APPENDIX I

DRAFT HYDRAULICS STUDY

OC Loop Bikeway Segments OPQ

Hydraulics Study
Artesia Blvd. & Valley View Street Undercrossings

Prepared For:

ORANGE COUNTY PublicWorks

Draft Submittal
July 1, 2020
Revision No. 1
August 19, 2020

Table of Contents

Appendix Index

1. Introduction

1.1 Purpose of the Report

The purpose of this Location Hydraulics Study (Study) is to provide the Hydrology and Hydraulic basis for the existing conditions and evaluation of the proposed improvements along Coyote Creek at proposed undercrossings at Valley View Street and Artesia Boulevard. This Study is being prepared in conjunction with Improvement Plans and CEQA/NEPA Documents for OC Loop Bikeway Segments OPQ.

1.2 Goals and Objectives

This Study provides a detailed methodology for establishing the existing high confidence (HC) flow rates along the project limits with a focus on two proposed bridge under crossings that require encroachment into and modification to the existing improved Coyote Creek Channel. This study utilizes a steady state analysis performed in HEC-RAS for both the existing and proposed conditions to document the channel flow characteristics for each condition.

The primary goal and objectives of this study include the following:

- Research, collect, and review previous hydrology and hydraulic studies, as-built / record information, and improvement plans along the study area and project reaches.
- Develop high confidence flow rates for analysis of the existing Coyote Creek Channel
- Model the proposed and existing condition using the HEC-RAS platform developed by the US Army Corp of Engineers (ACOE).
- Prepare a hydraulic analysis one-thousand feet (1,000') upstream and downstream of the Valley View Street and Artesia Boulevard bridge crossings.

2. Project Information

2.1 Project Description

The Orange County Loop (OC Loop) is primarily a Class I bikeway facility accommodating bicyclists and pedestrians and is located in the northwestern portions of Orange County, California. When completed, the 66-mile loop will provide commuting & recreational opportunities for users and will link important regional facilities such as the Santa Ana River Bikeway, the Coastal Bikeway, the San Gabriel River Bikeway and the Coyote Creek Bikeway.

A 2.7 mile gap in the OC Loop, designated as Segments O, P, and Q, currently exists along the Coyote Creek Channel. This gap is located upstream and downstream of the Santa Ana Freeway (I-5), beginning at the North Fork Channel confluence and ending at La Mirada Blvd. bridge crossing. The Orange County Bike Loop O/P/Q Segments Project (Project) proposes to close the existing gap through the construction of a Class I bikeway along the Coyote Creek Channel.

2.2 Project Location and Setting

The Project begins at the existing Coyote Creek Bikeway, in the city of Cerritos in Los Angeles County, where the Coyote Creek North Fork Channel and the Coyote Creek Channel confluence. Construction of the bikeway is proposed continue east along the Coyote Creek Channel for approximately 2.7 miles where a connection to a segment of the Coyote Creek Bikeway at La Mirada Blvd. in the city of Buena Park exists. Project construction will occur in both Los Angeles and Orange Counties along the 2.7 mile stretch of Coyote Creek Channel. The majority of the property required for the project is owned by the Los Angeles County Flood Control District.

2.3 Purpose and Need for Project

The Project is a safety and mobility enhancement for Orange County and is included in the 2008 Coyote Creek Bikeway Master Plan (Rivers and Mountains Conservancy and Trails4All), 2009 OCTA Commuter Bikeway Strategic Plan, 2012 OCTA Fourth District Bikeways Strategy report, 2014 County of Orange General Plan, and the 2015 OC Loop Gap Feasibility Study (OC Parks).

The Project, as part of a comprehensive and complete bicycle network, will greatly benefit Orange County residents and visitors by enhancing safety and mobility for non-motorized users, advance efforts to achieve greenhouse gas reduction goals, improve aesthetics, access and maintenance to the flood control channel, and enhance public health.

2.4 Proposed Improvements

Proposed improvements that occur within the Coyote Creek Channel occur at two places, the under crossing at Valley View Street, and the undercrossing at Artesia Boulevard. The undercrossing at Valley View Street proposes to modify the channel cross section to include a 12' wide concrete bike path "cut into" the northern (left side looking upstream) side of the channel, and the undercrossing at Artesia Boulevard proposes to install a hybrid bike path "cut into" the northern (left side looking upstream) side of the channel adjacent to the abutment with a cantilevered section to provide a complete 12' wide bike path.

The channel cross section under Valley View will increase in cross sectional area in the locations where the bike path is constructed. The bike path will match the existing side slope of the channel on the inside edge of the bike path, and on the outside edge a vertical wall will be constructed from the bike path elevation to the elevation of the existing channel side slope. The maximum slopes down into and up out of the undercrossing are 5%. The vertical clearance from the top of the bike path to the bridge soffit is eleven (11) feet minimum.

The channel cross section under Artesia Boulevard will increase the sectional area in the locations where the bike path in constructed. The northern channel wall is vertical and where the bike path dips below the existing top of wall the channel will be widened and a new vertical wall constructed along the channel/bike path edge interface. As the bike path meanders into the channel cross section to avoid the existing abutments, it will cantilever over the channel for a portion of the bike path width, to provide a 13' bike path. The maximum ingress and egress slopes into and out of the under crossing are 5%. The minimum vertical clearance from the top of the bike path to the bridge soffit is 9'-3" minimum.

3. Regulatory Setting

3.1 California's National Flood Insurance Program

FEMA is the nationwide administrator of the National Flood Insurance Program (NFIP), which is a program that was established by the National Flood Insurance Act of 1968 to protect lives and property, and to reduce the financial burden of providing disaster assistance. Under the NFIP, FEMA has the lead responsibility for flood hazard assessment and mitigation and offers federally backed flood insurance to homeowners, renters, and business owners in communities that choose to participate in the program. FEMA has adopted the 100-year floodplain as the base flood standard for the NFIP and issues the Flood Insurance Rate Maps (FIRMs) for communities that participate in the NFIP. These FIRMs present delineations of flood hazard zones.

In California, nearly all of the State's flood-prone communities participate in the NFIP, which is locally administered by the California Department of Water Resources' (DWR) Division of Flood Management. Under California's NFIP, communities have a mutual agreement with the State and Federal government to regulate floodplain development according to certain criteria and standards, which is further detailed in the NFIP. Typically, each county (or community) has a Flood Insurance Study (FIS), which is used to locally develop FIRMs and Base Flood Elevations (BFE).

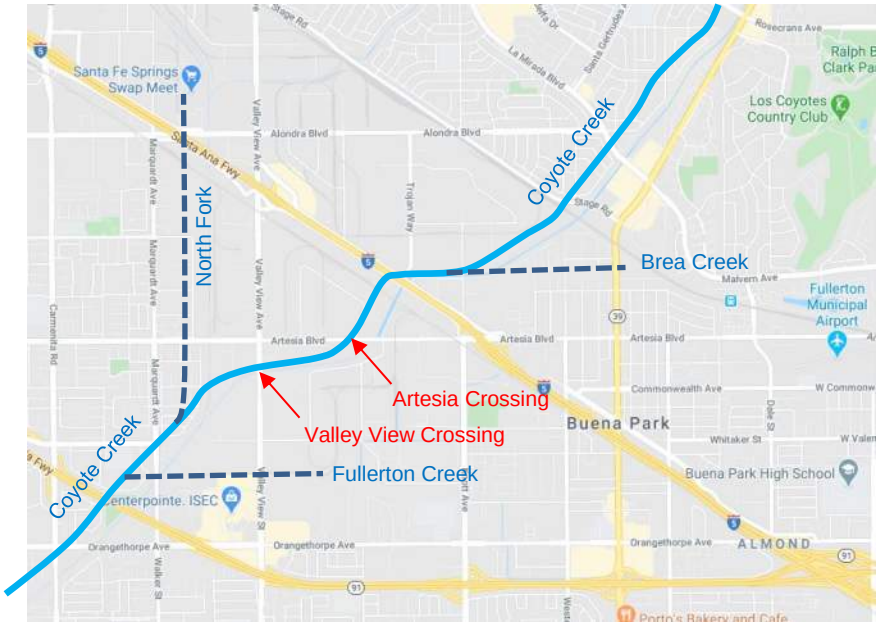
3.2 Coyote Creek between Valley View Street and Artesia Boulevard

According to the most current FIRM maps for the area 1,000' upstream and downstream of each of the two undercrossings, the areas are either unmapped and/or shown to have a 0.2% chance of flooding. Water surface and base flood elevations are not provided. Copies of the FIRM maps have been included in the Appendices.

4. Hydraulic Analysis

4.1 Hydraulic Analysis Summary

Preparation of this hydraulic analysis has been completed in conjunction with the project improvement plans for OC Loop OPQ along Coyote Creek, in north Orange County, including evaluating channel encroachments at two under crossings at Valley View Street and Artesia Boulevard. Below is a summary of the steps to arrive at the 100-Year High Confidence (HC) Flow Rates to be used as the Base Flow Rates in the HecRas model at the undercrossing locations. The high confidence flow rates within Coyote Creek are being used for purposes of establishing existing water surface elevations and to compare against the proposed condition water surface elevations to determine the impact, if any, resulting from the proposed project. In addition, the HC flow rates have been approved for use in this project by Orange County Public Works, and a copy of the correspondence has been included in the Appendices to this Study. The proposed locations for study are shown on the map below.



4.2 Existing Information / Conditions

GHD conducted a search of available information from Orange County Public Works (OCPW), Orange County Flood Control District (OCFCD), Los Angeles County Flood Control District (LAFCD), FEMA, and the Army Corps of Engineering (ACOE) to obtain as-built drawings, hydrology and hydraulics data and reports, and other miscellaneous information. The following list of information summarizes the results of the search and is a list of documents that provide data, flow rates, exhibits, calculations, and/or results, and is included in the Appendices.

- Plans for the Construction of Brea Channel, OCFCD Facility No. A02 – November, 1996
- Army Corps of Engineer's – Plate 4, File No. 198/89 – Coyote Creek Channel Std. Discharges
- Army Corps of Engineer's – Plate 10, File No. 373/120 – Coyote Creek Channel Std. Discharges

The following table summarizes the findings within the above information and other sources related to flow rates along project length within Coyote Creek. See Appendix B illustrating the locations denoted for each of the below flow rates.

Table 4.1 Existing Flow Rate Information

Concentration Point	LACFCD 1935 Plans – Theoretical Q (cfs)	USACE "Design Discharge" Q (cfs)	USACE 100-Year Q (CFS)	1949 Survey Report Q (cfs)	OCHM 100-Year Design Q - HC (cfs)	OCHM 100-Year EV Q (cfs)
CC Above Brea Creek	15,600	15,000		7,500		
Brea Creek D/S of Western		12,000		6,000	8,023	6,710
CC Below Brea Creek	19,500	21,500		13,000		
CC Below North Fork	23,300	37,000		23,000		
CC Below Fullerton Creek		40,000				
Fullerton Creek		13,500				7,700
CC Above San Gabriel River		50,000	38,000	30,000		

CC = Coyote Creek D/S = Downstream HC = High Confidence EV = Expected Value

4.3 Proposed Methodology

Table 4.1 illustrates the gaps in flow rates across multiple criteria. The Orange County Hydrology Manual permits the use of Expected Value numbers in the analysis of existing facilities, and for purposes of this project, the higher OCHM 100-Year Design Flows (High Confidence Flows) will be used to analyze the existing and proposed conditions 1,000 feet upstream and downstream of the Coyote Creek crossings at Artesia Boulevard and Valley View Street.

In order to determine the high confidence flows for the areas of Coyote Creek from below North Fork to above Brea Creek, the following ratio was used to establish a conversion factor to calculate the high confidence flow rate for this analysis. The conversion factor is based upon known flow rates for Break Creek downstream of Western, and is as follows:

(OCHM 100-Year High Confidence **/** USACE Design Discharge) = Conversion Factor

8,023 cfs / 12,000 cfs = 0.669

USACE Design Discharge x **0.669** = OCHM 100-High Confidence

To calculate the water surface elevation within Coyote Creek GHD prepared a HecRas model utilizing the Coyote Creek As-Built plans, and verified/updated the model with field survey cross sectional field data and detailed bridge survey data. Calculated high confidence flow rates were then modelled in HecRas for cross sectional analysis to determine the water surface elevation within the existing channel. The downstream water surface elevation was determined by calculating the cross sectional normal depth and used as the downstream control water surface elevation in the HecRas model. Bridge decks, piers, sidewalls, and soffits were modeled using elevation obtained through field topographic survey.

4.4 Proposed High Confidence Flow Rates

Table 4.2 summarizes the results of applying the 0.669 conversion factor to the USACE Design Discharge rates. The rates listed under the OCHM 100-Year Design Q – HC (cfs) column are the rates used in the HecRas model.

Table 4.2 Proposed / High Confidence Flow Rate Information

Concentration Point	LACFCD 1935 Plans – Theoretical Q (cfs)	USACE "Design Discharge" Q (cfs)	USACE 100-Year Q (CFS)	1949 Survey Report Q (cfs)	OCHM 100-Year Design Q - HC (cfs)	OCHM 100-Year EV Q (cfs)
CC Above Brea Creek	15,600	15,000		7,500	10,035	
Brea Creek D/S of Western		12,000		6,000	8,023	6,710
CC Below Brea Creek	19,500	21,500		13,000	14,384	
CC Below North Fork	23,300	37,000		23,000	24,753	
CC Below Fullerton Creek		40,000				
Fullerton Creek		13,500				7,700
CC Above San Gabriel River		50,000	38,000	30,000		

CC = Coyote Creek D/S = Downstream HC = High Confidence EV = Expected Value

5. Results

5.1 Results

Utilizing the high confidence flow rates listed in Table 4.2 resulted in HecRas output illustrating that the flow rates are contained within Coyote Creek for the existing condition. Containment within Coyote Creek is consistent with the FIRM maps, and the area being unmapped. A second HecRas analysis was completed evaluating the proposed improvements. Due to the limitations of the HecRas software platform, the Manning's C value for the cantilever surfaces and vertical wall adjacent to the bike path in cantilever areas was increased to 0.05 (from 0.014) to account for loses that may be incurred due to the cantilever sections. Cross sectional analysis 1,000 feet upstream and downstream of the Valley View Street and Artesia Boulevard is summarized below. HecRas output has been included in the Appendices. Below is a station map/exhibit illustrating where cross sectional analysis was completed, and a subsequent table illustrating the existing versus proposed water surface elevations.

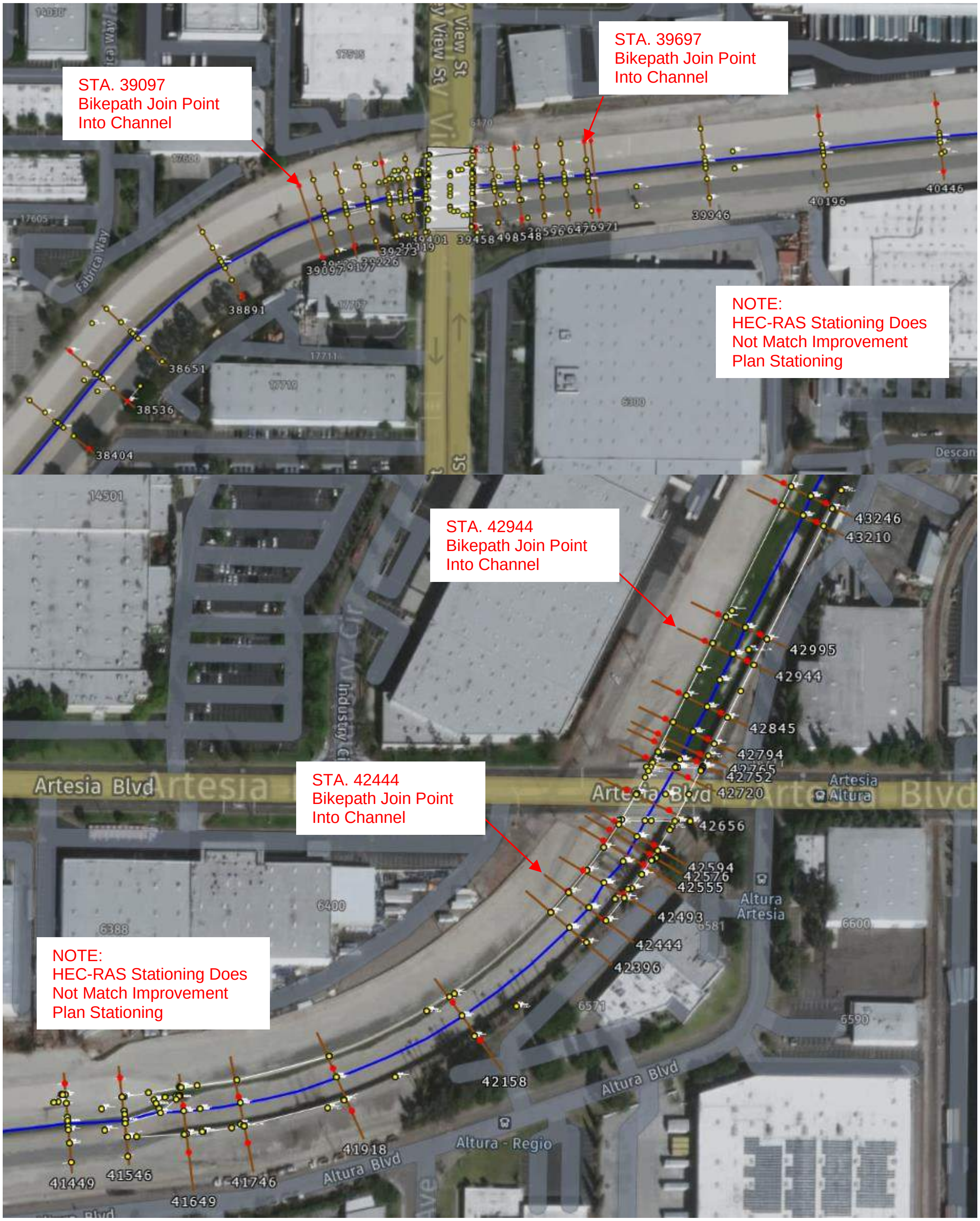

STA. 39097
Bikepath Join Point
Into Channel
STA. 39697
Bikepath Join Point
Into Channel
NOTE:
HEC-RAS Stationing Does
Not Match Improvement
Plan Stationing
38404
38536
38651
38891
39946
40196
40446
STA. 42944
Bikepath Join Point
Into Channel
STA. 42444
Bikepath Join Point
Into Channel
NOTE:
HEC-RAS Stationing Does
Not Match Improvement
Plan Stationing
43246
43210
42995
42944
42845
42794
42752
42720
42656
42555
42493
42444
42396
42158
41918
41746
41649
41546
41449
Artesia Blvd
Altura Blvd
Industry Cir
Fabrica Way

Table 5.1 Cross Sectional Analysis Results

River Sta.	Flow Rate – Q (cfs)	Existing W.S. Elev	Proposed W.S. Elev.	Delta	Location
43722	14,384	54.67	54.67	0.00	Channel
43672	14,384	53.88	53.88	0.00	Channel
43531	14,384	53.49	53.49	0.00	Channel
43495	14,384	53.34	53.34	0.00	Channel
43246	14,384	52.99	52.97	-0.02	Channel
43210	14,384	52.98	52.95	-0.03	Channel
42995	14,384	53.01	52.99	-0.02	Channel
42944	14,384	53.00	52.98	-0.02	Channel
42845	14,384	52.51	52.44	-0.07	Upstream
42794	14,384	52.46	52.38	-0.08	Upstream
42765	14,384	52.42	51.80	-0.62	Upstream
42752	14,384	51.71	51.78	0.07	Upstream
42720	14,384	51.57	51.76	0.19	Artesia Bridge
42656	14,384	51.61	51.79	0.18	Artesia Bridge
42594	14,384	51.66	51.83	0.17	Artesia Bridge
42576	14,384	51.35	51.72	0.37	Downstream
42555	14,384	51.32	51.48	0.16	Downstream
42493	14,384	51.65	51.76	0.11	Downstream
42444	14,384	50.69	50.69	0.00	Channel
42396	14,384	50.60	50.60	0.00	Channel
42158	14,384	50.00	50.00	0.00	Channel
41918	14,384	49.53	49.53	0.00	Channel
41746	14,384	49.21	49.21	0.00	Channel
41649	14,384	48.92	48.92	0.00	Channel
41546	14,384	48.37	48.37	0.00	Channel
41449	14,384	48.06	48.06	0.00	Channel
41199	14,384	47.41	47.41	0.00	Channel
40950	14,384	46.79	46.79	0.00	Channel
40699	14,384	46.60	46.63	0.03	Channel
40446	14,384	46.62	46.66	0.04	Channel
40196	14,384	46.76	46.80	0.04	Channel
39946	14,384	46.47	46.52	0.05	Channel
39711	14,384	46.34	46.39	0.05	Channel
39697	14,384	46.32	46.30	-0.02	Channel
39647	14,384	46.31	46.31	0.00	Upstream
39596	14,384	46.27	46.27	0.00	Upstream
39548	14,384	46.29	46.29	0.00	Upstream
39498	14,384	46.46	46.48	0.02	Upstream
39458	14,384	46.69	46.73	0.04	Valley View
39319	14,384	46.46	46.52	0.06	Valley View
39273	14,384	46.42	46.42	0.00	Downstream
39226	14,384	46.42	46.42	0.00	Downstream
39177	14,384	46.38	46.38	0.00	Downstream
39132	14,384	46.33	46.33	0.00	Downstream
39097	14,384	46.31	46.31	0.00	Channel
38891	14,384	46.22	46.22	0.00	Channel
38651	14,384	46.13	46.13	0.00	Channel
38536	14,384	46.03	46.03	0.00	Channel
38404	14,384	45.97	45.97	0.00	Channel

6. Conclusions

Based upon the High Confidence flow rate analysis within Coyote Creek Channel, the proposed improvements have minimal impact to the water surface elevation within the channel at the proposed under crossings. Implementation of the proposed improvements do not cause the water surface to impact existing infrastructure or tributary improvements.

Appendix A
FEMA – FIRM Maps

National Flood Hazard Layer FIRMette

FEMA

118°2'18"W 33°52'19"N

118°1'41"W 33°51'49"N

Feet

0 250 500 1,000 1,500 2,000

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

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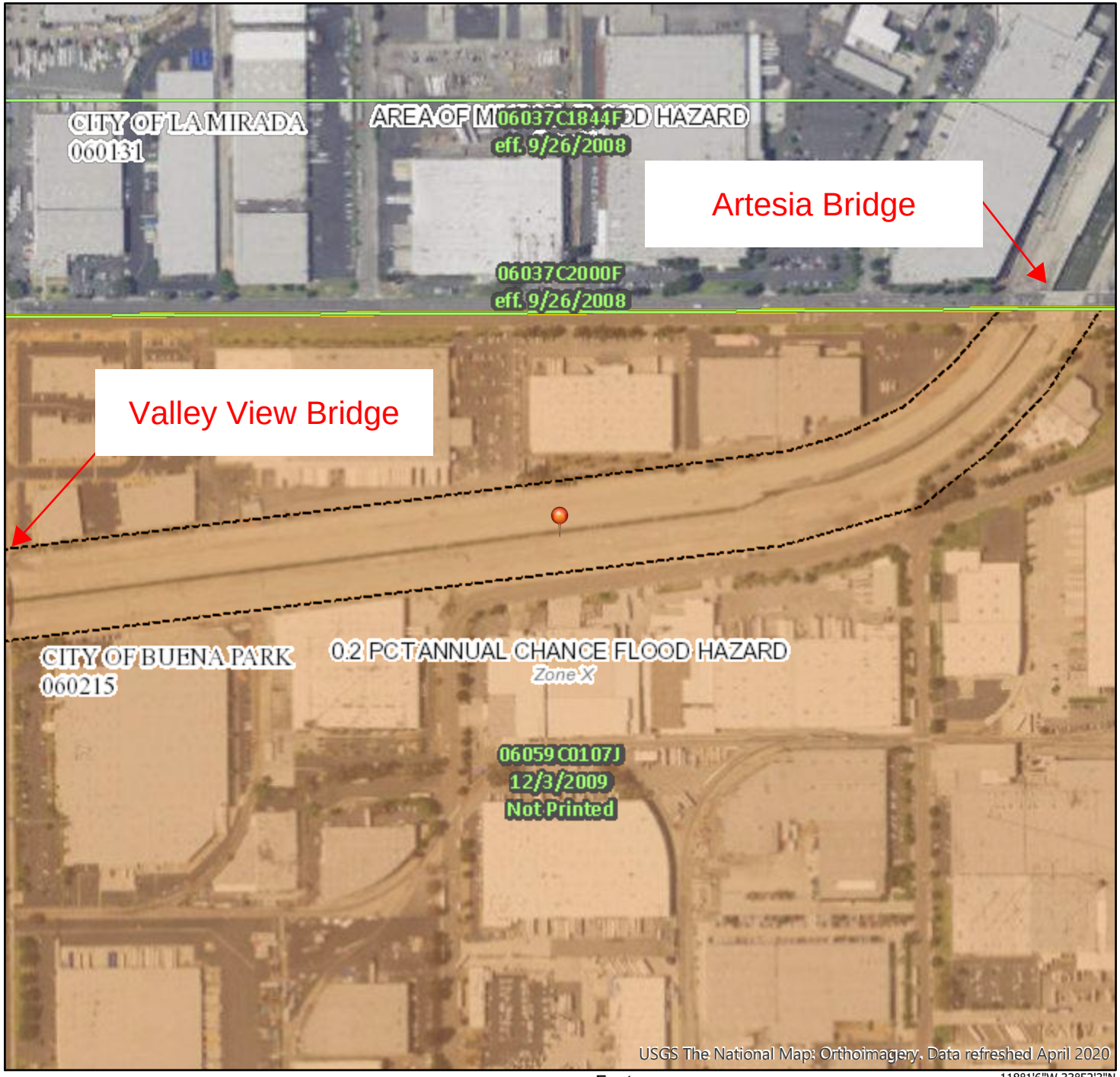
This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

National Flood Hazard Layer FIRMette

FEMA

118°1'43"W 33°52'33"N



118°1'6"W 33°52'3"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
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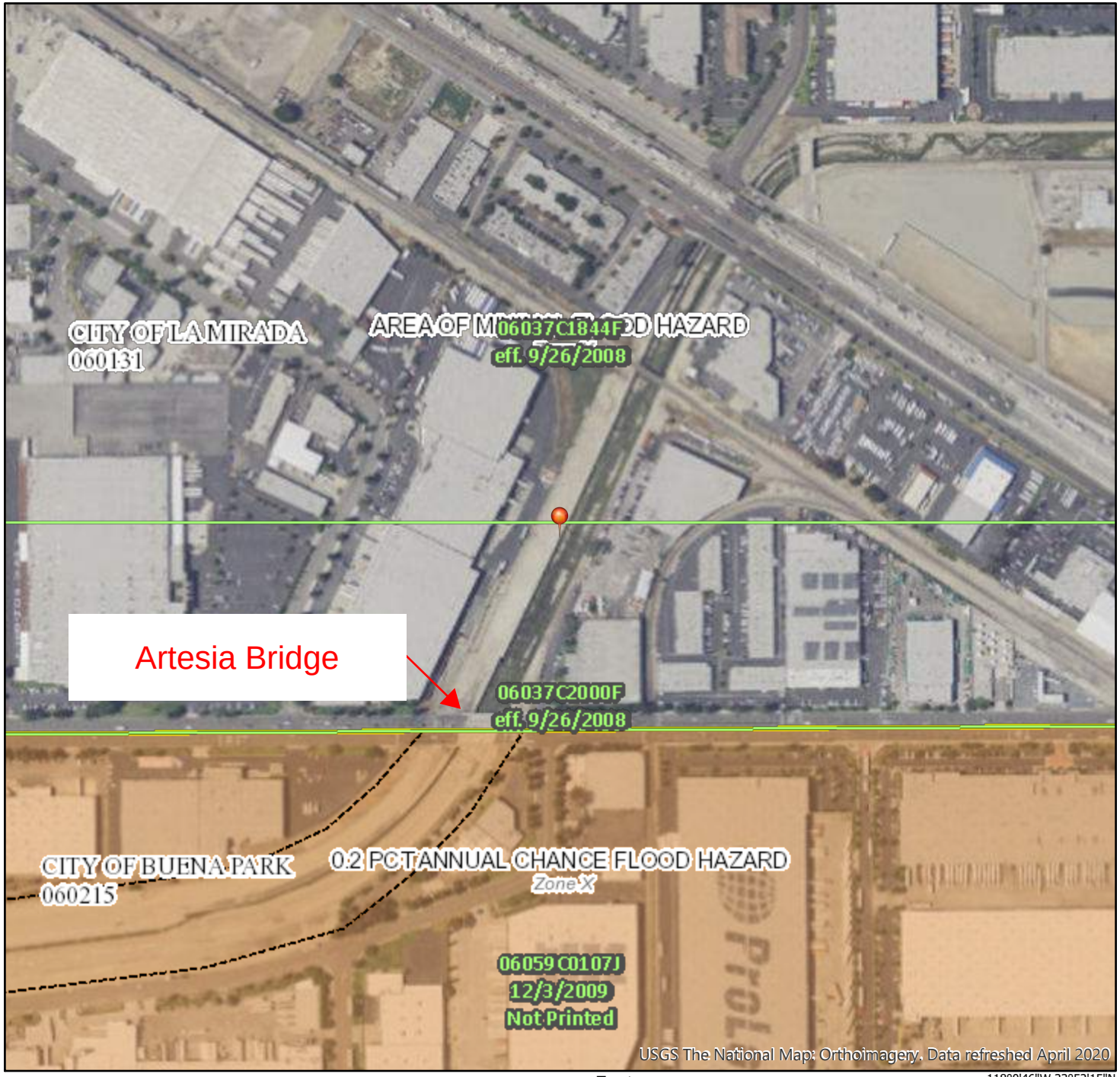
National Flood Hazard Layer FIRMette

