Master Development Drainage Plan and
Final Drainage Report for

Newport Estates
Filing No. 1
Colorado Springs, Colorado

Prepared for:
Rockwood Homes, LLC
5436 Carvel Grove
Colorado Springs, CO 80922
(719) 930-5087

Prepared by:
Kimley-Horn and Associates, Inc.
2 N Nevada Ave
Suite 300
Colorado Springs, CO 80903
(719) 453-0180
Contact: Eric Gunderson, P.E.

Project #: 096726000

November 25, 2020

Kimley»Horn

CERTIFICATION

ENGINEERS STATEMENT

This report and plan for the drainage design of Newport Estates Filing No. 1 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 REGISTERED ERIC JON GUNDERSON 49487 1/26/21 PROFESSIONAL ENGINEER

SIGNATURE (Affix Seal): Eric Gunderson

Colorado P.E. No. 49487 Date

DEVELOPER'S STATEMENT

Rockwood Homes, LLC hereby certifies that the drainage facilities for Newport Estates Filing No. 1 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 Newport Estates Filing No. 1, guarantee that final drainage design review will absolve Rockwood Homes, LLC and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

ROCKWOOD HOMES, LLC
Name of Developer

1/25/2021
Authorized Signature Date

JOHN RAPTIS
Printed Name

MANAGER
Title

5436 CARVEL GROVE CO SPRINGS, CO 80922
Address:

CITY OF COLORADO SPRINGS STATEMENT

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

Joel Mulin 03/05/2021
For City Engineer Date

Conditions:

Kimley»Horn

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INTRODUCTION

PURPOSE AND SCOPE OF STUDY

This Master Development Drainage Plan ("MDDP") and Final Drainage Report ("FDR") is being prepared in conjunction with the proposed Development Plan for the Newport Estates Filing No. 1 ("Project"). The purpose of this Final Drainage Report ("Report") is to determine the required storm sewer and drainage improvements necessary to support the Project. This Report identifies on-site and off-site drainage patterns, storm sewer and inlet locations and sizes, water quality and detention pond sizes and location and areas tributary to the site. The property is approximately 10.71 acres in size.

GENERAL PROJECT DESCRIPTION

The Project includes constructing 31 patio homes with garages near the southwest corner of Woodmen Drive and Austin Bluffs Parkway. Site improvements consist of two public streets with cul-de-sac dead ends, dedicated tracts, water, sewer and storm facilities. The project is located on the 10.71-acre parcel of land at the north side of the tee intersection at Bridle Pass Drive and Shimmering Moon Lane in the City of Colorado Springs ("City"), El Paso County, Colorado ("Site"). The Site is vacant, un-platted and was previously owned by Colorado Springs School District 11. The Site will be platted as Newport Estates Filing No. 1.

The Project is located within the northwest ¼ corner of Section 11, Township 13 South, Range 66 West of the 6th Principal Meridian, City of Colorado Springs, County of El Paso, State of Colorado (see Vicinity Map in Appendix). The property is bounded by Newport Heights West Subdivision Filing No. 9 (Rec. No. 201019244) to the west, Bridle Pass Drive and Newport Heights West Subdivision Filing No. 10 (Rec. No. 99164242) to the south, Newport Heights East Subdivision Filing No. 1 (Rec. No. 981564581) and Big Timber Drive to the east and Cottonwood Creek to the north. The Property is currently undeveloped and consists of vacant land. The Property generally slopes from the east to west with the anticipated stormwater outfall being Cottonwood Creek at the west end of the Property. The Property is approximately 10.71 acres in size and consists of 31 lots. The Property is outside of the Streamside Overlay Zone inner and outer buffers.

An ALTA and topographic field survey was completed for the Project by Land Development Consultants, Inc. dated June 27, 2018 and is the basis for design for the drainage improvements.

DEVELOPMENT DESIGN CRITERIA REFERENCE AND CONSTRAINTS

The proposed storm facilities are designed to be in compliance with the City of Colorado Springs Drainage Criteria Manual, Volumes 1 and 2 (2014) (the "CRITERIA") and the Urban Storm Drainage Criteria Manual (the "MANUAL"). Site drainage is not significantly impacted by such constraints as utilities or existing development.

The 5-year and 100-year design storm events were used in determining rainfall and runoff for the Project per section 6 of the CRITERIA. Table 6-2 of the CRITERIA is the source for rainfall data for the 5-year and 100-year design storm events. Design runoff was calculated using the Rational Method for developed conditions as established in the CRITERIA and MANUAL. Runoff coefficients for the proposed development were determined using Table 6-6 of the

MANUAL by calculating weighted impervious values for each specific Site basin. A variance is requested for the inlet structures to serve as junctions due to the utility spacing constraints and horizontal geometry. Additionally, there is a proposed retaining wall within the detention basin, with a footing below the WQCV and EURV. A variance request for both variances is included as a part of the Appendix. There are no additional provisions selected or deviations from the City of Colorado Springs Drainage Criteria, dated May 2014, for the proposed development.

PROJECT CHARACTERISTICS

The existing Site consists of vacant land with native vegetation. The existing site imperviousness value for the Site is 2%. The Site generally consists of very steep slopes across the center section and southwest corner. Slopes on-site vary from 2% to 40%, with an average approximate slope of 10% from the highest to the lowest point. Existing drainage is undetained and conveyed overland from east to west to Cottonwood Creek. An existing drainage plan is included in the Appendix of this report for reference. The Site was included as sub-basins III and IV in the Newport Heights West Filing No. 10 Final Drainage Report dated April 1999, included in the Appendix of this Report. The Site is also part of the Cottonwood Creek Drainage Basin Planning Study ("DBPS").

NRCS soil data is available for this Site and it has been noted that soils onsite are generally USCS Type A. Soils information is provided in the Appendix of this Report. There are no major drainage ways or irrigation facilities within the Site. The Site does not currently provide water quality or detention for the Project area. The existing land use is undeveloped vacant land. The proposed land use is residential.

HYDROLOGIC ANALYSIS

MAJOR DRAINAGE BASIN DESCRIPTION

The Project is within the Cottonwood Creek Drainage Basin and is located adjacent to Cottonwood Creek. The Property is ultimately tributary to Cottonwood Creek. There are no known major irrigation facilities within 100 feet of the property.

EXISTING DRAINAGE CONDITIONS

The existing runoff within the Property generally drains over undeveloped, vacant land from east to west to Cottonwood Creek. Below is a description of the existing sub-basins and an existing conditions drainage plan is included in the Appendix.

Basin EX A

Basin EX A consists of the southeast corner of the Site totaling 2.89-acres in size and is currently undeveloped vacant land. Drainage flows overland from northeast to southwest at approximately a 3.5% slope to Bridle Pass Drive. Runoff during the 5-year and 100-year events are 0.89 cfs and 6.53 cfs respectively. Drainage is conveyed westward to the existing inlet at the southwest corner of the Site, along Bridle Pass Drive. Drainage is conveyed from this inlet via storm pipe to Cottonwood Creek.

Basin EX B

Basin EX B of the northwest portion of the Site totaling 8.76-acres in size and is currently undeveloped vacant land. Drainage flows overland from east to west at approximately a 25% slope to Cottonwood Creek. Runoff during the 5-year and 100-year events are 2.50 cfs and 18.34 cfs respectively. Runoff flows over undeveloped vacant land towards Cottonwood Creek.

PROPOSED DRAINAGE CONDITIONS

The Project is divided into eleven catchment areas. A proposed drainage plan is included in the appendix of this Report for reference. The proposed imperviousness value for the Site is approximately 34.9%. A proposed storm layout is shown on the proposed drainage plan. The proposed storm system consists of four Type R inlets, three Type C inlets and one outlet structure and flared end section. The system has both Public and Private components, which are indicated on the drainage maps included in the Appendix. An outlet pipe discharges flows from the proposed private full spectrum extended detention basin ultimately outfalls to Cottonwood Creek. Emergency overflow routing for the Site is conveyed within the public streets and ultimately west to Cottonwood Creek. Water quality treatment and detention will be provided by a proposed full spectrum extended detention basin located at the west end of the Site. The pond will include a concrete trickle channel, forebay, micropool, and outlet structure per the CRITERIA. A proposed conditions map has been provided in Appendix.

Sub-basin A

Sub-basin A is 1.28 acres in size and is located at the southeast corner of the Site. This sub-basin consists of a section of proposed public drive, patio homes and landscape area. The 5-year runoff (cfs) is 1.11 and the 100-year runoff (cfs) is 3.82. Developed flows within this sub-basin is collected via a public CDOT Type C storm inlet at design point 1. A proposed landscape swale along the southern boundary of the basin collects any flows headed towards Bridle Pass Drive and directs them over to design point 1. Flows are conveyed to the private full spectrum detention pond at the west end of the Site which outfalls to Cottonwood Creek.

Sub-basin B

Sub-basin B is 0.70 acres in size and is located at the southeast corner of the Site. This sub-basin consists of a section of proposed public drive, patio homes and landscape area. The 5-year runoff (cfs) is 1.96 and the 100-year runoff (cfs) is 4.15. Developed flows within this sub-basin is collected via a public 5’ Type R storm inlet at design point 2. Flows are conveyed to the private full spectrum detention pond at the west end of the Site which outfalls to Cottonwood Creek.

Sub-basin C

Sub-basin C is 0.88 acres in size and is located at the east side of the Site. This sub-basin consists of a section of proposed public drive, patio homes and landscape area. The 5-year runoff (cfs) is 1.75 and the 100-year runoff (cfs) is 4.18. Developed flows within this sub-basin is collected via a public 5’ Type R storm inlet at design point 3. Flows are conveyed to the private full spectrum detention pond at the west end of the Site which outfalls to Cottonwood Creek.

Sub-basin D

Sub-basin D is 1.18 acres in size and is located at the northeast side of the Site. This sub-basin consists of a section of proposed public drive, patio homes and landscape area. The 5-year runoff (cfs) is 2.50 and the 100-year runoff (cfs) is 5.95. Developed flows within this sub-basin is collected via a public 5' Type R storm inlet at design point 4. Flows are conveyed to the private full spectrum detention pond at the west end of the Site which outfalls to Cottonwood Creek.

Sub-basin E

Sub-basin E is 1.31 acres in size and is located at the west side of the Site. This sub-basin consists of patio homes, landscape area, and proposed private full spectrum detention basin. The 5-year runoff (cfs) is 1.42 and the 100-year runoff (cfs) is 4.61.

Sub-basin F

Sub-basin F is 2.16 acres in size and is located at the northwest side of the Site. This sub-basin consists of patio homes, landscape area, and Cottonwood Creek trail. The 5-year runoff (cfs) is 1.46 and the 100-year runoff (cfs) is 6.07. Developed flows within this sub-basin flow overland and within a landscape swale and captured by a CDOT Type C inlet and are conveyed to the proposed forebay within the private full spectrum detention pond at design point 6.

Sub-basin G

Sub-basin G is 1.48 acres in size and is located at the center of the Site. This sub-basin consists of a section of proposed public drive, patio homes and landscape area. The 5-year runoff (cfs) is 3.68 and the 100-year runoff (cfs) is 8.14. Developed flows within this sub-basin are collected via a public 15' Type R storm inlet at design point 7. Flows are conveyed to the private full spectrum detention pond at the west end of the Site which outfalls to Cottonwood Creek via the public storm sewer system leaving the pond outlet structure and traveling west.

Sub-basin H

Sub-basin H is 1.66 acres in size and is located at the south side of the Site. This sub-basin consists of patio homes and landscape area. The 5-year runoff (cfs) is 1.99 and the 100-year runoff (cfs) is 5.98. Developed flows within this sub-basin are conveyed via a proposed CDOT Type C inlet at design point 8. Flows are conveyed to the private full spectrum detention pond at the west end of the Site which outfalls to Cottonwood Creek via the public storm sewer system leaving the pond outlet structure and traveling west.

Sub-basin I

Sub-basin I is 0.02 acres in size and is located at the south side of the Site. This sub-basin consists of a section of proposed public drive. The 5-year runoff (cfs) is 0.09 and the 100-year runoff (cfs) is 0.16. Developed flows within this sub-basin follow historic patterns into the existing concrete curb and gutter along Bridle Pass Drive at design point 9.

Sub-basin J

Sub-basin J of the northeast portion of the Site totaling 0.49-acres in size and is currently runoff generated from single family homes offsite, directly adjacent to the Site. Drainage flows

overland from east to west at approximately a 2% slope to Cottonwood Creek. Runoff during the 5-year and 100-year events are 1.12 cfs and 2.35 cfs respectively. This existing offsite drainage flows from the Newport Heights East Subdivision Filing No. 1 is directed around the Site to the north and then to the west towards Cottonwood Creek over the existing terrain.

Sub-basin K

Sub-basin K of the northeast portion of the Site totaling 0.45-acres in size and is currently runoff generated from single family homes offsite, directly adjacent to the Site. Drainage flows overland from east to west at approximately a 2% slope to Cottonwood Creek. Runoff during the 5-year and 100-year events are 1.03 cfs and 2.16 cfs respectively. This existing offsite drainage flows from the Newport Heights East Subdivision Filing No. 1 is bypassed around the Site by a drainage swale adjacent to the Property boundary and conveyed south into Bridle Pass Drive by a curb chase.

METHODOLOGY

The 5-year and 100-year design storm events were used in determining rainfall and runoff for the proposed drainage system per section 6 of the CRITERIA. Table 6-2 of the CRITERIA is the source for rainfall data for the 5-year and 100-year design storm events. Design runoff was calculated using the Rational Method for developed conditions as established in the CRITERIA and MANUAL. Runoff coefficients for the proposed development were determined using Table 6-6 of the MANUAL by calculating weighted impervious values for each specific Site basin. The water quality capture volume storage requirement was calculated using methods as specified in the CRITERIA and MANUAL.

HYDRAULIC ANALYSIS

MAJOR DRAINAGEWAYS

The Site is adjacent to Cottonwood Creek, which serves as the major drainageway for the surrounding area northeast of the Site. There is an existing 30 inch RCP pipe that runs along the western edge of the Site and outfalls to the Creek. This project proposes a new outfall to the Creek, releasing the flows from the Private Full Spectrum Extended Detention Basin.

METHODOLOGY

The proposed drainage facilities are designed in accordance with the CRITERIA and MANUAL. Floodplain identification was determined using FIRM panels by FEMA. Hydraulic calculations were computed using STORMCAD, which makes use of the Standard Step method to compute the hydraulic profile. Results of the hydraulic calculations are summarized in Appendix. Inlet capacity calculations have been provided in the Appendix for all inlets proposed on site in accordance with the MANUAL. The capacity of each inlet is adequate for the 100-year developed flows for each sub-basin. The water quality-only detention basin outlet structures were designed to release the Water Quality Capture Volume (WQCV) in 40 hours. Based upon this approach, the drainage design provided for the Site is conservative and in keeping with the zoning and historic drainage concept for the area.

Four-Step Process

Step 1. **Employ Runoff Reduction Practices**- The Project was designed to minimize the amount of proposed impervious area and maintain as much of the existing pervious area as possible. Additionally, areas of the Site with existing steep slopes were designed to be undisturbed. This resulted in a reduction of the C coefficient values. The IRF spreadsheet was completed document the impervious areas. This spreadsheet is included in the Appendix of the report.

Step 2. Implement BMPs That Provide a Water Quality Capture Volume with Slow Release The Project includes a proposed full spectrum extended detention basin to provide detention and controlled release prior to discharge to Cottonwood Creek.

Step 3 Stabilize Drainageways–Channel improvements are required for this project to stabilize the downstream drainageway, Cottonwood Creek. Instead of channel improvements and analysis, the City has approved a fee in lieu of improvements, to be paid by the developer for future improvements to Cottonwood Creek.

Step 4. Implement Site Specific and Other Source Control BMPs – The erosion control construction BMPs for both the initial and final stages of the Project will be designed to reduce contamination. Source control BMPs include the use of vehicle tracking control, inlet protection, concrete washout areas, stockpile management, and stabilized staging areas. No permanent source control BMPs are needed because there are no outdoor material storage areas or other contaminant sources that have the potential for contaminates to enter the City's MS4 permit Emergency Overflow Routing

STRUCTURE CHARACTERISTICS

Water Quality and Detention Storage Requirements and Design

The required Water Quality Capture Volume and Detention Volume will be provided by a private full spectrum detention basin, capturing runoff from the proposed sub-basins A through I. The Water Quality Capture Volume to be detained and released for the Project is 6,795 cubic feet. The required 100 Year Detention Volume to be detained and released for the Project is 31,973 cubic feet. A final design of the pond is shown on the Proposed Drainage Plan and is based on a Site imperviousness of 34.9%. The pond as shown meets the required detention and water quality volume per the CRITERIA and includes the required 1-foot freeboard. Detailed design of the outlet structure and storage calculations are included in the Appendix of this Report.

Emergency Overflow Routing

Emergency overflow routing consists of flows conveyed within the Public streets and following the proposed drainage pattern of east to west. Given the Adamo Court street slopes north from Bridle Pass Drive, conveyed flows would overtop the curb at the northern portion of the site and then convey west through the dedicated tract. Shimmering Moon Lane follows the same pattern as Adamo Court. Flows would be conveyed from Bridle Pass Drive to the low point in the street and overtop the curb, flowing west. Once the flows reach the west portion of the Site, they will overtop the west side of the private full spectrum detention pond and sheet flow directly west to Cottonwood Creek.
area.

Streamside overlay buffer

The Project is adjacent to Cottonwood Creek and is subject to the Streamside Overlay zoning and buffers. Along the project frontage there is a required 30 foot inner buffer and 60 foot outer buffer. The limits of disturbance for the project remain outside of the outer buffer.

Outlet Requirements

The outlet structure was designed per the CRITERIA. The stage outlet structure will release the detained pond volume at the required rates and meets the micro-pool requirement which includes the additional initial surcharge volume. The calculations and design of the outlet structure are included in the Appendix of this Report.

Channel Design and Soil Erodibility

A proposed riprap rundown is provided at the outfall point to provide stability and prevent erosion of the Cottonwood Creek embankment. The shown outfall point is adjacent to the current outfall location of the 30 inch RCP pipe outletting to the Creek. The riprap rundown will be Type L riprap and the dimensions were determined by riprap calculations provided in the Appendix.

Emergency Spillway Path

The proposed water quality and detention basin on the west side of the Site is designed with an emergency spillway/overflow path lined with Type L rip rap that will direct flows west to sheet flow directly to Cottonwood Creek. The emergency spillway is a notch in the proposed retaining wall on the west side of the pond that has been sized per the CRITERIA. The pond design also includes a public outfall pipe that will convey restricted 100-year flows to Cottonwood Creek.

Floodplains

FEDERAL EMERGENCY MANAGEMENT AGENCY, Flood Insurance Rate Map, Map Number 08041C0528 G and 08041C0536 G, effective date December 7, 2018 and updated May 14, 2020, indicates the area in the vicinity of this parcel of land to be a Zone X (area determined to be out of the 500 year flood plain

ENVIRONMENTAL EVALUTIONS

There are no impacts to wetland or riparian areas for this Project. This Project stays outside of the inner and outer Streamside Overlay buffers. Additionally, there is not environmental permitting required with this project.

EROSION CONTROL PLAN

An Erosion Control Plan has been submitted to the City for review and approval.

FEES DEVELOPMENT

DRAINAGE, BRIDGE AND POND FEES

The 2021 drainage basin and bridge fees for the platting of the Project are estimated at $16,852 per acre. For the entire 10.71-acre Site, this total fee amounts to $180,484.92. This entire Site falls under the Cottonwood Creek Drainage, Bridge and Pond Fee basin. Fees are due prior to plat recordation. See the detailed breakdown below.

-	Drainage Fee/Acre =	$14,858	x	10.71 acres =	$159,129.18
-	Bridge Fee/Acre	$1,216	x	10.71 acres =	$13,023.36
-	Surcharge	$778	x	10.71 acres =	$8,332.38
				Total =	**$180,484.92**

CONSTRUCTION COST OPINION

An opinion of probable construction cost for the construction of the public and private drainage facilities for the Project has been included in the Appendix. All costs are non-reimbursable.

CONCLUSIONS

COMPLIANCE WITH STANDARDS

The drainage design presented within this report for Newport Estates Filing No. 1, conforms to the City of Colorado Springs Storm Drainage Criteria, the Urban Drainage and Flood Control District Manual and Cottonwood Creek DBPS. A variance is requested for the inlet structures to serve as junctions due to the utility spacing constraints and horizontal geometry and for a retaining wall within the detention basin with footings below the WQCV and EURV. The request for both variances is included in the Appendix of this report. Site runoff and storm drain appurtenances associated with the proposed development will not adversely affect the Cottonwood Creek and the surrounding developments.

REFERENCES

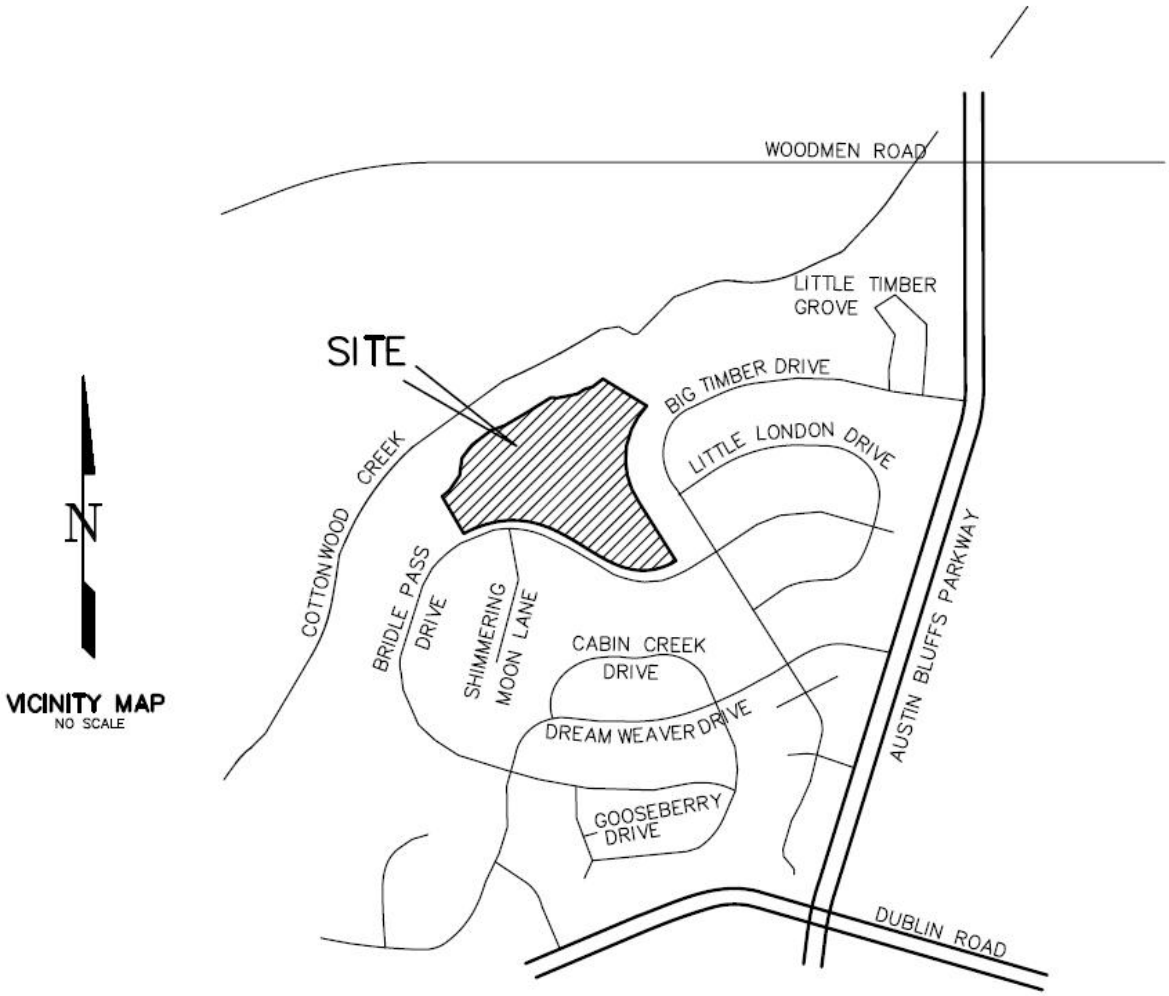
1. City of Colorado Springs Drainage Criteria Manual, May 2014.

2. Urban Drainage and Flood Control District Drainage Criteria Manual (UDFCDCM), Vol. 1, prepared by Wright-McLaughlin Engineers, June 2001, with latest revisions.

3. Flood Insurance Rate Map, El Paso County, Colorado and Incorporated Areas, Map Number 08041C0536F, Effective Date March 17, 1997, prepared by the Federal Emergency Management Agency (FEMA).

