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

Discharge 80.14 ft³/s
Elevation Range 0.00 to 0.80 ft
Flow Area 11.32 ft²
Wetted Perimeter 43.50 ft
Hydraulic Radius 0.26 ft
Top Width 43.00 ft
Normal Depth 0.73 ft
Critical Depth 0.94 ft

Worksheet for Deer Springs North Half Street Section

Results

Critical Slope	0.00498	ft/ft
Velocity	7.08	ft/s
Velocity Head	0.78	ft
Specific Energy	1.51	ft
Froude Number	2.43	
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	0.73	ft
Critical Depth	0.94	ft
Channel Slope	0.03500	ft/ft
Critical Slope	0.00498	ft/ft

Cross Section for Deer Springs North Half Street Section

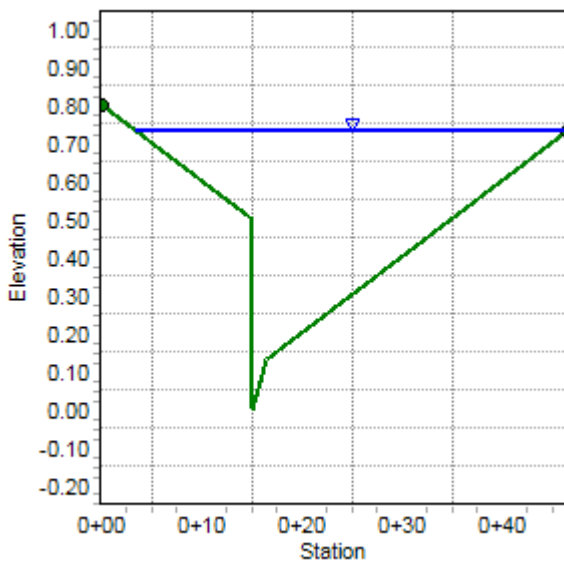
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.03500	ft/ft
Normal Depth	0.73	ft
Discharge	80.14	ft ³ /s

Cross Section Image



Worksheet for SH_Deer Springs Ex 36" RCP

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.03380	ft/ft
Diameter	3.00	ft
Discharge	58.00	ft ³ /s

Results

Normal Depth	1.45	ft
Flow Area	3.39	ft ²
Wetted Perimeter	4.62	ft
Hydraulic Radius	0.73	ft
Top Width	3.00	ft
Critical Depth	2.47	ft
Percent Full	48.4	%
Critical Slope	0.00753	ft/ft
Velocity	17.11	ft/s
Velocity Head	4.55	ft
Specific Energy	6.00	ft
Froude Number	2.84	
Maximum Discharge	131.90	ft ³ /s
Discharge Full	122.62	ft ³ /s
Slope Full	0.00756	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	48.41	%
Downstream Velocity	Infinity	ft/s

T3 FKR 05/09/2013, Checked By:JSD 05/09/2013

[illegible]

Program Package Serial Number: 1455

WATER SURFACE PROFILE LISTING

Date: 5- 9-2013 Time: 1:36: 8

Ranch-Fort Apache Storm Drain Project

Deer Springs Lateral

FKR 05/09/2013, Checked By:JSD 05/09/2013

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height | Base Wt | | No Wth
        | Elev  | (FT)  | Elev  | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|
7000.000 | 2634.310 | 2.438 | 2636.749 | 224.00 | 22.97 | 8.19 | 2644.94 | .00 | 4.60 | 4.00 | 4.000 | 4.000 | .00 | 0 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
23.810 | .0223 | | | | | .0368 | .88 | 2.44 | 2.59 | 2.93 | .013 | .00 | .00 | RECTANG
7023.810 | 2634.840 | 2.381 | 2637.221 | 224.00 | 23.52 | 8.59 | 2645.81 | .00 | 4.60 | 4.00 | 4.000 | 4.000 | .00 | 0 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
5.841 | .0879 | | | | | .0369 | .22 | 2.38 | 2.69 | 1.74 | .013 | .00 | .00 | RECTANG
7029.651 | 2635.354 | 2.430 | 2637.783 | 224.00 | 23.05 | 8.25 | 2646.03 | .00 | 4.60 | 4.00 | 4.000 | 4.000 | .00 | 0 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
11.679 | .0879 | | | | | .0338 | .40 | 2.43 | 2.61 | 1.74 | .013 | .00 | .00 | RECTANG
7041.330 | 2636.380 | 2.548 | 2638.928 | 224.00 | 21.97 | 7.50 | 2646.43 | 2.00 | 4.60 | 4.00 | 4.000 | 4.000 | .00 | 0 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
3.341 | .0879 | | | | | .0311 | .10 | 4.55 | 2.43 | 1.74 | .013 | .00 | .00 | RECTANG
7044.671 | 2636.674 | 2.588 | 2639.261 | 224.00 | 21.64 | 7.27 | 2646.53 | 1.94 | 4.60 | 4.00 | 4.000 | 4.000 | .00 | 0 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
9.037 | .0879 | | | | | .0288 | .26 | 4.53 | 2.37 | 1.74 | .013 | .00 | .00 | RECTANG
7053.708 | 2637.469 | 2.714 | 2640.182 | 224.00 | 20.63 | 6.61 | 2646.79 | 1.76 | 4.60 | 4.00 | 4.000 | 4.000 | .00 | 0 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
7.498 | .0879 | | | | | .0255 | .19 | 4.48 | 2.21 | 1.74 | .013 | .00 | .00 | RECTANG
7061.206 | 2638.128 | 2.846 | 2640.974 | 224.00 | 19.67 | 6.01 | 2646.98 | 1.60 | 4.60 | 4.00 | 4.000 | 4.000 | .00 | 0 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
6.230 | .0879 | | | | | .0225 | .14 | 4.45 | 2.06 | 1.74 | .013 | .00 | .00 | RECTANG
7067.436 | 2638.676 | 2.985 | 2641.661 | 224.00 | 18.76 | 5.46 | 2647.13 | 1.46 | 4.60 | 4.00 | 4.000 | 4.000 | .00 | 0 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
5.164 | .0879 | | | | | .0200 | .10 | 4.44 | 1.91 | 1.74 | .013 | .00 | .00 | RECTANG
7072.600 | 2639.130 | 3.131 | 2642.261 | 224.00 | 17.89 | 4.97 | 2647.23 | .00 | 4.60 | 4.00 | 4.000 | 4.000 | .00 | 0 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
JUNCT STR | .0305 | | | | | .0193 | .44 | 4.45 | 1.78 | .013 | .00 | .00 | .00 | RECTANG

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Program Package Serial Number: 1455

WATER SURFACE PROFILE LISTING

Date: 5- 9-2013 Time: 1:36: 8

Ranch-Fort Apache Storm Drain Project

Deer Springs Lateral

FKR 05/09/2013, Checked By:JSD 05/09/2013

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
        | Elev  | (FT)  | Elev  | (CFS) | (FPS) | Head | Grd.El. | Elev  | Depth  | Width  | Dia.-FT | or I.D. | ZL | Prs/Pip
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
***** |***** |***** |***** |***** |***** |***** |***** |***** |***** |***** |***** |***** |***** |***** |*****
7095.330 | 2639.822 | 2.983 | 2642.805 | 217.00 | 18.19 | 5.14 | 2647.94 | .00 | 4.50 | 4.00 | 4.000 | 4.000 | .00 | 0 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
JUNCT STR .0304 | | | | | .0205 | .07 | 2.98 | 1.86 | | | .013 | .00 | .00 | RECTANG
7098.520 | 2639.919 | 2.885 | 2642.804 | 214.00 | 18.54 | 5.34 | 2648.14 | .00 | 4.46 | 4.00 | 4.000 | 4.000 | .00 | 0 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
JUNCT STR .0304 | | | | | .0251 | .67 | 2.89 | 1.92 | | | .013 | .00 | .00 | RECTANG
7125.050 | 2640.726 | 2.367 | 2643.093 | 195.00 | 20.60 | 6.59 | 2649.68 | .00 | 4.19 | 4.00 | 4.000 | 4.000 | .00 | 0 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
JUNCT STR .0304 | | | | | .0311 | 1.50 | 2.37 | 2.36 | | | .013 | .00 | .00 | RECTANG
7173.320 | 2642.195 | 2.203 | 2644.398 | 189.00 | 21.45 | 7.15 | 2651.54 | .00 | 4.11 | 4.00 | 4.000 | 4.000 | .00 | 0 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
58.680 | .0304 | | | | .0338 | 1.98 | 2.20 | 2.55 | 2.27 | .013 | .00 | .00 | RECTANG
7232.000 | 2643.980 | 2.167 | 2646.147 | 189.00 | 21.80 | 7.38 | 2653.53 | .00 | 4.11 | 4.00 | 4.000 | 4.000 | .00 | 0 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
JUNCT STR .0195 | | | | | .0369 | .19 | 2.17 | 2.61 | | | .013 | .00 | .00 | RECTANG
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
----- WARNING - Junction Analysis - Change in Channel Type -----
7237.120 | 2644.080 | 2.244 | 2646.324 | 172.00 | 23.70 | 8.72 | 2655.05 | .00 | 3.74 | 3.97 | 4.000 | .000 | .00 | 1 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
29.009 | .0596 | | | | .0371 | 1.08 | 2.24 | 3.09 | 1.98 | .013 | .00 | .00 | PIPE
7266.128 | 2645.809 | 2.326 | 2648.135 | 172.00 | 22.68 | 7.99 | 2656.13 | .00 | 3.74 | 3.95 | 4.000 | .000 | .00 | 1 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
23.750 | .0596 | | | | .0330 | .78 | 2.33 | 2.88 | 1.98 | .013 | .00 | .00 | PIPE
7289.878 | 2647.224 | 2.420 | 2649.644 | 172.00 | 21.63 | 7.26 | 2656.91 | .00 | 3.74 | 3.91 | 4.000 | .000 | .00 | 1 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
18.428 | .0596 | | | | .0292 | .54 | 2.42 | 2.67 | 1.98 | .013 | .00 | .00 | PIPE

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Program Package Serial Number: 1455

WATER SURFACE PROFILE LISTING

Date: 5- 9-2013 Time: 1:36: 8

Ranch-Fort Apache Storm Drain Project

Deer Springs Lateral

FKR 05/09/2013, Checked By:JSD 05/09/2013

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height | Base Wt | | No Wth
        | Elev  | (FT)  | Elev  | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
***** |***** |***** |***** |***** |***** |***** |***** |***** |***** |***** |***** |***** |***** |***** |*****
7308.306 | 2648.322 | 2.520 | 2650.842 | 172.00 | 20.62 | 6.60 | 2657.45 | .00 | 3.74 | 3.86 | 4.000 | .000 | .00 | 1 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
        14.663 | .0596 | | | | | .0259 | .38 | 2.52 | 2.47 | 1.98 | .013 | .00 | .00 | PIPE
7322.969 | 2649.196 | 2.626 | 2651.822 | 172.00 | 19.66 | 6.00 | 2657.82 | .00 | 3.74 | 3.80 | 4.000 | .000 | .00 | 1 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
        11.798 | .0596 | | | | | .0230 | .27 | 2.63 | 2.28 | 1.98 | .013 | .00 | .00 | PIPE
7334.767 | 2649.899 | 2.740 | 2652.639 | 172.00 | 18.75 | 5.46 | 2658.10 | .00 | 3.74 | 3.72 | 4.000 | .000 | .00 | 1 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
        9.568 | .0596 | | | | | .0205 | .20 | 2.74 | 2.10 | 1.98 | .013 | .00 | .00 | PIPE
7344.335 | 2650.469 | 2.862 | 2653.331 | 172.00 | 17.87 | 4.96 | 2658.29 | .00 | 3.74 | 3.61 | 4.000 | .000 | .00 | 1 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
        7.729 | .0596 | | | | | .0183 | .14 | 2.86 | 1.93 | 1.98 | .013 | .00 | .00 | PIPE
7352.064 | 2650.930 | 2.994 | 2653.924 | 172.00 | 17.04 | 4.51 | 2658.43 | .00 | 3.74 | 3.47 | 4.000 | .000 | .00 | 1 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
        6.119 | .0596 | | | | | .0164 | .10 | 2.99 | 1.76 | 1.98 | .013 | .00 | .00 | PIPE
7358.183 | 2651.295 | 3.140 | 2654.435 | 172.00 | 16.25 | 4.10 | 2658.53 | .00 | 3.74 | 3.29 | 4.000 | .000 | .00 | 1 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
        4.689 | .0596 | | | | | .0149 | .07 | 3.14 | 1.60 | 1.98 | .013 | .00 | .00 | PIPE
7362.872 | 2651.574 | 3.303 | 2654.877 | 172.00 | 15.49 | 3.73 | 2658.60 | .00 | 3.74 | 3.03 | 4.000 | .000 | .00 | 1 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
        3.235 | .0596 | | | | | .0136 | .04 | 3.30 | 1.43 | 1.98 | .013 | .00 | .00 | PIPE
7366.106 | 2651.767 | 3.493 | 2655.260 | 172.00 | 14.77 | 3.39 | 2658.65 | .00 | 3.74 | 2.66 | 4.000 | .000 | .00 | 1 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
        1.394 | .0596 | | | | | .0127 | .02 | 3.49 | 1.24 | 1.98 | .013 | .00 | .00 | PIPE
7367.500 | 2651.850 | 3.737 | 2655.587 | 172.00 | 14.08 | 3.08 | 2658.67 | .00 | 3.74 | 1.98 | 4.000 | .000 | .00 | 1 .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
JUNCT STR | .0199 | | | | | .0133 | .07 | 3.74 | 1.00 | .013 | .00 | .00 | PIPE

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----- WARNING - Junction Analysis - Change in Channel Type -----

Program Package Serial Number: 1455

WATER SURFACE PROFILE LISTING

Date: 5- 9-2013 Time: 1:36: 8

Ranch-Fort Apache Storm Drain Project

Deer Springs Lateral

FKR 05/09/2013, Checked By:JSD 05/09/2013

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt I.D.	ZL	No Prs/Pip	Wth
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type	Ch
7372.520	2651.950	5.083	2657.033	147.00	12.40	2.39	2659.42	.00	2.99	.00			9	0	.0
18.328	.0370					.0133	.24	5.08	.00	1.756	.013			IR-COV	
7390.848	2652.628	4.647	2657.275	147.00	12.40	2.39	2659.66	.00	2.99	.00			9	0	.0
HYDRAULIC JUMP															
7390.848	2652.628	1.968	2654.597	147.00	18.93	5.56	2660.16	.00	2.99	4.73			9	0	.0
15.133	.0370					.0247	.37	1.97	2.60	1.756	.013			IR-COV	
7405.981	2653.189	2.001	2655.190	147.00	18.55	5.34	2660.53	.00	2.99	4.67			9	0	.0
28.125	.0370					.0227	.64	2.00	2.51	1.756	.013			IR-COV	
7434.106	2654.230	2.085	2656.315	147.00	17.69	4.86	2661.17	.00	2.99	4.54			9	0	.0
20.862	.0370					.0202	.42	2.09	2.30	1.756	.013			IR-COV	
7454.968	2655.002	2.176	2657.178	147.00	16.86	4.42	2661.59	.00	2.99	4.40			9	0	.0
15.911	.0370					.0180	.29	2.18	2.11	1.756	.013			IR-COV	
7470.879	2655.592	2.275	2657.867	147.00	16.08	4.01	2661.88	.00	2.99	4.24			9	0	.0
12.337	.0370					.0161	.20	2.28	1.93	1.756	.013			IR-COV	
7483.216	2656.048	2.382	2658.430	147.00	15.33	3.65	2662.08	.00	2.99	4.03			9	0	.0
9.400	.0370					.0145	.14	2.38	1.75	1.756	.013			IR-COV	

Program Package Serial Number: 1455

WATER SURFACE PROFILE LISTING

Date: 5- 9-2013 Time: 1:36: 8

Ranch-Fort Apache Storm Drain Project

Deer Springs Lateral

FKR 05/09/2013, Checked By:JSD 05/09/2013

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
        | Elev  | (FT)  | Elev  | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip
L/Elem | Ch Slope |          |          |          |          | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****
7492.616 2656.396 | 2.502 | 2658.898 | 147.00 | 14.62 | 3.32 | 2662.22 | .00 | 2.99 | 3.78 | | | 9 | 0 .0
        -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
        6.964 .0370 | | | | | | .0131 | .09 | 2.50 | 1.58 | 1.756 | .013 | | | IR-COV
7499.580 2656.654 | 2.637 | 2659.291 | 147.00 | 13.94 | 3.02 | 2662.31 | .00 | 2.99 | 3.50 | | | 9 | 0 .0
        -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
        4.717 .0370 | | | | | | .0120 | .06 | 2.64 | 1.42 | 1.756 | .013 | | | IR-COV
7504.297 2656.829 | 2.793 | 2659.622 | 147.00 | 13.29 | 2.74 | 2662.36 | .00 | 2.99 | 3.06 | | | 9 | 0 .0
        -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
        1.923 .0370 | | | | | | .0112 | .02 | 2.79 | 1.23 | 1.756 | .013 | | | IR-COV
7506.220 2656.900 | 2.994 | 2659.894 | 147.00 | 12.67 | 2.49 | 2662.39 | .00 | 2.99 | 2.33 | | | 9 | 0 .0
        -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
JUNCT STR .0200 | | | | | | .0095 | .05 | 2.99 | 1.00 | .013 | | | IR-COV
        ----- WARNING - Junction Analysis - Irregular Channel -----
7511.220 2657.000 | 4.217 | 2661.217 | 124.00 | 10.46 | 1.70 | 2662.92 | .00 | 2.83 | .00 | | | 9 | 0 .0
        -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
        86.360 .0207 | | | | | | .0095 | .82 | 4.22 | .00 | 1.886 | .013 | | | IR-COV
7597.580 2658.790 | 3.244 | 2662.034 | 124.00 | 10.46 | 1.70 | 2663.73 | .00 | 2.83 | .00 | | | 9 | 0 .0
        -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
JUNCT STR .0200 | | | | | | .0021 | .01 | 3.24 | .00 | .013 | | | IR-COV
        ----- WARNING - Junction Analysis - Irregular Channel -----
7602.580 2658.890 | 5.318 | 2664.208 | 58.00 | 8.21 | 1.05 | 2665.25 | .00 | 2.47 | .00 | 3.000 | .000 | .00 | 1 .0
        -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
        47.541 .0338 | | | | | | .0076 | .36 | 5.32 | .00 | 1.45 | .013 | .00 | .00 | PIPE

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Program Package Serial Number: 1455

WATER SURFACE PROFILE LISTING

Date: 5- 9-2013 Time: 1:36: 8

Ranch-Fort Apache Storm Drain Project

Deer Springs Lateral

FKR 05/09/2013, Checked By:JSD 05/09/2013

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*****
| Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
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
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****
|
7650.121 2660.497 4.070 2664.567 58.00 8.21 1.05 2665.61 .00 2.47 .00 3.000 .000 .00 1 .0
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
HYDRAULIC JUMP
|
7650.121 2660.497 1.450 2661.947 58.00 17.14 4.56 2666.51 .00 2.47 3.00 3.000 .000 .00 1 .0
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
2.459 .0338 .0340 .08 1.45 2.84 1.45 .013 .00 .00 PIPE
|
7652.580 2660.580 1.450 2662.030 58.00 17.14 4.56 2666.59 .00 2.47 3.00 3.000 .000 .00 1 .0
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-

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TABLE B4.3.1: DROP INLET DEPTH CALCULATIONS
FORT APACHE STORM DRAIN -- DEER SPRINGS COLLECTION SYSTEM
LBG Project: CCB 1121

By: EPF
Check By: JSD
Date: 4/29/2013

Inlet Name	Station & Offset	Inlet Type	Pipe					Drop Inlet		
			Size d	Area	Slope S	Flow Q	Velocity v	Curb Height CF	Minimum Depth V	Actual Depth D
			(inches)	(sq feet)	(ft/ft)	(cfs)	(ft/s)	(feet)	(feet)	(feet)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
DS-N1	"DS" 312+63.00 31.50' RT	"DM" DROP INLET (L=22')	30	4.91	0.0100	37	7.6	0.83	4.92	7.11
DS-N2	"DS" 311+72.00 31.00' RT	"DM" DROP INLET (L=22')	24	3.14	0.0200	23	7.4	0.83	4.36	5.50
DS-N3	"DS" 310+34.00 31.50' RT	"DM" DROP INLET (L=22')	30	4.91	0.0130	25	5.1	0.83	4.32	5.50
DS-N4	"DS" 307+88.00 31.00' RT	"DM" DROP INLET (L=22')	24	3.14	0.0149	19	6.0	0.83	4.00	7.00
DS-S1	"DS" 312+45.00 31.50' LT	"DM" DROP INLET (L=22')	24	3.14	0.0830	29	9.1	0.83	4.90	4.90
DS-S2	"DS" 308+87.00 31.50' LT	"DM" DROP INLET (L=17')	24	3.14	0.0123	17	5.4	0.83	3.88	7.50
DS-S3	"DS" 308+21.00 31.00' LT	"DM" DROP INLET (L=17')	18	1.77	0.0331	6	3.6	0.83	3.08	6.00

$$V = CF + 0.5 + 1.2 (v^2/2g) + d/\cos(S) \quad \text{Source: CCRFCD HCDDM Equation 801}$$

V = Depth of the catch basin from the pipe invert to the top of the curb in feet

CF = Vertical dimension of the curb face in feet.

v = Average velocity of the flow in the pipe, assuming a full pipe section in feet per second.

d = Diameter of the connector pipe in feet.

S = Slope of the connector pipe

Note: The term 1.2 ($v^2/2g$) includes an entrance loss of 0.2 of the velocity head.

$$v = Q / A$$

Q = Flow intercepted by the drop inlet, in cubic feet per second.

A = Cross sectional area of the pipe, in square feet.

Worksheet for DI DS-N1

Project Description

Solve For Efficiency

Input Data

Discharge	80.00	ft ³ /s
Slope	0.03550	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.09	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Local Depression	0.00	in
Local Depression Width	0.00	ft
Grate Width	1.50	ft
Grate Length	11.00	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	11.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	46.73	%
Intercepted Flow	37.38	ft ³ /s
Bypass Flow	42.62	ft ³ /s
Spread	29.19	ft
Depth	0.69	ft
Flow Area	8.60	ft ²
Gutter Depression	0.10	ft
Total Depression	0.10	ft
Velocity	9.30	ft/s
Splash Over Velocity	97.34	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.37	
Grate Flow Ratio	0.15	
Equivalent Cross Slope	0.03015	ft/ft
Active Grate Length	11.00	ft
Length Factor	0.00	
Total Interception Length	135.67	ft

Worksheet for DI DS-N2

Project Description

Solve For Efficiency

Input Data

Discharge	43.00	ft ³ /s
Slope	0.03760	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.09	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Local Depression	0.00	in
Local Depression Width	0.00	ft
Grate Width	1.50	ft
Grate Length	11.00	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	11.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	54.10	%
Intercepted Flow	23.26	ft ³ /s
Bypass Flow	19.74	ft ³ /s
Spread	22.77	ft
Depth	0.56	ft
Flow Area	5.26	ft ²
Gutter Depression	0.11	ft
Total Depression	0.11	ft
Velocity	8.17	ft/s
Splash Over Velocity	97.34	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.43	
Grate Flow Ratio	0.19	
Equivalent Cross Slope	0.03360	ft/ft
Active Grate Length	11.00	ft
Length Factor	0.00	
Total Interception Length	99.64	ft

Worksheet for DI DS-N3

Project Description

Solve For Efficiency

Input Data

Discharge	48.00	ft ³ /s
Slope	0.03640	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.09	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Local Depression	0.00	in
Local Depression Width	0.00	ft
Grate Width	1.50	ft
Grate Length	11.00	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	11.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	52.99	%
Intercepted Flow	25.44	ft ³ /s
Bypass Flow	22.56	ft ³ /s
Spread	23.91	ft
Depth	0.58	ft
Flow Area	5.79	ft ²
Gutter Depression	0.10	ft
Total Depression	0.10	ft
Velocity	8.29	ft/s
Splash Over Velocity	97.34	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.42	
Grate Flow Ratio	0.18	
Equivalent Cross Slope	0.03255	ft/ft
Active Grate Length	11.00	ft
Length Factor	0.00	
Total Interception Length	105.35	ft

Worksheet for DI DS-N4

Project Description

Solve For Efficiency

Input Data

Discharge	31.00	ft ³ /s
Slope	0.03040	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.09	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Local Depression	0.00	in
Local Depression Width	0.00	ft
Grate Width	1.50	ft
Grate Length	11.00	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	11.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	60.74	%
Intercepted Flow	18.83	ft ³ /s
Bypass Flow	12.17	ft ³ /s
Spread	20.92	ft
Depth	0.52	ft
Flow Area	4.45	ft ²
Gutter Depression	0.10	ft
Total Depression	0.10	ft
Velocity	6.96	ft/s
Splash Over Velocity	97.34	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.50	
Grate Flow Ratio	0.21	
Equivalent Cross Slope	0.03446	ft/ft
Active Grate Length	11.00	ft
Length Factor	0.00	
Total Interception Length	80.27	ft

Worksheet for DI DS-EX-N1

Project Description

Solve For Efficiency

Input Data

Discharge	12.00	ft ³ /s
Slope	0.02100	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.09	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Local Depression	0.00	in
Local Depression Width	0.00	ft
Grate Width	1.50	ft
Grate Length	7.50	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	7.50	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	60.89	%
Intercepted Flow	7.31	ft ³ /s
Bypass Flow	4.69	ft ³ /s
Spread	15.50	ft
Depth	0.42	ft
Flow Area	2.48	ft ²
Gutter Depression	0.11	ft
Total Depression	0.11	ft
Velocity	4.83	ft/s
Splash Over Velocity	27.02	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.45	
Grate Flow Ratio	0.29	
Equivalent Cross Slope	0.04131	ft/ft
Active Grate Length	7.50	ft
Length Factor	0.00	
Total Interception Length	43.25	ft

Worksheet for DI DS-S1

Project Description

Solve For Efficiency

Input Data

Discharge	56.00	ft ³ /s
Slope	0.03560	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.09	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Local Depression	0.00	in
Local Depression Width	0.00	ft
Grate Width	1.50	ft
Grate Length	11.00	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	11.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	51.25	%
Intercepted Flow	28.70	ft ³ /s
Bypass Flow	27.30	ft ³ /s
Spread	25.47	ft
Depth	0.61	ft
Flow Area	6.56	ft ²
Gutter Depression	0.10	ft
Total Depression	0.10	ft
Velocity	8.53	ft/s
Splash Over Velocity	97.34	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.41	
Grate Flow Ratio	0.17	
Equivalent Cross Slope	0.03173	ft/ft
Active Grate Length	11.00	ft
Length Factor	0.00	
Total Interception Length	113.36	ft

Worksheet for DI DS-S2

Project Description

Solve For Efficiency

Input Data

Discharge	27.00	ft ³ /s
Slope	0.01590	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.09	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Local Depression	0.00	in
Local Depression Width	0.00	ft
Grate Width	1.50	ft
Grate Length	8.50	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	11.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	61.93	%
Intercepted Flow	16.72	ft ³ /s
Bypass Flow	10.28	ft ³ /s
Spread	22.47	ft
Depth	0.55	ft
Flow Area	5.13	ft ²
Gutter Depression	0.10	ft
Total Depression	0.10	ft
Velocity	5.27	ft/s
Splash Over Velocity	40.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.48	
Grate Flow Ratio	0.20	
Equivalent Cross Slope	0.03340	ft/ft
Active Grate Length	8.50	ft
Length Factor	0.04	
Total Interception Length	63.54	ft

Worksheet for DI DS-S3

Project Description

Solve For Efficiency

Input Data

Discharge	10.00	ft ³ /s
Slope	0.03290	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.09	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Local Depression	0.00	in
Local Depression Width	0.00	ft
Grate Width	1.50	ft
Grate Length	8.50	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	6.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	64.52	%
Intercepted Flow	6.45	ft ³ /s
Bypass Flow	3.55	ft ³ /s
Spread	13.20	ft
Depth	0.37	ft
Flow Area	1.82	ft ²
Gutter Depression	0.10	ft
Total Depression	0.10	ft
Velocity	5.50	ft/s
Splash Over Velocity	40.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.46	
Grate Flow Ratio	0.34	
Equivalent Cross Slope	0.04342	ft/ft
Active Grate Length	8.50	ft
Length Factor	0.00	
Total Interception Length	44.48	ft

Worksheet for DI DS-EX-S1

Project Description

Solve For Efficiency

Input Data

Discharge	4.00	ft ³ /s
Slope	0.01770	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.09	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Local Depression	0.00	in
Local Depression Width	0.00	ft
Grate Width	1.50	ft
Grate Length	7.50	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	7.50	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	76.94	%
Intercepted Flow	3.08	ft ³ /s
Bypass Flow	0.92	ft ³ /s
Spread	10.26	ft
Depth	0.31	ft
Flow Area	1.13	ft ²
Gutter Depression	0.11	ft
Total Depression	0.11	ft
Velocity	3.54	ft/s
Splash Over Velocity	27.02	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.59	
Grate Flow Ratio	0.44	
Equivalent Cross Slope	0.05106	ft/ft
Active Grate Length	7.50	ft
Length Factor	0.00	
Total Interception Length	22.81	ft

Worksheet for Pipe DS-N1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Diameter	2.50	ft
Discharge	37.38	ft ³ /s

Results

Normal Depth	1.87	ft
Flow Area	3.95	ft ²
Wetted Perimeter	5.23	ft
Hydraulic Radius	0.75	ft
Top Width	2.17	ft
Critical Depth	2.07	ft
Percent Full	75.0	%
Critical Slope	0.00816	ft/ft
Velocity	9.47	ft/s
Velocity Head	1.39	ft
Specific Energy	3.27	ft
Froude Number	1.24	
Maximum Discharge	44.12	ft ³ /s
Discharge Full	41.01	ft ³ /s
Slope Full	0.00831	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	74.97	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe DS-N2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01660	ft/ft
Diameter	2.00	ft
Discharge	23.26	ft ³ /s

Results

Normal Depth	1.35	ft
Flow Area	2.26	ft ²
Wetted Perimeter	3.86	ft
Hydraulic Radius	0.59	ft
Top Width	1.87	ft
Critical Depth	1.71	ft
Percent Full	67.5	%
Critical Slope	0.00984	ft/ft
Velocity	10.30	ft/s
Velocity Head	1.65	ft
Specific Energy	3.00	ft
Froude Number	1.65	
Maximum Discharge	31.35	ft ³ /s
Discharge Full	29.15	ft ³ /s
Slope Full	0.01057	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	67.54	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe DS-N3

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01500	ft/ft
Diameter	2.50	ft
Discharge	25.00	ft ³ /s

Results

Normal Depth	1.25	ft
Flow Area	2.45	ft ²
Wetted Perimeter	3.92	ft
Hydraulic Radius	0.62	ft
Top Width	2.50	ft
Critical Depth	1.70	ft
Percent Full	49.9	%
Critical Slope	0.00569	ft/ft
Velocity	10.22	ft/s
Velocity Head	1.62	ft
Specific Energy	2.87	ft
Froude Number	1.82	
Maximum Discharge	54.04	ft ³ /s
Discharge Full	50.23	ft ³ /s
Slope Full	0.00372	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	49.87	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe DS-N4

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01490	ft/ft
Diameter	2.00	ft
Discharge	19.00	ft ³ /s

Results

Normal Depth	1.22	ft
Flow Area	2.01	ft ²
Wetted Perimeter	3.58	ft
Hydraulic Radius	0.56	ft
Top Width	1.95	ft
Critical Depth	1.57	ft
Percent Full	60.9	%
Critical Slope	0.00769	ft/ft
Velocity	9.48	ft/s
Velocity Head	1.40	ft
Specific Energy	2.61	ft
Froude Number	1.65	
Maximum Discharge	29.70	ft ³ /s
Discharge Full	27.61	ft ³ /s
Slope Full	0.00705	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	60.95	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe DS-EX-N1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.02330	ft/ft
Diameter	1.50	ft
Discharge	7.00	ft ³ /s

Results

Normal Depth	0.69	ft
Flow Area	0.80	ft ²
Wetted Perimeter	2.24	ft
Hydraulic Radius	0.36	ft
Top Width	1.50	ft
Critical Depth	1.02	ft
Percent Full	46.2	%
Critical Slope	0.00676	ft/ft
Velocity	8.77	ft/s
Velocity Head	1.19	ft
Specific Energy	1.89	ft
Froude Number	2.12	
Maximum Discharge	17.25	ft ³ /s
Discharge Full	16.03	ft ³ /s
Slope Full	0.00444	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	46.21	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe DS-S1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.08300	ft/ft
Diameter	2.00	ft
Discharge	28.70	ft ³ /s

Results

Normal Depth	0.93	ft
Flow Area	1.43	ft ²
Wetted Perimeter	3.00	ft
Hydraulic Radius	0.48	ft
Top Width	1.99	ft
Critical Depth	1.84	ft
Percent Full	46.4	%
Critical Slope	0.01397	ft/ft
Velocity	20.09	ft/s
Velocity Head	6.27	ft
Specific Energy	7.20	ft
Froude Number	4.19	
Maximum Discharge	70.10	ft ³ /s
Discharge Full	65.17	ft ³ /s
Slope Full	0.01610	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	46.44	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe DS-S2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01230	ft/ft
Diameter	2.00	ft
Discharge	16.72	ft ³ /s

Results

Normal Depth	1.19	ft
Flow Area	1.96	ft ²
Wetted Perimeter	3.53	ft
Hydraulic Radius	0.55	ft
Top Width	1.96	ft
Critical Depth	1.47	ft
Percent Full	59.7	%
Critical Slope	0.00684	ft/ft
Velocity	8.55	ft/s
Velocity Head	1.14	ft
Specific Energy	2.33	ft
Froude Number	1.51	
Maximum Discharge	26.99	ft ³ /s
Discharge Full	25.09	ft ³ /s
Slope Full	0.00546	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	59.69	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe DS-S3

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.03310	ft/ft
Diameter	1.50	ft
Discharge	6.45	ft ³ /s

Results

Normal Depth	0.60	ft
Flow Area	0.66	ft ²
Wetted Perimeter	2.06	ft
Hydraulic Radius	0.32	ft
Top Width	1.47	ft
Critical Depth	0.98	ft
Percent Full	40.0	%
Critical Slope	0.00646	ft/ft
Velocity	9.76	ft/s
Velocity Head	1.48	ft
Specific Energy	2.08	ft
Froude Number	2.57	
Maximum Discharge	20.56	ft ³ /s
Discharge Full	19.11	ft ³ /s
Slope Full	0.00377	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	40.03	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe DS-EX-S1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.06460	ft/ft
Diameter	1.50	ft
Discharge	3.08	ft ³ /s

Results

Normal Depth	0.34	ft
Flow Area	0.31	ft ²
Wetted Perimeter	1.50	ft
Hydraulic Radius	0.20	ft
Top Width	1.26	ft
Critical Depth	0.67	ft
Percent Full	22.9	%
Critical Slope	0.00515	ft/ft
Velocity	10.07	ft/s
Velocity Head	1.58	ft
Specific Energy	1.92	ft
Froude Number	3.61	
Maximum Discharge	28.72	ft ³ /s
Discharge Full	26.70	ft ³ /s
Slope Full	0.00086	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	22.93	%
Downstream Velocity	Infinity	ft/s

Worksheet for DI DS-EX-S1

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).

B.5 Echelon Point Collection System

B.5.1 Street Capacity Calculations

B.5.2 Echelon Point Lateral WSPG Model

B.5.3 Lateral Calculations

Worksheet for Echelon Point North Half Street Section

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.03000 ft/ft
Discharge 41.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.65
0+26.00	0.13
0+27.42	0.00
0+27.50	0.48
0+28.00	0.50
0+40.00	0.74

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.65)	(0+40.00, 0.74)	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 0.61 ft
Elevation Range 0.00 to 0.74 ft
Flow Area 7.04 ft²
Wetted Perimeter 32.28 ft
Hydraulic Radius 0.22 ft
Top Width 31.86 ft
Normal Depth 0.61 ft

Worksheet for Echelon Point North Half Street Section

Results

Critical Depth	0.77	ft
Critical Slope	0.00556	ft/ft
Velocity	5.82	ft/s
Velocity Head	0.53	ft
Specific Energy	1.14	ft
Froude Number	2.18	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.61	ft
Critical Depth	0.77	ft
Channel Slope	0.03000	ft/ft
Critical Slope	0.00556	ft/ft

Cross Section for Echelon Point North Half Street Section

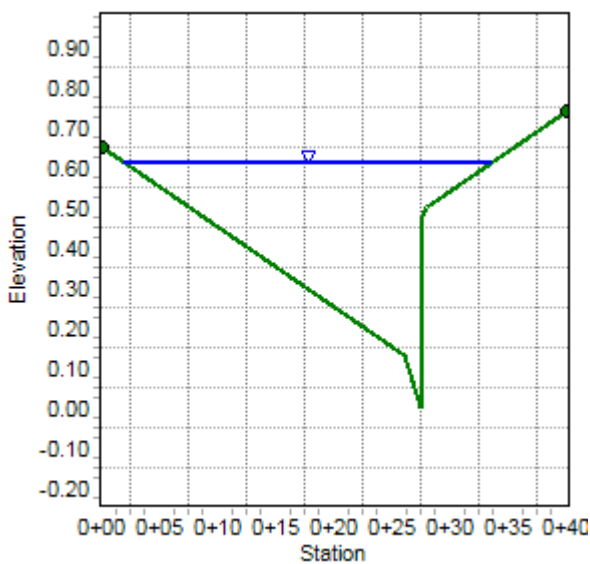
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03000	ft/ft
Normal Depth	0.61	ft
Discharge	41.00	ft ³ /s

Cross Section Image



Worksheet for SH_Echelon Ex 24" RCP

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.04410	ft/ft
Diameter	2.00	ft
Discharge	29.00	ft ³ /s

Results

Normal Depth	1.13	ft
Flow Area	1.83	ft ²
Wetted Perimeter	3.40	ft
Hydraulic Radius	0.54	ft
Top Width	1.98	ft
Critical Depth	1.85	ft
Percent Full	56.4	%
Critical Slope	0.01425	ft/ft
Velocity	15.87	ft/s
Velocity Head	3.91	ft
Specific Energy	5.04	ft
Froude Number	2.91	
Maximum Discharge	51.10	ft ³ /s
Discharge Full	47.50	ft ³ /s
Slope Full	0.01643	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	56.44	%
Downstream Velocity	Infinity	ft/s

T2 Echelon Lateral

SO	8008.1102625.000	1	2628.519
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[illegible]

Program Package Serial Number: 1455

WATER SURFACE PROFILE LISTING

Date: 4-29-2013 Time: 4: 9:57

Ranch-Fort Apache Storm Drain Project

Echelon Lateral

FKR 04/28/2013, Checked By:JSD 04/28/2013

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height | Base Wt | | No Wth
        | Elev   | (FT)  | Elev   | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip
        | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-
L/Elem | Ch Slope |          |          |          |          | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | *****
8008.109 | 2625.000 | 1.705 | 2626.705 | 73.00 | 17.60 | 4.81 | 2631.52 | .00 | 2.70 | 2.97 | 3.000 | .000 | .00 | 1 .0
        | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-
5.370 | .0756 |          |          |          |          | .0302 | .16 | 1.70 | 2.63 | 1.32 | .013 | .00 | .00 | PIPE
        | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-
8013.479 | 2625.406 | 1.748 | 2627.154 | 73.00 | 17.07 | 4.52 | 2631.68 | .00 | 2.70 | 2.96 | 3.000 | .000 | .00 | 1 .0
        | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-
7.058 | .0756 |          |          |          |          | .0273 | .19 | 1.75 | 2.50 | 1.32 | .013 | .00 | .00 | PIPE
        | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-
8020.537 | 2625.939 | 1.819 | 2627.758 | 73.00 | 16.27 | 4.11 | 2631.87 | .00 | 2.70 | 2.93 | 3.000 | .000 | .00 | 1 .0
        | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-
5.821 | .0756 |          |          |          |          | .0242 | .14 | 1.82 | 2.32 | 1.32 | .013 | .00 | .00 | PIPE
        | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-
8026.358 | 2626.379 | 1.894 | 2628.273 | 73.00 | 15.52 | 3.74 | 2632.01 | .00 | 2.70 | 2.89 | 3.000 | .000 | .00 | 1 .0
        | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-
4.805 | .0756 |          |          |          |          | .0215 | .10 | 1.89 | 2.14 | 1.32 | .013 | .00 | .00 | PIPE
        | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-
8031.163 | 2626.742 | 1.974 | 2628.716 | 73.00 | 14.79 | 3.40 | 2632.11 | .00 | 2.70 | 2.85 | 3.000 | .000 | .00 | 1 .0
        | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-
3.947 | .0756 |          |          |          |          | .0191 | .08 | 1.97 | 1.98 | 1.32 | .013 | .00 | .00 | PIPE
        | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-
8035.110 | 2627.040 | 2.060 | 2629.100 | 73.00 | 14.11 | 3.09 | 2632.19 | .00 | 2.70 | 2.78 | 3.000 | .000 | .00 | 1 .0
        | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-
5.000 | .0200 |          |          |          |          | .0179 | .09 | 2.06 | 1.82 | 1.98 | .013 | .00 | .00 | PIPE
        | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-
8040.110 | 2627.140 | 2.064 | 2629.204 | 73.00 | 14.08 | 3.08 | 2632.28 | .00 | 2.70 | 2.78 | 3.000 | .000 | .00 | 1 .0
        | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-
4.096 | .0091 |          |          |          |          | .0181 | .07 | 2.06 | 1.82 | 3.00 | .013 | .00 | .00 | PIPE
        | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-
8044.206 | 2627.177 | 2.048 | 2629.226 | 73.00 | 14.19 | 3.13 | 2632.35 | .00 | 2.70 | 2.79 | 3.000 | .000 | .00 | 1 .0
        | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-
22.308 | .0091 |          |          |          |          | .0194 | .43 | 2.05 | 1.84 | 3.00 | .013 | .00 | .00 | PIPE
        | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-
8066.514 | 2627.381 | 1.964 | 2629.345 | 73.00 | 14.89 | 3.44 | 2632.79 | .00 | 2.70 | 2.85 | 3.000 | .000 | .00 | 1 .0
        | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-   | -|-
20.813 | .0091 |          |          |          |          | .0218 | .45 | 1.96 | 2.00 | 3.00 | .013 | .00 | .00 | PIPE

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Program Package Serial Number: 1455

WATER SURFACE PROFILE LISTING

Date: 4-29-2013 Time: 4: 9:57

Ranch-Fort Apache Storm Drain Project

Echelon Lateral

FKR 04/28/2013, Checked By:JSD 04/28/2013

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt or I.D.	ZL	No Prs/Pip	Wth
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type	Ch
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
8087.327	2627.571	1.884	2629.455	73.00	15.61	3.78	2633.24	.00	2.70	2.90	3.000	.000	.00	1	.0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
19.683	.0091					.0246	.48	1.88	2.17	3.00	.013	.00	.00	PIPE	
8107.010	2627.750	1.810	2629.560	73.00	16.37	4.16	2633.72	.00	2.70	2.94	3.000	.000	.00	1	.0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
JUNCT STR	.0200					.0292	.15	1.81	2.34		.013	.00	.00	PIPE	
8112.010	2627.850	1.515	2629.365	61.00	17.04	4.51	2633.87	.00	2.52	3.00	3.000	.000	.00	1	.0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
16.861	.0424					.0313	.53	1.52	2.75	1.40	.013	.00	.00	PIPE	
8128.871	2628.564	1.545	2630.109	61.00	16.62	4.29	2634.40	.00	2.52	3.00	3.000	.000	.00	1	.0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
23.718	.0424					.0285	.67	1.55	2.65	1.40	.013	.00	.00	PIPE	
8152.589	2629.569	1.605	2631.174	61.00	15.84	3.90	2635.07	.00	2.52	2.99	3.000	.000	.00	1	.0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
16.881	.0424					.0251	.42	1.61	2.46	1.40	.013	.00	.00	PIPE	
8169.470	2630.284	1.668	2631.952	61.00	15.11	3.54	2635.50	.00	2.52	2.98	3.000	.000	.00	1	.0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
12.660	.0424					.0222	.28	1.67	2.29	1.40	.013	.00	.00	PIPE	
8182.130	2630.820	1.735	2632.555	61.00	14.40	3.22	2635.78	.00	2.52	2.96	3.000	.000	.00	1	.0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
JUNCT STR	.0200					.0339	.17	1.73	2.12		.013	.00	.00	PIPE	
8187.130	2630.920	1.982	2632.902	51.00	16.26	4.10	2637.01	.00	1.98	.38	2.000	.000	.00	1	.0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
246.811	.0461					.0461	11.39	1.98	1.00	1.75	.013	.00	.00	PIPE	
8433.940	2642.300	1.956	2644.256	51.00	16.32	4.14	2648.39	.00	1.98	.59	2.000	.000	.00	1	.0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
8433.940	2642.300	1.982	2644.282	51.00	16.26	4.10	2648.39	.00	1.98	.38	2.000	.000	.00	1	.0
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
JUNCT STR	.0200					.0317	.16	1.98	1.00		.013	.00	.00	PIPE	