FEMA

118°1'24"W 33°52'45"N



118°0'46"W 33°52'15"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
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- Regulatory Floodway

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MAP PANELS
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- Unmapped

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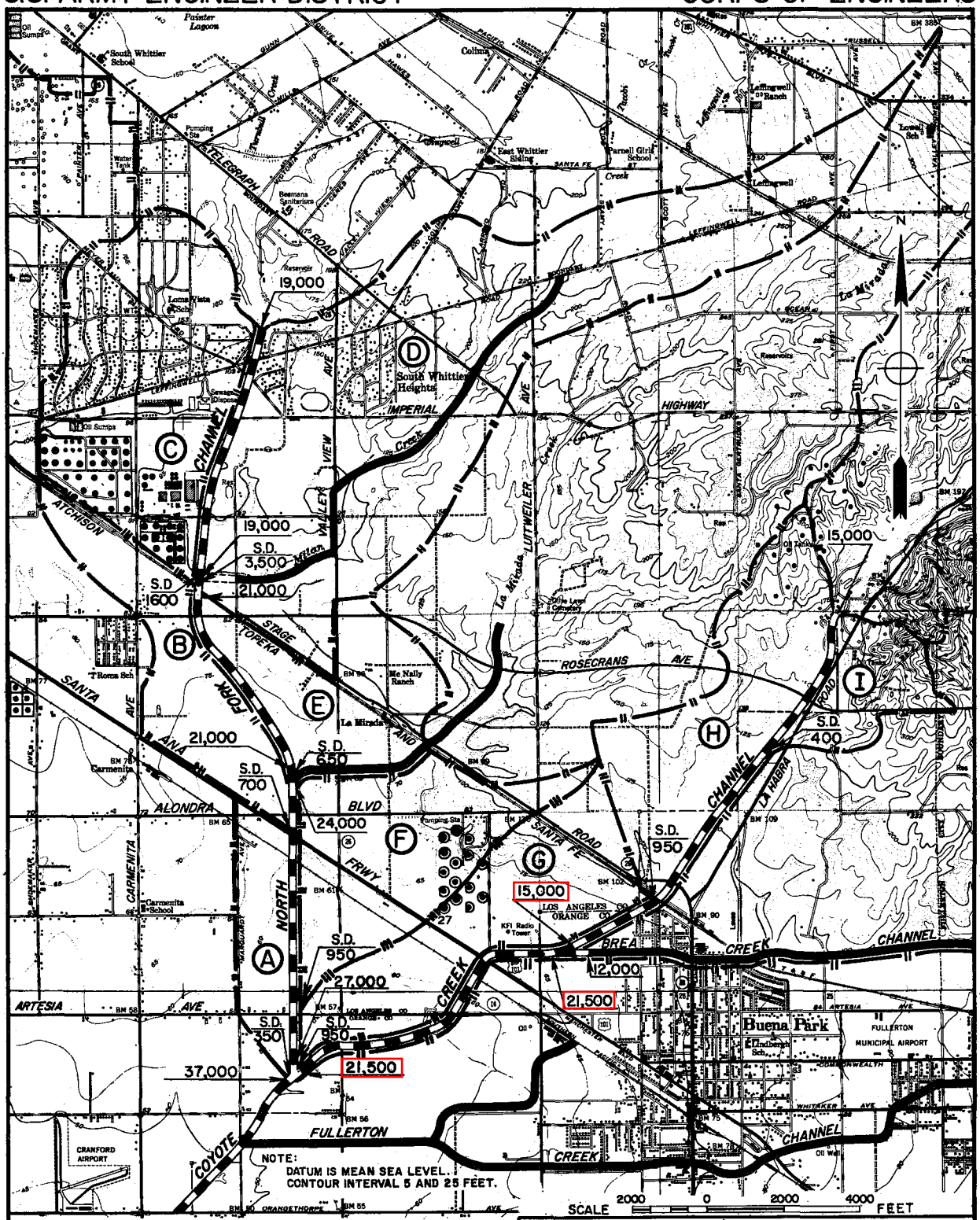
Appendix B

Record Information

(Reference)

U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS



LEGEND

- BOUNDARY OF PROJECT-UNIT DRAINAGE SUBAREA.
- BOUNDARY OF PROJECT-UNIT SIDE-DRAINAGE SUBAREA.
- PROJECT CHANNEL.
- EXISTING CHANNEL.
- PROPOSED CHANNEL BY LOCAL INTERESTS.
- (A) SIDE-DRAINAGE SUBAREA DESIGNATION.
- S.D. / 700 — SIDE DRAINAGE DISCHARGE IN CUBIC FEET PER SECOND.
- 37,000 — CHANNEL-DESIGN DISCHARGE IN CUBIC FEET PER SECOND.

LOS ANGELES COUNTY DRAINAGE AREA, CALIF.

COYOTE CREEK CHANNELS

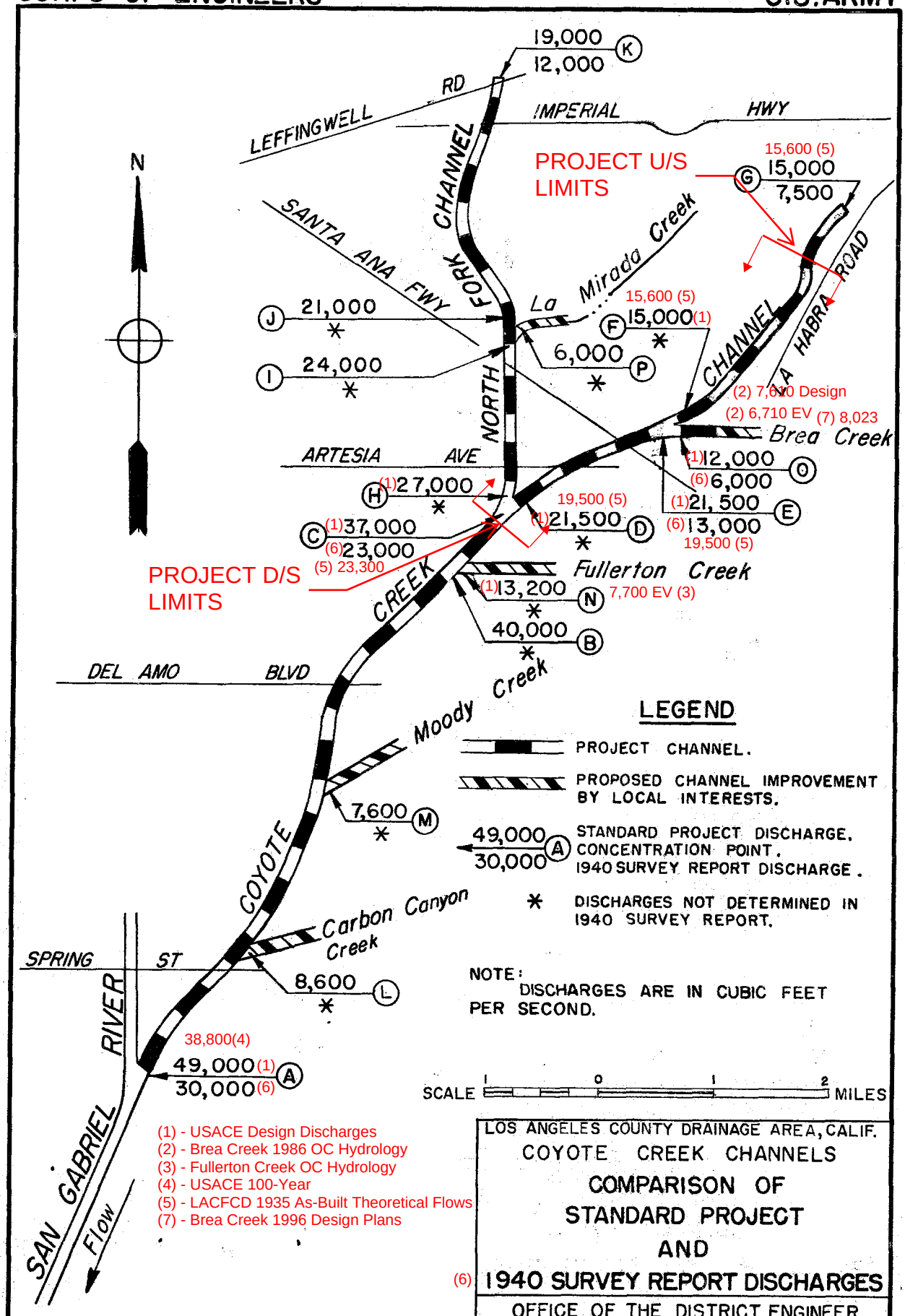
COYOTE CREEK CHANNEL UPSTREAM FROM NORTH FORK AND NORTH FORK CHANNEL

CHANNEL-DESIGN AND SIDE-DRAINAGE DISCHARGES

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES, CORPS OF ENGINEERS
DESIGN MEMO. NO. 3

FILE NO. 198/89 PLATE 4

CORPS OF ENGINEERS U.S.ARMY



(1) - USACE Design Discharges
(2) - Brea Creek 1986 OC Hydrology
(3) - Fullerton Creek OC Hydrology
(4) - USACE 100-Year
(5) - LACFCD 1935 As-Built Theoretical Flows
(7) - Brea Creek 1996 Design Plans

LOS ANGELES COUNTY DRAINAGE AREA, CALIF.

COYOTE CREEK CHANNELS

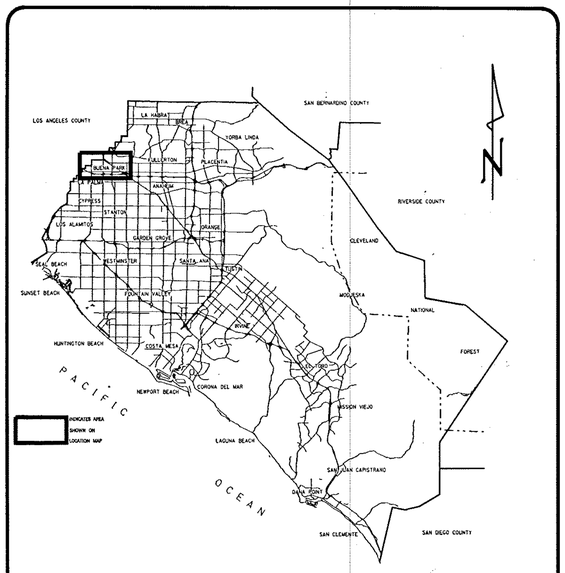
COMPARISON OF STANDARD PROJECT AND

(6) 1940 SURVEY REPORT DISCHARGES

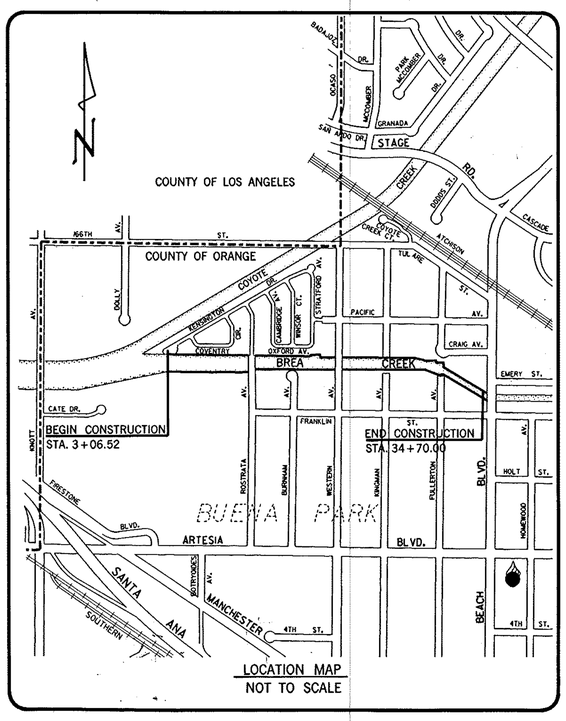
OFFICE OF THE DISTRICT ENGINEER
LOS ANGELES, CALIFORNIA
DESIGN MEMO NO. 1 DATED: FEB., 1959

FILE NO. 373/120 PLATE 10

A02-101-5R 1 of 26



VICINITY MAP



LOCATION MAP
NOT TO SCALE

ORANGE COUNTY
ENVIRONMENTAL MANAGEMENT AGENCY

SANTA ANA, CALIFORNIA

JOHN W. SIBLEY, ACTING DIRECTOR

PLANS FOR CONSTRUCTION OF

BREA CREEK CHANNEL

O.C.F.C.D. FACILITY NO. A02

FROM

RECORD DRAWING

250 FT. U/S OF COYOTE CREEK CHANNEL

TO

150 FT. D/S OF BEACH BLVD.

NOVEMBER 1996

FUNDED BY: ORANGE COUNTY FLOOD CONTROL DISTRICT

MAINTAINED BY: ORANGE COUNTY FLOOD CONTROL DISTRICT

INDEX OF SHEETS

UTILITY OWNER	PHONE NO.	CONTACT
1. SOUTHERN CALIFORNIA GAS CO.	(714) 634-3040	RONALD E. REED
2. SOUTHERN CALIFORNIA EDISON CO.	(714) 934-0846	A. J. APARICIO
3. COMCAST CABLE	(714) 582-7655	MIKE BOUNDS
4. CITY OF BUENA PARK (WATER & SEWER)	(714) 562-3685	NABIL HENEIN
5. COUNTY SANITATION DIST. OF O.C.	(714) 962-2411 X5052	CHUCK WINSOR
6. UNDER GROUND SERVICE ALERT (U.S.A.)	(800) 422-4133	

BENCH MARK: 404 – 23 – 86

206 FT. SOUTHEASTERLY ALONG THE ATCHISON TOPEKA AND SANTA FE RAILWAY FROM ITS INTERSECTION WITH THE CENTERLINE PROLONGATION TO THE NORTH OF STANTON STREET.

ADJ. 1976 ELEV. 86.493'

BASIS OF BEARINGS:

THE BASIS OF BEARINGS SHOWN HEREON ARE BASED ON THE BEARING BETWEEN O.C.S. HORIZONTAL CONTROL STATIONS G.P.S. NO. 3580 AND G.P.S. NO. 3579, BEING N 00°29'15" E PER RECORDS ON FILE IN THE OFFICE OF THE ORANGE COUNTY SURVEYOR. SAID BEARING IS ALSO THE BEARING OF THE CENTERLINE OF WESTERN AVE.

CITY OF BUENA PARK

APPROVED: Donald L. Jensen CITY ENGINEER 10/8/96 DATE

EMA – PUBLIC WORKS

SUBMITTED: Hany S. Henein for FLOOD CONTROL DIVISION MANAGER 10/8/96 DATE

REGISTERED PROFESSIONAL ENGINEER – Hany S. Henein – 33090 – Exp. 6-30-98 – CIVIL – STATE OF CALIFORNIA

RECOMMENDED: James A. Miller ACTING DESIGN DIVISION MANAGER 10-3-96 DATE

REGISTERED PROFESSIONAL ENGINEER – JAMES A MILLER – No. 27177 – Exp. 2-21-97 – CIVIL – STATE OF CALIFORNIA

APPROVED: W L Jam DIRECTOR OF PUBLIC WORKS 10-15-96 DATE

RECORD DRAWINGS

CONTRACTOR : BEL CZAK
INSPECTOR : GEORGE ZAUN
RESIDENT ENGINEER : HERNAN PELAEZ
START DATE : NO DATE
COMPLETION DATE : 09-05-1997

AGREEMENTS

CITY OF BUENA PARK AGREEMENT NO. D96-124

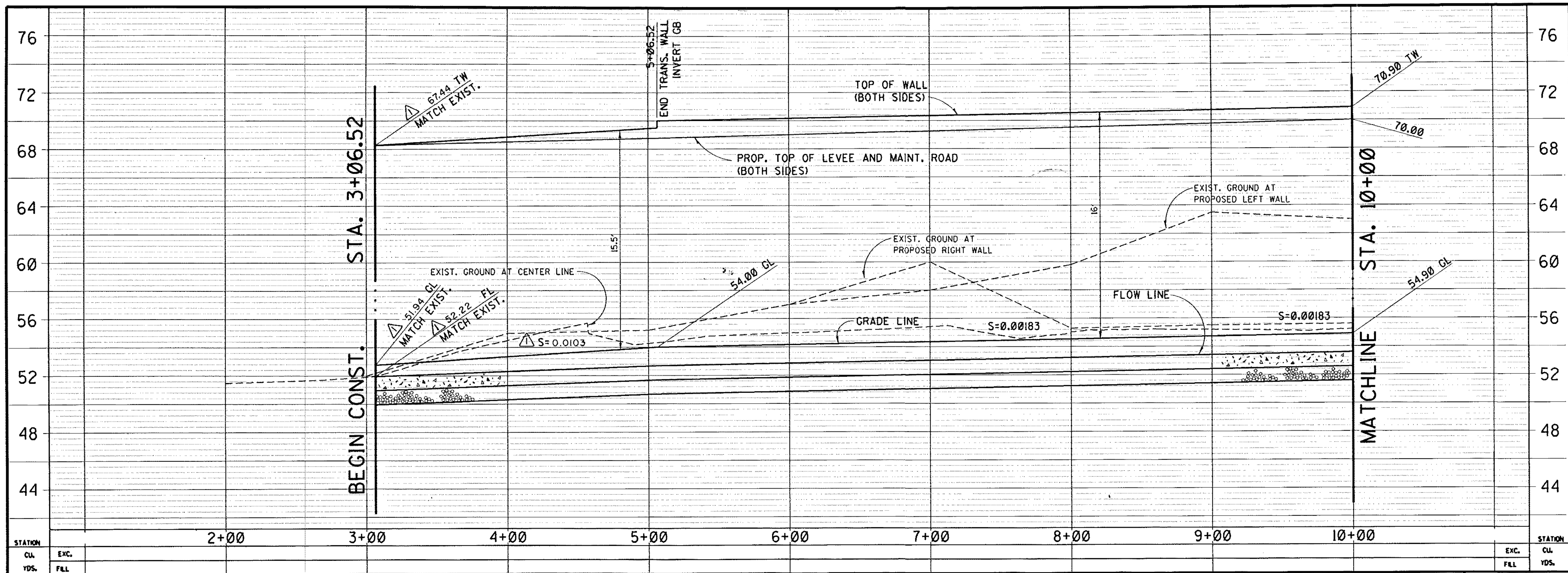
COUNTY SANITATION DIST. OF O.C. AGREEMENT NO. D96-125

NO.	DESCRIPTION	SHT.	APPROVED	DATE

REVISIONS

W. O. NO. EF07169
DWG. NO. A02-101-5R

SHEET 1 OF 26



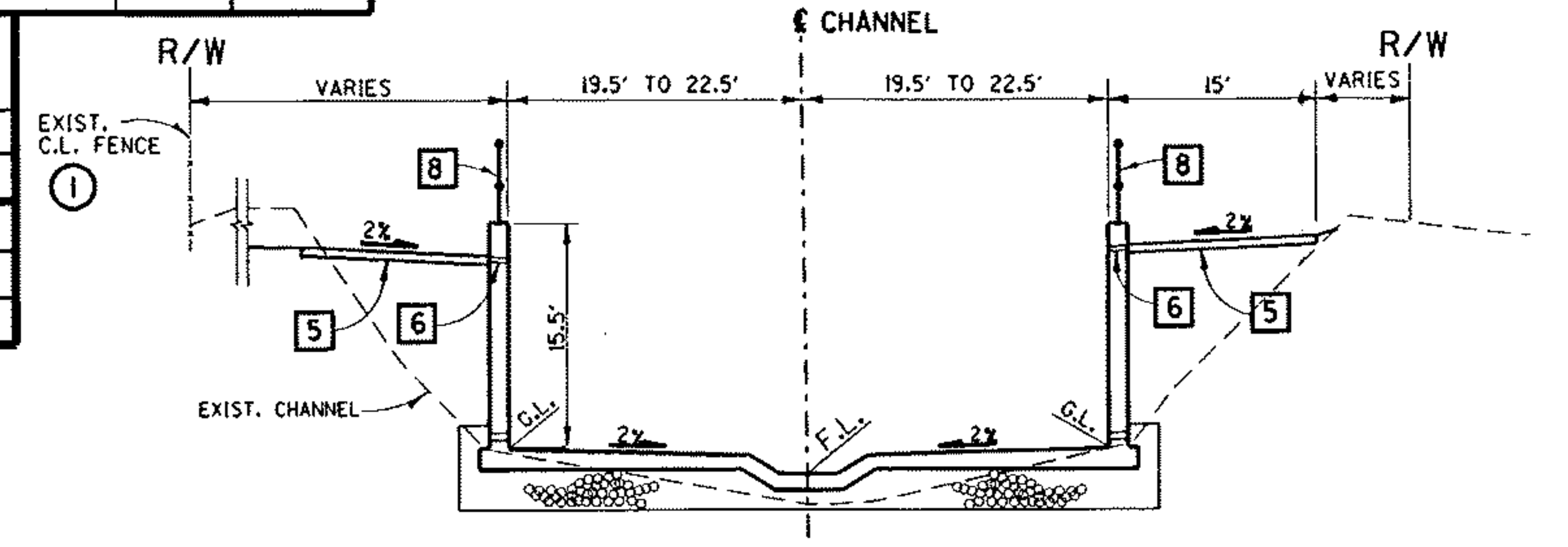
PROFILE
HORIZ. 1"= 40'
VERT. 1"= 4'

CONSTRUCTION NOTES

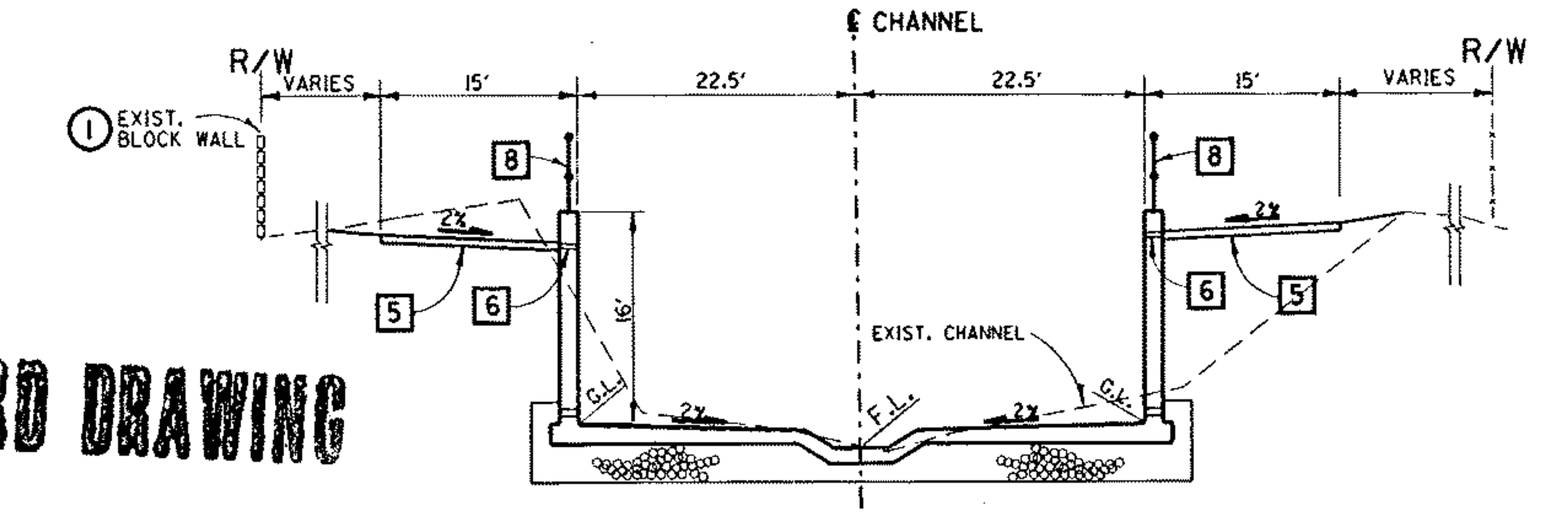
1. CONSTRUCT R.C. RECT. CHANNEL PER PLAN, PROFILE, TYPICAL SECTION ON SHEETS 2, 3, 4, 5, 6 AND STRUCTURAL DETAILS ON SHEET 7.
2. CONSTRUCT R.C. TRANSITION WALL PER PLAN, PROFILE AND DETAILS ON SHEET 8.
3. CONSTRUCT R.C. ACCESS RAMP PER PLAN, TYPICAL SECTION AND DETAILS ON SHEETS 9, 10 & 11.
4. CONSTRUCT JUNCTION STRUCTURE TYPE V MODIFIED WITH FLAP GATE PER PLAN, PROFILE, DETAIL SHEET 13 AND OCEMA STD. PLAN 1314.
5. CONSTRUCT 6" UNTREATED BASE MAINTENANCE ROAD.
6. CONSTRUCT 4" DIA. SCUPPER DRAIN 50' O.C. (AS NEEDED) ON CHANNEL WALL PER TYPICAL SECTION AND DETAIL SHEET 13.
7. CONSTRUCT 6' C.L. FENCE AND/OR GATE PER PLAN ON SHEETS 2, 3, 4, 5 & 6 AND OCEMA STD. PLAN 600-0-OC AND DETAIL SHEET 8.
8. CONSTRUCT 3.5' GUARD CABLE FENCE PER OCEMA STD. PLAN 1413.
9. CONSTRUCT R.C. CUTOFF WALL PER PLAN, PROFILE ON SHEET 6 AND DETAILS ON SHEET 8.
10. REMOVE EXISTING TRANSITION WALLS AND INVERT PER PLAN.
11. REMOVE EXISTING CHANNEL LINING.
12. REMOVE AND SALVAGE EXISTING RIPRAP.
13. GRADE TO DRAIN.
14. FURNISH AND PLACE PROJECT INFORMATION SIGN PER OCEMA STD. PLAN 1418.
15. CONSTRUCT DRIVEWAY APPROACH PER PLAN AND DETAIL SHEET 8 WITH W=14', X=2.5' AND OCEMA STD. PLAN 1209.
16. CONSTRUCT TRANSVERSE EXPANSION JOINT PER OCEMA STD. PLAN 1318.
17. CONSTRUCT 6" P.C.C. LANDING PER DETAIL SHEET 8.
18. CONSTRUCT 3" AIR PLACED CONCRETE SLOPE PROTECTION WITH 6"X6" W1.4 W.W.M.

HYDRAULIC DATA

Station to Station	Q	Section		S	n= 0.015		F	n= 0.015	
		b	z		Dn	Vn		Dc	Vc
0+00 - 3+06.52	8069	39	0	.0045	9.18	22.53	1.31	11.0	18.18
3+06.52 - 5+06.52	8023	39-45	0	.0103	T R	A N	S I T	I O	N
5+06.52 - 10+00	8023	45	0	.00183	11.06	16.12	0.85	9.96	17.9



TYPICAL CHANNEL SECTION
FROM STA. 3+06.52 TO STA. 5+06.52
N.T.S.



