(Amendment Letter)
MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT for SHILOH MESA & SHILOH MESA FILING NO. 1 and FINAL DRAINAGE REPORT for SHILOH MESA FILING NO. 4

OCTOBER 2017

Prepared for:

ASPEN VIEW HOMES, LLC
1710 Jet Stream Drive
Colorado Springs, CO 80921
Kevin Hart

Prepared by:

CIVIL CONSULTANTS, INC.

20 Boulder Crescent, Suite 110
Colorado Springs, CO
80903 (719) 955-5485

Project #08-039

(Amendment Letter)

MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT for SHILOH MESA FILING NO. 1 & FINAL DRAINAGE LETTER FOR SHILOH MESA FILING NO. 4

DRAINAGE PLAN STATEMENTS

ENGINEER'S STATEMENT

This report and plan for the drainage design of Shiloh Mesa Filing No. 4 was prepared under my supervision and is correct to the best of my knowledge and belief. Said drainage report and plan has been prepared in accordance with the City of Colorado Springs Drainage Criteria Manual and is in conformity with the master plan of the drainage basin. I understand that the City of Colorado Springs does not and will not assume liability for drainage facilities designed by others. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

Virgil A. Sanchez, P.E. #37160
For and on Behalf of M & S Civil Consultants, Inc.

9-28-17

DEVELOPER'S STATEMENT

Aspen View Homes, LLC hereby certifies that the drainage facilities for the Shiloh Mesa Filing No. 4, shall be constructed according to the design presented in this report. I understand that the City of Colorado Springs does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that are submitted to the City of Colorado Springs pursuant to Section 7.7.906 of the City Code; and cannot, on behalf of the Shiloh Mesa Filing No. 4, guarantee that final drainage design review will absolve Aspen View Homes, LLC and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

BY: _____ DATE: 9.27.17
Kevin Hart

TITLE: Developer

ADDRESS: Aspen View Homes, LLC
1710 Jet Stream Drive
Colorado Springs, CO 80921

CITY OF COLORADO SPRINGS

Filed in accordance with Section 7.7.906 of the Code of the City of Colorado Springs} 2001, as amended,

BY: _____ DATE: 12-13-17
For the City Engineer

CONDITIONS:

October 19, 2017

City of Colorado Springs
Subdivision Engineering Review Team
30 South Nevada Avenue, Suite 401
Colorado Springs, Colorado 80903
Attn: Anna Bergmark

RE: Amendment Letter to the Master Development Drainage Plan and Final Drainage Report for Shiloh Mesa Filing No. 1 & Final Drainage Letter for Shiloh Mesa Filing No. 4.

Dear Anna,

The following is the Final Drainage Letter for Shiloh Mesa Filing No. 4 to amend the "Master Development Drainage Plan and Final Drainage Report for Shiloh Mesa & Shiloh Mesa Filing No. 1", (MDDP FDR SM1) prepared by M&S Civil Consultants, Inc., dated December 2015. The amendment letter will address the drainage fees associated with Shiloh Mesa Filing No. 4. The proposed drainage patterns have remained the same as discussed in the previous approved report MDDP FDR SM1. Per requirements from the City of Colorado Springs, the original Sand Filter pond will be replaced by an Extended Detention Basin (EDB).

This letter is being prepared to accompany the proposed Final Plat for Shiloh Mesa Filing No. 4 (14.056 acres, 47 lots) and will address drainage fees associated with the acreage on the plat. Proposed acreage tributary to Design Point A1and grading changes are minor and will result in replacing the 6' sump inlet with two 6' sump inlets. The low point at the most western point in the cul de sac in Moorebank Drive will be moved to the entrance of the west cul de sac in Moorebank Drive. With this change a portion of Basin A2 will be routed via a crosspan, at Callendale Drive, to Design Point A1. The flows at Design Point A1 will include Basin A1, 4.05 acres (Q5=4.3 cfs, Q100=12.9 cfs) and a portion of Basin A2, 1.66 acres (Q5=1.9 cfs, Q100=5.4 cfs) (see the attached Shiloh Mesa Filing No. 4 drainage map exhibit). These grading changes will not adversely affect the overall drainage patterns intercepted at Design Point A1 (Q5=6.1 cfs, Q100=17.9 cfs). The new runoff coefficient numbers have been incorporated in calculate percent impervious and runoff. The increased acreage and flows are minimal and will be conveyed via a 24" RCP storm sewer to the north EDB and ultimately to Sand Creek (see proposed Area Drainage Summary, Surface Routing Summary, Storm Sewer Routing Summary, Proposed Drainage map exhibit, attachment). The approved MDDP FDR SM1 Area Drainage Summary, Surface Routing Summary, Storm Sewer Routing Summary and Proposed Drainage map are included as an attachment and reference. The EDB has been sized per the UD-Detention, Version 3.07 sheet provided by Urban Storm Drainage Criteria Manual. Also as attachments with this letter, are the spillway sizing calculation, partial pipe flow calculator sheets, riprap sizing sheets and open channel flow calculator with erosion material and performance specification sheet. There are no changes to drainage patterns and the overall grading changes will not adversely affect downstream inlets and storm infrastructure.

EXTENDED DETENTION BASIN

North EDB Pond, has combined upstream developed runoff of Q5=6.1 cfs and Q100=17.9 cfs. The proposed Detention Pond functions to provide full spectrum detention and water quality for runoff calculated onsite. The pond is designed to treat approx 5.71 acres of the platted 14.056 acres. The remaining 8.346 acres have been accounted for in the MDDP FDR SM1. The pond will provide 0.097 ac-ft of water quality storage and 0.519 ac-ft of 100-year storage. The forebay, trickle channel, micropool, outlet structure and pipe have been designed per the UDFCD manual and per the Detention Design-UD-Detention v3.07 workbook. The outlet structure has a grate opening of 5.7'x2.9' and is a CDOT type D

inlet. Flows intercepted by the outlet structure will be routed via an 18" RCP which will outfall into Sand Creek. A 15'x15'x18" thick~D50= 9" riprap pad (UDFCD Fig. 9-37) will be constructed to dissipate energy and prevent local scour at the FES outlet. In the event of clogging or total outlet failure, flows will over top the bank via a 29'x24'x24" thick~D50=12" riprap lined emergency spillway and outfall into the Sand Creek. The riprap apron will be constructed to dissipate energy and prevent local scour at the outlet. The Extended Detention Basin (EDB) pond will be private and be maintained by the Homeowners Association. The 100-year, EURV and WQCV volumes required for the site has been determined based on the guidelines as set forth in the City of Colorado Springs/El Paso County Drainage Criteria Manual - Volume II.

FOUR STEP PROCESS

Step 1 **Employ Runoff Reduction Practices**. – Approx. 3.66 acres of Tract C (pervious surface) along the Sand Creek Regional Trail will be dedicated to the City of Colorado Springs for ownership and maintenance of drainage improvements. Urban Drainage site-level reduction method was implemented on the 5.71 acres tributary to the EDB. Roof drains shall be routed via side lots swales or over lawns. The Site-Level Low Impact Development (LID) spreadsheet included with this letter.

Step 2 **Implement BMPs that provide a water quality capture volume with slow release.** – An Extended Detention Basin with water quality features is proposed to provide WQCV and Detention.

Step 3 **Stabilize streams.** – Stabilization of the existing channel banks and channel bed of Sand Creek will commence prior to the final build out of Shiloh Mesa Filing No. 4. Channel improvements shall include 10-year riprap, select lining and grade control structures, as recommended by the Sand Creek Drainage Basin Planning Study (DBPS) and will be finalized by the "Technical Memorandum Sand Creek Channel Study (North of Woodmen Road)", prepared by M&S Civil Consultants, Inc.

Step 4 **Implement site specific and other source control BMPs.** – A final grading and erosion control plans will be submitted for review and approval and will address site specific needs. The proposed project will use silt fence, a vehicle tracking control pad, concrete washout area, inlet protection, check dams, mulching and reseeding to mitigate the potential for erosion across the site. The temporary sediment basins will be placed adjacent to Full Spectrum Detention Pond and at the ends of Callendale Drive and Sandsmere Drive.

CONSTRUCTION COST OPINION

Public Drainage Facilities **Reimbursable-** 72" Storm Conveyance System (**Filing No. 1**)
Submitted with Shiloh Mesa Filing No. 1 Improvements. Use as reference only.

Item	Description	Quantity	Unit Cost	Cost
1.	72" RCP	1119 LF	$350/LF	$ 391,650.00
2.	22.7'x3.0' CDOT Inlet	1 EA	$25,000/LF	$ 25,000.00
3.	Type 1 MH	2 EA	$10,000/EA	$ 20,000.00
			Total=	**$ 436,650.00**

Public Drainage Facilities **Reimbursable-** Sand Creek Improvements (**Filing No. 2 & 3**)

Item	Description	Quantity	Unit Cost	Cost
1.	Channel Selective Lining	2200 LF	$150/LF	$ 330,000.00
2.	Channel 10-yr Riprap	300 LF	$150/LF	$ 45,000.00
3.	Channel Grade Control	3 EA	$150,000/EA	$ 450,000.00
4.	72" RCP	94 LF	$350/LF	$ 32,900.00

Total= $ 857,900.00

Public Drainage Facilities **NON-Reimbursable**-Shiloh Mesa-Residential (**Filing No. 2**)

Item	Description	Quantity	Unit Cost	Cost
1.	18" RCP	16 LF	$40/LF	$ 640.00
2.	24" RCP	463 LF	$50/LF	$ 23,150.00
3.	30" RCP	281 LF	$65/LF	$ 18,265.00
4.	36" RCP	467 LF	$75/LF	$ 35,025.00
5.	42" RCP	262 LF	$85/LF	$ 22,270.00
6.	Type 1 MH	5 EA	$6,500/EA	$ 32,500.00
7.	Type 2 MH	3 EA	$4,500/EA	$ 13,500.00
8.	4' Sump Inlet	3 EA	$3,000/EA	$ 9,000.00
9.	6' Sump Inlet	1 EA	$4,000/EA	$ 4,000.00
10.	8' Sump Inlet	2 EA	$5,000/EA	$ 10,000.00
11.	Central WQ Pond Pvt*	1 EA	$15,000/EA	$ 15,000.00
12.	Type VL Riprap Pvt	60 CY	$40/CY	$ 2,400.00
			Total=	**$ 185,750.00**

* Includes outlet box, grate, and outlet and spillway riprap protection
Private (Pvt) facilities to be maintained by the HOA.

Public Drainage Facilities **NON-Reimbursable**-Shiloh Mesa-Residential (**Filing No. 3**)
No NON-Reimbursable Improvements

Public Drainage Facilities **NON-Reimbursable**-Shiloh Mesa-Residential (**Future Filing No.4**)

Item	Description	Quantity	Unit Cost	Cost
1.	18" RCP	121 LF	$40/LF	$ 4,840.00
1.	24" RCP	293 LF	$50/LF	$ 14,650.00
2.	Type 1 MH	2 EA	$6,500/EA	$ 13,000.00
3.	6' Sump Inlet	2 EA	$4,000/EA	$ 8,000.00
4.	North EDB Pond Pvt*	1 EA	$23,000/EA	$ 23,000.00
			Total=	**$ 63,490.00**

* Includes outlet box, grate, and outlet and spillway riprap protection
Private (Pvt) facilities to be maintained by the HOA.

DRAINAGE, BRIDGE AND POND FEES

The Shiloh Mesa-Residential site is located within the Sand Creek Drainage Basin. The site as defined above consists of 68.88 acres. Shiloh Mesa Filing No.1 consists of 19.956 acres, the remaining future filings total 48.924 acres. The 2015 Drainage, Bridge and Pond Fees per the City of Colorado Springs for these sites are listed below:

Shiloh Mesa Residential Filing No. 1 (19.956 ac)

Submitted with Shiloh Mesa Filing No. 1 Improvements. Use as reference only.

