STAGECOACH MOUNTAIN RANCH

CONCEPTUAL DRAINAGE STUDY

Prepared for:

Kyle Collins
Discovery Land Company
528 Montauk Highway, PO Box 865
East Quogue, New York 11942

Prepared by:

Kimley-Horn and Associates, Inc.
2 N Nevada Ave, Suite 900
Colorado Springs, CO 80903

Project #: 196778000

Prepared: February 2025

Kimley»Horn

TABLE OF CONTENTS

CERTIFICATION STATEMENT

"I hereby affirm that this Conceptual Drainage Study for the preliminary design of Stagecoach Mountain Ranch was prepared by me (or under my direct supervision) for the owners thereof and is, to the best of my knowledge, in accordance with the provisions of the Routt County Drainage Criteria which references the City of Steamboat Springs Drainage Criteria and approved variances. I understand that Routt County does not and will not assume liability for drainage facilities designed by others.

_____

Brice Hammersland, PE

State of Colorado No. 56012

SCOPE AND PURPOSE

The purpose of this Conceptual Drainage Study (the "Report") is to support the Preliminary Plan Application by outlining the preliminary drainage design for the proposed Stagecoach Mountain Ranch ("SMR") Project (the "Project"). This Report presents an overview for the proposed drainage infrastructure design to be constructed as part of the Project. The drainage design has been informed by the current drainage criteria set forth by Routt County, the City of Steamboat Springs Engineering Standards Manual and from the Mile High Flood District Urban Storm Drainage Criteria Manual.

I. INTRODUCTION

A. Location

The SMR Project will be separated into several phases. The general Project location is southwest of Stagecoach State Park and Reservoir, approximately 16 miles south of Steamboat Springs (the "Site") within unincorporated Routt County, Colorado (see **Appendix A** for a Vicinity Map). This Conceptual Drainage Study outlines the preliminary drainage design of all phases of the Project.

Final drainage studies and associated final stormwater infrastructure design will be completed for each individual phase and filing during subsequent final subdivision applications.

B. Description of the Project

SMR consists of a master planned residential community having 613 residential homes to be constructed on a portion of approximately 5,059 acres of privately-owned property in the Stagecoach area. An additional component of the development is the recreational amenities that will be offered to the residents of SMR. The SMR plan also proposes development of public amenities and services for the Stagecoach community such as a public neighborhood commercial center, recreational trails and parks, housing, as well as upgrades to roads and infrastructure.

Implementing this plan is expected to be a major contributor to the fiscal health of South Routt County, replacing lost property tax base and jobs as the area transitions from the coal-based economy that has been the primary economic driver for the past 100 years. The plan respects and incorporates land use directives of the 2017 Stagecoach Community Plan and 2022 Routt County Master Plan and provides an economically viable framework for the Stagecoach community to realize the goals and objectives for this Tier 2 growth area within Routt County.

SMR consists of the existing Stagecoach ski mountain property and Stetson Ranch property. These parcels are currently zoned Commercial (C), Planned Unit Development (PUD), High Density Residential (HDR), and Agricultural / Forestry (AF). Two parcels associated with the mountain property totaling approximately 2.14 acres are zoned PUD, which permits the construction of 10,000 square feet of commercial space, and a gas station. Two other parcels on the mountain property totaling approximately 16.75

acres are zoned Commercial which is approved for the construction of a 13,300 sqft ski lodge with a 178 space parking lot, and the existing maintenance facilities for the existing private ski mountain, respectively. The area zoned HDR represents 14.7 acres of the ski mountain property, which permits residential development at one dwelling unit per 3,000 sq. ft. of land area. The balance of the mountain properties, approximately 4,134 acres, is zoned Agricultural / Forestry, which permits residential development at one dwelling unit per 35 acres. The potential residential development yield, under these existing zoning designations is 640 dwelling units.

The total area of the Stetson Ranch property is approximately 891 acres, which is all zoned AF. The 652 acres located south of County Road 14 is the subject to an existing conservation easement held by the Colorado Cattlemen's Agricultural Land Trust, leaving the 239 acres located north of Couty Road 14 for further development, which represents an additional 7 residential dwelling units.

Property taxes from the project will generate significant revenue for Routt County and other local agencies providing additional funding for these agencies to provide a higher level of services to the community residents. At full build out, the project alone is anticipated to generate $33 million in annual property tax revenue, roughly 1.2 times the County's current property tax revenue of $28 million.

The following describes the proposed land use mix for the project:

Residential Development

A thorough site analysis was conducted to have the attributes of the land inform where development should be located. Routt County values rural character and agricultural land uses and encourages conservation of large acreage through their Land Preservation Subdivision (LPS) regulations. In response, residential development plan for Stagecoach Mountain Ranch voluntarily proposes creating 67 single-family 5 to 7 acre lots in two LPS subdivisions, resulting in 1,383 acres in remainder parcels. The remaining 546 homes will be a mix of single detached homes, duplex, multi-family townhomes and condominiums all discreetly placed on the subject properties to manage the impacts and be compatible with the existing Routt character. All the development located on the Ski Mountain Property will be served by the Morrison Creek Metropolitan Water and Sanitation District (MCMWSD). Approximately 99% of the residential development is anticipated to be located on the mountain property and 1% at Stetson Ranch property.

Of the total developable area of 4,407 acres, excluding the existing 652-acre conservation easement located in Stetson, approximately 3,285 acres or 75% will be considered open space consisting of both active and passive uses.

In 2024, Routt County created a Unified Development Code (UDC). Section 3.21 defines the requirement for essential housing and employee housing. SMR's plan exceeds the requirements by providing, 95 essential dwelling units where 90 units are required and housing for 90 employees where only providing housing of 85 employees is required. This results in a total of 137 workforce housing units being provided, and when combined with the 613 housing units proposed, a total of 750 dwelling units will be constructed.

Residential Amenities

SMR will offer a variety of recreational activities for its residents that will be owned and operated by the homeowner's association. These activities are expected to include Nordic and alpine skiing, trails for hiking, biking, and horseback riding, racquet sports, a fitness center with swimming pool, and other recreational amenities, as well as accessory support facilities including a ski lodge and maintenance support facilities. SMR will also continue to maintain agricultural operations on a large portion of the Stetson Ranch property.

The expansion of the existing ski mountain is the primary recreational facilities. Currently, the existing private ski mountain operates under an existing Special Use Permit (SUP) 94-228. Since the SUP was first permitted, the mountain property holdings have increased, and the proposal plan is to provide additional ski lifts, terrain, and snowmaking as well as enhanced lodging and other amenities to the ski mountain.

The development plan seeks to create a forward-thinking model for residential and recreational development with a focus on sustainability, conservation, wildlife protection, and protection of sky lines and night skies.

C. Description of the Property

According to the Natural Resources Conservation Service (NRCS), the Site consists of various soil types with Hydrologic Soil Group (HSG) classifications ranging from HSG A to HSG D. HSG D was conservatively utilized for all hydrologic calculations for the Site. A Custom Soil Resource Report from the NRCS Web Soil Survey website for the Site is included in **Appendix B**.

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) panels 08107C1050D, 08107C1075D, 08107C1225D, and 08107C1250D for Routt County and incorporated areas (effective February 4, 2005), the majority of the Project is located within Zone X, which is classified as areas determined to be outside the 0.2% annual change floodplain. There is a portion of the Project located within regulatory floodplain (Zone A) associated with Yampa River and its tributaries. The FEMA FIRM for the Project area is included in **Appendix A**.

II. DRAINAGE DESIGN CRITERIA

A. Criteria Reference

Routt County has limited drainage criteria and defers to the City of Steamboat Springs and Mile High Flood District (MHFD) for their drainage criteria; therefore, Chapter 5 of the City of Steamboat Springs Engineering Standards Manual (ESM) and the MHFD Urban Storm Drainage Criteria Manual (USDCM) were used as a reference and guide for applicable criteria for this Project.

B. Hydrologic Criteria

Runoff Method

The Colorado Urban Hydrograph Procedure (CUHP) and the EPA Stormwater Management Model (EPA-SWMM) (version 5.2.4) were used for hydrologic analysis to estimate the peak runoff discharge and characteristics of each basin.

Supporting hydrologic calculations for the existing and proposed analysis of the Site are included in **Appendix B**.

Rainfall and Storm Frequencies

The 1-hour rainfall depths used for the hydrologic analysis of the Site were obtained from NOAA Atlas 14 for the Site. The following storm frequencies and rainfall depths were used throughout the hydrologic analysis:

- Minor Storm Event: 5-year: 0.68 inches
- Major Storm Event: 100-year: 1.42 inches

For the hydrograph analysis, the recommended 2-hour design storm duration generated by CUHP was utilized within the EPA-SWMM. Peak discharges for the 5-year and 100-year storm events were analyzed using CUHP to generate hydrographs for each sub-basin. Hydrographs for the sub-basins were routed using EPA-SWMM to determine peak discharge rates at select design points. Snowmelt runoff impacts were not evaluated as part of this report.

Runoff Coefficients/Imperviousness

The imperviousness and associated runoff coefficient were calculated for each subbasin utilizing the Steamboat Springs ESM. The imperviousness and composite runoff coefficients are calculated for each subbasin based on HSG D soils and utilizing Tables 5.6.1 and 5.6.3 from the Steamboat Springs ESM.

C. Hydraulic Criteria

Street Capacity

The majority of the proposed roadways are anticipated to have roadway edge conditions with no curb and gutter due to the topographic constraints within the mountainous terrain. Where curb and gutter is to be installed, street/gutter capacity will be designed with inlets and culverts spaced such that the stormwater does not exceed 6-inches at the gutter flow line for the minor event and does not exceed the allowable spread as described in the Steamboat Springs ESM (Sections 5.7.6 and 5.8.3) for the major event.

For arterial and collector roadways:

- At least one (1) 12-foot lane of traffic remains open in each direction during the major event.
- The major storm shall not encroach upon any drive lane.

For local roadways, primary commercial, and multifamily access drives:

- Stormwater will not exceed 12-inches at the gutter flow line during the major event.
- The major storm will not inundate the outside edge of the outside drive lane by more than 6 inches.

Street/gutter capacity will be evaluated utilizing MHFD-Inlet with the Final Drainage Report.

Roadside Swales

Most of the proposed roadways are anticipated to have roadside swales. Roadside swales will be designed to convey the minor storm event (5-year) within the swale, meet street capacity criteria for the 100-year storm event, and meet applicable criteria as outlined in the Steamboat Springs ESM (Section 5.7.6):

- Maximum longitudinal slopes driven by a maximum allowable Froude number of 0.80 and a maximum allowable velocity of seven (7) feet per second (fps).
- Side slopes shall be no steeper than 2H:1V.
- Flow depth shall not be greater than 3-feet.
- Minimum velocity of two (2) fps

Due to the natural steep topography within the site ditch slopes will exceed 3% which will increase the erosion potential at these locations. Ditch checks will be proposed at these locations as a method to slow down the ditch flow velocities and prevent unnecessary erosion.

Roadside swales will be evaluated utilizing Bentley's Flowmaster with the Final Drainage Report.

Culverts

Existing and proposed culverts will be analyzed utilizing the procedures outlined in the Steamboat Springs ESM (Section 5.10). All culverts will be sized to maintain velocities between two (2) fps and fifteen (15) fps. The minimum culvert size placed in a public drainageway is 18-inches. Private culverts will have a minimum culvert size of 8-inches. Additionally several bridges will be proposed specifically where roadways cross wetlands and streams. A detailed analysis of the bridges will be completed during final design.

For arterial and collector roadways:

- The major storm event will be used to design culvert crossings.
- The major storm shall not cause headwater at any culvert to encroach on any drive lane.
- HW/D for the major storm shall not exceed 1.5.

For local roadways, primary commercial, and multifamily access drives:

- The minor storm event will be used to design culvert crossings (unless the local roadway is the only road providing access to an area, in which case the major storm event will be used).

- The minor storm shall not inundate the outside edge of the outside drive lane by more than 6-inches.
- HW/D for the minor storm shall not exceed 1.5.

Culverts will be analyzed utilizing the Federal Highway Administration's (FWA) HY-8 culvert hydraulic program with the Final Drainage Report.

Storm Sewer System

The proposed storm sewer system will be designed as outlined in the Steamboat Springs ESM (Section 5.9). The proposed storm sewer system will be designed with inlets and culverts to capture and convey the 5-year storm event without surcharging. A minimum pipe size of 12-inches will be utilized. The storm sewer system must maintain velocities between two (2) fps and ten (10) fps. Manhole spacing throughout the Project will be such that pipes less than or equal to 24-inches will not exceed 300 feet and for pipes greater than 24-inches the manhole spacing will not exceed 400 feet.

Bentley StormCAD will be used to size the proposed storm sewer system throughout the Project. Hydraulic calculations for the storm sewer system will be provided with the Final Drainage Report.

Detention

Detention will be provided such that peak flows from the developed basins are less than or equal to pre-development flows for the 5-year and 100-year storm events as outlined in Section 5.11 of the Steamboat Springs ESM. SWMM was utilized to analyze the increased runoff from the proposed improvements for the project. Preliminary locations of detention ponds are shown on the proposed drainage maps provided in **Appendix D**. Preliminary detention volume required is provided in **Appendix C.** Refer to section IV.C.in this report for additional information regarding detention.

Water Quality

Water quality will be implemented holistically throughout the project site per Steamboat Springs ESM. The Project will utilize Best Management Practices ("BMPs") to mitigate the increase in stormwater runoff pollutant loads resulting from the development.

Examples of potential BMPs to be utilized and sized with the Final Drainage Report are provided in **Appendix E.**

BMPs will also be used to control site runoff during construction utilizing temporary control measures such as silt fence, vehicle tracking control, check dams, and inlet/outlet protection. The placement and design of the temporary control measures will be provided with the Final Drainage Report. Refer to section IV.C.in this report for additional information regarding the water quality approach.

III. DRAINAGE BASINS AND SUB-BASINS

A. Existing Major Basin Description

Existing storm runoff within the Site generally flows down the mountain slope to the Yampa River and Stagecoach Reservoir.

Existing major drainage basins were delineated based on existing drainageways that convey flow down the mountain toward the Yampa River and Stagecoach Reservoir. Each major drainage basin was delineated into sub-basins based on existing roadway crossings. Topographic information obtained from Lidar was utilized to delineate each subbasin.

Appendix B includes hydrologic calculations for the existing sub-basins. **Appendix D** includes the existing drainage maps.

Major Basin 100

Basin 100 consists of a total of 1,743 acres at 2.5% impervious in the existing condition. Basin 100 is subdivided into four (4) sub-basins based on existing roadway crossings. Runoff within Basin 100 is conveyed north to south via Jack Creek and its tributaries and eventually discharges directly to the Yampa River.

Major Basin 200

Basin 200 consists of a total of approximately 2,683 acres at 2.3% impervious in the existing condition. Basin 200 is subdivided into seven (7) sub-basins based on existing roadway crossings. Runoff within Basin 200 is conveyed south to north via Raspberry Creek and its tributaries and eventually discharges directly to the Yampa River.

Major Basin 300

Basin 300 consists of a total of 709 acres at 8.9% impervious in the existing condition. Basin 300 is subdivided into twelve (12) sub-basins based on existing roadway crossings. Runoff within Basin 300 is conveyed south to north via Middle Creek and its tributaries and eventually discharges directly to the Stagecoach Reservoir.

Major Basin 400

Basin 400 consists of a total of 2,285 acres at 6.0% impervious in the existing condition. Basin 400 is subdivided into twenty (20) sub-basins based on existing roadway crossings. Runoff within Basin 400 is conveyed south to north via natural drainageways and eventually discharges directly to the Stagecoach Reservoir.

Major Basin 500

Basin 500 consists of a total of 526 acres at 6.5% impervious in the existing condition. Basin 500 is subdivided into five (5) sub-basins based on existing roadway crossings. Runoff within Basin 500 is conveyed south to north via natural drainageways and discharges to Little Morrison Creek, where runoff eventually discharges to the Stagecoach Reservoir.

Major Basin 600

Basin 600 consists of a total of 359 acres at 2.1% impervious in the existing condition. Basin 600 includes one (1) sub-basin based on existing roadway crossings. Runoff within Basin 600 is conveyed south to north via natural drainageways and discharges to Little Morrison Creek, where runoff eventually discharges to the Stagecoach Reservoir.

Major Basin 700

Basin 700 consists of a total of 1,520 acres at 2.3% impervious in the existing condition. Basin 700 is subdivided into two (2) sub-basins based on existing roadway crossings. Runoff within Basin 700 is conveyed west to east via Whipple Creek and its tributaries and eventually discharges to the Yampa River.

Major Basin 800

Basin 800 consists of a total of 6,621 acres at 2.4% impervious in the existing condition. Basin 800 is subdivided into six (6) sub-basins based on existing roadway crossings. Runoff within Basin 800 is conveyed west to east via natural drainageways and eventually discharges to the Yampa River.

B. Proposed Major Basin Description

The proposed major drainage basins are the same as the existing drainage basins. The only change in the proposed hydrology is the imperviousness that is increased due to the development and the delineation of subbasins based on the proposed roadways within the Project limits.

Appendix B includes hydrologic calculations for the proposed sub-basins. **Appendix D** includes the proposed drainage maps.

Major Basin 100

Basin 100 consists of a total of 1,743 acres at 3.1% impervious in the proposed condition. Basin 100 is subdivided into four (4) sub-basins based on existing and proposed roadway crossings. Runoff within Basin 100 is conveyed north to south via Jack Creek and its tributaries and eventually discharges directly to the Yampa River.

Major Basin 200

Basin 200 consists of a total of 2,683 acres at 5.3% impervious in the proposed condition. Basin 200 is subdivided into nine (9) sub-basins based on existing and proposed roadway crossings. Runoff within Basin 200 is conveyed south to north via Raspberry Creek and its tributaries and eventually discharges directly to the Yampa River.

Major Basin 300

Basin 300 consists of a total of 709 acres at 8.9% impervious in the proposed condition. Basin 300 is subdivided into twelve (12) sub-basins based on existing and proposed roadway crossings. Runoff within Basin 300 is conveyed south to north via Middle Creek and its tributaries and eventually discharges directly to the Stagecoach Reservoir.

Major Basin 400

Basin 400 consists of a total of 2,285 acres at 9.7% impervious in the proposed condition. Basin 400 is subdivided into twenty-three (23) sub-basins based on existing and proposed roadway crossings. Runoff within Basin 400 is conveyed south to north via natural drainageways and eventually discharges directly to the Stagecoach Reservoir.

Major Basin 500

Basin 500 consists of a total of 526 acres at 13.9% impervious in the proposed condition. Basin 500 is subdivided into seven (7) sub-basins based on existing and proposed roadway crossings. Runoff within Basin 500 is conveyed south to north via natural drainageways and discharges to Little Morrison Creek, where runoff eventually discharges to the Stagecoach Reservoir.

Major Basin 600

Basin 600 consists of a total of 359 acres at 2.8% impervious in the proposed condition. Basin 600 is subdivided into one (1) sub-basin based on existing and proposed roadway crossings. Runoff within Basin 600 is conveyed south to north via natural drainageways and discharges to Little Morrison Creek, where runoff eventually discharges to the Stagecoach Reservoir.

Major Basin 700

Basin 700 consists of a total of 1,520 acres at 4.9% impervious in the proposed condition. Basin 700 is subdivided into eight (8) sub-basins based on existing and proposed roadway crossings. Runoff within Basin 700 is conveyed west to east via Whipple Creek and its tributaries and eventually discharges to the Yampa River.

Major Basin 800

Basin 800 consists of a total of 6,621 acres at 2.8% impervious in the proposed condition. Basin 800 is subdivided into eight (8) sub-basins based on existing and proposed roadway crossings. Runoff within Basin 800 is conveyed west to east via natural drainageways and eventually discharges to the Yampa River.

IV. PROPOSED DRAINAGE PLAN

A. Proposed Drainage Plan Summary

The overall SMR project will provide and incorporate full spectrum detention ponds and enhanced grass swales/channels, as well as grass lined roadside ditches to safely convey surface water runoff and promote water quality. Detention ponds will be placed throughout the project to collect and store excess stormwater, helping to mitigate the impact of increased runoff. These ponds will allow for gradual release of the storm water, reducing the risk of flooding downstream. Additionally, the Project will implement enhanced grass swales and channels, which are designed to slow down and filter stormwater runoff, promoting water quality. The swales and channels will be grass lined, which will act as a natural filter, removing pollutants and sediments from the water as it

flows through the grass. Similarly, the grass lined roadside ditches will further aid in filtering runoff and improving water quality throughout the project. In areas with steep slopes or that are adjacent to creeks, it may not be possible to direct runoff to a detention pond or grass line swales/channels. For these areas, enhancements to the soils and vegetation may be required to manage runoff prior to discharging into creeks, drainageways, and the reservoir. This may include enhancing the existing plantings and re-working the surface to promote infiltration and water quality in these areas. Additionally, the SMR master plan designates an area of 891 acres in the southern portion of the subject property for potential future development. This area is shown in the drainage maps that can be found in **Appendix D**. The area is currently zoned as agricultural/forestry (AF) and is estimated to have approximately 35 residential lots with lot sizes ranging from 5-7 acres. This area will incorporate and provide water quality treatment features and detention ponds per County requirements. This analysis will be completed in a future phase of the project.

B. Surface Water Conveyance

The conveyance of the runoff from the proposed internal roadways will be conveyed with grass lined swales/ditches and where Froude numbers are greater than 0.8, ditch checks will be implemented into the swales/ditches to assist with reducing velocities and stabilizing the swales/channels. Where flows will be concentrated and cross under roadways within the SMR project via culverts, erosion mitigation measures will be implemented on the downstream end to assist with slowing the runoff. Erosion mitigation measures such as soil riprap protection, low water stilling basins, and level spreaders will be utilized to slow runoff especially at areas with high velocities and erosive forces such as on the downstream side of culverts. These mitigation measures will be designed with the Final Drainage Report.

C. Detention and Water Quality

Detention ponds will be placed throughout the project, generally downstream of higher impervious areas and located on flatter terrain areas. As previously mentioned, the site was analyzed for both the 5-year and 100-year storm events and each basin area (i.e. basins 100's, 200's, 300's, etc.) was analyzed using SWMM. The inflow volumes at specific design points were compared between the existing condition and proposed condition models to determine preliminary storage volumes needed to reduce the runoff for each basin to pre-development release rates. Refer to **Appendix C** for the preliminary calculations for the required pond volumes for each basin area.

Water quality BMPs will be implemented throughout the site to provide a holistic water quality approach to the site to ensure sufficient water quality treatment is provided. The water quality capture volume (WQCV) was determined for each basin area utilizing the percent impervious for each of the basin areas and adding that to the required pond storage area.

In areas where full spectrum detention ponds are unable to be implemented to assist with treating water quality, additional water quality measures will be utilized to promote water quality treatment. Potential water quality measures to be utilized in these areas

include but are not limited to: water quality ponds, rain gardens, enhanced grass swales/channels, terraced filter strips, vegetated filter strips, and permeable pavement. Refer to **Appendix C** for preliminary calculations for required WQCV for each basin area.

Final locations and sizing of detention ponds and water quality BMPs will be determined with the Final Drainage Report.

V. NWCCOG REGIONAL WATER QUALITY MANAGEMENT PLAN COMPLIANCE

The Project is not located within any specific watershed plan associated with the Northwest Colorado Council of Governments (NWCCOG) water quality management plan ("208 Plan"); however, the Project is subject to the policies outlined in Volume 1 of the 208 Plan. Compliance with these six (6) polices are outlined below:

Policy 1. Protect and Enhance Water Quality

The surface and ground waters of the region shall be protected to minimize degradation of existing water quality and maintain existing and designated uses of those waters; waters not currently supporting designated uses shall be restored as soon as is financially and technically feasible.

Policy 1 is being addressed by the implementation of the proposed water quality features on site. Water quality BMPs will be strategically implemented throughout the site providing a holistic water quality approach to the site to ensure sufficient water quality treatment is provided. Final design of water quality facilities will be detailed in the Final Drainage Report and Final Construction Documents at the time of Final Subdivision application.

Policy 2. Water Use and Development

The project developer shall mitigate the impacts to water quality and the aquatic environment caused by water supply projects.

The SMR development is not a surface water supply project. Domestic water supply will be provided by the adjacent water and sewer district via existing wells and underground water distribution mains.

Policy 3. Land Use and Disturbance

Water quality, including wetlands, floodplains, shorelines and riparian areas, must be protected from land use and development so that significant degradation of water quality is prevented.

50-ft wetland buffers will be respected with all planned development with the only exception being roadway crossings of existing wetlands. To the extent practical, raised crossing including open bottomed box culverts or traditional bridges will be used to reduce wetland impacts at these locations.

All proposed disturbance will be located outside regulatory floodplain. Sufficient erosion control will be implemented during construction adjacent to these areas to ensure protection.

Snow storage requirements include storage area for 30% of area to be plowed on individual lots. Snow storage area of 50-ft x 120-ft for every 400 LF of roadway will be provided. Runoff from snow storage areas will be directed through a detention or infiltration facility or other best management practice that removes pollutants, including vegetated areas.

Maintaining Hydrological Characteristics

Developers should maintain the hydrological characteristics of the development site similar to pre-development conditions. Drainage plans should be designed and implemented, including calculation of storm runoff volumes and velocities (before and after development), using accepted hydrologic calculation procedures.

Historic drainage patterns will be maintained with the proposed development. The calculation of stormwater runoff volumes and velocities are documented in the Preliminary Drainage Report. Final drainage design for the development will follow Routt County Engineering standards and latest MHFD criteria.

Minimizing Impervious Surfaces

Development should minimize impervious surfaces and break up large connected impervious areas.

Connected impervious areas are limited to proposed roadway infrastructure. All roads are planned to be paved with asphalt with roadside drainage swales.

Stormwater Discharges

Stormwater discharges should not result in any significant increase in total pollutant loads and should not result in the direct discharge of stormwater to a waterbody or drainage way. Efforts should be taken to practice “green infrastructure.”

The implementation of the proposed WQ features on site will address the potential increase in total pollutant loads prior to discharging to historic outfall points and drainageways.

Mountain Driveways

Design and maintenance of mountain driveways will follow the “Mountain Driveway Best Management Practices”, prepared for the Colorado Nonpoint Source Task Force, 1999.

The implementation of the 5 step process outlined in the “Mountain Driveway Best Management Practices will be used as part of the sites driveway designs to mitigate the erosion potential at all proposed driveways.

Policy 4. Domestic, Municipal, and Industrial Water/Wastewater Treatment Facilities

Decisions to locate water supplies, wastewater treatment systems, and other water and wastewater facilities shall be made in a manner which protects water quality and the aquatic environment. Where growth and development require the need for additional

facility capacity, existing facilities should be expanded instead of developing new facilities, unless expansion is not feasible because of technical, legal or political reasons.

Domestic water supply and wastewater treatment is anticipated to be provided by the adjacent Morrison Creek Metropolitan Water and Sewer District. Expansion of their district boundary and infrastructure is planned to serve the development. Construction of new wastewater treatment facilities is not proposed as part of the project. Construction of additional domestic water supply wells will be planned in conjunction with MCMWSD and will be located outside of all County required water body setbacks.

Only 7 of the planned residential units will utilize individual private domestic wells and septic fields for wastewater treatment.

Policy 5. Chemical Management

The uses of pesticides, fertilizers, algaecides, road deicing and friction materials, and other chemicals which would temporarily or permanently cause a significant degradation of water quality or impair the current or designated uses of these waters should be regulated to the extent allowed by law in a manner that minimizes potential for degradation of water quality.

Chemical management will be implemented as part of the future O&M plan for the Site. Impacts of any chemical use will be mitigated by the implementation of the proposed water quality features on site.

Policy 6. Management System

Management agencies are designated to best reflect their legal and jurisdictional authorities. The waters of the region shall be protected by a management agency structure within the existing governmental and regulatory framework that allows decisions to be made at the most appropriate level of control. For nonpoint source pollution control the recommended level of management is at the watershed level.

The proposed development will be analyzed to ensure all water quality requirements are being met. Compliance with all water quality requirements will be documented in the drainage report. The drainage report will be reviewed and approved by the proper management authority prior to construction. The primary management agencies and authorities have jurisdiction include Routt County, USACE, and FEMA.

VI. CONCLUSION

The drainage facilities for the Stagecoach Mountain Ranch Project have been preliminarily designed to conform to the current drainage criteria set forth by the County Standards, City of Steamboat Springs Engineering Standards Manual, and the Mile High Flood District Urban Storm Drainage Criteria Manual.

Based on the preliminary analysis, the SMR project aims to manage peak flows from the development from the developed basins to pre-development levels for both 5-year and 100-year storm events as much as possible. To address the increase in stormwater runoff and pollutant loads resulting from the development, the project will include detention

ponds, enhanced grass swales/channels, grass-lined roadside swales, rain gardens, permeable pavement, and other BMPs identified in the Final Drainage Report for each phase of the development. The detention ponds will help collect and store excess stormwater, ensuring gradual release and reducing the risk of downstream flooding. Water quality BMPs will slow down and filter stormwater runoff, improving water quality by removing pollutants and sediments. These measures are intended to minimize the negative impacts of increased runoff and ensure that the development maintains a high standard of water quality.

REFERENCES

Custom Soil Resource Report, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. March 2024.

Engineering Standards Manual - Chapter 5, City of Steamboat Springs, Revised July 2019.

Flood Insurance Rate Map, Panel Number 08107C1050D for Routt County and Incorporated Areas, Federal Emergency Management Agency, Effective February 4, 2005.

Flood Insurance Rate Map, Panel Number 08107C1075D for Routt County and Incorporated Areas, Federal Emergency Management Agency, Effective February 4, 2005.

Flood Insurance Rate Map, Panel Number 08107C1225D for Routt County and Incorporated Areas, Federal Emergency Management Agency, Effective February 4, 2005.

Flood Insurance Rate Map, Panel Number 08107C1250D for Routt County and Incorporated Areas, Federal Emergency Management Agency, Effective February 4, 2005.

Model Water Quality Protection Standards for Local Governments, Northwest Colorado Council of Governments (NWCCOG), June 2018.

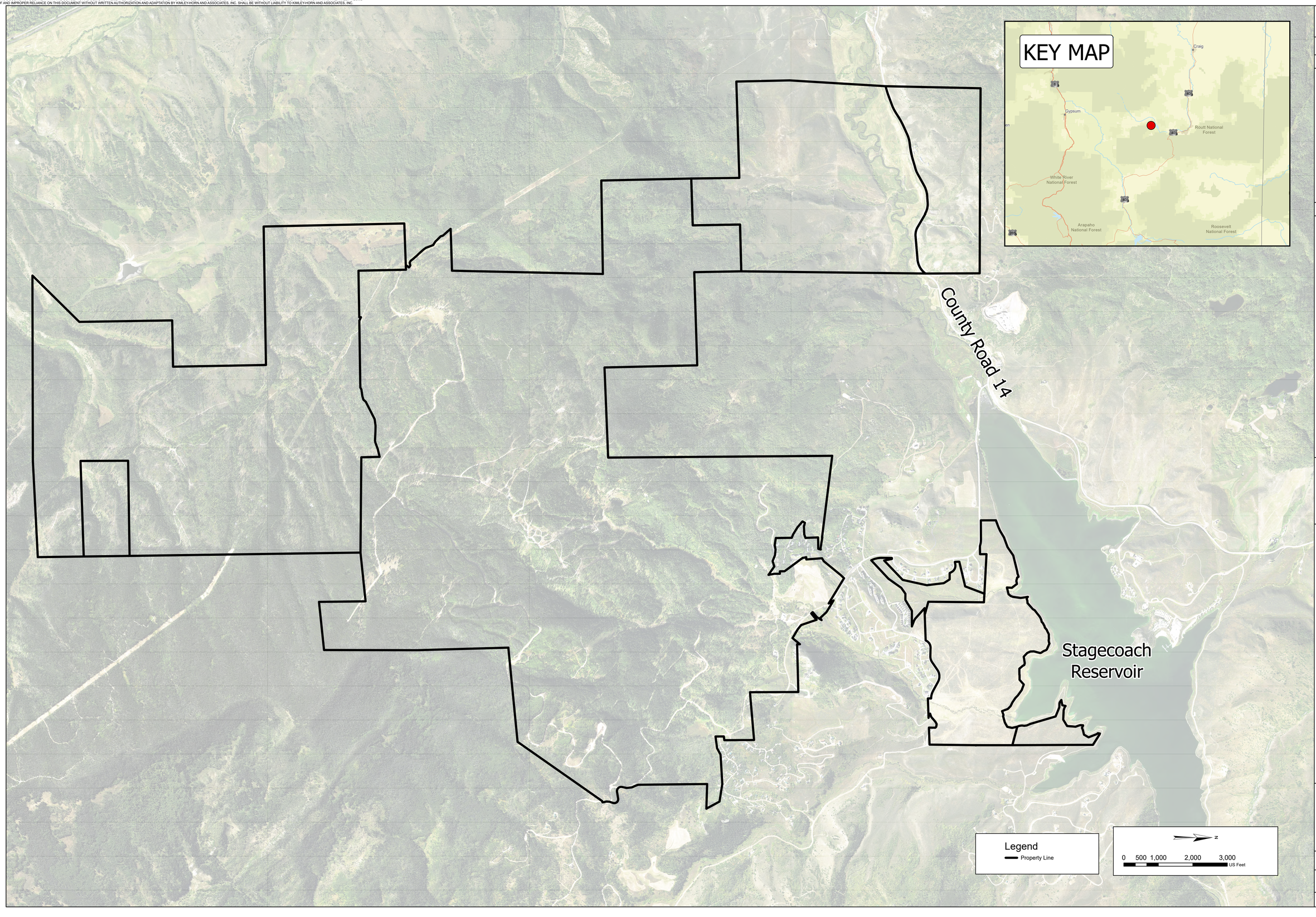
Mountain Driveway Best Management Practices Manual, prepared by Wright Water Engineers, Inc. and Denver Regional Council of Governments, June 1999.

