

**30% PRELIMINARY DESIGN REPORT
GOWAN NORTH – EL CAPITAN BRANCH
LONE MOUNTAIN ROAD TO ANN ROAD**

412-661

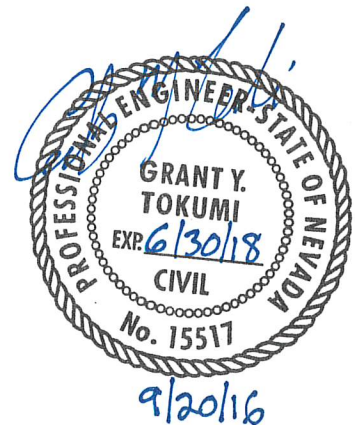
September 2016

Prepared For:

**City of Las Vegas
Public Works
Design Engineering Department
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Las Vegas, NV 89106
Phone: (702) 229-6272
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Prepared By:

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GCV
ENGINEERS SURVEYORS



MEETING AGENDA
for
GOWAN NORTH – EL CAPITAN BRANCH
LONE MOUNTAIN ROAD TO ANN ROAD
November 29, 2016, 1:30 pm

1. DISCUSSION ITEMS

- ☐ ROW Acquisition
 - Status/Approve
 - Review ROW Exhibit
 - BLM Easement – Stephen to Ann
- ☐ Ann Road
 - Hydrology
 - Proposed Facilities
 - ☐ 100-year lateral/inlet to accommodate extension west.
- ☐ Updated CLV General Notes – *Dennis to send updated*

2. STATUS UPDATE

- ☐ Record of Survey (Recorded)
- ☐ Section 8 Environment (Approved) – *Send to Oh-Sung, Pete*
- ☐ Potholing (Completed/Survey)
 - Additional for inlets *LUVWD Info Survey*
- ☐ Geotechnical (Draft 11/30/16)

3. 30% COMMENT REVIEW

- ☐ Sheet PP5 – Sewer in Hammer
 - Less than 10-ft clearance horizontally with inlet and sewer
- ☐ Others

4. SUBMITTALS/SCHEDULE

- ☐ Utility Coordination Meeting
- ☐ 70% Design Submittal 1/3/17

5. OPEN DISCUSSION



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for
GOWAN NORTH - EL CAPITAN BRANCH
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5. OPEN DISCUSSION

TIME OF CONCENTRATION

CITY OF LAS VEGAS

Project No:	412.661
Date:	17-Nov-16
Calculated by:	mmmc/qyt

ENGINEERS SURVEYORS

Rainfall and C:Ns for D16 referenced from EAEB-C. Rainfall and C:Ns for D17 referenced from TBEB-C. Rainfall and C:Ns for D18 referenced from ARFP-C.

Existing: $V1 = 14.8^*(S/100)^{1/2}$
 $V2 = 29.4^*(S/100)^{1/2}$

Developed: $V1 = 20.2 \cdot (S/100)^{1/2}$
 $V2 = 30.6 \cdot (S/100)^{1/2}$

STANDARD FORM 4

```

1*****
*
*   FLOOD HYDROGRAPH PACKAGE   (HEC-1)
*       JUN 1998
*       VERSION 4.1
*
*   RUN DATE   18NOV16   TIME   14:56:55
*
*****

```

```

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

```

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

*** FREE ***

***DIAGRAM**

```

1 ID *****
2 ID
3 ID
4 ID
5 ID
6 ID
7 ID
8 ID
9 ID
10 ID
11 ID
12 ID
13 ID
14 ID
15 ID
16 ID
17 ID
18 ID
19 ID
20 ID
21 ID
22 ID
23 ID
24 ID
25 ID
26 ID
27 ID
28 ID
29 ID
30 ID
31 IT
32 IO
33 IN
34 JR

```

```

*****
GOWAN NORTH - EL CAPITAN BRANCH
LONE MOUNTAIN ROAD TO ANN ROAD
ULTIMATE CONDITIONS (ANN ROAD)
*****
RETURN PERIOD_ 100 & 10 -YEAR
DISTRIBUTION_ 6-HOUR SDN3
PROJECT NO_ 412.661
FILENAME_ EX.H1
DATE MODELED_ 11/17/2016
MODELED BY_ MMC/GYT
*****
*****
JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:

```

		AREA	DARF						
		SQ.MI.							
		0.0 - 0.5	1.00						
		0.5 - 1.0	0.98						
		1.0 - 2.0	0.95						
		2.0 - 4.0	0.92						
		4.0 - 6.0	0.91						
		6.0 - 8.0	0.89						
PREC	1	0.98	0.95	0.92	0.91	0.89	0.57		

[illegible]

