



June 04, 2020

City of Aurora – Public Works Department, Engineering Control Division
15151 E. Alameda Pkwy
Aurora, CO 80012

**RE: Preliminary Drainage Letter
Popeyes at Smoky Hill Crossing
23250 E. Smoky Hill Road
Aurora, CO 80016
Adams Project No. 2019.062**

To Whom it May Concern:

A drainage analysis has been conducted for the proposed Popeyes at Smoky Hill Crossing development located at 23250 E. Smoky Hill Road. The subject site is Lot 4, Block 1 of the Smoky Hill Crossing Subdivision Filing No.1. As described within the approved Final Drainage Report for "Smoky Hill Crossing Subdivision Filing No.1 Retail Development" by Entitlement and Engineering Solutions, Inc., (henceforth referred to as: Master Drainage Report) the respective lot that is proposed for a Popeyes Restaurant has been accounted for as consisting of asphalt with curb and gutter (refer to Appendix E for City approved cover sheet and applicable excerpts from said report). The proposed drainage patterns for the developed Popeyes lot are in general conformance to those as described in the aforementioned drainage report. The City of Aurora Storm Drainage Design and Technical Criteria (ASDDTC) was used in conjunction with the Urban Storm Drainage Criteria Manual – Volume 1 (USDCM – Vol.1) to calculate stormwater runoff associated with the development of the proposed Popeyes. Composite runoff coefficients (C Values) and post-developed stormwater runoff (Q) associated with the minor storm (2-year storm event) and major storm (100-year storm event) have been calculated for each of the proposed Popeyes sub-basins. C Values listed in Table 1 of the ASDDTC were used to calculate the composite C Values for each sub-basin. Refer to Appendix A – Composite Runoff Coefficients Calculations for further detail and an excerpt of Table 1 from the ASDDTC. Stormwater runoff was calculated using the Rational Method in accordance with Chapter 5 of the ASDDTC. Refer to Appendix B for the stormwater runoff calculations associated with the proposed Popeyes.

Onsite grate inlets and a network of storm sewer pipes are being utilized to convey the majority of the onsite stormwater runoff generated by the development of the proposed Popeyes underground to the proposed onsite 18" storm sewer stub to be provided by the developer. A portion of the stormwater runoff from the proposed Popeyes runs offsite to the north (DA-1) and offsite to the south (DA-7). However, no improvements associated with the construction of Popeyes are located in either of these drainage areas, and thus these drainage areas conform to existing conditions. A small portion of the stormwater runoff from the development of the proposed Popeyes bypasses all onsite inlets and drains offsite to the west along the private drive located at the southern portion of the Popeyes lot. This drainage pattern conforms to the anticipated drainage pattern as described in the Master Drainage Report and is described in further detail in the section below.

Three (3) onsite design points were analyzed in order to compare the proposed drainage patterns resulting from the development of the proposed Popeyes to projected drainage patterns as provided in the Master Drainage Report. Refer to Appendix C – Popeyes Proposed Drainage Area Map for locations of the design points. The proposed Popeyes Design Point 1 was used to evaluate the proposed stormwater runoff received by the proposed onsite 18" storm sewer stub to be provided by the developer. Per the Master Drainage Report, the proposed onsite 18" storm sewer stub was anticipated to receive a stormwater runoff of 1.19 CFS with the 2-year storm event and 4.24 CFS with the 100-year storm event. In comparison, the calculated stormwater runoff being routed to the proposed 18" storm sewer stub with the development of the proposed Popeyes is 0.91 CFS for the 2-year storm event and 2.75 CFS for the 100-year storm event. Thus, the proposed Popeyes is contributing less flow to the proposed onsite 18" storm sewer stub than anticipated. The proposed Popeyes Design Point 2 was used to evaluate the proposed stormwater runoff received by the proposed onsite curb inlet to be provided by the developer. The proposed onsite curb inlet is associated with "Design Point 10" as shown in the Master Drainage Report. Per the Master Proposed Drainage Map provided in the Master Drainage Report, "Design Point 10" is projected to receive stormwater runoff from a portion of the proposed Popeyes lot, a larger portion of the lot east of the proposed Popeyes, and a portion of the private drive connecting these lots. The associated basin designation as shown in the Master Drainage Report is basin D-2. "Design Point 10" was anticipated to receive a stormwater runoff of 1.19 CFS for the 2-year storm event and 4.36 CFS for the 100-year storm event. The



