EPC STORMWATER REVIEW COMMENTS IN ORANGE BOXES WITH BLACK TEXT

ENGINEERING REVIEW COMMENTS IN BLUE BOXES WITH BLUE TEXT

FINAL DRAINAGE REPORT

FOR

MAYBERRY, COLORADO SPRINGS – FILING NO. 4

PREPARED FOR:

COLORADO SPRINGS MAYBERRY, LLC
3296 DEVINE HEIGHTS #208
COLORADO SPRINGS, CO 80922

PREPARED BY:

R & R ENGINEERS - SURVEYORS, INC.
1635 W. 13TH AVE, SUITE 310
DENVER, CO 80204
CONTACT: CLIF DAYTON, P.E.
(303) 753-6730

R&R JOB #MC22249
EPC PROJECT NO.

SF2317

ORIGINAL SUBMITTAL: APRIL 2023

Note: due to the amount of comments and clarifications, a more detailed review will be provided on the next submittal. Additional comments my be provided.

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 County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for liability caused by negligent acts, errors, or omissions on my part in preparing this report.

SIGNATURE: _____

Clif Dayton, P.E.
Registered Professional Engineer
State of Colorado No. 51674

DEVELOPER'S STATEMENT:

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

SIGNATURE: _____

John Mick
Colorado Springs Mayberry, LLC
3296 Devine Heights #208
Colorado Springs, CO 80922

EL PASO COUNTY'S STATEMENT:

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

SIGNATURE: _____

Joshua Palmer, P.E.
County Engineer/ECM Administrator

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Please provide references from Filing 3 FDR confirming statement.

I. GENERAL LOCATION AND DESCRIPTION

A. Background

Mayberry, Colorado Springs (formerly known as "Ellicott Town Center") is a proposed subdivision located west of Ellicott, Colorado in El Paso County. Mayberry Filing 4 encompasses 9.78 acres east of Springs Road, south of Highway 94, west of the Gillespie Family Revocable and north of Filing 3. Final Drainage Report for Mayberry Colorado Springs – Filing No. 3 (referred to as Filing 3 FDR hereon) by R&R Engineers-Surveyors is currently undergoing review by El Paso County. Filing 3 FDR will design and size all drainage infrastructure that Filing 4 is tributary to. This Drainage Report will include documentation and calculations to support that the new layout of this area is still in compliance with the in process Filing 3 FDR.

B. Scope

This Drainage Report has been prepared to fulfill the El Paso County requirements due to it being tributary to the Filing 3 FDR by R&R Engineers-Surveyors.

Mayberry Filing 4 proposes to construction of Positive Place and associated infrastructure as well as overlot grading 8 sites for future commercial use. A temporary cul-de-sac is proposed at the eastern end of positive place as a placeholder for future improvements. Channel E, which is designed in Mayberry Filing 3, will be redirected and place outside of the Filing 4 property. The existing channel section is maintained, and no additional flow is added to the channel.

This Drainage Report will provide a summary of the site-specific drainage design and the conformance with the Filing 3 FDR. This Drainage Report is based on the guidelines and criteria outline in the El Paso County Drainage Criteria Manual.

C. Site Location and Description

The Mayberry, Colorado Springs (Ellicott Town Center) parcel comprises the west half of Section 14 along with the contiguous east quarter of Section 15, as well the west half of the northeast quarter of Section 14, Township 14 South, Range 63 West of the 6th Principal Meridian. The site is located at an elevation of approximately 6,050 feet above mean sea level. Filing No. 4 comprises 9.78-acres in the northeastern area of the Mayberry development.

Springs Road borders filing 4 to the west, High 94 to the north the Gillespie Family Revocable to the east and of Filing 3 to the south.

Please include the county that the property is located in per the FDR checklist (i.e. El Paso County).

Please revise the location description to include the entire name of the platted developments adjacent to this filing.

The primary access to Filing 4 will be provided by Positive Place via Springs Road.

The terrain is generally flat with gentle northwest to southeast slopes ranging from one to two percent. Historic drainage patterns from the site are conveyed overland to the south and east boundaries of the site. The entire site is covered with native grasses.

D. General Soil Conditions

According to the Soil Survey of El Paso County prepared by the Soil Conservation Service, on-site soils are comprised primarily of Blakeland series (type 8) and Truckton series (type 95) soils. Both soils are characterized as well-drained loamy sand with rapid permeability, slow surface runoff rates, and moderate hazard of erosion. These soils are classified as hydrologic soils group "A" for drainage analysis purposes.

E. References

Revise citation TBD

October 14, 2020

El Paso County "Engineering Criteria Manual," January 9, 2006.

El Paso County "Drainage Criteria Manual County of El Paso, Colorado – Volumes 1 and 2" dated October 31, 2018.

El Paso County Resolution No. 15-042 (El Paso County adoption of "Chapter 6: Hydrology" and "Chapter 13, Section 3.2.1: Full Spectrum Detention" of the City of Colorado Springs Drainage Criteria Manual dated May 2014).

R&R Engineers-Surveyors, "Final Drainage Report for Mayberry Colorado Springs – Filing No. 3," *CURRENTLY IN REVIEW - NOT APPROVED*

approved 6/14/2023

II. DRAINAGE BASINS AND SUB-BASINS

A. Major Drainage Basins

The proposed development lies primarily within the Ellicott Consolidated Drainage Basin (CHBS1200) as classified by El Paso County. This basin is comprised of the area tributary to the West Fork of Black Squirrel Creek, with the majority of the basin bounded by SH94 to the north and Ellicott Highway to the east. No drainage planning study has been completed for the Ellicott Consolidated Drainage Basin or any adjacent drainage basins.

The major drainage basins lying in and around the proposed development are depicted in Figure EX1 and is sourced from the Phase 1 PUD Amended Drainage Report. Mayberry, Colorado Springs is located primarily within the Ellicott Consolidated Drainage Basin, which comprises a tributary area of about 13 square

Include this report in the references section

Please refer to El Paso County DCM Volume 1 Update Chapter 6, Table 6-1 Methods for Estimating Design Flow. Rational Method shall only be used for sites less than 130 acres.

miles, or 8,320 acres. The proposed subdivision represents a total of 551 acres of development, or 7 percent of the total basin area. An "on-site" drainage planning approach has been proposed in Filing 3 based on the relatively small developed area in comparison to the remaining undeveloped basin area, which is primarily agricultural land.

and filing 4?

State the flow values

The existing site topography has one off-site drainage basin (EC-10) that enters the through the north of Filing 4. Triple 30-inch CMP culverts cross SH94 at this location following existing grass-lined swales southeasterly around the site. Filing 4 historically consists of one major basin conveying flows towards the south and eastern boundaries of the site, as shown in Figure EX2. Flows from Filing 4 combine with the tributary areas from Filing 3, 2 and 2A and surrounding offsite areas downstream of the site, flowing southeasterly to an existing natural channel towards Black Squirrel Creek.

B. Floodplain Impacts

Mayberry – Filing 4, Colorado Springs is located approximately one mile southwest of the 100-year floodplain limits for the West Fork of Black Squirrel Creek, as delineated by the Federal Emergency Management Agency (FEMA). The floodplain limits in the vicinity of the site are shown in Flood Insurance Rate Map (FIRM) Number 08041C0810G, dated December 7, 2018 (see Appendix C).

C. Sub-Basin Description

The developed drainage basins lying within Filing 4 are depicted in Figure D1.1-D1.3. The interior site layout has been delineated into several drainage basins based on the proposed interior road layout and grading scheme. The natural drainage patterns will be impacted through development by site grading and concentration of runoff in subdivision street gutters, storm drains, and channels. Most sub-basins drain to the southeast, collecting in the interior roads and drainage channels. On-site flows will be diverted to a proposed extended detention basin (EDB) located at the southeast boundary of the site, and detained flows will discharge to the east, following historic drainage paths.

Clarify what site

III. DRAINAGE DESIGN CRITERIA

A. Development Criteria Reference

The Ellicott Consolidated Drainage Basin has not had a Drainage Basin Planning Study performed for the basin. Most areas within the basin are comprised of agricultural lands and rural residential uses.

Include reports in the references section

A "Master Development Drainage Plan (MDDP) for Ellicott Town Center" was approved concurrent with the original Overall PUD, and a Preliminary Drainage Report for Ellicott Town Center Phase One was approved with the original Phase One PUD and Preliminary Plan.

JPS Engineering prepared the "Preliminary & Final Drainage Report for Mayberry, Colorado Springs - Filing No. 1," revised October 27, 2020 (approved by El Paso County November 5, 2020) in support of the final approval and recording of Filing No. 1.

The "Final Drainage Report for Mayberry, Colorado Springs – Filing No. 3" fully conforms to the previously approved MDDP and Preliminary/Final Drainage Reports, along with the "Preliminary Drainage Report Amendment for Mayberry, Colorado Springs Phase 1 PUD" dated February, 2022 prepared in support of the Phase 1 PUD Amendment.

This, "Final Drainage Report for Mayberry, Colorado Springs – Filing No. 4" fully conforms to "Final Drainage Report for Mayberry, Colorado Springs – Filing No. 3".

B. ~~Hydrologic Criteria~~

SCS procedures were utilized for analysis of major basin flows impacting the site. In accordance with El Paso County drainage criteria, SCS hydrologic calculations were based on the following assumptions:

If this is only in the MDDP and other reports it doesn't need to be included here.

• Design storm (minor)	5-year
• Design storm (major)	100-year
• Storm distribution	SCS Type IIA (eastern Colorado)
• 100-year, 24-hour rainfall	4.4 inches per hour (NOAA isopluvial map)
• 5-year, 24-hour rainfall	2.6 inches per hour (NOAA isopluvial map)
• Hydrologic soil type	A

- SCS curve number - undeveloped conditions 61 (pasture / range)
- SCS curve number - developed conditions 80 (1/8-1/4 acre lots)
- SCS curve number - developed conditions 92 (commercial areas)

Hydraflow Hydrographs was utilized for the modeling of these storms.

Rational method procedures were utilized for calculation of peak flows within the on-site drainage basins. Rational method hydrologic calculations were based on the following assumptions:

• Design storm (minor)	5-year
• Design storm (major)	100-year
• Rainfall Intensities	El Paso County I-D-F Curve
• Hydrologic soil type	A

Include the full name of the table and location in the DCM.

Composite runoff coefficients for the developed commercial areas have been calculated based Table 6-6 in El Paso County Drainage Criteria Manual. A rational method spreadsheet was utilized for modeling these flows.

Hydraulic Criteria

Please indicate if this is Type A or Type B, and if its curb/gutter or roadside ditch.

Please revise statement to El Paso County DCM Volume 1 Section 3 Chapter 6, Table 6-1 Allowable Use of Roads and Streets to avoid confusion with other "Table 6-1" in the DCM.

Streets and Inlets

Street and inlet capacities were calculated using the UD_Inlet utilizing the street geometries at each inlet. The criteria used for design was that of Local/Residential/Collector roads from Table 6-1 of the EPC DCM. The criteria states that for the 5 year storm, flow depths would not exceed 6 inches or overtop the street crown while for the 100 year storm, the depth of water at the flow line would not exceed 12 inches.

"of depth in the cross pan or gutter flow line"

"gutter"

Underground Storm Sewer Pipe Systems

Three pipe systems are proposed as part of the Filing 4 development. Pipes are sized so that the 100 year HGLs are a minimum of 1 foot below finished grades. HGLs are derived using Bentley StormCAD software. Velocities in pipes do not exceed 18 fps as stated in the EPC DCM. All peak flows for pipes were derived via the Rational Method.

Channels

One temporary grass lined channel are proposed and one grass lined channel (Channel E) to be moved as part of the Filing 4 development: E and southern channel. Channels are sized so that there is a minimum of 1 foot of freeboard between the 100 year water surface elevation and the top of channels. Where channels make defined bends, additional freeboard is provided per Equation 10-4 of the EPC DCM. Channels are designed to not exceed velocities of 5 fps and will be lined with native grasses. Because the EPC DCM does not give specific guidance on the use of native grasses for channel lining, Table 12-6 of the Colorado Springs DCM Vol. 1 was utilized to establish maximum velocities and roughness coefficients. Peak flows for Channels E was obtained using the SCS method due to the size of the offsite basins being routed through the channel. Refer to Appendix B for the referenced calculations taken from the Mayberry Filing No. 3 Final Drainage Report. The smaller grass swale, Swale C-5, located along the southern property boundary, was calculated using flow master, the supporting calculation sheet and cross section can be found in Appendix B.

Sod was used for calculations and called out as such on drawings

Is this paragraph needed? Provide plan showing this area if so.

Additional criteria have been referenced for the analysis of an existing roadside ditch along Log Road. Table 6-1 of the EPC DCM states that during the 100 Year storm, the flow shall not exceed 6 inches at the shoulder.

Please revise statement and calculations accordingly. Refer to EPC DCM Vol.1 section 3, Chapter 10.4 Table 10-4 for allowed grasses based on max permissible velocities. Include the table in the Appendix and delineate which grasses are to be used.

Discuss existing pipes adjacent to the north boundary of the site.

Culverts

District shall maintain the cul-de-sac if culvert does not meet criteria

One temporary culvert is proposed beneath temporary cul-de-sacs east of the proposed development. The culverts are designed so that during the 100 year storm event, water levels do not exceed 12 inches above finished grade when overtopping the roadway above per Table 6-4 of EPC DCM.

Please see above comment regarding Table 6-1 and revise reference to Table 6-4 accordingly.

D. Detention and Water Quality Criteria

Detention volumes and required release rates have been calculated in Filing 3 and will be utilized to provide water quality and detention for Filing 4 and Filing 3 as well as the future development of Filing 2 and Filing 2A. The facility is designed to pass and release the water quality captured volume (WQCV), excess urban runoff volume (EURV), and 100 year storm to meet all local and state regulations by means of a multi-stage outlet structure.

Reference Section VI.E below for additional information.

The WQCV will be routed through an existing orifice plate installed during the Mayberry Filing 3 construction. This existing orifice plate is proposed to be modified within the outlet structure to accommodate a 40 hour draw down time. The orifice plate will also drain 97% the EURV within 72 hours. The final orifice plate will be installed within the future filing to the south of Mayberry Drive. Finally, a restrictor plate and weir combination will pass the 100 year flow at 90% of the pre-developed rate.

Positive Place?

Per El Paso County Engineering Criteria Manual Section 1.7.1.C.1, up to one acre of development may be exempt from stormwater treatment. Due to the requirement that temporary cul-de-sacs be provided for fire department access to Union Pacific and El Reno Way, these developed areas are unable to drain to the proposed detention pond. These areas will drain to Channel E and flow offsite undetained. These cul-de-sac areas total to 0.3 acres, so well below the 1 acre requirement.

Discuss if there are any impacts from the flow from the cul-de-sacs to offsite the property. Where are the flows ultimately going towards and does Channel E have sufficient capacity.

IV. DRAINAGE PLANNING FOUR STEP PROCESS

El Paso County Drainage Criteria require drainage planning to include a Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainageways, and implementing long-term source controls.

As stated in DCM Volume 2, the Four Step Process is applicable to all new and re-development projects with construction activities that disturb 1 acre or greater or that disturb less than 1 acre but are part of a larger common plan of development. The Four Step Process has been implemented as follows in the planning of this project:

Step 1: Employ Runoff Reduction Practices

- Minimize Impacts: The approved Planned Unit Development includes commercial use areas resulting in a moderate level of impervious site development.
- Minimize Directly Connected Impervious Areas (MDCIA): The proposed development will include landscaped areas adjoining the proposed building and parking lots, providing for impervious areas to drain across pervious areas where feasible.
- Grass Swales: The proposed drainage plan incorporates grass-lined swales in selected locations to encourage stormwater infiltration while providing positive drainage through the site.

Step 2: Stabilize Drainageways

- Proper erosion control measures will be implemented along the grass-lined drainage channels to provide stabilized drainageways within the site.

Step 3: Provide Water Quality Capture Volume (WQCV)

- EDB: The developed areas of the site will drain through proposed Full-Spectrum Extended Detention Basins (EDB) southeast of the developed areas. Site drainage will be routed through the extended detention basins, which will capture and slowly release the WQCV over an extended release period.
- Stormwater detention and WQCV for Filing 4 will be provided by EDB-D.

Step 4: Consider Need for Industrial and Commercial BMPs

- Commercial land uses are proposed as part of the Filing No. 4 development.

Please elaborate on step 4. If commercial uses are proposed are specialized industrial/commercial BMPs required/needed. For example gas stations have BMPs for the fuel canopy's etc.

V. GENERAL DRAINAGE RECOMMENDATIONS

The developed drainage plan for the site is to provide and maintain positive drainage away from structures and conform to the established drainage patterns for the overall site. Positive drainage shall be established and maintained away from all structures within the site in conformance with applicable building codes and geotechnical engineering recommendations.

Site grading and drainage improvements performed as a part of subdivision infrastructure development includes overlot grading and subdivision drainage improvements depicted on the subdivision construction drawings. Individual lot grading is the sole responsibility of the individual builders and property owners. Final grading of each home site should establish proper protective slopes and positive drainage in accordance with HUD guidelines and building codes. In general, main floor elevations for each home should be established approximately 2 feet above the top of curb of the adjoining street.

In general, we recommend a minimum of 6 inches clearance from the top of concrete foundation walls to adjacent finished site grades. Positive drainage slopes should be maintained away from all structures, with a minimum recommended slope of 5 percent for the first 10 feet away from buildings in landscaped areas, a minimum recommended slope of 2 percent for the first 10 feet away from buildings in paved areas, and a minimum slope of 1 percent for paved areas beyond buildings.

VI. DRAINAGE FACILITY DESIGN

Please confirm if the extended detention pond is being built with this filing. Previous sections are unclear on the EDB status.

A. General Concept

Consistent with generally accepted practices in eastern El Paso County, the general concept for management of stormwater from development of Mayberry – Filing 4 will be to construct a storm sewer system and channels to connect to the storm sewer system, channels, and extended detention basing along the southeast boundary of the site proposed in Filing 3.

Development of the Mayberry – Filing 4 project will require site grading and paving, resulting in additional impervious areas across the site. The general drainage pattern will consist of grading away from home sites to drainage swales and gutters along the internal roads within the subdivision, conveying runoff flows through the site. The Amended PUD includes 4-foot minimum side-lot drainage easements, and the proposed easements are adequate for the required side-lot drainage swales to accommodate proper grading of the individual home sites.

Runoff from the site will flow by street gutters to curb inlets at low points, thence by storm drains and drainage channels to the proposed detention ponds. The storm inlets and storm sewer system within the development will be designed as the "minor" drainage system, sized for 5-year developed peak flows. The drainage channels, and detention pond will be designed as the "major" drainage system, sized for 100-year peak flows. Street flows within the street will be maintained below allowable levels in accordance with El Paso County drainage criteria.

Due to an offsite basin north of SH94 flowing onto the subject property, Filing 3 proposed a temporary swale (channel E) that conveys the flow around the proposed development. Filing 4 will move the temporary further east and continue to route flow around the site and combine with the pond discharge.

"swale"

B. Specific Details

Existing Basins

Historic drainage conditions for Filing 4 are depicted in Figure D1.1. The site has been

Figure D1.1 was not provided in this report. Please revise.

Please verify statement. The drainage map shows the entire site in EX-1.

located into one basin (D1.5). The site generally drains from northwest to southeast. Undeveloped flows sheet flow generally towards southeast corner of the property towards Design Points 12 with 5 year and 100 year peak flows of 31.6 and 57.6 cfs respectively. There is no existing stormwater conveyance infrastructure currently on site (piping, inlets, channels, etc) and no detention/water quality facilities existing on the site.

Map shows design point 1 with 5 year and 100 year flows being 1.98 and 13.29. Please revise.

The existing off-site drainage basins north of Filing 4 generally flow into Channel E around the proposed site shown on Sheet D1.1 and D1.3, flowing south through existing grass-lined drainage swales and channels.

Sheets were not provided in this report please revise.

Basin D1.5 will combine with basin D1.6 and enter the storm sewer system proposed by Filing 3. The storm sewer system will direct runoff south and combine with basins D1.7-D1.10 where it will be released into Channel D at Design Point 19 with 5 year and 100 year peak flow of 53.1 and 106.8 cfs respectively.

Channel D will route flow south with the addition of basin D2.0 runoff at Design Point 20. Channel D and Channel C2 will release into Pond D at Design Point 22 with 5 year and 100 year peak flows of 98.5 and 237.8 cfs.

values seem high

Pond D has been sized to attenuate peak flows and mitigate developed drainage impacts. The total volume storage equivalent to the 100 Year + ½ WQCV produced by the onsite developed area of Filing 2, 2A, 3 and 4. Detention volume will be routed through a modified CDOT Type C structure. The WQCV and EURV will be controlled by a multi-stage orifice plate While the 100-year volume will be routed through a 36" pipe with a restrictor plate. Release rates remain in compliance

Provide background on approved release rates and comparison

Pond D will release into Channel F with 5 year and 100 year peak flows of 1.2 cfs and 39.6 cfs and will travel east to Design Point EX6

Revise design point naming for existing conditions to existing design point #, EX-DP #.

