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Flying Horse North Filing No. 4
Final Drainage Report

January 2024

Prepared For:

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Appendices

Engineer's Statement

This report and plan for the drainage design of the development, Flying Horse North Filing No. 4, was prepared by me (or under my direct supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the *El Paso County Drainage Criteria* Manual and is in conformity with the master plan of the drainage basin. I understand that El Paso County 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.

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Richie Lyon, PE Date

State of Colorado No. 53921

For and on behalf of HR Green Development, LLC

Developer's Statement

I, the developer, have read and will comply with all of the requirements specified in this drainage report and plan.

Flying Horse Development, LLC

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Drew Balsick Date

Vice President

Flying Horse Development, LLC
2138 Flying Horse Club Drive

Colorado Springs, CO 80921

El Paso County:

Filed in accordance with the requirements of the El Paso County Land Development Code, Drainage Criteria Manual, Volumes 1 and 2 and the Engineering Criteria Manual, as amended.

______________________________ ______________________________

Joshua Palmer, P.E. Date

County Engineer/ECM Administrator

Final Drainage Report – Flying Horse North

I. General Purpose, Location and Description

a. Purpose and Scope

The Purpose of this Final Drainage Report (FDR) is to identify specific solutions to drainage concerns for onsite and offsite tributary areas resulting from the development of the subdivision to be platted. The FDR is to describe the onsite and offsite drainage patterns, existing and proposed storm infrastructure as it relates to water quality and stormwater detention for any proposed or existing facilities, the planned storm water management for the Flying Horse North development for Filing No. 4.

The Preliminary Drainage Report for Flying Horse North Preliminary Plan and Final Drainage Report for Flying Horse North Filing No. 1 is a combined Preliminary Drainage Report (PDR) and Final Drainage Report (FDR) that was developed by Classic Consulting, latest revision June 2018. The combined PDR/FDR was approved by the County in September of 2018 and is included in Appendix E. This approved report identifies the proposed Filing No. 4 area for the PDR and Preliminary Plan portion of the report.

A more recent Master Development Drainage Plan (MDDP) was prepared by HR Green Development, LLC. and was approved by the County in September of 2022, entitled *Flying Horse North Master Development Drainage Plan* latest revision date of September 9, 2022. This MDDP also referenced the Classic Consulting report from 2018 for master drainage design of the proposed Filing No. 4 area.

The items discussed in this FDR include final plat layout, land uses, and drainage patterns for Filing No. 4. Included in this report are final hydrologic and hydraulic drainage calculations and design as required for the final design of the development of the single-family residential estate lot areas with assumed conservative drainage analysis for a future Flats area. This report references the aforementioned reports to compare and contrast findings in the final design to ensure that existing infrastructure and facilities are not negatively impacted by this development.

b. DBPS Investigations

Flying Horse North is split by the Arkansas River Basin and South Platte Basin. Within the South Platte Basin, the site is withing the East Cherry Creek Drainage Basin. A Drainage Basin Planning Study (DBPS) does not currently exist for the East Cherry Creek Drainage Bain. This FDR is consistent with the 2022 MDDP which complies with standard El Paso County regulations regarding drainage within this corridor.

The Filing No. 4 area falls within the East Cherry Creek Basin which is to consist of 2.5-acre single-family residential estate lots. Proposed developed areas are provided with water quality and full spectrum detention (FSD) prior to release offsite. Areas that are tributary to Flying Horse Filing No. 4 have no increase in required stormwater quality or detention volumes. There is a relatively small area of 2.5-acre single-family lots that drain directly offsite. There is no proposed basin transfer and therefore the historical drainage patterns are to remain in place including at the roadway and lots at the major basin delineation.

c. Stakeholder Process

There are no amendments to the current DBPS.

d. Agency Jurisdictions

Listed below are the jurisdictions that this project will conform to:

El Paso County

Federal Emergency Management Agency

e. General Project Description

Flying Horse North Filing No. 4 is in El Paso County jurisdiction and is located within the larger Flying Horse North subdivision. The overall Flying Horse North development is bordered by Highway 83 to the west, Black Forest Road to the east, Cathedral Pines to the south, and High Forest Ranch to the north. The greater Flying Horse North area contains approximately 1,459 acres within the whole Section 36, Township 11 South, Range 66 West of the Sixth Principal Meridian, and a portion of Section 30 and 31, Township 11 South, and Range 65 West of the Sixth Principal Meridian. The Flying Horse Filing No. 4 area is 175.76 acres in total.

This FDR covers Filing No. 4 and includes offsite upstream and downstream areas to analyze existing and proposed drainageways and facilities. The Filing No. 4 area totals approximately 175.8 acres including 48 total 2.5-acre single-family residential estate lots. The development includes the single-family residential estate lots, 60’ width rights-of-way that consist of asphalt paved roadways with roadside swale sections and electric easements, and three full spectrum detention pond facilities.

Filing No. 4 was previously assessed in the 2018 Classic Consulting report with a similar land use plan that included 2-acre single-family residential estate lots and roadways. This report assesses the lots as 2.5-acre lots. The layout shown in the developed conditions hydrology map of this report and the corresponding construction drawings differs slightly from the approved FDR/PDR with adjusted roadway alignments and lot lines. However, the drainage patterns, typical roadway section, and land use densities are similar.

The existing vegetative cover is 90 percent as evidenced by a field survey and aerial imagery. The existing vegetation includes native grasses and weeds, shrubs, and pinyon pine trees. Previous clearing of future planned roadways was done several years ago, and native grass and weeds have covered those areas.

f. Data Sources

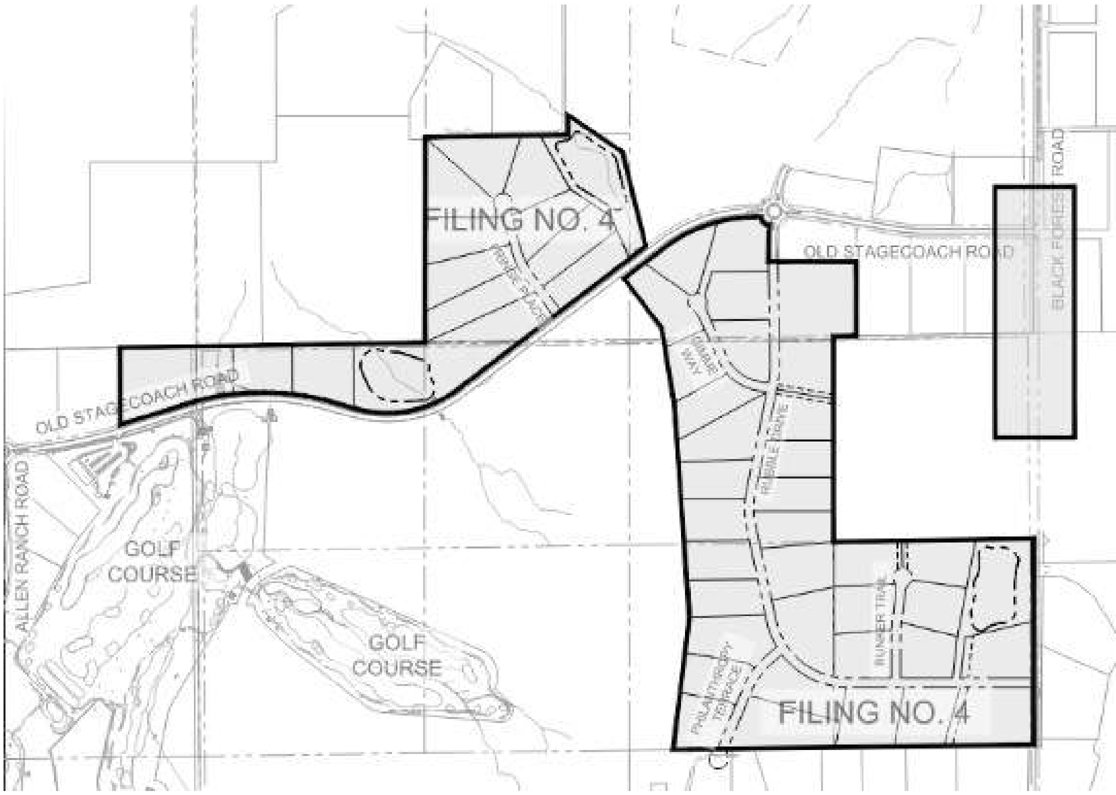


Figure 1 – Vicinity Map

Listed Below are the technical resources reviewed in the preparation of this MDDP:

El Paso County Drainage Criteria Manual (DCM)

Mile High Flood District

NOAA Atlas 14

NRCS Soil Survey for El Paso County Area, Colorado

FEMA FIRM 08041C0305G and FIRM 08041C0315G (eff. 12/7/2018)

El Paso County Assessor Property Records

Preliminary Drainage Report for Flying Horse North Preliminary Plan and Final Drainage Report for Flying Horse North Filing No. 1 prepared by Classic Consulting – June 2018

Flying Horse North Master Development Drainage Report prepared by HR Green Development, LLC. – latest revision September 9, 2022

g. Applicable Criteria and Standards

Per El Paso County Criteria Manual, flows from the proposed site will be limited to historic flows to maintain the stability of the existing channels within the drainage basins. The master plan follows the Drainage Criteria Manual for El Paso County which refers to the City of Colorado Springs Drainage

Criteria Manuals as amended. Criteria within the County and City manuals refer to the Mile High Flood District manuals, particularly for extended detention basin design and runoff reduction calculations which are utilized in this report.

A distinct difference in the 2018 FDR/PDR and this report are the hydrologic methodologies utilized to compute peak runoff values. The 2018 Classic Consulting report utilized the NRCS Curve Number method in order to be consistent with their previous MDDP for the greater Flying Horse North master development. The NRCS Curve Number method was used for the future development of the area that is now proposed as Filing No. 4 for the portion of the report considered to be a Preliminary Drainage Report and it was used for sub-basins that did not exceed 100 acres. Typically, the Rational Method is used for hydrologic computations when basin analysis is under 100 acres due to the NRCS Curve Number method yielding smaller minor and major storm event peak runoff values. The resultant hydraulics in this report are similar to that of the approved 2018 FDR/PDR on a basin-by-basin basis, however, any differences in calculated stormwater runoff will be discussed. The difference in methodologies between the 2018 report and this report result in larger cumulative stormwater runoff values reported for the minor and major storm events. Due to the more conservative nature of the Rational Method, cumulative peak flow rates are greater than that of the 2018 FDR/PDR for the minor and major storm events for downstream design points. Because of the discrepancy between methodologies of the NRCS Curve Number and Rational Method's, existing hydrology calculations have been completed on the proposed Filing No. 4 area. This was done to determine if any downstream mitigation was needed, which will be discussed later in this report.

HR Green has previously discussed this discrepancy in hydrologic methodology with El Paso County engineering staff. The chosen method for most hydrologic computations included with this Report is the Rational Method to ensure sound design of the storm infrastructure for Filing No. 4 including swales, channels, culvert pipes, inlets, and roadway capacities. In addition to the Rational Method, major and minor storm events have also been modeled using the Colorado Urban Hydrograph Procedure (CUHP), version 2.0.0, and EPA Storm Water Management Model (SWMM), version 5.1. This methodology allows CUHP generated hydrographs from a number of sub-catchments, to be combined and routed through a series of links (channels, gutters, pipes, dummy links, etc.) and nodes (junctures, storage, diversion, etc.) to compute the resultant hydrographs at any number of design points within the watershed. CUHP / SWMM calculations were performed primarily for sizing the site detention facilities.

It was discussed that no existing drainage infrastructure will require redesign or retrofits unless explicit discrepancies in detention volumes are discovered as the tributary areas and percent imperviousness for respective detention ponds have not changed significantly between the 2018 FDR/PDR and this report for Filing No. 4. Due to the use of the NRCS Curve Number method in the 2018 FDR/PDR, the peak runoff values in this report are larger than that of the approved 2018 FDR/PDR. To complete a fair assessment of the impacts downstream of the site, existing hydrology calculations have been completed and included in Appendix B. As discussed with County engineering staff, while peak runoff values have increased due to the use of the Rational Method, there are no anticipated negative impacts to downstream offsite infrastructure because of this development as all other drainage parameters remain consistent with the 2018 FDR/PDR. Review of the CUHP / SWMM generated hydrology results in peak values generally less than calculated with the Rational Method. The resultant peak runoff figures are used to assess all existing and proposed stormwater infrastructure associated with Filing No. 4's development, as well as a future Filing No. 5 development for Pond B in particular.

II. Project Characteristics

a. Location in Drainage Basin, Offsite Flows, Size

Filing No. 4 is located within the East Cherry Creek Basin. There is not a current planning study of the drainage basin, but generally it slopes from southwest to northeast. The basin eventually flows into the South Platte River.

Within the portion of the East Cherry Creek Basin investigated with this Report, three major drainage basins have been designated by the proposed pond in which the area is draining to. One drainage basin consists of seven sub-basins, "A" basins, conveyed to the proposed detention pond at Design Point A6, Pond A. The respective contributing flow from the sub-basins is shown in the table below:

Basin Name	Acreage	5 Year Flow (cfs)	100 Year Flow (cfs)
A1	9.6	5.2	22.1
A2	10.8	6.7	27.6
A3	72.7	21.2	126.2
A4	18.4	10.2	42.0
A5	6.1	3.7	15.4
A6	2.8	1.8	7.2
A7	8.1	5.1	20.9

Drainage within the "A" drainage basin flows ultimately from the southwest to northeast to reach Pond A. Design points are located at proposed culverts underneath roadways and proposed swales that direct flow to the detention pond. Drainage outfalls from Pond A into an existing channel that ultimately outfalls to the South Platte River.

The second drainage basin consists of six sub-basins, "B" basins, conveyed to the proposed detention pond at Design Point B3, Pond B. Two Basins, B5 and B6, flow directly offsite. Additional volume has been included in Pond B to compensate for these basins, see additional discussion below. The respective contributing flow from the sub-basins is shown in the table below:

Basin Name	Acreage	5 Year Flow (cfs)	100 Year Flow (cfs)
B1	57.8	15.9	97.5
B2	35.8	18.2	73.1
B3	1.1	1.5	4.0
B4	11.0	8.0	28.1
B5	10.6	6.3	25.9
B6	16.0	8.7	35.8

Drainage within the "B" drainage basin flows ultimately from the southeast to northwest to reach Pond B. Design points are located at an existing culvert under Old Stagecoach Road and at existing and proposed swales that direct flow to the detention pond. Drainage outfalls from Pond B into an existing channel that ultimately outfalls to the South Platte River.

The third drainage basin consists of five sub-basins, “C” basins, conveyed to the proposed detention pond at Design Point C2, Pond C. Two of the basins, C4 and C5, flow directly offsite. Additional volume has been included in Pond C to compensate for these basins, see additional discussion below. The respective contributing flow from the sub-basins is shown in the table below:

Basin Name	Acreage	5 Year Flow (cfs)	100 Year Flow (cfs)
C1	10.5	8.7	37.2
C2	20.9	1.9	5.9
C3	9.3	11.3	50.6
C4	11.0	2.9	11.9
C5	11.0	1.4	5.7

Drainage within the “C” drainage basin flows ultimately from south to north to reach Pond C. Design points are located at existing and proposed culverts underneath roadways and proposed swales that direct flow to the detention pond. Drainage outfalls from Pond C into an existing channel that ultimately outfalls to the South Platte River.

There are five sub-basins that drain directly offsite due to the natural drainage patterns. These sub-basins have relatively small areas within Filing No. 4 and include parts of the 2.5-acre single-family residential estate lots at the northeast & western edges of the development. Additional volume has been included in Pond A to compensate for these basins, see additional discussion below.

Basin Name	Acreage	5 Year Flow (cfs)	100 Year Flow (cfs)
G1	2.6	1.7	6.8
G2	4.4	1.3	9.7
H1	5.2	3.4	13.9
H2	14.5	9.1	37.5
H3	36.8	9.1	66.9

There are two sub-basins that will drain to future proposed detention ponds. Currently, drainage from these basins will follow historic drainage patterns flowing to the northeast utilizing existing culverts within Old Stagecoach Road to outfall into existing channels. The respective flow from the sub-basins are shown in the table below:

Basin Name	Acreage	5 Year Flow (cfs)	100 Year Flow (cfs)
F1	12.2	7.3	30.0
F2	13.9	8.1	33.3
F3	16.7	4.5	11.4

This Filing No. 4 FDR utilizes tributary areas, runoff coefficients (when comparing the NRCS Curve Number method and the Rational Method), and percent imperviousness for respective sub-basins and downstream detention facilities that match the amended layout as compared to 2018 Classic Consulting

FDR/PDR which utilized its 2016 PUD layout of the subdivision. Changes in the peak runoff numbers as compared to the 2018 report are due to the change in hydrologic computation methodology as well as the change in the overall layout within Filing No. 4 per the PUD Minor Amendment. Due to these differences in the computational methodology between the previously approved 2018 FDR and the values being calculated in this report, additional analysis of existing conditions has been completed. The existing conditions major flow values have been added to Appendix B. A table showing the Classic 2018 FDR/PDR NRCS Method peak runoff values compared to the HR Green 2024 FDR Rational Method peak runoff values for proposed conditions is provided below. The basins in this table that qualify for large lot exclusion under ECM code I.7.1.B.5 are Basins B4, B5, B6, C4, C5, G1, G2, H1, H2, and H3.

Basin Name		Area (acre)		Proposed Q5 (cfs)		Proposed Q100 (cfs)	
Classic	**HRG**	**Classic**	**HRG**	**Classic**	**HRG**	**Classic**	**HRG**
CC-13C	A1	9.9	9.6	3.4	5.2	16.5	22.1
OS-15	A3	70.8	72.7	14.8	21.2	84.2	126.2
CC-13A	A4	19.3	18.4	5.4	10.2	27.3	42.0
CC-13B	A2	25.5	10.8	7.2	6.7	36.1	27.6
	A5		6.1		3.7		15.4
	A6		2.8		1.8		7.2
	A7		8.1		5.1		20.9
CC-10	B1	85.6	57.8	14.1	15.9	91.9	97.5
CC-8	B2	7.7	35.8	2.5	18.2	12.0	73.1
CC-11	B3	18.6	1.1	5.0	1.5	28.1	4.0
	B4		11.0		8.0		28.1
CC-12	B5	12.2	10.6	3.9	6.3	18.7	25.9
not labeled	B6		16.0		8.7		35.8
CC-15	C1	12.8	15.9	4.3	8.7	20.4	37.2
CC-20	C2	39.3	2.0	12.9	1.9	61.0	5.9
	C3		21.4		11.3		50.6
	C4		4.3		2.9		11.9
	C5		2.3		1.4		5.7
CC-16	F1	16.3	12.2	4.6	7.3	23.6	30.0
CC-17	F2	25.0	13.9	6.5	8.1	32.8	33.3
OS-16	F3	4.5	16.7	1.5	4.5	7.2	11.4
CC-14	G1	4.6	2.6	1.6	1.7	7.8	6.8
not labeled	G2		4.4		1.3		9.7
CC-13D	H1	18.8	5.2	6.2	3.4	29.2	13.9
	H2		14.5		9.1		37.5
not labeled	H3		36.8		9.1		66.9

It is important to note that while there is an increase in peak runoff for these basins as compared to the 2018 report, there is a discrepancy in methodology. The proposed improvements with this report will be designed using the updated values and pond sizing, which relies on a historic model, will be designed using CUHP / SWMM including a historic model. As seen in Appendix B, the peak runoffs have increased due to the discrepancy in methodology and the updates in basin delineation, however the total flowrates being released off-site into Cherry Creek basin has been reduced overall. While there is a slight increase of runoff downstream for the basins that qualify for large lot inclusion, over-detention has been provided in the three proposed detention ponds for these basins flowing offsite to ensure the total flows being released downstream have been reduced. Combined for all three site outfalls providing detention with Filing No. 4, the total flow released off-site has been reduced by 4% in the major storm event. Because of this no downstream mitigation is proposed.

b. Compliance with DBPS

This FDR is in general conformance with the current drainage flows of the East Cherry Creek Basin. Flying Horse North will construct multiple full spectrum detention facilities to limit the effects of development and mimic natural flow patterns. The Filing No. 4 development will follow historic drainage patterns and utilize the existing natural swales throughout the area for conveyance of stormwater runoff toward respective proposed detention facilities.

Existing downstream infrastructure is currently limited to the historic drainage channels and minimal downstream improvements exist. As such, the site restricts offsite flow rates to not exceed historic flow rates. The site’s ultimate outfalls will generally be along the same historic tributaries. Although outfall rates will be at or below historic, the cumulative volume of runoff will increase and therefore downstream facilities may see an increase in the duration of flows. This may provide a net benefit to the downstream facilities by providing more water to assist with the sustenance of vegetation, however it should be noted that increased volume may expedite potential erosion or channel movement. Any deviations from the approved 2018 Classic Consulting PDR/FDR in terms of runoff flow rate and water quality and detention volumes are assessed within this report to show compliance with the previously approved report in terms of capacities for drainage facilities including roadside swales, natural drainageways, and detention ponds.

c. Site Characteristics

Per the NRCS web soil survey, the site is made up entirely of Type B soils. Filing No. 4 is within the East Cherry Creek Basin which consists of Peyton sandy loam and Peyton-Pring complex. See Appendix A for the NRCS soil map.

The current ground cover in Filing No. 4 is short to mid-grass prairie grasslands and former farmland which consists of non-native weeds and grasses. This portion of the site has very few, if any, trees and a minimal number of shrubs are found on the site.

d. Major Drainage Ways and Structures

No major drainage ways exist within the development; however, small tertiary tributaries are within the site currently and function to convey flows to unnamed tributaries. These informal drainage ways are assessed within this report for stormwater runoff capacity and water surface elevations during the 100-year event as future development of single-family residential lots with basement or walkout conditions is considered. Roadside swales are included as a part of the typical roadway section and are assessed within sub-basins to ensure that swale and culvert pipe capacities are met and do not result in excessive pooling in the roadway sections, per code.

The existing minor drainage channels within the site are planned to be maintained to the maximum extent possible, however, do not require improvements or formal platting of drainage easements as a part of this filing as none of these drainageways exceed criteria requiring permanent control measures or platting for continued maintenance by the Metro District or County. These channels will continue to be used for conveyance of storm drainage flows in their natural state. The limits of construction and disturbance plan for no significant earthwork alterations to the existing minor drainage channels that would affect the drainage patterns or capacity of the sections throughout the filing as they are proven to have sufficient capacities for their respective tributary areas and to maintain the natural features of the site including existing trees and vegetation. These natural tertiary channels do not have the requisite velocities or scouring to justify permanent control measures such as turf rolled matting.

Other drainageways of note including roadside swales are described within this report with parameters to demonstrate compliance with swale design criteria and capacities. Culvert pipes are sized to convey upstream flow under proposed roadways and maintain historic drainage patterns. Roadside swales are prescribed matting products for various areas in order to minimize erosion and sediment runoff downstream per hydraulic analysis.

e. Existing and proposed land uses

The existing Filing No. 4 area is open rangeland within a forested area consisting of sparse native grasses, weeds, and pinyon pine trees as well as baren pervious soil. The existing Filing No. 4 area consists of no development other than a previously cut-in maintenance pathway that was originally planned as the future roadway corridor and golf cart paths. As part of Filing No. 1, a road was constructed along with facilities to support a golf course. The Filing No. 4 development will connect to these existing roadways at the boundary between the two filings.

The 2018 Classic Consulting PDR/FDR assumed 2-acre single-family residential estate lot development with the same percent imperviousness within the filing area. This report includes the final design layout of 2.5-acre lots with rural roadway sections. Any deviations in basin areas, land use acreages, and resultant composite coefficients are shown within this report and demonstrated to meet downstream stormwater runoff and volume capacities for proposed and existing facilities.

III. Hydrologic Analysis

a. Major Basins and Sub-basins

Major Basin Description

Per FEMA FIRM 08041C0305G and 08041C0315G (eff. 12/7/2018), Flying Horse North has the East Cherry Creek run through the northwest portion of the site. This portion is not within Filing No. 4 boundary. Currently, FEMA shows a LOMR effective April 4th, 2019 Base Flood Elevations and Zone A. Per the El Paso County Land Development Code Chapter 8 Section 8.4.2.B.1.e.i, the base flood elevations for Zone A will be determined once the platted lots are solidified and are confirmed within 300-ft of the current floodplain designation. Certification of the flood elevations will be via the FEMA

CLOMR/LOMR process or Floodplain Certification Letter. This LOMR or any FEMA floodplain identified in the FIRM maps do not have any affect on Filing No. 4 as there are no FEMA Floodplains within this Filing.

The site has been divided into several major drainage basins where each basin is tributary to a full spectrum detention pond facility with the exception of basins that drain directly offsite which have supporting water quality runoff reduction calculations. These basins and associated sub-basins are described in more detail in the next section of this report.

Existing Subbasin Description

The existing conditions for Filing No. 4 are consistent with the conditions and hydrology map presented within the 2022 HR Green Development MDDP. The previous report's existing and developed conditions drainage maps are included in Appendix E of this report for reference.

The following basins are presented on the Existing Conditions Drainage Map within the appendix and are described as follows:

Existing Basin A1: 71.50 acres, undeveloped (Q_5 = 19.2 cfs, Q_{100} = 141.1 cfs)

Runoff generated in this basin sheet flows from the southwest to the northwest over existing topography through native grass till it is concentrated in an existing channel at design point A1. Slopes in this basin average between 5% and 15% with a maximum elevation of 7675' and a minimum elevation of 7565'.

Existing Basin A2: 56.45 acres, undeveloped (Q_5 = 16.5 cfs, Q_{100} = 121.2 cfs)

Runoff generated in this basin sheet flows from the west to east over existing topography through native grass till it is concentrated in an existing channel flowing to the north to design point A2. Slopes in this basin average between 4% and 12% with a maximum elevation of 7645' and a minimum elevation of 7525'.

Existing Basin B1: 93.60 acres, undeveloped / roadway (minor collector) (Q_5 = 24.1 cfs, Q_{100} = 155.8 cfs)

Basin B1 is delineated across both Filing No. 4 and proposed Filing No. 5 within the Flying Horse North Project. Runoff generated in this basin sheet flows generally from the southeast to the northwest over existing topography through native grass till it is concentrated in an existing tributary flowing to the north to design point B1. Concentrated flow at design point B1 is discharged through an existing public 48-inch reinforced concrete culvert. Slopes in this basin average between 4.8% and 11.2% with a maximum elevation of 7645' and a minimum elevation of 7540'.

Basin B1 is identified as Basin CC-10 in the Classic Consulting FDR. Where design point B1 is located on the Existing Conditions Map in this report where Classic Consulting used design point 26. The developed conditions at design point 26 are Q_5=14.1 cfs and Q_{100}=91.9 cfs. The existing public culvert was adequately sized to pass these existing flowrates.

Existing Basin B2: 15.74 acres undeveloped / roadway (minor collector) (Q_5 = 7.2 cfs, Q_{100} = 31.1 cfs)

This basin is located north of the existing Old Stagecoach Road. Runoff generated in this basin flows offsite to the north. Runoff sheet flows from the east and west within the basin over existing topography through native grass till it is concentrated in an existing tributary flowing to the north to design point B2.

Slopes in this basin average between 0% and 14.4% with a maximum elevation of 7585' and a minimum elevation of 7525'.

Existing Basin B3: 11.28 acres, undeveloped (Q_5 = 3.1 cfs, Q_{100} = 23.1 cfs)

This basin is located at the north end of the site. Runoff generated in this basin sheet flows offsite from the east to west over existing topography through native grass. Slopes in this basin average between 5.5% and 13% with a maximum elevation of 7585' and a minimum elevation of 7535'.

Existing Basin B4: 12.36 acres, undeveloped (Q_5 = 4.8 cfs, Q_{100} = 25.3 cfs)

This basin is located north of the existing Old Stagecoach Road. Runoff generated in this basin flows offsite to the north. Runoff sheet flows from the east and west within the basin over existing topography through native grass till it is concentrated in an existing tributary flowing to the north to design point B4. Slopes in this basin average between 6% and 35% with a maximum elevation of 7555' and a minimum elevation of 7510'.

Existing Basin C1: 12.47 acres, undeveloped / roadway (minor collector) (Q_5 = 6.0 cfs, Q_{100} = 28.1 cfs)

Runoff generated in this basin sheet flows generally from the southeast to the northwest over existing topography through native grass till it is concentrated at design point C1. Concentrated flow at design point C1 is discharged through an existing public dual 30-inch reinforced concrete culvert. Slopes in this basin average between 2% and 7.5% with a maximum elevation of 7615' and a minimum elevation of 7570'.

Basin C1 is identified as Basin CC-15 in the Classic Consulting FDR. The developed flow rates from basin CC-15 are Q_5=4.3 cfs and Q_{100}=20.4 cfs. The existing public dual culvert was adequately sized to pass these existing flowrates.

Existing Basin C2: 22.36 acres, roadway (minor collector) (Q_5 = 8.9 cfs, Q_{100} = 49.3 cfs)

This basin is located north of the existing Old Stagecoach Road. Runoff generated in this basin flows offsite to the north. Runoff sheet flows from the east and west within the basin over existing topography through native grass till it is concentrated in an existing tributary flowing to the north to design point C2. Slopes in this basin average between 3.5% and 12.5% with a maximum elevation of 7585' and a minimum elevation of 7530'.

Existing Basin C3: 4.56 acres, undeveloped (Q_5 = 1.4 cfs, Q_{100} = 10.4 cfs)

This basin is located at the north end of the site. Runoff generated in this basin sheet flows offsite to the north over existing topography through native grass. Slopes in this basin average between 4.0% and 8.2% with a maximum elevation of 7565' and a minimum elevation of 7545'.

Existing Basin C4: 2.27 acres, undeveloped (Q_5 = 0.7 cfs, Q_{100} = 4.8 cfs)

This basin is located at the north end of the site. Runoff generated in this basin sheet flows offsite to the west and north over existing topography through native grass and is concentrated in an existing tributary at design point C4. Slopes in this basin average between 8.0% and 13% with a maximum elevation of 7560' and a minimum elevation of 7525'.

Existing Basin F1: 11.08 acres, undeveloped (Q_5 = 3.9 cfs, Q_{100} = 23.9 cfs)

Runoff generated in this basin sheet flows generally from the south to the north over existing topography through native grass till it is concentrated at design point F1. Concentrated flow at design point F1 is discharged through an existing public 30-inch reinforced concrete culvert. Slopes in this basin average between 2% and 7.5% with a maximum elevation of 7615' and a minimum elevation of 7570'.

Basin F1 is identified as Basin CC-16 in the Classic Consulting FDR. The developed flow rates from basin CC-16 are Q_5=4.6 cfs and Q_{100}=23.6 cfs. The existing public culvert was adequately sized to pass these existing flowrates.

Existing Basin F2: 34.75 acres, undeveloped (Q_5 = 11.4 cfs, Q_{100} = 72.3 cfs)

Runoff generated in this basin sheet flows generally from the south to the north over existing topography through native grass till it is concentrated in a roadside ditch along Old Stagecoach and flows to the east to design point F2. Concentrated flow at design point F2 is discharged through an existing public 36-inch reinforced concrete culvert. Slopes in this basin average between 2% and 10% with a maximum elevation of 7615' and a minimum elevation of 7570'.

Basin F1 is identified as Basin CC-17 in the Classic Consulting FDR. The developed flow rates from basin CC-17 are Q_5=6.5 cfs and Q_{100}=32.8 cfs. The existing public culvert was adequately sized to pass these existing flowrates.

Existing Basin G1: 7.67 acres, undeveloped (Q_5 = 2.4 cfs, Q_{100} = 17.3 cfs)

This basin is located on the east side of the site. Runoff generated in this basin sheet flows to the east over existing topography through native grass before being concentrated at design point G1. Flows from this basin flow in an existing channel to basin H1. Slopes in this basin average between 3.5% and 11.8% with a maximum elevation of 7615' and a minimum elevation of 7555'.

Existing Basin H1: 56.27 acres, undeveloped (Q_5 = 17.1 cfs, Q_{100} = 125.8 cfs)

Runoff generated in this basin flows over existing topography through native grass within the basin and is concentrated in an existing channel flowing to the east to design point H2. Slopes in this basin average between 2% and 25% with a maximum elevation of 7620' and a minimum elevation of 7515'.

Existing Basin R1: 0.92 acres, undeveloped / roadway (Q_5 = 1.6 cfs, Q_{100} = 3.4 cfs)

Runoff generated in this basin briefly flows over existing topography through native grass and flows across one-lane of existing roadway from the south to the north. The existing slopes along the roadway range from 0.5% to 1.0%.

The onsite basins relevant to this report that are utilized in the 2018 report are the following: Basins CC-8, CC-10, CC-11, CC-12, CC-13A, CC-13B, CC-13C, CC-13D, CC-14, CC-15, CC-16, CC-17, and CC-20

The offsite basins relevant to this report that are utilized in the 2018 report are the following: OS-15

Proposed Subbasin Description

The net area of some basins described in this report may differ from the 2018 Classic Consulting FDR/PDR due to changes of alignment of proposed roads and slight adjustments of the delineations with new topographic survey information. The net Q_5 & Q_{100} values may differ in this report because of the different methodologies used between the reports. Classic Consulting's FDR had used a Curve Number Method to report 5-year and 100-year drainage flows while this report utilizes the Rational Method to determine peak flow values. The Rational Method yields higher minor and major storm peak runoff values. Because of these two discrepancies, the values reported in this FDR may be higher across all design points that had also been evaluated in Classic Consulting's FDR from 2018.

The following basins are presented on the Developed Conditions Drainage Map within the appendix and are described as follows:

Proposed Basin A1: 9.57 acres, undeveloped / residential (2.5 acre lots) (Q_5 = 5.2 cfs, Q_{100} = 22.1 cfs)

Runoff generated in this basin sheet flows from west to east over existing topography through native grass. The runoff will flow over proposed 2.5-acre lots until it is concentrated in the proposed roadside ditches along Stable Ford Terrace and Rubble Drive. The flows are directed to the east under Rubble Drive at design point A1 through a proposed public 18-inch RCP culvert (Culvert 4) to Basin A2.

Proposed Basin A2: 10.79 acres, residential (2.5 acre lots) (Q_5 = 6.7 cfs, Q_{100} = 27.6 cfs)

Runoff generated in this basin first sheet flows over existing topography through proposed 2.5-acre lots, then combines with upstream tributary flows in a proposed private tertiary swale represented as section B-B. Runoff will also be collected in roadside ditches along the northside of Rubble Drive and the west side of Bunker Trail. Combined flows are directed to the east to basin A5 through a proposed public 42-inch RCP culvert (Culvert 11).

Proposed Basin A3: 72.74 acres, undeveloped / residential (5.0 acre lots) (Q_5 = 21.2 cfs, Q_{100} = 126.2 cfs)

Runoff generated in this basin sheet flows from south to north over existing topography through native grass. Stormwater will travel through proposed five-acre lots within Filing No. 5 and through proposed 2.5-acre lots within Filing No.4. The flows are collected in an existing public channel with a 70-foot drainage easement represented as section A-A on the plans and directed to design point A3. Runoff will continue in this existing channel to basin A4.

Proposed Basin A4: 18.39 acres, residential (2.5 acre lots) (Q_5 = 10.2 cfs, Q_{100} = 42.0 cfs)

Runoff generated in this basin sheet flows over existing topography through proposed 2.5-acre lots and is combined with flows from upstream tributary basin A3 in an existing public channel represented as section A-A on the plans. Runoff will also be collected in roadside ditches along the south side of Rubble Drive and the west side of Stableford Terrace. Combined flows are directed to the north to basin A6 through a proposed public 60-inch RCP culvert (Culvert 2).

From Classic Consulting's FDR for Flying Horse North Filing No. 1, Basin A4 was identified as Basin CC-13A. Classic's FDR reported a total basin area for CC-13A to be 19.3 acres with a Q_5=5.4 CFS and a Q_{100}=27.3 CFS. The cumulative flow at design point 28 (this includes basins CC-13A and OS-15) shown in this report has a net area of 90.1 acres, a net Q_5=19.8 CFS, and a net Q_{100}=110 CFS. See the statement preceding Basin A1 description for an explanation of discrepancies between values reported here and values reported in Classic Consulting's 2018 FDR.

Proposed Basin A5: 6.10 acres, residential (2.5 acre lots) (Q_5 = 3.7 cfs, Q_{100} =15.4 cfs)

Runoff generated in this basin sheet flows over existing topography through proposed 2.5-acre lots and combines with the flows from upstream tributary basins A1 and A2 in a proposed private tertiary swale represented as section I-I on the plans. Runoff will also be collected in roadside ditches along the north side of Rubble Drive and the east side of Bunker Trail. The combined flows are directed to the east to basin A6 through a proposed private 48-inch RCP culvert (Culvert 12).

Proposed Basin A6: 2.76 acres, residential (2.5 acre lots) (Q_5 = 1.8 cfs, Q_{100} = 7.2 cfs)

Runoff generated in this basin sheet flows over existing topography through proposed 2.5-acre lots and combines with flows from upstream tributary basins A3 and A4 in a proposed public channel represented as section H-H on the plans. Runoff will also be collected in roadside ditches along the north side of Rubble Drive. Combined flows from basins A1-A6 will discharge at a 100-year rate 102.7 CFS via a rundown rock chute into proposed detention Pond A.

From Classic Consulting's FDR for Flying Horse North Filing No. 1, Basin A6 was identified as Basin CC-13B. Classic's FDR reported a total basin area for CC-13B to be 25.5 acres with a Q_5=7.2 CFS and a Q_{100}=36.1 CFS. The cumulative flow at design point 29 (this includes basins CC-13A – CC-13C and OS-15) shown in this report have a net area of 125.5 acres, a net Q_5= 26.6 CFS, and a net Q_{100}=155 CFS. See the statement preceding Basin A1 description for an explanation of discrepancies between values reported here and values reported in Classic Consulting's 2018 FDR.

Proposed Basin A7: 8.11 acres, residential (2.5 acre lots) (Q_5 = 5.1 cfs, Q_{100} = 20.9 cfs)

Runoff generated in this basin travels via sheet flow over existing topography into the proposed Pond A. Within the pond, flows travel through trickle channels and outfall through a proposed private Type-C modified outlet structure. The reduced 100-year flow outfalling from Pond A is 160 CFS.

Proposed Basin B1: 57.78 acres, undeveloped / roadway (minor collector) / residential (2.5 acre lots) (Q_5 = 15.9 cfs, Q_{100} = 97.5 cfs)

Runoff generated in this basin sheet flows over existing topography from southeast to northwest through proposed 2.5-acre lots. Runoff is collected in an existing private tertiary swale and existing roadside ditches along Old Stagecoach Road and directed to basin B2.

Proposed Basin B2: 35.77 acres roadway (minor collector) / residential (2.5 acre lots) (Q_5 = 18.2 cfs, Q_{100} = 73.1 cfs)

Runoff generated in this basin sheet flows over existing topography from south to north. Minimal flow produced within Basin B2 will travel shallow concentrated flow in existing roadside ditches along Old Stagecoach Road. Combined flows from basin B1 and B2 are directed to the north to basin B3 through an existing public 48-inch RCP culvert.

From Classic Consulting's FDR for Flying Horse North Filing No. 1, Basin B2 (and Basin B1) was identified as Basin CC-10. Classic's FDR reported a total basin area for CC-10 to be 85.6 acres with a Q_5=14.1 CFS and a Q_{100}=91.9 CFS. The cumulative flow at design point 26 (this includes basins CC-8 and CC-10) shown in this report have a net area of 93.3 acres, a net Q_5= 15.9 CFS, and a net Q_{100}=102 CFS. The cumulative flow calculated with this report at design point B2 is significantly higher at Q5 = 33.2 CFS and Q100 = 285.8 CFS due to the discrepancies in methodology used between reports. The existing 48-inch RCP culvert must be modified to a dual 48-inch RCP culvert accommodate the increase in flows.

See Appendix C for calculations on this existing culvert calculations and proposed culvert improvement calculations.

Proposed Basin B3: 1.10 acres, roadway (minor collector) / residential (2.5 acre lots) (Q_5 = 1.5 cfs, Q_{100} = 4.0 cfs)

Runoff generated in this basin sheet flows over existing topography and travels via shallow concentrated flow in existing roadside ditches north of Old Stagecoach Road. Combined flows from basins B1, B2 and B3 travel through a proposed private channel represented as section F-F on the plans. The combined 100-year flow totaling to 102.8 CFS is collected in proposed detention Pond B via a proposed rundown rock chute.

Proposed Basin B4: 11.00 acres, roadway (minor collector) / residential (2.5 acre lots) (Q_5 = 8.0 cfs, Q_{100} = 28.1 cfs)

Runoff generated in this basin sheet flows over existing topography to detention Pond B. Within Pond B, runoff travels through trickle channels to a private Type-C modified outfall structure. The reduced 100-year flow outfalling from Pond B is 216.5 CFS.

Proposed Basin B5: 10.62 acres, residential (2.5 acre lots) (Q_5 = 6.3 cfs, Q_{100} = 25.9 cfs)

Runoff in from this basin is generated completely within the proposed 2.5 acres lots. The runoff will follow existing drainage patterns and sheet flow directly offsite to the west to existing channels and tributaries. Pond B has volume capacity for over-detention of this basin. This area is included in the large lot exclusion (ECM I.7.1.B.5). The flow leaving this site in the proposed conditions is higher than the flow leaving the site in the existing conditions when doing a direct comparison analysis. This is due to the increase in imperviousness from 2% in the undeveloped land use condition, to 11% in the residential land use condition. However, a SWMM model has been developed to analyze the discharge from the site in the historic condition and the developed condition. This is a more detailed analysis of the overall discharges offsite to ensure that they are at or below historic rates. As shown in the detention pond summary table in Appendix D, the overall post development discharge from basin B is 262 CFS which is the same as the overall predevelopment discharge from basin B. As mentioned before, Pond B has volume capacity for over-detention for Basin B5 to ensure that the discharge from the overall site will remain at or below historical rates. Additionally, channel analysis has been done to ensure that the existing channel can handle the increase in offsite flows at design point B5. See channel calculations for Section K-K in Appendix C as well as the cross-section on sheet DR5 in the drainage plans.

Proposed Basin B6: 15.96 acres, residential (2.5 acre lots) (Q_5 = 8.7 cfs, Q_{100} = 35.8 cfs)

Runoff in from this basin is generated completely within the proposed 2.5 acres lots. The runoff will follow existing drainage patterns and sheet flow directly offsite to the north to existing channels and tributaries. Pond B has volume capacity for over-detention of this basin. This area is included in the large lot exclusion (ECM I.7.1.B.5). The proposed flow leaving this site is higher than the flow leaving the site in the existing conditions when doing a direct comparison analysis. This is due to the increase in imperviousness from 2% in the undeveloped land use condition, to 11% in the residential land use condition. However, a SWMM model has been developed to analyze the discharge from the site in the historic condition and the developed condition. This is a more detailed analysis of the overall discharges offsite to ensure that they are at or below historic rates. As shown in the detention pond summary table in Appendix D, the overall post development discharge from basin B is 262 CFS which is the same as the overall predevelopment discharge from basin B. As mentioned before, Pond B has volume capacity for over-detention for Basin B6 to ensure that the discharge from the overall site will remain at or below historical rates. Additionally, channel analysis has been done to ensure that the existing channel can handle the increase in offsite flows at design point B6. See channel calculations for Section J-J in Appendix C as well as the cross-section on sheet DR5 in the drainage plans.

Proposed Basin C1: 15.94 acres, undeveloped / roadway (minor collector) / residential (2.5 acre lots) (Q_5 = 8.7 cfs, Q_{100} = 37.2 cfs)

Runoff generated from this basin will sheet flow over existing topography to the north and east. Runoff will also flow through proposed roadside ditches along the west side of Gimme Way and eventually discharge through a proposed public 18-inch culvert (Culvert 7). Runoff outfalls from this culvert into a proposed public channel represented as section E-E on the plans. Stormwater from this channel will travel through an existing public 30-inch culvert under Old Stagecoach Road to basin C2.

The flow calculated with this report at design point C1 is significantly higher than what was calculated in the Classic Consulting FDR due to the discrepancies in methodology used between reports. The existing 30-inch RCP culvert must be modified to a dual 30-inch RCP culvert accommodate the increase in flows. See Appendix C for calculations on this existing culvert calculations and proposed culvert improvement calculations.

Proposed Basin C2: 1.98 acres, roadway (minor collector) / residential (2.5 acre lots) (Q_5 = 1.9 cfs, Q_{100} = 5.9 cfs)

Runoff generated in this basin will sheet flow over existing topography to a proposed private channel represented as section G-G on the plans. Combined flows from Basin C1 and C2 in this swale will discharge to detention Pond C via a rundown rock chute.

From Classic Consulting's FDR for Flying Horse North Filing No. 1, Basin C2 was identified as Basin CC-20. Classic's FDR reported a total basin area for CC-20 to be 39.3 acres with a Q_5= 12.9 CFS and a Q_{100}= 61.0 CFS. The cumulative flow at design point 27 (this includes basins CC-15 and CC-20) shown in this report have a net area of 52.1 acres, a net Q_5= 17.2 CFS, and a net Q_{100}= 81 CFS. See the statement preceding Basin A1 description for an explanation of discrepancies between values reported here and values reported in Classic Consulting's 2018 FDR.

Proposed Basin C3: 21.39 acres, undeveloped / roadway (minor collector) / residential (2.5 acre lots) (Q_5 = 11.3 cfs, Q_{100} = 50.6 cfs)

Runoff generated in this basin mostly sheet flows to Pond C over existing topography. A portion of this basin flows through Fringe Place and is collected in the roadside ditches before traveling through a proposed 18-inch culvert (Culvert 10) to outfall towards Pond C. The concentrated flow from this culvert will outfall to a level spreader to change the flow from concentrated flow to sheet flow to travel the rest of the way to the pond. Flow within the pond will travel via trickle channels and outfall through a private Modified Type-C Outlet Structure. The reduced 100-year flow outfalling from Pond C is 57.4 cfs

Proposed Basin C4: 4.31 acres, residential (2.5 acre lots) (Q_5 = 2.9 cfs, Q_{100} = 11.9 cfs)

Runoff in from this basin is generated completely within the proposed 2.5-acre lots. The runoff will follow existing drainage patterns and sheet flow directly offsite to the north. Pond C has volume capacity for over-detention of this basin. This area is included in the large lot exclusion (ECM I.7.1.B.5) and are excluded from water quality treatment requirements. The proposed flow leaving this site is significantly higher than the flow leaving the site in the existing conditions when doing a direct comparison analysis. This is due to the increase in imperviousness from 2% in the undeveloped land use condition, to 11% in the residential land use condition. However, a SWMM model has been developed to analyze the discharge from the site in the historic condition and the developed condition. There was an issue within the rational sheet and the incorrect C factor was being used for the existing conditions calculations. This issue has been resolved and the difference in flow rates is much less significant now. Further discussion has been added to the report to discuss any differences between proposed and existing conditions at these locations. As shown in the detention pond summary table in Appendix D, the overall post development discharge from basin C is 73.2 CFS which is less than overall predevelopment discharge from basin C of 78 CFS. As mentioned before, Pond C has volume capacity for over-detention for Basin C4 to ensure that the discharge from the site will remain at or below historical rates. Additionally, channel analysis has been done to ensure that the existing channel can handle the increase in offsite flows at design point C4. See channel calculations for Section M-M in Appendix C as well as the cross-section on sheet DR5 in the drainage plans.

Proposed Basin C5: 2.27 acres, residential (2.5 acre lots) (Q_5 = 1.4 cfs, Q_{100} = 5.7 cfs)

Runoff in from this basin is generated on existing ground cover. The runoff will follow existing drainage patterns and sheet flow directly offsite to the north to existing channels and tributaries. Pond C has volume capacity for over-detention of this basin. This area is included in the large lot exclusion (ECM I.7.1.B.5) and are excluded from water quality treatment requirements. The proposed flow leaving this site is significantly higher than the flow leaving the site in the existing conditions when doing a direct comparison analysis. This is due to the increase in imperviousness from 2% in the undeveloped land use condition, to 11% in the residential land use condition. However, a SWMM model has been developed to analyze the discharge from the site in the historic condition and the developed condition. There was an issue within the rational sheet and the incorrect C factor was being used for the existing conditions calculations. This issue has been resolved and the difference in flow rates is much less significant now. Further discussion has been added to the report to discuss any differences between proposed and existing conditions at these locations. As shown in the detention pond summary table in Appendix D, the overall post development discharge from basin C is 73.2 CFS which is less than overall predevelopment discharge from basin C of 78 CFS. As mentioned before, Pond C has volume capacity for over-detention for Basin C5 to ensure that the discharge from the site will remain at or below historical rates. Additionally, channel analysis has been done to ensure that the existing channel can handle the increase in offsite flows at design point C5. See channel calculations for Section L-L in Appendix C as well as the cross-section on sheet DR5 in the drainage plans.

Proposed Basin F1: 12.18 acres, residential (2.5 acre lots) (Q_5 = 7.3 cfs, Q_{100} = 30.0 cfs)

Runoff generated in this basin will sheet flow across existing topography and flow in the proposed roadside ditches along Rubble Drive and existing roadside ditches along Old Stagecoach Road. Flows from this basin will eventually travel through an existing public 30-inch culvert under Old Stagecoach Road and outfall to the north where it will continue to follow existing drainage conditions. Runoff from this basin is anticipated to be collected in a future detention pond that is to be built with the future filing to the north of Filing No. 4. Before this future filing is constructed and the detention pond is functioning, the discharge from Basin F1 will be collected in a temporary sediment basin to the north. Runoff will outfall from the existing culvert and follow natural tertiary swales before being collected in the temporary sediment basin located to the north of Old Stagecoach Road.

From Classic Consulting's FDR for Flying Horse North Filing No. 1, Basin F1 was identified as Basin CC-16. Classic's FDR reported a total basin area for CC-16 to be 16.3 acres with a Q_5= 4.6 CFS and a Q_{100}= 23.6 CFS. These differences in flows are due to the discrepancies in methodology between reports. Although the flows in this report are higher, analysis has been completed to ensure the downstream infrastructure is adequately sized to pass these increased flows.

Proposed Basin F2: 13.89 acres, residential (2.5 acre lots) (Q_5 = 8.1 cfs, Q_{100} = 33.3 cfs)

Runoff generated in this basin will sheet flow across existing topography and flow in the existing roadside ditches along Old Stagecoach Road to the east until eventually flowing to the north under the road through a proposed public dual 36-inch culvert. Runoff from this basin is anticipated to be collected in a future detention pond that is to be built with the future filing to the north of Filing No. 4. Before this future filing is constructed and the detention pond is functioning, the discharge from Basin F2 will be collected in a temporary sediment basin to the north. Runoff will outfall from the existing culvert and follow natural tertiary swales before being collected in the temporary sediment basin located to the north of Old Stagecoach Road.

Proposed Basin F3: 16.74 acres, undeveloped (Q_5 = 4.5 cfs, Q_{100} = 11.4 cfs)

Runoff generated in this basin will sheet flow across existing topography and flow in the existing roadside ditches along Old Stagecoach Road to the east until eventually flowing to the north under the road through a proposed public dual 36-inch culvert. Runoff from this basin is anticipated to be collected in a future detention pond that is to be built with the future filing to the north of Filing No. 4. Before this future filing is constructed and the detention pond is functioning, the combined discharge from Basin F2 and F3 will be collected in a temporary sediment basin to the north. Runoff will outfall from the proposed culvert and follow natural tertiary swales before being collected in the temporary sediment basin located to the north of Old Stagecoach Road.

Proposed Basin G1: 2.55 acres, residential (2.5 acre lots) (Q_5 = 1.7 cfs, Q_{100} = 6.8 cfs)

Runoff from this basin will sheet flow over existing topography through proposed 2.5-acre lots. The runoff will follow existing drainage patterns and sheet flow to the east and be collected in an existing tertiary swale in Basin G2. This area is included in the large lot exclusion (ECM I.7.1.B.5) and are excluded from water quality treatment requirements.

Proposed Basin G2: 4.42 acres, roadway (minor arterial) (Q_5 = 1.3 cfs, Q_{100} = 9.7 cfs)

Runoff in from this basin is generated on existing ground cover. The runoff will follow existing drainage patterns and travel shallow concentrated flow through an existing tertiary swale to an existing stock pond that has no records or design plans. Runoff will continue to an existing private channel represented as D-D on the plans.

Proposed Basin H1: 5.20 acres, residential (2.5 acre lots) (Q_5 = 3.4 cfs, Q_{100} = 13.9 cfs)

Runoff generated in this basin sheet flows from west to east through proposed 2.5 acre-lots and travels shallow concentrated flow in the proposed roadside ditches on the west side of Rubble Drive. The flows are directed to the east under Rubble Drive through a proposed public 18-inch RCP culvert (Culvert 5) to

Basin H2. The majority of this basin area is included in the large lot exclusion (ECM I.7.1.B.5) and is excluded from water quality treatment requirements. 0.28 acres of this basin is roadway grading and is also excluded from the water quality volume standard (ECM I.7.1.C.1) as the total area from Basin H1 and Basin H2 leaving the site is less than 1 acre.

Proposed Basin H2: 14.46 acres, residential (2.5 acre lots) (Q_5 = 9.1 cfs, Q_{100} = 37.5 cfs)

Runoff generated in this basin sheet flows through 2.5-acre lots and travels shallow concentrated flow in an existing private channel represented as section C-C on the plans. The majority of this basin area is included in the large lot exclusion (ECM I.7.1.B.5) and is excluded from water quality treatment requirements. 0.28 acres of this basin is roadway grading and is also excluded from the water quality volume standard (ECM I.7.1.C.1) as the total area from Basin H1 and Basin H2 leaving the site is less than 1 acre.

Proposed Basin H3: 36.80 acres, roadway (minor arterial) (Q_5 = 9.1 CFS, Q_{100} = 66.9 CFS)

Runoff generated in this basin is offsite flow collected in an existing private channel that captures all the flows from Basins G1 and G2 and Basins H1 and H2. This existing channel follows existing drainage patterns and is represented as section D-D on the plan.

Proposed Basin R1: 0.92 acres, undeveloped / roadway (Q_5 = 2.4 cfs, Q_{100} = 4.5 cfs)

Runoff generated in this basin briefly flows over existing topography through native grass and flows across redeveloped roadway from the south to the north. The existing slopes along the roadway range from 0.5% to 3.0%. The area within this basin is excluded from post-construction stormwater management as defined in the MS4 permit part I E.4.a.i.(B) that states if the site adds less than 1 acre of paved area per mile it is excluded roadway development.

Runoff Comparison of Existing and Proposed Conditions			
Historic Design Point	**Proposed Design Point**	**Historic Q_{100} (cfs)**	**Proposed Q_{100} (cfs)**
A2 + H1	A7	267.4	248.5
B1+B2+B3+B4	B4	262.7	262.4
C2+C3+C4	C3	78	73.2

*Summary of routing included in Appendix D

b. Water Quality and Detention Facilities

There are three Full Spectrum Detention ponds that are proposed within this filing. Full Spectrum Detention (FSD) is a design concept introduced by the Mile High Flood District (MHFD, Urbonas and Wulliman 2005) that provides better control of the full range of runoff rates that pass through detention facilities than the conventional multi-stage concept. This concept also provides some mitigation of increased runoff volumes by releasing a portion of the increased runoff volume at a low rate over an extended period of time. Site detention ponds are designed as FSDs to provide the required volume stages for Water Quality Capture Volume (WQCV), Excess Urban Runoff Volume (EURV), and the 100-year stage (flood control volume). In FSDs, the flood volume is equal to the entire volume and is inclusive of the EURV and the WQCV.

Areas tributary to storage facilities are greater than 5 acres. Therefore, detention volumes have been determined using the CUHP/MHFD SWMM methodology. When multiple basins are tributary to a single pond, basins are first routed together within the SWMM program to develop a combined detention pond inflow hydrograph. The hydrographs were then added to a Mile High Flood District MHFD-Detention workbook for each pond. Then the release curve / estimated outlet condition was adjusted until the desired peak pond outflow was achieved. Once the 100-year peak release rate was confirmed, resultant stage-release curves were transferred back to the prepared SWMMs and re-run to confirm the similar results as found with the MHFD-Detention analysis.

The MHFD-Detention workbook is utilized to design the outlet structures with orifice plates and restrictor plates. The outlet structures and plates are designed to achieve the target release rates of the various stages: WQCV at 40 hours, and EURV and 100-year release rates within the requisite 120 hours, with the goal of being in the range of 52 to 72 hours, as feasible for the runoff conditions. The developed condition outlet flow rates are not to exceed predeveloped conditions, and over-detention is provided within the three ponds to account for sub-basins that drain directly offsite without capture per the existing drainage patterns of the site.

The ponds include the required infrastructure such as concrete forebays, an emergency spillway with rip-rap weirs, concrete trickle channels, and a 2.5-foot depth micro-pool attached to the outlet structure. Ponds include 15'-20' width maintenance paths with vehicular access to the bottom of pond to access forebays and outlet structures for continued maintenance. The pathways have access from the public right-of-way and proper turning radii and longitudinal and cross slopes for a maintenance vehicle. The ponds include 1.0-foot of freeboard to the emergency spillway berm of the pond with the crest elevation at or above the 100-year water surface elevation. The spillways are sized with a trapezoidal weir for the 100-year inflow with rip-rap prescribed for the outflow velocity as energy dissipation.

The proposed ponds are described below.

Pond A (Design Point A5) provides WQCV and EURV for the stormwater runoff from the A basins and includes over-detention to account for nearby sub-basins that drain directly offsite to ensure that the released stormwater to downstream properties and infrastructure is equal to or less than historical runoff. This is confirmed by comparing the routed peak flows of similar basins in the historic condition, to the routed peak flows inclusive of detention in the developed condition. Both historic and developed SWMM models note this location as O_BASIN_H and modeling results at this location are included in the table below.

The A basins include areas of upstream offsite developed single-family residence RR-5 lots, undeveloped open space area, onsite developed area for proposed 2.5-acre single-family residential lots and rural local residential roadways. The pond includes a minimum 1.0-foot of freeboard to the top of berm and the 100-year water surface elevation is below the crest of the emergency spillway weir.

The MHFD-Detention / SWMM analysis yields the following pond sizing results:

Proposed Pond A

(Ownership and maintenance by the Flying Horse North HOA)

WQCV (ac-ft)	EURV (ac-ft)	100-year / Total Volume (ac-ft)
0.53	0.83	2.23

Pond A hydraulics are summarized in the following table:

	Peak Inflow (cfs)	Design Release / Outflow (cfs)	Time to Drain 99% of Inflow Volume (hrs)	Historic Peak Flowrate at O_BASIN_H	Developed Peak Flowrate at O_BASIN_H
Minor Storm (Q5)	42.5	31.3	52	52	38
Major Storm (Q100)	183.8	156.0	41	267	249

Pond A includes a concrete forebay sized for the required volume of the inflow, a 4-foot width concrete trickle channel with 6" vertical concrete curb, a 2.5-foot depth concrete micro pool, and an outlet structure that is includes a top trash rack, orifice plate, and restrictor plate on the outlet pipe.

Pond B (Design Point B) provides WQCV and EURV for the stormwater runoff from the B basins as well as over-detention of nearby sub-basins that drain directly offsite and converge with the ultimate downstream drainageway that Pond B outfalls to. This is confirmed by comparing the routed peak flows of similar basins in the historic condition, to the routed peak flows inclusive of detention in the developed condition. Both historic and developed SWMM models note this location as O_BASIN_B and modeling results at this location are included in the table below.

It is noted that the B basins include future developed conditions for a future Filing No. 5 so that this future development may be designed and constructed to drain to Pond B with minimal future improvements or retrofits to the pond.

The B basins consist of Filing No. 4 site area for 2.5-acre single-family residential development and local rural residential roadways. The pond includes a minimum 1.0-foot of freeboard to the top of berm and the 100-year water surface elevation is below the crest of the emergency spillway weir.

The MHFD-Detention / SWMM analysis yields the following pond sizing results:

Proposed Pond B

(Ownership and maintenance by the Flying Horse North HOA)

WQCV (ac-ft)	EURV (ac-ft)	100-year / Total Volume (ac-ft)
0.50	0.81	2.17

Pond B hydraulics are described in the following table:

	Peak Inflow (cfs)	Design Release/Outflow (cfs)	Time to Drain 99% of Inflow Volume (hrs)	Historic Peak Flowrate at O_BASIN_B	Developed Peak Flowrate at O_BASIN_B
Minor Storm (Q5)	59.1	49.2	50	58	54
Major Storm (Q100)	247.1	216.0	36	263	262

Pond B includes a concrete forebay sized for the required volume of the inflow, a 4-foot width concrete trickle channel with 6” vertical concrete curb, a 2.5-foot depth concrete micro pool, and an outlet structure that is includes a top trash rack, orifice plate, and restrictor plate on the outlet pipe.

Pond C (Design Point C) provides WQCV and EURV for the stormwater runoff from the C basins as well as over-detention of nearby sub-basins that drain directly offsite and converge with the ultimate downstream drainageway that Pond C outfalls to. This is confirmed by comparing the routed peak flows of similar basins in the historic condition, to the routed peak flows inclusive of detention in the developed condition. Both historic and developed SWMM models note this location as O_BASIN_C and modeling results at this location are included in the table below.

Proposed Pond C

(Ownership and maintenance by the Flying Horse North HOA)

WQCV (ac-ft)	EURV (ac-ft)	100-year / Total Volume (ac-ft)
0.23	0.39	0.90

Pond C hydraulics are described in the following table:

	Peak Inflow (cfs)	Design Release/Outflow (cfs)	Time to Drain 99% of Inflow Volume (hrs)	Historic Peak Flowrate at O_BASIN_C	Developed Peak Flowrate at O_BASIN_C
Minor Storm (Q5)	18.0	10.2	59	19	11
Major Storm (Q100)	69.0	62.4	50	78	73

Pond C includes a concrete forebay sized for the required volume of the inflow, a 4-foot width concrete trickle channel with 6” vertical concrete curb, a 2.5-foot depth concrete micro pool, and an outlet structure that is includes a top trash rack, orifice plate, and restrictor plate on the outlet pipe.

A comparison of the existing conditions as identified in the 2022 MDDP, and proposed conditions releasing off-site from the identified Filing No. 4 boundary into Cherry Creek is provided below to show that the detention being provided on site from the proposed ponds in Filing No. 4 will negate any impact downstream.

Basin ID	Existing Conditions (HRG MDDP 2022)	Proposed Conditions (HRG Filing 4 FDR 2024)
Cherry Creek	371.2 CFS	24.0 CFS

c. Methodology

Design rainfall was determined utilizing Table 6-2 from the City of Colorado Springs Drainage Criteria Manual to determine the 5-year and 100-year rainfall values for the 1-hour events. The 1-hour rainfall depths are 1.5 and 2.52 in/hr respectively.

The proposed development will consist of 48 2.5-acre single-family residential estate lots which are assumed at a percent imperviousness of 11% per the County ECM Table 3-1 Typical Values of Percent Impervious within Appendix L of the ECM which provides guidance for larger rural lot developments. Existing golf course areas are to remain undisturbed and utilize a land use category of "lawn" with a percent imperviousness of 2% per the County ECM Table 6-6 land use table. Composite coefficients, rainfall intensities, and runoff flow rates are calculated on a Rational Method spreadsheet and provided within the Appendix. As discussed previously, the Rational Method used in this report will result in higher peak flow rates for the minor and major storm events as compared to the 2018 Classic Consulting FDR/PDR which utilized the NRCS Curve Number Method. Design points within Filing No. 4 are designed per the findings of this report which utilizes the Rational Method and CUHP/SWMM modeling.

Mile High Flood District (MHFD) UD-BMP Runoff Reduction calculations are provided to demonstrate WQCV reduction for the sub-basins that drain directly offsite, however the sub-basins that drain directly off-site do fall under ECM code I.7.1.B.5, which excludes areas of "large lots" to require water quality.

Areas tributary to storage facilities are greater than 5 acres. Therefore, detention volumes have been determined using the CUHP/MHFD SWMM methodology. When multiple basins are tributary to a single pond, basins are first routed together within the SWMM program to develop a combined detention pond inflow hydrograph. The hydrographs were then added to a MHFD-Detention workbook for each pond. Then the release curve / estimated outlet condition was adjusted until the desired peak pond outflow was achieved. Once the 100-year peak release rate was confirmed, resultant stage-release curves were transferred back to the prepared SWMMs and re-run to confirm the similar results as found with the MHFD-Detention analysis.

The MHFD-Detention workbook is utilized to design the outlet structures with orifice plates and restrictor plates. The outlet structures and plates are designed to achieve the target release rates of the various stages: WQCV at 40 hours, and EURV and 100-year release rates within the requisite 120 hours, with the goal of being in the range of 52 to 72 hours, as feasible for the runoff conditions.

Reference to the 2018 Classic Consulting PDR/FDR set of calculations and spreadsheets is included to demonstrate compliance and consistency with the previously approved report which anticipated similar land uses and basin acreages tributary to existing stormwater facilities.

IV. Hydraulic Analysis

a. Major Drainageways

There are no major drainageways that exist within the development of Filing No. 4; however, small tertiary tributaries are within the site currently and function to convey flows to unnamed tributaries. These tertiary drainage ways are analyzed within this report to assess the water surface elevation within the swales during the 100-year storm event and determine buildability of lots adjacent to these sections. Roadside swales are to be constructed at a minimum to meet the typical roadway section (4:1 for 10' and 3:1 for 9' resulting in a total swale depth of 2.5’). The roadside swales are assessed along the roadways that capture sub-basins and result in cumulative flow. All of the proposed roadside swales will be installed with lining. The existing channel, labeled as Section A-A on the Drainage Plans will be installed with lining. The proposed tertiary swales label as Section F-F, G-G, H-H, and I-I on the Drainage Plans will also be armored with lining. See Appendix C for all swale and channel lining calculations.

b. Storm Sewer Infrastructure and Culvert Pipes

The Filing No. 4 development consists of rural development with 2.5-acre single family residential estate lots and rural roadway sections with roadside swales. The storm infrastructure within these areas consist of public culvert pipes for roadway crossings and consideration for future public culvert pipes for future driveways for each lot. Culvert calculations and graphics are provided within the Appendix of this report to demonstrate culvert capacities and show any roadway/driveway overtopping as a result of peak flows. The culverts are designed to have full capacity of the minor (5-year) storm event and a maximum of 4” of roadway or driveway pooling during the major (100-year) storm event.

The level spreader located in Basin C3 to disperse concentrated flow from Culvert 12 to sheet flow was designed using the criteria outlined in the Mile High Flood District Criteria Manual, Volume 3. The width of the level spreader was calculated using the 2-year flow from the tributary area in the following equation:

$$W = Q_2 / 0.05$$

A 2-year of 0.9 cfs was used to provide a width of 18 feet. The minimum length of 14 feet was used.

V. Environmental Evaluations

a. Significant Existing or Potential Wetland and Riparian Areas Impacts

As part of this work, the developer has engaged Bristlecone Ecology, LLC to perform environmental studies of the site that will be submitted with the planning documents. These documents have been included in the greater 2016 PUD as well as previous Final Plat filings. Major information in the report concerning wetlands concludes that there is a wetland associated with Black Squirrel Creek. Black Squirrel Creek is known to be a jurisdictional stream. This filing does not include this drainage basin.

At this time, there are no improvements proposed for Black Squirrel Creek. The minimal impact to the stream will keep the natural habitat intact and the natural function of the Creek as it is to maintain the wetland habitat.

b. Stormwater Quality Considerations and Proposed Practices

As part of the development, full spectrum detention facilities will be installed to provide water quality for the development. The facilities are designed using El Paso County criteria and provide stormwater quality by slowing the release of stormwater captured by the ponds and allowing solids to settle out. Additionally, when possible, the existing natural drainage ways will be used to convey stormwater to more closely mimic the natural hydrologic and hydraulic cycle. Some of the drainage ways will be used to convey water to the ponds and others will receive water from the ponds and in both scenarios will provide additional water quality benefits.

On site practices for the estate homes includes direct discharge of roof and hardscape runoff to the surrounding landscaped areas. This would include discharge of the gutters onto landscape areas vs. directly connecting to storm sewer and as discussed above as well using natural ditches and swales where it is logical and makes sense to convey stormwater in lieu of storm sewer piping.

c. Permitting Requirements

When work infringes upon the wetlands or floodplain a 404 Permit will be required. If the work within the waterways is minimal, it will likely be covered under a nationwide 404 permit; it is however possible that an individual permit will be required.

The Colorado Department of Public Health and Environment will require permits for any disturbance that exceeds 1 acre of land. Should groundwater be encountered, a dewatering permit will also be required.

El Paso County will require an Erosion and Stormwater Quality Control Permit, and any other construction permits required to complete the construction of the site.

Should development occur which affects the floodplain, FEMA will require a permit for work withing the floodplain prior to the commencement of any construction or development within any special flood hazard area (SFHA). If the infrastructure is to be installed within the channel the designer shall route the design through the proper FEMA channels whether that be with a no rise certification or via the CLOMR/LOMR process should a more major improvement within the floodplain be proposed. At this time the project does not propose any direct development within the floodplain, however storm infrastructure will discharge into the existing FEMA channel.

d. 4-Step Process

In accordance with the Engineering Criteria Manual I.7.2.A and DCM V2, this site has implemented the four-step process to minimize adverse impacts of urbanization. The four-step process includes reducing runoff volumes, stabilizing drainageways, treating the water quality capture volume, and considering the need for Industrial Commercial BMPs.

Step 1 – Reducing Runoff Volumes: Disturbed areas on site are routed to one of the three proposed detention ponds on site, Pond A, Pond B, or Pond C. The runoff reduction volumes for the disturbed areas are provided in these ponds. The areas that are not disturbed and drain directly offsite fall within the large lot exclusion under ECM code I.7.1.B.5 and are excluded from runoff reduction.

Step 2 – Stabilize Drainageways: The existing tertiary drainage ways are assessed for stormwater runoff capacity, velocity, and shear stress. Any altered drainage ways will be designed in a manner that provides water quality benefits through infiltration and the removal of pollutants via phytoremediation. Vegetation and/or matting will also be selected to stabilize the drainage ways by reducing the velocity of flows and decreasing any scour. These improvements help stabilize drainageways and minimize erosion and sediment runoff. Roadside ditches are stabilized swales by way of compaction per the roadway typical section and are also prescribed any required seeding, erosion control blanketing, and/or matting.

Step 3 – Provide WQCV: Runoff from this development is treated through capture and slow release of the WQCV via detention ponds that are designed per current El Paso County DCM V2 and the MHFD. Proposed ponds A, B and C provide WQCV for their respective tributary basins. 77% of the site includes disturbed areas that are routed through the proposed detention ponds and outfall to the East Cherry

Creek Basin. 23% of the site is not disturbed and flows directly offsite. These areas are not tributary to a detention pond have been proven to be excluded from WQCV requirements as they fall under the "large lot" exclusion I.7.1.B.5 of the El Paso County ECM. While runoff reduction is not required for these areas, it is being provided with well managed stormwater practices. The areas that fall under the exclusion under I.7.1.B.5 of the El Paso County ECM may not exceed 10 percent imperviousness unless a study specific to the watershed and/or MS4 shows that expected soil and vegetation conditions are suitable for infiltration/filtration of the WQCV for a typical site, and the permittee accepts such study as applicable with the MS4 boundaries. The maximum total lot impervious covered under this exclusion shall be 20 percent. 1 acre of disturbed area on site is excluded from water quality treatment per El Paso County ECM I.7.1.C.1 and flows directly off site. There are 2.30 acres of disturbed area that runs directly offsite and is not included under the exclusion I.7.1.B.5 or I.7.1.C.1. This area is identified as Separate Pervious Areas (SPA) and does not receive runoff from impervious areas. Additionally, 0.92 acres of disturbed area along Black Forest Road is excluded from water quality treatment as defined in the MS4 permit part I E.4.a.i.(B) that states if the site adds less than 1 acre of paved area per mile it is excluded roadway development.

Step 4 – Consider the need for Industrial and Commercial BMP's: A site specific storm water quality and erosion control plan and narrative will be prepared with subsequent land use approvals prepared in conjunction with the report prior to any construction. Site specific temporary source control BMPs as well as permanent BMPs are detailed in this plan and narrative. Guidelines detailed in the El Paso DCM V2 4.2 pertaining to the covering and storage handline and spill containment and control shall be followed as necessary. This filing does not contain any commercial or industrial land use.

VI. Drawings

Please refer to the appendices for the Vicinity Map, FEMA Floodplain Map, NRCS Soils Map, hydrology and hydraulic calculations, and drainage basin maps. Reference materials from previously approved reports are included in the appendix including the 2018 Classic Consulting FDR/PDR calculations and drainage maps.

VII. Drainage and Bridge Fees

The East Cherry Creek Basin does not currently have a Drainage Basin Fee.

VIII. Permanent Control Measure Cost Estimates

There are three (3) permanent, private full-spectrum detention ponds within Filing No. 4. A cost estimate of the construction and infrastructure for each respective pond is provided below and reflected in the Financial Assurances Estimate for the filing.

Pond A - Cost Estimate for Permanent Control Measure				
Item (All Private)	**Quantity**	**Unit**	**$/Unit**	**Total**
Earthwork (Cut)	2860	CY	$ 8.00	$ 22,880.00
Earthwork (Fill)	6930	CY	$ 5.00	$ 34,650.00
Maintenance Access Path	850	LF	$ 15.00	$ 12,750.00
Concrete Rundown	955	SF	$ 20.00	$ 19,100.00

Forebay (w/ walls, baffle wall, rebar)	990	SF	$ 25.00	$ 24,750.00
Rip-Rap *	485	CY	$ 55.00	$ 26,669.50
Trickle Channel	305	LF	$ 20.00	$ 6,100.00
Outlet Structure **	1	EA	$ 27,500.00	$ 27,500.00
Outlet Pipe (69.8 LF of 54" RCP)	69.8	LF	$ 320.00	$ 22,336.00
Outlet Pipe FES (54")	1	EA	$ 1,920.00	$ 1,920.00
			TOTAL	**$ 198,655.50**

Notes:
* Rip-Rap cost item includes forebay rip-rap, emergency spillway rip-rap, and outlet pipe outfall rip-rap. Excludes site rip-rap (swales to rundown). Includes all quantities for respective sizes and types (43.1 CY of D_{50}=9", 441.8 CY of D_{50}=18"). $/Unit is the weighted cost.

** Outlet Structure cost item includes micropool, trash rack, orifice plate, restrictor plate.

Pond B - Cost Estimate for Permanent Control Measure

Item (All Private)	Quantity	Unit	$/Unit	Total
Earthwork (Cut)	6826	CY	$ 5.00	$ 34,130.00
Earthwork (Fill)	5744	CY	$ 6.00	$ 34,464.00
Maintenance Access Path	435	LF	$ 15.00	$ 6,525.00
Concrete Rundown	1240	SF	$ 20.00	$ 24,800.00
Forebay (w/ walls, baffle wall, rebar)	900	SF	$ 25.00	$ 22,500.00
Rip-Rap *	392	CY	$ 52.50	$ 20,564.25
Trickle Channel	208	LF	$ 20.00	$ 4,160.00
Outlet Structure **	1	EA	$ 32,500.00	$ 32,500.00
Outlet Pipe (61 LF of 60" RCP)	61.0	LF	$ 374.00	$ 22,814.00
Outlet Pipe FES (60")	1	EA	$ 2,244.00	$ 2,244.00
			TOTAL	**$ 204,701.25**

Notes:
* Rip-Rap cost item includes forebay rip-rap, emergency spillway rip-rap, and outlet pipe outfall rip-rap. Excludes site rip-rap (swales to rundown). Includes all quantities for respective sizes and types (47.2 CY of D_{50}=9", 344.5 CY of D50=18"). $/Unit is the weighted cost.

** Outlet Structure cost item includes micropool, trash rack, orifice plate, restrictor plate.

Pond C - Cost Estimate for Permanent Control Measure				
Item (All Private)	**Quantity**	**Unit**	**$/Unit**	**Total**
Earthwork (Cut)	15155	CY	$ 5.00	$ 75,775.00
Earthwork (Fill)	4756	CY	$ 6.00	$ 28,536.00
Maintenance Access Path	800	LF	$ 15.00	$ 12,000.00
Concrete Rundown	715	SF	$ 20.00	$ 14,300.00
Forebay (w/ walls, baffle wall, rebar)	430	SF	$ 25.00	$ 10,750.00
Rip-Rap *	268	CY	$ 50.00	$ 13,405.00
Trickle Channel	290	LF	$ 20.00	$ 5,800.00
Outlet Structure **	1	EA	$ 17,250.00	$ 17,250.00
Outlet Pipe (46.2 LF of 36" RCP)	46.2	LF	$ 151.00	$ 6,976.20
Outlet Pipe FES (36")	1	EA	$ 906.00	$ 906.00
			TOTAL	**$ 185,698.20**

Notes:
* Rip-Rap cost item includes forebay rip-rap, emergency spillway rip-rap, and outlet pipe outfall rip-rap. Excludes site rip-rap (swales to rundown). Includes all quantities for respective sizes and types (43.1 CY of D_{50}=9", 5.6 CY of D_{50}=12", 223.6 CY of D_{50}=18") $/Unit is the weighted cost.

** Outlet Structure cost item includes micropool, trash rack, orifice plate, restrictor plate.

All pond infrastructure is private and is owned and maintained by the Flying Hose North Metropolitan District per their respective Tract ownership and maintenance assigns. All private infrastructure within these permanent control measure cost estimates are not included in Section 2 Public Improvements within the Financial Assurances Estimate form for the filing. The total of the permanent control measure financial assurances is included within Section 1 – Grading and Erosion Control (Construction and Permanent BMP's) as an added line item to represent each pond and its respective cost.

IX. Summary

Flying Horse North Filing No. 4 is a 175.8-acre single-family residential estate lot development area that will contain paved roadways and roadside ditch sections and three Full Spectrum Detention ponds.

Pond B accounts for future development within Filing No. 5, anticipated to consist of local rural residential roadways within 60' public rights-of-way and single-family residential estate lots of 2.5 acres FSDs are proposed to provide water quality and detention to release the stormwater at or below historical rates.

The Filing No. 4 final design is assessed for stormwater capacity of roadway sections, roadside swales and the existing tertiary drainage ways to ensure that development of the 2.5-acre single-family residential estate lots will not be negatively impacted by drainage conditions, including existing and proposed altered areas for the roadway and lot construction phases.

All County and MHFD drainage design standards are met. It is anticipated that there will be no negative impacts to downstream and surrounding developments and facilities due to the development of Filing No. 4.

X. References

El Paso County – Drainage Criteria Manual, 2014

City of Colorado Springs – Drainage Criteria Manual, May 2014

Urban Storm Drainage Criteria Manual, Urban Drainage Flood Control District, January 2018

Mile High Flood District Urban Storm Drainage Criteria Manual Volumes 1, 2, and 3; latest revisions

Mile High Flood District Software Resources and Tools (MHFD-Detention, UD-Inlet, UD-BMP)

United States Department of Agriculture National Resources Conservation Service Rock Chute Design Data Spreadsheet

Preliminary Drainage Report for Flying Horse North Preliminary Plan and Final Drainage Report for Flying Horse North Filing No. 1, Classic Consulting Engineers and Surveyors, November 2017

Flying Horse North Master Development Drainage Plan, HR Green Development, LLC., September 2022

Flying Horse North Irrigation Reservoir Embankment Design Report, Classic Consulting Engineers and Surveyors, latest revision June 2018, County approved on September 25, 2018

Black Squirrel Drainage Basin Planning Study (DBPS), URS Consultants, January 1989

APPENDIX A

VICINITY MAP

NRCS SOILS MAP

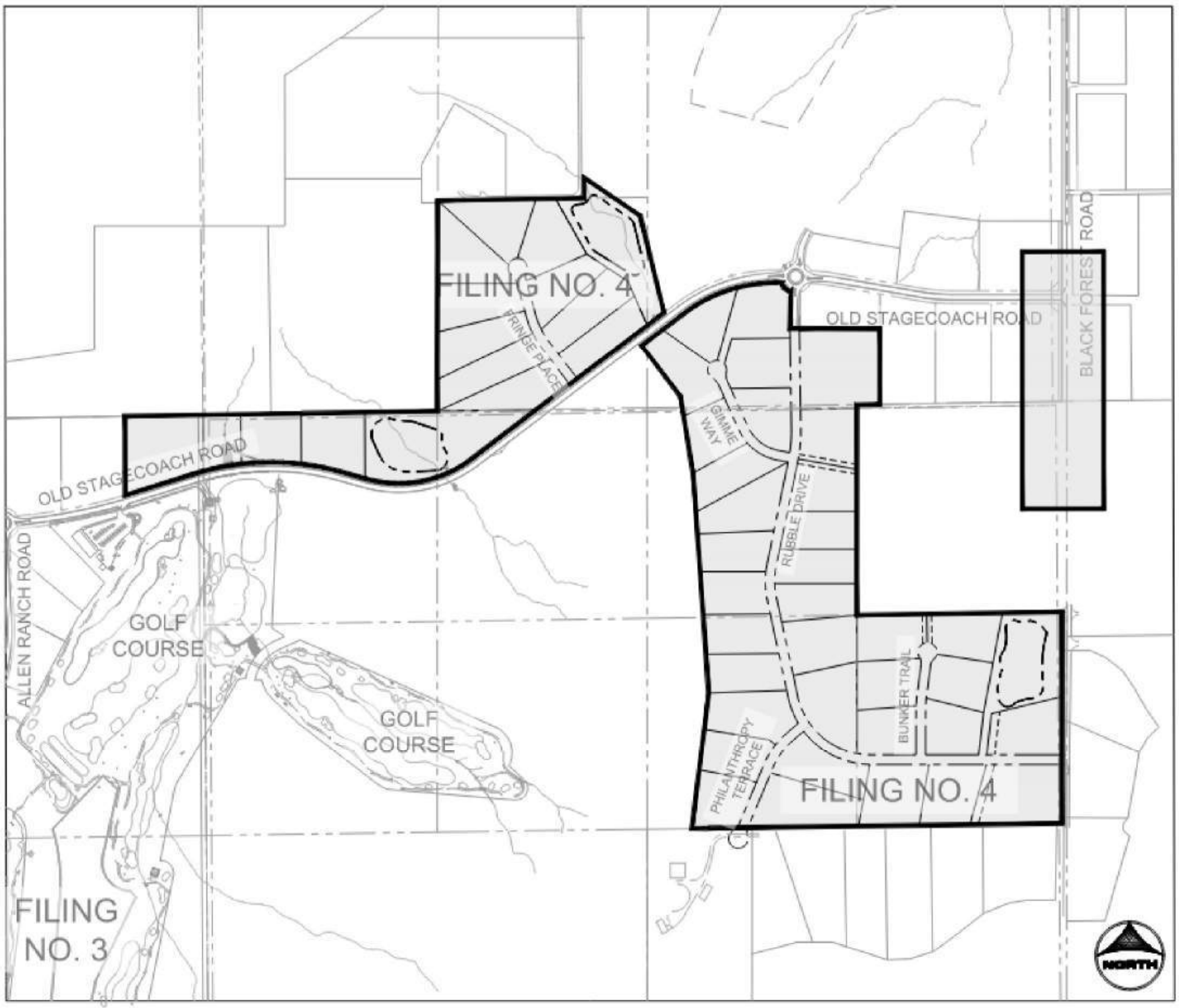
FEMA FLOODPLAIN MAP

EL PASO COUNTY MAJOR DRAINAGE BASINS MAP

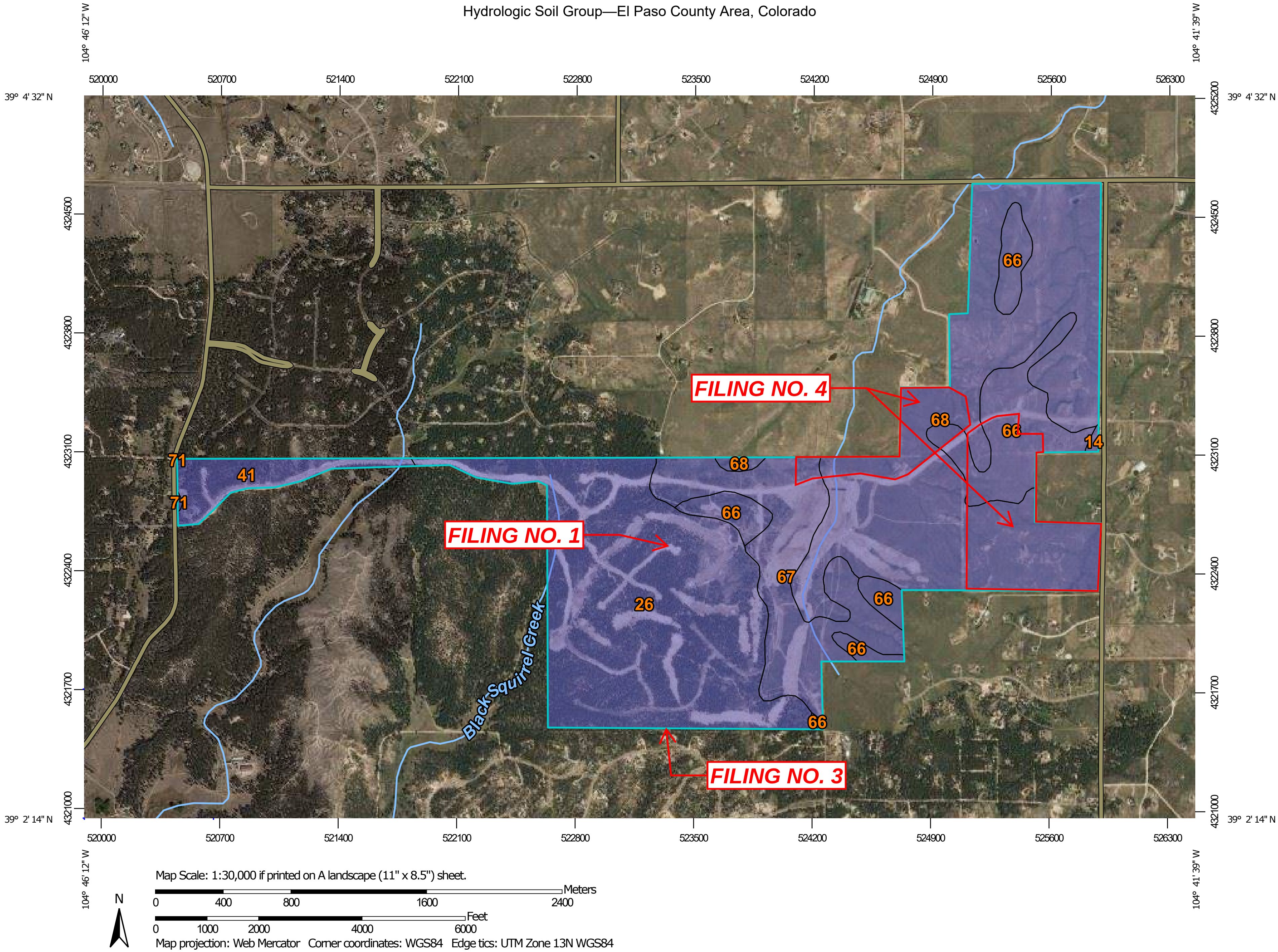
VICINITY MAP

FLYING HORSE NORTH FILING NO. 4

A PORTION OF SECTION 36, TOWNSHIP 11 SOUTH, RANGE 66 WEST OF THE SIXTH PRINCIPAL MERIDIAN COUNTY OF EL PASO, STATE OF COLORADO



NO SCALE


104° 46' 12" W
104° 41' 39" W
39° 4' 32" N
39° 2' 14" N
520000
520700
521400
522100
522800
523500
524200
524900
525600
526300
4325200
4324500
4323800
4323100
4322400
4321700
4321000
FILING NO. 4
FILING NO. 1
FILING NO. 3
Black Squirrel Creek
71
41
71
68
66
68
66
14
66
67
26
66
66
66
Map Scale: 1:30,000 if printed on A landscape (11" x 8.5") sheet.
Meters
0 400 800 1600 2400
N
Feet
0 1000 2000 4000 6000
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 19, Aug 31, 2021

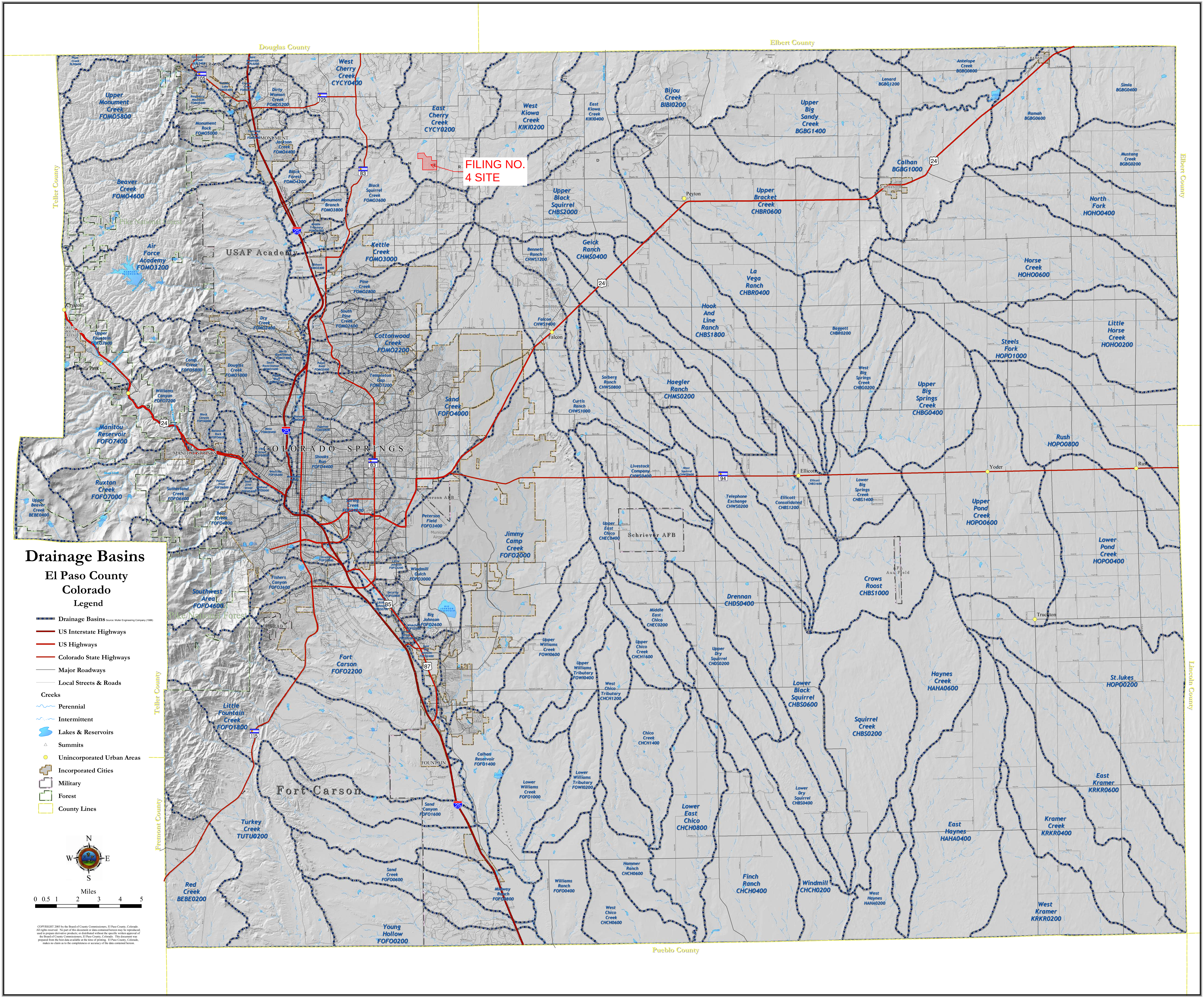
Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 19, 2018—May 26, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
14	Brussett loam, 1 to 3 percent slopes	B	1.9	0.1%
26	Elbeth sandy loam, 8 to 15 percent slopes	B	474.2	33.7%
41	Kettle gravelly loamy sand, 8 to 40 percent slopes	B	53.4	3.8%
66	Peyton sandy loam, 1 to 5 percent slopes	B	160.9	11.4%
67	Peyton sandy loam, 5 to 9 percent slopes	B	182.8	13.0%
68	Peyton-Pring complex, 3 to 8 percent slopes	B	533.4	37.9%
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	0.6	0.0%
Totals for Area of Interest			**1,407.3**	**100.0%**


Drainage Basins
El Paso County
Colorado
Legend
Drainage Basins
US Interstate Highways
US Highways
Colorado State Highways
Major Roadways
Local Streets & Roads
Creeks
Perennial
Intermittent
Lakes & Reservoirs
Summits
Unincorporated Urban Areas
Incorporated Cities
Military
Forest
County Lines
N
W
E
S
Miles
0 0.5 1 2 3 4 5
FILING NO. 4 SITE
Douglas County
Elbert County
Teller County
Fremont County
Pueblo County
Lincoln County
COLORADO SPRINGS
USAF Academy
Fort Carson
Schriever AFB
Peyton
Falcon
Ellicott
Yoder
Rush
Truckton
Calhan
Fountain
West Cherry Creek CYCY0400
East Cherry Creek CYCY0200
West Kiowa Creek KIKI0200
Bijou Creek BIBI0200
Upper Big Sandy Creek BGBG1400
Calhan BGBG1000
Upper Monument Creek FOMO5800
Beaver Creek FOMO4600
Air Force Academy FOMO3200
Upper Black Squirrel Creek CHBS2000
Upper Bracket Creek CHBR0600
Geick Ranch CHMS0400
La Vega Ranch CHBR0400
Kettle Creek FOMO3000
Hook And Line Ranch CHBS1800
Haegler Ranch CHMS0200
Cottonwood Creek FOMO2200
Sand Creek FOFO4000
Upper Big Springs Creek CHBG0400
Horse Creek HOHO0600
North Fork HOHO0400
Little Horse Creek HOHO0200
Steels Fork HOPO1000
Rush HOPO0800
Manitou Reservoir FOFO7400
Ruxton Creek FOFO7000
Jimmy Camp Creek FOFO2000
Upper Pond Creek HOPO0600
Lower Pond Creek HOPO0400
Crows Roost CHBS1000
Drennan CHBS0400
Southwest Area FOFO4600
Fort Carson FOFO2200
Little Fountain Creek FOFO1800
Lower Black Squirrel Creek CHBS0600
Haynes Creek HAHA0600
Squirrel Creek CHBS0200
St.lukes HOPO0200
East Kramer Creek KRKR0600
Lower East Chico CHCH0800
East Haynes HAHA0400
Kramer Creek KRKR0400
Turkey Creek TUTU0200
Red Creek BEBE0200
Finch Ranch CHCH0400
Windmill Creek CHCH0200
West Kramer KRKR0200
Young Hollow FOFO0200

possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

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The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

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This map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

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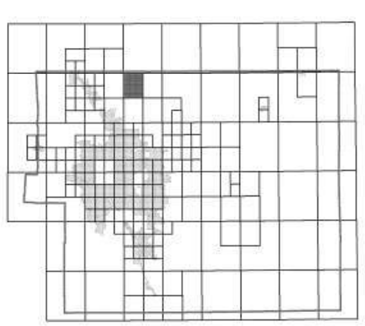
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

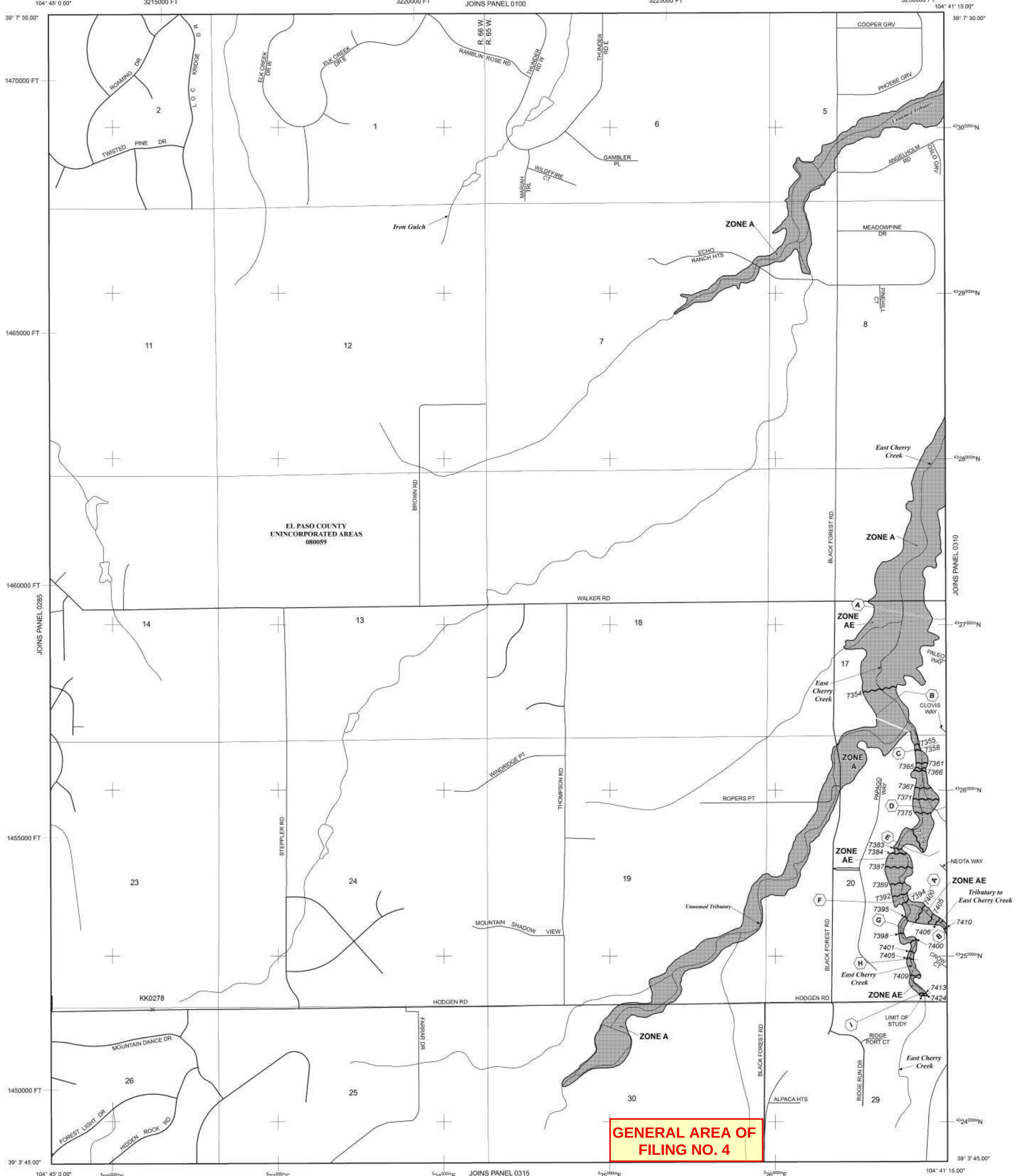
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	Floodplain boundary
	Floodway boundary
	Zone D Boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
~~ 513 ~~	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

(A)——(A)	Cross section line
(23)- - - -(23)	Transect line
97° 07' 30.00" 32° 22' 30.00"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000mN	1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT	5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

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MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0305G

FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 305 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0305	G

Notice to User: The **Map Number** shown below should be used when placing map orders: the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0305G

MAP REVISED

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

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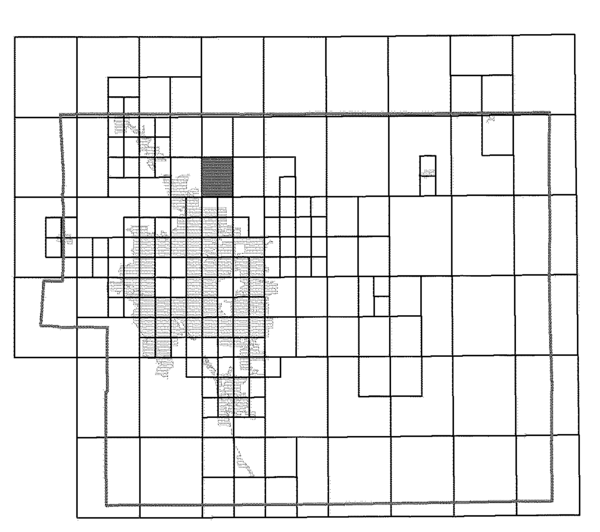

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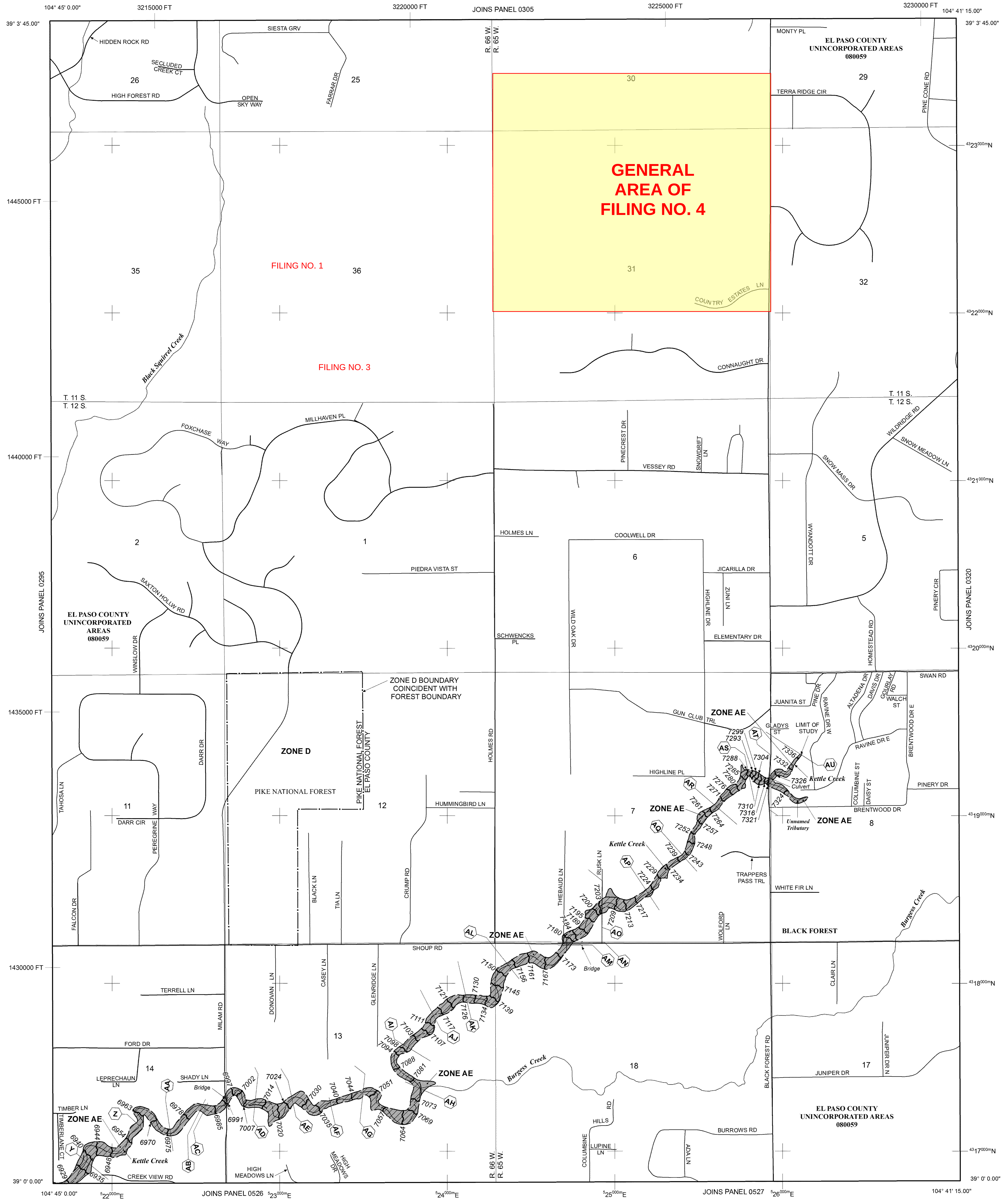