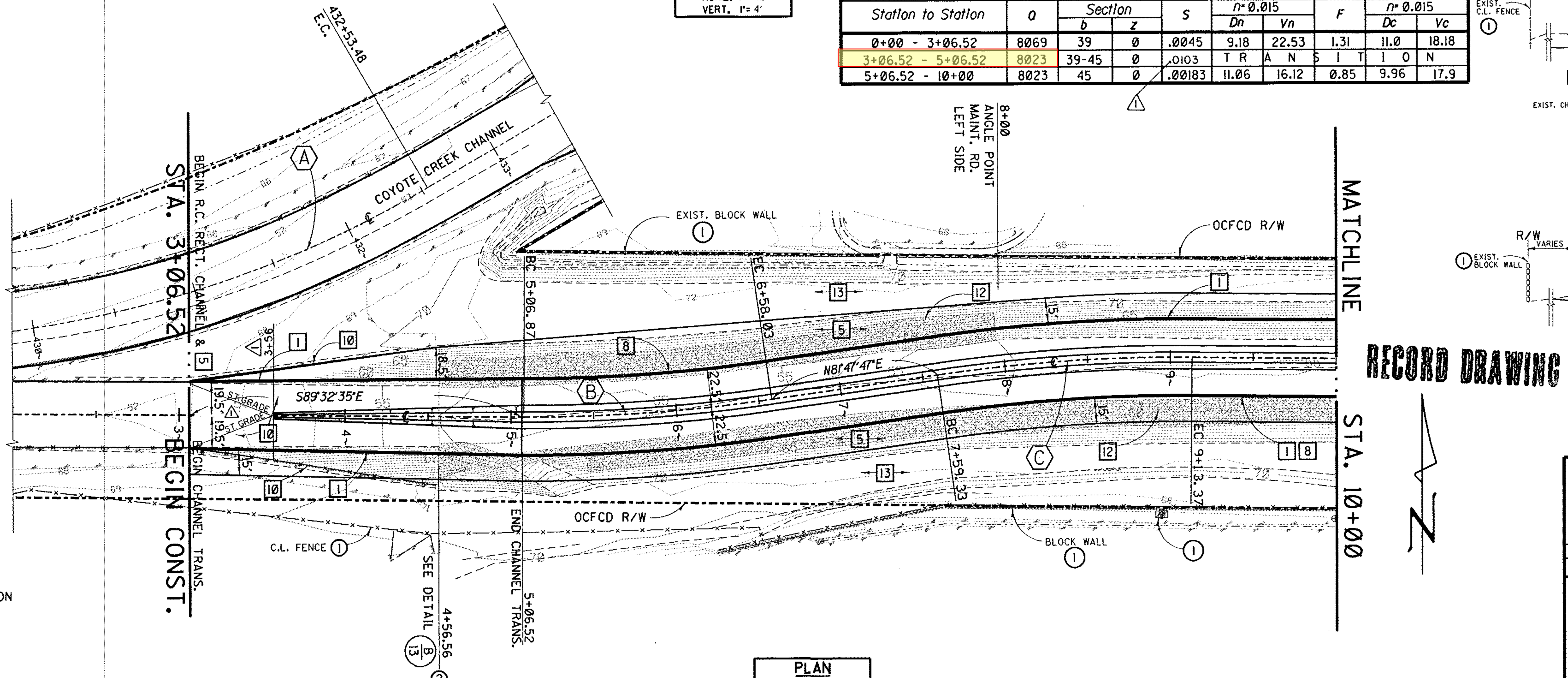
TYPICAL CHANNEL SECTION
FROM STA. 5+06.52 TO STA. 10+00
N.T.S.

CURVE DATA

(A) Δ=13°31'21" R=1500.00' L=354.02'

(B) Δ=08°39'38" R=1000.00' L=151.16'

(C) Δ=08°49'32" R=1000.00' L=154.04'



PLAN
1"= 40'

LEGEND

1. PROTECT IN PLACE
2. REMOVE
3. REMOVE INTERFERING PORTION
4. RELOCATE BY OTHERS
5. RELOCATE
6. REMOVE AND SALVAGE

MARK	DATE	DESCRIPTION
1	6-98	RECORD DRAWINGS

REVISIONS

PREPARED UNDER THE SUPERVISION OF

REGISTERED PROFESSIONAL ENGINEER Hany S. Henein 33090 Exp. 6-30-98 STATE OF CALIFORNIA

10-3-96
DATE

ORANGE COUNTY
ENVIRONMENTAL MANAGEMENT AGENCY

BREA CREEK CHANNEL (A02)

PLAN AND PROFILE

STA. 3+06.52 TO STA. 10+00.00

DESIGNED MOUHSEN HABIB
DRAWN THUY GUTIERREZ CHECKED H. HENEIN

SCALE	DATE	DRAWING NO.	SHEET
AS SHOWN	NOV. 96	A02-101-5R	2 OF 26

Appendix C

Orange County Public Works
Methodology Approval

Brandon Willnecker

From: Lew, Penny <Penny.Lew@ocpw.ocgov.com>
Sent: Thursday, April 16, 2020 1:47 PM
To: Brandon Willnecker; Fowler, Brad; Bruce Schmith
Cc: Llanes, Editha; Nguyen, Tim
Subject: RE: OC Loop OPQ - Hydraulics call

Hi Brandon,

GHD performed the procedure per our April 13, 2020 meeting using 100-yr HC flowrates based on the ratio of Brea Creek Channel's (A02) 1996 as-built design discharge (8,023 cfs) to the USACE's Standard Project Flood (SPF) design discharge (12,000) for A02. Thanks for providing the discharges.

The discharges were used for the existing conditions hydraulic model and it appears the results show that A01 has capacity for the estimated 100-yr HC flowrates. For the Artesia location hydraulics, it looks like we might be close on the required freeboard. I can't reference the section(s) because I didn't see any stations for the various sections provided. You're probably aware but I just wanted to point that out.

You can proceed with the analyses for the different alternatives and hopefully, there's an alternative that will maintain the existing water surface elevation in the channel and there will be no reduction in capacity whatsoever.

Penny
(714) 647-3990

From: Brandon Willnecker <Brandon.Willnecker@ghd.com>
Sent: Tuesday, April 14, 2020 5:08 PM
To: Fowler, Brad <Brad.Fowler2@ocpw.ocgov.com>; Bruce Schmith <Bruce.Schmith@ghd.com>; Lew, Penny <Penny.Lew@ocpw.ocgov.com>
Cc: Llanes, Editha <Editha.Llanes@ocpw.ocgov.com>; Nguyen, Tim <Tim.Nguyen@ocpw.ocgov.com>
Subject: RE: OC Loop OPQ - Hydraulics call

Team,

Thank you for your patience.

Attached is the following information.

1. Updated Coyote Creek High Confidence Calculations per out call yesterday.
2. Brea Creek Plan from 1996
3. Corps of Engineers Plate 10 Flows
4. Normal Depth calculation downstream of north fork to determine water surface elevation
5. Valley View Cross Sections 1000' upstream and down with High Confidence Flows (Existing Condition)
6. Artesia Cross Sections 1000' up and down High Confidence Flows (Existing Condition)

The results show that the channel has capacity for the High Confidence flow. Our recommendation is to move forward based upon these results with our alternative undercrossing analysis. Please advise.

Thank you,

Brandon Willnecker, PE, QSD, QISP
Regional Stormwater Leader

GHD
Proudly employee owned
T: 1 949 585 5228 | M: 949 433 8334 | E: brandon.willnecker@ghd.com
320 Goddard Way Suite 200 Irvine CA 92618 USA | www.ghd.com

Connect

From: Fowler, Brad <Brad.Fowler2@ocpw.ocgov.com>
Sent: Tuesday, April 14, 2020 12:55 PM
To: Bruce Schmith <Bruce.Schmith@ghd.com>; Lew, Penny <Penny.Lew@ocpw.ocgov.com>; Brandon Willnecker <Brandon.Willnecker@ghd.com>
Cc: Llanes, Editha <Editha.Llanes@ocpw.ocgov.com>; Nguyen, Tim <Tim.Nguyen@ocpw.ocgov.com>
Subject: RE: OC Loop OPQ - Hydraulics call

Bruce,

I see a meeting request, but haven't seen the revised information from Brandon this morning.

Regards,

Brad Fowler
OC Public Works Project Management
(O) 714-245-4503 (C) 949-337-0512

From: Fowler, Brad
Sent: Thursday, April 9, 2020 1:59 PM
To: 'Bruce Schmith' <Bruce.Schmith@ghd.com>; Lew, Penny <Penny.Lew@ocpw.ocgov.com>; Brandon Willnecker <Brandon.Willnecker@ghd.com>
Cc: Llanes, Editha <Editha.Llanes@ocpw.ocgov.com>
Subject: RE: OC Loop OPQ - Hydraulics call

Bruce,
Please add Editha to invite. She is available.

Regards,

Brad Fowler
OC Public Works Project Management
(O) 714-245-4503 (C) 949-337-0512

-----Original Appointment-----
From: Bruce Schmith <Bruce.Schmith@ghd.com>
Sent: Thursday, April 9, 2020 1:52 PM
To: Bruce Schmith; Lew, Penny; Brandon Willnecker; Fowler, Brad
Subject: OC Loop OPQ - Hydraulics call
When: Monday, April 13, 2020 4:00 PM-5:00 PM (UTC-08:00) Pacific Time (US & Canada).
Where: call in

Join Webex meeting
Meeting number (access code): 573 482 261

Join by phone
Tap to call in from a mobile device (attendees only)
+1-8324089370 US Toll
8772532715 US Toll Free

If you are a host, go here to view host information. IMPORTANT NOTICE: Please note that this Webex service allows audio and other information sent during the session to be recorded, which may be discoverable in a legal matter. By joining this session, you automatically consent to such recordings. If you do not consent to being recorded, discuss your concerns with the host or do not join the session.

Technical Memorandum

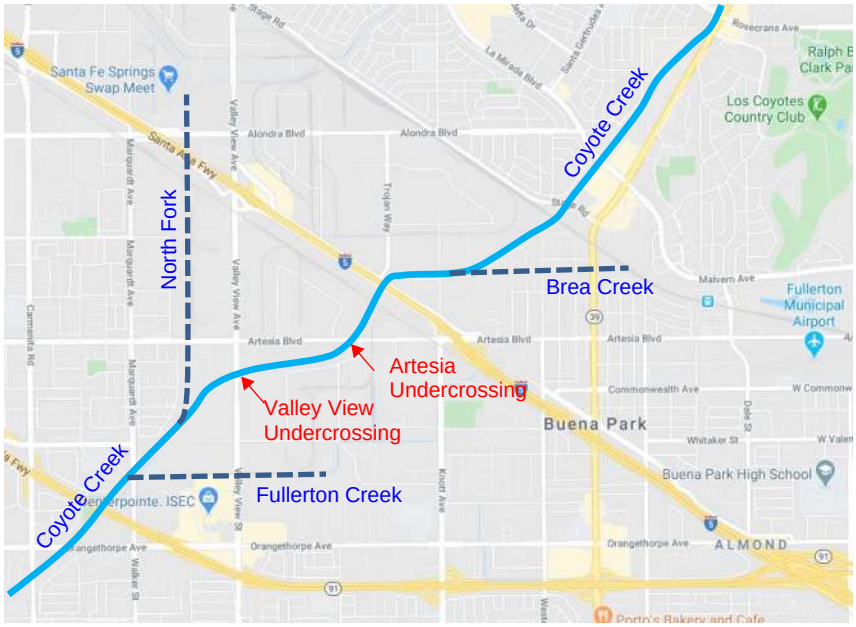
May 11, 2020

To:	Mr. Brad Fowler – OCPW Project Manager	Ref. No.:	11206772 (GHD)
From:	Brandon Willnecker	Tel:	(949) 585-5228
CC:	Bruce Schmith		

Subject: Coyote Creek O,P,Q – Flowrate Justification – High Confidence Values

1. Summary

Orange County Public Works has contracted with GHD Inc. (GHD) for the preparation of a hydraulic analysis in conjunction with the project improvement plans for OC Loop OPQ along Coyote Creek, in north Orange County, including evaluating channel encroachments at two undercrossings at Artesia Boulevard and Valley View Street. This memo has been prepared to summarize GHD's steps to arrive at the 100-Year High Confidence (HC) Flow Rates as the Base Flow Rates in the HecRas model and as approved by Penny Lew of OCPW on April 16, 2020. The high confidence flow rates within Coyote Creek are being used for purposes of establishing existing water surface elevations. The proposed locations for study are shown on the map below.



2. Existing Information

GHD conducted a search of available information from Orange County Public Works (OCPW), Orange County Flood Control District (OCFCD), Los Angeles County Flood Control District (LAFCD), FEMA, and the Army Corps of Engineering (ACOE) to obtain as-built drawings, hydrology and hydraulics data and reports, and other miscellaneous information. The following list of information summarizes the results of the search and is a list of documents that provide data, flow rates, exhibits, calculations, and/or results, and is included in Appendix #3.

- Plans for the Construction of Brea Channel, OCFCD Facility No. A02 – November, 1996
- Army Corps of Engineer's – Plate 4, File No. 198/89 – Coyote Creek Channel Std. Discharges
- Army Corps of Engineer's – Plate 10, File No. 373/120 – Coyote Creek Channel Std. Discharges

The following table summarizes the findings within the above information and other sources related to flow rates along project length within Coyote Creek. See Appendix #1 illustrating the locations denoted for each of the below flow rates.

Table 2.1 Existing Flow Rate Information

Concentration Point	LACFCD 1935 Plans – Theoretical Q (cfs)	USACE "Design Discharge" Q (cfs)	USACE 100-Year Q (CFS)	1949 Survey Report Q (cfs)	OCHM 100-Year Design Q - HC (cfs)	OCHM 100-Year EV Q (cfs)
CC Above Brea Creek	15,600	15,000		7,500		
Brea Creek D/S of Western		12,000		6,000	8,023	6,710
CC Below Brea Creek	19,500	21,500		13,000		
CC Below North Fork	23,300	37,000		23,000		
CC Below Fullerton Creek		40,000				
Fullerton Creek		13,500				7,700
CC Above San Gabriel River		50,000	38,000	30,000		

CC = Coyote Creek D/S = Downstream HC = High Confidence EV = Expected Value

3. Proposed Methodology

Table 2.1 in Section 2 of this memo illustrates the gaps in flow rates across multiple criteria. The Orange County Hydrology Manual permits the use of Expected Value numbers in the analysis of existing facilities, and for purposes of this project, the higher OCHM 100-Year Design Flows (High Confidence Flows) will be used to analyze the existing and proposed conditions 1,000 feet upstream and downstream of the Coyote Creek crossings at Artesia Boulevard and Valley View Street.

In order to determine the high confidence flows for the areas of Coyote Creek from below North Fork to above Brea Creek, the following ratio was used to establish a conversion factor to calculate the high confidence flow rate for this analysis. The conversion factor is based upon known flow rates for Break Creek downstream of Western, and is as follows:

(OCHM 100-Year High Confidence **/** USACE Design Discharge) = Conversion Factor

8,023 cfs / 12,000 cfs = 0.669

USACE Design Discharge x **0.669** = OCHM 100-High Confidence

To calculate the water surface elevation within Coyote Creek GHD prepared a HecRas model utilizing the Coyote Creek As-Built plans, and verified/updated the model with cross sectional field survey data and detailed bridge survey data. Calculated high confidence flow rates were then modelled in HecRas for cross sectional analysis to determine the water surface elevation within the channel. The downstream water surface elevation was determined by calculating the cross sectional normal depth and used as the downstream control water surface elevation in the HecRas model. Bridge decks, piers, sidewalls, and soffits were modeled using field topographic elevations.

4. Proposed High Confidence Flow Rates

Table 4.1 summarizes the results of applying the 0.669 conversion factor to the USACE Design Discharge rates. The rates listed under the OCHM 100-Year Design Q – HC (cfs) column are the rates used in the HecRas model.

Table 4.1 Proposed / High Confidence Flow Rate Information

Concentration Point	LACFCD 1935 Plans – Theoretical Q (cfs)	USACE "Design Discharge" Q (cfs)	USACE 100-Year Q (CFS)	1949 Survey Report Q (cfs)	OCHM 100-Year Design Q - HC (cfs)	OCHM 100-Year EV Q (cfs)
CC Above Brea Creek	15,600	15,000		7,500	**10,035**	
Brea Creek D/S of Western		**12,000**		6,000	**8,023**	6,710
CC Below Brea Creek	19,500	21,500		13,000	**14,384**	
CC Below North Fork	23,300	37,000		23,000	**24,753**	
CC Below Fullerton Creek		40,000				
Fullerton Creek		13,500				7,700
CC Above San Gabriel River		50,000	38,000	30,000		

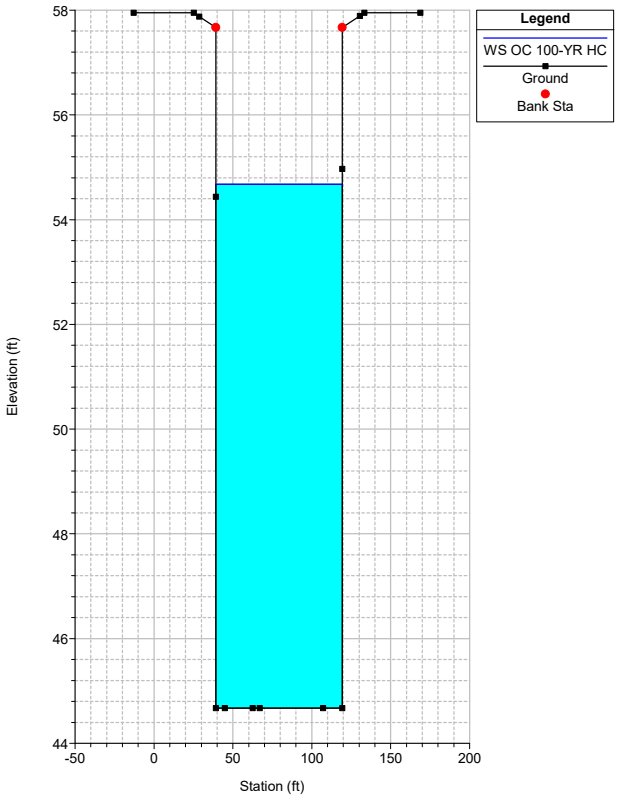
CC = Coyote Creek D/S = Downstream HC = High Confidence EV = Expected Value

5. Results

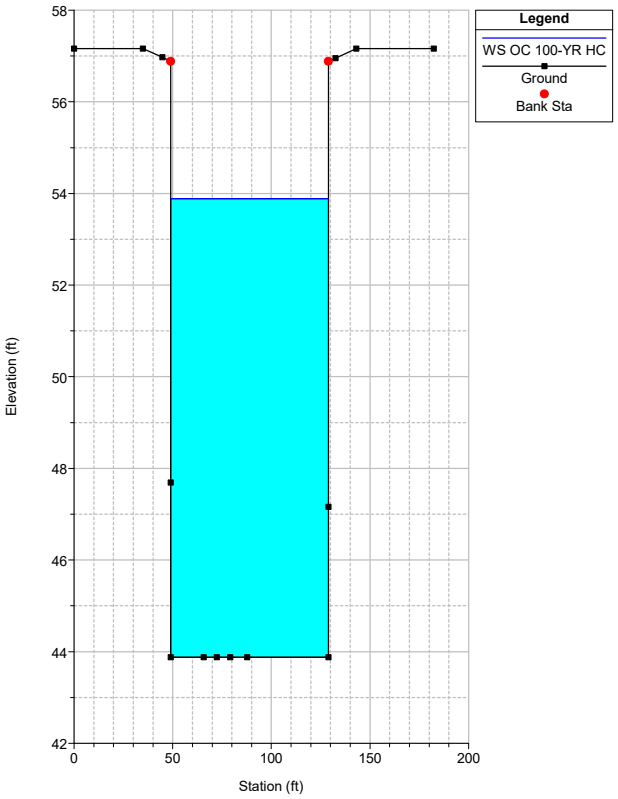
Utilizing the high confidence flow rates listed in Table 4.1 resulted in HecRas output illustrating that the flow rates are contained within Coyote Creek. Cross sectional analysis 1,000 feet upstream and downstream of the Valley View Street and Artesia Boulevard channel crossings have been included in Appendix #2.

Appendix D
Existing Conditions
Cross Sections

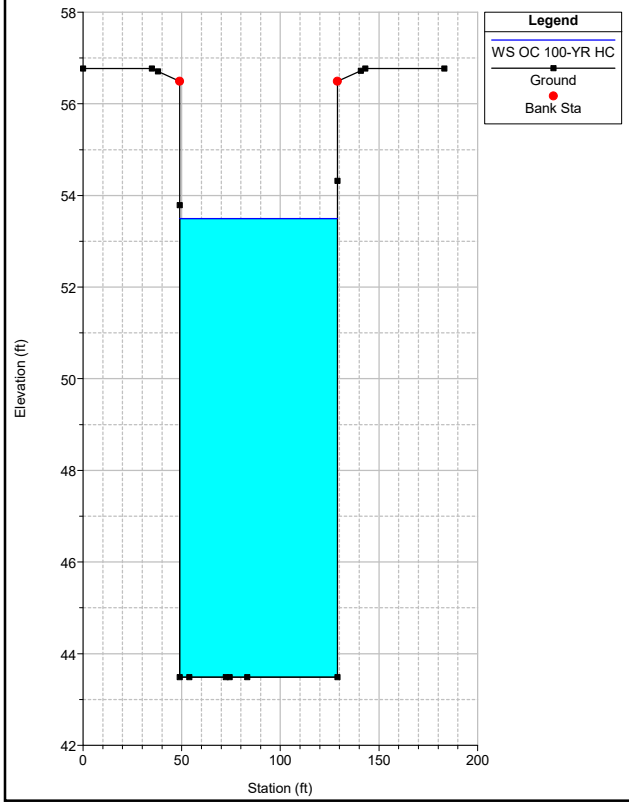
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 43722



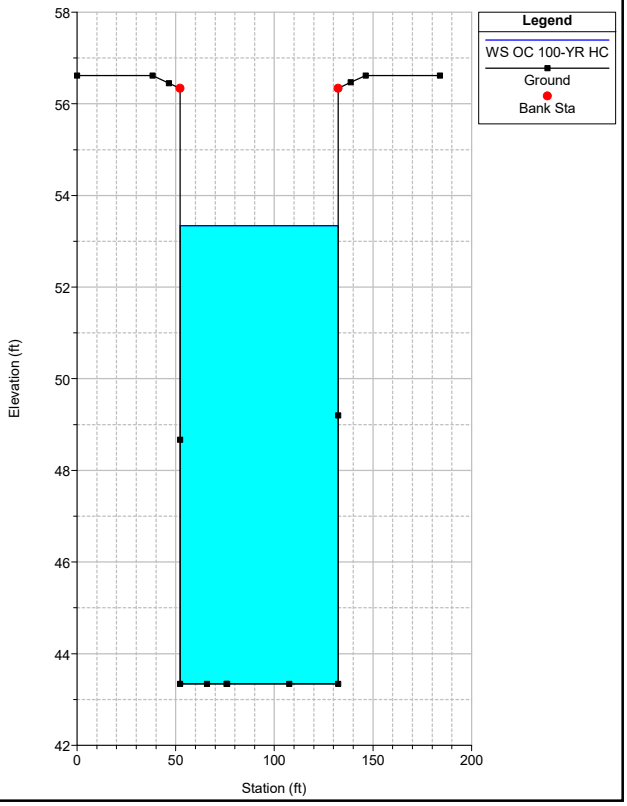
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 43672



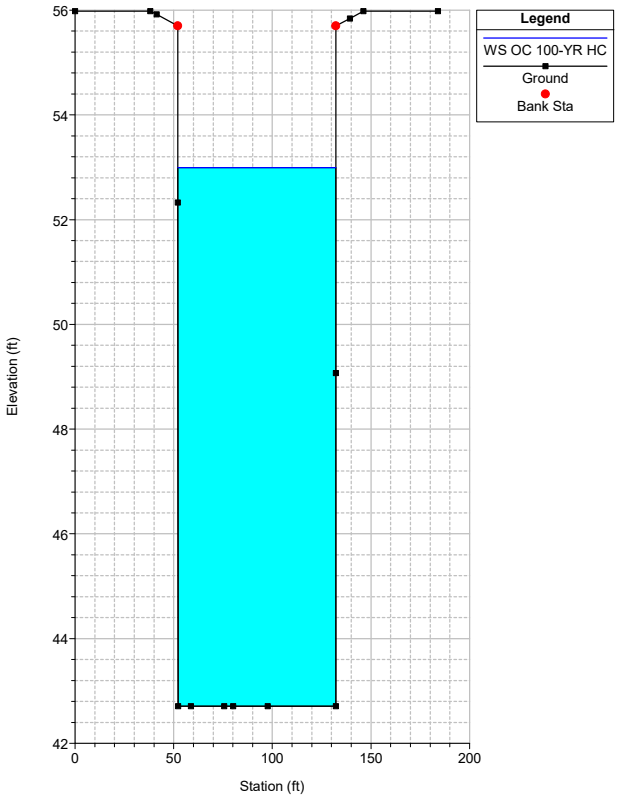
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 43531



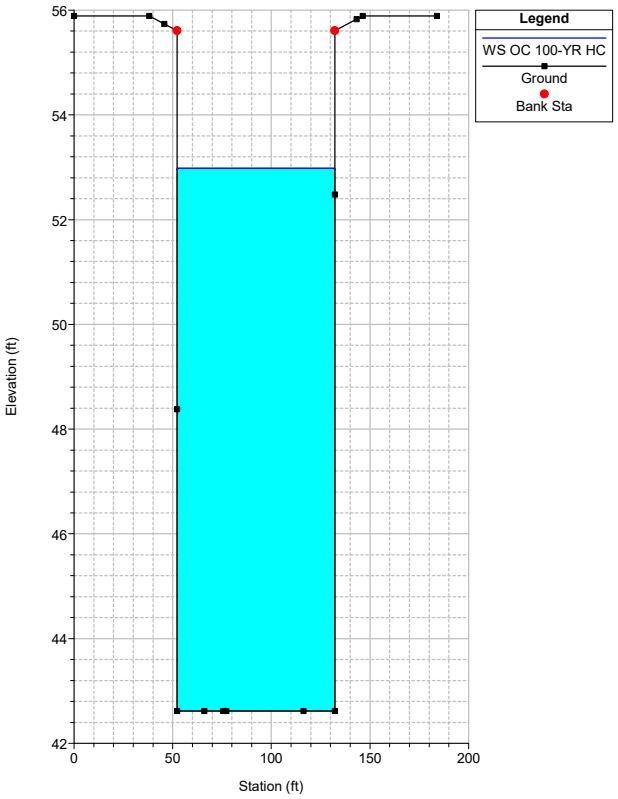
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 43495



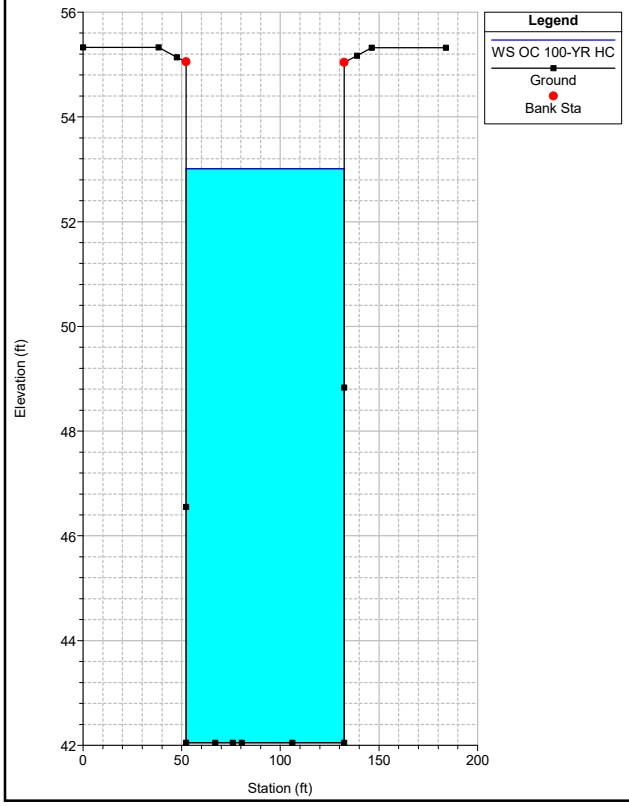
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 43246



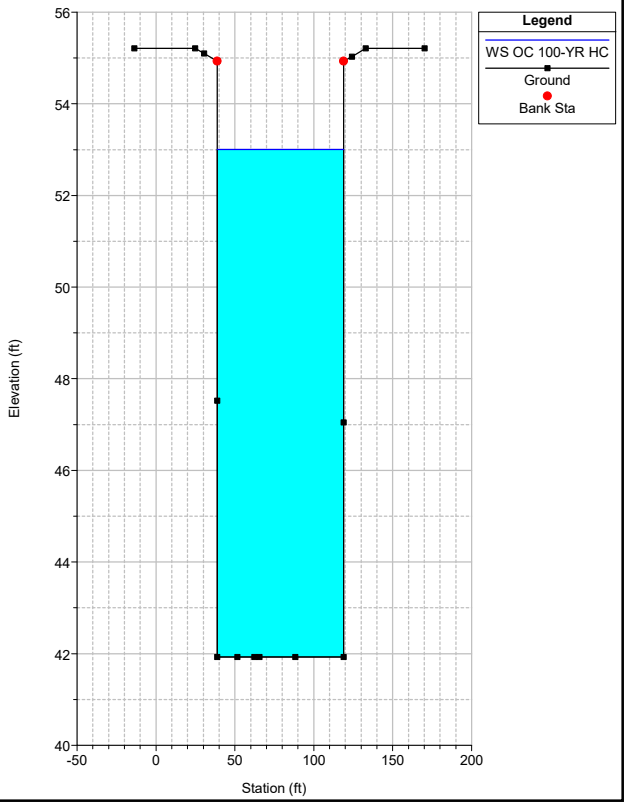
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 43210