Design points D1.5, D1.6. D2, and EX6 are not shown in the drainage maps. Please include them in the maps or provide a figure.

Basin OS-1 is a 0.23-acre basin that consist of springs road right of way. It is comprised of half of the springs road roadway section with pavement, curb and gutter, sidewalk and a landscape strip. The basin is conveyed via curb and gutter into filing 4 and combines with basin C-1 at design point 1. The 5 year and 100 year developed peak flows are 0.8 cfs and 1.5 cfs respectively.

Basin C-1 is a 2.07-acre basin that is analyzed entirely as a commercial development. The basin sheet flows from northwest to southeast and is ultimately conveyed via curb and gutter to an on-grade 10' Type R Inlet at design point 1. The 5 year and 100 year developed peak flows are 7.0 cfs and 12.7 cfs respectively.

Basin C-2 is a 1.23-acre basin that is analyzed entirely as a commercial development.

The basin sheet flows from northwest to southeast and is ultimately conveyed via curb and gutter to an on-grade 10' Type R Inlet at design point 2. The 5 year and 100 year developed peak flows are 4.3 cfs and 7.9 cfs respectively.

Basin C-3 is a 1.66-acre basin that is analyzed entirely as a commercial development. The basin sheet flows from northwest to southeast and is ultimately conveyed via curb and gutter to a 15' Type R inlet in sump at design point 3. The 5 year and 100 year developed peak flows are 5.8 cfs and 10.6 cfs respectively.

Basin C-4 is a 2.53-acre basin that is analyzed entirely as a commercial development. The basin sheet flows from southwest to northeast and is ultimately conveyed via curb and gutter to a 15' Type R inlet in sump at design point 4. The 5 year and 100 year developed peak flows are 7.4 cfs and 13.5 cfs respectively.

Basin C-5 is a 1.88-acre basin that is analyzed entirely as a commercial development. The basin sheet flows from northwest to southeast and is ultimately conveyed via a swale along the southern property boundary and ultimately to a flared end section at design point 5. The 5 year and 100 year developed peak flows are 5.3 cfs and 9.6 cfs respectively.

The swale in the rear of basin C-5 will be the responsibility of the lot developer to infill and replace with 24" RCP Pipe. The swale is sized to provide appropriate slope and cover for the future storm infrastructure.

Basin U-1 is a 0.42-acre basin that is comprised of the existing channel E designed in the Filing 3 FDR. Drainage patterns and flows will follow the proposed design in filing 3 with the 5 year and 100 year developed peak flows are 0.1 cfs and 1.1 cfs respectively.

C. Emergency Conditions Analysis

State the cfs entering the site from the culverts underneath the highway.

In the event of clogging, the storm inlets within the Filing 4 development area will overflow to the adjacent channel which generally flow southeasterly. Emergency overflows would sheet flow southeasterly along the public streets, flowing into Channels E and Detention Pond D. Channel E is designed to bypass Pond D

Pond D also has measures in place to mitigate an emergency condition. A buried riprap emergency spillway will route emergency flows over the embankment and into a swale that will carry flows east of the site.

D. Comparison of Developed to Filing 3 FDR

Major Basin D1.5 in the Filing 3 FDR was designed to be 95% impervious with 5- and 100-year peak flow rates of 31.6 and 57.6 cfs respectively. With the development of Filing 4, the composite site will have an imperviousness of 94.7% with 5- and 100-year

peak flow rates of 27.0 and 49.3 cfs respectively. Design point 6 is the ultimate discharge point of filing 4. Storm Sewer HGL's and inlet calculations are provided in the following appendices showing all proposed storm infrastructure within filing 4 will function as intended and be in conformance with the El Paso County Drainage Criteria Manual.

The development of Filing 4 is in compliance with the Filing 3 FDR.

E. Detention Design

The total developed storm runoff downstream of the Filing No. 4 development along with the future developments of Filings 2, 2A, 3, and the area south of Filing 3 area will be maintained at historic levels by routing flows through Detention Pond D located at the southeast corner of the subdivision. The proposed detention facility has been sized to attenuate onsite peak flows through the pond, mitigating developed drainage impacts.

The total volume requiring storage is equivalent to the 100 Year + ½ WQCV produced by the onsite developed area. The required pond volume was determined using the ultimate buildout conditions for all areas tributary to the pond in the Filing 3 FDR. The calculated volume to be stored is 9.1 ac-ft and was calculated by means of the UD_Detention spreadsheet. The detention volume will be routed through the extended detention basin by means of a modified CDOT Type C structure. The WQCV and EURV will be controlled by a multi-stage orifice plate within the Type C structure while the 100-year volume will be routed through a 36" pipe with restrictor plate within the Type C structure.

Two scenarios for Pond D have been examined for design purposes within and downstream of the pond: Interim Condition and Ultimate Development. The interim condition assumes Filing 2, 2A and 3 are fully developed, while ultimate development assumes all tributary basins are fully developed. The Type C outlet structure and multi-stage orifice plate proposed with Filing 3 will meet the required release rates during the interim condition. The orifice plate will be modified as needed to ensure release rates remain in compliance with the development of Filing 4. Please see Appendix B for the updated Mile High Flood District Detention Pond spreadsheet. The Filing 3 Drainage Report uses an interim imperviousness of 23%. When Filing 4 gets developed, the interim imperviousness will increase to 33%. This will require two of the existing orifices to enlarge to provide adequate release rates.

Release rates for ultimate development were utilized for sizing riprap and channels downstream of the pond to ensure these facilities will not need to be replaced as the tributary area upstream is developed.

The proposed detention pond will be privately owned and maintained by the Metropolitan District, under the terms of a "Private Detention Basin Maintenance

Agreement" recorded during final platting. Gravel maintenance access roads will be provided around the perimeter of the detention ponds to facilitate maintenance access.

The pond outlet structures have been designed to release historic flows southeast of the site towards the existing natural swales downstream. Based on the proposed approach of reducing developed flows to historic levels at the site boundaries, no significant downstream drainage impacts are anticipated, and no downstream drainage improvements are proposed.

F. Onsite Drainage Facility Design

Storm Sewer System Layout

Generally, streets are designed with cross slopes of 2%, pushing water from the centerlines to curb and gutter systems. The street convey flows to low points at various points around the site where Type R curb inlets are proposed to convey street flows to an underground storm sewer system. The storm sewer system contains reinforced concrete pipes (RCP) with minimum sizes of 18 inches and minimum slopes of 0.5%.

Basins C1-C5 drain to a dedicated storm sewer system that connects to the storm sewer system designed in Filing 3 which will ultimately discharged to channel D at DP19. The channel will ultimately drain to Detention Pond D.

Open Channel System Layout

Four open channels were proposed as part of the Filing 3 development: C2, D, E, and F. These channels will generally be designed as stable native grass-lined channels with subcritical flow regimes. Drainage channels will be designed to convey 100-year flows, with trapezoidal cross-sections, side slopes of 4:1, and minimum freeboard of 1-foot.

The proposed development will require an adjustment of Channel E to be extended eastward to convey flows from offsite basins EC-10 and OS-1 around the site. The portion of Channel E south of property limits will not be modified. The channel will maintain the general design as a grass-lined channel with a bottom width of 8 feet and a depth of 3.25 feet.

G. Analysis of Existing and Proposed Downstream Facilities

The general concept of the proposed drainage plan is to attenuate peak flows from the developed site by routing flows through the on-site detention pond D. An analysis of drainage patterns downstream of the subdivision was performed as part of the Filing 3 report to ensure historic drainage patterns are maintained. Filing 4 will remain in compliance of Filing 3.

H. Anticipated Drainage Problems and Solutions

The proposed stormwater detention pond is designed to mitigate the impacts of developed drainage from this project. The overall drainage plan for the subdivision includes a system of improved public streets with curb and gutter, storm inlets, and storm sewers conveying developed flows to improved drainage channels running through the site. The primary drainage problems anticipated within this development will consist of maintenance of these storm sewer systems, culverts, drainage channels, and detention pond facilities. Care will need to be taken to implement proper erosion control measures in the proposed channels and swales, which will be designed to meet allowable velocity criteria.

A trail system will be maintained along the major drainage channel to provide maintenance access to the drainage facilities throughout the development. Proper construction and maintenance will minimize downstream drainage impacts. The proposed public streets will be owned and maintained by El Paso County. The proposed detention ponds and channels running through open space tracts and storm drains through private alleys will be privately owned and maintained by the homeowners association or metropolitan district.

VII. EROSION CONTROL

The Contractor will be required to implement best management practices (BMP's) for erosion control during construction. The proposed erosion control plan is included in the Grading & Erosion Control (GEC) Plans submitted with the subdivision construction drawings. Erosion control measures will include installation of silt fence at the toe of disturbed slopes and hay bales protecting drainage ditches. Cut and fill slopes will be stabilized during excavation if necessary and vegetation will be established for stabilization of the disturbed areas. All ditches have been designed to meet El Paso County criteria for slope and velocity. Additionally, gravel vehicle tracking pads will be installed at construction access points and inlet protection will be provided to minimize conveyance of sediment into storm inlets.

VIII. COST ESTIMATE AND DRAINAGE FEES

The developer will pay all capital costs for roadway and drainage improvements. As detailed in Appendix C. The engineer's estimate for Filing 4 drainage improvements is approximately $211,798.66. Filing 4 is located entirely within the Ellicott Consolidated Drainage Basin, which currently does not have a drainage or bridge fee requirement. As such, no drainage basin fees are applicable.

IX. MAINTENANCE

All proposed road and drainage construction within the Mayberry – Filing 4, Colorado Springs project will be performed to El Paso County Standards. Interior roads will be dedicated as public right-of-way. Roads and drainage facilities within the public right-of-way will be maintained by El Paso County upon final acceptance of these facilities after the warranty period. The Metropolitan District will maintain drainage channels and stormwater detention pond within the proposed open space areas.

X. SUMMARY

The Mayberry – Filing 4, Colorado Springs consists of 8 commercial lots in the northeast part of the master development, with access connections to State Highway 94 at Springs Road. The commercial lots are platted within Filing 4. The development will generate an increase in developed runoff from the site, which will be mitigated through stormwater detention and water quality facility.

The proposed drainage patterns will remain consistent with historic conditions, and new drainage facilities constructed to El Paso County standards will safely convey runoff to adequate outfalls. Detention Pond D southeast of the development areas will ensure that developed flows remain below historic levels. Construction and proper maintenance of the proposed drainage and erosion control facilities will ensure that this subdivision has no significant adverse drainage impacts on downstream or surrounding areas.

XI. APPENDICES

Appendix A - Hydrologic Computations

1. Hydrologic References
2. Pre Developed Flow Rates
3. Post Developed Flow Rates

Appendix B – Hydraulic Computations

1. Detention and Water Quality Facility Design
2. Storm Sewer Capacity
3. Inlet and Street Capacity
4. Channel Design

Appendix C – Reference Information

1. Vicinity Map

2. Cost Estimate
3. NRCS Soils Report
4. FEMA Flood Insurance Maps
5. Drainage Maps

APPENDIX A - HYDROLOGIC COMPUTATIONS

POST-DEVELOPMENT C VALUES

Designer: LAO
Company: R&R Engineers-Surveyors
Date: 4/5/2023
Project: Mayberry Filing 4
Location: El Paso County

Global Parameters[1]			
Land Use	% Imp.	C_5	C_{100}
SF LOTS (1/6 AC)	47.5	0.375	0.545
Hardscape	100	0.9	0.96
Commercial	95	0.81	0.88
Landscape/Park	2	0.08	0.35

Summary	
Total Area (ac)	100.16
Composite Impervious	50.85%

Cells of this color are for required user-input
Cells of this color are for optional user-input

[1] From Table 6-6 in El Paso County DCM
[2] From Table 6-6 in El Paso County DCM

Basin Name	Area (ac)	NRCS Hydrologic Soil Group	SF LOTS (1/6 AC)		Hardscape		Commercial		Landscape/Park		% Check	Percent Imperviousness	Runoff Coefficient, C[2]				
			Area (ac)	%	Area (ac)	%	Area (ac)	%	Area (ac)	%			2-yr	5-yr	10-yr	25-yr	100-yr
C2.1	0.77	A	0.77	100.0%	0.00	0.0%	0.00	0.0%	0.00	0.0%	100.00%	47.5%		0.38			0.55
C2.2	0.33	A	0.33	100.0%	0.00	0.0%	0.00	0.0%	0.00	0.0%	100.00%	47.5%		0.38			0.55
C2.3	1.81	A	1.81	100.0%	0.00	0.0%	0.00	0.0%	0.00	0.0%	100.00%	47.5%		0.38			0.55
C2.4	1.16	A	0.00	0.0%	0.93	80.0%	0.00	0.0%	0.23	20.0%	100.00%	80%		0.74			0.84
C2.5	9.61	A	9.61	100.0%	0.00	0.0%	0.00	0.0%	0.00	0.0%	100.00%	47.5%		0.38			0.55
C3.0	35.40	A	17.70	50.0%	0.00	0.0%	0.00	0.0%	17.70	50.0%	100.00%	25%		0.23			0.45
D1.1	1.73	A	0.00	0.0%	0.00	0.0%	1.73	100.0%	0.00	0.0%	100.00%	95%		0.81			0.88
D1.2	2.56	A	2.56	100.0%	0.00	0.0%	0.00	0.0%	0.00	0.0%	100.00%	47.5%		0.38			0.55
D1.3	2.02	A	2.02	100.0%	0.00	0.0%	0.00	0.0%	0.00	0.0%	100.00%	47.5%		0.38			0.55
D1.4	3.75	A	3.52	93.9%	0.00	0.0%	0.23	6.1%	0.00	0.0%	100.00%	50%		0.40			0.57
D1.5	9.88	A	0.00	0.0%	0.00	0.0%	9.88	100.0%	0.00	0.0%	100.00%	95%		0.81			0.88
D1.6	1.96	A	1.96	100.0%	0.00	0.0%	0.00	0.0%	0.00	0.0%	100.00%	47.5%		0.38			0.55
D1.7	1.56	A	1.56	100.0%	0.00	0.0%	0.00	0.0%	0.00	0.0%	100.00%	47.5%		0.38			0.55
D1.8	1.27	A	1.27	100.0%	0.00	0.0%	0.00	0.0%	0.00	0.0%	100.00%	47.5%		0.38			0.55
D1.9	0.54	A	0.54	100.0%	0.00	0.0%	0.00	0.0%	0.00	0.0%	100.00%	47.5%		0.38			0.55
D1.10	2.13	A	2.13	100.0%	0.00	0.0%	0.00	0.0%	0.00	0.0%	100.00%	47.5%		0.38			0.55
D1.11	1.23	A	0.00	0.0%	0.98	80.0%	0.00	0.0%	0.25	20.0%	100.00%	80%		0.74			0.84
D1.12	3.42	A	3.42	100.0%	0.00	0.0%	0.00	0.0%	0.00	0.0%	100.00%	47.5%		0.38			0.55
D1.13	3.07	A	0.00	0.0%	0.00	0.0%	3.07	100.0%	0.00	0.0%	100.00%	95%		0.81			0.88
D1.14	0.91	A	0.60	65.9%	0.00	0.0%	0.31	34.1%	0.00		100.00%	64%		0.52			0.66
D2.0	11.90	A	9.50	79.8%	0.00	0.0%	0.00	0.0%	2.40	20.2%	100.00%	38%		0.32			0.51
E1	3.92	A	0.00	0.0%	0.00	0.0%	0.00	0.0%	3.92	100.0%	100.00%	2%		0.08			0.35
D2.1	3.15	A	0.00	0.0%	0.00	0.0%	0.00	0.0%	3.15	100.0%	100.00%	2%		0.08			0.35
OS-1	2.65	A	0.00	0.0%	0.91	34.3%	0.00	0.0%	1.74	65.7%	100.00%	36%		0.36			0.56
C Basins	49.08	A	30.22	61.6%	0.93	1.9%	0.00	0.0%	17.93	36.5%	100.00%	32%		0.28			0.48
D Basins	51.08	A	29.08	56.9%	0.98	1.9%	15.22	29.8%	2.65	5.2%	93.83%	57%		0.48			0.61
Pond - Developed	100.16	A	59.30	59.2%	1.91	1.9%	15.22	15.2%	20.58	20.5%	96.86%	45%		0.38			0.55
D1.5 (dev)	9.88	A	0.00	0.0%	0.00	0.0%	9.88	100.0%	0.00	0.0%	100.00%	95%		0.81			0.88
D2.0 (pre-dev)	11.90	A	0.00	0.0%	0.00	0.0%	0.00	0.0%	11.90	100.0%	100.00%	2%		0.08			0.35
C3.0 (pre-dev)	35.40	A	0.00	0.0%	0.00	0.0%	0.00	0.0%	35.40	100.0%	100.00%	2%		0.08			0.35
Pond - F2, F3, F4 Dev only	100.16	A	32.10	32.0%	1.91	1.9%	15.22	15.2%	50.93	50.8%	100.00%	33%					

EXISTING C VALUES

Designer: ESJ
Company: R&R Engineers-Surveyors
Date: 4/5/2023
Project: Mayberry Filing 3
Location: El Paso County

Verify if this is the correct project.

Global Parameters[1]			
Land Use	% Imp.	C_5	C_{100}
Agriculture	2	0.09	0.36
Hardscape	100	0.9	0.96
Commercial/Industrial	80	0.59	0.7
Landscape/Park	2	0.08	0.35

Summary	
Total Area (ac)	9.78
Composite Impervious	2.0%

Cells of this color are for required user-input
Cells of this color are for optional user-input

[1] From Table 6-6 in El Paso County DCM
[2] From Table 6-6 in El Paso County DCM

Basin Name	Area (ac)	NRCS Hydrologic Soil Group	Agriculture		Hardscape		Commercial/Industrial		Landscape/Park		% Check	Percent Imperviousness	Runoff Coefficient, C[2]				
			Area (ac)	%	Area (ac)	%	Area (ac)	%	Area (ac)	%			2-yr	5-yr	10-yr	25-yr	100-yr
EX-1	9.78	A	9.78	100.0%	0.00	0.0%	0.00	0.0%	0.00	0.0%	100.00%	2.0%		0.09			0.36

EX DEVELOPMENT CN VALUES

Designer: ESJ
Company: R&R Engineers-Surveyors
Date: 4/5/2023
Project: Mayberry Filing 3
Location: El Paso County

Global Parameters[1]	
Land Use	CN
PASTURE - GOOD	61

Basin Name	Area (ac)	NRCS Hydrologic Soil Group	PASTURE - GOOD		% Check	SCS CN
			Area (ac)	%		CN
EX-1	9.78	A	9.78	100.0%		61.00

This does not appear to be the correct project name.

If this is for existing conditions please revise header to state that.

TIME OF CONCENTRATION

Designer: ESJ
Company: R&R Engineers-Surveyors
Date: 4/5/2023
Project: Aspen Distillers
Location: El Paso County

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_i^{0.33}}$$

Computed $t_c = t_i + t_t$

$t_{minimum}$ = 5 (urban)
$t_{minimum}$ = 10 (non-urban)

Non Urban Li max = 300'
Urban Li Max = 100'

$$t_t = \frac{L_t}{60K\sqrt{S_t}} = \frac{L_t}{60V_t}$$

Selected $t_c = \max\{t_{minimum}, \min(\text{Computed } t_c, \text{Regional } t_c)\}$

$$\text{Regional } t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

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Subbasin Data				Overland (Initial) Flow Time			Channelized (Travel) Flow Time					Time of Concentration			
Basin	Area	% Impervious	C5	Overland Flow Length L_i (ft)	Overland Flow Slope S_i (ft/ft)	Overland Flow Time t_i (min)	Channelized Flow Length L_t (ft)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V_t (ft/sec)	Channelized Flow Time t_t (min)	Computed t_c (min)	Regional t_c (min)	Selected t_c (min)	Remarks
EX-1	9.78	2.0%	0.09	300.00	0.020	25.13	737.00	0.020	5	0.71	17.37	42.50	35.02	35.02	

Please revise and use 100 ft max for urban conditions.