Program Package Serial Number: 1455

WATER SURFACE PROFILE LISTING

Date: 4-29-2013 Time: 4: 9:57

Ranch-Fort Apache Storm Drain Project

Echelon Lateral

FKR 04/28/2013, Checked By:JSD 04/28/2013

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
        | Elev  | (FT)  | Elev  | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip
L/Elem | Ch Slope | | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****
8438.940 | 2642.400 | 6.833 | 2649.232 | 29.00 | 9.23 | 1.32 | 2650.56 | .00 | 1.85 | .00 | 2.000 | .000 | .00 | 1 | .0
        | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -
130.896 | .0441 | | | | | | .0164 | 2.15 | 6.83 | .00 | 1.13 | .013 | .00 | .00 | PIPE
        | | | | | | | | | | | | | | | |
8569.836 | 2648.168 | 3.228 | 2651.396 | 29.00 | 9.23 | 1.32 | 2652.72 | .00 | 1.85 | .00 | 2.000 | .000 | .00 | 1 | .0
        | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -
HYDRAULIC JUMP
8569.836 | 2648.168 | 1.118 | 2649.286 | 29.00 | 16.06 | 4.01 | 2653.29 | .00 | 1.85 | 1.99 | 2.000 | .000 | .00 | 1 | .0
        | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -
76.274 | .0441 | | | | | | .0467 | 3.56 | 1.12 | 2.97 | 1.13 | .013 | .00 | .00 | PIPE
        | | | | | | | | | | | | | | | |
8646.110 | 2651.530 | 1.100 | 2652.630 | 29.00 | 16.38 | 4.17 | 2656.80 | .00 | 1.85 | 1.99 | 2.000 | .000 | .00 | 1 | .0
        | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -
5.000 | .0200 | | | | | | .0492 | .25 | 1.10 | 3.06 | 1.49 | .013 | .00 | .00 | PIPE
        | | | | | | | | | | | | | | | |
8651.110 | 2651.630 | 1.083 | 2652.712 | 29.00 | 16.71 | 4.33 | 2657.05 | .00 | 1.85 | 1.99 | 2.000 | .000 | .00 | 1 | .0
        | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -
12.924 | .0422 | | | | | | .0514 | .66 | 1.08 | 3.15 | 1.14 | .013 | .00 | .00 | PIPE
        | | | | | | | | | | | | | | | |
8664.034 | 2652.176 | 1.069 | 2653.245 | 29.00 | 16.95 | 4.46 | 2657.71 | .00 | 1.85 | 2.00 | 2.000 | .000 | .00 | 1 | .0
        | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -
29.696 | .0422 | | | | | | .0560 | 1.66 | 1.07 | 3.23 | 1.14 | .013 | .00 | .00 | PIPE
        | | | | | | | | | | | | | | | |
8693.730 | 2653.430 | 1.030 | 2654.460 | 29.00 | 17.78 | 4.91 | 2659.37 | .00 | 1.85 | 2.00 | 2.000 | .000 | .00 | 1 | .0
        | - | - | - | - | - | - | - | - | - | - | - | - | - | - | -

```


TABLE B5.3.1: DROP INLET DEPTH CALCULATIONS
FORT APACHE STORM DRAIN -- ECHELON POINT COLLECTION SYSTEM
LBG Project: CCB 1121

By: EPF
Check By: JSD
Date: 4/29/2013

Inlet Name	Station & Offset	Inlet Type	Pipe					Drop Inlet		
			Size d	Area	Slope S	Flow Q	Velocity v	Curb Height CF	Minimum Depth V	Actual Depth D
			(inches)	(sq feet)	(ft/ft)	(cfs)	(ft/s)	(feet)	(feet)	(feet)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
EP-N1	"EC" 211+05.00 27.50' RT	"DM" DROP INLET (L=22')	24	3.14	0.0081	22	6.9	0.83	4.23	8.18
EP-N2	"EC" 208+45.00 27.50' RT	"DM" DROP INLET (L=22')	18	1.77	0.0700	10	5.7	0.83	3.45	7.80
EP-N3	"EC" 207+70.00 27.50' RT	"DM" DROP INLET (L=12')	18	1.77	0.0260	4	2.3	0.83	2.93	9.50
EP-I1	"EC" 208+25.00 19.30' LT	NDOT TYPE 2 DROP INLET	18	1.77	0.5172	5	2.8	0.00	2.33	4.00
EP-I2	"EC" 206+82.00 25.50' LT	NDOT TYPE 2 DROP INLET	18	1.77	0.2633	3	1.7	0.00	2.10	5.80
EP-S1	"EC" 207+64.00 27.50' LT	"DM" DROP INLET (L=22')	18	1.77	0.1000	8	4.3	0.83	3.19	TBD

$$V = CF + 0.5 + 1.2 (v^2/2g) + d/\cos(S) \quad \text{Source: CCRFCD HCDDM Equation 801}$$

V = Depth of the catch basin from the pipe invert to the top of the curb in feet

CF = Vertical dimension of the curb face in feet.

v = Average velocity of the flow in the pipe, assuming a full pipe section in feet per second.

d = Diameter of the connector pipe in feet.

S = Slope of the connector pipe

Note: The term $1.2 (v^2/2g)$ includes an entrance loss of 0.2 of the velocity head.

$$v = Q / A$$

Q = Flow intercepted by the drop inlet, in cubic feet per second.

A = Cross sectional area of the pipe, in square feet.

Note: Inlet EP-S1 is a future inlet for the Echelon Point Drive south half street improvements.

Worksheet for DI EP-N1

Project Description

Solve For Efficiency

Input Data

Discharge	37.00	ft ³ /s
Slope	0.02920	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.09	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Local Depression	0.00	in
Local Depression Width	0.00	ft
Grate Width	1.50	ft
Grate Length	11.00	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	11.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	58.93	%
Intercepted Flow	21.80	ft ³ /s
Bypass Flow	15.20	ft ³ /s
Spread	22.57	ft
Depth	0.55	ft
Flow Area	5.17	ft ²
Gutter Depression	0.10	ft
Total Depression	0.10	ft
Velocity	7.16	ft/s
Splash Over Velocity	97.34	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.49	
Grate Flow Ratio	0.20	
Equivalent Cross Slope	0.03334	ft/ft
Active Grate Length	11.00	ft
Length Factor	0.00	
Total Interception Length	87.13	ft

Worksheet for DI EP-N2

Project Description

Solve For Efficiency

Input Data

Discharge	15.00	ft ³ /s
Slope	0.03970	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.09	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Local Depression	0.00	in
Local Depression Width	0.00	ft
Grate Width	1.50	ft
Grate Length	11.00	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	11.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	67.48	%
Intercepted Flow	10.12	ft ³ /s
Bypass Flow	4.88	ft ³ /s
Spread	14.94	ft
Depth	0.40	ft
Flow Area	2.31	ft ²
Gutter Depression	0.11	ft
Total Depression	0.11	ft
Velocity	6.49	ft/s
Splash Over Velocity	97.34	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.53	
Grate Flow Ratio	0.30	
Equivalent Cross Slope	0.04124	ft/ft
Active Grate Length	11.00	ft
Length Factor	0.00	
Total Interception Length	57.55	ft

Worksheet for DI EP-N3

Project Description

Solve For Efficiency

Input Data

Discharge	5.00	ft ³ /s
Slope	0.02640	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.09	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Local Depression	0.00	in
Local Depression Width	0.00	ft
Grate Width	1.50	ft
Grate Length	6.00	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	11.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	78.84	%
Intercepted Flow	3.94	ft ³ /s
Bypass Flow	1.06	ft ³ /s
Spread	10.38	ft
Depth	0.31	ft
Flow Area	1.15	ft ²
Gutter Depression	0.10	ft
Total Depression	0.10	ft
Velocity	4.33	ft/s
Splash Over Velocity	15.01	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.37	
Grate Flow Ratio	0.44	
Equivalent Cross Slope	0.04978	ft/ft
Active Grate Length	6.00	ft
Length Factor	0.17	
Total Interception Length	28.67	ft

Worksheet for DI EP-I1

Project Description

Solve For Efficiency

Input Data

Roughness Coefficient	0.020	
Slope	0.02630	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	10.00	ft ³ /s
Grate Width	2.00	ft
Grate Length	1.25	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	0.00	%

Options

Grate Flow Option Exclude None

Results

Efficiency	47.22	%
Intercepted Flow	4.72	ft ³ /s
Bypass Flow	5.28	ft ³ /s
Flow Area	1.79	ft ²
Wetted Perimeter	5.66	ft
Top Width	5.52	ft
Velocity	5.59	ft/s
Splash Over Velocity	6.35	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.00	
Grate Flow Ratio	0.47	
Active Grate Length	1.25	ft
Critical Depth	0.58	ft
Critical Slope	0.00808	ft/ft
Froude Number	1.73	
Flow Type	Supercritical	
Specific Energy	0.91	ft
Velocity Head	0.49	ft
Depth	0.42	ft

Worksheet for DI EP-I2

Project Description

Solve For Efficiency

Input Data

Roughness Coefficient	0.020	
Slope	0.02630	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	5.00	ft ³ /s
Grate Width	2.00	ft
Grate Length	1.25	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	0.00	%

Options

Grate Flow Option Exclude None

Results

Efficiency	53.99	%
Intercepted Flow	2.70	ft ³ /s
Bypass Flow	2.30	ft ³ /s
Flow Area	1.08	ft ²
Wetted Perimeter	4.57	ft
Top Width	4.45	ft
Velocity	4.62	ft/s
Splash Over Velocity	6.35	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.01	
Grate Flow Ratio	0.54	
Active Grate Length	1.25	ft
Critical Depth	0.39	ft
Critical Slope	0.00892	ft/ft
Froude Number	1.65	
Flow Type	Supercritical	
Specific Energy	0.62	ft
Velocity Head	0.33	ft
Depth	0.29	ft

Worksheet for DI EP-S1 (future)

Project Description

Solve For Efficiency

Input Data

Discharge	10.00	ft ³ /s
Slope	0.02630	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.09	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Local Depression	0.00	in
Local Depression Width	0.00	ft
Grate Width	1.50	ft
Grate Length	11.00	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	11.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	75.98	%
Intercepted Flow	7.60	ft ³ /s
Bypass Flow	2.40	ft ³ /s
Spread	13.80	ft
Depth	0.38	ft
Flow Area	1.98	ft ²
Gutter Depression	0.10	ft
Total Depression	0.10	ft
Velocity	5.04	ft/s
Splash Over Velocity	97.34	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.64	
Grate Flow Ratio	0.33	
Equivalent Cross Slope	0.04237	ft/ft
Active Grate Length	11.00	ft
Length Factor	0.00	
Total Interception Length	42.21	ft

Worksheet for Pipe EP-N1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00810	ft/ft
Diameter	2.00	ft
Discharge	21.80	ft ³ /s

Results

Normal Depth	1.82	ft
Flow Area	3.01	ft ²
Wetted Perimeter	5.08	ft
Hydraulic Radius	0.59	ft
Top Width	1.13	ft
Critical Depth	1.67	ft
Percent Full	91.2	%
Critical Slope	0.00901	ft/ft
Velocity	7.25	ft/s
Velocity Head	0.82	ft
Specific Energy	2.64	ft
Froude Number	0.79	
Maximum Discharge	21.90	ft ³ /s
Discharge Full	20.36	ft ³ /s
Slope Full	0.00929	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	91.18	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe EP-N2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.07000	ft/ft
Diameter	1.50	ft
Discharge	10.12	ft ³ /s

Results

Normal Depth	0.63	ft
Flow Area	0.70	ft ²
Wetted Perimeter	2.11	ft
Hydraulic Radius	0.33	ft
Top Width	1.48	ft
Critical Depth	1.23	ft
Percent Full	41.7	%
Critical Slope	0.00933	ft/ft
Velocity	14.49	ft/s
Velocity Head	3.26	ft
Specific Energy	3.89	ft
Froude Number	3.72	
Maximum Discharge	29.89	ft ³ /s
Discharge Full	27.79	ft ³ /s
Slope Full	0.00928	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	41.73	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe EP-N3

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.02600	ft/ft
Diameter	1.50	ft
Discharge	3.94	ft ³ /s

Results

Normal Depth	0.49	ft
Flow Area	0.50	ft ²
Wetted Perimeter	1.83	ft
Hydraulic Radius	0.28	ft
Top Width	1.41	ft
Critical Depth	0.76	ft
Percent Full	32.8	%
Critical Slope	0.00539	ft/ft
Velocity	7.81	ft/s
Velocity Head	0.95	ft
Specific Energy	1.44	ft
Froude Number	2.30	
Maximum Discharge	18.22	ft ³ /s
Discharge Full	16.94	ft ³ /s
Slope Full	0.00141	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	32.80	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe EP-I1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.51720	ft/ft
Diameter	1.50	ft
Discharge	4.72	ft ³ /s

Results

Normal Depth	0.25	ft
Flow Area	0.20	ft ²
Wetted Perimeter	1.27	ft
Hydraulic Radius	0.16	ft
Top Width	1.13	ft
Critical Depth	0.83	ft
Percent Full	16.9	%
Critical Slope	0.00567	ft/ft
Velocity	23.82	ft/s
Velocity Head	8.82	ft
Specific Energy	9.07	ft
Froude Number	10.01	
Maximum Discharge	81.26	ft ³ /s
Discharge Full	75.54	ft ³ /s
Slope Full	0.00202	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	16.94	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe EP-I2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.26330	ft/ft
Diameter	1.50	ft
Discharge	2.70	ft ³ /s

Results

Normal Depth	0.23	ft
Flow Area	0.17	ft ²
Wetted Perimeter	1.20	ft
Hydraulic Radius	0.14	ft
Top Width	1.08	ft
Critical Depth	0.62	ft
Percent Full	15.2	%
Critical Slope	0.00506	ft/ft
Velocity	15.90	ft/s
Velocity Head	3.93	ft
Specific Energy	4.16	ft
Froude Number	7.06	
Maximum Discharge	57.98	ft ³ /s
Discharge Full	53.90	ft ³ /s
Slope Full	0.00066	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	15.22	%
Downstream Velocity	Infinity	ft/s

Worksheet for Pipe EP-S1 (future)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.10000	ft/ft
Diameter	1.50	ft
Discharge	7.60	ft ³ /s

Results

Normal Depth	0.49	ft
Flow Area	0.50	ft ²
Wetted Perimeter	1.82	ft
Hydraulic Radius	0.27	ft
Top Width	1.41	ft
Critical Depth	1.07	ft
Percent Full	32.5	%
Critical Slope	0.00715	ft/ft
Velocity	15.25	ft/s
Velocity Head	3.62	ft
Specific Energy	4.10	ft
Froude Number	4.52	
Maximum Discharge	35.73	ft ³ /s
Discharge Full	33.22	ft ³ /s
Slope Full	0.00524	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	32.51	%
Downstream Velocity	Infinity	ft/s

APPENDIX C
90% DESIGN PLANS

DEPARTMENT OF PUBLIC WORKS

Mayor:
CAROLYN G. GOODMAN

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

City Manager:
ELIZABETH N. FRETWELL

Director of Public Works:
JORGE CERVANTES, P.E., P.T.O.E.

City Engineer:
DAVID N. BOWERS, P.E., P.T.O.E.



RANCHO-FORT APACHE STORM DRAIN

Funded By:
CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT

Reviewed By:

CLV CITY ENGINEER _____ DATE _____

CLV PROJECT MANAGER _____ DATE _____

CLV CITY TRAFFIC ENGINEER	DATE
---------------------------	------

CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT DATE _____

CLARK COUNTY PUBLIC WORKS
DATE

REGIONAL TRANSPORTATION COMMISSION OF SOUTHERN NEVADA	DATE
--	------

SOUTHWEST GAS CORPORATION DATE _____

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

COX COMMUNICATIONS LAS VEGAS, INC.
DATE

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

NV ENERGY – TRANSMISSION	DATE
--------------------------	------

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
DATE: _____ PROJECT# 117002
SHEETS: G-1.4:C-1-6,C-8-10,C-12-15:U-1-6,U-8-21:RC-1-15:LP-1-7

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

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

CLV BID NO. 13.36802

[illegible]

DEPARTMENT OF PUBLIC WORKS

Mayor:
CAROLYN G. GOODMAN

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

City Manager:
ELIZABETH N. FRETWELL

Director of Public Works:
JORGE CERVANTES, P.E., P.T.O.E.

City Engineer:
DAVID N. BOWERS, P.E., P.T.O.E.



RANCHO-FORT APACHE STORM DRAIN

Funded By:
CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT

Reviewed By:

CLV CITY ENGINEER _____ DATE _____

CLV PROJECT MANAGER	DATE
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CLV CITY TRAFFIC ENGINEER	DATE
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CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT DATE _____

CLARK COUNTY PUBLIC WORKS

DATE

REGIONAL TRANSPORTATION COMMISSION
OF SOUTHERN NEVADA

SOUTHWEST GAS CORPORATION _____ DATE _____

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

COX COMMUNICATIONS LAS VEGAS, INC. DATE

NV ENERGY - DISTRIBUTION DATE _____

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

NV ENERGY - TRANSMISSION	DATE
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APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
DATE: _____ PROJECT# 117002
SHEETS: G-1.4-C-1-6.C-8-10.C-12-15:U-1-6.U-8-21:RC-1-15:LP-1-7

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

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

CLV BID NO. 13.36802

90% DESIGN SUBMITTAL 4 / 30 / 2013 - NOT FOR CONSTRUCTION									
DEPARTMENT OF PUBLIC WORKS RANCHO-FORT APACHE STORM DRAIN COVER SHEET 90% DESIGN SUBMITTAL 4/30/2013 NOT FOR CONSTRUCTION									
PROJECT: G-1 OF 109									
SHEET: 327V150									
CLV DRAWING NO: 327V150									
PROJECT: G-1 OF 109									
SHEET: 327V150									
CLV DRAWING NO: 327V150									
PROJECT: G-1 OF 109									
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PROJECT: G-1 OF 109									
SHEET: 327V150									
CLV DRAWING NO: 327V150									
PROJECT: G-1 OF 109									

RANCHO - FORT APACHE STORM DRAIN

1. ALL CONSTRUCTION SIGNING, BARRICADING, AND TRAFFIC DELINEATION SHALL CONFORM TO THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES", LATEST EDITION.
2. THE STREET SIGN CONTRACTOR SHALL OBTAIN STREET NAMES AND BLOCK NUMBERING FROM THE PLANNING DEPARTMENT PRIOR TO CONSTRUCTION.
3. BEFORE ANY WORK IS STARTED IN THE RIGHT-OF-WAY, THE CONTRACTOR SHALL INSTALL ALL ADVANCE WARNING SIGNS FOR THE CONSTRUCTION ZONE. THE CONTRACTOR SHALL INSTALL TEMPORARY STOP SIGNS AT ALL NEW STREET ENCROACHMENTS INTO EXISTING CITY STREETS WHERE WARRANTED IMMEDIATELY AFTER FIRST GRADING WORK IS ACCOMPLISHED, AND SHALL MAINTAIN SAID SIGNS UNTIL PERMANENT SIGNS ARE INSTALLED.
4. WHEN A DESIGNATED "SUGGESTED ROUTE TO SCHOOL" IS ENCLOSED UPON BY A CONSTRUCTION WORK ZONE AND PUBLIC WORKS STAFF IDENTIFIES A NEED FOR STUDENTS TO BE ASSISTED IN THE SAFE CROSSING THROUGH THAT WORK ZONE, THE CONTRACTOR SHALL BE REQUIRED TO PROVIDE A QUALIFIED "CROSSING GUARD". THE GUARD SHALL BE PRESENT FOR THE FULL DURATION OF TIME THAT CHILDREN ARE LIKELY TO BE PRESENT.
5. IF THE IMPROVEMENTS NECESSITATE THE OBLITERATION, TEMPORARY OBSTRUCTION, TEMPORARY REMOVAL OR RELOCATION OF ANY EXISTING TRAFFIC PAVEMENT MARKING, SUCH PAVEMENT MARKING SHALL BE RESTORED OR REPLACED WITH LIKE MATERIALS TO THE SATISFACTION OF THE CITY TRAFFIC ENGINEER.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AND INSTALLING ALL PERMANENT SIGNS SHOWN ON THE PLANS. ALL NEW TRAFFIC SIGNS SHALL BE FABRICATED WITH DIAMOND GRADE, VIP CLASS 6 REFLECTIVE SHEETING OR APPROVED EQUAL OR NEW TRAFFIC SIGN, EXCEPT STOP PLATE AND SCHOOL SPEED LIMIT SIGNS, SHALL HAVE 3M SERIES 1160 OR APPROVED EQUIVALENT ANTI-GRAFFITI PROTECTIVE OVERLAY FILM; SCHOOL ZONE SIGNS SHALL HAVE 3M SERIES 1150 ANTI-GRAFFITI PROTECTIVE OVERLAY FILM. STREET NAME SIGNS SHALL CONFORM IN THEIR ENTIRETY TO CURRENT CITY STANDARDS. ALL OTHER SIGNS SHALL BE STANDARD SIZE UNLESS OTHERWISE SPECIFIED ON THE PLANS. ALL SIGN POSTS SHALL BE INSTALLED IN ACCORDANCE WITH THE CURRENT CITY STANDARDS.
7. WHEN A PROPOSED STREET LIGHT STANDARD IS LOCATED WITHIN FIVE (5') FEET OF ANY PROPOSED SIGN SHOWN ON THE PLANS TO BE MOUNTED ON A SIGNPOST, THE SIGN SHALL BE MOUNTED ON THE STREET LIGHT STANDARD AND THE SIGNPOST SHALL BE ELIMINATED.
8. ALL PERMANENT TRAFFIC CONTROL DEVICES CALLED FOR HEREON SHALL BE IN PLACE AND IN FINAL POSITION PRIOR TO ALLOWING ANY PUBLIC TRAFFIC ONTO THE PORTIONS OF THE ROAD(S) BEING IMPROVED HERE UNDER, REGARDLESS OF THE STATUS OF COMPLETION OF PAVING OR OTHER OFF-SITE IMPROVEMENTS CALLED FOR BY THESE PLANS.
9. STREET SIGNS AND STOP SIGNS SHALL BE INSTALLED PER CITY STANDARD SPECIFICATIONS FOR PLACEMENT OF STREET NAME SIGNS.
10. THE CONTRACTOR SHALL PROVIDE ALL NECESSARY TRAFFIC CONTROL DEVICES AND FLAGGERS TO INSURE THE SAFETY OF THE PUBLIC IN OR AROUND THE WORK AREA. THE CONTRACTOR SHALL HAVE A CERTIFIED ATSSA TRAFFIC CONTROL TECHNICIAN OR IMSA WORK ZONE SAFETY SPECIALIST SET UP, MAINTAIN AND/OR REMOVE ALL TRAFFIC CONTROL DEVICES IN THE CITY OF LAS VEGAS RIGHT OF WAY.
11. WORK IN PUBLIC STREETS, ONCE BEGUN, SHALL BE EXPEDITED TO COMPLETION SO AS TO PROVIDE MINIMUM INCONVENIENCE TO ADJACENT PROPERTY OWNERS AND TO THE TRAVELING PUBLIC.
12. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING CITIZENS AREA TRANSIT (C.A.T.) IF THE CONSTRUCTION INTERRUPTS OR RELOCATES A BUS STOP OR HAS AN ADVERSE EFFECT ON BUS SERVICE ON THAT STREET TO ARRANGE FOR TEMPORARY RELOCATION OF STOP.
13. GUARDS SHALL BE OBTAINED BY CONTACTING THE METROPOLITAN POLICE DEPARTMENT SPECIAL EVENTS UNIT (PHONE # 828-3442) WHO WILL PROVIDE OFFICERS PROPERLY TRAINED IN TRAFFIC CONTROL. FEES FOR THE USE OF THESE OFFICERS SHALL BE SET BY METRO AND WILL BE PAID BY THE CONTRACTOR. THE CONTRACTOR IS RESPONSIBLE FOR ALL ARRANGEMENTS WITH METRO.
14. ANY WORK WITHIN 300' OF A SIGNALIZED INTERSECTION WILL BE NIGHT WORK, UNLESS DIRECTED BY THE CITY OF LAS VEGAS TRAFFIC ENGINEER.
15. THE CONTRACTOR SHALL CONTACT THE TRAFFIC ENGINEERING DIVISION (TRANSPORTATION SECTION) THROUGH THE PROJECT'S OFFSITE INSPECTOR PRIOR TO INITIATING PAVING TO RECEIVE DIRECTION FOR ANY PERMANENT OR TEMPORARY MODIFICATIONS TO THE APPROVED DRAWINGS REGARDING FINAL PAVEMENT TRANSITIONS, MARKINGS AND SIGNING THAT ARE REQUIRED TO MATCH ADJACENT ROADWAY SEGMENTS. THE CONTRACTOR SHALL PROVIDE A DRAWING FOR APPROVAL BY THE TRAFFIC ENGINEERING DIVISION DEPICTING ANY ADJUSTMENTS TO THE FINAL PAVEMENT MARKINGS AND SIGNAGE, WHICH MAY INCLUDE OMITTING, ADDING OR MODIFYING PAVEMENT MARKINGS AND TRAFFIC CONTROL SIGNS SUCH THAT ADEQUATE TRANSITIONS AND LANE TERMINATIONS BETWEEN ADJACENT ROADWAY SEGMENTS ARE CONSTRUCTED.

CITY OF LAS VEGAS TRAFFIC SIGNAL NOTES

- | | |
|--------------------------|----------------|
| CALL-BEFORE-YOU-OVERHEAD | 1-702-593-6111 |
| CALL-BEFORE-YOU-DIG | 1-800-227-2600 |
| STREETLIGHTS | 1-702-229-6331 |
| F.A.S.T. | 1-702-432-5300 |

- CHECK CONDUIT AND CABLE SCHEDULE FOR CONDUIT, CABLE AND WIRE SIZE. VERIFY ALL EXISTING CONDUIT RUNS.
1. ALL PULLBOXES SHALL BE IN ACCORDANCE WITH UNIFORM STANDARD DRAWINGS NO. 404.110, NO. 404.120 AND NO. 404.130.
0. TRAFFIC SIGNAL CABLE SHALL BE 15 OR 25 CONDUCTOR #14 AWG SOLID (TYPICAL) CABLE AND SHALL CONFORM TO IMSA SPEC. NO. 20-1.
