### CITY OF ALBUQUERQUE

*Hydrology Section Planning Department* David S. Campbell, Director



Timothy M. Keller, Mayor

March 5, 2018

Asa Nilsson-Weber Isaacson & Arfman, P.A. 128 Monroe St NE Albuquerque, NM 87108

### RE: Stormcloud Units 4A & 4B Supplemental Calculations Engineer's Stamp Date: 03/13/2018 Hydrology File: H09D022A

Dear Ms. Donart:

Based on the information provided in the Drainage Report Supplement received on 3/14/2018 the above-referenced application is approved for Work Order and Grading Permit.

PO Box 1293 Prior to constructing the additional grading in the Unit 4A pond please submit shop drawings with sections showing horizontal and vertical dimensions to the property line and the fence and materials specifications to DRC. Please copy both AMAFCA and Hydrology with the shop drawings and sections.

Albuquerque An Approved Engineer's Certification for release of financial guarantees is required prior to close out of the Work Order and acceptance of the Unit 4A infrastructure.

NM 87103

If you have any questions, please contact me at 924-3986 or e-mail at jhughes@cabq.gov.

www.cabq.gov

Sincerely, ame

James D. Hughes Principal Engineer, Planning Dept. Development Review Services

### Hughes, James D.

From:	Nicole Friedt <nfriedt@amafca.org></nfriedt@amafca.org>
Sent:	Friday, March 23, 2018 2:41 PM
То:	Hughes, James D.
Cc:	'Åsa Weber'; 'Donart, Genny'; Brad Bingham
Subject:	RE: Storm Cloud Unit 4 at the Mirehaven Arroyo.

I have reviewed the Supplemental Drainage Calculations for Stormcloud Subdivision, Units 4A & 4B and have no comments or concerns.

Please ensure that the heightened Berm between the AMAFCA ROW and the Water Quality Pond is compacted and has erosion control to prevent deterioration of the Berm surface.

Thanks, Nicole

Nicole M. Friedt, P.E., CFM Development Review Engineer Main: (505) 884-2215 Cell: (505)362-1272

From: Hughes, James D. [mailto:jhughes@cabq.gov]
Sent: Thursday, March 22, 2018 4:44 PM
To: Nicole Friedt <<u>nfriedt@amafca.org</u>>
Cc: 'Åsa Weber' <<u>asaw@iacivil.com</u>>; 'Donart, Genny' <<u>gennyd@iacivil.com</u>>
Subject: RE: Storm Cloud Unit 4 at the Mirehaven Arroyo.

### Here are the attachments

From: Hughes, James D.
Sent: Thursday, March 22, 2018 4:42 PM
To: 'Friedt, Nicole'
Cc: 'Åsa Weber'; Donart, Genny
Subject: Storm Cloud Unit 4 at the Mirehaven Arroyo.

### Nicole,

The attached report has been submitted to resolve the issue of the undersized pipe from the Unit 4 pond into the AMAFCA shotcrete arroyo. Since the solution involves diversion of flows into different AMAFCA facilities than originally planned, AMAFCA approval will be required before I will give City approval. I think that Asa was demonstrated that the City infrastructure will be adequate after the dam is fixed between the pond and the AMAFCA R/W. Please let me know if this solution will be acceptable to AMAFCA.

Nicole also please be aware that Genny submitted the LOMR for the AMAFCA channel. I apologize if you did not get a copy. Perhaps Genny can provide a copy for you if you would like.

Sincerely Doug Hughes PE CFM Principal Engineer Planning Dept. jhughes@cabq.gov 924-3986 ISAACSON & ARFMAN, P.A.



. Consulting Engineering Associates

Thomas O. Isaacson, PE(RET.) & LS(RET.) . Fred C. Arfman, PE . Åsa Nilsson-Weber, PE

March 13, 2018

Mr. Doug Hughes, PE Principal Engineer, Planning Dept. City of Albuquerque 600 2<sup>nd</sup> Street NW Albuquerque, NM 87103

### RE: H09D022A – Stormcloud Unit 4 Drainage Calculations for Unit 4 Storm Drain

Dear Mr. Hughes:

Please see attached for a drainage report addressing your concern regarding the insufficient capacity of the existing 24-inch storm drain that is installed from the first flush pond to the Mirehaven Arroyo. The storm drain was indeed undersized because the calculations did not include the inlet losses. The report includes revised storm drain calculations to determine the actual capacity of the existing 24-inch pipe and also the capacity of the on-site storm drain systems based on the elevated pond water surface elevation. The report also includes quantifying the bypass flow rates and analyzing the impact to existing street and storm drain capacity in the adjacent neighborhoods.