Nutrient Loading Report for Stagecoach Mountain Ranch, P.W. Grosser Consulting Engineer, Inc., June 2024.

Urban Storm Drainage Criteria Manual, Volumes 1-3, Mile High Flood District, latest revision.

208 Regional Water Quality Management Plan, Northwest Colorado Council of Governments (NWCCOG), 2012.

APPENDIX A – GENERAL MAPS



Kimley»Horn

2 North Nevada Avenue, Suit 900
Colorado Springs, CO (719) 453-0180

SCALE(H):1"=
SCALE(V):
DESIGNED BY:
DRAWN BY:
CHECKED BY:
DATE:

STAGECOACH DRAINAGE BASIN STUDY

VINICITY MAP

PROJECT NO.

DRAWING NAME

Sheet:

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 Elevation** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data 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 should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevation (BFEs) shown on this map apply only landward of 0.0' North American Vertical Datum (NAVD). Users of this FIRM should be aware that coastal flood elevations may also be provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this community. 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 in this jurisdiction.

The **projection** used in the preparation of this map is Universal Tranverse Mercator (UTM) zone 13. The **horizontal datum** is NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM 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 the FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. 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 www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3191

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 their website at www.ngs.noaa.gov.

Base map information shown on this FIRM was provided in digital format by Routt County GIS Department.

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.

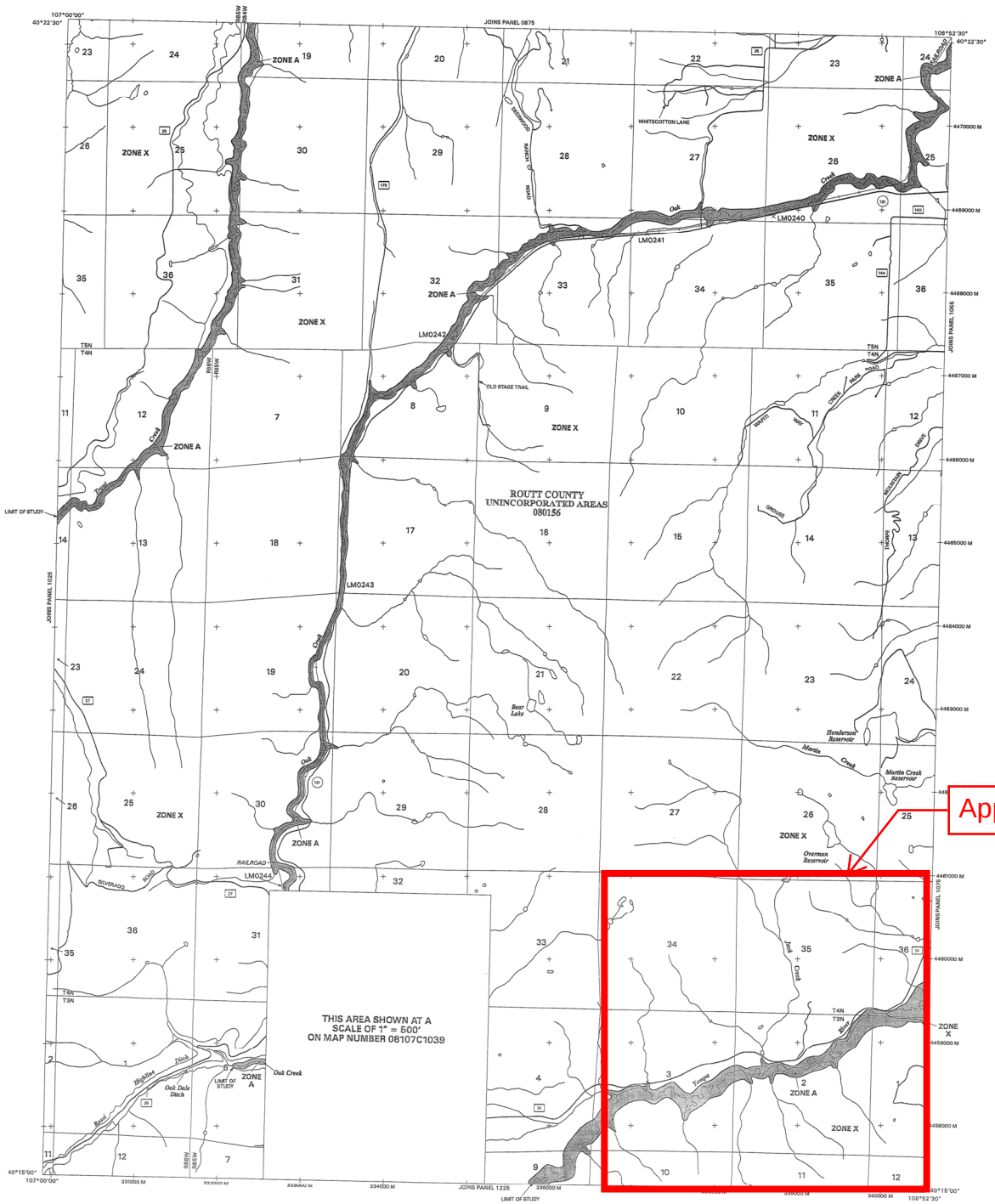
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which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

An accompanying Flood Insurance Study report, Letters of Map Revision or Letters of Map Amendment revising portions of this panel, and digital versions of this PANEL may be available. Contact the **FEMA Map Service Center** at the following phone numbers and Internet address for information on all related products available from FEMA:

Phone: 800-358-9616
FAX: 800-358-9620
www.fema.gov/msc

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 www.fema.gov.

This map reflects more detailed and up-to-date stream channel configurations 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 may reflect stream channel distances that differ from what is shown on this map.



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD EVENT

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	Area of special flood hazard formerly protected from the 1% annual chance flood event 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 event.
ZONE A99	Area to be protected from 1% annual chance flood event 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 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

A — A	Cross Section Line
23 — 23	Transect Line
97°07'30", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4276000M	1000-meter Universal Transverse Mercator grid values, zone 13
600000 FT	5000-foot grid ticks
DX5510	Bench mark (see explanation in Notes to Users section of this FIRM panel).
M1.5	River Mile

MAP REPOSITORY
Refer to Repository Listing on Index Map

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
FEBRUARY 4, 2005

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

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 (800) 638-6620.

1" = 2000'
2000 4000 FEET
600 1200 METERS

PANEL 1050D

FIRM
FLOOD INSURANCE RATE MAP
ROUTT COUNTY,
COLORADO
AND INCORPORATED AREAS

PANEL 1050 OF 1475
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ROUTT COUNTY, UNINCORPORATED AREAS	080156	1050	D

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
08107C1050D

EFFECTIVE DATE:
FEBRUARY 4, 2005

Federal Emergency Management Agency

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 Elevation** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data 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 should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevation (BFEs) shown on this map apply only landward of 0.0' North American Vertical Datum (NAVD). Users of this FIRM should be aware that coastal flood elevations may also be provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this community. 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 in this jurisdiction.

The **projection** used in the preparation of this map is Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** is NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM 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 the FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. 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 www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3191

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 their website at www.ngs.noaa.gov.

Base map information shown on this FIRM was provided in digital format by Routt County GIS Department.

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.

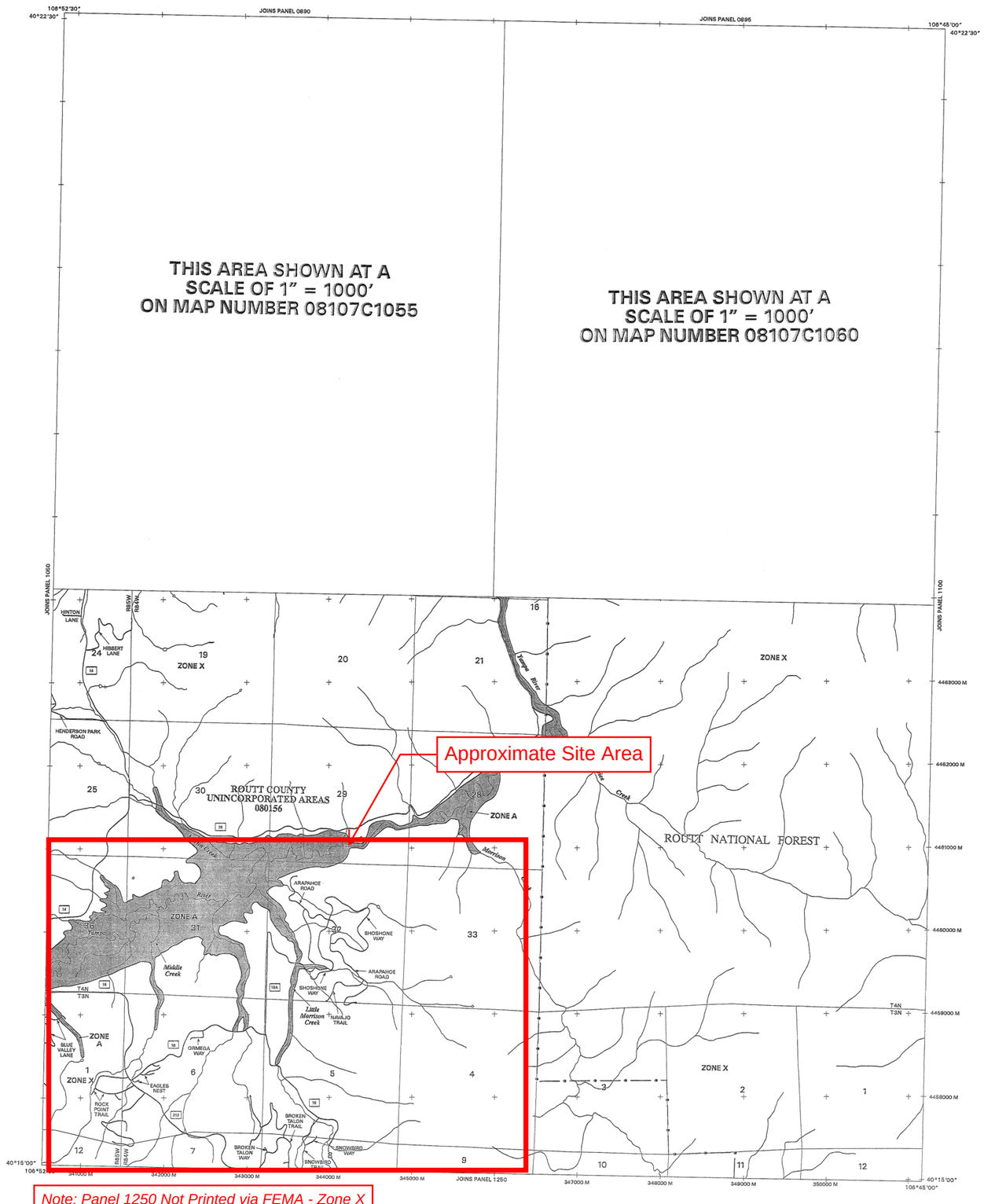
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which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

An accompanying Flood Insurance Study report, Letters of Map Revision or Letters of Map Amendment revising portions of this panel, and digital versions of this PANEL may be available. Contact the **FEMA Map Service Center** at the following phone numbers and Internet address for information on all related products available from FEMA:

Phone: 800-358-9616
FAX: 800-358-9620
www.fema.gov/msc

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 www.fema.gov.

This map reflects more detailed and up-to-date stream channel configurations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transfered 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 may reflect stream channel distances that differ from what is shown on this map.



Note: Panel 1250 Not Printed via FEMA - Zone X

LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD EVENT

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 Area of special flood hazard formerly protected from the 1% annual chance flood event 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 event.

ZONE A99 Area to be protected from 1% annual chance flood event 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 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

- (A)—(A) Cross Section Line
- (23)------(23) Transect Line
- 97°07'30", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4276000M — 1000-meter Universal Transverse Mercator grid values, zone 13
- 600000 FT — 5000-foot grid ticks
- DX5510× — Bench mark (see explanation in Notes to Users section of this FIRM panel).
- M1.5 — River Mile

MAP REPOSITORY
Refer to Repository Listing on Index Map

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
FEBRUARY 4, 2005

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

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 (800) 638-6620.

MAP SCALE 1" = 2000'
1000 0 2000 4000 FEET
600 0 600 1200 METERS

PANEL 1075D

FIRM
FLOOD INSURANCE RATE MAP
ROUTT COUNTY,
COLORADO
AND INCORPORATED AREAS

PANEL 1075 OF 1475
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ROUTT COUNTY, UNINCORPORATED AREAS	080156	1075	D

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
08107C1075D

EFFECTIVE DATE:
FEBRUARY 4, 2005

Federal Emergency Management Agency

APPENDIX B – HYDROLOGIC CALCULATIONS

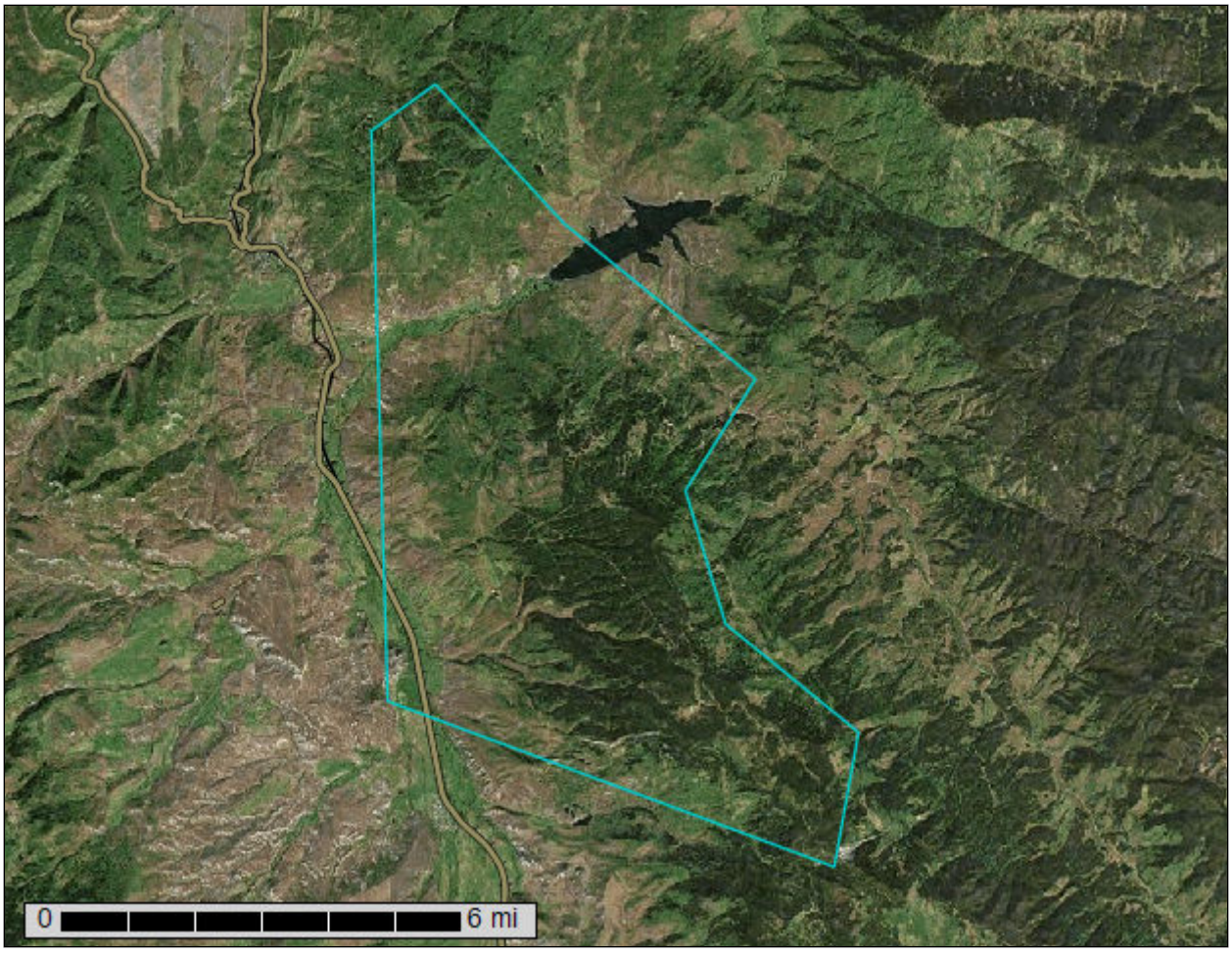
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

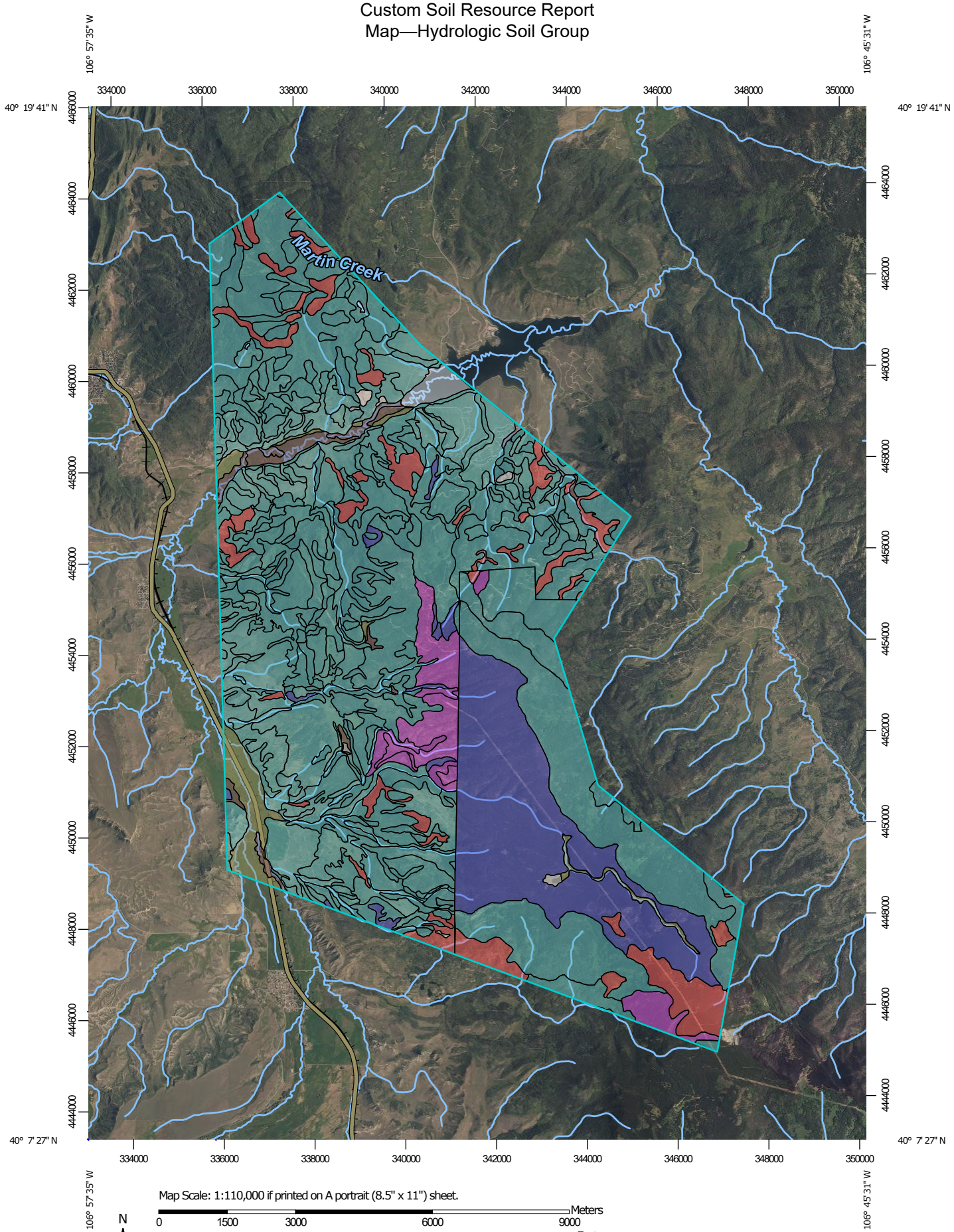
A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Routt Area, Colorado, Parts of Rio Blanco and Routt Counties; and Routt National Forest Area, Colorado, Parts of Grand, Jackson, Moffat, and Routt Counties



March 7, 2024

Custom Soil Resource Report
Map—Hydrologic Soil Group



Map Scale: 1:110,000 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 1500 3000 6000 9000

Feet
0 5000 10000 20000 30000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

Soil Survey Area: Routt Area, Colorado, Parts of Rio Blanco and Routt Counties
Survey Area Data: Version 13, Aug 23, 2023

Soil Survey Area: Routt National Forest Area, Colorado, Parts of Grand, Jackson, Moffat, and Routt Counties
Survey Area Data: Version 7, Aug 23, 2023

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Date(s) aerial images were photographed: Jul 2, 2021—Aug 25, 2021

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
2E	Routtskin loam, 12 to 25 percent slopes	C	483.1	1.6%
2F	Lintim loam, 25 to 65 percent slopes	C	278.8	0.9%
8F	Dunckley-Skyway complex, 15 to 65 percent slopes	C	87.0	0.3%
27A	Middlecreek loam, 1 to 5 percent slopes	C/D	96.2	0.3%
34E	Coutis fine sandy loam, 3 to 25 percent slopes	A	33.4	0.1%
34F	Coutis fine sandy loam, 25 to 65 percent slopes	A	7.1	0.0%
41C	Jerry loam, 1 to 12 percent slopes	C	231.5	0.8%
49A	Slocum loam, gravelly substratum, 0 to 3 percent slopes	B/D	64.9	0.2%
50C	Lintim loam, 3 to 12 percent slopes	C	702.5	2.3%
50E	Lintim loam, 12 to 25 percent slopes	C	135.0	0.4%
50F	Routt loam, 25 to 65 percent slopes, very stony	C	376.7	1.2%
57A	Mooseflat sandy clay loam, 0 to 5 percent slopes	B/D	177.4	0.6%
66D	Foidel loam, 15 to 25 percent slopes	C	102.7	0.3%
66F	Foidel loam, 25 to 65 percent slopes	C	36.8	0.1%
68C	Rabbitears loam, 3 to 12 percent slopes	C	193.1	0.6%
68D	Rabbitears loam, 12 to 25 percent slopes	C	406.9	1.3%
70F	Skyway sandy loam, 25 to 65 percent slopes	B	22.9	0.1%
78D	Frisco, very stony-Dorpat complex, 3 to 25 percent slopes	C	90.8	0.3%
78F	Fulvance very gravelly sandy loam, 25 to 65 percent slopes, very stony	C	1,027.8	3.4%
80D	Foidel loam, 5 to 25 percent slopes	C	940.2	3.1%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
80F	Foidel loam, 20 to 50 percent slopes, cool	C	143.3	0.5%
83D	Routt loam, 3 to 25 percent slopes, very stony	C	793.3	2.6%
83F	Routt loam, 25 to 65 percent slopes, cool, very stony	C	813.1	2.7%
94	Dorpat-Reddles complex, 30 to 65 percent slopes	C	424.9	1.4%
97	Rogert, extremely stony-Foidel complex, 25 to 65 percent slopes	D	316.0	1.0%
103	Foidel-Rock outcrop complex, 20 to 60 percent slopes	C	1,183.3	3.9%
104	Foidel loam, 25 to 50 percent slopes	C	249.6	0.8%
109	Dorpat loam, 3 to 20 percent slopes	C	672.4	2.2%
110	Elkhead clay loam, 0 to 3 percent slopes	D	0.0	0.0%
111	Evna, very stony-Lintim complex, 5 to 25 percent slopes	C	1,747.5	5.8%
111C	Slater-Routt complex, 5 to 25 percent slopes, very stony	C	814.1	2.7%
111D	Slater-Routt complex, 25 to 65 percent slopes, very stony	D	381.3	1.3%
111F	Evna, very stony-Lintim complex, 25 to 65 percent slopes	C	90.5	0.3%
115	Gateview cobbly loam, 30 to 75 percent slopes, very bouldery	B	93.3	0.3%
116	Gateview loam, 10 to 30 percent slopes, extremely stony	B	49.6	0.2%
117	Handran, extremely bouldery-Venable complex, 0 to 5 percent slopes	B/D	3.6	0.0%
120	Eckmanpark clay loam, 25 to 65 percent slopes	D	123.1	0.4%
124	Vabem-Rabbitears complex, 25 to 65 percent slopes	D	301.7	1.0%
125	Reddles loam, 3 to 20 percent slopes	C	213.2	0.7%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
126	Sanford very fine sandy loam, 25 to 65 percent slopes	C	807.5	2.7%
133	Lintim loam, 3 to 25 percent slopes	C	324.5	1.1%
139	Maciver stony loam, 3 to 25 percent slopes, extremely stony	C	783.1	2.6%
145	Mine-Reddles complex, 3 to 25 percent slopes	C	1,359.9	4.5%
146	Perfecto very stony sandy loam, 3 to 25 percent slopes	A	732.0	2.4%
149	Rabbitears-Inchau complex, 3 to 25 percent slopes	C	16.4	0.1%
150	Wander bouldery fine sandy loam, 25 to 65 percent slopes, very stony	B	42.5	0.1%
151	Fulvance-Merino complex, 10 to 50 percent slopes, very stony	C	5.7	0.0%
156	Egeria clay, 0 to 3 percent slopes	C/D	487.7	1.6%
158	Tanella loam, 0 to 3 percent slopes	B	7.3	0.0%
160	Northwater loam, 25 to 75 percent slopes	C	733.9	2.4%
165	Northwater loam, 3 to 25 percent slopes	C	660.0	2.2%
191	Perfecto very stony sandy loam, 25 to 65 percent slopes	A	173.2	0.6%
206	Domepeak very gravelly loam, 15 to 50 percent slopes, very stony	C	330.2	1.1%
AW	Venable, mucky peat, 0 to 3 percent slopes, frequently flooded	B/D	189.9	0.6%
C10	Impass silty clay loam, 3 to 12 percent slopes	C	41.4	0.1%
GP	Pits, gravel		30.7	0.1%
MS	Teedown clay loam, 5 to 70 percent slopes	D	128.8	0.4%
RRS	Rock outcrop-Rubble land complex		12.8	0.0%
W	Water		200.8	0.7%
Subtotals for Soil Survey Area			**20,977.0**	**69.4%**
Totals for Area of Interest			**30,220.9**	**100.0%**

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
11	Mord family stony loam, 5 to 20 percent slopes, very stony	C	0.0	0.0%
28	Haviland-Hollandlake families, complex, 10 to 40 percent slopes, landslides	C	0.4	0.0%
47	Grenadier taxadjunct cobbly loam, 10 to 40 percent slopes	B	3,826.5	12.7%
101A	Finn and Tepete families, 0 to 15 percent slopes	C/D	94.0	0.3%
155A	Libeg-Youga-Bywell families, association, 0 to 20 percent slopes	C	70.6	0.2%
210B	Gateway-Cowood families, association, 10 to 40 percent slopes, extremely stony	D	2.6	0.0%
232C	Mord family stony loam, 15 to 40 percent slopes	C	184.5	0.6%
249B	Frisco-Tamarron complex, 10 to 40 percent slopes	C	423.9	1.4%
255C	Waybe family-Gothic association, 20 to 50 percent slopes	D	277.5	0.9%
270C	Agneston family gravelly sandy loam, landslide, 30 to 60 percent slopes, very stony	C	1.1	0.0%
609B	Hollandlake-Jumpstart families, complex, 15 to 40 percent slopes, landslides	C	3,121.0	10.3%
700C	Como-Agneston family-Legault family association, 30 to 60 percent slopes, extremely stony	A	258.6	0.9%
710B	Agneston-Legault families, association, 10 to 40 percent slopes, extremely stony	C	460.3	1.5%
712C	Rogert-Bowen association, 20 to 55 percent slopes, extremely stony	D	15.2	0.1%
740A	Gorpas gravelly loam, 1 to 15 percent slopes	D	486.8	1.6%
W	Water		19.7	0.1%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Subtotals for Soil Survey Area			**9,242.7**	**30.6%**
Totals for Area of Interest			**30,220.9**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Legend

- PROJECT SITE
- EXISTING BASINS

HYDROLOGIC SOIL GROUP

- A
- B
- B/D
- C
- C/D
- D

0 1,000 2,000 4,000 6,000 US Feet

SOURCE: CUSTOM SOIL RESOURCE REPORT, NATURAL RESOURCES CONSERVATION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE. WEB SOIL SURVEY. MARCH 2024.

