MDDP AND FINAL DRAINAGE REPORT
For
PATHS AT PIKEVIEW

August 2018
REVISED JULY 2019

Prepared for:

Goodwin Knight
8605 Explorer Drive #250
Colorado Springs, CO 80920
(719) 598-5191

Prepared By:

CATAMOUNT
ENGINEERING
321 W. Henrietta, Suite A
Woodland Park, CO 80863
719-426-2124

MDDP AND FINAL DRAINAGE REPORT FOR PATHS AT PIKEVIEW

Engineer's Statement:

This report and plan for the drainage design of PATHS AT PIKEVIEW 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 City of Colorado Springs Drainage Criteria Manual and is in conformity with the master plan of the drainage basin. I understand that the City of Colorado Springs does not and will not assume liability for drainage facilities designed by others. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

COLORADO LICENSED DAVID L. MIJARES 40510 PROFESSIONAL ENGINEER

David L. Mijares, Colorado PE #40510 — Date 7.11.19

For and on behalf of Catamount Engineering

Developer's Statement:

Goodwin Knight hereby certifies that the drainage facilities for PATHS AT PIKEVIEW shall be constructed according to the design presented in this report. I understand that the City of Colorado Springs does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that are submitted to the City of Colorado Springs pursuant to section 7.7.906 of the City Code; and cannot, on behalf of PATHS OF PIKEVIEW guarantee that final drainage design review will absolve Goodwin Knight and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

Goodwin Knight

Name of Developer

Authorized Signature — Date 7.12.19

Bryan Kniep

Printed Name

Director of Planning

Title

8605 Explorer Drive, #250.

Colorado Springs, CO 80920

Address

City of Colorado Springs Only:

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

For City Engineer — Date 07/30/2019

Conditions:

MDDP AND FINAL DRAINAGE REPORT FOR PATHS AT PIKEVIEW

PURPOSE

The purpose of this master development drainage report and final drainage report for Paths at Pikeview is to quantify historic storm water runoff from offsite basins, analyze impacts of site development, present solutions for collection and conveyance to the proposed regional detention facility within the southern portion of the parcel, and exhibit compliance with previous approved drainage studies.

The study presents analysis and sizing of proposed private on-site full spectrum detention pond and public conveyance of runoff from existing upstream development through the parcel to outfall within Monument Creek. Development of the proposed Paths at Pikeview development requires full spectrum detention of on-site impervious areas prior to outfall to Monument Creek and proposes development of a private on-site extended detention basin.

GENERAL LOCATION AND DESCRIPTION

The subject 11.32 acres are located within a portion of SW ¼, Section 30, T13S, R66W within the City of Colorado Springs, El Paso County, Colorado. The parcel is bounded to the North by the Templeton Gap Floodway, to the East by Emerald Acres Filing No. 2, to the South by unplatted land developed as a mobile home park, and to the West by unplatted land and Monument Creek. The parcel is proposed to be developed into 90 duplex lots conforming to the existing R-5 residential zoning.

The development is subject to developed runoff from basins to the east and tributary to Monument Creek within the Roswell Area Drainage Plan and is indicated as Pikeview Reservoir No. 2 (since abandoned and sold by the City of Colorado Springs). The site is predominantly sparsely vegetated with native grasses and shrubs with stands of mature tree along the channel frontage and the southeast corner of the site. Existing soils within the drainage consist of Truckton sandy loam (Hydrologic Group A) as determined by the Natural Resources Conservation Service Web Soil Survey. Significant unclassified fill is present along the western limits of the property presumably placed to mitigate bank erosion within Monument Creek.

EXISTING DRAINAGE BASINS

The area was included in the “Roswell Area Drainage Study Drainage Plan” (DBPS) prepared by United Planning and Engineering dated June 1978 and as further affected by outfall from the Final Drainage Report for Emerald Acres 1&2 prepared by H.J. Kreattli and Sons dated April 1972. Areas studied in the reports were tributary to Pikeview Reservoir No. 2 when owned and utilized by the City of Colorado Springs. Tributary Basins and facilities existing or installed upon the recommendations identified in the DBPS are as follows:

• Basin II-V	8.26 acres	Q_p=13.4 cfs	24" CMP under Nevada Ave
• Basin II-W	.5.89 acres	Q_p= 9.2 cfs	24" CMP outfalls to Winters Dr. Collected in 9' radial inlet at Cascade and Winters
• Basin II-X	18.82 acres	Q_P= 23.9 cfs	24"x24" Area grate with plastic outfall to 36" x22"CMP arch
• Basin II-Y	13.12 acres	Q_p= 18.2 cfs	Outfalls through street system to subject parcel at southeast corner

.
Development of Basin II-Y was additionally studied in the Final Drainage Report for Emerald Acres and identifies collection within the street systems and outfall to the "Reservoir Area" as follows:

- North side P street Q_p=3.3 cfs
- South side P Street Q_p=0.2 cfs
- Swale N/W Corner Fil. 1 Q_p=7.1 cfs

Analysis was performed utilizing City of Colorado Springs Criteria current at the time and systems were designed using the 5 year, 6 hour precipitation.

The subject parcel is included in 2 DBPS Basins with the minor northern portion being included in Basin II-E and directly tributary to the Templeton Gap Floodway, and the southern portion identified as Basin II-Z (Pikeview Reservoir) being directly tributary to Monument Creek.

EXISTING CONDITIONS

Existing runoff from basins II-V, II-W, and II-X are limited by upstream infrastructure and capacities as presented in the MDDP were utilized in determining inflow to the 42" CMP at P1 (Q_{cap} =54.5 cfs, Q_{design}=46.5 cfs). The basins within the Emerald Acres mobile home park which directly outfall to the Paths at Pikeview development parcel were remodeled utilizing current criteria. The proposed runoff represented in the original report was significantly lower than results from current criteria.

Basin OS1 (1.29 Acres, Q_2=1.4 cfs, Q_5=1.9 cfs, Q_{10}=2.4 cfs, Q_{25}=3.0 cfs, Q_{50}=3.5 cfs, and Q_{100}=4.1 cfs) sheet flows from the existing development to the eastern perimeter of the development.

Basin OS2 (1.06 Acres, Q_2=0.8 cfs, Q_5=1.2 cfs, Q_{10}=1.6 cfs, Q_{25}=2.1 cfs, Q_{50}=2.6 cfs, and Q_{100}=3.1 cfs) sheet flows from the vacant unplatted parcel south of the development to the rear lots at the south of the development and is collected in the existing unimproved swale and conveyed directly to Monument Creek

Basin OS3 (5.87 Acres, Q_2=6.1 cfs, Q_5=8.4 cfs, Q_{10}=10.6 cfs, Q_{25}=13.4 cfs, Q_{50}=15.9 cfs, and Q_{100}=18.4 cfs) consisting of the Emerald Acres Filing No. 2 mobile home park originally modeled a peak flow of 3.5 cfs discharged from the westerly limits of 'P' street. Flows from the mobile home park is collected in the existing unimproved swale and conveyed directly to Monument Creek.

Basin OS4 (6.75 Acres, Q_2=7.0 cfs, Q_5=9.6 cfs, Q_{10}=12.2 cfs, Q_{25}=15.4 cfs, Q_{50}=18.3 cfs, and Q_{100}=21.2 cfs) consisting of the Emerald Acres Filing No. 1 originally modeled a peak flow of 7.1 cfs discharged through a concrete swale through a storage tract at the northwest corner of the mobile home park. Flow within the concrete swale is collected in the existing unimproved swale and conveyed directly to Monument Creek.

ONSITE DEVELOPED DRAINAGE BASINS

The intent of the proposed development is to follow closely to historic drainage patterns while satisfying current City of Colorado Springs development and water quality criteria. The area of the site proposed for impervious development will be contained within the parking/private roadway section and private on-site storm sewer system conveying flows to a proposed regional full spectrum detention basin and water quality facility within the southwest portion of the site prior to outfall.

Development of the site is currently proposed to consist of 134 residential duplex units and a shared clubhouse to include required parking and drive aisles. On-site development will require development of a small diameter stormwater system allowing for capture of impervious areas with connected roof drain and landscape area drain systems not depicted within this report. The small diameter will be conveyed to private pipe conveyance system within the proposed street system and ultimately outfall within the proposed regional detention facility. Final layout and calculations for on-site storm sewer 15" and larger will be provided in an addendum to be submitted with final storm sewer plans.

Basin B1 (0.15 Acres, Q_2=0.0 cfs, Q_5=0.1 cfs, Q_{10}=0.2 cfs, Q_{25}=0.3 cfs, Q_{50}=0.5 cfs, and Q_{100}=0.5 cfs) consist of flow generated within the landscaped areas east and south of the proposed public roadway at the northerly limit of the property. Flows generated within Basin B1 will sheetflow north to the existing Templeton Gap Drainage. The ROW connection is proposed to allow for future development of the westerly parcel.

Basin B2 (0.78 Acres, Q_2=0.2 cfs, Q_5=0.5 cfs, Q_{10}=0.8 cfs, Q_{25}=1.2 cfs, Q_{50}=1.6 cfs, and Q_{100}=2.0 cfs) consisting of entirely landscape area will sheetflow west into the adjacent parcel and be conveyed southerly and into Monument Creek.

Basin B3 (1.85 Acres, Q_2=0.2 cfs, Q_5=0.7 cfs, Q_{10}=1.2 cfs, Q_{25}=1.9 cfs, Q_{50}=2.5 cfs, and Q_{100}=3.0 cfs) consisting of entirely landscape area collects sheetflow from offsite basins OS-1 and OS-4. Flow is conveyed in a 4' wide grass-lined swale at a minimum grade of 0.5% to Design Point 6 at the southerly limit of the property and into Monument Creek.

'A' designated basins consist of the area of the development proposed for residential development. 'A' basins were modeled based on contributing area of roadways/walks (100% impervious), roof areas (90% impervious) and landscape areas (13% impervious). A basins are collected in 24' minimum/60' maximum width curbed inverted crown roadway and parking section and collected in private 10' D=9 inlets and conveyed in private HDPE Storm system to outfall within the proposed regional detention facility.

BASIN	AREA (ACRES)	ROOF (ACRES)	DRIVE (ACRES)	LANDSCAPE (ACRES)	Q2	Q5	Q10	Q25	Q50	Q100
A1	2.52	0.61	1.06	0.85	4.9	6.6	8.2	10.0	11.9	13.4
A2	2.20	0.86	0.60	0.74	3.8	5.1	6.4	7.8	9.4	10.5
A3	1.87	0.46	0.60	0.81	3.0	4.1	5.2	6.5	7.9	8.8
A4	1.14	0.29	0.39	0.46	2.1	2.8	3.6	4.4	5.3	6.0
A5	0.45	0.14	0.15	0.16	0.9	1.2	1.5	1.8	2.2	2.4
A6	0.70	0.06	0.00	0.64	0.3	0.7	1.0	1.7	2.4	2.7

Basin A1 consists of the northerly portion of the development and includes the proposed public street section at the northerly limit. Runoff within the ROW sheet flows to the 8: vertical curb flowline and is conveyed to a crosspan at a lowpoint conveying runoff into the inverted crown private street section. Flows are conveyed in the inverted crown roadway to the proposed private 10' D-9 inlet at Design Point 2. At design point 2 the at-grade inlet intercepts flows of Q_5=4.3 cfs and Q_{100}=6.4 cfs and allows a flow-by of Q_5=2.3 cfs and Q_{100}=7.0 cfs. Intercepted flows are represented by pipe design point P2 are conveyed in a private 15" HDPE storm to pipe design point P3.

Basin A2 sheet flows to the inverted crown roadway and runoff is conveyed to the proposed private 10' D-9 inlet at Design Point 3. At design point 3 the at-grade inlet intercepts flows of Q_5=4.6 cfs and Q_{100}=7.4 cfs and allows a flow-by of Q_5=2.7 cfs and Q_{100}=9.8 cfs. Combined Intercepted flow of Q_5=8.9 cfs and Q_{100}=13.8 cfs is represented by pipe design point P3 are conveyed in a private 18" HDPE storm to the proposed private Type I manhole at pipe design point P6.

Basin A3 sheet flows to the inverted crown roadway and runoff is conveyed to the proposed private 10' D-9 inlet at Design Point 4. At design point 4 the at-grade inlet intercepts flows of Q_5=3.3 cfs and Q_{100}=5.1 cfs and allows a flow-by of Q_5=0.8 cfs and Q_{100}=3.7 cfs. Intercepted flows are represented by pipe design point P4 are conveyed in a private 15" HDPE storm to pipe design point P6.

Basin A4 sheet flows to the inverted crown roadway and runoff is conveyed to the proposed private 10' D-9 inlet at Design Point 5. At design point 5 the sump inlet intercepts all flows of Q_5=5.9 cfs and Q_{100}=18.5 cfs and ponds to a calculated depth of 0.67'. Intercepted flows are represented by pipe design point P5 are conveyed in a private 18" HDPE storm to the private Type I manhole at pipe design point P6.

Combined flows at design point P6 of 18.1 cfs and Q_{100}=37.4 cfs are conveyed in a private 30" RCP to a concrete forebay in the proposed on-site pond.

Basin A5 consists of the area of the development directly north of the proposed pond location. Flows from basin A5 are collected in a private 5' D-9 inlet and conveyed directly to the pond in a private 12" HDPE storm pipe identified as pipe design point P9.

Basin A6 consists of landscape area and a small area of proposed building roofline directly tributary to the proposed Extended Detention Basin. Runoff generated within Basin A6 sheetflow across landscape areas and out

Offsite flows from Basin OS-1 of Q_2=1.4 cfs, Q_5=1.9 cfs, Q_{10}=2.4 cfs, Q_{25}=3.0 cfs, Q_{50}=3.5 cfs, and Q_{100}=4.1 cfs are diverted in a swale along the easterly property boundary to DP-6 and conveyed in a 4' wide grass-lined swale at a minimum grade of 0.5% to the southerly limit of the property and into Monument Creek.