The storm drain software used for the calculations in this report is Stormwater Studio. This software performs EGL calculations in the same fashion as StormCAD, taking into account the momentum energy losses at junctions (per DPM). Stormwater Studio costs ~500/seat or ~\$1,000 for unlimited seats and is, in my opinion, much more user friendly than StormCAD that costs around \$5,700/seat. For your use, below is a link explaining how the calculations are performed.

https://www.hydrologystudio.com/stormwater-studio-help/index.html?losses in junctions.htm

The report shows that the downstream street and storm drain capacities are sufficient to accept the additional bypass flows.

If you have questions regarding this submittal, please call me at 266-1688 or email me at <u>asaw@iacivil.com</u>. Please let me know if you and Shahab would like to meet with me to go over the report.

Thank you.

Sincerely, ISAACSON & ARFMAN

CUllson-Telebe

Åsa Nilsson-Weber

Attachment



### City of Albuquerque

Planning Department Development & Building Services Division DRAINAGE AND TRANSPORTATION INFORMATION SHEET (REV 09/2015)

Project Title:	Building Permit #:	City Drainage #:
DRB#: EPC#:		Work Order#:
Legal Description:		
City Address:		
Engineering Firm:		Contact:
Address:		
Phone#: Fax#:		E-mail:
Owner:		Contact:
Address:		
Phone#: Fax#:		_ E-mail:
Architect:		Contact:
Address:		
Phone#: Fax#:		_ E-mail:
Other Contact:		Contact:
Address:		
Phone#: Fax#:		E-mail:
MS4/ EROSION & SEDIMENT CONTROL	CERTIFICAT	E OF OCCUPANCY
TYPE OF SUBMITTAL:		
ENGINEER ARCHITECT CERTIFICATION	SITE PLAN	FOR SUB'D APPROVAL
	SITE PLAN I	FOR BLDG. PERMIT APPROVAL
CONCEPTUAL G & D PLAN	FINAL PLAT	T APPROVAL
GRADING PLAN	X_SIA/ RELEA	SE OF FINANCIAL GUARANTEE
DRAINAGE MASTER PLAN	FOUNDATIO	ON PERMIT APPROVAL
DRAINAGE REPORT	GRADING P	ERMIT APPROVAL
CLOMR/LOMR	SO-19 APPR	OVAL
TRAFFIC CIRCUI ATION LAVOUT (TCL)	PAVING PE	RMIT APPROVAL
TRAFFIC IMPACT STUDY (TIS)	GRADING/ F	PAD CERTIFICATION
EROSION & SEDIMENT CONTROL PLAN (ESC)		R APPROVAL
X OTHER (SPECIFY) Supplemental Drainage Calculations	PRE-DESIGN	MEETING
	OTHER (SPI	ECIFY)
IS THIS A RESUBMITTAL?: X Yes No	×	
DATE SUBMITTED March 13 2018 B. Åsa Nil	sson-Weber	
DATE SUBMITTED. March 10, 2010 By, Mourtain		

COA STAFF: ELECTRONIC SUBMITTAL RECEIVED: \_\_\_\_

MARCH 13, 2018

### SUPPLEMENTAL DRAINAGE CALCULATIONS

FOR

### **STORMCLOUD SUBDIVISION, UNITS 4A & 4B**

### A 181-DWELLING UNIT SINGLE-DETACHED RESIDENTIAL SUBDIVISION

### ALBUQUERQUE, NEW MEXICO

Revised/supplemental calculations for onsite storm drain and offsite street and storm drain capacities

BY





I&A Project No. 2174/1821

### **INTRODUCTION**

During the final inspection for the Mirehaven Arroyo adjacent to Stormcloud Unit 4A, City of Albuquerque Hydrology Department questioned the capacity of the 24-inch storm drain from the first-flush pond going to the Mirehaven Arroyo. After looking into the storm drain calculations, the losses at the pond inlet were not taken into consideration in the calculations and the storm drain was in fact under-sized. An inlet in the Mirehaven Arroyo tying to the 24-inch storm drain had also been added during construction to capture 2.0 cfs.