calculated stormwater runoff being routed to "Design Point 10" from the development of the proposed Popeyes is 0.13 CFS for the 2-year storm event and 0.38 CFS for the 100-year storm event. Thus, the proposed Popeyes is contributing approximately 11% of the anticipated 2-year storm runoff and 9% of the anticipated 100-year storm runoff associated with "Design Point 10". The proposed Popeyes Design Point 3 was used to evaluate the stormwater runoff being routed offsite to the West and down the private drive to the developer's inlet associated with "Design Point 9" as shown in the Master Drainage Report. "Design Point 9" is projected to receive stormwater runoff from the majority of the proposed Popeyes lot, the majority of the lot west of the proposed Popeyes, and a portion of the private drive connecting these lot. The associated basin designation as shown in the Master Drainage Report is D-1. "Design Point 9" was anticipated to receive a stormwater runoff of 1.76 CFS for the 2-year storm event and 6.44 CFS for the 100-year storm event. The calculated stormwater runoff being routed westward offsite to "Design Point 9" from the development of the proposed Popeyes is 0.22 CFS for the 2-year storm event and 0.66 CFS for the 100-year storm event. Thus, the proposed Popeyes is contributing approximately 12% of the anticipated 2-year storm runoff and 10% of the anticipated 100-year storm runoff associated with "Design Point 9". See the Design Point Table below for additional information. Refer to Appendix D for the Master Proposed Drainage Map and Appendix E for applicable excerpts from the Master Drainage report.

Design Point Analysis									
Design Point	Associated Design Point from Master Drainage Report	Anticipated Total Peak Discharge (cfs)		Proposed Popeyes Peak Discharge (cfs)		Percent of Popeyes Contribution to Total Anticipated Peak Discharge		Contributing Drainage Areas	Description
		2-Year	100-Year	2-Year	100-Year	2-Year	100-Year		
1	END OF PIPE WEST	1.19	4.24	0.91	2.75	0.76	0.65	DA-2, DA-3, DA-4	Drains to proposed 18" onsite storm stub
2	10	1.19	4.36	0.13	0.38	0.11	0.09	DA-6	Drains to proposed onsite curb inlet
3	9	1.76	6.44	0.22	0.66	0.12	0.10	DA-5	Drains offsite to the W to developer's inlet A-3

Due to the drainage patterns remaining generally the same as previously approved studies for the development and associated Popeyes contribution of storm water runoff being below those anticipated, it is in my professional opinion that the development of this site will not overburden the drainage infrastructure proposed for this subject location.

Respectfully,
Adams Engineering & Development Consultants

Carter Delleney, PE, MPA
Director of Public Works



Appendix A – Composite Runoff Coefficient Calculations

POST-DEVELOPMENT COMPOSITE RUNOFF COEFFICIENTS									
Drainage Area Number	Runoff Coefficients						Total Area (acres)		
	Minor Storm (2YR)			Major Storm (100YR)				Minor Storm (2YR)	Major Storm (100YR)
	Streets (Paved)	Roof	Lawns, Sandy Soil (>7% Slope)	Streets (Paved)	Roof	Lawns, Sandy Soil (>7% Slope)		Composite Runoff Coefficient	Composite Runoff Coefficient
	0.87	0.80	0.15	0.93	0.90	0.20			
DA-1	0.02	0.00	0.00	0.02	0.00	0.00	0.02	0.87	0.93
DA-2	0.06	0.05	0.02	0.06	0.05	0.02	0.13	0.73	0.81
DA-3	0.20	0.00	0.08	0.20	0.00	0.08	0.28	0.66	0.72
DA-4	0.03	0.00	0.00	0.03	0.00	0.00	0.03	0.87	0.93
DA-5	0.08	0.00	0.03	0.08	0.00	0.03	0.11	0.67	0.73
DA-6	0.05	0.00	0.00	0.05	0.00	0.00	0.05	0.87	0.93
DA-7	0.01	0.00	0.04	0.01	0.00	0.04	0.05	0.29	0.35
Composite	0.45	0.05	0.17	0.45	0.05	0.17	0.67	0.68	0.74



