Appendix G

Technical Appendix for Hydrology and Water Quality

Appendix G1

Preliminary Hydrology Calculations



Thienes Engineering, Inc.

PRELIMINARY HYDROLOGY CALCULATIONS

FOR

SOUTH BAY INDUSTRIAL CENTER REDONDO BEACH BLVD. AND VERMONT AVE. LOS ANGELES, CALIFORNIA

PREPARED FOR

PROLOGIS, INC. 3546 CONCOURS STREET, SUITE 100 ONTARIO, CALIFORNIA 91764 PHONE: (909) 673-8700 FAX: (909) 673-8702

> OCTOBER 28, 2016 REVISED AUGUST 5, 2019

> > JOB NO. 3491

PREPARED BY

THIENES ENGINEERING 14349 FIRESTONE BOULEVARD LA MIRADA, CALIFORNIA 90638 (714) 521-4811

PRELIMINARY HYDROLOGY **CALCULATIONS**

FOR

SOUTH BAY INDUSTRIAL CENTER

PREPARED BY ED TOLEDANES UNDER THE SUPERVISION OF

REINHARD STENZEL DATE: R.C.E. 56155 EXP. 12/31/20

INTRODUCTION

A: PROJECT LOCATION

The project site is located at the northeast corner of Redondo Beach Boulevard and Vermont Avenue in the City of Los Angeles. Please see next page for vicinity map.

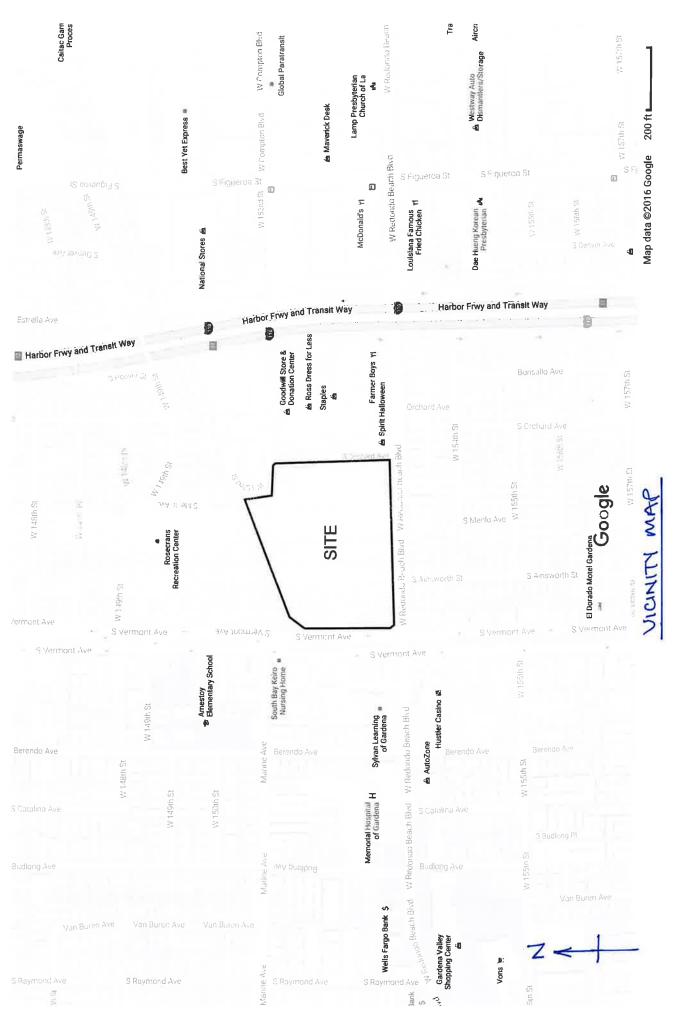
B: STUDY PURPOSE

The purpose of this study is to determine the 50-year peak flow rate from the project site that ultimately drains to Project No. 74, a Los Angeles County maintained storm drain adjacent to the northeast corner of the site.

C: PROJECT STAFF:

Thienes Engineering staff involved in this study include:

Reinhard Stenzel, PE Ricky Hwa Eduardo Toledanes



Google Maps

DISCUSSION

The project site encompasses approximately 15.05 acres. Proposed improvements to the project site consist of one commercial type building of 315,400 square feet. There will be a truck yard on the north side of the building, underground chambers for water quality purposes and vehicle parking lots on the east, south and west sides of the building. The remainder of the site will be reserved for landscaping.

County Hydrology

Per county hydrology data, the project site is located in Subareas 146, 147, 148 and 149, which are tabled to Project No. 74, a County maintained 93-inch storm drain adjacent to the northeast corner of the site. Allowable discharge from the project site to Project No. 74 is 1.15 cfs per acre. Please see Appendix "A" for County hydrology, as-built storm drain plans and other pertinent reference materials.

Existing Condition

The project site currently consists of paved parking lots and several demolished warehouse type buildings.

Proposed Condition

The north half of the proposed building, the northerly truck yard, the north-westerly drive aisle and the westerly parking lot (Subareas 1A-2A, 9.70 acres) drain to catch basins in the drive aisle and truck yard. Runoff is then conveyed northerly via a proposed storm drain system to Project No. 74. The 50-year peak flow rate from these areas is approximately 20.1 cfs.

The south half of the proposed building, the southerly and easterly parking lots (Subareas 3A-4A, 4.90 acres) drain to catch basin in the parking lots. Runoff is then conveyed northerly via the same proposed storm drain system to Project No. 74. The 50-year peak flow rate from these areas is approximately 11.4 cfs (10.0 cfs from Subarea 3A + 1.4 cfs from Subarea 4A).

The total proposed condition 50-year peak flow rate from the project site tributary to Project No. 74 via the proposed onsite storm drain system is approximately 31.5 cfs.

The north-easterly entry driveway fronting Orchard Avenue including the northwesterly portion of Orchard Avenue (Subarea 2B, 0.50 acres) will surface drain to a proposed catch basin north of the driveway and conveyed to the existing 93" R.C.P. public storm drain northeast of the project site. The 50-year peak flow rate at this location is

approximately 1.2 cfs. The westerly landscape area fronting Vermont Avenue including the southerly landscaped area adjacent to Redondo Beach Boulevard (Subarea 1B, 0.45 acres) will surface drain to Redondo Beach Boulevard. The 50-year peak flow rate from these areas is approximately 0.8 cfs.

See Appendix "B" for proposed condition hydrology calculations and Appendix "E" for proposed condition hydrology map.

Detention

The proposed condition 50-year runoff from the project site (31.5 cfs) to Project No. 74 is higher than the allowable discharge $(15.05 \text{ acres } x \ 1.15 \text{ cfs/acre} = 17.3 \text{ cfs})$. Detention in the northerly truck yard will be utilized to reduce overall proposed condition site discharge to below the allowable discharge.

Per detention calculations, approximately 5.1 cfs out of the proposed condition runoff tributary to the truck yard (20.1 cfs in Subareas 1A-2A) will be allowed to discharge via the proposed storm drain system. The remaining runoff of 15.0 cfs or 14,828 cubic feet will be detained in the truck yard at a depth of 1.27 ft or 48.20 W.S.E. Runoff from the remainder of the site (10.0 cfs from Subarea 3A + 1.4 cfs from Subarea 4A) will be allowed to discharge undetained via the proposed storm drain system. With detention in the truck yard, the total proposed condition 50-year discharge from the project site will be 16.5 cfs (5.1 cfs from Subareas 1A-2A + 10.0 cfs from Subarea 3A + 1.4 cfs from Subarea 4A), which is less than the allowable discharge of 17.3 cfs.

See Appendix "D" for detention analysis.

Methodology

Hydrology and hydrograph were computed using the L.A.C.D.P.W. HydroCalc calculator. The soil type is 16 and the rainfall is 5.9" per the Los Angeles County Hydrology Manual. See Appendix "A" for pertinent reference materials.

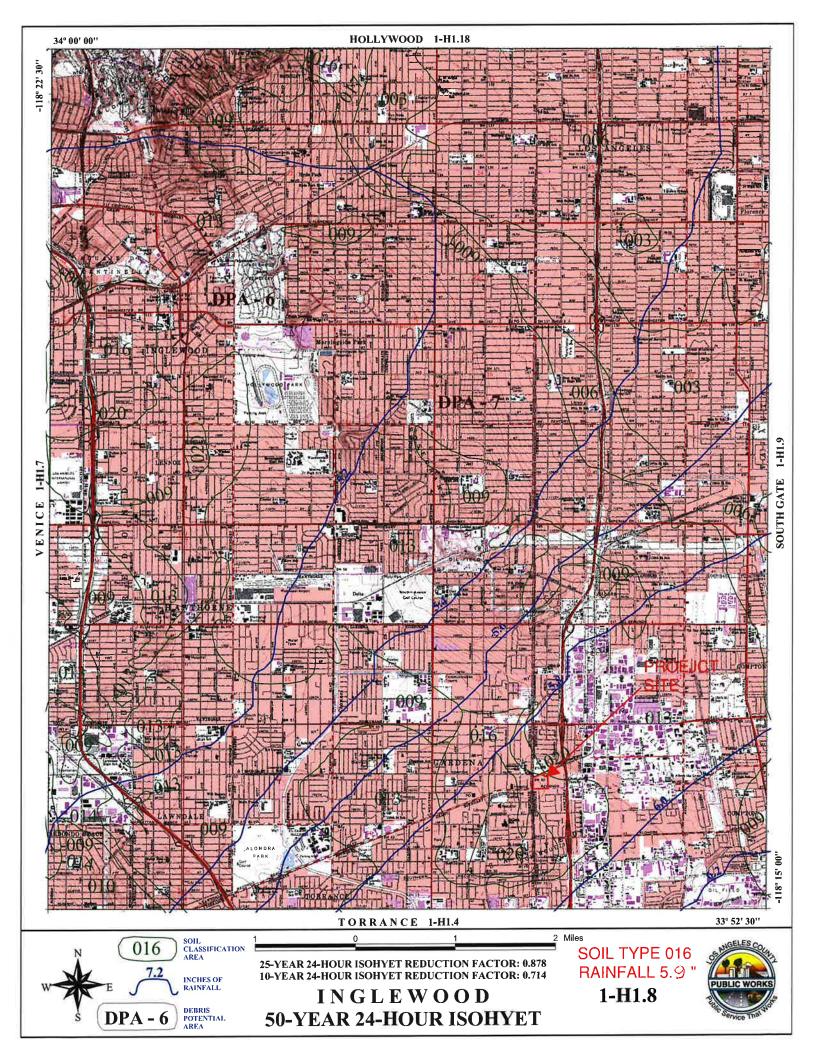
APPENDIX

DESCRIPTION

Α	REFERENCE MATERIALS
В	HYDROLOGY CALCULATIONS
С	HYDRAULIC CALCULATIONS
D	DETENTION ANALYSIS
Ε	HYDROLOGY MAP

APPENDIX A

REFERENCE MATERIALS





LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS DESIGN DIVISION – HYDRAULIC ANALYSIS UNIT

Office Use Only Office Use Only Sent Initials: Fax Xemail Other: ______ Date: ______

INFORMATION REQUEST SUMMARY

Company: Thienes En	gineering, Inc			
*Phone Number: 714-5	521-4811 Fa	x Number: 7	14-521-4173	
*Email: Angie@Thiene	sEng.com			
Method of Contact: 🗌 Walk-in	Phone Fax	K Email	🗋 Prelim. Mtg.	Date: <u>9/14/2016</u>
Intended Use: Research				
Proposed Project Type: Industri	al		Acreage	Involved:
. , , ,				
*Will information be used in any Case Info. Name: INFORMATION REQUESTED (Attach Assessor Ma	No:	L	ocation:
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BELOW SECTION TO BE COMPLETED BY THE HYDRAULIC ANALYSIS UNIT