### SUPPORTING INFORMATION

See Appendix A for the following excerpts from drainage reports:

- Stormcloud Units 4 & 5 drainage report by Advanced Engineering dated September 11, 2006, showing allowable discharge rates.
- The Crossing Subdivision Unit 3 drainage report by Bohannan Huston dated March 16, 2004 showing street and storm drain flows at Roaring Fork Place/Eagle River Road.
- Tierra Oeste Unit 3 drainage report by Bohannan Huston dated February 13, 2001 showing street and storm drain flows at Gunnison Place/Casa Florida.

### **DRAINAGE ANALYSIS**

A new storm drain software was used for the storm drain calculations, Stormwater Studio, which performs EGL calculations based on HEC-22 3<sup>rd</sup> Edition methodology taking into account momentum energy losses at junctions, per criteria outlined in the DPM and required by City of Albuquerque Hydrology Department. The calculations were performed to analyze how much flow would fit in the onsite storm drain system before it reached capacity at certain starting water surface elevations in the pond. See Appendix B for calculations.

Calculations show that the 24-inch storm drain from the pond to the Mirehaven Arroyo can convey 29.2 cfs of the 42.6 cfs total going into the pond at a water surface elevation of 67.12 in the first flush pond along with 2 cfs from the added inlet in the Mirehaven Arroyo right-of-way for a total of 31.2 cfs. The remaining onsite 13.4 cfs would overflow to three outfall locations in the neighboring streets and storm drain systems. See Appendix B for a revised basin map. The street and storm drain capacities in the neighborhood are not compromised by the additional flows.

### Summary of bypass flow to offsite:

- A. 5.0 cfs would bypass sump inlets 9 and 10 in Monsoon Road and overflow east of the pond at a street elevation of 68.15 to the east end of Animas Place for a total of 23.9 cfs; allowable discharge=20.5 cfs; net additional flow=3.4 cfs.
- B. 3.0 cfs would bypass inlet 7 and flow to the south end of Gunnison Place for a total street flow of 15.5 cfs; allowable discharge=13.0 cfs; net additional flow=2.5 cfs.
- C. 5.4 cfs would bypass sump inlets 9 and 10 and overflow at a street elevation of 68.8 to the sump inlets and storm drain at the south end of Summer Breeze Drive. This storm drain has capacity for the added flows as shown in the storm drain calculations in Appendix B.

The northeast corner of the pond tract adjacent to the Mirehaven Arroyo is a couple of tenths lower than the overflow elevation in Monsoon Road, so prior to the final grading certification, this area shall be built up to prevent the water from overflowing into the AMAFCA right-of-way.



### **Animas Place Additional Street Flow**

The below exhibit shows the street flows including the additional 3.4 cfs at Animas Place (formerly named Henry Fork Rd NW). The storm drain has additional capacity to carry the excess flow since the HGL is approximately 3 feet below grade at the downstream inlet and pipe as shown on storm drain summary and profile in the excerpts from the Crossing Unit 3 drainage report in Appendix A. See Appendix B for street capacity calculations.





Q-street= 37.2+3.4=40.4 cfs Cattle guard inlet and surface overflow.

### **Gunnison Place Additional Street Flow**

The below exhibit shows the street flows including the additional 2.5 cfs at Gunnison Place. As shown in Appendix A, excerpts from Tierra Oeste Unit 3 drainage report, the sump inlet at the knuckle has capacity for 36.4 cfs and the total flow at this point, including the 2.5 cfs is 32.9 cfs. The storm drain was designed for non-pressure flow (see table in Appendix A) and has capacity for the additional flow of 2.5 cfs. Street capacity calculations included in Appendix B shows that the street has capacity for the additional flow.

2.5 cfs additional flow Q-street=13.0+2.5=15.5 cfs



### SUMMARY

The storm drain from the first flush pond into the Mirehaven Arroyo as designed and installed does not have capacity for all of the onsite flows going into the pond. As a result, flows in excess of what was designated as allowable flows on the drainage reports of the neighboring subdivisions (The Crossing Unit 3 and Tierra Oeste Unit 3) will be directed to downstream outfall points as shown below.

- 3.4 cfs will be added to the street/storm drain system at Eagle River Road and Roaring Fork Place.
- 2.5 cfs in Gunnison Place will be added to the street/storm drain system in Gunnison Place/Casa Florida.
- 5.4 cfs will be added to the storm drain system in Summer Breeze Drive.

The offsite streets and storm drain systems have capacity for the additional flows as shown by the street capacity and Summer Breeze storm drain calculations in Appendix B and storm drain information from drainage reports for neighboring subdivisions in Appendix A.