APPENDIX

VICINITY MAP



SOILS MAP

Hydrologic Soil Group—El Paso County Area, Colorado

Map Scale: 1:1,680 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 20 40 80 120

Feet
0 50 100 200 300

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:
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 15, Oct 10, 2017

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

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	1.6	23.3%
98	Truckton-Blakeland complex, 9 to 20 percent slopes	A	5.2	76.7%
Totals for Area of Interest			**6.8**	**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

FEMA FLOODPLAIN MAP

National Flood Hazard Layer FIRMette

FEMA

104°45'3"W 38°56'25"N

104°44'25"W 38°55'57"N

Feet

0 250 500 1,000 1,500 2,000

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 9/30/2020 at 1:28 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

HYDROLOGIC CALCULATIONS

Weighted Imperviousness Calculations

SUB-BASIN	AREA (SF)	AREA (Acres)	ROOF AREA	ROOF IMPERVIOUSNESS	ROOF				LANDSCAPE AREA	LANDSCAPE IMPERVIOUSNESS	LANDSCAPE				PAVEMENT AREA	PAVEMENT IMPERVIOUSNESS	PAVEMENT				WEIGHTED IMPERVIOUSNESS	WEIGHTED COEFFICIENTS			
					C2	C5	C10	C100			C2	C5	C10	C100			C2	C5	C10	C100		C2	C5	C10	C100
EX A	126,035	2.89	0	90%	0.71	0.73	0.75	0.81	126,035	2%	0.02	0.08	0.15	0.35	0	100%	0.89	0.90	0.92	0.96	2.0%	0.02	0.08	0.15	0.35
EX B	381,671	8.76	0	90%	0.71	0.73	0.75	0.81	381,671	2%	0.02	0.08	0.15	0.35	0	100%	0.89	0.90	0.92	0.96	2.0%	0.02	0.08	0.15	0.35
TOTAL	507,706	11.66	0	90%	0.71	0.73	0.75	0.81	507,706	2%	0.02	0.08	0.15	0.35	0	100%	0.89	0.90	0.92	0.96	2.0%	0.02	0.08	0.15	0.35

Newport Heights (Existing Conditions) - Drainage Report
Existing Runoff Calculations
Time of Concentration

Watercourse Coefficient

Forest & Meadow	2.50	Short Grass Pasture & Lawns	7.00	Grassed Waterway	15.00
Fallow or Cultivation	5.00	Nearly Bare Ground	10.00	Paved Area & Shallow Gutter	20.00

	SUB-BASIN DATA				INITIAL / OVERLAND TIME			TRAVEL TIME T(t)					T(c) CHECK (URBANIZED BASINS)			FINAL T(c)
DESIGN POINT	DRAIN BASIN	AREA sq. ft.	AREA ac.	C(5)	Length ft.	Slope %	T(i) min	Length ft.	Slope %	Coeff.	Velocity fps	T(t) min.	COMP. T(c)	TOTAL LENGTH	L/180+10	min.
1	EX A	126,035	2.89	0.08	300	3.8%	20.7	70	1.0%	10.00	1.0	1.2	21.9	370	12.1	12.1
2	EX B	381,671	8.76	0.08	300	9.0%	15.6	525	9.0%	10.00	3.0	2.9	18.5	825	14.6	14.6

Newport Heights (Existing Conditions) - Drainage Report
Existing Runoff Calculations *Design Storm* 5 Year
(Rational Method Procedure)

BASIN INFORMATION				DIRECT RUNOFF				CUMMULATIVE RUNOFF				
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	NOTES
1	EX A	2.89	0.08	12.1	0.23	3.84	0.89					
2	EX B	8.76	0.08	14.6	0.70	3.56	2.50					

Newport Heights (Existing Conditions) - Drainage Report
Existing Runoff Calculations *Design Storm* *100 Year*
(Rational Method Procedure)

BASIN INFORMATION				DIRECT RUNOFF				CUMMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
1	EX A	2.89	0.35	12.1	1.01	6.45	6.53					
2	EX B	8.76	0.35	14.6	3.07	5.98	18.34					

SUMMARY - EXISTING RUNOFF TABLE						
DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	DIRECT 5-YR RUNOFF (CFS)	DIRECT 100-YR RUNOFF (CFS)	CUMULATIVE 5-YR RUNOFF (CFS)	CUMULATIVE 100-YR RUNOFF (CFS)
1	EX A	2.89	0.89	6.53	0.89	6.53
2	EX B	8.76	2.50	18.34	2.50	18.34

Weighted Imperviousness Calculations

SUB-BASIN	AREA (SF)	AREA (Acres)	ROOF AREA	ROOF IMPERVIOUSNESS	ROOF C2	ROOF C5	ROOF C10	ROOF C100	LANDSCAPE AREA	LANDSCAPE IMPERVIOUSNESS	LANDSCAPE C2	LANDSCAPE C5	LANDSCAPE C10	LANDSCAPE C100	PAVEMENT AREA	PAVEMENT IMPERVIOUSNESS	PAVEMENT C2	PAVEMENT C5	PAVEMENT C10	PAVEMENT C100	WEIGHTED IMPERVIOUSNESS	WEIGHTED COEFFICIENTS C2	WEIGHTED COEFFICIENTS C5	WEIGHTED COEFFICIENTS C10	WEIGHTED COEFFICIENTS C100
A	55,543	1.28	6,000	90%	0.71	0.73	0.75	0.81	44,728	2%	0.02	0.08	0.15	0.35	4,815	100%	0.89	0.90	0.92	0.96	20.0%	0.17	0.22	0.28	0.45
B	30,661	0.70	6,000	90%	0.71	0.73	0.75	0.81	11,651	2%	0.02	0.08	0.15	0.35	13,010	100%	0.89	0.90	0.92	0.96	60.8%	0.52	0.56	0.59	0.70
C	38,420	0.88	4,000	90%	0.71	0.73	0.75	0.81	21,565	2%	0.02	0.08	0.15	0.35	12,855	100%	0.89	0.90	0.92	0.96	44.0%	0.38	0.42	0.47	0.60
D	51,407	1.18	4,000	90%	0.71	0.73	0.75	0.81	28,855	2%	0.02	0.08	0.15	0.35	18,552	100%	0.89	0.90	0.92	0.96	44.2%	0.39	0.43	0.47	0.61
E	56,986	1.31	8,000	90%	0.71	0.73	0.75	0.81	44,164	2%	0.02	0.08	0.15	0.35	4,822	100%	0.89	0.90	0.92	0.96	22.6%	0.19	0.24	0.30	0.47
F	94,230	2.16	12,000	90%	0.71	0.73	0.75	0.81	81,847	2%	0.02	0.08	0.15	0.35	383	100%	0.89	0.90	0.92	0.96	13.6%	0.11	0.17	0.23	0.41
G	64,575	1.48	6,000	90%	0.71	0.73	0.75	0.81	29,995	2%	0.02	0.08	0.15	0.35	28,580	100%	0.89	0.90	0.92	0.96	53.5%	0.47	0.50	0.55	0.66
H	72,458	1.66	16,000	90%	0.71	0.73	0.75	0.81	52,195	2%	0.02	0.08	0.15	0.35	4,263	100%	0.89	0.90	0.92	0.96	27.2%	0.22	0.27	0.33	0.49
I	859	0.02	0	90%	0.71	0.73	0.75	0.81	0	2%	0.02	0.08	0.15	0.35	859	100%	0.89	0.90	0.92	0.96	100.0%	0.89	0.90	0.92	0.96
J	21,441	0.49	15,300	90%	0.71	0.73	0.75	0.81	6,141	2%	0.02	0.08	0.15	0.35	0	100%	0.89	0.90	0.92	0.96	64.8%	0.51	0.54	0.58	0.68
K	19,582	0.45	14,000	90%	0.71	0.73	0.75	0.81	5,582	2%	0.02	0.08	0.15	0.35	0	100%	0.89	0.90	0.92	0.96	64.9%	0.51	0.54	0.58	0.68
TOTAL	506,162	11.62	91,300	90%	0.71	0.73	0.75	0.81	326,722	2%	0.02	0.08	0.15	0.35	88,140	100%	0.89	0.90	0.92	0.96	34.9%	0.30	0.34	0.39	0.54

Newport Estates - Drainage Report
Proposed Runoff Calculations
Time of Concentration

Watercourse Coefficient

					Forest & Meadow	2.50	Short Grass Pasture & Lawns	7.00			Grassed Waterway	15.00				
					Fallow or Cultivation	5.00	Nearly Bare Ground	10.00			Paved Area & Shallow Gutter	20.00				
	SUB-BASIN DATA				INITIAL / OVERLAND TIME			TRAVEL TIME T(t)					T(c) CHECK (URBANIZED BASINS)			FINAL T(c)
DESIGN POINT	DRAIN BASIN	AREA sq. ft.	AREA ac.	C(5)	Length ft.	Slope %	T(i) min	Length ft.	Slope %	Coeff.	Velocity fps	T(t) min.	COMP. T(c)	TOTAL LENGTH	L/180+10	min.
1	A	55,543	1.28	0.22	100	4.7%	9.6	245	2.6%	15.00	2.4	1.7	11.3	345	11.9	11.3
2	B	30,661	0.70	0.56	100	8.7%	4.9	161	4.6%	20.00	4.3	0.6	5.5	261	11.5	5.5
3	C	38,420	0.88	0.42	100	8.6%	6.1	237	6.3%	20.00	5.0	0.8	6.9	337	11.9	6.9
4	D	51,407	1.18	0.43	100	11.6%	5.4	116	7.5%	20.00	5.5	0.4	5.8	216	11.2	5.8
5	E	56,986	1.31	0.24	100	8.2%	7.8	0	1.0%	15.00	1.5	0.0	7.8	100	10.6	7.8
6	F	94,230	2.16	0.17	100	14.4%	7.0	605	3.8%	15.00	2.9	3.4	10.4	705	13.9	10.4
7	G	64,575	1.48	0.50	100	12.5%	4.7	255	3.4%	20.00	3.7	1.2	5.9	355	12.0	5.9
8	H	72,458	1.66	0.27	100	9.7%	7.1	310	7.3%	15.00	4.1	1.3	8.4	410	12.3	8.4
9	I	859	0.02	0.90	45	5.6%	1.4	0	1.0%	20.00	2.0	0.0	5.0	45	10.3	5.0
10	J	21,441	0.49	0.54	140	2.0%	9.6	0	1.0%	15.00	1.5	0.0	9.6	140	10.8	9.6
11	K	19,582	0.45	0.54	140	2.0%	9.5	0	1.0%	20.00	2.0	0.0	9.5	140	10.8	9.5

Newport Estates - Drainage Report
Proposed Runoff Calculations
(Rational Method Procedure)

Design Storm 5 Year

BASIN INFORMATION				DIRECT RUNOFF				CUMULATIVE RUNOFF				
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	NOTES
1	A	1.28	0.22	11.3	0.28	3.95	1.11	11.3	0.28	3.95	1.11	
2	B	0.70	0.56	5.5	0.39	5.02	1.96	11.3	0.67	3.95	2.66	A+B
3	C	0.88	0.42	6.9	0.37	4.69	1.75	11.3	1.05	3.95	4.13	A+B+C
4	D	1.18	0.43	5.8	0.50	4.96	2.50	11.3	1.55	3.95	6.11	A+B+C+D
5	E	1.31	0.24	7.8	0.31	4.50	1.42					
6	F	2.16	0.17	10.4	0.36	4.07	1.46					
7	G	1.48	0.50	5.9	0.75	4.93	3.68	11.3	2.29	3.95	9.06	A+B+C+D+H
8	H	1.66	0.27	8.4	0.45	4.40	1.99					
9	I	0.02	0.90	5.0	0.02	5.17	0.09					
10	J	0.49	0.54	9.6	0.27	4.19	1.12					
11	K	0.45	0.54	9.5	0.24	4.21	1.03					
10	-							11.3	2.75	3.95	10.84	A+B+C+D+G+H

Newport Estates - Drainage Report
Proposed Runoff Calculations
(Rational Method Procedure)

Design Storm *100 Year*

BASIN INFORMATION				DIRECT RUNOFF				CUMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
1	A	1.28	0.45	11.3	0.58	6.63	3.82	11.3	0.58	6.63	3.82	
2	B	0.70	0.70	5.5	0.49	8.43	4.15	11.3	1.07	6.63	7.08	
3	C	0.88	0.60	6.9	0.53	7.87	4.18	11.3	1.60	6.63	10.60	A+B+C
4	D	1.18	0.61	5.8	0.72	8.33	5.95	11.3	2.32	6.63	15.34	A+B+C+D
5	E	1.31	0.47	7.8	0.61	7.56	4.61					
6	F	2.16	0.41	10.4	0.89	6.83	6.07					
7	G	1.48	0.66	5.9	0.98	8.28	8.14	11.3	3.30	6.63	21.85	A+B+C+D+H
8	H	1.66	0.49	8.4	0.81	7.38	5.98					
9	I	0.02	0.96	5.0	0.02	8.68	0.16					
10	J	0.49	0.68	9.6	0.33	7.04	2.35					
11	K	0.45	0.68	9.5	0.31	7.06	2.16					
10	-							11.3	4.11	6.63	27.23	A+B+C+D+G+H

SUMMARY - PROPOSED RUNOFF TABLE						
DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	DIRECT 5-YR RUNOFF (CFS)	DIRECT 100-YR RUNOFF (CFS)	CUMULATIVE 5-YR RUNOFF (CFS)	CUMULATIVE 100-YR RUNOFF (CFS)
1	A	1.28	1.11	3.82	1.11	3.82
2	B	0.70	1.96	4.15	2.66	7.08
3	C	0.88	1.75	4.18	4.13	10.60
4	D	1.18	2.50	5.95	6.11	15.34
5	E	1.31	1.42	4.61	1.42	4.61
6	F	2.16	1.46	6.07	1.46	6.07
7	G	1.48	3.68	8.14	9.06	21.85
8	H	1.66	1.99	5.98	1.99	5.98
9	I	0.02	0.09	0.16	0.09	0.16
10	J	0.49	1.12	2.35	1.12	2.35
11	K	0.45	1.03	2.16	1.03	2.16
TOTAL		10.68	15.95	43.07	30.18	80.04

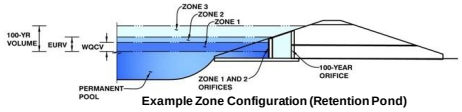
HYDRAULIC CALCULATIONS

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: _____

Basin ID: _____



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	11.15	acres
Watershed Length =	1,050	ft
Watershed Length to Centroid =	525	ft
Watershed Slope =	0.060	ft/ft
Watershed Imperviousness =	35.70%	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
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

		Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.156 acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.418 acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.300 acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.407 acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.493 acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.679 acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.855 acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	1.090 acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	1.592 acre-feet		inches
Approximate 2-yr Detention Volume =	0.265 acre-feet		
Approximate 5-yr Detention Volume =	0.351 acre-feet		
Approximate 10-yr Detention Volume =	0.436 acre-feet		
Approximate 25-yr Detention Volume =	0.544 acre-feet		
Approximate 50-yr Detention Volume =	0.621 acre-feet		
Approximate 100-yr Detention Volume =	0.734 acre-feet		

Define Zones and Basin Geometry

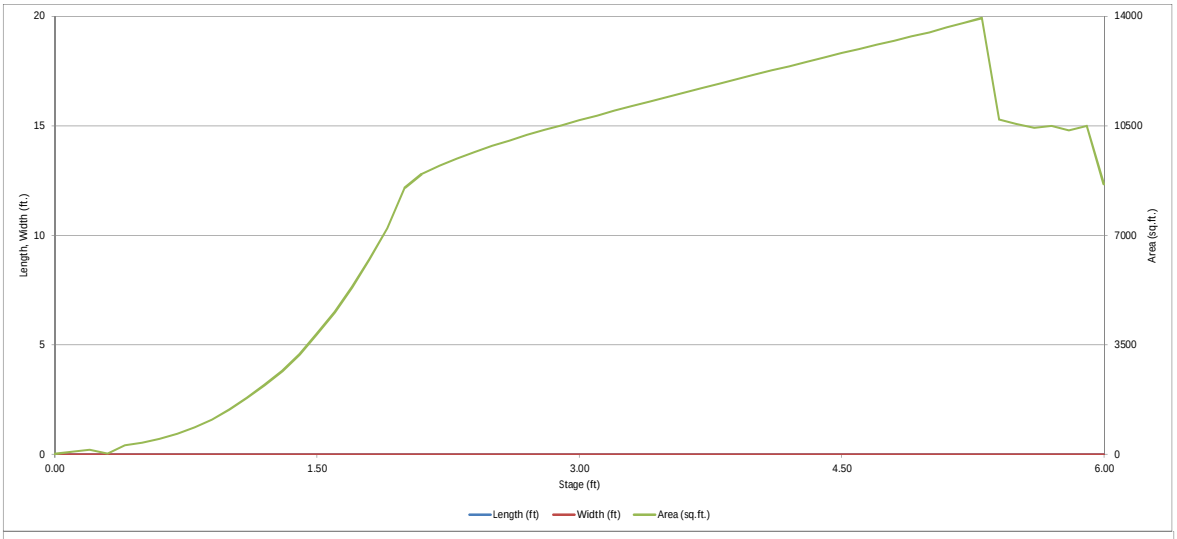
Zone 1 Volume (WQCV) =	0.156	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.261	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.316	acre-feet
Total Detention Basin Volume =	0.734	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (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_{LW}) =	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

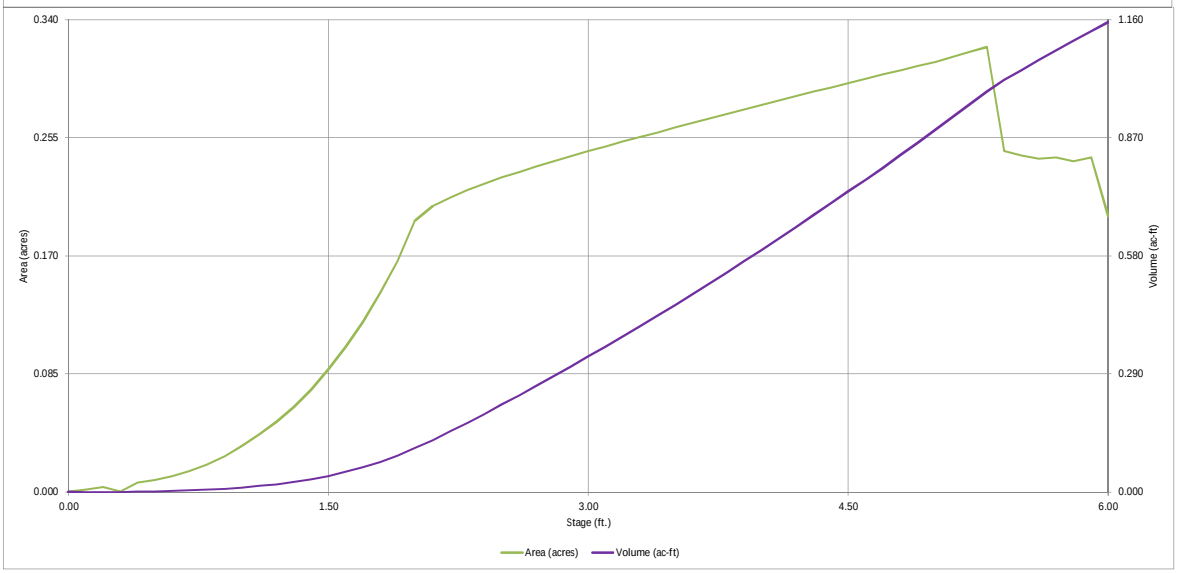
Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	16	0.000		
6649.1	--	0.10	--	--	--	81	0.002	5	0.000
6649.2	--	0.20	--	--	--	150	0.003	16	0.000
6649.3	--	0.30	--	--	--	22	0.001	25	0.001
6649.4	--	0.40	--	--	--	299	0.007	41	0.001
6649.5	--	0.50	--	--	--	380	0.009	75	0.002
6649.6	--	0.60	--	--	--	493	0.011	119	0.003
6649.7	--	0.70	--	--	--	657	0.015	176	0.004
6649.8	--	0.80	--	--	--	867	0.020	252	0.006
6649.9	--	0.90	--	--	--	1,118	0.026	352	0.008
6650	--	1.00	--	--	--	1,444	0.033	480	0.011
6650.1	--	1.10	--	--	--	1,802	0.041	642	0.015
6650.2	--	1.20	--	--	--	2,207	0.051	842	0.019
6650.3	--	1.30	--	--	--	2,661	0.061	1,086	0.025
6650.4	--	1.40	--	--	--	3,200	0.073	1,379	0.032
6650.5	--	1.50	--	--	--	3,854	0.088	1,732	0.040
6650.6	--	1.60	--	--	--	4,552	0.104	2,152	0.049
6650.7	--	1.70	--	--	--	5,338	0.123	2,646	0.061
6650.8	--	1.80	--	--	--	6,234	0.143	3,225	0.074
6650.9	--	1.90	--	--	--	7,234	0.166	3,898	0.089
6651	--	2.00	--	--	--	8,514	0.195	4,686	0.108
6651.1	--	2.10	--	--	--	8,962	0.206	5,560	0.128
6651.2	--	2.20	--	--	--	9,228	0.212	6,469	0.149
6651.3	--	2.30	--	--	--	9,463	0.217	7,404	0.170
6651.4	--	2.40	--	--	--	9,670	0.222	8,360	0.192
6651.5	--	2.50	--	--	--	9,860	0.226	9,337	0.214
6651.6	--	2.60	--	--	--	10,037	0.230	10,332	0.237
6651.7	--	2.70	--	--	--	10,207	0.234	11,344	0.260
6651.8	--	2.80	--	--	--	10,371	0.238	12,373	0.284
6651.9	--	2.90	--	--	--	10,530	0.242	13,418	0.308
6652	--	3.00	--	--	--	10,683	0.245	14,478	0.332
6652.1	--	3.10	--	--	--	10,834	0.249	15,554	0.357
6652.2	--	3.20	--	--	--	10,984	0.252	16,645	0.382
6652.3	--	3.30	--	--	--	11,132	0.256	17,751	0.408
6652.4	--	3.40	--	--	--	11,280	0.259	18,872	0.433
6652.5	--	3.50	--	--	--	11,425	0.262	20,007	0.459
6652.6	--	3.60	--	--	--	11,569	0.266	21,156	0.486
6652.7	--	3.70	--	--	--	11,712	0.269	22,321	0.512
6652.8	--	3.80	--	--	--	11,853	0.272	23,499	0.539
6652.9	--	3.90	--	--	--	11,992	0.275	24,691	0.567
6653	--	4.00	--	--	--	12,132	0.279	25,897	0.595
6653.1	--	4.10	--	--	--	12,272	0.282	27,117	0.623
6653.2	--	4.20	--	--	--	12,411	0.285	28,352	0.651
6653.3	--	4.30	--	--	--	12,549	0.288	29,600	0.680
6653.4	--	4.40	--	--	--	12,688	0.291	30,861	0.708
6653.5	--	4.50	--	--	--	12,826	0.294	32,137	0.738
6653.6	--	4.60	--	--	--	12,961	0.298	33,426	0.767
6653.7	--	4.70	--	--	--	13,092	0.301	34,729	0.797
6653.8	--	4.80	--	--	--	13,224	0.304	36,045	0.827
6653.9	--	4.90	--	--	--	13,356	0.307	37,374	0.858
6654	--	5.00	--	--	--	13,486	0.310	38,716	0.889
6654.1	--	5.10	--	--	--	13,641	0.313	40,072	0.920
6654.2	--	5.20	--	--	--	13,796	0.317	41,444	0.951
6654.3	--	5.30	--	--	--	13,952	0.320	42,832	0.983
6654.4	--	5.40	--	--	--	10,701	0.246	44,064	1.012
6654.5	--	5.50	--	--	--	10,559	0.242	45,127	1.036
6654.6	--	5.60	--	--	--	10,447	0.240	46,178	1.060
6654.7	--	5.70	--	--	--	10,494	0.241	47,225	1.084
6654.8	--	5.80	--	--	--	10,366	0.238	48,268	1.108
6654.9	--	5.90	--	--	--	10,497	0.241	49,311	1.132
6655	--	6.00	--	--	--	8,644	0.198	50,268	1.154

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)



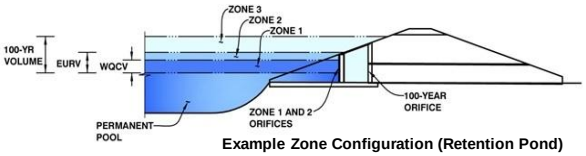


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project:

Basin ID:



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.24	0.156	Orifice Plate
Zone 2 (EURV)	3.34	0.261	Orifice Plate
Zone 3 (100-year)	4.49	0.316	Weir&Pipe (Restrict)
Total (all zones)		0.734	

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	5.139E-03	ft^2
Depth at top of Zone using Orifice Plate =	3.34	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	13.40	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	0.74	sq. inches (diameter = 15/16 inch)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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	1.11	2.23					
Orifice Area (sq. inches)	0.74	0.74	0.74					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.34	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	3.34	N/A	feet
Overflow Weir Front Edge Length =	4.33	N/A	feet	Overflow Weir Slope Length =	4.33	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	17.02	N/A	
Horiz. Length of Weir Sides =	4.33	N/A	feet	Overflow Grate Open Area w/o Debris =	13.12	N/A	ft^2
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	6.56	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.77	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.39	N/A	feet
Restrictor Plate Height Above Pipe Invert =	8.10		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.47	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	4.49	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.28	feet
Spillway Crest Length =	40.00	feet	Stage at Top of Freeboard =	5.77	feet
Spillway End Slopes =	0.00	H:V	Basin Area at Top of Freeboard =	0.24	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	1.10	acre-ft

Calculated Parameters for Spillway

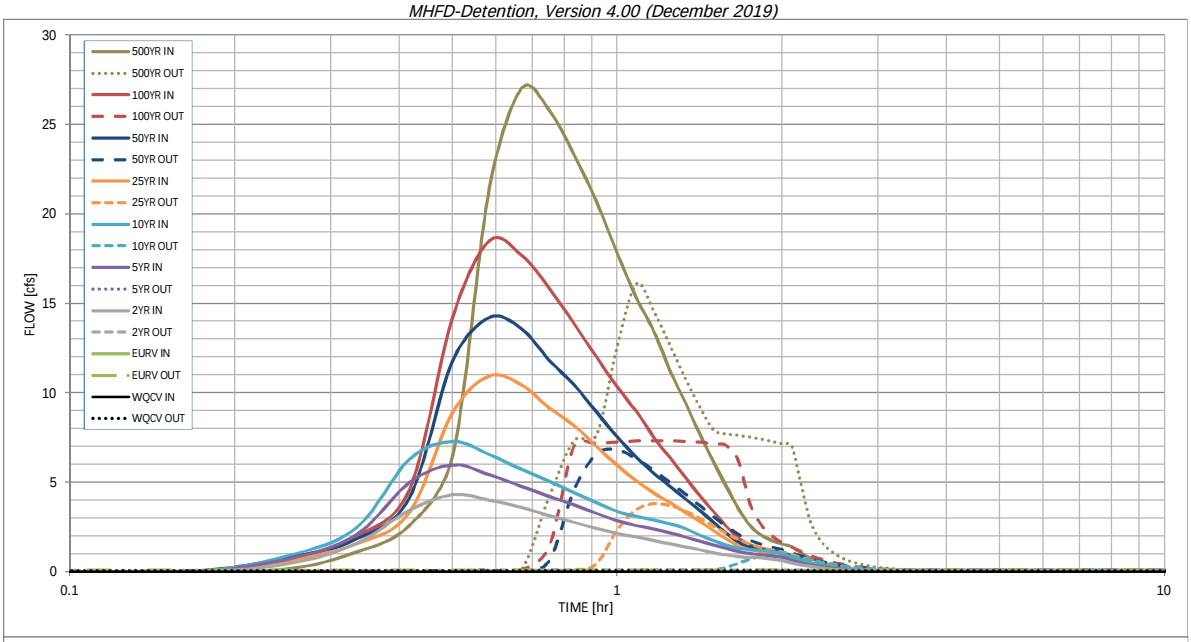
Routed Hydrograph Results

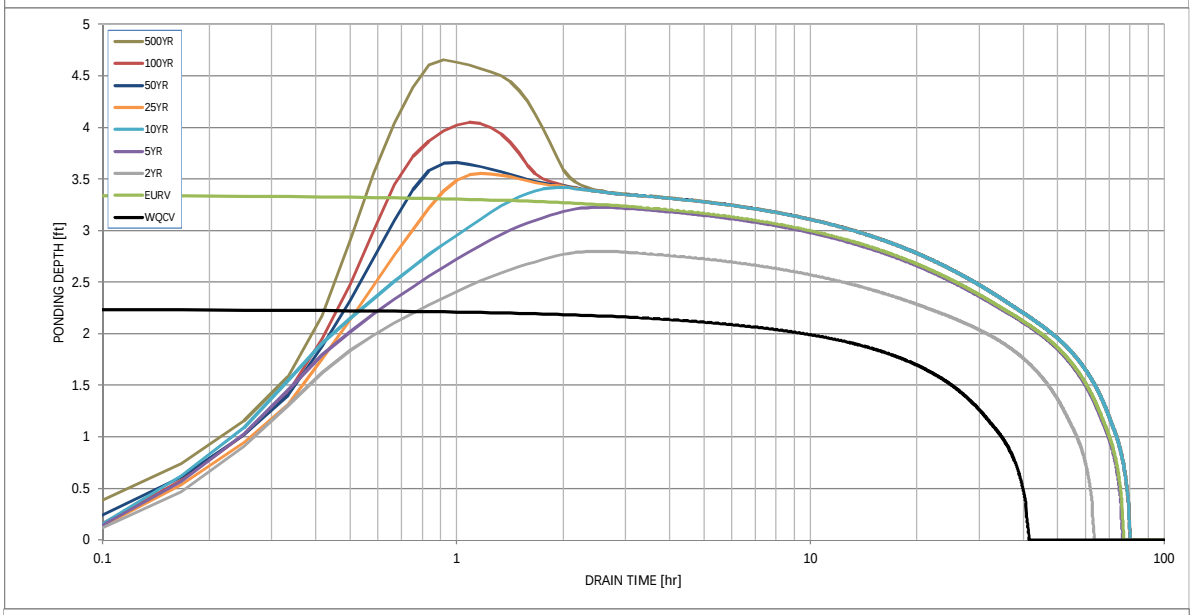
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