Drainage Fee:	$10,247/acre x 19.499*acres	$199,806.25
Bridge Fee:	$ 622/acre x 19.499* acres	$ 12,128.38
Pond Fee (Land):	$ 1,070/acre x 19.499* acres	$ 20,863.93
Pond Fee (Facilities):	$ 3,005/acre x 19.499* acres	$ 58.594.50
	Total fees:	**$291,393.06**

***100-year flood plain subtracted out from developed acreage (0.457 ac).**

Shiloh Mesa Residential Filing No. 2 (20.310 ac)

Drainage Fee:	$10,247/acre x 18.954*acres	$194,221.64
Bridge Fee:	$ 622/acre x 18.954* acres	$ 11,789.39

Pond Fee (Land):	$ 1,070/acre x 18.954* acres		$ 20,280.78
Pond Fee (Facilities):	$ 3,005/acre x 18.954* acres		$ 56.956.77
		Total fees:	**$283,248.58**

***100-year flood plain subtracted out from developed acreage (1.356 ac).**

Shiloh Mesa Residential Filing No. 3 (14.554 ac)

Drainage Fee:	$10,247/acre x 13.955*acres		$142,996.89
Bridge Fee:	$ 622/acre x 13.955* acres		$ 8,680.01
Pond Fee (Land):	$ 1,070/acre x 13.955* acres		$ 14,931.85
Pond Fee (Facilities):	$ 3,005/acre x 13.955* acres		$ 41.934.78
		Total fees:	**$208,543.53**

***100-year flood plain subtracted out from developed acreage (0.599 ac).**

The 2017 Drainage, Bridge and Pond Fees per the City of Colorado Springs for these sites are listed below:

Shiloh Mesa Residential Filings No. 4 (14.056 ac)

Drainage Fee:	$11,154/acre x 14.056 acres		$ 156,780.62
Bridge Fee:	$ 675/acre x 14.056 acres		$ 9,487.80
Pond Fee (Land):	$ 1,070/acre x 14.056 acres		$ 15,039.92
Pond Fee (Facilities):	$ 3,259/acre x 14.056 acres		$ 45,808.50
		Total fees:	**$ 227,116.84**

DRAINAGE COST COMPARISON AND CREDIT SUMMARY

Sand Creek Drainage Basin Planning Study Assumed Costs (Filing No. 1)

Description	DBPS Cost	Inflation Multiplier	Today's Dollars-Reimbursable
Mustang Road 2-60" CMP	$14,400	x 1.79	$0*
*Not to be installed with this Development			
Reach 150-2 Riprap lined channel	$480,000	x 1.79	$859,200.00
		Total=	**$859,200.00**

Sand Creek Drainage Basin Planning Study Assumed Costs (Filing No. 2 & 3)

Sand Creek 160 Selective Lining	$279,400	x 1.79	$500,126.00
Sand Creek 160 Grade Control	$64,800	x 1.79	$115,992.00
Sand Creek 160 10-yr Riprap	$71,400	x 1.79	$127,806.00
		Total=	**$743,924.00**

Public Facilities:

Submitted with Shiloh Mesa Filing No. 1 Improvements. Use as reference only.

Total Public Reimbursable Estimated Cost-Shiloh Mesa Residential (Filing No. 1)	$ 436,650.00
Total Estimated Drainage Facility Fees Filing No. 1 (19.499 ac)	$ -199,806.25
Total Difference/Credit	**$ 236,843.75**

***Because Public Reimbursable facility costs do exceed the fees due for drainage fees, $236,843.75 is an excess cost at this time. Payment of Bridge and Pond Land is still required.**

Public Facilities:

Total Public Reimbursable Estimated Cost-Shiloh Mesa Residential (Filing 2&3)	$ 857,900.00
Total Public Reimbursable Estimated Cost-Shiloh Mesa Filing 1 **Credit	$ 236,843.75
Total Estimated Drainage Facility Fees Filing No. 2 (18.954 ac)	$ -194,221.64

Total Estimated Drainage Facility Fees Filing No. 3 (13.955 ac)	$ -142,996.89
Total Estimated Drainage Facility Fees Filing No. 4 (14.056 ac)	$ -156,780.62
Total Difference/Credit	**$ 600,744.60**

***Because Public Reimbursable facility costs do exceed the fees due for drainage fees, $600,744.60 is a credit at this time. Payment of Bridge and Pond Land will still be required.**
****The "Master Development Drainage Plan and Final Drainage Report for Shiloh Mesa & Shiloh Mesa Filing No. 1", does not include the credit in the overall calculation. The credit will be accounted for in this report.**

Refer to the "Master Development Drainage Plan and Final Drainage Report for Shiloh Mesa & Shiloh Mesa Filing No. 1", prepared by M&S Civil Consultants, Inc., dated December 2015 for information regarding the "Sand Creek Drainage Basin Planning Study", prepared by Kiowa Engineering, CORP., dated Rev. March 1996, estimated storm infrastructure and Sand Creek improvement costs associated with Shiloh Mesa Residential Subdivision.

M & S Civil Consultants, Inc. (M & S) cannot and does not guarantee the construction cost will not vary from these opinions of probable costs. These opinions represent our best judgment as design professionals familiar with the construction industry and this development in particular. The above is only an estimate of the facility cost and drainage basin fee amounts in 2017 (Shiloh Mesa Filing No. 4). Upon completion of the aforementioned improvements, M & S shall submit the actual construction costs to the City of Colorado Springs/City Drainage Board for reimbursement.

The amendment drainage letter for Shiloh Mesa Filing No. 4 and development of the Shiloh Mesa Filing No. 4 subdivisions shall not adversely affect adjacent or downstream property and is in accordance with the Master Development Drainage Plan and Final Drainage Report for Shiloh Mesa & Final Drainage Report for Shiloh Mesa Filing No. 1.

Respectfully,

Virgil A. Sanchez, P.E.
M&S Civil Consultants, Inc.

Attachments:
Shiloh Mesa Filing No. 4 Grading and Erosion Control sheet GR03
Proposed Area Drainage Summary
Proposed Surface Routing Summary
Proposed Storm Sewer Routing Summary
Proposed Drainage map exhibit
Urban Storm Drainage Criteria Manual UD-Detention, Version 3.07 sheet
Spillway Sizing Calculation
Partial Pipe Flow Calculator sheet
Riprap Sizing sheet
Open Channel Flow Calculator with Erosion Material and Performance Specification sheets
MDDP FDR SM1 Area Drainage Summary
MDDP FDR SM1 Surface Routing Summary
MDDP FDR SM1 Storm Sewer Routing Summary
MDDP FDR SM1 Proposed Drainage map

AMENDMENT TO THE MASTER DEVELOPMENT DRAINAGE PLAN SHILOH MESA AND FINAL DRAINAGE REPORT FOR SHILOH MESA FILING NO.1 & FINAL DRAINAGE LETTER FOR SHILOH MESA FILING NO.4

(Area Runoff Coefficient Summary)

		STREETS / DEVELOPED			*OVERLAND / DEVELOPED*			*OVERLAND / UNDEVELOPED*			*WEIGHTED*	
BASIN	**TOTAL AREA** *(Acres)*	**AREA** *(Acres)*	C_5	C_{100}	**AREA** *(Acres)*	C_5	C_{100}	**AREA** *(Acres)*	C_5	C_{100}	C_5	C_{100}
A1	4.05	0.0	0.90	0.96	3.5	0.33	0.52	0.6	0.08	0.35	*0.29*	*0.49*
**A2*	1.66	0.0	0.90	0.96	1.66	0.33	0.52	0.0	0.08	0.35	*0.33*	*0.52*

Overland developed calc at 0.15 ac ~ 61% impervious

Overland undeveloped area of pond 0.6 ac

* "Master Development Drainage Plan for Woodmen Heights Master Plan" by Classic Consulting Engineers and Surveyors, LLC., dated June 2004

AMENDMENT TO THE MASTER DEVELOPMENT DRAINAGE PLAN SHILOH MESA AND FINAL DRAINAGE REPORT FOR SHILOH MESA FILING NO. 1 & FINAL DRAINAGE LETTER FOR SHILOH MESA FILING NO. 4

(Area Drainage Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*STREET / CHANNEL FLOW*				*Time of Travel (T_t)*	*INTENSITY **		*TOTAL FLOWS*	
BASIN	**AREA TOTAL** *(Acres)*	C_5	C_{100}	C_5	**Length** *(ft)*	**Height** *(ft)*	T_C *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	T_t *(min)*	**TOTAL** *(min)*	I_5 *(in/hr)*	I_{100} *(in/hr)*	Q_5 *(c.f.s.)*	Q_{100} *(c.f.s.)*
		From DCM Table 5-1														
A1	4.05	0.29	0.49	0.29	100	3	10.5	819	1.5%	4.3	3.1	13.6	3.6	6.4	*4.3*	*12.9*
**A2*	1.66	0.33	0.52	0.33	100	2	11.5	802	1.5%	4.3	3.1	14.5	3.5	6.3	*1.9*	*5.4*

* Intensity equations assume a minimum travel time of 5 minutes.

* "Master Development Drainage Plan for Woodmen Heights Master Plan" by Classic Consulting Engineers and Surveyors, LLC., dated June 2004

Calculated by: ET
Date: 10/11/2017
Checked by: VAS

#REF!		*#REF!*
CA_5	**Basin**	CA_{100}
1.19	A1	2.00
0.55	*A2	0.86

AMENDMENT TO THE MASTER DEVELOPMENT DRAINAGE PLAN SHILOH MESA AND FINAL DRAINAGE REPORT FOR SHILOH MESA FILING NO. 1 & FINAL DRAINAGE LETTER FOR SHILOH MESA FILING NO. 4

(Basin Routing Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*PIPE / CHANNEL FLOW*				*Time of Travel (T_t)*	*INTENSITY* *		*TOTAL FLOWS*		COMMENTS
DESIGN POINT	CONTRIBUTING BASINS	CA_5	CA_{100}	C_5	Length (ft)	Height (ft)	T_C (min)	Length (ft)	Slope (%)	Velocity (fps)	T_t (min)	TOTAL (min)	I_5 (in/hr)	I_{100} (in/hr)	Q_5 (c.f.s.)	Q_{100} (c.f.s.)	
A1	A1+ *A2	1.73	2.87									14.5	3.5	6.3	*6.1*	*17.9*	FLOW AT DP A1 FLOWS SPLIT AT INLETS

* Intensity equations assume a minimum travel time of 5 minutes.

* "Master Development Drainage Plan for Woodmen Heights Master Plan" by Classic Consulting Engineers and Surveyors, LLC., dated June 2004

Calculated by: ET
Date: 10/11/2017
Checked by: VAS

AMENDMENT TO THE MASTER DEVELOPMENT DRAINAGE PLAN SHILOH AND FINAL DRAINAGE REPORT FOR SHILOH MESA FILING NO. 1 & FINAL DRAINAGE LETTER FOR SHILOH MESA FILING NO. 4

PIPE ROUTING SUMMARY

PIPE RUN	*Contributing Pipes/Design Points*	*Equivalent CA_5*	*Equivalent CA_{100}*	*Maximum T_C*	*Intensity**		*Flow*		PIPE SIZE
					I_5	I_{100}	Q_5	Q_{100}	
1	**1/2 DP A1**	0.87	1.43	14.5	3.5	6.3	***3.0***	***9.0***	18" RCP
2	**DP A1 to Pond**	1.73	2.87	14.5	3.5	6.3	***6.1***	***17.9***	24" RCP
3	**DP A1 outfall Sand Creek**	SEE UD DENTENTION SHEET FOR RELEASE RATE					***0.3***	***7.8***	18" RCP Pipe slope 7.8%

* Intensity equations assume a minimum travel time of 5 minutes.

DP - Design Point
EX - Existing Design Point
FB- Flow By from Design Point
INT- Intercepted Flow from Design Point

Calculated by: ET
Date: 10/11/2017
Checked by: VAS

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

***Design Storm: 1-Hour Rain Depth	WQCV Event	0.25	Inches	Designer:	Eugene Tellez
***Minor Storm: 1-Hour Rain Depth	10-Year Event	1.75	Inches	Company:	M&S Civil Consultants
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	Inches	Date:	October 12, 2017
Optional User Defined Storm (CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	CUHP 100-Year Event			Project:	Shiloh Mesa Filing No. 4
				Location:	Northeast of Marksheffel Rd/Kenosha Drive intersectgion.