PROPOSED STORM DRAINAGE SYSTEM DESIGN - 5-YEAR DESIGN STORM

Designer: ESJ
Company: R&R Engineers-Surveyors
Date: 4/5/2023
Project: Mayberry Filing 3
Location: El Paso County

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Cells of this color are for optional user-input

$I_5 = -1.50 \ln(D) + 7.583$

R&R ENGINEERS SURVEYORS INC

DESGIN POINT	STREET/ CONTRIBUTING BASINS	DIRECT RUNOFF							TOTAL RUNOFF					STREET BYPASS		PIPE			TRAVEL TIME				
		Basin Name	Area (ac)	Coeff C	Tc (min)	C*A (ac)	I	Q (cfs)	Tc (min)	Sum Area (ac)	Sum C*A (ac)	I in/hr	Q cfs	Slope %	Street Q cfs	Design Q cfs	Slope %	PIPE SIZE	L ft	VEL ft/sec	Tt min	Q add'l	Remarks
		EX-1	9.78	0.09	35.0	0.88	2.25	1.98															
1	EX-1								35.0	9.78	0.88	2.25	1.98										

PROPOSED STORM DRAINAGE SYSTEM DESIGN - 100-YEAR DESIGN STORM

Designer:	ESJ
Company:	R&R Engineers-Surveyors
Date:	4/5/2023
Project:	Mayberry Filing 3
Location:	El Paso County

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Cells of this color are for optional user-input

$$I_{100} = -2.52 \ln(D) + 12.735$$

ENGINEERS SURVEYORS INC

DESGIN POINT	STREET/ CONTRIBUTING BASINS	DIRECT RUNOFF							TOTAL RUNOFF					STREET BYPASS		PIPE			TRAVEL TIME				
		Basin Name	Area (ac)	Coeff C	Tc (min)	C*A (ac)	I	Q (cfs)	Tc (min)	Sum Area (ac)	Sum C*A (ac)	I in/hr	Q cfs	Slope %	Street Q cfs	Design Q cfs	Slope %	PIPE SIZE	L ft	VEL ft/sec	Tt min	Q add'l	Remarks
		EX-1	9.78	0.36	35.0	3.52	3.77	13.29															
1	EX-1								35.0	9.78	3.52	3.77	13.29										

POST-DEVELOPMENT C VALUES

Designer: GWH
Company: R&R Engineers-Surveyors
Date: 4/5/2023
Project: Mayberry Filing 4
Location: El Paso County

Global Parameters[1]			
Land Use	% Imp.	C_5	C_{100}
Commercial	95	0.81	0.88
Hardscape	100	0.9	0.96
Landscape/Park	2	0.08	0.35
Gravel	80	0.57	0.7

Summary	
Total Area (ac)	19.61
Composite Impervious	92.8%

Cells of this color are for required user-input
Cells of this color are for optional user-input

[1] From Table 6-6 in El Paso County DCM
[2] From Table 6-6 in El Paso County DCM

Basin Name	Area (ac)	NRCS Hydrologic Soil Group	Commercial		Hardscape		Landscape/Park		Gravel		% Check	Percent Imperviousness	Runoff Coefficient, C[2]				
			Area (ac)	%	Area (ac)	%	Area (ac)	%	Area (ac)	%			2-yr	5-yr	10-yr	25-yr	100-yr
C-1	2.07	A	2.07	100.0%	0.00	0.0%	0.00	0.0%	0.00	0.0%	100.00%	95.0%		0.81			0.88
C-2	1.23	A	1.23	100.0%	0.00	0.0%	0.00	0.0%	0.00	0.0%	100.00%	95.0%		0.81			0.88
C-3	1.66	A	1.66	100.0%	0.00	0.0%	0.00	0.0%	0.00	0.0%	100.00%	95.0%		0.81			0.88
C-4	2.53	A	2.53	100.0%	0.00	0.0%	0.00	0.0%	0.00	0.0%	100.00%	95.0%		0.81			0.88
C-5	1.88	A	1.88	100.0%	0.00	0.0%	0.00	0.0%	0.00	0.0%	100.00%	95.0%		0.81			0.88
U-1	0.42	A	0.00	0.0%	0.00	0.0%	0.42	100.0%	0.00	0.0%	100.00%	2.0%		0.08			0.35
OS-1	0.23	A	0.00	0.0%	0.19	83.2%	0.04	16.8%	0.00	0.0%	100.00%	83.5%		0.76			0.86
SITE	9.60	A	9.37	97.6%	0.19	2.0%	0.04	0.4%	0.00	0.0%	100.00%	94.7%		0.81			0.88

POST-DEVELOPMENT CN VALUES

Designer: ESJ
Company: R&R Engineers-Surveyors
Date: 4/5/2023
Project: Mayberry Filing 4
Location: El Paso County

Global Parameters[1]	
Land Use	CN
SF LOTS (1/6 AC)	80
PASTURE - GOOD	61
COMMERCIAL	92
OPEN SPACE - GOOD	61
PAVED STREETS	98

Basin Name	Area (ac)	NRCS Hydrologic Soil Group	SF LOTS (1/6 AC)		PASTURE - GOOD		COMMERCIAL		OPEN SPACE - GOOD		PAVED STREETS		% Check	SCS CN
			Area (ac)	%	Area (ac)	%	Area (ac)	%	Area (ac)	%	Area (ac)	%		CN
U-1	0.42	A	0.00	0.0%	0.00	0.0%	0.00	0.0%	0.42	100.0%	0.00	0.0%	100.00%	61.00

Provide a name for this table

Designer: ESJ
Company: R&R Engineers-Surveyors
Date: 4/5/2023
Project: Mayberry Filing 4
Location: El Paso County

Cells of this color are for required user-input
Cells of this color are for optional user-input

$I_5 = -1.50 \ln(D) + 7.583$

DESGIN POINT	STREET/ CONTRIBUTING BASINS	DIRECT RUNOFF							TOTAL RUNOFF					STREET BYPASS		PIPE			TRAVEL TIME				Remarks
		Basin Name	Area (ac)	Coeff C	Tc (min)	C*A (ac)	I	Q (cfs)	Tc (min)	Sum Area (ac)	Sum C*A (ac)	I in/hr	Q cfs	Slope %	Street Q cfs	Design Q cfs	Slope %	PIPE SIZE	L ft	VEL ft/sec	Tt min	Q add'l	
		C-1	2.07	0.81	9.8	1.68	4.16	6.97															
		OS-1	0.23	0.76	7.7	0.18	4.53	0.80															
1	C-1, OS-1								9.8	2.30	1.85	4.16	7.70										
		C-2	1.23	0.81	8.7	1.00	4.33	4.33															
2	DP1, C-2								8.7	3.53	2.85	4.33	12.36										
		C-3	1.66	0.81	8.9	1.34	4.31	5.79															
3	DP2, C-3								8.9	5.19	4.20	4.31	18.08										
		C-4	2.53	0.81	14.0	2.05	3.62	7.41															
4	DP-3, C-4								14.0	7.72	6.24	3.62	22.61										
		C-5	1.88	0.81	15.5	1.52	3.48	5.29															
5	C-5								15.5	1.88	1.52	3.48	5.29										
6	DP1, DP2, DP3, DP4, DP5								15.5	9.6	7.8	3.48	26.98										
		U-1	0.42	0.08	8.4	0.03	4.39	0.15															
7	U-1								8.4	0.42	0.03	4.39	0.15										

PROPOSED STORM DRAINAGE SYSTEM DESIGN - 100-YEAR DESIGN STORM

Designer: ESJ
Company: R&R Engineers-Surveyors
Date: 4/5/2023
Project: Mayberry Filing 4
Location: El Paso County

Cells of this color are for required user-input
Cells of this color are for optional user-input

$$I_{100} = -2.52 \ln(D) + 12.735$$

DESGIN POINT	STREET/ CONTRIBUTING BASINS	DIRECT RUNOFF							TOTAL RUNOFF					STREET BYPASS		PIPE			TRAVEL TIME				Remarks
		Basin Name	Area (ac)	Coeff C	Tc (min)	C*A (ac)	I	Q (cfs)	Tc (min)	Sum Area (ac)	Sum C*A (ac)	I in/hr	Q cfs	Slope %	Street Q cfs	Design Q cfs	Slope %	PIPE SIZE	L ft	VEL ft/sec	Tt min	Q add'l	
		C-1	2.07	0.88	9.8	1.82	6.98	12.71															
		OS-1	0.23	0.86	7.7	0.20	7.61	1.52											470	5	1.6		
1	C-1, OS-1								9.8	2.30	2.02	6.98	14.10										
		C-2	1.23	0.88	8.7	1.09	7.28	7.90															
2	DP1, C-2								8.7	3.53	3.11	7.28	22.60										
		C-3	1.66	0.88	8.9	1.46	7.24	10.56															
3	DP2, C-3								8.9	5.19	4.56	7.24	33.03						160	5	0.5		
		C-4	2.53	0.88	14.0	2.22	6.08	13.52															
4	DP-3, C-4								14.0	7.72	6.79	6.08	41.27										
		C-5	1.88	0.88	15.5	1.65	5.84	9.64															
5	C-5								15.5	1.88	1.65	5.84	9.64										
6	DP1, DP2, DP3, DP4, DP5								15.5	9.6	8.4	5.84	49.25										
		U-1	0.42	0.35	8.4	0.15	7.36	1.07															
7	U-1								8.4	0.42	0.15	7.36	1.07										

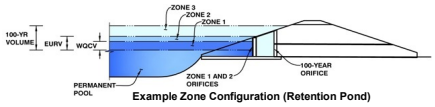
APPENDIX B - HYDRAULIC COMPUTATIONS

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: MAYBERRY FILING 3

Basin ID: INTERIM DETENTION POND D (with Filing 4 Developed)



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	100.20	acres
Watershed Length =	2,867	ft
Watershed Length to Centroid =	1,433	ft
Watershed Slope =	0.010	ft/ft
Watershed Imperviousness =	33.00%	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) =	1.340	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	3.394	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	2.446	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	3.340	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	4.073	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	5.780	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	7.384	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	9.520	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	14.111	acre-feet	3.14	inches
Approximate 2-yr Detention Volume =	2.143	acre-feet		
Approximate 5-yr Detention Volume =	2.852	acre-feet		
Approximate 10-yr Detention Volume =	3.549	acre-feet		
Approximate 25-yr Detention Volume =	4.456	acre-feet		
Approximate 50-yr Detention Volume =	5.111	acre-feet		
Approximate 100-yr Detention Volume =	6.121	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	1.340	acre-feet
Zone 2 Volume (EURV - Zone 1) =	2.054	acre-feet
Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2) =	3.397	acre-feet
Total Detention Basin Volume =	6.791	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

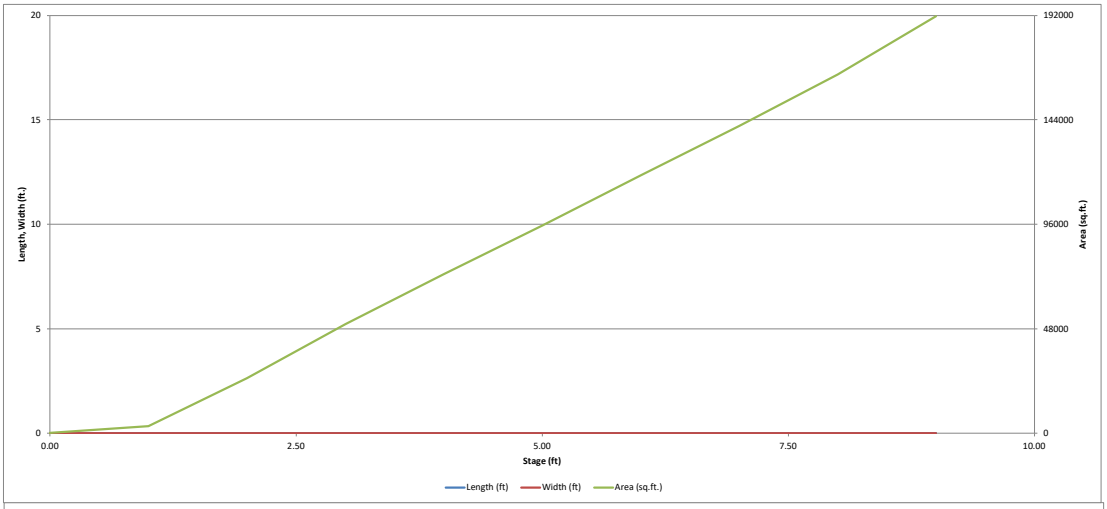
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

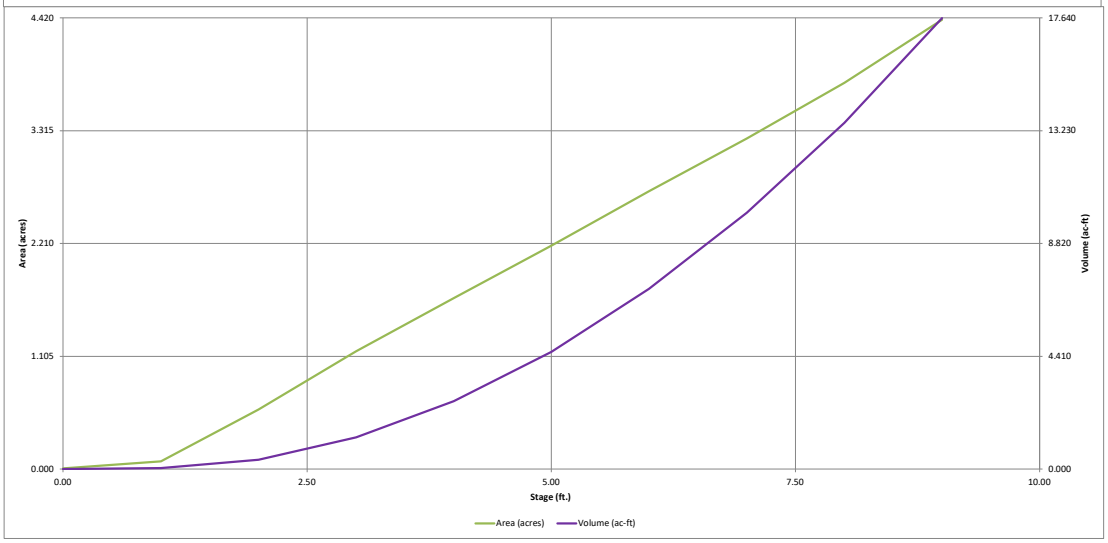
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	170	0.004		
6027	--	1.00	--	--	--	3,344	0.077	1,757	0.040
6028	--	2.00	--	--	--	25,396	0.583	16,127	0.370
6029	--	3.00	--	--	--	50,286	1.154	53,968	1.239
6030	--	4.00	--	--	--	72,956	1.675	115,589	2.654
6031	--	5.00	--	--	--	95,393	2.190	199,763	4.586
6032	--	6.00	--	--	--	118,525	2.721	306,722	7.041
6033	--	7.00	--	--	--	141,085	3.239	436,527	10.021
6034	--	8.00	--	--	--	164,866	3.785	589,503	13.533
6035	--	9.00	--	--	--	191,669	4.400	767,770	17.626

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



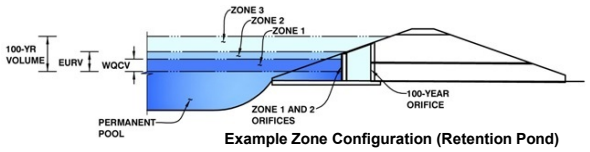


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: MAYBERRY FILING 3

Basin ID: INTERIM DETENTION POND D (with Filing 4 Developed)



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.09	1.340	Orifice Plate
Zone 2 (EURV)	4.42	2.054	Orifice Plate
Zone 3 (100+1/2WQCV)	5.91	3.397	Weir&Pipe (Restrict)
Total (all zones)		6.791	

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)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	3.60	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	14.40	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches	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	1.20	2.40					
Orifice Area (sq. inches)	4.00	5.00	6.25					

	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 =	5.50	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	5.50	N/A	feet
Overflow Weir Front Edge Length =	7.00	N/A	feet	Overflow Weir Slope Length =	6.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	6.46	N/A	
Horiz. Length of Weir Sides =	6.00	N/A	feet	Overflow Grate Open Area w/o Debris =	29.23	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	14.62	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 =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	4.53	N/A	ft^2
Outlet Pipe Diameter =	36.00	N/A	inches	Outlet Orifice Centroid =	1.04	N/A	feet
Restrictor Plate Height Above Pipe Invert =	22.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.79	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.75	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.65	feet
Spillway Crest Length =	50.00	feet	Stage at Top of Freeboard =	8.40	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	4.03	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	15.10	acre-ft

Calculated Parameters for Spillway

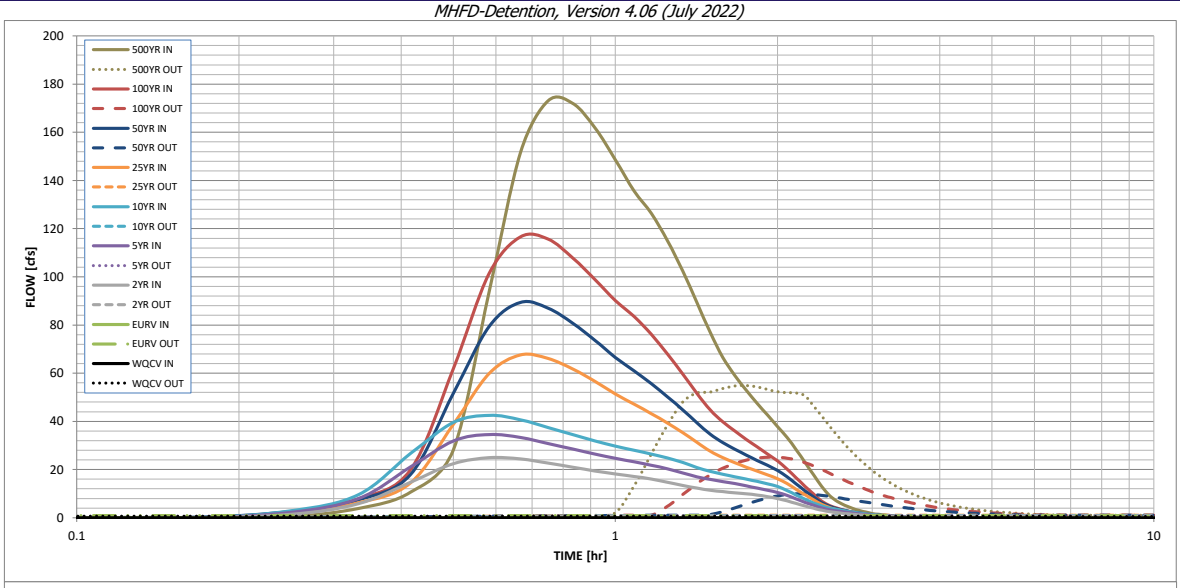
Routed Hydrograph Results

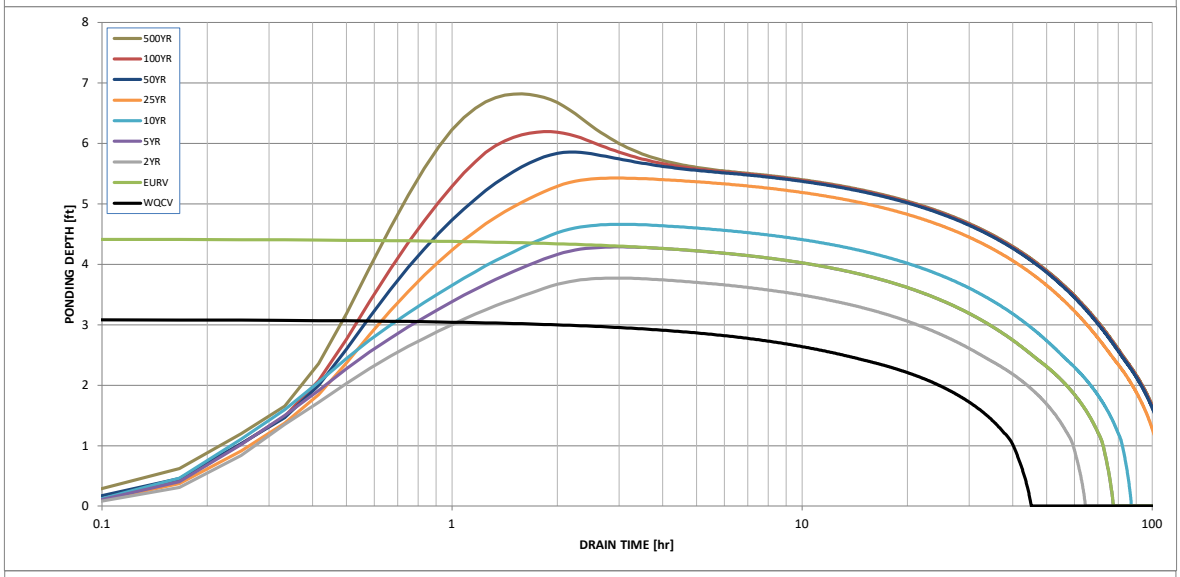
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