Kimley»Horn

2 North Nevada Avenue, Suite 900
Colorado Springs, CO (719) 453-0180

DESIGNED BY: SNM
DRAWN BY: JMA
CHECKED BY: BAH

DATE: 08/07/2024

STAGECOACH
DRAINAGE BASIN STUDY
HYDROLOGIC SOIL GROUP MAP

PROJECT NO.
196778000

DRAWING NAME
SOILS OVERVIEW

Yampa River
Whipple Creek
Raspberry Creek
Jack Creek
Middle Creek
Little Morrison Creek
Lawson Creek
Stagecoach Reservoir

ID: 800 2802 AC
ID: 801 300 AC
ID: 802 1704 AC
ID: 803 160 AC
ID: 804 434 AC
ID: 805 418 AC
ID: 806 242 AC
ID: 807 61 AC
ID: 100 1130 AC
ID: 101 406 AC
ID: 102 157 AC
ID: 103 51 AC
ID: 200 89 AC
ID: 201 49 AC
ID: 202 275 AC
ID: 203 229 AC
ID: 204 1176 AC
ID: 205 389 AC
ID: 206 399 AC
ID: 207 58 AC
ID: 208 18 AC
ID: 300 53 AC
ID: 301 31 AC
ID: 302 86 AC
ID: 303 72 AC
ID: 304 41 AC
ID: 305 65 AC
ID: 306 24 AC
ID: 307 25 AC
ID: 308 32 AC
ID: 309 157 AC
ID: 310 85 AC
ID: 311 38 AC
ID: 400 483 AC
ID: 401 227 AC
ID: 402 53 AC
ID: 403 34 AC
ID: 404 162 AC
ID: 405 61 AC
ID: 406 224 AC
ID: 407 26 AC
ID: 408 23 AC
ID: 409 141 AC
ID: 410 46 AC
ID: 411 13 AC
ID: 412 64 AC
ID: 413 30 AC
ID: 414 53 AC
ID: 415 156 AC
ID: 416 117 AC
ID: 417 79 AC
ID: 418 63 AC
ID: 419 41 AC
ID: 420 124 AC
ID: 421 50 AC
ID: 422 14 AC
ID: 500 43 AC
ID: 501 131 AC
ID: 502 71 AC
ID: 503 140 AC
ID: 504 82 AC
ID: 505 31 AC
ID: 506 29 AC
ID: 600 359 AC
ID: 700 268 AC
ID: 701 207 AC
ID: 702 38 AC
ID: 703 159 AC
ID: 704 550 AC
ID: 705 168 AC
ID: 706 71 AC
ID: 707 59 AC

Legend

Proposed Basins
Drainageways

Proposed Land Use
- Asphalt
- Commercial
- Gravel
- Greenbelts
- Parks
- Residential (< 0.25 ac)
- Residential (0.25 - 0.75 ac)
- Residential (0.75 - 2.5 ac)
- Residential (2.5 - 5.0 ac)
- Residential (> 5 ac)

N
0 1,000 2,000 4,000 6,000 US Feet

Kimley»Horn

2 North Nevada Avenue, Suite 900
Colorado Springs, CO (719) 453-0180

Engineering, Planning and Environmental Consultants

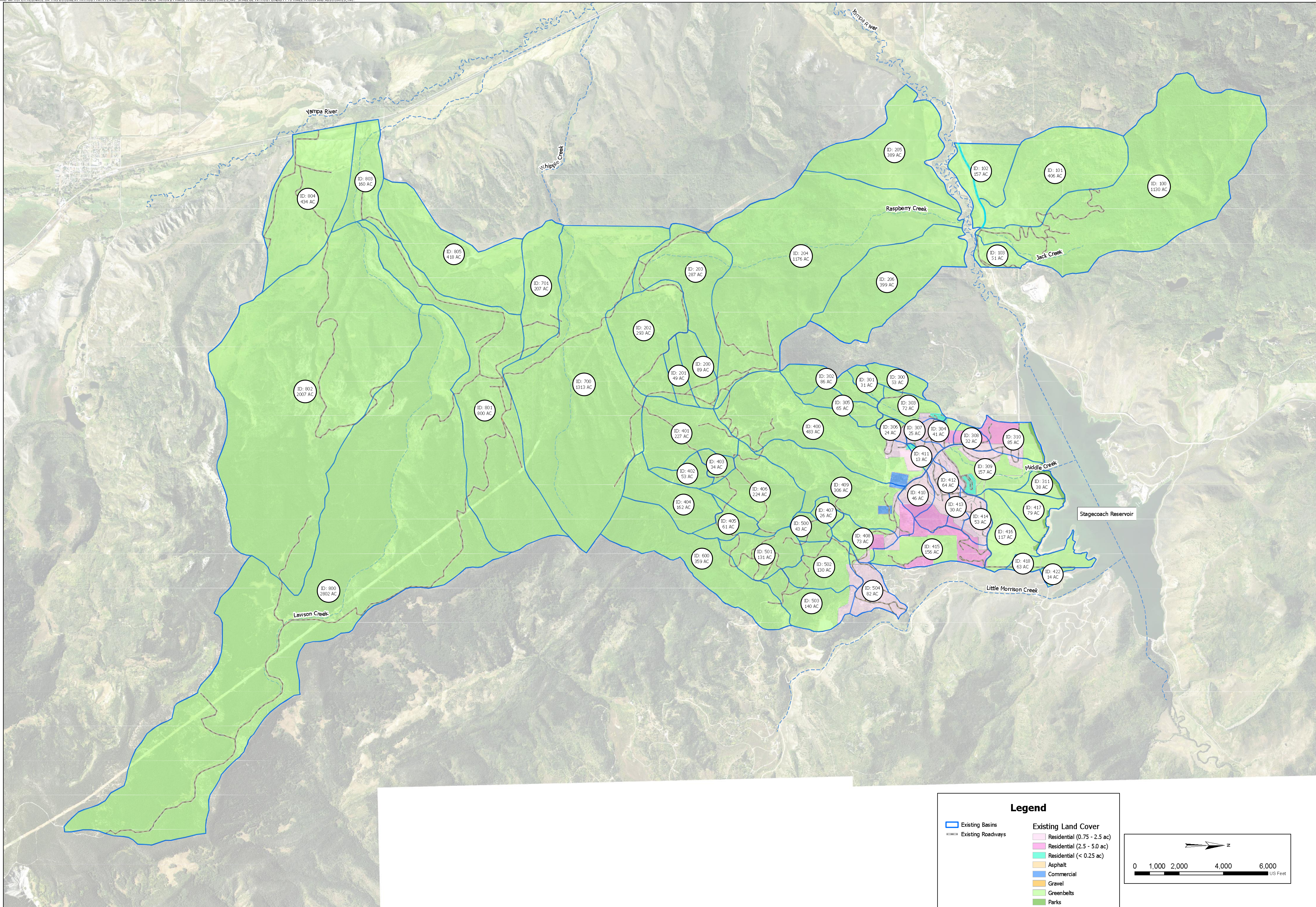
DESIGNED BY: SNM
DRAWN BY: TOS
CHECKED BY: BAH
DATE: 11/22/2024

STAGECOACH DRAINAGE BASIN STUDY

PROPOSED LAND USE MAP

PROJECT NO. 196778000

DRAWING NAME PROP LAND USE



STAGECOACH DRAINAGE BASIN STUDY

EXISTING LAND USE MAP

DESIGNED BY: SNM
DRAWN BY: TOS
CHECKED BY: BAH
DATE: 11/25/2024

Kimley»Horn

Engineering, Planning and Environmental Consultants
2 North Nevada Avenue, Suite 900
Colorado Springs, CO (719) 453-0180

PROJECT NO. 196778000

DRAWING NAME
EX LAND USE

NOAA Atlas 14, Volume 8, Version 2
Location name: Oak Creek, Colorado, USA*
Latitude: 40.2551°, Longitude: -106.8555°
Elevation: 7433 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.122 (0.097-0.159)	0.183 (0.145-0.238)	0.278 (0.220-0.363)	0.353 (0.278-0.464)	0.453 (0.339-0.616)	0.526 (0.386-0.730)	0.597 (0.421-0.854)	0.665 (0.448-0.986)	0.750 (0.485-1.15)	0.810 (0.513-1.28)
10-min	0.179 (0.143-0.233)	0.267 (0.212-0.348)	0.406 (0.322-0.531)	0.517 (0.407-0.680)	0.664 (0.497-0.901)	0.771 (0.565-1.07)	0.874 (0.617-1.25)	0.973 (0.657-1.44)	1.10 (0.710-1.69)	1.19 (0.751-1.87)
15-min	0.219 (0.174-0.284)	0.326 (0.259-0.425)	0.496 (0.393-0.648)	0.631 (0.497-0.829)	0.809 (0.606-1.10)	0.940 (0.689-1.30)	1.06 (0.752-1.52)	1.19 (0.801-1.76)	1.34 (0.866-2.06)	1.45 (0.916-2.28)
30-min	0.288 (0.229-0.375)	0.406 (0.323-0.529)	0.597 (0.473-0.781)	0.754 (0.593-0.991)	0.967 (0.728-1.32)	1.13 (0.830-1.57)	1.29 (0.914-1.86)	1.45 (0.982-2.16)	1.66 (1.08-2.56)	1.82 (1.15-2.87)
60-min	0.372 (0.296-0.484)	0.490 (0.389-0.638)	0.684 (0.541-0.893)	0.846 (0.666-1.11)	1.07 (0.810-1.47)	1.25 (0.920-1.74)	1.42 (1.01-2.06)	1.61 (1.09-2.40)	1.85 (1.20-2.86)	2.03 (1.29-3.21)
2-hr	0.456 (0.368-0.585)	0.573 (0.461-0.736)	0.770 (0.617-0.992)	0.938 (0.747-1.22)	1.18 (0.903-1.60)	1.37 (1.02-1.89)	1.56 (1.12-2.23)	1.76 (1.21-2.60)	2.04 (1.34-3.12)	2.25 (1.44-3.51)
3-hr	0.530 (0.430-0.674)	0.638 (0.517-0.812)	0.822 (0.663-1.05)	0.982 (0.787-1.26)	1.21 (0.940-1.64)	1.40 (1.06-1.92)	1.59 (1.16-2.26)	1.80 (1.24-2.64)	2.08 (1.38-3.16)	2.30 (1.48-3.55)
6-hr	0.676 (0.555-0.848)	0.785 (0.644-0.986)	0.972 (0.795-1.23)	1.14 (0.922-1.44)	1.37 (1.08-1.82)	1.56 (1.19-2.11)	1.76 (1.29-2.46)	1.97 (1.38-2.84)	2.26 (1.51-3.38)	2.48 (1.61-3.78)
12-hr	0.859 (0.715-1.06)	0.989 (0.822-1.22)	1.21 (1.00-1.51)	1.41 (1.16-1.76)	1.70 (1.35-2.22)	1.93 (1.49-2.57)	2.17 (1.62-2.99)	2.43 (1.72-3.46)	2.79 (1.89-4.12)	3.07 (2.02-4.61)
24-hr	1.07 (0.900-1.30)	1.22 (1.03-1.49)	1.49 (1.25-1.82)	1.73 (1.44-2.13)	2.08 (1.68-2.69)	2.37 (1.86-3.12)	2.68 (2.02-3.64)	3.00 (2.16-4.23)	3.46 (2.38-5.04)	3.83 (2.54-5.66)
2-day	1.30 (1.11-1.56)	1.47 (1.25-1.76)	1.77 (1.50-2.13)	2.04 (1.72-2.48)	2.45 (2.00-3.13)	2.79 (2.21-3.62)	3.15 (2.40-4.22)	3.54 (2.57-4.91)	4.09 (2.84-5.87)	4.54 (3.04-6.60)
3-day	1.45 (1.24-1.72)	1.64 (1.41-1.95)	1.98 (1.69-2.36)	2.28 (1.94-2.74)	2.73 (2.24-3.45)	3.10 (2.48-3.99)	3.49 (2.68-4.63)	3.92 (2.86-5.38)	4.51 (3.15-6.41)	4.98 (3.37-7.19)
4-day	1.57 (1.36-1.86)	1.78 (1.54-2.11)	2.15 (1.85-2.55)	2.47 (2.11-2.95)	2.95 (2.44-3.70)	3.34 (2.68-4.26)	3.75 (2.89-4.94)	4.19 (3.07-5.71)	4.80 (3.36-6.77)	5.29 (3.59-7.58)
7-day	1.89 (1.65-2.21)	2.12 (1.85-2.48)	2.52 (2.20-2.96)	2.87 (2.48-3.40)	3.38 (2.82-4.18)	3.79 (3.07-4.77)	4.22 (3.28-5.48)	4.68 (3.46-6.28)	5.30 (3.75-7.37)	5.80 (3.97-8.20)
10-day	2.15 (1.90-2.50)	2.40 (2.11-2.79)	2.82 (2.47-3.28)	3.18 (2.77-3.73)	3.71 (3.11-4.54)	4.13 (3.37-5.15)	4.57 (3.58-5.88)	5.04 (3.75-6.70)	5.67 (4.04-7.82)	6.18 (4.25-8.67)
20-day	2.88 (2.57-3.28)	3.16 (2.82-3.62)	3.64 (3.24-4.18)	4.06 (3.58-4.68)	4.66 (3.96-5.60)	5.13 (4.24-6.29)	5.63 (4.46-7.11)	6.14 (4.63-8.04)	6.85 (4.93-9.29)	7.41 (5.16-10.2)
30-day	3.50 (3.15-3.96)	3.84 (3.46-4.36)	4.42 (3.96-5.02)	4.90 (4.36-5.61)	5.59 (4.78-6.64)	6.13 (5.10-7.42)	6.68 (5.33-8.35)	7.25 (5.50-9.38)	8.02 (5.80-10.7)	8.61 (6.04-11.8)
45-day	4.33 (3.93-4.86)	4.78 (4.34-5.37)	5.52 (4.98-6.21)	6.12 (5.49-6.93)	6.95 (5.98-8.15)	7.58 (6.34-9.07)	8.22 (6.59-10.1)	8.85 (6.75-11.3)	9.69 (7.05-12.8)	10.3 (7.28-14.0)
60-day	5.08 (4.64-5.66)	5.64 (5.14-6.29)	6.54 (5.94-7.32)	7.27 (6.55-8.18)	8.24 (7.11-9.57)	8.96 (7.53-10.6)	9.67 (7.79-11.8)	10.4 (7.93-13.1)	11.2 (8.21-14.8)	11.9 (8.43-16.0)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

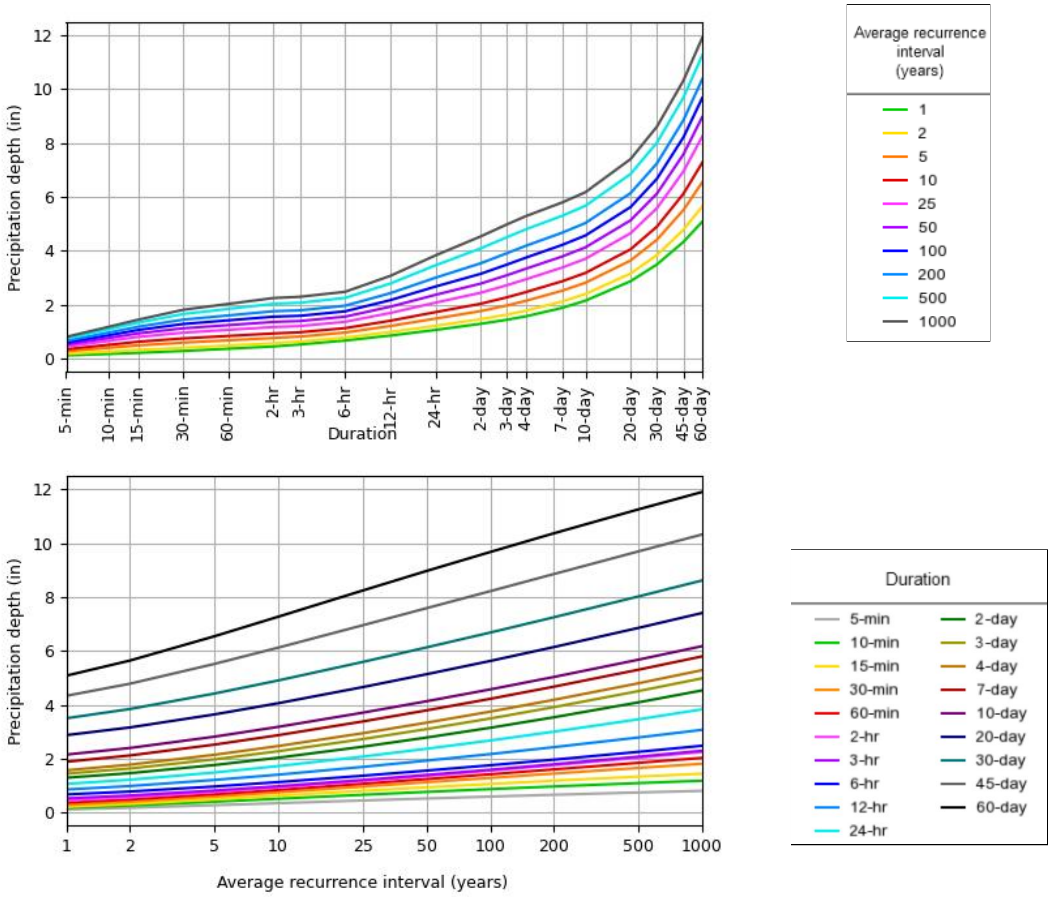
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 40.2551°, Longitude: -106.8555°



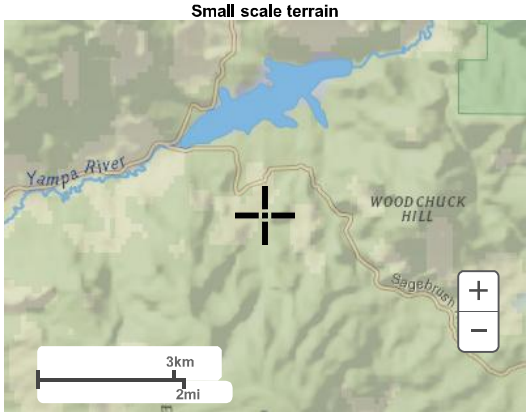
NOAA Atlas 14, Volume 8, Version 2

Created (GMT): Wed Apr 17 21:54:57 2024

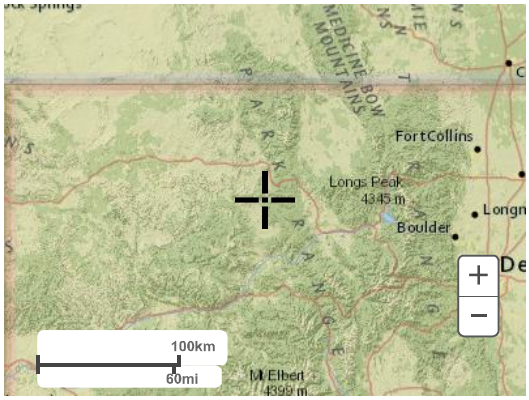
Back to Top

Maps & aerials

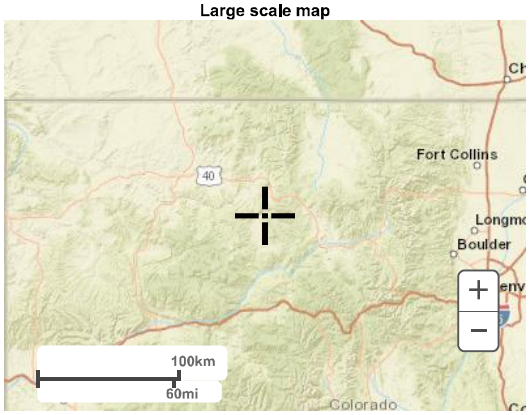
Small scale terrain



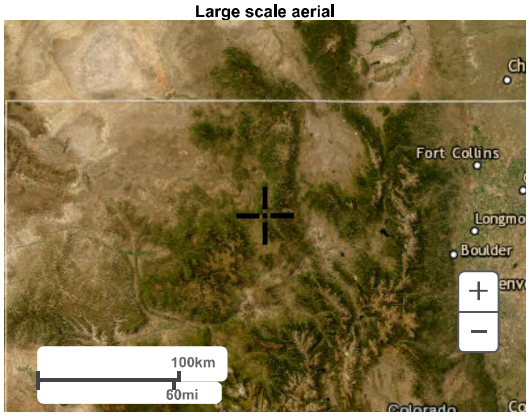
Large scale terrain



Large scale map



Large scale aerial



Back to Top

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Table 5.6.3. Recommended Imperviousness Values

Land Use or Cover	Percent Impervious
Commercial/Mixed Use	
Downtown and Base Areas*	95
All Other Commercial Areas	75
Residential	
Single Family	
2.5 acres or larger lot size	12
0.75 – 2.5 acres lot size	20
0.25 – 0.75 acres lot size	30
0.25 acres or smaller lot size	45
Multifamily and Resort Residential	75
Industrial	
Light industrial	80
Heavy industrial	90
Parks, cemeteries	10
Playgrounds	25
Schools	55
Railroad yards	50
Undeveloped Areas	
Historic Flow analysis	2
Greenbelts, agriculture	2
Off-site flow analysis	45
(when land use not defined)	
Streets & Surfacing	
Paved (concrete/asphalt)	100
Road base or recycled asphalt	80
Gravel (uniformly graded)	40
Drives and walks	90
Roofs	90
Lawns and golf courses (all soils)	2

Reference: UDFCD (2016)
*Downtown and Base Area Commercial defined as CO, G1, and G2 zoned parcels

5.6.2.3 HEC Models

The USACE HEC has developed models designed to simulate various hydrologic and hydraulic processes. The HEC-1 Flood Hydrograph Package was the first hydrologic model developed. Its successor, HEC-HMS (Hydrologic Modeling System), is designed to simulate the precipitation-runoff processes of branching watershed systems. It is designed to be applicable in a wide range of geographic areas for modeling the widest possible range of hydrologic conditions. This includes large river basin water supply and flood hydrology, and small urban or natural watershed runoff.

Either program is acceptable for use in the City of Steamboat Springs. The designer is referred to the HEC-1 and HEC-HMS User's Manuals for additional guidance. The following subsections offer guidance for determining some of the inputs to the HEC programs.

Kimley»Horn

STANDARD FORM SF-1
RUNOFF COEFFICIENTS - IMPERVIOUS CALCULATION

PROJECT NAME: STAGECOACH **(EXISTING)**
PROJECT NUMBER: 196778000
CALCULATED BY: DCM
CHECKED BY: TOS

LAND USE:	PAVEMENT AREA	GRAVEL AREA	SINGLE FAMILY < 0.25-AC	SINGLE FAMILY 0.25 TO 0.75-AC	SINGLE FAMILY 0.75 TO 2.5-AC	SINGLE FAMILY 2.5 TO 5.0-AC	SINGLE FAMILY > 5.0-AC	PARK AREA	COMMERCIAL AREA	GREEN BELTS AREA		
IMPERVIOUS %	100%	40%	45%	30%	20%	12%	8%	10%	75%	2%		
BASIN	MAJOR BASIN	PAVEMENT AREA (AC)	GRAVEL AREA (AC)	SINGLE FAMILY < 0.25-AC (AC)	SINGLE FAMILY 0.25 TO 0.75-AC (AC)	SINGLE FAMILY 0.75 TO 2.5-AC (AC)	SINGLE FAMILY 2.5 TO 5.0-AC (AC)	SINGLE FAMILY > 5.0-AC (AC)	PARK AREA (AC)	COMMERCIAL AREA (AC)	GREEN BELTS AREA (AC)	TOTAL AREA (AC)	Imp %
100	100	0.28	9.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1120.8	**1130.1**	2.3%
101		0.48	0.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	404.4	**405.8**	2.2%
102		2.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	154.4	**156.6**	3.4%
103		1.12	1.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	48.3	**50.7**	5.2%
200	200	0.00	2.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	86.9	**89.1**	2.9%
201		0.00	1.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	47.8	**49.1**	2.9%
202		0.00	5.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	287.2	**293.0**	2.8%
203		0.00	3.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	283.5	**287.1**	2.5%
204		0.00	7.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1167.9	**1175.9**	2.3%
205		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	389.3	**389.3**	2.0%
206		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	399.0	**399.0**	2.0%
300	300	0.00	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	52.8	**53.3**	2.3%
301		0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.8	**30.9**	2.1%
302		0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	86.4	**86.5**	2.0%
303		0.00	1.66	3.56	0.00	4.51	0.00	0.00	0.00	0.00	62.3	**72.1**	6.1%
304		0.15	2.07	0.55	0.00	27.53	4.98	0.00	0.00	0.00	6.0	**41.2**	18.1%
305		0.00	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	64.8	**65.1**	2.2%
306		0.91	0.58	0.00	0.00	6.45	0.00	0.00	0.00	0.00	15.6	**23.6**	11.6%
307		0.84	0.59	0.17	0.00	16.13	0.00	0.00	0.00	0.00	7.1	**24.8**	18.2%
308		1.60	0.00	0.00	0.00	7.26	18.16	0.00	0.00	0.00	4.6	**31.6**	16.9%
309		6.02	0.00	8.70	0.00	45.94	0.00	0.00	0.43	0.00	96.1	**157.1**	13.4%
310		2.93	0.00	0.00	0.00	13.91	36.09	0.00	6.23	0.00	25.6	**84.8**	13.2%
311		0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.72	0.00	30.1	**37.8**	3.6%
400	400	1.78	4.93	0.53	0.00	27.74	0.00	0.00	0.00	9.55	439.0	**483.5**	5.3%
401		0.00	3.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	223.1	**227.1**	2.7%
402		0.00	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	52.0	**52.5**	2.4%
403		0.00	1.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	33.1	**34.2**	3.2%
404		0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	161.8	**162.2**	2.1%
405		0.00	1.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.8	**61.3**	2.9%
406		0.00	4.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	219.1	**224.1**	2.8%
407		0.00	0.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.2	**26.2**	3.3%
408		0.00	2.32	0.00	0.00	10.39	10.32	0.00	0.00	0.00	49.5	**72.5**	7.2%
409		1.68	2.38	0.00	0.00	7.29	16.98	0.00	0.00	7.65	269.6	**305.6**	5.6%
410		1.23	0.00	0.00	0.00	35.00	9.94	0.00	0.00	0.26	0.0	**46.4**	20.7%
411		0.97	0.00	3.57	0.00	6.24	0.00	0.00	0.00	0.00	2.5	**13.3**	29.3%
412		2.89	0.23	0.00	0.00	36.20	24.49	0.00	0.00	0.00	0.0	**63.8**	20.6%
413		1.69	0.26	0.00	0.00	23.90	4.23	0.00	0.00	0.00	0.0	**30.1**	23.6%
414		4.18	0.33	0.00	0.00	45.51	3.19	0.00	0.00	0.00	0.0	**53.2**	25.9%
415		0.48	5.15	0.00	0.00	7.26	60.24	0.00	0.00	0.00	83.3	**156.5**	8.2%
416		1.32	0.69	0.00	0.00	0.00	0.35	0.00	1.43	0.00	113.1	**116.9**	3.5%
417		0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.37	0.00	74.8	**79.2**	2.4%
418		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	62.8	**62.8**	2.0%
422		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.2	**14.2**	2.0%
500	500	0.00	1.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.7	**43.1**	3.2%
501		0.00	6.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	125.1	**131.2**	3.8%
502		0.00	3.78	0.00	0.00	9.08	0.00	0.00	0.00	0.00	117.3	**130.2**	4.4%
503		0.00	1.87	0.00	0.00	11.69	0.00	0.00	0.00	0.00	126.1	**139.6**	4.0%
504		0.00	5.28	0.00	0.00	72.54	0.00	0.00	0.00	0.00	3.7	**81.6**	20.5%
600	600	0.00	1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	357.6	**358.6**	2.1%
700	700	0.00	9.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1303.3	**1312.9**	2.3%
701		0.00	2.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	204.7	**206.9**	2.4%
800	800	0.00	27.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2773.9	**2801.8**	2.4%
801		0.00	18.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	780.6	**799.6**	2.9%
802		0.00	12.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1994.8	**2007.1**	2.2%
803		0.00	2.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	157.1	**159.8**	2.6%
804		0.00	8.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	425.4	**434.3**	2.8%
805		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	418.3	**418.3**	2.0%
SUBTOTAL (MAJOR BASIN)	100	4.11	11.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1727.82	**1743.2**	2.5%
	200	0.00	20.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2661.76	**2682.5**	2.3%
	300	12.45	5.92	12.99	0.00	121.73	59.23	0.00	14.37	0.00	482.16	**708.9**	8.9%
	400	16.24	29.55	4.10	0.00	199.55	129.74	0.00	5.80	17.46	1882.99	**2285.4**	6.0%
	500	0.00	18.37	0.00	0.00	93.31	0.00	0.00	0.00	0.00	413.95	**525.6**	6.5%
	600	0.00	1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	357.61	**358.6**	2.1%
	700	0.00	11.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1508.00	**1519.8**	2.3%
	800	0.00	70.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6550.22	**6620.9**	2.4%
TOTAL		32.81	169.37	17.08	0.00	414.59	188.97	0.00	20.18	17.46	15584.51	**16445.0**	3.3%

Comment	5-Year Design Storm Event		
1Hr Depth	0.684	NOAA Atlas 14 Point Precipitation Frequency Estimates: CO (Note: Use 60-minute recurrence interval depth)	
Return Period	5	Years	
Time	Depth	CurveValue	
0:05	0.014		0.02
0:10	0.025		0.037
0:15	0.06		0.087
0:20	0.105		0.153
0:25	0.171		0.25
0:30	0.089		0.13
0:35	0.04		0.058
0:40	0.03		0.044
0:45	0.025		0.036
0:50	0.025		0.036
0:55	0.021		0.03
1:00	0.021		0.03
1:05	0.021		0.03
1:10	0.021		0.03
1:15	0.017		0.025
1:20	0.015		0.022
1:25	0.015		0.022
1:30	0.015		0.022
1:35	0.015		0.022
1:40	0.01		0.015
1:45	0.01		0.015
1:50	0.01		0.015
1:55	0.01		0.015
2:00	0.009		0.013
2:05	0		

CUHP SUBCATCHMENTS

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

								Maximum Depression Storage (Watershed inches)		Horton's Infiltration Parameters			DCIA
Subcatchment Name	EPA SWMM Target Node	Raingage	Area (acre)	Length to Centroid (ft)	Length (ft)	Slope (ft/ft)	Percent Imperviousness	Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/seconds)	Final Rate (in/hr)	Level 0, 1, or 2
100	100	5YR	1130.1	9737.6	17740.8	0.06	2.3	0.35	0.1	3	0.0018	0.5	0
101	101	5YR	405.8	4901.8	8785.7	0.06	2.2	0.35	0.1	3	0.0018	0.5	0
102	102	5YR	156.6	2418.1	5888.5	0.06	3.4	0.35	0.1	3	0.0018	0.5	0
103	103	5YR	50.7	955.6	2559	0.06	5.2	0.35	0.1	3	0.0018	0.5	0
200	200	5YR	89.1	1904.6	3753.3	0.06	2.9	0.35	0.1	3.6	0.0015	0.7	0
201	201	5YR	49.1	1364.4	3213.5	0.06	2.9	0.35	0.1	3.9	0.0013	0.7	0
202	202	5YR	293	2159.8	5938.9	0.06	2.8	0.35	0.1	3.3	0.0016	0.6	0
203	203	5YR	287.1	2158.2	5584.6	0.06	2.5	0.35	0.1	3	0.0018	0.5	0
204	204	5YR	1175.9	8905	11586.7	0.06	2.3	0.35	0.1	3.1	0.0018	0.5	0
205	205	5YR	389.3	2003.2	4987	0.06	2	0.35	0.1	3	0.0018	0.5	0
206	206	5YR	399	4843.7	9646.3	0.06	2	0.35	0.1	3	0.0018	0.5	0
300	300	5YR	53.3	1431.8	3228	0.06	2.3	0.35	0.1	3	0.0018	0.5	0
301	301	5YR	30.9	1194	2220	0.06	2.1	0.35	0.1	3.2	0.0018	0.5	0
302	302	5YR	86.5	2642.3	4657.7	0.06	2	0.35	0.1	3	0.0018	0.5	0
303	303	5YR	72.1	1970.1	3348.3	0.06	6.1	0.35	0.1	3.4	0.0018	0.5	0
304	304	5YR	41.2	801.3	2226.7	0.06	18.1	0.35	0.1	3	0.0018	0.5	0
305	305	5YR	65.1	1760.2	4289.3	0.06	2.2	0.35	0.1	3	0.0018	0.5	0
306	306	5YR	23.6	618	1447.5	0.06	11.6	0.35	0.1	3	0.0018	0.5	0
307	307	5YR	24.8	1242.8	2071.9	0.06	18.2	0.35	0.1	3	0.0018	0.5	0
308	308	5YR	31.6	874.7	2092.6	0.06	16.9	0.35	0.1	3	0.0018	0.5	0
309	309	5YR	157.1	2591.1	5646.3	0.06	13.4	0.35	0.1	3	0.0018	0.5	0
310	310	5YR	84.8	1900.4	3426.3	0.06	13.2	0.35	0.1	3	0.0018	0.5	0
311	311	5YR	37.8	604.8	1681.7	0.06	3.6	0.35	0.1	3	0.0018	0.5	0
400	400	5YR	483.5	5636.6	10631.6	0.06	5.3	0.35	0.1	3	0.0018	0.5	0
401	401	5YR	227.1	2664.2	6071.1	0.06	2.7	0.35	0.1	3.6	0.0017	0.6	0
402	402	5YR	52.5	969.5	2536.1	0.06	2.4	0.35	0.1	3	0.0018	0.5	0
403	403	5YR	34.2	812.1	1793.3	0.06	3.2	0.35	0.1	3.2	0.0017	0.6	0
404	404	5YR	162.2	2214.2	5432.1	0.06	2.1	0.35	0.1	3	0.0018	0.5	0
405	405	5YR	61.3	1345.5	3162.7	0.06	2.9	0.35	0.1	3	0.0018	0.5	0
406	406	5YR	224.1	1992.8	5035.5	0.06	2.8	0.35	0.1	3.2	0.0017	0.6	0
407	407	5YR	26.2	656.3	2135.8	0.06	3.3	0.35	0.1	3	0.0018	0.5	0
408	408	5YR	72.5	1524.8	3669.7	0.06	7.2	0.35	0.1	3	0.0018	0.5	0
409	409	5YR	305.6	2823.9	7375.2	0.06	5.6	0.35	0.1	3	0.0018	0.5	0
410	410	5YR	46.4	758	1653.4	0.06	20.7	0.35	0.1	3	0.0018	0.5	0
411	411	5YR	13.3	562.2	1525.9	0.06	29.3	0.35	0.1	3	0.0018	0.5	0
412	412	5YR	63.8	886.6	2740	0.06	20.6	0.35	0.1	3	0.0018	0.5	0
413	413	5YR	30.1	895.3	2614	0.06	23.6	0.35	0.1	3	0.0018	0.5	0
414	414	5YR	53.2	1153.6	2897.5	0.06	25.9	0.35	0.1	3	0.0018	0.5	0
415	415	5YR	156.5	3472.4	6367.3	0.06	8.2	0.35	0.1	3	0.0018	0.5	0
416	416	5YR	116.9	1428	3827.3	0.06	3.5	0.35	0.1	3	0.0018	0.5	0
417	417	5YR	79.2	740.9	2363.1	0.06	2.4	0.35	0.1	3	0.0018	0.5	0
418	418	5YR	62.8	315.4	2342.4	0.06	2	0.35	0.1	3	0.0018	0.5	0
422	422	5YR	14.2	475	874	0.06	2	0.35	0.1	3	0.0018	0.5	0
500	500	5YR	43.1	1524.8	2481.8	0.06	3.2	0.35	0.1	3	0.0018	0.5	0
501	501	5YR	131.2	1958.6	4161.2	0.06	3.8	0.35	0.1	3	0.0018	0.5	0
502	502	5YR	130.2	2225.3	4340.8	0.06	4.4	0.35	0.1	3	0.0018	0.5	0
503	503	5YR	139.6	2385.5	5230.2	0.06	4	0.35	0.1	3	0.0018	0.5	0
504	504	5YR	81.6	1738	4000.4	0.06	20.5	0.35	0.1	3	0.0018	0.5	0
600	600	5YR	358.6	5321.4	9790.3	0.06	2.1	0.35	0.1	3	0.0018	0.5	0
700	700	5YR	1312.9	7848.6	16074.1	0.06	2.3	0.35	0.1	4	0.0015	0.7	0
701	701	5YR	206.9	3383.5	6450.2	0.06	2.4	0.35	0.1	3	0.0018	0.5	0
800	800	5YR	2801.8	16054.6	35869.9	0.06	2.4	0.35	0.1	4.3	0.0017	0.6	0
801	801	5YR	799.6	13786.4	20705.1	0.06	2.9	0.35	0.1	4.4	0.0014	0.7	0
802	802	5YR	2007.1	8822.7	19152.7	0.06	2.2	0.35	0.1	3.5	0.0018	0.5	0
803	803	5YR	159.8	3476.3	5324.9	0.06	2.6	0.35	0.1	3	0.0018	0.5	0
804	804	5YR	434.3	5289.5	9438.6	0.06	2.8	0.35	0.1	3	0.0018	0.5	0
805	805	5YR	418.3	5794.6	9789.2	0.06	2	0.35	0.1	3	0.0018	0.5	0