INFORMATION PROVIDED: Allowable q per acre. BI 74 Hydraulic and hydrologic calculation.	as built, hydrology map
REFERENCES SEARCHED: BI 74 Hydrology and hydr	DETOS ANGELLO
COMMENTS, ETC: Allowable q per acre = 1.15	DESIGN DIVISION Hydraulic Analysis Unit RECORD DICUMENT Issued
INFORMATION PROVIDED BY: Ambrose C Ajaelo PE	
INFORMATION REVIEWED BY:	Date:
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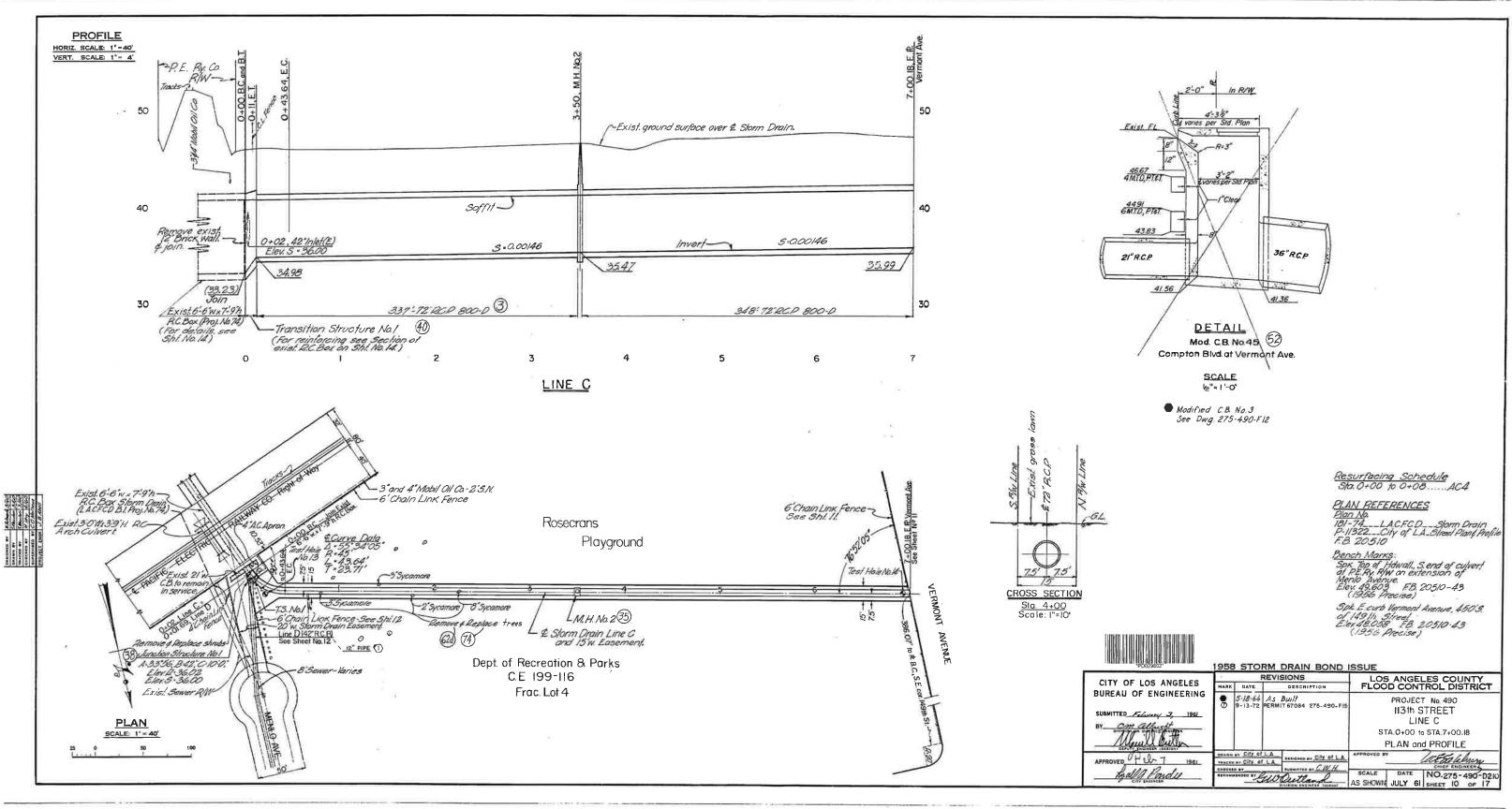
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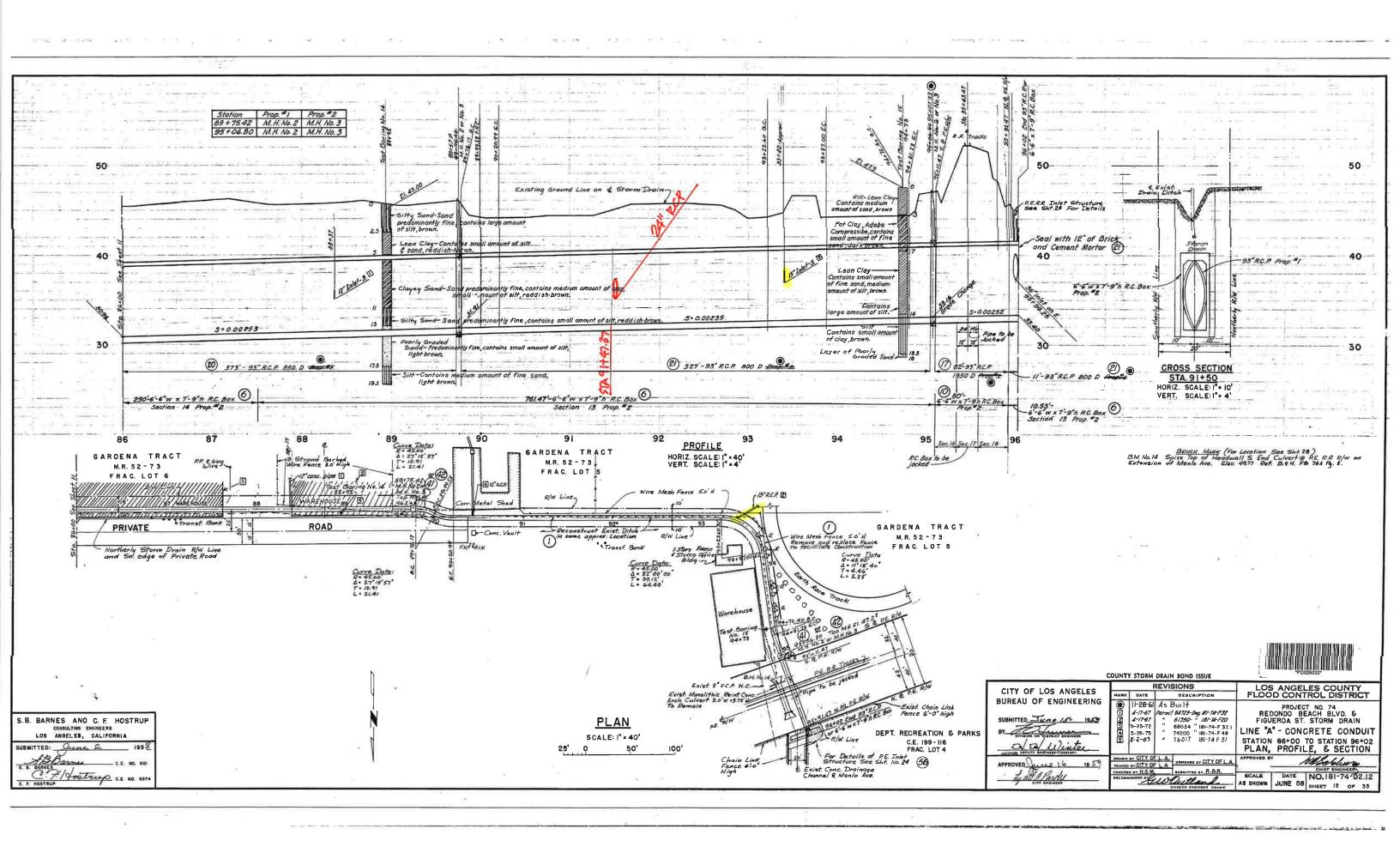
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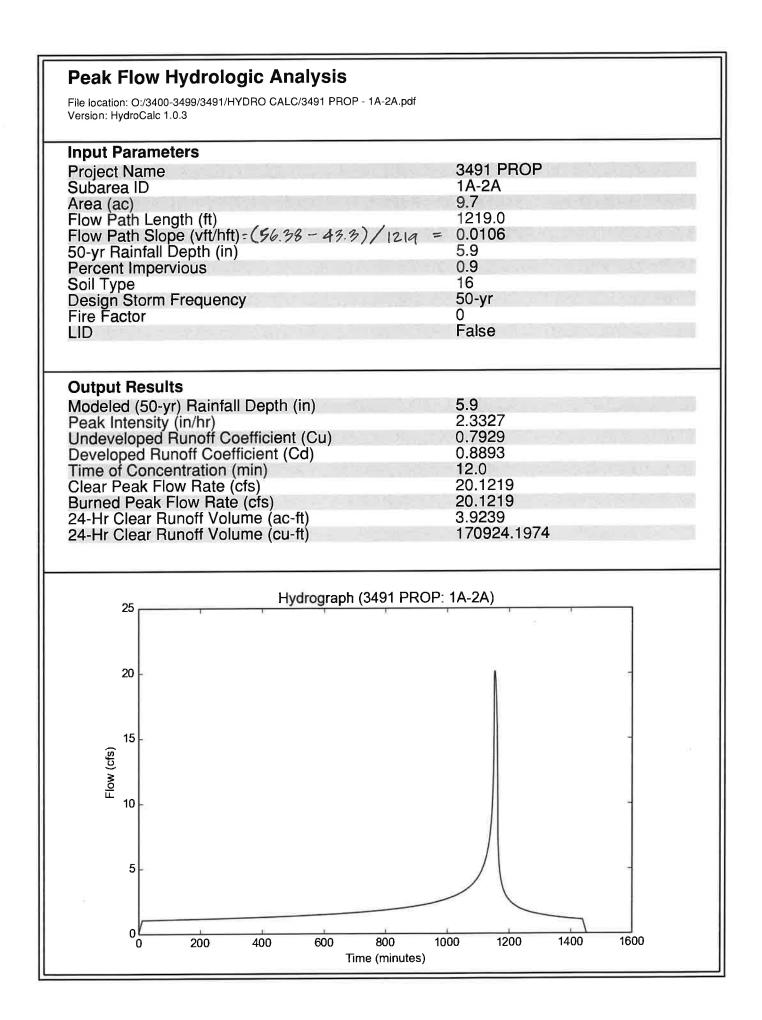


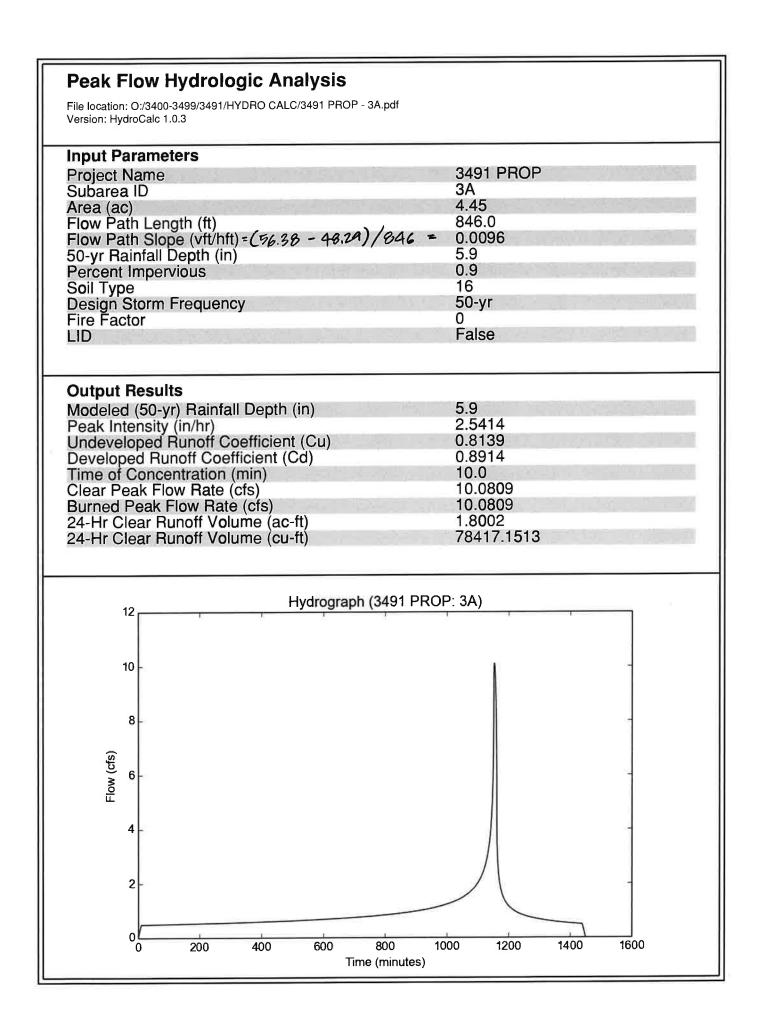
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APPENDIX B

HYDROLOGY CALCULATIONS





Peak Flow Hydrologic Analysis

File location: O:/3400-3499/3491/HYDRO CALC/3491 PROP - 4A.pdf Version: HydroCalc 1.0.3

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Input Parameters	0401 BBOB
Project Name	3491 PROP
Subarea ID	4A
Area (ac)	0.45
Flow Path Length (ft)	289.0
Flow Path Slope (vft/hft) = (49.96 - 47.87)/ 289 =	0.0072
50-yr Rainfall Depth (in)	5.9
Percent Impervious	0.9
Soil Type	16
Design Storm Frequency	50-yr
Fire Factor	0
LID	False
Output Results	5.0
Modeled (50-yr) Rainfall Depth (in)	5.9 3.5201
Peak Intensity (in/hr) Undeveloped Runoff Coefficient (Cu)	0.8761
Developed Runoff Coefficient (Cd)	0.8976
Developed Runoff Coefficient (Cd)	5.0
Time of Concentration (min)	1.4218
Clear Peak Flow Rate (cfs)	1.4218
Burned Peak Flow Rate (cfs) 24-Hr Clear Runoff Volume (ac-ft)	0.1821
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24-Hr Clear Runoff Volume (cu-ft)	7930.4878
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24-Hr Clear Runoff Volume (cu-ft) Hydrograph (3491 PRO	7930.4878
24-Hr Clear Runoff Volume (cu-ft) 1.6 1.6 1.4 -	7930.4878
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24-Hr Clear Runoff Volume (cu-ft) 1.6 1.4 1.2 1.0	7930.4878
24-Hr Clear Runoff Volume (cu-ft) 1.6 1.4 1.2 1.0	7930.4878
24-Hr Clear Runoff Volume (cu-ft) Hydrograph (3491 PRO 1.4 1.2 1.0 (S) 0.8 	7930.4878
24-Hr Clear Runoff Volume (cu-ft) 1.6 1.4 1.2 1.0	7930.4878
24-Hr Clear Runoff Volume (cu-ft) Hydrograph (3491 PRO 1.4 1.2 1.0 (S) 0.8 	7930.4878
24-Hr Clear Runoff Volume (cu-ft) Hydrograph (3491 PRO 1.4 1.2 1.0 (S) 0.8 	7930.4878
24-Hr Clear Runoff Volume (cu-ft) 1.6 1.4 1.2 1.0 .0.6 .0.7	7930.4878
24-Hr Clear Runoff Volume (cu-ft) Hydrograph (3491 PROI 1.4 1.2 1.0 0.8 0.8 0.6 0.4 -	7930.4878
24-Hr Clear Runoff Volume (cu-ft) 1.6 1.4 1.2 1.0 (S) 0.8 0.6 -	7930.4878
24-Hr Clear Runoff Volume (cu-ft) 1.6 1.4 1.2 1.0 (S) NE 0.8 0.6 0.4 0.2 -	7930.4878
24-Hr Clear Runoff Volume (cu-ft) Hydrograph (3491 PROI 1.4 1.2 1.0 0.8 0.6 0.4 0.2 0.0 0.0 0.0 0.0 0.0 0.0 0.0	7930.4878

Peak Flow Hydrologic Analysis File location: O:/3400-3499/3491/HYDRO CALC/3491 PROP - 1B.pdf Version: HydroCalc 1.0.3 **Input Parameters** 3491 PROP **Project Name** 1B Subarea ID 0.45 Area (ac) Flow Path Length (ft) 1458.0 Flow Path Slope (vft/hft) = (51.97 - 48.46)/1458 =0.0024 50-yr Rainfall Depth (in) 5.9 0.9 Percent Impervious 16 Soil Type 50-yr **Design Storm Frequency** Fire Factor 0 False LID **Output Results** 5.9 Modeled (50-yr) Rainfall Depth (in) Peak Intensity (in/hr) Undeveloped Runoff Coefficient (Cu) 1.9279 0.7459 Developed Runoff Coefficient (Cd) 0.8846 18.0 Time of Concentration (min) Clear Peak Flow Rate (cfs) 0.7674 0.7674 Burned Peak Flow Rate (cfs) 24-Hr Clear Runoff Volume (ac-ft) 0.182 7928.5568 24-Hr Clear Runoff Volume (cu-ft) Hydrograph (3491 PROP: 1B) 0.8 0.7 0.6 0.5 ⁻low (cfs) 0.4 0.3 0.2 0.1 0.0 1600 1000 1400 200 400 600 800 1200 0 Time (minutes)

Peak Flow Hydrologic Analysis

File location: O:/3400-3499/3491/HYDRO CALC/3491 PROP - 2B.pdf Version: HydroCalc 1.0.3