### APPENDIX A

**Excerpts from Drainage Reports** 

DRAINAGE REPORT

### STORM CLOUD SUBDIVISION UNITS 4 & 5

Prepared by:



4416 Anaheim Ave., NE Albuquerque, New Mexico 87113

September, 2006



Shahab Biazar PE NO. 13479



developed flow rate of 1.25 cfs. The flow of 1.25 cfs is less than 4 cfs as it was indicated in the drainage report for Las Lomitas Subdivision Drainage report.

The souther portion of the subdivision (south of Mirehaven Arroyo) is analyzed under the sub-basins A1 through A3, B, C, D, & E (Exhibit G). Basins A1 through A3 fall within Basin Off-1A under the Storm Cloud Units 1 and 2 (which was designed for a future developed runoff of 29.76 cfs). Sub-basins A1 through A3 drain to a series of inlets within sub-basin A3 and then discharge to a proposed 24" sd pipe at a total developed flow rate of 26.88 cfs (which is less than allowable flow rate of 29 76 cfs) Sub-basin B with a developed runoff of 3.23 cfs drains to Animas Place NW (The Crossing Subdivision). Sub-basin B fall withing Basins D4 (2.91 cfs developed runoff) and D5 (0.56 developed runoff) under the Crossing Subdivision. Therefore, the discharge from our sub-basin B (3.23 cfs) is slightly lower than the allowed total discharge for Basins D4 and D5 (3.47 cfs). Sub-basin C with developed runoff rate of 12.80 cfs drains to Gunnison Place. Based on the Analysis Point F under the basin map for the Crossing Subdivision 13.00 cfs is designed to enter Gunnison Place. Sub-basins D1 through D5 drain to a series of inlets and then discharges to Mirehaven Arroyo via 30" Storm sewer pipe at a flow rate of 40.88 cfs. Sub-basin E with a developed flow rate of 19.22 cfs discharge into Henry Fork Road. Sub-basin E drains to Discharge Point G under the Crossing Subdivision basin map with allowable discharge rate of 20.50 cfs. Mirahaven Arroyo will be chanalized per Wilson and Company Design (see Section VIII for copies of the construction plans). Box culverts will be placed at the Tierra Pintada Street at the arroyo crossing. Box culvert would be built with a total opening width of 36' by a



DESIGN ANALYSIS REPORT FOR TIERRA OESTE UNIT 3 (TRACT E AND A PORTION OF TRACT A OF THE CROSSINGS)

JULY 13, 2001

PREPARED BY:

BOHANNAN HUSTON, INC. COURTYARD I 7500 JEFFERSON STREET NE ALBUQUERQUE, NM 87109

PREPARED FOR:

WESTLAND DEVELOPMENT 401 COORS BOULEVARD NW ALBUQUERQUE, NM 87121

PREPARED BY: 2/13/01 QA и m Yolanda Padilla, E.I. Date

![](_page_14_Picture_7.jpeg)

![](_page_15_Figure_0.jpeg)

Gunnison

I

### GUNNISON CUL-DE-SAC INLET

L= 4.0 ft L(double grate)=[2(2.67)+2(1.8')]=8.A(double grate)=8.19 sf A=2.0 sf Q=3.0(4,0')H\*\*1.5=12.0H\*\*1.5 Q=3.0(8.94)H^1.5=26.82\*H^1.5 Q=4.194\*(64.4\*H)^0.5 Q=1.2\*(64.4\*H)^0.5 Q=1.2\*( Wing opening ORIFICE: Q=C\*A\*(2\*G\*H)\*\*0.5 C=0.6 ANALYSIS OF AN INLET IN A SUMP CONDITION - At the end of the cul-de-sac low point INLET TYPE: Double Grate Type "A" with curb opening wings on both sides on inlet. Grate opening C=0.6 Grate opeining C=3.0 Q=C\*L\*H^1.5 Wing opening WEIR: C= 3.0