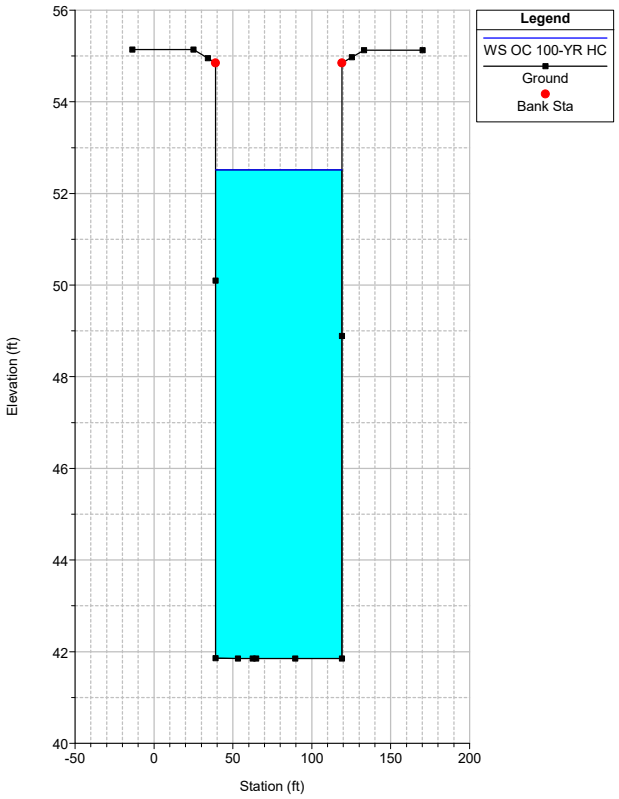
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42995



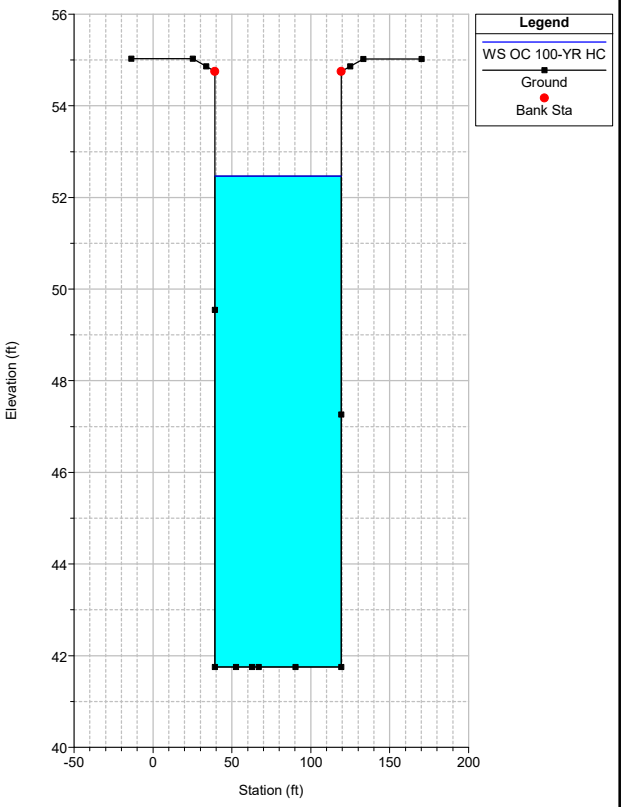
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42944



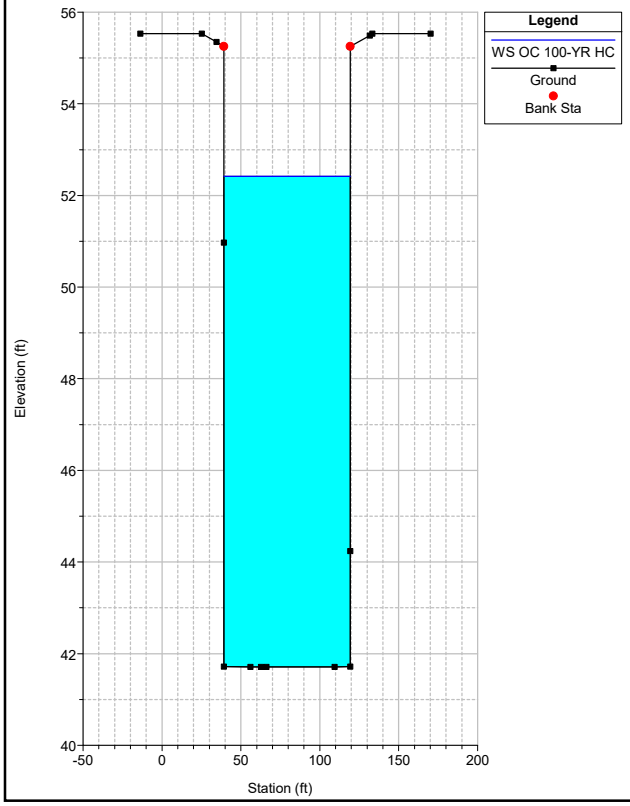
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42845



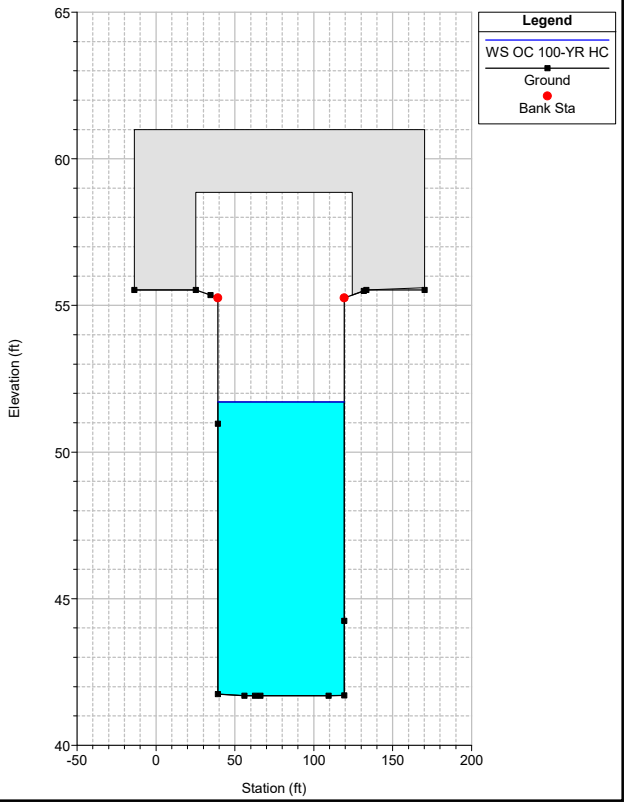
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42794



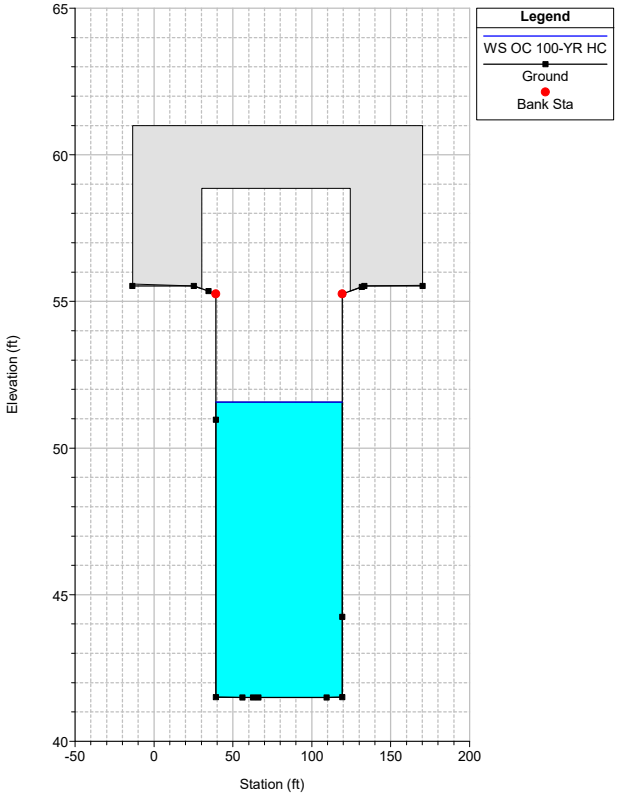
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42765



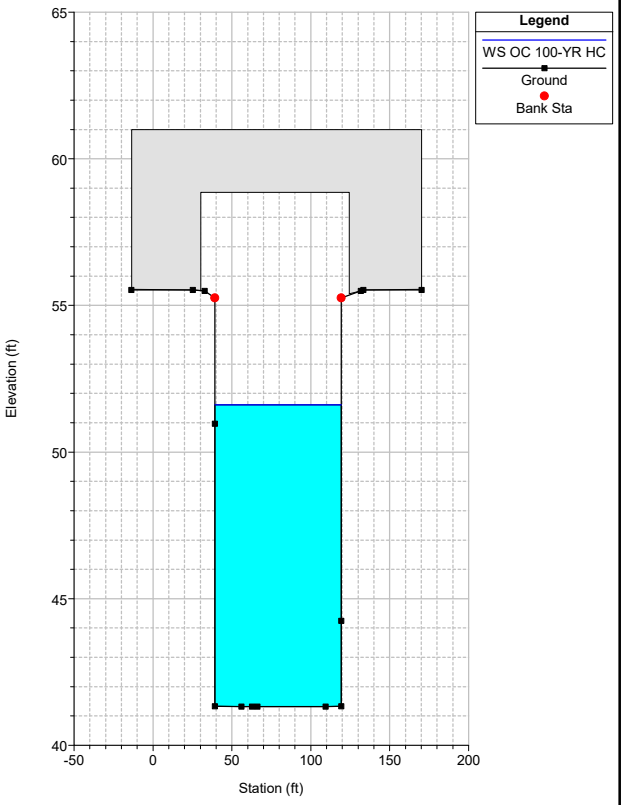
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42752 Artesia Blvd Bridge



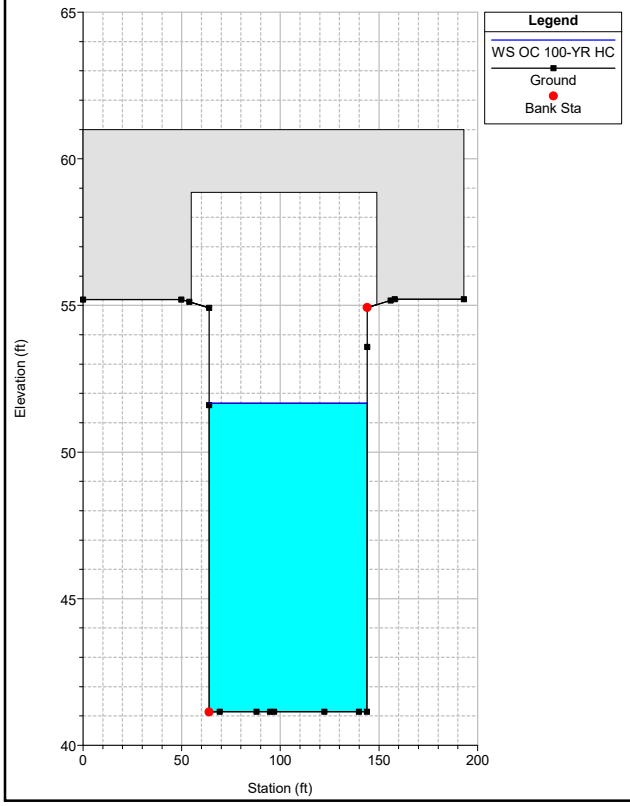
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42720 Artesia Blvd Bridge



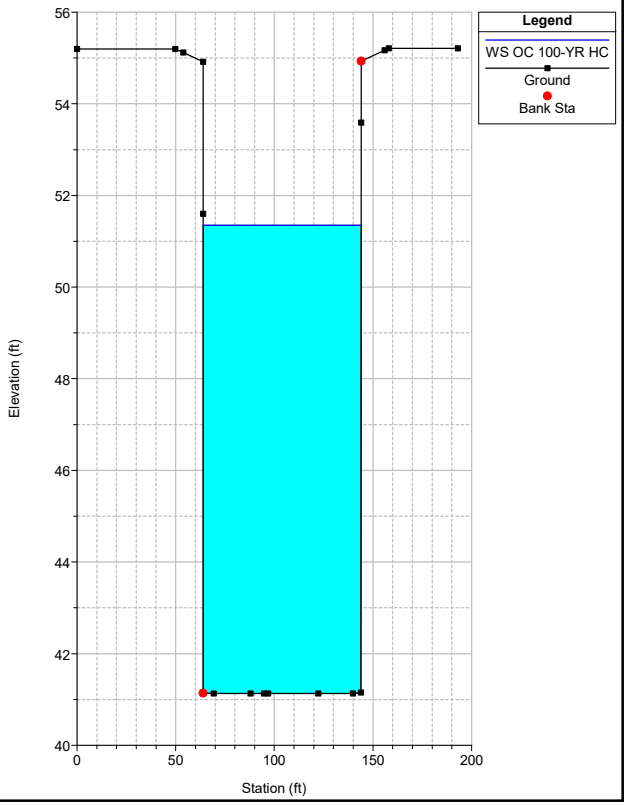
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42656 Artesia Blvd Bridge



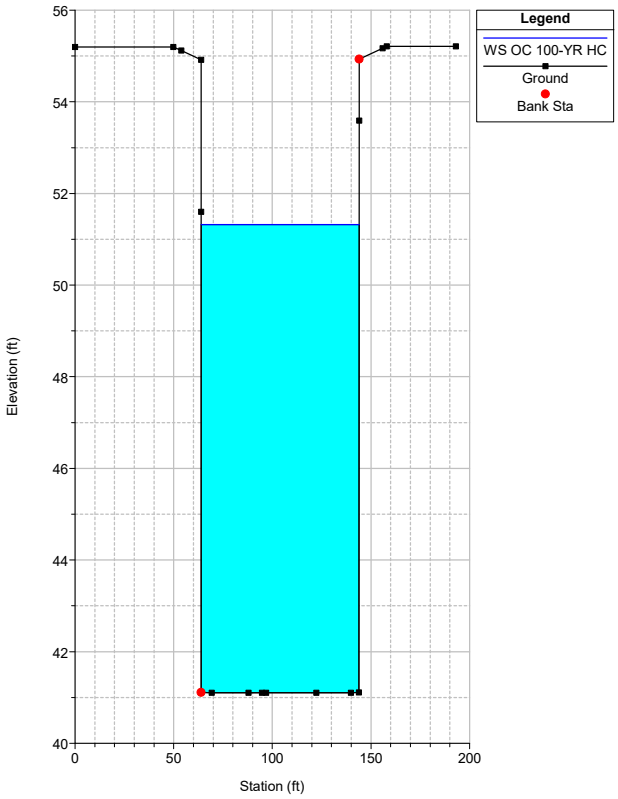
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42594 Artesia Blvd Bridge



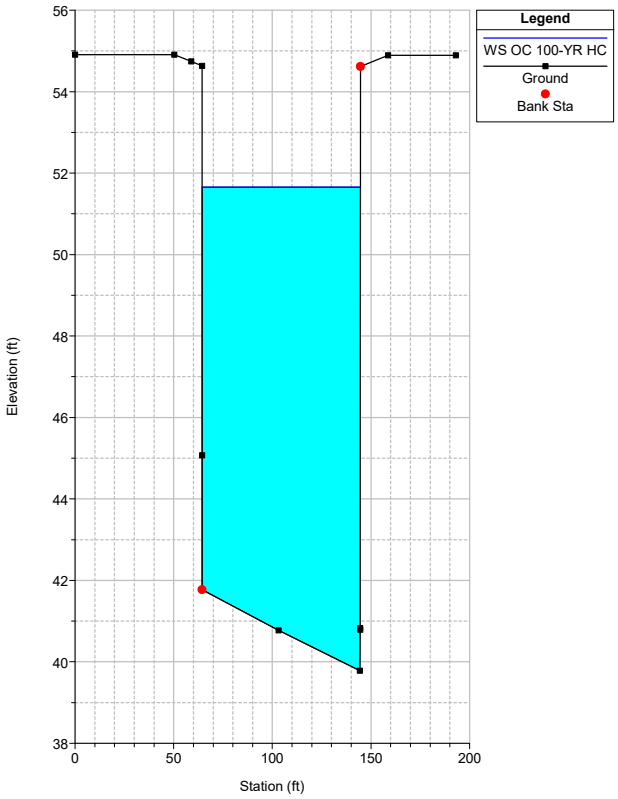
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42576



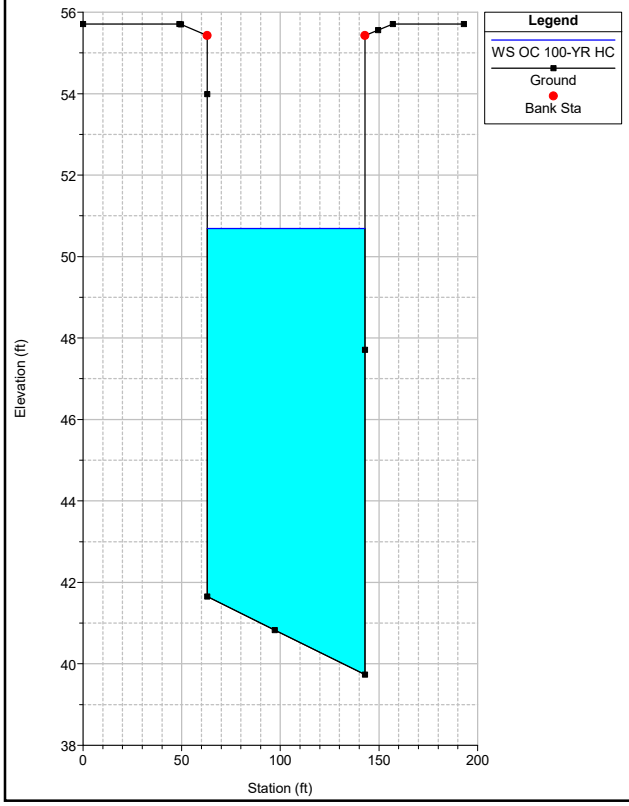
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42555



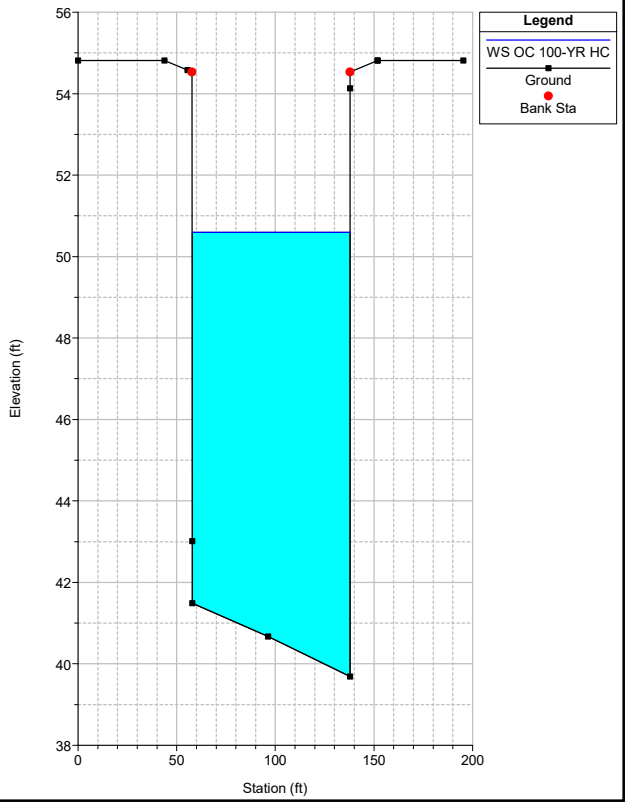
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42493



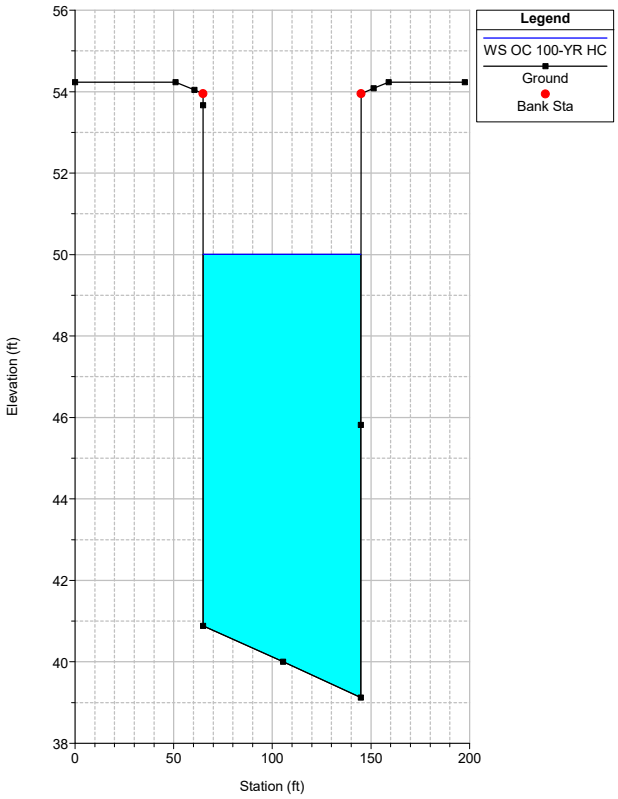
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42444



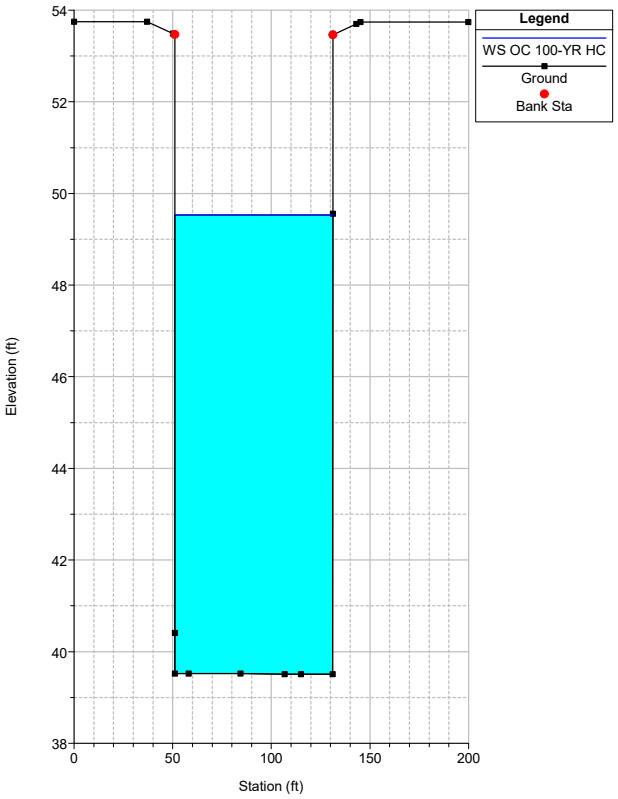
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42396



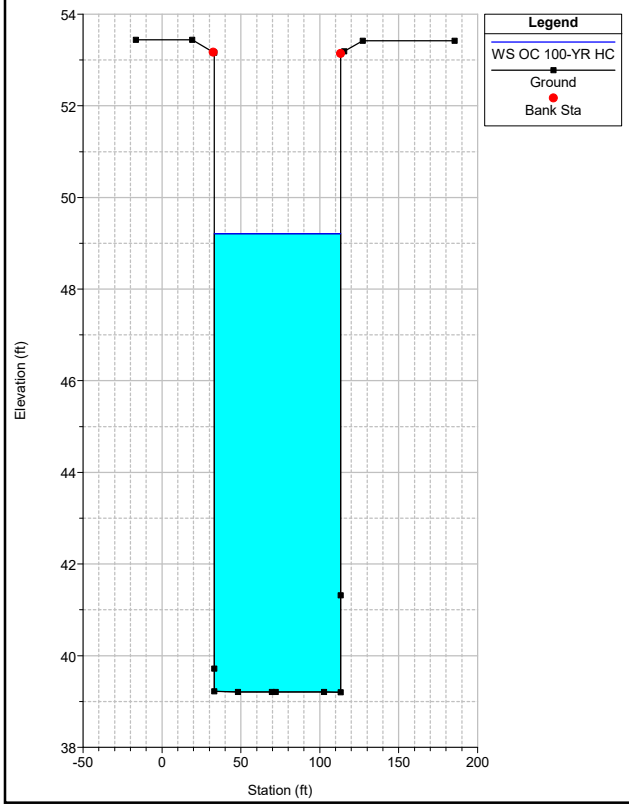
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42158



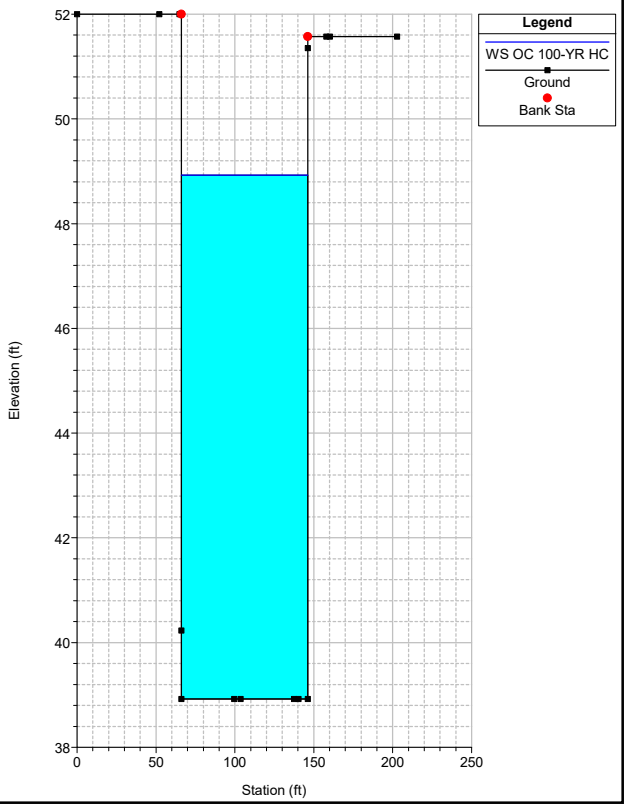
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 41918



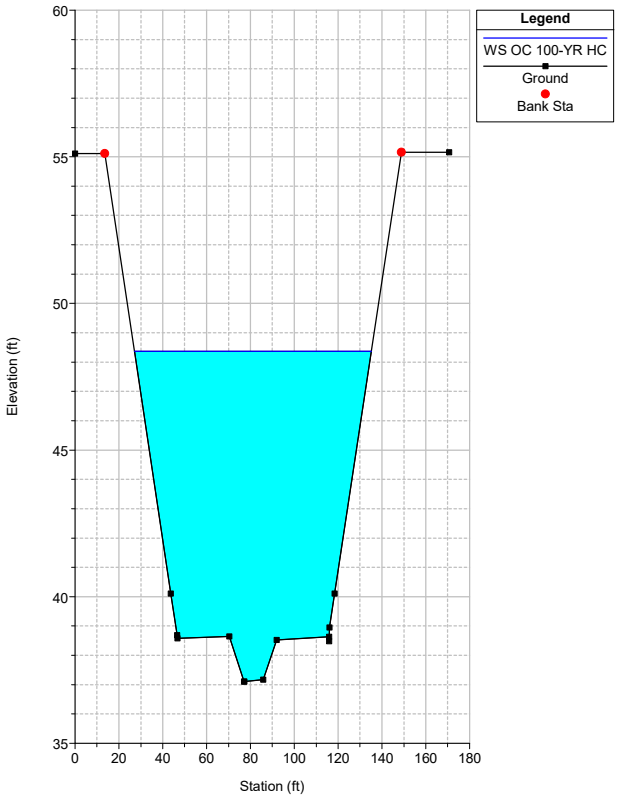
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 41746



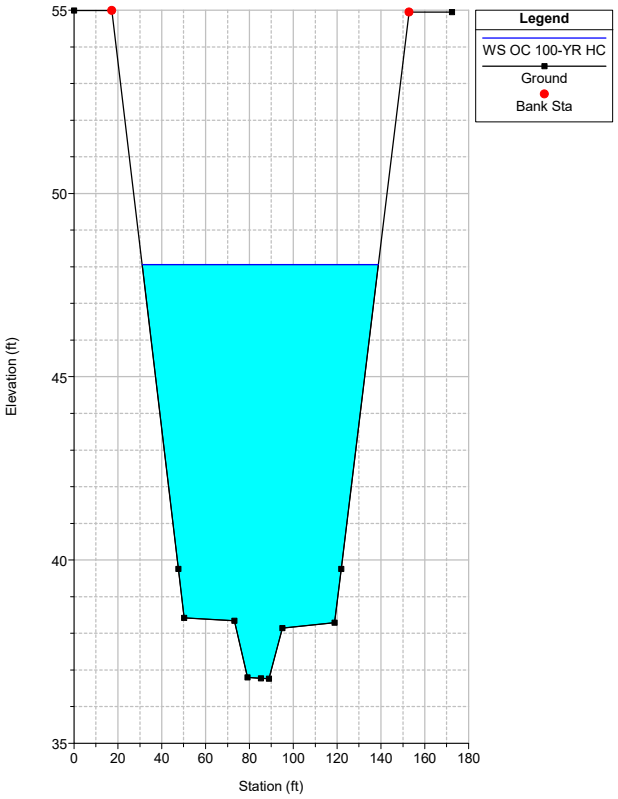
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 41649