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

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Floodway boundary

Zone D Boundary

CBRS and OPA boundary

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(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

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23 - - - 23	Transect line
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● M1.5	River Mile

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EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
MARCH 17, 1997

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DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

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MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

PANEL 0315G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO

AND INCORPORATED AREAS

PANEL 315 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0315	G

Notice to User: The **Map Number** shown below should be used when placing map orders: the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0315G

MAP REVISED
DECEMBER 7, 2018

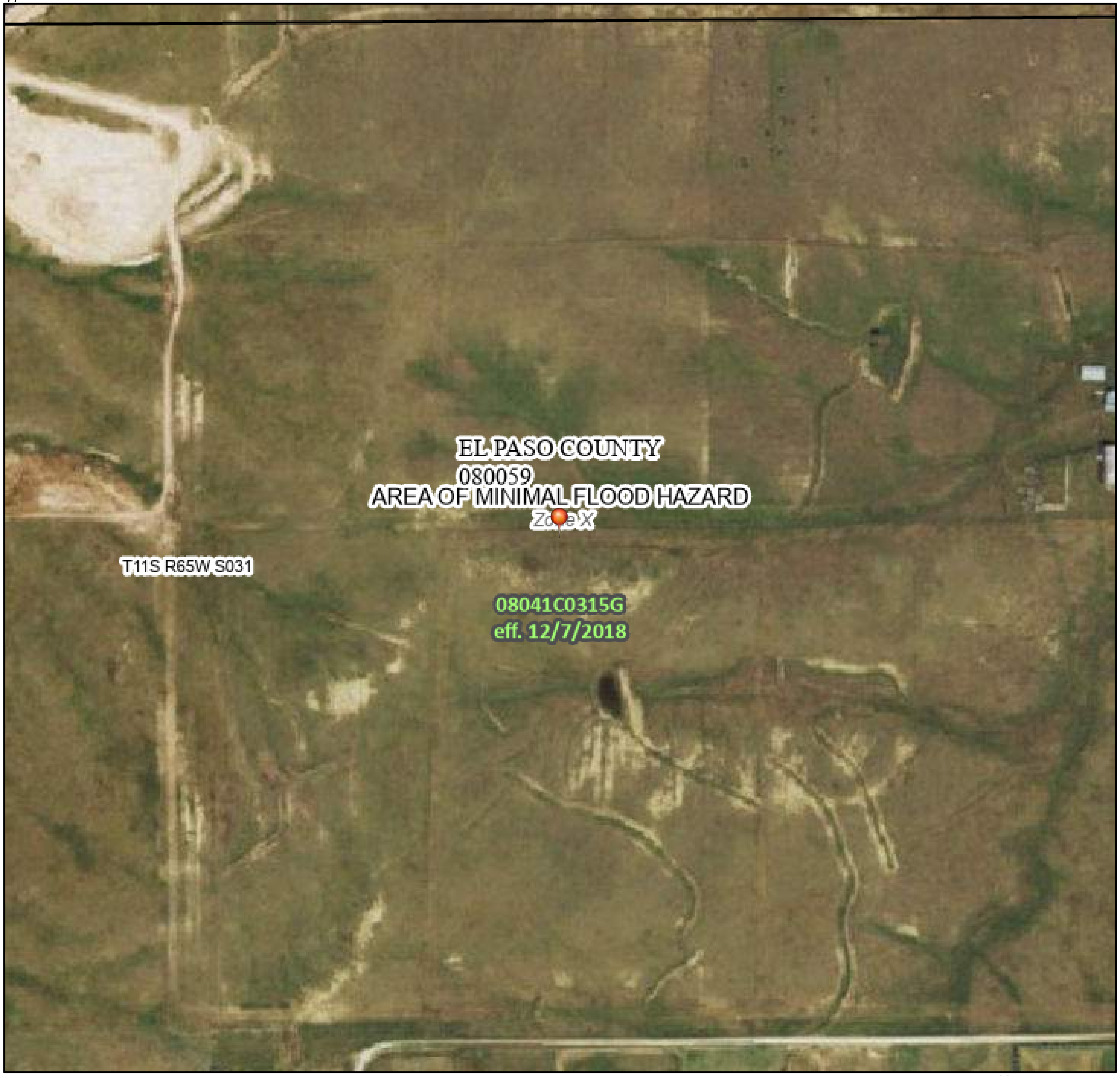
Federal Emergency Management Agency

1DWLRQDO)ORRG +DJDUG /DHU)LUPHWWH

FEMA

1DWLRQDO)ORRG+D]DUG/DHU)5OWWH

FEMA



/HJHQG

L WKRXW %DVH)ORRG (OHYDWLRQ %(
=RQH $ 9 $
L WK %(RU 'HSWK =RQH $ $2 $+ 9($5
5HJXODWRU\ )ORRGZD\

)XWXUH &RQGLWLRQV $QQXDO &KDQFH)ORRG +D]DUG =RQH ;
$UHD RI 0LQLPDO)ORRG +D]DUG =RQH ;
(IIHFWLYH /2056
$UHD RI 8QGHWHUPLQHG)ORRG +D]DUG =RQH '
&KDQQHO &XOYHUW RU 6WRUP 6HZHU
/HYHH 'LNH RU)ORRGZDOO
&URVV 6HFWLRQV ZLWK $QQXDO &KDQFH
:DWHU 6XUIDFH (OHYDWLRQ
&RDVWDO 7UDQVHFW
%DVH)ORRG (OHYDWLRQ /LQH %(
/LPLW RI 6WXG\
-XULVGLFWLRQ %RXQGDU\
&RDVWDO 7UDQVHFW %DVHOLQH
3URILOH %DVHOLQH
+\GURJUDSKLF)HDWXUH
'LJLWDO 'DWD $YDLODEOH
1R 'LJLWDO 'DWD $YDLODEOH
8QPDSSHG

)HHW

%DVHPDS ,PDJHU\ 6RXUFH 86*6 1DWLRQDO 0DS

APPENDIX B

HYDROLOGY CALCULATIONS

RATIONAL METHOD CALCULATIONS – EXISTING CONDITIONS

FLYING HORSE NORTH FILING NO. 4

EXISTING CONDITIONS

EL PASO COUNTY, COLORADO

Calc'd by:	TMM
Checked by:	RDL
Date:	1/11/2025

COMPOSITE 'C' FACTORS

BASIN	GOLF COURSE / UNDEVELOPED	ROADWAY	RESIDENTIAL (2.5 AC LOT)	RESIDENTIAL (5.0 AC LOT)	TOTAL	SOIL TYPE	GOLF COURSE / UNDEVELOPED			ROADWAY			RESIDENTIAL (2.5 AC LOT)			RESIDENTIAL (5.0 AC LOT)			COMPOSITE IMPERVIOUSNESS & C		
	ACRES						%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5*	C_{100}*	%I	C_5*	C_{100}*	%I	C_5	C_{100}
A1	71.50	0.00	0.00	0.00	71.50	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	2.0	0.08	0.35
A2	56.45	0.00	0.00	0.00	56.45	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	2.0	0.08	0.35
B1	92.08	1.53	0.00	0.00	93.60	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	3.6	0.09	0.36
B2	14.25	1.49	0.00	0.00	15.74	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	11.3	0.16	0.41
B3	11.28	0.00	0.00	0.00	11.28	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	2.0	0.08	0.35
B4	11.73	0.63	0.00	0.00	12.36	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	7.0	0.12	0.38
C1	11.53	0.94	0.00	0.00	12.47	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	9.4	0.14	0.40
C2	21.42	0.94	0.00	0.00	22.36	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	6.1	0.11	0.38
C3	4.56	0.00	0.00	0.00	4.56	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	2.0	0.08	0.35
C4	2.27	0.00	0.00	0.00	2.27	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	2.0	0.08	0.35
F1	10.80	0.28	0.00	0.00	11.08	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	4.5	0.10	0.37
F2	34.08	0.67	0.00	0.00	34.75	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	3.9	0.10	0.36
G1	7.67	0.00	0.00	0.00	7.67	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	2.0	0.08	0.35
H1	56.27	0.00	0.00	0.00	56.27	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	2.0	0.08	0.35
R1	0.44	0.49	0.00	0.00	0.92	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	10	0.14	0.39	53.7	0.51	0.67
GRAND TOTAL	**406.32**	**6.33**	**0.00**	**0.00**	**413.28**														**3.65%**	**0.12**	**0.46**

	FLYING HORSE NORTH FILING NO. 4	Calc'd by:	TMM
HRGreen	EXISTING CONDITIONS	Checked by:	RDL
	EL PASO COUNTY, COLORADO	Date:	1/10/2025

TIME OF CONCENTRATION

BASIN DATA			OVERLAND TIME (T_i)			TRAVEL TIME (T_t)					TOTAL	tc=(L/180)+10	Design tc
DESIGNATION	C_5	AREA (ac)	LENGTH (ft)	SLOPE %	t_i (min)	C_V	LENGTH (ft)	SLOPE %	V (ft/s)	t_t (min)	t_c (min)	tc max	tc design (min)
A1	0.08	71.50	300	7.0	16.9	10	908	4.00	2.0	7.6	24.5	16.7	16.7
A2	0.08	56.45	300	5.7	18.1	10	372	2.60	1.6	3.8	22.0	13.7	13.7
B1	0.09	93.60	300	4.5	19.4	10	2400	6.70	2.6	15.5	34.8	25.0	25.0
B2	0.16	15.74	300	11.4	13.3	10	2014	6.70	2.6	13.0	26.3	22.9	22.9
B3	0.08	11.28	300	6.1	17.7	10	658	5.20	2.3	4.8	22.5	15.3	15.3
B4	0.12	12.36	300	5.4	17.7	10	1238	3.80	1.9	10.6	28.3	18.5	18.5
C1	0.14	12.47	300	6.0	16.7	10	842	4.30	2.1	6.8	23.5	16.3	16.3
C2	0.11	22.36	300	5.2	18.1	10	650	5.00	2.2	4.8	22.9	15.3	15.3
C3	0.08	4.56	130	7.4	10.9	10	188	6.30	2.5	1.2	12.2	11.8	11.8
C4	0.08	2.27	300	4.5	19.6	10	494	6.70	2.6	3.2	22.8	14.4	14.4
F1	0.10	11.08	300	3.3	21.3	10	600	2.00	1.4	7.1	28.4	15.0	15.0
F2	0.10	34.75	300	3.0	22.1	10	780	3.00	1.7	7.5	29.6	16.0	16.0
G1	0.08	7.67	300	7.4	16.6	10	90	7.40	2.7	0.6	17.2	12.2	12.2
H1	0.08	56.27	166	10.1	11.1	10	268	1.20	1.1	4.1	15.2	12.4	12.4
R1	0.51	0.92	300	1.3	17.1	10	1030	1.20	1.1	15.7	32.8	17.4	17.4

	FLYING HORSE NORTH FILING NO. 4	Calc'd by:	TMM
HRGreen	EXISTING CONDITIONS	Checked by:	RDL
	DESIGN STORM: 5-YEAR	Date:	1/10/2025
			3.358889249

		DIRECT RUNOFF						TOTAL RUNOFF				REMARKS
DESIGN POINT	BASIN ID	AREA (ac)	C_5	t_c (min)	C_5*A (ac)	I (in./ hr.)	Q (cfs)	t_c (min)	C_5*A (ac)	I (in./ hr.)	Q (cfs)	
A1	A1	71.50	0.08	16.7	5.72	3.36	19.2					FLOW TO DESIGN POINT A1
A2	A2	56.45	0.08	13.7	4.52	3.65	16.5					COMBINED FLOW FROM BASINS A1 AND A2 TO DESIGN POINT A2
								16.7	10.24	3.36	34.4	
B1	B1	93.60	0.09	25.0	8.74	2.75	24.1					FLOW TO DEISGN POINT B1
B2	B2	15.74	0.16	22.9	2.48	2.89	7.2					COMBINED FLOW FROM BASINS B1 AND B2 TO DESIGN POINT B2
								25.0	11.22	2.75	30.9	
B3	B3	11.28	0.08	15.3	0.90	3.49	3.1					FLOW TO DESIGN POINT B3
B4	B4	12.36	0.12	18.5	1.51	3.20	4.8					OFFSITE FLOW TO DESIGN POINT B4
C1	C1	12.47	0.14	16.3	1.77	3.39	6.0					OFFSITE FLOW TO DESIGN POINT C1
C2	C2	22.36	0.11	15.3	2.56	3.49	8.9					COMBINED FLOW FROM BASINS C1 AND C2 TO DESIGN POINT C2
								16.3	4.33	3.39	14.7	
C3	C3	4.56	0.08	11.8	0.36	3.89	1.4					OFFSITE FLOW TO DESIGN POINT C3
C4	C4	2.27	0.08	14.4	0.18	3.58	0.7					OFFSITE FLOW TO DESIGN POINT C4
F1	F1	11.08	0.10	15.0	1.12	3.52	3.9					OFFSITE FLOW TO EXISTING CULVERT AT DESIGN POINT F1
F2	F2	34.75	0.10	16.0	3.33	3.42	11.4					OFFSITE FLOW TO EXISTING CULVERT AT DESIGN POINT F1
G1	G1	7.67	0.08	12.2	0.61	3.83	2.4					FLOW TO DESIGN POINT G1
H1	H1	56.27	0.08	12.4	4.50	3.81	17.1					COMBINED FLOW FROM BASINS G1 AND H1 TO DESIGN POINT H1
								12.4	5.12	3.81	19.5	
R1	R1	0.92	0.51	17.4	0.47	3.30	1.6					FLOW TO DPR1

HRGreen

FLYING HORSE NORTH FILING NO. 4	Calc'd by:	TMM
EXISTING CONDITIONS	Checked by:	RDL
DESIGN STORM: 100-YEAR	Date:	1/10/2025

		DIRECT RUNOFF						TOTAL RUNOFF				REMARKS
DESIGN PONT	BASIN ID	AREA (ac)	C_{100}	t_c (min)	C_{100}*A (ac)	*I* (in./ hr.)	Q (cfs)	t_c (min)	C_{100}*A (ac)	*I* (in./ hr.)	Q (cfs)	
A1	A1	71.50	0.35	16.7	25.03	5.64	141.1					FLOW TO DESIGN POINT A1
A2	A2	56.45	0.35	13.7	19.76	6.13	121.2					COMBINED FLOW FROM BASINS A1 AND A2 TO DESIGN POINT A2
								16.7	44.78	8.51	381.1	
B1	B1	93.60	0.36	25.0	33.69	4.62	155.8					FLOW TO DEISGN POINT B1
B2	B2	15.74	0.41	22.9	6.42	4.85	31.1					COMBINED FLOW FROM BASINS B1 AND B2 TO DESIGN POINT B2
								25.0	40.11	7.91	317.1	
B3	B3	11.28	0.35	15.3	3.95	5.86	23.1					FLOW TO DESIGN POINT B3
B4	B4	12.36	0.38	18.5	4.71	5.38	25.3					OFFSITE FLOW TO DESIGN POINT B4
C1	C1	12.47	0.40	16.3	4.94	5.69	28.1					OFFSITE FLOW TO DESIGN POINT C1
C2	C2	22.36	0.38	15.3	8.40	5.86	49.3					COMBINED FLOW FROM BASINS C1 AND C2 TO DESIGN POINT C2
								16.3	13.34	8.54	114.0	
C3	C3	4.56	0.35	11.8	1.60	6.52	10.4					OFFSITE FLOW TO DESIGN POINT C3
C4	C4	2.27	0.35	14.4	0.79	6.01	4.8					OFFSITE FLOW TO DESIGN POINT C4
F1	F1	11.08	0.37	15.0	4.05	5.91	23.9					OFFSITE FLOW TO EXISTING CULVERT AT DESIGN POINT F1
F2	F2	34.75	0.36	16.0	12.57	5.75	72.3					OFFSITE FLOW TO EXISTING CULVERT AT DESIGN POINT F1
G1	G1	7.67	0.35	12.2	2.68	6.44	17.3					FLOW TO DESIGN POINT G1
H1	H1	56.27	0.35	12.4	19.69	6.39	125.8					COMBINED FLOW FROM BASINS G1 AND H1 TO DESIGN POINT H1
								12.4	22.38	8.96	200.5	
R1	R1	0.92	0.67	17.4	0.62	5.54	3.4					FLOW TO DPR1

RATIONAL METHOD CALCULATIONS – DEVELOPED CONDITIONS

	FLYING HORSE NORTH FILING NO. 4															Calc'd by:					TMM
HRGreen	PROPOSED CONDITIONS															Checked by:					RDL
	EL PASO COUNTY, COLORADO															Date:					1/11/2025
COMPOSITE 'C' FACTORS																					
BASIN	GOLF COURSE / UNDEVELOPED	ROADWAY	RESIDENTIAL (2.5 AC LOT)	RESIDENTIAL (5.0 AC LOT)	TOTAL	SOIL TYPE	GOLF COURSE / UNDEVELOPED			ROADWAY			RESIDENTIAL (2.5 AC LOT)			RESIDENTIAL (5.0 AC LOT)			COMPOSITE IMPERVIOUSNESS & C FACTOR		
	ACRES						%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5*	C_{100}*	%I	C_5*	C_{100}*	%I	C_5	C_{100}
A1	1.02	0.00	8.55	0.00	9.57	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	10.0	0.16	0.41
A2	0.00	0.00	10.79	0.00	10.79	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	11.0	0.17	0.42
A3	42.91	0.00	0.00	29.83	72.74	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	4.1	0.10	0.37
A4	0.00	0.00	18.39	0.00	18.39	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	11.0	0.17	0.42
A5	0.00	0.00	6.10	0.00	6.10	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	11.0	0.17	0.42
A6	0.00	0.00	2.76	0.00	2.76	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	11.0	0.17	0.42
A7	0.00	0.00	8.11	0.00	8.11	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	11.0	0.17	0.42
B1	48.37	0.41	9.00	0.00	57.78	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	4.1	0.10	0.36
B2	0.00	0.28	35.49	0.00	35.77	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	11.7	0.18	0.42
B3	0.00	0.28	0.82	0.00	1.10	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	33.7	0.36	0.56
B4	0.00	0.65	10.35	0.00	11.00	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	16.3	0.21	0.45
B5	0.00	0.00	10.62	0.00	10.62	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	11.0	0.17	0.42
B6	0.00	0.00	15.96	0.00	15.96	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	11.0	0.17	0.42
C1	4.83	0.40	10.71	0.00	15.94	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	10.5	0.16	0.41
C2	0.00	0.22	1.76	0.00	1.98	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	20.9	0.25	0.48
C3	6.30	0.23	14.86	0.00	21.39	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	9.3	0.15	0.40
C4	0.00	0.00	4.31	0.00	4.31	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	11.0	0.17	0.42
C5	0.00	0.00	2.27	0.00	2.27	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	11.0	0.17	0.42
F1	0.00	0.00	12.18	0.00	12.18	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	11.0	0.17	0.42
F2	0.00	0.00	13.89	0.00	13.89	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	11.0	0.17	0.42
F3	16.74	0.00	0.00	0.00	16.74	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	8	0.14	0.39	2.0	0.08	0.35
G1	0.00	0.00	2.55	0.00	2.55	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	11.0	0.17	0.42
G2	4.42	0.00	0.00	0.00	4.42	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	2.0	0.08	0.35
H1	0.00	0.00	5.20	0.00	5.20	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	11.0	0.17	0.42
H2	0.00	0.00	14.46	0.00	14.46	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	11.0	0.17	0.42
H3	36.80	0.00	0.00	0.00	36.80	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	7	0.14	0.39	2.0	0.08	0.35
R1	0.11	0.81	0.00	0.00	0.92	B	2	0.08	0.35	100	0.90	0.96	11	0.17	0.42	8	0.14	0.39	88.5	0.80	0.89

TOTAL ONSITE	**113.97**	**3.05**	**171.11**	**29.83**	**317.97**														**8.00%**	**0.14**	**0.39**
TOTAL OFFSITE	**41.22**	**0.00**	**33.16**	**0.00**	**74.38**														**6.01%**	**0.12**	**0.38**
GRAND TOTAL	**161.49**	**3.28**	**219.13**	**29.83**	**413.74**														**7.90%**	**0.14**	**0.39**

HRGreen	FLYING HORSE NORTH FILING NO. 4	Calc'd by:	TMM
	PROPOSED CONDITIONS	Checked by:	RDL
	EL PASO COUNTY, COLORADO	Date:	1/10/2025

TIME OF CONCENTRATION

BASIN DATA			OVERLAND TIME (T_i)			TRAVEL TIME (T_t)					TOTAL	tc=(L/180)+10	Design tc
DESIGNATION	C_5	AREA (ac)	LENGTH (ft)	SLOPE %	t_i (min)	C_V	LENGTH (ft)	SLOPE %	V (ft/s)	t_t (min)	t_c (min)	tc max	tc design (min)
A1	0.16	9.57	300	7.0	15.6	10	908	4.0	2.0	7.6	23.2	16.7	16.7
A2	0.17	10.79	300	5.7	16.5	10	372	2.6	1.6	3.8	20.4	13.7	13.7
A3	0.10	72.74	300	11.0	14.2	10	2230	4.0	2.0	18.6	32.8	24.1	24.1
A4	0.17	18.39	300	6.3	16.0	10	1115	2.2	1.5	12.5	28.5	17.9	17.9
A5	0.17	6.10	300	7.4	15.2	10	442	7.4	2.7	2.7	17.9	14.1	14.1
A6	0.17	2.76	300	11.0	13.3	10	227	11.4	3.4	1.1	14.4	12.9	12.9
A7	0.17	8.11	300	7.6	15.0	10	317	7.7	2.8	1.9	16.9	13.4	13.4
B1	0.10	57.78	300	4.5	19.2	10	2400	6.7	2.6	15.5	34.7	25.0	25.0
B2	0.18	35.77	300	11.4	13.0	10	2014	6.7	2.6	13.0	26.0	22.9	22.9
B3	0.36	11.00	300	12.0	10.3	10	293	11.6	3.4	1.4	11.8	13.3	11.8
B4	0.21	10.62	300	12.0	12.3	10	844	3.7	1.9	7.3	19.6	16.4	16.4
B5	0.17	10.62	300	6.1	16.2	10	658	5.2	2.3	4.8	21.0	15.3	15.3
B6	0.17	15.96	300	5.4	16.8	10	1238	3.8	1.9	10.6	27.4	18.5	18.5
C1	0.16	15.94	300	6.0	16.4	10	842	4.3	2.1	6.8	23.2	16.3	16.3
C2	0.25	1.98	300	5.2	15.6	10	257	6.0	2.4	1.7	17.3	13.1	13.1
C3	0.15	21.39	300	5.2	17.4	10	650	5.0	2.2	4.8	22.2	15.3	15.3
C4	0.17	4.31	130	7.4	10.0	10	188	6.3	2.5	1.2	11.2	11.8	11.2
C5	0.17	2.27	300	4.5	17.9	10	494	6.7	2.6	3.2	21.1	14.4	14.4
F1	0.17	12.18	300	3.3	19.8	10	600	2.0	1.4	7.1	26.9	15.0	15.0
F2	0.17	13.89	300	3.0	20.5	10	780	3.0	1.7	7.5	28.0	16.0	16.0
F3	0.08	16.74	300	3.0	22.5	10	960	4.0	2.0	8.0	30.5	17.0	17.0
G1	0.17	2.55	300	7.4	15.2	10	90	7.4	2.7	0.6	15.7	12.2	12.2
G2	0.08	4.42	300	6.9	17.0	10	250	6.9	2.6	1.6	18.6	13.1	13.1
H1	0.17	5.20	166	10.1	10.2	10	268	1.2	1.1	4.1	14.2	12.4	12.4
H2	0.17	14.46	300	5.0	17.3	10	286	3.1	1.8	2.7	20.0	13.3	13.3
H3	0.08	36.80	300	5.0	18.9	10	1489	3.1	1.8	14.1	33.0	19.9	19.9
R1	0.80	0.92	300	0.5	11.9	10	1030	2.7	1.6	10.4	22.3	17.4	17.4

HRGreen

FLYING HORSE NORTH FILING NO. 4	Calc'd by:	TMM
PROPOSED CONDITIONS	Checked by:	RDL
DESIGN STORM: 5-YEAR	Date:	1/10/2025

STREET	DESIGN POINT	BASIN ID	DIRECT RUNOFF AREA (ac)	C_5	t_c (min)	C_5*A (ac)	I (in./ hr.)	Q (cfs)	TOTAL RUNOFF t_c (min)	C_5*A (ac)	I (in./ hr.)	Q (cfs)	REMARKS
	A1	A1	9.57	0.16	16.7	1.54	3.36	**5.2**					OVERLAND FLOW TO DP A1
	A2	A2	10.79	0.17	13.7	1.84	3.65	**6.7**					
									16.7	3.37	3.36	**11.3**	COMBINED BASIN A1 AND A2 FLOW IN PROPOSED SWALE TO DPA2
	A3	A3	72.74	0.10	24.1	7.53	2.81	**21.2**					FLOW TO DPA3
	A4	A4	18.39	0.17	17.9	3.13	3.26	**10.2**					
									24.1	10.66	2.81	**30.0**	COMBINED BASIN A3 AND A4 FLOW IN EXISTING SWALE TO DPA4
	A5	A5	6.10	0.17	14.1	1.04	3.61	**3.7**					
									16.7	4.41	3.36	**14.8**	COMBINED BASIN A1, A2, AND 5 FLOW IN PROPOSED SWALE TO DPA5
	A6	A6	2.76	0.17	12.9	0.47	3.74	**1.8**					
									24.1	11.13	2.81	**31.3**	COMBINED BASIN A1 - A6 FLOW INTO POND A
	A7	A7	8.11	0.17	13.4	1.38	3.69	**5.1**					FLOW FROM A7 TO POND A
									16.7	5.79	3.36	**19.5**	COMBINED BASIN FLOW A1 - A7
	B1	B1	57.78	0.10	25.0	5.77	2.75	**15.9**					FLOW TO DPB1
	B2	B2	35.77	0.18	22.9	6.29	2.89	**18.2**					
									25.0	12.07	2.75	**33.2**	COMBINED BASIN B1 AND B2 FLOW
	B3	B3	1.10	0.36	11.8	0.39	3.89	**1.5**					
									25.0	12.46	2.75	**34.3**	COMBINED B1 - B3 BASIN FLOW TO POND B
	B4	B4	11.00	0.21	16.4	2.35	3.39	**8.0**					FLOW FROM B4 TO POND B
									25.0	14.80	2.75	**40.8**	COMBINED BASIN FLOW B1 - B4
	B5	B5	10.62	0.17	15.3	1.81	3.49	**6.3**					OFFSITE BASIN FLOW
	B6	B6	15.96	0.17	18.5	2.72	3.20	**8.7**					OFFSITE BASIN FLOW
	C1	C1	15.94	0.16	16.3	2.57	3.39	**8.7**					FLOW TO DPC1
	C2	C2	1.98	0.25	13.1	0.50	3.72	**1.9**					
									16.3	3.06	3.39	**10.4**	COMBINED C1 AND C2 BASIN FLOW TO POND C
	C3	C3	21.39	0.15	15.3	3.24	3.49	**11.3**					FLOW FROM CS TO POND C
									16.3	6.30	3.39	**21.4**	COMBINED FLOWS C1 - C3
	C4	C4	4.31	0.17	11.2	0.73	3.96	**2.9**					OFFSITE BASIN FLOW
	C5	C5	2.27	0.17	14.4	0.39	3.58	**1.4**					OFFSITE BASIN FLOW

HRGreen	FLYING HORSE NORTH FILING NO. 4	Calc'd by:	TMM
	PROPOSED CONDITIONS	Checked by:	RDL
	DESIGN STORM: 5-YEAR	Date:	1/10/2025

			DIRECT RUNOFF						TOTAL RUNOFF				REMARKS
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C_5	t_c (min)	C_5*A (ac)	*I* (in./ hr.)	Q (cfs)	t_c (min)	C_5*A (ac)	*I* (in./ hr.)	Q (cfs)	
	F1	F1	12.18	0.17	15.0	2.07	3.52	**7.3**					FLOW TO DPF1 (TO PROPOSED FUTURE DETENTION)
	F2	F2	13.89	0.17	16.0	2.36	3.42	**8.1**					FLOW TO DPF2 (TO PROPOSED FUTURE DETENTION)
	F3	F3	16.74	0.08	17.0	1.34	3.33	**4.5**					
									17.0	3.70	3.33	**12.3**	COMBINED F2 AND F3 FLOW TO DPF3 (TO PROPOSED FUTURE DETENTION)
	G1	G1	2.55	0.17	12.2	0.43	3.83	**1.7**					FLOW TO DPG1
	G2	G2	4.42	0.08	13.1	0.35	3.73	**1.3**					
									13.1	0.79	3.73	**2.9**	COMBINED BASIN G1 AND G2 FLOWS
	H1	H1	5.20	0.17	12.4	0.89	3.81	**3.4**					FLOW TO DPH1
	H2	H2	14.46	0.17	13.3	2.46	3.71	**9.1**					
									13.3	3.35	3.71	**12.4**	COMBINE BASIN H1 AND H2 FLOW
	H3	H3	36.80	0.08	19.9	2.94	3.09	**9.1**					
									19.9	7.08	3.09	**21.9**	COMBINED G1, G2, AND H1 - H3 FLOW
	R1	R1	0.92	0.80	17.4	0.74	3.30	**2.4**					FLOW TO DPR1

FLYING HORSE NORTH FILING NO. 4	Calc'd by:	TMM
PROPOSED CONDITIONS	Check	RDL
DESIGN STORM: 100-YEAR	Date:	1/10/2025

			DIRECT RUNOFF						TOTAL RUNOFF				REMARKS
STREET	DESIGN PONT	BASIN ID	AREA (ac)	C_{100}	t_c (min)	C_{100}*A (ac)	I (in./ hr.)	Q (cfs)	t_c (min)	C_{100}*A (ac)	I (in./ hr.)	Q (cfs)	
	A1	A1	9.57	0.41	16.7	3.92	5.64	**22.1**					OVERLAND FLOW TO DP A1
	A2	A2	10.79	0.42	13.7	4.50	6.13	**27.6**					
									16.7	8.42	8.51	**71.7**	COMBINED BASIN A1 AND A2 FLOW IN PROPOSED SWALE TO DPA2
	A3	A3	72.74	0.37	24.1	26.73	4.72	**126.2**					FLOW TO DPA3
	A4	A4	18.39	0.42	17.9	7.67	5.47	**42.0**					
									24.1	34.40	7.96	**274.0**	COMBINED BASIN A3 AND A4 FLOW IN EXISTING SWALE TO DPA4
	A5	A5	6.10	0.42	14.1	2.54	6.06	**15.4**					
									16.7	10.97	8.51	**93.3**	COMBINED BASIN A1, A2, AND 5 FLOW IN PROPOSED SWALE TO DPA5
	A6	A6	2.76	0.42	12.9	1.15	6.29	**7.2**					
									24.1	35.55	7.96	**283.2**	COMBINED BASIN A1 - A6 FLOW INTO POND A
	A7	A7	8.11	0.42	13.4	3.38	6.19	**20.9**					FLOW FROM A7 TO POND A
									16.7	14.35	8.51	**122.1**	COMBINED BASIN FLOW A1 - A7
	B1	B1	57.78	0.36	25.0	21.08	4.62	**97.5**					FLOW TO DPB1
	B2	B2	35.77	0.42	22.9	15.07	4.85	**73.1**					
									25.0	36.15	7.91	**285.8**	COMBINED BASIN B1 AND B2 FLOW
	B3	B3	1.10	0.56	11.8	0.61	6.53	**4.0**					
									25.0	36.76	7.91	**290.7**	COMBINED B1 - B3 BASIN FLOW TO POND B
	B4	B4	11.00	0.45	16.4	4.94	5.69	**28.1**					FLOW FROM B4 TO POND B
									25.0	41.70	7.91	**329.7**	COMBINED BASIN FLOW B1 - B4
	B5	B5	10.62	0.42	15.3	4.43	5.86	**25.9**					OFFSITE BASIN FLOW
	B6	B6	15.96	0.42	18.5	6.66	5.38	**35.8**					OFFSITE BASIN FLOW
	C1	C1	15.94	0.41	16.3	6.54	5.69	**37.2**					FLOW TO DPC1
	C2	C2	1.98	0.48	13.1	0.95	6.25	**5.9**					
									16.3	7.49	8.54	**64.0**	COMBINED C1 AND C2 BASIN FLOW TO POND C
	C3	C3	21.39	0.40	15.3	8.62	5.86	**50.6**					FLOW FROM CS TO POND C
									16.3	16.11	8.54	**137.6**	COMBINED FLOWS C1 - C3
	C4	C4	4.31	0.42	11.2	1.80	6.64	**11.9**					OFFSITE BASIN FLOW
	C5	C5	2.27	0.42	14.4	0.95	6.01	**5.7**					OFFSITE BASIN FLOW

HRGreen

FLYING HORSE NORTH FILING NO. 4

PROPOSED CONDITIONS

DESIGN STORM: 100-YEAR

Calc'd by: TMM

Check RDL

Date: 1/10/2025

			DIRECT RUNOFF						TOTAL RUNOFF				REMARKS
STREET	DESIGN PONT	BASIN ID	AREA (ac)	C_{100}	t_c (min)	C_{100}*A (ac)	I (in./ hr.)	Q (cfs)	t_c (min)	C_{100}*A (ac)	I (in./ hr.)	Q (cfs)	
													OFF SITE BASIN FLOW
	F1	F1	12.18	0.42	15.0	5.08	5.91	**30.0**					FLOW TO DPF1 (TO PROPOSED FUTURE DETENTION)
	F2	F2	13.89	0.42	16.0	5.79	5.75	**33.3**					FLOW TO DPF2 (TO PROPOSED FUTURE DETENTION)
	F3	F3	16.74	0.08	17.0	1.34	8.49	**11.4**					FLOW TO DPF2 (TO PROPOSED FUTURE DETENTION)
									17.0	7.13	8.49	**60.5**	
	G1	G1	2.55	0.42	12.2	1.06	6.44	**6.8**					FLOW TO DPG1
	G2	G2	4.42	0.35	13.1	1.55	6.26	**9.7**					
									13.1	2.61	8.88	**23.2**	COMBINED BASIN G1 AND G2 FLOWS
	H1	H1	5.20	0.42	12.4	2.17	6.39	**13.9**					FLOW TO DPH1
	H2	H2	14.46	0.42	13.3	6.03	6.22	**37.5**					
									13.3	4.78	8.86	**42.3**	COMBINE BASIN H1 AND H2 FLOW
	H3	H3	36.80	0.35	19.9	12.88	5.19	**66.9**					
									19.9	20.27	8.25	**167.1**	COMBINED G1, G2, AND H1 - H3 FLOW
	R1	R1	0.92	0.89	17.4	0.82	5.54	**4.5**					FLOW TO DPR1

COLORADO URBAN HYDROGRAPH PROCEDURE (CUHP)

CUHP SUBCATCHMENTS - HISTORIC

Columns with this color heading are for required user-input
Columns with this color heading are for optional override values
Columns with this color heading are for program-calculated values

								Maximum Depression Storage (Watershed inches)		Horton's Infiltration Parameters			DCIA
Subcatchment Name	EPA SWMM Target Node	Raingage	Area (mi^2)	Length to Centroid (mi)	Length (mi)	Slope (ft/ft)	Percent Imperviousness	Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/seconds)	Final Rate (in/hr)	Level 0, 1, or 2
A1	A1	100-Year	0.11172	0.24808	0.50417	0.044	2	0.4	0.1	4.5	0.0018	0.6	0
A2	A2	100-Year	0.0882	0.28006	0.49237	0.055	2	0.4	0.1	4.5	0.0018	0.6	0
B1	B1	100-Year	0.14625	0.17679	0.556	0.039	3.6	0.4	0.1	4.5	0.0018	0.6	0
B2	B2	100-Year	0.07147	0.17404	0.27683	0.046	5.2	0.4	0.1	4.5	0.0018	0.6	0
B3	B3	100-Year	0.01763	0.07669	0.17258	0.062	2	0.4	0.1	4.5	0.0018	0.6	0
B4	B4	100-Year	0.01931	0.09155	0.17623	0.056	7	0.4	0.1	4.5	0.0018	0.6	0
C1	C1	100-Year	0.01948	0.05134	0.17182	0.048	9.4	0.4	0.1	4.5	0.0018	0.6	0
C2	C2	100-Year	0.03494	0.08962	0.21493	0.044	6.1	0.4	0.1	4.5	0.0018	0.6	0
C3	C3	100-Year	0.00713	0.03548	0.07618	0.064	2	0.4	0.1	4.5	0.0018	0.6	0
C4	C4	100-Year	0.00355	0.03177	0.08547	0.072	2	0.4	0.1	4.5	0.0018	0.6	0
F1	F1	100-Year	0.01731	0.07509	0.26483	0.035	4.5	0.4	0.1	4.5	0.0018	0.6	0
F2	F2	100-Year	0.05429	0.18144	0.41906	0.035	3.9	0.4	0.1	4.5	0.0018	0.6	0
G1	G1	100-Year	0.01198	0.0589	0.24273	0.056	2	0.4	0.1	4.5	0.0018	0.6	0
H1	H1	100-Year	0.08792	0.10799	0.50482	0.047	2	0.4	0.1	4.5	0.0018	0.6	0

5-Year Historic Results
Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
A1		0.157	0.175	32.8	4.71	17.0	3.33	7.9	102	259,548	0.22	57,209	40.0	20	57,208	0.28
A2		0.157	0.158	36.2	4.68	18.8	3.31	7.8	73	204,906	0.22	45,165	41.0	14	45,164	0.25
B1		0.152	0.192	26.6	4.22	13.8	2.99	7.0	165	339,768	0.24	81,189	38.0	33	81,182	0.35
B2		0.148	0.135	25.0	2.89	13.0	2.04	4.8	86	166,039	0.26	42,781	36.0	18	42,775	0.38
B3		0.157	0.076	23.6	1.68	12.3	1.19	2.8	22	40,958	0.22	9,028	35.0	4	9,026	0.36
B4		0.142	0.072	25.3	1.71	13.2	1.21	2.8	23	44,861	0.28	12,511	35.0	5	12,509	0.40
C1		0.135	0.069	19.4	1.34	10.1	0.94	2.2	30	45,256	0.31	13,917	33.0	6	13,920	0.52
C2		0.145	0.096	22.4	1.96	11.6	1.38	3.3	47	81,173	0.27	21,774	35.0	10	21,772	0.43
C3		0.157	0.051	16.4	0.94	8.5	0.66	1.6	13	16,564	0.22	3,650	32.0	2	3,646	0.47
C4		0.157	0.037	21.9	0.92	11.4	0.65	1.5	5	8,247	0.22	1,817	35.0	1	1,816	0.38
F1		0.150	0.072	33.1	2.14	17.2	1.51	3.6	16	40,215	0.25	10,032	37.0	3	10,031	0.29
F2		0.151	0.122	37.7	3.84	19.6	2.71	6.4	43	126,127	0.24	30,579	40.0	9	30,579	0.26
G1		0.157	0.064	29.8	1.77	15.5	1.25	3.0	12	27,832	0.22	6,132	36.0	2	6,131	0.30
H1		0.157	0.157	24.1	3.22	12.5	2.27	5.4	109	204,256	0.22	45,021	37.0	20	45,019	0.36

100-Year Historic Results
Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
A1		0.157	0.175	32.8	4.70	17.0	3.32	7.8	102	259,548	1.33	344,851	46.0	97	344,849	1.36
A2		0.157	0.157	36.2	4.67	18.8	3.30	7.8	73	204,906	1.33	272,251	47.0	71	272,247	1.26
B1		0.151	0.191	26.6	4.20	13.8	2.97	7.0	165	339,768	1.35	457,853	43.0	149	457,810	1.59
B2		0.146	0.134	25.0	2.87	13.0	2.03	4.8	86	166,039	1.37	226,897	41.0	76	226,872	1.66
B3		0.157	0.076	23.6	1.68	12.3	1.19	2.8	22	40,958	1.33	54,419	41.0	19	54,406	1.67
B4		0.140	0.072	25.3	1.69	13.1	1.19	2.8	23	44,861	1.39	62,267	41.0	20	62,254	1.64
C1		0.132	0.068	19.4	1.32	10.1	0.93	2.2	30	45,256	1.42	64,121	39.0	25	64,134	1.98
C2		0.143	0.095	22.4	1.94	11.6	1.37	3.2	47	81,173	1.38	111,795	40.0	40	111,781	1.78
C3		0.157	0.051	16.4	0.94	8.5	0.66	1.6	13	16,564	1.33	22,008	36.0	10	21,986	2.12
C4		0.157	0.037	21.9	0.92	11.4	0.65	1.5	5	8,247	1.33	10,958	40.0	4	10,950	1.74
F1		0.148	0.072	33.0	2.12	17.2	1.50	3.5	16	40,215	1.36	54,620	44.0	15	54,615	1.34
F2		0.150	0.122	37.6	3.81	19.6	2.70	6.4	43	126,127	1.35	170,409	47.0	43	170,407	1.23
G1		0.157	0.064	29.8	1.77	15.5	1.25	2.9	12	27,832	1.33	36,979	42.0	11	36,973	1.41
H1		0.157	0.157	24.1	3.21	12.5	2.27	5.3	109	204,256	1.33	271,387	41.0	94	271,372	1.67

CUHP SUBCATCHMENTS - DEVELOPED

Columns with this color heading are for required user-input
Columns with this color heading are for optional override values
Columns with this color heading are for program-calculated values

								Maximum Depression Storage (Watershed inches)		Horton's Infiltration Parameters			DCIA
Subcatchment Name	EPA SWMM Target Node	Raingage	Area (mi^2)	Length to Centroid (mi)	Length (mi)	Slope (ft/ft)	Percent Imperviousness	Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/seconds)	Final Rate (in/hr)	Level 0, 1, or 2
A1	A1	100-Year	0.01495	0.06629	0.22879	0.040	10.2	0.4	0.05	4.5	0.0018	0.6	0
A2	A2	100-Year	0.01686	0.06174	0.12727	0.026	11.0	0.4	0.05	4.5	0.0018	0.6	0
A3	A3	100-Year	0.11366	0.24242	0.47917	0.040	4.1	0.4	0.05	4.5	0.0018	0.6	0
A4	A4	100-Year	0.02873	0.20436	0.26799	0.022	11.0	0.4	0.05	4.5	0.0018	0.6	0
A5	A5	100-Year	0.00386	0.03409	0.09981	0.114	11.0	0.4	0.05	4.5	0.0018	0.6	0
A6	A6	100-Year	0.00997	0.05587	0.14053	0.074	11.0	0.4	0.05	4.5	0.0018	0.6	0
A7	A7	100-Year	0.0127	0.05492	0.11686	0.077	11.0	0.4	0.05	4.5	0.0018	0.6	0
B1	B1	100-Year	0.15562	0.17803	0.51136	0.068	4.1	0.4	0.05	4.5	0.0018	0.6	0
B2	B2	100-Year	0.05589	0.21155	0.43826	0.068	11.7	0.4	0.05	4.5	0.0018	0.6	0
B3	B3	100-Year	0.00172	0.01705	0.08902	0.116	33.7	0.4	0.05	4.5	0.0018	0.6	0
B4	B4	100-Year	0.01719	0.12121	0.21496	0.037	10.2	0.4	0.05	4.5	0.0018	0.6	0
B5	B5	100-Year	0.01659	0.08051	0.14458	0.052	11.0	0.4	0.05	4.5	0.0018	0.6	0
B6	B6	100-Year	0.02494	0.05130	0.16422	0.038	11.0	0.4	0.05	4.5	0.0018	0.6	0
C1	C1	100-Year	0.02491	0.07630	0.21629	0.043	10.5	0.4	0.05	4.5	0.0018	0.6	0
C2	C2	100-Year	0.00309	0.05303	0.10549	0.060	20.9	0.4	0.05	4.5	0.0018	0.6	0
C3	C3	100-Year	0.03342	0.09570	0.20540	0.050	9.3	0.4	0.05	4.5	0.0018	0.6	0
C4	C4	100-Year	0.00673	0.03561	0.06045	0.063	11.0	0.4	0.05	4.5	0.0018	0.6	0
C5	C5	100-Year	0.00355	0.03788	0.08236	0.067	11.0	0.4	0.05	4.5	0.0018	0.6	0
F1	F1	100-Year	0.02005	0.07509	0.26483	0.020	11.0	0.4	0.05	4.5	0.0018	0.6	0
F2	F2	100-Year	0.02064	0.10766	0.26980	0.030	11.0	0.4	0.05	4.5	0.0018	0.6	0
F3	F3	100-Year	0.026156	0.09124	0.22906	0.036	11.0	0.4	0.05	4.5	0.0018	0.6	0
G1	G1	100-Year	0.00398	0.02309	0.07386	0.074	11.0	0.4	0.05	4.5	0.0018	0.6	0
G2	G2	100-Year	0.00691	0.05845	0.10417	0.069	2.0	0.4	0.05	4.5	0.0018	0.6	0
H1	H1	100-Year	0.00813	0.07519	0.06572	0.012	11.0	0.4	0.05	4.5	0.0018	0.6	0
H2	H2	100-Year	0.02259	0.05209	0.08858	0.031	11.0	0.4	0.05	4.5	0.0018	0.6	0
H3	H3	100-Year	0.0575	0.08230	0.27341	0.031	2.0	0.4	0.05	4.5	0.0018	0.6	0

5-Year Developed Results
Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)

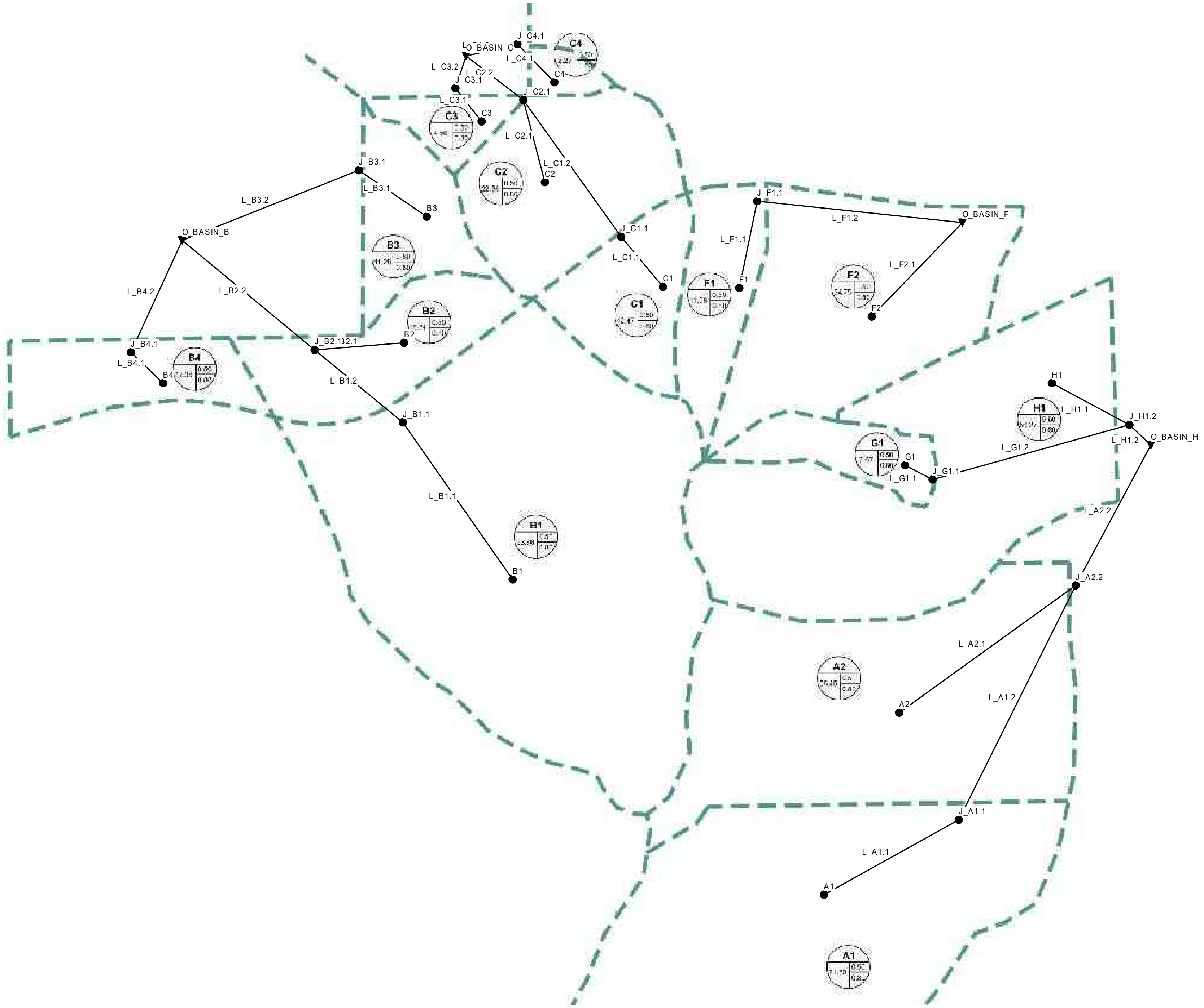
		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
A1		0.132	0.061	29.6	1.68	15.4	1.19	2.8	15	34,732	0.32	11,022	36.0	4	11,019	0.38
A2		0.129	0.063	22.6	1.39	11.8	0.98	2.3	22	39,169	0.33	12,920	35.0	5	12,921	0.48
A3		0.151	0.170	32.0	4.49	16.7	3.17	7.5	106	264,055	0.24	64,659	39.0	22	64,655	0.30
A4		0.129	0.080	47.0	3.18	24.4	2.25	5.3	18	66,746	0.33	22,016	41.0	5	22,015	0.27
A5		0.129	0.032	20.6	0.81	10.7	0.57	1.4	6	8,968	0.33	2,958	33.0	1	2,955	0.51
A6		0.129	0.050	22.3	1.15	11.6	0.81	1.9	13	23,162	0.33	7,640	35.0	3	7,639	0.49
A7		0.129	0.055	18.0	1.06	9.3	0.75	1.8	21	29,505	0.33	9,732	31.0	5	9,726	0.57
B1		0.151	0.196	21.8	3.58	11.3	2.53	6.0	214	361,536	0.25	88,754	36.0	42	88,751	0.42
B2		0.127	0.106	34.1	3.08	17.7	2.18	5.1	49	129,844	0.34	44,014	38.0	13	44,011	0.36
B3		0.099	0.024	14.4	0.56	7.5	0.40	0.9	4	3,996	0.64	2,563	30.0	1	2,548	1.04
B4		0.119	0.060	35.6	1.94	18.5	1.37	3.2	14	39,936	0.40	15,955	37.0	4	15,953	0.38
B5		0.129	0.062	23.3	1.42	12.1	1.00	2.4	21	38,542	0.33	12,713	35.0	5	12,714	0.47
B6		0.129	0.075	17.9	1.33	9.3	0.94	2.2	42	57,941	0.33	19,111	32.0	9	19,115	0.58
C1		0.131	0.076	24.0	1.70	12.5	1.20	2.8	31	57,871	0.32	18,701	35.0	7	18,697	0.46
C2		0.113	0.027	31.6	0.96	16.5	0.68	1.6	3	7,179	0.46	3,318	35.0	1	3,316	0.46
C3		0.135	0.089	22.2	1.81	11.5	1.28	3.0	45	77,641	0.31	23,934	35.0	10	23,930	0.47
C4		0.129	0.042	14.8	0.77	7.7	0.55	1.3	14	15,635	0.33	5,157	31.0	3	5,150	0.66
C5		0.129	0.031	23.3	0.86	12.1	0.61	1.4	5	8,247	0.33	2,720	35.0	1	2,718	0.47
F1		0.129	0.068	34.8	2.11	18.1	1.49	3.5	17	46,580	0.33	15,364	37.0	4	15,362	0.34
F2		0.129	0.069	37.3	2.27	19.4	1.61	3.8	17	47,951	0.33	15,816	37.0	4	15,816	0.32
F3		0.129	0.077	27.5	1.92	14.3	1.36	3.2	29	60,766	0.33	20,043	36.0	7	20,041	0.42
G1		0.129	0.033	16.2	0.71	8.4	0.50	1.2	7	9,246	0.33	3,050	31.0	2	3,045	0.62
G2		0.157	0.050	24.1	1.23	12.5	0.87	2.0	9	16,053	0.22	3,542	35.0	2	3,542	0.35
H1		0.129	0.045	30.2	1.35	15.7	0.96	2.3	8	18,888	0.33	6,230	36.0	2	6,230	0.38
H2		0.129	0.072	14.7	1.11	7.6	0.78	1.9	46	52,481	0.33	17,311	31.0	10	17,301	0.67
H3		0.157	0.130	21.1	2.41	11.0	1.70	4.0	82	133,584	0.22	29,485	35.0	15	29,484	0.40

100-Year Developed Results
Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
A1		0.130	0.060	29.5	1.66	15.4	1.17	2.8	15	34,732	1.43	49,514	41.0	14.3	49,504	1.50
A2		0.127	0.062	22.5	1.37	11.7	0.97	2.3	22	39,169	1.44	56,348	40.0	19.6	56,353	1.81
A3		0.150	0.169	32.0	4.46	16.7	3.15	7.4	106	264,055	1.35	357,276	45.0	101.6	357,257	1.40
A4		0.127	0.079	46.8	3.13	24.4	2.21	5.2	18	66,746	1.44	96,019	50.0	20.0	96,014	1.09
A5		0.127	0.032	20.5	0.80	10.7	0.57	1.3	6	8,968	1.44	12,901	40.0	4.7	12,888	1.92
A6		0.127	0.049	22.2	1.13	11.5	0.80	1.9	13	23,162	1.44	33,321	40.0	11.7	33,314	1.83
A7		0.127	0.054	17.9	1.05	9.3	0.74	1.7	21	29,505	1.44	42,445	36.0	17.1	42,413	2.11
B1		0.150	0.194	21.8	3.55	11.3	2.51	5.9	214	361,536	1.35	489,397	41.0	182.0	489,384	1.83
B2		0.125	0.105	34.0	3.04	17.7	2.15	5.1	49	129,844	1.45	188,018	45.0	49.5	188,002	1.38
B3		0.098	0.024	14.1	0.56	7.3	0.40	0.9	4	3,996	1.75	7,002	35.0	3.0	6,962	2.77
B4		0.118	0.060	35.4	1.93	18.4	1.36	3.2	15	39,936	1.51	60,315	45.0	15.1	60,311	1.37
B5		0.127	0.061	23.2	1.39	12.1	0.98	2.3	21	38,542	1.44	55,446	40.0	18.9	55,452	1.78
B6		0.127	0.074	17.8	1.31	9.3	0.93	2.2	42	57,941	1.44	83,352	36.0	33.9	83,372	2.12
C1		0.128	0.075	24.0	1.67	12.5	1.18	2.8	31	57,871	1.43	82,851	40.0	27.7	82,825	1.74
C2		0.111	0.027	31.4	0.95	16.3	0.67	1.6	3	7,179	1.57	11,299	41.0	3.0	11,293	1.52
C3		0.132	0.087	22.1	1.78	11.5	1.26	3.0	45	77,641	1.42	109,982	40.0	39.0	109,959	1.82
C4		0.127	0.041	14.8	0.76	7.7	0.54	1.3	14	15,635	1.44	22,492	35.0	10.3	22,461	2.40
C5		0.127	0.031	23.2	0.85	12.1	0.60	1.4	5	8,247	1.44	11,865	40.0	4.0	11,855	1.77
F1		0.127	0.067	34.6	2.08	18.0	1.47	3.5	17	46,580	1.44	67,009	45.0	17.3	66,999	1.35
F2		0.127	0.068	37.2	2.24	19.4	1.58	3.7	17	47,951	1.44	68,981	46.0	16.9	68,979	1.28
F3		0.127	0.075	27.4	1.89	14.3	1.33	3.1	29	60,766	1.44	87,416	41.0	26.6	87,405	1.59
G1		0.127	0.032	16.1	0.70	8.4	0.49	1.2	7	9,246	1.44	13,302	35.0	5.7	13,278	2.26
G2		0.157	0.050	24.1	1.23	12.5	0.87	2.0	9	16,053	1.33	21,329	40.0	7.2	21,331	1.64
H1		0.127	0.045	30.1	1.33	15.7	0.94	2.2	8	18,888	1.44	27,171	41.0	7.7	27,174	1.48
H2		0.127	0.071	14.7	1.09	7.6	0.77	1.8	46	52,481	1.44	75,498	36.0	35.0	75,456	2.42
H3		0.157	0.130	21.1	2.40	11.0	1.70	4.0	82	133,584	1.33	177,493	40.0	66.9	177,491	1.82

STORM WATER MANAGEMENT MODEL (SWMM)

FLYING HORSE NORTH FILING NO. 4
HISTORIC SWMM MODEL



```
[TITLE]
;;Project Title/Notes
Flying Horse North Filing No. 4
Final Drainage Report

[OPTIONS]
;;Option             Value
FLOW_UNITS           CFS
INFILTRATION         HORTON
FLOW_ROUTING         KINWAVE
LINK_OFFSETS         DEPTH
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           01/01/2005
START_TIME           00:00:00
REPORT_START_DATE    01/01/2005
REPORT_START_TIME    00:00:00
END_DATE             01/05/2005
END_TIME             00:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:05:00
WET_STEP             00:05:00
DRY_STEP             01:00:00
ROUTING_STEP         0:01:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         12.557
MAX_TRIALS           8
HEAD_TOLERANCE       0.005
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              1

[FILES]
;;Interfacing Files
USE INFLOWS "SWMM_Existing_Interface_100.txt"

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO

[JUNCTIONS]
;;Name           Elevation  MaxDepth   InitDepth  SurDepth   Aponded
;;-------------- ---------- ---------- ---------- ---------- ----------
A1               7605       0          0          0          0
A2               7597       0          0          0          0
B1               7572       0          0          0          0
B2               7558       0          0          0          0
B3               7558       0          0          0          0
B4               7552       0          0          0          0
C1               7586       0          0          0          0
C2               7562       0          0          0          0
C3               7553       0          0          0          0
C4               7536       0          0          0          0
H1               7550       0          0          0          0
G1               7585       0          0          0          0
F2               7568       0          0          0          0
F1               7582       0          0          0          0
J_B1.1           7536       0          0          0          0
J_A1.1           7565       0          0          0          0
J_G1.1           7555       0          0          0          0
J_C1.1           7570       0          0          0          0
J_A2.2           7525       0          0          0          0
```

```
J_H1.2           7516       0          0          0          0
J_F1.1           7572       0          0          0          0
J_B4.1           7510       0          0          0          0
J_B2.1           7522       0          0          0          0
J_B3.1           7533       0          0          0          0
J_C3.1           7544       0          0          0          0
J_C2.1           7529       0          0          0          0
J_C4.1           7524       0          0          0          0

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
O_BASIN_B        7510       FREE                        NO
O_BASIN_C        7520       FREE                        NO
O_BASIN_F        7547       FREE                        NO
O_BASIN_H        7515       FREE                        NO

[CONDUITS]
;;Name           From Node        To Node          Length     Roughness  InOffset   OutOffset  InitFlow
MaxFlow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ---------- -----
-----
L_A1.1           A1               J_A1.1           400        .013       0          0          0          0
L_A2.1           A2               J_A2.2           400        .013       0          0          0          0
L_A1.2           J_A1.1           J_A2.2           1505       .035       0          0          0          0
L_G1.1           G1               J_G1.1           400        .013       0          0          0          0
L_H1.1           H1               J_H1.2           400        .013       0          0          0          0
L_G1.2           J_G1.1           J_H1.2           1031       .035       0          0          0          0
L_F1.1           F1               J_F1.1           400        .013       0          0          0          0
L_B1.1           B1               J_B1.1           400        .013       0          0          0          0
L_B2.1           B2               J_B2.1           400        .013       0          0          0          0
L_B1.2           J_B1.1           J_B2.1           400        .013       0          0          0          0
L_B4.1           B4               J_B4.1           400        .013       0          0          0          0
L_B3.1           B3               J_B3.1           400        .013       0          0          0          0
L_C3.1           C3               J_C3.1           400        .013       0          0          0          0
L_C4.1           C4               J_C4.1           400        .013       0          0          0          0
L_C1.1           C1               J_C1.1           400        .013       0          0          0          0
L_C1.2           J_C1.1           J_C2.1           400        .013       0          0          0          0
L_C2.1           C2               J_C2.1           400        .013       0          0          0          0
L_A2.2           J_A2.2           O_BASIN_H        680        .035       0          0          0          0
L_H1.2           J_H1.2           O_BASIN_H        400        .013       0          0          0          0
L_F2.1           F2               O_BASIN_F        400        .013       0          0          0          0
L_F1.2           J_F1.1           O_BASIN_F        1200       .030       0          0          0          0
L_B4.2           J_B4.1           O_BASIN_B        400        .013       0          0          0          0
L_B2.2           J_B2.1           O_BASIN_B        400        .013       0          0          0          0
L_B3.2           J_B3.1           O_BASIN_B        400        .013       0          0          0          0
L_C3.2           J_C3.1           O_BASIN_C        400        .013       0          0          0          0
L_C2.2           J_C2.1           O_BASIN_C        400        .013       0          0          0          0
L_C4.2           J_C4.1           O_BASIN_C        400        .013       0          0          0          0

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ---------- ---------- ----------
L_A1.1           DUMMY        0                0          0          0          1
L_A2.1           DUMMY        0                0          0          0          1
L_A1.2           TRAPEZOIDAL  5                5          4          4          1
L_G1.1           DUMMY        0                0          0          0          1
L_H1.1           DUMMY        0                0          0          0          1
L_G1.2           TRAPEZOIDAL  4                5          4          4          1
L_F1.1           DUMMY        0                0          0          0          1
L_B1.1           DUMMY        0                0          0          0          1
L_B2.1           DUMMY        0                0          0          0          1
L_B1.2           DUMMY        0                0          0          0          1
L_B4.1           DUMMY        0                0          0          0          1
L_B3.1           DUMMY        0                0          0          0          1
L_C3.1           DUMMY        0                0          0          0          1
L_C4.1           DUMMY        0                0          0          0          1
L_C1.1           DUMMY        0                0          0          0          1
L_C1.2           DUMMY        0                0          0          0          1
L_C2.1           DUMMY        0                0          0          0          1
L_A2.2           TRAPEZOIDAL  5                10         4          4          1
L_H1.2           DUMMY        0                0          0          0          1
L_F2.1           DUMMY        0                0          0          0          1
L_F1.2           TRIANGULAR   2                16         0          0          1
```

```
L_B4.2           DUMMY        0                 0          0          0          1
L_B2.2           DUMMY        0                 0          0          0          1
L_B3.2           DUMMY        0                 0          0          0          1
L_C3.2           DUMMY        0                 0          0          0          1
L_C2.2           DUMMY        0                 0          0          0          1
L_C4.2           DUMMY        0                 0          0          0          1

[REPORT]
;;Reporting Options
INPUT      NO
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS -2727.273 0.000 12727.273 10000.000
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
A1               6821.306           2325.315
A2               7424.143           3779.629
B1               4340.564           4852.974
B2               3974.670           6858.617
B3               3649.430           7759.802
B4               1528.598           6587.584
C1               5539.885           7190.633
C2               4327.012           8051.162
C3               4083.620           8522.337
C4               4930.061           8837.157
H1               8083.297           6216.763
G1               6452.759           5965.243
F2               7199.961           6960.255
F1               6142.933           7183.857
J_B1.1           3459.707           6106.501
J_A1.1           7898.053           2920.962
J_G1.1           7691.867           5647.194
J_C1.1           5206.186           7594.502
J_A2.2           8837.854           4803.052
J_H1.2           9262.835           6086.666
J_F1.1           6292.001           7881.767
J_B4.1           1230.461           6845.066
J_B2.1           2599.178           6865.393
J_B3.1           3107.364           8125.696
J_C3.1           3882.630           8787.561
J_C2.1           4421.738           8692.249
J_C4.1           4424.717           9261.142
O_BASIN_B        1697.993           7563.303
O_BASIN_C        3969.007           9043.712
O_BASIN_F        7931.750           7705.595
O_BASIN_H        9436.296           5930.551

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
```

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)
--------------------------------------------------------------

Flying Horse North Filing No. 4
Final Drainage Report

WARNING 04: minimum elevation drop used for Conduit L_B4.2

*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ NO
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Flow Routing Method ...... KINWAVE
Starting Date ............ 01/01/2005 00:00:00
Ending Date .............. 01/05/2005 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:05:00
Routing Time Step ........ 60.00 sec


**************************        Volume         Volume
Flow Routing Continuity        acre-feet       10^6 gal
**************************     ---------      ---------
Dry Weather Inflow .......         0.000          0.000
Wet Weather Inflow .......         0.000          0.000
Groundwater Inflow .......         0.000          0.000
RDII Inflow ..............         0.000          0.000
External Inflow ..........         8.818          2.873
External Outflow .........         8.842          2.881
Flooding Loss ............         0.000          0.000
Evaporation Loss .........         0.000          0.000
Exfiltration Loss ........         0.000          0.000
Initial Stored Volume ....         0.000          0.000
Final Stored Volume ......         0.000          0.000
Continuity Error (%) .....        -0.282


********************************
Highest Flow Instability Indexes
********************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :    60.00 sec
Average Time Step           :    60.00 sec
Maximum Time Step           :    60.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     1.00
Percent Not Converging      :     0.00
```

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
A1	JUNCTION	0.00	0.00	7605.00	0 00:00	0.00
A2	JUNCTION	0.00	0.00	7597.00	0 00:00	0.00
B1	JUNCTION	0.00	0.00	7572.00	0 00:00	0.00
B2	JUNCTION	0.00	0.00	7558.00	0 00:00	0.00
B3	JUNCTION	0.00	0.00	7558.00	0 00:00	0.00
B4	JUNCTION	0.00	0.00	7552.00	0 00:00	0.00
C1	JUNCTION	0.00	0.00	7586.00	0 00:00	0.00
C2	JUNCTION	0.00	0.00	7562.00	0 00:00	0.00
C3	JUNCTION	0.00	0.00	7553.00	0 00:00	0.00
C4	JUNCTION	0.00	0.00	7536.00	0 00:00	0.00
H1	JUNCTION	0.00	0.00	7550.00	0 00:00	0.00
G1	JUNCTION	0.00	0.00	7585.00	0 00:00	0.00
F2	JUNCTION	0.00	0.00	7568.00	0 00:00	0.00
F1	JUNCTION	0.00	0.00	7582.00	0 00:00	0.00
J_B1.1	JUNCTION	0.00	0.00	7536.00	0 00:00	0.00
J_A1.1	JUNCTION	0.01	0.63	7565.63	0 00:41	0.63
J_G1.1	JUNCTION	0.00	0.17	7555.17	0 00:37	0.17
J_C1.1	JUNCTION	0.00	0.00	7570.00	0 00:00	0.00
J_A2.2	JUNCTION	0.01	0.72	7525.72	0 00:44	0.72
J_H1.2	JUNCTION	0.00	0.17	7516.17	0 00:44	0.17
J_F1.1	JUNCTION	0.01	1.07	7573.07	0 00:35	1.07
J_B4.1	JUNCTION	0.00	0.00	7510.00	0 00:00	0.00
J_B2.1	JUNCTION	0.00	0.00	7522.00	0 00:00	0.00
J_B3.1	JUNCTION	0.00	0.00	7533.00	0 00:00	0.00
J_C3.1	JUNCTION	0.00	0.00	7544.00	0 00:00	0.00
J_C2.1	JUNCTION	0.00	0.00	7529.00	0 00:00	0.00
J_C4.1	JUNCTION	0.00	0.00	7524.00	0 00:00	0.00
O_BASIN_B	OUTFALL	0.00	0.00	7510.00	0 00:00	0.00
O_BASIN_C	OUTFALL	0.00	0.00	7520.00	0 00:00	0.00
O_BASIN_F	OUTFALL	0.01	1.06	7548.06	0 00:39	1.05
O_BASIN_H	OUTFALL	0.01	0.72	7515.72	0 00:47	0.72

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
A1	JUNCTION	19.90	19.90	0 00:41	0.428	0.428	0.000
A2	JUNCTION	14.37	14.37	0 00:42	0.338	0.338	0.000
B1	JUNCTION	32.86	32.86	0 00:39	0.607	0.607	0.000
B2	JUNCTION	17.57	17.57	0 00:37	0.32	0.32	0.000
B3	JUNCTION	4.06	4.06	0 00:36	0.0675	0.0675	0.000
B4	JUNCTION	4.18	4.18	0 00:37	0.074	0.074	0.000
C1	JUNCTION	6.43	6.43	0 00:34	0.104	0.104	0.000
C2	JUNCTION	9.54	9.54	0 00:36	0.163	0.163	0.000
C3	JUNCTION	2.16	2.16	0 00:33	0.0273	0.0273	0.000
C4	JUNCTION	0.86	0.86	0 00:36	0.0136	0.0136	0.000
H1	JUNCTION	20.18	20.18	0 00:38	0.337	0.337	0.000
G1	JUNCTION	2.27	2.27	0 00:37	0.0459	0.0459	0.000
F2	JUNCTION	1.97	1.97	0 00:44	0.074	0.074	0.000
F1	JUNCTION	21.05	21.05	0 00:35	0.274	0.274	0.000
J_B1.1	JUNCTION	0.00	32.86	0 00:39	0	0.607	0.000
J_A1.1	JUNCTION	0.00	19.90	0 00:41	0	0.428	0.000
J_G1.1	JUNCTION	0.00	2.27	0 00:37	0	0.0459	0.000
J_C1.1	JUNCTION	0.00	6.43	0 00:34	0	0.104	0.000
J_A2.2	JUNCTION	0.00	33.39	0 00:44	0	0.77	0.000
J_H1.2	JUNCTION	0.00	22.00	0 00:38	0	0.383	0.000
J_F1.1	JUNCTION	0.00	21.05	0 00:35	0	0.274	0.000

J_B4.1	JUNCTION	0.00	4.18	0	00:37	0	0.074	0.000
J_B2.1	JUNCTION	0.00	50.33	0	00:38	0	0.927	0.000
J_B3.1	JUNCTION	0.00	4.06	0	00:36	0	0.0675	0.000
J_C3.1	JUNCTION	0.00	2.16	0	00:33	0	0.0273	0.000
J_C2.1	JUNCTION	0.00	15.94	0	00:36	0	0.267	0.000
J_C4.1	JUNCTION	0.00	0.86	0	00:36	0	0.0136	0.000
O_BASIN_B	OUTFALL	0.00	58.46	0	00:38	0	1.07	0.000
O_BASIN_C	OUTFALL	0.00	18.92	0	00:36	0	0.308	0.000
O_BASIN_F	OUTFALL	0.00	22.28	0	00:39	0	0.35	0.000
O_BASIN_H	OUTFALL	0.00	52.26	0	00:44	0	1.15	0.000

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
O_BASIN_B	3.40	12.15	58.46	1.069
O_BASIN_C	3.09	3.85	18.92	0.308
O_BASIN_F	4.64	2.92	22.28	0.350
O_BASIN_H	6.77	6.60	52.26	1.155
System	4.47	25.52	145.71	2.881

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days	hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
L_A1.1	DUMMY	19.90	0	00:41			
L_A2.1	DUMMY	14.37	0	00:42			
L_A1.2	CONDUIT	19.44	0	00:46	4.24	0.01	0.12
L_G1.1	DUMMY	2.27	0	00:37			
L_H1.1	DUMMY	20.18	0	00:38			
L_G1.2	CONDUIT	2.17	0	00:44	2.36	0.00	0.04
L_F1.1	DUMMY	21.05	0	00:35			
L_B1.1	DUMMY	32.86	0	00:39			
L_B2.1	DUMMY	17.57	0	00:37			
L_B1.2	DUMMY	32.86	0	00:39			
L_B4.1	DUMMY	4.18	0	00:37			
L_B3.1	DUMMY	4.06	0	00:36			
L_C3.1	DUMMY	2.16	0	00:33			
L_C4.1	DUMMY	0.86	0	00:36			
L_C1.1	DUMMY	6.43	0	00:34			
L_C1.2	DUMMY	6.43	0	00:34			
L_C2.1	DUMMY	9.54	0	00:36			
L_A2.2	CONDUIT	33.23	0	00:47	3.61	0.02	0.14
L_H1.2	DUMMY	22.00	0	00:38			
L_F2.1	DUMMY	1.97	0	00:44			
L_F1.2	CONDUIT	20.37	0	00:39	4.69	0.18	0.53
L_B4.2	DUMMY	4.18	0	00:37			
L_B2.2	DUMMY	50.33	0	00:38			
L_B3.2	DUMMY	4.06	0	00:36			
L_C3.2	DUMMY	2.16	0	00:33			
L_C2.2	DUMMY	15.94	0	00:36			
L_C4.2	DUMMY	0.86	0	00:36			

```
*************************
Conduit Surcharge Summary
*************************

No conduits were surcharged.


Analysis begun on:  Wed Sep 11 10:15:11 2024
Analysis ended on:  Wed Sep 11 10:15:11 2024
Total elapsed time: < 1 sec
```

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)
--------------------------------------------------------------

Flying Horse North Filing No. 4
Final Drainage Report

WARNING 04: minimum elevation drop used for Conduit L_B4.2

*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ NO
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Flow Routing Method ...... KINWAVE
Starting Date ............ 01/01/2005 00:00:00
Ending Date .............. 01/05/2005 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:05:00
Routing Time Step ........ 60.00 sec


**************************        Volume         Volume
Flow Routing Continuity        acre-feet       10^6 gal
**************************     ---------      ---------
Dry Weather Inflow .......         0.000          0.000
Wet Weather Inflow .......         0.000          0.000
Groundwater Inflow .......         0.000          0.000
RDII Inflow ..............         0.000          0.000
External Inflow ..........        50.816         16.559
External Outflow .........        50.865         16.575
Flooding Loss ............         0.000          0.000
Evaporation Loss .........         0.000          0.000
Exfiltration Loss ........         0.000          0.000
Initial Stored Volume ....         0.000          0.000
Final Stored Volume ......         0.000          0.000
Continuity Error (%) .....        -0.095


********************************
Highest Flow Instability Indexes
********************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :    60.00 sec
Average Time Step           :    60.00 sec
Maximum Time Step           :    60.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     1.00
Percent Not Converging      :     0.00
```

```
******************
Node Depth Summary
******************

---------------------------------------------------------------------------------
                                 Average  Maximum  Maximum  Time of Max    Reported
                                   Depth    Depth      HGL   Occurrence   Max Depth
Node                 Type           Feet     Feet     Feet  days hr:min        Feet
---------------------------------------------------------------------------------
A1                   JUNCTION       0.00     0.00  7605.00     0  00:00        0.00
A2                   JUNCTION       0.00     0.00  7597.00     0  00:00        0.00
B1                   JUNCTION       0.00     0.00  7572.00     0  00:00        0.00
B2                   JUNCTION       0.00     0.00  7558.00     0  00:00        0.00
B3                   JUNCTION       0.00     0.00  7558.00     0  00:00        0.00
B4                   JUNCTION       0.00     0.00  7552.00     0  00:00        0.00
C1                   JUNCTION       0.00     0.00  7586.00     0  00:00        0.00
C2                   JUNCTION       0.00     0.00  7562.00     0  00:00        0.00
C3                   JUNCTION       0.00     0.00  7553.00     0  00:00        0.00
C4                   JUNCTION       0.00     0.00  7536.00     0  00:00        0.00
H1                   JUNCTION       0.00     0.00  7550.00     0  00:00        0.00
G1                   JUNCTION       0.00     0.00  7585.00     0  00:00        0.00
F2                   JUNCTION       0.00     0.00  7568.00     0  00:00        0.00
F1                   JUNCTION       0.00     0.00  7582.00     0  00:00        0.00
J_B1.1               JUNCTION       0.00     0.00  7536.00     0  00:00        0.00
J_A1.1               JUNCTION       0.02     1.41  7566.41     0  00:47        1.41
J_G1.1               JUNCTION       0.01     0.41  7555.41     0  00:43        0.41
J_C1.1               JUNCTION       0.00     0.00  7570.00     0  00:00        0.00
J_A2.2               JUNCTION       0.03     1.71  7526.71     0  00:49        1.71
J_H1.2               JUNCTION       0.01     0.41  7516.41     0  00:48        0.41
J_F1.1               JUNCTION       0.02     1.88  7573.88     0  00:39        1.87
J_B4.1               JUNCTION       0.00     0.00  7510.00     0  00:00        0.00
J_B2.1               JUNCTION       0.00     0.00  7522.00     0  00:00        0.00
J_B3.1               JUNCTION       0.00     0.00  7533.00     0  00:00        0.00
J_C3.1               JUNCTION       0.00     0.00  7544.00     0  00:00        0.00
J_C2.1               JUNCTION       0.00     0.00  7529.00     0  00:00        0.00
J_C4.1               JUNCTION       0.00     0.00  7524.00     0  00:00        0.00
O_BASIN_B            OUTFALL        0.00     0.00  7510.00     0  00:00        0.00
O_BASIN_C            OUTFALL        0.00     0.00  7520.00     0  00:00        0.00
O_BASIN_F            OUTFALL        0.02     1.87  7548.87     0  00:42        1.86
O_BASIN_H            OUTFALL        0.03     1.71  7516.71     0  00:51        1.71


*******************
Node Inflow Summary
*******************

-------------------------------------------------------------------------------------------------
                                  Maximum  Maximum                  Lateral       Total        Flow
                                  Lateral    Total  Time of Max      Inflow      Inflow     Balance
                                   Inflow   Inflow   Occurrence      Volume      Volume       Error
Node                 Type             CFS      CFS  days hr:min    10^6 gal    10^6 gal     Percent
-------------------------------------------------------------------------------------------------
A1                   JUNCTION       97.12    97.12     0  00:47        2.58        2.58       0.000
A2                   JUNCTION       71.21    71.21     0  00:48        2.04        2.04       0.000
B1                   JUNCTION      148.90   148.90     0  00:44        3.42        3.42       0.000
B2                   JUNCTION       75.76    75.76     0  00:42         1.7         1.7       0.000
B3                   JUNCTION       18.83    18.83     0  00:42       0.407       0.407       0.000
B4                   JUNCTION       19.56    19.56     0  00:42       0.446       0.446       0.000
C1                   JUNCTION       24.71    24.71     0  00:40        0.48        0.48       0.000
C2                   JUNCTION       39.79    39.79     0  00:41       0.836       0.836       0.000
C3                   JUNCTION        9.67     9.67     0  00:37       0.164       0.164       0.000
C4                   JUNCTION        3.96     3.96     0  00:41      0.0819      0.0819       0.000
H1                   JUNCTION       93.99    93.99     0  00:42        2.03        2.03       0.000
G1                   JUNCTION       10.83    10.83     0  00:43       0.277       0.277       0.000
F2                   JUNCTION       10.52    10.52     0  00:55       0.446       0.446       0.000
F1                   JUNCTION       94.56    94.56     0  00:39        1.65        1.65       0.000
J_B1.1               JUNCTION        0.00   148.90     0  00:44           0        3.42       0.000
J_A1.1               JUNCTION        0.00    97.12     0  00:47           0        2.58       0.000
J_G1.1               JUNCTION        0.00    10.83     0  00:43           0       0.277       0.000
J_C1.1               JUNCTION        0.00    24.71     0  00:40           0        0.48       0.000
J_A2.2               JUNCTION        0.00   167.62     0  00:49           0        4.62       0.000
J_H1.2               JUNCTION        0.00   104.43     0  00:43           0        2.31       0.000
J_F1.1               JUNCTION        0.00    94.56     0  00:39           0        1.65       0.000
J_B4.1               JUNCTION        0.00    19.56     0  00:42           0       0.446       0.000
```

J_B2.1	JUNCTION	0.00	224.49	0	00:43	0	5.12	0.000
J_B3.1	JUNCTION	0.00	18.83	0	00:42	0	0.407	0.000
J_C3.1	JUNCTION	0.00	9.67	0	00:37	0	0.164	0.000
J_C2.1	JUNCTION	0.00	64.49	0	00:41	0	1.32	0.000
J_C4.1	JUNCTION	0.00	3.96	0	00:41	0	0.0819	0.000
O_BASIN_B	OUTFALL	0.00	262.74	0	00:43	0	5.97	0.000
O_BASIN_C	OUTFALL	0.00	78.00	0	00:41	0	1.56	0.000
O_BASIN_F	OUTFALL	0.00	103.21	0	00:43	0	2.1	0.000
O_BASIN_H	OUTFALL	0.00	267.35	0	00:49	0	6.93	0.000

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
O_BASIN_B	3.52	65.57	262.74	5.974
O_BASIN_C	3.23	18.71	78.00	1.562
O_BASIN_F	4.83	16.86	103.21	2.104
O_BASIN_H	7.10	37.77	267.35	6.933
System	4.67	138.92	699.63	16.574

These max flow values are used to set the detention pond release rates.

Detention pond release plus undetained flow must be less than or equal to these values.

****
Link Flow Summary
****

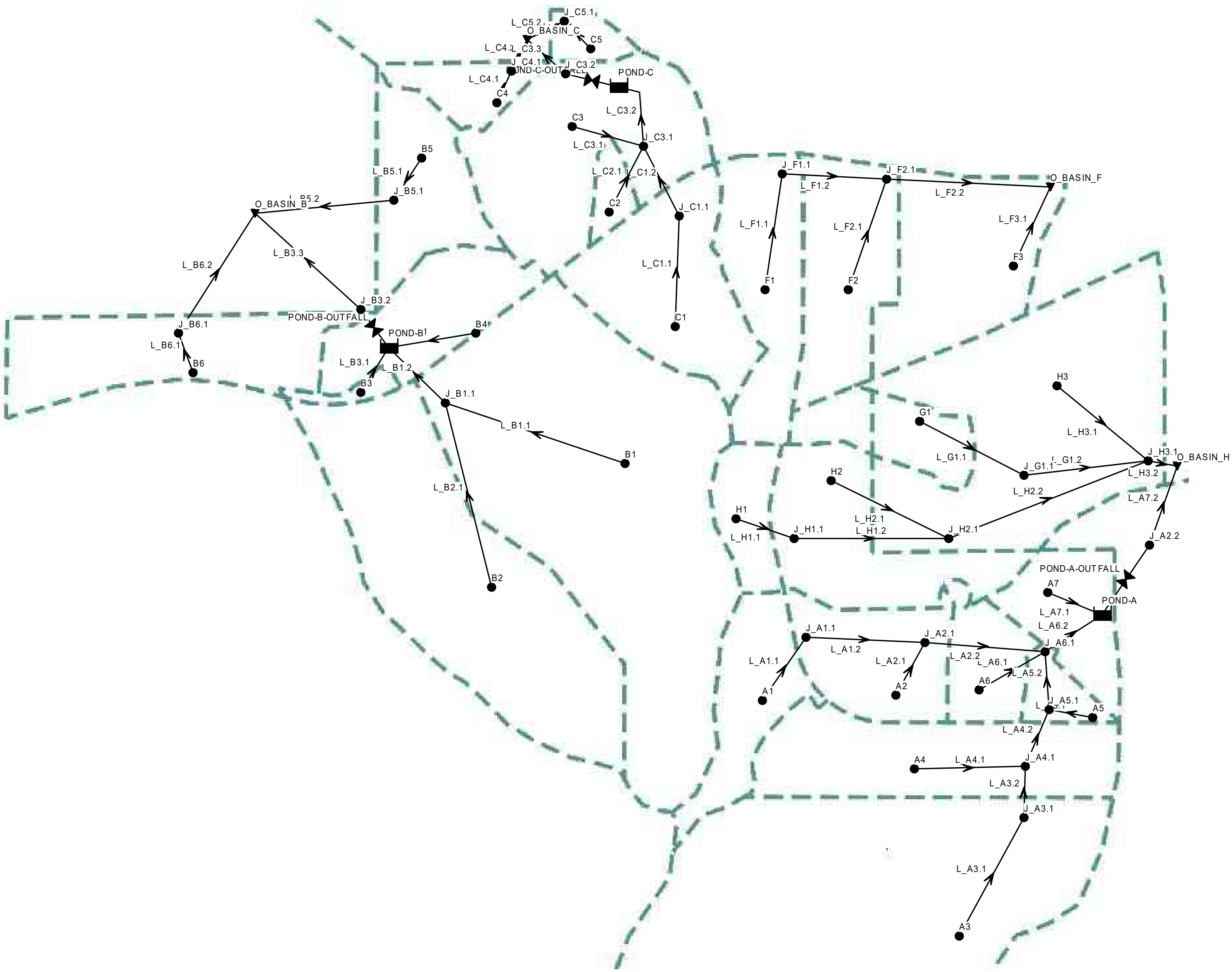
Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days	Time of Max Occurrence hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
L_A1.1	DUMMY	97.12	0	00:47			
L_A2.1	DUMMY	71.21	0	00:48			
L_A1.2	CONDUIT	96.63	0	00:50	6.49	0.06	0.28
L_G1.1	DUMMY	10.83	0	00:43			
L_H1.1	DUMMY	93.99	0	00:42			
L_G1.2	CONDUIT	10.78	0	00:48	3.94	0.01	0.10
L_F1.1	DUMMY	94.56	0	00:39			
L_B1.1	DUMMY	148.90	0	00:44			
L_B2.1	DUMMY	75.76	0	00:42			
L_B1.2	DUMMY	148.90	0	00:44			
L_B4.1	DUMMY	19.56	0	00:42			
L_B3.1	DUMMY	18.83	0	00:42			
L_C3.1	DUMMY	9.67	0	00:37			
L_C4.1	DUMMY	3.96	0	00:41			
L_C1.1	DUMMY	24.71	0	00:40			
L_C1.2	DUMMY	24.71	0	00:40			
L_C2.1	DUMMY	39.79	0	00:41			
L_A2.2	CONDUIT	167.38	0	00:51	5.81	0.11	0.34
L_H1.2	DUMMY	104.43	0	00:43			
L_F2.1	DUMMY	10.52	0	00:55			
L_F1.2	CONDUIT	93.94	0	00:42	6.76	0.84	0.94
L_B4.2	DUMMY	19.56	0	00:42			
L_B2.2	DUMMY	224.49	0	00:43			
L_B3.2	DUMMY	18.83	0	00:42			
L_C3.2	DUMMY	9.67	0	00:37			
L_C2.2	DUMMY	64.49	0	00:41			
L_C4.2	DUMMY	3.96	0	00:41			

```
*************************
Conduit Surcharge Summary
*************************

No conduits were surcharged.


Analysis begun on:  Wed Sep 04 10:57:37 2024
Analysis ended on:  Wed Sep 04 10:57:37 2024
Total elapsed time: < 1 sec
```

FLYING HORSE NORTH FILING NO. 4
DEVELOPED SWMM MODEL



```
[TITLE]
;;Project Title/Notes
Flying Horse North Filing No. 4
Final Drainage report

[OPTIONS]
;;Option             Value
FLOW_UNITS           CFS
INFILTRATION         HORTON
FLOW_ROUTING         KINWAVE
LINK_OFFSETS         DEPTH
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           01/01/2005
START_TIME           00:00:00
REPORT_START_DATE    01/01/2005
REPORT_START_TIME    00:00:00
END_DATE             01/02/2005
END_TIME             00:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:05:00
WET_STEP             00:05:00
DRY_STEP             01:00:00
ROUTING_STEP         0:02:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         12.557
MAX_TRIALS           8
HEAD_TOLERANCE       0.005
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              1

[FILES]
;;Interfacing Files
USE INFLOWS "SWMM_Developed_Interface_100.txt"

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO

[JUNCTIONS]
;;Name           Elevation  MaxDepth   InitDepth  SurDepth   Aponded
;;-------------- ---------- ---------- ---------- ---------- ----------
A1               7621       0          0          0          0
A2               7590       0          0          0          0
A3               7605       0          0          0          0
A4               7590       0          0          0          0
A5               7550       0          0          0          0
A6               7555       0          0          0          0
A7               7550       0          0          0          0
B1               7572       0          0          0          0
B2               7574       0          0          0          0
B3               7555       0          0          0          0
B4               7558       0          0          0          0
B5               7558       0          0          0          0
B6               7552       0          0          0          0
C1               7586       0          0          0          0
C2               7562       0          0          0          0
C3               7562       0          0          0          0
C4               7553       0          0          0          0
C5               7536       0          0          0          0
F1               7582       0          0          0          0
```

```
F2               7576       0          0          0          0
G1               7585       0          0          0          0
H1               7610       0          0          0          0
H2               7570       0          0          0          0
H3               7550       0          0          0          0
J_A1.1           7600       0          0          0          0
J_A2.1           7566       0          0          0          0
J_A2.2           7525       0          0          0          0
J_A3.1           7562       0          0          0          0
J_A4.1           7548       0          0          0          0
J_A5.1           7538       0          0          0          0
J_A6.1           7536       0          0          0          0
J_B1.1           7536       0          0          0          0
J_C1.1           7570       0          0          0          0
J_C3.1           7533       0          0          0          0
J_G1.1           7555       0          0          0          0
J_H1.1           7594       0          0          0          0
J_H2.1           7560       0          0          0          0
J_H3.1           7514       0          0          0          0
F3               7568       0          0          0          0
J_F1.1           7572       0          0          0          0
J_F2.1           7558       0          0          0          0
J_B3.2           7522       0          0          0          0
J_B5.1           7533       0          0          0          0
J_B6.1           7510       0          0          0          0
J_C4.1           7544       0          0          0          0
J_C3.2           7529       0          0          0          0
J_C5.1           7524       0          0          0          0

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
O_BASIN_B        7510       FREE                        NO
O_BASIN_C        7520       FREE                        NO
O_BASIN_F        7547       FREE                        NO
O_BASIN_H        7515       FREE                        NO

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params            N/A      Fevap    Psi
Ksat     IMD
;;-------------- -------- ---------- ----------- ---------- ---------------------------- -------- --------
-------- --------
POND-A           7530     7          0          TABULAR    POND-A_STORAGE               0        0
POND-B           7528     10         0          TABULAR    POND-B_STORAGE               0        0
POND-C           7530     10         0          TABULAR    POND-C_STORAGE               0        0

[CONDUITS]
;;Name           From Node        To Node          Length     Roughness  InOffset   OutOffset  InitFlow
MaxFlow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ---------- -----
-----
L_A1.1           A1               J_A1.1           400        .013       0          0          0          0
L_A2.1           A2               J_A2.1           400        .013       0          0          0          0
L_A1.2           J_A1.1           J_A2.1           840        .035       0          0          0          0
L_G1.1           G1               J_G1.1           400        .013       0          0          0          0
L_H3.1           H3               J_H3.1           400        .013       0          0          0          0
L_G1.2           J_G1.1           J_H3.1           1031       .035       0          0          0          0
L_F1.1           F1               J_F1.1           400        .013       0          0          0          0
L_B1.1           B1               J_B1.1           400        .013       0          0          0          0
L_B2.1           B2               J_B1.1           400        .013       0          0          0          0
L_B1.2           J_B1.1           POND-B           400        .013       0          0          0          0
L_B6.1           B6               J_B6.1           400        .013       0          0          0          0
L_B5.1           B5               J_B5.1           400        .013       0          0          0          0
L_C4.1           C4               J_C4.1           400        .013       0          0          0          0
L_C5.1           C5               J_C5.1           400        .013       0          0          0          0
L_C1.1           C1               J_C1.1           400        .013       0          0          0          0
L_C1.2           J_C1.1           J_C3.1           400        .013       0          0          0          0
L_C2.1           C2               J_C3.1           400        .013       0          0          0          0
L_A3.1           A3               J_A3.1           400        .013       0          0          0          0
L_A3.2           J_A3.1           J_A4.1           500        .035       0          0          0          0
L_A4.2           J_A4.1           J_A5.1           460        .035       0          0          0          0
L_A4.1           A4               J_A4.1           400        .013       0          0          0          0
L_A6.1           A6               J_A6.1           400        .013       0          0          0          0
L_A5.2           J_A5.1           J_A6.1           400        .013       0          0          0          0
```

```
L_A5.1           A5               J_A5.1           400        .013       0          0          0          0
L_A2.2           J_A2.1           J_A6.1           545        .035       0          0          0          0
L_A7.1           A7               POND-A           400        .013       0          0          0          0
L_A6.2           J_A6.1           POND-A           400        .013       0          0          0          0
L_H1.1           H1               J_H1.1           400        .013       0          0          0          0
L_H2.1           H2               J_H2.1           400        .013       0          0          0          0
L_H1.2           J_H1.1           J_H2.1           860        .035       0          0          0          0
L_H2.2           J_H2.1           J_H3.1           400        .013       0          0          0          0
L_A7.2           J_A2.2           O_BASIN_H        680        .035       0          0          0          0
L_H3.2           J_H3.1           O_BASIN_H        400        .013       0          0          0          0
L_B3.1           B3               POND-B           400        .013       0          0          0          0
L_B4.1           B4               POND-B           400        .013       0          0          0          0
L_C3.2           J_C3.1           POND-C           400        .013       0          0          0          0
L_C3.1           C3               J_C3.1           400        .013       0          0          0          0
L_F2.1           F2               J_F2.1           400        .013       0          0          0          0
L_F3.1           F3               O_BASIN_F        400        .013       0          0          0          0
L_F1.2           J_F1.1           J_F2.1           580        .030       0          0          0          0
L_F2.2           J_F2.1           O_BASIN_F        620        .030       0          0          0          0
L_B6.2           J_B6.1           O_BASIN_B        400        .013       0          0          0          0
L_B3.3           J_B3.2           O_BASIN_B        400        .013       0          0          0          0
L_B5.2           J_B5.1           O_BASIN_B        400        .013       0          0          0          0
L_C4.2           J_C4.1           O_BASIN_C        400        .013       0          0          0          0
L_C3.3           J_C3.2           O_BASIN_C        400        .013       0          0          0          0
L_C5.2           J_C5.1           O_BASIN_C        400        .013       0          0          0          0

[OUTLETS]
;;Name           From Node        To Node          Offset     Type            QTable/Qcoeff    Qexpon     Gated
;;-------------- ---------------- ---------------- ---------- --------------- ---------------- ---------- -----
---
POND-A-OUTFALL   POND-A           J_A2.2           0          TABULAR/DEPTH   POND-A_RELEASE              NO
POND-B-OUTFALL   POND-B           J_B3.2           0          TABULAR/DEPTH   POND-B_RELEASE              NO
POND-C-OUTFALL   POND-C           J_C3.2           0          TABULAR/DEPTH   POND-C_RELEASE              NO

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ---------- ---------- ----------
L_A1.1           DUMMY        0                0          0          0          1
L_A2.1           DUMMY        0                0          0          0          1
L_A1.2           TRAPEZOIDAL  4                4          4          4          1
L_G1.1           DUMMY        0                0          0          0          1
L_H3.1           DUMMY        0                0          0          0          1
L_G1.2           TRAPEZOIDAL  4                5          4          4          1
L_F1.1           DUMMY        0                0          0          0          1
L_B1.1           DUMMY        0                0          0          0          1
L_B2.1           DUMMY        0                0          0          0          1
L_B1.2           DUMMY        0                0          0          0          1
L_B6.1           DUMMY        0                0          0          0          1
L_B5.1           DUMMY        0                0          0          0          1
L_C4.1           DUMMY        0                0          0          0          1
L_C5.1           DUMMY        0                0          0          0          1
L_C1.1           DUMMY        0                0          0          0          1
L_C1.2           DUMMY        0                0          0          0          1
L_C2.1           DUMMY        0                0          0          0          1
L_A3.1           DUMMY        0                0          0          0          1
L_A3.2           TRAPEZOIDAL  5                6          4          4          1
L_A4.2           TRAPEZOIDAL  2                2          4          4          1
L_A4.1           DUMMY        0                0          0          0          1
L_A6.1           DUMMY        0                0          0          0          1
L_A5.2           DUMMY        0                0          0          0          1
L_A5.1           DUMMY        0                0          0          0          1
L_A2.2           TRAPEZOIDAL  2                2          4          4          1
L_A7.1           DUMMY        0                0          0          0          1
L_A6.2           DUMMY        0                0          0          0          1
L_H1.1           DUMMY        0                0          0          0          1
L_H2.1           DUMMY        0                0          0          0          1
L_H1.2           TRAPEZOIDAL  5                5          4          4          1
L_H2.2           TRAPEZOIDAL  4                5          4          4          1
L_A7.2           TRAPEZOIDAL  5                10         4          4          1
L_H3.2           DUMMY        0                0          0          0          1
L_B3.1           DUMMY        0                0          0          0          1
L_B4.1           DUMMY        0                0          0          0          1
L_C3.2           DUMMY        0                0          0          0          1
L_C3.1           DUMMY        0                0          0          0          1
L_F2.1           DUMMY        0                0          0          0          1
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L_F3.1           DUMMY        0                0           0           0           1
L_F1.2           TRIANGULAR   2                16          0           0           1
L_F2.2           TRIANGULAR   2                16          0           0           1
L_B6.2           DUMMY        0                0           0           0           1
L_B3.3           DUMMY        0                0           0           0           1
L_B5.2           DUMMY        0                0           0           0           1
L_C4.2           DUMMY        0                0           0           0           1
L_C3.3           DUMMY        0                0           0           0           1
L_C5.2           DUMMY        0                0           0           0           1

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
POND-A_RELEASE   Rating     0          0
POND-A_RELEASE              0.5        0.04
POND-A_RELEASE              1          0.08
POND-A_RELEASE              1.5        0.12
POND-A_RELEASE              2          0.17
POND-A_RELEASE              2.5        0.21
POND-A_RELEASE              2.72       0.23
POND-A_RELEASE              3          0.31
POND-A_RELEASE              3.18       0.34
POND-A_RELEASE              3.5        16.14
POND-A_RELEASE              4          65.05
POND-A_RELEASE              4.5        132.43
POND-A_RELEASE              4.85       160.22
POND-A_RELEASE              5          162.26
POND-A_RELEASE              5.5        229.95
POND-A_RELEASE              6          352.81
POND-A_RELEASE              6.5        516.42
POND-A_RELEASE              7          716.74
;
POND-B_RELEASE   Rating     0          0
POND-B_RELEASE              0.5        0.05
POND-B_RELEASE              1          0.11
POND-B_RELEASE              1.5        0.15
POND-B_RELEASE              2          0.23
POND-B_RELEASE              2.28       0.26
POND-B_RELEASE              2.5        0.29
POND-B_RELEASE              2.84       0.33
POND-B_RELEASE              3          6.89
POND-B_RELEASE              3.5        59.48
POND-B_RELEASE              4          139.49
POND-B_RELEASE              4.5        208.28
POND-B_RELEASE              4.98       216.56
POND-B_RELEASE              5          216.9
POND-B_RELEASE              5.5        225.2
POND-B_RELEASE              6          277.32
POND-B_RELEASE              6.5        370.54
POND-B_RELEASE              7          495.34
;
POND-C_RELEASE   Rating     0          0
POND-C_RELEASE              0.5        0.02
POND-C_RELEASE              1.5        0.06
POND-C_RELEASE              2          0.09
POND-C_RELEASE              2.24       0.1
POND-C_RELEASE              2.5        0.11
POND-C_RELEASE              2.62       0.11
POND-C_RELEASE              3          18.98
POND-C_RELEASE              3.47       64.63
POND-C_RELEASE              3.5        65.06
POND-C_RELEASE              4.5        96.21
POND-C_RELEASE              5          146.69
POND-C_RELEASE              5.5        217.39
POND-C_RELEASE              6          308.17
POND-C_RELEASE              6.5        419.52
POND-C_RELEASE              7          552.1
;
POND-A_STORAGE   Storage    0          10
POND-A_STORAGE              0.5        376
POND-A_STORAGE              1          2192
POND-A_STORAGE              1.5        7097
POND-A_STORAGE              2          14797
POND-A_STORAGE              2.5        22565
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POND-A_STORAGE              2.72       25765.12
POND-A_STORAGE              3          29838
POND-A_STORAGE              3.18       32505.96
POND-A_STORAGE              3.5        37249
POND-A_STORAGE              4          43958
POND-A_STORAGE              4.5        49678
POND-A_STORAGE              4.85       52552.9
POND-A_STORAGE              5          53785
POND-A_STORAGE              5.5        56812
POND-A_STORAGE              6          59334
POND-A_STORAGE              6.5        62623
POND-A_STORAGE              7          64854
;
POND-B_STORAGE   Storage    0          10
POND-B_STORAGE              0.5        2138.28
POND-B_STORAGE              1          7169.09
POND-B_STORAGE              1.5        13715.31
POND-B_STORAGE              2          18728.56
POND-B_STORAGE              2.28       21475.96
POND-B_STORAGE              2.5        23634.63
POND-B_STORAGE              2.84       26332.66
POND-B_STORAGE              3          27602.32
POND-B_STORAGE              3.5        30042.07
POND-B_STORAGE              4          32273.85
POND-B_STORAGE              4.5        34626.01
POND-B_STORAGE              4.98       36954.82
POND-B_STORAGE              5          37051.85
POND-B_STORAGE              5.5        39551.39
POND-B_STORAGE              6          42124.62
POND-B_STORAGE              6.5        44775.53
POND-B_STORAGE              7          47666.69
;
POND-C_STORAGE   Storage    0          10
POND-C_STORAGE              0.5        261
POND-C_STORAGE              1.5        5965
POND-C_STORAGE              2          12887
POND-C_STORAGE              2.19       16037.58
POND-C_STORAGE              2.5        21178
POND-C_STORAGE              2.53       21693.94
POND-C_STORAGE              3          29777
POND-C_STORAGE              3.37       35491.28
POND-C_STORAGE              3.5        37499
POND-C_STORAGE              4.5        50444
POND-C_STORAGE              5          55960
POND-C_STORAGE              5.5        55960
POND-C_STORAGE              6          55960
POND-C_STORAGE              6.5        55960
POND-C_STORAGE              7          55960

[REPORT]
;;Reporting Options
INPUT      NO
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS -2727.273 0.000 12727.273 10000.000
Units      None

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
A1               5852.080           3834.143
A2               7253.258           3852.399
A3               7842.026           2547.067
A4               7654.898           3400.553
A5               8567.718           3870.655
A6               7691.411           4062.348
A7               8102.180           4564.398
B1               4814.939           5640.594
```

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B2               3809.784           4700.287
B3               3128.872           6182.544
B4               3689.350           6622.589
B5               3680.086           7734.282
B6               1608.409           6446.756
C1               5491.219           6900.512
C2               4958.533           7794.498
C3               4508.350           7693.203
C4               3842.208           8378.137
C5               4926.108           8827.446
F1               6130.442           7178.435
F2               6914.644           7135.956
G1               7043.309           5951.884
H1               5895.032           5135.830
H2               6698.374           5426.070
H3               8081.329           6231.386
J_A1.1           6185.259           4313.373
J_A2.1           7358.232           4349.886
J_A2.2           8781.879           5021.807
J_A3.1           7837.462           2948.708
J_A4.1           8106.744           3514.656
J_A5.1           8298.436           3984.758
J_A6.1           8239.103           4185.578
J_B1.1           3457.748           6099.167
J_C1.1           5315.201           7525.839
J_C3.1           4958.533           8044.629
J_G1.1           7838.601           5550.458
J_H1.1           6091.980           5063.270
J_H2.1           7341.047           5001.076
J_H3.1           8775.757           5660.875
F3               7754.737           7140.178
J_F1.1           6332.068           7815.629
J_F2.1           6999.076           7802.964
J_B3.2           2819.437           6804.229
J_B5.1           3129.490           8044.439
J_B6.1           1425.618           6790.570
J_C4.1           3963.640           8666.499
J_C3.2           4340.348           8769.237
J_C5.1           4454.502           9024.181
O_BASIN_B        2013.301           7541.059
O_BASIN_C        4058.768           8921.442
O_BASIN_F        8033.360           7731.197
O_BASIN_H        8999.559           5612.652
POND-A           8427.940           4487.213
POND-B           3022.335           6516.052
POND-C           4762.717           8491.463