1. PEDESTRIAN PUSH BUTTONS SHALL BE AUDIBLE TACTILE POLARA NAVIGATOR TYPE (2 WIRE SYSTEM) OR CAMPBELL COMPANY ADVANCED ACCESSIBLE PEDESTRIAN SYSTEM PART NUMBERS AAP8 APB912 (BUTTONS) WITH AAP8 APC (CONTROLLER) IN ACCORDANCE WITH CITY OF LAS VEGAS SPECIAL PROVISIONS AND SECTION 623 OF THE COMP. U.S. SPEC. BUTTON SIGNS SHALL BE R10-12 PER MUTCD 2009 EDITION, WITH FULL MOUNTING BRACKETS, AND AS MODIFIED BY THE MANUFACTURER TO FIT ON A 9'X12' SIGN. ALL PUSH BUTTONS TO BE MOUNTED 42" ABOVE SIDEWALK. THE MAXIMUM HORIZONTAL REACH DISTANCE IS TO BE 24". SIDEWALK RAMPS WILL BE ACCORDING TO U.S.D. NO. 235 (1-4) LATEST EDITION.
2. THE ROUTING AND TERMINATION OF CONDUITS AND THE PLACING OF POLES AND CABINETS SHALL BE NOTIFIED ON THE PLANS. ALL CHANGES SHALL BE APPROVED BY THE ENGINEER.
3. MAST ARM R10-12 SIGNS TO BE ADJACENT (NO GAP) TO THE M-5 SIGNAL HEAD.
4. INSTALL TYPE VII CABINET. THIS IS COMMONLY REFERRED TO AS AN R CABINET. THE CABINET SHALL CONFORM TO THE UNIFORM STANDARD DRAWINGS SPECIFICATIONS AND SPECIAL PROVISIONS, CLARK COUNTY AREA, NEVADA. INSTALL CABINET NEAR THE R.O.W. LINE OR AS SHOWN ON THE DRAWINGS.
5. THE CONTRACTOR SHALL SUPPLY A 2070N OR M53 CONTROLLER TO THE CITY OF LAS VEGAS TRAFFIC SIGNAL REPAIR SHOP, FOURTEEN DAYS PRIOR TO THE SIGNAL TURN-ON, FOR TESTING PURPOSES. THE CONTRACTOR SHALL DELIVER THE CONTROLLER TO, AND PICKUP THE CONTROLLER AT 2801 E. CHARLESTON BLVD. CONTRACTOR SHALL NOTIFY THE TRAFFIC SIGNAL REPAIR SHOP (292-6075) SEVEN DAYS PRIOR TO PICK UP ALL 2070N OR M53 CONTROLLERS MUST BE COMPATIBLE WITH AND FUNCTION PROPERLY WITH OS9 1996 OPERATION SYSTEM; THE LATEST REVISION OF THE NEXT PHASE INTERSECTION MANAGEMENT SOFTWARE (SIEMENS) AND THE ICONS (SIEMENS) GENERAL SOFTWARE.
6. CONTRACTOR SHALL POTHOLE SIGNAL POLE LOCATIONS PRIOR TO ORDERING OF POLES.

- REVISÉ JANUARY 26, 2010

REVISED FEBRUARY 10, 2010

REVISED JANUARY 2008

RANCHO-FORT APACHE

CHO-FORT AP

UTILITY NOTES

SHEET TITLE.



THE Louis Berger Group, INC.
500 E. Amigo Court, Suite 100 Voice: 702-736-6632
Las Vegas, Nevada 89119 Fax: 702-736-0704

THE Louis Berger Group, INC.
500 E. Amigo Court, Suite 100 Voice: 702-736-6632
Las Vegas, Nevada 89119 Fax: 702-736-0704

THE Louis Berger Group, INC.
500 E. Amigo Court, Suite 100 Voice: 702-736-6632
Las Vegas, Nevada 89119 Fax: 702-736-0704

[illegible]

1. ALL WORK SHALL BE DONE IN STRICT ACCORDANCE WITH THE CITY OF LAS VEGAS FIRE DEPARTMENT'S ORDINANCE # 5667, "HYDRANT SPECIFICATIONS", AND "HYDRANT INSTALLATION SPECIFICATION".
2. AUTHORIZED FIRE HYDRANTS FOR THIS PROJECT ARE:
A. KENNEDY – GUARDIAN MODELS K81A AND K81D
B. MUELLER – SUPER CENTURION 250 MODEL A-423
C. CLOW – MEDALLION MODEL F-2546LVD
D. TROY VALVE – PATRIOT MODEL PT8100N NEVADA HYDRANT
E. U.S. PIPE – METROFLOW/M-03
3. ON ANY RESIDENTIAL OR COMMERCIAL INSTALLATIONS FIRE HYDRANTS SHALL BE INSTALLED AND FIRE APPARATUS ACCESS ROADS SHALL BE MAINTAINED BEFORE COMMENCEMENT OF ANY COMBUSTIBLE CONSTRUCTION. ALL FIRE HYDRANTS SHALL BE IN GOOD WORKING ORDER AND SHALL BE CAPABLE OF DELIVERING THE REQUIRED FIRE FLOW.
4. TO IDENTIFY THE FIRE HYDRANT LOCATIONS, CONTRACTOR SHALL PLACE A BLUE REFLECTIVE MARKER AT THE CENTER LINE OF STREET ADJACENT TO THE FIRE HYDRANTS AS REQUIRED BY ORDINANCE # 5667.
5. ALL UNDERGROUND INSPECTIONS, PRESSURE AND FLUSH VERIFICATIONS OF ALL FIRE HYDRANTS AND FIRE LINES, SHALL BE CONDUCTED BEFORE COVERING THE LINES. CALL THE CITY OF LAS VEGAS INSPECTION HOT-LINE AT 229-2071 TO REQUEST AN INSPECTION BY THE CITY OF LAS VEGAS FIRE DEPARTMENT.
6. PAINTING OF THE CURBS AND FIRE HYDRANTS AND ALL OTHER WORK NECESSARY AS REQUIRED BY ORDINANCE # 5667, FOR THE PROTECTION OF FIRE HYDRANTS FROM PHYSICAL DAMAGE, SHALL BE COMPLETED BEFORE APPROVAL BY THE CITY OF LAS VEGAS FIRE DEPARTMENT.
7. A PERMIT IS REQUIRED FROM THE CITY OF LAS VEGAS FIRE DEPARTMENT FOR THE ON-SITE WATER LINES AND FIRE HYDRANTS. THE PERMIT AND CONTRACTOR'S MATERIAL AND TEST CERTIFICATE FOR UNDERGROUND PIPING FORM SHALL BE OBTAINED FROM THE FIRE PROTECTION ENGINEER BEFORE COMMENCEMENT OF WORK.
8. PRIVATE FIRE HYDRANTS SHALL BE PAINTED RED.
9. PRIOR TO THE FINAL OCCUPANCY, A FLOW TEST MUST BE WITNESSED BY THE CITY OF LAS VEGAS FIRE DEPARTMENT TO VERIFY AVAILABILITY OF THE REQUIRED FIRE FLOW.
10. ALL ON-SITE UNDERGROUND WATER MAINS AND MATERIALS SHALL BE U.L. LISTED, A.W.W.A. APPROVED, AND SHALL BE RATED FOR THE APPROPRIATE WORKING PRESSURE.
11. FIRE HYDRANTS SPACING SHALL BE:
RESIDENTIAL – 500 FEET UNSPRINKLERED; 600 FEET SPRINKLERED.
COMMERCIAL – 300 FEET UNSPRINKLERED; 400 FEET SPRINKLERED.
12. WHERE NEW WATER MAINS ARE EXTENDED ALONG STREETS OR NEW STREETS ARE INSTALLED WHERE FIRE HYDRANTS ARE NOT NEEDED FOR PROTECTION OF THE STRUCTURES, FIRE HYDRANTS SHALL BE INSTALLED AT MAXIMUM 1,000 FOOT SPACING, TO PROVIDE FOR TRANSPORTATION HAZARDS. WHERE STREETS ARE PROVIDED WITH MEDIAN DIVIDERS OR HAVE FOUR OR MORE TRAFFIC LANES AND HAVE A TRAFFIC COUNT OF MORE THAN 30,000 PER DAY, HYDRANTS ARE REQUIRED ON EACH SIDE OF THE STREET SPACED AT 500 FEET ON AN ALTERNATING BASIS.
13. NO FIRE HYDRANTS SHALL BE LOCATED WITHIN THE REQUIRED RADIUS OF A CUL-DE-SAC OR WITHIN 20 FEET OF THE PERIMETER OF THE RADIUS OF THE CUL-DE-SAC.
14. NO FIRE HYDRANTS SHALL BE LOCATED WITHIN 6 FEET OF ANY CURB RETURN, DRIVEWAY, POWER POLE, STREETLIGHT OR ANY OTHER OBSTRUCTION.
15. THE MAXIMUM DISTANCE FROM A FIRE HYDRANT TO A ONE-TWO FAMILY DWELLING SHALL NOT EXCEED 300 FEET, AS MEASURED BY AN APPROVED ROUTE.
16. THE MAXIMUM DISTANCE FROM A FIRE HYDRANT TO A FIRE DEPARTMENT CONNECTION (FDC) SHALL NOT EXCEED 100 FEET, AS MEASURED BY AN APPROVED ROUTE.
17. THE MAXIMUM DISTANCE FROM A FIRE HYDRANT TO THE END OF A DEAD-END STREET SHALL NOT EXCEED 200 FEET.
18. TWO SOURCES OF SUPPLY ARE REQUIRED WHENEVER THERE ARE 4 OR MORE FIRE HYDRANTS/SPRINKLER LEAD-IN ARE INSTALLED ON A SINGLE SYSTEM. SECTIONAL CONTROL VALVES SHALL BE INSTALLED SO THAT NO MORE THAN 2 FIRE HYDRANTS CAN BE OUT OF SERVICE DUE TO A BREAK IN A WATER MAIN.
19. ALL FIRE APPARATUS ACCESS ROADS SHALL BE PAVED TO PROVIDE ALL-WEATHER DRIVING CAPABILITIES, AND SHALL BE DESIGNED AND MAINTAINED TO SUPPORT THE IMPOSED LOADS OF THE FIRE APPARATUS.
20. THE GRADIENT FOR THE FIRE APPARATUS ACCESS ROADS SHALL NOT EXCEED 12%. ANGLES OF APPROACH AND ANGLES OF DEPARTURE SHALL NOT EXCEED 6% FOR 25 FEET PRIOR TO OR AFTER THE GRADE CHANGE. ADJACENT TO THE STRUCTURES GRADIENT SHALL NOT EXCEED 6%.
21. THE TURNING RADIUS OF THE FIRE APPARATUS ACCESS ROADS SHALL BE NO LESS THAN 52 FEET OUTSIDE AND 28 FEET INSIDE TURNING RADIUS.
22. VERTICAL CLEARANCE OF ALL FIRE APPARATUS ACCESS ROADS SHALL BE NOT LESS THAN 13 FEET 6 INCHES.
23. FIRE DEPARTMENT ACCESS ROADS IN ALL RESIDENTIAL DEVELOPMENTS (EXCEPT FOR THE APARTMENT BUILDINGS) SHALL HAVE A MINIMUM UNOBSTRUCTED WIDTH OF NOT LESS THAN 36 FEET FLOW LINE TO THE FLOW LINE (THIS WIDTH MAY BE REDUCED TO 24 FEET, IF ALL BUILDINGS FRONTING THE STREET ARE SPRINKLERED) FOR MAIN RESIDENTIAL STREETS, WITH PARKING PERMITTED ON BOTH SIDES OF THE STREET. PRIVATE DRIVE AISLES, DRIVEWAYS, ETC. SHALL BE ALLOWED TO BE REDUCED TO A MINIMUM WIDTH OF 24 FEET WIDE FLOW LINE TO THE FLOW LINE WHEN SERVING NO MORE THAN 6 RESIDENCES, AND WHEN ON STREET PARKING IS DISALLOWED.
24. ALL FIRE APPARATUS ACCESS ROADS IN COMMERCIAL DEVELOPMENTS AND APARTMENT COMPLEXES SHALL HAVE A MINIMUM UNOBSTRUCTED WIDTH OF NOT LESS THAN 24 FEET (FLOW LINE TO THE FLOW LINE), PROVIDED NO PARKING IS ALLOWED ON EITHER SIDE; 32 FEET (FLOW LINE TO THE FLOW LINE), IF PARALLEL PARKING IS ALLOWED ON ONE SIDE ONLY; AND 40 FEET (FLOW LINE TO THE FLOW LINE), IF PARALLEL PARKING IS ALLOWED ON BOTH SIDES. THESE WIDTHS MAY BE REDUCED BY 4 FEET IF ALL BUILDINGS ARE SPRINKLERED.
25. A FIRE DEPARTMENT ACCESS ROAD SHALL EXTEND TO WITHIN 50 FEET OF A SINGLE EXTERIOR DOOR PROVIDING ACCESS TO THE INTERIOR OF THE BUILDING.
26. A FIRE APPARATUS ACCESS ROAD SHALL BE REQUIRED WHEN ANY PORTION OF AN EXTERIOR WALL OF THE FIRST STORY IS LOCATED MORE THAN 150 FEET FROM A FIRE DEPARTMENT VEHICLE ACCESS. THIS DISTANCE COULD BE INCREASED TO 250 FEET IF THE BUILDING IS SPRINKLERED.
27. APPROVED SECONDARY FIRE APPARATUS ACCESS SHALL BE PROVIDED FOR 100 OR MORE DWELLING UNITS, ROAD(S) WITH DEAD-ENDS OR WITH A SINGLE POINT OF ACCESS IN EXCESS OF 600 FEET, AND FOR ALL COMMERCIAL, INDUSTRIAL, AND MULTI-FAMILY RESIDENTIAL DEVELOPMENTS.
28. ALL DEAD-END FIRE APPARATUS ACCESS ROADS AND OR FIRE LANES, PUBLIC OR PRIVATE, IN EXCESS OF 150 FEET IN LENGTH SHALL BE PROVIDED WITH AN APPROVED TURN AROUND AREA HAVING A MINIMUM DIAMETER OF 81 FEET.
29. ALL FIRE APPARATUS ACCESS ROADS SHALL BE MARKED BY PLACING APPROVED SIGNS AT THE START OF THE DESIGNATED FIRE LANE, ONE SIGN AT THE END OF THE FIRE LANE AND WITH SIGNS AT INTERVALS 100 FEET ALONG ALL DESIGNATED FIRE LANES. SIGNS TO BE PLACED ON BOTH SIDES OF AN ACCESS ROADWAY IF NEEDED TO PREVENT PARKING ON EITHER SIDE. SIGNS TO BE INSTALLED NO HIGHER THAN 10 FEET OR LESS THAN 6 FEET FROM ROADWAY LEVEL. THE CURB ALONG OR ON THE PAVEMENT OR CEMENT IF A CURB IS NOT PROVIDED SHALL BE PAINTED WITH A RED WEATHER RESISTANT PAINT IN ADDITION TO THE SIGNS.
30. ELECTRICALLY CONTROLLED ACCESS GATES SHALL BE PROVIDED WITH AN APPROVED EMERGENCY VEHICLE DETECTOR/RECEIVER SYSTEM. SAID SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE CITY OF LAS VEGAS GUIDELINES FOR AUTOMATIC EMERGENCY VEHICLE ACCESS GATES.

LVVWD PROJECT # 117002

1. NO WORK SHALL BEGIN UNTIL THE WATER PLANS HAVE BEEN APPROVED FOR CONSTRUCTION BY THE LVVWD. FOLLOWING WATER PLAN APPROVAL, NOTICE SHALL BE GIVEN TO THE LVVWD COMMUNICATION SUPPORT CENTER (258-7171) TWO (2) WORKING DAYS PRIOR TO START OF CONSTRUCTION. FOR FUTURE INSPECTIONS, NOTICE MUST BE GIVEN BY 2:00 P.M. THE BUSINESS DAY PRIOR TO THE REQUESTED LVVWD INSPECTION. WHEN REQUESTING INSPECTIONS, PLEASE REFER TO THE PROJECT # IDENTIFIED ABOVE.
2. ALL WORK SHALL CONFORM TO LVVWD STANDARD PLATES, DRAWINGS, AND SPECIFICATIONS, AND TO THE 2010 EDITION OF THE UNIFORM DESIGN AND CONSTRUCTION STANDARDS FOR POTABLE WATER SYSTEMS (UDACS). THE LATEST EDITION OF UDACS SHALL SUPERSEDE ANY CONFLICTS CONTAINED IN THE APPROVED DRAWINGS AND/OR SPECIFICATIONS.
3. ALL WORK, EXCEPT AS MODIFIED BY THESE PLANS OR BY NOTE 2 ABOVE, SHALL BE DONE IN ACCORDANCE WITH THE MOST RECENT DRAFT OR EDITION OF THE UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION OFFSITE IMPROVEMENT, CLARK COUNTY AREA.
4. A SINGLE PIPE MATERIAL SHALL BE USED THROUGHOUT THE PROJECT UNLESS OTHERWISE APPROVED BY THE LVVWD.
5. ALL SERVICE LATERALS TWO (2) INCHES IN DIAMETER AND SMALLER SHALL BE TYPE K COPPER TUBING WITH LVVWD APPROVED SERVICE SADDLES.
6. ALL WATER METER BOXES SHALL BE LOCATED OUTSIDE OF DRIVEWAY AREAS.
7. ALL VALVES SHALL BE LOCATED OUTSIDE OF DRIVEWAYS, VALLEY AND CURB GUTTERS.
8. ALL WATER AND STORM DRAIN OR SANITARY SEWER CROSSINGS SHALL CONFORM TO SECTION 2.22 OF THE 2010 EDITION OF THE UDACS.
9. ALL WATER FACILITIES SHALL BE FILLED, DISINFECTED, PRESSURE TESTED, FLUSHED, FILLED AND AN ACCEPTABLE WATER SAMPLE OBTAINED, PRIOR TO CONNECTION TO THE LVVWD DISTRIBUTION SYSTEM.
10. THE CONTRACTOR MUST OBTAIN ALL METERS TWO (2) INCHES AND SMALLER FROM LVVWD CENTRAL STORES. TELEPHONE 258-3152 OR 258-3802 TWO (2) WORKING DAYS PRIOR TO METER PICKUP.
11. ANY INTERRUPTION OF SERVICE MUST BE PERFORMED IN ACCORDANCE WITH UDACS SECTION 3.14.01, AND APPROVED BY THE LVVWD INSPECTION DIVISION PRIOR TO SHUTDOWN. PROPER WRITTEN NOTIFICATION MUST BE GIVEN TO ALL AFFECTED CUSTOMERS
12. ALL WATER FACILITY CONSTRUCTION MATERIALS USED MUST BE LISTED ON THE LVVWD PRE-APPROVED MATERIAL AND MANUFACTURER'S LISTING FOR NEW FACILITIES, LATEST REVISION, OR SPECIFICALLY APPROVED ON THESE PLANS.
13. TELEPHONE "CALL BEFORE YOU DIG" AT "811" OR 1-800-227-2600.
14. THE INSTALLATION OF LAS VEGAS VALLEY WATER DISTRICT (LVVWD) MUNICIPAL WATER FACILITIES WITHIN ALL STREETS IS ASSUMED TO BE IN COMPLIANCE WITH THE UNIFORM STANDARDS, INCLUDING THE PLACEMENT OF ASPHALT PAVING STREET SURFACES. ANY REPAIR WORK DONE BY THE LVVWD TO THE MUNICIPAL WATER FACILITIES WILL INCLUDE THE PLACEMENT OF AN APPROPRIATELY SIZED ASPHALT REPAIR PATCH ON THE STREET SURFACE.
15. ANY DECORATIVE PAVING SURFACE WITHIN THE STREET IS THE RESPONSIBILITY OF THE OWNERS ASSOCIATION, OR THE INDIVIDUAL PROPERTY OWNERS IF NO OWNER'S ASSOCIATION IS IN EXISTENCE, OR THE AGENCY HAVING JURISDICTION. DECORATIVE SURFACE MATERIALS PLACED WITHIN THE TEN FOOT EASEMENT ABUTTING A PUBLIC OR PRIVATE STREET, IF DISTURBED BY THE LVVWD DURING THE REPAIR OR OPERATION OF ITS FACILITIES, WILL BE REPLACED BY LVVWD WITH AN APPROPRIATELY SIZED PLAIN FINISH CONCRETE PATCH. THE LVVWD WILL NOT RESTORE, AND WILL NOT BE RESPONSIBLE FOR THE RESTORATION OF, ANY DECORATIVE PAVING SURFACE WITHIN THE STREET. THE LVVWD WILL NOT ATTEMPT TO MATCH COLOR OR FINISH OF ANY ADJACENT MATERIALS.
16. FOR TRENCHES FOUR (4) FEET WIDE AND GREATER: CONTRACTOR MUST SUBMIT SHOP DRAWINGS TO LVVWD ENGINEERING SERVICES BEFORE CONSTRUCTION TO SHOW HOW WATERLINES SPANNING A TRENCH WILL BE SUPPORTED DURING EXCAVATION AND BACKFILL. SUPPORTED PIPE MAY BE EXPOSED FOR NO LONGER THAN 90 DAYS MAXIMUM IF THE PIPE WILL BE EXPOSED FOR MORE THAN 90 DAYS, PIPE MUST BE RELOCATED PER APPROVED PLANS. IF THE PIPE MATERIAL IS ACP, REPLACE FROM COUPLING TO COUPLING WITH DUCTILE IRON PIPE.

THE LOCATION OF WATER SERVICE IS NOT SHOWN ON THE DRAWINGS. HOWEVER, IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO RELOCATE ALL WATER SERVICES INTERFERING WITH CONSTRUCTION ACCORDING TO THE LAS VEGAS VALLEY WATER DISTRICT'S STANDARDS. ANY WATER METER TO BE OUT OF SERVICE MUST BE PROVIDED WITH TEMPORARY SERVICE.

"FIRE HYDRANT AND LATERAL ABANDONMENT" (EXISTING LATERAL TO BE ABANDONED) WHERE SHOWN ON THE DRAWING(S), THE CONTRACTOR SHALL ABANDON THE EXISTING FIRE HYDRANT(S) BY REMOVING BOTH THE UPPER AND LOWER BARRELS OF THE FIRE HYDRANT SO THAT NO PORTION OF THE REMAINING FIRE HYDRANT ASSEMBLY IS CLOSER THAN TWO (2) FEET TO THE EXISTING GRADE. FIRE HYDRANTS SHALL BE TESTED PRIOR TO AND AFTER RELOCATION UNDER THE DIRECTION OF THE DISTRICT TO ENSURE QUALITY OF THE FIRE HYDRANT(S). THE EXISTING HYDRANT SHALL BE INSTALLED AT THE NEW LOCATION AS INDICATED ON THE DRAWING, IN ACCORDANCE WITH UDACS PLATE 40. THE EXISTING VALVE SHALL BE ABANDONED IN A CLOSED POSITION, UNLESS SHOWN OTHERWISE, BY REMOVING A MINIMUM OF THE TOP TWENTY-FOUR (24) INCHES OF THE VALVE BOX, AND THEN FILLING THE BOTTOM OF THE BOX WITH A MINIMUM OF EIGHT (8) INCHES OF SAND OR TYPE 2 AGGREGATE BASE, THE REMAINING PORTION OF THE VALVE BOX SHALL BE FILLED WITH CONCRETE HAVING A COMPRESSIVE STRENGTH OF AT LEAST TWO-THOUSAND (2000) PSI. THE LATERAL SHALL BE CUT WITHIN THREE (3) FEET OF THE ABANDONED VALVE, OR AS SHOWN ON PLANS, AND CAPPED. WHERE A JOINT OR COUPLING IN THE EXISTING PIPE IS UNCOVERED AT THE CUT AND CAP LOCATION, THE INSTALLATION OF A PLUG MAY BE PERMITTED, WITH DISTRICT APPROVAL. A CONCRETE THRUST BLOCK SHALL BE INSTALLED AT ALL CUT AND CAP LOCATIONS IN ACCORDANCE WITH THE PROVISIONS OF UDACS PLATE 31.

ABANDONMENT OF EXISTING SERVICE(S) - LARGER THAN 2"

ALL VALVES TO BE ABANDONED SHALL BE ABANDONED IN THE CLOSED POSITION, UNLESS SHOWN OTHERWISE, BY REMOVING A MINIMUM OF THE TOP 24 INCHES OF THE VALVE BOX, AND THEN FILLING THE REMAINING PORTION OF THE VALVE BOX WITH CONCRETE HAVING A COMPRESSIVE STRENGTH OF AT LEAST 2000 PSI THE CONTRACTOR SHALL CUT THE EXISTING PIPE 3± BEYOND THE ABANDONED VALVE AND INSTALL A CAP. WHERE A JOINT OR COUPLING IN THE EXISTING PIPE IS UNCOVERED AT THE CUT AND CAP LOCATIONS, THE INSTALLATION OF A PLUG MAY BE PERMITTED, WITH DISTRICT APPROVAL. THE CONTRACTOR SHALL INSTALL A CONCRETE THRUST BLOCK IN ACCORDANCE WITH THE PROVISIONS OF THE DISTRICT'S STANDARD PLATE NO 31 AT ALL CAP OR PLUG LOCATIONS. THE EXISTING METER(S) SHALL BE REMOVED AND DELIVERED TO THE DISTRICT. THE CONTRACTOR SHALL THEN REMOVE AND/OR BACKFILL THE ABANDONED VAULT WITH TYPE II MATERIAL.

RECONNECTION OF SERVICE LATERALS. 2" AND SMALLER ALL SERVICE LATERALS 2" AND SMALLER THAT ARE CUT OR DAMAGED MAY BE RECONNECTED, PROVIDED THE FOLLOWING CRITERIA ARE MET:

- 1) IF THE LATERAL IS COPPER, THE LATERAL MAY BE CUT AND SPLICED NOT MORE THAN ONCE IN A MANNER APPROVED BY THE DISTRICT.
- 2) IF THE LATERAL IS NOT COPPER, THE LATERAL MUST BE ABANDONED FROM THE EXISTING WATER MAIN, AND REPLACED WITH COPPER SERVICE LATERAL PER UDACS PLATE NO 1B OR 1D. IF THE CORROSION STOP IS DAMAGED BEYOND REPAIR OR PULLED FROM THE EXISTING WATER MAIN, THE MAIN SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE IN A MANNER APPROVED BY THE LVWMD. IF THE CORROSION STOP IS NOT WATER TIGHT, THE CONTRACTOR SHALL NOTIFY LVWMD COMMUNICATION SUPPORT CENTER (258-7171) FOR FUTURE DIRECTION.

THE CONTRACTOR SHALL INSTALL A NEW SERVICE OF LIKE SIZE ADJACENT TO THE DAMAGED SERVICE IN ACCORDANCE WITH UDACS PLATE NO 2 OR 4. ESN.031 REV 6/1/04

EASEMENT WITH TREES, SHRUBS, DECORATIVE ROCKS, BLOCK WALL, OR FENCE TREES, SHRUBS, OR DECORATIVE ROCKS AND ANY BLOCK WALL OR OTHER FENCE MATERIAL, SHALL BE DESIGNED AND CONSTRUCTED AROUND THE EASEMENT(S) TO ALLOW THE DISTRICT ACCESS TO THE VAULT(S), BACK FLOW ASSEMBLIES, AND PIPING FROM THE ADJACENT RIGHT-OF-WAY. ESN.008 REV 6/1/04

CUT AND CAP

THE LATERAL MUST BE CUT WITHIN THREE (3) FEET OF THE ABANDONED VALVE, OR AS SHOWN ON PLANS, AND CAPPED. THE CONTRACTOR SHALL CUT THE EXISTING PIPE WHERE SHOWN ON THE DRAWING, AND INSTALL A CAP COMPLETE WITH THRUST BLOCK. WHERE A JOINT OR COUPLING IN THE EXISTING PIPE IS UNCOVERED AT THE CUT AND CAP LOCATIONS, THE INSTALLATION OF A PLUG MAY BE PERMITTED WITH DISTRICT APPROVAL. A CONCRETE THRUST BLOCK SHALL BE INSTALLED AT ALL CAP OR PLUG LOCATIONS, IN ACCORDANCE WITH THE PROVISIONS OF UDACS PLATE 31. ESN.003 REV 6/1/04

DIP PIPE SHALL BE DEFLECTED AT THE JOINT ONLY. THE MAXIMUM ALLOWABLE DEFLECTION SHALL BE 2.5 DEGREE PER JOINT WITH A MINIMUM RADIUS OF CURVATURE OF 415', PER UDACS 2.06.03.

ANNULAR SPACE BETWEEN PIPE AND CASING SHALL BE FILLED WITH CLASS 1 CLSM, FOR PIPES GREATER THAN 12" DIAMETER. SEE UDACS PLATES 16 THROUGH 19 FOR BEDDING AND BACKFILL REQUIREMENTS ESN. 038A.

INSTALL PIPELINE MARKER BALLS IN TRENCH ABOVE EACH DIRECTIONAL FITTING, PER UDACS PLATE NO 15. ESN.062 REV 6/1/04

APPROVED REDUCED PRESSURE PRINCIPAL ASSEMBLY SHALL BE INSTALLED PER UDACS PLATE NO 8 OR 56. NO WATER SHALL BE TAKEN FROM A SERVICE REQUIRING BACKFLOW PREVENTION UNTIL THE REDUCED PRESSURE PRINCIPAL ASSEMBLY HAS BEEN SUCCESSFULLY TESTED BY THE LVWMD.

ANY BLOCK WALL OR OTHER FENCE MATERIAL SHALL BE DESIGNED AND CONSTRUCTED AROUND THE OUTSIDE OF THE EASEMENT(S) TO ALLOW THE DISTRICT DIRECT ACCESS FROM THE ADJACENT RIGHT-OF-WAY.

EASEMENTS SHALL BE CLEARLY MARKED OR STAKED PRIOR TO THE START OF CONSTRUCTION. ESN.026 REV 6/1/04

THE DISTRICT CANNOT GUARANTEE A WATERTIGHT SHUTDOWN WHERE CONNECTIONS OR REPAIRS TO EXISTING FACILITIES ARE REQUIRED. THE CONTRACTOR SHALL ENSURE ALL LABOR AND EQUIPMENT IS AVAILABLE TO REMOVE FUGITIVE WATER THAT MAY IMPEDE CONSTRUCTION AT ALL TIMES. COORDINATION WITH INSPECTION DIVISION MUST TAKE PLACE PRIOR TO ANY TRIAL SHUTDOWN. CONTRACTOR TO INSTALL TEMPORARY SERVICE TO ENSURE PROPER SHUTDOWN IN THE EVENT NO OTHER APPURTENANCES ARE AVAILABLE. ESN.048 REV 6/1/04

ABANDONED VALVE CUT AND CAP

ALL VALVES TO BE ABANDONED SHALL BE ABANDONED IN THE CLOSED POSITION, UNLESS SHOWN OTHERWISE, BY REMOVING A MINIMUM OF THE TOP TWENTY-FOUR (24) INCHES OF THE VALVE BOX, AND THEN FILLING THE BOTTOM OF THE BOX WITH A MINIMUM OF EIGHT (8) INCHES OF SAND OR TYPE II AGGREGATE BASE, THE REMAINING PORTION OF THE VALVE BOX SHALL BE FILLED WITH CONCRETE HAVING A COMPRESSIVE STRENGTH OF AT LEAST TWO THOUSAND (2000) PSI. THE LATERAL SHALL BE CUT WITHIN THREE (3) FEET OF THE ABANDONED VALVE, OR AS SHOWN ON PLANS, AND CAPPED. WHERE A JOINT OR COUPLING IN THE EXISTING PIPE IS UNCOVERED AT THE CUT AND CAP LOCATION, THE INSTALLATION OF A PLUG MAY BE PERMITTED, WITH DISTRICT APPROVAL. A CONCRETE THRUST BLOCK SHALL BE INSTALLED AT ALL CUT AND CAP LOCATIONS IN ACCORDANCE WITH THE PROVISIONS OF UDACS PLATE 31. ESN.033 REV 6/1/04

13. RELOCATE WATER METER AND ABANDON VAULT
THE CONTRACTOR WILL REMOVE THE TOP OF THE EXISTING VAULT AND
RELOCATE THE EXISTING METER TO THE NEW VAULT. THE OLD VAULT MAY
BE ABANDONED IN PLACE BY SPOOLING THROUGH FROM WALL FLANGE
TO WALL FLANGE, AND BACKFILLING TO THE JURISDICTIONAL AGENCY'S
STANDARDS. ESN.016 REV 6/1/04
14. THIS PROJECT PROVIDES FOR THE OFF-SITE MAINS ONLY, AND DOES NOT
PROVIDE OR IMPLY ANY WATER COMMITMENT. ESN.054 REV 6/1/04
15. STEEL CASING WHERE REQUIRED, INSTALL WATERLINE IN STEEL CASING
PER UDCS LATE 2001 AND PLUS TO 23 MINIMUM. MINIMUM
CLEARANCE IS REQUIRED ABOVE TOP OF CASING (UNLESS OTHERWISE
NOTED). FROM THE UPPER BENDS THRU THE LOWER SECTION OF PIPE.
DUCTILE IRON PIPE WITH RESTRAINED JOINTS IS REQUIRED. IN ADDITION,
ANCHOR BLOCKS ARE TO BE INSTALLED AT THE UPPER BENDS ESN.038
REV 6/1/04.
16. CONTRACTOR MUST SUBMIT SHOP DRAWINGS TO LVVWD BEFORE
CONSTRUCTION TO SHOW HOW WATERLINE SPANNING A TRENCH WILL BE
SUPPORTED DURING EXCAVATION AND BACKFILL. DRAWINGS WILL
INCLUDE ALL LOCATIONS WHERE WATERLINES SPAN TRENCH GREATER
THAN FOUR (4) FEET WIDE.

APPROVAL OF THESE PLANS SHALL NOT BE CONSTRUED TO BE A
PERMIT FOR OR AN APROVAL OF ANY VIOLATION OF ANY OF THE