The City of Aurora Storm Drainage Design and Technical Criteria (ASDDTC) Excerpt – Table 1

TABLE 1 (continued)

RUNOFF COEFFICIENTS AND PERCENTS IMPERVIOUS

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	FREQUENCY			
		2	5	10	100
<u>Streets:</u>					
Paved	100	.87	.88	.90	.93
Gravel	40	.15	.25	.35	.65
<u>Concrete Drive and Walks</u>	96	.87	.87	.88	.89
<u>Roofs</u>	90	.80	.85	.90	.90
<u>Lawns, Sandy Soil (A and B Soils):</u>	2				
2% Slope		.05	.06	.08	.10
2-7% Slope		.10	.11	.13	.15
>7% Slope		.15	.16	.18	.20
<u>Lawns, Clay Soil (C and D Soils):</u>	5				
2% Slope		.13	.14	.15	.17
2-7% Slope		.18	.19	.20	.22
>7% Slope		.25	.27	.30	.35

NOTE: These Rational Formula coefficients may not be valid for large basins

(*)See Figures *RO-3 through RO-5* of USDCM Volume 1 for percent impervious.

(**)Up to 5 units per acre. Single-family with more than 5 units per acre, use values for multi-unit/detached



Appendix B – Drainage Basin Runoff Calculations

POST-DEVELOPMENT DRAINAGE AREA CALCULATIONS									
Drainage Area Designation	Drainage Area	2-Year Runoff Coefficient	100-Year Runoff Coefficient	Time of Concentration	2-Year Rainfall Intensity (I2)	2-Year Peak Discharge (Q2)	100-Year Rainfall Intensity (I100)	100-Year Peak Discharge (Q100)	Comments
-	(ac)	"C2"	"C100"	(min)	(in/hr)	(cfs)	(in/hr)	(cfs)	
DA-1	0.02	0.87	0.93	5	2.95	0.1	8.21	0.2	Drains offsite to the North
DA-2	0.13	0.73	0.81	5	2.95	0.3	8.21	0.9	Drains to Grate Inlet 1A
DA-3	0.28	0.66	0.72	5	2.95	0.5	8.21	1.7	Drains to Grate Inlet 2
DA-4	0.03	0.87	0.93	5	2.95	0.1	8.21	0.2	Drains to Grate Inlet 1B
DA-5	0.11	0.67	0.73	5	2.95	0.2	8.21	0.7	Drains offsite to the West
DA-6	0.05	0.87	0.93	5	2.95	0.1	8.21	0.4	Drains to proposed curb inlet
DA-7	0.05	0.29	0.35	5	2.95	0.0	8.21	0.1	Drains offsite to the South
Total	0.67					1.3		4.1	

Note: Calculations based on the Rational Method: $Q = C \cdot I \cdot A$



Appendix C – Popeyes Proposed Drainage Plan

8951 Cypress Waters Blvd, Suite 150
Dallas, Texas 75019
817.328.3200

13785 Research Blvd., Suite 125
Austin, Texas 78759
512.218.4263

1101 E. SE Loop 323, Suite 101
Tyler, Texas 75701
903.324.8400



Appendix D – Master Proposed Drainage Area Map

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Appendix E
City Approved Cover Sheet and Applicable Excerpts of Master Drainage Report