Offsite flows from Basin OS-4 of Q_2=7.0 cfs, Q_5=9.6 cfs, Q_{10}=12.2 cfs, Q_{25}=15.4 cfs, Q_{50}=18.3 cfs, and Q_{100}=21.2 cfs enter the site from a private concrete swale/rundown and are conveyed in a 4' wide grass-lined swale at a minimum grade of 0.5% to Design Point 6 at the southerly limit of the property and into Monument Creek.

Combined flows at DP-6 of Q_2=6.6 cfs, Q_5=9.3 cfs, Q_{10}=12.2 cfs, Q_{25}=15.7 cfs, Q_{50}=18.9 cfs, and Q_{100}=22.1 cfs are conveyed in a grass lined swale to historic outfall within Monument Creek..

Offsite flows from Basin OS-3 of Q_2=6.1 cfs, Q_5=8.4 cfs, Q_{10}=10.6 cfs, Q_{25}=13.4 cfs, Q_{50}=15.9 cfs, and Q_{100}=18.4 cfs are collected in a public 10' Type R inlet at the terminus of the street within the adjacent easterly mobile home subdivision. All flows are intercepted in the inlet ponding to a depth of 8.5". Collected flows (pipe design point P8) are conveyed in a public 18" HDPE storm sewer to a public Type 1 manhole at pipe design point P7.

Pipe design point P1 represents the existing 42" CMP entering the site from the offsite intersection of Cascade Boulevard and Winters Drive. The current pipe ultimate capacity is Q_{100}=54.5 cfs per the Master Development Drainage Report and this number was assumed in downstream calculations. Combined flows at pipe design point P7 of Q_{100}=72.9 cfs are conveyed in a public 48" RCP to a public type 1 manhole at Pipe Design point P10. At the manhole flows are combined with outfall from the proposed on-site extended detention basin. Combined flow at DP P10 of Q_{100}=75.3 cfs are conveyed to protected outfall within Fountain Creek. The outfall will consist of a minimum of 36' long by 12' rip rap pad with an 18" depth of type 'L' rip rap.

EXTENDED DETENTION BASIN

The parcel proposes to develop 11.32 acres tributary to Monument Creek requiring development of water quality treatment and full-spectrum detention per the criteria of the City of Colorado Springs Drainage Criteria Manual Volume 1. Areas proposed to receive impervious cover will be collected in the street and storm conveyance systems and directed to pond prior to offsite release.

The development requires a WQCV of 0.166 acre feet, EURV of 0.431 acre feet, and total (100-YR) detention volume of 0.919 acre-feet. The basin provides the required volume at a WSE of 6132.13. The emergency overflow weir is set an elevation of 6132.25.

The pond will be constructed with 3:1 minimum side slopes above the proposed 100-YR water surface and 4:1 slopes below the 100-YR water surface and is to be vegetated per the approved final landscape plan. Access will be from the proposed Monument Creek trail/emergency access road along the westerly pond limits.

Outfall from the pond will be to the proposed public 48” RCP proposed along the southerly project boundary which outfalls at a velocity of 11.59 ft/sec to a 10’ wide by 36’ long 1.5’ deep type ‘L’ rip rap pad within a proposed storm drain easement within Monument Creek. The emergency spillway will consist of a 15’ long 2’ depth of Type ‘M’ buried riprap along the 4:1 pond embankment and extended to the existing concrete trail.

4-STEP PROCESS

1. The development addresses Low Impact Development strategies primarily through the utilization of landscape swales within rear of buildings directing runoff from buildings and walkways through swales with minimal longitudinal grade prior to outfall to storm systems/extended detention basins where appropriate.
2. On-site flow is directed to the on-site private proposed full spectrum extended detention basin constructed with development of the project which outfalls to a small diameter pipe system conveying attenuated flows directly to historic outfall within Monument Creek. Flows will be conveyed in an HDPE pipe system directly to creek outfall to mitigate concerns with existing slope. The extended detention basin provides Water Quality Capture Volume required for this site and attenuates release of flows to approximate historic runoff.
3. The ultimate recipient of runoff from the site is Monument Creek. Flows from the site are tributary to the full spectrum extended detention basin constructed on site with development of the Paths at Pikeview development attenuating flows to predevelopment levels. Drainage fees paid at plat recordation will be utilized in funding channel improvements projects throughout the basin. No impacts to Monument Creek are anticipated.
4. A Grading, Erosion Control, and Stormwater Quality Plan and narrative will be approved by the city prior to any soil disturbance. The erosion control plan will include specific source control BMP’s as well as defined overall site management practices for the construction period. The grading narrative will address materials storage and spill containment during construction operations.

COST ESTIMATE

Private Improvements Non-reimbursable

10’ D-9 Inlet	4 EA	@$	6,800/EA	$	27,200
12” HDPE	65 LF	@$	20/LF	$	1,300
15” HDPE	602 LF	@$	25/LF	$	15,050
18” HDPE	221 LF	@$	40/LF	$	8,840
30” RCP	116 LF	@$	65/LF	$	7,540
Type I Manhole	3 EA	@$	4,000/EA	$	12,000
		SUBTOTAL		**$**	**71,930**
		10% CONTINGENCY		*$*	*7,193*
		TOTAL		**$**	**79,123**

Public Improvement Reimbursable

10' Type R Inlet	1 EA	@$ 6,800/EA	$ 6,800
18" HDPE	89 LF	@$ 40/LF	$ 3,560
48" RCP	824 LF	@$ 125/LF	$ 103,000
Type I Manhole	1 EA	@$ 6,000/EA	$ 6,000
		SUBTOTAL	**$ 119,360**
		10% CONTINGENCY	*$ 11,936*
		TOTAL	**$ 131,296**

FLOODPLAIN STATEMENT

Portions of the development are proposed within the 500-YR floodplain (Zone X). No portion of the development are proposed within the 100-Yr floodplain as designated per FIRM panel 08041C0514 F, effective March 17, 1997. Flood Insurance Rate Map has been provided in the appendix.

DRAINAGE FEE CALCULATION (2019)

Development of the Paths at Pikeview proposes to plat 11.32 acres within the Roswell Drainage Basin Planning Area subject to the Miscellaneous Basin Fee. The Miscellaneous Basin Fee does not require bridge or pond fees. Drainage Fees are due at the time of plat recordation.

Drainage Fee:
11.32 acres X $11,905 = $134.764.6

DRAINAGE METHODOLOGY

This drainage report was prepared in accordance to the criteria established in the City of Colorado Springs Drainage Criteria Manual Volumes 1 and 2, as revised May 2014.

The rational method for drainage basin study areas of less than 100 acres was utilized in the analysis. For the Rational Method, flows were calculated for the 2, 5, 10, 25, 50, and 100-year recurrence intervals. The average runoff coefficients, 'C' values, are taken from Table 6-6 and the Intensity-Duration-Frequency curves are taken from Figure 6-5 of the City Drainage Criteria Manual. Time of concentration for overland flow and storm drain or gutter flow are calculated per Section 3.2 of the City Drainage Criteria Manual. Calculations for the Rational Method are shown in the Appendix of this report.

Urban Drainage and Flood Control District methodology was utilized for determination of street capacity, inlet sizing, and extended detention basin design. UD-Inlet Version 4.05 was utilized in street capacity and inlet sizing calculations. UD-Culvert Version 3.05 was utilized in developing preliminary pipe sizing. Details and analysis of final storm drain conveyance and collection system will be developed in an addendum to the final drainage report submitted with Private Storm Sewer Plans for Fillmore Apartments Subdivision. Preliminary sizing calculations were provided in the appendix of this report. UD-Detention version 3.07 was utilized in development of extended detention basin and outfall. Street and Inlet Hydraulics version 3.14 was utilized in modeling roadway concrete swales as they exhibit curb section hydraulics. Calculations are included in the appendix of this report.

SUMMARY

Development of the Paths at Pikeview residential development will require that flows be treated for water quality and be detained to historic levels prior to release from the site. Site runoff and storm drain and appurtenances will not adversely affect the downstream and surrounding developments. This report is in general conformance with all previously approved reports which included this site.

REFERENCES:

City of Colorado Springs Engineering Division Drainage Criteria Manual Volumes 1 and 2, revised May 2014

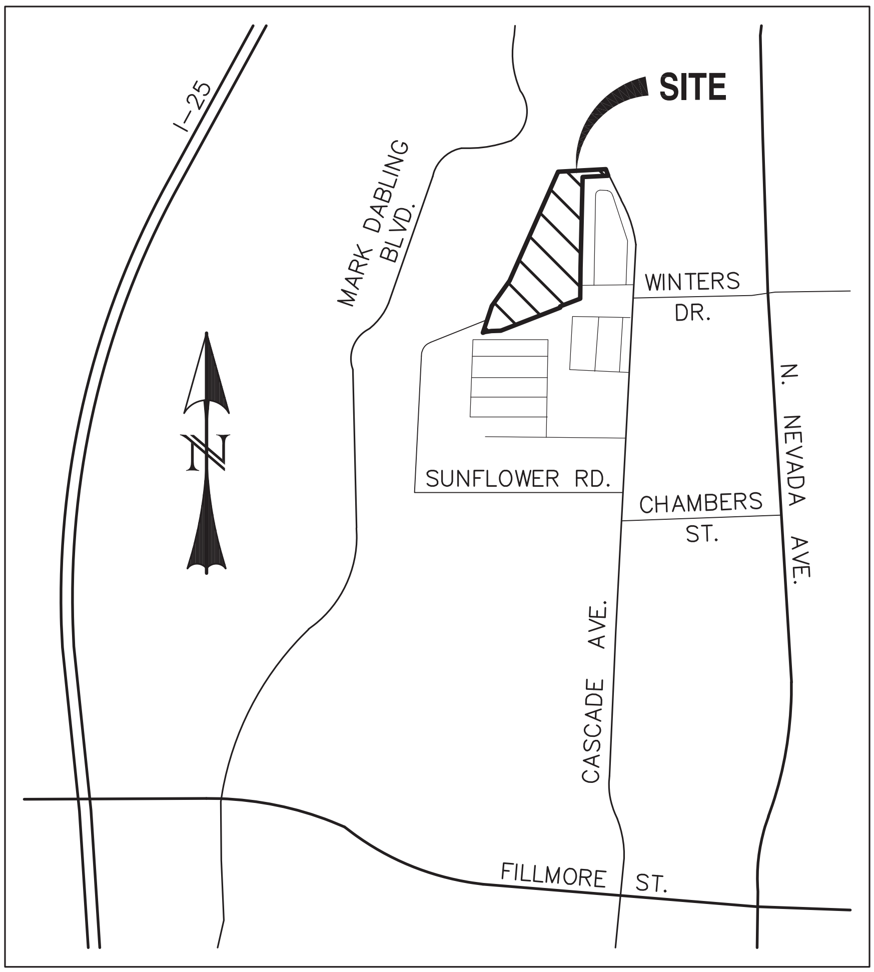
"ROSWELL DRAINAGE AREA Drainage Study", prepared by United Planning and Engineering Co., dated June 1978.

"Final Drainage report for Emerald Acres Subdivision Nos, 1 & 2" prepared by H.J. Kraettli & Sons Consulting Engineers, dated April 16, 1972.

"Preliminary Drainage report for Pikeview Development", prepared by Catamount Engineering, dated January 2018.

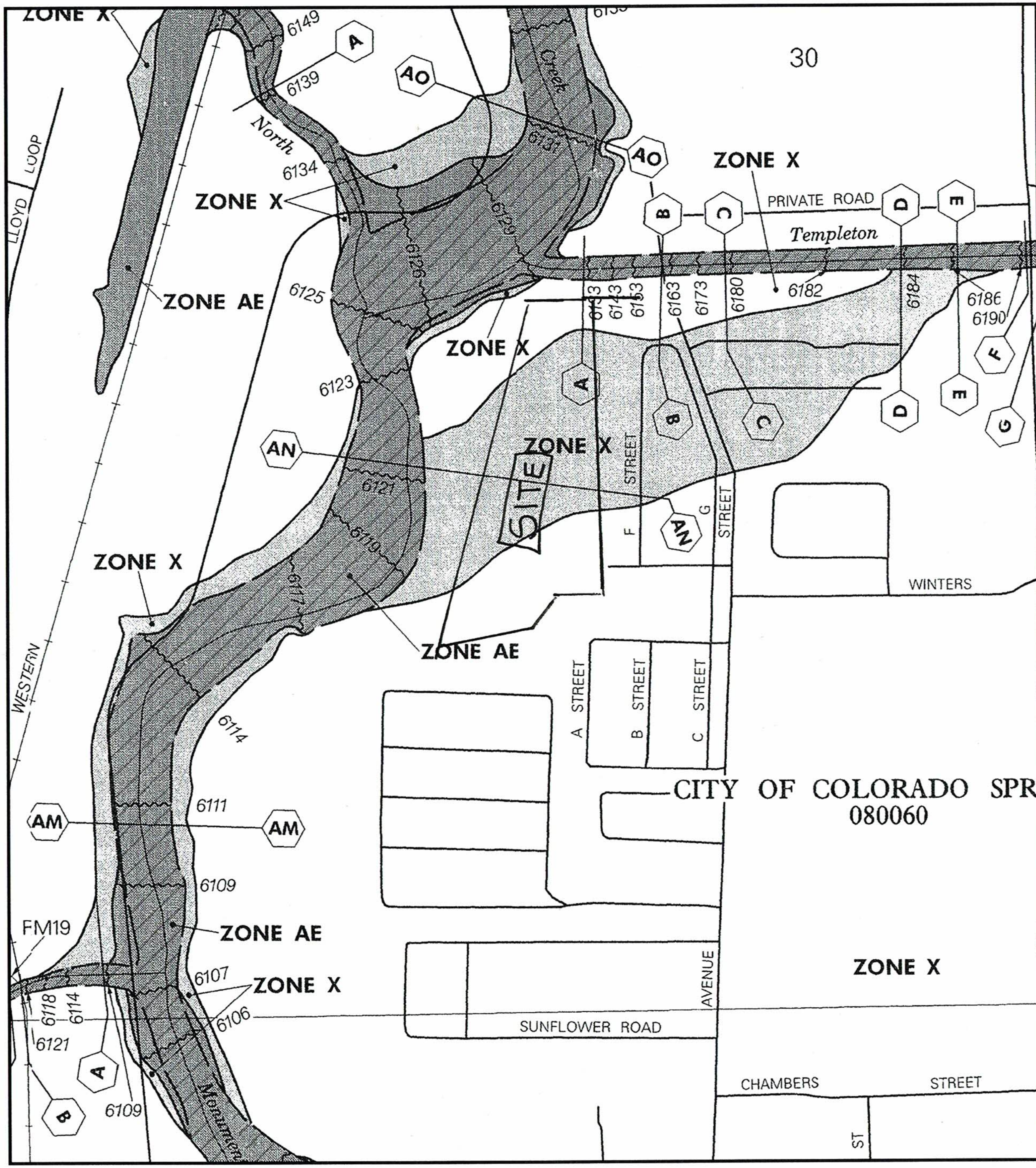
Natural Resources Conservation Service Web Soil Survey

APPENDIX



VICINITY MAP

SCALE: N.T.S.