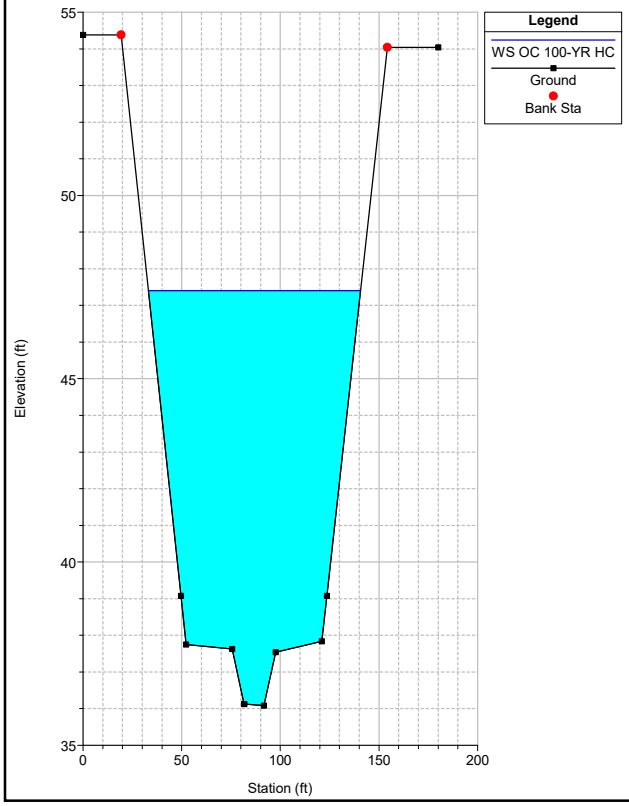
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 41546



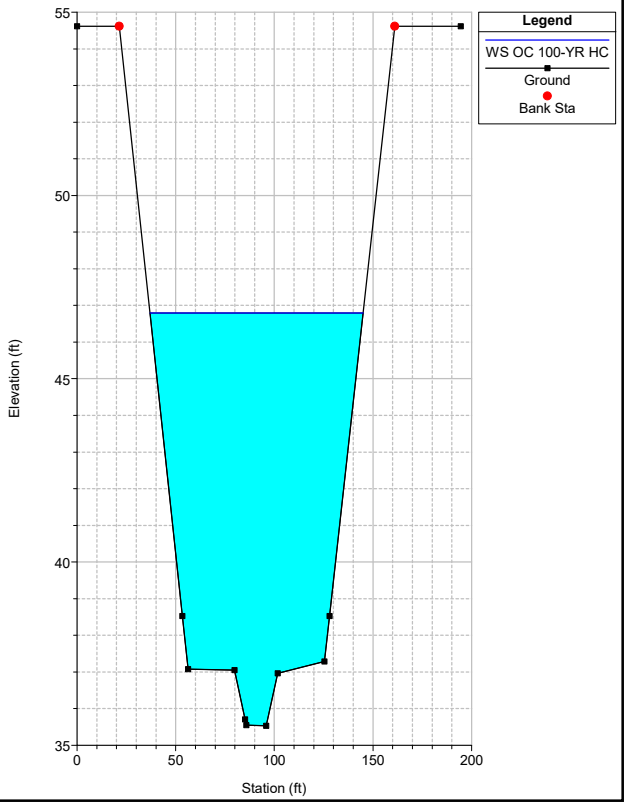
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 41449



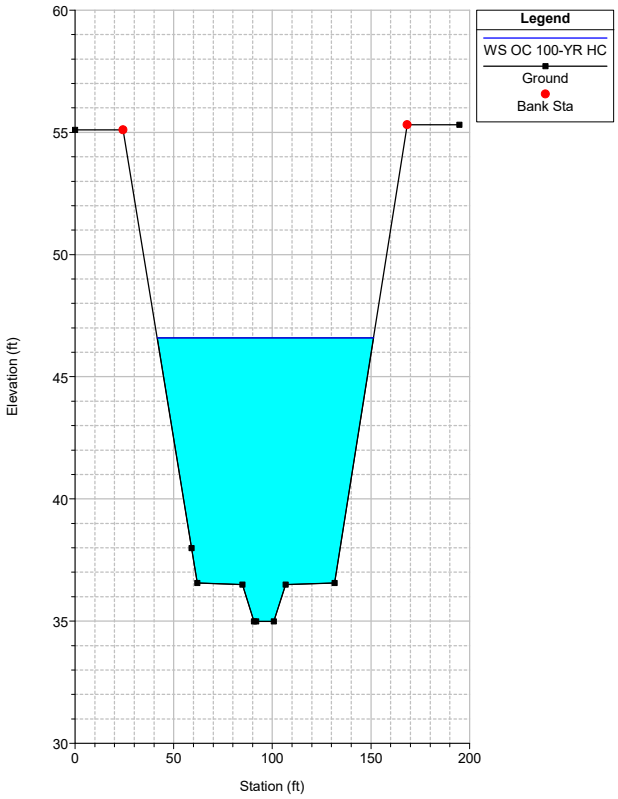
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 41199



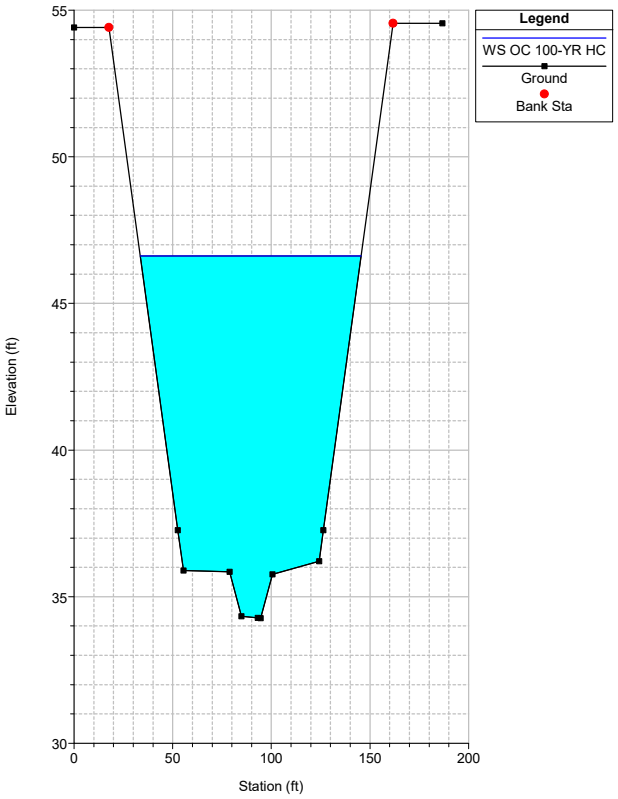
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 40950



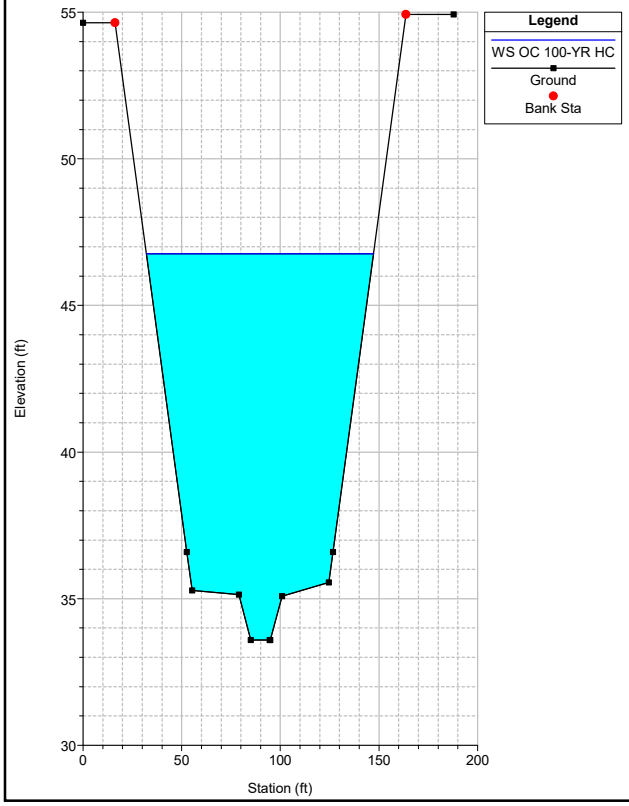
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 40699



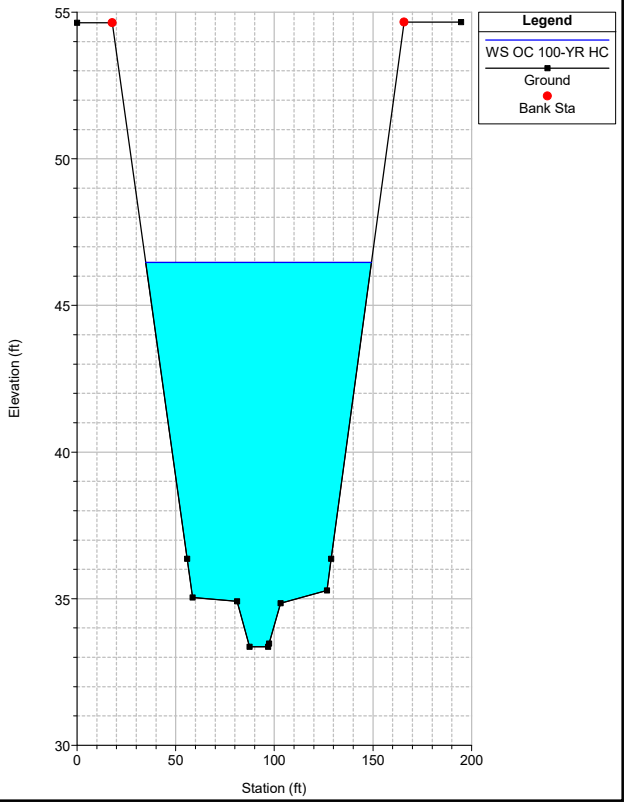
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 40446



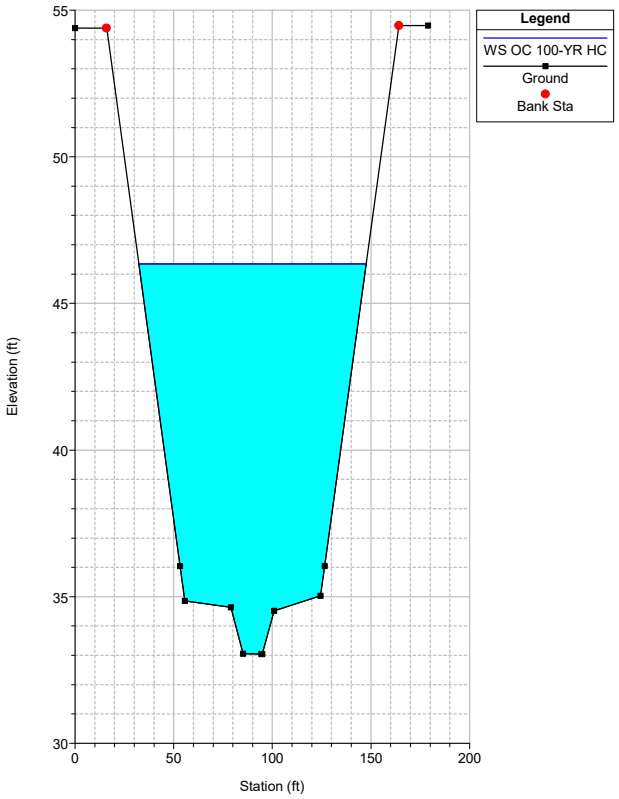
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 40196



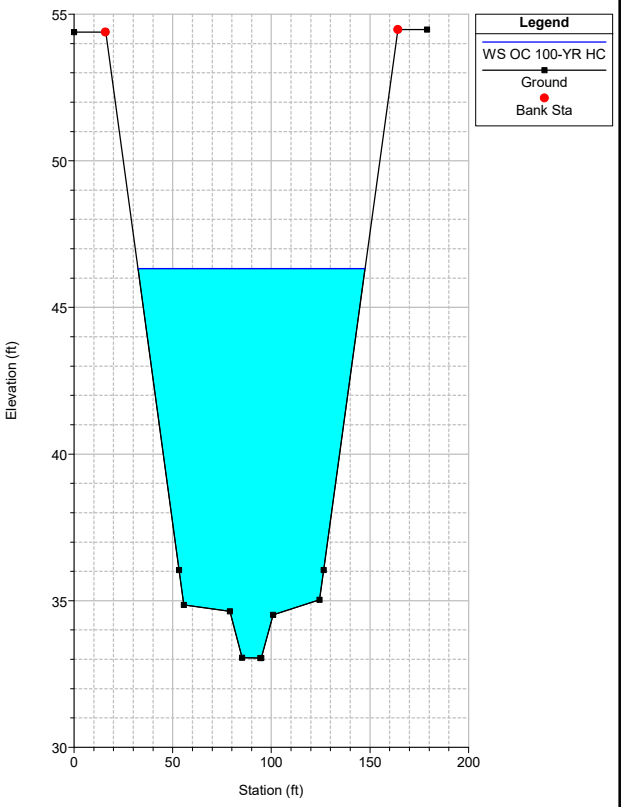
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39946



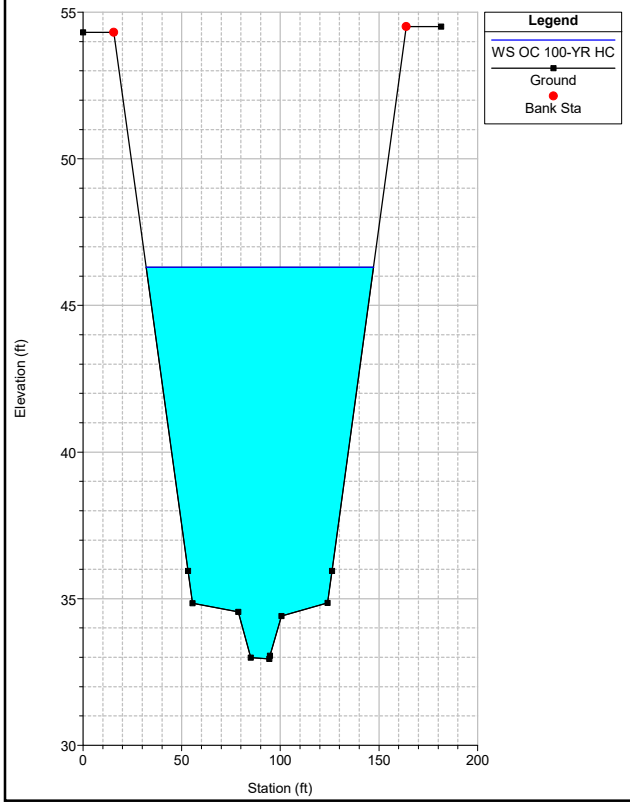
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39711



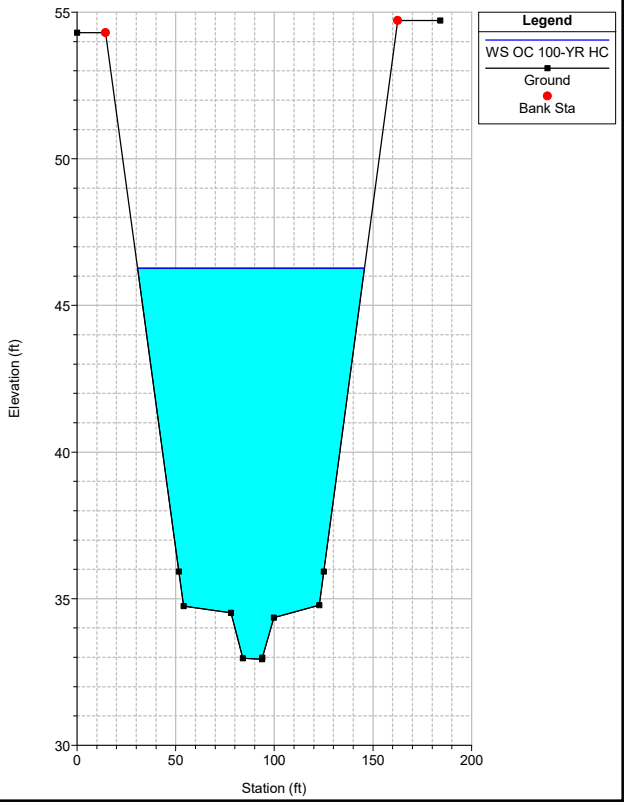
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39697



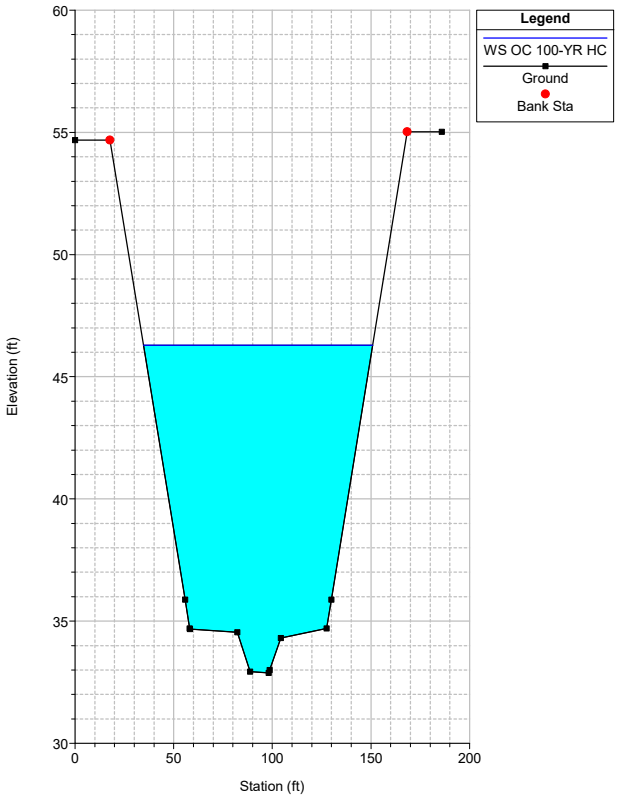
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39647



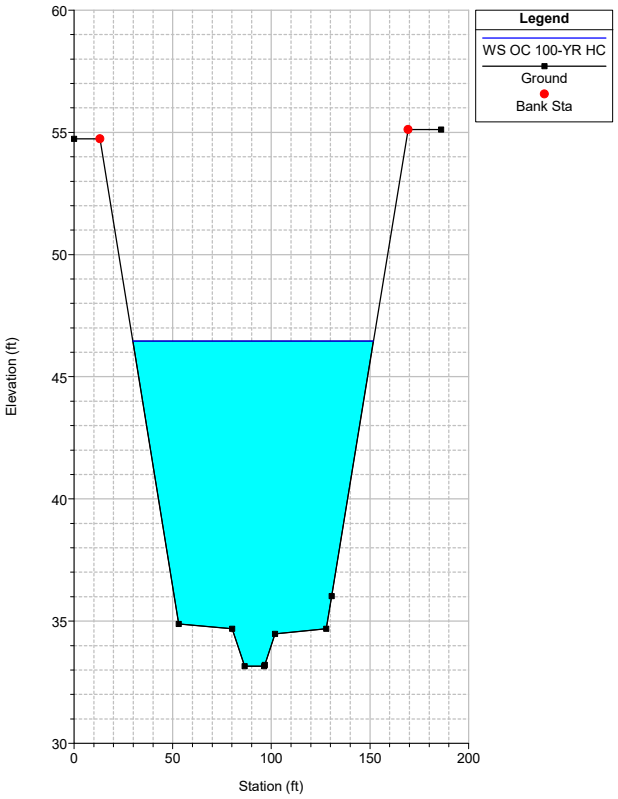
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39596



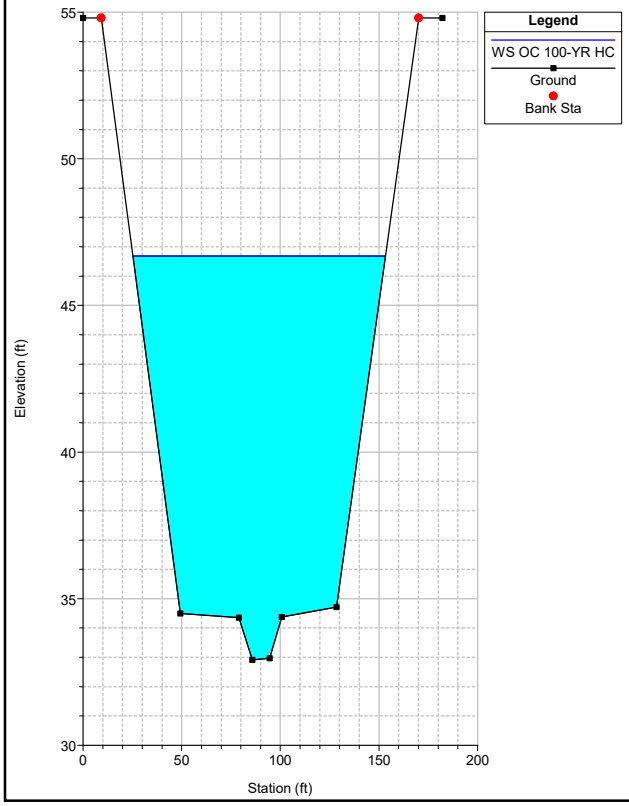
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39548



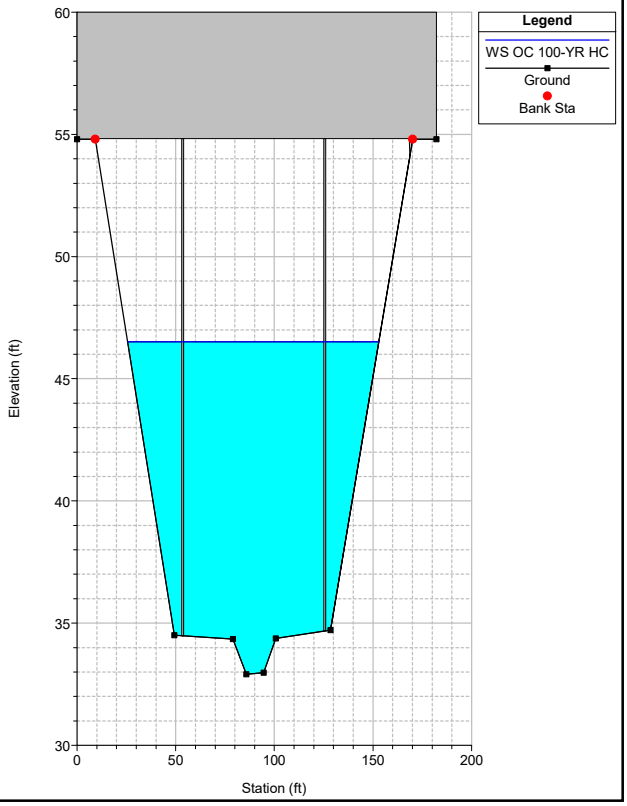
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39498



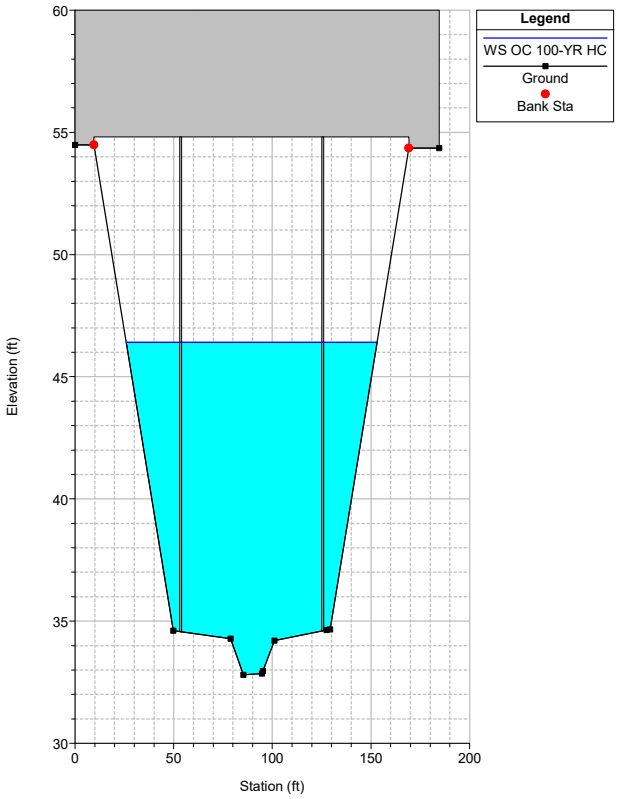
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39458



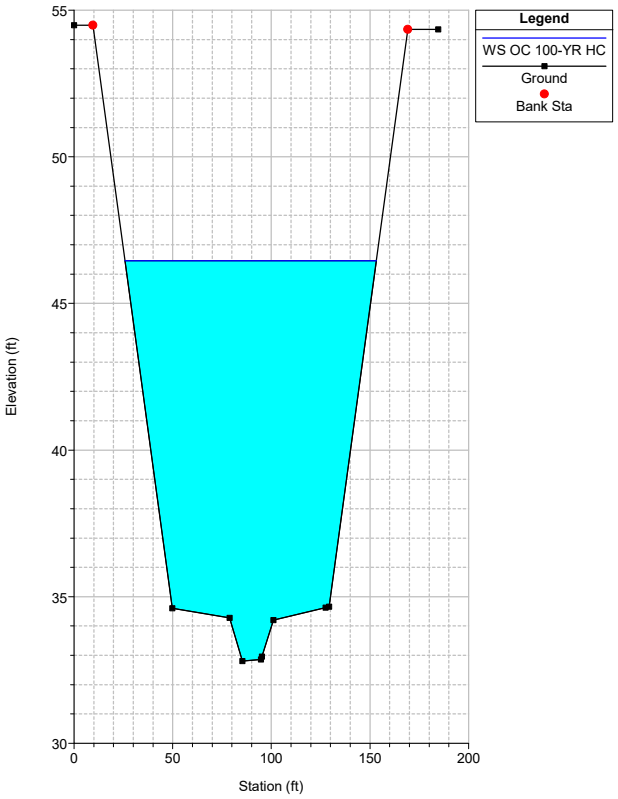
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39401 BR Valley View Street



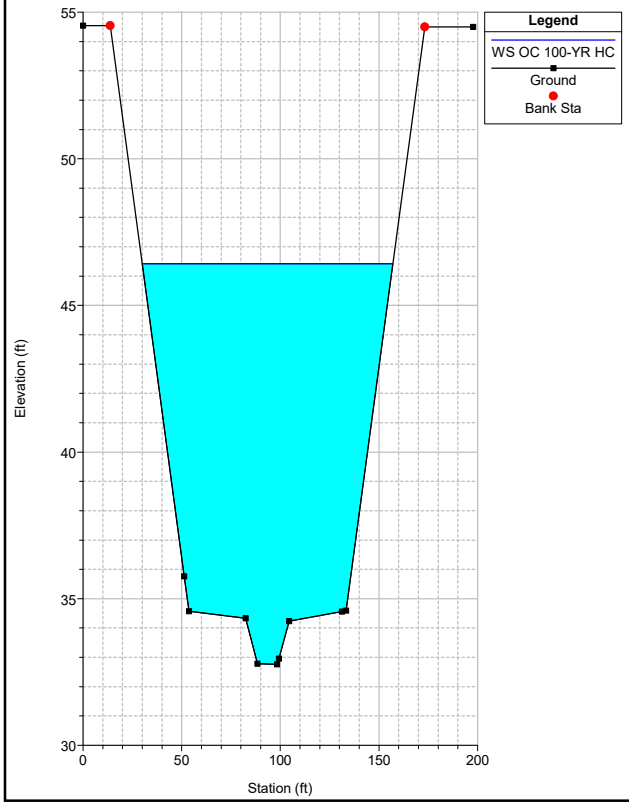
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39401 BR Valley View Street



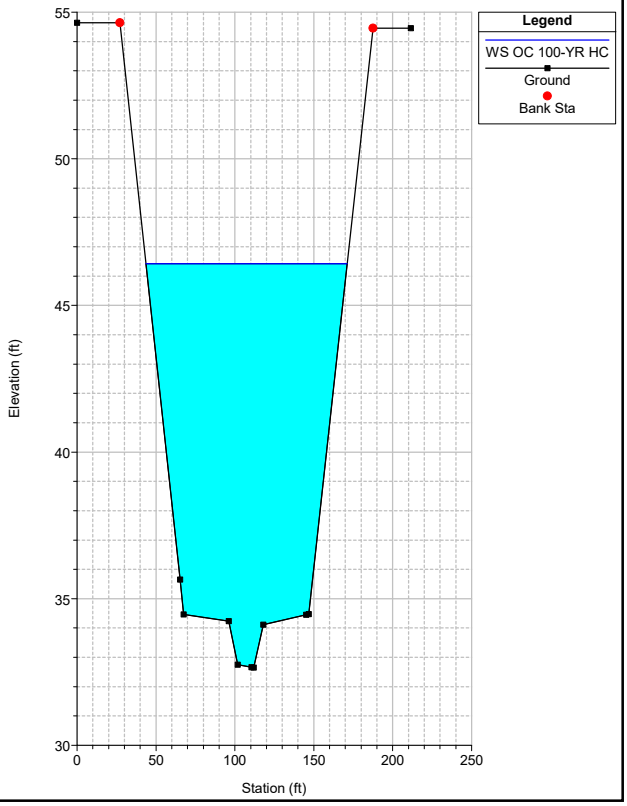
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39319

