

Parker Adventist Hospital MOB III



August 8, 2018

Town of Parker
Engineering Development Review
20120 East Main Street
Parker, CO 80138

Denver

Abu Dhabi

RE: Parker Adventist Hospital – MOB III

Civil
Structural
Integrated Services

To whom it may concern,

This letter serves as a Drainage Conformance Letter for the MOB III addition at the Parker Adventist Hospital. This letter references the Final Drainage and Erosion Control Report for the Parker Adventist Hospital, prepared by S. A. Miro, Inc., dated May 1, 2002. The latest update to the report was for the Parking Lot a, prepared by S. A. Miro, Inc., dated March, 2018.

The purpose of this letter is to demonstrate the existing and proposed storm sewer facilities serving the improvements for the Parker Adventist Hospital can convey the runoff generated by the proposed MOB III. All tributary drainage from the MOB is routed through existing and proposed storm sewer facilities to the south detention/water quality pond.

I. PROJECT DESCRIPTION

Improvements that impact the storm sewer facilities are as follows:

- The construction of Medical Office Building III, located northeast of the Sierra MOB, with a footprint of 23,288 sq. ft.
- Proposed parking lot, with an added impervious area of 151,740 sq. ft. (188,840 sq. ft. total parking lot area)
- The addition of approximately 1,185 LF of proposed storm sewer pipe and 12 proposed inlets.

The Basins that have been modified for these additions are the following, DA5, DA6, DA13, and F1, with the addition of sub-basins E1-E15.

The Parker Adventist Hospital campus was master planned with the anticipation of the entire campus to be fully developed. While the proposed development is increasing imperviousness, it is still within the planned overall imperviousness. The existing storm infrastructure was sized with future development in mind and can convey increased flows to the South pond. The proposed design is accounting for future development to be conveyed through the system as well. See the appendix for further information regarding storm sewer conveyance.

II. DRAINAGE FACILITY DESIGN

Detention/Water Quality

All proposed storm runoff will be conveyed via storm pipe and discharged to the South pond. The South pond has been master planned to detain and treat the eastern half of the Parker Adventist Hospital site in a future, fully-developed condition.

Parker Adventist Hospital MOB III

Storm Sewer Layout

The proposed storm sewer system will tie into the existing infrastructure at three different locations. The roof drain will connect into an existing storm line which previously led to an inlet but is being removed. Storm line B will tie into an existing area inlet located at the north end of existing parking lot C. Storm line A will tie into the 24" PVC line that currently takes on flows from basin F1, but as designed with the intention of taking on future development flows. The proposed storm sewer was analyzed using the StormCAD V8i program to ensure that the added storm infrastructure does not overwhelm the existing system. The hydraulic grade lines are under the required 1-foot below finish grade at the manholes. The system was checked against flows in the 100-yr condition, but Parker minimum pipe size standards (18" RCP) drove a majority of the pipe sizes. Therefore, the existing and proposed storm sewer is expected to function adequately to convey the anticipated runoff flows.

III. CONCLUSIONS

Compliance with Standards

This Drainage Conformance Letter complies with the Town of Parker Storm Drainage and Environmental Criteria Manual, and the Urban Storm Drainage Criteria Manual. The drainage system is designed to efficiently intercept runoff in curb and gutter and storm sewer and convey the flows to the South detention/water quality pond. The site provides a drainage system which does not exceed the allowable capacities of the existing storm sewer/drainage facilities.

Please call us if you have any questions.

Sincerely,

Jason D. Carr, P.E.
Associate Principle

IV. APPENDICIES

- a. HYDROLOGIC CALCULATIONS**
- b. HYDRAULIC CALCULATIONS**
- c. MAPS**

APPENDIX

**Appendix A
Hydrologic Calculations**



Historic Composite C Calculations

Project Information
 Project Name: MOB III
 Miro Project No: 18057
 Revised Date: 8/7/2018
 Calculated By: MHV

Jurisdiction Impervious Value
 Pond Area 100% Impervious
 Landscape Area 0% Impervious
 Paved Area 100% Impervious
 Roof Area 90% Impervious

Coefficient Equations
 $K_{CD(2)} = 0$ $K_{CD(10)} = -0.18i + 0.21$
 $K_{CD(5)} = -0.10i + 0.11$ $K_{CD(100)} = -0.39i + 0.46$
 $C_{CD} = K_{CD} + (0.858i^3 - 0.786i^2 + 0.774i + 0.04)$

*NOTE: K_{CD} & C_{CD} Equations from UDFCD Criteria Manual

Basin Designation	A _{pond} (ft ²)	A _{landscape} (ft ²)	A _{paved} (ft ²)	A _{roof} (ft ²)	A _{total} (acres)	Impervious-ness	K _{CD} 02-yr	K _{CD} 05-yr	K _{CD} 10-yr	K _{CD} 100-yr	C _{CD} 02 yr	C _{CD} 05 yr	C _{CD} 10 yr	C _{CD} 100 yr
*A1					4.61	67%	0	0.04	0.09	0.20	0.46	0.51	0.55	0.66
*A2					0.71	52%	0	0.06	0.12	0.26	0.35	0.41	0.47	0.61
*A3					0.32	2%	0	0.11	0.21	0.45	0.06	0.16	0.26	0.51
A4		7131	515		0.18	7%	0	0.10	0.20	0.43	0.09	0.19	0.29	0.52
A5		5045	15105		0.46	75%	0	0.04	0.08	0.17	0.54	0.57	0.62	0.71
B1#					1.20	80%	0	0.03	0.07	0.15	0.60	0.63	0.66	0.74
B1A#					0.14	80%	0	0.03	0.07	0.15	0.60	0.63	0.66	0.74
B2#					0.82	85%	0	0.03	0.06	0.13	0.66	0.68	0.71	0.79
B2A#					0.73	79%	0	0.03	0.07	0.15	0.58	0.61	0.65	0.74
B2B#					1.15	85%	0	0.03	0.06	0.13	0.66	0.68	0.71	0.79
B3***					0.73	67%	0	0.04	0.09	0.20	0.46	0.51	0.55	0.66
B3-1***					0.03	0%	0	0.11	0.21	0.46	0.04	0.15	0.25	0.50
B3-2***					0.14	60%	0	0.05	0.10	0.23	0.41	0.46	0.51	0.63
B4***					1.24	100%	0	0.01	0.03	0.07	0.89	0.90	0.92	0.96
B5***					0.55	72%	0	0.04	0.08	0.18	0.51	0.55	0.59	0.69
B5A***					0.10	89%	0	0.02	0.05	0.11	0.71	0.73	0.76	0.82
B5B***					0.20	80%	0	0.03	0.07	0.15	0.60	0.63	0.66	0.74
B5C***					0.08	88%	0	0.02	0.05	0.12	0.70	0.72	0.75	0.81
B6A(EX)**					0.67	78%	0	0.03	0.07	0.16	0.57	0.60	0.64	0.73
B6B(EX)					0.53	87%	0	0.02	0.05	0.12	0.68	0.71	0.74	0.80
B6C**					0.03	82%	0	0.03	0.06	0.14	0.62	0.65	0.68	0.76
B6D**					0.02	28%	0	0.08	0.16	0.35	0.21	0.30	0.37	0.56
B7 (EX)*					2.20	37%	0	0.07	0.14	0.32	0.26	0.34	0.41	0.58
B7A		21,047	69,660		2.08	77%	0	0.03	0.07	0.16	0.56	0.59	0.63	0.72
B7B	26319	12,883			0.90	67%	0	0.04	0.09	0.20	0.47	0.51	0.55	0.66
B8***					0.18	11%	0	0.10	0.19	0.42	0.12	0.22	0.31	0.53
C1A#					0.05	41%	0	0.07	0.14	0.30	0.28	0.35	0.42	0.58
C1B#					0.18	47%	0	0.06	0.13	0.28	0.32	0.38	0.44	0.60
C1C#					0.31	86%	0	0.02	0.06	0.12	0.67	0.69	0.73	0.79
C1D#					0.93	89%	0	0.02	0.05	0.11	0.71	0.73	0.76	0.82
C2#					0.36	92%	0	0.02	0.04	0.10	0.75	0.77	0.80	0.86
C3***					0.41	88%	0	0.02	0.05	0.12	0.70	0.72	0.75	0.81
C5#					0.22	50%	0	0.06	0.12	0.27	0.34	0.40	0.46	0.60
C7 (EX)**					1.75	45%	0	0.07	0.13	0.28	0.31	0.37	0.44	0.59
C7		26,034	50,346		1.75	66%	0	0.04	0.09	0.20	0.45	0.50	0.55	0.66
C8**					0.48	80%	0	0.03	0.07	0.15	0.60	0.63	0.66	0.74
C9		4,162	6,898		0.25	62%	0	0.05	0.10	0.22	0.43	0.47	0.52	0.64
D1#					0.26	90%	0	0.02	0.05	0.11	0.73	0.75	0.77	0.83
D2#					0.49	90%	0	0.02	0.05	0.11	0.73	0.75	0.77	0.83
D3#					0.53	90%	0	0.02	0.05	0.11	0.73	0.75	0.77	0.83
D4**					0.67	90%	0	0.02	0.05	0.11	0.73	0.75	0.77	0.83
D5***					0.40	90%	0	0.02	0.05	0.11	0.73	0.75	0.77	0.83
D6#					0.25	90%	0	0.02	0.05	0.11	0.73	0.75	0.77	0.83
D7**					0.67	90%	0	0.02	0.05	0.11	0.73	0.75	0.77	0.83
DA1#					0.66	71%	0	0.04	0.08	0.18	0.50	0.54	0.58	0.68
DA2#					0.47	95%	0	0.02	0.04	0.09	0.80	0.82	0.84	0.89
DA5#					0.97	93%	0	0.02	0.04	0.10	0.77	0.79	0.81	0.87
DA6#					0.61	50%	0	0.06	0.12	0.27	0.34	0.40	0.46	0.60
DA7#					0.19	96%	0	0.01	0.04	0.09	0.82	0.83	0.85	0.90
DA8#					0.48	88%	0	0.02	0.05	0.12	0.70	0.72	0.75	0.81
DA9#					0.08	74%	0	0.04	0.08	0.17	0.53	0.57	0.61	0.70
DA10#					1.17	99%	0	0.01	0.03	0.07	0.87	0.88	0.90	0.94
DA11#					0.03	4%	0	0.11	0.20	0.44	0.07	0.18	0.27	0.51
DA12#					0.43	76%	0	0.03	0.07	0.16	0.55	0.58	0.62	0.71
DA13*					1.50	69%	0	0.04	0.09	0.19	0.48	0.52	0.57	0.67
DA15#					0.05	20%	0	0.09	0.17	0.38	0.17	0.26	0.34	0.55
DA16#					0.08	57%	0	0.05	0.11	0.24	0.38	0.44	0.49	0.62
OS-1*					6.40	2%	0	0.11	0.21	0.45	0.06	0.16	0.26	0.51
OS-2*					12.80	2%	0	0.11	0.21	0.45	0.06	0.16	0.26	0.51
OS-3*					164.50	2%	0	0.11	0.21	0.45	0.06	0.16	0.26	0.51
OS-4*					3.11	2%	0	0.11	0.21	0.45	0.06	0.16	0.26	0.51
OS-5*					0.54	100%	0	0.01	0.03	0.07	0.89	0.90	0.92	0.96
F1*					5.37	63%	0	0.05	0.10	0.21	0.43	0.48	0.53	0.64
R1#					0.48	90%	0	0.02	0.05	0.11	0.73	0.75	0.77	0.83
F3*					0.36	69%	0	0.04	0.09	0.19	0.48	0.52	0.57	0.67
F4*					0.69	73%	0	0.04	0.08	0.18	0.52	0.56	0.60	0.70
F5#					2.24	100%	0	0.01	0.03	0.07	0.89	0.90	0.92	0.96
F6*					0.23	71%	0	0.04	0.08	0.18	0.50	0.54	0.58	0.68
					0.00									
South Pond Trib					28.89	44%	0	0.07	0.13	0.29	0.30	0.37	0.43	0.59
SW Pond Trib					25.40	61%	0	0.05	0.10	0.22	0.41	0.46	0.51	0.64
Total Onsite					54.29	52%	0	0.06	0.12	0.26	0.35	0.41	0.46	0.61