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
L_C3.2           4921.476           8456.882
```

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)
--------------------------------------------------------------

WARNING 04: minimum elevation drop used for Conduit L_B6.2

*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ NO
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Flow Routing Method ...... KINWAVE
Starting Date ............ 01/01/2005 00:00:00
Ending Date .............. 01/02/2005 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:05:00
Routing Time Step ........ 120.00 sec


**************************        Volume         Volume
Flow Routing Continuity        acre-feet       10^6 gal
**************************     ---------      ---------
Dry Weather Inflow .......         0.000          0.000
Wet Weather Inflow .......         0.000          0.000
Groundwater Inflow .......         0.000          0.000
RDII Inflow ..............         0.000          0.000
External Inflow ..........        10.906          3.554
External Outflow .........         9.874          3.217
Flooding Loss ............         0.000          0.000
Evaporation Loss .........         0.000          0.000
Exfiltration Loss ........         0.000          0.000
Initial Stored Volume ....         0.000          0.000
Final Stored Volume ......         1.007          0.328
Continuity Error (%) .....         0.231


********************************
Highest Flow Instability Indexes
********************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :   120.00 sec
Average Time Step           :   120.00 sec
Maximum Time Step           :   120.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     1.00
Percent Not Converging      :     0.00
```

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
A1	JUNCTION	0.00	0.00	7621.00	0 00:00	0.00
A2	JUNCTION	0.00	0.00	7590.00	0 00:00	0.00
A3	JUNCTION	0.00	0.00	7605.00	0 00:00	0.00
A4	JUNCTION	0.00	0.00	7590.00	0 00:00	0.00
A5	JUNCTION	0.00	0.00	7550.00	0 00:00	0.00
A6	JUNCTION	0.00	0.00	7555.00	0 00:00	0.00
A7	JUNCTION	0.00	0.00	7550.00	0 00:00	0.00
B1	JUNCTION	0.00	0.00	7572.00	0 00:00	0.00
B2	JUNCTION	0.00	0.00	7574.00	0 00:00	0.00
B3	JUNCTION	0.00	0.00	7555.00	0 00:00	0.00
B4	JUNCTION	0.00	0.00	7558.00	0 00:00	0.00
B5	JUNCTION	0.00	0.00	7558.00	0 00:00	0.00
B6	JUNCTION	0.00	0.00	7552.00	0 00:00	0.00
C1	JUNCTION	0.00	0.00	7586.00	0 00:00	0.00
C2	JUNCTION	0.00	0.00	7562.00	0 00:00	0.00
C3	JUNCTION	0.00	0.00	7562.00	0 00:00	0.00
C4	JUNCTION	0.00	0.00	7553.00	0 00:00	0.00
C5	JUNCTION	0.00	0.00	7536.00	0 00:00	0.00
F1	JUNCTION	0.00	0.00	7582.00	0 00:00	0.00
F2	JUNCTION	0.00	0.00	7576.00	0 00:00	0.00
G1	JUNCTION	0.00	0.00	7585.00	0 00:00	0.00
H1	JUNCTION	0.00	0.00	7610.00	0 00:00	0.00
H2	JUNCTION	0.00	0.00	7570.00	0 00:00	0.00
H3	JUNCTION	0.00	0.00	7550.00	0 00:00	0.00
J_A1.1	JUNCTION	0.01	0.25	7600.25	0 00:38	0.24
J_A2.1	JUNCTION	0.02	0.48	7566.48	0 00:38	0.47
J_A2.2	JUNCTION	0.07	0.65	7525.65	0 01:04	0.65
J_A3.1	JUNCTION	0.03	0.61	7562.61	0 00:42	0.61
J_A4.1	JUNCTION	0.06	1.01	7549.01	0 00:42	1.01
J_A5.1	JUNCTION	0.06	1.01	7539.01	0 00:44	1.01
J_A6.1	JUNCTION	0.02	0.48	7536.48	0 00:40	0.48
J_B1.1	JUNCTION	0.00	0.00	7536.00	0 00:00	0.00
J_C1.1	JUNCTION	0.00	0.00	7570.00	0 00:00	0.00
J_C3.1	JUNCTION	0.00	0.00	7533.00	0 00:00	0.00
J_G1.1	JUNCTION	0.00	0.14	7555.14	0 00:32	0.13
J_H1.1	JUNCTION	0.01	0.16	7594.16	0 00:38	0.15
J_H2.1	JUNCTION	0.01	0.17	7560.17	0 00:36	0.17
J_H3.1	JUNCTION	0.01	0.17	7514.17	0 00:36	0.17
F3	JUNCTION	0.00	0.00	7568.00	0 00:00	0.00
J_F1.1	JUNCTION	0.04	0.58	7572.58	0 00:38	0.58
J_F2.1	JUNCTION	0.06	0.79	7558.79	0 00:40	0.79
J_B3.2	JUNCTION	0.00	0.00	7522.00	0 00:00	0.00
J_B5.1	JUNCTION	0.00	0.00	7533.00	0 00:00	0.00
J_B6.1	JUNCTION	0.00	0.00	7510.00	0 00:00	0.00
J_C4.1	JUNCTION	0.00	0.00	7544.00	0 00:00	0.00
J_C3.2	JUNCTION	0.00	0.00	7529.00	0 00:00	0.00
J_C5.1	JUNCTION	0.00	0.00	7524.00	0 00:00	0.00
O_BASIN_B	OUTFALL	0.00	0.00	7510.00	0 00:00	0.00
O_BASIN_C	OUTFALL	0.00	0.00	7520.00	0 00:00	0.00
O_BASIN_F	OUTFALL	0.06	0.79	7547.79	0 00:44	0.79
O_BASIN_H	OUTFALL	0.07	0.65	7515.65	0 01:06	0.65
POND-A	STORAGE	2.82	3.62	7533.62	0 01:04	3.62
POND-B	STORAGE	2.52	3.53	7531.53	0 00:52	3.53
POND-C	STORAGE	2.40	2.81	7532.81	0 01:04	2.81

```
******************
Node Inflow Summary
******************
```

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days	Time of Max Occurrence hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
A1	JUNCTION	3.65	3.65	0	00:38	0.0824	0.0824	0.000
A2	JUNCTION	5.20	5.20	0	00:36	0.0966	0.0966	0.000
A3	JUNCTION	22.12	22.12	0	00:42	0.484	0.484	0.000
A4	JUNCTION	4.90	4.90	0	00:42	0.165	0.165	0.000
A5	JUNCTION	1.27	1.27	0	00:36	0.0221	0.0221	0.000
A6	JUNCTION	3.10	3.10	0	00:36	0.0571	0.0571	0.000
A7	JUNCTION	4.66	4.66	0	00:34	0.0727	0.0727	0.000
B1	JUNCTION	41.84	41.84	0	00:38	0.664	0.664	0.000
B2	JUNCTION	12.80	12.80	0	00:40	0.329	0.329	0.000
B3	JUNCTION	1.15	1.15	0	00:32	0.0191	0.0191	0.000
B4	JUNCTION	4.22	4.22	0	00:38	0.119	0.119	0.000
B5	JUNCTION	5.00	5.00	0	00:36	0.0951	0.0951	0.000
B6	JUNCTION	9.22	9.22	0	00:34	0.143	0.143	0.000
C1	JUNCTION	7.24	7.24	0	00:38	0.14	0.14	0.000
C2	JUNCTION	0.92	0.92	0	00:38	0.0248	0.0248	0.000
C3	JUNCTION	10.04	10.04	0	00:36	0.179	0.179	0.000
C4	JUNCTION	2.85	2.85	0	00:32	0.0385	0.0385	0.000
C5	JUNCTION	1.06	1.06	0	00:36	0.0203	0.0203	0.000
F1	JUNCTION	4.40	4.40	0	00:38	0.115	0.115	0.000
F2	JUNCTION	4.27	4.27	0	00:40	0.118	0.118	0.000
G1	JUNCTION	1.58	1.58	0	00:32	0.0228	0.0228	0.000
H1	JUNCTION	2.00	2.00	0	00:38	0.0466	0.0466	0.000
H2	JUNCTION	9.63	9.63	0	00:34	0.129	0.129	0.000
H3	JUNCTION	14.61	14.61	0	00:38	0.221	0.221	0.000
J_A1.1	JUNCTION	0.00	3.65	0	00:38	0	0.0824	0.000
J_A2.1	JUNCTION	0.00	8.55	0	00:38	0	0.179	0.000
J_A2.2	JUNCTION	0.00	27.78	0	01:04	0	0.847	0.000
J_A3.1	JUNCTION	0.00	22.12	0	00:42	0	0.484	0.000
J_A4.1	JUNCTION	0.00	26.97	0	00:42	0	0.648	0.000
J_A5.1	JUNCTION	0.00	28.01	0	00:44	0	0.671	0.000
J_A6.1	JUNCTION	0.00	39.08	0	00:42	0	0.907	0.000
J_B1.1	JUNCTION	0.00	54.54	0	00:38	0	0.993	0.000
J_C1.1	JUNCTION	0.00	7.24	0	00:38	0	0.14	0.000
J_C3.1	JUNCTION	0.00	18.18	0	00:36	0	0.344	0.000
J_G1.1	JUNCTION	0.00	1.58	0	00:32	0	0.0228	0.000
J_H1.1	JUNCTION	0.00	2.00	0	00:38	0	0.0466	0.000
J_H2.1	JUNCTION	0.00	10.83	0	00:36	0	0.176	0.000
J_H3.1	JUNCTION	0.00	26.60	0	00:38	0	0.42	0.000
F3	JUNCTION	6.96	6.96	0	00:38	0.15	0.15	0.000
J_F1.1	JUNCTION	0.00	4.40	0	00:38	0	0.115	0.000
J_F2.1	JUNCTION	0.00	8.63	0	00:40	0	0.233	0.000
J_B3.2	JUNCTION	0.00	44.34	0	00:52	0	1.01	0.000
J_B5.1	JUNCTION	0.00	5.00	0	00:36	0	0.0951	0.000
J_B6.1	JUNCTION	0.00	9.22	0	00:34	0	0.143	0.000
J_C4.1	JUNCTION	0.00	2.85	0	00:32	0	0.0385	0.000
J_C3.2	JUNCTION	0.00	9.59	0	01:04	0	0.259	0.000
J_C5.1	JUNCTION	0.00	1.06	0	00:36	0	0.0203	0.000
O_BASIN_B	OUTFALL	0.00	53.58	0	00:50	0	1.25	0.000
O_BASIN_C	OUTFALL	0.00	10.99	0	01:02	0	0.318	0.000
O_BASIN_F	OUTFALL	0.00	15.21	0	00:42	0	0.383	0.000
O_BASIN_H	OUTFALL	0.00	38.01	0	01:04	0	1.27	0.000
POND-A	STORAGE	0.00	43.06	0	00:42	0	0.98	0.391
POND-B	STORAGE	0.00	59.75	0	00:38	0	1.13	0.426
POND-C	STORAGE	0.00	18.18	0	00:36	0	0.344	0.588

```
********************
Node Flooding Summary
********************

No nodes were flooded.
```

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
POND-A	27.285	12	0	0	52.312	22	0 01:04	27.78
POND-B	26.141	8	0	0	50.023	16	0 00:52	44.34
POND-C	15.113	4	0	0	23.875	6	0 01:02	9.59

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
O_BASIN_B	99.44	1.94	53.58	1.249
O_BASIN_C	99.44	0.50	10.99	0.318
O_BASIN_F	18.61	3.19	15.21	0.383
O_BASIN_H	99.31	1.97	38.01	1.266
System	79.20	7.60	104.35	3.217

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
L_A1.1	DUMMY	3.65	0 00:38			
L_A2.1	DUMMY	5.20	0 00:36			
L_A1.2	CONDUIT	3.58	0 00:42	2.98	0.00	0.06
L_G1.1	DUMMY	1.58	0 00:32			
L_H3.1	DUMMY	14.61	0 00:38			
L_G1.2	CONDUIT	1.40	0 00:42	2.09	0.00	0.03
L_F1.1	DUMMY	4.40	0 00:38			
L_B1.1	DUMMY	41.84	0 00:38			
L_B2.1	DUMMY	12.80	0 00:40			
L_B1.2	DUMMY	54.54	0 00:38			
L_B6.1	DUMMY	9.22	0 00:34			
L_B5.1	DUMMY	5.00	0 00:36			
L_C4.1	DUMMY	2.85	0 00:32			
L_C5.1	DUMMY	1.06	0 00:36			
L_C1.1	DUMMY	7.24	0 00:38			
L_C1.2	DUMMY	7.24	0 00:38			
L_C2.1	DUMMY	0.92	0 00:38			
L_A3.1	DUMMY	22.12	0 00:42			
L_A3.2	CONDUIT	22.07	0 00:42	4.29	0.01	0.12
L_A4.2	CONDUIT	26.95	0 00:44	4.42	0.20	0.51
L_A4.1	DUMMY	4.90	0 00:42			
L_A6.1	DUMMY	3.10	0 00:36			
L_A5.2	DUMMY	28.01	0 00:44			
L_A5.1	DUMMY	1.27	0 00:36			
L_A2.2	CONDUIT	8.53	0 00:40	4.61	0.04	0.24
L_A7.1	DUMMY	4.66	0 00:34			
L_A6.2	DUMMY	39.08	0 00:42			
L_H1.1	DUMMY	2.00	0 00:38			
L_H2.1	DUMMY	9.63	0 00:34			
L_H1.2	CONDUIT	1.94	0 00:44	2.28	0.00	0.03
L_H2.2	CONDUIT	10.78	0 00:36	11.08	0.00	0.04
L_A7.2	CONDUIT	27.68	0 01:06	3.40	0.02	0.13
L_H3.2	DUMMY	26.60	0 00:38			
L_B3.1	DUMMY	1.15	0 00:32			
L_B4.1	DUMMY	4.22	0 00:38			

L_C3.2	DUMMY	18.18	0	00:36			
L_C3.1	DUMMY	10.04	0	00:36			
L_F2.1	DUMMY	4.27	0	00:40			
L_F3.1	DUMMY	6.96	0	00:38			
L_F1.2	CONDUIT	4.38	0	00:42	3.31	0.04	0.29
L_F2.2	CONDUIT	8.60	0	00:44	3.50	0.08	0.39
L_B6.2	DUMMY	9.22	0	00:34			
L_B3.3	DUMMY	44.34	0	00:52			
L_B5.2	DUMMY	5.00	0	00:36			
L_C4.2	DUMMY	2.85	0	00:32			
L_C3.3	DUMMY	9.59	0	01:04			
L_C5.2	DUMMY	1.06	0	00:36			
POND-A-OUTFALL	DUMMY	27.78	0	01:04			
POND-B-OUTFALL	DUMMY	44.34	0	00:52			
POND-C-OUTFALL	DUMMY	9.59	0	01:04			

```
*************************
Conduit Surcharge Summary
*************************

No conduits were surcharged.


Analysis begun on:  Thu Sep 05 13:59:33 2024
Analysis ended on:  Thu Sep 05 13:59:33 2024
Total elapsed time: < 1 sec
```

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)
--------------------------------------------------------------

WARNING 04: minimum elevation drop used for Conduit L_B6.2

*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ NO
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Flow Routing Method ...... KINWAVE
Starting Date ............ 01/01/2005 00:00:00
Ending Date .............. 01/02/2005 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:05:00
Routing Time Step ........ 120.00 sec


**************************        Volume         Volume
Flow Routing Continuity        acre-feet      10^6 gal
**************************     ---------      ---------
Dry Weather Inflow .......         0.000          0.000
Wet Weather Inflow .......         0.000          0.000
Groundwater Inflow .......         0.000          0.000
RDII Inflow ..............         0.000          0.000
External Inflow ..........        52.489         17.104
External Outflow .........        51.425         16.757
Flooding Loss ............         0.000          0.000
Evaporation Loss .........         0.000          0.000
Exfiltration Loss ........         0.000          0.000
Initial Stored Volume ....         0.000          0.000
Final Stored Volume ......         1.018          0.332
Continuity Error (%) .....         0.089


********************************
Highest Flow Instability Indexes
********************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :   120.00 sec
Average Time Step           :   120.00 sec
Maximum Time Step           :   120.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     1.00
Percent Not Converging      :     0.00
```

```
******************
Node Depth Summary
******************

  ---------------------------------------------------------------------------------
                                 Average  Maximum  Maximum  Time of Max    Reported
                                   Depth    Depth      HGL   Occurrence   Max Depth
  Node                 Type         Feet     Feet     Feet  days hr:min        Feet
  ---------------------------------------------------------------------------------
  A1                   JUNCTION     0.00     0.00  7621.00     0  00:00        0.00
  A2                   JUNCTION     0.00     0.00  7590.00     0  00:00        0.00
  A3                   JUNCTION     0.00     0.00  7605.00     0  00:00        0.00
  A4                   JUNCTION     0.00     0.00  7590.00     0  00:00        0.00
  A5                   JUNCTION     0.00     0.00  7550.00     0  00:00        0.00
  A6                   JUNCTION     0.00     0.00  7555.00     0  00:00        0.00
  A7                   JUNCTION     0.00     0.00  7550.00     0  00:00        0.00
  B1                   JUNCTION     0.00     0.00  7572.00     0  00:00        0.00
  B2                   JUNCTION     0.00     0.00  7574.00     0  00:00        0.00
  B3                   JUNCTION     0.00     0.00  7555.00     0  00:00        0.00
  B4                   JUNCTION     0.00     0.00  7558.00     0  00:00        0.00
  B5                   JUNCTION     0.00     0.00  7558.00     0  00:00        0.00
  B6                   JUNCTION     0.00     0.00  7552.00     0  00:00        0.00
  C1                   JUNCTION     0.00     0.00  7586.00     0  00:00        0.00
  C2                   JUNCTION     0.00     0.00  7562.00     0  00:00        0.00
  C3                   JUNCTION     0.00     0.00  7562.00     0  00:00        0.00
  C4                   JUNCTION     0.00     0.00  7553.00     0  00:00        0.00
  C5                   JUNCTION     0.00     0.00  7536.00     0  00:00        0.00
  F1                   JUNCTION     0.00     0.00  7582.00     0  00:00        0.00
  F2                   JUNCTION     0.00     0.00  7576.00     0  00:00        0.00
  G1                   JUNCTION     0.00     0.00  7585.00     0  00:00        0.00
  H1                   JUNCTION     0.00     0.00  7610.00     0  00:00        0.00
  H2                   JUNCTION     0.00     0.00  7570.00     0  00:00        0.00
  H3                   JUNCTION     0.00     0.00  7550.00     0  00:00        0.00
  J_A1.1               JUNCTION     0.03     0.52  7600.52     0  00:44        0.52
  J_A2.1               JUNCTION     0.05     0.90  7566.90     0  00:44        0.90
  J_A2.2               JUNCTION     0.14     1.68  7526.68     0  01:02        1.68
  J_A3.1               JUNCTION     0.08     1.35  7563.35     0  00:48        1.34
  J_A4.1               JUNCTION     0.13     1.93  7549.93     0  00:48        1.93
  J_A5.1               JUNCTION     0.13     1.93  7539.93     0  00:50        1.93
  J_A6.1               JUNCTION     0.05     0.90  7536.90     0  00:46        0.90
  J_B1.1               JUNCTION     0.00     0.00  7536.00     0  00:00        0.00
  J_C1.1               JUNCTION     0.00     0.00  7570.00     0  00:00        0.00
  J_C3.1               JUNCTION     0.00     0.00  7533.00     0  00:00        0.00
  J_G1.1               JUNCTION     0.01     0.29  7555.29     0  00:38        0.28
  J_H1.1               JUNCTION     0.02     0.34  7594.34     0  00:44        0.34
  J_H2.1               JUNCTION     0.02     0.37  7560.37     0  00:40        0.37
  J_H3.1               JUNCTION     0.02     0.37  7514.37     0  00:40        0.37
  F3                   JUNCTION     0.00     0.00  7568.00     0  00:00        0.00
  J_F1.1               JUNCTION     0.07     0.96  7572.96     0  00:46        0.96
  J_F2.1               JUNCTION     0.10     1.32  7559.32     0  00:48        1.32
  J_B3.2               JUNCTION     0.00     0.00  7522.00     0  00:00        0.00
  J_B5.1               JUNCTION     0.00     0.00  7533.00     0  00:00        0.00
  J_B6.1               JUNCTION     0.00     0.00  7510.00     0  00:00        0.00
  J_C4.1               JUNCTION     0.00     0.00  7544.00     0  00:00        0.00
  J_C3.2               JUNCTION     0.00     0.00  7529.00     0  00:00        0.00
  J_C5.1               JUNCTION     0.00     0.00  7524.00     0  00:00        0.00
  O_BASIN_B            OUTFALL      0.00     0.00  7510.00     0  00:00        0.00
  O_BASIN_C            OUTFALL      0.00     0.00  7520.00     0  00:00        0.00
  O_BASIN_F            OUTFALL      0.10     1.32  7548.32     0  00:50        1.32
  O_BASIN_H            OUTFALL      0.14     1.68  7516.68     0  01:04        1.68
  POND-A               STORAGE      2.90     4.89  7534.89     0  01:02        4.89
  POND-B               STORAGE      2.59     5.22  7533.22     0  00:56        5.21
  POND-C               STORAGE      2.44     3.44  7533.44     0  00:54        3.44
```

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days	Time of Max Occurrence hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
A1	JUNCTION	14.30	14.30	0	00:44	0.37	0.37	0.000
A2	JUNCTION	19.57	19.57	0	00:42	0.422	0.422	0.000
A3	JUNCTION	101.45	101.45	0	00:48	2.67	2.67	0.000
A4	JUNCTION	20.00	20.00	0	00:52	0.718	0.718	0.000
A5	JUNCTION	4.73	4.73	0	00:42	0.0964	0.0964	0.000
A6	JUNCTION	11.66	11.66	0	00:42	0.249	0.249	0.000
A7	JUNCTION	17.12	17.12	0	00:38	0.317	0.317	0.000
B1	JUNCTION	181.77	181.77	0	00:42	3.66	3.66	0.000
B2	JUNCTION	49.44	49.44	0	00:46	1.41	1.41	0.000
B3	JUNCTION	3.01	3.01	0	00:38	0.0521	0.0521	0.000
B4	JUNCTION	15.04	15.04	0	00:46	0.451	0.451	0.000
B5	JUNCTION	18.88	18.88	0	00:42	0.415	0.415	0.000
B6	JUNCTION	33.86	33.86	0	00:38	0.624	0.624	0.000
C1	JUNCTION	27.69	27.69	0	00:42	0.62	0.62	0.000
C2	JUNCTION	3.00	3.00	0	00:44	0.0845	0.0845	0.000
C3	JUNCTION	39.03	39.03	0	00:42	0.823	0.823	0.000
C4	JUNCTION	10.29	10.29	0	00:38	0.168	0.168	0.000
C5	JUNCTION	4.01	4.01	0	00:42	0.0887	0.0887	0.000
F1	JUNCTION	17.27	17.27	0	00:46	0.501	0.501	0.000
F2	JUNCTION	16.94	16.94	0	00:48	0.516	0.516	0.000
G1	JUNCTION	5.74	5.74	0	00:38	0.0994	0.0994	0.000
H1	JUNCTION	7.68	7.68	0	00:44	0.203	0.203	0.000
H2	JUNCTION	35.02	35.02	0	00:38	0.565	0.565	0.000
H3	JUNCTION	66.87	66.87	0	00:42	1.33	1.33	0.000
J_A1.1	JUNCTION	0.00	14.30	0	00:44	0	0.37	0.000
J_A2.1	JUNCTION	0.00	33.49	0	00:44	0	0.792	0.000
J_A2.2	JUNCTION	0.00	160.82	0	01:02	0	4.71	0.000
J_A3.1	JUNCTION	0.00	101.45	0	00:48	0	2.67	-0.000
J_A4.1	JUNCTION	0.00	121.26	0	00:48	0	3.39	0.000
J_A5.1	JUNCTION	0.00	125.49	0	00:50	0	3.49	0.000
J_A6.1	JUNCTION	0.00	169.54	0	00:48	0	4.53	0.000
J_B1.1	JUNCTION	0.00	230.41	0	00:44	0	5.07	0.000
J_C1.1	JUNCTION	0.00	27.69	0	00:42	0	0.62	0.000
J_C3.1	JUNCTION	0.00	69.70	0	00:42	0	1.53	0.000
J_G1.1	JUNCTION	0.00	5.74	0	00:38	0	0.0994	0.000
J_H1.1	JUNCTION	0.00	7.68	0	00:44	0	0.203	0.000
J_H2.1	JUNCTION	0.00	41.20	0	00:40	0	0.768	0.000
J_H3.1	JUNCTION	0.00	113.43	0	00:42	0	2.2	0.000
F3	JUNCTION	26.57	26.57	0	00:44	0.654	0.654	0.000
J_F1.1	JUNCTION	0.00	17.27	0	00:46	0	0.501	0.000
J_F2.1	JUNCTION	0.00	34.20	0	00:48	0	1.02	0.000
J_B3.2	JUNCTION	0.00	215.66	0	00:56	0	5.45	0.000
J_B5.1	JUNCTION	0.00	18.88	0	00:42	0	0.415	0.000
J_B6.1	JUNCTION	0.00	33.86	0	00:38	0	0.624	0.000
J_C4.1	JUNCTION	0.00	10.29	0	00:38	0	0.168	0.000
J_C3.2	JUNCTION	0.00	61.92	0	00:54	0	1.44	0.000
J_C5.1	JUNCTION	0.00	4.01	0	00:42	0	0.0887	0.000
O_BASIN_B	OUTFALL	0.00	260.91	0	00:48	0	6.49	0.000
O_BASIN_C	OUTFALL	0.00	73.21	0	00:52	0	1.7	0.000
O_BASIN_F	OUTFALL	0.00	60.23	0	00:48	0	1.67	0.000
O_BASIN_H	OUTFALL	0.00	248.45	0	00:54	0	6.9	0.000
POND-A	STORAGE	0.00	185.08	0	00:48	0	4.85	0.166
POND-B	STORAGE	0.00	248.09	0	00:44	0	5.57	0.119
POND-C	STORAGE	0.00	69.70	0	00:42	0	1.53	0.259

****
Node Flooding Summary
****

No nodes were flooded.

```
**********************
Storage Volume Summary
**********************

--------------------------------------------------------------------------------------------------
                        Average     Avg  Evap Exfil       Maximum     Max    Time of Max    Maximum
                         Volume    Pcnt  Pcnt  Pcnt        Volume    Pcnt     Occurrence    Outflow
Storage Unit           1000 ft3    Full  Loss  Loss      1000 ft3    Full    days hr:min        CFS
--------------------------------------------------------------------------------------------------
POND-A                   30.297      13     0     0       111.834      47       0  01:02     160.82
POND-B                   28.109       9     0     0       101.570      32       0  00:56     215.66
POND-C                   15.997       4     0     0        43.891      11       0  00:54      61.92


***********************
Outfall Loading Summary
***********************

-----------------------------------------------------------
                       Flow       Avg       Max       Total
                       Freq      Flow      Flow      Volume
Outfall Node           Pcnt       CFS       CFS    10^6 gal
-----------------------------------------------------------
O_BASIN_B             99.44     10.09    260.91       6.486
O_BASIN_C             99.44      2.64     73.21       1.697
O_BASIN_F             19.17     13.49     60.23       1.671
O_BASIN_H             99.31     10.76    248.45       6.903
-----------------------------------------------------------
System                79.34     36.98    639.55      16.756
```

```
*******************
Link Flow Summary
*******************

-----------------------------------------------------------------------------
                                Maximum  Time of Max   Maximum    Max/    Max/
                                 |Flow|   Occurrence   |Veloc|    Full    Full
Link                Type            CFS  days hr:min    ft/sec    Flow   Depth
-----------------------------------------------------------------------------
L_A1.1              DUMMY         14.30     0  00:44
L_A2.1              DUMMY         19.57     0  00:42
L_A1.2              CONDUIT       14.26     0  00:46      4.51    0.01    0.13
L_G1.1              DUMMY          5.74     0  00:38
L_H3.1              DUMMY         66.87     0  00:42
L_G1.2              CONDUIT        5.60     0  00:44      3.27    0.00    0.07
L_F1.1              DUMMY         17.27     0  00:46
L_B1.1              DUMMY        181.77     0  00:42
L_B2.1              DUMMY         49.44     0  00:46
L_B1.2              DUMMY        230.41     0  00:44
L_B6.1              DUMMY         33.86     0  00:38
L_B5.1              DUMMY         18.88     0  00:42
L_C4.1              DUMMY         10.29     0  00:38
L_C5.1              DUMMY          4.01     0  00:42
L_C1.1              DUMMY         27.69     0  00:42
L_C1.2              DUMMY         27.69     0  00:42
L_C2.1              DUMMY          3.00     0  00:44
L_A3.1              DUMMY        101.45     0  00:48
L_A3.2              CONDUIT      101.47     0  00:48      6.61    0.06    0.27
L_A4.2              CONDUIT      121.20     0  00:50      6.46    0.92    0.96
L_A4.1              DUMMY         20.00     0  00:52
L_A6.1              DUMMY         11.66     0  00:42
L_A5.2              DUMMY        125.49     0  00:50
L_A5.1              DUMMY          4.73     0  00:42
L_A2.2              CONDUIT       33.44     0  00:46      6.59    0.16    0.45
L_A7.1              DUMMY         17.12     0  00:38
L_A6.2              DUMMY        169.54     0  00:48
L_H1.1              DUMMY          7.68     0  00:44
L_H2.1              DUMMY         35.02     0  00:38
L_H1.2              CONDUIT        7.65     0  00:48      3.59    0.00    0.07
L_H2.2              CONDUIT       41.25     0  00:40     17.31    0.01    0.09
L_A7.2              CONDUIT      160.81     0  01:04      5.75    0.10    0.34
L_H3.2              DUMMY        113.43     0  00:42
L_B3.1              DUMMY          3.01     0  00:38
L_B4.1              DUMMY         15.04     0  00:46
L_C3.2              DUMMY         69.70     0  00:42
L_C3.1              DUMMY         39.03     0  00:42
L_F2.1              DUMMY         16.94     0  00:48
L_F3.1              DUMMY         26.57     0  00:44
L_F1.2              CONDUIT       17.26     0  00:48      4.65    0.14    0.48
L_F2.2              CONDUIT       34.14     0  00:50      4.91    0.33    0.66
L_B6.2              DUMMY         33.86     0  00:38
L_B3.3              DUMMY        215.66     0  00:56
L_B5.2              DUMMY         18.88     0  00:42
L_C4.2              DUMMY         10.29     0  00:38
L_C3.3              DUMMY         61.92     0  00:54
L_C5.2              DUMMY          4.01     0  00:42
POND-A-OUTFALL      DUMMY        160.82     0  01:02
POND-B-OUTFALL      DUMMY        215.66     0  00:56
POND-C-OUTFALL      DUMMY         61.92     0  00:54


*************************
Conduit Surcharge Summary
*************************

No conduits were surcharged.