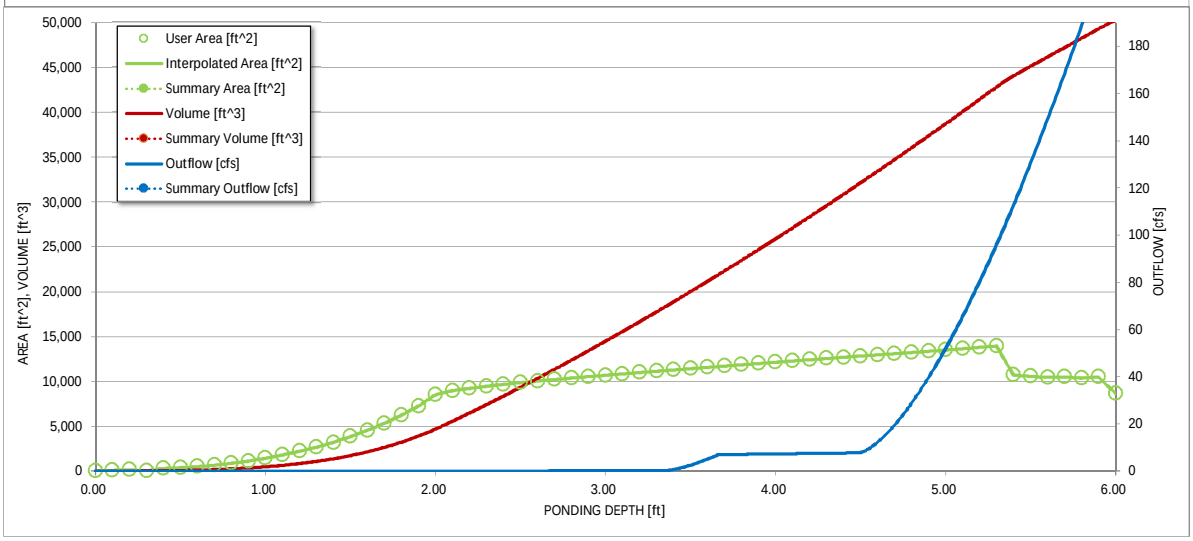
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.156	0.418	0.300	0.407	0.493	0.679	0.855	1.090	1.592
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.300	0.407	0.493	0.679	0.855	1.090	1.592
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.2	0.3	2.4	4.9	8.0	14.3
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.02	0.22	0.44	0.72	1.28
Peak Inflow Q (cfs) =	N/A	N/A	4.3	6.0	7.3	10.9	14.2	18.5	27.0
Peak Outflow Q (cfs) =	0.1	0.1	0.1	0.1	0.9	3.8	6.8	7.3	16.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	3.4	1.6	1.4	0.9	1.1
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.00	N/A	N/A	0.1	0.3	0.5	0.5	0.6
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	69	58	69	72	69	68	66	62
Time to Drain 99% of Inflow Volume (hours) =	40	74	61	73	77	76	75	73	71
Maximum Ponding Depth (ft) =	2.24	3.35	2.80	3.22	3.42	3.55	3.66	4.05	4.66
Area at Maximum Ponding Depth (acres) =	0.21	0.26	0.24	0.25	0.26	0.26	0.27	0.28	0.30
Maximum Volume Stored (acre-ft) =	0.157	0.420	0.282	0.387	0.436	0.472	0.499	0.608	0.782

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)





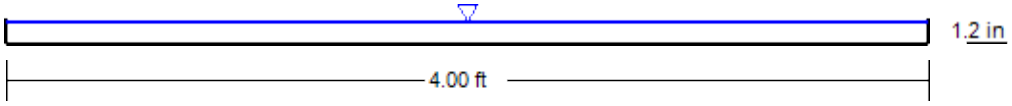


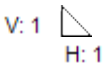
S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

Cross Section for Trickle Channel

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.013
Channel Slope	0.007 ft/ft
Normal Depth	1.2 in
Bottom Width	4.00 ft
Discharge	0.76 cfs





Kimley»Horn

Forebay Sizing Calculations- North Forebay

Contributing Sub-Basins: F

Date 10/9/2020

Prepared By KRK

Checked By EJG

	Required	Forebay A Flow: Q_{100} = (cfs)	Forebay A Release Rate
Forebay Release and Configuration	Release 2% of the undetained 100-year peak discharge by way of a wall/notch or berm/pipe configuration	6.07	0.12

			Required (CF)	Provided (CF)
Minimum Forebay Volume Required	2% of the WQCV	40hr drain time a = 1 I = 0.394 A = 7.78 AC	26.03	92.63

Maximum Forebay Depth	Required	Provided
	18" Max	18"

Forebay Notch Calculations			
$Q = C_o A_o (2gH_o)^{0.5}$			
Q_a	0.12	cfs	2% of Peak 100 YR Discharge for contributing Sub-Basins
C_o	0.6		
H_o	0.5	ft	
g	32.2	ft/s^2	
A_a	0.04	ft^2	
L_a	0.02	ft	
	0.29	in	3" Minimum per Criteria

$$WQCV = a(0.91I^3 - 1.19I^2 + 0.78I)$$ Equation 3-1

Where:

WQCV = Water Quality Capture Volume (watershed inches)

a = Coefficient corresponding to WQCV drain time (Table 3-2)

I = Imperviousness (%/100) (see Figures 3-3 through 3-5 [single family land use] and /or the *Runoff* chapter of Volume 1[other typical land uses])

Table 3-2. Drain Time Coefficients for WQCV Calculations

Drain Time (hrs)	Coefficient, a
12 hours	0.8
24 hours	0.9
40 hours	1.0

Kimley»Horn

Forebay Sizing Calculations- East Forebay

Contributing Sub-Basins: A-D, G, H

Date 10/9/2020
Prepared By KRK
Checked By EJG

	Required	Forebay A Flow: Q_{100} = (cfs)	Forebay A Release Rate
Forebay Release and Configuration	Release 2% of the undetained 100-year peak discharge by way of a wall/notch or berm/pipe configuration	32.22	0.64

			Required (CF)	Provided (CF)
Minimum Forebay Volume Required	2% of the WQCV	40hr drain time a = 1 I = 0.394 A = 7.78 AC	86.51	92.63

	Required	Provided
Maximum Forebay Depth	18" Max	18"

Forebay Notch Calculations			
$Q = C_o A_o (2gH_o)^{0.5}$			
Q_a	0.64	cfs	2% of Peak 100 YR Discharge for contributing Sub-Basins
C_o	0.6		
H_o	0.5	ft	
g	32.2	ft/s^2	
A_a	0.19	ft^2	
L_a	0.13	ft	
	1.51	in	3" Minimum per Criteria

$$WQCV = a(0.91I^3 - 1.19I^2 + 0.78I)$$ Equation 3-1

Where:

WQCV = Water Quality Capture Volume (watershed inches)

a = Coefficient corresponding to WQCV drain time (Table 3-2)

I = Imperviousness (%/100) (see Figures 3-3 through 3-5 [single family land use] and /or the *Runoff* chapter of Volume 1[other typical land uses])

Table 3-2. Drain Time Coefficients for WQCV Calculations

Drain Time (hrs)	Coefficient, a
12 hours	0.8
24 hours	0.9
40 hours	1.0

Rip-Rap Calculation

Pond Outfall

.

Applicable Equations:

$L_p = (1/2\tan\Theta)(A_t/Y_t-D)$	Equation 9-11 per USCDM
$A_t = Q/V$	Equation 9-12 per USDCM
$\Theta = \tan^{-1}(1/(2*\text{ExpansionFactor}))$	Equation 9-13 per USDCM
$W = 2(L_p\tan\Theta)+D$	Equation 9-14 per USDCM
$T = 2D_{50}$	Equation 9-15 per USDCM

Assumptions

Maximum Major Event Velocity is 7fps for FES outletting into trickle channels

Input parameters:

Description		Variable	Input	Unit
Width of the conduit (use diameter for circular conduits),		D:	1.50	ft
HGL Elevation			6644.55	ft
Invert Elevation			6644.06	ft
Tailwater depth (ft),		Y_t:	0.49	ft
Expansion angle of the culvert flow		Θ:	0.10	radians
Design discharge (cfs)*		Q:	4.90	cfs
Froude Number		F_r	0.70	Subcritical
Unitless Variables for Tables:				
	For Figure 9-35	$Q/D^{2.5}$	1.78	
	For Figure 9-35	Y_t/D	0.33	
	For Figure 9-38	$Q/D^{1.5}$	2.67	
	For Figure 9-38	Y_t/D	0.33	
Allowable non-eroding velocity in the downstream channel (ft/sec)		V:	5	ft/sec
Expansion Factor (Figure 9-35), 1/(2tan(θ))			5	

Solve for:

Description	Variable	Output	Unit
1. Required area of flow at allowable velocity (ft^2)	A_t:	0.98	ft^2
2. Length of Protection	L_p:	2.50	ft
	L_p < 3D?	Yes	
	L_{pmin}:	4.50	ft
3. Width of downstream riprap protection	W:	16.00	ft
4. Rip Rap Type (Figure 9-38)	-	L	
5. Rip Rap Size (Figure 8-34)	D_{50}:	9	inches

Rip Rap Summary

Length	L_p	5.00	ft
Width	W	16.00	ft
Size	D_{50}	9	inches
Type	-	L	-
Thickness	T	18	inches

Worksheet Protected

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

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

***Design Storm: 1-Hour Rain Depth	WQCV Event	1.19	inches
***Minor Storm: 1-Hour Rain Depth	2-Year Event	1.19	inches
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches
Optional User Defined Storm	NRCS Method		
(NRCS Type II Method) 24-Hour Storm Event and Rainfall Depth for User Defined Storm	100-Year Event		
Max Intensity for Optional User Defined Storm	0		

Designer: Eric Gunderson
Company: Kimley-Horn and Associates, Inc.
Date: October 5, 2020
Project: Newport Estates Filing No. 1
Location:

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	A	B	C	D	E	F	G	H	I	J	K			
Receiving Pervious Area Soil Type	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand	Loamy Sand			
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	1.280	0.700	0.880	1.180	1.310	2.160	1.480	1.660	0.020	0.490	0.450			
Directly Connected Impervious Area (DCIA, acres)	0.110	0.300	0.300	0.430	0.110	0.010	0.660	0.100	0.020	0.350	0.320			
Unconnected Impervious Area (UIA, acres)	0.140	0.140	0.092	0.092	0.184	0.280	0.140	0.370	0.000	0.000	0.000			
Receiving Pervious Area (RPA, acres)	0.140	0.140	0.092	0.092	0.184	0.280	0.140	0.370	0.000	0.000	0.000			
Separate Pervious Area (SPA, acres)	0.890	0.120	0.396	0.566	0.832	1.590	0.540	0.820	0.000	0.140	0.130			
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C	C	C	C	V	C	C	C	C	C	C			

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	1.280	0.700	0.880	1.180	1.310	2.160	1.480	1.660	0.020	0.490	0.450			
Directly Connected Impervious Area (DCIA, %)	8.6%	42.9%	34.1%	36.4%	8.4%	0.5%	44.6%	6.0%	100.0%	71.4%	71.1%			
Unconnected Impervious Area (UIA, %)	10.9%	20.0%	10.5%	7.8%	14.0%	13.0%	9.5%	22.3%	0.0%	0.0%	0.0%			
Receiving Pervious Area (RPA, %)	10.9%	20.0%	10.5%	7.8%	14.0%	13.0%	9.5%	22.3%	0.0%	0.0%	0.0%			
Separate Pervious Area (SPA, %)	69.5%	17.1%	45.0%	48.0%	63.5%	73.6%	36.5%	49.4%	0.0%	28.6%	28.9%			
A_R (RPA / UIA)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000			
I_a Check	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	1.000	1.000	1.000			
f / I for WQCV Event:	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6			
f / I for 2-Year Event:	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6			
f / I for 100-Year Event:	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4			
f / I for Optional User Defined Storm NRCS Method:														
IRF for WQCV Event:	0.68	0.68	0.68	0.68	0.00	0.68	0.68	0.68	1.00	1.00	1.00			
IRF for 2-Year Event:	0.86	0.86	0.86	0.86	0.84	0.86	0.86	0.86	1.00	1.00	1.00			
IRF for 100-Year Event:	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	1.00	1.00	1.00			
IRF for Optional User Defined Storm NRCS Method:														
Total Site Imperviousness: I_{total}	19.5%	62.9%	44.5%	44.2%	22.4%	13.4%	54.1%	28.3%	100.0%	71.4%	71.1%			
Effective Imperviousness for WQCV Event:	16.0%	56.5%	41.2%	41.7%	8.4%	9.3%	51.0%	21.2%	100.0%	71.4%	71.1%			
Effective Imperviousness for 2-Year Event:	18.0%	60.1%	43.1%	43.2%	20.1%	11.6%	52.8%	25.2%	100.0%	71.4%	71.1%			
Effective Imperviousness for 100-Year Event:	18.6%	61.1%	43.6%	43.6%	21.2%	12.3%	53.2%	26.4%	100.0%	71.4%	71.1%			
Effective Imperviousness for Optional User Defined Storm NRCS Method:														

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	13.6%	8.6%	4.6%	3.4%	N/A	26.4%	3.9%	17.5%	0.0%	0.0%	0.0%	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:	5.4%	2.7%	2.1%	1.6%	6.1%	9.9%	1.5%	7.3%	1.3%	0.1%	0.1%	N/A	N/A	N/A
User Defined NRCS Method CREDIT: Reduce Detention By:														

Total Site Imperviousness:	35.7%
Total Site Effective Imperviousness for WQCV Event:	30.7%
Total Site Effective Imperviousness for 2-Year Event:	34.0%
Total Site Effective Imperviousness for 100-Year Event:	34.6%
Total Site Effective Imperviousness for Optional User Defined Storm NRCS Method:	

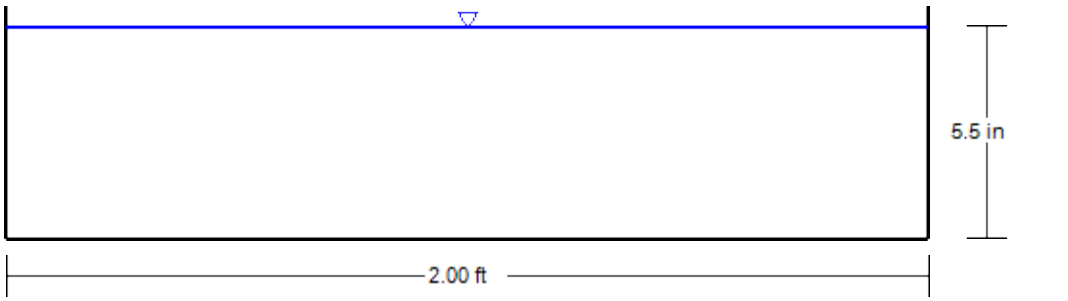
Notes:

* 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

Cross Section for Curb Chase- Offsite Flows into Bridle Pass Dr.

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Roughness Coefficient	0.013	
Channel Slope	0.002	ft/ft
Normal Depth	5.5	in
Bottom Width	2.00	ft
Discharge	2.16	cfs



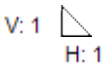


Figure 13-12c. Emergency Spillway Protection

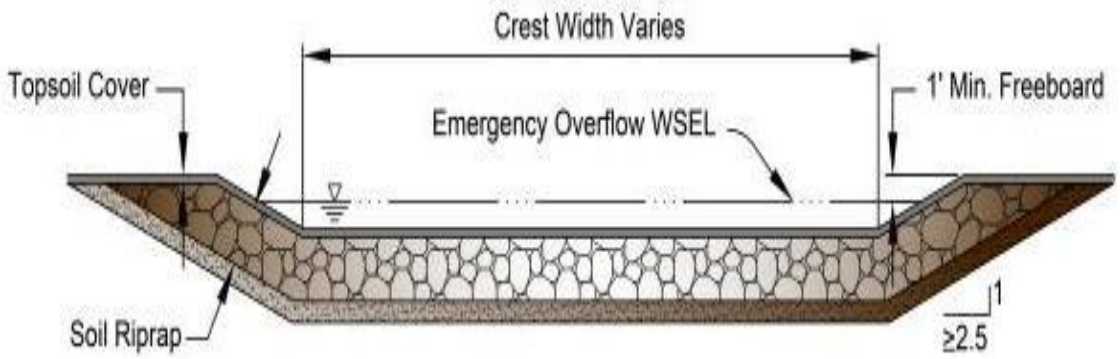
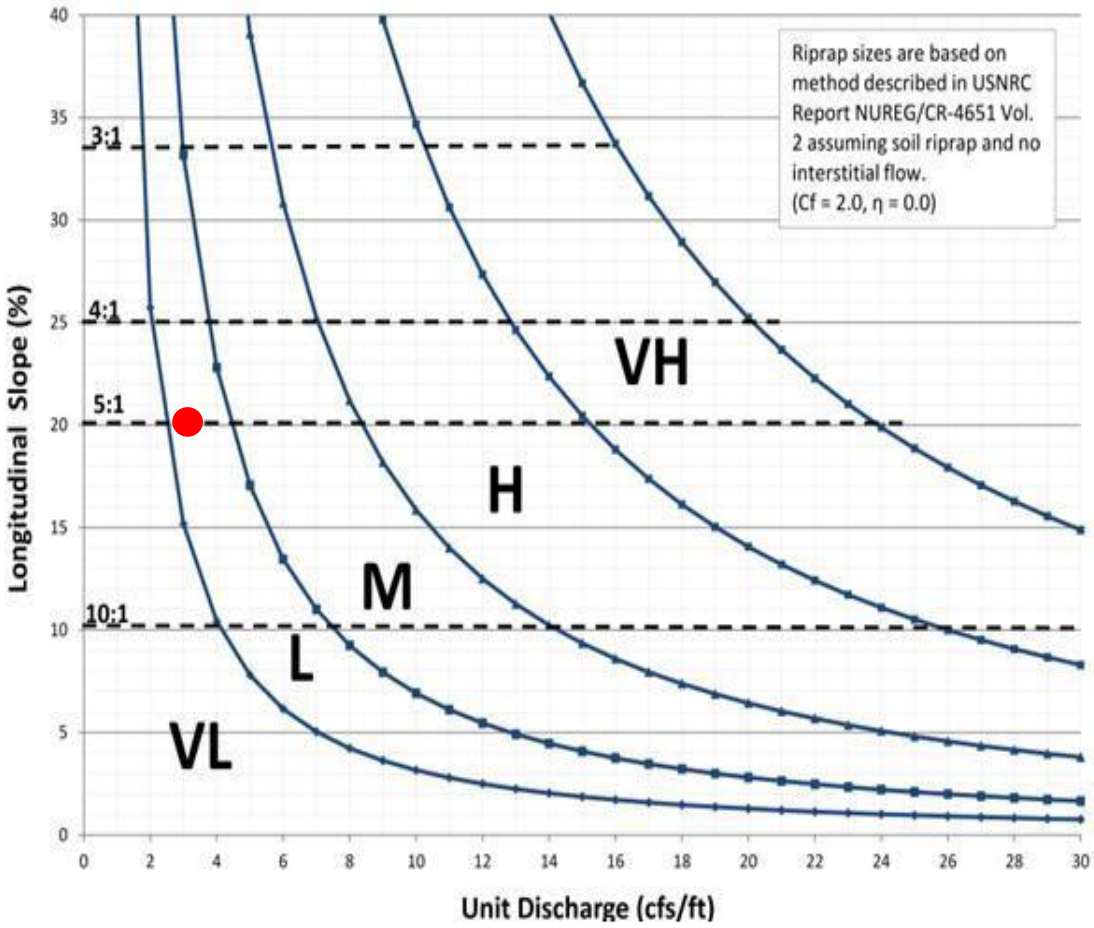
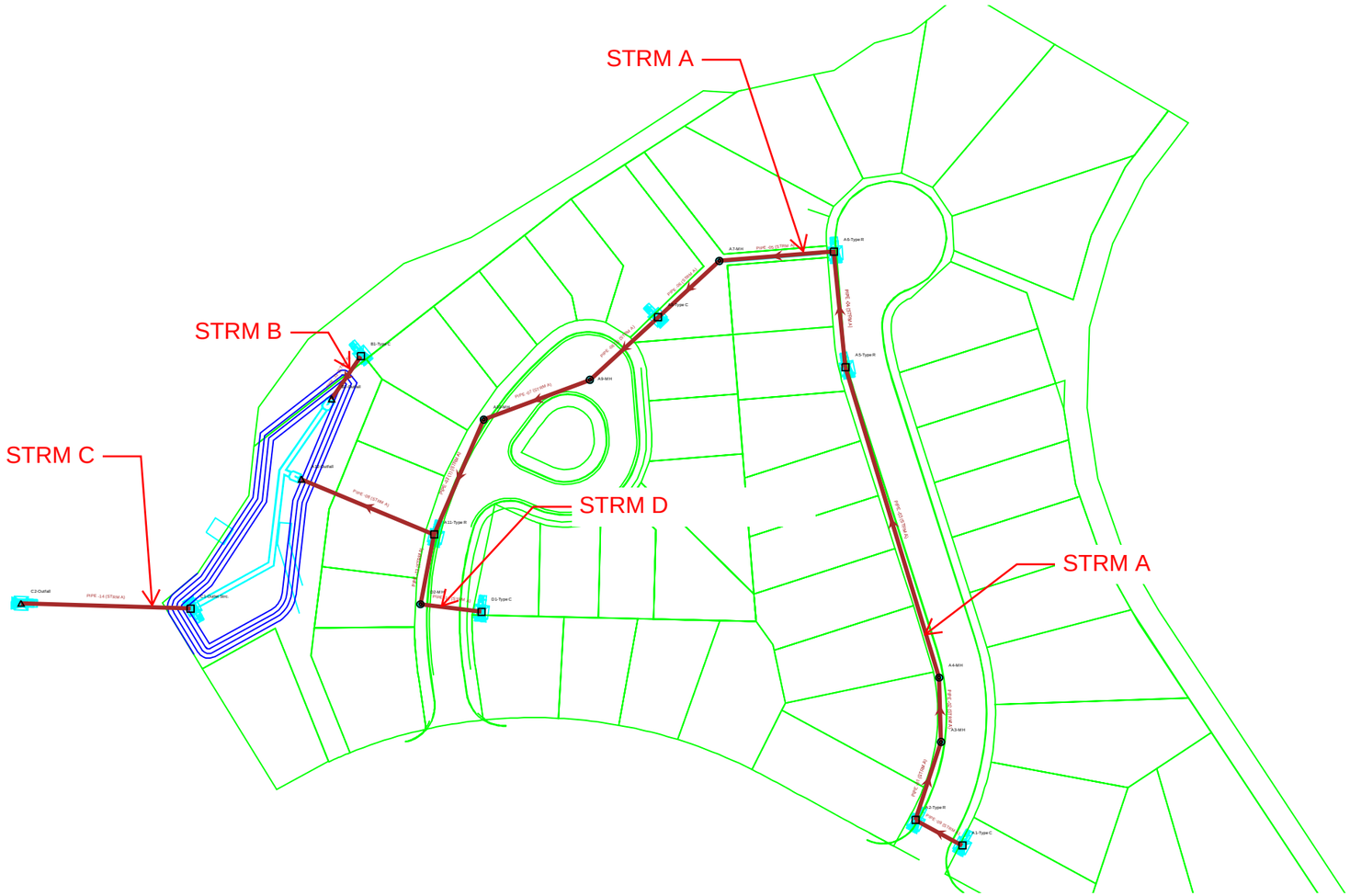