From Addendum to Final Drainage Plan dated 7/22/2008

* Approved Master Planned Impervious Values used

** From Update dated 1/6/2010

*** From Update dated 6/13/2014

Master Basin B	6.72	80%
	9.37	74%
	12.80	2%
Master Basin A	8.36	82%
	5.62	75%
	5.76	81%
	6.40	2%



Composite C Calculations

Project Information

Project Name: Parker MOB III
Miro Project No: 18057
Revised Date: 8/6/2018
Calculated By: DAT

Jurisdiction Impervious Value

Pond Area 100%
Landscape Area 0%
Paved Area 100%
Roof Area 90%

Coefficient Equations

$C_{CD(2)} = 0.83i^{1.122}$ $C_{CD(10)} = 0.74i + 0.132$
 $C_{CD(5)} = 0.82i + 0.035$ $C_{CD(100)} = 0.4i + 0.484$

*NOTE: C_{CD} Equations from UDFCD Criteria Manual updated March 2017

Basin Designation	A _{pond} (ft ²)	A _{landscape} (ft ²)	A _{paved} (ft ²)	A _{roof} (ft ²)	A _{total} (acres)	Impervious-ness	C _{CD} 02 yr	C _{CD} 05 yr	C _{CD} 10 yr	C _{CD} 100 yr
E1				23,473	0.54	90%	0.72	0.77	0.80	0.84
E2		23,244			0.53	0%	0.00	0.04	0.13	0.48
E3		2,562	6,608		0.21	72%	0.56	0.63	0.67	0.77
E4		4,010	10,513		0.33	72%	0.56	0.63	0.67	0.77
E5		4,799	11,708		0.38	71%	0.55	0.62	0.66	0.77
E6		11,551			0.27	0%	0.00	0.04	0.13	0.48
E7		12,542	18,703		0.72	60%	0.46	0.53	0.57	0.72
E8		1,360	3,183		0.10	70%	0.54	0.61	0.65	0.76
E9		1,971	25,406		0.63	93%	0.75	0.80	0.82	0.86
E10		2,585	19,070		0.50	88%	0.70	0.76	0.78	0.84
E11		917	26,635		0.63	97%	0.78	0.83	0.85	0.87
E12			16,075		0.37	100%	0.81	0.86	0.87	0.88
E13		1,748	10,475		0.28	86%	0.68	0.74	0.77	0.83
E14		735	20,646		0.49	97%	0.78	0.83	0.85	0.87
E15		9,837	5,494		0.35	36%	0.26	0.33	0.40	0.63
					0.00					
F1		82,679			1.90	0%	0.00	0.04	0.13	0.48
TOTAL		160,540	174,516	23,473	8.23	55%	0.41	0.48	0.54	0.70
					0.00					
DA1		8,337	20,412		0.66	71%	0.55	0.62	0.66	0.77
DA2		1,024	19,450		0.47	95%	0.77	0.81	0.83	0.86
DA7		331	7,945		0.19	96%	0.78	0.82	0.84	0.87
DA8		2,509	18,400		0.48	88%	0.70	0.76	0.78	0.84
DA9		906	2,579		0.08	74%	0.58	0.64	0.68	0.78
DA10		509	50,456		1.17	99%	0.80	0.85	0.86	0.88
DA11		1,254	52		0.03	4%	0.02	0.07	0.16	0.50
DA15		1,742	436		0.05	20%	0.13	0.20	0.28	0.56
DA16		1,498	1,986		0.08	57%	0.43	0.50	0.55	0.71
F3		4,861	10,820		0.36	69%	0.54	0.60	0.64	0.76
F4		8,115	21,941		0.69	73%	0.57	0.63	0.67	0.78
					0.00					



TIME OF CONCENTRATION

Project Information
 Project Name: Parker MOB III
 S.A. Project No: 18057
 Revised Date: 8/6/2018
 Calculated By: DAT

Conveyance Coefficient Value
 Grassed Waterway 15
 Heavy Meadow 2.5
 Nearly Bare Ground 10
 Paved Areas and Shallow Paved Swales 20
 Short Pasture and Lawns 7
 Tillage / Field 5

Time of Concentration Equations
 $t_t = 0.395(1.1 - C_5)L^{1/2} / S^{1/3}$ $t_t = (L/v)/60$
 $t_c \text{ check: } t_c = (26-17i) + (L/(60(14i+19)S^{1/2}))$

*NOTE: Cv Values, T_i, T_t, & T_c Equations from UDFCD Criteria Manual updated March 2017

SUB-BASIN DATA			INITIAL/OVERLAND TIME (t _i)			TRAVEL TIME (t _t)						t _i + t _t		t _c CHECK (urbanized basins)		FINAL t _c USED
Basin Designation	Area (acres)	C _{CD} 05 yr	length (ft)	slope %	t _i (min)	length (ft)	slope %	Type of Land Surface	Conveyance Coefficient Cv	velocity (ft/sec)	t _t (min)	t _c (min)	Total Length (ft)	t _c (min)	t _c (min)	
E1	0.54	0.77	225	1.00%	8.99	0	1.00%	Paved areas and shallow paved swales	20	2.00	0	8.99	225	12.44	8.99	
E2	0.53	0.04	86	15.00%	7.34	275	2.50%	Paved areas and shallow paved swales	20	3.16	1.45	8.79	361	30.23	8.79	
E3	0.21	0.63	55	4.00%	4.06	91	4.30%	Paved areas and shallow paved swales	20	4.15	0.37	4.43	146	14.36	5.00	
E4	0.33	0.63	84	1.20%	7.45	148	2.60%	Paved areas and shallow paved swales	20	3.22	0.76	8.22	232	14.95	8.22	
E5	0.38	0.62	110	2.00%	7.38	120	2.90%	Paved areas and shallow paved swales	20	3.41	0.59	7.96	230	15.13	7.96	
E6	0.27	0.04	66	18.00%	6.05	0	1.00%	Paved areas and shallow paved swales	20	2.00	0	6.05	66	27.22	6.05	
E7	0.72	0.53	271	4.00%	10.92	0	1.00%	Paved areas and shallow paved swales	20	2.00	0	10.92	271	18.42	10.92	
E8	0.10	0.61	110	2.00%	7.49	0	10.0%	Paved areas and shallow paved swales	20	6.32	0	7.49	110	14.40	7.49	
E9	0.63	0.80	200	2.90%	5.53	63	1.0%	Paved areas and shallow paved swales	20	2.00	0.53	6.05	263	12.22	6.05	
E10	0.50	0.76	236	3.6%	6.30	0	1.0%	Paved areas and shallow paved swales	20	2.00	0	6.30	236	12.87	6.30	
E11	0.63	0.83	206	3.80%	4.59	83	1.8%	Paved areas and shallow paved swales	20	2.68	0.52	5.11	289	11.16	5.11	
E12	0.37	0.86	138	4.00%	3.32	85	1.6%	Paved areas and shallow paved swales	20	2.53	0.56	3.88	223	10.28	5.00	
E13	0.28	0.74	85	3.50%	4.03	45	3.0%	Paved areas and shallow paved swales	20	3.46	0.22	4.25	130	12.03	5.00	
E14	0.49	0.83	150	2.80%	4.35	115	1.5%	Paved areas and shallow paved swales	20	2.45	0.78	5.13	265	11.19	5.13	
E15	0.35	0.33	0	1.00%	0.00	300	2.40%	Paved areas and shallow paved swales	20	3.10	1.61	1.61	300	22.21	5.00	
F1	1.90	0.04	192	4.60%	16.27	0	1.0%	Paved areas and shallow paved swales	20	2.00	0	16.27	192	29.56	16.27	
TOTAL	8.23	0.48			0			Paved areas and shallow paved swales	20		0	0.00	0	#DIV/0!	#DIV/0!	
								Paved areas and shallow paved swales								