Analysis begun on:  Thu Sep 05 13:58:30 2024
Analysis ended on:  Thu Sep 05 13:58:30 2024
Total elapsed time: < 1 sec
```

SWWM hydrographs representing runoff entering ponds, transferred to MHFD-Detention

Table - Node Total Inflow			
		POND-A	
Days	Hours	5-Year	100-Year
0	0:05:00	0	0
0	0:10:00	0.01	0.02
0	0:15:00	0.1	0.11
0	0:20:00	0.3	0.29
0	0:25:00	2.36	1.83
0	0:30:00	11.47	19.59
0	0:35:00	31.46	96.08
0	0:40:00	42.49	161.92
0	0:45:00	42.09	182.46
0	0:50:00	38.34	183.84
0	0:55:00	34.02	175.93
0	1:00:00	30.05	164.79
0	1:05:00	26.4	153.37
0	1:10:00	23.39	142.09
0	1:15:00	20.9	126.74
0	1:20:00	18.58	110.87
0	1:25:00	16.3	96.01
0	1:30:00	14.09	82.24
0	1:35:00	12.12	69.97
0	1:40:00	10.6	60.01
0	1:45:00	9.32	52.05
0	1:50:00	8.13	45.12
0	1:55:00	7.07	39.03
0	2:00:00	6.16	33.71
0	2:05:00	5.36	29.08
0	2:10:00	4.62	24.94
0	2:15:00	3.92	21.21
0	2:20:00	3.25	17.72
0	2:25:00	2.63	14.39
0	2:30:00	2.05	11.28
0	2:35:00	1.57	8.63
0	2:40:00	1.25	6.76
0	2:45:00	1.04	5.46
0	2:50:00	0.88	4.45
0	2:55:00	0.76	3.64
0	3:00:00	0.65	2.98
0	3:05:00	0.55	2.43
0	3:10:00	0.45	1.96
0	3:15:00	0.37	1.57
0	3:20:00	0.29	1.23
0	3:25:00	0.21	0.91
0	3:30:00	0.15	0.63
0	3:35:00	0.11	0.44
0	3:40:00	0.09	0.32
0	3:45:00	0.07	0.23
0	3:50:00	0.06	0.16
0	3:55:00	0.05	0.12
0	4:00:00	0.04	0.08
0	4:05:00	0.03	0.06
0	4:10:00	0.03	0.04
0	4:15:00	0.02	0.03
0	4:20:00	0.02	0.02
0	4:25:00	0.01	0.02

Table - Node Total Inflow			
		POND-B	
Days	Hours	5-Year	100-Year
0	0:05:00	0	0
0	0:10:00	0.02	0.03
0	0:15:00	0.29	0.32
0	0:20:00	0.84	0.81
0	0:25:00	5.28	4.04
0	0:30:00	28.18	47.72
0	0:35:00	55.99	177.86
0	0:40:00	59.11	240.83
0	0:45:00	52.91	247.06
0	0:50:00	45.39	236.61
0	0:55:00	39.31	219.08
0	1:00:00	33.91	200.33
0	1:05:00	28.93	183.22
0	1:10:00	24.45	163.76
0	1:15:00	21.11	137.51
0	1:20:00	18.47	115.66
0	1:25:00	15.99	97.45
0	1:30:00	13.64	81.53
0	1:35:00	11.47	67.41
0	1:40:00	9.51	54.87
0	1:45:00	7.57	43.86
0	1:50:00	5.83	33.94
0	1:55:00	4.79	26.61
0	2:00:00	4.12	21.52
0	2:05:00	3.56	17.61
0	2:10:00	3.01	14.31
0	2:15:00	2.51	11.6
0	2:20:00	2.04	9.28
0	2:25:00	1.6	7.3
0	2:30:00	1.18	5.61
0	2:35:00	0.81	4.07
0	2:40:00	0.55	2.75
0	2:45:00	0.4	1.87
0	2:50:00	0.31	1.28
0	2:55:00	0.24	0.88
0	3:00:00	0.19	0.58
0	3:05:00	0.15	0.37
0	3:10:00	0.12	0.23
0	3:15:00	0.09	0.15
0	3:20:00	0.07	0.11
0	3:25:00	0.05	0.08
0	3:30:00	0.04	0.07
0	3:35:00	0.03	0.05
0	3:40:00	0.02	0.04
0	3:45:00	0.01	0.03
0	3:50:00	0.01	0.02
0	3:55:00	0.00	0.01
0	4:00:00	0.00	0.01
0	4:05:00	0.00	0.00
0	4:10:00	0.00	0.00
0	4:15:00	0.00	0.00
0	4:20:00	0.00	0.00
0	4:25:00	0.00	0.00

Table - Node Total Inflow			
		POND-C	
Days	Hours	5-Year	100-Year
0	0:05:00	0	0
0	0:10:00	0.01	0.02
0	0:15:00	0.16	0.17
0	0:20:00	0.44	0.42
0	0:25:00	3.1	2.4
0	0:30:00	12.19	23.71
0	0:35:00	18.04	57.21
0	0:40:00	17.52	69.03
0	0:45:00	15.52	68.8
0	0:50:00	13.42	65.25
0	0:55:00	11.68	60.06
0	1:00:00	10.12	54.88
0	1:05:00	8.65	50.27
0	1:10:00	7.28	44.01
0	1:15:00	6.21	36.31
0	1:20:00	5.39	30.18
0	1:25:00	4.68	25.27
0	1:30:00	4.04	21.11
0	1:35:00	3.44	17.52
0	1:40:00	2.82	14.24
0	1:45:00	2.17	11.2
0	1:50:00	1.56	8.38
0	1:55:00	1.1	6
0	2:00:00	0.81	4.2
0	2:05:00	0.63	2.99
0	2:10:00	0.49	2.1
0	2:15:00	0.38	1.45
0	2:20:00	0.29	0.96
0	2:25:00	0.22	0.61
0	2:30:00	0.16	0.37
0	2:35:00	0.12	0.25
0	2:40:00	0.09	0.18
0	2:45:00	0.07	0.13
0	2:50:00	0.05	0.1
0	2:55:00	0.04	0.07
0	3:00:00	0.02	0.05
0	3:05:00	0.02	0.04
0	3:10:00	0.01	0.02
0	3:15:00	0.01	0.02
0	3:20:00	0.01	0.01
0	3:25:00	0.00	0.01
0	3:30:00	0.00	0.00
0	3:35:00	0.00	0.00
0	3:40:00	0.00	0.00
0	3:45:00	0.00	0.00
0	3:50:00	0.00	0.00
0	3:55:00	0.00	0.00
0	4:00:00	0.00	0.00
0	4:05:00	0.00	0.00
0	4:10:00	0.00	0.00
0	4:15:00	0.00	0.00
0	4:20:00	0.00	0.00
0	4:25:00	0.00	0.00

SWWM hydrographs representing runoff entering ponds, transferred to MHFD-Detention

Table - Node Total Inflow			
		POND-A	
Days	Hours	5-Year	100-Year
0	4:30:00	0.01	0.02
0	4:35:00	0.01	0.01
0	4:40:00	0.01	0.01
0	4:45:00	0.01	0.01
0	4:50:00	0.00	0.01
0	4:55:00	0.00	0.01
0	5:00:00	0.00	0.00
0	5:05:00	0.00	0.00
0	5:10:00	0.00	0.00
0	5:15:00	0.00	0.00
0	5:20:00	0.00	0.00
0	5:25:00	0.00	0.00
0	5:30:00	0.00	0.00
0	5:35:00	0.00	0.00
0	5:40:00	0.00	0.00
0	5:45:00	0.00	0.00
0	5:50:00	0.00	0.00
0	5:55:00	0.00	0.00
0	6:00:00	0.00	0.00

Table - Node Total Inflow			
		POND-B	
Days	Hours	5-Year	100-Year
0	4:30:00	0.00	0.00
0	4:35:00	0.00	0.00
0	4:40:00	0.00	0.00
0	4:45:00	0.00	0.00
0	4:50:00	0.00	0.00
0	4:55:00	0.00	0.00
0	5:00:00	0.00	0.00
0	5:05:00	0.00	0.00
0	5:10:00	0.00	0.00
0	5:15:00	0.00	0.00
0	5:20:00	0.00	0.00
0	5:25:00	0.00	0.00
0	5:30:00	0.00	0.00
0	5:35:00	0.00	0.00
0	5:40:00	0.00	0.00
0	5:45:00	0.00	0.00
0	5:50:00	0.00	0.00
0	5:55:00	0.00	0.00
0	6:00:00	0.00	0.00

Table - Node Total Inflow			
		POND-C	
Days	Hours	5-Year	100-Year
0	4:30:00	0.00	0.00
0	4:35:00	0.00	0.00
0	4:40:00	0.00	0.00
0	4:45:00	0.00	0.00
0	4:50:00	0.00	0.00
0	4:55:00	0.00	0.00
0	5:00:00	0.00	0.00
0	5:05:00	0.00	0.00
0	5:10:00	0.00	0.00
0	5:15:00	0.00	0.00
0	5:20:00	0.00	0.00
0	5:25:00	0.00	0.00
0	5:30:00	0.00	0.00
0	5:35:00	0.00	0.00
0	5:40:00	0.00	0.00
0	5:45:00	0.00	0.00
0	5:50:00	0.00	0.00
0	5:55:00	0.00	0.00
0	6:00:00	0.00	0.00

APPENDIX C

HYDRAULIC CALCULATIONS

EXISTING CULVERT CALCULATIONS

Culvert Report

ANALYSIS DONE ON EXISTING CULVERTS WITH PROPOSED FLOWS

Existing 48-inch Culvert - DPB2 (Old Stagecoach Road)

Invert Elev Dn (ft)	=	7532.00
Pipe Length (ft)	=	123.98
Slope (%)	=	1.33
Invert Elev Up (ft)	=	7533.65
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

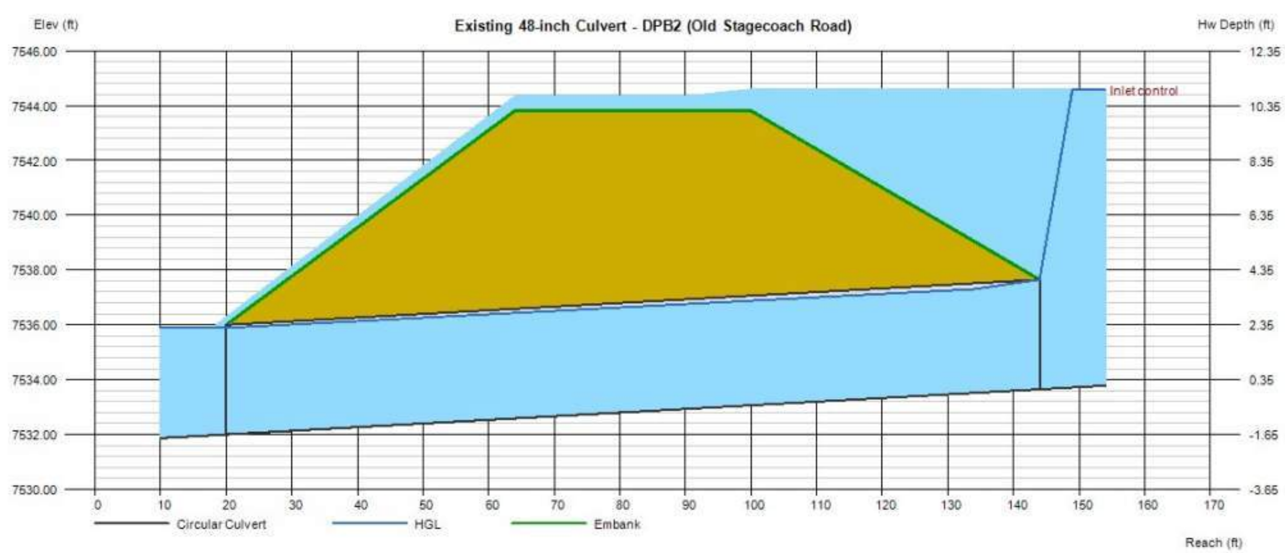
Top Elevation (ft)	=	7543.81
Top Width (ft)	=	36.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	285.80
Qmax (cfs)	=	285.80
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	285.80
Qpipe (cfs)	=	181.21
Qovertop (cfs)	=	104.59
Veloc Dn (ft/s)	=	14.53
Veloc Up (ft/s)	=	14.74
HGL Dn (ft)	=	7535.89
HGL Up (ft)	=	7537.43
Hw Elev (ft)	=	7544.58
Hw/D (ft)	=	2.73
Flow Regime	=	Inlet Control



Culvert Report

ANALYSIS DONE ON EXISTING CULVERTS WITH PROPOSED FLOWS

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Oct 22 2024

Existing 30-inch Culvert - DPC1 (Old Stagecoach Road)

Invert Elev Dn (ft)	= 7564.75
Pipe Length (ft)	= 82.63
Slope (%)	= 4.54
Invert Elev Up (ft)	= 7568.50
Rise (in)	= 30.0
Shape	= Circular
Span (in)	= 30.0
No. Barrels	= 1
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Square edge w/headwall (C)
Coeff. K,M,c,Y,k	= 0.0098, 2, 0.0398, 0.67, 0.5

Embankment

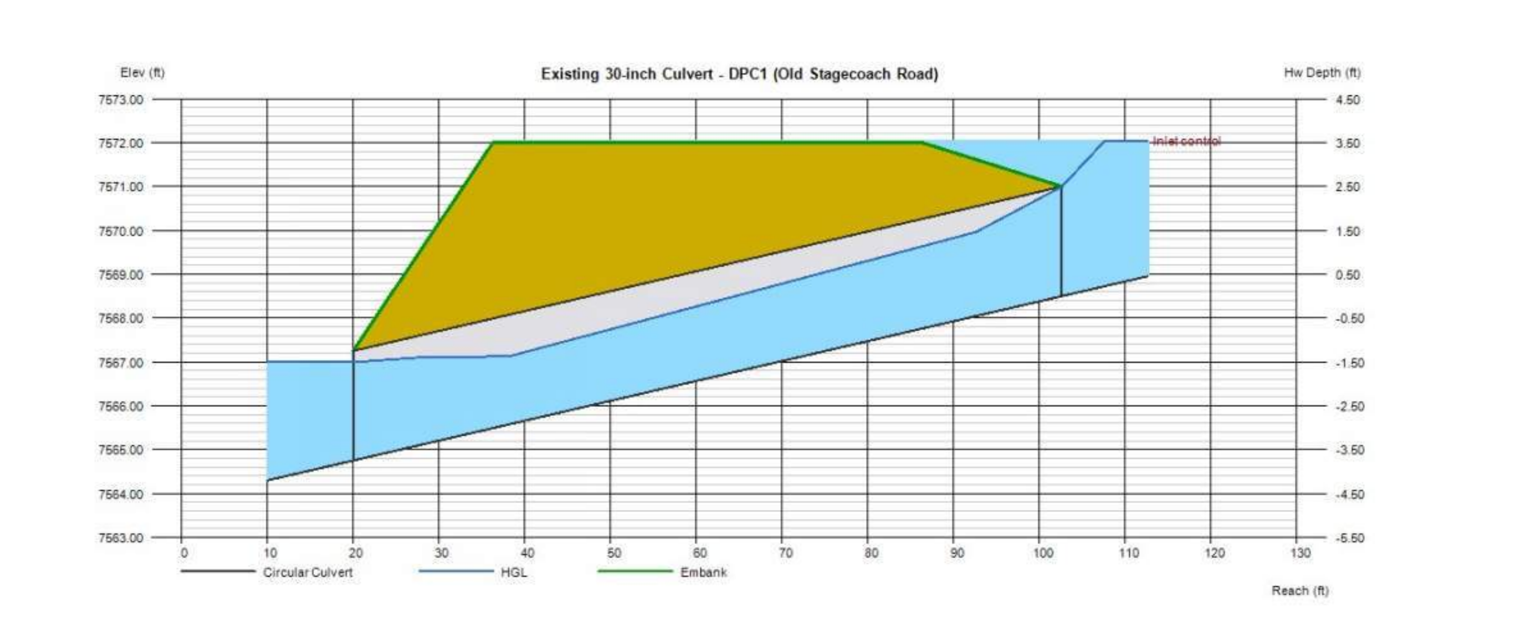
Top Elevation (ft)	= 7572.00
Top Width (ft)	= 50.00
Crest Width (ft)	= 100.00

Calculations

Qmin (cfs)	= 37.20
Qmax (cfs)	= 37.20
Tailwater Elev (ft)	= (dc+D)/2

Highlighted

Qtotal (cfs)	= 37.20
Qpipe (cfs)	= 34.15
Qovertop (cfs)	= 3.05
Veloc Dn (ft/s)	= 7.36
Veloc Up (ft/s)	= 8.17
HGL Dn (ft)	= 7566.99
HGL Up (ft)	= 7570.49
Hw Elev (ft)	= 7572.05
Hw/D (ft)	= 1.42
Flow Regime	= Inlet Control



Culvert Report

ANALYSIS DONE ON EXISTING CULVERTS WITH PROPOSED FLOWS

Existing 30-inch Culvert - DPF1 (Old Stagecoach Road)

Invert Elev Dn (ft)	=	7568.00
Pipe Length (ft)	=	100.00
Slope (%)	=	1.00
Invert Elev Up (ft)	=	7569.00
Rise (in)	=	30.0
Shape	=	Circular
Span (in)	=	30.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

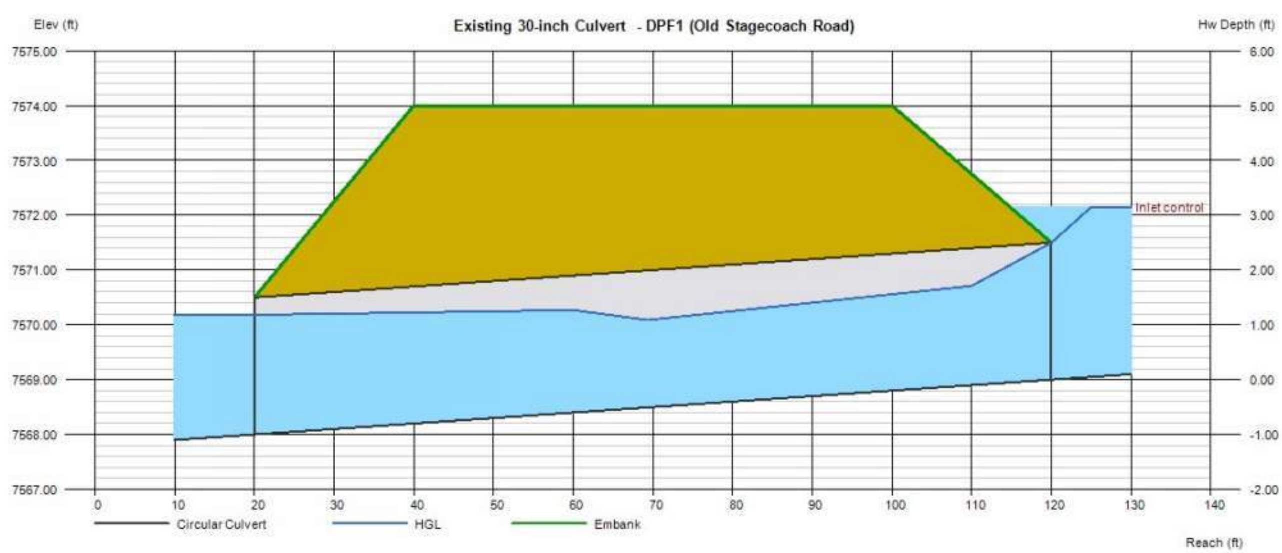
Top Elevation (ft)	=	7574.00
Top Width (ft)	=	60.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	30.00
Qmax (cfs)	=	30.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	30.00
Qpipe (cfs)	=	30.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.60
Veloc Up (ft/s)	=	7.64
HGL Dn (ft)	=	7570.18
HGL Up (ft)	=	7570.87
Hw Elev (ft)	=	7572.15
Hw/D (ft)	=	1.26
Flow Regime	=	Inlet Control



Culvert Report

ANALYSIS DONE ON EXISTING CULVERTS WITH PROPOSED FLOWS

Existing 36-inch Culvert - DPF2 (Old Stagecoach Road)

Invert Elev Dn (ft)	=	7543.08
Pipe Length (ft)	=	86.00
Slope (%)	=	2.81
Invert Elev Up (ft)	=	7545.50
Rise (in)	=	36.0
Shape	=	Circular
Span (in)	=	36.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

Top Elevation (ft)	=	7549.16
Top Width (ft)	=	36.00
Crest Width (ft)	=	40.00

Calculations

Qmin (cfs)	=	60.50
Qmax (cfs)	=	60.50
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	60.50
Qpipe (cfs)	=	48.94
Qovertop (cfs)	=	11.56
Veloc Dn (ft/s)	=	7.43
Veloc Up (ft/s)	=	8.51
HGL Dn (ft)	=	7545.72
HGL Up (ft)	=	7547.78
Hw Elev (ft)	=	7549.38
Hw/D (ft)	=	1.29
Flow Regime	=	Inlet Control

CULVERT CALCULATIONS

Culvert Report

Culvert 1 (5-Year)

Invert Elev Dn (ft)	=	7578.00
Pipe Length (ft)	=	136.05
Slope (%)	=	1.37
Invert Elev Up (ft)	=	7579.86
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

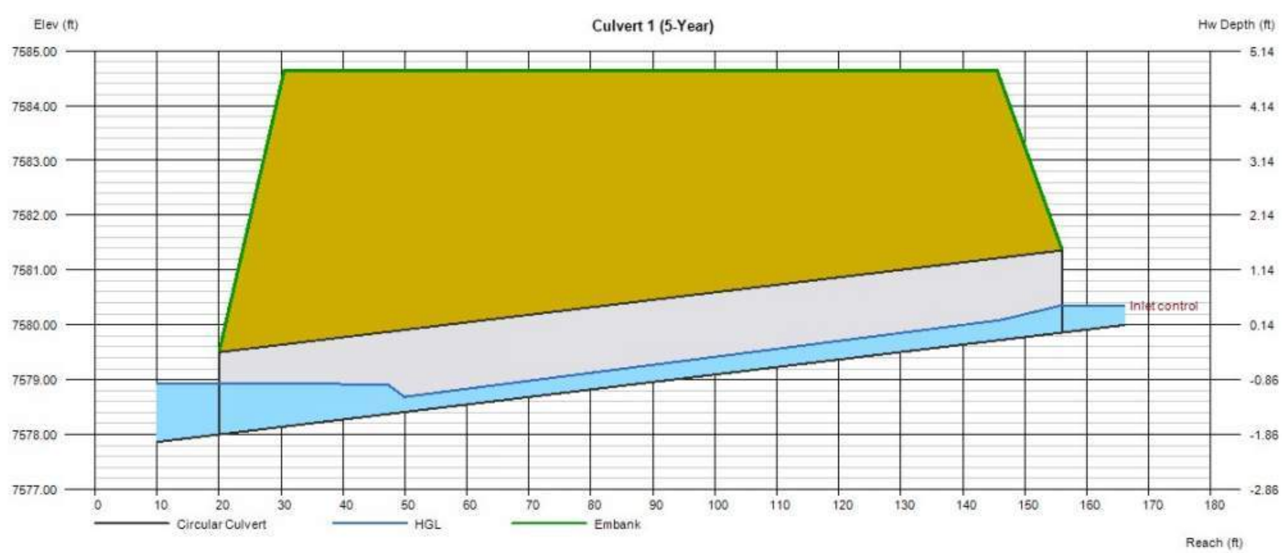
Top Elevation (ft)	=	7584.64
Top Width (ft)	=	115.00
Crest Width (ft)	=	30.00

Calculations

Qmin (cfs)	=	1.00
Qmax (cfs)	=	1.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	1.00
Qpipe (cfs)	=	1.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	0.86
Veloc Up (ft/s)	=	2.92
HGL Dn (ft)	=	7578.94
HGL Up (ft)	=	7580.23
Hw Elev (ft)	=	7580.36
Hw/D (ft)	=	0.33
Flow Regime	=	Inlet Control



Culvert Report

Culvert 1 (100-Year)

Invert Elev Dn (ft)	= 7578.00
Pipe Length (ft)	= 136.05
Slope (%)	= 1.37
Invert Elev Up (ft)	= 7579.86
Rise (in)	= 18.0
Shape	= Circular
Span (in)	= 18.0
No. Barrels	= 1
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Square edge w/headwall (C)
Coeff. K,M,c,Y,k	= 0.0098, 2, 0.0398, 0.67, 0.5

Embankment

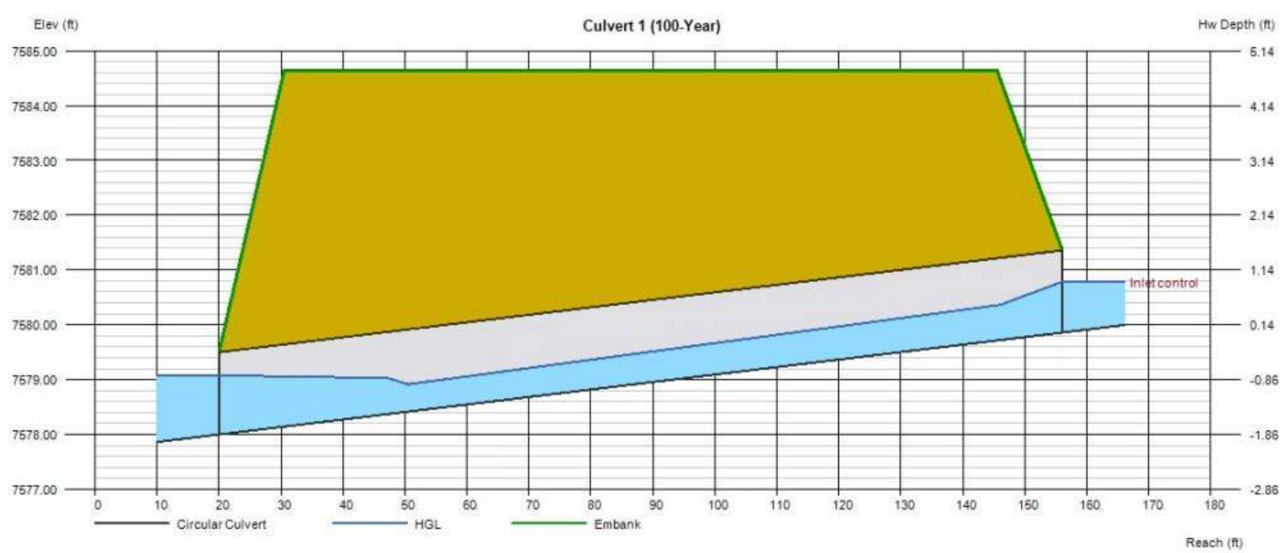
Top Elevation (ft)	= 7584.64
Top Width (ft)	= 115.00
Crest Width (ft)	= 30.00

Calculations

Qmin (cfs)	= 3.00
Qmax (cfs)	= 3.00
Tailwater Elev (ft)	= (dc+D)/2

Highlighted

Qtotal (cfs)	= 3.00
Qpipe (cfs)	= 3.00
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 2.20
Veloc Up (ft/s)	= 4.02
HGL Dn (ft)	= 7579.08
HGL Up (ft)	= 7580.52
Hw Elev (ft)	= 7580.79
Hw/D (ft)	= 0.62
Flow Regime	= Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Sep 13 2024

Culvert 2 - DPA4 (5-Year)

Invert Elev Dn (ft)	=	7545.83
Pipe Length (ft)	=	210.30
Slope (%)	=	1.19
Invert Elev Up (ft)	=	7548.34
Rise (in)	=	60.0
Shape	=	Circular
Span (in)	=	60.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

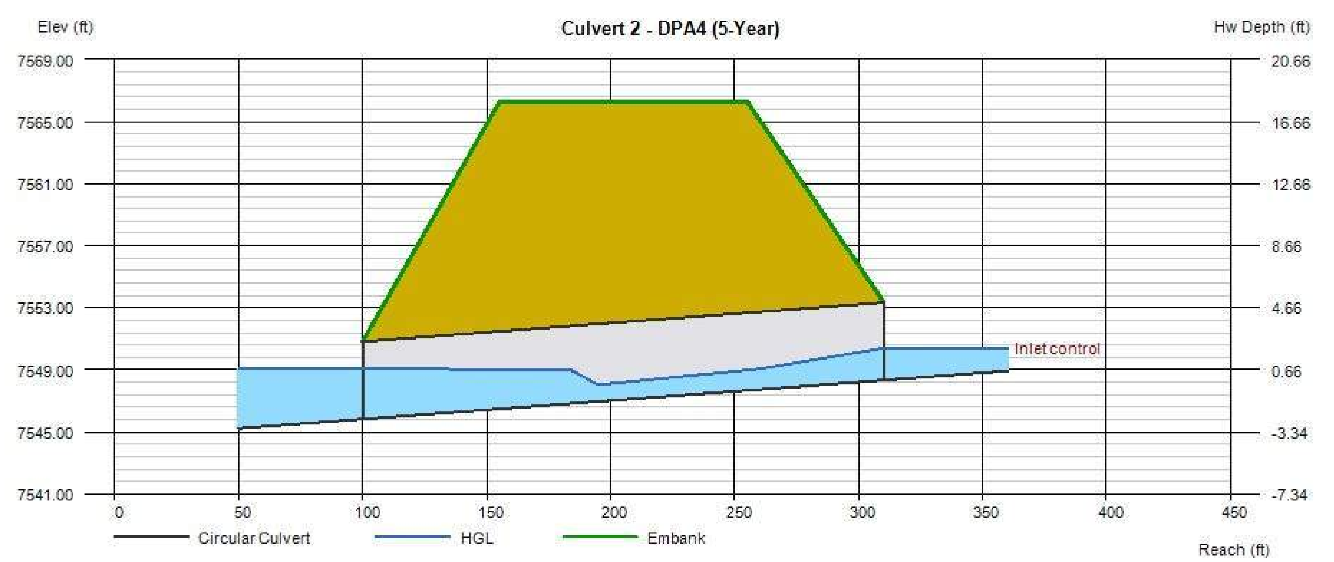
Top Elevation (ft)	=	7566.27
Top Width (ft)	=	100.00
Crest Width (ft)	=	270.00

Calculations

Qmin (cfs)	=	30.00
Qmax (cfs)	=	30.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	30.00
Qpipe (cfs)	=	30.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	2.21
Veloc Up (ft/s)	=	5.95
HGL Dn (ft)	=	7549.09
HGL Up (ft)	=	7549.86
Hw Elev (ft)	=	7550.40
Hw/D (ft)	=	0.41
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Sep 13 2024

Culvert 2 - DPA4 (100-Year)

Invert Elev Dn (ft)	=	7545.83
Pipe Length (ft)	=	210.30
Slope (%)	=	1.19
Invert Elev Up (ft)	=	7548.34
Rise (in)	=	60.0
Shape	=	Circular
Span (in)	=	60.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

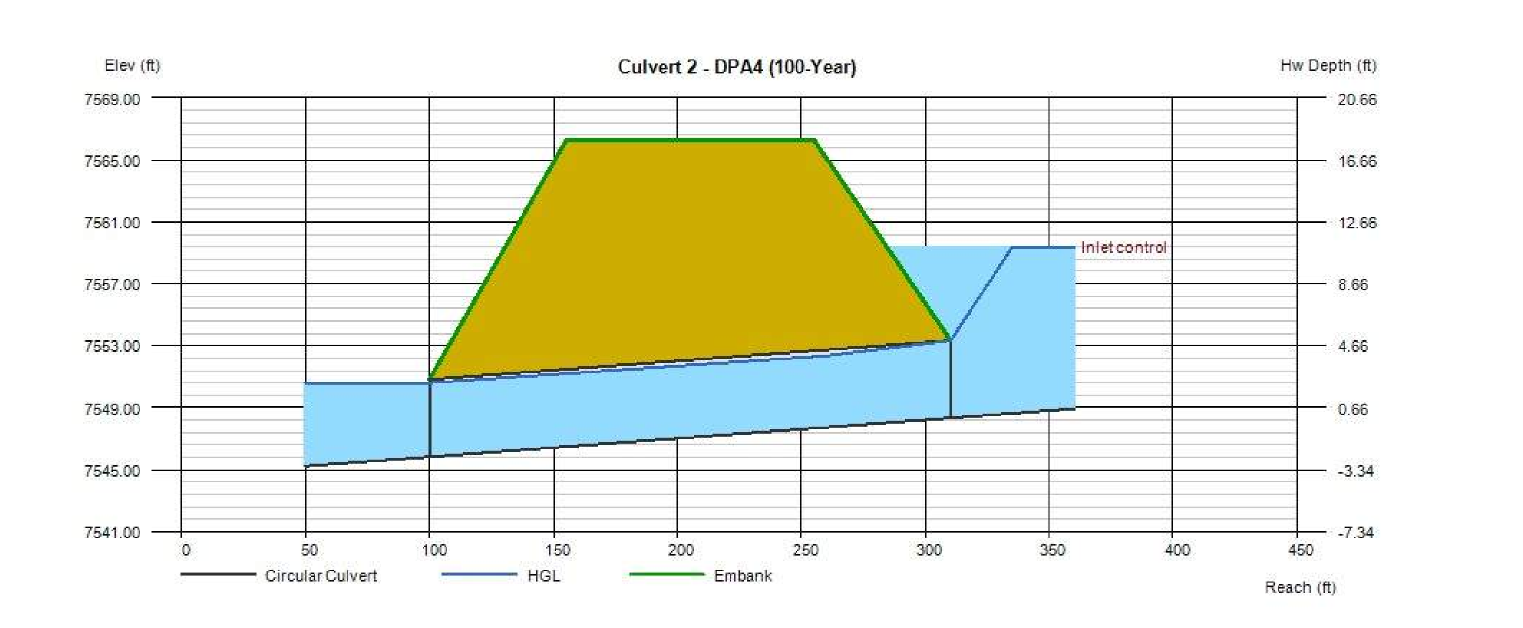
Top Elevation (ft)	=	7566.27
Top Width (ft)	=	100.00
Crest Width (ft)	=	270.00

Calculations

Qmin (cfs)	=	274.00
Qmax (cfs)	=	274.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	274.00
Qpipe (cfs)	=	274.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	14.18
Veloc Up (ft/s)	=	14.59
HGL Dn (ft)	=	7550.61
HGL Up (ft)	=	7552.90
Hw Elev (ft)	=	7559.41
Hw/D (ft)	=	2.21
Flow Regime	=	Inlet Control



Culvert Report

Culvert 3 (5-Year)

Invert Elev Dn (ft)	=	7597.25
Pipe Length (ft)	=	70.14
Slope (%)	=	0.50
Invert Elev Up (ft)	=	7597.60
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

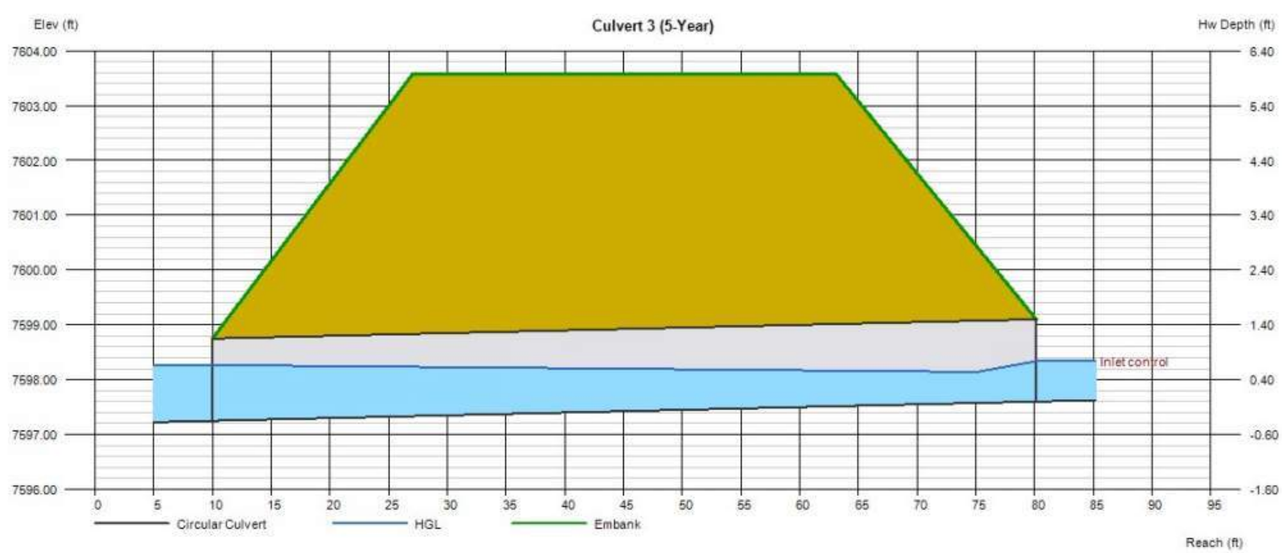
Top Elevation (ft)	=	7603.58
Top Width (ft)	=	36.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	2.00
Qmax (cfs)	=	2.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	2.00
Qpipe (cfs)	=	2.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	1.57
Veloc Up (ft/s)	=	3.56
HGL Dn (ft)	=	7598.27
HGL Up (ft)	=	7598.13
Hw Elev (ft)	=	7598.34
Hw/D (ft)	=	0.49
Flow Regime	=	Inlet Control



Culvert Report

Culvert 3 (100-Year)

Invert Elev Dn (ft)	=	7597.25
Pipe Length (ft)	=	70.14
Slope (%)	=	0.50
Invert Elev Up (ft)	=	7597.60
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

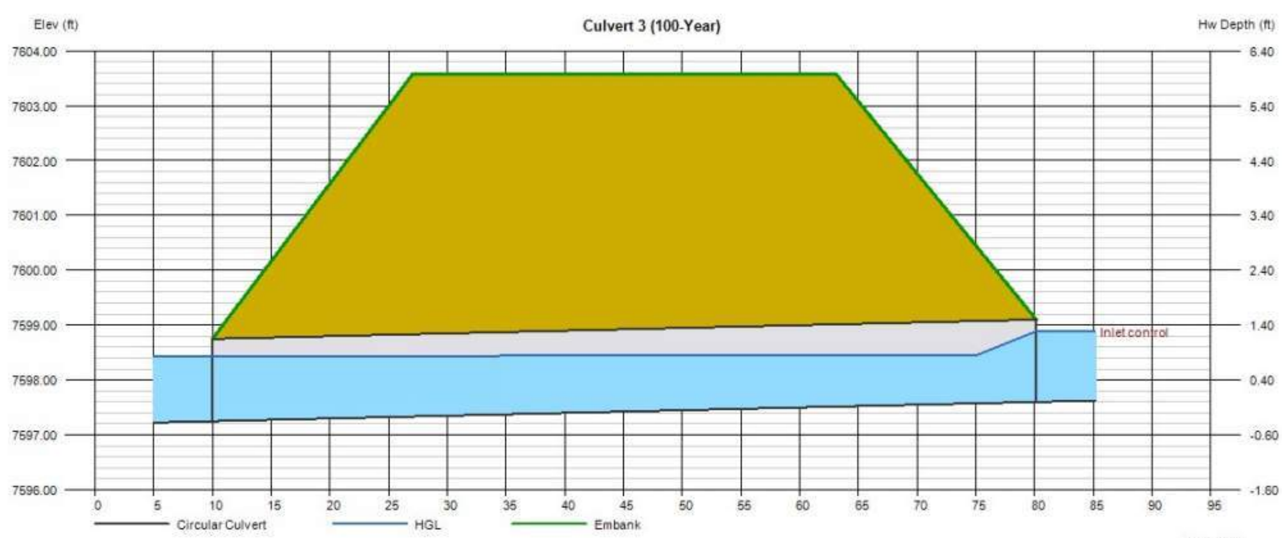
Top Elevation (ft)	=	7603.58
Top Width (ft)	=	36.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	5.00
Qmax (cfs)	=	5.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	5.00
Qpipe (cfs)	=	5.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	3.35
Veloc Up (ft/s)	=	4.75
HGL Dn (ft)	=	7598.43
HGL Up (ft)	=	7598.46
Hw Elev (ft)	=	7598.89
Hw/D (ft)	=	0.86
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Sep 11 2024

Culvert 4 - DPA1 (5-Year)

Invert Elev Dn (ft)	=	7590.12
Pipe Length (ft)	=	122.21
Slope (%)	=	0.41
Invert Elev Up (ft)	=	7590.62
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

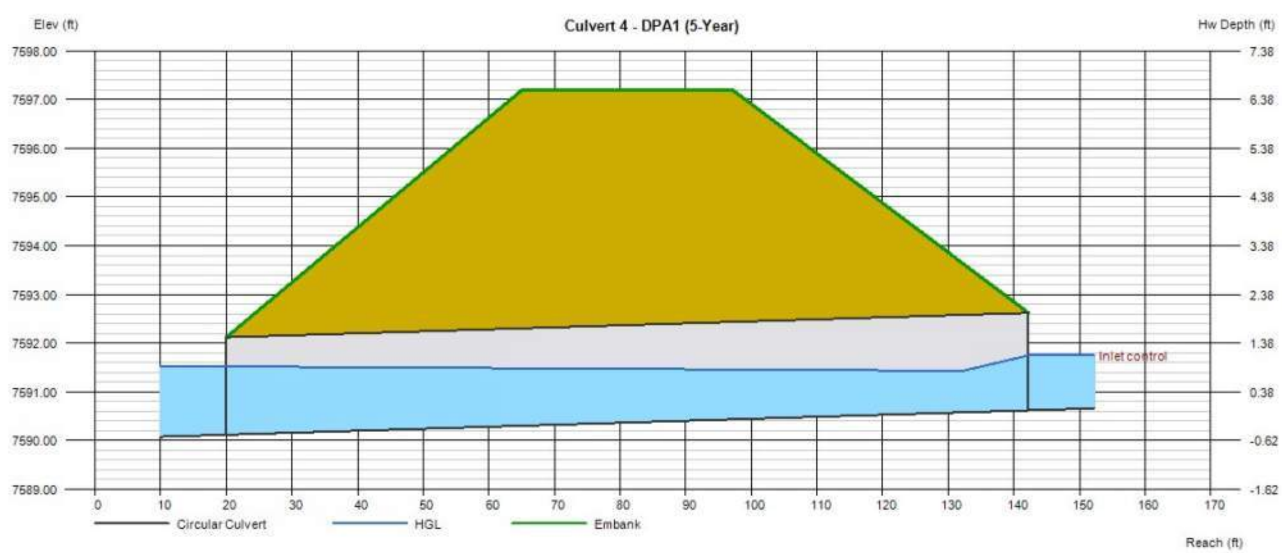
Top Elevation (ft)	=	7597.20
Top Width (ft)	=	32.00
Crest Width (ft)	=	75.00

Calculations

Qmin (cfs)	=	5.20
Qmax (cfs)	=	5.20
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	5.20
Qpipe (cfs)	=	5.20
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	2.21
Veloc Up (ft/s)	=	4.41
HGL Dn (ft)	=	7591.52
HGL Up (ft)	=	7591.42
Hw Elev (ft)	=	7591.75
Hw/D (ft)	=	0.56
Flow Regime	=	Inlet Control



Culvert Report

Culvert 4 - DPA1 (100-Year)

Invert Elev Dn (ft)	=	7590.12
Pipe Length (ft)	=	122.21
Slope (%)	=	0.41
Invert Elev Up (ft)	=	7590.62
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

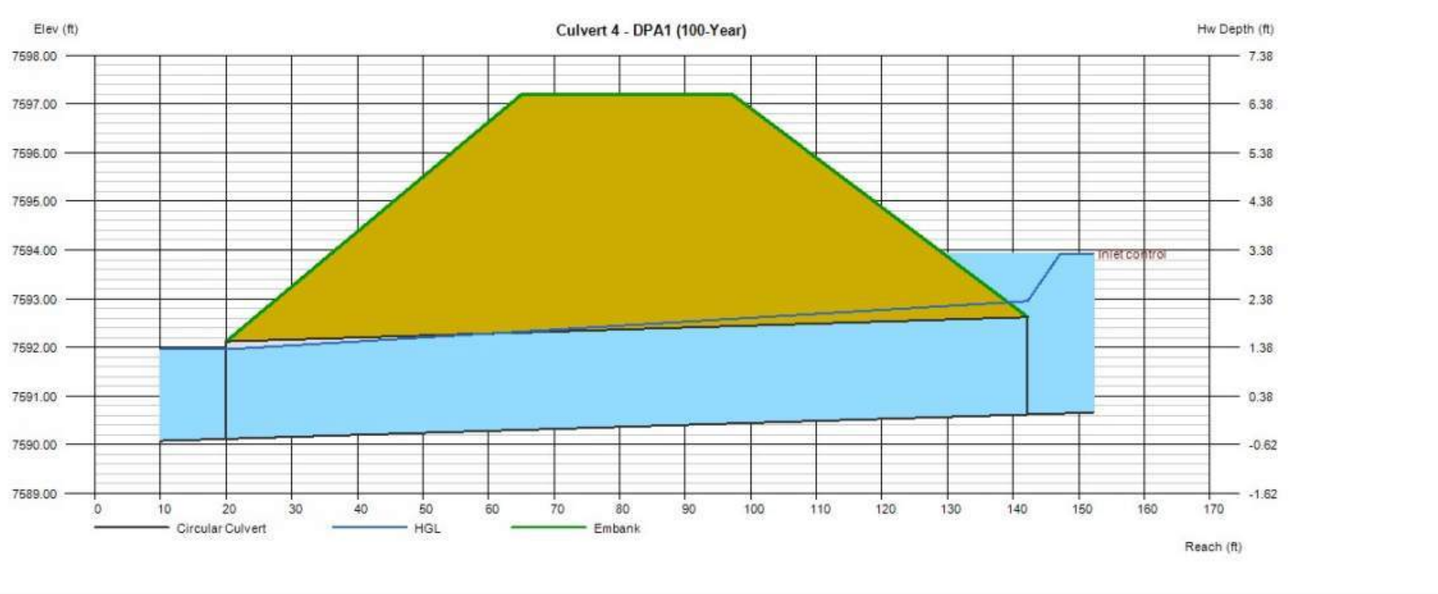
Top Elevation (ft)	=	7597.20
Top Width (ft)	=	32.00
Crest Width (ft)	=	75.00

Calculations

Qmin (cfs)	=	22.10
Qmax (cfs)	=	22.10
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	22.10
Qpipe (cfs)	=	22.10
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	7.31
Veloc Up (ft/s)	=	7.03
HGL Dn (ft)	=	7591.96
HGL Up (ft)	=	7592.95
Hw Elev (ft)	=	7593.93
Hw/D (ft)	=	1.65
Flow Regime	=	Inlet Control



Culvert Report

Culvert 5 - DPH1 (5-Year)

Invert Elev Dn (ft)	= 7588.21
Pipe Length (ft)	= 151.43
Slope (%)	= 1.06
Invert Elev Up (ft)	= 7589.82
Rise (in)	= 18.0
Shape	= Circular
Span (in)	= 18.0
No. Barrels	= 1
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Square edge w/headwall (C)
Coeff. K,M,c,Y,k	= 0.0098, 2, 0.0398, 0.67, 0.5

Embankment

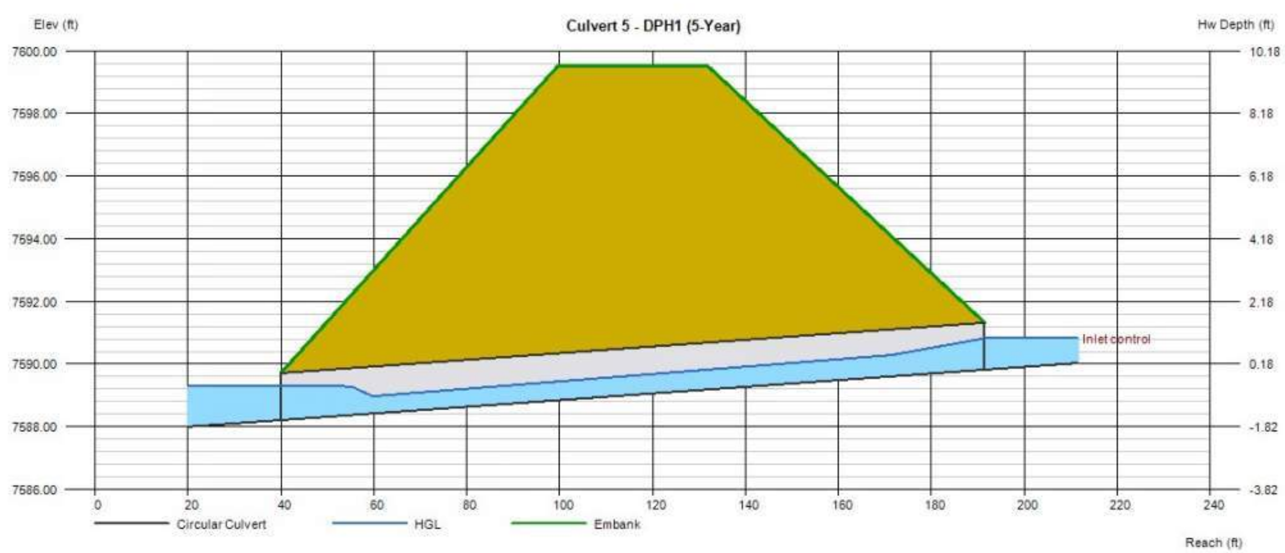
Top Elevation (ft)	= 7599.53
Top Width (ft)	= 32.00
Crest Width (ft)	= 125.00

Calculations

Qmin (cfs)	= 3.40
Qmax (cfs)	= 3.40
Tailwater Elev (ft)	= (dc+D)/2

Highlighted

Qtotal (cfs)	= 3.40
Qpipe (cfs)	= 3.40
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 2.45
Veloc Up (ft/s)	= 4.18
HGL Dn (ft)	= 7589.31
HGL Up (ft)	= 7590.52
Hw Elev (ft)	= 7590.82
Hw/D (ft)	= 0.67
Flow Regime	= Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Sep 12 2024

Culvert 5 - DPH1 (100-Year)

Invert Elev Dn (ft)	=	7588.21
Pipe Length (ft)	=	151.43
Slope (%)	=	1.06
Invert Elev Up (ft)	=	7589.82
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

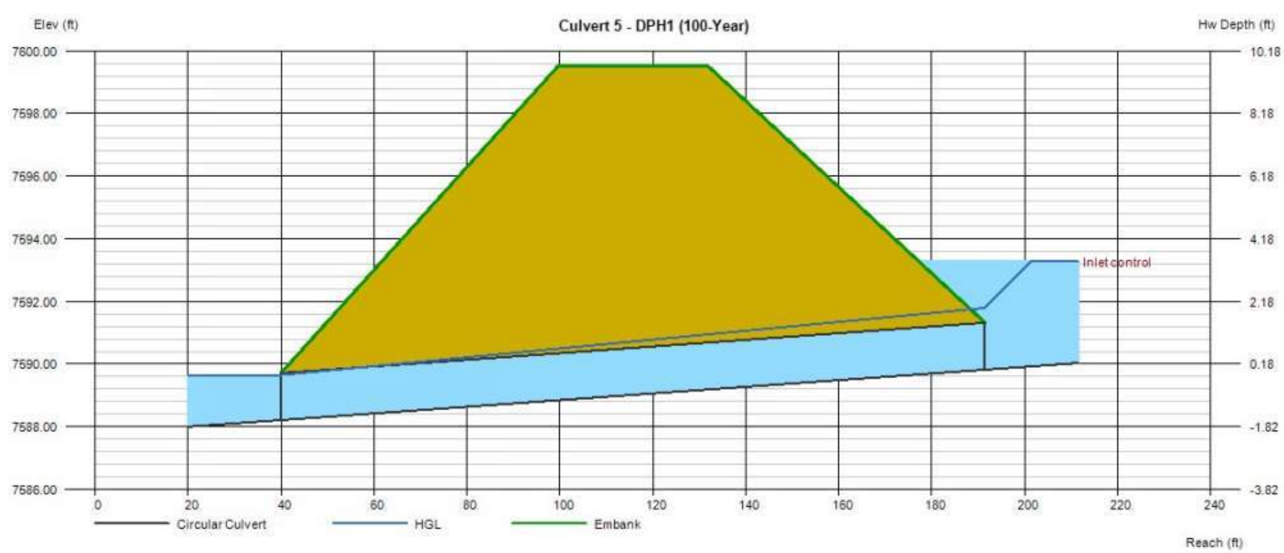
Top Elevation (ft)	=	7599.53
Top Width (ft)	=	32.00
Crest Width (ft)	=	125.00

Calculations

Qmin (cfs)	=	13.90
Qmax (cfs)	=	13.90
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	13.90
Qpipe (cfs)	=	13.90
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	7.98
Veloc Up (ft/s)	=	7.87
HGL Dn (ft)	=	7589.65
HGL Up (ft)	=	7591.79
Hw Elev (ft)	=	7593.28
Hw/D (ft)	=	2.31
Flow Regime	=	Inlet Control



Culvert Report

Culvert 6 (5-Year)

Invert Elev Dn (ft)	= 7593.80
Pipe Length (ft)	= 62.24
Slope (%)	= 1.29
Invert Elev Up (ft)	= 7594.60
Rise (in)	= 18.0
Shape	= Circular
Span (in)	= 18.0
No. Barrels	= 1
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Square edge w/headwall (C)
Coeff. K,M,c,Y,k	= 0.0098, 2, 0.0398, 0.67, 0.5

Embankment

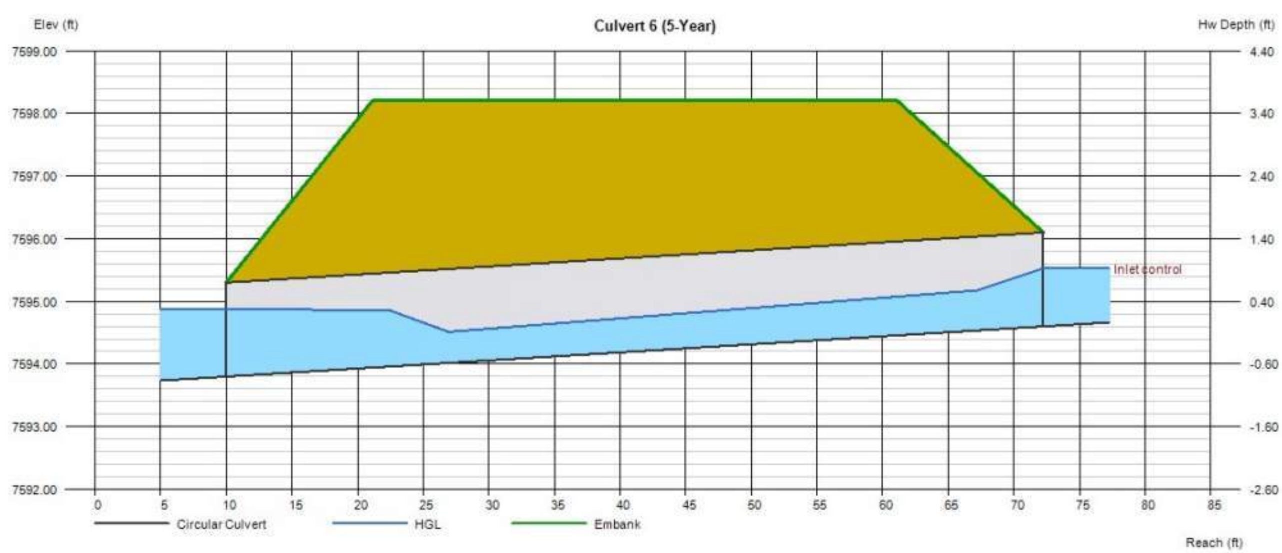
Top Elevation (ft)	= 7598.20
Top Width (ft)	= 40.00
Crest Width (ft)	= 40.00

Calculations

Qmin (cfs)	= 3.00
Qmax (cfs)	= 3.00
Tailwater Elev (ft)	= (dc+D)/2

Highlighted

Qtotal (cfs)	= 3.00
Qpipe (cfs)	= 3.00
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 2.20
Veloc Up (ft/s)	= 4.02
HGL Dn (ft)	= 7594.88
HGL Up (ft)	= 7595.26
Hw Elev (ft)	= 7595.53
Hw/D (ft)	= 0.62
Flow Regime	= Inlet Control



Culvert Report

Culvert 6 (100-Year)

Invert Elev Dn (ft)	=	7593.80
Pipe Length (ft)	=	62.24
Slope (%)	=	1.29
Invert Elev Up (ft)	=	7594.60
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

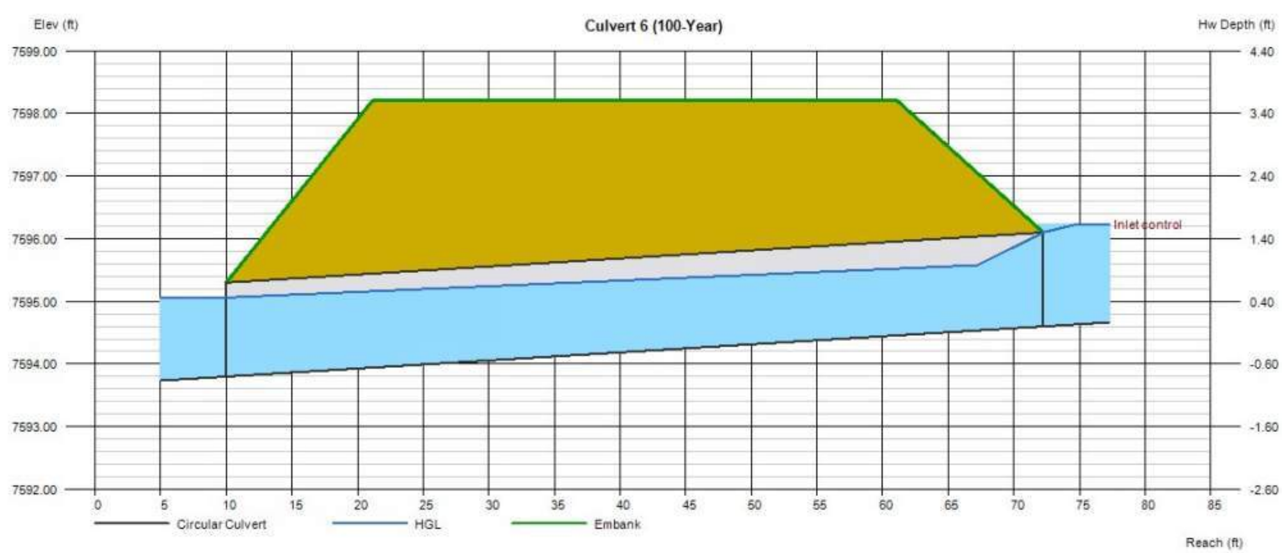
Top Elevation (ft)	=	7598.20
Top Width (ft)	=	40.00
Crest Width (ft)	=	40.00

Calculations

Qmin (cfs)	=	7.00
Qmax (cfs)	=	7.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

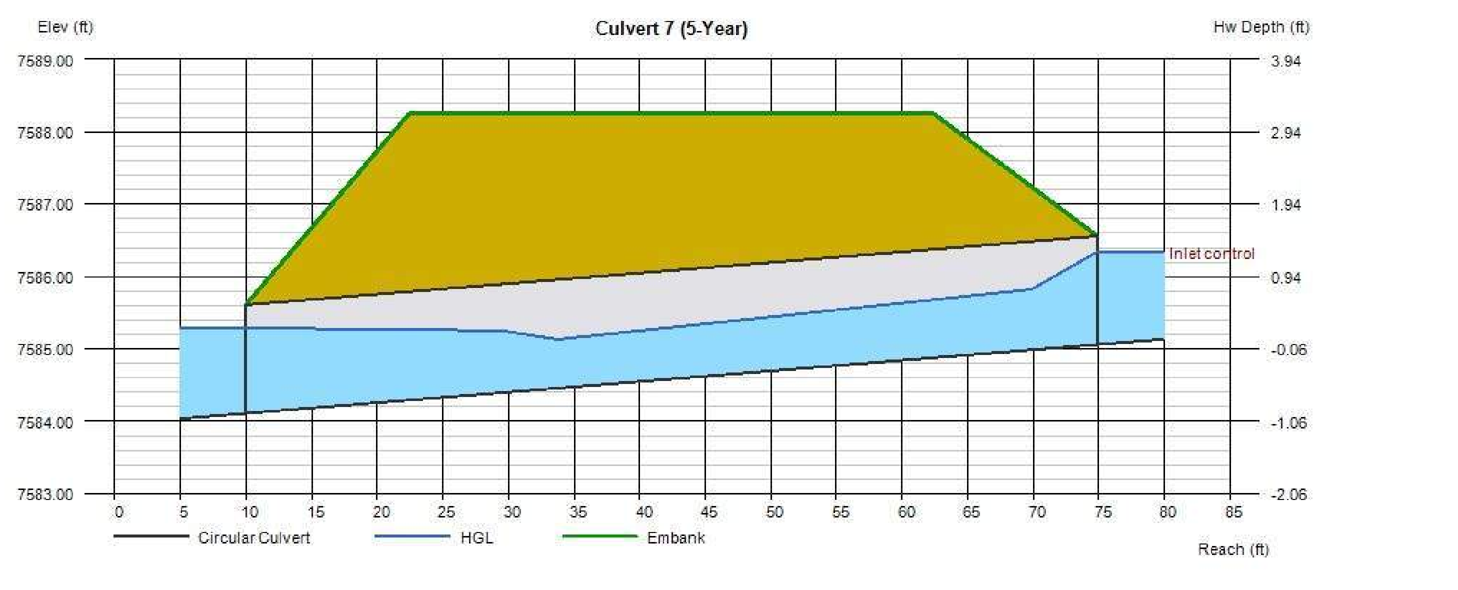
Qtotal (cfs)	=	7.00
Qpipe (cfs)	=	7.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.41
Veloc Up (ft/s)	=	5.45
HGL Dn (ft)	=	7595.06
HGL Up (ft)	=	7595.62
Hw Elev (ft)	=	7596.23
Hw/D (ft)	=	1.09
Flow Regime	=	Inlet Control



Culvert Report

Culvert 7 (5-Year)

Invert Elev Dn (ft)	= 7584.11	**Calculations**	
Pipe Length (ft)	= 64.88	Qmin (cfs)	= 5.00
Slope (%)	= 1.46	Qmax (cfs)	= 5.00
Invert Elev Up (ft)	= 7585.06	Tailwater Elev (ft)	= (dc+D)/2
Rise (in)	= 18.0		
Shape	= Circular	**Highlighted**	
Span (in)	= 18.0	Qtotal (cfs)	= 5.00
No. Barrels	= 1	Qpipe (cfs)	= 5.00
n-Value	= 0.012	Qovertop (cfs)	= 0.00
Culvert Type	= Circular Concrete	Veloc Dn (ft/s)	= 3.35
Culvert Entrance	= Square edge w/headwall (C)	Veloc Up (ft/s)	= 4.77
Coeff. K,M,c,Y,k	= 0.0098, 2, 0.0398, 0.67, 0.5	HGL Dn (ft)	= 7585.29
		HGL Up (ft)	= 7585.92
Embankment		Hw Elev (ft)	= 7586.34
Top Elevation (ft)	= 7588.25	Hw/D (ft)	= 0.85
Top Width (ft)	= 40.00	Flow Regime	= Inlet Control
Crest Width (ft)	= 40.00		



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Sep 13 2024

Culvert 7 (100-Year)

Invert Elev Dn (ft)	=	7584.11
Pipe Length (ft)	=	64.88
Slope (%)	=	1.46
Invert Elev Up (ft)	=	7585.06
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

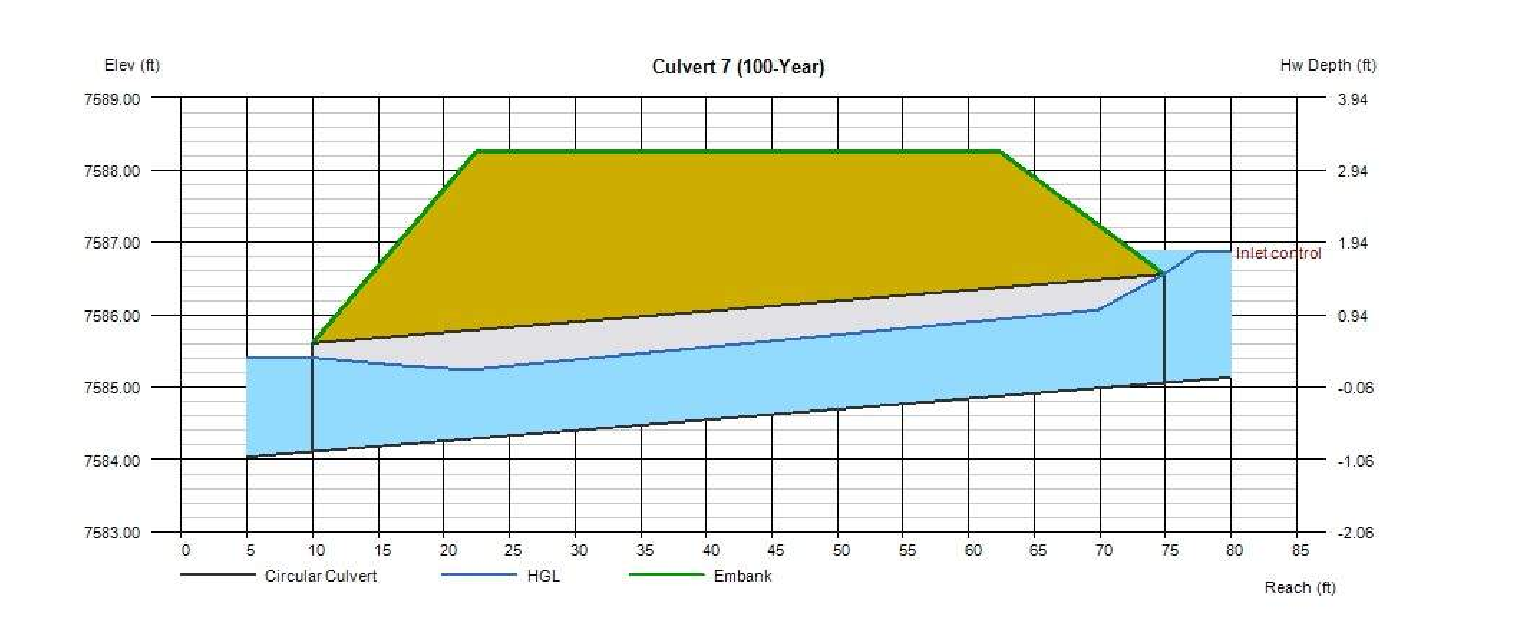
Top Elevation (ft)	=	7588.25
Top Width (ft)	=	40.00
Crest Width (ft)	=	40.00

Calculations

Qmin (cfs)	=	8.00
Qmax (cfs)	=	8.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

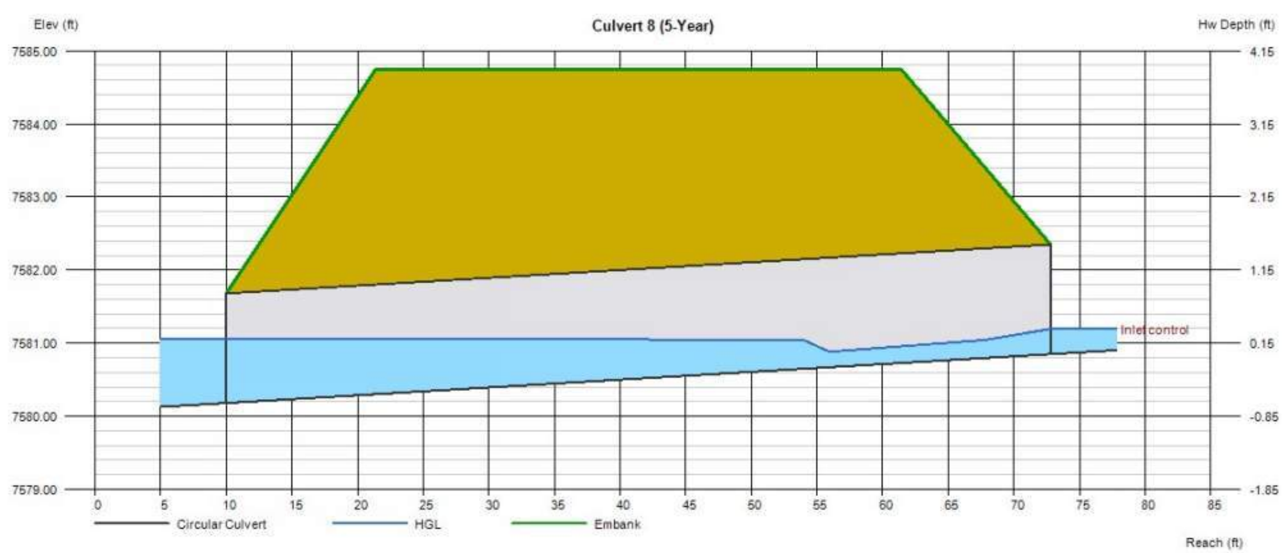
Qtotal (cfs)	=	8.00
Qpipe (cfs)	=	8.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.92
Veloc Up (ft/s)	=	5.79
HGL Dn (ft)	=	7585.41
HGL Up (ft)	=	7586.16
Hw Elev (ft)	=	7586.87
Hw/D (ft)	=	1.21
Flow Regime	=	Inlet Control



Culvert Report

Culvert 8 (5-Year)

Invert Elev Dn (ft)	= 7580.18	**Calculations**	
Pipe Length (ft)	= 62.79	Qmin (cfs)	= 0.50
Slope (%)	= 1.07	Qmax (cfs)	= 0.50
Invert Elev Up (ft)	= 7580.85	Tailwater Elev (ft)	= (dc+D)/2
Rise (in)	= 18.0		
Shape	= Circular	**Highlighted**	
Span (in)	= 18.0	Qtotal (cfs)	= 0.50
No. Barrels	= 1	Qpipe (cfs)	= 0.50
n-Value	= 0.012	Qovertop (cfs)	= 0.00
Culvert Type	= Circular Concrete	Veloc Dn (ft/s)	= 0.46
Culvert Entrance	= Square edge w/headwall (C)	Veloc Up (ft/s)	= 2.42
Coeff. K,M,c,Y,k	= 0.0098, 2, 0.0398, 0.67, 0.5	HGL Dn (ft)	= 7581.06
		HGL Up (ft)	= 7581.11
Embankment		Hw Elev (ft)	= 7581.20
Top Elevation (ft)	= 7584.75	Hw/D (ft)	= 0.23
Top Width (ft)	= 40.00	Flow Regime	= Inlet Control
Crest Width (ft)	= 33.00		



Culvert Report

Culvert 8 (100-Year)

Invert Elev Dn (ft)	=	7580.18
Pipe Length (ft)	=	62.79
Slope (%)	=	1.07
Invert Elev Up (ft)	=	7580.85
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

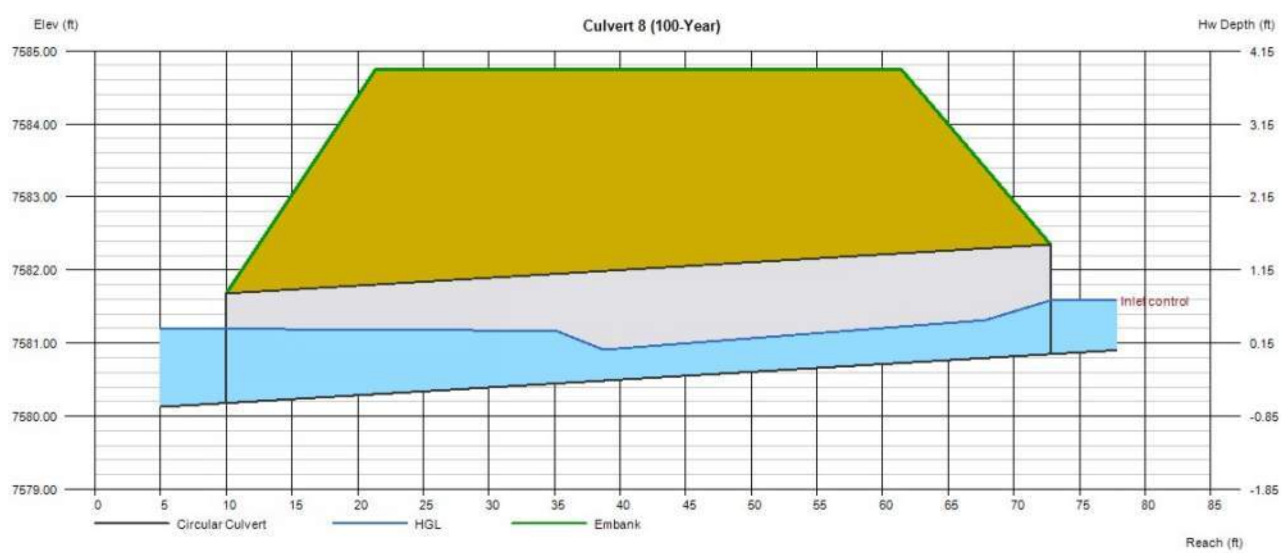
Top Elevation (ft)	=	7584.75
Top Width (ft)	=	40.00
Crest Width (ft)	=	33.00

Calculations

Qmin (cfs)	=	2.00
Qmax (cfs)	=	2.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	2.00
Qpipe (cfs)	=	2.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	1.57
Veloc Up (ft/s)	=	3.56
HGL Dn (ft)	=	7581.20
HGL Up (ft)	=	7581.38
Hw Elev (ft)	=	7581.58
Hw/D (ft)	=	0.49
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Oct 23 2024

Culvert 9 (5-Year)

Invert Elev Dn (ft)	=	7579.55
Pipe Length (ft)	=	52.11
Slope (%)	=	1.69
Invert Elev Up (ft)	=	7580.43
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

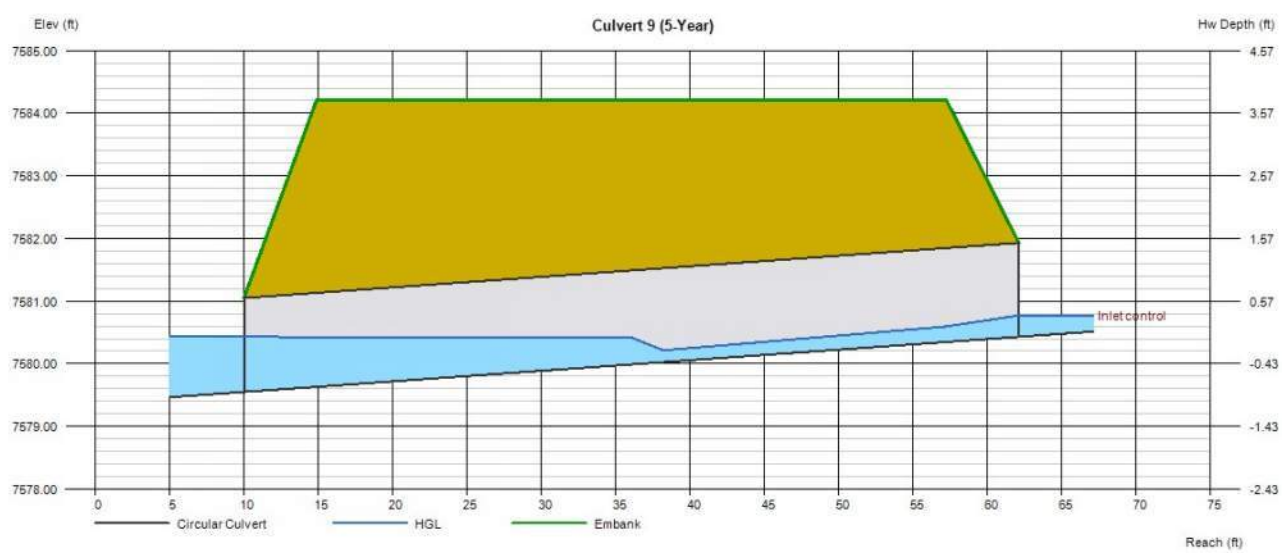
Top Elevation (ft)	=	7584.21
Top Width (ft)	=	42.34
Crest Width (ft)	=	35.00

Calculations

Qmin (cfs)	=	0.50
Qmax (cfs)	=	0.50
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	0.50
Qpipe (cfs)	=	0.50
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	0.46
Veloc Up (ft/s)	=	2.42
HGL Dn (ft)	=	7580.43
HGL Up (ft)	=	7580.69
Hw Elev (ft)	=	7580.77
Hw/D (ft)	=	0.23
Flow Regime	=	Inlet Control



Culvert Report

Culvert 9 (100-Year)

Invert Elev Dn (ft)	=	7579.55
Pipe Length (ft)	=	52.11
Slope (%)	=	1.69
Invert Elev Up (ft)	=	7580.43
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

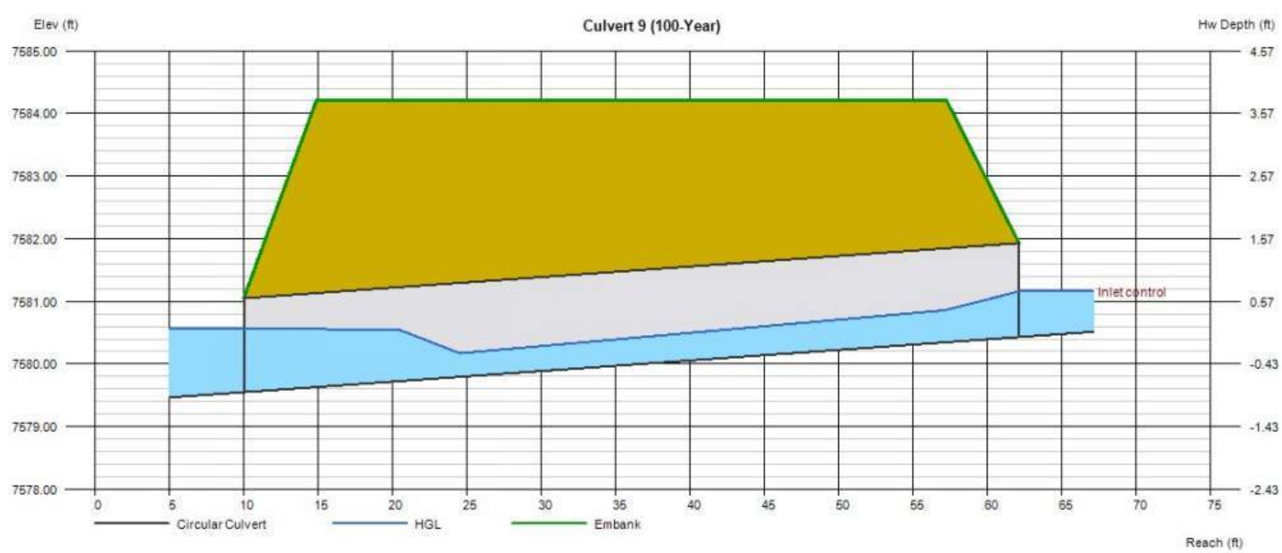
Top Elevation (ft)	=	7584.21
Top Width (ft)	=	42.34
Crest Width (ft)	=	35.00

Calculations

Qmin (cfs)	=	2.00
Qmax (cfs)	=	2.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	2.00
Qpipe (cfs)	=	2.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	1.57
Veloc Up (ft/s)	=	3.56
HGL Dn (ft)	=	7580.57
HGL Up (ft)	=	7580.96
Hw Elev (ft)	=	7581.16
Hw/D (ft)	=	0.49
Flow Regime	=	Inlet Control



Culvert Report

Culvert 10 (5-Year)

Invert Elev Dn (ft)	=	7562.82
Pipe Length (ft)	=	221.65
Slope (%)	=	0.79
Invert Elev Up (ft)	=	7564.57
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

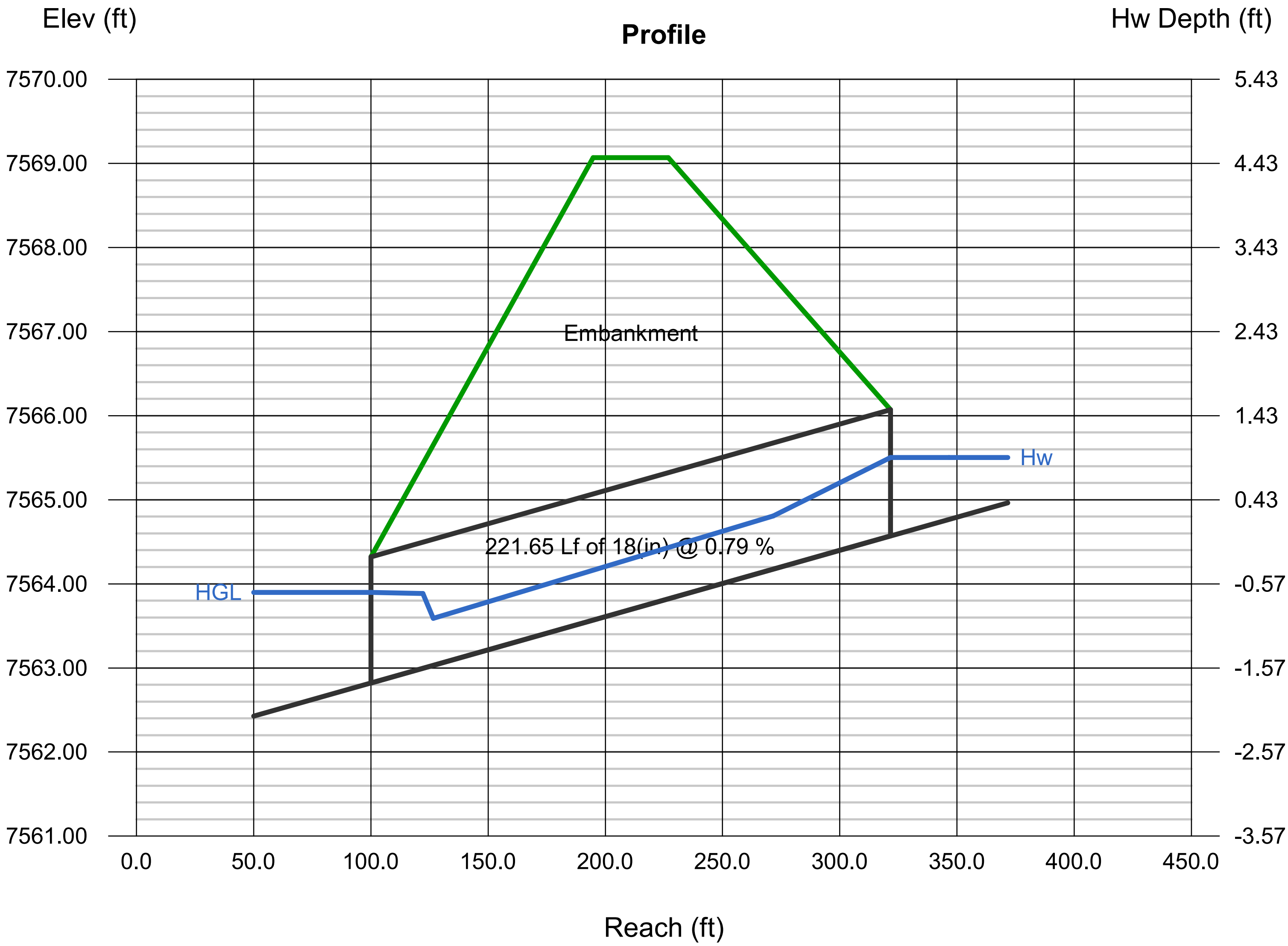
Top Elevation (ft)	=	7569.07
Top Width (ft)	=	32.00
Crest Width (ft)	=	60.00

Calculations

Qmin (cfs)	=	3.00
Qmax (cfs)	=	3.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	3.00
Qpipe (cfs)	=	3.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	2.20
Veloc Up (ft/s)	=	4.02
HGL Dn (ft)	=	7563.90
HGL Up (ft)	=	7565.23
Hw Elev (ft)	=	7565.50
Hw/D (ft)	=	0.62
Flow Regime	=	Inlet Control



Culvert Report

Culvert 10 (100-Year)

Invert Elev Dn (ft)	=	7562.82
Pipe Length (ft)	=	221.65
Slope (%)	=	0.79
Invert Elev Up (ft)	=	7564.57
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

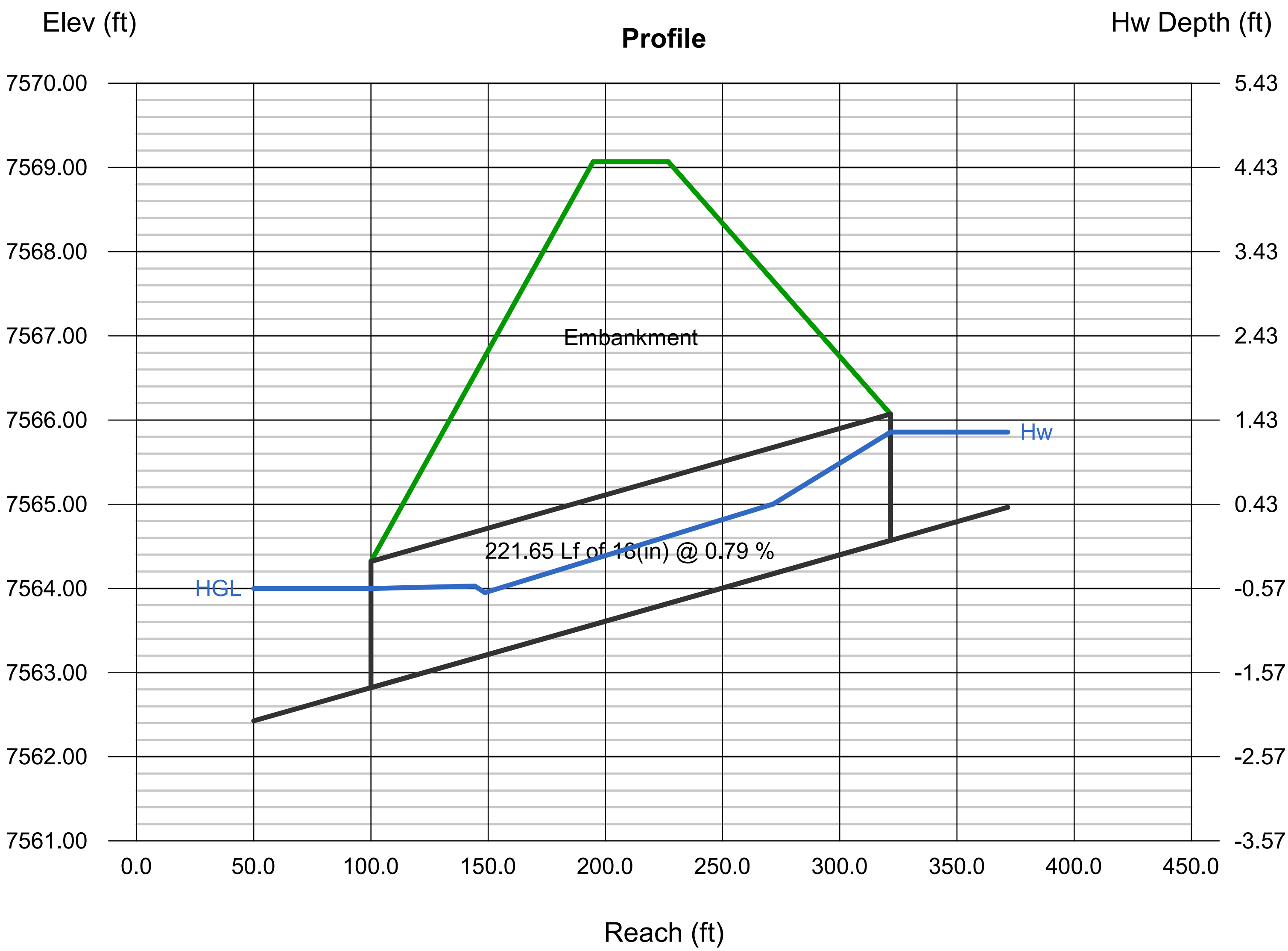
Top Elevation (ft)	=	7569.07
Top Width (ft)	=	32.00
Crest Width (ft)	=	60.00

Calculations

Qmin (cfs)	=	5.00
Qmax (cfs)	=	5.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	5.00
Qpipe (cfs)	=	5.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	3.35
Veloc Up (ft/s)	=	4.77
HGL Dn (ft)	=	7564.00
HGL Up (ft)	=	7565.43
Hw Elev (ft)	=	7565.86
Hw/D (ft)	=	0.86
Flow Regime	=	Inlet Control



Culvert Report

Culvert 11 - DPA2 (5-Year)

Invert Elev Dn (ft)	= 7559.50
Pipe Length (ft)	= 106.87
Slope (%)	= 0.43
Invert Elev Up (ft)	= 7559.96
Rise (in)	= 42.0
Shape	= Circular
Span (in)	= 42.0
No. Barrels	= 1
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Square edge w/headwall (C)
Coeff. K,M,c,Y,k	= 0.0098, 2, 0.0398, 0.67, 0.5

Embankment

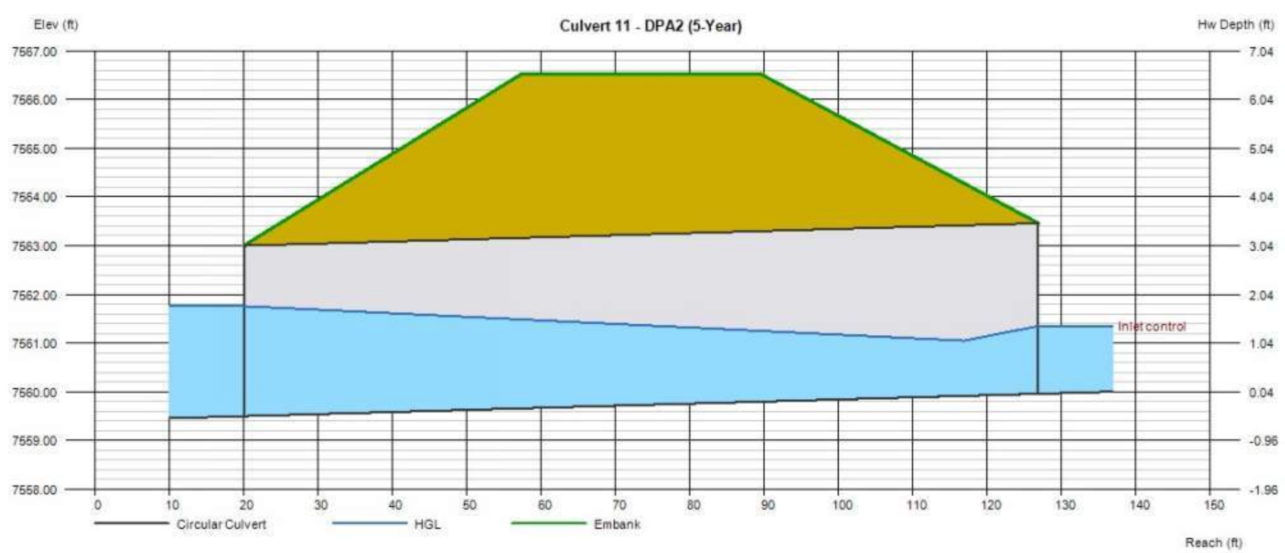
Top Elevation (ft)	= 7566.53
Top Width (ft)	= 32.00
Crest Width (ft)	= 93.00

Calculations

Qmin (cfs)	= 11.30
Qmax (cfs)	= 11.30
Tailwater Elev (ft)	= (dc+D)/2

Highlighted

Qtotal (cfs)	= 11.30
Qpipe (cfs)	= 11.30
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 1.72
Veloc Up (ft/s)	= 4.86
HGL Dn (ft)	= 7561.76
HGL Up (ft)	= 7560.98
Hw Elev (ft)	= 7561.35
Hw/D (ft)	= 0.40
Flow Regime	= Inlet Control



Culvert Report

Culvert 11 - DPA2 (100-Year)

Invert Elev Dn (ft)	=	7559.50
Pipe Length (ft)	=	106.87
Slope (%)	=	0.43
Invert Elev Up (ft)	=	7559.96
Rise (in)	=	42.0
Shape	=	Circular
Span (in)	=	42.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

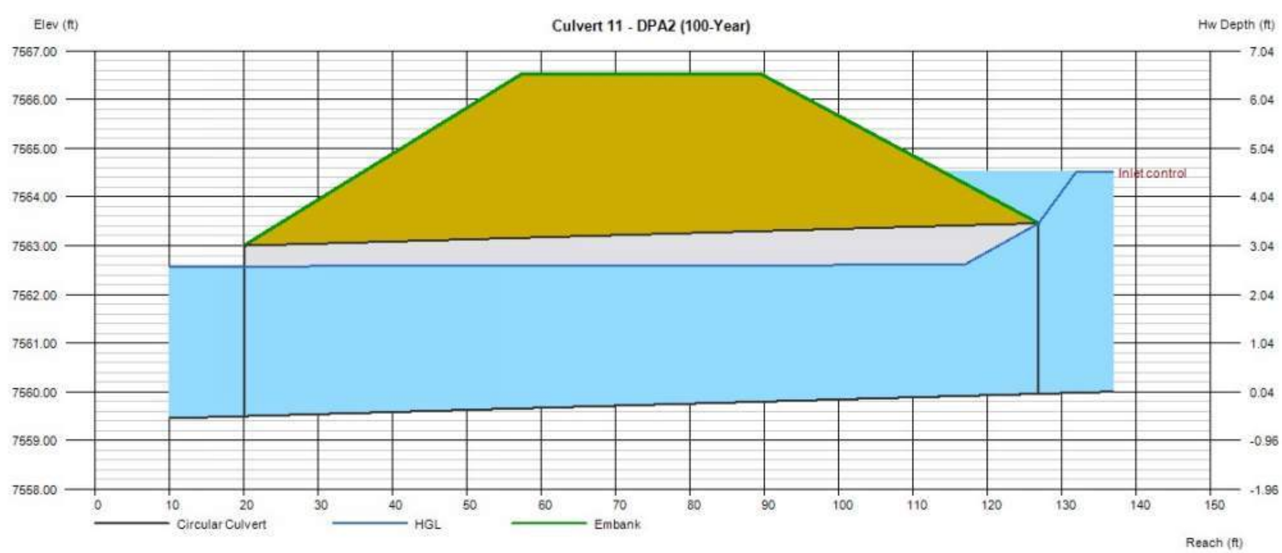
Top Elevation (ft)	=	7566.53
Top Width (ft)	=	32.00
Crest Width (ft)	=	93.00

Calculations

Qmin (cfs)	=	71.70
Qmax (cfs)	=	71.70
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	71.70
Qpipe (cfs)	=	71.70
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	8.01
Veloc Up (ft/s)	=	9.17
HGL Dn (ft)	=	7562.58
HGL Up (ft)	=	7562.61
Hw Elev (ft)	=	7564.51
Hw/D (ft)	=	1.30
Flow Regime	=	Inlet Control



Culvert Report

Culvert 12 - DPA5 (5-Year)

Invert Elev Dn (ft)	=	7540.00
Pipe Length (ft)	=	104.44
Slope (%)	=	1.00
Invert Elev Up (ft)	=	7541.04
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

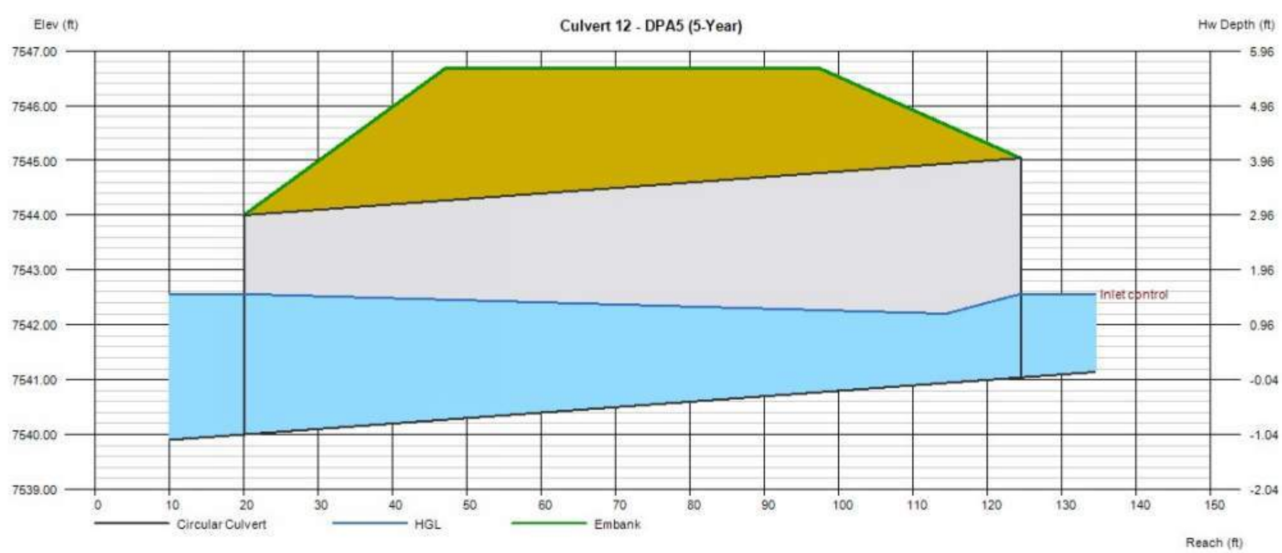
Top Elevation (ft)	=	7546.69
Top Width (ft)	=	50.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	14.80
Qmax (cfs)	=	14.80
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	14.80
Qpipe (cfs)	=	14.80
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	1.74
Veloc Up (ft/s)	=	5.10
HGL Dn (ft)	=	7542.56
HGL Up (ft)	=	7542.17
Hw Elev (ft)	=	7542.56
Hw/D (ft)	=	0.38
Flow Regime	=	Inlet Control



Culvert Report

Culvert 12 - DPA5 (100-Year)

Invert Elev Dn (ft)	= 7540.00
Pipe Length (ft)	= 104.44
Slope (%)	= 1.00
Invert Elev Up (ft)	= 7541.04
Rise (in)	= 48.0
Shape	= Circular
Span (in)	= 48.0
No. Barrels	= 1
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Square edge w/headwall (C)
Coeff. K,M,c,Y,k	= 0.0098, 2, 0.0398, 0.67, 0.5

Embankment

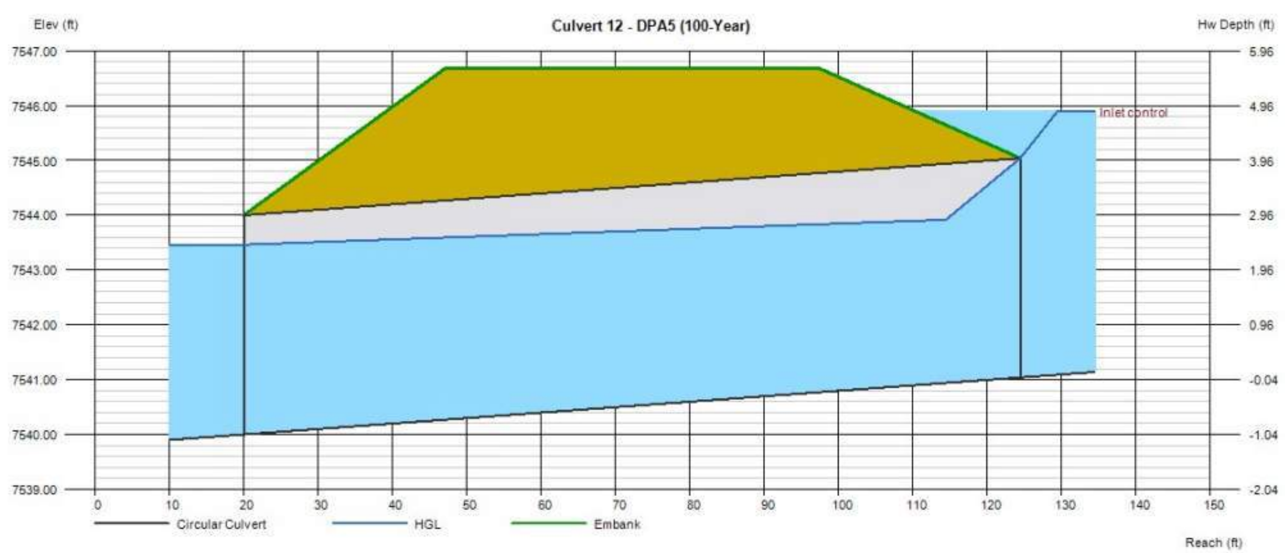
Top Elevation (ft)	= 7546.69
Top Width (ft)	= 50.00
Crest Width (ft)	= 100.00

Calculations

Qmin (cfs)	= 93.30
Qmax (cfs)	= 93.30
Tailwater Elev (ft)	= (dc+D)/2

Highlighted

Qtotal (cfs)	= 93.30
Qpipe (cfs)	= 93.30
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 8.07
Veloc Up (ft/s)	= 9.47
HGL Dn (ft)	= 7543.46
HGL Up (ft)	= 7543.97
Hw Elev (ft)	= 7545.89
Hw/D (ft)	= 1.21
Flow Regime	= Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. — Friday, Oct 25 2024

Proposed Dual 48-inch Culvert - DPB2 (Old Stagecoach Road) (5-year)

Invert Elev Dn (ft)	=	7532.00
Pipe Length (ft)	=	123.98
Slope (%)	=	1.33
Invert Elev Up (ft)	=	7533.65
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	2
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

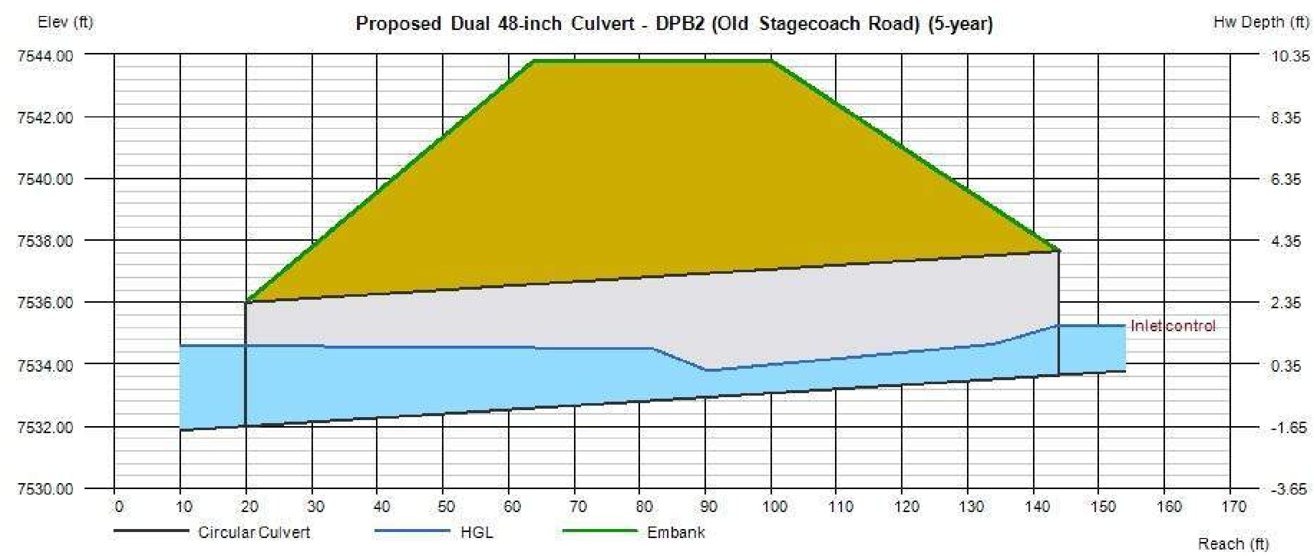
Top Elevation (ft)	=	7543.81
Top Width (ft)	=	36.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	33.20
Qmax (cfs)	=	33.20
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	33.20
Qpipe (cfs)	=	33.20
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	1.92
Veloc Up (ft/s)	=	5.27
HGL Dn (ft)	=	7534.60
HGL Up (ft)	=	7534.84
Hw Elev (ft)	=	7535.27
Hw/D (ft)	=	0.40
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 25 2024

Proposed Dual 48-inch Culvert - DPB2 (Old Stagecoach Road) (100-year)

Invert Elev Dn (ft)	=	7532.00
Pipe Length (ft)	=	123.98
Slope (%)	=	1.33
Invert Elev Up (ft)	=	7533.65
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	2
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

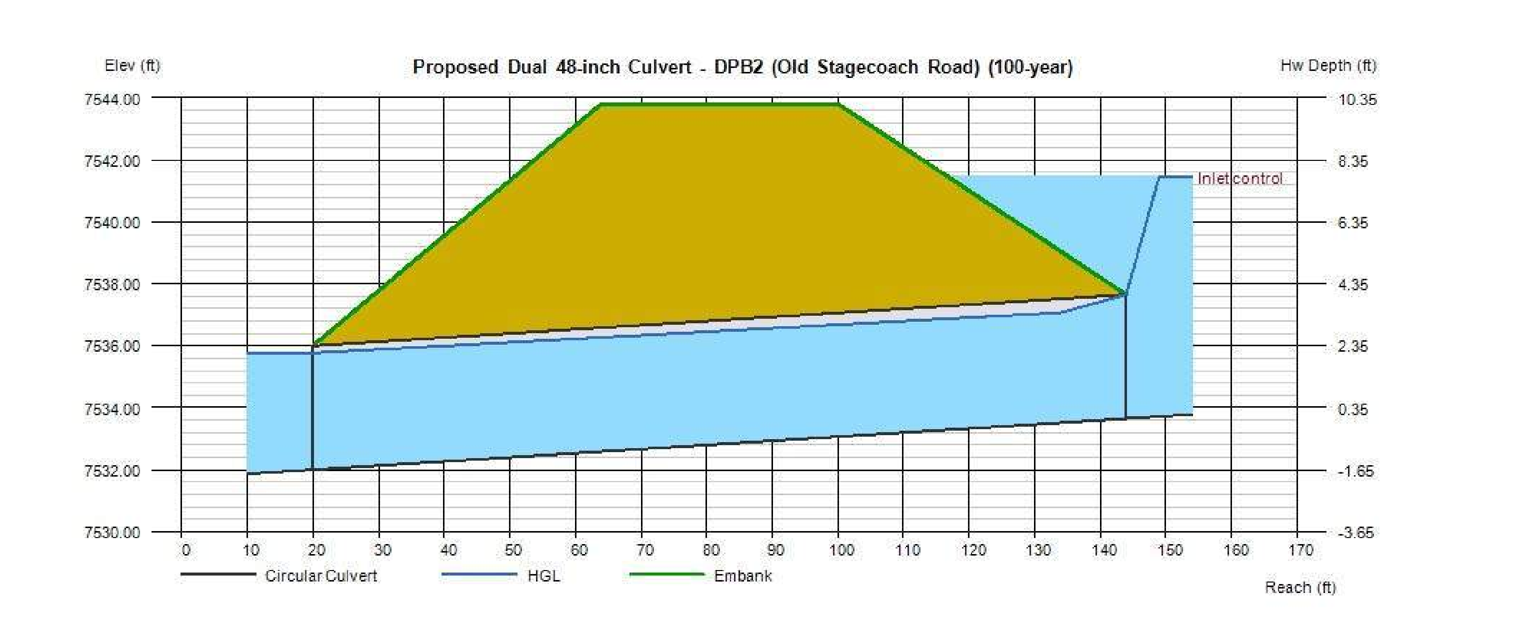
Top Elevation (ft)	=	7543.81
Top Width (ft)	=	36.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	285.80
Qmax (cfs)	=	285.80
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	285.80
Qpipe (cfs)	=	285.80
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	11.64
Veloc Up (ft/s)	=	12.16
HGL Dn (ft)	=	7535.77
HGL Up (ft)	=	7537.19
Hw Elev (ft)	=	7541.45
Hw/D (ft)	=	1.95
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 25 2024

Proposed 30-inch Culvert - DPC1 (Old Stage Coach Road) (5-Year)

Invert Elev Dn (ft)	=	7564.75
Pipe Length (ft)	=	82.63
Slope (%)	=	4.54
Invert Elev Up (ft)	=	7568.50
Rise (in)	=	30.0
Shape	=	Circular
Span (in)	=	30.0
No. Barrels	=	2
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

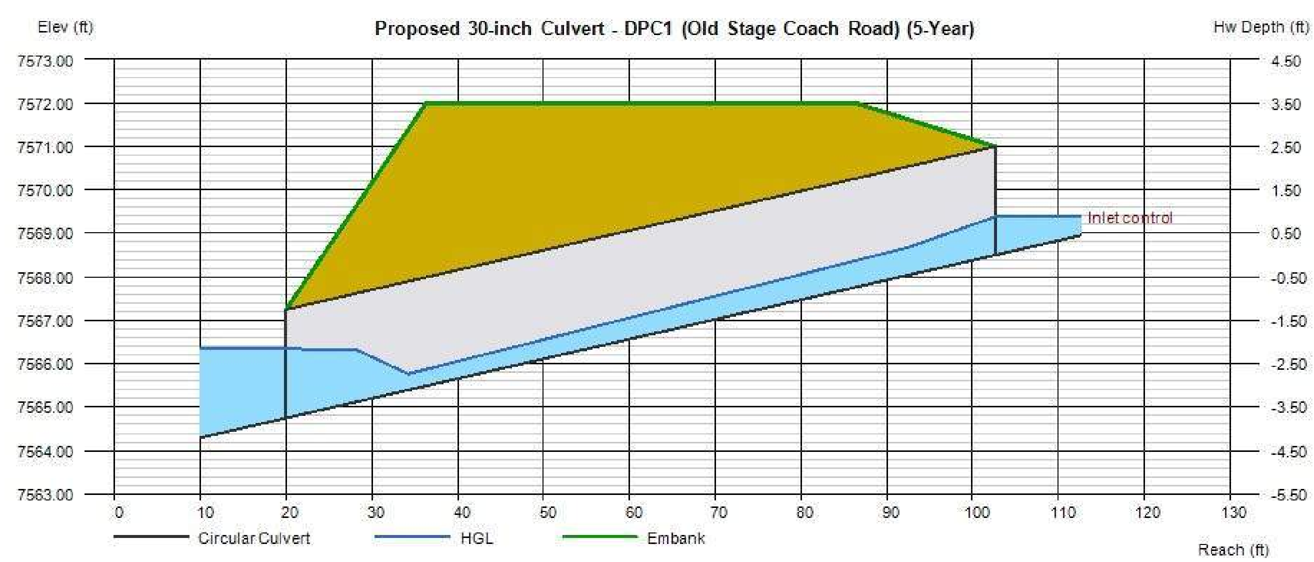
Top Elevation (ft)	=	7572.00
Top Width (ft)	=	50.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	8.70
Qmax (cfs)	=	8.70
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	8.70
Qpipe (cfs)	=	8.70
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	1.32
Veloc Up (ft/s)	=	3.98
HGL Dn (ft)	=	7566.34
HGL Up (ft)	=	7569.19
Hw Elev (ft)	=	7569.38
Hw/D (ft)	=	0.35
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 25 2024

Proposed 30-inch Culvert - DPC1 (Old Stage Coach Road) (100-Year)

Invert Elev Dn (ft)	=	7564.75
Pipe Length (ft)	=	82.63
Slope (%)	=	4.54
Invert Elev Up (ft)	=	7568.50
Rise (in)	=	30.0
Shape	=	Circular
Span (in)	=	30.0
No. Barrels	=	2
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

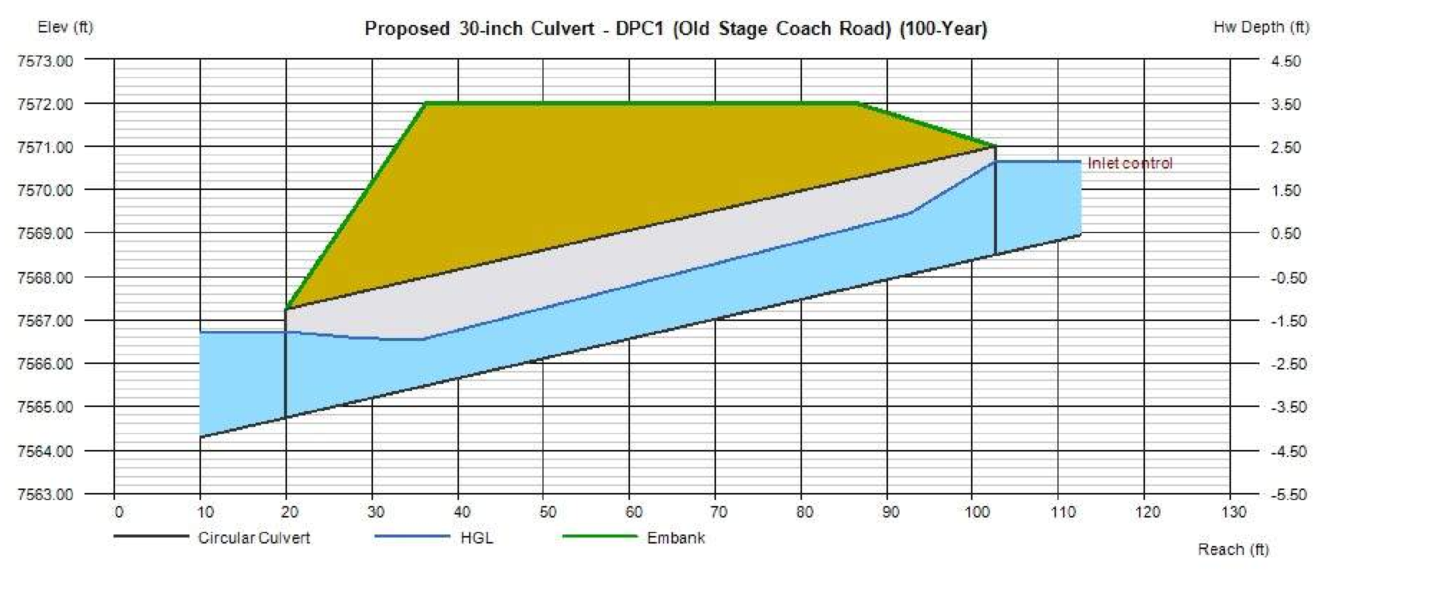
Top Elevation (ft)	=	7572.00
Top Width (ft)	=	50.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	37.20
Qmax (cfs)	=	37.20
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	37.20
Qpipe (cfs)	=	37.20
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.46
Veloc Up (ft/s)	=	6.25
HGL Dn (ft)	=	7566.73
HGL Up (ft)	=	7569.96
Hw Elev (ft)	=	7570.65
Hw/D (ft)	=	0.86
Flow Regime	=	Inlet Control



Culvert Report

Proposed 36-inch Culvert - DPF3 (Old Stagecoach Road) (5-Year)

Invert Elev Dn (ft)	= 7543.08
Pipe Length (ft)	= 86.00
Slope (%)	= 2.81
Invert Elev Up (ft)	= 7545.50
Rise (in)	= 36.0
Shape	= Circular
Span (in)	= 36.0
No. Barrels	= 2
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Square edge w/headwall (C)
Coeff. K,M,c,Y,k	= 0.0098, 2, 0.0398, 0.67, 0.5

Embankment

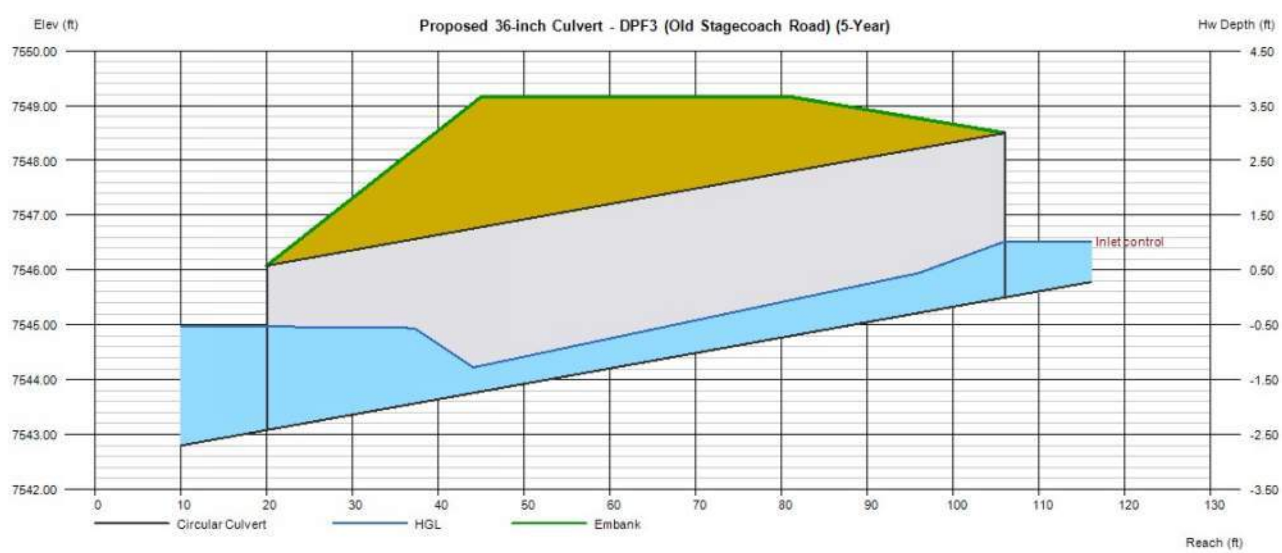
Top Elevation (ft)	= 7549.16
Top Width (ft)	= 36.00
Crest Width (ft)	= 40.00

Calculations

Qmin (cfs)	= 12.30
Qmax (cfs)	= 12.30
Tailwater Elev (ft)	= (dc+D)/2

Highlighted

Qtotal (cfs)	= 12.30
Qpipe (cfs)	= 12.30
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 1.31
Veloc Up (ft/s)	= 4.23
HGL Dn (ft)	= 7544.97
HGL Up (ft)	= 7546.28
Hw Elev (ft)	= 7546.52
Hw/D (ft)	= 0.34
Flow Regime	= Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Dec 3 2024

Proposed 36-inch Culvert - DPF3 (Old Stagecoach Road) (100-Year)

Invert Elev Dn (ft)	=	7543.08
Pipe Length (ft)	=	86.00
Slope (%)	=	2.81
Invert Elev Up (ft)	=	7545.50
Rise (in)	=	36.0
Shape	=	Circular
Span (in)	=	36.0
No. Barrels	=	2
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

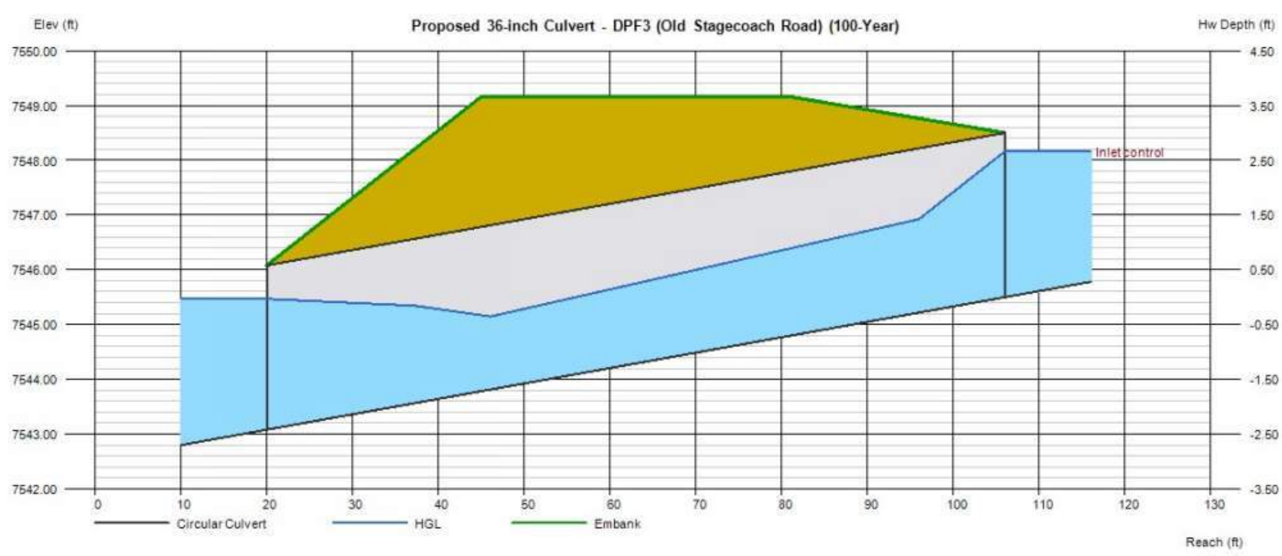
Top Elevation (ft)	=	7549.16
Top Width (ft)	=	36.00
Crest Width (ft)	=	40.00

Calculations

Qmin (cfs)	=	60.50
Qmax (cfs)	=	60.50
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	60.50
Qpipe (cfs)	=	60.50
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.01
Veloc Up (ft/s)	=	6.92
HGL Dn (ft)	=	7545.47
HGL Up (ft)	=	7547.28
Hw Elev (ft)	=	7548.16
Hw/D (ft)	=	0.89
Flow Regime	=	Inlet Control



Culvert Report

Pond A Outlet Pipe (5-Year)

Invert Elev Dn (ft)	=	7527.25
Pipe Length (ft)	=	69.69
Slope (%)	=	3.24
Invert Elev Up (ft)	=	7529.51
Rise (in)	=	54.0
Shape	=	Circular
Span (in)	=	54.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

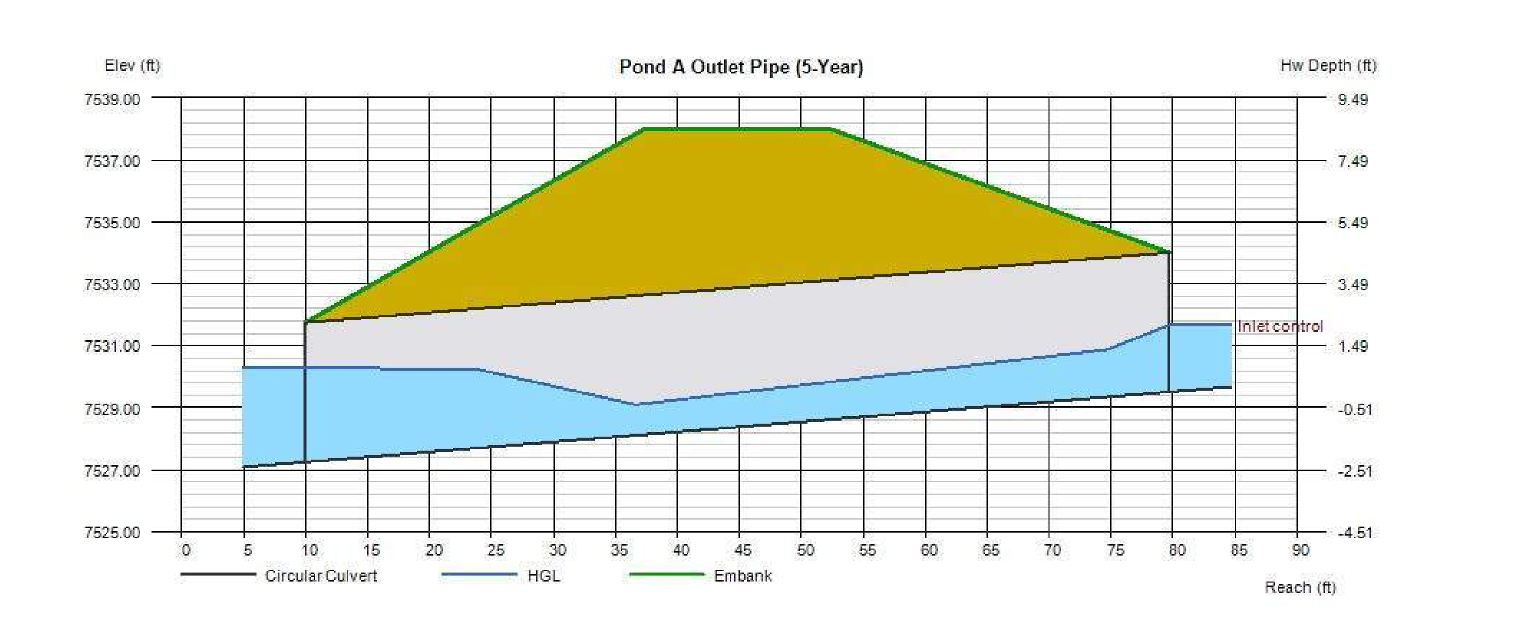
Top Elevation (ft)	=	7538.00
Top Width (ft)	=	15.00
Crest Width (ft)	=	56.00

Calculations

Qmin (cfs)	=	31.30
Qmax (cfs)	=	31.30
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	31.30
Qpipe (cfs)	=	31.30
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	2.73
Veloc Up (ft/s)	=	6.17
HGL Dn (ft)	=	7530.30
HGL Up (ft)	=	7531.11
Hw Elev (ft)	=	7531.67
Hw/D (ft)	=	0.48
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 25 2024

Pond A Outlet Pipe (100-Year)

Invert Elev Dn (ft)	=	7527.25
Pipe Length (ft)	=	69.69
Slope (%)	=	3.24
Invert Elev Up (ft)	=	7529.51
Rise (in)	=	54.0
Shape	=	Circular
Span (in)	=	54.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

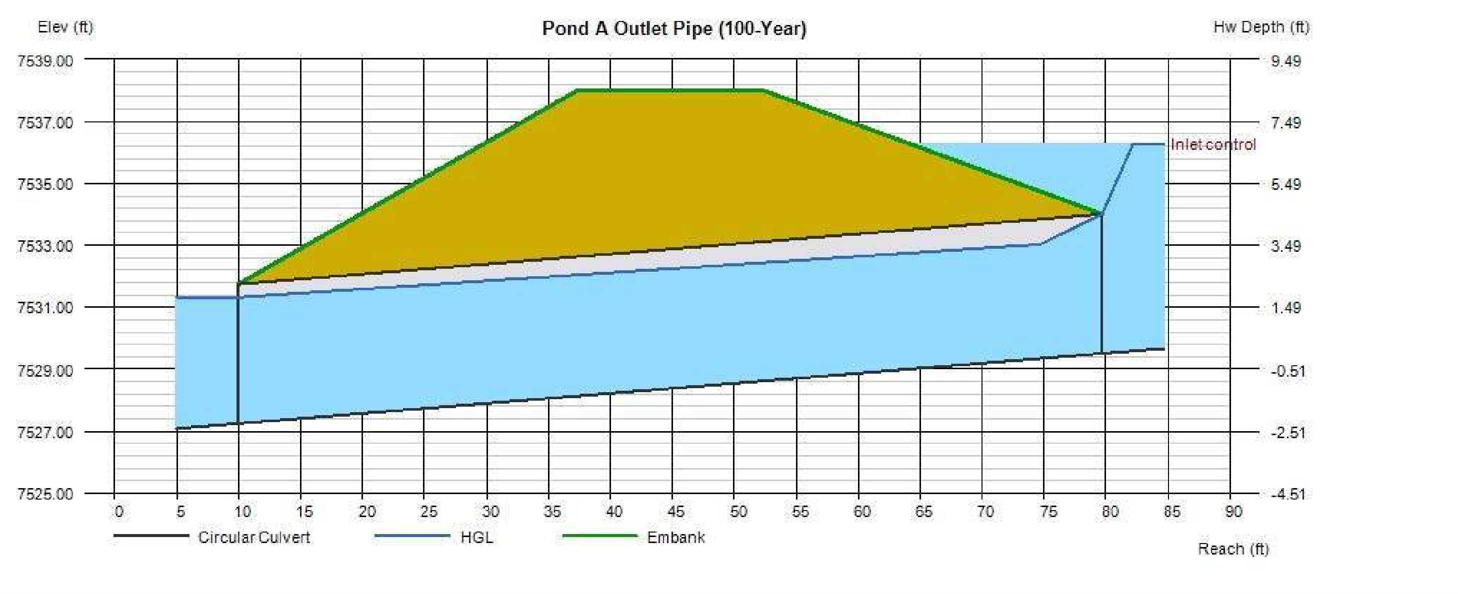
Top Elevation (ft)	=	7538.00
Top Width (ft)	=	15.00
Crest Width (ft)	=	56.00

Calculations

Qmin (cfs)	=	156.00
Qmax (cfs)	=	156.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	156.00
Qpipe (cfs)	=	156.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	10.30
Veloc Up (ft/s)	=	11.28
HGL Dn (ft)	=	7531.33
HGL Up (ft)	=	7533.16
Hw Elev (ft)	=	7536.28
Hw/D (ft)	=	1.50
Flow Regime	=	Inlet Control



Culvert Report

Pond B Outlet Pipe (5-Year)

Invert Elev Dn (ft)	=	7522.12
Pipe Length (ft)	=	60.98
Slope (%)	=	0.29
Invert Elev Up (ft)	=	7522.30
Rise (in)	=	60.0
Shape	=	Circular
Span (in)	=	60.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

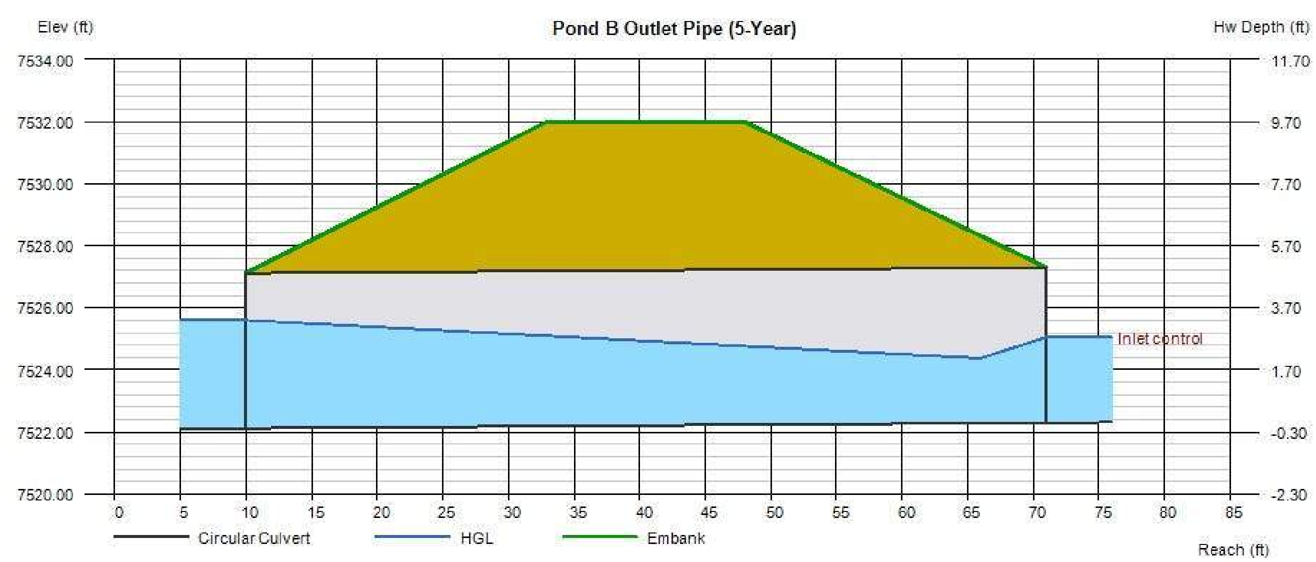
Top Elevation (ft)	=	7532.00
Top Width (ft)	=	15.00
Crest Width (ft)	=	40.00

Calculations

Qmin (cfs)	=	49.20
Qmax (cfs)	=	49.20
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	49.20
Qpipe (cfs)	=	49.20
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	3.37
Veloc Up (ft/s)	=	6.88
HGL Dn (ft)	=	7525.60
HGL Up (ft)	=	7524.26
Hw Elev (ft)	=	7525.05
Hw/D (ft)	=	0.55
Flow Regime	=	Inlet Control



Culvert Report

Pond B Outlet Pipe (100-Year)

Invert Elev Dn (ft)	=	7522.12
Pipe Length (ft)	=	60.98
Slope (%)	=	0.29
Invert Elev Up (ft)	=	7522.30
Rise (in)	=	60.0
Shape	=	Circular
Span (in)	=	60.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

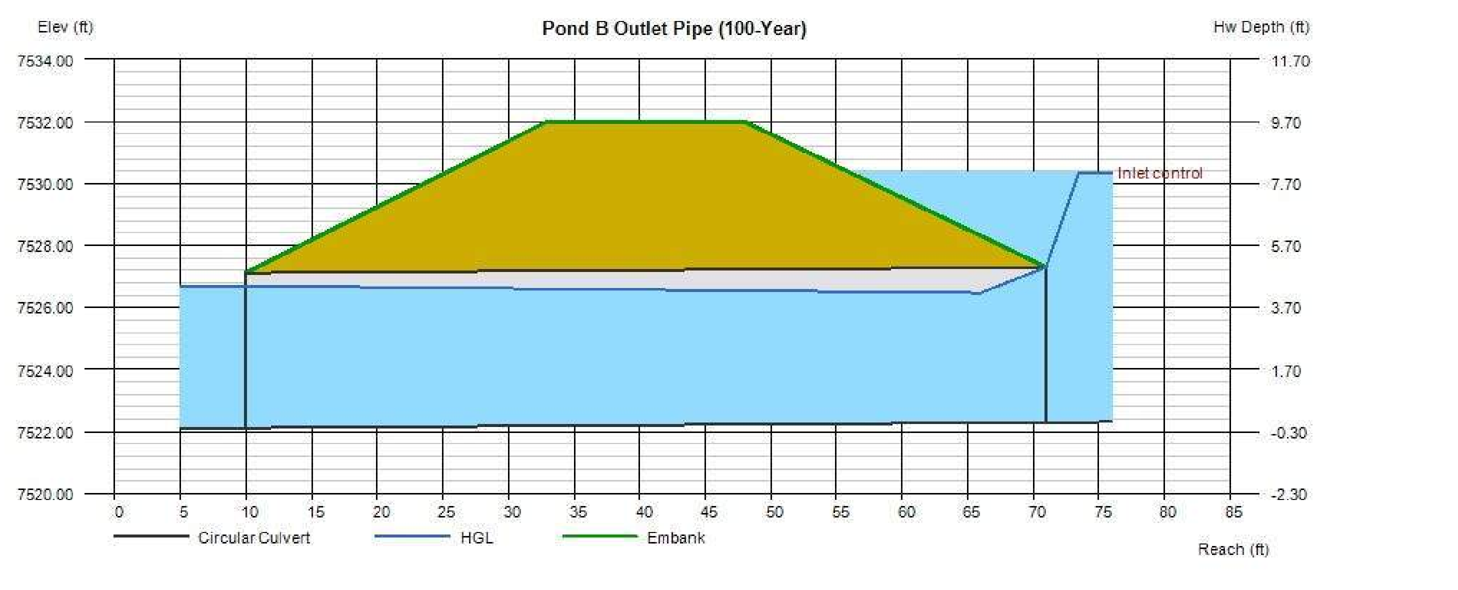
Top Elevation (ft)	=	7532.00
Top Width (ft)	=	15.00
Crest Width (ft)	=	40.00

Calculations

Qmin (cfs)	=	213.60
Qmax (cfs)	=	213.60
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	213.60
Qpipe (cfs)	=	213.60
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	11.34
Veloc Up (ft/s)	=	12.25
HGL Dn (ft)	=	7526.70
HGL Up (ft)	=	7526.45
Hw Elev (ft)	=	7530.35
Hw/D (ft)	=	1.61
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 25 2024

Pond C Outlet Pipe (5-Year)

Invert Elev Dn (ft)	=	7528.00
Pipe Length (ft)	=	57.68
Slope (%)	=	0.50
Invert Elev Up (ft)	=	7528.29
Rise (in)	=	36.0
Shape	=	Circular
Span (in)	=	36.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

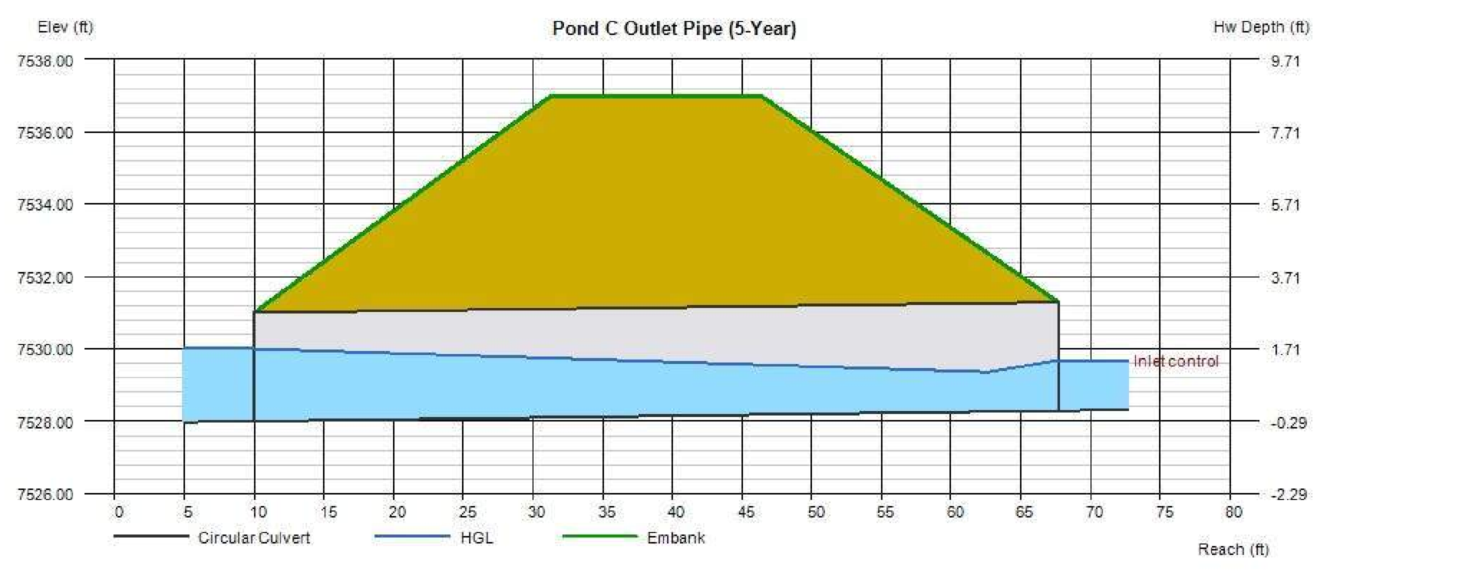
Top Elevation (ft)	=	7537.00
Top Width (ft)	=	15.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	10.20
Qmax (cfs)	=	10.20
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	10.20
Qpipe (cfs)	=	10.20
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	2.03
Veloc Up (ft/s)	=	4.88
HGL Dn (ft)	=	7530.01
HGL Up (ft)	=	7529.30
Hw Elev (ft)	=	7529.68
Hw/D (ft)	=	0.46
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Oct 25 2024

Pond C Outlet Pipe (100-Year)

Invert Elev Dn (ft)	=	7528.00
Pipe Length (ft)	=	57.68
Slope (%)	=	0.50
Invert Elev Up (ft)	=	7528.29
Rise (in)	=	36.0
Shape	=	Circular
Span (in)	=	36.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

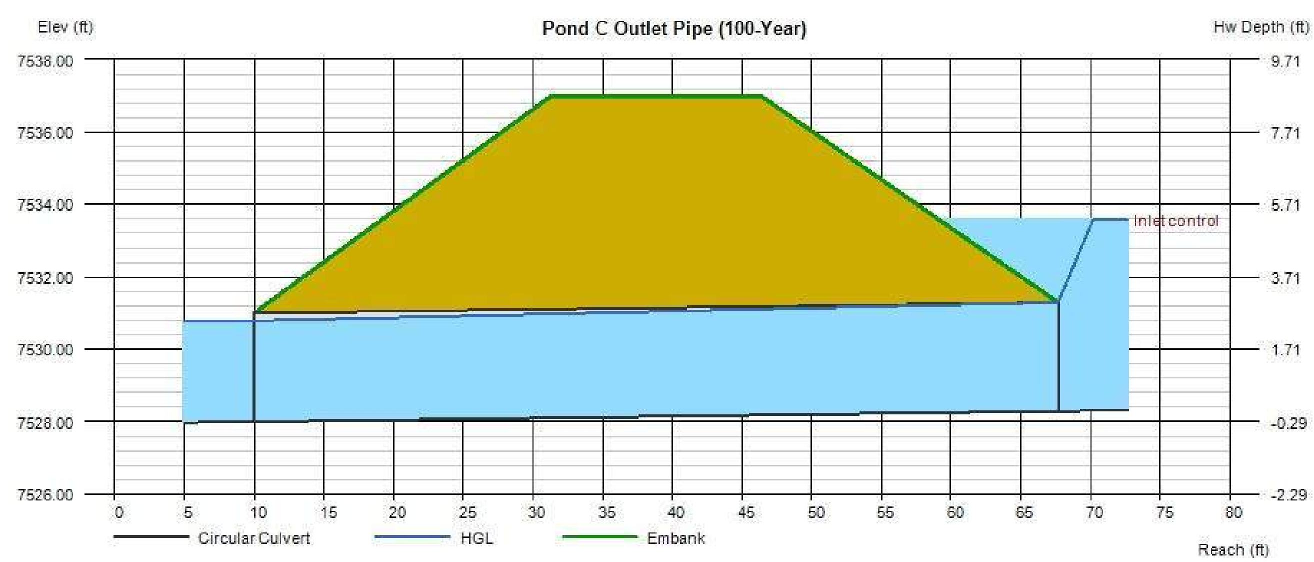
Top Elevation (ft)	=	7537.00
Top Width (ft)	=	15.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	64.20
Qmax (cfs)	=	64.20
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	64.20
Qpipe (cfs)	=	64.20
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	9.38
Veloc Up (ft/s)	=	9.08
HGL Dn (ft)	=	7530.79
HGL Up (ft)	=	7531.30
Hw Elev (ft)	=	7533.58
Hw/D (ft)	=	1.76
Flow Regime	=	Inlet Control



SWALE CALCULATIONS

Worksheet for SECTION A1 - RUBBLE DRIVE

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	3.50 %
Left Side Slope	3.000 H:V
Right Side Slope	4.000 H:V
Discharge	42.00 cfs

Results

Normal Depth	1.4 ft
Flow Area	6.9 ft²
Wetted Perimeter	10.2 ft
Hydraulic Radius	0.7 ft
Top Width	9.81 ft
Critical Depth	1.6 ft
Critical Slope	2.05 %
Velocity	6.10 ft/s
Velocity Head	0.58 ft
Specific Energy	1.98 ft
Froude Number	1.285
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.4 ft
Critical Depth	1.6 ft
Channel Slope	3.50 %
Critical Slope	2.05 %

Worksheet for SECTION A2 - RUBBLE DRIVE

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.035
Channel Slope	2.80 %
Left Side Slope	3.000 H:V
Right Side Slope	4.000 H:V
Discharge	31.60 cfs

Results	
Normal Depth	1.3 ft
Flow Area	6.0 ft²
Wetted Perimeter	9.6 ft
Hydraulic Radius	0.6 ft
Top Width	9.20 ft
Critical Depth	1.4 ft
Critical Slope	2.13 %
Velocity	5.23 ft/s
Velocity Head	0.42 ft
Specific Energy	1.74 ft
Froude Number	1.137
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.3 ft
Critical Depth	1.4 ft
Channel Slope	2.80 %
Critical Slope	2.13 %

Worksheet for SECTION B - GIMME WAY

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.035
Channel Slope	2.50 %
Left Side Slope	3.000 H:V
Right Side Slope	4.000 H:V
Discharge	37.90 cfs

Results	
Normal Depth	1.4 ft
Flow Area	7.2 ft²
Wetted Perimeter	10.5 ft
Hydraulic Radius	0.7 ft
Top Width	10.06 ft
Critical Depth	1.5 ft
Critical Slope	2.08 %
Velocity	5.24 ft/s
Velocity Head	0.43 ft
Specific Energy	1.86 ft
Froude Number	1.091
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.4 ft
Critical Depth	1.5 ft
Channel Slope	2.50 %
Critical Slope	2.08 %

Worksheet for SECTION C - STABLEFORD TERRACE

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	1.90 %
Left Side Slope	3.000 H:V
Right Side Slope	4.000 H:V
Discharge	22.10 cfs

Results

Normal Depth	1.2 ft
Flow Area	5.3 ft²
Wetted Perimeter	9.0 ft
Hydraulic Radius	0.6 ft
Top Width	8.65 ft
Critical Depth	1.2 ft
Critical Slope	2.23 %
Velocity	4.14 ft/s
Velocity Head	0.27 ft
Specific Energy	1.50 ft
Froude Number	0.928
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.2 ft
Critical Depth	1.2 ft
Channel Slope	1.90 %
Critical Slope	2.23 %

Worksheet for SECTION D - BUNKER TRAIL

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	3.10 %
Left Side Slope	3.000 H:V
Right Side Slope	4.000 H:V
Discharge	27.60 cfs

Results

Normal Depth	1.2 ft
Flow Area	5.3 ft²
Wetted Perimeter	8.9 ft
Hydraulic Radius	0.6 ft
Top Width	8.58 ft
Critical Depth	1.3 ft
Critical Slope	2.17 %
Velocity	5.25 ft/s
Velocity Head	0.43 ft
Specific Energy	1.65 ft
Froude Number	1.183
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.2 ft
Critical Depth	1.3 ft
Channel Slope	3.10 %
Critical Slope	2.17 %

Worksheet for SECTION E - FRINGE PLACE

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.035
Channel Slope	3.10 %
Left Side Slope	4.000 H:V
Right Side Slope	5.000 H:V
Discharge	50.60 cfs

Results	
Normal Depth	1.4 ft
Flow Area	8.8 ft²
Wetted Perimeter	12.9 ft
Hydraulic Radius	0.7 ft
Top Width	12.55 ft
Critical Depth	1.5 ft
Critical Slope	2.02 %
Velocity	5.78 ft/s
Velocity Head	0.52 ft
Specific Energy	1.91 ft
Froude Number	1.220
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.4 ft
Critical Depth	1.5 ft
Channel Slope	3.10 %
Critical Slope	2.02 %

DRAINAGE CHANNEL

SECTION CALCULATIONS

Worksheet for SECTION A-A

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	2.20 %
Discharge	274.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	7,565.15
0+49	7,560.92
0+82	7,558.00
0+97	7,556.00
1+19	7,554.00
1+55	7,554.00
1+87	7,560.00
2+20	7,564.00
2+33	7,565.25

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 7,565.15)	(2+33, 7,565.25)	0.035

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	1.1 ft
Roughness Coefficient	0.035
Elevation	7,555.06 ft
Elevation Range	7,554.0 to 7,565.3 ft
Flow Area	47.3 ft²
Wetted Perimeter	53.6 ft
Hydraulic Radius	0.9 ft
Top Width	53.49 ft
Normal Depth	1.1 ft
Critical Depth	1.1 ft
Critical Slope	1.84 %
Velocity	5.79 ft/s
Velocity Head	0.52 ft
Specific Energy	1.58 ft
Froude Number	1.086
Flow Type	Supercritical

GVF Input Data

Worksheet for SECTION A-A

GVF Input Data	
Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.1 ft
Critical Depth	1.1 ft
Channel Slope	2.20 %
Critical Slope	1.84 %

Worksheet for SECTION B-B

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.90	%
Discharge	71.70	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	7,589.08
0+35	7,588.00
0+73	7,585.93
0+89	7,584.00
1+08	7,584.00
1+29	7,585.70
1+51	7,586.83
1+72	7,588.27
1+88	7,589.13

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 7,589.08)	(1+88, 7,589.13)	0.035

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results		
Normal Depth	0.7	ft
Roughness Coefficient	0.035	
Elevation	7,584.70	ft
Elevation Range	7,584.0 to 7,589.1	ft
Flow Area	18.3	ft²
Wetted Perimeter	33.3	ft
Hydraulic Radius	0.5	ft
Top Width	33.21	ft
Normal Depth	0.7	ft
Critical Depth	0.7	ft
Critical Slope	2.21	%
Velocity	3.92	ft/s
Velocity Head	0.24	ft
Specific Energy	0.94	ft
Froude Number	0.932	
Flow Type	Subcritical	

GVF Input Data

Worksheet for SECTION B-B

GVF Input Data	
Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.7 ft
Critical Depth	0.7 ft
Channel Slope	1.90 %
Critical Slope	2.21 %

Worksheet for SECTION C-C

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.035
Channel Slope	3.00 %
Left Side Slope	4.00 H:V
Right Side Slope	4.00 H:V
Discharge	42.40 cfs

Results	
Normal Depth	1.4 ft
Flow Area	7.6 ft²
Wetted Perimeter	11.3 ft
Hydraulic Radius	0.7 ft
Top Width	10.99 ft
Critical Depth	1.5 ft
Critical Slope	2.06 %
Velocity	5.61 ft/s
Velocity Head	0.49 ft
Specific Energy	1.86 ft
Froude Number	1.193
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.4 ft
Critical Depth	1.5 ft
Channel Slope	3.00 %
Critical Slope	2.06 %

Worksheet for SECTION D-D

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.90	%
Discharge	167.40	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	7,540.10
0+25	7,538.00
0+72	7,532.16
0+94	7,530.00
1+08	7,529.51
1+77	7,529.95
1+91	7,532.00
2+27	7,536.14
2+37	7,538.00
2+67	7,540.29

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 7,540.10)	(2+67, 7,540.29)	0.035

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results		
Normal Depth	0.8	ft
Roughness Coefficient	0.035	
Elevation	7,530.26	ft
Elevation Range	7,529.5 to 7,540.3 ft	
Flow Area	44.9	ft²
Wetted Perimeter	88.3	ft
Hydraulic Radius	0.5	ft
Top Width	88.21	ft
Normal Depth	0.8	ft
Critical Depth	0.7	ft
Critical Slope	2.28	%
Velocity	3.73	ft/s
Velocity Head	0.22	ft
Specific Energy	0.97	ft
Froude Number	0.922	
Flow Type	Subcritical	

Worksheet for SECTION D-D

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.8 ft
Critical Depth	0.7 ft
Channel Slope	1.90 %
Critical Slope	2.28 %

Worksheet for SECTION E-E

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	9.00 %
Left Side Slope	5.00 H:V
Right Side Slope	4.00 H:V
Discharge	5.00 cfs

Results

Normal Depth	0.5 ft
Flow Area	1.0 ft²
Wetted Perimeter	4.4 ft
Hydraulic Radius	0.2 ft
Top Width	4.31 ft
Critical Depth	0.6 ft
Critical Slope	2.76 %
Velocity	4.84 ft/s
Velocity Head	0.36 ft
Specific Energy	0.84 ft
Froude Number	1.742
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.5 ft
Critical Depth	0.6 ft
Channel Slope	9.00 %
Critical Slope	2.76 %

Worksheet for SECTION F-F

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.035
Channel Slope	2.20 %
Left Side Slope	4.00 H:V
Right Side Slope	3.00 H:V
Discharge	297.40 cfs

Results	
Normal Depth	3.2 ft
Flow Area	35.6 ft²
Wetted Perimeter	23.2 ft
Hydraulic Radius	1.5 ft
Top Width	22.31 ft
Critical Depth	3.4 ft
Critical Slope	1.58 %
Velocity	8.37 ft/s
Velocity Head	1.09 ft
Specific Energy	4.27 ft
Froude Number	1.168
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	3.2 ft
Critical Depth	3.4 ft
Channel Slope	2.20 %
Critical Slope	1.58 %

Worksheet for SECTION G-G

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.035
Channel Slope	8.20 %
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Discharge	21.00 cfs

Results	
Normal Depth	0.9 ft
Flow Area	3.1 ft²
Wetted Perimeter	7.2 ft
Hydraulic Radius	0.4 ft
Top Width	7.00 ft
Critical Depth	1.1 ft
Critical Slope	2.26 %
Velocity	6.86 ft/s
Velocity Head	0.73 ft
Specific Energy	1.61 ft
Froude Number	1.830
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.9 ft
Critical Depth	1.1 ft
Channel Slope	8.20 %
Critical Slope	2.26 %

Worksheet for SECTION H-H

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.035
Channel Slope	2.00 %
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Discharge	283.20 cfs

Results	
Normal Depth	3.0 ft
Flow Area	36.6 ft²
Wetted Perimeter	24.9 ft
Hydraulic Radius	1.5 ft
Top Width	24.18 ft
Critical Depth	3.2 ft
Critical Slope	1.60 %
Velocity	7.75 ft/s
Velocity Head	0.93 ft
Specific Energy	3.96 ft
Froude Number	1.111
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	3.0 ft
Critical Depth	3.2 ft
Channel Slope	2.00 %
Critical Slope	1.60 %

Worksheet for SECTION I-I

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.035
Channel Slope	6.50 %
Left Side Slope	4.000 H:V
Right Side Slope	5.000 H:V
Discharge	93.30 cfs

Results	
Normal Depth	1.5 ft
Flow Area	10.5 ft²
Wetted Perimeter	14.1 ft
Hydraulic Radius	0.7 ft
Top Width	13.74 ft
Critical Depth	1.9 ft
Critical Slope	1.87 %
Velocity	8.90 ft/s
Velocity Head	1.23 ft
Specific Energy	2.76 ft
Froude Number	1.795
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.5 ft
Critical Depth	1.9 ft
Channel Slope	6.50 %
Critical Slope	1.87 %

Worksheet for SECTION J-J

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	5.00 %
Left Side Slope	12.00 H:V
Right Side Slope	21.00 H:V
Bottom Width	13.56 ft
Discharge	35.80 cfs

Results

Normal Depth	0.4 ft
Flow Area	8.3 ft²
Wetted Perimeter	27.1 ft
Hydraulic Radius	0.3 ft
Top Width	27.05 ft
Critical Depth	0.5 ft
Critical Slope	2.52 %
Velocity	4.31 ft/s
Velocity Head	0.29 ft
Specific Energy	0.70 ft
Froude Number	1.373
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.4 ft
Critical Depth	0.5 ft
Channel Slope	5.00 %
Critical Slope	2.52 %

Worksheet for SECTION K-K

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	4.70 %
Discharge	25.90 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	7,555.80
0+24	7,555.92
0+50	7,555.39
0+80	7,553.80
1+00	7,553.27
1+29	7,553.66
1+50	7,555.00
2+00	7,559.08

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 7,555.80)	(2+00, 7,559.08)	0.035

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.4 ft
Roughness Coefficient	0.035
Elevation	7,553.66 ft
Elevation Range	7,553.3 to 7,559.1 ft
Flow Area	8.4 ft²
Wetted Perimeter	43.3 ft
Hydraulic Radius	0.2 ft
Top Width	43.34 ft
Normal Depth	0.4 ft
Critical Depth	0.4 ft
Critical Slope	2.97 %
Velocity	3.08 ft/s
Velocity Head	0.15 ft
Specific Energy	0.54 ft
Froude Number	1.235
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 ft

Worksheet for SECTION K-K

GVF Input Data	
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.4 ft
Critical Depth	0.4 ft
Channel Slope	4.70 %
Critical Slope	2.97 %

Worksheet for SECTION L-L

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	2.80 %
Left Side Slope	10.00 H:V
Right Side Slope	9.00 H:V
Bottom Width	33.00 ft
Discharge	5.70 cfs

Results

Normal Depth	0.1 ft
Flow Area	3.6 ft²
Wetted Perimeter	35.0 ft
Hydraulic Radius	0.1 ft
Top Width	35.03 ft
Critical Depth	0.1 ft
Critical Slope	3.93 %
Velocity	1.57 ft/s
Velocity Head	0.04 ft
Specific Energy	0.15 ft
Froude Number	0.858
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.1 ft
Critical Depth	0.1 ft
Channel Slope	2.80 %
Critical Slope	3.93 %

Worksheet for SECTION M-M

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.035
Channel Slope	3.20 %
Left Side Slope	7.00 H:V
Right Side Slope	5.00 H:V
Bottom Width	3.50 ft
Discharge	17.60 cfs

Results	
Normal Depth	0.6 ft
Flow Area	4.3 ft²
Wetted Perimeter	10.8 ft
Hydraulic Radius	0.4 ft
Top Width	10.74 ft
Critical Depth	0.6 ft
Critical Slope	2.41 %
Velocity	4.10 ft/s
Velocity Head	0.26 ft
Specific Energy	0.86 ft
Froude Number	1.143
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.6 ft
Critical Depth	0.6 ft
Channel Slope	3.20 %
Critical Slope	2.41 %

CHANNEL LINING CALCULATIONS

FROUDE NUMBER CALCULATIONS			CALCULATED BY:	TMM	DATE:	9/4/2024
PROJECT: 211030 FILING NO. 4			CHECKED BY:	RHL		
Froude Number Calculations: 100-YR						
Section	Velocity	Gravitational Constant	Hydraulic depth	Xsectional Area	top Width	Froude #
-	ft/s	ft/s^2	ft	ft^2	ft	N/A
A-A	5.79	32.17	0.88	47.30	53.49	1.09
B-B	3.92	32.17	0.55	18.3	33.21	0.93
C-C	5.61	32.17	0.69	7.59	10.99	1.19
D-D	3.91	32.17	0.55	48.5	88.91	0.93
E-E	4.84	32.17	0.23	1.0	4.31	1.77
F-F	7.56	32.17	1.34	39.4	29.43	1.15
G-G	6.86	32.17	0.44	3.1	7.00	1.82
H-H	7.75	32.17	1.51	36.6	24.18	1.11
I-I	8.90	32.17	0.76	10.5	13.74	1.79
J-J	4.31	32.17	0.31	8.3	27.05	1.37
K-K	3.08	32.17	0.19	8.4	43.34	1.23
L-L	1.57	32.17	0.10	3.6	35.03	0.86
M-M	4.10	32.17	0.40	4.3	10.74	1.14
SECTION A1	6.10	32.17	0.70	6.9	9.81	1.28
SECTION A2	5.23	32.17	0.65	6.0	9.2	1.14
SECTION B	5.24	32.17	0.72	7.2	10.06	1.09
SECTION C	4.14	32.17	0.61	5.3	8.65	0.93
SECTION D	5.25	32.17	0.62	5.3	8.58	1.18
SECTION E	5.78	32.17	0.70	8.8	12.55	1.22

SHEAR STRESS & CHANNEL LININGS	CALCULATED BY:	TMM	DATE:	9/4/2024
PROJECT: 211030 FILING NO. 4	CHECKED BY:	RHL		

Shear Stress Calculations: 100-YR				
Section	unit weight of water	Depth of flow	Slope	Shear Stress
-	lb/ft^3	ft	ft/ft	lb/ft^2
A-A	62.43	1.10	0.022	1.51
B-B	62.43	0.70	0.019	0.83
C-C	62.43	1.40	0.030	2.62
D-D	62.43	0.80	0.019	0.95
E-E	62.43	0.50	0.090	2.81
F-F	62.43	2.70	0.022	3.71
G-G	62.43	0.90	0.082	4.61
H-H	62.43	3.00	0.020	3.75
I-I	62.43	1.50	0.065	6.09
J-J	62.43	0.40	0.050	1.25
K-K	62.43	0.40	0.047	1.17
L-L	62.43	0.10	0.028	0.17
M-M	62.43	0.60	0.032	1.20
SECTION A1	62.43	1.40	0.035	3.06
SECTION A2	62.43	1.30	0.028	2.27
SECTION B	62.43	1.40	0.025	2.19
SECTION C	62.43	1.20	0.019	1.42
SECTION D	62.43	1.20	0.031	2.32
SECTION E	62.43	1.40	0.031	2.71

Channel Lining Determination					
	Calculated Values		P300 Max Values		
Section	Shear Stress	Velocity	Shear Stress	Velocity	Lining Required
A-A	1.51	5.79	3	9	NONE
B-B	0.83	3.92	3	9	P300
C-C	2.62	5.61	3	9	P300
D-D	0.95	3.91	3	9	NONE
E-E	2.81	4.84	3	9	P300
F-F	3.71	7.56	3	9	TMAX
G-G	4.61	6.86	3	9	TMAX
H-H	3.75	7.75	3	9	TMAX
I-I	6.09	8.90	3	9	TMAX
J-J	1.25	4.31	3	9	NONE
K-K	1.17	3.08	3	9	NONE
L-L	0.17	1.57	3	9	NONE
M-M	1.20	4.10	3	9	NONE
SECTION A1	3.06	6.10	3	9	TMAX
SECTION A2	2.27	5.23	3	9	P300
SECTION B	2.19	5.24	3	9	P300
SECTION C	1.42	4.14	3	9	P300
SECTION D	2.32	5.25	3	9	P300
SECTION E	2.71	5.78	3	9	P300

RIPRAP SIZING ANALYSIS

HRGreen	FLYING HORSE NORTH FILING NO. 4	Calc'd by:	TMM
	211030	Checked by:	RHL
	FES 1D RIPRAP	Date:	9/3/2024

Input Parameters		
Flow (Q)	3	cfs
Tailwater depth (Y_t)	0.60	ft
Conduit Diameter (D_c)	18	in
Expansion Factor (per Fig. 9-35)	6.5	
Soil Type	Non-Cohesive Soils	

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	1.09	
D_{50} =	1.35	in
UDFCD Riprap Type =	Type VL	
Design D_{50} =	6	in
Minimum Mantle Thickness =	12	in
Minimum Length of Apron =	4.5	ft

Calculated D_{50} for riprap was calculated using Equation 9-16 in the USDCM Vol 2.

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}}$$

Calculated minimum length of apron was calculated using Equations 9-11 and 9-12 in the USDCM Vol. 2

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right) \quad \text{Equation 9-11}$$

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

$$A_t = \frac{Q}{V} \quad \text{Equation 9-12}$$

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft²)

Note:

[1] Calculations follow criteria in the USDCM Vol.2 Chapter 9

[2] Calculations assume a circular culvert

[3] This spreadsheet assumes y_t/D_t=0.4 in cases where y_t is unknown or a hydraulic jump is suspected downstream of the outlet.

[4] Per the USDCM Vol.2 in no case should L_p be less than 3D, nor does L_p need to be greater than 10D whenever the Froude parameter is less than 6.0. whenever the Froude parameter is greater than 6, increase the maximum L_p required by 1/4 D_c for each whole number by which the Froude parameter is greater than 6

HRGreen	FLYING HORSE NORTH FILING NO. 4	Calc'd by:	TMM
	211030	Checked by:	RHL
	FES 2D RIPRAP	Date:	9/12/2024

Input Parameters		
Flow (Q)	274	cfs
Tailwater depth (Y_t)	2.00	ft
Conduit Diameter (D_c)	60	in
Expansion Factor (per Fig. 9-35)	2.5	
Soil Type	Non-Cohesive Soils	

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	4.90	
D_{50} =	20.31	in
UDFCD Riprap Type =	Type VH	
Design D_{50} =	24	in
Minimum Mantle Thickness =	48	in
Minimum Length of Apron =	56.0	ft

Calculated D_{50} for riprap was calculated using Equation 9-16 in the USDCM Vol 2.

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}}$$

Calculated minimum length of apron was calculated using Equations 9-11 and 9-12 in the USDCM Vol. 2

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right) \quad \text{Equation 9-11}$$

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

$$A_t = \frac{Q}{V} \quad \text{Equation 9-12}$$

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft²)

Note:

[1] Calculations follow criteria in the USDCM Vol.2 Chapter 9

[2] Calculations assume a circular culvert

[3] This spreadsheet assumes y_t/D_t=0.4 in cases where y_t is unknown or a hydraulic jump is suspected downstream of the outlet.

[4] Per the USDCM Vol.2 in no case should L_p be less than 3D, nor does L_p need to be greater than 10D whenever the Froude parameter is less than 6.0. whenever the Froude parameter is greater than 6, increase the maximum L_p required by 1/4 D_c for each whole number by which the Froude parameter is greater than 6

HRGreen	FLYING HORSE NORTH FILING NO. 4	Calc'd by:	TMM
	211030	Checked by:	RHL
	FES 3D RIPRAP	Date:	9/12/2024

Input Parameters		
Flow (Q)	5	cfs
Tailwater depth (Y_t)	0.60	ft
Conduit Diameter (D_c)	18	in
Expansion Factor (per Fig. 9-35)	6.25	
Soil Type	Non-Cohesive Soils	

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	1.81	
D_{50} =	2.26	in
UDFCD Riprap Type =	Type VL	
Design D_{50} =	6	in
Minimum Mantle Thickness =	12	in
Minimum Length of Apron =	4.5	ft

Calculated D_{50} for riprap was calculated using Equation 9-16 in the USDCM Vol 2.

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}}$$

Calculated minimum length of apron was calculated using Equations 9-11 and 9-12 in the USDCM Vol. 2

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right) \quad \text{Equation 9-11}$$

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

$$A_t = \frac{Q}{V} \quad \text{Equation 9-12}$$

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft²)

Note:

[1] Calculations follow criteria in the USDCM Vol.2 Chapter 9

[2] Calculations assume a circular culvert

[3] This spreadsheet assumes y_t/D_t=0.4 in cases where y_t is unknown or a hydraulic jump is suspected downstream of the outlet.

[4] Per the USDCM Vol.2 in no case should L_p be less than 3D, nor does L_p need to be greater than 10D whenever the Froude parameter is less than 6.0. whenever the Froude parameter is greater than 6, increase the maximum L_p required by 1/4 D_c for each whole number by which the Froude parameter is greater than 6

	FLYING HORSE NORTH FILING NO. 4	Calc'd by:	TMM
HRGreen	211030	Checked by:	RHL
	FES 4D RIPRAP	Date:	9/12/2024

Input Parameters		
Flow (Q)	22.1	cfs
Tailwater depth (Y_t)	0.80	ft
Conduit Diameter (D_c)	24	in
Expansion Factor (per Fig. 9-35)	3.75	
Soil Type	Non-Cohesive Soils	

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	3.91	
D_{50} =	6.48	in
UDFCD Riprap Type =	Type L	
Design D_{50} =	9	in
Minimum Mantle Thickness =	18	in
Minimum Length of Apron =	13.2	ft

Calculated D_{50} for riprap was calculated using Equation 9-16 in the USDCM Vol 2.

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}}$$

Calculated minimum length of apron was calculated using Equations 9-11 and 9-12 in the USDCM Vol. 2

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right) \quad \text{Equation 9-11}$$

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

$$A_t = \frac{Q}{V} \quad \text{Equation 9-12}$$

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft²)

Note:

[1] Calculations follow criteria in the USDCM Vol.2 Chapter 9

[2] Calculations assume a circular culvert

[3] This spreadsheet assumes y_t/D_t=0.4 in cases where y_t is unknown or a hydraulic jump is suspected downstream of the outlet.

[4] Per the USDCM Vol.2 in no case should L_p be less than 3D, nor does L_p need to be greater than 10D whenever the Froude parameter is less than 6.0. whenever the Froude parameter is greater than 6, increase the maximum L_p required by 1/4 D_c for each whole number by which the Froude parameter is greater than 6

HRGreen	FLYING HORSE NORTH FILING NO. 4	**Calc'd by:**	**TMM**
	211030	**Checked by:**	**RHL**
	FES 5D RIPRAP	**Date:**	**9/12/2024**

Input Parameters		
Flow (Q)	13.9	cfs
Tailwater depth (Y_t)	0.60	ft
Conduit Diameter (D_c)	18	in
Expansion Factor (per Fig. 9-35)	2.5	
Soil Type	Non-Cohesive Soils	

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	5.04	
D_{50} =	6.27	in
UDFCD Riprap Type =	Type L	
Design D_{50} =	9	in
Minimum Mantle Thickness =	18	in
Minimum Length of Apron =	7.8	ft

Calculated D_{50} for riprap was calculated using Equation 9-16 in the USDCM Vol 2.

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}}$$

Calculated minimum length of apron was calculated using Equations 9-11 and 9-12 in the USDCM Vol. 2

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right) \quad \text{Equation 9-11}$$

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

$$A_t = \frac{Q}{V} \quad \text{Equation 9-12}$$

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft²)

Note:

[1] Calculations follow criteria in the USDCM Vol.2 Chapter 9

[2] Calculations assume a circular culvert

[3] This spreadsheet assumes y_t/D_t=0.4 in cases where y_t is unknown or a hydraulic jump is suspected downstream of the outlet.

[4] Per the USDCM Vol.2 in no case should L_p be less than 3D, nor does L_p need to be greater than 10D whenever the Froude parameter is less than 6.0. whenever the Froude parameter is greater than 6, increase the maximum L_p required by 1/4 D_c for each whole number by which the Froude parameter is greater than 6

	FLYING HORSE NORTH FILING NO. 4	Calc'd by:	TMM
HRGreen	211030	Checked by:	RHL
	FES 6D RIPRAP	Date:	9/12/2024

Input Parameters		
Flow (Q)	7	cfs
Tailwater depth (Y_t)	0.60	ft
Conduit Diameter (D_c)	18	in
Expansion Factor (per Fig. 9-35)	5	
Soil Type	Non-Cohesive Soils	

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	2.54	
D_{50} =	3.16	in
UDFCD Riprap Type =	Type VL	
Design D_{50} =	6	in
Minimum Mantle Thickness =	12	in
Minimum Length of Apron =	4.5	ft

Calculated D_{50} for riprap was calculated using Equation 9-16 in the USDCM Vol 2.

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}}$$

Calculated minimum length of apron was calculated using Equations 9-11 and 9-12 in the USDCM Vol. 2

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right) \quad \text{Equation 9-11}$$

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

$$A_t = \frac{Q}{V} \quad \text{Equation 9-12}$$

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft²)

Note:

[1] Calculations follow criteria in the USDCM Vol.2 Chapter 9

[2] Calculations assume a circular culvert

[3] This spreadsheet assumes y_t/D_t=0.4 in cases where y_t is unknown or a hydraulic jump is suspected downstream of the outlet.

[4] Per the USDCM Vol.2 in no case should L_p be less than 3D, nor does L_p need to be greater than 10D whenever the Froude parameter is less than 6.0. whenever the Froude parameter is greater than 6, increase the maximum L_p required by 1/4 D_c for each whole number by which the Froude parameter is greater than 6

HRGreen	FLYING HORSE NORTH FILING NO. 4	Calc'd by:	TMM
	211030	Checked by:	RHL
	FES 7D RIPRAP	Date:	9/12/2024

Input Parameters		
Flow (Q)	8	cfs
Tailwater depth (Y_t)	0.60	ft
Conduit Diameter (D_c)	18	in
Expansion Factor (per Fig. 9-35)	4.5	
Soil Type	Non-Cohesive Soils	

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	2.90	
D_{50} =	3.61	in
UDFCD Riprap Type =	Type VL	
Design D_{50} =	6	in
Minimum Mantle Thickness =	12	in
Minimum Length of Apron =	5.25	ft

Calculated D_{50} for riprap was calculated using Equation 9-16 in the USDCM Vol 2.

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}}$$

Calculated minimum length of apron was calculated using Equations 9-11 and 9-12 in the USDCM Vol. 2

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right) \quad \text{Equation 9-11}$$

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

$$A_t = \frac{Q}{V} \quad \text{Equation 9-12}$$

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft²)

Note:

[1] Calculations follow criteria in the USDCM Vol.2 Chapter 9

[2] Calculations assume a circular culvert

[3] This spreadsheet assumes y_t/D_t=0.4 in cases where y_t is unknown or a hydraulic jump is suspected downstream of the outlet.

[4] Per the USDCM Vol.2 in no case should L_p be less than 3D, nor does L_p need to be greater than 10D whenever the Froude parameter is less than 6.0. whenever the Froude parameter is greater than 6, increase the maximum L_p required by 1/4 D_c for each whole number by which the Froude parameter is greater than 6

HRGreen	FLYING HORSE NORTH FILING NO. 4	Calc'd by:	TMM
	211030	Checked by:	RHL
	FES 8D RIPRAP	Date:	9/12/2024

Input Parameters		
Flow (Q)	2	cfs
Tailwater depth (Y_t)	0.60	ft
Conduit Diameter (D_c)	18	in
Expansion Factor (per Fig. 9-35)	6.5	
Soil Type	Non-Cohesive Soils	

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	0.73	
D_{50} =	0.90	in
UDFCD Riprap Type =	Type VL	
Design D_{50} =	6	in
Minimum Mantle Thickness =	12	in
Minimum Length of Apron =	4.5	ft

Calculated D_{50} for riprap was calculated using Equation 9-16 in the USDCM Vol 2.

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}}$$

Calculated minimum length of apron was calculated using Equations 9-11 and 9-12 in the USDCM Vol. 2

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right) \quad \text{Equation 9-11}$$

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

$$A_t = \frac{Q}{V} \quad \text{Equation 9-12}$$

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft²)

Note:

[1] Calculations follow criteria in the USDCM Vol.2 Chapter 9

[2] Calculations assume a circular culvert

[3] This spreadsheet assumes y_t/D_t=0.4 in cases where y_t is unknown or a hydraulic jump is suspected downstream of the outlet.

[4] Per the USDCM Vol.2 in no case should L_p be less than 3D, nor does L_p need to be greater than 10D whenever the Froude parameter is less than 6.0. whenever the Froude parameter is greater than 6, increase the maximum L_p required by 1/4 D_c for each whole number by which the Froude parameter is greater than 6

HRGreen	FLYING HORSE NORTH FILING NO. 4	Calc'd by:	TMM
	211030	Checked by:	RHL
	FES 9D RIPRAP	Date:	9/12/2024

Input Parameters		
Flow (Q)	2	cfs
Tailwater depth (Y_t)	0.60	ft
Conduit Diameter (D_c)	18	in
Expansion Factor (per Fig. 9-35)	6.5	
Soil Type	Non-Cohesive Soils	

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	0.73	
D_{50} =	0.90	in
UDFCD Riprap Type =	Type VL	
Design D_{50} =	6	in
Minimum Mantle Thickness =	12	in
Minimum Length of Apron =	4.5	ft

Calculated D_{50} for riprap was calculated using Equation 9-16 in the USDCM Vol 2.

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}}$$

Calculated minimum length of apron was calculated using Equations 9-11 and 9-12 in the USDCM Vol. 2

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right) \quad \text{Equation 9-11}$$

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

$$A_t = \frac{Q}{V} \quad \text{Equation 9-12}$$

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft²)

Note:

[1] Calculations follow criteria in the USDCM Vol.2 Chapter 9

[2] Calculations assume a circular culvert

[3] This spreadsheet assumes y_t/D_t=0.4 in cases where y_t is unknown or a hydraulic jump is suspected downstream of the outlet.

[4] Per the USDCM Vol.2 in no case should L_p be less than 3D, nor does L_p need to be greater than 10D whenever the Froude parameter is less than 6.0. whenever the Froude parameter is greater than 6, increase the maximum L_p required by 1/4 D_c for each whole number by which the Froude parameter is greater than 6

HRGreen	FLYING HORSE NORTH FILING NO. 4	**Calc'd by:**	TMM
	211030	**Checked by:**	RHL
	FES 10D RIPRAP	**Date:**	9/11/2024

Input Parameters		
Flow (Q)	5	cfs
Tailwater depth (Y_t)	0.60	ft
Conduit Diameter (D_c)	18	in
Expansion Factor (per Fig. 9-35)	6.25	
Soil Type	Non-Cohesive Soils	

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	1.81	
D_{50} =	2.26	in
UDFCD Riprap Type =	Type VL	
Design D_{50} =	6	in
Minimum Mantle Thickness =	12	in
Minimum Length of Apron =	4.5	ft

Calculated D_{50} for riprap was calculated using Equation 9-16 in the USDCM Vol 2.

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}}$$

Calculated minimum length of apron was calculated using Equations 9-11 and 9-12 in the USDCM Vol. 2

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right) \quad \text{Equation 9-11}$$

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

$$A_t = \frac{Q}{V} \quad \text{Equation 9-12}$$

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft²)

Note:

[1] Calculations follow criteria in the USDCM Vol.2 Chapter 9

[2] Calculations assume a circular culvert

[3] This spreadsheet assumes y_t/D_t=0.4 in cases where y_t is unknown or a hydraulic jump is suspected downstream of the outlet.

[4] Per the USDCM Vol.2 in no case should L_p be less than 3D, nor does L_p need to be greater than 10D whenever the Froude parameter is less than 6.0. whenever the Froude parameter is greater than 6, increase the maximum L_p required by 1/4 D_c for each whole number by which the Froude parameter is greater than 6

	FLYING HORSE NORTH FILING NO. 4	Calc'd by:	TMM
	211030	Checked by:	RHL
	FES 11D RIPRAP	Date:	9/12/2024

Input Parameters		
Flow (Q)	71.7	cfs
Tailwater depth (Y_t)	1.60	ft
Conduit Diameter (D_c)	48	in
Expansion Factor (per Fig. 9-35)	5.5	
Soil Type	Non-Cohesive Soils	

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	2.24	
D_{50} =	7.43	in
UDFCD Riprap Type =	Type L	
Design D_{50} =	9	in
Minimum Mantle Thickness =	18	in
Minimum Length of Apron =	27.3	ft

Calculated D_{50} for riprap was calculated using Equation 9-16 in the USDCM Vol 2.

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}}$$

Calculated minimum length of apron was calculated using Equations 9-11 and 9-12 in the USDCM Vol. 2

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right) \quad \text{Equation 9-11}$$

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

$$A_t = \frac{Q}{V} \quad \text{Equation 9-12}$$

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft²)

Note:

[1] Calculations follow criteria in the USDCM Vol.2 Chapter 9

[2] Calculations assume a circular culvert

[3] This spreadsheet assumes y_t/D_t=0.4 in cases where y_t is unknown or a hydraulic jump is suspected downstream of the outlet.

[4] Per the USDCM Vol.2 in no case should L_p be less than 3D, nor does L_p need to be greater than 10D whenever the Froude parameter is less than 6.0. whenever the Froude parameter is greater than 6, increase the maximum L_p required by 1/4 D_c for each whole number by which the Froude parameter is greater than 6

HRGreen	FLYING HORSE NORTH FILING NO. 4	Calc'd by:	TMM
	211030	Checked by:	RHL
	FES 12D RIPRAP	Date:	9/12/2024

Input Parameters		
Flow (Q)	93.3	cfs
Tailwater depth (Y_t)	1.60	ft
Conduit Diameter (D_c)	48	in
Expansion Factor (per Fig. 9-35)	4.5	
Soil Type	Non-Cohesive Soils	

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	2.92	
D_{50} =	9.67	in
UDFCD Riprap Type =	Type M	
Design D_{50} =	12	in
Minimum Mantle Thickness =	24	in
Minimum Length of Apron =	34.5	ft

Calculated D_{50} for riprap was calculated using Equation 9-16 in the USDCM Vol 2.

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}}$$

Calculated minimum length of apron was calculated using Equations 9-11 and 9-12 in the USDCM Vol. 2

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right) \quad \text{Equation 9-11}$$

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

$$A_t = \frac{Q}{V} \quad \text{Equation 9-12}$$

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft²)

Note:

[1] Calculations follow criteria in the USDCM Vol.2 Chapter 9

[2] Calculations assume a circular culvert

[3] This spreadsheet assumes y_t/D_t=0.4 in cases where y_t is unknown or a hydraulic jump is suspected downstream of the outlet.

[4] Per the USDCM Vol.2 in no case should L_p be less than 3D, nor does L_p need to be greater than 10D whenever the Froude parameter is less than 6.0. whenever the Froude parameter is greater than 6, increase the maximum L_p required by 1/4 D_c for each whole number by which the Froude parameter is greater than 6

HRGreen	FLYING HORSE NORTH FILING NO. 4	Calc'd by:	TMM
	211030	Checked by:	RHL
	FES 13D RIPRAP	Date:	10/25/2024

Input Parameters		
Flow (Q)	285.8	cfs
Tailwater depth (Y_t)	2.87	ft
Conduit Diameter (D_c)	86	in
Expansion Factor (per Fig. 9-35)	4.5	
Soil Type	Non-Cohesive Soils	

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	2.08	
D_{50} =	12.35	in
UDFCD Riprap Type =	Type H	
Design D_{50} =	18	in
Minimum Mantle Thickness =	36	in
Minimum Length of Apron =	57.5	ft

Calculated D_{50} for riprap was calculated using Equation 9-16 in the USDCM Vol 2.

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}}$$

Calculated minimum length of apron was calculated using Equations 9-11 and 9-12 in the USDCM Vol. 2

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right) \qquad \text{Equation 9-11}$$

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

$$A_t = \frac{Q}{V} \qquad \text{Equation 9-12}$$

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft^2)

Note:

[1] Calculations follow criteria in the USDCM Vol.2 Chapter 9

[2] Calculations assume a circular culvert

[3] This spreadsheet assumes y_t/D_t=0.4 in cases where y_t is unknown or a hydraulic jump is suspected downstream of the outlet.

[4] Per the USDCM Vol.2 in no case should L_p be less than 3D, nor does L_p need to be greater than 10D whenever the Froude parameter is less than 6.0. whenever the Froude parameter is greater than 6, increase the maximum L_p required by 1/4 D_c for each whole number by which the Froude parameter is greater than 6

	FLYING HORSE NORTH FILING NO. 4	Calc'd by:	TMM
HRGreen	211030	Checked by:	RHL