Max Intensity for Optional User Defined Storm: 0

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	A1 TYPE A	A2 TYPE A	A1 TYPE B	A2 TYPE B										
Receiving Pervious Area Soil Type	Sand	Sand	Loamy Sand	Loamy Sand										
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	0.490	0.290	3.560	1.370										
Directly Connected Impervious Area (DCIA, acres)	0.060	0.090	0.730	0.520										
Unconnected Impervious Area (UIA, acres)	0.200	0.170	1.150	0.280										
Receiving Pervious Area (RPA, acres)	0.230	0.030	1.680	0.570										
Separate Pervious Area (SPA, acres)	0.000	0.000	0.000	0.000										
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	V	V	V	V										

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against Input)	0.490	0.290	3.560	1.370										
Directly Connected Impervious Area (DCIA, %)	12.2%	31.0%	20.5%	38.0%										
Unconnected Impervious Area (UIA, %)	40.8%	58.6%	32.3%	20.4%										
Receiving Pervious Area (RPA, %)	46.9%	10.3%	47.2%	41.6%										
Separate Pervious Area (SPA, %)	0.0%	0.0%	0.0%	0.0%										
A_R (RPA / UIA)	1.150	0.176	1.461	2.036										
I_a Check	0.470	0.850	0.410	0.330										
f / I for WQCV Event:	23.4	23.4	7.7	7.7										
f / I for 10-Year Event:	0.6	0.6	0.5	0.5										
f / I for 100-Year Event:	0.6	0.6	0.4	0.4										
f / I for Optional User Defined Storm CUHP:														
IRF for WQCV Event:	0.00	0.00	0.00	0.00										
IRF for 10-Year Event:	0.82	0.92	0.86	0.82										
IRF for 100-Year Event:	0.84	0.94	0.89	0.85										
IRF for Optional User Defined Storm CUHP:														
Total Site Imperviousness: I_{total}	53.1%	89.7%	52.8%	58.4%										
Effective Imperviousness for WQCV Event:	12.2%	31.0%	20.5%	38.0%										
Effective Imperviousness for 10-Year Event:	45.8%	85.0%	48.3%	54.8%										
Effective Imperviousness for 100-Year Event:	46.7%	85.9%	49.2%	55.4%										
Effective Imperviousness for Optional User Defined Storm CUHP:														

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10-Year Event CREDIT**: Reduce Detention By:	14.2%	5.6%	8.9%	6.5%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100-Year Event CREDIT**: Reduce Detention By:	11.9%	4.0%	6.7%	5.1%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
User Defined CUHP CREDIT: Reduce Detention By:														

Total Site Imperviousness:	56.0%
Total Site Effective Imperviousness for WQCV Event:	24.5%
Total Site Effective Imperviousness for 10-Year Event:	51.5%
Total Site Effective Imperviousness for 100-Year Event:	52.3%
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	

Notes:

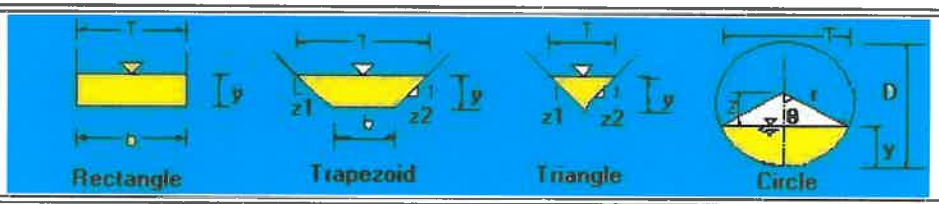
* Use Green-Ampt average infiltration rate values from Table 3-3.

** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.

*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

The open channel flow calculator

Select Channel Type: Trapezoid



Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: 0.19 ft/ft	Water depth(y): 0.4 ft	Bottom width(b) 4 ft
Flow velocity 8.4205 ft/s	LeftSlope (Z1): 4 to 1 (H:V	RightSlope (Z2): 4 to 1 (H:V
Flow discharge 18.8619 ft^3/s	Input n value 0.035 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 7.3 ft	Flow area 2.24 ft^2	Top width(T) 7.2 ft
Specific energy 1.5 ft	Froude number 2.66	Flow status Supercritical flow
Critical depth 0.7 ft	Critical slope 0.0231 ft/ft	Velocity head 1.1 ft

SPILL WAY OUTFALL

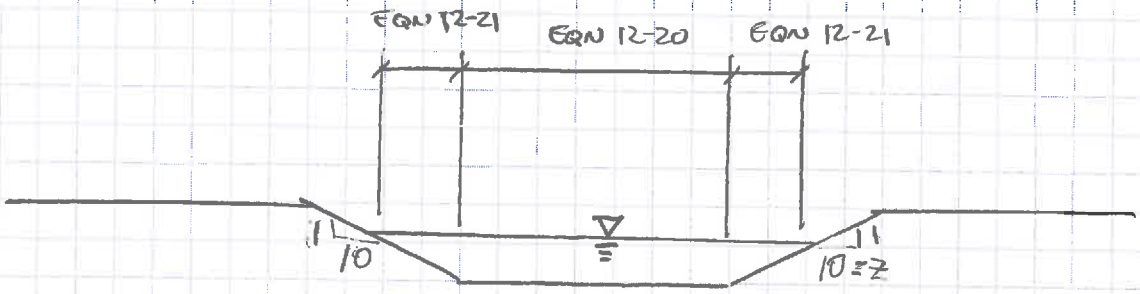
CIVIL CONSULTANTS, INC.

20 BOULDER CRESCENT, STE 110
COLORADO SPRINGS, CO 80903
(719) 955-5485

PROJECT: SHILOH MESA FILING No. 4

DATE: 9/11/2017

SIZE SPILLWAY - FULL SPECTRUM POND



~~FROM UDFCD 12-33 STORAGE~~

$Q_{100} = 21.6$ $C = 3.0$

EQN 12-20 $Q = CLH^{1.5}$ $Q = 3.0\ (6)\ (0.7)^{1.5} = 10.54$ cfs

EQN 12-21 $Q = \frac{2}{5} C2H^{2.5}$ $Q = \frac{2}{5}\ (3.0)\ (10)\ (0.7)^{2.5} = 4.92$ cfs

$Q_T = 10.54$ cfs + 2 (4.92 cfs) = 20.38 cfs > 17.9 cfs Ok

SPILLWAY RUNDOWN PROTECTION

RIPRAP SIZING (UDFCD 12-34)

FIGURE 12-21

BASED ON SLOPE AND UNIT DISCHARGE

$Q_{100} = 17.9$ cfs SLOPE 19.0%

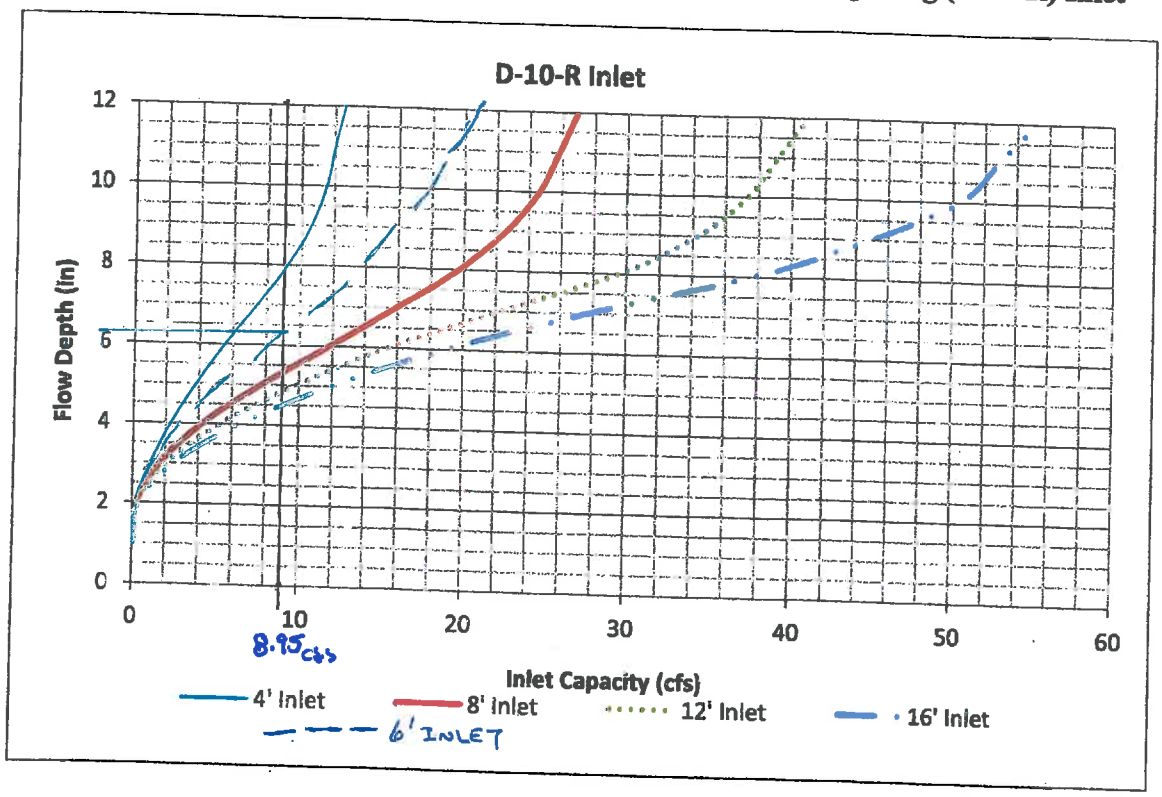
UNIT DISCHARGE 17.9 cfs / 6 ft = 2.98

FIGURE R-21 USE TYPE M

TYPE M $D_{50} = 12''$

SOIL RIPRAP DEPTH $2\ D_{50}$: $2 \times 12'' = 24'' = 2'$

Figure 8-12. Inlet Capacity Chart Sump Conditions, Curb Opening (D-10-R) Inlet



DP A1 Q_{100} = 17.9 cfs FLOWS SPLIT Q_{100} = 8.95 cfs /SIDE

Partially Full Pipe Flow Calculator and Equations

Fluid Flow Table of Contents | Hydraulic and Pneumatic Knowledge
Fluid Power Equipment

This engineering calculator determines the Flow within a partially full pipe using the Manning equation. This calculator can also be used for uniform flow in a pipe, but the Manning roughness coefficient needs to be considered to be variable, dependent upon the depth of flow.

Partially Full Pipe Flow Calculations - U.S. Units

II. Calculation of Discharge, Q, and average velocity, V
for pipes more than half full

Instructions: *Enter values in blue boxes. Calculations in yellow*

Inputs

Pipe Diameter, D =	18	in
Depth of flow, y =	14	in

(must have y ≥ D/2)

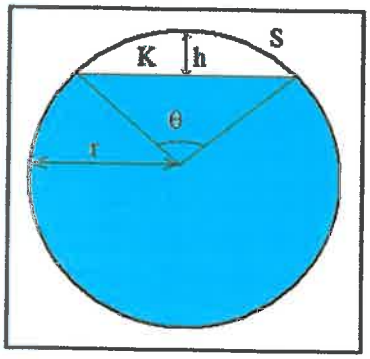
Full Pipe Manning roughness, n_{full} =	0.013	
Channel bottom slope, S =	0.01	ft/ft

Calculations

n/n_{full} =	1.111111	
Partially Full Manning roughness, n =	0.014	

Calculations

Pipe Diameter, D =	1.5	ft
Pipe Radius, r =	0.75	ft
Circ. Segment Height, h =	0.333	ft
Central Angle, q =	1.96	radians
Cross-Sect. Area, A =	1.47	ft^2
Wetted Perimeter, P =	3.2	ft
Hydraulic Radius, R =	0.46	ft
Discharge, Q =	9.00	cfs
Ave. Velocity, V =	6.10	ft/sec
pipe % full [$(A/A_{full})*100\%$] =	83.5%	



Partially Full Pipe Flow Parameters
(More Than Half Full)

r = D/2

h = 2r - y

(hydraulic radius)

R = A/P

(Manning Equation)

$Q = (1.49/n)(A)(R^{2/3})(S^{1/2})$

V = Q/A

P

$$\theta = 2\arccos\left(\frac{r-h}{r}\right)$$

$$A = \pi r^2 - \frac{r^2(\theta - \sin\theta)}{2}$$

$$P = 2\pi r - r*\theta$$

Equation used for n/n_{full}: $n/n_{full} = 1.25 - (y/D - 0.5)*0.5$ (for $0.5 \le y/D \le 1$)

PIPE Run 1
18" RCP FROM INLETS Q100 FLOW SPLIT

Partially Full Pipe Flow Calculator and Equations

Fluid Flow Table of Contents | Hydraulic and Pneumatic Knowledge
Fluid Power Equipment

This engineering calculator determines the Flow within a partially full pipe using the Manning equation. This calculator can also be used for uniform flow in a pipe, but the Manning roughness coefficient needs to be considered to be variable, dependent upon the depth of flow.