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Basin Designation	Area (acres)	C _{CD} 05 yr	length (ft)	slope %	t _i (min)	length (ft)	slope %	Type of Land Surface	Conveyance Coefficient Cv	velocity (ft/sec)	t _t (min)	t _c (min)	Total Length (ft)	t _c (min)	t _c (min)	
DA1	0.66	0.62	202	4.00%	7.93	0	1.0%	Paved areas and shallow paved swales	20	2.00	0	7.93	202	15.71	7.93	
DA2	0.47	0.81	200	3.70%	4.79	18	2.0%	Paved areas and shallow paved swales	20	2.83	0.11	4.90	218	11.00	5.00	
DA7	0.19	0.82	12	2.00%	1.40	250	2.00%	Paved areas and shallow paved swales	20	2.83	1.47	2.87	262	11.06	5.00	
DA8	0.48	0.76	12	3.10%	1.50	225	3.10%	Paved areas and shallow paved swales	20	3.52	1.06	2.56	237	12.09	5.00	
DA9	0.08	0.64	12	2.90%	2.04	240	2.90%	Paved areas and shallow paved swales	20	3.41	1.17	3.22	252	14.69	5.00	
DA10	1.17	0.85	20	3.80%	1.33	130	3.80%	Paved areas and shallow paved swales	20	3.90	0.56	1.89	150	9.73	5.00	
DA11	0.03	0.07	52	2.00%	10.83	0	2.60%	Paved areas and shallow paved swales	20	3.22	0	10.83	52	25.89	10.83	
DA15	0.05	0.20	93	2.00%	12.64	0	1.00%	Paved areas and shallow paved swales	20	2.00	0	12.64	93	23.91	12.64	
DA16	0.08	0.50	63	2.00%	6.90	0	1.00%	Paved areas and shallow paved swales	20	2.00	0	6.90	63	16.93	6.90	
F3	0.36	0.60	10	2.00%	2.30	300	3.7%	Paved areas and shallow paved swales	20	3.85	1.30	3.60	310	15.71	5.00	
F4	0.03	0.63	14	2.00%	2.54	300	2.7%	Paved areas and shallow paved swales	20	3.29	1.52	4.06	314	15.25	5.00	



Runoff Calculations (Rational Method)

Project Information

Project Name: Parker MOB III
S.A. Project No: 18057
Revised Date: 8/6/2018
Calculated By: DAT

Intensity Equation

$$I = 28.5 (P_1)/(10+T_c)^{0.786}$$

*NOTE: P & Intensity Equation from UDFCD Criteria Manual

Basin Designation	Area (ac.)	'c'	cA	t _c (min)	P ₁	intensity (in/hr)	Q (cfs)	
E1	0.54	0.72	0.39	8.99	0.99	2.79	1.08	02 YR
		0.77	0.42		1.39	3.92	1.63	05 YR
		0.80	0.43		1.64	4.62	1.99	10 YR
		0.84	0.45		2.60	7.33	3.33	100 YR
E2	0.53	0.00	0.00	8.79	0.99	2.81	0.00	02 YR
		0.04	0.02		1.39	3.95	0.07	05 YR
		0.13	0.07		1.64	4.66	0.33	10 YR
		0.48	0.26		2.60	7.39	1.91	100 YR
E3	0.21	0.56	0.12	5.00	0.99	3.36	0.40	02 YR
		0.63	0.13		1.39	4.71	0.62	05 YR
		0.67	0.14		1.64	5.56	0.78	10 YR
		0.77	0.16		2.60	8.82	1.43	100 YR
E4	0.33	0.56	0.19	8.22	0.99	2.88	0.54	02 YR
		0.63	0.21		1.39	4.05	0.85	05 YR
		0.67	0.22		1.64	4.77	1.06	10 YR
		0.77	0.26		2.60	7.57	1.95	100 YR
E5	0.38	0.55	0.21	7.96	0.99	2.91	0.61	02 YR
		0.62	0.23		1.39	4.09	0.96	05 YR
		0.66	0.25		1.64	4.83	1.20	10 YR
		0.77	0.29		2.60	7.65	2.23	100 YR
E6	0.27	0.00	0.00	6.05	0.99	3.18	0.00	02 YR
		0.04	0.01		1.39	4.47	0.04	05 YR
		0.13	0.04		1.64	5.27	0.18	10 YR
		0.48	0.13		2.60	8.36	1.07	100 YR
E7	0.72	0.46	0.33	10.92	0.99	2.59	0.85	02 YR
		0.53	0.38		1.39	3.63	1.37	05 YR
		0.57	0.41		1.64	4.28	1.77	10 YR
		0.72	0.52		2.60	6.79	3.52	100 YR
E8	0.10	0.54	0.06	7.49	0.99	2.98	0.17	02 YR
		0.61	0.06		1.39	4.18	0.27	05 YR
		0.65	0.07		1.64	4.93	0.33	10 YR
		0.76	0.08		2.60	7.82	0.62	100 YR
E9	0.63	0.75	0.47	6.05	0.99	3.18	1.49	02 YR
		0.80	0.50		1.39	4.47	2.24	05 YR
		0.82	0.51		1.64	5.27	2.71	10 YR
		0.86	0.54		2.60	8.36	4.49	100 YR
E10	0.50	0.70	0.35	6.30	0.99	3.15	1.10	02 YR
		0.76	0.38		1.39	4.42	1.66	05 YR
		0.78	0.39		1.64	5.21	2.03	10 YR
		0.84	0.42		2.60	8.26	3.43	100 YR
E11	0.63	0.78	0.49	5.11	0.99	3.34	1.65	02 YR
		0.83	0.52		1.39	4.69	2.45	05 YR
		0.85	0.54		1.64	5.53	2.96	10 YR
		0.87	0.55		2.60	8.77	4.83	100 YR



Runoff Calculations (Rational Method)

Project Information

Project Name: Parker MOB III
S.A. Project No: 18057
Revised Date: 8/6/2018
Calculated By: DAT

Intensity Equation

$$I = 28.5 (P_1)/(10+T_c)^{0.786}$$

*NOTE: P & Intensity Equation from UDFCD Criteria Manual

Basin Designation	Area (ac.)	'c'	cA	t _c (min)	P ₁	intensity (in/hr)	Q (cfs)	
E12	0.37	0.81	0.30	5.00	0.99	3.36	1.01	02 YR
		0.86	0.32		1.39	4.71	1.49	05 YR
		0.87	0.32		1.64	5.56	1.79	10 YR
		0.88	0.33		2.60	8.82	2.88	100 YR
E13	0.28	0.68	0.19	5.00	0.99	3.36	0.64	02 YR
		0.74	0.21		1.39	4.71	0.98	05 YR
		0.77	0.21		1.64	5.56	1.20	10 YR
		0.83	0.23		2.60	8.82	2.05	100 YR
E14	0.49	0.78	0.38	5.13	0.99	3.33	1.28	02 YR
		0.83	0.41		1.39	4.68	1.90	05 YR
		0.85	0.42		1.64	5.52	2.30	10 YR
		0.87	0.43		2.60	8.76	3.74	100 YR
E15	0.35	0.26	0.09	5.00	0.99	3.36	0.30	02 YR
		0.33	0.12		1.39	4.71	0.55	05 YR
		0.40	0.14		1.64	5.56	0.78	10 YR
		0.63	0.22		2.60	8.82	1.95	100 YR
F1	1.90	0.00	0.00	16.27	0.99	2.16	0.00	02 YR
		0.04	0.07		1.39	3.04	0.20	05 YR
		0.13	0.25		1.64	3.58	0.90	10 YR
		0.48	0.92		2.60	5.68	5.22	100 YR
DA1	0.66	0.55	0.36	7.93	0.99	2.92	1.06	02 YR
		0.62	0.41		1.39	4.10	1.67	05 YR
		0.66	0.43		1.64	4.84	2.10	10 YR
		0.77	0.51		2.60	7.67	3.89	100 YR
DA2	0.47	0.77	0.36	5.00	0.99	3.36	1.21	02 YR
		0.81	0.38		1.39	4.71	1.80	05 YR
		0.83	0.39		1.64	5.56	2.18	10 YR
		0.86	0.41		2.60	8.82	3.58	100 YR
DA7	0.19	0.78	0.15	5.00	0.99	3.36	0.49	02 YR
		0.82	0.16		1.39	4.71	0.74	05 YR
		0.84	0.16		1.64	5.56	0.89	10 YR
		0.87	0.16		2.60	8.82	1.45	100 YR



Runoff Calculations (Rational Method)

Project Information

Project Name: Parker MOB III
S.A. Project No: 18057
Revised Date: 8/6/2018
Calculated By: DAT

Intensity Equation

$$I = 28.5 (P_1)/(10+T_c)^{0.786}$$

*NOTE: P & Intensity Equation from UDFCD Criteria Manual

Basin Designation	Area (ac.)	'c'	cA	t _c (min)	P ₁	intensity (in/hr)	Q (cfs)	
DA8	0.48	0.70	0.34	5.00	0.99	3.36	1.13	02 YR
		0.76	0.36		1.39	4.71	1.71	05 YR
		0.78	0.38		1.64	5.56	2.09	10 YR
		0.84	0.40		2.60	8.82	3.54	100 YR
DA9	0.08	0.58	0.05	5.00	0.99	3.36	0.16	02 YR
		0.64	0.05		1.39	4.71	0.24	05 YR
		0.68	0.05		1.64	5.56	0.30	10 YR
		0.78	0.06		2.60	8.82	0.55	100 YR
DA10	1.17	0.80	0.94	5.00	0.99	3.36	3.15	02 YR
		0.85	0.99		1.39	4.71	4.67	05 YR
		0.86	1.01		1.64	5.56	5.63	10 YR
		0.88	1.03		2.60	8.82	9.08	100 YR
DA11	0.03	0.02	0.00	10.83	0.99	2.59	0.00	02 YR
		0.07	0.00		1.39	3.64	0.01	05 YR
		0.16	0.00		1.64	4.30	0.02	10 YR
		0.50	0.01		2.60	6.81	0.10	100 YR
DA15	0.05	0.13	0.01	12.64	0.99	2.43	0.02	02 YR
		0.20	0.01		1.39	3.41	0.03	05 YR
		0.28	0.01		1.64	4.02	0.06	10 YR
		0.56	0.03		2.60	6.38	0.18	100 YR
DA16	0.08	0.43	0.03	6.90	0.99	3.06	0.11	02 YR
		0.50	0.04		1.39	4.29	0.17	05 YR
		0.55	0.04		1.64	5.06	0.22	10 YR
		0.71	0.06		2.60	8.03	0.46	100 YR
F3	0.36	0.54	0.19	5.00	0.99	3.36	0.65	02 YR
		0.60	0.22		1.39	4.71	1.02	05 YR
		0.64	0.23		1.64	5.56	1.29	10 YR
		0.76	0.27		2.60	8.82	2.41	100 YR
F4	0.69	0.57	0.39	5.00	0.99	3.36	1.32	02 YR
		0.63	0.44		1.39	4.71	2.06	05 YR
		0.67	0.46		1.64	5.56	2.58	10 YR
		0.78	0.54		2.60	8.82	4.72	100 YR