	FES 14D RIPRAP	Date:	10/25/2024

Input Parameters		
Flow (Q)	37.2	cfs
Tailwater depth (Y_t)	2.00	ft
Conduit Diameter (D_c)	60	in
Expansion Factor (per Fig. 9-35)	4.5	
Soil Type	Non-Cohesive Soils	

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	0.67	
D_{50} =	2.76	in
UDFCD Riprap Type =	Type VL	
Design D_{50} =	6	in
Minimum Mantle Thickness =	12	in
Minimum Length of Apron =	15.0	ft

Calculated D_{50} for riprap was calculated using Equation 9-16 in the USDCM Vol 2.

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}}$$

Calculated minimum length of apron was calculated using Equations 9-11 and 9-12 in the USDCM Vol. 2

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right) \qquad \text{Equation 9-11}$$

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

$$A_t = \frac{Q}{V} \qquad \text{Equation 9-12}$$

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft²)

Note:

[1] Calculations follow criteria in the USDCM Vol.2 Chapter 9

[2] Calculations assume a circular culvert

[3] This spreadsheet assumes y_t/D_t=0.4 in cases where y_t is unknown or a hydraulic jump is suspected downstream of the outlet.

[4] Per the USDCM Vol.2 in no case should L_p be less than 3D, nor does L_p need to be greater than 10D whenever the Froude parameter is less than 6.0. whenever the Froude parameter is greater than 6, increase the maximum L_p required by 1/4 D_c for each whole number by which the Froude parameter is greater than 6

HRGreen	**FLYING HORSE NORTH FILING NO. 4**	**Calc'd by:**	**TMM**
	211030	**Checked by:**	**RHL**
	FES 14D RIPRAP	**Date:**	**10/25/2024**

Input Parameters		
Flow (Q)	40	cfs
Tailwater depth (Y_t)	2.40	ft
Conduit Diameter (D_c)	72	in
Expansion Factor (per Fig. 9-35)	4.5	
Soil Type	Non-Cohesive Soils	

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	0.45	
D_{50} =	2.26	in
UDFCD Riprap Type =	Type VL	
Design D_{50} =	6	in
Minimum Mantle Thickness =	12	in
Minimum Length of Apron =	18.0	ft

Calculated D_{50} for riprap was calculated using Equation 9-16 in the USDCM Vol 2.

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}}$$

Calculated minimum length of apron was calculated using Equations 9-11 and 9-12 in the USDCM Vol. 2

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right) \quad \text{Equation 9-11}$$

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

$$A_t = \frac{Q}{V} \quad \text{Equation 9-12}$$

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft²)

Note:

[1] Calculations follow criteria in the USDCM Vol.2 Chapter 9

[2] Calculations assume a circular culvert

[3] This spreadsheet assumes y_t/D_t=0.4 in cases where y_t is unknown or a hydraulic jump is suspected downstream of the outlet.

[4] Per the USDCM Vol.2 in no case should L_p be less than 3D, nor does L_p need to be greater than 10D whenever the Froude parameter is less than 6.0. whenever the Froude parameter is greater than 6, increase the maximum L_p required by 1/4 D_c for each whole number by which the Froude parameter is greater than 6

HRGreen	FLYING HORSE NORTH FILING NO. 4	Calc'd by:	TMM
	211030	Checked by:	RHL
	FES AD RIPRAP	Date:	10/25/2024

Input Parameters		
Flow (Q)	156	cfs
Tailwater depth (Y_t)	1.80	ft
Conduit Diameter (D_c)	54	in
Expansion Factor (per Fig. 9-35)	3.5	
Soil Type	Non-Cohesive Soils	

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	3.63	
D_{50} =	13.54	in
UDFCD Riprap Type =	Type H	
Design D_{50} =	18	in
Minimum Mantle Thickness =	36	in
Minimum Length of Apron =	44.9	ft

Calculated D_{50} for riprap was calculated using Equation 9-16 in the USDCM Vol 2.

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}}$$

Calculated minimum length of apron was calculated using Equations 9-11 and 9-12 in the USDCM Vol. 2

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right) \quad \text{Equation 9-11}$$

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

$$A_t = \frac{Q}{V} \quad \text{Equation 9-12}$$

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft²)

Note:

[1] Calculations follow criteria in the USDCM Vol.2 Chapter 9

[2] Calculations assume a circular culvert

[3] This spreadsheet assumes y_t/D_t=0.4 in cases where y_t is unknown or a hydraulic jump is suspected downstream of the outlet.

[4] Per the USDCM Vol.2 in no case should L_p be less than 3D, nor does L_p need to be greater than 10D whenever the Froude parameter is less than 6.0. whenever the Froude parameter is greater than 6, increase the maximum L_p required by 1/4 D_c for each whole number by which the Froude parameter is greater than 6

HRGreen	FLYING HORSE NORTH FILING NO. 4	Calc'd by:	TMM
	211030	Checked by:	RHL
	FES BD RIPRAP	Date:	10/25/2024

Input Parameters		
Flow (Q)	213.6	cfs
Tailwater depth (Y_t)	2.00	ft
Conduit Diameter (D_c)	60	in
Expansion Factor (per Fig. 9-35)	3.5	
Soil Type	Non-Cohesive Soils	

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	3.82	
D_{50} =	15.83	in
UDFCD Riprap Type =	Type H	
Design D_{50} =	18	in
Minimum Mantle Thickness =	36	in
Minimum Length of Apron =	57.3	ft

Calculated D_{50} for riprap was calculated using Equation 9-16 in the USDCM Vol 2.

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}}$$

Calculated minimum length of apron was calculated using Equations 9-11 and 9-12 in the USDCM Vol. 2

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right) \quad \text{Equation 9-11}$$

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

$$A_t = \frac{Q}{V} \quad \text{Equation 9-12}$$

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft²)

Note:

[1] Calculations follow criteria in the USDCM Vol.2 Chapter 9

[2] Calculations assume a circular culvert

[3] This spreadsheet assumes y_t/D_t=0.4 in cases where y_t is unknown or a hydraulic jump is suspected downstream of the outlet.

[4] Per the USDCM Vol.2 in no case should L_p be less than 3D, nor does L_p need to be greater than 10D whenever the Froude parameter is less than 6.0. whenever the Froude parameter is greater than 6, increase the maximum L_p required by 1/4 D_c for each whole number by which the Froude parameter is greater than 6

HRGreen	FLYING HORSE NORTH FILING NO. 4	Calc'd by:	TMM
	211030	Checked by:	RHL
	FES CD RIPRAP	Date:	10/25/2024

Input Parameters		
Flow (Q)	64.2	cfs
Tailwater depth (Y_t)	1.20	ft
Conduit Diameter (D_c)	36	in
Expansion Factor (per Fig. 9-35)	3.25	
Soil Type	Non-Cohesive Soils	

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	4.12	
D_{50} =	10.24	in
UDFCD Riprap Type =	Type M	
Design D_{50} =	12	in
Minimum Mantle Thickness =	24	in
Minimum Length of Apron =	25.0	ft

Calculated D_{50} for riprap was calculated using Equation 9-16 in the USDCM Vol 2.

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}}$$

Calculated minimum length of apron was calculated using Equations 9-11 and 9-12 in the USDCM Vol. 2

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right)$$ Equation 9-11

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

$$A_t = \frac{Q}{V}$$ Equation 9-12

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft²)

Note:

[1] Calculations follow criteria in the USDCM Vol.2 Chapter 9

[2] Calculations assume a circular culvert

[3] This spreadsheet assumes y_t/D_t=0.4 in cases where y_t is unknown or a hydraulic jump is suspected downstream of the outlet.

[4] Per the USDCM Vol.2 in no case should L_p be less than 3D, nor does L_p need to be greater than 10D whenever the Froude parameter is less than 6.0. whenever the Froude parameter is greater than 6, increase the maximum L_p required by 1/4 D_c for each whole number by which the Froude parameter is greater than 6

WEIR SECTION ANALYSIS

MAJOR STORM (100-YEAR)

Worksheet for Pond A Rundown

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.040
Channel Slope	10.40 %
Bottom Width	17.81 ft
Discharge	284.00 cfs

Results	
Normal Depth	1.3 ft
Flow Area	22.3 ft²
Wetted Perimeter	20.3 ft
Hydraulic Radius	1.1 ft
Top Width	17.81 ft
Critical Depth	2.0 ft
Critical Slope	2.43 %
Velocity	12.75 ft/s
Velocity Head	2.52 ft
Specific Energy	3.78 ft
Froude Number	2.009
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.3 ft
Critical Depth	2.0 ft
Channel Slope	10.40 %
Critical Slope	2.43 %

Worksheet for Pond B Rundown

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.040
Channel Slope	5.00 %
Bottom Width	16.75 ft
Discharge	297.40 cfs

Results	
Normal Depth	1.7 ft
Flow Area	28.4 ft²
Wetted Perimeter	20.1 ft
Hydraulic Radius	1.4 ft
Top Width	16.75 ft
Critical Depth	2.1 ft
Critical Slope	2.45 %
Velocity	10.46 ft/s
Velocity Head	1.70 ft
Specific Energy	3.40 ft
Froude Number	1.415
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.7 ft
Critical Depth	2.1 ft
Channel Slope	5.00 %
Critical Slope	2.45 %

Worksheet for Pond C Rundown

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.040
Channel Slope	3.00 %
Bottom Width	9.30 ft
Discharge	63.70 cfs

Results	
Normal Depth	1.1 ft
Flow Area	10.5 ft²
Wetted Perimeter	11.6 ft
Hydraulic Radius	0.9 ft
Top Width	9.30 ft
Critical Depth	1.1 ft
Critical Slope	2.99 %
Velocity	6.05 ft/s
Velocity Head	0.57 ft
Specific Energy	1.70 ft
Froude Number	1.001
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.1 ft
Critical Depth	1.1 ft
Channel Slope	3.00 %
Critical Slope	2.99 %

APPENDIX D

WATER QUALITY AND DETENTION CALCULATIONS

Flying Horse North Filing No. 4 - Detention Modeling Summary

Pond A Developed Parameters			
Catchment Name/ID	Area (sq.mi.)	Area (ac.)	Percent Imperv.
A1	0.017	10.84	10.2
A2	0.017	10.79	11.0
A3	0.111	71.16	4.1
A4	0.029	18.71	11.0
A5	0.004	2.47	11.0
A6	0.010	6.38	11.0
A7	0.013	8.13	11.0
Total		**128.48**	**7.1**

Peak Storage Volume		Peak Release
(cu-ft)	(ac-ft)	(cfs)
111,834	2.6	160.8

Pre-Development Flow	
Catchment Name/ID	Peak Flow (cfs)
A1	97.1
A2	71.2
G1	10.8
H1	94.0
Total	**273.2**
O_BASIN_H	**267.4**

Post-Development Flow		
Catchment Name/ID	Peak Flow (cfs)	
A1	14.3	
A2	19.6	
A3	101.6	
A4	20.0	
A5	4.7	
A6	11.7	
A7	17.1	
G1	5.7	
G2	7.2	
H1	7.7	
H2	35.0	
H3	66.9	
Total	**311.6**	Direct summation
O_BASIN_H	**248.5**	Less than or equal to historic at same location

Pond B Developed Parameters			
Catchment Name/ID	Area (sq.mi.)	Area (ac.)	Percent Imperv.
B1	0.090	57.78	4.1
B2	0.056	35.77	11.7
B3	0.002	1.10	33.7
Total		**94.65**	**7.3**

Peak Storage Volume		Peak Release
(cu-ft)	(ac-ft)	(cfs)
103,808	2.4	216.7

Pre-Development Flow	
Catchment Name/ID	Peak Flow (cfs)
B1	148.9
B2	75.8
B3	18.8
B4	19.6
Total	**263.0**
O_BASIN_B	**262.7**

Post-Development Flow		
Catchment Name/ID	Peak Flow (cfs)	
B1	182.0	Detained
B2	49.5	Detained
B3	3.0	Detained
B4	15.1	Detained
B5	18.9	Undetained
B6	33.9	Undetained
Total	**302.3**	Direct summation
O_BASIN_B	**262.4**	Less than or equal to historic at same location

Pond C Developed Parameters			
Catchment Name/ID	Area (sq.mi.)	Area (ac.)	Percent Imperv.
C1	0.025	15.94	10.5
C2	0.003	1.98	20.9
C3	0.033	21.39	9.3
Total		**39.31**	**10.4**

Peak Storage Volume		Peak Release
(cu-ft)	(ac-ft)	(cfs)

Pre-Development Flow	
Catchment Name/ID	Peak Flow (cfs)
C1	24.7
C2	39.8
C3	9.7
C4	4.0
Total	**78.2**
O_BASIN_C	**78.0**

Post-Development Flow		
Catchment Name/ID	Peak Flow (cfs)	
C1	27.7	Detained
C2	3.0	Detained
C3	39.0	Detained
C4	10.3	Undetained
C5	4.0	Undetained
Total	**84.1**	Direct summation
O_BASIN_C	**73.2**	Less than or equal to historic at same location

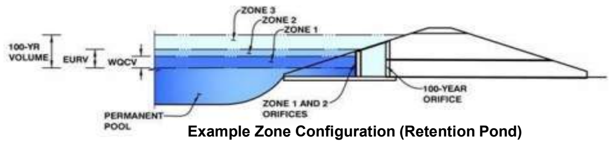
POND A

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: FLYING HORSE NORTH FILING NO. 4

Basin ID: POND A



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	128.48	acres
Watershed Length =	3,560	ft
Watershed Length to Centroid =	1,400	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	7.10%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.532	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.834	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.441	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	3.437	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	5.467	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	9.207	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	11.701	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	15.348	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	21.917	acre-feet		inches
Approximate 2-yr Detention Volume =	0.514	acre-feet		
Approximate 5-yr Detention Volume =	0.830	acre-feet		
Approximate 10-yr Detention Volume =	2.029	acre-feet		
Approximate 25-yr Detention Volume =	2.980	acre-feet		
Approximate 50-yr Detention Volume =	3.081	acre-feet		
Approximate 100-yr Detention Volume =	4.055	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.532	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.302	acre-feet
Zone 3 Volume (User Defined - Zones 1 & 2) =	1.726	acre-feet
Total Detention Basin Volume =	2.560	acre-feet

Total detention volume is less than 100-year volume.

Depth Increement = ft

7532

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)
Top of Micropool	--	0.00	--	--	--	10	0.000		
7532.5	--	0.50	--	--	--	376	0.009	96	0.002
7533.0	--	1.00	--	--	--	2,192	0.050	738	0.017
7533.5	--	1.50	--	--	--	7,097	0.163	3,061	0.070
7534.0	--	2.00	--	--	--	14,797	0.340	8,534	0.196
7534.5	--	2.50	--	--	--	22,565	0.518	17,875	0.410
7535.0	--	3.00	--	--	--	29,838	0.685	30,975	0.711
7535.5	--	3.50	--	--	--	37,249	0.855	47,747	1.096
7536.0	--	4.00	--	--	--	43,958	1.009	68,049	1.562
7536.5	--	4.50	--	--	--	49,678	1.140	91,458	2.100
7537.0	--	5.00	--	--	--	53,785	1.235	117,324	2.693
7537.5	--	5.50	--	--	--	56,812	1.304	144,973	3.328
7538.0	--	6.00	--	--	--	59,334	1.362	174,009	3.995
7538.5	--	6.50	--	--	--	62,623	1.438	204,499	4.695
7539.0	--	7.00	--	--	--	64,854	1.489	236,368	5.426
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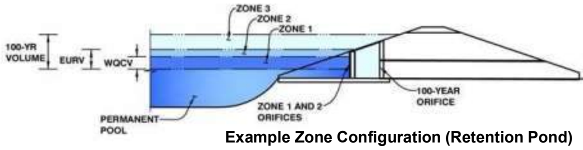
DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: FLYING HORSE NORTH FILING NO. 4
Basin ID: POND A



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.72	0.53	Orifice Plate
Zone 2 (EURV)	3.18	0.30	Circular Orifice
Zone 3 (User)	4.90	1.73	Weir&Pipe (Restrict)
Total (all zones)		2.56	

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)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	2.72	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	1.74	sq. inches (diameter = 1-1/2 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row =	1.208E-02	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	0.90	1.80					
Orifice Area (sq. inches)	1.74	1.74	1.74					

	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)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	2.72	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	3.18	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	2.29	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.03	N/A	ft^2
Vertical Orifice Centroid =	0.10	N/A	feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.18	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	22.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	5.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	3.18	N/A	feet
Overflow Weir Slope Length =	5.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	5.30	N/A	
Overflow Grate Open Area w/o Debris =	76.56	N/A	ft^2
Overflow Grate Open Area w/ Debris =	38.28	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 =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	54.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	46.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	14.44	N/A	ft^2
Outlet Orifice Centroid =	2.06	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.35	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.25	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	100.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.71	feet
Stage at Top of Freeboard =	6.96	feet
Basin Area at Top of Freeboard =	1.48	acres
Basin Volume at Top of Freeboard =	5.37	acre-ft

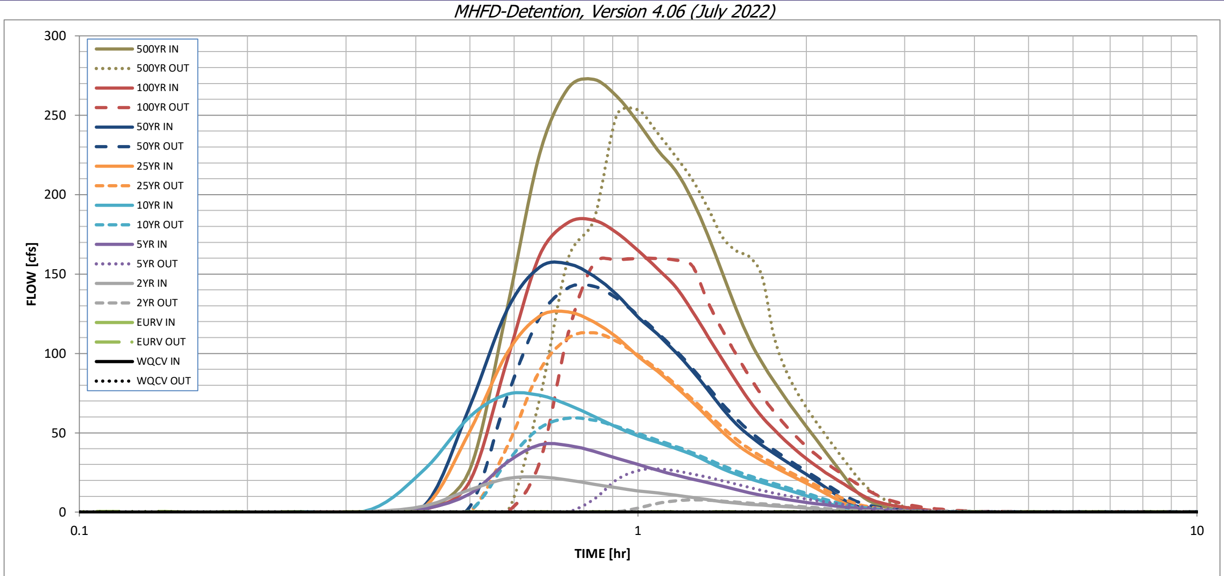
Routed Hydrograph Results

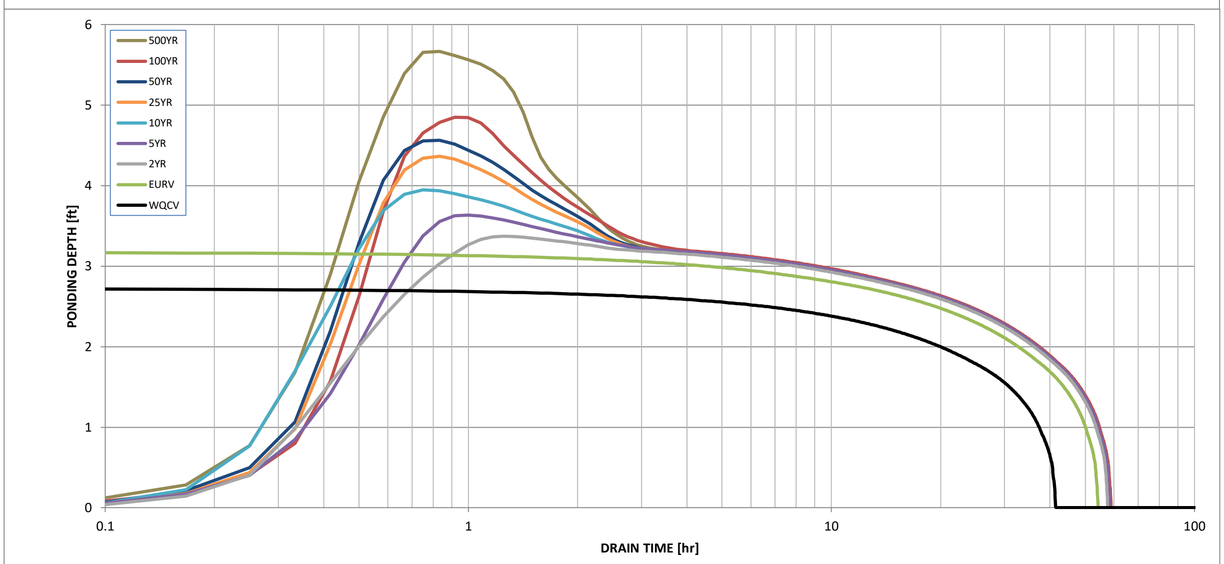
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

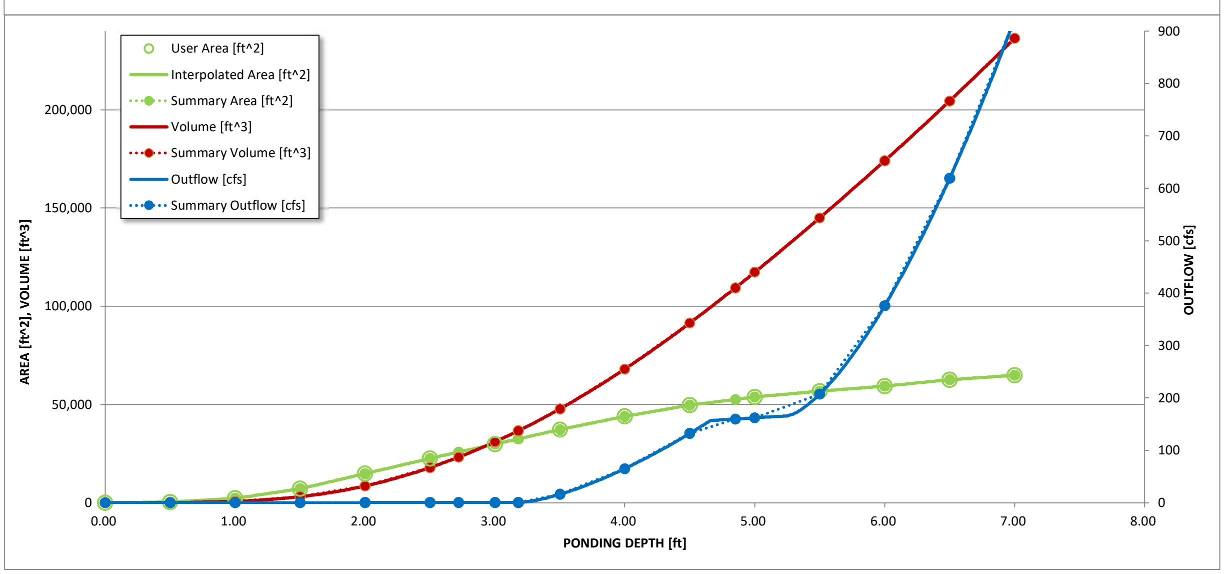
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.532	0.834	1.441	3.437	5.467	9.207	11.701	15.348	21.917
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.441	3.005	5.467	9.207	11.701	14.869	21.917
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	16.2	44.9	67.6	120.7	151.3	192.2	267.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A						160	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.13	0.35	0.53	0.94	1.18	1.25	2.08
Peak Inflow Q (cfs) =	N/A	N/A	22.2	42.5	74.2	126.0	156.4	183.8	272.6
Peak Outflow Q (cfs) =	0.2	0.3	7.7	27.2	59.2	112.9	142.3	160	253.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.6	0.9	0.9	0.9	1.0	0.9
Structure Controlling Flow =	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	0.09	0.4	0.8	1.5	1.8	2.1	2.2
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) =	38	49	50	46	39	31	27	22	11
Time to Drain 99% of Inflow Volume (hours) =	**40**	52	54	53	49	45	43	41	35
Maximum Ponding Depth (ft) =	2.72	3.18	3.37	3.64	3.95	4.37	4.56	4.85	5.67
Area at Maximum Ponding Depth (acres) =	0.59	0.75	0.81	0.90	0.99	1.10	1.15	1.20	1.32
Maximum Volume Stored (acre-ft) =	0.53	0.84	0.99	1.21	1.50	1.94	2.17	2.50	3.54
Elevation (ft) =	7534.72	7535.18		7535.64				7536.85	
Pond Bottom (ft) =	7532.00								

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	USER	CUHP	CUHP	CUHP	USER	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.02	0.03
	0:15:00	0.00	0.00	0.08	0.10	0.17	0.11	0.15	0.11	0.22
	0:20:00	0.00	0.00	0.35	0.30	1.95	0.36	0.43	0.29	1.85
	0:25:00	0.00	0.00	4.04	2.36	27.62	3.85	5.06	1.83	26.88
	0:30:00	0.00	0.00	14.17	11.47	60.17	51.16	66.72	19.59	128.86
	0:35:00	0.00	0.00	21.13	31.46	74.24	100.43	127.66	96.08	225.74
	0:40:00	0.00	0.00	22.21	42.49	73.61	123.55	154.32	161.92	267.09
	0:45:00	0.00	0.00	20.28	42.09	67.55	126.03	156.43	182.46	272.56
	0:50:00	0.00	0.00	17.61	38.34	60.42	119.92	148.66	183.84	261.90
	0:55:00	0.00	0.00	15.34	34.02	53.43	110.12	137.06	175.93	245.60
	1:00:00	0.00	0.00	13.42	30.05	48.07	98.07	122.87	164.79	228.11
	1:05:00	0.00	0.00	12.05	26.40	43.94	88.75	112.15	153.37	215.24
	1:10:00	0.00	0.00	10.68	23.39	40.13	79.20	100.85	142.09	196.94
	1:15:00	0.00	0.00	9.27	20.90	36.37	69.50	89.18	126.74	174.54
	1:20:00	0.00	0.00	7.85	18.58	31.81	59.80	77.06	110.87	150.60
	1:25:00	0.00	0.00	6.55	16.30	27.25	50.53	65.20	96.01	127.37
	1:30:00	0.00	0.00	5.60	14.09	23.76	42.74	55.29	82.24	108.37
	1:35:00	0.00	0.00	4.98	12.12	21.04	36.98	47.98	69.97	93.96
	1:40:00	0.00	0.00	4.45	10.60	18.66	32.40	42.10	60.01	82.32
	1:45:00	0.00	0.00	3.96	9.32	16.48	28.40	36.94	52.05	71.99
	1:50:00	0.00	0.00	3.47	8.13	14.45	24.78	32.28	45.12	62.66
	1:55:00	0.00	0.00	2.98	7.07	12.42	21.42	27.94	39.03	53.98
	2:00:00	0.00	0.00	2.49	6.16	10.34	18.17	23.77	33.71	45.82
	2:05:00	0.00	0.00	1.99	5.36	8.26	14.99	19.66	29.08	38.00
	2:10:00	0.00	0.00	1.49	4.62	6.24	11.85	15.59	24.94	30.37
	2:15:00	0.00	0.00	1.00	3.92	4.32	8.72	11.57	21.21	22.87
	2:20:00	0.00	0.00	0.57	3.25	2.86	5.68	7.68	17.72	15.88
	2:25:00	0.00	0.00	0.31	2.63	2.05	3.42	4.81	14.39	10.67
	2:30:00	0.00	0.00	0.21	2.05	1.57	2.13	3.16	11.28	7.38
	2:35:00	0.00	0.00	0.16	1.57	1.22	1.36	2.12	8.63	5.10
	2:40:00	0.00	0.00	0.12	1.25	0.94	0.86	1.42	6.76	3.44
	2:45:00	0.00	0.00	0.09	1.04	0.72	0.54	0.94	5.46	2.22
	2:50:00	0.00	0.00	0.07	0.88	0.53	0.34	0.62	4.45	1.35
	2:55:00	0.00	0.00	0.05	0.76	0.38	0.21	0.39	3.64	0.76
	3:00:00	0.00	0.00	0.04	0.65	0.26	0.13	0.26	2.98	0.46
	3:05:00	0.00	0.00	0.03	0.55	0.18	0.10	0.19	2.43	0.33
	3:10:00	0.00	0.00	0.03	0.45	0.12	0.07	0.14	1.96	0.25
	3:15:00	0.00	0.00	0.02	0.37	0.09	0.05	0.10	1.57	0.19
	3:20:00	0.00	0.00	0.01	0.29	0.07	0.04	0.08	1.23	0.15
	3:25:00	0.00	0.00	0.01	0.21	0.05	0.03	0.06	0.91	0.11
	3:30:00	0.00	0.00	0.01	0.15	0.03	0.02	0.04	0.63	0.07
	3:35:00	0.00	0.00	0.00	0.11	0.02	0.01	0.03	0.44	0.05
	3:40:00	0.00	0.00	0.00	0.09	0.01	0.01	0.01	0.32	0.03
	3:45:00	0.00	0.00	0.00	0.07	0.00	0.00	0.01	0.23	0.01
	3:50:00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.16	0.00
	3:55:00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.12	0.00
	4:00:00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.08	0.00
	4:05:00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.06	0.00
	4:10:00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.04	0.00
	4:15:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.03	0.00
	4:20:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.02	0.00
	4:25:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.00
	4:30:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.00
	4:35:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	4:40:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	4:45:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft²]	Area [acres]	Volume [ft³]	Volume [ac-ft]	Total Outflow [cfs]
	0.00	10	0.000	0	0.000	0.00
	0.50	376	0.009	96	0.002	0.04
	1.00	2,192	0.050	738	0.017	0.08
	1.50	7,097	0.163	3,061	0.070	0.12
	2.00	14,797	0.340	8,534	0.196	0.17
	2.50	22,565	0.518	17,875	0.410	0.21
	2.72	25,765	0.591	23,191	0.532	0.23
	3.00	29,838	0.685	30,975	0.711	0.31
	3.18	32,506	0.746	36,586	0.840	0.34
	3.50	37,249	0.855	47,747	1.096	16.14
	4.00	43,958	1.009	68,049	1.562	65.05
	4.50	49,678	1.140	91,458	2.100	132.43
	4.85	52,553	1.206	109,348	2.510	159.84
	5.00	53,785	1.235	117,324	2.693	162.09
	5.50	56,812	1.304	144,973	3.328	207.18
	6.00	59,334	1.362	174,009	3.995	375.90
	6.50	62,623	1.438	204,499	4.695	619.12
	7.00	64,854	1.489	236,368	5.426	922.97

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

Area [ft²]	Stage Area	Total Outflow [cfs]	Stage Release
10	0 10	0.00	0 0
376	0.5 376	0.04	0.5 0.04
2,192	1 2192	0.08	1 0.08
7,097	1.5 7097	0.12	1.5 0.12
14,797	2 14797	0.17	2 0.17
22,565	2.5 22565	0.21	2.5 0.21
25,765	2.72 25765.12	0.23	2.72 0.23
29,838	3 29838	0.31	3 0.31
32,506	3.18 32505.96	0.34	3.18 0.34
37,249	3.5 37249	16.14	3.5 16.14
43,958	4 43958	65.05	4 65.05
49,678	4.5 49678	132.43	4.5 132.43
52,553	4.85 52552.9	159.84	4.85 159.84
53,785	5 53785	162.09	5 162.09
56,812	5.5 56812	207.18	5.5 207.18
59,334	6 59334	375.90	6 375.9
62,623	6.5 62623	619.12	6.5 619.12
64,854	7 64854	922.97	7 922.97

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer:	**RICHARD LYON, PE**
Company:	**HR GREEN**
Date:	**December 4, 2024**
Project:	**FLYING HORSE NORTH - FILING NO. 4**
Location:	**POND A**

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 7.1 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.071
C) Contributing Watershed Area	Area = 128.480 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: ○ Water Quality Capture Volume (WQCV) ◉ Excess Urban Runoff Volume (EURV)
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$)	V_{DESIGN}= ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$	$V_{DESIGN\ OTHER}$= ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= 0.532 ac-ft
I) NRCS Hydrologic Soil Groups of Tributary Watershed	
i) Percentage of Watershed consisting of Type A Soils	HSG_A = 0 %
ii) Percentage of Watershed consisting of Type B Soils	HSG_B = 100 %
iii) Percentage of Watershed consisting of Type C/D Soils	$HSG_{C/D}$ = 0 %
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	$EURV_{DESIGN}$ = ac-f t
K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired)	$EURV_{DESIGN\ USER}$= 0.834 ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 1
3. Basin Side Slopes	
A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 4.00 ft / ft
4. Inlet	
A) Describe means of providing energy dissipation at concentrated inflow locations:	
5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)	V_{FMIN} = 0.016 ac-ft
B) Actual Forebay Volume	V_F = 0.018 ac-ft
C) Forebay Depth (D_F = 18 inch maximum)	D_F = 18.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 326.90 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 6.54 cfs
E) Forebay Discharge Design	Choose One: ○ Berm With Pipe ◉ Wall with Rect. Notch ○ Wall with V-Notch Weir — Flow too small for berm w/ pipe
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P = in
G) Rectangular Notch Width	Calculated W_N = 16.4 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**RICHARD LYON, PE**
Company:	**HR GREEN**
Date:	**December 4, 2024**
Project:	**FLYING HORSE NORTH - FILING NO. 4**
Location:	**POND A**

6. Trickle Channel

A) Type of Trickle Channel — Choose One: (●) Concrete ( ) Soft Bottom

F) Slope of Trickle Channel — S = 0.0050 ft / ft

7. Micropool and Outlet Structure

A) Depth of Micropool (2.5-feet minimum) — D_M = 2.5 ft

B) Surface Area of Micropool (10 ft^2 minimum) — A_M = 10 sq ft

C) Outlet Type — Choose One: (●) Orifice Plate ( ) Other (Describe):

D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention) — $D_{orifice}$ = [X] inches

E) Total Outlet Area — A_{ot} = [X] square inches

8. Initial Surcharge Volume

A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches) — D_{IS} = [X] in

B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV) — V_{IS} = ~~70~~ cu ft

C) Initial Surcharge Provided Above Micropool — V_s = [X] cu ft

Reference MHFD detention basin outlet structure design for any information that is not available on this sheet.

9. Trash Rack

A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$ — A_t = [X] square inches

B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.)

Other (Y/N): N

C) Ratio of Total Open Area to Total Area (only for type 'Other') — User Ratio = [X]

D) Total Water Quality Screen Area (based on screen type) — A_{total} = [X] sq. in.

E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E) — H= [X] feet

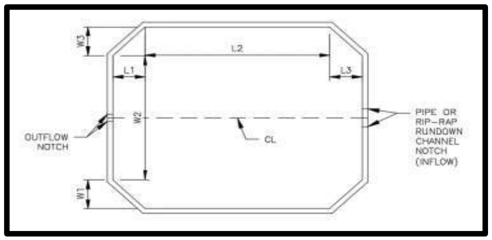
F) Height of Water Quality Screen (H_{TR}) — H_{TR}= [X] inches

G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended) — $W_{opening}$ = [X] inches

HR GREEN FOREBAY SIZING

PROJECT: FLYING HORSE NORTH FILING 4
DATE: 8/19/2024
DESIGNED BY: RDL
CHECKED BY: RDL
POND OR DP: POND A (DP A5)

	INNER DIMENSIONS			OUTER DIMENSIONS	
LENGTH					
L1	5	FT		5.83	FT
L2	23.750	FT		24.583	FT
L3	5	FT		5.83	FT
INNER L	33.750	FT	OUTER TOTAL L	35.416	FT
WIDTH					
W1	5	FT		5.83	FT
W2	17.8125	FT (75% of L2)		18.65	FT
W3	5	FT		5.83	FT
INNER W	27.813	FT	OUTER TOTAL W	29.479	FT
BAFFLE	(6'x0.83' + 4'x0.83')				
AREA	8.33	SF			



TRIANGLES	50	
RECTANGLE	423.0	
BAFFLE	8.33	
TOTAL SURFACE AREA	**464.7**	**SQ FT**
FOREBAY HT.	**1.5**	**FT**

FOREBAY VOLUME	**697**	**CF**
	25.8	**CY**
	0.016	**AC-FT**

SUFFICIENT VOLUME?	**YES**

REQ'D VOL (3% WQCV)	0.016	AC-FT
(per UD-BMP calc)	696	CF
Notch Width per UD-BMI	16.4	in

T-5 Extended Detention Basin (EDB)

Table EDB-4. EDB component criteria

	On-Site EDBs for Watersheds up to 1 Impervious Acre[1]	EDBs with Watersheds between 1 and 2 Impervious Acres[1]	EDBs with Watersheds up to 5 Impervious Acres	EDBs with Watersheds over 5 Impervious Acres	EDBs with Watersheds over 20 Impervious Acres
Forebay Release and Configuration	EDBs should not be used for watersheds with less than 1 impervious acre.	Release 2% of the undetained 100-year peak discharge by way of a wall/notch configuration	Release 2% of the undetained 100-year peak discharge by way of a wall/notch configuration	Release 2% of the undetained 100-year peak discharge by way of a wall/notch configuration	Release 2% of the undetained 100-year peak discharge by way of a wall/notch or berm/pipe[2] configuration
Minimum Forebay Volume		1% of the WQCV	2% of the WQCV	3% of the WQCV	3% of the WQCV
Maximum Forebay Depth		12 inches	18 inches	18 inches	30 inches
Trickle Channel Capacity		≥ the maximum possible forebay outlet capacity	≥ the maximum possible forebay outlet capacity	≥ the maximum possible forebay outlet capacity	≥ the maximum possible forebay outlet capacity
Micropool		Area ≥ 10 ft²	Area ≥ 10 ft²	Area ≥ 10 ft²	Area ≥ 10 ft²
Initial Surcharge Volume		Depth ≥ 4 inches	Depth ≥ 4 inches	Depth ≥ 4 in. Volume ≥ 0.3% WQCV	Depth ≥ 4 in. Volume ≥ 0.3% WQCV

[1] EDBs are not recommended for sites with less than 2 impervious acres. Consider a sand filter or rain garden.

[2] Round up to the first standard pipe size (minimum 8 inches).

Worksheet for Pond A Spillway

Project Description

Solve For	Headwater Elevation

Input Data

Discharge	183.80 cfs
Crest Elevation	7,537.25 ft
Tailwater Elevation	7,537.25 ft
Crest Surface Type	Gravel
Crest Breadth	50.00 ft
Crest Length	100.0 ft

Results

Headwater Elevation	7,538.01 ft
Headwater Height Above Crest	0.76 ft
Tailwater Height Above Crest	0.00 ft
Weir Coefficient	2.77 ft^(1/2)/s
Submergence Factor	1.000
Adjusted Weir Coefficient	2.77 ft^(1/2)/s
Flow Area	76.1 ft²
Velocity	2.42 ft/s
Wetted Perimeter	101.5 ft
Top Width	100.00 ft

Worksheet for Pond A & B Trickle Channel Capacity

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.005 ft/ft
Normal Depth	6.0 in

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.58
0+00	0.08
0+02	0.00
0+04	0.08
0+04	0.58

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.58)	(0+04, 0.58)	0.013

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Discharge	7.76 cfs
Roughness Coefficient	0.013
Elevation Range	0.0 to 0.6 ft
Flow Area	1.8 ft²
Wetted Perimeter	4.8 ft
Hydraulic Radius	4.6 in
Top Width	4.00 ft
Normal Depth	6.0 in
Critical Depth	6.4 in
Critical Slope	0.004 ft/ft
Velocity	4.24 ft/s
Velocity Head	0.28 ft
Specific Energy	0.78 ft
Froude Number	1.103
Flow Type	Supercritical

POND A MAX FOREBAY RELEASE RATE IS 6.54 CFS AND POND B MAX FOREBAY RELEASE RATE IS 3.75 CFS

GVF Input Data

Worksheet for Pond A & B Trickle Channel Capacity

GVF Input Data

Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	6.0 in
Critical Depth	6.4 in
Channel Slope	0.005 ft/ft
Critical Slope	0.004 ft/ft

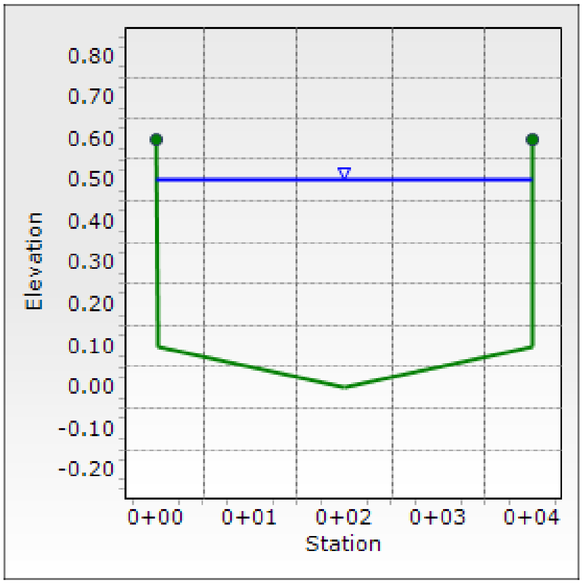
Cross Section for Pond A & B Trickle Channel Capacity

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.005 ft/ft
Normal Depth	6.0 in
Discharge	7.76 cfs



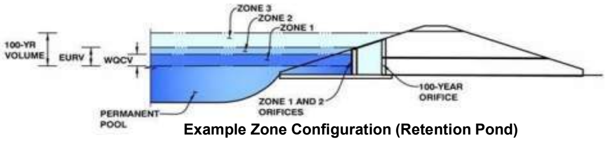
POND B

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **FLYING HORSE NORTH FILING NO. 4**

Basin ID: **POND B**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	105.65	acres
Watershed Length =	3,000	ft
Watershed Length to Centroid =	1,000	ft
Watershed Slope =	0.035	ft/ft
Watershed Imperviousness =	8.25%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.50	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.81	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.27	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	2.93	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	4.61	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	7.66	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	9.71	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	12.69	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	18.09	acre-feet		inches
Approximate 2-yr Detention Volume =	0.50	acre-feet		
Approximate 5-yr Detention Volume =	0.80	acre-feet		
Approximate 10-yr Detention Volume =	1.83	acre-feet		
Approximate 25-yr Detention Volume =	2.63	acre-feet		
Approximate 50-yr Detention Volume =	2.73	acre-feet		
Approximate 100-yr Detention Volume =	3.57	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.50	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.31	acre-feet
Zone 3 Volume (User Defined - Zones 1 & 2) =	1.51	acre-feet
Total Detention Basin Volume =	2.32	acre-feet

Total detention volume is less than 100-year volume.

Depth Increment = 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)
7526	**Top of Micropool**	--	0.00	--	--	--	10	0.000		
	7526.5	--	0.50	--	--	--	2,138	0.049	537	0.012
	7527.0	--	1.00	--	--	--	7,169	0.165	2,864	0.066
	7527.5	--	1.50	--	--	--	13,715	0.315	8,085	0.186
	7528.0	--	2.00	--	--	--	18,729	0.430	16,196	0.372
	7528.5	--	2.50	--	--	--	23,635	0.543	26,787	0.615
	7529.0	--	3.00	--	--	--	27,602	0.634	39,596	0.909
	7529.5	--	3.50	--	--	--	30,042	0.690	54,007	1.240
	7530.0	--	4.00	--	--	--	32,274	0.741	69,586	1.597
	7530.5	--	4.50	--	--	--	34,626	0.795	86,311	1.981
	7531.0	--	5.00	--	--	--	37,052	0.851	104,230	2.393
	7531.5	--	5.50	--	--	--	39,551	0.908	123,381	2.832
	7532.0	--	6.00	--	--	--	42,125	0.967	143,800	3.301
	7532.5	--	6.50	--	--	--	44,776	1.028	165,525	3.800
	7533.0	--	7.00	--	--	--	47,667	1.094	188,636	4.330
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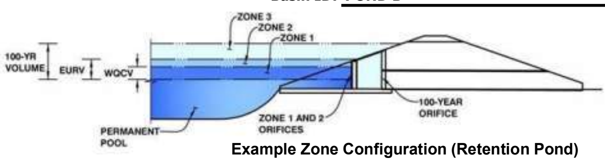
DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: FLYING HORSE NORTH FILING NO. 4

Basin ID: POND B



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.28	0.500	Orifice Plate
Zone 2 (EURV)	2.84	0.307	Circular Orifice
Zone 3 (User)	4.92	1.513	Weir&Pipe (Restrict)
Total (all zones)		2.320	

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)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	2.28	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	9.20	inches
Orifice Plate: Orifice Area per Row =	2.19	sq. inches (diameter = 1-5/8 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row =	1.521E-02	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	0.80	1.60					
Orifice Area (sq. inches)	2.19	2.19	2.19					

	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)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	2.28	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	2.84	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	1.00	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.01	N/A	ft^2
Vertical Orifice Centroid =	0.04	N/A	feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.85	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	30.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	5.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	2.85	N/A	feet
Overflow Weir Slope Length =	5.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	5.89	N/A	
Overflow Grate Open Area w/o Debris =	104.40	N/A	ft^2
Overflow Grate Open Area w/ Debris =	52.20	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 =	3.70	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	60.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	50.75		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	17.71	N/A	ft^2
Outlet Orifice Centroid =	2.28	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.33	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.10	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	100.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.86	feet
Stage at Top of Freeboard =	6.96	feet
Basin Area at Top of Freeboard =	1.09	acres
Basin Volume at Top of Freeboard =	4.29	acre-ft

Routed Hydrograph Results

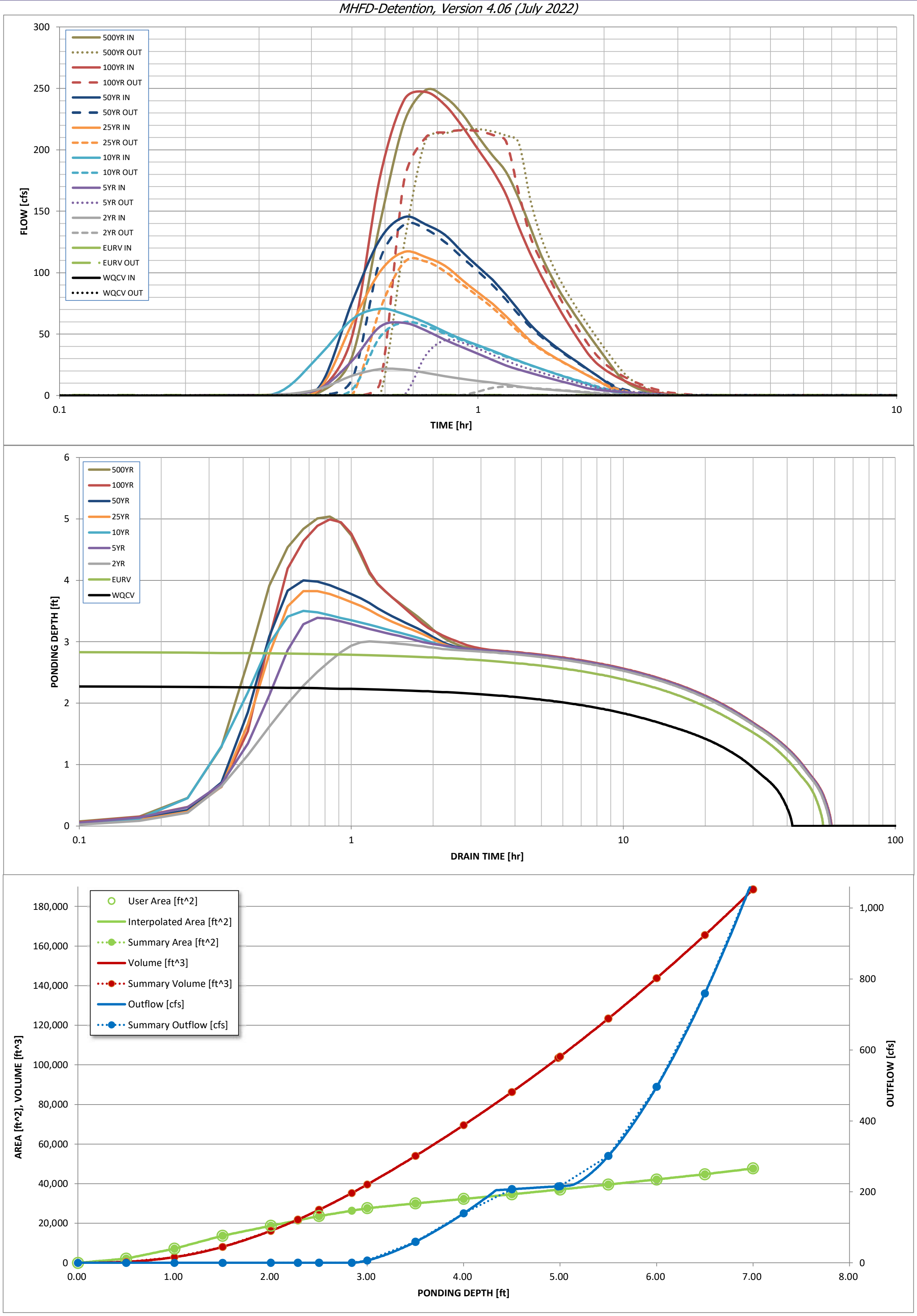
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

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) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.500	0.807	1.270	2.932	4.609	7.657	9.710	12.690	18.086
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.270	3.472	4.609	7.657	9.710	17.082	18.086
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	14.9	41.7	63.1	109.6	138.0	172.8	240.7
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A						216.0	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.14	0.39	0.60	1.04	1.31	2.04	2.28
Peak Inflow Q (cfs) =	N/A	N/A	21.5	59.1	70.7	116.9	145.3	247.1	248.6
Peak Outflow Q (cfs) =	0.3	0.3	7.2	45.1	59.7	109.1	139.2	216.0	216.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.1	0.9	1.0	1.0	1.0	0.9
Structure Controlling Flow =	Plate	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	0.06	0.4	0.6	1.0	1.3	2.1	2.1
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) =	37	48	48	41	38	31	27	16	14
Time to Drain 99% of Inflow Volume (hours) =	**40**	52	54	50	48	44	42	36	35
Maximum Ponding Depth (ft) =	2.28	2.84	3.00	3.39	3.50	3.83	4.00	4.99	5.04
Area at Maximum Ponding Depth (acres) =	0.49	0.60	0.63	0.68	0.69	0.72	0.74	0.85	0.85
Maximum Volume Stored (acre-ft) =	0.50	0.81	0.91	1.16	1.24	1.47	1.59	2.38	2.42
Elevation (ft) =	7528.28	7528.84						7530.99	
Pond Bottom (ft) =	7526.00								

SWMM volume: 103,808

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)



DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

Time Interval: 5.00 min

SOURCE	CUHP	CUHP	CUHP	USER	CUHP	CUHP	CUHP	USER	CUHP
TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:10:00	0.00	0.00	0.00	0.02	0.00	0.00	0.01	0.03	0.05
0:15:00	0.00	0.00	0.13	0.29	0.25	0.17	0.22	0.32	0.32
0:20:00	0.00	0.00	0.50	0.84	2.56	0.51	0.61	0.81	2.42
0:25:00	0.00	0.00	5.28	5.28	32.00	5.01	6.58	4.04	31.16
0:30:00	0.00	0.00	16.15	28.18	61.85	58.31	75.74	47.72	140.12
0:35:00	0.00	0.00	21.48	55.99	70.65	100.78	127.30	177.86	222.60
0:40:00	0.00	0.00	21.19	59.11	66.12	116.93	145.33	240.83	248.61
0:45:00	0.00	0.00	18.41	52.91	59.32	112.63	139.24	247.06	242.92
0:50:00	0.00	0.00	15.77	45.39	51.88	105.76	130.83	236.61	229.34
0:55:00	0.00	0.00	13.51	39.31	45.74	94.10	116.93	219.08	210.73
1:00:00	0.00	0.00	11.89	33.91	40.89	83.71	104.89	200.33	195.31
1:05:00	0.00	0.00	10.45	28.93	36.47	74.57	94.22	183.22	182.16
1:10:00	0.00	0.00	8.87	24.45	32.13	64.62	82.26	163.76	160.97
1:15:00	0.00	0.00	7.27	21.11	28.23	54.18	69.62	137.51	137.05
1:20:00	0.00	0.00	6.00	18.47	24.80	44.69	57.74	115.66	114.12
1:25:00	0.00	0.00	5.21	15.99	21.68	37.99	49.23	97.45	96.67
1:30:00	0.00	0.00	4.56	13.64	18.77	32.53	42.20	81.53	82.47
1:35:00	0.00	0.00	3.98	11.47	16.17	27.90	36.24	67.41	70.56
1:40:00	0.00	0.00	3.40	9.51	13.77	23.69	30.82	54.87	59.85
1:45:00	0.00	0.00	2.83	7.57	11.49	19.86	25.89	43.86	50.04
1:50:00	0.00	0.00	2.28	5.83	9.29	16.17	21.17	33.94	40.82
1:55:00	0.00	0.00	1.71	4.79	7.07	12.63	16.64	26.61	32.21
2:00:00	0.00	0.00	1.15	4.12	4.87	9.19	12.28	21.52	24.12
2:05:00	0.00	0.00	0.67	3.56	3.31	5.81	7.96	17.61	16.50
2:10:00	0.00	0.00	0.42	3.01	2.45	3.59	5.15	14.31	11.29
2:15:00	0.00	0.00	0.30	2.51	1.89	2.28	3.44	11.60	7.89
2:20:00	0.00	0.00	0.23	2.04	1.47	1.48	2.35	9.28	5.46
2:25:00	0.00	0.00	0.18	1.60	1.14	0.95	1.58	7.30	3.68
2:30:00	0.00	0.00	0.13	1.18	0.86	0.62	1.08	5.61	2.39
2:35:00	0.00	0.00	0.10	0.81	0.63	0.40	0.71	4.07	1.45
2:40:00	0.00	0.00	0.07	0.55	0.45	0.25	0.46	2.75	0.84
2:45:00	0.00	0.00	0.06	0.40	0.31	0.17	0.31	1.87	0.55
2:50:00	0.00	0.00	0.05	0.31	0.21	0.12	0.22	1.28	0.38
2:55:00	0.00	0.00	0.04	0.24	0.15	0.09	0.17	0.88	0.30
3:00:00	0.00	0.00	0.03	0.19	0.11	0.06	0.13	0.58	0.24
3:05:00	0.00	0.00	0.02	0.15	0.08	0.05	0.09	0.37	0.18
3:10:00	0.00	0.00	0.01	0.12	0.06	0.03	0.07	0.23	0.13
3:15:00	0.00	0.00	0.01	0.09	0.03	0.02	0.05	0.15	0.09
3:20:00	0.00	0.00	0.01	0.07	0.02	0.01	0.03	0.11	0.05
3:25:00	0.00	0.00	0.00	0.05	0.01	0.01	0.02	0.08	0.03
3:30:00	0.00	0.00	0.00	0.04	0.00	0.00	0.01	0.07	0.01
3:35:00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.05	0.00
3:40:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.04	0.00
3:45:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.03	0.00
3:50:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.00
3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft²]	Area [acres]	Volume [ft³]	Volume [ac-ft]	Total Outflow [cfs]
	0.00	10	0.000	0	0.000	0.00
	0.50	2,138	0.049	537	0.012	0.05
	1.00	7,169	0.165	2,864	0.066	0.11
	1.50	13,715	0.315	8,085	0.186	0.15
	2.00	18,729	0.430	16,196	0.372	0.23
	2.28	21,476	0.493	21,824	0.501	0.26
	2.50	23,635	0.543	26,787	0.615	0.29
	2.84	26,333	0.605	35,281	0.810	0.33
	3.00	27,602	0.634	39,596	0.909	6.89
	3.50	30,042	0.690	54,007	1.240	59.48
	4.00	32,274	0.741	69,586	1.597	139.49
	4.50	34,626	0.795	86,311	1.981	207.54
	4.98	36,955	0.848	103,490	2.376	215.79
	5.00	37,052	0.851	104,230	2.393	216.13
	5.50	39,551	0.908	123,381	2.832	301.25
	6.00	42,125	0.967	143,800	3.301	495.87
	6.50	44,776	1.028	165,525	3.800	759.26
	7.00	47,667	1.094	188,636	4.330	1,080.97

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

Area [ft²]	Stage Area	Total Outflow [cfs]	Stage Release
10	0 10	0.00	0 0
2,138	0.5 2138.28	0.05	0.5 0.05
7,169	1 7169.09	0.11	1 0.11
13,715	1.5 13715.31	0.15	1.5 0.15
18,729	2 18728.56	0.23	2 0.23
21,476	2.28 21475.96	0.26	2.28 0.26
23,635	2.5 23634.63	0.29	2.5 0.29
26,333	2.84 26332.66	0.33	2.84 0.33
27,602	3 27602.32	6.89	3 6.89
30,042	3.5 30042.07	59.48	3.5 59.48
32,274	4 32273.85	139.49	4 139.49
34,626	4.5 34626.01	207.54	4.5 207.54
36,955	4.98 36954.82	215.79	4.98 215.79
37,052	5 37051.85	216.13	5 216.13
39,551	5.5 39551.39	301.25	5.5 301.25
42,125	6 42124.62	495.87	6 495.87
44,776	6.5 44775.53	759.26	6.5 759.26
47,667	7 47666.69	1,080.97	7 1080.97

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer:	RICHARD LYON, PE
Company:	HR GREEN
Date:	December 4, 2024
Project:	FLYING HORSE NORTH - FILING NO. 4
Location:	POND B

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 7.5 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.075
C) Contributing Watershed Area	Area = 109.200 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: ◯ Water Quality Capture Volume (WQCV); ◉ Excess Urban Runoff Volume (EURV)
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$)	V_{DESIGN}= ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$	$V_{DESIGN\ OTHER}$= ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= 0.475 ac-ft
I) NRCS Hydrologic Soil Groups of Tributary Watershed	
i) Percentage of Watershed consisting of Type A Soils	HSG_A = 0 %
ii) Percentage of Watershed consisting of Type B Soils	HSG_B = 100 %
iii) Percentage of Watershed consisting of Type C/D Soils	$HSG_{C/D}$ = 0 %
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	$EURV_{DESIGN}$ = ac-f t
K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired)	$EURV_{DESIGN\ USER}$= 0.752 ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 1
3. Basin Side Slopes	
A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 4.00 ft / ft
4. Inlet	
A) Describe means of providing energy dissipation at concentrated inflow locations:	
5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)	V_{FMIN} = 0.014 ac-ft
B) Actual Forebay Volume	V_F = 0.014 ac-ft
C) Forebay Depth (D_F = 18 inch maximum)	D_F = 18.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 187.60 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 3.75 cfs
E) Forebay Discharge Design	Choose One: ◯ Berm With Pipe; ◉ Wall with Rect. Notch; ◯ Wall with V-Notch Weir — Flow too small for berm w/ pipe
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P = in
G) Rectangular Notch Width	Calculated W_N = 11.0 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer: RICHARD LYON, PE
Company: HR GREEN
Date: December 4, 2024
Project: FLYING HORSE NORTH - FILING NO. 4
Location: POND B

6. Trickle Channel	
A) Type of Trickle Channel	Choose One (●) Concrete ( ) Soft Bottom
F) Slope of Trickle Channel	S = 0.0050 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = 10 sq ft
C) Outlet Type	Choose One (●) Orifice Plate ( ) Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = [X] inches
E) Total Outlet Area	A_{ot} = [X] square inches
8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = [X] in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = 62 [X] cu ft
C) Initial Surcharge Provided Above Micropool	V_s = [X] cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = [X] square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) Other (Y/N): N	
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio = [X]
D) Total Water Quality Screen Area (based on screen type)	A_{total} = [X] sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= [X] feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= [X] inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = [X] inches

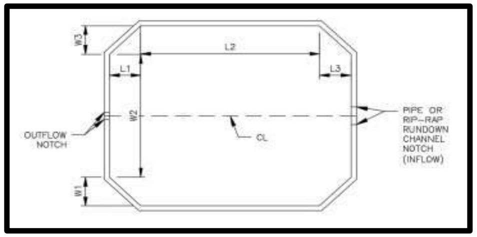
Reference MHFD detention basin outlet structure design for any information that is not available on this sheet.

HR GREEN FOREBAY SIZING

PROJECT: FLYING HORSE NORTH FILING 4
DATE: 8/19/2024
DESIGNED BY: RDL
CHECKED BY: RDL
POND OR DP: POND B

	INNER DIMENSIONS			OUTER DIMENSIONS	
LENGTH					
L1	5	FT		5.83	FT
L2	22.333	FT		23.166	FT
L3	5	FT		5.83	FT
INNER L	32.333	FT	OUTER TOTAL L	33.999	FT
WIDTH					
W1	5	FT		5.83	FT
W2	16.74975	FT (75% of L2)		17.58	FT
W3	5	FT		5.83	FT
INNER W	26.750	FT	OUTER TOTAL W	28.416	FT

BAFFLE (6'x0.83' + 4'x0.83')
AREA 8.33 SF



TRIANGLES	50	
RECTANGLE	374.0721668	
BAFFLE	8.33	
TOTAL SURFACE AREA	**415.7421668**	**SQ FT**
FOREBAY HT.	**1.5**	**FT**
FOREBAY VOLUME	**623.6132501**	**CF**
	23.09678704	**CY**
	0.01431619	**AC-FT**
REQ'D VOL (3% WQCV)	0.01425	AC-FT
(per UD-BMP calc)	620.73	CF
Notch Width per UD-BMP	11.0	in

SUFFICIENT VOLUME?	**YES**

T-5 Extended Detention Basin (EDB)

Table EDB-4. EDB component criteria

	On-Site EDBs for Watersheds up to 1 Impervious Acre[1]	EDBs with Watersheds between 1 and 2 Impervious Acres[1]	EDBs with Watersheds up to 5 Impervious Acres	EDBs with Watersheds over 5 Impervious Acres	EDBs with Watersheds over 20 Impervious Acres
Forebay Release and Configuration	EDBs should not be used for watersheds with less than 1 impervious acre.	Release 2% of the undetained 100-year peak discharge by way of a wall/notch configuration	Release 2% of the undetained 100-year peak discharge by way of a wall/notch configuration	Release 2% of the undetained 100-year peak discharge by way of a wall/notch configuration	Release 2% of the undetained 100-year peak discharge by way of a wall/notch or berm/pipe[2] configuration
Minimum Forebay Volume		1% of the WQCV	2% of the WQCV	3% of the WQCV	3% of the WQCV
Maximum Forebay Depth		12 inches	18 inches	18 inches	30 inches
Trickle Channel Capacity		≥ the maximum possible forebay outlet capacity	≥ the maximum possible forebay outlet capacity	≥ the maximum possible forebay outlet capacity	≥ the maximum possible forebay outlet capacity
Micropool		Area ≥ 10 ft²	Area ≥ 10 ft²	Area ≥ 10 ft²	Area ≥ 10 ft²
Initial Surcharge Volume		Depth ≥ 4 inches	Depth ≥ 4 inches	Depth ≥ 4 in. Volume ≥ 0.3% WQCV	Depth ≥ 4 in. Volume ≥ 0.3% WQCV

[1] EDBs are not recommended for sites with less than 2 impervious acres. Consider a sand filter or rain garden.

[2] Round up to the first standard pipe size (minimum 8 inches).

Worksheet for Pond B Spillway

Project Description	
Solve For	Headwater Elevation

Input Data	
Discharge	247.10 cfs
Crest Elevation	7,531.10 ft
Tailwater Elevation	7,522.00 ft
Crest Surface Type	Gravel
Crest Breadth	75.00 ft
Crest Length	100.0 ft

Results	
Headwater Elevation	7,532.02 ft
Headwater Height Above Crest	0.92 ft
Tailwater Height Above Crest	-9.10 ft
Weir Coefficient	2.81 ft^(1/2)/s
Submergence Factor	1.000
Adjusted Weir Coefficient	2.81 ft^(1/2)/s
Flow Area	91.8 ft²
Velocity	2.69 ft/s
Wetted Perimeter	101.8 ft
Top Width	100.00 ft

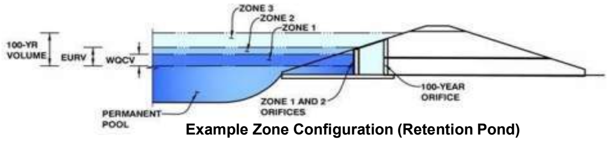
POND C

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: FLYING HORSE NORTH FILING NO. 4

Basin ID: POND C



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**		**Note: L / W Ratio < 1**	
Watershed Area =	39.31	acres	**L / W Ratio = 0.99**	
Watershed Length =	1,300	ft		
Watershed Length to Centroid =	700	ft		
Watershed Slope =	0.055	ft/ft		
Watershed Imperviousness =	10.40%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	100.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Target WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.227	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.385	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.534	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.166	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.796	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	2.914	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	3.678	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	4.777	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	6.781	acre-feet		inches
Approximate 2-yr Detention Volume =	0.247	acre-feet		
Approximate 5-yr Detention Volume =	0.386	acre-feet		
Approximate 10-yr Detention Volume =	0.788	acre-feet		
Approximate 25-yr Detention Volume =	1.094	acre-feet		
Approximate 50-yr Detention Volume =	1.146	acre-feet		
Approximate 100-yr Detention Volume =	1.477	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.227	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.159	acre-feet
Zone 3 Volume (User Defined - Zones 1 & 2) =	0.615	acre-feet
Total Detention Basin Volume =	1.000	acre-feet

Total detention volume is less than 100-year volume.

Depth Increment = ft

7530

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)
Top of Micropool	--	0.00	--	--	--	10	0.000		
7530.5	--	0.50	--	--	--	249	0.006	65	0.001
7531.0	--	1.00	--	--	--	1,554	0.036	516	0.012
7531.5	--	1.50	--	--	--	5,593	0.128	2,302	0.053
7532.0	--	2.00	--	--	--	11,944	0.274	6,687	0.154
7532.5	--	2.50	--	--	--	19,387	0.445	14,520	0.333
7533.0	--	3.00	--	--	--	26,211	0.602	25,919	0.595
7533.5	--	3.50	--	--	--	31,825	0.731	40,428	0.928
7534.0	--	4.00	--	--	--	35,777	0.821	57,329	1.316
7534.5	--	4.50	--	--	--	38,050	0.874	75,785	1.740
7535.0	--	5.00	--	--	--	40,396	0.927	95,397	2.190
7535.5	--	5.50	--	--	--	42,815	0.983	116,199	2.668
7536.0	--	6.00	--	--	--	45,306	1.040	138,230	3.173
7536.5	--	6.50	--	--	--	47,871	1.099	161,524	3.708
7537.0	--	7.00	--	--	--	50,508	1.160	186,119	4.273
7537.5	--	7.50	--	--	--	53,221	1.222	212,051	4.868
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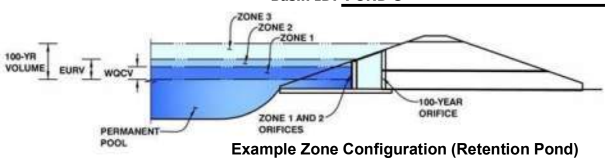
DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: FLYING HORSE NORTH FILING NO. 4

Basin ID: POND C



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.24	0.227	Orifice Plate
Zone 2 (EURV)	2.62	0.159	Orifice Plate
Zone 3 (User)	3.60	0.615	Weir&Pipe (Restrict)
Total (all zones)		1.000	

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)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	2.62	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	10.20	inches
Orifice Plate: Orifice Area per Row =	0.88	sq. inches (diameter = 1-1/16 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row =	6.111E-03	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	0.87	1.75					
Orifice Area (sq. inches)	0.88	0.88	0.88					

	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 with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.63	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	8.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	5.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	2.63	N/A	feet
Overflow Weir Slope Length =	5.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	3.97	N/A	
Overflow Grate Open Area w/o Debris =	27.84	N/A	ft^2
Overflow Grate Open Area w/ Debris =	13.92	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 =	1.70	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	36.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	35.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	7.01	N/A	ft^2
Outlet Orifice Centroid =	1.49	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.81	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	53.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.56	feet
Stage at Top of Freeboard =	7.56	feet
Basin Area at Top of Freeboard =	1.22	acres
Basin Volume at Top of Freeboard =	4.87	acre-ft

Routed Hydrograph Results

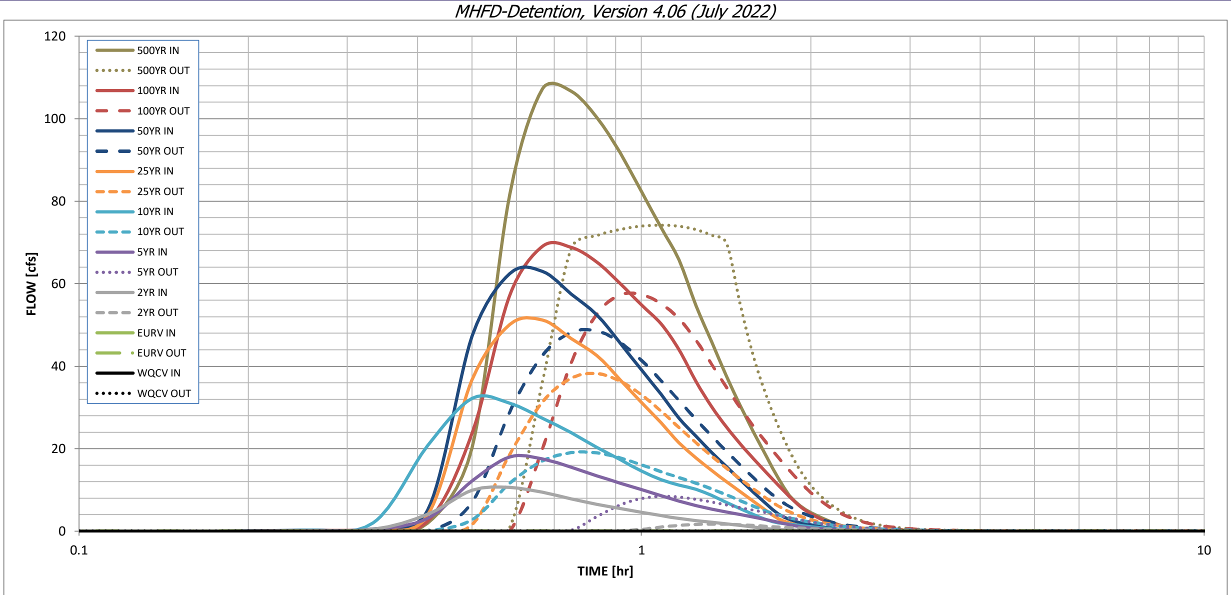
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

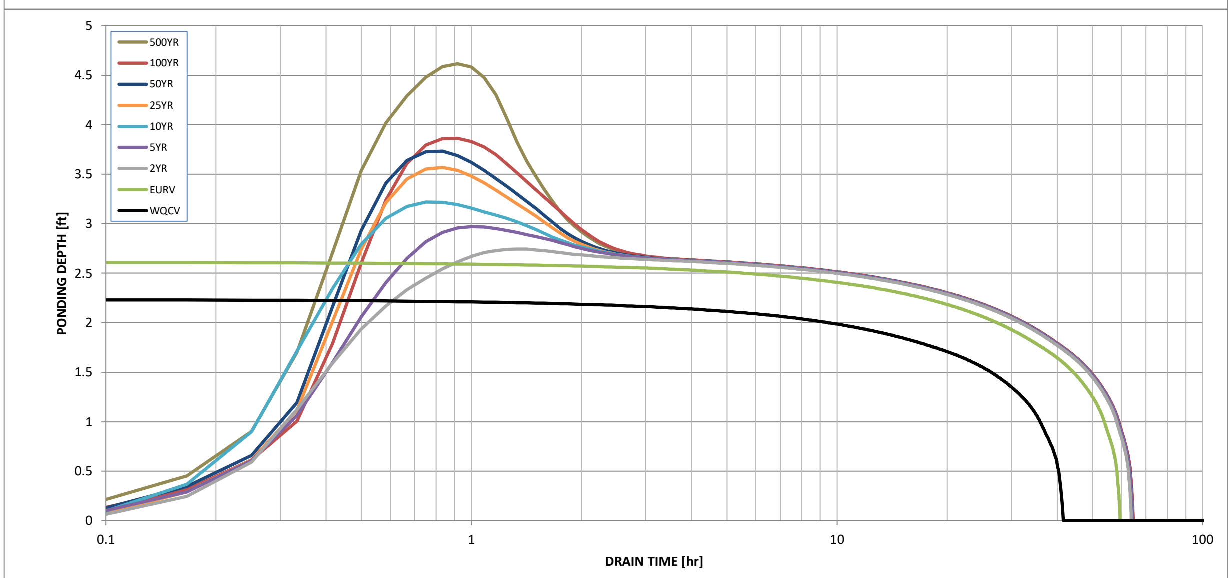
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.227	0.385	0.534	1.166	1.796	2.914	3.678	4.777	6.781
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.534	1.053	1.796	2.914	3.678	4.683	6.781
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	6.8	18.3	27.1	47.3	59.0	74.0	102.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A						64.0	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.17	0.47	0.69	1.20	1.50	1.63	2.61
Peak Inflow Q (cfs) =	N/A	N/A	10.6	18.0	32.2	51.2	63.0	69.0	107.2
Peak Outflow Q (cfs) =	0.1	0.1	1.7	8.4	19.1	38.2	48.6	57.4	74.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	0.7	0.8	0.8	0.9	0.7
Structure Controlling Flow =	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	0.05	0.3	0.7	1.4	1.7	2.1	2.7
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) =	38	54	57	54	49	43	39	34	26
Time to Drain 99% of Inflow Volume (hours) =	**40**	57	61	59	57	54	53	51	47
Maximum Ponding Depth (ft) =	2.24	2.62	2.74	2.97	3.22	3.57	3.73	3.86	4.62
Area at Maximum Ponding Depth (acres) =	0.36	0.48	0.52	0.59	0.66	0.74	0.77	0.80	0.89
Maximum Volume Stored (acre-ft) =	0.23	0.39	0.45	0.58	0.73	0.97	1.10	1.20	1.84
Elevation (ft) =	7532.24	7532.62						7533.86	
Pond Bottom (ft) =	7530.00								

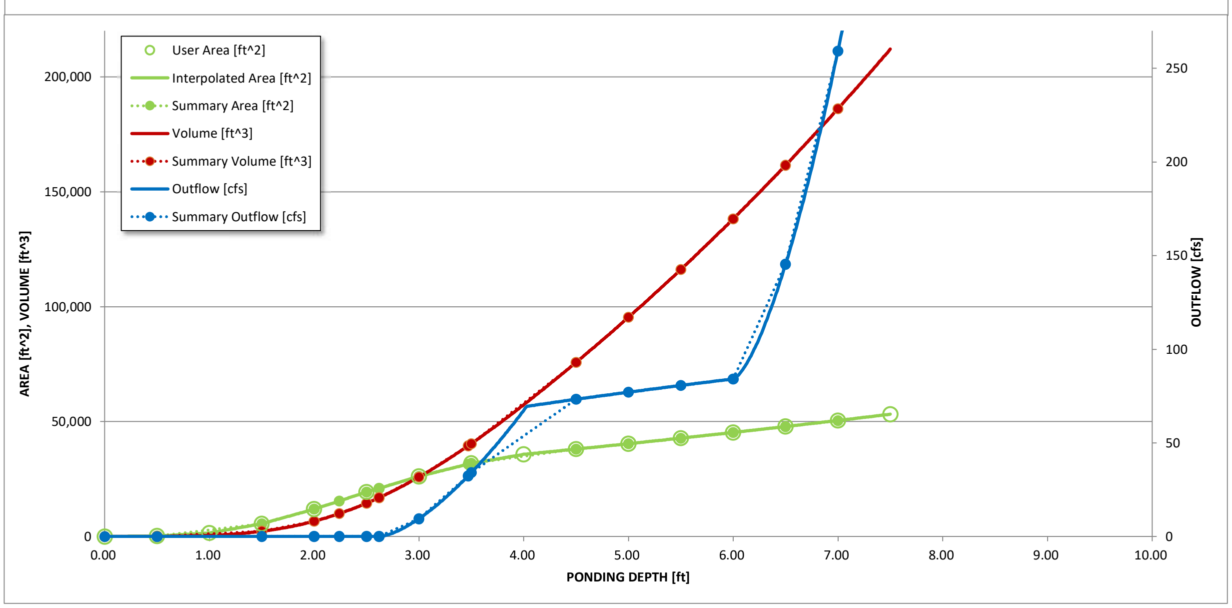
SWMM volume	43,891	1.01
SWMM release		61.9

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	USER	CUHP	CUHP	CUHP	USER	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.02	0.05
	0:15:00	0.00	0.00	0.13	0.16	0.26	0.17	0.21	0.17	0.30
	0:20:00	0.00	0.00	0.46	0.44	2.03	0.45	0.52	0.42	1.91
	0:25:00	0.00	0.00	4.10	3.10	20.74	3.87	5.06	2.40	20.17
	0:30:00	0.00	0.00	9.96	12.19	32.18	36.67	47.27	23.71	81.63
	0:35:00	0.00	0.00	10.60	18.04	31.02	50.08	62.48	57.21	107.23
	0:40:00	0.00	0.00	9.44	17.52	27.38	51.18	63.00	69.03	106.70
	0:45:00	0.00	0.00	7.85	15.52	23.86	46.69	57.48	68.80	100.27
	0:50:00	0.00	0.00	6.54	13.42	20.36	42.59	52.46	65.25	91.74
	0:55:00	0.00	0.00	5.52	11.68	17.36	36.72	45.58	60.06	82.30
	1:00:00	0.00	0.00	4.58	10.12	14.59	31.23	39.08	54.88	73.61
	1:05:00	0.00	0.00	3.78	8.65	12.50	26.32	33.22	50.27	65.75
	1:10:00	0.00	0.00	3.09	7.28	11.19	21.43	27.38	44.01	54.71
	1:15:00	0.00	0.00	2.59	6.21	10.19	17.79	23.04	36.31	45.89
	1:20:00	0.00	0.00	2.16	5.39	8.66	14.73	19.11	30.18	37.59
	1:25:00	0.00	0.00	1.76	4.68	7.00	12.06	15.64	25.27	30.34
	1:30:00	0.00	0.00	1.38	4.04	5.46	9.55	12.42	21.11	24.01
	1:35:00	0.00	0.00	1.00	3.44	4.03	7.20	9.42	17.52	18.18
	1:40:00	0.00	0.00	0.65	2.82	2.77	4.98	6.59	14.24	12.87
	1:45:00	0.00	0.00	0.41	2.17	2.05	3.04	4.16	11.20	8.63
	1:50:00	0.00	0.00	0.32	1.56	1.68	1.99	2.85	8.38	6.12
	1:55:00	0.00	0.00	0.27	1.10	1.38	1.36	2.05	6.00	4.50
	2:00:00	0.00	0.00	0.23	0.81	1.11	0.97	1.55	4.20	3.35
	2:05:00	0.00	0.00	0.18	0.63	0.86	0.65	1.08	2.99	2.30
	2:10:00	0.00	0.00	0.13	0.49	0.64	0.44	0.75	2.10	1.50
	2:15:00	0.00	0.00	0.10	0.38	0.46	0.29	0.51	1.45	0.93
	2:20:00	0.00	0.00	0.07	0.29	0.33	0.19	0.34	0.96	0.58
	2:25:00	0.00	0.00	0.06	0.22	0.22	0.14	0.24	0.61	0.41
	2:30:00	0.00	0.00	0.04	0.16	0.15	0.10	0.17	0.37	0.29
	2:35:00	0.00	0.00	0.03	0.12	0.11	0.07	0.12	0.25	0.22
	2:40:00	0.00	0.00	0.02	0.09	0.08	0.05	0.09	0.18	0.16
	2:45:00	0.00	0.00	0.02	0.07	0.06	0.04	0.07	0.13	0.12
	2:50:00	0.00	0.00	0.01	0.05	0.04	0.03	0.05	0.10	0.09
	2:55:00	0.00	0.00	0.01	0.04	0.02	0.02	0.03	0.07	0.06
	3:00:00	0.00	0.00	0.00	0.02	0.01	0.01	0.02	0.05	0.03
	3:05:00	0.00	0.00	0.00	0.02	0.00	0.00	0.01	0.04	0.02
	3:10:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.01
	3:15:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.00
	3:20:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]
	0.00	10	0.000	0	0.000	0.00
	0.50	249	0.006	65	0.001	0.02
	1.50	5,593	0.128	2,302	0.053	0.06
	2.00	11,944	0.274	6,687	0.154	0.09
WQCV	2.24	15,517	0.356	9,982	0.229	0.10
	2.50	19,387	0.445	14,520	0.333	0.11
EURV	2.62	21,025	0.483	16,944	0.389	0.11
	3.00	26,211	0.602	25,919	0.595	9.55
100-YEAR	3.47	31,488	0.723	39,478	0.906	32.39
	3.50	31,825	0.731	40,428	0.928	34.13
	4.50	38,050	0.874	75,785	1.740	73.30
	5.00	40,396	0.927	95,397	2.190	77.09
	5.50	42,815	0.983	116,199	2.668	80.70
	6.00	45,306	1.040	138,230	3.173	84.16
	6.50	47,871	1.099	161,524	3.708	145.40
	7.00	50,508	1.160	186,119	4.273	259.29

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

Area [ft^2]	Stage Area	Total Outflow [cfs]	Stage Release
10	0 10	0	0 0
249	0.5 249.43	0	0.5 0.02
5,593	1.5 5592.99	0	1.5 0.06
11,944	2 11944.46	0	2 0.09
15,517	2.24 15517.1	0	2.24 0.1
19,387	2.5 19387.47	0	2.5 0.11
21,025	2.62 21025.09	0	2.62 0.11
26,211	3 26210.88	10	3 9.55
31,488	3.47 31487.98	32	3.47 32.39
31,825	3.5 31824.82	34	3.5 34.13
38,050	4.5 38050.1	73	4.5 73.3
40,396	5 40395.84	77	5 77.09
42,815	5.5 42814.52	81	5.5 80.7
45,306	6 45306.16	84	6 84.16
47,871	6.5 47870.75	145	6.5 145.4
50,508	7 50508.29	259	7 259.29

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer:	**RICHARD LYON, PE**
Company:	**HR GREEN**
Date:	**December 4, 2024**
Project:	**FLYING HORSE NORTH - FILING NO. 4**
Location:	**POND C**

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 10.4 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.104
C) Contributing Watershed Area	Area = 39.300 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: ○ Water Quality Capture Volume (WQCV) ◉ Excess Urban Runoff Volume (EURV)
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$)	V_{DESIGN}= ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$	$V_{DESIGN\ OTHER}$= ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= 0.227 ac-ft
I) NRCS Hydrologic Soil Groups of Tributary Watershed	
i) Percentage of Watershed consisting of Type A Soils	HSG_A = 0 %
ii) Percentage of Watershed consisting of Type B Soils	HSG_B = 100 %
iii) Percentage of Watershed consisting of Type C/D Soils	$HSG_{C/D}$ = 0 %
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	$EURV_{DESIGN}$ = ac-f t
K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired)	$EURV_{DESIGN\ USER}$= 0.385 ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 1
3. Basin Side Slopes	
A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 4.00 ft / ft
4. Inlet	
A) Describe means of providing energy dissipation at concentrated inflow locations:	
5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 2% of the WQCV)	V_{FMIN} = 0.005 ac-ft
B) Actual Forebay Volume	V_F = 0.005 ac-ft
C) Forebay Depth (D_F = 18 inch maximum)	D_F = 18.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 78.00 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 1.56 cfs
E) Forebay Discharge Design	Choose One: ○ Berm With Pipe ◉ Wall with Rect. Notch ○ Wall with V-Notch Weir — **Flow too small for berm w/ pipe**
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P = in
G) Rectangular Notch Width	Calculated W_N = 6.7 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**RICHARD LYON, PE**
Company:	**HR GREEN**
Date:	**December 4, 2024**
Project:	**FLYING HORSE NORTH - FILING NO. 4**
Location:	**POND C**

6. Trickle Channel

A) Type of Trickle Channel — Choose One: (●) Concrete ( ) Soft Bottom

F) Slope of Trickle Channel — S = 0.0050 ft / ft

7. Micropool and Outlet Structure

A) Depth of Micropool (2.5-feet minimum) — D_M = 2.5 ft

B) Surface Area of Micropool (10 ft^2 minimum) — A_M = 10 sq ft

C) Outlet Type — Choose One: (●) Orifice Plate ( ) Other (Describe):

D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention) — $D_{orifice}$ = [ ] inches

E) Total Outlet Area — A_{ot} = [ ] square inches

8. Initial Surcharge Volume

A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches) — D_{IS} = [ ] in

B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV) — V_{IS} = [ ] cu ft

C) Initial Surcharge Provided Above Micropool — V_s= [ ] cu ft

Reference MHFD detention basin outlet structure design for any information that is not available on this sheet.

9. Trash Rack

A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$ — A_t = [ ] square inches

B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.)

Other (Y/N): N

C) Ratio of Total Open Area to Total Area (only for type 'Other') — User Ratio = [ ]

D) Total Water Quality Screen Area (based on screen type) — A_{total} = [ ] sq. in.

E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E) — H= [ ] feet

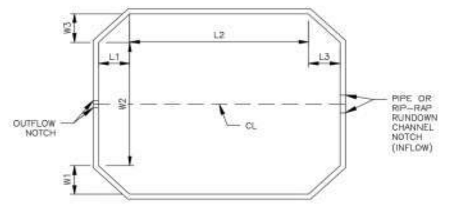
F) Height of Water Quality Screen (H_{TR}) — H_{TR}= [ ] inches

G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended) — $W_{opening}$ = [ ] inches

HR GREEN FOREBAY SIZING

PROJECT: FLYING HORSE NORTH FILING 4
DATE: 8/19/2024
DESIGNED BY: RDL
CHECKED BY: RDL
POND OR DP: POND C

	INNER DIMENSIONS			OUTER DIMENSIONS	
LENGTH					
L1	5	FT		5.83	FT
L2	12.167	FT		13.000	FT
L3	5	FT		5.83	FT
INNER L	22.167	FT	OUTER TOTAL L	23.833	FT
WIDTH					
W1	5	FT		5.83	FT
W2	9.12525	FT (75% of L2)		9.96	FT
W3	5	FT		5.83	FT
INNER W	19.125	FT	OUTER TOTAL W	20.791	FT
BAFFLE	(6'x0.83' + 4'x0.83')				
AREA	8.33	SF			



TRIANGLES	50	
RECTANGLE	111.0269168	
BAFFLE	8.33	
TOTAL SURFACE AREA	**152.6969168**	**SQ FT**
FOREBAY HT.	**1.5**	**FT**
FOREBAY VOLUME	**229**	**CF**
	8.483	**CY**
	0.005	**AC-FT**
REQ'D VOL (2% WQCV)	0.005	AC-FT
(per UD-BMP calc)	198	CF
Notch Width per UD-BMP	6.7	in

SUFFICIENT VOLUME?	**YES**

T-5 Extended Detention Basin (EDB)

Table EDB-4. EDB component criteria

	On-Site EDBs for Watersheds up to 1 Impervious Acre[1]	EDBs with Watersheds between 1 and 2 Impervious Acres[1]	EDBs with Watersheds up to 5 Impervious Acres	EDBs with Watersheds over 5 Impervious Acres	EDBs with Watersheds over 20 Impervious Acres
Forebay Release and Configuration	EDBs should not be used for watersheds with less than 1 impervious acre.	Release 2% of the undetained 100-year peak discharge by way of a wall/notch configuration	Release 2% of the undetained 100-year peak discharge by way of a wall/notch configuration	Release 2% of the undetained 100-year peak discharge by way of a wall/notch configuration	Release 2% of the undetained 100-year peak discharge by way of a wall/notch or berm/pipe[2] configuration
Minimum Forebay Volume		1% of the WQCV	2% of the WQCV	3% of the WQCV	3% of the WQCV
Maximum Forebay Depth		12 inches	18 inches	18 inches	30 inches
Trickle Channel Capacity		≥ the maximum possible forebay outlet capacity	≥ the maximum possible forebay outlet capacity	≥ the maximum possible forebay outlet capacity	≥ the maximum possible forebay outlet capacity
Micropool		Area ≥ 10 ft²	Area ≥ 10 ft²	Area ≥ 10 ft²	Area ≥ 10 ft²
Initial Surcharge Volume		Depth ≥ 4 inches	Depth ≥ 4 inches	Depth ≥ 4 in. Volume ≥ 0.3% WQCV	Depth ≥ 4 in. Volume ≥ 0.3% WQCV

[1] EDBs are not recommended for sites with less than 2 impervious acres. Consider a sand filter or rain garden.

[2] Round up to the first standard pipe size (minimum 8 inches).

Worksheet for Pond C Spillway

Project Description	
Solve For	Headwater Elevation

Input Data	
Discharge	69.00 cfs
Crest Elevation	7,536.00 ft
Tailwater Elevation	7,528.00 ft
Crest Surface Type	Gravel
Crest Breadth	40.00 ft
Crest Length	53.0 ft

Results	
Headwater Elevation	7,536.61 ft
Headwater Height Above Crest	0.61 ft
Tailwater Height Above Crest	-8.00 ft
Weir Coefficient	2.73 ft^(1/2)/s
Submergence Factor	1.000
Adjusted Weir Coefficient	2.73 ft^(1/2)/s
Flow Area	32.4 ft²
Velocity	2.13 ft/s
Wetted Perimeter	54.2 ft
Top Width	53.00 ft

Worksheet for Pond C Trickle Channel

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.005 ft/ft
Normal Depth	6.0 in

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.58
0+00	0.08
0+01	0.00
0+02	0.08
0+02	0.58

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.58)	(0+02, 0.58)	0.013

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Discharge	3.49 cfs
Roughness Coefficient	0.013
Elevation Range	0.0 to 0.6 ft
Flow Area	0.9 ft²
Wetted Perimeter	2.8 ft
Hydraulic Radius	3.9 in
Top Width	2.01 ft
Normal Depth	6.0 in
Critical Depth	6.0 in
Critical Slope	0.005 ft/ft
Velocity	3.81 ft/s
Velocity Head	0.23 ft
Specific Energy	0.73 ft
Froude Number	0.994
Flow Type	Subcritical

GVF Input Data

Worksheet for Pond C Trickle Channel

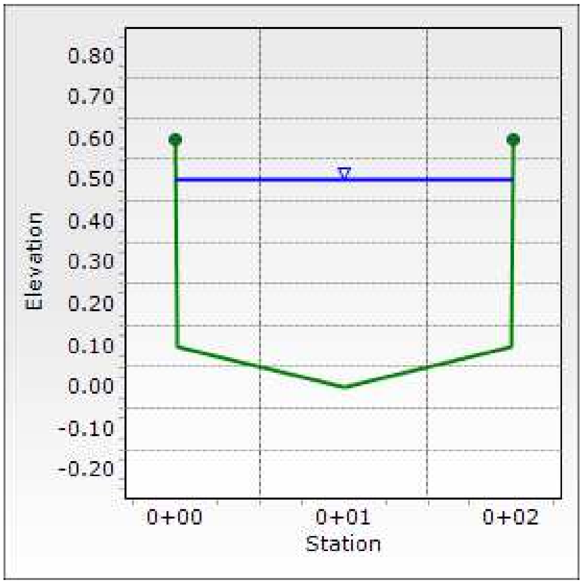
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	6.0 in
Critical Depth	6.0 in
Channel Slope	0.005 ft/ft
Critical Slope	0.005 ft/ft

Cross Section for Pond C Trickle Channel

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data	
Channel Slope	0.005 ft/ft
Normal Depth	6.0 in
Discharge	3.49 cfs



SEPARATE PERVIOUS AREA (SPA) CALCULATIONS

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Designer: Theresa McMunn
Company: HR GREEN LLC
Date: January 13, 2025
Project: Flying Horse North Filing No. 4
Location: Black Forest Road and Old Stagecoach Road

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth: 0.60 inches

Depth of Average Runoff Producing Storm, d_6 = 0.43 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	SPA											
Area ID	1											
Downstream Design Point ID	2											
Downstream BMP Type	None											
DCIA (ft^2)	--											
UIA (ft^2)	--											
RPA (ft^2)	--											
SPA (ft^2)	98,446											
HSG A (%)	0%											
HSG B (%)	100%											
HSG C/D (%)	0%											
Average Slope of RPA (ft/ft)	--											
UIA:RPA Interface Width (ft)	--											

CALCULATED RUNOFF RESULTS

Area ID	1											
UIA:RPA Area (ft^2)	--											
L / W Ratio	--											
UIA / Area	--											
Runoff (in)	0.00											
Runoff (ft^3)	0											
Runoff Reduction (ft^3)	4922											

CALCULATED WQCV RESULTS

Area ID	1											
WQCV (ft^3)	0											
WQCV Reduction (ft^3)	0											
WQCV Reduction (%)	0%											
Untreated WQCV (ft^3)	0											

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	2											
DCIA (ft^2)	0											
UIA (ft^2)	0											
RPA (ft^2)	0											
SPA (ft^2)	98,446											
Total Area (ft^2)	98,446											
Total Impervious Area (ft^2)	0											
WQCV (ft^3)	0											
WQCV Reduction (ft^3)	0											
WQCV Reduction (%)	0%											
Untreated WQCV (ft^3)	0											

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	98,446
Total Impervious Area (ft^2)	0
WQCV (ft^3)	0
WQCV Reduction (ft^3)	0
WQCV Reduction (%)	0%
Untreated WQCV (ft^3)	0

APPENDIX E

REFERENCE MATERIALS

INNOVATIVE DESIGN. **CLASSIC RESULTS.**

PRELIMINARY DRAINAGE REPORT
FOR
FLYING HORSE NORTH PRELIMINARY PLAN
AND
FINAL DRAINAGE REPORT
FOR
FLYING HORSE NORTH FILING NO. 1

NOVEMBER 2017
Revised June 2018

Prepared for:
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PCD File No. SP-17-012 and SF-18-001

CLASSIC CONSULTING

and B-B channel calculations) These facilities not only meet all current drainage criteria but also remain consistent with the intent of the DBPS. It is also noted that these facilities release well under the pre-development flows as established by the DBPS. Thus, the downstream corridor within the existing Reach 13 on the adjacent property will not be significantly affected with the installation of these full-spectrum facilities. Portions of the Cathedral Pines Development to the south contributes developed flows to this property. These flows will be accommodated in the various on-site facility designs. A smaller on-site basin at the southeast corner of section 36 releases historic flows onto the Cathedral Pines and the Edmonds Subdivision. An on-site detention/storm water quality facility is planned in this corridor to help mitigate development.

East Cherry Creek Drainage Basin

The Palmer Divide traverses the eastern half of section 36 which defines the major basin line between the Black Squirrel Creek and the East Cherry Creek Basins. The vegetation also changes drastically in this area. The majority of the East Cherry Creek Basin contains very little trees and more grazing prairie land and meadows. This area defines the edge of Black Forest. In general, historic flow patterns in this basin travel in a northeasterly direction towards Hodgen Road. The MDDP designates several major design points along the north boundary. Again, multiple detention/storm water quality facilities are planned for these corridors and to be constructed along with future land development. This report has analyzed the downstream corridors along the north property line for the pre-development condition (per MDDP hydrology) and post-development condition (per UD-detention designed release). No significant erosion currently exists in these channels and we have been consistently maintaining proper BMPs along this property boundary. This effort will continue through final construction and revegetation of the permanent detention/SWQ facilities. (See Appendix for Sections D-D and E-E channel calculations). Portions of the Palmer Divide Subdivision and multiple large unplatted properties the south contribute developed flows to this property. These flows will be accommodated in the various on-site facility designs.

PROPOSED DRAINAGE CONDITIONS