Partially Full Pipe Flow Calculations - U.S. Units

II. Calculation of Discharge, Q, and average velocity, V
for pipes more than half full

Instructions: *Enter values in blue boxes. Calculations in yellow*

Inputs

Pipe Diameter, D =	24	in
Depth of flow, y =	18	in

(must have y ≥ D/2)

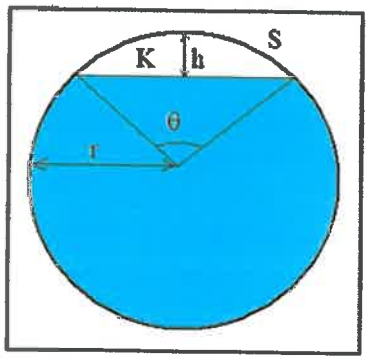
Full Pipe Manning roughness, n_{full} =	0.013	
Channel bottom slope, S =	0.01	ft/ft

Calculations

n/n_{full} =	1.125	
Partially Full Manning roughness, n =	0.015	

Calculations

Pipe Diameter, D =	2	ft
Pipe Radius, r =	1	ft
Circ. Segment Height, h =	0.500	ft
Central Angle, q =	2.09	radians
Cross-Sect. Area, A =	2.53	ft^2
Wetted Perimeter, P =	4.2	ft
Hydraulic Radius, R =	0.60	ft
Discharge, Q =	18.39	cfs
Ave. Velocity, V =	7.27	ft/sec
pipe % full [$(A/A_{full})*100\%$] =	80.4%	



Partially Full Pipe Flow Parameters (More Than Half Full)

r = D/2

h = 2r - y

(hydraulic radius)

R = A/P

(Manning Equation)

$Q = (1.49/n)(A)(R^{2/3})(S^{1/2})$

V = Q/A

P

$$\theta = 2\arccos\left(\frac{r-h}{r}\right)$$

$$A = \pi r^2 - \frac{r^2(\theta - \sin\theta)}{2}$$

$$P = 2\pi r - r*\theta$$

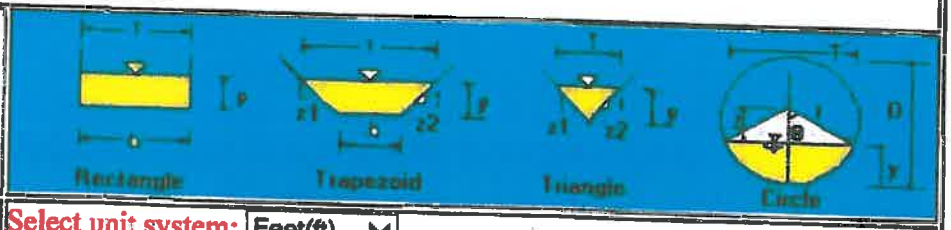
Equation used for n/n_{full}: $n/n_{full} = 1.25 - (y/D - 0.5)*0.5$ (for $0.5 \le y/D \le 1$)

PIPE Run 2

24" RCP OUTFALL INTO FSD

The open channel flow calculator

Select Channel Type: Trapezoid



Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: 0.05 ft/ft	Water depth(y): 0.42 ft	Bottom width(b) 4 ft
Flow velocity 4.551 ft/s	LeftSlope (Z1): 3 to 1 (H:V	RightSlope (Z2): 3 to 1 (H:V
Flow discharge 10.054 ft^3/s	Input n value 0.035 or select r	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 6.66 ft	Flow area 2.21 ft^2	Top width(T) 6.52 ft
Specific energy 0.74 ft	Froude number 1.38	Flow status Supercritical flow
Critical depth 0.51 ft	Critical slope 0.025 ft/ft	Velocity head 0.32 ft

CHANNEL @ NORTHEAST OF SITE DP 051

SC 150

NORTH AMERICAN GREEN

A tensar Company

Material and Performance Specification Sheet

North American Green
14649 Highway 41 North
Evansville, IN 47725
800-772-2040
FAX: 812-867-0247
www.nagreen.com

SC150 Erosion Control Blanket

The extended-term double net erosion control blanket shall be a machine-produced mat of 70% agricultural straw and 30% coconut fiber with a functional longevity of up to 24 months. (NOTE: functional longevity may vary depending upon climatic conditions, soil, geographical location, and elevation). The blanket shall be of consistent thickness with the straw and coconut evenly distributed over the entire area of the mat. The blanket shall be covered on the top side with a heavyweight photodegradable polypropylene netting having ultraviolet additives to delay breakdown and an approximate 0.63 x 0.63 (1.59 x 1.59 cm) mesh, and on the bottom side with a lightweight photodegradable polypropylene netting with an approximate 0.50 x 0.50 in (1.27 x 1.27 cm) mesh. The blanket shall be sewn together on 1.50 inch (3.81 cm) centers with degradable thread.

The SC150 shall meet requirements established by the Erosion Control Technology Council (ECTC) Specification and the US Department of Transportation, Federal Highway Administration's (FHWA) *Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects, FP-03 Section 713.17 as a type 3.B Extended-term Erosion Control Blanket.*

The SC150 is also available with the DOT System™, which consists of installation staple patterns clearly marked on the erosion control blanket with environmentally safe paint. The blanket shall be manufactured with a colored thread stitched along both outer edges (approximately 2-5 inches [5-12.5 cm] from the edge) as an overlap guide for adjacent mats.

Material Content		
Matrix	70% Straw Fiber	0.35 lbs/yd² (0.19 kg/m²)
	30% Coconut Fiber	0.15 lbs/yd² (0.08 kg/m²)
Nettings	Top – Heavyweight photodegradable with UV additives	3.0 lb/1000 ft² (1.47 kg/100 m²)
	Bottom – Lightweight Photodegradable	1.5 lb/1000 ft² (0.73 kg/100 m²)
Thread	Degradable	

SC150 is available in the following standard roll sizes:

Width	6.67 ft (2.03 m)	16 ft (4.87 m)
Length	108 ft (32.92 m)	108 ft (32.92 m)
Weight ± 10%	44 lbs (19.95 kg)	105.6 lbs (47.9 kg)
Area	80.0 yd² (66.9 m²)	192 yd² (185.5 m²)

Index Value Properties:

Property	Test Method	Typical
Thickness	ASTM D6525	0.39 in (9.91 mm)
Resiliency	ECTC Guidelines	75%
Water Absorbency	ASTM D1117	285%
Mass/Unit Area	ASTM 6475	11.44 oz/yd² (388 g/m²)
Swell	ECTC Guidelines	30%
Smolder Resistance	ECTC Guidelines	Yes
Stiffness	ASTM D1388	1.11 oz-in
Light Penetration	ECTC Guidelines	8.7%
Tensile Strength –MD	ASTM D6818	146.6 lbs/ft (2.17 kN/m)
Elongation – MD	ASTM D6818	26.9%
Tensile Strength – TD	ASTM D6818	147.6 lbs/ft (2.19 kN/m)
Elongation – TD	ASTM D6818	25.2%

Performance Design Values:

Maximum Permissible Shear Stress	
Unvegetated Shear Stress	2.00 lbs/ft² (96 Pa)
Unvegetated Velocity	8.00 ft/s (2.44 m/s)

Slope Design Data: C Factors			
	Slope Gradients (S)		
Slope Length (L)	≤ 3:1	3:1 – 2:1	≥ 2:1
≤ 20 ft (6 m)	0.001	0.048	0.100
20-50 ft	0.051	0.079	0.145
≥ 50 ft (15.2 m)	0.10	0.110	0.190

Bench Scale Testing* (NTPEP):

Test Method	Parameters	Results
ECTC Method 2 Rainfall	50 mm (2 in)/hr for 30 min	SLR** = 5.47
	100mm (4 in)/hr for 30 min	SLR** = 5.67
	150 mm (6 in)/hr for 30 min	SLR** = 5.88
ECTC Method 3 Shear Resistance	Shear at 0.50 inch soil loss	2.72 lbs/ft²
ECTC Method 4 Germination	Top Soil, Fescue, 21 day incubation	538% improvement of biomass

*Bench Scale tests should not be used for design purposes

** Soil Loss Ratio = Soil loss with Bare Soil/Soil Loss with RECP (soil loss is based on regression analysis)

Roughness Coefficients- Unveg.	
Flow Depth	Manning's n
≤ 0.50 ft (0.15 m)	0.050
0.50 – 2.0 ft	0.050 – 0.018
≥ 2.0 ft (0.60 m)	0.018

Product Participant of: QDOR

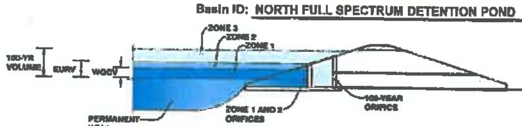
Updated 3/09

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: SHILOH MESA FILING NO. 4

Basin ID: NORTH FULL SPECTRUM DETENTION POND



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	5.71	acres
Watershed Length =	919	ft
Watershed Slope =	0.015	ft/ft
Watershed Imperviousness =	56.00%	percent
Percentage Hydrologic Soil Group A =	11.2%	percent
Percentage Hydrologic Soil Group B =	88.8%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.106	acre-feet
Excess Urban Runoff Volume (EURV) =	0.349	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.279	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.378	acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	0.494	acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	0.659	acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	0.781	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	0.939	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	0.261	acre-feet
Approximate 5-yr Detention Volume =	0.354	acre-feet
Approximate 10-yr Detention Volume =	0.457	acre-feet
Approximate 25-yr Detention Volume =	0.502	acre-feet
Approximate 50-yr Detention Volume =	0.527	acre-feet
Approximate 100-yr Detention Volume =	0.581	acre-feet

Optional User Override 1-hr Precipitation

1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.52	inches
	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.106	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.243	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.232	acre-feet
Total Detention Basin Volume =	0.581	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2

Depth Increment = 0.25 ft

	Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
6955.27	Top of Micropool	--	0.00	--	--	--	10	0.000		
6956		--	0.73	--	--	--	1,361	0.031	487	0.011
6957		--	1.00	--	--	--	5,639	0.129	1,390	0.032
6958		--	2.00	--	--	--	7,348	0.169	7,865	0.181
6959		--	3.00	--	--	--	9,280	0.213	16,253	0.373
6960		--	4.00	--	--	--	11,414	0.262	26,600	0.611
6961		--	5.00	--	--	--	13,658	0.314	39,136	0.898
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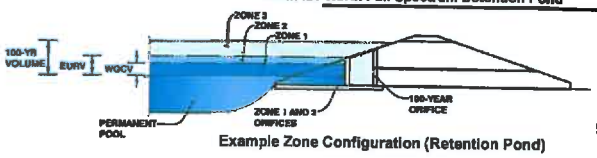
Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Shiloh Mesa Filing No. 4

Basin ID: North Full Spectrum Detention Pond



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.53	0.106	Orifice Plate
Zone 2 (EURV)	2.89	0.243	Orifice Plate
Zone 3 (100-year)	3.89	0.232	Weir&Pipe (Restrict)
		0.581	Total

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	N/A	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	2.89	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	18.40	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

WQ Orifice Area per Row =	N/A	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.96	1.93					
Orifice Area (sq. inches)	0.75	0.75	1.50					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.89	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	5.70	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	2.90	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	2.89	N/A	feet
Over Flow Weir Slope Length =	2.90	N/A	feet
Grate Open Area / 100-yr Orifice Area =	20.12	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	11.57	N/A	ft^2
Overflow Grate Open Area w/ Debris =	5.79	N/A	ft^2

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	6.50		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.58	N/A	ft^2
Outlet Orifice Centroid =	0.32	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.29	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	3.90	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	5.00	feet
Spillway End Slopes =	10.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