Figure 13-12d. Riprap Types for Emergency Spillway Protection

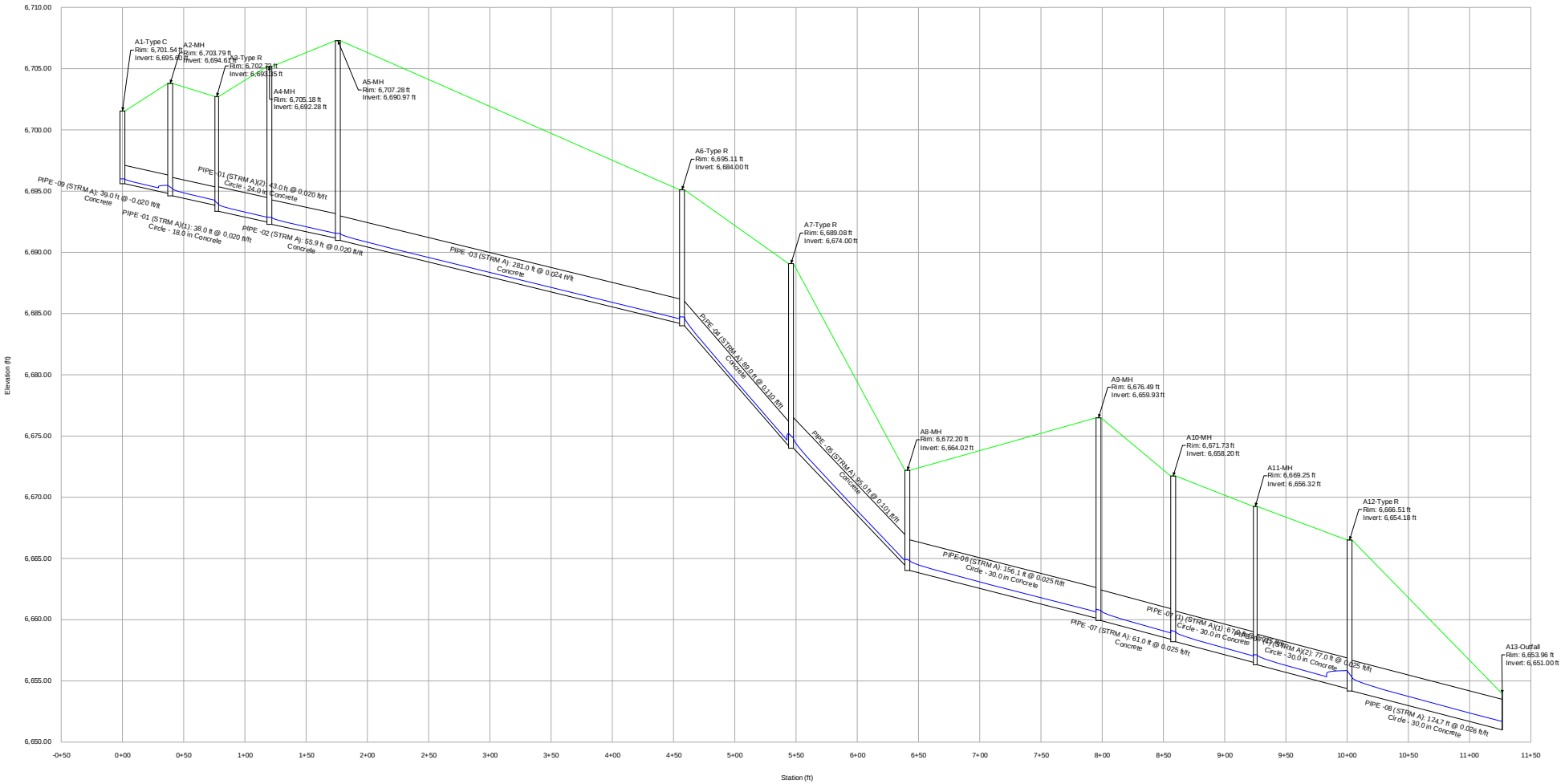


Scenario: 100-Year



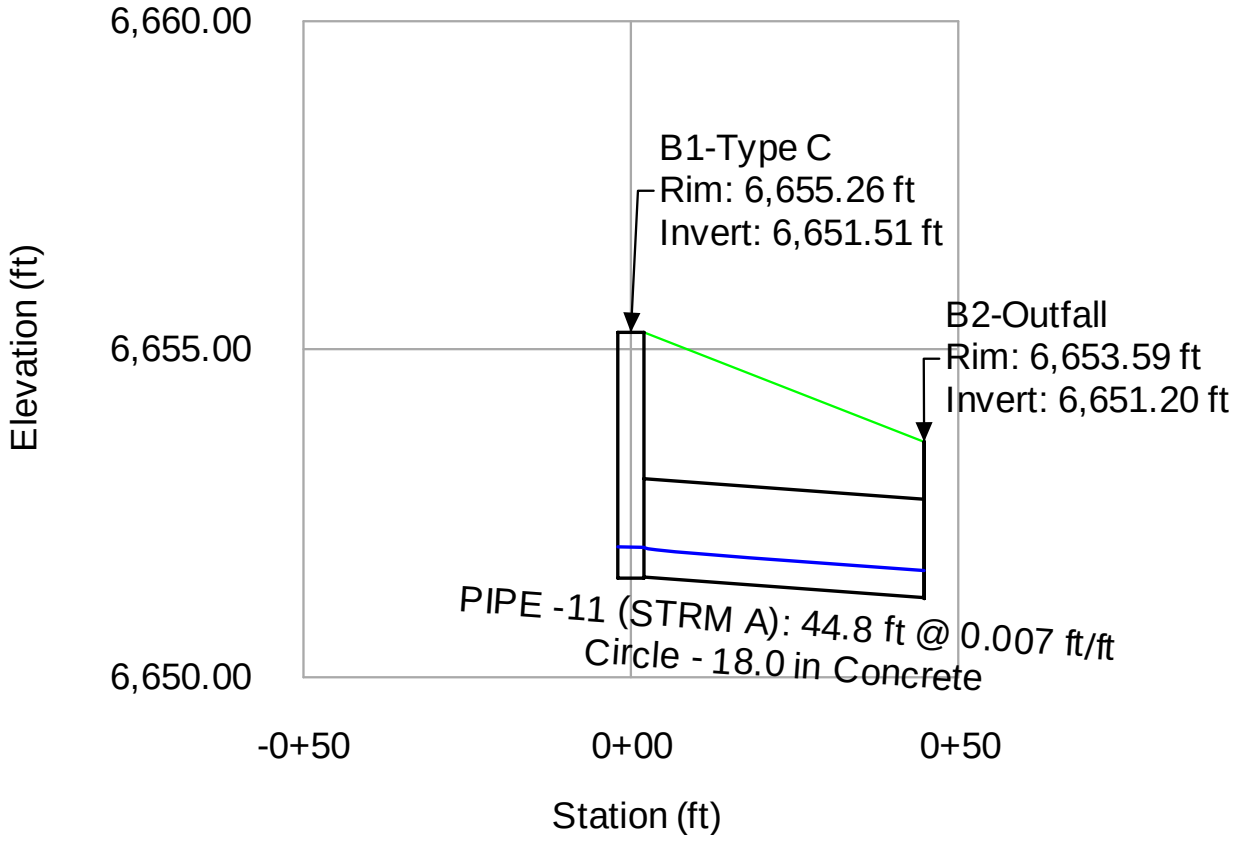
Profile Report

Engineering Profile - STRM A **5 YEAR**



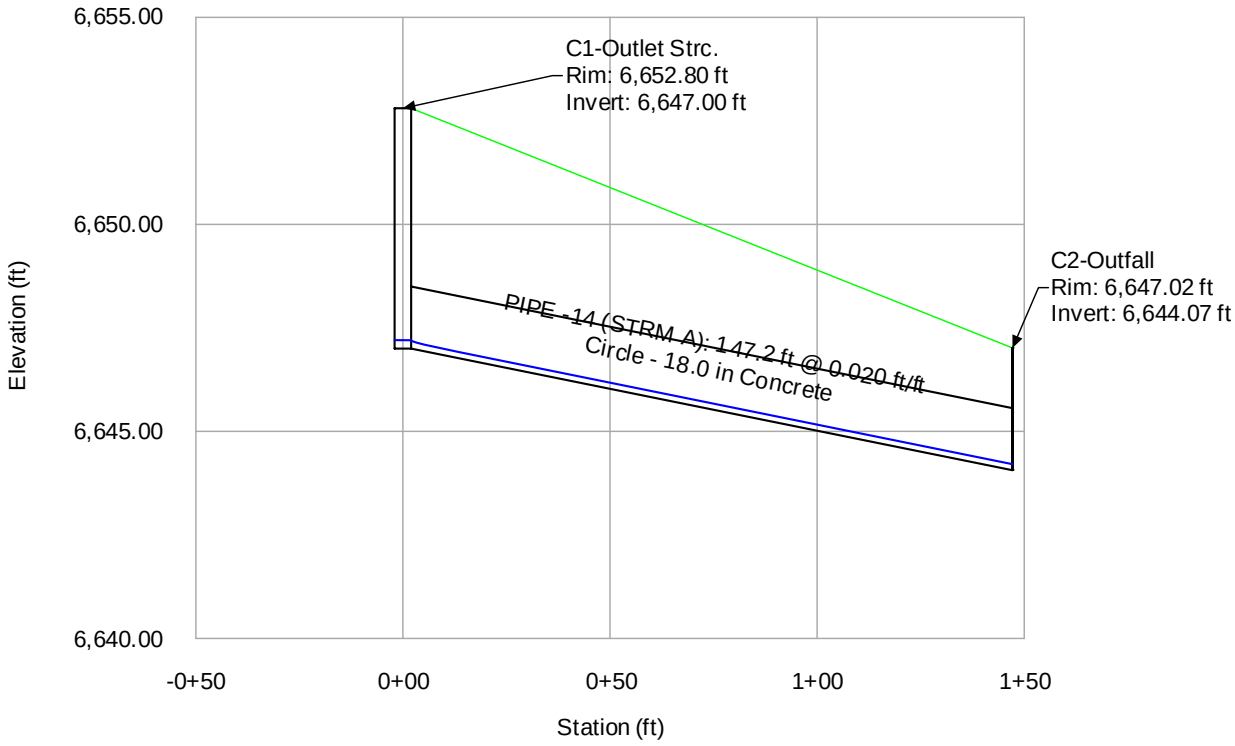
Profile Report

Engineering Profile - STRM B **5 YEAR**



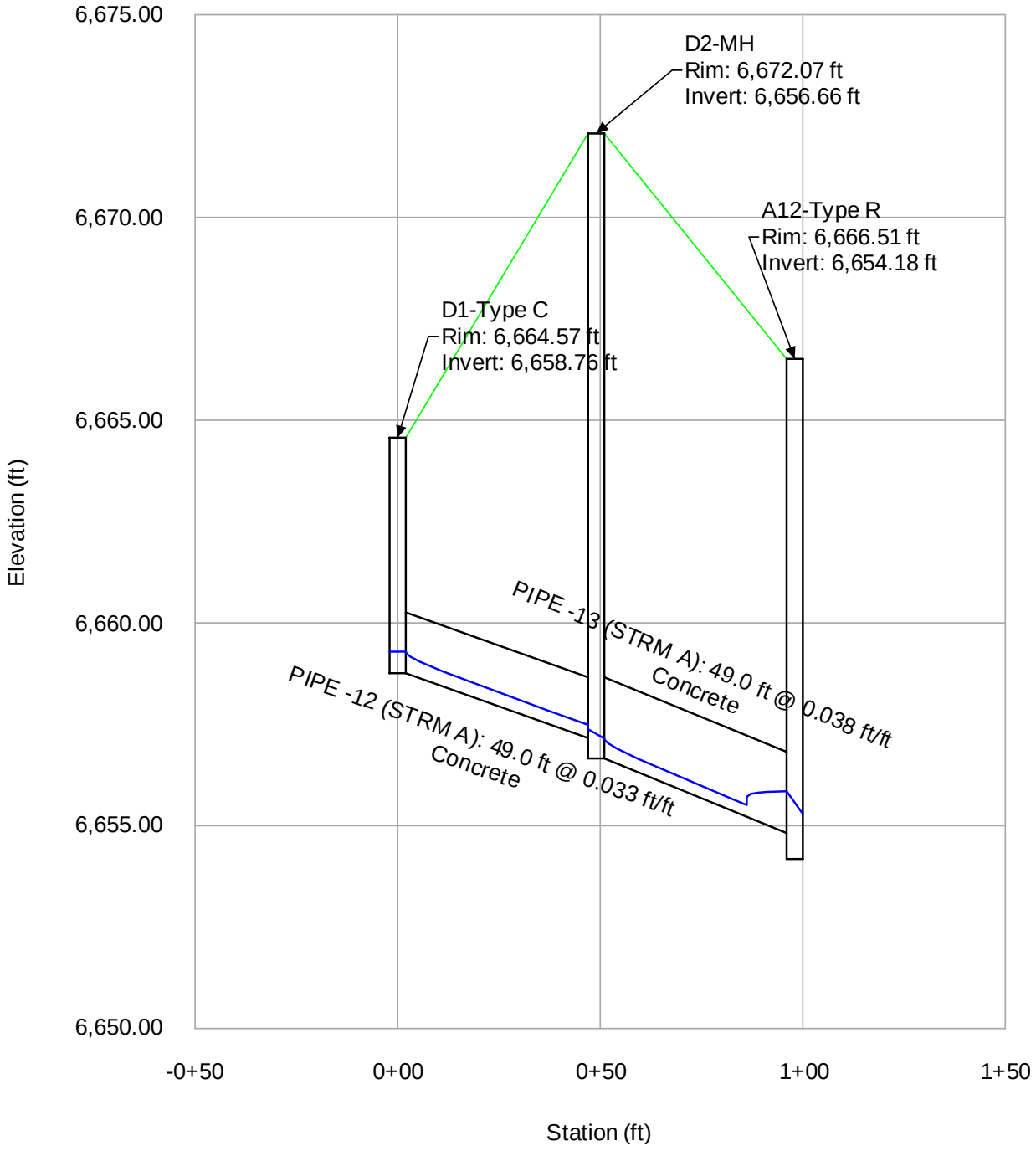
Profile Report

Engineering Profile - STRM C **5 YEAR**



Profile Report

Engineering Profile - STRM D **5 YEAR**



5 YEAR

FlexTable: Catch Basin Table

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
A1-Type C	6,701.54	6,695.60	6,696.00	6,695.99
A6-Type R	6,695.11	6,684.00	6,684.74	6,684.71
A7-Type R	6,689.08	6,674.00	6,675.21	6,674.82
A12-Type R	6,666.51	6,654.18	6,655.85	6,655.29
D1-Type C	6,664.57	6,658.76	6,659.29	6,659.29
B1-Type C	6,655.26	6,651.51	6,651.99	6,651.98
C1-Outlet Strc.	6,652.80	6,647.00	6,647.21	6,647.20
A3-Type R	6,702.72	6,693.35	6,694.19	6,693.92

5 YEAR

FlexTable: Conduit Table

Start Node	Stop Node	Invert (Start) (ft)	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n	Flow (cfs)	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Flow / Capacity (Design) (%)
A5-MH	A6-Type R	6,690.97	6,684.20	281.0	0.024	24.0	0.013	2.66	6.58	35.11	6,691.54	6,684.57	7.6
A4-MH	A5-MH	6,692.28	6,691.17	55.9	0.020	24.0	0.013	2.66	6.15	31.88	6,692.85	6,691.56	8.3
A2-MH	A1-Type C	6,694.82	6,695.60	39.0	-0.020	18.0	0.013	1.11	4.93	14.85	6,695.99	6,695.47	7.5
A6-Type R	A7-Type R	6,684.00	6,674.20	89.0	0.110	24.0	0.013	4.13	12.81	75.06	6,684.71	6,675.21	5.5
A7-Type R	A8-MH	6,674.00	6,664.45	95.0	0.101	30.0	0.013	6.11	13.55	130.04	6,674.82	6,664.82	4.7
A9-MH	A10-MH	6,659.93	6,658.40	61.0	0.025	30.0	0.013	6.11	8.31	64.96	6,660.75	6,658.92	9.4
D2-MH	A12-Type R	6,656.66	6,654.82	49.0	0.038	24.0	0.013	1.99	7.07	43.84	6,657.15	6,655.85	4.5
D1-Type C	D2-MH	6,658.76	6,657.16	49.0	0.033	18.0	0.013	1.99	6.97	18.98	6,659.29	6,657.49	10.5
A12-Type R	A13-Outfall	6,654.18	6,651.00	124.7	0.026	30.0	0.013	11.00	9.91	65.51	6,655.29	6,651.69	16.8
B1-Type C	B2-Outfall	6,651.53	6,651.21	44.8	0.007	18.0	0.013	1.46	3.68	8.79	6,651.98	6,651.63	16.6
C1-Outlet Strc.	C2-Outfall	6,647.00	6,644.06	147.2	0.020	18.0	0.013	0.30	3.34	14.85	6,647.20	6,644.21	2.0
A2-MH	A3-Type R	6,694.61	6,693.85	38.0	0.020	18.0	0.013	2.34	6.13	14.85	6,695.19	6,694.25	15.8
A3-Type R	A4-MH	6,693.35	6,692.48	43.0	0.020	24.0	0.013	2.66	6.19	32.18	6,693.92	6,692.87	8.3
A8-MH	A9-MH	6,664.02	6,660.13		0.025	30.0	0.013	6.11	8.29	64.75	6,664.84	6,660.65	9.4
A10-MH	A11-MH	6,658.20	6,656.52	67.0	0.025	30.0	0.013	6.11	8.31	64.95	6,659.02	6,657.04	9.4
A11-MH	A12-Type R	6,656.32	6,654.38	77.0	0.025	30.0	0.013	6.11	8.32	65.10	6,657.14	6,655.85	9.4

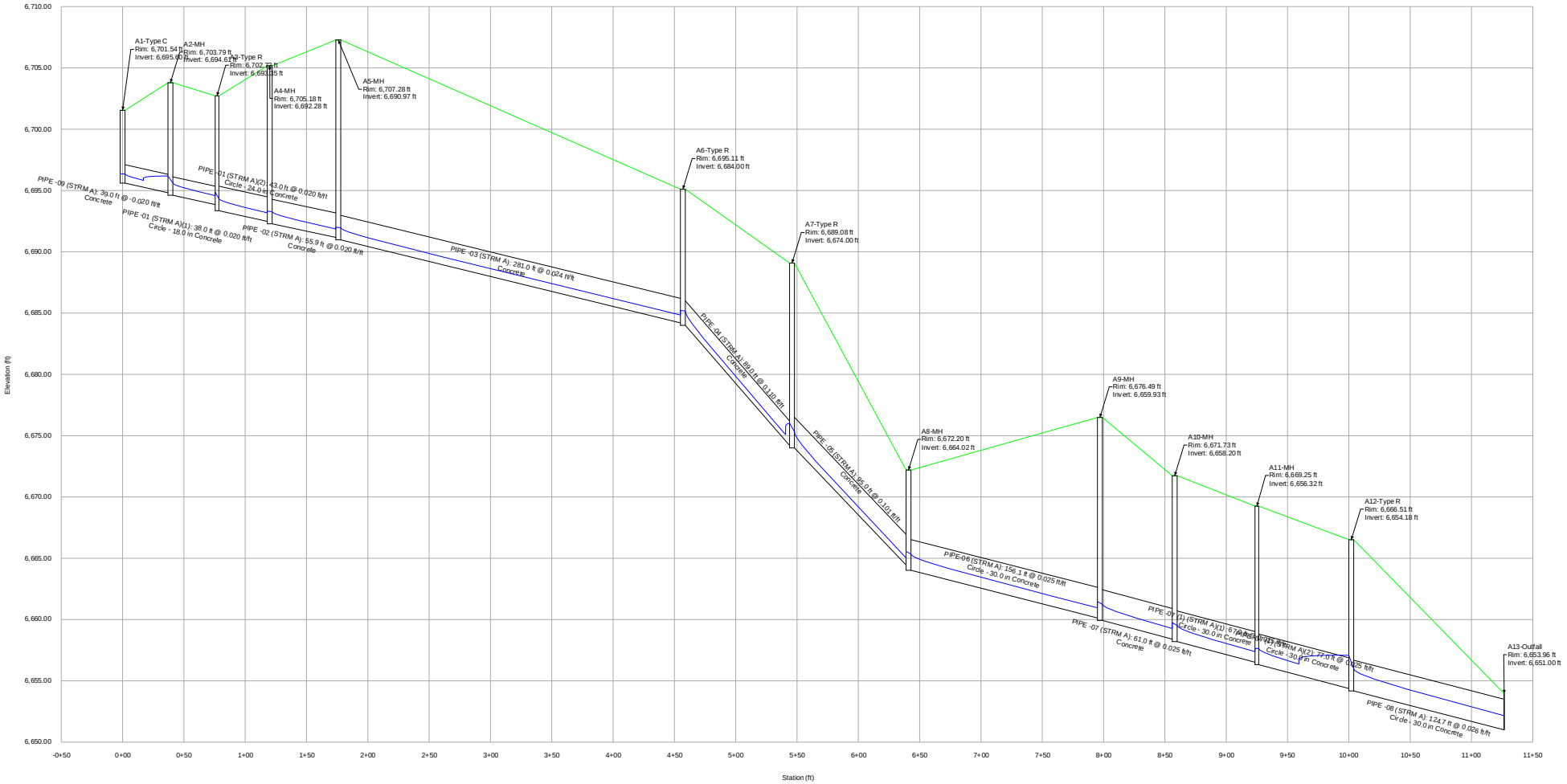
5 YEAR

FlexTable: Manhole Table

Label	Elevation (Rim) (ft)	Flow (Total Out) (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss Coefficient (Standard)	Headloss (ft)
A5-MH	6,707.28	2.66	6,691.56	6,691.54	0.100	0.02
A4-MH	6,705.18	2.66	6,692.87	6,692.85	0.100	0.02
A9-MH	6,676.49	6.11	6,660.87	6,660.75	0.400	0.12
A8-MH	6,672.20	6.11	6,664.96	6,664.84	0.400	0.12
D2-MH	6,672.07	1.99	6,657.38	6,657.15	1.320	0.23
A10-MH	6,671.73	6.11	6,659.14	6,659.02	0.400	0.12
A2-MH	6,703.79	2.34	6,695.47	6,695.19	1.320	0.28
A11-MH	6,669.25	6.11	6,657.14	6,657.14		0.00

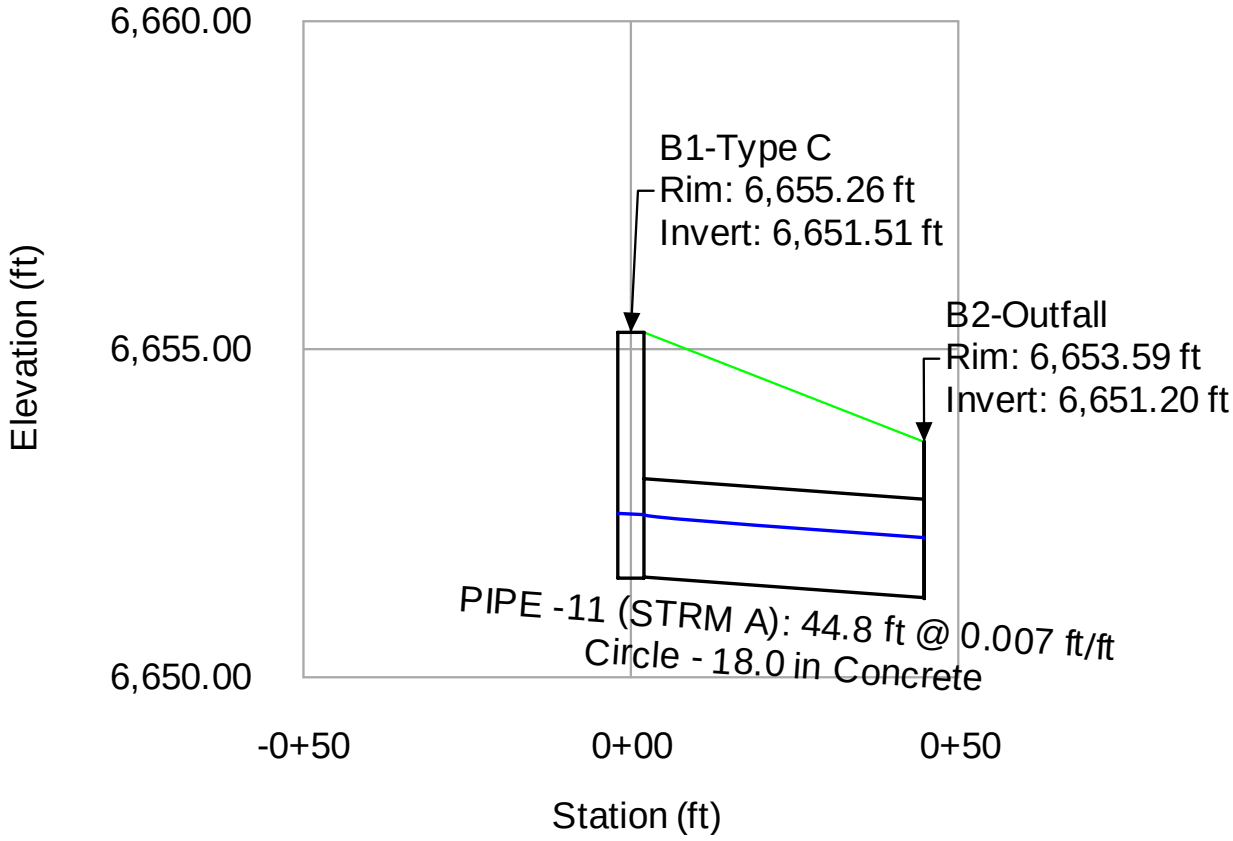
Profile Report

Engineering Profile - STRM A **100 YEAR**



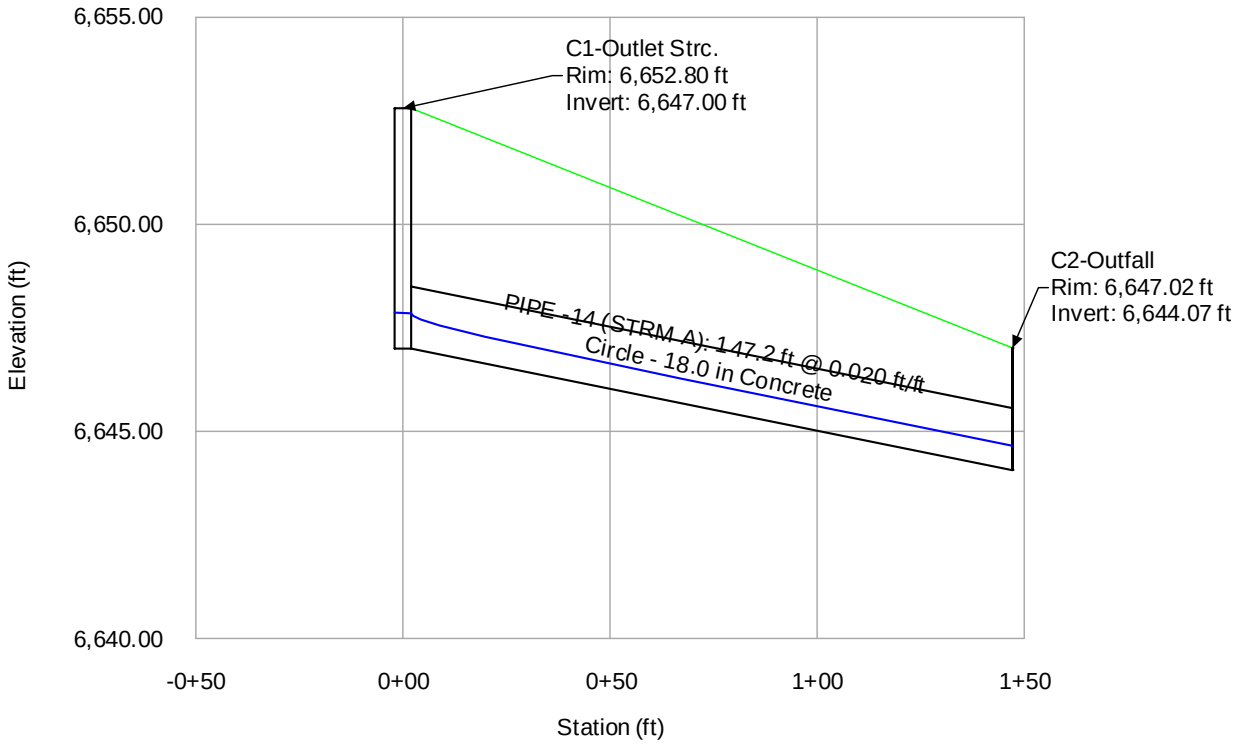
Profile Report

Engineering Profile - STRM B **100 YEAR**



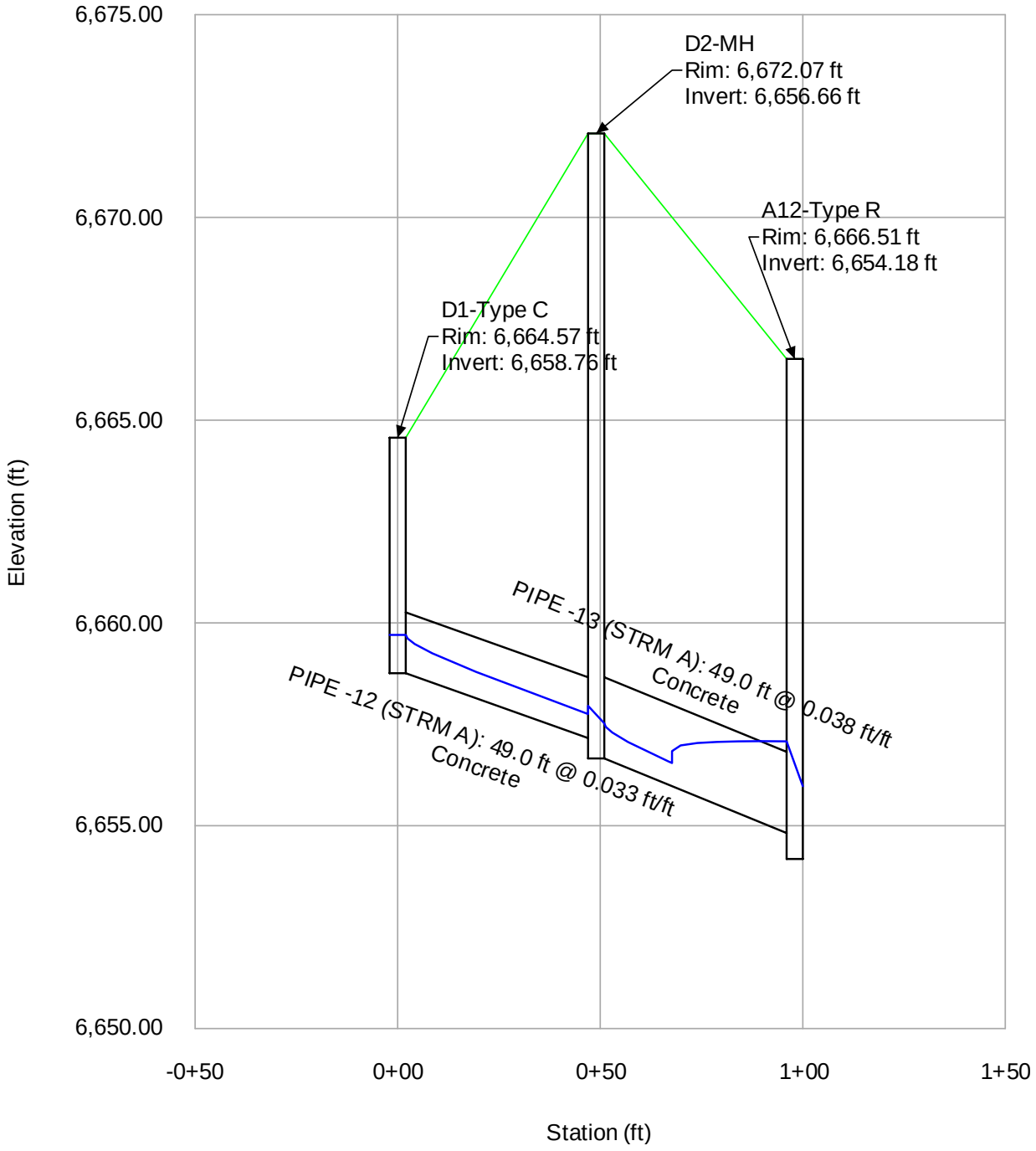
Profile Report

Engineering Profile - STRM C **100 YEAR**



Profile Report

Engineering Profile - STRM D **100 YEAR**



100 YEAR

FlexTable: Catch Basin Table

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
A1-Type C	6,701.54	6,695.60	6,696.36	6,696.35
A6-Type R	6,695.11	6,684.00	6,685.21	6,685.17
A7-Type R	6,689.08	6,674.00	6,676.02	6,675.32
A12-Type R	6,666.51	6,654.18	6,657.08	6,655.97
D1-Type C	6,664.57	6,658.76	6,659.70	6,659.70
B1-Type C	6,655.26	6,651.51	6,652.50	6,652.48
C1-Outlet Strc.	6,652.80	6,647.00	6,647.87	6,647.85
A3-Type R	6,702.72	6,693.35	6,694.86	6,694.34