APPROXIMATE SCALE IN FEET

500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 514 OF 1300

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0514	F

MAP NUMBER
08041C0514 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Map Scale: 1:2,040 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 30, 60, 120, 180

Feet: 0, 50, 100, 200, 300

N

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.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
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 12, Sep 29, 2014

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

Date(s) aerial images were photographed: Jun 3, 2014—Jun 17, 2014

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

Hydrologic Soil Group— Summary by Map Unit — El Paso County Area, Colorado (CO625)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
97	Truckton sandy loam, 3 to 9 percent slopes	A	3.6	35.8%
101	Ustic Torrifluvents, loamy	B	0.1	0.6%
111	Water		6.3	63.6%
Totals for Area of Interest			**9.9**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

HYDROLOGIC AND HYDRAULIC CALCULATIONS

EXISTING HYDROLOGY

											CONVEYANCE TC						TT	INTENSITY						TOTAL FLOWS					
BASIN	**AREA TOTAL (Acres)**	**C_2**	**C_5**	**C_{10}**	**C_{25}**	**C_{50}**	**C_{100}**	**Length (ft)**	**Height (ft)**	**TI (min)**	**Length (ft)**	**Height (ft)**	**C_V**	**Slope (%)**	**Velocity (fps)**	**TC (min)**	**TOTAL (min)**	**I_2 (in/hr)**	**I_5 (in/hr)**	**I_{10} (in/hr)**	**I_{25} (in/hr)**	**I_{50} (in/hr)**	**I_{100} (in/hr)**	**Q_2 (c.f.s.)**	**Q_5 (c.f.s.)**	**Q_{10} (c.f.s.)**	**Q_{25} (c.f.s.)**	**Q_{50} (c.f.s.)**	**Q_{100} (c.f.s.)**
A	6.90	**0.03**	**0.09**	**0.17**	**0.26**	**0.31**	**0.36**	100	1.5	16.9	593	5.5	5	0.9%	0.5	20.5	37.4	1.7	2.1	2.5	2.9	3.2	3.6	**0.4**	**1.3**	**2.9**	**5.1**	**6.9**	**9.0**
OS-1	1.29	**0.41**	**0.45**	**0.49**	**0.54**	**0.57**	**0.59**	187	4	13.3	651	7	20	1.1%	2.1	5.2	18.5	2.6	3.2	3.7	4.3	4.8	5.4	**1.4**	**1.9**	**2.4**	**3.0**	**3.5**	**4.1**
OS-2	1.06	**0.26**	**0.32**	**0.38**	**0.44**	**0.48**	**0.51**	200	8	13.6	341	6	20	1.8%	2.7	2.1	15.7	2.8	3.5	4.0	4.6	5.2	5.8	**0.8**	**1.2**	**1.6**	**2.1**	**2.6**	**3.1**
OS-3	5.87	**0.41**	**0.45**	**0.49**	**0.54**	**0.57**	**0.59**	158	2	14.5	705	12	20	1.7%	2.6	4.5	19.0	2.5	3.2	3.7	4.2	4.8	5.3	**6.1**	**8.4**	**10.6**	**13.4**	**15.9**	**18.4**
OS-4	6.75	**0.41**	**0.45**	**0.49**	**0.54**	**0.57**	**0.59**	110	1.5	11.8	820	7.5	20	0.9%	1.9	7.1	18.9	2.5	3.2	3.7	4.2	4.8	5.3	**7.0**	**9.6**	**12.2**	**15.4**	**18.3**	**21.2**

Calculated by: DLM

Date: 2/8/2018

		WEIGHTED						TT	INTENSITY						TOTAL FLOWS					
DESIGN POINT	**AREA TOTAL (Acres)**	**C_2**	**C_5**	**C_{10}**	**C_{25}**	**C_{50}**	**C_{100}**	**TOTAL (min)**	**I_2 (in/hr)**	**I_5 (in/hr)**	**I_{10} (in/hr)**	**I_{25} (in/hr)**	**I_{50} (in/hr)**	**I_{100} (in/hr)**	**Q_2 (c.f.s.)**	**Q_5 (c.f.s.)**	**Q_{10} (c.f.s.)**	**Q_{25} (c.f.s.)**	**Q_{50} (c.f.s.)**	**Q_{100} (c.f.s.)**
1	8.19	**0.09**	**0.15**	**0.22**	**0.30**	**0.35**	**0.40**	37.4	1.7	2.1	2.5	2.9	3.2	3.6	**1.3**	**2.6**	**4.5**	**7.1**	**9.3**	**11.7**
OS-1	1.29	0.41	0.45	0.49	0.54	0.57	0.59													
A	6.90	0.03	0.09	0.17	0.26	0.31	0.36													
P1 (CAPACITY)																				**54.5**

Calculated by: DLM

Date: 2/8/2018

PROPOSED HYDROLOGY

											CONVEYANCE TC						TT	INTENSITY						TOTAL FLOWS					
BASIN	AREA TOTAL (Acres)	C_{2}	C_{5}	C_{10}	C_{25}	C_{50}	C_{100}	Length (ft)	Height (ft)	TI (min)	Length (ft)	Height (ft)	C_{V}	Slope (%)	Velocity (fps)	TC (min)	TOTAL (min)	I_{2} (in/hr)	I_{5} (in/hr)	I_{10} (in/hr)	I_{25} (in/hr)	I_{50} (in/hr)	I_{100} (in/hr)	Q_{2} (c.f.s.)	Q_{5} (c.f.s.)	Q_{10} (c.f.s.)	Q_{25} (c.f.s.)	Q_{50} (c.f.s.)	Q_{100} (c.f.s.)
A1	2.52	**0.57**	**0.61**	**0.65**	**0.69**	**0.72**	**0.74**	100	3	6.2	391	5	20	1.3%	2.3	2.9	9.0	3.4	4.3	5.0	5.7	6.4	7.2	**4.9**	**6.6**	**8.2**	**10.0**	**11.9**	**13.4**
Roof	*0.61*	*0.71*	*0.73*	*0.75*	*0.78*	*0.80*	*0.81*				478	8.5	20	1.8%	2.7	3.0	*DP-3*												
Walk/Drive	*1.06*	*0.89*	*0.90*	*0.92*	*0.94*	*0.95*	*0.96*				123	2	20	1.6%	2.6	0.8	*DP-5*												
Landscape	*0.85*	*0.07*	*0.16*	*0.24*	*0.32*	*0.37*	*0.41*																						
A2	2.20	**0.54**	**0.58**	**0.62**	**0.67**	**0.70**	**0.72**	100	1.5	8.1	478	8.5	20	1.8%	2.7	3.0	11.1	3.2	4.0	4.6	5.3	6.0	6.7	**3.8**	**5.1**	**6.4**	**7.8**	**9.4**	**10.5**
Roof	*0.86*	*0.71*	*0.73*	*0.75*	*0.78*	*0.80*	*0.81*																						
Walk/Drive	*0.60*	*0.89*	*0.90*	*0.92*	*0.94*	*0.95*	*0.96*																						
Landscape	*0.74*	*0.07*	*0.16*	*0.24*	*0.32*	*0.37*	*0.41*																						
A3	1.87	**0.49**	**0.54**	**0.58**	**0.63**	**0.66**	**0.68**	100	2	8.1	346	6.2	20	1.8%	2.7	2.2	10.2	3.3	4.1	4.8	5.5	6.1	6.9	**3.0**	**4.1**	**5.2**	**6.5**	**7.9**	**8.8**
Roof	*0.46*	*0.71*	*0.73*	*0.75*	*0.78*	*0.80*	*0.81*				81	1.2	20	1.5%	2.4	0.6	*DP-5*												
Walk/Drive	*0.60*	*0.89*	*0.90*	*0.92*	*0.94*	*0.95*	*0.96*																						
Landscape	*0.81*	*0.07*	*0.16*	*0.24*	*0.32*	*0.37*	*0.41*																						
A4	1.14	**0.51**	**0.56**	**0.60**	**0.65**	**0.68**	**0.70**	100	2	7.8	35	0.7	20	2.0%	2.8	0.2	8.0	3.6	4.5	5.2	6.0	6.7	7.5	**2.1**	**2.8**	**3.6**	**4.4**	**5.3**	**6.0**
Roof	*0.29*	*0.71*	*0.73*	*0.75*	*0.78*	*0.80*	*0.81*																						
Walk/Drive	*0.39*	*0.89*	*0.90*	*0.92*	*0.94*	*0.95*	*0.96*																						
Landscape	*0.46*	*0.07*	*0.16*	*0.24*	*0.32*	*0.37*	*0.41*																						
A5	0.45	**0.54**	**0.58**	**0.63**	**0.67**	**0.70**	**0.72**	100	3.5	6.2	420	20	20	4.8%	4.4	1.6	7.8	3.6	4.5	5.3	6.0	6.8	7.6	**0.9**	**1.2**	**1.5**	**1.8**	**2.2**	**2.4**
Roof	*0.14*	*0.71*	*0.73*	*0.75*	*0.78*	*0.80*	*0.81*																						
Walk/Drive	*0.15*	*0.89*	*0.90*	*0.92*	*0.94*	*0.95*	*0.96*																						
Landscape	*0.16*	*0.07*	*0.16*	*0.24*	*0.32*	*0.37*	*0.41*																						
A6	0.70	**0.12**	**0.21**	**0.28**	**0.36**	**0.41**	**0.44**	94	16	6.1	96	1.9	7	2.0%	1.0	1.6	7.7	3.6	4.5	5.3	6.0	6.8	7.6	**0.3**	**0.7**	**1.0**	**1.5**	**2.1**	**2.4**
Roof	*0.06*	*0.71*	*0.73*	*0.75*	*0.78*	*0.80*	*0.81*																						
Walk/Drive	*0.00*	*0.89*	*0.90*	*0.92*	*0.94*	*0.95*	*0.96*																						
Landscape	*0.64*	*0.07*	*0.16*	*0.24*	*0.32*	*0.37*	*0.41*																						
B1	0.15	**0.07**	**0.16**	**0.24**	**0.32**	**0.37**	**0.41**	20	1.5	3.9	364	15	7	4.1%	1.4	4.3	5.0	4.1	5.2	6.0	6.9	7.8	8.7	**0.0**	**0.1**	**0.2**	**0.3**	**0.5**	**0.5**
Roof	*0.00*	*0.71*	*0.73*	*0.75*	*0.78*	*0.80*	*0.81*										*MIN*												
Walk/Drive	*0.00*	*0.89*	*0.90*	*0.92*	*0.94*	*0.95*	*0.96*																						
Landscape	*0.15*	*0.07*	*0.16*	*0.24*	*0.32*	*0.37*	*0.41*																						
B2	1.51	**0.07**	**0.16**	**0.24**	**0.32**	**0.37**	**0.41**	41	4	5.1	825	6	7	0.7%	0.6	23.0	28.2	2.1	2.6	3.0	3.4	3.9	4.3	**0.2**	**0.6**	**1.1**	**1.7**	**2.4**	**2.7**
Roof	*0.00*	*0.71*	*0.73*	*0.75*	*0.78*	*0.80*	*0.81*																						
Walk/Drive	*0.00*	*0.89*	*0.90*	*0.92*	*0.94*	*0.95*	*0.96*																						
Landscape	*1.51*	*0.07*	*0.16*	*0.24*	*0.32*	*0.37*	*0.41*																						
B3	1.85	**0.07**	**0.16**	**0.24**	**0.32**	**0.37**	**0.41**	10	0.5	3.2	1645	30.5	7	1.9%	1.0	28.8	31.9	1.9	2.4	2.8	3.2	3.6	4.0	**0.2**	**0.7**	**1.2**	**1.9**	**2.7**	**3.0**
Roof	*0.00*	*0.71*	*0.73*	*0.75*	*0.78*	*0.80*	*0.81*																						
Walk/Drive	*0.00*	*0.89*	*0.90*	*0.92*	*0.94*	*0.95*	*0.96*																						
Landscape	*1.85*	*0.07*	*0.16*	*0.24*	*0.32*	*0.37*	*0.41*																						