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

49	KK	D17	
50	KM	BASIN D17	
51	PB	2.96	
52	BA	0.1261	
53	LS	0	76.7
54	UD	.230	
	*		

55	KK	D16	
56	KM	BASIN D16	
57	PB	2.97	
58	BA	0.2143	
59	LS	0	76.5
60	UD	.327	

ANN.OUT

61 KK CD16
 62 KM COMBINE D16, D17 AND D18
 63 HC 3
 *
 64 ZZ

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

```

35      D18
      .
49      .      D17
      .      .
55      .      .      D16
      .      .      .
61      CD16.....
  
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

 * FLOOD HYDROGRAPH PACKAGE (HEC-1) *
 * JUN 1998 *
 * VERSION 4.1 *
 * RUN DATE 18NOV16 TIME 14:56:55 *

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

 *
 * GOWAN NORTH - EL CAPITAN BRANCH
 * LONE MOUNTAIN ROAD TO ANN ROAD
 * ULTIMATE CONDITIONS (ANN ROAD)
 *
 * RETURN PERIOD_ _ _ 100 & 10 -YEAR
 * DISTRIBUTION_ _ _ 6-HOUR SDN3
 * PROJECT NO_ _ _ 412.661
 * FILENAME_ _ _ EX.H1
 * DATE MODELED_ _ _ 11/17/2016
 * MODELED BY_ _ _ MMC/GYT
 *

JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:

	AREA	DARF
	SQ.MI.	
	0.0 - 0.5	1.00
	0.5 - 1.0	0.98
	1.0 - 2.0	0.95
	2.0 - 4.0	0.92
	4.0 - 6.0	0.91
	6.0 - 8.0	0.89

32 IO

OUTPUT CONTROL VARIABLES

IPRNT 5 PRINT CONTROL
 IPLOT 0 PLOT CONTROL
 QSCAL 0. HYDROGRAPH PLOT SCALE

IT

HYDROGRAPH TIME DATA

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

COMPUTATION INTERVAL .08 HOURS
 TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS

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

JP

MULTI-PLAN OPTION

NPLAN 1 NUMBER OF PLANS

JR

MULTI-RATIO OPTION

RATIOS OF PRECIPITATION
 1.00 .98 .95 .92 .91 .89 .57

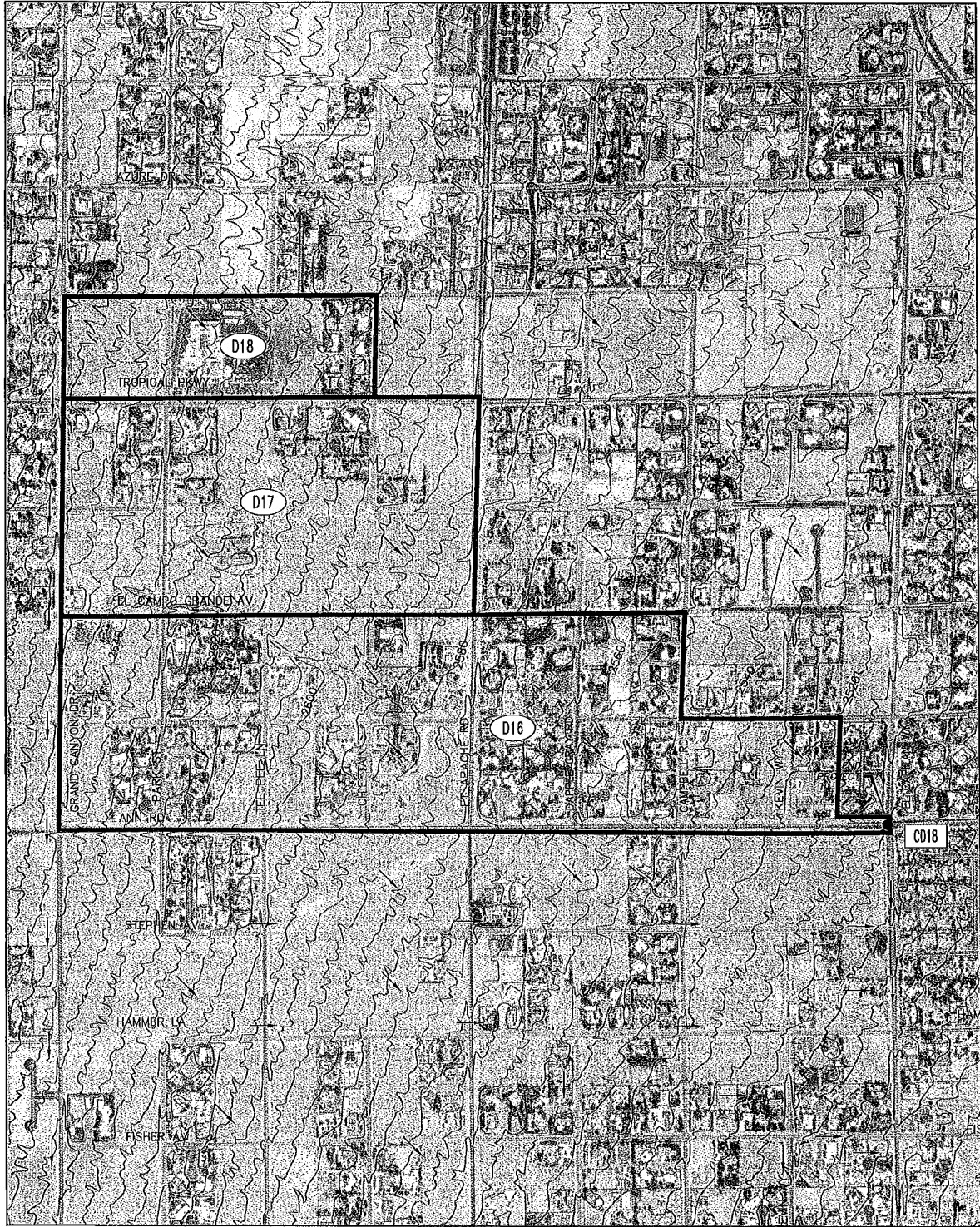
1

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

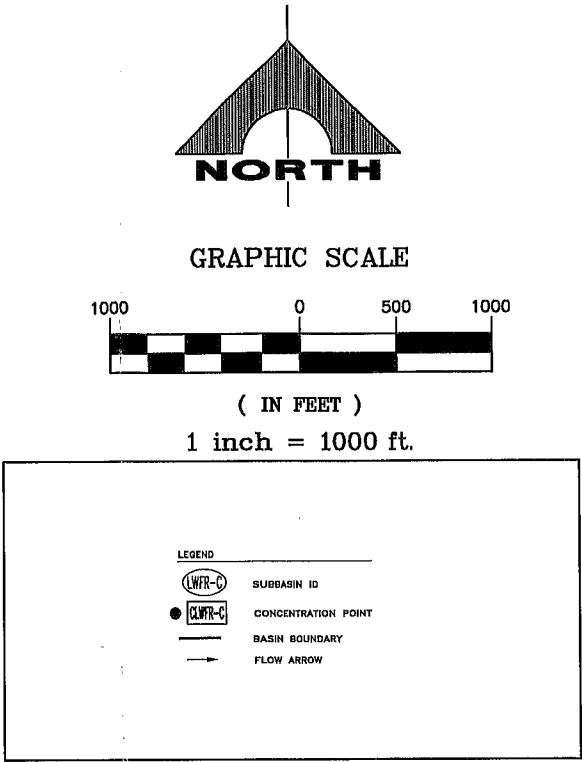
OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION						
				RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7
				1.00	.98	.95	.92	.91	.89	.57

				ANN.OUT							
HYDROGRAPH AT	D18	.04	1	FLOW	34.	33.	31.	29.	28.	27.	8.
+				TIME	3.58	3.58	3.58	3.67	3.67	3.67	3.67
HYDROGRAPH AT	D17	.13	1	FLOW	95.	91.	85.	80.	78.	74.	24.
+				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.75
HYDROGRAPH AT	D16	.21	1	FLOW	136.	130.	122.	114.	111.	106.	34.
+				TIME	3.75	3.75	3.75	3.75	3.83	3.83	3.83
3 COMBINED AT	CD16	.38	1	FLOW	254.	244.	229.	214.	210.	200.	64.
+				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75

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



SUMMARY OF ULTIMATE CONDITIONS HEC-1 MODEL			
SB OR CP	AREA (AC)	100 YR (CFS)	10 YR (CFS)
D18	28.50	34	8
D17	80.70	95	24
D16	137.10	136	34
CD18	-	254	64



CITY OF LAS VEGAS

GOWAN NORTH - EL CAPITAN BRANCH - LONE MOUNTAIN ROAD TO ANN ROAD

FIGURE 6A
ANN ROAD ULTIMATE CONDITIONS HYDROLOGY

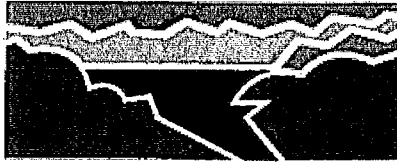
SHEET

Fig 6A

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REGIONAL FLOOD CONTROL DISTRICT



Steven C. Parrish, P.E.
General Manager/Chief
Engineer

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November 7, 2016

Mr. Dennis B. Moyer, P.E.
Engineering Project Manager
Department of Public Work
City of Las Vegas
333 North Rancho Drive, 9th Floor
Las Vegas, Nevada 89106

**RE: GOWAN NORTH – EL CAPITAN BRANCH – LONE MOUNTAIN TO
ANN RD. (LAS24J15)**

Dear Mr. Moyer:

Clark County Regional Flood Control District (District) completed a review of 30% Preliminary Design Report for *Gowan North – El Capitan Branch, Lone Mountain to Ann road* dated September 2016 prepared by GCW for the City of Las Vegas (City). Improvements include construction of approximately one mile of reinforced concrete box culvert (RCB) within El Capitan right of way from Lone Mountain Road to Ann Road, and appurtenant facilities. This facility is labeled GOEC 0000, 0026, 0051 and 0076 on District's 2013 Master Plan Update (MPU). The following comments are offered for your consideration as the project proceeds:

General

1. A facility-specific environmental analysis in accordance with Chapter 8 of District's *Supplemental Programmatic Environmental Impact Statement, Clark County Regional Flood Control District, 2002 Master Plan Update, September 2004* has been submitted and accepted. *The District's Policies and Procedures regarding environmental permitting as a pre-requisite for construction funding eligibility have been satisfied.*
2. Identify all right-of-way (ROW) and easement acquisition requirements for this project. All ROW/easements must be acquired prior to City's request for construction funding.
3. Continue coordination with Clark County Public Works Department (CCPW) regarding Permitting, Traffic Control, utility franchise agreements, and ongoing projects in Lone Mountain and Ann Road.



Mr. Dennis B. Moyer, P.E.
November 7, 2016
Page 2

4. Please provide pothole information for any major utilities within the proposed storm drain alignment with the 70% submittal.
5. City and CCPW must coordinate future maintenance responsibilities for mainline and appurtenant facilities and incorporate into District's Maintenance Work Program once construction is complete.
6. Coordinate all water line crossings with Las Vegas Valley Water District (LVVWD). See attached LVVWD Engineering Services Notice (ESN) that identifies requirements for storm sewer lateral crossings. Refer to UDACS for mainline RCB crossings.

Report

7. Provide Geotechnical report with 70% submittal.
8. Expand section IX to justify reasons for revising soil condition from Good Hydrologic Condition to Poor Hydrologic Condition.
9. Section XIII – Pavement Replacement states that El Capitan Way shall remain open for local traffic during construction. Coordinate with Clark County Traffic to discuss acceptable traffic control alternatives. It appears this project could be constructed more efficiently if traffic were shut down to through traffic from intersection to intersection, providing residential access as necessary.

Hydrology

10. Refine analysis to quantify ultimate conditions runoff in Ann Road and coordinate findings with CCPW. District recommends a meeting with CCPW to coordinate proposed storm drain facility requirements within Ann Road.
11. Identify and analyze split flow locations upstream of El Capitan Way and provide with next submittal.

Hydraulics

12. Only a cursory review of the WSPG analysis was conducted at this time. A detailed review will be provided at 70% level of design.



Mr. Dennis B. Moyer, P.E.
November 7, 2016
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13. Provide detailed lateral and drop inlet sizing calculations with 70% submittal.

Plans

14. Provide the following information with 70% submittal:
- a. Draft Special Provisions;
 - b. Horizontal Control Plan;
 - c. Removal Plan
 - d. Utilities
 - e. Signage and Striping
 - f. Trench Sections;
 - g. Draft Structural Drawings;
 - h. Lateral Profiles;
 - i. First round pothole information.
15. Refine DI/lateral design for 70% submittal. A conservative approach to DI sizing and placement is warranted for this project due to expected sediment load and lack of curb and gutter throughout the project limits.
16. Sheet PP1: Revise 36-inch RCP to C905 for waterline crossing at Verde Way. If feasible, tie proposed 24-inch lateral into proposed 36-inch C905 west of existing waterline to avoid waterline crossing. Verify location and elevation of tie in point to existing 12-ft x 5-ft RCB. Provide draft structural detail of transition with 70% submittal. Show and label existing utility crossings, typical all. Provide construction and key notes.
17. Sheet PP2: Verify and/or identify all service lateral crossings, typical all. Provide elastomeric joint sealant and slurry encase 54-inch RCP lateral 10 feet either side of waterline crossing at Verde Way. Verify with LVVWD if encasement is required for the entire length (23± feet) or only at joint locations. If feasible, tie proposed 24-inch RCP lateral into proposed 54-inch RCP west of 36-inch waterline. Otherwise construct lateral with C905 water quality pipe.
18. Sheet PP3: Consider moving DI's to roadside ditches in Rosada instead of adjacent to Lone Mountain. Limit waterline crossings where possible. Revise 24-inch RCP crossing waterline to C905.
19. Sheet PP4: Revise 24-inch lateral alignment, east of Lone Mountain, at Washburn to avoid waterline crossings. It is acceptable to tie nuisance laterals into mainline at 90-degrees.



Mr. Dennis B. Moyer, P.E.

November 7, 2016

Page 4

20. Sheet PP5: See redlines.
21. Sheet PP6: Extend mainline through Ann Road intersection. Coordinate stub and lateral/inlet facilities with CCPW Ann Road project.
22. Sheet DT1: Revise 2/DT1 to include 2-inch layer of crushed rock for leveling course. Revise backfill requirements within pipe zone to allow for Type II with minimum clearance of 18-inch from edge of trench to RCB or CLSM with 6-inch minimum clearance from edge of trench to RCB.
23. See additional redlined comments on attached check prints.

Cost Estimate

24. Refine cost estimate as design progresses. Reduce contingency to 10% when 90% design level is reached.

Special Provisions

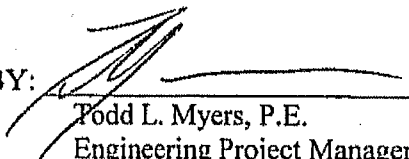
25. Provide draft Special Provisions with next submittal.

If you have any questions, please give me a call.

STEVEN C. PARRISH, P.E.

General Manager/Chief Engineer

BY:


Todd L. Myers, P.E.

Engineering Project Manager

TLM:sa

c: Andrew Trelease, P.E., CCRFCD
Oh-Sang Kwon, P.E., City of Las Vegas
Grant Tokumi, P.E., GCW

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EXECUTIVE SUMMARY

INTRODUCTION

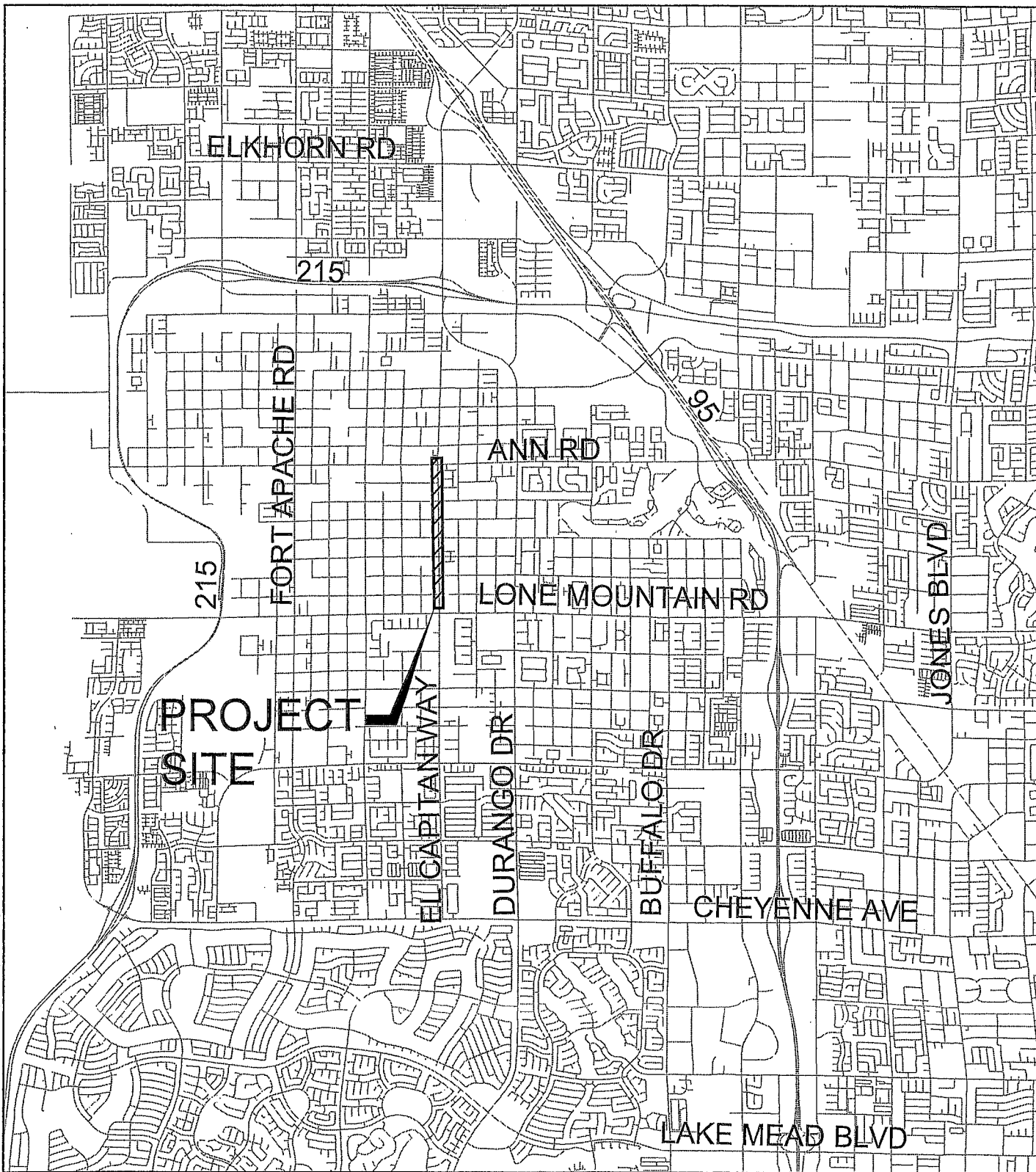
The City of Las Vegas (CLV) is proposing to construct approximately 5,280 linear-feet (LF) of Reinforced Concrete Box (RCB), known as the Gowan North – El Capitan Branch, Lone Mountain Road to Ann Road. The basis for the project design is the criteria in the Clark County Regional Flood Control District (CCRFCD) *Hydrologic Criteria and Drainage Design Manual* (Manual).

The purpose of this design report is to present the results of the hydrologic and hydraulic analyses which detail the estimated flow magnitude and the hydraulic characteristics of the Gowan North – El Capitan Branch facilities from Lone Mountain Road to Ann Road. Information contained herein includes hydrologic analysis, preliminary hydraulic analysis of the mainline facility, and preliminary hydraulic calculations for storm drain laterals. In addition, information contained herein addresses preliminary design concerns related to survey, right-of-way, geotechnical conditions, utility impacts, permitting, design and construction scheduling, project coordination, adjacent development, and facility cost.

A vicinity map and a location map showing the proposed facility alignment are included as **Figure E-1** and **Figure E-2**.

The project consists of providing peak 100-year design flows and their corresponding concentration points to existing and future storm drain facilities, and hydraulic design of the planned regional flood control facilities. The following is a list of the regional facilities shown in the 2013 Master Plan Update, Clark County Regional Flood Control District that are to be constructed in this project:

- ♦ GOEC 0000 is a 1,445-LF 10-foot wide by 7-foot high RCB
- ♦ GOEC 0026 is a 1,320-LF 10-foot wide by 8-foot high RCB
- ♦ GOEC 0051 is a 1,320-LF 10-foot wide by 7-foot high RCB
- ♦ GOEC 0076 is a 1,320-LF 10-foot wide by 6-foot high RCB

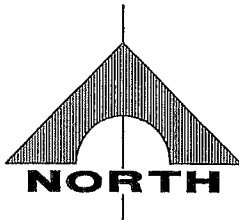


GRAPHIC SCALE



(IN FEET)

1 inch = 5000 ft.



CITY OF LAS VEGAS
GOWAN NORTH - EL CAPITAN BRANCH
LONE MOUNTAIN ROAD TO ANN ROAD

FIGURE E-1

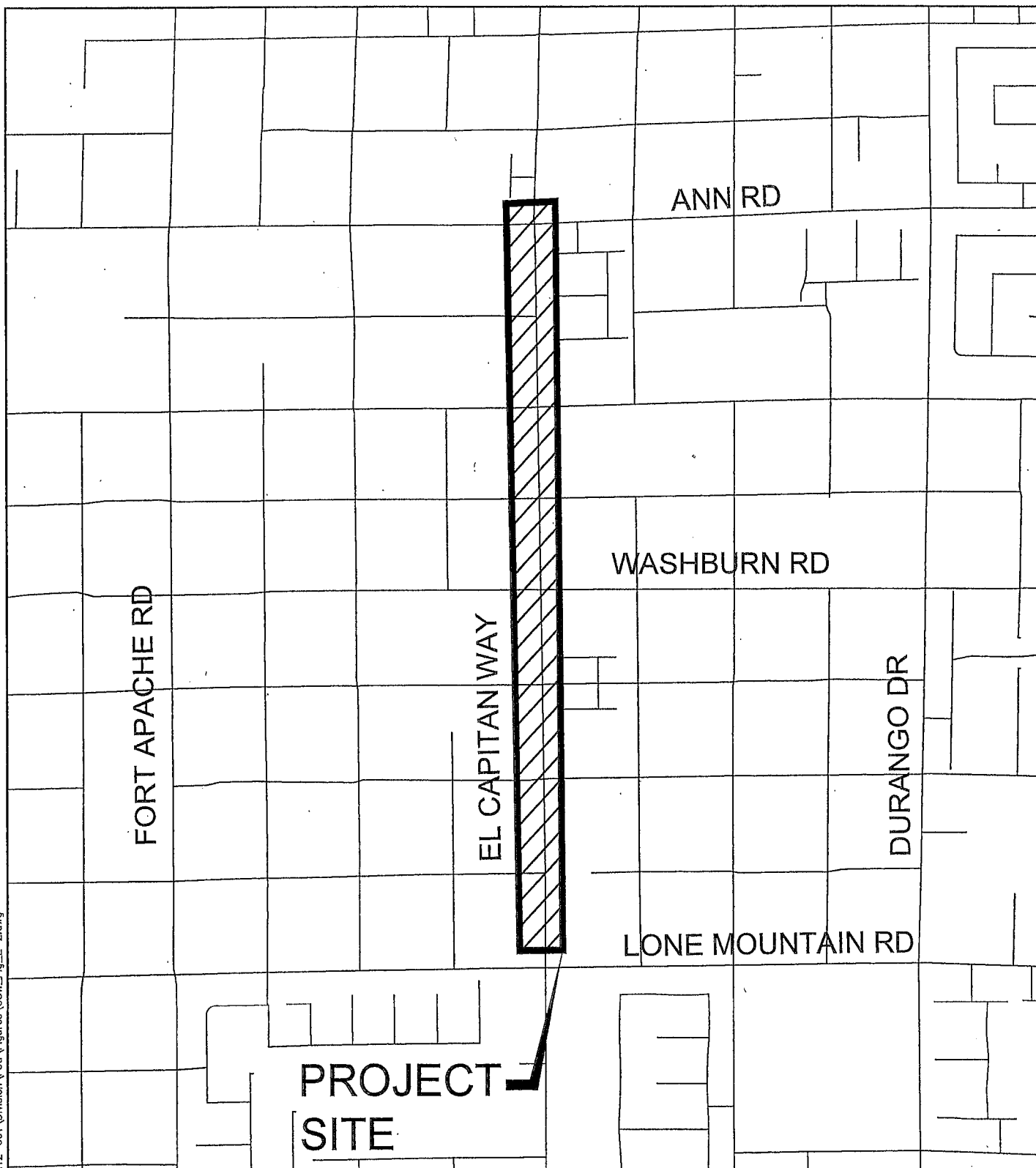
VICINITY MAP

GCW

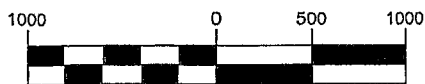
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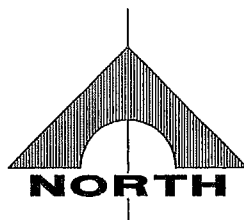


GRAPHIC SCALE



(IN FEET)

1 inch = 1000 ft.



CITY OF LAS VEGAS
GOWAN NORTH - EL CAPITAN BRANCH
LONE MOUNTAIN ROAD TO ANN ROAD

FIGURE E-2

LOCATION MAP

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CONCLUSIONS AND RECOMMENDATIONS

1. Methodology in this report is in compliance with Clark County Regional Flood Control District (CCRFCD) criteria.
2. The project facilities are not located in a FEMA-designated Special Flood Hazard Area.
3. The Gowan North - El Capitan Branch, Lone Mountain Road to Ann Road facilities connect to the existing Gowan North Channel Phase III facilities (existing Facility GONO 0183) at the intersection of Lone Mountain Road and El Capitan Way at the downstream end. At the Ann Road intersection, the RCB facility will be stubbed for future extension north in El Capitan Way. (future CCRFD Facilities GOEC 0100, 0126, 0151, and 0176).
4. The proposed alignment and function of the mainline facility are in conformance with the CCRFCD *Las Vegas Flood Control Master Plan* as outlined in the 2013 MPU. The proposed improvements will intercept flows currently impacting properties west of El Capitan Way between Lone Mountain Road and Ann Road.
5. The Gowan North - El Capitan Branch, Lone Mountain Road to Ann Road facilities will have design flows beginning with 724 cfs at the upstream end at Ann Road. The peak flow at the downstream end at Lone Mountain Road will have a calculated design flow of 1,154 cfs where the system ties into the Gowan North Channel Phase III facility. The Gowan North Channel Phase III facility is designed to convey a 100-year flow of 1,240 cfs.
6. The Project proposes to construct approximately one (1) mile of CCRFCD Facilities GOEC 0000, 0026, 0051, 0076, and a stub for 0100.
7. The proposed improvements do not significantly alter existing peak flows or the character of flows downstream of the Gowan North – El Capitan Branch Lone Mountain Road to Ann Road improvements. Specifically, the peak outflow (1,154 cfs) at the downstream end of Gowan North – El Capitan

Branch Lone Mountain Road to Ann Road is less than the peak inflow (1,240 cfs) at the upstream end of Gowan North Channel Phase III.

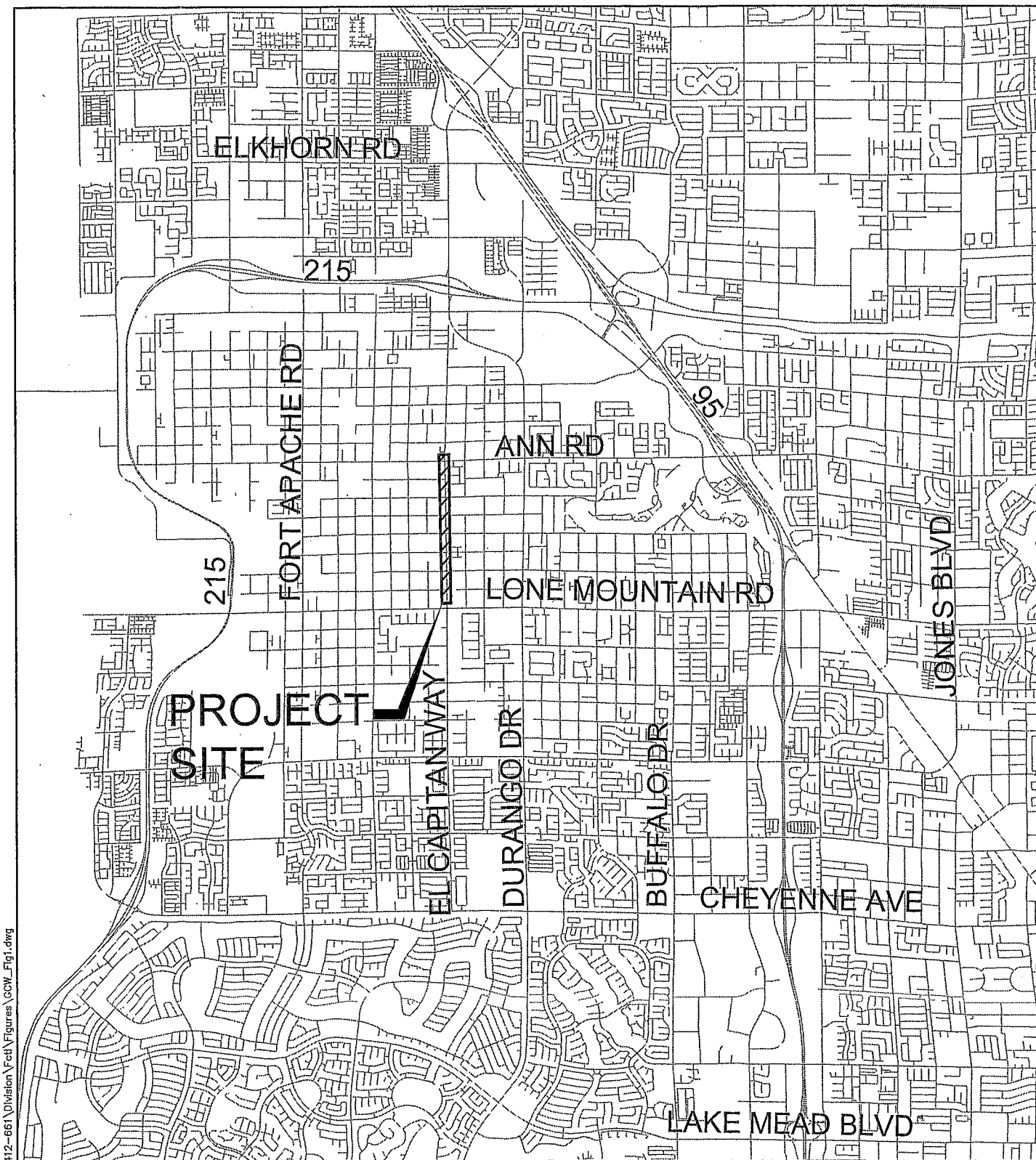
8. The project provides temporary area inlets at key locations along the Project alignment to help reduce surface flows along El Capitan Way. Future local storm facilities, inlets, and storm drains will be installed as the roadway develops to full street improvements.
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I. INTRODUCTION

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- Collect and review pertinent improvement plans and hydraulic information from existing and previously approved drainage studies near and/or adjacent to the project site.
- Identify record drawings for the area projects and utilities, and extracted information pertinent to the recommended drainage facilities.
- Identify FEMA floodplain designations within the project limits.
- Identify existing and proposed CCRFCD drainage facilities adjacent to the project site.
- Perform field investigation.
- Estimate runoff generated from onsite and offsite subbasins during the 100-year return period storm event during interim and ultimate conditions.
- Determine design flows for recommended ultimate drainage facilities.

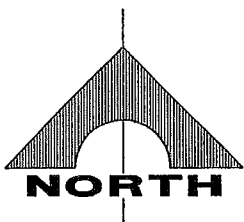


GRAPHIC SCALE



(IN FEET)

1 inch = 5000 ft.



CITY OF LAS VEGAS
GOWAN NORTH - EL CAPITAN BRANCH
LONE MOUNTAIN ROAD TO ANN ROAD

FIGURE 1

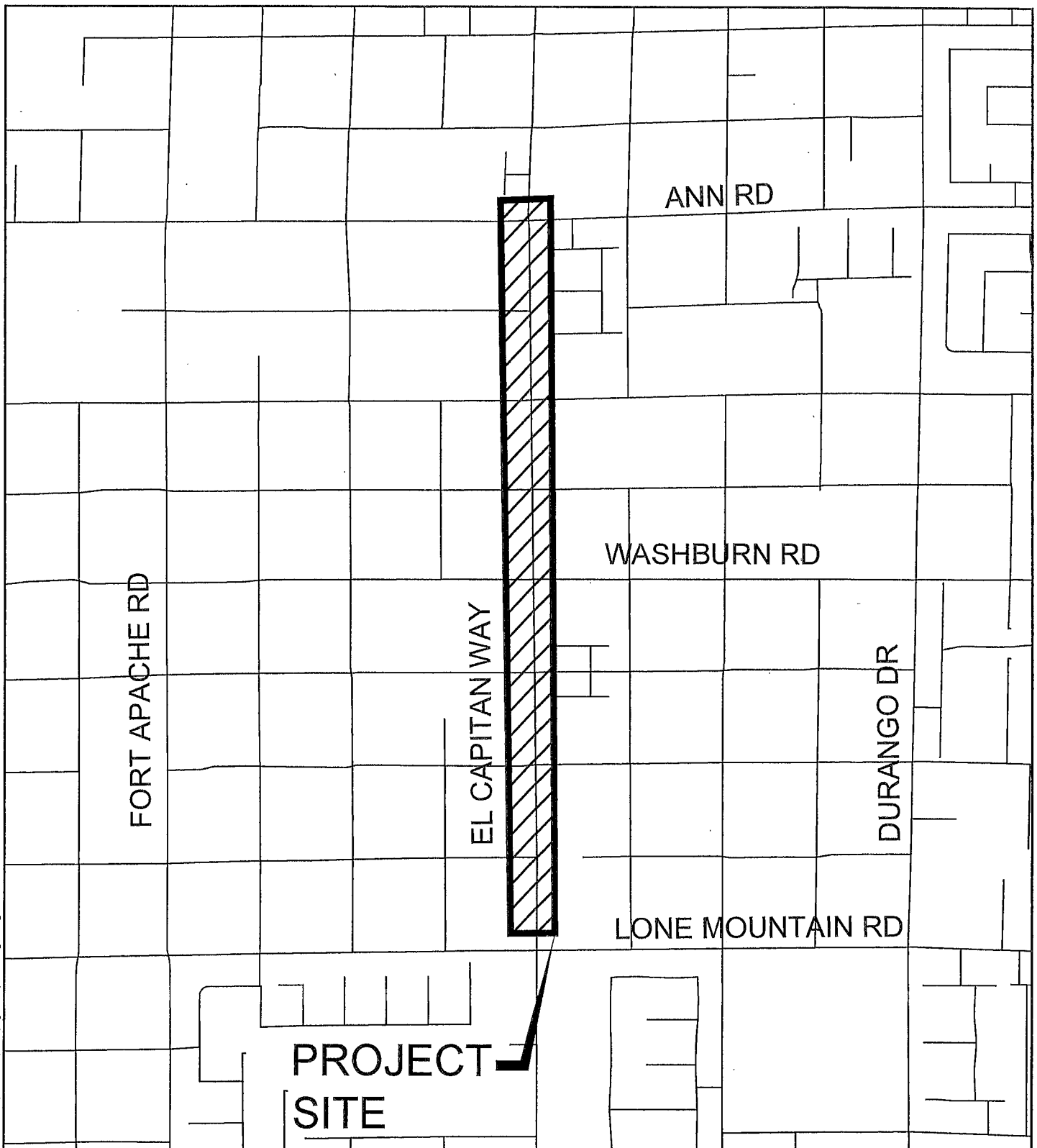
VICINITY MAP

GCW

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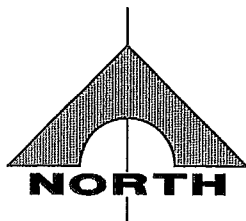
PROJECT
SITE

GRAPHIC SCALE



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CITY OF LAS VEGAS
GOWAN NORTH - EL CAPITAN BRANCH
LONE MOUNTAIN ROAD TO ANN ROAD

FIGURE 2

LOCATION MAP

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- Recommend storm drain facilities based on hydraulic modeling and the capacity of existing and/or downstream facilities.
- Prepare 30 percent storm drain improvement plans incorporating recommended drainage facilities.

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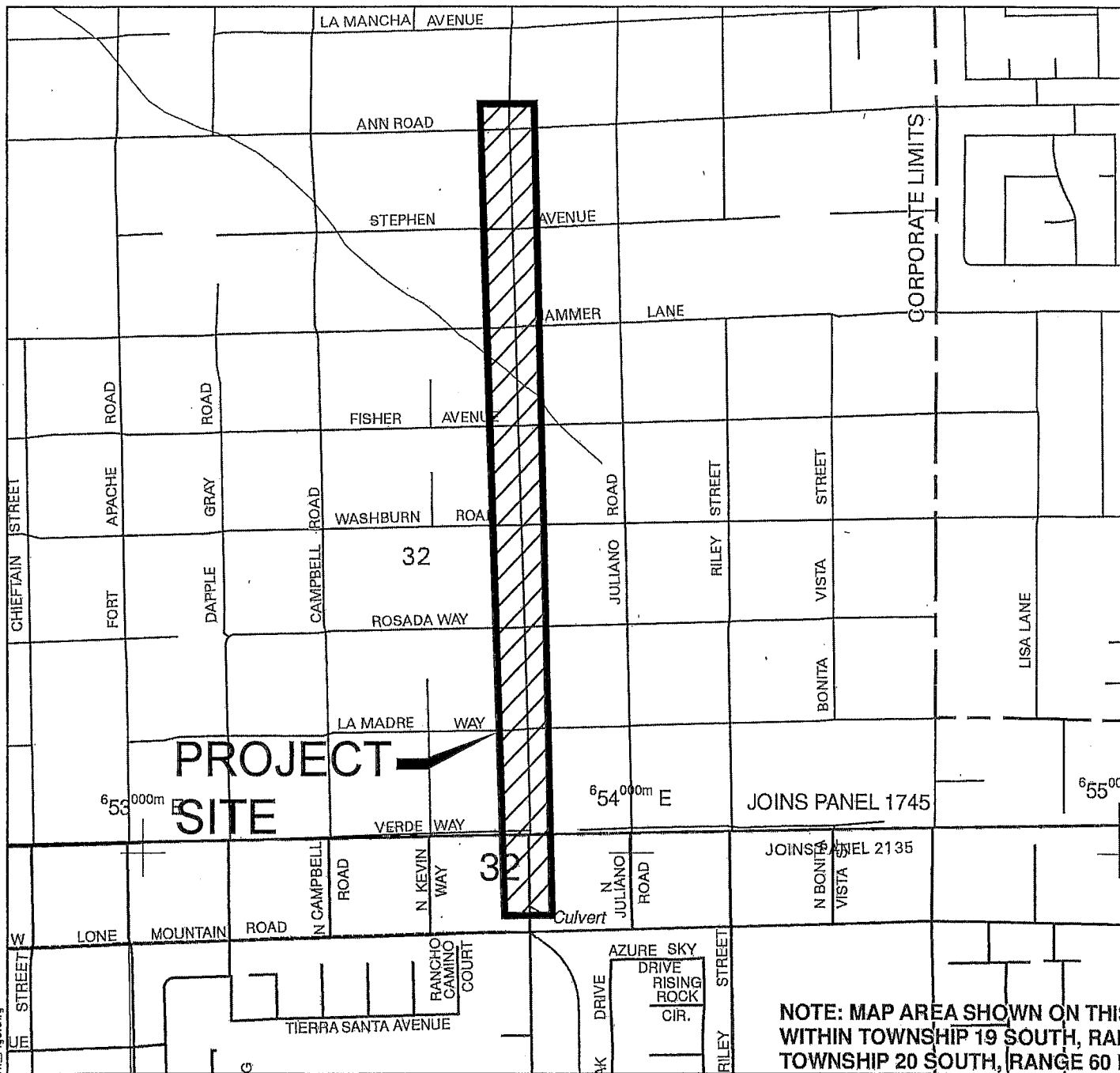
Two environmental processes were considered for the project: a Section 8 analysis and a determination by Army Corps of Engineers (USACE) on whether the project outfall impacts any Waters of the United States.

Section 8 Analysis

A copy of the Section 8 Analysis is included in Appendix J.

USACE 404 Permit

A copy of the email from USACE in Appendix J indicates that a permit is not required from USACE. "Any jurisdictional water under the road has already been impacted, so there are no additional impacts."



NOTE: MAP AREA SHOWN ON THIS WITHIN TOWNSHIP 19 SOUTH, RANGE 60 E

PANEL 1745 E
FIRM
FLOOD INSURANCE RATE MAP
CLARK COUNTY,
NEVADA AND
INCORPORATED AREAS

PANEL 1745 OF 4090
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

COMMUNITY	NUMBER	PANEL	DATE
LAS VEGAS, CITY OF	32078	1746	E
CLARK COUNTY	32083	1746	C

Map Number
32003C1745 E

MAP REVISED:
SEPTEMBER 27, 2002

Federal Emergency Management Agency

PANEL 2135F
FIRM
FLOOD INSURANCE RATE MAP
CLARK COUNTY,
NEVADA
AND INCORPORATED AREAS

PANEL 2135 OF 4090
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

COMMUNITY	NUMBER	PANEL	DATE
LAS VEGAS, CITY OF	32078	2135	F
CLARK COUNTY	32078	2135	F

Map Number
32003C2135F

MAP REVISED
NOVEMBER 16, 2011

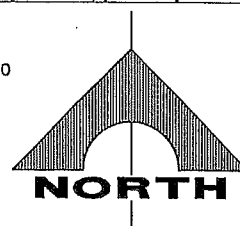
Federal Emergency Management Agency

GRAPHIC SCALE



(IN FEET)

1 inch = 1000 ft.



CITY OF LAS VEGAS
GOWAN NORTH - EL CAPITAN BRANCH
LONE MOUNTAIN ROAD TO ANN ROAD

FIGURE 3

F.I.R.M.

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V. FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)

Figure 3 shows the project site in relation to designated Federal Emergency Management Agency (FEMA) flood zones. According to Flood Insurance Rate Map (FIRM) Panel 32003C 1745 E, dated September 27, 2002, the project site lies within FEMA-designated Zone X. Areas designated as Zone X are described as being outside of the 500-year floodplain.

VI. CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT (CCRFCD) FACILITIES

Figure 4 is reproduced from Figure F-19 of the 2013 MPU. These figures depict the project site in relation to existing and proposed CCRFCD facilities. As shown on the figure, the following facilities are within or adjacent to the project site:

- ♦ Gowan North System (GONO 0030, 0225)
- ♦ Gowan North – El Capitan Branch (GOEC 0000, 0026, 0051, 0076, 0100)

CCRFCD Facilities to be constructed with this project include: GOEC 0000, 0026, 0051 and 0076.

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EXECUTIVE SUMMARY

INTRODUCTION

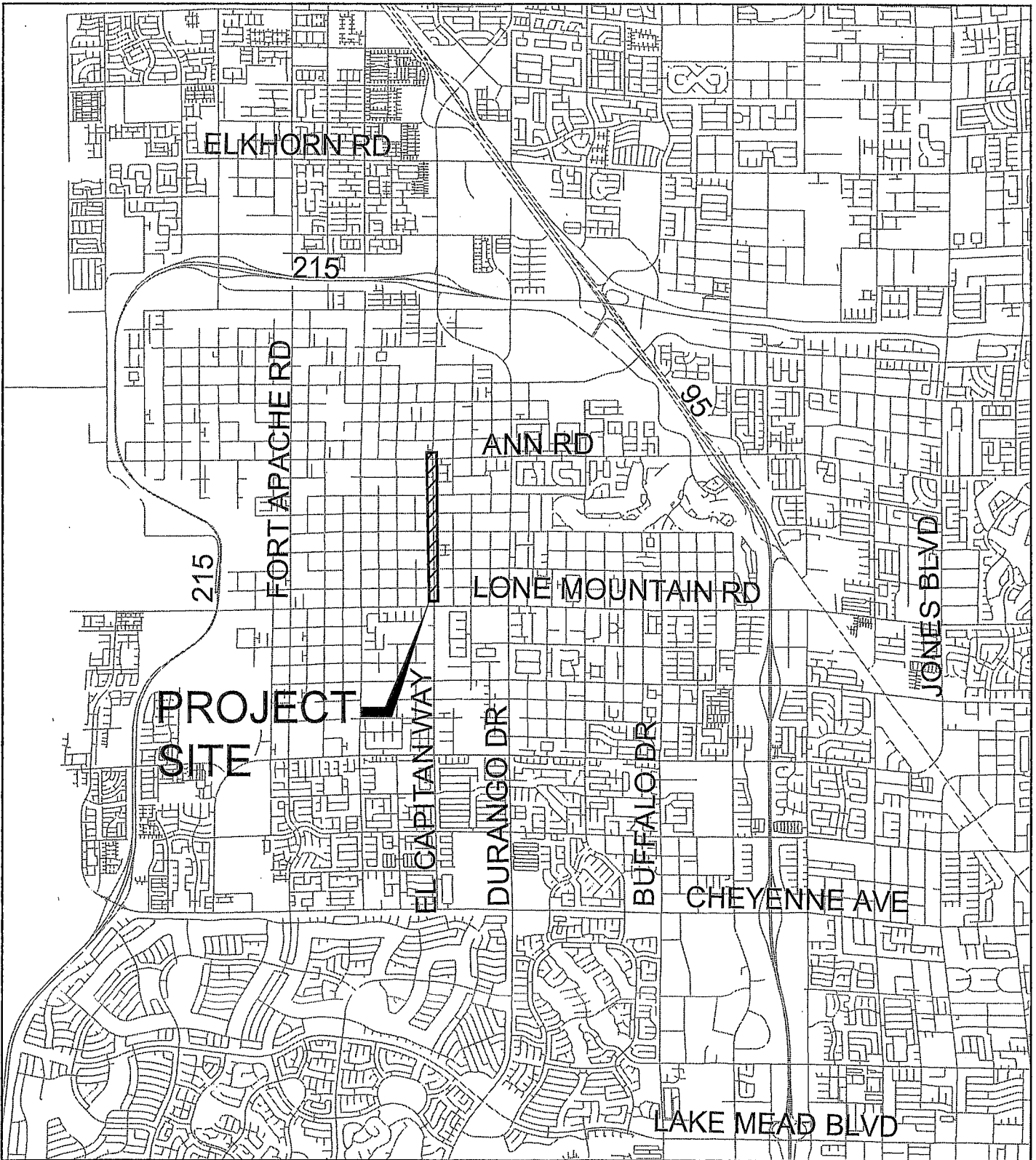
The City of Las Vegas (CLV) is proposing to construct approximately 5,280 linear-feet (LF) of Reinforced Concrete Box (RCB), known as the Gowan North – El Capitan Branch, Lone Mountain Road to Ann Road. The basis for the project design is the criteria in the Clark County Regional Flood Control District (CCRFCD) *Hydrologic Criteria and Drainage Design Manual* (Manual).

The purpose of this design report is to present the results of the hydrologic and hydraulic analyses which detail the estimated flow magnitude and the hydraulic characteristics of the Gowan North – El Capitan Branch facilities from Lone Mountain Road to Ann Road. Information contained herein includes hydrologic analysis, preliminary hydraulic analysis of the mainline facility, and preliminary hydraulic calculations for storm drain laterals. In addition, information contained herein addresses preliminary design concerns related to survey, right-of-way, geotechnical conditions, utility impacts, permitting, design and construction scheduling, project coordination, adjacent development, and facility cost.

A vicinity map and a location map showing the proposed facility alignment are included as **Figure E-1** and **Figure E-2**.

The project consists of providing peak 100-year design flows and their corresponding concentration points to existing and future storm drain facilities, and hydraulic design of the planned regional flood control facilities. The following is a list of the regional facilities shown in the 2013 Master Plan Update, Clark County Regional Flood Control District that are to be constructed in this project:

- ♦ GOEC 0000 is a 1,445-LF 10-foot wide by 7-foot high RCB
- ♦ GOEC 0026 is a 1,320-LF 10-foot wide by 8-foot high RCB
- ♦ GOEC 0051 is a 1,320-LF 10-foot wide by 7-foot high RCB
- ♦ GOEC 0076 is a 1,320-LF 10-foot wide by 6-foot high RCB

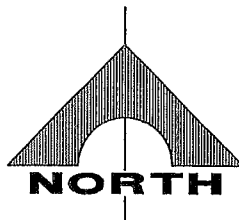


GRAPHIC SCALE



(IN FEET)

1 inch = 5000 ft.



CITY OF LAS VEGAS
GOWAN NORTH - EL CAPITAN BRANCH
LONE MOUNTAIN ROAD TO ANN ROAD

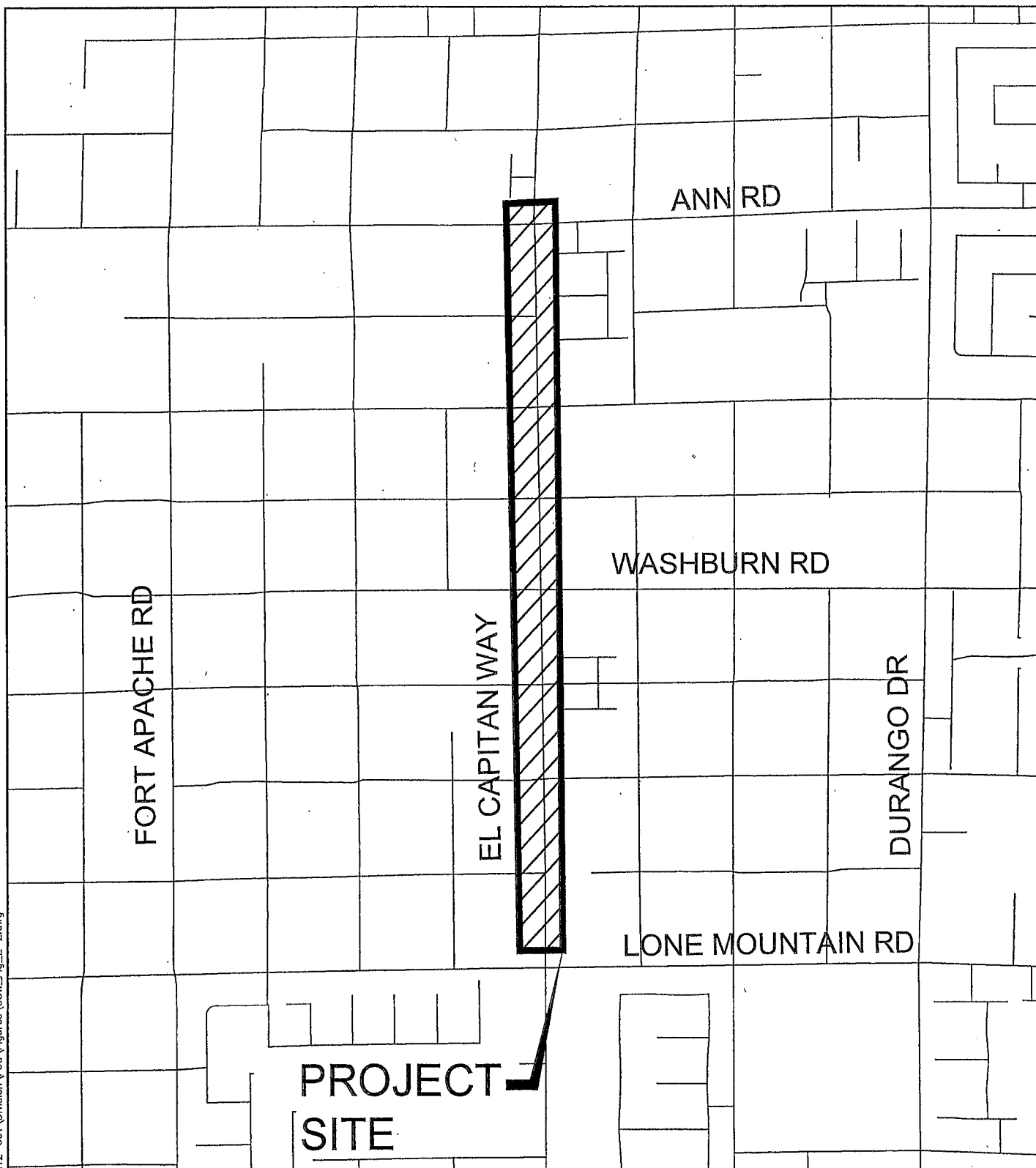
FIGURE E-1

VICINITY MAP

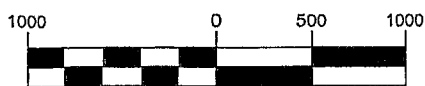
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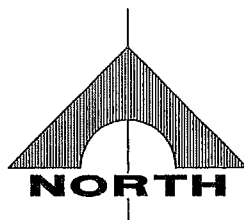


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CITY OF LAS VEGAS
GOWAN NORTH - EL CAPITAN BRANCH
LONE MOUNTAIN ROAD TO ANN ROAD

FIGURE E-2

LOCATION MAP

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CONCLUSIONS AND RECOMMENDATIONS

1. Methodology in this report is in compliance with Clark County Regional Flood Control District (CCRFCD) criteria.
2. The project facilities are not located in a FEMA-designated Special Flood Hazard Area.
3. The Gowan North - El Capitan Branch, Lone Mountain Road to Ann Road facilities connect to the existing Gowan North Channel Phase III facilities (existing Facility GONO 0183) at the intersection of Lone Mountain Road and El Capitan Way at the downstream end. At the Ann Road intersection, the RCB facility will be stubbed for future extension north in El Capitan Way. (future CCRFD Facilities GOEC 0100, 0126, 0151, and 0176).
4. The proposed alignment and function of the mainline facility are in conformance with the CCRFCD *Las Vegas Flood Control Master Plan* as outlined in the 2013 MPU. The proposed improvements will intercept flows currently impacting properties west of El Capitan Way between Lone Mountain Road and Ann Road.
5. The Gowan North - El Capitan Branch, Lone Mountain Road to Ann Road facilities will have design flows beginning with 724 cfs at the upstream end at Ann Road. The peak flow at the downstream end at Lone Mountain Road will have a calculated design flow of 1,154 cfs where the system ties into the Gowan North Channel Phase III facility. The Gowan North Channel Phase III facility is designed to convey a 100-year flow of 1,240 cfs.
6. The Project proposes to construct approximately one (1) mile of CCRFCD Facilities GOEC 0000, 0026, 0051, 0076, and a stub for 0100.
7. The proposed improvements do not significantly alter existing peak flows or the character of flows downstream of the Gowan North – El Capitan Branch Lone Mountain Road to Ann Road improvements. Specifically, the peak outflow (1,154 cfs) at the downstream end of Gowan North – El Capitan

Branch Lone Mountain Road to Ann Road is less than the peak inflow (1,240 cfs) at the upstream end of Gowan North Channel Phase III.

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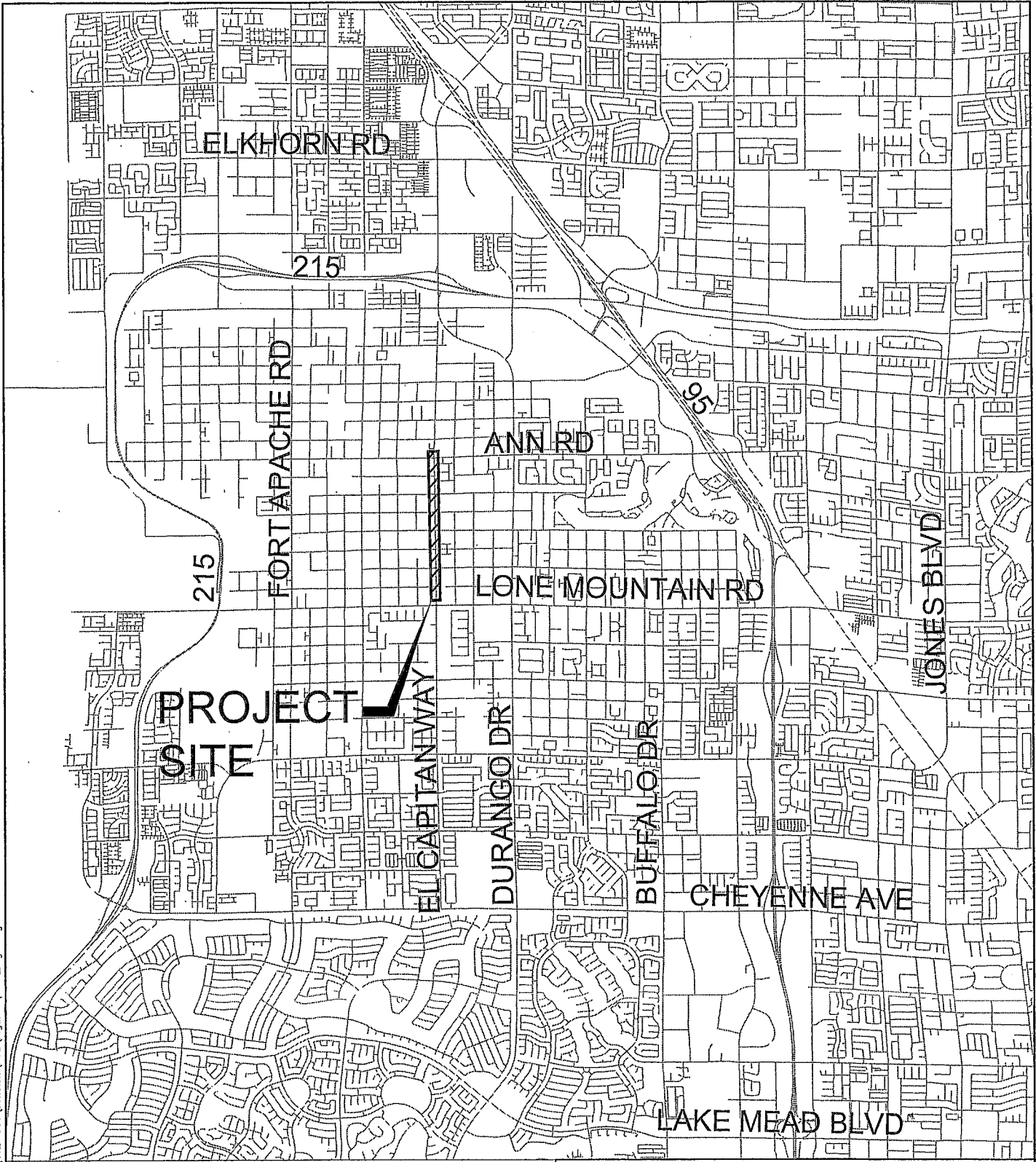
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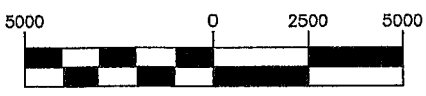
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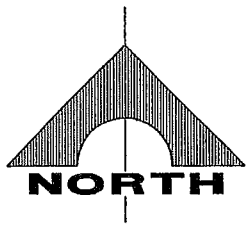


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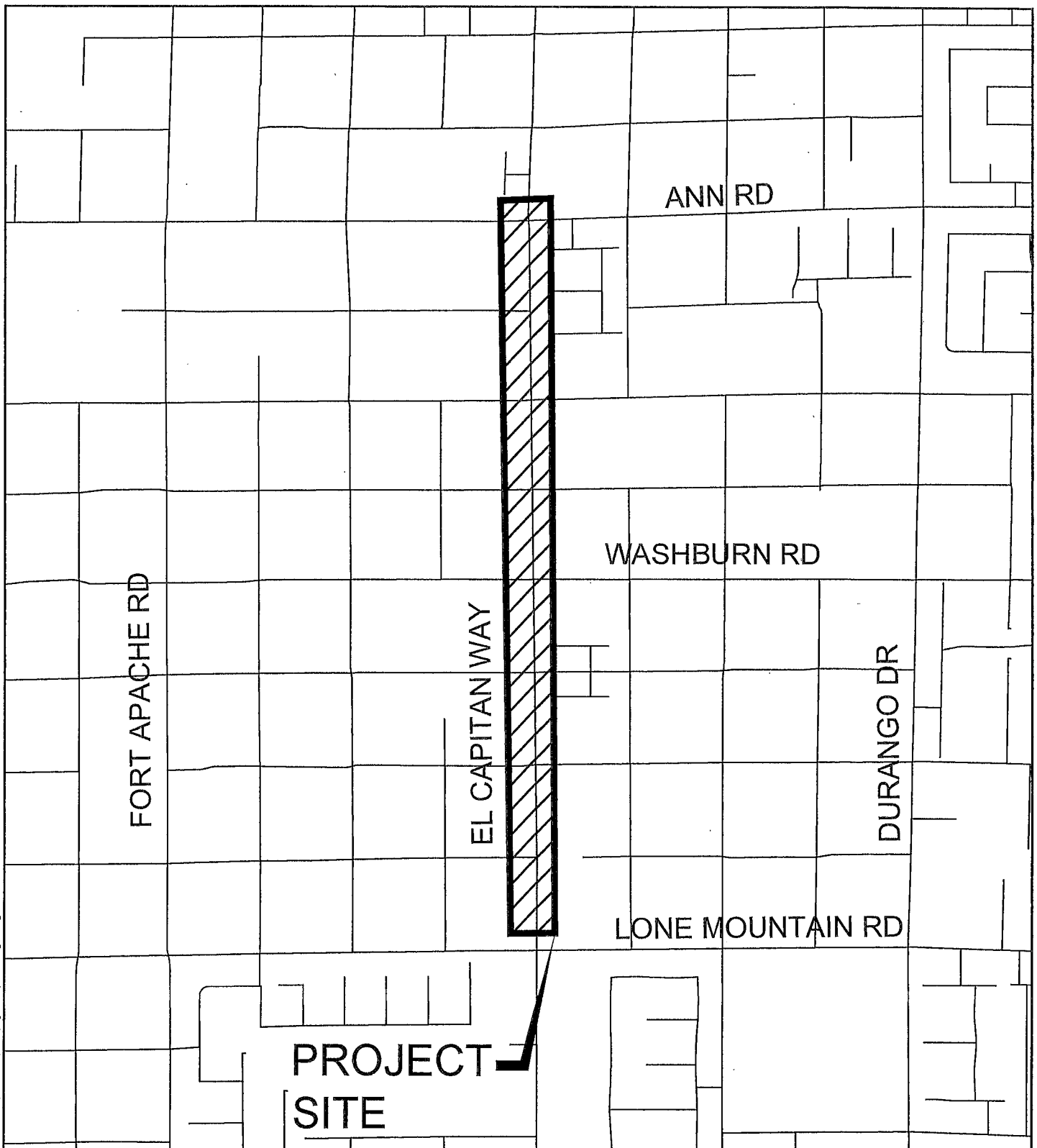
CITY OF LAS VEGAS
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VICINITY MAP

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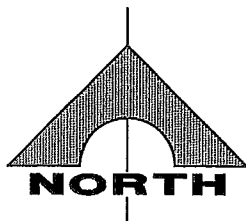


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LOCATION MAP

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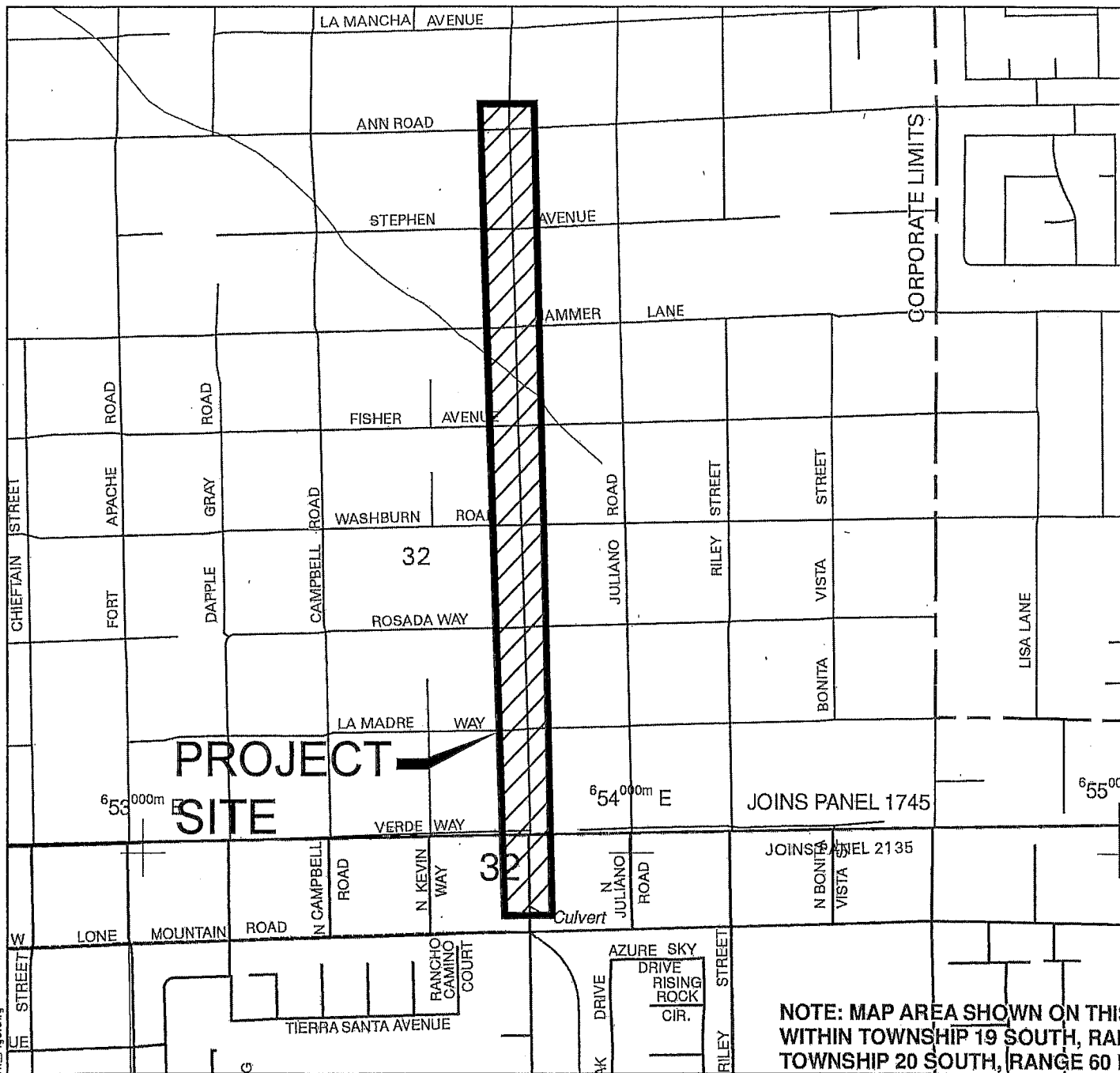
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PANEL 1745 E

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

PANEL 1745 OF 4090
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

COMMUNITY	NUMBER	PANEL	DATE
LAS VEGAS, CITY OF	32078	1746	E
UNINCORPORATED AREAS	32083	1746	C

Map Number 32003C1745 E
Map Revised: SEPTEMBER 27, 2002

Federal Emergency Management Agency

PANEL 2135F

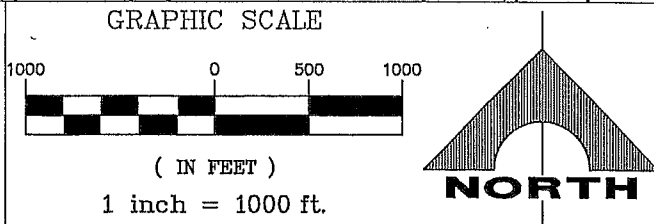
FIRM
FLOOD INSURANCE RATE MAP
CLARK COUNTY,
NEVADA
AND INCORPORATED AREAS

PANEL 2135 OF 4090
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

COMMUNITY	NUMBER	PANEL	DATE
LAS VEGAS, CITY OF	32078	2135	F
UNINCORPORATED AREAS	32083	2135	F

Map Number 32003C2135F
Map Revised: NOVEMBER 16, 2011

Federal Emergency Management Agency



CITY OF LAS VEGAS
GOWAN NORTH - EL CAPITAN BRANCH
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FIGURE 3
F.I.R.M.

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V. FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)

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- ♦ Gowan North – El Capitan Branch (GOEC 0000, 0026, 0051, 0076, 0100)

CCRFCD Facilities to be constructed with this project include: GOEC 0000, 0026, 0051 and 0076.

VII. SURVEY SUMMARY

As part of the 30 percent design process, extensive survey data has been gathered as a basis for design. Aerial mapping and topographic information at a contour interval of 1 foot were acquired. In addition, an extensive ground survey was completed to gather horizontal and vertical data for points at key locations along the project corridor.

The project control survey was performed using GPS fast static survey techniques. Multiple baseline observations exist for each controlling point. A GPS Real Time Kinematic (RTK) adjustment was performed from the control survey and is the basis for collection of additional topographic data. Points were gathered for surface features including but not limited to edge of asphalt, utility valves, vaults, pull boxes, manholes, driveways, swing gates, and street signs.

Multiple benchmarks are used to vertically tie the project to City of Las Vegas Vertical Control 2008 published values. All elevation data are based on 1988 North American Vertical Datum (NAVD 88). Horizontal control is referenced to NAD83/2002 Nevada East Zone (2701) State Plane Coordinates published values for Las Vegas Valley Water District Continuously Operating Reference Station NVCA and NVTP. A local ground coordinate system was established as shown on the Record of Survey for this project. A copy of the Preliminary Record of Survey is included with the 30 percent improvements plan set.

VIII. RIGHT-OF-WAY AND EASEMENT SUMMARY

An exhibit included in Appendix D identifies proposed right-of-way required for the project with the 30 percent design. A summary table of the areas is included on the figure, consisting of the following parcels:

125-32-802-020 – Fernandez M & E Family Trust and Fernandez Esteban & Mary
Co-TRS
125-32-302-010 – USA
125-32-204-005 – Hammer-El Capitan LLC
125-32-102-029 – USA

Full street right-of-way is available along the remaining length of the El Capitan Way corridor within the project limits. The estimated construction limits are shown on the plan and profile sheets in the 30 percent plan set.

The majority of the land adjacent to the project area is developed. However the following private parcels have been identified in the vicinity of the project as potential staging areas with direct access to the project site.

125-32-802-020 – Fernandez M & E Family Trust and Fernandez Esteban & Mary
Co-TRS – 2.5 acres

125-32-302-012 – Steward, Faith – 0.5 acres

125-32-204-005 – Hammer-El Capitan LLC – 2.5 acres

125-32-102-031 – Liao Lih-Nan & Shu-Chen – 0.96 acres

IX. HYDROLOGY

The methodology presented in this study is in compliance with the Manual (Reference 8). Hydrologic models for the interim and ultimate conditions provided with this report reflect current development and future planned development. The 2013 MPU, 1999 NWNS and improvements for local developments adjacent to and upstream of the proposed El Capitan Way improvements were reviewed and pertinent drainage patterns were incorporated into the models. In general, the proposed subbasins and drainage patterns are consistent with the 2013 MPU and 1999 NWNS. Current land uses and curve numbers have been determined using data and procedures developed in the 2013 MPU. An Exhibit showing the location and name of the referenced studies has been included in Appendix A. Pertinent reference material has been included in Appendix K.

Model Description – The watersheds were modeled using the SCS Unit Hydrograph method within the *U. S. Army Corps of Engineers HEC-1 Flood Hydrograph Package* (Reference 9).

Precipitation - The project site lies outside the McCarran Rainfall Area as delineated in the Manual. Point precipitation values for the 100-year return period storm were referenced from the CCRFCD GIS coverage developed with the MPU. Rainfall values range between 2.94 and 2.97 inches.

The total drainage area tributary to the Gowan North – El Capitan Branch System, is less than 8 square miles, an SDN 3 design storm was selected for use in the HEC-1 computer model.

Curve Numbers (CN) – The project site lies within the area covered by *Soil Survey of Clark County Area, Nevada* (Reference 10) and *Soil Survey of Las Vegas Valley Area, Nevada, Part of Clark County* (Reference 11). These surveys delineate families of soil types and Hydrologic Soil Group (HSG) of each family. A soils map containing the project site is included in Appendix A. The soils classifications for the site have been revised since the release of the 2013 MPU. A copy of the soil survey has been included in Appendix A. The soil classification used in the curve number calculations has been revised accordingly. The soils report shows that the project area consists of Soil Type 190 (Dalian very gravelly fine sandy loam), Soil Type 191 (Dalian very cobbly fine sandy loam) and Soil Type 400 (Tencee very gravelly fine sandy loam). The hydrologic characteristics of Soil Type 190 consist of 100 percent HSG Type “A”. This differs from the previous soil which consisted of 10 percent HSG Type “A”, 85 percent Type “B” and 5 percent Type “D”. The hydrologic characteristics of soil type 191 consist of 100 percent HSG Type “A”. This differs from the previous soil which consisted of 5 percent HSG Type “A”, 85 percent Type “B” and 10 percent Type “D”. The hydrologic characteristics of soil type 400 consist of 100 percent HSG Type “D”. This differs from the previous soil which consisted of 10 percent HSG Type “B” and 90 percent HSG Type “D”. The following table compares previous curve numbers to the current curve numbers based on the revised soil classification breakdown.

TABLE 1 PERVIOUS AREA CURVE NUMBERS COMPARISON TABLE				
	MPU Soils Data		2014 Soils Data	
MAP UNIT	CN1*	CN2**	CN1*	CN2**
190	76	60	63	39
191	77	62	63	39
400	87	78	88	80

*Desert Shrub Poor, Hydrologic Condition

**Landscaped, Lawns, Trees, Good Hydrologic Condition

The table indicates that Condition 2 Curve Number (CN2 - landscaped, lawns, trees in good hydrologic condition) values are reduced from 60 to 39, and from 62 to 39,

for Soils Type 190 and 191, respectively based on the revised soil classification breakdown. Preliminary hydrology results using latest soils information significantly reduced flow rates in El Capitan Way during the Ultimate Conditions. Flow rates were essentially reduced by more than half of the 2008 MPU. As discussed with CLV and CCRFCD during a meeting on July 28, 2016 and subsequent correspondence, the Condition 2 Curve Number was revised from Landscaped, Lawns, Trees, GOOD Hydrologic Condition, to Landscaped, Lawns, Trees, POOR Hydrologic Condition for the purpose of this project specific hydrology.

TABLE 2 PERVIOUS AREA CURVE NUMBERS COMPARISON TABLE						
	MPU Soils Data		2014 Soils Data		2014 Soils Data (Poor Condition)	
MAP UNIT	CN1*	CN2**	CN1*	CN2**	CN1*	CN2***
190	76	60	63	39	63	68
191	77	62	63	39	63	68
400	87	78	88	80	88	89

* CN1 = Desert Shrub Poor, Hydrologic Condition

** CN2 = Landscaped, Lawns, Trees, GOOD Hydrologic Condition

***CN2 = Landscaped, Lawns, Trees, POOR Hydrologic Condition

As a result of the revisions, resulting peak flows impacting the project are more comparable to those presented in the MPU.

Drainage Areas and Flow Patterns - The onsite and offsite subbasins and flow patterns used in the hydrologic modeling are based on the 2013 MPU Ultimate Conditions Hydrologic Basin Map and the Clark County GIS Management Office (GISMO) 5-foot contour files.

Lag Time - The lag time (TLAG) is described as the time between the center of mass of rainfall and the time of peak discharge from a basin. Lag time can be related to time of concentration (Tc) by the following relationship: $TLAG = 0.6 (Tc)$. The time of concentration (Tc) is defined as the time required for runoff to flow from the most hydraulically distant area of the basin to the outlet of the basin or to a design point. The procedure for calculating Tc is outlined in Section 602 of the Manual. Lag time calculations for the drainage subbasins are included in Appendix A on Standard Form 4.

X. EXISTING/INTERIM CONDITIONS HYDROLOGIC MODEL

Existing conditions drainage subbasins and flow patterns impacting the project area along El Capitan Way are shown on Figure 5. The HEC-1 model was prepared based on existing topography, review of reference studies in the upstream tributary areas shown on Exhibit 1 and field visit to observe potential flow patterns.

The existing tributary area impacting the project site under existing/interim conditions originates along the 215 Western Beltway, currently under construction, sloping generally in a southeast direction at between 2 and 5 percent. Due to the rural nature of the area with sparse disjointed developments located between undeveloped parcels, rural streets, and lack of defined washes, the flow patterns through the region are not well established. As a result, some of the offsite flow patterns assumed in the reference studies reviewed for this project may not be consistent with the flow patterns used for this project's hydrology. In general, and as good engineering practice, the reference drainage studies tended to be conservative in nature, accounting for the potential for upstream offsite flows to drain towards their project site. However, using the same reference flow patterns were not always conservative if assumed for this project. Therefore, when flow patterns through the region were not well established via topography, review of reference improvement plans, and/or site visit inspection, the project hydrology followed the same conservative tendency for the purpose of sizing the mainline storm drain facility. Specifically, when flows entered a major intersection, and the outflow direction was not clear or well established, it was assumed that flows generally followed a west to east direction, instead of a north to south direction. In this way, the offsite flows would tend to reach El Capitan Way further upstream and the proposed mainline storm drain would be sized accordingly to convey that flow. This is a conservative assumption, making the system adequately sized if future development or actual flow patterns brought flows to El Capitan Way towards the upstream end of the system. The system would still be adequately sized if future development brought the flows into the system further downstream, or entered the Lone Mountain system instead of the proposed El Capitan system.