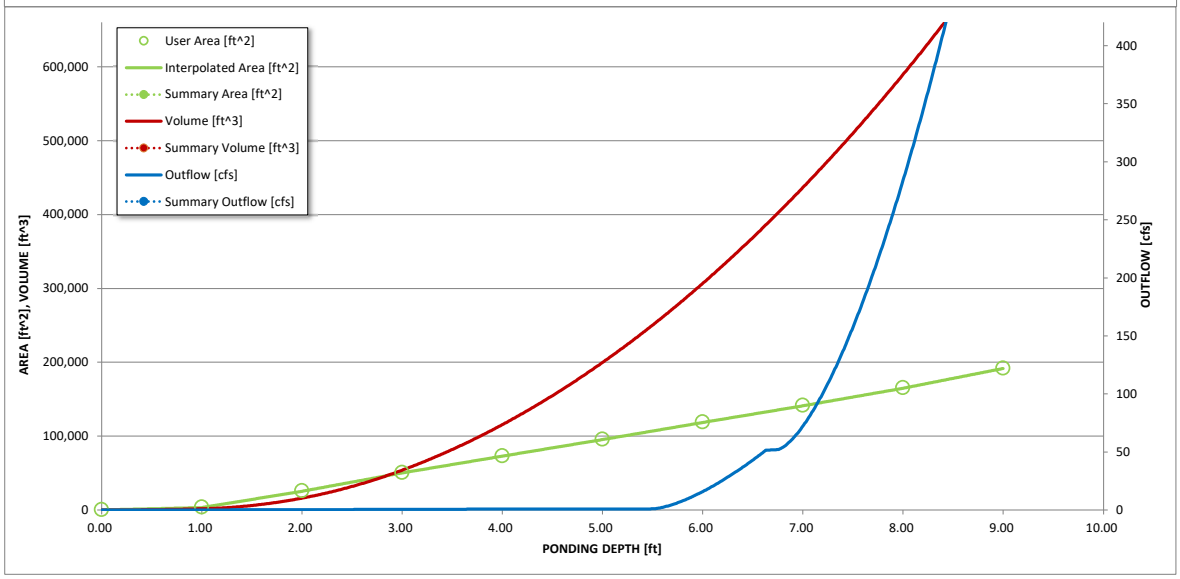
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	1.340	3.394	2.446	3.340	4.073	5.780	7.384	9.520	14.111
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	2.446	3.340	4.073	5.780	7.384	9.520	14.111
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.6	1.2	1.7	15.6	31.3	51.8	94.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.02	0.16	0.31	0.52	0.94
Peak Inflow Q (cfs) =	N/A	N/A	24.9	34.5	42.5	67.6	89.4	116.6	173.1
Peak Outflow Q (cfs) =	0.6	0.9	0.8	0.9	0.9	1.0	9.9	25.1	54.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.7	0.5	0.1	0.3	0.5	0.6
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	0.3	0.8	1.8
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) =	40	68	57	68	77	96	99	97	92
Time to Drain 99% of Inflow Volume (hours) =	**43**	73	61	73	82	102	106	105	103
Maximum Ponding Depth (ft) =	3.09	4.42	3.77	4.28	4.66	5.42	5.85	6.19	6.81
Area at Maximum Ponding Depth (acres) =	1.20	1.89	1.55	1.82	2.01	2.41	2.64	2.81	3.14
Maximum Volume Stored (acre-ft) =	1.345	3.402	2.267	3.143	3.851	5.553	6.639	7.540	9.415

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

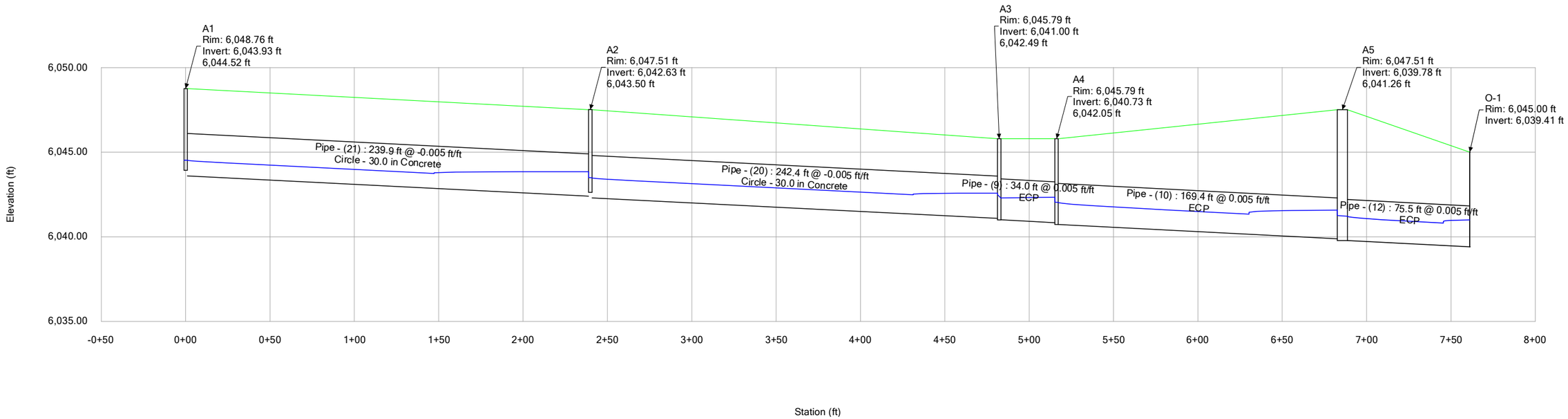
	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.02	0.54
	0:15:00	0.00	0.00	1.40	2.28	2.87	1.95	2.56	2.44	3.86
	0:20:00	0.00	0.00	5.82	7.90	9.51	6.15	7.37	7.78	10.58
	0:25:00	0.00	0.00	14.71	21.13	26.61	14.42	17.94	19.84	28.17
	0:30:00	0.00	0.00	22.45	31.83	39.54	38.80	51.63	61.91	93.83
	0:35:00	0.00	0.00	24.90	34.55	42.51	59.89	79.42	101.48	151.65
	0:40:00	0.00	0.00	24.39	33.27	40.67	67.58	89.38	116.64	173.06
	0:45:00	0.00	0.00	22.68	30.75	37.44	66.08	86.97	115.63	171.96
	0:50:00	0.00	0.00	20.90	28.50	34.49	61.77	80.72	107.85	161.77
	0:55:00	0.00	0.00	19.39	26.43	31.84	56.60	73.62	98.77	148.57
	1:00:00	0.00	0.00	18.13	24.64	29.72	51.36	66.51	90.14	135.55
	1:05:00	0.00	0.00	17.14	23.18	28.00	47.15	60.94	83.49	126.25
	1:10:00	0.00	0.00	15.98	21.81	26.38	43.19	55.56	76.04	115.00
	1:15:00	0.00	0.00	14.68	20.27	24.76	39.28	50.24	67.93	102.43
	1:20:00	0.00	0.00	13.41	18.59	22.89	35.24	44.78	59.63	89.40
	1:25:00	0.00	0.00	12.26	17.01	20.82	31.31	39.47	51.64	76.92
	1:30:00	0.00	0.00	11.41	15.84	19.25	27.60	34.64	44.76	66.56
	1:35:00	0.00	0.00	10.82	15.03	18.05	24.90	31.16	39.76	58.96
	1:40:00	0.00	0.00	10.33	14.15	16.99	22.82	28.42	35.93	52.91
	1:45:00	0.00	0.00	9.88	13.21	16.01	21.01	26.04	32.54	47.51
	1:50:00	0.00	0.00	9.44	12.29	15.07	19.32	23.80	29.41	42.56
	1:55:00	0.00	0.00	8.76	11.41	14.09	17.74	21.69	26.42	37.86
	2:00:00	0.00	0.00	7.97	10.52	12.94	16.19	19.63	23.55	33.34
	2:05:00	0.00	0.00	6.96	9.24	11.28	14.11	16.95	20.15	28.22
	2:10:00	0.00	0.00	5.88	7.79	9.43	11.78	14.02	16.54	22.90
	2:15:00	0.00	0.00	4.84	6.40	7.66	9.52	11.18	13.04	17.76
	2:20:00	0.00	0.00	3.90	5.13	6.11	7.44	8.55	9.77	13.00
	2:25:00	0.00	0.00	3.10	4.05	4.86	5.60	6.26	6.88	9.18
	2:30:00	0.00	0.00	2.51	3.28	4.01	4.22	4.71	5.05	6.78
	2:35:00	0.00	0.00	2.08	2.73	3.37	3.32	3.71	3.90	5.18
	2:40:00	0.00	0.00	1.74	2.29	2.82	2.68	2.99	3.05	3.97
	2:45:00	0.00	0.00	1.45	1.91	2.34	2.16	2.40	2.38	3.04
	2:50:00	0.00	0.00	1.20	1.58	1.93	1.74	1.93	1.85	2.31
	2:55:00	0.00	0.00	0.99	1.30	1.58	1.41	1.54	1.43	1.75
	3:00:00	0.00	0.00	0.82	1.06	1.29	1.13	1.24	1.12	1.36
	3:05:00	0.00	0.00	0.68	0.87	1.05	0.92	1.01	0.92	1.10
	3:10:00	0.00	0.00	0.56	0.71	0.85	0.75	0.81	0.74	0.89
	3:15:00	0.00	0.00	0.45	0.56	0.67	0.60	0.64	0.59	0.70
	3:20:00	0.00	0.00	0.35	0.44	0.53	0.47	0.50	0.46	0.54
	3:25:00	0.00	0.00	0.27	0.34	0.40	0.35	0.38	0.35	0.40
	3:30:00	0.00	0.00	0.20	0.25	0.29	0.26	0.27	0.25	0.28
	3:35:00	0.00	0.00	0.13	0.17	0.20	0.18	0.19	0.16	0.18
	3:40:00	0.00	0.00	0.09	0.12	0.13	0.11	0.11	0.10	0.11
	3:45:00	0.00	0.00	0.05	0.07	0.07	0.06	0.06	0.05	0.05
	3:50:00	0.00	0.00	0.02	0.04	0.03	0.03	0.02	0.02	0.01
	3:55:00	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FlexTable: Conduit Table

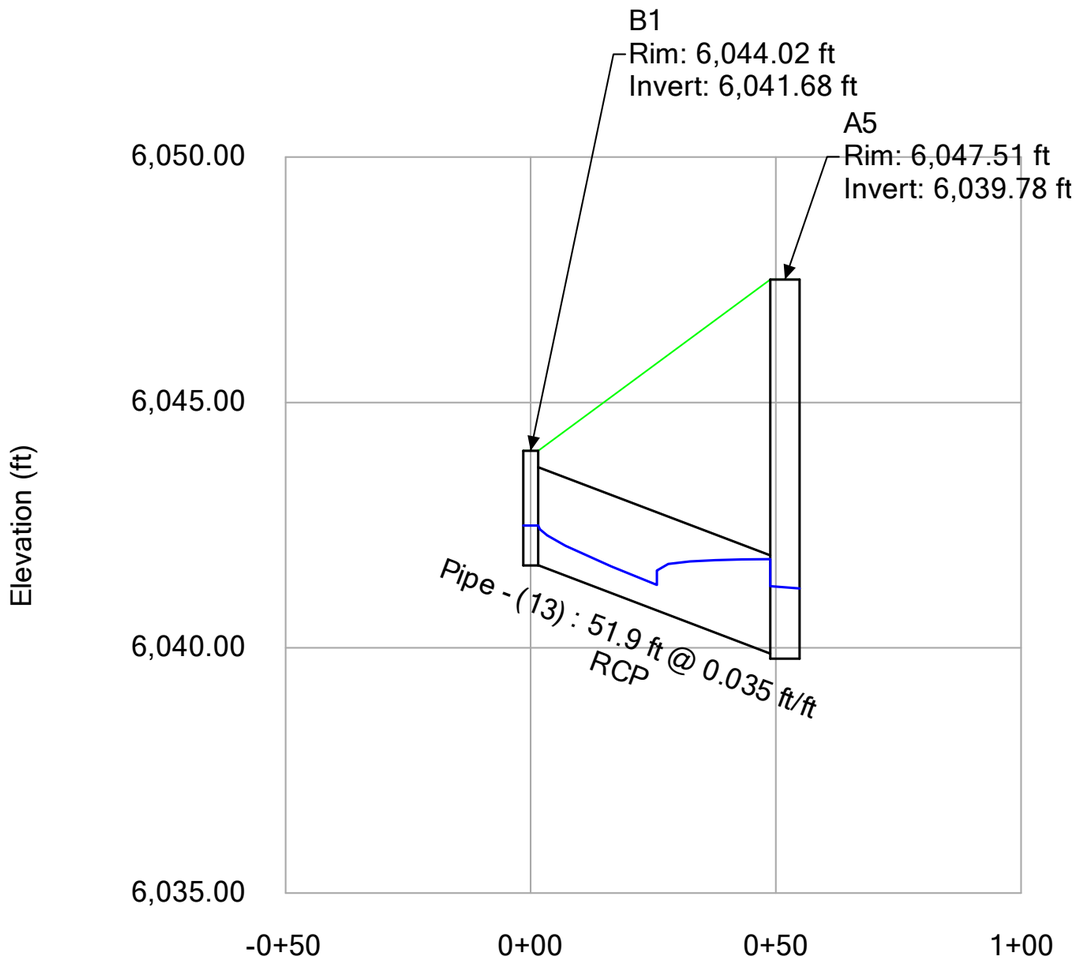
5-YEAR

ID	Start Node	Invert (Start) (ft)	Stop Node	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)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
38	A5	6,039.78	O-1	6,039.41	75.5	0.005		0.013	26.98	6.82	46.48	58.1	6,041.21	6,041.00
39	A2	6,042.40	A1	6,043.60	239.9	-0.005	30.0	0.013	7.70	4.99	29.01	26.5	6,044.52	6,043.85
40	A3	6,041.09	A2	6,042.30	242.4	-0.005	30.0	0.013	12.36	5.67	28.98	42.6	6,043.48	6,042.57
41	A4	6,040.73	A5	6,039.88	169.4	0.005		0.013	22.61	6.47	46.61	48.5	6,042.03	6,041.57
42	B1	6,041.68	A5	6,039.88	51.9	0.035	24.0	0.013	5.29	9.16	42.14	12.6	6,042.49	6,041.80
43	A3	6,041.00	A4	6,040.83	34.0	0.005		0.013	18.08	6.04	46.61	38.8	6,042.29	6,042.33

Profile Report
Engineering Profile - Storm Line A (MC22249.stsw)
5-YEAR



Profile Report
Engineering Profile - Storm Line B (MC22249.stsw)
5-YEAR

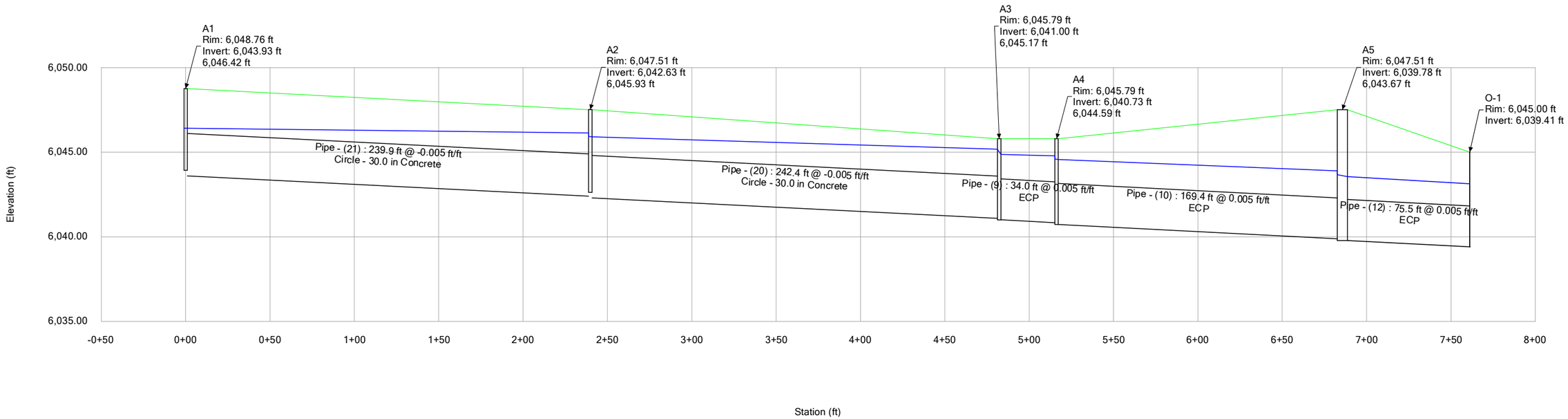


FlexTable: Conduit Table

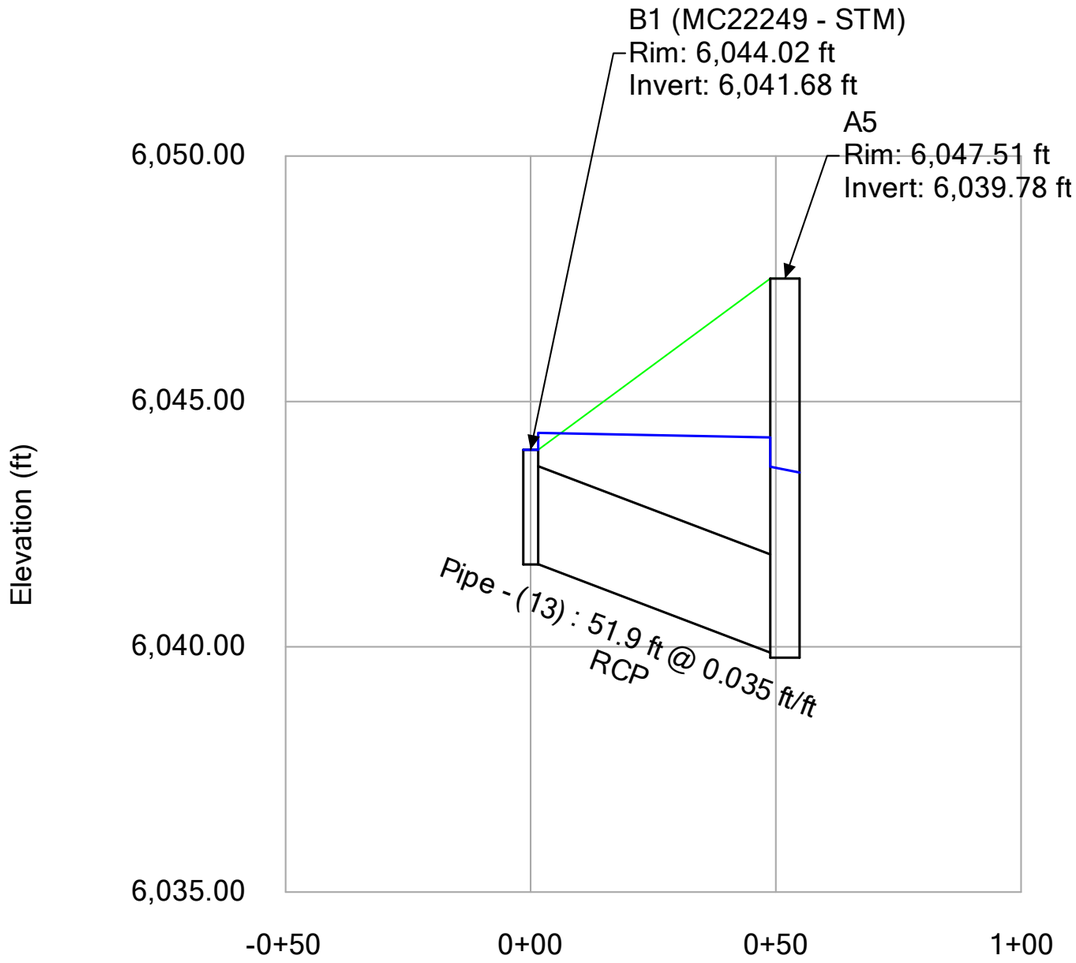
100-YEAR

ID	Start Node	Invert (Start) (ft)	Stop Node	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)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
38	A5	6,039.78	O-1	6,039.41	75.5	0.005		0.013	49.30	6.93	46.48	106.1	6,043.55	6,043.13
39	A2	6,042.40	A1	6,043.60	239.9	-0.005	30.0	0.013	14.10	2.87	29.01	48.6	6,046.42	6,046.13
40	A3	6,041.09	A2	6,042.30	242.4	-0.005	30.0	0.013	22.60	4.60	28.98	78.0	6,045.91	6,045.17
41	A4	6,040.73	A5	6,039.88	169.4	0.005		0.013	41.30	5.80	46.61	88.6	6,044.57	6,043.90
42	B1	6,041.68	A5	6,039.88	51.9	0.035	24.0	0.013	9.60	3.06	42.14	22.8	6,044.36	6,044.27
43	A3	6,041.00	A4	6,040.83	34.0	0.005		0.013	33.00	4.64	46.61	70.8	6,044.87	6,044.78

Profile Report
Engineering Profile - Storm Line A (MC22249.stsw)
100-YEAR



Profile Report
Engineering Profile - Storm Line B (MC22249.stsw)
100-YEAR



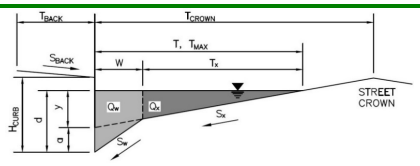
MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project: **Mayberry Filing No. 4**