PROVISIONS OF THE STATE OR COUNTY LAWS.

NV ENERGY, CENTURY LINK TELEPHONE, AND SOUTHWEST GAS SHOWN FOR INFORMATION ONLY. REFERENCE NV ENERGY, CENTURY LINK TELEPHONE, AND SOUTHWEST GAS DRAWINGS FOR CONSTRUCTION DETAILS. CONTRACTOR TO COORDINATE WITH UTILITIES FOR REMOVAL AND INSTALLATION OF FACILITIES.

ALL EXISTING UTILITY LOCATIONS SHOWN HEREON ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO DETERMINE THE EXACT VERTICAL AND HORIZONTAL LOCATION OF ALL EXISTING UNDERGROUND UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL UTILITIES ARE SHOWN HEREON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN IN THEIR PROPER LOCATION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE LOCATION OF THE VARIOUS UTILITIES DEPICTED ON THE PLANS VARIOUS THROUGHOUT THE PROJECT AREA. THE CONTRACTOR SHALL EXERCISE EXTREME CARE WHERE EXCAVATING AND GRADING THE SUBBASE IN THE VICINITY OF UTILITIES TO AVOID DAMAGE TO THE LATTER.

RANCHO - FORT APACHE STORM DRAIN

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LEGEND

- (XX) CALCULATED CONTROL POINT
(XXXX) MONUMENTED CONTROL POINT (SEE NOTE 2)

NOTES

1. SEE SHEET CP-5 FOR LINE DATA, CURVE DATA AND CALCULATED CONTROL POINT DATA.
2. SEE RECORD OF SURVEY PLANS FOR MONUMENTED CONTROL POINT DATA.

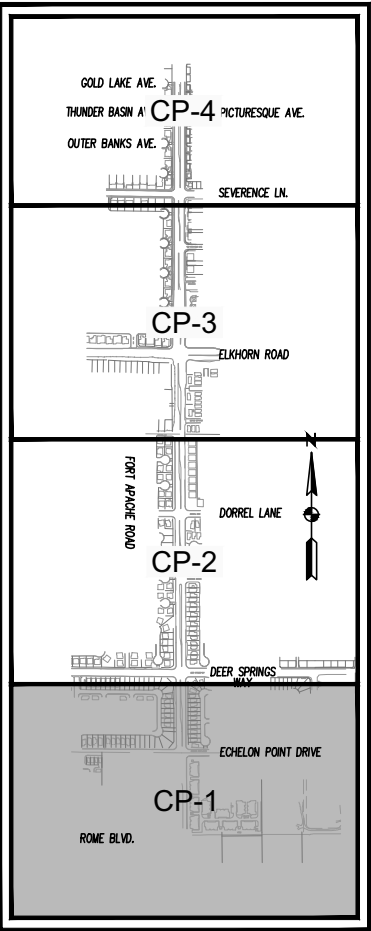
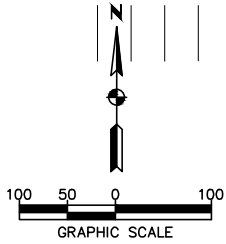
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N 89° 11' 50" W BEING THE SOUTHERLY LINE OF THE SOUTHEAST ONE-QUARTER (SE ¼") OF THE SOUTHEAST ONE-QUARTER (SE ¼") OF SECTION 18, TOWNSHIP 19 SOUTH, RANGE 60 EAST, MOUNT DIABLO MERIDIAN, CITY OF LAS VEGAS, CLARK COUNTY, NEVADA PER A SUBDIVISION PLAT ON FILE WITH THE CLARK COUNTY, NEVADA, RECORDER BOOK 123, PAGE 38 OF PLATS.

BENCHMARK NOTE

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ELEVATION 811.556 METERS
ELEVATION 2662.58 U.S. SURVEY FEET

MATCHLINE "FA "119+10 - SEE SHEET CP-2



SHEET KEY

90% DESIGN SUBMITTAL 4 / 30 / 2013 - NOT FOR CONSTRUCTION

DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE

STORM DRAIN

HORIZONTAL CONTROL PLAN

SHEET:

CP-1

CLV DRAWING NO:

327V150

90%
DESIGN
SUBMITTAL
4/30/2013
NOT FOR CONSTRUCTION

PROJECT:

90%
DESIGN
SUBMITTAL
4/30/2013
NOT FOR CONSTRUCTION

PROJECT:

RANCHO-FORT APACHE
STORM DRAIN
HORIZONTAL CONTROL PLAN

DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE

STORM DRAIN

HORIZONTAL CONTROL PLAN



SCALE(H): AS SHOWN
FIELD BOOK #:
SCALE(V): NONE
DATE: 4/30/2013
DESIGN/CHK BY: JSJ/KK
WA#:
No. DATE DESCRIPTION BY

THE Louis Berger Group, INC.
500 E. Amigo Court, Suite 100
Las Vegas, Nevada 89119
Voice: 702-736-6632
Fax: 702-736-0704

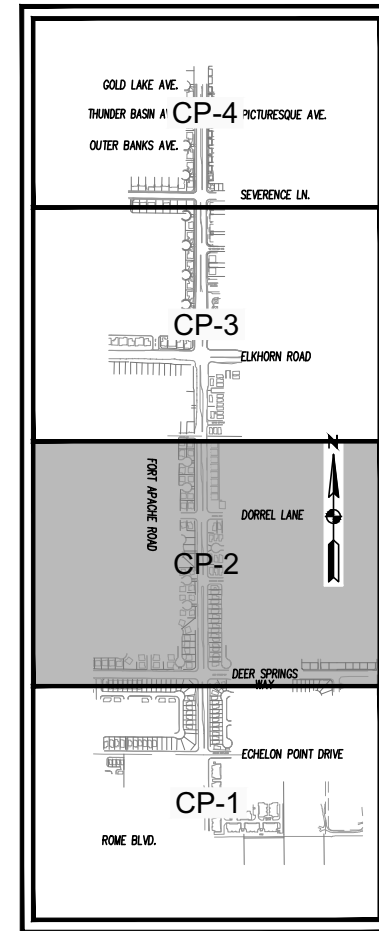
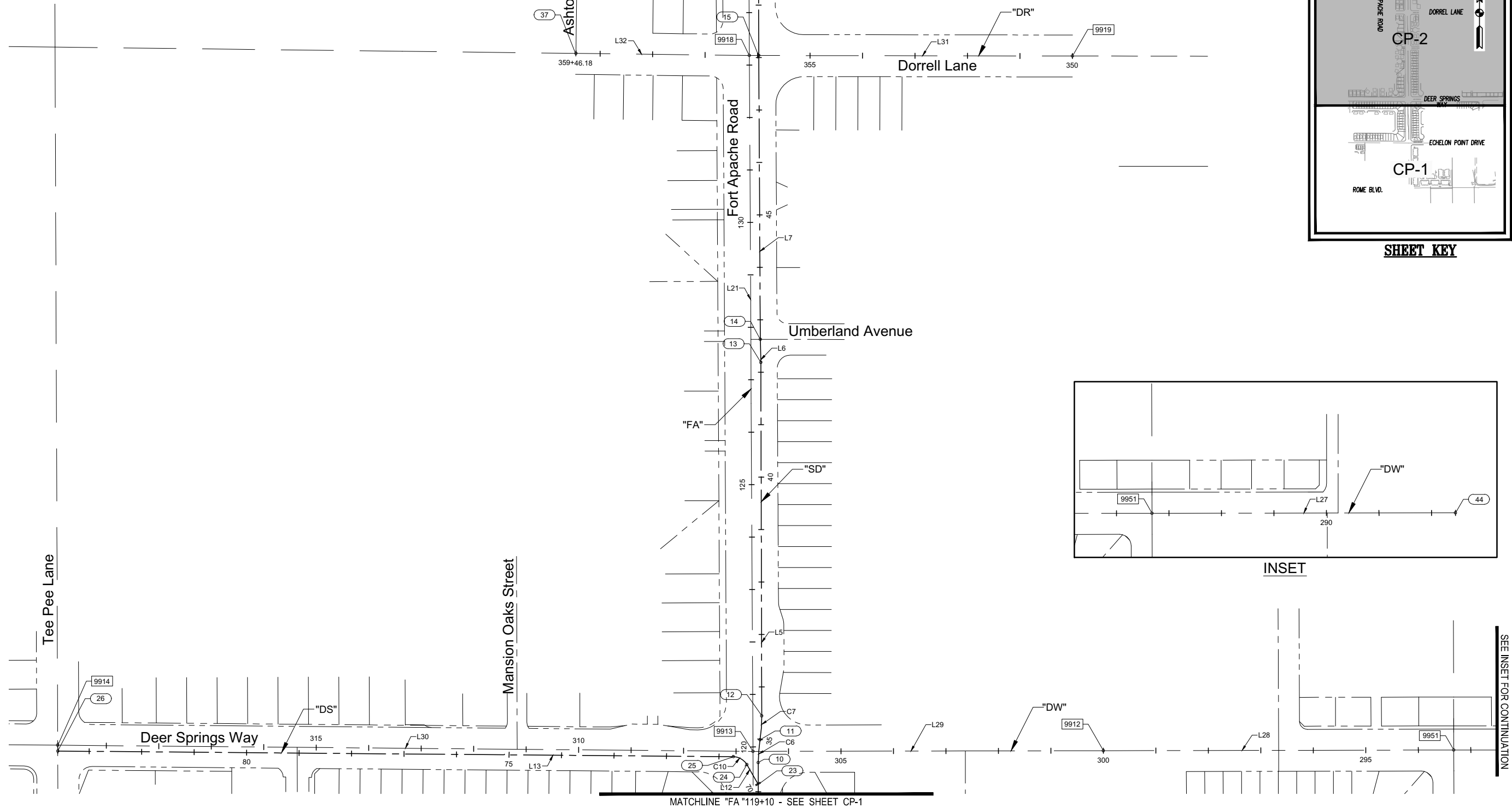
	CALCULATED CONTROL POINT
	MONUMENTED CONTROL POINT (SEE NOTE 2)

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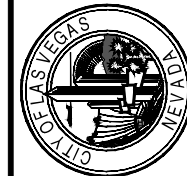
N 89° 11' 50" W BEING THE SOUTHERLY LINE OF THE SOUTHEAST ONE-QUARTER (SE $\frac{1}{4}$ ") OF THE SOUTHEAST ONE-QUARTER (SE $\frac{1}{4}$ ") OF SECTION 18, TOWNSHIP 19 SOUTH, RANGE 60 EAST, MOUNT DIABLO MERIDIAN, CITY OF LAS VEGAS, CLARK COUNTY, NEVADA PER A SUBDIVISION PLAT ON FILE WITH THE CLARK COUNTY, NEVADA, RECORDER BOOK 123, PAGE 38 OF PLATS.

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ELEVATION	811.556 METERS
ELEVATION	2662.58 U.S. SURVEY FEET



SHEET KEY



2013 - NOT FOR CONSTRUCTION

DEPARTMENT OF PUBLIC WORKS

PROJECT: RANCHO-FORT APACHE
STORM DRAIN
HORIZONTAL CONTROL PLAN

90%
DESIGN
SUBMITTAL
4/30/2013
NOT FOR CONSTRUCTION

SHEET:
CP-2
6 OF 109
CLV DRAWING NO:
327V150

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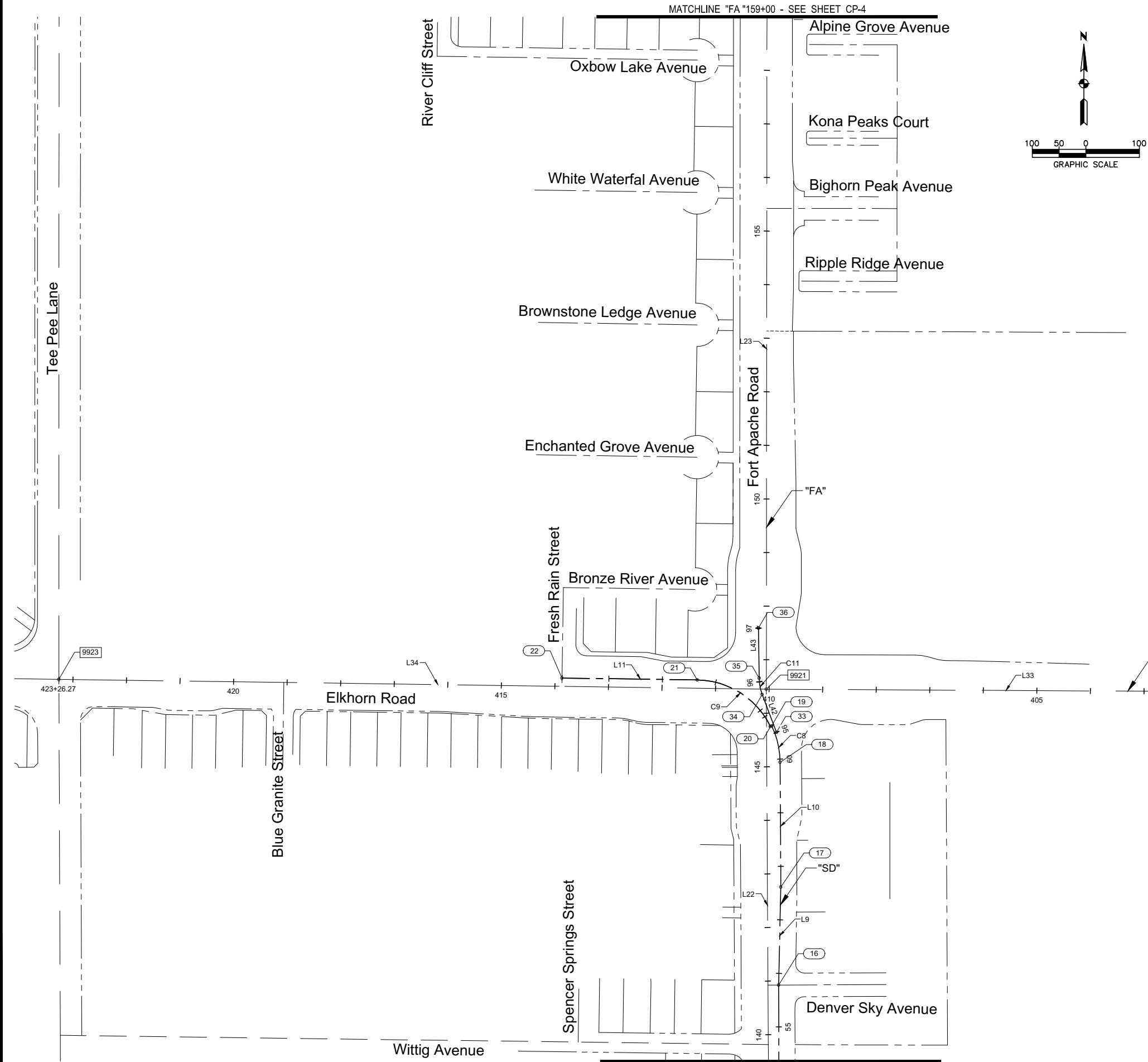
THE Louis Berger Group, INC.
500 E. Amigo Court, Suite 100 Voice: 702-736-6632
Las Vegas, Nevada 89119 Fax: 702-736-0704



BANCHO - FORT APACHE STORM DRAIN

SHEET 111 F.

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LEGEND

- XX CALCULATED CONTROL POINT
- XXXXX MONUMENTED CONTROL POINT (SEE NOTE 2)

NOTES

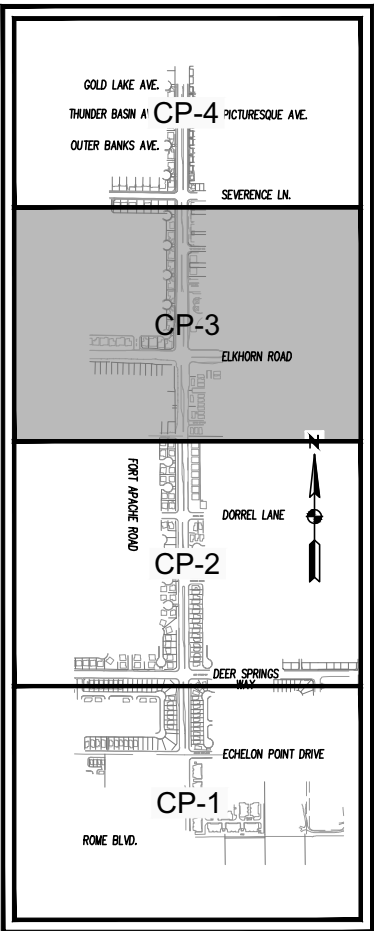
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BENCHMARK NOTE

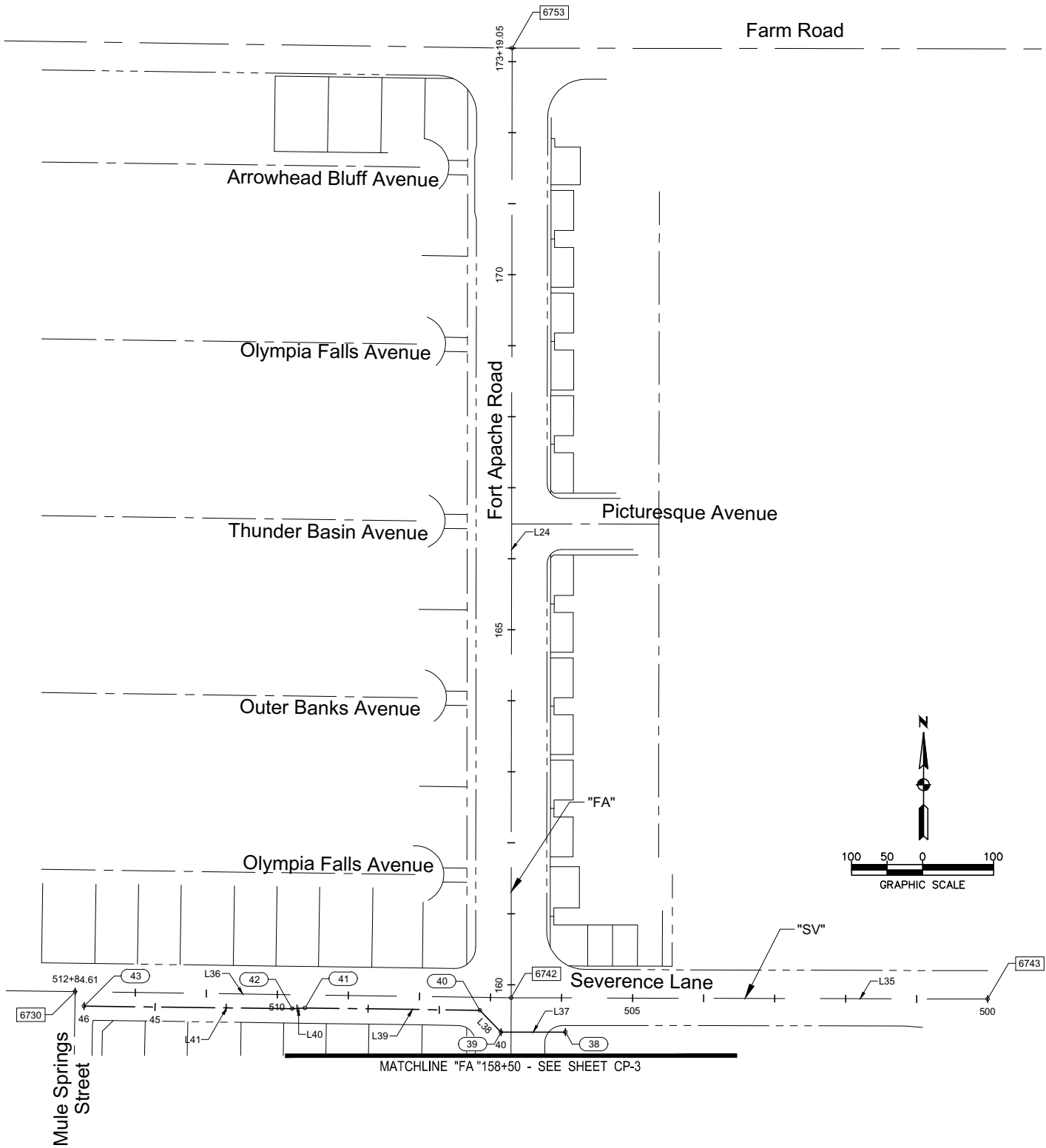
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ELEVATION 811.556 METERS
ELEVATION 2662.58 U.S. SURVEY FEET



SHEET KEY

90% DESIGN SUBMITTAL 4 / 30 / 2013 - NOT FOR CONSTRUCTION		BY	
DEPARTMENT OF PUBLIC WORKS		DESCRIPTION	
PROJECT: RANCHO-FORT APACHE STORM DRAIN HORIZONTAL CONTROL PLAN		No.	
SHEET TITLE:		DATE	
90% DESIGN SUBMITTAL 4/30/2013 NOT FOR CONSTRUCTION		WA#	
SHEET: CP-3		SCALE(V): NONE	
CLV DRAWING NO: 327V150		DATE: 4/30/2013	
7 OF 109		DSGN/CHK BY: JSD/SJD	
H#36802		Voice: 702-736-6632	
		Fax: 702-736-0704	
		THE Louis Berger Group, INC.	
		500 E. Amigo Court, Suite 100	
		Las Vegas, Nevada 89119	
		Voice: 702-736-6632	
		Fax: 702-736-0704	
		RANCHO - FORT APACHE STORM DRAIN	

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LEGEND

- XX CALCULATED CONTROL POINT
- XXXXX MONUMENTED CONTROL POINT (SEE NOTE 2)

NOTES

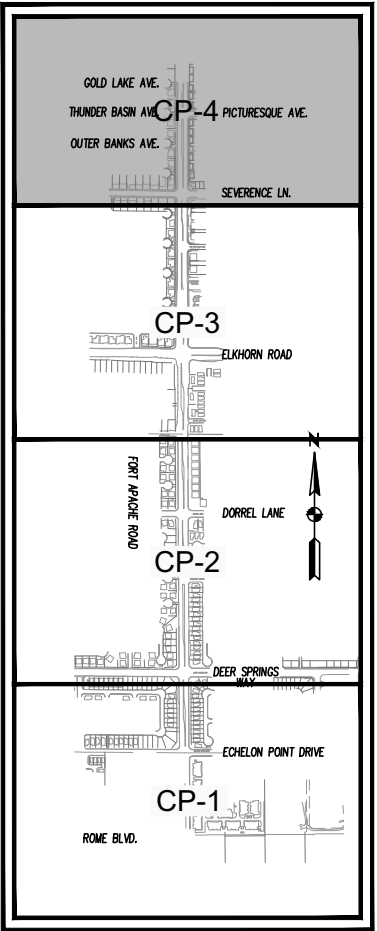
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DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE

STORM DRAIN

HORIZONTAL CONTROL PLAN

SHEET TITLE:

SHEET:

CP-4
8 OF 109
CLV DRAWING NO:
327V150

No.	DATE	DESCRIPTION	BY

THE Louis Berger Group, INC.
500 E. Amigo Court, Suite 100
Las Vegas, Nevada 89119
Voice: 702-736-6632
Fax: 702-736-0704



RANCHO - FORT APACHE STORM DRAIN

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ALIGNMENT	LINE DATA		
	LINE	LENGTH	DIRECTION
"SD"	L1	1,259.36'	S 89°42'58" W
	L2	396.21'	N 00°19'48" W
	L3	466.65'	N 00°19'48" W
	L4	169.17'	N 00°11'53" E
	L5	673.90'	N 00°09'23" W
	L6	43.97'	N 01°22'29" W
	L7	541.05'	N 00°18'07" W
	L8	774.40'	N 00°09'49" W
	L9	183.02'	N 01°15'14" E
	L10	232.92'	N 00°18'42" W
	L11	252.51'	N 89°11'50" W
"DS"	L12	43.45'	S 29°48'07" E
"EP"	L13	1,287.27'	N 89°31'20" W
	L14	37.61'	N 45°19'48" W
	L15	611.00'	N 89°34'09" W
"FA"	L16	42.75'	N 79°32'44" W
	L17	204.37'	N 89°26'39" W
	L18	664.06'	N 00°19'23" W
	L19	663.77'	N 00°19'48" W
	L20	663.77'	N 00°19'48" W
	L21	1,326.62'	N 00°18'07" W
	L22	1,326.60'	N 00°18'42" W
	L23	1,337.14'	N 00°03'03" E
	L24	1,337.10'	N 00°03'51" E
	L25	666.93'	S 89°48'15" W
"EC"	L26	1,325.98'	N 89°34'09" W
"DW"	L27	578.19'	S 89°55'58" W
	L28	667.66'	S 89°53'09" W
	L29	667.72'	S 89°53'33" W
	L30	1,324.78'	N 89°29'31" W
"DR"	L31	615.75'	N 89°54'37" W
"EK"	L32	330.44'	N 89°18'15" W
	L33	1,005.10'	N 89°42'02" W
"SV"	L34	1,321.17'	N 89°11'50" W
	L35	670.94'	N 89°49'57" W
"SL"	L36	613.67'	N 89°12'14" W
	L37	90.65'	S 89°58'54" W
	L38	42.68'	N 44°12'14" W
	L39	246.11'	N 89°12'14" W
	L40	18.14'	S 86°51'05" W
"FS"	L41	293.08'	N 89°19'13" W
	L42	75.52'	N 20°40'55" W
	L43	93.23'	N 00°47'19" W

ALIGNMENT	CALCULATED CONTROL POINTS			
	POINT NUMBER	NORTHING	EASTING	DESCRIPTION
"SD"	1	809,463.9411	42,075.9657	"SD" 8+00.00 POT
	2	809,457.7001	40,816.6183	"SD" 20+59.36 PC
	3	809,557.1227	40,716.1244	"SD" 22+16.36 POT
	4	809,953.3276	40,713.8416	"SD" 26+12.57 PC
	5	810,017.5653	40,736.7218	"SD" 26+82.16 PRC
	6	810,081.8031	40,759.6021	"SD" 27+51.75 POT
	7	810,548.4474	40,756.9133	"SD" 32+18.40 PC
	8	810,581.2899	40,751.1657	"SD" 32+51.90 PRC
	9	810,615.0545	40,745.4169	"SD" 32+86.32 POT
	10	810,784.2273	40,746.0020	"SD" 34+55.49 PC
	11	810,827.8542	40,749.3437	"SD" 34+99.28 PRC
	12	810,873.3370	40,752.6860	"SD" 35+44.93 POT
	13	811,547.2321	40,750.8475	"SD" 42+18.83 PI
	14	811,591.1865	40,749.7927	"SD" 42+62.80 PI
	15	812,132.2288	40,746.9424	"SD" 48+03.85 PI
	16	812,906.6233	40,744.7312	"SD" 55+78.25 PI
	17	813,089.5969	40,748.7363	"SD" 57+61.26 PI
	18	813,322.5125	40,747.4697	"SD" 59+94.18 PC
	19	813,390.3255	40,731.6594	"SD" 60+64.40 POC BACK = "SD" 60+64.40, 2.50' RT AHEAD
	20	813,389.2321	40,729.4112	"SD" 60+64.40 POC AHEAD = "SD" 60+64.40, 2.50' LT BACK
	21	813,476.1436	40,592.6370	"SD" 62+34.99 PT
	22	813,479.6819	40,340.1538	"SD" 64+87.49 POT
"DS"	23	810,742.6949	40,745.8583	"DS" 69+97.90 POT
	24	810,780.4018	40,724.2617	"DS" 70+41.35 PC
	25	810,795.4907	40,698.4794	"DS" 70+72.62 PT
	26	810,806.2229	39,411.2518	"DS" 83+59.90 POT
"EP"	27	810,102.9894	40,759.4800	"EP" 80+00.00 POT
	28	810,129.4302	40,732.7327	"EP" 80+37.61 PI
	29	810,134.0258	40,121.7488	"EP" 86+48.61 PI
	30	810,141.7830	40,079.7080	"EP" 86+91.36 PI
	31	810,143.7660	39,875.3490	"EP" 91+52.26 POT
"FA"	32	808,814.0894	40,747.3238	"FA" 100+00.00 POT
"FS"	33	813,378.3441	40,740.6287	"FS" 95+00.00 POT = "SD" 60+64.40, 3.50' RT
	34	813,448.9960	40,713.9570	"FS" 95+75.52 PC
	35	813,479.5435	40,708.1656	"FS" 96+06.77 PT
	36	813,572.7676	40,706.8824	"FS" 97+00.00 POT
"DR"	37	812,136.2704	40,398.5304	"DR" 359+46.18 POT
"SL"	38	814,747.5944	40,799.3674	"SL" 39+09.35 POT
	39	814,747.5652	40,708.7201	"SL" 40+00.00 PI
	40	814,778.1577	40,678.9662	"SL" 40+42.68 PI
	41	814,781.5775	40,432.8789	"SL" 42+88.790 PI
	42	814,780.5814	40,414.7698	"SL" 43+06.92 PI
	43	814,784.0576	40,121.7135	"SL" 46+00.00 POT

ALIGNMENT	MONUMENTED CONTROL POINTS	
	POINT NUMBER	DESCRIPTION
"FA"	32	"FA" 100+00.00 POT
	9906	"FA" 106+64.04 PI
	9910	"FA" 113+27.83 PI = "EC" 206+66.93 PI
	9913	"FA" 119+91.60 PI = "DW" 306+67.71 PI
	9918	"FA" 133+18.22 PI = "DR" 356+15.75 PI
	9921	"FA" 146+44.81 PI = "EK" 410+05.10 PI
	6742	"FA" 159+81.96 PI = "SV" 506+70.95 PI
	6753	"FA" 173+19.05 POT
	9911	"EC" 200+00.00 POT
	9910	"FA" 113+27.83 PI = "EC" 206+66.93 PI
"EC"	9909	"EC" 219+92.90 POT
"DW"	44	"DW" 287+54.15 POT
	7001	"DW" 293+32.34 PI
	9912	"DW" 300+00.00 PI
	9913	"FA" 119+91.60 PI = "DW" 306+67.71 PI
	9914	"DW" 319+92.49 POT
"DR"	9919	"DR" 350+00.00 POT
	9918	"FA" 133+18.22 PI = "DR" 356+15.75 PI
	37	"DR" 359+46.18 POT
"EK"	9920	"EK" 400+00.00 POT
	9921	"FA" 146+44.81 PI = "EK" 410+05.10 PI
	9923	"EK" 423+26.27 POT
"SV"	6743	"SV" 500+00.00 POT
	6742	"FA" 159+81.96 PI = "SV" 506+70.95 PI
	6730	"SV" 512+84.62 POT

ALIGNMENT	CURVE DATA						
	CURVE	RADIUS	LENGTH	CHORD	TANGENT	DELTA	RADIUS POINT NORTHING EASTING
"SD"	C1	100.00'	157.00'	N 45° 18' 25" W	99.92'	89°57'14"	809,557.6989 40,816.1227
	C2	100.00'	69.59'	N 19° 36' 18" E	36.27'	39°52'12"	809,953.9037 40,813.8399
	C3	100.00'	69.59'	N 19° 36' 18" E	36.27'	39°52'12"	810,081.2289 40,659.6037
	C4	100.00'	33.50'	N 09° 55' 36" W	16.91'	19°11'35"	810,547.8712 40,656.9150
	C5	100.00'	34.42'	N 09° 39' 45" W	17.38'	19°43'17"	810,614.7087 40,845.4163
	C6	300.00'	43.79'	N 04° 22' 48" E	21.94'	8°21'50"	810,783.1898 41,046.0002
	C7	300.00'	45.65'	N 04° 12' 10" E	22.87'	8°43'06"	810,872.5186 40,452.6871
	C8	157.00'	70.22'	N 13° 07' 26" W	35.70'	25°37'28"	813,321.6588 40,590.4720
	C9	154.50'	170.59'	N 57° 34' 00" W	95.16'	63°15'40"	813,321.6588 40,590.4720
"DS"	C10	30.00'	31.27'	N 59° 39' 43" W	17.22'	59°43'14"	810,765.4918 40,698.2293
"FS"	C11	90.00'	31.25'	N 10° 44' 07" W	15.78'	19°53'36"	813,480.7822 40,798.1570

LEGEND

(xx)

CALCULATED CONTROL POINT

xxxx

MONUMENTED CONTROL POINT
(SEE NOTE 1)

NOTES

- SEE RECORD OF SURVEY PLANS FOR MONUMENTED CONTROL POINT DATA.
- NORTHING AND EASTING COORDINATES REFERENCE A PROJECT GROUND COORDINATE SYSTEM IN U.S. SURVEY FEET. SEE RECORD OF SURVEY PLANS FOR CONVERTING THE PROJECT COORDINATES TO NEVADA STATE PLANE EAST ZONE (2710) COORDINATES.

BASIS OR BEARING

N 89° 11' 50" W BEING THE SOUTHERLY LINE OF THE SOUTHEAST ONE-QUARTER (SE ¼") OF THE SOUTHEAST ONE-QUARTER (SE ¼") OF SECTION 18, TOWNSHIP 19 SOUTH, RANGE 60 EAST, MOUNT DIABLO MERIDIAN, CITY OF LAS VEGAS, CLARK COUNTY, NEVADA PER A SUBDIVISION PLAT ON FILE WITH THE CLARK COUNTY, NEVADA, RECORDER BOOK 123, PAGE 38 OF PLATS.

BENCHMARK NOTE

THE ELEVATION DATA SHOWN HEREON ARE U.S. SURVEY FEET REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988, CITY OF LAS VEGAS 2008 ADJUSTMENT BENCHMARK NO. 5LV9019NEE6, BEING A RIVET AND PLATE IN TOP OF CURB @ NORTHWEST CORNER OF DORRELL AND FORT APACHE.
ELEVATION 811.556 METERS
ELEVATION 2662.58 U.S. SURVEY FEET

90% DESIGN SUBMITTAL 4 / 30 / 2013 - NOT FOR CONSTRUCTION

DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE

STORM DRAIN

HORIZONTAL CONTROL PLAN

PROJECT:

SHEET:

CP-5
9 OF 109
CLV DRAWING NO:
327V150

NOT FOR CONSTRUCTION

90%
DESIGN
SUBMITTAL
4/30/2013

DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE

STORM DRAIN

HORIZONTAL CONTROL PLAN

PROJECT:

SHEET:

CP-5
9 OF 109
CLV DRAWING NO:
327V150

DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE

STORM DRAIN

HORIZONTAL CONTROL PLAN

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9 OF 109
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DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE

STORM DRAIN

HORIZONTAL CONTROL PLAN

PROJECT:

SHEET:

CP-5
9 OF 109
CLV DRAWING NO:
327V150

DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE

STORM DRAIN

HORIZONTAL CONTROL PLAN

PROJECT:

SHEET:

CP-5
9 OF 109
CLV DRAWING NO:
327V150

DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE

STORM DRAIN

HORIZONTAL CONTROL PLAN

PROJECT:

SHEET:

CP-5
9 OF 109
CLV DRAWING NO:
327V150

DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE

STORM DRAIN

HORIZONTAL CONTROL PLAN

PROJECT:

SHEET:

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9 OF 109
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DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE

STORM DRAIN

HORIZONTAL CONTROL PLAN

PROJECT:

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CP-5
9 OF 109
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327V150

DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE

STORM DRAIN

HORIZONTAL CONTROL PLAN

PROJECT:

SHEET:

CP-5
9 OF 109
CLV DRAWING NO:
327V150

DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE

STORM DRAIN

HORIZONTAL CONTROL PLAN

PROJECT:

SHEET:

CP-5
9 OF 109
CLV DRAWING NO:
327V150

DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE

STORM DRAIN

HORIZONTAL CONTROL PLAN

PROJECT:

SHEET:

CP-5
9 OF 109
CLV DRAWING NO:
327V150

DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE

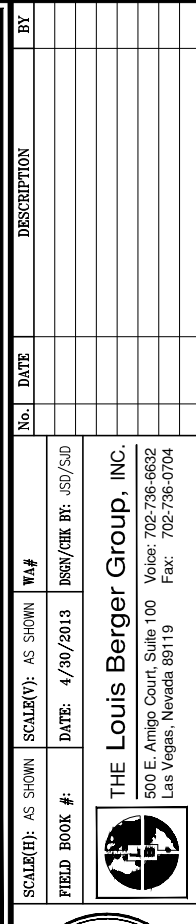
STORM DRAIN

HORIZONTAL CONTROL PLAN

PROJECT:

SHEET:

CP-5
9 OF 109
CLV DRAWING NO:<



PROJECT: RANCHO-FORT APACHE
STORM DRAIN
PLAN AND PROFILE
"SD" 59+50 TO "SD" 64+87.82

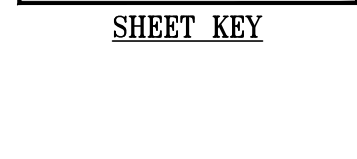
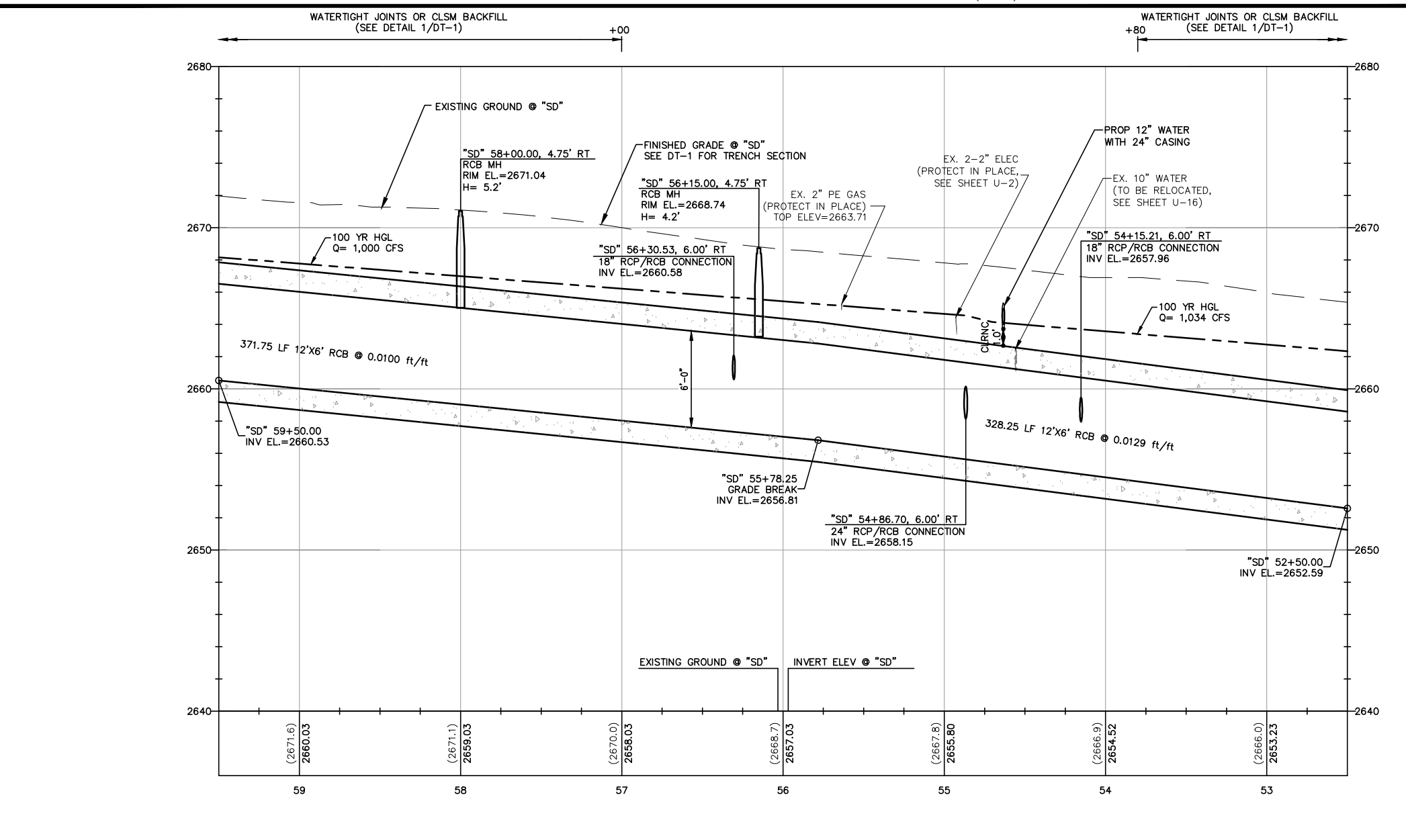
- NOTES:

- APPROVED FOR CONSTRUCTION

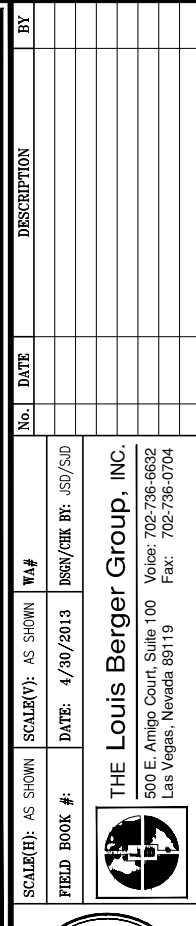
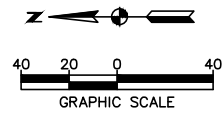
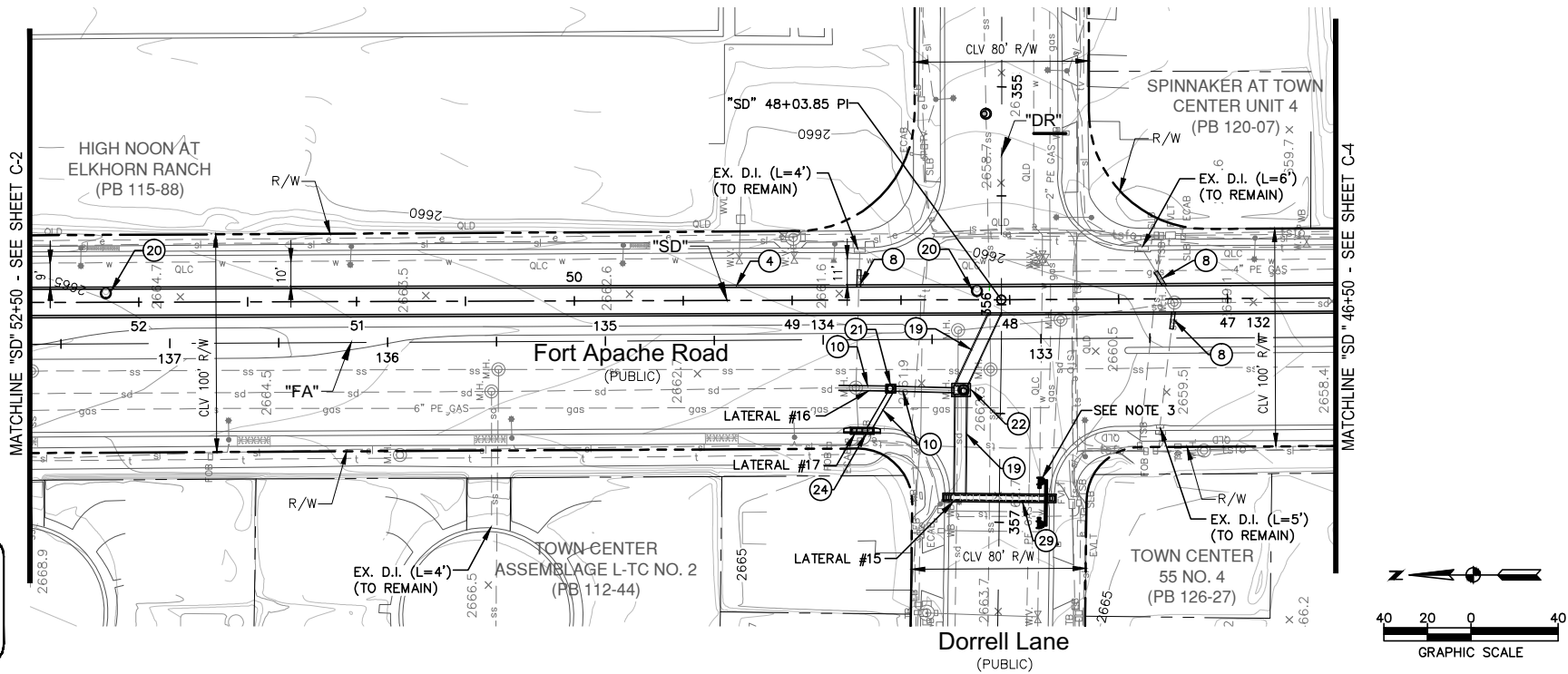
PROJECT NO. 117002 DATE:

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4/30/2013
NOT FOR CONSTRUCTION

SHEET:
C-1
25 OF 109
CLV DRAWING NO:
327V150

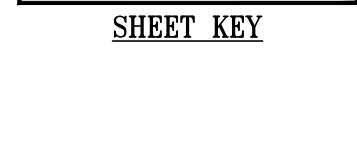
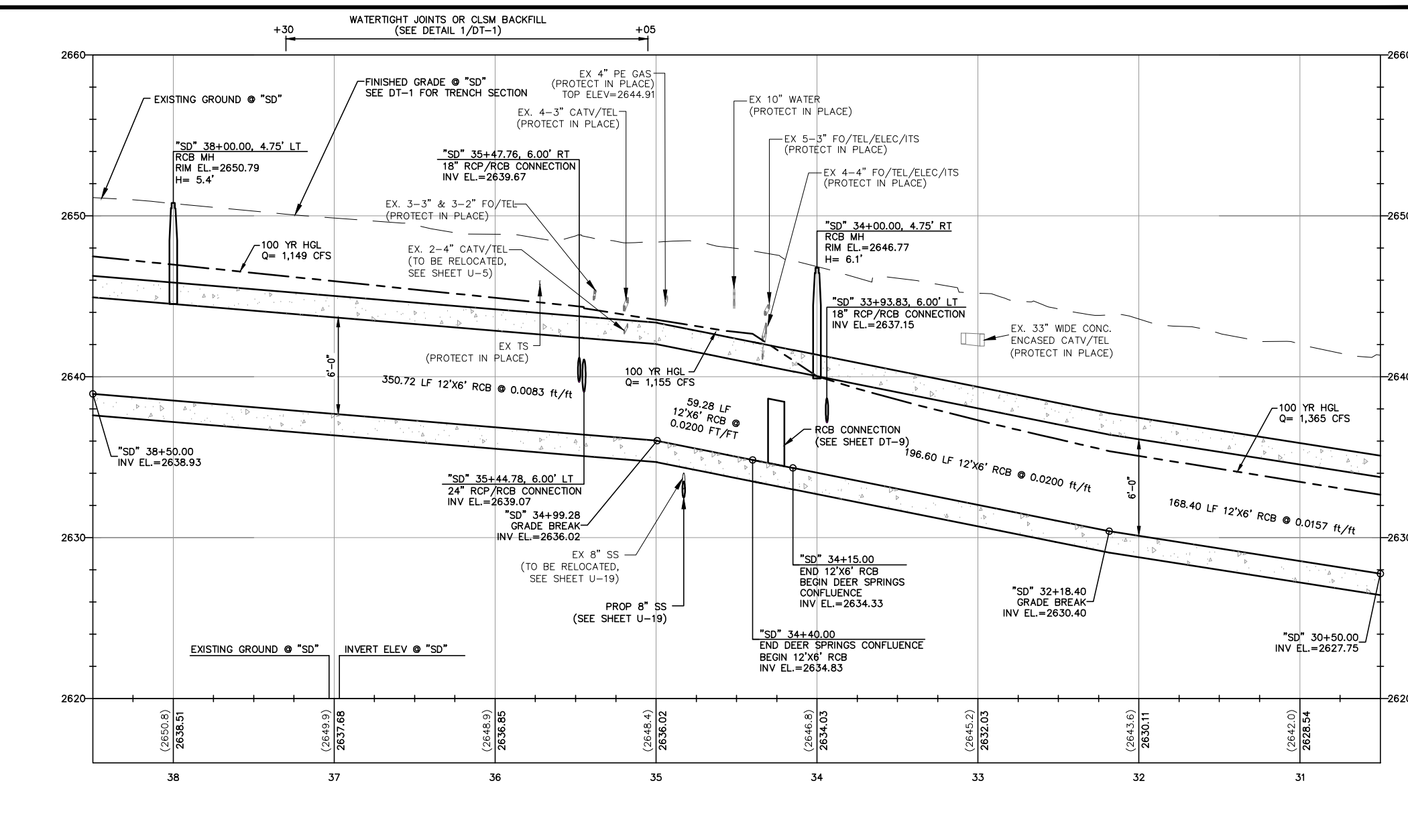
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BANCHO - FORT APACHE STORM DRAIN



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4/30/2013
NOT FOR CONSTRUCTION

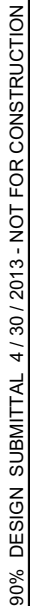
SHEET:
C-3
27 OF 109
CLV DRAWING NO:
327V150



90% DESIGN SUBMITTAL 4/30/2013 NOT FOR CONSTRUCTION		DEPARTMENT OF PUBLIC WORKS PROJECT: RANCHO-FORT APACHE STORM DRAIN PLAN AND PROFILE "SD" 30+50 TO "SD" 38+50				THE Louis Berger Group, INC. 500 E. Amigo Court, Suite 100 Las Vegas, Nevada 89119 Voice: 702-726-6632 Fax: 702-726-0704		SCALE(H): AS SHOWN SCALE(W): AS SHOWN FIELD BOOK #:		WA# DATE: 4/30/2013 DSGN/CHK BY: JSD/JSD		No. DATE		DESCRIPTION		BY	
SHEET: C-5 29 OF 109 CLV DRAWING NO: 327V150		OUR DESIGN SUBMITTAL 4/30/2013, NOT FOR CONSTRUCTION		SHEET TITLE:		DATE		DESCRIPTION		BY		DATE		DESCRIPTION		BY	

RANCHO - FORT APACHE STORM DRAIN

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MATCHLINE "SD" 22+50 - SEE SHEET C-6

"SD" 22+16.36 PT

Plan view of the proposed sewer line. The sewer line is shown as a curved line with stationing from 22+00 to 27+00. A 50' offset is indicated from the sewer line to the right-of-way boundary. The right-of-way boundary is labeled "CLV 50' R/W". The sewer line is labeled "2636.5". The plan view also shows the sewer line crossing the "CLV 50' R/W" boundary.

NVN 060079
CLARK COUNTY ROADS

NVN 060079
CLARK COUNTY ROADS

NVN 061323
CLARK COUNTY RIGHT OF
WAY FOR BELTWAY
DOC. 20021002:100537 O.R.

Call before you Underground **Call before you Overhead**

1-702-453-5300
 FREEWAY AND ARTERIAL SYSTEM
 OF TRANSPORTATION (F.A.S.T.)

1-702-402-2929
 NEVADA POWER ENVIRONMENT AND
 SAFETY SERVICES DEPARTMENT

1-800-227-2600
 AND
 CLARK COUNTY TRAFFIC OPERATIONS
1-702-455-7544



1-800-227-2600
AND
ARK COUNTY TRAFFIC OPERATIONS
1-702-455-7544

WILLOWS AT
TOWN CENTER LLC
PB 125-20-301-022

EXISTING BLOCK WALL
(PROTECT IN PLACE)

CC 215 BELTWAY

MATCHLINE "SD" 15+50 - SEE SHEET C-8

40 20 0 20 40
GRAPHIC SCALE



INSTALL 45"x29" HERCP AND CONNECT TO
EXISTING RCP WITH CONCRETE COLLAR
(SEE DETAILS 1/DT-3 AND 3/DT-4)

CONSTRUCT RCB MH (SEE DETAIL 1/DT-4)

CONSTRUCT 12'x6' RCB PER
NDOT STD DWGS B-20.1.2 AND B-20.1.2.1

1. SEE SHEETS CP-1 THROUGH CP-5 FOR HORIZONTAL CONTROL PLANS.
2. SEE SHEETS R-1 THROUGH R-15 FOR REMOVAL PLANS.
3. SEE SHEETS U-16 AND U-17 FOR WATERLINE RELOCATION PLANS.
4. SEE SHEETS U-17 THROUGH U-21 FOR SEWERLINE RELOCATION PLANS.
5. SEE SHEETS LP-1 THROUGH LP-7 FOR STORM DRAIN LATERAL PROFILES.

DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE

PLAN AND PROFILE

"SD"	22+50	T0	"SD"	15+50
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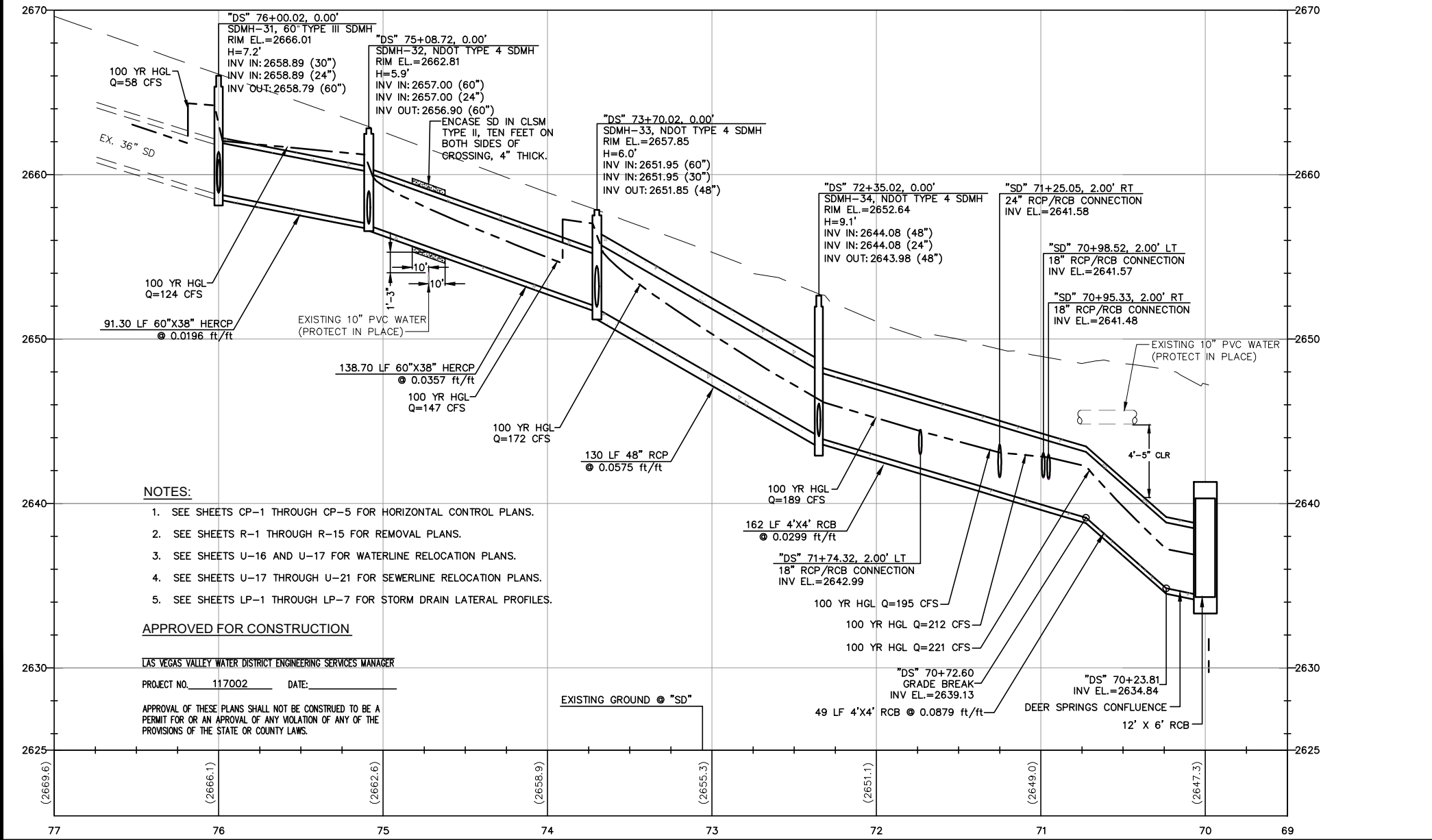
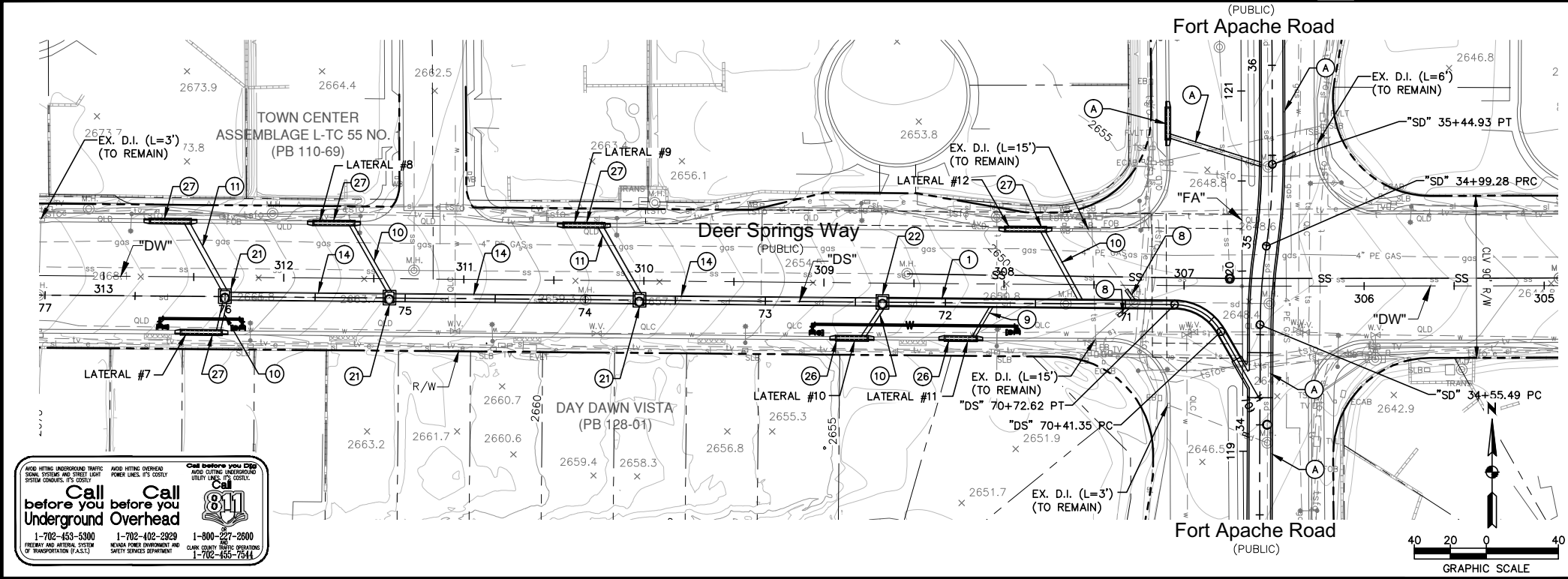
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SHEET TITLE:

90%
DESIGN
SUBMITTAL
4/30/2013
NOT FOR CONSTRUCTION

SHEET:
C-7
31 OF 109
CLV DRAWING NO:
327V150

H#36802



- NOTES:
1. SEE SHEETS CP-1 THROUGH CP-5 FOR HORIZONTAL CONTROL PLANS.
 2. SEE SHEETS R-1 THROUGH R-15 FOR REMOVAL PLANS.
 3. SEE SHEETS U-16 AND U-17 FOR WATERLINE RELOCATION PLANS.
 4. SEE SHEETS U-17 THROUGH U-21 FOR SEWERLINE RELOCATION PLANS.
 5. SEE SHEETS LP-1 THROUGH LP-7 FOR STORM DRAIN LATERAL PROFILES.

APPROVED FOR CONSTRUCTION

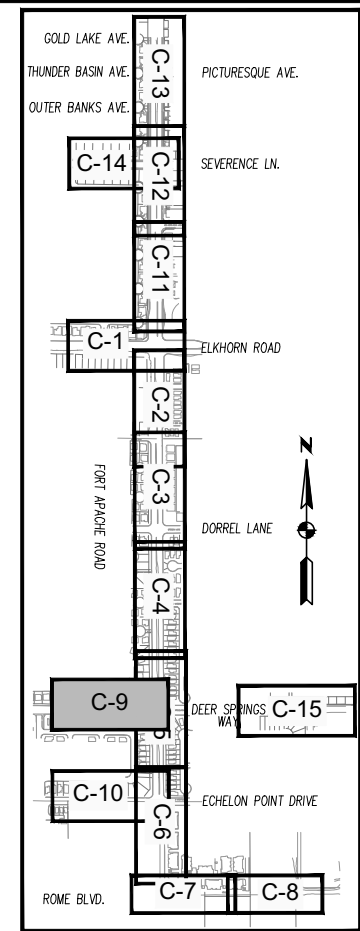
LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER

PROJECT NO. 117002 DATE: _____

APPROVAL OF THESE PLANS SHALL NOT BE CONSTRUED TO BE A PERMIT FOR OR AN APPROVAL OF ANY VIOLATION OF ANY OF THE PROVISIONS OF THE STATE OR COUNTY LAWS.

CONSTRUCTION ITEMS

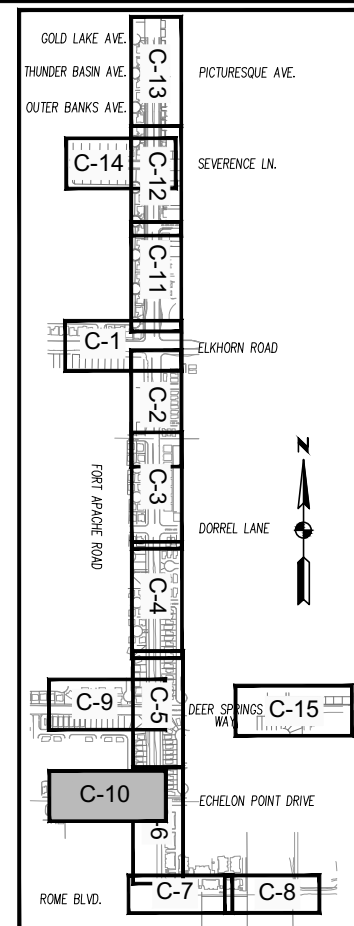
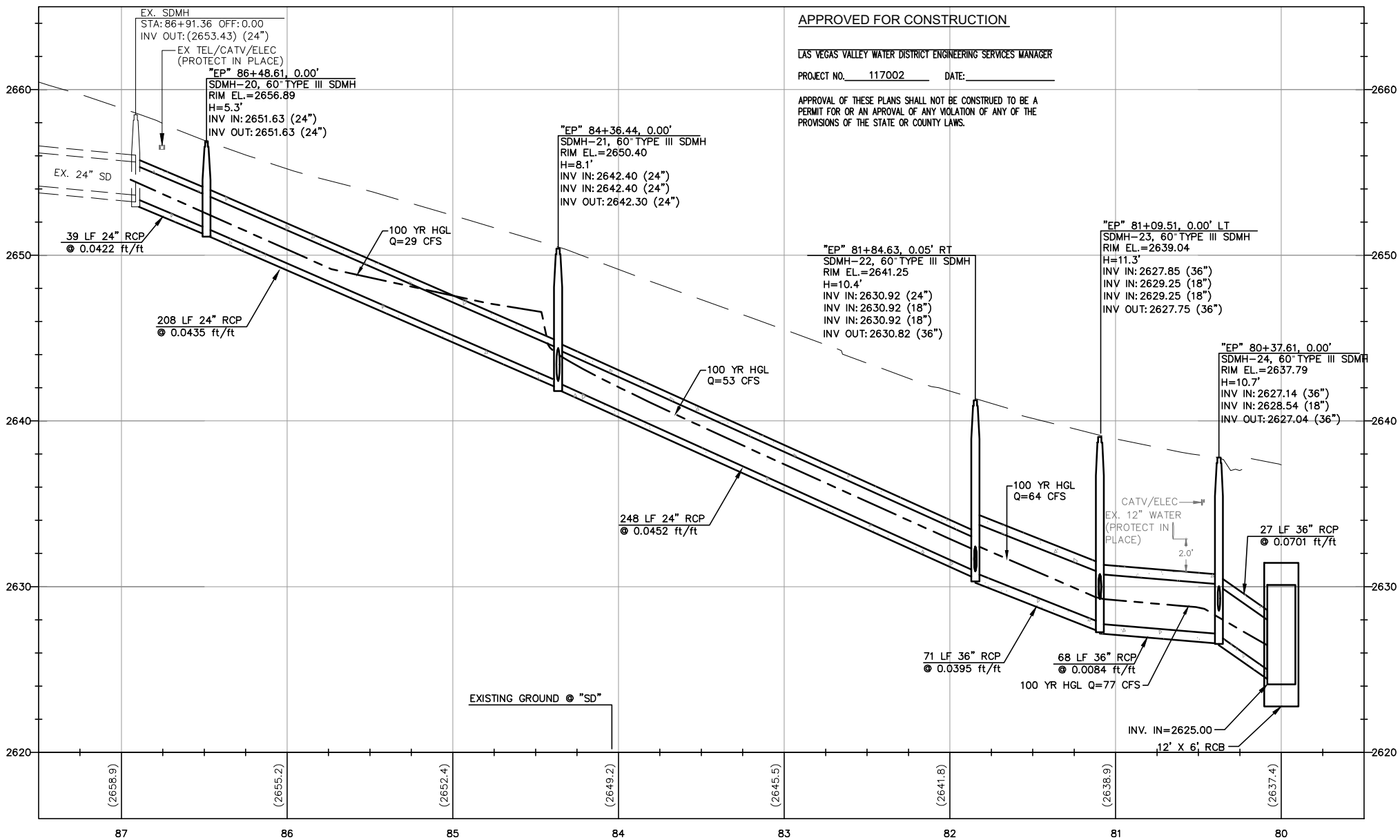
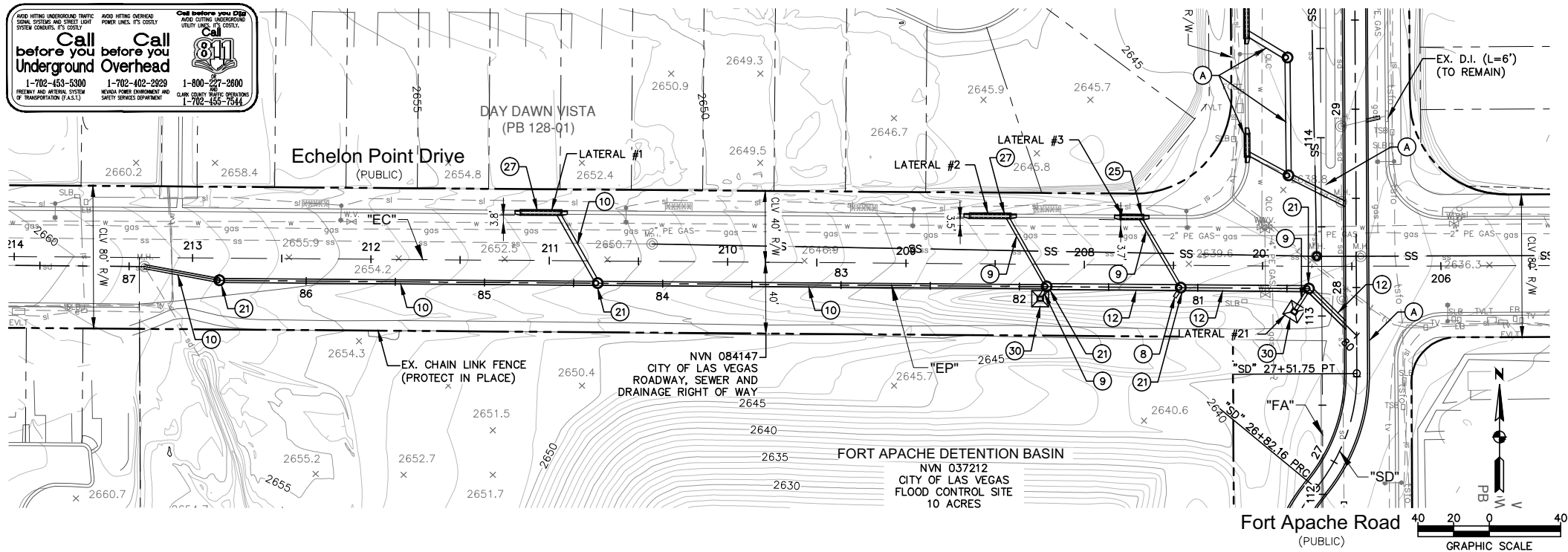
- | | |
|---|---|
| ① "DS" 70+23.81, 0.00' RT TO "DS" 72+34.90, 0.00' RT | INSTALL 4'X4' PRECAST RCB |
| ⑧ "DS" 70+95.33, 2.00' RT TO "DS" 70+99.52, 8.06' RT TO "DS" 70+98.52, 2.00' LT TO "DS" 71+03.75, 6.57' LT | INSTALL 8 LF OF 18" RCP AND CONNECT TO EXISTING RCP (SEE DETAILS 1/DT-3 AND 3/DT-4) |
| ⑨ "DS" 71+74.32, 2.00' LT TO "DS" 71+84.17, 19.01' LT | INSTALL 18" RCP (SEE DETAIL 1/DT-3) |
| ⑩ "DS" 71+25.05, 2.00' RT TO "DS" 71+46.29, 40.26' RT "DS" 72+35.02, 0.00' LT TO "DS" 72+45.47, 19.31' LT "DS" 75+08.72, 0.00' RT TO "DS" 75+30.32, 40.49' RT "DS" 76+00.02, 0.00' RT TO "DS" 76+03.53, 19.10' LT | INSTALL 24" RCP (SEE DETAIL 1/DT-3) |
| ⑪ "DS" 73+70.02, 0.00' RT TO "DS" 73+91.81, 40.47' RT "DS" 76+00.02, 0.28' RT TO "DS" 76+21.44, 40.71' RT | INSTALL 30" RCP |
| ⑭ "DS" 75+08.72, 0.00' RT TO "DS" 76+00.08, 0.00' RT | INSTALL 48" RCP |
| ⑰ "DS" 72+35.02, 0.00' RT TO "DS" 73+70.02, 0.00' RT "DS" 73+70.02, 0.00' RT TO "DS" 75+08.72, 0.00' RT | INSTALL 60"X38" HERCP |
| ⑳ "DS" 76+00.02, 0.00' RT | CONSTRUCT 60" TYPE III SDMH (SEE DETAIL 1/DT-5) |
| ㉒ "DS" 72+35.02, 0.00' RT "DS" 73+70.02, 0.00' RT "DS" 75+08.72, 0.00' RT | CONSTRUCT NDOT TYPE 4 SDMH PER NDOT STD DWG R-4.3.3 |
| ㉔ "DS" 71+91.23, 20.50' LT "DS" 72+51.71, 20.80' LT | CONSTRUCT TYPE "DM" DI (L=17') (SEE SHEET DT-6) |
| ㉕ "DS" 71+55.85, 41.74' RT "DS" 74+01.03, 41.95' RT "DS" 75+39.88, 41.98' RT "DS" 76+13.00, 20.58' LT "DS" 76+30.71, 42.23' RT | CONSTRUCT TYPE "DM" DI (L=22') (SEE SHEET DT-6) |



BY		DESCRIPTION		No.		DATE		WA#		SCALE(V): AS SHOWN		DATE: 4/30/2013		DSGN/CHK BY: JSD/SJD		THE Louis Berger Group, INC. 500 E. Amigo Court, Suite 100 Las Vegas, Nevada 89119 Voice: 702-736-6632 Fax: 702-736-0704	
90% DESIGN SUBMITTAL 4/30/2013 - NOT FOR CONSTRUCTION		DEPARTMENT OF PUBLIC WORKS RANCHO-FORT APACHE STORM DRAIN PLAN AND PROFILE "DS" 70+00 TO "DS" 77+00		SHEET: C-9		33 OF 109		CLV DRAWING NO: 327V150		90% DESIGN SUBMITTAL 4/30/2013 - NOT FOR CONSTRUCTION		90% DESIGN SUBMITTAL 4/30/2013 - NOT FOR CONSTRUCTION		90% DESIGN SUBMITTAL 4/30/2013 - NOT FOR CONSTRUCTION		90% DESIGN SUBMITTAL 4/30/2013 - NOT FOR CONSTRUCTION	

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AVOID HITTING UNDERGROUND TRAFFIC SIGNAL SYSTEMS AND STREET LIGHT SYSTEMS. IT'S COSTLY Call before you Underground 1-702-453-5300 FREEWAY AND AIRPORT SYSTEM OF TRANSPORTATION (F.A.S.T.)	AVOID HITTING OVERHEAD POWER LINES. IT'S COSTLY Call before you Overhead 1-702-402-2929 NEVADA POWER ENVIRONMENT AND SAFETY SERVICES DEPARTMENT	Call before you Dig AVOID CUTTING UNDERGROUND UTILITY LINES. IT'S COSTLY. Call 811 1-800-227-2600 CLARK COUNTY TRAFFIC OPERATIONS 1-702-455-7544
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RANCHO - FORT APACHE STORM DRAIN

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H#36802