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
100		0.157	0.429	81.0	27.00	42.1	19.08	45.0	654	4,102,263	0.01	22,618	74.0	3	22,618	0.00
101		0.158	0.316	56.5	14.03	29.4	9.91	23.4	337	1,473,054	0.01	7,748	55.0	2	7,748	0.00
102		0.154	0.233	44.2	8.21	23.0	5.80	13.7	166	568,458	0.01	4,767	46.0	1	4,767	0.01
103		0.150	0.144	29.9	3.59	15.5	2.54	6.0	80	184,041	0.01	2,469	38.0	1	2,469	0.02
200		0.156	0.193	38.9	6.05	20.2	4.28	10.1	107	323,433	0.00	1,048	40.0	0	1,048	0.00
201		0.156	0.147	40.2	4.85	20.9	3.43	8.1	57	178,233	0.00	336	39.0	0	336	0.00
202		0.157	0.285	34.8	7.93	18.1	5.60	13.2	394	1,063,590	0.00	4,934	42.0	2	4,934	0.01
203		0.157	0.284	34.0	7.71	17.7	5.45	12.9	396	1,042,173	0.01	6,279	43.0	2	6,278	0.01
204		0.157	0.435	62.5	21.15	32.5	14.95	35.3	882	4,268,517	0.01	23,248	64.0	4	23,248	0.00
205		0.158	0.313	28.4	7.13	14.8	5.04	11.9	643	1,413,159	0.00	6,722	41.0	3	6,722	0.01
206		0.158	0.316	59.1	14.62	30.7	10.33	24.4	317	1,448,370	0.00	6,889	56.0	1	6,889	0.00
300		0.157	0.154	39.8	5.00	20.7	3.53	8.3	63	193,479	0.01	1,067	42.0	0	1,067	0.01
301		0.158	0.121	38.9	3.91	20.2	2.76	6.5	37	112,167	0.00	548	41.0	0	548	0.01
302		0.158	0.192	51.2	7.85	26.6	5.55	13.1	79	313,995	0.00	1,494	46.0	0	1,494	0.00
303		0.148	0.166	41.0	5.53	21.3	3.91	9.2	82	261,723	0.02	4,031	42.0	1	4,031	0.01
304		0.119	0.109	26.9	2.54	14.0	1.80	4.2	72	149,556	0.07	10,837	36.0	3	10,838	0.08
305		0.158	0.169	46.0	6.25	23.9	4.42	10.4	66	236,313	0.01	1,243	44.0	0	1,243	0.00
306		0.132	0.091	25.6	2.08	13.3	1.47	3.5	43	85,668	0.04	3,162	36.0	1	3,162	0.05
307		0.119	0.087	40.2	2.97	20.9	2.10	5.0	29	90,024	0.07	6,576	40.0	1	6,576	0.06
308		0.120	0.097	30.9	2.61	16.0	1.84	4.3	48	114,708	0.07	7,514	37.0	2	7,515	0.06
309		0.126	0.195	43.6	6.83	22.7	4.83	11.4	169	570,273	0.05	26,402	44.0	6	26,402	0.04
310		0.126	0.156	37.1	4.75	19.3	3.35	7.9	107	307,824	0.05	13,926	41.0	3	13,925	0.04
311		0.154	0.129	22.4	2.52	11.7	1.78	4.2	79	137,214	0.01	1,225	36.0	1	1,225	0.01
400		0.150	0.317	62.7	15.57	32.6	11.00	25.9	362	1,755,105	0.01	24,058	57.0	4	24,058	0.01
401		0.157	0.264	42.0	8.84	21.9	6.24	14.7	253	824,373	0.00	3,739	45.0	1	3,739	0.00
402		0.157	0.153	29.6	3.76	15.4	2.66	6.3	83	190,575	0.01	1,099	38.0	0	1,099	0.01
403		0.156	0.125	27.9	2.97	14.5	2.10	4.9	58	124,146	0.01	733	36.0	0	732	0.01
404		0.158	0.241	40.3	7.75	21.0	5.48	12.9	188	588,786	0.01	2,948	44.0	1	2,948	0.01
405		0.156	0.162	35.9	4.77	18.6	3.37	7.9	80	222,519	0.01	1,571	41.0	0	1,571	0.01
406		0.157	0.263	33.6	7.08	17.5	5.00	11.8	313	813,483	0.01	4,132	41.0	1	4,132	0.01
407		0.155	0.110	30.8	2.91	16.0	2.05	4.8	40	95,106	0.01	772	38.0	0	772	0.01
408		0.144	0.163	37.7	5.02	19.6	3.55	8.4	90	263,175	0.02	5,128	41.0	1	5,128	0.02
409		0.149	0.275	43.3	9.44	22.5	6.67	15.7	331	1,109,328	0.01	16,184	47.0	4	16,184	0.01
410		0.115	0.113	21.1	2.13	11.0	1.51	3.6	103	168,432	0.09	14,775	33.0	5	14,771	0.11
411		0.104	0.064	28.2	1.69	14.7	1.19	2.8	22	48,279	0.14	6,798	35.0	2	6,797	0.13
412		0.115	0.131	25.1	2.82	13.1	2.00	4.7	119	231,594	0.09	20,181	36.0	6	20,179	0.10
413		0.111	0.092	33.8	2.69	17.6	1.90	4.5	42	109,263	0.10	11,447	37.0	3	11,447	0.09
414		0.108	0.119	30.3	3.06	15.8	2.17	5.1	82	193,116	0.12	22,945	37.0	6	22,943	0.11
415		0.142	0.215	54.2	9.26	28.2	6.54	15.4	135	568,095	0.02	12,900	49.0	3	12,900	0.02
416		0.154	0.215	30.2	5.29	15.7	3.74	8.8	181	424,347	0.01	3,673	40.0	1	3,673	0.01
417		0.157	0.183	20.9	3.24	10.9	2.29	5.4	178	287,496	0.01	1,658	36.0	1	1,658	0.01
418		0.158	0.166	15.3	2.26	8.0	1.59	3.8	192	227,964	0.00	1,084	33.0	1	1,084	0.01
422		0.158	0.085	22.7	1.78	11.8	1.26	3.0	29	51,546	0.00	245	35.0	0	245	0.01
500		0.155	0.138	39.7	4.50	20.7	3.18	7.5	51	156,453	0.01	1,229	41.0	0	1,229	0.01
501		0.153	0.220	35.6	6.31	18.5	4.46	10.5	173	476,256	0.01	4,510	42.0	1	4,509	0.01
502		0.152	0.217	38.7	6.76	20.1	4.78	11.3	158	472,626	0.01	5,260	43.0	1	5,260	0.01
503		0.153	0.223	42.9	7.65	22.3	5.41	12.8	153	506,748	0.01	5,076	45.0	1	5,076	0.01
504		0.115	0.146	37.3	4.49	19.4	3.17	7.5	103	296,208	0.09	25,641	40.0	6	25,641	0.07
600		0.158	0.305	64.3	15.37	33.4	10.86	25.6	262	1,301,718	0.01	6,519	57.0	1	6,519	0.00
700		0.158	0.450	66.6	23.30	34.6	15.58	38.9	924	4,765,827	0.00	9,971	67.0	2	9,971	0.00
701		0.157	0.258	49.9	10.17	26.0	7.19	17.0	194	751,047	0.01	4,332	49.0	1	4,332	0.00
800		0.157	0.564	109.9	38.47	57.2	25.72	79.9	1,195	10,170,534	0.00	35,017	109.0	4	35,017	0.00
801		0.156	0.385	114.3	34.06	59.4	24.07	56.8	328	2,902,548	0.00	5,259	93.0	1	5,258	0.00
802		0.158	0.511	67.4	23.61	35.1	15.78	44.6	1,395	7,285,773	0.00	35,982	73.0	6	35,981	0.00
803		0.157	0.238	49.8	9.39	25.9	6.64	15.7	150	580,074	0.01	3,644	48.0	1	3,644	0.01
804		0.156	0.320	59.4	14.90	30.9	10.53	24.8	343	1,576,509	0.01	10,721	56.0	2	10,721	0.00
805		0.158	0.320	63.9	16.02	33.2	11.32	26.7	307	1,518,429	0.00	7,223	58.0	1	7,223	0.00

Comment	100-Year Design Storm Event		
1Hr Depth	1.42	NOAA Atlas 14 Point Precipitation Frequency Estimates: CO (Note: Use 60-minute recurrence interval depth)	
Return Period	100	Years	
Time	Depth	CurveValue	
0:05	0.014		0.01
0:10	0.043		0.03
0:15	0.065		0.046
0:20	0.114		0.08
0:25	0.199		0.14
0:30	0.355		0.25
0:35	0.199		0.14
0:40	0.114		0.08
0:45	0.088		0.062
0:50	0.071		0.05
0:55	0.057		0.04
1:00	0.057		0.04
1:05	0.057		0.04
1:10	0.028		0.02
1:15	0.028		0.02
1:20	0.017		0.012
1:25	0.017		0.012
1:30	0.017		0.012
1:35	0.017		0.012
1:40	0.017		0.012
1:45	0.017		0.012
1:50	0.017		0.012
1:55	0.017		0.012
2:00	0.017		0.012
2:05	0		

CUHP SUBCATCHMENTS

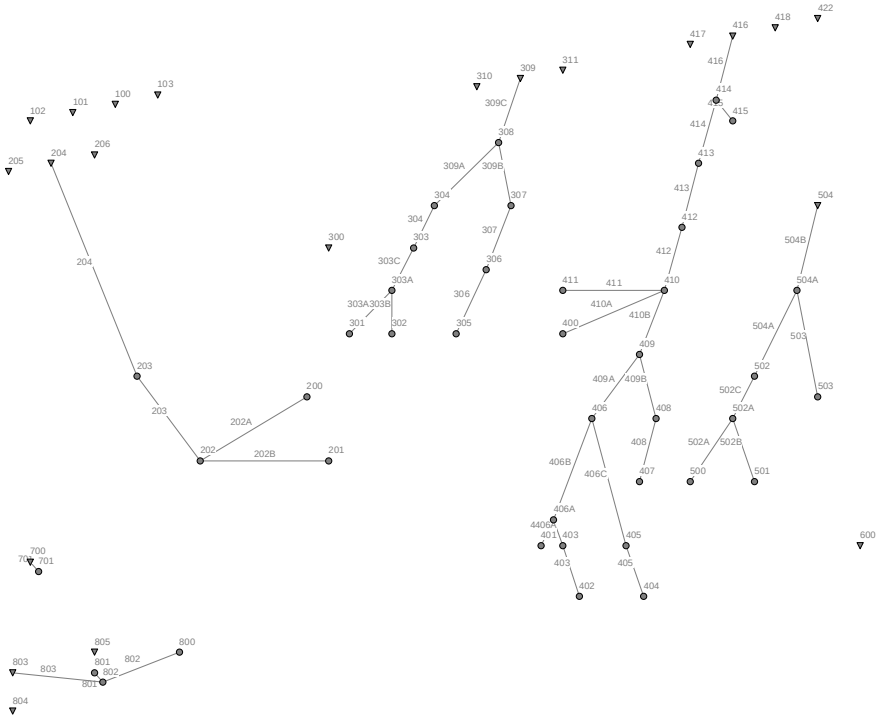
Columns with this color heading are for required user-input
Columns with this color heading are for optional override values
Columns with this color heading are for program-calculated values

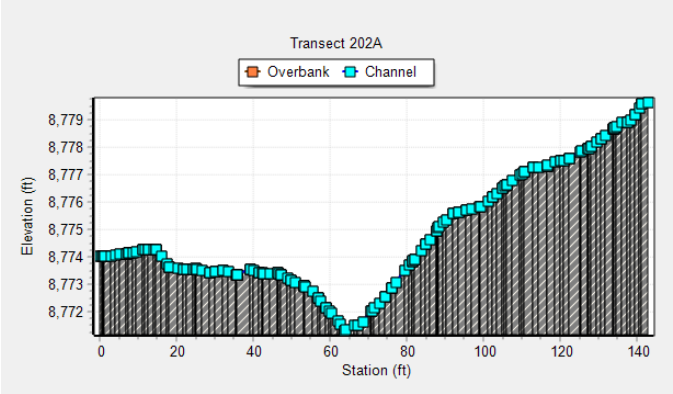
								Maximum Depression Storage (Watershed inches)		Horton's Infiltration Parameters			DCIA
Subcatchment Name	EPA SWMM Target Node	Raingage	Area (acre)	Length to Centroid (ft)	Length (ft)	Slope (ft/ft)	Percent Imperviousness	Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/seconds)	Final Rate (in/hr)	Level 0, 1, or 2
100	100	100YR	1130.1	9737.6	17740.8	0.06	2.3	0.35	0.1	3	0.0018	0.5	0
101	101	100YR	405.8	4901.8	8785.7	0.06	2.2	0.35	0.1	3	0.0018	0.5	0
102	102	100YR	156.6	2418.1	5888.5	0.06	3.4	0.35	0.1	3	0.0018	0.5	0
103	103	100YR	50.7	955.6	2559	0.06	5.2	0.35	0.1	3	0.0018	0.5	0
200	200	100YR	89.1	1904.6	3753.3	0.06	2.9	0.35	0.1	3.6	0.0015	0.7	0
201	201	100YR	49.1	1364.4	3213.5	0.06	2.9	0.35	0.1	3.9	0.0013	0.7	0
202	202	100YR	293	2159.8	5938.9	0.06	2.8	0.35	0.1	3.3	0.0016	0.6	0
203	203	100YR	287.1	2158.2	5584.6	0.06	2.5	0.35	0.1	3	0.0018	0.5	0
204	204	100YR	1175.9	8905	11586.7	0.06	2.3	0.35	0.1	3.1	0.0018	0.5	0
205	205	100YR	389.3	2003.2	4987	0.06	2	0.35	0.1	3	0.0018	0.5	0
206	206	100YR	399	4843.7	9646.3	0.06	2	0.35	0.1	3	0.0018	0.5	0
300	300	100YR	53.3	1431.8	3228	0.06	2.3	0.35	0.1	3	0.0018	0.5	0
301	301	100YR	30.9	1194	2220	0.06	2.1	0.35	0.1	3.2	0.0018	0.5	0
302	302	100YR	86.5	2642.3	4657.7	0.06	2	0.35	0.1	3	0.0018	0.5	0
303	303	100YR	72.1	1970.1	3348.3	0.06	6.1	0.35	0.1	3.4	0.0018	0.5	0
304	304	100YR	41.2	801.3	2226.7	0.06	18.1	0.35	0.1	3	0.0018	0.5	0
305	305	100YR	65.1	1760.2	4289.3	0.06	2.2	0.35	0.1	3	0.0018	0.5	0
306	306	100YR	23.6	618	1447.5	0.06	11.6	0.35	0.1	3	0.0018	0.5	0
307	307	100YR	24.8	1242.8	2071.9	0.06	18.2	0.35	0.1	3	0.0018	0.5	0
308	308	100YR	31.6	874.7	2092.6	0.06	16.9	0.35	0.1	3	0.0018	0.5	0
309	309	100YR	157.1	2591.1	5646.3	0.06	13.4	0.35	0.1	3	0.0018	0.5	0
310	310	100YR	84.8	1900.4	3426.3	0.06	13.2	0.35	0.1	3	0.0018	0.5	0
311	311	100YR	37.8	604.8	1681.7	0.06	3.6	0.35	0.1	3	0.0018	0.5	0
400	400	100YR	483.5	5636.6	10631.6	0.06	5.3	0.35	0.1	3	0.0018	0.5	0
401	401	100YR	227.1	2664.2	6071.1	0.06	2.7	0.35	0.1	3.6	0.0017	0.6	0
402	402	100YR	52.5	969.5	2536.1	0.06	2.4	0.35	0.1	3	0.0018	0.5	0
403	403	100YR	34.2	812.1	1793.3	0.06	3.2	0.35	0.1	3.2	0.0017	0.6	0
404	404	100YR	162.2	2214.2	5432.1	0.06	2.1	0.35	0.1	3	0.0018	0.5	0
405	405	100YR	61.3	1345.5	3162.7	0.06	2.9	0.35	0.1	3	0.0018	0.5	0
406	406	100YR	224.1	1992.8	5035.5	0.06	2.8	0.35	0.1	3.2	0.0017	0.6	0
407	407	100YR	26.2	656.3	2135.8	0.06	3.3	0.35	0.1	3	0.0018	0.5	0
408	408	100YR	72.5	1524.8	3669.7	0.06	7.2	0.35	0.1	3	0.0018	0.5	0
409	409	100YR	305.6	2823.9	7375.2	0.06	5.6	0.35	0.1	3	0.0018	0.5	0
410	410	100YR	46.4	758	1653.4	0.06	20.7	0.35	0.1	3	0.0018	0.5	0
411	411	100YR	13.3	562.2	1525.9	0.06	29.3	0.35	0.1	3	0.0018	0.5	0
412	412	100YR	63.8	886.6	2740	0.06	20.6	0.35	0.1	3	0.0018	0.5	0
413	413	100YR	30.1	895.3	2614	0.06	23.6	0.35	0.1	3	0.0018	0.5	0
414	414	100YR	53.2	1153.6	2897.5	0.06	25.9	0.35	0.1	3	0.0018	0.5	0
415	415	100YR	156.5	3472.4	6367.3	0.06	8.2	0.35	0.1	3	0.0018	0.5	0
416	416	100YR	116.9	1428	3827.3	0.06	3.5	0.35	0.1	3	0.0018	0.5	0
417	417	100YR	79.2	740.9	2363.1	0.06	2.4	0.35	0.1	3	0.0018	0.5	0
418	418	100YR	62.8	315.4	2342.4	0.06	2	0.35	0.1	3	0.0018	0.5	0
422	422	100YR	14.2	475	874	0.06	2	0.35	0.1	3	0.0018	0.5	0
500	500	100YR	43.1	1524.8	2481.8	0.06	3.2	0.35	0.1	3	0.0018	0.5	0
501	501	100YR	131.2	1958.6	4161.2	0.06	3.8	0.35	0.1	3	0.0018	0.5	0
502	502	100YR	130.2	2225.3	4340.8	0.06	4.4	0.35	0.1	3	0.0018	0.5	0
503	503	100YR	139.6	2385.5	5230.2	0.06	4	0.35	0.1	3	0.0018	0.5	0
504	504	100YR	81.6	1738	4000.4	0.06	20.5	0.35	0.1	3	0.0018	0.5	0
600	600	100YR	358.6	5321.4	9790.3	0.06	2.1	0.35	0.1	3	0.0018	0.5	0
700	700	100YR	1312.9	7848.6	16074.1	0.06	2.3	0.35	0.1	4	0.0015	0.7	0
701	701	100YR	206.9	3383.5	6450.2	0.06	2.4	0.35	0.1	3	0.0018	0.5	0
800	800	100YR	2801.8	16054.6	35869.9	0.06	2.4	0.35	0.1	4.3	0.0017	0.6	0
801	801	100YR	799.6	13786.4	20705.1	0.06	2.9	0.35	0.1	4.4	0.0014	0.7	0
802	802	100YR	2007.1	8822.7	19152.7	0.06	2.2	0.35	0.1	3.5	0.0018	0.5	0
803	803	100YR	159.8	3476.3	5324.9	0.06	2.6	0.35	0.1	3	0.0018	0.5	0
804	804	100YR	434.3	5289.5	9438.6	0.06	2.8	0.35	0.1	3	0.0018	0.5	0
805	805	100YR	418.3	5794.6	9789.2	0.06	2	0.35	0.1	3	0.0018	0.5	0

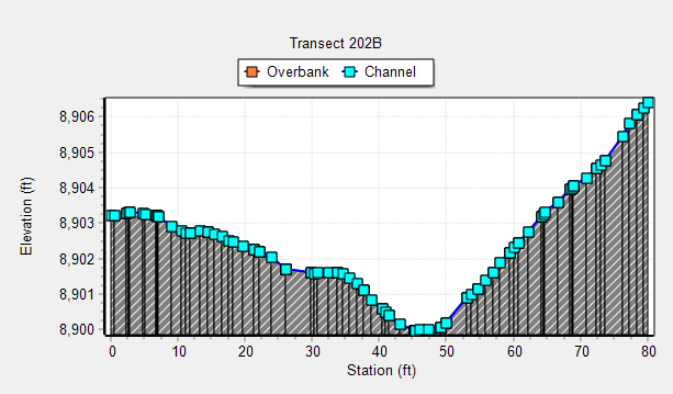
Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)

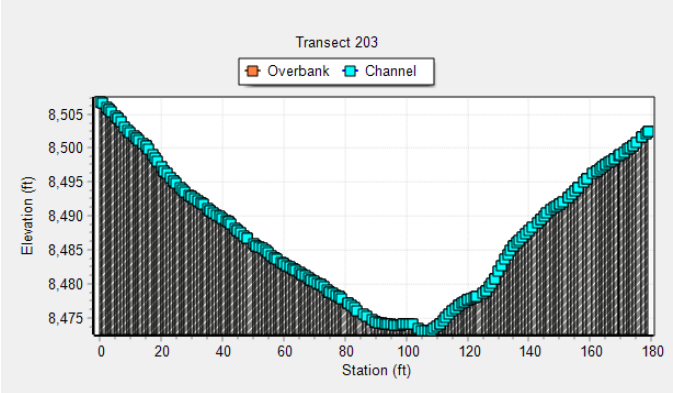
		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
100		0.156	0.426	80.9	26.77	42.1	18.92	44.6	654	4,102,263	0.49	1,991,434	81.0	301	1,991,423	0.27
101		0.156	0.314	56.5	13.92	29.4	9.83	23.2	337	1,473,054	0.48	713,866	63.0	144	713,862	0.35
102		0.153	0.230	44.1	8.11	23.0	5.73	13.5	166	568,458	0.49	281,179	54.0	68	281,176	0.43
103		0.147	0.141	29.8	3.53	15.5	2.49	5.9	80	184,041	0.51	93,831	45.0	29	93,827	0.58
200		0.155	0.191	38.9	5.99	20.2	4.24	10.0	107	323,433	0.28	89,614	49.0	26	89,610	0.30
201		0.155	0.146	40.2	4.81	20.9	3.40	8.0	57	178,233	0.23	40,162	49.0	11	40,162	0.23
202		0.155	0.282	34.8	7.84	18.1	5.54	13.1	394	1,063,590	0.37	398,581	51.0	123	398,578	0.42
203		0.155	0.281	34.0	7.65	17.7	5.40	12.7	396	1,042,173	0.49	507,655	50.0	150	507,616	0.52
204		0.156	0.431	62.5	20.97	32.5	14.82	35.0	883	4,268,517	0.48	2,059,380	72.0	390	2,059,379	0.33
205		0.157	0.311	28.4	7.08	14.8	5.00	11.8	643	1,413,159	0.48	682,494	48.0	232	682,476	0.59
206		0.157	0.313	59.1	14.52	30.7	10.26	24.2	317	1,448,370	0.48	699,499	64.0	136	699,497	0.34
300		0.156	0.153	39.7	4.96	20.7	3.50	8.3	63	193,479	0.49	93,924	50.0	24	93,922	0.45
301		0.157	0.120	38.9	3.88	20.2	2.74	6.5	37	112,167	0.48	53,593	49.0	14	53,591	0.45
302		0.157	0.191	51.2	7.79	26.6	5.51	13.0	79	313,995	0.48	151,646	55.0	32	151,644	0.37
303		0.144	0.162	40.9	5.41	21.3	3.82	9.0	83	261,723	0.51	132,411	51.0	33	132,411	0.46
304		0.116	0.108	26.5	2.49	13.8	1.76	4.2	73	149,556	0.63	93,721	43.0	30	93,723	0.72
305		0.156	0.167	46.0	6.20	23.9	4.38	10.3	66	236,313	0.48	114,521	53.0	26	114,517	0.41
306		0.126	0.088	25.4	2.01	13.2	1.42	3.4	43	85,668	0.57	48,485	42.0	16	48,477	0.69
307		0.116	0.086	39.7	2.91	20.6	2.06	4.8	29	90,024	0.63	56,500	47.0	13	56,497	0.54
308		0.118	0.096	30.5	2.55	15.9	1.80	4.3	49	114,708	0.62	70,576	45.0	20	70,577	0.65
309		0.123	0.192	43.3	6.69	22.5	4.73	11.1	170	570,273	0.58	332,195	52.0	78	332,190	0.49
310		0.123	0.154	36.8	4.64	19.1	3.28	7.7	108	307,824	0.58	178,744	48.0	47	178,743	0.55
311		0.152	0.127	22.4	2.49	11.6	1.76	4.2	79	137,214	0.50	68,101	42.0	26	68,097	0.69
400		0.147	0.312	62.6	15.27	32.5	10.79	25.4	362	1,755,105	0.51	896,314	66.0	165	896,310	0.34
401		0.155	0.262	42.0	8.74	21.8	6.18	14.6	253	824,373	0.38	311,890	53.0	83	311,885	0.36
402		0.156	0.151	29.6	3.73	15.4	2.64	6.2	83	190,575	0.49	92,673	46.0	29	92,667	0.56
403		0.153	0.123	27.9	2.93	14.5	2.07	4.9	58	124,146	0.40	49,243	44.0	17	49,238	0.50
404		0.157	0.239	40.3	7.70	21.0	5.44	12.8	188	588,786	0.48	284,846	52.0	74	284,847	0.45
405		0.154	0.161	35.8	4.72	18.6	3.34	7.9	80	222,519	0.49	109,134	48.0	30	109,130	0.49
406		0.155	0.260	33.5	7.00	17.4	4.95	11.7	313	813,483	0.39	319,699	49.0	101	319,685	0.45
407		0.153	0.109	30.8	2.87	16.0	2.03	4.8	40	95,106	0.49	46,963	46.0	14	46,958	0.55
408		0.141	0.159	37.6	4.90	19.6	3.46	8.2	90	263,175	0.53	138,688	49.0	37	138,686	0.50
409		0.146	0.270	43.2	9.25	22.5	6.54	15.4	332	1,109,328	0.51	569,358	54.0	139	569,356	0.46
410		0.112	0.112	20.8	2.09	10.8	1.48	3.5	105	168,432	0.65	109,756	41.0	41	109,729	0.88
411		0.102	0.067	26.4	1.66	13.7	1.17	2.8	24	48,279	0.74	35,582	41.0	11	35,575	0.81
412		0.112	0.130	24.7	2.76	12.9	1.95	4.6	121	231,594	0.65	150,691	42.0	50	150,680	0.78
413		0.109	0.092	33.1	2.64	17.2	1.86	4.4	43	109,263	0.68	74,290	46.0	20	74,289	0.65
414		0.106	0.118	29.7	3.00	15.5	2.12	5.0	84	193,116	0.70	135,704	44.0	39	135,694	0.73
415		0.137	0.210	54.0	8.99	28.1	6.35	15.0	136	568,095	0.54	304,300	57.0	61	304,297	0.39
416		0.152	0.212	30.2	5.22	15.7	3.69	8.7	181	424,347	0.50	210,253	47.0	66	210,243	0.57
417		0.156	0.182	20.9	3.22	10.9	2.27	5.4	178	287,496	0.49	139,803	42.0	57	139,779	0.72
418		0.157	0.165	15.3	2.24	8.0	1.58	3.7	192	227,964	0.48	110,097	40.0	55	110,070	0.87
422		0.157	0.085	22.7	1.77	11.8	1.25	3.0	29	51,546	0.48	24,894	41.0	9	24,890	0.66
500		0.153	0.136	39.7	4.45	20.6	3.15	7.4	51	156,453	0.49	77,125	49.0	20	77,124	0.46
501		0.151	0.217	35.6	6.23	18.5	4.40	10.4	173	476,256	0.50	237,173	50.0	67	237,167	0.51
502		0.149	0.214	38.7	6.65	20.1	4.70	11.1	158	472,626	0.50	237,757	51.0	63	237,759	0.48
503		0.151	0.220	42.9	7.54	22.3	5.33	12.6	153	506,748	0.50	253,211	53.0	62	253,209	0.44
504		0.113	0.145	36.7	4.39	19.1	3.10	7.3	104	296,208	0.65	192,447	48.0	49	192,447	0.60
600		0.157	0.303	64.3	15.25	33.4	10.78	25.4	262	1,301,718	0.48	629,753	67.0	114	629,746	0.32
700		0.157	0.447	66.6	23.15	34.6	16.36	38.6	925	4,765,827	0.26	1,221,409	73.0	230	1,221,395	0.18
701		0.156	0.255	49.9	10.09	25.9	7.13	16.8	194	751,047	0.49	365,219	57.0	80	365,217	0.39
800		0.156	0.559	109.9	38.46	57.1	25.71	79.2	1,195	10,170,534	0.35	3,574,501	115.0	411	3,574,504	0.15
801		0.155	0.381	114.2	33.77	59.4	23.86	56.3	328	2,902,548	0.23	665,277	93.0	74	665,275	0.09
802		0.156	0.507	67.4	23.60	35.1	15.78	44.3	1,395	7,285,773	0.47	3,421,801	81.0	609	3,421,810	0.30
803		0.155	0.235	49.8	9.31	25.9	6.58	15.5	150	580,074	0.49	283,044	56.0	62	283,036	0.39
804		0.154	0.317	59.4	14.74	30.9	10.42	24.6	343	1,576,509	0.49	771,881	65.0	149	771,863	0.34
805		0.157	0.318	63.9	15.90	33.2	11.24	26.5	307	1,518,429	0.48	733,334	67.0	134	733,336	0.32

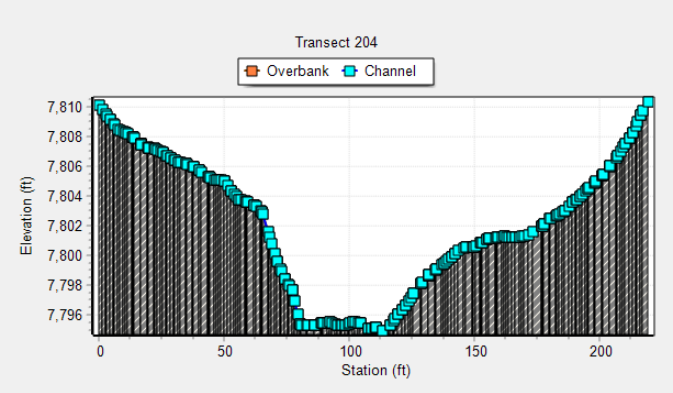
Stagecoach - Existing Conditions (Linked to CUHP)

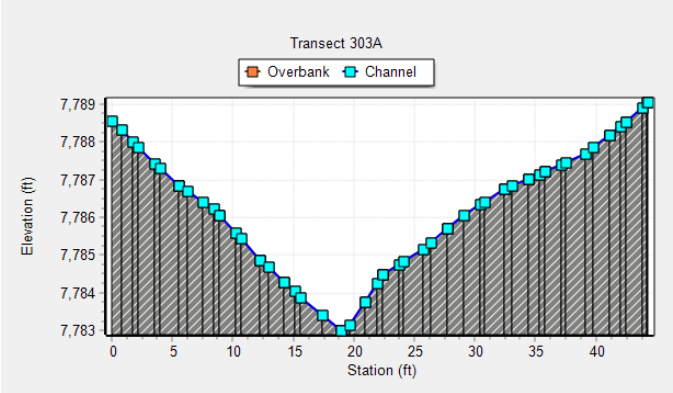


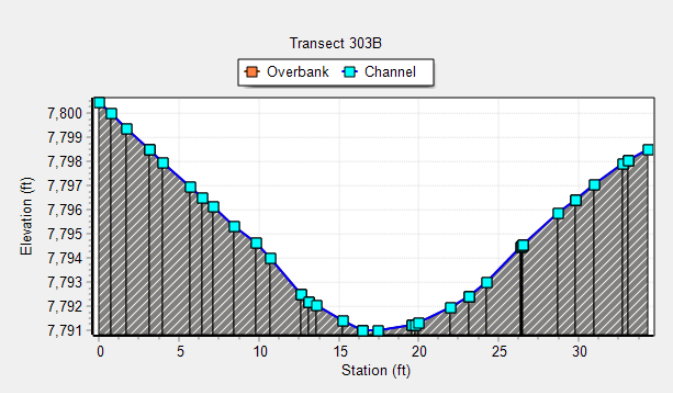

Transect 202A
Overbank
Channel
Elevation (ft)
8,779
8,778
8,777
8,776
8,775
8,774
8,773
8,772
0
20
40
60
80
100
120
140
Station (ft)