Storm Sewer Routing

Project Information
 Project Name: Parker MOB III
 Miro Project No: 18057
 Revised Date: 8/6/2018
 Calculated by: 18057

05 Yr Event

Design Point	Basin(s)	Direct Runoff							Total Runoff					Travel Time (Pipe)							Remarks	
		Area (ac.)	C5	tc (min)	cA (ac.)	P1 (in)	I (in/hr)	Q5 (cfs)	tc (min)	Σ (cA) (ac.)	P1 (in)	I (in/hr)	Q5 (cfs)	Design Flow (cfs)	Slope (ft/ft)	Size (in)	Length (ft)	Manning's n	Depth (in)	Velocity (ft/sec)		tt (min)
	E1	0.54	0.77	8.99	0.42	1.39	3.92	1.63						1.63								
	E2	0.53	0.04	8.79	0.02	1.39	3.95	0.07						0.07								
	DA11	0.03	0.07	10.83	0.00	1.39	3.64	0.01						0.01								
	DA15	0.05	0.20	12.64	0.01	1.39	3.41	0.03						0.03								
	DA16	0.08	0.50	6.90	0.04	1.39	4.29	0.17						0.17								
1	E+E2+DA11+D A15+DA16							1.66	12.64	0.49	1.39	3.41	1.66	1.66	0.022	24.00	36	0.013	5.3652	7.01	0.09	
	E6	0.27	0.04	6.05	0.01	1.39	4.47	0.04						0.04								
	E7	0.72	0.53	10.92	0.38	1.39	3.63	1.37						1.37								
2	E6+E7							1.40	10.92	0.39	1.39	3.63	1.40	1.40	0.010	18.00	100	0.013	8.1204	5.68	0.29	
	E8	0.10	0.61	7.49	0.06	1.39	4.18							0.00								
3	DP2+E8							1.62	11.21	0.45	1.39	3.59	1.62	1.62	0.010	18.00	228	0.013	8.6244	5.84	0.65	
	E4	0.33	0.63	8.22	0.21	1.39	4.05	0.85						0.85								
4	DP3+E4							2.31	11.86	0.66	1.39	3.51	2.31	2.31	0.010	18.00	41	0.013	10.2048	6.25	0.11	
	E5	0.38	0.62	7.96	0.23	1.39	4.09							0.00								
5	DP4+E5							3.12	11.97	0.89	1.39	3.49	3.12	3.12	0.020	18.00	50	0.013	9.642	8.65	0.10	
	DA1	0.66	0.62	7.93	0.41	1.39	4.10							0.00								
6	DP5+DA1							4.53	12.07	1.30	1.39	3.48	4.53	4.53	0.031	18.00	63	0.013	10.3356	11.05	0.09	
	E5	0.38	0.62	7.96	0.23	1.39	4.09							0.00								
7	DP6+E5							5.32	12.16	1.53	1.39	3.47	5.32	5.32	0.070	18.00	41	0.013	8.8308	15.60	0.04	
8	DP1+DP7							6.90	12.64	2.02	1.39	3.41	6.90	6.90	0.038	24.00	103	0.013	10.8564	13.34	0.13	
	E12	0.37	0.86	5.00	0.32	1.39	4.71	1.49						1.49								
	E13	0.28	0.74	5.00	0.21	1.39	4.71	0.98						0.98								
	F1	1.90	0.04	16.27	0.07	1.39	3.04	0.20						0.20								
9	E12+E13=F1							1.79	16.27	0.59	1.39	3.04	1.79	1.79	0.010	18.00	13	0.013	12.1584	6.60	0.03	
	E14	0.49	0.83	5.13	0.41	1.39	4.68	1.90						1.90								
10	DP9+E14							3.02	16.30	0.99	1.39	3.03	3.02	3.02	0.020	18.00	26	0.013	11.3832	9.17	0.05	
11	DP9+DP10							3.01	16.35	0.99	1.39	3.03	3.01	3.01	0.028	18.00	176	0.013	10.1892	10.45	0.28	
	E11	0.63	0.83	5.11	0.52	1.39	4.69	2.45						2.45								
12	DP11+E11							4.56	16.63	1.52	1.39	3.00	4.56	4.56	0.024	18.00	37	0.013	12.7152	10.33	0.06	
	E9	0.63	0.80	6.05	0.50	1.39	4.47	2.24						2.24								
	E10	0.50	0.76	6.30	0.38	1.39	4.42	1.66						1.66								
14	DP12+E9+E10							7.18	16.69	2.39	1.39	3.00	7.18	7.18	0.010	24.00	190	0.013	16.914	8.07	0.39	
	DA1	0.66	0.62	7.93	0.41	1.39	4.10	1.67						1.67								
	DA2	0.47	0.81	5.00	0.38	1.39	4.71	1.80						1.80								
	DA7	0.19	0.82	5.00	0.16	1.39	4.71	0.74						0.74								
	DA8	0.48	0.76	5.00	0.36	1.39	4.71	1.71						1.71								
	DA9	0.08	0.64	5.00	0.05	1.39	4.71	0.24						0.24								
	DA10	1.17	0.85	5.00	0.99	1.39	4.71	4.67						4.67								
	F4	0.69	0.63	5.00	0.44	1.39	4.71	2.06						2.06								
	F3	0.36	0.60	5.00	0.22	1.39	4.71	1.02						1.02								
15	BASIN B							21.99	17.08	7.42	1.39	2.96	21.99	21.99	0.036	36.00	70	0.013	16.3584	17.16	0.07	



Storm Sewer Routing

Project Information
 Project Name: Parker MOB III
 Miro Project No: 18057
 Revised Date: 8/6/2018
 Calculated by: 18057