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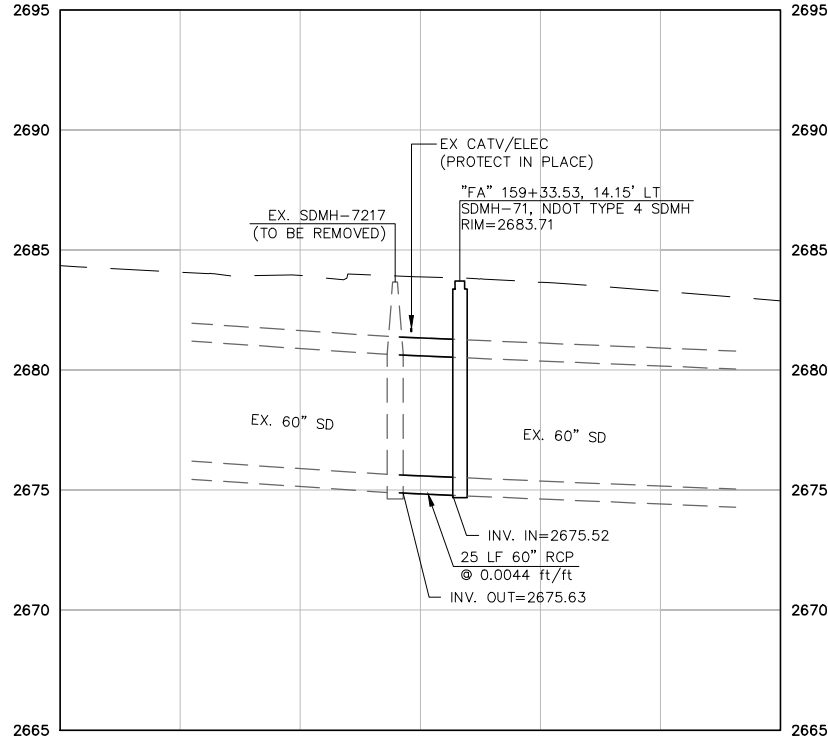
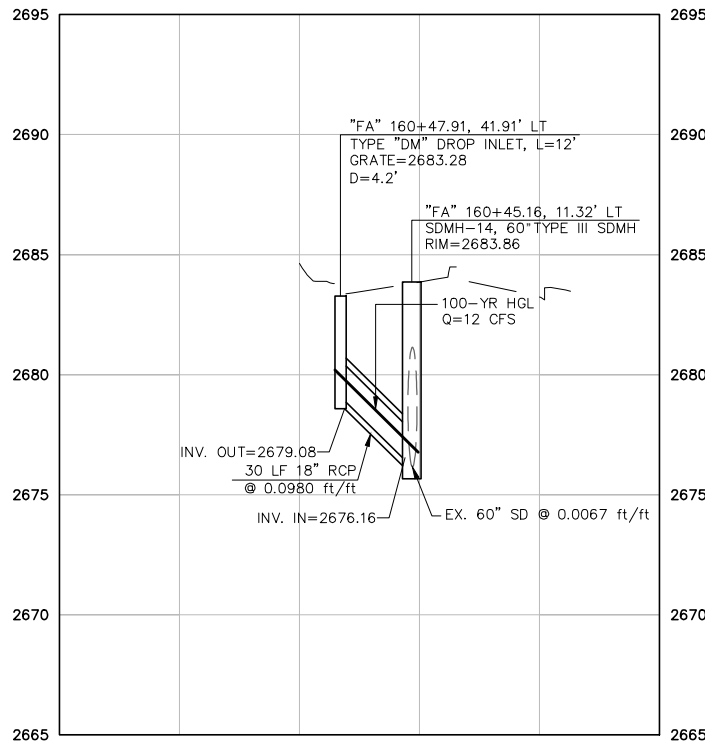
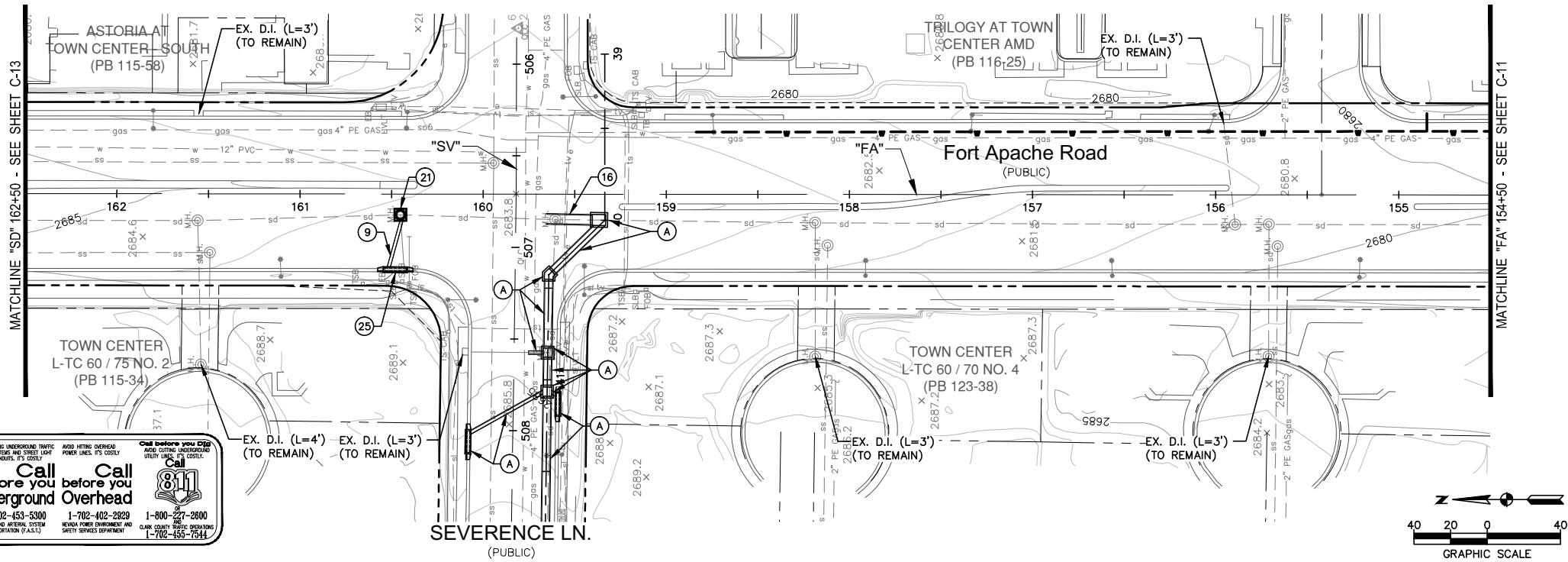
RANCHO - FORT APACHE STORM DRAIN

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Call before you Dig
Call before you Dig
Call before you Dig

1-702-453-5300
1-702-402-2829
1-800-227-2600

NEVADA POWER ENVIRONMENT AND SAFETY SERVICES DEPARTMENT
CLARK COUNTY WATER OPERATIONS
1-702-453-1044



CONSTRUCTION ITEMS

- ⑨ "FA" 160+45.16, 11.32' LT TO "FA" 160+51.65, 40.39' LT
INSTALL 18" RCP
- ⑩ "FA" 159+36.29, 14.05' LT TO "FA" 159+65.55, 13.52' LT
INSTALL 60" RCP
- ⑪ "FA" 160+45.16, 11.32' LT
CONSTRUCT 60" TYPE III SDMH (SEE DETAIL 1/DT-5)
- ⑫ "FA" 160+47.91, 41.91' LT
CONSTRUCT TYPE "DM" DI (L=12') (SEE SHEET DT-6)
- Ⓐ SEE SHEET C-14

NOTES:

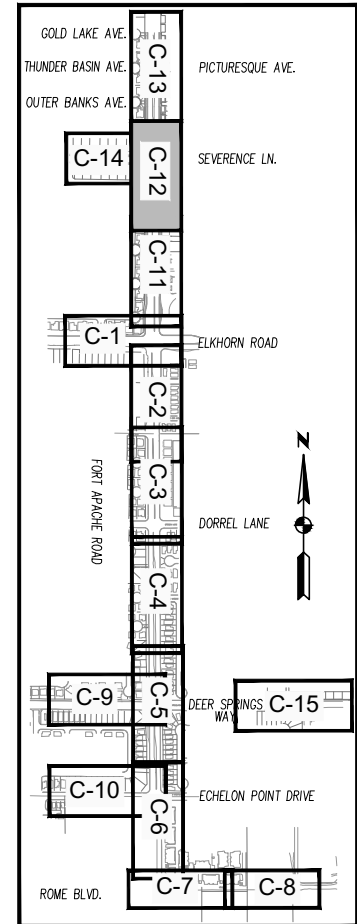
- SEE SHEETS CP-1 THROUGH CP-5 FOR HORIZONTAL CONTROL PLANS.
- SEE SHEETS R-1 THROUGH R-15 FOR REMOVAL PLANS.
- SEE SHEETS U-16 AND U-17 FOR WATERLINE RELOCATION PLANS.
- SEE SHEETS U-17 THROUGH U-21 FOR SEWERLINE RELOCATION PLANS.
- SEE SHEETS LP-1 THROUGH LP-7 FOR STORM DRAIN LATERAL PROFILES.

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER

PROJECT NO. 117002 DATE: _____

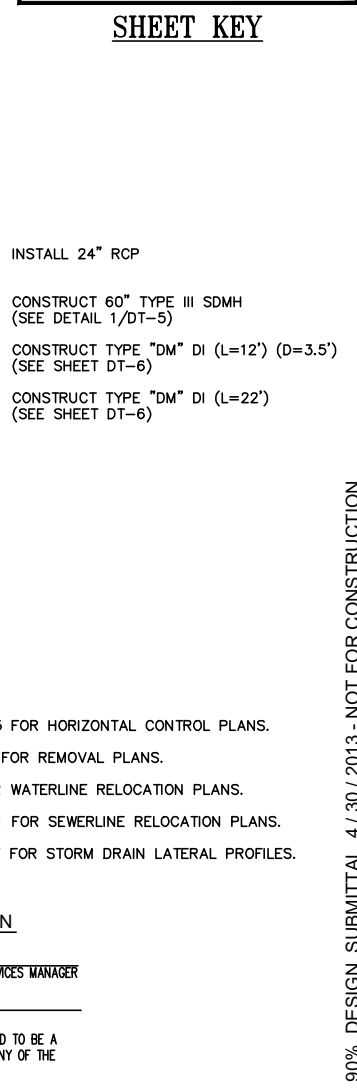
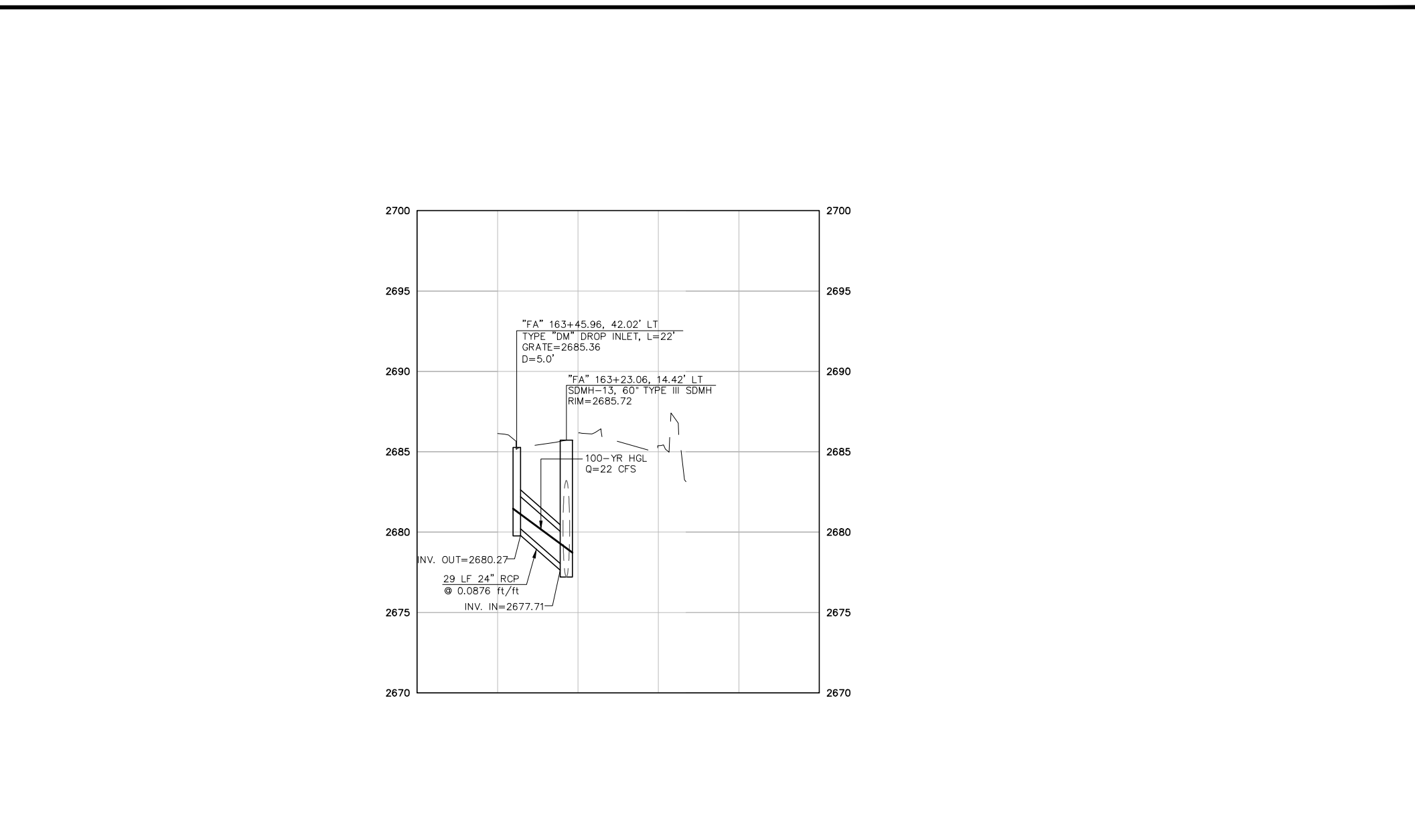
APPROVAL OF THESE PLANS SHALL NOT BE CONSTRUED TO BE A PERMIT FOR OR AN APPROVAL OF ANY VIOLATION OF ANY OF THE PROVISIONS OF THE STATE OR COUNTY LAWS.



SHEET KEY

90% DESIGN SUBMITTAL 4/30/2013 - NOT FOR CONSTRUCTION	DEPARTMENT OF PUBLIC WORKS RANCHO-FORT APACHE STORM DRAIN PLAN AND PROFILE	90% DESIGN SUBMITTAL 4/30/2013 NOT FOR CONSTRUCTION
SHEET: C-12 OF 109 CLV DRAWING NO: 327V150	PROJECT: RANCHO-FORT APACHE STORM DRAIN PLAN AND PROFILE	SHEET TITLE: RANCHO - FORT APACHE STORM DRAIN

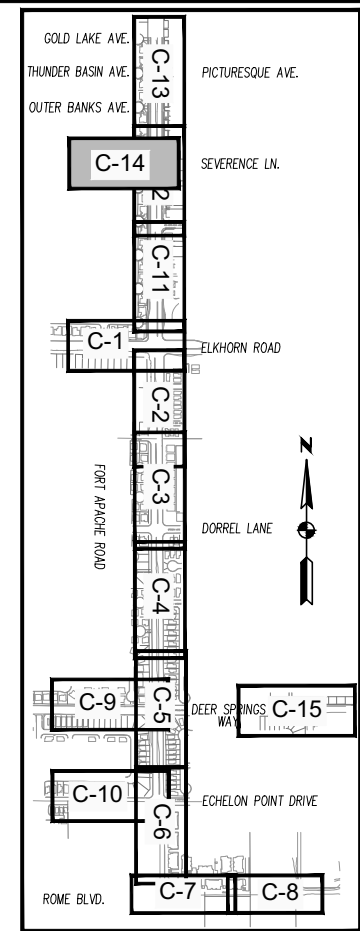
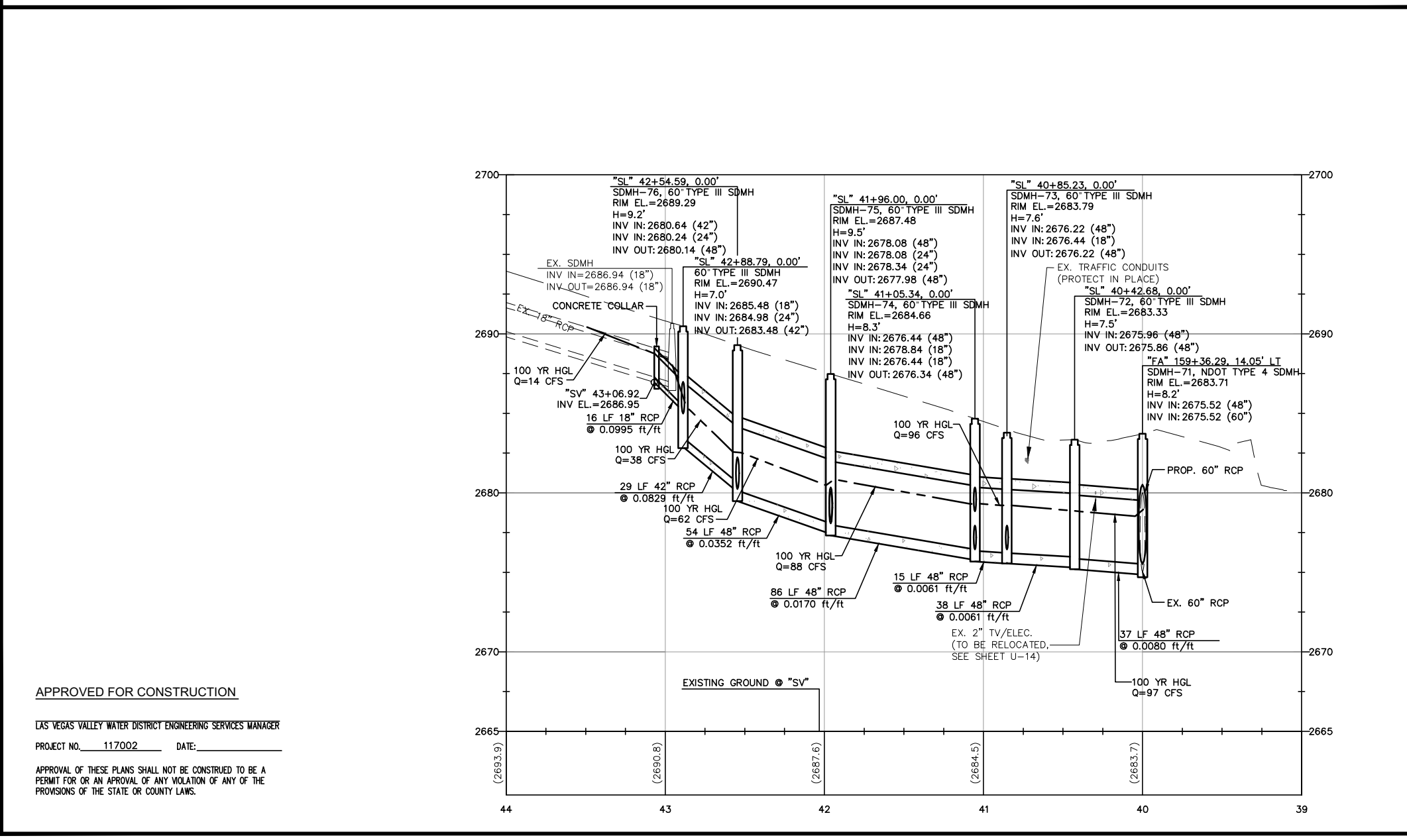
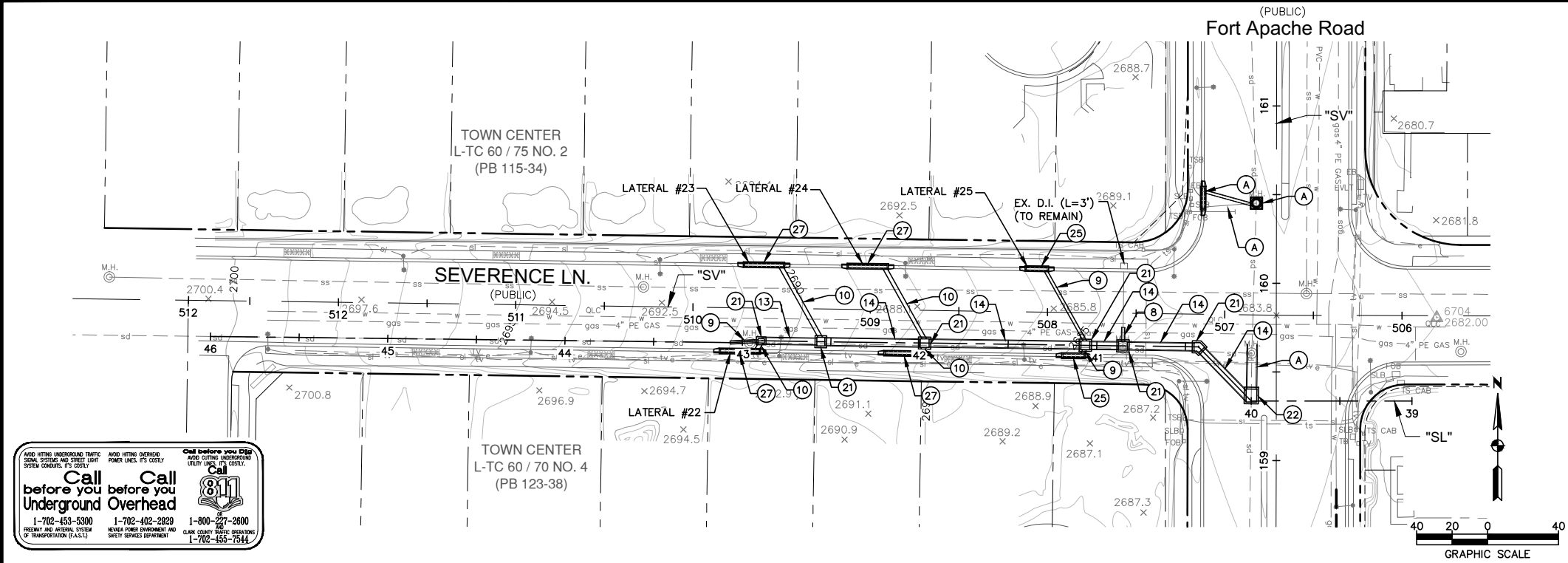
THE Louis Berger Group, INC.
500 E. Amigo Court, Suite 100
Las Vegas, Nevada 89119
Voice: 702-736-6632
Fax: 702-736-0704



SHEET: C-13		CLV DRAWING NO: 327V150		NOT FOR CONSTRUCTION		SHEET TITLE: PLAN AND PROFILE	
90% DESIGN SUBMITTAL 4/30/2013				PROJECT: RANCHO-FORT APACHE STORM DRAIN			
DEPARTMENT OF PUBLIC WORKS							
CLV DESIGN SUBMITTAL 4/30/2013 NOT FOR CONSTRUCTION				THE Louis Berger Group, INC. 500 E. Amigo Court, Suite 100 Las Vegas, Nevada 89119 Voice: 702-736-6632 Fax: 702-736-0704			
SCALE(H): AS SHOWN		SCALE(V): AS SHOWN		WA#		DATE: 4/30/2013	
FIELD BOOK #:		DATE: 4/30/2013		DSGN/CHK BY: JSD/SJD		DESCRIPTION	
No.		DATE		BY			

RANCHO - FORT APACHE STORM DRAIN

P:\CL\VCcb1121_fort apache_sd\Plans\Sheets\03_Construction\CB1121_C-1.dwg May 09, 2013 - 2:48pm jsmclz



CONSTRUCTION ITEMS				DESCRIPTION
ITEM	DESCRIPTION	AMOUNT	UNIT	
8	"SL" 40+85.22, 0.00' LT TO 40+85.25, 10.42' RT	10.42	LF	INSTALL 8 LF OF 18" RCP AND CONNECT TO EXISTING RCP WITH CONCRETE COLLAR (SEE DETAIL 3/DT-4)
9	"SL" 41+06.44, 0.00' LT TO 41+29.54, 41.93' RT	41.93	LF	INSTALL 18" RCP
10	"SL" 41+06.44, 0.00' LT TO 41+08.27, 5.07' RT	5.07	LF	INSTALL 24" RCP
13	"SL" 42+55.68, 0.00' LT TO 42+89.32, 0.04' RT	0.04	LF	INSTALL 42" RCP
14	"FA" 159+36.29, 14.05' LT TO 40+42.68, 0.00' LT	14.05	LF	INSTALL 48" RCP
21	"SL" 40+42.68, 0.00' LT TO 40+85.22, 0.00' LT	42.54	LF	CONSTRUCT 60" TYPE III SDMH (SEE DETAIL 1/DT-5)
22	"FA" 159+36.29, 14.05' LT	14.05	LF	CONSTRUCT NDOT TYPE 4 MH (SEE DETAIL 2/DT-5)
25	"SL" 41+13.12, 6.57' LT TO 41+34.39, 43.43' RT	43.43	LF	CONSTRUCT TYPE "DM" DI (L=12') (SEE SHEET DT-6)
27	"SL" 42+08.48, 6.57' LT TO 42+29.75, 43.43' RT	43.43	LF	CONSTRUCT TYPE "DM" DI (L=22') (SEE SHEET DT-6)
A	SEE SHEET C-12			

90% DESIGN SUBMITTAL 4 / 30 / 2013 - NOT FOR CONSTRUCTION

DEPARTMENT OF PUBLIC WORKS
RANCHO-FORT APACHE
STORM DRAIN
PLAN AND PROFILE

90%
DESIGN
SUBMITTAL
4/30/2013
NOT FOR CONSTRUCTION

SHEET:
C-14
OF 109
CLV DRAWING NO:
327V150

BY

DATE

WA#

SCALE(V): AS SHOWN

SCALE(H): AS SHOWN

DATE: 4/30/2013

DESIGN/CHK BY: USD/SLD

FIELD BOOK #:

THE Louis Berger Group, INC.
500 E. Amigo Court, Suite 100
Las Vegas, Nevada 89119
Voice: 702-736-6632
Fax: 702-736-0704

CLV LAS VEGAS NEVADA

RANCHO - FORT APACHE STORM DRAIN



CAUTION:
CONTRACTOR TO CALL SOUTHWEST
GAS AT 365-2296 FOR STANDBY WHEN
EXCAVATING OVER OR NEAR HIGH
PRESSURE GAS

40 20 0 40

GRAPHIC SCALE



1. SEE SHEETS CP-1 THROUGH CP-5 FOR HORIZONTAL CONTROL PLANS.
2. SEE SHEETS U-16 THROUGH U-17 FOR WATERLINE RELOCATION PLANS AND PROFILES.
3. SEE SHEETS U-18 THROUGH U-21 FOR SEWER RELOCATION PLANS AND PROFILES.
4. SEE SHEETS RC-1 THROUGH RC-14 FOR VALVE AND COVER ADJUSTMENTS.

SHEET KEY

90% DESIGN SUBMITTAL 4 / 30 / 2013 - NOT FOR CONSTRUCTION

SHIFTS TIME.

SHEET:
U-1
40 OF 109
CLV DRAWING NO:
327V150



P:\CLV\csb1121.dwg - apache.safPlans\Sheets\04_Uilities\CS1121_U-1.dwg May 09, 2013 2:15pm jschmidez

Call before you dig
UNDERGROUND

1-702-453-5300
FIREARM AND ARTISAN SYSTEM
OF TRANSPORTATION (F.A.S.T.)

Call before you dig
OVERHEAD

1-702-402-2929
NEVADA POWER ENVIRONMENT AND
SAFETY SERVICES DEPARTMENT

Call before you dig
Call 811

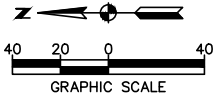
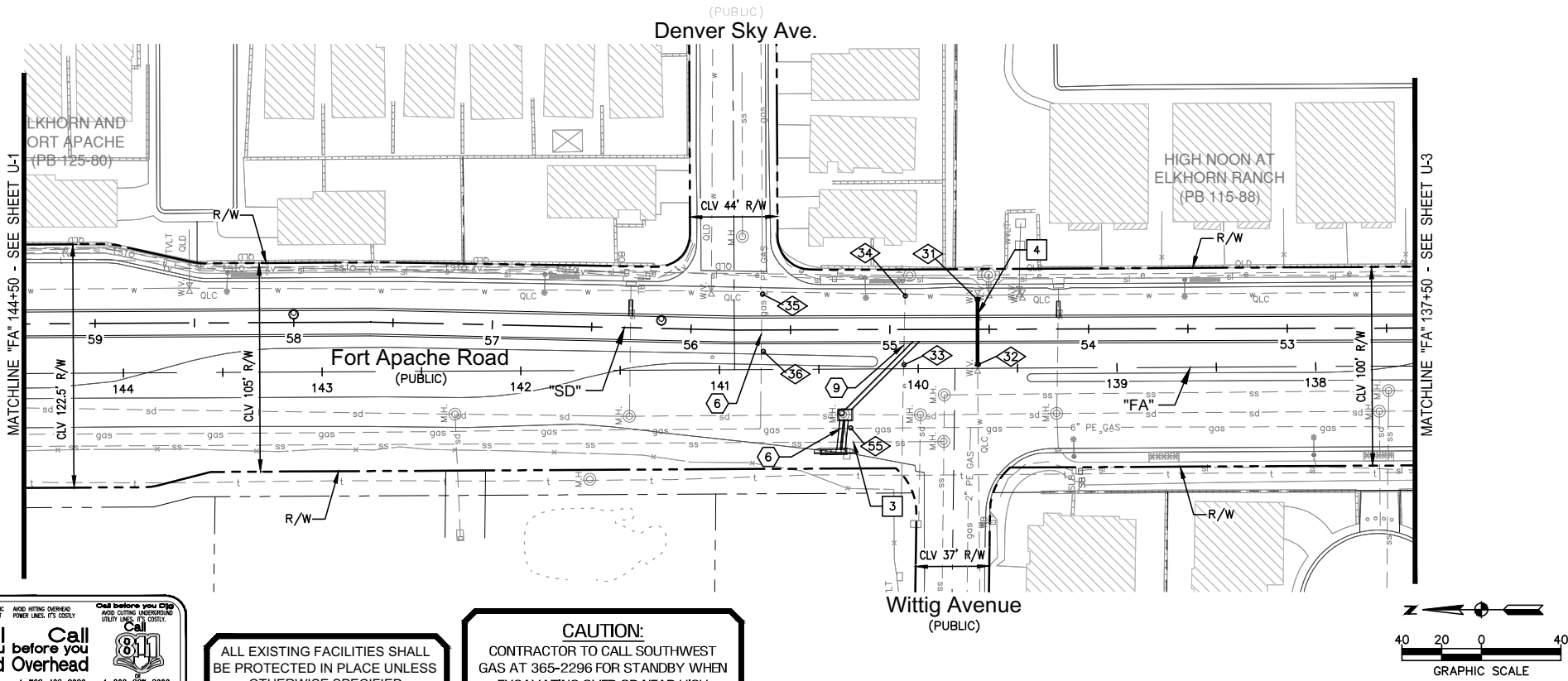
1-800-277-2600
CLARK COUNTY TRUCK OPERATIONS
1-702-455-7544

ALL EXISTING FACILITIES SHALL
BE PROTECTED IN PLACE UNLESS
OTHERWISE SPECIFIED

CAUTION:
CONTRACTOR TO CALL SOUTHWEST
GAS AT 365-2296 FOR STANDBY WHEN
EXCAVATING OVER OR NEAR HIGH
PRESSURE GAS

TH No.	Utility			Depth to Top (ft)	Depth to Bottom (ft)	Top Elev	Bottom Elev	Algmt.	Station	Offset
	Type	Dia (inches)	Width (inches)							
TH31	WATER	12	N/A	4.42	N/A	2662.76	---	"FA"	139+69.9	34.4' RT
TH32	WATER	10	N/A	5.95	N/A	2661.78	---	"FA"	139+69.8	1.9' RT
TH33	ELEC	2-2"	N/A	3.46	N/A	2664.60	---	"FA"	140+07.1	2.1' RT
TH34	ELEC	2-2"	N/A	3.84	N/A	2663.83	---	"FA"	140+06.3	36.7' RT
TH34	WATER	12	N/A	4.40	N/A	2663.27	---	"FA"	140+06.3	36.7' RT
TH35	GAS	2	N/A	3.11	N/A	2664.95	---	"FA"	140+78.1	37.9' RT
TH35	WATER	12	N/A	3.91	N/A	2664.15	---	"FA"	140+78.1	37.9' RT
TH36	GAS	2	N/A	3.17	N/A	2665.32	---	"FA"	140+77.8	9.1' RT
TH55	GAS	6	N/A	4.78	N/A	2663.01	---	"FA"	140+34.1	29.6' LT

- NOTES:**
- SEE SHEETS CP-1 THROUGH CP-5 FOR HORIZONTAL CONTROL PLANS.
 - SEE SHEETS U-16 THROUGH U-17 FOR WATERLINE RELOCATION PLANS AND PROFILES.
 - SEE SHEETS U-18 THROUGH U-21 FOR SEWER RELOCATION PLANS AND PROFILES.
 - SEE SHEETS RC-1 THROUGH RC-14 FOR VALVE AND COVER ADJUSTMENTS.



APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
PROJECT NO. 117002 DATE: _____

APPROVAL OF THESE PLANS SHALL NOT BE CONSTRUED TO BE A
PERMIT FOR OR AN APPROVAL OF ANY VIOLATION OF ANY OF THE
PROVISIONS OF THE STATE OR COUNTY LAWS.

DRY UTILITY ITEMS

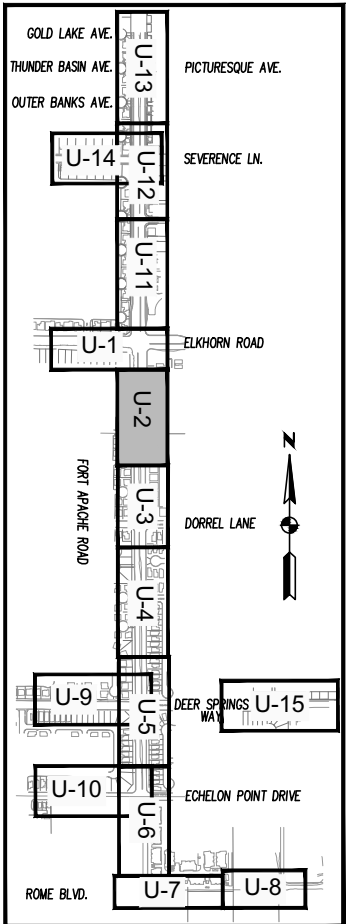
- EXISTING GAS FACILITIES TO BE RELOCATED BY SOUTHWEST GAS
- EXISTING CATV FACILITIES TO BE RELOCATED BY COX COMMUNICATIONS
- EXISTING TELEPHONE FACILITIES TO BE RELOCATED BY CENTURY LINK
- EXISTING ELECTRIC FACILITIES TO BE RELOCATED BY NV ENERGY
- EXISTING FIBER OPTIC FACILITIES TO BE RELOCATED BY CONTRACTOR
- EXISTING GAS FACILITIES TO BE PROTECTED IN PLACE
- EXISTING CATV FACILITIES TO BE PROTECTED IN PLACE
- EXISTING TELEPHONE FACILITIES TO BE PROTECTED IN PLACE
- EXISTING ELECTRIC FACILITIES TO BE PROTECTED IN PLACE
- EXISTING FIBER OPTIC FACILITIES TO BE PROTECTED IN PLACE
- EXISTING TRAFFIC/STREET LIGHT FACILITIES TO BE PROTECTED IN PLACE

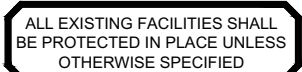
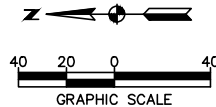
UTILITY RELOCATION AND REMOVAL ITEMS

- EXISTING SEWER TO BE RELOCATED (SEE NOTE 3 BELOW)
- EXISTING SEWER TO BE REMOVED
- EXISTING SEWER TO BE PROTECTED IN PLACE
- EXISTING WATER LINE TO BE RELOCATED (SEE NOTE 2 BELOW)
- EXISTING WATER LINE TO BE REMOVED
- EXISTING WATER TO BE PROTECTED IN PLACE
- EXISTING MANHOLE AND MANHOLE BASE TO BE REMOVED
- EXISTING SEWER TO BE ABANDONED
- EXISTING SEWER MANHOLE TO BE PLUGGED WHERE SEWER IS REMOVED AND RE-FORM TROUGH

UTILITY CONSTRUCTION ITEMS

- INSTALL 8-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- INSTALL 12-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- INSTALL 15-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- INSTALL 60-INCH STANDARD PRE-CAST MANHOLE WITH CORROSION PROTECTION PER DCSWCS SD-1A, SD-1B, SD-3, 3.16.8 AND 4.9.9.
- CONNECT TO EXISTING MANHOLE/SEWER.
- INSTALL 10-INCH D.I.P. WATER LINE WITH RESTRAINED JOINTS PER UDACS.
- INSTALL 12-INCH D.I.P. WATER LINE WITH RESTRAINED JOINTS PER UDACS.
- INSTALL 45 DEG. BEND WITH RESTRAINED JOINTS PER UDACS.
- INSTALL 90 DEG. BEND WITH RESTRAINED JOINTS PER UDACS.
- INSTALL WET TAPPING SLEEVE WITH MECHANICAL JOINTS AND 10" TAPPING VALVE PER UDACS.
- CUT AND CAP EXISTING WATERLINE PER UDACS.
- INSTALL 20-INCH STEEL CASING PER UDDACS PLATE 23.
- INSTALL 24-INCH STEEL CASING PER UDACS PLATE 23.
- INSTALL 18-INCH PVC SDR35 SANITARY SEWER LINE PER DCSWCS.
- INSTALL 72-INCH STANDARD PRE-CAST MANHOLE WITH CORROSION PROTECTION PER DCSWCS SD-1A, SD-1B, SD-3, 3.16.8 AND 4.9.9.





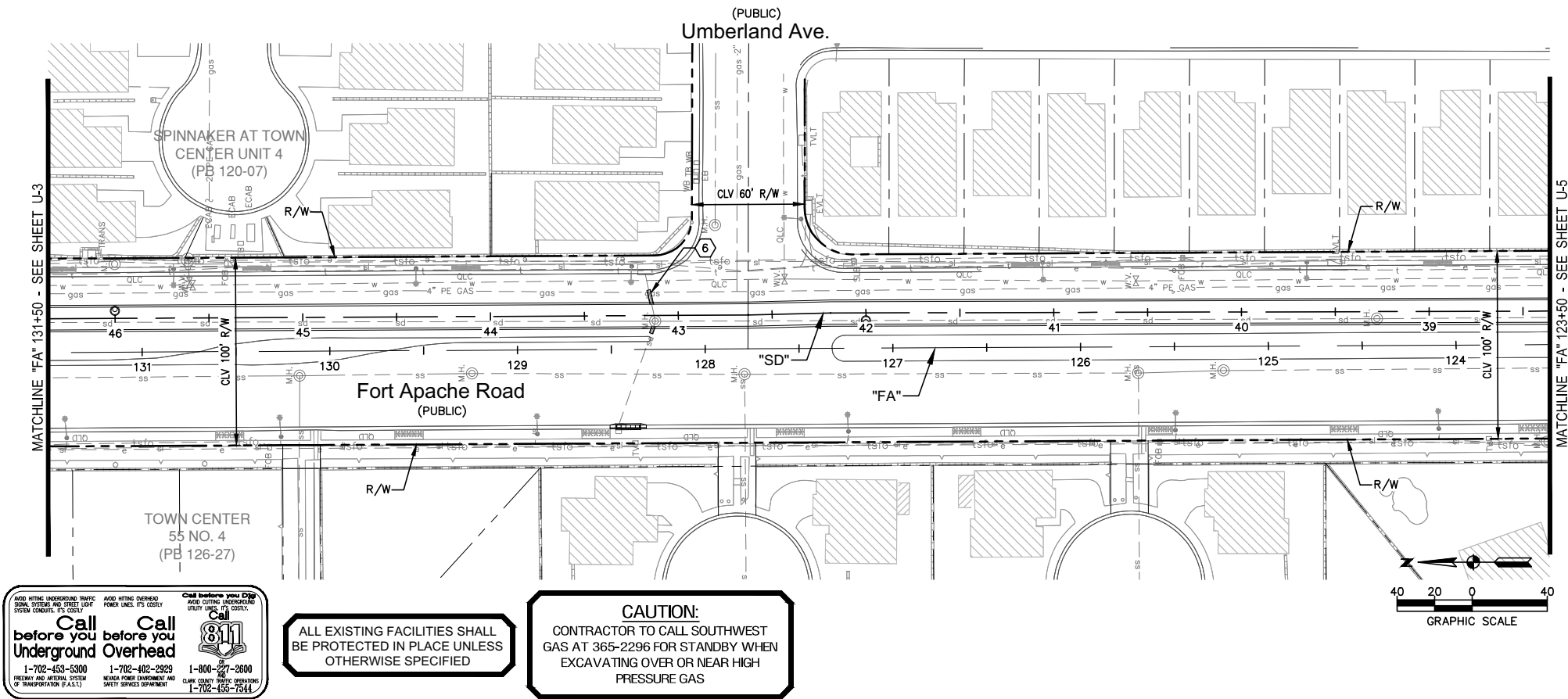
NOTES:

1. SEE SHEETS CP-1 THROUGH CP-5 FOR HORIZONTAL CONTROL PLANS.
2. SEE SHEETS U-16 THROUGH U-17 FOR WATERLINE RELOCATION PLANS AND PROFILES.
3. SEE SHEETS U-18 THROUGH U-21 FOR SEWER RELOCATION PLANS AND PROFILES.
4. SEE SHEETS RC-1 THROUGH RC-14 FOR VALVE AND COVER ADJUSTMENTS.

- ① INSTALL 8-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- ② INSTALL 12-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- ③ INSTALL 15-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- ④ INSTALL 60-INCH STANDARD PRE-CAST MANHOLE WITH CORROSION PROTECTION PER DCSWCS SD-1A, SD-1B, SD-3, 3.16.8 AND 4.9.9.
- ⑤ CONNECT TO EXISTING MANHOLE/SEWER.
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- ⑪ CUT AND CAP EXISTING WATERLINE PER UDACS.
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- ⑬ INSTALL 24-INCH STEEL CASING PER UDACS PLATE 23.
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- ⑮ INSTALL 72-INCH STANDARD PRE-CAST MANHOLE WITH CORROSION PROTECTION PER DCSWCS SD-1A, SD-1B, SD-3, 3.16.8 AND 4.9.9.



90% DESIGN SUBMITTAL 4 / 30 / 2013 - NOT FOR CONSTRUCTION



Call before you Dig
1-702-453-5300
FREIGHT AND AIRPORT SYSTEM OF TRANSPORTATION (F.A.S.T.)

Call before you Dig
1-702-402-2929
NEVADA POWER ENVIRONMENT AND SAFETY SERVICES DEPARTMENT

Call before you Dig
1-800-227-2600
CLARK COUNTY PUBLIC UTILITIES DEPARTMENT

ALL EXISTING FACILITIES SHALL BE PROTECTED IN PLACE UNLESS OTHERWISE SPECIFIED

CAUTION:
CONTRACTOR TO CALL SOUTHWEST GAS AT 365-2296 FOR STANDBY WHEN EXCAVATING OVER OR NEAR HIGH PRESSURE GAS

NOTES:

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APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
PROJECT NO. 117002 DATE: _____

APPROVAL OF THESE PLANS SHALL NOT BE CONSTRUED TO BE A PERMIT FOR OR AN APPROVAL OF ANY VIOLATION OF ANY OF THE PROVISIONS OF THE STATE OR COUNTY LAWS.

DRY UTILITY ITEMS

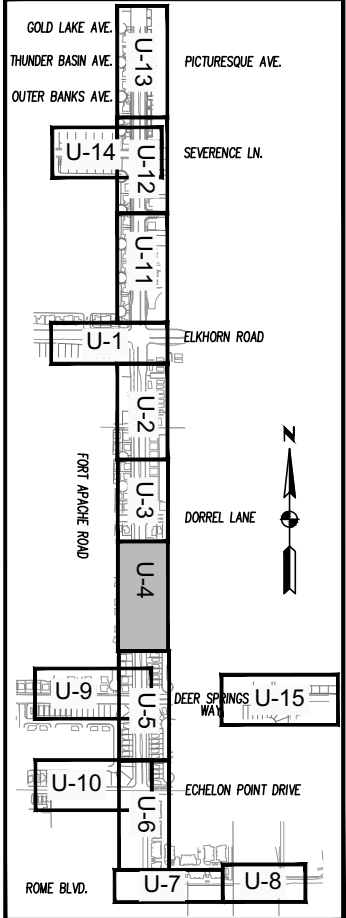
- 1 EXISTING GAS FACILITIES TO BE RELOCATED BY SOUTHWEST GAS
- 2 EXISTING CATV FACILITIES TO BE RELOCATED BY COX COMMUNICATIONS
- 3 EXISTING TELEPHONE FACILITIES TO BE RELOCATED BY CENTURY LINK
- 4 EXISTING ELECTRIC FACILITIES TO BE RELOCATED BY NV ENERGY
- 5 EXISTING FIBER OPTIC FACILITIES TO BE RELOCATED BY CONTRACTOR
- 6 EXISTING GAS FACILITIES TO BE PROTECTED IN PLACE
- 7 EXISTING CATV FACILITIES TO BE PROTECTED IN PLACE
- 8 EXISTING TELEPHONE FACILITIES TO BE PROTECTED IN PLACE
- 9 EXISTING ELECTRIC FACILITIES TO BE PROTECTED IN PLACE
- 10 EXISTING FIBER OPTIC FACILITIES TO BE PROTECTED IN PLACE
- 11 EXISTING TRAFFIC/STREET LIGHT FACILITIES TO BE PROTECTED IN PLACE

UTILITY RELOCATION AND REMOVAL ITEMS

- 1 EXISTING SEWER TO BE RELOCATED (SEE NOTE 3 BELOW)
- 2 EXISTING SEWER TO BE REMOVED
- 3 EXISTING SEWER TO BE PROTECTED IN PLACE
- 4 EXISTING WATER LINE TO BE RELOCATED (SEE NOTE 2 BELOW)
- 5 EXISTING WATER LINE TO BE REMOVED
- 6 EXISTING WATER TO BE PROTECTED IN PLACE
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- 8 EXISTING SEWER TO BE ABANDONED
- 9 EXISTING SEWER MANHOLE TO BE PLUGGED WHERE SEWER IS REMOVED AND RE-FORM TROUGH

UTILITY CONSTRUCTION ITEMS

- 1 INSTALL 8-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- 2 INSTALL 12-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
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SHEET KEY

BY		DESCRIPTION		No.		DATE		WA#		SCALE(V)		NONE		DATE: 4/30/2013		DESIGN/CHK BY: TOT/DJM		FIELD BOOK #:		SCALE(ED): AS SHOWN		FIELD BOOK #:		THE Louis Berger Group, INC. 500 E. Amigo Court, Suite 100 Las Vegas, Nevada 89119 Voice: 702-736-6632 Fax: 702-736-0704		CLV DRAWING NO: 327V150	

DEPARTMENT OF PUBLIC WORKS
RANCHO-FORT APACHE STORM DRAIN UTILITIES PLAN
"FA" 123+50 TO "FA" 131+50
90% DESIGN SUBMITTAL 4/30/2013 NOT FOR CONSTRUCTION
U-4
43 OF 109
327V150

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Call before you dig

Call before you dig

Call before you dig

1-702-453-5300

1-702-402-2829

1-800-227-2800

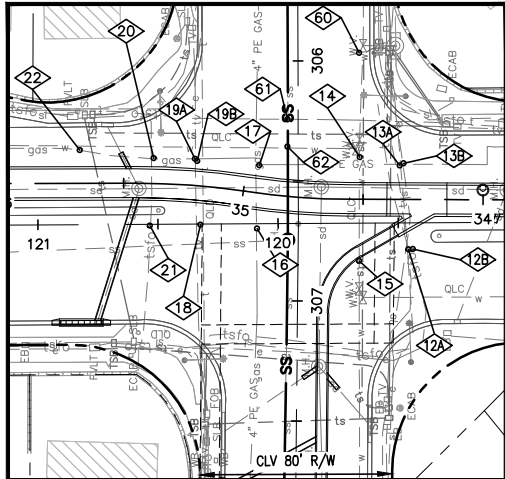
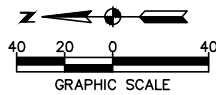
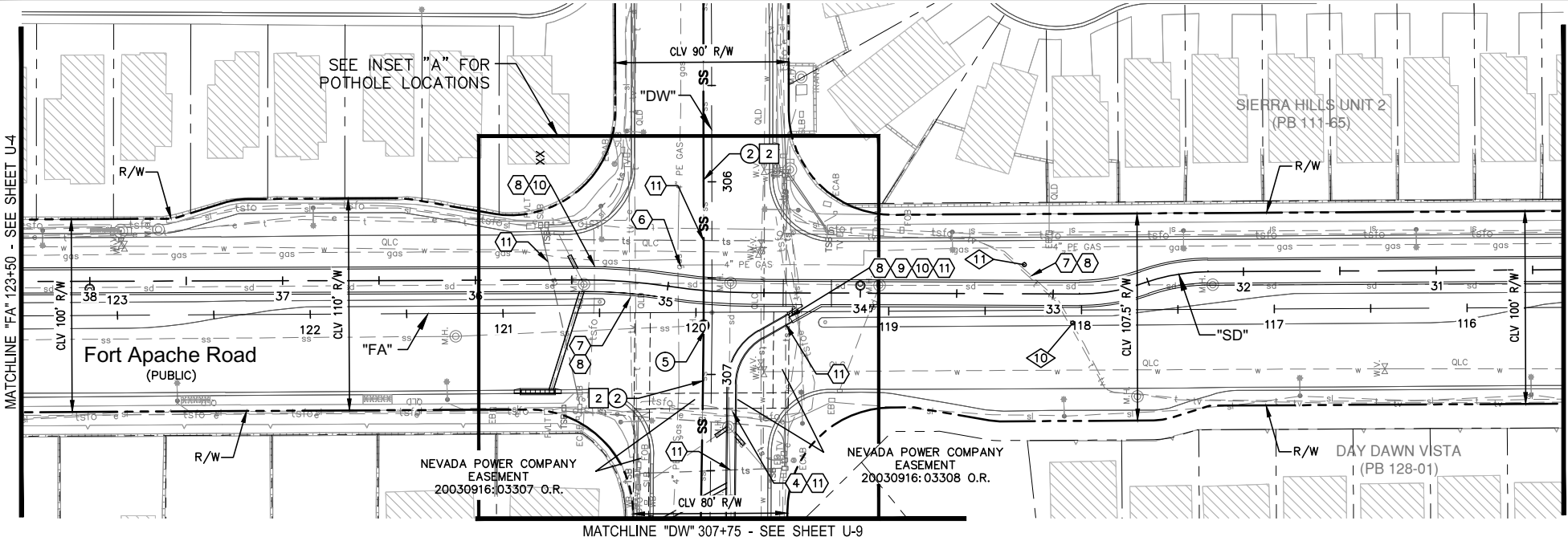
NEVADA POWER COMPANY

20030916:03307 O.R.

20030916:03308 O.R.

TH No.	Utility			Depth to Top (ft)	Depth to Bottom (ft)	Top Elev	Bottom Elev	Algmt.	Station	Offset
	Type	Dia (inches)	Width (inches)							
TH10	ENCASED TV/TEL	N/A	33	3.13	3.94	2642.62	2641.81	"FA"	118+04.9	7.3' LT
TH11	ENCASED TV/TEL	N/A	33	2.62	3.23	2642.73	2642.12	"FA"	118+29.8	23.2' RT
TH12A	FO/TEL/ELEC	N/A	4-4"	4.19	N/A	2643.61	---	"FA"	119+45.7	11.0' LT
TH12B	FO/TEL/ELEC	N/A	5-3"	3.09	N/A	2644.65	---	"FA"	119+44.0	10.9' LT
TH13A	FO/TEL/ELEC	4	5-3"	3.62	N/A	2643.89	---	"FA"	119+47.5	24.8' RT
TH13A	GAS	4	4	4.63	N/A	2642.88	---	"FA"	119+47.5	24.8' RT
TH13B	FO/TEL	N/A	2-4"	5.31	N/A	2642.26	---	"FA"	119+49.1	23.8' RT
TH13B	ELEC	N/A	2-4"	6.72	N/A	2640.85	---	"FA"	119+49.1	23.8' RT
TH14	WATER	10	N/A	3.33	N/A	2644.69	---	"FA"	119+65.8	27.4' RT
TH15	WATER	10	N/A	2.80	N/A	2645.66	---	"FA"	119+66.4	15.8' LT
TH16	GAS	4	N/A	3.69	N/A	2645.22	---	"FA"	120+08.7	2.1' LT
TH17	GAS	4	N/A	3.80	N/A	2644.60	---	"FA"	120+07.6	24.4' RT
TH18	TV	N/A	4-4"	3.69	N/A	2645.24	---	"FA"	120+32.3	0.4' LT
TH18-2	TEL	N/A	2-3"	5.39	N/A	2643.54	---	"FA"	120+32.3	0.4' LT
TH19A	GAS	6	N/A	4.36	N/A	2644.08	---	"FA"	120+34.5	27.2' RT
TH19B	TEL/GAS	N/A	4-3"/4"	4.16	N/A	2644.29	---	"FA"	120+33.6	26.2' RT
TH19B-2	TV	N/A	2-4"	5.62	N/A	2642.83	---	"FA"	120+33.6	26.2' RT
TH20	GAS	4	N/A	3.62	N/A	2644.97	---	"FA"	120+51.6	27.5' RT
TH20-2	FO	N/A	3-3"/3-2"	3.10	N/A	2645.49	---	"FA"	120+51.6	27.5' RT
TH21	TS/FO	N/A	3-3"/3-2"	4.36	N/A	2644.71	---	"FA"	120+53.4	0.7' LT
TH22	GAS	4	N/A	4.56	N/A	2644.24	---	"FA"	120+82.3	31' RT
TH60	WATER	10	N/A	4.02	N/A	2643.28	---	"DW"	305+96.8	25.6' LT
TH61	TV/TEL/STLT	2-4"/2-3"	N/A	6.02	N/A	2642.09	---	"FA"	119+95.9	43.3' RT
TH62	WATER	12	N/A	3.82	N/A	2644.49	---	"FA"	119+95.9	32.0' RT

- NOTES:
- SEE SHEETS CP-1 THROUGH CP-5 FOR HORIZONTAL CONTROL PLANS.
 - SEE SHEETS U-16 THROUGH U-17 FOR WATERLINE RELOCATION PLANS AND PROFILES.
 - SEE SHEETS U-18 THROUGH U-21 FOR SEWER RELOCATION PLANS AND PROFILES.
 - SEE SHEETS RC-1 THROUGH RC-14 FOR VALVE AND COVER ADJUSTMENTS.



INSET "A"

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
PROJECT NO. 117002 DATE:

APPROVAL OF THESE PLANS SHALL NOT BE CONSTRUED TO BE A PERMIT FOR OR AN APPROVAL OF ANY VIOLATION OF ANY OF THE PROVISIONS OF THE STATE OR COUNTY LAWS.

DRY UTILITY ITEMS

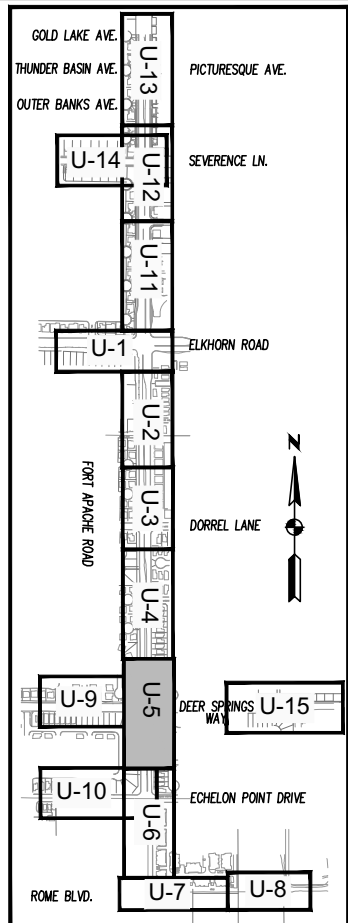
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- EXISTING CATV FACILITIES TO BE RELOCATED BY COX COMMUNICATIONS
- EXISTING TELEPHONE FACILITIES TO BE RELOCATED BY CENTURY LINK
- EXISTING ELECTRIC FACILITIES TO BE RELOCATED BY NV ENERGY
- EXISTING FIBER OPTIC FACILITIES TO BE RELOCATED BY CONTRACTOR
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- EXISTING FIBER OPTIC FACILITIES TO BE PROTECTED IN PLACE
- EXISTING TRAFFIC/STREET LIGHT FACILITIES TO BE PROTECTED IN PLACE

UTILITY RELOCATION AND REMOVAL ITEMS

- EXISTING SEWER TO BE RELOCATED (SEE NOTE 3 BELOW)
- EXISTING SEWER TO BE REMOVED
- EXISTING SEWER TO BE PROTECTED IN PLACE
- EXISTING WATER LINE TO BE RELOCATED (SEE NOTE 2 BELOW)
- EXISTING WATER LINE TO BE REMOVED
- EXISTING WATER TO BE PROTECTED IN PLACE
- EXISTING MANHOLE AND MANHOLE BASE TO BE REMOVED
- EXISTING SEWER TO BE ABANDONED
- EXISTING SEWER MANHOLE TO BE PLUGGED WHERE SEWER IS REMOVED AND RE-FORM TROUGH

UTILITY CONSTRUCTION ITEMS

- INSTALL 8-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- INSTALL 12-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- INSTALL 15-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- INSTALL 60-INCH STANDARD PRE-CAST MANHOLE WITH CORROSION PROTECTION PER DCSWCS SD-1A, SD-1B, SD-3, 3.16.8 AND 4.9.9.
- CONNECT TO EXISTING MANHOLE/SEWER.
- INSTALL 10-INCH D.I.P. WATER LINE WITH RESTRAINED JOINTS PER UDACS.
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- INSTALL 20-INCH STEEL CASING PER UDDACS PLATE 23.
- INSTALL 24-INCH STEEL CASING PER UDACS PLATE 23.
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SHEET KEY

90% DESIGN SUBMITTAL 4 / 30 / 2013 - NOT FOR CONSTRUCTION

DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE

STORM DRAIN

UTILITIES PLAN

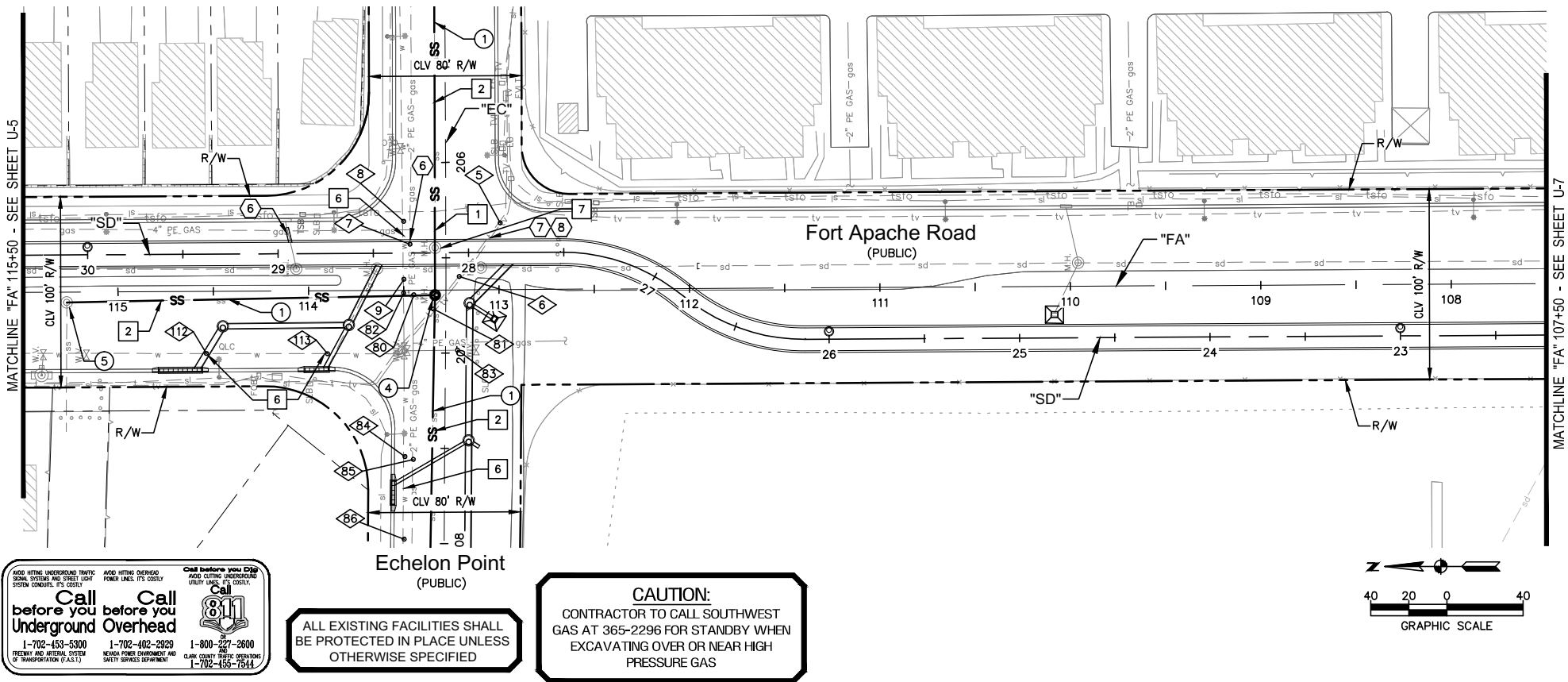
"FA" 115+50 TO "FA" 123+50

90%
DESIGN
SUBMITTAL
4/30/2013
NOT FOR CONSTRUCTION

SHEET:
U-5
44 OF 109
CLV DRAWING NO:
327V150

H#36802

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TH No.	Utility			Depth to Top (ft)	Depth to Bottom (ft)	Top Elev	Bottom Elev	Algmt.	Station	Offset
	Type	Dia (inches)	Width (inches)							
TH5	TEL/CATV	N/A	2-4"/2-2"	3.04	N/A	2634.11	---	"FA"	112+99.1	34.9' RT
TH6	TEL/CATV	N/A	2-4"/2-2"	3.66	N/A	2634.54	---	"FA"	113+20.8	7.0' RT
TH7	GAS	4	N/A	3.04	N/A	2635.31	---	"FA"	113+46.5	24' RT
TH8	WATER	10	N/A	3.63	N/A	2634.43	---	"FA"	113+49.8	36' RT
TH9	WATER	10	N/A	5.66	N/A	2633.06	---	"FA"	113+49.9	5.6' RT
TH80	GAS	4	N/A	3.44	N/A	2635.27	---	"FA"	113+44.6	2.5' LT
TH81	CATV/TEL	2-2"/2-4"	20	3.36	N/A	2635.25	---	"FA"	113+34.3	10.0' LT
TH82	WATER	10	N/A	6.02	N/A	2632.75	---	"FA"	113+50.0	1.5' LT
TH83	WATER	12	N/A	4.60	N/A	2633.87	---	"FA"	113+21.9	31.6' LT
TH84	WATER	10	N/A	5.80	N/A	2633.92	---	"EP"	207+54.7	20.8' RT
TH85	GAS	2	N/A	3.92	N/A	2635.93	---	"EP"	207+56.0	16.3' RT
TH86	WATER	10	N/A	4.54	N/A	2636.27	---	"EP"	207+98.0	20.9' RT
TH112	WATER	12	N/A	4.49	N/A	2635.13	---	"FA"	114+57.5	31.8' LT
TH113	WATER	12	N/A	5.17	N/A	2633.64	---	"FA"	113+87.5	32' LT

NOTES:

- SEE SHEETS CP-1 THROUGH CP-5 FOR HORIZONTAL CONTROL PLANS.
- SEE SHEETS U-16 THROUGH U-17 FOR WATERLINE RELOCATION PLANS AND PROFILES.
- SEE SHEETS U-18 THROUGH U-21 FOR SEWER RELOCATION PLANS AND PROFILES.
- SEE SHEETS RC-1 THROUGH RC-14 FOR VALVE AND COVER ADJUSTMENTS.

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER

PROJECT NO. 117002 DATE:

APPROVAL OF THESE PLANS SHALL NOT BE CONSTRUED TO BE A PERMIT FOR OR AN APPROVAL OF ANY VIOLATION OF ANY OF THE PROVISIONS OF THE STATE OR COUNTY LAWS.

DRY UTILITY ITEMS

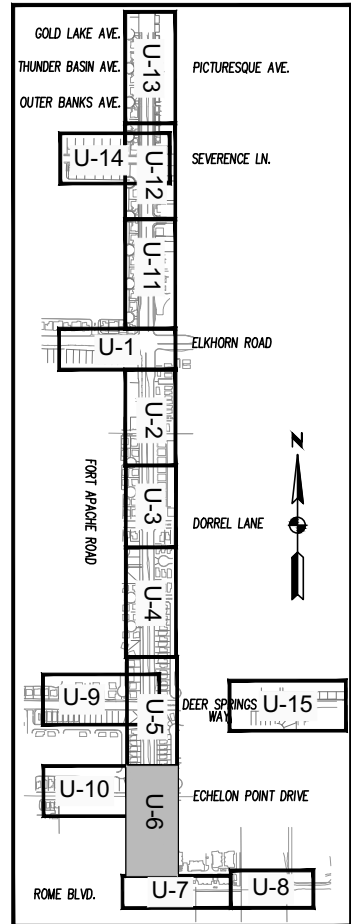
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UTILITY RELOCATION AND REMOVAL ITEMS

- EXISTING SEWER TO BE RELOCATED (SEE NOTE 3 BELOW)
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UTILITY CONSTRUCTION ITEMS

- INSTALL 8-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- INSTALL 12-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- INSTALL 15-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
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- CONNECT TO EXISTING MANHOLE/SEWER.
- INSTALL 10-INCH D.I.P. WATER LINE WITH RESTRAINED JOINTS PER UDACS.
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SHEET KEY

90% DESIGN SUBMITTAL 4/30/2013 - NOT FOR CONSTRUCTION

DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE

STORM DRAIN

UTILITIES PLAN

"FA" 107+50 TO "FA" 115+50

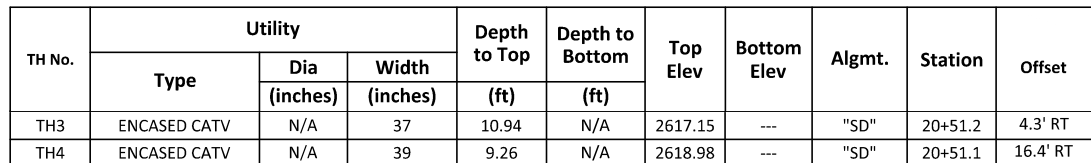
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DESIGN
SUBMITTAL
4/30/2013
NOT FOR CONSTRUCTION

SHEET:
U-6
45 OF 109
CLV DRAWING NO:
327V150

H#36802

RANCHO - FORT APACHE STORM DRAIN



TH No.	Utility			Depth to Top	Depth to Bottom	Top Elev	Bottom Elev	Algmt.	Station	Offset
	Type	Dia	Width							
		(inches)	(inches)	(ft)	(ft)					
TH3	ENCASED CATV	N/A	37	10.94	N/A	2617.15	---	"SD"	20+51.2	4.3' RT
TH4	ENCASED CATV	N/A	39	9.26	N/A	2618.98	---	"SD"	20+51.1	16.4' RT

1. SEE SHEETS CP-1 THROUGH CP-5 FOR HORIZONTAL CONTROL PLANS.
2. SEE SHEETS U-16 THROUGH U-17 FOR WATERLINE RELOCATION PLANS AND PROFILES.
3. SEE SHEETS U-18 THROUGH U-21 FOR SEWER RELOCATION PLANS AND PROFILES.
4. SEE SHEETS RC-1 THROUGH RC-14 FOR VALVE AND COVER ADJUSTMENTS.

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90% DESIGN SUBMITTAL 4 / 30 / 2013 - NOT FOR CONSTRUCTION

DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE

UTILITIES PLAN

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U-7

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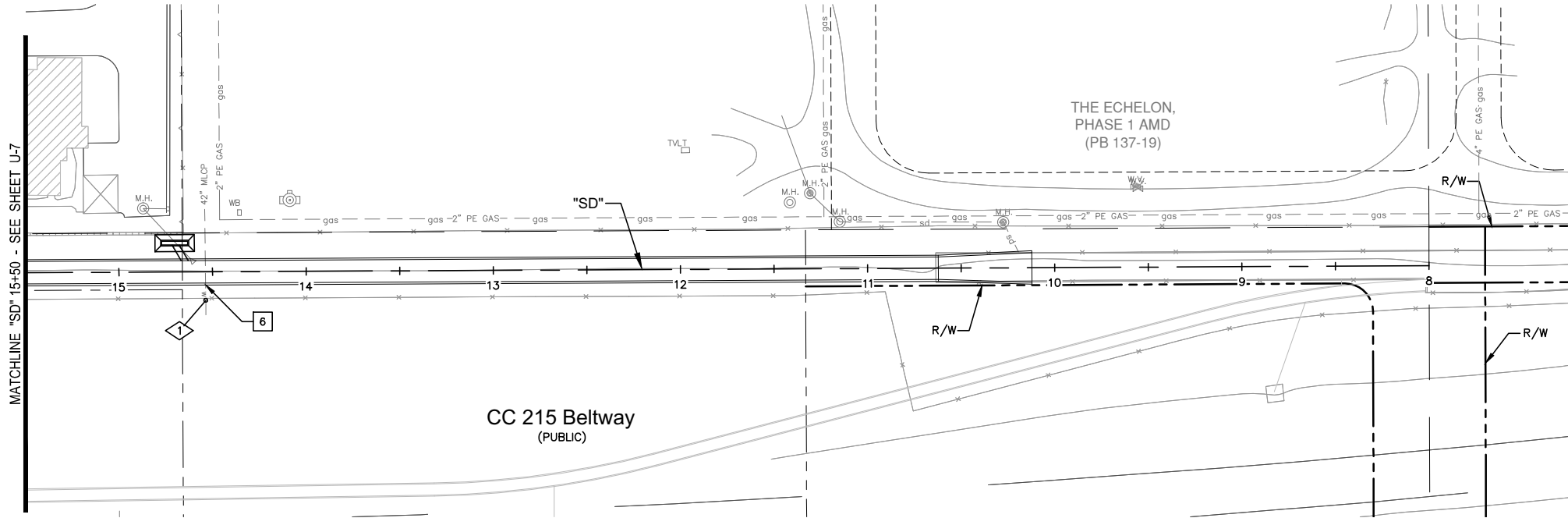
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H#36802

BRANICHO - FORT APACHE STORM DRAIN

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Call before you Dig