Calculated by: DLM

Date: 7/11/2019

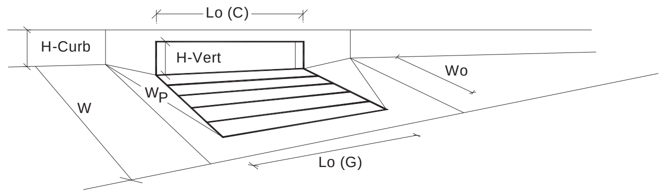
DESIGN POINT	AREA TOTAL (Acres)	WEIGHTED C_2	C_5	C_{10}	C_{25}	C_{50}	C_{100}	TT TOTAL (min)	INTENSITY I_2 (in/hr)	I_5 (in/hr)	I_{10} (in/hr)	I_{25} (in/hr)	I_{50} (in/hr)	I_{100} (in/hr)	TOTAL FLOWS Q_2 (c.f.s.)	Q_5 (c.f.s.)	Q_{10} (c.f.s.)	Q_{25} (c.f.s.)	Q_{50} (c.f.s.)	Q_{100} (c.f.s.)
2	2.52	**0.57**	**0.61**	**0.65**	**0.69**	**0.72**	**0.74**	**9.0**	3.4	4.3	5.0	5.7	6.4	7.2	**4.9**	**6.6**	**8.2**	**10.0**	**11.6**	**13.4**
BASIN A1	2.52	0.57	0.61	0.65	0.69	0.72	0.74	9.0												
3	2.20	**0.54**	**0.58**	**0.62**	**0.67**	**0.70**	**0.72**	**12.0**	3.1	3.9	4.5	5.1	5.8	6.5		**7.3**				**17.2**
BASIN A2	2.20	0.54	0.58	0.62	0.67	0.70	0.72	11.1												
FLOW-BY DP 2								12.0								2.3				7.0
4	1.38	**0.66**	**0.73**	**0.79**	**0.86**	**0.90**	**0.93**	**10.2**	3.3	4.1	4.8	5.5	6.1	6.9	**3.0**	**4.1**	**5.2**	**6.5**	**7.6**	**8.8**
BASIN A3	1.87	0.49	0.54	0.58	0.63	0.66	0.68	10.2												
5	0.92	**0.64**	**0.69**	**0.75**	**0.80**	**0.84**	**0.87**	**12.8**	3.0	3.8	4.4	5.0	5.6	6.3		**5.9**				**18.5**
BASIN A4	1.14	0.51	0.56	0.60	0.65	0.68	0.70	8.0												
FLOW-BY DP 3								12.8								2.7				9.8
FLOW BY DP 4								10.8								0.8				3.7
6	9.89	**0.35**	**0.40**	**0.44**	**0.50**	**0.53**	**0.56**	**31.9**	1.9	2.4	2.8	3.2	3.6	4.0	**6.6**	**9.3**	**12.2**	**15.7**	**18.9**	**22.1**
BASIN OS-1	1.29	0.41	0.45	0.49	0.54	0.57	0.59	18.5												
BASIN OS-4	6.75	0.41	0.45	0.49	0.54	0.57	0.59	18.9												
BASIN B3	1.85	0.07	0.16	0.24	0.32	0.37	0.41	31.9												
7	0.45	**0.54**	**0.58**	**0.63**	**0.67**	**0.70**	**0.72**	**7.8**	3.6	4.5	5.3	6.0	6.8	7.6	**0.9**	**1.2**	**1.5**	**1.8**	**2.1**	**2.4**
BASIN A5	0.45	0.54	0.58	0.63	0.67	0.70	0.72	7.8												
P2																**4.3**				**6.4**
INT DP-2																4.3				6.4
P3																**8.9**				**13.8**
INT DP-3																4.6				7.4
DP P2																4.3				6.4
P4																**3.3**				**5.1**
INT DP-4																3.3				5.1
P5																**5.9**				**18.5**
DP-5																5.9				18.5
P6																**18.1**				**37.4**
DP- P3																8.9				13.8
DP-P4																3.3				5.1
DP-P5																5.9				18.5
P7																				**72.9**
DP-P8																8.4				18.4
DP-P1(capacity)																				54.5
P8																**8.4**				**18.4**
Basin OS-3																8.4				18.4
P9																**1.2**				**2.4**
DP-7																1.2				2.4
P10																				**75.3**
DP-P7																				72.9
POND OUT																0.2				2.4

Calculated by: DLM

Date: 7/11/2019

INLET IN A SUMP OR SAG LOCATION

Project = **Paths at Pikeview**
Inlet ID = **Design Point E1**

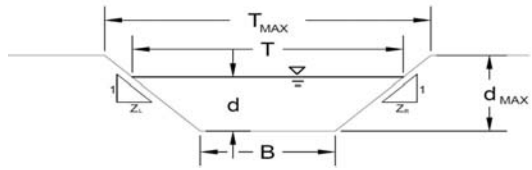


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	1.00	1.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	8.2	inches
				☐ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**10.4**	**18.6**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	8.4	18.4	cfs

AREA INLET IN A TRAPEZOIDAL GRASS-LINED CHANNEL

Paths at Pikeview

Design Point 2



Grass Type	Limiting Manning's n
A	0.06
B	0.04
C	0.033
D	0.03
E	0.024

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D or E		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.013	
Channel Invert Slope	S_O =	0.0100	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	50.00	ft/ft
Right Side Slope	Z2 =	50.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Sandy	5.0 fps	0.50
Non-Sandy	7.0 fps	0.80

Choose One:
- ○ Sandy
- ● Non-Sandy

		Minor Storm	Major Storm	
Max. Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**24.00**	**40.00**	**feet**
Max. Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**0.24**	**0.40**	**feet**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	**8.03**	**31.35**	**cfs**
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	**0.24**	**0.40**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**6.60**	**13.40**	**cfs**
Water Depth	d =	**0.22**	**0.29**	**feet**

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

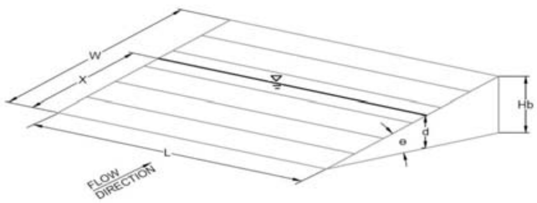
AREA INLET IN A TRAPEZOIDAL GRASS-LINED CHANNEL

Paths at Pikeview

Design Point 2

Inlet Design Information (Input)

Type of Inlet	Inlet Type =	User-Defined		
Angle of Inclined Grate (must be <= 30 degrees)	θ =	0.00		degrees
Width of Grate	W =	2.00		feet
Length of Grate	L =	10.00		feet
Open Area Ratio	A_{RATIO} =	0.70		
Height of Inclined Grate	H_B =	0.00		feet
Clogging Factor	C_f =	0.50		
Grate Discharge Coefficient	C_d =	N/A		
Orifice Coefficient	C_o =	0.64		
Weir Coefficient	C_w =	2.05		



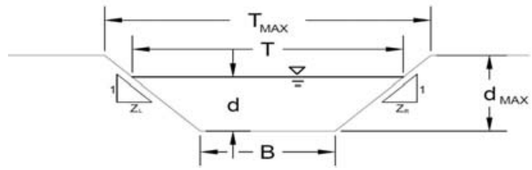
		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.22	0.29	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**4.32**	**6.43**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Minor and Major Storms	**Bypassed Flow, Q_b =**	**2.28**	**6.97**	**cfs**
	Capture Percentage = Q_a/Q_o = C%	**65**	**48**	**%**

Warning 04: Froude No. exceeds USDCM Volume I recommendation.

AREA INLET IN A TRAPEZOIDAL GRASS-LINED CHANNEL

Paths at Pikeview

Design Point 3



Grass Type	Limiting Manning's n
A	0.06
B	0.04
C	0.033
D	0.03
E	0.024

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D or E		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.013	
Channel Invert Slope	S_O =	0.0100	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	50.00	ft/ft
Right Side Slope	Z2 =	50.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Sandy	5.0 fps	0.50
Non-Sandy	7.0 fps	0.80

Choose One:
- ○ Sandy
- ● Non-Sandy

		Minor Storm	Major Storm	
Max. Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	24.00	40.00	feet
Max. Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	0.24	0.65	feet

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	**8.03**	**31.35**	**cfs**
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	**0.24**	**0.40**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**7.30**	**17.20**	**cfs**
Water Depth	d =	**0.23**	**0.32**	**feet**

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

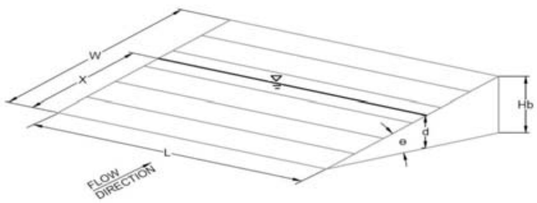
AREA INLET IN A TRAPEZOIDAL GRASS-LINED CHANNEL

Paths at Pikeview

Design Point 3

Inlet Design Information (Input)

Type of Inlet	Inlet Type =	User-Defined	
Angle of Inclined Grate (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grate	W =	2.00	feet
Length of Grate	L =	10.00	feet
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grate	H_B =	0.00	feet
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	N/A	
Orifice Coefficient	C_o =	0.64	
Weir Coefficient	C_w =	2.05	

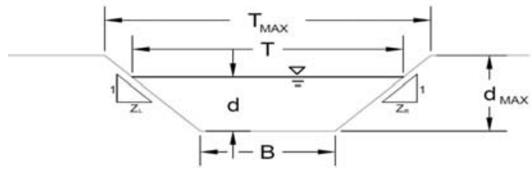


		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.23	0.32	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**4.57**	**7.40**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Minor and Major Storms	**Bypassed Flow, Q_b =**	**2.73**	**9.80**	**cfs**
	Capture Percentage = Q_a/Q_o = C%	**63**	**43**	**%**

Warning 04: Froude No. exceeds USDCM Volume I recommendation.

AREA INLET IN A TRAPEZOIDAL GRASS-LINED CHANNEL

Paths at Pikeview
Design Point 4



Grass Type	Limiting Manning's n
A	0.06
B	0.04
C	0.033
D	0.03
E	0.024

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D or E		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.013	
Channel Invert Slope	S_O =	0.0100	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	50.00	ft/ft
Right Side Slope	Z2 =	50.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Sandy	5.0 fps	0.50
Non-Sandy	7.0 fps	0.80

Choose One:
- ○ Sandy
- ● Non-Sandy

		Minor Storm	Major Storm	
Max. Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	24.00	40.00	feet
Max. Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	0.24	0.40	feet

Allowable Channel Capacity Based On Channel Geometry		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	**8.03**	**31.35**	**cfs**
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	**0.24**	**0.40**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**4.10**	**8.80**	**cfs**
Water Depth	d =	**0.19**	**0.25**	**feet**

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

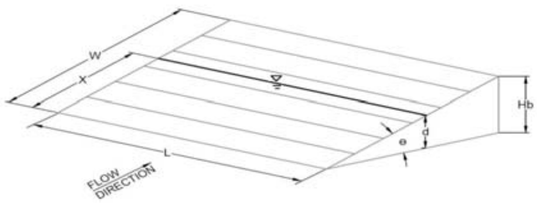
AREA INLET IN A TRAPEZOIDAL GRASS-LINED CHANNEL

Paths at Pikeview

Design Point 4

Inlet Design Information (Input)

Type of Inlet	Inlet Type =	User-Defined	
Angle of Inclined Grate (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grate	W =	2.00	feet
Length of Grate	L =	10.00	feet
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grate	H_B =	0.00	feet
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	N/A	
Orifice Coefficient	C_o =	0.64	
Weir Coefficient	C_w =	2.05	



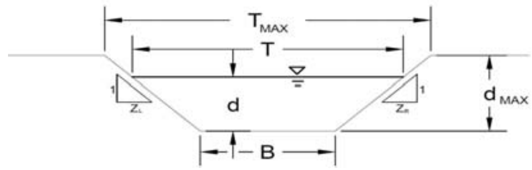
		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.19	0.25	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**3.30**	**5.08**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Minor and Major Storms	**Bypassed Flow, Q_b =**	**0.80**	**3.72**	**cfs**
	Capture Percentage = Q_a/Q_o = C%	**81**	**58**	**%**

Warning 04: Froude No. exceeds USDCM Volume I recommendation.