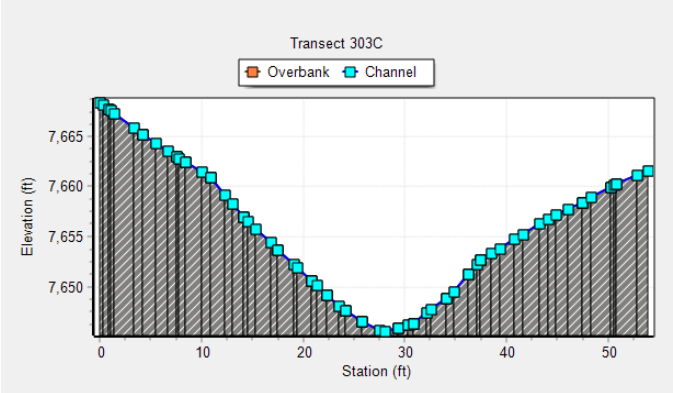

Transect 202B
Overbank
Channel
Elevation (ft)
8,906
8,905
8,904
8,903
8,902
8,901
8,900
0
10
20
30
40
50
60
70
80
Station (ft)

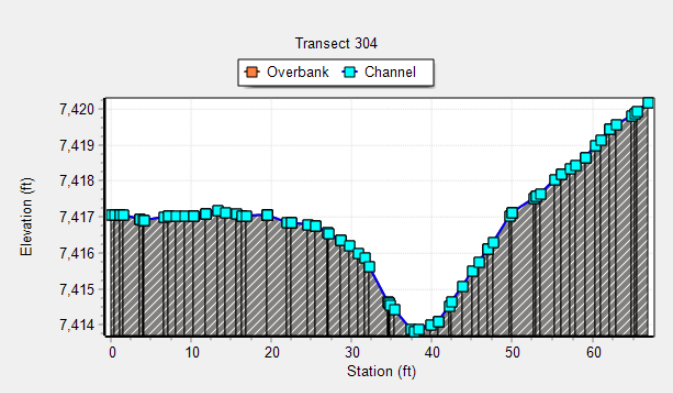

Transect 203
Overbank
Channel
Elevation (ft)
8,505
8,500
8,495
8,490
8,485
8,480
8,475
0
20
40
60
80
100
120
140
160
180
Station (ft)

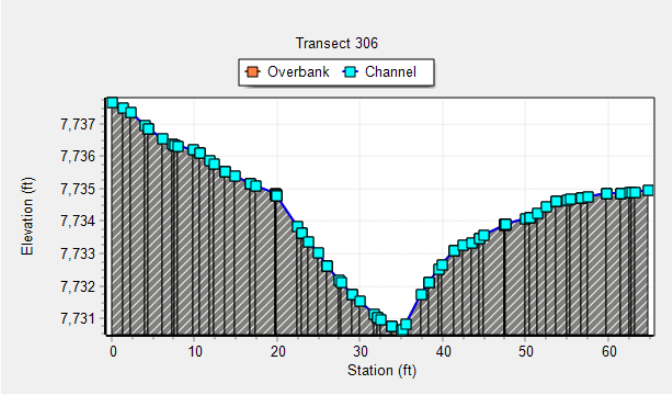

Transect 204
Overbank
Channel
Elevation (ft)
7,810
7,808
7,806
7,804
7,802
7,800
7,798
7,796
0
50
100
150
200
Station (ft)

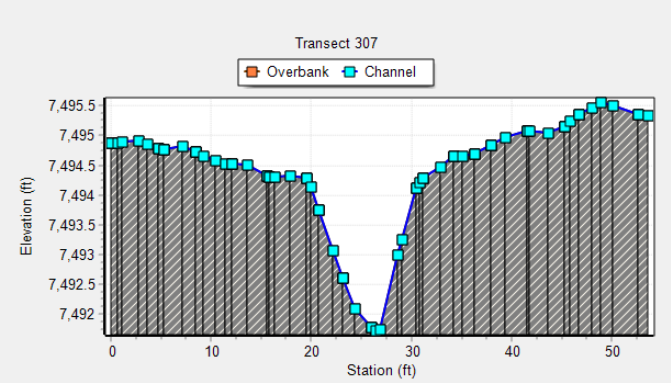

Transect 303A
Overbank
Channel
Elevation (ft)
7,789
7,788
7,787
7,786
7,785
7,784
7,783
0
5
10
15
20
25
30
35
40
Station (ft)

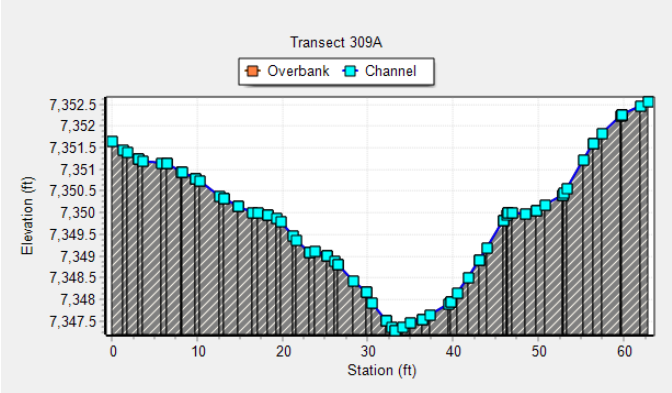

Transect 303B
Overbank
Channel
Elevation (ft)
7,800
7,799
7,798
7,797
7,796
7,795
7,794
7,793
7,792
7,791
0
5
10
15
20
25
30
Station (ft)

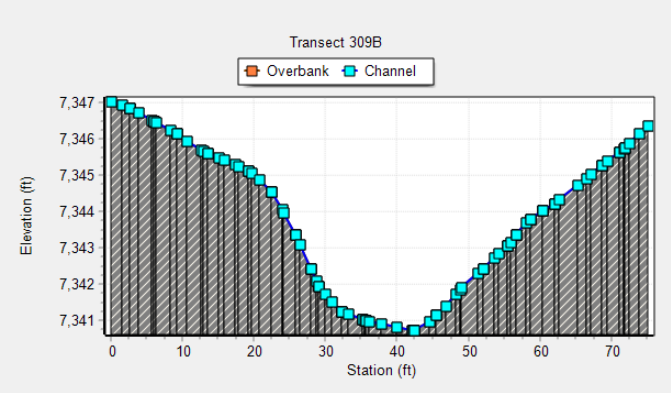

Transect 303C
Overbank
Channel
Elevation (ft)
7,665
7,660
7,655
7,650
0
10
20
30
40
50
Station (ft)

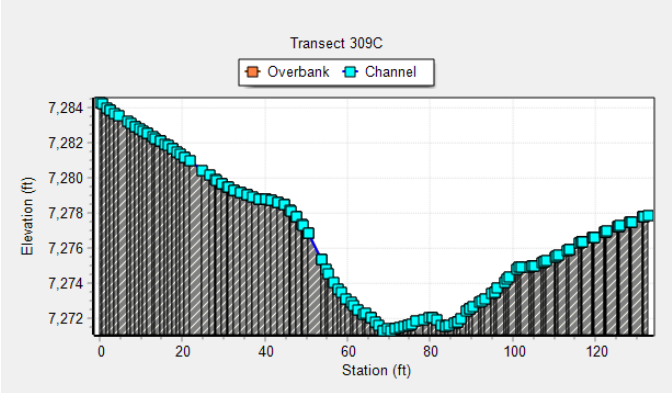

Transect 304
Overbank
Channel
Elevation (ft)
7,420
7,419
7,418
7,417
7,416
7,415
7,414
0
10
20
30
40
50
60
Station (ft)

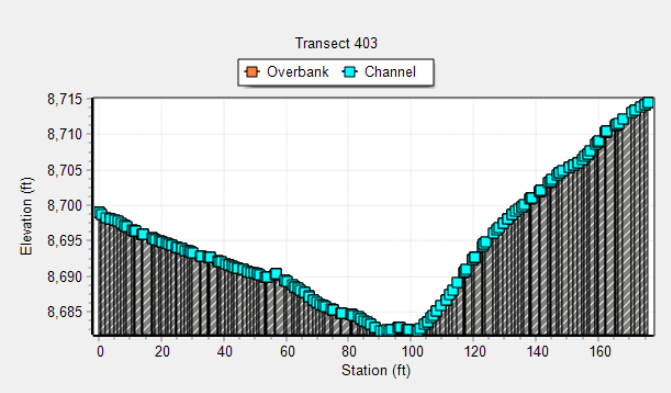




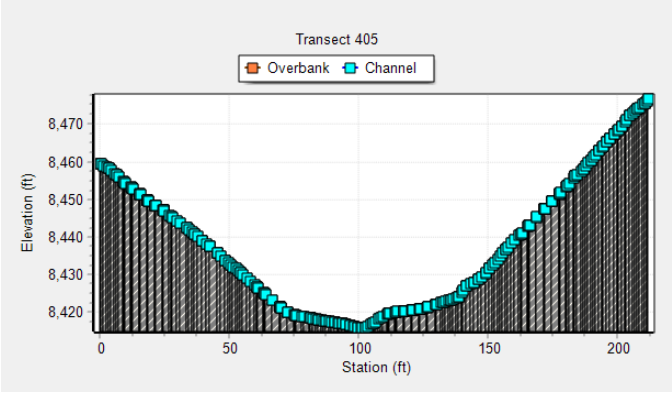


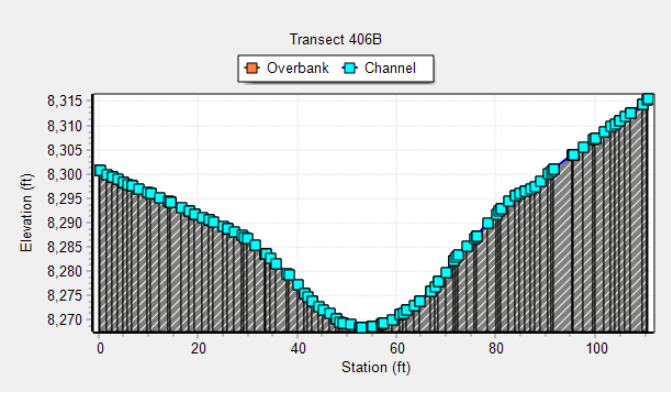


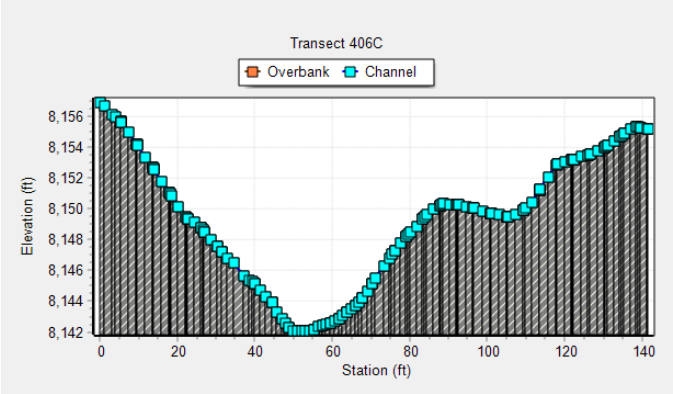


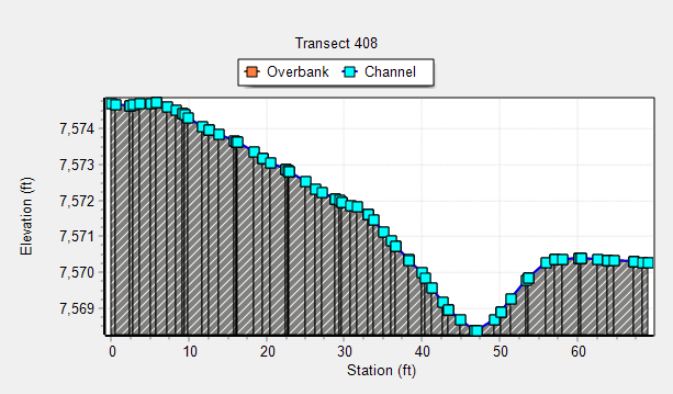


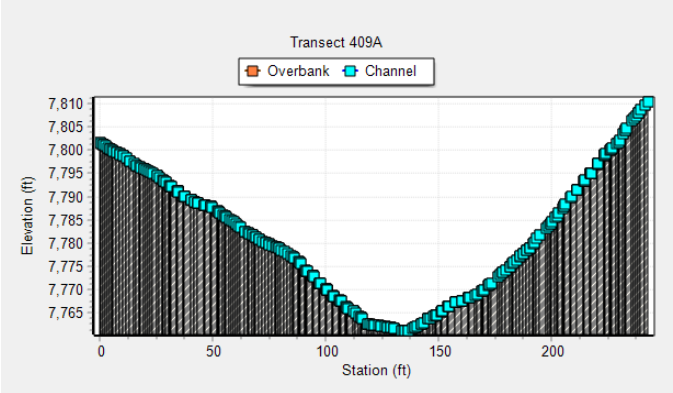
Transect 403 used for Conduit 403 and 406A

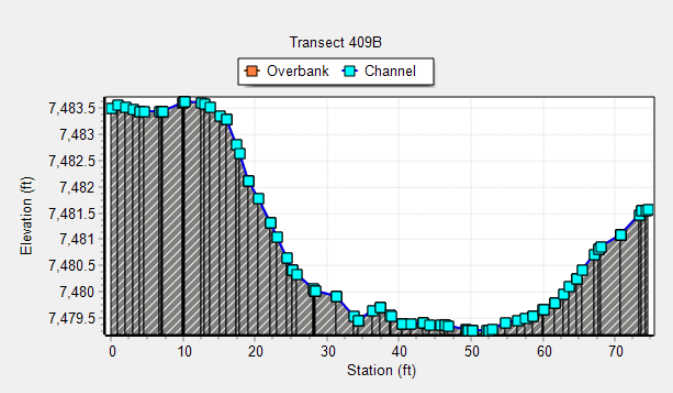


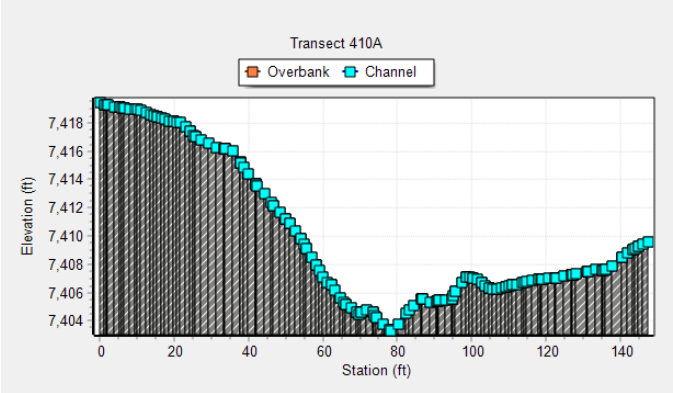


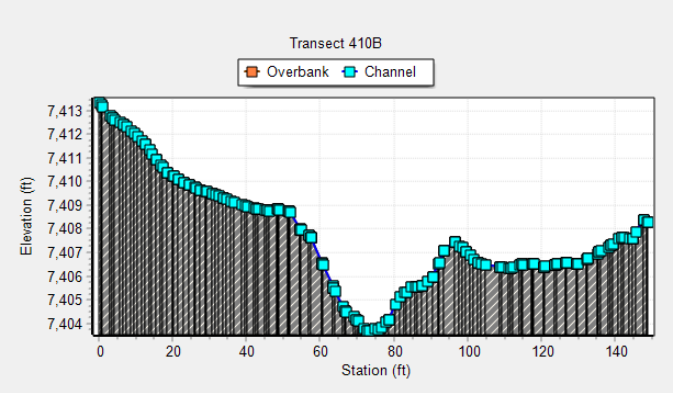

Transect 406C
Overbank
Channel
Elevation (ft)
8,156
8,154
8,152
8,150
8,148
8,146
8,144
8,142
0
20
40
60
80
100
120
140
Station (ft)

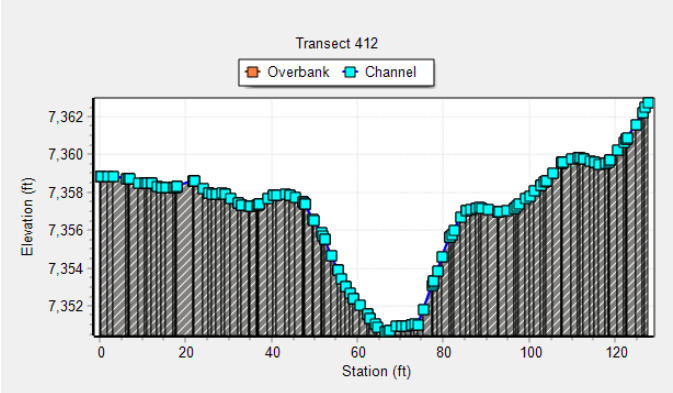

Transect 408
Overbank
Channel
Elevation (ft)
7,574
7,573
7,572
7,571
7,570
7,569
0
10
20
30
40
50
60
Station (ft)

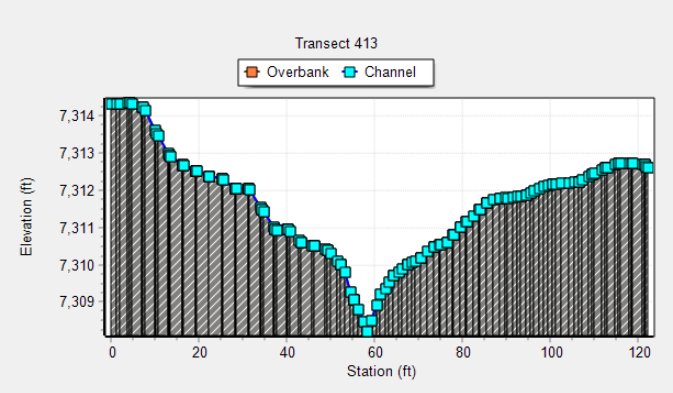

Transect 409A
Overbank
Channel
Elevation (ft)
7,810
7,805
7,800
7,795
7,790
7,785
7,780
7,775
7,770
7,765
0
50
100
150
200
Station (ft)

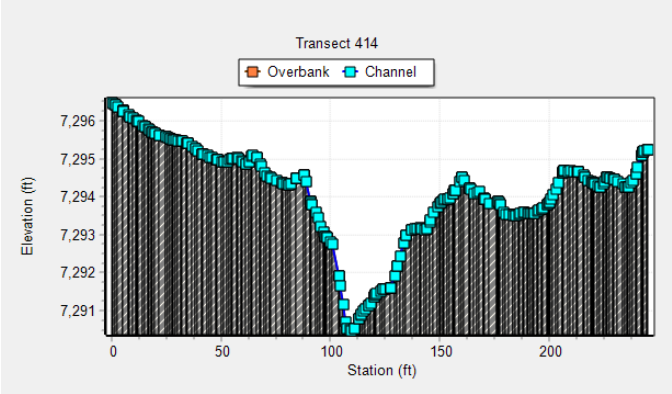

Transect 409B
Overbank
Channel
Elevation (ft)
7,483.5
7,483
7,482.5
7,482
7,481.5
7,481
7,480.5
7,480
7,479.5
0
10
20
30
40
50
60
70
Station (ft)

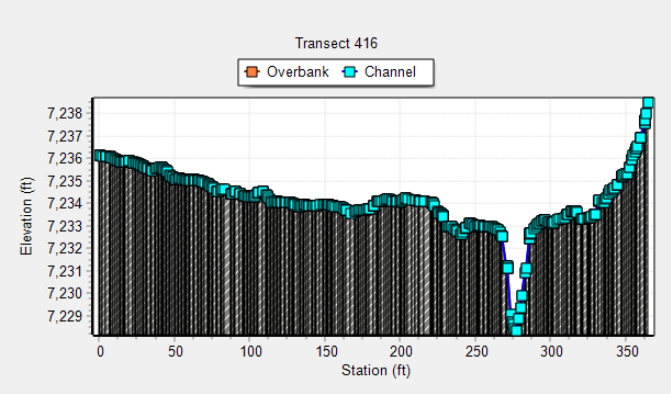

Transect 410A
Overbank
Channel
Elevation (ft)
7,418
7,416
7,414
7,412
7,410
7,408
7,406
7,404
0
20
40
60
80
100
120
140
Station (ft)

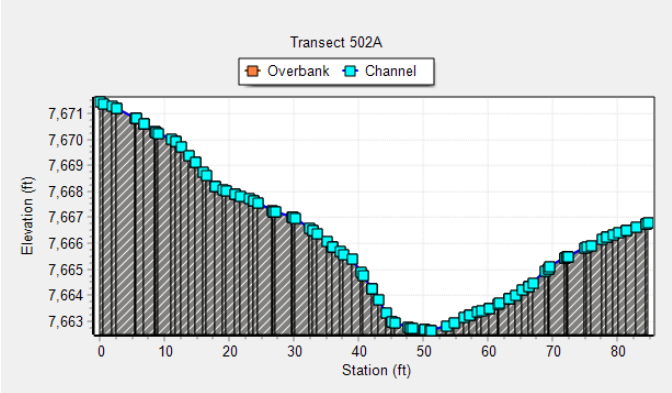

Transect 410B
Overbank
Channel
Elevation (ft)
7,413
7,412
7,411
7,410
7,409
7,408
7,407
7,406
7,405
7,404
0
20
40
60
80
100
120
140
Station (ft)

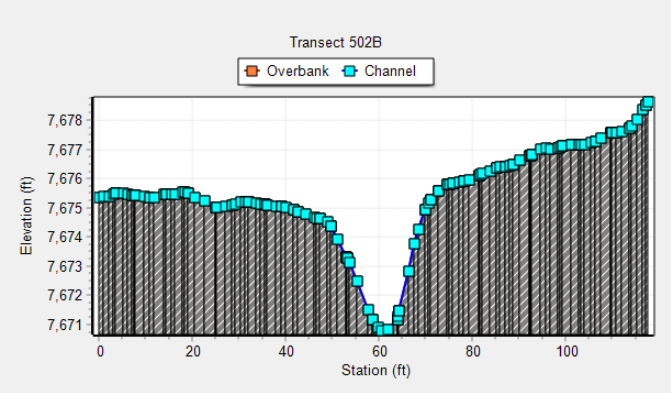

Transect 412
Overbank
Channel
Elevation (ft)
7,362
7,360
7,358
7,356
7,354
7,352
0
20
40
60
80
100
120
Station (ft)

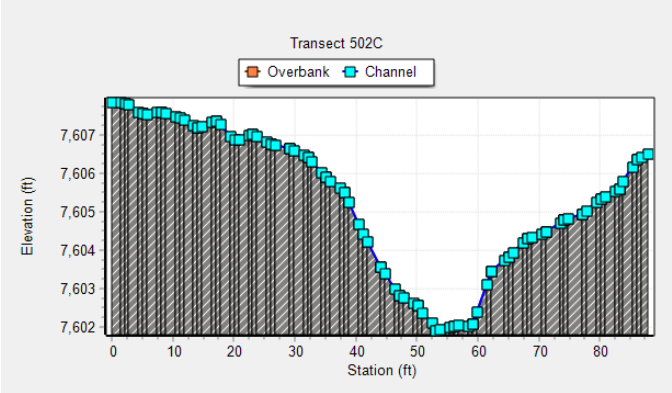

Transect 413
Overbank
Channel
Elevation (ft)
7,314
7,313
7,312
7,311
7,310
7,309
0
20
40
60
80
100
120
Station (ft)

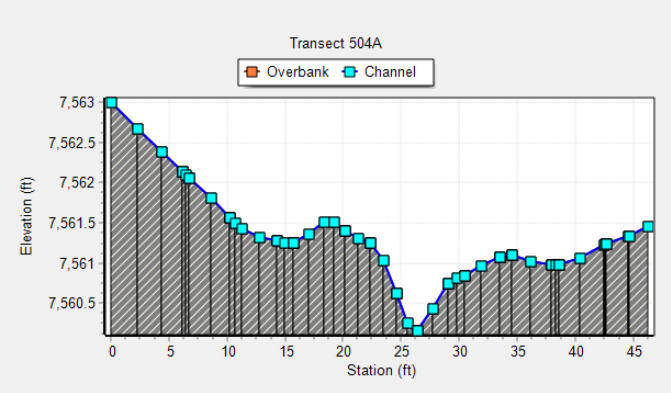

Transect 414
Overbank
Channel
Elevation (ft)
7,296
7,295
7,294
7,293
7,292
7,291
0
50
100
150
200
Station (ft)

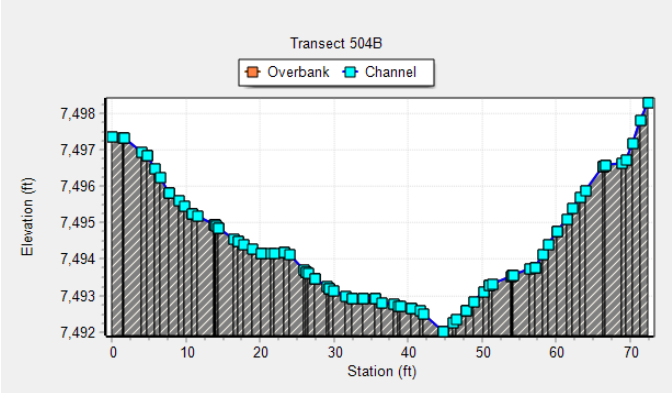

Transect 416
Overbank
Channel
Elevation (ft)
7,238
7,237
7,236
7,235
7,234
7,233
7,232
7,231
7,230
7,229
0
50
100
150
200
250
300
350
Station (ft)

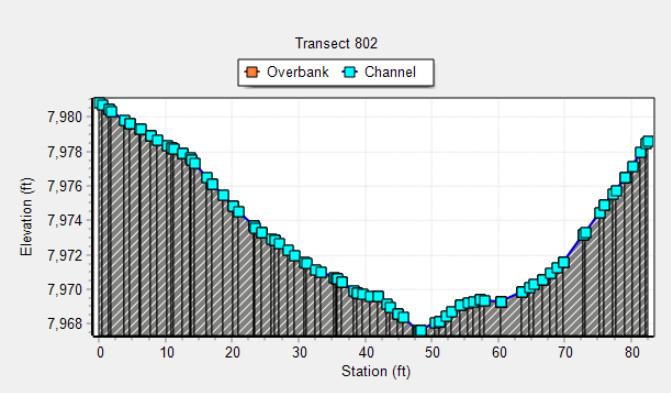

Transect 502A
Overbank
Channel
Elevation (ft)
7,671
7,670
7,669
7,668
7,667
7,666
7,665
7,664
7,663
0
10
20
30
40
50
60
70
80
Station (ft)

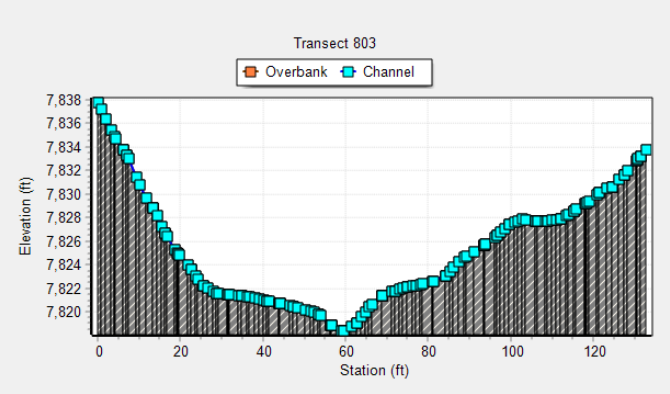

Transect 502B
Overbank
Channel
Elevation (ft)
7,678
7,677
7,676
7,675
7,674
7,673
7,672
7,671
0
20
40
60
80
100
Station (ft)


Transect 502C
Overbank
Channel
Elevation (ft)
7,607
7,606
7,605
7,604
7,603
7,602
0
10
20
30
40
50
60
70
80
Station (ft)


Transect 504A
Overbank
Channel
Elevation (ft)
7,563
7,562.5
7,562
7,561.5
7,561
7,560.5
0
5
10
15
20
25
30
35
40
45
Station (ft)


Transect 504B
Overbank
Channel
Elevation (ft)
7,498
7,497
7,496
7,495
7,494
7,493
7,492
0
10
20
30
40
50
60
70
Station (ft)


Transect 802
Overbank
Channel
Elevation (ft)
7,980
7,978
7,976
7,974
7,972
7,970
7,968
0
10
20
30
40
50
60
70
80
Station (ft)



Note: "Dummy" Conduits utilized for Links 401, 411, 415, 503, 701, 801

Stagecoach - Existing Conditions (Linked to CUHP)

Node Inflow Summary

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error %
100	OUTFALL	3.43	3.43	0	01:14	0.169	0.169	0.000
101	OUTFALL	1.63	1.63	0	00:55	0.058	0.058	0.000
102	OUTFALL	1.21	1.21	0	00:46	0.0357	0.0357	0.000
103	OUTFALL	0.83	0.83	0	00:38	0.0185	0.0185	0.000
200	JUNCTION	0.29	0.29	0	00:40	0.00784	0.00784	0.000
201	JUNCTION	0.08	0.08	0	00:39	0.00251	0.00251	0.000
202	JUNCTION	1.60	1.62	0	00:43	0.0369	0.0501	0.000
203	JUNCTION	2.04	2.09	0	00:46	0.047	0.099	0.000
204	OUTFALL	4.49	4.76	0	01:06	0.174	0.315	0.000
205	OUTFALL	2.59	2.59	0	00:41	0.0503	0.0503	0.000
206	OUTFALL	1.40	1.40	0	00:56	0.0515	0.0515	0.000
300	OUTFALL	0.30	0.30	0	00:42	0.00798	0.00798	0.000
301	JUNCTION	0.16	0.16	0	00:41	0.0041	0.0041	0.000
302	JUNCTION	0.34	0.34	0	00:46	0.0112	0.0112	0.000
303	JUNCTION	1.02	1.02	0	00:42	0.0301	0.0465	0.000

Stagecoach - Existing Conditions (Linked to CUHP)

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error %
303A	JUNCTION	0.00	0.46	0	00:57	0	0.0155	0.000
304	JUNCTION	3.24	3.44	0	00:43	0.0811	0.129	0.000
305	JUNCTION	0.31	0.31	0	00:44	0.0093	0.0093	0.000
306	JUNCTION	1.06	1.08	0	00:41	0.0237	0.0332	0.000
307	JUNCTION	1.42	2.19	0	00:53	0.0492	0.084	0.000
308	JUNCTION	2.04	6.91	0	00:54	0.0562	0.271	0.000
309	OUTFALL	5.77	8.59	0	01:25	0.197	0.502	0.000
310	OUTFALL	3.46	3.46	0	00:41	0.104	0.104	0.000
311	OUTFALL	0.53	0.53	0	00:36	0.00916	0.00916	0.000
400	JUNCTION	4.37	4.37	0	00:57	0.18	0.18	0.000
401	JUNCTION	1.02	1.02	0	00:45	0.028	0.028	0.000
402	JUNCTION	0.39	0.39	0	00:38	0.00822	0.00822	0.000
403	JUNCTION	0.28	0.43	0	00:54	0.00548	0.0102	0.000
404	JUNCTION	0.83	0.83	0	00:44	0.0221	0.0221	0.000
405	JUNCTION	0.48	0.87	0	01:02	0.0118	0.0192	0.000
406	JUNCTION	1.39	2.60	0	01:18	0.0309	0.0891	0.000
406A	JUNCTION	0.00	1.41	0	00:47	0	0.0365	0.000

Stagecoach - Existing Conditions (Linked to CUHP)