1-702-453-5300
FIREARM AND AMMUNITION SYSTEM
OF TRANSPORTATION (F.A.S.T.)

Call before you Overhead
1-702-402-2929
NEVADA POWER ENVIRONMENT AND
SAFETY SERVICES DEPARTMENT

Call before you Dig
1-800-227-2600
CLARK COUNTY PUBLIC OPERATIONS
1-702-436-7544

ALL EXISTING FACILITIES SHALL
BE PROTECTED IN PLACE UNLESS
OTHERWISE SPECIFIED

CAUTION:
CONTRACTOR TO CALL SOUTHWEST
GAS AT 365-2296 FOR STANDBY WHEN
EXCAVATING OVER OR NEAR HIGH
PRESSURE GAS

TH No.	Utility			Depth to Top	Depth to Bottom	Top Elev	Bottom Elev	Algmt.	Station	Offset
	Type	Dia (inches)	Width (inches)							
TH1	WATER	42	N/A	17.00	N/A	2592.51	---	"SD"	14+53.7	15.3' LT

NOTES:

- SEE SHEETS CP-1 THROUGH CP-5 FOR HORIZONTAL CONTROL PLANS.
- SEE SHEETS U-16 THROUGH U-17 FOR WATERLINE RELOCATION PLANS AND PROFILES.
- SEE SHEETS U-18 THROUGH U-21 FOR SEWER RELOCATION PLANS AND PROFILES.
- SEE SHEETS RC-1 THROUGH RC-14 FOR VALVE AND COVER ADJUSTMENTS.

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
PROJECT NO. 117002 DATE:

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DRY UTILITY ITEMS

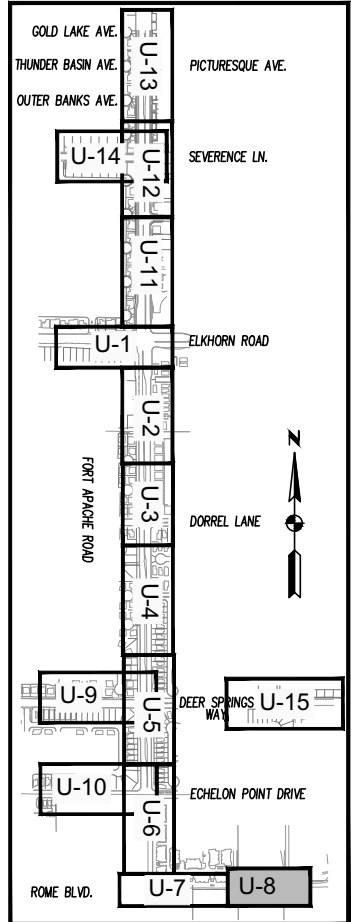
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UTILITY RELOCATION AND REMOVAL ITEMS

- EXISTING SEWER TO BE RELOCATED (SEE NOTE 3 BELOW)
- EXISTING SEWER TO BE REMOVED
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- EXISTING WATER LINE TO BE RELOCATED (SEE NOTE 2 BELOW)
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UTILITY CONSTRUCTION ITEMS

- INSTALL 8-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- INSTALL 12-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- INSTALL 15-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
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SHEET KEY



DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE
STORM DRAIN
UTILITIES PLAN

"SD" 8+00 TO "SD" 15+50

90%
DESIGN
SUBMITTAL
4/30/2013
NOT FOR CONSTRUCTION

SHEET:
U-8
CLV DRAWING NO:
327V150

90% DESIGN SUBMITTAL 4/30/2013 - NOT FOR CONSTRUCTION

H#36802

RANCHO - FORT APACHE STORM DRAIN

TH No.	Utility			Depth to Top (ft)	Depth to Bottom (ft)	Top Elev	Bottom Elev	Algmt.	Station	Offset
	Type	Dia	Width							
		(inches)	(inches)							
TH5	TEL/CATV	N/A	2-4"/2-2"	3.04	N/A	2634.11	---	"FA"	112+99.1	34.9' RT
TH6	TEL/CATV	N/A	2-4"/2-2"	3.66	N/A	2634.54	---	"FA"	113+20.8	7.0' RT
TH7	GAS	4	N/A	3.04	N/A	2635.31	---	"FA"	113+46.5	24' RT
TH8	WATER	10	N/A	3.63	N/A	2634.43	---	"FA"	113+49.8	36' RT
TH9	WATER	10	N/A	5.66	N/A	2633.06	---	"FA"	113+49.9	5.6' RT
TH80	GAS	4	N/A	3.44	N/A	2635.27	---	"FA"	113+44.6	2.5' LT
TH81	CATV/TEL	2-2"/2-4"	20	3.36	N/A	2635.25	---	"FA"	113+34.3	10.0' LT
TH82	WATER	10	N/A	6.02	N/A	2632.75	---	"FA"	113+50.0	1.5' LT
TH83	WATER	12	N/A	4.60	N/A	2633.87	---	"FA"	113+21.9	31.6' LT
TH84	WATER	10	N/A	5.80	N/A	2633.92	---	"EP"	207+54.7	20.8' RT
TH85	GAS	2	N/A	3.92	N/A	2635.93	---	"EP"	207+56.0	16.3' RT
TH86	WATER	10	N/A	4.54	N/A	2636.27	---	"EP"	207+98.0	20.9' RT
TH87	GAS	2	N/A	4.20	N/A	2637.32	---	"EP"	208+16.3	16.5' RT
TH88	WATER	10	N/A	3.86	N/A	2638.69	---	"EP"	208+47.8	21.3' RT
TH89	WATER	10	N/A	3.40	N/A	2647.58	---	"EP"	210+86.6	21.0' RT
TH90	GAS	2	N/A	3.66	N/A	2647.47	---	"EP"	210+89.6	17.0' RT
TH91	WATER	10	N/A	3.54	N/A	2648.39	---	"EP"	211+18.5	21.1' RT
TH113	WATER	12	N/A	5.17	N/A	2633.64	---	"FA"	113+87.5	32' LT

NOTES:

1. SEE SHEETS CP-1 THROUGH CP-5 FOR HORIZONTAL CONTROL PLANS.
2. SEE SHEETS U-16 THROUGH U-17 FOR WATERLINE RELOCATION PLANS AND PROFILES.
3. SEE SHEETS U-18 THROUGH U-21 FOR SEWER RELOCATION PLANS AND PROFILES.
4. SEE SHEETS RC-1 THROUGH RC-14 FOR VALVE AND COVER ADJUSTMENTS.

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER

PROJECT NO. 117002 DATE: _____

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DRY UTILITY ITEMS

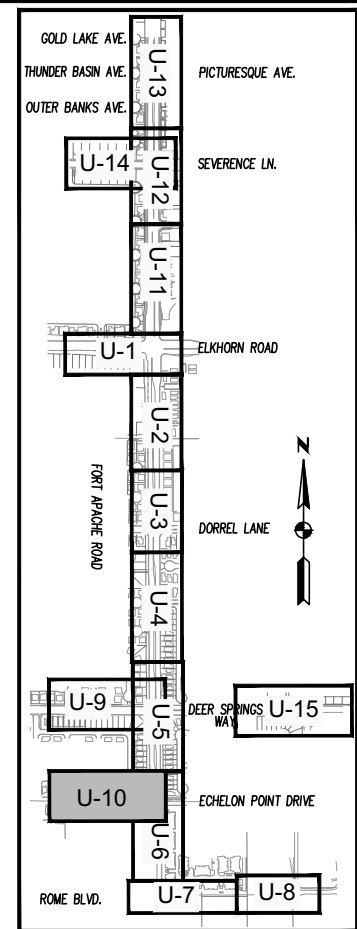
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UTILITY RELOCATION AND REMOVAL ITEMS

- 1 EXISTING SEWER TO BE RELOCATED (SEE NOTE 3 BELOW)
- 2 EXISTING SEWER TO BE REMOVED
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- 9 EXISTING SEWER MANHOLE TO BE PLUGGED WHERE SEWER IS REMOVED AND RE-FORM TROUGH

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- ④ INSTALL 60-INCH STANDARD PRE-CAST MANHOLE WITH CORROSION PROTECTION PER DCSWCS SD-1A, SD-1B, SD-3, 3.16.8 AND 4.9.9.
- ⑤ CONNECT TO EXISTING MANHOLE/SEWER.
- ⑥ INSTALL 10-INCH D.I.P. WATER LINE WITH RESTRAINED JOINTS PER UDACS.
- ⑦ INSTALL 12-INCH D.I.P. WATER LINE WITH RESTRAINED JOINTS PER UDACS.
- ⑧ INSTALL 45 DEG. BEND WITH RESTRAINED JOINTS PER UDACS.
- ⑨ INSTALL 90 DEG. BEND WITH RESTRAINED JOINTS PER UDACS.
- ⑩ INSTALL WET TAPPING SLEEVE WITH MECHANICAL JOINTS AND 10" TAPPING VALVE PER UDACS.
- ⑪ CUT AND CAP EXISTING WATERLINE PER UDACS.
- ⑫ INSTALL 20-INCH STEEL CASING PER UDDACS PLATE 23.
- ⑬ INSTALL 24-INCH STEEL CASING PER UDACS PLATE 23.
- ⑭ INSTALL 18-INCH PVC SDR35 SANITARY SEWER LINE PER DCSWCS.
- ⑮ INSTALL 72-INCH STANDARD PRE-CAST MANHOLE WITH CORROSION PROTECTION PER DCSWCS SD-1A, SD-1B, SD-3, 3.16.8 AND 4.9.9.



SHEET KEY



DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE

STORM DRAIN
UTILITIES PLAN

"EP" 206+00 TO "EP" 214+00

SHEET TWO.

90%
DESIGN
SUBMITTAL
4/30/2013
NOT FOR CONSTRUCTION

SHEET: U-10
49 OF 10
CLV DRAWING NO: 327V150

90% DESIGN SUBMITTAL 4 / 30 / 2013 - NOT FOR CONSTRUCTION

RANCHO - FORT APACHE STORM DRAIN

P:\CLV\csl121_fort_apache_ssfPlans\Sheets\04_Uilities\CS1121_U-1.dwg May 09, 2013 2:56pm jschmidez



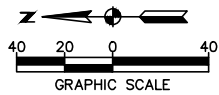
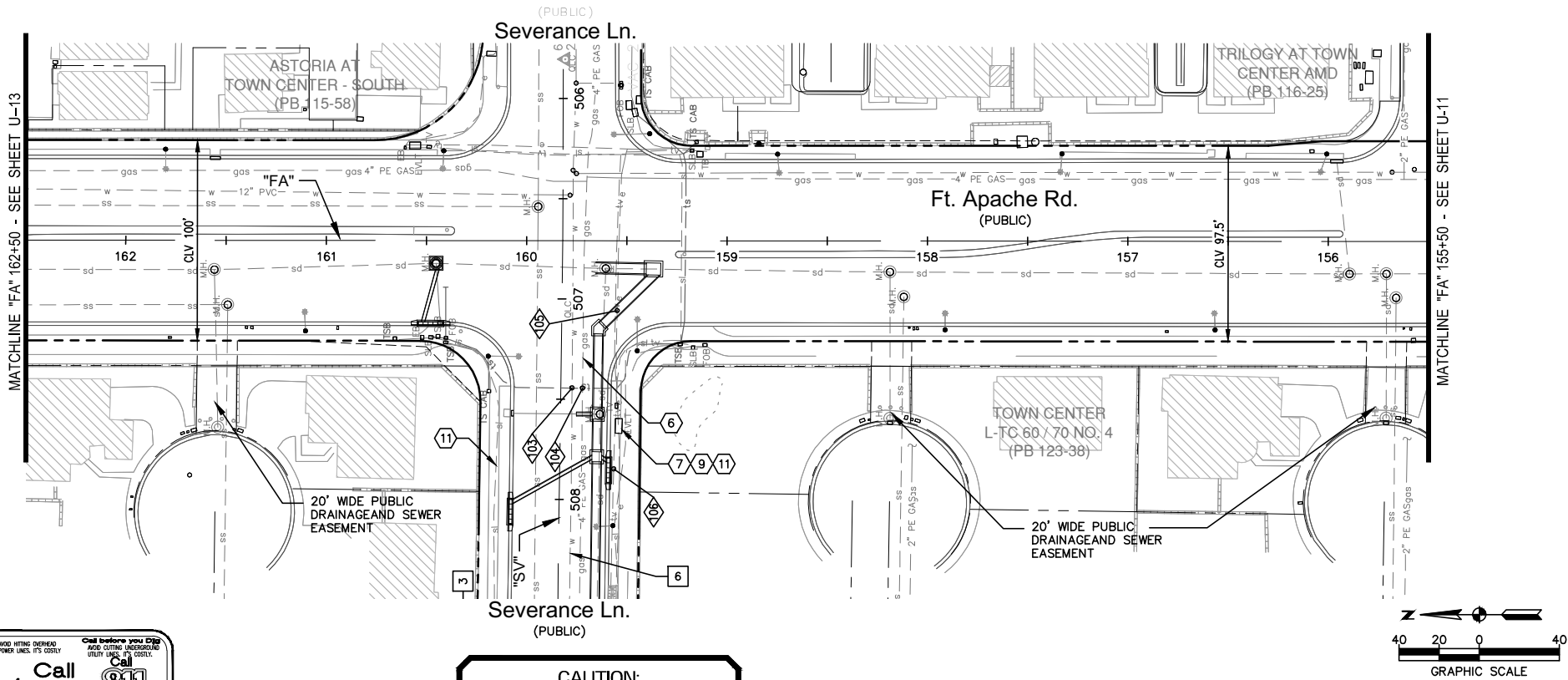
ALL EXISTING FACILITIES SHALL BE PROTECTED IN PLACE UNLESS OTHERWISE SPECIFIED

CAUTION:
CONTRACTOR TO CALL SOUTHWEST GAS AT 365-2296 FOR STANDBY WHEN EXCAVATING OVER OR NEAR HIGH PRESSURE GAS

TH No.	Utility			Depth to Top (ft)	Depth to Bottom (ft)	Top Elev	Bottom Elev	Algmt.	Station	Offset
	Type	Dia (inches)	Width (inches)							
TH103	WATER	16	N/A	5.64	N/A	2678.85	---	"SV"	507+44.8	5.1' LT
TH103	TS	2-2"/3-3"/4"	N/A	2.32	N/A	2682.17	---	"SV"	507+44.8	5.1' LT
TH104	GAS	4	N/A	3.68	N/A	2680.57	---	"SV"	507+45.1	10.9' LT
TH105	TV/ELEC	2", X"	N/A	4.17	4.59	2679.45	2679.03	"SV"	507+3.7	27.9' LT
TH106	TV	2", 3"	N/A	2.38	3.00	2682.98	2682.36	"SV"	507+86.1	27.4' LT

NOTES:

- SEE SHEETS CP-1 THROUGH CP-5 FOR HORIZONTAL CONTROL PLANS.
- SEE SHEETS U-16 THROUGH U-17 FOR WATERLINE RELOCATION PLANS AND PROFILES.
- SEE SHEETS U-18 THROUGH U-21 FOR SEWER RELOCATION PLANS AND PROFILES.
- SEE SHEETS RC-1 THROUGH RC-14 FOR VALVE AND COVER ADJUSTMENTS.



APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
PROJECT NO. 117002 DATE: _____

APPROVAL OF THESE PLANS SHALL NOT BE CONSTRUED TO BE A PERMIT FOR OR AN APPROVAL OF ANY VIOLATION OF ANY OF THE PROVISIONS OF THE STATE OR COUNTY LAWS.

DRY UTILITY ITEMS

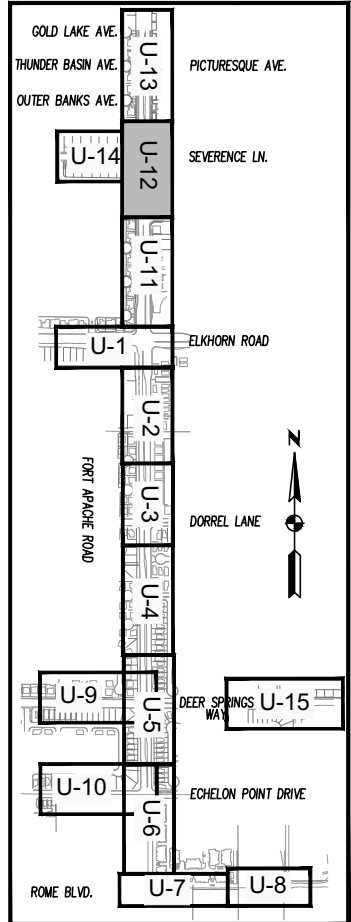
- EXISTING GAS FACILITIES TO BE RELOCATED BY SOUTHWEST GAS
- EXISTING CATV FACILITIES TO BE RELOCATED BY COX COMMUNICATIONS
- EXISTING TELEPHONE FACILITIES TO BE RELOCATED BY CENTURY LINK
- EXISTING ELECTRIC FACILITIES TO BE RELOCATED BY NV ENERGY
- EXISTING FIBER OPTIC FACILITIES TO BE RELOCATED BY CONTRACTOR
- EXISTING GAS FACILITIES TO BE PROTECTED IN PLACE
- EXISTING CATV FACILITIES TO BE PROTECTED IN PLACE
- EXISTING TELEPHONE FACILITIES TO BE PROTECTED IN PLACE
- EXISTING ELECTRIC FACILITIES TO BE PROTECTED IN PLACE
- EXISTING FIBER OPTIC FACILITIES TO BE PROTECTED IN PLACE
- EXISTING TRAFFIC/STREET LIGHT FACILITIES TO BE PROTECTED IN PLACE

UTILITY RELOCATION AND REMOVAL ITEMS

- EXISTING SEWER TO BE RELOCATED (SEE NOTE 3 BELOW)
- EXISTING SEWER TO BE REMOVED
- EXISTING SEWER TO BE PROTECTED IN PLACE
- EXISTING WATER LINE TO BE RELOCATED (SEE NOTE 2 BELOW)
- EXISTING WATER LINE TO BE REMOVED
- EXISTING WATER TO BE PROTECTED IN PLACE
- EXISTING MANHOLE AND MANHOLE BASE TO BE REMOVED
- EXISTING SEWER TO BE ABANDONED
- EXISTING SEWER MANHOLE TO BE PLUGGED WHERE SEWER IS REMOVED AND RE-FORM TROUGH

UTILITY CONSTRUCTION ITEMS

- INSTALL 8-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- INSTALL 12-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- INSTALL 15-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- INSTALL 60-INCH STANDARD PRE-CAST MANHOLE WITH CORROSION PROTECTION PER DCSWCS SD-1A, SD-1B, SD-3, 3.16.8 AND 4.9.9.
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SHEET KEY

90% DESIGN SUBMITTAL 4 / 30 / 2013 - NOT FOR CONSTRUCTION

DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE

STORM DRAIN

UTILITIES PLAN

"FA" 155+50 TO "FA" 162+50

90%
DESIGN
SUBMITTAL
4/30/2013
NOT FOR CONSTRUCTION

SHEET:
U-12
51 OF 109
CLV DRAWING NO:
327V150

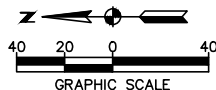


THE Louis Berger Group, INC.
500 E. Amigo Court, Suite 100
Las Vegas, Nevada 89119
Voice: 702-736-6632
Fax: 702-736-0704

RANCHO - FORT APACHE STORM DRAIN



CAUTION:
CONTRACTOR TO CALL SOUTHWEST
GAS AT 365-2296 FOR STANDBY WHEN
EXCAVATING OVER OR NEAR HIGH
PRESSURE GAS



- APPROVED FOR CONSTRUCTION

APPROVAL OF THESE PLANS SHALL NOT BE CONSTRUED TO BE A PERMIT FOR OR AN APPROVAL OF ANY VIOLATION OF ANY OF THE PROVISIONS OF THE STATE OR COUNTY LAWS.

DRY UTILITY ITEMS

- ① EXISTING GAS FACILITIES TO BE RELOCATED BY SOUTHWEST GAS
- ② EXISTING CATV FACILITIES TO BE RELOCATED BY COX COMMUNICATIONS
- ③ EXISTING TELEPHONE FACILITIES TO BE RELOCATED BY CENTURY LINK
- ④ EXISTING ELECTRIC FACILITIES TO BE RELOCATED BY NV ENERGY
- ⑤ EXISTING FIBER OPTIC FACILITIES TO BE RELOCATED BY CONTRACTOR
- ⑥ EXISTING GAS FACILITIES TO BE PROTECTED IN PLACE
- ⑦ EXISTING CATV FACILITIES TO BE PROTECTED IN PLACE
- ⑧ EXISTING TELEPHONE FACILITIES TO BE PROTECTED IN PLACE
- ⑨ EXISTING ELECTRIC FACILITIES TO BE PROTECTED IN PLACE
- ⑩ EXISTING FIBER OPTIC FACILITIES TO BE PROTECTED IN PLACE
- ⑪ EXISTING TRAFFIC/STREET LIGHT FACILITIES TO BE PROTECTED IN PLACE

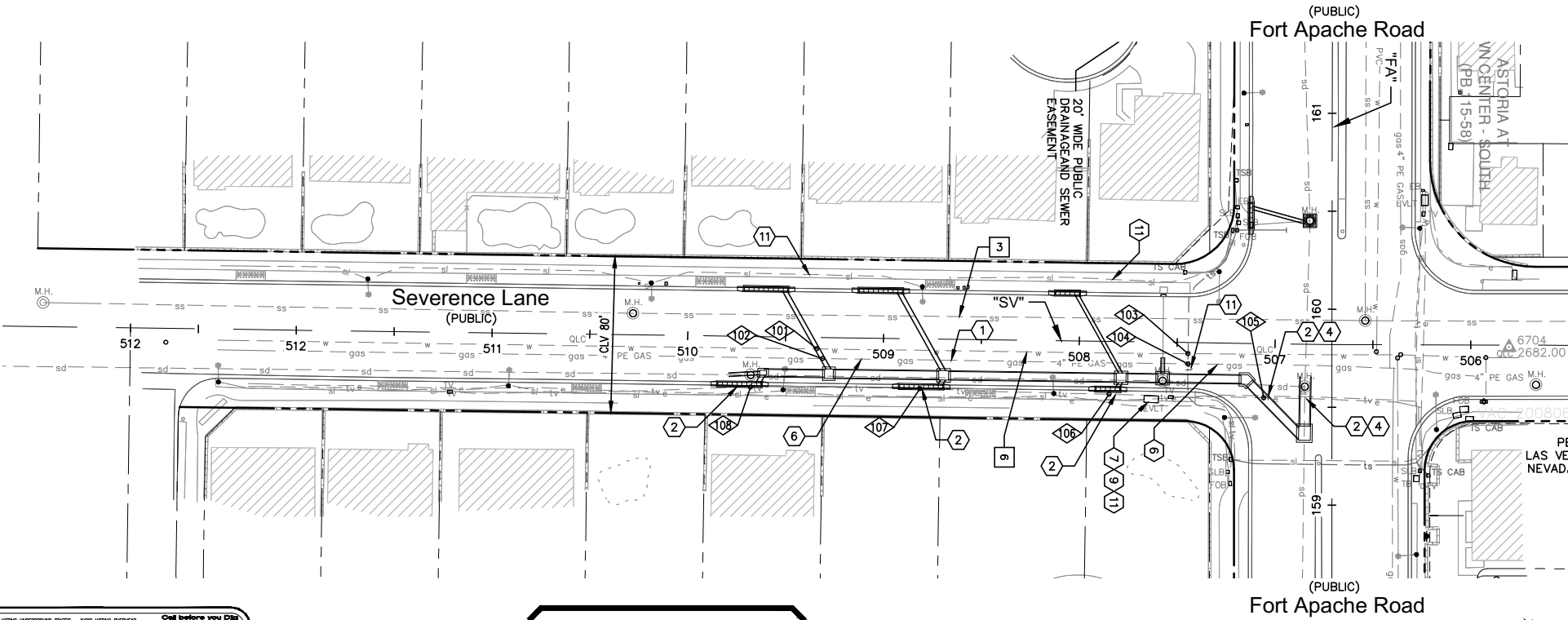
UTILITY RELOCATION AND REMOVAL ITEMS

- | | |
|---|--|
| 1 | EXISTING SEWER TO BE RELOCATED (SEE NOTE 3 BELOW) |
| 2 | EXISTING SEWER TO BE REMOVED |
| 3 | EXISTING SEWER TO BE PROTECTED IN PLACE |
| 4 | EXISTING WATER LINE TO BE RELOCATED (SEE NOTE 2 BELOW) |
| 5 | EXISTING WATER LINE TO BE REMOVED |
| 6 | EXISTING WATER TO BE PROTECTED IN PLACE |
| 7 | EXISTING MANHOLE AND MANHOLE BASE TO BE REMOVED |
| 8 | EXISTING SEWER TO BE ABANDONED |
| 9 | EXISTING SEWER MANHOLE TO BE PLUGGED WHERE SEWER IS REMOVED AND RE-FORM TROUGH |

UTILITY CONSTRUCTION ITEMS

- ① INSTALL 8-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- ② INSTALL 12-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- ③ INSTALL 15-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
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- ⑤ CONNECT TO EXISTING MANHOLE/SEWER.
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Call before you Dig
1-702-453-5300
1-702-402-2829
1-800-227-2800

Call before you Dig
1-702-453-5300
1-702-402-2829
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1-702-402-2829
1-800-227-2800

ALL EXISTING FACILITIES SHALL BE PROTECTED IN PLACE UNLESS OTHERWISE SPECIFIED

CAUTION:
CONTRACTOR TO CALL SOUTHWEST GAS AT 365-2296 FOR STANDBY WHEN EXCAVATING OVER OR NEAR HIGH PRESSURE GAS

TH No.	Utility			Depth to Top (ft)	Depth to Bottom (ft)	Top Elev	Bottom Elev	Algmt.	Station	Offset
	Type	Dia (inches)	Width (inches)							
TH101	WATER	10	N/A	4.40	N/A	2685.63	---	"SV"	509+33.9	5.5' LT
TH102	GAS	4	N/A	1.93	N/A	2687.93	---	"SV"	509+31.8	10.9' LT
TH103	WATER	16	N/A	5.64	N/A	2678.85	---	"SV"	507+44.8	5.1' LT
TH103	TS	2-2"/3-3"/4"	N/A	2.32	N/A	2682.17	---	"SV"	507+44.8	5.1' LT
TH104	GAS	4	N/A	3.68	N/A	2680.57	---	"SV"	507+45.1	10.9' LT
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TH106	TV	2", 3"	N/A	2.38	3.00	2682.98	2682.36	"SV"	507+86.1	27.4' LT
TH107	TV	2", 3"	6.25	1.79	1.96	2686.64	2686.47	"SV"	508+86.2	25.4' LT
TH108	TV	2", 3"	6	2.65	N/A	2688.22	---	"SV"	509+66.1	25.3' LT

- NOTES:**
- SEE SHEETS CP-1 THROUGH CP-5 FOR HORIZONTAL CONTROL PLANS.
 - SEE SHEETS U-16 THROUGH U-17 FOR WATERLINE RELOCATION PLANS AND PROFILES.
 - SEE SHEETS U-18 THROUGH U-21 FOR SEWER RELOCATION PLANS AND PROFILES.
 - SEE SHEETS RC-1 THROUGH RC-14 FOR VALVE AND COVER ADJUSTMENTS.

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
PROJECT NO. 117002 DATE:

APPROVAL OF THESE PLANS SHALL NOT BE CONSTRUED TO BE A PERMIT FOR OR AN APPROVAL OF ANY VIOLATION OF ANY OF THE PROVISIONS OF THE STATE OR COUNTY LAWS.

DRY UTILITY ITEMS

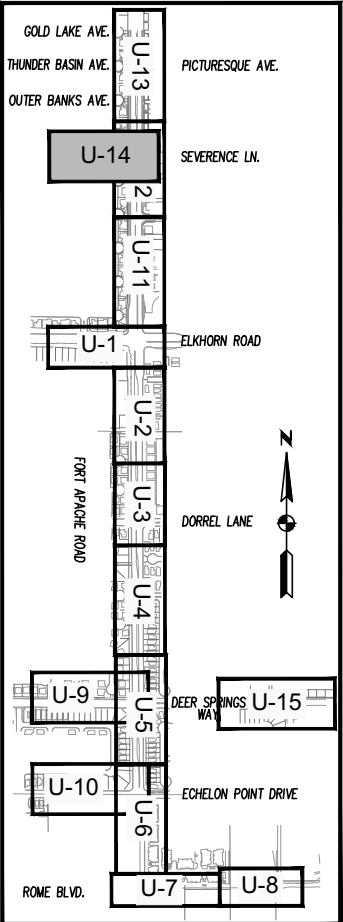
- EXISTING GAS FACILITIES TO BE RELOCATED BY SOUTHWEST GAS
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- EXISTING SEWER MANHOLE TO BE PLUGGED WHERE SEWER IS REMOVED AND RE-FORM TROUGH

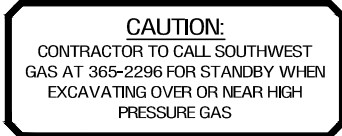
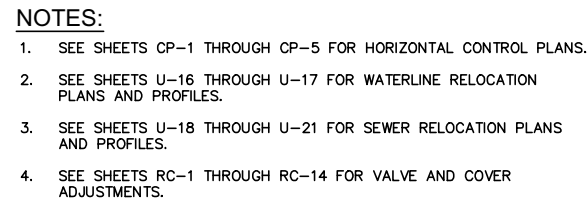
UTILITY CONSTRUCTION ITEMS

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SHEET KEY

DEPARTMENT OF PUBLIC WORKS
RANCHO-FORT APACHE STORM DRAIN UTILITIES PLAN
PROJECT: "SV" 505+50 TO "SV" 513+50
SHEET TITLE: U-14
90% DESIGN SUBMITTAL 4/30/2013 - NOT FOR CONSTRUCTION
SHEET: 53 OF 109
CLV DRAWING NO: 327V150
H#36802



APPROVED FOR CONSTRUCTION

PROJECT NO. 117002 DATE: _____

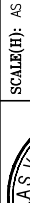
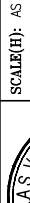
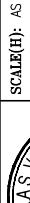
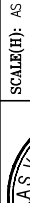
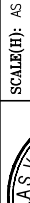
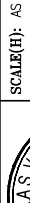
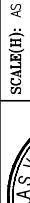
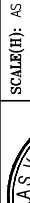
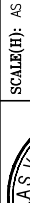
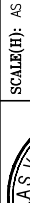
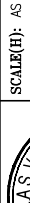
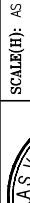
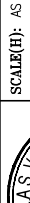
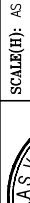
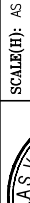
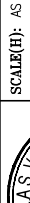
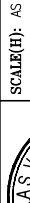
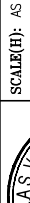
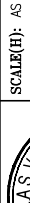
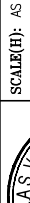
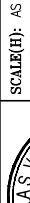
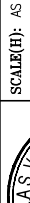
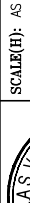
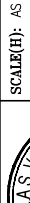
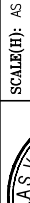
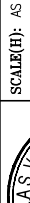
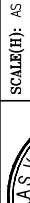
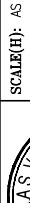
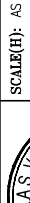
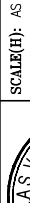
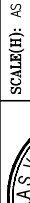
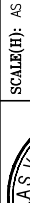
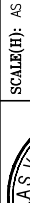
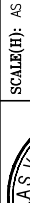
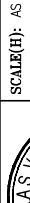
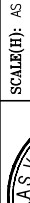
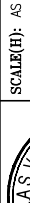
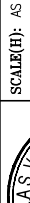
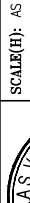
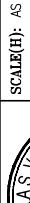
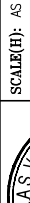
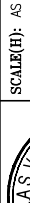
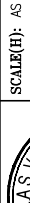
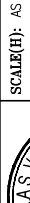
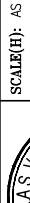
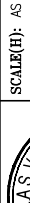
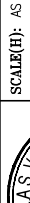
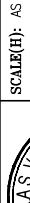
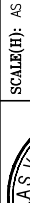
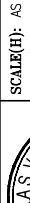
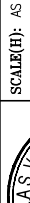
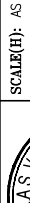
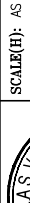
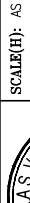
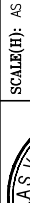
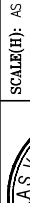
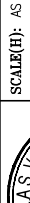
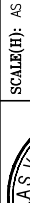
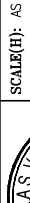
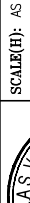
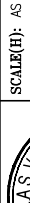
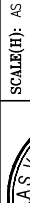
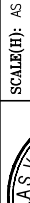
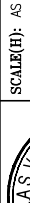
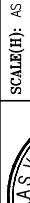
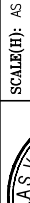
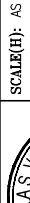
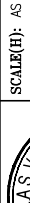
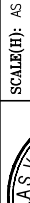
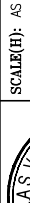
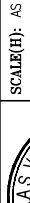
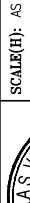
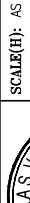
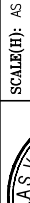
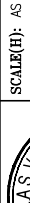
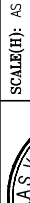
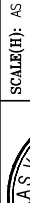
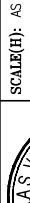
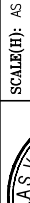
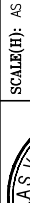
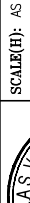
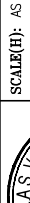
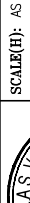
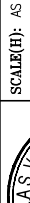
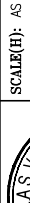
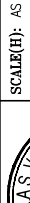
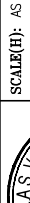
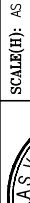
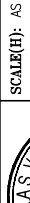
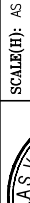
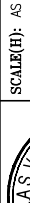
APPROVAL OF THESE PLANS SHALL NOT BE CONSTRUED TO BE A PERMIT FOR OR AN APPROVAL OF ANY VIOLATION OF ANY OF THE PROVISIONS OF THE STATE OR COUNTY LAWS.

- ① EXISTING GAS FACILITIES TO BE RELOCATED BY SOUTHWEST GAS
- ② EXISTING CATV FACILITIES TO BE RELOCATED BY COX COMMUNICATIONS
- ③ EXISTING TELEPHONE FACILITIES TO BE RELOCATED BY CENTURY LINK
- ④ EXISTING ELECTRIC FACILITIES TO BE RELOCATED BY NV ENERGY
- ⑤ EXISTING FIBER OPTIC FACILITIES TO BE RELOCATED BY CONTRACTOR
- ⑥ EXISTING GAS FACILITIES TO BE PROTECTED IN PLACE
- ⑦ EXISTING CATV FACILITIES TO BE PROTECTED IN PLACE
- ⑧ EXISTING TELEPHONE FACILITIES TO BE PROTECTED IN PLACE
- ⑨ EXISTING ELECTRIC FACILITIES TO BE PROTECTED IN PLACE
- ⑩ EXISTING FIBER OPTIC FACILITIES TO BE PROTECTED IN PLACE
- ⑪ EXISTING TRAFFIC/STREET LIGHT FACILITIES TO BE PROTECTED IN PLACE

- 1 EXISTING SEWER TO BE RELOCATED (SEE NOTE 3 BELOW)
- 2 EXISTING SEWER TO BE REMOVED
- 3 EXISTING SEWER TO BE PROTECTED IN PLACE
- 4 EXISTING WATER LINE TO BE RELOCATED (SEE NOTE 2 BELOW)
- 5 EXISTING WATER LINE TO BE REMOVED
- 6 EXISTING WATER TO BE PROTECTED IN PLACE
- 7 EXISTING MANHOLE AND MANHOLE BASE TO BE REMOVED
- 8 EXISTING SEWER TO BE ABANDONED
- 9 EXISTING SEWER MANHOLE TO BE PLUGGED WHERE SEWER IS REMOVED AND RE-FORM TROUGH

- ① INSTALL 8-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- ② INSTALL 12-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- ③ INSTALL 15-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- ④ INSTALL 60-INCH STANDARD PRE-CAST MANHOLE WITH CORROSION PROTECTION PER DCSWCS SD-1A, SD-1B, SD-3, 3.16.8 AND 4.9.9.
- ⑤ CONNECT TO EXISTING MANHOLE/SEWER.
- ⑥ INSTALL 10-INCH D.I.P. WATER LINE WITH RESTRAINED JOINTS PER UDACS.
- ⑦ INSTALL 12-INCH D.I.P. WATER LINE WITH RESTRAINED JOINTS PER UDACS.
- ⑧ INSTALL 45 DEG. BEND WITH RESTRAINED JOINTS PER UDACS.
- ⑨ INSTALL 90 DEG. BEND WITH RESTRAINED JOINTS PER UDACS.
- ⑩ INSTALL WET TAPPING SLEEVE WITH MECHANICAL JOINTS AND 10" TAPPING VALVE PER UDACS.
- ⑪ CUT AND CAP EXISTING WATERLINE PER UDACS.
- ⑫ INSTALL 20-INCH STEEL CASING PER UDDACS PLATE 23.
- ⑬ INSTALL 24-INCH STEEL CASING PER UDACS PLATE 23.
- ⑭ INSTALL 18-INCH PVC SDR35 SANITARY SEWER LINE PER DCSWCS.
- ⑮ INSTALL 72-INCH STANDARD PRE-CAST MANHOLE WITH CORROSION PROTECTION PER DCSWCS SD-1A, SD-1B, SD-3, 3.16.8 AND 4.9.9.



90% DESIGN SUBMITTAL 4/30/2013 - NOT FOR CONSTRUCTION		DEPARTMENT OF PUBLIC WORKS		90% DESIGN SUBMITTAL 4/30/2013 NOT FOR CONSTRUCTION		SHEET: U-15	
PROJECT:		RANCHO-FORT APACHE STORM DRAIN UTILITIES PLAN		CLV DRAWING NO:		54 OF 109	
SHEET TITLE:		"DW" 290+00 TO "DW" 297+50		327V150			
							
							
							
							
							
							
							
							
							
							
							
							
							
							
							
							
							
							
							
							
							
							
							

90% DESIGN SUBMITTAL 4 / 30 / 2013 - NOT FOR CONSTRUCTION

DEPARTMENT OF PUBLIC WORKS

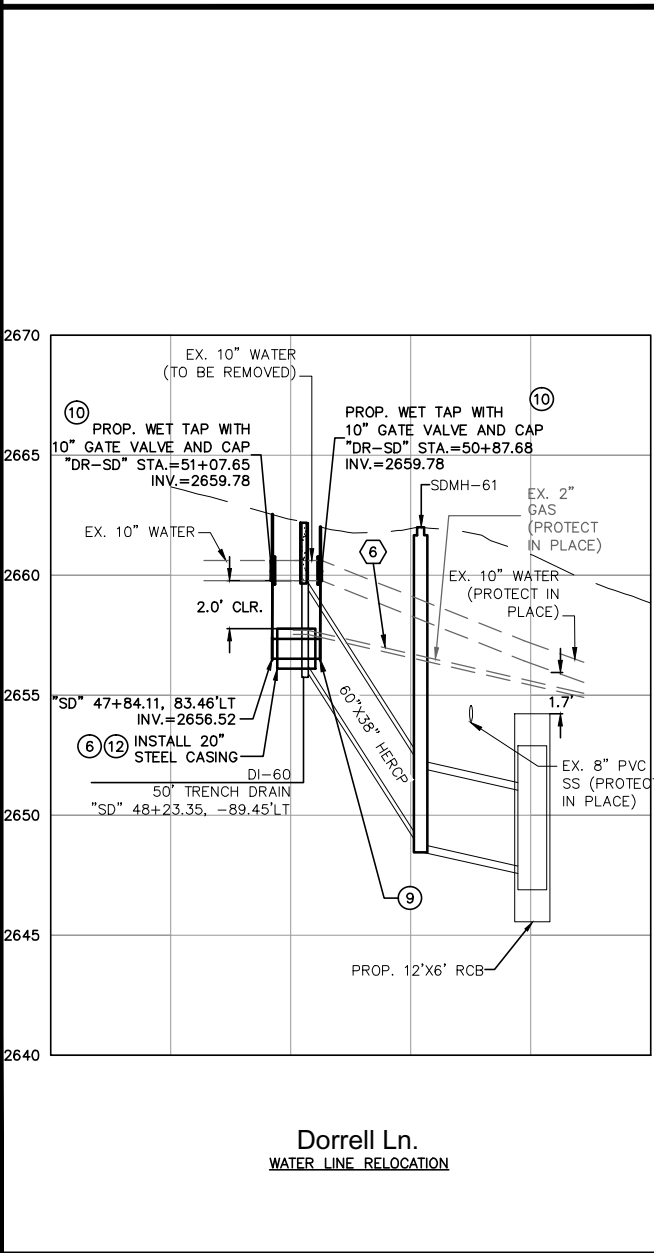
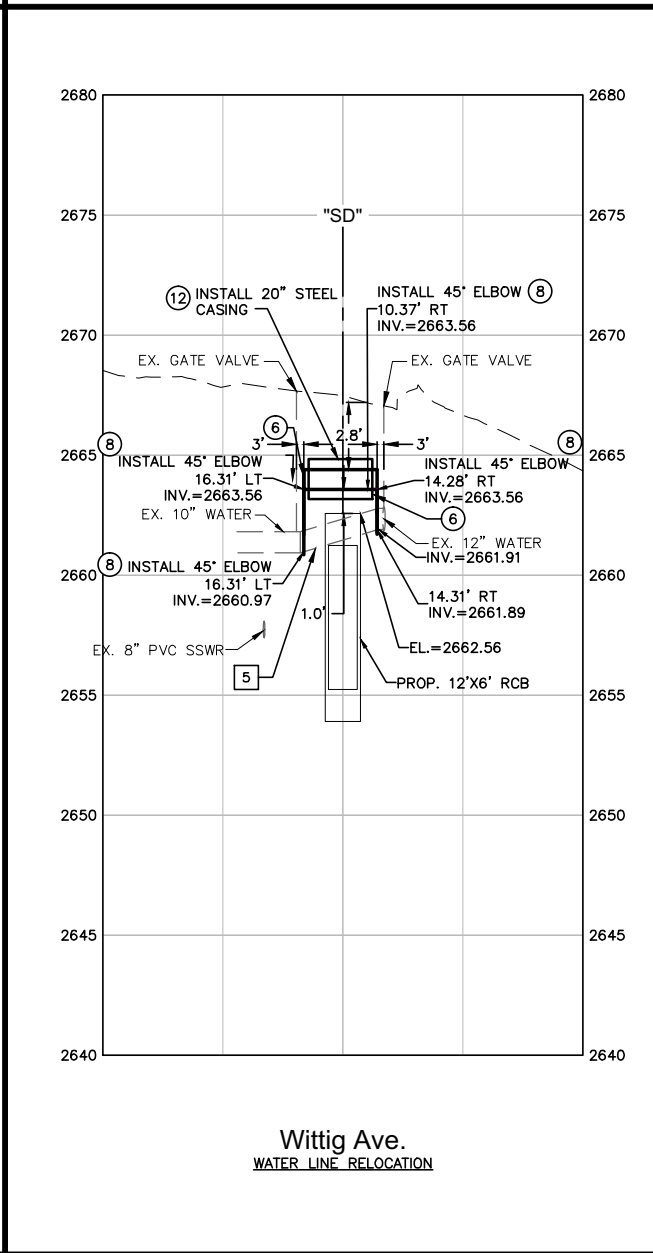
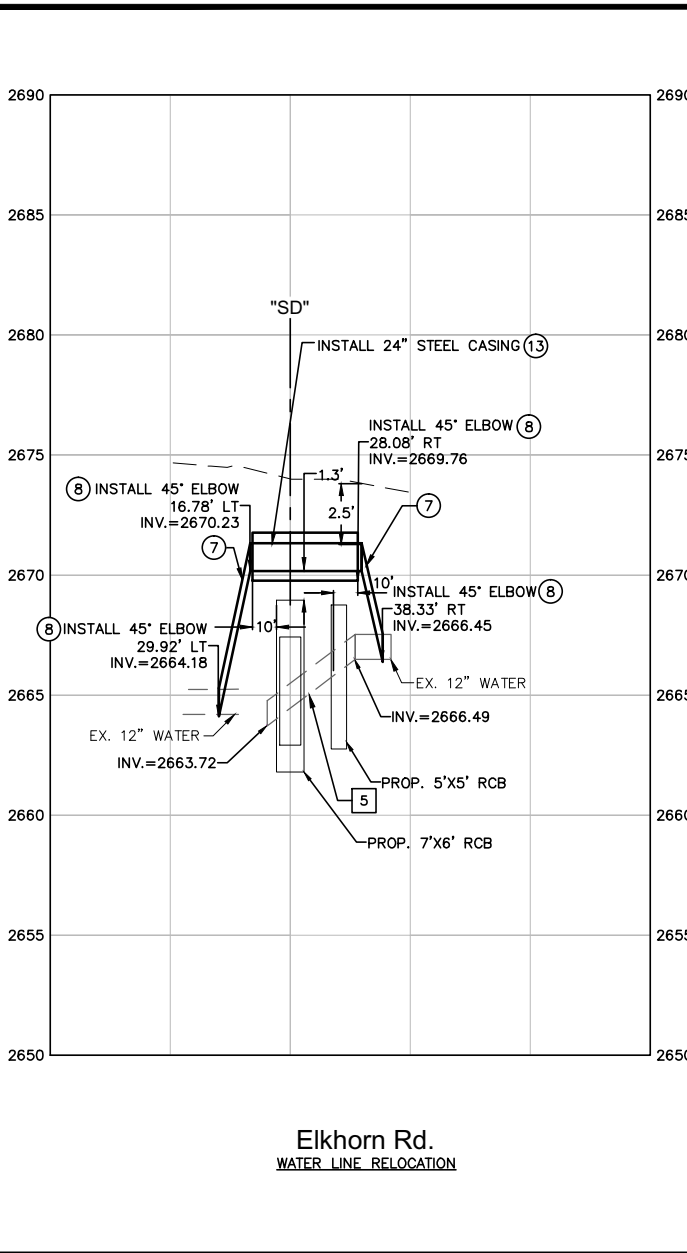
RANCHO-FORT APACHE

STORM DRAIN UTILITIES PLAN

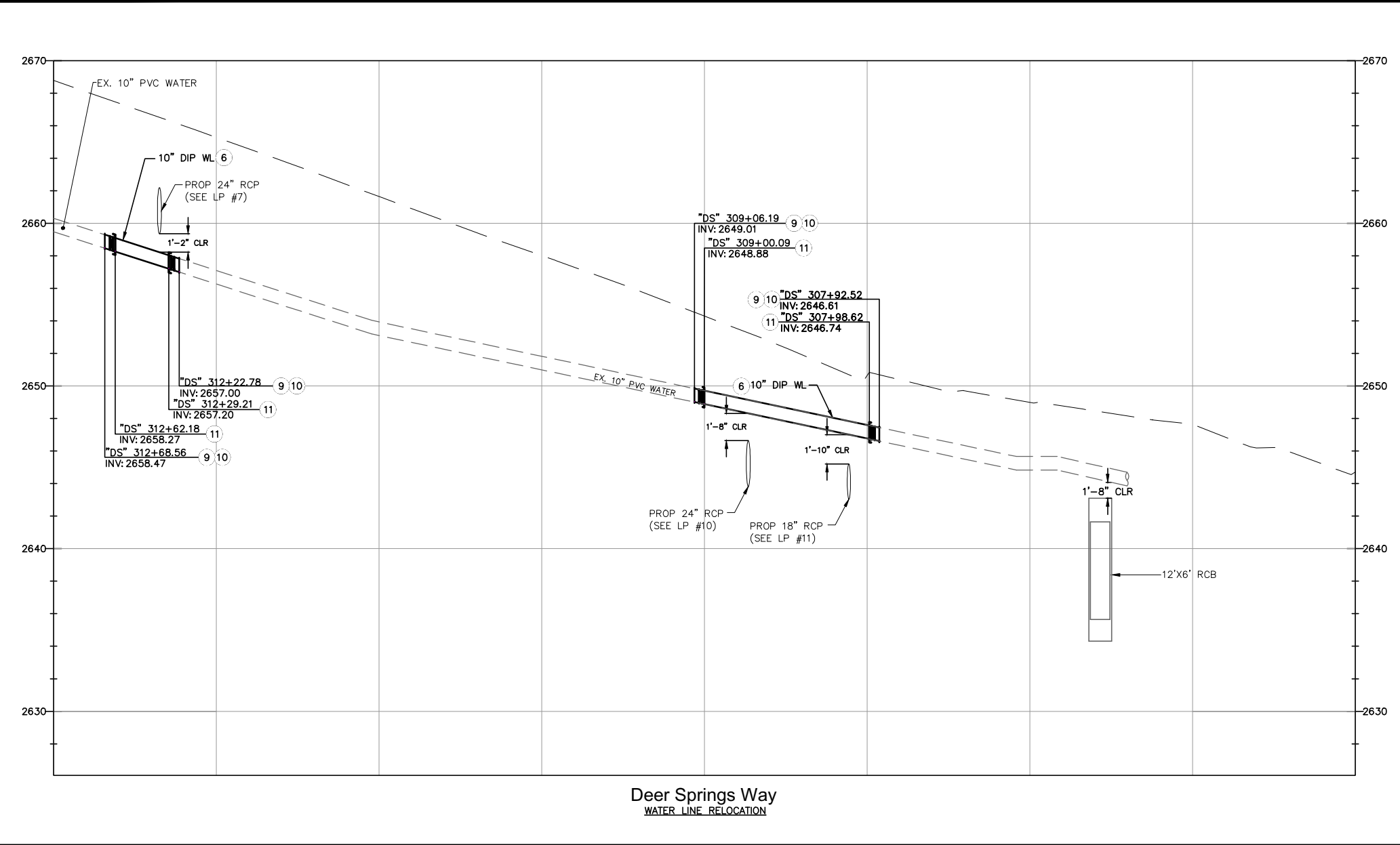
"DW" 290+00 TO "DW" 297+50

SHIFTS TIME.

BRANCHO - EORT APACHE STORM DRAIN



DEPARTMENT OF PUBLIC WORKS RANCHO-FORT APACHE STORM DRAIN WATER RELOCATION PLANS AND SECTIONS		 THE Louis Berger Group, INC. 500 E. Amigo Court, Suite 100 Las Vegas, Nevada 89119 Voice: 702-736-6632 Fax: 702-736-0704		SCALE(H): AS SHOWN	SCALE(V): AS SHOWN	WA#	No.	DATE	DESCRIPTION	BY
				FIELD BOOK #:	DATE: 4/30/2013	DSGN/CHK BY: TGT/DJM				
PROJECT:										
SHEET TITLE:										
90% DESIGN SUBMITTAL 4/30/2013 NOT FOR CONSTRUCTION		SHEET: U-16 55 OF 109 CLV DRAWING NO: 327V150								



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[illegible]



H#36802



1. SEE SHEETS CP-1 THROUGH CP-5 FOR HORIZONTAL CONTROL PLANS.
2. SEE SHEETS U-1 THROUGH U-14 FOR POTHOLE INFORMATION.

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER

PROJECT NO. 117002 DATE:

APPROVAL OF THESE PLANS SHALL NOT BE CONSTRUED TO BE A PERMIT FOR OR AN APPROVAL OF ANY VIOLATION OF ANY OF THE PROVISIONS OF THE STATE OR COUNTY LAWS.

DRY UTILITY ITEMS

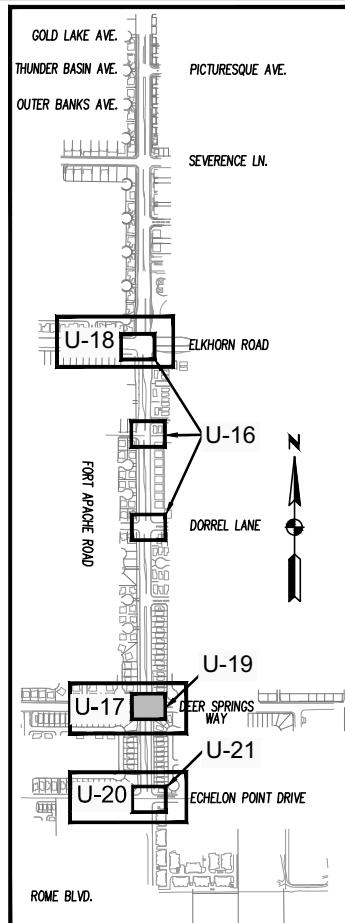
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- ⑨ EXISTING ELECTRIC FACILITIES TO BE PROTECTED IN PLACE