Inlet ID: **Inlet A1**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.5	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} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.050	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 =	0.005	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

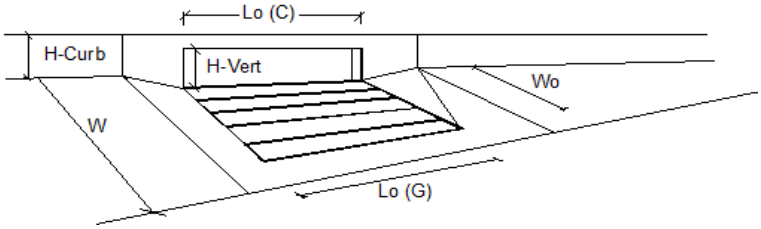
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**7.7**	**57.1**	**cfs**

WARNING: MINOR STORM max. allowable capacity is less than the design peak flow of 7.70 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 14.10 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



CDOT Type R Curb Opening

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: WARNING: Q > ALLOWABLE Q FOR MINOR & MAJOR STORM		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**7.7**	**11.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**2.3**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**99**	**84**	**%**

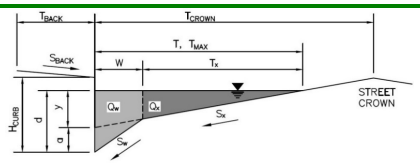
MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project: Mayberry Filing No. 4

Inlet ID: Inlet A2



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.5	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} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	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 =	0.005	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

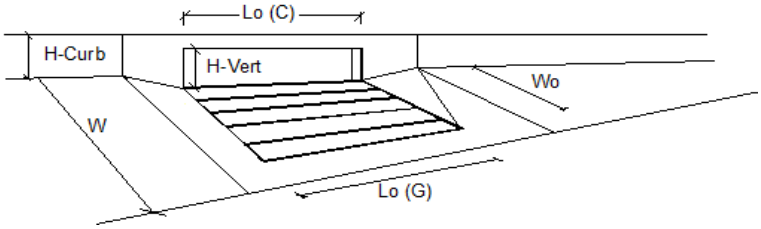
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**9.5**	**99.6**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 4.35 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 10.21 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



CDOT Type R Curb Opening

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 =**	**4.3**	**8.9**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.3**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**87**	**%**

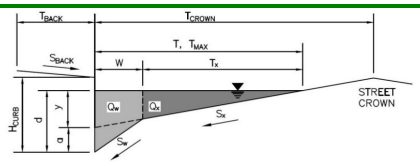
MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project: Mayberry Filing No. 4

Inlet ID: Inlet A3



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.5	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} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	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} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

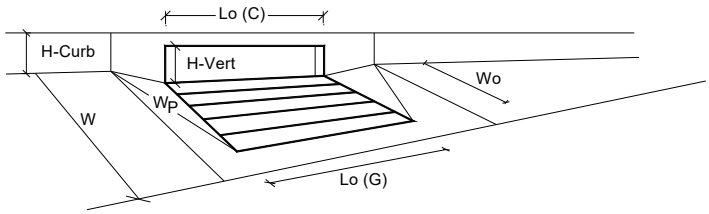
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



CDOT Type R Curb Opening

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 =	5.6	12.0	☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area 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) =	15.00	15.00	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} =	0.30	0.83	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.76	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**6.5**	**36.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	5.8	11.9	cfs

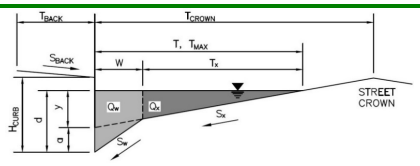
MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project: Mayberry Filing No. 4

Inlet ID: Inlet A4



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.5	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} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	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} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

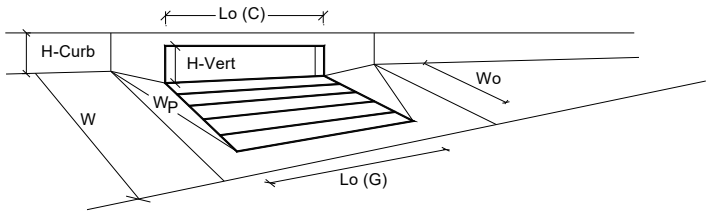
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



CDOT Type R Curb Opening

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	12.0	☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area 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) =	15.00	15.00	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	0.83	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.79	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**7.8**	**36.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	7.4	13.5	cfs

SWALE C-5 (100-YEAR)

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.030
Channel Slope	0.010 ft/ft
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Discharge	9.60 cfs

Results	
Normal Depth	11.0 in
Flow Area	3.3 ft²
Wetted Perimeter	7.5 ft
Hydraulic Radius	5.3 in
Top Width	7.31 ft
Critical Depth	9.8 in
Critical Slope	0.018 ft/ft
Velocity	2.88 ft/s
Velocity Head	0.13 ft
Specific Energy	1.04 ft
Froude Number	0.751
Flow Type	Subcritical

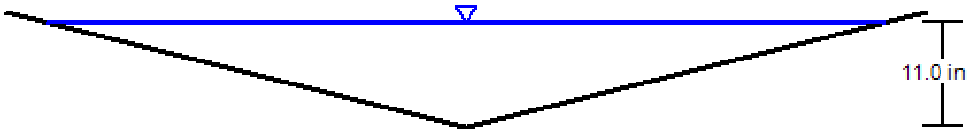
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

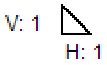
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	11.0 in
Critical Depth	9.8 in
Channel Slope	0.010 ft/ft
Critical Slope	0.018 ft/ft

SWALE C-5 X-SECTION (100-YEAR)

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.030
Channel Slope	0.010 ft/ft
Normal Depth	11.0 in
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Discharge	9.60 cfs





Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Dec 30 2022

Channel E -100 Year

Trapezoidal

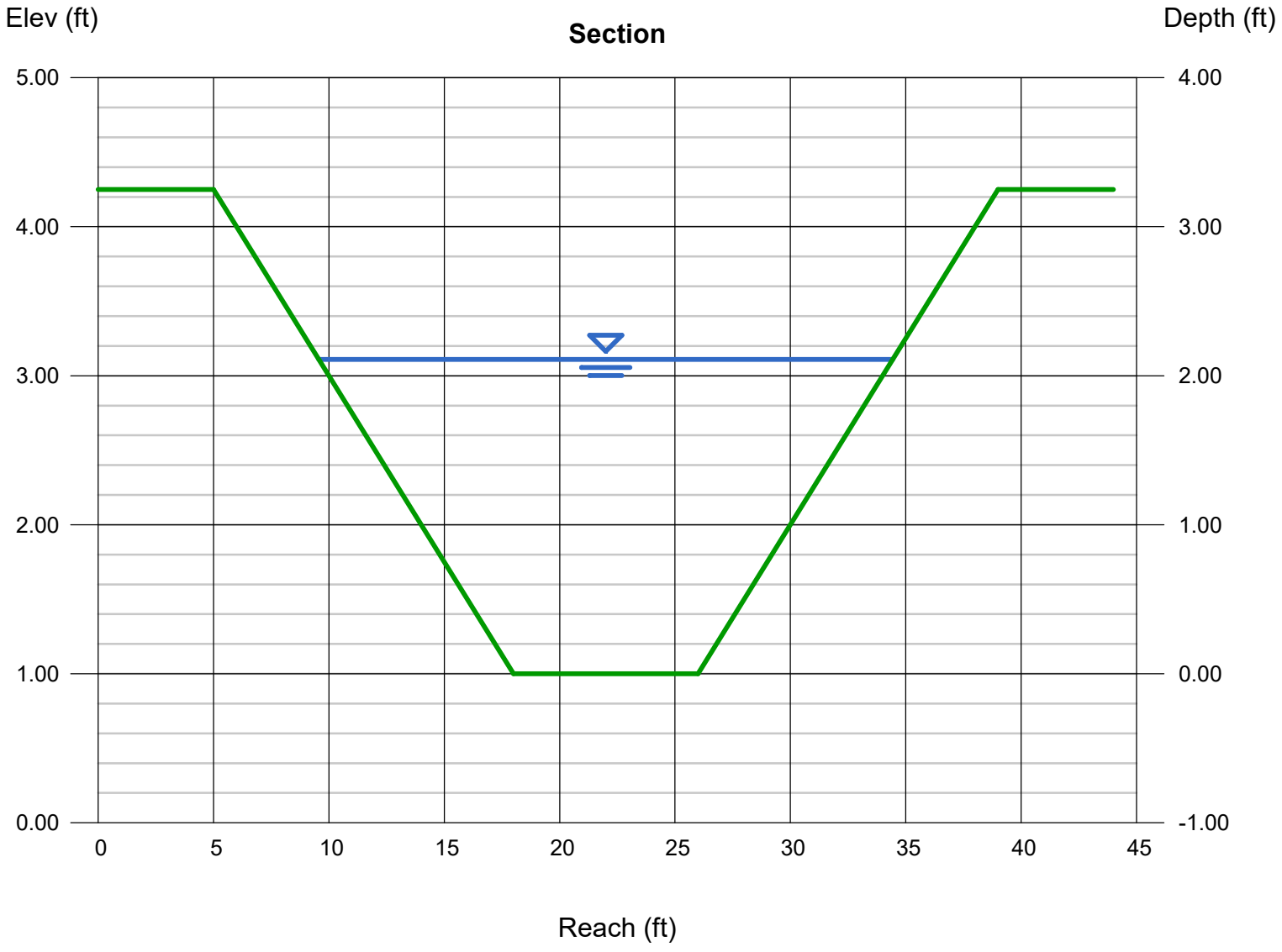
Bottom Width (ft)	= 8.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 3.25
Invert Elev (ft)	= 1.00
Slope (%)	= 0.50
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 148.60

Highlighted

Depth (ft)	= 2.11
Q (cfs)	= 148.60
Area (sqft)	= 34.69
Velocity (ft/s)	= 4.28
Wetted Perim (ft)	= 25.40
Crit Depth, Yc (ft)	= 1.67
Top Width (ft)	= 24.88
EGL (ft)	= 2.40



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Dec 30 2022

Channel E Culvert - 100 Year

Invert Elev Dn (ft)	=	6040.26
Pipe Length (ft)	=	115.00
Slope (%)	=	0.50
Invert Elev Up (ft)	=	6040.84
Rise (in)	=	38.0
Shape	=	Elliptical
Span (in)	=	60.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Horizontal Ellipse Concrete
Culvert Entrance	=	Square edge w/headwall (H)
Coeff. K,M,c,Y,k	=	0.01, 2, 0.0398, 0.67, 0.5

Embankment

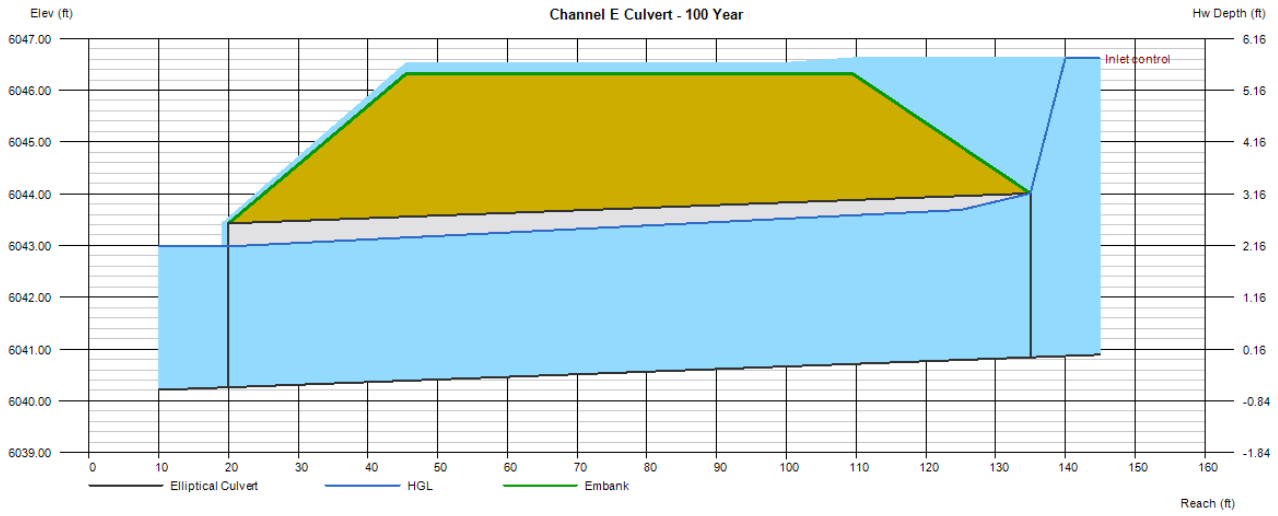
Top Elevation (ft)	=	6046.32
Top Width (ft)	=	64.00
Crest Width (ft)	=	60.80

Calculations

Qmin (cfs)	=	48.60
Qmax (cfs)	=	148.60
Tailwater Elev (ft)	=	(dc+D)/2

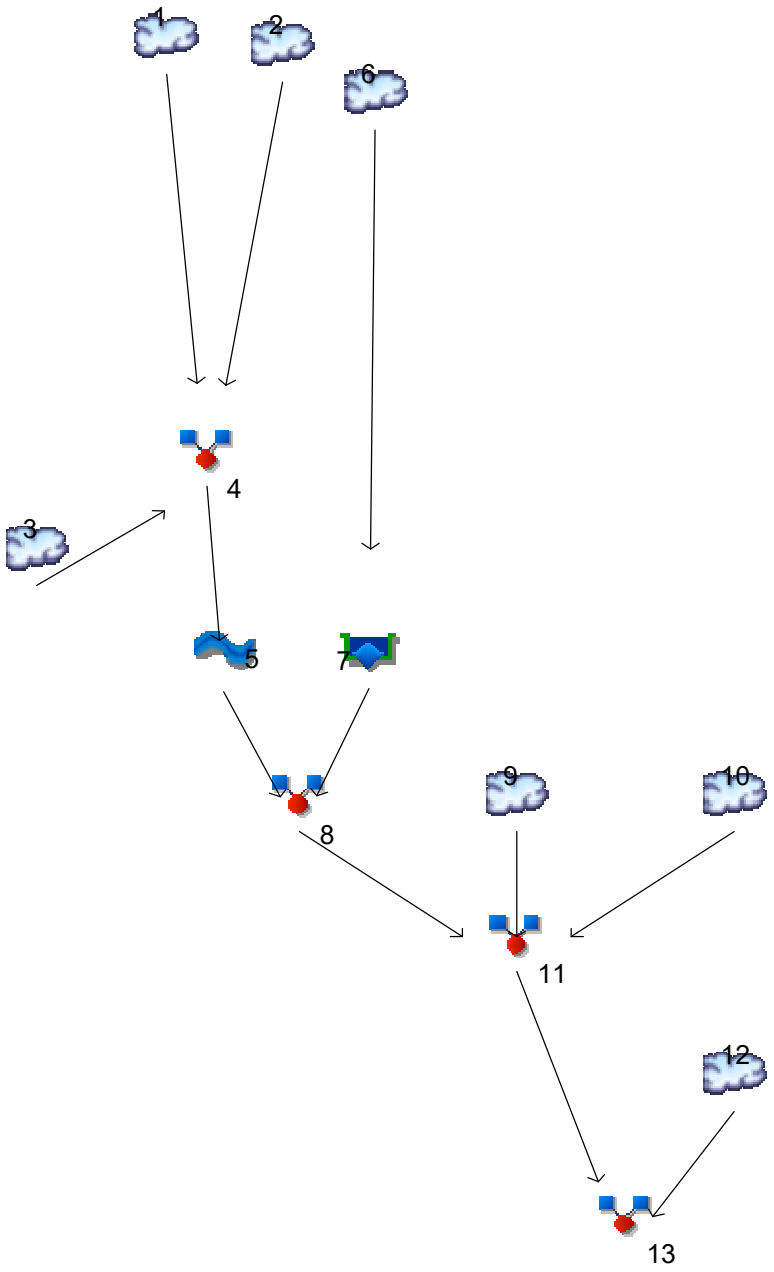
Highlighted

Qtotal (cfs)	=	148.60
Qpipe (cfs)	=	119.26
Qovertop (cfs)	=	29.34
Veloc Dn (ft/s)	=	10.26
Veloc Up (ft/s)	=	9.99
HGL Dn (ft)	=	6042.98
HGL Up (ft)	=	6043.75
Hw Elev (ft)	=	6046.61
Hw/D (ft)	=	1.82
Flow Regime	=	Inlet Control



Hydraflow Table of Contents

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	EC10 - PRESENT
2	SCS Runoff	E1
3	SCS Runoff	OS-1
4	Combine	DP11
5	Reach	CHANNEL TO DP24
6	SCS Runoff	BASIN D
7	Reservoir	POND D
8	Combine	EX-5
9	SCS Runoff	EX-E
10	SCS Runoff	EX-LOG
11	Combine	EX-6
12	SCS Runoff	EX-Z
13	Combine	EX-7

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	-------	-------	18.43	-------	-------	-------	144.67	EC10 - PRESENT
2	SCS Runoff	------	-------	-------	-------	0.320	-------	-------	-------	2.846	E1
3	SCS Runoff	------	-------	-------	-------	1.349	-------	-------	-------	4.333	OS-1
4	Combine	1, 2, 3	-------	-------	-------	18.93	-------	-------	-------	148.45	DP11
5	Reach	4	-------	-------	-------	17.61	-------	-------	-------	138.52	CHANNEL TO DP24
6	SCS Runoff	------	-------	-------	-------	61.50	-------	-------	-------	190.38	BASIN D
7	Reservoir	6	-------	-------	-------	1.722	-------	-------	-------	39.58	POND D
8	Combine	5, 7	-------	-------	-------	18.66	-------	-------	-------	177.50	EX-5
9	SCS Runoff	------	-------	-------	-------	6.054	-------	-------	-------	53.32	EX-E
10	SCS Runoff	------	-------	-------	-------	3.682	-------	-------	-------	6.317	EX-LOG
11	Combine	8, 9, 10	-------	-------	-------	21.86	-------	-------	-------	204.65	EX-6
12	SCS Runoff	------	-------	-------	-------	8.146	-------	-------	-------	63.40	EX-Z
13	Combine	11, 12	-------	-------	-------	26.53	-------	-------	-------	244.45	EX-7

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

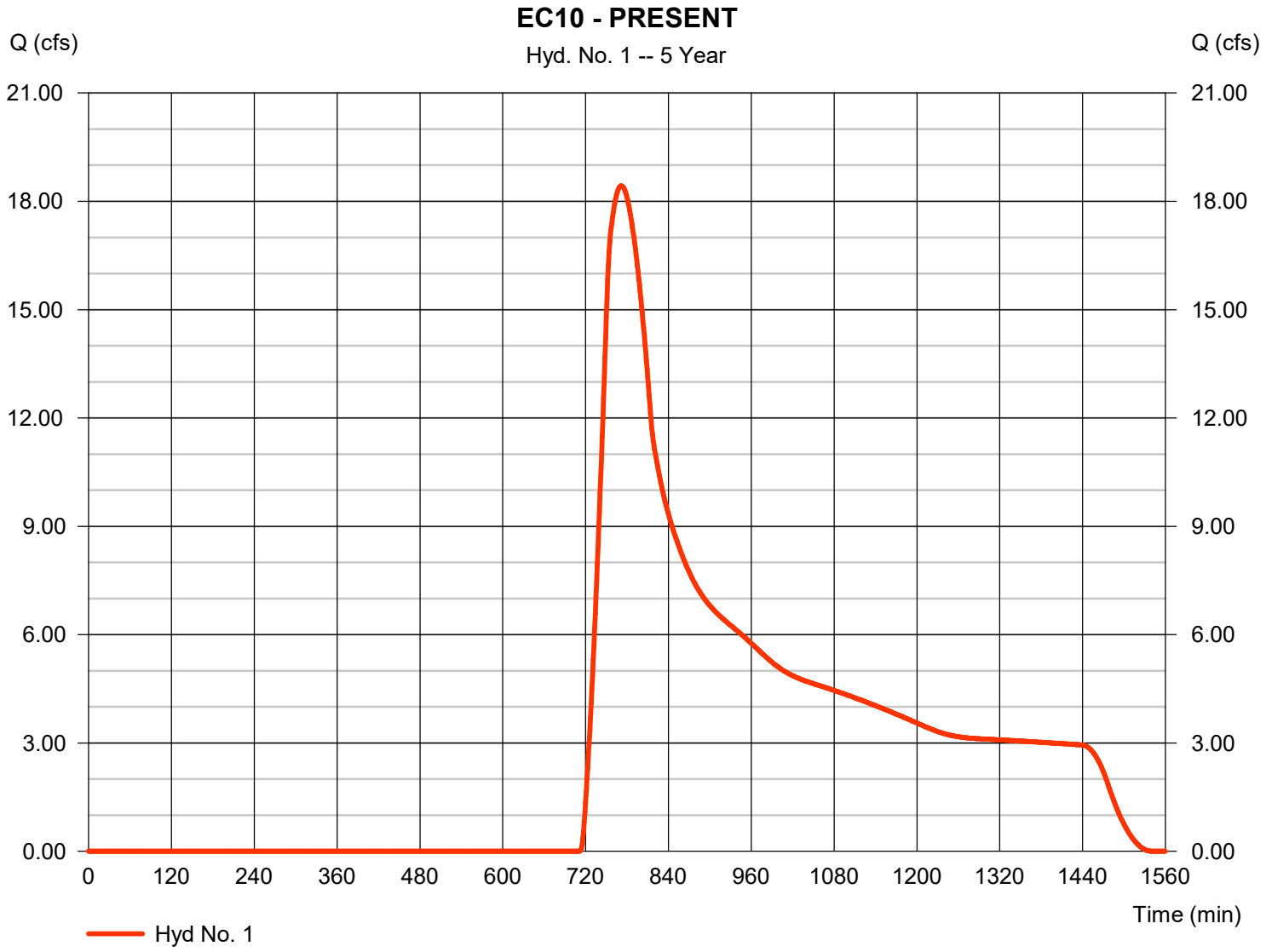
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	18.43	1	772	262,007	------	------	------	EC10 - PRESENT
2	SCS Runoff	0.320	1	742	3,200	------	------	------	E1
3	SCS Runoff	1.349	1	734	6,442	------	------	------	OS-1
4	Combine	18.93	1	771	271,649	1, 2, 3	------	------	DP11
5	Reach	17.61	1	789	271,640	4	------	------	CHANNEL TO DP24
6	SCS Runoff	61.50	1	730	256,733	------	------	------	BASIN D
7	Reservoir	1.722	1	1443	150,906	6	6031.02	201,385	POND D
8	Combine	18.66	1	789	422,546	5, 7	------	------	EX-5
9	SCS Runoff	6.054	1	745	62,432	------	------	------	EX-E
10	SCS Runoff	3.682	1	729	15,373	------	------	------	EX-LOG
11	Combine	21.86	1	784	500,351	8, 9, 10	------	------	EX-6
12	SCS Runoff	8.146	1	742	76,284	------	------	------	EX-Z
13	Combine	26.53	1	761	576,634	11, 12	------	------	EX-7