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error %
407	JUNCTION	0.26	0.26	0	00:38	0.00578	0.00578	0.000
408	JUNCTION	1.37	1.41	0	00:43	0.0384	0.0456	0.000
409	JUNCTION	4.03	4.57	0	00:52	0.121	0.253	0.000
410	JUNCTION	5.12	11.94	0	01:02	0.11	0.599	0.000
411	JUNCTION	1.74	1.74	0	00:35	0.0508	0.0508	0.000
412	JUNCTION	6.18	15.35	0	01:03	0.151	0.752	0.000
413	JUNCTION	2.70	17.10	0	01:08	0.0856	0.839	0.000
414	JUNCTION	5.80	21.68	0	01:15	0.172	1.11	0.000
415	JUNCTION	2.51	2.51	0	00:49	0.0965	0.0965	0.000
416	OUTFALL	1.28	21.71	0	01:26	0.0275	1.15	0.000
417	OUTFALL	0.79	0.79	0	00:36	0.0124	0.0124	0.000
418	OUTFALL	0.66	0.66	0	00:33	0.00811	0.00811	0.000
422	OUTFALL	0.11	0.11	0	00:35	0.00183	0.00183	0.000
500	JUNCTION	0.34	0.34	0	00:41	0.00919	0.00919	0.000
501	JUNCTION	1.36	1.36	0	00:42	0.0337	0.0337	0.000
502	JUNCTION	1.46	2.07	0	01:11	0.0393	0.0873	0.000
502A	JUNCTION	0.00	1.33	0	01:04	0	0.0467	0.000

Stagecoach - Existing Conditions (Linked to CUHP)

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error %
503	JUNCTION	1.30	1.30	0	00:45	0.038	0.038	0.000
504	OUTFALL	5.83	6.66	0	00:55	0.192	0.323	0.000
504A	JUNCTION	0.00	2.89	0	01:10	0	0.125	0.000
600	OUTFALL	1.22	1.22	0	00:57	0.0488	0.0488	0.000
700	OUTFALL	1.72	2.54	0	01:02	0.0746	0.107	0.000
701	JUNCTION	1.01	1.01	0	00:49	0.0324	0.0324	0.000
800	JUNCTION	3.92	3.92	0	01:49	0.262	0.262	0.000
801	JUNCTION	0.51	0.51	0	01:33	0.0393	0.0393	0.000
802	JUNCTION	6.48	7.13	0	01:18	0.269	0.576	0.000
803	OUTFALL	0.84	7.02	0	02:25	0.0273	0.617	0.000
804	OUTFALL	2.13	2.13	0	00:56	0.0802	0.0802	0.000
805	OUTFALL	1.36	1.36	0	00:58	0.054	0.054	0.000

Stagecoach - Existing Conditions (Linked to CUHP)

Node Inflow Summary

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error %
100	OUTFALL	300.97	300.97	0	01:21	14.9	14.9	0.000
101	OUTFALL	143.73	143.73	0	01:03	5.34	5.34	0.000
102	OUTFALL	67.52	67.52	0	00:54	2.1	2.1	0.000
103	OUTFALL	29.24	29.24	0	00:45	0.702	0.702	0.000
200	JUNCTION	26.45	26.45	0	00:49	0.67	0.67	0.000
201	JUNCTION	11.49	11.49	0	00:49	0.3	0.3	0.000
202	JUNCTION	122.68	145.39	0	00:53	2.98	4	0.000
203	JUNCTION	150.25	248.94	0	01:05	3.8	7.99	0.000
204	OUTFALL	389.54	541.52	0	01:19	15.4	24.2	0.000
205	OUTFALL	231.61	231.61	0	00:48	5.1	5.1	0.000
206	OUTFALL	135.96	135.96	0	01:04	5.23	5.23	0.000
300	OUTFALL	24.12	24.12	0	00:50	0.703	0.703	0.000
301	JUNCTION	13.88	13.88	0	00:49	0.401	0.401	0.000
302	JUNCTION	32.31	32.31	0	00:55	1.13	1.13	0.000
303	JUNCTION	32.88	75.22	0	00:59	0.99	2.54	0.000

Stagecoach - Existing Conditions (Linked to CUHP)

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error %
303A	JUNCTION	0.00	45.63	0	00:55	0	1.54	0.000
304	JUNCTION	29.77	97.67	0	01:01	0.701	3.25	0.000
305	JUNCTION	26.41	26.41	0	00:53	0.857	0.857	0.000
306	JUNCTION	16.25	40.28	0	00:53	0.363	1.22	0.000
307	JUNCTION	13.46	52.18	0	00:58	0.423	1.65	0.000
308	JUNCTION	20.42	165.78	0	01:03	0.528	5.44	0.000
309	OUTFALL	77.59	210.47	0	01:16	2.48	8.07	0.000
310	OUTFALL	46.64	46.64	0	00:48	1.34	1.34	0.000
311	OUTFALL	25.91	25.91	0	00:42	0.509	0.509	0.000
400	JUNCTION	165.03	165.03	0	01:06	6.7	6.7	0.000
401	JUNCTION	82.53	82.53	0	00:53	2.33	2.33	0.000
402	JUNCTION	29.45	29.45	0	00:46	0.693	0.693	0.000
403	JUNCTION	17.20	45.95	0	00:47	0.368	1.06	0.000
404	JUNCTION	73.74	73.74	0	00:52	2.13	2.13	0.000
405	JUNCTION	30.23	101.07	0	00:55	0.816	2.95	0.000
406	JUNCTION	100.73	305.50	0	00:58	2.39	8.79	0.000
406A	JUNCTION	0.00	127.27	0	00:52	0	3.4	0.000

Stagecoach - Existing Conditions (Linked to CUHP)

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error %
407	JUNCTION	14.30	14.30	0	00:46	0.351	0.351	0.000
408	JUNCTION	36.52	47.61	0	00:53	1.04	1.41	0.000
409	JUNCTION	139.12	458.90	0	01:07	4.26	14.6	0.000
410	JUNCTION	40.63	644.18	0	01:11	0.821	22.4	0.000
411	JUNCTION	10.71	10.71	0	00:41	0.266	0.266	0.000
412	JUNCTION	49.87	672.00	0	01:12	1.13	23.5	-0.000
413	JUNCTION	19.70	684.12	0	01:15	0.556	24.1	0.000
414	JUNCTION	38.60	740.61	0	01:20	1.01	27.4	0.000
415	JUNCTION	61.22	61.22	0	00:57	2.28	2.28	0.000
416	OUTFALL	66.46	698.67	0	01:35	1.57	29	0.000
417	OUTFALL	56.67	56.67	0	00:42	1.05	1.05	0.000
418	OUTFALL	54.55	54.55	0	00:40	0.823	0.823	0.000
422	OUTFALL	9.38	9.38	0	00:41	0.186	0.186	0.000
500	JUNCTION	19.69	19.69	0	00:49	0.577	0.577	0.000
501	JUNCTION	66.62	66.62	0	00:50	1.77	1.77	0.000
502	JUNCTION	62.70	142.25	0	00:57	1.78	4.17	0.000
502A	JUNCTION	0.00	84.27	0	00:55	0	2.38	0.000

Stagecoach - Existing Conditions (Linked to CUHP)

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error %
503	JUNCTION	61.97	61.97	0	00:53	1.89	1.89	0.000
504	OUTFALL	48.67	237.21	0	01:05	1.44	7.56	0.000
504A	JUNCTION	0.00	201.92	0	00:57	0	6.06	-0.000
600	OUTFALL	114.10	114.10	0	01:07	4.71	4.71	0.000
700	OUTFALL	230.14	300.69	0	01:11	9.14	11.9	0.000
701	JUNCTION	80.29	80.29	0	00:57	2.73	2.73	0.000
800	JUNCTION	411.17	411.17	0	01:55	26.7	26.7	0.000
801	JUNCTION	74.24	74.24	0	01:33	4.98	4.98	0.000
802	JUNCTION	608.56	878.65	0	01:41	25.6	57.4	0.000
803	OUTFALL	62.03	904.85	0	01:48	2.12	59.7	0.000
804	OUTFALL	149.17	149.17	0	01:05	5.77	5.77	0.000
805	OUTFALL	133.88	133.88	0	01:07	5.49	5.49	0.000

Existing Runoff - Overall					
Design Point	Tributary Basin(s)	Direct Runoff (cfs)		Routed Runoff (cfs)	
		Q5	Q100	Q5	Q100
100	100	3.4	301.0	-	-
101	101	1.6	143.7	-	-
102	102	1.2	67.5	-	-
103	103	0.8	29.2	-	-
200	200	0.3	26.5	-	-
201	201	0.1	11.5	-	-
-	202	1.6	122.7	-	-
202	200/201/202	-	-	1.6	145.4
-	203	2.0	150.3	-	-
203	200/201/202/203	-	-	2.1	248.9
-	204	4.5	389.5	-	-
204	200/201/202/203/204	-	-	4.8	541.5
205	205	2.6	231.6	-	-
206	206	1.4	136.0	-	-
300	300	0.3	24.1	-	-
301	301	0.2	13.9	-	-
302	302	0.3	32.3	-	-
-	303	1.0	32.9	-	-
303	301/302/303	-	-	1.0	75.2
-	304	3.2	29.8	-	-
304	301/302/303/304	-	-	3.4	97.7
305	305	0.3	26.4	-	-
-	306	1.1	16.3	-	-
306	305/306	-	-	1.1	40.3
-	307	1.4	13.5	-	-
307	305/306/307	-	-	2.2	52.2
-	308	2.0	20.4	-	-
308	301/302/303/304/305/ 306/307/308	-	-	6.9	165.8
-	309	5.8	77.6	-	-
309	301/302/303/304/305/ 306/307/308/309	-	-	8.6	210.5
310	310	3.5	46.6	-	-
311	311	0.5	25.9	-	-
400	400	4.4	165.0	-	-
401	401	1.0	82.5	-	-
402	402	0.4	29.5	-	-
-	403	0.3	17.2	-	-
403	402/403	-	-	0.4	46.0
404	404	0.8	73.7	-	-
-	405	0.5	30.2	-	-
405	404/405	-	-	0.9	101.1
-	406	1.4	100.7	-	-
406	401/402/403/404/405/406	-	-	2.6	305.5
407	407	0.3	14.3	-	-
-	408	1.4	36.5	-	-
408	407/408	-	-	1.4	47.6
-	409	4.0	139.1	-	-
409	401/402/403/404/405/ 406/407/408/409	-	-	4.6	458.9
-	410	5.1	40.6	-	-
410	400/401/402/403/404/405/ 406/407/408/409/410/411	-	-	11.9	644.2
411	411	1.7	10.7	-	-
-	412	6.2	49.9	-	-
412	400/401/402/403/404/405/ 406/407/408/409/410/411/ 412	-	-	15.4	672.0
-	413	2.7	19.7	-	-
413	400/401/402/403/404/405/ 406/407/408/409/410/411/ 412/413	-	-	17.1	684.1
-	414	5.8	38.6	-	-
414	400/401/402/403/404/405/ 406/407/408/409/410/411/ 412/413/414	-	-	21.7	740.6
415	415	2.5	61.2	-	-
-	416	1.3	66.5	-	-
416	400/401/402/403/404/405/ 406/407/408/409/410/411/ 412/413/414/415/416	-	-	21.7	698.7
417	417	0.8	56.7	-	-
418	418	0.7	54.6	-	-
422	422	0.1	9.4	-	-
500	500	0.3	19.7	-	-
501	501	1.4	66.6	-	-
-	502	1.5	62.7	-	-
502	500/501/502	-	-	2.1	142.3
503	503	1.3	62.0	-	-
-	504	5.8	48.7	-	-
504	500/501/502/503/504	-	-	6.7	237.2
600	600	1.2	114.1	-	-
-	700	1.7	230.1	-	-
700	700/701	-	-	2.5	300.7
701	701	1.0	80.3	-	-
800	800	3.9	411.2	-	-
801	801	0.5	74.2	-	-
-	802	6.5	608.6	-	-
802	800/801/802	-	-	7.1	878.7
-	803	0.8	62.0	-	-
803	800/801/802/803	-	-	7.0	904.9
804	804	2.1	149.2	-	-
805	805	1.4	133.9	-	-

Kimley»Horn

STANDARD FORM SF-1
RUNOFF COEFFICIENTS - IMPERVIOUS CALCULATION

PROJECT NAME: STAGECOACH **(PROPOSED)**
PROJECT NUMBER: 196778000
CALCULATED BY: DCM
CHECKED BY: TOS

	LAND USE:	Asphalt AREA	Gravel AREA	Residential (< 0.25 ac) < 0.25-AC	Residential (0.25 - 0.75 ac) 0.25 TO 0.75-AC	Residential (0.75 - 2.5 ac) 0.75 TO 2.5-AC	Residential (2.5 - 5.0 ac) 2.5 TO 5.0-AC	Residential (> 5 ac) > 5.0-AC	Parks AREA	Commercial AREA	Greenbelts AREA		
	IMPERVIOUS %	100%	40%	45%	30%	20%	12%	8%	10%	75%	2%		
BASIN	MAJOR BASIN	Asphalt AREA (AC)	Gravel AREA (AC)	Residential (< 0.25 ac) < 0.25-AC (AC)	sidential (0.25 - 0.75 0.25 TO 0.75-AC (AC)	sidential (0.75 - 2.5 0.75 TO 2.5-AC (AC)	esidential (2.5 - 5.0 a 2.5 TO 5.0-AC (AC)	Residential (> 5 ac) > 5.0-AC (AC)	Parks AREA (AC)	Commercial AREA (AC)	Greenbelts AREA (AC)	TOTAL AREA (AC)	Imp %
100	100	3.41	7.80	0.00	0.00	0.00	0.00	3.07	0.00	0.00	1115.86	**1130.1**	2.6%
101		3.52	0.87	0.00	0.00	0.00	0.00	11.95	0.00	0.00	389.46	**405.8**	3.1%
102		4.33	0.00	0.00	0.00	0.00	0.00	32.52	0.00	0.00	119.72	**156.6**	6.0%
103		1.12	1.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	48.25	**50.7**	5.2%
200	200	6.79	0.00	0.00	11.27	1.67	4.21	28.04	0.00	0.00	37.15	**89.1**	15.7%
201		5.55	0.00	0.00	11.19	0.00	0.00	9.55	0.00	0.00	22.76	**49.1**	20.6%
202		17.11	0.00	0.00	3.24	4.04	5.27	138.85	0.00	0.00	106.52	**275.0**	11.9%
203		0.00	0.00	0.00	0.00	0.00	0.00	20.25	0.00	0.00	208.97	**229.2**	2.5%
204		14.21	0.00	0.00	25.39	11.68	6.90	40.45	0.00	0.00	1077.26	**1175.9**	4.2%
205		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	389.30	**389.3**	2.0%
206		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	399.05	**399.0**	2.0%
207		7.26	0.00	0.00	2.15	3.26	0.76	29.88	0.00	0.00	14.60	**57.9**	19.6%
208		2.97	0.00	0.00	0.00	0.00	0.00	3.15	0.00	0.00	11.87	**18.0**	19.2%
300	300	0.00	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	52.79	**53.3**	2.3%
301		0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.78	**30.9**	2.1%
302		0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	86.38	**86.5**	2.0%
303		0.00	1.66	3.56	0.00	4.51	0.00	0.00	0.00	0.00	62.31	**72.1**	6.1%
304		0.15	2.07	0.55	0.00	27.53	4.98	0.00	0.00	0.00	5.96	**41.2**	18.1%
305		0.00	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	64.78	**65.1**	2.2%
306		0.91	0.58	0.00	0.00	6.45	0.00	0.00	0.00	0.00	15.64	**23.6**	11.6%
307		0.84	0.59	0.17	0.00	16.13	0.00	0.00	0.00	0.00	7.12	**24.8**	18.2%
308		1.60	0.00	0.00	0.00	7.25	18.16	0.00	0.00	0.00	4.58	**31.6**	16.8%
309		6.02	0.00	8.70	0.00	45.99	0.00	0.00	0.43	0.00	96.00	**157.2**	13.4%
310		2.93	0.00	0.00	0.00	13.91	36.09	0.00	6.23	0.00	25.67	**84.8**	13.2%
311		0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.72	0.00	30.09	**37.8**	3.6%
400	400	6.89	4.93	0.53	2.05	28.39	0.00	0.00	0.00	8.78	431.92	**483.5**	6.3%
401		12.45	1.52	0.00	7.93	21.29	8.59	0.00	0.00	0.00	175.29	**227.1**	10.7%
402		1.25	0.00	0.00	0.00	8.78	2.22	4.02	0.00	0.00	36.27	**52.5**	8.2%
403		2.06	0.00	0.00	0.00	0.00	0.00	1.79	0.00	0.00	30.33	**34.2**	8.2%
404		2.60	0.00	0.00	2.29	8.07	8.58	4.48	0.00	0.00	136.13	**162.2**	5.6%
405		4.50	0.00	0.00	0.00	1.66	8.47	0.00	0.00	0.00	46.71	**61.3**	11.1%
406		2.57	3.82	0.00	0.00	0.01	5.16	15.85	0.00	0.00	196.66	**224.1**	4.4%
407		3.04	0.00	0.00	2.62	9.01	0.00	0.00	0.00	0.00	11.49	**26.2**	22.4%
408		4.65	0.00	0.00	2.78	6.02	0.00	0.00	0.00	0.00	9.07	**22.5**	30.5%
409		1.13	0.00	0.00	0.67	10.65	0.00	0.00	0.00	0.00	128.81	**141.3**	4.3%
410		2.34	0.00	0.00	0.00	33.96	9.92	0.00	0.00	0.20	0.00	**46.4**	22.6%
411		2.34	0.00	3.57	0.00	5.45	0.00	0.00	0.00	0.00	1.89	**13.3**	38.3%
412		2.89	0.23	0.00	0.00	36.20	24.49	0.00	0.00	0.00	0.00	**63.8**	20.6%
413		1.69	0.26	0.00	0.00	23.90	4.23	0.00	0.00	0.00	0.00	**30.1**	23.6%
414		4.18	0.33	0.00	0.00	45.49	3.19	0.00	0.00	0.00	0.02	**53.2**	25.9%
415		0.48	5.15	0.00	0.00	6.62	60.24	0.00	0.00	0.00	83.98	**156.5**	8.2%
416		1.32	0.00	0.00	0.00	1.35	0.35	0.00	2.29	0.00	111.62	**116.9**	3.5%
417		0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.37	0.00	74.81	**79.2**	2.4%
418		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	62.76	**62.8**	2.0%
419		2.00	0.00	0.00	2.14	6.62	0.00	0.00	0.00	0.00	29.88	**40.6**	11.2%
420		15.37	0.00	0.00	13.34	22.22	17.00	0.00	0.00	6.31	49.42	**123.7**	25.5%
421		5.37	0.00	0.00	1.99	12.84	10.23	0.00	0.00	0.00	19.56	**50.0**	20.3%
422		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.20	**14.2**	2.0%
500	500	1.06	0.00	0.00	0.00	3.06	0.00	0.00	0.00	0.00	38.95	**43.1**	5.7%
501		10.86	0.00	0.00	0.00	53.18	7.24	2.05	0.00	0.00	57.86	**131.2**	18.1%
502		5.26	0.00	0.00	4.48	18.90	0.00	0.00	0.00	0.00	42.13	**70.8**	15.9%
503		3.55	0.00	0.00	0.00	13.43	10.64	0.00	0.00	0.00	112.00	**139.6**	7.0%
504		0.82	0.00	0.00	0.00	78.29	0.00	0.00	0.00	0.00	2.46	**81.6**	20.3%
505		2.90	0.00	0.00	1.58	10.04	0.00	0.00	0.00	0.00	16.26	**30.8**	18.5%
506		1.91	0.00	0.00	0.00	7.51	0.71	0.00	0.00	0.00	18.51	**28.6**	13.5%
600	600	1.71	0.00	0.00	0.00	4.62	1.20	3.70	0.00	0.00	347.40	**358.6**	2.8%
700	700	9.44	0.00	0.00	0.00	0.00	0.00	74.10	0.00	0.00	184.23	**267.8**	7.1%
701		2.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	204.54	**206.9**	3.1%
702		3.03	0.00	0.00	0.00	0.00	0.00	11.12	0.00	0.00	24.02	**38.2**	11.5%
703		8.24	0.00	0.00	7.37	9.80	11.36	12.94	0.00	0.00	108.99	**158.7**	10.7%
704		1.20	1.10	0.00	0.00	0.00	0.12	20.94	0.00	0.00	526.75	**550.1**	2.5%
705		0.00	1.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	166.77	**168.3**	2.4%
706		4.79	0.00	0.00	0.00	0.00	0.00	7.02	0.00	0.00	58.72	**70.5**	9.3%
707		1.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	57.58	**59.3**	4.8%
800	800	0.00	27.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2773.93	**2801.8**	2.4%
801		20.00	7.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	771.86	**799.6**	4.8%
802		0.09	11.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1693.13	**1704.3**	2.3%
803		0.00	2.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	157.15	**159.8**	2.6%
804		6.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	428.32	**434.3**	3.4%
805		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	418.25	**418.3**	2.0%
806		3.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	238.55	**241.7**	3.3%
807		2.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	58.31	**61.1**	6.5%
SUBTOTAL (MAJOR BASIN)	100	12.38	9.97	0.00	0.00	0.00	0.00	47.53	0.00	0.00	1673.29	**1743.2**	3.1%
	200	53.90	0.00	0.00	53.23	20.65	17.14	270.17	0.00	0.00	2267.46	**2682.5**	5.3%
	300	12.46	5.92	12.99	0.00	121.77	59.23	0.00	14.38	0.00	482.09	**708.9**	8.9%
	400	79.14	16.22	4.10	35.82	288.52	162.67	26.13	6.67	15.30	1650.81	**2285.4**	9.7%
	500	26.35	0.00	0.00	6.06	184.41	18.59	2.05	0.00	0.00	288.17	**525.6**	13.9%
	600	1.71	0.00	0.00	0.00	4.62	1.20	3.70	0.00	0.00	347.40	**358.6**	2.8%
	700	30.75	2.65	0.00	7.37	9.80	11.48	126.12	0.00	0.00	1331.60	**1519.8**	4.9%
	800	32.05	49.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6539.50	**6620.9**	2.8%
TOTAL		248.73	84.10	17.08	102.47	629.77	270.30	475.70	21.05	15.30	14580.33	**16445.0**	5.0%

CUHP SUBCATCHMENTS

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

								Maximum Depression Storage (Watershed inches)		Horton's Infiltration Parameters			DCIA
Subcatchment Name	EPA SWMM Target Node	Raingage	Area (acre)	Length to Centroid (ft)	Length (ft)	Slope (ft/ft)	Percent Imperviousness	Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/seconds)	Final Rate (in/hr)	Level 0, 1, or 2
100	100	5YR	1130.1	9737.6	17740.8	0.06	2.573985059	0.35	0.1	3	0.0018	0.5	0
101	101	5YR	405.8	4901.8	8785.7	0.06	3.107580979	0.35	0.1	3	0.0018	0.5	0
102	102	5YR	156.6	2418.1	5888.5	0.06	5.952436296	0.35	0.1	3	0.0018	0.5	0
103	103	5YR	50.7	955.6	2559	0.06	5.15458782	0.35	0.1	3	0.0018	0.5	0
200	200	5YR	89.1	1904.6	3753.3	0.06	15.70678617	0.35	0.1	3.6	0.0015	0.6	0
201	201	5YR	49.1	1364.4	3213.5	0.06	20.64454602	0.35	0.1	3.9	0.0013	0.7	0
202	202	5YR	275	2159.8	5938.9	0.06	11.91063921	0.35	0.1	3.3	0.0016	0.6	0
203	203	5YR	229.2	2158.2	5584.6	0.06	2.529965689	0.35	0.1	3	0.0018	0.5	0
204	204	5YR	1175.9	8905	11586.7	0.06	4.232965447	0.35	0.1	3.1	0.0018	0.5	0
205	205	5YR	389.3	2003.2	4987	0.06	1.999976563	0.35	0.1	3	0.0018	0.5	0
206	206	5YR	399	4843.7	9646.3	0.06	2.000000301	0.35	0.1	3	0.0018	0.5	0
207	207	5YR	57.9	1341.1	3387.9	0.06	19.56758023	0.35	0.1	3	0.0018	0.5	0
208	208	5YR	18	574.1	1296.1	0.06	19.24948817	0.35	0.1	3	0.0018	0.5	0
300	300	5YR	53.3	1431.8	3228	0.06	2.329863902	0.35	0.1	3	0.0018	0.5	0
301	301	5YR	30.9	1194	2220	0.06	2.130472258	0.35	0.1	3.2	0.0018	0.5	0
302	302	5YR	86.5	2642.3	4657.7	0.06	2.038296605	0.35	0.1	3	0.0018	0.5	0
303	303	5YR	72.1	1970.1	3348.3	0.06	6.128992071	0.35	0.1	3.4	0.0018	0.5	0
304	304	5YR	41.2	801.3	2226.7	0.06	18.06513221	0.35	0.1	3	0.0018	0.5	0
305	305	5YR	65.1	1760.2	4289.3	0.06	2.203825077	0.35	0.1	3	0.0018	0.5	0
306	306	5YR	23.6	618	1447.5	0.06	11.62544458	0.35	0.1	3	0.0018	0.5	0
307	307	5YR	24.8	1242.8	2071.9	0.06	18.20838265	0.35	0.1	3	0.0018	0.5	0
308	308	5YR	31.6	874.7	2092.6	0.06	16.84719807	0.35	0.1	3	0.0018	0.5	0
309	309	5YR	157.1	2591.1	5646.3	0.06	13.42725745	0.35	0.1	3	0.0018	0.5	0
310	310	5YR	84.8	1900.4	3426.3	0.06	13.18533493	0.35	0.1	3	0.0018	0.5	0
311	311	5YR	37.8	604.8	1681.7	0.06	3.633141345	0.35	0.1	3	0.0018	0.5	0
400	400	5YR	483.5	5636.6	10631.6	0.06	6.33254853	0.35	0.1	3	0.0018	0.5	0
401	401	5YR	227.1	2664.2	6071.1	0.06	10.67230392	0.35	0.1	3.6	0.0017	0.6	0
402	402	5YR	52.5	969.5	2536.1	0.06	8.227668866	0.35	0.1	3	0.0018	0.5	0
403	403	5YR	34.2	812.1	1793.3	0.06	8.221575237	0.35	0.1	3.2	0.0017	0.6	0
404	404	5YR	162.2	2214.2	5432.1	0.06	5.557114025	0.35	0.1	3	0.0018	0.5	0
405	405	5YR	61.3	1345.5	3162.7	0.06	11.05210699	0.35	0.1	3	0.0018	0.5	0
406	406	5YR	224.1	1992.8	5035.5	0.06	4.427516454	0.35	0.1	3.2	0.0017	0.6	0
407	407	5YR	26.2	656.3	2135.8	0.06	22.39568597	0.35	0.1	3	0.0018	0.5	0
408	408	5YR	22.5	610.7	1786.2	0.06	30.49160428	0.35	0.1	3	0.0018	0.5	0
409	409	5YR	141.3	2800.7	5633.9	0.06	4.276298486	0.35	0.1	3	0.0018	0.5	0
410	410	5YR	46.4	758	1653.4	0.06	22.55837758	0.35	0.1	3	0.0018	0.5	0
411	411	5YR	13.3	562.2	1525.9	0.06	38.32873181	0.35	0.1	3	0.0018	0.5	0
412	412	5YR	63.8	886.6	2740	0.06	20.62507825	0.35	0.1	3	0.0018	0.5	0
413	413	5YR	30.1	895.3	2614	0.06	23.55005649	0.35	0.1	3	0.0018	0.5	0
414	414	5YR	53.2	1153.6	2897.5	0.06	25.92018607	0.35	0.1	3	0.0018	0.5	0
415	415	5YR	156.5	3475.3	6367.3	0.06	8.163484611	0.35	0.1	3	0.0018	0.5	0
416	416	5YR	116.9	1428	3827.3	0.06	3.505029243	0.35	0.1	3	0.0018	0.5	0
417	417	5YR	79.2	740.9	2363.1	0.06	2.441626778	0.35	0.1	3	0.0018	0.5	0
418	418	5YR	62.8	315.4	2342.4	0.06	1.998653312	0.35	0.1	3	0.0018	0.5	0
419	419	5YR	40.6	1977.9	4051.8	0.06	11.22882663	0.35	0.1	3	0.0018	0.5	0
420	420	5YR	123.7	1469.6	3086.4	0.06	25.53673534	0.35	0.1	3	0.0018	0.5	0
421	421	5YR	50	1230.8	1883.5	0.06	20.31377375	0.35	0.1	3	0.0018	0.5	0
422	422	5YR	14.2	475	873.9	0.06	2	0.35	0.1	3	0.0018	0.5	0
500	500	5YR	43.1	1524.8	2481.8	0.06	5.685043794	0.35	0.1	3	0.0018	0.5	0
501	501	5YR	131.2	1958.6	4161.2	0.06	18.05651611	0.35	0.1	3	0.0018	0.5	0
502	502	5YR	70.8	1652	2079.9	0.06	15.86788685	0.35	0.1	3	0.0018	0.5	0
503	503	5YR	139.6	2385.5	5230.2	0.06	6.98348822	0.35	0.1	3	0.0018	0.5	0
504	504	5YR	81.6	1738	4000.4	0.06	20.26199255	0.35	0.1	3	0.0018	0.5	0
505	505	5YR	30.8	934.2	2261	0.06	18.53119101	0.35	0.1	3	0.0018	0.5	0
506	506	5YR	28.6	848.5	1963	0.06	13.48983811	0.35	0.1	3	0.0018	0.5	0
600	600	5YR	358.6	5321.4	9790.3	0.06	2.793709804	0.35	0.1	3	0.0018	0.5	0
700	700	5YR	267.8	1762.9	4648.1	0.06	7.114205839	0.35	0.1	3	0.0018	0.5	0
701	701	5YR	206.9	3416	6450.2	0.06	3.107223021	0.35	0.1	3	0.0018	0.5	0
702	702	5YR	39.2	1506.8	3953	0.06	11.53957879	0.35	0.1	3.4	0.0016	0.6	0
703	703	5YR	158.7	3555.7	7732.7	0.06	10.7078933	0.35	0.1	4.3	0.0012	0.8	0
704	704	5YR	550.1	5192.1	10160.3	0.06	2.520270201	0.35	0.1	4.4	0.0015	0.7	0
705	705	5YR	168.3	2637	6401.3	0.06	2.350373055	0.35	0.1	4.4	0.0013	0.8	0
706	706	5YR	70.5	1544.8	2886.9	0.06	9.258487627	0.35	0.1	3	0.0018	0.5	0
707	707	5YR	59.3	1500.5	4265.4	0.06	4.823409328	0.35	0.1	3.1	0.0018	0.5	0
800	800	5YR	2801.8	16054.6	35869.9	0.06	2.378184021	0.35	0.1	4.3	0.0017	0.6	0
801	801	5YR	799.6	13786.4	20705.1	0.06	4.820223097	0.35	0.1	4.4	0.0014	0.7	0
802	802	5YR	1704.3	7818.1	17322.9	0.06	2.251562485	0.35	0.1	3.5	0.0018	0.5	0
803	803	5YR	159.8	3476.3	5324.9	0.06	2.625827786	0.35	0.1	3	0.0018	0.5	0
804	804	5YR	434.3	5289.5	9438.6	0.06	3.359244834	0.35	0.1	3	0.0018	0.5	0
805	805	5YR	418.3	5794.6	9789.2	0.06	1.999988218	0.35	0.1	3	0.0018	0.5	0
806	806	5YR	241.7	3909.9	9171.2	0.06	3.281329899	0.35	0.1	3	0.0018	0.5	0
807	807	5YR	61.1	1237.6	1826.8	0.06	6.450677049	0.35	0.1	3	0.0018	0.5	0