100 YEAR

FlexTable: Conduit Table

Start Node	Stop Node	Invert (Start) (ft)	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n	Flow (cfs)	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Flow / Capacity (Design) (%)
A5-MH	A6-Type R	6,690.97	6,684.20	281.0	0.024	24.0	0.013	7.80	8.99	35.11	6,691.96	6,685.21	22.2
A4-MH	A5-MH	6,692.28	6,691.17	55.9	0.020	24.0	0.013	7.80	8.38	31.88	6,693.27	6,691.86	24.5
A2-MH	A1-Type C	6,694.82	6,695.60	39.0	-0.020	18.0	0.013	3.82	7.04	14.85	6,696.35	6,696.18	25.7
A6-Type R	A7-Type R	6,684.00	6,674.20	89.0	0.110	24.0	0.013	10.60	16.89	75.06	6,685.17	6,676.02	14.1
A7-Type R	A8-MH	6,674.00	6,664.45	95.0	0.101	30.0	0.013	15.34	17.78	130.04	6,675.32	6,665.03	11.8
A9-MH	A10-MH	6,659.93	6,658.40	61.0	0.025	30.0	0.013	15.34	10.82	64.96	6,661.25	6,659.73	23.6
D2-MH	A12-Type R	6,656.66	6,654.82	49.0	0.038	24.0	0.013	5.98	9.76	43.84	6,657.52	6,657.08	13.6
D1-Type C	D2-MH	6,658.76	6,657.16	49.0	0.033	18.0	0.013	5.98	9.51	18.98	6,659.70	6,657.76	31.5
A12-Type R	A13-Outfall	6,654.18	6,651.00	124.7	0.026	30.0	0.013	27.68	12.78	65.51	6,655.97	6,652.16	42.3
B1-Type C	B2-Outfall	6,651.53	6,651.21	44.8	0.007	18.0	0.013	6.07	5.37	8.79	6,652.48	6,652.13	69.1
C1-Outlet Strc.	C2-Outfall	6,647.00	6,644.06	147.2	0.020	18.0	0.013	4.90	7.54	14.85	6,647.85	6,644.65	33.0
A2-MH	A3-Type R	6,694.61	6,693.85	38.0	0.020	18.0	0.013	6.60	8.16	14.85	6,695.60	6,694.86	44.4
A3-Type R	A4-MH	6,693.35	6,692.48	43.0	0.020	24.0	0.013	7.80	8.44	32.18	6,694.34	6,693.18	24.2
A8-MH	A9-MH	6,664.02	6,660.13		0.025	30.0	0.013	15.34	10.80	64.75	6,665.34	6,661.46	23.7
A10-MH	A11-MH	6,658.20	6,656.52	67.0	0.025	30.0	0.013	15.34	10.82	64.95	6,659.52	6,657.38	23.6
A11-MH	A12-Type R	6,656.32	6,654.38	77.0	0.025	30.0	0.013	15.34	10.85	65.10	6,657.64	6,657.08	23.6

100 YEAR

FlexTable: Manhole Table

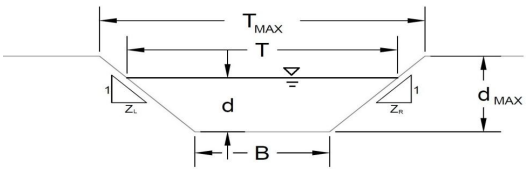
Label	Elevation (Rim) (ft)	Flow (Total Out) (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss Coefficient (Standard)	Headloss (ft)
A5-MH	6,707.28	7.80	6,692.00	6,691.96	0.100	0.04
A4-MH	6,705.18	7.80	6,693.31	6,693.27	0.100	0.04
A9-MH	6,676.49	15.34	6,661.46	6,661.25	0.400	0.21
A8-MH	6,672.20	15.34	6,665.55	6,665.34	0.400	0.21
D2-MH	6,672.07	5.98	6,657.96	6,657.52	1.320	0.43
A10-MH	6,671.73	15.34	6,659.73	6,659.52	0.400	0.21
A2-MH	6,703.79	6.60	6,696.18	6,695.60	1.320	0.58
A11-MH	6,669.25	15.34	6,657.64	6,657.64		0.00

Version 4.05 Released March 2017

AREA INLET IN A SWALE

Newport Estates Filing No. 1

Inlet- Design Point 1



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D or E	B	
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	see details below	
Channel Invert Slope	S_O =	0.0250	ft/ft
Bottom Width	B =	2.00	ft
Left Side Slope	Z1 =	4.00	ft/ft
Right Side Slope	Z2 =	4.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Max. Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	10.00	18.00	feet
Max. Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	1.00	2.00	feet

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	3.2	69.5	cfs
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	1.00	2.00	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	1.1	3.8	cfs
Water Depth	d =	0.63	1.06	feet

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Version 4.05 Released March 2017

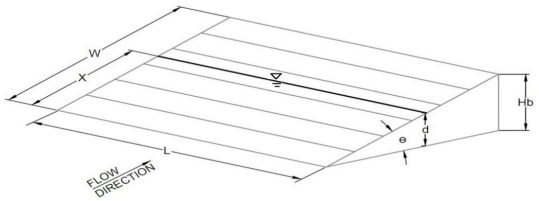
AREA INLET IN A SWALE

Newport Estates Filing No. 1

Inlet- Design Point 1

Inlet Design Information (Input)

Type of Inlet: CDOT Type C — Inlet Type = CDOT Type C



Angle of Inclined Grade (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grade	W =	3.00	feet
Length of Grade	L =	3.00	feet
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grade	H_B =	0.00	feet
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	0.96	
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 =	0.63	1.06	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**9.2**	**16.7**	**cfs**
	Bypassed Flow, Q_b =	**0.0**	**0.0**	**cfs**
	Capture Percentage = Q_a/Q_o = C%	**100**	**100**	**%**

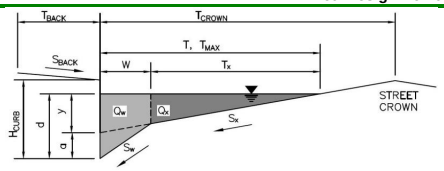
Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Newport Estates Filing No. 1

Inlet ID: Inlet- Design Point 2



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	11.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	34.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.040	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.047	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	34.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	9.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

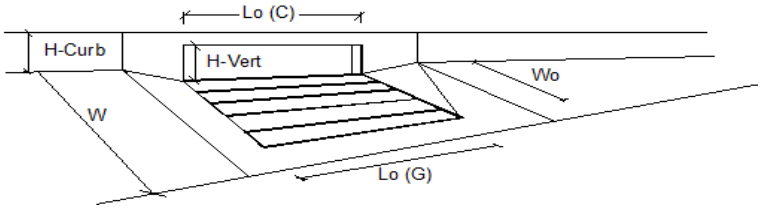
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**10.2**	**30.9**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.0**	**4.1**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**

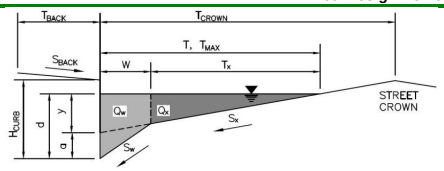
Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Newport Estates Filing No. 1

Inlet ID: Inlet- Design Point 3



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	11.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	34.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.040	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.050	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	34.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	9.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

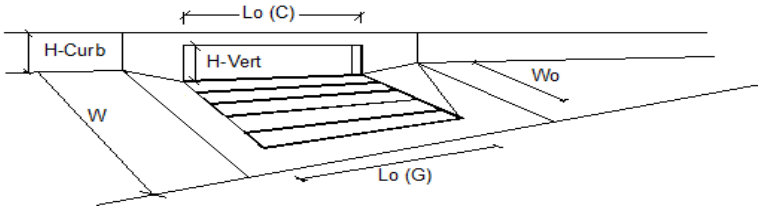
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**10.0**	**30.3**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.9**	**5.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**

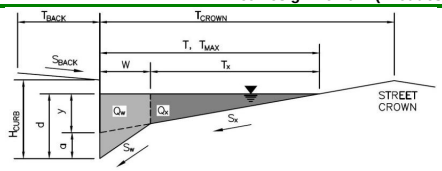
Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Newport Estates Filing No. 1

Inlet ID: Inlet-Design Point 4- (inlcudes SubBasin J)



Gutter Geometry (Enter data in the blue cells)

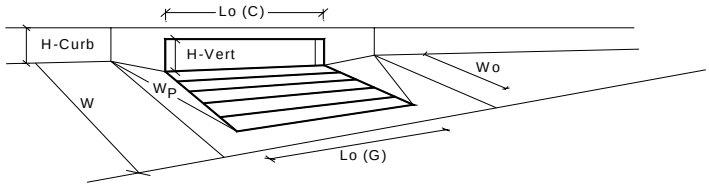
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	87.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.065	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	45.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	9.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	9.0	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
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	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.58	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.77	1.00	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

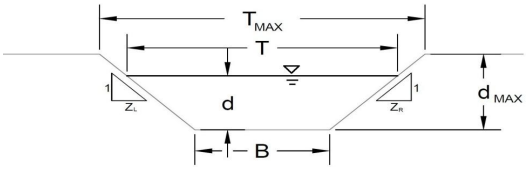
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**5.4**	**10.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	2.5	10.5	cfs

Version 4.05 Released March 2017

AREA INLET IN A SWALE

Newport Estates Filing No. 1

Inlet-Design Point 6



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D or E	B	
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	see details below	
Channel Invert Slope	S_O =	0.0250	ft/ft
Bottom Width	B =	0.50	ft
Left Side Slope	Z1 =	4.00	ft/ft
Right Side Slope	Z2 =	4.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

Choose One:
- (•) **Non-Cohesive**
- ( ) **Cohesive**
- ( ) **Paved**

		Minor Storm	Major Storm	
Max. Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**8.00**	**12.00**	**feet**
Max. Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**1.00**	**1.50**	**feet**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	**1.8**	**9.2**	**cfs**
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	**0.94**	**1.44**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**1.5**	**6.1**	**cfs**
Water Depth	**d** =	**0.86**	**1.36**	**feet**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Version 4.05 Released March 2017

AREA INLET IN A SWALE

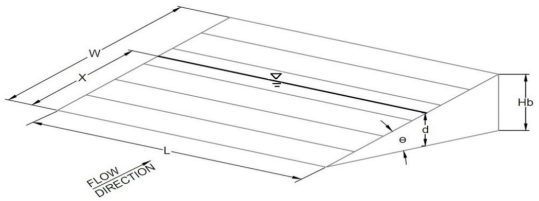
Newport Estates Filing No. 1

Inlet-Design Point 6

Inlet Design Information (Input)

Type of Inlet: CDOT Type C (Depresse

Inlet Type = CDOT Type C (Depressed)



Angle of Inclined Grade (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grade	W =	3.00	feet
Length of Grade	L =	3.00	feet
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grade	H_B =	0.00	feet
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	0.84	
Orifice Coefficient	C_o =	0.56	
Weir Coefficient	C_w =	1.81	

		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	1.86	2.36	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**19.4**	**21.8**	**cfs**
	Bypassed Flow, Q_b =	**0.0**	**0.0**	**cfs**
	Capture Percentage = Q_a/Q_o = C%	**100**	**100**	**%**

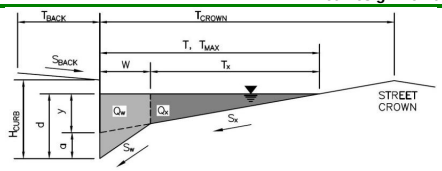
Version 4.05 Released March 2017

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Newport Estates Filing No. 1

Inlet ID: Inlet-Design Point 7



Gutter Geometry (Enter data in the blue cells)

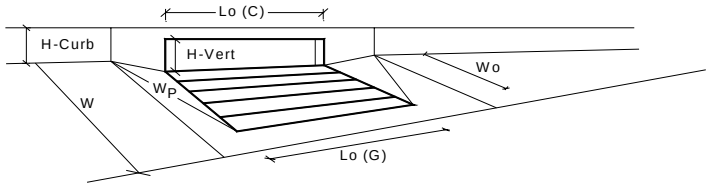
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	11.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	28.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.040	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	28.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	9.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	9.0	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
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	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.58	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.77	1.00	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

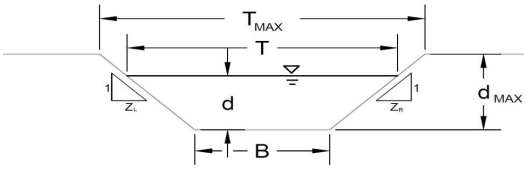
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**5.4**	**10.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	3.7	8.1	cfs

Version 4.05 Released March 2017

AREA INLET IN A SWALE

Newport Estates Filing No. 1

Inlet-Design Point 8



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D or E =	B	
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	see details below	
Channel Invert Slope	S_O =	0.1300	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	4.00	ft/ft
Right Side Slope	Z2 =	4.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Max. Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	8.00	18.00	feet
Max. Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	1.00	2.00	feet

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	9.0	178.6	cfs
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	1.00	2.00	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	2.0	6.0	cfs
Water Depth	d =	0.75	0.92	feet

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Version 4.05 Released March 2017

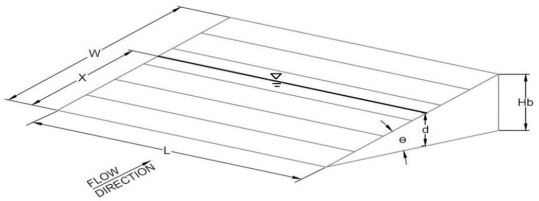
AREA INLET IN A SWALE

Newport Estates Filing No. 1

Inlet-Design Point 8

Inlet Design Information (Input)

Type of Inlet: CDOT Type C — Inlet Type = CDOT Type C



Angle of Inclined Grade (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grade	W =	3.00	feet
Length of Grade	L =	3.00	feet
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grade	H_B =	0.00	feet
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	0.96	
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 =	0.75	0.92	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**12.0**	**15.5**	**cfs**
	Bypassed Flow, Q_b =	**0.0**	**0.0**	**cfs**
	Capture Percentage = Q_a/Q_o = C%	**100**	**100**	**%**

EOPCC

Kimley»Horn

Kimley-Horn & Associates, Inc. **Opinion of Probable Construction Cost**

Client:	**ROCKWOOD HOMES, LLC**	**Date:**	**10/9/2020**
Project:	**Newport Estates Filing No. 1**	**Prepared By:**	**KRK**
KHA No.:	**096726000**	**Checked By:**	**EJG**

Sheet: **1 of 1**

This OPC is not intended for basing financial decisions, or securing funding. Review all notes and assumptions. Since Kimley-Horn & Associates, Inc. has no control over the cost of labor, materials, equipment, or services furnished by others, or over methods of determining price, or over competitive bidding or market conditions, any and all opinions as to the cost herein, including but not limited to opinions as to the costs of construction materials, shall be made on the basis of experience and best available data. Kimley-Horn & Associates, Inc. cannot and does not guarantee that proposals, bids, or actual costs will not vary from the opinions on costs shown herein. The total costs and other numbers in this Opinion of Probable Cost have been rounded.

Item No.	Item Description	Quantity	Unit	Unit Price	Item Cost
	Private Extended Detention Basin - Non-Reimbursable				
1	18" RCP	28	LF	$70.00	$1,960
2	Concrete Forebay	2	EA	$7,500.00	$15,000
3	Concrete Outlet Structure	1	EA	$10,000.00	$10,000
4	Concrete Trickle Channel	228	LF	$10.00	$2,280
5	Earthwork	1,775	CY	$15.00	$26,625
6	Retaining Wall	275	LF	$100.00	$27,500
7	Emergency Overflow (Type L Riprap)	365	CY	$70.00	$25,550
		Subtotal:			$108,915
		Contingency (%,+/-)		10%	$10,892
		Project Total:			**$119,807**

Basis for Cost Projection:

- ☐ No Design Completed
- ☐ Preliminary Design
- ☑ Final Design

Design Engineer:

Eric Gunderson
Registered Professional Engineer, State of Colorado No. 49487

Kimley»Horn

Kimley-Horn & Associates, Inc. **Opinion of Probable Construction Cost**

Client:	**ROCKWOOD HOMES, LLC**	**Date:**	**10/9/2020**
Project:	**Newport Estates Filing No. 1**	**Prepared By:**	**KRK**
KHA No.:	**096726000**	**Checked By:**	**EJG**

Sheet: 1 of 1

This OPC is not intended for basing financial decisions, or securing funding. Review all notes and assumptions. Since Kimley-Horn & Associates, Inc. has no control over the cost of labor, materials, equipment, or services furnished by others, or over methods of determining price, or over competitive bidding or market conditions, any and all opinions as to the cost herein, including but not limited to opinions as to the costs of construction materials, shall be made on the basis of experience and best available data. Kimley-Horn & Associates, Inc. cannot and does not guarantee that proposals, bids, or actual costs will not vary from the opinions on costs shown herein. The total costs and other numbers in this Opinion of Probable Cost have been rounded.

Item No.	Item Description	Quantity	Unit	Unit Price	Item Cost
	Public Storm Sewer - Non-Reimbursable				
1	18" RCP	338	LF	$70.00	$23,660
2	24" RCP	470	LF	$110.00	$51,700
3	30" RCP	582	LF	$140.00	$81,480
4	5' Type R Inlet	2	EA	$5,000.00	$10,000
5	10' Type R Inlet	1	EA	$8,600.00	$8,600
6	15' Type R Inlet	1	EA	$15,300.00	$15,300
7	CDOT Type C Inlet	3	EA	$3,000.00	$9,000
8	4' Type II Manhole	8	EA	$6,000.00	$48,000
9	Concrete Forebay	2	EA	$7,500.00	$15,000
10	18" Concrete Flared End Section	1	EA	$2,750.00	$2,750
11	Maintenance Road Material (CDOT Class 6 Base)	70	CY	$70.00	$4,900
12	Type L Riprap (Outfall)	6	CY	$100.00	$600
		Subtotal:			$265,490
		Contingency (%,+/-)		10%	$26,549
		Project Total:			**$292,039**

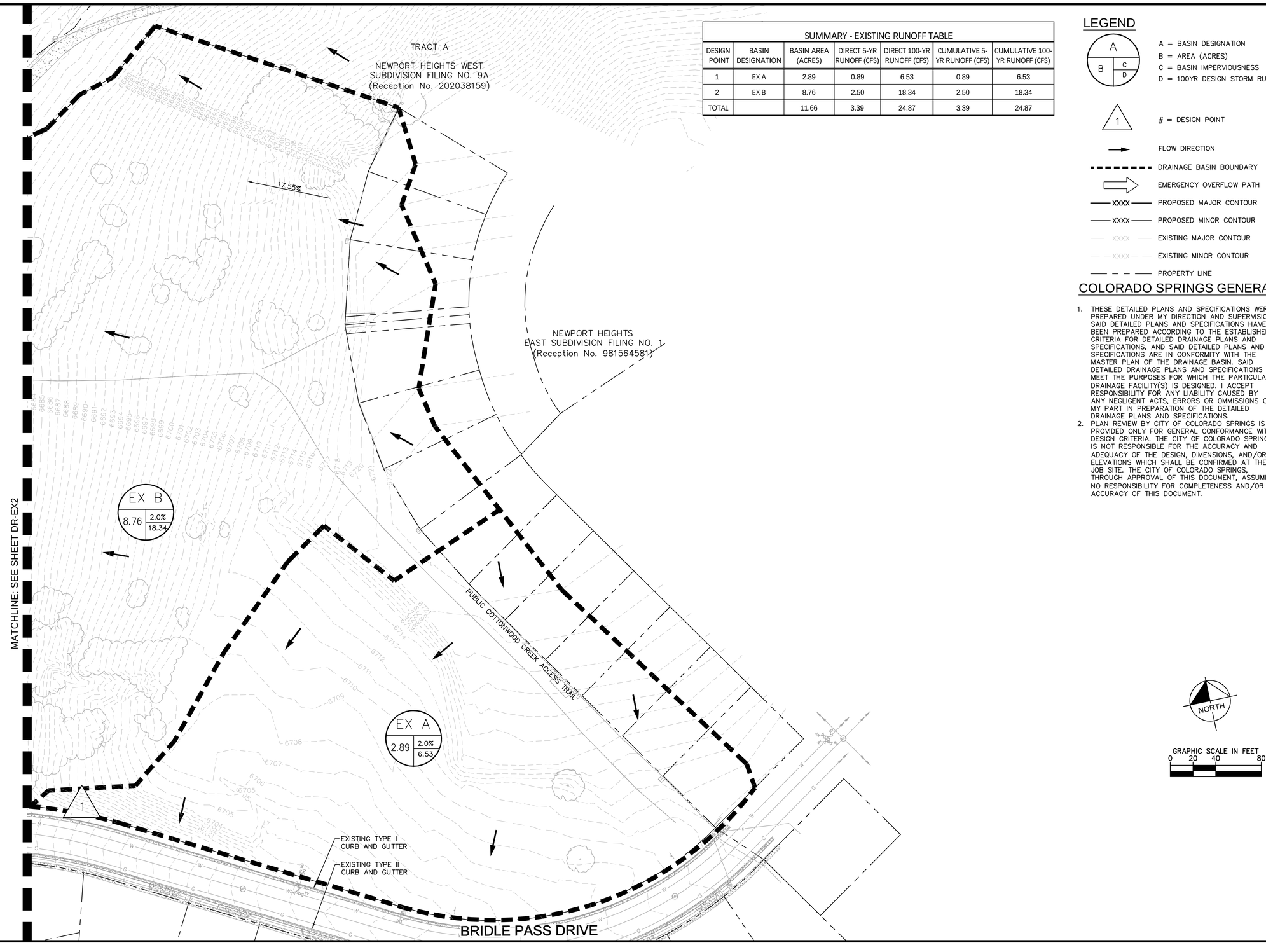
Basis for Cost Projection:

- ☐ No Design Completed
- ☐ Preliminary Design
- ☑ Final Design

Design Engineer:

Eric Gunderson
Registered Professional Engineer, State of Colorado No. 49487

DRAINAGE MAPS



SUMMARY - EXISTING RUNOFF TABLE						
DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	DIRECT 5-YR RUNOFF (CFS)	DIRECT 100-YR RUNOFF (CFS)	CUMULATIVE 5-YR RUNOFF (CFS)	CUMULATIVE 100-YR RUNOFF (CFS)
1	EX A	2.89	0.89	6.53	0.89	6.53
2	EX B	8.76	2.50	18.34	2.50	18.34
TOTAL		11.66	3.39	24.87	3.39	24.87

LEGEND

A = BASIN DESIGNATION
B = AREA (ACRES)
C = BASIN IMPERVIOUSNESS
D = 100YR DESIGN STORM RUNOFF (CFS)

= DESIGN POINT

FLOW DIRECTION

DRAINAGE BASIN BOUNDARY

EMERGENCY OVERFLOW PATH

XXXX PROPOSED MAJOR CONTOUR

XXXX PROPOSED MINOR CONTOUR

XXXX EXISTING MAJOR CONTOUR

XXXX EXISTING MINOR CONTOUR

PROPERTY LINE

COLORADO SPRINGS GENERAL NOTES

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NO.	REVISION	BY	DATE	APPR.

Kimley»Horn
2019 KIMLEY-HORN AND ASSOCIATES, INC.
2 North Nevada Avenue Suite 300
Colorado Springs, Colorado 80903 (719) 453-0180

DESIGNED BY: EJG
DRAWN BY: JAR
CHECKED BY: EJG
DATE: 8/21/2019

NEWPORT ESTATES
COLORADO SPRINGS, COLORADO
CONSTRUCTION DOCUMENTS
EXISTING DRAINAGE MAP

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Kimley-Horn and Associates, Inc.