The existing regional storm drain system in Lone Mountain Road west of El Capitan Way, constructed as Gowan North Channel Phase IV Las Vegas Beltway to El

Capitan Way, also took the similar conservative approach as stated in the final design report:

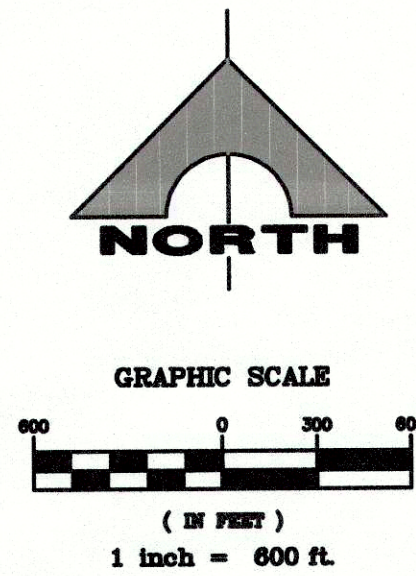
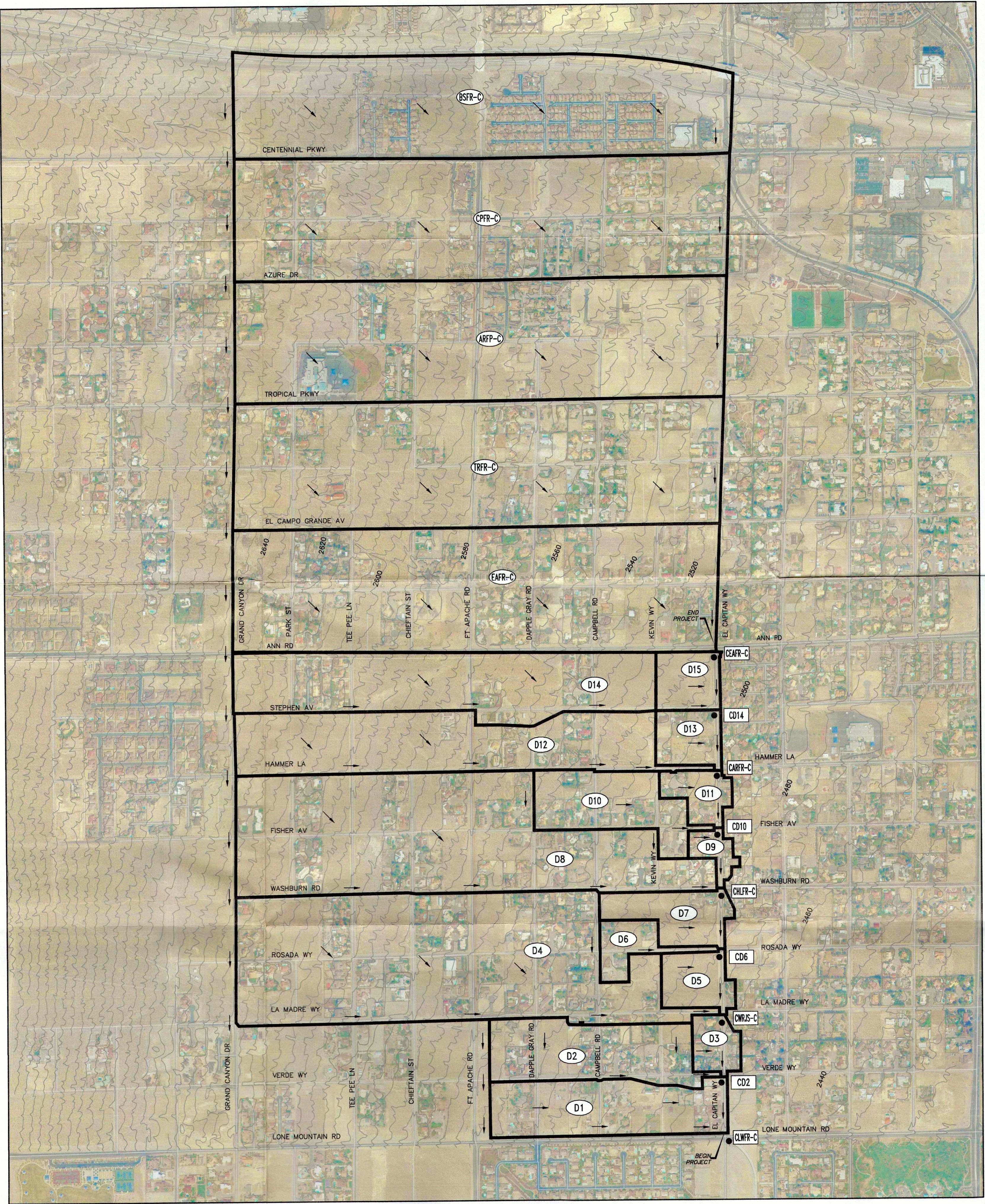
“MPU basins ARFR-C, HLFR-C, WRJS-C, and LWFR-C were prorated for areas west of Fort Apache and the total flow for these prorated areas was used in determining a conservative value for flows that could be conveyed down Fort Apache Road to Lone Mountain. This flow (265 cfs) was used to size the lateral that will be installed and stubbed as a part of this project for future connection. It should be noted that the prorated flow used to determine the lateral size is 21 percent of the total MPU flow in El Capitan Way. It is not likely that all of this flow will be captured by local facilities and conveyed into the Gowan North Channel Phase IV facilities, but since the upstream intersection facilities for Fort Apache Road have not been designed, the total prorated flow for that area was used to conservatively size the Gowan North Channel lateral at Fort Apache Road...”

Using these conservative assumptions in both the proposed Gowan North - El Capitan Branch, Lone Mountain Road to Ann Road project and the existing Gowan North Channel Phase IV project provide the flexibility as the upstream area develops, and future flow patterns become better established. Both the existing Lone Mountain Road system and the proposed El Capitan Way system converge at the intersection of Lone Mountain Road and El Capitan Way.

XI ULTIMATE CONDITIONS HYDROLOGIC MODEL

Ultimate conditions drainage subbasins and flow patterns are shown on Figure 6. The ultimate conditions hydrologic analysis is based on the 2013 MPU subbasins, with further subdividing to determine design 100-year flow rates at key intersection inflow points. Subbasins north of Ann Road remain the same as MPU basins with the exception of modifications and incorporating the updated curve number/soils information as previously discussed.

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- D1 SUBBASIN NAME
- SUBBASIN BOUNDARY
- CD14 CONCENTRATION POINT
- FLOW DIRECTION

SUMMARY OF ULTIMATE CONDITIONS HEC-1 MODEL		
SB OR CP	AREA (AC)	100 YR (CFS)
BSFR-C	132.59	201
CPFR-C	160.61	145
ARFR-C	157.76	144
TRFR-C	163.86	157
EAFR-C	159.29	151
CCEFR-C	-	724
D14	69.30	90
D15	9.90	16
CD14	-	805
D12	65.90	63
D13	9.60	16
CARFR-C	-	883
D10	24.50	30
D11	7.90	11
CD10	-	907
D8	121.10	118
D9	4.40	6
CHLFR-C	-	1018
D6	8.40	10
D7	14.90	18
CD6	-	1033
D4	136.30	124
D5	10.30	13
CWRJS-C	-	1154
D2	32.90	37
D3	6.90	9
CD2	-	1124
D1	33.90	39
CLWFR-C	-	1149

Under ultimate conditions, Grand Canyon Drive serves as the westerly boundary since a future regional facility in Grand Canyon Drive will intercept flows west of Grand Canyon Drive.

Additionally, it is assumed under ultimate conditions that the proposed system is extended north of Ann Road to the northern beltway.

An area of approximately 84 acres, bound by Grand Canyon Drive, La Madre Way, Fort Apache Road, and Lone Mountain Road enters the Lone Mountain Road system instead of the proposed El Capitan Way system due to a recent development currently under construction at the northeast corner of Lone Mountain Road and Fort Apache Road. Although MPU Subbasin LWFR-C (MPU Figure H-19) indicates the 84 acre area to be conveyed to the El Capitan Way system, the area is no longer able to continue east due to this development, thus the area has been removed from the ultimate condition hydrologic analysis. Pertinent reference material from the Technical Drainage Study for Lone Mountain and Fort Apache, by Taney Engineering, approved on August 4, 2015 by CCPW is included in Appendix K. As described previously under existing/interim conditions, this scenario of flows draining south in Fort Apache to the Lone Mountain Road storm drain (Gowan North Channel Phase IV Las Vegas Beltway to El Capitan Way project) instead of east to El Capitan Way has already been accounted for in the Lone Mountain storm drain system and Fort Apache Road storm drain lateral.

As discussed under existing/interim conditions, the flow patterns through the region are not well established due to the rural nature of the area with sparse disjointed developments located between undeveloped parcels, rural streets, and lack of defined washes. The subbasin delineations were generally based on the MPU Subbasins ARFR-C, HLFR-C, WRJS-C, and LWFR-C flow patterns (MPU Figure H-19). This was a preferable conservative assumption since these subbasins assumed that flows generally followed a west to east direction, instead of a north to south direction. In this way, the offsite flows would tend to reach El Capitan Way further upstream and the proposed mainline storm drain would be sized accordingly to convey that flow. This is a conservative assumption since the system would be adequately sized if future development or actual flow patterns brought flows to El

Capitan Way further downstream than anticipated or entered the Lone Mountain system instead of the proposed El Capitan Way system.

As discussed under existing/interim conditions, using these conservative assumptions in both the proposed El Capitan Way project and the existing Gowan North Channel Phase IV project provides the flexibility as the upstream area develops, and future flow patterns become better established. Both the existing Lone Mountain Road system and the proposed El Capitan Way converge at the intersection of Lone Mountain Road and El Capitan Way.

The 1999 CLV Northwest Neighborhood Study was also evaluated to compare storm drain facility flow rates at intersections along El Capitan Way to compare against ultimate conditions project hydrology.

Ultimate conditions yielded the highest flow rates in the mainline when compared to the existing/interim conditions hydrology and the 1999 Northwest Neighborhood Study. A comparison of the 100-year flow rates along the mainline storm drain is summarized in the following table:

TABLE 3 EL CAPITAN WAY MAINLINE 100-YEAR FLOW SUMMARY COMPARISON TABLE				
Location	100-Year Flow Rates (cfs)			
	Existing/Interim Condition	Ultimate Condition	1999 CLV NW Neighborhood Study	2013 MPU
Ann Road	416	724	670	745
Stephen Ave	446	805	-	
Hammer Lane	460	883	760	894
Fisher Ave	475	907	-	
Washburn Road	647	1,018	850	1,027
Rosada Way	654	1,033	-	
La Madre Way	760	1,154	953	1,162
Verde Way	762	1,154	-	
Lone Mountain Road	785	1,154	-	1,233

BOLD values: Design flow rates used for mainline facility sizing

XII STREET HYDRAULICS

Although this project does not include street improvements, the installation of facilities within Lone Mountain Road does include laterals for future drop inlets that will allow the fully improved roadway to comply with regional criteria. As a result,

normal depth cross sections will be performed at 70 percent in order to analyze, DxV, and future dry lane criteria.

XIII REGIONAL FLOOD CONTROL FACILITY DESIGN

Gowan North - El Capitan Branch, Lone Mountain Road to Ann Road Facilities -

The system extends north in El Capitan Way from Lone Mountain Road to just north of Ann Road. Refer to Figure 7 for the flood control facilities map.

Mainline Facilities

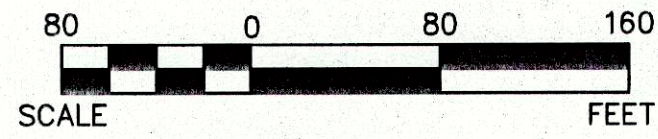
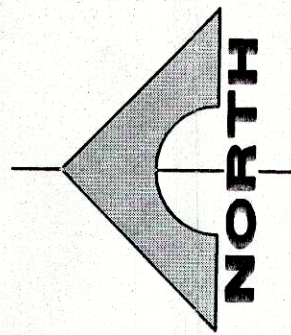
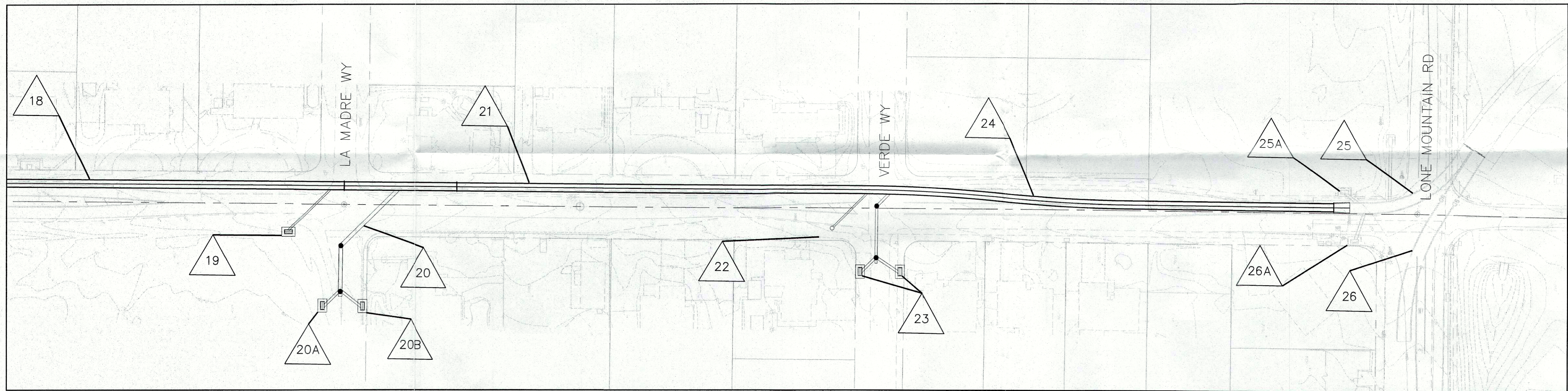
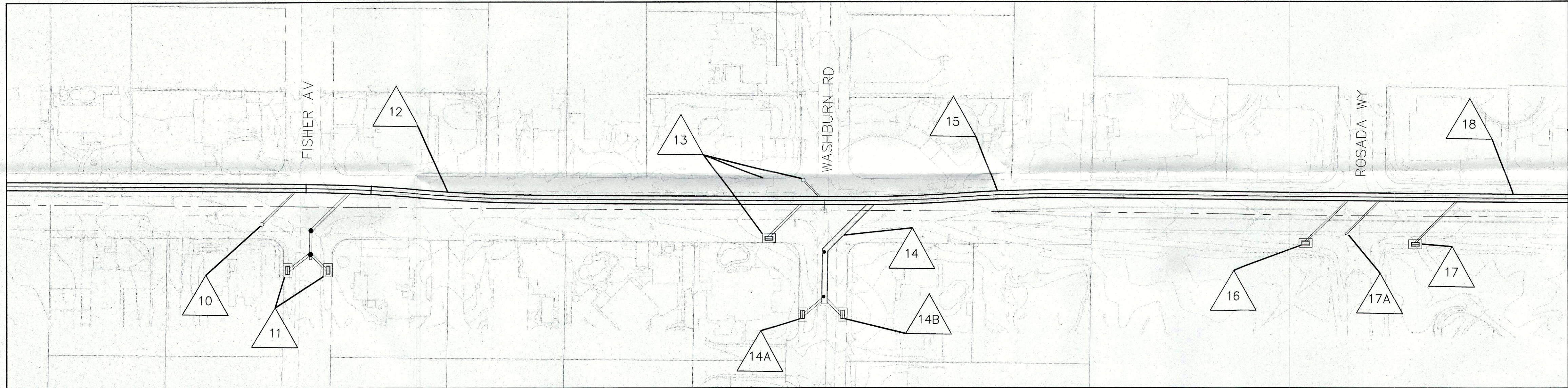
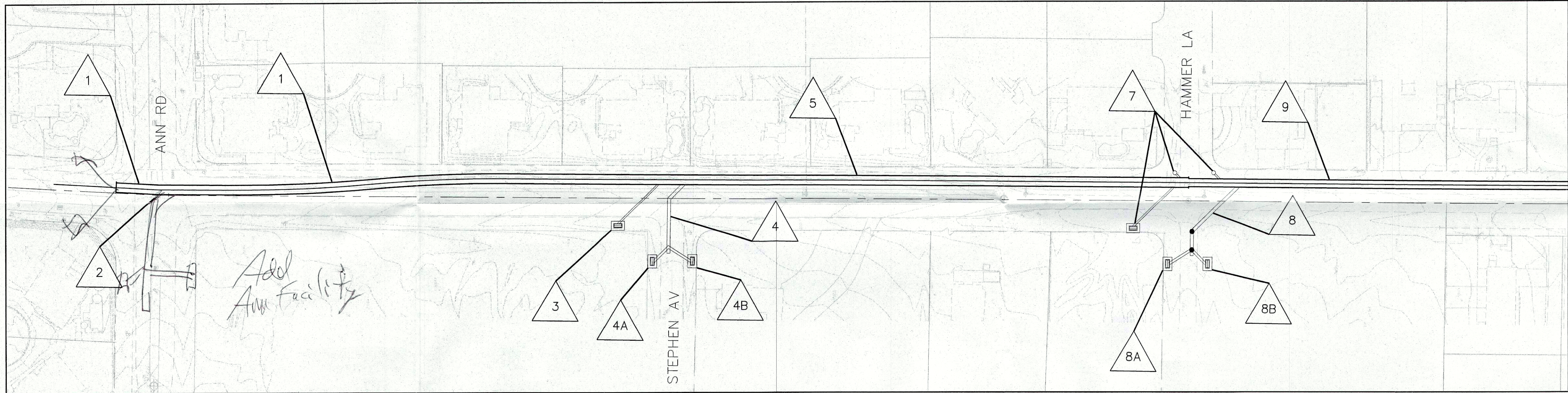
TABLE 4 MAINLINE FACILITIES SUMMARY			
Location	Design Flow (cfs)	Location	Facility
Ann Road	724	Ann Road to Hammer Lane	12'x6' RCB
Stephen Ave	805		
Hammer Lane	883		
Fisher Ave	907	Hammer Lane to Washburn Road	10'x7' RCB
Washburn Road	1,018		
Rosada Way	1,033	Washburn Road to Lone Mountain Road	10'x8' RCB
La Madre Way	1,154		
Verde Way	1,154		
Lone Mountain Road	1,154		

A preliminary WSPG hydraulic analysis is included in Appendix B. The hydraulic analyses results show that the system is generally partially surcharged as laterals bring side flows into the system, but return to open channel flow within the pipe. At the upstream end of the system between Hammer Lane and Ann Road where the RCB slope is minimized to clear existing utilities, the pipe remains surcharged; however, the RCB system and HGL is deep underground. Once the system is extended north in the future and lifted to a typical depth of cover and slope closer to existing grade, it is anticipated that the future system extension will be alleviated of the surcharged condition.

Storm Drain Laterals and Area Inlets

Because El Capitan Way is not proposed to be improved in the immediate future and existing improvements do not include curb and gutter, with the exception of the southwest corner of El Capitan Way and La Madre Way, temporary area inlets will be installed at future drop inlet tie in locations. Inlets along La Madre Way curb and

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FACILITY LOCATION

FLOOD PROTECTION FACILITIES			
LOCATION	Q ₁₀₀ INT (cfs)	Q ₁₀₀ ULT (cfs)	FACILITY
1	416	724	12-FOOT BY 6-FOOT RCB
2	-	-	36-INCH STUB FOR FUTURE USE
3	2	16	AREA DRAIN INLET W/ 24-INCH RCP
4A	17	45	AREA DRAIN INLET W/ 36-INCH RCP
4B	17	45	AREA DRAIN INLET W/ 36-INCH RCP
4	34	90	48-INCH RCP
5	446	805	12-FOOT BY 6-FOOT RCB
7	16	16	THREE (3) - AREA DRAIN INLETS W/ 24-INCH RCP
8A	10	42	AREA DRAIN INLETS W/ 36-INCH RCP
8B	10	42	AREA DRAIN INLETS W/ 36-INCH RCP
8	19	83	48-INCH RCP
9	460	883	10-FOOT BY 7-FOOT RCB
10	11	11	AREA DRAIN INLET W/ 24-INCH RCP
11	30	30	TWO (2) - AREA DRAIN INLETS W/ 36-INCH RCP
12	475	907	10-FOOT BY 7-FOOT RCB
13	7	6	(3) AREA DRAIN INLETS W/ 24-INCH RCP
14A	125	59	AREA DRAIN INLETS W/ 36-INCH RCP
14B	125	59	AREA DRAIN INLETS W/ 36-INCH RCP
14	250	118	6-FOOT BY 4-FOOT RCB
15	647	1,018	10-FOOT BY 7-FOOT RCB
16	5	18	AREA DRAIN INLET W/ 24-INCH RCP
17	11	10	AREA DRAIN INLET W/ 24-INCH RCP
17A	11	10	24-INCH RCP STUB FOR FUTURE USE
18	654	1,033	10-FOOT BY 7-FOOT RCB
19	4	13	AREA DRAIN INLET W/ 24-INCH RCP
20	134	124	TWO (2) - AREA DRAIN INLETS W/ 24-INCH RCP
20A	67	62	AREA DRAIN INLET W/ 36-INCH RCP
20B	67	62	TYPE CM2 DROP INLET W/ 36-INCH RCP
21	760	1,154	10-FOOT BY 8-FOOT RCB
22	10	9	AREA DRAIN INLET W/ 24-INCH RCP
23	38	37	(2) AREA DRAIN INLETS W/ 36-INCH RCP
24	762	1,154	10-FOOT BY 8-FOOT RCB
25	785	1,154	EXISTING 12-FOOT BY 5-FOOT RCB
25A	-	-	EXISTING AREA DRAIN W/ 36-INCH RCP
26	-	1,540	EXISTING 13-FOOT BY 5-FOOT RCB

CITY OF LAS VEGAS

GOWAN NORTH - EL CAPTAIN BRANCH LONE MOUNTAIN ROAD TO ANN ROAD

FIGURE 7
FACILITIES MAP

DRAWING
FIG7

OF
SHTS

DESIGN: 1555 S. RAINBOW BLVD.
DRAWN: LAS VEGAS, NV 89146
CHECK: T: 702.804.2000
ISSUE DATE: F: 702.804.2299
ISSUE EDITOR: gowengineering.com
PLOT DATE: 09-19-16
PLOT TIME: 14:37:12

REVISIONS
REV. DATE DESCRIPTION

DATE AGENT DATE GOW APP. DATE

gutter will be Type CM drop inlets. Laterals and temporary area inlets (using NDOT Type 2B grate geometry) will be designed based on the higher flow produced by the ultimate or interim condition hydrologic analyses. For this 30 percent submittal, normal depth calculations were used to estimate storm drain lateral sizes, using a 1% design slope and assuming a minimum of 6-inches of freeboard within the storm drain. Area inlet sizing calculations and further refined hydraulic analysis will be performed for the storm drain laterals in later submittals. Laterals will be provided at the following intersections:

TABLE 5 LATERAL SUMMARY			
Lateral Location	Ultimate Design Flow (cfs)	Interim Design Flow (cfs)	Facility
Ann Road	63 cfs per NWNS	-	36-inch RCP per NWNS
Stephen Ave	90	34	48-inch RCP
Hammer Lane	83	19	48-inch RCP
Fisher Ave	30	30	36-inch RCP
Washburn Road	118	250	6'x4' RCB
Rosada Way	10	11	24-inch RCP
La Madre Way	124	134	54-inch RCP
Verde Way	37	38	36-inch RCP
Lone Mountain Road	39	0	Existing inlets at El Capitan Way

BOLD values: Design flow rates used for lateral facility sizing

The 1999 City of Las Vegas NWNS proposes to install local facilities that tie into the Gowan North El Capitan Branch system at Ann Road (36-inch RCP), and Washburn Road (24-inch RCP). This project will install storm drain laterals at those locations that will connect to future local facilities.

Since the facility is located within CCPW jurisdiction, CCPW requested that considerations be made for storm drain lateral alignments and area inlet placements such that future Type CM drop inlets could be constructed without requiring relocation of the storm drain laterals. Area inlet catch basins were placed a minimum of 13-feet away from intersection's future back of curb returns (BCRs), based on Standard Drawing 201, which accounted for the NDOT Type 2B inlets to have a 3-ft concrete apron and remain 10-ft away from the BCR, and for the future Type CM drop inlet 3-ft gutter wings to remain 10-ft from the BCR. In some intersections (such as at Washburn, and at Hammer) where placing area inlets based on future street improvements appeared problematic during interim conditions (placing inlet too close

to an existing property wall for example), smaller area inlets were proposed at locations that were reasonable for the interim condition, with the assumption that future laterals and drop inlets will be constructed if/when the roadway widens to full street improvements.

The area inlets used for the project have catch basin sump dimensions that are based on standard Type CM2 drop inlets per Standard Drawing 412.1, assuming an "L" dimension of 10-ft (3 grates) and a width of 4-ft. The intent of utilizing the Type CM drop inlet dimension is to provide opportunity for the tops of the area inlets to be removed and replaced with Type CM drop inlets if/when the streets are improved with curb and gutters at the request of CCPW. The area inlets include NDOT Type 2B style grates and a concrete apron around the inlets.

Horizontal and vertical layout of proposed laterals with clearances across existing utilities (including an existing parallel 36-inch SNWA waterline in El Capitan Way) will be done at 70 percent once the potholes are completed. Relocation of the existing 36-inch SNWA waterline is estimated to be approximately \$500K to \$600K, and will be avoided during the project design unless absolutely necessary.

Pavement Replacement

The project will consist of removal and replacement of existing pavement due to trenching during construction. No additional widening will be performed. El Capitan Way shall remain open for local traffic. Gravel access will be sufficient for local access during construction.

XIV. CONCLUSIONS AND RECOMMENDATIONS

1. Methodology in this report is in compliance with Clark County Regional Flood Control District (CCRFCDD) criteria.
2. The project facilities are not located in a FEMA-designated Special Flood Hazard Area.
3. The Gowan North - El Capitan Branch, Lone Mountain Road to Ann Road facilities connect to the existing Gowan North Channel Phase III facilities (existing Facility GONO 0183) at the intersection of Lone Mountain Road and El Capitan Way at the downstream end. At the Ann Road intersection, the RCB facility will be stubbed for future extension north in El Capitan Way. (future CCRFD Facilities GOEC 0100, 0126, 0151, and 0176).
4. The proposed alignment and function of the mainline facility are in conformance with the CCRFCDD *Las Vegas Flood Control Master Plan* as outlined in the 2013 MPU. The proposed improvements will intercept flows currently impacting properties west of El Capitan Way between Lone Mountain Road and Ann Road.
5. The Gowan North - El Capitan Branch, Lone Mountain Road to Ann Road facilities will have design flows beginning with 724 cfs at the upstream end at Ann Road. The peak flow at the downstream end at Lone Mountain Road will have a calculated design flow of 1,154 cfs where the system ties into the Gowan North Channel Phase III facility. The Gowan North Channel Phase III facility is designed to convey a 100-year flow of 1,240 cfs.
6. The Project proposes to construct approximately one (1) mile of CCRFCDD Facilities GOEC 0000, 0026, 0051, 0076, and a stub for 0100.
7. The proposed improvements do not significantly alter existing peak flows or the character of flows downstream of the Gowan North – El Capitan Branch, Lone Mountain Road to Ann Road improvements. Specifically, the peak outflow (1,154 cfs) at the downstream end of Gowan North – El Capitan

Branch Lone Mountain Road to Ann Road is less than the peak inflow (1,240 cfs) at the upstream end of Gowan North Channel Phase III.

8. The project provides temporary area inlets at key locations along the Project alignment to help reduce surface flows along El Capitan Way. Future local storm facilities, inlets, and storm drains will be installed as the roadway develops to full street improvements.
9. A preliminary cost estimate for the project is included in Appendix F with a estimate construction cost of \$8,800,480.

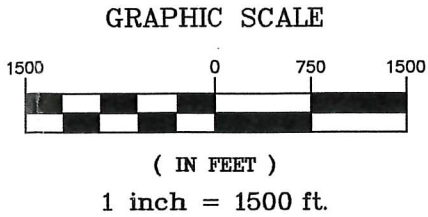
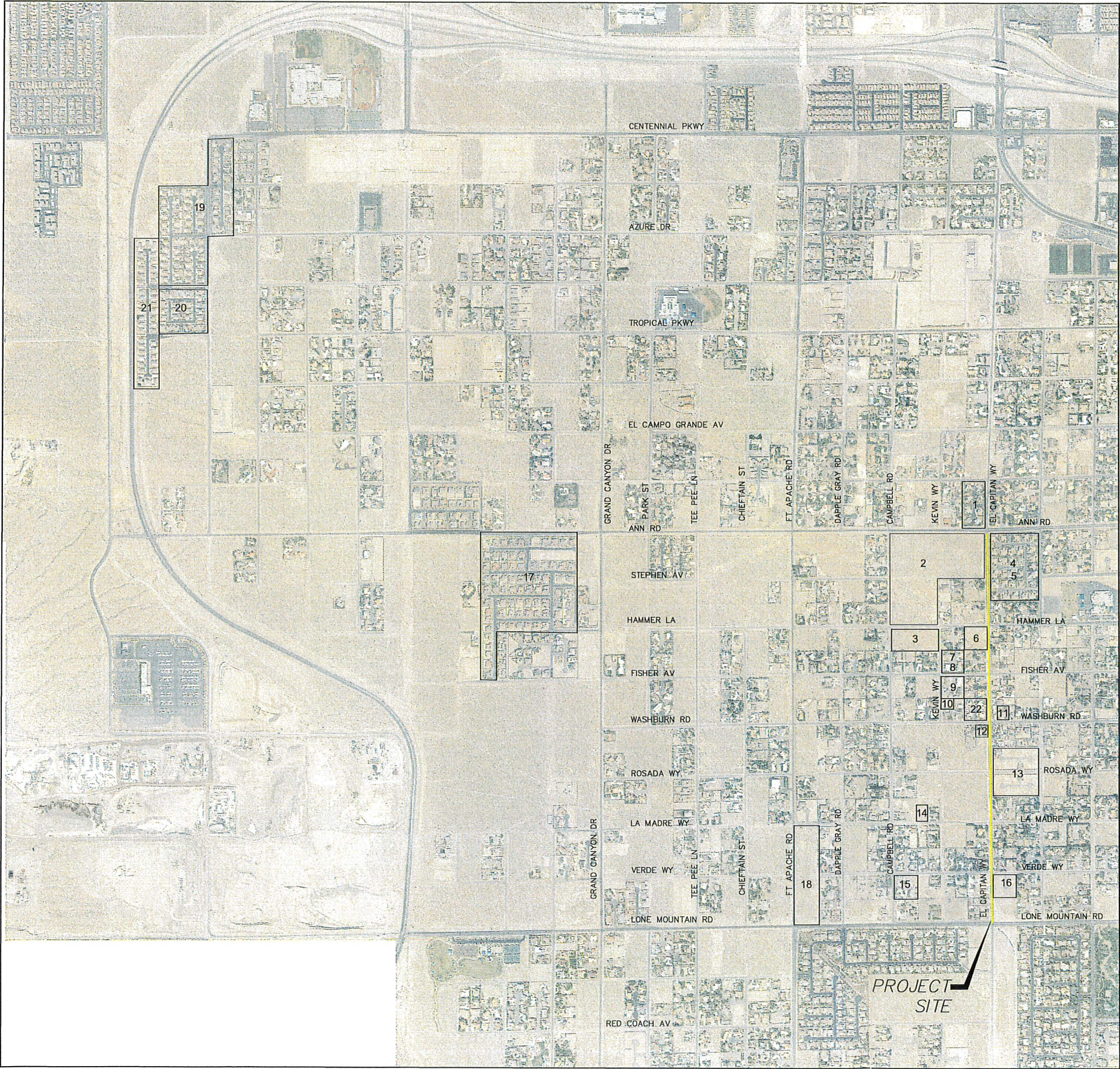
XV. REFERENCES

1. PBS&J, *2013 Clark county Regional Flood Control District (CCRFCD) Las Vegas Valley Flood Control Master Plan Update*, 2013.
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5. Louis Berger Group, Inc., *Preliminary Hydraulic Design Report for the Western Segment Las Vegas Beltway Ann Road to El Capitan Way Initial Improvements*, March 2002.
6. CH2MHILL, *90% Onsite Drainage Technical Memorandum Western Clark County 215 Bruce Woodbury Beltway Craig Road to Hualapai Way*, July 2008.
7. Tanney Engineering, *Technical Drainage Study for Lone Mountain and Fort Apache Residential Development*, 2014.
8. Clark County Regional Flood Control District. *Hydrologic Criteria and Drainage Design Manual*. August 1999.
9. U.S. Army Corps of Engineers. *HEC-1 Flood Hydrograph Package*. Revised June 1998.
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APPENDIX A

Hydrologic Analysis

09-14-16 17:45:21 F:\Projects\400\412-661\Division\Ext\Figures\GCW\Exhibit_1--Key-Map-Adjacent Projects Exhibit.dwg mcsstell



LEGEND

1 TDS LOCATION NUMBER

TDS #	Development	H.T.E. #
1	Ann/El Capitan Estates	99-10007
2*	Ann/Campbell Middle School	00-3191
3*	Hammer & Kevin Residential Dev.	13-24525
4	Ann/El Capitan Estates	03-18653
5	Silverstone	02-21183
6*	Hammer & El Capitan	15-44594
7	Ray Thom Parcel Map	99-10974
8	NPM 19-99	00-32556
9	MSM 0010-03	03-18823
10	MSM 0171-05	05-42448
11	Washburn/El Capitan	99-33648
12	MSM 0263-04	05-02586
13	Scenic Brook Estates	04-47321
14	Jeff Adams 1979 Trust	14-6755
15	PMN 395-94	95-14124
16	Parcel Map MSM 0245-03	03-50824
17	Serenity Brooks Estates	05-47575
18	Lone Mountain/Fort Apache	14-24158
19	Constellation Estates	01-470
20	Alpine Ridge (Tropical & Bright Angel)	05-46472
21	Tropical & 215, Units 1 and 2	13-4178
22	PM 161-90	

* Project not built

CITY OF LAS VEGAS

GOWAN NORTH - EL CAPITAN BRANCH LONE MOUNTAIN ROAD TO ANN ROAD

EXHIBIT 1

ADJACENT COMPLETED PROJECTS EXHIBIT

SHEET

EXH 1

SHTOF 0 SHTS

1555 S. RAINBOW BLVD.
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GCW
ENGINEERS / SURVEYORS

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

RUNOFF CURVE NUMBERS (URBAN AREAS¹)

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

See Table 602A

Developing urban areas

Newly graded areas (pervious areas only, no vegetation) ⁵	77	86	91	94
--	----	----	----	----

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

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

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

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

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

Revision	Date

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

RUNOFF CURVE NUMBERS (SEMIARID RANGELANDS¹)

Cover description		Curve numbers for hydrologic soil group—			
Cover type	Hydrologic condition ²	A ³	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

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

²Poor: <30% ground cover (litter, grass, and brush overstory).

Fair: 30 to 70% ground cover.

Good: >70% ground cover.

³Curve numbers for group A have been developed only for desert shrub.

Revision	Date

**WRC
ENGINEERING**

REFERENCE:

SCS TR-55, USDA, June 1986.

**TABLE 602
4 of 4**



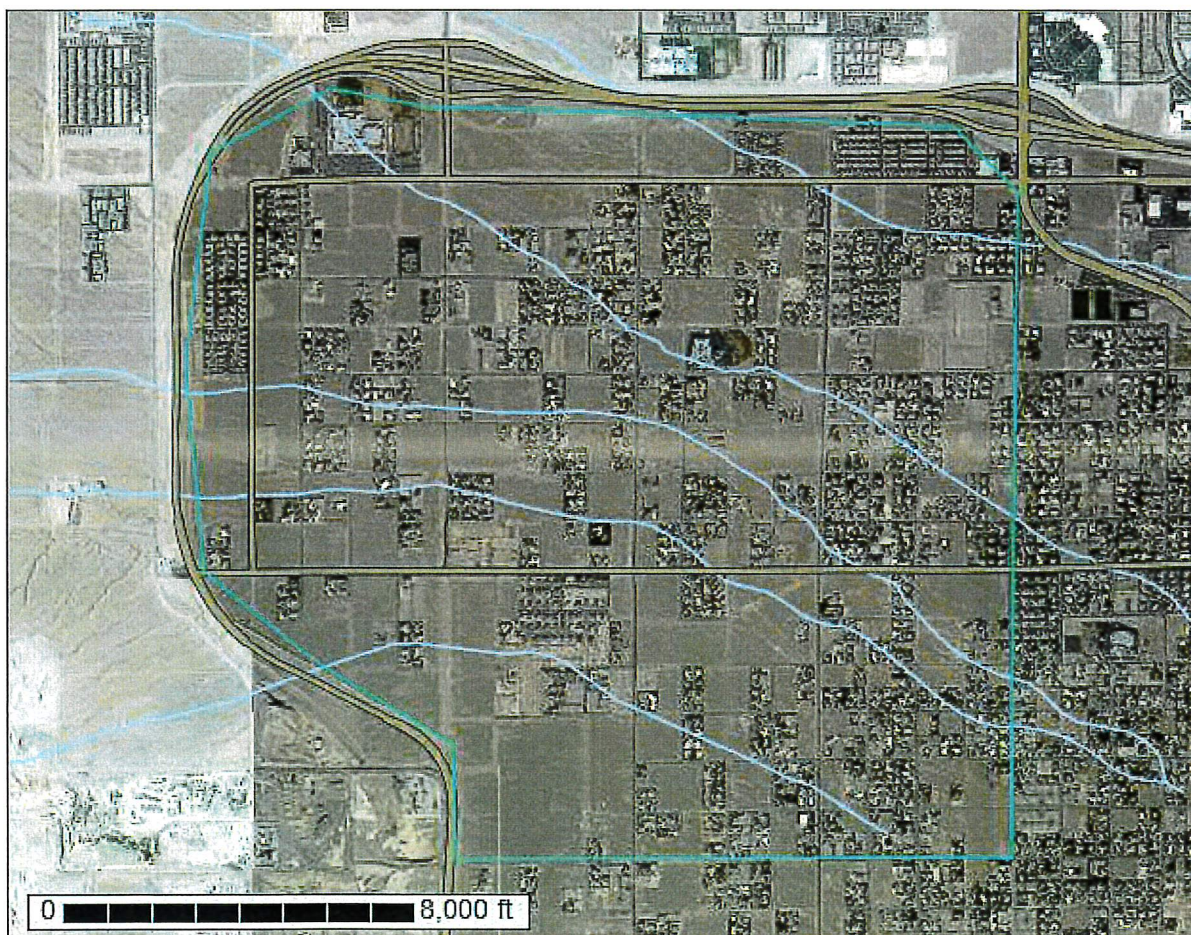
United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for Las Vegas Valley Area, Nevada, Part of Clark County



Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<http://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units).

Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

Custom Soil Resource Report

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

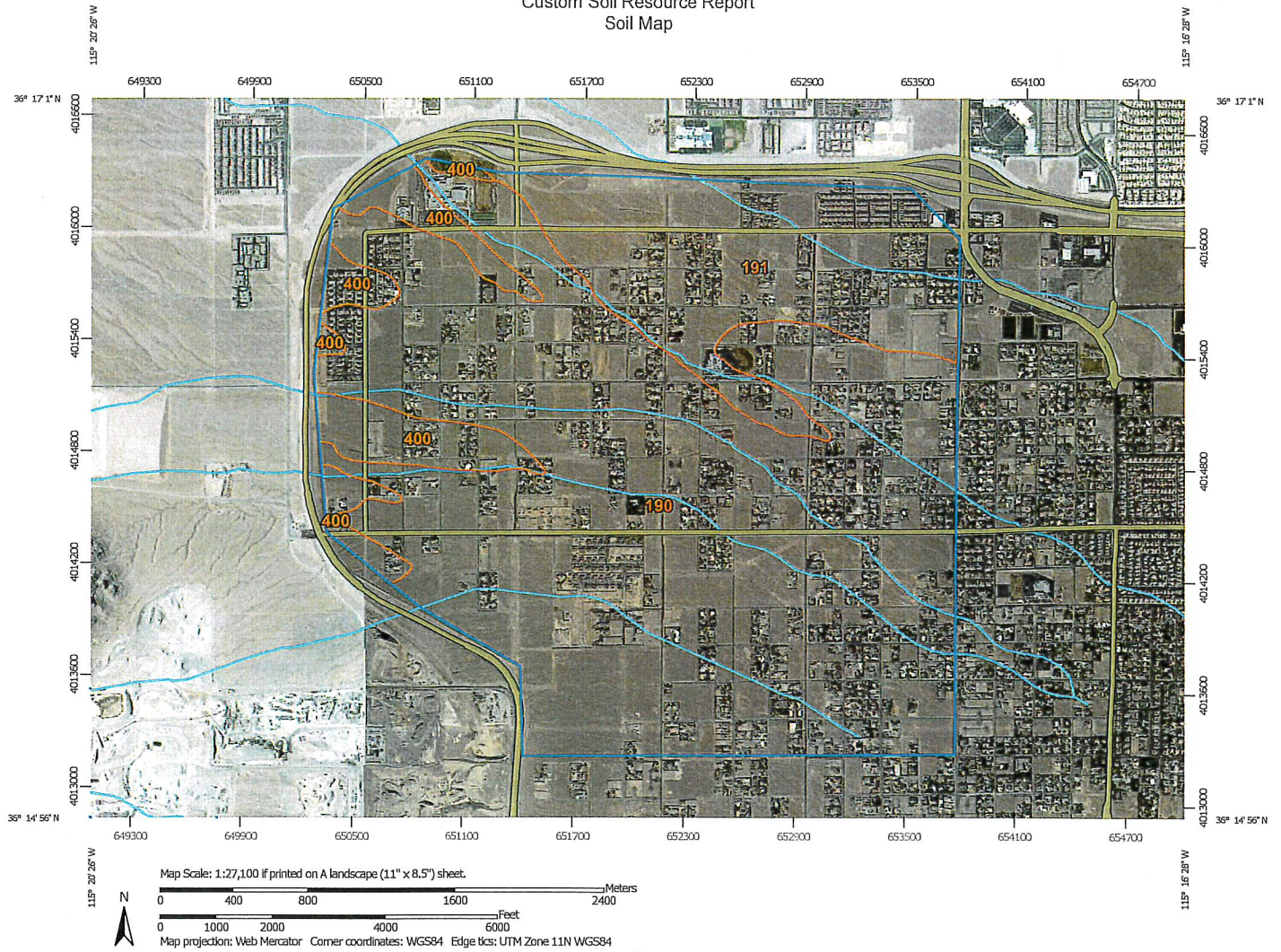
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map



Custom Soil Resource Report

MAP LEGEND

Area of Interest (AOI)			Spoil Area
	Area of Interest (AOI)		Stony Spot
Soils			Very Stony Spot
	Soil Map Unit Polygons		Wet Spot
	Soil Map Unit Lines		Other
	Soil Map Unit Points		Special Line Features
Special Point Features			
	Blowout	Water Features	
	Borrow Pit		Streams and Canals
	Clay Spot	Transportation	
	Closed Depression		Rails
	Gravel Pit		Interstate Highways
	Gravelly Spot		US Routes
	Landfill		Major Roads
	Lava Flow		Local Roads
	Marsh or swamp	Background	
	Mine or Quarry		Aerial Photography
	Miscellaneous Water		
	Perennial Water		
	Rock Outcrop		
	Saline Spot		
	Sandy Spot		
	Severely Eroded Spot		
	Sinkhole		
	Slide or Slip		
	Sodic Spot		

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Las Vegas Valley Area, Nevada, Part of Clark County

Survey Area Data: Version 10, Aug 22, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 7, 2011—Feb 25, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Las Vegas Valley Area, Nevada, Part of Clark County (NV788)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
190	Dalian very gravelly fine sandy loam, 2 to 4 percent slopes	1,755.0	72.8%
191	Dalian very cobbly fine sandy loam, 2 to 8 percent slopes	474.4	19.7%
400	Tencee very gravelly fine sandy loam, 2 to 8 percent slopes	180.0	7.5%
Totals for Area of Interest		2,409.4	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments

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on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Las Vegas Valley Area, Nevada, Part of Clark County

190—Dalian very gravelly fine sandy loam, 2 to 4 percent slopes

Map Unit Setting

National map unit symbol: hrb3

Elevation: 2,200 to 3,400 feet

Mean annual precipitation: 4 to 6 inches

Mean annual air temperature: 61 to 66 degrees F

Frost-free period: 210 to 250 days

Farmland classification: Not prime farmland

Map Unit Composition

Dalian and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dalian

Setting

Landform: Fan skirts

Down-slope shape: Linear

Across-slope shape: Convex

Parent material: Alluvium derived from limestone and dolostone

Typical profile

H1 - 0 to 4 inches: very gravelly fine sandy loam

H2 - 4 to 61 inches: extremely gravelly fine sandy loam

Properties and qualities

Slope: 2 to 4 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum in profile: 60 percent

Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water storage in profile: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: A

191—Dalian very cobbly fine sandy loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: hrb4

Elevation: 2,200 to 3,400 feet

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Mean annual precipitation: 4 to 6 inches
Mean annual air temperature: 61 to 66 degrees F
Frost-free period: 210 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Dalian and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dalian

Setting

Landform: Fan skirts
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from limestone and dolostone

Typical profile

H1 - 0 to 5 inches: very cobbly fine sandy loam
H2 - 5 to 60 inches: very gravelly fine sandy loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 60 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A

400—Tencee very gravelly fine sandy loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: hrc1
Elevation: 2,400 to 5,700 feet
Mean annual precipitation: 4 to 10 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 180 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Tencee and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

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Description of Tencee

Setting

Landform: Fan remnants

Down-slope shape: Linear

Across-slope shape: Convex

Parent material: Alluvium derived from limestone and dolomite

Typical profile

H1 - 0 to 9 inches: very gravelly fine sandy loam

H2 - 9 to 15 inches: very gravelly sandy loam

H3 - 15 to 19 inches: indurated

Properties and qualities

Slope: 2 to 8 percent

Depth to restrictive feature: 7 to 20 inches to petrocalcic

Natural drainage class: Well drained

Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum in profile: 40 percent

Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Sodium adsorption ratio, maximum in profile: 2.0

Available water storage in profile: Very low (about 1.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: D

Soil Information for All Uses

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Soil Physical Properties

This folder contains a collection of tabular reports that present soil physical properties. The reports (tables) include all selected map units and components for each map unit. Soil physical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Engineering Properties

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. The criteria for determining Hydrologic soil group is found in the National Engineering Handbook, Chapter 7 issued May 2007(<http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba>).

Listing HSGs by soil map unit component and not by soil series is a new concept for the engineers. Past engineering references contained lists of HSGs by soil series. Soil series are continually being defined and redefined, and the list of soil series names changes so frequently as to make the task of maintaining a single national list virtually impossible. Therefore, the criteria is now used to calculate the HSG using the component soil properties and no such national series lists will be maintained. All such references are obsolete and their use should be discontinued. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic

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soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number.

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Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

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Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(<http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba>).

Engineering Properties—Las Vegas Valley Area, Nevada, Part of Clark County														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity Index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				Pct	Pct					Pct	
190—Dallan very gravelly fine sandy loam, 2 to 4 percent slopes														
Dallan	100	A	0-4	Very gravelly fine sandy loam	GM	A-1	0- 0- 0	0- 0- 0	30-43-55	25-38-50	20-30-40	10-18-25	0-7 -14	NP
			4-61	Very gravelly sandy loam, extremely gravelly fine sandy loam, very gravelly fine sandy loam	GM, GP-GM	A-1	0- 0- 0	5- 8- 10	30-30-55	25-25-50	20-20-40	10-12-25	0-7 -14	NP
191—Dallan very cobbly fine sandy loam, 2 to 8 percent slopes														
Dallan	100	A	0-5	Very cobbly fine sandy loam	GM	A-1, A-2	0- 0- 0	35-43-50	55-60-65	50-55-60	40-48-55	20-25-30	0-7 -14	NP
			5-60	Very gravelly sandy loam, very gravelly fine sandy loam	GM	A-1	0- 0- 0	5- 8- 10	35-45-55	30-40-50	20-30-40	10-18-25	0-7 -14	NP

Custom Soil Resource Report

Engineering Properties—Las Vegas Valley Area, Nevada, Part of Clark County														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity Index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				Pct	Pct					Pct	
400—Tencee very gravelly fine sandy loam, 2 to 8 percent slopes														
Tencee	100	D	0-9	Very gravelly fine sandy loam	GC-GM, GC	A-2	0- 0- 0	0- 8- 15	35-45- 55	30-40- 50	20-33- 45	10-15- 20	20-25 -30	5-8 -10
			9-15	Extremely gravelly sandy loam, very gravelly loam, very gravelly sandy loam	GC-GM, GC	A-2	0- 0- 0	0-13- 25	35-43- 50	25-35- 45	15-28- 40	5-20- 35	20-25 -30	5-8 -10
			15-19	Indurated	—	—	—	—	—	—	—	—	—	—

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

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United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

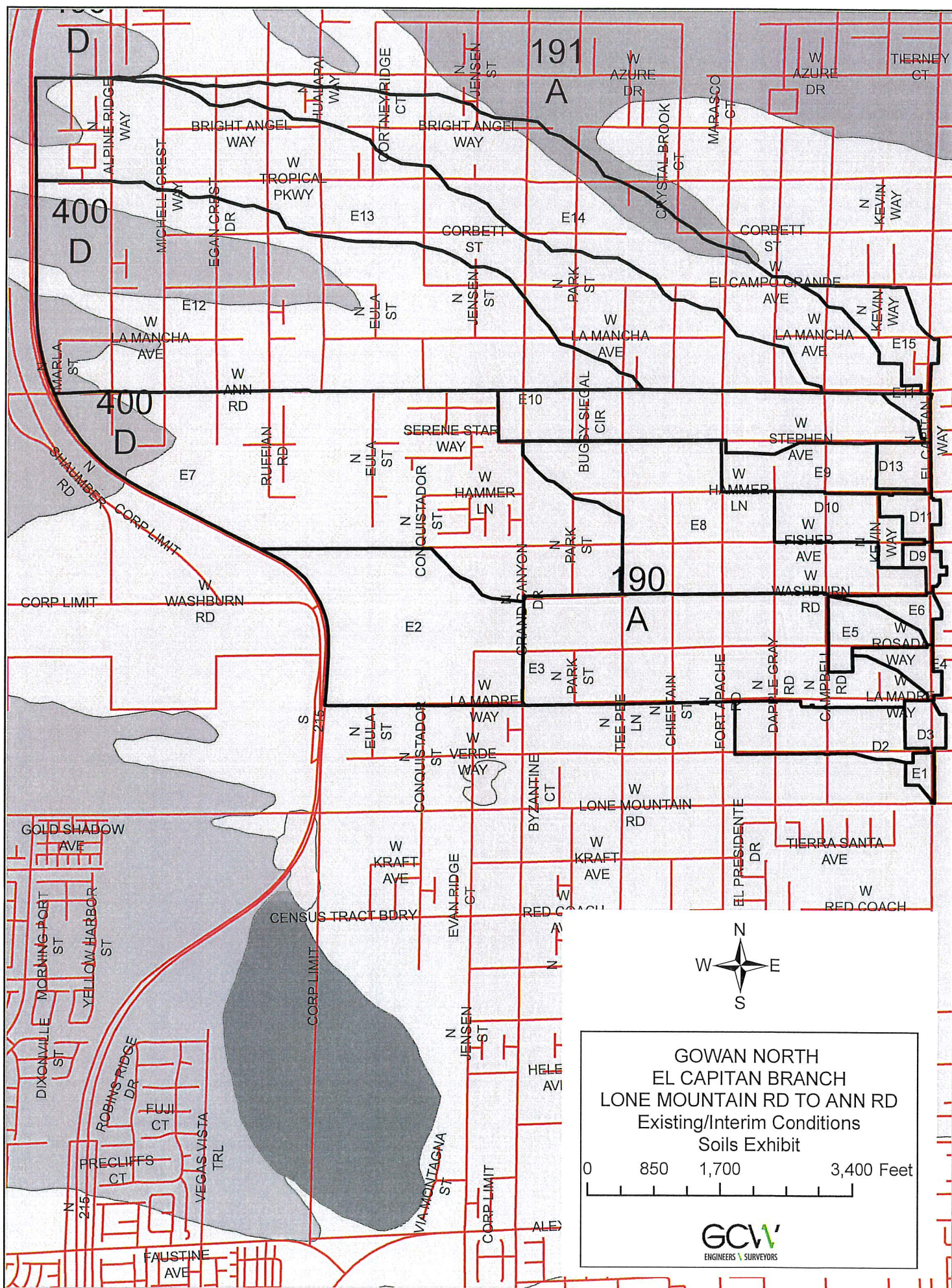
United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. <http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelpdb1043084>

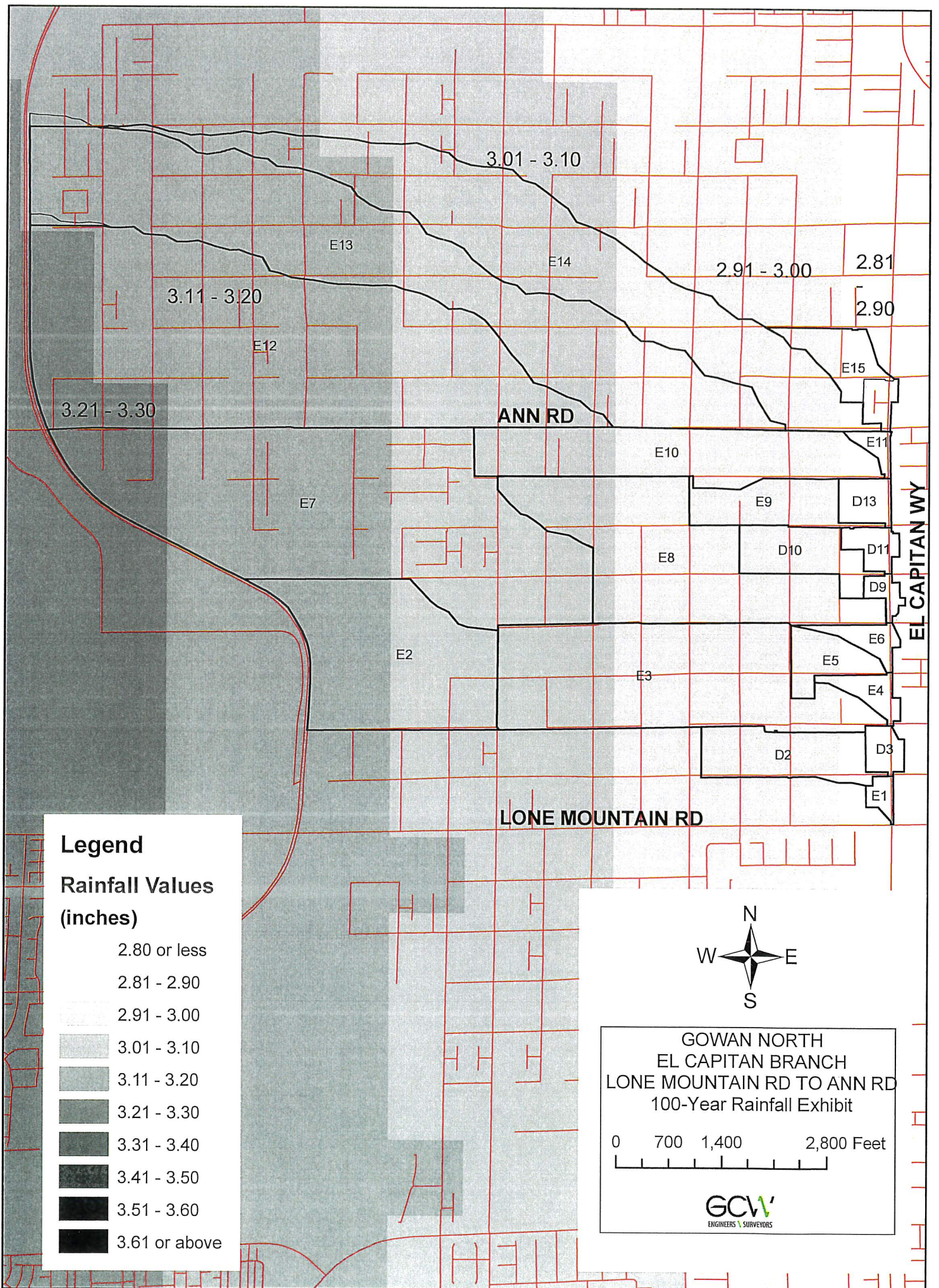
Custom Soil Resource Report

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GOWAN NORTH - EL CAPITAN BRANCH - LONE MOUNTAIN RD TO ANN RD

WEIGHTED CURVE NUMBERS

EXISTING/INTERIM CONDITIONS

Basin	Basin Area	Soil	Area (Ac)	Percent	CN	Land Use Index	WCN
E1	3.7	190	3.7	100.0%	74.0	Low Density Residential	74.0
E2	109.4	190	103.9	95.0%	63.0	Undeveloped Land, Open Desert	63.6
			5.5	5.0%	74.0	Low Density Residential	
E3	138.6	190	55.4	40.0%	63.0	Undeveloped Land, Open Desert	69.6
			83.2	60.0%	74.0	Low Density Residential	
E4	8.1	190	7.3	90.0%	63.0	Undeveloped Land, Open Desert	64.1
			0.8	10.0%	74.0	Low Density Residential	
E5	15.6	190	8.6	55.0%	63.0	Undeveloped Land, Open Desert	68.0
			7.0	45.0%	74.0	Low Density Residential	
E6	7.6	190	4.6	60.0%	63.0	Undeveloped Land, Open Desert	67.4
			3.0	40.0%	74.0	Low Density Residential	
E7	278.7	190	128.9	46.2%	63.0	Undeveloped Land, Open Desert	70.0
			128.9	46.2%	74.0	Low Density Residential	
		400	15.7	5.6%	88.0	Undeveloped Land, Open Desert	
			5.2	1.9%	91.0	Low Density Residential	
E8	121.7	190	30.4	25.0%	63.0	Undeveloped Land, Open Desert	71.3
			91.3	75.0%	74.0	Low Density Residential	
E9	27.1	190	10.8	40.0%	63.0	Undeveloped Land, Open Desert	69.6
			16.3	60.0%	74.0	Low Density Residential	
E10	80.3	190	60.2	75.0%	63.0	Undeveloped Land, Open Desert	65.8
			20.1	25.0%	74.0	Low Density Residential	
E11	4.2	190	3.4	80.0%	63.0	Undeveloped Land, Open Desert	65.2
			0.8	20.0%	74.0	Low Density Residential	
E12	331.2	190	138.5	41.8%	63.0	Undeveloped Land, Open Desert	74.0
			92.4	27.9%	74.0	Low Density Residential	
		400	60.2	18.2%	88.0	Undeveloped Land, Open Desert	
			40.1	12.1%	91.0	Low Density Residential	
E13	258.2	190	99.3	38.5%	63.0	Undeveloped Land, Open Desert	70.3
			130.1	50.4%	74.0	Low Density Residential	
			18.8	7.3%	75.0	10,000 Sq Ft Lots*	
		400	0.0	0.0%	88.0	Undeveloped Land, Open Desert	
			10.0	3.9%	87.0	10,000 Sq Ft Lots*	
E14	183.7	190	80.8	44.0%	63.0	Undeveloped Land, Open Desert	68.5
			80.8	44.0%	74.0	Low Density Residential	
		191	10.9	5.9%	63.0	Undeveloped Land, Open Desert	
			10.9	5.9%	74.0	Low Density Residential	
		400	0.2	0.1%	88.0	Undeveloped Land, Open Desert	
			0.0	0.0%	91.0	Low Density Residential	
E15	23.2	190	4.6	20.0%	63.0	Undeveloped Land, Open Desert	71.8
			18.6	80.0%	74.0	Low Density Residential	

* CNs referenced from Alpine Ridge Study

SOILSYM	basinid	area_acre
190.000000000000 D2		32.893
190.000000000000 D3		6.851
190.000000000000 D9		4.371
190.000000000000 D10		24.513
190.000000000000 D11		7.865
190.000000000000 D13		9.581
190.000000000000 E10		80.282
190.000000000000 E11		4.195
190.000000000000 E12		231.075
400.000000000000 E12		100.242
190.000000000000 E13		248.197
400.000000000000 E13		10.002
190.000000000000 E14		161.652
191.000000000000 E14		21.787
400.000000000000 E14		0.228
190.000000000000 E15		23.189
190.000000000000 E1		3.713
190.000000000000 E2		109.408
190.000000000000 E3		138.600
190.000000000000 E4		8.138
190.000000000000 E5		15.571
190.000000000000 E6		7.607
190.000000000000 E7		257.756
400.000000000000 E7		20.985
190.000000000000 E8		121.619
190.000000000000 E9		27.141

HYDROLOGIC CRITERIA AND DESIGN MANUAL

TIME OF CONCENTRATION



ENGINEERS SURVEYORS

CITY OF LAS VEGAS

GOWAN NORTH - EL CAPITAN BRANCH LONE MOUNTAIN RD TO ANN RD
Existing/Interim Conditions

Project No: 412.661
Date: 8-Jul-08
Calculated by: mmc/gyt

SUB-BASIN DATA						INITIAL / OVERLAND TIME (Ti)			TRAVEL TIME (Tt)					Tc CHECK		Tc	Tag	REMARKS
DESIG:	DEV/JEX. (D or E)	CN	K	AREA Ac	AREA Sq Mi	INITIAL LENGTH Feet	SLOPE %	Ti Min	TRAVEL LENGTH Feet	SLOPE %	V1 VELOCITY fps	V2 VELOCITY fps	Tt Min	TOTAL LENGTH Feet	Tc = (L/180)+10 Min	Min		
(1)		(16)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9a)	(9b)	(10)	(11)	(12)	(13)	(14)	(15)	Rainfall:
D2	D	76.1	0.6145	32.9	0.0514	100	1.00	8.7	3000	1.7	2.6	4.0	13.7	3100	27.2	22.5	0.225	2.97
D3	D	76.1	0.6145	6.9	0.0107	100	1.00	8.7	900	1.1	2.1	3.2	6.0	1000	15.6	14.7	0.147	2.97
D9	D	76.8	0.6234	4.4	0.0068	100	1.00	8.6	800	1.3	2.3	3.4	5.2	900	15.0	13.7	0.137	2.97
D10	D	76.8	0.6234	24.5	0.0383	100	1.00	8.6	2400	1.9	2.8	4.2	10.6	2500	23.9	19.1	0.191	2.97
D11	D	76.8	0.6234	7.9	0.0123	100	1.00	8.6	1100	1.4	2.4	3.6	6.3	1200	16.7	14.9	0.149	2.97
D13	D	80.2	0.6686	9.6	0.0150	100	1.00	7.8	1100	1.4	2.4	3.6	4.4	1200	16.7	14.1	0.141	2.97
E1	D	74.0	0.5868	3.7	0.0058	100	1.00	9.2	700	1.4	2.4	3.6	4.4	800	14.4	13.6	0.136	2.87
E2	D	63.6	0.4495	109.4	0.1709	500	1.00	26.2	3500	4.5	4.3	6.5	9.6	4000	32.2	35.8	0.322	3.11
E3	D	69.6	0.5287	138.6	0.2165	300	1.00	17.8	5100	2.6	3.3	4.9	18.1	5400	40.0	35.9	0.359	2.98
E4	D	64.1	0.4561	8.1	0.0127	100	1.00	11.6	1400	1.8	2.7	4.1	6.7	1500	18.3	18.3	0.183	2.88
E5	D	68.0	0.5076	15.6	0.0243	100	1.00	10.7	1300	2.3	3.1	4.6	5.6	1400	17.8	16.3	0.163	2.90
E6	D	67.4	0.4997	7.6	0.0119	100	1.00	10.8	1600	1.9	2.8	4.2	7.3	1700	19.4	18.1	0.181	2.88
E7	D	70.0	0.5340	278.7	0.4355	500	1.00	22.8	7300	4.5	4.3	6.5	19.4	7800	53.3	42.2	0.422	3.13
E8	D	71.3	0.5512	121.7	0.1901	500	1.00	22.1	5100	2.6	3.3	4.9	18.1	5600	41.1	40.2	0.402	2.98
E9	D	69.6	0.5287	27.1	0.0424	300	1.0	17.8	2500	2.3	3.1	4.6	9.9	2800	25.6	27.7	0.256	2.93
E10	D	65.8	0.4786	80.3	0.1254	500	1.0	25.0	5000	2.8	3.4	5.1	17.1	5500	40.6	42.1	0.406	2.98
E11	D	65.2	0.4706	4.2	0.0066	300	1.0	19.6	700	1.8	2.7	4.1	3.9	1000	15.6	23.5	0.156	2.87
E12	D	74.0	0.5868	331.2	0.5175	500	1.0	20.7	8100	3.3	3.7	5.6	25.1	8600	57.8	45.7	0.457	3.15
E13	D	70.3	0.5380	258.2	0.4034	500	1.0	22.6	10700	2.0	2.9	4.3	42.2	11200	72.2	64.8	0.648	3.10
E14	D	68.5	0.5142	183.7	0.2870	500	1.0	23.6	11000	2.8	3.4	5.1	36.6	11500	73.9	60.2	0.602	3.02
E15	D	71.8	0.5578	23.2	0.0363	100	1.0	9.8	2600	2.0	2.9	4.3	11.0	2700	25.0	20.8	0.208	2.87
Rainfall and CNs for D2 and D3 referenced from LWFR-C, Rainfall and CNs for D9, D10, D11 referenced from HLFR-C, Rainfall and CNs for D13 referenced from ARFR-C																		

Rainfall and CNs for D2 and D3 referenced from LWFRC, Rainfall and CNs for D9, D10, D11 referenced from HLFRC, Rainfall and CNs for D13 referenced from ARFR-C

Tc = Ti + Tt For the travel time (Tt) calculations,

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

K = 0.0132 (CN) - 0.39

V1 applies to the first 500 feet of travel distance;

V2 applies to the remaining travel distance.

Existing:

V1 = 14.8*(S/100)^{1/2}

V2 = 29.4*(S/100)^{1/2}

Developed:

V1 = 20.2*(S/100)^{1/2}

V2 = 30.6*(S/100)^{1/2}

REFERENCE:

STANDARD FORM 4

EX.OUT

 * FLOOD HYDROGRAPH PACKAGE (HEC-1) *
 * JUN 1998 *
 * VERSION 4.1 *
 * RUN DATE 15SEP16 TIME 10:08:24 *

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