The proposed land development within the Flying Horse North Filing No. 1 and future development within the remaining portions of the Preliminary Plan will be 2.5-5 acre large lot residential with associated paved streets and roadside ditches. The 18-hole private Golf Course with a club house site, driving range and maintenance facility is also planned as a part of Filing No. 1. Based on the current El Paso County ECM Section I.7.1.B. and given the size of the lots within this entire development area, stormwater quality is not required to be provided. However, detention/EURV will still be provided in specific locations on-site to limit the on-site development flow release to remain consistent with pre-development conditions within the major drainage corridors. These proposed facilities will aide in limiting any detrimental effects on downstream corridors. At specific areas where the Filing No. 1 development creates concentrated flows into future development areas, temporary sediment basins will be constructed to minimize sediment transfer downstream and off-site. The Filing No. 1 Final Drainage Report portion of this report will define the permanent facilities providing an Excess Urban Runoff Volume (EURV) in the lower portion of the facility storage volume with an outlet control device. Frequent and infrequent inflows are released at rates approximating undeveloped conditions. This concept provides some mitigation of increased runoff volume by releasing a portion of the increased runoff at a low rate over an extended period of time, up to 72 hours. This means that frequent storms, smaller than the 2 year event, will be reduced to very low flows near or below the sediment carrying threshold value for downstream drainage ways. Also, by incorporating an outlet structure that limits the 100-year runoff to the undeveloped condition rate, the discharge hydrograph for storms between the 2 year and the 100 year event will approximate the hydrograph for the undeveloped conditions and will help effectively mitigate the effects of this development. Again, prior to any land development beyond the Filing No. 1 Final Plat area, additional final drainage reports, final plats and construction plans will be required detailing this criteria.

Given the rural nature of this development, roadside ditches are planned along all roadways. Concrete curb and gutter will only be used at the round-about locations and along the jurisdictional dam embankment as required by the State. The typical roadside ditch will be designed as a V-ditch with a depth of 24 inches. The natural terrain within much of this development creates some steeper slopes on many of the roadways. These slopes range from 1% to 10%. An analysis of the roadside ditches was performed in order to determine the necessary ditch lining required to maintain allowable velocity and shear stress.
The following three basic ditch improvements are recommended throughout the development:
(See Appendix for reference)

1. Revegetation with native seeding (Grass lined only)
   Slope 2% or less and minimal flow

2. Erosion Control Blanket (North American Green SC150 or equiv.) with native seeding Slope 5% or less and max. flow range of 7-43 cfs.
3. Turf Reinforcement Mat (North American Green P300 or equiv.) with natives seeding Slope 10% or less and max. flow of 70 cfs.

The specific ditch lining locations will be shown on the street improvements plans

The following hydrology descriptions will start at the western edge of the Flying Horse North property and move east into the East Cherry Creek Basin, describing the development within the Filing No. 1 area first.

FLYING HORSE NORTH FILING NO. 1

Black Squirrel Creek Drainage Basin

As mentioned previously, Flying Horse North is located in the upper region of the Black Squirrel Creek Drainage Basin. Per the approved DBPS for Black Squirrel Creek, the reaches in this area were proposed to remain as natural as possible. There were no recommendations for detention facilities within the area that is Flying Horse North, but due to current drainage criteria, detention/EURV facilities will be proposed with this development.

High Forest Ranch Detention Pond 26 outfalls onto the property at the very northwest corner of the site. These existing flows will continue to enter the site and travel within the natural channel towards the existing 48" CMP culvert crossing at Hwy. 83. Drainage easements across the proposed lots in this area will be provided on the final plat. The existing stock pond within lots 2 and 3 will be removed with grading of the road in this area. Tract B is platted in order to provide a detention/EURV facility for the lots and public road in this area. This facility will be constructed with Filing No. 1 with ownership and maintenance by the Flying Horse North HOA.

Design Point 1 (Q_2 = 2 cfs Q_5 = 3 cfs, Q_{100} = 11 cfs) represents the existing off-site and on-site developed flows from Basins OS-1A and BS-2B. The combined flow from these basins travel to a low point just east of Stagecoach Road where a proposed 24" RCP culvert will be installed to convey these flows under the road. (See Appendix for culvert design)

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Design Point 26 (Q_2 = 3 cfs Q_5 = 16 cfs, Q_{100} = 102 cfs) represents the full build-out developed flows from Basins CC-8 and CC-10. Basin CC-8 represents future residential lots and CC-10 mostly future passive park area. These flows will continue to sheet flow towards the low-point where a 48" RCP culvert is sized to handle the fully developed flows at this location. (See Appendix for culvert design) After crossing Stagecoach Road, these flows will continue to flow directly into the existing stock pond just north of the roadway. This facility will provided sediment control for the small developed roadway area. Upon future development and plating of the lots planned within these basins, this stock pond will be formally designed into a detention facility.

Basin CC-15 (Q_2 = 1 cfs Q_5 = 4 cfs, Q_{100} = 20 cfs) represents the full build-out developed flows from the future residential lots tributary to this basin. These flows will continue to sheet flow towards the low-point where a 30" RCP culvert is sized to handle the fully developed flows at this location. (See Appendix for culvert design) A downstream sediment basin will be installed to provide sediment control for the small developed roadway area.

Basin CC-16 (Q_2 = 1 cfs Q_5 = 5 cfs, Q_{100} = 24 cfs) represents the full build-out developed flows from the future residential lots tributary to this basin. These flows will continue to sheet flow towards the low-point at the southwest corner of Old Stagecoach Road and Rubble Drive where a 24" RCP culvert is sized to handle the fully developed flows at this location. (See Appendix for culvert design) A downstream sediment basin will be installed to provide sediment control for the small developed roadway area.

Design Point 30 (Q_2 = 0.7 cfs Q_5 = 2 cfs, Q_{100} = 10 cfs) represents the full build-out developed flows from Basin CC-18. This Basin represents future residential lots. The flows will continue to sheet flow towards the low-point where a 24" RCP culvert is sized to handle the fully developed flows at this location. (See Appendix for culvert design) A downstream sediment basin will be installed to provide sediment control for the small developed roadway area.

Design Point 31 (Q_2 = 0.9 cfs Q_5 = 3 cfs, Q_{100} = 15 cfs) represents the full build-out developed flows from Basin CC-19 and the upstream release from DP-30. This Basin represents future residential 5 ac. lots. The flows will continue to sheet flow within a proposed drainage easement towards the existing low-point where an existing 24" CMP culvert will adequately handle the fully developed flows at this location.

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Basin BS-26 (Q_2 = 0.04 cfs Q_5 = 0.4 cfs, Q_{100} = 3 cfs) represents sheet flow from the extreme rear portion of a future residential lot. This area of the lot will likely not be built upon, therefore not significantly changing the drainage conditions from the pre-development condition. The pre-development flow from the historic basin area equals **Q_2 = 0.04 cfs Q_5 = 0.4 cfs, Q_{100} = 3 cfs.** Also, given the lot size, no water quality is required.

Basins BS-31 (Q_2 = 0.3 cfs Q_5 = 2 cfs, Q_{100} = 12 cfs), BS-32 (Q_2 = 0.3 cfs Q_5 = 2 cfs, Q_{100} = 9 cfs) and BS-33 (Q_2 = 0.8 cfs Q_5 = 3 cfs, Q_{100} = 15 cfs) represent smaller basins that will continue to sheet flow off-site to the south. These basins represent some golf course development and multiple future residential lots. Given the lot size, no water quality is required. However, permanent sediment basins will be installed downstream of the golf course development to provide sediment control. Developed flows released from these basins will not be significantly different than the pre-development flows.

East Cherry Creek Drainage Basin

The following basins are not tributary to the Filing No. 1 platting area but are within the East Chery Creek Drainage Basin and planned for future residential lot development.

Design Point 28 (Q_2 = 5 cfs Q_5 = 20 cfs, Q_{100} = 110 cfs) represents the full build-out developed flows from Basins OS-13 and CC-13A. Basin CC-13A represents future residential lots and OS-13 platted, 5-ac. zoned residential property. These flows will continue to sheet flow towards the low-point where a future culvert will be installed to handle the fully developed flows at this location. The flows are then conveyed in the natural channel towards Design Point 29.

Design Point 29 (Q_2 = 6 cfs Q_5 = 27 cfs, Q_{100} = 155 cfs) represents the full build-out developed flows from Basins CC-13B, CC-13C and release from DP-28. These basins represent future residential lots. At this location, a future detention facility will be installed to meet EURV requirements and release pre-development flow quantities. This future facility will be constructed in a tract with ownership and maintenance by the Flying Horse North HOA.

Basin CC-13D (Q_2 = 2 cfs Q_5 = 6 cfs, Q_{100} = 29 cfs) represents future residential lots that will continue to sheet flow off-site. Given the lot size, no water quality is required. However, a permanent sediment basin will be installed just prior to release off-site to provide sediment control. Developed flows released from this basin will not be significantly different than the pre-development flows.

Basin CC-14 (Q_2 = 0.4 cfs Q_5 = 2 cfs, Q_{100} = 8 cfs) represents sheet flow from the rear portion of two future residential lots. The majority of this area is not anticipated to be developed, therefore not significantly changing the drainage conditions from the pre-development condition. Also, given the lot size, no water quality is required.

Design Point 27 (Q_2 = 4 cfs Q_5 = 17 cfs, Q_{100} = 81 cfs) represents the full build-out developed flows from the previously described basin CC-15 and CC-20. These basins represent future residential lots. At this location, a future detention facility will be installed to meet EURV requirements and release pre-development flow quantities. This future facility will be constructed in a tract with ownership and maintenance by the Flying Horse North HOA.

Basins CC-21 (Q_2 = 0.1 cfs Q_5 = 1 cfs, Q_{100} = 9 cfs) and CC-22 (Q_2 = 1 cfs Q_5 = 5 cfs, Q_{100} = 21 cfs) represent future residential 5 ac. lots and park area that will continue to sheet flow off-site. Given the lot size, no water quality is required. However, a permanent sediment basin will be installed just prior to release off-site to provide sediment control. Developed flows released from this basin will not be significantly different than the pre-development flows.

Basins CC-23 (Q_2 = 0.4 cfs Q_5 = 1 cfs, Q_{100} = 8 cfs) and CC-24 (Q_2 = 3 cfs Q_5 = 13 cfs, Q_{100} = 62 cfs) represent future 5 ac. residential lots that will continue to sheet flow off-site. Given the lot size, no water quality is required. Given that the proposed lots are planned for 5 ac. residential, the developed flows released from this basin will not be significantly different than the pre-development flows. However, multiple permanent sediment basins may be installed just prior to release off-site to provide sediment control. This basin also contains a portion of the adjacent Franktown/Parker Reservoir emergency spillway crossing two proposed lots. This existing facility, which doesn't appear to be within any existing easement, will be further analyzed with a final drainage report for this area. Appropriate drainage easements may be provided at time of final plating.

Basin CC-25 (Q_2 = 0.3 cfs Q_5 = 1 cfs, Q_{100} = 6 cfs) represents a small portion of two future residential 5 ac. lots that will continue to sheet flow off-site. Given that the proposed lots are planned for 5 ac. residential, the developed flows released from this basin will not be significantly different than the pre-development flows.

Design Point 34 (Q_2 = 6 cfs Q_5 = 24 cfs, Q_{100} = 168 cfs) represents the full build-out developed flows from Basins CC-26, CC-27, CC-28, release from CC-16 and release from DP-32. These basins represent future residential lots and park area. At this location, a future detention facility will be installed and likely replace the existing stock pond to meet EURV requirements and release pre-development flow quantities. The downstream existing culvert under Hodgen Road will be further analyzed with future final drainage reports. This future facility will be constructed in a tract with ownership and maintenance by the Flying Horse North HOA.

FACILITY MAINTENANCE

All proposed drainage structures within the platted County ROW will be owned and maintained by El Paso County. All proposed drainage structures within easements or tracts will be owned and maintained by the Flying Horse North HOA of Golf Course owner.

DRAINAGE CRITERIA

Hydrologic calculations were performed using the City of Colorado Springs/El Paso County Drainage Criteria Manual, revised in November 1991 and October 1994 with County adopted Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs/El Paso County Drainage Criteria Manual as revised in May 2014. Detention storage and storm sewer conveyance to Black Squirrel Creek Drainage Basin was established with the Black Squirrel DBPS, previously referenced. The IDF curves from Figure 6-5 of the City of Colorado Springs/El Paso County DCM was used to estimate storm water runoff anticipated from design storms for the 2 year, 5 year and 100 year recurrence interval. (See Appendix)

The City of Colorado Springs/El Paso County DCM requires the Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls. The Four Step Process pertains to management of smaller, frequently occurring storm events, as opposed to larger storms for which drainage and flood control infrastructure are sized. Implementation of these four steps helps to achieve storm water permit requirements. This site adheres to this **Four Step Process** as follows:

1. **Employ Runoff Reduction Practices:** Development of project site is proposed large lot single family residential (2.5 ac. min.) with homes and associated landscaping along with a private golf course. Proposed impervious areas (roof tops, patios) will sheet flow across landscaped ground, through open space areas and across the golf course to slow runoff and increase time of concentration prior to being conveyed to the proposed public streets. This will minimize directly connected impervious areas within the project site.

2. **Stabilize Drainageways:** This site will utilize roadside ditches with culvert crossings throughout the site and channel stabilization and grade control structures installed within some of the historic natural channels. These facilities will then direct the on-site development flows to the multiple detention/SWQ ponds mentioned above, designed to release at or below historic rates into Black Squirrel and East Cherry Creek. Based upon the proposed reduction in released flows compared to the pre-developed flows, no impact to downstream drainageways is anticipated.

3. **Provide Water Quality Capture Volume (WQCV):** Runoff from this development will be treated through capture and slow release of the WQCV in multiple permanent Extended Detention Basins designed per current El Paso County drainage criteria.

4. **Consider need for Industrial and Commercial BMPs**: No industrial or commercial uses are proposed within this development. However, a site specific storm water quality and erosion control plan and narrative was previously approved for this development in October 2016 (PUD-16-002). Details such as site specific source control construction BMP's as well as permanent BMP's were detailed in this plan and narrative to protect receiving waters. Much of these BMP's are currently constructed and being maintained as the majority of the development has been graded and erosion control methods employed.

ALL LAND ASSUMED 2 ACRE RESIDENTIAL LOTS, UNDEVELOPED WOODS OR
GOOD CONDITION OPEN SPACE (LAWNS, PARKS GOLF COURSES, CEMETARIES ETC.)

C_N VALUES - DEVELOPED CONDITIONS

BASIN (label)	BASIN AREA (Ac)	**GOLF COURSE / WOODS (B)**		**2 AC. RESIDENTIAL (B)**		**COMPOSITE** C_N
		CN	AREA (Ac.)	CN	AREA (Ac.)	
OS-1A	4.4	61	4.4	65	0.0	**61.0**
OS-1B	5.6	61	5.6	65	0.0	**61.0**
EX-DP-3 (Pre-Dev.)	36.0	60	36.0	65	0.0	**60.0**
OS-2	2.9	61	2.9	65	0.0	**61.0**
OS-3	10.2	61	0.0	65	10.2	**65.0**
OS-4	32.9	61	0.0	65	32.9	**65.0**
OS-5	29.7	61	0.0	65	29.7	**65.0**
OS-6	9.2	61	0.0	65	9.2	**65.0**
OS-7	5.0	61	0.0	65	5.0	**65.0**
OS-8	14.2	61	0.0	65	14.2	**65.0**
OS-9	9.8	60	9.8	65	0.0	**60.0**
OS-10	4.1	61	0.0	65	4.1	**65.0**
OS-11	28.0	61	0.0	65	28.0	**65.0**
OS-12	68.1	61	40.0	65	28.1	**62.7**
OS-13	36.9	61	18.0	65	18.9	**63.0**
OS-14	26.4	61	20.0	65	6.4	**62.0**
OS-15	70.8	61	20.0	65	50.8	**63.9**
OS-16	4.5	61	0.0	65	4.5	**65.0**
OS-17	15.8	61	0.0	65	15.8	**65.0**
OS-18	13.0	61	0.0	65	13.0	**65.0**

ALL LAND ASSUMED 2 ACRE RESIDENTIAL LOTS, UNDEVELOPED WOODS OR
GOOD CONDITION OPEN SPACE (LAWNS, PARKS GOLF COURSES, CEMETARIES ETC.)

CN VALUES - DEVELOPED CONDITIONS

BASIN (label)	BASIN AREA (Ac)	**GOLF COURSE / WOODS (B)**		**2 AC. RESIDENTIAL (B)**		**COMPOSITE** CN
		CN	AREA (Ac.)	CN	AREA (Ac.)	
CC-1A	9.8	61	0.0	65	9.8	**65.0**
CC-1B	12.6	61	0.5	65	12.1	**64.8**
CC-2A	11.0	61	0.0	65	11.0	**65.0**
CC-2B	20.8	61	0.0	65	20.8	**65.0**
CC-2C	6.4	61	0.0	65	6.4	**65.0**
CC-3	52.5	61	25.0	65	27.5	**63.1**
CC-4A	108.7	61	65.0	65	43.7	**62.6**
CC-4B	8.1	85	4.5	65	3.6	**76.1**
CC-4C (Pre-Dev.)	7.4	61	7.4	65	0.0	**61.0**
CC-5	22.4	61	0.0	65	22.4	**65.0**
CC-6	27.8	61	0.0	65	27.8	**65.0**
CC-7	18.4	61	0.0	65	18.4	**65.0**
CC-8	7.7	61	0.0	65	7.7	**65.0**
CC-9	5.6	61	0.0	65	5.6	**65.0**
CC-10	85.6	61	51.0	65	34.6	**62.6**
CC-11	18.6	61	9.0	65	9.6	**63.1**
CC-12	12.2	61	0.0	65	12.2	**65.0**
CC-13A	19.3	61	0.0	65	19.3	**65.0**
CC-13B	25.5	61	0.0	65	25.5	**65.0**
CC-13C	9.9	61	0.0	65	9.9	**65.0**
CC-13D	18.8	61	0.0	65	18.8	**65.0**
CC-14	4.6	61	0.0	65	4.6	**65.0**
CC-15	12.8	61	0.0	65	12.8	**65.0**
CC-16	16.3	61	0.0	65	16.3	**65.0**
CC-17	25.0	61	0.0	65	25.0	**65.0**
CC-18	6.2	65	5.8	89	0.4	**66.5**
CC-19	3.7	61	0.0	65	3.7	**65.0**
CC-20	39.3	61	0.0	65	39.3	**65.0**
CC-21	6.2	61	6.2	65	0.0	**61.0**
CC-22	13.8	61	0.0	65	13.8	**65.0**
CC-23	5.7	61	0.4	65	5.3	**64.7**
CC-24	39.6	61	0.0	65	39.6	**65.0**
CC-25	3.5	61	0.0	65	3.5	**65.0**
CC-26	16.7	61	0.0	65	16.7	**65.0**
CC-27	18.9	61	3.0	65	15.9	**64.4**
CC-28	154.8	61	23.0	65	131.8	**64.4**

TIME OF CONCENTRATION - DEVELOPED

BASIN	COMPOSITE Cn	C(5)	OVERLAND Length *(ft)*	OVERLAND Height *(ft)*	Tc *(min)*	STREET / CHANNEL FLOW (DCM Vol. 1 Fig. 6-25) Length *(ft)*	Slope *(%)*	Velocity *(fps)*	Tc *(min)*	Tc TOTAL *(min)*	Tc LAG (0.6tc) *(min)*	Tc LAG (0.6tc) *(hr)*
OS-1A	61.0	0.08	300	20	17.1	150	4.0%	1.0	2.5	19.6	11.7	0.20
OS-1B	61.0	0.08	300	20	17.1	300	8.0%	1.4	3.6	20.6	12.4	0.21
EX-DP-3 (Pre-Dev.)	60.0	0.08	300	20	17.1	900	5.0%	1.9	7.9	25.0	15.0	0.25
OS-2	61.0	0.08	300	20	17.1	300	6.0%	2.0	2.5	19.6	11.7	0.20
OS-3	65.0	0.08	300	22	16.5	275	6.2%	2.0	2.3	18.8	11.3	0.19
OS-4	65.0	0.08	300	18	17.7	420	4.3%	1.3	5.4	23.0	13.8	0.23
OS-5	65.0	0.08	300	12	20.2	1200	2.5%	1.1	19.0	39.2	23.5	0.39
OS-6	65.0	0.08	300	17	18.0	300	5.5%	1.9	2.6	20.6	12.4	0.21
OS-7	65.0	0.08	300	20	17.1	180	6.5%	2.1	1.4	18.5	11.1	0.18
OS-8	65.0	0.08	300	14	19.2	260	5.5%	0.6	7.5	26.7	16.0	0.27
OS-9	60.0	0.08	300	12	20.2	500	3.5%	0.5	16.7	36.9	22.1	0.37
OS-10	65.0	0.08	300	19	17.3					17.3	10.4	0.17
OS-11	65.0	0.08	300	14	19.2	600	6.5%	0.7	15.4	34.6	20.7	0.35
OS-12	62.7	0.08	300	10	21.4	1400	2.5%	1.5	15.6	37.0	22.2	0.37
OS-13	63.0	0.08	300	10	21.4	1000	3.0%	1.5	11.1	32.6	19.5	0.33
OS-14	62.0	0.08	300	8	23.1	1000	5.0%	2.1	7.9	31.0	18.6	0.31
OS-15	63.9	0.08	300	16	18.4	2200	4.0%	1.9	19.3	37.7	22.6	0.38
OS-16	65.0	0.08	300	7	24.1					24.1	14.5	0.24
OS-17	65.0	0.08	300	20	17.1	350	6.0%	2.5	2.3	19.4	11.6	0.19
OS-18	65.0	0.08	300	18	17.7	300	6.0%	2.5	2.0	19.7	11.8	0.20
BS-1A	65.0	0.08	300	19	17.3					17.3	10.4	0.17
BS-1B	65.0	0.08	300	18	17.7	200	2.5%	1.2	2.8	20.4	12.3	0.20
BS-2	89.0	0.08	300	16	18.4	630	7.0%	0.7	16.2	34.5	20.7	0.35
BS-2A	89.0	0.08	30	1.5	5.9	700	6.5%	1.7	6.9	12.8	7.7	0.13
BS-2B	89.0	0.08	30	1.5	5.9	800	6.5%	2.2	6.1	12.0	7.2	0.12
BS-3	65.0	0.08	300	18	17.7	300	5.3%	2.2	2.3	19.9	12.0	0.20
BS-4	67.0	0.08	300	22	16.5	960	7.0%	2.4	6.7	23.2	13.9	0.23
BS-5	65.0	0.08	300	20	17.1	150	7.0%	2.4	1.0	18.1	10.9	0.18
BS-6	89.0	0.08	10	0.2	4.6	700	7.0%	2.4	4.9	9.5	5.7	0.09

TIME OF CONCENTRATION - DEVELOPED

BASIN	COMPOSITE Cn	C(5)	Length (ft)	OVERLAND Height (ft)	Tc (min)	STREET / CHANNEL FLOW (DCM Vol. 1 Fig. 6-25) Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	Tc LAG (0.6tc) (min)	Tc LAG (0.6tc) (hr)
CC-1A	65.0	0.08	300	16	18.4	500	5.0%	1.7	4.9	23.3	14.0	0.23
CC-1B	64.8	0.08	300	14	19.2	700	4.0%	2.0	5.8	25.0	15.0	0.25
CC-2A	65.0	0.08	300	14	19.2	250	3.0%	1.5	2.8	22.0	13.2	0.22
CC-2B	65.0	0.08	300	14	19.2	280	3.0%	1.5	3.1	22.3	13.4	0.22
CC-2C	65.0	0.08	300	18	17.7					17.7	10.6	0.18
CC-3	63.1	0.08	300	18	17.7	2300	3.0%	1.5	25.6	43.2	25.9	0.43
CC-4A	62.6	0.08	300	14	19.2	2700	2.0%	1.8	25.0	44.2	26.5	0.44
CC-4B	76.1	0.08	300	12	20.2	600	3.0%	1.6	6.3	26.4	15.9	0.26
CC-4C (Pre-Dev.)	61.0	0.08	40	0.8	9.3	350	3.0%	1.5	3.9	13.2	7.9	0.13
CC-5	65.0	0.08	300	18	17.7	1000	4.0%	2.0	8.3	26.0	15.6	0.26
CC-6	65.0	0.08	300	14	19.2	550	2.5%	1.6	5.7	24.9	14.9	0.25
CC-7	65.0	0.08	300	16	18.4	1000	3.0%	1.6	10.4	28.8	17.3	0.29
CC-8	65.0	0.08	300	10	21.4	250	2.0%	1.2	3.5	24.9	14.9	0.25
CC-9	65.0	0.08	300	18	17.7	100	2.0%	1.2	1.4	19.0	11.4	0.19
CC-10	62.6	0.08	300	22	16.5	2400	3.0%	1.8	22.2	38.7	23.2	0.39
CC-11	63.1	0.08	300	18	17.7	450	5.0%	2.1	3.6	21.2	12.7	0.21
CC-12	65.0	0.08	300	11	20.8	650	4.0%	2.0	5.4	26.2	15.7	0.26
CC-13A	65.0	0.08	300	14	19.2	1400	4.0%	2.0	11.7	30.9	18.5	0.31
CC-13B	65.0	0.08	300	18	17.7	1300	3.0%	1.6	13.5	31.2	18.7	0.31
CC-13C	65.0	0.08	300	14	19.2	350	4.0%	2.0	2.9	22.1	13.3	0.22
CC-13D	65.0	0.08	300	20	17.1	900	4.0%	2.0	7.5	24.6	14.7	0.25
CC-14	65.0	0.08	300	10	21.4					21.4	12.9	0.21
CC-15	65.0	0.08	300	14	19.2	550	3.0%	1.8	5.1	24.3	14.6	0.24
CC-16	65.0	0.08	300	10	21.4	650	2.5%	1.3	8.3	29.8	17.9	0.30
CC-17	65.0	0.08	300	9	22.2	950	2.0%	1.2	13.2	35.4	21.2	0.35
CC-18	66.5	0.08	300	7	24.1	400	2.0%	1.2	5.6	29.7	17.8	0.30
CC-19	65.0	0.08	300	8	23.1	100	2.0%	1.0	1.7	24.7	14.8	0.25
CC-20	65.0	0.08	300	9	22.2	350	6.0%	2.2	2.7	24.8	14.9	0.25
CC-21	61.0	0.08	300	18	17.7	200	3.0%	1.8	1.9	19.5	11.7	0.20
CC-22	65.0	0.08	300	14	19.2	700	4.0%	2.0	5.8	25.0	15.0	0.25
CC-23	64.7	0.08	300	10	21.4	850	2.0%	1.2	11.8	33.2	19.9	0.33
CC-24	65.0	0.08	300	20	17.1	900	4.0%	1.9	7.9	25.0	15.0	0.25
CC-25	65.0	0.08	300	16	18.4	500	3.0%	1.8	4.6	23.0	13.8	0.23
CC-26	65.0	0.08	300	14	19.2	900	5.0%	2.1	7.1	26.3	15.8	0.26
CC-27	64.4	0.08	300	14	19.2	1300	3.0%	1.8	12.0	31.2	18.7	0.31
CC-28	64.4	0.08	300	14	19.2	4700	3.0%	1.8	43.5	62.7	37.6	0.63

BASIN SUMMARY - DEVELOPED CONDITIONS

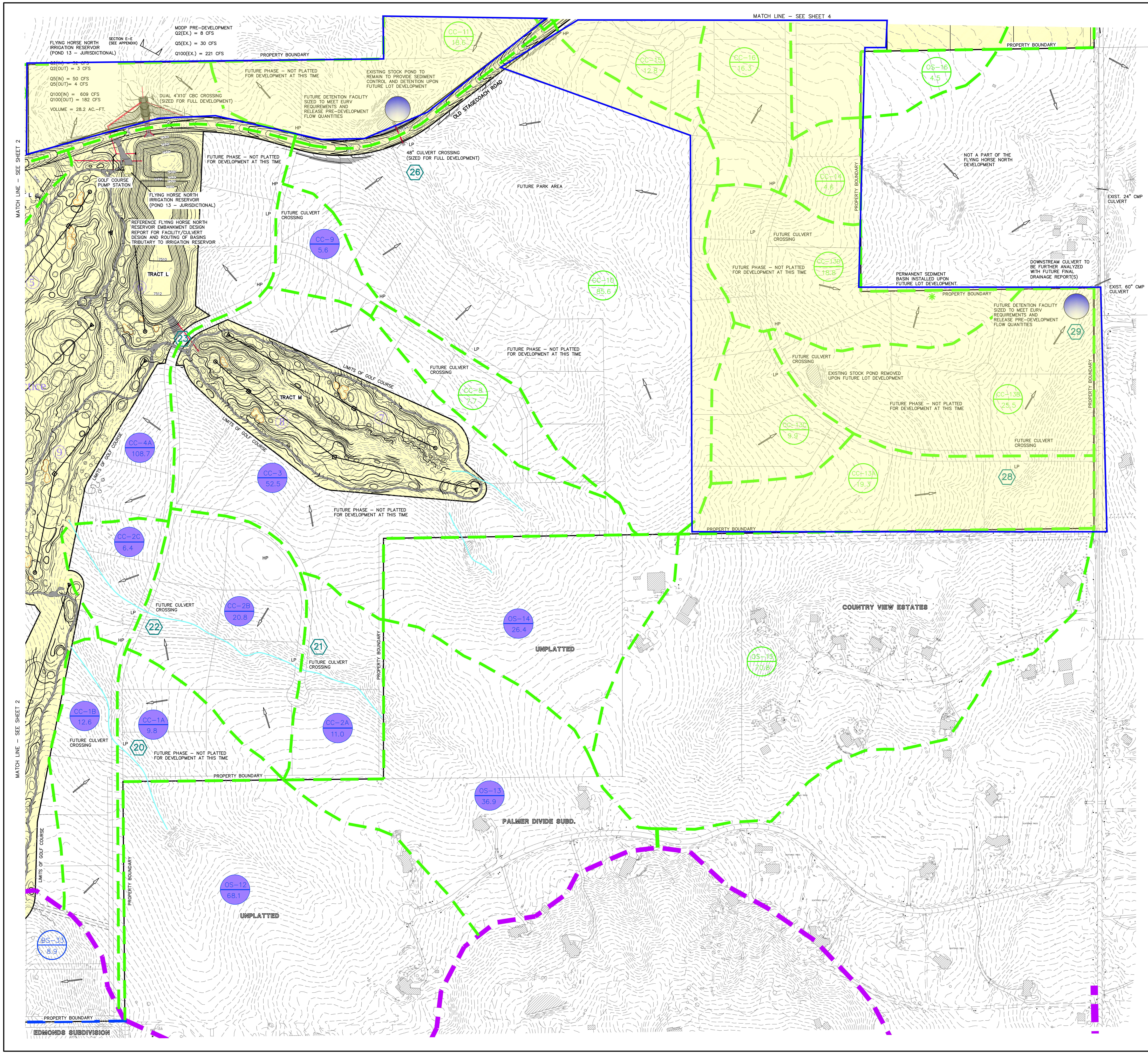
BASIN (label)	AREA (acres)	COMPOSITE CN	TOTAL LAG TIME (hours)	Q 2 Yr. (cfs)	Q 5 Yr. (cfs)	Q 100 Yr. (cfs)
OS-1A	4.40	61.0	0.20	0.4	1.6	7.7
OS-1B	5.60	61.0	0.21	0.5	1.9	9.4
EX-DP-3 (Pre-Dev.)	36.00	60.0	0.25	0.5	4.8	41.3
OS-2	2.90	61.0	0.20	0.1	0.6	4.0
OS-3	10.20	65.0	0.19	1.0	3.8	17.9
OS-4	32.90	65.0	0.23	2.8	11.2	53.6
OS-5	29.70	65.0	0.39	1.9	7.1	37.0
OS-6	9.20	65.0	0.21	0.9	3.2	15.5
OS-7	5.00	65.0	0.18	0.5	2.0	9.0
OS-8	14.20	65.0	0.27	2.1	6.2	24.7
OS-9	9.80	60.0	0.37	0.1	1.0	9.1
OS-10	4.10	65.0	0.17	0.7	2.1	8.2
OS-11	28.00	65.0	0.35	2.4	8.2	38.7
OS-12	68.10	62.7	0.37	2.2	11.9	75.8
OS-13	36.90	63.0	0.33	1.4	7.4	45.0
OS-14	26.40	62.0	0.31	0.7	4.6	31.0
OS-15	70.80	63.9	0.38	3.3	14.8	84.2
OS-16	4.50	65.0	0.24	0.4	1.5	7.2
OS-17	15.80	65.0	0.19	1.6	5.9	27.7
OS-18	13.00	65.0	0.20	1.3	4.7	22.6

BASIN SUMMARY - DEVELOPED CONDITIONS

BASIN (label)	AREA (acres)	COMPOSITE CN	TOTAL LAG TIME (hours)	Q 2 Yr. (cfs)	Q 5 Yr. (cfs)	Q 100 Yr. (cfs)
CC-1A	9.80	65.0	0.23	0.8	3.3	16.0
CC-1B	12.60	64.8	0.25	1.0	4.0	19.4
CC-2A	11.00	65.0	0.22	1.0	3.8	18.3
CC-2B	20.80	65.0	0.22	1.9	7.1	34.6
CC-2C	6.40	65.0	0.18	0.7	2.5	11.5
CC-3	52.50	63.1	0.43	1.8	8.8	54.5
CC-4A	108.70	62.6	0.44	15.4	39.0	156.0
CC-4B	8.10	76.1	0.26	4.0	7.3	20.6
CC-4C (Pre-Dev.)	7.40	61.0	0.13	0.2	1.8	11.2
CC-5	22.40	65.0	0.26	1.8	7.1	34.3
CC-6	27.80	65.0	0.25	2.3	9.1	43.2
CC-7	18.40	65.0	0.29	1.4	5.4	27.0
CC-8	7.70	65.0	0.25	0.6	2.5	12.0
CC-9	5.60	65.0	0.19	0.6	2.1	9.8
CC-10	85.60	62.6	0.39	2.6	14.1	91.9
CC-11	18.60	63.1	0.21	0.9	5.0	28.1
CC-12	12.20	65.0	0.26	1.0	3.9	18.7
CC-13A	19.30	65.0	0.31	1.4	5.4	27.3
CC-13B	25.50	65.0	0.31	1.8	7.2	36.1
CC-13C	9.90	65.0	0.22	0.9	3.4	16.5
CC-13D	18.80	65.0	0.25	1.5	6.2	29.2
CC-14	4.60	65.0	0.21	0.4	1.6	7.8
CC-15	12.80	65.0	0.24	1.1	4.3	20.4
CC-16	16.30	65.0	0.30	1.2	4.6	23.6
CC-17	25.00	65.0	0.35	1.7	6.5	32.8
CC-18	6.20	66.5	0.30	0.7	2.2	9.7
CC-19	3.70	65.0	0.25	0.3	1.2	5.8
CC-20	39.30	65.0	0.25	3.2	12.9	61.0
CC-21	6.20	61.0	0.20	0.1	1.2	8.5
CC-22	13.80	65.0	0.25	1.1	4.5	21.4
CC-23	5.70	64.7	0.33	0.4	1.5	7.7
CC-24	39.60	65.0	0.25	3.3	13.0	61.5
CC-25	3.50	65.0	0.23	0.3	1.2	5.7
CC-26	16.70	65.0	0.26	1.4	5.3	25.6
CC-27	18.90	64.4	0.31	1.2	4.9	25.8
CC-28	154.80	64.4	0.63	6.5	24.7	136.3

DESIGN POINTS SURFACE ROUTING SUMMARY - DEVELOPED CONDITIONS

Design Point (label)	**Contributing Basins**	**Q 2 Yr.** Q (cfs)	**Q 5 Yr.** Q (cfs)	**Q 100 Yr.** Q (cfs)
DP-18 DEV	BS-28, BS-29, BS-30, OS-18	5.0	21.6	115
DP-19 DEV	BS-27, OS-17, Release from DP-18	3.8	16.8	126
DP-20 DEV	CC-1A, OS-12	3.2	14.3	88
DP-21 DEV	CC-2A, OS-13	2.1	10.5	62
DP-22 DEV	CC-2B, Release from DP-21	3.7	16.6	92
DP-23 DEV	CC-3, OS-14	2.5	13.0	84
DP-24 DEV	CC-4C (Pre-Dev.), CC-5	1.9	8.4	45
TOTAL INFLOW TO POND 12 (UD Detention hydrograph)	**CC-4C, CC-5, CC-6**	**6**	**9**	**85**
DP-25 DEV	**Release from FHN Pond 12**	**0.2**	**0.3**	**45**
DP-26 DEV	CC-8, CC-10	3.0	15.9	102
DP-27 DEV	CC-15, CC-20	4.3	17.2	81
DP-28 DEV	CC-13A, OS-15	4.6	19.8	110
DP-29 DEV	CC-13B, CC-13C, Release from DP-28	5.8	26.6	155
DP-30 DEV	CC-18	0.7	2.2	10
DP-31 DEV	CC-19, Release from DP-30	0.9	3.2	15
DP-32 DEV	CC-17, OS-16	2.0	7.8	40
DP-33 DEV	CC-23, CC-24	3.6	14.4	69
DP-34 DEV	CC-26, CC-27, CC-28 and Release from CC-16 & DP-32	6.0	23.5	168



BASIN SUMMARY - DEVELOPED CONDITIONS

BASIN (label)	AREA (acres)	COMPOSITE CN	TOTAL LAG TIME (hours)	Q 2 Yr. (cfs)	Q 5 Yr. (cfs)	Q 100 Yr. (cfs)
OS-8	14.20	65.0	0.27	2.1	6.2	24.7
OS-9	9.80	60.0	0.37	0.1	1.0	9.1
OS-10	4.10	65.0	0.17	0.7	2.1	8.2
OS-11	28.00	65.0	0.35	2.4	8.2	38.7
OS-12	68.10	62.7	0.37	2.2	11.9	75.8
OS-13	36.90	63.0	0.33	1.4	7.4	45.0
OS-14	26.40	62.0	0.31	0.7	4.6	31.0
OS-15	70.80	63.9	0.38	3.3	14.8	84.2
OS-16	4.50	65.0	0.24	0.4	1.5	7.2
OS-17	15.80	65.0	0.19	1.6	5.9	27.7
OS-18	13.00	65.0	0.20	1.3	4.7	22.6
CC-1A	9.80	65.0	0.23	0.8	3.3	16.0
CC-1B	12.60	64.8	0.25	1.0	4.0	19.4
CC-2A	11.00	65.0	0.22	1.0	3.8	18.3
CC-2B	20.80	65.0	0.22	1.9	7.1	34.6
CC-2C	6.40	65.0	0.18	0.7	2.5	11.5
CC-3	52.50	63.1	0.43	1.8	8.8	54.5
CC-4A	108.70	62.6	0.44	15.4	39.0	156.0
CC-4B	8.10	76.1	0.26	4.0	7.3	20.6
CC-4C (Pre-Dev.)	7.40	61.0	0.13	0.2	1.8	11.2
CC-5	22.40	65.0	0.26	1.8	7.1	34.3
CC-6	27.80	65.0	0.25	2.3	9.1	43.2
CC-7	18.40	65.0	0.29	1.4	5.4	27.0
CC-8	7.70	65.0	0.25	0.6	2.5	12.0
CC-9	5.60	65.0	0.19	0.6	2.1	9.8
CC-10	85.60	62.6	0.39	2.6	14.1	91.9
CC-11	18.60	63.1	0.21	0.9	5.0	28.1
CC-12	12.20	65.0	0.26	1.0	3.9	18.7
CC-13A	19.30	65.0	0.31	1.4	5.4	27.3
CC-13B	25.50	65.0	0.31	1.8	7.2	36.1
CC-13C	9.90	65.0	0.22	0.9	3.4	16.5
CC-13D	18.80	65.0	0.25	1.5	6.2	29.2
CC-14	4.60	65.0	0.21	0.4	1.6	7.8
CC-15	12.80	65.0	0.24	1.1	4.3	20.4
CC-16	16.30	65.0	0.30	1.2	4.6	23.6
CC-17	25.00	65.0	0.35	1.7	6.5	32.8
CC-18	6.20	66.5	0.30	0.7	2.2	9.7
CC-19	3.70	65.0	0.25	0.3	1.2	5.8
CC-20	39.30	65.0	0.25	3.2	12.9	61.0
CC-21	6.20	61.0	0.20	0.1	1.2	8.5
CC-22	13.80	65.0	0.25	1.1	4.5	21.4
CC-23	5.70	64.7	0.33	0.4	1.5	7.7
CC-24	39.60	65.0	0.25	3.3	13.0	61.5
CC-25	3.50	65.0	0.23	0.3	1.2	5.7
CC-26	16.70	65.0	0.26	1.4	5.3	25.6
CC-27	18.90	64.4	0.31	1.2	4.9	25.8
CC-28	154.80	64.4	0.63	6.5	24.7	136.3

DESIGN POINTS SURFACE ROUTING SUMMARY - DEVELOPED CONDITIONS

Design Point (label)	Contributing Basins	Q 2 Yr. Q (cfs)	Q 5 Yr. Q (cfs)	Q 100 Yr. Q (cfs)
DP-20 DEV	CC-1A, OS-12	3.2	14.3	88
DP-21 DEV	CC-2A, OS-13	2.1	10.5	62
DP-22 DEV	CC-2B, Release from DP-21	3.7	16.6	92
DP-23 DEV	CC-3, OS-14	2.5	13.0	84
DP-24 DEV	CC-4C (Pre-Dev.), CC-5	1.9	8.4	45
TOTAL INFLOW TO POND 12 (UD Detention hydrograph)	**CC-4C, CC-5, CC-6**	**6**	**9**	**85**
DP-25 DEV	**Release from FHN Pond 12**	**0.2**	**0.3**	**45**
DP-26 DEV	CC-8, CC-10	3.0	15.9	102
DP-27 DEV	CC-15, CC-20	4.3	17.2	81
DP-28 DEV	CC-13A, OS-15	4.6	19.8	110
DP-29 DEV	CC-13B, CC-13C, Release from DP-28	5.8	26.6	155
DP-30 DEV	CC-18	0.7	2.2	10
DP-31 DEV	CC-19, Release from DP-30	0.9	3.2	15
DP-32 DEV	CC-17, OS-16	2.0	7.8	40
DP-33 DEV	CC-23, CC-24	3.6	14.4	69
DP-34 DEV	CC-26, CC-27, CC-28 and Release from CC-16 & DP-32	6.0	23.5	168

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY EAST CHERRY CREEK	
MAJOR BASIN BOUNDARY	
DESIGN POINT	3
BASIN IDENTIFIER / AREA IN ACRES	BB 10.0
EXISTING DIRECTION OF FLOW	
PROPOSED DIRECTION OF FLOW	
STORM SEWER	
FILING NO. 1 PLAT AREA	

N

200 100 0 200 400

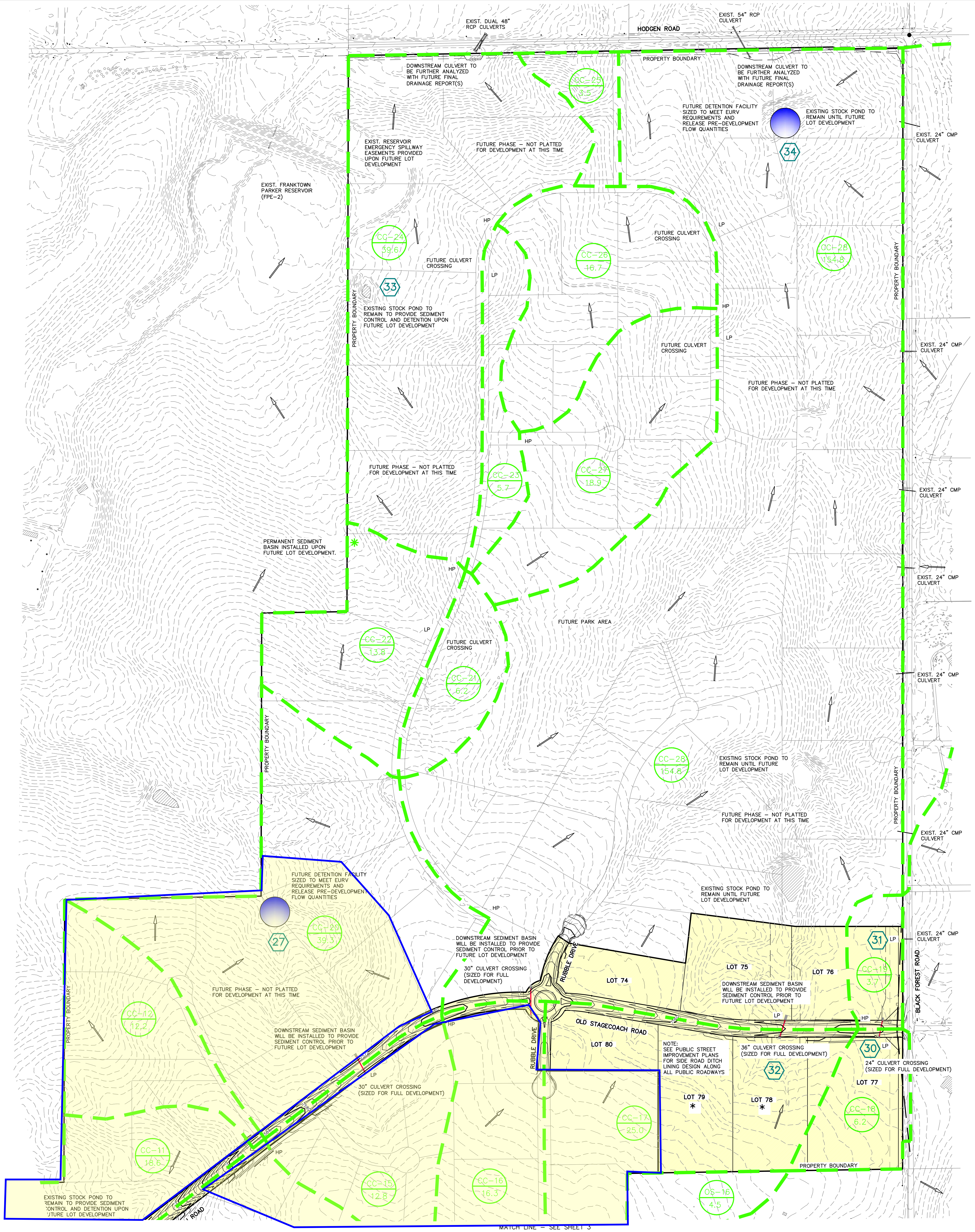
SCALE: 1" = 200'

CLASSIC CONSULTING ENGINEERS & SURVEYORS

619 N. Cascade Avenue, Suite 200
Colorado Springs, Colorado 80903
(719)785-0790
(719)785-0799 (Fax)

FLYING HORSE NORTH
PRELIMINARY/FINAL DRAINAGE REPORT
FILING NO. 1 AND
PRELIMINARY PLAN DRAINAGE MAP

DESIGNED BY	MAW	SCALE	DATE	10-25-17
DRAWN BY	MAW	(H) 1"= 200'	SHEET 3 OF 4	
CHECKED BY		(V) 1"= N/A	JOB NO.	1096.11



BASIN SUMMARY - DEVELOPED CONDITIONS

BASIN (label)	AREA (acres)	COMPOSITE CN	TOTAL LAG TIME (hours)	Q 2 Yr. (cfs)	Q 5 Yr. (cfs)	Q 100 Yr. (cfs)
OS-16	4.50	65.0	0.24	0.4	1.5	7.2
OS-17	15.80	65.0	0.19	1.6	5.9	27.7
OS-18	13.00	65.0	0.20	1.3	4.7	22.6
CC-11	18.60	63.1	0.21	0.9	5.0	28.1
CC-12	12.20	65.0	0.26	1.0	3.9	18.7
CC-13A	19.30	65.0	0.31	1.4	5.4	27.3
CC-13B	25.50	65.0	0.31	1.8	7.2	36.1
CC-13C	9.90	65.0	0.22	0.9	3.4	16.5
CC-13D	18.80	65.0	0.25	1.5	6.2	29.2
CC-14	4.60	65.0	0.21	0.4	1.6	7.8
CC-15	12.80	65.0	0.24	1.1	4.3	20.4
CC-16	16.30	65.0	0.30	1.2	4.6	23.6
CC-17	25.00	65.0	0.35	1.7	6.5	32.8
CC-18	6.20	66.5	0.30	0.7	2.2	9.7
CC-19	3.70	65.0	0.25	0.3	1.2	5.8
CC-20	39.30	65.0	0.25	3.2	12.9	61.0
CC-21	6.20	61.0	0.20	0.1	1.2	8.5
CC-22	13.80	65.0	0.25	1.1	4.5	21.4
CC-23	5.70	64.7	0.33	0.4	1.5	7.7
CC-24	39.60	65.0	0.25	3.3	13.0	61.5
CC-25	3.50	65.0	0.23	0.3	1.2	5.7
CC-26	16.70	65.0	0.26	1.4	5.3	25.6
CC-27	18.90	64.4	0.31	1.2	4.9	25.8
CC-28	154.80	64.4	0.63	6.5	24.7	136.3

DESIGN POINTS SURFACE ROUTING SUMMARY - DEVELOPED CONDITIONS

Design Point (label)	Contributing Basins	Q 2 Yr. Q (cfs)	Q 5 Yr. Q (cfs)	Q 100 Yr. Q (cfs)
DP-27 DEV	CC-15, CC-20	4.3	17.2	81
DP-28 DEV	CC-13A, OS-15	4.6	19.8	110
DP-29 DEV	CC-13B, CC-13C, Release from DP-28	5.8	26.6	155
DP-30 DEV	CC-18	0.7	2.2	10
DP-31 DEV	CC-19, Release from DP-30	0.9	3.2	15
DP-32 DEV	CC-17, OS-16	2.0	7.8	40
DP-33 DEV	CC-23, CC-24	3.6	14.4	69
DP-34 DEV	CC-26, CC-27, CC-28 and Release from CC-16 & DP-32	6.0	23.5	168

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
BASIN BOUNDARY EAST CHERRY CREEK	
MAJOR BASIN BOUNDARY	
BASIN BOUNDARY BLACK SQUIRREL	
DESIGN POINT	3
LOTS WITH NON-STANDARD CULVERT SIZE	*
BASIN IDENTIFIER / AREA IN ACRES	BB 10.0
EXISTING DIRECTION OF FLOW	
PROPOSED DIRECTION OF FLOW	
STORM SEWER	
FILING NO. 1 PLAT AREA	

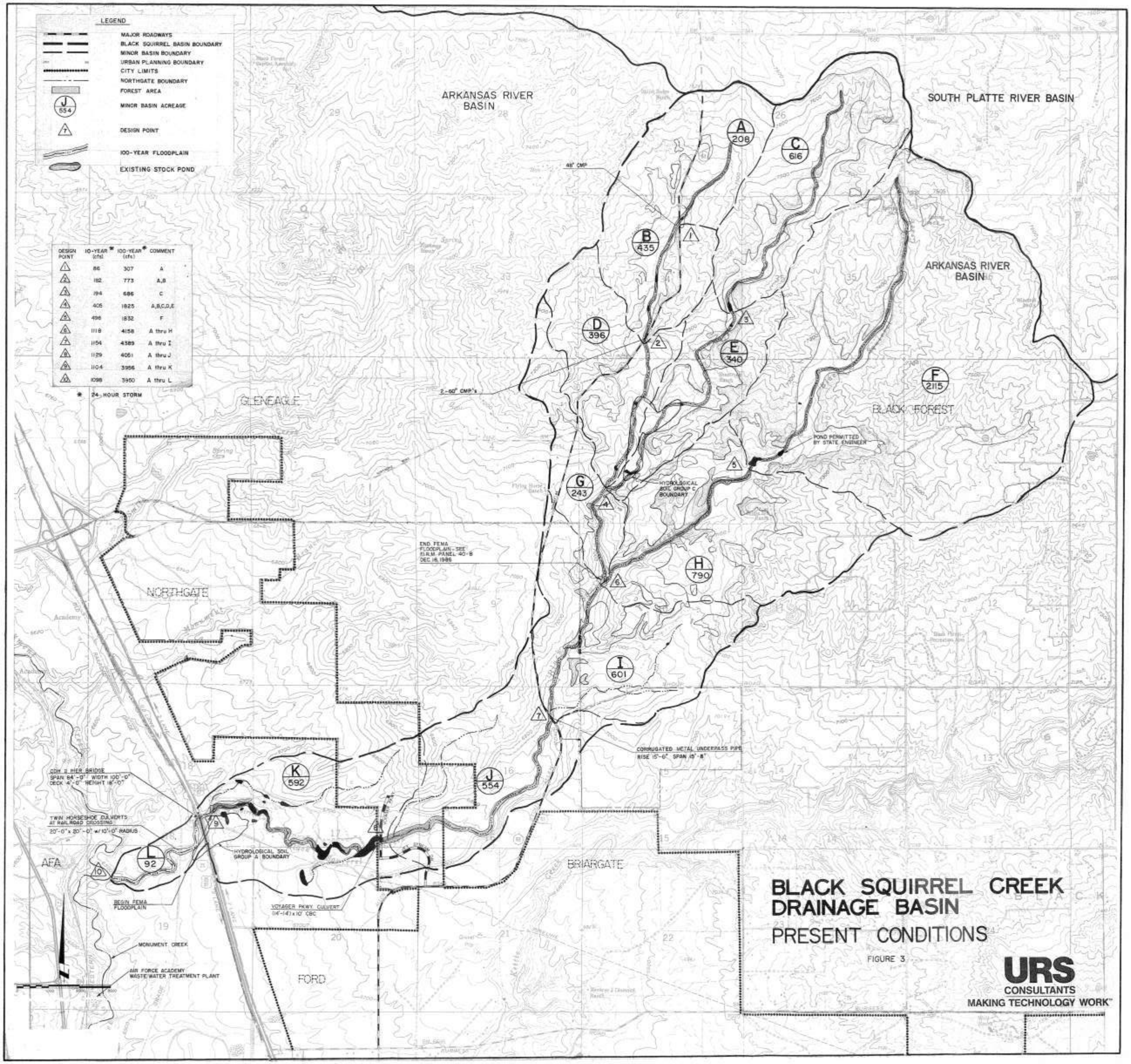
200 100 0 200 400

SCALE: 1" = 200'

CLASSIC CONSULTING ENGINEERS & SURVEYORS
619 N. Cascade Avenue, Suite 200
Colorado Springs, Colorado 80903
(719)785-0790
(719)785-0799 (Fax)

FLYING HORSE NORTH
PRELIMINARY/FINAL DRAINAGE REPORT
FILING NO. 1 AND
PRELIMINARY PLAN DRAINAGE MAP

DESIGNED BY MAW	SCALE	DATE 10-17-17	
DRAWN BY MAW	(H) 1"= 200'	SHEET 4 OF 4	
CHECKED BY	(V) 1"= N/A	JOB NO. 1096.11	



DESIGN POINT	10-YEAR* (cfs)	100-YEAR* (cfs)	COMMENT
1	86	307	A
2	182	773	A,B
3	194	686	C
4	405	1825	A,B,C,D,E
5	496	1832	F
6	1118	4158	A thru H
7	1154	4389	A thru I
8	1129	4051	A thru J
9	1104	3956	A thru K
10	1098	3960	A thru L

* 24 HOUR STORM

BLACK SQUIRREL CREEK DRAINAGE BASIN

PRESENT CONDITIONS

FIGURE 3

HRGreen

HRGREEN.COM

Flying Horse North
Master Development Drainage Plan

March 09, 2022

Revised: July 28, 2022

Revised: September 9th, 2022

HR Green Project No: 211030.01

Prepared For:

Mr. Drew Balsick

Vice President / Project Manager

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g. Applicable Criteria and Standards

Per the DBPS and El Paso County Criteria Manual, flows from the proposed site will be limited to historic flows to maintain the stability of the existing channels within the drainage basins. The master plan follows the Drainage Criteria Manual for El Paso County which refers to the City of Colorado Springs Drainage Criteria Manuals as amended.

II. Project Characteristics

a. Location in Drainage Basin, Offsite Flows, Size

Flying Horse North is located within both the Black Squirrel Drainage Basin and East Cherry Creek Basin. Predominantly, the existing Filing No.1 and part of the proposed Filing No. 2 is located within the Black Squirrel Drainage Basin. This drainage basin encompasses 10.9 square miles of mostly forested area and generally slopes from east to west and outfalls into Monument Creek. Black Squirrel is a sub-basin of the Arkansas River. The remaining filings and part of Filing No. 2 is located within the East Cherry Creek Basin. There is not a current planning study of the drainage basin, but generally it slopes from southwest to northeast. The basin eventually flows into the South Platte River.

As the site generally lies at the top of each of the respective basins, minimal offsite flows are conveyed onto the site. The Black Squirrel Creek Drainage basin has no offsite flow come onto the site sans those flows generated as part of Filing 1 of Flying Horse North. The development which is within the Black Squirrel Creek Drainage Basin is unchanged from the FDR shown in Filing 1.

For the East Cherry Creek basin, 4 drainage basins are conveyed onto the site on the southwestern portion of the basin. These basins are labeled A, C, F and Q. The respective contributing flows from these basins is shown in the table below:

Basin Name	Acreage	5 Year Flow (cfs)	100 Year Flow (cfs)
A	18.99	20.84	43.83
C	36.39	33.36	71.27
F	25.25	24.27	51.63
Q	72.29	64.68	137.80

These four basins are generally conveyed through the development via natural drainage ways. The proposed ponds discussed later within this report have been sized to pass through the offsite flows.

b. Compliance with DBPS

This MDDP is in general conformance with the guidelines outlined in the Black Squirrel DBPS and current drainage flows of the East Cherry Creek Basin. Flying Horse North will construct multiple full spectrum detention facilities to limit the effects of development and mimic natural flow patterns.

Existing downstream infrastructure is currently limited to the historic drainage channels and minimal downstream improvements exist. As such, the site follows the DBPS and restricts offsite flow rates to not exceed historic flow rates. The sites ultimate outfalls will generally be along the same historic tributaries. Although outfall rates will be at or below historic, the cumulative volume of runoff will increase and therefore downstream facilities may see an increase in the duration of flows. This may provide a net benefit to the downstream facilities by providing more water to assist with the sustenance of vegetation however it should be noted that increased volume may expedite potential erosion or channel movement.

c. Site Characteristics

Per the NRCS web soil survey, the site is made up entirely of Type B soils. The ridge line between the Arkansas River and South Platte River Basins creates different soil environments for each. The portion of site that is within the Black Squirrel Drainage Basin, which includes Flying Horse Norse Filing No. 2 and No. 3, are predominately Elbeth sandy loam. The remaining filings are within the East Cherry Creek Basin which consists of Peyton sandy loam and Peyton-Pring complex. See Appendix A for the NRCS soil map.

Current ground cover varies between the two basins as well. Filings No. 2 and 3 are predominantly covered by Ponderosa Pine trees as a part of Black Forest and pasture. The remaining filings are short- to mid-grass prairie grasslands and former farmland which consists of non-native weeds and grasses. This portion of the site has very few, if any, trees and a minimal number of shrubs are found on the site.

d. Major Drainage Ways and Structures

No major drainage ways exist within the development; however, small tertiary tributaries are within the site currently and function to convey flows to unnamed tributaries of the East Cherry Creek and Black Squirrel Creek. Additionally, as part of the Flying Horse North Filing 1 development, a large irrigation pond was built for water storage and flood control. This drains to the north and to the aforementioned unnamed tributary.

Existing minor drainage channels within the site are planned to be maintained to the maximum extent possible within parkways and greenways with the development. These will continue to be used for conveyance of storm drainage flows.

The Franktown Parker Dam (080130) is located near the northwest corner of site. The dam is designated as a jurisdictional dam and has a low hazard class. It is located along East Cherry Creek. See Appendix A for characteristics and location of dam.

e. Existing and proposed land uses

The existing site is open rangeland on the eastern portion of the site and the western site is single family homes on large (~2.5 acre) home site within a heavily forested area. As part of Filing 1, a road was constructed along with facilities to support a golf course. Structures, outside of the homes are scattered throughout the overall development which will either be removed as part of the project or were built as part of Filing 1. The proposed development will consist of estate, low and medium lots, along with a future hotel site and multiple green spaces and small parks. The current land plan assumes approximately 897 dwelling units will be constructed on the site, not including an approximate 225 provided the proposed hotel.

Land Use	MAX DU/AC
Estate Lots (2.5 Acres)	0.32
Estate Lots (5 Acres)	0.2
Low	1.9
Medium	3.0

III. Hydrologic Analysis

a. Major Basins and subbasins

Major Basin Description

- Previous basin study: Black Squirrel Drainage Basin Planning Study
- Per FEMA FIRM 08041C0305G and 08041C0315G (eff. 12/7/2018), Flying Horse North has the East Cherry Creek run through the northwest portion of the site. Currently, FEMA shows a LOMR effective April 4th, 2019 Base Flood Elevations and Zone A. Per the El Paso County Land Development Code Chapter 8 Section 8.4.2.B.1.e.i, the base flood elevations for Zone A will be determined once the platted lots are solidified and are confirmed within 300-ft of the current floodplain designation. Certification of the flood elevations will be via the FEMA CLOMR/LOMR process or Floodplain Certification Letter.
- There is a large irrigation pond that accounts for water storage and water control on the east side of the site.

The site has been divided into several major drainage basins per where each basin is tributary to a full spectrum detention pond facility. These basins and associated sub basins are described in more detail in the next section of this report.

Existing Subbasin Description

The site's flows are split by the major ridgeline of the Arkansas River Basin and South Platte Basin. Within the South Platte Basin, flow is generally carried northeast throughout the site. On the other side of the ridgeline, the Arkansas River Basin flows in a southwest direction. Subbasin IDs with single letters are part of the South Platte Basin and Subbasin IDs with double letters are part of the Arkansas River Basin.

- Subbasin A is located off site and on the southeast corner. The basin drains towards the northwest and towards Subbasin B1. The basin is 18.99 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 20.84 cfs and 43.83 cfs respectively.
- Subbasin B is located north of Subbasin A. The basin drains towards the northwest into a natural drainageway that flows directly to an existing irrigation pond. The basin is 59.74 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 103.48 cfs and 221.28 cfs respectively.
- Subbasin C is located off site and on the southeast corner. The basin drains towards the northwest and towards Subbasin B2. The basin is 36.39 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 33.36 cfs and 71.27 cfs respectively.
- Subbasin D is located north of Subbasin B. The basin drains towards the northwest and towards the existing irrigation pond. The basin is 38.84 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 31.56 cfs and 67.84 cfs respectively.
- Subbasin E is in a central location of the site and includes the existing irrigation pond. The basin drains towards the north and towards existing irrigation pond. The basin is 106.53 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 223.69 cfs and 483.10 cfs respectively.

- Subbasin F is located off site and on the southeast corner. The basin drains towards the northwest and towards Subbasin G. The basin is 25.25 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 24.27 cfs and 51.63 cfs respectively.
- Subbasin G is directly north of Subbasin D and east of Subbasin E. The basin drains towards the northwest and towards Subbasin E with the irrigation pond. The basins consist of the existing golf course. The basin Is 52.19 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 79.17 cfs and 166.51 cfs respectively.
- Subbasin H is located directly downstream of Subbasin E and on the north side of Stagecoach Rd. The basin drains towards the north through a natural drainageway. There are existing lots on the west side of the basin. The basin is 20.63 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 18.59 cfs and 39.78 cfs respectively.
- Subbasin I is located west of Subbasin E and northeast of the major ridgeline between basins. The basin drains towards the northwest and towards an existing culvert. There are existing lots on the west side of the basin. The basin is 31.93 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 34.58 cfs and 72.63 cfs respectively
- Subbasin J is located downstream of Subbasin I. The basin drains towards the northeast to an unnamed tributary of the East Cherry Creek. The basin is 28.47 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 56.31 cfs and 120.46 cfs respectively.
- Subbasin K is located south of proposed section of Stagecoach Rd. The basin drains towards the northwest and into an existing 48" culvert. The basin is 93.15 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 92.05 cfs and 195.43 cfs respectively
- Subbasin L is downstream of Subbasin K and is located on the north side of the proposed section of Stagecoach Rd. The basin drains towards the northwest to a natural drainageway of East Cherry Creek. The basin is 16.39 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 107.58 cfs and 228.73 cfs respectively.
- Subbasin M is located on the east side of the site and between Subbasin N and V1. The basin drains towards the northwest and into an existing 30" culvert. The basin is 13.85 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 11.48 cfs and 24.61 cfs respectively.
- Subbasin N is located south of Subbasin O and north of proposed Stagecoach Rd. The basin drains towards the northwest to a nearby unnamed tributary and eventually East Cherry Creek. The basin is 49.00 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 64.68 cfs and 143.11 cfs respectively.
- Subbasin O is located south of Subbasin P. The basin drains towards the northwest and towards the north. The basin is 24.76 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 22.69 cfs and 48.54 cfs respectively.
- Subbasin P is in the northeast corner of the site and downstream of Subbasin O. The basin drains towards the northeast to an unnamed tributary of East Cherry Creek. The basin is 43.80 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 38.52 cfs and 82.17 cfs respectively.

- Subbasin Q is located off site and on the southeast corner. The basin drains towards the northeast and towards Subbasin R. The basin is 72.29 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 64.68 cfs and 137.80 cfs respectively.
- Subbasin R is located on the east side of site adjacent to Black Forest Rd. The basin drains towards the northeast. The basin is 54.98 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 108.65 cfs and 232.13 cfs respectively.
- Subbasin S is located north of Subbasin Q. The basin drains towards the southeast and overland towards Subbasin R. The basin is 24.36 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 25.99 cfs and 54.65 cfs respectively.
- Subbasin T is located off site and on the southeast corner. The basin drains towards the southeast and towards Black Forest Rd. The basin is 5.24 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 4.04 cfs and 8.68 cfs respectively.
- Subbasin U is located east of subbasin V and is composed of existing 2.5 acre lots. The basin drains offsite towards the southeast and follows historic drainage patterns. The basin is 5.86 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 4.15 cfs and 8.95 cfs respectively.
- Subbasin V is located on the east side of the site in between Subbasin M and U. The basin drains towards the north and towards Subbasin X via culvert. The basin is 38.57 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 29.63 cfs and 63.92 cfs respectively.
- Subbasin W is located north of Subbasin U on the site. The basin drains offsite through an existing 24” CMP culvert. The basin is 3.96 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 3.45 cfs and 7.33 cfs respectively.
- Subbasin X is located on the northeastern corner of the site. The basin drains north towards an unnamed tributary of East Cherry Creek. The basin is 190.88 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 167.76 cfs and 361.56 cfs respectively.
- Subbasins AA and CC are located on the west side of the site along the major ridgeline. Both basins were developed in Filing No. 1 and are included in the analysis to provide a better understanding for the flows draining towards Black Squirrel Creek. The basins drain towards the southwest. The basins are 33.8 acres and 37.15 acres, with a composite impervious value of 10% and 10% and runoff rates for the 5 and 100 year of 38.76 cfs and 80.22 cfs and 6.53 cfs and 13.57 cfs respectively.
- Subbasin BB is located downstream of Subbasin AA. The basin drains towards the southwest and towards Subbasin GG. A section of the area of the basin was developed in Filing No. 1 and consists of 2.5-acre lots. The basin is 37.15 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 40.62 cfs and 84.15 cfs respectively.
- Subbasin DD is located west and downstream of Subbasin EE. The basin drains towards the west. A portion developed in Filing No. 1 consists of the Flying Horse North Golf Course and 2.5-acre lots. The basin is 70.07 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 58.42 cfs and 123.69 cfs respectively.

Proposed Subbasin Description

- Subbasin A is located off site and on the southeast corner. The basin drains towards the northwest and towards Subbasin B1. The basin is 18.99 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 20.84 cfs and 43.83 cfs respectively.
- Subbasin B1 is located north of Subbasin A. The basin drains towards the northwest and towards proposed Detention Pond 11. Current planning documents call for low density dwelling units. The basin is 59.74 acres, with a composite impervious value of 29.83% and runoff rates for the 5 and 100 year of 66.93 cfs and 133.69 cfs respectively.
- Subbasin B2 is located northeast of Subbasin B1. The basin drains towards the northwest and towards the proposed Detention Pond 11. Current planning documents call for low density dwelling units. The basin is 19.99 acres, with a composite impervious value of 24.55% and runoff rates for the 5 and 100 year of 17.99 cfs and 37.14 cfs respectively.
- Subbasin C is located off site and on the southeast corner. The basin drains towards the northwest and towards Subbasin B2. The basin is 36.39 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 35.31 cfs and 75.28 cfs respectively.
- Subbasin D is located north of north of Subbasins B1 and B2. The basin drains towards the northwest and towards Detention Pond 15. Current planning documents call for low density dwelling units. The basin is 40.87 acres, with a composite impervious value of 37.20% and runoff rates for the 5 and 100 year of 61.12 cfs and 117.38 cfs respectively.
- Subbasin E is in a central location of the site and includes the existing irrigation pond. The basin drains towards the north and towards existing irrigation pond. Current planning documents call for two small parking lots. The basin is 106.53 acres, with a composite impervious value of 14.35% and runoff rates for the 5 and 100 year of 74.68 cfs and 157.91 cfs respectively.
- Subbasin F is located off site and on the southeast corner. The basin drains towards the northwest and towards Subbasin G. The basin is 25.25 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 24.27 cfs and 51.63 cfs respectively.
- Subbasin G is directly north of Subbasin D and east of Subbasin E. The basin drains towards the northwest and towards Subbasin E. Current planning documents call for a small amount of low density dwelling units, where most of the basin consist of the existing golf course. The basin is 31.45 acres, with a composite impervious value of 12.48% and runoff rates for the 5 and 100 year of 27.18 cfs and 57.12 cfs respectively.
- Subbasin H is located located directly downstream of Subbasin E and on the north side of Stagecoach Rd. The basin drains towards the north and towards Detention Pond 10. Current planning documents call for medium density dwelling units. There are existing lots on the west side of the basin. The basin is 21.96 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 17.86 cfs and 37.8 cfs respectively.
- Subbasin I is located west of Subbasin E and northeast of the major ridgeline between basins. The basin drains towards the northwest and towards proposed Detention Pond 16. There are existing lots on the west side of the basin. Current planning documents call for a commercial golf club. The basin is 28.99 acres, with a composite impervious value of 34.66% and runoff rates for the 5 and 100 year of 40.37 cfs and 78.06 cfs respectively

- Subbasin J is located downstream of Subbasin I. The basin drains towards the northeast to an unnamed tributary of the East Cherry Creek. Current planning documents do not call for any changes to this basin. The basin is 28.07 acres, with a composite impervious value of 10% and runoff rates for the 5 and 100 year of 24.25 cfs and 51.19 cfs respectively.
- Subbasin K is located south of proposed section of Stagecoach Rd. The basin drains towards the northwest and towards proposed Detention Pond 7. Current planning documents call for high, medium, and low density dwelling units and a few pocket parks. The basin is 114.73 acres, with a composite impervious value of 38.08% and runoff rates for the 5 and 100 year of 200.94 cfs and 382.3 cfs respectively
- Subbasin L is downstream of Subbasin K and is located on the north side of the proposed section of Stagecoach Rd. The basin drains towards the northwest into proposed Detention Pond 8. Current planning documents call for medium density dwelling units. The basin is 15.89 acres, with a composite impervious value of 24.82% and runoff rates for the 5 and 100 year of 15.97 cfs and 32.4 cfs respectively. The pond will discharge at predevelopment rates into an unnamed tributary of the East Cherry Creek via the ponds outlet structure.
- Subbasin M is located on the east side of the site and between Subbasin N and V1. The basin drains towards the northwest and towards proposed Detention Pond 6. Detention Pond 6 outlets into a culvert under proposed Stagecoach Rd. and eventually to Subbasin N. Current planning documents call for medium density dwelling units, potential fitness center, and a park. The basin is 26.83 acres, with a composite impervious value of 33.19% and runoff rates for the 5 and 100 year of 46.54 cfs and 89.08 cfs respectively.
- Subbasin N is located south of Subbasin O and North of proposed Stagecoach Rd. The basin drains towards the northwest towards proposed Detention Pond 5. Detention Pond 5 outlets to a nearby unnamed tributary and eventually East Cherry Creek. Current planning documents call for medium density dwelling units along with a pocket park. The basin is 41.57 acres, with a composite impervious value of 29.60% and runoff rates for the 5 and 100 year of 73.48 cfs and 141.24 cfs respectively.
- Subbasin O is located south of Subbasin P. The basin drains towards the northwest and towards Detention Pond 3. Current planning documents call for medium density dwelling units. The basin is 52.52 acres, with a composite impervious value of 30.10% and runoff rates for the 5 and 100 year of 63.86 cfs and 127.4 cfs respectively. The pond will discharge at predevelopment rates and into Pond 1 via a swale.
- Subbasin P is in the northeast corner of the site and downstream of Subbasin O. The basin drains towards the northeast to proposed Detention Pond 1. Current planning documents call for low density dwelling units. The basin is 43.71 acres, with a composite impervious value of 20.71% and runoff rates for the 5 and 100 year of 40 cfs and 82.83 cfs respectively. The pond will discharge at predevelopment rates into an unnamed tributary of the East Cherry Creek via the ponds outlet structure.
- Subbasin Q is located off site and on the southeast corner. The basin drains towards the northeast and towards Subbasin R. The basin is 72.29 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 64.68 cfs and 137.8 cfs respectively.

- Subbasin R is located on the east side of site adjacent to Black Forest Rd. The basin drains towards the northeast and towards Detention Pond 9. Current planning documents call for low density and 1-acre lots. The basin is 76.38 acres, with a composite impervious value of 21.81% and runoff rates for the 5 and 100 year of 56.59 cfs and 116.06 cfs respectively. The pond will discharge at predevelopment rates into an unnamed tributary of the East Cherry Creek via the ponds outlet structure.
- Subbasin S is located north of Subbasin Q. The basin drains towards the southeast and overland towards Subbasin R. Current planning documents call for low density dwelling units. The basin is 21.67 acres, with a composite impervious value of 40.88% and runoff rates for the 5 and 100 year of 30.83 cfs and 58.96 cfs respectively.
- Subbasin T is located off site and on the southeast corner. The basin drains towards the southeast and towards Black Forest Rd. The basin is 5.24 acres, with a composite impervious value of 2.00% and runoff rates for the 5 and 100 year of 4.04 cfs and 8.68 cfs respectively.
- Subbasin U is located east of subbasin V2 and is composed of existing 2.5 acre lots. The basin drains offsite towards the southeast and follows historic drainage patterns. The basin is 5.86 acres, with a composite impervious value of 2% and runoff rates for the 5 and 100 year of 4.96 cfs and 10.51 cfs respectively.
- Subbasin V1 is located on the east side of the site in between Subbasin M and V2. The basin drains towards the north and towards Subbasin X3 via culvert. Current planning documents call for low density dwelling units. The basin is 11.57 acres, with a composite impervious value of 38.62% and runoff rates for the 5 and 100 year of 13.99 cfs and 27.67 cfs respectively.
- Subbasin V2 is located south of subbasin X3 and proposed Stagecoach Rd. The basin drains towards the north and towards subbasin X3. The flows are directed through a culvert and eventually to Detention Pond 4. There are no proposed dwelling unit for the area, as there are existing 2.5 acre lots that cover the basin. The basin is 15.34 acres, with a composite impervious value of 15.00% and runoff rates for the 5 and 100 year of 16.15 cfs and 33.25 cfs respectively.
- Subbasin W is located on the north side of subbasin U. The basin drains offsite to the southeast. The basin is 3.76 acres, with a composite impervious value of 10.00% and runoff rates for the 5 and 100 year of 3.58 cfs and 7.46 cfs respectively.
- Subbasin X1 is located on the northeastern corner of the site. The basin drains north towards proposed Detention Pond 2. Current planning documents call for low density dwelling units, potential fire station and a pocket park. The basin is 76.38 acres, with a composite impervious value of 29.50% and runoff rates for the 5 and 100 year of 80.91 cfs and 163.27 cfs respectively. The pond will discharge at predevelopment rates into an unnamed tributary of the East Cherry Creek via the ponds outlet structure.
- Subbasin X2 is located south of Subbasin X1 The basin drains towards the northeast towards proposed Detention Pond 4. Current planning documents call for low density dwelling units along with a pocket park. The basin is 36.33 acres, with a composite impervious value of 33.33% and runoff rates for the 5 and 100 year of 41.46 cfs and 82.46 cfs respectively.
- Subbasin X3 is located south of Subbasin X2. The basin drains towards the north and towards Detention Pond 4. Current planning documents call for low density dwelling units and a pocket

The above-mentioned basins are large planning area basins and as drainage reports are developed for the individual developed parcels additional drainage reports and calculations will be required. It is expected that storm drainage infrastructure consisting of inlets, storm sewer and open drainage channels will be constructed as the property develops.

- Although mentioned above, offsite basins include basins A, C, F, and Q. Flow contributing to the site from these basins will be routed through the proposed detention ponds. Flow rates are shown below.

Offsite Flow Summary					
Basin Description	Ultimate Design Point	Basin Area (ac)	Receiving Detention Pond	5 Year Peak Runoff (cfs)	100 Year Peak Runoff (cfs)
A	A	18.99	Pond 11	20.84	43.83
C	C	36.39	Pond 11	33.36	71.27
F	F	25.25	Irr. Pond	24.27	51.63
Q	Q	72.29	Pond 9	64.68	137.80

b. Methodology

Design rainfall was determined utilizing Table 6-2 from the City of Colorado Springs Drainage Criteria Manual to determine the 5-year and 100-year rainfall values for the 1-hour events. The 1-hour rainfall depths are 1.5 and 2.52 in/hr respectively.

Composite percent impervious calculations were completed for each subbasin based on the density of lots and can be found in Appendix B. The El Paso County Drainage Criteria Manual Table 5-1 was used for reference when correlating land use to percent impervious values and located in Appendix F. Impervious values for 5-Acre Lots, 2.5-Acre Lots, Medium Density, Low Density, and Commercial Lots had impervious values of 10%, 15%, 45%, 55% and 75% respectively. The rainfall and percent impervious values were then used as inputs into the Colorado Urban Hydrograph Procedure (CUHP) spreadsheets to determine runoff values for both pre-development and post-development site.

CUHP is an evolution of the Snyder unit hydrograph and is calibrated for use along the Colorado Front Range. 1 Hour rainfall amounts are input into the program to produce a storm hyetograph that is then uses to calculate a storm hydrograph for each basin depending on the subbasins properties including slope, length, shape, impervious area, pervious depression storage area, and various infiltration rates. Tabular hydrographs are then computed and can be used in EPA SWMM. The CUHP results are included within Appendix B.

EPA SWMM was used to determine flow routing via the kinematic wave method. Subbasins were routed to their respective design points and detention ponds for both the developed and predeveloped condition to determine peak runoff amounts for the 5-year and 100-year storm events. Information from these models along with information and calculations performed in the Mile High Flood District BMP spreadsheets was used to determine pond sizing calculations and release rates.

c. Basin Hydrology

A summary of the flows for both the predeveloped and developed cases for each basin, subbasin and Pond are found on next page along with the full computation found in Appendix B.

Existing SWMM Basin Summary				
Basin Description	**Basin Area (ac)**	**% Impervious**	**5 Year Peak Runoff (cfs)**	**100 Year Peak Runoff (cfs)**
A	18.99	2.00	20.84	43.83
B	59.74	2.00	103.48	221.48
C	34.87	2.00	33.36	71.27
D	38.84	2.00	31.56	67.84
E	127.86	2.00	223.69	483.10
F	25.25	2.00	24.27	51.63
G	52.19	2.00	79.17	166.51
H	20.63	2.00	18.59	39.78
I	31.93	2.00	34.58	72.63
J	28.47	2.00	56.31	120.46
K	93.14	2.00	92.05	195.43
L	16.39	2.00	107.58	228.73
M	13.87	2.00	11.48	24.61
N	49.00	2.00	68.16	143.11
O	24.76	2.00	22.69	48.54
P	43.80	2.00	38.52	82.17
Q	72.29	2.00	64.68	137.80
R	54.98	2.00	108.65	232.13
S	24.36	2.00	25.99	48.54
T	5.24	2.00	4.04	8.68
U	5.48	2.00	4.15	8.95
V	38.47	2.00	29.63	63.92
W	3.76	2.00	3.45	7.33
X	190.88	2.00	167.76	361.56
AA	33.49	10.00	38.76	80.22
BB	37.15	10.00	40.62	84.15
CC	6.33	10.00	6.53	13.57
DD	70.06	10.00	58.42	123.69
EE	69.47	10.00	81.16	167.45
FF	17.62	2.00	162.77	340.42
GG	16.35	2.00	14.93	31.99
HH	12.61	2.00	13.01	27.42
II	97.53	2.00	81.77	175.59
JJ	8.72	2.00	9.74	20.50
KK	8.12	2.00	7.51	15.99
LL	6.10	2.00	6.88	14.48

Proposed SWMM Basin and Pond Summary						
Basin Description	Basin Area (ac)	% Impervious	5 Year Peak Runoff (cfs)	100 Year Peak Runoff (cfs)	5 Year Pond Volume (ac-ft)	100 Year Pond Volume (ac-ft)
P	43.71	20.71%	40.00	82.83		
			Pond 1		1.03	1.97
X1	76.38	29.50%	80.91	163.27		
			Pond 2		6.56	8.80
O	52.52	30.10%	63.86	127.40		
			Pond 3		3.79	6.37
X2	36.33	33.33%	41.46	82.46		
X3	61.99	13.53%	47.59	100.73		
V2	15.34	15.00%	16.15	33.25		
V1	11.57	38.62%	13.99	27.67		
			Pond 4		7.21	7.35
N	41.57	29.60%	73.48	141.24		
			Pond 5		1.86	2.55
M	26.83	33.19%	46.54	89.09		
			Pond 6		0.84	0.94
K	114.73	38.03%	200.94	382.30		
			Pond 7		8.38	12.59
L	15.89	24.82%	15.97	32.40		
			Pond 8		1.05	1.09
S	21.67	40.88%	30.83	58.96		
R	56.16	21.81%	56.59	116.06		
Q	72.29	2.00%	64.68	137.80		
			Pond 9		6.28	10.31
H	21.96	10.00%	17.86	37.80		
			Pond 10		0.66	0.94
B2	19.99	24.55%	17.99	37.14		
B1	59.74	29.83%	66.93	133.69		
A	18.99	2.00%	20.84	43.83		
C	36.39	2.00%	35.31	75.28		
			Pond 11		1.94	3.23
J	28.07	10.00%	24.25	51.19		
			Existing Pond 12			
EE2	16.36	75.00%	35.71	63.62		
EE3	6.67	55.00%	10.38	19.93		
			Pond 13		1.33	1.61
II3	23.97	10.0%	28.32	58.65		
II2	23.13	10.0%	28.04	116.62		
II1	50.43	10.0%	34.94	74.39		
			Pond 14		1.06	3.99
D	40.87	37.20%	61.12	117.38		
			Pond 15		1.94	3.23
E	106.53	14.35%	74.68	157.91		

I	26.99	34.66%	40.37	78.06		
			Pond 16		1.40	1.79
JJ	8.9	20.70%	11.49	22.8		
KK	8.4	12.09%	8.14	16.95		
LL	6.2	10.00%	7.36	15.07		
			Pond 17		1.09	1.23
G	31.45	12.48%	37.69	107.75		
			Irrigation Pond			
JJ	8.90	20.70%	11.06	28.04		
LL	6.2	12.09%	5.85	15.68		
KK	8.4	10.00%	5.9	16.72		
			Natural Drainage Way			
DD	69.5	10.0%	42.26	120.76		
EE1	50.87	10.0%	42.6	154.16		
			Existing Flying Horse North Detention Pond 6			
CC	6.33	10.0%	4.74	13.39		
FF	18.1	10.0%	100.02	325.29		
			Existing Flying Horse North Detention Pond 7			
GG	16.35	10.0%	11.25	32.04		
AA	33.8	10.0%	28.57	80.08		
BB	37.15	10.0%	29.52	83.01		
			Existing Flying Horse North Detention Pond 8			
HH	12.7	10.0%	9.86	27.77		
			Natural Drainage Way			
T	5.24	2.00%	2.92	8.56		
U	5.86	10.0%	3.63	10.37		
W	3.76	10.0%	2.6	7.36		
			Natural Drainage Way			

IV. Hydraulic Analysis

a. Major Drainageways

There are no major drainage ways exist within the development; however, small tertiary tributaries are within the site currently and function to convey flows to unnamed tributaries of the East Cherry Creek and Black Squirrel Creek.

V. Environmental Evaluations

a. Significant Existing or Potential Wetland and Riparian Areas Impacts

As part of this work, the developer has engaged Bristlecone Ecology, LLC to perform environmental studies of the site that will be submitted with the planning documents. Major information in the report concerning wetlands concludes that there is a wetland associated with Black Squirrel Creek. Black Squirrel Creek is known to be a jurisdictional stream.

At this time, there are no improvements proposed for Black Squirrel Creek. The minimal impact to the stream will keep the natural habitat intact and the natural function of the Creek as it is to maintain the wetland habitat.

b. Stormwater Quality Considerations and Proposed Practices

As part of the development, full spectrum detention facilities will be installed to provide water quality for the development. The facilities will be designed using El Paso County criteria and provide stormwater quality by slowing the release of stormwater captured by the ponds and allowing solids to settle out. Additionally, when possible, the existing natural drainage ways will be used to convey stormwater to more closely mimic the natural hydrologic and hydraulic cycle. Some of the drainage ways will be used to convey water to the ponds and others will receive water from the ponds and in both scenarios will provide additional water quality benefits.

On site practices for the homes, schools, churches, and other buildings should use means such that impervious areas drain across pervious area to allow for infiltration during the minor events. This would include discharge of the gutters onto landscape areas vs. directly connecting to storm sewer and as discussed above as well using natural ditches and swales where it is logical and makes sense to convey stormwater in lieu of storm sewer piping.

c. Permitting Requirements

When work infringes upon the wetlands or floodplain a 404 Permit will be required. If the work within the waterways is minimal, it will likely be covered under a nationwide 404 permit; it is however possible that an individual permits will be required.

The Colorado Department of Public Health and Environment will require permits for any disturbance that exceed 1 acre of land. Should groundwater be encountered, a dewatering permit will also be required.

El Paso County will require an Erosion and Stormwater Quality Control Permit and any other construction permits required to complete the construction of the site.

Should development occur which effects the floodplain, FEMA will require a permit for work withing the floodplain prior to the commencement of any construction or development within any special flood hazard area (SFHA). If the infrastructure is to be installed within the channel the designer shall route the design through the proper FEMA channels whether that be with a no rise certification or via the CLOMR/LOMR process should a more major improvement within the floodplain be proposed. At this time the project does not propose any direct development within the floodplain however storm infrastructure will discharge into the existing FEMA channel.

d. 4-Step Process

In accordance with the Engineering Criteria Manual I.7.2.A and DCM V2, this site has implemented the four-step process to minimize adverse impacts of urbanization. The four-step process includes reducing runoff volumes, stabilizing drainageways, treating the water quality capture volume, and considering the need for Industrial Commercial BMPs.

Step 1 – Reducing Runoff Volumes: The development of the project site includes a variety of land uses including open and vegetated areas interspersed to help disconnect imperious areas and reduce runoff volumes.

- Pond 2 is located to the east of Pond 1 and and discharges into another unnamed tributary of East Cherry Creek. The pond is planned to store a maximum of 8.8 ac-ft during the 100-year event and have a peak outflow of 74.6 cfs which is slightly below the predevelopment peak outflow of 81.0 cfs. The 5-year storage volume is 6.56 ac-ft with a peak outflow of 27.8 cfs.

- Pond 3 is located on the eastern portion of the site and south of Pond 1. The pond discharges into an unnamed tributary of East Cherry Creek. The pond is planned to store a maximum of 6.37 ac-ft during the 100-year event and have a peak outflow of 46.1 cfs which is slightly below the predevelopment peak outflow of 48.5 cfs. The 5-year storage volume is 3.79 ac-ft with a peak outflow of 22.7 cfs.