Hydrograph Report

Hyd. No. 1

EC10 - PRESENT

Hydrograph type	=	SCS Runoff	Peak discharge	=	18.43 cfs
Storm frequency	=	5 yrs	Time to peak	=	772 min
Time interval	=	1 min	Hyd. volume	=	262,007 cuft
Drainage area	=	320.000 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	63.00 min
Total precip.	=	2.60 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 1

EC10 - PRESENT

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.030		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.20		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 7.85**	**+**	**0.00**	**+**	**0.00**	**=**	**7.85**
Shallow Concentrated Flow							
Flow length (ft)	= 6086.00		0.00		0.00		
Watercourse slope (%)	= 1.30		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.84		0.00		0.00		
Travel Time (min)	**= 55.14**	**+**	**0.00**	**+**	**0.00**	**=**	**55.14**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

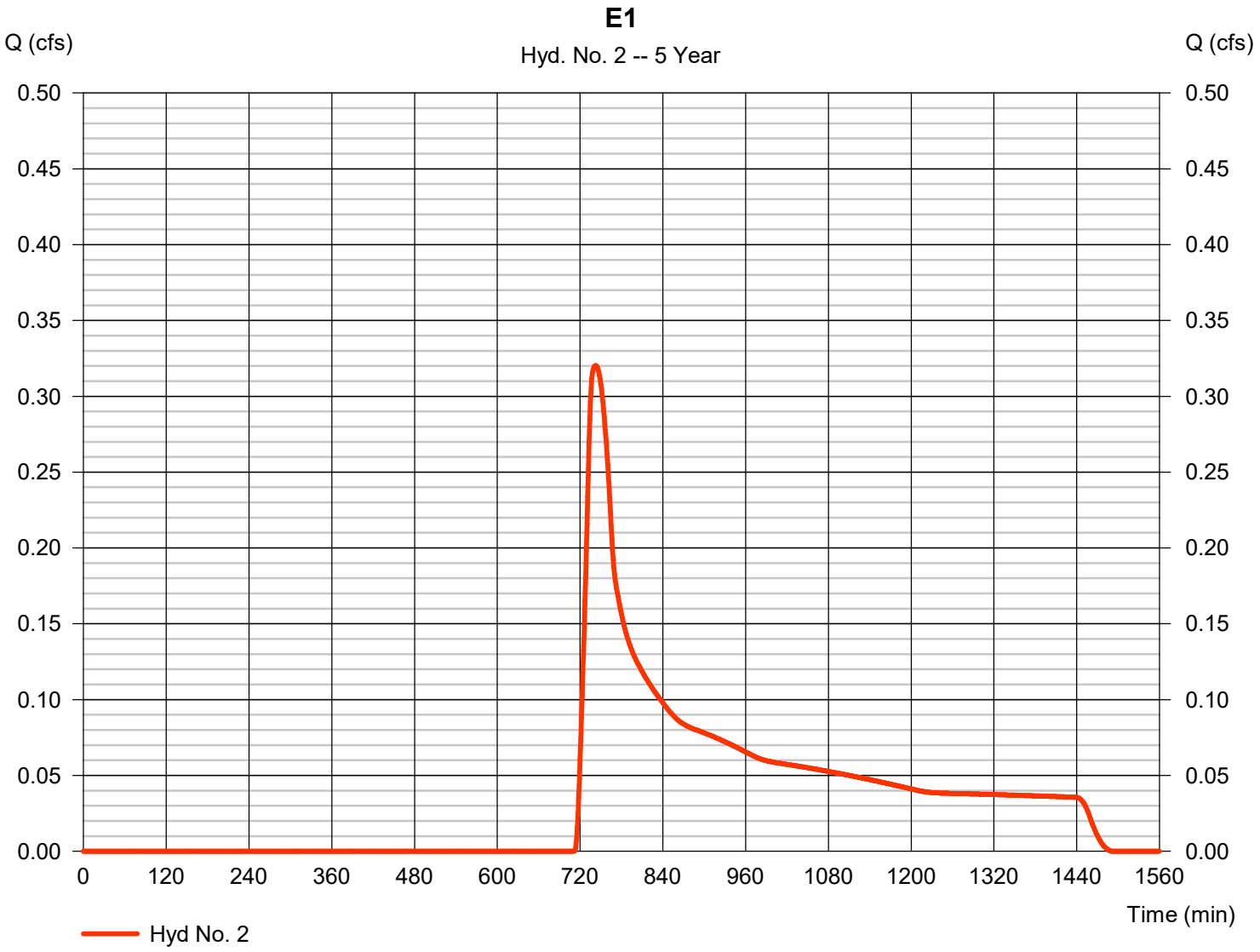
Total Travel Time, Tc ..... 63.00 min

Hydrograph Report

Hyd. No. 2

E1

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.320 cfs
Storm frequency	=	5 yrs	Time to peak	=	742 min
Time interval	=	1 min	Hyd. volume	=	3,200 cuft
Drainage area	=	3.920 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	32.50 min
Total precip.	=	2.60 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 2

E1

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 0.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 0.00		0.00		0.00		
Land slope (%)	= 0.00		0.00		0.00		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Shallow Concentrated Flow							
Flow length (ft)	= 2811.00		0.00		0.00		
Watercourse slope (%)	= 0.80		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.44		0.00		0.00		
Travel Time (min)	**= 32.46**	**+**	**0.00**	**+**	**0.00**	**=**	**32.46**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

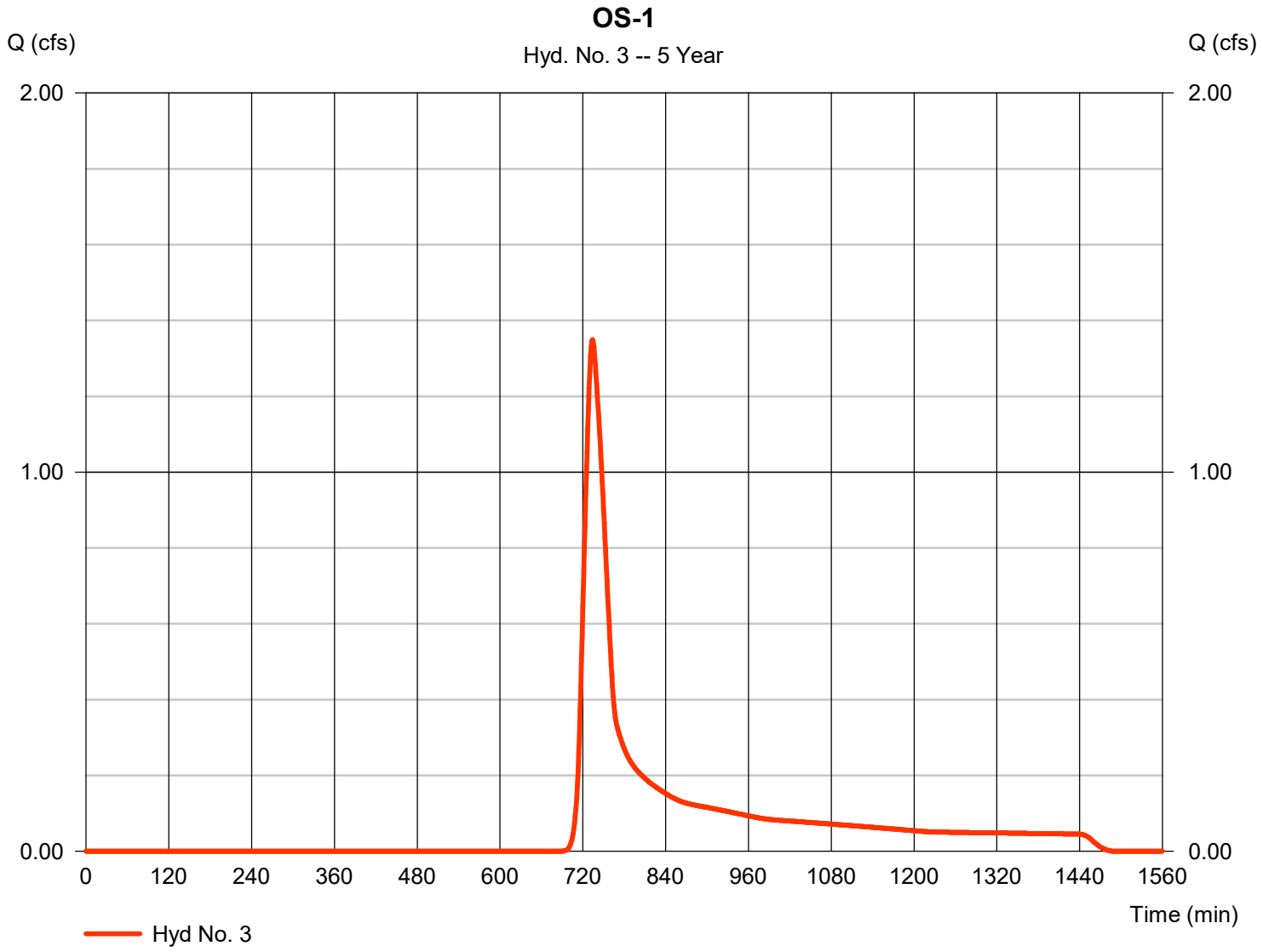
Total Travel Time, Tc ..... 32.50 min

Hydrograph Report

Hyd. No. 3

OS-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.349 cfs
Storm frequency	=	5 yrs	Time to peak	=	734 min
Time interval	=	1 min	Hyd. volume	=	6,442 cuft
Drainage area	=	2.650 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	32.10 min
Total precip.	=	2.60 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 3

OS-1

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.013		0.011		0.011		
Flow length (ft)	= 50.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.20		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 0.96**	**+**	**0.00**	**+**	**0.00**	**=**	**0.96**
Shallow Concentrated Flow							
Flow length (ft)	= 2525.00		0.00		0.00		
Watercourse slope (%)	= 0.70		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.35		0.00		0.00		
Travel Time (min)	**= 31.17**	**+**	**0.00**	**+**	**0.00**	**=**	**31.17**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

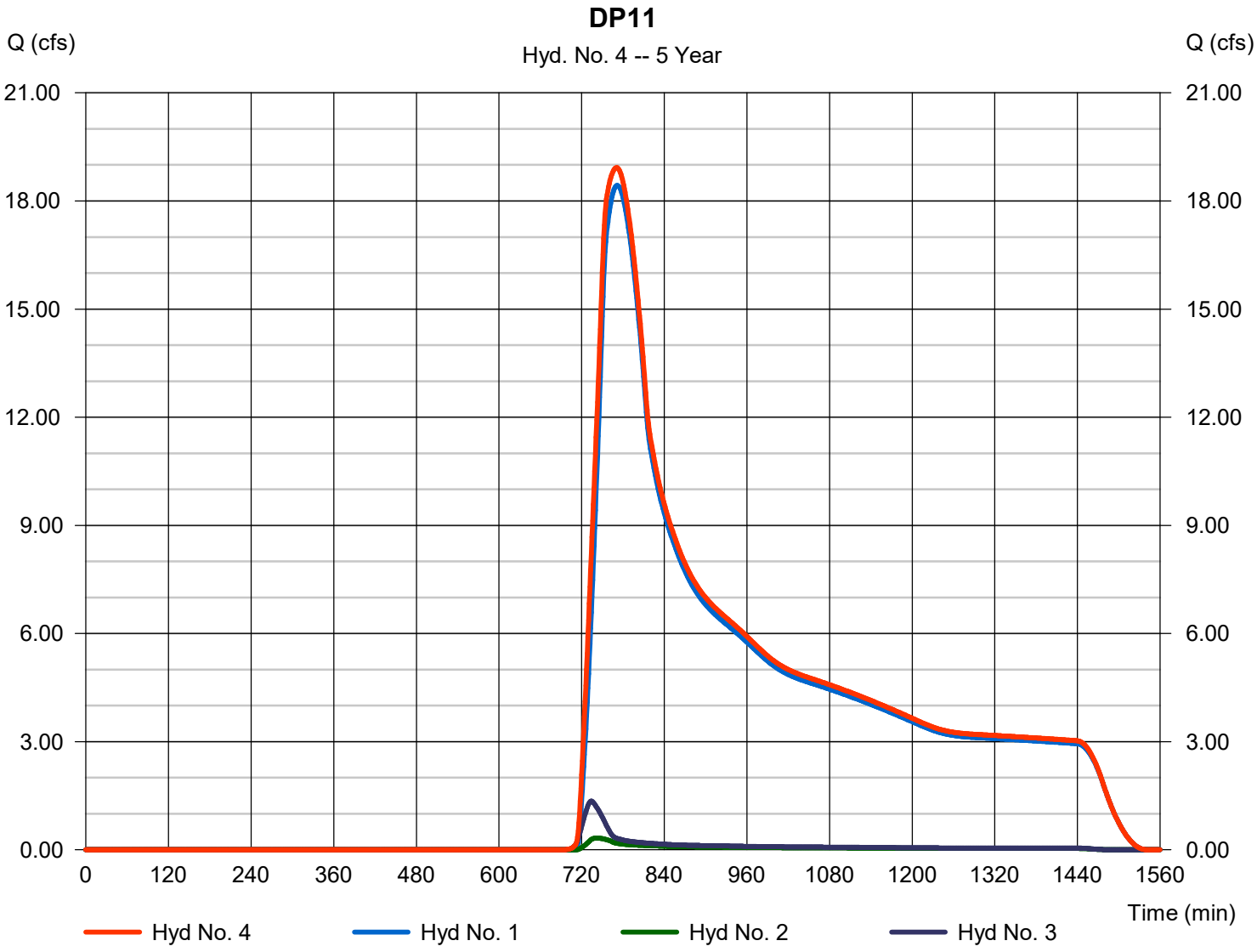
Total Travel Time, Tc ..... 32.10 min

Hydrograph Report

Hyd. No. 4

DP11

Hydrograph type	=	Combine	Peak discharge	=	18.93 cfs
Storm frequency	=	5 yrs	Time to peak	=	771 min
Time interval	=	1 min	Hyd. volume	=	271,649 cuft
Inflow hyds.	=	1, 2, 3	Contrib. drain. area	=	326.570 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

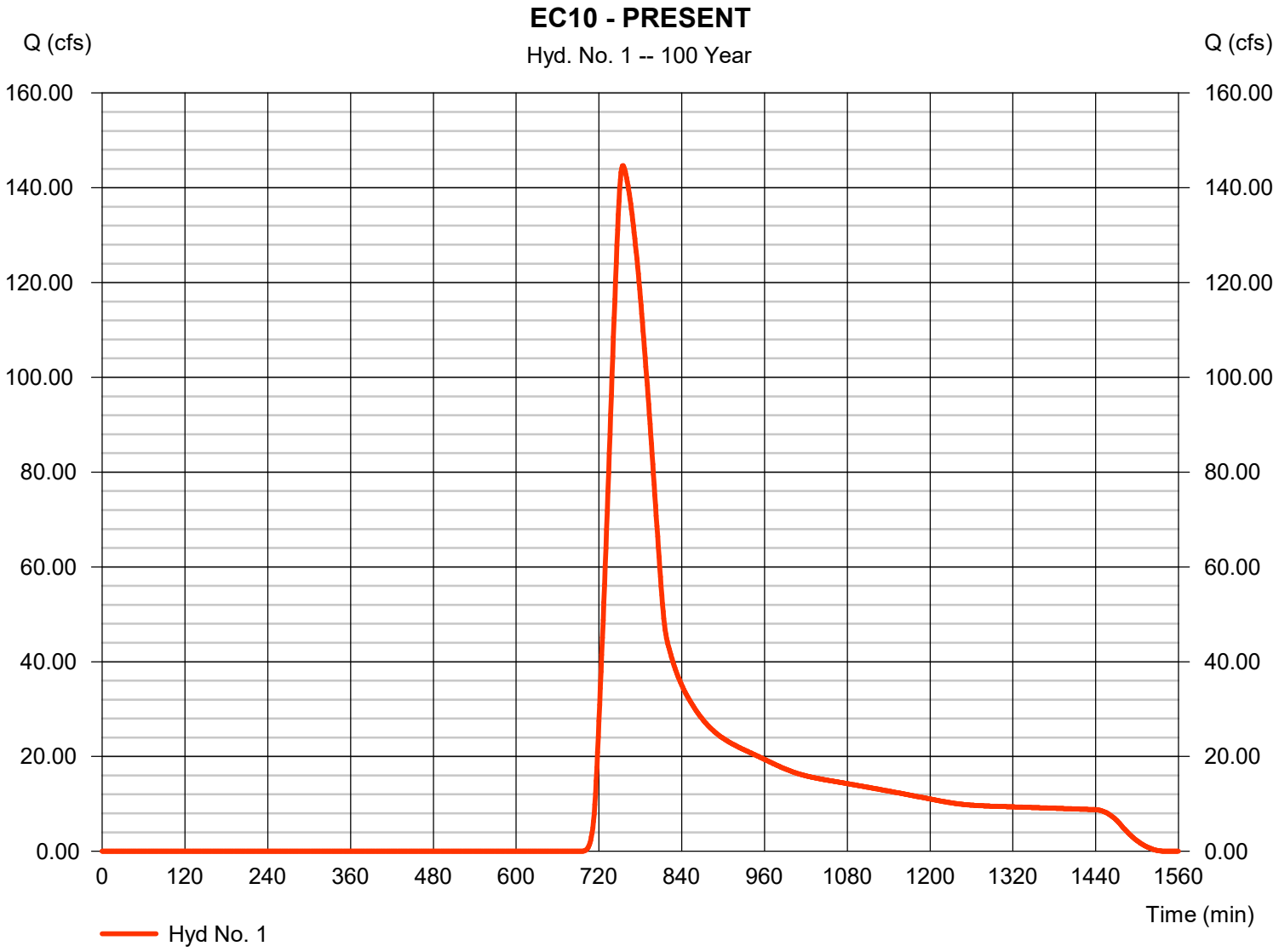
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	144.67	1	755	1,185,497	------	------	------	EC10 - PRESENT
2	SCS Runoff	2.846	1	735	14,479	------	------	------	E1
3	SCS Runoff	4.333	1	733	18,356	------	------	------	OS-1
4	Combine	148.45	1	754	1,218,333	1, 2, 3	------	------	DP11
5	Reach	138.52	1	766	1,218,326	4	------	------	CHANNEL TO DP24
6	SCS Runoff	190.38	1	730	718,796	------	------	------	BASIN D
7	Reservoir	39.58	1	759	610,089	6	6032.21	333,480	POND D
8	Combine	177.50	1	765	1,828,414	5, 7	------	------	EX-5
9	SCS Runoff	53.32	1	736	282,485	------	------	------	EX-E
10	SCS Runoff	6.317	1	729	27,009	------	------	------	EX-LOG
11	Combine	204.65	1	758	2,137,908	8, 9, 10	------	------	EX-6
12	SCS Runoff	63.40	1	736	328,266	------	------	------	EX-Z
13	Combine	244.45	1	754	2,466,175	11, 12	------	------	EX-7