			COMMENTS:	Flow at double "A" inlet w/ two wing openings	Weir controls on grate analysis							Q(100 yr) = 30.4 cfs is provided at this depth		
TOTAL	ď	(CFS)		0.00	1.61	4.55	8.35	12.86	17.97	23.62	29.76	36.36	43.39	50.82
Q (CFS)	ORIFICE	DOUBLE	GRATE	0.00	12.47	17.64	21.60	24.94	27.88	30.55	32.99	35.27	37.41	39.43
Q (CFS)	WEIR	DOUBLE	GRATE	0.00	0.85	2.40	4.41	6.78	9.48	12.46	15.71	19.19	22.90	26.82
Q (CFS)	WEIR	"A"	OPENING	0.00	0.38	1.07	1.97	3.04	4.24	5.58	7.03	8.59	10.25	12.00
		HEIGHT	ABOVE INLET	0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00
		WS	ELEVATION	0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.00	1.00
				~FL @ INLET							TOP OF CURB			ROW LIMIT

Qr(100) = 2\*[(runoff of the wing opening) + (the lesser of the weir or orifice amount taken by the double grate)]. THE 100 YR STORM EVENT =29.12 cfs at the sump condition THE 2 x 100 YR STORM EVENT =Does not apply to this subdivision The total runoff intercepted by the inlet at the low point in the road is:

NOTE

p:\99234\cdp\hydro\inletanalysis-7/12/2001

### Max RCP flow (non-pressure, full pipe)

Pipe Size (in)/	18	24	30	36
Slope (%)		Pi	pe Capacity	(cfs)
0.60%	8.16	17.57	31.86	51.80
0.76%	9.18	19.77	35.85	58.30
0.79%	9.36	20.16	36.55	59.44
1.41%	12.51	26.93	48.84	79.41

27.13

27.87

28.42

34.02

45.99

46.43

54.30

68.69

49.18

50.54

51.53

61.69

83.38

84.19

98.45

124.54

79.97

82.18

83.80

100.32

135.58

136.90

160.09

202.52

42

78.14 87.95 89.66 119.79

120.64

123.96

126.40

151.32

204.52

206.50

241.48

305.49

Table assumes Manning's n = 0.013

12.60

12.94

13.20

15.80

21.35

21.56

25.21

31.89

1.43%

1.51%

1.57%

2.25%

4.11%

4.19%

5.73%

9.17%

![](_page_18_Figure_0.jpeg)

### THE CROSSING SUBDIVISION UNIT 3

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### DRAINAGE REPORT REVISIONS 02/11/04

![](_page_19_Picture_2.jpeg)

![](_page_19_Picture_3.jpeg)

![](_page_20_Figure_0.jpeg)

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HHI

HI  +++

1.1.

### Hydraflow Plan View

![](_page_21_Figure_1.jpeg)

### **Storm Sewer Tabulation**

Station Len Drng Area		Rnoff	Rnoff Area x C		т	c .	Rain	Total	Сар	Vel	P	ipe	Inver	t Elev	HGL	Elev	Grnd / R	im Flev	Line ID			
Line	To		Incr	Total	coeff	Incr	Total	Inlet	Syst	(1)	flow	full		Size	Slope	Up	Dn	Up	Dn	Up	Dn	Line in
	Line	(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	- (ft)	(ft)	(ft)	-
	-							-														
	End	36.3	0.00	0.00	0.40	0.00	0.00	0.0	1.9	0.0	89.57	54.25	12.79	36	0.88	5219.80	5219.48	5223.24	5222.33	5226.14	5226.14	OUTFALL
		110.0	0.00	0.00	0.00	0.00	0.00	0.0	1.6	0.0	52.36	55.11	7.41	36	0.91	5221.30	5220.30	5224.52	5223.61	5226.94	5226.14	EAGLE RIVER R
Ľ		50.4	0.00	0.00	0.40	0.00	0.00	0.0	1.5	0.0	52.36	51.50	7.41	36	0.79	5221.80	5221.40	5225.78	5225.37	5227.48	5226.94	30 ROARING FO
6	3	50.4	0.00	0.00	0.00	0.00	0.00	0.0	1.4	0.0	42.90	34.69	8.74	30	0.95	5222.38	5221.90	5226.65	5225.91	5228.57	5227.48	30 ROARING FO
5	4	324.0	0.00	0.00	0.40	0.00	0.00	0.0	0.4	0.0	26.28	35.43	5.35	30	0.99	5225.70	5222.48	5228.60	5226.83	5232.90	5228.57	30 ROARING FO
7	0	50.0	0.00	0.00	0.40	0.00	0.00	0.0	0.2	0.0	26.28	60.53	6.12	30	2.90	5227.25	5225.80	5229.07	5229.04	5233.97	5232.90	30 CLARKS FOR
1		21.7	0.00	0.00	0.40	0.00	0.00	0.0	0.2	0.0	17.22	13.98	5.48	24	0.51	5227.45	5227.34	5230.34	5230.17	5234.27	5233.97	24 CLARKS FOR
8	1	26.8	0.00	0.00	0.40	0.00	0.00	0.0	0.0	0.0	8.61	14.17	2.74	24	0.52	5227.69	5227.55	5231.09	5231.04	5234.27	5234.27	Connects DI A C
9	6	27.7	0.00	0.00	0.40	0.00	0.00	0.0	0.0	0.0	4.53	7.92	2.56	18	0.76	5227.55	5227.34	5230.24	5230.17	5234.14	5233.97	Connects DI C C
10	4	12.6	0.00	0.00	0.40	0.00	0.00	0.0	0.0	0.0	8.31	17.01	4.70	18	3.49	5222.92	5222.48	5226.93	5226.83	5228.71	5228.57	Roaring DI A
11	4	27.5	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	8.31	29.55	4.70	18	10.55	5225.38	5222.48	5227.05	5226.83	5228.71	5228.57	Roaring DI A
12	3	27.0	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	4.73	28.99	2.77	18	10.15	5224.64	5221.90	5225.96	5225.91	5228.04	5227.48	Roaring DI C
13	3	50.0	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	4.73	9.10	2.68	18	1.00	5222.40	5221.90	5226.05	5225.91	5227.97	5227.48	Roaring DI C
																			*		· .	
																						·
												-										
						-																
Pro	piect Fil	e: SDd	esian 0:	20204 =										-								
			407.45													Number	of lines: 1	3		Run Dal	te: 02-11-	2004
NOT	ES: Inte	ensity =	127.16	/ (Inlet ti	me + 17	.80) ^ 0.	82; Re	turn per	od = 10	0 Yrs.								-				~