Input Parameters		
Project Name	3491 PROP	(OFFSITE)
Subarea ID	2B	
Area (ac)	0.5	
Flow Path Length (ft)	495.0	
Flow Path Slope (vft/hft) = $(49.71 - 46.5)/495 =$	0.0065	1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 -
50-yr Rainfall Depth (in)	5.9	
Percent Impervious	0.1	
Soil Type	16	
Design Storm Frequency	50-yr	
Fire Factor	0	
LID	False	
Output Results	5.9	
Modeled (50-yr) Rainfall Depth (in)	5.9 2.8224	
Peak Intensity (in/hr)	2.8224 0.8357	
Undeveloped Runoff Coefficient (Cu)	0.8421	the second se
Developed Runoff Coefficient (Cd)	8.0	
Time of Concentration (min) Clear Peak Flow Rate (cfs)	1.1884	
Burned Peak Flow Rate (cfs)	1.1884	
24-Hr Clear Runoff Volume (ac-ft)	0.0651	
24-Hr Clear Runoff Volume (cu-ft)	2836.9445	and an interview of
12 Hydrograph (3491 PRO	P: 2B)	
1.2 Hydrograph (3491 PRO	P: 2B)	.4.
1.2	P: 2B)	24
1.2 Hydrograph (3491 PROI 1.0	P: 2B)	-
1.2	P: 2B)	.1.
1.2	P: 2B)	-
1.2	P: 2B)	-
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1.2 1.0 0.8	P: 2B)	
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1.2 1.0 0.8	P: 2B)	-
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1.2 1.0 0.8 (sp) 0.6 1.2 0.8	P: 2B)	
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1.2 1.0 0.8 (sp) 0.6 0.4 0.4	P: 2B)	
1.2 1.0 0.8 (\$) 0.6 0.4 0.2	P: 2B)	
1.2 1.0 0.8 (S) 0.6 0.4 0.2 0.0 0.0 0.0 0.0 0.0 0.0 0.0	P: 2B)	1400 1600

APPENDIX C

HYDRAULIC CALCULATIONS

T2	3491 LINE "A	" (PUBLIC)						
SO	Q50 1003.	88 40.69	24				45.66		
R	1060.				.013		10.00		
JX	1060.			18	.013	1.2	41.46		45.00
R	1113.				.013				
R	1128.	28 41.58	24		.013			22.50	38.50
R	1137.	09 41.63	24		.013				
JX	1137.	09 41.64	24	18	.013	5.1	42.18		90.00
R	1145.	37 41.70	24		.013				
SH	1145.	37 41.70	24						
CD	84			0.67					
CD	12 4			1.00					
CD	18 4			1.50					
CD	24 4			2.00					

□ DATE: 8/ 5 TIME: 11:40	· - · -						515P							_	
			WA	TER SURFA	ACE PRO		ANNEL DEF					_, _, ,	PAG	_	1
CARD SECT CODE NO		NO OF AVE PIERS WID		ER WIDTI			INV Y(1) DROP	Y(2)	Y(3) Y(4	L) Y(5)	Y(6) Y(7) Y(8)	Y(9)	Υ(]	.0)
CD 8 CD 12 CD 18 CD 24	4 4 4 4		0,6 1,0 1,5 2,0	0 0	F	05151	P						PAGE	NO	3
		W Z	TER SURFACE	PROFILE											
UDADING I IN	UR NO 1 T		ILK SURFACE	r cot 100											
HEADING LIN	IE NO I I		3491												
HEADING LIN	NE NO 2 I		5.52												
			LINE "A" (PU	BLIC)											
HEADING LIN	NE NO 3 I	S -													
			Q50		F	05151	P						PAGE	NO	2
		WA	TER SURFACE	PROFILE	- ELEM	ENT CARD	LISTING								
ELEMENT NO) 1 IS	A SYSTEM OU U/S DATA	TLET *	* INVERT	*					W S ELEV					
		U/S DAIA	1003.88	40.69	24					45.66					
ELEMENT NO) 2 IS	A REACH U/S DATA	* STATION 1060.14	* INVERT 41.08	sect 24		N 0.013				RADIUS 0.00	ANGLE 0.00	ANG P 0.0		AN H O
ELEMENT NO) 3 IS	A JUNCTION U/S DATA	* STATION 1060.14	* INVERT 41.09	sect 24	* LAT-1 LAT 18	-2 N 0 0.013	Q3 1.2	Q4 0.0	INVERT-3 41.46	* INVERT-4 0.00		PHI 0.0		
ELEMENT NO	0 4 IS	A REACH U/S DATA	* STATION 1113.16	* INVERT 41.47	* SECT 24		N 0.013				RADIUS 0.00		ANG P 0.0		AN H O
ELEMENT NO	0 5 IS	A REACH U/S DATA	* STATION 1128.28	* INVERT 41.58	* SECT 24		N 0.013				RADIUS 22.50		ANG P 0.0		AN H O
ELEMENT NO	O 6 IS	A REACH U/S DATA	* STATION 1137.09	* INVERT 41.63			N 0.013				RADIUS 0.00		ANG P 0.0		AN H O
ELEMENT NO	O 7 IS	A JUNCTION U/S DATA	* STATION 1137.09	* INVERT 41.64	* SECT 24	* LAT-1 LAT 18	-2 N 0 0.013	Q3 5.1	Q4 0.0	INVERT-3 42.18			PHI 0.0		
ELEMENT NO	O 8 IS	A REACH U/S DATA	* STATION 1145.37	* INVERT 41.70	* SECT 24		N 0.013				RADIUS 0.00	ANGLE 0.00	ANG P 0.0		н иа 0
ELEMENT NO	0 9 IS	A SYSTEM HI U/S DATA			* SECT 24			*		W S ELEV 0.00					
** WARNING	NO. 2 **	OUNTERED-COM * - WATER SU ENGINEERING	MPUTATION IS URFACE ELEVAT	NOW DECT	N IS L	FO	OR EQUALS 515P PROFILE LI		ELEVATION	IN HDWKD	S, W.S.EI	LEV = INV	r + DC	D PAGE	ĩ
		3491 LINE Q50	"A" (PUBLIC)												
STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.		NO . IER	AVBPR
L/ELEM	S0	********	* * * * * * * * * * * * *	*******	*****	SF AVE ********	HF *********	******	*******	NORM DEPT *******	H ********	*******	ZR *****	****	* * * *
				17.7	5.63	0.493	46.153	0.00	1.516		2.00	0.00			0.00
1003.88	40.69	4.970	45.660	± / - /	2.02	.006122	0.34		2.024	1.540			0.00		
	0.00693		46 004	17.7	5.63	0.493	46.497	0.00	1.516		2.00	0.00		0	0.00
1060.14		4.924	46.004	±1.1	2.03	.005721	0.00	5.00	1.010				0.00		
JUNCT STR		F 020	46 100	16.5	5.25	0.428	46.556	0.00	1.465		2.00	0.00		0	0.00
1060.14		5.038	46.128	T0.2	5.40	.005320	0.28	0.00	2	1.430			0.00		
	0.00717	4 0 4 0	46 410	16 5	5.25	0.428	46.838	0.00	1.465	2	2.00	0.00		0	0.00
	41.47	4.940	46.410	16.5	5.45	0.428	46.838	0.00	1.100	1.420			0.00		
	0.00728			16 5	5 25	0.428	46.974	0.00	1.465	2.120	2.00	0.00		0	0.00
1128.28	41.58	4.966	46.546	16.5	5.25		46.974 ae 1	0.00	7.403		2.00	5.00		-	

8.81	0.00568					.005320	0.05			1.581			0.00		
1137.09	41.63	4.963	46.593	16.5	5.25	0.428	47.021	0.00	1.465		2.00	0.00	0.00	0	0.00
JUNCT STR	0.00000					.003929	0.00						0.00		
1137.09	41.64	5.401	47.041	11.4	3.63	0.204	47.245	0.00	1.212		2.00	0.00	0.00	0	0.00
8.28	0.00725					.002539	0.02			1.110			0.00		
1145.37 0.000	41.70	5.362	47.062	11.4	3.63	0.204	47.266	0.00	1.212		2.00	0.00	0.00	0	

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3491		
LINE	"A"	(PUBLIC)
Q50		

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1009.66																- 322	
1012.54																٠	
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1018.32	- 3																
1021.21	33																
1024.09	2															1.0	
1024.09	2															1.2	
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			15														
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	40.6	50	41.30	+4		74		10.04									

N O T E S 1. GLOSSARY I = INVERT ELEVATION C = CRITICAL DEPTH W = WATER SURFACE ELEVATION H = HEIGHT OF CHANNEL E = ENERGY GRADE LINE X = CURVES CROSSING OVER B = BRIDGE ENTRANCE OR EXIT Y = WALL ENTRANCE OR EXIT Y = WALL ENTRANCE OR EXIT 2. STATIONS FOR POINTS AT A JUMP MAY NOT BE PLOTTED EXACTLY

0 T1 T2 T3	3491 LINE 050	"B"	(PRIVAT)	E)			
so	-	01.00	41.89	18			
R	10	93.76	42.19	18		.012	
R	10	97.76	42.21	18		.015	
R	11	36.54	42.33	18		.012	
R	12	76.61	42.79	18		.012	
R	12	80.71	42.80	15		.015	
R	13	17.55	42.92	15		.012	
R	13	73.16	43.10	15		.012	
SH	13	73.16	43.10	15			
CD	8	4			0.67		
CD	12	4			1.00		
CD	15	4			1,25		
CD	18	4			1.50		
CD	24	4			2.00		

47.04

1 90.00 24.69 1

45.00 46.91

□ DATE: 8/ 5/201 TIME: 13:28	9												
		WATI	ER SURFA	CE PRO		515P HANNEL DEF	INITION	I LISTING				PAGE	1
CARD SECT CH CODE NO TY		PIER HEIGHT : TH DIAMETER		ZL		INV Y(1) DROP	Y(2)	Y(3) Y(4	4) Y(5)	¥(6) ¥(7	7) Y(8)	¥(9)	Y(10)
CD 8 4 CD 12 4 CD 15 4 CD 15 4 CD 18 4 CD 24 4		0.67 1.00 1.25 1.50 2.00											
				F	05151	2						PAGE NO	3
	WA	TER SURFACE PI	ROFILE -	TITLE	CARD LIS	STING							
HEADING LINE NO	1 IS -												
		3491											
HEADING LINE NO	2 IS -												
		LINE "B" (PRIV	VATE)										
HEADING LINE NO	3 IS -												
		Q50		ਸ	05151	D						PAGE NO) 2
	WA	TER SURFACE PI	PORTLE -										
ELEMENT NO 1	IS A SYSTEM OU		*	*									
PURMENI MO I	U/S DATA		INVERT 41.89	SECT 18					W S ELEV 47.04				
ELEMENT NO 2	IS A REACH U/S DATA	* STATION 1093.76	* INVERT 42.19	SECT 18		N 0.012				RADIUS 0.00	ANGLE 0.00	ANG PT 0.00	MAN H O
ELEMENT NO 3	IS A REACH U/S DATA	* STATION 1097.76	INVERT 42.21	* SECT 18		N 0.015				RADIUS 0.00	ANGLE 0.00	ANG PT 0.00	MAN H 1
ELEMENT NO 4	IS A REACH U/S DATA	* STATION 1 1136.54	* INVERT 42.33	SECT 18		N 0.012				RADIUS 90.00	ANGLE 24.69	ANG PT 0.00	MAN H 0
ELEMENT NO 5	IS A REACH U/S DATA	* STATION :	* INVERT	* SECT		N 0.012				RADIUS 0.00	ANGLE 0.00	ANG PT 0.00	MAN H 0
WARNING - ADJAC	ENT SECTIONS AR	1276.61 E NOT IDENTICA	42.79 AL - SEE	18 SECTI	ON NUMBER		NNEL DE	FINITIONS		0.00			
ELEMENT NO 6	IS A REACH U/S DATA	* STATION 1280.71		* SECT 15		N 0,015				RADIUS 0.00	ANGLE 0.00	ANG PT 0.00	MAN H 1
ELEMENT NO 7		STATION 3 1317.55	* INVERT 42.92	* SECT 15		N 0.012					ANGLE 46.91	ANG PT 0.00	MAN H O
ELEMENT NO 8	IS A REACH U/S DATA	* STATION 1 1373.16	* INVERT 43.10	* SECT 15		N 0.012					ANGLE 0.00	ANG PT 0.00	
ELEMENT NO 9	IS A SYSTEM HE U/S DATA	ADWORKS	INVERT	* SECT 15			*		W S ELEV 0.00				
NO EDIT ERRORS ** WARNING NO.	ENCOUNTERED-COM	PUTATION IS NO	OW BEGIN	NING	SS THAN (OR FOUALS	TNVERT	ELEVATION		. W.S.ELE	EV = INV	+ DC 🛛	
LICENSEE: THIEN	ES ENGINEERING	KERCE EDEVAIL			FOS	515P PROFILE LI						Pi	AGE 1
	3491 LINE Q50	"B" (PRIVATE)		HIII DIC									
	ERT DEPTH EV OF FLOW	W.S. (ELEV	2	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH			BASE/ ID NO.	ZL NO PII) AVBPR SR
L/ELEM SO) *******	*****	******	*****	SF AVE	HF ********	*****		NORM DEPTH	******	******	ZR *******	****
1001.00 41	.89 5.150	47.040	1.4	0.79	0.010	47.050	0.00	0.443		1.50	0.00	0.00	0.00
92.76 0.00					.000151	0.01			0.470			0.00	
1093.76 42	4.864	47.054	1.4	0.79	0.010	47.064	0.00	0.443		1.50	0.00	0.00	0.00
4.00 0.00	500				.000236	0.00			0.470			0.00	
1097.76 42	21 4.845	47.055	1.4	0.79	0.010	47.065	0.00	0.443		1.50	0.00	0.00	0.00
38.78 0.00	309				.000151	0.01			0.480			0.00	
1136.54 42	4.732	47.062	1.4	0.79	0.010	47.072	0.00	0.443		1.50	0.00	0.00	0.00
140.07 0.00	328				.000151	0.02			0.470			0.00	
					Dad	~o 1							

1276.61	42.79	4.294	47.084	1.4	1.14	0.020	47.104	0.00	0.468		1.25	0.00	0.00	0	0.00
4.10	0.00244					.000625	0.00			0.630			0.00		
1280.71	42.80	4.287	47.087	1.4	1.14	0.020	47.107	0.00	0.468		1.25	0.00	0.00	0	0.00
36.84	0.00326					.000400	0.01			0.510			0.00		
1317.55	42.92	4.185	47.105	1.4	1.14	0.020	47.125	0.00	0.468		1.25	0.00	0.00	0	0.00
55.61	0.00324					.000400	0.02			0.510			0.00		
1373.16 0.00□	43.10	4.027	47.127	1.4	1.14	0.020	47.147	0.00	0.468		1.25	0.00	0.00	0	
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1122.52	<u>1</u>															
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	10															
	41.	89	42.4	12	42.94	1	43.47	43.99		44.52	45.04	45.57	46.10	46.62	47.15	5

N O T E S 1. GLOSSARY I = INVERT ELEVATION C = CRITICAL DEPTH W = WATER SURFACE ELEVATION H = HEIGHT OF CHANNEL E = ENERGY GRADE LINE X = CURVES CROSSING OVER B = BRIDGE ENTRANCE OR EXIT Y = WALL ENTRANCE OR EXIT 2. STATIONS FOR POINTS AT A JUMP MAY NOT BE PLOTTED EXACTLY[]