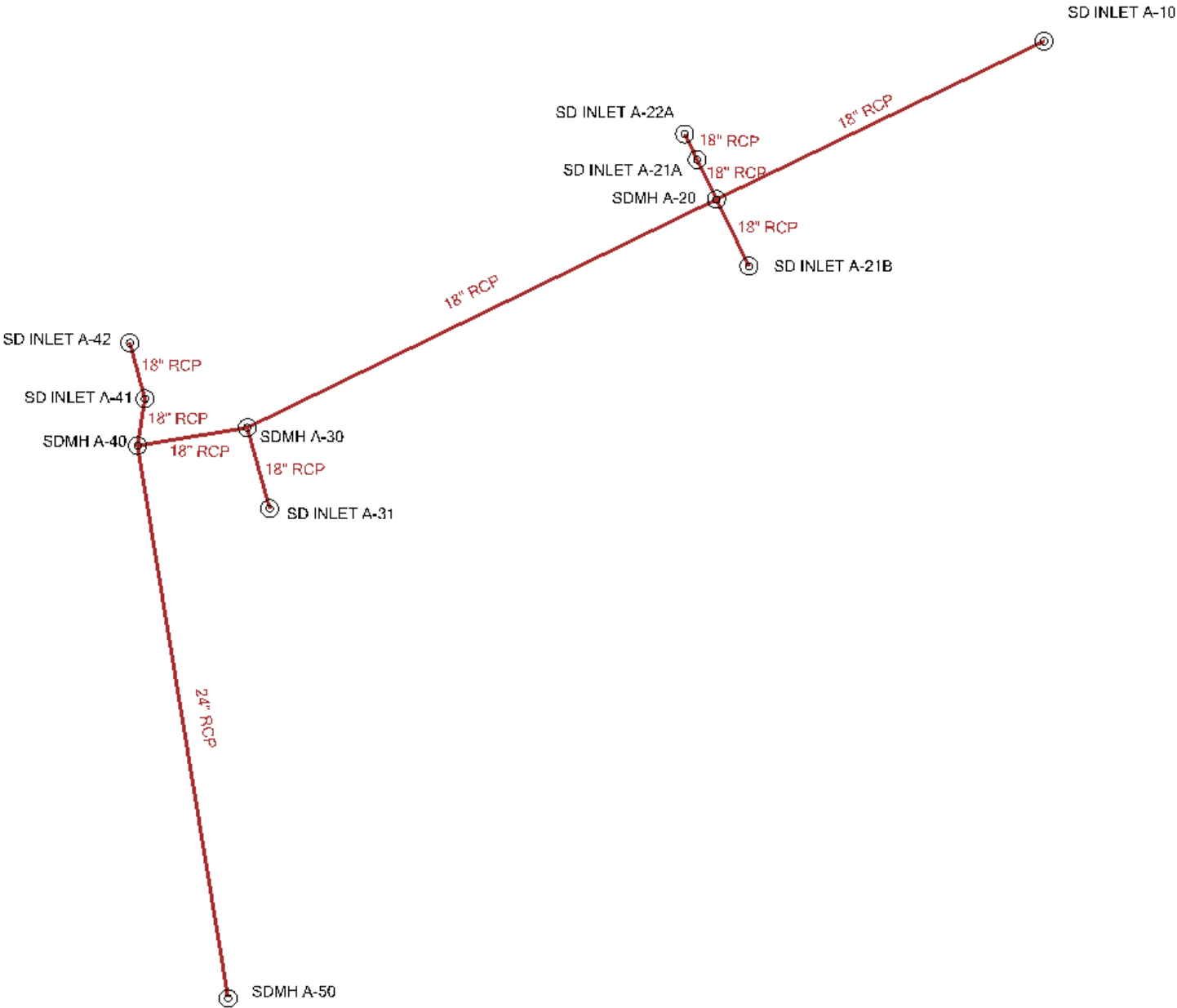
100 Yr Event

Design Point	Basin(s)	Direct Runoff							Total Runoff					Travel Time (Pipe)							Remarks	
		Area (ac.)	C100	tc (min)	cA (ac.)	P1 (in)	I (in/hr)	Q100 (cfs)	tc (min)	Σ (cA) (ac.)	P1 (in)	I (in/hr)	Q100 (cfs)	Design Flow (cfs)	Slope (ft/ft)	Size (in)	Length (ft)	Manning's n	Depth (in)	Velocity (ft/sec)		tt (min)
	E1	0.54	0.84	8.99	0.45	2.60	7.33	3.33														
	E2	0.53	0.48	8.79	0.26	2.60	7.39	1.91														
	DA11	0.03	0.50	10.83	0.01	2.60	6.81	0.10														
	DA15	0.05	0.56	12.64	0.03	2.60	6.38	0.18														
	DA16	0.08	0.71	6.90	0.06	2.60	8.03	0.46														
1	E+E2+DA11+D A15+DA16							5.19	12.64	0.81	2.60	6.38	5.19	5.19	0.022	24.00	36	0.013	5.3652	7.01	0.09	
	E6	0.27	0.48	6.05	0.13	2.60	8.36	1.07														
	E7	0.72	0.72	10.92	0.52	2.60	6.79	3.52														
2	E6+E7							4.40	10.92	0.65	2.60	6.79	4.40	4.40	0.010	18.00	100	0.013	8.1204	5.68	0.29	
	E8	0.10	0.76	7.49	0.08	2.60	7.82	0.00														
3	DP2+E8							4.88	11.21	0.73	2.60	6.72	4.88	4.88	0.010	18.00	228	0.013	8.6244	5.84	0.65	
	E4	0.33	0.77	8.22	0.26	2.60	7.57	1.95														
4	DP3+E4							6.46	11.86	0.98	2.60	6.56	6.46	6.46	0.010	18.00	41	0.013	10.2048	6.25	0.11	
	E5	0.38	0.77	7.96	0.29	2.60	7.65	0.00														
5	DP4+E5							8.34	11.97	1.28	2.60	6.53	8.34	8.34	0.020	18.00	50	0.013	9.642	8.65	0.10	
	DA1	0.66	0.77	7.93	0.51	2.60	7.67	0.00														
6	DP5+DA1							11.61	12.07	1.78	2.60	6.51	11.61	11.61	0.031	18.00	63	0.013	10.3356	11.05	0.09	
	E5	0.38	0.77	7.96	0.29	2.60	7.65	0.00														
7	DP6+E5							13.46	12.16	2.07	2.60	6.49	13.46	13.46	0.070	18.00	41	0.013	8.8308	15.60	0.04	
8	DP1+DP7							18.42	12.64	2.89	2.60	6.38	18.42	18.42	0.038	24.00	103	0.013	10.8564	13.34	0.13	
	E12	0.37	0.88	5.00	0.33	2.60	8.82	2.88														
	E13	0.28	0.83	5.00	0.23	2.60	8.82	2.05														
	F1	1.90	0.48	16.27	0.92	2.60	5.68	5.22														
9	E12+E13=F1							8.38	16.27	1.48	2.60	5.68	8.38	8.38	0.010	18.00	13	0.013	12.1584	6.60	0.03	
	E14	0.49	0.87	5.13	0.43	2.60	8.76	3.74														
10	DP9+E14							10.80	16.30	1.90	2.60	5.67	10.80	10.80	0.020	18.00	26	0.013	11.3832	9.17	0.05	
11	DP9+DP10							10.78	16.35	1.90	2.60	5.66	10.78	10.78	0.028	18.00	176	0.013	10.1892	10.45	0.28	
	E11	0.63	0.87	5.11	0.55	2.60	8.77	4.83														
12	DP11+E11							13.79	16.63	2.45	2.60	5.62	13.79	13.79	0.024	18.00	37	0.013	12.7152	10.33	0.06	
	E9	0.63	0.86	6.05	0.54	2.60	8.36	4.49														
	E10	0.50	0.84	6.30	0.42	2.60	8.26	3.43														
14	DP12+E9+E10							19.11	16.69	3.41	2.60	5.61	19.11	19.11	0.010	24.00	190	0.013	16.914	8.07	0.39	
	DA1	0.66	0.77	7.93	0.51	2.60	7.67	3.89														
	DA2	0.47	0.86	5.00	0.41	2.60	8.82	3.58														
	DA7	0.19	0.87	5.00	0.16	2.60	8.82	1.45														
	DA8	0.48	0.84	5.00	0.40	2.60	8.82	3.54														
	DA9	0.08	0.78	5.00	0.06	2.60	8.82	0.55														
	DA10	1.17	0.88	5.00	1.03	2.60	8.82	9.08														
	F4	0.69	0.78	5.00	0.54	2.60	8.82	4.72														
	F3	0.36	0.76	5.00	0.27	2.60	8.82	2.41														
15	BASIN B							53.63	17.08	9.67	2.60	5.54	53.63	53.63	0.036	36.00	70	0.013	16.3584	17.16	0.07	