Hydraflow Storm Sewers 2003

. Page 1

### **Storm Sewer Profile**

![](_page_23_Figure_2.jpeg)

Hydraflow Storm Sewers 2003

### **APPENDIX B**

Revised Basin Exhibit Storm Drain Calculations Street Capacity Calculations

![](_page_25_Figure_0.jpeg)

![](_page_26_Figure_0.jpeg)

### Project Name: 1821 MIREHAVEN PIPE

03-01-2018

## Energy Grade Line Calculations

					_	_	_	
		Enrgy Loss	(¥	00'0	1.53	0.01	0.01	7-12-15.sws
	Junction	EGLa Elev	ŧ,	64.39	67.12	64.40	64.44	E-REV5 2011
	,	HGLa Elev	ŧ	62.78	67.12ic	64.38	64.42	EHAVEN PIP
	e	Enrgy Loss	(¥)	0.247	0.731	0.002	0.030	: 1821 MIR
	į	n Value		0.013	0.013	0.013	0.013	<sup>a</sup> roject File
		EGL	ŧ	64.39	65.59	64.39	64.43	
		Vel Head	(H	1.61	1.44	0.02	0.02	
	E	<u>Vel</u>	(ft/s)	10.18	9.62	1.13	1.13	
llostream	Jpstrean	HGL	(L	62.78	64.15	64.37	64.41	
	2	Area	(sqft)	3.07	3.04	1.77	1.77	
		Depth	£	1.88²	1.85²	1.50	1.50	
		Invert Elev	(H	60.90	62.30	61.00	61.90	
	կյնս	Let	(H	15.00	47.00	4.50	84.00	
		EGL Elev	(H)	63.79	64.33	64.39	64.40	
		Vel Head	£	2.09	1.34	0.02	0.02	
	E	Vel	(ft/s)	11.60	9.30	1.13	1.13	
	ownstrea	HGL	(H)	61.90	62.98	64.37	64.38	critical.
	ŏ	Area	(sqft)	2.69	3.04	1.77	1.77	t Superc
		Depth	(#)	1.60‡	2.00	1.50	1.50	depth.
2		Invert Elev	ŧ	60.30	60.90	60.90	61.00	. <sup>2</sup> Critical
2011 A / I	c	J	(cfs)	31.20	29.20	2.00	2.00	d = 2-yrs
ter studio 20	Line	Size	(iii)	24	24	18	18	Return Period
stormwak	Line	Ŷ		-	2	en	4	Notes:

![](_page_28_Figure_0.jpeg)

Project File: 1921 MIREMAVEN PIPE-REVS 2017-12-15, pws

Profile View

Project Name: 1821 MIREHAVEN PIPE

![](_page_29_Figure_2.jpeg)

Plan View Stormwater Studio 2017 v 1.0.0.0

Project Name: Enter Project Name...