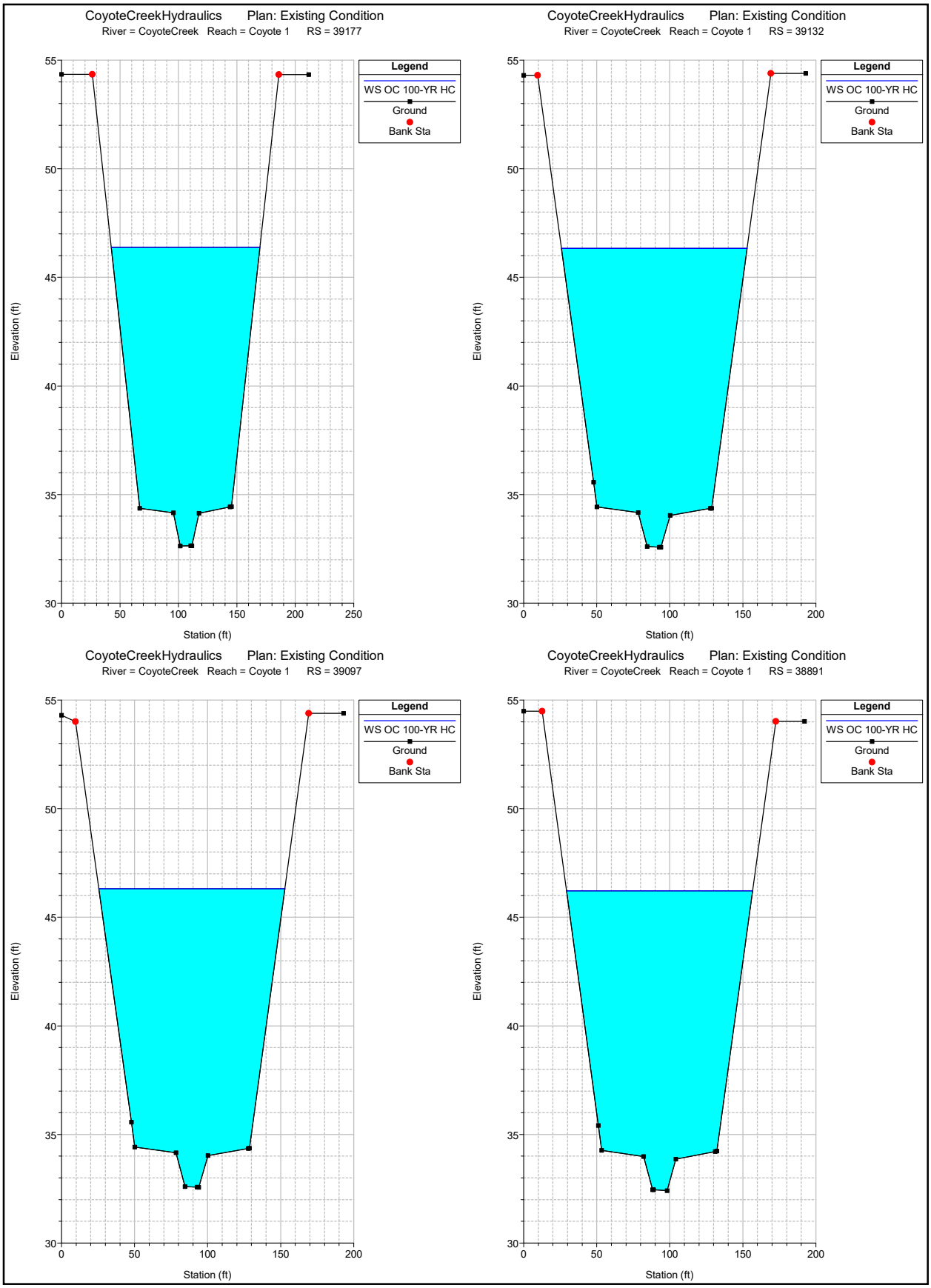


CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39273

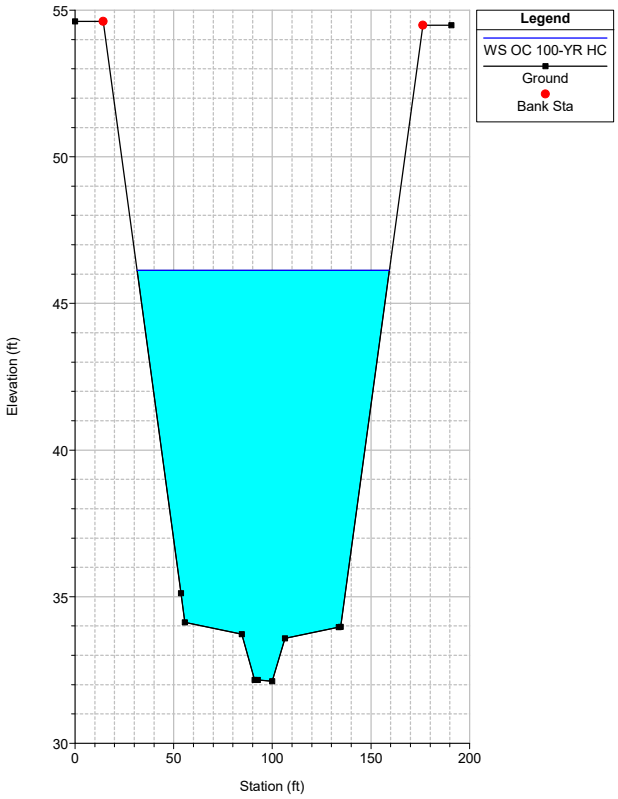


CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39226

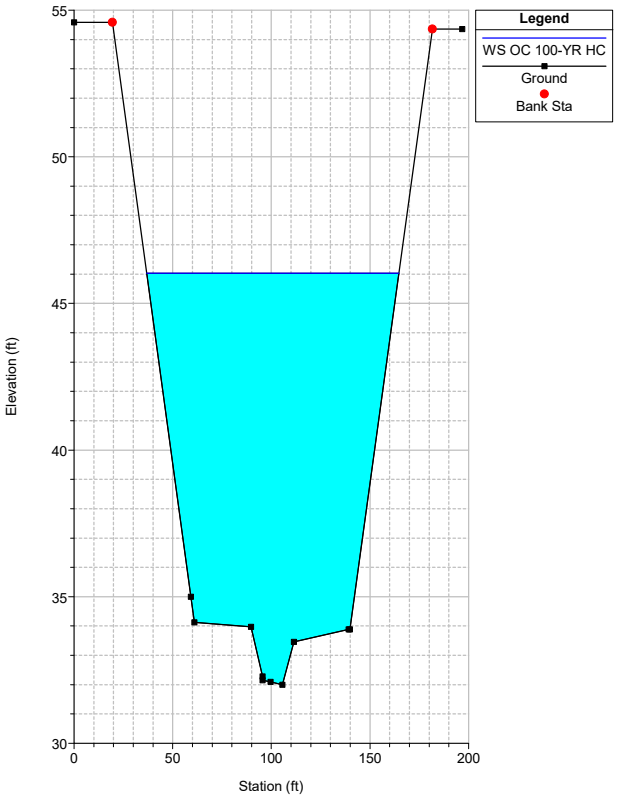



CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39177
Legend
WS OC 100-YR HC
Ground
Bank Sta
Elevation (ft)
Station (ft)
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39132
Legend
WS OC 100-YR HC
Ground
Bank Sta
Elevation (ft)
Station (ft)
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39097
Legend
WS OC 100-YR HC
Ground
Bank Sta
Elevation (ft)
Station (ft)
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 38891
Legend
WS OC 100-YR HC
Ground
Bank Sta
Elevation (ft)
Station (ft)

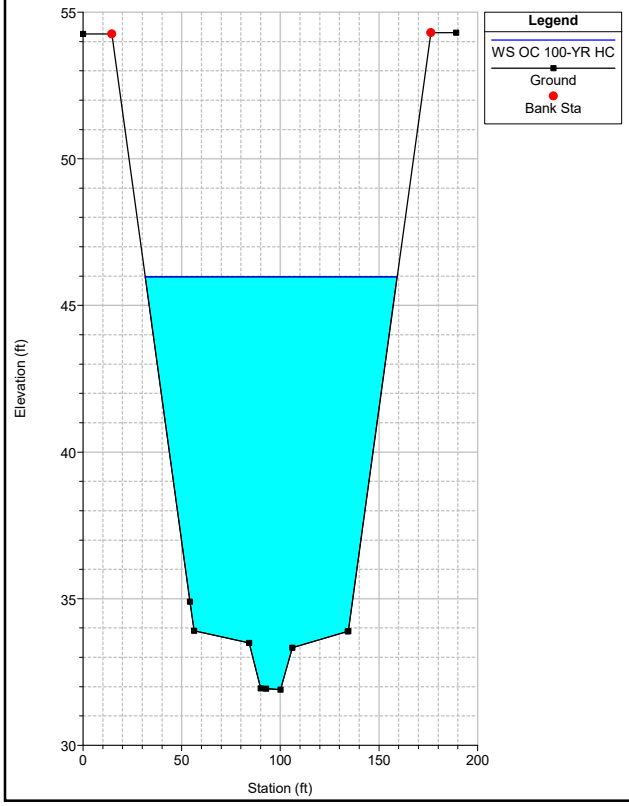
CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 38651



CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 38536

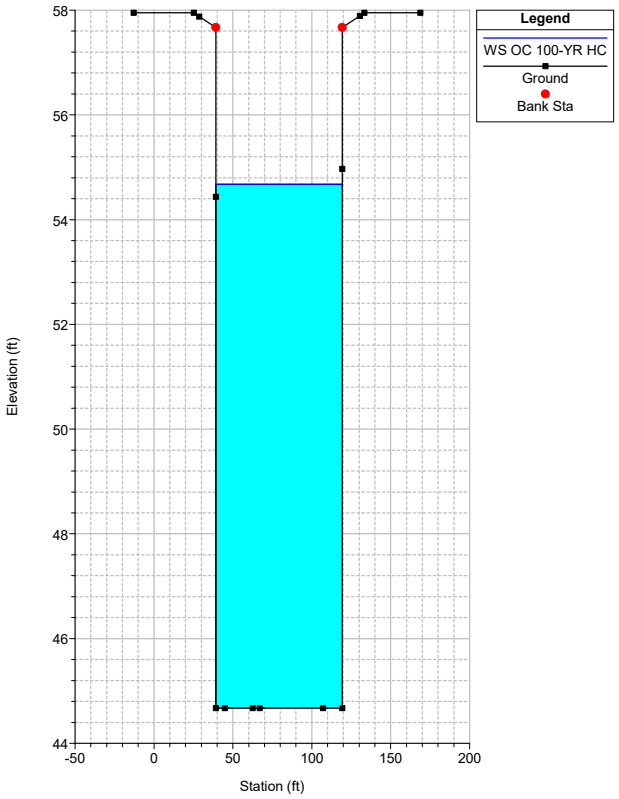


CoyoteCreekHydraulics Plan: Existing Condition
River = CoyoteCreek Reach = Coyote 1 RS = 38404

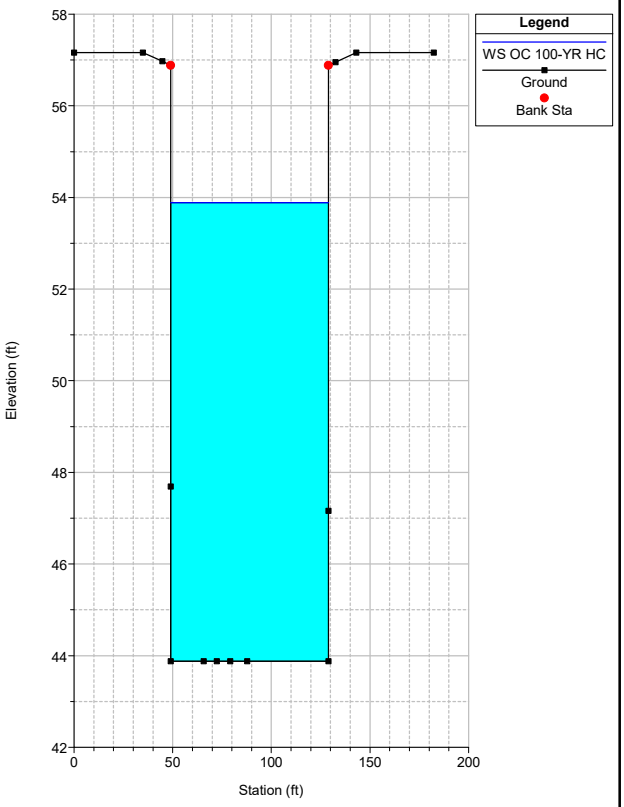


Appendix E
Proposed Conditions
Cross Sections

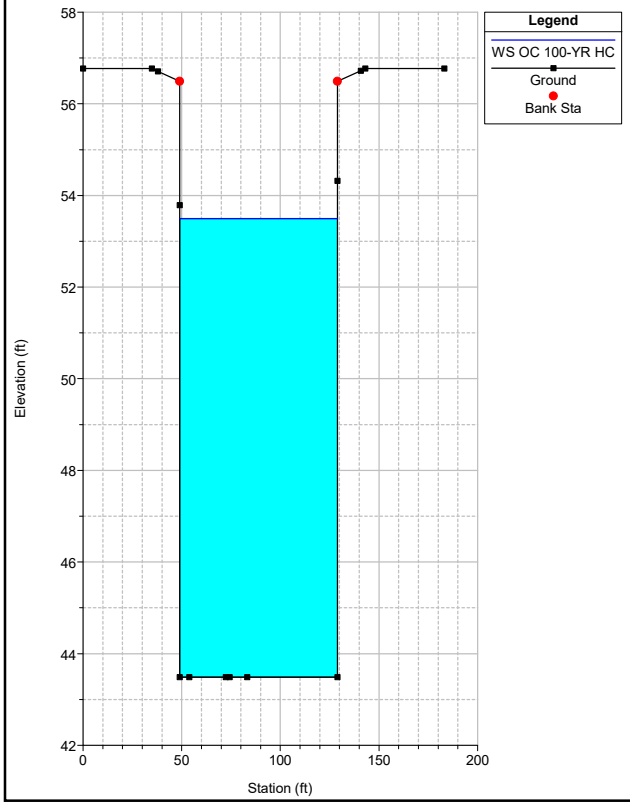
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 43722



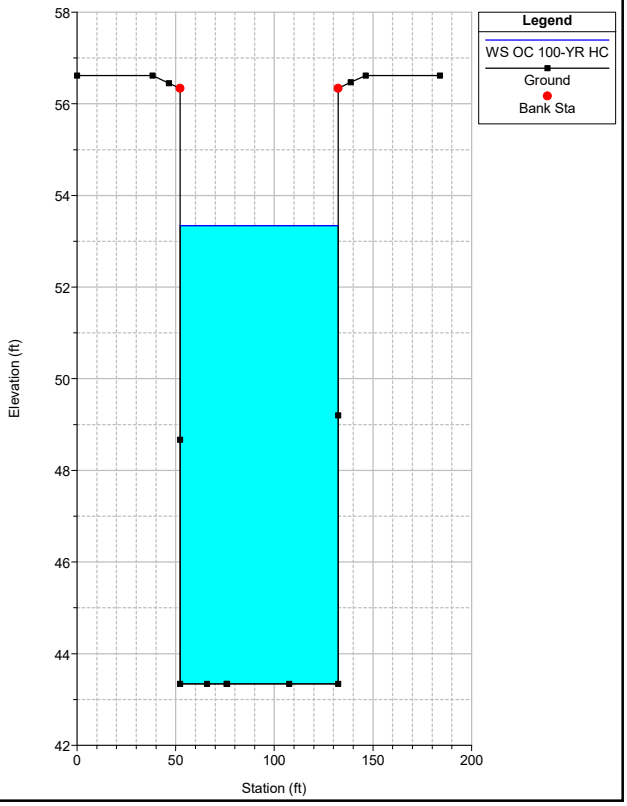
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 43672

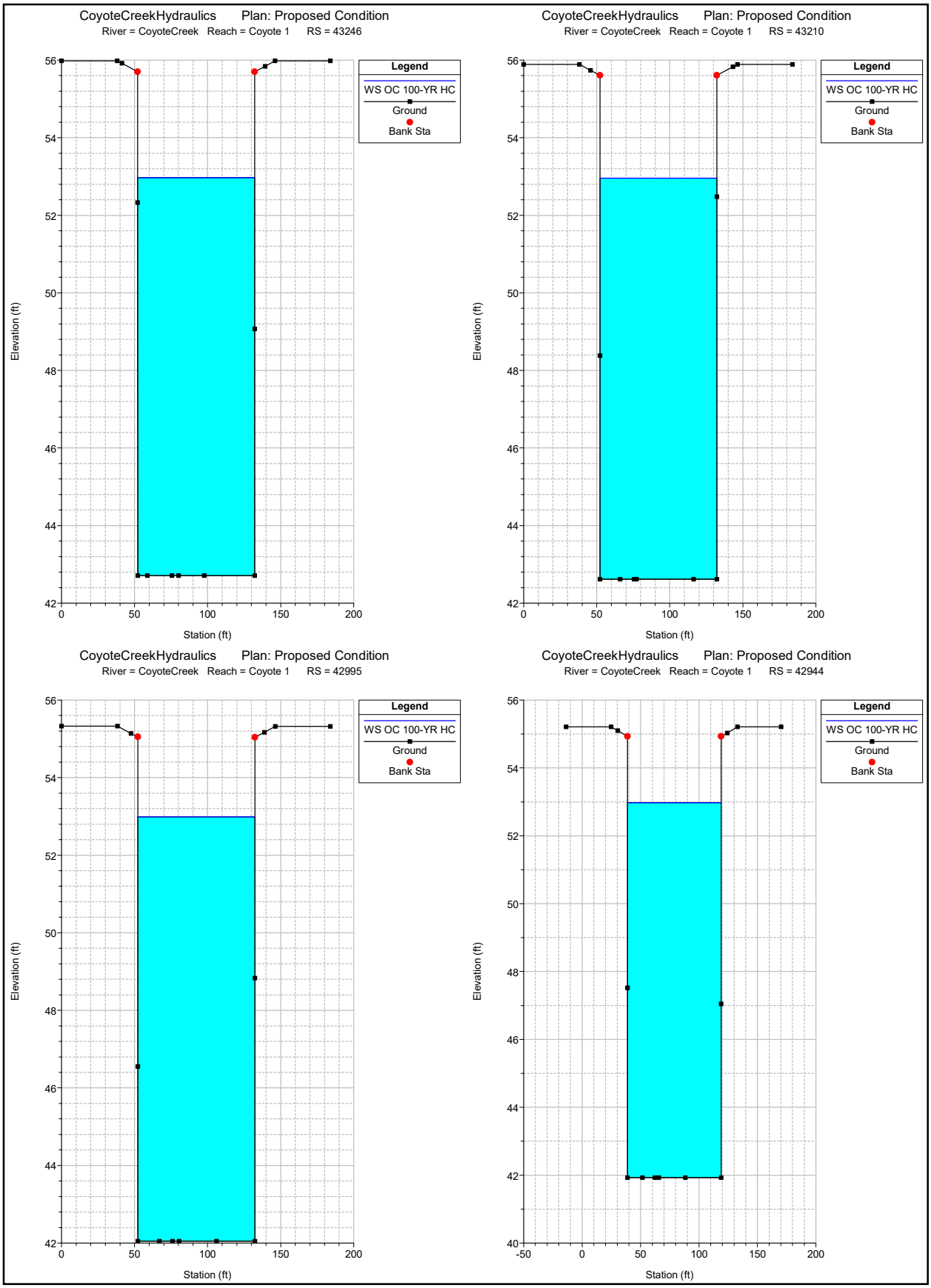


CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 43531

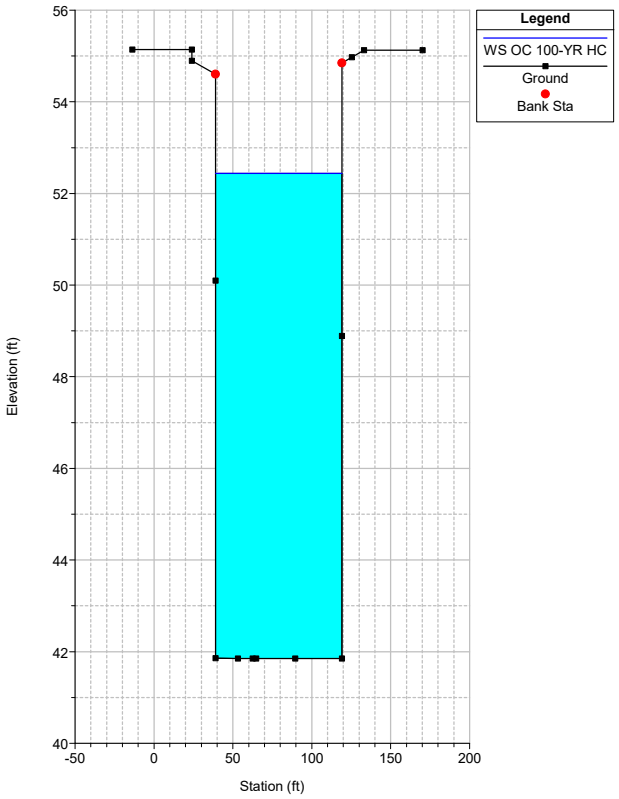


CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 43495

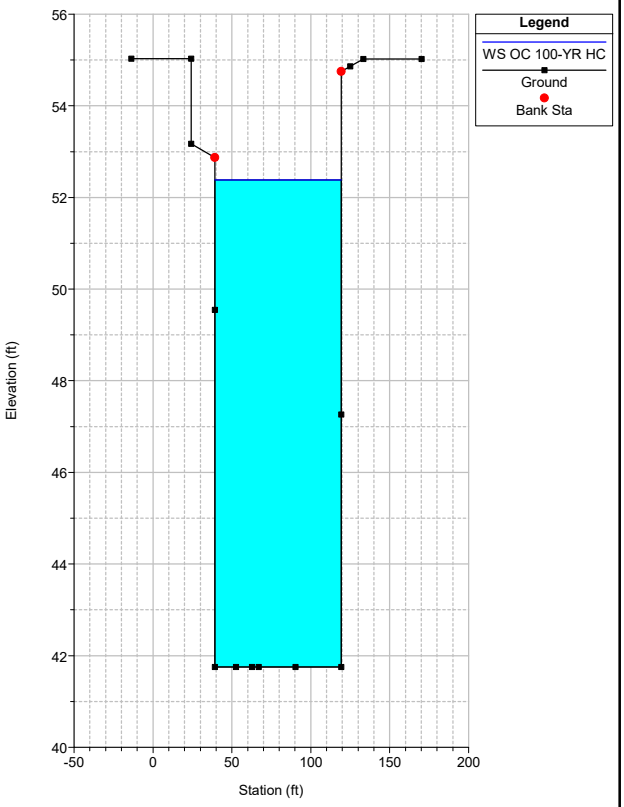



CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 43246
Legend
WS OC 100-YR HC
Ground
Bank Sta
Elevation (ft)
Station (ft)
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 43210
Legend
WS OC 100-YR HC
Ground
Bank Sta
Elevation (ft)
Station (ft)
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42995
Legend
WS OC 100-YR HC
Ground
Bank Sta
Elevation (ft)
Station (ft)
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42944
Legend
WS OC 100-YR HC
Ground
Bank Sta
Elevation (ft)
Station (ft)

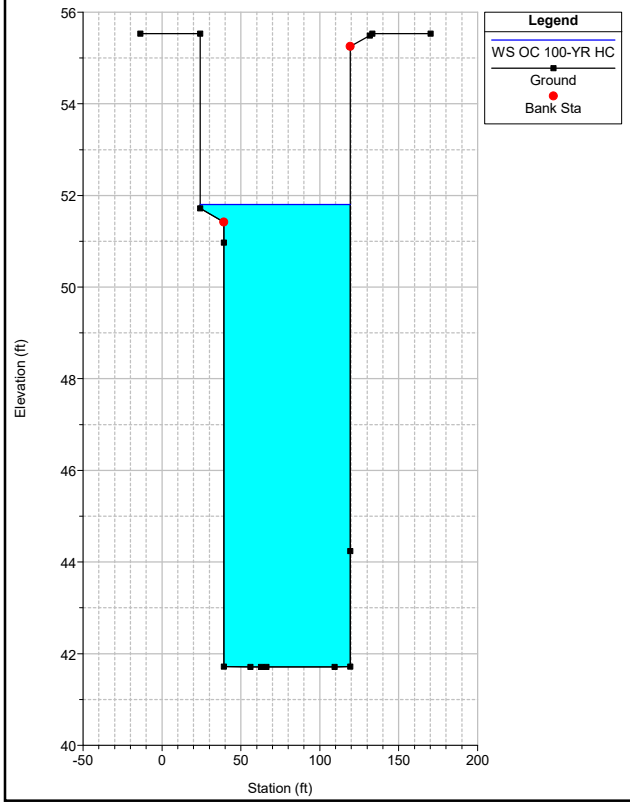
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42845



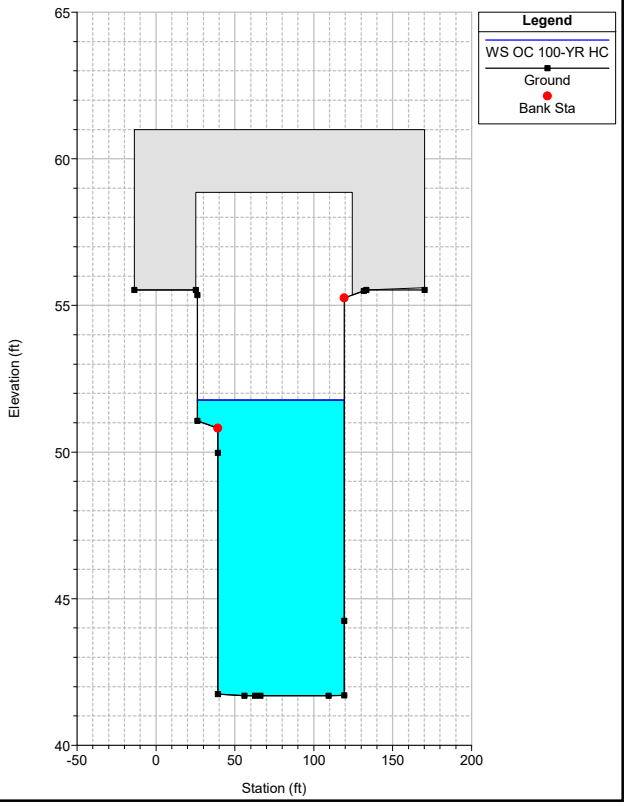
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42794



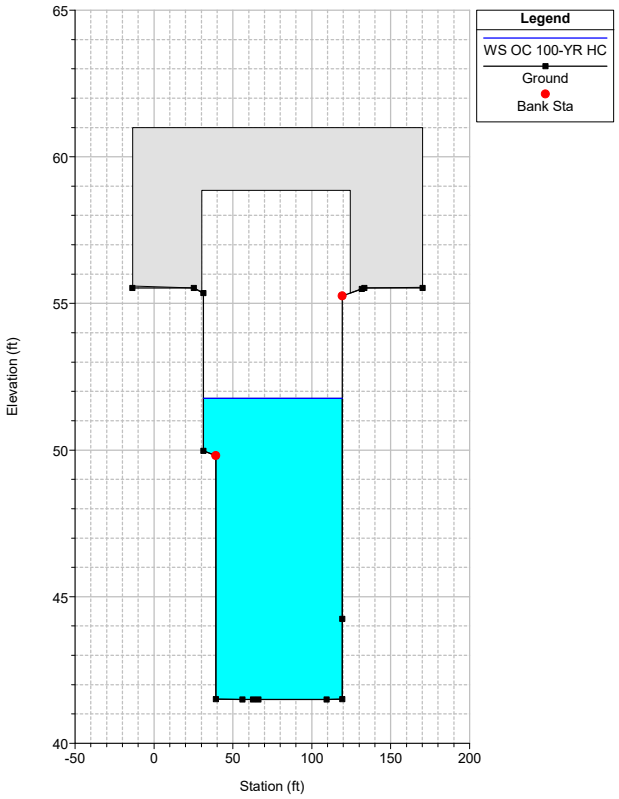
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42765



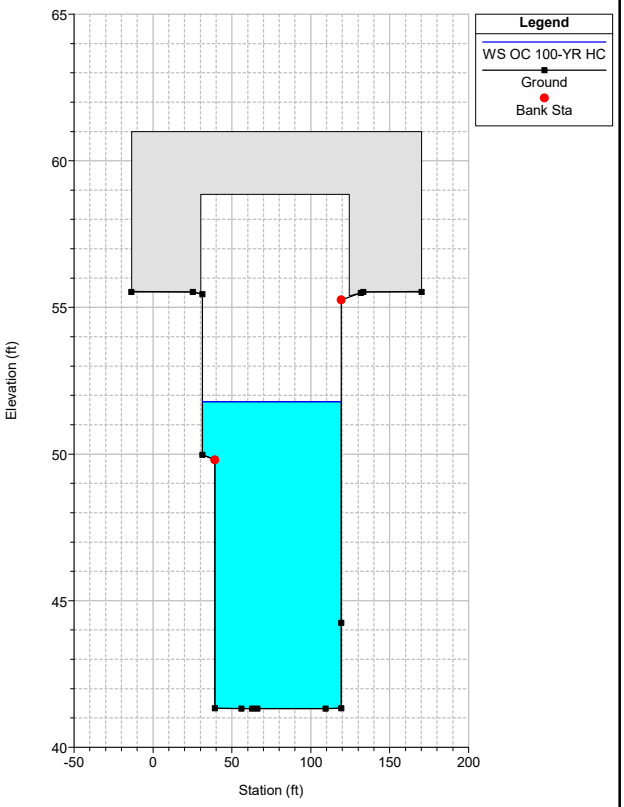
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42752