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903.324.8400*



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2019-3044
24T

**Final Drainage Report
For
SMOKY HILL CROSSING SUBDIVISION FILING NO. 1
RETAIL DEVELOPMENT**

10/04/2019, 12/30/2019, 01/24/2020, 03/18/2020, 04/30/2020, 05/07/2020

FACSIMILE	
THIS ELECTRONIC PLAN IS A FACSIMILE OF THE SIGNED AND SEALED PDF SET.	
Chris Mueller, PE 51699	DATE 05/07/2020
	

Prepared For Developer:


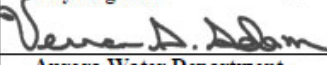
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EES

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501 S. Cherry Street, Suite 300
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APPROVED FOR ONE YEAR FROM THIS DATE	
05/22/2020	
 City Engineer	05/21/2020 Date
 Aurora Water Department	05/15/1010 Date

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Smoky Hill Crossing - Final Drainage Report

future pad development happens) and are ultimately routed to the detention pond. This future inlet will need to intercept 100% of the 100-year runoff.

Basin A-7 is 0.960 acres and was modelled with a surface characteristic of Neighborhood Areas (85%). The direct runoff is 1.19 cfs and 4.36 cfs for the 2-year and 100-year storms, respectively. Flows are directed to the south where they collect at design point 7, a future inlet, and are ultimately routed to the detention pond. This inlet will need to intercept 100% of the 100-year runoff.

Basin B-1 is 0.631 acres and was modelled with a surface characteristic of Neighborhood Areas (85%). The direct runoff is 1.19 cfs and 4.36 cfs for the 2-year and 100-year storms, respectively. Flows are directed to the south where they collect at design point 8, a double type R inlet on grade within the private drive and are ultimately routed to the detention pond. This inlet will intercept 92% of the 100-year runoff.

Basin C-1 is 0.728 acres and was modelled with a surface characteristic of Neighborhood Areas (85%). The direct runoff is 2.08 cfs and 6.11 cfs for the 2-year and 100-year storms, respectively. Flows are directed to the south where they collect at design point 9, a future inlet on grade, at the southwest corner of the easternmost lot to be developed, and are ultimately routed to the detention pond. This inlet will need to intercept 100% of the 100-year runoff.

Basin C-2 is 0.121 acres and consists of lawn (2%). The direct runoff is 0.03 cfs and 0.13 cfs for the 2-year and 100-year storms, respectively. Flows are directed to the south where they collect at design point 1, a double type R inlet on grade within S. Yellowstone Court and are ultimately routed to the detention pond. This inlet will intercept 100% of the 100-year runoff.

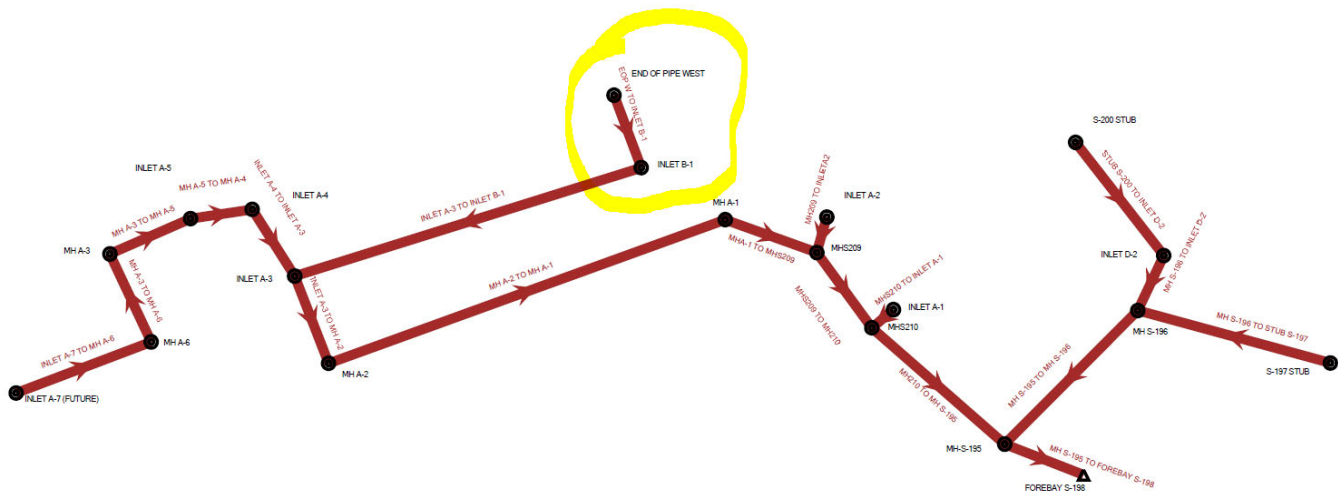
Basin D-1 is 0.304 acres and consists of asphalt with concrete curb and gutter (100%). The direct runoff is 0.87 cfs and 2.55 cfs for the 2-year and 100-year storms, respectively. Flows are directed to the south where they collect at design point 2, a double type R inlet on grade within the private drive and are ultimately routed to the detention pond. This inlet will intercept 100% of the 100-year runoff.