PROJECT NO.
096726000

SHEET
DR-EX1

SUMMARY - EXISTING RUNOFF TABLE						
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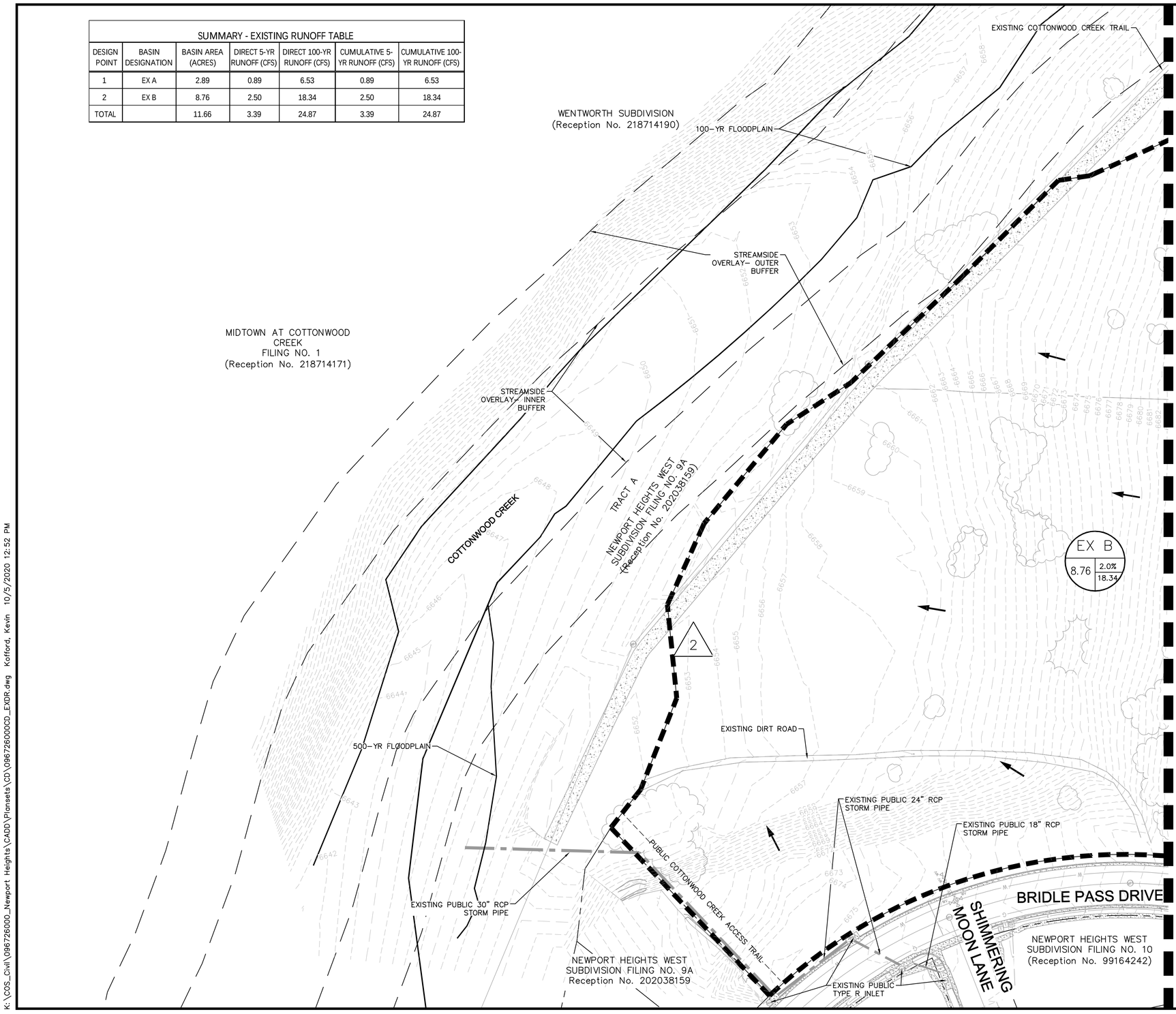
TOTAL		11.66	3.39	24.87	3.39	24.87



LEGEND

A = BASIN DESIGNATION
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C = BASIN IMPERVIOUSNESS
D = 100YR DESIGN STORM RUNOFF (CFS)

1 = # = DESIGN POINT

FLOW DIRECTION

DRAINAGE BASIN BOUNDARY

EMERGENCY OVERFLOW PATH

XXXX PROPOSED MAJOR CONTOUR

XXXX PROPOSED MINOR CONTOUR

XXXX EXISTING MAJOR CONTOUR

XXXX EXISTING MINOR CONTOUR

PROPERTY LINE

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DESIGNED BY: EJG
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DATE: 8/21/2019

NEWPORT ESTATES
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EXISTING DRAINAGE MAP

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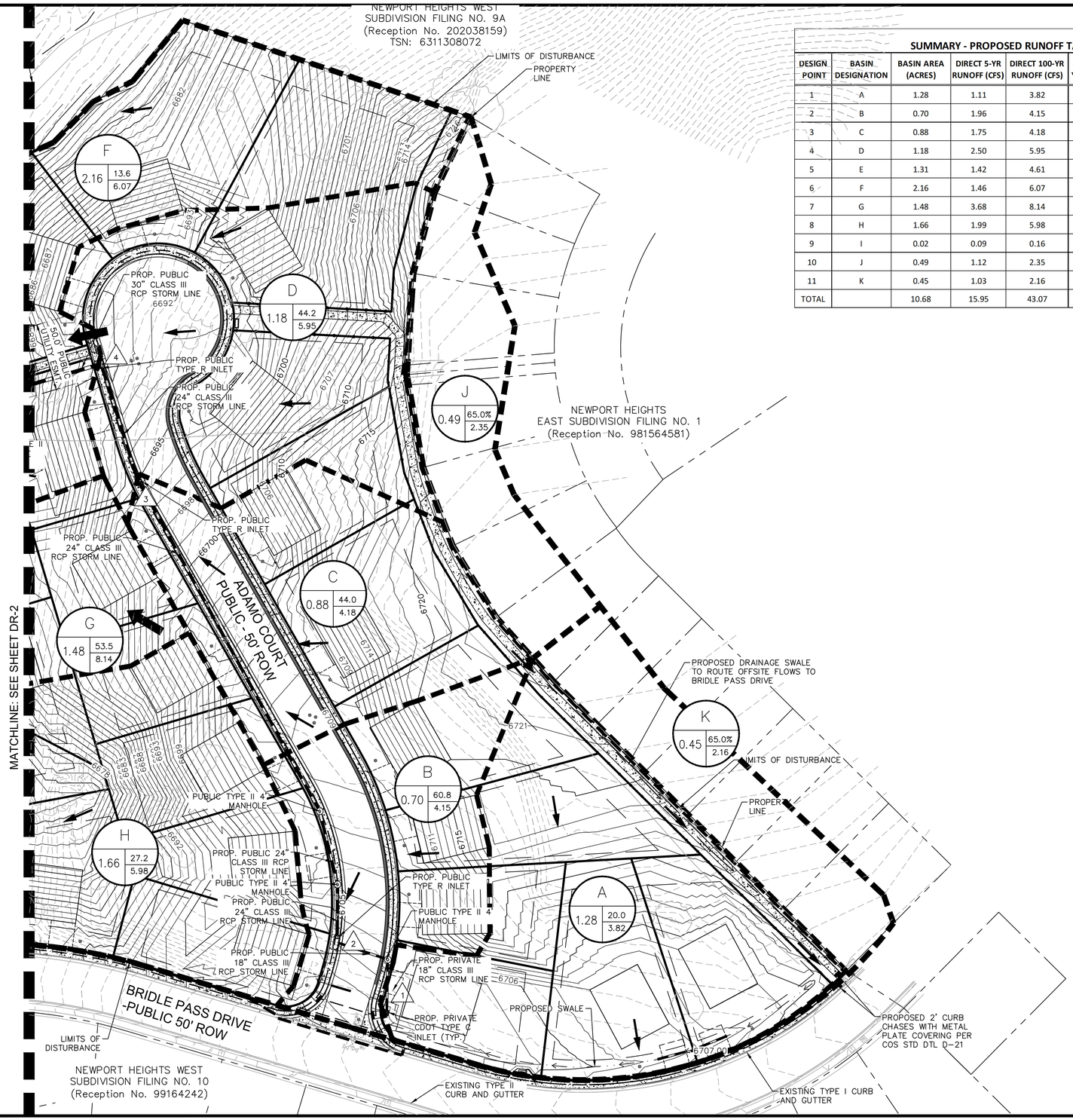
Kimley-Horn and Associates, Inc.

PROJECT NO.
096726000

SHEET
DR-EX2

K:\COS_Civil\096726000_Newport Heights\CADD\Planset\CD\096726000CD_EXDR.dwg Kofford, Kevin 10/5/2020 12:52 PM



SUMMARY - PROPOSED RUNOFF TABLE

DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	DIRECT 5-YR RUNOFF (CFS)	DIRECT 100-YR RUNOFF (CFS)	CUMULATIVE 5-YR RUNOFF (CFS)	CUMULATIVE 100-YR RUNOFF (CFS)
1	A	1.28	1.11	3.82	1.11	3.82
2	B	0.70	1.96	4.15	2.66	7.08
3	C	0.88	1.75	4.18	4.13	10.60
4	D	1.18	2.50	5.95	6.11	15.34
5	E	1.31	1.42	4.61	1.42	4.61
6	F	2.16	1.46	6.07	1.46	6.07
7	G	1.48	3.68	8.14	9.06	21.85
8	H	1.66	1.99	5.98	1.99	5.98
9	I	0.02	0.09	0.16	0.09	0.16
10	J	0.49	1.12	2.35	1.12	2.35
11	K	0.45	1.03	2.16	1.03	2.16
TOTAL		10.68	15.95	43.07	30.18	80.04

LEGEND

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B = AREA (ACRES)
C = BASIN IMPERVIOUSNESS
D = 100YR DESIGN STORM RUNOFF (CFS)

= DESIGN POINT

FLOW DIRECTION
DRAINAGE BASIN BOUNDARY
EMERGENCY OVERFLOW PATH
XXXX PROPOSED MAJOR CONTOUR
XXXX PROPOSED MINOR CONTOUR
XXXX EXISTING MAJOR CONTOUR
XXXX EXISTING MINOR CONTOUR
LIMITS OF DISTURBANCE

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PROJECT NO.
096726000

SHEET
DR-1

SUMMARY - PROPOSED RUNOFF TABLE

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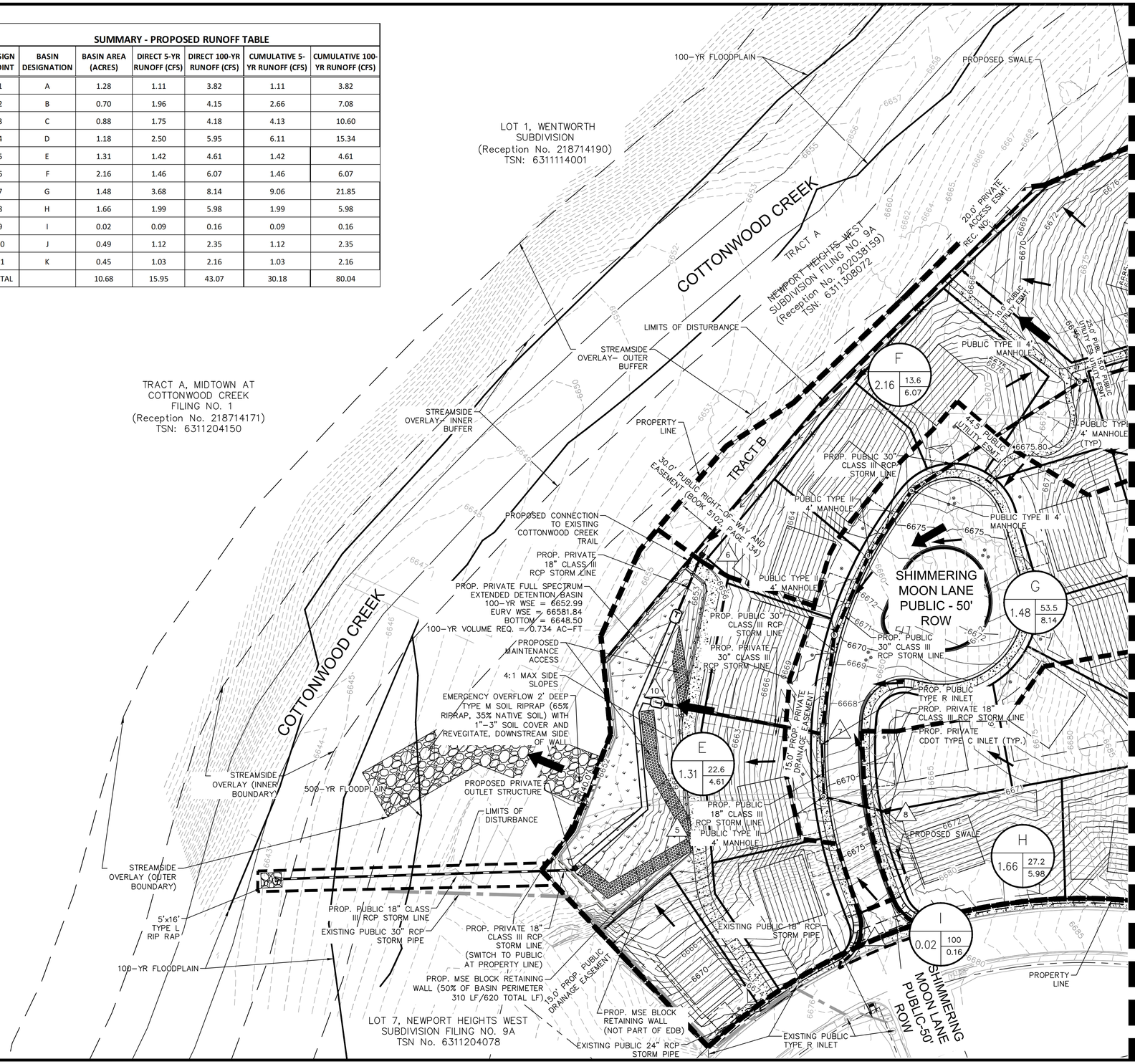

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Kimley-Horn and Associates, Inc.

PROJECT NO. 096726000

SHEET
DR-2

Kofford, Kevin

From:	Katie Whitford <katie@altitudelandco.com>
Sent:	Monday, December 14, 2020 12:43 PM
To:	Mulledy, Richard
Cc:	John Raptis
Subject:	RE: Newport Estates (18-074)
Categories:	External

Hi Richard,

Thank you for the response. We have a couple of questions:

- Will the $100k for channel improvements be paid at the same time as the drainage fees, which is at the time of platting?
- Is there a document that you will need signed and executed for this agreement?

Thanks,
Katie

Katie Whitford, PLA
Director of Planning & Landscape Architecture
Katie@AltitudeLandCo.com | 719.323.4747 (Mobile)

Altitude Land Consultants, Inc.
2727 N. Cascade Avenue, #160 | Colorado Springs, CO 80907
AltitudeLandCo.com | 720.594.9494 (Main)

Denver, CO | Colorado Springs, CO

> -------- Original Message --------
> Subject: RE: Newport Estates (18-074)
> From: "Mulledy, Richard" <Richard.Mulledy@coloradosprings.gov>
> Date: Mon, December 14, 2020 9:06 am
> To: Katie Whitford <katie@altitudelandco.com>
>
> Hello Katie.
> I did receive the email from your client. I needed to get confirmation that the drainage fee payment could be considered. We are willing to accept his proposal, as long as the drainage fees are paid in addition to the 100K for channel improvements.
>
> Thank you,
> Ricard.
>
> Richard Mulledy, P.E.
> Stormwater Enterprise Manager
> City of Colorado Springs, Public Works Department
> 30 S. Nevada Ave., Suite 401
> Colorado Springs, CO 80901
> Office: 719-385-5034
> Cell: 719-200-1466

From: Katie Whitford <katie@altitudelandco.com>
Sent: Friday, December 11, 2020 5:10 PM
To: Mulledy, Richard <Richard.Mulledy@coloradosprings.gov>
Subject: Newport Estates (18-074)

Hi Richard,

My client, John Raptis, asked me to follow up with you regarding the letter he sent to you on December 2nd about Newport Estates. He wanted to confirm that you have received it. Please let me know.

Thank you,
Katie

Katie Whitford, PLA
Director of Planning & Landscape Architecture
Katie@AltitudeLandCo.com | 719.323.4747 (Mobile)

Altitude Land Consultants, Inc.
2727 N. Cascade Avenue, #160 | Colorado Springs, CO 80907
AltitudeLandCo.com | 720.594.9494 (Main)

Denver, CO | Colorado Springs, CO

VARIANCE REQUEST

Kimley»Horn

November 25, 2020

Mr. Jonathan Scherer
Colorado Springs Public Works
30 S. Nevada Ave #401
Colorado Springs, CO 80903

Subject: ***Newport Estates Filing No. 1***
Variance Request for Inlets used as Junctions and Retaining Wall within Detention Basin with Footings Below WQCV and EURV

This memorandum provides a summary of the project requirements, the design considerations, and the subsequent request for a variance to the City of Colorado Springs Drainage Criteria Manual (the "Criteria") to allow for storm inlets to be used as junctions as part of the drainage improvements for the Newport Estates Filing No. 1 (the "Project").

Location

The Project is located within the northwest ¼ corner of Section 11, Township 13 South, Range 66 West of the 6th Principal Meridian, City of Colorado Springs, County of El Paso, State of Colorado (see Vicinity Map in Appendix). The property is bounded by Newport Heights West Subdivision Filing No. 9 (Rec. No. 201019244) to the west, Bridle Pass Drive and Newport Heights West Subdivision Filing No. 10 (Rec. No. 99164242) to the south, Newport Heights East Subdivision Filing No. 1 (Rec. No. 981564581) and Big Timber Drive to the east and Cottonwood Creek to the north. The Property is currently undeveloped and consists of vacant land. The Project includes constructing 31 patio homes with garages near the southwest corner of Woodmen Drive and Austin Bluffs Parkway. Site improvements consist of two public streets with cul-de-sac dead ends, dedicated tracts, water, sewer and storm facilities. Storm sewer main is shown under the west sidewalks with inlets shown as junction structures along the trunk line to help maintain utility separations. Additionally, a retaining wall is shown along the perimeter of the proposed private extended detention basin (less than 50% of perimeter) to achieve needed storage requirements. The footings for this retaining wall are proposed to be below the WQCV and EURV.

Drainage Criteria and Justification for Deviation

Volume 1, Section 9.6.2 of the Criteria provides direction on the type of bends allowed in a stormwater pipes:

"Inlets may be used as junction structures in place of manholes to connect adjacent inlets if the interconnecting pipe can be fit within the standard inlet dimensions without modification to the inlet and if the additional flow can be passed through the structure in accordance with standard hydraulic criteria. **Inlets may not be used as junctions along trunk lines.**"

- Site includes public water main, sanitary main, primary electric, and gas main to be fit within a 28' FL-FL roadway section.
- Sanitary main per CSU standards is to run down the center of the public street, water is run east or north of the sanitary main and have at least 4' from edge of pavement/ lip of gutter and

10’ of separation from the water main.
- Storm Sewer is shown with a minimum 10’ separation from both water main and sanitary main.
- Roadways on site include several horizontal bends which make achieving CSU required separations from edge of pavement/lip of gutter difficult to maintain.
- Storm sewer is shown under west sidewalks to provide 10’ separation from water mains and sanitary mains. The inlets are shown as junction structures on the storm sewer trunk line to meet these constraints.

Volume 1, Section 13.5.13 of the Criteria provides direction on the use of retaining walls within detention basins:

“The use of retaining walls within detention basins is discouraged due to the potential increase in longterm maintenance costs and concerns regarding the safety of the general public and maintenance personnel. Retaining walls shall only be considered for on-site facilities. **If retaining walls are proposed, footings shall be located above the WQCV or EURV**.”

- Existing public 30-inch storm pipe directly west of detention basin was not previously platted with public easement.
- 15-foot Public Drainage Easement will now be dedicated per plat to provide access to the 30-inch storm pipe.
- Footprint of detention basin needs to be reduced and walls used to achieve needed storage to accommodate the proposed Public Drainage Easement.
- Lot sizes must remain constant under current zoning requirements.

Conclusion

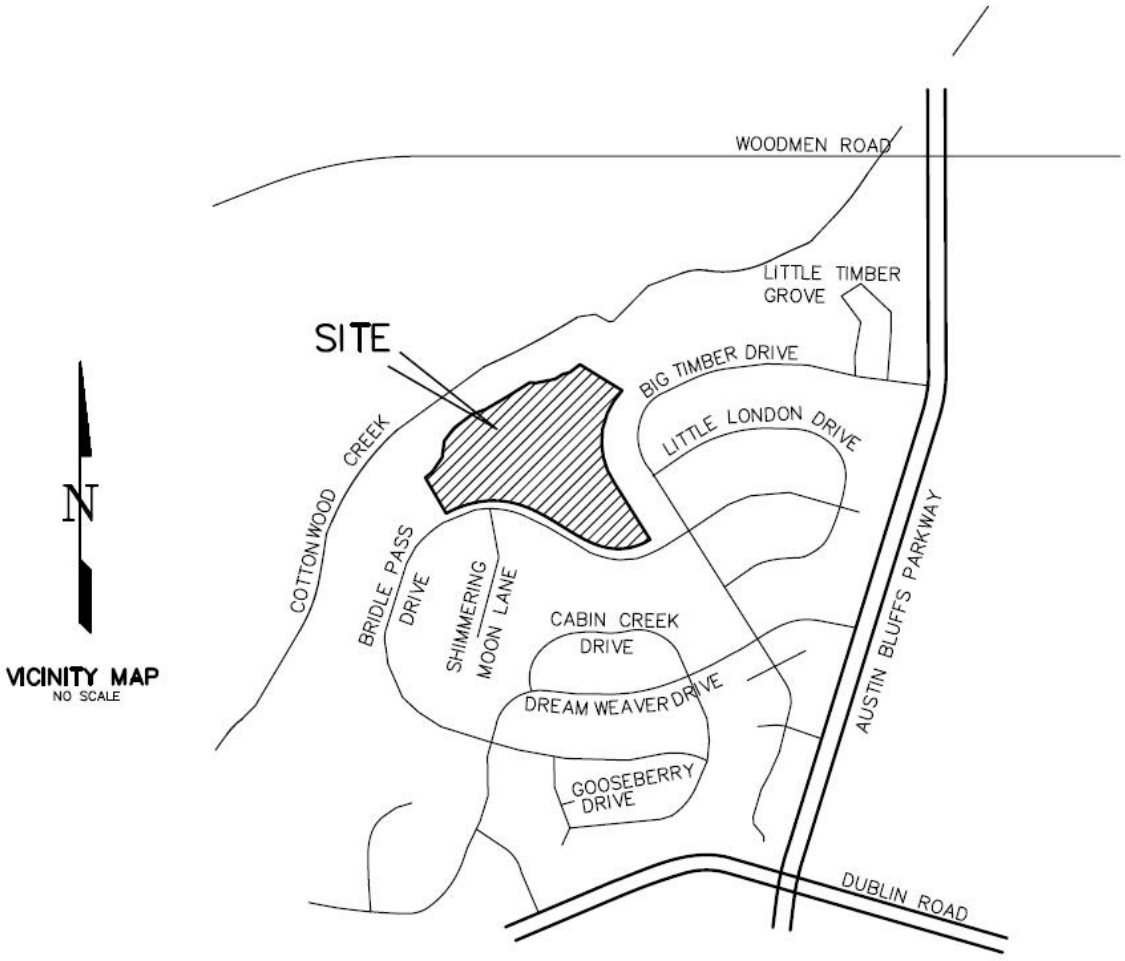
Due to several site constraints, inlets are proposed as junctions on the storm sewer trunk line and retaining walls are proposed within the detention basin with footings below the WQCV and EURV. This variance has no impact on peak flows and water quality within Fountain Creek, as all the requests to variance deal with methods of connection and storage. We hereby request that these variances from the Criteria be granted due to the challenges associated with the site constraints noted above. Should you have any questions or concerns, please do not hesitate to contact me at (719) 453-0182.

Sincerely,

KIMLEY-HORN AND ASSOCIATES, INC.

Eric J. Gunderson, P.E.
Project Manager

Vicinity Map



NEWPORT HEIGHTS WEST FILING NO. 10 FINAL DRAINAGE REPORT

NEWPORT HEIGHTS WEST FILING NO. 9 AND 10
FINAL DRAINAGE REPORT

APRIL, 1999

Prepared for:

Development Management, Inc.
4065 Sinton Road, Suite 200
Colorado Springs, CO 80907
(719) 593-2600

Prepared by:

Rockwell-Minchow Consultants, Inc.
2928 Straus Lane, Suite 100
Colorado Springs, CO 80907
(719) 475-2575

Project # 99-015

NEWPORT HEIGHTS FILINGS 9 AND 10
DRAINAGE PLAN STATEMENTS

ENGINEER'S STATEMENT

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the City of Colorado Springs for drainage reports, and said drainage report is in conformity with the Master Plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

Kent D. Rockwell, P.E.

COLORADO REGISTERED KENT D. ROCKWELL 25066 6/14/99 PROFESSIONAL ENGINEER

DEVELOPER'S STATEMENT

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

Development Management, Inc.

BY: _____ DATE 6/14/99

Kent Petre

TITLE: President

ADDRESS: 4065 Sinton Road, Suite 200
Colorado Springs, CO 80907

CITY OF COLORADO SPRINGS

Filed in accordance with Section 15-3-906 of the code of the City of Colorado Springs, 1980, as amended.

_____ Dec 22, 1999

CITY ENGINEER DATE

NEWPORT HEIGHTS FILINGS 9 AND 10
FINAL DRAINAGE REPORT
APRIL, 1999

PURPOSE

The purpose of this Final Drainage Report is to identify the existing and proposed runoff patterns affecting the Newport Heights Filings 9 and 10 subdivisions. This report will also recommend proposed drainage facilities and improvements required for the development of these subdivisions.

SUMMARY OF DATA

The sources of information used in the development of this study are listed below:

1. City of Colorado Springs and El Paso County "Drainage Criteria Manual", October 1987, revised November 1991.

2. Soil Survey for El Paso County, Colorado, U.S. Department of Agriculture, Soil Conservation Service, June 1980.

3. "Flood Insurance Studies for Colorado Springs and El Paso County, Colorado", prepared by the Federal Emergency Management Agency (FEMA), 1997.

4. "Cottonwood Creek Drainage Basin Planning Study" by URS Consultants, Inc., August, 1995.

5. "Cottonwood Creek Drainage Basin Planning Study" by Ayres Associates, October, 1996.

6. "Newport Heights Master Development Drainage Plan" by Rockwell Minchow Consultants, August 14, 1998.

GENERAL LOCATION AND DESCRIPTION

Newport Heights Filings 9 and 10 are located within the City of Colorado Springs, El Paso County, Colorado, within Section 11, Township 13 South, Range 66 West of the 6th P.M. (see Vicinity Map - Figure 1). These 2 subdivisions are bound on the north by open space, future park and future Newport Heights residential development; on the west by Cottonwood Creek; on the south by Newport Heights West Filing No. 2, Filing No. 5 and Filing No. 6; on the east by Newport East Filing No. 1, Filing No. 3 and Filing No. 4. Each of these Newport Heights subdivisions are residential subdivisions.

Existing ground cover originally consisted of well-established native grasses over the entire site. The site has recently been overlot graded as part of the overall Newport Heights Development. The entire development lies within the Cottonwood Creek Drainage Basin. There are no existing drainage facilities on the site.

SOILS

According to the Soil Survey of El Paso County Area, Colorado, prepared by the U.S. Department of Agriculture Soil Conservation Service, the soils underlying the Newport Heights Development consists of two soil types (See Figure 2). The first is Blakeland (Soil No. 8) which is considered a hydrological group A soil. The second soil type (Soil No. 98) is a combination of the Truckton series which is a hydrological group B soil and the Blakeland series which is a hydrological group A soil. Therefore, runoff coefficients were selected based on the A and B type soils.