DATE: 8/ 5/2019 TIME: 13:29	
F0515P WATER SURFACE PROFILE - CHANNEL DE	FINITION LISTING PAGE 1
CARD SECT CHN NO OF AVE PIER HEIGHT 1 BASE ZL ZR INV Y(1 CODE NO TYPE PIERS WIDTH DIAMETER WIDTH DROP) Y(2) Y(3) Y(4) Y(5) Y(6) Y(7) Y(8) Y(9) Y(10)
CD 8 4 0.67 CD 12 4 1.00 CD 15 4 1.25 CD 18 4 1.50 CD 24 2.00	
P F 0 5 1 5 P	PAGE NO 3
WATER SURFACE PROFILE - TITLE CARD LISTING	
HEADING LINE NO 1 IS -	
3491	
HEADING LINE NO 2 IS -	
LINE "B" (PRIVATE)	
HEADING LINE NO 3 IS -	
Q50 F 0 5 1 5 P	PAGE NO 2
WATER SURFACE PROFILE - ELEMENT CARD LISTING	
ELEMENT NO 1 IS A SYSTEM OUTLET * * *	
U/S DATA STATION INVERT SECT 1001.00 41.89 18	W S ELEV 47.04
ELEMENT NO 2 IS A REACH * * * U/S DATA STATION INVERT SECT N 1093.76 42.19 18 0 .012	RADIUS ANGLE ANG PT MAN H 0.00 0.00 0.00 0
ELEMENT NO 3 IS A REACH * * * U/S DATA STATION INVERT SECT N 1097.76 42.21 18 0.015	RADIUS ANGLE ANG PT MAN H 0.00 0.00 0.00 1
ELEMENT NO 4 IS A REACH * * * U/S DATA STATION INVERT SECT N 1136.54 42.33 18 0.012	RADIUS ANGLE ANG PT MAN H 90.00 24.69 0.00 0
ELEMENT NO 5 IS A REACH * * * U/S DATA STATION INVERT SECT N 1276.61 42.79 18 0.012	RADIUS ANGLE ANG PT MAN H 0.00 0.00 0.00 0
WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CH	ANNEL DEFINITIONS
ELEMENT NO 6 IS A REACH * * * U/S DATA STATION INVERT SECT N 1280.71 42.80 15 0.015	RADIUS ANGLE ANG PT MAN H 0.00 0.00 0.00 1
ELEMENT NO 7 IS A REACH * * * U/S DATA STATION INVERT SECT N 1317.55 42.92 15 0.012	RADIUS ANGLE ANG PT MAN H 45.00 46.91 0.00 0
ELEMENT NO 6 IS A REACH * * * U/S DATA STATION INVERT SECT N 1373.16 43.10 15 0.012	RADIUS ANGLE ANG PT MAN H 0.00 0.00 0.00 0
ELEMENT NO 9 IS A SYSTEM HEADWORKS * U/S DATA STATION INVERT SECT 1373.16 43.10 15	* W S ELEV 0.00
NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING ** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS LICENSEE: THIENES ENGINEERING F0515P	INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC \Box PAGE 1
WATER SURFACE PROFILE L 3491 LINE "B" (PRIVATE) 050	ISTING
STATION INVERT DEPTH W.S. Q VEL VEL ENERGY ELEV OF FLOW ELEV HEAD GRD.EL.	SUPER CRITICAL HGT/ BASE/ ZL NO AVBPR ELEV DEPTH DIA ID NO. PIER
L/ELEM SO SF AVE HF	NORM DEPTH ZR
	0.00 0.599 1.50 0.00 0.00 0.00
1001.00 41.89 5.150 47.040 2.5 1.41 0.031 47.071 92.76 0.00323 .000483 0.04	0.650 0.00
1093.76 42.19 4.895 47.085 2.5 1.41 0.031 47.116	0.00 0.599 1.50 0.00 0.00 0.00
4.00 0.00500 .000754 0.00	0.650 0.00
1097.76 42.21 4.879 47.089 2.5 1.41 0.031 47.120	0.00 0.599 1.50 0.00 0.00 0.00
38.78 0.00309 .000483 0.02	0.650 0.00
1136.54 42.33 4.781 47.111 2.5 1.41 0.031 47.142	0.00 0.599 1.50 0.00 0.00 0.00
140.07 0.00328 .000483 0.07	0.640 0.00

1276.61	42.79	4.3	389	47.1	79	2.5	5 2.04	0.06	54	47.243	0.00	0.633		1.25	0.00	0.00	0	0.00
4.10	0.00244							.00199	94	0.01			0.930			0.00		
							- 0.04	0.00	- 4	47.254	0.00	0.633		1.25	0 00	0.00	0	0.00
1280.71	42.80	4.3	390	47.1	90	2.5	5 2.04				0.00	0.000		1.00	0.000		_	
36.84	0.00326							.00127	76	0.05			0.720			0.00		
1317.55	42,92	4.3	327	47.2	47	2.5	5 2.04	1 0.06	54	47.311	0.00	0.633		1.25	0.00	0.00	0	0.00
55.61	0 00324							.00127	76	0.07			0.720			0.00		
											0.00	0.633		1.25	0 00	0.00	0	
1373.16 0.00□	43.10	4.2	218	47.3	18	2.5	5 2.04	1 0.06	94	47.382	0.00	0.033		1.25	0.00	0.00		
			3491 LINE Q50	"B"	(PRIVAT	E)												
1001.0 1008.6 1016.1 1023.7 1031.3 1036.9 1046.5 1054.1 1061.7 1069.3 1076.9 1084.5 1092.1 1099.7 1009.7 1107.3	099887776665554443	I	Ċ	сc	×	н	H H	24			34			2	WE WE		R R R	
1114.9	3															1.20		
$\begin{array}{c} 1122.5\\ 1130.1\\ 1137.7\\ 1145.3\\ 1152.9\\ 1160.5\\ 1168.0\\ 1175.6\\ 1183.2\\ 1190.8\\ 1198.4\\ 1206.0\\ 1213.6\\ 1221.2\\ 1228.8\\ 1226.2\\ 1228.8\\ 1226.1\\ 1221.2\\ 1226.8\\ 1226.2\\ 1251.6\\ 1259.2\\ 126.8\\ 1274.4\end{array}$	2	1	Γ	с			Н								x		R	
1282.0 1289.6	2 .			I I		C C		н н							WE WE	ne:	R R	
1297.2	21 *			_		-												
1304.8 1312.4 1319.9 1327.5 1335.1 1342.7 1350.3 1357.9	10 99 59 18 78 37 77			I			3	Н							WE	*********	R	
1365.5 1373.1					I		C	н							WE	522 112	R	
			¥		22			2000			365	385	1 5	16		U.		
	41	89	42.44	1	42.99		43.54	44.09	44	4.64	45.19	45.73	46.28	46.	83	47.38		

N O T E S 1. GLOSSARY I = INVERT ELEVATION C = CRITICAL DEPTH W = WATER SURFACE ELEVATION H = HEIGHT OF CHANNEL E = ENERGY GRADE LINE X = CURVES CROSSING OVER B = BRIDGE ENTRANCE OR EXIT Y = WALL ENTRANCE OR EXIT 2. STATIONS FOR POINTS AT A JUMP MAY NOT BE PLOTTED EXACTLY

□ DATE: 8/ 5/2019 TIME: 13:29					
	WATER SURFACE PROFI	F0515P ILE - CHANNEL DEFIN	ITION LISTING		PAGE 1
CARD SECT CHN NO OF AVE PIER HI CODE NO TYPE PIERS WIDTH DI	EIGHT 1 BASE ZL IAMETER WIDTH	ZR INV Y(1) DROP	Y(2) Y(3) Y(4) Y(5)	Y(6) Y(7) Y(8)	Y(9) Y(10)
CD 8 4 CD 12 4 CD 15 4 CD 18 4 CD 24 4	0.67 1.00 1.25 1.50 2.00				
	F 0	515P			PAGE NO 3
WATER SUR	FACE PROFILE - TITLE C	CARD LISTING			
HEADING LINE NO 1 IS -					
3491					
HEADING LINE NO 2 IS -					
LINE "B	" (PRIVATE)				
HEADING LINE NO 3 IS -					
Q50	F 0	515P			PAGE NO 2
WATER SURI	FACE PROFILE - ELEMENT	CARD LISTING			
ELEMENT NO 1 IS A SYSTEM OUTLET U/S DATA STATI(1003	* * * ON INVERT SECT 1.00 41.89 18		W S ELEV 47.04		
ELEMENT NO 2 IS A REACH U/S DATA STATI(109:	* * * ON INVERT SECT 3.76 42.19 18	N 0.012		RADIUS ANGLE 0.00 0.00	ANG PT MAN H 0.00 0
ELEMENT NO 3 IS A REACH U/S DATA STATI(109'	* * * ON INVERT SECT 7.76 42.21 18	N 0.015		RADIUS ANGLE 0.00 0.00	ANG PT MAN H 0.00 l
ELEMENT NO 4 IS A REACH U/S DATA STATI(1130	* * * ON INVERT SECT 6.54 42.33 18	N 0.012		RADIUS ANGLE 90.00 24.69	ANG PT MAN H 0.00 0
ELEMENT NO 5 IS A REACH U/S DATA STATIO 127	6.61 42.79 18	N 0.012	RI DEFINITIONS	RADIUS ANGLE 0.00 0.00	ANG PT MAN H 0.00 0
WARNING - ADJACENT SECTIONS ARE NOT IN	DENTICAL - SEE SECTION	N NUMBERS AND CHANN.	EL DEFINITIONS		
ELEMENT NO 6 IS A REACH U/S DATA STATIO 1280		N 0.015		RADIUS ANGLE 0.00 0.00	ANG PT MAN H 0.00 l
ELEMENT NO 7 IS A REACH U/S DATA STATI 131	* * * ON INVERT SECT 7.55 42.92 15	N 0.012		RADIUS ANGLE 45.00 46.91	ANG PT MAN H 0.00 0
U/S DATA STATI	* * * ON INVERT SECT 3.16 43.10 15	N 0.012		RADIUS ANGLE 0.00 0.00	ANG PT MAN H 0.00 0
	ON INVERT SECT 3.16 43.10 15		W S ELEV 0.00		
NO EDIT ERRORS ENCOUNTERED-COMPUTATIO ** WARNING NO. 2 ** - WATER SURFACE E LICENSEE: THIENES ENGINEERING	LEVATION GIVEN IS LESS	S THAN OR EQUALS IN F0515P URFACE PROFILE LIST		, W.S.ELEV = INV	+ DC PAGE 1
3491 LINE "B" (PR Q50	IVATE)				
STATION INVERT DEPTH W.S. ELEV OF FLOW ELEV	Q VEL	HEAD GRD.EL. E	LEV DEPTH	HGT/ BASE/ DIA ID NO.	ZL NO AVBPR PIER
L/ELEM SO ************************************		SF AVE HF *******************	NORM DEPTH		ZR ******
1001.00 41.89 5.150 47.040	3.2 1.81	0.051 47.091	0.00 0.681	1.50 0.00	0.00 0 0.00
92.76 0.00323	. (000791 0.07	0.741		0.00
1093.76 42.19 4.923 47.113	3.2 1.81	0.051 47.164	0.00 0.681	1.50 0.00	0.00 0 0.00
4.00 0.00500		0.00	0.750		0.00
1097.76 42.21 4.911 47.121	3.2 1.81	0.051 47.172	0.00 0.681	1.50 0.00	
38.78 0.00309	. (0.03	0.751		0.00
1136.54 42.33 4.827 47.157	3.2 1.81		0.00 0.681	1.50 0.00	
140.07 0.00328	÷.0	000791 0.11 Page 1	0.740		0.00

1276.61	42.79	4.478	47.268	3.2	2.61 0.10	6 47.374	0.00	0.721		1.25 0.00	0.00 0	0.00
4.10	0.00244				.00326	7 0.01			1.250		0.00	
1280.71	42.80	4.486	47.286	3.2	2.61 0.10	6 47.392	0.00	0.721		1.25 0.00	0.00 0	0.00
	0.00326				.00209	1 0.08			0.840		0.00	
1317.55	42.92	4.459	47.379	3.2	2.61 0.10	6 47.485	0.00	0.721		1.25 0.00	0.00 0	0.00
	0.00324	1.100			.00209				0.850		0.00	
		4 205	47 405	3.2	2.61 0.10		0.00	0.721		1.25 0.00	0.00 0	
1373.16 0.000	43.10	4.395	47.495	5.2	2.01 0.10	0 47.001	0.00					
		3491 LINI Q50	1 E "B" (PRIVA)	re)								
1001.0 1008.6 1016.1 1023.7 1031.3 1038.9 1046.5 1054.1 1061.7 1069.3 1076.9 1084.5	0.99.88.77.77.66.55.5.5	Ċ		н	0960	×		t	5	WE	.) 	
1092.1 1099.7 1107.3 1114.9 1122.5	4 3 3 2	I I	C C	H H						WE WE	R R	
1130.1 1137.7 1145.3 1152.9 1160.5 1168.0 1175.6 1183.2 1190.8 1198.4 1206.0 1213.6 1221.2 1228.8 1236.4 1244.0 1251.6 1259.2 1266.8 1274.4	1 1 0 0 9 9 8 87 77 76 75 76 75 76 75 76 73 744 73 744 73 744 73 75 75 75 76 77 76 73 744 73 74 73 74 73 75 75 76 75 75 76 75 75 75 75 76 75 75 75 76 76 75 75 75 75 75 75 75 75 75 75 75 75 75 75 <	I	С	Η						WE W E	R	
1282.0 1289.6 1297.2 1304.8 1312.4	51 . 21 . 80 .		I I	C C	H H					WE	. R	
1319.9 1327.5 1325.1 1342.7 1350.3 1357.9 1365.5	99 - 59 - 18 - 78 - 87 - 97 -		I	С	H					WE	* R	
1373.1		(1 4 7)	I	C	н.						S.R	
	41.					44.75	45.32	45.89	46.46	47.03	47.60	

N O T E S 1. GLOSSARY I = INVERT ELEVATION C = CRITICAL DEPTH W = WATER SURFACE ELEVATION H = HEIGHT OF CHANNEL E = ENERGY GRADE LINE X = CURVES CROSSING OVER B = BRIDGE ENTRANCE OR EXIT Y = WALL ENTRANCE OR EXIT 2. STATIONS FOR POINTS AT A JUMP MAY NOT BE PLOTTED EXACTLYD