Basin D-2 is 0.444 acres and was modelled with a surface characteristic of Neighborhood Areas (85%). The direct runoff is 0.88 cfs and 3.20 cfs for the 2-year and 100-year storms, respectively. Flows are directed to the south where they collect at design point 13, a double type R inlet on grade within the private drive and are ultimately routed to the detention pond. This inlet will intercept 86% of the 100-year runoff.

Basin E-1 is 0.276 acres and consists of asphalt with concrete curb and gutter (100%). The direct runoff is 0.79 cfs and 2.32 cfs for the 2-year and 100-year storms, respectively. Flows are directed to the southwest into a future lot, where they collect at design point 13, a double type R inlet on grade, and are ultimately routed to the detention pond. This inlet will intercept 86% of the 100-year runoff.

Basin OS-1 is 0.086 acres and consists of landscaping (2%). The direct runoff is 0.03 cfs and 0.08 cfs for the 2-year and 100-year storms, respectively. Flows are directed to the east via sheetflow and discharge onto the E-470 property, mimicking the existing condition.

Scenario: 2-Year





FlexTable: Network Elements Table

Label	Station (Calculated) (ft)	Inlet	Inlet Location	Inlet C	Inlet Drainage Area (acres)	Total Inlet Intensity (in/h)	Flow (Total In)	Flow (Captured) (cfs)
END OF PIPE WEST	6+42						1.190000057220	
MH S-201	0+95						46	
INLET A-1	1+23						0.600000023841	
INLET A-2	2+07						858	
FOREBAY S-198							0.639999985694	
FES S-202							885	
INLET A-3 TO INLET B-1							1.019999980926	
MH A-5 TO MH A-4							51	
INLET A-7 TO MH A-6								
MH A-2 TO MH A-1								
MHA-1 TO MHS209								
MHS209 TO MH210								
MH S-196 TO INLET D-2								
MH S-196 TO STUB S-197								
MH A-3 TO MH A-6								
MH A-3 TO MH A-5								
INLET A-3 TO MH A-2								
INLET A-4 TO INLET A-3								