```

X  X  XXXXXX  XXXXX  X
X  X  X      X      XX
X  X  X      X      X
XXXXXX XXXX  X      XXXX
X  X  X      X      X
X  X  X      X      X
X  X  XXXXXX  XXXXX  XXX
  
```

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

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

1 HEC-1 INPUT PAGE 1

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

*DIAGRAM

*** FREE ***

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1 ID *****
2 ID *
3 ID *
4 ID *
5 ID *
6 ID *
7 ID *
8 ID *
9 ID *
10 ID *
11 ID *
12 ID *
13 ID *
14 ID *
15 ID *
16 ID *
17 ID *****
18 ID
19 ID
20 ID
21 ID
22 ID
23 ID
24 ID
25 ID
26 ID
27 ID
28 ID
29 ID
30 ID
31 IT 5 0 0 300
32 IO 5 0 0
33 IN 5 0 0
34 JR PREC 1 0.98 0.95 0.92 0.91 0.89 0.57
*
35 KK E12
36 KM BASIN E12
37 PB 3.15
38 BA 0.5175
39 PC 0.000 0.020 0.057 0.070 0.087 0.108 0.124 0.130 0.130 0.130
40 PC 0.130 0.130 0.130 0.133 0.140 0.142 0.148 0.158 0.172 0.181
41 PC 0.190 0.197 0.199 0.200 0.201 0.204 0.214 0.229 0.241 0.249
42 PC 0.251 0.256 0.270 0.278 0.281 0.283 0.295 0.322 0.352 0.409
43 PC 0.499 0.590 0.710 0.744 0.781 0.812 0.819 0.835 0.851 0.856
44 PC 0.860 0.868 0.876 0.888 0.910 0.926 0.937 0.950 0.970 0.976
45 PC 0.982 0.985 0.987 0.989 0.990 0.993 0.993 0.994 0.995 0.998
46 PC 0.998 0.999 1.000
47 LS 0 74.0
48 UD .457
*
  
```

JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:

AREA	DARF
SQ. MI.	
0.0 - 0.5	1.00
0.5 - 1.0	0.98
1.0 - 2.0	0.95
2.0 - 4.0	0.92
4.0 - 6.0	0.91
6.0 - 8.0	0.89

1 HEC-1 INPUT PAGE 2

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

```

49 KK E13
50 KM BASIN E13
51 PB 3.10
52 BA 0.4034
53 LS 0 70.3
54 UD .648
*
55 KK E14
56 KM BASIN E14
57 PB 3.02
58 BA 0.2870
59 LS 0 68.5
60 UD .602
*
  
```


EX.OUT

61 KK CE14
62 KM COMBINE E12, E13 AND E14
63 HC 3
*
64 KK E15
65 KM BASIN E15
66 PB 2.87
67 BA 0.0363
68 LS 0 71.8
69 UD .208
*
70 KK CEAFFR-C
71 KM COMBINE CE14 AND E15
72 HC 2
*
73 KK E10
74 KM BASIN E10
75 PB 2.98
76 BA 0.1254
77 LS 0 65.8
78 UD .406
*
79 KK E11
80 KM BASIN E11
81 PB 2.87
82 BA 0.0066
83 LS 0 65.2
84 UD .156
*

1

HEC-1 INPUT

PAGE 3

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

85 KK CD14
86 KM COMBINE CEAFFR-C, E10 AND E11
87 HC 3
*
88 KK E9
89 KM BASIN E9
90 PB 2.93
91 BA 0.0424
92 LS 0 69.6
93 UD .256
*
94 KK D13
95 BA 0.015
96 PB 2.97
97 LS 0 80.2
98 UD 0.141
*
99 KK CARFR-C
100 KM COMBINE CD14, E9 AND D13
101 HC 3
*
102 KK D10
103 BA 0.038
104 PB 2.97
105 LS 0 76.8
106 UD 0.191
*
107 KK D11
108 BA 0.012
109 PB 2.97
110 LS 0 76.8
111 UD 0.149
*
112 KK CD10
113 KM COMBINE CARFR-C, D10 AND D11
114 HC 3
*
115 KK E7
116 KM BASIN E7
117 PB 3.13
118 BA 0.4355
119 LS 0 70.0
120 UD .422
*

1

HEC-1 INPUT

PAGE 4

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

121 KK E8
122 KM BASIN E8
123 PB 2.98
124 BA 0.1901
125 LS 0 71.3
126 UD .402
*
127 KK CE8
128 KM COMBINE E7 AND E8
129 HC 2
*
130 KK D9
131 BA 0.007
132 PB 2.97
133 LS 0 76.8
134 UD 0.137

EX.OUT

135 KK CHLFR-C
136 KM COMBINE CD10, CE8 AND D9
137 HC 3
*

138 KK E5
139 KM BASIN E5
140 PB 2.90
141 BA 0.0243
142 LS 0 68.0
143 UD .163
*

144 KK E6
145 KM BASIN E6
146 PB 2.88
147 BA 0.0119
148 LS 0 67.4
149 UD .181
*

150 KK CD6
151 KM COMBINE CHLFR-C, E5 AND E6
152 HC 3
*

153 KK E2
154 KM BASIN E2
155 PB 3.11
156 BA 0.1709
157 LS 0 63.6
158 UD .322
*

HEC-1 INPUT

PAGE 5

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

159 KK E3
160 KM BASIN E3
161 PB 2.98
162 BA 0.2165
163 LS 0 69.6
164 UD .359
*

165 KK CE3
166 KM COMBINE E2 AND E3
167 HC 2
*

168 KK E4
169 KM BASIN E4
170 PB 2.88
171 BA 0.0127
172 LS 0 64.1
173 UD .183
*

174 KK CWRJS-C
175 KM COMBINE CD6, CE3 AND E4
176 HC 3
*

177 KK D2
178 BA 0.051
179 PB 2.97
180 LS 0 76.1
181 UD 0.225
*

182 KK D3
183 BA 0.011
184 PB 2.97
185 LS 0 76.1
186 UD 0.147
*

187 KK CD2
188 KM COMBINE CWRJS-C, D2 AND D3
189 HC 3
*

190 KK E1
191 KM BASIN E1
192 PB 2.87
193 BA 0.0058
194 LS 0 74.0
195 UD .136
*

HEC-1 INPUT

PAGE 6

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

196 KK CLWFR-C
197 KM COMBINE CD2 AND E1
198 HC 2
199 ZZ

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT
LINE

(V) ROUTING (--->) DIVERSION OR PUMP FLOW
(.) CONNECTOR (<---) RETURN OF DIVERTED OR PUMPED FLOW

35 E12

EX.OUT

49 . E13
55 . E14
61 CE14
64 . E15
70 CEAFR-C
73 . E10
79 . E11
85 CD14
88 . E9
94 . D13
99 CARFR-C
102 . D10
107 . D11
112 CD10
115 . E7
121 . E8
127 CE8
130 . D9
135 CHLFR-C
138 . E5
144 . E6
150 CD6
153 . E2
159 . E3
165 CE3
168 . E4
174 CWRJS-C
177 . D2
182 . D3
187 CD2
190 . E1
196 CLWFR-C

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

1 *****
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* JUN 1998 *
* VERSION 4.1 *
* RUN DATE 15SEP16 TIME 10:08:24 *
* *****

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

					EX.OUT						
HYDROGRAPH AT	D13	.01	1	FLOW	16.	16.	15.	14.	14.	13.	5.
+				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58
3 COMBINED AT	CARFR-C	1.43	1	FLOW	520.	496.	460.	426.	414.	391.	99.
+				TIME	4.00	4.00	4.00	4.00	4.00	4.00	4.08
HYDROGRAPH AT	D10	.04	1	FLOW	30.	29.	28.	26.	25.	24.	8.
+				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT	D11	.01	1	FLOW	11.	10.	10.	9.	9.	9.	3.
+				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58
3 COMBINED AT	CD10	1.48	1	FLOW	536.	511.	475.	439.	428.	404.	103.
+				TIME	4.00	4.00	4.00	4.00	4.00	4.00	4.08
HYDROGRAPH AT	E7	.44	1	FLOW	183.	174.	161.	148.	144.	136.	31.
+				TIME	3.92	3.92	3.92	3.92	3.92	3.92	4.00
HYDROGRAPH AT	E8	.19	1	FLOW	79.	76.	70.	65.	63.	59.	14.
+				TIME	3.92	3.92	3.92	3.92	3.92	3.92	4.00
2 COMBINED AT	CE8	.63	1	FLOW	263.	250.	231.	213.	207.	195.	45.
+				TIME	3.92	3.92	3.92	3.92	3.92	3.92	4.00
HYDROGRAPH AT	D9	.01	1	FLOW	7.	6.	6.	6.	5.	5.	2.
+				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58
3 COMBINED AT	CHLFR-C	2.12	1	FLOW	795.	757.	702.	647.	630.	596.	148.
+				TIME	3.92	3.92	3.92	3.92	4.00	4.00	4.08
HYDROGRAPH AT	E5	.02	1	FLOW	11.	10.	9.	9.	8.	8.	1.
+				TIME	3.58	3.58	3.67	3.67	3.67	3.67	3.75
HYDROGRAPH AT	E6	.01	1	FLOW	5.	5.	4.	4.	4.	3.	0.
+				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.83
3 COMBINED AT	CD6	2.15	1	FLOW	804.	765.	709.	654.	636.	601.	149.
+				TIME	3.92	3.92	3.92	3.92	3.92	4.00	4.08
HYDROGRAPH AT	E2	.17	1	FLOW	49.	46.	42.	37.	36.	33.	5.
+				TIME	3.83	3.83	3.83	3.83	3.83	3.83	5.00
HYDROGRAPH AT	E3	.22	1	FLOW	85.	81.	74.	68.	66.	62.	13.
+				TIME	3.83	3.83	3.83	3.83	3.83	3.83	4.00
2 COMBINED AT	CE3	.39	1	FLOW	134.	127.	116.	105.	102.	95.	16.
+				TIME	3.83	3.83	3.83	3.83	3.83	3.83	4.00
HYDROGRAPH AT	E4	.01	1	FLOW	4.	4.	3.	3.	3.	2.	0.
+				TIME	3.67	3.67	3.67	3.67	3.67	3.67	4.92
3 COMBINED AT	CWRJS-C	2.55	1	FLOW	937.	892.	825.	760.	739.	697.	165.
+				TIME	3.92	3.92	3.92	3.92	3.92	3.92	4.00
HYDROGRAPH AT	D2	.05	1	FLOW	38.	36.	34.	32.	31.	29.	9.
+				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.75
HYDROGRAPH AT	D3	.01	1	FLOW	10.	9.	9.	8.	8.	8.	2.
+				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58
3 COMBINED AT	CD2	2.61	1	FLOW	964.	918.	850.	784.	762.	719.	171.
+				TIME	3.92	3.92	3.92	3.92	3.92	3.92	4.00
HYDROGRAPH AT	E1	.01	1	FLOW	4.	4.	4.	4.	3.	3.	1.
+				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT	CLWFR-C	2.62	1	FLOW	966.	920.	852.	785.	763.	720.	172.
+				TIME	3.92	3.92	3.92	3.92	3.92	3.92	4.00

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

REVISED (POOR CONDITION) LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE - COMPOSITE CURVE NUMBER BREAKDOWN

WATERSHED	2008 MPU BASINID	LAND USE INDEX NUMBER	SOIL MAP UNIT #	SUBREGION CN	SUBREGION AREA (SQ FT)	SUBBASIN AREA (SQ FT)	PERCENT OF SUBBASIN	CUMULATIVE PERCENT	AREAL WEIGHTED CN	CUMULATIVE CN	COMPOSITE CN
GOWAN BASIN	ARFP-C	2	190	69	177338	6871950	2.6%	2.6%	1.78	1.78	
GOWAN BASIN	ARFP-C	2	191	69	866552	6871950	12.9%	15.5%	8.90	10.68	
GOWAN BASIN	ARFP-C	4	190	74	2296632	6871950	33.4%	48.9%	24.72	35.40	
GOWAN BASIN	ARFP-C	4	191	74	2179273	6871950	31.7%	80.6%	23.47	58.87	
GOWAN BASIN	ARFP-C	6	191	87	9798	6871950	0.1%	80.7%	0.12	58.99	
GOWAN BASIN	ARFP-C	7	190	90	443067	6871950	6.4%	87.2%	5.80	64.80	
GOWAN BASIN	ARFP-C	7	191	90	463998	6871950	6.8%	93.9%	6.08	70.87	
GOWAN BASIN	ARFP-C	12	190	83	285475	6871950	4.3%	98.2%	3.57	74.44	
GOWAN BASIN	ARFP-C	12	191	83	120816	6871950	1.8%	100.0%	1.46	75.90	75.902
GOWAN BASIN	ARFR-C	2	190	69	825905	6757129	12.2%	12.2%	8.43	8.43	
GOWAN BASIN	ARFR-C	4	190	74	2491317	6757129	36.9%	49.1%	27.28	35.72	
GOWAN BASIN	ARFR-C	7	190	90	2171054	6757129	32.1%	81.2%	28.92	64.63	
GOWAN BASIN	ARFR-C	12	190	83	1268953	6757129	18.8%	100.0%	15.59	80.22	80.220
GOWAN BASIN	BSFR-C	1	191	63	446000	5775668	7.7%	7.7%	4.86	4.86	
GOWAN BASIN	BSFR-C	4	191	74	16066	5775668	0.3%	8.0%	0.21	5.07	
GOWAN BASIN	BSFR-C	6	191	87	2127151	5775668	36.8%	44.8%	32.04	37.11	
GOWAN BASIN	BSFR-C	7	191	90	707881	5775668	12.3%	57.1%	11.03	48.14	
GOWAN BASIN	BSFR-C	9	191	95	171	5775668	0.0%	57.1%	0.00	48.15	
GOWAN BASIN	BSFR-C	15	191	75	303886	5775668	5.3%	62.4%	3.95	52.09	
GOWAN BASIN	BSFR-C	16	191	86	1981386	5775668	34.3%	96.7%	29.50	81.59	
GOWAN BASIN	BSFR-C	17	191	89	193127	5775668	3.3%	100.0%	2.98	84.57	84.571
GOWAN BASIN	CPFR-C	1	191	63	218070	6996341	3.1%	3.1%	1.96	1.96	
GOWAN BASIN	CPFR-C	4	191	74	5852717	6996341	83.7%	86.8%	61.90	63.87	
GOWAN BASIN	CPFR-C	6	191	87	198072	6996341	2.8%	89.6%	2.46	66.33	
GOWAN BASIN	CPFR-C	7	191	90	722715	6996341	10.3%	99.9%	9.30	75.63	
GOWAN BASIN	CPFR-C	9	191	95	4766	6996341	0.1%	100.0%	0.08	75.69	75.692
GOWAN BASIN	EAFR-C	2	190	69	350	6938735	0.0%	0.0%	0.00	0.00	
GOWAN BASIN	EAFR-C	4	190	74	5841536	6938735	84.2%	84.2%	62.30	62.30	
GOWAN BASIN	EAFR-C	7	190	90	1095668	6938735	15.8%	100.0%	14.21	76.52	
GOWAN BASIN	EAFR-C	12	190	83	982	6938735	0.0%	100.0%	0.01	76.53	76.528
GOWAN BASIN	HLFR-C	2	190	69	289	6724346	0.0%	0.0%	0.00	0.00	
GOWAN BASIN	HLFR-C	4	190	74	5284771	6724346	78.6%	78.6%	56.16	58.16	
GOWAN BASIN	HLFR-C	7	190	90	815954	6724346	12.1%	90.7%	10.92	69.08	
GOWAN BASIN	HLFR-C	12	190	83	623432	6724346	9.3%	100.0%	7.70	76.78	76.775
GOWAN BASIN	LWFR-C	4	190	74	6151908	7099272	86.7%	86.7%	64.13	64.13	
GOWAN BASIN	LWFR-C	7	190	90	947365	7099272	13.3%	100.0%	12.01	76.14	76.135
GOWAN BASIN	TRFR-C	2	190	69	17096	7137607	0.2%	0.2%	0.17	0.17	
GOWAN BASIN	TRFR-C	2	191	69	7807	7137607	0.1%	0.3%	0.08	0.24	
GOWAN BASIN	TRFR-C	4	190	74	5014574	7137607	70.3%	70.6%	51.99	52.23	
GOWAN BASIN	TRFR-C	4	191	74	796187	7137607	11.2%	81.8%	8.25	60.48	
GOWAN BASIN	TRFR-C	7	190	90	901232	7137607	12.6%	94.4%	11.36	71.85	
GOWAN BASIN	TRFR-C	7	191	90	163411	7137607	2.3%	96.7%	2.06	73.91	
GOWAN BASIN	TRFR-C	12	190	83	99510	7137607	1.4%	98.1%	1.16	75.07	
GOWAN BASIN	TRFR-C	12	191	83	137789	7137607	1.9%	100.0%	1.60	76.67	76.668
GOWAN BASIN	WRJS-C	4	190	74	6316527	7077709	89.2%	89.2%	66.04	66.04	
GOWAN BASIN	WRJS-C	7	190	90	758231	7077709	10.7%	100.0%	9.64	75.68	
GOWAN BASIN	WRJS-C	12	190	83	2951	7077709	0.0%	100.0%	0.03	75.72	75.718

PERVIOUS AREA CURVE NUMBERS								
CONDITION 1:	----->	DESERT SHRUB POOR HYDROLOGIC CONDITION						
CONDITION 2*	----->	LANDSCAPED, LAWNS, TREES, POOR HYDROLOGIC CONDITION						
CN VALUES								
		HYDROLOGIC SOIL GROUP						
CONDITION		A	B	C	D	ROCK		
1	----->	63	77	85	88	90		
2*	----->	68	79	86	89	90		

Curve Number Matrix

MAP #	COMPONENTS		LAND USE CLASSIFICATION INDEX NUMBER																					
	OPEN	% IMP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	OPEN	OPEN	100	10	60	35	0	0	0	0	0	15	7	0	0	55	36	19	14	15	10	30	15	20
	DESERT	POOR	0	85	20	40	71	38	28	15	10	15	8	50	0	20	35	19	14	0	0	0	0	30
	% ---->		0	5	20	25	29	62	72	85	90	70	85	50	0	25	29	62	72	85	90	70	85	50
	CN	CN	CN	CN	CN	CN	CN	CN	CN	CN	CN	CN	CN	CN	CN	CN	CN	CN	CN	CN	CN	CN	CN	CN
SOIL TYPE COMPOSITE CN FOR LAND USE TYPE																								
190	63	68	63.0	69.0	71.0	74.0	77.0	87.0	90.0	94.0	95.0	88.0	93.0	83.0	30.0	73.0	75.0	86.0	89.0	93.0	95.0	88.0	93.0	82.0
191	63	68	63.0	69.0	71.0	74.0	77.0	87.0	90.0	94.0	95.0	88.0	93.0	83.0	30.0	73.0	75.0	86.0	89.0	93.0	95.0	88.0	93.0	82.0

Curve Number Matrix

MAP #	COMPONENTS			LAND USE CLASSIFICATION INDEX NUMBER																						
	OPEN DESERT	OPEN POOR	% IMP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
	100	10	60	35	0	0	0	0	0	0	0	0	15	7	0	0	55	36	19	14	15	10	30	15	20	
	0	85	20	40	71	38	28	15	10	15	10	10	15	8	50	0	20	35	19	14	0	0	0	0	30	
	0	5	20	25	29	62	72	85	90	70	85	90	70	85	50	0	25	29	62	72	85	90	70	85	50	
	CN	CN	CN	SOIL TYPE COMPOSITE CN FOR LAND USE TYPE																						
400	88	89	98	88.0	89.0	90.0	91.0	92.0	95.0	95.0	97.0	97.0	95.0	97.0	94.0	30.0	91.0	91.0	94.0	95.0	97.0	97.0	95.0	97.0	93.0	

HYDROLOGIC CRITERIA AND DESIGN MANUAL

TIME OF CONCENTRATION



CITY OF LAS VEGAS

GOWAN NORTH - EL CAPITAN BRANCH LONE MOUNTAIN RD TO ANN RD
ULTIMATE CONDITIONS

Project No: 412.661
Date: 8-Jul-08
Calculated by: mmc/gyt

SUB-BASIN DATA						INITIAL / OVERLAND TIME (Ti)				TRAVEL TIME (Tt)					Tc CHECK		Tc	Flag	REMARKS
DESIG:	DEV./EX. (D or E)	CN	K	AREA Ac	AREA Sq Mi	INITIAL LENGTH Feet	SLOPE %	Ti Min	TRAVEL LENGTH Feet	SLOPE %	V1 VELOCITY fps	V2 VELOCITY fps	Tt Min	TOTAL LENGTH Feet	Tc = (L/180)+10 Min	Min	Hours	Rainfall Q100 Inches	
(1)	(16)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9a)	(9b)	(10)	(11)	(12)	(13)	(14)	(15)			
D1	D	76.1	0.6145	33.9	0.053	100	1.00	8.7	3000	1.8	2.7	4.1	13.2	3100	27.2	22.0	0.220	2.97	
D2	D	76.1	0.6145	32.9	0.051	100	1.00	8.7	3000	1.7	2.6	4.0	13.7	3100	27.2	22.5	0.225	2.97	
D3	D	76.1	0.6145	6.9	0.011	100	1.00	8.7	900	1.1	2.1	3.2	6.0	1000	15.6	14.7	0.147	2.97	
D4	D	75.7	0.6095	136.3	0.213	100	1.00	8.8	6500	2.2	3.0	4.5	25.1	6600	46.7	33.9	0.339	2.97	
D5	D	75.7	0.6095	10.3	0.016	100	1.00	8.8	1200	1.7	2.6	4.0	6.1	1300	17.2	15.0	0.150	2.97	
D6	D	75.7	0.6095	8.4	0.013	100	1.00	8.8	2000	1.5	2.5	3.7	10.0	2100	21.7	18.9	0.189	2.97	
D7	D	75.7	0.6095	14.9	0.023	100	1.00	8.8	1600	1.9	2.8	4.2	7.4	1700	19.4	16.2	0.162	2.97	
D8	D	76.8	0.6234	121.1	0.189	100	1.00	8.6	6500	2.2	3.0	4.5	25.1	6600	46.7	33.7	0.337	2.97	
D9	D	76.8	0.6234	4.4	0.007	100	1.00	8.6	800	1.3	2.3	3.4	5.2	900	15.0	13.7	0.137	2.97	
D10	D	76.8	0.6234	24.5	0.038	100	1.00	8.6	2400	1.9	2.8	4.2	10.6	2500	23.9	19.1	0.191	2.97	
D11	D	76.8	0.6234	7.9	0.012	100	1.00	8.6	1100	1.4	2.4	3.6	6.3	1200	16.7	14.9	0.149	2.97	
D12	D	80.2	0.6689	65.9	0.103	100	1.00	7.8	5700	2.3	3.1	4.6	21.5	5800	42.2	29.2	0.292	2.97	
D13	D	80.2	0.6689	9.6	0.015	100	1.00	7.8	1100	1.4	2.4	3.6	6.3	1200	16.7	14.1	0.141	2.97	
D14	D	80.2	0.6689	69.3	0.108	100	1.00	7.8	5000	2.4	3.1	4.7	18.5	5100	38.3	26.2	0.262	2.97	
D15	D	80.2	0.6689	9.9	0.015	100	1.00	7.8	1200	1.3	2.3	3.4	7.1	1300	17.2	14.9	0.149	2.97	
EAFR-C	D	76.5	0.6202	159.3	0.249	100	1.00	8.6	6600	2.1	2.9	4.4	25.8	6700	47.2	34.4	0.344	2.97	
TRFR-C	D	76.7	0.6220	163.9	0.256	100	1.00	8.6	6600	2.1	2.9	4.5	25.6	6700	47.2	34.2	0.342	2.96	
ARFP-C	D	75.9	0.6119	157.8	0.247	100	1.00	8.8	6600	2.3	3.0	4.6	24.8	6700	47.2	33.6	0.336	2.95	
CPFR-C	D	75.7	0.6091	160.6	0.251	100	1.00	8.8	6600	2.3	3.0	4.6	24.8	6700	47.2	33.6	0.336	2.95	
BSFR-C	D	84.6	0.7263	132.6	0.207	100	1.00	6.7	6200	2.6	3.2	4.9	21.9	6300	45.0	28.6	0.286	2.94	
CNs for D1, D2, D3 referenced from LWFR-C; CNs for D4, D5, D6, D7 referenced from WRJS-C; CNs for D8, D9, D10, D11 referenced from HLFRC-C; CNs for D12, D13, D14, D15 referenced from ARFR-C																			
Tc = Ti + Tt Ti = 1.8 (1.1 - K) L ^{1/2} / S ^{1/3} K = 0.0132 (CN) - 0.39 For the travel time (Tt) calculations, V1 applies to the first 500 feet of travel distance; V2 applies to the remaining travel distance. Existing: V1 = 14.8*(S/100) ^{1/2} V2 = 29.4*(S/100) ^{1/2} Developed: V1 = 20.2*(S/100) ^{1/2} V2 = 30.6*(S/100) ^{1/2}																			

For the travel time (Tt) calculations,
V1 applies to the first 500 feet of travel distance;
V2 applies to the remaining travel distance.

Existing: $V1 = 14.8 \cdot (S/100)^{1/2}$
 $V2 = 29.4 \cdot (S/100)^{1/2}$
Developed: $V1 = 20.2 \cdot (S/100)^{1/2}$
 $V2 = 30.6 \cdot (S/100)^{1/2}$

REFERENCE:

STANDARD FORM 4


```

*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1
* RUN DATE 31AUG16 TIME 11:27:58
*****

```

```

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

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X X XXXXXX XXXX X
X X X X X XX
X X X X X X
XXXXXX XXXX X XXXX X
X X X X X X
X X X X X X
X X XXXXXX 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 -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION. NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE, SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY, DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL, LOSS RATE:GREEN AND AMPT INFILTRATION, KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1

HEC-1 INPUT

PAGE 1

```

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
*** FREE ***
*DIAGRAM
ID *****
ID *
ID *
ID *
ID * GOWAN NORTH - EL CAPITAN BRANCH
ID * LONE MOUNTAIN ROAD TO ANN ROAD
ID * ULTIMATE CONDITIONS
ID *
ID *
ID * RETURN PERIOD - 100 & 10 -YEAR
ID * DISTRIBUTION - 6-HOUR SDN3
ID * PROJECT NO - 412.661
ID * FILENAME - ALLGOW3R2.H1
ID * DATE MODELED - 8/31/2016
ID * MODELED BY - MMC/GYT
ID *
ID *
ID *****
ID JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:
ID
ID AREA DARF
ID SQ. MI.
ID 0-0.5 0.99
ID 0.5-1 0.975
ID 1-2 0.95
ID 2-3 0.925
ID 3-4 0.915
ID 4-5 0.908
ID 5-6 0.903
ID 6-7 0.895
ID 7-8 0.885
ID
ID JR CARD RATIOS REPRESENT DEPTH-AREA REDUCTION FACTORS (DARF'S)
ID
ID 100-YEAR, 6-HOUR STORM, SDN3
ID
ID IT 5 0 0 600
ID IO 5 0 0
ID IN 5 0 0
ID JR PREC 0.99 0.975 0.95 0.925 0.915 0.908 0.903 0.895 0.885
ID *

```

```

40 KK BSFR-C
41 KM 2008 MPU BASINS WITH REVISED CN/LAG PER 2014 SOILS
42 BA 0.207
43 PB 2.94
44 PC 0 0.02 0.057 0.07 0.087 0.108 0.124 0.13 0.13 0.13
45 PC 0.13 0.13 0.13 0.133 0.14 0.142 0.148 0.158 0.172 0.181
46 PC 0.19 0.197 0.199 0.2 0.201 0.204 0.214 0.229 0.241 0.249
47 PC 0.251 0.256 0.27 0.278 0.281 0.283 0.295 0.322 0.352 0.409
48 PC 0.499 0.59 0.71 0.744 0.781 0.812 0.819 0.835 0.851 0.856
49 PC 0.86 0.868 0.876 0.888 0.91 0.926 0.937 0.95 0.97 0.976
50 PC 0.982 0.985 0.987 0.989 0.99 0.993 0.993 0.994 0.995 0.998
51 PC 0.998 0.999 1

```

1

HEC-1 INPUT

PAGE 2

```

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
52 LS 0 84.6
53 UD 0.286
54 *
54 KK RBSFR-C
55 KM ROUTE BSFR-C TO CCPFR-C
56 KM FACILITY = GOWAN - EL CAPITAN BRANCH
57 KM FACILITY # = GOEC 0176
58 KM LINING = RCP
59 RD 1320 0.0115 0.013 0 CIRC 6.5
60 *
60 KK CPFR-C
61 KM 2008 MPU BASINS WITH REVISED CN/LAG PER 2014 SOILS
62 BA 0.251

```

63 PB 2.95
 64 LS 0 75.7
 65 UD 0.336
 *

66 KK CCPFR-C
 67 KM COMBINE RBSFR-C AND CPFR-C
 68 KM GOWAN-EL CAPITAN BRANCH @ RANCH HOUSE ROAD
 69 HC 2
 *

70 KKRCPPFR-C
 71 KM ROUTE CCPFR-C TO CARFP-C
 72 KM FACILITY = GOWAN - EL CAPITAN BRANCH
 73 KM FACILITY # = GOEC 0152
 74 KM LINING = RCB
 75 RD 1320 0.0076 0.015 0 TRAP 7 0
 *

76 KK ARFP-C
 77 KM 2008 MPU BASINS WITH REVISED CN/LAG PER 2014 SOILS
 78 BA 0.246
 79 PB 2.95
 80 LS 0 75.9
 81 UD 0.336
 *

82 KK CARFP-C
 83 KM COMBINE CARFP-C AND ARFP-C
 84 KM GOWAN-EL CAPITAN BRANCH @ TROPICAL PARKWAY
 85 HC 2
 *

86 KKRCARFP-C
 87 KM ROUTE RCARFP-C TO CTRFR-C
 88 KM FACILITY = GOWAN - EL CAPITAN BRANCH
 89 KM FACILITY # = GOEC 0126
 90 KM LINING = RCB
 91 RD 1320 0.0038 0.015 0 TRAP 10 0
 *

1.

HEC-1 INPUT

PAGE 3

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

92 KK TRFR-C
 93 KM 2008 MPU BASINS WITH REVISED CN/LAG PER 2014 SOILS
 94 BA 0.256
 95 PB 2.96
 96 LS 0 76.7
 97 UD 0.342
 *

98 KK CTRFR-C
 99 KM COMBINE RCARFP-C AND TRFR-C
 100 KM GOWAN-EL CAPITAN BRANCH @ EL CAMPO GRANDE
 101 HC 2
 *

102 KKRCTRFR-C
 103 KM ROUTE CTRFR-C TO CEAFR-C
 104 KM FACILITY = GOWAN - EL CAPITAN BRANCH
 105 KM FACILITY # = GOEC 0100
 106 KM LINING = RCB
 107 RD 1320 0.0076 0.015 0 TRAP 10 0
 *

108 KK EAFR-C
 109 KM 2008 MPU BASINS WITH REVISED CN/LAG PER 2014 SOILS
 110 BA 0.249
 111 PB 2.97
 112 LS 0 76.5
 113 UD 0.344
 *

114 KK CEAFR-C
 115 KM COMBINE RCTRFR-C AND EAFR-C
 116 KM GOWAN-EL CAPITAN BRANCH @ ANN ROAD
 117 HC 2
 *

118 KKRCFAFR-C
 119 KM ROUTE CEAFR-C TO CD14
 120 KM FACILITY = GOWAN - EL CAPITAN BRANCH
 121 KM FACILITY # = GOEC 0076
 122 KM LINING = RCB
 123 RD 610 0.0106 0.015 0 TRAP 10 0
 *

124 KK D14
 125 BA 0.108
 126 PB 2.97
 127 LS 0 80.2
 128 UD 0.262
 *

1.

HEC-1 INPUT

PAGE 4

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

129 KK D15
 130 BA 0.015
 131 PB 2.97
 132 LS 0 80.2
 133 UD 0.149
 *

134 KK CD14
 135 KM COMBINE CEAFR-C, D14 AND D15
 136 KM GOWAN-EL CAPITAN BRANCH @ STEPHEN AVE
 137 HC 3
 *

138 KK RCD14
 139 KM ROUTE CD14 TO CARFR-C
 140 KM FACILITY = GOWAN - EL CAPITAN BRANCH
 141 KM FACILITY # = GOEC 0076
 142 KM LINING = RCB
 143 RD 610 0.0106 0.015 0 TRAP 10 0
 *

144 KK D12
 145 BA 0.103
 146 PB 2.97
 147 LS 0 80.2
 148 UD 0.292
 *

149 KK D13
 150 BA 0.015
 151 PB 2.97
 152 LS 0 80.2
 153 UD 0.141
 *

154 KK CARFR-C
 155 KM COMBINE D12 AND D13
 156 KM GOWAN-EL CAPITAN BRANCH @ HAMMER LANE
 157 HC 3
 *

158 KKRCARFR-C
 159 KM ROUTE CARFR-C TO CD10
 160 KM FACILITY = GOWAN - EL CAPITAN BRANCH
 161 KM FACILITY # = GOEC 0051
 162 KM LINING = RCB
 163 RD 610 0.0106 0.015 0 TRAP 10 0
 *

HEC-1 INPUT

PAGE 5

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

164 KK D10
 165 BA 0.038
 166 PB 2.97
 167 LS 0 76.8
 168 UD 0.191
 *

169 KK D11
 170 BA 0.012
 171 PB 2.97
 172 LS 0 76.8
 173 UD 0.149
 *

174 KK CD10
 175 KM COMBINE CARFR-C, D10 AND D11
 176 KM GOWAN-EL CAPITAN BRANCH @ FISHER AVE
 177 HC 3
 *

178 KK RCD10
 179 KM ROUTE CD10 TO CHLFR-C
 180 KM FACILITY = GOWAN - EL CAPITAN BRANCH
 181 KM FACILITY # = GOEC 0051
 182 KM LINING = RCB
 183 RD 610 0.0106 0.015 0 TRAP 10 0
 *

184 KK D8
 185 BA 0.189
 186 PB 2.97
 187 LS 0 76.8
 188 UD 0.337
 *

189 KK D9
 190 BA 0.007
 191 PB 2.97
 192 LS 0 76.8
 193 UD 0.137
 *

194 KK CHLFR-C
 195 KM COMBINE D8 AND D9
 196 KM GOWAN-EL CAPITAN BRANCH @ WASHBURN ROAD
 197 HC 3
 *

198 KK RCHLFR-C
 199 KM ROUTE CHLFR-C TO CD6
 200 KM FACILITY = GOWAN - EL CAPITAN BRANCH
 201 KM FACILITY # = GOEC 0026
 202 KM LINING = RCB
 203 RD 610 0.0091 0.015 0 TRAP 10 0
 *

HEC-1 INPUT

PAGE 6

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

204 KK D6
 205 BA 0.013
 206 PB 2.97
 207 LS 0 75.7
 208 UD 0.189
 *

209 KK D7
 210 BA 0.023
 211 PB 2.97
 212 LS 0 75.7

213 UD 0.162 ALLGOW3R2.OUT
 *
 214 KK CD6
 215 KM COMBINE CHLFR-C, D6 AND D7
 216 KM GOWAN-EL CAPITAN BRANCH @ ROSADA WAY
 217 HC 3
 *
 218 KK D4
 219 BA 0.213
 220 PB 2.97
 221 LS 0 75.7
 222 UD 0.339
 *
 223 KK D5
 224 BA 0.016
 225 PB 2.97
 226 LS 0 75.7
 227 UD 0.150
 *
 228 KK CWRJS-C
 229 KM COMBINE D4 AND D5
 230 KM GOWAN-EL CAPITAN BRANCH @ LA MADRE WAY
 231 HC 3
 *
 232 KKRCWRJS-C
 233 KM ROUTE CWRJS-C TO CD2
 234 KM FACILITY = GOWAN - EL CAPITAN BRANCH
 235 KM FACILITY # = GOEC 0026
 236 KM LINING = RCB
 237 RD 610 0.0091 0.015 0 TRAP 10 0
 *
 238 KK D2
 239 BA 0.051
 240 PB 2.97
 241 LS 0 76.1
 242 UD 0.225
 *

1

HEC-1 INPUT

PAGE 7

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

243 KK D3
 244 BA 0.011
 245 PB 2.97
 246 LS 0 76.1
 247 UD 0.147
 *
 248 KK CD2
 249 KM COMBINE CWRJS-C, D2 AND D3
 250 KM GOWAN-EL CAPITAN BRANCH @ VERDE WAY
 251 HC 3
 *
 252 KK RCD2
 253 KM ROUTE CD2 TO CLWFR-C/GPEC JUNCTION WITH GONO
 254 KM FACILITY = GOWAN - EL CAPITAN BRANCH
 255 KM FACILITY # = GOEC 0000
 256 KM LINING = RCB
 257 RD 723 0.0136 0.015 0 TRAP 10 0
 *
 258 KK D1
 259 BA 0.053
 260 PB 2.97
 261 LS 0 76.1
 262 UD 0.220
 *
 263 KK CLWFR-C
 264 KM COMBINE CCD2 AND D1
 265 HC 2
 *
 266 ZZ

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT
 LINE (V) ROUTING (--->) DIVERSION OR PUMP FLOW
 NO. (.) CONNECTOR (<---) RETURN OF DIVERTED OR PUMPED FLOW
 40 BSFR-C
 V
 54 RBSFR-C
 V
 60 CPFR-C
 V
 66 CCPFR-C.....
 V
 70 RCCPFR-C
 V
 76 ARFP-C
 V
 82 CARFP-C.....
 V
 86 RCARFP-C
 V