03-01-2018

![](_page_30_Figure_2.jpeg)

Project File: 1821 GUNUSON SD-REV.sws

03-01-2018 Project Name: Enter Project Name...

Energy Grade Line Calculations

			_		_							_	_
_	Enrgy Loss	£	0.10	0.03	0.04	0.08	0.00	0.01	0.00	0.01	0.06	0.01	SD-REV.sws
Junction	EGLa Elev	ŧ	67.59	67.72	68.00	68.39	68.70	68.79	67.72	68.05	68.18	68.27	NOSIMMID
	HGLa Elev	ŧ	67.32	67.68	67.78	68.27	68.59	69.69	67.72	68.00	67.70	68.16	ct File: 1821
a	Enrgy Loss	£	0.102	0.090	0.144	0.263	0.269	0.037	0.000	0.021	0.342	0.040	Proje
ā	n Value		0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	
	EGL	£	67.49	67.70	67.96	68.31	68.70	68.78	67.72	68.04	68.12	68.27	
	Vel Head	ŧ	0.27	0.04	0.22	0.12	0.12	0.09	0.00	0.05	0.48	0.12	1
	le V	(ft/s)	4.13	1.67	3.76	2.74	2.74	2.43	0.01	1.81	5.54	2.77	1
Ipstream	HGL	£	67.22	67.65	67.74	68.19	68,59	68.68	67.72	65.99	67,64	68.15	1
	Area	(aqft)	70.7	70.7	3.14	3.14	3.14	1.77	1.77	1.77	3.14	3.14	1
	Depth	£	3.00	3.00	2.00	2.00	2.00	1.50	1.50	1.50	2.00	2.00	
	Invert Elev	(H)	61.09	62.34	62.65	63.48	64.13	64.30	62.77	64,40	62.40	62.75	
цį£	iuaŋ	£	63.20	288.00	52.97	182.00	186.00	22.00	42.80	23.00	67.80	27.10	1
	EGL Elev	£	67.39	67.61	67.81	68.05	68.43	68.74	67.72	68.02	67.78	68.23	
	Vel Head	Ê	0.27	0.04	0.22	0.12	0.12	0.09	0.00	0.05	0.48	0.12	1
E	Vel V	(ft/s)	4.13	1.67	3.76	2.74	2.74	2.43	0.01	1.81	5.54	2.77	
wnstrea	HGL	£	67.12	67.56	67.59	67.93	68.32	68.65	67.72	67.97	67.30	68.11	
å	Area	(sqft)	7.07	7.07	3.14	3.14	3.14	1.77	1.77	1.77	3.14	3.14	1
	Depth	£	3.00	3.00	2.00	2.00	2.00	1.50	1.50	1.50	2.00	2.00	1
	Invert Elev	£	60.50	61.19	62.44	62.75	63,58	64.23	62.44	62.97	61.19	62.60	
	a	(cfs)	29.21	11.81	11.80	8.60	8.60	4.30	0.01	3.20	17.40	8.70	= 2-yrs.
- I	Size	(iii)	36	36	24	24	24	18	18	18	24	24	eturn Period
	No.		-	2	m	4	ю	9	7	æ	6	10	Notes: R

![](_page_32_Figure_0.jpeg)

Project Name: Enter Project Name...

03-01-2018

![](_page_32_Figure_3.jpeg)

Project File: 1821 GUNUISON SO-REV.sws

Profile View

Project Name: Enter Project Name..

![](_page_33_Figure_2.jpeg)

Project File: 1821 GUNUSON SO-REV.sws

Plan View Stormwater Studio 2017 v 1.0.0.0

Project Name: SUMMER BREEZE

03-01-2018

![](_page_34_Figure_3.jpeg)