AREA INLET IN A TRAPEZOIDAL GRASS-LINED CHANNEL

Paths at Pikeview

Design Point 5 (SUMP)



Grass Type	Limiting Manning's n
A	0.06
B	0.04
C	0.033
D	0.03
E	0.024

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D or E		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.013	
Channel Invert Slope	S_O =	0.0005	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	33.00	ft/ft
Right Side Slope	Z2 =	33.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Sandy	5.0 fps	0.50
Non-Sandy	7.0 fps	0.80

Choose One:
- ○ Sandy
- ● Non-Sandy

		Minor Storm	Major Storm	
Max. Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**30.00**	**50.00**	**feet**
Max. Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**0.45**	**0.75**	**feet**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**6.33**	**24.73**	**cfs**
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	**0.45**	**0.75**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**5.90**	**18.50**	**cfs**
Water Depth	d =	**0.44**	**0.67**	**feet**

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

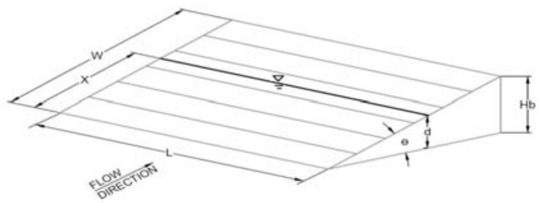
AREA INLET IN A TRAPEZOIDAL GRASS-LINED CHANNEL

Paths at Pikeview

Design Point 5 (SUMP)

Inlet Design Information (Input)

Type of Inlet	Inlet Type =	User-Defined	
Angle of Inclined Grate (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grate	W =	2.00	feet
Length of Grate	L =	10.00	feet
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grate	H_B =	0.00	feet
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	N/A	
Orifice Coefficient	C_o =	0.64	
Weir Coefficient	C_w =	2.05	

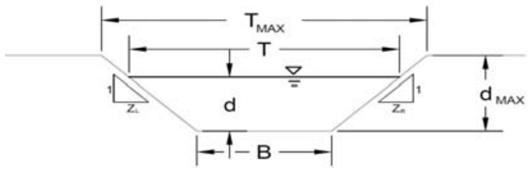


		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.44	0.67	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**11.89**	**22.62**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (> Q PEAK)	**Bypassed Flow, Q_b =**	**0.00**	**0.00**	**cfs**
	Capture Percentage = Q_a/Q_o = C%	**100**	**100**	**%**

AREA INLET IN A TRAPEZOIDAL GRASS-LINED CHANNEL

Paths at Pikeview

Design Point 7



Grass Type	Limiting Manning's n
A	0.06
B	0.04
C	0.033
D	0.03
E	0.024

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D or E			
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.013		
Channel Invert Slope	S_O =	0.0005		ft/ft
Bottom Width	B =	0.00		ft
Left Side Slope	Z1 =	33.00		ft/ft
Right Side Slope	Z2 =	33.00		ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Sandy	5.0 fps	0.50
Non-Sandy	7.0 fps	0.80

Choose One:
- ○ Sandy
- ● Non-Sandy

		Minor Storm	Major Storm	
Max. Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	30.00	50.00	feet
Max. Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	0.45	0.75	feet

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	6.33	24.73	cfs
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	0.45	0.75	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	1.20	2.40	cfs
Water Depth	d =	0.24	0.31	feet

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

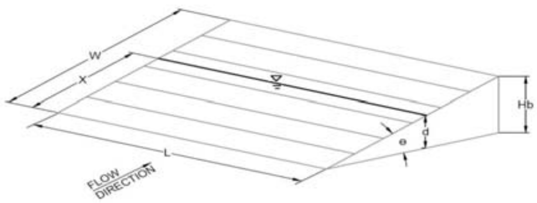
AREA INLET IN A TRAPEZOIDAL GRASS-LINED CHANNEL

Paths at Pikeview

Design Point 7

Inlet Design Information (Input)

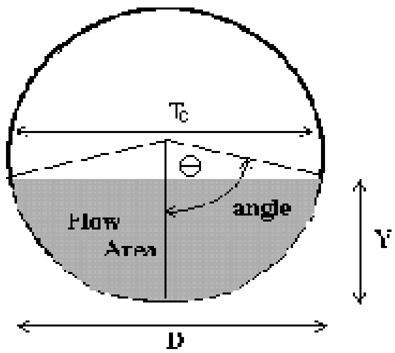
Type of Inlet	Inlet Type =	User-Defined	
Angle of Inclined Grate (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grate	W =	2.00	feet
Length of Grate	L =	5.00	feet
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grate	H_B =	0.00	feet
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	N/A	
Orifice Coefficient	C_o =	0.64	
Weir Coefficient	C_w =	2.05	



		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.24	0.31	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**2.73**	**4.03**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (> Q PEAK)	**Bypassed Flow, Q_b =**	**0.00**	**0.00**	**cfs**
	Capture Percentage = Q_a/Q_o = C%	**100**	**100**	**%**

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

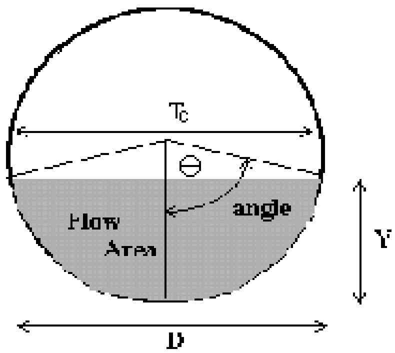
Project: **Paths at Pikeview**
Pipe ID: **DP-P2 15" HDPE**



Design Information (Input)			
Pipe Invert Slope	So =	0.0150	ft/ft
Pipe Manning's n-value	n =	0.0120	
Pipe Diameter	D =	15.00	inches
Design discharge	**Q =**	**6.40**	**cfs**
Full-flow Capacity (Calculated)			
Full-flow area	Af =	1.23	sq ft
Full-flow wetted perimeter	Pf =	3.93	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	8.59	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.86	radians
Flow area	An =	0.83	sq ft
Top width	Tn =	1.20	ft
Wetted perimeter	Pn =	2.33	ft
Flow depth	Yn =	0.80	ft
Flow velocity	Vn =	7.67	fps
Discharge	Qn =	6.40	cfs
Percent Full Flow	Flow =	74.5%	of full flow
Normal Depth Froude Number	Fr_n =	1.62	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.25	radians
Critical flow area	Ac =	1.07	sq ft
Critical top width	Tc =	0.97	ft
Critical flow depth	Yc =	1.02	ft
Critical flow velocity	Vc =	5.97	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

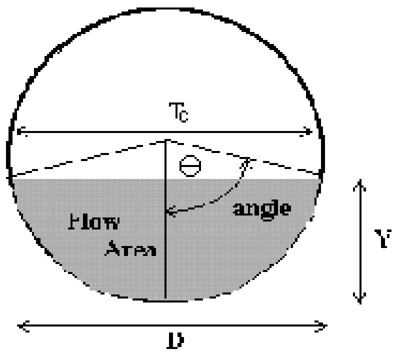
Project: **Paths at Pikeview**
Pipe ID: **DP-P3 18" HDPE**



Design Information (Input)			
Pipe Invert Slope	So =	0.0150	ft/ft
Pipe Manning's n-value	n =	0.0120	
Pipe Diameter	D =	18.00	inches
Design discharge	**Q =**	**13.80**	**cfs**
Full-flow Capacity (Calculated)			
Full-flow area	Af =	1.77	sq ft
Full-flow wetted perimeter	Pf =	4.71	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	13.97	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	2.24	radians
Flow area	An =	1.53	sq ft
Top width	Tn =	1.18	ft
Wetted perimeter	Pn =	3.35	ft
Flow depth	Yn =	1.21	ft
Flow velocity	Vn =	9.02	fps
Discharge	Qn =	13.80	cfs
Percent Full Flow	Flow =	98.8%	of full flow
Normal Depth Froude Number	Fr_n =	1.40	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.56	radians
Critical flow area	Ac =	1.70	sq ft
Critical top width	Tc =	0.83	ft
Critical flow depth	Yc =	1.38	ft
Critical flow velocity	Vc =	8.13	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

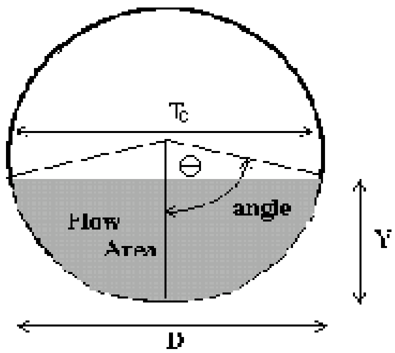
Project: **Paths at Pikeview**
Pipe ID: **DP-P4 15" HDPE**



Design Information (Input)			
Pipe Invert Slope	So =	0.0100	ft/ft
Pipe Manning's n-value	n =	0.0120	
Pipe Diameter	D =	15.00	inches
Design discharge	**Q =**	**5.10**	**cfs**
Full-flow Capacity (Calculated)			
Full-flow area	Af =	1.23	sq ft
Full-flow wetted perimeter	Pf =	3.93	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	7.02	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.84	radians
Flow area	An =	0.82	sq ft
Top width	Tn =	1.21	ft
Wetted perimeter	Pn =	2.30	ft
Flow depth	Yn =	0.79	ft
Flow velocity	Vn =	6.24	fps
Discharge	Qn =	5.10	cfs
Percent Full Flow	Flow =	72.6%	of full flow
Normal Depth Froude Number	Fr_n =	1.33	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.05	radians
Critical flow area	Ac =	0.96	sq ft
Critical top width	Tc =	1.11	ft
Critical flow depth	Yc =	0.92	ft
Critical flow velocity	Vc =	5.29	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

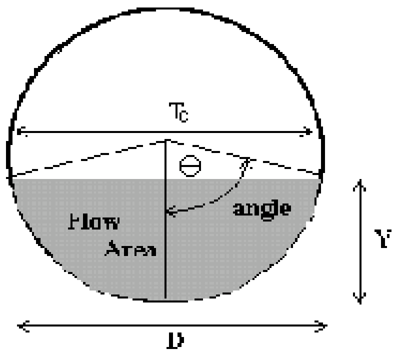
Project: **Paths at Pikeview**
Pipe ID: **DP-P5 18" HDPE**



Design Information (Input)			
Pipe Invert Slope	So =	0.0500	ft/ft
Pipe Manning's n-value	n =	0.0120	
Pipe Diameter	D =	18.00	inches
Design discharge	**Q =**	**18.50**	**cfs**
Full-flow Capacity (Calculated)			
Full-flow area	Af =	1.77	sq ft
Full-flow wetted perimeter	Pf =	4.71	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	25.51	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.84	radians
Flow area	An =	1.18	sq ft
Top width	Tn =	1.45	ft
Wetted perimeter	Pn =	2.75	ft
Flow depth	Yn =	0.95	ft
Flow velocity	Vn =	15.74	fps
Discharge	Qn =	18.50	cfs
Percent Full Flow	Flow =	72.5%	of full flow
Normal Depth Froude Number	Fr_n =	3.08	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.80	radians
Critical flow area	Ac =	1.75	sq ft
Critical top width	Tc =	0.51	ft
Critical flow depth	Yc =	1.46	ft
Critical flow velocity	Vc =	10.56	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

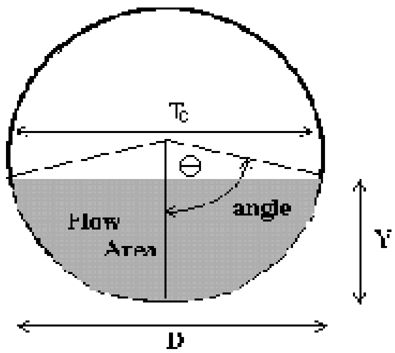
Project: Paths at Pikeview
Pipe ID: DP-P6 30" RCP



Design Information (Input)			
Pipe Invert Slope	So =	0.0092	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	30.00	inches
Design discharge	**Q =**	**37.40**	**cfs**
Full-flow Capacity (Calculated)			
Full-flow area	Af =	4.91	sq ft
Full-flow wetted perimeter	Pf =	7.85	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	39.45	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	2.16	radians
Flow area	An =	4.09	sq ft
Top width	Tn =	2.08	ft
Wetted perimeter	Pn =	5.39	ft
Flow depth	Yn =	1.94	ft
Flow velocity	Vn =	9.14	fps
Discharge	Qn =	37.40	cfs
Percent Full Flow	Flow =	94.8%	of full flow
Normal Depth Froude Number	Fr_n =	1.15	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.29	radians
Critical flow area	Ac =	4.34	sq ft
Critical top width	Tc =	1.89	ft
Critical flow depth	Yc =	2.07	ft
Critical flow velocity	Vc =	8.61	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

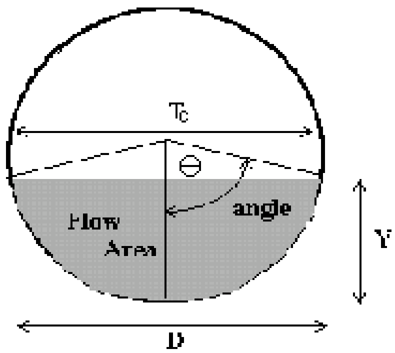
Project: **Paths at Pikeview**
Pipe ID: **DP-P7 48" RCP**



Design Information (Input)			
Pipe Invert Slope	So =	0.0630	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	48.00	inches
Design discharge	**Q =**	**72.90**	**cfs**
Full-flow Capacity (Calculated)			
Full-flow area	Af =	12.57	sq ft
Full-flow wetted perimeter	Pf =	12.57	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	361.51	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.17	radians
Flow area	An =	3.24	sq ft
Top width	Tn =	3.68	ft
Wetted perimeter	Pn =	4.68	ft
Flow depth	Yn =	1.22	ft
Flow velocity	Vn =	22.51	fps
Discharge	Qn =	72.91	cfs
Percent Full Flow	Flow =	20.2%	of full flow
Normal Depth Froude Number	Fr_n =	4.23	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	1.87	radians
Critical flow area	Ac =	8.58	sq ft
Critical top width	Tc =	3.83	ft
Critical flow depth	Yc =	2.58	ft
Critical flow velocity	Vc =	8.50	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

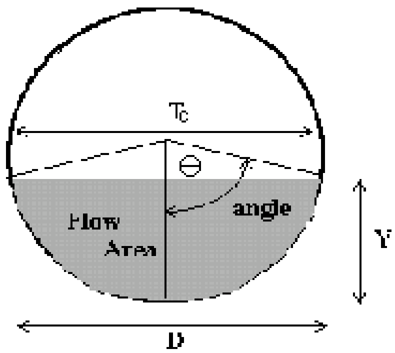
Project: **Paths at Pikeview**
Pipe ID: **DP-P8 18" HDPE**



Design Information (Input)			
Pipe Invert Slope	So =	0.0280	ft/ft
Pipe Manning's n-value	n =	0.0120	
Pipe Diameter	D =	18.00	inches
Design discharge	**Q =**	**18.40**	**cfs**
Full-flow Capacity (Calculated)			
Full-flow area	Af =	1.77	sq ft
Full-flow wetted perimeter	Pf =	4.71	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	19.09	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	2.19	radians
Flow area	An =	1.50	sq ft
Top width	Tn =	1.22	ft
Wetted perimeter	Pn =	3.28	ft
Flow depth	Yn =	1.18	ft
Flow velocity	Vn =	12.31	fps
Discharge	Qn =	18.40	cfs
Percent Full Flow	Flow =	96.4%	of full flow
Normal Depth Froude Number	Fr_n =	1.96	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.79	radians
Critical flow area	Ac =	1.75	sq ft
Critical top width	Tc =	0.51	ft
Critical flow depth	Yc =	1.46	ft
Critical flow velocity	Vc =	10.50	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