- Pond 4 is located near the eastern portion of the site adjacent to Black Forest Rd. The pond discharges into a natural drainage way, which outlets into an unnamed tributary of East Cherry Creek. The pond is planned to store a maximum of 7.35 ac-ft during the 100-year event and have a peak outflow of 198.8 cfs which is slightly below the predevelopment peak flow rate of 231.6 cfs. The 5-year storage volume is 7.12 ac-ft with a peak outflow of 70.6 cfs.

- Pond 5 is located in the northwest portion of the site. The pond discharges natural drainageway, which outlets into an unnamed tributary of East Cherry Creek. The pond is planned to store a maximum of 2.5 ac-ft during the 100-year event and have a peak outflow of 103.1 cfs which is greater than the predevelopment peak outflow of 116.9 cfs. The 5-year storage volume is 1.86 ac-ft with a peak outflow of 39.4 cfs.

- Pond 6 is located near the northwest corner of the site and upstream of Pond 5. The pond discharges into a natural drainageway which outlets into an unnamed tributary of East Cherry Creek. The pond is planned to store a maximum of 2.93 ac-ft during the 100-year event and have a peak outflow of 48.2 cfs which is greater than the predevelopment peak outflow of 47.5 cfs. The 5-year storage volume is 1.77 ac-ft with a peak outflow of 12.2 cfs.

- Pond 7 is located in the central portion of site. The pond discharges into a natural drainageway that eventually outlets to an unnamed tributary of East Cherry Creek. The pond is planned to store a maximum of 12.59 ac-ft during the 100-year event and have a peak outflow of 172.2 cfs which is slightly lower than the predevelopment peak outflow of 191.6 cfs. The 5-year storage volume is 8.38 ac-ft with a peak outflow of 65.4 cfs.

- Pond 8 is located near the central portion of the site and downstream of Pond 7. The pond discharges into an unnamed tributary of East Cherry Creek. The pond is planned to store a maximum of 0.94 ac-ft during the 100-year event and have a peak outflow of 28.9 cfs which lower than the predevelopment peak outflow of 32.7. The 5-year storage volume is 0.84 ac-ft with a peak outflow of 11.4 cfs.

- Pond 9 is located near the southeast corner of the site just and adjacent to Black Forest Road. The pond discharges into a natural drainageway and flows under Black Forest Rd. via culvert. The natural drainageway is southeast of the existing property and eventually drains northeast to East Cherry Creek. The pond is planned to store a maximum of 10.31 ac-ft during the 100-year event and have a peak outflow of 220.7 cfs which is lower than the predevelopment peak outflow of 282.3 cfs. The 5-year storage volume is 6.28 ac-ft with a peak outflow of 94.8 cfs.

- Pond 10 is located on the north central portion of the site and north of Stagecoach Road. The pond discharges into an unnamed tributary of East Cherry Creek. The pond is planned to store a maximum of 0.94 ac-ft during the 100-year event and have a peak outflow of 33.9 cfs which is lower than the predevelopment peak outflow of 39.2 cfs. The 5-year storage volume is 0.68 ac-ft with a peak outflow of 13.6 cfs.

- Pond 11 is located near the central portion of the site. The pond discharges into a natural drainageway which eventually discharges into the Irrigation Pond. The pond is planned to store a maximum of 6.83 ac-ft during the 100-year event and have a peak outflow of 230.0 cfs which is above than the predevelopment peak outflow of 221.3 cfs. The 5-year storage volume is 3.66 ac-ft with a peak outflow of 98.4 cfs.

- Existing Pond 12 is designed in the Classic Homes Filing No. 1 FDR and located near the northwest corner of the site and north of Stagecoach Road. The pond discharges into an unnamed tributary of East Cherry Creek. The pond is planned to have a peak outflow of 45.0 cfs.

- Pond 13 is located central portion of the site and just west of the major ridgeline between the two basins. The pond discharges into a natural drainageway to an existing pond of Filing No. 1, which ultimately outlets to Black Squirrel Creek. The pond is planned to store a maximum of 1.8 ac-ft during the 100-year event and have a peak outflow of 54.2 cfs which lower than the predevelopment peak outflow of 55.0. The 5-year storage volume is 1.3 ac-ft with a peak outflow of 17.2 cfs.

- Pond 14 is located near the southwest corner of the site just east of the Black Squirrel Creek. The pond discharges into a natural drainageway of Black Squirrel Creek. The pond is planned to store a maximum of 3.99 ac-ft during the 100-year event and have a peak outflow of 152.3 cfs which is slightly lower than the predevelopment peak outflow of 173.0 cfs. The 5-year storage volume is 1.06 ac-ft with a peak outflow of 59.0 cfs.

- Pond 15 is near the central portion of the site. The pond discharges into a natural drainageway which eventually discharges into the existing Irrigation Pond. The pond is planned to store a maximum of 3.23 ac-ft during the 100- year event and have a peak outflow of 68.4 cfs which is slightly above the predevelopment peak of 67.8 cfs. The 5-year storage volume is 1.94 ac-ft with a peak outflow of 30.9 cfs.

- Pond 16 is near the central portion of the site. The pond discharges into a culvert and goes under Stagecoach Road, which eventually discharges into an existing drainageway of East Cherry Creek. The pond is planned to store a maximum of 5.40 ac-ft during the 100-year event and have a peak outflow of 63.8 cfs which is slightly below the predevelopment peak of 71.2 cfs. The 5 year storage volume is 4.66 ac-ft with a peak outflow of 24.3 cfs.

- Pond 17 is near near the central portion of the site. The pond discharges into a natural drainageway which eventually discharges into an existing drainageway of Black Squirrel Creek. The pond is planned to store a maximum of 1.23 ac-ft during the 100 year event and have a peak outflow of 49.6 cfs which is slightly below the predevelopment peak of 49.9 cfs. The 5 year storage volume is 1.09 ac-ft with a peak outflow of 16.8 cfs..

- The existing Irrigation Pond is in the central portion of site and just south of existing Stagecoach Road. The pond discharges towards an unnamed tributary of East Cherry Creek. The irrigation pond was design and subsequently built as part of the Filing 1 project. Storage Volumes for the pond assumed different upstream development conditions and therefore the pond will receive a higher volume of water during the storm events however the rate into the pond will be reduced. The irrigation pond will store 35.92 ac-ft during the 100-year event with a peak outflow of 274.73 cfs and the 5 year storage volume is 19.67 ac-ft with a peak outflow of 114.0 cfs.

The site plans propose the construction of 2 culverts in the southwest corner of site that navigates flow under roads to proposed Detention Pond 14. Analyses were completed by flow master and calculations can be found in Appendix E.

- Culvert 1 carries flow from Subbasin II3 to Subbasin II2 in the southwest corner of site. Each of the basins consist of the Flying Horse Golf Course and 2.5-acre estate lots. The culvert is 36" RCP at a 1% slope and designed for the 100-year event. The culvert will have a peak outflow of 58.65 cfs, where the pipe is 72% full.

- Culvert 2 carries flow from Subbasin II2 to Subbasin II1 in the southwest corner of site. Each of the basins consist of the Flying Horse Golf Course and 2.5-acre estate lots. The culvert is 42" RCP at a 2% slope and designed for the 100-year event. The culvert will have a peak outflow of 116.62 cfs, where the pipe is 68% full.

The culverts sizes should be refined in the PDR and FDR. Energy dissipation calcs can also be performed later within the design.

Overall runoff from the site will by and large match or be less than predevelopment peak flows sans those for outfall 5 which is slightly greater than predevelopment flows. The volume of water will increase however as the drainage channels are designs, continuous simulation models will be done to see the effects of prolonged runoff rates. Predevelopment and post development flows for the 5-year and 100-year events are summarized in the following table for the 5 site outfalls.

OUTFALL	Predevelopment		Postdevelopment*	
	5 year	100 year	5 year	100 year
1	320.31	725.59	183.76	705.93
2	145.46	311.00	80.36	242.18
3	167.76	361.56	70.06	271.49
4	346.26	733.92	230.07	646.46
5	24.12	50.88	16.85	45.91

*Values to be refined with Preliminary and Final Drainage Reports for each filing

Basin Description	Park/Open Space	5 Acre	2.5 Acre	Low Density	Med Density	Commercial	Total Impervious	Total Acreage	Composite Percent Impervious	Predominant Soil Group	5 Year C Factor	100 Year C Factor
Impervious Percentage	10%	10%	15%	45%	55%	75%						
P	15.55	14.78	0.00	13.38	0.00	0.00	9.05	43.71	20.71%	B	0.15	0.41
						Pond 1		**43.71**	**20.71%**			
X1	38.32	3.30	0.00	25.66	0.00	9.10	22.53	76.38	29.50%	B	0.24	0.47
						Pond 2		**76.38**	**29.50%**			
O	13.17	0.00	10.72	28.63	0.00	0.00	15.81	52.52	30.10%	B	0.19	0.44
						Pond 3		**52.52**	**30.10%**			
X2	12.11	0.00	0.00	24.22	0.00	0.00	12.11	36.33	33.33%	B	0.19	0.44
X3	38.88	16.85	0.00	6.26	0.00	0.00	8.39	61.99	13.53%	B	0.13	0.40
V2	0.00	0.00	15.34	0.00	0.00	0.00	2.30	15.34	15.00%	B		
V1	2.11	0.00	0.00	9.46	0.00	0.00	4.47	11.57	38.62%	B	0.20	0.45
						Pond 4		**125.23**	**20.85%**			
N	10.44	11.52	0.00	6.77	12.84	0.00	12.30	41.57	29.60%	B	0.19	0.46
						Pond 5		**41.57**	**29.60%**			
M	14.55	0.00	0.00	1.24	6.94	4.10	8.91	26.83	33.19%	B	0.28	0.52
						Pond 6		**26.83**	**33.19%**			
K	26.45	2.93	0.00	61.89	23.46	0.00	43.69	114.73	38.08%	B	0.21	0.47
						Pond 7		**114.73**	**38.08%**			
L	6.93	5.54	0.00	0.00	2.72	0.00	2.74	15.19	18.06%	B	0.15	0.42
						Pond 8		**15.19**	**18.06%**			
S	2.31	0.24	0.00	19.12	0	0.00	8.86	21.67	40.88%	**B**	0.21	0.45
R	26.63	16.11	0.00	21.77	0.00	0.00	14.07	64.51	21.81%	B	0.15	0.41
						Pond 9		**86.18**	**21.81%**			
H	17.65	4.31	0.00	0.00	0.00	0.00	2.20	21.96	10.00%	B	0.12	0.39
						Pond 10		**21.96**	**10.00%**			
B2	7.20	4.48	0.00	8.31	0.00	0.00	4.91	19.99	24.55%	B	0.16	0.42
B1	12.86	13.03	0.00	33.85	0.00	0.00	17.82	59.74	29.83%	B	0.18	0.43
						Pond 11		**79.73**	**28.51%**			
J	28.07	0.00	0.00	0.00	0.00	0.00	2.81	28.07	10.00%	B	0.12	0.39
						Exisiting Pond 12						
I	17.99	0.00	0.00	0.00	0.00	11.00	10.05	28.99	34.66%	B	0.38	0.58
						Pond 16		**57.06**	**22.53%**			
EE2	0.00	0.00	0.00	0.00	0.00	16.36	12.27	16.36	75.00%	B	0.81	0.88
EE3	0.00	0.00	0.00	0.00	6.67	0.00	3.67	6.67	55.00%	B	0.30	0.58
						Pond 13		**23.03**	**69.21%**			
II2	0.00	23.13	0.00	0.00	0.00	0.00	2.31	23.13	10.00%	B	0.12	0.39
II3	0.00	23.97	0.00	0.00	0.00	0.00	2.40	23.97	10.00%	B	0.12	0.39
II1	15.77	34.66	0.00	0.00	0.00	0.00	5.04	50.43	10.00%	B	0.12	0.39
						Pond 14		**97.53**	**10.00%**			
D	4.41	4.70	0.00	31.76	0.00	0.00	15.20	40.87	37.20%	B	0.20	0.44
						Pond 15		**40.87**	**37.20%**			
E	99.63	8.80	0.00	1.72	0.00	6.90	16.79	117.05	14.35%	B	0.16	0.42
G	25.81	3.41	0.00	2.23	0.00	0.00	3.93	31.45	12.48%	B	0.13	0.39
						Irrigation Pond		**148.50**	**13.95%**			
JJ	1.86	4.32	0.00	2.72	0.00	0.00	1.84	8.90	20.70%	B	0.15	0.41
LL	4.39	1.44	0.00	0.37	0.00	0.00	0.75	6.20	12.09%	B	0.13	0.39
						Pond 17		**15.10**	**17.16%**			
KK	5.98	2.42	0.00	0.00	0.00	0.00	0.84	8.40	10.00%	B	0.12	0.39
AA	0.00	33.88	0.00	0.00	0.00	0.00	3.39	33.88	10.00%	B	0.12	0.39
BB	0.00	37.15	0.00	0.00	0.00	0.00	3.72	37.15	10.00%	B	0.12	0.39
CC	0.00	6.33	0.00	0.00	0.00	0.00	0.63	6.33	10.00%	B	0.12	0.39
DD	0.00	69.5	0.00	0.00	0.00	0.00	6.95	69.50	10.00%	B	0.12	0.39
FF	0.00	18.1	0.00	0.00	0.00	0.00	1.81	18.10	10.00%	B	0.12	0.39
GG	0.00	16.35	0.00	0.00	0.00	0.00	1.64	16.35	10.00%	B	0.12	0.39
HH	0.00	12.7	0.00	0.00	0.00	0.00	1.27	12.70	10.00%	B	0.12	0.39

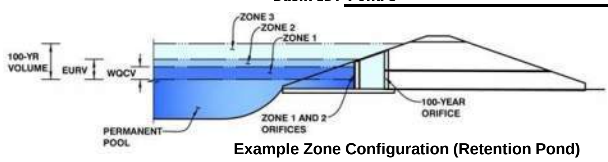
*2% imperviousness for all, and runoff coefficients are .09 and .36 for 5 and 100 yr respectively

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North**

Basin ID: **Pond 5**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.36	0.520	Orifice Plate
Zone 2 (EURV)	3.72	0.741	Circular Orifice
Zone 3 (100-year)	5.96	1.477	Weir&Pipe (Restrict)
Total (all zones)		2.738	

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 =	2.36	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	9.40	inches
Orifice Plate: Orifice Area per Row =	1.77	sq. inches (diameter = 1-1/2 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row =	1.229E-02	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	0.79	1.57					
Orifice Area (sq. inches)	1.77	1.77	1.77					

	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)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	2.38	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	3.59	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	24.00	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	3.14	N/A	ft^2
Vertical Orifice Centroid =	1.00	N/A	feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	6.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	6.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	4.00	N/A	feet
Overflow Weir Slope Length =	6.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	2.41	N/A	
Overflow Grate Open Area w/o Debris =	25.06	N/A	ft^2
Overflow Grate Open Area w/ Debris =	12.53	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 =	1.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	48.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	37.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	10.39	N/A	ft^2
Outlet Orifice Centroid =	1.70	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	60.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.80	feet
Stage at Top of Freeboard =	8.80	feet
Basin Area at Top of Freeboard =	0.94	acres
Basin Volume at Top of Freeboard =	5.10	acre-ft

Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

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) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.520	1.261	1.226	1.996	2.708	3.784	4.596	5.681	7.783
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.226	4.578	2.708	3.784	4.596	8.724	7.783
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	9.0	25.3	37.9	62.0	78.4	99.1	137.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		40.1				116.9	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.22	0.96	0.91	1.49	1.89	2.81	3.30
Peak Inflow Q (cfs) =	N/A	N/A	28.6	69.6	61.5	85.5	103.2	135.8	169.5
Peak Outflow Q (cfs) =	0.2	7.1	3.2	39.4	19.6	45.9	62.2	103.1	114.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.5	0.7	0.8	0.9	0.8
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.9	0.2	1.1	1.7	3.2	3.6
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	45	46	37	42	39	37	28	29
Time to Drain 99% of Inflow Volume (hours) =	**40**	48	49	46	48	47	46	42	43
Maximum Ponding Depth (ft) =	2.36	3.72	3.19	4.68	4.27	4.80	5.06	5.70	5.95
Area at Maximum Ponding Depth (acres) =	0.51	0.59	0.55	0.65	0.62	0.65	0.67	0.71	0.73
Maximum Volume Stored (acre-ft) =	0.522	1.265	0.957	1.858	1.598	1.929	2.108	2.551	2.732

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: *..\SWMM\Outflow hydrographs\Pond6_OutflowHydrograph.xlsx*

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

Time Interval: 5.00 min

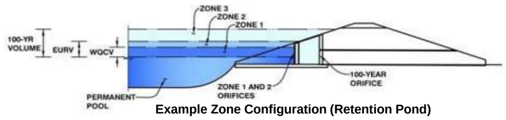
SOURCE	CUHP	CUHP	CUHP	USER	CUHP	CUHP	CUHP	USER	CUHP
TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:10:00	0.00	0.00	0.00	0.27	0.00	0.00	0.22	0.40	0.70
0:15:00	0.00	0.00	1.84	7.09	3.80	2.57	3.17	6.01	4.42
0:20:00	0.00	0.00	6.21	38.48	13.58	6.05	7.03	33.89	13.57
0:25:00	0.00	0.00	20.49	67.67	52.13	20.37	24.85	93.63	52.58
0:30:00	0.00	0.00	28.59	69.63	61.49	78.91	97.73	133.95	154.89
0:35:00	0.00	0.00	24.76	62.10	50.77	85.48	103.19	135.78	169.46
0:40:00	0.00	0.00	20.16	54.00	40.35	77.39	92.60	124.29	148.88
0:45:00	0.00	0.00	14.94	46.63	31.22	62.69	74.92	110.29	125.63
0:50:00	0.00	0.00	11.44	40.64	24.29	51.40	61.39	95.61	102.47
0:55:00	0.00	0.00	9.23	36.18	19.62	39.56	47.65	83.59	83.62
1:00:00	0.00	0.00	7.39	32.69	15.61	30.99	37.59	75.22	69.81
1:05:00	0.00	0.00	5.81	29.50	12.14	24.16	29.44	65.17	58.06
1:10:00	0.00	0.00	4.00	26.06	10.35	16.01	19.65	53.50	38.75
1:15:00	0.00	0.00	3.01	22.56	9.76	11.60	14.65	42.49	27.91
1:20:00	0.00	0.00	2.54	20.01	8.24	8.40	10.62	32.94	18.76
1:25:00	0.00	0.00	2.28	18.54	6.59	6.53	8.22	26.39	12.92
1:30:00	0.00	0.00	2.14	17.63	5.51	4.92	6.21	22.26	9.46
1:35:00	0.00	0.00	2.04	16.51	4.77	3.94	4.98	19.57	7.13
1:40:00	0.00	0.00	1.96	14.95	4.30	3.32	4.19	17.72	5.64
1:45:00	0.00	0.00	1.92	13.73	3.97	2.92	3.68	16.45	4.78
1:50:00	0.00	0.00	1.90	12.82	3.73	2.73	3.44	15.55	4.51
1:55:00	0.00	0.00	1.59	12.02	3.37	2.61	3.29	14.99	4.39
2:00:00	0.00	0.00	1.38	1.90	2.81	2.56	3.23	13.30	4.39
2:05:00	0.00	0.00	0.92	1.25	1.86	1.68	2.12	9.94	2.89
2:10:00	0.00	0.00	0.60	0.80	1.20	1.10	1.38	7.23	1.87
2:15:00	0.00	0.00	0.39	0.49	0.76	0.70	0.88	5.23	1.18
2:20:00	0.00	0.00	0.24	0.30	0.46	0.43	0.53	3.73	0.71
2:25:00	0.00	0.00	0.14	0.19	0.27	0.26	0.32	2.62	0.42
2:30:00	0.00	0.00	0.07	0.10	0.13	0.14	0.16	1.85	0.21
2:35:00	0.00	0.00	0.03	0.04	0.04	0.05	0.06	1.26	0.07
2:40:00	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.81	0.00
2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.00
2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00
2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00
3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North Master Drainage Plan**

Basin ID: **Pond 6**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	26.83	acres
Watershed Length =	1,140	ft
Watershed Length to Centroid =	570	ft
Watershed Slope =	0.039	ft/ft
Watershed Imperviousness =	33.19%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.360	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.921	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.903	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.424	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.899	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	2.602	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	3.143	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	3.855	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	5.243	acre-feet		inches
Approximate 2-yr Detention Volume =	0.666	acre-feet		
Approximate 5-yr Detention Volume =	0.945	acre-feet		
Approximate 10-yr Detention Volume =	1.349	acre-feet		
Approximate 25-yr Detention Volume =	1.543	acre-feet		
Approximate 50-yr Detention Volume =	1.623	acre-feet		
Approximate 100-yr Detention Volume =	1.899	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.360	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.561	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.978	acre-feet
Total Detention Basin Volume =	1.899	acre-feet
Initial Surcharge Volume (ISV) =	47	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	6.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.004	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	2	

Initial Surcharge Area (A_{ISV}) =	143	ft^2
Surcharge Volume Length (L_{ISV}) =	11.9	ft
Surcharge Volume Width (W_{ISV}) =	11.9	ft
Depth of Basin Floor (H_{FLOOR}) =	0.56	ft
Length of Basin Floor (L_{FLOOR}) =	154.2	ft
Width of Basin Floor (W_{FLOOR}) =	81.9	ft
Area of Basin Floor (A_{FLOOR}) =	12,634	ft^2
Volume of Basin Floor (V_{FLOOR}) =	2,636	ft^3
Depth of Main Basin (H_{MAIN}) =	4.61	ft
Length of Main Basin (L_{MAIN}) =	191.1	ft
Width of Main Basin (W_{MAIN}) =	118.8	ft
Area of Main Basin (A_{MAIN}) =	22,702	ft^2
Volume of Main Basin (V_{MAIN}) =	80,325	ft^3
Calculated Total Basin Volume (V_{total}) =	**1.907**	acre-feet

Depth Increment = 0.10 ft

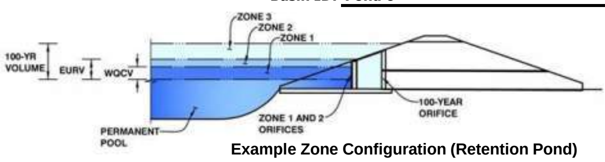
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	0.00		11.9	11.9	143		0.003		
ISV	0.33		11.9	11.9	143		0.003	47	0.001
	0.40		11.9	11.9	143		0.003	57	0.001
	0.50		11.9	11.9	143		0.003	71	0.002
	0.60		11.9	11.9	143		0.003	86	0.002
	0.70		11.9	11.9	143		0.003	100	0.002
	0.80		11.9	11.9	143		0.003	114	0.003
	0.90		29.7	20.7	615		0.014	143	0.003
	1.00		55.1	33.2	1,830		0.042	260	0.006
	1.10		80.5	45.7	3,679		0.084	530	0.012
	1.20		105.9	58.2	6,164		0.142	1,017	0.023
	1.30		131.3	70.7	9,283		0.213	1,784	0.041
Floor	1.39		154.2	81.9	12,634		0.290	2,766	0.064
	1.40		154.3	82.0	12,653		0.290	2,893	0.066
	1.50		155.1	82.8	12,842		0.295	4,168	0.096
	1.60		155.9	83.6	13,033		0.299	5,461	0.125
	1.70		156.7	84.4	13,226		0.304	6,774	0.156
	1.80		157.5	85.2	13,419		0.308	8,107	0.186
	1.90		158.3	86.0	13,614		0.313	9,458	0.217
	2.00		159.1	86.8	13,810		0.317	10,829	0.249
	2.10		159.9	87.6	14,007		0.322	12,220	0.281
	2.20		160.7	88.4	14,206		0.326	13,631	0.313
	2.30		161.5	89.2	14,406		0.331	15,062	0.346
Zone 1 (WQCV)	2.35		161.9	89.6	14,506		0.333	15,784	0.362
	2.40		162.3	90.0	14,607		0.335	16,512	0.379
	2.50		163.1	90.8	14,810		0.340	17,983	0.413
	2.60		163.9	91.6	15,013		0.345	19,474	0.447
	2.70		164.7	92.4	15,218		0.349	20,986	0.482
	2.80		165.5	93.2	15,425		0.354	22,518	0.517
	2.90		166.3	94.0	15,632		0.359	24,071	0.553
	3.00		167.1	94.8	15,841		0.364	25,644	0.589
	3.10		167.9	95.6	16,051		0.368	27,239	0.625
	3.20		168.7	96.4	16,263		0.373	28,855	0.662
	3.30		169.5	97.2	16,475		0.378	30,492	0.700
	3.40		170.3	98.0	16,689		0.383	32,150	0.738
	3.50		171.1	98.8	16,905		0.388	33,829	0.777
	3.60		171.9	99.6	17,121		0.393	35,531	0.816
	3.70		172.7	100.4	17,339		0.398	37,254	0.855
	3.80		173.5	101.2	17,558		0.403	38,999	0.895
Zone 2 (EURV)	3.87		174.0	101.8	17,712		0.407	40,233	0.924
	3.90		174.3	102.0	17,778		0.408	40,765	0.936
	4.00		175.1	102.8	18,000		0.413	42,554	0.977
	4.10		175.9	103.6	18,223		0.418	44,365	1.018
	4.20		176.7	104.4	18,447		0.423	46,199	1.061
	4.30		177.5	105.2	18,673		0.429	48,055	1.103
	4.40		178.3	106.0	18,900		0.434	49,934	1.146
	4.50		179.1	106.8	19,128		0.439	51,835	1.190
	4.60		179.9	107.6	19,357		0.444	53,759	1.234
	4.70		180.7	108.4	19,588		0.450	55,706	1.279
	4.80		181.5	109.2	19,820		0.455	57,677	1.324
	4.90		182.3	110.0	20,053		0.460	59,670	1.370
	5.00		183.1	110.8	20,287		0.466	61,687	1.416
	5.10		183.9	111.6	20,523		0.471	63,728	1.463
	5.20		184.7	112.4	20,760		0.477	65,792	1.510
	5.30		185.5	113.2	20,998		0.482	67,880	1.558
	5.40		186.3	114.0	21,238		0.488	69,992	1.607
	5.50		187.1	114.8	21,479		0.493	72,127	1.656
	5.60		187.9	115.6	21,721		0.499	74,287	1.705
	5.70		188.7	116.4	21,964		0.504	76,472	1.756
	5.80		189.5	117.2	22,209		0.510	78,680	1.806
	5.90		190.3	118.0	22,455		0.515	80,914	1.858
Zone 3 (100-year)	5.98		190.9	118.7	22,653		0.520	82,718	1.899
	6.00		191.1	118.8	22,702		0.521	83,171	1.909
	6.10		191.9	119.6	22,951		0.527	85,454	1.962
	6.20		192.7	120.4	23,201		0.533	87,762	2.015
	6.30		193.5	121.2	23,452		0.538	90,094	2.068
	6.40		194.3	122.0	23,704		0.544	92,452	2.122
	6.50		195.1	122.8	23,958		0.550	94,835	2.177
	6.60		195.9	123.6	24,213		0.556	97,244	2.232
	6.70		196.7	124.4	24,469		0.562	99,678	2.288
	6.80		197.5	125.2	24,727		0.568	102,137	2.345
	6.90		198.3	126.0	24,985		0.574	104,623	2.402
	7.00		199.1	126.8	25,245		0.580	107,135	2.459
	7.10		199.9	127.6	25,507		0.586	109,672	2.518
	7.20		200.7	128.4	25,769		0.592	112,236	2.577
	7.30		201.5	129.2	26,033		0.598	114,826	2.636
	7.40		202.3	130.0	26,298		0.604	117,443	2.696
	7.50		203.1	130.8	26,565		0.610	120,086	2.757
	7.60		203.9	131.6	26,833		0.616	122,756	2.818
	7.70		204.7	132.4	27,102		0.622	125,452	2.880
	7.80		205.5	133.2	27,372		0.628	128,176	2.943
	7.90		206.3	134.0	27,644		0.635	130,927	3.006
	8.00		207.1	134.8	27,916		0.641	133,705	3.069
	8.10		207.9	135.6	28,191		0.647	136,510	3.134
	8.20		208.7	136.4	28,466		0.653	139,343	3.199
	8.30		209.5	137.2	28,743		0.660	142,203	3.265
	8.40		210.3	138.0	29,021		0.666	145,092	3.331
	8.50		211.1	138.8	29,300		0.673	148,008	3.398
	8.60		211.9	139.6	29,581		0.679	150,952	3.465
	8.70		212.7	140.4	29,862		0.686	153,924	3.534
	8.80		213.5	141.2	30,145		0.692	156,924	3.602
	8.90		214.3	142.0	30,430		0.699	159,953	3.672
	9.00		215.1	142.8	30,715		0.705	163,010	3.742
	9.10		215.9	143.6	31,002		0.712	166,096	3.813
	9.20		216.7	144.4	31,291		0.718	169,211	3.885
	9.30		217.5	145.2	31,580		0.725	172,354	3.957
	9.40		218.3	146.0	31,871		0.732	175,527	4.030
	9.50		219.1	146.8	32,163		0.738	178,728	4.103
	9.60		219.9	147.6	32,456		0.745	181,959	4.177

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: Flying Horse North Master Drainage Plan

Basin ID: Pond 6



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.35	0.360	Orifice Plate
Zone 2 (EURV)	3.87	0.561	Circular Orifice
Zone 3 (100-year)	5.98	0.978	Weir&Pipe (Restrict)
Total (all zones)		1.899	

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 =	2.35	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	9.40	inches
Orifice Plate: Orifice Area per Row =	1.27	sq. inches (diameter = 1-1/4 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row =	8.819E-03	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	0.78	1.57					
Orifice Area (sq. inches)	1.27	1.27	1.27					

	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)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	2.35	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	3.87	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	12.00	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.79	N/A	ft^2
Vertical Orifice Centroid =	0.50	N/A	feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.20	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	1.50	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	1.50	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	4.20	N/A	feet
Overflow Weir Slope Length =	1.50	N/A	feet
Grate Open Area / 100-yr Orifice Area =	0.39	N/A	
Overflow Grate Open Area w/o Debris =	1.57	N/A	ft^2
Overflow Grate Open Area w/ Debris =	0.78	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 =	1.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	30.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	23.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	4.04	N/A	ft^2
Outlet Orifice Centroid =	1.05	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.13	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.30	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	29.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.93	feet
Stage at Top of Freeboard =	9.23	feet
Basin Area at Top of Freeboard =	0.72	acres
Basin Volume at Top of Freeboard =	3.91	acre-ft

Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

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) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.360	0.921	0.903	1.424	1.899	2.602	3.143	3.855	5.243
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.903	3.107	1.899	2.602	3.143	5.635	5.243
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	4.3	11.6	17.2	30.3	37.9	47.5	65.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.16	0.43	0.64	1.13	1.41	1.77	2.46
Peak Inflow Q (cfs) =	N/A	N/A	16.5	44.8	34.4	47.7	57.5	86.7	93.4
Peak Outflow Q (cfs) =	0.2	4.0	2.5	12.2	8.0	12.1	13.9	48.2	49.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.5	0.4	0.4	1.0	0.7
Structure Controlling Flow =	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	3.5	1.7	3.4	4.2	5.4	5.4
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	44	46	38	43	40	38	30	31
Time to Drain 99% of Inflow Volume (hours) =	**40**	48	49	47	48	48	47	44	44
Maximum Ponding Depth (ft) =	2.35	3.87	3.27	5.74	4.66	5.68	6.36	7.79	7.79
Area at Maximum Ponding Depth (acres) =	0.33	0.41	0.38	0.51	0.45	0.50	0.54	0.63	0.63
Maximum Volume Stored (acre-ft) =	0.362	0.924	0.685	1.776	1.261	1.745	2.101	2.930	2.936

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: *..\SWMM\Outflow hydrographs\Pond6_OutflowHydrograph.xlsx*

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

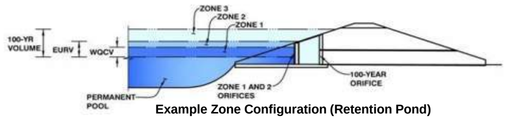
	SOURCE	CUHP	CUHP	CUHP	USER	CUHP	CUHP	CUHP	USER	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.09	0.00
	0:10:00	0.00	0.00	0.00	1.28	0.00	0.00	0.13	1.42	0.41
	0:15:00	0.00	0.00	1.10	9.19	2.27	1.53	1.91	7.77	2.68
	0:20:00	0.00	0.00	3.88	32.51	7.65	3.83	4.46	29.44	7.72
	0:25:00	0.00	0.00	11.46	44.81	27.18	11.35	13.73	68.64	27.37
	0:30:00	0.00	0.00	16.45	43.32	34.42	40.25	49.45	86.70	78.42
	0:35:00	0.00	0.00	15.52	38.43	31.05	47.72	57.47	84.90	93.38
	0:40:00	0.00	0.00	13.51	33.50	26.49	46.00	54.93	77.48	88.14
	0:45:00	0.00	0.00	11.12	29.15	22.63	40.10	47.88	68.88	79.41
	0:50:00	0.00	0.00	9.18	25.51	18.68	35.67	42.56	59.79	70.00
	0:55:00	0.00	0.00	7.60	22.86	15.52	29.20	34.93	52.73	59.52
	1:00:00	0.00	0.00	6.52	20.78	13.55	24.05	28.95	47.77	51.66
	1:05:00	0.00	0.00	5.79	18.84	12.11	20.68	25.05	40.76	46.51
	1:10:00	0.00	0.00	4.81	16.55	10.75	16.99	20.66	33.68	37.61
	1:15:00	0.00	0.00	3.90	14.19	9.44	13.77	16.83	26.52	29.85
	1:20:00	0.00	0.00	3.08	12.64	7.58	10.57	12.86	20.51	21.91
	1:25:00	0.00	0.00	2.40	11.79	5.80	7.81	9.45	16.51	15.33
	1:30:00	0.00	0.00	2.00	11.26	4.76	5.55	6.78	14.04	10.88
	1:35:00	0.00	0.00	1.82	10.33	4.13	4.22	5.21	12.41	8.22
	1:40:00	0.00	0.00	1.74	9.38	3.70	3.41	4.23	11.29	6.50
	1:45:00	0.00	0.00	1.68	8.67	3.39	2.88	3.58	10.51	5.31
	1:50:00	0.00	0.00	1.64	8.14	3.18	2.53	3.16	9.96	4.49
	1:55:00	0.00	0.00	1.43	7.59	2.90	2.31	2.88	9.61	3.90
	2:00:00	0.00	0.00	1.25	6.09	2.51	2.16	2.68	7.83	3.53
	2:05:00	0.00	0.00	0.94	4.45	1.84	1.59	1.97	5.73	2.57
	2:10:00	0.00	0.00	0.69	3.20	1.32	1.15	1.42	4.16	1.84
	2:15:00	0.00	0.00	0.51	2.27	0.94	0.82	1.02	3.00	1.33
	2:20:00	0.00	0.00	0.37	1.57	0.68	0.59	0.73	2.12	0.96
	2:25:00	0.00	0.00	0.26	1.08	0.48	0.41	0.51	1.48	0.67
	2:30:00	0.00	0.00	0.18	0.73	0.33	0.29	0.36	1.02	0.47
	2:35:00	0.00	0.00	0.12	0.48	0.22	0.20	0.25	0.66	0.32
	2:40:00	0.00	0.00	0.08	0.28	0.14	0.13	0.16	0.39	0.20
	2:45:00	0.00	0.00	0.04	0.15	0.07	0.07	0.09	0.20	0.11
	2:50:00	0.00	0.00	0.02	0.07	0.03	0.03	0.04	0.09	0.04
	2:55:00	0.00	0.00	0.01	0.02	0.01	0.01	0.01	0.03	0.01
	3:00:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: Flying Horse North Master Drainage Plan

Basin ID: Pond 7



Example Zone Configuration (Retention Pond)

Watershed Information

Parameter	Value	Unit	Optional User Overrides	Unit
Selected BMP Type =	**EDB**			
Watershed Area =	114.73	acres		
Watershed Length =	1,683	ft		
Watershed Length to Centroid =	1,362	ft		
Watershed Slope =	0.040	ft/ft		
Watershed Imperviousness =	38.80%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	100.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Target WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			

Note: L / W Ratio < 1

L / W Ratio = 0.57

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

Parameter	Value	Unit	Optional User Overrides	Unit
Water Quality Capture Volume (WQCV) =	1.689	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	4.663	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	4.575	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	6.891	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	8.978	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	11.989	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	14.328	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	17.379	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	23.422	acre-feet		inches
Approximate 2-yr Detention Volume =	3.427	acre-feet		
Approximate 5-yr Detention Volume =	4.799	acre-feet		
Approximate 10-yr Detention Volume =	6.641	acre-feet		
Approximate 25-yr Detention Volume =	7.450	acre-feet		
Approximate 50-yr Detention Volume =	7.822	acre-feet		
Approximate 100-yr Detention Volume =	8.992	acre-feet		

Define Zones and Basin Geometry

Parameter	Value	Unit
Zone 1 Volume (WQCV) =	1.689	acre-feet
Zone 2 Volume (EURV - Zone 1) =	2.974	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	4.329	acre-feet
Total Detention Basin Volume =	8.992	acre-feet
Initial Surcharge Volume (ISV) =	221	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	6.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.004	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	2	
Initial Surcharge Area (A_{ISV}) =	669	ft^2
Surcharge Volume Length (L_{ISV}) =	25.9	ft
Surcharge Volume Width (W_{ISV}) =	25.9	ft
Depth of Basin Floor (H_{FLOOR}) =	1.48	ft
Length of Basin Floor (L_{FLOOR}) =	401.8	ft
Width of Basin Floor (W_{FLOOR}) =	210.9	ft
Area of Basin Floor (A_{FLOOR}) =	84,720	ft^2
Volume of Basin Floor (V_{FLOOR}) =	45,839	ft^3
Depth of Main Basin (H_{MAIN}) =	3.69	ft
Length of Main Basin (L_{MAIN}) =	431.3	ft
Width of Main Basin (W_{MAIN}) =	240.4	ft
Area of Main Basin (A_{MAIN}) =	103,677	ft^2
Volume of Main Basin (V_{MAIN}) =	347,004	ft^3
Calculated Total Basin Volume (V_{total}) =	**9.031**	acre-feet

Depth Increment = 0.10 ft

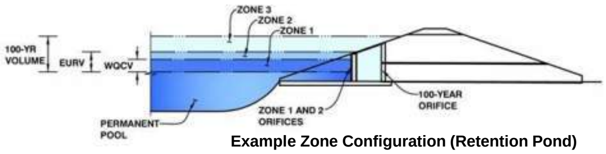
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	0.00		25.9	25.9	669		0.015		
ISV	0.33		25.9	25.9	669		0.015	221	0.005
	0.40		25.9	25.9	669		0.015	268	0.006
	0.50		25.9	25.9	669		0.015	334	0.008
	0.60		25.9	25.9	669		0.015	401	0.009
	0.70		25.9	25.9	669		0.015	468	0.011
	0.80		25.9	25.9	669		0.015	535	0.012
	0.90		43.6	34.6	1,510		0.035	630	0.014
	1.00		69.0	47.1	3,253		0.075	862	0.020
	1.10		94.4	59.6	5,630		0.129	1,301	0.030
	1.20		119.8	72.1	8,642		0.198	2,010	0.046
	1.30		145.2	84.6	12,289		0.282	3,051	0.070
	1.40		170.6	97.1	16,571		0.380	4,489	0.103
	1.50		196.0	109.6	21,488		0.493	6,386	0.147
	1.60		221.4	122.1	27,040		0.621	8,807	0.202
	1.70		246.8	134.6	33,228		0.763	11,815	0.271
	1.80		272.2	147.1	40,050		0.919	15,474	0.355
	1.90		297.6	159.6	47,507		1.091	19,847	0.456
	2.00		323.0	172.1	55,599		1.276	24,997	0.574
	2.10		348.4	184.6	64,326		1.477	30,988	0.711
	2.20		373.8	197.1	73,688		1.692	37,883	0.870
	2.30		399.2	209.6	83,685		1.921	45,746	1.050
Floor	2.31		401.8	210.9	84,720		1.945	46,588	1.070
	2.40		402.5	211.6	85,162		1.955	54,233	1.245
	2.50		403.3	212.4	85,654		1.966	62,774	1.441
	2.60		404.1	213.2	86,147		1.978	71,364	1.638
Zone 1 (WQCV)	2.63		404.3	213.4	86,295		1.981	73,950	1.698
	2.70		404.9	214.0	86,641		1.989	80,003	1.837
	2.80		405.7	214.8	87,137		2.000	88,692	2.036
	2.90		406.5	215.6	87,634		2.012	97,431	2.237
	3.00		407.3	216.4	88,132		2.023	106,219	2.438
	3.10		408.1	217.2	88,632		2.035	115,057	2.641
	3.20		408.9	218.0	89,133		2.046	123,945	2.845
	3.30		409.7	218.8	89,635		2.058	132,884	3.051
	3.40		410.5	219.6	90,138		2.069	141,872	3.257
	3.50		411.3	220.4	90,643		2.081	150,911	3.464
	3.60		412.1	221.2	91,149		2.092	160,001	3.673
	3.70		412.9	222.0	91,656		2.104	169,141	3.883
	3.80		413.7	222.8	92,165		2.116	178,332	4.094
	3.90		414.5	223.6	92,675		2.128	187,574	4.306
	4.00		415.3	224.4	93,186		2.139	196,867	4.519
Zone 2 (EURV)	4.07		415.9	224.9	93,544		2.147	203,403	4.669
	4.10		416.1	225.2	93,698		2.151	206,211	4.734
	4.20		416.9	226.0	94,212		2.163	215,607	4.950
	4.30		417.7	226.8	94,727		2.175	225,054	5.167
	4.40		418.5	227.6	95,243		2.186	234,552	5.385
	4.50		419.3	228.4	95,760		2.198	244,103	5.604
	4.60		420.1	229.2	96,279		2.210	253,705	5.824
	4.70		420.9	230.0	96,799		2.222	263,358	6.046
	4.80		421.7	230.8	97,321		2.234	273,064	6.269
	4.90		422.5	231.6	97,843		2.246	282,823	6.493
	5.00		423.3	232.4	98,367		2.258	292,633	6.718
	5.10		424.1	233.2	98,892		2.270	302,496	6.944
	5.20		424.9	234.0	99,419		2.282	312,412	7.172
	5.30		425.7	234.8	99,947		2.294	322,380	7.401
	5.40		426.5	235.6	100,476		2.307	332,401	7.631
	5.50		427.3	236.4	101,006		2.319	342,475	7.862
	5.60		428.1	237.2	101,538		2.331	352,602	8.095
	5.70		428.9	238.0	102,070		2.343	362,783	8.328
	5.80		429.7	238.8	102,605		2.355	373,016	8.563
	5.90		430.5	239.6	103,140		2.368	383,304	8.799
Zone 3 (100-year)	5.99		431.2	240.3	103,623		2.379	392,608	9.013
	6.00		431.3	240.4	103,677		2.380	393,644	9.037
	6.10		432.1	241.2	104,215		2.392	404,039	9.275
	6.20		432.9	242.0	104,754		2.405	414,487	9.515
	6.30		433.7	242.8	105,294		2.417	424,990	9.756
	6.40		434.5	243.6	105,836		2.430	435,546	9.999
	6.50		435.3	244.4	106,379		2.442	446,157	10.242
	6.60		436.1	245.2	106,924		2.455	456,822	10.487
	6.70		436.9	246.0	107,469		2.467	467,542	10.733
	6.80		437.7	246.8	108,016		2.480	478,316	10.981
	6.90		438.5	247.6	108,565		2.492	489,145	11.229
	7.00		439.3	248.4	109,114		2.505	500,029	11.479
	7.10		440.1	249.2	109,665		2.518	510,968	11.730
	7.20		440.9	250.0	110,217		2.530	521,962	11.983
	7.30		441.7	250.8	110,770		2.543	533,012	12.236
	7.40		442.5	251.6	111,325		2.556	544,116	12.491
	7.50		443.3	252.4	111,881		2.568	555,277	12.747
	7.60		444.1	253.2	112,438		2.581	566,493	13.005
	7.70		444.9	254.0	112,997		2.594	577,764	13.264
	7.80		445.7	254.8	113,556		2.607	589,092	13.524
	7.90		446.5	255.6	114,117		2.620	600,476	13.785
	8.00		447.3	256.4	114,680		2.633	611,915	14.048
	8.10		448.1	257.2	115,243		2.646	623,411	14.312
	8.20		448.9	258.0	115,808		2.659	634,964	14.577
	8.30		449.7	258.8	116,374		2.672	646,573	14.843
	8.40		450.5	259.6	116,942		2.685	658,239	15.111
	8.50		451.3	260.4	117,510		2.698	669,962	15.380
	8.60		452.1	261.2	118,080		2.711	681,741	15.651
	8.70		452.9	262.0	118,652		2.724	693,578	15.922
	8.80		453.7	262.8	119,224		2.737	705,471	16.195
	8.90		454.5	263.6	119,798		2.750	717,422	16.470
	9.00		455.3	264.4	120,373		2.763	729,431	16.745
	9.10		456.1	265.2	120,949		2.777	741,497	17.022
	9.20		456.9	266.0	121,527		2.790	753,621	17.301
	9.30		457.7	266.8	122,106		2.803	765,803	17.580
	9.40		458.5	267.6	122,686		2.816	778,042	17.861
	9.50		459.3	268.4	123,268		2.830	790,340	18.144
	9.60		460.1	269.2	123,851		2.843	802,696	18.427

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North Master Drainage Plan**

Basin ID: **Pond 7**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.63	1.689	Orifice Plate
Zone 2 (EURV)	4.07	2.974	Weir&Pipe (Circular)
Zone 3 (100-year)	5.99	4.329	Weir&Pipe (Restrict)
	Total (all zones)	8.992	

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 =	2.65	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	10.60	inches
Orifice Plate: Orifice Area per Row =	5.17	sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row =	3.590E-02	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	0.88	1.77					
Orifice Area (sq. inches)	5.17	5.17	5.17					

	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 with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 2 Weir	Zone 3 Weir	
Overflow Weir Front Edge Height, Ho =	4.50	4.70	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	6.00	10.00	feet
Overflow Weir Grate Slope =	0.00	4.00	H:V
Horiz. Length of Weir Sides =	6.00	12.00	feet
Overflow Grate Type =	Type C Grate	Type C Grate	
Debris Clogging % =	50%	50%	%

Calculated Parameters for Overflow Weir

	Zone 2 Weir	Zone 3 Weir	
Height of Grate Upper Edge, H_t =	4.50	7.70	feet
Overflow Weir Slope Length =	6.00	12.37	feet
Grate Open Area / 100-yr Orifice Area =	3.54	3.42	
Overflow Grate Open Area w/o Debris =	25.06	86.09	ft^2
Overflow Grate Open Area w/ Debris =	12.53	43.05	ft^2

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

	Zone 2 Circular	Zone 3 Restrictor	
Depth to Invert of Outlet Pipe =	2.50	2.70	ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter or Pipe Diameter =	36.00	72.00	inches
Restrictor Plate Height Above Pipe Invert =		60.00	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 2 Circular	Zone 3 Restrictor	
Outlet Orifice Area =	7.07	25.18	ft^2
Outlet Orifice Centroid =	1.50	2.70	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	2.30	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.80	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	119.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.98	feet
Stage at Top of Freeboard =	9.78	feet
Basin Area at Top of Freeboard =	2.87	acres
Basin Volume at Top of Freeboard =	18.94	acre-ft

Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

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) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	1.689	4.663	4.575	6.891	8.978	11.989	14.328	17.379	23.422
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	4.575	13.698	8.978	11.989	14.328	24.727	23.422
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	19.1	53.5	79.8	138.4	173.6	217.5	301.7
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		65.3				191.6	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.17	0.57	0.70	1.21	1.51	1.67	2.63
Peak Inflow Q (cfs) =	N/A	N/A	91.6	192.8	181.1	244.9	292.5	370.7	466.9
Peak Outflow Q (cfs) =	0.7	0.9	0.9	65.4	25.4	69.6	98.6	172.2	186.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.3	0.5	0.6	0.9	0.6
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2	Overflow Weir
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	2.1	0.8	2.2	3.0	3.9	4.0
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	0.1	0.0	0.1	0.2	0.9	1.0
Time to Drain 97% of Inflow Volume (hours) =	38	80	80	90	94	91	89	82	83
Time to Drain 99% of Inflow Volume (hours) =	**40**	84	83	99	100	99	98	95	95
Maximum Ponding Depth (ft) =	2.63	4.07	3.95	5.73	5.17	5.77	6.13	7.45	7.70
Area at Maximum Ponding Depth (acres) =	1.98	2.15	2.13	2.35	2.28	2.35	2.39	2.56	2.59
Maximum Volume Stored (acre-ft) =	1.698	4.669	4.413	8.375	7.081	8.493	9.323	12.594	13.264

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: *..\SWMM\Outflow hydrographs\Pond6_OutflowHydrograph.xlsx*

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

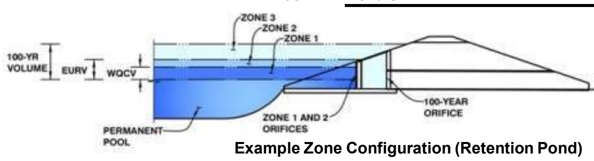
Time Interval	5.00 min

SOURCE	CUHP	CUHP	CUHP	USER	CUHP	CUHP	CUHP	USER	CUHP
TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:05:00	0.00	0.00	0.00	0.35	0.00	0.00	0.00	1.15	0.00
0:10:00	0.00	0.00	0.00	8.35	0.00	0.00	0.87	8.80	2.79
0:15:00	0.00	0.00	7.53	41.96	15.37	10.35	12.91	36.23	18.14
0:20:00	0.00	0.00	26.66	135.18	45.76	26.13	30.39	122.53	46.04
0:25:00	0.00	0.00	66.84	192.81	145.94	65.52	78.49	282.20	146.25
0:30:00	0.00	0.00	91.59	189.89	181.09	208.88	253.77	370.69	396.24
0:35:00	0.00	0.00	83.49	168.08	156.84	244.93	292.46	368.77	466.90
0:40:00	0.00	0.00	69.51	147.36	128.13	226.22	267.84	337.06	424.31
0:45:00	0.00	0.00	54.32	129.31	103.79	190.55	225.54	301.99	368.42
0:50:00	0.00	0.00	42.53	112.57	82.17	160.69	189.97	264.23	309.75
0:55:00	0.00	0.00	34.81	100.65	68.10	126.75	150.57	231.91	255.54
1:00:00	0.00	0.00	29.24	91.99	57.54	102.55	122.63	210.05	218.61
1:05:00	0.00	0.00	24.37	84.30	48.10	84.65	101.75	182.04	189.95
1:10:00	0.00	0.00	18.53	75.10	39.94	63.92	77.12	152.54	140.96
1:15:00	0.00	0.00	14.20	64.91	35.46	46.28	56.24	122.62	100.15
1:20:00	0.00	0.00	11.95	56.89	30.57	33.94	41.44	96.04	69.57
1:25:00	0.00	0.00	10.84	52.28	25.28	26.43	32.25	76.32	49.57
1:30:00	0.00	0.00	10.26	49.65	21.53	20.77	25.24	63.82	37.19
1:35:00	0.00	0.00	9.94	45.63	19.01	16.94	20.45	55.99	29.25
1:40:00	0.00	0.00	9.68	41.44	17.27	14.62	17.52	50.64	23.93
1:45:00	0.00	0.00	9.50	38.27	16.09	13.10	15.56	46.97	20.37
1:50:00	0.00	0.00	9.40	35.96	15.24	12.09	14.28	44.36	18.18
1:55:00	0.00	0.00	8.11	33.53	13.98	11.56	13.59	42.55	17.39
2:00:00	0.00	0.00	7.01	27.14	12.28	11.24	13.17	34.89	17.03
2:05:00	0.00	0.00	5.02	19.98	8.67	8.06	9.43	25.68	12.26
2:10:00	0.00	0.00	3.38	14.45	5.83	5.40	6.30	18.63	8.24
2:15:00	0.00	0.00	2.27	10.39	3.91	3.64	4.25	13.59	5.54
2:20:00	0.00	0.00	1.48	7.28	2.54	2.37	2.76	9.71	3.59
2:25:00	0.00	0.00	0.92	5.00	1.60	1.52	1.76	6.81	2.28
2:30:00	0.00	0.00	0.53	3.43	0.95	0.94	1.09	4.77	1.39
2:35:00	0.00	0.00	0.26	2.28	0.48	0.50	0.57	3.20	0.72
2:40:00	0.00	0.00	0.10	1.39	0.18	0.20	0.22	1.96	0.26
2:45:00	0.00	0.00	0.02	0.74	0.03	0.03	0.03	1.04	0.02
2:50:00	0.00	0.00	0.00	0.32	0.00	0.00	0.00	0.45	0.00
2:55:00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.15	0.00
3:00:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.03	0.00
3:05:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: Flying Horse North MDDP
Basin ID: Pond 8



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.39	0.178	Orifice Plate
Zone 2 (EURV)	3.67	0.221	Circular Orifice
Zone 3 (100-year)	5.97	0.543	Weir&Pipe (Restrict)
Total (all zones)		0.942	

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

Calculated Parameters for Underdrain

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)

Calculated Parameters for Plate

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	4.514E-03	ft^2
Depth at top of Zone using Orifice Plate =	2.39	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	9.60	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	0.65	sq. inches (diameter = 7/8 inch)	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	0.80	1.59					
Orifice Area (sq. inches)	0.65	0.65	0.65					

	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)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	2.39	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	3.67	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	2.88	N/A	inches

Calculated Parameters for Vertical Orif

	Zone 2 Circular	Not Selected
Vertical Orifice Area =	0.05	N/A
Vertical Orifice Centroid =	0.12	N/A

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	5.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow W

	Zone 3 Weir	Not Selected
Height of Grate Upper Edge, H_t =	5.00	N/A
Overflow Weir Slope Length =	5.00	N/A
Grate Open Area / 100-yr Orifice Area =	5.22	N/A
Overflow Grate Open Area w/o Debris =	13.92	N/A
Overflow Grate Open Area w/ Debris =	6.96	N/A

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 =	1.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	24.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	19.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Pla

	Zone 3 Restrictor	Not Selected
Outlet Orifice Area =	2.67	N/A
Outlet Orifice Centroid =	0.87	N/A
Half-Central Angle of Restrictor Plate on Pipe =	2.19	N/A

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Calculated Parameters for Spillway

Spillway Invert Stage=	6.30	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.85	feet
Spillway Crest Length =	11.00	feet	Stage at Top of Freeboard =	8.15	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.38	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	1.66	acre-ft

Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52
CUHP Runoff Volume (acre-ft) =	0.178	0.399	0.416	0.713	0.991	1.426	1.746	2.181
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.416	1.850	0.991	1.426	1.746	3.383
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	1.6	4.6	6.9	12.4	15.5	19.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		11.1				32.7
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.10	0.70	0.44	0.78	0.98	2.06
Peak Inflow Q (cfs) =	N/A	N/A	4.8	15.9	10.8	16.6	20.1	32.3
Peak Outflow Q (cfs) =	0.1	0.3	0.3	11.4	3.5	9.4	13.5	28.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.5	0.8	0.9	0.9
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.8	0.2	0.6	0.9	2.1
Max Velocity through Grate 2 (fps) =	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	49	51	48	55	51	49	38
Time to Drain 99% of Inflow Volume (hours) =	**40**	52	54	59	62	60	59	54
Maximum Ponding Depth (ft) =	2.39	3.67	3.51	5.52	5.22	5.46	5.58	5.99
Area at Maximum Ponding Depth (acres) =	0.15	0.19	0.19	0.26	0.25	0.26	0.27	0.28
Maximum Volume Stored (acre-ft) =	0.179	0.399	0.369	0.821	0.741	0.802	0.837	0.946

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

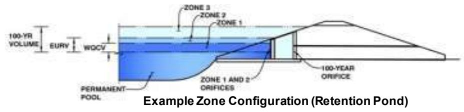
	SOURCE	CUHP	CUHP	CUHP	USER	CUHP	CUHP	CUHP	USER	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.06	0.00
	0:10:00	0.00	0.00	0.00	0.34	0.00	0.00	0.02	0.34	0.07
	0:15:00	0.00	0.00	0.18	2.78	0.37	0.25	0.31	2.31	0.44
	0:20:00	0.00	0.00	0.66	10.46	1.64	0.65	0.80	9.50	1.64
	0:25:00	0.00	0.00	2.63	14.81	7.18	2.58	3.15	22.52	7.13
	0:30:00	0.00	0.00	4.43	15.89	10.39	11.21	13.94	29.84	22.90
	0:35:00	0.00	0.00	4.81	15.66	10.85	15.07	18.39	32.21	30.64
	0:40:00	0.00	0.00	4.71	15.11	10.40	16.58	20.07	32.32	32.92
	0:45:00	0.00	0.00	4.31	14.56	9.75	16.12	19.49	31.57	32.76
	0:50:00	0.00	0.00	3.95	13.85	8.98	15.64	18.90	30.25	31.70
	0:55:00	0.00	0.00	3.62	13.31	8.27	14.42	17.48	28.95	30.01
	1:00:00	0.00	0.00	3.35	12.85	7.71	13.24	16.11	27.97	28.37
	1:05:00	0.00	0.00	3.13	12.39	7.26	12.28	15.01	26.11	27.13
	1:10:00	0.00	0.00	2.85	11.75	6.83	11.17	13.71	24.14	24.72
	1:15:00	0.00	0.00	2.57	10.98	6.41	10.13	12.46	21.80	22.36
	1:20:00	0.00	0.00	2.30	10.25	5.80	9.02	11.10	19.55	19.70
	1:25:00	0.00	0.00	2.04	9.75	5.13	7.96	9.80	17.56	17.19
	1:30:00	0.00	0.00	1.82	9.39	4.59	6.91	8.50	16.06	14.90
	1:35:00	0.00	0.00	1.66	8.88	4.19	6.09	7.51	14.87	13.13
	1:40:00	0.00	0.00	1.55	8.36	3.86	5.46	6.74	13.83	11.76
	1:45:00	0.00	0.00	1.45	7.87	3.57	4.94	6.10	12.89	10.57
	1:50:00	0.00	0.00	1.35	7.42	3.30	4.47	5.53	12.01	9.51
	1:55:00	0.00	0.00	1.22	6.93	3.01	4.05	5.01	11.18	8.53
	2:00:00	0.00	0.00	1.10	6.06	2.68	3.65	4.51	9.79	7.61
	2:05:00	0.00	0.00	0.95	5.17	2.31	3.17	3.91	8.39	6.58
	2:10:00	0.00	0.00	0.81	4.34	1.94	2.70	3.34	7.04	5.61
	2:15:00	0.00	0.00	0.67	3.57	1.60	2.25	2.78	5.79	4.67
	2:20:00	0.00	0.00	0.53	2.90	1.28	1.82	2.25	4.63	3.76
	2:25:00	0.00	0.00	0.41	2.39	0.98	1.40	1.73	3.63	2.89
	2:30:00	0.00	0.00	0.30	2.01	0.74	1.01	1.25	2.90	2.09
	2:35:00	0.00	0.00	0.22	1.68	0.59	0.70	0.88	2.34	1.50
	2:40:00	0.00	0.00	0.18	1.40	0.48	0.51	0.65	1.89	1.11
	2:45:00	0.00	0.00	0.15	1.16	0.39	0.38	0.49	1.51	0.82
	2:50:00	0.00	0.00	0.12	0.96	0.32	0.29	0.37	1.21	0.60
	2:55:00	0.00	0.00	0.10	0.78	0.26	0.22	0.29	0.97	0.44
	3:00:00	0.00	0.00	0.08	0.64	0.21	0.17	0.22	0.78	0.32
	3:05:00	0.00	0.00	0.07	0.52	0.16	0.13	0.17	0.64	0.23
	3:10:00	0.00	0.00	0.05	0.42	0.13	0.10	0.13	0.52	0.17
	3:15:00	0.00	0.00	0.04	0.32	0.10	0.08	0.10	0.42	0.14
	3:20:00	0.00	0.00	0.03	0.25	0.08	0.06	0.08	0.32	0.11
	3:25:00	0.00	0.00	0.03	0.18	0.06	0.05	0.06	0.24	0.09
	3:30:00	0.00	0.00	0.02	0.13	0.04	0.04	0.05	0.18	0.06
	3:35:00	0.00	0.00	0.01	0.08	0.03	0.03	0.04	0.12	0.05
	3:40:00	0.00	0.00	0.01	0.05	0.02	0.02	0.02	0.07	0.03
	3:45:00	0.00	0.00	0.01	0.03	0.01	0.01	0.02	0.04	0.02
	3:50:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North MDDP**

Basin ID: **Pond 8**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**			
Watershed Area =	15.89	acres		
Watershed Length =	1,507	ft		
Watershed Length to Centroid =	741	ft		
Watershed Slope =	0.040	ft/ft		
Watershed Imperviousness =	24.82%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	100.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Target WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.178	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.399	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.416	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.713	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.991	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	1.426	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.746	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.181	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	3.010	acre-feet		inches
Approximate 2-yr Detention Volume =	0.280	acre-feet		
Approximate 5-yr Detention Volume =	0.407	acre-feet		
Approximate 10-yr Detention Volume =	0.620	acre-feet		
Approximate 25-yr Detention Volume =	0.740	acre-feet		
Approximate 50-yr Detention Volume =	0.781	acre-feet		
Approximate 100-yr Detention Volume =	0.942	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.178	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.221	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.543	acre-feet
Total Detention Basin Volume =	0.942	acre-feet
Initial Surcharge Volume (ISV) =	23	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	6.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.004	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	2	
Initial Surcharge Area (A_{ISV}) =	70	ft^2
Surcharge Volume Length (L_{ISV}) =	8.4	ft
Surcharge Volume Width (W_{ISV}) =	8.4	ft
Depth of Basin Floor (H_{FLOOR}) =	0.35	ft
Length of Basin Floor (L_{FLOOR}) =	97.3	ft
Width of Basin Floor (W_{FLOOR}) =	52.1	ft
Area of Basin Floor (A_{FLOOR}) =	5,073	ft^2
Volume of Basin Floor (V_{FLOOR}) =	670	ft^3
Depth of Main Basin (H_{MAIN}) =	4.82	ft
Length of Main Basin (L_{MAIN}) =	135.8	ft
Width of Main Basin (W_{MAIN}) =	90.7	ft
Area of Main Basin (A_{MAIN}) =	12,321	ft^2
Volume of Main Basin (V_{MAIN}) =	40,648	ft^3
Calculated Total Basin Volume (V_{total}) =	**0.950**	acre-feet

Depth Increment = 0.10 ft

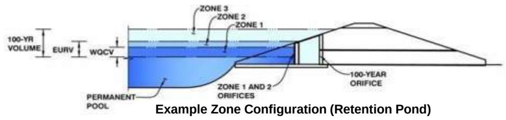
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	0.00		8.4	8.4	70		0.002		
ISV	0.33		8.4	8.4	70		0.002	23	0.001
	0.40		8.4	8.4	70		0.002	28	0.001
	0.50		8.4	8.4	70		0.002	35	0.001
	0.60		8.4	8.4	70		0.002	42	0.001
	0.70		8.4	8.4	70		0.002	49	0.001
	0.80		8.4	8.4	70		0.002	56	0.001
	0.90		26.2	17.1	449		0.010	75	0.002
	1.00		51.6	29.6	1,528		0.035	168	0.004
	1.10		77.0	42.1	3,243		0.074	402	0.009
Floor	1.18		97.3	52.1	5,073		0.116	732	0.017
	1.20		97.4	52.3	5,096		0.117	833	0.019
	1.30		98.2	53.1	5,217		0.120	1,349	0.031
	1.40		99.0	53.9	5,339		0.123	1,877	0.043
	1.50		99.8	54.7	5,462		0.125	2,417	0.055
	1.60		100.6	55.5	5,586		0.128	2,969	0.068
	1.70		101.4	56.3	5,711		0.131	3,534	0.081
	1.80		102.2	57.1	5,838		0.134	4,111	0.094
	1.90		103.0	57.9	5,966		0.137	4,702	0.108
	2.00		103.8	58.7	6,096		0.140	5,305	0.122
	2.10		104.6	59.5	6,226		0.143	5,921	0.136
	2.20		105.4	60.3	6,358		0.146	6,550	0.150
	2.30		106.2	61.1	6,492		0.149	7,192	0.165
Zone 1 (WQCV)	2.39		107.0	61.8	6,613		0.152	7,782	0.179
	2.40		107.0	61.9	6,626		0.152	7,848	0.180
	2.50		107.8	62.7	6,762		0.155	8,518	0.196
	2.60		108.6	63.5	6,899		0.158	9,201	0.211
	2.70		109.4	64.3	7,037		0.162	9,898	0.227
	2.80		110.2	65.1	7,177		0.165	10,608	0.244
	2.90		111.0	65.9	7,318		0.168	11,333	0.260
	3.00		111.8	66.7	7,460		0.171	12,072	0.277
	3.10		112.6	67.5	7,604		0.175	12,825	0.294
	3.20		113.4	68.3	7,748		0.178	13,593	0.312
	3.30		114.2	69.1	7,894		0.181	14,375	0.330
	3.40		115.0	69.9	8,042		0.185	15,172	0.348
	3.50		115.8	70.7	8,190		0.188	15,983	0.367
	3.60		116.6	71.5	8,340		0.191	16,810	0.386
Zone 2 (EURV)	3.67		117.2	72.1	8,446		0.194	17,397	0.399
	3.70		117.4	72.3	8,491		0.195	17,651	0.405
	3.80		118.2	73.1	8,644		0.198	18,508	0.425
	3.90		119.0	73.9	8,798		0.202	19,380	0.445
	4.00		119.8	74.7	8,953		0.206	20,268	0.465
	4.10		120.6	75.5	9,109		0.209	21,171	0.486
	4.20		121.4	76.3	9,266		0.213	22,089	0.507
	4.30		122.2	77.1	9,425		0.216	23,024	0.529
	4.40		123.0	77.9	9,585		0.220	23,975	0.550
	4.50		123.8	78.7	9,747		0.224	24,941	0.573
	4.60		124.6	79.5	9,909		0.227	25,924	0.595
	4.70		125.4	80.3	10,073		0.231	26,923	0.618
	4.80		126.2	81.1	10,239		0.235	27,939	0.641
	4.90		127.0	81.9	10,405		0.239	28,971	0.665
	5.00		127.8	82.7	10,573		0.243	30,020	0.689
	5.10		128.6	83.5	10,742		0.247	31,085	0.714
	5.20		129.4	84.3	10,912		0.251	32,168	0.738
	5.30		130.2	85.1	11,084		0.254	33,268	0.764
	5.40		131.0	85.9	11,257		0.258	34,385	0.789
	5.50		131.8	86.7	11,431		0.262	35,519	0.815
	5.60		132.6	87.5	11,607		0.266	36,671	0.842
	5.70		133.4	88.3	11,783		0.271	37,841	0.869
	5.80		134.2	89.1	11,961		0.275	39,028	0.896
	5.90		135.0	89.9	12,141		0.279	40,233	0.924
Zone 3 (100-year)	5.97		135.6	90.5	12,267		0.282	41,087	0.943
	6.00		135.8	90.7	12,321		0.283	41,456	0.952
	6.10		136.6	91.5	12,503		0.287	42,697	0.980
	6.20		137.4	92.3	12,686		0.291	43,957	1.009
	6.30		138.2	93.1	12,871		0.295	45,235	1.038
	6.40		139.0	93.9	13,057		0.300	46,531	1.068
	6.50		139.8	94.7	13,244		0.304	47,846	1.098
	6.60		140.6	95.5	13,432		0.308	49,180	1.129
	6.70		141.4	96.3	13,621		0.313	50,532	1.160
	6.80		142.2	97.1	13,812		0.317	51,904	1.192
	6.90		143.0	97.9	14,004		0.321	53,295	1.223
	7.00		143.8	98.7	14,198		0.326	54,705	1.256
	7.10		144.6	99.5	14,392		0.330	56,135	1.289
	7.20		145.4	100.3	14,588		0.335	57,584	1.322
	7.30		146.2	101.1	14,786		0.339	59,052	1.356
	7.40		147.0	101.9	14,984		0.344	60,541	1.390
	7.50		147.8	102.7	15,184		0.349	62,049	1.424
	7.60		148.6	103.5	15,385		0.353	63,578	1.460
	7.70		149.4	104.3	15,587		0.358	65,126	1.495
	7.80		150.2	105.1	15,791		0.363	66,695	1.531
	7.90		151.0	105.9	15,996		0.367	68,284	1.568
	8.00		151.8	106.7	16,202		0.372	69,894	1.605
	8.10		152.6	107.5	16,410		0.377	71,525	1.642
	8.20		153.4	108.3	16,618		0.382	73,176	1.680
	8.30		154.2	109.1	16,828		0.386	74,849	1.718
	8.40		155.0	109.9	17,040		0.391	76,542	1.757
	8.50		155.8	110.7	17,252		0.396	78,257	1.797
	8.60		156.6	111.5	17,466		0.401	79,992	1.836
	8.70		157.4	112.3	17,681		0.406	81,750	1.877
	8.80		158.2	113.1	17,898		0.411	83,529	1.918
	8.90		159.0	113.9	18,115		0.416	85,329	1.959
	9.00		159.8	114.7	18,334		0.421	87,152	2.001
	9.10		160.6	115.5	18,555		0.426	88,996	2.043
	9.20		161.4	116.3	18,776		0.431	90,863	2.086
	9.30		162.2	117.1	18,999		0.436	92,752	2.129
	9.40		163.0	117.9	19,223		0.441	94,663	2.173
	9.50		163.8	118.7	19,449		0.446	96,596	2.218
	9.60		164.6	119.5	19,675		0.452	98,553	2.262

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North MDDP**

Basin ID: **Pond 9**



Example Zone Configuration (Retention Pond)

Depth Increment = 0.10 ft

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	86.18	acres
Watershed Length =	2,354	ft
Watershed Length to Centroid =	1,434	ft
Watershed Slope =	0.039	ft/ft
Watershed Imperviousness =	21.81%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.883	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.880	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	2.026	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	3.599	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	5.087	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	7.473	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	9.201	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	11.580	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	16.065	acre-feet		inches
Approximate 2-yr Detention Volume =	1.301	acre-feet		
Approximate 5-yr Detention Volume =	1.913	acre-feet		
Approximate 10-yr Detention Volume =	3.018	acre-feet		
Approximate 25-yr Detention Volume =	3.681	acre-feet		
Approximate 50-yr Detention Volume =	3.888	acre-feet		
Approximate 100-yr Detention Volume =	4.742	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.883	acre-feet
Zone 2 Volume (5-year - Zone 1) =	1.030	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	2.829	acre-feet
Total Detention Basin Volume =	4.742	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
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

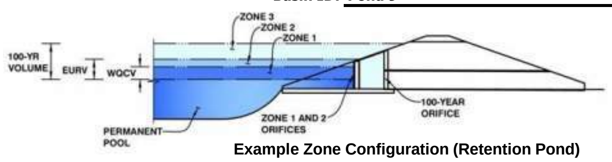
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	510	0.012		
	--	0.10	--	--	--	510	0.012	51	0.001
	--	0.20	--	--	--	510	0.012	102	0.002
	--	0.30	--	--	--	510	0.012	153	0.004
	--	0.40	--	--	--	510	0.012	204	0.005
	--	0.50	--	--	--	510	0.012	255	0.006
	--	0.60	--	--	--	510	0.012	306	0.007
	--	0.70	--	--	--	1,331	0.031	398	0.009
	--	0.80	--	--	--	3,124	0.072	620	0.014
	--	0.90	--	--	--	5,648	0.130	1,059	0.024
	--	1.00	--	--	--	8,903	0.204	1,786	0.041
	--	1.10	--	--	--	12,887	0.296	2,876	0.066
	--	1.20	--	--	--	17,602	0.404	4,400	0.101
	--	1.30	--	--	--	23,047	0.529	6,433	0.148
	--	1.40	--	--	--	29,222	0.671	9,046	0.208
	--	1.50	--	--	--	36,128	0.829	12,314	0.283
	--	1.60	--	--	--	43,764	1.005	16,308	0.374
	--	1.70	--	--	--	52,130	1.197	21,103	0.484
	--	1.80	--	--	--	57,500	1.320	26,584	0.610
	--	1.90	--	--	--	57,673	1.324	32,343	0.742
	--	2.00	--	--	--	58,107	1.334	38,132	0.875
	--	2.10	--	--	--	58,542	1.344	43,964	1.009
	--	2.20	--	--	--	58,979	1.354	49,840	1.144
	--	2.30	--	--	--	59,418	1.364	55,760	1.280
	--	2.40	--	--	--	59,858	1.374	61,724	1.417
	--	2.50	--	--	--	60,299	1.384	67,732	1.555
	--	2.60	--	--	--	60,742	1.394	73,784	1.694
	--	2.70	--	--	--	61,187	1.405	79,880	1.834
	--	2.80	--	--	--	61,632	1.415	86,021	1.975
	--	2.90	--	--	--	62,080	1.425	92,207	2.117
	--	3.00	--	--	--	62,529	1.435	98,437	2.260
	--	3.10	--	--	--	62,979	1.446	104,713	2.404
	--	3.20	--	--	--	63,431	1.456	111,033	2.549
	--	3.30	--	--	--	63,884	1.467	117,399	2.695
	--	3.40	--	--	--	64,338	1.477	123,810	2.842
	--	3.50	--	--	--	64,795	1.487	130,267	2.991
	--	3.60	--	--	--	64,840	1.489	136,748	3.139
	--	3.70	--	--	--	65,252	1.498	143,253	3.289
	--	3.80	--	--	--	65,711	1.509	149,801	3.439
	--	3.90	--	--	--	66,172	1.519	156,395	3.590
	--	4.00	--	--	--	66,634	1.530	163,036	3.743
	--	4.10	--	--	--	67,097	1.540	169,722	3.896
	--	4.20	--	--	--	67,562	1.551	176,455	4.051
	--	4.30	--	--	--	68,029	1.562	183,235	4.206
	--	4.40	--	--	--	68,497	1.572	190,061	4.363
	--	4.50	--	--	--	68,966	1.583	196,934	4.521
	--	4.60	--	--	--	69,437	1.594	203,854	4.680
	--	4.70	--	--	--	69,909	1.605	210,822	4.840
	--	4.80	--	--	--	70,383	1.616	217,836	5.001
	--	4.90	--	--	--	70,858	1.627	224,898	5.163
	--	5.00	--	--	--	71,335	1.638	232,008	5.326
	--	5.10	--	--	--	71,813	1.649	239,165	5.490
	--	5.20	--	--	--	72,293	1.660	246,371	5.656
	--	5.30	--	--	--	72,774	1.671	253,624	5.822
	--	5.40	--	--	--	73,257	1.682	260,926	5.990
	--	5.50	--	--	--	73,741	1.693	268,275	6.159
	--	5.60	--	--	--	74,227	1.704	275,674	6.329
	--	5.70	--	--	--	74,714	1.715	283,121	6.500
	--	5.80	--	--	--	75,202	1.726	290,617	6.672
	--	5.90	--	--	--	75,692	1.738	298,161	6.845
	--	6.00	--	--	--	76,184	1.749	305,755	7.019
	--	6.10	--	--	--	76,233	1.750	313,376	7.194
	--	6.20	--	--	--	76,677	1.760	321,021	7.370
	--	6.30	--	--	--	77,171	1.772	328,714	7.546
	--	6.40	--	--	--	77,667	1.783	336,456	7.724
	--	6.50	--	--	--	78,164	1.794	344,247	7.903
	--	6.60	--	--	--	78,663	1.806	352,089	8.083
	--	6.70	--	--	--	79,163	1.817	359,980	8.264
	--	6.80	--	--	--	79,665	1.829	367,921	8.446
	--	6.90	--	--	--	80,168	1.840	375,913	8.630
	--	7.00	--	--	--	80,673	1.852	383,955	8.814
	--	7.10	--	--	--	81,179	1.864	392,048	9.000
	--	7.20	--	--	--	81,687	1.875	400,191	9.187
	--	7.30	--	--	--	82,196	1.887	408,385	9.375
	--	7.40	--	--	--	82,707	1.899	416,630	9.565
	--	7.50	--	--	--	83,219	1.910	424,927	9.755
	--	7.60	--	--	--	83,732	1.922	433,274	9.947
	--	7.70	--	--	--	84,247	1.934	441,673	10.139
	--	7.80	--	--	--	84,764	1.946	450,124	10.333
	--	7.90	--	--	--	85,282	1.958	458,626	10.529
	--	8.00	--	--	--	85,801	1.970	467,180	10.725
	--	8.10	--	--	--	86,322	1.982	475,786	10.923
	--	8.20	--	--	--	86,845	1.994	484,445	11.121
	--	8.30	--	--	--	87,368	2.006	493,155	11.321
	--	8.40	--	--	--	87,894	2.018	501,918	11.522
	--	8.50	--	--	--	88,421	2.030	510,734	11.725
	--	8.60	--	--	--	88,949	2.042	519,603	11.928
	--	8.70	--	--	--	89,479	2.054	528,524	12.133
	--	8.80	--	--	--	90,010	2.066	537,498	12.339
	--	8.90	--	--	--	90,543	2.079	546,526	12.547
	--	9.00	--	--	--	91,077	2.091	555,607	12.755
	--	9.10	--	--	--	91,612	2.103	564,741	12.965
	--	9.20	--	--	--	92,149	2.115	573,930	13.176
	--	9.30	--	--	--	92,688	2.128	583,171	13.388
	--	9.40	--	--	--	93,228	2.140	592,467	13.601
	--	9.50	--	--	--	93,770	2.153	601,817	13.816
	--	9.60	--	--	--	94,313	2.165	611,221	14.032
	--	9.70	--	--	--	94,857	2.178	620,680	14.249
	--	9.80	--	--	--	95,403	2.190	630,193	14.467

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North MDDP**

Basin ID: **Pond 9**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.01	0.883	Orifice Plate
Zone 2 (5-year)	2.76	1.030	Weir&Pipe (Restrict)
Zone 3 (100-year)	4.64	2.829	Weir&Pipe (Restrict)
Total (all zones)		4.742	

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 =	2.36	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	9.40	inches
Orifice Plate: Orifice Area per Row =	3.45	sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row =	2.396E-02	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	0.79	1.57					
Orifice Area (sq. inches)	3.45	3.45	3.45					

	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 with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 2 Weir	Zone 3 Weir	
Overflow Weir Front Edge Height, Ho =	3.10	4.10	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	8.00	feet
Overflow Weir Grate Slope =	0.00	4.00	H:V
Horiz. Length of Weir Sides =	6.00	12.00	feet
Overflow Grate Type =	Type C Grate	Type C Grate	
Debris Clogging % =	50%	50%	%

Calculated Parameters for Overflow Weir

	Zone 2 Weir	Zone 3 Weir	
Height of Grate Upper Edge, H_t =	3.10	7.10	feet
Overflow Weir Slope Length =	6.00	12.37	feet
Grate Open Area / 100-yr Orifice Area =	1.82	2.92	
Overflow Grate Open Area w/o Debris =	16.70	68.87	ft^2
Overflow Grate Open Area w/ Debris =	8.35	34.44	ft^2

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

	Zone 2 Restrictor	Zone 3 Restrictor	
Depth to Invert of Outlet Pipe =	2.30	2.60	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	42.00	66.00	inches
Restrictor Plate Height Above Pipe Invert =	38.00	64.00	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 2 Restrictor	Zone 3 Restrictor	
Outlet Orifice Area =	9.16	23.55	ft^2
Outlet Orifice Centroid =	1.67	2.73	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.51	2.79	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.80	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	113.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.98	feet
Stage at Top of Freeboard =	9.78	feet
Basin Area at Top of Freeboard =	2.19	acres
Basin Volume at Top of Freeboard =	14.42	acre-ft

Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

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) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.883	1.880	2.026	3.599	5.087	7.473	9.201	11.580	16.065
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	2.026	17.291	5.087	7.473	9.201	31.926	16.065
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	11.0	30.3	46.1	81.0	101.4	129.3	179.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		95.0				282.3	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.13	1.10	0.53	0.94	1.18	3.28	2.09
Peak Inflow Q (cfs) =	N/A	N/A	28.4	148.4	67.1	103.1	125.4	309.0	207.1
Peak Outflow Q (cfs) =	0.4	0.5	0.5	94.8	21.0	46.0	61.0	220.7	118.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.5	0.6	0.6	0.8	0.7
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Weir 2	Overflow Weir 1	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2	Overflow Weir 2
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	4.5	1.2	2.7	3.4	6.1	4.9
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	0.3	N/A	0.0	0.1	1.7	0.5
Time to Drain 97% of Inflow Volume (hours) =	38	65	69	61	78	74	71	46	62
Time to Drain 99% of Inflow Volume (hours) =	**40**	68	72	78	84	83	82	70	78
Maximum Ponding Depth (ft) =	2.01	2.74	2.77	5.58	3.84	4.37	4.71	7.79	6.13
Area at Maximum Ponding Depth (acres) =	1.33	1.41	1.41	1.70	1.51	1.57	1.61	1.94	1.75
Maximum Volume Stored (acre-ft) =	0.889	1.890	1.932	6.278	3.484	4.300	4.856	10.314	7.229

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: *..\SWMM\Outflow hydrographs\Pond6_OutflowHydrograph.xlsx*

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

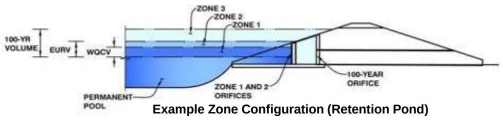
	SOURCE	CUHP	CUHP	CUHP	USER	CUHP	CUHP	CUHP	USER	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.19	0.00	0.00	0.00	0.48	0.00
	0:10:00	0.00	0.00	0.00	2.62	0.00	0.00	0.09	2.67	0.28
	0:15:00	0.00	0.00	0.76	19.04	1.55	1.04	1.33	15.51	1.92
	0:20:00	0.00	0.00	2.95	79.68	8.04	2.99	3.82	71.52	8.06
	0:25:00	0.00	0.00	13.17	128.64	38.75	12.89	15.88	184.41	38.44
	0:30:00	0.00	0.00	24.71	146.60	62.28	61.82	77.38	267.93	131.08
	0:35:00	0.00	0.00	28.36	148.36	67.13	92.57	113.75	302.41	190.37
	0:40:00	0.00	0.00	27.34	143.02	62.88	103.09	125.40	309.03	207.06
	0:45:00	0.00	0.00	24.41	137.31	57.36	98.90	119.90	302.18	202.23
	0:50:00	0.00	0.00	21.63	130.82	51.33	93.57	113.46	289.65	191.70
	0:55:00	0.00	0.00	19.31	124.44	46.31	84.26	102.47	276.21	177.33
	1:00:00	0.00	0.00	17.53	119.29	42.27	75.99	92.91	264.30	165.28
	1:05:00	0.00	0.00	15.91	115.25	38.56	68.79	84.53	247.33	155.08
	1:10:00	0.00	0.00	13.92	110.41	34.92	60.71	74.92	229.27	137.88
	1:15:00	0.00	0.00	11.89	104.32	31.47	52.43	65.01	209.03	119.21
	1:20:00	0.00	0.00	10.24	97.99	28.23	44.33	55.03	188.58	100.29
	1:25:00	0.00	0.00	9.11	92.36	25.24	38.41	47.78	169.75	85.97
	1:30:00	0.00	0.00	8.22	87.52	22.52	33.51	41.71	153.19	74.48
	1:35:00	0.00	0.00	7.43	82.28	20.08	29.37	36.58	139.26	64.85
	1:40:00	0.00	0.00	6.68	77.25	17.85	25.63	31.93	128.04	56.24
	1:45:00	0.00	0.00	5.94	72.85	15.74	22.26	27.74	118.85	48.37
	1:50:00	0.00	0.00	5.22	68.94	13.70	19.04	23.75	111.03	40.97
	1:55:00	0.00	0.00	4.38	64.94	11.58	15.95	19.92	104.07	34.02
	2:00:00	0.00	0.00	3.55	58.11	9.29	13.00	16.27	93.16	27.58
	2:05:00	0.00	0.00	2.64	50.37	6.91	9.71	12.19	80.96	20.65
	2:10:00	0.00	0.00	1.92	43.04	5.27	6.60	8.35	69.34	14.54
	2:15:00	0.00	0.00	1.47	36.34	4.21	4.68	6.04	58.65	10.55
	2:20:00	0.00	0.00	1.17	30.41	3.40	3.43	4.48	48.94	7.79
	2:25:00	0.00	0.00	0.94	25.39	2.74	2.56	3.37	40.27	5.71
	2:30:00	0.00	0.00	0.75	21.07	2.19	1.91	2.52	32.86	4.14
	2:35:00	0.00	0.00	0.60	17.30	1.72	1.45	1.92	26.42	2.94
	2:40:00	0.00	0.00	0.47	14.29	1.33	1.08	1.43	20.94	2.04
	2:45:00	0.00	0.00	0.37	11.86	1.02	0.80	1.06	16.66	1.43
	2:50:00	0.00	0.00	0.30	9.83	0.77	0.62	0.81	13.31	1.09
	2:55:00	0.00	0.00	0.24	8.11	0.59	0.48	0.63	10.64	0.85
	3:00:00	0.00	0.00	0.19	6.68	0.45	0.37	0.49	8.52	0.68
	3:05:00	0.00	0.00	0.14	5.47	0.34	0.29	0.37	6.87	0.53
	3:10:00	0.00	0.00	0.11	4.47	0.25	0.21	0.28	5.54	0.39
	3:15:00	0.00	0.00	0.07	3.61	0.17	0.15	0.20	4.47	0.28
	3:20:00	0.00	0.00	0.05	2.87	0.11	0.10	0.13	3.60	0.18
	3:25:00	0.00	0.00	0.03	2.23	0.06	0.06	0.08	2.85	0.11
	3:30:00	0.00	0.00	0.01	1.69	0.03	0.03	0.04	2.21	0.05