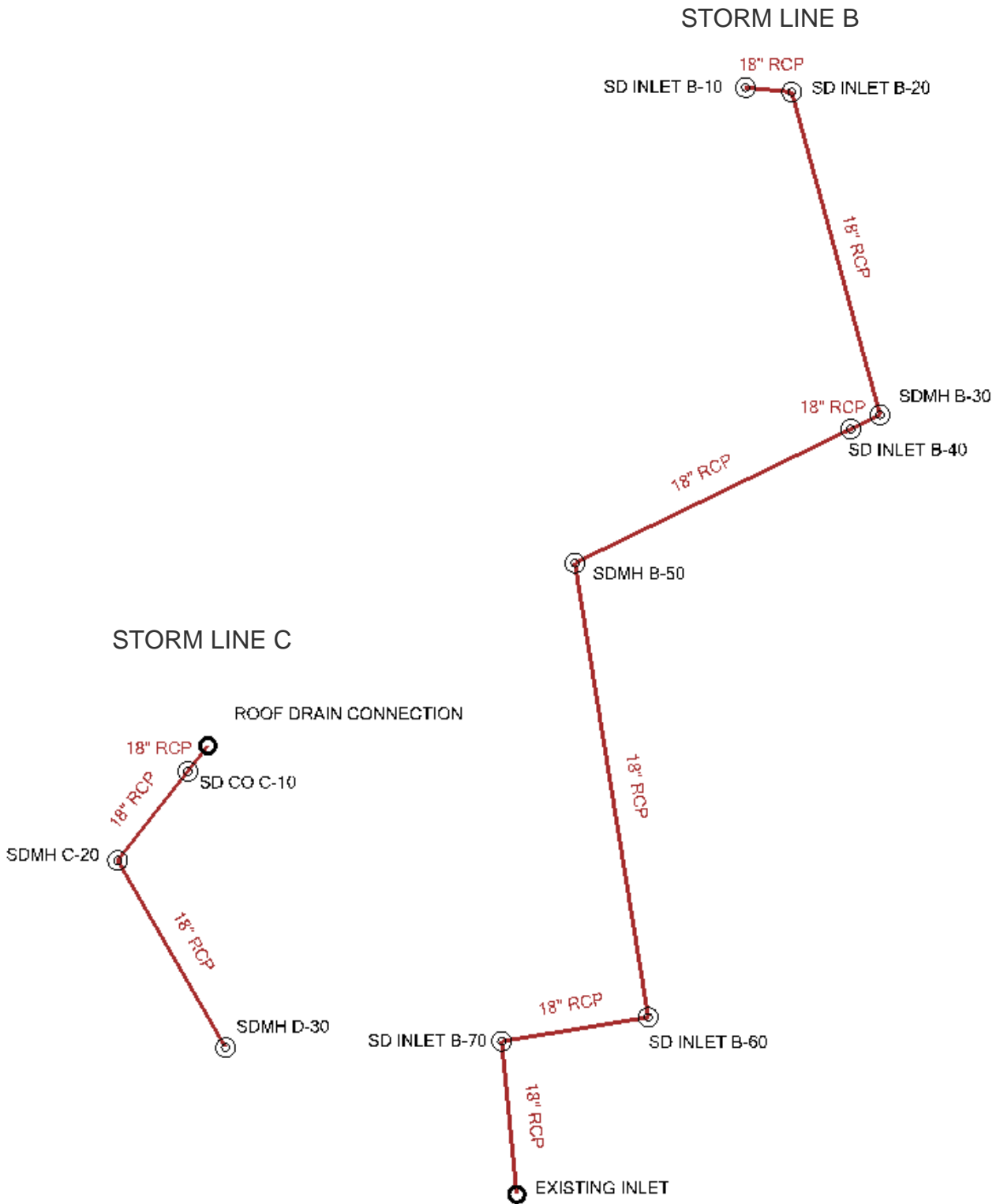
Appendix B
Hydraulic Calculations

Scenario: Base

STORM LINE A



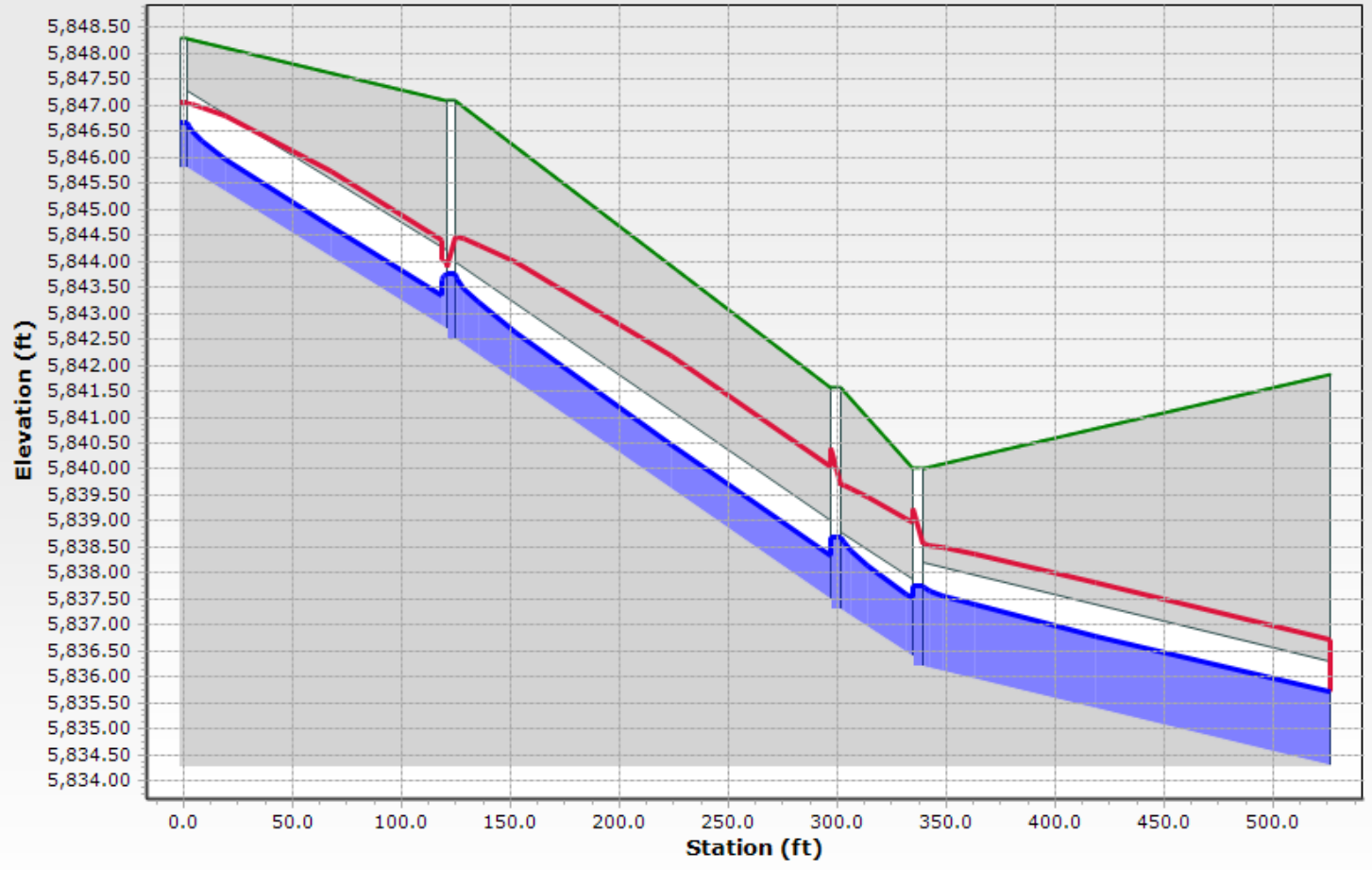
Scenario: Base



Profile Report

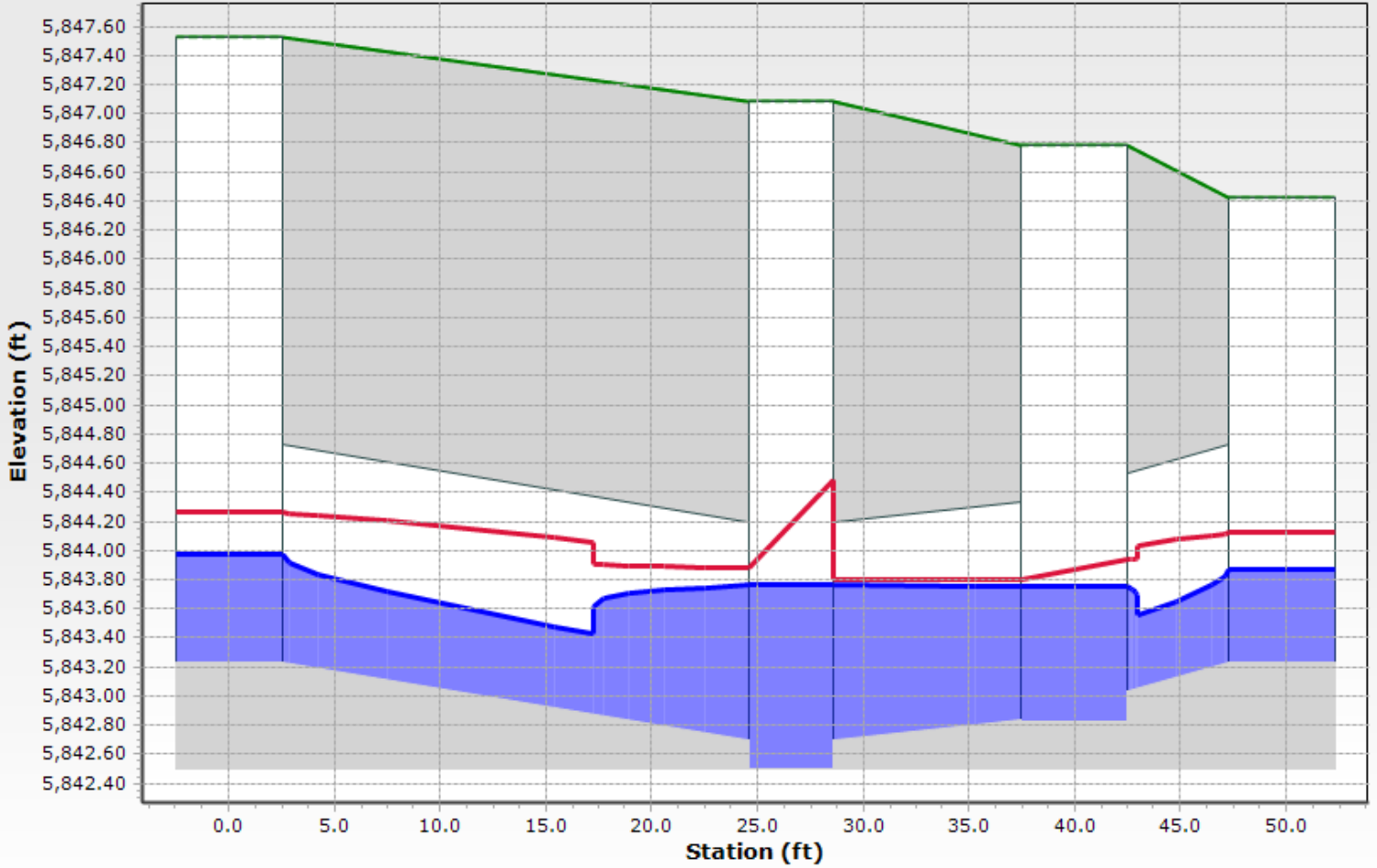
Profile: STORM LINE A

STORM LINE A - Base



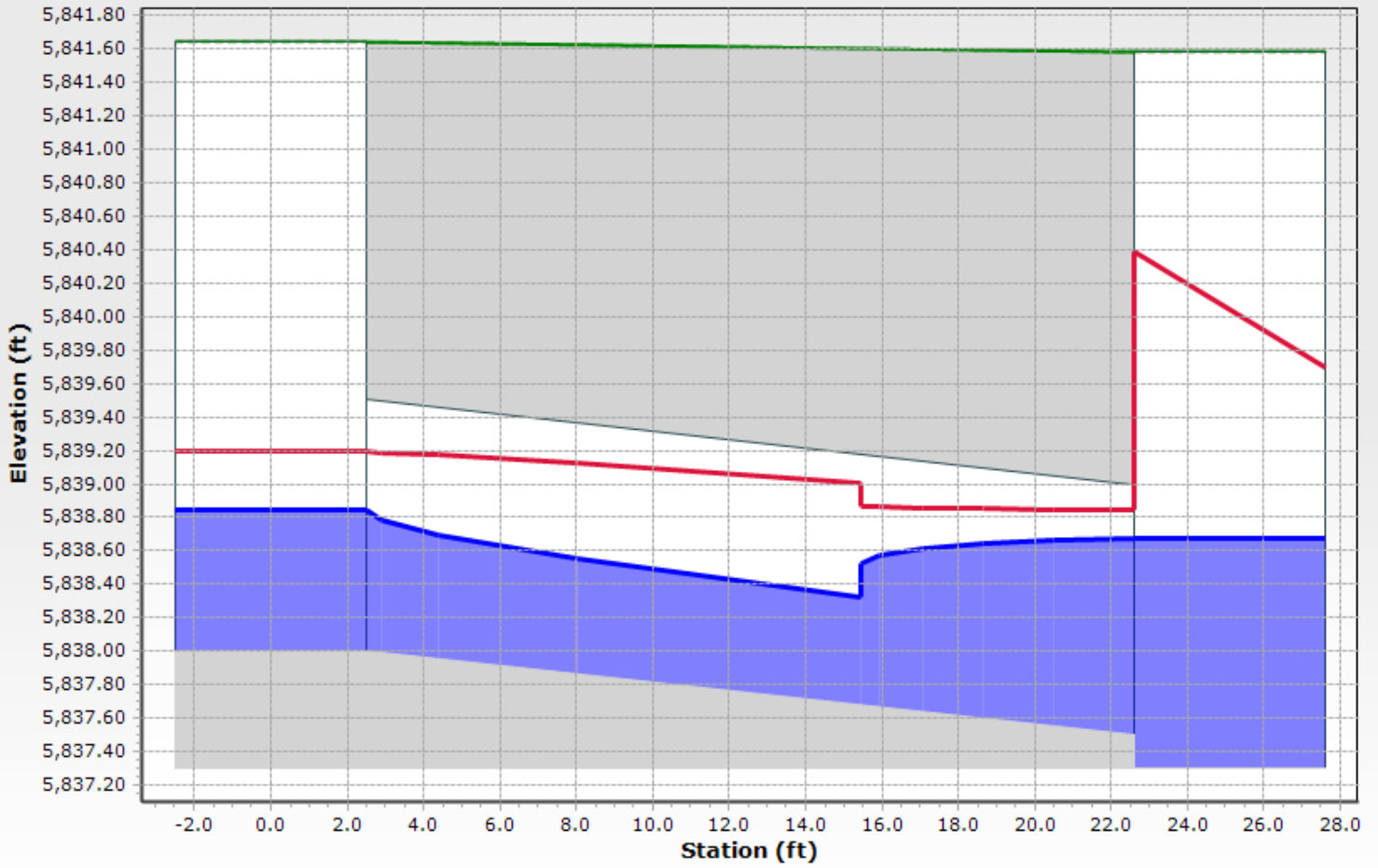
Profile Report
Profile: STORM LINE A-20

STORM LINE A-20 - Base



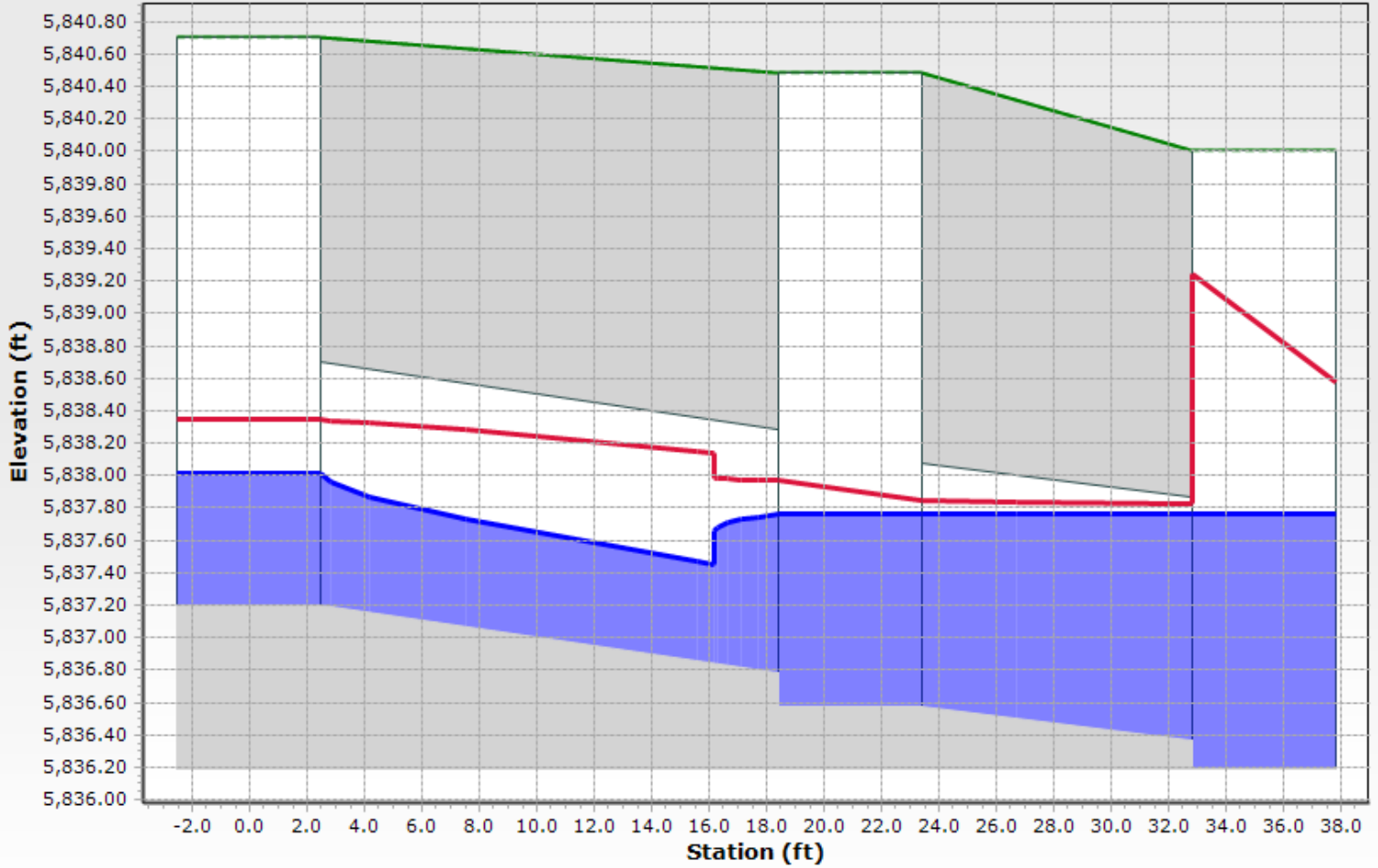
Profile Report
Profile: STORM LINE A-30

STORM LINE A-30 - Base



Profile Report
Profile: STORM LINE A-40

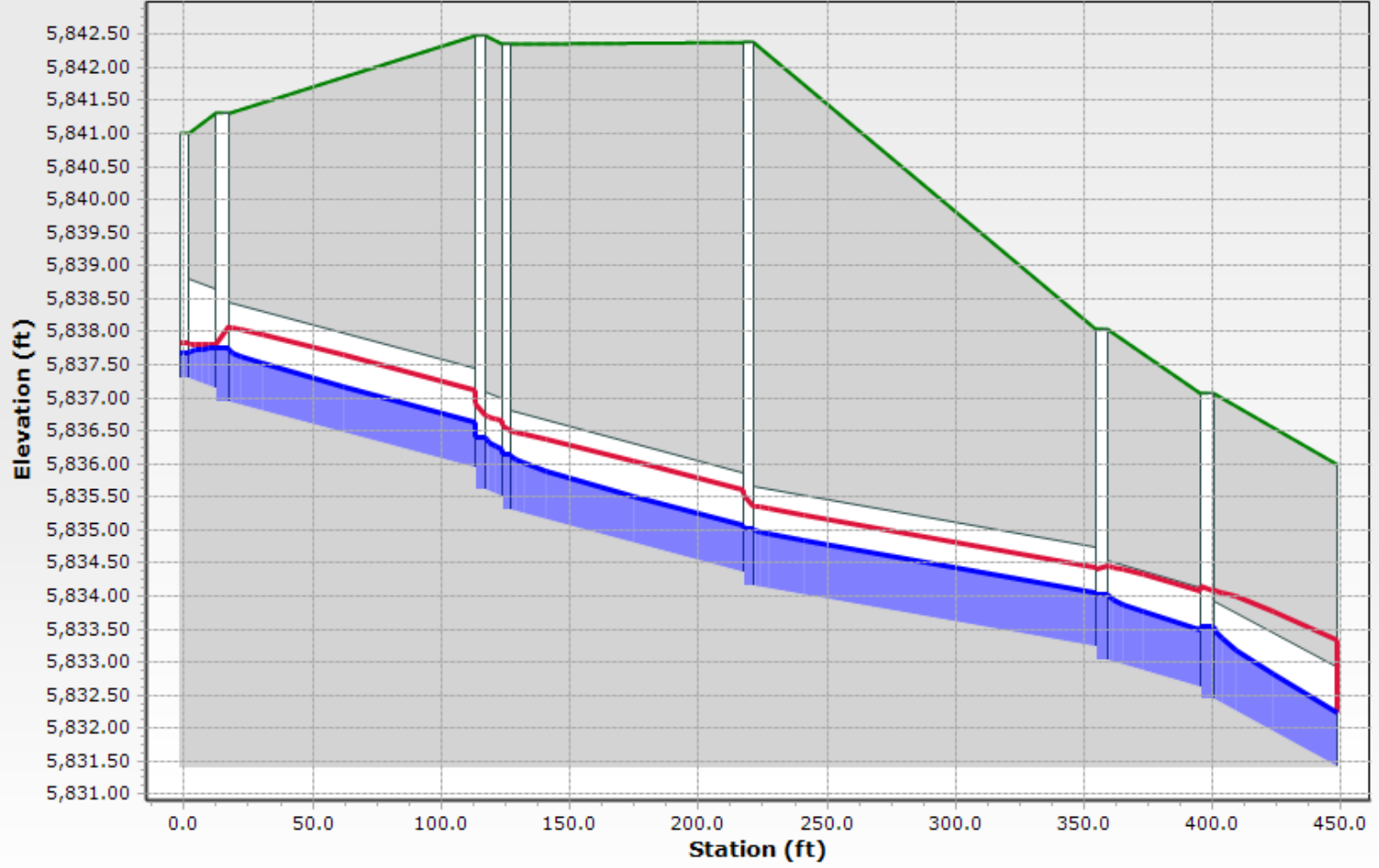
STORM LINE A-40 - Base



Profile Report

Profile: STORM LINE B

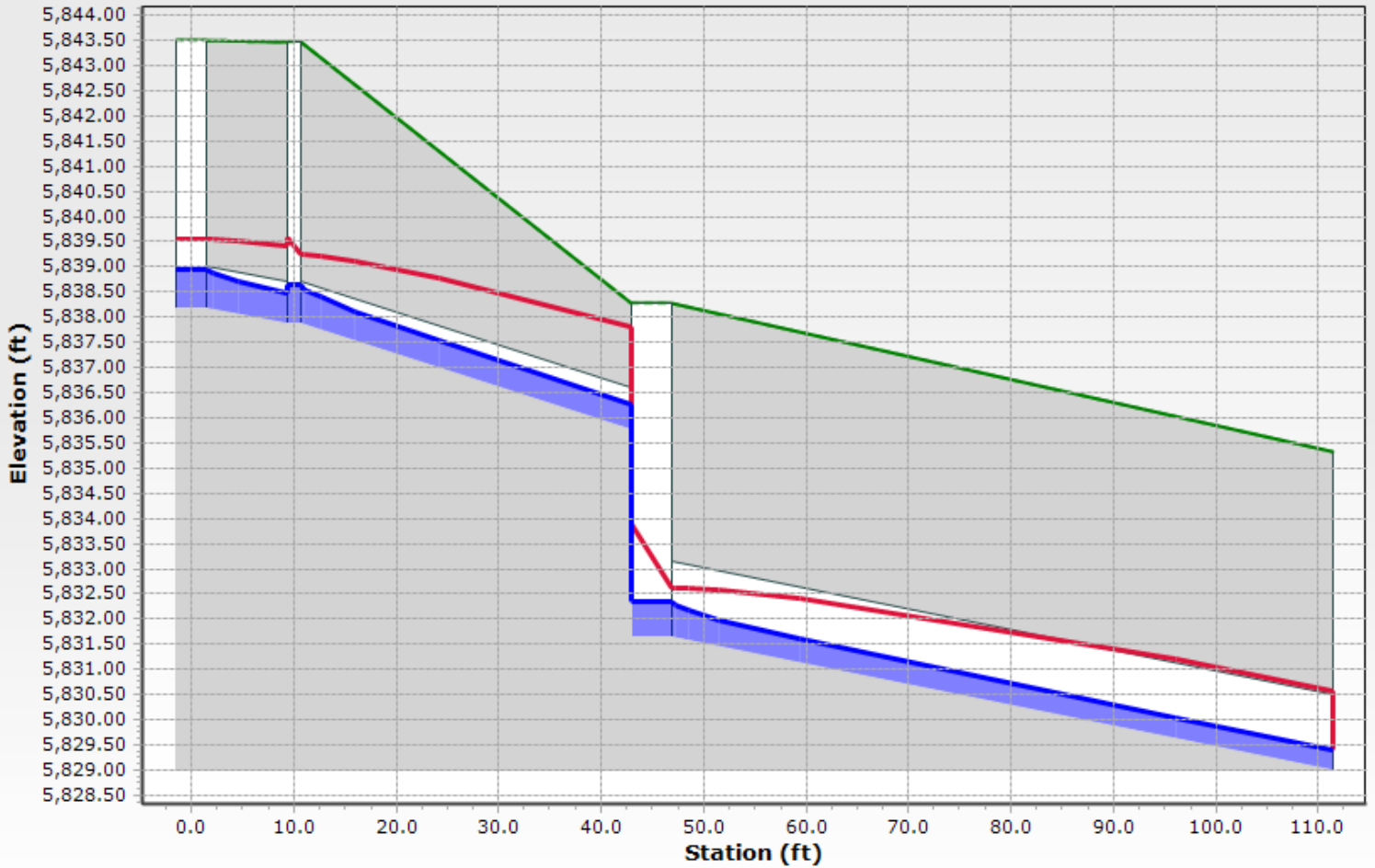
STORM LINE B - Base



Profile Report

Profile: STORM LINE C

STORM LINE C - Base



Scenario: Base
 Current Time Step: 0.000Hr
 FlexTable: Conduit Table

Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n	Flow (cfs)	Velocity (ft/s)	Hydraulic Grade Line (Out) (ft)	Capacity (Full Flow) (cfs)
SD INLET B-70	5,832.43	EXISTING INLET	5,831.42	50.5	0.020	18.0	0.013	8.34	8.65	5,832.25	14.85
ROOF DRAIN CONNECTION	5,838.17	SD CO C-10	5,837.87	10.0	0.030	10.0	0.010	3.33	9.71	5,838.48	4.93
SD INLET A-10	5,845.80	SDMH A-20	5,842.70	122.9	0.025	18.0	0.013	5.22	8.34	5,843.76	16.67
SD INLET A-21B	5,843.23	SDMH A-20	5,842.70	26.6	0.020	18.0	0.013	3.74	7.00	5,843.76	14.85