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
100		0.157	0.428	81.0	26.88	42.1	19.00	44.8	654	4,102,263	0.01	25,495	74.0	4	25,495	0.00
101		0.155	0.312	56.5	13.83	29.4	9.77	23.0	337	1,473,054	0.01	11,207	54.0	2	11,207	0.01
102		0.148	0.224	44.0	7.87	22.9	5.56	13.1	167	568,458	0.02	8,891	45.0	2	8,891	0.01
103		0.150	0.144	29.9	3.60	15.5	2.54	6.0	80	184,041	0.01	2,445	38.0	1	2,445	0.02
200		0.123	0.157	37.6	4.83	19.6	3.41	8.1	111	323,433	0.05	15,402	39.0	4	15,402	0.04
201		0.116	0.117	37.7	3.67	19.6	2.60	6.1	61	178,233	0.07	11,741	38.0	2	11,741	0.05
202		0.132	0.240	34.9	6.74	18.2	4.76	11.2	369	998,250	0.03	31,048	41.0	8	31,049	0.03
203		0.157	0.265	36.4	7.71	18.9	5.45	12.9	295	831,996	0.01	5,076	44.0	2	5,076	0.01
204		0.152	0.422	62.4	20.50	32.4	14.48	34.2	884	4,268,517	0.01	44,999	63.0	8	44,998	0.01
205		0.158	0.313	28.4	7.13	14.8	5.04	11.9	643	1,413,159	0.00	6,722	41.0	3	6,722	0.01
206		0.158	0.316	59.1	14.62	30.7	10.33	24.4	317	1,448,370	0.00	6,889	56.0	1	6,889	0.00
207		0.117	0.126	35.7	3.75	18.6	2.65	6.3	76	210,177	0.08	17,049	39.0	4	17,049	0.07
208		0.117	0.074	25.4	1.75	13.2	1.24	2.9	33	65,340	0.08	5,177	35.0	2	5,176	0.09
300		0.157	0.154	39.8	4.99	20.7	3.53	8.3	63	193,479	0.01	1,081	42.0	0	1,081	0.01
301		0.158	0.121	38.9	3.91	20.2	2.76	6.5	37	112,167	0.00	556	41.0	0	556	0.01
302		0.158	0.192	51.2	7.84	26.6	5.54	13.1	79	313,995	0.00	1,524	46.0	0	1,524	0.00
303		0.148	0.166	41.0	5.53	21.3	3.91	9.2	82	261,723	0.02	4,053	42.0	1	4,053	0.01
304		0.119	0.109	26.9	2.54	14.0	1.80	4.2	72	149,556	0.07	10,807	36.0	3	10,807	0.08
305		0.158	0.169	46.0	6.25	23.9	4.42	10.4	66	236,313	0.01	1,245	44.0	0	1,245	0.00
306		0.131	0.091	25.6	2.08	13.3	1.47	3.5	43	85,668	0.04	3,173	36.0	1	3,173	0.05
307		0.119	0.087	40.2	2.97	20.9	2.10	5.0	29	90,024	0.07	6,581	40.0	1	6,580	0.06
308		0.121	0.097	30.9	2.61	16.1	1.84	4.3	48	114,708	0.07	7,480	37.0	2	7,480	0.06
309		0.126	0.195	43.6	6.83	22.7	4.82	11.4	169	570,273	0.05	26,484	44.0	6	26,484	0.04
310		0.126	0.156	37.1	4.75	19.3	3.36	7.9	107	307,824	0.05	13,902	41.0	3	13,902	0.04
311		0.154	0.129	22.4	2.52	11.7	1.78	4.2	79	137,214	0.01	1,237	36.0	1	1,237	0.01
400		0.147	0.312	62.6	15.28	32.5	10.80	25.5	362	1,755,105	0.02	29,469	57.0	5	29,469	0.01
401		0.136	0.232	41.5	7.71	21.6	5.45	12.8	257	824,373	0.03	20,990	43.0	5	20,990	0.02
402		0.142	0.139	29.3	3.42	15.2	2.42	5.7	84	190,575	0.02	4,345	38.0	1	4,345	0.03
403		0.143	0.115	27.7	2.75	14.4	1.94	4.6	58	124,146	0.02	2,262	36.0	1	2,262	0.02
404		0.149	0.228	40.2	7.33	20.9	5.18	12.2	189	588,786	0.01	8,515	44.0	2	8,515	0.01
405		0.133	0.141	35.3	4.12	18.4	2.91	6.9	81	222,519	0.03	7,592	40.0	2	7,591	0.03
406		0.153	0.257	33.5	6.91	17.4	4.88	11.5	313	813,483	0.01	6,969	41.0	2	6,969	0.01
407		0.113	0.087	28.4	2.20	14.8	1.55	3.7	43	95,106	0.10	9,284	36.0	3	9,282	0.10
408		0.103	0.084	23.9	1.84	12.4	1.30	3.1	44	81,675	0.15	12,159	34.0	3	12,157	0.15
409		0.152	0.223	47.8	8.49	24.9	6.00	14.2	138	512,919	0.01	5,531	47.0	1	5,531	0.01
410		0.112	0.112	20.8	2.09	10.8	1.48	3.5	105	168,432	0.10	16,603	33.0	6	16,599	0.12
411		0.096	0.078	21.3	1.57	11.1	1.11	2.6	29	48,279	0.21	9,960	32.0	3	9,958	0.22
412		0.115	0.131	25.1	2.82	13.1	1.99	4.7	119	231,594	0.09	20,215	36.0	6	20,212	0.10
413		0.111	0.092	33.8	2.69	17.6	1.90	4.5	42	109,263	0.10	11,415	37.0	3	11,414	0.09
414		0.108	0.119	30.3	3.06	15.8	2.16	5.1	82	193,116	0.12	22,969	37.0	6	22,967	0.11
415		0.142	0.215	54.2	9.27	28.2	6.55	15.5	135	568,095	0.02	12,832	49.0	2	12,831	0.02
416		0.154	0.215	30.2	5.29	15.7	3.74	8.8	181	424,347	0.01	3,678	40.0	1	3,678	0.01
417		0.157	0.183	20.9	3.24	10.9	2.29	5.4	178	287,496	0.01	1,689	36.0	1	1,689	0.01
418		0.158	0.166	15.3	2.26	8.0	1.59	3.8	192	227,964	0.00	1,084	33.0	1	1,083	0.01
419		0.133	0.117	57.6	5.46	29.9	3.86	9.1	33	147,378	0.04	5,161	45.0	1	5,161	0.02
420		0.109	0.171	24.5	3.51	12.7	2.48	5.9	237	449,031	0.12	52,336	36.0	16	52,331	0.13
421		0.116	0.117	27.5	2.78	14.3	1.96	4.6	85	181,500	0.09	15,517	36.0	4	15,516	0.09
422		0.158	0.085	22.7	1.78	11.8	1.26	3.0	29	51,546	0.00	245	35.0	0	245	0.01
500		0.148	0.132	39.6	4.33	20.6	3.06	7.2	51	156,453	0.01	2,322	41.0	1	2,322	0.01
501		0.119	0.179	33.9	4.95	17.6	3.50	8.3	181	476,256	0.07	34,390	40.0	9	34,390	0.07
502		0.122	0.141	29.2	3.46	15.2	2.44	5.8	114	257,004	0.06	15,333	37.0	4	15,333	0.06
503		0.145	0.212	42.7	7.27	22.2	5.14	12.1	153	506,748	0.02	9,528	44.0	2	9,528	0.02
504		0.116	0.146	37.4	4.50	19.4	3.18	7.5	102	296,208	0.09	25,236	40.0	6	25,236	0.07
505		0.118	0.095	33.1	2.72	17.2	1.92	4.5	44	111,804	0.07	8,384	37.0	2	8,384	0.07
506		0.126	0.095	31.4	2.60	16.3	1.84	4.3	43	103,818	0.05	4,856	37.0	1	4,856	0.05
600		0.156	0.302	64.3	15.20	33.4	10.74	25.3	262	1,301,718	0.01	8,831	57.0	2	8,831	0.00
700		0.145	0.258	28.7	5.98	14.9	4.23	10.0	437	972,114	0.02	18,678	40.0	6	18,677	0.02
701		0.155	0.255	50.1	10.11	26.1	7.14	16.8	193	751,047	0.01	5,713	49.0	1	5,713	0.01
702		0.133	0.114	51.3	4.80	26.7	3.39	8.0	35	138,666	0.03	4,016	42.0	1	4,016	0.02
703		0.136	0.209	59.6	9.85	31.0	6.96	16.4	125	576,081	0.02	8,677	53.0	1	8,677	0.01
704		0.157	0.346	56.9	15.40	29.6	10.88	25.7	453	1,996,863	0.00	3,904	55.0	1	3,904	0.00
705		0.158	0.243	47.0	9.06	24.4	6.40	15.1	168	610,929	0.00	443	47.0	0	443	0.00
706		0.139	0.155	34.1	4.37	17.7	3.09	7.3	97	255,915	0.03	6,719	40.0	2	6,719	0.03
707		0.151	0.155	44.2	5.56	23.0	3.93	9.3	63	215,259	0.01	2,625	43.0	1	2,625	0.01
800		0.158	0.565	109.9	38.47	57.2	25.72	79.9	1,195	10,170,534	0.00	34,657	109.0	4	34,658	0.00
801		0.152	0.374	114.1	33.05	59.3	23.35	55.1	328	2,902,548	0.00	11,227	95.0	1	11,227	0.00
802		0.158	0.486	63.7	22.29	33.1	14.90	40.2	1,254	6,186,609	0.01	31,316	69.0	6	31,316	0.00
803		0.156	0.238	49.8	9.39	25.9	6.64	15.7	150	580,074	0.01	3,683	48.0	1	3,683	0.01
804		0.155	0.317	59.4	14.76	30.9	10.43	24.6	343	1,576,509	0.01	13,049	56.0	3	13,049	0.01
805		0.158	0.320	63.9	16.02	33.2	11.32	26.7	307	1,518,429	0.00	7,223	58.0	1	7,223	0.00
806		0.155	0.266	60.4	12.65	31.4	8.94	21.1	187	877,371	0.01	7,080	54.0	1	7,080	0.01
807		0.146	0.153	26.4	3.40	13.7	2.40	5.7	108	221,793	0.02	3,804	37.0	1	3,804	0.02

CUHP SUBCATCHMENTS

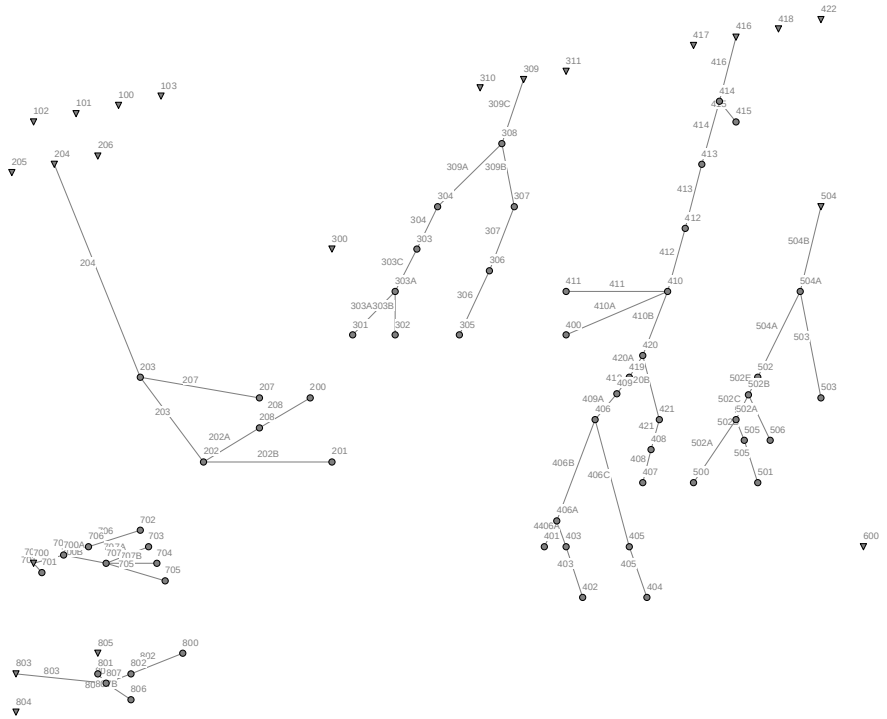
Columns with this color heading are for required user-input
Columns with this color heading are for optional override values
Columns with this color heading are for program-calculated values

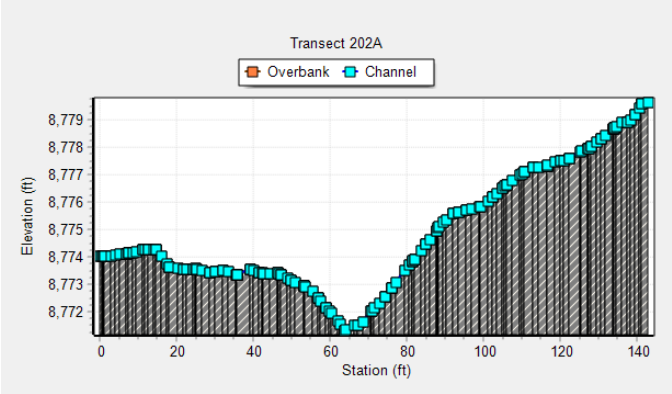
								Maximum Depression Storage (Watershed inches)		Horton's Infiltration Parameters			DCIA
Subcatchment Name	EPA SWMM Target Node	Raingage	Area (acre)	Length to Centroid (ft)	Length (ft)	Slope (ft/ft)	Percent Imperviousness	Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/seconds)	Final Rate (in/hr)	Level 0, 1, or 2
100	100	100YR	1130.1	9737.6	17740.8	0.06	2.6	0.35	0.1	3	0.0018	0.5	0
101	101	100YR	405.8	4901.8	8785.7	0.06	3.1	0.35	0.1	3	0.0018	0.5	0
102	102	100YR	156.6	2418.1	5888.5	0.06	6.0	0.35	0.1	3	0.0018	0.5	0
103	103	100YR	50.7	955.6	2559	0.06	5.2	0.35	0.1	3	0.0018	0.5	0
200	200	100YR	89.1	1904.6	3753.3	0.06	15.7	0.35	0.1	3.6	0.0015	0.6	0
201	201	100YR	49.1	1364.4	3213.5	0.06	20.6	0.35	0.1	3.9	0.0013	0.7	0
202	202	100YR	275	2159.8	5938.9	0.06	11.9	0.35	0.1	3.3	0.0016	0.6	0
203	203	100YR	229.2	2158.2	5584.6	0.06	2.5	0.35	0.1	3	0.0018	0.5	0
204	204	100YR	1175.9	8905	11586.7	0.06	4.2	0.35	0.1	3.1	0.0018	0.5	0
205	205	100YR	389.3	2003.2	4987	0.06	2.0	0.35	0.1	3	0.0018	0.5	0
206	206	100YR	399	4843.7	9646.3	0.06	2.0	0.35	0.1	3	0.0018	0.5	0
207	207	100YR	57.9	1341.1	3387.9	0.06	19.6	0.35	0.1	3	0.0018	0.5	0
208	208	100YR	18	574.1	1296.1	0.06	19.2	0.35	0.1	3	0.0018	0.5	0
300	300	100YR	53.3	1431.8	3228	0.06	2.3	0.35	0.1	3	0.0018	0.5	0
301	301	100YR	30.9	1194	2220	0.06	2.1	0.35	0.1	3.2	0.0018	0.5	0
302	302	100YR	86.5	2642.3	4657.7	0.06	2.0	0.35	0.1	3	0.0018	0.5	0
303	303	100YR	72.1	1970.1	3348.3	0.06	6.1	0.35	0.1	3.4	0.0018	0.5	0
304	304	100YR	41.2	801.3	2226.7	0.06	18.1	0.35	0.1	3	0.0018	0.5	0
305	305	100YR	65.1	1760.2	4289.3	0.06	2.2	0.35	0.1	3	0.0018	0.5	0
306	306	100YR	23.6	618	1447.5	0.06	11.6	0.35	0.1	3	0.0018	0.5	0
307	307	100YR	24.8	1242.8	2071.9	0.06	18.2	0.35	0.1	3	0.0018	0.5	0
308	308	100YR	31.6	874.7	2092.6	0.06	16.8	0.35	0.1	3	0.0018	0.5	0
309	309	100YR	157.1	2591.1	5646.3	0.06	13.4	0.35	0.1	3	0.0018	0.5	0
310	310	100YR	84.8	1900.4	3426.3	0.06	13.2	0.35	0.1	3	0.0018	0.5	0
311	311	100YR	37.8	604.8	1681.7	0.06	3.6	0.35	0.1	3	0.0018	0.5	0
400	400	100YR	483.5	5636.6	10631.6	0.06	6.3	0.35	0.1	3	0.0018	0.5	0
401	401	100YR	227.1	2664.2	6071.1	0.06	10.7	0.35	0.1	3.6	0.0017	0.6	0
402	402	100YR	52.5	969.5	2536.1	0.06	8.2	0.35	0.1	3	0.0018	0.5	0
403	403	100YR	34.2	812.1	1793.3	0.06	8.2	0.35	0.1	3.2	0.0017	0.6	0
404	404	100YR	162.2	2214.2	5432.1	0.06	5.6	0.35	0.1	3	0.0018	0.5	0
405	405	100YR	61.3	1345.5	3162.7	0.06	11.1	0.35	0.1	3	0.0018	0.5	0
406	406	100YR	224.1	1992.8	5035.5	0.06	4.4	0.35	0.1	3.2	0.0017	0.6	0
407	407	100YR	26.2	656.3	2135.8	0.06	22.4	0.35	0.1	3	0.0018	0.5	0
408	408	100YR	22.5	610.7	1786.2	0.06	30.5	0.35	0.1	3	0.0018	0.5	0
409	409	100YR	141.3	2800.7	5633.9	0.06	4.3	0.35	0.1	3	0.0018	0.5	0
410	410	100YR	46.4	758	1653.4	0.06	22.6	0.35	0.1	3	0.0018	0.5	0
411	411	100YR	13.3	562.2	1525.9	0.06	38.3	0.35	0.1	3	0.0018	0.5	0
412	412	100YR	63.8	886.6	2740	0.06	20.6	0.35	0.1	3	0.0018	0.5	0
413	413	100YR	30.1	895.3	2614	0.06	23.6	0.35	0.1	3	0.0018	0.5	0
414	414	100YR	53.2	1153.6	2897.5	0.06	25.9	0.35	0.1	3	0.0018	0.5	0
415	415	100YR	156.5	3475.3	6367.3	0.06	8.2	0.35	0.1	3	0.0018	0.5	0
416	416	100YR	116.9	1428	3827.3	0.06	3.5	0.35	0.1	3	0.0018	0.5	0
417	417	100YR	79.2	740.9	2363.1	0.06	2.4	0.35	0.1	3	0.0018	0.5	0
418	418	100YR	62.8	315.4	2342.4	0.06	2.0	0.35	0.1	3	0.0018	0.5	0
419	419	100YR	40.6	1977.9	4051.8	0.06	11.2	0.35	0.1	3	0.0018	0.5	0
420	420	100YR	123.7	1469.6	3086.4	0.06	25.5	0.35	0.1	3	0.0018	0.5	0
421	421	100YR	50	1230.8	1883.5	0.06	20.3	0.35	0.1	3	0.0018	0.5	0
422	422	100YR	14.2	475	873.9	0.06	2.0	0.35	0.1	3	0.0018	0.5	0
500	500	100YR	43.1	1524.8	2481.8	0.06	5.7	0.35	0.1	3	0.0018	0.5	0
501	501	100YR	131.2	1958.6	4161.2	0.06	18.1	0.35	0.1	3	0.0018	0.5	0
502	502	100YR	70.8	1652	2079.9	0.06	15.9	0.35	0.1	3	0.0018	0.5	0
503	503	100YR	139.6	2385.5	5230.2	0.06	7.0	0.35	0.1	3	0.0018	0.5	0
504	504	100YR	81.6	1738	4000.4	0.06	20.3	0.35	0.1	3	0.0018	0.5	0
505	505	100YR	30.8	934.2	2261	0.06	18.5	0.35	0.1	3	0.0018	0.5	0
506	506	100YR	28.6	848.5	1963	0.06	13.5	0.35	0.1	3	0.0018	0.5	0
600	600	100YR	358.6	5321.4	9790.3	0.06	2.8	0.35	0.1	3	0.0018	0.5	0
700	700	100YR	267.8	1762.9	4648.1	0.06	7.1	0.35	0.1	3	0.0018	0.5	0
701	701	100YR	206.9	3416	6450.2	0.06	3.1	0.35	0.1	3	0.0018	0.5	0
702	702	100YR	39.2	1506.8	3953	0.06	11.5	0.35	0.1	3.4	0.0016	0.6	0
703	703	100YR	158.7	3555.7	7732.7	0.06	10.7	0.35	0.1	4.3	0.0012	0.8	0
704	704	100YR	550.1	5192.1	10160.3	0.06	2.5	0.35	0.1	4.4	0.0015	0.7	0
705	705	100YR	168.3	2637	6401.3	0.06	2.4	0.35	0.1	4.4	0.0013	0.8	0
706	706	100YR	70.5	1544.8	2886.9	0.06	9.3	0.35	0.1	3	0.0018	0.5	0
707	707	100YR	59.3	1500.5	4265.4	0.06	4.8	0.35	0.1	3.1	0.0018	0.5	0
800	800	100YR	2801.8	16054.6	35869.9	0.06	2.4	0.35	0.1	4.3	0.0017	0.6	0
801	801	100YR	799.6	13786.4	20705.1	0.06	4.8	0.35	0.1	4.4	0.0014	0.7	0
802	802	100YR	1704.3	7818.1	17322.9	0.06	2.3	0.35	0.1	3.5	0.0018	0.5	0
803	803	100YR	159.8	3476.3	5324.9	0.06	2.6	0.35	0.1	3	0.0018	0.5	0
804	804	100YR	434.3	5289.5	9438.6	0.06	3.4	0.35	0.1	3	0.0018	0.5	0
805	805	100YR	418.3	5794.6	9789.2	0.06	2.0	0.35	0.1	3	0.0018	0.5	0
806	806	100YR	241.7	3909.9	9171.2	0.06	3.3	0.35	0.1	3	0.0018	0.5	0
807	807	100YR	61.1	1237.6	1826.8	0.06	6.5	0.35	0.1	3	0.0018	0.5	0

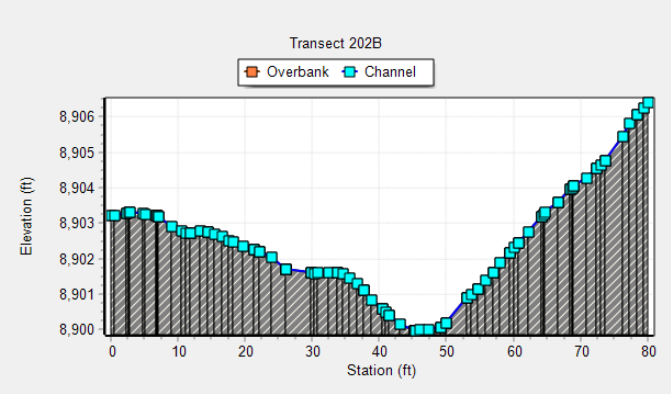
Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)

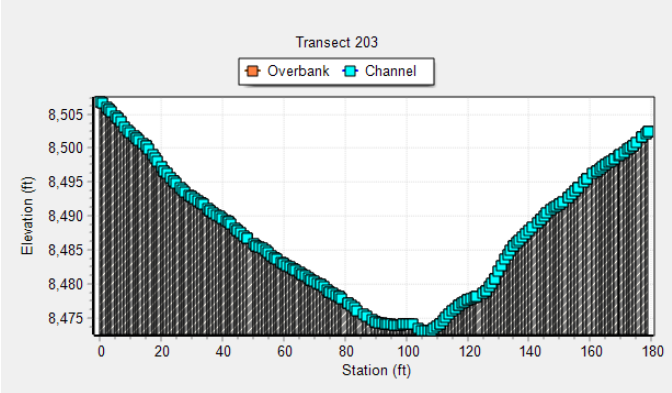
		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
100		0.155	0.424	80.9	26.63	42.1	18.82	44.4	655	4,102,263	0.49	2,000,791	81.0	302	2,000,792	0.27
101		0.153	0.308	56.5	13.67	29.4	9.66	22.8	337	1,473,054	0.49	725,015	63.0	146	725,013	0.36
102		0.145	0.219	44.0	7.70	22.9	5.44	12.8	167	568,458	0.52	293,470	53.0	70	293,468	0.45
103		0.147	0.141	29.8	3.53	15.5	2.50	5.9	80	184,041	0.51	93,760	45.0	29	93,756	0.58
200		0.120	0.155	37.2	4.72	19.3	3.34	7.9	112	323,433	0.47	153,622	48.0	41	153,617	0.46
201		0.114	0.116	37.2	3.61	19.4	2.55	6.0	62	178,233	0.43	76,234	47.0	20	76,234	0.40
202		0.126	0.231	34.6	6.44	18.0	4.55	10.7	372	998,250	0.46	462,221	49.0	134	462,205	0.49
203		0.155	0.263	36.4	7.64	18.9	5.40	12.7	295	831,996	0.49	405,483	51.0	114	405,482	0.50
204		0.150	0.415	62.3	20.18	32.4	14.26	33.6	885	4,268,517	0.50	2,128,707	70.0	400	2,128,696	0.34
205		0.157	0.311	28.4	7.08	14.8	5.00	11.8	643	1,413,159	0.48	682,493	48.0	232	682,476	0.59
206		0.157	0.313	59.1	14.52	30.7	10.26	24.2	317	1,448,370	0.48	699,499	64.0	136	699,497	0.34
207		0.114	0.125	35.2	3.67	18.3	2.59	6.1	77	210,177	0.64	134,664	47.0	35	134,665	0.61
208		0.114	0.074	25.1	1.72	13.0	1.22	2.9	34	65,340	0.64	41,665	41.0	14	41,656	0.76
300		0.156	0.152	39.7	4.95	20.7	3.50	8.3	63	193,479	0.49	93,972	50.0	24	93,970	0.45
301		0.157	0.120	38.9	3.88	20.2	2.74	6.5	37	112,167	0.48	53,622	49.0	14	53,619	0.45
302		0.157	0.191	51.2	7.79	26.6	5.50	13.0	79	313,995	0.48	151,746	55.0	32	151,743	0.37
303		0.144	0.162	40.9	5.40	21.3	3.82	9.0	83	261,723	0.51	132,476	51.0	33	132,477	0.46
304		0.116	0.108	26.5	2.49	13.8	1.76	4.2	73	149,556	0.63	93,671	43.0	30	93,674	0.72
305		0.156	0.167	46.0	6.20	23.9	4.38	10.3	66	236,313	0.48	114,529	53.0	26	114,525	0.41
306		0.126	0.088	25.4	2.01	13.2	1.42	3.3	43	85,668	0.57	48,505	42.0	16	48,497	0.69
307		0.116	0.086	39.7	2.91	20.6	2.06	4.8	29	90,024	0.63	56,508	47.0	13	56,504	0.54
308		0.118	0.096	30.5	2.55	15.9	1.80	4.3	49	114,708	0.61	70,519	45.0	20	70,520	0.65
309		0.123	0.192	43.2	6.68	22.5	4.72	11.1	170	570,273	0.58	332,339	52.0	78	332,334	0.49
310		0.123	0.154	36.8	4.64	19.1	3.28	7.7	108	307,824	0.58	178,703	48.0	47	178,701	0.55
311		0.152	0.127	22.4	2.49	11.6	1.76	4.2	79	137,214	0.50	68,139	42.0	26	68,135	0.69
400		0.143	0.305	62.4	14.94	32.5	10.55	24.9	363	1,755,105	0.52	911,801	66.0	168	911,793	0.35
401		0.130	0.224	41.2	7.40	21.4	5.23	12.3	258	824,373	0.45	374,687	52.0	96	374,681	0.42
402		0.137	0.135	29.2	3.33	15.2	2.35	5.5	84	190,575	0.54	102,127	45.0	32	102,125	0.61
403		0.138	0.112	27.6	2.67	14.3	1.88	4.4	58	124,146	0.44	55,058	43.0	19	55,056	0.55
404		0.146	0.223	40.1	7.19	20.9	5.08	12.0	189	588,786	0.51	301,977	52.0	77	301,966	0.48
405		0.128	0.136	35.1	3.97	18.2	2.81	6.6	82	222,519	0.56	124,826	47.0	34	124,818	0.55
406		0.150	0.252	33.5	6.78	17.4	4.79	11.3	314	813,483	0.41	331,854	49.0	104	331,837	0.46
407		0.110	0.086	27.9	2.15	14.5	1.52	3.6	44	95,106	0.67	63,541	43.0	19	63,535	0.73
408		0.101	0.087	22.5	1.81	11.7	1.28	3.0	47	81,675	0.75	61,190	41.0	20	61,182	0.91
409		0.150	0.220	47.8	8.36	24.8	5.91	13.9	139	512,919	0.50	257,490	55.0	58	257,481	0.41
410		0.110	0.112	20.4	2.05	10.6	1.45	3.4	107	168,432	0.67	112,799	40.0	42	112,782	0.90
411		0.095	0.080	20.5	1.56	10.6	1.10	2.6	30	48,279	0.83	40,152	40.0	14	40,144	1.03
412		0.112	0.130	24.7	2.76	12.9	1.95	4.6	121	231,594	0.65	150,747	42.0	50	150,736	0.78
413		0.109	0.092	33.2	2.64	17.2	1.86	4.4	43	109,263	0.68	74,236	46.0	20	74,235	0.65
414		0.106	0.118	29.7	3.00	15.5	2.12	5.0	84	193,116	0.70	135,743	44.0	39	135,733	0.73
415		0.137	0.210	54.0	9.00	28.1	6.36	15.0	136	568,095	0.54	304,119	57.0	61	304,116	0.39
416		0.152	0.212	30.2	5.22	15.7	3.69	8.7	181	424,347	0.50	210,271	47.0	66	210,261	0.57
417		0.156	0.182	20.9	3.21	10.9	2.27	5.4	178	287,496	0.49	139,903	42.0	57	139,878	0.72
418		0.157	0.165	15.3	2.24	8.0	1.58	3.7	192	227,964	0.48	110,094	40.0	55	110,067	0.87
419		0.127	0.113	57.2	5.25	29.7	3.71	8.7	33	147,378	0.56	82,912	54.0	15	82,909	0.38
420		0.106	0.170	24.0	3.44	12.5	2.43	5.7	242	449,031	0.70	313,912	42.0	104	313,893	0.84
421		0.113	0.116	27.1	2.72	14.1	1.92	4.5	87	181,500	0.65	117,595	43.0	37	117,591	0.73
422		0.157	0.085	22.7	1.77	11.8	1.25	3.0	29	51,546	0.48	24,894	41.0	9	24,890	0.66
500		0.145	0.130	39.5	4.24	20.6	3.00	7.1	51	156,453	0.51	80,412	49.0	20	80,411	0.47
501		0.116	0.177	33.4	4.85	17.4	3.42	8.1	184	476,256	0.63	298,254	47.0	82	298,241	0.62
502		0.119	0.139	28.9	3.39	15.0	2.39	5.6	115	257,004	0.61	155,624	45.0	47	155,621	0.67
503		0.141	0.208	42.6	7.09	22.1	5.01	11.8	154	506,748	0.53	266,100	52.0	65	266,090	0.46
504		0.113	0.145	36.8	4.40	19.1	3.11	7.3	104	296,208	0.65	191,768	48.0	48	191,767	0.59
505		0.115	0.094	32.6	2.66	17.0	1.88	4.4	44	111,804	0.63	70,524	46.0	19	70,524	0.63
506		0.123	0.094	31.1	2.55	16.2	1.80	4.2	43	103,818	0.58	60,562	45.0	18	60,565	0.61
600		0.154	0.299	64.2	15.04	33.4	10.63	25.1	262	1,301,718	0.49	637,271	66.0	115	637,267	0.32
700		0.141	0.252	28.6	5.83	14.9	4.12	9.7	439	972,114	0.53	511,565	47.0	167	511,568	0.62
701		0.153	0.252	50.1	9.99	26.0	7.06	16.7	194	751,047	0.49	369,652	57.0	81	369,650	0.39
702		0.127	0.110	51.0	4.59	26.5	3.25	7.7	35	138,666	0.46	63,173	51.0	13	63,172	0.35
703		0.133	0.204	59.4	9.62	30.9	6.80	16.0	125	576,081	0.23	132,031	56.0	25	132,029	0.16
704		0.156	0.343	56.8	15.28	29.6	10.80	25.5	454	1,996,863	0.25	490,228	62.0	106	490,223	0.19
705		0.157	0.242	46.9	9.01	24.4	6.37	15.0	168	610,929	0.16	95,837	53.0	25	95,834	0.15
706		0.134	0.151	33.9	4.23	17.6	2.99	7.0	97	255,915	0.54	139,447	47.0	39	139,443	0.56
707		0.148	0.152	44.1	5.47	23.0	3.86	9.1	63	215,259	0.50	108,428	51.0	26	108,428	0.43
800		0.156	0.560	109.9	38.46	57.1	25.71	79.2	1,195	10,170,534	0.35	3,572,407	115.0	411	3,572,408	0.15
801		0.149	0.369	114.0	32.58	59.3	23.02	54.3	329	2,902,548	0.25	723,912	91.0	81	723,912	0.10
802		0.156	0.482	63.7	22.29	33.1	14.90	39.8	1,255	6,186,609	0.47	2,908,262	76.0	543	2,908,198	0.32
803		0.155	0.235	49.8	9.30	25.9	6.57	15.5	150	580,074	0.49	283,169	56.0	62	283,161	0.39
804		0.153	0.313	59.4	14.58	30.9	10.30	24.3	343	1,576,509	0.49	779,257	65.0	150	779,239	0.35
805		0.157	0.318	63.9	15.90	33.2	11.24	26.5	307	1,518,429	0.48	733,334	67.0	134	733,336	0.32
806		0.153	0.263	60.4	12.50	31.4	8.84	20.8	188	877,371	0.49	433,105	63.0	82	433,100	0.34
807		0.143	0.150	26.3	3.33	13.7	2.35	5.5	109	221,793	0.52	115,449	44.0	39	115,443	0.64