Hydrograph Report

Hyd. No. 1

EC10 - PRESENT

Hydrograph type	=	SCS Runoff	Peak discharge	=	144.67 cfs
Storm frequency	=	100 yrs	Time to peak	=	755 min
Time interval	=	1 min	Hyd. volume	=	1,185,497 cuft
Drainage area	=	320.000 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	63.00 min
Total precip.	=	4.40 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

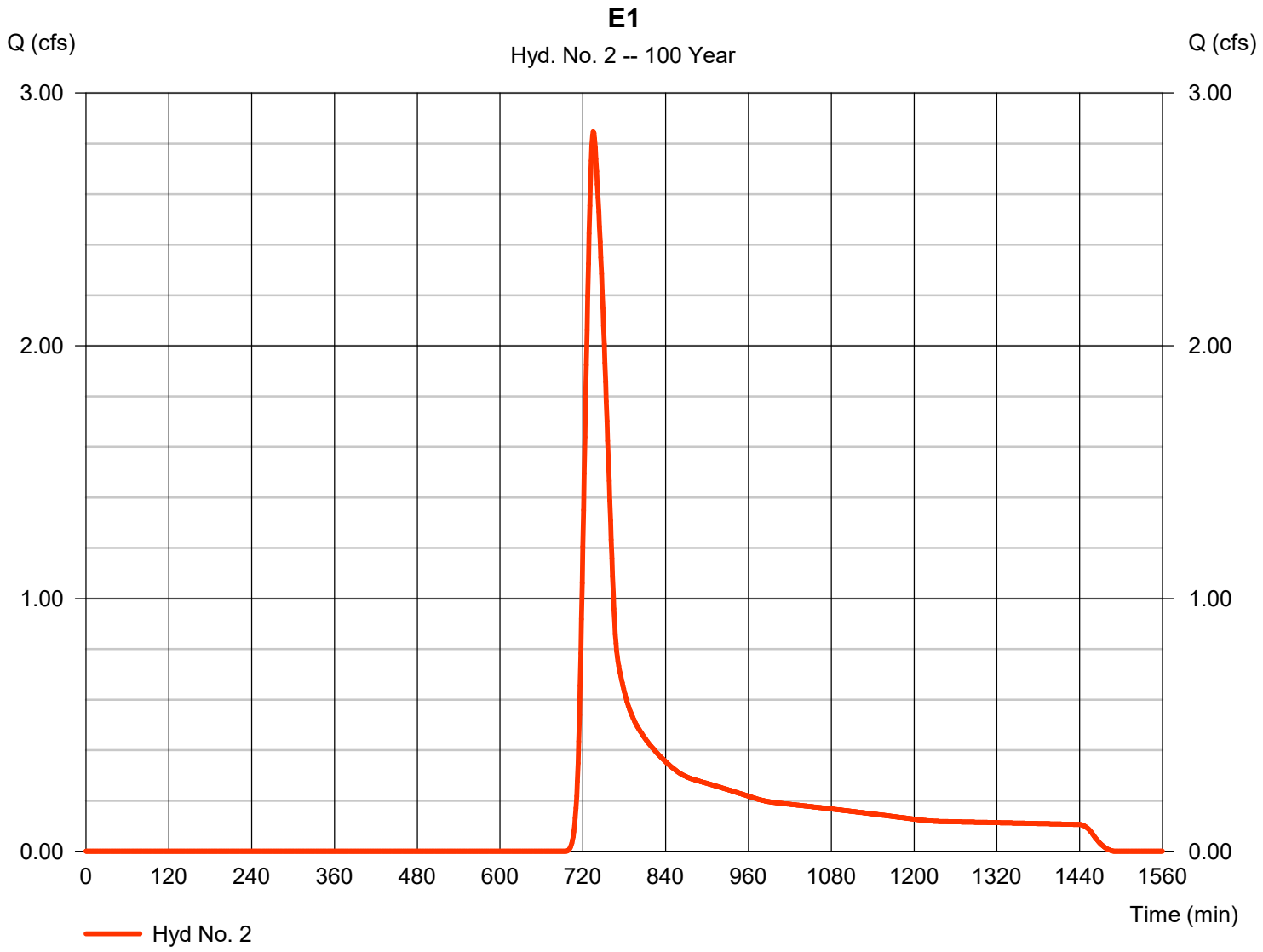


Hydrograph Report

Hyd. No. 2

E1

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.846 cfs
Storm frequency	=	100 yrs	Time to peak	=	735 min
Time interval	=	1 min	Hyd. volume	=	14,479 cuft
Drainage area	=	3.920 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	32.50 min
Total precip.	=	4.40 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

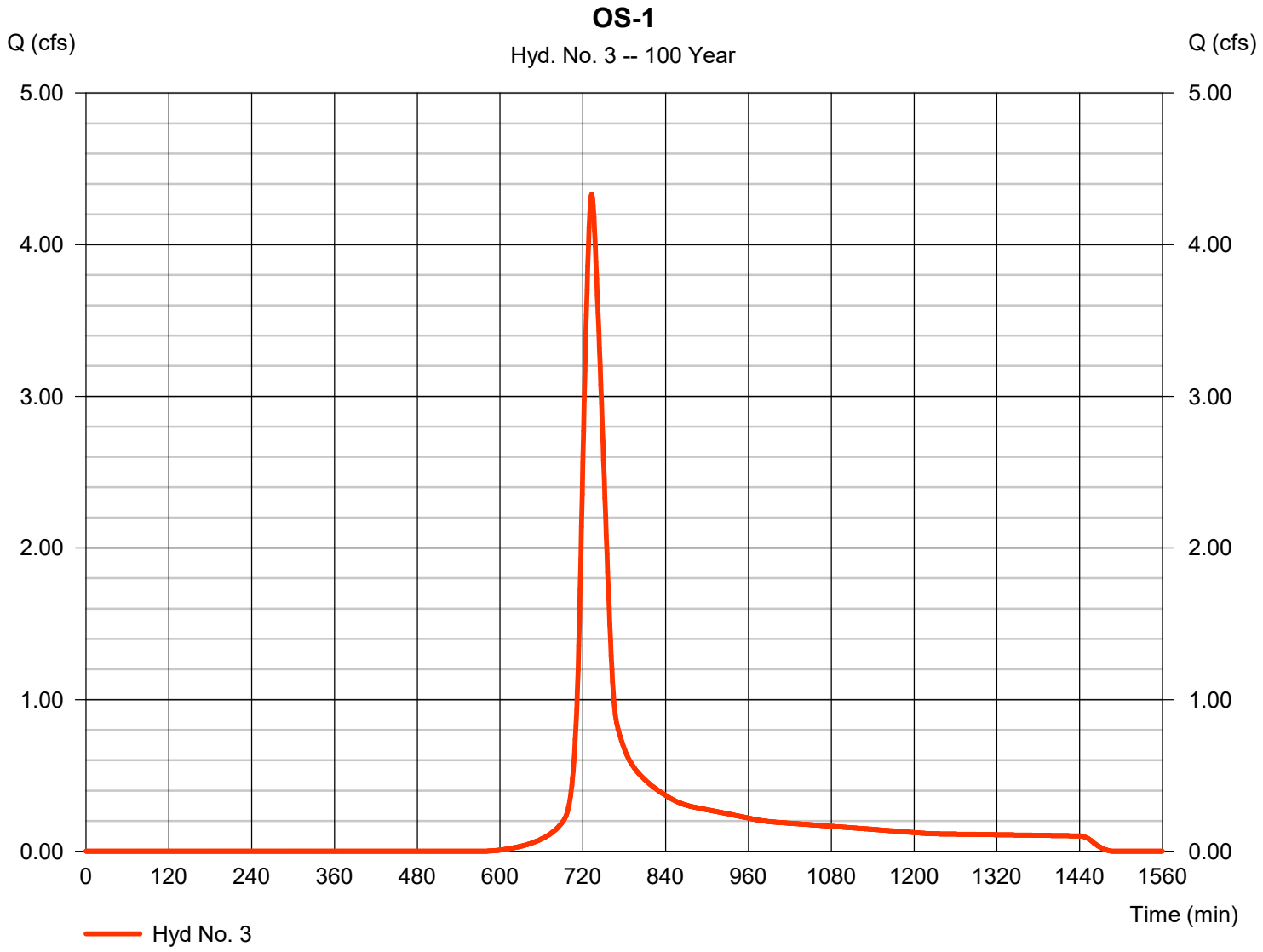


Hydrograph Report

Hyd. No. 3

OS-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.333 cfs
Storm frequency	=	100 yrs	Time to peak	=	733 min
Time interval	=	1 min	Hyd. volume	=	18,356 cuft
Drainage area	=	2.650 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	32.10 min
Total precip.	=	4.40 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

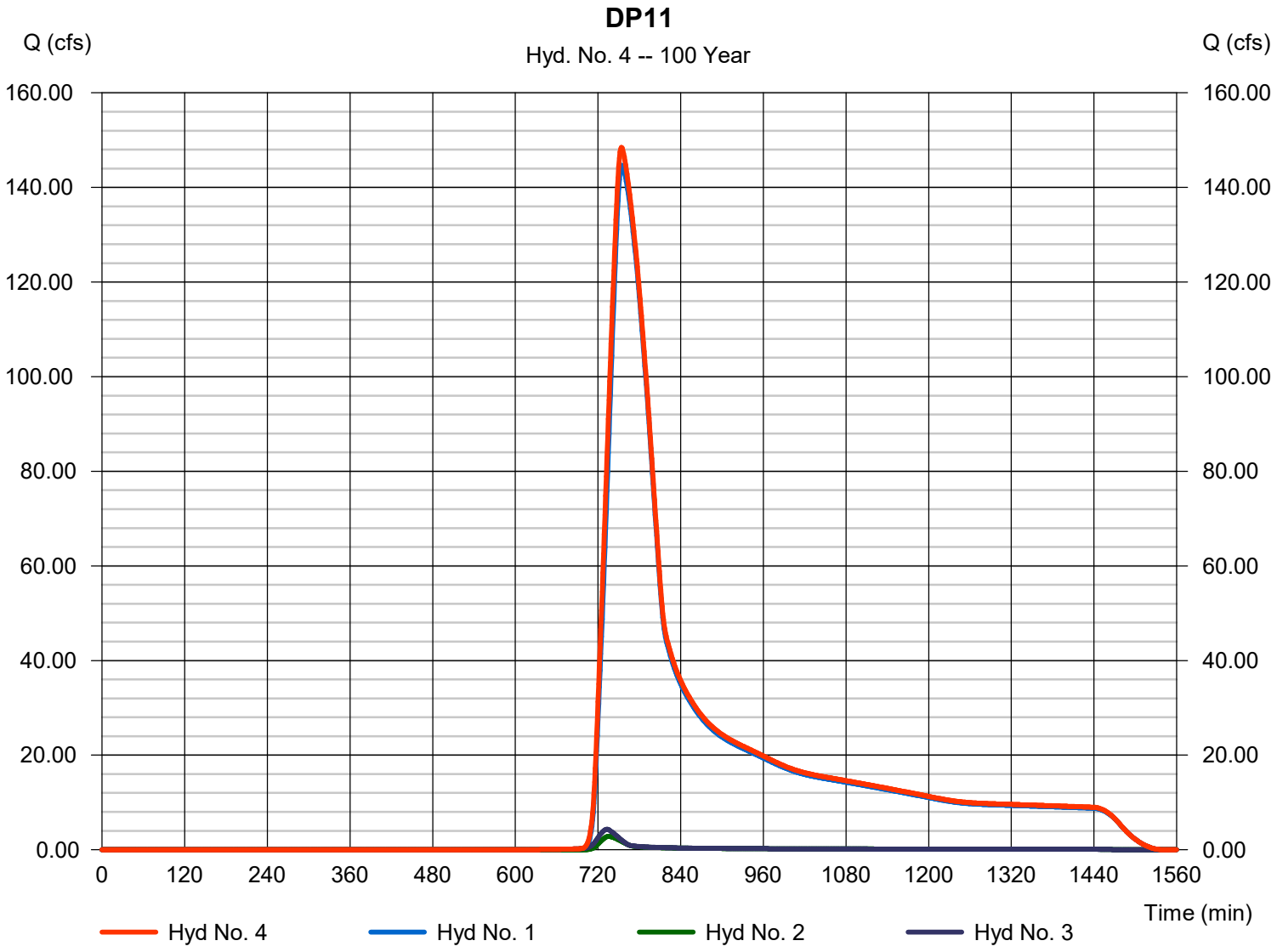


Hydrograph Report

Hyd. No. 4

DP11

Hydrograph type	=	Combine	Peak discharge	=	148.45 cfs
Storm frequency	=	100 yrs	Time to peak	=	754 min
Time interval	=	1 min	Hyd. volume	=	1,218,333 cuft
Inflow hyds.	=	1, 2, 3	Contrib. drain. area	=	326.570 ac

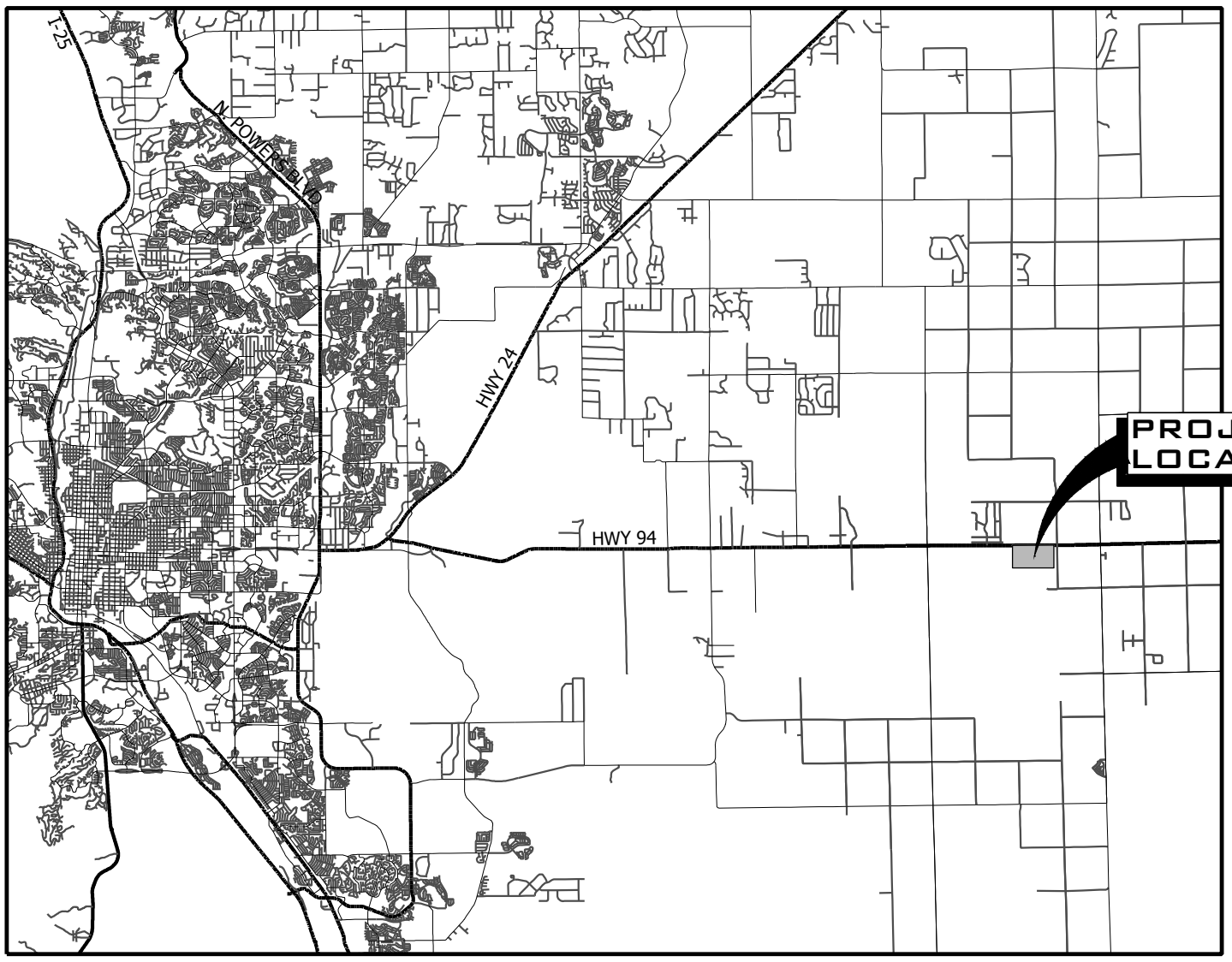


Hydraflow Rainfall Report

Precip. file name: Sample.pcp

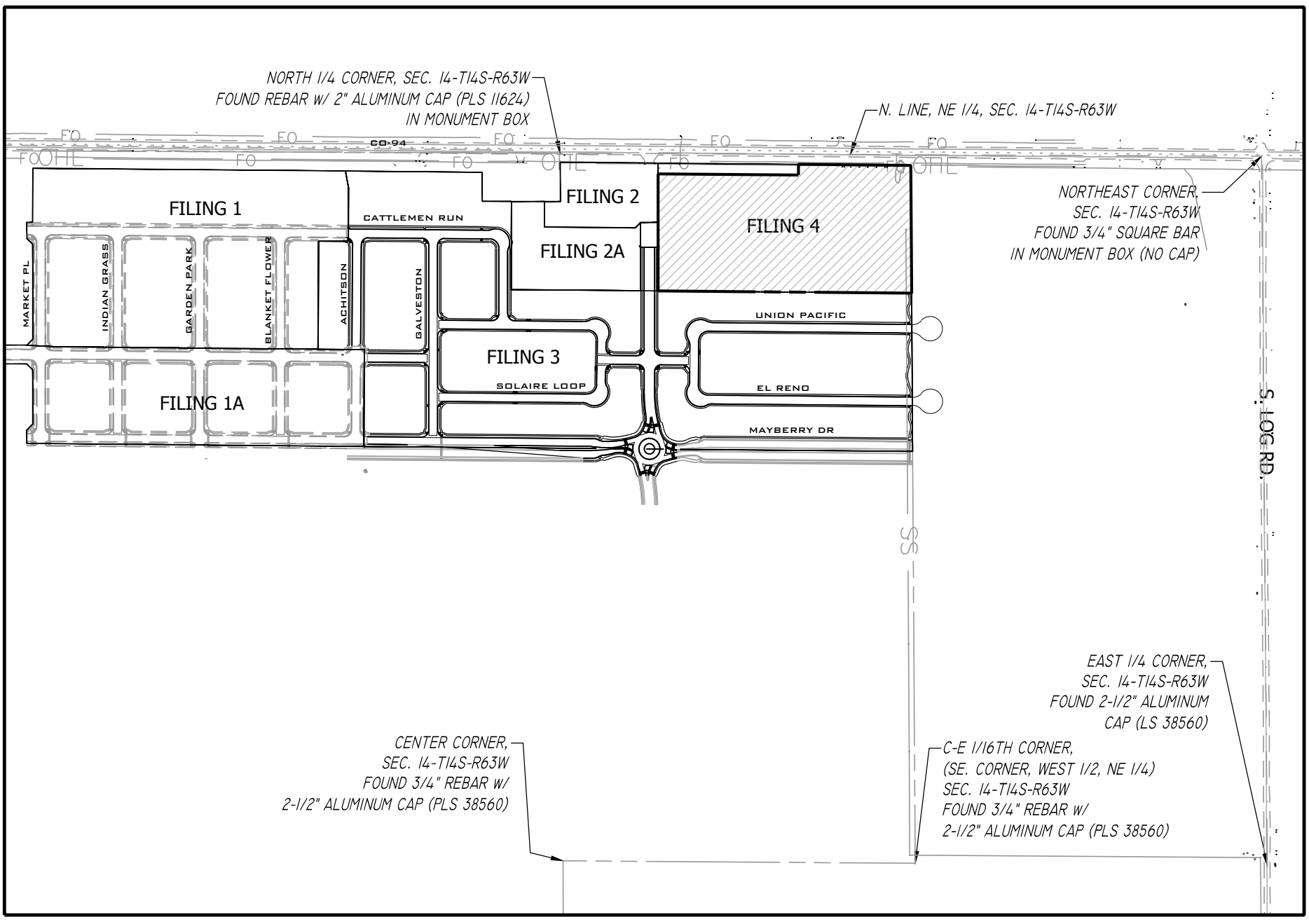
Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	2.20	0.00	2.60	4.25	5.77	6.80	4.40
SCS 6-Hr	0.00	1.80	0.00	0.00	2.60	0.00	0.00	0.00
Huff-1st	0.00	1.55	0.00	0.00	4.00	5.38	6.50	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	1.75	0.00	0.00	3.90	5.25	6.00	0.00