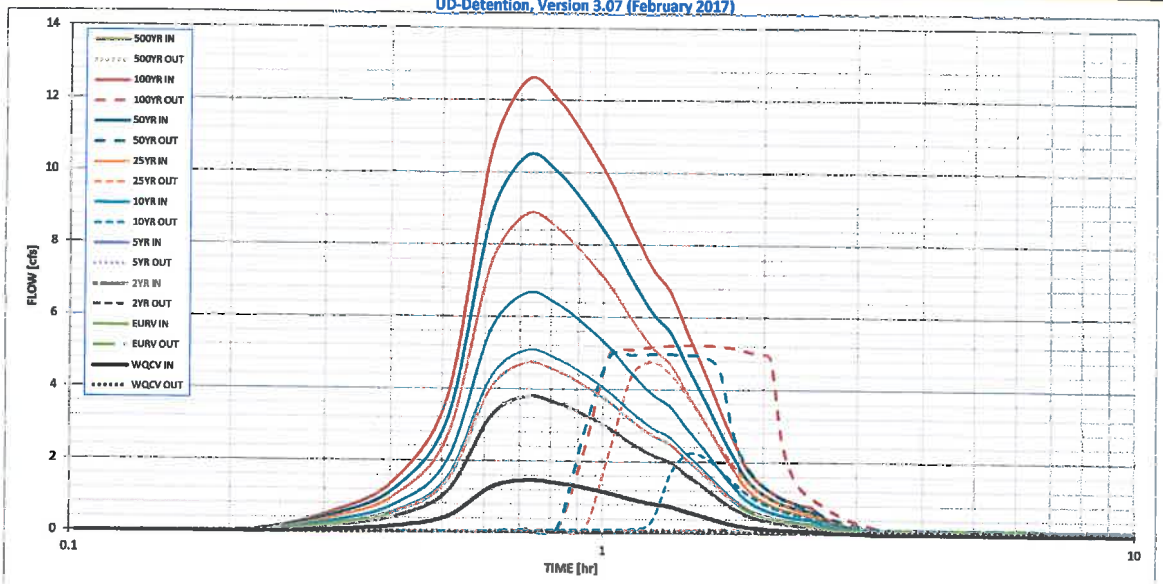
Spillway Design Flow Depth=	0.65	feet
Stage at Top of Freeboard =	5.55	feet
Basin Area at Top of Freeboard =	0.31	acres

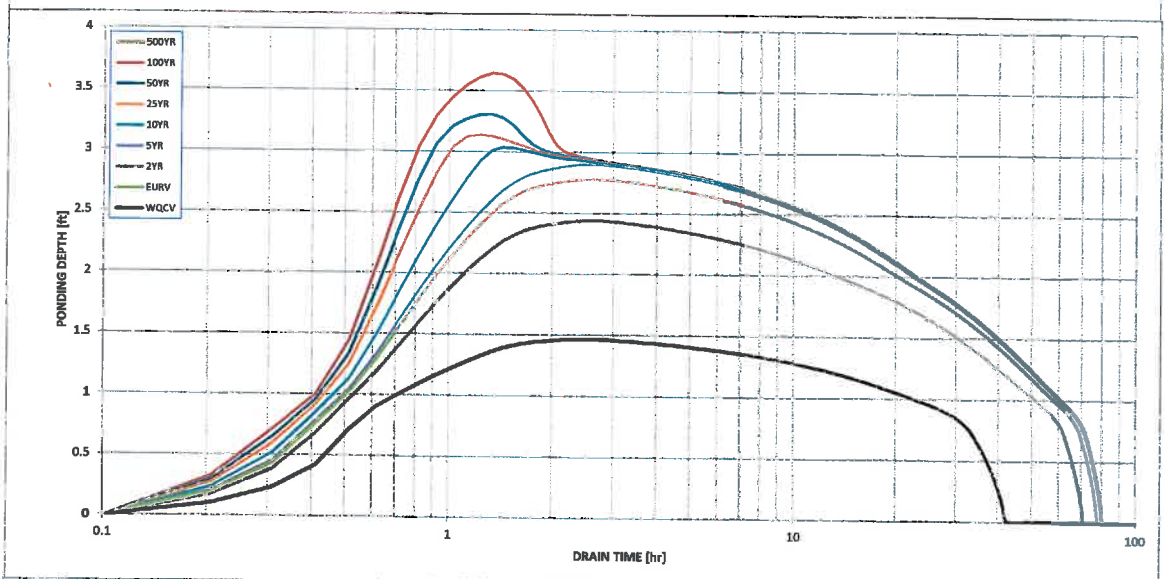
Routed Hydrograph Results

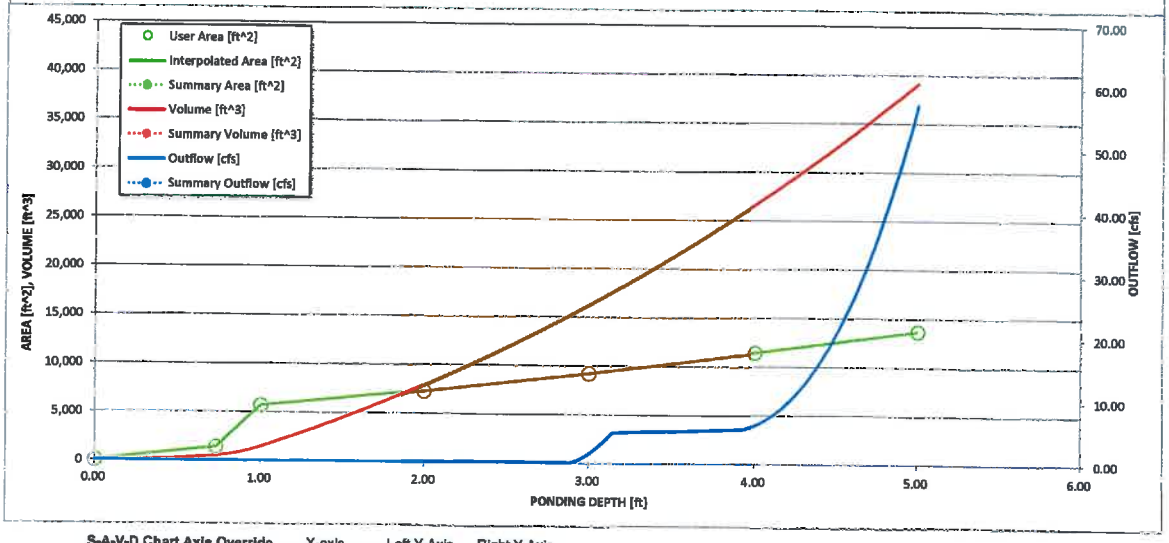
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.106	0.349	0.279	0.376	0.494	0.659	0.781	0.939	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.106	0.348	0.278	0.375	0.493	0.659	0.780	0.938	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.01	0.13	0.46	0.65	0.91	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.1	0.8	2.6	3.7	5.2	0.0
Peak Inflow Q (cfs) =	1.5	4.7	3.8	5.1	6.7	8.9	10.5	12.6	#N/A
Peak Outflow Q (cfs) =	0.0	0.1	0.1	0.2	2.2	4.8	5.0	5.2	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.1	2.9	1.8	1.2	1.0	#N/A
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.0	0.2	0.4	0.4	0.4	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	39	70	64	72	70	68	66	63	#N/A
Time to Drain 99% of Inflow Volume (hours) =	40	74	68	77	76	75	74	73	#N/A
Maximum Ponding Depth (ft) =	1.46	2.78	2.44	2.90	3.04	3.14	3.31	3.64	#N/A
Area at Maximum Ponding Depth (acres) =	0.15	0.20	0.19	0.21	0.21	0.22	0.23	0.24	#N/A
Maximum Volume Stored (acre-ft) =	0.097	0.325	0.259	0.352	0.380	0.401	0.439	0.519	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

Shiloh Mesa Filing No. 4

(Forebay North FSD Volume Calculation)

Forebay Calc

Elevation	SF	CF	Storage AF	Storage Sum
6956.00	262.00			0
6956.67	262.00	175.54	0.004	0.004

Total = 176 cf

Total = 0.004 Ac-ft

Calculated WQCV @ 3% = 128 cf
Actual WQCV Provided = 176 cf

Calculated by: GT
Date: 9/5/2017
Checked by: _____

Shiloh Mesa Filing No. 4

(Full Spectrum Detention Volume Calculation)

North FSD

Elevation	SF	CF	Storage AF	Storage Sum
6955.27	10.00			
6956.00	1,361.00	500.41	0.01	0.01
6957.00	5,639.00	3,500.00	0.08	0.08
6958.00	7,348.00	8,709.00	0.20	0.21
6958.90	9,897.00	9,087.00	0.21	0.29
6959.60	10,169.00	9,087.00	0.21	0.42

Total = 30,883 CF

Total = 0.71 Ac-ft

EURV WS Elevation = 6958.46

100-yr WS Elevation/Spillway Elevation = 6959.4

Calculated by: GT

Date: 9/5/2017

Checked by: _____

Irrigation in the Pacific Northwest

Rectangular Contracted Weir

This calculator finds the water flow rate for a rectangular contracted weir. A rectangular contracted weir has a rectangular opening where the sides are straight up and down. A contracted weir means that the ditch leading up to the weir is wider than the weir opening itself.

The length is found by measuring the bottom width of the weir and the height is determined from measuring the water height above the bottom of the weir.

Learn more about the units used on this page.

Length:

.15 ft = 1.75"

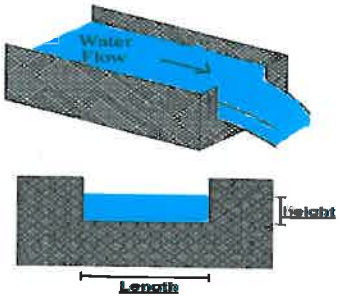
Height:

0.67 ft

Calculate

Flow Rate:

0.26 cfs



* Note: 1 point = 1/100 ft.

The Equation

The Equation used to determine the flow rate (Q) of a Rectangular Contracted Weir is:

$$Q = \frac{3.247 \cdot L \cdot H^{1.48} - 0.566 \cdot L^{1.9}}{1 + 2L^{1.87}} \cdot H^{1.9}$$

Where:

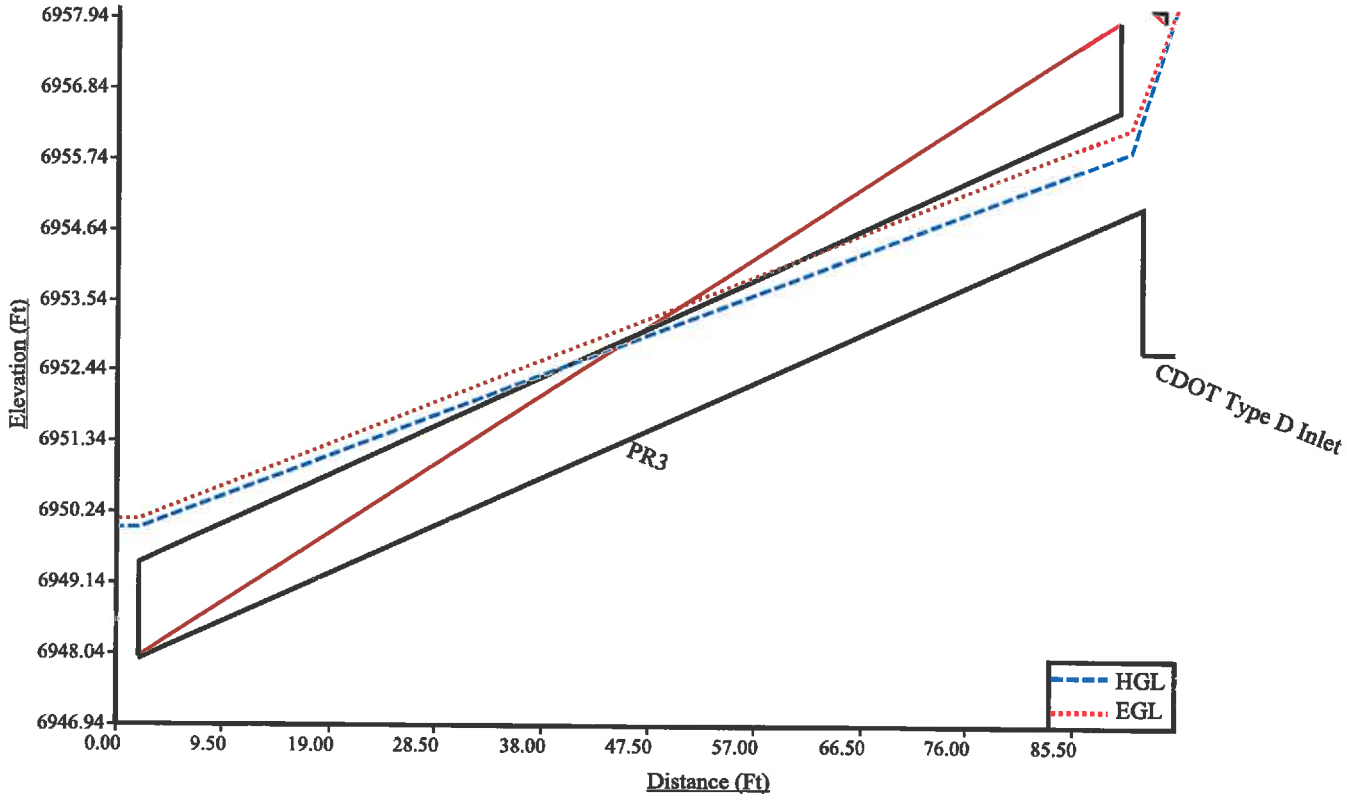
Q = Flow Rate in cfs.