- ⑩ EXISTING FIBER OPTIC FACILITIES TO BE PROTECTED IN PLACE
- ⑪ EXISTING TRAFFIC/STREET LIGHT FACILITIES TO BE PROTECTED IN PLACE

UTILITY RELOCATION AND REMOVAL ITEMS

- | | |
|---|--|
| 1 | EXISTING SEWER TO BE RELOCATED (SEE NOTE 3 BELOW) |
| 2 | EXISTING SEWER TO BE REMOVED |
| 3 | EXISTING SEWER TO BE PROTECTED IN PLACE |
| 4 | EXISTING WATER LINE TO BE RELOCATED (SEE NOTE 2 BELOW) |
| 5 | EXISTING WATER LINE TO BE REMOVED |
| 6 | EXISTING WATER TO BE PROTECTED IN PLACE |
| 7 | EXISTING MANHOLE AND MANHOLE BASE TO BE REMOVED |
| 8 | EXISTING SEWER TO BE ABANDONED |
| 9 | EXISTING SEWER MANHOLE TO BE PLUGGED WHERE SEWER IS REMOVED AND RE-FORM TROUGH |

UTILITY CONSTRUCTION ITEMS

- ① INSTALL 8-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- ② INSTALL 12-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- ③ INSTALL 15-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- ④ INSTALL 60-INCH STANDARD PRE-CAST MANHOLE WITH CORROSION PROTECTION PER DCSWCS SD-1A, SD-1B, SD-3, 3.16.8 AND 4.9.9.
- ⑤ CONNECT TO EXISTING MANHOLE/SEWER.
- ⑥ INSTALL 10-INCH D.I.P. WATER LINE WITH RESTRAINED JOINTS PER UDACS.
- ⑦ INSTALL 12-INCH D.I.P. WATER LINE WITH RESTRAINED JOINTS PER UDACS.
- ⑧ INSTALL 45 DEG. BEND WITH RESTRAINED JOINTS PER UDACS.
- ⑨ INSTALL 90 DEG. BEND WITH RESTRAINED JOINTS PER UDACS.
- ⑩ INSTALL WET TAPPING SLEEVE WITH MECHANICAL JOINTS AND 10" TAPPING VALVE PER UDACS.
- ⑪ CUT AND CAP EXISTING WATERLINE PER UDACS.
- ⑫ INSTALL 20-INCH STEEL CASING PER UDDACS PLATE 23.
- ⑬ INSTALL 24-INCH STEEL CASING PER UDACS PLATE 23.
- ⑭ INSTALL 18-INCH PVC SDR35 SANITARY SEWER LINE PER DCSWCS.
- ⑮ INSTALL 72-INCH STANDARD PRE-CAST MANHOLE WITH CORROSION PROTECTION PER DCSWCS SD-1A, SD-1B, SD-3, 3.16.8 AND 4.9.9.



SHEET KEY



DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE

SEWER RELOCATION
PLAN AND PROFILE

SHEET TWO.

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SUBMITTAL
4/30/2013
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SHEET:

II-19

58 OF 10

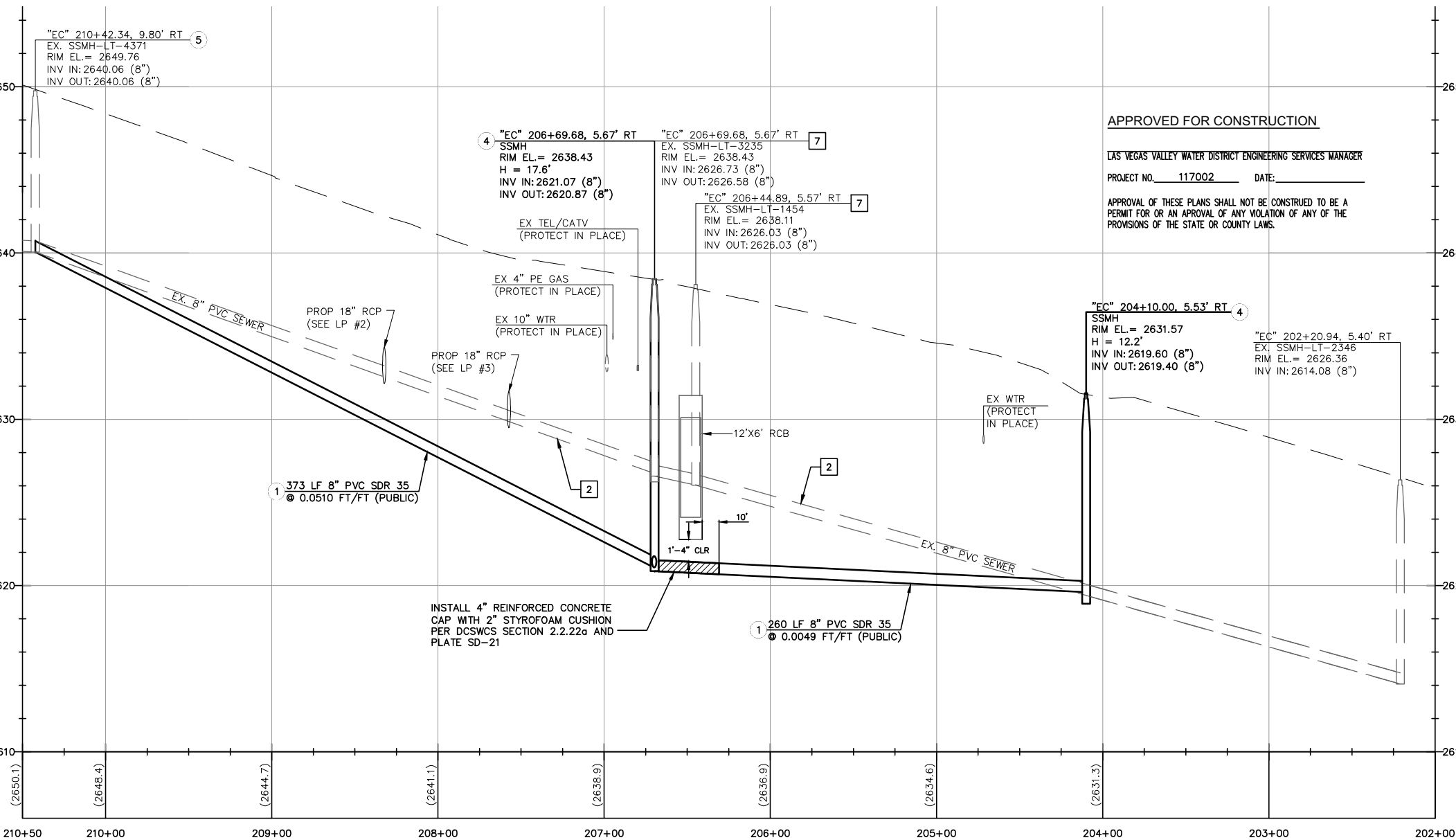
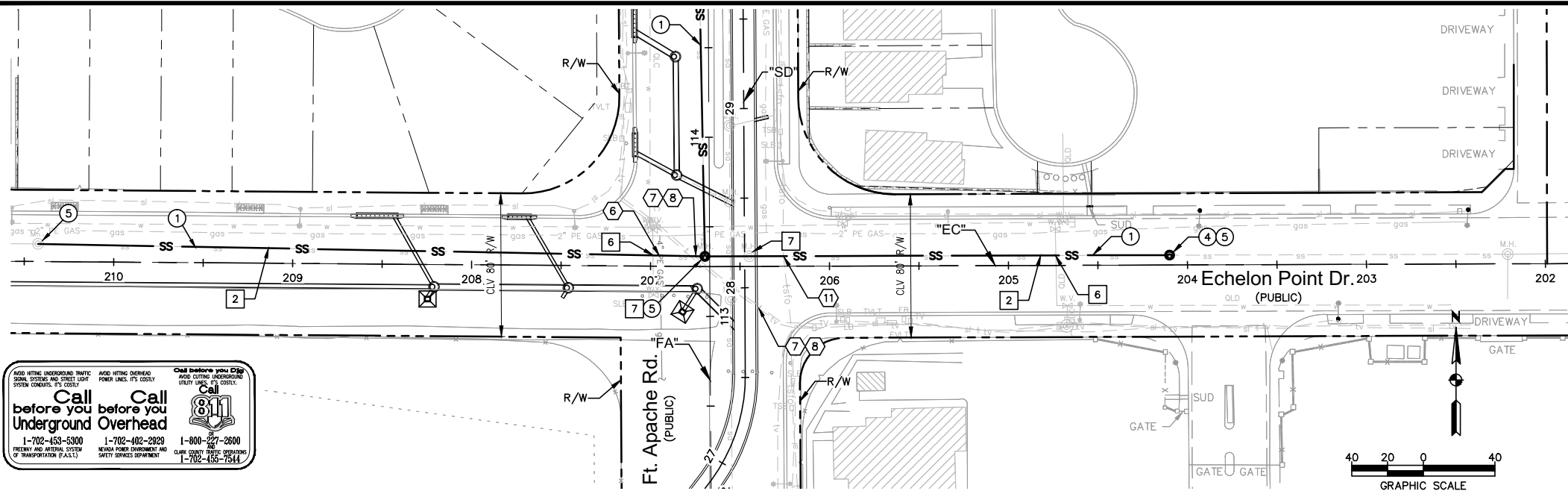
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327V150

H#36802

RANCHO - FORT APACHE STORM DRAIN

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NOTES:

- SEE SHEETS CP-1 THROUGH CP-5 FOR HORIZONTAL CONTROL PLANS.
- SEE SHEETS U-1 THROUGH U-14 FOR POTHOLE INFORMATION.

DRY UTILITY ITEMS

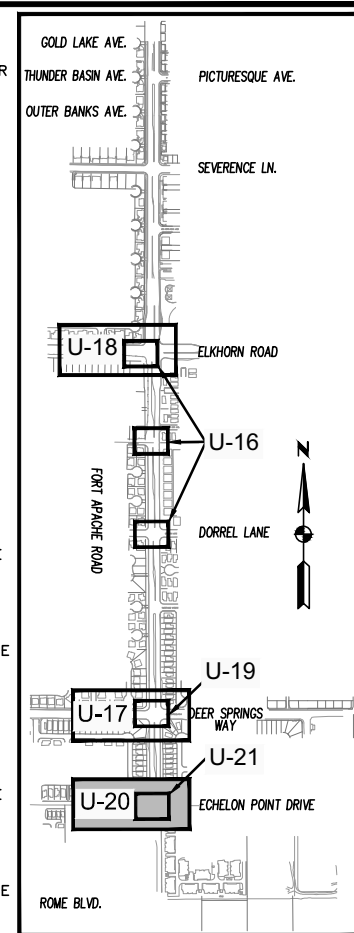
- EXISTING GAS FACILITIES TO BE RELOCATED BY SOUTHWEST GAS
- EXISTING CATV FACILITIES TO BE RELOCATED BY COX COMMUNICATIONS
- EXISTING TELEPHONE FACILITIES TO BE RELOCATED BY CENTURY LINK
- EXISTING ELECTRIC FACILITIES TO BE RELOCATED BY NV ENERGY
- EXISTING FIBER OPTIC FACILITIES TO BE RELOCATED BY CONTRACTOR
- EXISTING GAS FACILITIES TO BE PROTECTED IN PLACE
- EXISTING CATV FACILITIES TO BE PROTECTED IN PLACE
- EXISTING TELEPHONE FACILITIES TO BE PROTECTED IN PLACE
- EXISTING ELECTRIC FACILITIES TO BE PROTECTED IN PLACE
- EXISTING FIBER OPTIC FACILITIES TO BE PROTECTED IN PLACE
- EXISTING TRAFFIC/STREET LIGHT FACILITIES TO BE PROTECTED IN PLACE

UTILITY RELOCATION AND REMOVAL ITEMS

- EXISTING SEWER TO BE RELOCATED (SEE NOTE 3 BELOW)
- EXISTING SEWER TO BE REMOVED
- EXISTING SEWER TO BE PROTECTED IN PLACE
- EXISTING WATER LINE TO BE RELOCATED (SEE NOTE 2 BELOW)
- EXISTING WATER LINE TO BE REMOVED
- EXISTING WATER TO BE PROTECTED IN PLACE
- EXISTING MANHOLE AND MANHOLE BASE TO BE REMOVED
- EXISTING SEWER TO BE ABANDONED
- EXISTING SEWER MANHOLE TO BE PLUGGED WHERE SEWER IS REMOVED AND RE-FORM TROUGH

UTILITY CONSTRUCTION ITEMS

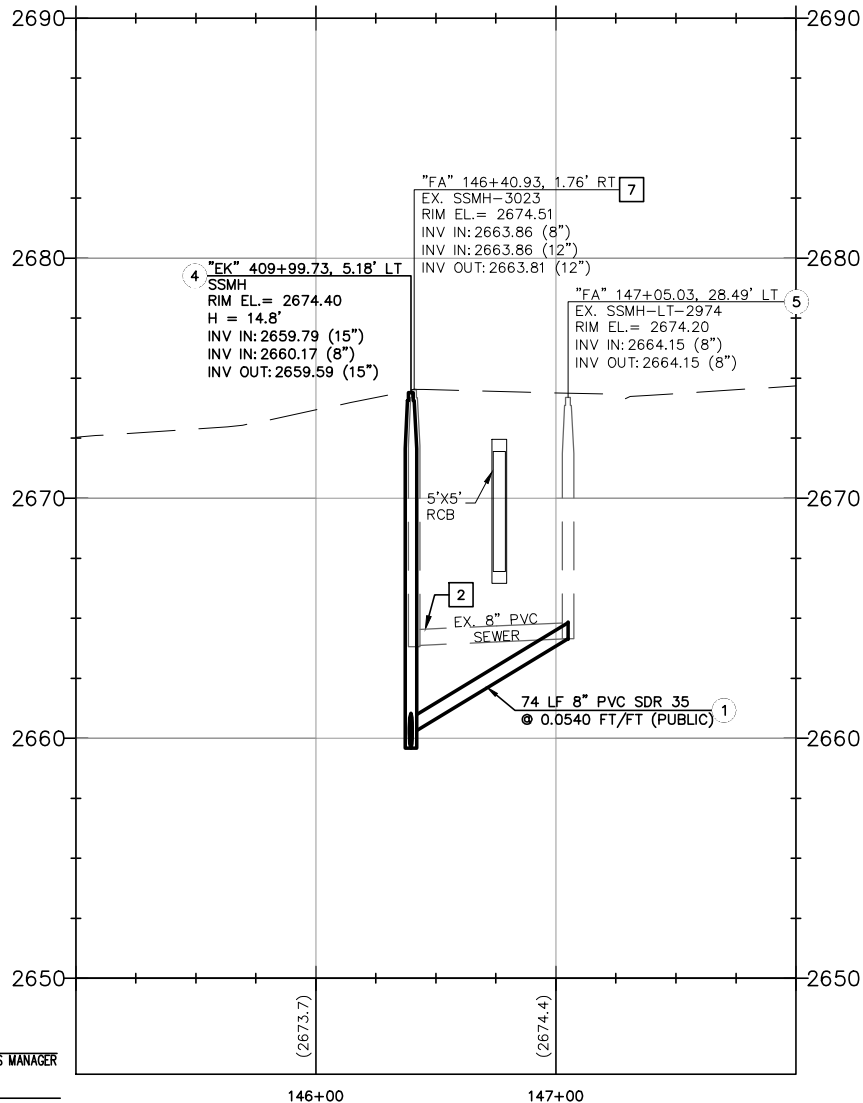
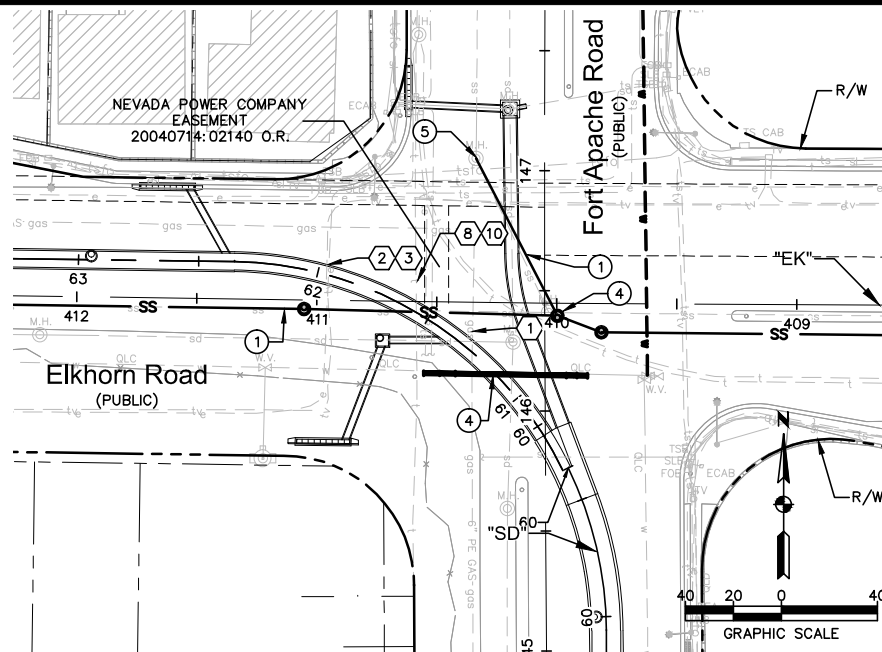
- INSTALL 8-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- INSTALL 12-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
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SHEET KEY

BY		DESCRIPTION		No.		DATE		W#		SCALE(V): AS SHOWN		SCALE(H): AS SHOWN		DATE: 4/30/2013		DESIGN/CHK BY: TOI/DJM		FIELD BOOK #:		PROJECT		SHEET TITLE:	
																				DEPARTMENT OF PUBLIC WORKS		RANCHO-FORT APACHE STORM DRAIN	
																				90% DESIGN SUBMITTAL 4/30/2013 - NOT FOR CONSTRUCTION		SHEET: U-20	
																				90% DESIGN SUBMITTAL 4/30/2013 - NOT FOR CONSTRUCTION		CLV DRAWING NO: 327V150	
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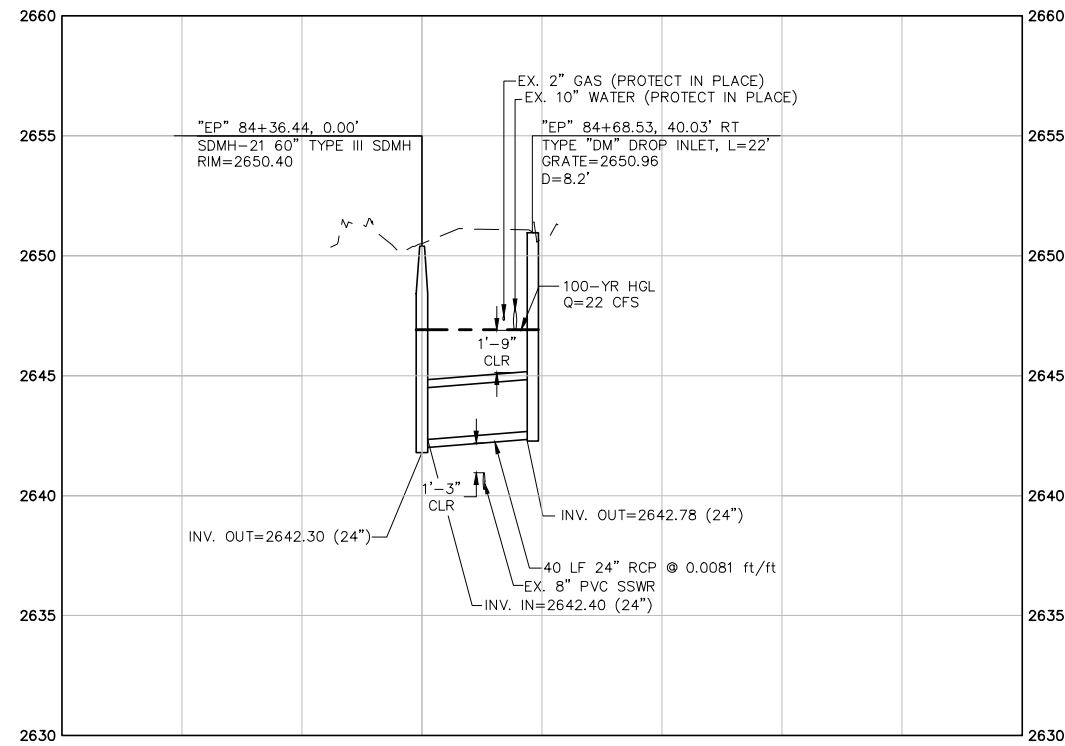
RANCHO - FORT APACHE STORM DRAIN



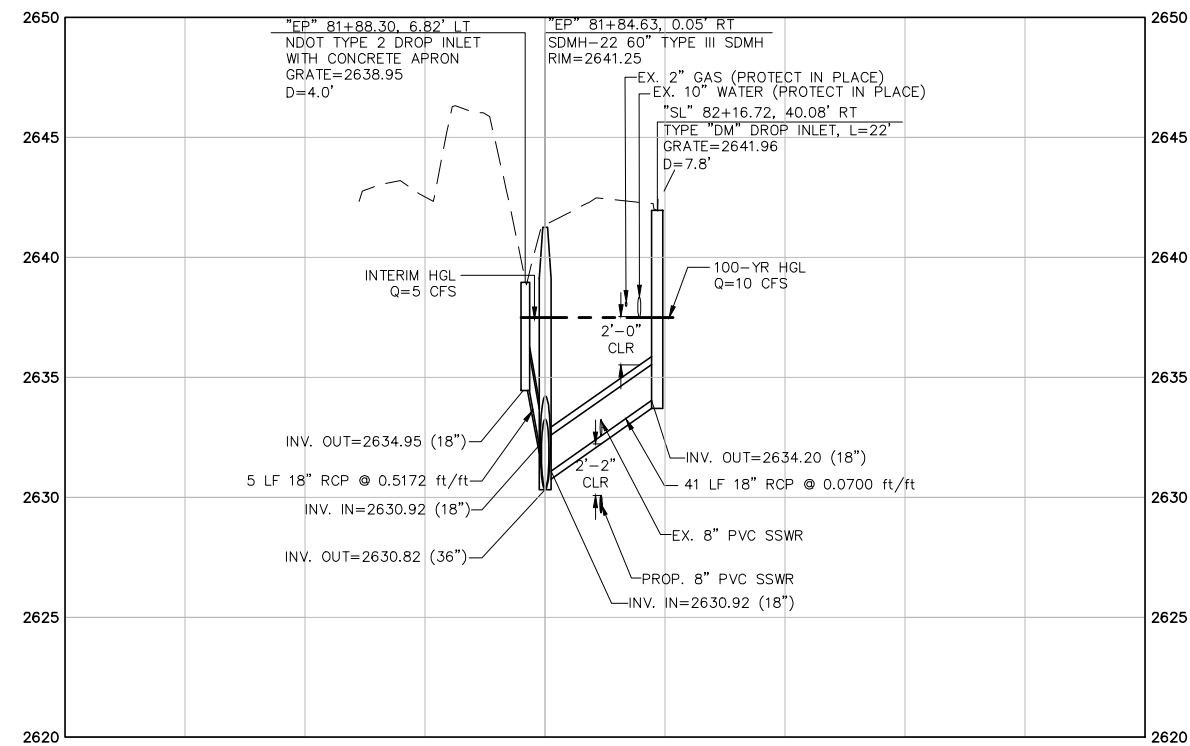
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- ① INSTALL 8-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
- ② INSTALL 12-INCH PVC SDR 35 SANITARY SEWER LINE PER DCSWCS.
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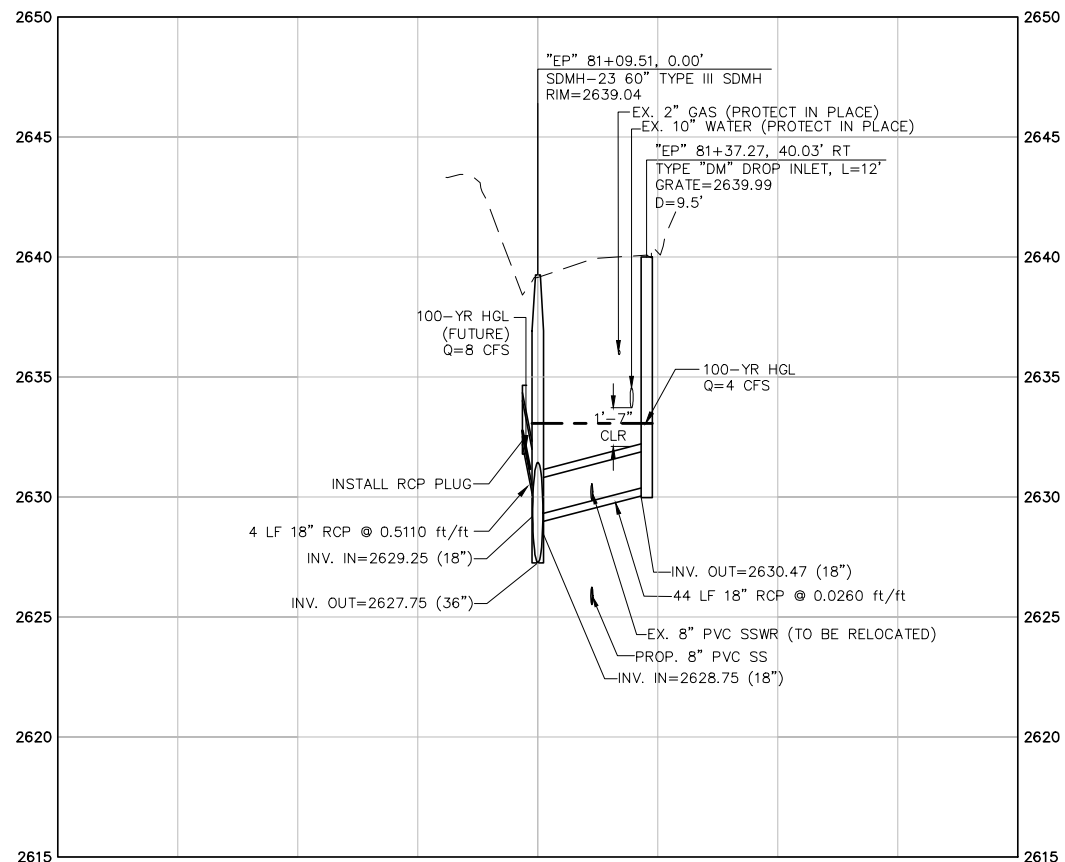
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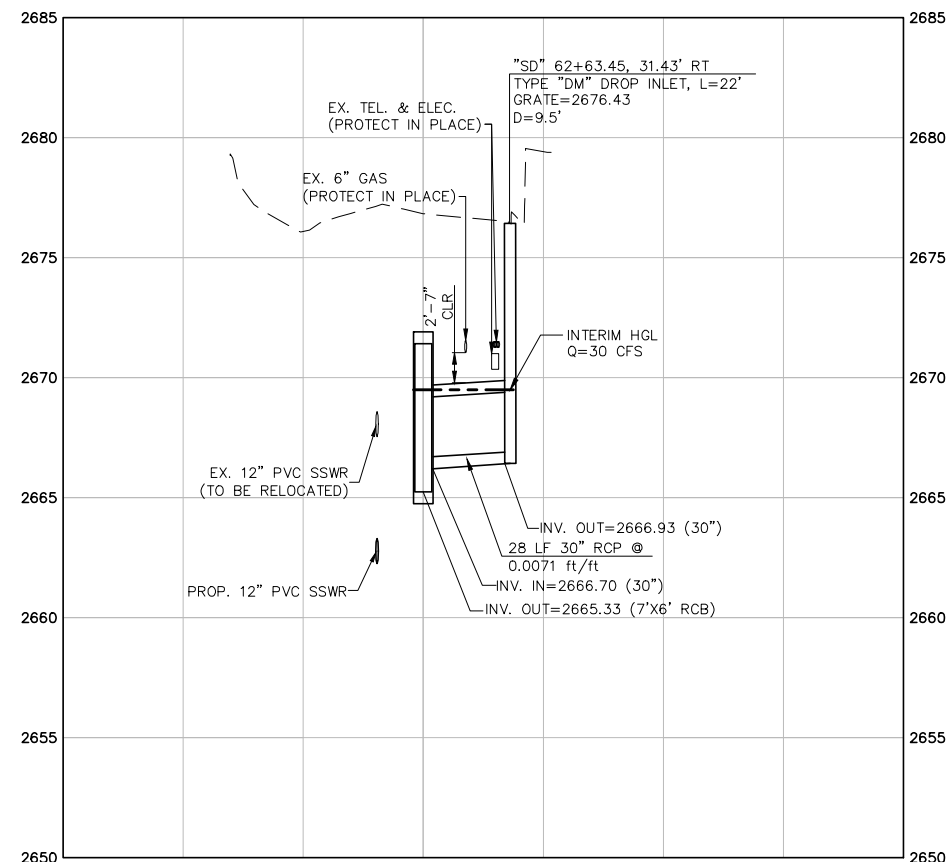
"EP" 84+43.74
LATERAL #1



"EP" 81+84.07
LATERAL #2



"EP" @ 81+08.94
LATERAL #3



"SD" @ 62+36.89
LATERAL #4

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER

PROJECT NO. 117002 DATE:

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PROJECT: RANCHO-FORT APACHE

DEPARTMENT OF PUBLIC WORKS

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4/30/2013
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SHEET: LP-1

91 OF 109
CLV DRAWING NO: 327V150

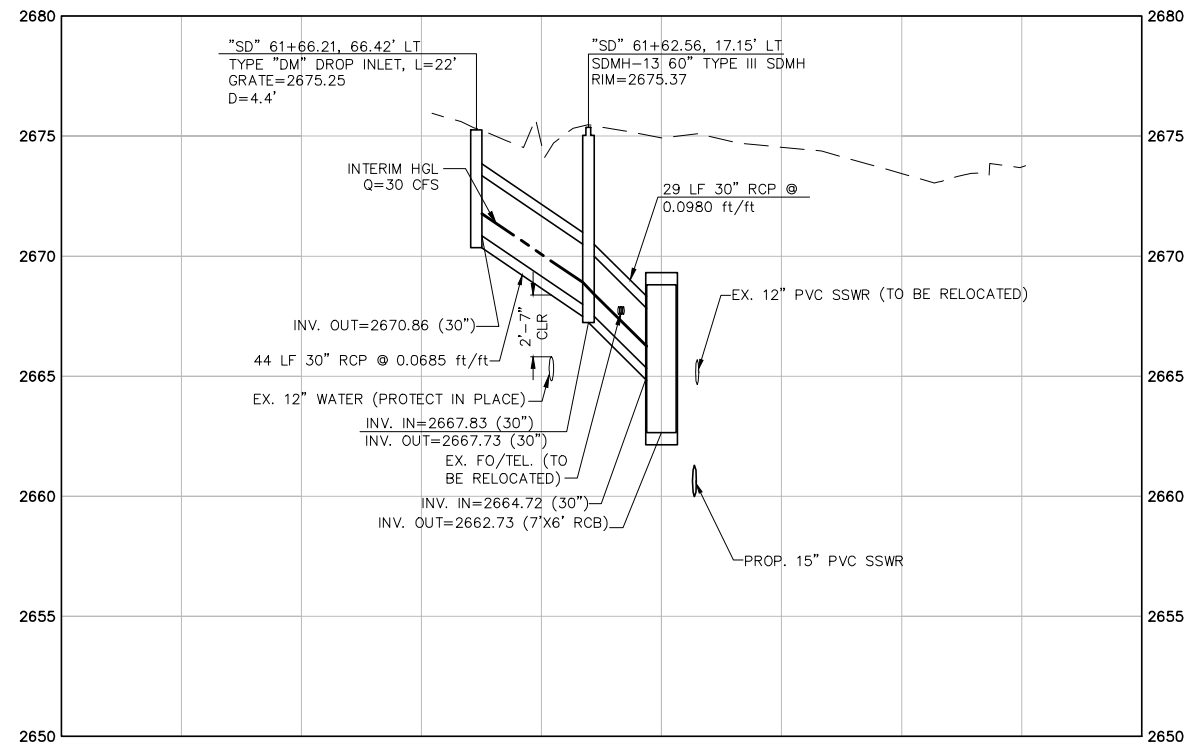
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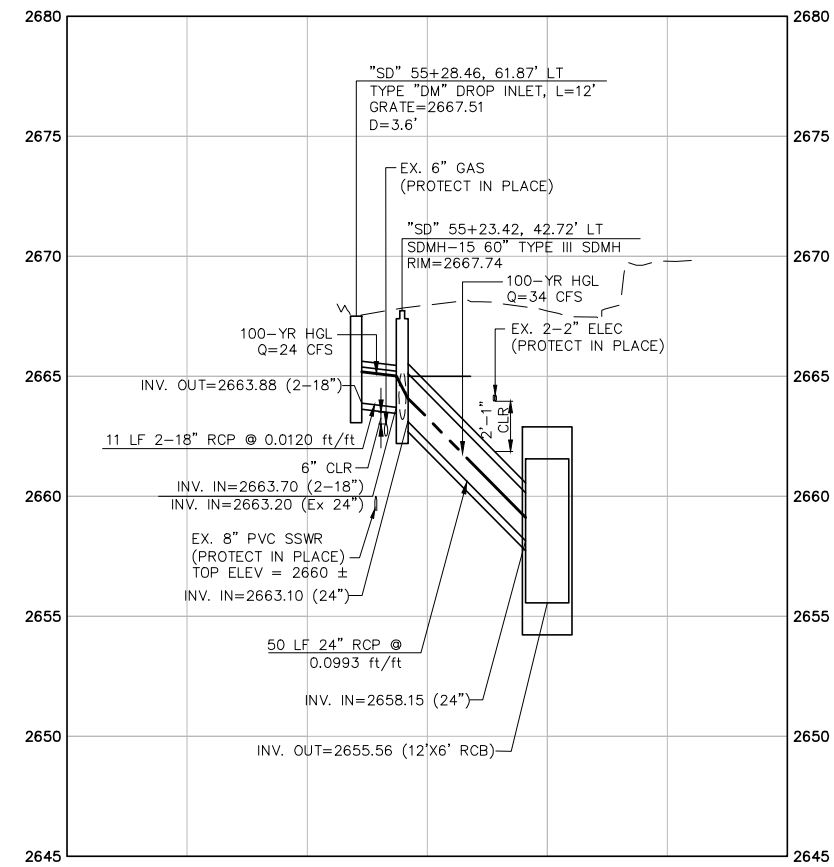
THE Louis Berger Group, INC.
500 E. Amigo Court, Suite 100 Voice: 702-736-6632
Las Vegas, Nevada 89119 Fax: 702-736-0704

RANCHO - FORT APACHE STORM DRAIN

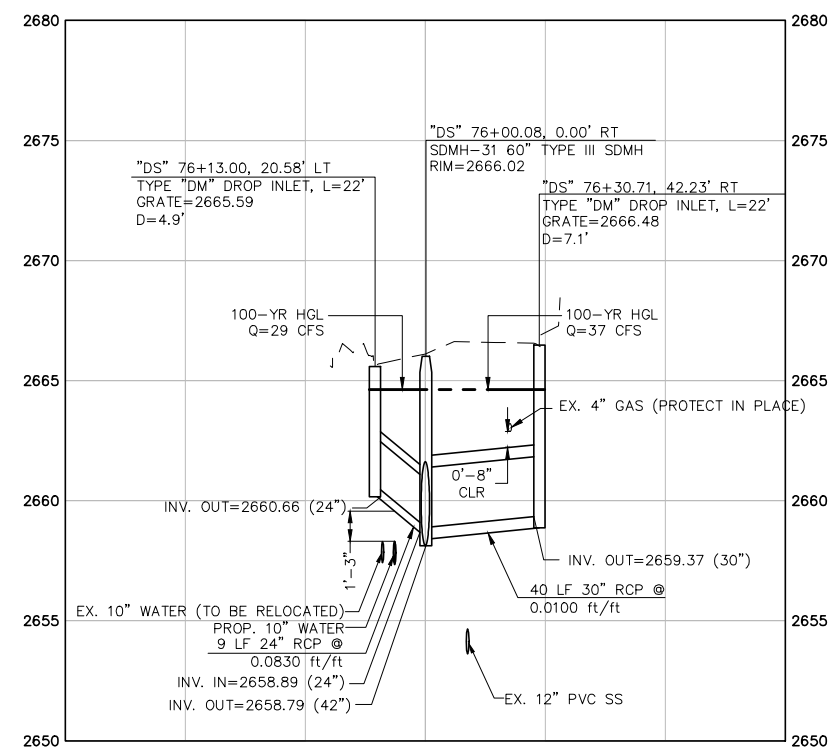
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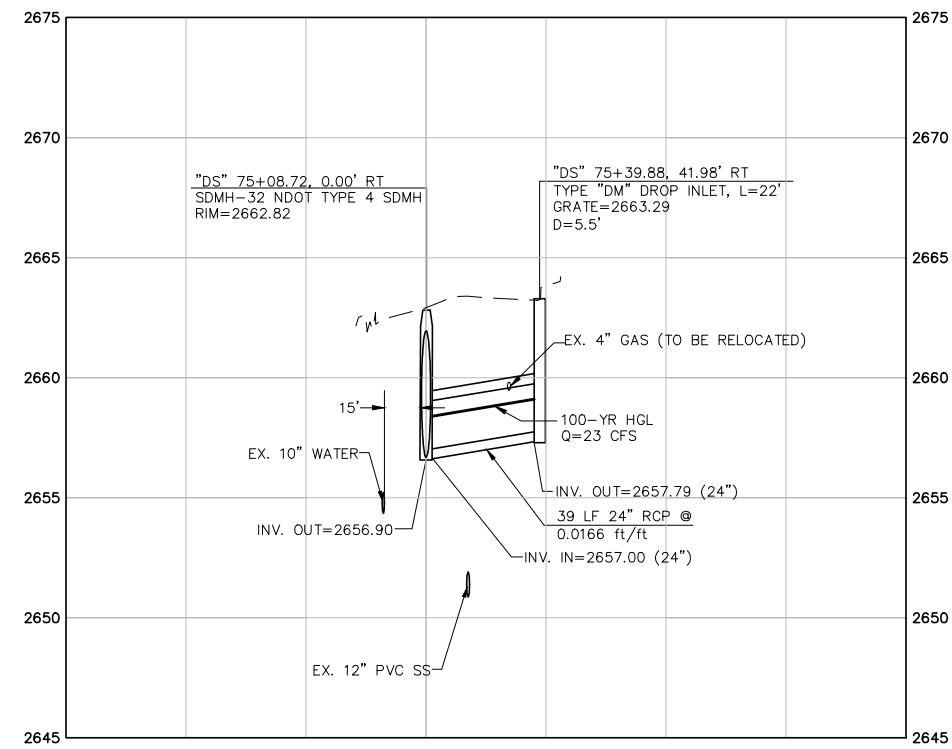
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LATERAL #5



"SD" @ 54+80.70
LATERAL #6



DS-SD @ 76+00.08
LATERAL #7



DS-SD @ 75+08.72
LATERAL #8

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LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER

PROJECT NO. 117002 DATE:

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DEPARTMENT OF PUBLIC WORKS
PROJECT: RANCHO-FORT APACHE
STORM DRAIN
LATERAL PROFILES

90%
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SUBMITTAL
4/30/2013
NOT FOR CONSTRUCTION

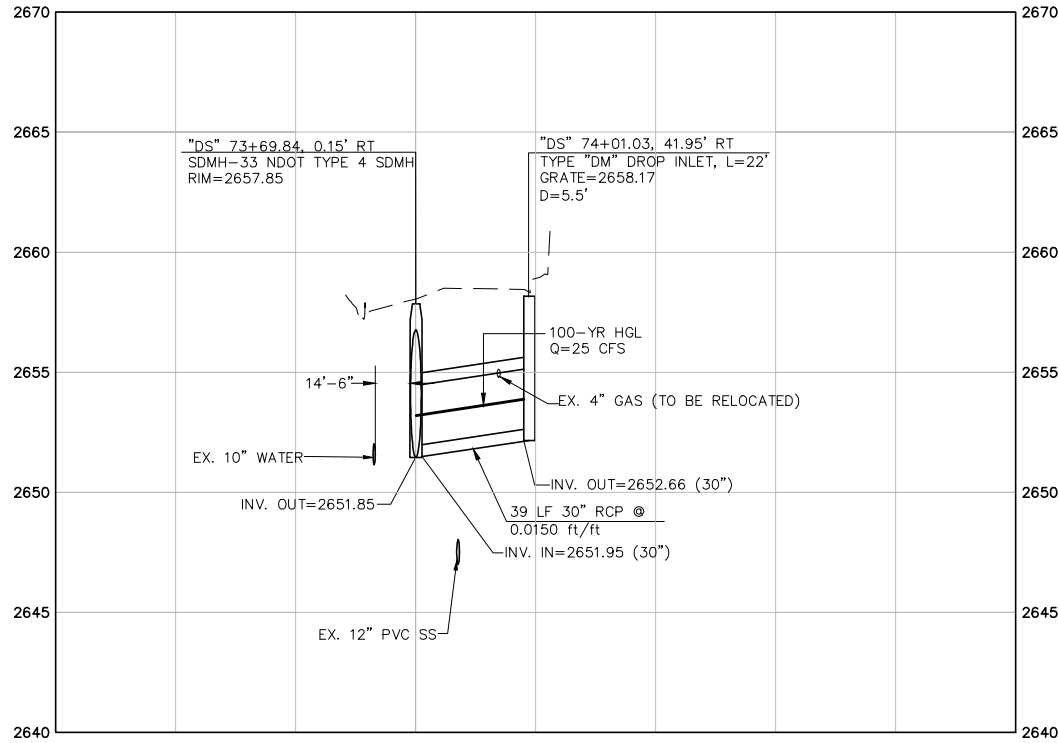
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92 OF 109
CLV DRAWING NO: 327V150

2

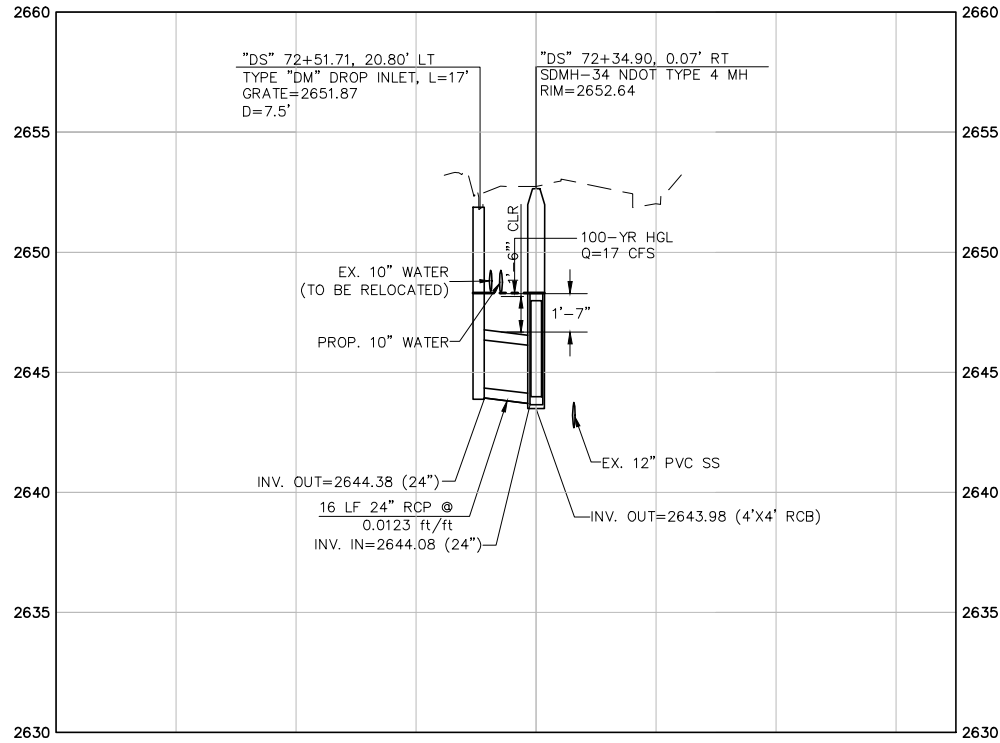
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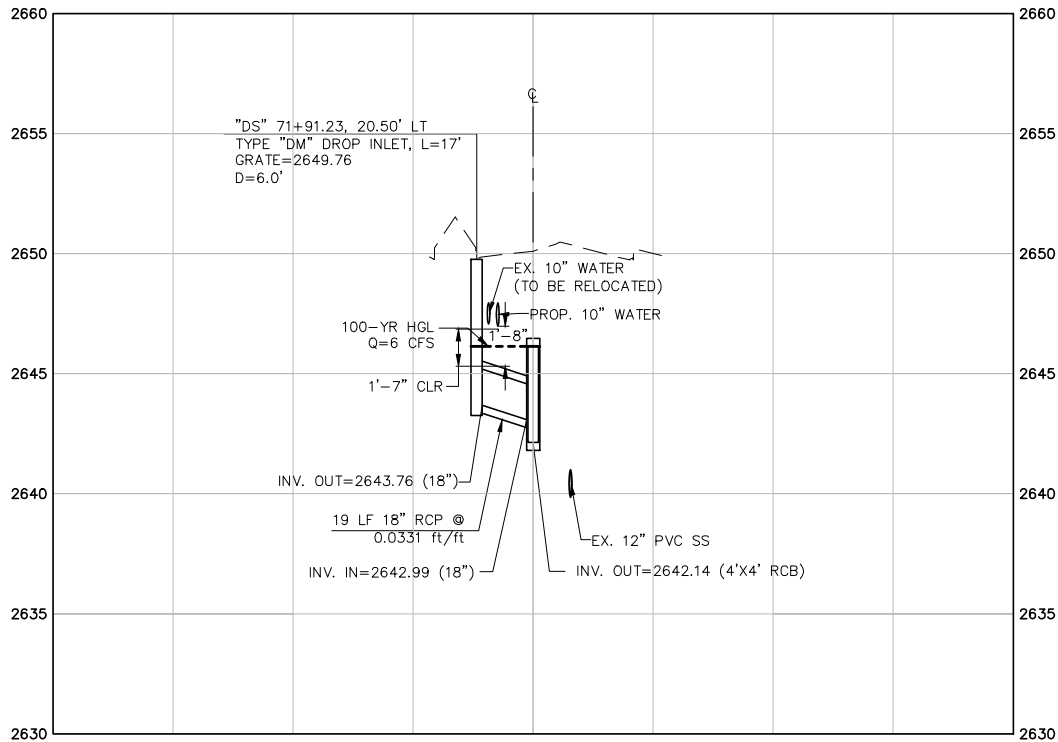
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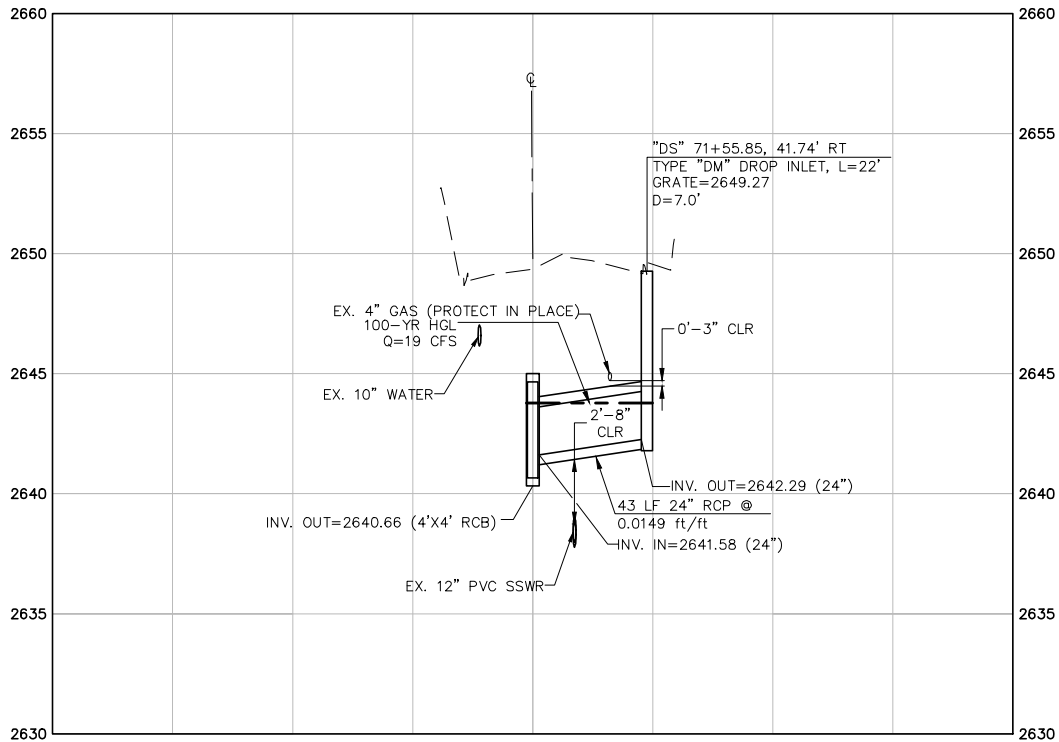
DS-SD @ 73+69.85
LATERAL #9



DS-SD @ 72+34.93
LATERAL #10



DS-SD @ 71+73.23
LATERAL #11



DS-SD @ 71+25.05
LATERAL #12

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LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER

PROJECT NO. 117002 DATE:

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DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE

STORM DRAIN

LATERAL PROFILES

SHEET:

LP-3

93 OF 109

CLV DRAWING NO:

327V150

SHEET TITLE:

SCALE(H): AS SHOWN SCALE(V): AS SHOWN WA#

FIELD BOOK #: DATE: 4/30/2013 DSGN/CHK BY: JSD

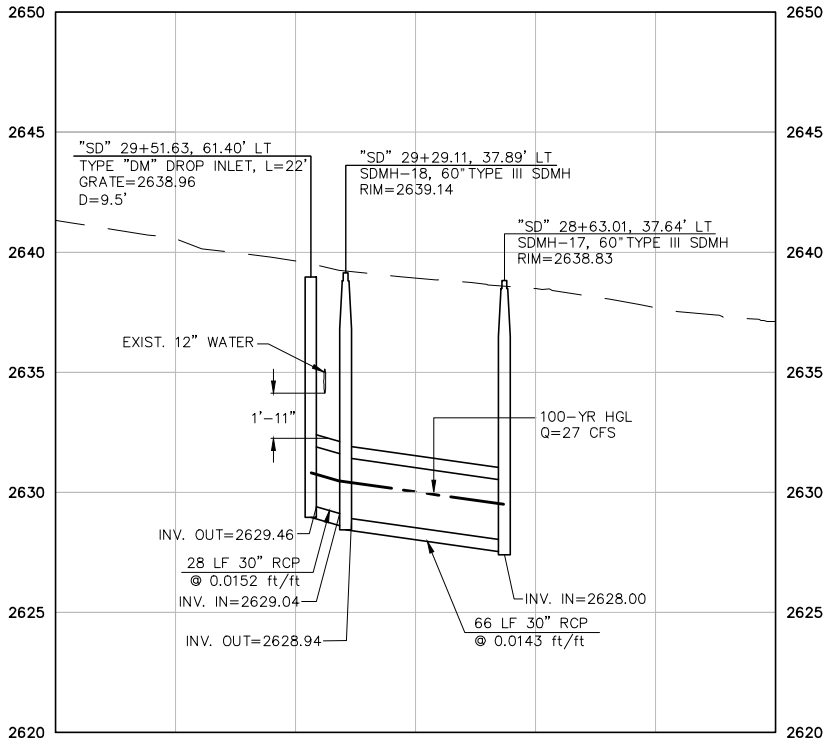
THE Louis Berger Group, INC.

500 E. Amigo Court, Suite 100 Las Vegas, Nevada 89119 Voice: 702-736-6632 Fax: 702-736-0704

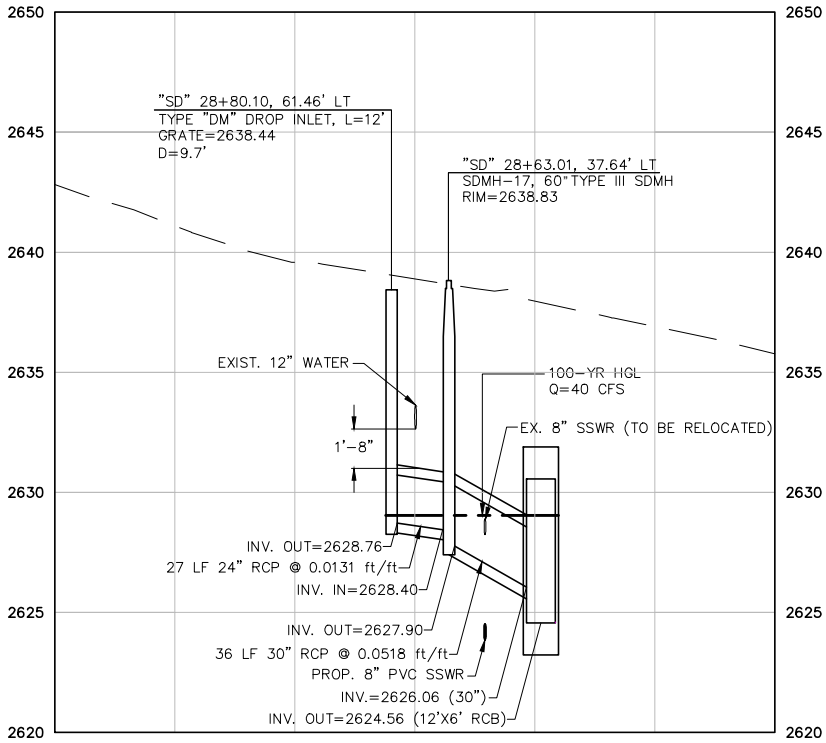


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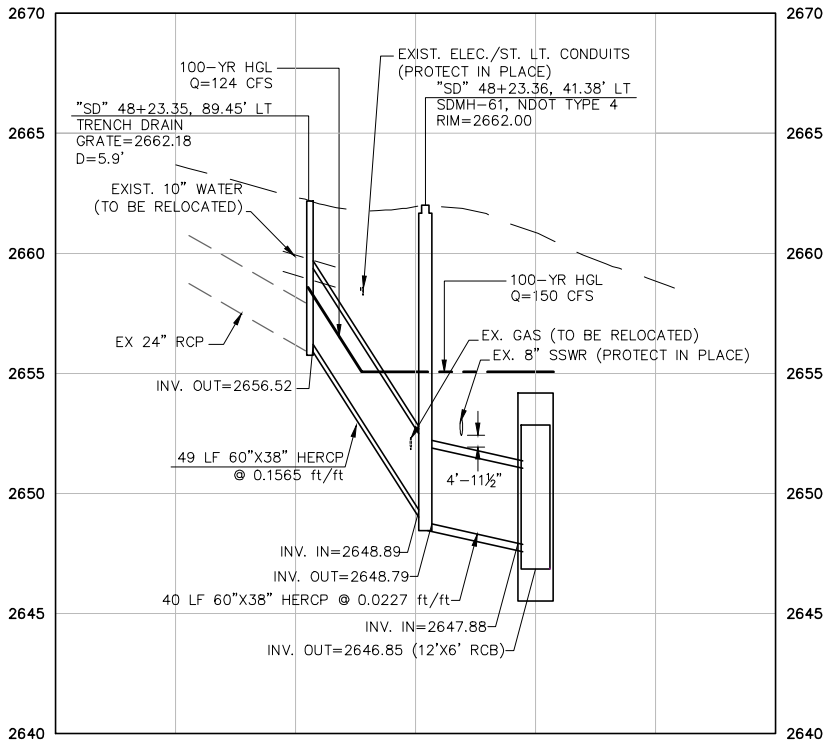
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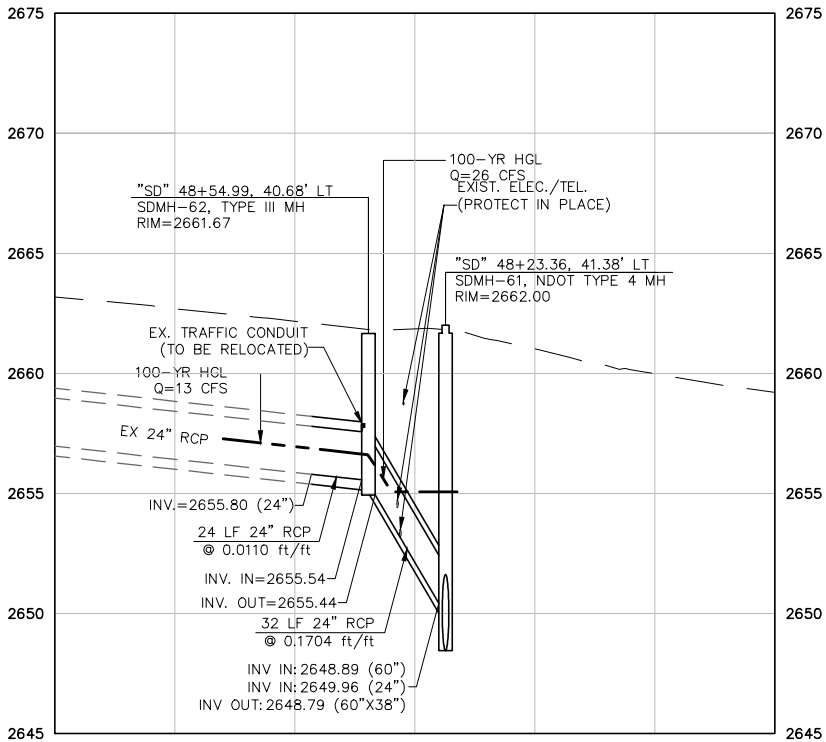
SD @ 28+75.41
LATERAL #13



SD @ 28+46.98
LATERAL #14



SD @ 48+03.77
LATERAL #15



SD @ 48+27.86
LATERAL #16

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LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER

PROJECT NO. 117002 DATE:

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DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE

STORM DRAIN

LATERAL PROFILES

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4/30/2013

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SHEET:

LP-4

94 OF 109

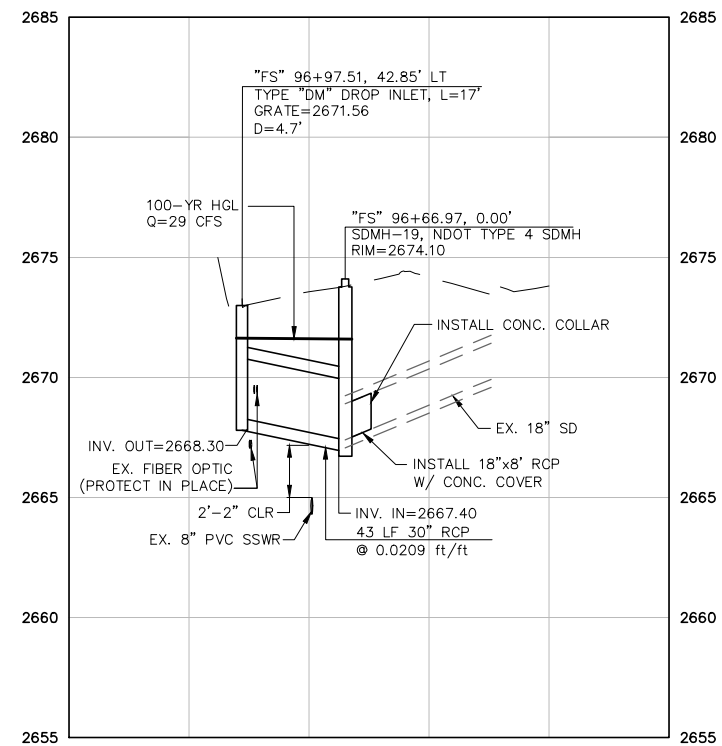
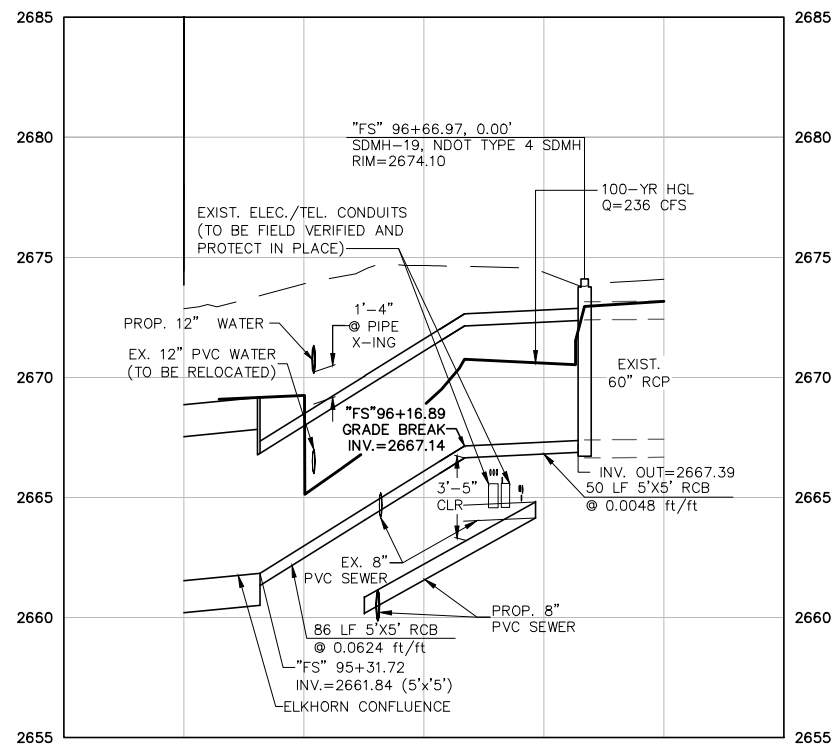
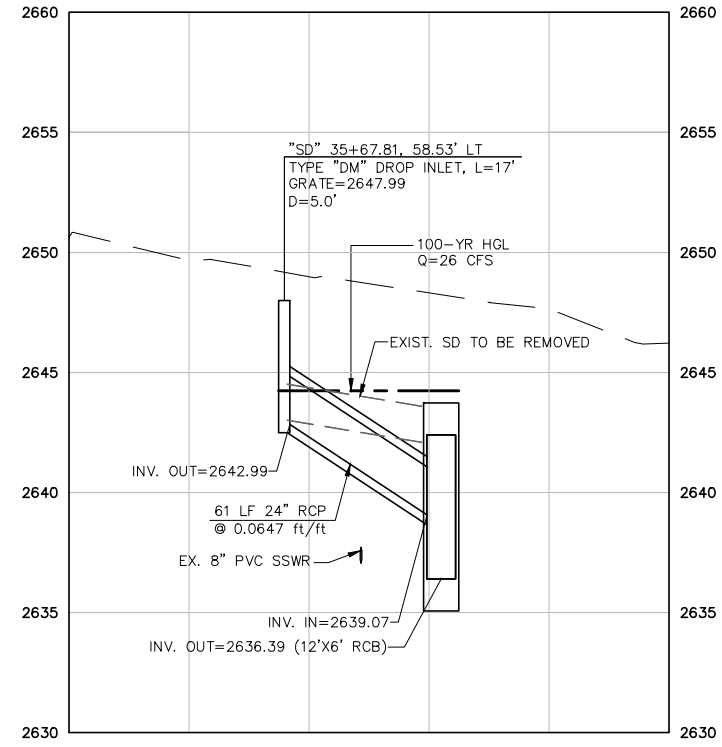
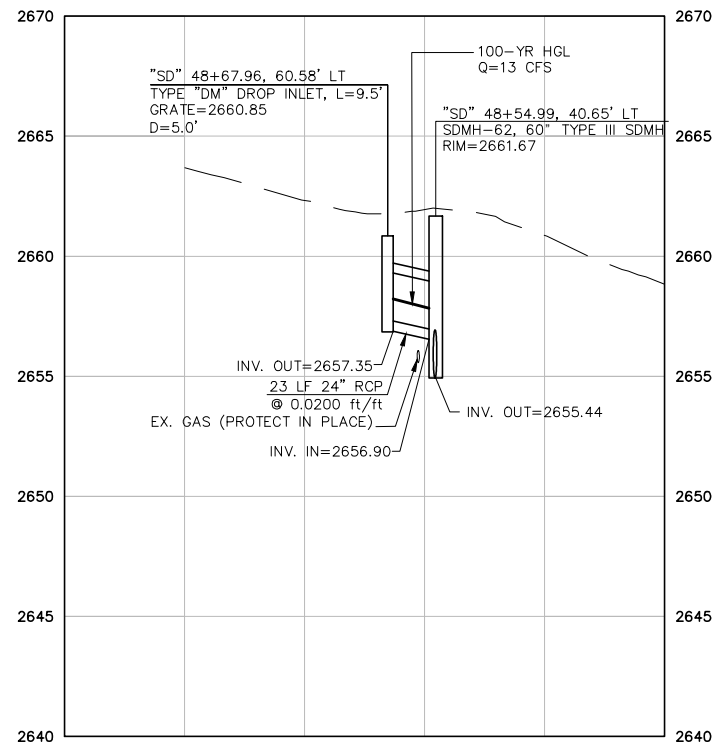
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SHEET TITLE:

RANCHO - FORT APACHE STORM DRAIN



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LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER

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2019 - RANCH CONSTRUCTION

DEPARTMENT OF PUBLIC WORKS

PROJECT: RANCHO-FORT APACHE
STORM DRAIN
LATERAL PROFILES

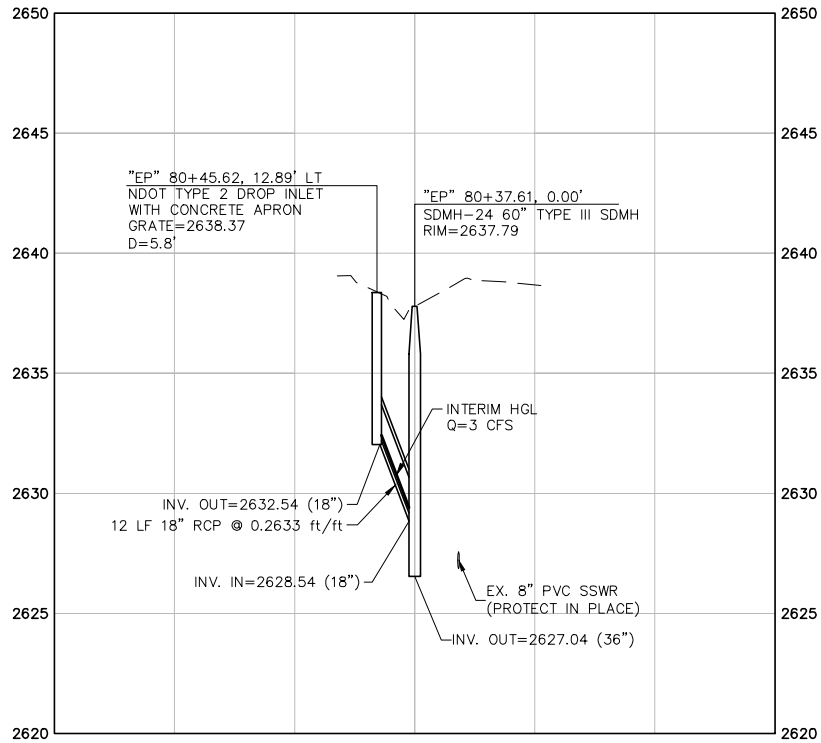
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4/30/2013
NOT FOR CONSTRUCTION

SHEET: **LP-5**
95 OF 109
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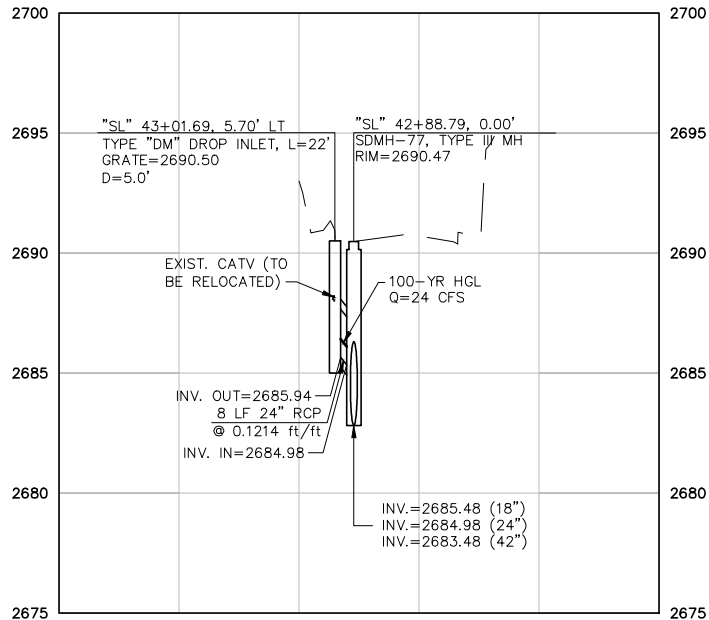
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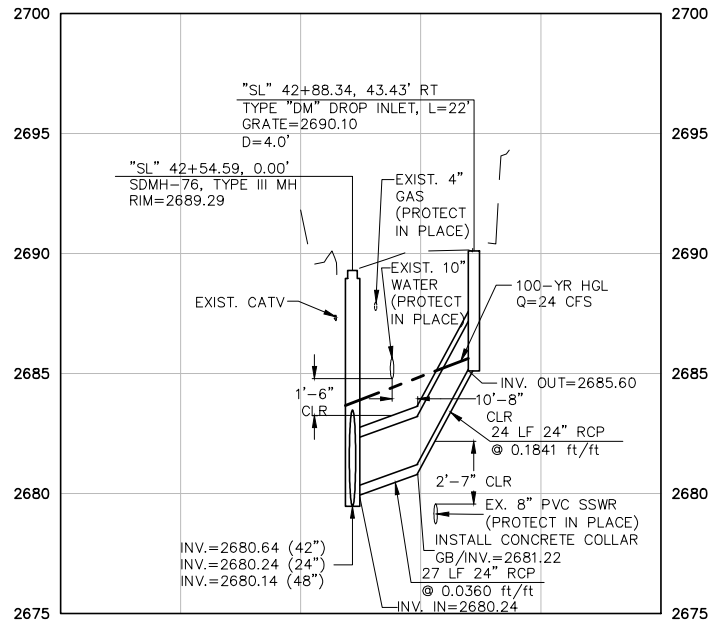
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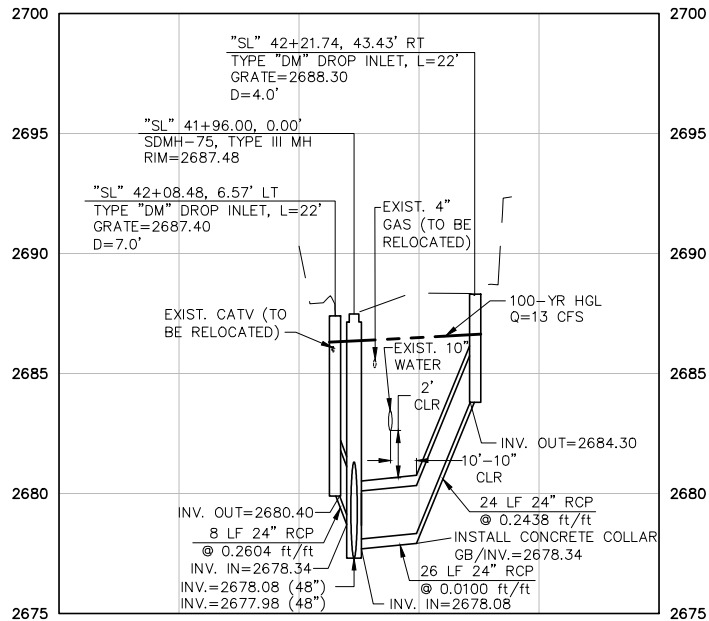
"EP" 80+37.61
LATERAL #21



SL @ 42+88.79
LATERAL #22



SL @ 42+54.59
LATERAL #23



SL @ 41+96.00
LATERAL #24

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LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER

PROJECT NO. 117002 DATE:

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DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE

STORM DRAIN

LATERAL PROFILES



THE Louis Berger Group, INC.
500 E. Amigo Court, Suite 100
Las Vegas, Nevada 89119
Voice: 702-736-6632
Fax: 702-736-0704

BY	DESCRIPTION	DATE	No.	WA#	SCALE(V): AS SHOWN	SCALE(H): AS SHOWN	FIELD BOOK #:	DATE	DESIGN/CHK BY:
									JSD

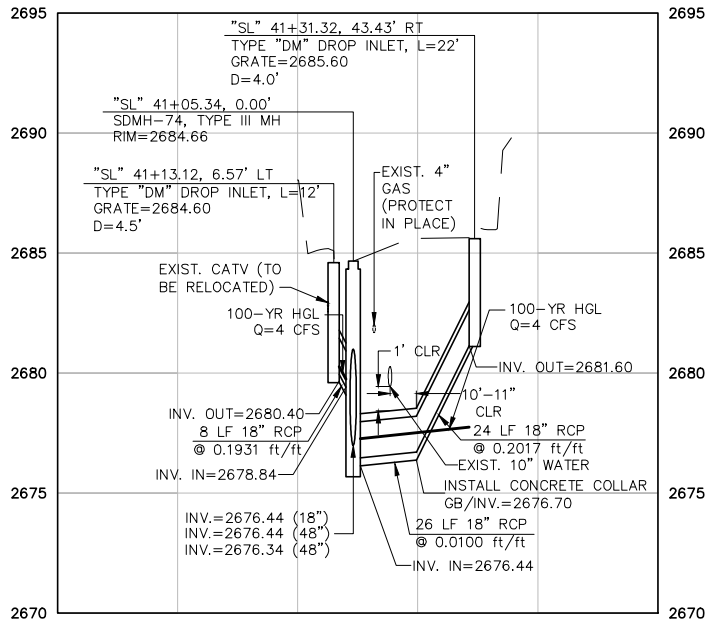
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RANCHO - FORT APACHE STORM DRAIN

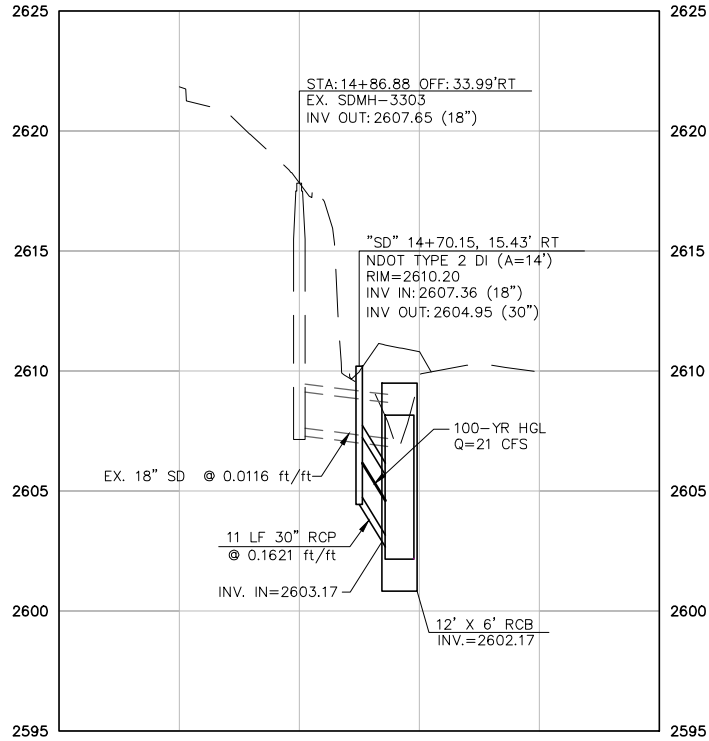
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SL @ 41+05.34
LATERAL #25



SD @ 14+70.15
LATERAL #26

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LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER
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DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE

STORM DRAIN

LATERAL PROFILES

SHEET:

LP-7

97 OF 109

CLV DRAWING NO:

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FIELD BOOK #:

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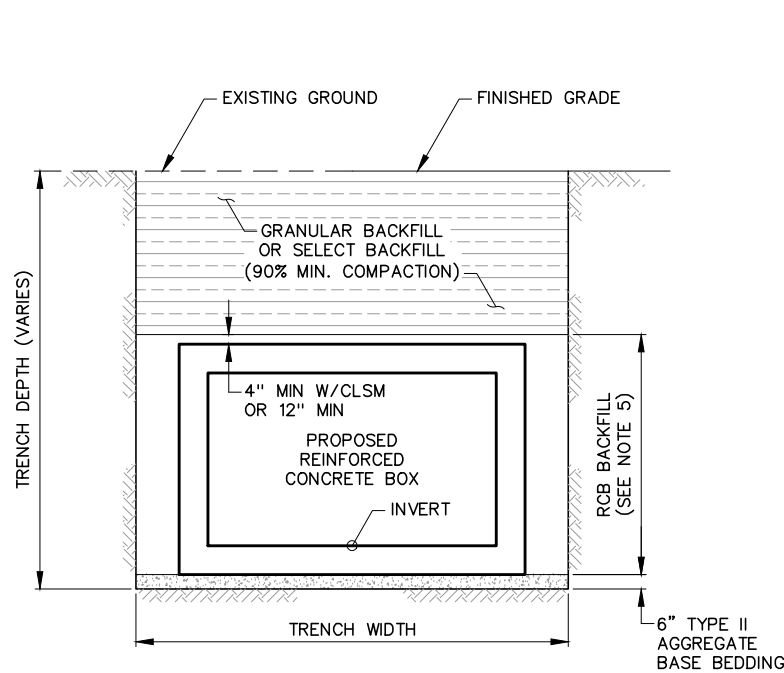
THE Louis Berger Group, INC.
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Las Vegas, Nevada 89119
Voice: 702-736-6632
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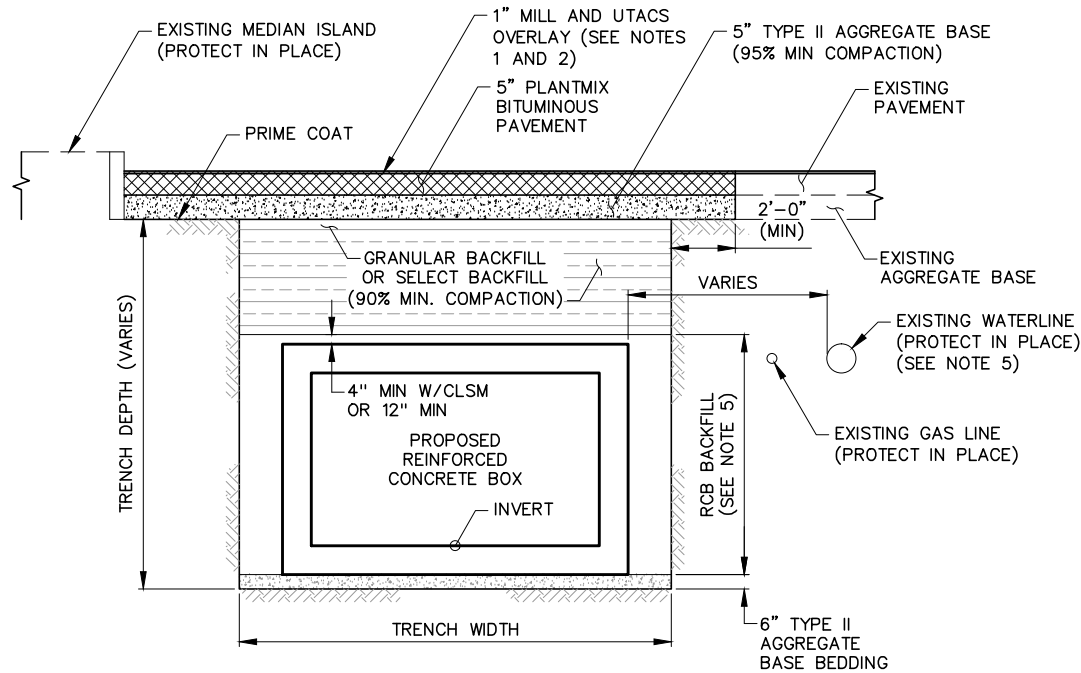
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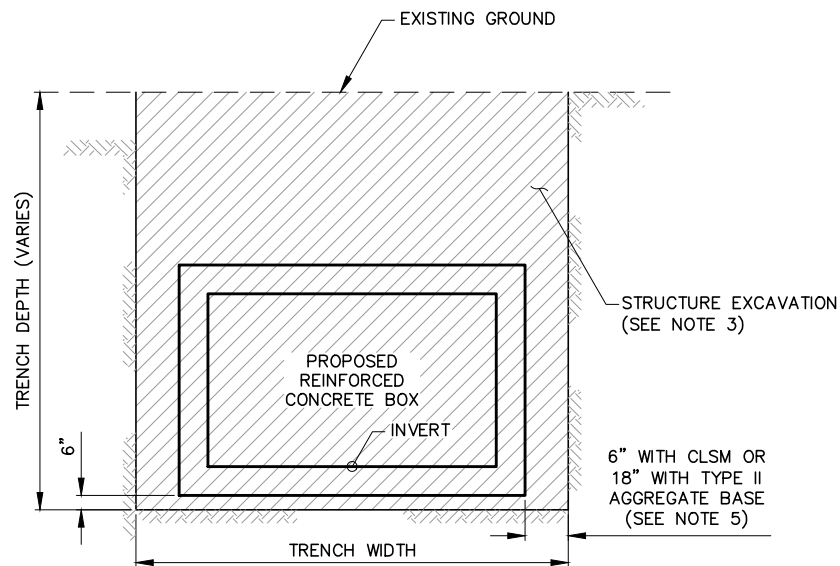
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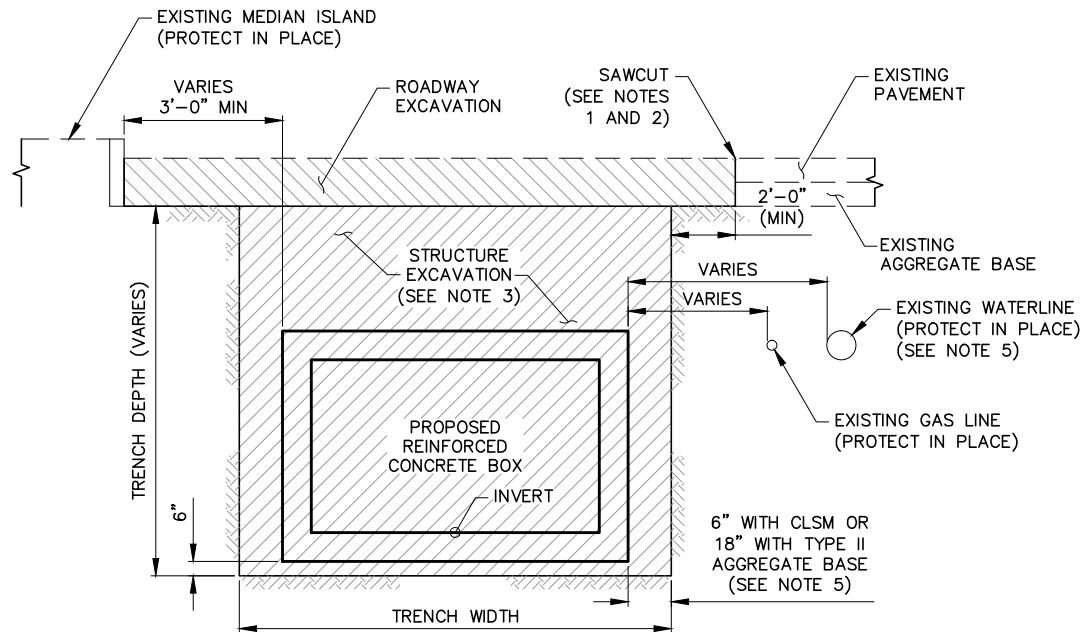
BACKFILL - UNPAVED AREAS



BACKFILL - PAVED AREAS



EXCAVATION - UNPAVED AREAS



EXCAVATION - PAVED AREAS

NOTES:

- DESIGN SPECIFICATIONS: "AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS" 5TH EDITION 2010 WITH REVISIONS TO DATE.
- CONTRACT SPECIFICATIONS: "CLARK COUNTY UNIFORM STANDARD SPECIFICATIONS" EXCEPT AS NOTED BELOW AND IN THE SPECIAL PROVISIONS FOR THIS CONTRACT.
- ALL CONCRETE SHALL HAVE A MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 4500 PSI. AND SHALL HAVE TYPE V CEMENT. ALL CONSTRUCTION JOINTS SHALL BE INTENTIONALLY ROUGHENED TO 1/4" AMPLITUDE. UNLESS OTHERWISE NOTED ALL REINFORCING BARS SHALL HAVE 2" CLEAR CONCRETE COVER. CHAMFER ALL EDGES OF CONCRETE 3/4" UNLESS OTHERWISE NOTED.
- CONCRETE CONSTRUCTION JOINTS DESIGNATED AS A "PERMISSIBLE JOINT" OR AS AN "OPTIONAL CONSTRUCTION JOINT" MAY BE INCORPORATED INTO THE CONSTRUCTION AT THE CONTRACTORS OPTION. JOINTS DESIGNATED AS A "CONSTRUCTION JOINT" ARE CONSIDERED MANDATORY AND SHALL BE INCORPORATED INTO THE CONSTRUCTION UNLESS OTHERWISE APPROVED IN WRITING BY THE ENGINEER.
- REINFORCING STEEL: ALL REINFORCING STEEL SHALL BE ASTM A615, GRADE 60, DEFORMED. (WHEN CONSIDERED AS BARS TO CONTROL TEMPERATURE, SHRINKAGE AND DISTRIBUTION STRESSES BY THE ENGINEER, MAY BE ADJUSTED BY THE CONTRACTOR UPON CONCURRENCE AND APPROVAL OF THE ENGINEER.) DIMENSIONS RELATING TO BAR SPACING ARE CENTER TO CENTER OF BAR.
- UNLESS OTHERWISE NOTED, THE FOLLOWING TABLE APPLIES TO ALL REINFORCED CONCRETE DRAINAGE STRUCTURES.

BAR SIZE LAP DISTANCE

BAR SIZE	LAP DISTANCE
#4	2'-0"
#5	2'-4"
#6	2'-9"
#7	3'-6"
#8	4'-7"
#9	5'-10"
#10	7'-4"

- DEAD LOAD: MAXIMUM COVER WITH EARTH LOAD MODIFICATION FACTOR.
- ALL STRUCTURES AND THEIR COMPONENTS SUPPORTING TRAFFIC LOADS SHALL BE DESIGNED FOR AASHTO HL-93 LOADING+IMPACT.
- SEISMIC LOAD: PGA=0.15g, SITE CLASS C APPLICABLE TO CHANNEL WALLS.
- UNLESS OTHERWISE NOTED ALL STRUCTURAL STEEL PLATES AND SHAPES SHALL BE ASTM A36. GRADE 50 STEEL MAY BE SUBSTITUTED FOR GRADE 36 AT NO ADDITIONAL COST.
- GEOTECHNICAL DESIGN PARAMETERS PER GEOTECHNICAL INVESTIGATION "RANCHO-FORT APACHE STORM DRAIN FORT APACHE ROAD, BETWEEN ELKHORN ROAD AND THE BRUCE WOODBURY BELTWAY, LAS VEGAS NEVADA" PROJECT # 10-34114-01 BY CONVERSE CONSULTANTS DATED APRIL 25, 2011.
 - ALLOWABLE SOIL BEARING PRESSURE: 5000 PSF FOR EMBEDMENT DEPTH 48" MINIMUM BELOW ADJACENT FINISH GRADE FOR A WIDTH OF 36" MINIMUM.
 - ULTIMATE SOIL BEARING CAPACITY: FOR CHANNEL WALLS $q_{ULT} (ksf) = 2.47B' + 2.53D_f$ WHERE:
 B' =EFFECTIVE WIDTH OF FOOTING
 D_f =DEPTH OF EMBEDMENT TO BOTTOM OF FOOTING
 - UNIT WEIGHT OF RETAINED SOIL: 130pcf (CHANNEL WALL, 135pcf (RCBs)

ACTIVE PCF	RESTRAINED EARTHQUAKE		SURCHARGE
	Peg TOP	Peg BOTTOM	
57	38.4H	9.6H	0.44q

GENERAL DRAINAGE STRUCTURE NOTES

2
DT-1 NTS

NOTES:

- SEE RC SHEETS FOR THE LIMITS OF SAW CUT AND MILL AND OVERLAY.
- FINAL SAWCUT AND PAVEMENT LIMITS SHALL BE APPROVED BY THE FIELD INSPECTOR.
- TRENCH WALLS SHOULD BE APPROPRIATELY SHORED OR LAID BACK PER OSHA REQUIREMENTS.
- GEOTECHNICAL INVESTIGATION REPORT BY CONVERSE CONSULTANTS, PROJECT NO. 10-34114-01, DATED APRIL 25, 2011.
- RCB BACKFILL SHALL BE CLSM IN AREAS WHERE THE HORIZONTAL SEPARATION BETWEEN THE RCB AND EXISTING WATERLINE (EDGE TO EDGE) IS LESS THAN 10 FEET.
- SEE DETAIL 4/DT-12 FOR MAXIMUM ALLOWABLE CHORD LENGTH FOR CURVED SECITONS.

1
DT-1 NTS RCB TRENCH EXCAVATION

90% DESIGN SUBMITTAL 4 / 30 / 2013 - NOT FOR CONSTRUCTION

DEPARTMENT OF PUBLIC WORKS

RANCHO-FORT APACHE STORM DRAIN

TRENCH DETAILS

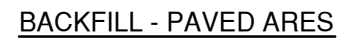
90%
DESIGN
SUBMITTAL
4/30/2013
NOT FOR CONSTRUCTION

SHEET:
DT-1
98 OF 109
CLV DRAWING NO:
327V150

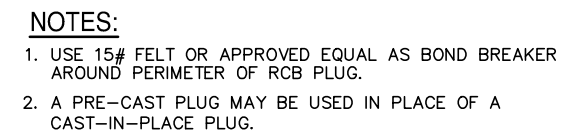
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RANCHO - FORT APACHE STORM DRAIN

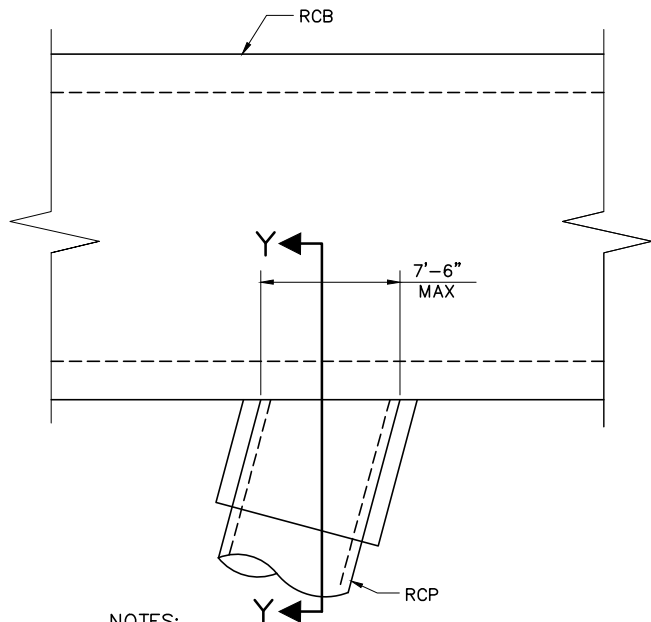
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1. SEE USGCCA NO. 503.2 FOR ADDITIONAL DETAILS NOT SHOWN.
2. FINAL SAWCUT AND RESTORATION LIMITS SHALL BE APPROVED BY THE FIELD INSPECTOR.
3. USE NORMAL BEDDING PER USGCCA NO. 505 UNLESS OTHERWISE SPECIFIED ON THE PLANS OR APPROVED BY THE ENGINEER.
4. TRENCH WALLS SHOULD BE APPROPRIATELY SHORED OR LAID BACK PER OSHA REQUIREMENTS.
5. GEOTECHNICAL INVESTIGATION REPORT BY ONVERSE CONSULTANTS, PROJECT NO. 10-34114-01, DATED APRIL 25, 2011.

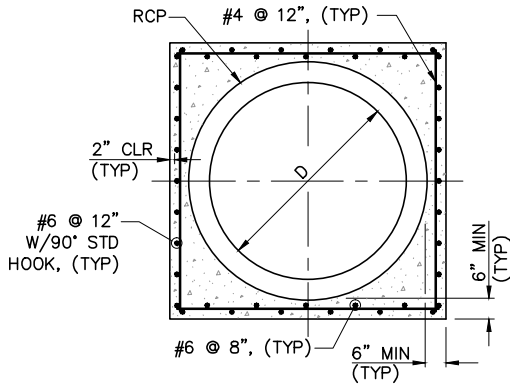


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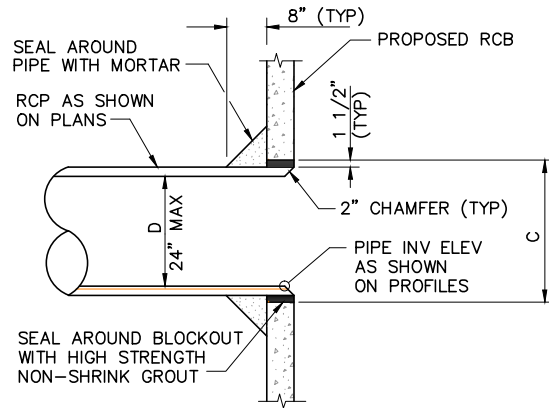


- NOTES:
1. WALL & SLAB REINFORCEMENT OF RCB AND RCP NOT SHOWN FOR CLARITY.
 2. OUTER RCP SURFACE TO BE ROUGHENED ALONG LENGTH OF COLLAR.

PLAN VIEW
NTS



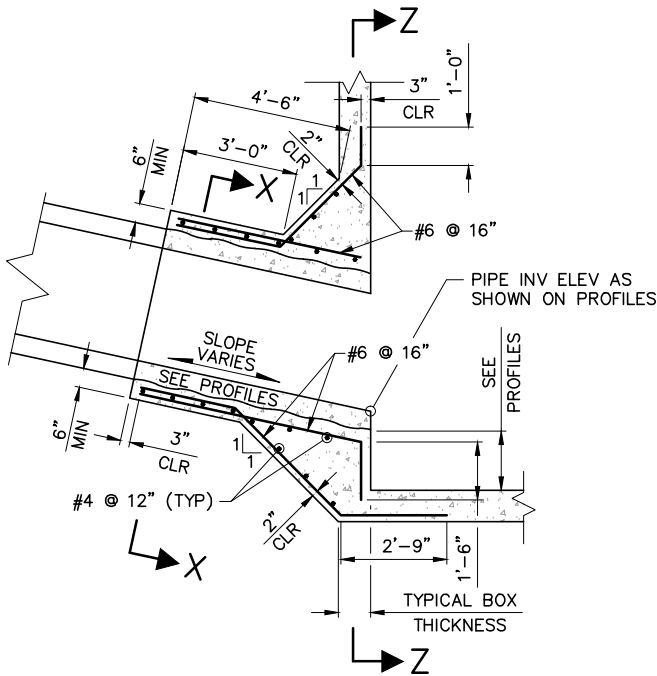
SECTION X-X
NTS



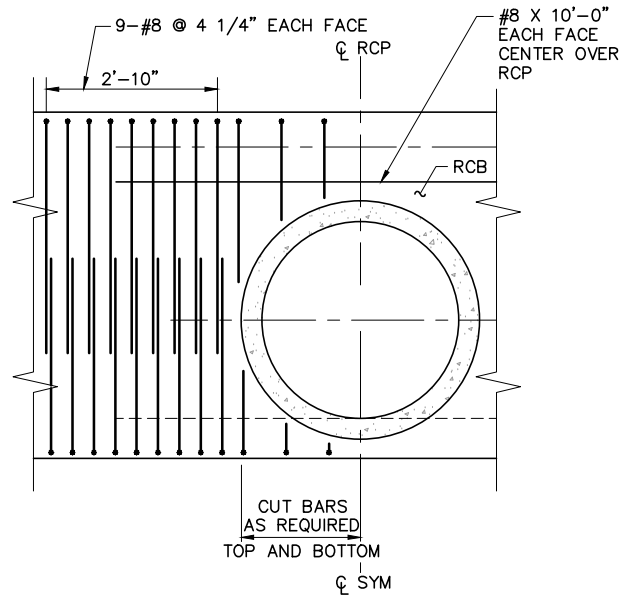
- NOTES:
1. DIMENSION C = PIPE O.D. + 3" FOR PERPENDICULAR PIPE CONNECTION. ADJUST BLOCKOUT DIMENSIONS TO ACCOUNT FOR PIPE SKEW.
 2. FORM PIPE BLOCKOUT AS PART OF WALL.
 3. SEE RCB PROFILE FOR CONNECTION LOCATIONS.
 4. ADD REINFORCEMENT BARS EQUIVALENT TO BARS CUT BY OPENING. VERTICAL BARS SHALL EXTEND FULL HEIGHT OF WALL. HORIZONTAL BARS SHALL EXTEND 24" PAST THE OPENING. SEE NOTE 5 FOR BAR SPACING.
 5. ADD ADDITIONAL VERTICAL WALL REINFORCEMENT AT 3" OC EACH SIDE OF RCP OPENING IN ADDITION TO TYPICAL VERTICAL REINFORCEMENT.

METHOD A, $D \leq 24"$

SECTION Y-Y
NTS



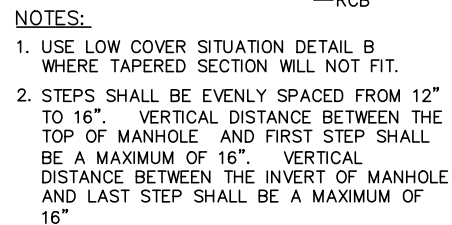
METHOD B, $D > 24"$



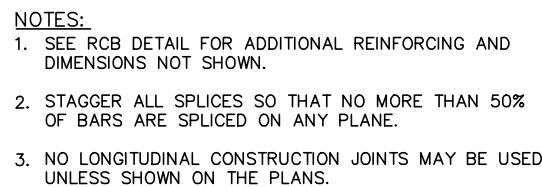
- NOTES:
1. RCP COLLAR NOT SHOWN
 2. HORIZONTAL BARS NOT SHOWN. CUT AS REQUIRED TO CLEAR RCP.

SECTION Z-Z
NTS

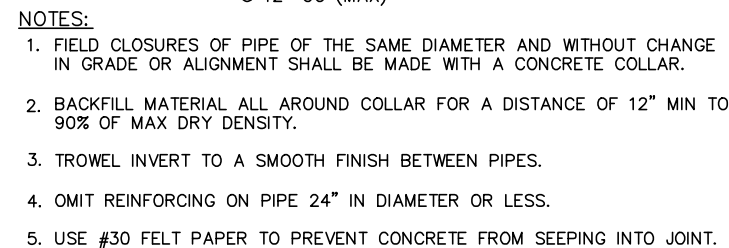




1 RCB MANHOLE
DT-4 NTS

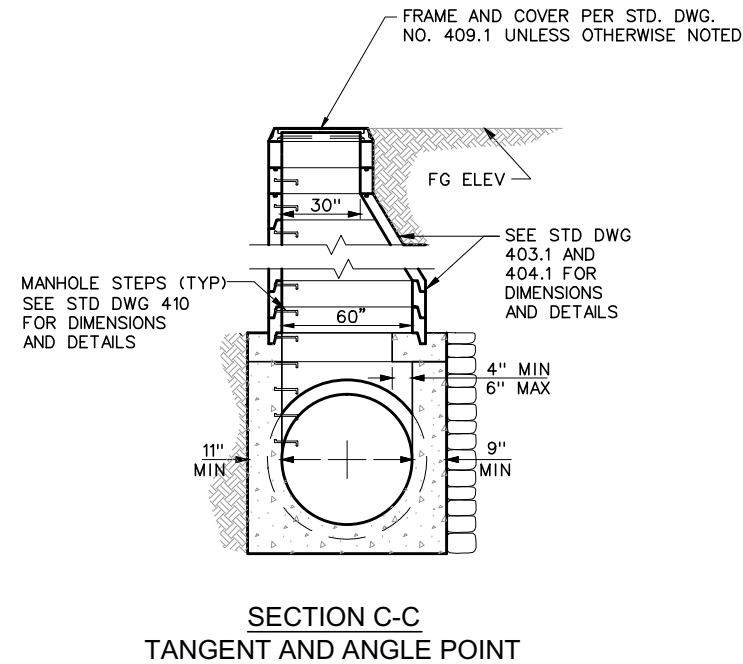
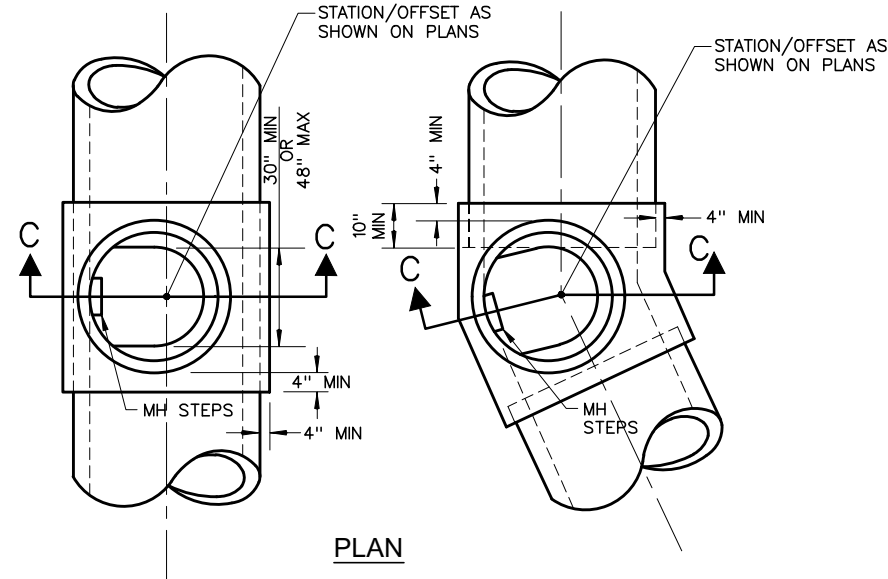


2
DT-4



D (IN)	L (FT)	T (IN)
< 24	1.0	6
24-60	1.75	12

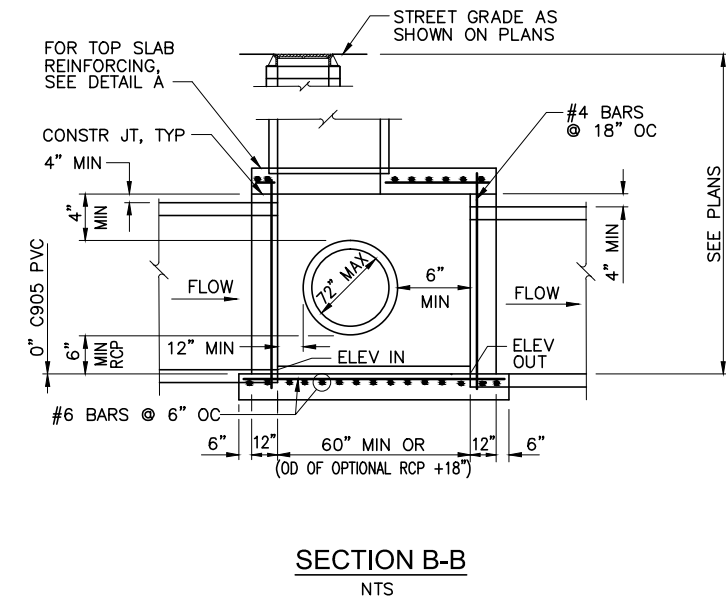
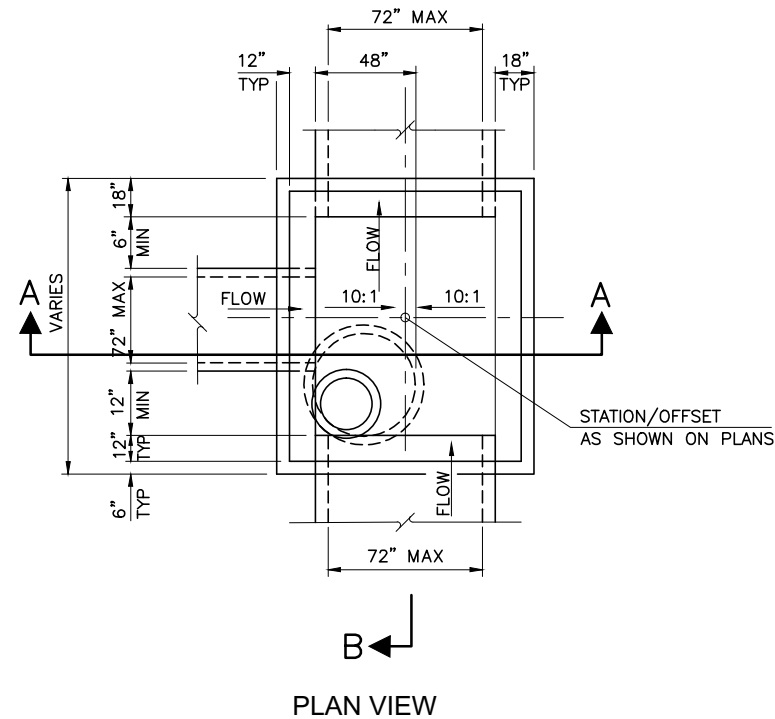
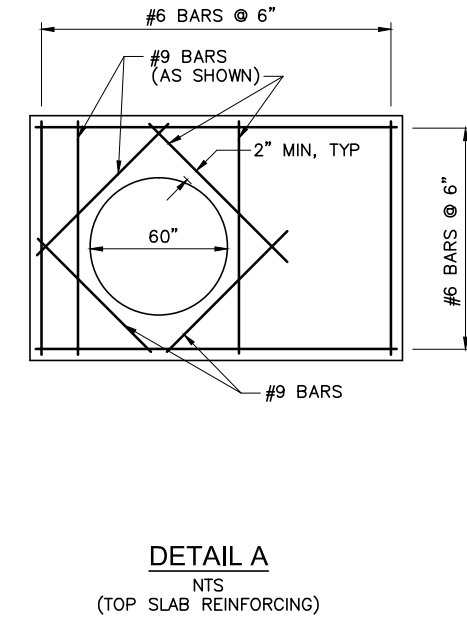
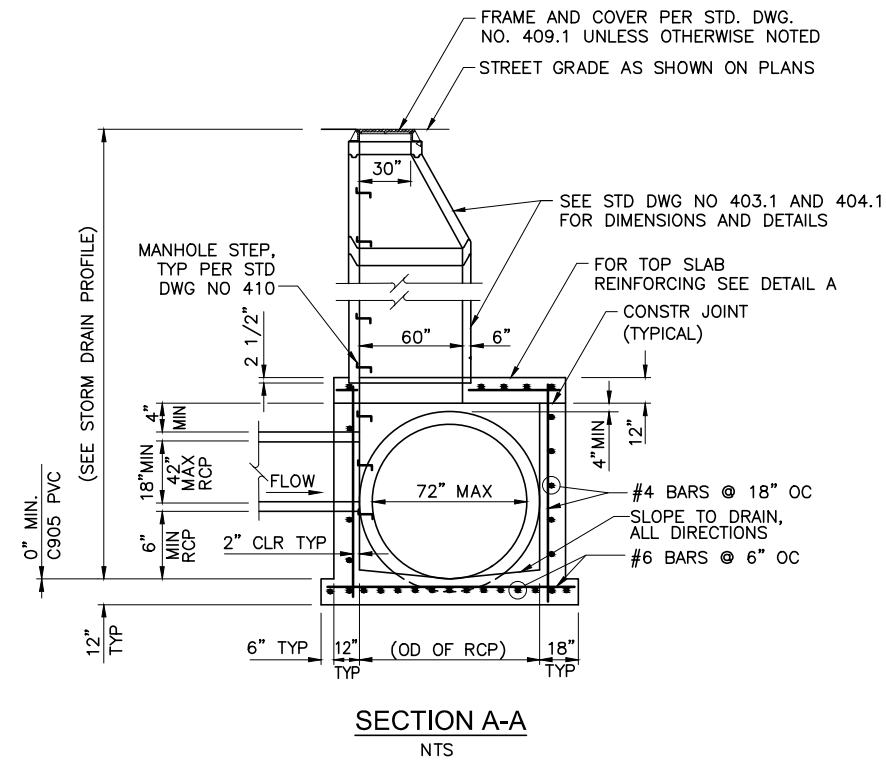
D (IN)	L (FT)	T (IN)
< 24	1.0	6
24-60	1.75	12



NOTES:

- 1 SEE STD DWG NO 406.1 FOR ADDITIONAL DETAILS NOT SHOWN.
- 2 MANHOLE STEPS SHALL BE SPACED FROM 12" TO 16". VERTICAL DISTANCE BETWEEN THE TOP OF MANHOLE AND FIRST STEP SHALL BE A MAXIMUM OF 16". VERTICAL DISTANCE BETWEEN THE RCP CENTERLINE AND LAST STEP SHALL BE A MAXIMUM OF 16".

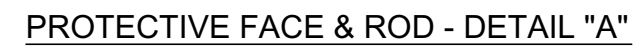
1 60" TYPE III MANHOLE
DT-5 NTS



NOTES:

1. SHAPE FLOW LINE IN MANHOLE TO OUTLET PIPE AND PROVIDE A MINIMUM 10H:1V SLOPE IN ALL DIRECTIONS TOWARDS FLOW LINE.
2. USE FLAT SLAB PER CCAUSD NO. 404.1 WHERE REQUIRED FOR LOW COVER SITUATIONS.

2 NDOT TYPE 4 MANHOLE
DT-5 NTS

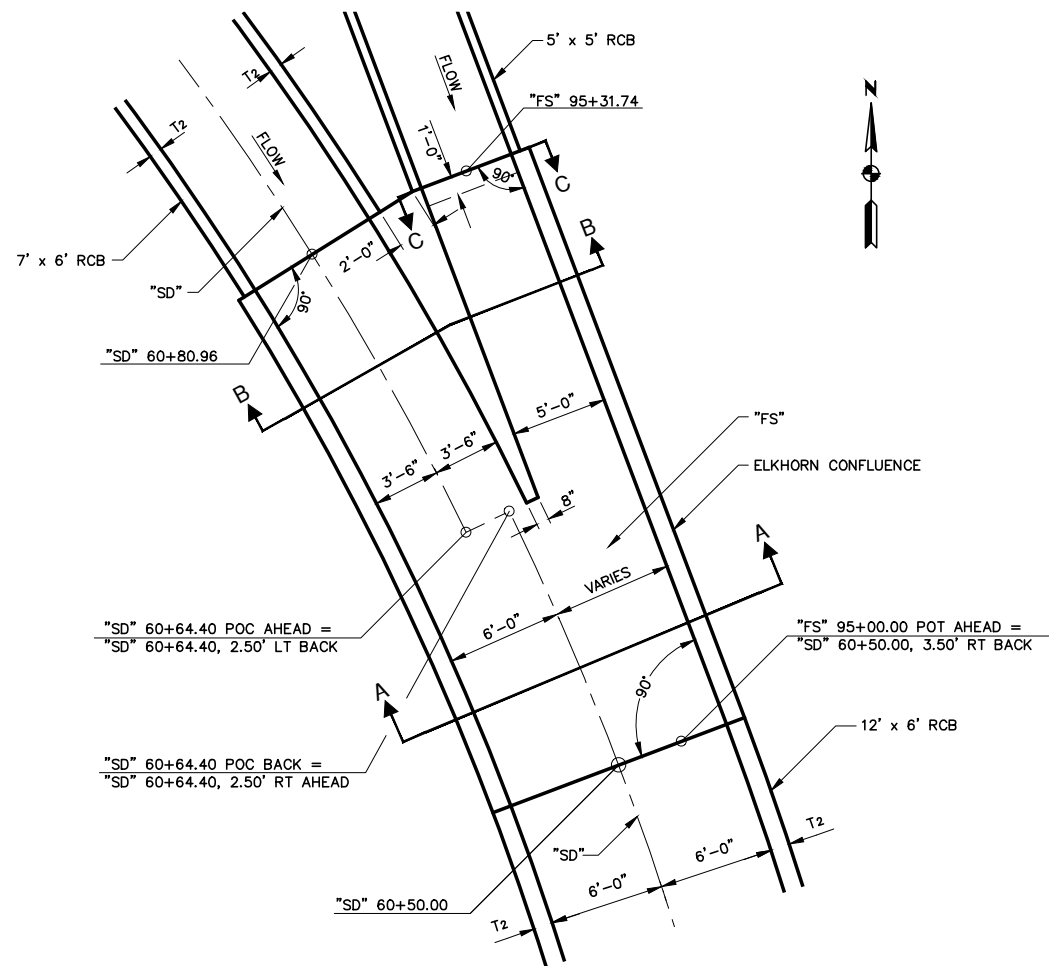


DETAIL "B"

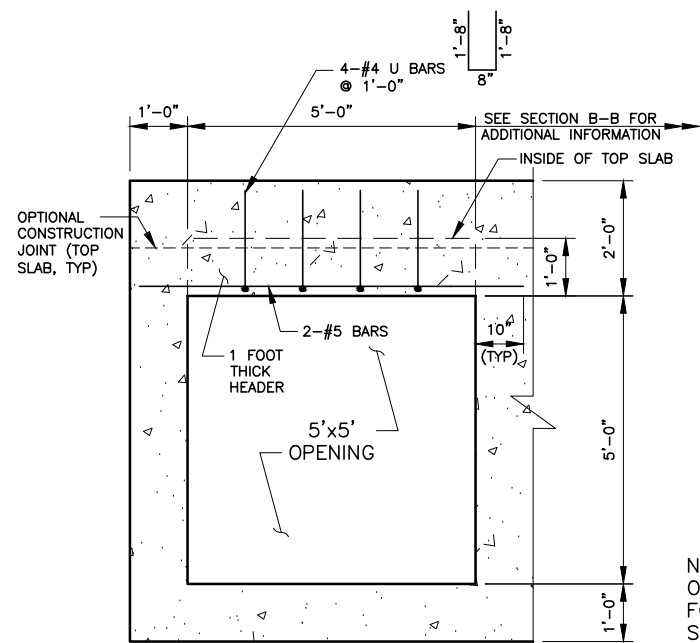


1 TYPE "DM" MODIFIED DROP INLET
DT-6 NTS

1

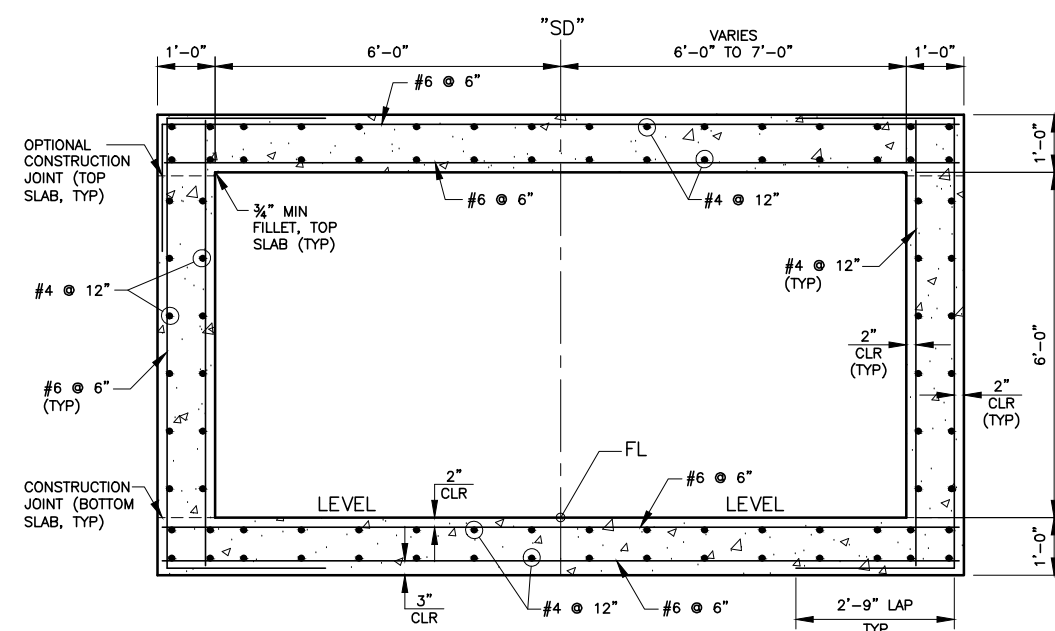


PLAN VIEW

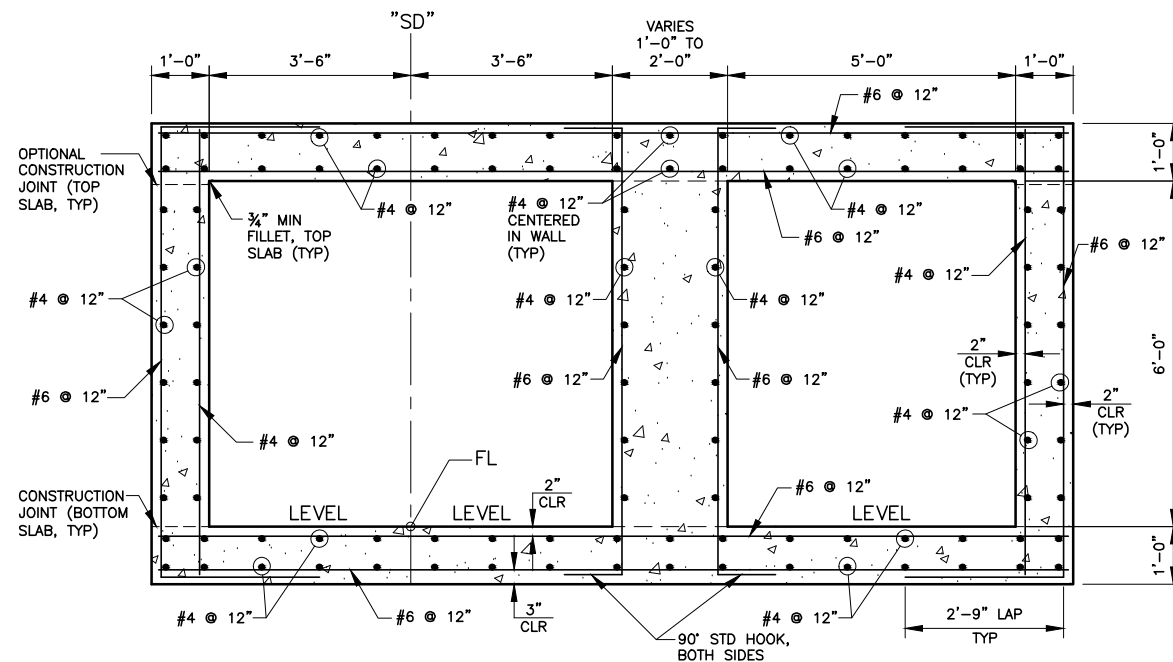


SECTION C-C

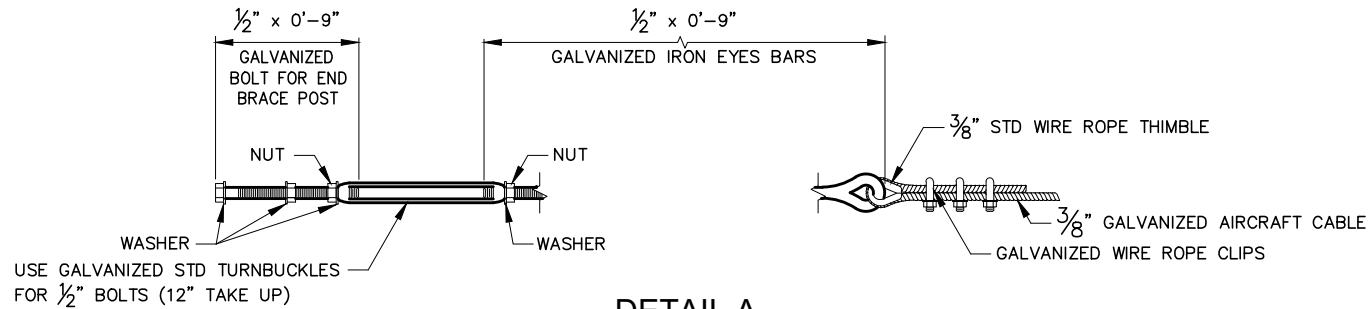
NOTE:
ONLY ADDITIONAL REINFORCING
FOR HEADER SHOWN, SEE
SECTION B-B FOR BALANCE OF
INFORMATION



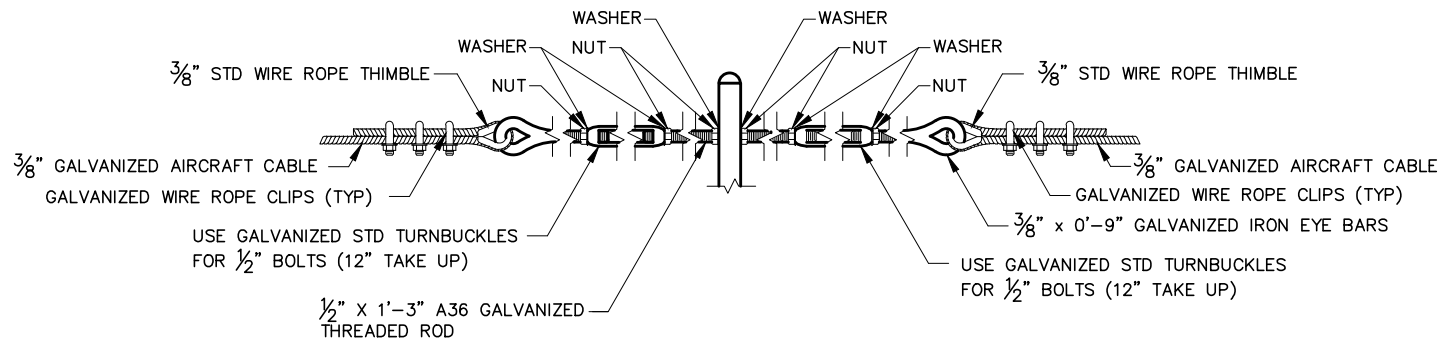
SECTION A-A



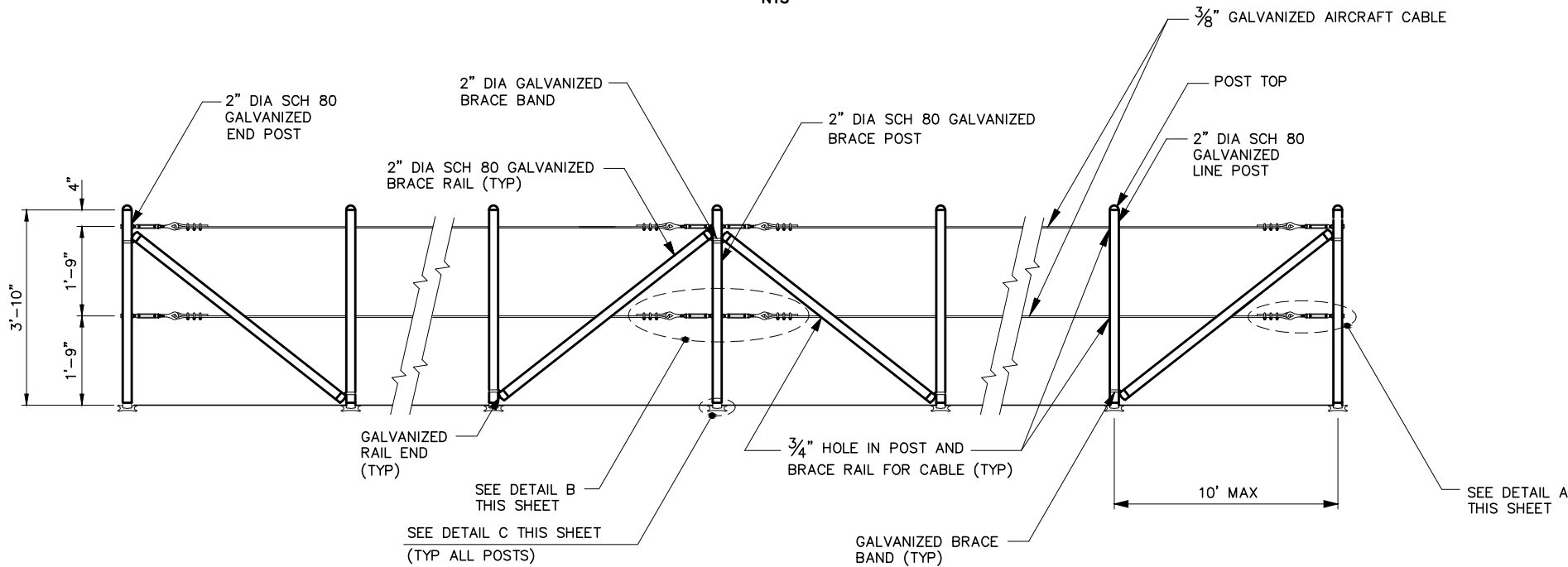
SECTION B-B



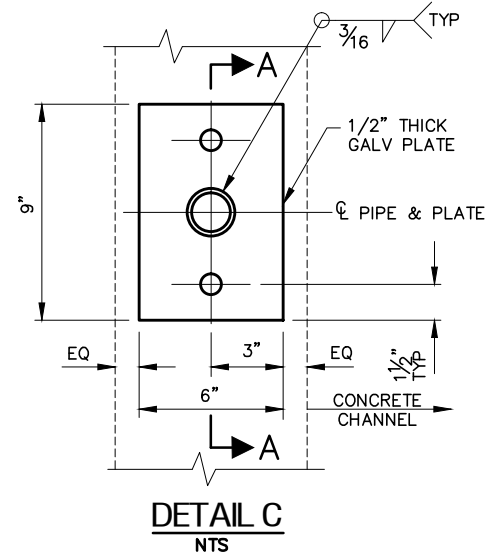
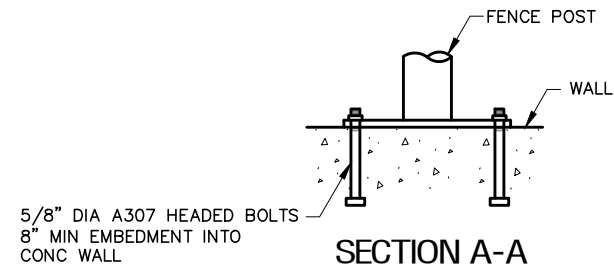
DETAIL A
NTS



DETAIL B
NTS



2 CABLE FENCE
NTS



NOTES:

1. BRACE POSTS SHALL BE PLACED A MAXIMUM OF 250' AND AT END POSTS.
2. GALVANIZE COMPONENTS AFTER FABRICATION.
3. POST/BRACE SHALL BE ASTM A53.
4. PLATES SHALL BE ASTM A572, GRADE 50.
5. WELDING E70 ELECTRODE.
6. GALVANIZED BRACE BANDS SIZED FOR 1500 LBS (WORKING LOAD).
7. BRACE RAILS SHALL NOT BE CONSTRUCTED ACROSS ANY CHANNEL EXPANSION JOINTS.
8. FENCE POST PLATES SHALL NOT BE LOCATED WITHIN 1 FOOT OF ANY CHANNEL WALL EXPANSION OR CONSTRUCTION JOINT.
9. SEE RECTANGULAR CONCRETE CHANNEL DETAIL FOR DIMENSIONS AND REINFORCEMENT NOT SHOWN.
10. 1/2" NUTS ON SIDES OF TURNBUCKLES TO BE TIGHTENED TO 30-FT LBS AFTER TENSION ON CABLE IS ESTABLISHED.
11. PIPE DIMENSIONS SHOWN ARE NOMINAL SIZES.

90% DESIGN SUBMITTAL 4 / 30 / 2013 - NOT FOR CONSTRUCTION

DEPARTMENT OF PUBLIC WORKS
RANCHO-FORT APACHE
STORM DRAIN
DRAINAGE DETAILS

90% DESIGN SUBMITTAL
4/30/2013
NOT FOR CONSTRUCTION
SHEET: DT-11
108 OF 109
CLV DRAWING NO: 327V150



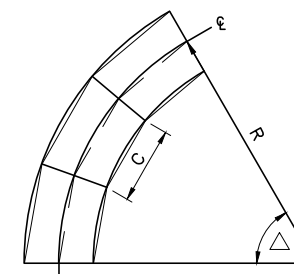
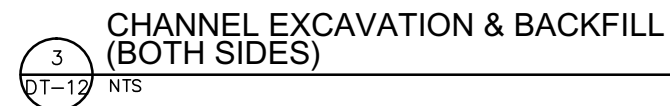
THE Louis Berger Group, INC.
500 E. Amigo Court, Suite 100
Las Vegas, Nevada 89119
Voice: 702-736-6632
Fax: 702-736-0704

SHEET TITLE:

H#36802

RANCHO - FORT APACHE STORM DRAIN

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CURVE STATION	R	MAXIMUM ALLOWABLE CHORD LENGTH "C"
"SD" 20+59.36 TO "SD" 22+16.36	100'	4'
"SD" 26+12.57 TO "SD" 26+82.16	100'	4'
"SD" 26+82.16 TO "SD" 27+51.75	100'	4'
"SD" 32+18.40 TO "SD" 32+51.90	100'	4'
"SD" 32+51.90 TO "SD" 32+86.32	100'	4'
"SD" 34+55.49 TO "SD" 34+99.28	300'	6'
"SD" 34+99.28 TO "SD" 35+44.93	300'	6'
"SD" 59+94.18 TO "SD" 60+64.40	157'	4'
"SD" 60+64.40 TO "SD" 62+34.99	154.5'	4'
"FS" 95+75.52 TO "FS" 96+06.77	90'	4'
"DS" 70+41.33 TO "DS" 70+72.59	30'	2'



APPENDIX D

RECORD OF SURVEY PLANS

RECORD OF SURVEY MAP FOR
FORT APACHE ROAD – ELKHORN ROAD TO LAS VEGAS BELTWAY 215

STATE PLANE COORDINATE TABLE

ID NUMBER	LATITUDE	LONGITUDE	ELLIPSOID HEIGHT	NORTHING (GRID) (U.S. SURVEY FEET)	EASTING (GRID) (U.S. SURVEY FEET)	ELEVATION	COMBINED FACTOR	CONVER- GENCE	DESCRIPTION	NORTHING (GROUND) (U.S. SURVEY FEET)	EASTING (GROUND) (U.S. SURVEY FEET)
9901	36°20'11.31039"N	115°18'53.51456"W	2669.852 SFT	26824212.07 SFT	735236.24 SFT	2759 SFT	0.999779744	0°09'33"	GIS801	829694.25	35386.50
9902	36°20'09.68218"N	115°15'38.97562"W	2337.207 SFT	26824096.06 SFT	751152.34 SFT	2427 SFT	0.999798787	0°11'28"	GIS802	829578.22	51305.86
9903	36°14'49.45181"N	115°12'27.68652"W	2027.221 SFT	26791771.77 SFT	766927.80 SFT	2119 SFT	0.999817292	0°13'20"	GIS909	797247.33	67084.54
9904	36°16'38.21571"N	115°17'32.50325"W	2488.789 SFT	26802683.71 SFT	741928.70 SFT	2579 SFT	0.999789646	0°10'20"	2" BRASS CAP	808161.50	42080.33
9905	36°16'38.14161"N	115°17'48.73576"W	2527.875 SFT	26802672.25 SFT	740599.71 SFT	2618 SFT	0.999787522	0°10'10"	NOT FOUND	808150.04	40751.07
9906	36°16'51.27334"N	115°17'48.77921"W	2540.910 SFT	26804000.08 SFT	740592.22 SFT	2631 SFT	0.999786899	0°10'10"	NOT FOUND	809478.14	40743.58