	3:35:00	0.00	0.00	0.00	1.25	0.01	0.01	0.01	1.67	0.02
	3:40:00	0.00	0.00	0.00	0.88	0.00	0.00	0.00	1.20	0.00
	3:45:00	0.00	0.00	0.00	0.58	0.00	0.00	0.00	0.82	0.00
	3:50:00	0.00	0.00	0.00	0.36	0.00	0.00	0.00	0.52	0.00
	3:55:00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.29	0.00
	4:00:00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.16	0.00
	4:05:00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.06	0.00
	4:10:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North Master Drainage Plan**

Basin ID: **Pond 10**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**			
Watershed Area =	21.96	acres		
Watershed Length =	1,715	ft		
Watershed Length to Centroid =	1,346	ft		
Watershed Slope =	0.056	ft/ft		
Watershed Imperviousness =	10.00%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	100.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Target WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.123	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.206	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.293	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.647	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.000	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	1.630	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	2.059	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.677	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	3.804	acre-feet		inches
Approximate 2-yr Detention Volume =	0.132	acre-feet		
Approximate 5-yr Detention Volume =	0.207	acre-feet		
Approximate 10-yr Detention Volume =	0.429	acre-feet		
Approximate 25-yr Detention Volume =	0.599	acre-feet		
Approximate 50-yr Detention Volume =	0.627	acre-feet		
Approximate 100-yr Detention Volume =	0.810	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.123	acre-feet
Zone 2 Volume (5-year - Zone 1) =	0.084	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.603	acre-feet
Total Detention Basin Volume =	0.810	acre-feet
Initial Surcharge Volume (ISV) =	16	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	6.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.004	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	2	
Initial Surcharge Area (A_{ISV}) =	49	ft^2
Surcharge Volume Length (L_{ISV}) =	7.0	ft
Surcharge Volume Width (W_{ISV}) =	7.0	ft
Depth of Basin Floor (H_{FLOOR}) =	0.37	ft
Length of Basin Floor (L_{FLOOR}) =	100.9	ft
Width of Basin Floor (W_{FLOOR}) =	53.2	ft
Area of Basin Floor (A_{FLOOR}) =	5,372	ft^2
Volume of Basin Floor (V_{FLOOR}) =	732	ft^3
Depth of Main Basin (H_{MAIN}) =	4.80	ft
Length of Main Basin (L_{MAIN}) =	139.3	ft
Width of Main Basin (W_{MAIN}) =	91.6	ft
Area of Main Basin (A_{MAIN}) =	12,767	ft^2
Volume of Main Basin (V_{MAIN}) =	42,274	ft^3
Calculated Total Basin Volume (V_{total}) =	**0.988**	acre-feet

Depth Increment = 0.10 ft

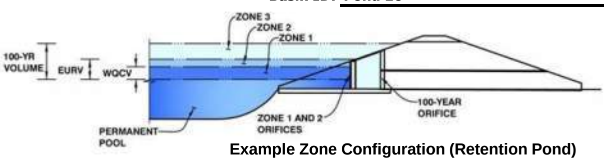
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	0.00		7.0	7.0	49		0.001		
ISV	0.33		7.0	7.0	49		0.001	16	0.000
	0.40		7.0	7.0	49		0.001	19	0.000
	0.50		7.0	7.0	49		0.001	24	0.001
	0.60		7.0	7.0	49		0.001	29	0.001
	0.70		7.0	7.0	49		0.001	34	0.001
	0.80		7.0	7.0	49		0.001	39	0.001
	0.90		24.7	15.7	389		0.009	54	0.001
	1.00		50.1	28.2	1,415		0.032	139	0.003
	1.10		75.5	40.7	3,076		0.071	358	0.008
Floor	1.20		100.9	53.2	5,372		0.123	775	0.018
	1.30		101.7	54.0	5,496		0.126	1,319	0.030
	1.40		102.5	54.8	5,622		0.129	1,874	0.043
	1.50		103.3	55.6	5,748		0.132	2,443	0.056
	1.60		104.1	56.4	5,876		0.135	3,024	0.069
	1.70		104.9	57.2	6,005		0.138	3,618	0.083
	1.80		105.7	58.0	6,135		0.141	4,225	0.097
	1.90		106.5	58.8	6,267		0.144	4,845	0.111
	2.00		107.3	59.6	6,400		0.147	5,479	0.126
	2.10		108.1	60.4	6,534		0.150	6,125	0.141
	2.20		108.9	61.2	6,670		0.153	6,785	0.156
	2.30		109.7	62.0	6,806		0.156	7,459	0.171
Zone 1 (WQCV)	2.32		109.9	62.2	6,834		0.157	7,596	0.174
	2.40		110.5	62.8	6,945		0.159	8,147	0.187
	2.50		111.3	63.6	7,084		0.163	8,848	0.203
	2.60		112.1	64.4	7,224		0.166	9,564	0.220
	2.70		112.9	65.2	7,366		0.169	10,293	0.236
	2.80		113.7	66.0	7,510		0.172	11,037	0.253
Zone 2 (5-year)	2.90		114.5	66.8	7,654		0.176	11,795	0.271
	3.00		115.3	67.6	7,800		0.179	12,568	0.289
	3.10		116.1	68.4	7,947		0.182	13,355	0.307
	3.20		116.9	69.2	8,095		0.186	14,157	0.325
	3.30		117.7	70.0	8,245		0.189	14,974	0.344
	3.40		118.5	70.8	8,395		0.193	15,806	0.363
	3.50		119.3	71.6	8,548		0.196	16,653	0.382
	3.60		120.1	72.4	8,701		0.200	17,516	0.402
	3.70		120.9	73.2	8,856		0.203	18,393	0.422
	3.80		121.7	74.0	9,012		0.207	19,287	0.443
	3.90		122.5	74.8	9,169		0.210	20,196	0.464
	4.00		123.3	75.6	9,327		0.214	21,121	0.485
	4.10		124.1	76.4	9,487		0.218	22,061	0.506
	4.20		124.9	77.2	9,648		0.221	23,018	0.528
	4.30		125.7	78.0	9,811		0.225	23,991	0.551
	4.40		126.5	78.8	9,974		0.229	24,980	0.573
	4.50		127.3	79.6	10,139		0.233	25,986	0.597
	4.60		128.1	80.4	10,306		0.237	27,008	0.620
	4.70		128.9	81.2	10,473		0.240	28,047	0.644
	4.80		129.7	82.0	10,642		0.244	29,103	0.668
	4.90		130.5	82.8	10,812		0.248	30,176	0.693
	5.00		131.3	83.6	10,983		0.252	31,265	0.718
	5.10		132.1	84.4	11,156		0.256	32,372	0.743
	5.20		132.9	85.2	11,330		0.260	33,497	0.769
	5.30		133.7	86.0	11,505		0.264	34,638	0.795
	5.40		134.5	86.8	11,681		0.268	35,798	0.822
	5.50		135.3	87.6	11,859		0.272	36,975	0.849
	5.60		136.1	88.4	12,038		0.276	38,169	0.876
	5.70		136.9	89.2	12,218		0.280	39,382	0.904
	5.80		137.7	90.0	12,400		0.285	40,613	0.932
	5.90		138.5	90.8	12,583		0.289	41,862	0.961
Zone 3 (100-year)	5.98		139.2	91.5	12,730		0.292	42,875	0.984
	6.00		139.3	91.6	12,767		0.293	43,130	0.990
	6.10		140.1	92.4	12,952		0.297	44,416	1.020
	6.20		140.9	93.2	13,139		0.302	45,720	1.050
	6.30		141.7	94.0	13,327		0.306	47,043	1.080
	6.40		142.5	94.8	13,516		0.310	48,386	1.111
	6.50		143.3	95.6	13,707		0.315	49,747	1.142
	6.60		144.1	96.4	13,899		0.319	51,127	1.174
	6.70		144.9	97.2	14,092		0.324	52,527	1.206
	6.80		145.7	98.0	14,286		0.328	53,945	1.238
	6.90		146.5	98.8	14,482		0.332	55,384	1.271
	7.00		147.3	99.6	14,679		0.337	56,842	1.305
	7.10		148.1	100.4	14,877		0.342	58,320	1.339
	7.20		148.9	101.2	15,076		0.346	59,817	1.373
	7.30		149.7	102.0	15,277		0.351	61,335	1.408
	7.40		150.5	102.8	15,479		0.355	62,873	1.443
	7.50		151.3	103.6	15,683		0.360	64,431	1.479
	7.60		152.1	104.4	15,887		0.365	66,009	1.515
	7.70		152.9	105.2	16,093		0.369	67,608	1.552
	7.80		153.7	106.0	16,300		0.374	69,228	1.589
	7.90		154.5	106.8	16,509		0.379	70,868	1.627
	8.00		155.3	107.6	16,718		0.384	72,530	1.665
	8.10		156.1	108.4	16,929		0.389	74,212	1.704
	8.20		156.9	109.2	17,142		0.394	75,916	1.743
	8.30		157.7	110.0	17,355		0.398	77,640	1.782
	8.40		158.5	110.8	17,570		0.403	79,387	1.822
	8.50		159.3	111.6	17,786		0.408	81,154	1.863
	8.60		160.1	112.4	18,004		0.413	82,944	1.904
	8.70		160.9	113.2	18,222		0.418	84,755	1.946
	8.80		161.7	114.0	18,442		0.423	86,588	1.988
	8.90		162.5	114.8	18,664		0.428	88,444	2.030
	9.00		163.3	115.6	18,886		0.434	90,321	2.073
	9.10		164.1	116.4	19,110		0.439	92,221	2.117
	9.20		164.9	117.2	19,335		0.444	94,143	2.161
	9.30		165.7	118.0	19,561		0.449	96,088	2.206
	9.40		166.5	118.8	19,789		0.454	98,056	2.251
	9.50		167.3	119.6	20,018		0.460	100,046	2.297
	9.60		168.1	120.4	20,248		0.465	102,059	2.343
	9.70		168.9	121.2	20,480		0.470	104,096	2.390
	9.80		169.7	122.0	20,712		0.475	106,155	2.437

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North Master Drainage Plan**

Basin ID: **Pond 10**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.98	0.123	Orifice Plate
Zone 2 (5-year)	2.53	0.084	Circular Orifice
Zone 3 (100-year)	5.36	0.603	Weir&Pipe (Restrict)
Total (all zones)		0.810	

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 =	1.98	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	8.80	inches
Orifice Plate: Orifice Area per Row =	0.45	sq. inches (diameter = 3/4 inch)

Calculated Parameters for Plate

WQ Orifice Area per Row =	3.125E-03	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	0.66	1.32					
Orifice Area (sq. inches)	0.45	0.45	0.45					

	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)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	1.98	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	2.53	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	18.00	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	1.77	N/A	ft^2
Vertical Orifice Centroid =	0.75	N/A	feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.70	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	3.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	3.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	4.70	N/A	feet
Overflow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	1.55	N/A	
Overflow Grate Open Area w/o Debris =	6.26	N/A	ft^2
Overflow Grate Open Area w/ Debris =	3.13	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 =	1.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	36.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	20.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	4.03	N/A	ft^2
Outlet Orifice Centroid =	0.95	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.68	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.70	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	26.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.94	feet
Stage at Top of Freeboard =	8.64	feet
Basin Area at Top of Freeboard =	0.42	acres
Basin Volume at Top of Freeboard =	1.92	acre-ft

Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

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) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.123	0.206	0.293	0.647	1.000	1.630	2.059	2.677	3.804
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.293	2.509	1.000	1.630	2.059	4.656	3.804
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	2.0	5.7	8.7	15.6	19.6	25.0	35.0
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A		13.3				39.2	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.09	0.60	0.40	0.71	0.89	1.79	1.60
Peak Inflow Q (cfs) =	N/A	N/A	3.3	17.8	10.1	17.0	21.0	37.7	36.7
Peak Outflow Q (cfs) =	0.1	1.1	1.0	13.6	6.5	10.7	13.6	33.9	31.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.8	0.7	0.7	0.9	0.9
Structure Controlling Flow =	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	)verflow Weir :
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	N/A	N/A	0.2	3.0	2.7
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	43	44	21	35	29	25	6	11
Time to Drain 99% of Inflow Volume (hours) =	**40**	45	47	38	44	41	40	30	33
Maximum Ponding Depth (ft) =	1.99	2.52	2.46	4.85	3.37	4.28	4.85	5.83	5.71
Area at Maximum Ponding Depth (acres) =	0.15	0.16	0.16	0.25	0.19	0.22	0.25	0.29	0.28
Maximum Volume Stored (acre-ft) =	0.124	0.206	0.195	0.680	0.357	0.544	0.680	0.938	0.904

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: *..\SWMM\Outflow hydrographs\Pond6_OutflowHydrograph.xlsx*

<u>Inflow Hydrographs</u>

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

Time Interval: 5.00 min

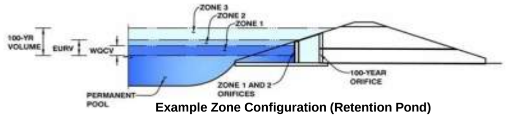
SOURCE	CUHP	CUHP	CUHP	USER	CUHP	CUHP	CUHP	USER	CUHP
TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
0:10:00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.05	0.01
0:15:00	0.00	0.00	0.03	1.83	0.06	0.04	0.05	1.39	0.07
0:20:00	0.00	0.00	0.11	9.48	0.47	0.11	0.13	8.51	0.45
0:25:00	0.00	0.00	0.97	14.91	5.06	0.92	1.21	22.24	4.95
0:30:00	0.00	0.00	2.57	17.12	8.84	9.02	11.66	31.63	20.83
0:35:00	0.00	0.00	3.18	17.81	9.99	14.05	17.64	36.02	30.90
0:40:00	0.00	0.00	3.29	17.64	10.09	16.51	20.48	37.66	35.22
0:45:00	0.00	0.00	3.11	17.35	9.65	17.00	21.04	37.68	36.71
0:50:00	0.00	0.00	2.84	16.96	8.96	16.79	20.76	36.95	36.31
0:55:00	0.00	0.00	2.61	16.50	8.35	15.81	19.62	36.11	35.07
1:00:00	0.00	0.00	2.41	16.04	7.79	14.79	18.46	35.23	33.85
1:05:00	0.00	0.00	2.22	15.74	7.25	13.82	17.33	33.48	32.63
1:10:00	0.00	0.00	2.01	15.37	6.84	12.57	15.85	31.77	30.15
1:15:00	0.00	0.00	1.85	14.87	6.52	11.51	14.62	29.79	27.86
1:20:00	0.00	0.00	1.70	14.33	6.07	10.54	13.40	27.78	25.45
1:25:00	0.00	0.00	1.55	13.77	5.55	9.62	12.24	25.86	23.11
1:30:00	0.00	0.00	1.41	13.20	5.03	8.72	11.10	23.99	20.91
1:35:00	0.00	0.00	1.26	12.43	4.51	7.84	9.99	22.18	18.81
1:40:00	0.00	0.00	1.12	11.70	4.01	6.98	8.91	20.48	16.77
1:45:00	0.00	0.00	0.99	11.14	3.55	6.14	7.85	19.08	14.83
1:50:00	0.00	0.00	0.88	10.69	3.23	5.39	6.92	17.99	13.15
1:55:00	0.00	0.00	0.81	10.23	2.98	4.85	6.25	17.09	11.89
2:00:00	0.00	0.00	0.75	9.42	2.74	4.42	5.71	15.71	10.84
2:05:00	0.00	0.00	0.69	8.54	2.50	4.03	5.21	14.26	9.85
2:10:00	0.00	0.00	0.63	7.69	2.27	3.68	4.74	12.87	8.95
2:15:00	0.00	0.00	0.57	6.90	2.05	3.35	4.31	11.57	8.10
2:20:00	0.00	0.00	0.52	6.17	1.84	3.03	3.90	10.38	7.31
2:25:00	0.00	0.00	0.46	5.49	1.64	2.73	3.51	9.28	6.57
2:30:00	0.00	0.00	0.41	4.85	1.44	2.44	3.13	8.23	5.87
2:35:00	0.00	0.00	0.35	4.25	1.25	2.15	2.76	7.22	5.19
2:40:00	0.00	0.00	0.30	3.68	1.07	1.86	2.39	6.26	4.51
2:45:00	0.00	0.00	0.25	3.14	0.89	1.58	2.03	5.32	3.84
2:50:00	0.00	0.00	0.20	2.62	0.72	1.29	1.67	4.39	3.17
2:55:00	0.00	0.00	0.15	2.14	0.54	1.01	1.31	3.51	2.50
3:00:00	0.00	0.00	0.10	1.79	0.37	0.73	0.95	2.76	1.84
3:05:00	0.00	0.00	0.06	1.52	0.25	0.45	0.61	2.21	1.24
3:10:00	0.00	0.00	0.04	1.29	0.19	0.28	0.40	1.80	0.85
3:15:00	0.00	0.00	0.03	1.10	0.15	0.18	0.27	1.47	0.60
3:20:00	0.00	0.00	0.02	0.94	0.12	0.12	0.19	1.22	0.42
3:25:00	0.00	0.00	0.02	0.79	0.10	0.08	0.13	1.00	0.28
3:30:00	0.00	0.00	0.01	0.66	0.07	0.05	0.09	0.81	0.19
3:35:00	0.00	0.00	0.01	0.54	0.06	0.04	0.06	0.66	0.12
3:40:00	0.00	0.00	0.01	0.44	0.04	0.02	0.04	0.54	0.07
3:45:00	0.00	0.00	0.01	0.35	0.03	0.02	0.03	0.44	0.05
3:50:00	0.00	0.00	0.01	0.27	0.02	0.01	0.02	0.35	0.04
3:55:00	0.00	0.00	0.00	0.21	0.02	0.01	0.02	0.27	0.03
4:00:00	0.00	0.00	0.00	0.15	0.01	0.01	0.01	0.21	0.02
4:05:00	0.00	0.00	0.00	0.11	0.01	0.00	0.01	0.15	0.02
4:10:00	0.00	0.00	0.00	0.07	0.01	0.00	0.01	0.10	0.01
4:15:00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.06	0.01
4:20:00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.03	0.01
4:25:00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Flying Horse North Master Drainage Plan**

Basin ID: **Pond 11**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	79.73	acres
Watershed Length =	2,715	ft
Watershed Length to Centroid =	1,530	ft
Watershed Slope =	0.037	ft/ft
Watershed Imperviousness =	28.50%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.975	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	2.322	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	2.370	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	3.903	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	5.321	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	7.486	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	9.112	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	11.293	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.39 in.) =	17.208	acre-feet	3.39	inches
Approximate 2-yr Detention Volume =	1.653	acre-feet		
Approximate 5-yr Detention Volume =	2.375	acre-feet		
Approximate 10-yr Detention Volume =	3.504	acre-feet		
Approximate 25-yr Detention Volume =	4.095	acre-feet		
Approximate 50-yr Detention Volume =	4.317	acre-feet		
Approximate 100-yr Detention Volume =	5.132	acre-feet		

Define Zones and Basin Geometry

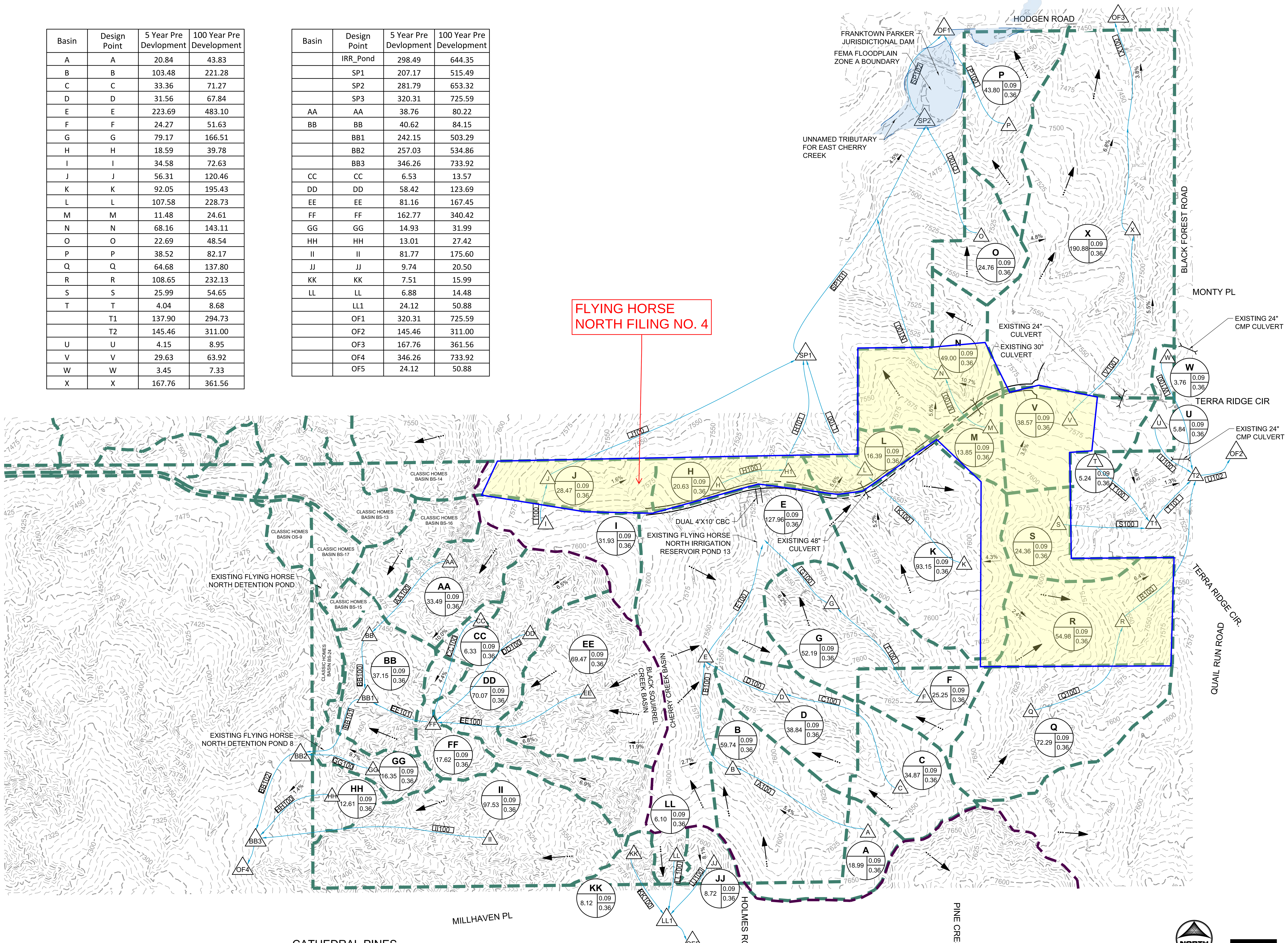
Zone 1 Volume (WQCV) =	0.975	acre-feet
Zone 2 Volume (5-year - Zone 1) =	1.400	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	2.757	acre-feet
Total Detention Basin Volume =	5.132	acre-feet
Initial Surcharge Volume (ISV) =	127	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	6.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.004	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	2	
Initial Surcharge Area (A_{ISV}) =	386	ft^2
Surcharge Volume Length (L_{ISV}) =	19.6	ft
Surcharge Volume Width (W_{ISV}) =	19.6	ft
Depth of Basin Floor (H_{FLOOR}) =	0.99	ft
Length of Basin Floor (L_{FLOOR}) =	271.1	ft
Width of Basin Floor (W_{FLOOR}) =	143.4	ft
Area of Basin Floor (A_{FLOOR}) =	38,876	ft^2
Volume of Basin Floor (V_{FLOOR}) =	14,235	ft^3
Depth of Main Basin (H_{MAIN}) =	4.18	ft
Length of Main Basin (L_{MAIN}) =	304.5	ft
Width of Main Basin (W_{MAIN}) =	176.8	ft
Area of Main Basin (A_{MAIN}) =	53,855	ft^2
Volume of Main Basin (V_{MAIN}) =	192,959	ft^3
Calculated Total Basin Volume (V_{total}) =	**4.764**	acre-feet

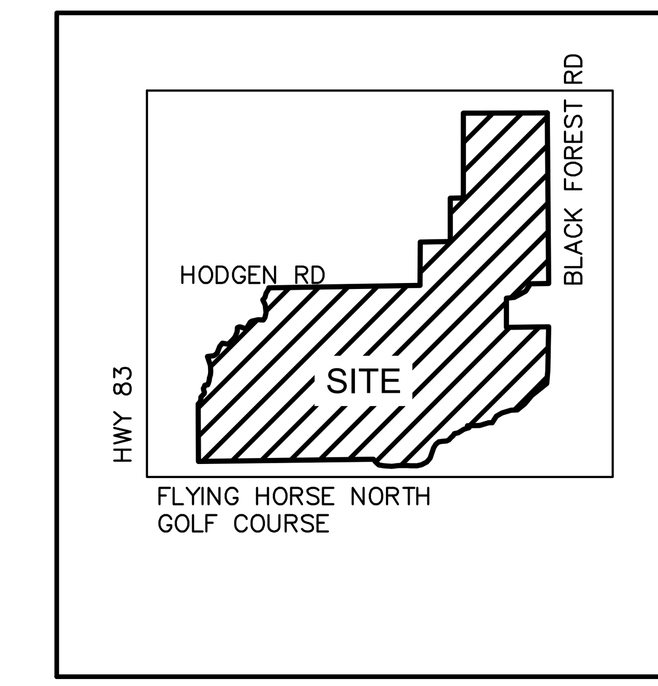
Depth Increment = 0.10 ft

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)
Top of Micropool	0.00		19.6	19.6	386		0.009		
ISV	0.33		19.6	19.6	386		0.009	127	0.003
	0.40		19.6	19.6	386		0.009	154	0.004
	0.50		19.6	19.6	386		0.009	193	0.004
	0.60		19.6	19.6	386		0.009	232	0.005
	0.70		19.6	19.6	386		0.009	270	0.006
	0.80		19.6	19.6	386		0.009	309	0.007
	0.90		37.4	28.4	1,063		0.024	369	0.008
	1.00		62.8	40.9	2,569		0.059	546	0.013
	1.10		88.2	53.4	4,711		0.108	904	0.021
	1.20		113.6	65.9	7,488		0.172	1,509	0.035
	1.30		139.0	78.4	10,899		0.250	2,423	0.056
	1.40		164.4	90.9	14,946		0.343	3,710	0.085
	1.50		189.8	103.4	19,628		0.451	5,433	0.125
	1.60		215.2	115.9	24,944		0.573	7,657	0.176
	1.70		240.6	128.4	30,896		0.709	10,443	0.240
	1.80		266.0	140.9	37,482		0.860	13,857	0.318
Floor	1.82		271.1	143.4	38,876		0.892	14,621	0.336
	1.90		271.7	144.0	39,142		0.899	17,741	0.407
	2.00		272.5	144.8	39,475		0.906	21,672	0.498
	2.10		273.3	145.6	39,809		0.914	25,636	0.589
	2.20		274.1	146.4	40,145		0.922	29,634	0.680
	2.30		274.9	147.2	40,482		0.929	33,665	0.773
	2.40		275.7	148.0	40,821		0.937	37,730	0.866
Zone 1 (WQCV)	2.45		276.1	148.4	40,990		0.941	39,776	0.913
	2.50		276.5	148.8	41,160		0.945	41,830	0.960
	2.60		277.3	149.6	41,501		0.953	45,963	1.055
	2.70		278.1	150.4	41,844		0.961	50,130	1.151
	2.80		278.9	151.2	42,187		0.968	54,331	1.247
	2.90		279.7	152.0	42,532		0.976	58,567	1.345
	3.00		280.5	152.8	42,878		0.984	62,838	1.443
	3.10		281.3	153.6	43,225		0.992	67,143	1.541
	3.20		282.1	154.4	43,574		1.000	71,483	1.641
Zone 2 (5-year)	3.23		282.4	154.7	43,679		1.003	72,792	1.671
	3.30		282.9	155.2	43,924		1.008	75,858	1.741
	3.40		283.7	156.0	44,275		1.016	80,268	1.843
	3.50		284.5	156.8	44,627		1.025	84,713	1.945
	3.60		285.3	157.6	44,981		1.033	89,193	2.048
	3.70		286.1	158.4	45,336		1.041	93,709	2.151
	3.80		286.9	159.2	45,693		1.049	98,260	2.256
	3.90		287.7	160.0	46,050		1.057	102,848	2.361
	4.00		288.5	160.8	46,409		1.065	107,471	2.467
	4.10		289.3	161.6	46,769		1.074	112,129	2.574
	4.20		290.1	162.4	47,131		1.082	116,824	2.682
	4.30		290.9	163.2	47,493		1.090	121,556	2.791
	4.40		291.7	164.0	47,857		1.099	126,323	2.900
	4.50		292.5	164.8	48,223		1.107	131,127	3.010
	4.60		293.3	165.6	48,589		1.115	135,968	3.121
	4.70		294.1	166.4	48,957		1.124	140,845	3.233
	4.80		294.9	167.2	49,326		1.132	145,759	3.346
	4.90		295.7	168.0	49,696		1.141	150,710	3.460
	5.00		296.5	168.8	50,068		1.149	155,698	3.574
	5.10		297.3	169.6	50,441		1.158	160,724	3.690
	5.20		298.1	170.4	50,815		1.167	165,787	3.806
	5.30		298.9	171.2	51,191		1.175	170,887	3.923
	5.40		299.7	172.0	51,568		1.184	176,025	4.041
	5.50		300.5	172.8	51,946		1.193	181,201	4.160
	5.60		301.3	173.6	52,325		1.201	186,414	4.279
	5.70		302.1	174.4	52,706		1.210	191,666	4.400
	5.80		302.9	175.2	53,087		1.219	196,955	4.521
	5.90		303.7	176.0	53,471		1.228	202,283	4.644
Zone 3 (100-year)	5.98		304.4	176.7	53,778		1.235	206,573	4.742
	6.00		304.5	176.8	53,855		1.236	207,649	4.767
	6.10		305.3	177.6	54,241		1.245	213,054	4.891
	6.20		306.1	178.4	54,628		1.254	218,498	5.016
	6.30		306.9	179.2	55,016		1.263	223,980	5.142
	6.40		307.7	180.0	55,406		1.272	229,501	5.269
	6.50		308.5	180.8	55,797		1.281	235,061	5.396
	6.60		309.3	181.6	56,189		1.290	240,660	5.525
	6.70		310.1	182.4	56,582		1.299	246,299	5.654
	6.80		310.9	183.2	56,977		1.308	251,977	5.785
	6.90		311.7	184.0	57,373		1.317	257,694	5.916
	7.00		312.5	184.8	57,770		1.326	263,451	6.048
	7.10		313.3	185.6	58,169		1.335	269,248	6.181
	7.20		314.1	186.4	58,569		1.345	275,085	6.315
	7.30		314.9	187.2	58,970		1.354	280,962	6.450
	7.40		315.7	188.0	59,372		1.363	286,879	6.586
	7.50		316.5	188.8	59,776		1.372	292,837	6.723
	7.60		317.3	189.6	60,181		1.382	298,834	6.860
	7.70		318.1	190.4	60,587		1.391	304,873	6.999
	7.80		318.9	191.2	60,994		1.400	310,952	7.138
	7.90		319.7	192.0	61,403		1.410	317,072	7.279
	8.00		320.5	192.8	61,813		1.419	323,232	7.420
	8.10		321.3	193.6	62,225		1.428	329,434	7.563
	8.20		322.1	194.4	62,637		1.438	335,677	7.706
	8.30		322.9	195.2	63,051		1.447	341,962	7.850
	8.40		323.7	196.0	63,466		1.457	348,288	7.996
	8.50		324.5	196.8	63,883		1.467	354,655	8.142
	8.60		325.3	197.6	64,301		1.476	361,064	8.289
	8.70		326.1	198.4	64,720		1.486	367,515	8.437
	8.80		326.9	199.2	65,140		1.495	374,008	8.586
	8.90		327.7	200.0	65,561		1.505	380,543	8.736
	9.00		328.5	200.8	65,984		1.515	387,121	8.887
	9.10		329.3	201.6	66,409		1.525	393,740	9.039
	9.20		330.1	202.4	66,834		1.534	400,402	9.192
	9.30		330.9	203.2	67,261		1.544	407,107	9.346
	9.40		331.7	204.0	67,689		1.554	413,855	9.501
	9.50		332.5	204.8	68,118		1.564	420,645	9.657
	9.60		333.3	205.6	68,548		1.574	427,478	9.814

Basin	Design Point	5 Year Pre Devlopment	100 Year Pre Development
A	A	20.84	43.83
B	B	103.48	221.28
C	C	33.36	71.27
D	D	31.56	67.84
E	E	223.69	483.10
F	F	24.27	51.63
G	G	79.17	166.51
H	H	18.59	39.78
I	I	34.58	72.63
J	J	56.31	120.46
K	K	92.05	195.43
L	L	107.58	228.73
M	M	11.48	24.61
N	N	68.16	143.11
O	O	22.69	48.54
P	P	38.52	82.17
Q	Q	64.68	137.80
R	R	108.65	232.13
S	S	25.99	54.65
T	T	4.04	8.68
	T1	137.90	294.73
	T2	145.46	311.00
U	U	4.15	8.95
V	V	29.63	63.92
W	W	3.45	7.33
X	X	167.76	361.56

Basin	Design Point	5 Year Pre Devlopment	100 Year Pre Development
	IRR_Pond	298.49	644.35
	SP1	207.17	515.49
	SP2	281.79	653.32
	SP3	320.31	725.59
AA	AA	38.76	80.22
BB	BB	40.62	84.15
	BB1	242.15	503.29
	BB2	257.03	534.86
	BB3	346.26	733.92
CC	CC	6.53	13.57
DD	DD	58.42	123.69
EE	EE	81.16	167.45
FF	FF	162.77	340.42
GG	GG	14.93	31.99
HH	HH	13.01	27.42
II	II	81.77	175.60
JJ	JJ	9.74	20.50
KK	KK	7.51	15.99
LL	LL	6.88	14.48
	LL1	24.12	50.88
	OF1	320.31	725.59
	OF2	145.46	311.00
	OF3	167.76	361.56
	OF4	346.26	733.92
	OF5	24.12	50.88





VICINITY MAP

LEGEND:

PROPOSED MAJOR CONTOUR — 5250
PROPOSED MINOR CONTOUR
EXISTING MAJOR CONTOUR — 5250
EXISTING MINOR CONTOUR
EXISTING CULVERT
PROPOSED DRAINAGE CHANNEL
PROPOSED ROAD
PROPERTY LINE
DIRECTIONAL FLOW ARROW
EMERGENCY OVERFLOW ARROW
EXISTING 100-YR FLOODWAY
EXISTING 100-YR FLOODPLAIN
PROPOSED 100-YR FLOODPLAIN
WATERSHED BOUNDARY
MAJOR BASIN LINE
100YR ZONE A FLOODPLAIN
PROPOSED DETENTION LOCATION (A)
POTENTIAL WATER QUALITY LOCATION (WQ)
SWMM CONVEYANCE ELEMENT (SWMM)
PROPOSED PEAK FLOW RATE (CFS) (850)
DESIGN POINT (X)
PROPOSED BASIN LABEL — XX BASIN DESIGNATION; AREA (AC.) XX; XX C5; XX C100

NOTES:

NORTH 0 300 600

HRGreen

Job No.:	211030.01
Prepared By:	CLB
Date:	02/21/2022

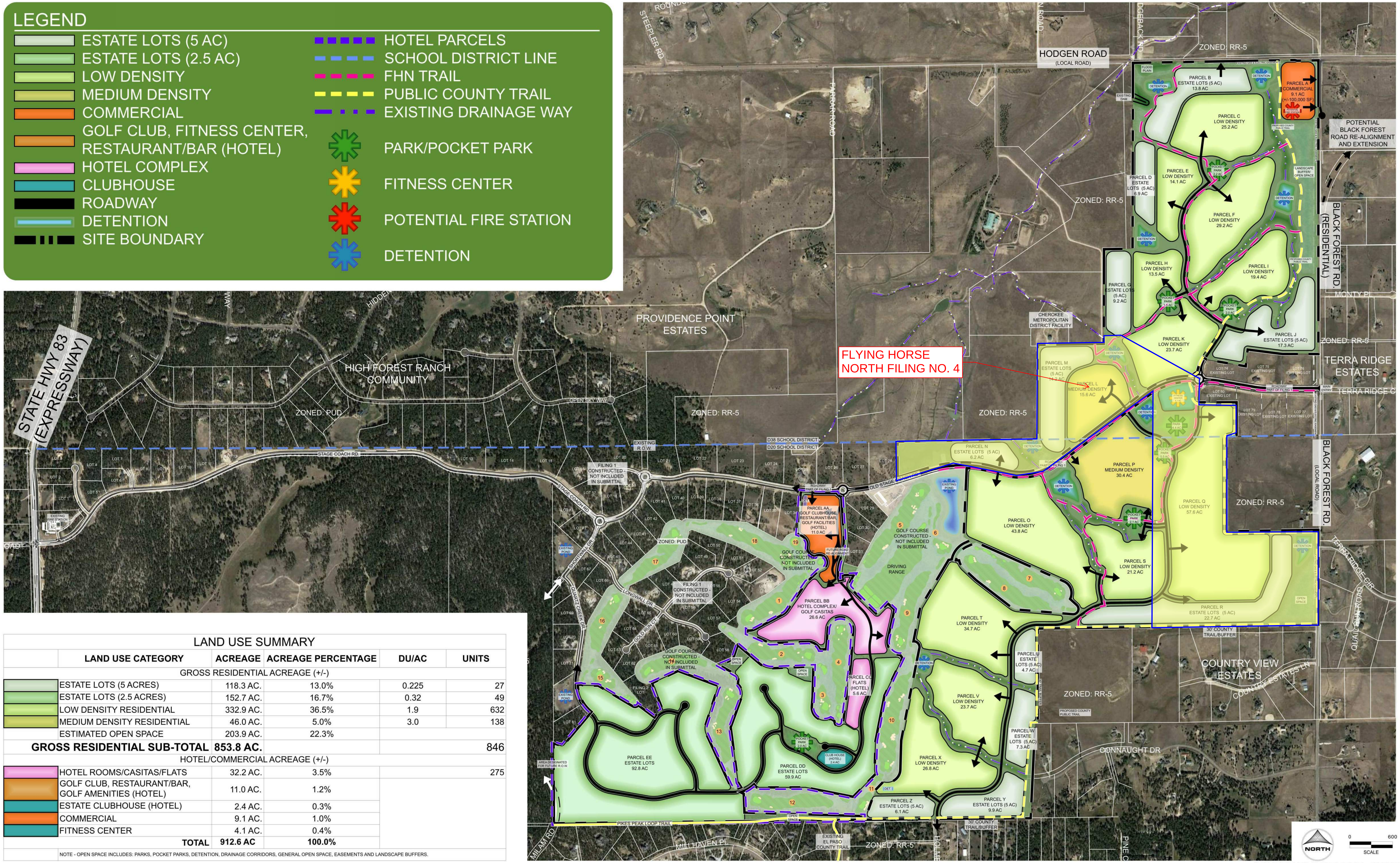
EXISTING EX1

FIG.EX1

BUDGE, CASSIDY, 8/1/2022 8:26 AM

HRGreen DRAWING PATH:J:\2021\211030.01\CAD\Dwgs\MDDP Exhibits\EX1 Exhibit.dwg

FLYING HORSE NORTH SKETCH PLAN



COUNTY FILE NUMBER: SKP223

	LAND USE CATEGORY	ACREAGE	ACREAGE PERCENTAGE	DU/AC	UNITS
	GROSS RESIDENTIAL ACREAGE (+/-)				
	ESTATE LOTS (5 ACRES)	118.3 AC.	13.0%	0.225	27
	ESTATE LOTS (2.5 ACRES)	152.7 AC.	16.7%	0.32	49
	LOW DENSITY RESIDENTIAL	332.9 AC.	36.5%	1.9	632
	MEDIUM DENSITY RESIDENTIAL	46.0 AC.	5.0%	3.0	138
	ESTIMATED OPEN SPACE	203.9 AC.	22.3%		
GROSS RESIDENTIAL SUB-TOTAL		**853.8 AC.**			846
	HOTEL/COMMERCIAL ACREAGE (+/-)				
	HOTEL ROOMS/CASITAS/FLATS	32.2 AC.	3.5%		275
	GOLF CLUB, RESTAURANT/BAR, GOLF AMENITIES (HOTEL)	11.0 AC.	1.2%		
	ESTATE CLUBHOUSE (HOTEL)	2.4 AC.	0.3%		
	COMMERCIAL	9.1 AC.	1.0%		
	FITNESS CENTER	4.1 AC.	0.4%		
	TOTAL	**912.6 AC**	**100.0%**		
	NOTE - OPEN SPACE INCLUDES: PARKS, POCKET PARKS, DETENTION, DRAINAGE CORRIDORS, GENERAL OPEN SPACE, EASEMENTS AND LANDSCAPE BUFFERS.				

HR GREEN Xrefs: EX-Topo; EX-Alta; xgt-1-ARCH DH01; EX-Parcels

DRAWN BY: JAG | JOB DATE: 05/21/2023
APPROVED: PLS | JOB NUMBER: 211030
CAD DATE: 07/01/2022
CAD FILE: J:\2021\211030\CAD\Dwgs\C\Sketch-Plan\BUBBLE-PLAN

BAR IS ONE INCH ON OFFICIAL DRAWINGS. 0 1" IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY.

NO.	DATE	BY	REVISION DESCRIPTION

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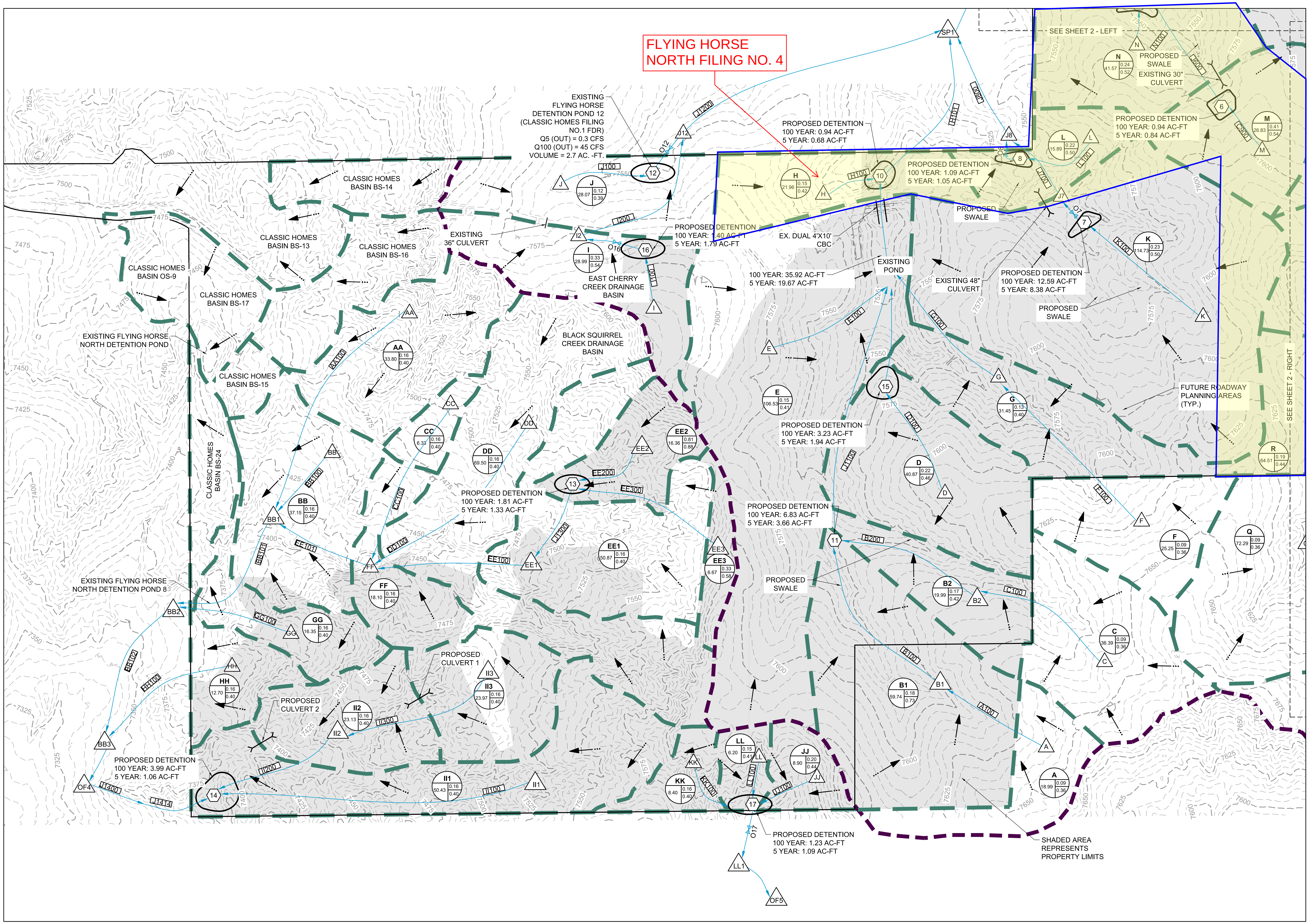
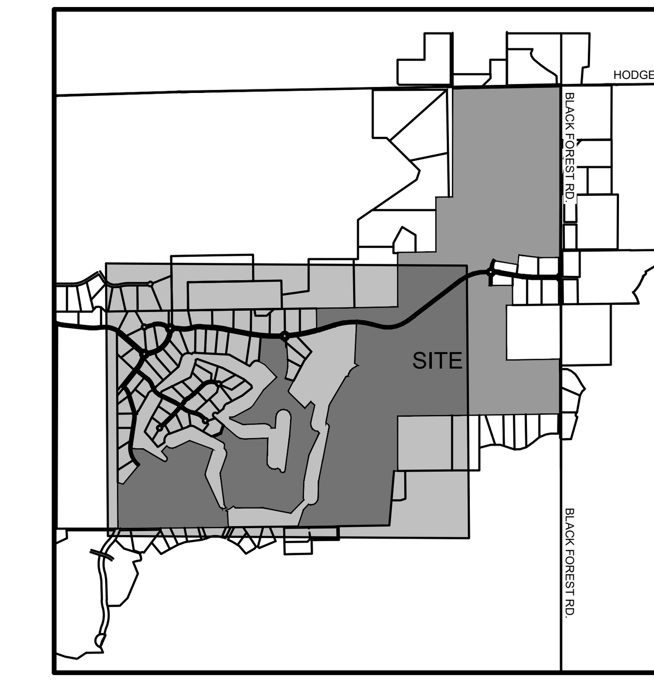
FLYING HORSE NORTH DEVELOPMENT, LLC.
EL PASO COUNTY, COLORADO

FLYING HORSE NORTH SKETCH PLAN
SKETCH PLAN DRAWING

SHEET SP.2 2





VICINITY MAP

LEGEND:

PROPOSED MAJOR CONTOUR	5250
PROPOSED MINOR CONTOUR	
EXISTING MAJOR CONTOUR	5250
EXISTING MINOR CONTOUR	
PROPOSED STORM DRAIN PIPE	
EXISTING STORM DRAIN PIPE	
PROPOSED DRAINAGE CHANNEL	
PROPOSED ROAD	
PROPERTY LINE	
DIRECTIONAL FLOW ARROW	
EMERGENCY OVERFLOW ARROW	
EXISTING 100-YR FLOODWAY	
EXISTING 100-YR FLOODPLAIN	
PROPOSED 100-YR FLOODPLAIN	
WATERSHED BOUNDARY	
MAJOR BASIN LINE	
100YR ZONE A FLOODPLAIN	
PROPOSED DETENTION LOCATION	A
POTENTIAL WATER QUALITY LOCATION	WQ
SWMM CONVEYANCE ELEMENT	SWMM
PROPOSED PEAK FLOW RATE (CFS)	850
DESIGN POINT	X
PROPOSED BASIN LABEL	XX BASIN DESIGNATION; AREA (AC.) XX; XX C5; XX C100

NOTES:

SEE SHEET 2 FOR DESIGN FLOWS

NORTH 0 200 400

HRGreen

Job No.:	211030.01
Prepared By:	TBI
Date:	9/9/2022

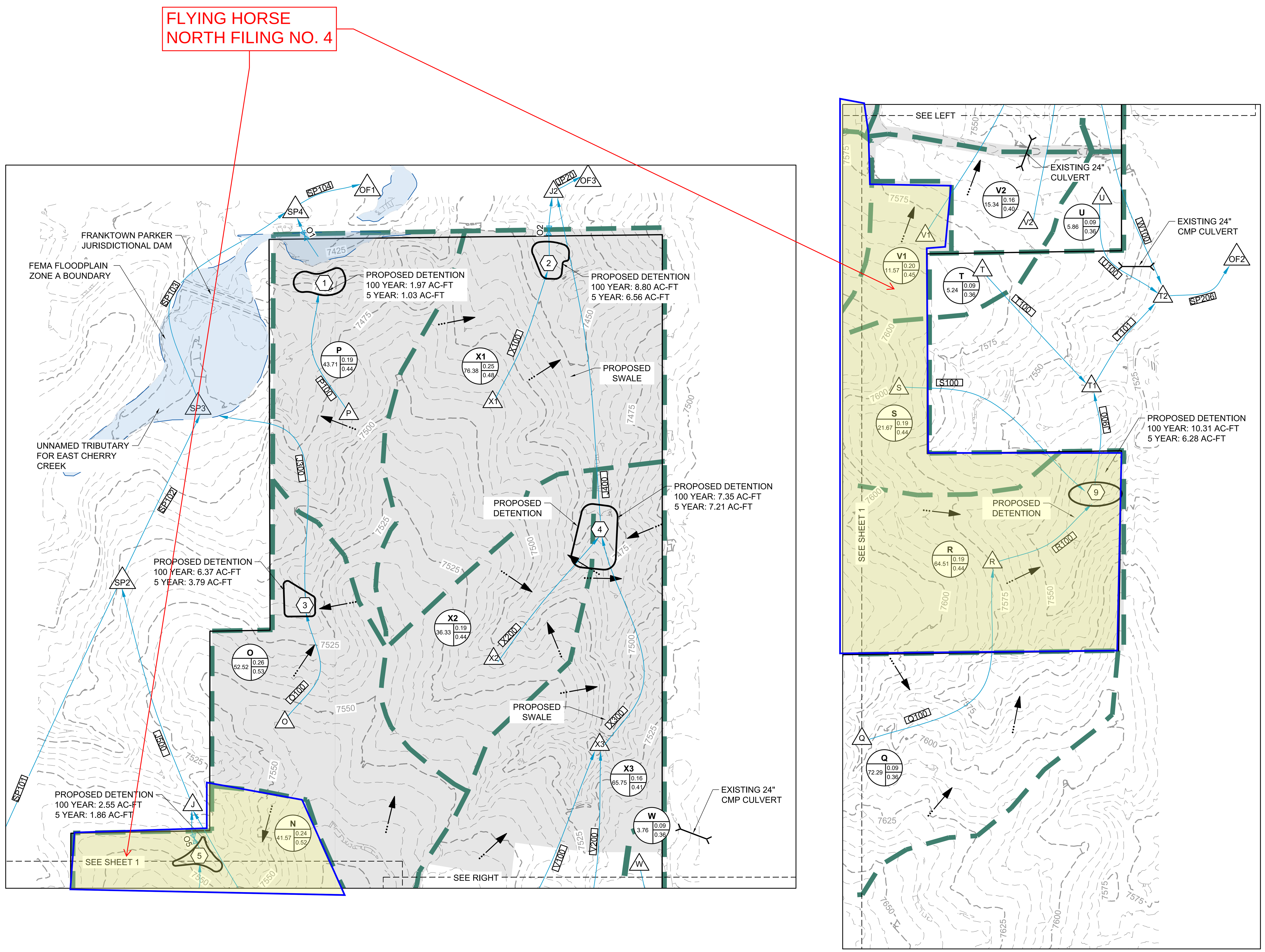
PROPOSED DRAINAGE BASINS

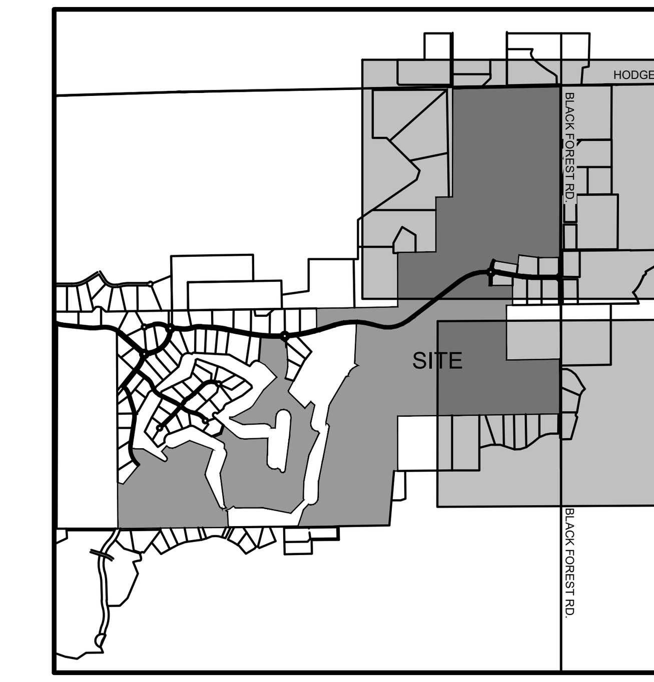
FIG.1

FERNANDEZ, SARAH, 9/9/2022 9:13 AM

HRGreen DRAWING PATH:J:\2021\211030.01\CAD\Dwgs\MDDP Exhibits\01_MDDP_PR_DRAINAGE_BASINS.dwg

BASIN	DESIGN POINT	5 YEAR POST DEVELOPMENT	100 YEAR POST DEVELOPMENT
A	A	20.84	43.83
AA	AA	39.23	81.18
B1	B1	66.93	133.69
B2	B2	17.99	37.14
BB	BB	40.62	84.15
	BB1	214.28	483.72
	BB2	229.61	515.49
	BB3	307.27	646.46
C	C	35.31	75.28
CC	CC	6.53	13.57
D	D	61.12	117.38
DD	DD	57.78	122.41
E	E	74.68	157.91
EE1	EE1	53.25	156.68
EE2	EE2	35.71	63.62
EE3	EE3	10.38	19.33
F	F	24.27	51.63
FF	FF	20.78	330.28
G	G	27.18	108.76
GG	GG	15.49	32.48
H	H	17.86	37.80
HH	HH	13.56	28.16
I	I	40.37	78.06
II1	II1	34.94	74.39
II2	II2	28.04	116.26
II3	II3	28.32	58.65
	IRR_J	114.18	274.80
	IRR_POND	243.77	550.27
J	J	24.45	51.19
JJ	JJ	11.49	22.80
K	K	200.94	382.30
KK	KK	8.14	16.95
L	L	15.97	32.40
LL	LL	7.36	15.07
	LL1	0	49.55
M	M	46.54	89.08
N	N	73.48	141.24
O	O	63.86	127.40
	OF1	240.43	705.93
	OF2	104.34	242.18
	OF3	95.68	271.49
	OF4	307.27	646.46
	OF5	16.85	49.55
P	P	40	82.83
Q	Q	64.68	137.80
R	R	56.59	253.86
S	S	30.83	58.96
	SP1	189.85	511.89
	SP2	223.43	618.35
	SP3	212.45	641.31
	SP4	240.49	706.05
T	T	4.04	8.68
	T1	98.27	228.33
	T2	104.34	242.18
U	U	4.81	10.51
V1	V1	13.99	27.67
V2	V2	16.15	33.25
W	W	3.45	7.46
X1	X1	80.91	163.27
X2	X2	41.46	82.46
X3	X3	47.59	100.73





VICINITY MAP

LEGEND:

PROPOSED MAJOR CONTOUR
PROPOSED MINOR CONTOUR
EXISTING MAJOR CONTOUR
EXISTING MINOR CONTOUR
PROPOSED STORM DRAIN PIPE
EXISTING STORM DRAIN PIPE
PROPOSED DRAINAGE CHANNEL
PROPOSED ROAD
PROPERTY LINE
DIRECTIONAL FLOW ARROW
EMERGENCY OVERFLOW ARROW
EXISTING 100-YR FLOODWAY
EXISTING 100-YR FLOODPLAIN
PROPOSED 100-YR FLOODPLAIN
WATERSHED BOUNDARY
MAJOR BASIN LINE
100YR ZONE A FLOODPLAIN
PROPOSED DETENTION LOCATION
POTENTIAL WATER QUALITY LOCATION
SWMM CONVEYANCE ELEMENT
PROPOSED PEAK FLOW RATE (CFS)
DESIGN POINT
PROPOSED BASIN LABEL (BASIN DESIGNATION; AREA (AC.); C5; C100)

NOTES:

NORTH 0 200 400

HRGreen

Job No.:	211030.01
Prepared By:	TBI
Date:	9/9/2022

PROPOSED DRAINAGE BASINS

FIG.1

Publication No. FHWA-NHI-05-114
September 2005

U.S. Department of Transportation

Federal Highway Administration

Hydraulic Engineering Circular No. 15, Third Edition

Design of Roadside Channels with Flexible Linings

National Highway Institute

Table 2.1. Typical Roughness Coefficients for Selected Linings

Lining Category	Lining Type	Manning's n[1] Maximum	Typical	Minimum
Rigid	Concrete	0.015	0.013	0.011
	Grouted Riprap	0.040	0.030	0.028
	Stone Masonry	0.042	0.032	0.030
	Soil Cement	0.025	0.022	0.020
	Asphalt	0.018	0.016	0.016
Unlined	Bare Soil[2]	0.025	0.020	0.016
	Rock Cut (smooth, uniform)	0.045	0.035	0.025
RECP	Open-weave textile	0.028	0.025	0.022
	Erosion control blankets	0.045	0.035	0.028
	Turf reinforcement mat	0.036	0.030	0.024

[1]Based on data from Kouwen, et al. (1980), Cox, et al. (1970), McWhorter, et al. (1968) and Thibodeaux (1968).
[2]Minimum value accounts for grain roughness. Typical and maximum values incorporate varying degrees of form roughness.

Table 2.2. Typical Roughness Coefficients for Riprap, Cobble, and Gravel Linings

Lining Category	Lining Type	Manning's n for Selected Flow Depths[1] 0.15 m (0.5 ft)	0.50 m (1.6 ft)	1.0 m (3.3 ft)
Gravel Mulch	D_{50} = 25 mm (1 in.)	0.040	0.033	0.031
	D_{50} = 50 mm (2 in.)	0.056	0.042	0.038
Cobbles	D_{50} = 0.10 m (0.33 ft)	--[2]	0.055	0.047
Rock Riprap	D_{50} = 0.15 m (0.5 ft)	--[2]	0.069	0.056
	D_{50} = 0.30 m (1.0 ft)	--[2]	--[2]	0.080

[1]Based on Equation 6.1 (Blodgett and McConaughy, 1985). Manning's n estimated assuming a trapezoidal channel with 1:3 side slopes and 0.6 m (2 ft) bottom width.
[2]Shallow relative depth (average depth to D_{50} ratio less than 1.5) requires use of Equation 6.2 (Bathurst, et al., 1981) and is slope-dependent. See Section 6.1.

2.2 SHEAR STRESS

2.2.1 Equilibrium Concepts

Most highway drainage channels cannot tolerate bank instability and possible lateral migration. Stable channel design concepts focus on evaluating and defining a channel configuration that will perform within acceptable limits of stability. Methods for evaluation and definition of a stable configuration depend on whether the channel boundaries can be viewed as:

- essentially rigid (static)
- movable (dynamic).

In the first case, stability is achieved when the material forming the channel boundary effectively resists the erosive forces of the flow. Under such conditions the channel bed and banks are in protected. Therefore permissible shear stress is not significantly affected by the erodibility of the underlying soil. However, if the lining moves, the underlying soil will be exposed to the erosive force of the flow.

Table 2.3 provides typical examples of permissible shear stress for selected lining types. Representative values for different soil types are based on the methods found in Chapter 4 while those for gravel mulch and riprap are based on methods found in Chapter 7. Vegetative and RECP lining performance relates to how well they protect the underlying soil from shear stresses so these linings do not have permissible shear stresses independent of soil types. Chapters 4 (vegetation) and 5 (RECPs) describe the methods for analyzing these linings. Permissible shear stress for gabion mattresses depends on rock size and mattress thickness as is described in Section 7.2.

Table 2.3. Typical Permissible Shear Stresses for Bare Soil and Stone Linings

		Permissible Shear Stress	
Lining Category	Lining Type	N/m^2	lb/ft^2
Bare Soil[1] Cohesive (PI = 10)	Clayey sands	1.8-4.5	0.037-0.095
	Inorganic silts	1.1-4.0	0.027-0.11
	Silty sands	1.1-3.4	0.024-0.072
Bare Soil[1] Cohesive (PI $\geq$ 20)	Clayey sands	4.5	0.094
	Inorganic silts	4.0	0.083
	Silty sands	3.5	0.072
	Inorganic clays	6.6	0.14
Bare Soil[2] Non-cohesive (PI < 10)	Finer than coarse sand D_{75}<1.3 mm (0.05 in)	1.0	0.02
	Fine gravel D_{75}=7.5 mm (0.3 in)	5.6	0.12
	Gravel D_{75}=15 mm (0.6 in)	11	0.24
Gravel Mulch[3]	Coarse gravel D_{50} = 25 mm (1 in)	19	0.4
	Very coarse gravel D_{50} = 50 mm (2 in)	38	0.8
Rock Riprap[3]	D_{50} = 0.15 m (0.5 ft)	113	2.4
	D_{50} = 0.30 m (1.0 ft)	227	4.8

[1]Based on Equation 4.6 assuming a soil void ratio of 0.5 (USDA, 1987).
[2]Based on Equation 4.5 derived from USDA (1987)
[3]Based on Equation 6.7 with Shield's parameter equal to 0.047.

2.3 DESIGN PARAMETERS

2.3.1 Design Discharge Frequency

Design flow rates for permanent roadside and median drainage channel linings usually have a 5 or 10-year return period. A lower return period flow is allowable if a transitional lining is to be used, typically the mean annual storm (approximately a 2-year return period, i.e., 50 percent probability of occurrence in a year). Transitional channel linings are often used during the establishment of vegetation. The probability of damage during this relatively short time is low,

TABLE 10-1

COMPOSITE ROUGHNESS COEFFICIENTS FOR UNLINED OPEN CHANNELS
(Reference: Chow, Ven Te, 1959; Open-Channel Hydraulics)

$$n = (n_o + n_1 + n_2 + n_3 + n_4)m \qquad (10\text{-}2)$$

	Channel Conditions	Value
Material Type n_o	Earth	0.020
	Fine Gravel	0.024
	Coarse Gravel	0.028
Degree of Irregularity n_1	Smooth	0.000
	Minor	0.005
	Moderate	0.010
	Severe	0.020
Variation of Channel Cross Section n_2	Gradual	0.000
	Alternating Occasionally	0.005
	Alternating Frequently	0.010 - 0.015
Relative Effect of Obstructions n_3	Negligible	0.000
	Minor	0.010 - 0.015
	Appreciable	0.020 - 0.030
	Severe	0.040 - 0.060
Vegetation n_4	Low	0.005 - 0.010
	Medium	0.010 - 0.025
	High	0.025 - 0.050
	Very High	0.050 - 0.100
Degree of Meandering m	Minor	1.000 - 1.200
	Appreciable	1.200 - 1.500
	Severe	1.500

- significant uncertainty regarding the design discharge
- consequences of failure are high

The basic procedure for flexible lining design consists of the following steps and is summarized in Figure 3.1. (An alternative process for determining an allowable discharge given slope and shape is presented in Section 3.6.)

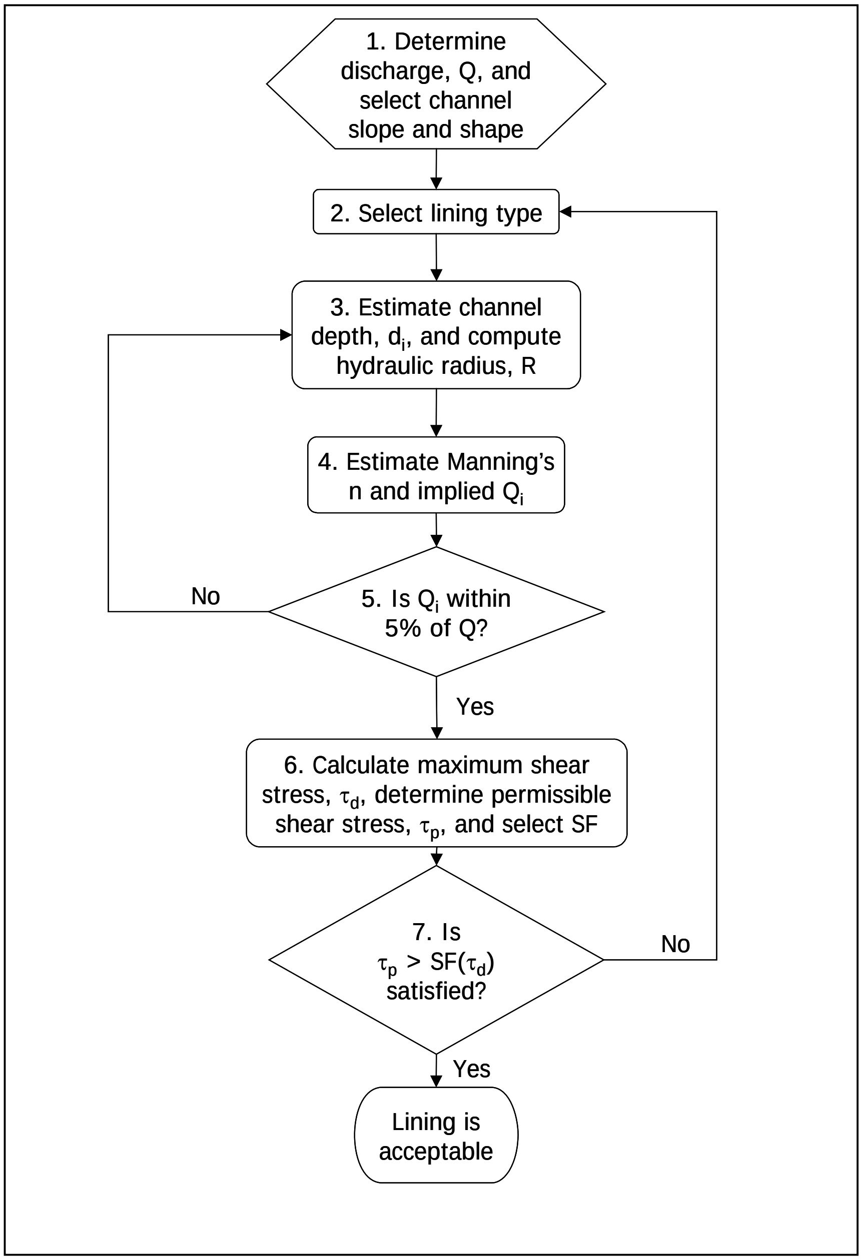
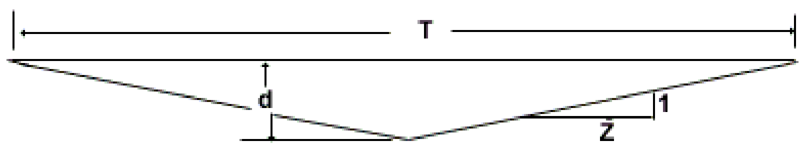


Figure 3.1. Flexible Channel Lining Design Flow Chart

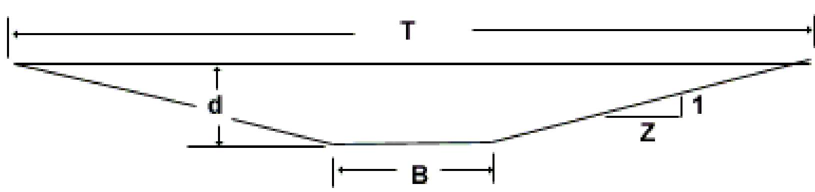
APPENDIX B: CHANNEL GEOMETRY EQUATIONS

V- SHAPE



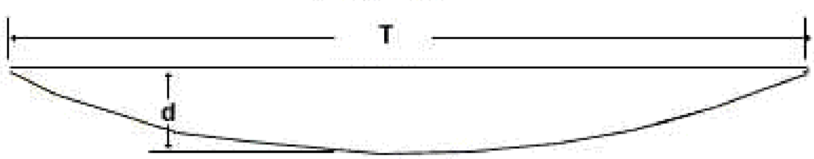
$$A = Zd^2$$
$$p = 2d\sqrt{Z^2 + 1}$$
$$T = 2dZ$$

TRAPEZOIDAL



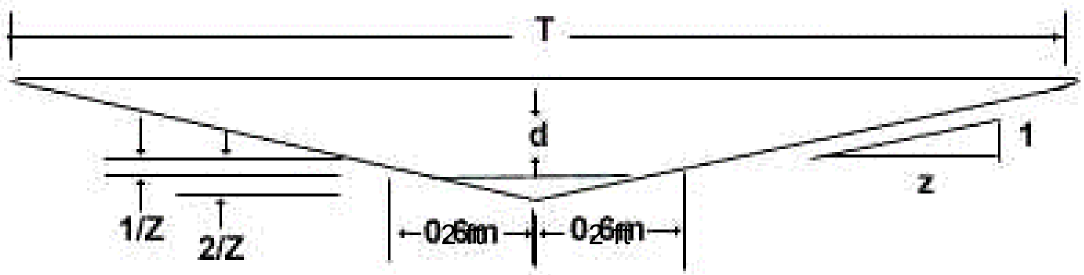
$$A = Bd + Zd^2$$
$$P = B + 2d\sqrt{z^2 + 1}$$
$$T = B + 2dZ$$

PARABOLIC



$$A = \frac{2}{3}Td$$
$$P = \frac{1}{2}\sqrt{16d^2 + T^2} + \left(\frac{T^2}{8d}\right)\ln_e\left(\frac{4d + \sqrt{16d^2 + T^2}}{T}\right)$$
$$T = 1.5\frac{A}{d}$$

V-SHAPE WITH ROUNDED BOTTOM



2 CASES

No. 1

If d ≤ 1/Z, then:

$$A = \frac{8}{3} d \sqrt{dZ}$$

$$P = 2Z \ln_e \left(\sqrt{\frac{d}{Z}} + \sqrt{1 + \frac{d}{Z}} \right) + 2\sqrt{d^2 + dZ}$$

$$T = 4\sqrt{dZ}$$

No. 2

If d > 1/Z, then:

$$A = \frac{8}{3} d + 4\left(d - \frac{1}{Z} \right) + Z\left(d - \frac{1}{Z} \right)^2$$

$$P = 2Z \ln_e \left(\frac{1 + \sqrt{Z^2 + 1}}{Z} \right) + 2\frac{\sqrt{Z^2 + 1}}{Z} + 2\left(d - \frac{1}{Z} \right)\sqrt{1 + Z^2}$$

$$T = 4 + 2Z\left(d - \frac{1}{Z} \right)$$

Note: The equations for V-shape with rounded bottom only apply in customary units for a channel with a 4 ft wide rounded bottom.

ROADSIDE DITCH CALCUALTIONS

Limits of specific Ditch Lining relative to max. slope

		Erosion Control Blanket (ECB)		**Turf Reinforcement Mat (TRM)**		**Revegetation - Grass lined**
		(North American Green - SC150)		**(North American Green - P300)**		**(Native Seed Mix)**
	Given:	**(Temporary - 24 months)**		**(Permanent)**		
	Max. Design Flow (cfs)	7.4		70.0		4.3
	Permissible Shear (lbs/ft.^{2})	2.0		8.0		2.0
	Permissible Velocity (ft./sec.)	8.0		16.0		3.0
	Safety Factor	1		1		1
	Max. Ditch Slope	5%		10%		2%
	Ditch Section (24 in. depth)	V-Ditch		V-Ditch		V-Ditch
	Flow Area (ft.^{2})	1.69		6.25		1.44
	Wetted Perimeter (ft.)	5.37		10.33		4.96
	Hydraulic Radius	0.31		0.61		0.29
	Mannings n	0.035		0.030		0.030
	Depth of Flow (max.)	0.65		1.25		0.60
	Calculations:					
	Shear Stress (lbs/ft.^{2})	2.0		7.8		0.7
	Velocity (ft./sec.)	4.4		11.2		3.0
	Allowed Flow (cfs)	7.4		70.2		4.4

ROADSIDE DITCH CALCUALTIONS

Limits of specific Ditch Lining relative to max. flow

		Erosion Control Blanket (ECB)		**Turf Reinforcement Mat (TRM)**		**Revegetation - Grass lined**
		(North American Green - SC150)		**(North American Green - P300)**		**(Native Seed Mix)**
	Given:	**(Temporary - 24 months)**		**(Permanent)**		
	Max. Design Flow (cfs)	43.8		70.0		4.3
	Permissible Shear (lbs/ft.^{2})	2.0		8.0		2.0
	Permissible Velocity (ft./sec.)	8.0		16.0		3.0
	Safety Factor	1		1		1
	Max. Ditch Slope	2%		10%		2%
	Ditch Section (24 in. depth)	V-Ditch		V-Ditch		V-Ditch
	Flow Area (ft.^{2})	9.00		6.25		1.44
	Wetted Perimeter (ft.)	12.39		10.33		4.96
	Hydraulic Radius	0.73		0.61		0.29
	Mannings n	0.035		0.030		0.030
	Depth of Flow (max.)	1.50		1.25		0.60
	Calculations:					
	Shear Stress (lbs/ft.^{2})	1.9		7.8		0.7
	Velocity (ft./sec.)	4.9		11.2		3.0
	Allowed Flow (cfs)	43.8		70.2		4.4

ROLLMAX™
ROLLED EROSION CONTROL

ROLLED EROSION CONTROL

SYSTEMS BROCHURE

NORTH AMERICAN GREEN®

Temporary RollMax™ Solutions

Erosion control has never been so simple yet effective. North American Green RollMax™ temporary Erosion Control Blankets (ECBs) provide immediate erosion protection and vegetation establishment assistance, then degrade once the vegetation's root and stem systems are mature enough to stabilize the soil.

Our high-quality temporary solutions are available in varying functional longevities and materials:

- Short-term photodegradable blankets with a functional longevity of 45 days up to 12 months
- Extended-term and long-term photodegradable blankets for protection up to 36 months
- Short-term biodegradable blankets for protection up to 12 months
- Extended-term and long-term biodegradable products for protection and mulching from 18 to 24 months

ERONET™ EROSION CONTROL BLANKETS

North American Green EroNet™ ECBs incorporate photodegradable nettings, which means they are broken down by the ultraviolet rays in sunlight. These temporary products can be used in a variety of scenarios, including moderate to steep slopes, medium-to high-flow channels, shorelines and other areas needing protection until permanent vegetation establishment.

EroNet™ C125® Long-Term Photodegradable Double-Net Coconut Blanket

The C125® ECB is made of 100% coconut fiber stitched between heavyweight UV-stabilized polypropylene nets. It offers excellent durability, erosion control and longevity for severe slopes, steep embankments, high-flow channels and other areas where vegetation may take up to 36 months to grow in.

The EroNet temporary ECBs are designed to provide immediate erosion protection and vegetation establishment assistance, and then degrade after the vegetation is mature enough to permanently stabilize the underlying soil. Both short-term and extended-term ECBs are available.

EroNet™ SC150® Extended-Term Photodegradable Double-Net Straw/Coconut Blanket

With a layer of 70% straw and 30% coconut fiber stitched between a heavyweight UV-stabilized polypropylene top net and a lightweight photodegradable polypropylene bottom net, the SC150® ECB has increased durability, erosion control capabilities and longevity. It is suitable for steeper slopes, medium-flow channels and other areas where it may take vegetation up to 24 months to grow in.

EroNet™ S150® Short-Term Photodegradable Double-Net Straw Blanket

The S150 ECB is made with a 100% straw fiber matrix stitched between lightweight photodegradable polypropylene top and bottom nets. The S150 ECB's double-net construction has greater structural integrity than single net blankets for use on steeper slopes and in channels with moderate water flow. It provides erosion protection and mulching for up to 12 months.

EroNet™ DS150™ Ultra Short-Term Photodegradable Double-Net Straw Blanket

The DS150™ ECB is suitable for high maintenance areas where close mowing will occur soon after installation. Special additives in the thread and top and bottom net ensure it degrades in adequate sunlight within 60 days.

EroNet™ S75® Short-Term Photodegradable Single-Net Straw Blanket

The S75® ECB protects and mulches moderate slopes and low-flow channels in low maintenance areas for up to 12 months. It is constructed of 100% straw fiber stitched with degradable thread to a lightweight photodegradable polypropylene top net.

EroNet™ DS75™ Ultra Short-Term Photodegradable Single-Net Straw Blanket

Designed for high maintenance areas where close mowing will occur soon after installation, the DS75™ ECB degrades within 45 days because of special additives in the thread and top net that facilitate rapid breakdown in adequate sunlight.

Every site has its own unique characteristics and challenges. EroNet Erosion Control Blankets are available in varying longevities to suit a variety of scenarios and conditions.

With our Erosion Control Materials Design Software (ECMDS), you can select either short-term, extended-term or long-term EroNet blankets based on your specific design needs.

Back in the day, rock riprap, articulated concrete blocks and poured concrete were the only way to deal with erosion in high-flow channels, on shorelines and other areas where water and/or wind exceed the shear limits of unreinforced vegetation.

Not anymore. North American Green permanent Turf Reinforce-ment Mats (TRMs) use 100% synthetic components or a composite of synthetic and natural materials for long-term erosion protection and vegetation establishment. Whether com-pared to rock riprap or concrete, the RollMax™ Systems' permanent TRMs offer a number of significant advantages:

- Prevent loss of precious topsoil to wind and water erosion
- Permanently reinforce vegetation root and stem structures
- Provide excellent conditions for quick, healthy vegetation growth
- Stabilize slopes from erosion to keep roadways safe and clean
- Protect water quality in lakes, rivers and streams
- Protect dormant seeding during winter months
- Easily conform to landscape features
- Lightweight for easy handling and transportation

VMAX® COMPOSITE TURF REINFORCEMENT MATS

VMax® C-TRMs combine three-dimensional matting with fiber matrix material for permanent erosion control on severe slopes, spillways, stream banks, shorelines and in high- to extreme-flow channels. These extensively tested products provide maximum performance through all three phases of reinforced vegetative lining development: unvegetated, establishment, and maturity. Incorporating the best performance features of temporary and permanent North American Green erosion control products, VMax C-TRMs deliver these tangible benefits:

- Surface-applied for the highest level of immediate soil protection
- Less than one third of the installed cost of rock or concrete
- No heavy equipment needed to install
- More attractive and effective "Green" alternative than rock riprap or concrete

VMax® High-Performance TRMs (HPTRMs)

VMax® HPTRMs utilize patent-pending woven 3-D structures that are soil-filled for use in areas experiencing high stress and strain. The VMax HPTRMs are designed to provide appropriate thickness and open area for effective erosion and vegetation reinforcement against high flow induced shear forces. Our HPTRMs are excellent for increased bearing capacity of vegetated soils subjected to heavy loads from maintenance equipment and other vehicular traffic.

The TRMs easily conform to various landscape features to prevent the loss of precious topsoil.

The RollMax TRMs are installed in a one-step operation directly over the prepared seedbed saving time and money and ensuring the highest level of erosion control and vegetation reinforcement.

VMAx® TMaxTM Permanent HPTRM

The TMax HPTRM woven polypropylene technology is designed to provide appropriate thickness and open area for effective erosion and vegetation reinforcement against high flow induced shear forces up to 15 pfs (kN/m2), and with the highest tensile strength on the market up to 5,000 lbs/ft (73 kN/m). TMax maybe used as an alternative to hard armor system in extreme erosion control applications.

VMax® P550® Permanent TRM

P550® TRM has a polypropylene fiber matrix augmenting the permanent netting structure with permanent mulching and erosion control performance. Unvegetated, the P550 TRM reduces soil loss to less than 0.5 in. (12.7 mm) under shear stress up to 4.0 lbs/ft^2 (191 Pa). The ultra-strong structure drives the vegetated shear resistance up to 14 lbs/ft^2 (672 Pa). The P550 TRM may be used as an alternative for poured concrete or articulated concrete blocks in extreme erosion control projects.

VMax® C350® Permanent TRM

A 100% coconut fiber matrix supplements the C350's permanent three-dimensional netting structure with initial mulching and erosion control performance for up to 36 months. Unvegetated, the C350® TRM reduces soil loss to less than 0.5 in. (12.7 mm) under shear stress up to 3.2 lbs/ft^2 (153 Pa) and boosts permanent vegetation performance up to 12 lbs/ft^2 (576 Pa). This environmentally friendly alternative to 30 in. (76 cm) or larger rock riprap is ideal for severe erosion control projects.

VMax® SC250® Permanent TRM

The SC250® permanent TRM has a 70% straw/30% coconut fiber matrix to enhance initial mulching and erosion control performance for up to 24 months. Unvegetated, SC250 TRMs reduce soil loss to less than 0.5 in. (12.7 mm) under shear stress up to 3.0 lbs/ft^2, and increases permanent vegetation performance up to 10 lbs/ft^2 (480 Pa) for a green alternative to rock riprap.

ERONET™ PERMANENT EROSION CONTROL BLANKETS

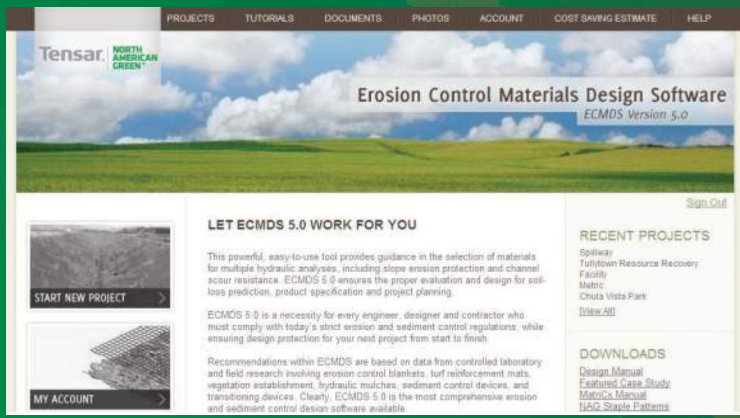
The EroNet™ Permanent ECB provides immediate erosion protection and vegetation establishment assistance until vegetation roots and stems mature.

EroNet™ P300® Permanent Erosion Control Blankets

The P300® permanent erosion control blanket consists of UV-stabilized polypropylene fiber stitched between heavy-weight UV-stabilized polypropylene top and bottom nets. These mats reduce soil loss and protect vegetation from being washed away or uprooted, even under high stress. Unvegetated, they reduce soil loss to less than 0.5 in. (12.7 mm) under shear stress up to 3.0 lbs/ft^2 (144 Pa), and protect vegetation from being washed away or uprooted when exposed to shear stresses up to 8 lbs/ft^2 (383 Pa).

To boost performance of the VMax turf reinforcement mats in critical applications, combine with our ShoreMax® flexible transition mat to create a system that can dramatically elevate the permissible shear stress and velocity protection beyond many hard armor solutions.

VMax Mats are perfect for pipe outlets, channel bottoms, shoreline transition zones, and other areas subjected to highly turbulent water flows.



Design and Installation Tools

SHIFT, CONTROL, ENTER

Professional guidance on RECP selection, design and project planning is at your fingertips with Tensar's proprietary Erosion Control Materials Design Software (ECMDS®). This web-based program incorporates design methodologies from the Federal Highway Administration and United States Department of Agriculture to analyze your specific site conditions, and make quantified recommendations based on data from controlled laboratory and field research. ECMDS is a must-have if you face tough erosion and sediment control regulations. Best of all, it's free of charge, compliments of North American Green. To learn more and access the software directly, go to **www.ECMDS.com**.

INSTRUCTIONS INCLUDED

Proper anchoring patterns and rates must be used to achieve optimal results in RECP installation. View our installation guides for stapling patterns. Site specific staple pattern recommendations based on soil type and severity of application may be acquired through our ECMDS.

HOLD ON TIGHT

When under the pressure of severe conditions, even the best erosion control products can't function to their full potential without proper installation and anchoring. North American Green supplies a wide variety of fastener options for nearly every application and soil type.

For use in cohesive soils, wire staples are a cost-effective means to fasten RECPs. Available in 6 in., 8 in., 10 in. and 12 in. lengths, our U-shaped staples can reach to various depths to ensure adequate pull-out resistance. For installation using our handy Pin Pounder installation tool, 6 in. V-top staples or 6 in. circle top pins are available.

Our biodegradable BioStakes® are available in 4 in. and 6 in. lengths and provide an environmentally friendly alternative to metal staples. For an even more durable, deeper reaching yet all-natural anchoring option, our wood EcoStakes® are available in 6 in., 12 in., 18 in. and 24 in. lengths.

For severe applications needing the ultimate, long-lasting hold, try our 12 and 18 in. rebar staples, our 12 in. plastic ShoreMax® stakes, or our complete line of percussion earth anchors. The Tensar earth anchors reach deep into the soil strata to offer enhanced anchoring in the worst conditions. Our variety of earth anchors are designed for durability and holding power under extreme hydraulic stresses and adverse soil conditions *(Table 1)*.

For more information on the RollMax Systems or other systems within the North American Green Erosion Control Solutions, call **800-772-2040** or visit **nagreen.com**.

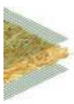
Earth Anchor Options

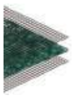
					EA 400		EA 680	
	Tendon Type (3/32 in. x 36 in.)	**Assembly Description**	Fast Install	Economic Anchor	Stainless	Galvanized	Stainless	Galvanized
End Piece Options with a PVC Face Plate	**Copper Stop Sleeve** with Stainless Steel Washer	Manually crimped to the stainless steel cable to secure the face plate.		X	X		X	
	Grip End Piece with Stainless Steel Washer	Three-dimensional, self-securing metal end piece that does not require manual crimping for tendon tensioning.	X	X	X	X	X	X
	Wedge Grip Piece	Self-securing end piece that installs flush to the face plate. Does not require manual crimping for tendon tensioning.	X		X	X	X	X
	Aluminum Stop Sleeve with Stainless Steel Washer	Manually crimped to the galvanized cable to secure the face plate.		X		X		X

TABLE 1

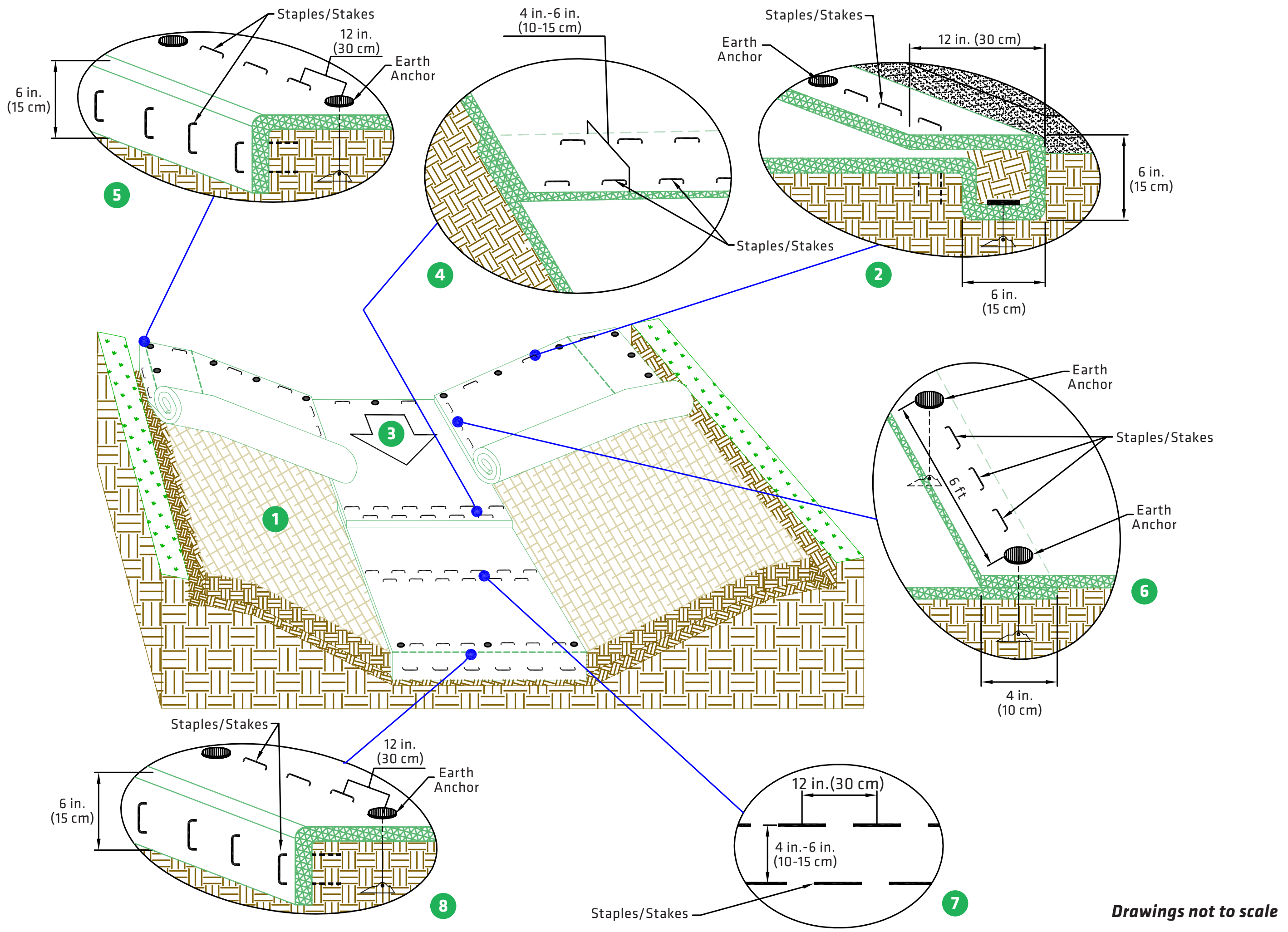
The complete line of RollMax™ products offers a variety of options for both short-term and permanent erosion control needs. Reference the RollMax Products Chart below to find the right solution for your next project.

RollMax Product Selection Chart

TEMPORARY					
	Product Description	**Longevity**	**Applications**	**Design Permissible Shear Stress lbs/ft² (Pa)**	**Design Permissible Velocity ft/s (m/s)**
ERONET					
 DS75	1.5 lb., accelerated photodegradable, polypropylene top net, 100% straw fiber matrix	45 days	Low Flow Channels 4:1 - 3:1 Slopes	Unvegetated 1.55 (74)	Unvegetated 5.0 (1.52)
 DS150	1.5 lb., photodegradable, polypropylene top & bottom net, 100% straw fiber matrix	60 days	Moderate Flow Channels 3:1 - 2:1 Slopes	Unvegetated 1.75 (84)	Unvegetated 6.0 (1.83)
 S75	1.5 lb., photodegradable, polypropylene top net, 100% straw fiber matrix	12 months	Low Flow Channels 4:1 - 3:1 Slopes	Unvegetated 1.55 (74)	Unvegetated 5.0 (1.52)
 S150	1.5 lb., photodegradable, polypropylene top & bottom net, 100% straw fiber matrix	12 months	Moderate Flow Channels 3:1 - 2:1 Slopes	Unvegetated 1.75 (84)	Unvegetated 6.0 (1.83)
 SC150	2.9 lb., UV-stable polypropylene top net, 70% straw/30% coconut fiber matrix, 1.5 lb., photodegradable polypropylene bottom net	24 months	Medium Flow Channels 2:1 - 1:1 Slopes	Unvegetated 2.0 (96)	Unvegetated 8.0 (2.44)
 C125	2.9 lb., UV stable polypropylene top & bottom nets, 100% coconut fiber matrix	36 months	High Flow Channels 1:1 and Greater Slopes	Unvegetated 2.25 (108)	Unvegetated 10.0 (3.05)
BIONET					
 S75BN	9.3 lb., leno woven biodegradable jute top net, 100% straw fiber matrix	12 months	Low Flow Channels 4:1 - 3:1 Slopes	Unvegetated 1.60 (76)	Unvegetated 5.0 (1.52)
 S150BN	9.3 lb., leno woven biodegradable jute top net, 100% straw fiber matrix, 7.7 lb., woven biodegradable jute bottom net	12 months	Moderate Flow Channels 3:1 - 2:1 Slopes	Unvegetated 1.85 (88)	Unvegetated 6.0 (1.83)
 SC150BN	9.3 lb., leno woven biodegradable jute top net, 70% straw/30% coconut fiber matrix, 7.7 lb., woven biodegradable jute bottom net	18 months	Medium Flow Channels 2:1 - 1:1 Slopes	Unvegetated 2.10 (100)	Unvegetated 8.0 (2.44)

	Product Description	Longevity	Applications	Design Permissible Shear Stress lbs/ft² (Pa)	Design Permissible Velocity ft/s (m/s)
TEMPORARY					
BIONET CONT'D					
 C125BN	9.3 lb., leno woven biodegradable jute top net, 100% coconut fiber matrix, 7.7 lb., woven biodegradable jute bottom net	24 mo.	High Flow Channels 1:1 and Greater Slopes	Unvegetated 2.35 (112)	Unvegetated 10.0 (3.05)
 C700BN	143 lb., (700 g) woven biodegradable coir top net, 100% coconut fiber matrix, 7.7 lb., woven biodegrdable jute bottom net	36 mo.	High Flow Channels 1:1 and Greater Slopes	Unvegetated 2.35 (112)	Unvegetated 10.0 (3.05)
PERMANENT					
ERONET					
 P300	5.0 lb., UV-stable polypropylene top net, 100% polypropylene fiber matrix, 3.0 lb., UV-stable polypropylene bottom net	Permanent	High Flow Channels 1:1 Slopes	Unvegetated 3.0 (144) Vegetated 8.0 (383)	Unvegetated 9.0 (2.7) Vegetated 16.0 (4.9)
VMAX					
 SC250	5.0 lb., UV-stable polypropylene top & bottom nets, 24.0 lb., UV-stable polypropylene corrugated center net, 70% straw/30% coconut fiber matrix	Permanent	High Flow Channels 1:1 and Greater Slopes	Unvegetated 3.0 (144) Vegetated 10.0 (480)	Unvegetated 9.5 (2.9) Vegetated 15.0 (4.6)
 C350	8.0 lb., UV-stable polypropylene top & bottom nets, 24.0 lb., UV-stable polypropylene corrugated center net, 100% coconut fiber matrix	Permanent	High Flow Channels 1:1 and Greater Slopes	Unvegetated 3.2 (153) Vegetated 12.0 (576)	Unvegetated 10.5 (3.2) Vegetated 20.0 (6.0)
 P550	24.0 lb., UV-stable polypropylene top & bottom nets, 24.0 lb., UV-stable polypropylene corrugated center net, 100% polypropylene fiber matrix	Permanent	Extreme High Flow Channels 1:1 and Greater Slopes	Unvegetated 4.0 (191) Vegetated 14.0 (672)	Unvegetated 12.5 (3.8) Vegetated 25.0 (7.6)
 TMax	100% UV-stable polypropylene monofilament yarns, woven into a 3-D structure	Permanent	Extreme High Flow Channels 1:1 and Greater Slopes	Vegetated 15.0 (718)	Vegetated 25.0 (7.6)
 W3000	100% UV-stable polypropylene monofilament yarns, woven into a 3-D structure	Permanent	Extreme High Flow Channels 1:1 and Greater Slopes	Vegetated 16.0 (766)	Vegetated 25.0 (7.6)

Channel Installation Detail

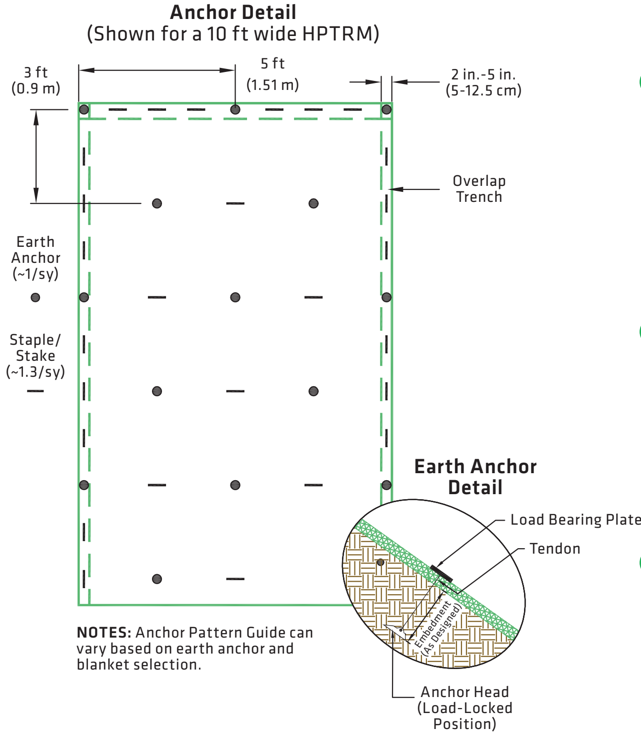


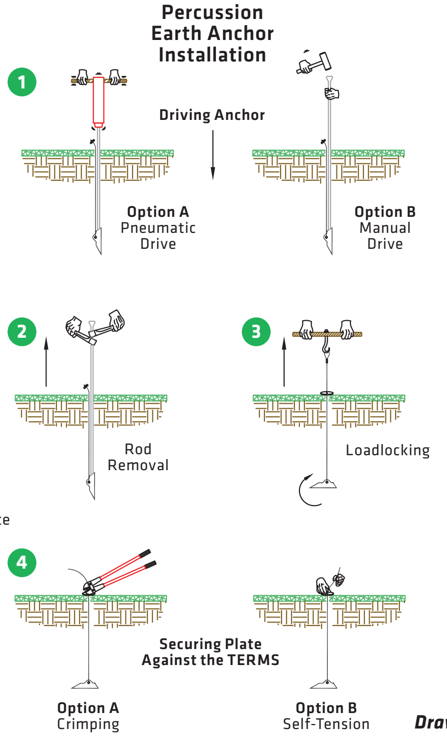
Drawings not to scale

GENERAL INSTALLATION

1. Prepare soil before installing the HPTRM, including any necessary application of soil amendments such as lime or fertilizer. See seeding and vegetating section for details regarding preseeding, overseeding or use with sod.
2. Begin at the top of the channel by anchoring the HPTRM in a 6 in. (15 cm) deep x 6 in. (15 cm) wide trench with approximately 12 in. (30 cm) of HPTRM extended beyond the upslope portion of the trench. Anchor the HPTRM with a row of anchors/staples/stakes spaced approximately 12 in. (30 cm) apart in the bottom of the trench. Backfill and compact the trench after stapling. Compact soil and fold remaining 12 in.(30 cm) portion of HPTRM back over compacted soil. Secure HPTRM over soil with a row of anchors/staples/stakes spaced approximately 12 in. (30 cm) across the width of the HPTRM.
3. Roll center HPTRM in direction of water flow in bottom of channel. HPTRMs will unroll with appropriate side against the soil surface. All HPTRMs must be securely fastened to soil surface by placing anchors/staples/stakes in appropriate locations as shown in the anchoring detail.
4. Place consecutive HPTRMs end over end (shingle style) with a 4 in. x 6 in. (10 cm-15 cm) overlap. Use a double row of staples/stakes staggered 12 in. (30 cm) apart and 12 in. (30 cm) on center to secure HPTRMs.
5. Full length edge of HPTRMs at top of side slopes must be anchored with a row of staples/stakes approximately 12 in. (30 cm) apart in a 6 in. (15 cm) deep x 6 in. (15 cm) wide trench. Backfill and compact the trench after stapling.
6. Adjacent HPTRMs must be overlapped approximately 4 in. (10 cm) and fastened.
7. In high flow channel applications, a staple/stake check slot is recommended at 30 ft to 40 ft (9 m-12 m) intervals. Use a double row of staples/stakes staggered 4 in. (10 cm) apart and 12 in. (30 cm) on center over entire width of the channel.
8. The terminal end of the HPTRMs must be anchored with a row of staples/stakes approximately 12 in. (30 cm) apart in a 6 in. (15 cm) deep x 6 in. (15 cm) wide trench. Backfill and compact the trench after stapling.

Anchoring Detail





Drawings not to scale

ANCHORING DETAIL

The performance of ground anchoring devices is highly dependent on numerous site/project specific variables. It is the sole responsibility of the project engineer and/or contractor to select the appropriate anchor type and length. Anchoring shall be selected to hold the mat in intimate contact with the soil subgrade and resist pullout in accordance with the project's design intent.

1. Staples and/or stakes should be at least 6 in. (15 cm) in length and with sufficient ground penetration to resist pullout. Longer staples and/or stakes may be needed in looser soils.
2. The percussion earth anchor assembly consists of an anchor head, a tendon, a faceplate, and an end-piece device. See North American Green® Earth Anchor specification for detailed information on assembly components and associated pull-out strength.

PERCUSSION EARTH ANCHOR INSTALLATION

1. Insert the drive rod into the assembly's anchor head then use either a sledge hammer or vibratory hammer to drive the anchor to their desired depth.
2. After the desired anchor depth is achieved, retract the drive rod.
3. Lock the anchor assembly by swiftly pulling the cable upwards until the anchor head rotates as signaled by sudden resistance to pulling. A hooked setting tool may be used to aid in this step.

NOTE: *Larger anchors may require more force to set the anchor. This can be achieved through using simple mechanical equipment for greater leverage, such as a fulcrum, manual or hydraulic jack, winch, or post puller.*

4. Secure the faceplate to the High-performance Turf Reinforcement Mat (HPTRM) surface by locking the end-piece. If using a copper or aluminum stop, crimp the ferrule to secure. If using a self-tensioning end-piece (grip or wedge grip) set by simply tightening the end-piece against the faceplate. If desired, cut the remaining cable assembly, above end-piece, to desired length.

SEEDING AND VEGETATING

When using a Composite Turf Reinforcement Mat (C-TRM) with fiber components:

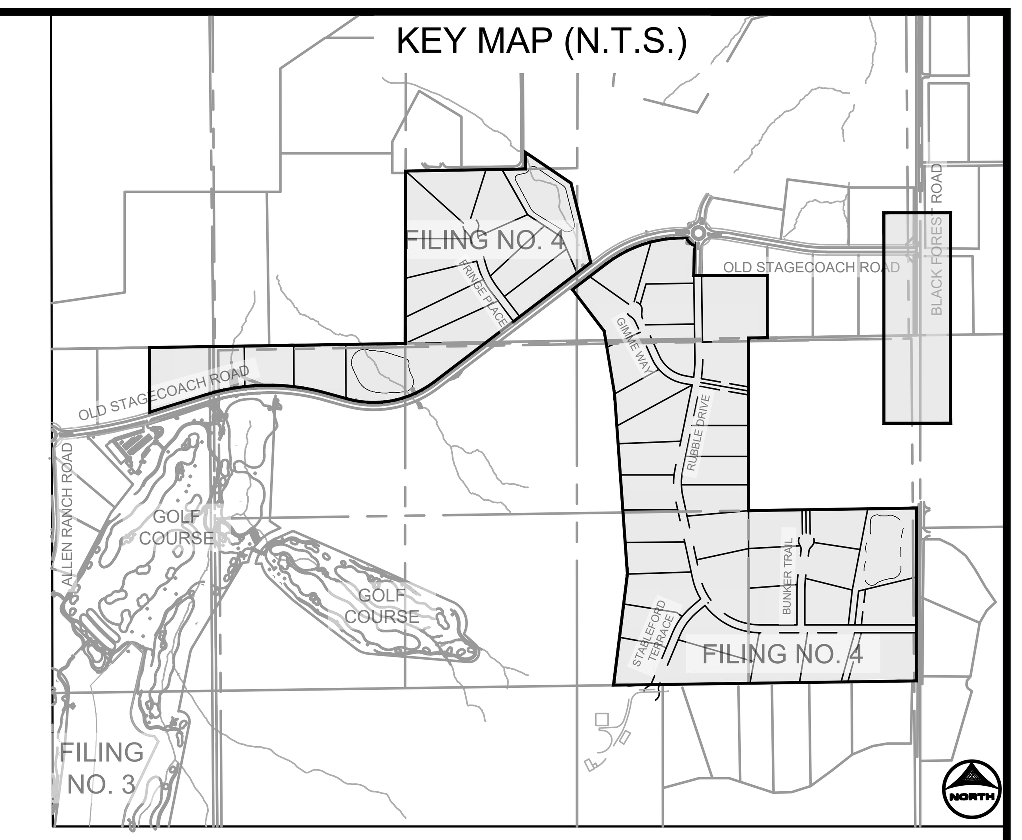
1. Pre-seed prepared soils prior to the installation of the C-TRM. Install matting as directed. C-TRM does not require soil infill or a top dressing of seed. Overseeding may be done as a secondary form of seeding.
2. Sod may be installed in place of seeding on top of the C-TRM. Additional staking of sod is recommended in high-flow conditions. Sodded areas should be irrigated until rooting through the mat and into subgrade occurs.

When using a woven HPTRM:

1. Install the HPTRM as directed prior to seed and soil filling.
2. Place seed into the installed HPTRM. After seeding, spread a layer of fine soil into the mat. Using the flat side of a rake, broom or other tool, completely fill the voids. Smooth soil-fill in order to just expose the top of the HPTRM matrix. Do not place excessive soil above the mat.
3. Additional seed, hydraulic mulching of the use of a temporary Erosion Control Blanket (ECB) can be applied over the soil-filled mat for increased protection.
4. Sod may be installed in place of seeding. Install HPTRM, and soil-fill as outlined above. Place sod directly onto the soil-filled HPTRM. Additional staking of sod is recommended in high-flow conditions. Sodded areas should be irrigated until rooting through the mat and into subgrade occurs.
5. Consult with a manufacturer's technical representative for installation assistance if unique conditions apply.

APPENDIX F

DRAINAGE MAPS



LEGEND:

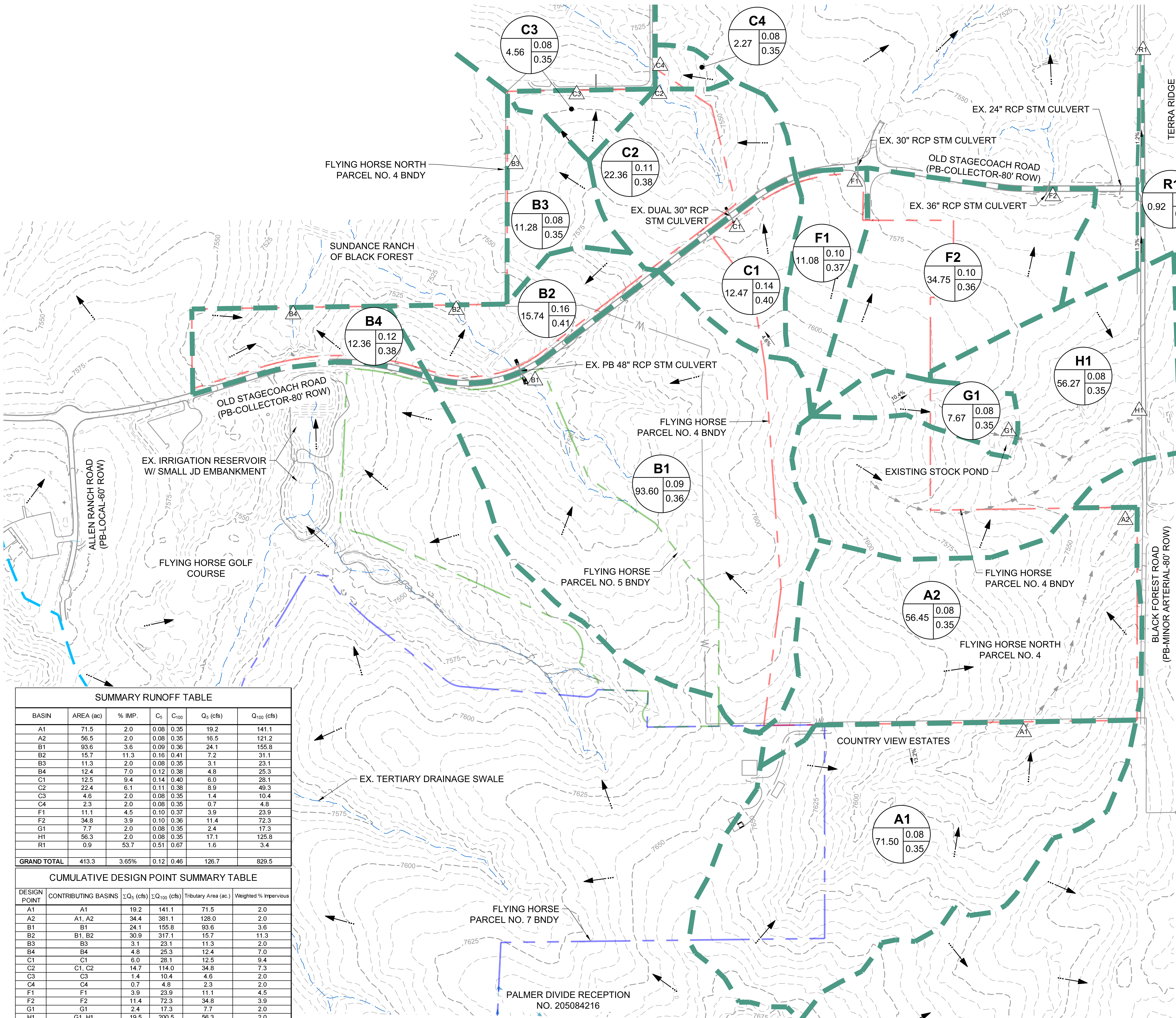
- PROPOSED MAJOR CONTOUR — 5250
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR — 5250
- EXISTING MINOR CONTOUR
- PROPOSED STORM SEWER
- EXISTING STORM SEWER
- EXISTING DRAINAGE SWALE
- PROPOSED DRAINAGE SWALE
- EXISTING TERTIARY DRAINAGE WAY
- PARCEL BOUNDARY
- FLOW DIRECTION
- DRAINAGE BASIN
- DESIGN POINT — X
- BASIN LABEL — A1 (AREA (AC.) 1.00; MINOR 5-YR RUNOFF COEF. 0.40; MAJOR 100-YR RUNOFF COEF. 0.60; BASIN DESIGNATION)

ECM LARGE LOT EXCLUSION (I.7.1.B.5)
TOTAL AREA = 107 ACRES

AREA EXCLUDED FROM WQ TREATMENT PER ECM APP I.7.1.C.1
TOTAL AREA = 1.00 ACRES

AREA EXCLUDED FROM WQ TREATMENT PER MS4 PERMIT PART I E.4.A.I.(B)
TOTAL AREA = 0.92 ACRES

SEPARATE PERVIOUS AREA (SPA)
TOTAL AREA = 2.30 ACRES



SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMP.	C_5	C_{100}	Q_5 (cfs)	Q_{100} (cfs)
A1	71.5	2.0	0.08	0.35	19.2	141.1
A2	56.5	2.0	0.08	0.35	16.5	121.2
B1	93.6	3.6	0.09	0.36	24.1	155.8
B2	15.7	11.3	0.16	0.41	7.2	31.1
B3	11.3	2.0	0.08	0.35	3.1	23.1
B4	12.4	7.0	0.12	0.38	4.8	25.3
C1	12.5	9.4	0.14	0.40	6.0	28.1
C2	22.4	6.1	0.11	0.38	8.9	49.3
C3	4.6	2.0	0.08	0.35	1.4	10.4
C4	2.3	2.0	0.08	0.35	0.7	4.8
F1	11.1	4.5	0.10	0.37	3.9	23.9
F2	34.8	3.9	0.10	0.36	11.4	72.3
G1	7.7	2.0	0.08	0.35	2.4	17.3
H1	56.3	2.0	0.08	0.35	17.1	125.8
R1	0.9	53.7	0.51	0.67	1.6	3.4
GRAND TOTAL	413.3	3.65%	0.12	0.46	126.7	829.5

CUMULATIVE DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	ΣQ_5 (cfs)	ΣQ_{100} (cfs)	Tributary Area (ac.)	Weighted % Impervious
A1	A1	19.2	141.1	71.5	2.0
A2	A1, A2	34.4	381.1	128.0	2.0
B1	B1	24.1	155.8	93.6	3.6
B2	B1, B2	30.9	317.1	15.7	11.3
B3	B3	3.1	23.1	11.3	2.0
B4	B4	4.8	25.3	12.4	7.0
C1	C1	6.0	28.1	12.5	9.4
C2	C1, C2	14.7	114.0	34.8	7.3
C3	C3	1.4	10.4	4.6	2.0
C4	C4	0.7	4.8	2.3	2.0
F1	F1	3.9	23.9	11.1	4.5
F2	F2	11.4	72.3	34.8	3.9
G1	G1	2.4	17.3	7.7	2.0
H1	G1, H1	19.5	200.5	56.3	2.0
R1	G1, H2	1.6	3.4	0.9	53.7

PCD FILE NO.: SF2422

DRAWN BY: TMM JOB DATE: 12/6/2024
APPROVED: RHL JOB NUMBER: 210742.24
CAD DATE: 9/5/2024
CAD FILE: J:\2021\211030\CAD\Dwgs\C\Drainage\FDR Filing 4\FHN_FH4_EX

BAR IS ONE INCH ON OFFICIAL DRAWINGS. 0 — 1"
IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY.

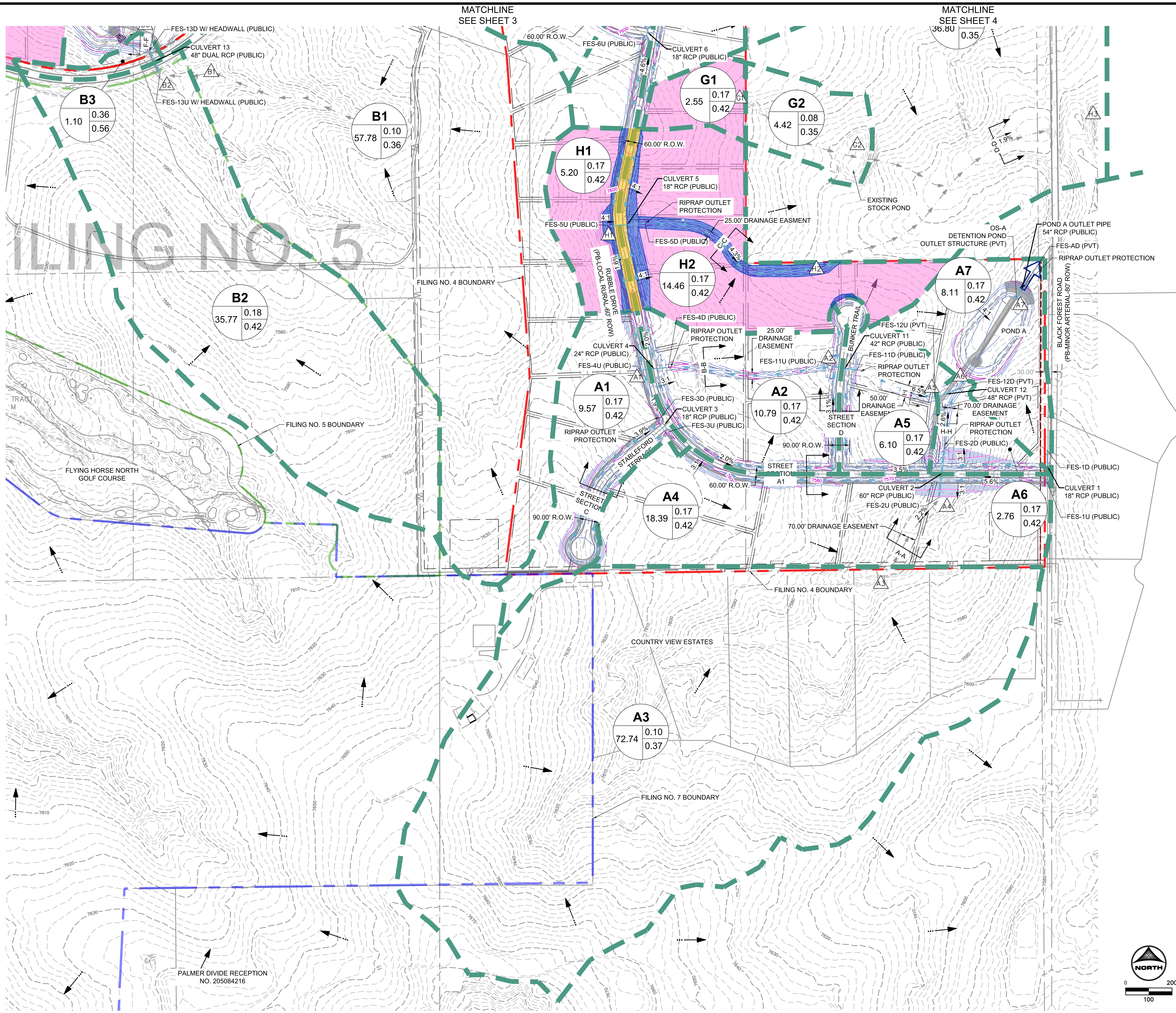
NO.	DATE	BY	REVISION DESCRIPTION

HRGreen
HR GREEN - COLORADO SPRINGS
1975 RESEARCH PARKWAY SUITE 160
COLORADO SPRINGS, CO 80920
PHONE: 719.300.4140
FAX: 713.965.0044

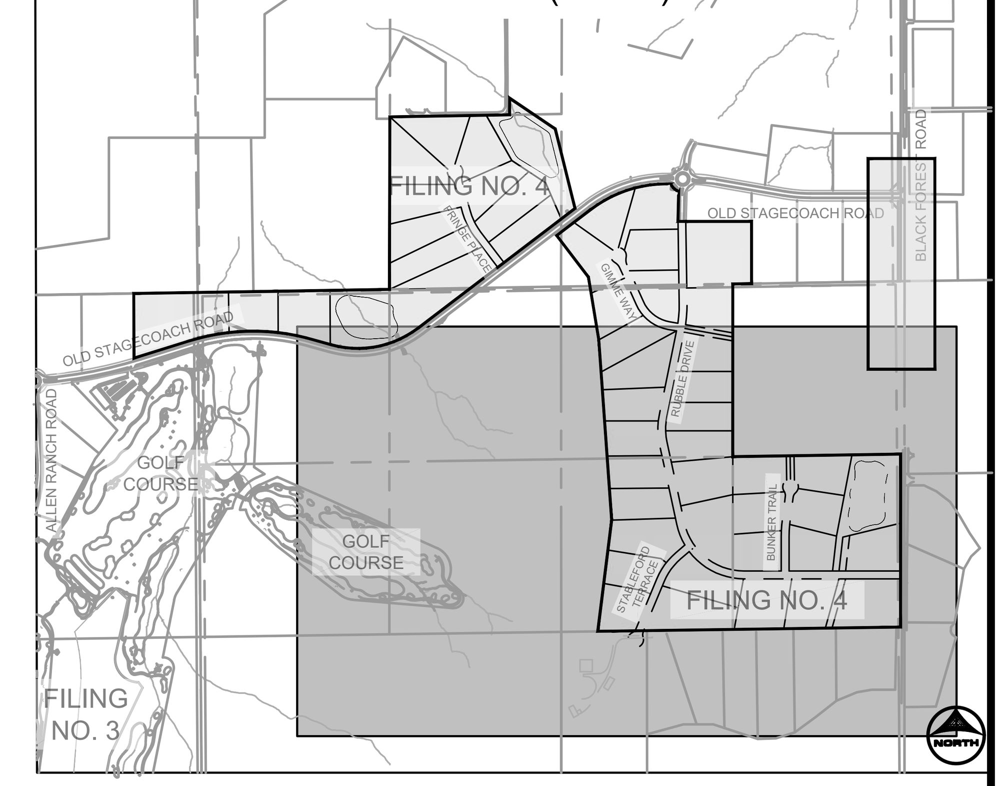
FLYING HORSE NORTH FILING 4
PRI #2, LLC.
EL PASO COUNTY, CO

FINAL DRAINAGE REPORT
EXISTING CONDITIONS DRAINAGE MAP

SHEET DR1 1



KEY MAP (N.T.S.)



LEGEND:

- PROPOSED MAJOR CONTOUR (5250)
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR (5250)
- EXISTING MINOR CONTOUR
- PROPOSED STORM SEWER
- EXISTING STORM SEWER
- EXISTING DRAINAGE SWALE
- PROPOSED DRAINAGE SWALE
- EXISTING TERTIARY DRAINAGE WAY
- PARCEL BOUNDARY
- FLOW DIRECTION
- DRAINAGE BASIN
- DESIGN POINT (X)
- BASIN LABEL

BASIN DESIGNATION: A1; AREA (AC.): 1.00; MINOR 5-YR RUNOFF COEF.: 0.40; MAJOR 100-YR RUNOFF COEF.: 0.60

- ECM LARGE LOT EXCLUSION (I.7.1.B.5) TOTAL AREA = 107 ACRES
- AREA EXCLUDED FROM WQ TREATMENT PER ECM APP I.7.1.C.1 TOTAL AREA = 1.00 ACRES
- AREA EXCLUDED FROM WQ TREATMENT PER MS4 PERMIT PART I E.4.A.I.(B) TOTAL AREA = 0.92 ACRES
- SEPARATE PERVIOUS AREA (SPA) TOTAL AREA = 2.30 ACRES

PCD FILE NO.: SF2422

DRAWN BY: TMM
JOB DATE: 12/6/2024
APPROVED: RHL
JOB NUMBER: 210742.24
CAD DATE: 9/5/2024
CAD FILE: J:\2021\211030\CAD\Dwgs\C\Drainage\FDR Filing 4\FHN_FN4_FDR

BAR IS ONE INCH ON OFFICIAL DRAWINGS. 0 1"
IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY.

NO.	DATE	BY	REVISION DESCRIPTION

HRGreen
HR GREEN - COLORADO SPRINGS
1975 RESEARCH PARKWAY SUITE 160
COLORADO SPRINGS, CO 80920
PHONE: 719.300.4140
FAX: 713.965.0044

FLYING HORSE NORTH FILING 4
PRI #2, LLC.
EL PASO COUNTY, CO

FINAL DRAINAGE REPORT
DEVELOPED CONDITIONS DRAINAGE MAP

SHEET DR2 2

HR GREEN Xrefs: xv-util-1030; xv-dsgn-1030; xv-row-1030; xc-row-030.240; Legend_FDR_Map_Filing4; xc-dsgn-240; XC-BASIN; xgt-1-dh01-1030.240; key_map

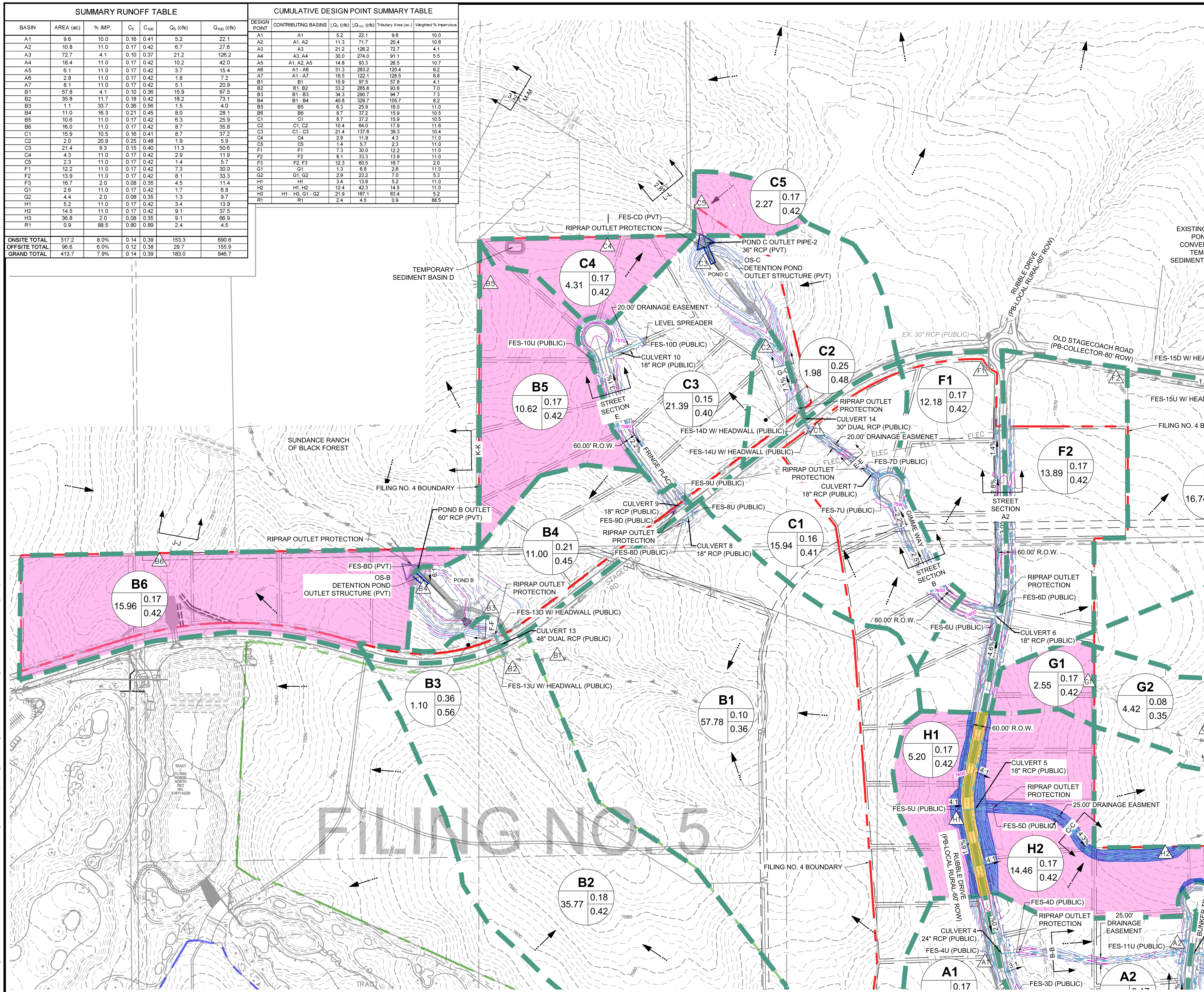
MCMUNN, THERESA, 1/21/2025 12:35 PM

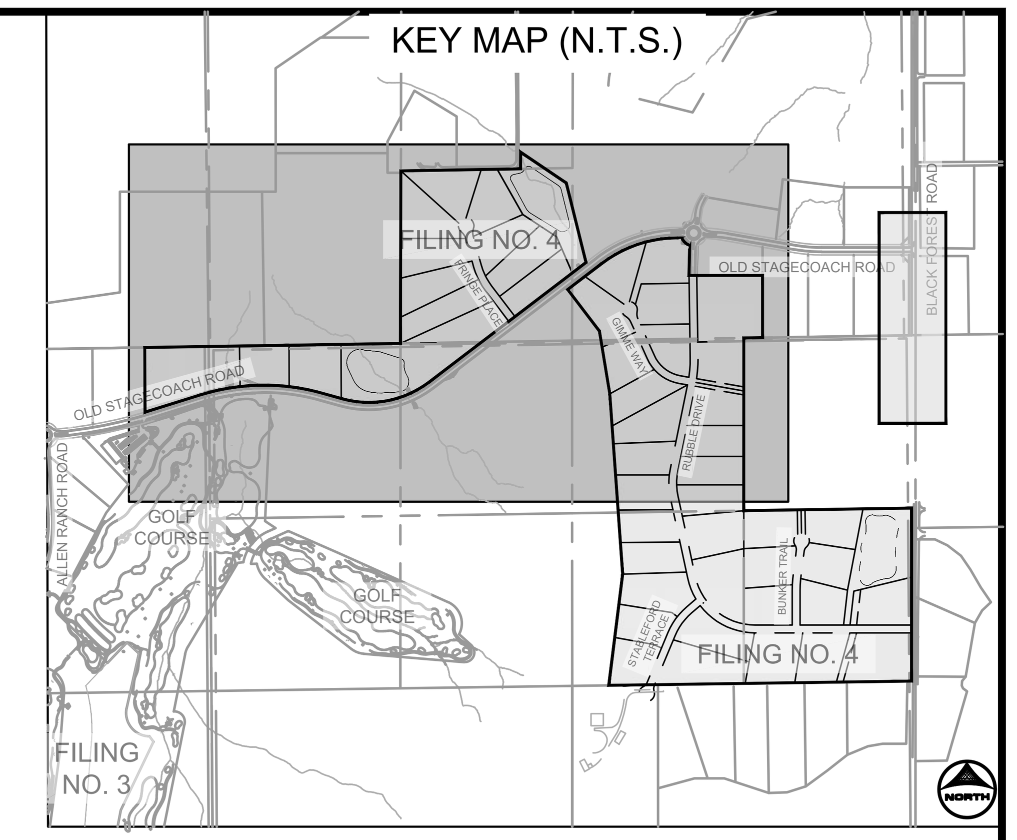
SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMP.	C_5	C_{100}	Q_5 (cfs)	Q_{100} (cfs)
A1	9.6	10.0	0.16	0.41	5.2	22.1
A2	10.8	11.0	0.17	0.42	6.7	27.6
A3	72.7	4.1	0.10	0.37	21.2	126.2
A4	18.4	11.0	0.17	0.42	10.2	42.0
A5	6.1	11.0	0.17	0.42	3.7	15.4
A6	2.8	11.0	0.17	0.42	1.8	7.2
A7	8.1	11.0	0.17	0.42	5.1	20.9
B1	57.8	4.1	0.10	0.36	15.9	97.5
B2	35.8	11.7	0.18	0.42	18.2	73.1
B3	1.1	33.7	0.36	0.56	1.5	4.0
B4	11.0	16.3	0.21	0.45	8.0	28.1
B5	10.6	11.0	0.17	0.42	6.3	25.9
B6	16.0	11.0	0.17	0.42	8.7	35.8
C1	15.9	10.5	0.16	0.41	8.7	37.2
C2	2.0	20.9	0.25	0.48	1.9	5.9
C3	21.4	9.3	0.15	0.40	11.3	50.6
C4	4.3	11.0	0.17	0.42	2.9	11.9
C5	2.3	11.0	0.17	0.42	1.4	5.7
F1	12.2	11.0	0.17	0.42	7.3	30.0
F2	13.9	11.0	0.17	0.42	8.1	33.3
F3	16.7	2.0	0.08	0.35	4.5	11.4
G1	2.6	11.0	0.17	0.42	1.7	6.8
G2	4.4	2.0	0.08	0.35	1.3	9.7
H1	5.2	11.0	0.17	0.42	3.4	13.9
H2	14.5	11.0	0.17	0.42	9.1	37.5
H3	36.8	2.0	0.08	0.35	9.1	66.9
R1	0.9	88.5	0.80	0.89	2.4	4.5
ONSITE TOTAL	317.2	8.0%	0.14	0.39	153.3	690.8
OFFSITE TOTAL	96.6	6.0%	0.12	0.38	29.7	155.9
GRAND TOTAL	413.7	7.9%	0.14	0.39	183.0	846.7

CUMULATIVE DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	ΣQ_5 (cfs)	ΣQ_{100} (cfs)	Tributary Area (ac.)	Weighted % Impervious
A1	A1	5.2	22.1	9.6	10.0
A2	A1, A2	11.3	71.7	20.4	10.6
A3	A3	21.2	126.2	72.7	4.1
A4	A3, A4	30.0	274.0	91.1	5.5
A5	A1, A2, A5	14.8	93.3	26.5	10.7
A6	A1 - A6	31.3	283.2	120.4	6.2
A7	A1 - A7	19.5	122.1	128.5	6.8
B1	B1	15.9	97.5	57.8	4.1
B2	B1, B2	33.2	285.8	93.6	7.0
B3	B1 - B3	34.3	290.7	94.7	7.3
B4	B1 - B4	40.8	329.7	105.7	8.2
B5	B5	6.3	25.9	16.0	11.0
B6	B6	8.7	37.2	15.9	10.5
C1	C1	8.7	37.2	15.9	10.5
C2	C1, C2	10.4	64.0	17.9	11.6
C3	C1 - C3	21.4	137.6	39.3	10.4
C4	C4	2.9	11.9	4.3	11.0
C5	C5	1.4	5.7	2.3	11.0
F1	F1	7.3	30.0	12.2	11.0
F2	F2	8.1	33.3	13.9	11.0
F3	F2, F3	12.3	60.5	16.7	2.0
G1	G1	1.3	6.8	2.6	11.0
G2	G1, G2	2.9	23.2	7.0	5.3
H1	H1	3.4	13.9	5.2	11.0
H2	H1, H2	12.4	42.3	14.5	11.0
H3	H1 - H3, G1 - G2	21.9	167.1	63.4	5.2
R1	R1	2.4	4.5	0.9	88.5





LEGEND:

- PROPOSED MAJOR CONTOUR — 5250
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR — 5250
- EXISTING MINOR CONTOUR
- PROPOSED STORM SEWER
- EXISTING STORM SEWER
- EXISTING DRAINAGE SWALE
- PROPOSED DRAINAGE SWALE
- EXISTING TERTIARY DRAINAGE WAY
- PARCEL BOUNDARY
- FLOW DIRECTION
- DRAINAGE BASIN
- DESIGN POINT
- BASIN LABEL

BASIN DESIGNATION: A1; AREA (AC.): 1.00; MINOR 5-YR RUNOFF COEF.: 0.40; MAJOR 100-YR RUNOFF COEF.: 0.60

ECM LARGE LOT EXCLUSION (I.7.1.B.5)
TOTAL AREA = 107 ACRES

AREA EXCLUDED FROM WQ TREATMENT PER ECM APP I.7.1.C.1
TOTAL AREA = 1.00 ACRES

AREA EXCLUDED FROM WQ TREATMENT PER MS4 PERMIT PART I E.4.A.I.(B)
TOTAL AREA = 0.92 ACRES

SEPARATE PERVIOUS AREA (SPA)
TOTAL AREA = 2.30 ACRES

NORTH
0 100 200

MATCHLINE
SEE SHEET 2

PCD FILE NO.: SF2422

HR GREEN Xrefs: xv-util-1030; xv-dsgn-1030; xv-row-1030; xc-row-030,240; Legend_FDR_Map_Filing4; xc-dsgn-240; XC-BASIN; xgt-1-dh01-1030,240; key_map

DRAWN BY: TMM	JOB DATE: 12/6/2024		
APPROVED: RHL	JOB NUMBER: 210742.24		
CAD DATE: 9/5/2024			
CAD FILE: J:\2021\211030\CAD\Dwgs\C\Drainage\FDR Filing 4\FHN_FN4_FDR			

BAR IS ONE INCH ON OFFICIAL DRAWINGS. 0 — 1" IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY.

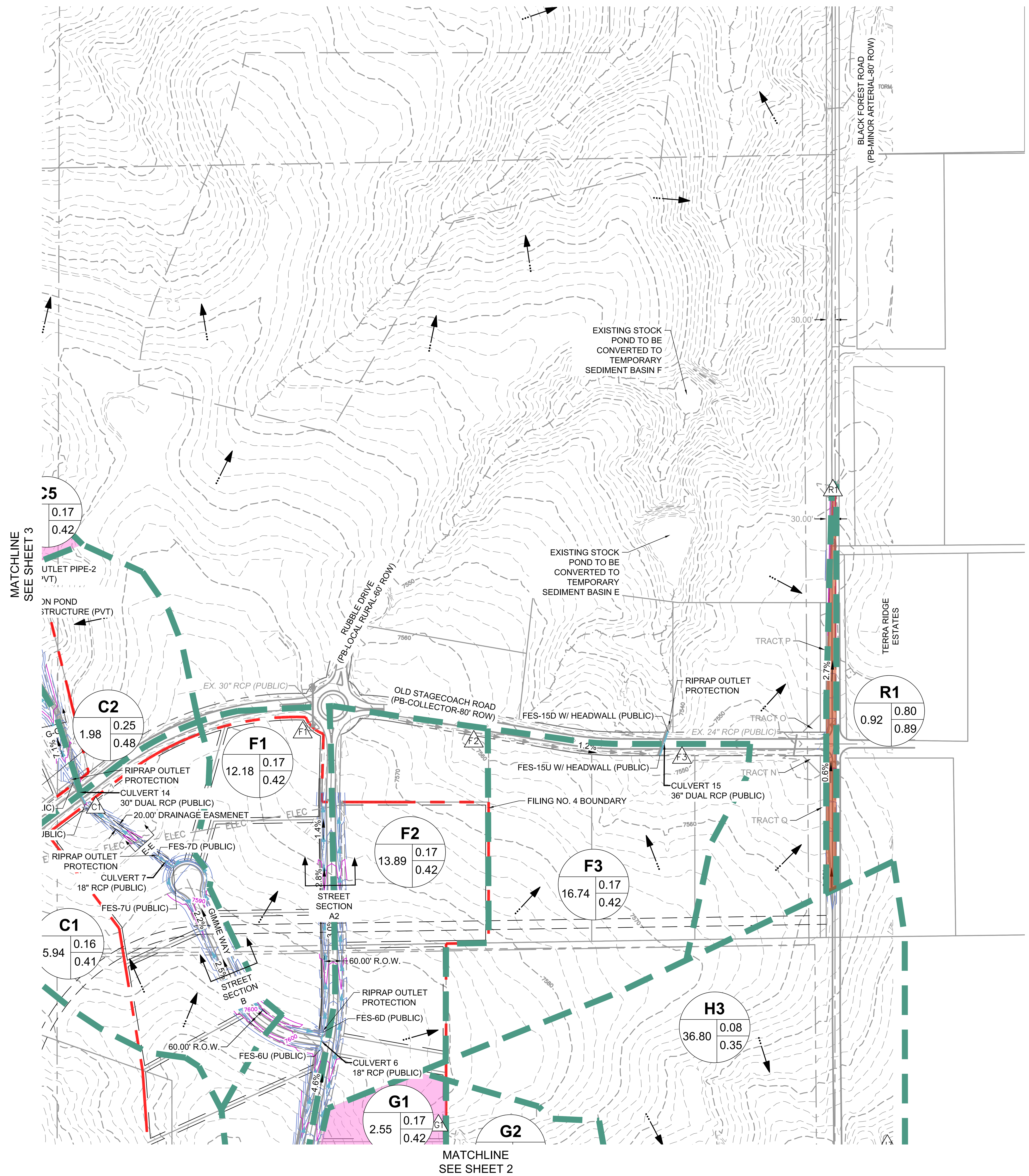
NO.	DATE	BY	REVISION DESCRIPTION

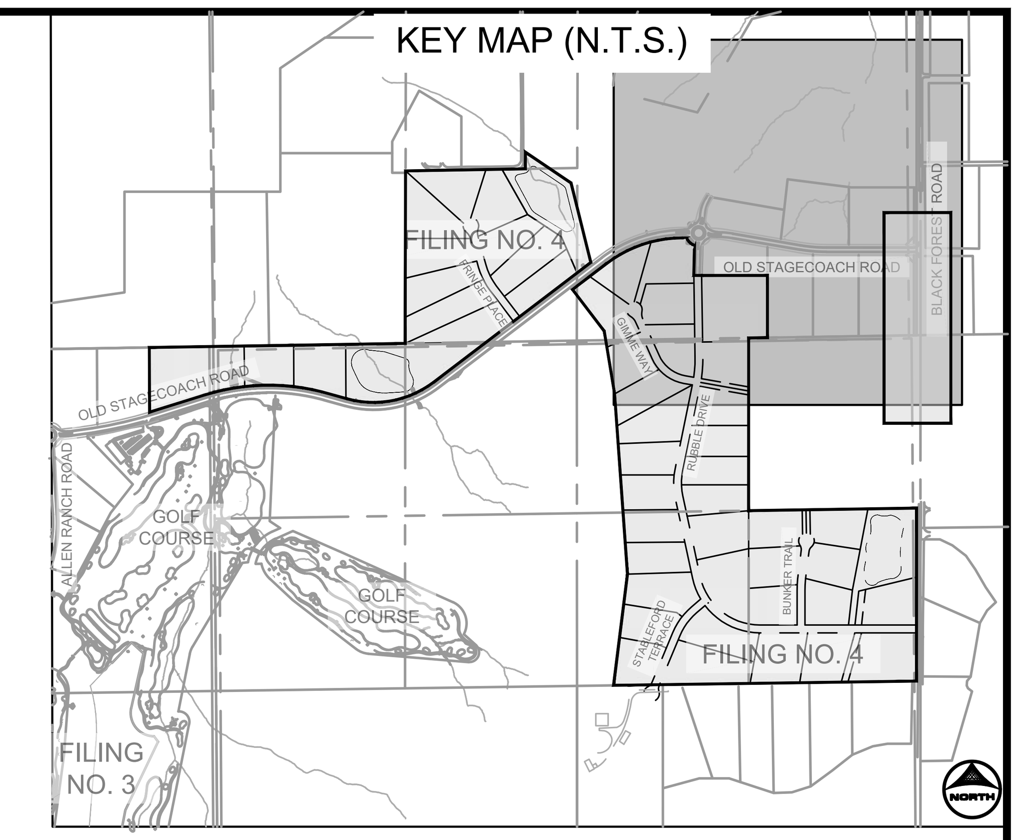
HRGreen
HR GREEN - COLORADO SPRINGS
1975 RESEARCH PARKWAY SUITE 160
COLORADO SPRINGS, CO 80920
PHONE: 719.300.4140
FAX: 713.965.0044

FLYING HORSE NORTH FILING 4
PRI #2, LLC.
EL PASO COUNTY, CO

FINAL DRAINAGE REPORT
DEVELOPED CONDITIONS DRAINAGE MAP

SHEET DR3 3





LEGEND:

PROPOSED MAJOR CONTOUR	5250
PROPOSED MINOR CONTOUR	
EXISTING MAJOR CONTOUR	5250
EXISTING MINOR CONTOUR	
PROPOSED STORM SEWER	
EXISTING STORM SEWER	
EXISTING DRAINAGE SWALE	
PROPOSED DRAINAGE SWALE	
EXISTING TERTIARY DRAINAGE WAY	
PARCEL BOUNDARY	
FLOW DIRECTION	
DRAINAGE BASIN	
DESIGN POINT	
BASIN LABEL	

BASIN DESIGNATION: A1
AREA (AC.): 1.00
MINOR 5-YR RUNOFF COEF.: 0.40
MAJOR 100-YR RUNOFF COEF.: 0.60

ECM LARGE LOT EXCLUSION (I.7.1.B.5)
TOTAL AREA = 107 ACRES

AREA EXCLUDED FROM WQ TREATMENT
PER ECM APP I.7.1.C.1
TOTAL AREA = 1.00 ACRES

AREA EXCLUDED FROM WQ TREATMENT
PER MS4 PERMIT PART I E.4.A.I.(B)
TOTAL AREA = 0.92 ACRES

SEPARATE PERVIOUS AREA (SPA)
TOTAL AREA = 2.30 ACRES

NORTH
0 100 200

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FINAL DRAINAGE REPORT
DEVELOPED CONDITIONS DRAINAGE MAP

SHEET DR4 4

PCD FILE NO.: SF2422

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APPROVED: RHL	JOB NUMBER: 210742.24	
CAD DATE: 9/5/2024		
CAD FILE: J:\2021\211030\CAD\Dwgs\C\Drainage\FDR Filing 4\FHN_FN4_FDR		

NO.	DATE	BY	REVISION DESCRIPTION

HRGreen

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FINAL DRAINAGE REPORT
DEVELOPED CONDITIONS DRAINAGE MAP

SHEET DR4 5

MCMUNN, THERESA, 1/21/2025 12:36 PM

HR GREEN Xrefs: xv-util-1030; xv-dsgn-1030; xv-row-1030; xc-row-030.240; Legend_FDR_Map_Filing4; xc-dsgn-240; XC-BASIN; xgt-1-dh01-1030.240; key_map