DATE: 8/ 5/2019 TIME: 13:30 F0515P PAGE 1 WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING Y(1) Y(2) Y(3) Y(4) Y(5) Y(6) Y(7) Y(8) Y(9) Y(10) INV CARD SECT CHN NO OF AVE PIER HEIGHT 1 BASE 7.1. ZR DROP DIAMETER WIDTH CODE NO TYPE PTERS WIDTH CD 8 4 0.67 12 1.00 CD 4 4 1.25 CD 15 CD 18 4 1.50 2.00 CD 24 4 PAGE NO 3 F 0 5 1 5 P WATER SURFACE PROFILE - TITLE CARD LISTING HEADING LINE NO 1 IS -3491 HEADING LINE NO 2 IS -LINE "B" (PRIVATE) HEADING LINE NO 3 IS -0 050 2 PAGE NO F 0 5 1 5 P WATER SURFACE PROFILE - ELEMENT CARD LISTING 1 IS A SYSTEM OUTLET ELEMENT NO W S ELEV INVERT SECT U/S DATA STATION 47.04 41.89 18 1001.00 2 IS A REACH * * ELEMENT NO RADIUS ANGLE ANG PT MAN H STATION INVERT SECT N U/S DATA 0 0.00 0.00 0.00 0.012 1093.76 42.19 18 ELEMENT NO 3 IS A REACH ANG PT MAN H INVERT SECT N RADTUS ANGLE STATION U/S DATA 0.015 0.00 0.00 0.00 1 1097.76 42.21 18 ELEMENT NO 4 IS A REACH MAN H INVERT SECT N RADIUS ANGLE ANG PT STATION U/S DATA 0.012 90.00 24.69 0.00 0 42.33 18 1136.54 ELEMENT NO 5 IS A REACH ANGLE ANG PT MAN H RADIUS STATION INVERT SECT Ν U/S DATA 0.00 0.00 0 0.012 0.00 1276.61 42.79 18 WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS 6 IS A REACH * ELEMENT NO RADIUS ANGLE ANG PT MAN H STATION INVERT SECT N U/S DATA 0.00 0.00 0.00 1 0.015 1280.71 42.80 15 ELEMENT NO 7 IS A REACH ANG PT MAN H ANGLE RADIUS U/S DATA STATION INVERT SECT Ν 46.91 0.00 0 1317.55 42.92 15 0.012 45.00 8 IS A REACH ELEMENT NO RADIUS ANGLE ANG PT MAN H INVERT SECT N STATION U/S DATA 0 0.012 0.00 0.00 0.00 43.10 15 1373.16 ELEMENT NO 9 IS A SYSTEM HEADWORKS W S ELEV U/S DATA STATION INVERT SECT 0.00 1373.16 43.10 15 NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC 🗆 PAGE LICENSEE: THIENES ENGINEERING F0515P WATER SURFACE PROFILE LISTING 3491 LINE "B" (PRIVATE) 050 NO AVBPR HGT/ BASE/ \mathbf{ZL} SUPER CRITICAL 0 VEL. VEL. ENERGY STATION INVERT DEPTH W.S. PIER ID NO. DIA ELEV DEPTH ELEV OF FLOW ELEV HEAD GRD.EL. SF AVE HF NORM DEPTH ZR L/ELEM SO ******** ******* ***** 0.00 0.00 0 0.00 0.724 1.50 47.040 2.04 0.064 47.104 0.00 1001.00 41.89 5.150 3.6 0.00 0.800 001001 0.09 92.76 0.00323 0.00 0.00 0.00 0 0.064 47.197 0.00 0.724 1.50 3.6 2.04 1093.76 42.19 4.943 47.133 0.800 0.00 .001564 0.01 4.00 0.00500 0.724 1.50 0.00 0.00 0 0.00 2.04 0.064 47.206 0.00 47.142 3.6 1097.76 42.21 4 932 0.00 .001001 0.04 0.810 38.78 0.00309 1.50 0.00 0.00 0 0.00 47.252 0.724 0.00 42.33 4.858 47.188 3.6 2.04 0.064 1136.54

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0.00

140.07 0.00328

Page 1

0.14

001001

0.800

1276.61	42.79	4.538	47.328	3.6	2.93	0.134	47.462	0.00	0.766		1.25	0.00	0.00	0	0.00
4.10	0.00244					.004135	0.02			1.250			0.00		
1280.71	42.80	4.552	47.352	3.6	2.93	0.134	47.486	0.00	0.766		1.25	0.00	0.00	0	0.00
36.84	0.00326					.002646	0.10			0.930			0.00		
1317.55	42.92	4.548	47.468	3.6	2.93	0.134	47.602	0.00	0.766		1.25	0.00	0.00	0	0.00
55.61	0.00324					.002646	0.15			0.930			0.00		
1373.16 0.00□	43.10	4.516	47.616	3.6	2.93	0.134	47.750	0.00	0.766		1.25	0.00	0.00	0	

			3491 LINE Q50	"Вп	(PRIV	ATE)														
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1001.00	.1		c			Н									WE				52	R
1008.60																			1 2	
1016.19	- <u>2</u>																		50	
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1099.74	<i></i>	I		C			н								WE					R
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1168.09	-																		÷.	
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1198.47	÷																		¥3	
1206.07	*																		÷.	
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1221.26																			÷)	
1228.85																			×	
1236.45																			*	
1244.04																			7 /	
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					÷.		5.0		(ie))	(1 4)	10	2	ie.	80	ŧŝ.			1	S	
	41.	89	42.48	1	43.0	6	43.6	5	44.23	44.82		45.41	45.99	46.58	47	7.16		4	47.75	

N O T E S 1. GLOSSARY I = INVERT ELEVATION C = CRITICAL DEPTH W = WATER SURFACE ELEVATION H = HEIGHT OF CHANNEL E = ENERGY GRADE LINE X = CURVES CROSSING OVER B = BRIDGE ENTRANCE OR EXIT Y = WALL ENTRANCE OR EXIT 2. STATIONS FOR POINTS AT A JUMP MAY NOT BE PLOTTED EXACTLY□

DATE: 8/ 5/2019 TIME: 13:31 F0515P WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING PAGE 1 Y(1) Y(2) Y(3) Y(4) Y(5) Y(6) Y(7) Y(8) Y(9) Y(10) SECT CHN NO OF AVE PIER HEIGHT 1 BASE \mathbf{ZL} ZR INV CARD DROP CODE NO TYPE PIERS WIDTH DIAMETER WIDTH CD 8 4 0.67 12 1.00 CD 4 CD 4 1.25 15 CD 18 4 1.50 CD 24 4 2.00 0 PAGE NO 3 F 0 5 1 5 P WATER SURFACE PROFILE - TITLE CARD LISTING HEADING LINE NO 1 IS -3491 HEADING LINE NO 2 IS -LINE "B" (PRIVATE) HEADING LINE NO 3 IS -Q50 PAGE NO 2 F 0 5 1 5 P WATER SURFACE PROFILE - ELEMENT CARD LISTING ELEMENT NO 1 IS A SYSTEM OUTLET * W S ELEV U/S DATA STATION INVERT SECT 47.04 1001.00 41.89 18 2 IS A REACH ELEMENT NO RADTUS ANGLE ANG PT MAN H STATION INVERT SECT M U/S DATA 0.00 0 0.00 1093.76 42.19 18 0.012 0.00 ELEMENT NO 3 IS A REACH N RADIUS ANGLE ANG PT MAN H STATION INVERT SECT U/S DATA 0.015 0.00 0.00 0.00 1 1097.76 42.21 18 4 IS A REACH ELEMENT NO RADIUS ANGLE ANG PT MAN H INVERT SECT N U/S DATA STATION 0.012 90.00 24.69 0.00 0 1136.54 42.33 18 5 IS A REACH ELEMENT NO RADIUS ANGLE ANG PT MAN H STATION INVERT SECT N U/S DATA 0.00 0.00 0.00 0 1276.61 42.79 18 0.012 WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS 6 IS A REACH ELEMENT NO ANGLE ANG PT MAN H RADIUS STATION INVERT SECT N U/S DATA 0.00 0.00 1 1280.71 42.80 15 0.015 0.00 ELEMENT NO 7 IS A REACH MAN H ANG PT STATION INVERT SECT N RADIUS ANGLE U/S DATA 0 1317.55 42.92 15 0.012 45.00 46.91 0.00 8 IS A REACH ELEMENT NO RADIUS ANGLE ANG PT MAN H STATION INVERT SECT N U/S DATA 0.00 0.00 0.00 0 0.012 43.10 15 1373.16 ELEMENT NO 9 IS A SYSTEM HEADWORKS W S ELEV STATION INVERT SECT U/S DATA 1373.16 43.10 15 0.00 NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING ** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC 🗆 PAGE LICENSEE: THIENES ENGINEERING F0515P WATER SURFACE PROFILE LISTING 3491 LINE "B" (PRIVATE) 050 NO AVBPR HGT / BASE/ \mathbf{ZL} VEL ENERGY SUPER CRITICAL STATION INVERT DEPTH W.S. 0 VEL PIER ID NO. ELEV OF FLOW ELEV HEAD GRD.EL. FLEV DEPTH DIA нF NORM DEPTH ZR SF AVE L/ELEM SO ***** * * * 0.00 0.00 0.00 0 2.38 0.088 47.128 0.00 0.785 1.50 1001.00 41.89 5.150 47.040 4.2 0.00 0.880 .001362 0.13 92.76 0.00323 47.254 0.00 0.785 1.50 0.00 0.00 0 0.00 4.2 2.38 0.088 1093.76 42.19 4.976 47.166 0.00 0.880 .002128 0.01 4.00 0.00500 47.267 0.00 0.00 0.088 0.00 0.785 1.50 0.00 0 2.38 1097.76 42.21 4,969 47.179 4.2 .001362 0.05 0.890 0.00 38.78 0.00309 0.00 0.00 0 1.50 0.00 1136.54 42.33 4.911 47.241 4.2 2.38 0.088 47.329 0.00 0.785 0.880 0.00 .001362 0.19

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N O T E S 1. GLOSSARY I = INVERT ELEVATION C = CRITICAL DEPTH W = WATER SURFACE ELEVATION H = HEIGHT OF CHANNEL E = ENERGY GRADE LINE X = CURVES CROSSING OVER B = BRIDGE ENTRANCE OR EXIT Y = WALL ENTRANCE OR EXIT 2. STATIONS FOR POINTS AT A JUMP MAY NOT BE PLOTTED EXACTLYD

DATE: 8/ 5/2019 TIME: 13:32 F0515P WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING PAGE 1 Y(1) Y(2) Y(3) Y(4) Y(5) Y(6) Y(7) Y(8) Y(9) Y(10) CHN NO OF AVE PIER HEIGHT 1 BASE \mathbf{ZL} ZR INV CARD SECT DROP CODE NO TYPE PIERS WIDTH DIAMETER WIDTH CD 8 4 0.67 1.00 CD 12 4 1.25 CD 4 15 CD 18 4 1.50 CD 24 4 2.00 PAGE NO 3 F 0 5 1 5 P WATER SURFACE PROFILE - TITLE CARD LISTING HEADING LINE NO 1 IS -3491 HEADING LINE NO 2 IS -LINE "B" (PRIVATE) HEADING LINE NO 3 IS -050 PAGE NO 2 F 0 5 1 5 P WATER SURFACE PROFILE - ELEMENT CARD LISTING 1 IS A SYSTEM OUTLET ELEMENT NO W S ELEV U/S DATA STATION INVERT SECT 47.04 1001.00 41.89 18 2 IS A REACH ELEMENT NO RADIUS ANGLE ANG PT MAN H STATION INVERT SECT M U/S DATA 0.00 0 1093.76 42.19 18 0.012 0.00 0.00 ELEMENT NO 3 IS A REACH RADIUS ANGLE ANG PT MAN H STATION INVERT SECT Ν U/S DATA 0.00 0.00 0.00 1 42.21 0.015 1097.76 18 4 IS A REACH ELEMENT NO * * MAN H RADIUS ANGLE ANG PT SECT Ν U/S DATA STATION INVERT 90.00 24.69 0.00 0 0.012 1136.54 42.33 18 5 IS A REACH ELEMENT NO MAN H RADIUS ANGLE ANG PT STATION INVERT SECT N U/S DATA 0.00 0.00 0.00 0 1276.61 42.79 18 0.012 WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS 6 IS A REACH ELEMENT NO ANG PT MAN H RADTUS ANGLE STATION INVERT SECT N U/S DATA 0.00 0.00 1 1280.71 42.80 15 0.015 0.00 ELEMENT NO 7 IS A REACH INVERT SECT STATION N RADIUS ANGLE ANG PT MAN H U/S DATA 1317.55 42.92 15 0.012 45.00 46.91 0.00 0 8 IS A REACH ELEMENT NO RADIUS ANGLE ANG PT MAN H STATION TNVERT SECT N U/S DATA 0.012 0.00 0.00 0.00 0 43.10 1373.16 15 ELEMENT NO 9 IS A SYSTEM HEADWORKS W S ELEV U/S DATA STATION INVERT SECT 1373.16 43.10 15 0.00 NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING ** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC 🗆 PAGE LICENSEE: THIENES ENGINEERING F0515P WATER SURFACE PROFILE LISTING 3491 LINE "B" (PRIVATE) 050 NO AVBPR HGT/ BASE / $\mathbf{Z}\mathbf{L}$ VEL VEL. ENERGY SUPER CRITICAL STATION INVERT DEPTH W.S. 0 PIER ID NO. DIA ELEV OF FLOW ELEV HEAD GRD. EL. ELEV DEPTH SF AVE нF NORM DEPTH ZR L/ELEM SO ****** *** **** 0.00 1.50 0.00 0.00 47.040 4.7 2.66 0.110 47.150 0.00 0.833 0 1001.00 41.89 5.150 0.950 0.00 .001706 0.16 92.76 0.00323 0.833 1.50 0.00 0.00 0 0.00 4.7 2.66 0.110 47.308 0.00 1093.76 42.19 5.008 47.198 0.00 0.950 .002665 0.01 4.00 0.00500 0.00 0.00 0.110 47.324 0.00 0.833 1.50 0.00 0 4.7 2.66 1097.76 42.21 5.004 47.214 .001706 0.07 0.960 0.00 38.78 0.00309 0.00 0.00 0.00 1.50 0 0.833 1136.54 42.33 4.962 47.292 4.7 2.66 0.110 47.402 0.00

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N O T E S 1. GLOSSARY I = INVERT ELEVATION C = CRITICAL DEPTH W = WATER SURFACE ELEVATION H = HEIGHT OF CHANNEL E = ENERGY GRADE LINE X = CURVES CROSSING OVER B = BRIDGE ENTRANCE OR EXIT Y = WALL ENTRANCE OR EXIT 2. STATIONS FOR POINTS AT A JUMP MAY NOT BE PLOTTED EXACTLY[]

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STATION INVERT DEPTH OF FLOW W.S. ELEV Q VEL VEL HEAD ENERGY GRD.EL. SUPER CRITICAL DEPTH HGT/ DIA BASE/ IDNO. ZL NO AVER PRE L/ELEM SO SO SO SO SF AVE HF NORM DEPTH ZZ ZZ NO 0.00			LIN	E "B" (PRIVATE											
1/2 Line 30 100 1.50 0.00 0.00 0.00 0.00 1001.00 41.89 5.150 47.040 5.1 2.89 0.129 47.169 0.00 0.869 1.50 0.00 0.00 92.76 0.00323 .002009 0.19 1.000 0.00 0.00 1093.76 42.19 5.036 47.226 5.1 2.89 0.129 47.355 0.00 0.869 1.50 0.00 0.00 0.00 4.00 0.00500 .003138 0.01 1.010 0.00 0.00 0.00 0.00 1097.76 42.21 5.035 47.245 5.1 2.89 0.129 47.374 0.00 0.869 1.50 0.00 0.00 0.00 38.78 0.00309 .002009 0.08 1.020 0.00 0.00 0.00 1136.54 42.33 5.007 47.337 5.1 2.89 0.129 47.466 0.00 0.869 1.50 0.00 0.00	STATION		DEPTH	W.S.	Q	VEL									
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1097.76 42.21 5.035 47.245 5.1 2.89 0.129 47.374 0.00 0.869 1.50 0.00 0.00 38.78 0.00309 .002009 0.08 1.020 0.00 1136.54 42.33 5.007 47.337 5.1 2.89 0.129 47.466 0.00 0.869 1.50 0.00 0.00	1093.76	42.19	5.036	47.226	5.1	2.89	0.129	47, 355	0.00	0.869		1.50	0.00	0.00	0.00
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1136.54 42.33 5.007 47.337 5.1 2.89 0.129 47.466 0.00 0.869 1.50 0.00 0.00	1097.76	42.21	5.035	47.245	5.1	2.89	0.129	47.374	0.00	0.869		1.50	0.00	0.00	0.00
	38.78	0.00309)				002009	0.08							
002008 0.28 1.000 0.00	1136.54	42.33	5.007	47.337	5.1	2.89	0.129	47.466	0.00	0.869		1.50	0.00		0 0.00
140.07 0.00328 .002009 0.28 1.000 0.00	140.07	0.00328	3								1.000			0.00	