SDMH A-20	5,842.50	SDMH A-30	5,837.50	176.3	0.028	18.0	0.013	10.78	10.50	5,838.35	17.69
SD INLET A-21A	5,842.83	SDMH A-20	5,842.70	13.4	0.010	18.0	0.013	2.05	4.61	5,843.76	10.50
SD INLET A-22A	5,843.23	SD INLET A-21A	5,843.03	9.8	0.020	18.0	0.013	2.88	6.51	5,843.75	14.85
SD CO C-10	5,837.87	SDMH C-20	5,835.78	34.9	0.060	10.0	0.013	3.33	10.36	5,836.27	5.36
SD INLET B-20	5,836.95	SDMH B-30	5,835.94	100.6	0.010	18.0	0.013	4.40	5.68	5,836.62	10.50
SDMH B-30	5,835.60	SD INLET B-40	5,835.50	10.0	0.010	18.0	0.013	4.40	5.68	5,836.21	10.50
SD INLET B-40	5,835.30	SDMH B-50	5,834.36	94.3	0.010	18.0	0.013	4.88	5.84	5,835.08	10.50
SDMH B-50	5,834.16	SD INLET B-60	5,833.24	137.4	0.007	18.0	0.013	4.88	5.02	5,834.05	8.60
SDMH A-40	5,836.19	SDMH A-50	5,834.30	189.2	0.010	24.0	0.013	19.11	8.07	5,835.71	22.62
SD INLET A-31	5,838.00	SDMH A-30	5,837.50	25.1	0.020	18.0	0.013	4.83	7.51	5,838.68	14.85
SDMH A-30	5,837.30	SDMH A-40	5,836.40	37.5	0.024	18.0	0.013	13.79	10.32	5,837.52	16.26
SD INLET B-10	5,837.30	SD INLET B-20	5,837.15	14.7	0.010	18.0	0.013	1.07	3.82	5,837.75	10.50
SD INLET A-42	5,837.20	SD INLET A-41	5,836.78	20.9	0.020	18.0	0.013	4.49	7.36	5,837.76	14.85
SD INLET A-41	5,836.58	SDMH A-40	5,836.37	14.4	0.015	18.0	0.013	3.43	6.10	5,837.77	12.68
SDMH C-20	5,831.66	SDMH C-30	5,829.00	66.5	0.040	18.0	0.013	3.33	8.68	5,829.40	21.00