CLIMATE

This area of El Paso County can be described as the foothills, with total precipitation amounts typical of a semi-arid region. Winters are generally cold and dry, and summers relatively warm and dry. Precipitation ranges from 12 to 14 inches per year, with the majority of this moisture occurring in the spring and summer in the form of rainfall. Thunderstorms are common during the summer months.

FLOODPLAIN STATEMENT

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panels #08041CO528F & #08041CO536F, none of the site lies in a designated floodplain.

DRAINAGE CRITERIA

The current City of Colorado Springs/El Paso County Drainage Criteria was utilized in this report. Peak runoff quantities were determined using the Rational Method for both the 5 year and 100 year storms, as required for drainage area less than 100 acres.

HISTORIC DRAINAGE BASIN DESCRIPTIONS

A brief description of each historic drainage basin for the site is provided in this section of the report. A summary of peak historic runoff rates for each of the basins is depicted on the Historic Drainage Plan provided in the appendix (Exhibit 1). The site has been divided into 2 historical drainage basins which depict the area within the proposed Newport Heights West Filings 9 and 10.

Basin H-1 consists of 7.32 acres north of proposed Filings 9 and 10. Runoff rates of Q_5 = 4.9 cfs and Q_{100} = 12.0 cfs generated from this basin flow to the west and enter Cottonwood Creek as sheet flow.

Approximately 47.61 acres directly south of Basin H-1 comprises Basins H-2. This basin generates runoff rates of 30.9 cfs during the 5 year storm and 75.0 cfs during the 100 year storm. Runoff from this basin also sheet flows to the west and enters Cottonwood Creek.

DEVELOPED DRAINAGE BASIN DESCRIPTIONS

Newport Heights Filings 9 and 10 will consist of single family residential lots. A brief description of each developed drainage basin including developed runoff rates, drainage patterns and proposed drainage facilities for each basin is provided in this section of the report. A summary of peak developed runoff for the basins and designated design points are depicted on the Developed Drainage Plan provided in the back of the report (Exhibit 2).

Several off-site areas contribute flows to proposed Newport Heights West Filings 9 and 10. Off-site Basin OS-1 consists of 2.45 acres located just northwest of proposed Filing No. 10. This basin generates runoff rates of 6.0 cfs during the 5 year storm and 12.2 cfs during the 100 year storm. Runoff flows westerly within the south side of Bridle Pass Drive and enters Basin I as street flow.

Likewise, runoff rates of Q_5 = 8.9 cfs and Q_{100} = 18.0 cfs generated from the 3.62 acre off-site Basin OS-2 flow westerly within the north side of Bridle Pass Drive. These flows enter on-site Basin III as street flow.

Basin I consists of 4.14 acres along the south side of Bridle Pass Drive and generates runoff rates of Q_5 = 9.2 cfs and Q_{100} = 18.5 cfs. These flows combine with the flows from off-site Basin OS-1 and reach Design Point 2 as street flow. The flows from the lots upstream of Basin I will be conveyed through Basin I within side lot swales which shall be constructed as part of the house construction and final lot landscaping. The combined flows reaching Design Point 2 are 14.2 cfs during the 100 year storm and 28.6 cfs during the 100 year storm. This portion of Bridle Pass Drive at a minimum slope of 4% and a 5 year street capacity of 22.5 cfs per side has adequate capacity to convey these flows to the intersection of Shimmering Moon Lane and Bridle Pass Drive.

Shimmering Moon Lane and the lots on either side of Shimmering Moon Lane comprise Basin II. Runoff rates of 11.6 cfs and 23.9 cfs are generated from this basin during the 5 year and 100 year storms, respectively. Swales will also be utilized along the side lot lines to convey the flows from upstream lots. Shimmering Moon Lane has a 5 year street capacity of 15.9 cfs per side based on a street slope of 2%. A 15' inlet will be installed on the west side of Shimmering Moon Lane just south of Bridle Pass Drive to limit the street flows just west of the Shimmering Moon Lane and Bridle Pass Drive intersection. This inlet will collect 7.2 cfs during the 5 year storm and 11.3 cfs during the 100 year storm. Approximately 4.4 cfs during the 5 year storm and 12.6 cfs during the 100 year storm will combine with the flows reaching Design Point 2. This results in total street flows of Q_5 = 18.6 cfs and Q_{100} = 41.2 cfs reaching a 20' inlet just west of the Shimmering Moon Lane and Bridle Pass Drive intersection. This 20' inlet will collect 11.4 cfs during the 5 year storm and 18.3 cfs during the 100 year storm. Street flows of Q_5 = 7.2 cfs and Q_{100} = 22.9 cfs will enter Basin V just west of this 20' inlet.

Basin III consists of the north side of Bridle Pass Drive and the lots to the north of Bridle Pass Drive. This 3.70 acre basin generates runoff rates of 8.7 cfs during the 5 year storm and 17.3 cfs during the 100 year storm. Side lot swales will be utilized in this area to convey drainage from upstream lots to downstream lots. Combined runoff rates of Q_5 = 15.8 cfs and Q_{100} = 31.8 cfs generated from Basins III and OS-2 reach Design Point 3 as street flow. A 15' inlet will be constructed at Design Point 3 to collect 8.1 cfs during the 5 year storm and 10.9 cfs during the 100 year storm. Street flows of Q_5 = 7.7 cfs and Q_{100} = 20.9 cfs will enter Basin VI just downstream of the 15' inlet. A 24" RCP will convey the collected flows from the 2-15' inlets and the 1-20' inlet northwesterly to Cottonwood Creek.

Basin IV consists of future residential lots and open space. Runoff rates of 14.9 cfs during the 5 year storm and 30.5 cfs during the 100 year storm flow to the west toward Cottonwood Creek. These flows will enter Cottonwood Creek as sheet flow.

The 2.73 acres just downstream of Basin II comprises Basin V. As in the other similar situation, side low swales will convey runoff from the upstream lots through the downstream lots and into Bridle Pass Drive. The runoff rates of Q_5 = 6.4 cfs and Q_{100} = 13.2 cfs generated from this basin combine with the flows bypassing the 20' inlet resulting in street flows of 13.6 cfs during the 5 year storm and 36.1 cfs during the 100 year storm. These flows reach the north side of a proposed 20' inlet to be installed at the common low point of Basin V and Basin VII.

Basin VI, located just northwest of Basin V, generates runoff rates of 2.2 cfs during the 5 year storm and 4.4 cfs during the 100 year storm. Total flows of 9.9 cfs and 25.3 cfs, including the 7.7 cfs (5 year) and 20.9 cfs (100 year) bypassing Design Point 3, reach the proposed 20' sump inlet located at the low point of Basin VI.

Off-site Basins OS-3 and OS-4 combine at Design Point 1 just north of the Dream Weaver Drive and Bridle Pass Drive intersection. The combined flows at Design Point 1 are 18.5 cfs during the 5 year storm and 36.5 cfs during the 100 year storm. Based on a maximum street slope of 4%, Bridle Pass Drive has a 5 year street capacity of 22.5 cfs per side. This is adequate to convey the flows from Basins OS-3 and OS-4.

Basin VII, consisting of 3.26 acres along the north side of Bridle Pass Drive, generates runoff rates of 8.4 cfs during the 5 year storm and 16.9 cfs during the 100 year storm. These flows combine with the flows from Design Point 1 and continue west and north within Bridle Pass Drive. The street capacity of Bridle Pass Drive along its north side is exceeded just east of the Standing Rock Place and Bridle Pass Drive intersection. A 20' on-grade inlet will be installed at this point to collect runoff rates of 11.6 cfs during the 5 year storm and 17.1 cfs during the 100 year storm. An 18" RCP will convey these flows to the low point of Bridle Pass Drive. The remaining flows generated from Basin VII along with the flows bypassing the 20' on-grade inlet will continue to the low point in Bridle Pass Drive. Runoff rates of $Q_5 = 14.2$ and $Q_{100} = 34.2$ approach a proposed 20' sump inlet along the east side of Bridle Pass from the south. As stated above, runoff rates of 13.6 cfs during the 5 year storm and 36.1 cfs reach this same sump inlet from the north.

Basin VIII consists of the southwest side of Bridle Pass Drive and generates runoff of 2.7 cfs during the 5 year storm and 5.4 cfs during the 100 year storm. A portion of the flows ($Q_5 = 1.1$ cfs and $Q_{100} = 2.1$ cfs) reaching Design Point 1 enter this basin as street flow. Street flows of 3.8 cfs during the 5 year storm and 7.5 cfs during the 100 year storm reach a second 20' sump inlet along the west side of Bridle Pass Drive from the south. Runoff rates of 9.9 cfs and 25.3 cfs reach this same inlet from the north during the 5 year and 100 year storms, respectively. A 36" RCP and 42" RCP will convey these flows to Cottonwood Creek.

Basin IX consists of the Standing Rock Place cul-de-sac and the surrounding lots. This 3.23 acre basin generates runoff rates of 8.7 cfs during the 5 year storm and 17.4 cfs during the 100 year storm. The drainage created from the upstream lots will be conveyed to the proposed cul-de-sac via side lot swales. A 4' sump inlet will collect these flows and a 18" RCP will convey these flows to Cottonwood Creek.

Basin X consists of the rear lots of several lots on the west side of Bridle Pass Drive. Runoff rates of $Q_5 = 14.0$ cfs and $Q_{100} = 28.0$ cfs sheet flow through this basin and into Cottonwood Creek.

All on-site residential and collector streets, as well as adjoining arterial streets will remain within street capacity. Individual lot drainage, including the side lot swales utilized to convey runoff from the upstream lots through the downstream lots, is the responsibility of the lot owner/builder/homeowner.

In addition to the on-site facilities required for this subdivision, a grade control structure will have to be constructed along Cottonwood Creek as specified in Ayres' Prudent Line Study for Cottonwood Creek.

EROSION CONTROL

Erosion control measures will be installed per approved grading/erosion control plans.

DRAINAGE, BRIDGE AND POND FEES

Newport Heights West Filings 9 and 10 are within the Cottonwood Creek Drainage Basin. The 1999 Drainage, Bridge and Pond Fees for these filings are listed below.

Filing No. 9

	Acres	$/Acre	Total Fee
Drainage Fees	11.329	$5,673.00	$64,269.42
Add'l Drainage Fees	11.329	$ 709.00	$ 8,032.26
Bridge Fees	11.329	$ 285.00	$ 3,228.77
Add'l Bridge Fees	11.329	$ 280.00	$ 3,172.12
Pond Fees (Land)	11.329	$ 110.00	$ 1,246.19
Pond Fees (Facilities)	11.329	$ 344.00	$ 3,897.18
			$83,845.94

Filing No. 10

	Acres	$/Acre	Total Fee
Drainage Fees	9.058	$5,673.00	$51,386.03
Add'l Drainage Fees	9.058	$ 709.00	$ 6,422.12
Bridge Fees	9.058	$ 285.00	$ 2,581.53
Add'l Bridge Fees	9.058	$ 280.00	$ 2,536.24
Pond Fees (Land)	9.058	$ 110.00	$ 996.38
Pond Fees (Facilities)	9.058	$ 344.00	$ 3,115.95
			$67,038.25

DRAINAGE FACILTIES

The following drainage facilities will be required within Filings 9 and 10. These will be public non-reimbursable facilities.

Filing No. 9

ITEM	QUANTITY		UNIT PRICE	EXTENDED COST
4' D-10-R Inlets	1	Ea.	$2,000.00	$ 2,000.00
20' D-10-R Inlets	3	Ea.	$5,200.00	$ 15,600.00
18" RCP	650	L.F.	$28.00	$ 18,200.00
36" RCP	40	L.F.	$44.00	$ 1,760.00
42" RCP	320	L.F.	$62.00	$ 19,840.00
Rip Rap Pad	1	Ea.	$1,500.00	$ 1,500.00
			Sub-Total	$ 58,900.00
			15% Eng. & Contingency	$ 8,835.00
			Grand Total	$ 67,735.00

Filing No. 10

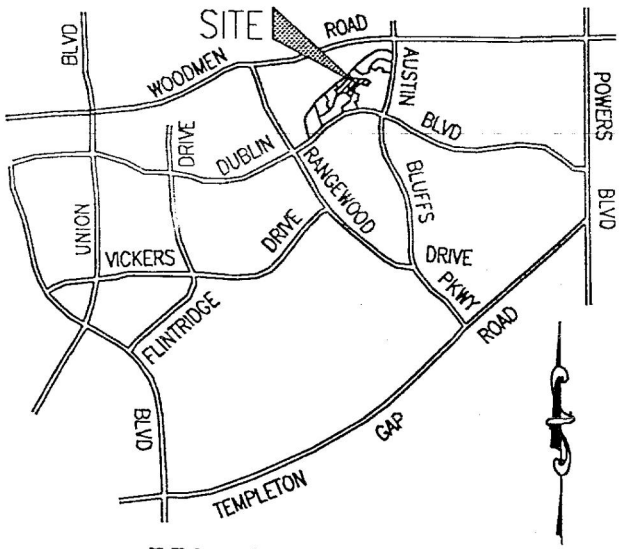
ITEM	QUANTITY		UNIT PRICE	EXTENDED COST
15' D-10-R Inlets	2	Ea.	$4,000.00	$ 8,000.00
20' D-10-R Inlets	1	Ea.	$5,200.00	$ 5,200.00
Type 2 Manhole	1	Ea.	$2,000.00	$ 2,000.00
18" RCP	15	L.F.	$28.00	$ 420.00
24" RCP	410	L.F.	$32.00	$13,120.00
24" x 45° Bend	1	Ea.	$400.00	$ 400.00
Rip-Rap Pad	1	Ea.	$1,500.00	$ 1,500.00
			Sub-Total	$ 30,640.00
			15% Eng. & Contingency	$ 4,596.00
			Grand Total	$35,236.00

Flint #10

The proposed grade control structure along Cottonwood Creek will be a public reimbursable item.

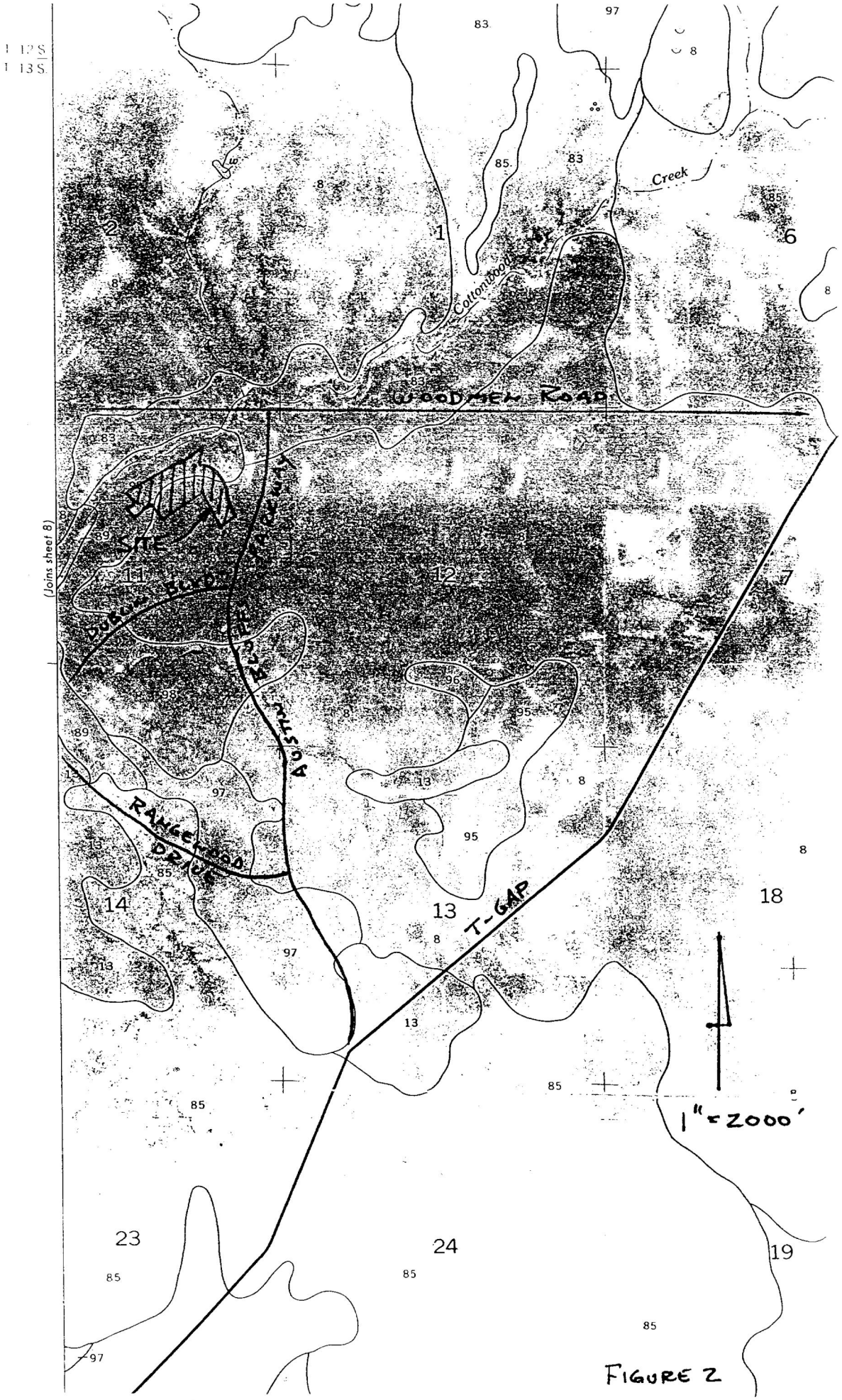
Item	Quantity	Unit Cost	Extended Cost
1. Channel Grade Control Structure	1 Ea.	$75,500.00/Ea	$ 75,500.00
	Sub-Total		$ 75,500.00
	15 % Engineering and Contingency		$ 11,325.00
	Grand Total		$ 86,825.00

APPENDIX



Vicinity Map

NOT TO SCALE


WOODMEN ROAD
SITE
DUBOIS BLVD
RED STAR PKWY
RAILROAD DRIVE
T-GAP
Cotton Boot Creek
(Joins sheet 8)
1"=2000'
FIGURE 2

Hydrology

Location: H-1
Area: 7.32 Ac.
Soil or Land Use: _____

Runoff Coefficient, C:

Area Zone	C5	C100	%Area
OPEN SPACE	0.25	0.35	

Composite: C5 0.25 C100 0.35 100%

Time of Concentration: T_c in minutes:

Travel Type	L(ft)	s%	v(fps)	T_c
OVERLAND	850	8.5%		22.9

T_c Total: 22.9

Intensity, I (inches/hr) from Fig 5-1

I5: 2.7 in/hr I100 4.7 in/hr

Peak Flow: Q = CIA in cfs

Q5 4.7 cfs Q100: 12.0 cfs

Hydrology

Location: H-2
Area: 47.6 Ac.
Soil or Land Use: _____

Runoff Coefficient, C:

Area Zone	C5	C100	%Area
OPEN SPACE	0.25	0.35	

Composite: C5 0.25 C100 0.35 100%

Time of Concentration: T_c in minutes:

Travel Type	L(ft)	s%	v(fps)	T_c
OVERLAND	850	7.8%		23.5
SWALE	350	5.0%	3.5	1.6

T_c Total: 25.2

Intensity, I (inches/hr) from Fig 5-1

I5: 2.6 in/hr I100 4.5 in/hr

Peak Flow: Q = CIA in cfs

Q5 30.9 cfs Q100: 75.0 cfs

Hydrology

Location: OS-1
Area: 2.45 Ac.
Soil or Land Use: _____

Runoff Coefficient, C:

Area Zone	C5	C100	%Area
1/3 Ac R-2	0.60	0.70	

Composite: C5 0.60 C100 0.70 100%

Time of Concentration: T_c in minutes:

Travel Type	L(ft)	s%	v(fps)	T_c
OVERLAND	150	4%		7.2
STREET	400	2%	3	2.2

T_c Total: 9.4

Intensity, I (inches/hr) from Fig 5-1

I5: 4.1 in/hr I100 7.1 in/hr

Peak Flow: Q = CIA in cfs

Q5 6.0 cfs Q100: 12.2 cfs

Hydrology

Location: OS-2
Area: 3.62 Ac.
Soil or Land Use: _____

Runoff Coefficient, C:

Area Zone	C5	C100	%Area
1/3 Ac R-2	0.60	0.70	

Composite: C5 0.60 C100 0.70 100%

Time of Concentration: T_c in minutes:

Travel Type	L(ft)	s%	v(fps)	T_c
OVERLAND	150	4%		7.2
STREET	400	2%	3.0	2.2

T_c Total: 9.4

Intensity, I (inches/hr) from Fig 5-1

I5: 4.1 in/hr I100 7.1 in/hr

Peak Flow: Q = CIA in cfs

Q5 8.9 cfs Q100: 18.0 cfs

Hydrology

Location: OS-3
Area: 6.04 Ac.
Soil or Land Use: _____

Runoff Coefficient, C:

Area Zone	C5	C100	%Area
1/8 Ac Res	0.60	0.70	

Composite: C5 0.60 C100 0.70 100%

Time of Concentration: T_c, in minutes:

Travel Type	L(ft)	s%	v(fps)	T_c
OVERLAND	200	5%		7.8
STREET	650	2.8%	3.2	3.4

T_c Total: 11.2

Intensity, I (inches/hr) from Fig 5-1

I5: 3.9 in/hr I100 6.6 in/hr

Peak Flow: Q = CIA in cfs

Q5 14.1 cfs Q100: 27.9 cfs

Hydrology

Location: OS-4
Area: 1.87 Ac
Soil or Land Use: _____

Runoff Coefficient, C:

Area Zone	C5	C100	%Area
1/8 Ac Res			

Composite: C5 0.60 C100 0.70 100%

Time of Concentration: T_c, in minutes:

Travel Type	L(ft)	s%	v(fps)	T_c
OVERLAND	150	3.3%		7.7
STREET	450	4.0%	4.0	1.9

T_c Total: 9.6

Intensity, I (inches/hr) from Fig 5-1

I5: 4.1 in/hr I100 7.1 in/hr

Peak Flow: Q = CIA in cfs

Q5 4.6 cfs Q100: 9.3 cfs

Hydrology

Location: I
Area: 4.14 Ac.
Soil or Land Use: _____

Runoff Coefficient, C:

Area Zone	C5	C100	%Area
1/3 Ac Res	0.60	0.7	

Composite: C5 0.60 C100 0.7 100%

Time of Concentration: T_c in minutes:

Travel Type	L(ft)	s%	v(fps)	T_c
OVERLAND	300	4%		10.2
STREET	650	4.6%	4.5	2.4

T_c Total: 12.6

Intensity, I (inches/hr) from Fig 5-1

I5: 3.7 in/hr I100 6.4 in/hr

Peak Flow: Q = CIA in cfs

Q5 9.2 cfs Q100: 18.5 cfs

Hydrology

Location: II
Area: 4.94 Ac
Soil or Land Use: _____

Runoff Coefficient, C:

Area Zone	C5	C100	%Area
1/3 Ac Res	0.60	0.7	

Composite: C5 0.60 C100 0.7 100%

Time of Concentration: T_c in minutes:

Travel Type	L(ft)	s%	v(fps)	T_c
OVERLAND	200	5%		7.8
STREET	550	2%	3.0	3.1

T_c Total: 10.9

Intensity, I (inches/hr) from Fig 5-1

I5: 3.9 in/hr I100 6.9 in/hr

Peak Flow: Q = CIA in cfs

Q5 11.6 cfs Q100: 23.9 cfs

Hydrology

Location: III
Area: 3.70 Ac.
Soil or Land Use: _____

Runoff Coefficient, C:

Area Zone	C5	C100	%Area
1/8 Ac. R/S	0.60	0.70	

Composite: C5 0.60 C100 0.70 100%

Time of Concentration: T_c in minutes:

Travel Type	L(ft)	s%	v(fps)	T_c
OVERLAND	260	5.4%		8.6
SWALE	750	4.6%	4.5	2.8

T_c Total: 11.4

Intensity, I (inches/hr) from Fig 5-1

I5: 3.9 in/hr I100 6.7 in/hr

Peak Flow: Q = CIA in cfs

Q5 8.7 cfs Q100: 17.3 cfs

Hydrology

Location: IV
Area: 6.22 Ac.
Soil or Land Use: _____

Runoff Coefficient, C:

Area Zone	C5	C100	%Area
1/8 Ac. R/S	0.60	0.70	

Composite: C5 0.60 C100 0.70 100%

Time of Concentration: T_c in minutes:

Travel Type	L(ft)	s%	v(fps)	T_c
OVERLAND	220	10%		6.5
SWALE	450	10%	2.2	3.4

T_c Total: 9.9

Intensity, I (inches/hr) from Fig 5-1

I5: 4.9 in/hr I100 7.9 in/hr

Peak Flow: Q = CIA in cfs

Q5 14.9 cfs Q100: 30.5 cfs

Hydrology

Location: V
Area: 2.73 Ac.
Soil or Land Use: _____

Runoff Coefficient, C:

Area Zone	C5	C100	%Area
1/3 Ac Res	0.60	0.70	

Composite: C5 0.6- C100 0.7- 100%

Time of Concentration: T_c in minutes:

Travel Type	L(ft)	s%	v(fps)	T_c
OVERLAND	200	4%		8.4
STREET	400	2.5%	3.1	2.2

T_c Total: 10.6

Intensity, I (inches/hr) from Fig 5-1

I5: 3.9 in/hr I100 6.9 in/hr

Peak Flow: Q = CIA in cfs

Q5 6.4 cfs Q100: 13.2 cfs

Hydrology

Location: VI
Area: 0.79 Ac
Soil or Land Use: _____

Runoff Coefficient, C:

Area Zone	C5	C100	%Area
1/3 Ac Res	0.60	0.70	

Composite: C5 0.60 C100 0.70 100%

Time of Concentration: T_c in minutes

Travel Type	L(ft)	s%	v(fps)	T_c
OVERLAND	50	4%		4.2
STREET	500	2.5%	3.1	2.7

T_c Total: 6.9

Intensity, I (inches/hr) from Fig 5-1

I5: 4 in/hr I100 8.0 in/hr

Peak Flow: Q = CIA in cfs

Q5 3.2 cfs Q100: 4.4 cfs

Hydrology

Location: VII
Area: 3.26 Ac.
Soil or Land Use: _____

Runoff Coefficient, C:

Area Zone	C5	C100	%Area
½ Ac Res	0.60	0.70	

Composite: C5 0.60 C100 0.70 100%

Time of Concentration: T_c, in minutes:

Travel Type	L(ft)	s%	v(fps)	T_c
OVERLAND	150	4%		7.2
STREET	450	5.9%	4.8	1.6

T_c Total: 8.8

Intensity, I (inches/hr) from Fig 5-1

I5: 4.3 in/hr I100 7.4 in/hr

Peak Flow: Q = CIA in cfs

Q5 8.4 cfs Q100: 16.9 cfs

Hydrology

Location: VIII
Area: 0.90 Ac
Soil or Land Use: _____

Runoff Coefficient, C:

Area Zone	C5	C100	%Area
½ Ac Res	0.60	0.70	

Composite: C5 0.60 C100 0.70 100%

Time of Concentration: T_c, in minutes:

Travel Type	L(ft)	s%	v(fps)	T_c
OVERLAND	50	4%		4.2
STREET	450	5.8%	4.8	1.6

T_c Total: 5.8

Intensity, I (inches/hr) from Fig 5-1

I5: 5 in/hr I100 8.5 in/hr

Peak Flow: Q = CIA in cfs

Q5 2.7 cfs Q100: 5.4 cfs

Hydrology

Location: IX
Area: 3.23 Ac.
Soil or Land Use: _____

Runoff Coefficient, C:

Area Zone	C5	C100	%Area
1/8 Ac Res	0.60	0.70	

Composite: C5 0.60 C100 0.70 100%

Time of Concentration: T_c in minutes:

Travel Type	L(ft)	s%	v(fps)	T_c
OVERLAND	150	4.7%		6.9
STREET	230	4.0%	4.0	1.0

T_c Total: 7.9

Intensity, I (inches/hr) from Fig 5-1

I5: 4.5 in/hr I100 7.7 in/hr

Peak Flow: Q = CIA in cfs

Q5 8.7 cfs Q100: 17.4 cfs

Hydrology

Location: X
Area: 5.20 Ac.
Soil or Land Use: _____

Runoff Coefficient, C:

Area Zone	C5	C100	%Area
1/8 Ac Res	0.60	0.70	

Composite: C5 0.60 C100 0.70 100%

Time of Concentration: T_c in minutes:

Travel Type	L(ft)	s%	v(fps)	T_c
OVERLAND	300	10%		7.6

T_c Total: 7.6

Intensity, I (inches/hr) from Fig 5-1

I5: 4.5 in/hr I100 7.7 in/hr

Peak Flow: Q = CIA in cfs

Q5 14.0 cfs Q100: 28.0 cfs

Hydrology

Location: DESIGN PT #1
Area: 7.91 Ac.
Soil or Land Use: _____

Runoff Coefficient, C:

Area Zone	C5	C100	%Area
OS-3	0.60	0.70	
OS-4	0.60	0.70	

Composite: C5 0.60 C100 0.70 100%

Time of Concentration: T_c, in minutes:

Travel Type	L(ft)	s%	v(fps)	T_c
BASIN OS-3				11.2

T_c Total: 11.2

Intensity, I (inches/hr) from Fig 5-1

I5: 3.9 in/hr I100 6.6 in/hr

Peak Flow: Q = CIA in cfs

Q5 18.5 cfs Q100: 36.5 cfs

Hydrology

Location: _____
Area: _____ Ac.
Soil or Land Use: _____

Runoff Coefficient, C:

Area Zone	C5	C100	%Area

Composite: C5 C100 100%

Time of Concentration: T_c, in minutes:

Travel Type	L(ft)	s%	v(fps)	T_c

T_c Total: _____

Intensity, I (inches/hr) from Fig 5-1

I5: in/hr I100 in/hr

Peak Flow: Q = CIA in cfs

Q5 cfs Q100: cfs

Hydrology

Location: DP # 2
Area: 6.59 Ac.
Soil or Land Use: _____

Runoff Coefficient, C:

Area Zone	Area	C5	C100	%Area
OS-1	2.45	0.60	0.70	
I	4.14	0.60	0.70	
	6.59			

Composite: C5 0.60 C100 0.70 100%

Time of Concentration: T_c in minutes:

Travel Type	L(ft)	s%	v(fps)	T_c
BASIN OS-1				9.4
STREET	800	4%	4.0	3.3

T_c Total: 12.7

Intensity, I (inches/hr) from Fig 5-1

I5: 3.6 in/hr I100 6.2 in/hr

Peak Flow: Q = CIA in cfs

Q5 14.2 cfs Q100: 23.0 cfs

Hydrology

Location: DP # 3
Area: 7.32 Ac.
Soil or Land Use: _____

Runoff Coefficient, C:

Area Zone	Area	C5	C100	%Area
OS-2	3.62	0.60	0.70	
III	3.70	0.60	0.70	
	7.32			

Composite: C5 0.60 C100 0.70 100%

Time of Concentration: T_c in minutes:

Travel Type	L(ft)	s%	v(fps)	T_c
BASIN OS-2				9.4
STREET	800	4%		3.3

T_c Total: 12.7

Intensity, I (inches/hr) from Fig 5-1

I5: 3.6 in/hr I100 6.2 in/hr

Peak Flow: Q = CIA in cfs

Q5 15.8 cfs Q100: 31.8 cfs

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BASIN II

$Q_5 = 11.6$

$S = 2\%$

$T = 3.04 \left[\frac{T}{(S)^{1/2}} \right]^{0.375}$

$T_5 = 3.04 \left[\frac{11.6}{(.02)^{1/2}} \right]^{0.375}$

$T_5 = 15.9$

$F_w = 16.4 \left[(T-2)(S_x) \right]^{1/2} S^{1/2}$

$F_w = 16.4 \left[(15.9-2)(0.02) \right]^{1/2} (0.02)^{1/2}$

$F_w = 1.87$

$L_1 = 2.49 (S_x)^{0.3} F_w T$

$= 2.49 (0.02)^{0.3} 1.87 (15.9)$

$L_1 = 22.9$

$L_2 = 3.27 (S_x)^{0.5} F_w T$

$= 3.27 (0.02)^{0.5} (1.87)(15.9)$

$= 13.7$

$L_3 = 1.65 (F_w)(T)$

$= 1.65 (1.87)(15.9)$

$L_3 = 49.1$

TRY $L_c = 15' > L_2$

$\therefore Q_c = Q \left(\frac{L_c}{L_3} \right)^{0.4}$

$= 11.6 \left(\frac{15}{49.1} \right)^{0.4}$

$Q_c = 7.2$

$Q_{FB} = 4.4$

$Q_{100} = 23.9$

$T_{100} = 3.04 \left[\frac{23.9}{(0.02)^{1/2}} \right]^{0.375}$

$T_{100} = 20.8$

$F_w = 16.4 \left[(20.8-2)(0.02) \right]^{1/2} (0.02)^{1/2}$

$F_w = 1.97$

$L_1 = 2.49 (0.02)^{0.3} (1.97)(20.8)$

$L_1 = 31.6$

$L_2 = 3.27 (0.02)^{0.5} 1.97 (20.8)$

$= 18.9$

$L_3 = 1.65 (1.97)(20.8)$

$L_3 = 67.6$

$L_c = 15 < L_2$

$\therefore Q_c = Q \left(\frac{L_c}{L} \right)$

$= 23.9 \left(\frac{15}{31.6} \right)$

$Q_c = 11.3$

$Q_{FB} = 12.6$

DESIGN PT #2

$Q_5 = 14.2$ $Q_{100} = 28.6$

FLOWBY FROM BASIN II ENTERS BRIDLE PASS DRIVE

(T_c's ARE SIMILAR)

$Q_5 = 14.2 + 4.4$

$= 18.6$

$Q_{100} = 28.6 + 2.6$

$= 41.2$

$S = 3\%$

5 YR STREET CAPACITY $= (112.6)(0.03)^{\frac{1}{2}}$

$= 19.5$ cfs/SIDE

∴ INSTALL ADD'L INLET JUST WEST OF SHIMMERING LANE & BRIDLE PASS DRIVE ON SOUTH SIDE OF BRIDLE PASS

$T = 3.04 \left[\frac{18.6}{(0.03)^{\frac{1}{2}}}\right]^{0.375}$

$= 17.6$

$T = 3.04 \left[\frac{41.2}{(0.03)^{\frac{1}{2}}}\right]^{0.375}$

$= 23.7$

$F_w = 16.4 \left[(17.6^2)(0.02)\right]^{\frac{1}{6}} (0.03)^{\frac{1}{2}}$

$= 2.34$

$F_w = 16.4 \left[(23.7^2)(0.02)\right]^{\frac{1}{6}} (0.03)^{\frac{1}{2}}$

$= 2.47$

$L_1 = 2.49(0.02)^{0.3} 2.34(17.6)$

$L_1 = 31.7$

$L_1 = 2.49(0.02)^{0.3} (2.47)(23.7)$

$L_1 = 45.1$

$L_2 = 3.27(0.02)^{0.5} 2.34(17.6)$

$L_2 = 19.0$

$L_2 = 3.27(0.02)^{0.5} 2.47(23.7)$

$L_2 = 27.1$

$L_3 = 1.65(2.34)(17.6)$

$= 68.0$

$L_3 = 1.65(2.47)(23.7)$

$= 96.6$

Try $L_1 = 20 > 19.0$

$\therefore Q_1 = Q\left(\frac{L_1}{L_3}\right)^{0.4}$

$Q_1 = 18.6\left(\frac{20}{68.0}\right)^{0.4}$

$Q_1 = 11.4$

$Q_{FB} = 7.2$

$L_1 = 20 < L_2$

$\therefore Q_1 = 41.2\left(\frac{20}{45.1}\right)$

$Q_1 = 18.3$

$Q_{FB} = 22.9$

DESIGN P_T #3

$S = 3\%$

$Q_5 = 15.8$

$T = 3.04\left[\frac{15.8}{(0.03)^{1/2}}\right]^{0.375}$

$T = 16.5$

$F_W = 16.4\left[(16.5-2)(0.02)\right]^{1/2}(0.03)^{1/2}$

$= 2.31$

$L_1 = 2.49(0.02)^{0.3}(2.31)(16.5)$

$= 29.3$

$L_2 = 3.27(0.02)^{0.3}(2.31)(16.5)$

$L_2 = 17.6$

$L_3 = 4.65(2.31)(16.5)$

$= 62.9$

Try $L_1 = 15 < L_2$

$Q_1 = Q\left(\frac{L_1}{L_3}\right)$

$= 15.8\left(\frac{15}{29.3}\right)$

$Q_1 = 8.1$

$Q_{FB} = 7.7$

$Q_{100} = 31.8$

$T = 3.04\left[\frac{31.8}{(0.02)^{1/2}}\right]^{0.375}$

$T = 23.2$

$F_W = 16.4\left[(23.2-2)(0.02)\right]^{1/2}(0.03)^{1/2}$

$= 2.46$

$L_1 = 2.49(0.02)^{0.3}(2.46)(23.2)$

$= 43.9$

$L_2 = 3.27(0.02)^{0.3}(2.46)(23.2)$

$L_2 = 26.4$

$L_3 = 4.65(2.46)(23.2)$

$= 94.2$

$L_1 = 15 < L_2$

$Q_1 = 31.8\left(\frac{15}{43.9}\right)$

$= 10.9$

$Q_{FB} = 20.9$

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FLOWS FROM BASIN V FROM BASIN I & II

$Q_5 = 6.4 + 7.2$

$= 13.6$

$Q_{100} = 13.2 + 22.9$

$= 36.1$

THESE FLOWS REACH LOW POINT OF BRIDGE PASS ON EAST SIDE OF STREET. ADD FLOWS REACH LOW PT FROM SOUTH FROM BASINS ES-2 & OS-4 & VIII

(DESIGN PT #1)

DESIGN POINT #1 FLOWS

SE SIDE OF BRIDGE PASS $Q_5 = (18.5)\left(\frac{0.45}{7.91}\right) = 1.1$

$Q_{100} = (36.5)\left(\frac{0.45}{7.91}\right) = 2.1$

NE SIDE OF BRIDGE PASS $Q_5 = 18.5\left(\frac{7.46}{7.91}\right) = 17.4$

$Q_{100} = 36.5\left(\frac{7.46}{7.91}\right) = 34.4$

5 yr STREET CAPACITY w/ 6" RAISED CURB $= 112.6\,(0.04)^{\frac{1}{2}}$

$= 22.5$

STREET FLOWS THROUGH BASIN VII

$Q_5 = 17.4 + 8.4$

$= 25.8$

$Q_{100} = 34.4 + 36.5$

$= 70.9$

∴ INSTALL INLET APPROXIMATELY 300' SOUTH OF LOW PT IN BRIDGE PASS

$Q_5 = 17.4 + \left(\frac{1.47}{3.26}\right)(8.4)$

$= 21.2$

$Q_{100} = 34.4 + \left(\frac{1.47}{3.26}\right)(10.0)$

$= 42.0$

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INLET @ STAMBOUL ROAD & BRASS POLE INTERSECTION

$Q_5 = 21.2$

$T = 3.04 \left[\frac{21.2}{(0.04)^2}\right]^{0.375}$

$T = 17.5$

$F_w = 2.70$

$L_1 = 2.49 (0.02)^{0.3} (2.70)(17.5)$

$= 36.4$

$L_2 = 3.27 (0.02)^{0.5} (2.70)(17.5)$

$L_2 = 21.9$

$L_3 = 1.65 (2.70)(17.5)$

$L_3 = 78.0$

TRY $L_1 = 20 < L_2$

$Q_i = 21.2 \left(\frac{20}{36.4}\right)$

$= 11.6$

$Q_{PB} = 9.6$

$Q_{100} = 42.0$

$T = 3.04 \left[\frac{42.0}{(0.04)^2}\right]^{0.375}$

$T = 22.6$

$F_w = 2.93$

$L_1 = 2.49 (0.02)^{0.3} (2.93)(22.6)$

$= 49.2$

$L_2 = 3.27 (0.02)^{0.5} (2.93)(22.6)$

$L_2 = 29.6$

$L_3 = 1.65 (2.93)(22.6)$

$= 105.5$

$Q_i = 42.0 \left(\frac{20}{49.2}\right)$

$= 17.1$

$Q_{PB} = 24.9$

TOTAL FLOW @ SUMP INLET (EAST SIDE)

$Q_5 = 9.6 + \frac{1.79}{3.72}(8.4)$

$Q_5 = 14.2$

$Q_{100} = 24.9 + \frac{1.79}{3.72}(16.9)$

$= 34.2$

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SUMP INLET EAST SIDE OF BRIDLE PASS

$Q_5 = 14.2$ $\quad$ $Q_5 = 13.6$

$Q_{100} = 34.2$ $\quad$ $Q_{100} = 36.1$

APPROACH FLOWS

$$Q = 0.56\left(\frac{1}{n}\right)(S_x)^{\frac{5}{3}}(S)^{\frac{1}{2}}\, d^{\frac{8}{3}}$$

$$14.2 = 0.56\left(\frac{1}{0.016}\right)(0.02)(0.003)^{\frac{1}{2}}\, d^{\frac{8}{3}} \qquad (5\ yr)$$

$$d = 0.49$$

$$36.1 = 0.56\left(\frac{1}{0.016}\right)(0.02)(0.003)^{\frac{1}{2}}\, d^{\frac{8}{3}} \qquad (100\ yr)$$

$$d = 0.69$$

TO MH FLOWS

$$Q = 1.7\left(L_1 + 1.8(w)\right)(d_{max} + 0.33)^{1.5}$$

$$27.8 = 1.7\left(20 + 1.8(3)\right)(d_{max} + 0.33)^{1.5}$$

$$d = 0.46$$

$$70.3 = 1.7\left(20 + 1.8(3)\right)(d_{max} + 0.33)^{1.5}$$

$$d = 0.97$$ *

FLOWS WILL OVERTOP & SPILL

SUMP INLET WEST SIDE OF BRIDLE PASS

BASIN [illegible] & PORTION OF OP [illegible] | BASIN XI + F.C. BY OP #3

$Q_5 = 2.7 + 1.1 = 3.8$ → ▭ ← $Q_5 = 2.2 + 7.7 = 9.9$

$Q_{100} = 5.4 + 2.1 = 7.5$ | $Q_{100} = 4.4 + 20.9 = 25.3$

[illegible]

TOTAL FLOWS : TRY L=20

Q_5 $13.7 = 1.7(20 + 1.8(3))(d_{max} + 0.33)^{1.85}$

$d = 0.21$

Q_{100} $32.8 = 1.7(20 + 1.8(3))(d_{max} + 0.33)^{1.85}$

$d = 0.53$

CHECK TOTAL 100 YR FLOWS

TOTAL $Q_{100} = 34.2 + 36.1 + 7.5 + 25.3$

$= 103.1$

$103.1/2 = 51.6$

$51.6 = 1.7(20 + 1.8(3))(d_{max} + 0.33)^{1.85}$

$d = 0.77$ ∴ OK

Basin IX

$Q_5 = 8.7$ $Q_{100} = 17.4$

Sump Inlet

Approach Flow O.K. (see Page [illegible])

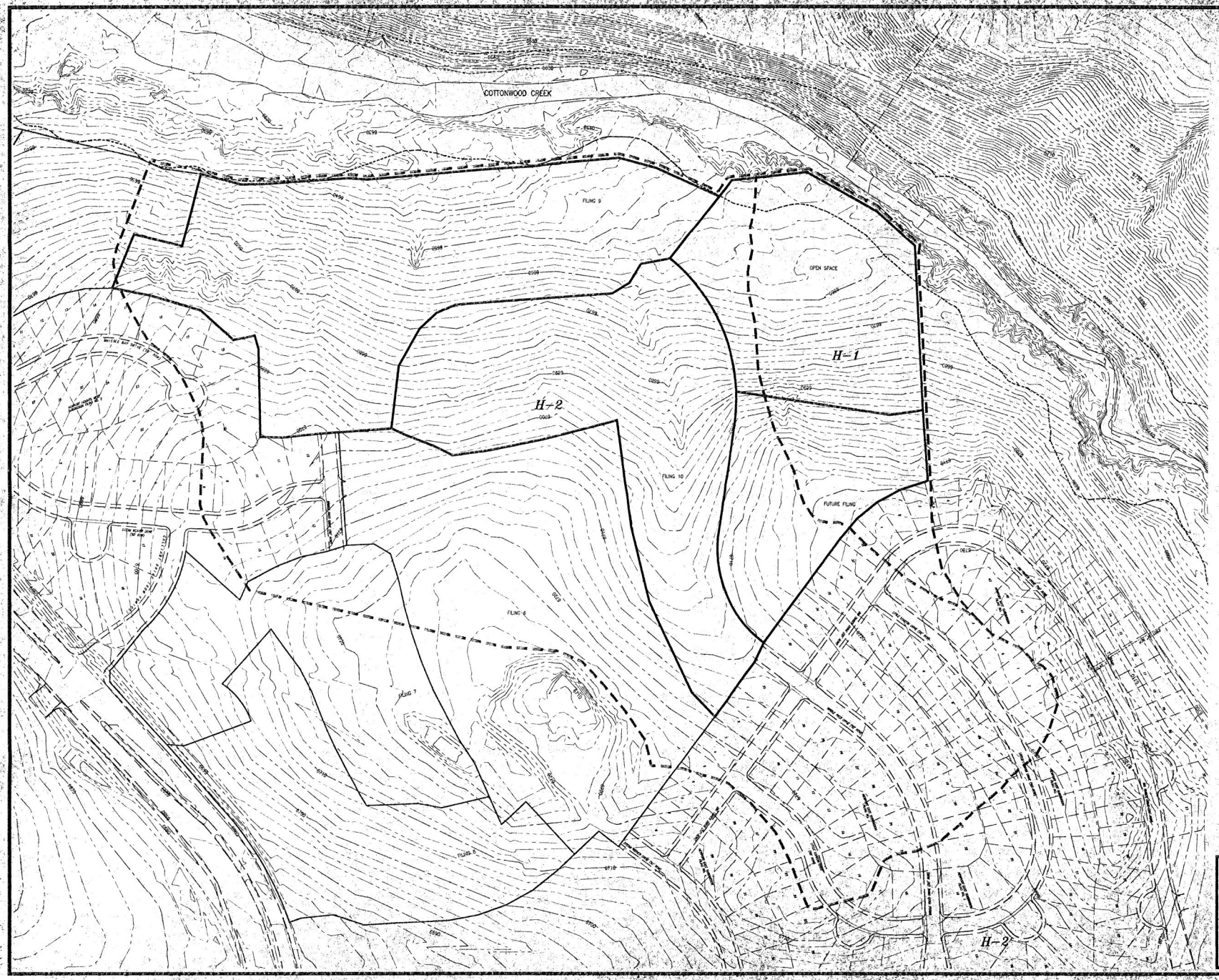
Total [illegible] 7 1/2 L = 4

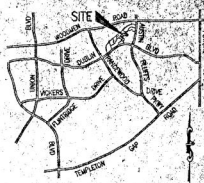
$8.7 = 1.7(4 + 1.8(3))(d_{max} + 0.33)^{1.85}$

$d = 0.39$

$17.4 = 1.7(4 + 1.8(3))(d_{max} + 0.33)^{1.85}$

$d = 0.72$





Vicinity Map

NOT TO SCALE

1" = 100'

0 25 50 100 200

Scale in Feet

LEGEND

- EXISTING CONTOURS (6100)
- BASIN BOUNDARIES
- H-1 HISTORIC BASIN DESIGNATOR
- DIRECTION OF FLOW
- SUBDIVISION FILING BOUNDARY

DRAINAGE BASIN TABLE

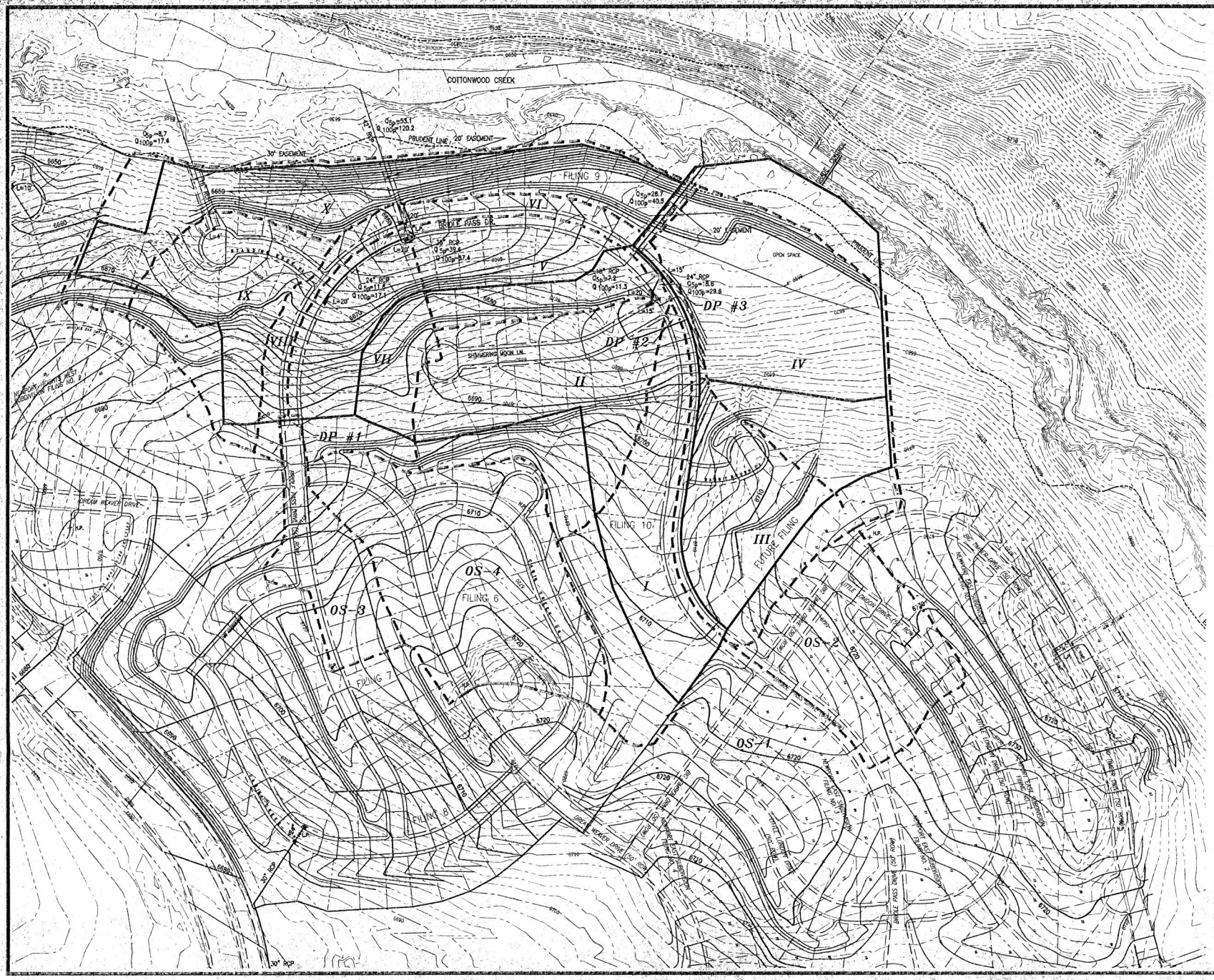
BASIN	AREA (Ac)	Q_5 cfs	Q_{100} cfs
H-1	7.32	4.9	12.0
H-2	47.61	30.9	75.0

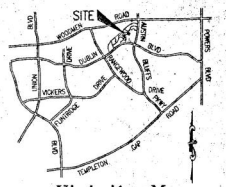
EXHIBIT 1

FILE: 99015SP.DWG 4/24/98

ROCKWELL MINCHOW CONSULTANTS, INC.

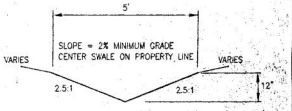
TITLE:	NEWPORT HEIGHTS WEST NO. 9 & 10 HISTORIC DRAINAGE PLAN		
SCALE:	1"=100'	DRAWN BY:	FRG
DATE:	4/24/98	CHECKED BY:	FDR
		JOB NO.	99-015





Vicinity Map

NOT TO SCALE



TYPICAL LOT LINE SWALE
NO SCALE

1" = 100'

0 25 50 100 200
Scale in Feet

LEGEND

- 6100 — EXISTING CONTOURS
- BASIN BOUNDARIES
- IV — BASIN DESIGNATOR
- DP #1 — DESIGN POINT
- 30 — PROPOSED 2' CONTOURS
- DIRECTION OF FLOW
- SUBDIVISION FILING BOUNDA

DRAINAGE BASIN TABLE

BASIN	AREA (Ac)	Q_5 cfs	Q_{100} cfs
I	4.14	9.2	18.5
II	4.94	11.6	23.9
III	3.70	8.7	17.3
IV	6.22	14.9	30.5
V	2.73	6.4	13.2
VI	0.79	2.2	4.4
VII	3.26	8.4	16.9
VIII	0.90	2.7	5.4
IX	3.23	8.7	17.4
X	5.20	14.0	28.0
OS-1	2.45	5.0	12.2
OS-2	3.62	8.9	18.0
OS-3	6.64	14.1	27.9
OS-4	1.87	4.8	9.3

DESIGN POINT TABLE

DP	AREA (Ac)	Q_5 cfs	Q_{100} cfs
DP#1	7.91	18.5	36.5
DP#2	6.59	14.2	28.6
DP#3	7.52	15.8	31.8

NOT TO BE USED FOR CONSTRUCTION

EXHIBIT 2

FILE 9901SDP.DWG 6/11/99

ROCKWELL MINCHOW CONSULTANTS, INC.

ENGINEERING • SURVEYING
2878 STONE LANE, SUITE #100
COLORADO SPRINGS, CO 80917
(719) 470-2575 • FAX (719) 475-9222

TITLE :	NEWPORT HEIGHTS WEST NO. 9 & 10 DEVELOPED DRAINAGE PLAN		
SCALE :	1"=100'	DRAWN BY : FRC	99-015
DATE :	6/11/99	CHECKED BY : KDR	JOB NO.