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N O T E S 1. GLOSSARY I = INVERT ELEVATION C = CRITICAL DEPTH W = WATER SURFACE ELEVATION H = HEIGHT OF CHANNEL E = ENERGY GRADE LINE X = CURVES CROSSING OVER B = BRIDGE ENTRANCE OR EXIT Y = WALL ENTRANCE OR EXIT Y = WALL ENTRANCE OR EXIT 2. STATIONS FOR POINTS AT A JUMP MAY NOT BE PLOTTED EXACTLYD

APPENDIX D

DETENTION ANALYSIS

			TRUCK YAR	D DETENTIC	ON AREA "2/	۹"			
Т			In	Cu	Cd	Q		Volume	
(MIN.)			(In/HR)			(CFS.)		(CF.)	
1115.4	0.671422	3.961392	0.615143	0.29568	0.839568	5.009609	60.04413	111780	
1115.6	0.671795	3.963592	0.616519	0.296931	0.839693	5.02156	60.18701	111840.2	
1115.8	0.672169	3.965798	0.617904	0.298191	0.839819	5.033598	60.33095	111900.5	
1116	0.672544	3.968009	0.619299	0.29946	0.839946	5.045726	60.47595	111961	
1116.2	0.67292	3.970226	0.620704	0.300738	0.840074	5.057944	60.62202	112021.6	
1116.4	0.673296	3.972449	0.62212	0.302026	0.840203	5.070253	60.76918	112082.4	
1116.6	0.673674	3.974678	0.623545	0.303322	0.840332	5.082654	60.91744	112143.3	
1116.8	0.674053	3.976913	0.624981	0.304628	0.840463	5.095149	61.06682	112204.4	
1117	0.674433	3.979153	0.626427	0.305943	0.840594	5.107739	61.21733	112265.6	$\leftarrow -$
1117.2	0.674814	3.9814	0.627884	0.307268	0.840727	5.120425	61.36898	112327	
1117.4	0.675195	3.983653	0.629351	0.308603	0.84086	5.133207	61.52179	112388.5	
1117.6	0.675578	3.985912	0.63083	0.309948	0.840995	5.146089	61.67578	112450.2	
1117.8	0.675962	3.988177	0.632319	0.311303	0.84113	5.15907	61.83095	112512	
1118	0.676347	3.990448	0.63382	0.312667	0.841267	5.172152	61.98733	112574	
1118.2	0.676733	3.992726	0.635332	0.314042	0.841404	5.185336	62.14493	112636.1	
1118.4	0.67712	3.99501	0.636855	0.315428	0.841543	5.198625	62.30377	112698.4	
1118.6	0.677509	3.9973	0.63839	0.316824	0.841682	5.212018	62.46385	112760.9	
1118.8	0.677898	3.999597	0.639936	0.318231	0.841823	5.225518	62.62521	112823.5	
1119	0.678288	4.001901	0.641495	0.319648	0.841965	5.239125	62.78786	112886.3	
1119.2	0.67868	4.004211	0.643065	0.321076	0.842108	5.252842	62.95181	112949.3	
1119.4	0.679072	4.006527	0.644648	0.322516	0.842252	5.26667	63.11708	113012.4	
1119.6	0.679466	4.00885	0.646243	0.323967	0.842397	5.28061	63.28368	113075.7	
1119.8	0.679861	4.01118	0.64785	0.325429	0.842543	5.294665	63.45165	113139.1	
1120	0.680257	4.013517	0.649471	0.326902	0.84269	5.308834	63.62099	113202.7	
1120.2	0.680654	4.015861	0.651104	0.328388	0.842839	5.323121	63.79173	113266.5	
1120.4	0.681053	4.018211	0.65275	0.329885	0.842988	5.337526	63.96388	113330.5	
1120.6	0.681452	4.020569	0.654409	0.331394	0.843139	5.352052	64.13747	113394.6	
1120.8	0.681853	4.022934	0.656082	0.332915	0.843292	5.3667	64.31251	113458.9	
1121	0.682255	4.025305	0.657768	0.334449	0.843445	5.381471	64.48903	113523.4	
1121.2	0.682658	4.027684	0.659468	0.335995	0.8436	5.396368	64.66704	113588.1	
1121.4	0.683063	4.030071	0.661182	0.337554	0.843755	5.411393	64.84657	113652.9	
1121.6	0.683469	4.032464	0.66291	0.339126	0.843913	5.426546	65.02764	113718	
1121.8	0.683876	4.034865	0.664652	0.34071	0.844071	5.441831	65.21026	113783.2	
1122	0.684284	4.037274	0.666409	0.342308	0.844231	5.457249	65.39448	113848.6	
1122.2	0.684693	4.03969	0.668181	0.34392	0.844392	5.472801	65.5803	113914.2	
1122.4	0.685104	4.042114	0.669967	0.345545	0.844554	5.488491	65.76775	113979.9	
1122.6	0.685516	4.044545	0.671769	0.347184	0.844718	5.504319	65.95686	114045.9	
1122.8	0.68593	4.046984	0.673586	0.348836	0.844884	5.520289	66.14765	114112	
1123	0.686344	4.049432	0.675419	0.350503	0.84505	5.536401	66.34014	114178.4	
1123.2		4.051887				5.552659			
1123.4		4.05435	0.679132	0.353881	0.845388	5.569065	66.73035	114311.6	

1123.6	0.687597	4.056821	0.681013	0.355592	0.845559	5.58562	66.92811	114378.6
1123.8	0.688017	4.0593	0.682911	0.357318	0.845732	5.602328	67.12769	114445.7
1124	0.688439	4.061788	0.684825	0.359059	0.845906	5.619189	67.3291	114513
1124.2	0.688862	4.064284	0.686757	0.360816	0.846082	5.636208	67.53239	114580.5
1124.4	0.689286	4.066788	0.688706	0.362588	0.846259	5.653386	67.73757	114648.3
1124.6	0.689712	4.069301	0.690672	0.364377	0.846438	5.670726	67.94467	114716.2
1124.8	0.690139	4.071823	0.692656	0.366181	0.846618	5.688231	68.15374	114784.4
1125	0.690568	4.074353	0.694659	0.368003	0.8468	5.705902	68.3648	114852.7
1125.2	0.690999	4.076892	0.69668	0.369841	0.846984	5.723743	68.57787	114921.3
1125.4	0.691431	4.079441	0.698719	0.371696	0.84717	5.741757	68.793	114990.1
1125.6	0.691864	4.081998	0.700778	0.373568	0.847357	5.759946	69.01022	115059.1
1125.8	0.692299	4.084564	0.702856	0.375458	0.847546	5.778314	69.22956	115128.4
1126	0.692735	4.087139	0.704953	0.377366	0.847737	5.796862	69.45106	115197.8
1126.2	0.693174	4.089724	0.707071	0.379292	0.847929	5.815595	69.67474	115267.5
1126.4	0.693613	4.092318	0.709208	0.381236	0.848124	5.834515	69.90066	115337.4
1126.6	0.694055	4.094922	0.711367	0.383199	0.84832	5.853626	70.12885	115407.5
1126.8	0.694498	4.097536	0.713546	0.385181	0.848518	5.87293	70.35934	115477.9
1127	0.694942	4.100159	0.715747	0.387183	0.848718	5.892432	70.59217	115548.5
1127.2	0.695388	4.102792	0.717969	0.389204	0.84892	5.912134	70.82739	115619.3
1127.4	0.695836	4.105435	0.720213	0.391245	0.849125	5.93204	71.06504	115690.4
1127.6	0.696286	4.108088	0.72248	0.393307	0.849331	5.952153	71.30516	115761.7
1127.8	0.696738	4.110752	0.724769	0.395389	0.849539	5.972478	71.54778	115833.2
1128	0.697191	4.113426	0.727081	0.397492	0.849749	5.993017	71.79297	115905
1128.2	0.697646	4.11611	0.729417	0.399617	0.849962	6.013776	72.04076	115977
1128.4	0.698102	4.118805	0.731777	0.401763	0.850176	6.034757	72.2912	116049.3
1128.6	0.698561	4.12151	0.734162	0.403932	0.850393	6.055965	72.54433	116121.9
1128.8	0.699022	4.124227	0.736571	0.406123	0.850612	6.077404	72.80021	116194.7
1129	0.699484	4.126955	0.739006	0.408338	0.850834	6.099078	73.05889	116267.7
1129.2	0.699948	4.129693	0.741466	0.410575	0.851058	6.120992	73.32042	116341.1
1129.4	0.700414	4.132443	0.743952	0.412837	0.851284	6.14315	73.58485	116414.6
1129.6	0.700882	4.135205	0.746465	0.415123	0.851512	6.165557	73.85224	116488.5
1129.8	0.701352	4.137978	0.749006	0.417433	0.851743	6.188217	74.12265	116562.6
1130	0.701824	4.140763	0.751574	0.4191	0.85191	6.210649	74.3932	116637
1130.2	0.702298	4.14356	0.75417	0.420359	0.852036	6.233023	74.66203	116711.7
1130.4	0.702774	4.146369	0.756794	0.421632	0.852163	6.25565	74.93204	
1130.6	0.703253	4.14919	0.759449	0.422919	0.852292	6.278537	75.20513	116861.8
1130.8	0.703733	4.152024	0.762132	0.424221		6.301688	75.48135	116937.3
1131	0.704215	4.15487	0.764847	0.425537		6.325107	75.76077	117013.1
1131.2	0.7047	4.157729	0.767592	0.426868	0.852687		76.04345	117089.1
1131.4	0.705187	4.160601	0.770369	0.428215	0.852821		76.32946	117165.4
1131.6	0.705676	4.163486	0.773178	0.429577	0.852958	6.397035	76.61887	117242
1131.8	0.706167	4.166384	0.77602	0.430955	0.853096	6.421586	76.91173	117319
1132	0.70666	4.169296	0.778896	0.432349	0.853235	6.446435	77.20813	117396.2
		4.172222		0.43376			77.50813	117473.7
1132.4	0.707654	4.175161	0.78475	0.435188	0.853519	6.49705	77.81182	117551.5

1132.6	0.708155	4.178115	0.78773	0.436634	0.853663	6.522828	78.11927	117629.6
1132.8	0.708658	4.181083	0.790747	0.438096	0.85381	6.54893	78.43055	117708
1133	0.709164	4.184066	0.793801	0.439577	0.853958	6.575363	78.74576	117786.8
1133.2	0.709672	4.187063	0.796893	0.441077	0.854108	6.602132	79.06497	117865.8
1133.4	0.710182	4.190075	0.800023	0.442595	0.854259	6.629247	79.38828	117945.2
1133.6	0.710695	4.193103	0.803194	0.444132	0.854413	6.656714	79.71576	118024.9
1133.8	0.711211	4.196146	0.806404	0.445689	0.854569	6.684541	80.04753	118105
1134	0.71173	4.199205	0.809656	0.447266	0.854727	6.712737	80.38367	118185.4
1134.2	0.712251	4.20228	0.812951	0.448863	0.854886	6.741309	80.72427	118266.1
1134.4	0.712775	4.205371	0.816288	0.450482	0.855048	6.770267	81.06946	118347.2
1134.6	0.713302	4.208479	0.81967	0.452122	0.855212	6.799619	81.41932	118428.6
1134.8	0.713831	4.211604	0.823097	0.453784	0.855378	6.829375	81.77397	118510.4
1135	0.714364	4.214746	0.82657	0.455468	0.855547	6.859544	82.13352	118592.5
1135.2	0.714899	4.217905	0.830091	0.457175	0.855718	6.890137	82.49809	118675
1135.4	0.715438	4.221082	0.83366	0.458906	0.855891	6.921162	82.86779	118757.9
1135.6	0.715979	4.224277	0.837279	0.460661	0.856066	6.952632	83.24277	118841.1
1135.8	0.716524	4.22749	0.840949	0.46244	0.856244	6.984556	83.62313	118924.7
1136	0.717072	4.230722	0.844671	0.464245	0.856425	7.016947	84.00902	119008.7
1136.2	0.717623	4.233973	0.848446	0.466076	0.856608	7.049816	84.40058	119093.1
1136.4	0.718177	4.237243	0.852276	0.467933	0.856793	7.083175	84.79794	119177.9
1136.6	0.718735	4.240534	0.856162	0.469817	0.856982	7.117037	85.20127	119263.1
1136.8	0.719296	4.243844	0.860106	0.47173	0.857173	7.151414	85.6107	119348.8
1137	0.71986	4.247175	0.864108	0.473671	0.857367	7.186322	86.02641	119434.8
1137.2	0.720428	4.250527	0.868171	0.475641	0.857564	7.221773	86.44856	119521.2
1137.4	0.721	4.2539	0.872297	0.477642	0.857764	7.257782	86.87733	119608.1
1137.6	0.721575	4.257295	0.876486	0.479673	0.857967	7.294365	87.31288	119695.4
1137.8	0.722155	4.260712	0.880741	0.481736	0.858174	7.331537	87.75541	119783.2
1138	0.722738	4.264152	0.885063	0.483832	0.858383	7.369316	88.20512	119871.4
1138.2	0.723325	4.267615	0.889454	0.485962	0.858596	7.407717	88.6622	119960
1138.4	0.723916	4.271102	0.893917	0.488126	0.858813	7.44676	89.12686	120049.2
1138.6	0.724511	4.274613	0.898453	0.490325	0.859033	7.486462	89.59933	120138.8
1138.8	0.72511	4.278148	0.903064	0.492561	0.859256	7.526844	90.07984	120228.8
1139	0.725713	4.281709	0.907753	0.494835	0.859483	7.567924	90.56861	120319.4
1139.2	0.726321	4.285296	0.912521	0.497147	0.859715	7.609725	91.0659	120410.5
1139.4	0.726934	4.288909	0.917372	0.499499	0.85995	7.652269	91.57197	120502.1
1139.6	0.727551	4.29255	0.922307	0.501893	0.860189	7.695578	92.08708	120594.1
1139.8	0.728172	4.296218	0.92733	0.504328	0.860433	7.739677	92.61153	120686.8
1140	0.728799	4.299914	0.932442	0.506807	0.860681	7.78459	93.1456	120779.9
1140.2	0.72943	4.303639	0.937648	0.509332	0.860933	7.830345	93.68962	120873.6
1140.4	0.730067	4.307395	0.942949	0.511902	0.86119	7.876969	94.24389	120967.8
1140.6	0.730709	4.31118	0.94835	0.514521	0.861452	7.924491	94.80876	121062.6
1140.8	0.731356	4.314997	0.953852	0.517189	0.861719	7.972941	95.38459	121158
1141	0.732008	4.318847		0.519909				121254
1141.2	0.732666	4.322729	0.965179	0.522682	0.862268	8.072754	96.57063	121350.6
1141.4	0.73333	4.326645	0.971009	0.525509	0.862551	8.124187	97.18165	121447.7