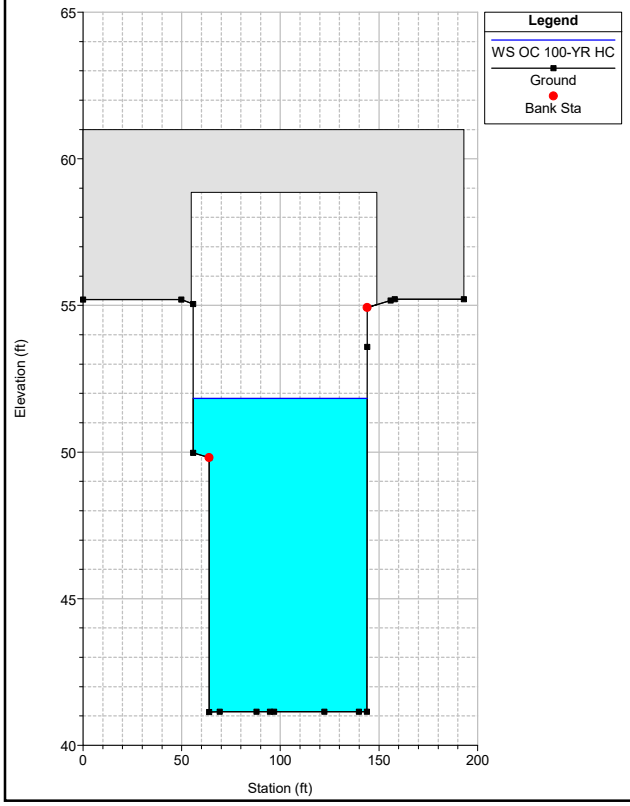
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42720



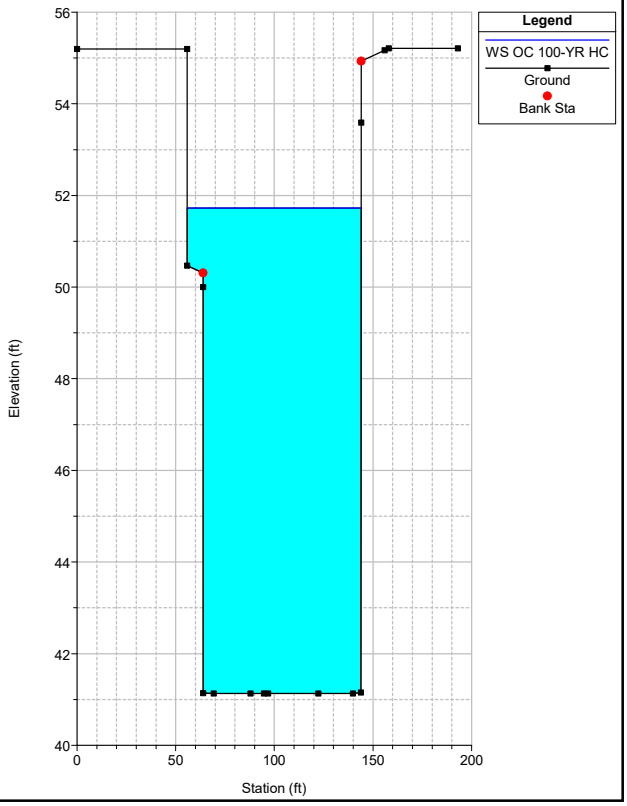
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42656



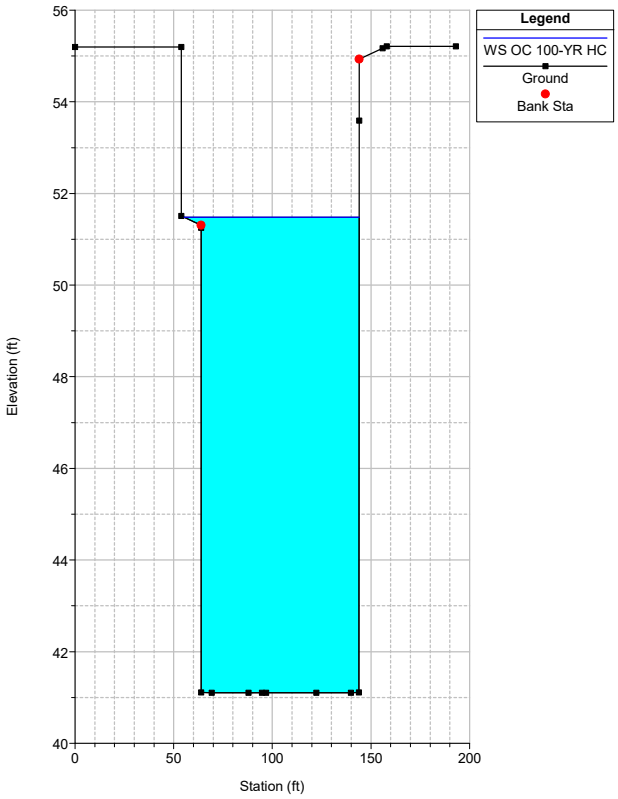
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42594



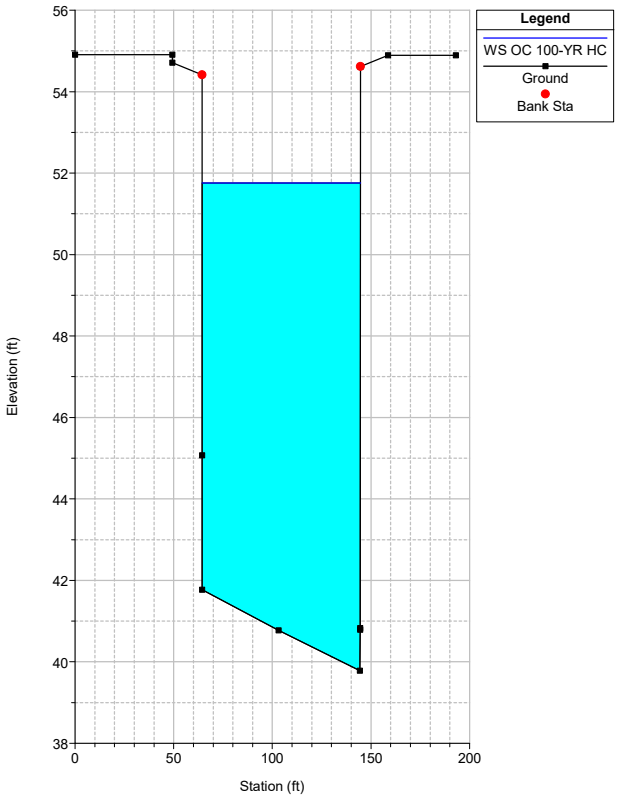
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42576



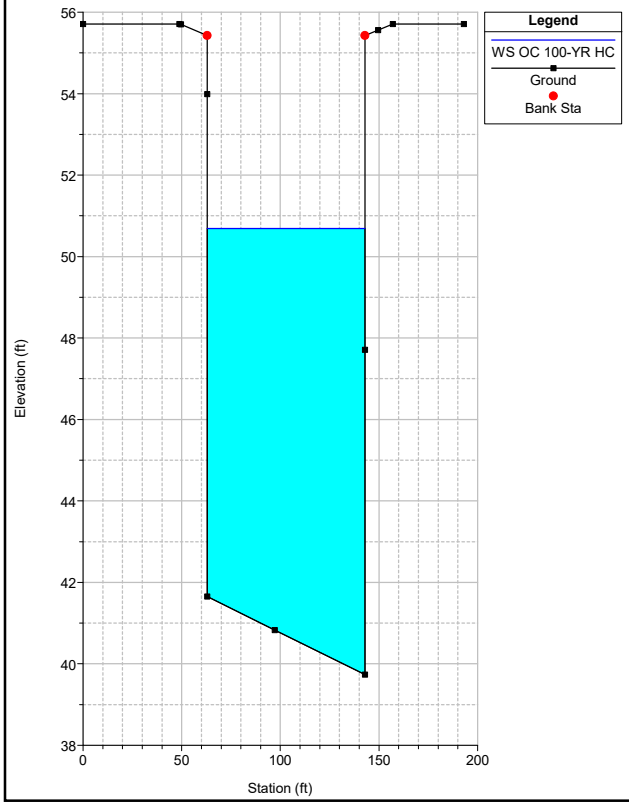
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42555



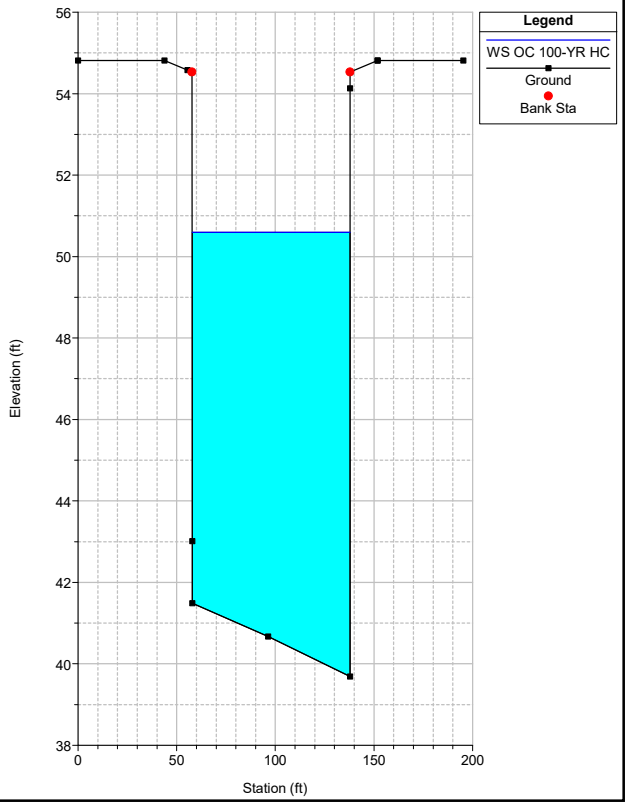
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42493



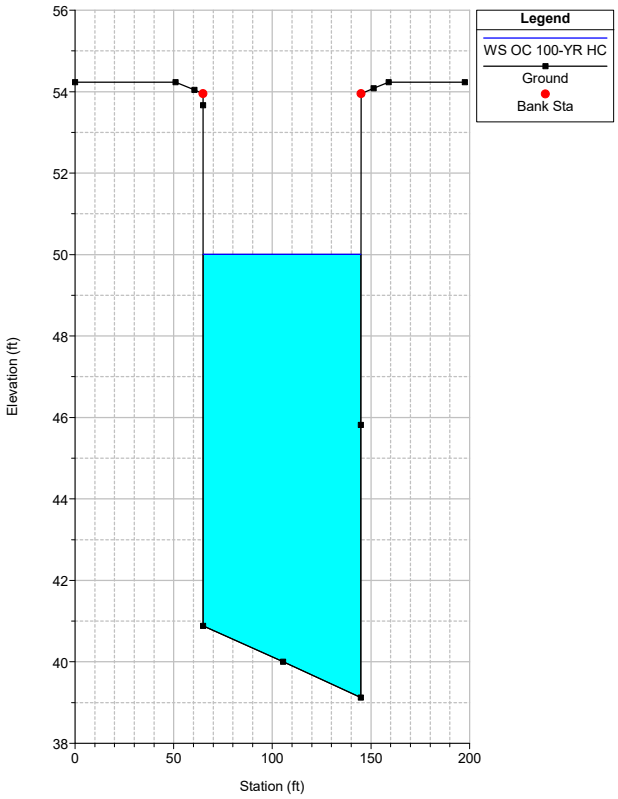
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42444



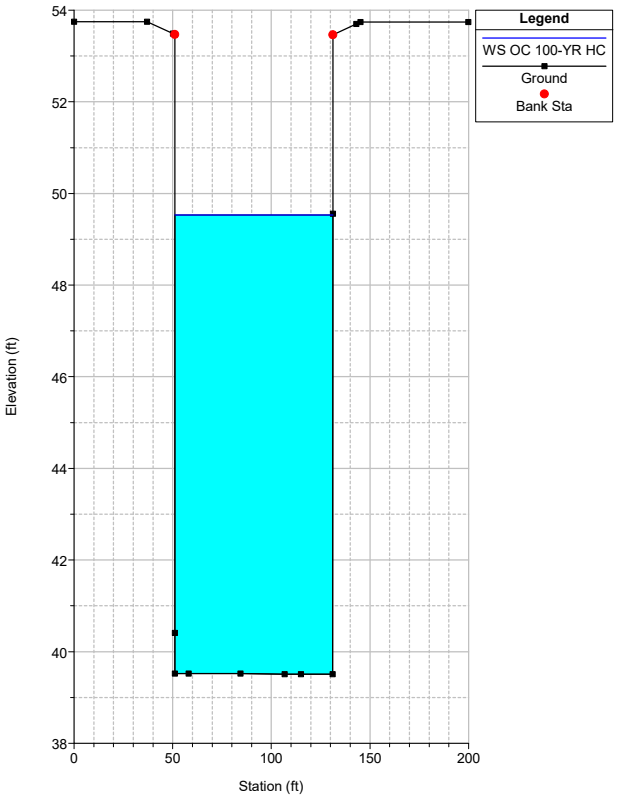
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42396



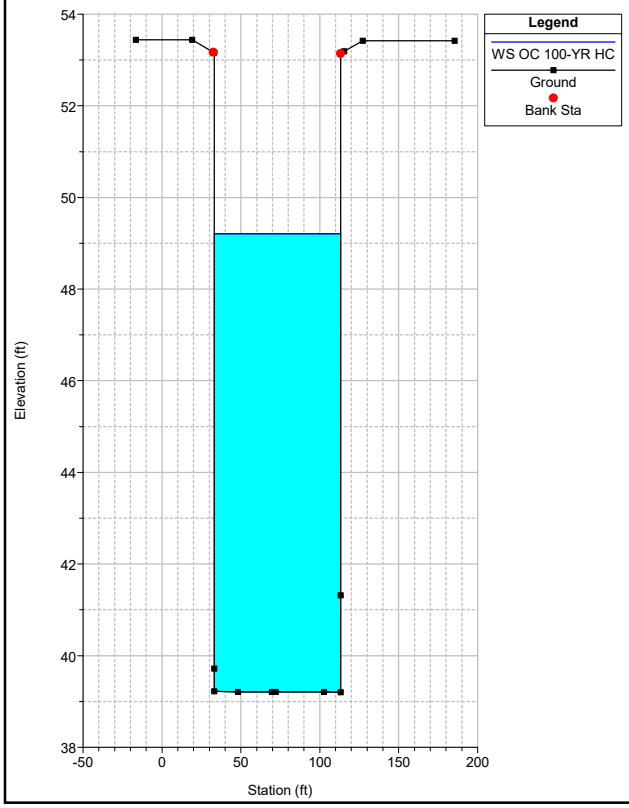
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 42158



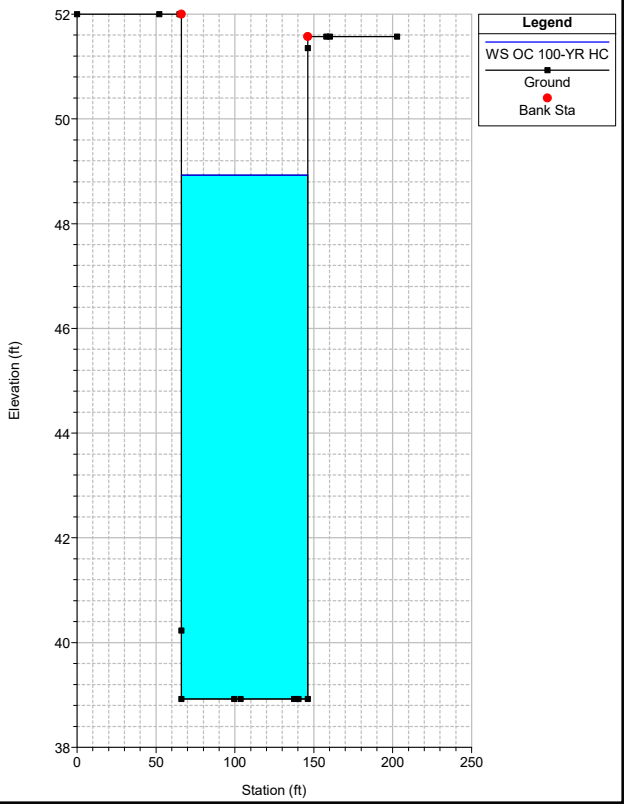
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 41918



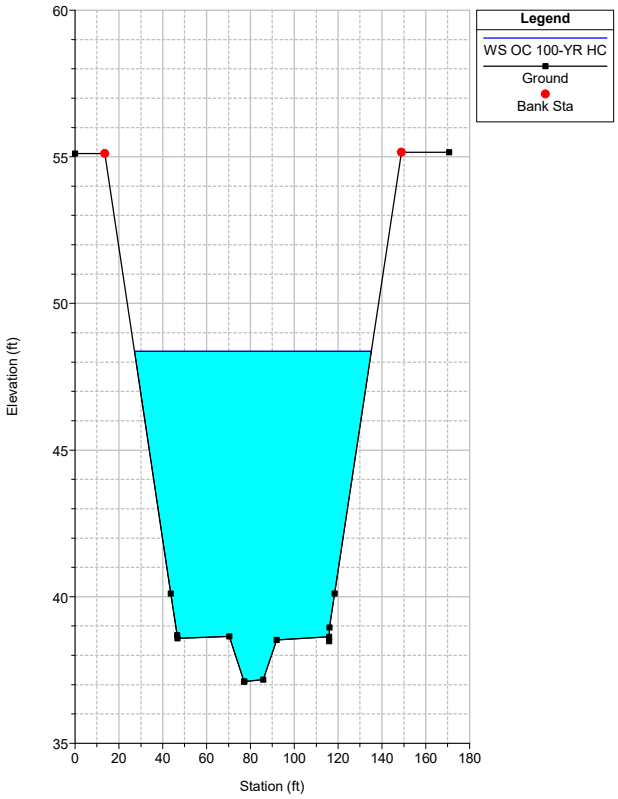
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 41746



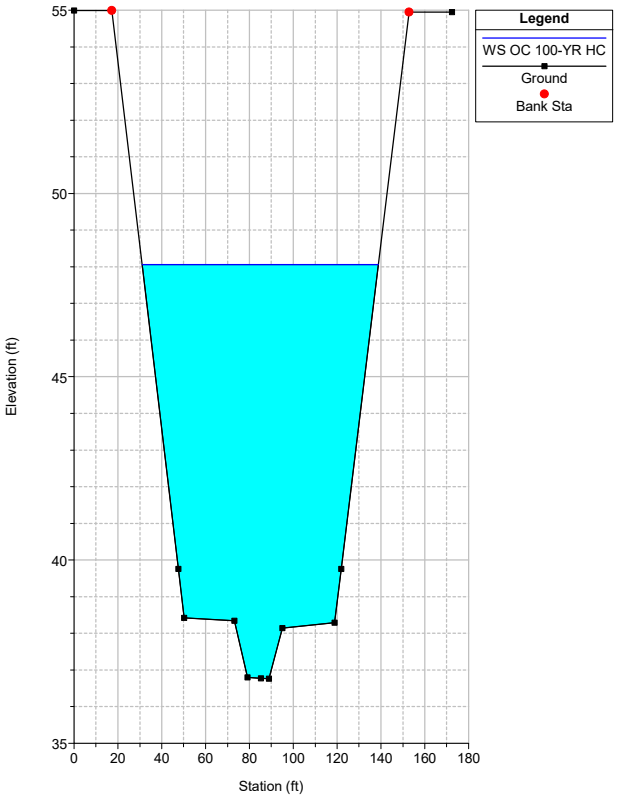
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 41649



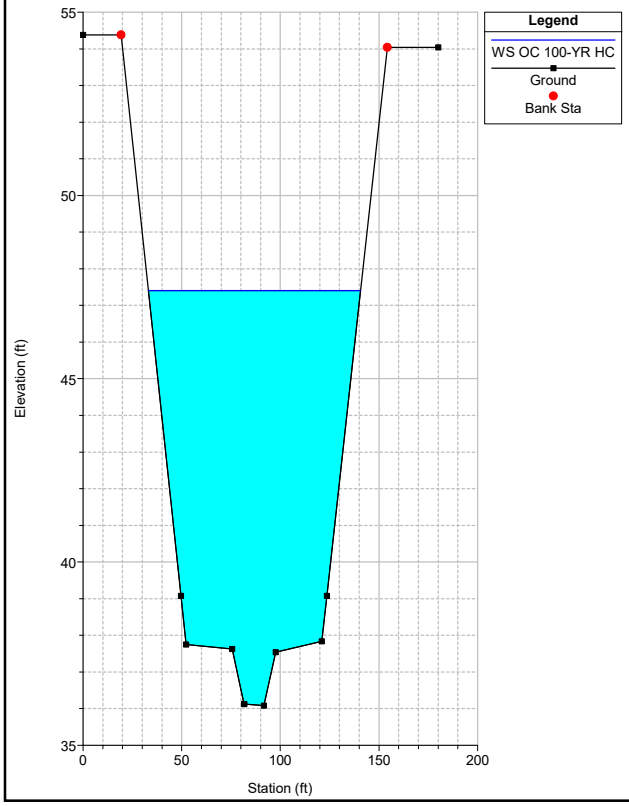
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 41546



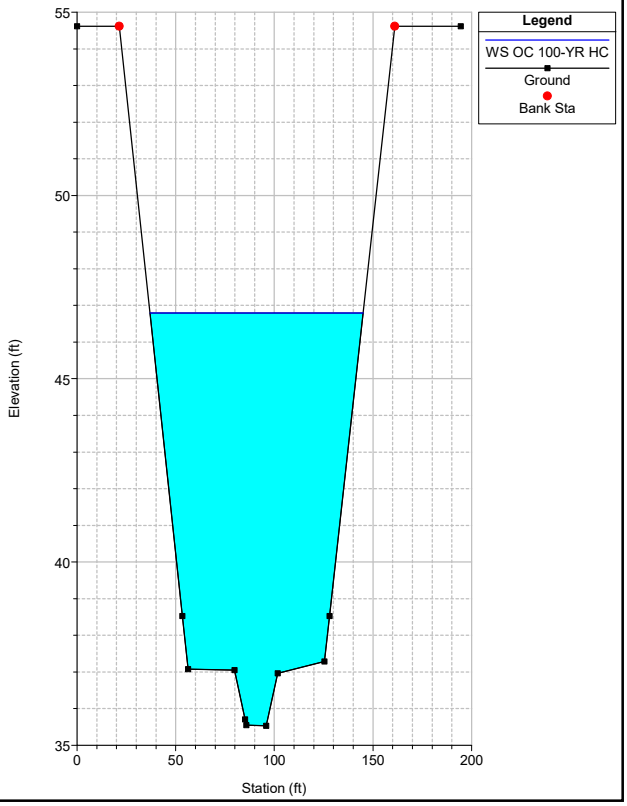
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 41449



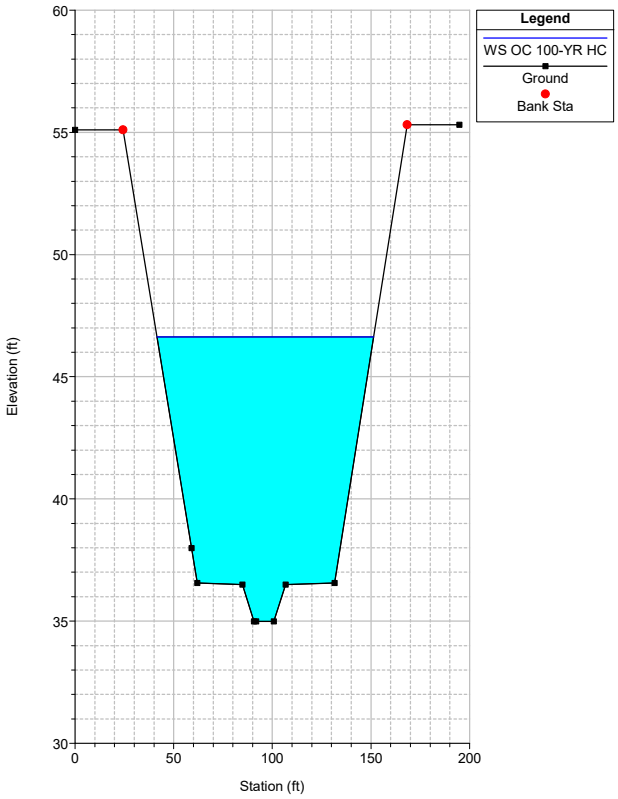
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 41199



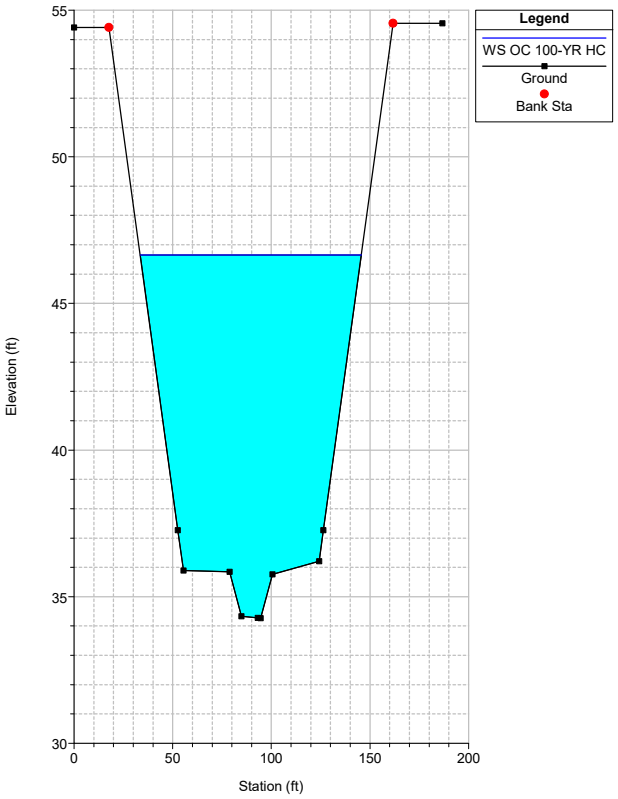
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 40950



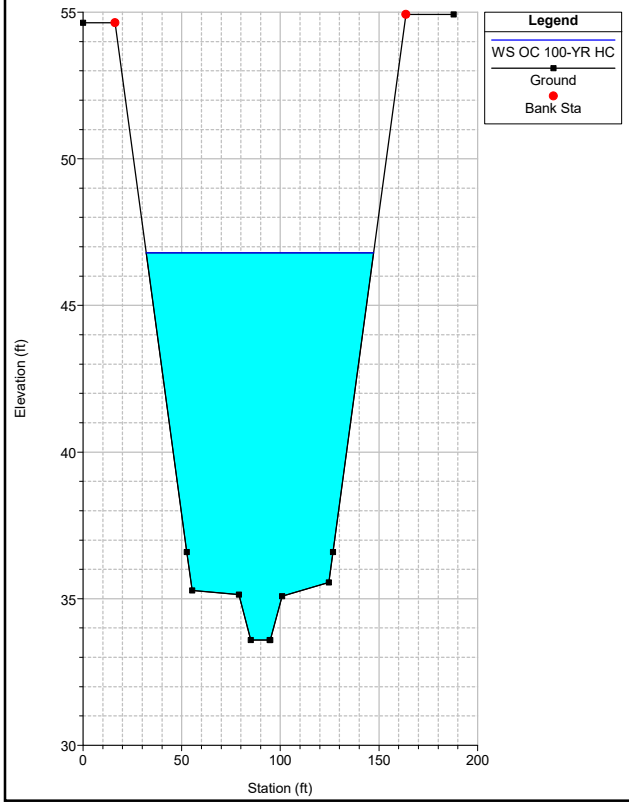
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 40699