Project File: SUMMER BREEZE.sws

# Energy Grade Line Calculations

Project Name: SUMMER BREEZE

<b>m</b> -										_
3-01-2018		Enrgy Loss	Ê	0.01	0.10	0.00	0.00	0.26	0.06	REEZE.sws
Ū	Junction	EGLa Elev	ŧ	60.50	60.81	61.16	62.14	62.14	62.41	C SUMMER B
		HGLa Elev	ŧ	60.11	60.60	60.78	61.85	60,92	62.11	Project File
	ed	Enrgy Loss	ŧ	0.406	0.127	0.133	0.106	0.589	0.094	
	ā	n Value		0.013	0.013	0.013	0.013	0.013	0.013	
		EGL	£	60.50	60.71	61.16	62.14	61,89	62.36	
		Vel Head	ŧ	0.39	0.21	0.39	0.29	1.22	0.30	
	_	Vel	(ft/s)	5.01	3.68	4.99	4.34	8,85	4.42	
	Jpstream	HGL Elev	£	60.11	60.50	60.78	61.85	60.67	62.05	
		Area	(sqft)	7.07	9.62	1.52	0.87	3.14	3.14	
		Depth	£	3.00	3.50	0.98²	0.742	2.00	2.00	
		Invert Elev	ŧ	52.68	55.85	59.80	61.10	57,65	58.10	
	գյթս	юŊ	£	144.00	102.37	44.12	30.20	39.00	24.80	
		EGL	ŧ	60'09	60.59	60.84	61.22	61.30	62.26	
		Vel Head	£	0.39	0.21	0.09	0.12	1.22	0.30	
	E	Vel	(£/s)	5.01	3.68	2.42	2.73	8,85	4.43	
	wnstrea	HGL	£	59.70	60.38	60.75	61.10	60.08	61.96	
	ă	Area	(sqft)	7.07	9.62	3.14	1.39	3.14	3.14	
		Deptin	ŧ	3,00	3.50	2.00	1.10	2.00	2.00	depth.
07		Invert Elev	£	48.36	52.78	56.85	60.00	56.85	57.85	2 Critical
17 v 1.0.(	c	Ţ	(cfs)	35.40	35.40	7.60	3.80	27.80	13.90	1 = 2-yrs
er Studio 201	Line	Size	(ii)	36	42	24	18	24	24	Return Period
tormwat	Line	Ŷ		-	7	m	4	9	9	Notes: F

![](_page_36_Figure_0.jpeg)

Project Name: SUMMER BREEZE

![](_page_36_Figure_2.jpeg)

Project File: SUMMER BREEZE sws

![](_page_37_Figure_0.jpeg)

Project File: SUMMER BREEZE.sws

STREET	FLOW CAP	ACITY CALCULATIONS						
STREET NAME:	Roaring Fork		1					
LOCATION:	Before 4 inlet	s in Clarks Fork						
STREET INFORMA	TION	HALF STREET CALCULATIONS						
Slope	0.005	Road Width/2	16					
Q <sub>100</sub>	49.4	Curb Height	0.67					
Right-of-way Width	50	1/2 Wetted Perimeter (P)	16.602					
Road Width	32	1/2 Area(STD)	7.078					
Curb Type	std	1/2 Area(MDN)						
Road Cross Slope	0.02	1/2 Area(MTBL)						
Manning's N	0.017	Discharge (1/2 Q)	24.713					
Depth	0.602							
	RESL	JLTS						
HGL								
Q <sub>100</sub> FLOW CAPACITY =	49.43 cfs	ок						
at an HGL Depth=	0.60 ft	< Curb height =	0.67					
		OK						
FGI								
Velocity	3 49 fns							
$V^2/2q$	0.10 tpc							
EGL Depth =	0.79 ft	< Right-of-way height =	0 84					
	0.70	OK	0.04					
		-						
~~~~~~~~~		~~~~~~	~					
STREET NAME:	Gunnison		2					
LOCATION:	Before 4 inlet	s @ Casa Florida PI NW						
STREET INFORMA	TION	HALF STREET CALCUL	ATIONS					
Slope	0.015	Road Width/2	15					
Q <sub>100</sub>	31.8	Curb Height	0.67					
Right-of-way Width	51	1/2 Wetted Perimeter (P)	15.403					
Road Width	30	1/2 Area(STD)	3.797					
Curb Type	std	1/2 Area(MDN)						
Road Cross Slope	0.02	1/2 Area(MTBL)						
Manning's N	0.017	Discharge (1/2 Q)	15.903					

0.403

31.81 cfs

0.40 ft

4.19 fps

0.27 ft

0.68 ft

RESULTS

ок < ОК

Curb height = 0.67

< Right-of-way height = 0.87 OK

Depth

Velocity

V<sup>2</sup>/2g EGL Depth =

EGL

HGL Q<sub>100</sub> FLOW CAPACITY = at an HGL Depth=