```

92      .      TRFR-C
      .
98      CTRFR-C.....
      V
102     RCTRFR-C
      .
108     .      EAFR-C
      .
114     CEAFR-C.....
      V
118     RCEAFR-C
      .
124     .      D14
      .
129     .      .      D15
      .
134     CD14.....
      V
138     RCD14
      .
144     .      D12
      .
149     .      .      D13
      .
154     CARFR-C.....
      V
158     RCARFR-C
      .
164     .      D10
      .
169     .      .      D11
      .
174     CD10.....
      V
178     RCD10
      .
184     .      D8
      .
189     .      .      D9
      .
194     CHLFR-C.....
      V
198     RCHLFR-C
      .
204     .      D6
      .
209     .      .      D7
      .
214     CD6.....
      .
218     .      D4
      .
223     .      .      D5
      .
228     CWRJS-C.....
      V
232     RCWRJS-C
      .
238     .      D2
      .
243     .      .      D3
      .
248     CD2.....
      V
252     RCD2
      .
258     .      D1
      .
263     CLWFR-C.....

```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1
*

```

```

*****
*
* U.S. ARMY CORPS OF ENGINEERS
* HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET
* DAVIS, CALIFORNIA 95616
*

```

* RUN DATE 31AUG16 TIME 11:27:58 *

ALLGOW3R2.OUT

(916) 756-1104 *

```

*****
*
*  GOWAN NORTH - EL CAPITAN BRANCH
*  LONE MOUNTAIN ROAD TO ANN ROAD
*  ULTIMATE CONDITIONS
*
*  RETURN PERIOD  _ _ 100 & 10 -YEAR
*  DISTRIBUTION  _ _ 6-HOUR SDN3
*  PROJECT NO  _ _ 412.661
*  FILENAME  _ _ ALLGOW3R2.H1
*  DATE MODELED  _ _ 8/31/2016
*  MODELED BY  _ _ MMC/GYT
*
*****
  
```

JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:

AREA	DARF
SQ. MI.	
0-0.5	0.99
0.5-1	0.975
1-2	0.95
2-3	0.925
3-4	0.915
4-5	0.908
5-6	0.903
6-7	0.895
7-8	0.885

JR CARD RATIOS REPRESENT DEPTH-AREA REDUCTION FACTORS (DARF'S)
 100-YEAR, 6-HOUR STORM, SDN3

37 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 600 NUMBER OF HYDROGRAPH ORDINATES
 NDDATE 3 0 ENDING DATE
 NDTIME 0155 ENDING TIME
 ICENT 19 CENTURY MARK

COMPUTATION INTERVAL .08 HOURS
 TOTAL TIME BASE 49.92 HOURS

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

JP MULTI-PLAN OPTION
 NPLAN 1 NUMBER OF PLANS

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

1

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	BSFR-C	.21	1 FLOW TIME	201. 3.75	196. 3.75	189. 3.75	181. 3.75	178. 3.75	175. 3.75	174. 3.75	171. 3.75	168. 3.75
ROUTED TO	RBSFR-C	.21	1 FLOW TIME	200. 3.75	196. 3.75	188. 3.75	180. 3.75	177. 3.75	174. 3.75	173. 3.75	170. 3.75	167. 3.75
HYDROGRAPH AT	CPFR-C	.25	1 FLOW TIME	145. 3.83	140. 3.83	133. 3.83	126. 3.83	123. 3.83	121. 3.83	119. 3.83	117. 3.83	114. 3.83
2 COMBINED AT	CCPFR-C	.46	1 FLOW TIME	344. 3.75	334. 3.75	319. 3.75	303. 3.75	297. 3.75	293. 3.75	290. 3.75	285. 3.75	279. 3.75
ROUTED TO	RCCPFR-C	.46	1 FLOW TIME	340. 3.75	330. 3.75	315. 3.75	299. 3.75	293. 3.75	289. 3.75	286. 3.75	281. 3.75	275. 3.75
HYDROGRAPH AT	ARFP-C	.25	1 FLOW TIME	144. 3.83	139. 3.83	132. 3.83	125. 3.83	122. 3.83	120. 3.83	119. 3.83	116. 3.83	113. 3.83
2 COMBINED AT												

				ALLGOW3R2.OUT									
+	CARFP-C	.70	1	FLOW TIME	482. 3.75	468. 3.75	445. 3.75	422. 3.75	413. 3.75	407. 3.75	402. 3.75	395. 3.75	386. 3.75
ROUTED TO													
+	RCARFP-C	.70	1	FLOW TIME	478. 3.83	464. 3.83	443. 3.83	421. 3.83	412. 3.83	405. 3.83	402. 3.83	394. 3.83	386. 3.83
HYDROGRAPH AT													
+	TRFR-C	.26	1	FLOW TIME	157. 3.83	152. 3.83	144. 3.83	136. 3.83	133. 3.83	131. 3.83	130. 3.83	127. 3.83	124. 3.83
2 COMBINED AT													
+	CTRFR-C	.96	1	FLOW TIME	634. 3.83	616. 3.83	587. 3.83	557. 3.83	545. 3.83	537. 3.83	531. 3.83	521. 3.83	511. 3.83
ROUTED TO													
+	RCTRFR-C	.96	1	FLOW TIME	633. 3.83	614. 3.83	585. 3.83	555. 3.83	543. 3.83	535. 3.83	529. 3.83	519. 3.83	508. 3.83
HYDROGRAPH AT													
+	EAFR-C	.25	1	FLOW TIME	151. 3.83	147. 3.83	139. 3.83	132. 3.83	129. 3.83	127. 3.83	125. 3.83	123. 3.83	120. 3.83
2 COMBINED AT													
+	CEAFR-C	1.21	1	FLOW TIME	784. 3.83	761. 3.83	724. 3.83	687. 3.83	672. 3.83	661. 3.83	654. 3.83	642. 3.83	628. 3.83
ROUTED TO													
+	RCEAFR-C	1.21	1	FLOW TIME	783. 3.83	760. 3.83	723. 3.83	686. 3.83	670. 3.83	660. 3.83	653. 3.83	640. 3.83	627. 3.83
HYDROGRAPH AT													
+	D14	.11	1	FLOW TIME	90. 3.67	88. 3.67	84. 3.67	79. 3.67	78. 3.67	77. 3.67	76. 3.67	75. 3.67	73. 3.67
HYDROGRAPH AT													
+	D15	.01	1	FLOW TIME	16. 3.58	15. 3.58	15. 3.58	14. 3.58	14. 3.58	14. 3.58	13. 3.58	13. 3.58	13. 3.58
3 COMBINED AT													
+	CD14	1.33	1	FLOW TIME	871. 3.83	846. 3.83	805. 3.83	764. 3.83	747. 3.83	735. 3.83	728. 3.83	714. 3.83	699. 3.83
ROUTED TO													
+	RCD14	1.33	1	FLOW TIME	870. 3.83	845. 3.83	804. 3.83	763. 3.83	746. 3.83	734. 3.83	727. 3.83	713. 3.83	698. 3.83
HYDROGRAPH AT													
+	D12	.10	1	FLOW TIME	83. 3.75	80. 3.75	77. 3.75	73. 3.75	72. 3.75	71. 3.75	70. 3.75	69. 3.75	67. 3.75
HYDROGRAPH AT													
+	D13	.01	1	FLOW TIME	16. 3.58	16. 3.58	15. 3.58	14. 3.58	14. 3.58	14. 3.58	14. 3.58	13. 3.58	13. 3.58
3 COMBINED AT													
+	CARFR-C	1.45	1	FLOW TIME	955. 3.83	928. 3.83	883. 3.83	839. 3.83	820. 3.83	808. 3.83	800. 3.83	785. 3.83	768. 3.83
ROUTED TO													
+	RCARFR-C	1.45	1	FLOW TIME	954. 3.83	927. 3.83	882. 3.83	838. 3.83	819. 3.83	807. 3.83	799. 3.83	784. 3.83	766. 3.83
HYDROGRAPH AT													
+	D10	.04	1	FLOW TIME	30. 3.67	29. 3.67	28. 3.67	26. 3.67	26. 3.67	25. 3.67	25. 3.67	24. 3.67	24. 3.67
HYDROGRAPH AT													
+	D11	.01	1	FLOW TIME	11. 3.58	10. 3.58	10. 3.58	9. 3.58	9. 3.58	9. 3.58	9. 3.58	9. 3.58	8. 3.58
3 COMBINED AT													
+	CD10	1.50	1	FLOW TIME	981. 3.83	953. 3.83	907. 3.83	861. 3.83	843. 3.83	830. 3.83	821. 3.83	806. 3.83	788. 3.83
ROUTED TO													
+	RCD10	1.50	1	FLOW TIME	981. 3.83	952. 3.83	906. 3.83	860. 3.83	841. 3.83	829. 3.83	820. 3.83	805. 3.83	787. 3.83
HYDROGRAPH AT													
+	D8	.19	1	FLOW TIME	118. 3.83	114. 3.83	108. 3.83	103. 3.83	100. 3.83	99. 3.83	98. 3.83	96. 3.83	94. 3.83
HYDROGRAPH AT													
+	D9	.01	1	FLOW TIME	6. 3.58	6. 3.58	6. 3.58	6. 3.58	5. 3.58	5. 3.58	5. 3.58	5. 3.58	5. 3.58
3 COMBINED AT													
+	CHLFR-C	1.70	1	FLOW TIME	1102. 3.83	1070. 3.83	1018. 3.83	966. 3.83	945. 3.83	930. 3.83	920. 3.83	903. 3.83	883. 3.83
ROUTED TO													
+	RCHLFR-C	1.70	1	FLOW TIME	1100. 3.83	1069. 3.83	1017. 3.83	964. 3.83	943. 3.83	929. 3.83	919. 3.83	902. 3.83	882. 3.83
HYDROGRAPH AT													
+	D6	.01	1	FLOW TIME	10. 3.67	9. 3.67	9. 3.67	8. 3.67	8. 3.67	8. 3.67	8. 3.67	8. 3.67	8. 3.67
HYDROGRAPH AT													
+	D7	.02	1	FLOW TIME	18. 3.58	18. 3.58	17. 3.58	16. 3.58	16. 3.58	15. 3.58	15. 3.58	15. 3.58	15. 3.58
3 COMBINED AT													
+	CD6	1.73	1	FLOW TIME	1118. 3.83	1086. 3.83	1033. 3.83	980. 3.83	959. 3.83	944. 3.83	934. 3.83	917. 3.83	896. 3.83
HYDROGRAPH AT													
+	D4	.21	1	FLOW TIME	124. 3.83	121. 3.83	114. 3.83	108. 3.83	105. 3.83	104. 3.83	102. 3.83	101. 3.83	98. 3.83
HYDROGRAPH AT													

+	D5	.02	1	FLOW TIME	13. 3.58	13. 3.58	12. 3.58	12. 3.58	11. 3.58	11. 3.58	11. 3.58	11. 3.58	10. 3.58
+	3 COMBINED AT CWRJS-C	1.96	1	FLOW TIME	1250. 3.83	1214. 3.83	1154. 3.83	1095. 3.83	1071. 3.83	1054. 3.83	1043. 3.83	1023. 3.83	1000. 3.83
+	ROUTED TO RCWRJS-C	1.96	1	FLOW TIME	1250. 3.83	1213. 3.83	1153. 3.83	1093. 3.83	1069. 3.83	1053. 3.83	1042. 3.83	1022. 3.83	999. 3.83
+	HYDROGRAPH AT D2	.05	1	FLOW TIME	37. 3.67	36. 3.67	34. 3.67	32. 3.67	31. 3.67	31. 3.67	30. 3.67	30. 3.67	29. 3.67
+	HYDROGRAPH AT D3	.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
+	3 COMBINED AT CD2	2.02	1	FLOW TIME	1284. 3.83	1247. 3.83	1186. 3.83	1124. 3.83	1099. 3.83	1082. 3.83	1071. 3.83	1050. 3.83	1027. 3.83
+	ROUTED TO RCD2	2.02	1	FLOW TIME	1283. 3.83	1246. 3.83	1185. 3.83	1123. 3.83	1098. 3.83	1081. 3.83	1069. 3.83	1049. 3.83	1025. 3.83
+	HYDROGRAPH AT D1	.05	1	FLOW TIME	39. 3.67	37. 3.67	35. 3.67	33. 3.67	33. 3.67	32. 3.67	32. 3.67	31. 3.67	30. 3.67
+	2 COMBINED AT CLWFR-C	2.08	1	FLOW TIME	1314. 3.83	1275. 3.83	1213. 3.83	1149. 3.83	1124. 3.83	1107. 3.83	1095. 3.83	1074. 3.83	1050. 3.83

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

INTERPOLATED TO
COMPUTATION INTERVAL
PEAK TIME TO
PEAK

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
FOR PLAN = 1	RATIO=	.00							
RBSFR-C	MANE	1.20	200.51	225.64	1.48	5.00	200.38	225.00	1.49

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1639E+02 EXCESS= .0000E+00 OUTFLOW= .1639E+02 BASIN STORAGE= .1335E-03 PERCENT ERROR= .0

FOR PLAN = 1	RATIO=	.00							
RBSFR-C	MANE	1.21	195.81	225.52	1.45	5.00	195.60	225.00	1.45

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1599E+02 EXCESS= .0000E+00 OUTFLOW= .1599E+02 BASIN STORAGE= .1374E-03 PERCENT ERROR= .0

FOR PLAN = 1	RATIO=	.00							
RBSFR-C	MANE	1.22	188.06	224.94	1.39	5.00	188.05	225.00	1.39

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1533E+02 EXCESS= .0000E+00 OUTFLOW= .1533E+02 BASIN STORAGE= .1325E-03 PERCENT ERROR= .0

FOR PLAN = 1	RATIO=	.00							
RBSFR-C	MANE	1.23	180.05	225.64	1.33	5.00	179.80	225.00	1.33

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1467E+02 EXCESS= .0000E+00 OUTFLOW= .1467E+02 BASIN STORAGE= .1474E-03 PERCENT ERROR= .0

FOR PLAN = 1	RATIO=	.00							
RBSFR-C	MANE	1.23	177.02	225.20	1.30	5.00	176.84	225.00	1.31

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1441E+02 EXCESS= .0000E+00 OUTFLOW= .1441E+02 BASIN STORAGE= .1414E-03 PERCENT ERROR= .0

FOR PLAN = 1	RATIO=	.00							
RBSFR-C	MANE	1.23	174.71	225.76	1.29	5.00	174.49	225.00	1.29

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1422E+02 EXCESS= .0000E+00 OUTFLOW= .1422E+02 BASIN STORAGE= .1423E-03 PERCENT ERROR= .0

FOR PLAN = 1	RATIO=	.00							
RBSFR-C	MANE	1.24	173.27	224.93	1.28	5.00	173.26	225.00	1.28

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1409E+02 EXCESS= .0000E+00 OUTFLOW= .1409E+02 BASIN STORAGE= .1479E-03 PERCENT ERROR= .0

FOR PLAN = 1	RATIO=	.00							
RBSFR-C	MANE	1.24	170.70	225.58	1.26	5.00	170.39	225.00	1.26

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1388E+02 EXCESS= .0000E+00 OUTFLOW= .1388E+02 BASIN STORAGE= .1461E-03 PERCENT ERROR= .0

FOR PLAN = 1	RATIO=	.00							
RBSFR-C	MANE	1.24	167.66	225.16	1.23	5.00	167.50	225.00	1.23

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1362E+02 EXCESS= .0000E+00 OUTFLOW= .1362E+02 BASIN STORAGE= .1394E-03 PERCENT ERROR= .0

FOR PLAN = 1	RATIO=	.00							
RCCPFR-C	MANE	1.00	343.15	226.05	1.19	5.00	339.60	225.00	1.19

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2906E+02 EXCESS= .0000E+00 OUTFLOW= .2906E+02 BASIN STORAGE= .1226E-02 PERCENT ERROR= .0

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FOR PLAN = 1	RATIO= .00								
RCCPFR-C	MANE	1.02	333.08	226.54	1.16	5.00	329.94	225.00	1.16
CONTINUITY SUMMARY (AC-FT) - INFLOW= .2827E+02 EXCESS= .0000E+00 OUTFLOW= .2827E+02 BASIN STORAGE= .1188E-02 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCCPFR-C	MANE	1.03	317.88	226.64	1.10	5.00	314.81	225.00	1.11
CONTINUITY SUMMARY (AC-FT) - INFLOW= .2697E+02 EXCESS= .0000E+00 OUTFLOW= .2697E+02 BASIN STORAGE= .1141E-02 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCCPFR-C	MANE	1.06	302.79	226.00	1.05	5.00	299.40	225.00	1.05
CONTINUITY SUMMARY (AC-FT) - INFLOW= .2568E+02 EXCESS= .0000E+00 OUTFLOW= .2568E+02 BASIN STORAGE= .1272E-02 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCCPFR-C	MANE	1.06	296.32	226.74	1.03	5.00	293.19	225.00	1.03
CONTINUITY SUMMARY (AC-FT) - INFLOW= .2517E+02 EXCESS= .0000E+00 OUTFLOW= .2517E+02 BASIN STORAGE= .1221E-02 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCCPFR-C	MANE	1.07	292.24	225.96	1.02	5.00	289.00	225.00	1.02
CONTINUITY SUMMARY (AC-FT) - INFLOW= .2481E+02 EXCESS= .0000E+00 OUTFLOW= .2481E+02 BASIN STORAGE= .1263E-02 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCCPFR-C	MANE	1.07	289.17	226.80	1.01	5.00	286.12	225.00	1.01
CONTINUITY SUMMARY (AC-FT) - INFLOW= .2456E+02 EXCESS= .0000E+00 OUTFLOW= .2456E+02 BASIN STORAGE= .1170E-02 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCCPFR-C	MANE	1.08	284.53	226.28	.99	5.00	280.95	225.00	.99
CONTINUITY SUMMARY (AC-FT) - INFLOW= .2415E+02 EXCESS= .0000E+00 OUTFLOW= .2415E+02 BASIN STORAGE= .1156E-02 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCCPFR-C	MANE	1.09	278.51	225.98	.97	5.00	275.29	225.00	.97
CONTINUITY SUMMARY (AC-FT) - INFLOW= .2365E+02 EXCESS= .0000E+00 OUTFLOW= .2365E+02 BASIN STORAGE= .1232E-02 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCARFP-C	MANE	1.25	481.02	226.83	1.11	5.00	477.93	230.00	1.11
CONTINUITY SUMMARY (AC-FT) - INFLOW= .4164E+02 EXCESS= .0000E+00 OUTFLOW= .4164E+02 BASIN STORAGE= .1688E-02 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCARFP-C	MANE	1.26	467.06	227.04	1.08	5.00	464.44	230.00	1.08
CONTINUITY SUMMARY (AC-FT) - INFLOW= .4046E+02 EXCESS= .0000E+00 OUTFLOW= .4046E+02 BASIN STORAGE= .1843E-02 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCARFP-C	MANE	1.29	444.77	227.73	1.03	5.00	442.67	230.00	1.03
CONTINUITY SUMMARY (AC-FT) - INFLOW= .3854E+02 EXCESS= .0000E+00 OUTFLOW= .3853E+02 BASIN STORAGE= .1730E-02 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCARFP-C	MANE	1.31	422.13	227.32	.98	5.00	420.86	230.00	.98
CONTINUITY SUMMARY (AC-FT) - INFLOW= .3661E+02 EXCESS= .0000E+00 OUTFLOW= .3661E+02 BASIN STORAGE= .1842E-02 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCARFP-C	MANE	1.33	413.18	227.99	.96	5.00	411.73	230.00	.96
CONTINUITY SUMMARY (AC-FT) - INFLOW= .3586E+02 EXCESS= .0000E+00 OUTFLOW= .3586E+02 BASIN STORAGE= .1843E-02 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCARFP-C	MANE	1.33	406.87	228.05	.94	5.00	405.41	230.00	.94
CONTINUITY SUMMARY (AC-FT) - INFLOW= .3533E+02 EXCESS= .0000E+00 OUTFLOW= .3533E+02 BASIN STORAGE= .1731E-02 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCARFP-C	MANE	1.34	402.97	227.69	.93	5.00	401.57	230.00	.93
CONTINUITY SUMMARY (AC-FT) - INFLOW= .3496E+02 EXCESS= .0000E+00 OUTFLOW= .3496E+02 BASIN STORAGE= .1643E-02 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCARFP-C	MANE	1.35	395.30	228.06	.91	5.00	394.08	230.00	.92
CONTINUITY SUMMARY (AC-FT) - INFLOW= .3436E+02 EXCESS= .0000E+00 OUTFLOW= .3435E+02 BASIN STORAGE= .1724E-02 PERCENT ERROR= .0									

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FOR PLAN = 1	RATIO=	.00							
RCARFR-C	MANE	1.36	386.71	227.34	.90	5.00	386.21	230.00	.90
CONTINUITY SUMMARY (AC-FT) - INFLOW= .3361E+02 EXCESS= .0000E+00 OUTFLOW= .3361E+02 BASIN STORAGE= .1707E-02 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCTRFR-C	MANE	.91	632.94	230.33	1.08	5.00	632.66	230.00	1.08
CONTINUITY SUMMARY (AC-FT) - INFLOW= .5540E+02 EXCESS= .0000E+00 OUTFLOW= .5540E+02 BASIN STORAGE= .1505E-02 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCTRFR-C	MANE	.92	614.73	230.28	1.05	5.00	614.42	230.00	1.05
CONTINUITY SUMMARY (AC-FT) - INFLOW= .5381E+02 EXCESS= .0000E+00 OUTFLOW= .5381E+02 BASIN STORAGE= .1503E-02 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCTRFR-C	MANE	.94	585.21	230.17	1.00	5.00	584.97	230.00	1.00
CONTINUITY SUMMARY (AC-FT) - INFLOW= .5122E+02 EXCESS= .0000E+00 OUTFLOW= .5122E+02 BASIN STORAGE= .1514E-02 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCTRFR-C	MANE	.96	555.53	230.19	.95	5.00	555.23	230.00	.95
CONTINUITY SUMMARY (AC-FT) - INFLOW= .4863E+02 EXCESS= .0000E+00 OUTFLOW= .4863E+02 BASIN STORAGE= .1406E-02 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCTRFR-C	MANE	.96	543.36	230.30	.93	5.00	542.93	230.00	.93
CONTINUITY SUMMARY (AC-FT) - INFLOW= .4761E+02 EXCESS= .0000E+00 OUTFLOW= .4761E+02 BASIN STORAGE= .1367E-02 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCTRFR-C	MANE	.97	534.97	230.77	.92	5.00	534.53	230.00	.92
CONTINUITY SUMMARY (AC-FT) - INFLOW= .4690E+02 EXCESS= .0000E+00 OUTFLOW= .4690E+02 BASIN STORAGE= .1348E-02 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCTRFR-C	MANE	.97	529.62	230.73	.91	5.00	529.17	230.00	.91
CONTINUITY SUMMARY (AC-FT) - INFLOW= .4640E+02 EXCESS= .0000E+00 OUTFLOW= .4640E+02 BASIN STORAGE= .1372E-02 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCTRFR-C	MANE	.98	519.67	230.51	.89	5.00	519.09	230.00	.89
CONTINUITY SUMMARY (AC-FT) - INFLOW= .4558E+02 EXCESS= .0000E+00 OUTFLOW= .4558E+02 BASIN STORAGE= .1485E-02 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCTRFR-C	MANE	.99	508.71	230.48	.87	5.00	508.08	230.00	.87
CONTINUITY SUMMARY (AC-FT) - INFLOW= .4457E+02 EXCESS= .0000E+00 OUTFLOW= .4457E+02 BASIN STORAGE= .1476E-02 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCEAFR-C	MANE	.35	782.89	230.35	1.07	5.00	782.79	230.00	1.07
CONTINUITY SUMMARY (AC-FT) - INFLOW= .6876E+02 EXCESS= .0000E+00 OUTFLOW= .6876E+02 BASIN STORAGE= .5907E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCEAFR-C	MANE	.35	760.09	230.26	1.04	5.00	759.68	230.00	1.04
CONTINUITY SUMMARY (AC-FT) - INFLOW= .6677E+02 EXCESS= .0000E+00 OUTFLOW= .6677E+02 BASIN STORAGE= .5508E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCEAFR-C	MANE	.36	723.09	230.22	.99	5.00	722.58	230.00	.99
CONTINUITY SUMMARY (AC-FT) - INFLOW= .6352E+02 EXCESS= .0000E+00 OUTFLOW= .6352E+02 BASIN STORAGE= .5844E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCEAFR-C	MANE	.37	686.06	230.36	.93	5.00	685.56	230.00	.94
CONTINUITY SUMMARY (AC-FT) - INFLOW= .6028E+02 EXCESS= .0000E+00 OUTFLOW= .6027E+02 BASIN STORAGE= .5588E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCEAFR-C	MANE	.37	670.63	230.21	.92	5.00	670.03	230.00	.92
CONTINUITY SUMMARY (AC-FT) - INFLOW= .5900E+02 EXCESS= .0000E+00 OUTFLOW= .5900E+02 BASIN STORAGE= .5928E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCEAFR-C	MANE	.37	660.12	230.17	.90	5.00	659.60	230.00	.90
CONTINUITY SUMMARY (AC-FT) - INFLOW= .5811E+02 EXCESS= .0000E+00 OUTFLOW= .5811E+02 BASIN STORAGE= .5887E-03 PERCENT ERROR= .0									

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FOR PLAN = 1	RATIO= .00								
RCEAFR-C	MANE	.37	653.58	230.37	.89	5.00	653.05	230.00	.89
CONTINUITY SUMMARY (AC-FT) - INFLOW= .5748E+02 EXCESS= .0000E+00 OUTFLOW= .5748E+02 BASIN STORAGE= .5856E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCEAFR-C	MANE	.38	641.01	230.26	.88	5.00	640.33	230.00	.88
CONTINUITY SUMMARY (AC-FT) - INFLOW= .5646E+02 EXCESS= .0000E+00 OUTFLOW= .5646E+02 BASIN STORAGE= .5562E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCEAFR-C	MANE	.38	627.24	230.39	.86	5.00	626.59	230.00	.86
CONTINUITY SUMMARY (AC-FT) - INFLOW= .5520E+02 EXCESS= .0000E+00 OUTFLOW= .5520E+02 BASIN STORAGE= .5580E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCD14	MANE	.33	869.92	230.21	1.08	5.00	869.89	230.00	1.08
CONTINUITY SUMMARY (AC-FT) - INFLOW= .7679E+02 EXCESS= .0000E+00 OUTFLOW= .7679E+02 BASIN STORAGE= .5787E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCD14	MANE	.34	844.52	230.24	1.05	5.00	844.52	230.00	1.05
CONTINUITY SUMMARY (AC-FT) - INFLOW= .7458E+02 EXCESS= .0000E+00 OUTFLOW= .7458E+02 BASIN STORAGE= .5961E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCD14	MANE	.34	803.85	230.02	1.00	5.00	803.79	230.00	1.00
CONTINUITY SUMMARY (AC-FT) - INFLOW= .7096E+02 EXCESS= .0000E+00 OUTFLOW= .7096E+02 BASIN STORAGE= .5845E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCD14	MANE	.35	762.94	230.27	.95	5.00	762.76	230.00	.95
CONTINUITY SUMMARY (AC-FT) - INFLOW= .6736E+02 EXCESS= .0000E+00 OUTFLOW= .6736E+02 BASIN STORAGE= .5672E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCD14	MANE	.36	745.97	230.23	.93	5.00	745.71	230.00	.93
CONTINUITY SUMMARY (AC-FT) - INFLOW= .6595E+02 EXCESS= .0000E+00 OUTFLOW= .6595E+02 BASIN STORAGE= .5832E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCD14	MANE	.36	734.51	230.22	.91	5.00	734.24	230.00	.91
CONTINUITY SUMMARY (AC-FT) - INFLOW= .6496E+02 EXCESS= .0000E+00 OUTFLOW= .6496E+02 BASIN STORAGE= .5605E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCD14	MANE	.36	727.21	230.07	.90	5.00	727.02	230.00	.91
CONTINUITY SUMMARY (AC-FT) - INFLOW= .6426E+02 EXCESS= .0000E+00 OUTFLOW= .6426E+02 BASIN STORAGE= .5546E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCD14	MANE	.36	713.30	230.04	.89	5.00	713.18	230.00	.89
CONTINUITY SUMMARY (AC-FT) - INFLOW= .6313E+02 EXCESS= .0000E+00 OUTFLOW= .6313E+02 BASIN STORAGE= .5529E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCD14	MANE	.36	698.08	230.21	.87	5.00	697.68	230.00	.87
CONTINUITY SUMMARY (AC-FT) - INFLOW= .6173E+02 EXCESS= .0000E+00 OUTFLOW= .6173E+02 BASIN STORAGE= .5960E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCARFR-C	MANE	.32	954.51	229.90	1.09	5.00	954.41	230.00	1.09
CONTINUITY SUMMARY (AC-FT) - INFLOW= .8448E+02 EXCESS= .0000E+00 OUTFLOW= .8448E+02 BASIN STORAGE= .5593E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCARFR-C	MANE	.33	927.08	230.00	1.06	5.00	927.07	230.00	1.06
CONTINUITY SUMMARY (AC-FT) - INFLOW= .8207E+02 EXCESS= .0000E+00 OUTFLOW= .8207E+02 BASIN STORAGE= .5797E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCARFR-C	MANE	.33	882.33	229.91	1.01	5.00	882.29	230.00	1.01
CONTINUITY SUMMARY (AC-FT) - INFLOW= .7811E+02 EXCESS= .0000E+00 OUTFLOW= .7811E+02 BASIN STORAGE= .5844E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO= .00								
RCARFR-C	MANE	.34	837.75	229.99	.96	5.00	837.73	230.00	.96
CONTINUITY SUMMARY (AC-FT) - INFLOW= .7417E+02 EXCESS= .0000E+00 OUTFLOW= .7417E+02 BASIN STORAGE= .5627E-03 PERCENT ERROR= .0									

ALLGOW3R2.OUT

FOR PLAN = 1	RATIO=	.00							
RCARFR-C	MANE	.34	819.26	229.99	.94	5.00	819.26	230.00	.94
CONTINUITY SUMMARY (AC-FT) - INFLOW= .7261E+02 EXCESS= .0000E+00 OUTFLOW= .7261E+02 BASIN STORAGE= .5643E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCARFR-C	MANE	.34	806.76	230.04	.92	5.00	806.66	230.00	.93
CONTINUITY SUMMARY (AC-FT) - INFLOW= .7153E+02 EXCESS= .0000E+00 OUTFLOW= .7153E+02 BASIN STORAGE= .5818E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCARFR-C	MANE	.35	798.62	230.25	.92	5.00	798.54	230.00	.92
CONTINUITY SUMMARY (AC-FT) - INFLOW= .7077E+02 EXCESS= .0000E+00 OUTFLOW= .7077E+02 BASIN STORAGE= .5806E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCARFR-C	MANE	.35	783.64	230.26	.90	5.00	783.55	230.00	.90
CONTINUITY SUMMARY (AC-FT) - INFLOW= .6953E+02 EXCESS= .0000E+00 OUTFLOW= .6953E+02 BASIN STORAGE= .5760E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCARFR-C	MANE	.35	766.73	230.17	.88	5.00	766.44	230.00	.88
CONTINUITY SUMMARY (AC-FT) - INFLOW= .6799E+02 EXCESS= .0000E+00 OUTFLOW= .6799E+02 BASIN STORAGE= .5589E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCD10	MANE	.32	980.83	229.99	1.09	5.00	980.80	230.00	1.09
CONTINUITY SUMMARY (AC-FT) - INFLOW= .8724E+02 EXCESS= .0000E+00 OUTFLOW= .8724E+02 BASIN STORAGE= .5761E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCD10	MANE	.32	952.45	230.10	1.06	5.00	952.38	230.00	1.06
CONTINUITY SUMMARY (AC-FT) - INFLOW= .8475E+02 EXCESS= .0000E+00 OUTFLOW= .8475E+02 BASIN STORAGE= .5597E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCD10	MANE	.33	906.43	230.09	1.01	5.00	906.32	230.00	1.01
CONTINUITY SUMMARY (AC-FT) - INFLOW= .8065E+02 EXCESS= .0000E+00 OUTFLOW= .8065E+02 BASIN STORAGE= .5783E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCD10	MANE	.34	860.45	230.21	.96	5.00	860.38	230.00	.96
CONTINUITY SUMMARY (AC-FT) - INFLOW= .7658E+02 EXCESS= .0000E+00 OUTFLOW= .7658E+02 BASIN STORAGE= .5530E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCD10	MANE	.34	841.49	230.23	.94	5.00	841.46	230.00	.94
CONTINUITY SUMMARY (AC-FT) - INFLOW= .7497E+02 EXCESS= .0000E+00 OUTFLOW= .7497E+02 BASIN STORAGE= .5826E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCD10	MANE	.34	828.70	229.96	.92	5.00	828.68	230.00	.92
CONTINUITY SUMMARY (AC-FT) - INFLOW= .7385E+02 EXCESS= .0000E+00 OUTFLOW= .7385E+02 BASIN STORAGE= .5538E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCD10	MANE	.34	820.23	230.21	.91	5.00	820.11	230.00	.91
CONTINUITY SUMMARY (AC-FT) - INFLOW= .7306E+02 EXCESS= .0000E+00 OUTFLOW= .7306E+02 BASIN STORAGE= .5786E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCD10	MANE	.34	804.86	230.23	.90	5.00	804.76	230.00	.90
CONTINUITY SUMMARY (AC-FT) - INFLOW= .7178E+02 EXCESS= .0000E+00 OUTFLOW= .7178E+02 BASIN STORAGE= .5713E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCD10	MANE	.35	787.29	230.19	.88	5.00	787.05	230.00	.88
CONTINUITY SUMMARY (AC-FT) - INFLOW= .7020E+02 EXCESS= .0000E+00 OUTFLOW= .7020E+02 BASIN STORAGE= .5518E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCHLFRC	MANE	.32	1100.58	229.88	1.08	5.00	1100.49	230.00	1.08
CONTINUITY SUMMARY (AC-FT) - INFLOW= .9793E+02 EXCESS= .0000E+00 OUTFLOW= .9793E+02 BASIN STORAGE= .5801E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCHLFRC	MANE	.32	1068.80	230.03	1.05	5.00	1068.73	230.00	1.05
CONTINUITY SUMMARY (AC-FT) - INFLOW= .9512E+02 EXCESS= .0000E+00 OUTFLOW= .9512E+02 BASIN STORAGE= .6046E-03 PERCENT ERROR= .0									

ALLGOW3R2.OUT

FOR PLAN = 1	RATIO=	.00							
RCHLFRC	MANE	.33	1016.67	230.05	1.00	5.00	1016.53	230.00	1.00
CONTINUITY SUMMARY (AC-FT) - INFLOW= .9050E+02 EXCESS= .0000E+00 OUTFLOW= .9050E+02 BASIN STORAGE= .6100E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCHLFRC	MANE	.34	964.58	230.22	.95	5.00	964.44	230.00	.95
CONTINUITY SUMMARY (AC-FT) - INFLOW= .8591E+02 EXCESS= .0000E+00 OUTFLOW= .8591E+02 BASIN STORAGE= .6130E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCHLFRC	MANE	.34	943.34	230.24	.93	5.00	943.23	230.00	.93
CONTINUITY SUMMARY (AC-FT) - INFLOW= .8411E+02 EXCESS= .0000E+00 OUTFLOW= .8411E+02 BASIN STORAGE= .6043E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCHLFRC	MANE	.34	928.99	229.96	.92	5.00	928.97	230.00	.92
CONTINUITY SUMMARY (AC-FT) - INFLOW= .8284E+02 EXCESS= .0000E+00 OUTFLOW= .8284E+02 BASIN STORAGE= .6126E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCHLFRC	MANE	.34	919.23	230.24	.91	5.00	919.08	230.00	.91
CONTINUITY SUMMARY (AC-FT) - INFLOW= .8195E+02 EXCESS= .0000E+00 OUTFLOW= .8195E+02 BASIN STORAGE= .5804E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCHLFRC	MANE	.34	902.05	230.26	.89	5.00	901.91	230.00	.89
CONTINUITY SUMMARY (AC-FT) - INFLOW= .8051E+02 EXCESS= .0000E+00 OUTFLOW= .8051E+02 BASIN STORAGE= .6157E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCHLFRC	MANE	.35	882.06	230.25	.87	5.00	881.80	230.00	.87
CONTINUITY SUMMARY (AC-FT) - INFLOW= .7872E+02 EXCESS= .0000E+00 OUTFLOW= .7872E+02 BASIN STORAGE= .5873E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCWRJS-C	MANE	.30	1249.59	230.02	1.07	5.00	1249.53	230.00	1.07
CONTINUITY SUMMARY (AC-FT) - INFLOW= .1115E+03 EXCESS= .0000E+00 OUTFLOW= .1115E+03 BASIN STORAGE= .6065E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCWRJS-C	MANE	.31	1213.24	229.99	1.04	5.00	1213.22	230.00	1.04
CONTINUITY SUMMARY (AC-FT) - INFLOW= .1083E+03 EXCESS= .0000E+00 OUTFLOW= .1083E+03 BASIN STORAGE= .6187E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCWRJS-C	MANE	.31	1153.41	230.00	.98	5.00	1153.40	230.00	.99
CONTINUITY SUMMARY (AC-FT) - INFLOW= .1030E+03 EXCESS= .0000E+00 OUTFLOW= .1030E+03 BASIN STORAGE= .5759E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCWRJS-C	MANE	.32	1093.56	230.13	.93	5.00	1093.31	230.00	.93
CONTINUITY SUMMARY (AC-FT) - INFLOW= .9774E+02 EXCESS= .0000E+00 OUTFLOW= .9774E+02 BASIN STORAGE= .5836E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCWRJS-C	MANE	.32	1069.31	229.94	.91	5.00	1069.29	230.00	.92
CONTINUITY SUMMARY (AC-FT) - INFLOW= .9567E+02 EXCESS= .0000E+00 OUTFLOW= .9567E+02 BASIN STORAGE= .5838E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCWRJS-C	MANE	.32	1053.17	230.06	.90	5.00	1052.96	230.00	.90
CONTINUITY SUMMARY (AC-FT) - INFLOW= .9422E+02 EXCESS= .0000E+00 OUTFLOW= .9421E+02 BASIN STORAGE= .5762E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCWRJS-C	MANE	.33	1041.78	230.08	.89	5.00	1041.53	230.00	.89
CONTINUITY SUMMARY (AC-FT) - INFLOW= .9319E+02 EXCESS= .0000E+00 OUTFLOW= .9319E+02 BASIN STORAGE= .6219E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCWRJS-C	MANE	.33	1022.17	230.18	.88	5.00	1021.90	230.00	.88
CONTINUITY SUMMARY (AC-FT) - INFLOW= .9154E+02 EXCESS= .0000E+00 OUTFLOW= .9154E+02 BASIN STORAGE= .6271E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCWRJS-C	MANE	.33	999.13	229.97	.86	5.00	999.13	230.00	.86
CONTINUITY SUMMARY (AC-FT) - INFLOW= .8950E+02 EXCESS= .0000E+00 OUTFLOW= .8950E+02 BASIN STORAGE= .6151E-03 PERCENT ERROR= .0									

ALLGOW3R2.OUT

FOR PLAN = 1	RATIO=	.00							
RCD2	MANE	.31	1283.48	229.98	1.06	5.00	1283.43	230.00	1.06
CONTINUITY SUMMARY (AC-FT) - INFLOW= .1148E+03 EXCESS= .0000E+00 OUTFLOW= .1148E+03 BASIN STORAGE= .6079E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCD2	MANE	.32	1245.80	230.16	1.03	5.00	1245.70	230.00	1.03
CONTINUITY SUMMARY (AC-FT) - INFLOW= .1115E+03 EXCESS= .0000E+00 OUTFLOW= .1115E+03 BASIN STORAGE= .6205E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCD2	MANE	.32	1184.54	229.98	.98	5.00	1184.52	230.00	.98
CONTINUITY SUMMARY (AC-FT) - INFLOW= .1060E+03 EXCESS= .0000E+00 OUTFLOW= .1060E+03 BASIN STORAGE= .6351E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCD2	MANE	.33	1122.64	229.98	.93	5.00	1122.63	230.00	.93
CONTINUITY SUMMARY (AC-FT) - INFLOW= .1006E+03 EXCESS= .0000E+00 OUTFLOW= .1006E+03 BASIN STORAGE= .6329E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCD2	MANE	.33	1098.02	230.02	.91	5.00	1097.94	230.00	.91
CONTINUITY SUMMARY (AC-FT) - INFLOW= .9847E+02 EXCESS= .0000E+00 OUTFLOW= .9847E+02 BASIN STORAGE= .6302E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCD2	MANE	.34	1081.19	230.09	.90	5.00	1080.89	230.00	.90
CONTINUITY SUMMARY (AC-FT) - INFLOW= .9698E+02 EXCESS= .0000E+00 OUTFLOW= .9698E+02 BASIN STORAGE= .6329E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCD2	MANE	.34	1069.44	230.08	.89	5.00	1069.16	230.00	.89
CONTINUITY SUMMARY (AC-FT) - INFLOW= .9593E+02 EXCESS= .0000E+00 OUTFLOW= .9593E+02 BASIN STORAGE= .6184E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCD2	MANE	.34	1049.29	230.13	.87	5.00	1048.92	230.00	.87
CONTINUITY SUMMARY (AC-FT) - INFLOW= .9422E+02 EXCESS= .0000E+00 OUTFLOW= .9422E+02 BASIN STORAGE= .6381E-03 PERCENT ERROR= .0									
FOR PLAN = 1	RATIO=	.00							
RCD2	MANE	.34	1025.86	230.15	.85	5.00	1025.43	230.00	.85
CONTINUITY SUMMARY (AC-FT) - INFLOW= .9212E+02 EXCESS= .0000E+00 OUTFLOW= .9212E+02 BASIN STORAGE= .6161E-03 PERCENT ERROR= .0									

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

APPENDIX B

Hydraulic Analysis

MAIN.WSW

T1 GOWAN NORTH - EL CAPITAN MAINLINE DRAIN

T2 GCW INC. PROJECT# 412.661

T3 FILENAME: MAIN.WSW JAM

SO	906.2202436.500	1			2441.500				
R	927.4302436.695	1	.013					.000	
R	957.2202436.969	1	.013					-13.000	
R	1058.9802441.022	1	.013					-45.000	
R	1084.2702442.030	1	.013					.000	
TS	1104.2702442.189	2	.015					.000	
R	1355.5402444.185	2	.015					.000	
R	1525.3102445.533	2	.015					-5.500	
R	1695.0802446.882	2	.015					5.500	
R	1900.5302448.514	2	.015					.000	
R	2200.5302453.014	2	.015					.000	
R	2337.6402454.423	2	.015					.000	
JX	2342.6402454.474	3 66	.015	121.000	2454.474		0.0	45.0	
R	3008.5102461.359	3	.015				.000		
JX	3013.5102461.411	3 30	.015	15.000	2461.411		0.0	45.0	
R	3369.3102465.090	3	.015				-4.500		
R	3510.0602466.545	3	.015				4.500		
R	3650.8102468.001	3	.015				.000		
R	3679.6202468.269	3	.015				.000		
JX	3684.6202468.316	3 66	.015	111.000	2468.316		0.0	45.0	
R	4050.8002471.728	3	.015				.000		
R	4191.5602473.040	3	.015				-4.500		
R	4251.0602473.594	3	.015				1.900		
R	4332.3002474.351	3	.015				2.600		
JX	4337.3002474.398	3 36	.015	24.000	2474.398		0.0	45.0	
R	4967.2502480.268	3	.015				.000		
JX	4972.2502480.315	4 54	.015	78.000	2480.315		0.0	45.0	
R	5610.8502482.840	4	.015				.000		
JX	5615.8502482.860	4 54	.015	81.000	2482.860		0.0	45.0	
R	5823.4902483.681	4	.015				.000		
R	5993.2602484.352	4	.015				-5.500		
R	6163.0302485.023	4	.015				5.500		
R	6259.7802485.406	4	.015				.000	-3.000	
R	6311.7502486.445	4	.015				.000		
SH	6311.7502486.445	4							
CD	1 3 0	.000	5.000	12.000	.000	.000	.00		
CD	2 3 0	.000	8.000	10.000	.000	.000	.00		
CD	3 3 0	.000	7.000	10.000	.000	.000	.00		
CD	4 3 0	.000	6.000	12.000	.000	.000	.00		
CD	30 4 0	.000	2.500	.000	.000	.000	.00		
CD	36 4 0	.000	3.000	.000	.000	.000	.00		
CD	54 4 0	.000	4.500	.000	.000	.000	.00		
CD	66 4 0	.000	5.500	.000	.000	.000	.00		
Q			724.000	.0					

FILE: MAIN.WSW

MAIN.EDT

W S P G W - EDIT LISTING - Version 14.10

Date: 9-14-2016 Time: 5:10:39

CARD CODE	SECT NO	CHN TYPE	NO OF PIER	AVE PIER WIDTH	HEIGHT 1 BASE DIAMETER	WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
00	1	3	0	.000	5.000	12.000	.000	.000	.00										
00	2	3	0	.000	8.000	10.000	.000	.000	.00										
00	3	3	0	.000	7.000	10.000	.000	.000	.00										
00	4	3	0	.000	6.000	12.000	.000	.000	.00										
00	30	4	0		2.500														
00	36	4	0		3.000														
00	54	4	0		4.500														
00	66	4	0		5.500														

W S P G W

PAGE NO 1

WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -

GOWAN NORTH - EL CAPITAN MAINLINE DRAIN

HEADING LINE NO 2 IS -

GCW INC. PROJECT# 412.661

HEADING LINE NO 3 IS -

FILENAME: MAIN.WSW JAM

W S P G W

PAGE NO 2

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO	1 IS A	SYSTEM OUTLET	U/S DATA	STATION	INVERT	SECT	W S ELEV	RADIUS	ANGLE	ANG PT	MAN H
ELEMENT NO	2 IS A	REACH	U/S DATA	STATION	INVERT	SECT	2441.500				
ELEMENT NO	3 IS A	REACH	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	4 IS A	REACH	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	5 IS A	REACH	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	6 IS A	TRANSITION	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	7 IS A	REACH	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	8 IS A	REACH	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	9 IS A	REACH	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	10 IS A	REACH	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	11 IS A	REACH	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	12 IS A	REACH	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	13 IS A	JUNCTION	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	14 IS A	REACH	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	15 IS A	JUNCTION	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	16 IS A	REACH	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	17 IS A	REACH	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	18 IS A	REACH	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	19 IS A	REACH	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	20 IS A	JUNCTION	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	21 IS A	REACH	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	22 IS A	REACH	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	23 IS A	REACH	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	24 IS A	REACH	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	25 IS A	JUNCTION	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	26 IS A	REACH	U/S DATA	STATION	INVERT	SECT					