1141.6	0.733999	4.330596	0.976957	0.528394	0.862839	8.176686	97.80523	121545.6	
1141.8	0.734675	4.334584	0.983027	0.531337	0.863134	8.230289	98.44185	121644	
1142	0.735357	4.338607	0.989222	0.534341	0.863434	8.285039	99.09197	121743.1	
1142.2	0.736046	4.342669	0.995547	0.537408	0.863741	8.340979	99.75611	121842.8	
1142.4	0.736741	4.346771	1.002008	0.540122	0.864012	8.397748	100.4324	121943.3	
1142.6	0.737443	4.350912	1.008609	0.541947	0.864195	8.454858	101.1156	122044.4	
1142.8	0.738152	4.355095	1.015357	0.543813	0.864381	8.513256	101.8087	122146.2	
1143	0.738868	4.359321	1.022256	0.54572	0.864572	8.572994	102.5175	122248.7	
1143.2	0.739592	4.363592	1.029313	0.547671	0.864767	8.634126	103.2427	122352	
1143.4	0.740323	4.367908	1.036535	0.549667	0.864967	8.696712	103.985	122455.9	
1143.6	0.741063	4.372272	1.043928	0.551711	0.865171	8.760813	104.7451	122560.7	
1143.8	0.741811	4.376684	1.051501	0.553804	0.86538	8.826496	105.5239	122666.2	
1144	0.742567	4.381148	1.05926	0.555949	0.865595	8.893831	106.322	122772.5	
1144.2	0.743333	4.385665	1.067214	0.558148	0.865815	8.962894	107.1404	122879.7	
1144.4	0.744108	4.390236	1.075373	0.560403	0.86604	9.033766	107.98	122987.7	
1144.6	0.744892	4.394864	1.083745	0.562718	0.866272	9.106532	108.8418	123096.5	
1144.8	0.745687	4.399551	1.092342	0.565094	0.866509	9.181285	109.7269	123206.2	
1145	0.746492	4.4043	1.101173	0.567535	0.866754	9.258125	110.6365	123316.9	
1145.2	0.747307	4.409113	1.110252	0.570045	0.867005	9.337158	111.5717	123428.4	
1145.4	0.748135	4.413994	1.119591	0.572627	0.867263	9.4185	112.534	123541	
1145.6	0.748974	4.418944	1.129203	0.575284	0.867528	9.502276	113.5247	123654.5	
1145.8	0.749825	4.423967	1.139105	0.578021	0.867802	9.588619	114.5454	123769	
1146	0.750689	4.429067	1.149311	0.580842	0.868084	9.677678	115.5978	123884.6	
1146.2	0.751567	4.434248	1.15984	0.583753	0.868375	9.76961	116.6837	124001.3	
1146.4	0.75246	4.439514	1.170711	0.586758	0.868676	9.864591	117.8052	124119.1	
1146.6	0.753367	4.444868	1.181945	0.589863	0.868986	9.96281	118.9644	124238.1	
1146.8	0.754291	4.450317	1.193565	0.593076	0.869308	10.06447	120.1637	124358.3	
1147	0.755231	4.455865	1.205596	0.596402	0.86964	10.16982	121.4058	124479.7	
1147.2	0.75619	4.461518	1.218067	0.599849	0.869985	10.27909	122.6934	124602.4	
1147.4	0.757167	4.467283	1.231009	0.603427	0.870343	10.39257	124.03	124726.4	
1147.6	0.758164	4.473168	1.244455	0.607144	0.870714	10.51058	125.4189	124851.8	
1147.8	0.759183	4.479179	1.258446	0.611011	0.871101	10.63346	126.8643	124978.7	
1148	0.760225	4.485327	1.273023	0.615041	0.871504	10.76162	128.3705	125107	
1148.2	0.761292	4.49162	1.288237	0.619246	0.871925	10.89548	129.9426	125237	
1148.4	0.762385	4.498072	1.304142	0.623643	0.872364	11.03556	131.5863	125368.6	
1148.6	0.763507	4.504694	1.320802	0.628249	0.872825	11.18244	133.308	125501.9	
1148.8	0.764661	4.511502	1.338291	0.633083	0.873308	11.33678	135.1153	125637	
1149	0.76585	4.518513	1.356692	0.63817	0.873817	11.49936	137.0168	125774	
	0.767076						139.0225	125913	
	0.768344						141.1444		
	0.769659						143.3964		
	0.771026					12.25288			
1150	0.772454								
1150.2			1.493437				151.125		
1150.4	0.775526	4.575604	1.52251	0.681367	0.878137	12.96862	154.0908	126796.9	

1150 6	0 777100	4 505 47	1 55 4205	0.000400	0.079642	12 2460	157 2022	126054.2
1150.6	0.777198	4.58547	1.554285	0.686422	0.878642	13.2469	157.2932 160.809	126954.2 127115
1150.8	0.778987	4.596024	1.589377	0.692006	0.879201 0.879826	13.5546 13.89956	164.7249	127279.8
1151	0.780923	4.607443	1.628668	0.698257			169.1603	127279.8
1151.2	0.78305	4.619998	1.673508	0.705392	0.880539	14.29381	174.3078	
1151.4	0.785447	4.63414	1.726152	0.713767	0.881377	14.75748		127623.2
1151.6	0.788262	4.650743	1.790967	0.72408	0.882408	15.32952	180.522	127803.8
1151.8	0.79187	4.672036	1.87909	0.738101	0.88381	16.10936	188.6333	127992.4
1152	0.8	4.72	2.10043	0.768066	0.886807	18.06795	205.0639	128197.5
1152.2	0.804237	4.745001	2.206806	0.779429	0.887943	19.00732	222.4516	128419.9
1152.4	0.806118	4.756099	2.243522	0.783351	0.888335	19.3321	230.0365	128649.9
1152.6	0.807585	4.764753	2.267864	0.785951	0.888595	19.54757	233.278	128883.2
1152.8	0.808835	4.772124	2.285635	0.787849	0.888785	19.70495	235.5151	129118.7
1153	0.809944	4.778668	2.299108	0.789288	0.888929	19.82431	237.1756	129355.9
1153.2	0.810953	4.78462	2.309457	0.790394	0.889039	19.91602	238.442	129594.4
1153.4	0.811885	4.790122	2.317381	0.79124	0.889124	19.98626	239.4137	129833.8
1153.6	0.812757	4.795264	2.323338	0.791876	0.889188	20.03907	240.152	130073.9
1153.8	0.813578	4.800112	2.327643	0.792336	0.889234	20.07724	240.6978	130314.6
1154	0.814358	4.804713	2.330527	0.792644	0.889264	20.10282	241.0803	130555.7
1154.2	0.815102	4.809102	2.332163	0.792819	0.889282	20.11732	241.3208	130797
1154.4	0.815815	4.813307	2.332684	0.792875	0.889287	20.12194	241.4356	131038.5
1154.6	0.8165	4.817351	2.332194	0.792823	0.889282	20.1176	241.4372	131279.9
1154.8	0.817161	4.821251	2.330778	0.792671	0.889267	20.10504	241.3358	131521.2
1155	0.8178	4.825022	2.328502	0.792428	0.889243	20.08486	241.1393	131762.4
1155.2	0.81842	4.828676	2.325422	0.792099	0.88921	20.05755	240.8544	132003.2
1155.4	0.819021	4.832225	2.321584	0.791689	0.889169	20.02351	240.4864	132243.7
1155.6	0.819606	4.835676	2.317024	0.791202	0.88912	19.98309	240.0396	132483.7
1155.8	0.820176	4.839039	2.311773	0.790641	0.889064	19.93655	239.5178	132723.3
1156	0.820732	4.84232	2.305857	0.790009	0.889001	19.88412	238.924	132962.2
1156.2	0.821275	4.845524	2.299296	0.789308	0.888931	19.82598	238.2606	133200.5
1156.4	0.821806	4.848657	2.292106	0.78854	0.888854	19.76227	237.5295	133438
1156.6	0.822326	4.851724	2.284301	0.787707	0.888771	19.69313	236.7324	133674.7
1156.8	0.822835	4.854729	2.275889	0.786808	0.888681	19.61863	235.8706	133910.6
1157	0.823335	4.857676	2.266878	0.785846	0.888585	19.53884	234.9448	134145.5
1157.2	0.823825	4.860568	2.257272	0.784819	0.888482	19.45379	233.9557	134379.5
1157.4	0.824306	4.863408	2.247071	0.78373	0.888373	19.3635	232.9037	134612.4
1157.6	0.824779	4.866199	2.236275	0.782577	0.888258	19.26796	231.7888	134844.2
1157.8	0.825245	4.868943	2.22488	0.781359	0.888136	19.16716	230.6108	135074.8
1158	0.825702	4.871644	2.212881	0.780078	0.888008	19.06104	229.3692	135304.2
1158.2	0.826153	4.874302	2.200269	0.778731	0.887873	18.94953	228.0634	135532.2
1158.4	0.826597	4.87692	2.187034	0.777317	0.887732	18.83254	226.6924	135758.9
1158.6	0.827034	4.879501	2.173162	0.775835	0.887584	18.70997	225.2551	135984.2
1158.8	0.827465	4.882044	2.158638	0.774284	0.887428	18.58167	223.7499	136207.9
1159	0.82789	4.884553		0.77266	0.887266	18.44749	222.1749	136430.1
1159.2	0.82831		2.127551				220.5283	
1159.4			2.110941			18.16066	218.8073	136869.4

1159.6	0.829133	4.891884	2.093581	0.767334	0.886733	18.00755	217.0093	137086.4
1159.8	0.829537	4.894267	2.075438	0.765396	0.88654	17.84759	215.1309	137301.6
1160	0.829936	4.896621	2.056471	0.76337	0.886337	17.68045	213.1682	137514.7
1160.2	0.83033	4.898947	2.036635	0.761252	0.886125	17.50572	211.117	137725.9
1160.4	0.83072	4.901247	2.015879	0.759034	0.885903	17.32297	208.9722	137934.8
1160.6	0.831105	4.903522	1.99414	0.756406	0.885641	17.13108	206.7244	138141.5
1160.8	0.831487	4.905772	1.971349	0.75278	0.885278	16.92836	204.3566	138345.9
1161	0.831864	4.907998	1.947422	0.748973	0.884897	16.7157	201.8644	138547.8
1161.2	0.832237	4.9102	1.922263	0.74497	0.884497	16.49229	199.248	138747
1161.4	0.832607	4.912381	1.895756	0.740752	0.884075	16.25711	196.4964	138943.5
1161.6	0.832973	4.914539	1.867761	0.736298	0.88363	16.00897	193.5965	139137.1
1161.8	0.833335	4.916677	1.83811	0.731581	0.883158	15.74642	190.5323	139327.6
1162	0.833694	4.918794	1.806593	0.726566	0.882657	15.46763	187.2843	139514.9
1162.2	0.834049	4.920892	1.772946	0.721213	0.882121	15.17035	183.8279	139698.8
1162.4	0.834402	4.92297	1.736831	0.715467	0.881547	14.85164	180.1319	139878.9
1162.6	0.834751	4.925029	1.697798	0.709256	0.880926	14.50765	176.1558	140055
1162.8	0.835097	4.927071	1.655234	0.702484	0.880248	14.13307	171.8443	140226.9
1163	0.83544	4.929094	1.608256	0.69501	0.879501	13.72029	167.1201	140394
1163.2	0.83578	4.931101	1.555515	0.686618	0.878662	13.25768	161.8678	140555.9
1163.4	0.836117	4.93309	1.494753	0.676335	0.877633	12.7249	155.8955	140711.8
1163.6	0.836451	4.935064	1.421603	0.656114	0.875611	12.07428	148.7951	140860.6
1163.8	0.836783	4.937021	1.324926	0.629389	0.872939	11.21882	139.7586	141000.3
1164	0.837112	4.938963	1.094813	0.565777	0.866578	9.202786	122.5296	141122.9
1164.2	0.837439	4.940889	0.979444	0.529599	0.86296	8.19864	104.4086	141227.3
1164.4	0.837763	4.942801	0.933511	0.507325	0.860733	7.793979	95.95572	141323.2
1164.6	0.838085	4.944699	0.899727	0.490943	0.859094	7.497618	91.74958	141415
1164.8	0.838404	4.946582	0.872287	0.477637	0.857764	7.257699	88.5319	141503.5
1165	0.838721	4.948451	0.848916	0.466304	0.85663	7.053906	85.86963	141589.4
1165.2	0.839035	4.950308	0.828435	0.456372	0.855637	6.87575	83.57794	141672.9
1165.4	0.839348	4.95215	0.810144	0.447503	0.85475	6.716969	81.55631	141754.5
	0.839658	4.95398			0.853947		79.74262	141834.2
1165.8	0.839966	4.955798	0.778429	0.432123	0.853212	6.442399	78.09521	141912.3
1166	0.840272	4.957603	0.76445	0.425344	0.852534	6.321683	76.5845	141988.9
1166.2	0.840576	4.959396	0.751469	0.41905	0.851905	6.20975		142064.1
1166.4	0.840877	4.961177	0.739349			6.102134	73.8713	142138
1166.6	0.841177	4.962947	0.727979	0.398309	0.849831	6.000993	72.61876	142210.6
		4.964705		0.38857		5.90595	71.44166	142282
				0.379366			70.33361	
1167.2	0.842066	4.968188	0.697561	0.370642	0.847064	5.731527	69.28707	142421.7
1167.4	0.842358			0.362351		5.651092	68.29571	142490
				0.354453		5.574603	67.35417	142557.3
				0.346913		5.501704	66.45784	142623.8
		4.975028		0.3397		5.432089	65.60276	142689.4
				0.332789				142754.2
1168.4	0.843794	4.978387	0.648651	0.326157	0.842616	5.301666	64.00292	142818.2

1168.6	0.844077	4.980053	0.641642	0.319782	0.841978	5.240412	63.25247	142881.4	
					0.841365				
1169	0.844636	4.983355	0.628396	0.307735	0.840773	5.124888	61.83857	143005.8	←
1169.2	0.844914	4.984993	0.622125	0.302031	0.840203	5.070301	61.17113	143067	
1169.4	0.84519	4.986621	0.616068	0.296522	0.839652	5.017647	60.52769	1 4 3127.5	
1169.6	0.845465	4.988241	0.610213	0.291196	0.83912	4.966804	59.90671	143187.4	

SOUTH BAY INDUSTRIAL CENTER TRUCK YARD PONDING

Elevation	Depth (feet)	Area (sq. ft.)	Volume (c.f.)	Σ Volume (c.f.)	Σ Volume (ac-ft)	Qdischarge (cfs)
46.93	0.00	63				
47.10	0.17	681	63	63	0.00	1.40
47.30	0.37	3145	383	446	0.01	2.50
			1062	1,508	0.03	3.20
47.50	0.57	7474	890	2,398	0.06	3.60
47.60	0.67	10334	2775	5,173	0.12	4.20
47.80	0.87	17414				
48.00	1.07	25868	4328	9,501	0.22	4.70
		25004	6096	15,597	0.36	5.10
48.20	1.27	35091				

TRACT No.