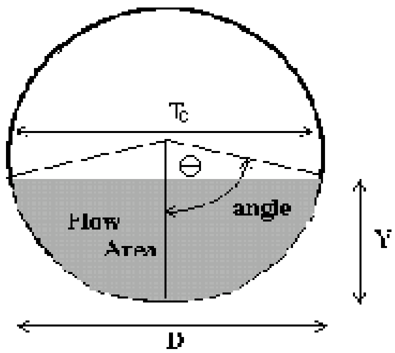
Project: **Paths at Pikeview**
Pipe ID: **DP-P9 12" HDPE**



Design Information (Input)			
Pipe Invert Slope	So =	0.0325	ft/ft
Pipe Manning's n-value	n =	0.0120	
Pipe Diameter	D =	12.00	inches
Design discharge	**Q =**	**2.40**	**cfs**
Full-flow Capacity (Calculated)			
Full-flow area	Af =	0.79	sq ft
Full-flow wetted perimeter	Pf =	3.14	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	6.98	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.38	radians
Flow area	An =	0.30	sq ft
Top width	Tn =	0.98	ft
Wetted perimeter	Pn =	1.38	ft
Flow depth	Yn =	0.40	ft
Flow velocity	Vn =	8.06	fps
Discharge	Qn =	2.40	cfs
Percent Full Flow	Flow =	34.4%	of full flow
Normal Depth Froude Number	Fr_n =	2.58	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	1.90	radians
Critical flow area	Ac =	0.55	sq ft
Critical top width	Tc =	0.95	ft
Critical flow depth	Yc =	0.66	ft
Critical flow velocity	Vc =	4.34	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

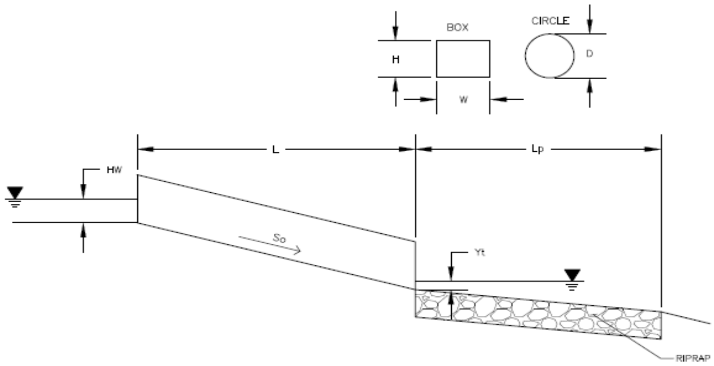
Project: **Paths at Pikeview**
Pipe ID: **DP-P10 48" RCP**



Design Information (Input)			
Pipe Invert Slope	So =	0.0100	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	48.00	inches
Design discharge	**Q =**	**75.30**	**cfs**
Full-flow Capacity (Calculated)			
Full-flow area	Af =	12.57	sq ft
Full-flow wetted perimeter	Pf =	12.57	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	144.03	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.60	radians
Flow area	An =	6.50	sq ft
Top width	Tn =	4.00	ft
Wetted perimeter	Pn =	6.39	ft
Flow depth	Yn =	2.05	ft
Flow velocity	Vn =	11.59	fps
Discharge	Qn =	75.31	cfs
Percent Full Flow	Flow =	52.3%	of full flow
Normal Depth Froude Number	Fr_n =	1.60	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	1.89	radians
Critical flow area	Ac =	8.75	sq ft
Critical top width	Tc =	3.80	ft
Critical flow depth	Yc =	2.63	ft
Critical flow velocity	Vc =	8.61	fps
Critical Depth Froude Number	Fr_c =	1.00	

Determination of Culvert Headwater and Outlet Protection

Project: PATHS AT PIKEVIEW
Basin ID: DP-P10 PUBLIC STORM OUTFALL



Soil Type:
Choose One:
(●) Sandy
( ) Non-Sandy

Supercritical Flow! Using Da to calculate protection type.

Design Information (Input):

Design Discharge	Q =	75.3	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =	48	inches
Inlet Edge Type (Choose from pull-down list)		1.5 : 1 Beveled Edge	
Box Culvert:		**OR**	
Barrel Height (Rise) in Feet	Height (Rise) =		ft
Barrel Width (Span) in Feet	Width (Span) =		ft
Inlet Edge Type (Choose from pull-down list)			
Number of Barrels	No =	1	
Inlet Elevation	Elev IN =	6118.03	ft
Outlet Elevation **OR** Slope	So =	0.01	ft/ft
Culvert Length	L =	193.5	ft
Manning's Roughness	n =	0.013	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	Elev Y_t =		ft
Max Allowable Channel Velocity	V =	5	ft/s

Required Protection (Output):

Tailwater Surface Height	Y_t =	1.60	ft
Flow Area at Max Channel Velocity	A_t =	15.06	ft^2
Culvert Cross Sectional Area Available	A =	12.57	ft^2
Entrance Loss Coefficient	k_e =	0.20	
Friction Loss Coefficient	k_f =	0.95	
Sum of All Losses Coefficients	k_s =	2.15	ft
Culvert Normal Depth	Y_n =	2.05	ft
Culvert Critical Depth	Y_c =	2.63	ft
Tailwater Depth for Design	d =	3.31	ft
Adjusted Diameter **OR** Adjusted Rise	D_a =	3.03	ft
Expansion Factor	1/(2*tan(Θ)) =	6.51	
Flow/Diameter$^{2.5}$ **OR** Flow/(Span * Rise$^{1.5}$)	Q/D^2.5 =	2.35	$ft^{0.5}/s$
Froude Number	Fr =	1.60	**Supercritical!**
Tailwater/Adjusted Diameter **OR** Tailwater/Adjusted Rise	Yt/D =	0.53	
Inlet Control Headwater	HW_I =	3.86	ft
Outlet Control Headwater	HW_O =	2.58	
Design Headwater Elevation	**HW =**	**6,121.89**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**0.97**	
Minimum Theoretical Riprap Size	d_{50} =	8	in
Nominal Riprap Size	d_{50} =	9	in
UDFCD Riprap Type	**Type =**	**L**	
Length of Protection	**L_p =**	**36**	**ft**
Width of Protection	**T =**	**10**	**ft**

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator
LID Credit by Impervious Reduction Factor (IRF) Method

User Input

Calculated cells

***Design Storm: 1-Hour Rain Depth	2-Year Event	1.19	inches
***Minor Storm: 1-Hour Rain Depth	5-Year Event	1.50	inches
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches
Optional User Defined Storm	CUHP		
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event		
Max Intensity for Optional User Defined Storm	0		

Designer:	**David Mijares**
Company:	**Catamount Engineering**
Date:	**July 16, 2019**
Project:	**Paths at Pikeview**
Location:	

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	**A1**	**A2**	**A3**	**A4**	**A5**	**A6**								
Receiving Pervious Area Soil Type	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam								
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	2.520	2.200	1.870	1.140	0.450	0.700								
Directly Connected Impervious Area (DCIA, acres)	1.060	0.600	0.600	0.390	0.150	0.000								
Unconnected Impervious Area (UIA, acres)	0.610	0.860	0.460	0.290	0.140	0.060								
Receiving Pervious Area (RPA, acres)	0.850	0.740	0.810	0.460	0.160	0.320								
Separate Pervious Area (SPA, acres)	0.000	0.000	0.000	0.000	0.000	0.320								
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C	C	C	C	C	C								

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	2.520	2.200	1.870	1.140	0.450	0.700								
Directly Connected Impervious Area (DCIA, %)	42.1%	27.3%	32.1%	34.2%	33.3%	0.0%								
Unconnected Impervious Area (UIA, %)	24.2%	39.1%	24.6%	25.4%	31.1%	8.6%								
Receiving Pervious Area (RPA, %)	33.7%	33.6%	43.3%	40.4%	35.6%	45.7%								
Separate Pervious Area (SPA, %)	0.0%	0.0%	0.0%	0.0%	0.0%	45.7%								
A_R (RPA / UIA)	1.393	0.860	1.761	1.586	1.143	5.333								
I_a Check	0.420	0.540	0.360	0.390	0.470	0.160								
f / I for 2-Year Event:	0.9	0.9	0.9	0.9	0.9	0.9								
f / I for 5-Year Event:	0.5	0.5	0.5	0.5	0.5	0.5								
f / I for 100-Year Event:	0.3	0.3	0.3	0.3	0.3	0.3								
f / I for Optional User Defined Storm CUHP:														
IRF for 2-Year Event:	0.79	0.82	0.78	0.79	0.81	0.59								
IRF for 5-Year Event:	0.88	0.90	0.87	0.88	0.89	0.68								
IRF for 100-Year Event:	0.92	0.94	0.91	0.92	0.93	0.71								
IRF for Optional User Defined Storm CUHP:														
Total Site Imperviousness: I_{total}	66.3%	66.4%	56.7%	59.6%	64.4%	8.6%								
Effective Imperviousness for 2-Year Event:	61.3%	59.4%	51.2%	54.2%	58.4%	5.1%								
Effective Imperviousness for 5-Year Event:	63.4%	62.6%	53.6%	56.5%	61.1%	5.8%								
Effective Imperviousness for 100-Year Event:	64.3%	63.9%	54.5%	57.5%	62.2%	6.1%								
Effective Imperviousness for Optional User Defined Storm CUHP:														

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

This line only for WQCV Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
This line only for 10-Year Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100-Year Event CREDIT**: Reduce Detention By:	2.8%	3.5%	3.7%	3.5%	3.4%	38.1%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
User Defined CUHP CREDIT: Reduce Detention By:														

Total Site Imperviousness:	**58.8%**
Total Site Effective Imperviousness for 2-Year Event:	**53.2%**
Total Site Effective Imperviousness for 5-Year Event:	**55.6%**
Total Site Effective Imperviousness for 100-Year Event:	**56.6%**
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	

Notes:

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

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

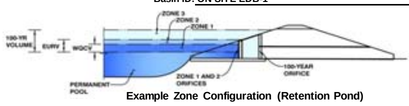
*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: PATHS AT PIKEVIEW

Basin ID: ON SITE EDB-1



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**			
Watershed Area =	8.83	acres		
Watershed Length =	1,486	ft		
Watershed Slope =	0.010	ft/ft		
Watershed Imperviousness =	56.60%	percent		
Percentage Hydrologic Soil Group A =	100.0%	percent		
Percentage Hydrologic Soil Group B =	0.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	Denver - Capitol Building			
Water Quality Capture Volume (WQCV) =	0.166	acre-feet	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	0.597	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	0.409	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.535	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.656	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.806	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.984	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	1.192	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	1.670	acre-feet		inches
Approximate 2-yr Detention Volume =	0.386	acre-feet		
Approximate 5-yr Detention Volume =	0.506	acre-feet		
Approximate 10-yr Detention Volume =	0.614	acre-feet		
Approximate 25-yr Detention Volume =	0.745	acre-feet		
Approximate 50-yr Detention Volume =	0.827	acre-feet		
Approximate 100-yr Detention Volume =	0.919	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.166	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.431	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.322	acre-feet
Total Detention Basin Volume =	0.919	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

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)
Top of Micropool	--	0.00	--	--	--	20	0.000		
ISV/6127.0	--	0.67	--	--	--	20	0.000	13	0.000
6128	--	1.67	--	--	--	4,120	0.095	2,042	0.047
6130	--	3.67	--	--	--	9,059	0.208	15,262	0.350
6132	--	5.67	--	--	--	13,890	0.319	38,211	0.877
6133	--	6.67	--	--	--	16,736	0.384	53,524	1.229
6134	--	7.77	--	--	--	19,119	0.439	73,245	1.681
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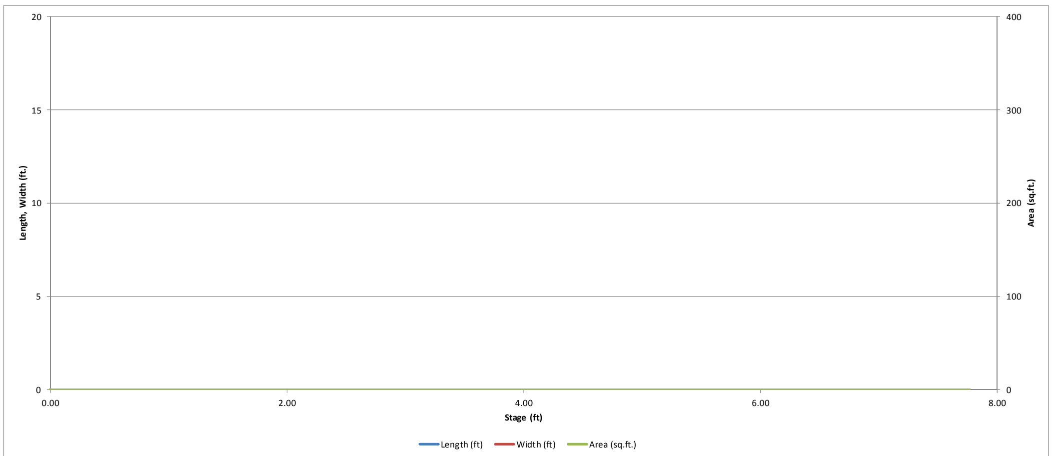
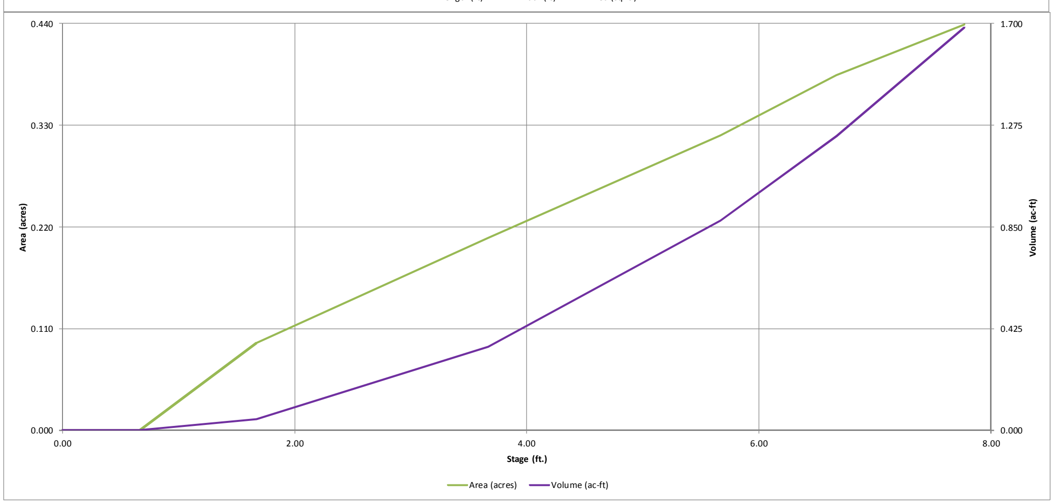
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