W S P G W

PAGE NO 3

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO	14 IS A	REACH	U/S DATA	STATION	INVERT	SECT	W S ELEV	RADIUS	ANGLE	ANG PT	MAN H
ELEMENT NO	15 IS A	JUNCTION	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	16 IS A	REACH	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	17 IS A	REACH	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	18 IS A	REACH	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	19 IS A	REACH	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	20 IS A	JUNCTION	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	21 IS A	REACH	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	22 IS A	REACH	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	23 IS A	REACH	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	24 IS A	REACH	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	25 IS A	JUNCTION	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	26 IS A	REACH	U/S DATA	STATION	INVERT	SECT					

W S P G W

PAGE NO 4

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO	24 IS A	REACH	U/S DATA	STATION	INVERT	SECT	W S ELEV	RADIUS	ANGLE	ANG PT	MAN H
ELEMENT NO	25 IS A	JUNCTION	U/S DATA	STATION	INVERT	SECT					
ELEMENT NO	26 IS A	REACH	U/S DATA	STATION	INVERT	SECT					

MAIN. EDT										
ELEMENT NO	27	IS	A JUNCTION	4967.250	2480.268	3	*	*	.015	
			U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	
				4972.250	2480.315	4	54	0	.015	
										Q3 78.000
										Q4 .000
										INVERT-3 INVERT-4 PHI 3 PHI 4
										.000 2480.315 .000 .000 45.000
										RADIUS .000
										ANGLE .000
ELEMENT NO	28	IS	A REACH	*	*	*				
			U/S DATA	STATION	INVERT	SECT			N	
				5610.850	2482.840	4			.015	
										RADIUS .000
										ANGLE .000
										ANG PT .000
										MAN H 0
ELEMENT NO	29	IS	A JUNCTION	*	*	*				
			U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	
				5615.850	2482.860	4	54	0	.015	
										Q3 81.000
										Q4 .000
										INVERT-3 INVERT-4 PHI 3 PHI 4
										.000 2482.860 .000 .000 45.000
										RADIUS .000
										ANGLE .000
ELEMENT NO	30	IS	A REACH	*	*	*				
			U/S DATA	STATION	INVERT	SECT			N	
				5823.490	2483.681	4			.015	
										RADIUS .000
										ANGLE .000
										ANG PT .000
										MAN H 0
ELEMENT NO	31	IS	A REACH	*	*	*				
			U/S DATA	STATION	INVERT	SECT			N	
				5993.260	2484.352	4			.015	
										RADIUS 1768.560
										ANGLE -5.500
										ANG PT .000
										MAN H 0
										PAGE NO 5
										W S P G W
										ELEMENT CARD LISTING
ELEMENT NO	32	IS	A REACH	*	*	*				
			U/S DATA	STATION	INVERT	SECT			N	
				6163.030	2485.023	4			.015	
										RADIUS 1768.565
										ANGLE 5.500
										ANG PT .000
										MAN H 0
ELEMENT NO	33	IS	A REACH	*	*	*				
			U/S DATA	STATION	INVERT	SECT			N	
				6259.780	2485.406	4			.015	
										RADIUS .000
										ANGLE .000
										ANG PT -3.000
										MAN H 0
ELEMENT NO	34	IS	A REACH	*	*	*				
			U/S DATA	STATION	INVERT	SECT			N	
				6311.750	2486.445	4			.015	
										RADIUS .000
										ANGLE .000
										ANG PT .000
										MAN H 0
ELEMENT NO	35	IS	A SYSTEM HEADWORKS	*	*	*				
			U/S DATA	STATION	INVERT	SECT			N	
				6311.750	2486.445	4			.015	
										W S ELEV .000

FILE: MAIN.WSW

MAIN.OUT
W S P G W - CIVILDESIGN Version 14.08
Program Package Serial Number: 3074
WATER SURFACE PROFILE LISTING
GOWAN NORTH - EL CAPITAN MAINLINE DRAIN
GCW INC. PROJECT# 412.661
FILENAME: MAIN.WSW JAM

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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
906.220	2436.500	3.723	2440.223	1154.00	25.83	10.36	2450.58	.00	5.00	12.00	5.000	12.000	.00	0 .0
21.210	.0092					.0171	.36	3.72	2.36	4.63	.013	.00	.00	BOX
927.430	2436.695	3.686	2440.381	1154.00	26.09	10.57	2450.95	5.00	5.00	12.00	5.000	12.000	.00	0 .0
29.790	.0092					.0177	.53	5.00	2.39	4.63	.013	.00	.00	BOX
957.220	2436.969	3.634	2440.603	1154.00	26.47	10.88	2451.48	5.00	5.00	12.00	5.000	12.000	.00	0 .0
27.728	.0398					.0172	.48	5.00	2.45	2.76	.013	.00	.00	BOX
984.948	2438.073	3.768	2441.842	1154.00	25.52	10.11	2451.96	5.00	5.00	12.00	5.000	12.000	.00	0 .0
29.936	.0398					.0153	.46	5.00	2.32	2.76	.013	.00	.00	BOX
1014.884	2439.266	3.952	2443.218	1154.00	24.33	9.19	2452.41	5.00	5.00	12.00	5.000	12.000	.00	0 .0
24.282	.0398					.0134	.32	5.00	2.16	2.76	.013	.00	.00	BOX
1039.167	2440.233	4.145	2444.378	1154.00	23.20	8.36	2452.74	5.00	5.00	12.00	5.000	12.000	.00	0 .0
19.813	.0398					.0117	.23	5.00	2.01	2.76	.013	.00	.00	BOX
1058.980	2441.022	4.347	2445.369	1154.00	22.12	7.60	2452.97	.00	5.00	12.00	5.000	12.000	.00	0 .0
11.223	.0399					.0105	.12	4.35	1.87	2.76	.013	.00	.00	BOX
1070.203	2441.469	4.489	2445.958	1154.00	21.42	7.13	2453.09	.00	5.00	12.00	5.000	12.000	.00	0 .0
14.067	.0399					.0094	.13	4.49	1.78	2.76	.013	.00	.00	BOX
1084.270	2442.030	4.708	2446.738	1154.00	20.43	6.48	2453.22	.00	5.00	12.00	5.000	12.000	.00	0 .0
TRANS STR	.0079					.0098	.20	4.71	1.66		.015	.00	.00	BOX

WARNING - Flow depth near top of box conduit

FILE: MAIN.WSW

W S P G W - CIVILDESIGN Version 14.08
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WATER SURFACE PROFILE LISTING
GOWAN NORTH - EL CAPITAN MAINLINE DRAIN
GCW INC. PROJECT# 412.661
FILENAME: MAIN.WSW JAM

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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
1104.270	2442.189	6.517	2448.706	1154.00	17.71	4.87	2453.57	.00	7.45	10.00	8.000	10.000	.00	0 .0
251.270	.0079					.0081	2.04	6.52	1.22	6.53	.015	.00	.00	BOX
1355.540	2444.185	6.428	2450.614	1154.00	17.95	5.00	2455.62	.06	7.45	10.00	8.000	10.000	.00	0 .0
169.770	.0079					.0086	1.46	6.48	1.25	6.53	.015	.00	.00	BOX
1525.310	2445.533	6.255	2451.788	1154.00	18.45	5.29	2457.07	.06	7.45	10.00	8.000	10.000	.00	0 .0
20.373	.0079					.0089	.18	6.31	1.30	6.53	.015	.00	.00	BOX
1545.683	2445.695	6.226	2451.921	1154.00	18.53	5.33	2457.26	.06	7.45	10.00	8.000	10.000	.00	0 .0
149.397	.0079					.0096	1.43	6.29	1.31	6.53	.015	.00	.00	BOX
1695.080	2446.882	5.936	2452.818	1154.00	19.44	5.87	2458.69	.00	7.45	10.00	8.000	10.000	.00	0 .0
15.758	.0079					.0103	.16	5.94	1.41	6.53	.015	.00	.00	BOX
1710.838	2447.007	5.899	2452.906	1154.00	19.56	5.94	2458.85	.00	7.45	10.00	8.000	10.000	.00	0 .0
103.660	.0079					.0110	1.14	5.90	1.42	6.53	.015	.00	.00	BOX
1814.498	2447.831	5.625	2453.455	1154.00	20.52	6.54	2459.99	.00	7.45	10.00	8.000	10.000	.00	0 .0
86.032	.0079					.0125	1.08	5.62	1.52	6.53	.015	.00	.00	BOX
1900.530	2448.514	5.363	2453.876	1154.00	21.52	7.19	2461.07	.00	7.45	10.00	8.000	10.000	.00	0 .0
71.917	.0150					.0130	.93	5.36	1.64	5.12	.015	.00	.00	BOX

FILE: MAIN.WSW

W S P G W - CIVILDESIGN Version 14.08
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WATER SURFACE PROFILE LISTING
GOWAN NORTH - EL CAPITAN MAINLINE DRAIN
GCW INC. PROJECT# 412.661
FILENAME: MAIN.WSW JAM

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MAIN.OUT

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
1972.447	2449.593	5.452	2455.044	1154.00	21.17	6.96	2462.00	.00	7.45	10.00	8.000	10.000	.00	0 .0
120.850	.0150					.0120	1.45	5.45	1.60	5.12	.015	.00	.00	BOX
2093.297	2451.405	5.718	2457.123	1154.00	20.18	6.32	2463.45	.00	7.45	10.00	8.000	10.000	.00	0 .0
66.678	.0150					.0106	.70	5.72	1.49	5.12	.015	.00	.00	BOX
2159.975	2452.406	5.997	2458.403	1154.00	19.24	5.75	2464.15	.00	7.45	10.00	8.000	10.000	.00	0 .0
40.555	.0150					.0093	.38	6.00	1.38	5.12	.015	.00	.00	BOX
2200.530	2453.014	6.290	2459.304	1154.00	18.35	5.23	2464.53	.00	7.45	10.00	8.000	10.000	.00	0 .0
55.216	.0103					.0085	.47	6.29	1.29	5.91	.015	.00	.00	BOX
2255.746	2453.582	6.457	2460.038	1154.00	17.87	4.96	2465.00	.00	7.45	10.00	8.000	10.000	.00	0 .0
52.799	.0103					.0077	.41	6.46	1.24	5.91	.015	.00	.00	BOX
2308.545	2454.124	6.772	2460.896	1154.00	17.04	4.51	2465.41	.00	7.45	10.00	8.000	10.000	.00	0 .0
22.958	.0103					.0068	.16	6.77	1.15	5.91	.015	.00	.00	BOX
2331.504	2454.360	7.102	2461.462	1154.00	16.25	4.10	2465.56	.00	7.45	10.00	8.000	10.000	.00	0 .0
6.136	.0103					.0060	.04	7.10	1.07	5.91	.015	.00	.00	BOX
2337.640	2454.423	7.450	2461.873	1154.00	15.49	3.73	2465.60	.00	7.45	10.00	8.000	10.000	.00	0 .0
JUNCT STR	.0102					.0085	.04	7.45	1.00		.015	.00	.00	BOX

----- WARNING - Flow depth near top of box conduit -----
W S P G W - CIVILDESIGN Version 14.08

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Program Package Serial Number: 3074
WATER SURFACE PROFILE LISTING
GOWAN NORTH - EL CAPITAN MAINLINE DRAIN
GCW INC. PROJECT# 412.661
FILENAME: MAIN.WSW JAM

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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
2342.640	2454.474	8.300	2462.775	1033.00	14.76	3.38	2466.16	.00	6.92	10.00	7.000	10.000	.00	0 .0
436.070	.0103					.0085	3.69	8.30	.98	5.42	.015	.00	.00	BOX
2778.709	2458.983	7.486	2466.469	1033.00	14.76	3.38	2469.85	.00	6.92	10.00	7.000	10.000	.00	0 .0
HYDRAULIC JUMP														
2778.709	2458.983	5.523	2464.506	1033.00	18.70	5.43	2469.94	.00	6.92	10.00	7.000	10.000	.00	0 .0
229.801	.0103					.0095	2.19	5.52	1.40	5.42	.015	.00	.00	BOX
3008.510	2461.359	5.674	2467.033	1033.00	18.21	5.15	2472.18	.00	6.92	10.00	7.000	10.000	.00	0 .0
JUNCT STR	.0104					.0097	.05	5.70	1.35		.015	.00	.00	BOX
3013.510	2461.411	5.372	2466.783	1018.00	18.95	5.58	2472.36	.02	6.85	10.00	7.000	10.000	.00	0 .0
355.800	.0103					.0100	3.55	5.40	1.44	5.36	.015	.00	.00	BOX
3369.310	2465.090	5.496	2470.586	1018.00	18.52	5.33	2475.91	.06	6.85	10.00	7.000	10.000	.00	0 .0
140.750	.0103					.0093	1.31	5.56	1.39	5.36	.015	.00	.00	BOX
3510.060	2466.545	5.664	2472.209	1018.00	17.97	5.02	2477.22	.00	6.85	10.00	7.000	10.000	.00	0 .0
17.364	.0103					.0089	.15	5.66	1.33	5.36	.015	.00	.00	BOX
3527.424	2466.724	5.697	2472.422	1018.00	17.87	4.96	2477.38	.00	6.85	10.00	7.000	10.000	.00	0 .0
84.268	.0103					.0083	.70	5.70	1.32	5.36	.015	.00	.00	BOX
3611.692	2467.596	5.975	2473.572	1018.00	17.04	4.51	2478.08	.00	6.85	10.00	7.000	10.000	.00	0 .0
39.118	.0103					.0073	.29	5.98	1.23	5.36	.015	.00	.00	BOX

FILE: MAIN.WSW

W S P G W - CIVILDESIGN Version 14.08
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WATER SURFACE PROFILE LISTING
GOWAN NORTH - EL CAPITAN MAINLINE DRAIN
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FILENAME: MAIN.WSW JAM

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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
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****

MAIN.OUT															
3650.810	2468.001	6.267	2474.268	1018.00	16.24	4.10	2478.37	.00	6.85	10.00	7.000	10.000	.00	0	.0
22.005	.0093	-	-	-	-	.0065	.14	6.27	1.14	5.58	.015	.00	.00	BOX	
3672.815	2468.206	6.534	2474.740	1018.00	15.58	3.77	2478.51	.00	6.85	10.00	7.000	10.000	.00	0	.0
6.805	.0093	-	-	-	-	.0058	.04	6.53	1.07	5.58	.015	.00	.00	BOX	
WARNING - Flow depth near top of box conduit															
3679.620	2468.269	6.854	2475.123	1018.00	14.85	3.43	2478.55	.00	6.85	10.00	7.000	10.000	.00	0	.0
JUNCT STR	.0094	-	-	-	-	.0065	.03	6.85	1.00	.015	.00	.00	.00	BOX	
WARNING - Flow depth near top of box conduit															
3684.620	2468.316	8.115	2476.430	907.00	12.96	2.61	2479.04	.00	6.35	10.00	7.000	10.000	.00	0	.0
309.882	.0093	-	-	-	-	.0065	2.02	8.11	.86	5.11	.015	.00	.00	BOX	
3994.502	2471.203	7.250	2478.454	907.00	12.96	2.61	2481.06	.00	6.35	10.00	7.000	10.000	.00	0	.0
HYDRAULIC JUMP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3994.502	2471.203	5.174	2476.377	907.00	17.53	4.77	2481.15	.00	6.35	10.00	7.000	10.000	.00	0	.0
56.298	.0093	-	-	-	-	.0090	.51	5.17	1.36	5.11	.015	.00	.00	BOX	
4050.800	2471.728	5.188	2476.916	907.00	17.48	4.75	2481.66	.05	6.35	10.00	7.000	10.000	.00	0	.0
140.760	.0093	-	-	-	-	.0087	1.23	5.24	1.35	5.11	.015	.00	.00	BOX	

FILE: MAIN.WSW

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WATER SURFACE PROFILE LISTING

Date: 9-14-2016 Time: 5:10:46

GOWAN NORTH - EL CAPITAN MAINLINE DRAIN

GCW INC. PROJECT# 412.661

FILENAME: MAIN.WSW JAM

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
4191.560	2473.040	5.299	2478.339	907.00	17.12	4.55	2482.89	.05	6.35	10.00	7.000	10.000	.00	0 .0
59.500	.0093	-	-	-	-	.0083	.49	5.35	1.31	5.11	.015	.00	.00	BOX
4251.060	2473.594	5.389	2478.983	907.00	16.83	4.40	2483.38	.05	6.35	10.00	7.000	10.000	.00	0 .0
1.300	.0093	-	-	-	-	.0081	.01	5.44	1.28	5.11	.015	.00	.00	BOX
4252.360	2473.606	5.391	2478.998	907.00	16.82	4.39	2483.39	.05	6.35	10.00	7.000	10.000	.00	0 .0
79.939	.0093	-	-	-	-	.0076	.61	5.44	1.28	5.11	.015	.00	.00	BOX
4332.300	2474.351	5.655	2480.006	907.00	16.04	4.00	2484.00	.00	6.35	10.00	7.000	10.000	.00	0 .0
JUNCT STR	.0094	-	-	-	-	.0082	.04	5.65	1.19	.015	.00	.00	.00	BOX
4337.300	2474.398	5.010	2479.407	883.00	17.63	4.82	2484.23	.00	6.23	10.00	7.000	10.000	.00	0 .0
50.691	.0093	-	-	-	-	.0093	.47	5.01	1.39	5.01	.015	.00	.00	BOX
4387.991	2474.870	5.010	2479.880	883.00	17.63	4.82	2484.70	.00	6.23	10.00	7.000	10.000	.00	0 .0
360.182	.0093	-	-	-	-	.0090	3.24	5.01	1.39	5.01	.015	.00	.00	BOX
4748.173	2478.227	5.152	2483.378	883.00	17.14	4.56	2487.94	.00	6.23	10.00	7.000	10.000	.00	0 .0
138.280	.0093	-	-	-	-	.0081	1.13	5.15	1.33	5.01	.015	.00	.00	BOX
4886.453	2479.515	5.403	2484.918	883.00	16.34	4.15	2489.07	.00	6.23	10.00	7.000	10.000	.00	0 .0
52.872	.0093	-	-	-	-	.0072	.38	5.40	1.24	5.01	.015	.00	.00	BOX
4939.324	2480.008	5.667	2485.675	883.00	15.58	3.77	2489.44	.00	6.23	10.00	7.000	10.000	.00	0 .0
22.153	.0093	-	-	-	-	.0063	.14	5.67	1.15	5.01	.015	.00	.00	BOX

FILE: MAIN.WSW

W S P G W - CIVILDESIGN Version 14.08

Program Package Serial Number: 3074

WATER SURFACE PROFILE LISTING

Date: 9-14-2016 Time: 5:10:46

GOWAN NORTH - EL CAPITAN MAINLINE DRAIN

GCW INC. PROJECT# 412.661

FILENAME: MAIN.WSW JAM

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
4961.478	2480.214	5.943	2486.157	883.00	14.86	3.43	2489.59	.00	6.23	10.00	7.000	10.000	.00	0 .0
5.772	.0093	-	-	-	-	.0056	.03	5.94	1.07	5.01	.015	.00	.00	BOX
4967.250	2480.268	6.234	2486.502	883.00	14.16	3.11	2489.62	.00	6.23	10.00	7.000	10.000	.00	0 .0
JUNCT STR	.0094	-	-	-	-	.0051	.03	6.23	1.00	.015	.00	.00	.00	BOX

MAIN.OUT														
4972.250	2480.315	7.657	2487.972	805.00	11.18	1.94	2489.91	.00	5.19	12.00	6.000	12.000	.00	0 .0
638.600	.0040					.0051	3.23	7.66	.80	5.38	.015	.00	.00	BOX
5610.850	2482.840	8.360	2491.200	805.00	11.18	1.94	2493.14	.00	5.19	12.00	6.000	12.000	.00	0 .0
JUNCT STR	.0040					.0041	.02	8.36	.80		.015	.00	.00	BOX
5615.850	2482.860	8.927	2491.787	724.00	10.06	1.57	2493.36	.00	4.84	12.00	6.000	12.000	.00	0 .0
207.640	.0040					.0041	.85	8.93	.72	4.97	.015	.00	.00	BOX
5823.490	2483.681	8.955	2492.636	724.00	10.06	1.57	2494.21	.00	4.84	12.00	6.000	12.000	.00	0 .0
169.770	.0040					.0041	.69	.00	.72	4.97	.015	.00	.00	BOX
5993.260	2484.352	9.056	2493.408	724.00	10.06	1.57	2494.98	.00	4.84	12.00	6.000	12.000	.00	0 .0
169.770	.0040					.0041	.69	.00	.72	4.97	.015	.00	.00	BOX
6163.030	2485.023	9.157	2494.179	724.00	10.06	1.57	2495.75	.00	4.84	12.00	6.000	12.000	.00	0 .0
96.750	.0040					.0041	.40	9.16	.72	4.97	.015	.00	.00	BOX
6259.780	2485.406	9.185	2494.591	724.00	10.06	1.57	2496.16	.00	4.84	12.00	6.000	12.000	.00	0 .0
51.970	.0200					.0041	.21	9.18	.72	2.80	.015	.00	.00	BOX

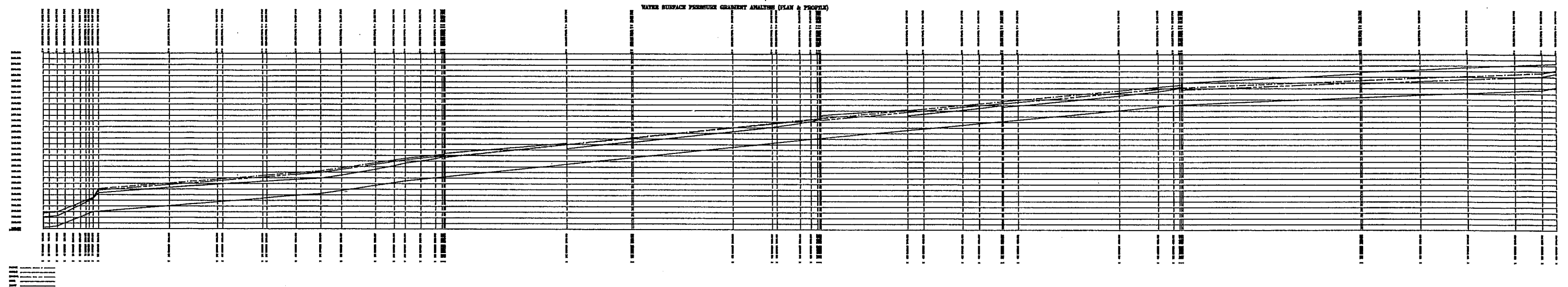
‡ FILE: MAIN.WSW
 W S P G W - CIVILDESIGN Version 14.08
 Program Package Serial Number: 3074
 WATER SURFACE PROFILE LISTING
 GOWAN NORTH - EL CAPITAN MAINLINE DRAIN
 GCW INC. PROJECT# 412.661
 FILENAME: MAIN.WSW JAM
 Date: 9-14-2016 Time: 5:10:46
 PAGE 8

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt 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
6311.750	2486.445	8.358	2494.803	724.00	10.06	1.57	2496.37	.00	4.84	12.00	6.000	12.000	.00	0 .0

GOWAN NORTH - EL CAPITAN MAINLINE DRAIN
GCW INC. PROJECT# 412.661

FILENAME: MAIN.WSW JAM

[No.]	TYPE OPERATION	STATION (FT)	INV ELEV (FT)	WATER LEVEL (FT)	CHAN HT (FT)	TYPE CHANNEL	'N' #PIER/PIP	FLOW RATE (CFS)	VELOCITY (FT/S)	TOP WIDTH (FT)	CHAN WTH (FT)	PIER WIDTH (FT)	ZL	ZR	SUPEL RT B (FT)	SUPEL LT B (FT)	CRIT DPTH (FT)	RADIUS/<PT (FT OR <)	RMKS
[1]	SYSTEM OUTLET	906.220	2436.500	3.723	5.000	BOX	.013 0	1154.000	25.832	12.000	12.000	.000	.000	.000	.000	.000	5.000	.000	
[2]	REACH	927.430	2436.695	3.686	5.000	BOX	.013 0	1154.000	26.088	12.000	12.000	.000	.000	.000	.000	.000	5.000	131.295	
[3]	REACH	957.220	2436.969	3.634	5.000	BOX	.013 0	1154.000	26.466	12.000	12.000	.000	.000	.000	.000	.000	5.000	129.565	
[4]	REACH	984.948	2438.073	3.769	5.000	BOX	.013 0	1154.000	25.521	12.000	12.000	.000	.000	.000	.000	.000	5.000	129.565	
[5]	REACH	1014.884	2439.266	3.952	5.000	BOX	.013 0	1154.000	24.333	12.000	12.000	.000	.000	.000	.000	.000	5.000	129.565	
[6]	REACH	1039.167	2440.233	4.145	5.000	BOX	.013 0	1154.000	23.201	12.000	12.000	.000	.000	.000	.000	.000	5.000	129.565	
[7]	REACH	1058.980	2441.022	4.347	5.000	BOX	.013 0	1154.000	22.121	12.000	12.000	.000	.000	.000	.000	.000	5.000	.000	
[8]	REACH	1070.203	2441.469	4.489	5.000	BOX	.013 0	1154.000	21.424	12.000	12.000	.000	.000	.000	.000	.000	5.000	.000	
[9]	REACH	1084.270	2442.030	4.708	5.000	BOX	.015 0	1154.000	20.427	12.000	12.000	.000	.000	.000	.000	.000	5.000	.000	
[10]	TRANSITION	1104.270	2442.189	6.517	8.000	BOX	.015 0	1154.000	17.709	10.000	10.000	.000	.000	.000	.000	.000	7.450	.000	
[11]	REACH	1355.540	2444.185	6.429	8.000	BOX	.015 0	1154.000	17.952	10.000	10.000	.000	.000	.000	.056	.000	7.450	1768.565	
[12]	REACH	1525.310	2445.533	6.255	8.000	BOX	.015 0	1154.000	18.450	10.000	10.000	.000	.000	.000	-.060	.060	7.450	1768.563	
[13]	REACH	1545.683	2445.695	6.226	8.000	BOX	.015 0	1154.000	18.535	10.000	10.000	.000	.000	.000	.000	.060	7.450	1768.563	
[14]	REACH	1695.080	2446.882	5.936	8.000	BOX	.015 0	1154.000	19.440	10.000	10.000	.000	.000	.000	.000	.000	7.450	.000	
[15]	REACH	1710.838	2447.007	5.899	8.000	BOX	.015 0	1154.000	19.562	10.000	10.000	.000	.000	.000	.000	.000	7.450	.000	
[16]	REACH	1814.498	2447.831	5.624	8.000	BOX	.015 0	1154.000	20.517	10.000	10.000	.000	.000	.000	.000	.000	7.450	.000	
[17]	REACH	1900.530	2448.514	5.362	8.000	BOX	.015 0	1154.000	21.519	10.000	10.000	.000	.000	.000	.000	.000	7.450	.000	
[18]	REACH	1972.447	2449.593	5.451	8.000	BOX	.015 0	1154.000	21.167	10.000	10.000	.000	.000	.000	.000	.000	7.450	.000	
[19]	REACH	2093.297	2451.405	5.718	8.000	BOX	.015 0	1154.000	20.182	10.000	10.000	.000	.000	.000	.000	.000	7.450	.000	
[20]	REACH	2159.975	2452.406	5.997	8.000	BOX	.015 0	1154.000	19.243	10.000	10.000	.000	.000	.000	.000	.000	7.450	.000	
[21]	REACH	2200.530	2453.014	6.290	8.000	BOX	.015 0	1154.000	18.348	10.000	10.000	.000	.000	.000	.000	.000	7.450	.000	
[22]	REACH	2255.746	2453.582	6.456	8.000	BOX	.015 0	1154.000	17.873	10.000	10.000	.000	.000	.000	.000	.000	7.450	.000	
[23]	REACH	2308.545	2454.124	6.772	8.000	BOX	.015 0	1154.000	17.041	10.000	10.000	.000	.000	.000	.000	.000	7.450	.000	
[24]	REACH	2331.504	2454.360	7.102	8.000	BOX	.015 0	1154.000	16.248	10.000	10.000	.000	.000	.000	.000	.000	7.450	.000	
[25]	REACH	2337.640	2454.423	7.450	8.000	BOX	.015 0	1154.000	15.490	10.000	10.000	.000	.000	.000	.000	.000	7.450	.000	
[26]	JUNCTION	2342.640	2454.474	8.301	7.000	BOX	.015 0	1033.000	14.757	10.000	10.000	.000	.000	.000	.000	.000	6.920	.000	
[27]	HYD JUMP	2778.709	2458.983	7.486	7.000	BOX	.015 0	1033.000	14.757	10.000	10.000	.000	.000	.000	.000	.000	6.920	.000	HYD JUMP
[28]	REACH	2778.709	2458.983	5.523	7.000	BOX	.015 0	1033.000	18.704	10.000	10.000	.000	.000	.000	.000	.000	6.920	.000	
[29]	REACH	3008.510	2461.359	5.674	7.000	BOX	.015 0	1033.000	18.206	10.000	10.000	.000	.000	.000	.023	-.009	6.920	.000	
[30]	JUNCTION	3013.510	2461.411	5.372	7.000	BOX	.015 0	1018.000	18.951	10.000	10.000	.000	.000	.000	.024	.000	6.854	4530.187	
[31]	REACH	3369.310	2465.090	5.496	7.000	BOX	.015 0	1018.000	18.522	10.000	10.000	.000	.000	.000	.000	.060	6.854	1792.085	
[32]	REACH	3510.060	2466.545	5.664	7.000	BOX	.015 0	1018.000	17.973	10.000	10.000	.000	.000	.000	.000	.000	6.854	.000	
[33]	REACH	3527.424	2466.724	5.698	7.000	BOX	.015 0	1018.000	17.868	10.000	10.000	.000	.000	.000	.000	.000	6.854	.000	
[34]	REACH	3611.692	2467.596	5.976	7.000	BOX	.015 0	1018.000	17.036	10.000	10.000	.000	.000	.000	.000	.000	6.854	.000	
[35]	REACH	3650.810	2468.001	6.267	7.000	BOX	.015 0	1018.000	16.243	10.000	10.000	.000	.000	.000	.000	.000	6.854	.000	
[36]	REACH	3672.815	2468.206	6.534	7.000	BOX	.015 0	1018.000	15.580	10.000	10.000	.000	.000	.000	.000	.000	6.854	.000	
[37]	REACH	3679.620	2468.269	6.854	7.000	BOX	.015 0	1018.000	14.853	10.000	10.000	.000	.000	.000	.000	.000	6.854	.000	
[38]	JUNCTION	3684.620	2468.316	8.114	7.000	BOX	.015 0	907.000	12.957	10.000	10.000	.000	.000	.000	.000	.000	6.346	.000	
[39]	HYD JUMP	3994.502	2471.203	7.251	7.000	BOX	.015 0	907.000	12.957	10.000	10.000	.000	.000	.000	.000	.000	6.346	.000	HYD JUMP
[40]	REACH	3994.502	2471.203	5.174	7.000	BOX	.015 0	907.000	17.531	10.000	10.000	.000	.000	.000	.000	.000	6.346	.000	
[41]	REACH	4050.800	2471.728	5.188	7.000	BOX	.015 0	907.000	17.482	10.000	10.000	.000	.000	.000	.053	.000	6.346	1792.212	
[42]	REACH	4191.560	2473.040	5.299	7.000	BOX	.015 0	907.000	17.117	10.000	10.000	.000	.000	.000	-.025	.051	6.346	1794.263	
[43]	REACH	4251.060	2473.594	5.389	7.000	BOX	.015 0	907.000	16.830	10.000	10.000	.000	.000	.000	-.006	.049	6.346	1790.267	
[44]	REACH	4252.360	2473.606	5.392	7.000	BOX	.015 0	907.000	16.823	10.000	10.000	.000	.000	.000	.000	.049	6.346	1790.267	
[45]	REACH	4332.300	2474.351	5.655	7.000	BOX	.015 0	907.000	16.040	10.000	10.000	.000	.000	.000	.000	.000	6.346	.000	
[46]	JUNCTION	4337.300	2474.398	5.009	7.000	BOX	.015 0	883.000	17.626	10.000	10.000	.000	.000	.000	.000	.000	6.234	.000	
[47]	REACH	4387.991	2474.870	5.010	7.000	BOX	.015 0	883.000	17.626	10.000	10.000	.000	.000	.000	.000	.000	6.234	.000	
[48]	REACH	4748.173	2478.227	5.151	7.000	BOX	.015 0	883.000	17.141	10.000	10.000	.000	.000	.000	.000	.000	6.234	.000	
[49]	REACH	4886.453	2479.515	5.403	7.000	BOX	.015 0	883.000	16.343	10.000	10.000	.000	.000	.000	.000	.000	6.234	.000	
[50]	REACH	4939.324	2480.008	5.667	7.000	BOX	.015 0	883.000	15.582	10.000	10.000	.000	.000	.000	.000	.000	6.234	.000	
[51]	REACH	4961.478	2480.214	5.943	7.000	BOX	.015 0	883.000	14.857	10.000	10.000	.000	.000	.000	.000	.000	6.234	.000	
[52]	REACH	4967.250	2480.268	6.234	7.000	BOX	.015 0	883.000	14.164	10.000	10.000	.000	.000	.000	.000	.000	6.234	.000	
[53]	JUNCTION	4972.250	2480.315	7.657	6.000	BOX	.015 0	805.000	11.181	12.000	12.000	.000	.000	.000	.000	.000	5.190	.000	
[54]	REACH	5610.850	2482.840	8.360	6.000	BOX	.015 0	805.000	11.181	12.000	12.000	.000	.000	.000	.000	.000	5.190	.000	
[55]	JUNCTION	5615.850	2482.860	8.927	6.000	BOX	.015 0	724.000	10.056	12.000	12.000	.000	.000	.000	.000	.000	4.835	.000	
[56]	REACH	5823.490	2483.681	8.955	6.000	BOX	.015 0	724.000	10.056	12.000	12.000	.000	.000	.000	.000	.000	4.835	1768.560	
[57]	REACH	5993.260	2484.352	9.056	6.000	BOX	.015 0	724.000	10.056	12.000	12.000	.000	.000	.000	.000	.000	4.835	1768.565	
[58]	REACH	6163.030	2485.023	9.156	6.000	BOX	.015 0	724.000	10.056	12.000	12.000	.000	.000	.000	.000	.000	4.835	.000	
[59]	REACH	6259.780	2485.406	9.185	6.000	BOX	.015 0	724.000	10.056	12.000	12.000	.000	.000	.000	.000	.000	4.835	-3.000	
[60]	HEADWORKS	6311.750	2486.445	8.358	6.000	BOX	.015 0	724.000	10.056	12.000	12.000	.000	.000	.000	.000	.000	4.835	.000	



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1 110 STATION 1355.540

1 120 STATION 1325.310
1 130 STATION 1345.683

1 140 STATION 1695.080
1 150 STATION 1710.898

1 160 STATION 1814.498

1 170 STATION 1500.530

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1 190 STATION 2095.297

1 200 STATION 2159.975

1 210 STATION 2200.530

1 220 STATION 2255.746

1 230 STATION 2308.545

1 240 STATION 2331.804
1 250 STATION 2342.848

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Q = 1154.000 F43/S, V = 26.088 F4/S
Q = 1154.000 F43/S, V = 26.466 F4/S
Q = 1154.000 F43/S, V = 25.521 F4/S
Q = 1154.000 F43/S, V = 24.333 F4/S
Q = 1154.000 F43/S, V = 23.201 F4/S
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Q = 1154.000 F43/S, V = 21.424 F4/S
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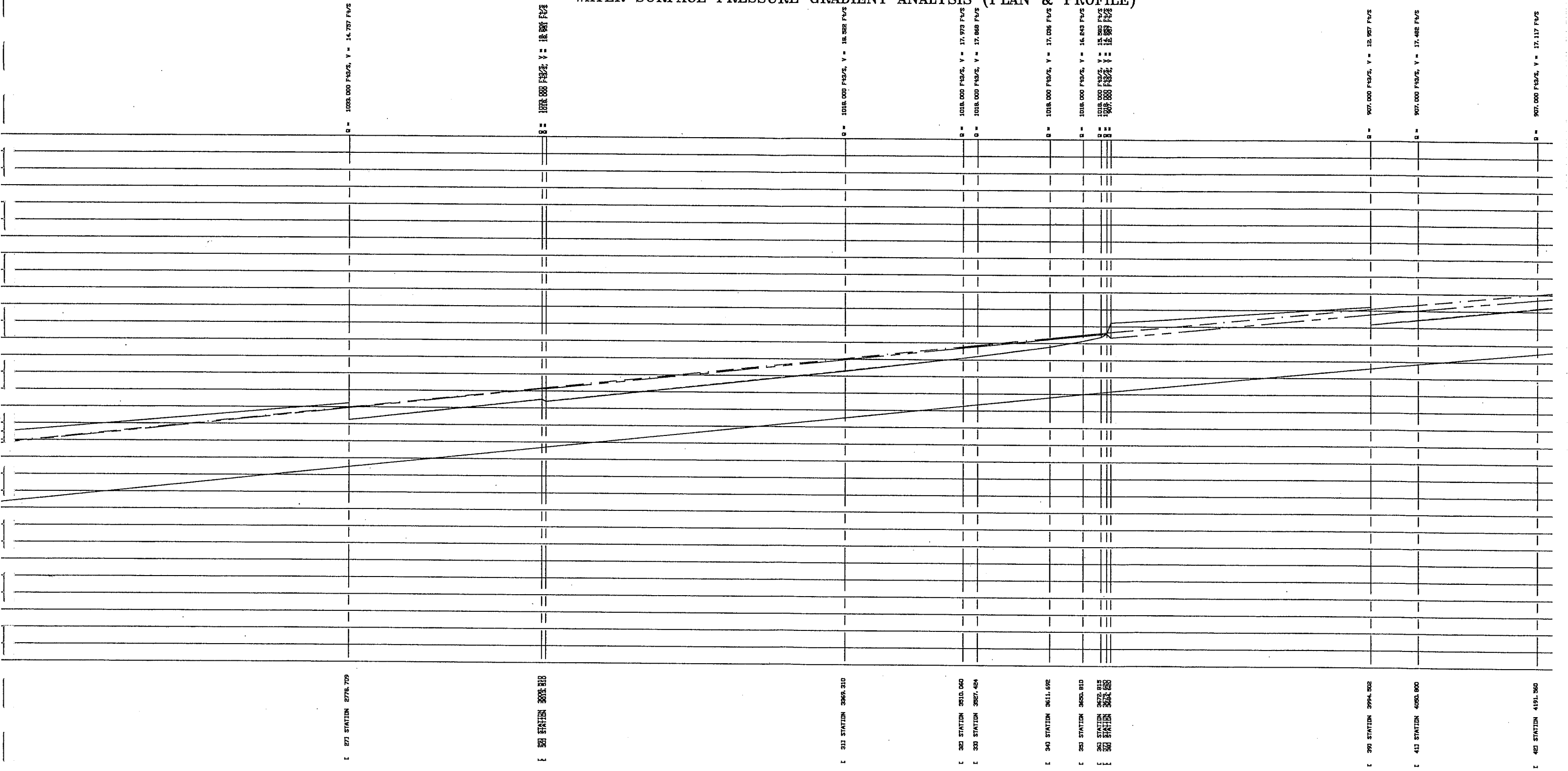
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Q = 1083.000 F43/S, V = 14.759 F4/S

WATER SURFACE PRESSURE GRADIENT ANALYSIS (PLAN & PROFILE)



432 STATION 4851.000
Z = 907.000 F19/2, Y = 16.800 F1/2

432 STATION 4857.000
Z = 888.000 F19/2, Y = 16.800 F1/2

433 STATION 4867.000
Z = 882.000 F19/2, Y = 17.440 F1/2

433 STATION 4745.172
Z = 882.000 F19/2, Y = 17.440 F1/2

433 STATION 4896.428
Z = 882.000 F19/2, Y = 16.240 F1/2

433 STATION 4926.264
Z = 882.000 F19/2, Y = 16.260 F1/2

433 STATION 4911.478
Z = 882.000 F19/2, Y = 16.260 F1/2

433 STATION 5818.888
Z = 882.000 F19/2, Y = 16.260 F1/2

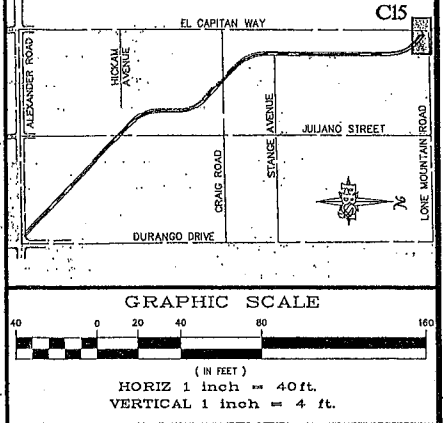
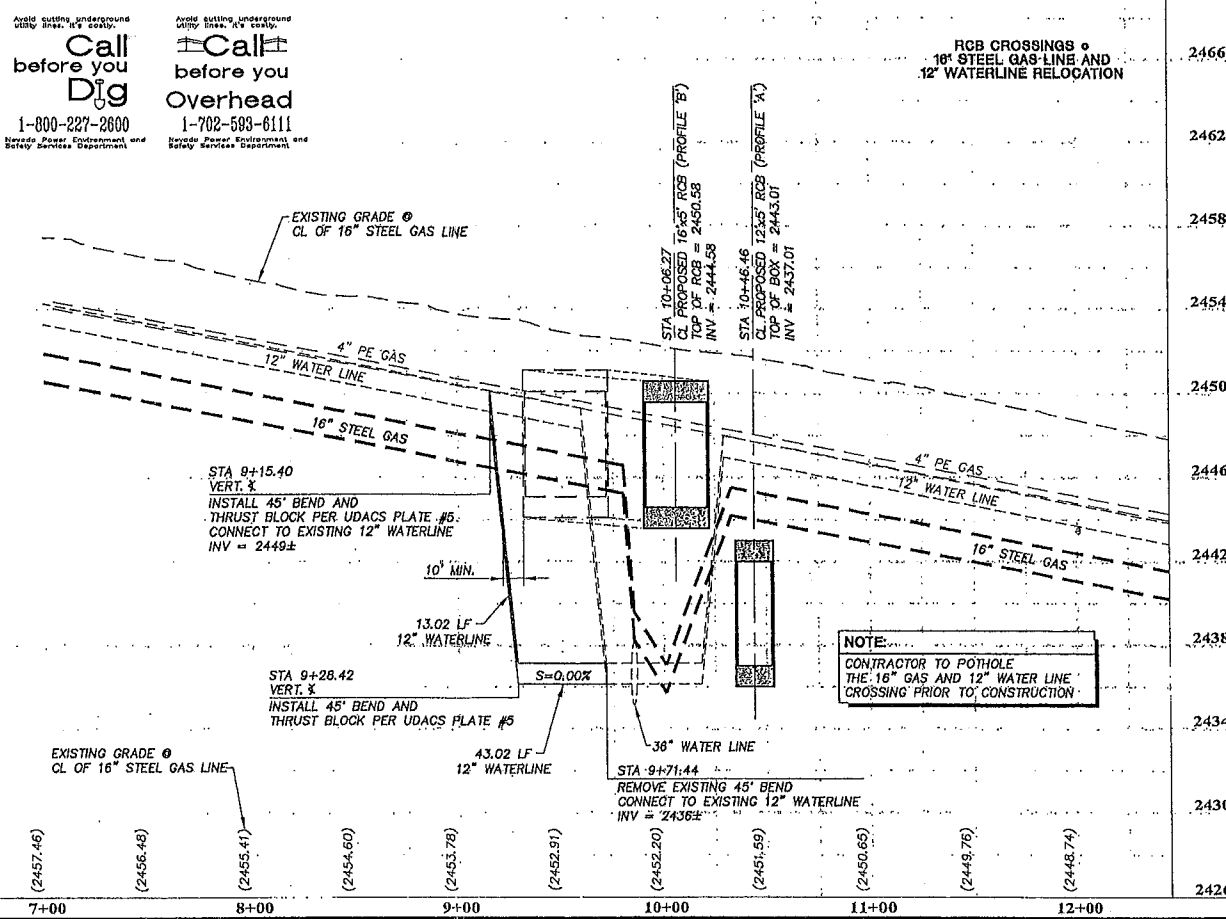
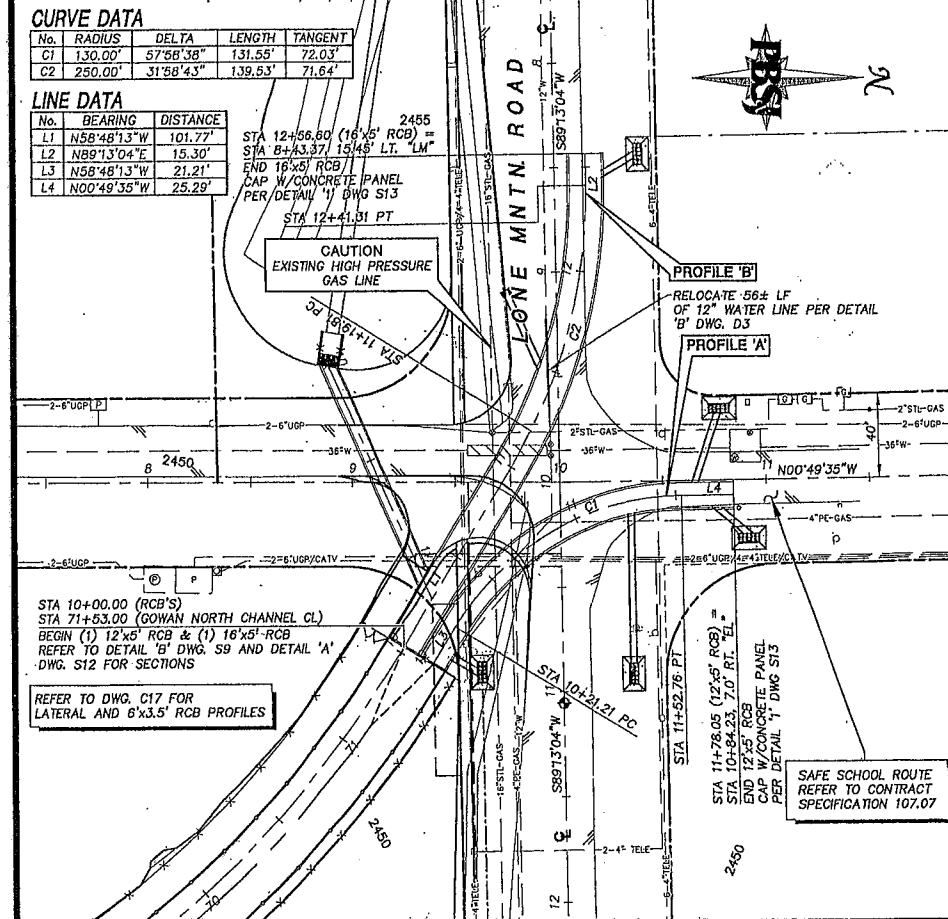
433 STATION 5825.400
Z = 784.000 F19/2, Y = 10.000 F1/2