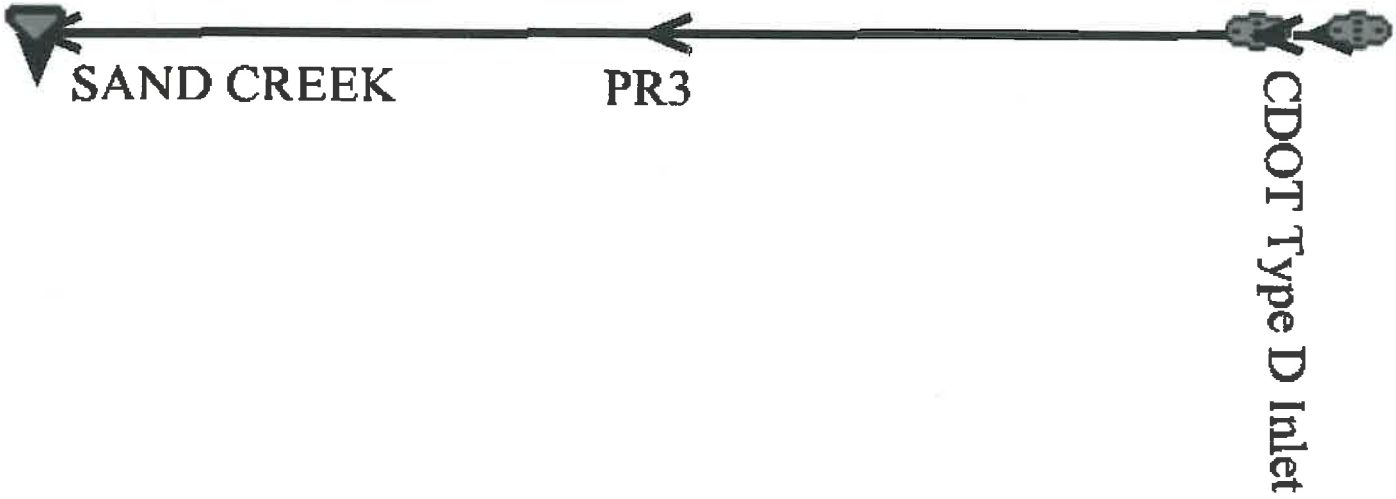
L = Bottom width of the weir in feet.

H = Height of the upstream water above the weir crest in feet.

$Q_{100} = 12.6$ cfs $\times 0.02 = 0.25$ cfs $\cong 0.26$ cfs

18" STRM POND OUTFALL





Program: UDSEWER Math Model Interface 2.1.1.4
Run Date: 10/19/2017 9:49:55 AM

UDSewer Results Summary

Project Title: SHILOH MESA FILING NO. 4
Project Description: 18" STRM POND OUTFALL

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 6950.00

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
PR3	91.73	6947.96	7.7	6955.02	0.013	1.00	0.00	CIRCULAR	18.00 in	18.00 in
CDOT Type D Inlet	2.92	6952.77	0.0	6952.77	0.005	0.50	0.00	BOX	5.32 ft	5.70 ft

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
PR3	29.23	16.54	10.54	4.84	5.14	12.49	3.97	Supercritical Jump	5.20	7.29	
CDOT Type D Inlet	5.20	0.17	63.84	0.17	63.84	0.17	0.00	Pressurized	5.20	2.92	Velocity is Too Low

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
PR3	5.20	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
CDOT Type D Inlet	5.20	BOX	5.32 ft	5.70 ft	1.50 ft	1.50 ft	5.32 ft	5.70 ft	30.32	Exceeds max. Depth/Rise

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

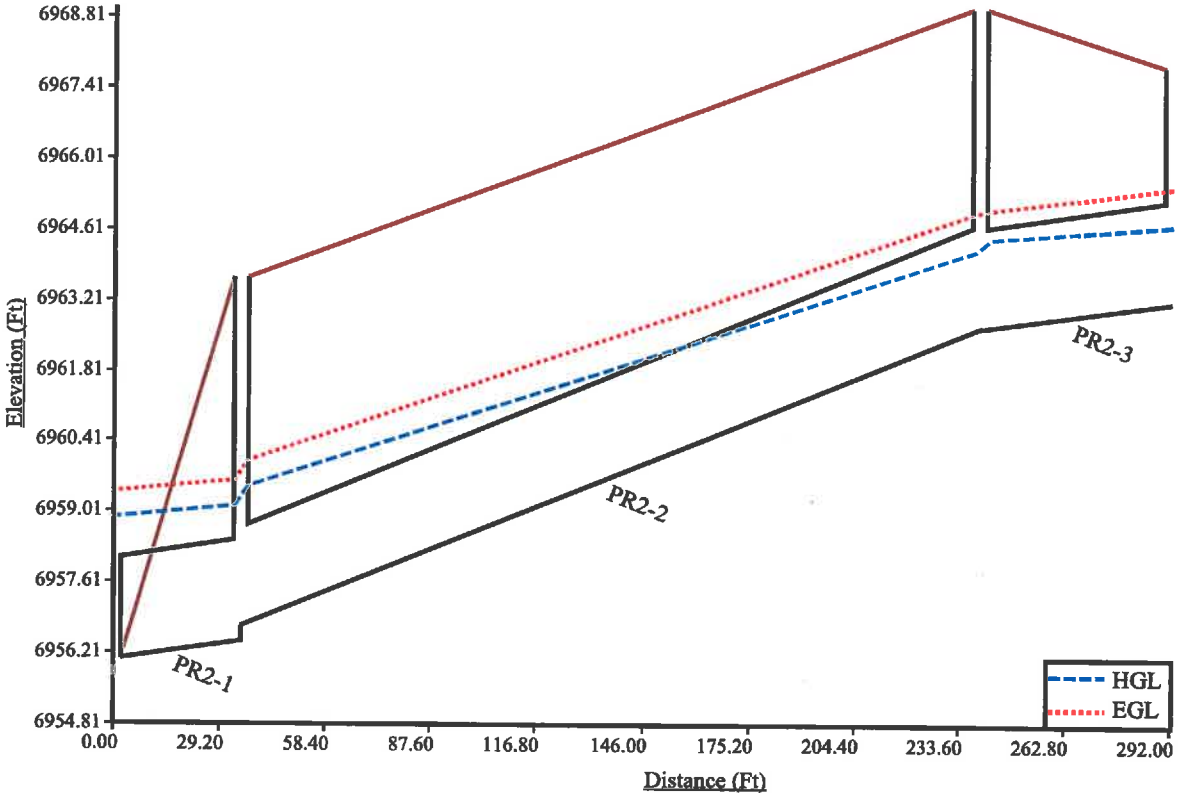
Grade Line Summary:

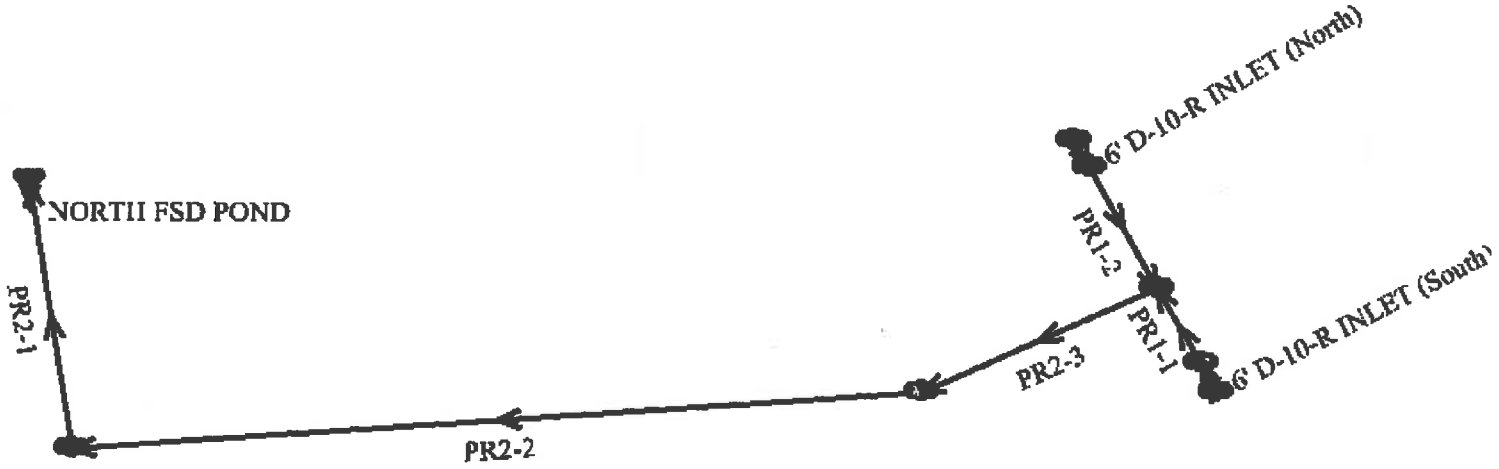
Tailwater Elevation (ft): 6950.00

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
PR3	6947.96	6955.02	0.00	0.00	6950.00	6955.90	6950.13	6.13	6956.26
CDOT Type D Inlet	6952.77	6952.77	0.00	0.00	6958.09	6958.09	6958.09	0.00	6958.09

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

24 STRM POND OUTFALL





Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 10/16/2017 9:24:11 AM	**UDSewer Results Summary** **Project Title:** SHILOH MESA FILING NO. 4 **Project Description:** 24" STRM POND OUTFALL & 18" STRM DRAIN

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: No

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 6958.90

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	Sewer Length (ft)	Downstream Invert (ft)	Slope (%)	Upstream Invert (ft)	Mannings n	Bend Loss	Lateral Loss	Cross Section	Rise (ft or in)	Span (ft or in)
PR2-1	34.98	6956.10	1.0	6956.45	0.013	1.00	0.00	CIRCULAR	24.00 in	24.00 in
PR2-2	204.45	6956.75	2.9	6962.68	0.013	0.79	0.00	CIRCULAR	24.00 in	24.00 in
PR2-3	52.98	6962.67	1.0	6963.20	0.013	0.11	0.00	CIRCULAR	24.00 in	24.00 in
PR1-2	26.75	6963.70	1.0	6963.97	0.013	1.33	0.25	CIRCULAR	18.00 in	18.00 in
6' D-10-R INLET (North)	4.00	6963.97	7.5	6964.27	0.013	0.50	0.00	BOX	4.00 ft	6.00 ft
PR1-1	3.59	6963.70	1.0	6963.74	0.013	1.33	0.25	CIRCULAR	18.00 in	18.00 in
6' D-10-R INLET (South)	4.00	6963.74	7.5	6964.04	0.013	0.50	0.00	BOX	4.00 ft	6.00 ft

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	Flow (cfs)	Velocity (fps)	Depth (in)	Velocity (fps)	Depth (in)	Velocity (fps)	Froude Number	Flow Condition	Flow (cfs)	Surcharged Length (ft)	Comment
PR2-1	22.68	7.22	18.29	6.97	16.08	8.00	1.29	Pressurized	17.90	34.98	
PR2-2	38.63	12.30	18.29	6.97	11.48	12.06	2.47	Supercritical Jump	17.90	33.60	
PR2-3	22.68	7.22	18.29	6.97	16.08	8.00	1.29	Supercritical	17.90	0.00	
PR1-2	10.53	5.96	13.89	6.12	12.74	6.69	1.19	Pressurized	8.95	26.75	
6' D-10-R INLET (North)	850.69	35.45	4.92	3.64	1.97	9.08	3.95	Supercritical	8.95	0.00	
PR1-1	10.53	5.96	13.89	6.12	12.74	6.69	1.19	Pressurized	8.95	3.59	
6' D-10-R INLET (South)	850.69	35.45	4.92	3.64	1.97	9.08	3.95	Supercritical	8.95	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	Peak Flow (cfs)	Cross Section	Rise	Span	Rise	Span	Rise	Span	Area (ft^2)	Comment
PR2-1	17.90	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
PR2-2	17.90	CIRCULAR	24.00 in	24.00 in	21.00 in	21.00 in	24.00 in	24.00 in	3.14	
PR2-3	17.90	CIRCULAR	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	24.00 in	3.14	
PR1-2	8.95	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
6' D-10-R INLET (North)	8.95	BOX	4.00 ft	6.00 ft	1.50 ft	1.50 ft	4.00 ft	6.00 ft	24.00	
PR1-1	8.95	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
6' D-10-R INLET (South)	8.95	BOX	4.00 ft	6.00 ft	1.50 ft	1.50 ft	4.00 ft	6.00 ft	24.00	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6958.90