SD INLET B-60	5,833.04	SD INLET B-70	5,832.63	40.9	0.010	18.0	0.013	6.46	6.25	5,833.48	10.50

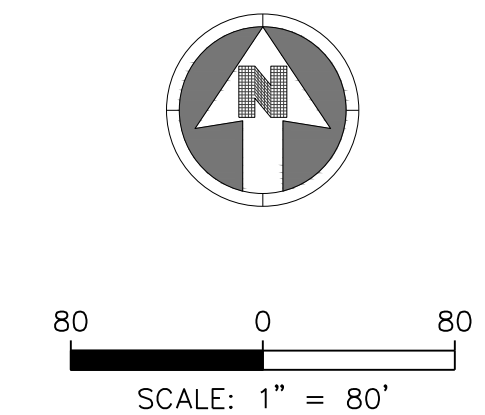
MAPS



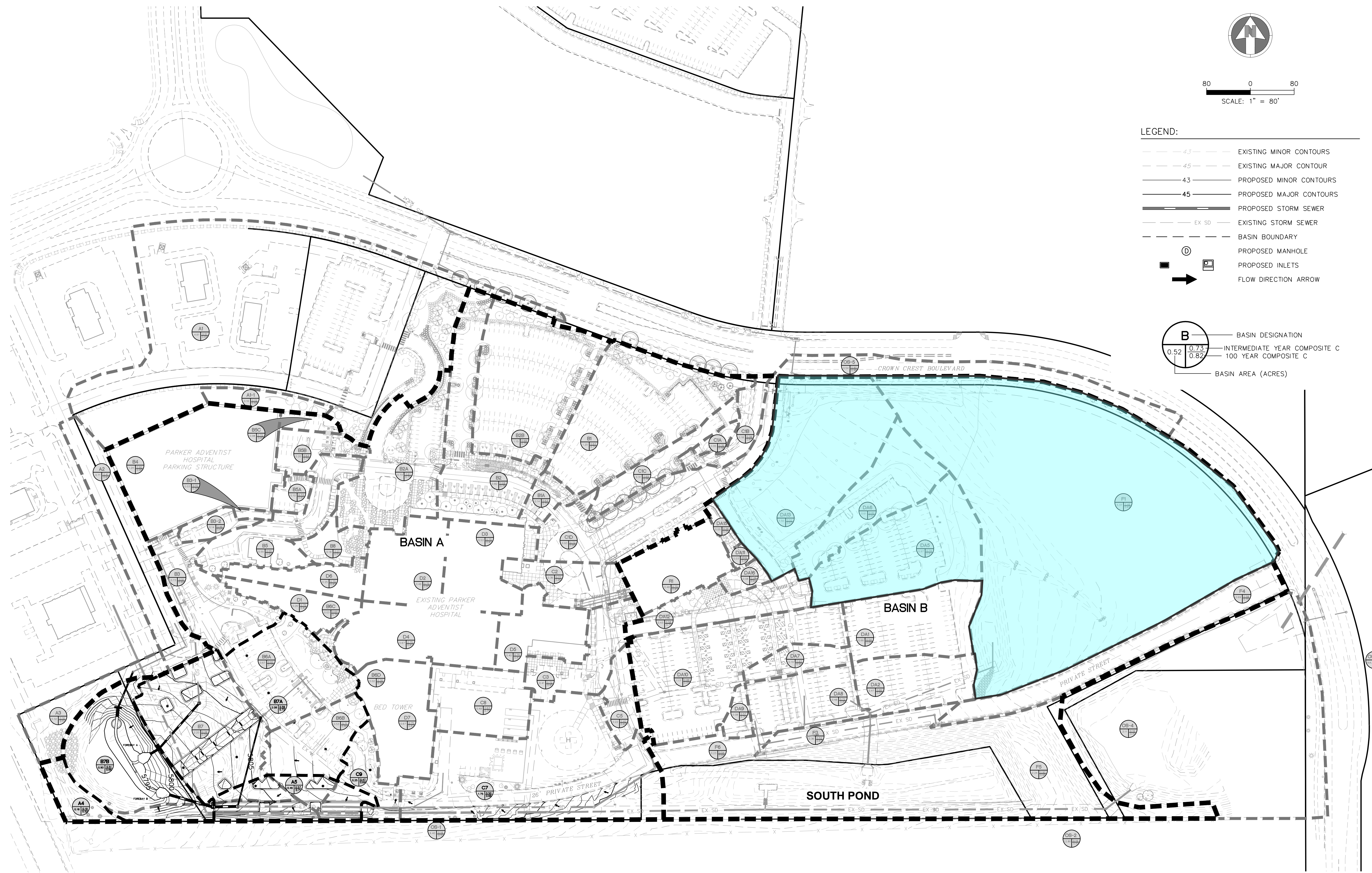
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4582 South Ulster Street Pkwy.
Suite 750 Denver, CO 80237
ph. 303-741-3737
fax 303-694-3134



Know what's below.
Call before you dig.



- LEGEND:**
- 43--- EXISTING MINOR CONTOURS
 - 45--- EXISTING MAJOR CONTOUR
 - 43— PROPOSED MINOR CONTOURS
 - 45— PROPOSED MAJOR CONTOURS
 - — — EX SD — EXISTING STORM SEWER
 - — — BASIN BOUNDARY
 - ⊙ PROPOSED MANHOLE
 - PROPOSED INLETS
 - FLOW DIRECTION ARROW
-
- B** — BASIN DESIGNATION
- | | | |
|------|------|-------------------------------|
| 0.52 | 0.73 | INTERMEDIATE YEAR COMPOSITE C |
| | 0.82 | 100 YEAR COMPOSITE C |
- BASIN AREA (ACRES)



DATE	DESCRIPTION

REV.	DESCRIPTION
1	
2	
3	
4	
5	
6	
7	
8	

NOT FOR CONSTRUCTION

CLIENT NAME:	PARKER ADVENTIST HOSPITAL
PROJECT NAME:	PARKER MOB III 9403 CROWN CREST BLVD.
DRAWING TITLE:	HISTORIC DRAINAGE MAP
DESIGNED BY:	DAT
DRAWN BY:	DAT
CHECKED BY:	MHV
DATE:	07/30/2018
MIRO JOB NUMBER:	18057
CLIENT JOB NUMBER:	

DRAWING NUMBER:
FIG. 3

FILE PATH: J:\Jobs\15029 PKR Parking Lot Addition\04 Civil Design\Drainage\FIG.2 Overall Drainage Map.dwg - 24X36 - 8/8/2018