433 STATION 5895.860
Z = 784.000 F19/2, Y = 10.000 F1/2

433 STATION 6163.000
Z = 784.000 F19/2, Y = 10.000 F1/2

433 STATION 6259.760
Z = 784.000 F19/2, Y = 10.000 F1/2

433 STATION 6311.760
Z = 784.000 F19/2, Y = 10.000 F1/2



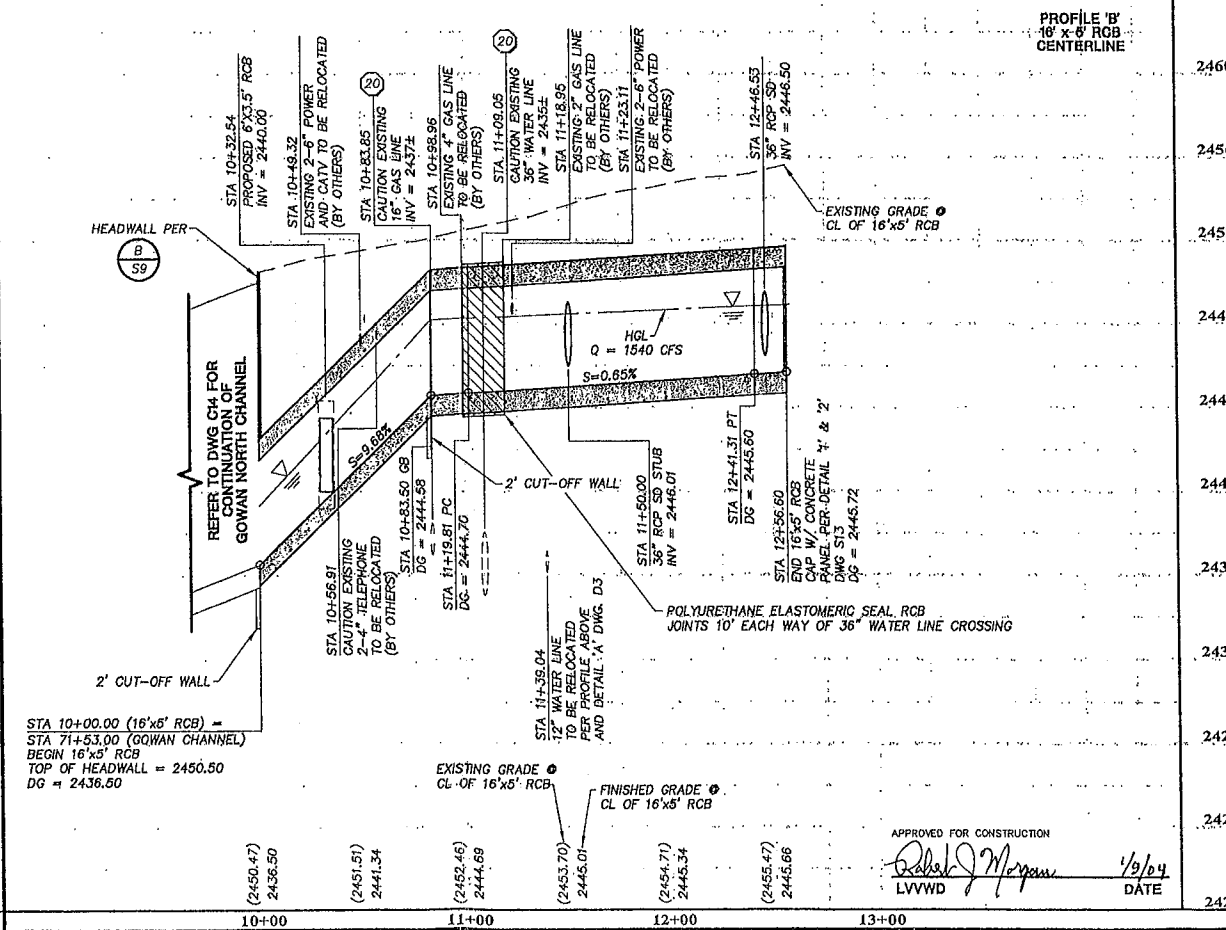
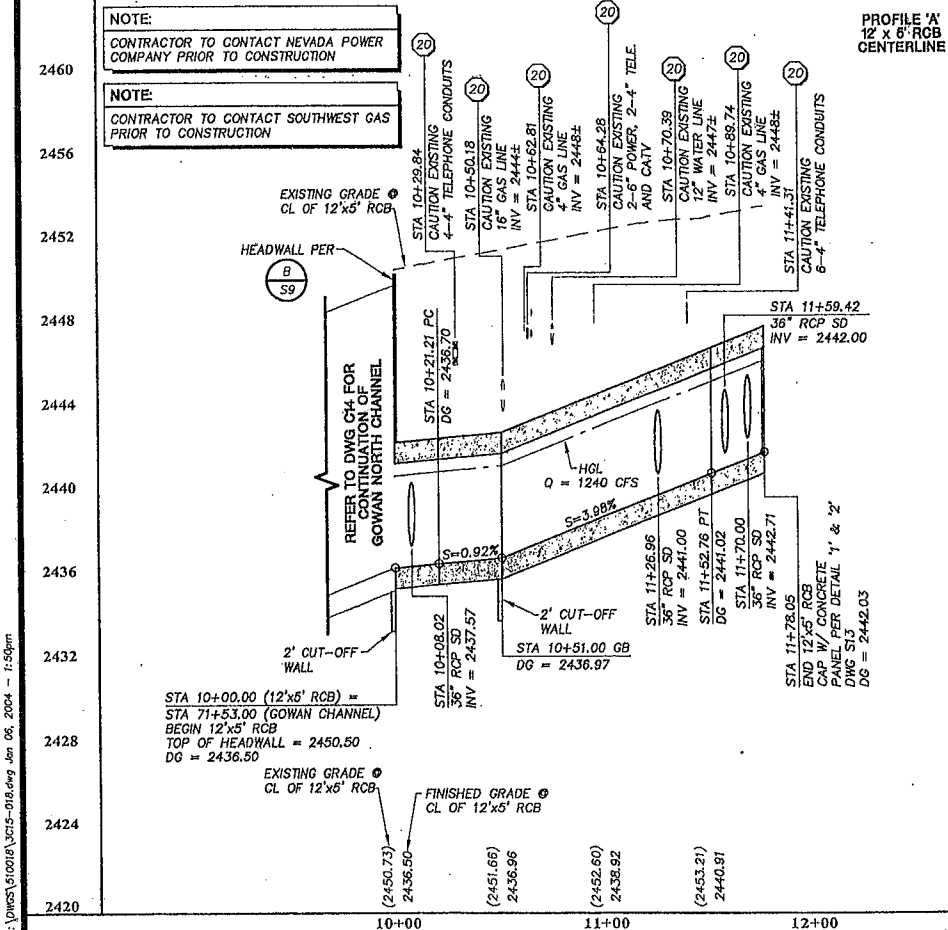
BASIS OF BEARING
THE BASIS OF BEARING FOR THE SURVEY SHOWN HEREON IS GRID NORTH AS DEFINED BY THE NEVADA COORDINATE SYSTEM OF 1983 (NCS83) EAST ZONE (2701)

BENCHMARK
CITY OF LAS VEGAS BENCHMARK NO. 11VDD 3W4 - RIVET AND PLATE IN "ELECTRIC BASE, 250' EAST OF BUFFALO DRIVE ON SOUTH SIDE OF CRAIG ROAD.

NAVD 1988
DATUM ELEVATION = 14,731.0
METERS 2345.01 FEET

CAUTION:
EXISTING UTILITIES ARE LOCATED ON THE PLANS FROM A SEARCH OF AVAILABLE RECORDS. CONTRACTOR TO VERIFY LOCATIONS AND DEPTHS PRIOR TO CONSTRUCTION.

- KEY NOTES**
- CONSTRUCTION ITEMS:**
1. CONSTRUCT RECTANGULAR CHANNEL PER SECTION 'B' DWG C5.
 2. CONSTRUCT DOUBLE ARCH PER SECTION 'C' DWG C6.
 3. CONSTRUCT 6' HIGH CHAIN LINK FENCE PER DETAIL 'B' DWG D1.
 4. CONSTRUCT MAINTENANCE ROAD - 2" AC OVER 4" TYPE II BASE PER SECTION 'B' DRAWING C5.
 5. INSTALL 12" PVC CLASS C900 WATERLINE PER DETAIL 'H' DRAWING D1. CONNECT NEW LINE TO EXISTING 12" PVC WELL DISCHARGE LINE. LENGTH PER PLANS.
 6. INSTALL CHANNEL ACCESS LADDER PER DETAIL 'A' DWG D1.
 7. CONSTRUCT 5.5" PLANT MIX BITUMINOUS SURFACE OVER 13" TYPE II AGGREGATE BASE. REFER TO SECTIONS THIS SHEET.
 8. INSTALL DOUBLE SWING GATE PER DETAIL 'C' DWG D1.
 9. INSTALL 12" PVC CLASS C900 WATERLINE PER DETAIL 'G' DRAWING D1. CONNECT NEW LINE TO EXISTING 12" PVC WELL DISCHARGE LINE. LENGTH PER PLANS.
 10. CONSTRUCT CONCRETE 6"x3" CUT OFF WALL PER DETAIL 'F' DWG. D1. LENGTH PER PLANS.
 11. CONSTRUCT ACCESS ROAD PER SECTION 'A' DWG E1.
 12. REMOVE AND RESET EXISTING SIGN.
 13. SAWCUT TO CLEAN EDGE, MATCH EXISTING.
 14. INSTALL MODIFIED NDOT TYPE 2A DROP INLET PER DETAIL 'C' DWG D2.
 15. INSTALL 36" CLASS III RCP PER DETAIL 'C' DWG. D3.
 16. INSTALL CONCRETE APRON PER DETAIL 'C' DWG D2.
 17. ADJUST EXISTING WATER VALVE BOX COVER TO FINISH GRADE PER UDACS PLATE #8.
 18. EXISTING GAS APPURTENANCES TO BE ADJUSTED TO FINISH GRADE (BY OTHERS).
 19. RELOCATE TELEPHONE MANHOLE (BY SPRINT).
 20. PROTECT-IN-PLACE.
 21. CONSTRUCT POST AND CABLE RAILING PER DETAIL 'A' DRAWING D2.
 22. CONSTRUCT 2" WIDE SIDEWALK DRAIN PER STD. DRAWING #235.
 23. ADJUST EXISTING WATER MANHOLE COVER TO FINISH GRADE PER USD #408.
 24. INSTALL 4" WIDE WHITE PAINTED EDGE LINE.
 25. INSTALL TYPE I CENTERLINE PER STD. DWG. #244.
 26. CONSTRUCT 5" WIDE AC SIDEWALK 2" AC OVER 6" TYPE II AGGREGATE BASE.
 27. RELOCATE NEVADA POWER FACILITIES. (BY NEVADA POWER).
 28. CONSTRUCT CONCRETE APRON PER ENLARGEMENT 'A' DRAWING G1.
 29. INSTALL 24" WHITE STOP LINE (TYPE 1 PMF) PER USD #254A.
 30. INSTALL 24" CROSSWALK RECTANGLES (TYPE 1 PMF) PER USD #254A.
 31. INSTALL 6" TYPE II AGGREGATE WITH 95% COMPACTION.
 32. INSTALL PORTABLE CONCRETE BARRIER RAIL PER STD. DWG. #602.



DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION

CITY ENGINEER: CHARLES K. KOWSKI, JR., P.E.
CITY PROJECT ENGINEER: MARVIN STINE, P.E.
PROJECT MANAGER: ALI ZENHARI, P.E.
DESIGN BY: PC
DRAWN BY: LSB
CHECK BY: AZ
DATE: DEC. 12, 2003

GOWAN NORTH CHANNEL / PHASE III
EL CAPITAN WAY / LONE MOUNTAIN ROAD / 16" GAS CROSSING

C15
16 OF 42
731-85B

WSPG – FOR EL CAPITAN/LONE
MOUNTAIN 10' X 5' RCB (alternative 2)

STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
Portions Copyrighted by CIVILSOFT, 1986, 1987, 1989

Version
Serial Number

Aug 13, 1999 17:14:27

Input file : ELCAP-1.DAT
Output file: ELCAP-1.OUT

INPUT FILE LISTING

T1 GOWAN PHASE III
T2 10' X 5' RCB IN EL CAPITAN
T3 PBS&J REFERENCE NO. 51018

SO	1016.00	439.69	1	.013	447.40
R	1021.40	439.80	1	.013	
R	1122.59	441.82	1	.013	100.00
R	1175.00	442.87	1	.013	
SH	1175.00	442.87	1	.013	446.57

1 SP
WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING

0 CARD	SECT	CHN	NO OF	AVE PIER	HEIGHT 1	BASE	ZL	ZR	INV	Y(1)	Y(2)	Y(3)	Y(4)
CODE	NO	TYPE	PIERS	WIDTH	DIAMETER	WIDTH			DROP				
CD	1	3	0	.00	6.00	10.00	.00	.00	.00				

1
0 WATER SURFACE PROFILE - TITLE CARD LISTING
0 HEADING LINE NO 1 IS -
0 GOWAN PHASE III
0 HEADING LINE NO 2 IS -
0 10' X 5' RCB IN EL CAPITAN
0 HEADING LINE NO 3 IS -
0 PBS&J REFERENCE NO. 51018

1
0 WATER SURFACE PROFILE - ELEMENT CARD LISTING

0 ELEMENT NO	1 IS A	SYSTEM OUTLET	* U/S DATA	STATION	INVERT	SECT							
				1016.00	439.69	1							
0 ELEMENT NO	2 IS A	REACH	* U/S DATA	STATION	INVERT	SECT				N			
				1021.40	439.80	1				.013			
0 ELEMENT NO	3 IS A	REACH	* U/S DATA	STATION	INVERT	SECT				N			
				1122.59	441.82	1				.013			
0 ELEMENT NO	4 IS A	REACH	* U/S DATA	STATION	INVERT	SECT				N			
				1175.00	442.87	1				.013			
0 ELEMENT NO	5 IS A	SYSTEM HEADWORKS	* U/S DATA	STATION	INVERT	SECT				N			
				1175.00	442.87	1				.013			

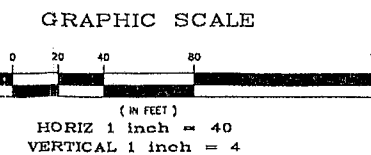
NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

WATER SURFACE PROFILE LISTING

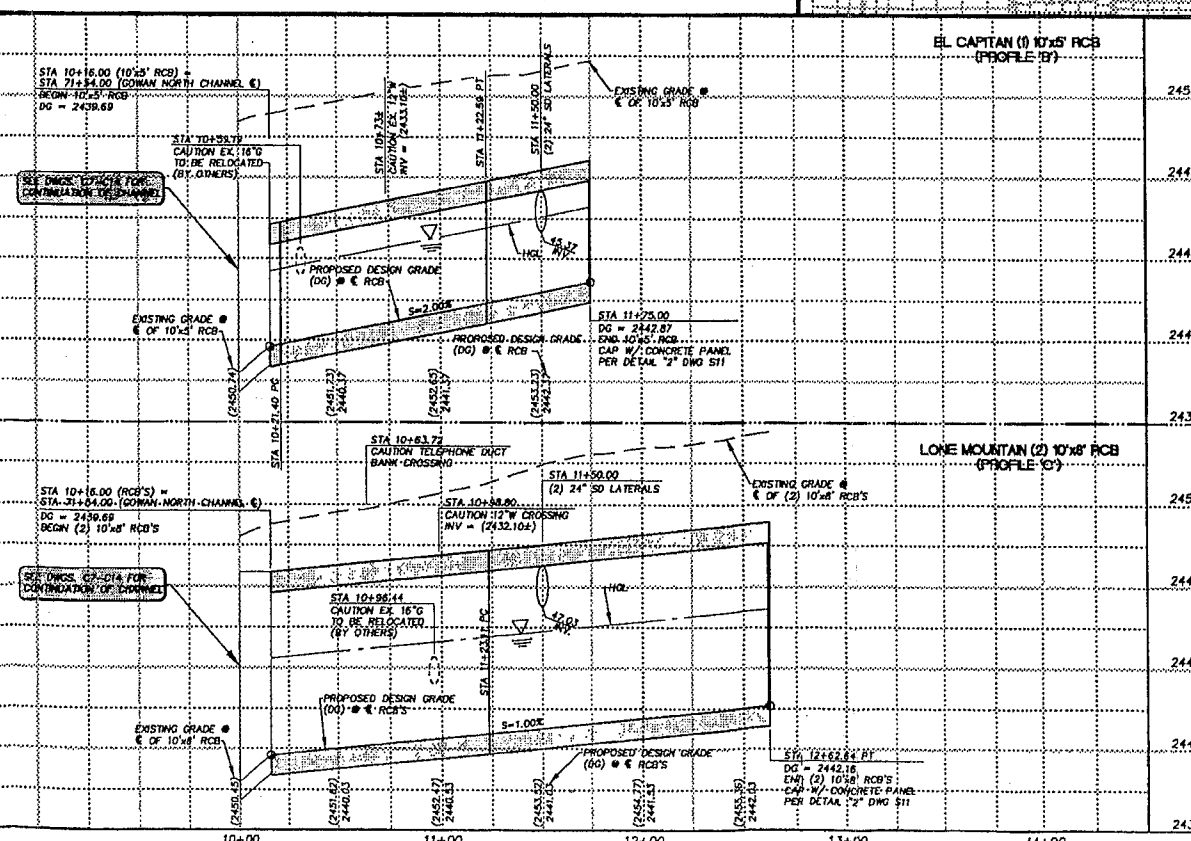
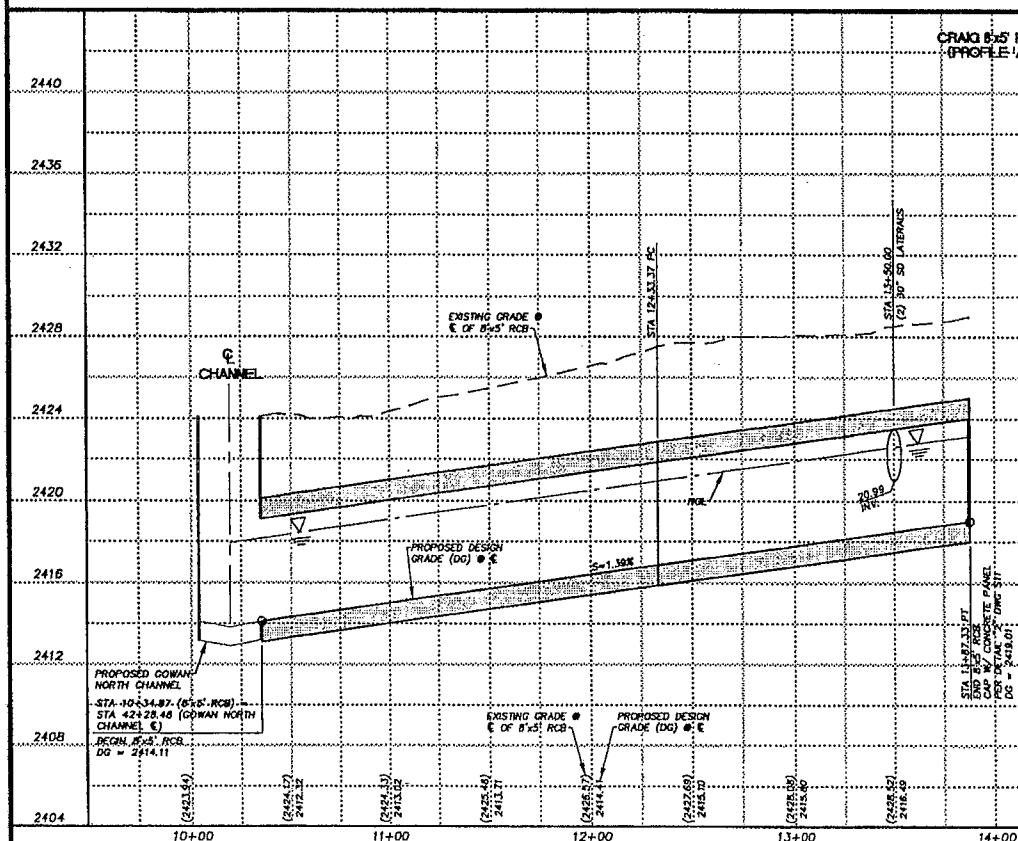
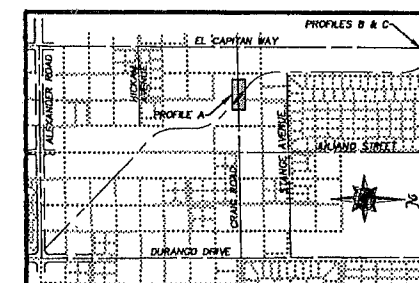
GOWAN PHASE III
 10' X 5' RCB IN EL CAPITAN
 PBS&J REFERENCE NO. 51018

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD SF AVE	ENERGY GRD.EL. HF	SUPER ELEV	CRITICAL DEPTH	NORM
0 L/ELEM	SO									
0 1016.00	439.69	3.70	443.39	990.0	26.75	11.12	454.51	.00	6.00	
0 5.40	.02037					.02002	.11			
0 1021.40	439.80	3.70	443.50	990.0	26.75	11.12	454.62	.00	6.00	
0 .00	.02037					.02002	.00			
0 1021.40	439.80	3.70	443.50	990.0	26.75	11.12	454.62	.00	6.00	
0 101.19	.01996					.02003	2.03			
0 1122.59	441.82	3.70	445.52	990.0	26.76	11.13	456.65	.00	6.00	
0 .00	.01996					.02004	.00			
0 1122.59	441.82	3.70	445.52	990.0	26.76	11.13	456.65	.00	6.00	
0 35.11	.02003					.02004	.70			
0 1157.70	442.52	3.70	446.22	990.0	26.76	11.13	457.35	.00	6.00	
0 17.30	.02003					.02004	.35			
0 1175.00	442.87	3.70	446.57	990.0	26.76	11.13	457.70	.00	6.00	

Call
before you
Overhead
1-702-593-6111
Nevada Parent Environment and
Safety Services Department



CURVE DATA				BACK OF CURVE
No.	RADIUS	DELTA	LENGTH	TANGENT
C1	500.00'	17°36'30"	153.95'	77.59'
C2	100.00'	57°58'39"	101.19'	55.41'
C3	250.00'	31°54'44"	119.53'	77.84'



REVISIONS

	GOWAN NORTH CHANNEL	SURVEY NO.	DATE
		BY	

PRELIMINARY
ONLY
NOT FOR CONSTRUCTION
70% 08/16/99

Department of Public Works
GOWAN NORTH CHANNEL PHASE I
CRAIG ROAD / LONE MOUNTAIN
RCB PROFILES



DRAWING No.
C16

15 / 49

Worksheet for Verde Way Lateral - 36" RCP

Project Description

Friction Method Manning Formula
Solve For Full Flow Diameter

Input Data

Roughness Coefficient 0.013
Channel Slope 1.00 %
Normal Depth 2.43 ft
Diameter 2.43 ft
Discharge 38.00 ft³/s

Results

Diameter 2.43 ft
Normal Depth 2.43 ft
Flow Area 4.64 ft²
Wetted Perimeter 7.63 ft
Hydraulic Radius 0.61 ft
Top Width 0.00 ft
Critical Depth 2.09 ft
Percent Full 100.0 %
Critical Slope 0.00928 ft/ft
Velocity 8.20 ft/s
Velocity Head 1.04 ft
Specific Energy 3.47 ft
Froude Number 0.00
Maximum Discharge 40.88 ft³/s
Discharge Full 38.00 ft³/s
Slope Full 0.01000 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 %

Worksheet for Verde Way Lateral - 36" RCP

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.43	ft
Critical Depth	2.09	ft
Channel Slope	1.00	%
Critical Slope	0.00928	ft/ft

Cross Section for Verde Way Lateral - 36" RCP

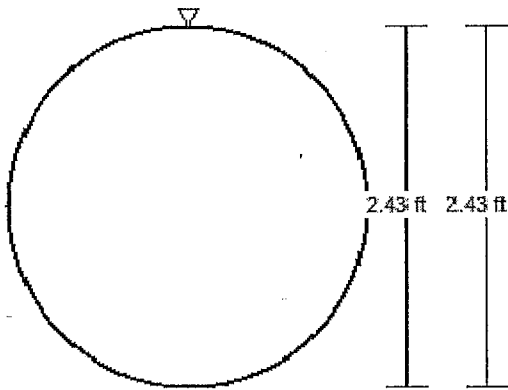
Project Description

Friction Method Manning Formula
Solve For Full Flow Diameter

Input Data

Roughness Coefficient	0.013
Channel Slope	1.00 %
Normal Depth	2.43 ft
Diameter	2.43 ft
Discharge	38.00 ft ³ /s

Cross Section Image



V: 1
H: 1

Worksheet for La Madre Way Lateral - 54" RCP

Project Description

Friction Method Manning Formula
Solve For Full Flow Diameter

Input Data

Roughness Coefficient	0.013
Channel Slope	1.00 %
Normal Depth	3.90 ft
Diameter	3.90 ft
Discharge	134.00 ft ³ /s

Results

Diameter	3.90 ft
Normal Depth	3.90 ft
Flow Area	11.93 ft ²
Wetted Perimeter	12.24 ft
Hydraulic Radius	0.97 ft
Top Width	0.00 ft
Critical Depth	3.45 ft
Percent Full	100.0 %
Critical Slope	0.00895 ft/ft
Velocity	11.23 ft/s
Velocity Head	1.96 ft
Specific Energy	5.86 ft
Froude Number	0.00
Maximum Discharge	144.15 ft ³ /s
Discharge Full	134.00 ft ³ /s
Slope Full	0.01000 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 %

Worksheet for La Madre Way Lateral - 54" RCP

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.90	ft
Critical Depth	3.45	ft
Channel Slope	1.00	%
Critical Slope	0.00895	ft/ft

Cross Section for La Madre Way Lateral - 54" RCP

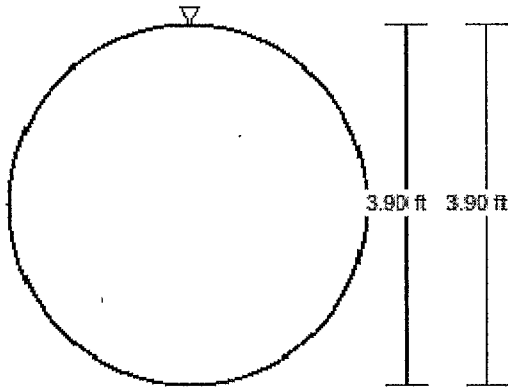
Project Description

Friction Method Manning Formula
Solve For Full Flow Diameter

Input Data

Roughness Coefficient	0.013
Channel Slope	1.00 %
Normal Depth	3.90 ft
Diameter	3.90 ft
Discharge	134.00 ft ³ /s

Cross Section Image



V: 1
H: 1

Worksheet for Verde Way Lateral - 36" RCP

Project Description

Friction Method Manning Formula
Solve For Full Flow Diameter

Input Data

Roughness Coefficient	0.013
Channel Slope	1.00 %
Normal Depth	2.43 ft
Diameter	2.43 ft
Discharge	38.00 ft ³ /s

Results

Diameter	2.43 ft
Normal Depth	2.43 ft
Flow Area	4.64 ft ²
Wetted Perimeter	7.63 ft
Hydraulic Radius	0.61 ft
Top Width	0.00 ft
Critical Depth	2.09 ft
Percent Full	100.0 %
Critical Slope	0.00928 ft/ft
Velocity	8.20 ft/s
Velocity Head	1.04 ft
Specific Energy	3.47 ft
Froude Number	0.00
Maximum Discharge	40.88 ft ³ /s
Discharge Full	38.00 ft ³ /s
Slope Full	0.01000 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 %

Worksheet for Verde Way Lateral - 36" RCP

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.43	ft
Critical Depth	2.09	ft
Channel Slope	1.00	%
Critical Slope	0.00928	ft/ft

Cross Section for Verde Way Lateral - 36" RCP

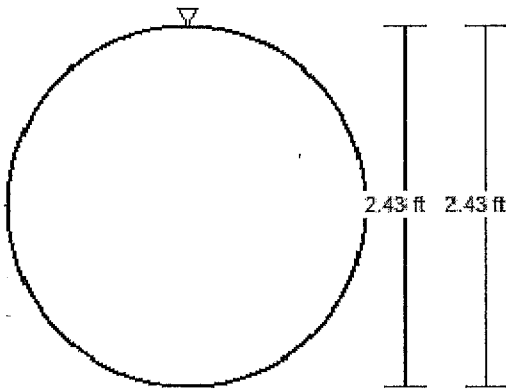
Project Description

Friction Method Manning Formula
Solve For Full Flow Diameter

Input Data

Roughness Coefficient	0.013
Channel Slope	1.00 %
Normal Depth	2.43 ft
Diameter	2.43 ft
Discharge	38.00 ft ³ /s

Cross Section Image



V: 1
H: 1

Worksheet for La Madre Way Lateral - 54" RCP

Project Description

Friction Method Manning Formula
Solve For Full Flow Diameter

Input Data

Roughness Coefficient	0.013
Channel Slope	1.00 %
Normal Depth	3.90 ft
Diameter	3.90 ft
Discharge	134.00 ft ³ /s

Results

Diameter	3.90 ft
Normal Depth	3.90 ft
Flow Area	11.93 ft ²
Wetted Perimeter	12.24 ft
Hydraulic Radius	0.97 ft
Top Width	0.00 ft
Critical Depth	3.45 ft
Percent Full	100.0 %
Critical Slope	0.00895 ft/ft
Velocity	11.23 ft/s
Velocity Head	1.96 ft
Specific Energy	5.86 ft
Froude Number	0.00
Maximum Discharge	144.15 ft ³ /s
Discharge Full	134.00 ft ³ /s
Slope Full	0.01000 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 %

Worksheet for La Madre Way Lateral - 54" RCP

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.90	ft
Critical Depth	3.45	ft
Channel Slope	1.00	%
Critical Slope	0.00895	ft/ft

Cross Section for La Madre Way Lateral - 54" RCP

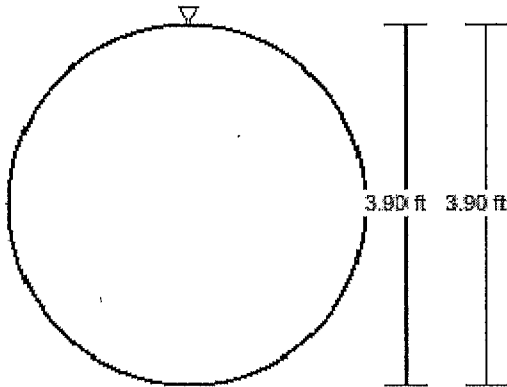
Project Description

Friction Method Manning Formula
Solve For Full Flow Diameter

Input Data

Roughness Coefficient	0.013
Channel Slope	1.00 %
Normal Depth	3.90 ft
Diameter	3.90 ft
Discharge	134.00 ft ³ /s

Cross Section Image



V: 1
H: 1

Worksheet for Rosada Way Lateral - 24" RCP

Project Description

Friction Method Manning Formula
Solve For Full Flow Diameter

Input Data

Roughness Coefficient	0.013
Channel Slope	1.00 %
Normal Depth	1.53 ft
Diameter	1.53 ft
Discharge	11.00 ft ³ /s

Results

Diameter	1.53 ft
Normal Depth	1.53 ft
Flow Area	1.83 ft ²
Wetted Perimeter	4.79 ft
Hydraulic Radius	0.38 ft
Top Width	0.00 ft
Critical Depth	1.27 ft
Percent Full	100.0 %
Critical Slope	0.00975 ft/ft
Velocity	6.01 ft/s
Velocity Head	0.56 ft
Specific Energy	2.09 ft
Froude Number	0.00
Maximum Discharge	11.83 ft ³ /s
Discharge Full	11.00 ft ³ /s
Slope Full	0.01000 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 %

Worksheet for Rosada Way Lateral - 24" RCP

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.53	ft
Critical Depth	1.27	ft
Channel Slope	1.00	%
Critical Slope	0.00975	ft/ft

Cross Section for Rosada Way Lateral - 24" RCP

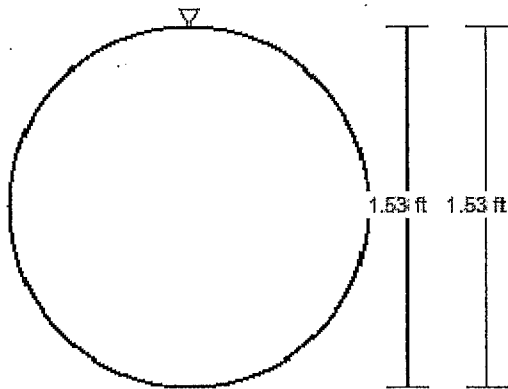
Project Description

Friction Method Manning Formula
Solve For Full Flow Diameter

Input Data

Roughness Coefficient	0.013
Channel Slope	1.00 %
Normal Depth	1.53 ft
Diameter	1.53 ft
Discharge	11.00 ft ³ /s

Cross Section Image



V: 1 
H: 1

Worksheet for Washburn Road Lateral Interim - 6x4 RCB

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient 0.013
Channel Slope 1.00 %
Height 4.00 ft
Bottom Width 6.00 ft
Discharge 250.00 ft³/s

Results

Normal Depth 2.84 ft
Flow Area 17.01 ft²
Wetted Perimeter 11.67 ft
Hydraulic Radius 1.46 ft
Top Width 6.00 ft
Critical Depth 3.78 ft
Percent Full 70.9 %
Critical Slope 0.00469 ft/ft
Velocity 14.69 ft/s
Velocity Head 3.36 ft
Specific Energy 6.19 ft
Froude Number 1.54
Discharge Full 309.78 ft³/s
Slope Full 0.01535 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 70.89 %
Downstream Velocity Infinity ft/s

Worksheet for Washburn Road Lateral Interim - 6x4 RCB

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	2.84	ft
Critical Depth	3.78	ft
Channel Slope	1.00	%
Critical Slope	0.00469	ft/ft

Cross Section for Washburn Road Lateral Interim - 6x4 RCB

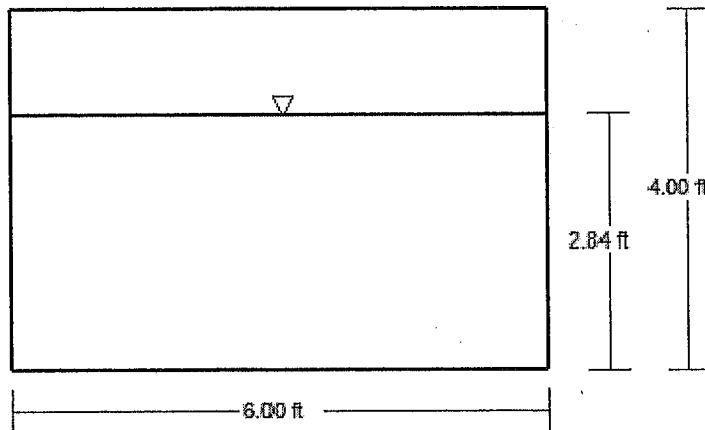
Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.013
Channel Slope	1.00 %
Normal Depth	2.84 ft
Height	4.00 ft
Bottom Width	6.00 ft
Discharge	250.00 ft ³ /s

Cross Section Image



V: 1
H: 1

Worksheet for Fisher Avenue Lateral - 36" RCP

Project Description

Friction Method Manning Formula
Solve For Full Flow Diameter

Input Data

Roughness Coefficient 0.013
Channel Slope 1.00 %
Normal Depth 2.22 ft
Diameter 2.22 ft
Discharge 30.00 ft³/s

Results

Diameter 2.22 ft
Normal Depth 2.22 ft
Flow Area 3.88 ft²
Wetted Perimeter 6.98 ft
Hydraulic Radius 0.56 ft
Top Width 0.00 ft
Critical Depth 1.90 ft
Percent Full 100.0 %
Critical Slope 0.00936 ft/ft
Velocity 7.73 ft/s
Velocity Head 0.93 ft
Specific Energy 3.15 ft
Froude Number 0.00
Maximum Discharge 32.27 ft³/s
Discharge Full 30.00 ft³/s
Slope Full 0.01000 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 %

Worksheet for Fisher Avenue Lateral - 36" RCP

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.22	ft
Critical Depth	1.90	ft
Channel Slope	1.00	%
Critical Slope	0.00936	ft/ft

Cross Section for Fisher Avenue Lateral - 36" RCP

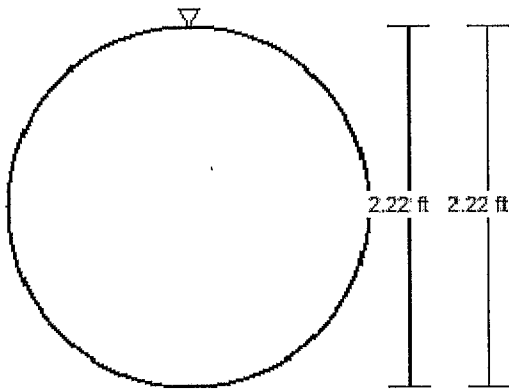
Project Description

Friction Method Manning Formula
Solve For Full Flow Diameter

Input Data

Roughness Coefficient	0.013
Channel Slope	1.00 %
Normal Depth	2.22 ft
Diameter	2.22 ft
Discharge	30.00 ft ³ /s

Cross Section Image



V: 1
H: 1

Worksheet for Hammer Lane Lateral - 48" RCP

Project Description

Friction Method Manning Formula
Solve For Full Flow Diameter

Input Data

Roughness Coefficient	0.013
Channel Slope	1.00 %
Normal Depth	3.26 ft
Diameter	3.26 ft
Discharge	83.00 ft ³ /s

Results

Diameter	3.26 ft
Normal Depth	3.26 ft
Flow Area	8.33 ft ²
Wetted Perimeter	10.23 ft
Hydraulic Radius	0.81 ft
Top Width	0.00 ft
Critical Depth	2.85 ft
Percent Full	100.0 %
Critical Slope	0.00906 ft/ft
Velocity	9.97 ft/s
Velocity Head	1.54 ft
Specific Energy	4.80 ft
Froude Number	0.00
Maximum Discharge	89.28 ft ³ /s
Discharge Full	83.00 ft ³ /s
Slope Full	0.01000 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 %

Worksheet for Hammer Lane Lateral - 48" RCP

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.26	ft
Critical Depth	2.85	ft
Channel Slope	1.00	%
Critical Slope	0.00906	ft/ft

Cross Section for Hammer Lane Lateral - 48" RCP

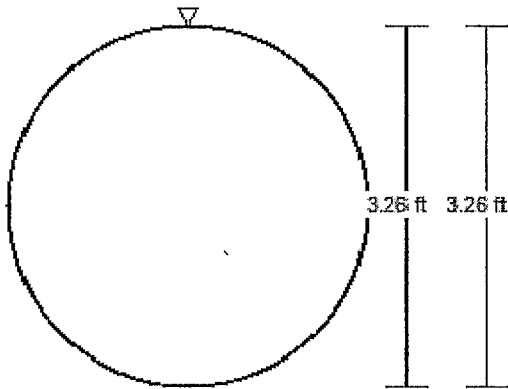
Project Description

Friction Method Manning Formula
Solve For Full Flow Diameter

Input Data

Roughness Coefficient	0.013
Channel Slope	1.00 %
Normal Depth	3.26 ft
Diameter	3.26 ft
Discharge	83.00 ft ³ /s

Cross Section Image



V: 1
H: 1

Worksheet for Stephen Avenue Lateral - 48" RCP

Project Description

Friction Method Manning Formula
Solve For Full Flow Diameter

Input Data

Roughness Coefficient	0.013
Channel Slope	1.00 %
Normal Depth	3.36 ft
Diameter	3.36 ft
Discharge	90.00 ft ³ /s

Results

Diameter	3.36 ft
Normal Depth	3.36 ft
Flow Area	8.85 ft ²
Wetted Perimeter	10.55 ft
Hydraulic Radius	0.84 ft
Top Width	0.00 ft
Critical Depth	2.94 ft
Percent Full	100.0 %
Critical Slope	0.00904 ft/ft
Velocity	10.17 ft/s
Velocity Head	1.61 ft
Specific Energy	4.96 ft
Froude Number	0.00
Maximum Discharge	96.81 ft ³ /s
Discharge Full	90.00 ft ³ /s
Slope Full	0.01000 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 %

Worksheet for Stephen Avenue Lateral - 48" RCP

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.36	ft
Critical Depth	2.94	ft
Channel Slope	1.00	%
Critical Slope	0.00904	ft/ft

Cross Section for Stephen Avenue Lateral - 48" RCP

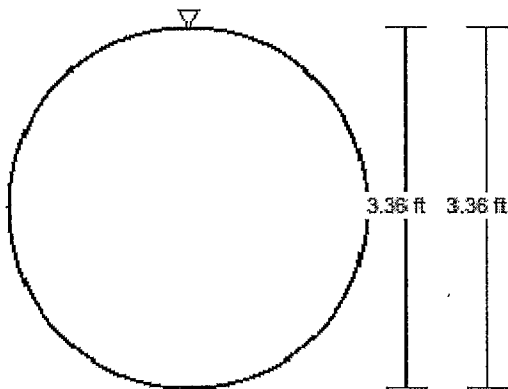
Project Description

Friction Method Manning Formula
Solve For Full Flow Diameter

Input Data

Roughness Coefficient	0.013
Channel Slope	1.00 %
Normal Depth	3.36 ft
Diameter	3.36 ft
Discharge	90.00 ft ³ /s