APPENDIX C – REFERENCE INFORMATION



VICINITY MAP

SCALE 1" = 20,000'



SITE MAP

SCALE 1" = 500'

REVISIONS

R&R ENGINEERS SURVEYORS INC
WWW.RRENGINEERS.COM

SITE MAP

MAYBERRY FILING NO. 4

3296 DEVINE HEIGHTS #208
COLORADO SPRINGS, CO 80922

R&R

JOB NO.	MC22249
DATE	12-20-2022
DRN GWH	CHK CD
EXHIBIT NAME	SITE MAP
SHEET NO.	1 OF 1

ENGINEER'S OPINION OF PROBABLE COSTS
FOR
Mayberry Filing 4 - Drainage Improvements

Item	Description	Total Work Units	Unit Price ($)	Total Cost ($)
Riprap		25 Ton	89.00 Ton	2,202.75
24" RCP		52 LF	$ 83.00 LF	$ 4,316.00
30" RCP		482 LF	$ 104.00 LF	$ 50,128.00
45" RCP		203 LF	$ 171.00 LF	$ 34,713.00
60" RCP		116 LF	$ 319.00 LF	$ 37,004.00
10' Type R		2 EA	$ 8,447.00 EA	$ 16,894.00
15' Type R		2 EA	$ 10,984.00 EA	$ 21,968.00
Storm Manhole		1 EA	$ 12,876.00 EA	$ 12,876.00
24" FES		1 EA	$ 495.00 EA	$ 495.00
60" FES		2 EA	$ 1,788.00 EA	$ 3,576.00
Grass Channels		1 AC	$ 1,520.00 EA	$ 866.40
SUBTOTAL				$ 184,172.75
Contingency (15%)				$ 27,625.91
TOTAL				**$ 211,798.66**

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for El Paso County Area, Colorado

December 20, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

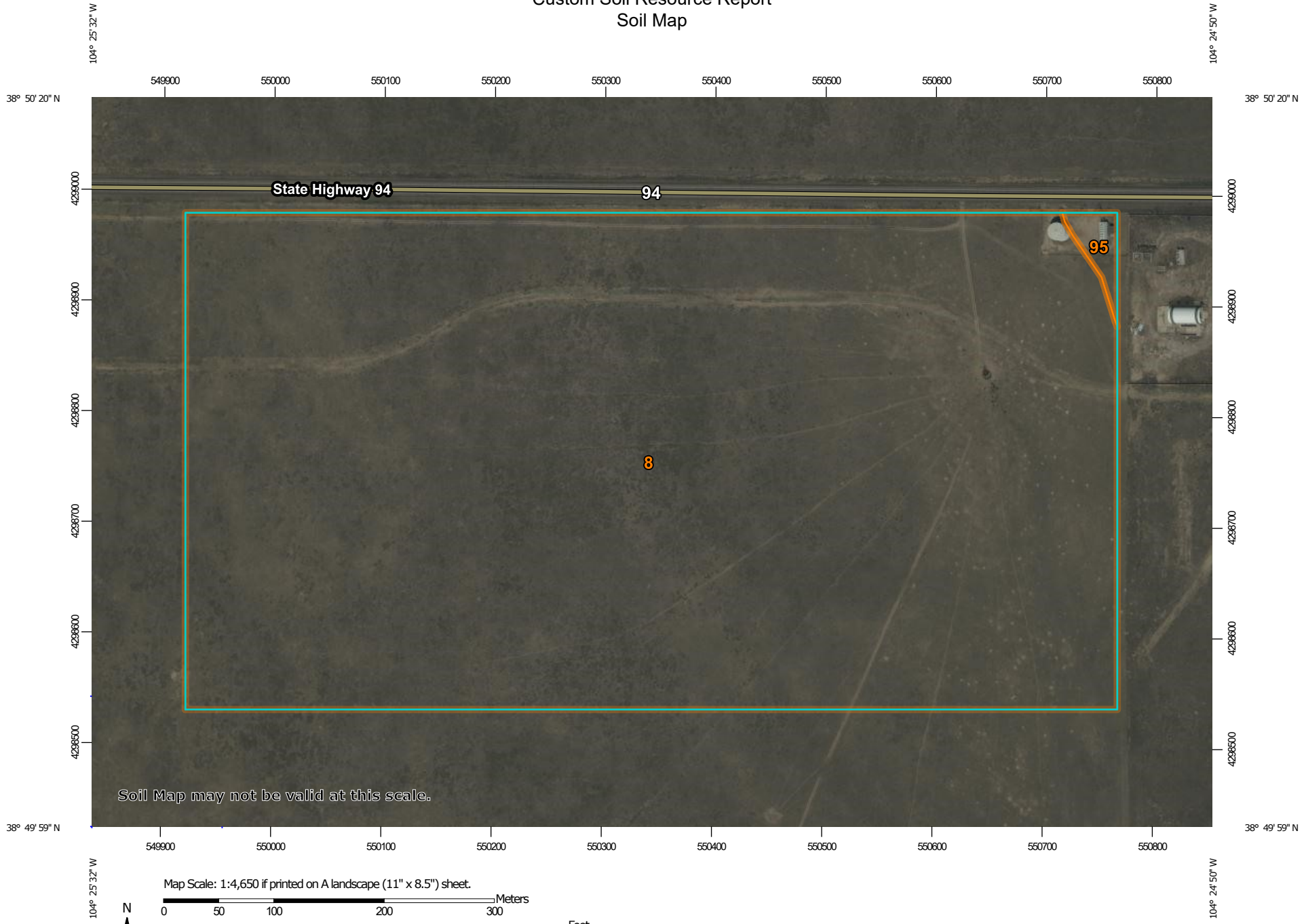
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:4,650 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 200 400 800 1200

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 Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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 20, Sep 2, 2022

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

Date(s) aerial images were photographed: Sep 11, 2018—Oct 20, 2018

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	93.6	99.4%
95	Truckton loamy sand, 1 to 9 percent slopes	0.6	0.6%
Totals for Area of Interest		**94.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

El Paso County Area, Colorado

8—Blakeland loamy sand, 1 to 9 percent slopes

Map Unit Setting

National map unit symbol: 369v
Elevation: 4,600 to 5,800 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Blakeland and similar soils: 98 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blakeland

Setting

Landform: Flats, hills
Landform position (three-dimensional): Side slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sedimentary rock and/or eolian deposits derived from sedimentary rock

Typical profile

A - 0 to 11 inches: loamy sand
AC - 11 to 27 inches: loamy sand
C - 27 to 60 inches: sand

Properties and qualities

Slope: 1 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 1 percent

Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

95—Truckton loamy sand, 1 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2yvrm
Elevation: 5,800 to 7,100 feet
Mean annual precipitation: 12 to 19 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 90 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Truckton and similar soils: 87 percent
Minor components: 13 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Truckton

Setting

Landform: Interfluves, fan remnants
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Wind re-worked alluvium derived from arkose

Typical profile

A - 0 to 4 inches: loamy sand
Bt1 - 4 to 12 inches: sandy loam
Bt2 - 12 to 19 inches: sandy loam
C - 19 to 80 inches: sandy loam

Properties and qualities

Slope: 1 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Maximum salinity: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Blakeland

Percent of map unit: 5 percent
Landform: Interfluves, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Bresser

Percent of map unit: 5 percent
Landform: Interfluves, terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Urban land

Percent of map unit: 2 percent
Hydric soil rating: No

Ellicott, occasionally flooded

Percent of map unit: 1 percent
Landform: Flood plains, drainageways
Down-slope shape: Linear
Across-slope shape: Linear, concave
Ecological site: R067BY031CO - Sandy Bottomland
Hydric soil rating: No

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NOTES TO USERS

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

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

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

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

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

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

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

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

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

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

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

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

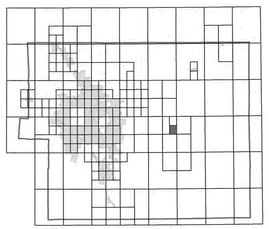
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

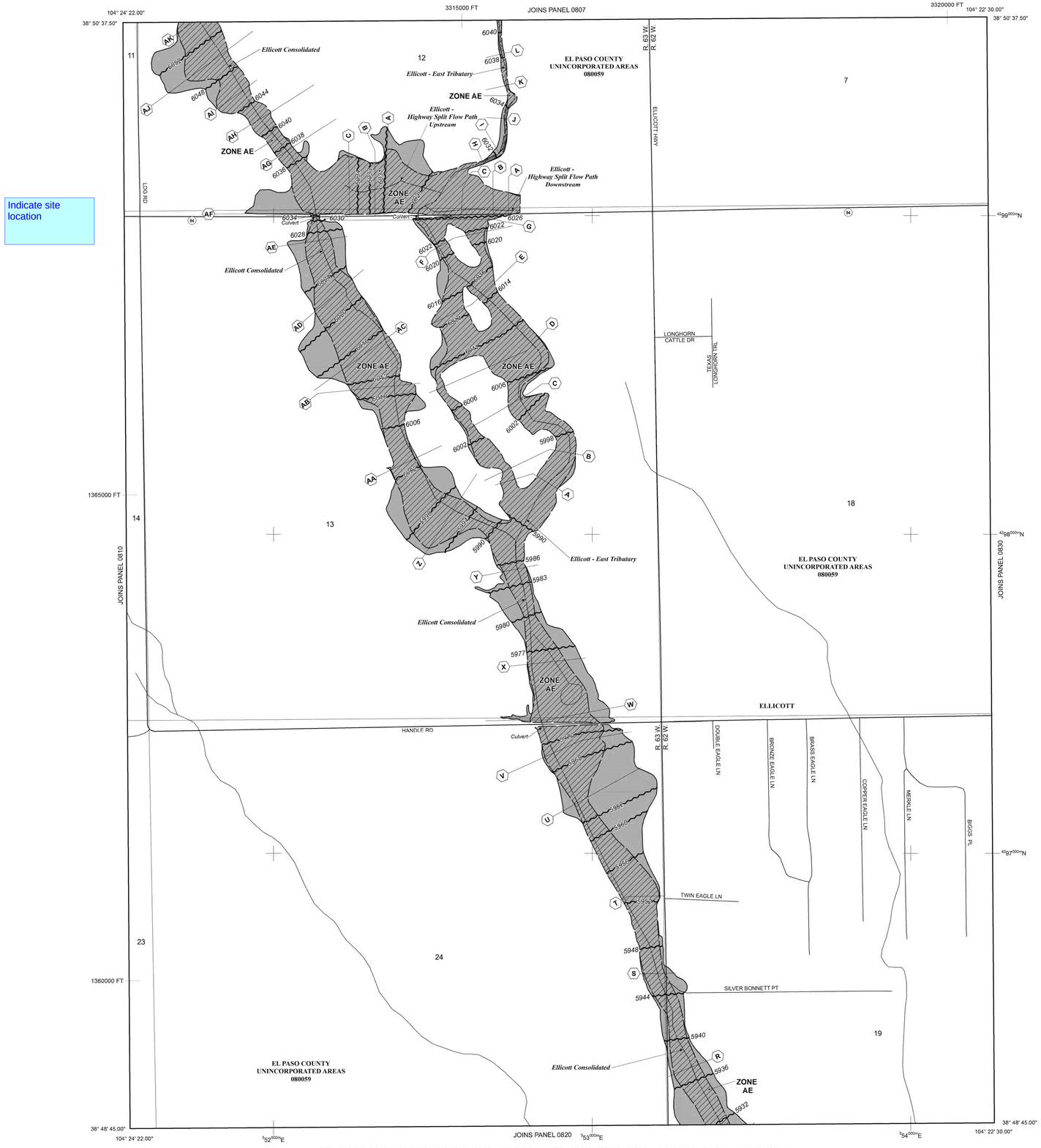
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

Panel Location Map



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

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



Indicate site location

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 14 SOUTH, RANGE 62 WEST, AND TOWNSHIP 14 SOUTH, RANGE 63 WEST.

LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

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

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

A — A Cross section line
23 — 23 Transect line
97° 07' 30.00" / 32° 22' 30.00" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4675000mN 1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5 River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

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

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'
250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

PANEL 0809G

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 809 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0809	G

provide 810G also

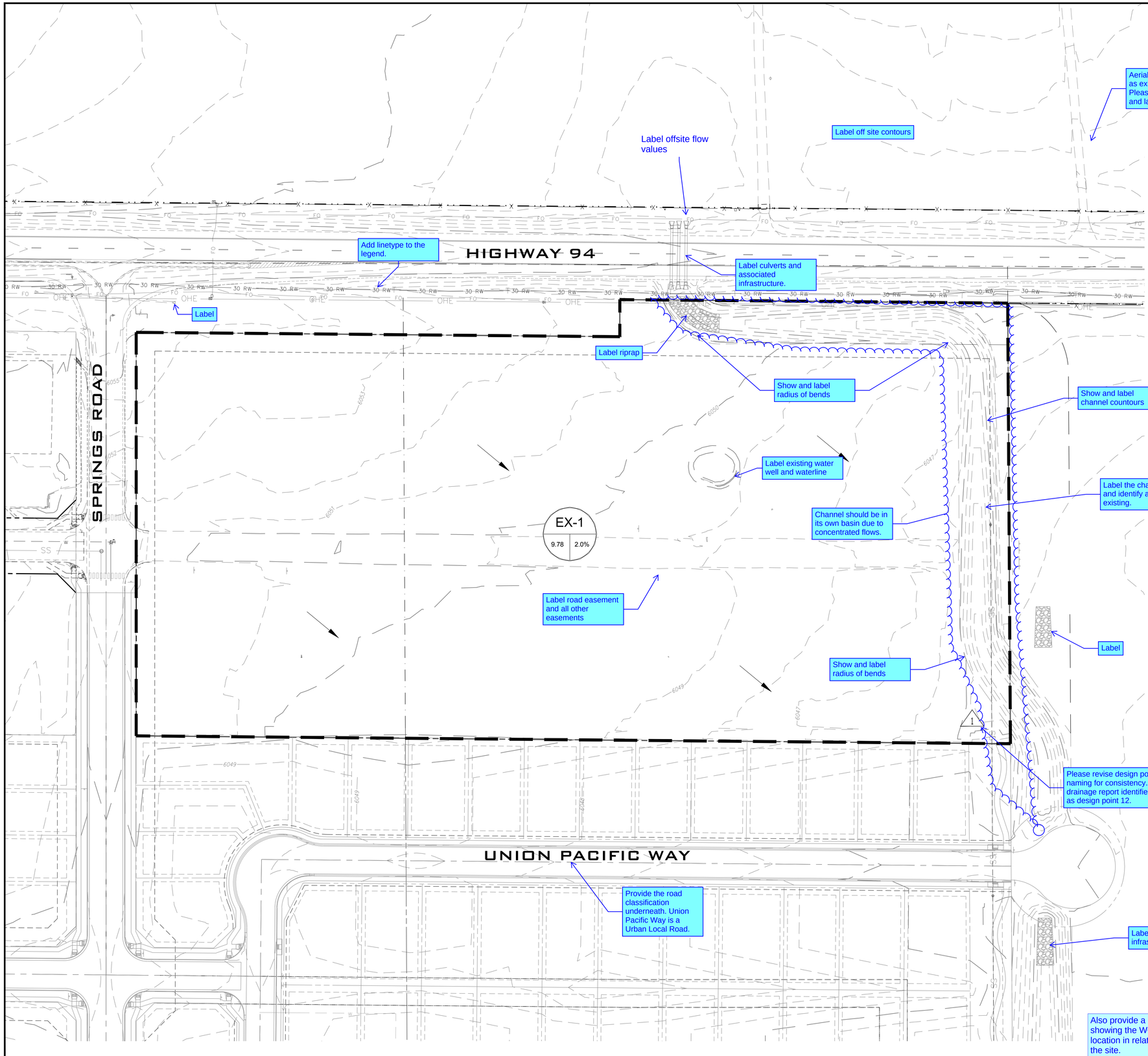
Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0809G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

MAP REVISED TO REFLECT LOMR EFFECTIVE DATE(S)



Know what's **below.**
Call before you dig.

EXISTING	DESCRIPTION	PROPOSED
	PROPERTY LINE	
	EASEMENT	
	EDGE OF PAVEMENT	
	VERTICAL CURB AND GUTTER	
	SPILL GUTTER	
	TRANSITION GUTTER	
5825	MAJOR CONTOUR	5825
5822	MINOR CONTOUR	5822
	STORM SEWER PIPE	
	STORM SEWER MANHOLE	
	STORM SEWER INLET	
	STORM SEWER FLARED END SECTION	
	STORM SEWER HEADWALL	

DRAINAGE BASIN LABEL
* BASIN LABEL
** TRIBUTARY AREA (AC)
*** IMPERVIOUS (%)

C-1*
1** | 2***

FLOW ARROW

DESIGN POINT

DRAINAGE AREA BOUNDARY

BASIN SUMMARY TABLE

Basin	Area (acres)	5-yr (cfs)	100-yr (cfs)
EX-1	9.78	1.98	13.29

NO.	REVISION	BY	DATE

R&R ENGINEERS SURVEYORS INC

R&R ENGINEERS-SURVEYORS, INC.
1635 WEST 13TH AVENUE, SUITE 310
DENVER, COLORADO 80204
PHONE: 303-753-6730

WWW.RRENGINEERS.COM

MAYBERRY - FILING NO. 4

SITE ADDRESS: MAYBERRY, COLORADO SPRINGS
EL PASO COUNTY

PREPARED FOR: MAYBERRY COMMUNITIES, LLC
3296 DEVINE HEIGHTS #208
COLORADO SPRINGS, CO 80922

CONSTRUCTION DOCUMENTS

JOB NO. MC22249
ORG. SUBM. DATE 04/05/2023
DWN: GWH CHKD: CJD
NAME

####

NO. ####

label inlets, swales and channels in accordance with Calculation Spreadsheets.

Know what's **below.** **Call** before you dig.

Include offsite drainage area

Label offsite flow values

Label pipes and culverts

Label riprap and provide type.

Label contours outside the site

Label existing water well and waterline

Label inlet

Label inlet

Label inlet

Label inlet

Label street name

Provide drainage easement

Provide elevations and contours for the swale.

Label swale C5

Label

Show and label construction/permanent easement for the channel relocation

If the channel is being relocated then remove old channel design from the proposed conditions

Show and label channel contours

Label all channels shown.

DP-7 should include upstream offsite flows through the culvert

Verify flow rate totals. DP-3 and C-4 do not add up to the total shown for DP-4.

Show and label all easements and right-of-way including for the cul-de-sac and offsite improvements.

Label

Provide cross sections for all channels

Label map as proposed conditions

Add "PCD File No. SF2317"

HIGHWAY 94

UNION PACIFIC WAY

SPRINGS ROAD

OS-1 | 0.23 | 83.5%

U-1 | 0.42 | 2.0%

C-1 | 2.07 | 95.0%

C-2 | 1.23 | 95.0%

C-3 | 1.66 | 95.0%

C-4 | 2.53 | 95.0%

C-5 | 1.88 | 95.0%

EXISTING	DESCRIPTION	PROPOSED
	PROPERTY LINE	
	EASEMENT	
	EDGE OF PAVEMENT	
	VERTICAL CURB AND GUTTER	
	SPILL GUTTER	
	TRANSITION GUTTER	
5825	MAJOR CONTOUR	5825
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	STORM SEWER HEADWALL	

DRAINAGE BASIN LABEL
* BASIN LABEL
** TRIBUTARY AREA (AC)
*** IMPERVIOUS (%)

C-1* | 1** | 2***

FLOW ARROW

DESIGN POINT

DRAINAGE AREA BOUNDARY

BASIN SUMMARY TABLE

Basin	Area (acres)	5-yr (cfs)	100-yr (cfs)
C-1	2.07	7.0	12.7
C-2	1.23	4.3	7.9
C-3	1.66	5.8	10.6
C-4	2.53	7.4	13.5
C-5	1.88	5.3	9.6
U-1	0.42	0.1	1.1
OS-1	0.23	0.8	1.5

DESIGN POINT SUMMARY TABLE

Design Point	Contributing Basins	Area (acres)	5-yr (cfs)	100-yr (cfs)
1	C-1, OS-1	2.3	7.7	14.1
2	DP1, C-2	3.5	12.4	22.6
3	DP2, C-3	5.3	18.4	33.9
4	DP-3, C-4	7.7	22.6	41.3
5	C-5	1.9	5.3	9.6
6	DP1, DP2, DP3, DP4, DP5	9.6	27.0	49.3
7	U-1	0.4	0.1	1.1

0 20' 40' 60'

SCALE: 1" = 20'

NO.	REVISION	BY	DATE

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