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	Downstream (ft)	Upstream (ft)	Bend Loss (ft)	Lateral Loss (ft)	Downstream (ft)	Upstream (ft)	Downstream (ft)	Friction Loss (ft)	Upstream (ft)
PR2-1	6956.10	6956.45	0.00	0.00	6958.90	6959.12	6959.40	0.22	6959.62
PR2-2	6956.75	6962.68	0.40	0.00	6959.52	6964.20	6960.02	4.94	6964.96
PR2-3	6962.67	6963.20	0.06	0.00	6964.44	6964.72	6965.01	0.46	6965.48
PR1-2	6963.70	6963.97	0.53	0.40	6966.01	6966.21	6966.41	0.19	6966.61
6' D-10-R INLET (North)	6963.97	6964.27	0.00	0.00	6966.60	6966.60	6966.61	0.00	6966.61
PR1-1	6963.70	6963.74	0.53	0.40	6966.01	6966.04	6966.41	0.03	6966.44
6' D-10-R INLET (South)	6963.74	6964.04	0.00	0.00	6966.43	6966.43	6966.44	0.00	6966.44

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

LEGEND

BASIN DESIGNATION

Z
25 | .25 | C5
.35 | C100
ACRES

2A — SURFACE DESIGN PT

BASIN BOUNDARY

PROP FLOW ARROW

EX FLOW ARROW

EMERGENCY OVERFLOW

LOT 11 — LOT NUMBER

H.P. — HIGH POINT

L.P. — LOW POINT

STORM SEWER

INLET

(6920) — EX MAJ CONTOUR

(6918) — EX MIN CONTOUR

6920 — PROP MAJ CONTOUR

6918 — PROP MIN CONTOUR

SAND CREEK
100-YR FLOODPLAIN
EX WETLANDS
INSTALL NORTH AMERICAN GREEN SC 150 EROSION CONTROL BLANKET
OS1
PROP CDOT TYPE D OUTLET STRUC. PROP 18" RCP STRM PIPE RUN3
11' ACCESS RD.
PROP 15'x15'x1.5' DEEP TYPE L~ D50=9" RIPRAP PER UDFCD FIG. 9-37
PROP NORTH EXTENDED DETENTION BASIN
INSTALL CONCRETE FOREBAY
PROP 16' TRAIL
PROP 6' D-10-R SUMP INLET
PROP 18" RCP STRM PIPE RUN 1
PROP 24" RCP STRM PIPE RUN 2
PROP 6' D-10-R SUMP INLET
PROP 29'x24'x2.0' DEEP TYPE M~ D50=12" RIPRAP SPILLWAY
INSTALL 72'x15'x2'DEEP D50=12"~TYPE M SOIL RIPRAP SPILLWAY RUNDOWN
INSTALL NORTH AMERICAN GREEN SC 150 EROSION CONTROL BLANKET
25' PUBLIC DRAINAGE EASEMENT
MOOREBANK DRIVE
BARRAPORT DRIVE
SANDSEDGE DRIVE
CALLENDALE DRIVE
SHILOH MESA FILING NO.3
EX MUSTAND RD
A1 4.05 | 0.5 | 0.6
A2 1.66 | 0.5 | 0.6
OS1 4.3 | 0.3 | 0.4

M&S CIVIL CONSULTANTS, INC.

20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

BASIN SUMMARY			
BASIN	AREA (ACRES)	Q5	Q100
*OS1	4.3	3.8	9.0
A1	4.05	4.3	12.9
*A2	1.66	1.9	5.4

*"MASTER DEVELOPMENT DRAINAGE PLAN FOR WOODMEN HEIGHTS MASTER PLAN" BY CLASSIC CONSULTING ENGINEERS AND SURVEYORS, LLC., DATED JUNE 2004

DESIGN POINT SUMMARY			
DESIGN POINT	Q5	Q100	BASIN
*OS1	3.8	9.0	*OS1
A1	6.1	17.9	A1+A2

PIPE ROUTING SUMMARY			
PIPE RUN	Q5	Q100	PIPE SIZE
1	3.0	9.0	18" RCP
2	6.1	17.9	24" RCP
3	0.2	5.2	18" RCP

NORTH EXTENDED DETENTION BASIN DATA

WQ WATER SURFACE EL=6956.73
WQ VOLUME=0.097 AC-FT
EURV WATER SURFACE EL=6958.05
EURV VOLUME=0.325 AC-FT
100-YR WATER SURFACE EL=6958.91
SPILLWAY CREST EL=6958.91
TOP OF EMBANKMENT EL=6960.61
100-YR VOLUME=0.519 AC-FT
CALC 100-YR INFLOW=17.9 CFS
100-YR INFLOW =12.6 CFS
100-YR RELEASE=5.2 CFS

EXHIBIT DRAINAGE BASIN REVISION FOR MASTER DEVELOPMENT DRAINAGE PLAN AND FINAL DRAINAGE REPORT FOR SHILOH MESA FILING NO. 1 & FINAL DRAINAGE LETTER FOR SHILOH MESA FILING NO. 4

1" = 100'
0 50 100 200
Scale in Feet

Shiloh Mesa
Final Drainage Report
(Area Drainage Summary)

Post Development

From Composite Runoff Coefficient Summary				Initial / Overland				Channel/Street					Time of Travel (T_c)		INTENSITY *		TOTAL FLOWS	
BASIN	AREA TOTAL (Acres)	C_5	C_{100}	Length (ft)	Height (ft)	T_i (min)	T_{100} (min)	Length (ft)	Slope (%)	Cv	Velocity (fps)	T_t (min)	TOTAL (min)	Location	I_5 (in/hr)	I_{100} (in/hr)	Q_5 (c.f.s.)	Q_{100} (c.f.s.)
A1	3.78	0.50	0.60	147	3	10.8	9.0	920	1.5%	20	4.3	3.5	12.5		3.7	6.7	7.1	15.1
A2	6.20	0.50	0.60	285	4.3	16.5	13.8	1660	1.8%	20	4.6	6.0	19.8		3.0	5.4	9.4	20.1
A3	2.30	0.50	0.60	72	1	8.5	7.1	995	2.1%	20	5.1	3.3	10.4		4.0	7.2	4.7	9.9
A4	1.20	0.50	0.55	150	7.5	10.8	7.4	75	24.0%	15	17.1	0.1	7.5		4.5	8.1	1.6	5.3
B1	1.20	0.60	0.70	56	1	5.8	4.6	958	2.1%	20	5.0	3.2	7.8		4.5	8.0	3.2	6.7
B2	4.10	0.50	0.50	214	6	11.7	9.7	886	2.0%	20	5.0	3.0	12.7		3.7	6.6	7.6	16.3
C1	1.70	0.50	0.60	226	6	12.2	10.2	337	1.6%	20	4.5	1.3	11.4		3.9	6.9	3.3	7.1
C2	4.64	0.60	0.70	344	10	12.2	9.8	594	2.5%	20	5.6	1.8	11.5		3.9	6.9	10.8	22.4
D1	4.53	0.50	0.60	162	4	10.6	8.8	935	1.3%	20	4.0	3.9	12.8		3.7	6.6	8.4	18.0
D2	6.18	0.50	0.60	68	1.4	7.3	6.1	1861	1.3%	20	4.1	7.7	13.7		3.6	6.4	11.1	23.8
D3	1.72	0.50	0.60	130	2	11.1	9.2	326	1.5%	20	4.2	1.3	10.5		4.0	7.2	3.5	7.4
D5	0.40	0.90	0.95	63	0.7	2.9	2.2	225	1.2%	20	3.8	1.0	5.0		5.1	9.1	1.8	3.5
D6	1.65	0.50	0.60	200	2	15.9	13.2	120	1.0%	20	3.5	0.6	13.8		3.6	6.4	3.0	6.3
F1	2.38	0.50	0.60	166	3	11.9	9.9	401	1.6%	20	4.4	1.5	11.4		3.9	6.9	4.6	9.9
F2	2.16	0.50	0.60	275	7	13.7	11.4	327	1.4%	20	4.1	1.3	12.7		3.7	6.6	4.0	8.6
G1	1.75	0.50	0.60	263	7	13.2	11.0	295	1.7%	20	4.6	1.1	12.0		3.8	6.8	3.3	7.1
G2	2.58	0.50	0.60	160	4	10.5	8.7	408	2.0%	20	4.9	1.4	10.1		4.1	7.3	5.3	11.2
OS7**	1.8	0.90	0.95	30	0.6	1.6	1.2	1424	2.0%	19.4	2.7	8.7	9.9		4.1	7.3	6.7	12.5
OS10**	1.9	0.90	0.95	30	0.6	1.6	1.2	1424	2.0%	19.2	2.7	8.7	10.0		4.1	7.3	7.0	13.2
OS4**	0.9	0.90	0.95	100	4	2.4	1.8	617	2.0%	19.2	2.7	3.8	5.6		5.0	8.8	4.0	7.6
OS9**	0.7	0.90	0.95	40	1.6	0.7	1.1	594	2.0%	19.2	2.7	3.6	5.0		5.1	9.1	3.2	6.0
OS2**	1.3	0.90	0.95	102	2	3.0	2.3	678	2.0%	19.2	2.7	4.2	6.4		4.8	8.5	5.6	10.5
OS3**	1.3	0.90	0.95	60	1.2	2.3	1.7	697	2.0%	19.2	2.7	4.3	6.0		4.9	8.6	5.7	10.7

** Revised areas and flows for "Master Development Drainage Plan for Shiloh Mesa at Woodmen Heights" prepared by Matrix, approved November 2009

* Intensity equations assume a minimum travel time of 5 minutes for Urbanized Basins & 10 min. for Non-Urbanized

"Master Development Drainage Plan for Shiloh Mesa at Woodmen Heights

Type of Land Surface	Cv
Heavy Meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

T_t=L/60V (Velocity From Fig. 501)

Velocity V=Cv*S^0.5, S in ft/ft

T_c Check = 10+L/180

For Urbanized basins a minimum T_c of 5.0 minutes is required.

For non-urbanized basins a minimum T_c of 10.0 minutes is required

Calculated by: ET

Date: 3/12/2015

Checked by: VAS

Shiloh Mesa
Final Drainage Report
Surface Routing Summary

Design Point(s)	Contributing Basins	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	Intensity I_5	Intensity I_{100}	Flow Q_5	Flow Q_{100}	Comments
				North WQ Pond Tributary					
A1	A1	1.89	2.27	12.5	3.7	6.7	*7.1*	*15.1*	*6' D-10-R Sump Inlet*
									Release into North WQ Pond
				Central WQ Pond Tributary					
A2	A2	3.10	3.72	19.8	3.0	5.4	*9.4*	*20.1*	*8' D-10-R Sump Inlet*
A3	A3	1.15	1.38	10.4	4.0	7.2	*4.7*	*9.9*	*4' D-10-R Sump Inlet*
B1	B1	0.72	0.84	7.8	4.5	8.0	*3.2*	*6.7*	*4' D-10-R Sump Inlet*
B2	B2	2.05	2.46	12.7	3.7	6.6	*7.6*	*16.3*	*6' D-10-R Sump Inlet*
C1	C1	0.85	1.02	11.4	3.9	6.9	*3.3*	*7.1*	*4' D-10-R Sump Inlet*
C2	C2	2.78	3.25	11.5	3.9	6.9	*10.8*	*22.4*	*10' D-10-R Sump Inlet*
A4	C1, C2, B1, B2, A2, A3, A4	11.01	13.33	19.8	3.0	5.4	*33.4*	*72.0*	*Release into Central WQ Pond*
				Southern WQ Pond(s) Tributary					
G1	G1	0.88	1.05	12.0	3.8	6.8	*3.3*	*7.1*	*4' D-10-R Sump Inlet*
G2	G2	1.29	1.55	10.1	4.1	7.3	*5.3*	*11.2*	*4' D-10-R Sump Inlet*
F1	F1	1.19	1.43	11.4	3.9	6.9	*4.6*	*9.9*	*4' D-10-R Sump Inlet*
F2	F2	1.08	1.30	12.7	3.7	6.6	*4.0*	*8.6*	*4' D-10-R Sump Inlet*
D2	D2	3.09	3.71	13.7	3.6	6.4	*11.1*	*23.8*	*12' D-10-R At-Grade Inlet*
D1	D1	2.27	2.72	12.8	3.7	6.6	*8.4*	*18.0*	*8' D-10-R Sump Inlet*
D5	D5	0.36	0.38	5.0	5.1	9.1	*1.8*	*3.5*	*4' D-10-R Sump Inlet*
D3	D3	0.86	1.03	10.5	4.0	7.2	*3.5*	*7.4*	*4' D-10-R Sump Inlet*
D4	G1, G2, F1, F2, D1, D2, D3, D5	9.71	12.04	13.7	3.6	6.4	*35.0*	*77.2*	*Release into Southeast WQ Pond*
				Offsite Tributary					
D2	Flowby D2	1.30	1.13	13.7	3.6	6.4	*4.7*	*7.2*	*Flow-by*
D6	D6	0.83	0.99	13.8	3.6	6.4	*3.0*	*6.3*	*Sheet Flow*
OS7	OS7**, OS10**	3.33	3.52	10.0	4.1	7.3	*13.7*	*25.7*	*TBD*
OS4	OS4**	0.81	0.86	5.6	5.0	8.8	*4.0*	*7.6*	*PER MDDP MATRIX*
OS9	OS9**	0.63	0.67	5.0	5.1	9.1	*3.2*	*6.0*	*PER MDDP MATRIX*
OS2	OS2**	1.17	1.24	6.4	4.8	8.5	*5.6*	*10.5*	*PER MDDP MATRIX*
OS3	OS3**	1.17	1.24	6.0	4.9	8.6	*5.7*	*10.7*	*PER MDDP MATRIX*