Thienes Engineering, Inc.

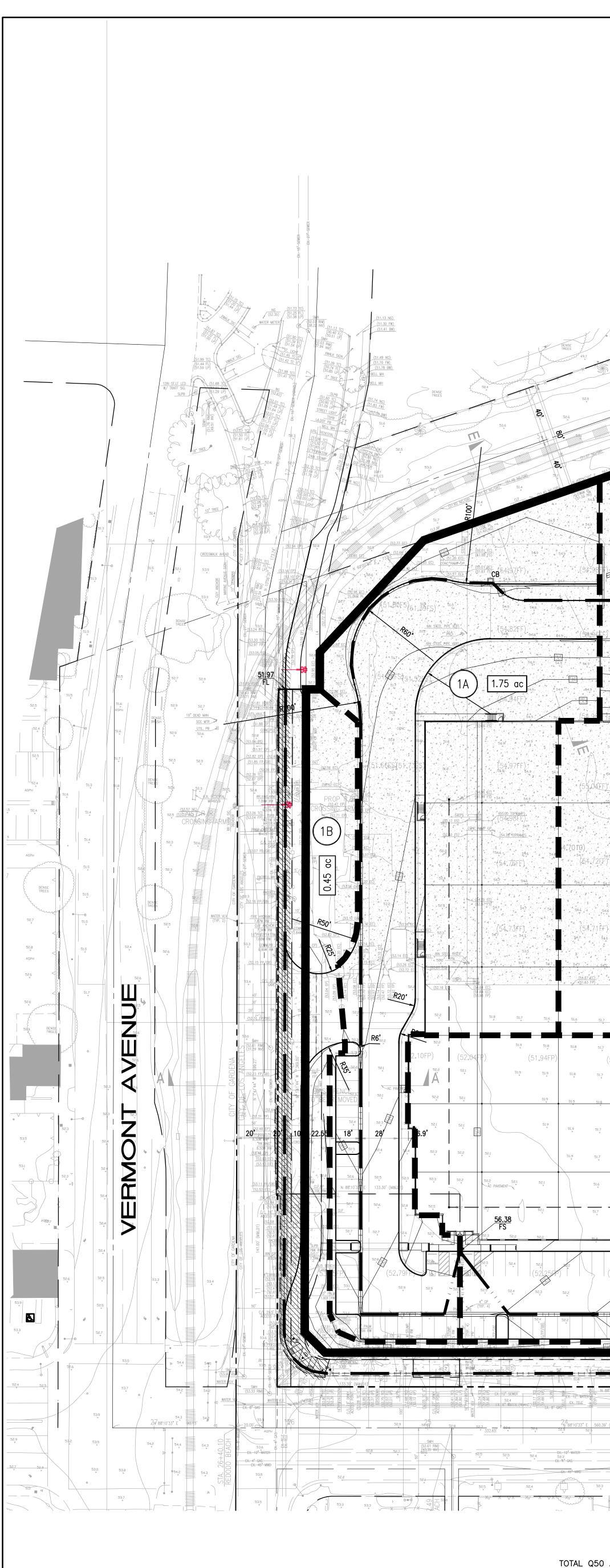
CIVIL ENGINEERING • LAND SURVEYING

date 8/19 job no. 3491 subject 3491 sheet of bv Q50= 20.1 OFS. V. = 143,006 OF - 112,266 CF. 30,740 cF. "Å" VOLUME DETAINED Qour = 5.1 OFS. NIN. MIN. TO 43,000 (1169 - 1117)V2 = 5.1 CF × 60 sec. × 52 min = 15,912 CF. Volume required to detained @ the truck yard: Vdet. Vdet. = V1 - V2 Vact = 30,740 CF - 15,912 CF = 14,828 CF. Vdet. = 14, 828 CF.

14349 Firestone Blvd. • La Mirada, CA 90638 • Tel: (714) 521-4811 • Fax: (714) 521-4173

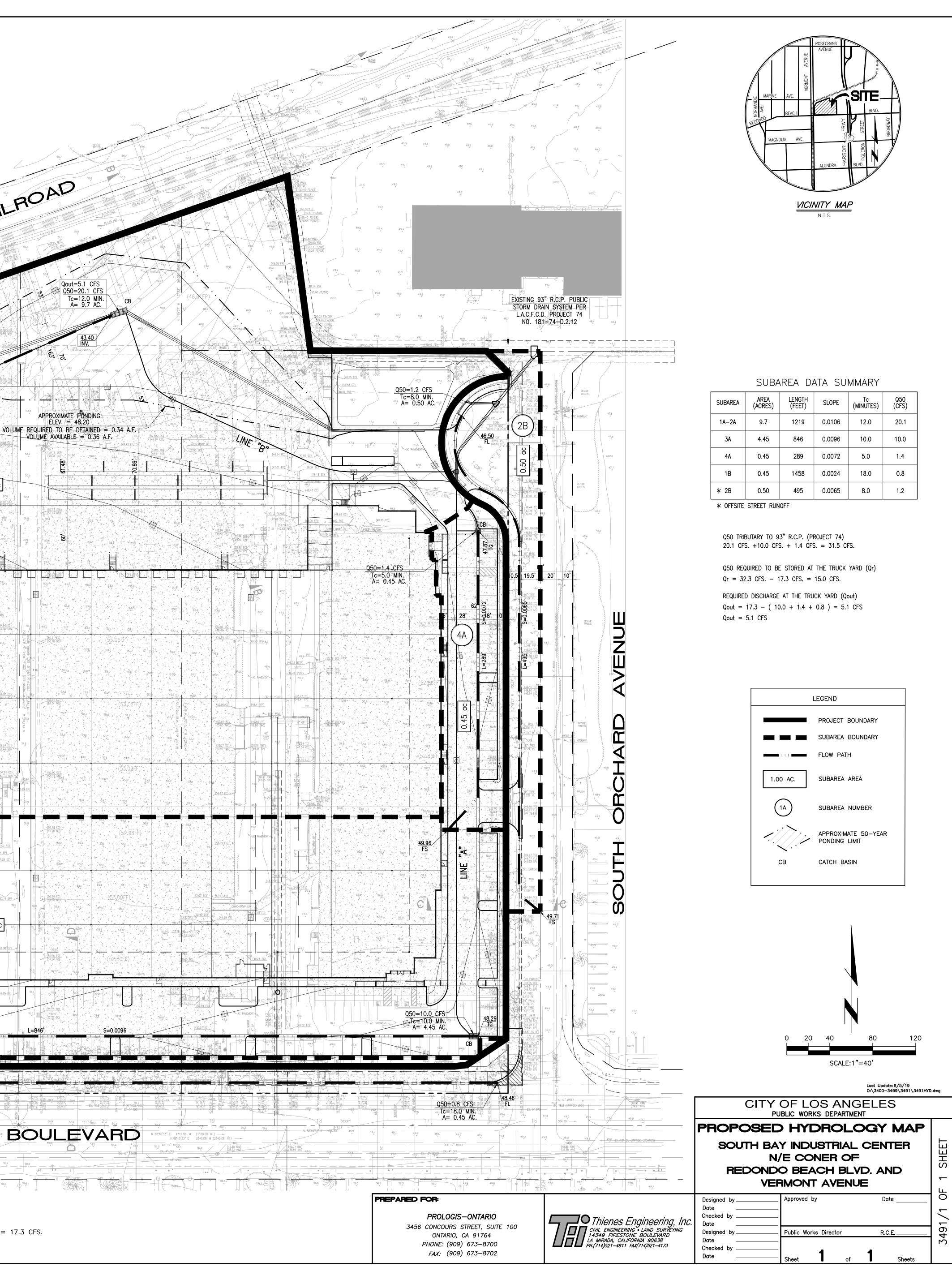
APPENDIX E

HYDROLOGY MAP



			ENSS MARTIN C	49.3 × 52.8 × 52.8
	49.4 x 49.6 x	48.7 48.7 49.4 49.4 49.4 49.4 49.4 49.4 49.4 49	48.7 48.7 48.7 51 51 51 51 51 51 51 51 51 51	52.4 53.4 53.4 53.4 53.4 50.4 50.5 50.5 50.5 50.5 50.5 50.5 50.5
DENSE TREES 49,7 52,5 52,5 52,5 52,5 52,5 52,5 52,5 52	50.7 (50.69) 50.7 (50.69)		Solution (1) (1) (1) (1) (1) (1) (1) (1) (1) (1)	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
52.6 52.6 50.7	50.6 60.81 MB (CB) W Plo 15,249 14 15,249 14 15,255,1 15,2	19-51 19	49.5 49.3 49.5	48.2 49.2 AC*PAN (3) (3) (3) (4) (4) (4) (4) (4) (4) (4) (4) (4) (4
54.9 54.9 54.9 54.9 54.9 54.9 54.9 54.9	54.9 54.9 54.9 54.9 54.9 54.5 54.9 54.5 54.5 54.5 55.1 55.2 55.1 55.2		(49.43.19//5) (0.442.60)	ABS. ABS.
	(554) (54,91) (54,9	221F) (555 02FF) (54.87 E0) (555 02FF) (555 02FF)	ss (5235,F8) (50,34 NS) (53,34 NS) (5	532 532 532 49 43 44 49 49 49 43 44 49 49 49 44 44 49 49 49 44 44 49 49 49 44 531 531 49 49 44 531 531 49 49 44 531 531 49 49 43 531 531 49 49 43 531 531 49 49 43 531 531 49 49 43 531 531 49 49 43 531 531 49 49 439 531 531 531 49 439 531 531 531 531 439 531 531 531 531 531
5494 (55,Ø3FF) (55,O4FF) 9 1 545 (55,O4FF) 545 545 545 545 545 545 545	54.9 54.9 54.9 54.9 54.9 54.9 54.9 54.9 54.9 54.9 54.9 54.9 54.9 54.9 54.9 54.9 54.9 54.9 55.0	SS1 SS1 SS1 SS1 SS1 SS1 SS1 SS1 SS1 SS1	532 ⁴ 532 4532 532 4532 532 532 532 532 532 533 532 533 532 533 531 531 531 533 533 532 532 1 563 531 531 533 532 532 533 532 532	22 538 5392 532 2 538 5392 532 1 531 551 (49.49.47.FP) 1 531 551 (19.49.47.FP) 1 532 552 532 1 532 532
47 (2019) (54.70FF) (54.72FF) 54.7 54.	50NC 5531 554 554 554 554 554 554 554 554 554 55	3551 551 3551		33.2 53.2 55.2 55.2 53.2 53.2 53.2 53.2 (1) (1) 53.2 (2) (3) 53.2 (3) (3) 53.2 (3) (3) 53.2 (3) (3) 53.2 (3) (3) 53.2 (3) (3) 53.2 (3) (3) 53.2 (3) (3) 53.2 (3) (3) 53.2 (3) (3) 53.2 (3) (3) 53.2 (3) (3) 53.2 (3) (3) 53.3 (3) (3) 53.4 (3) (3) 53.2 (3) (3) 53.3 (3) (3) 53.4 (3) (3) 53.2 (3) (3) 53.3 (3) (3) 53.4 (3) (3) 53.2 (3) (3) 53.3 (3) (3) 53.4 (3) (3) 53.5 (3) (3) 53.5 (3) (3) 53.5 (3) 53.5
(54,67 + C0) (54,73 - E0) (55,63 - FP) (54,63 - FP) (54,59 - E0) (54,64 - E0) (54,59 - E0) (51,43 - E0) (51,43 - E0) (51,53 - FP) (51,53 - FP) (51,43 - E0) (51,53 - FP) (51,23 - FP) (51,23 - FP) (51,53 - FP) (51,23 - FP) (51,23 - FP) (51,51 - E0) (51,23 - FP) (51,23 - FP) (51,51 - E0) (51,27 - E0) (51,27 - E0) (51,8 - 51,7 - 51,6 - 51,4 - 51,2 - 51,4 - 51,2 - 51,4 - 51,2 - 51,4 - 51,4 - 51,2 - 51,4 -	(54.98 FF (59) (51.50 EC) (51.50 EC) (51.60 FP) (51.60 FP) (51.60 FP) (51.60 FP) (51.60 FP) (51.50 EC) (51.50	54.67 EC) 457.77 EC) 54.67 EC) 55.6 EC	532 533 531 531 531 (53.02FF) (50.39 M952 532 532 532 532 5331 531 531 531 531 531 531 531 531 531 531 532 533 531 531 531 531 531 531 531 531 531 531	4 .531 531 531 531 533 552 532 534 533 552 532 534 533 551 882 534 533 533 531 8805
$\begin{array}{c} 51.9 \\ 51.9 \\ x \\ x \\ 51.9 \\ x \\ 51.9 \\ x \\ 51.9 \\ x \\ 51.7 \\ x \\ 51.5 \\ x \\ 51.5 \\ x \\ 51.4 \\ 51.5 \\ x \\ 51.5 \\ x \\ 51.4 \\ 51.3 \\ x \\ 51.2 \\ x \\ 5$	(50.47 TG) (47.75 BTA) 50.5 50.8 50.8 51.2 51.2 51.2 51.2 51.2	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	5 522 531 531 531 531 5324 531 531 531 532 533 531 531 532 533 531 531 532 533 531 531 532 533 531 531 532 533 531 531 531 533 531 531 531 533 531 531 531 533 531 531 531 533 531 531 531 533 531 531 531 533 531 531 531 533 531 531 531 533 532 523 523 523 523 523 523	2.531 552 552 552 552 552 552 552 552 552 55
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	51.2 51.1	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	52.9 5	137.// (12.7// <t< td=""></t<>
522 522 522 522 522 522 522 522	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	30' 51.5 × •	52.8 52.9 52.7 52.8	
A H AB 210 33 E 530.39 (M & LD2) C A <t< td=""><td>SMH</td><td></td><td>50.5 x 50.7 x 50.4 x x x x x x x x x x x x x</td><td>Image: Solution of the soluti</td></t<>	SMH		50.5 x 50.7 x 50.4 x x x x x x x x x x x x x	Image: Solution of the soluti

Q50 ALLOWABLE TO PROJECT 74 = 1.15 CFS. PER ACRE TOTAL AREA = 15.05 ACRES TOTAL Q50 ALLOWABLE FROM THE SITE TO PROJECT 74 = 1.15 CFS. PER ACRE x 15.05 ACRES = 17.3 CFS.



LENGTH (FEET)	SLOPE	Tc (MINUTES)	Q50 (CFS)	
1219	0.0106	12.0	20.1	
846	0.0096	10.0	10.0	
289	0.0072	5.0	1.4	
1458	0.0024	18.0	0.8	
495	0.0065	8.0	1.2	