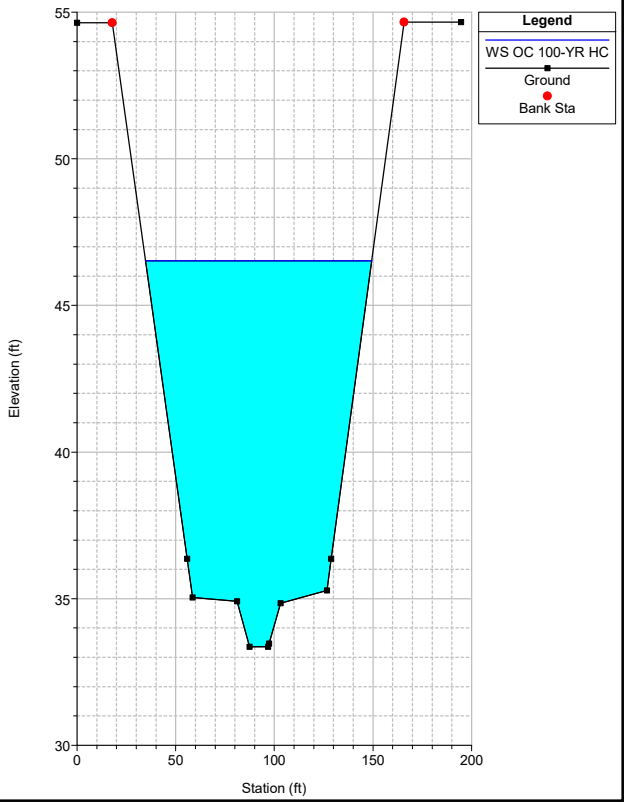
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 40446

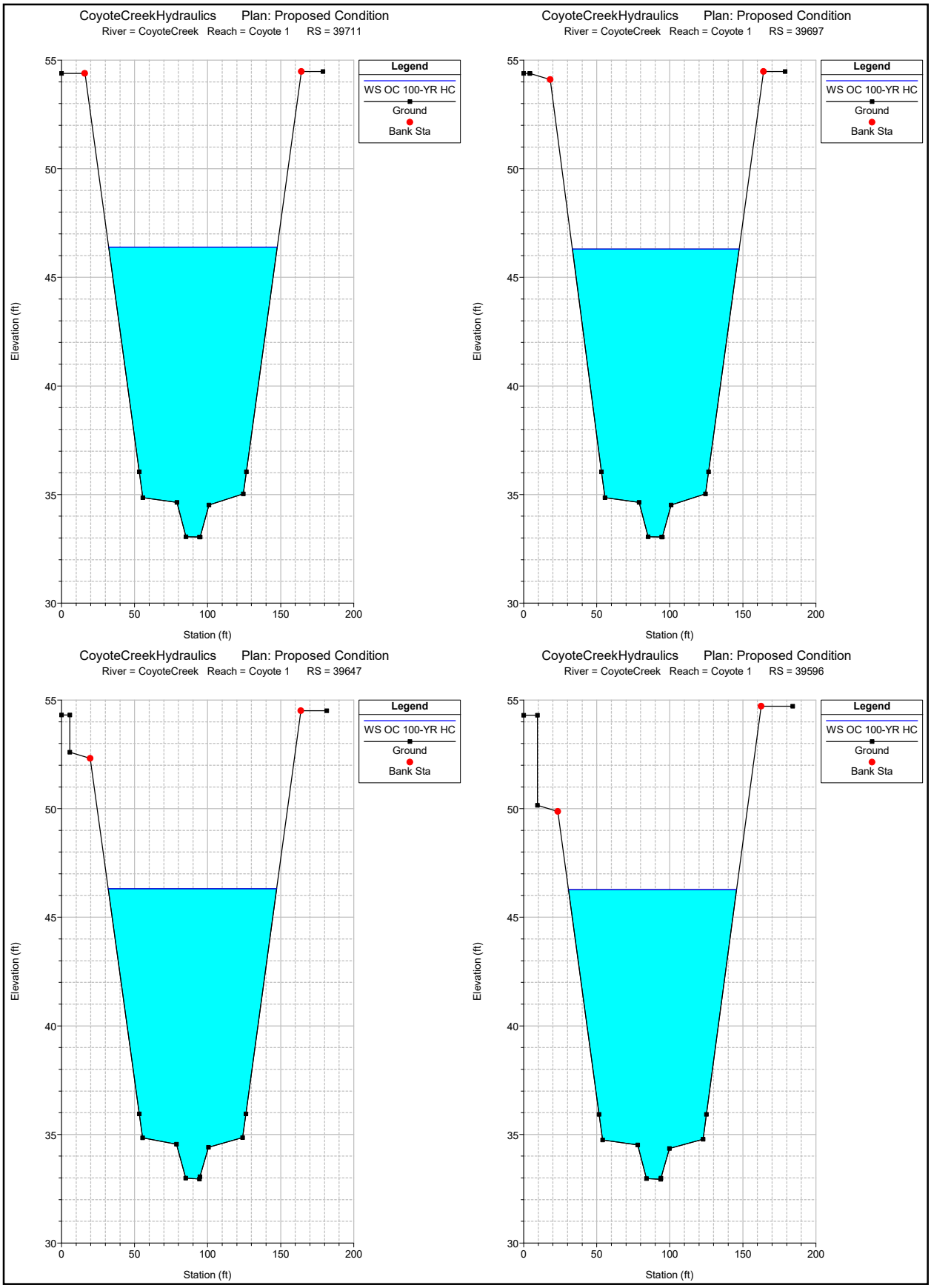


CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 40196

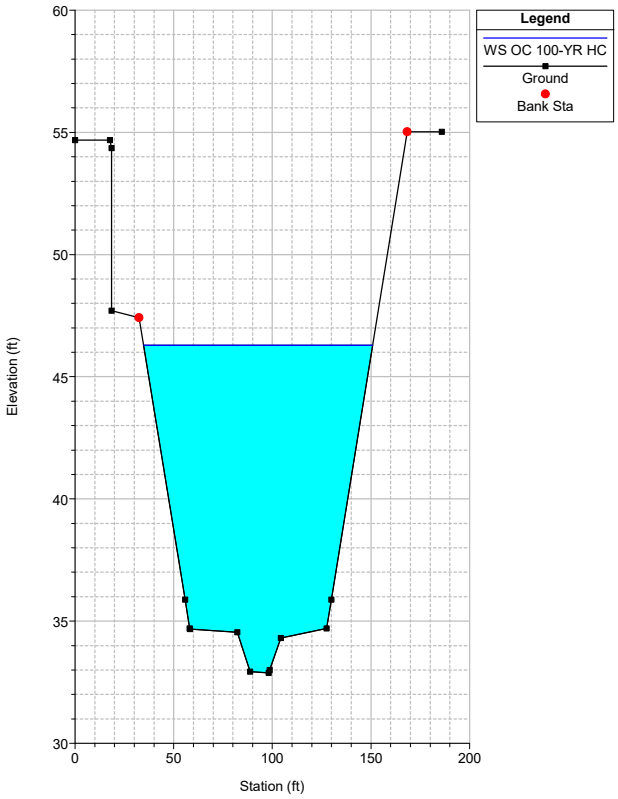


CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39946

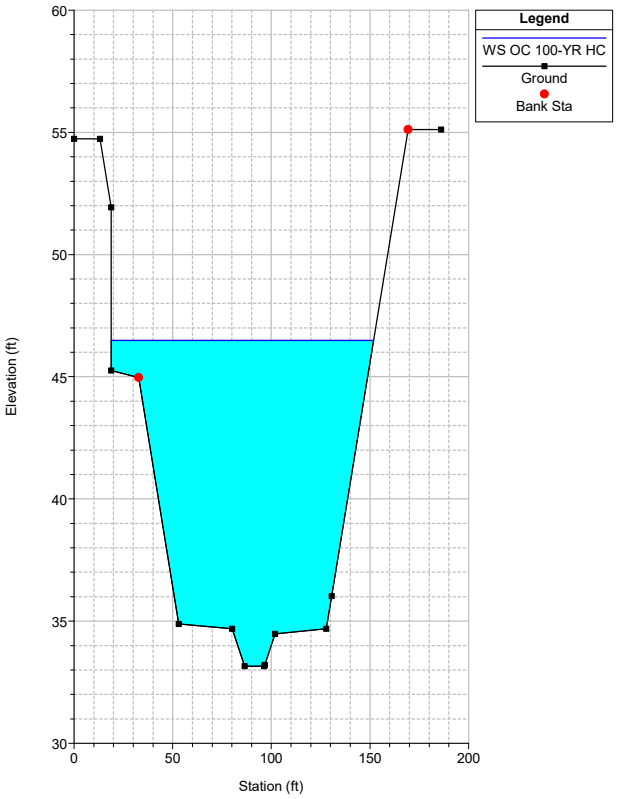



CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39711
Legend
WS OC 100-YR HC
Ground
Bank Sta
Elevation (ft)
Station (ft)
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39697
Legend
WS OC 100-YR HC
Ground
Bank Sta
Elevation (ft)
Station (ft)
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39647
Legend
WS OC 100-YR HC
Ground
Bank Sta
Elevation (ft)
Station (ft)
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39596
Legend
WS OC 100-YR HC
Ground
Bank Sta
Elevation (ft)
Station (ft)

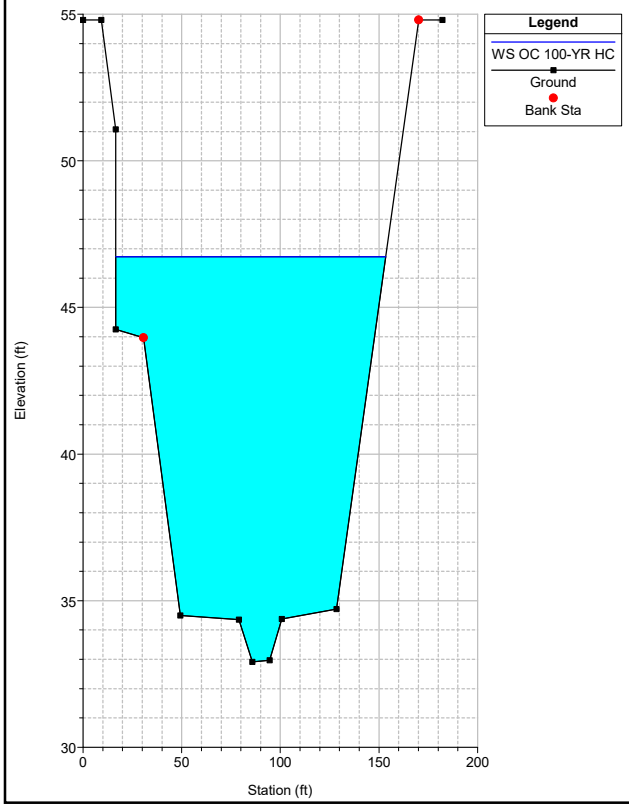
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39548



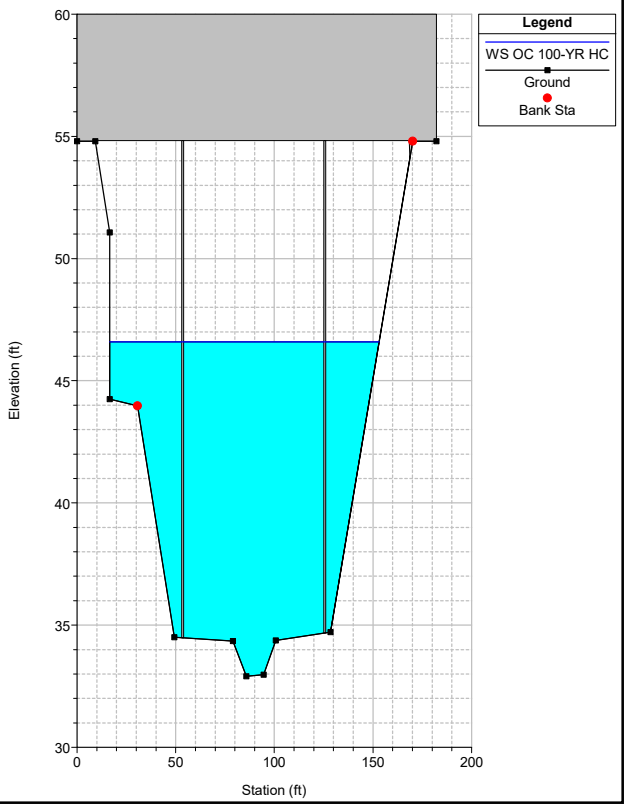
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39498



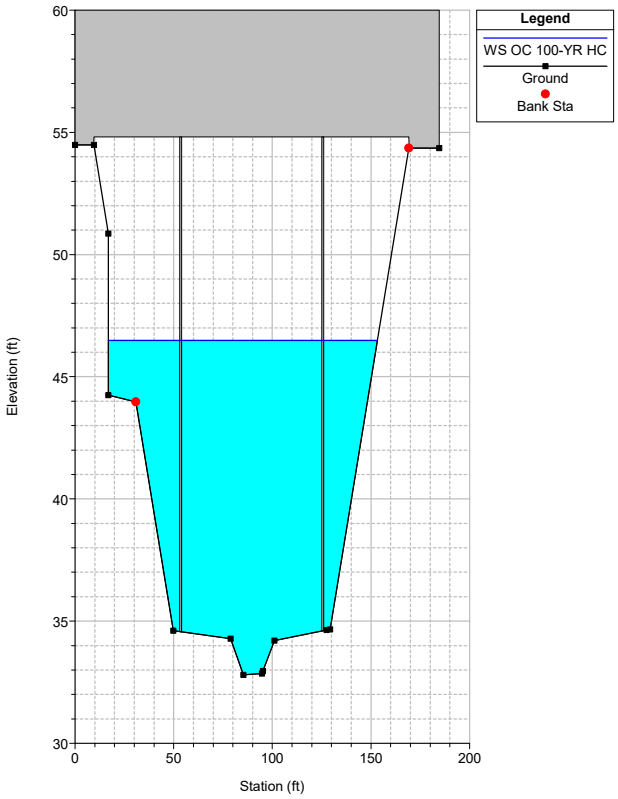
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39458



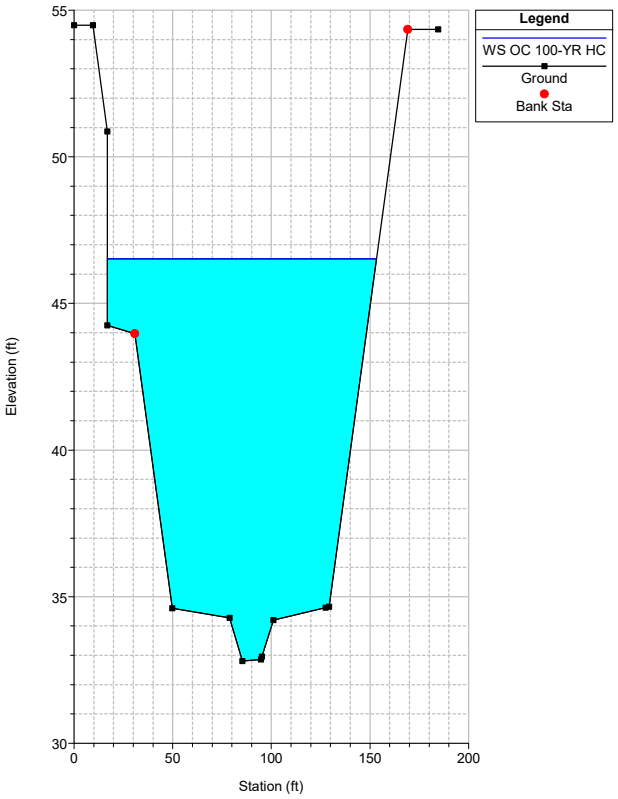
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39401 BR Valley View Street



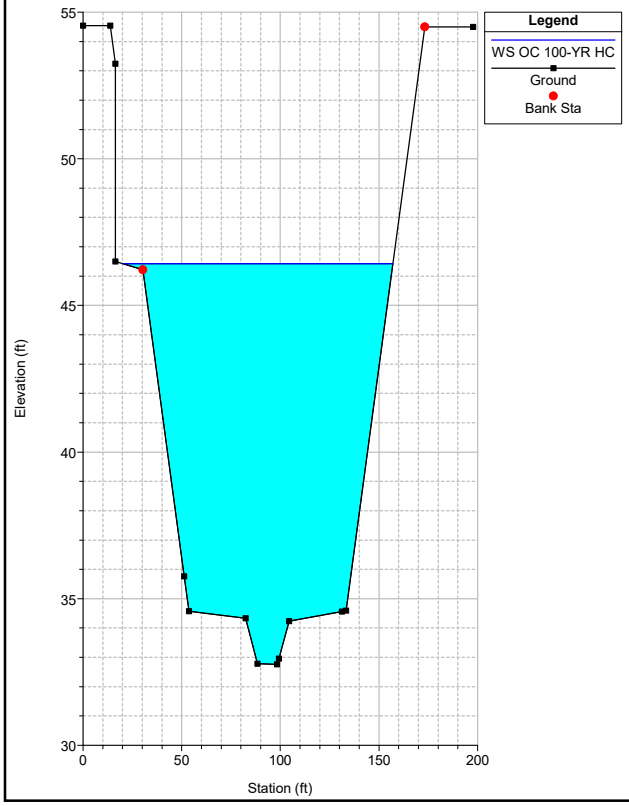
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39401 BR Valley View Street



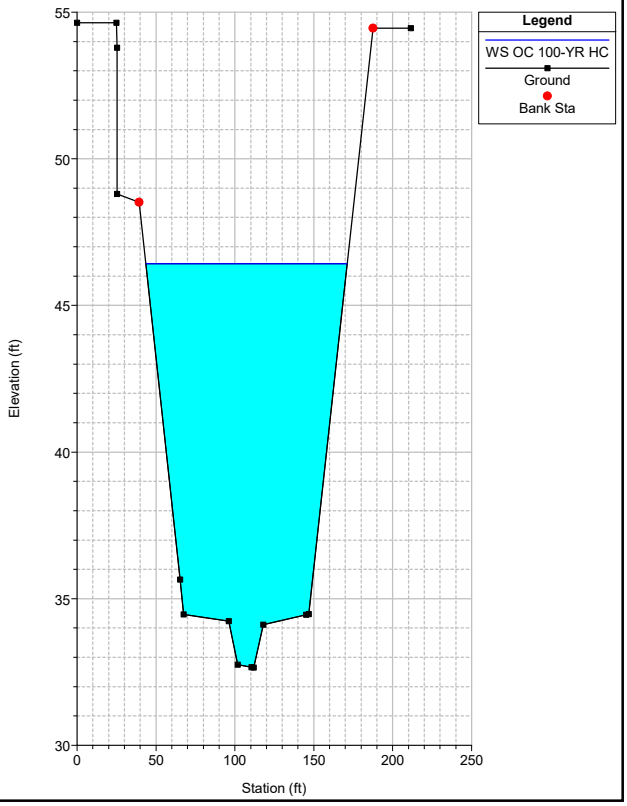
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39319



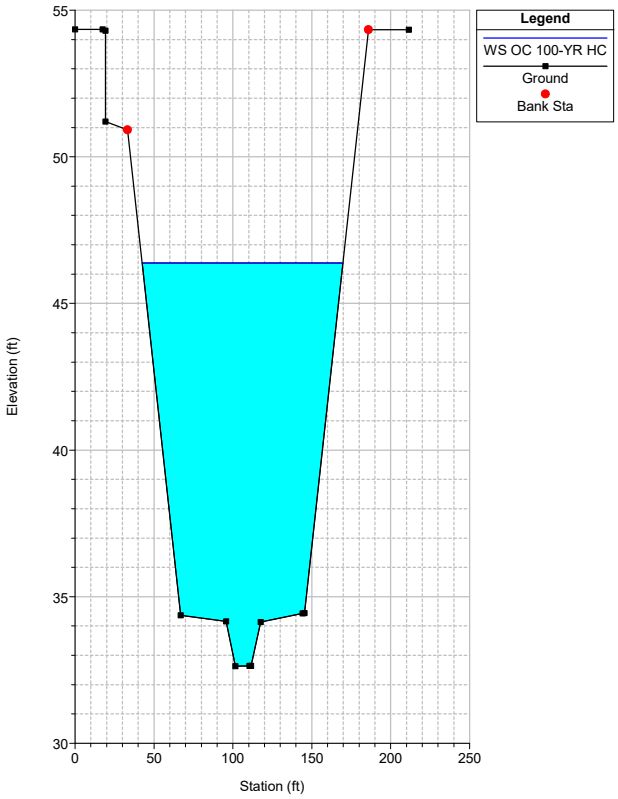
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39273



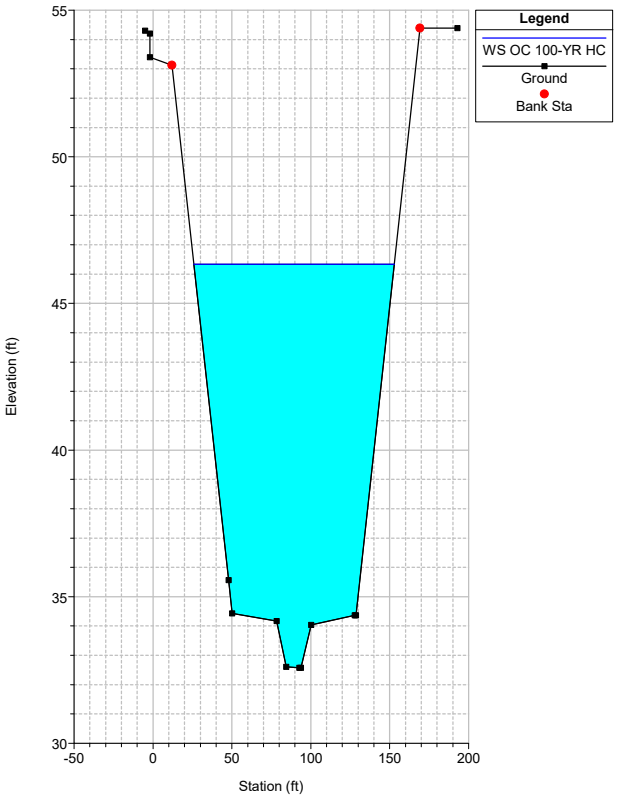
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39226



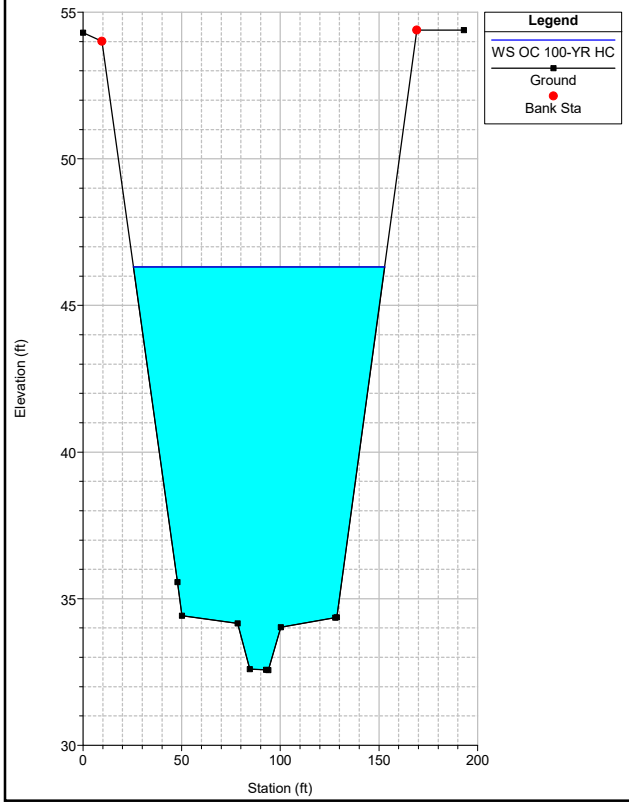
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39177



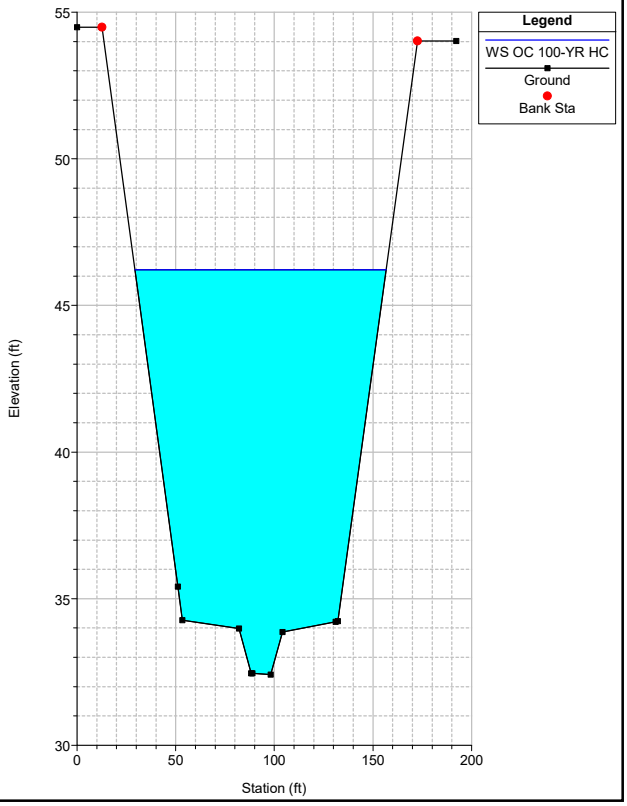
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39132

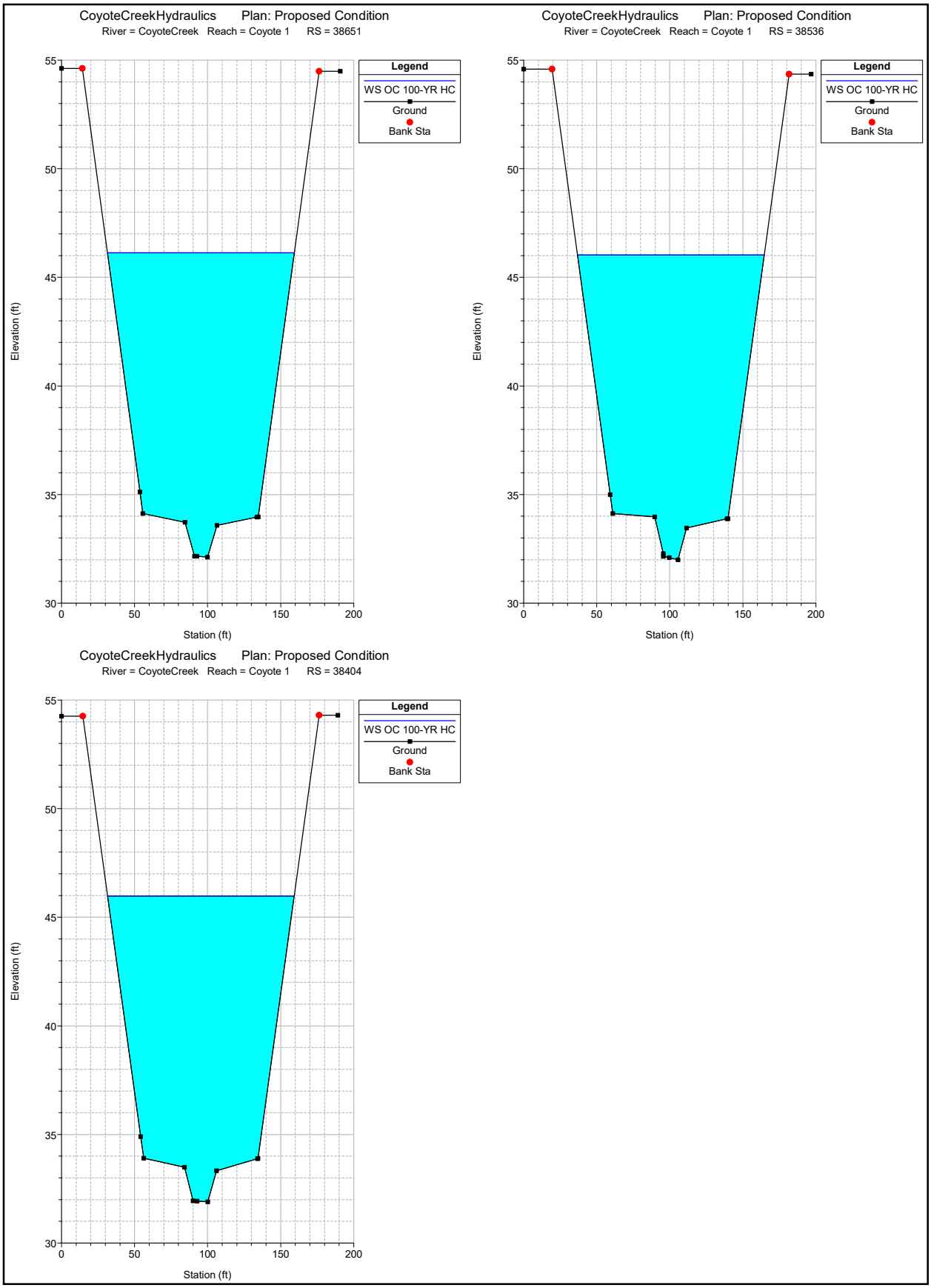


CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 39097



CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 38891




CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 38651
Legend
WS OC 100-YR HC
Ground
Bank Sta
Elevation (ft)
Station (ft)
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 38536
Legend
WS OC 100-YR HC
Ground
Bank Sta
Elevation (ft)
Station (ft)
CoyoteCreekHydraulics Plan: Proposed Condition
River = CoyoteCreek Reach = Coyote 1 RS = 38404
Legend
WS OC 100-YR HC
Ground
Bank Sta
Elevation (ft)
Station (ft)

about GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

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