Calculated by: ET

Date: 3/16/2015

Checked by: VAS

SHILOH MESA
FINAL DRAINAGE REPORT
(Storm Sewer Routing Summary)

Pipe Run	Contributing Design Points/Pipe Runs	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	Intensity		Flow		Comments
					I_5	I_{100}	Q_5	Q_{100}	
1	OS5*						72.0	340.0	2-60" CMP
2	OS5*						72.0	340.0	72" RCP
3	DP A1	1.89	2.27	12.5	3.7	6.7	7.1	15.1	24" RCP
4	DP B1	0.72	0.84	7.8	4.5	8.0	3.2	6.7	18" RCP
5	DP B2	2.05	2.46	12.7	3.7	6.6	7.6	16.3	24" RCP
6	PR 4 + PR 5	2.77	3.30	12.7	3.7	6.6	10.3	21.9	24" RCP
7	DP C1	0.85	1.02	11.4	3.9	6.9	3.3	7.1	18" RCP
8	DP C2	2.78	3.25	11.5	3.9	6.9	10.8	22.4	30" RCP
9	PR 7 + PR 8	3.63	4.27	11.5	3.9	6.9	14.1	29.5	30" RCP
10	PR 6 + PR 9	6.40	7.57	12.7	3.7	6.6	23.9	50.2	36" RCP
11	DP A3	1.15	1.38	10.4	4.0	7.2	4.7	9.9	18" RCP
12	DP A2	3.10	3.72	19.8	3.0	5.4	8.3	20.8	24" RCP
14	PR 11 + PR 12	4.25	5.10	19.8	3.0	5.4	12.9	27.5	30" RCP
15	PR 10 + PR 14	10.65	12.67	19.8	3.0	5.4	32.3	68.4	42" RCP
16	DP G1	0.88	1.05	12.0	3.8	6.8	3.3	7.1	18" RCP
17	DP G2	1.29	1.55	10.1	4.1	7.3	5.3	11.2	18" RCP
18	PR 16 + PR 17	2.17	2.60	12.0	3.8	6.8	8.2	17.6	24" RCP
19	DP F2	1.08	1.30	12.7	3.7	6.6	4.0	8.6	18" RCP
20	DP F1	1.19	1.43	11.4	3.9	6.9	4.6	9.9	18" RCP
21	PR19 + PR 20	2.27	2.72	12.7	3.7	6.6	8.5	18.1	24" RCP
22	PR 18 + PR 21	4.44	5.32	12.7	3.7	6.6	16.5	35.3	30" RCP
28	DP D2	1.79	2.59	13.7	3.6	6.4	6.4	16.6	24" RCP
29	PR 22 + PR 28	6.23	7.91	13.7	3.6	6.4	22.4	50.7	36" RCP
23	DP D1	2.27	2.72	12.8	3.7	6.6	8.4	18.0	24" RCP
24	DP D5	0.36	0.38	5.0	5.1	9.1	1.8	3.5	18" RCP
25	PR 29 + PR 23 + PR 24	8.85	11.01	13.7	3.6	6.4	31.9	70.6	42" RCP
26	DP D3	0.86	1.03	10.5	4.0	7.2	3.5	7.4	18" RCP
27	PR 25 + PR 26	9.71	12.04	13.7	3.6	6.4	35.0	77.2	42" RCP

NOTES:

1. Pipe sizes per preliminary design, Computations in appendix).

2. DP - DESIGN POINT

3. PR - PIPE RUN

Calculated by: ET

Date: 3/16/2015

Checked by: VAS

SHILOH MESA
POST DEVELOPMENT DRAINAGE PLAN
APRIL 2015

NORTH
1" = 100'

LEGEND

DESIGN POINT
FLOW DIRECTION
EMERGENCY OVERFLOW
BASIN DESIGNATION (A; 5.0 ACRES; .25 C100; .35 C5)
PROPOSED MINOR CONTOUR
PROPOSED MAJOR CONTOUR
EXISTING MINOR CONTOUR
EXISTING MAJOR CONTOUR
BASIN BOUNDARY
EMERGENCY OVERFLOW PATH
SAND FILTRATION BASIN
PIPE RUN IDENTIFIER
SELECTIVE LINING
GRADE CONTROL

DRAINAGE NOTES

1. PROPOSED TYPE D-10-R DROP INLET, SUMP & AT-GRADE COND'N
2. PROPOSED STORM SEWER PIPE
3. PROPOSED FABRICATED END SECTION
4. REMOVE & REPLACE EX. CMP PIPES W/ PROPOSED RCBC CROSSING
5. PROPOSED STORM DRAIN HEADWALL
6. PROPOSED WATER QUALITY FEATURE – SAND FILTRATION BASIN
7. PROPOSED POND OUTLET, DESIGNED TO BYPASS Q100
8. PROPOSED RIPRAP APRON
9. PROPOSED TRAPEZOIDAL DIVERSION CHANNEL

BASIN SUMMARY TABLE

BASIN ID	BASIN AREA (Acres)	FLOW Q5 (CFS)	FLOW Q100 EST. (CFS)
OS1*	4.3	3.8	9.0
OS5*	323	72.0	340.0
A1	3.78	7.1	15.1
A2	6.20	9.4	20.1
A3	2.30	4.7	9.9
A4	1.20	1.6	5.3
B1	1.20	3.2	6.7
B2	4.10	7.6	16.3
C1	1.70	3.3	7.1
C2	4.64	10.8	22.4
D1	4.53	8.4	18.0
D2	6.18	11.1	23.8
D3	1.72	3.5	7.4
D5	0.40	1.8	3.5
D6	1.65	3.0	6.3
F1	2.38	4.6	9.9
F2	2.16	4.0	8.6
G1	1.75	3.3	7.1
G2	2.58	5.3	11.2
OS7**	1.8	6.7	12.5
OS10**	1.9	7.0	13.2

*Q5 & Q100 REFERENCED FROM "MASTER DEVELOPMENT DRAINAGE PLAN FOR SHILOH MESA AT WOODMEN HEIGHTS", PREPARED BY MATRIX

**Q5 & Q100 REVISED AREAS AND FLOWS FOR "MASTER DEVELOPMENT DRAINAGE PLAN FOR SHILOH MESA AT WOODMEN HEIGHTS", PREPARED BY MATRIX

PIPE TABLE

PIPE #	DIA.(IN.) & MTL	FLOW Q5 (CFS)	FLOW Q100 (CFS)
1	2-60" CMP	72.0	340.0
2	72" RCP	72.0	340.0
3	24" RCP	7.1	15.1
4	18" RCP	3.2	6.7
5	24" RCP	7.6	16.3
6	24" RCP	10.3	21.9
7	18" RCP	3.3	7.1
8	30" RCP	10.8	22.4
9	30" RCP	14.1	29.5
10	36" RCP	23.9	50.2
11	18" RCP	4.7	9.9
12	24" RCP	8.3	20.8
13	30" RCP	12.9	27.5
14	42" RCP	32.3	68.4
15	18" RCP	3.3	7.1
16	18" RCP	5.3	11.2
17	24" RCP	8.2	17.6
18	18" RCP	4.0	8.6
19	18" RCP	4.6	9.9
20	24" RCP	8.5	18.1
21	30" RCP	16.5	35.3
22	24" RCP	8.4	18.0
23	18" RCP	1.8	3.5
24	42" RCP	31.9	70.6
25	18" RCP	3.5	7.4
26	42" RCP	35.0	77.2
27	24" RCP	6.4	16.6
28	24" RCP	22.4	50.7
29	36" RCP		

DESIGN POINT SUMMARY TABLE

DESIGN PT.	PEAK Q5 (CFS)	PEAK Q100 (CFS)	COMMENTS
NORTH WQ POND TRIBUTARY			
A1	7.1	15.1	6-FT SUMP D-10-R
			RELEASE INTO N. WQ POND
CENTRAL WQ POND TRIBUTARY			
A2	9.4	20.1	8-FT SUMP D-10-R
A3	4.7	9.9	4-FT SUMP D-10-R
B1	3.2	6.7	4-FT SUMP D-10-R
B2	7.6	16.3	6-FT SUMP D-10-R
C1	3.3	7.1	4-FT SUMP D-10-R
C2	10.8	22.4	10-FT SUMP D-10-R
A4	33.4	72.0	RELEASE INTO C. WQ POND
SOUTHERN WQ POND TRIBUTARY			
D1	8.4	18.0	8-FT SUMP D-10-R
D2	11.1	23.8	12-FT AT-GRADED-10-R
D3	3.5	7.4	4-FT SUMP D-10-R
F1	4.6	9.9	4-FT SUMP D-10-R
F2	4.0	8.6	4-FT SUMP D-10-R
G1	3.3	7.1	4-FT SUMP D-10-R
G2	5.3	11.2	4-FT SUMP D-10-R
D5	1.8	3.5	4-FT SUMP D-10-R
D4	35.0	77.2	RELEASE INTO S. WQ POND
OS7 OFFSITE TRIBUTARY			
OS7,OS10	11.4	21.5	TBD
D2	4.7	7.2	FLOW-BY
D6	3.0	6.3	SHEET FLOW

OWNER: BARHAM TED R
LOCATION: 8245 MUSTANG RD

OWNER: ERNST GORDON W
ERNST WANDA R
LOCATION: 8185 MUSTANG RD

OWNER: HOFER ROBERT P & CAROLYN S
LOCATION: 8035 MUSTANG RD

OWNER: HOFER ROBERT P & CAROLYN S
LOCATION: 8035 MUSTANG RD

OWNER: CLEARWATER WILLIAM F & MELINDA E
LOCATION: 7950 MAVERICK RD

OWNER: PETERSON PAUL K & PETERSON LAURIE A
LOCATION: 7898 MUSTANG RD

OWNER: BRACE-HALL FAMILY TRUST
LOCATION: 8335 MUSTANG PL

OWNER: KOOP LEONARD & EDNA
LOCATION: 8255 MUSTANG PL

OWNER: WOLF-MEDLOCK APRIL
WOLF-MEDLOCK JUSTIN I
LOCATION: 8175 MUSTANG PL

OWNER: CENTER FOR STRATEGIC MINISTRY
LOCATION: 0 4-13-65

OWNER: MARK SHEFFELL-WOODMEN INVESTMENTS LLC
LOCATION: 0 4-13-65

MUSTANG ROAD
KENOSHA ROAD
MARK SHEFFELL ROAD
OUTER STREAMSIDE BOUNDARY
INNER STREAMSIDE BOUNDARY

AR PUD 14-00692

102 E. PIKES PEAK AVE., STE 306
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COLORADO 80903
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CIVIL CONSULTANTS, INC.

SHILOH-MESA
POST DEVELOPMENT DRAINAGE PLAN

PROJECT NO. 08-026	FILE: O:\08026\Documents\Reports\Drainage\DP		
DESIGNED BY: VAS	SCALE	DATE: 4/02/2015	
DRAWN BY: ET	HORIZ: 1"=100'	SHEET 2 OF 3	DP-1
CHECKED BY: VAS	VERT: N/A		