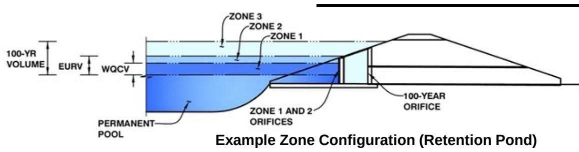




Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: PATHS AT PIKEVIEW
Basin ID: ON-SITE EDB



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.64	0.166	Orifice Plate
Zone 2 (EURV)	4.71	0.431	Orifice Plate
Zone 3 (100-year)	5.80	0.322	Weir&Pipe (Restrict)
		0.919	Total

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	4.71	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	18.80	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.57	3.14					
Orifice Area (sq. inches)	0.85	0.85	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)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.71	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Slope =	4.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	5.71	N/A	feet
Over Flow Weir Slope Length =	4.12	N/A	feet
Grate Open Area / 100-yr Orifice Area =	60.58	N/A	should be $\geq$ 4
Overflow Grate Open Area w/o Debris =	11.54	N/A	ft^2
Overflow Grate Open Area w/ Debris =	5.77	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 =	12.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	3.50		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.19	N/A	ft^2
Outlet Orifice Centroid =	0.17	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.92	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	15.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

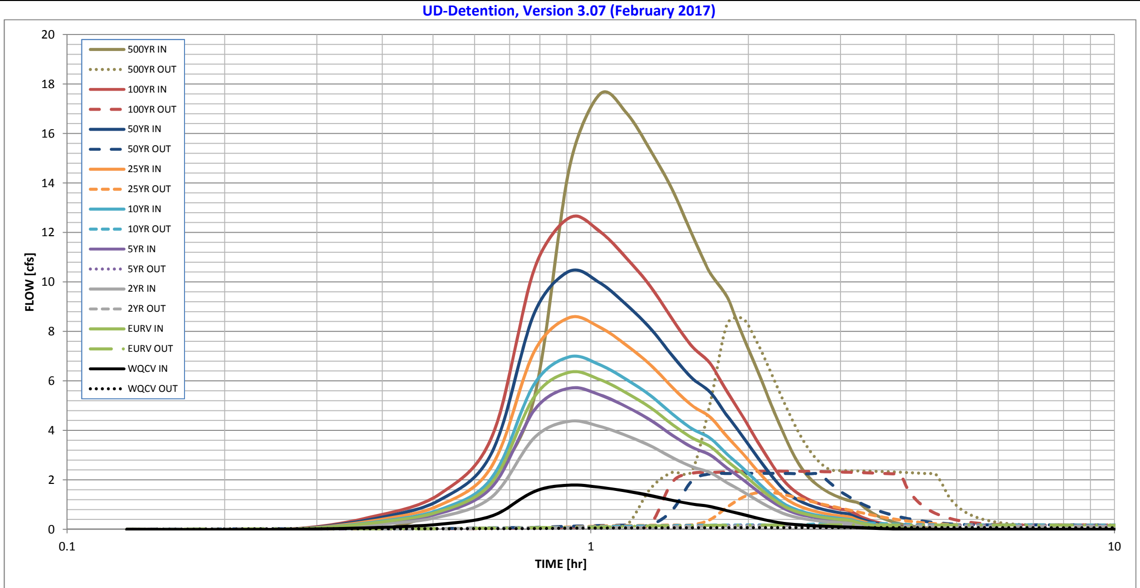
Spillway Design Flow Depth=	0.40	feet
Stage at Top of Freeboard =	7.32	feet
Basin Area at Top of Freeboard =	0.42	acres

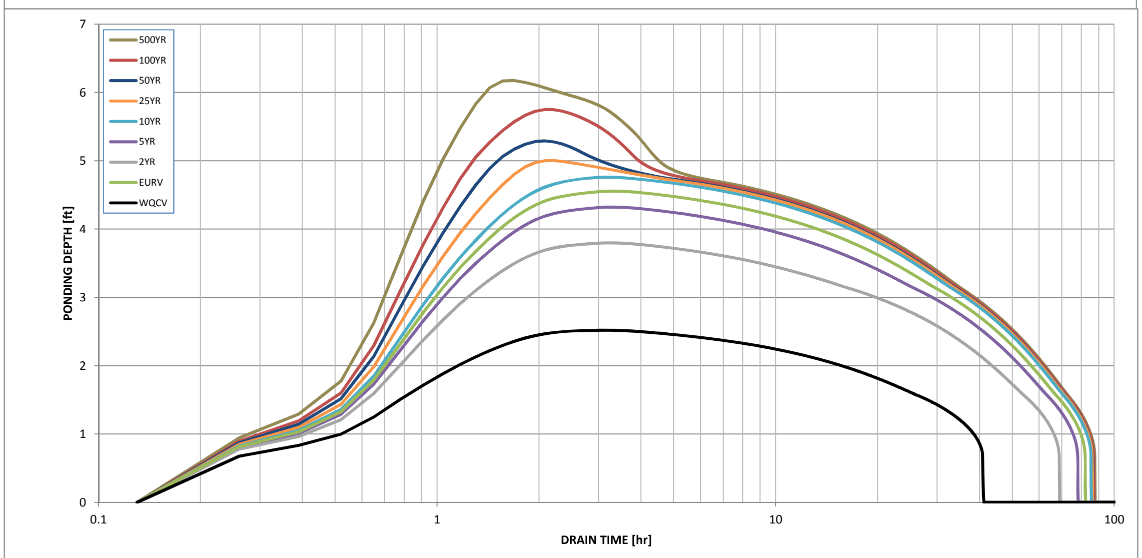
Routed Hydrograph Results

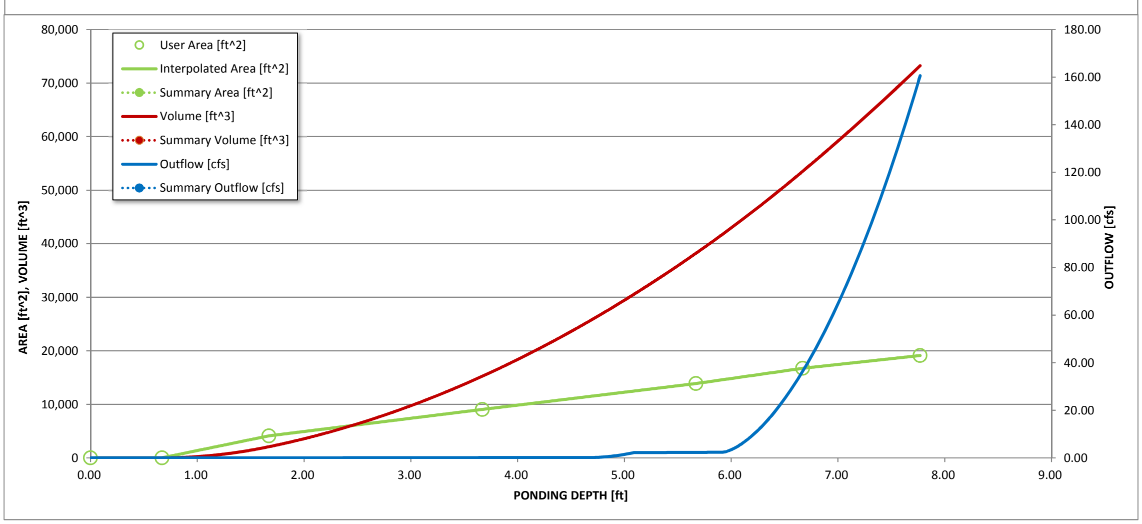
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.14
Calculated Runoff Volume (acre-ft) =	0.166	0.597	0.409	0.535	0.656	0.806	0.984	1.192	1.670
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.165	0.596	0.408	0.535	0.655	0.806	0.985	1.192	1.671
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.00	0.00	0.01	0.01	0.11	0.26	0.63
Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.0	0.1	0.1	0.9	2.3	5.5
Peak Inflow Q (cfs) =	1.8	6.4	4.4	5.7	7.0	8.6	10.4	12.6	17.6
Peak Outflow Q (cfs) =	0.1	0.2	0.1	0.2	0.3	1.5	2.3	2.4	8.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	7.0	4.7	12.0	2.4	1.0	1.5
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.1	0.2	0.2	0.2
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) =	39	75	64	72	78	77	75	74	70
Time to Drain 99% of Inflow Volume (hours) =	**40**	80	67	76	83	83	82	82	81
Maximum Ponding Depth (ft) =	2.52	4.56	3.80	4.32	4.76	5.00	5.29	5.75	6.17
Area at Maximum Ponding Depth (acres) =	0.14	0.26	0.21	0.24	0.27	0.28	0.30	0.32	0.35
Maximum Volume Stored (acre-ft) =	0.149	0.555	0.376	0.497	0.607	0.676	0.760	0.903	1.045

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

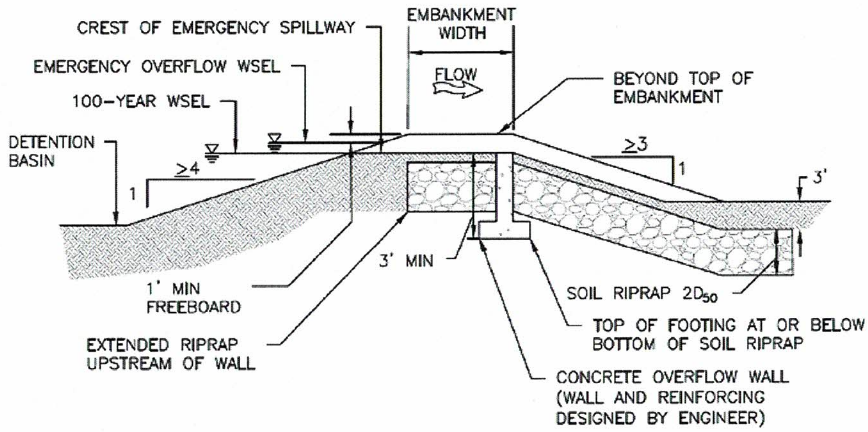
Storm Inflow Hydrographs **UD-Detention, Version 3.07 (February 2017)**