Cross Section Image



V: 1
H: 1

APPENDIX C

Site Photographs

VERDE WAY



EL CAPITAN / VERDE WAY – FACING NORTHWEST

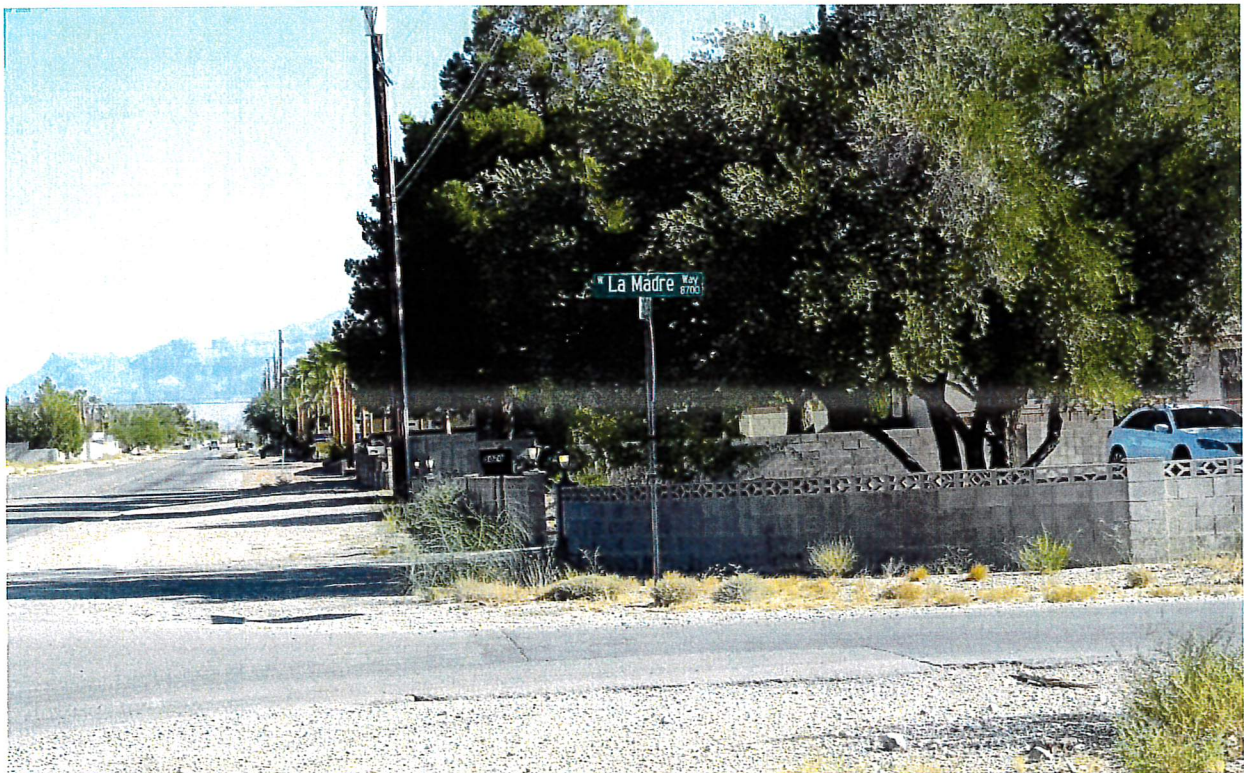


EL CAPITAN / VERDE WAY – FACING WEST

LA MADRE WAY



EL CAPITAN / LA MADRE WAY – FACING NORTH



EL CAPITAN / LA MADRE WAY – FACING NORTH

LA MADRE WAY

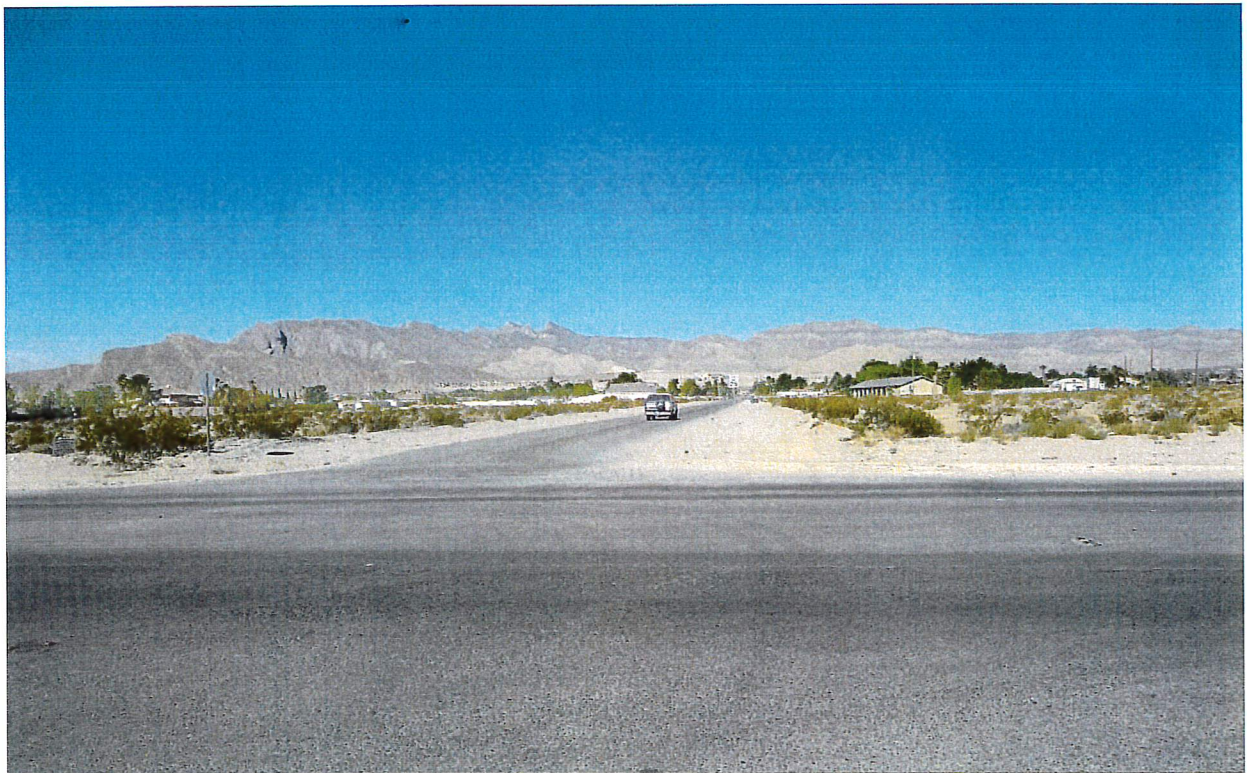


EL CAPITAN / LA MADRE WAY – FACING NORTHWEST

ROSADA WAY



EL CAPITAN / ROSADA WAY – FACING NORTH



BLM PROPERTY – FACING WEST

ROSADA WAY



EL CAPITAN / ROSADA WAY – FACING WEST

WASHBURN ROAD



EL CAPITAN / WASHBURN ROAD – FACING NORTH



EL CAPITAN / WASHBURN ROAD – FACING NORTHWEST

WASHBURN ROAD

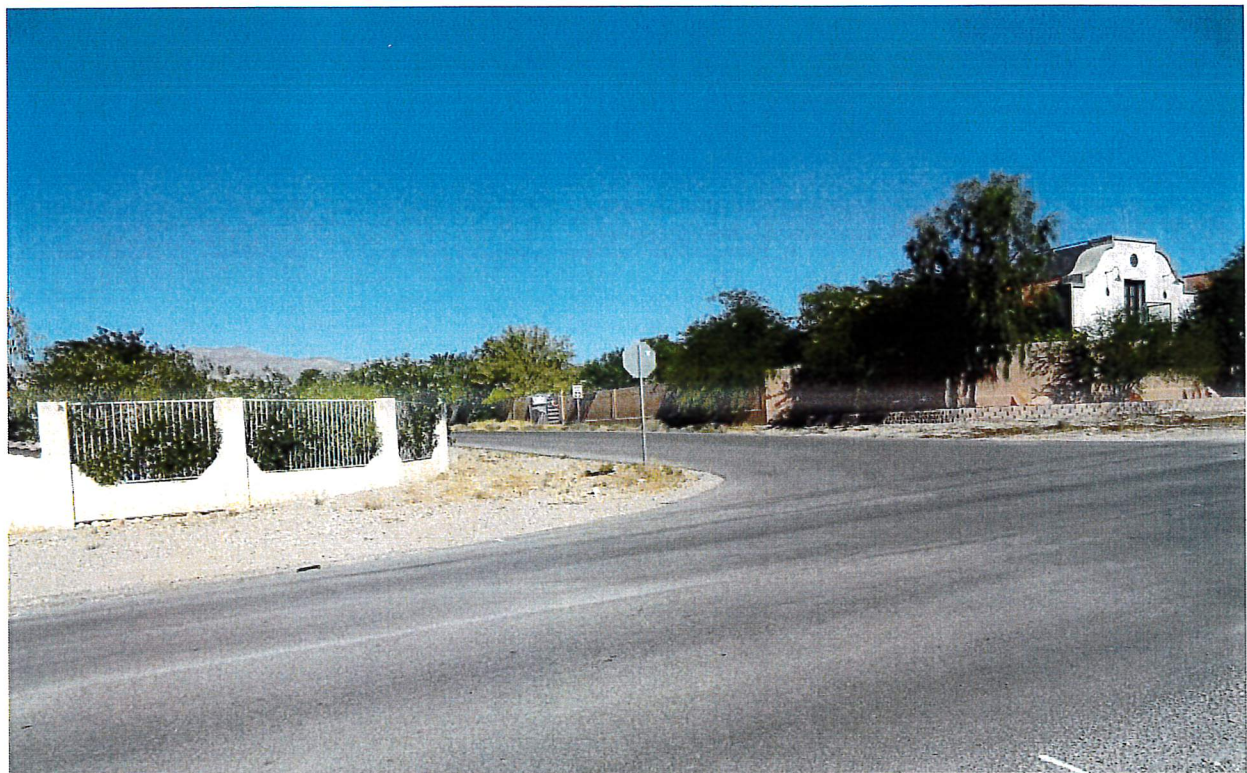


EL CAPITAN / WASHBURN ROAD – FACING WEST

FISHER AVENUE



EL CAPITAN / FISHER AVENUE – FACING NORTH



EL CAPITAN / FISHER AVENUE – FACING NORTHWEST

HAMMER LANE



EL CAPITAN / HAMMER LANE – FACING NORTH

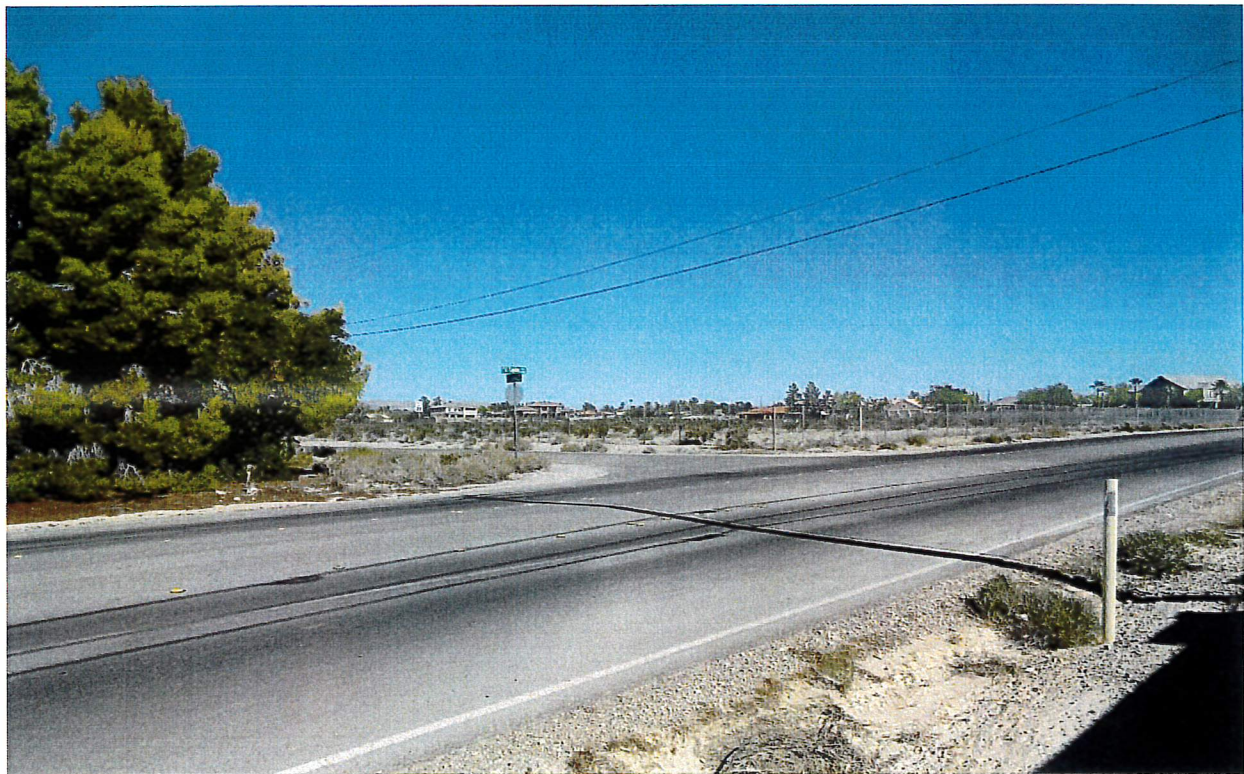


EL CAPITAN / HAMMER LANE – FACING NORTHWEST

STEPHEN AVENUE



EL CAPITAN / STEPHEN AVENUE – FACING WEST



EL CAPITAN / STEPHEN AVENUE – FACING NORTHWEST

STEPHEN AVENUE



EL CAPITAN / STEPHEN AVENUE – FACING WEST



BLM PROPERTY – EL CAPITAN / STEPHEN AVENUE – FACING WEST

ANN ROAD



EL CAPITAN / ANN ROAD – FACING NORTHWEST



EL CAPITAN / ANN ROAD – FACING SOUTH (8/22/2016 STORM EVENT)
SEDIMENTATION ALONG NORTH AND SOUTH HALF OF ANN ROAD, WEST TO EAST

ANN ROAD



EL CAPITAN / ANN ROAD – FACING NORTHWEST

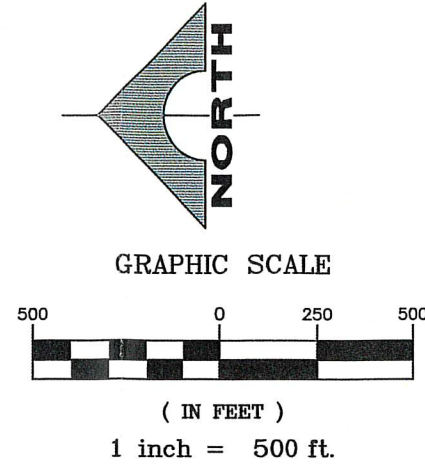
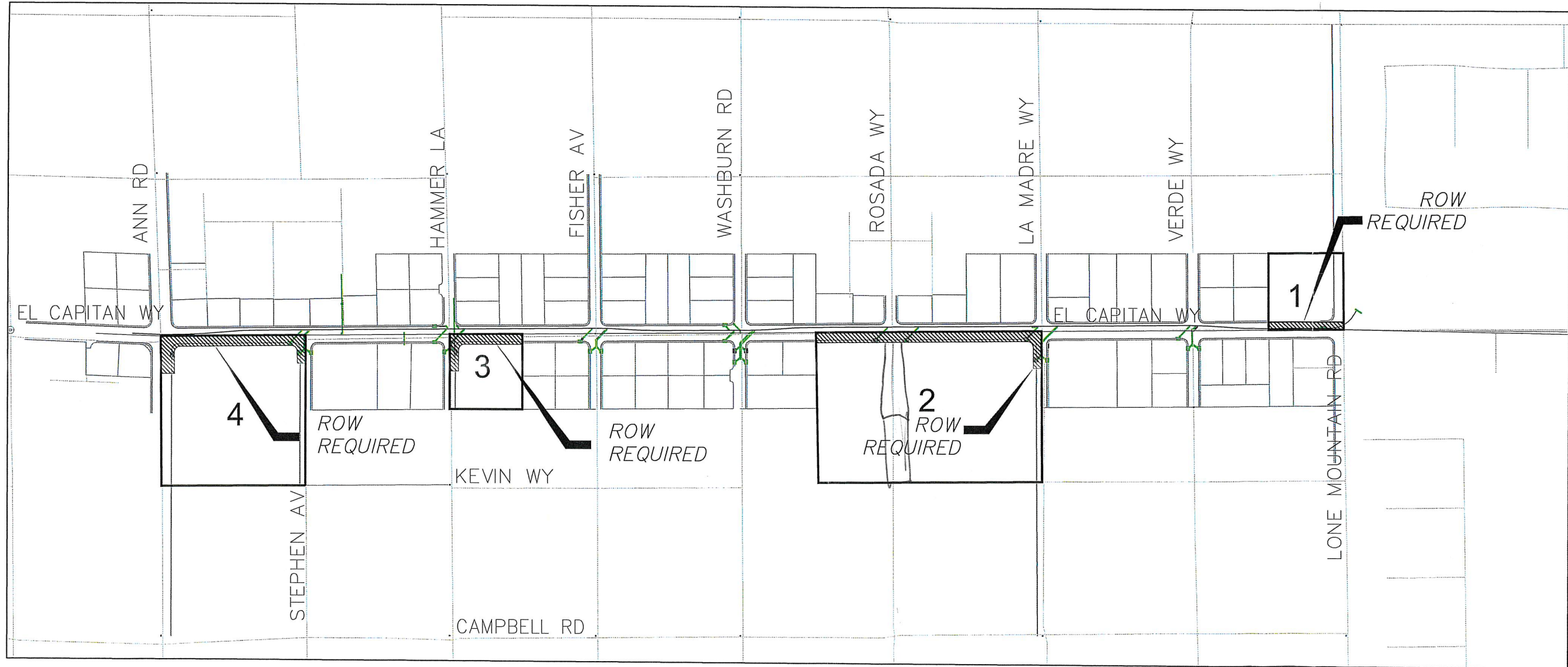


EL CAPITAN / ANN ROAD – FACING WEST

APPENDIX D

Right-of-Way requirements

09-15-16 15:23:25 F:\Projects\400\412-661\Division\Fct\Figures\SCW_Exhibit_2-ROW Exhibit.dwg mcastell



RIGHT-OF-WAY PROPERTY SCHEDULE			
1	125-32-802-020	FERNANDEZ M & E FAMILY TRUST	ROW
2	125-32-302-010	USA	BLM ROW Grant
3	125-32-204-005	HAMMER-EL CAPITAN LLC	ROW
4	125-32-102-029	USA	BLM ROW Grant

CITY OF LAS VEGAS

GOWAN NORTH - EL CAPITAN BRANCH LONE MOUNTAIN ROAD TO ANN ROAD

EXHIBIT 2
ROW EXHIBIT

1555 S. RAINBOW BLVD.
LAS VEGAS, NV 89146
T: 702.804.2000
F: 702.804.2299
gcwengineering.com

GCW
ENGINEERS SURVEYORS

SHEET

EXH 2

SHTOF 0 SHTS

APPENDIX E

Utility Conflict Information

GOWAN NORTH - EL CAPITAN BRANCH
UTILITY CONFLICT SCHEDULE

CONFLICT NUMBER	SHEET	STATION	OFFSET	ALIGNMENT	UTILITY SIZE AND TYPE			PROPOSED FACILITY SIZE AND TYPE	CLEARANCE w/ RESPECT TO PROP. FACILITY	RESOLUTION
1	PP1	11+25		"ECW"	GAS	4"	PE	10'x8' RCB SD		TO BE RELOCATED / POTHOLE
2	PP1	16+50		"ECW"	WATER	8"	PVC	10'x8' RCB SD		TO BE RELOCATED / POTHOLE
3	PP1	17+00		"ECW"	GAS	2"	PE	10'x8' RCB SD		PROTECT IN PLACE
4	PP2	23+25		"ECW"	WATER	8"	PVC	10'x8' RCB SD		PROTECT IN PLACE / POTHOLE
5	PP4	37+00		"ECW"	WATER	10"	PVC	10'x7' RCB SD		
6	PP4	43+50		"ECW"	GAS	2"	PE	10'x7' RCB SD		
7	PP5	49+50		"ECW"	SEWER	8"	PVC	10'x7' RCB SD		
8	PP5	49+75		"ECW"	WATER	8"	PVC	12'x6' RCB SD		PROTECT IN PLACE / POTHOLE
9	PP5	54+50		"ECW"	SEWER	8"	PVC	12'x6' RCB SD		
10	PP6	62+00		"ECW"	WATER	36"	MLCP	12'x6' RCB SD		PROTECT IN PLACE / POTHOLE
11	PP6	63+00		"ECW"	WATER	12"	PVC	12'x6' RCB SD		TO BE RELOCATED

APPENDIX F

Preliminary Cost Estimate

**GOWAN NORTH - EL CAPITAN BRANCH
LONE MOUNTAIN TO ANN ROAD
30% CONSTRUCTION COST ESTIMATE**

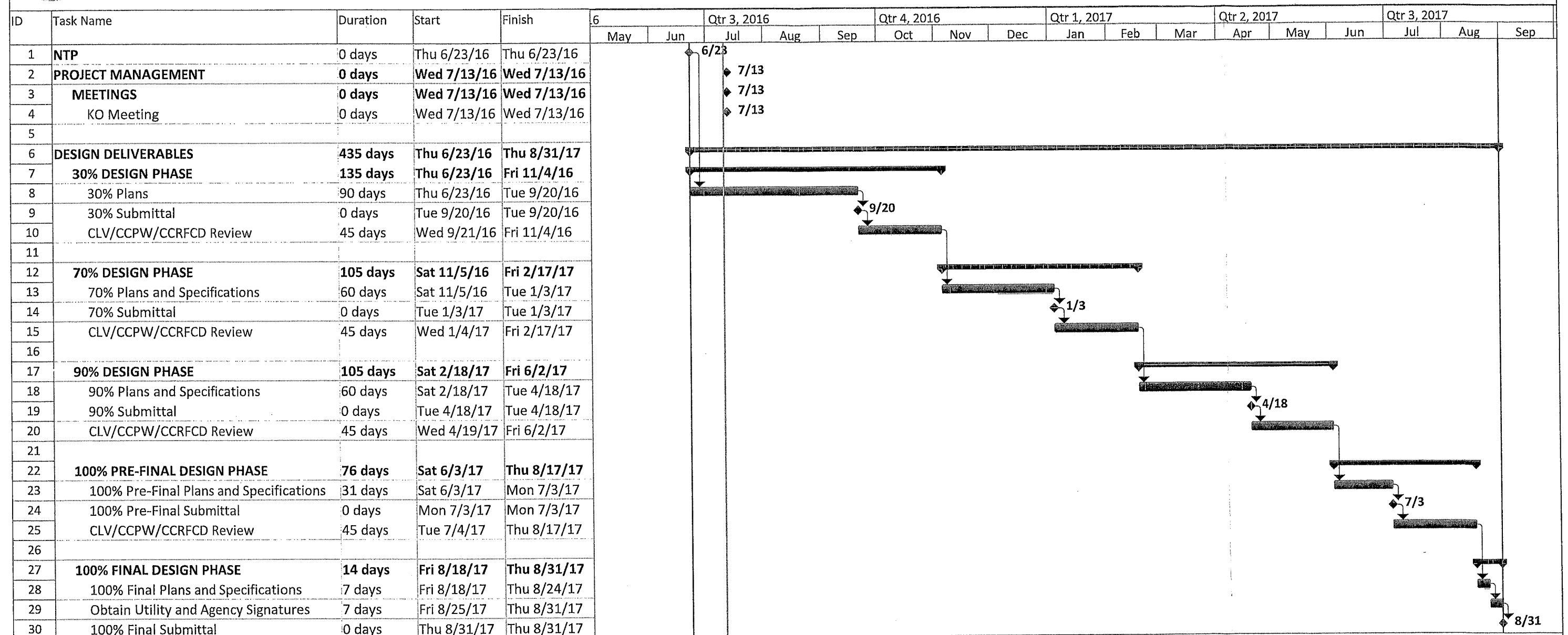
Item No.	Description	Unit	Quantity	Unit Price	Cost
109.01	OWNER CAUSED DELAY ALLOWANCE	DAY	15	\$500.00	\$7,500.00
109.02	OWNER CAUSED DELAY AMOUNT IN ADDITION TO ALLOWANCE	DAY	15	\$670.00	\$10,050.00
200.01	MOBILIZATION AND DEMOBILIZATION	LS	1	\$320,000.00	\$320,000.00
200.02	PROJECT SIGN	EA	2	\$800.00	\$1,600.00
201.01	CLEARING AND GRUBBING	LS	1	\$10,000.00	\$10,000.00
202.01	REMOVE BITUMINOUS ACCESS PATH	SY	3,600	\$4.00	\$14,400.00
203.01	QUALITY CONTROL TESTING	LS	1	\$33,500.00	\$33,500.00
203.02	EXCAVATION	CY	49,100	\$7.50	\$368,250.00
207.01	BACKFILL	CY	27,500	\$20.00	\$550,000.00
302.01	TYPE II AGGREGATE BASE	CY	3,400	\$25.00	\$85,000.00
402.01	PLANTMIX BITUMINOUS SURFACE (2-INCH - ACCESS PATH)	SY	3,600	\$15.00	\$54,000.00
402.02	PLANTMIX BITUMINOUS SURFACE (6-INCH - EL CAPITAN WAY)	SY	12,600	\$35.00	\$441,000.00
502.01	6' X 4' PRECAST REINFORCED CONCRETE BOX	LF	150	\$350.00	\$52,500.00
502.02	10' X 7' PRECAST REINFORCED CONCRETE BOX	LF	2,630	\$675.00	\$1,775,250.00
502.03	10' X 8' PRECAST REINFORCED CONCRETE BOX	LF	1,240	\$725.00	\$899,000.00
502.04	12' X 6' PRECAST REINFORCED CONCRETE BOX	LF	1,340	\$775.00	\$1,038,500.00
502.05	6-FOOT BY 4-FOOT AND 10-FOOT BY 7-FOOT RCB TO 10-FOOT BY 8-FOOT JUNCTION STRUCTURE	EA	1	\$7,500.00	\$7,500.00
502.06	10-FOOT BY 8-FOOT TO 12-FOOT BY 5-FOOT RCB TRANSITION STRUCTURE	EA	1	\$13,000.00	\$13,000.00
502.07	10-FOOT BY 7-FOOT TO 10-FOOT BY 8-FOOT PRECAST RCB TRANSITION STRUCTURE	EA	1	\$4,800.00	\$4,800.00
502.08	12-FOOT BY 6-FOOT TO 10-FOOT BY 7-FOOT PRECAST RCB TRANSITION STRUCTURE	EA	1	\$5,100.00	\$5,100.00
502.09	6-FOOT BY 4-FOOT RCB PLUG	EA	1	\$350.00	\$350.00
502.10	12-FOOT BY 6-FOOT RCB PLUG	EA	1	\$1,100.00	\$1,100.00
603.01	24-INCH REINFORCED CONCRETE PIPE (CLASS III)	LF	680	\$165.00	\$112,200.00
603.02	36-INCH REINFORCED CONCRETE PIPE (CLASS III)	LF	580	\$200.00	\$116,000.00
603.03	48-INCH REINFORCED CONCRETE PIPE (CLASS III)	LF	210	\$300.00	\$63,000.00
603.04	54-INCH REINFORCED CONCRETE PIPE (CLASS III)	LF	160	\$350.00	\$56,000.00
603.05	24-INCH PRECAST RCP PLUG	EA	2	\$1,750.00	\$3,500.00
603.06	36-INCH PRECAST RCP PLUG	EA	2	\$2,000.00	\$4,000.00
603.07	48-INCH PRECAST RCP PLUG	EA	2	\$2,250.00	\$4,500.00
603.08	54-INCH PRECAST RCP PLUG	EA	1	\$2,500.00	\$2,500.00
609.01	STORM DRAIN MANHOLE NDOT TYPE 4	EA	10	\$15,000.00	\$150,000.00
609.02	48-INCH ACCESS MANHOLE	EA	16	\$4,000.00	\$64,000.00
609.03	NDOT TYPE 2B DROP INLET AND CONCRETE APRON	EA	24	\$5,500.00	\$132,000.00
622.01	CONSTRUCTION SURVEYING	LS	1	\$50,000.00	\$50,000.00
624.01	TRAFFIC CONTROL AND MAINTENANCE	LS	1	\$90,000.00	\$90,000.00
629.01	RELOCATE 8-INCH WATER LINE	LS	2	\$40,000.00	\$80,000.00
629.02	RELOCATE 10-INCH WATER LINE	LS	1	\$60,000.00	\$60,000.00
629.03	RELOCATE 12-INCH WATER LINE	LS	1	\$70,000.00	\$70,000.00
637.01	DUST CONTROL	LS	1	\$15,000.00	\$15,000.00
637.02	TEMPORARY POLLUTION CONTROL	LS	1	\$4,500.00	\$4,500.00
SUBTOTAL					\$6,769,600.00
30% CONTINGENCY					\$2,030,880.00
TOTAL CONSTRUCTION COST					\$8,800,480

APPENDIX G

Project Schedule



GOWAN NORTH
EL CAPITAN BRANCH
LONE MOUNTAIN ROAD TO ANN ROAD



Project: GowanNorth_2
Date: Mon 7/11/16

Task		Project Summary		Inactive Milestone		Manual Summary Rollup	Deadline	
Split		External Tasks		Inactive Summary		Manual Summary	Progress	
Milestone		External Milestone		Manual Task		Start-only		
Summary		Inactive Task		Duration-only		Finish-only		

APPENDIX H

Project Correspondence

July 13, 2016

Job #412-661

16. The project schedule was provided and reviewed. The following is the submittal schedule:

30% Design	11/4/16 (135 days)
70% Design	2/17/17 (105 days)
90% Design	6/2/17 (105 days)
100% Pre-Final Design	8/17/17 (76 days)
100% Final Design	8/31/17 (14 days)

- The schedule includes a six week review for CLV/CCPW/CCRFGD.

ACTION ITEMS:

- *GCW to schedule coordination meeting with CLV Survey and CCPW Survey. DONE*
- *CLV to send GCW CAD and drawing standards. DONE.*
- *GCW to start Section 8 Analysis. DONE.*

cc: Attendees

GOWAN NORTH – EL CAPITAN BRANCH, LONE MOUNTAIN ROAD TO ANN ROAD
Kickoff Meeting
July 13, 2016

[illegible]



MEETING NOTES
By: Grant Tokumi

Project No. 412-661
Date: July 20, 2016

SUBJECT:	Gowan North – El Capitan Branch Lone Mountain Road to Ann Road Survey Coordination Meeting	
PLACE:	CCPW Survey Conference Room 2nd Floor	
TIME:	8:00 am to 9:00 am	
DATE:	July 20, 2016	
ATTENDING:	Dennis Moyer, CLV Public Works Alan Riecki, CLV Survey Todd Myers, CCRFCD Joe Yatson, CCPW James Marlett, CCPW Survey Spring Dineen, CCPW Jinxin Xie, CCPW Kevin Campbell, VTN Tony Johnson, VTN Paul Burn, GCW Survey Ryan Belsick, GCW Grant Tokumi, GCW	

The following items were discussed:

1. Three adjacent projects currently under design:
 - a. CLV Project - Gowan North - El Capitan Branch, Lone Mountain Road to Ann Road. The consultant is GCW Inc. Survey by GCW Inc.
 - b. CCPW Project - Lone Mountain Road from CC 215 to Tenaya Way. The consultant is CA Group. Survey by VTN Nevada.
 - c. CCPW Project - Ann Road from CC 215 to Durango Road. The project will be designed in-house. Survey by VTN Nevada.
2. CLV Gowan North - El Capitan Branch project will be NCRS – Las Vegas Zone. Survey by GCW.
3. CCPW Lone Mountain Road and Ann Road projects will be on Modified State Plane, Grid to Ground. Survey by VTN Nevada.
4. VTN is in receipt of GCW's survey values, both horizontal and vertical. VTN will share with GCW common points between Ann Road and Washburn Road today. Common point in Lone Mountain will followup next week.
5. If surveys by GCW and VTN match each other within acceptable tolerances, then both projects, when designed, can be shared with each other by applying a rotation.
6. The GCW Record of Survey (ROS) will include an additional column in the point table to present the coordinates in the VTN coordinate system, and vice versa.



MEETING NOTES
By: Grant Tokumi

Project No. 412-661
Date: July 28, 2016

SUBJECT:	Gowan North – El Capitan Branch Lone Mountain Road to Ann Road Hydrology Meeting	
PLACE:	CLV, 9 th Floor, Gravel Pit Conference Room	
TIME:	10:30 am	
DATE:	July 28, 2016	
ATTENDING:	Dennis Moyer, CLV PW Peter Jackson, CLV FC Oh-Sang Kwon, CLV FC Todd Myers, CCRFCD	Ryan Belsick, GCW Grant Tokumi, GCW Michelle Castell, GCW

The following items were presented and discussed:

1. The soils report, from <http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm>, shows that the project area consists of Soil Type 190 (Dalian) and Soil Type 191 (Dalian). The hydrologic characteristics of Soil Type 190 consist of 100 percent Type A. This differs from the previous soil breakdown which consisted of 10 percent Type A, 85 percent Type B and 5 percent Type D. The hydrologic characteristics of soil type 191 consist of 100 percent Type A. This differs from the previous soil breakdown which consisted of 5 percent Type A, 85 percent Type B and 10 percent Type D.
2. Condition 2 Curve Number (CN2) values were reduced from 60 to 39, and from 62 to 39, for Soils Type 190 and 191, respectively. CN2 is for landscaped, lawns, trees in good hydrologic condition.
3. Preliminary hydrology results using latest soils information significantly reduced flow rates in El Capitan Way during the Ultimate Conditions. Flow rates were essentially reduced by more than half of the 2008 MPU.
4. Preliminary hydrology analysis for Interim Conditions using latest soils data resulted in flow rates less than 500 cfs.
5. Another project downstream of this project was discussed. The project extends west in Lone Mountain Road from Buffalo Drive to Conough Lane, north in Conough Lane to Washburn Road, and west in Washburn Road to Cimarron Road. It was questioned on what soils was used in the development of the hydrologic model for that project.
6. CCRFCD put together a hydrologic model of the area after the 2004 flood event using the actual rainfall data collected during the event. The resulting flows were close to the estimated flow rates experienced during the flood event. CCRFCD may revisit this model and modify the curve numbers to reflect the new soils to compare results.

August 31, 2016

Job #412-661

8. The project schedule for CCPW Project - Lone Mountain Road from CC 215 to Tenaya Way was provided by Spring Dineen at CCPW.
9. GCW will contact Spring Dineen with CCPW to inquire whether CCPW general notes should be added to the improvement plans in addition to the CLV general notes since the project is in County jurisdiction.
10. It was suggested that CCPW should invite Peter Jackson to coordination meetings for the CCPW Project - Lone Mountain Road from CC 215 to Tenaya Way.
11. Geotech will verify AC thickness and subgrade. If existing pavement does not meet current criteria, the project will put back pavement thickness up to current standards.
12. GCW explained that the Record of Survey (ROS) is completed, pending receipt of information from VTN Nevada for Lone Mountain Road for comparison as discussed in the survey coordination meeting July 20, 2016. Once information is received from VTN Nevada, GCW will send the ROS to Dennis for CLV review.
13. The project walk through will be scheduled after the 30% submittal.
14. The existing walkway along the east side of El Capitan will need to remain open during construction. Any temporary path during construction will be required to be a hardened surface. GCW will investigate if the walkway is designated as a Safe Route to School corridor.
15. Title reports on adjacent parcels except the 4 parcels requiring right-of-way will be put on hold until it is determined whether or not those title reports and research into pertinent easements on those parcels are necessary.

ACTION ITEMS:

- ***GCW will contact CLV sewer and investigate future extension of the existing sewer stubs in El Capitan.***
- ***GCW will research a drainage study at the northeast corner of Lone Mountain Road and Fort Apache Road to verify proposed flow patterns.***
- ***GCW will send Record of Survey to Dennis for CLV review.***
- ***GCW will contact CCPW regarding inclusion of CCPW general notes on improvement plans.***

cc: Attendees

GOWAN OUTFALL - EL CAPITAN BRANCH, LONE MOUNTAIN TO ANN ROAD
UTILITY SUBMITTAL MATRIX

JOB #	TITLE	CONTACT	TELEPHONE #/EMAIL	ADDRESS	PRELIMINARY			30%			ADDITIONAL NOTES	PRE-FINAL		FINAL		MYLAR SIGNATURE	NOTES
					PRELIM OVERALL EXHIBIT Submittal Date	ENTITIES/UTILITY RESPONSE	NOTES	30% IMPROVEMENTS Submittal Date	ENTITIES/UTILITY RESPONSE	NOTES		PRE-FINAL IMPROVEMENTS Submittal Date	ENTITIES/UTILITY RESPONSE	FINAL IMPROVEMENTS	ENTITIES/UTILITY RESPONSE		
1	CITY OF LAS VEGAS PUBLIC WORKS	Dennis Moyer	702-229-6018 dmoyer@LasVegasnevada.gov	City of Las Vegas N Rancho Drive, 5th Fl Vegas, NV 89105													
2	CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT	Todd Myers	702-685-0000	CCRFGD 800 S Grand Central Parkway, Suite 300													
3	CCWRD	Kathleen Minert	702-688-8168 KMinert@clearwaterteam.com	Clark County Water Reclamation District 5857 E. Flamingo Road Las Vegas, NV 89122	1/20/2016	1/27/2016	received email indicating no utilities										
4	CENTURY LINK	Steve Turner		Central Telephone dba Century Link 6700 Via Austral Parkway Las Vegas, NV 89122	1/20/2016	2/22/2016	received asbuilts										
5	COX COMMUNICATIONS	Doney Villareal	702-210-5985 702-545-1679 Doney.Villareal@cox.com	Cox Communication 1700 West Vegas Drive Las Vegas, NV 89106	1/20/2016	2/8/2016	received asbuilts										
6	LVVWD	Alison Moore	702-870-2011	LVVWD 1001 South Valley View Blvd. Las Vegas, NV 89153	1/21/2016	1/25/2016	received asbuilts										
7	NV ENERGY DISTRIBUTION	Don Jackson Patricia Brown Garren Beltran	702-402-6812 (T) 702-275-6290 (M) brownpn@nvenergy.com 702-402-6784 Gbeltran@nvenergy.com	NV Energy - Distribution 7155 Lindell Road Las Vegas, NV 89118	7/12/2016	8/3/2016	received asbuilts										
8	NV ENERGY TRANSMISSION	Lisa Harvey	LHarvey@nvenergy.com	NV Energy - Transmission 6226 West Sahara Avenue Las Vegas, NV 89146	1/20/2016	2/9/2016	received email indicating no facilities in project area										
9	SOUTHWEST GAS	Ariana Alaniz	ariana.AlanizOrtiz@swgas.com	Southwest Gas Corporation 6355 Shatz Street North Las Vegas, NV 89115	1/20/2016	1/22/2016	received asbuilts										

GOWAN NORTH - EL CAPITAN BRANCH LONE MOUNTAIN ROAD TO ANN ROAD
ENTITY SUBMITTAL MATRIX

JOB #	TITLE			30%			PRE-FINAL		FINAL		
				30% IMPROVEMENTS Submittal Date	ENTITIES/UTILITY RESPONSE	NOTES	PRE-FINAL IMPROVEMENTS Submittal Date	ENTITIES/UTILITY RESPONSE	FINAL IMPROVEMENTS	ENTITIES/UTILITY RESPONSE	
ENTITIES											
CONTACT											
Telephone #/email											
Address											
SECTION 8 ANALYSIS	Stephanie Locke	702-373-9990 slocke@newfields.com	3265 North Fort Apache Road, Ste 110 Las Vegas, NV 89129	9/20/2016							
USACE 404 PERMIT											no 404 permit required 7/15/16 email from Ken MacDonald

APPENDIX I

Permit Matrix

Gowan North - El Capitan Branch - Lone Mountain Road to Ann Road
Environmental Permit Matrix

Entity	Permit	Issuing Agency	Contact	When to Submit	Who Submits
Clark County	Drainage Study & Approval	CC Dept. of Public Works Design Div.	Joe Yatson (702) 455-6082	Design Phase	Consultant
	Construction Documents (Improvement Plans and Specifications)	CC Dept. of Public Works Design Div.	Joe Yatson (702) 455-6082	Design Phase	Consultant
	Encroachment Permit	CC Dept. of Public Works Design Div.	Joe Yatson (702) 455-6082	Design Phase	Consultant
	Soils Report Submittal	CC Dept. of Building	(702) 455-3030	After 30% Submittal	Consultant
	Temporary Stock Pile Permit	CC Dept. of Public Works Design Div.	(702) 455-3030	Construction Phase	Contractor
	Traffic Control Plan Approval	CC Dept. of Public Works Traffic Operations		Construction Phase	Contractor
	Traffic Baricade Plan Approval	CC Dept. of Public Works Traffic Operations		Construction Phase	Contractor
	Temporary Sign Permit	CC Development Services	(702) 455-3031	Construction Phase	Contractor
	Encroachment Permit (Discharge Water)	CC Dept. of Public Works Design Div.	Joe Yatson (702) 455-6082	Construction Phase	Contractor
	Grading Permit	CC Dept. of Building	(702) 455-3030	Construction Phase	Contractor
	Drainage Study & Approval	Dept. of Public Works, Flood Control	Dennis Moyer	Design Phase	Consultant
City of Las Vegas	Construction Documents (Improvement Plans and Specifications)	CLV Public Works	Jeremy Leavitt (702) 229-6278	Design Phase	Consultant
	Drainage Review	CCRFCD	Todd Myers (702) 685-0000	Design Phase	Consultant
	Utility Services Coordination	Century Link	Steve Turner	Submitted 1/20/16	Consultant
	Utility Services Coordination	Southwest Gas	Ariana Alaniz (702) 365-2027	Submitted 1/20/16	Consultant
	Utility Services Coordination	Cox Communications	Doney Villareal (702) 545-1679	Submitted 1/20/16	Consultant
	Utility Services Coordination	NV Energy - Distribution	Don Jackson (702) 402-8815	Submitted 1/20/16	Consultant
	Utility Services Coordination	NV Energy - Transmission	Lisa Harvey (702) 367-5327	Submitted 1/20/16	Consultant
	Utility Services Coordination	LVWWD	Alison Moore (702) 870-2011	Submitted 1/20/16	Consultant
	Utility Services Coordination	CCWRD	Kathleen Minert (702) 688-8168	Submitted 1/20/16	Consultant
	Other Coordination	Private Owner	To be determined	Ongoing Coordination	Consultant & CLV
	Chapter 8 Screening Analysis	CCRFCD	Todd Myers (702) 685-0000	Approved 9/9/16	Subconsultant
	ROW Temporary Use Permit (TUP)	BLM	Vanessa Hice (702) 515-5069	Ongoing Coordination	Consultant
	BLM ROW Grant	BLM	Vanessa Hice (702) 515-5069	Ongoing Coordination	Consultant

**This is not an all inclusive list to cover every permit required by the Contractor.

APPENDIX J

Section 8 Environmental Screening Information

No 404 Permit Required (e-mail) Information



Technical Memorandum

To: Timothy E. Sutko
Assistant General Manager
Clark County Regional Flood Control District (CCRFCFCD)

From: Stephanie Locke
NewFields

CC: John Tennert Grant Tokumi, P.E.
CCRFCFCD GCW

Date: September 9, 2016

Subject: Gowan North - El Capitan Branch - Lone Mountain to Ann Road Flood Control Facility-Specific Environmental Analysis (Section 8 Report)

INTRODUCTION

This technical memorandum provides an analysis of the potential environmental impacts related to the construction of the proposed Gowan North - El Capitan Branch - Lone Mountain to Ann Road (Project). The Project is located in an existing roadway (El Capitan Road) between Lone Mountain Road and Ann Road in Las Vegas, Nevada (Figure 1). This analysis was conducted pursuant to Chapter 8 of the *Supplemental Programmatic Environmental Impact Statement, Clark County Regional Flood Control District (CCRFCFCD) 2002 Master Plan Update, Final September 2004* (Bureau of Land Management [BLM] 2004), hereafter referred to as the SEIS, which outlines the process necessary to determine the appropriate level of National Environmental Policy Act (NEPA) documentation for a particular facility.

PROJECT DESCRIPTION

The Project features approximately 1 mile (5,400 linear feet) of CCRFCFCD master plan storm drain facility that is described in the 2013 *Las Vegas Valley Flood Control Master Plan Update* (MPU) as facility numbers GOEC 0000, 0026, 0051, and 0076. The drain would extend under El Capitan Way from Lone Mountain Road to Ann Road. The storm drain will tie into the existing system at Lone Mountain Road and will extend through the Ann Road intersection. Although the project area is located within the jurisdiction of Clark County, the project falls within the Gowan Watershed, which is managed by the City of Las Vegas (CLV).

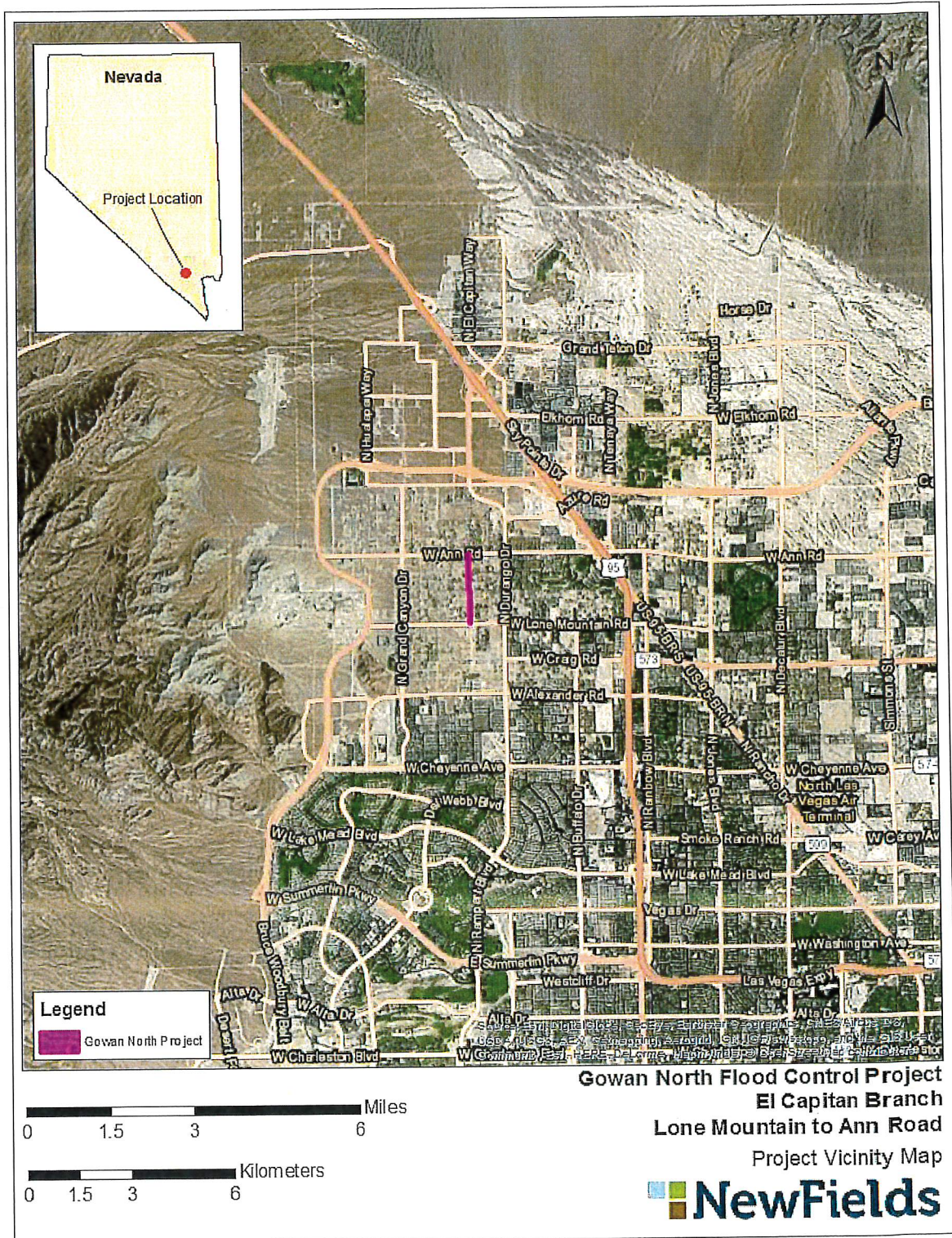


Figure 1. Gowan North Flood Control Project Vicinity

Grant Tokumi

From: Ken MacDonald [kmacdonald@newfields.com]
Sent: Friday, July 15, 2016 12:38 PM
To: Grant Tokumi; Ryan Belsick
Cc: John Tennert; Andrew Butsavich
Subject: Gowan North - No Corps permit required
Attachments: PastedGraphic-1.tiff

Grant and Ryan,

See below email from the Corps where they confirmed that a 404 permit is not needed for Gowan North - El Capitan Branch. Please delete that from the scope when you send the Task Order.

Sincerely,

Ken

Ken MacDonald
Partner

3265 N. Fort Apache Road
Suite 110
Las Vegas, Nevada 89129
702-340-9324
kmacdonald@newfields.com

-----Original Message-----

From: Brown, Craig J SPK [<mailto:Craig.J.Brown@usace.army.mil>]
Sent: Thursday, July 14, 2016 2:11 PM
To: Andrew Butsavich
Subject: RE: Flood Control Channel Question

Hi Andrew,

If the work is taking place in the middle of the road, you won't need a permit from us. Any jurisdictional water under the road has already been impacted, so there are no additional impacts.

Craig

Craig J. Brown
Senior Project Manager, St. George Regulatory Office U.S. Army Corps of Engineers
196 E Tabernacle St. Suite 30
St. George, Utah 84770-3474
Ph: 435-986-3979

* Our customer service hours are 9am to 3pm Monday through Friday.

* Information on the Regulatory Program can be found at;
<http://www.spk.usace.army.mil/Missions/Regulatory.aspx>

Let us know how we're doing. Please complete the survey at:
http://corpsmapu.usace.army.mil/cm_apex/f?p=regulatory_survey

-----Original Message-----

From: Andrew Butsavich [<mailto:abutsavich@newfields.com>]

Sent: Thursday, July 14, 2016 2:41 PM

To: Brown, Craig J SPK <Craig.J.Brown@usace.army.mil>

Subject: [EXTERNAL] Flood Control Channel Question

Hi Craig,

CCRFCDD plans to install a RCB in the middle of a road and wanted to make sure the engineers handled the USACE permitting. I attached the plans so you can take a quick look, but am not seeing where there will be any Corp's consultation other than possible work where they connect to the existing concrete lined channel. I just want to make sure we cover all of our bases here, am I missing anything? Thanks in advance for your help

Feel free to contact me if you have any other question

Thank you,

Andrew Butsavich

Project Manager/Environmental Scientist

NewFields

3265 N. Fort Apache Rd. Suite 110

Las Vegas, NV 89129

Office: 702-906-2500

Cell: 702-813-8557

Please note that this message and any attachments may be protected by federal and/or state privacy laws and might also contain information that is privileged, confidential, and/or subject to attorney/client, attorney work product, or other similar protections. If you suspect that you are not the intended recipient of this message, please be so kind as to reply and let me know of my error and then delete the message and any attachments, without further dissemination, copying,

APPENDIX L

(Not Bound)

30% Drainage Plan and Profile Drawings