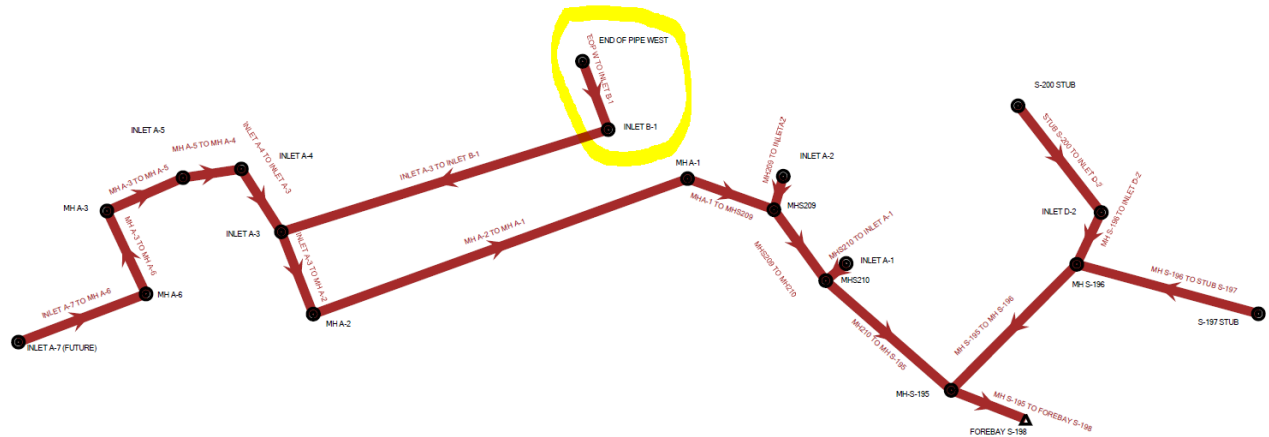
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Scenario: 100-Year