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

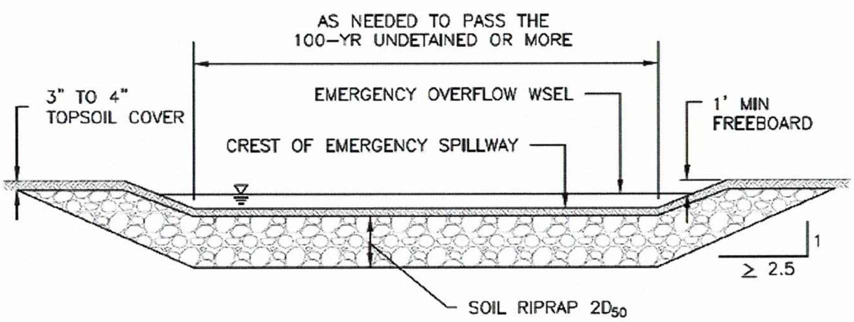
Time Interval: 7.80 min

Hydrograph Constant: 0.641

SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
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
0:07:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:15:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:23:24	0.08	0.28	0.20	0.25	0.31	0.38	0.46	0.55	0.76
0:31:12	0.22	0.76	0.52	0.68	0.83	1.02	1.24	1.49	2.07
0:39:00	0.56	1.95	1.35	1.75	2.14	2.62	3.18	3.83	5.32
0:46:48	1.53	5.36	3.70	4.82	5.87	7.19	8.74	10.52	14.60
0:54:36	1.79	6.35	4.37	5.71	6.97	8.56	10.43	12.60	17.59
1:02:24	1.70	6.06	4.16	5.44	6.66	8.17	9.97	12.04	16.83
1:10:12	1.55	5.52	3.79	4.95	6.06	7.44	9.08	10.97	15.32
1:18:00	1.37	4.92	3.38	4.42	5.41	6.65	8.12	9.82	13.74
1:25:48	1.17	4.25	2.91	3.81	4.67	5.75	7.03	8.51	11.93
1:33:36	1.03	3.70	2.54	3.32	4.07	5.01	6.12	7.40	10.37
1:41:24	0.93	3.35	2.30	3.01	3.69	4.54	5.55	6.71	9.40
1:49:12	0.75	2.77	1.89	2.48	3.04	3.75	4.60	5.57	7.83
1:57:00	0.61	2.26	1.53	2.02	2.49	3.07	3.77	4.57	6.45
2:04:48	0.46	1.74	1.17	1.55	1.92	2.37	2.92	3.56	5.04
2:12:36	0.33	1.29	0.87	1.15	1.43	1.77	2.19	2.68	3.83
2:20:24	0.24	0.94	0.63	0.84	1.03	1.28	1.59	1.95	2.81
2:28:12	0.19	0.73	0.49	0.65	0.80	0.99	1.22	1.50	2.14
2:36:00	0.16	0.60	0.40	0.53	0.66	0.81	1.00	1.22	1.74
2:43:48	0.14	0.51	0.34	0.45	0.56	0.69	0.85	1.04	1.47
2:51:36	0.12	0.45	0.30	0.40	0.49	0.61	0.75	0.91	1.29
2:59:24	0.11	0.40	0.27	0.36	0.44	0.55	0.67	0.82	1.16
3:07:12	0.10	0.37	0.25	0.33	0.41	0.50	0.62	0.75	1.06
3:15:00	0.07	0.27	0.18	0.24	0.30	0.37	0.45	0.55	0.78
3:22:48	0.05	0.20	0.14	0.18	0.22	0.27	0.33	0.40	0.57
3:30:36	0.04	0.15	0.10	0.13	0.16	0.20	0.24	0.30	0.42
3:38:24	0.03	0.11	0.07	0.10	0.12	0.15	0.18	0.22	0.31
3:46:12	0.02	0.08	0.05	0.07	0.08	0.10	0.13	0.16	0.22
3:54:00	0.01	0.05	0.04	0.05	0.06	0.07	0.09	0.11	0.16
4:01:48	0.01	0.04	0.03	0.03	0.04	0.05	0.07	0.08	0.12
4:09:36	0.01	0.03	0.02	0.02	0.03	0.04	0.04	0.05	0.08
4:17:24	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.05
4:25:12	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.02	0.03
4:33:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
4:40:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:48:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:56:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:04:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:12:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:19:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:27:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:35:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:43:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:51:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:58:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:06:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:14:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:22:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:37:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:45:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:53:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7:01:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7:09:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7:16:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7:24:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7:32:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7:40:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7:48:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7:55:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8:03:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8:11:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8:19:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8:27:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8:34:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8:42:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8:50:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8:58:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9:06:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9:13:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9:21:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



EMERGENCY SPILLWAY PROFILE



EMERGENCY SPILLWAY SECTION AND SPILLWAY CHANNEL

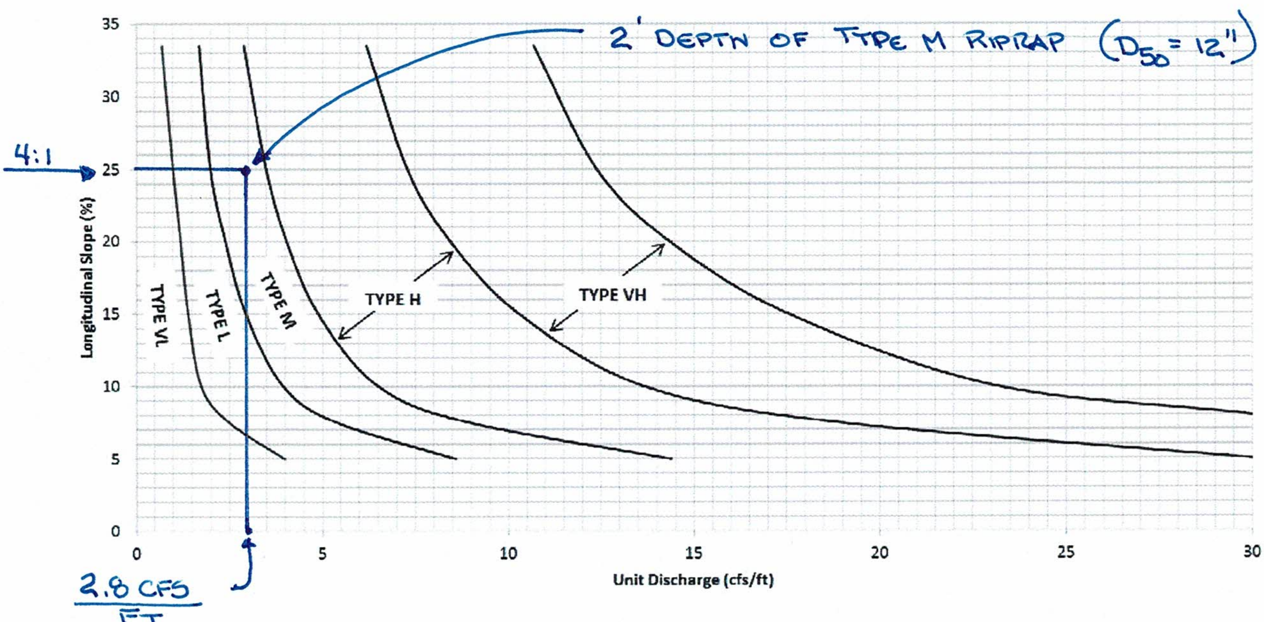


Figure 12-21. Embankment protection details and rock sizing chart (adapted from Arapahoe County)

Q_{100} POND = 42.2 CFS
15' OVERFLOW SPILLWAY

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**David Mijares**
Company:	**Catamount Engineering**
Date:	**July 16, 2019**
Project:	**Paths at Pikeview**
Location:	**EDB 1**

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 56.6 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.566
C) Contributing Watershed Area	Area = 8.830 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}= 0.166 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)	$V_{DESIGN\ USER}$= ______ ac-ft
I) Predominant Watershed NRCS Soil Group	Choose One: ● A ○ B ○ C / D
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 = 0.597 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:	

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**David Mijares**
Company:	**Catamount Engineering**
Date:	**July 16, 2019**
Project:	**Paths at Pikeview**
Location:	**EDB 1**

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 2% of the WQCV) — V_{FMIN} = 0.003 ac-ft

B) Actual Forebay Volume — V_F = 0.003 ac-ft

C) Forebay Depth (D_F = 18 inch maximum) — D_F = 12.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 37.40 cfs

ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$) — Q_F = 0.75 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 = 5.1 in

6. Trickle Channel

A) Type of Trickle Channel

Choose One
- ◉ Concrete
- ○ Soft Bottom

F) Slope of Trickle Channel — S = ______ 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 = 40 sq ft

C) Outlet Type

Choose One
- ○ Orifice Plate
- ○ Other (Describe):

With 8" initial surcharge depth, micropool provides 26.8 CF of initial surcharge volume which exceeds 21.7 CF (0.3% of WQCV).

D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention) — $D_{orifice}$ = ______ inches

E) Total Outlet Area — A_{ot} = ______ square inches

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**David Mijares**
Company:	**Catamount Engineering**
Date:	**July 16, 2019**
Project:	**Paths at Pikeview**
Location:	**EDB 1 WEST FOREBAY**

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 56.6 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.566
C) Contributing Watershed Area	Area = 0.450 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}= 0.008 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)	$V_{DESIGN\ USER}$= ____ ac-ft
I) Predominant Watershed NRCS Soil Group	Choose One ◉ A ○ B ○ C / D
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 = 0.030 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:	

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**David Mijares**
Company:	**Catamount Engineering**
Date:	**July 16, 2019**
Project:	**Paths at Pikeview**
Location:	**EDB 1 WEST FOREBAY**

5. Forebay		
A) Minimum Forebay Volume (V_{FMIN} = 0% of the WQCV)	V_{FMIN} = 0.000 ac-ft	**A FOREBAY MAY NOT BE NECESSARY FOR THIS SIZE SITE**
B) Actual Forebay Volume	V_F = 0.003 ac-ft	
C) Forebay Depth (D_F = 12 inch maximum)	D_F = 12.0 in	
D) Forebay Discharge		
i) Undetained 100-year Peak Discharge	Q_{100} = 2.40 cfs	
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 0.05 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 = 2.6 in	
6. Trickle Channel		
A) Type of Trickle Channel	Choose One: ● Concrete; ○ Soft Bottom	
F) Slope of Trickle Channel	S = ____ 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 = 40 sq ft	
C) Outlet Type	Choose One: ○ Orifice Plate; ○ Other (Describe): With 8" initial surcharge depth, micropool provides 26.8 CF of initial surcharge volume which exceeds 21.7 CF (0.3% of WQCV).	
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = ____ inches	
E) Total Outlet Area	A_{ot} = ____ square inches	

DRAINAGE MAP

DRAINAGE BASINS							
BASIN	AREA (ACRES)	Q2 (CFS)	Q5 (CFS)	Q10 (CFS)	Q25 (CFS)	Q50 (CFS)	Q100 (CFS)
A	6.90	0.4	1.3	2.9	5.1	6.9	9.0
OS–1	1.29	1.4	1.9	2.4	3.0	3.5	4.1
OS–2	1.06	0.8	1.2	1.6	2.1	2.6	3.1
OS–3	5.87	6.1	8.4	10.6	13.4	15.9	18.4
OS–4	6.75	7.0	9.6	12.2	15.4	18.3	21.2

DESIGN POINTS						
DESIGN POINT	Q2 (CFS)	Q5 (CFS)	Q10 (CFS)	Q25 (CFS)	Q50 (CFS)	Q100 (CFS)
1	1.3	2.6	4.5	7.1	9.3	11.7
P1(CAPACITY)						54.5

DRAINAGE LEGEND

BASIN IDENTIFIER / BASIN AREA [AC]	F 0.36
DESIGN POINT IDENTIFIERS	3
DRAINAGE BASIN BOUNDARY	
SURFACE SHEET FLOW DIRECTION	
EXISTING MAJOR CONTOUR (10')	
EXISTING MINOR CONTOUR (2')	
PROPOSED MAJOR CONTOUR (10')	
PROPOSED MINOR CONTOUR (2')	
PROPOSED	(E) (P) (F)
SLOPE/DIRECTION	1.00%
(E) STORM SEWER	
(P) STORM SEWER, INLET, OUTFALL	

PREPARED FOR:	CATAMOUNT ENGINEERING	PATHS AT PIKEVIEW	SCALE: 1"=50'	DRAWN BY: DLM
GOODWIN KNIGHT 8605 EXPLORER DRIVE SUITE 250 COLORADO SPRINGS, CO 80920	PO BOX 692 DIVIDE, CO 80814 (719) 426-2124	EXISTING DRAINAGE PLAN	DATE: 08/01/18	
			JOB NUMBER 17–131	SHEET 1 OF 1

DRAINAGE BASINS

BASIN	AREA (ACRES)	Q2 (CFS)	Q5 (CFS)	Q10 (CFS)	Q25 (CFS)	Q50 (CFS)	Q100 (CFS)
OS-1	1.29	1.4	1.9	2.4	3.0	3.5	4.1
OS-2	1.06	0.8	1.2	1.6	2.1	2.6	3.1
OS-3	5.87	6.1	8.4	10.6	13.4	15.9	18.4
OS-4	6.75	7.0	9.6	12.2	15.4	18.3	21.2
A1	2.52	4.9	6.6	8.2	10.0	11.9	13.4
A2	2.20	3.8	5.1	6.4	7.8	9.4	10.5
A3	1.87	3.0	4.1	5.2	6.5	7.9	8.8
A4	1.14	2.1	2.8	3.6	4.4	5.3	6.0
A5	0.45	0.9	1.2	1.5	1.8	2.2	2.4
A6	0.70	0.3	0.7	1.0	1.5	2.1	2.4
B1	0.15	0.0	0.1	0.2	0.3	0.5	0.5
B2	1.51	0.2	0.6	1.1	1.7	2.4	2.7
B3	1.85	0.2	0.7	1.2	1.9	2.7	3.0

DESIGN POINTS

DESIGN POINT	DESCRIPTION	Q2 (CFS)	Q5 (CFS)	Q10 (CFS)	Q25 (CFS)	Q50 (CFS)	Q100 (CFS)
E1	10' TYPE R	6.1	8.4	10.6	13.4	15.9	18.4
E2	SWALE	7.0	9.6	12.2	15.4	18.3	21.2
2	10' D-9	4.9	6.6	8.2	10.0	11.6	13.4
3	10' D-9		7.3				17.2
4	10' D-9	3.0	4.1	5.2	6.5	7.6	8.8
5	10' D-9 SUMP		5.9				18.5
6	SWALE	6.6	9.3	12.2	15.7	18.9	22.1
7	5' D-9 SUMP	0.9	1.2	1.5	1.8	2.1	2.4
P1(CAPACITY)	42" CMP		45.0				54.5
P2	15" HDPE		4.3				6.4
P3	18" HDPE		8.9				13.8
P4	15" HDPE		3.3				5.1
P5	18" HDPE		5.9				18.5
P6	30" RCP		18.1				37.4
P7	48" RCP		53.4				72.9
P8	18" HDPE		8.4				18.4
P9	12" HDPE		1.2				2.4
P10	48" RCP		54.6				75.3

REV.	DESCRIPTION	DATE

Know what's below. Call 72 hours before you dig. For more details visit: www.call811.com

PREPARED FOR:
GOODWIN KNIGHT
8605 EXPLORER DRIVE SUITE 250
COLORADO SPRINGS, CO 80920

CATAMOUNT ENGINEERING
321 W. HENRIETTA AVE, PO BOX 221, WOODLAND PARK, CO 80866, (719)426-2124

PATHS AT PIKEVIEW

PROPOSED DRAINAGE PLAN

DESIGNED BY: DLM	DRAWN BY: XXX
SCALE: 1" = 50'	DATE: 08/01/18
JOB NUMBER	SHEET
17-131	1 OF 1