9907	36°16'51.29935"N	115°17'32.50884"W	2504.825 SFT	26804006.68 SFT	741924.27 SFT	2595 SFT	0.99978888	0°10'20"	2" BRASS CAP	809484.74	42075.90
9908	36°16'51.39291"N	115°18'04.98604"W	2577.998 SFT	26804008.27 SFT	739265.34 SFT	2668 SFT	0.999784875	0°10'01"	2" ALUMINUM CAP	809486.34	39416.43
9909	36°16'57.97338"N	115°18'04.99423"W	2587.016 SFT	26804673.67 SFT	739262.73 SFT	2677 SFT	0.999784444	0°10'01"	1 1/2" ALUMINUM CAP	810151.87	39413.82
9910	36°16'57.83636"N	115°17'48.80194"W	2547.929 SFT	26804663.70 SFT	740588.40 SFT	2638 SFT	0.999786563	0°10'10"	MAG NAIL	810141.90	40739.76
9911	36°16'57.83931"N	115°17'40.65724"W	2529.886 SFT	26804665.98 SFT	741255.19 SFT	2620 SFT	0.999787553	0°10'15"	60D NAIL	810144.18	41406.68
9912	36°17'04.39216"N	115°17'40.67016"W	2539.905 SFT	26805328.58 SFT	741252.15 SFT	2630 SFT	0.999787075	0°10'15"	1 1/2" ALUMINUM CAP	810806.91	41403.65
9913	36°17'04.39937"N	115°17'48.82467"W	2558.947 SFT	26805327.33 SFT	740584.57 SFT	2649 SFT	0.999786036	0°10'10"	2" BRASS CAP	810805.66	40735.93
9914	36°17'04.55398"N	115°18'05.00242"W	2588.034 SFT	26805339.07 SFT	739260.12 SFT	2678 SFT	0.999784395	0°10'01"	1 1/2" ALUMINUM CAP	810817.41	39411.21
9915	36°17'04.70223"N	115°18'21.19048"W	2635.123 SFT	26805350.24 SFT	737934.83 SFT	2725 SFT	0.999781898	0°09'51"	2" BRASS CAP	810828.57	38085.64
9916	36°17'17.91006"N	115°18'21.16326"W	2656.159 SFT	26806685.77 SFT	737933.23 SFT	2746 SFT	0.999780894	0°09'51"	2" BRASS CAP	812164.38	38084.05
9917	36°17'17.71353"N	115°18'05.01938"W	2613.071 SFT	26806669.72 SFT	739254.86 SFT	2703 SFT	0.999783199	0°10'01"	1 1/2" ALUMINUM CAP	812148.33	39405.94
9918	36°17'17.51625"N	115°17'48.86208"W	2570.986 SFT	26806653.65 SFT	740577.59 SFT	2661 SFT	0.999785461	0°10'10"	1 1/2" ALUMINUM CAP	812132.26	40728.94
9919	36°17'17.48864"N	115°17'41.34196"W	2550.947 SFT	26806652.69 SFT	741193.21 SFT	2641 SFT	0.999786536	0°10'15"	1 1/2" ALUMINUM CAP	812131.29	41344.69
9920	36°17'30.55138"N	115°17'36.62671"W	2553.964 SFT	26807974.71 SFT	741575.25 SFT	2644 SFT	0.999786467	0°10'18"	1 1/2" ALUMINUM CAP	813453.58	41726.81
9921	36°17'30.63290"N	115°17'48.90225"W	2584.026 SFT	26807979.96 SFT	740570.37 SFT	2674 SFT	0.999784837	0°10'10"	3" BRASS CAP	813458.83	40721.73
9922	36°17'39.50554"N	115°17'48.86012"W	2591.054 SFT	26808877.14 SFT	740571.17 SFT	2681 SFT	0.999784502	0°10'10"	2" ALUMINUM CAP	814356.20	40722.52
9923	36°17'30.85429"N	115°18'05.03631"W	2624.110 SFT	26807998.47 SFT	739249.60 SFT	2714 SFT	0.999782671	0°10'01"	2" ALUMINUM CAP	813477.35	39400.69
9924	36°17'31.08282"N	115°18'21.14938"W	2669.196 SFT	26808017.77 SFT	737930.55 SFT	2759 SFT	0.999780271	0°09'51"	2" BRASS CAP	813496.65	38081.36

COORDINATE CONVERSION

TO CONVERT NEVADA STATE PLANE EAST ZONE (2701) COORDINATES TO EQUIVALENT PROJECT GROUND COORDINATES

MULTIPLY THE NORTHING IN METERS BY 3937/1200, THEN
MULTIPLY NORTHING BY 1.000204375, THEN SUBTRACT 26,000,000

MULTIPLY THE EASTING IN METERS BY 3937/1200, THEN
MULTIPLY EASTING BY 1.000204375, THEN SUBTRACT 700,000

TO CONVERT PROJECT GROUND COORDINATES TO NEVADA STATE PLANE EAST ZONE (2701) COORDINATES

ADD 26,000,000 TO NORTHING, THEN MULTIPLY BY 0.999795667, THEN DIVIDE BY 3937/1200 TO OBTAIN GRID COORDINATES IN METERS

ADD 700,000 TO EASTING, THEN MULTIPLY BY 0.999795667, THEN DIVIDE BY 3937/1200 TO OBTAIN GRID COORDINATES IN METERS

NOTE: "ELEVATION" LISTED ON THE STATE PLANE COORDINATE TABLE ARE FOR CALCULATION PURPOSES ONLY.

REFERENCE MAPS

SUBDIVISION PLATS	BOOK	PAGE
115	65	
112	44	
115	88	
120	07	
122	23	
123	38	
125	80	
126	27	
128	01	
132	69	
136	48	
137	19	

RECORD OF SURVEYS	FILE	PAGE
88	53	

LEGEND

SECTION LINE	— — — — —
CENTER SECTION LINE	— — — — —
ONE-SIXTEENTH SECTION LINE	— — — — —
SECTION ALIQUOT	— — — — —
CENTERLINE / CONTROL LINE	— — — — —

COUNTY RECORDER'S NOTE

ANY SUBSEQUENT CHANGES TO THIS MAP SHOULD BE EXAMINED AND MAY BE DETERMINED BY REFERENCE TO THE COUNTY RECORDER'S CUMULATIVE MAP INDEX. N.R.S. 278.5695

PROJECT NO.: 11 019 01.LM
PREPARED BY: JJJ
REVIEWED BY: WTA

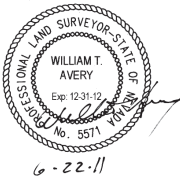
BASIS OF BEARINGS

N 89° 11' 50" W BEING THE SOUTHERLY LINE OF THE SOUTHEAST ONE-QUARTER (SE ¼) OF THE SOUTHEAST ONE-QUARTER (SE ¼) OF SECTION 18, TOWNSHIP 19 SOUTH, RANGE 60 EAST, MOUNT DIABLO MERIDIAN, CITY OF LAS VEGAS, CLARK COUNTY, NEVADA PER A SUBDIVISION PLAT ON FILE WITH THE CLARK COUNTY, NEVADA, RECORDER IN BOOK 123, PAGE 38 OF PLATS.

SURVEYOR'S CERTIFICATE

I, WILLIAM T. AVERY, A PROFESSIONAL LAND SURVEYOR LICENSED IN THE STATE OF NEVADA, AS AGENT FOR TRI STATE SURVEYING, LTD., DO HEREBY CERTIFY THAT:

- THIS PLAT REPRESENTS THE RESULTS OF A SURVEY CONDUCTED UNDER MY DIRECT SUPERVISION AT THE INSTANCE OF **LOUIS BERGER GROUP**.
- THE LANDS SURVEYED LIE WITHIN SITUATE IN THE SOUTHWEST ONE-QUARTER (SW1/4) OF THE SOUTHWEST ONE-QUARTER (SW1/4) OF SECTION 17, AND THE SOUTH ONE-HALF (S1/2) OF THE SOUTHEAST ONE-QUARTER (SE1/4) OF SECTION 18, AND THE, NORTHEAST ONE-QUARTER (NE1/4) AND THE SOUTHEAST ONE-QUARTER (SE1/4) OF SECTION 19, AND THE WEST ONE-HALF (W1/2) OF THE WEST ONE-HALF (W1/2) OF SECTION 20, TOWNSHIP 19 SOUTH, RANGE 60 EAST, MOUNT DIABLO MERIDIAN, CITY OF LAS VEGAS, CLARK COUNTY, NEVADA
- THIS SURVEY WAS COMPLETED ON APRIL 4, 2011.
- THIS PLAT COMPLIES WITH THE APPLICABLE STATE STATUTES AND ANY LOCAL ORDINANCE IN EFFECT ON THE DATE THAT THE SURVEY WAS COMPLETED, AND THE SURVEY WAS CONDUCTED IN ACCORDANCE WITH CHAPTER 625 OF THE NEVADA ADMINISTRATIVE CODE.
- THE MONUMENTS DEPICTED ON THE PLAT ARE OF THE CHARACTER SHOWN, OCCUPY THE POSITIONS INDICATED, AND ARE OF SUFFICIENT NUMBER AND DURABILITY.



WILLIAM T. AVERY
PROFESSIONAL LAND SURVEYOR
NEVADA CERTIFICATE NO. 5571

BENCHMARK NOTE

THE ELEVATION DATA SHOWN HEREON ARE U.S. SURVEY FEET REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988, CITY OF LAS VEGAS 2008 ADJUSTMENT BENCHMARK NO. SLV9019NEE6, BEING A RIVET AND PLATE IN TOP OF CURB @ NORTHWEST CORNER OF DORRELL AND FORT APACHE.

ELEVATION 811.556 METERS
ELEVATION 2662.58 U.S. SURVEY FEET

RECORD OF SURVEY
FOR
LOUIS BERGER GROUP

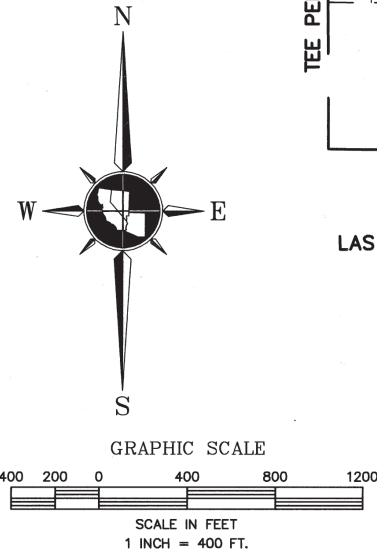
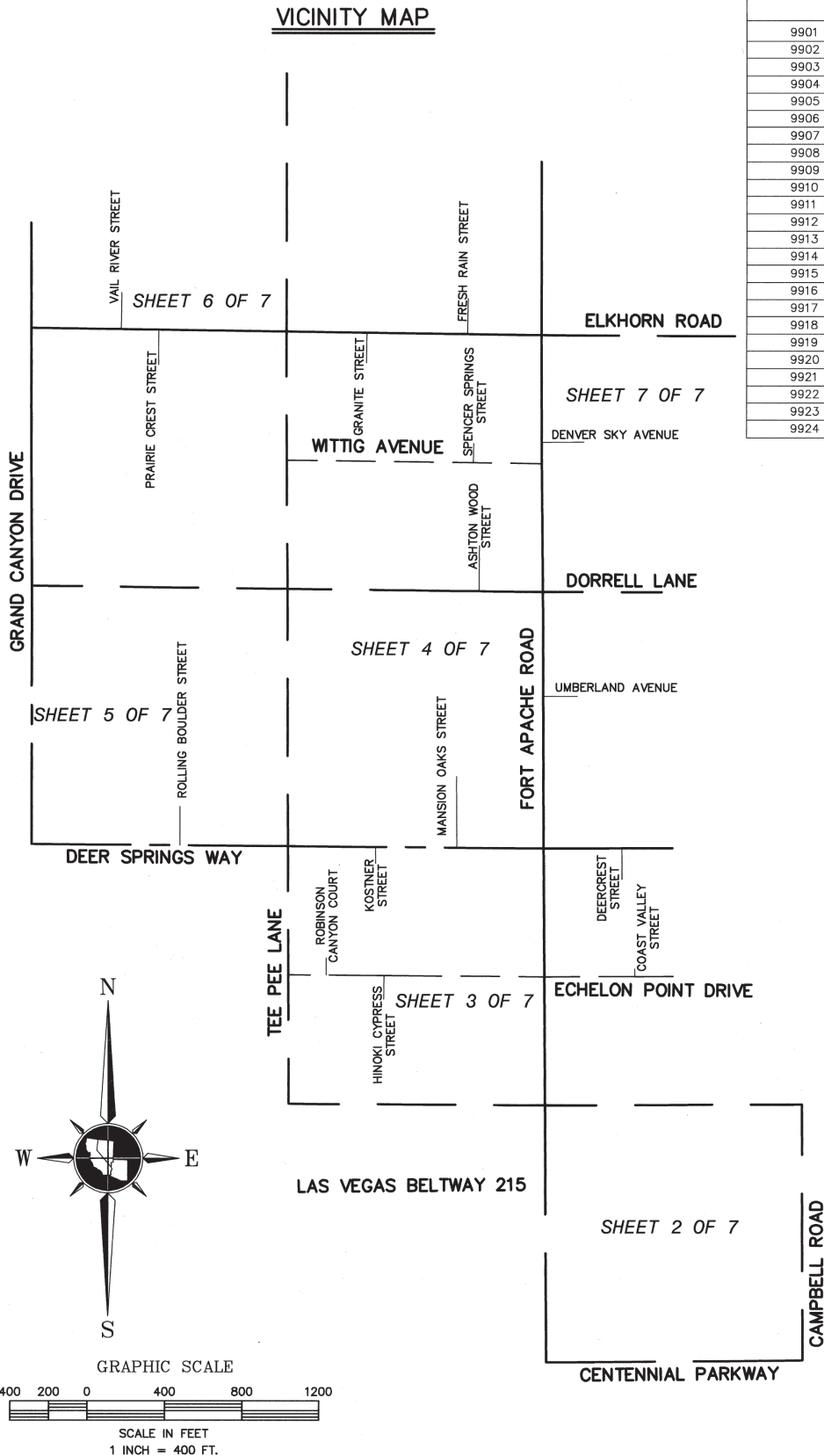
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LAS VEGAS, NEVADA 89118
PHONE: (702) 222-0986

SHEET 1
OF 7

NO. 00258
FILED AT THE REQUEST OF
TRI STATE SURVEYING, LTD.
DATE 6-27-10 AT 8:45 AM.
FILE 184 PAGE 36
OF SURVEYS
OFFICIAL RECORDS BOOK NO. 20110627
CLARK COUNTY, NEVADA RECORDS.
DEBBIE CONWAY, RECORDER
FEE \$ 81 DEPUTY GLEN



MATCH TO SHEET 3

MATCH TO SHEET 3

LAS VEGAS BELTWAY 215

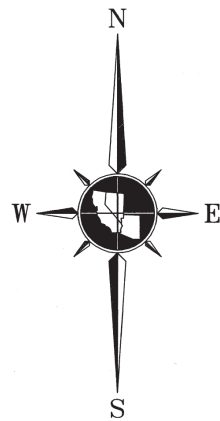
FOUND 2-INCH
ALUMINUM CAP

FOUND 2-INCH
BRASS CAP

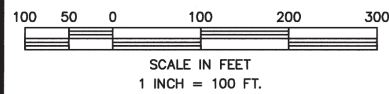
FOUND 2-INCH
BRASS CAP
JEFFERSON
T19S R60E
SW 1/16 S20
2006
PLS 8421

CENTENNIAL PARKWAY

CAMPBELL ROAD



GRAPHIC SCALE



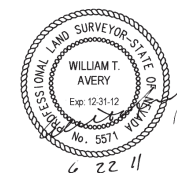
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- CENTER SECTION LINE
- ONE-SIXTEENTH SECTION LINE
- SECTION ALIQUOT
- CENTERLINE / CONTROL LINE
- FOUND MONUMENT AS DESCRIBED

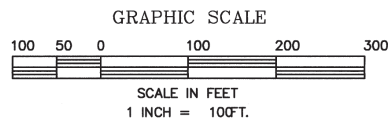
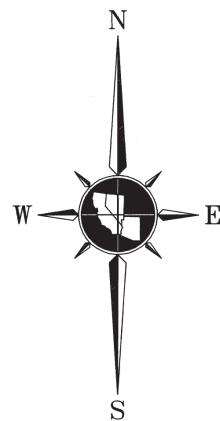
PROJECT NO.: 11 019 01.LM
PREPARED BY: JJJ
REVIEWED BY: WTA



TRI STATE SURVEYING, LTD.
3471 WEST OQUENDO ROAD, SUITE 101
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PHONE: (702) 222-0986



184/36



LEGEND

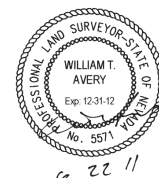
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- FOUND MONUMENT AS DESCRIBED

MATCH TO SHEET 4

MATCH TO SHEET 5

MATCH TO SHEET 2

MATCH TO SHEET 2

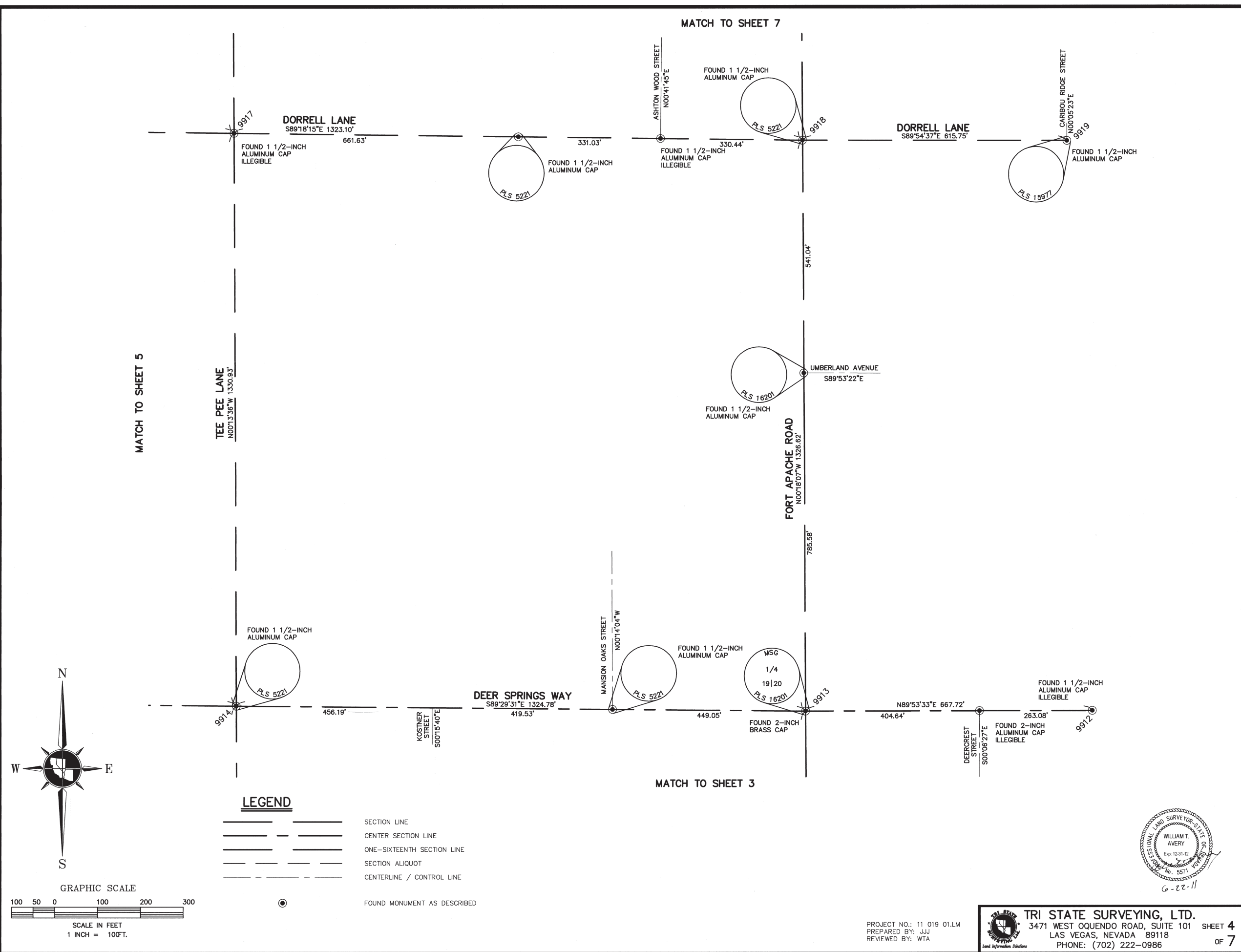


PROJECT NO.: 11 019 01.LM
PREPARED BY: JJJ
REVIEWED BY: WTA

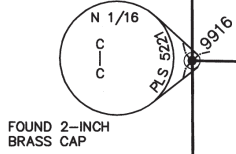


TRI STATE SURVEYING, LTD.
3471 WEST OQUENDO ROAD, SUITE 101 SHEET 3
LAS VEGAS, NEVADA 89118
PHONE: (702) 222-0986 OF 7

184/36

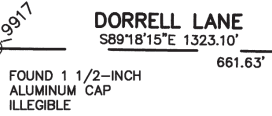


MATCH TO SHEET 6



GRAND CANYON DRIVE
N00°04'07"W 1335.81'

S89°18'15"E 1322.00'

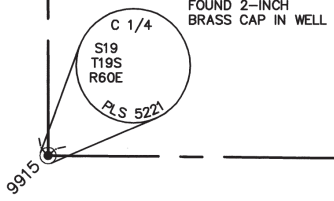


DORRELL LANE
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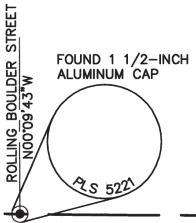
661.63'

TEE PEE LANE
N00°13'38"W 1330.93'

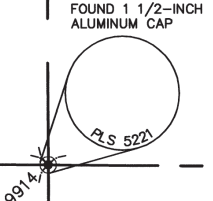
MATCH TO SHEET 4



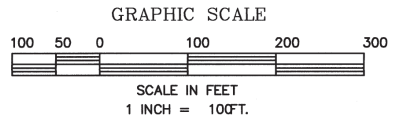
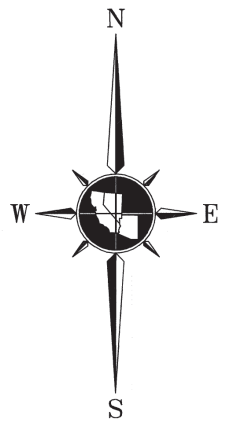
DEER SPRINGS WAY
S89°31'03"E 1325.61'



ROLLING BOULDER STREET
N00°09'43"W

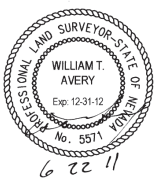


KOSTNER STREET
S00°15'40"E



LEGEND

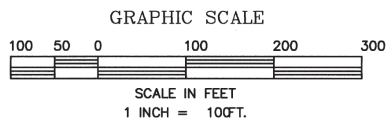
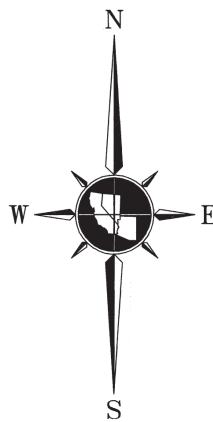
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- — — — — ONE-SIXTEENTH SECTION LINE
- — — — — SECTION ALIQUOT
- — — — — CENTERLINE / CONTROL LINE
- FOUND MONUMENT AS DESCRIBED



PROJECT NO.: 11 019 01.LM
PREPARED BY: JJJ
REVIEWED BY: WTA

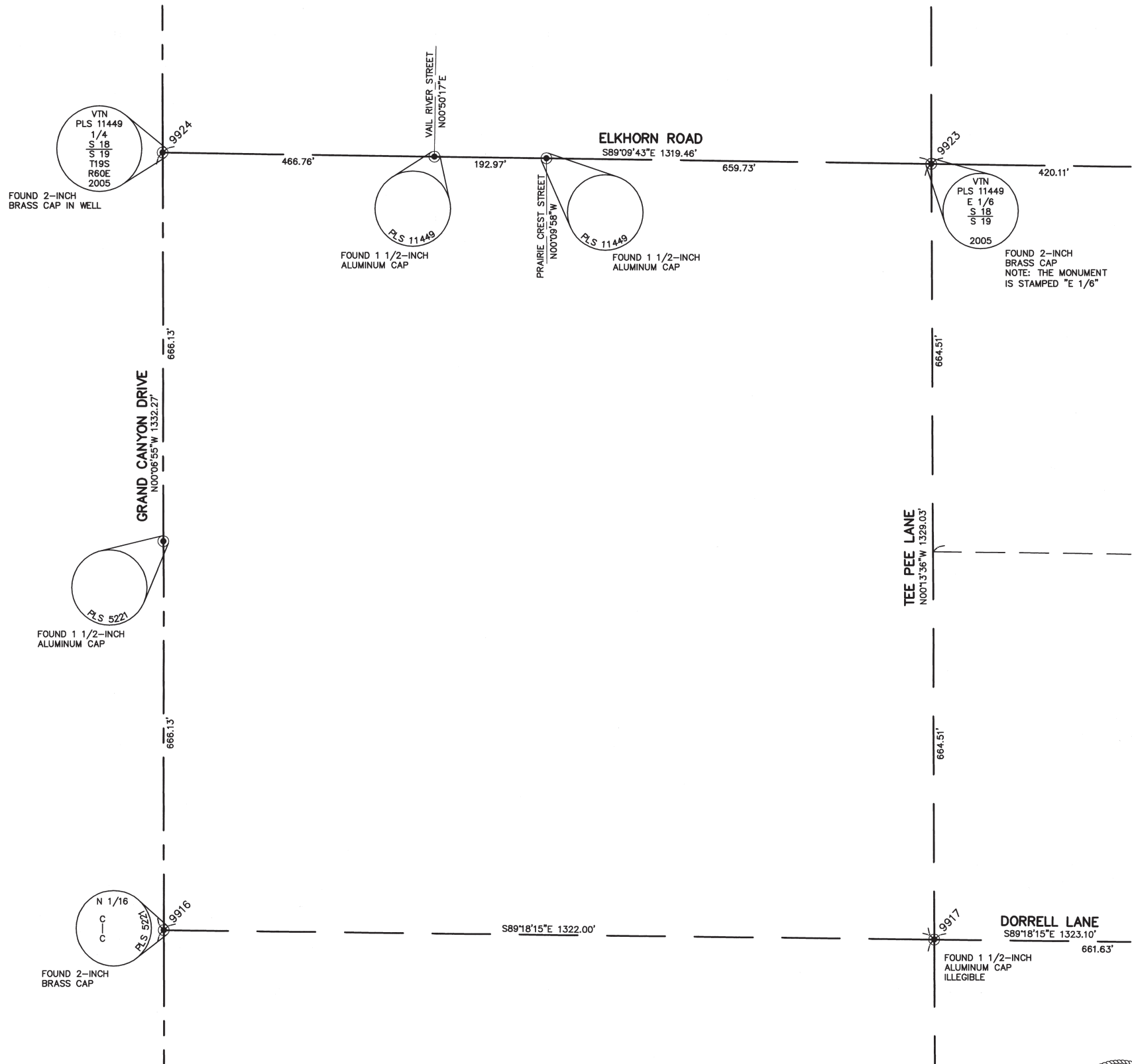
TRI STATE SURVEYING, LTD.
3471 WEST OQUENDO ROAD, SUITE 101 SHEET 5
LAS VEGAS, NEVADA 89118
PHONE: (702) 222-0986 OF 7

184/36



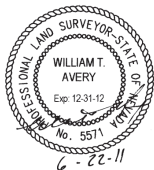
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- SECTION LINE
- CENTER SECTION LINE
- ONE-SIXTEENTH SECTION LINE
- SECTION ALIQUOT
- CENTERLINE / CONTROL LINE
- FOUND MONUMENT AS DESCRIBED



MATCH TO SHEET 5

MATCH TO SHEET 7



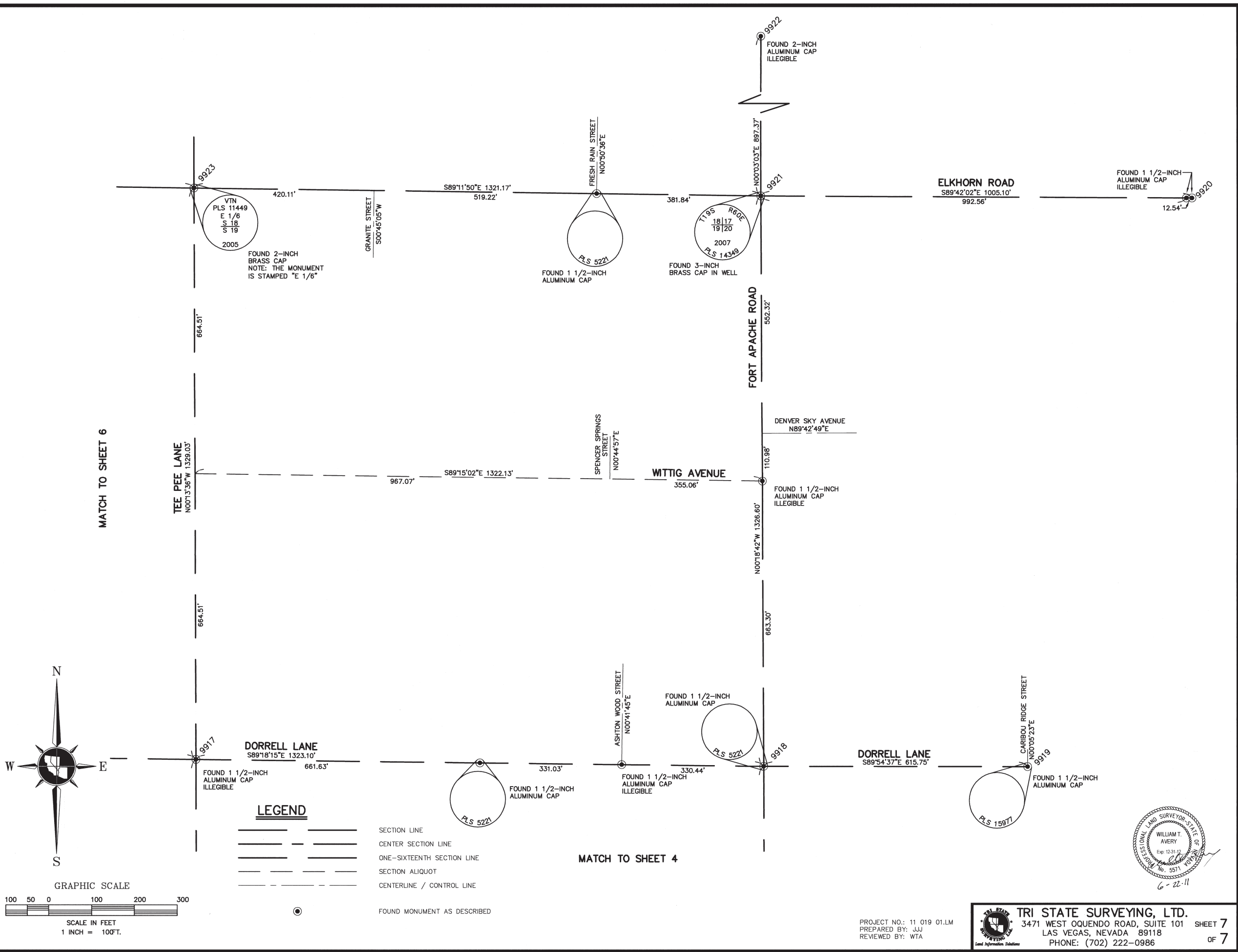
PROJECT NO.: 11 019 01.LM
PREPARED BY: JJJ
REVIEWED BY: WTA



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SHEET 6
OF 7

184/36



RECORD OF SURVEY MAP FOR
FORT APACHE ROAD – ELKHORN ROAD TO FARM ROAD

COORDINATE CONVERSION

TO CONVERT NEVADA STATE PLANE EAST ZONE (2701) COORDINATES TO EQUIVALENT PROJECT GROUND COORDINATES

MULTIPLY THE NORTHING IN METERS BY 3937/1200, THEN
MULTIPLY NORTHING BY 1.000204375, THEN SUBTRACT 26,000,000

MULTIPLY THE EASTING IN METERS BY 3937/1200, THEN
MULTIPLY EASTING BY 1.000204375, THEN SUBTRACT 700,000

TO CONVERT PROJECT GROUND COORDINATES TO NEVADA STATE PLANE EAST ZONE (2701) COORDINATES

ADD 26,000,000 TO NORTHING, THEN MULTIPLY BY 0.999795667, THEN DIVIDE BY 3937/1200 TO OBTAIN GRID COORDINATES IN METERS

ADD 700,000 TO EASTING, THEN MULTIPLY BY 0.999795667, THEN DIVIDE BY 3937/1200 TO OBTAIN GRID COORDINATES IN METERS

NOTE: "ELEVATION" LISTED ON THE STATE PLANE COORDINATE TABLE ARE FOR CALCULATION PURPOSES ONLY.

STATE PLANE COORDINATE TABLE

ID NUMBER	LATITUDE	LONGITUDE	ELLIPSOID HEIGHT	NORTHING (GRID) (U.S. SURVEY FEET)	EASTING (GRID) (U.S. SURVEY FEET)	ELEVATION	COMBINED FACTOR	CONVER- GENCE	DESCRIPTION	NORTHING (GROUND)	EASTING (GROUND)
										(U.S. SURVEY FEET)	(U.S. SURVEY FEET)
6730	36°17'44.07388"N	115°18'04.98503"W	2632.605 SFT	26809335.20 SFT	739249.91 SFT	2722 SFT	0.99978227	0°10'01"	2" BRASS CAP	814814.35	39400.99
6742	36°17'43.85384"N	115°17'48.83948"W	2593.835 SFT	26809316.83 SFT	740571.56 SFT	2683 SFT	0.99978437	0°10'10"	1 3/4" ALUMINUM CAP	814795.98	40722.91
6743	36°17'43.81466"N	115°17'40.64453"W	2574.393 SFT	26809314.87 SFT	741242.36 SFT	2664 SFT	0.99978543	0°10'15"	1 1/2" ALUMINUM CAP	814794.01	41393.85
6750	36°17'57.29835"N	115°18'04.94070"W	2637.030 SFT	26810672.43 SFT	739249.64 SFT	2726 SFT	0.99978205	0°10'01"	3 1/4" BRASS CAP	816151.86	39400.72
6753	36°17'57.07416"N	115°17'48.77285"W	2602.277 SFT	26810653.65 SFT	740573.05 SFT	2692 SFT	0.99978397	0°10'10"	1 1/2" ALUMINUM CAP	816133.07	40724.41
6754	36°17'57.03689"N	115°17'38.20739"W	2574.589 SFT	26810652.45 SFT	741437.86 SFT	2664 SFT	0.99978546	0°10'17"	1 1/2" ALUMINUM CAP	816131.87	41589.39
9921	36°17'30.63290"N	115°17'48.90225"W	2584.026 SFT	26807979.96 SFT	740570.37 SFT	2674 SFT	0.999784837	0°10'10"	3" BRASS CAP	813458.83	40721.73
9923	36°17'30.85429"N	115°18'05.03631"W	2624.110 SFT	26807998.47 SFT	739249.60 SFT	2714 SFT	0.999782671	0°10'01"	2" ALUMINUM CAP	813477.35	39400.69

BASIS OF BEARINGS

N 89° 11' 50" W BEING THE SOUTHERLY LINE OF THE SOUTHEAST ONE-QUARTER (SE ¼) OF THE SOUTHEAST ONE-QUARTER (SE ¼) OF SECTION 18, TOWNSHIP 19 SOUTH, RANGE 60 EAST, MOUNT DIABLO MERIDIAN, CITY OF LAS VEGAS, CLARK COUNTY, NEVADA PER A SUBDIVISION PLAT ON FILE WITH THE CLARK COUNTY, NEVADA, RECORDER IN BOOK 123, PAGE 38 OF PLATS.

SURVEYOR'S CERTIFICATE

I, WILLIAM T. AVERY, A PROFESSIONAL LAND SURVEYOR LICENSED IN THE STATE OF NEVADA, AS AGENT FOR TRI STATE SURVEYING, LTD., DO HEREBY CERTIFY THAT:

- THIS PLAT REPRESENTS THE RESULTS OF A SURVEY CONDUCTED UNDER MY DIRECT SUPERVISION AT THE INSTANCE OF LOUIS BERGER GROUP.
- THE LANDS SURVEYED LIE WITHIN SITUATE IN THE EAST ONE-HALF (E 1/2) OF THE SOUTHEAST ONE-QUARTER (SE 1/4) OF SECTION 18 AND THE WEST ONE-HALF (W 1/2) OF THE SOUTHWEST ONE-QUARTER (SW 1/4) OF SECTION 17, TOWNSHIP 19 SOUTH, RANGE 60 EAST, MOUNT DIABLO MERIDIAN, CITY OF LAS VEGAS, CLARK COUNTY, NEVADA.

THIS SURVEY WAS COMPLETED ON MAY 31, 2012.
- THIS PLAT COMPLIES WITH THE APPLICABLE STATE STATUTES AND ANY LOCAL ORDINANCE IN EFFECT ON THE DATE THAT THE SURVEY WAS COMPLETED, AND THE SURVEY WAS CONDUCTED IN ACCORDANCE WITH CHAPTER 625 OF THE NEVADA ADMINISTRATIVE CODE.
- THE MONUMENTS DEPICTED ON THE PLAT ARE OF THE CHARACTER SHOWN, OCCUPY THE POSITIONS INDICATED, AND ARE OF SUFFICIENT NUMBER AND DURABILITY.



WILLIAM T. AVERY
PROFESSIONAL LAND SURVEYOR
NEVADA CERTIFICATE NO. 5571

BENCHMARK NOTE

THE ELEVATION DATA SHOWN HEREON ARE U.S. SURVEY FEET REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988, CITY OF LAS VEGAS 2008 ADJUSTMENT BENCHMARK NO. SLV9019NEE6, BEING A RIVET AND PLATE IN TOP OF CURB @ NORTHWEST CORNER OF DORRELL AND FORT APACHE.

ELEVATION 811.556 METERS
ELEVATION 2662.58 U.S. SURVEY FEET

LEGEND

	SECTION LINE
	CENTER SECTION LINE
	ONE-SIXTEENTH SECTION LINE
	SECTION ALIQUOT
	CENTERLINE / CONTROL LINE

REFERENCE MAPS

SUBDIVISION PLATS	
BOOK	PAGE
115	65
112	44
115	88
120	07
122	23
123	38
125	80
126	27
128	01
132	69
136	48
137	19

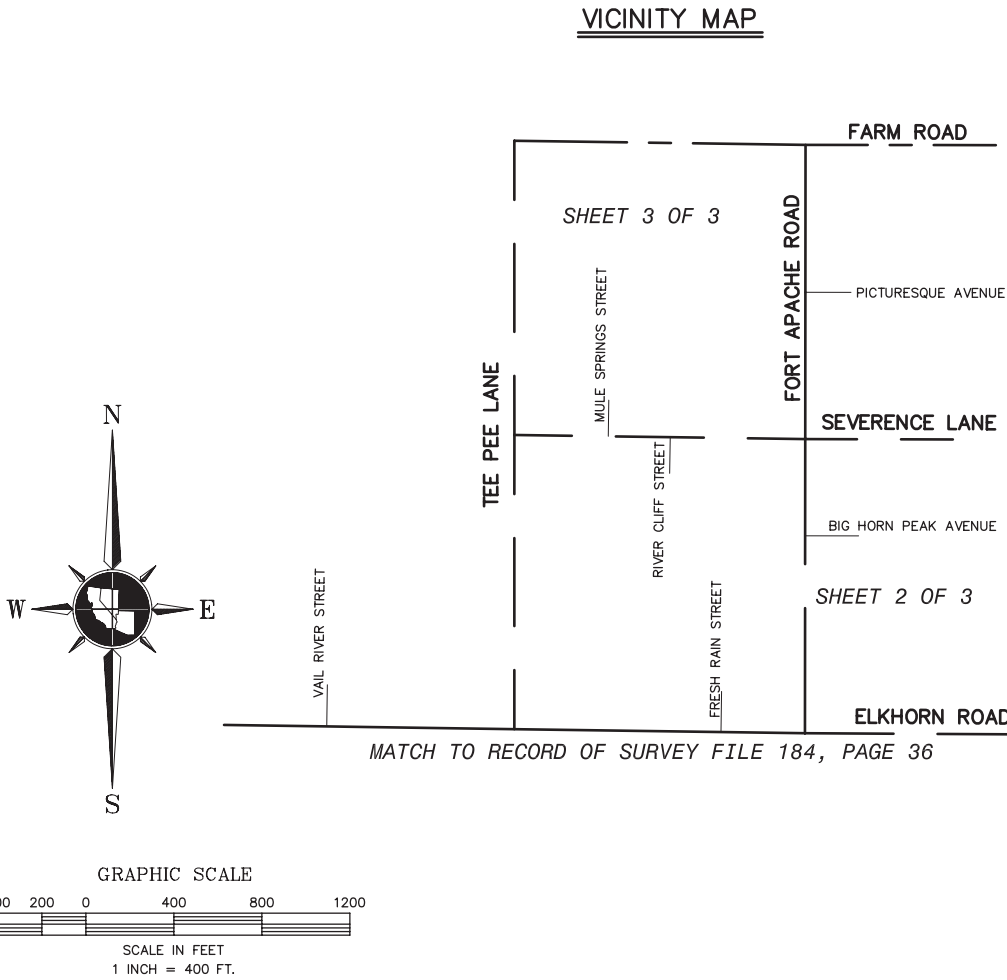
RECORD OF SURVEYS	
FILE	PAGE
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184	36

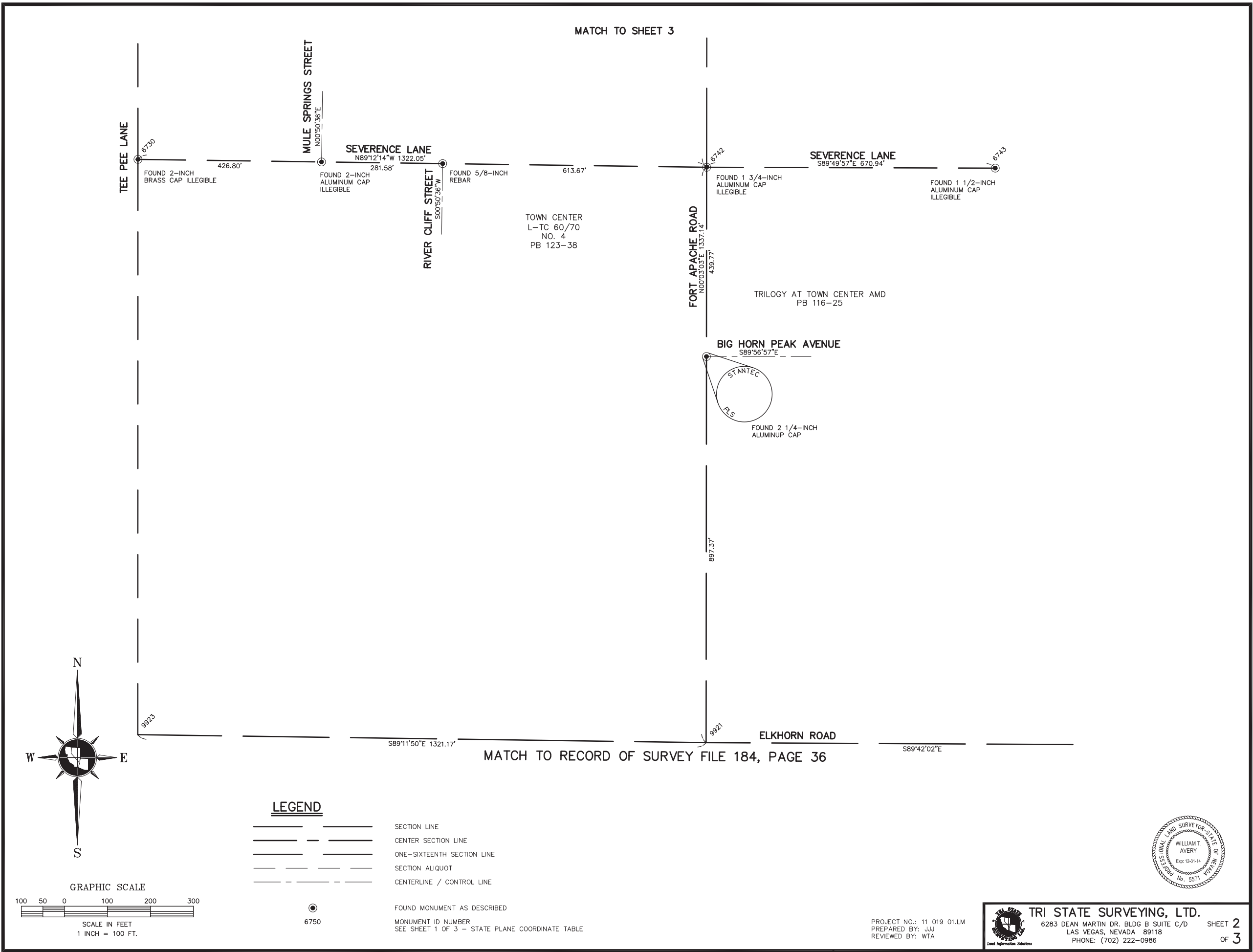
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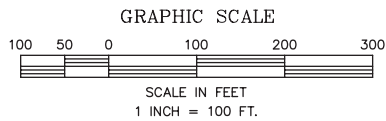
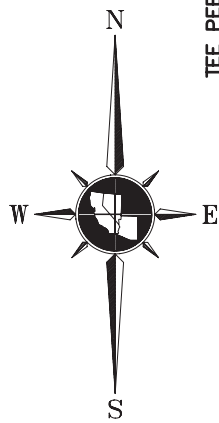
ANY SUBSEQUENT CHANGES TO THIS MAP SHOULD BE EXAMINED AND MAY BE DETERMINED BY REFERENCE TO THE COUNTY RECORDER'S CUMULATIVE MAP INDEX. N.R.S. 278.5695

PROJECT NO.: 11 019 01.LM
PREPARED BY: JJJ
REVIEWED BY: WTA

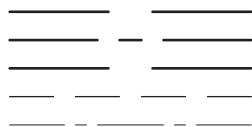
RECORD OF SURVEY FOR LOUIS BERGER GROUP SITUATE IN THE EAST ONE-HALF (E 1/2) OF THE SOUTHEAST ONE-QUARTER (SE 1/4) OF SECTION 18 AND THE WEST ONE-HALF (W 1/2) OF THE SOUTHWEST ONE-QUARTER (SW 1/4) OF SECTION 17, TOWNSHIP 19 SOUTH, RANGE 60 EAST, MOUNT DIABLO MERIDIAN, CITY OF LAS VEGAS, CLARK COUNTY, NEVADA	NO. _____ FILED AT THE REQUEST OF TRI STATE SURVEYING, LTD. DATE _____ AT _____ M. FILE _____ PAGE _____ OF SURVEYS OFFICIAL RECORDS BOOK NO. _____ CLARK COUNTY, NEVADA RECORDS. DEBBIE CONWAY, RECORDER FEE \$ _____ DEPUTY _____
TRI STATE SURVEYING, LTD. 6283 DEAN MARTIN DR. BLDG B SUITE C/D LAS VEGAS, NEVADA 89118 PHONE: (702) 222-0986	SHEET 1 OF 3







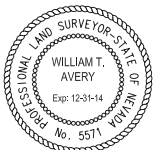
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SECTION LINE
CENTER SECTION LINE
ONE-SIXTEENTH SECTION LINE
SECTION ALIQUOT
CENTERLINE / CONTROL LINE

FOUND MONUMENT AS DESCRIBED
MONUMENT ID NUMBER
SEE SHEET 1 OF 3 - STATE PLANE COORDINATE TABLE

MATCH TO SHEET 2



PROJECT NO.: 11 019 01.LM
PREPARED BY: JJJ
REVIEWED BY: WTA



TRI STATE SURVEYING, LTD.
6283 DEAN MARTIN DR. BLDG B SUITE C/D
LAS VEGAS, NEVADA 89118
PHONE: (702) 222-0986

SHEET **3**
OF **3**

Record of Survey - Deer Springs Way (Fort Apache to Campbell)

RECORD OF SURVEY MAP FOR
DEER SRINGS WAY AND CAMPBELL ROAD

STATE PLANE COORDINATE TABLE

ID NUMBER	LATITUDE	LONGITUDE	ELLIPSOID HEIGHT	NORTHING (GRID) (U.S. SURVEY FEET)	EASTING (GRID) (U.S. SURVEY FEET)	ELEVATION	COMBINED FACTOR	CONVER- GENCE	DESCRIPTION	NORTHING (GROUND) (U.S. SURVEY FEET)	EASTING (GROUND) (U.S. SURVEY FEET)
9907	36°16'51.29935"N	115°17'32.50884"W	2504.825 SFT	26804006.68 SFT	741924.27 SFT	2595 SFT	0.99978888	0°10'20"	2" BRASS CAP	809484.74	42075.90
9912	36°17'04.39216"N	115°17'40.67016"W	2539.905 SFT	26805328.58 SFT	741252.15 SFT	2630 SFT	0.99978707	0°10'15"	1 1/2" ALUMINUM CAP	810806.91	41403.65
9913	36°17'04.39937"N	115°17'48.82467"W	2558.947 SFT	26805327.33 SFT	740584.57 SFT	2649 SFT	0.99978604	0°10'10"	2" BRASS CAP	810805.66	40735.93
9951	36°17'04.38555"N	115°17'32.51639"W	2517.863 SFT	26805329.91 SFT	741919.67 SFT	2608 SFT	0.99978826	0°10'20"	2" BRASS CAP	810808.24	42071.30

COORDINATE CONVERSION

TO CONVERT NEVADA STATE PLANE EAST ZONE (2701) COORDINATES TO EQUIVALENT PROJECT GROUND COORDINATES

MULTIPLY THE NORTHING IN METERS BY 3937/1200, THEN
MULTIPLY NORTHING BY 1.000204375, THEN SUBTRACT 26,000,000

MULTIPLY THE EASTING IN METERS BY 3937/1200, THEN
MULTIPLY EASTING BY 1.000204375, THEN SUBTRACT 700,000

TO CONVERT PROJECT GROUND COORDINATES TO NEVADA STATE PLANE EAST ZONE (2701) COORDINATES

ADD 26,000,000 TO NORTHING, THEN MULTIPLY BY 0.999795667, THEN DIVIDE BY 3937/1200 TO OBTAIN GRID COORDINATES IN METERS

ADD 700,000 TO EASTING, THEN MULTIPLY BY 0.999795667, THEN DIVIDE BY 3937/1200 TO OBTAIN GRID COORDINATES IN METERS

NOTE: "ELEVATION" LISTED ON THE STATE PLANE COORDINATE TABLE ARE FOR CALCULATION PURPOSES ONLY.

BASIS OF BEARINGS

N 89° 53' 33" E BEING THE CENTERLINE OF DEER SPRINGS WAY, AS DESCRIBED BY MONUMENTS, EAST OF FORT APACHE ROAD. PER RECORD OF SURVEY FILE 184, PAGE 36.

BENCHMARK NOTE

THE ELEVATION DATA SHOWN HEREON ARE U.S. SURVEY FEET REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988, CITY OF LAS VEGAS 2008 ADJUSTMENT BENCHMARK NO. 5LV9019NEE6, BEING A RIVET AND PLATE IN TOP OF CURB @ NORTHWEST CORNER OF DORRELL AND FORT APACHE.

ELEVATION 811.556 METERS

ELEVATION 2662.58 U.S. SURVEY FEET

REFERENCE MAPS

SUBDIVISION PLATS	
BOOK	PAGE
105	27
111	56
111	65
112	28
112	44
115	88
120	07
122	23
123	38
125	80
126	27
128	01
132	69
136	48
137	19

RECORD OF SURVEYS	
FILE	PAGE
88	53
184	36

COUNTY RECORDER'S NOTE

ANY SUBSEQUENT CHANGES TO THIS MAP SHOULD BE EXAMINED AND MAY BE DETERMINED BY REFERENCE TO THE COUNTY RECORDER'S CUMULATIVE MAP INDEX. N.R.S. 278.5695

PROJECT NO.: 11 019 01.LM
PREPARED BY: JJJ
REVIEWED BY: WTA

SURVEYOR'S CERTIFICATE

I, WILLIAM T. AVERY, A PROFESSIONAL LAND SURVEYOR LICENSED IN THE STATE OF NEVADA, AS AGENT FOR TRI STATE SURVEYING, LTD., DO HEREBY CERTIFY THAT:

- THIS PLAT REPRESENTS THE RESULTS OF A SURVEY CONDUCTED UNDER MY DIRECT SUPERVISION AT THE INSTANCE OF LOUIS BERGER GROUP.
- THE LANDS SURVEYED LIE WITHIN SITUATE IN THE SOUTH ONE-HALF (S 1/2) OF THE NORTHWEST ONE-QUARTER (NW 1/4) OF SECTION 20 AND THE NORTH ONE-HALF (N 1/2) OF THE SOUTHWEST ONE-QUARTER (SW 1/4) OF SECTION 20, TOWNSHIP 19 SOUTH, RANGE 60 EAST, MOUNT DIABLO MERIDIAN, CITY OF LAS VEGAS, CLARK COUNTY, NEVADA.

THIS SURVEY WAS COMPLETED ON APRIL 31, 2013.
- THIS PLAT COMPLIES WITH THE APPLICABLE STATE STATUTES AND ANY LOCAL ORDINANCE IN EFFECT ON THE DATE THAT THE SURVEY WAS COMPLETED, AND THE SURVEY WAS CONDUCTED IN ACCORDANCE WITH CHAPTER 625 OF THE NEVADA ADMINISTRATIVE CODE.
- THE MONUMENTS DEPICTED ON THE PLAT ARE OF THE CHARACTER SHOWN, OCCUPY THE POSITIONS INDICATED, AND ARE OF SUFFICIENT NUMBER AND DURABILITY.



WILLIAM T. AVERY
PROFESSIONAL LAND SURVEYOR
NEVADA CERTIFICATE NO. 5571

RECORD OF SURVEY

FOR

LOUIS BERGER GROUP

SITUATE IN THE SOUTH ONE-HALF (S 1/2) OF THE NORTHWEST ONE-QUARTER (NW 1/4) OF SECTION 20 AND THE NORTH ONE-HALF (N 1/2) OF THE SOUTHWEST ONE-QUARTER (SW 1/4) OF SECTION 20, TOWNSHIP 19 SOUTH, RANGE 60 EAST, MOUNT DIABLO MERIDIAN, CITY OF LAS VEGAS, CLARK COUNTY, NEVADA



TRI STATE SURVEYING, LTD.

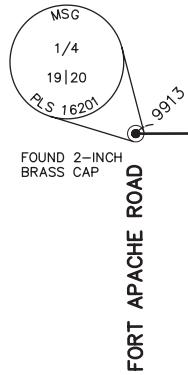
6283 DEAN MARTIN DR. BLDG B SUITE C/D
LAS VEGAS, NEVADA 89118
PHONE: (702) 222-0986

SHEET 1
OF 2

NO. _____
FILED AT THE REQUEST OF
TRI STATE SURVEYING, LTD.
DATE _____ AT _____ M.
FILE _____ PAGE _____
OF SURVEYS
OFFICIAL RECORDS BOOK NO. _____

CLARK COUNTY, NEVADA RECORDS.
DEBBIE CONWAY, RECORDER

FEE \$ _____ DEPUTY _____



BASIS OF BEARINGS

N89°53'33"E 667.72'

DEERCREST STREET

FOUND 1 1/2-INCH ALUMINUM CAP ILLEGIBLE

263.08'

FOUND 2-INCH ALUMINUM CAP ILLEGIBLE

9912

N89°53'09"E 667.66'

DEER SPRINGS WAY

CAMPBELL ROAD

CONCORDIA AT DEER SPRINGS UNIT 3
PB 112-28
125-20-212

FOUND 2-INCH BRASS CAP

VTN
PLS 11449
W 1/6
C-C
S20
2004

9951

CONCORDIA AT DEER SPRINGS
PB 105-27
125-20-210

FOUND 1 1/2-INCH ALUMINUM CAP "PLS 11449"

BELOVED STREET

SIERRA HILLS UNIT 1
PB 111-56
125-20-310

125-20-301-006
D.R. HORTON, INC.
20130220: 02442 O.R.

CAMPBELL ROAD

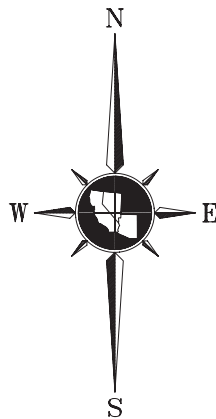
N00°11'56"W 1323.51'

FOUND 2-INCH BRASS CAP

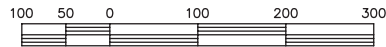
BR JEFFERSON
T19S R60E
SW 1/16 S20
2006
PLS 842

9907

LAS VEGAS BELTWAY 215

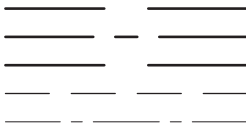


GRAPHIC SCALE



SCALE IN FEET
1 INCH = 100 FT.

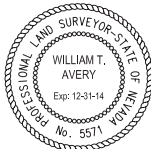
LEGEND



SECTION LINE
CENTER SECTION LINE
ONE-SIXTEENTH SECTION LINE
SECTION ALIQUOT
CENTERLINE / CONTROL LINE



FOUND MONUMENT AS DESCRIBED



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LAS VEGAS, NEVADA 89118
PHONE: (702) 222-0986

PROJECT NO.: 11 019 01.LM
PREPARED BY: JJJ
REVIEWED BY: WTA

APPENDIX D RECORD OF SURVEY PLANS

APPENDIX E
DATA CD