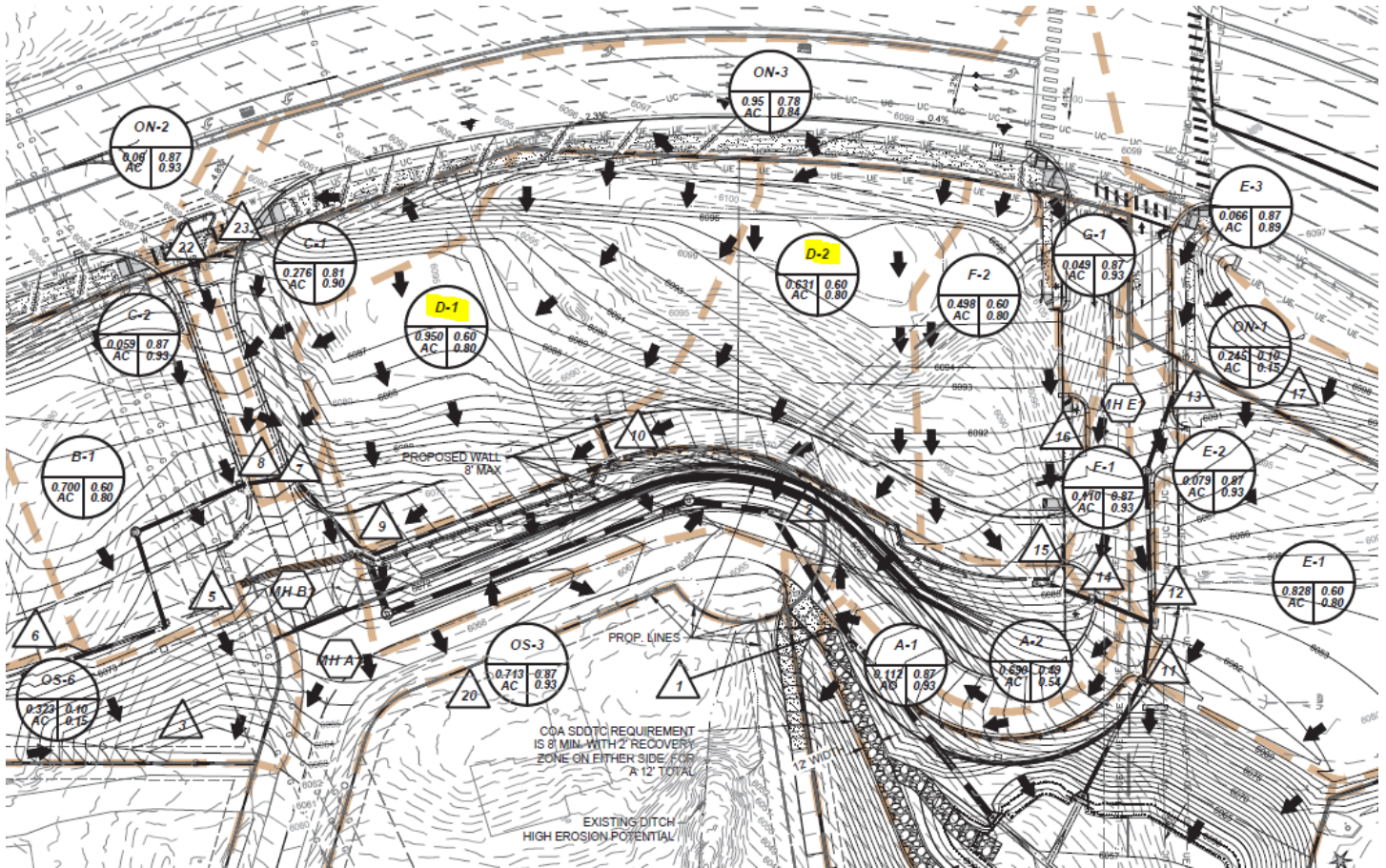
FlexTable: Network Elements Table

Label	Station (Calculated) (ft)	Inlet	Inlet Location	Inlet C	Inlet Drainage Area (acres)	Total Inlet Intensity (in/h)	Flow (Total In)	Flow (Captured) (cfs)	Flow (Total Bypassed) (cfs)
MH A-2	4+31						55.54000091552 73		
MH A-1	2+47						55.54000091552 73		
INLET A-7 (FUTURE)	7+96						4.280000209808 35		
MH A-6	7+03						12.86999988555 91		
INLET A-5	5+70						18.11000061035 16		
INLET A-4	5+39						26.77000045776 37		
INLET A-3	4+63						49.25999832153 32		
INLET B-1	6+12						8.479999542236 33		
MHS209	1+94						61.90000152587 89		
MHS210	1+09						65.72000122070 31		
INLET D-2	1+66						11.03999996185 3		
MH S-196	1+31						23.63999938964 84		
S-197 STUB	2+65						6.300000190734 86		
OUTLET O-3	1+71						0.699999988079 071		
MH A-3	6+42						17.18000030517 58		
MH-S-195	0+31						89.36000061035 16		
S-200 STUB	2+41						5.519999980926 51		
END OF PIPE WEST	6+42						4.239999771118 16		
MH S-201	0+95						1.399999976158 14		
INLET A-1	1+23						1.909999966621 4		

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RUNOFF SUMMARY							
BASIN	DESIGN POINT	AREA (ACRES)	% IMP.	C ₂	C ₁₀₀	Q ₂ (CFS)	Q ₁₀₀ (CFS)
A-1	1	0.112	100.0%	0.87	0.93	0.32	0.94
A-2	2	0.690	51.0%	0.49	0.54	1.11	3.36
B-1	5	0.700	85.0%	0.60	0.80	1.22	4.46
B-2	6	0.960	85.0%	0.60	0.80	1.19	4.36
C-1	7	0.276	96.8%	0.81	0.90	0.74	2.24
C-2	8	0.059	100.0%	0.87	0.93	0.17	0.50
D-1	9	0.950	85.0%	0.60	0.80	1.76	6.44
D-2	10	0.631	85.0%	0.60	0.80	1.19	4.36
E-1	11	0.828	85.0%	0.60	0.80	1.63	5.98
E-2	12	0.079	100.0%	0.87	0.93	0.23	0.66
E-3	13	0.066	100.0%	0.87	0.93	0.19	0.55
F-1	14	0.110	100.0%	0.87	0.93	0.31	0.92
F-2	15	0.498	85.0%	0.60	0.80	0.98	3.59
G-1	16	0.049	100.0%	0.87	0.93	0.14	0.41
ON-1	17	0.245	2.0%	0.10	0.15	0.08	0.33
EDB-1	19	1.069	2.0%	0.10	0.15	0.35	1.44
ON-2	22	0.060	100.0%	0.87	0.93	0.17	0.50
ON-3	23	0.950	88.7%	0.78	0.84	2.22	6.56
SITE COMPOSITE		8.012	62.4%	0.48	0.61	14.02	47.62