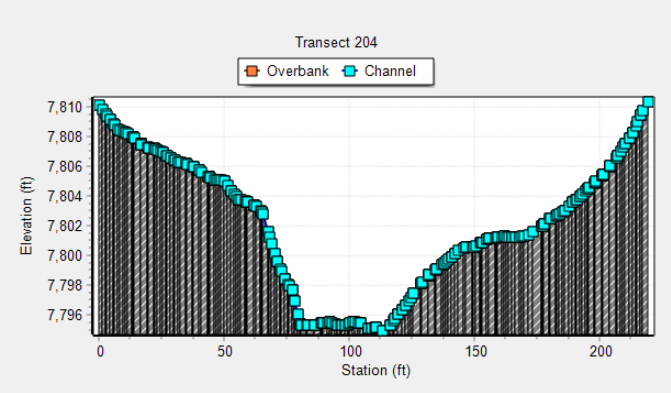
Stagecoach - Proposed Conditions (Linked to CUHP)

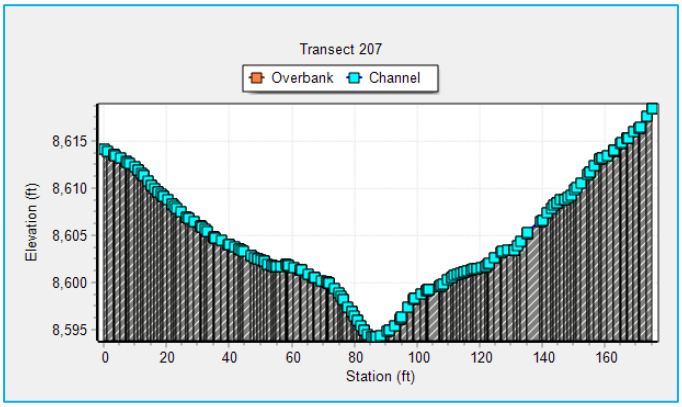


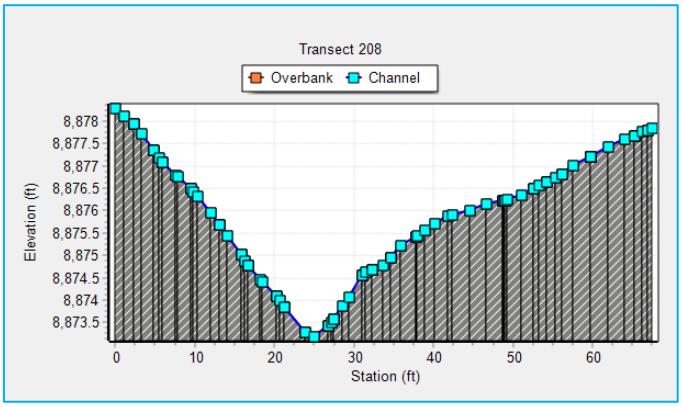

Transect 202A
Overbank
Channel
Elevation (ft)
8,779
8,778
8,777
8,776
8,775
8,774
8,773
8,772
0
20
40
60
80
100
120
140
Station (ft)

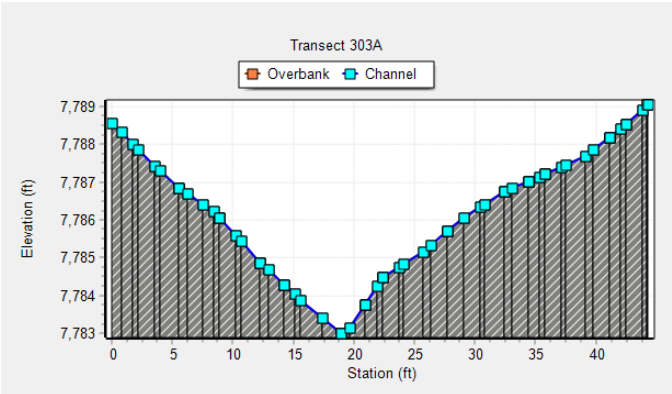

Transect 202B
Overbank
Channel
Elevation (ft)
8,906
8,905
8,904
8,903
8,902
8,901
8,900
0
10
20
30
40
50
60
70
80
Station (ft)

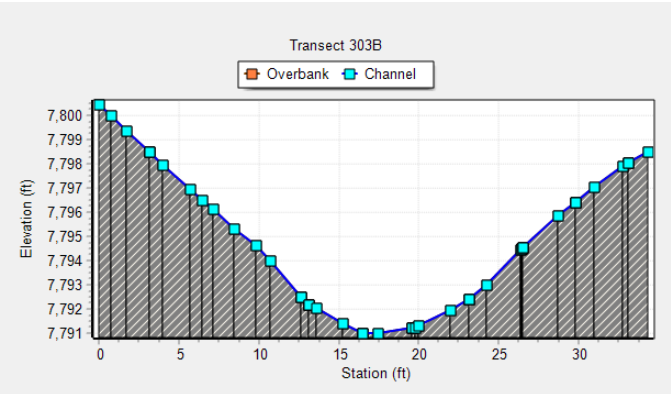

Transect 203
Overbank
Channel
Elevation (ft)
8,505
8,500
8,495
8,490
8,485
8,480
8,475
0
20
40
60
80
100
120
140
160
180
Station (ft)

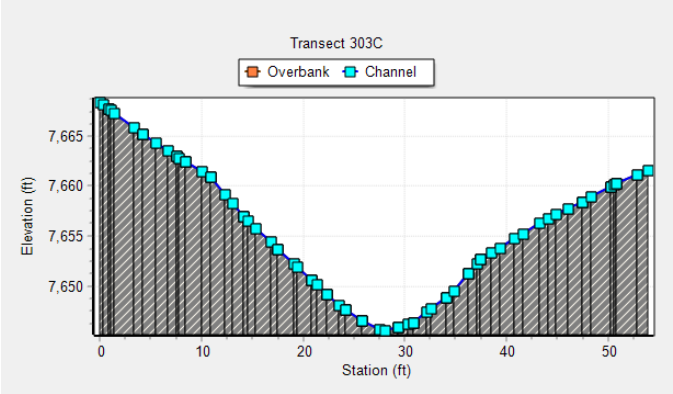

Transect 204
Overbank
Channel
Elevation (ft)
7,810
7,808
7,806
7,804
7,802
7,800
7,798
7,796
0
50
100
150
200
Station (ft)

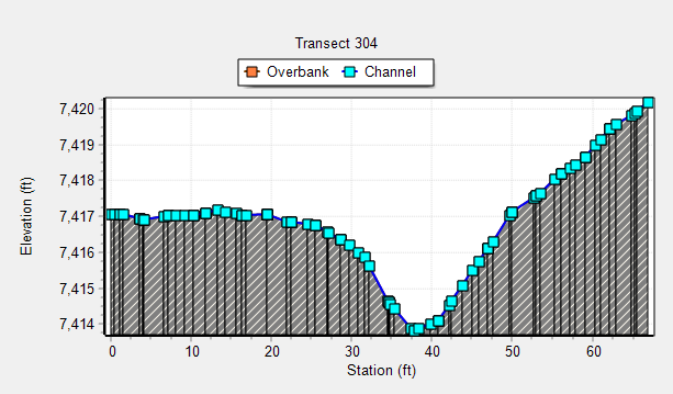

Transect 207
Overbank
Channel
Elevation (ft)
8,615
8,610
8,605
8,600
8,595
0
20
40
60
80
100
120
140
160
Station (ft)

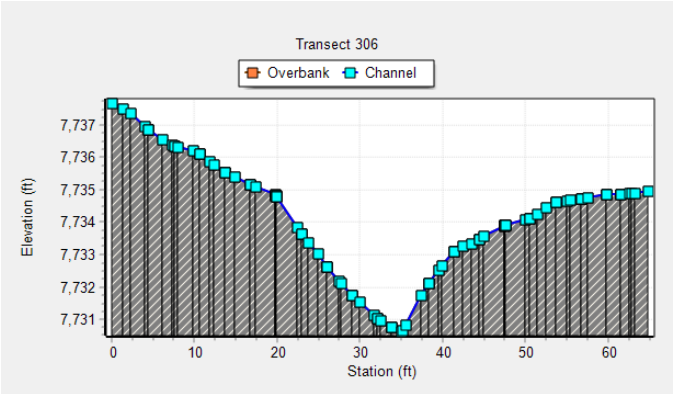

Transect 208
Overbank
Channel
Elevation (ft)
8,878
8,877.5
8,877
8,876.5
8,876
8,875.5
8,875
8,874.5
8,874
8,873.5
0
10
20
30
40
50
60
Station (ft)

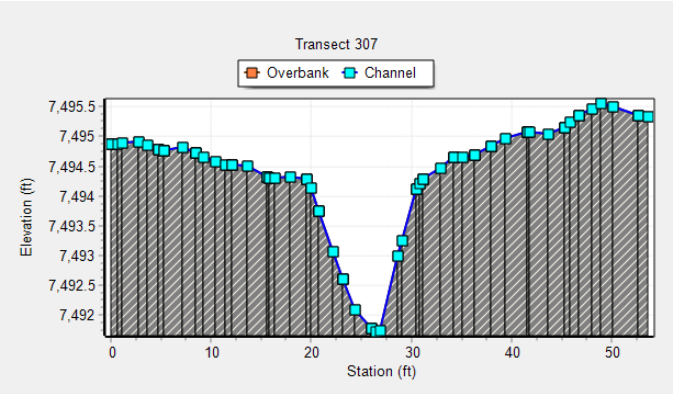

Transect 303A
Overbank
Channel
Elevation (ft)
7,789
7,788
7,787
7,786
7,785
7,784
7,783
0
5
10
15
20
25
30
35
40
Station (ft)

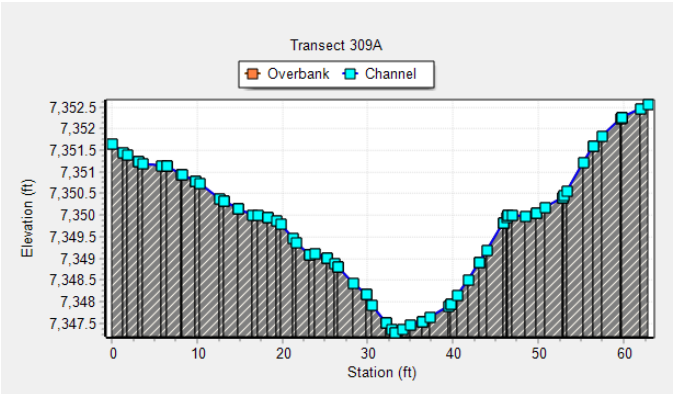

Transect 303B
Overbank
Channel
Elevation (ft)
7,800
7,799
7,798
7,797
7,796
7,795
7,794
7,793
7,792
7,791
0
5
10
15
20
25
30
Station (ft)

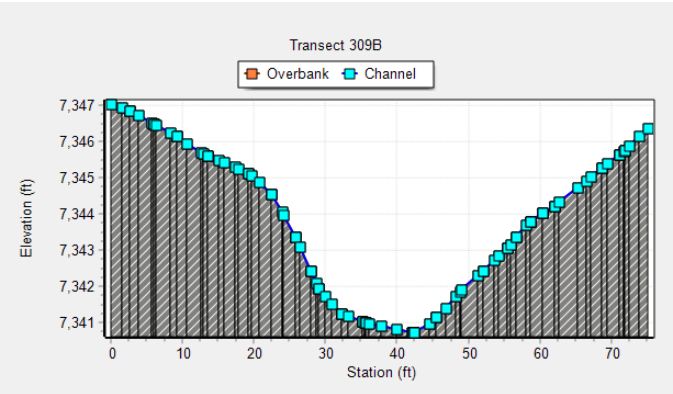


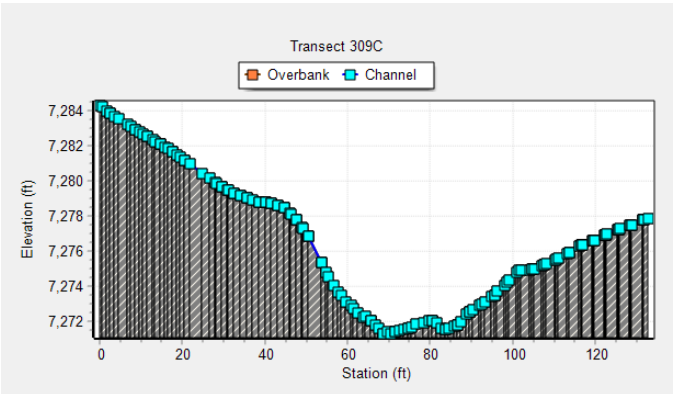


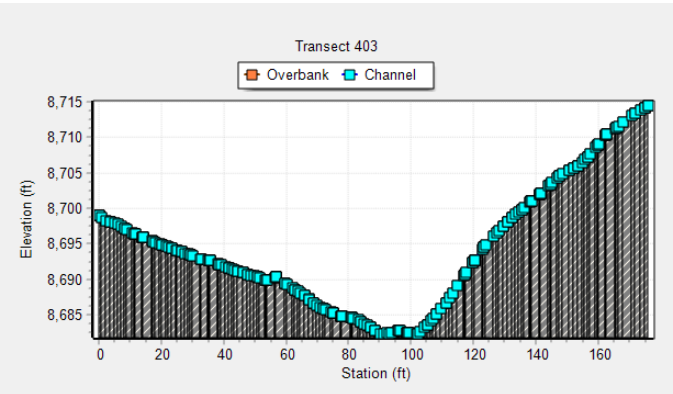




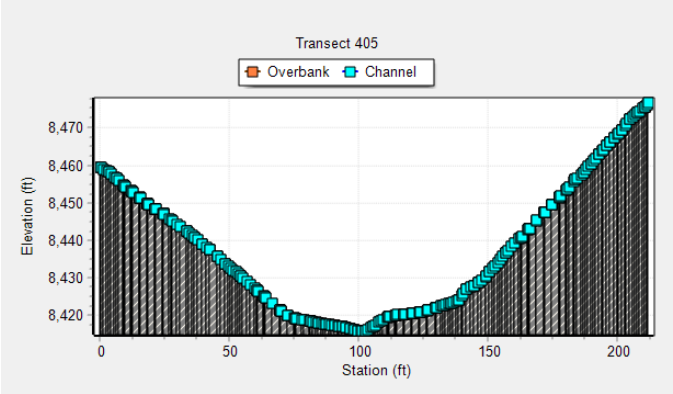


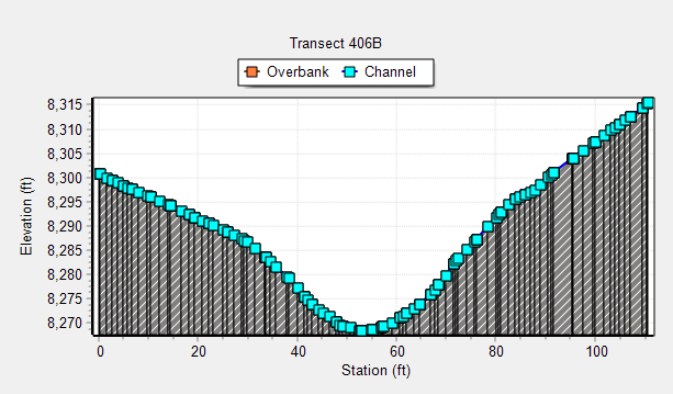


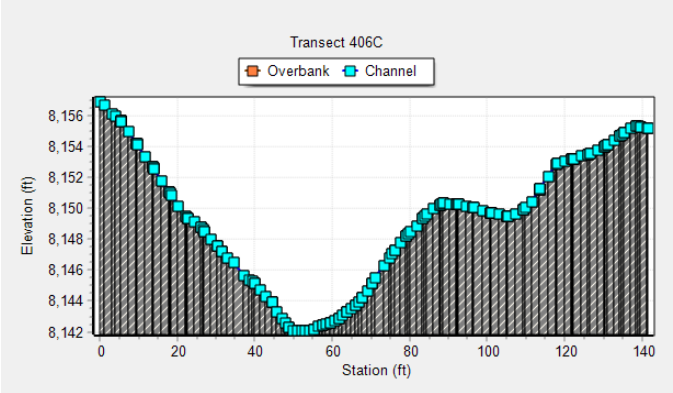


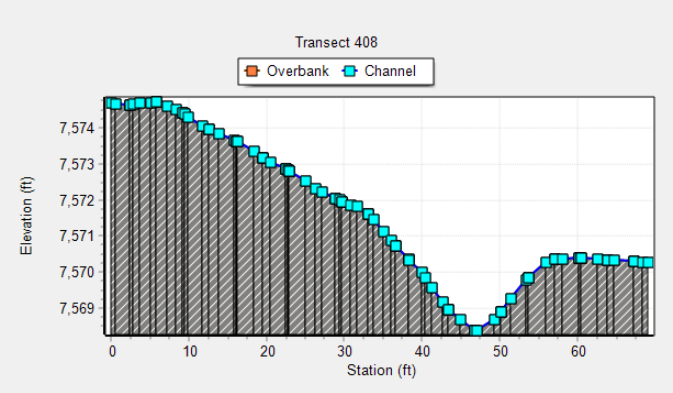


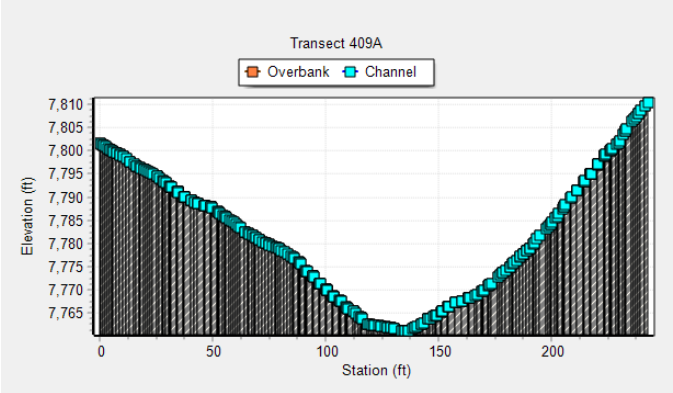
Transect 403 used for Conduit 403 and 406A

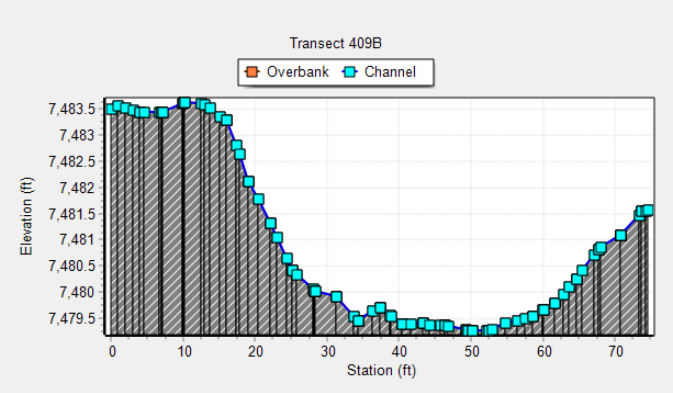

Transect 405
Overbank
Channel
Elevation (ft)
8,470
8,460
8,450
8,440
8,430
8,420
0
50
100
150
200
Station (ft)

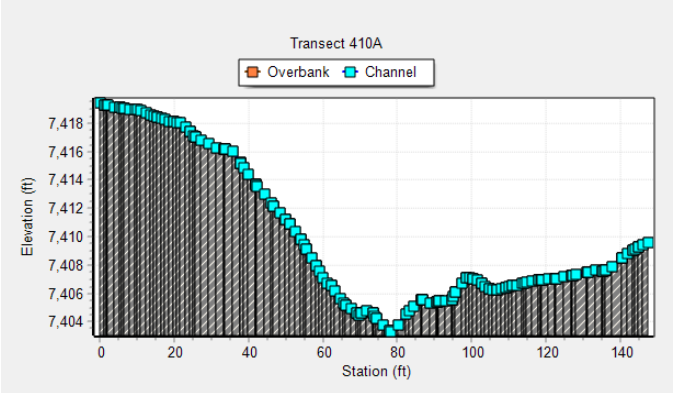

Transect 406B
Overbank
Channel
Elevation (ft)
8,315
8,310
8,305
8,300
8,295
8,290
8,285
8,280
8,275
8,270
0
20
40
60
80
100
Station (ft)

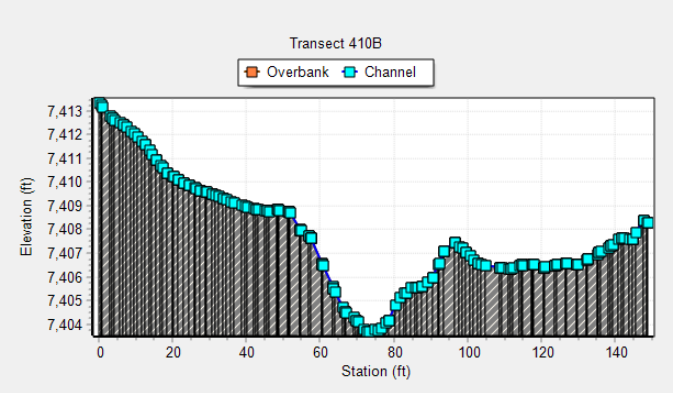

Transect 406C
Overbank
Channel
Elevation (ft)
8,156
8,154
8,152
8,150
8,148
8,146
8,144
8,142
0
20
40
60
80
100
120
140
Station (ft)

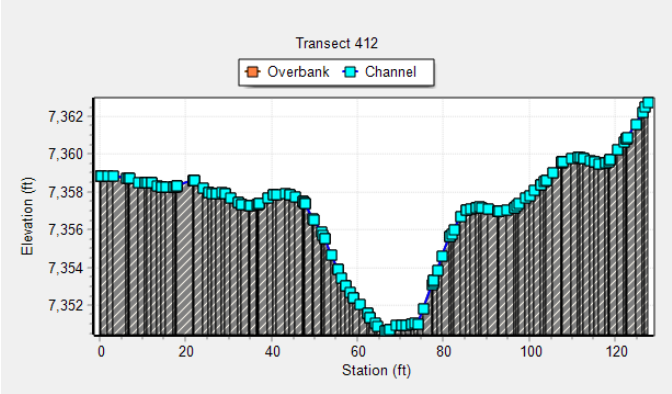

Transect 408
Overbank
Channel
Elevation (ft)
7,574
7,573
7,572
7,571
7,570
7,569
0
10
20
30
40
50
60
Station (ft)

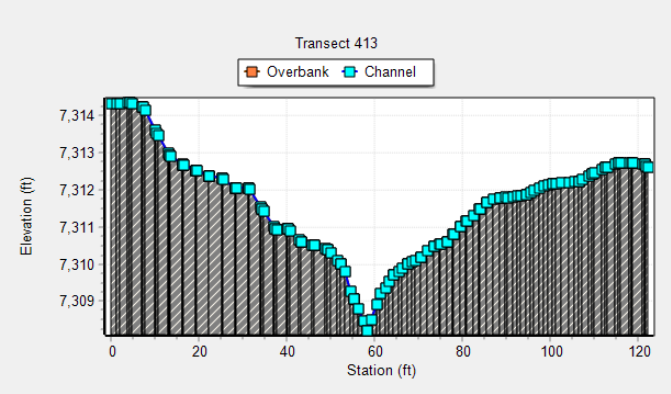

Transect 409A
Overbank
Channel
Elevation (ft)
7,810
7,805
7,800
7,795
7,790
7,785
7,780
7,775
7,770
7,765
0
50
100
150
200
Station (ft)

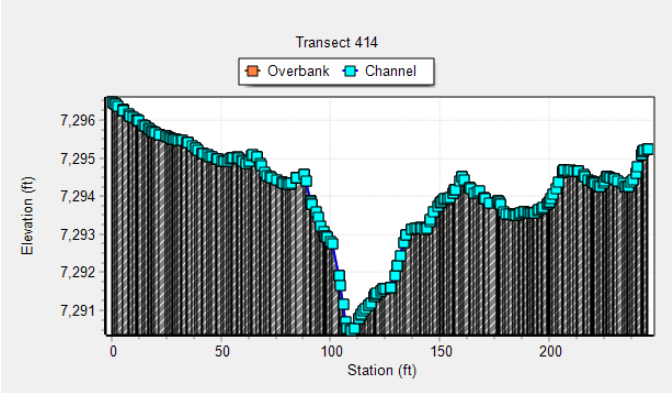

Transect 409B
Overbank
Channel
Elevation (ft)
7,483.5
7,483
7,482.5
7,482
7,481.5
7,481
7,480.5
7,480
7,479.5
0
10
20
30
40
50
60
70
Station (ft)

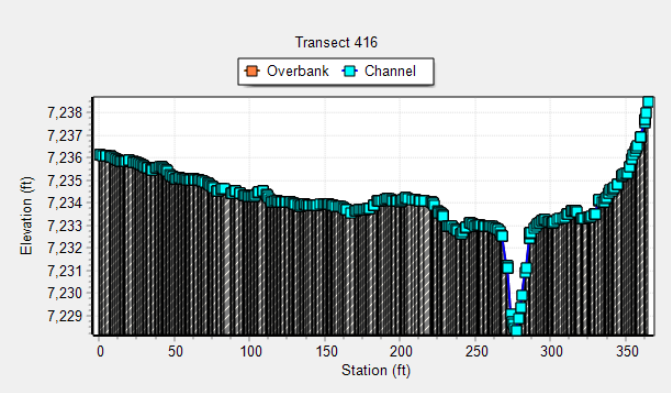

Transect 410A
Overbank
Channel
Elevation (ft)
7,418
7,416
7,414
7,412
7,410
7,408
7,406
7,404
0
20
40
60
80
100
120
140
Station (ft)

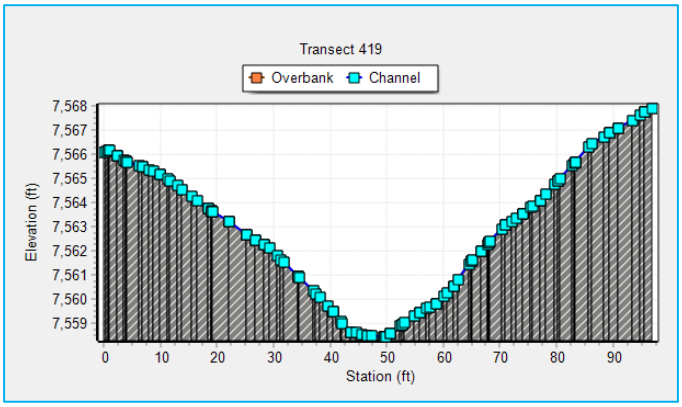

Transect 410B
Overbank
Channel
Elevation (ft)
7,413
7,412
7,411
7,410
7,409
7,408
7,407
7,406
7,405
7,404
0
20
40
60
80
100
120
140
Station (ft)

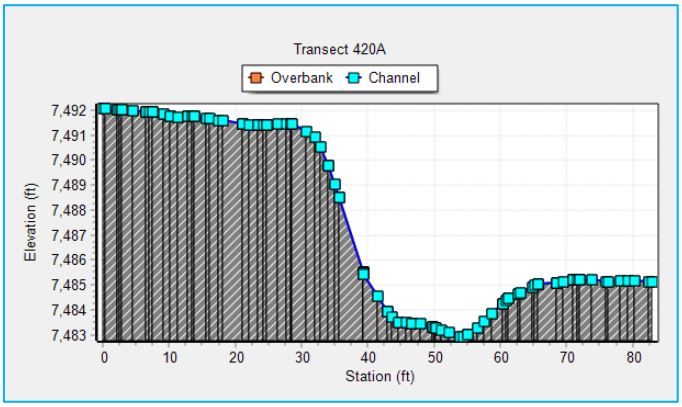

Transect 412
Overbank
Channel
Elevation (ft)
7,362
7,360
7,358
7,356
7,354
7,352
0
20
40
60
80
100
120
Station (ft)

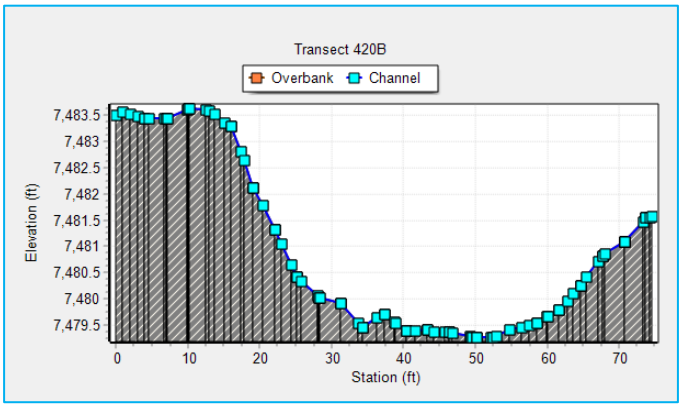

Transect 413
Overbank
Channel
Elevation (ft)
7,314
7,313
7,312
7,311
7,310
7,309
0
20
40
60
80
100
120
Station (ft)

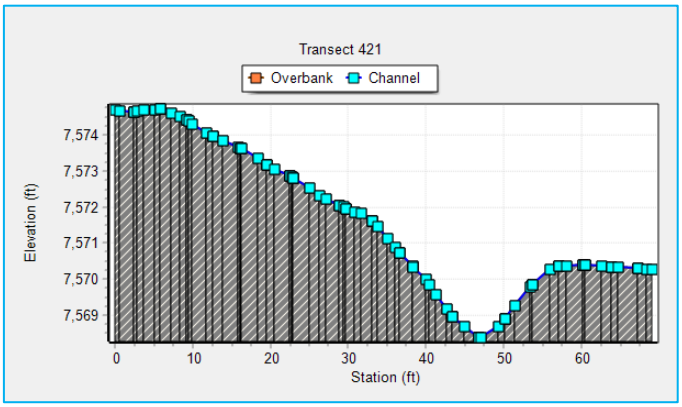

Transect 414
Overbank
Channel
Elevation (ft)
7,296
7,295
7,294
7,293
7,292
7,291
0
50
100
150
200
Station (ft)

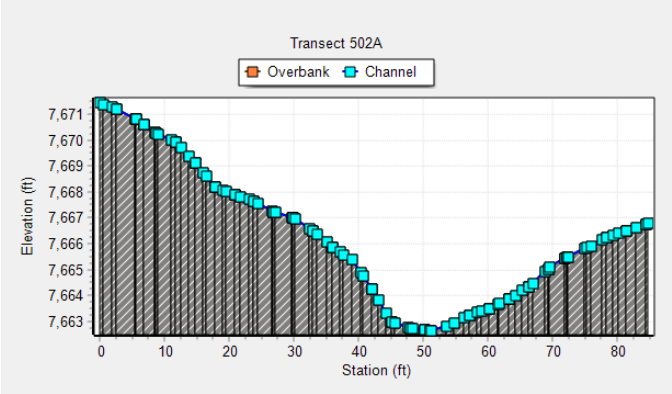

Transect 416
Overbank
Channel
Elevation (ft)
7,238
7,237
7,236
7,235
7,234
7,233
7,232
7,231
7,230
7,229
0
50
100
150
200
250
300
350
Station (ft)

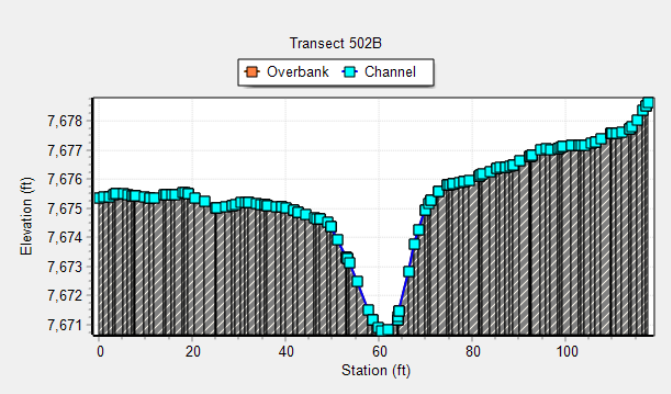

Transect 419
Overbank
Channel
Elevation (ft)
7,568
7,567
7,566
7,565
7,564
7,563
7,562
7,561
7,560
7,559
0
10
20
30
40
50
60
70
80
90
Station (ft)

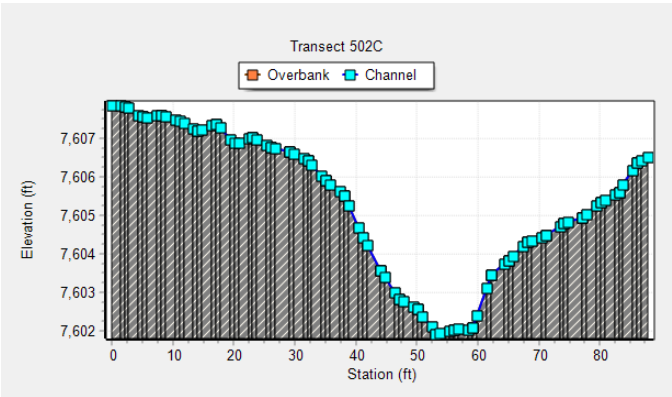

Transect 420A
Overbank
Channel
Elevation (ft)
7,492
7,491
7,490
7,489
7,488
7,487
7,486
7,485
7,484
7,483
0
10
20
30
40
50
60
70
80
Station (ft)

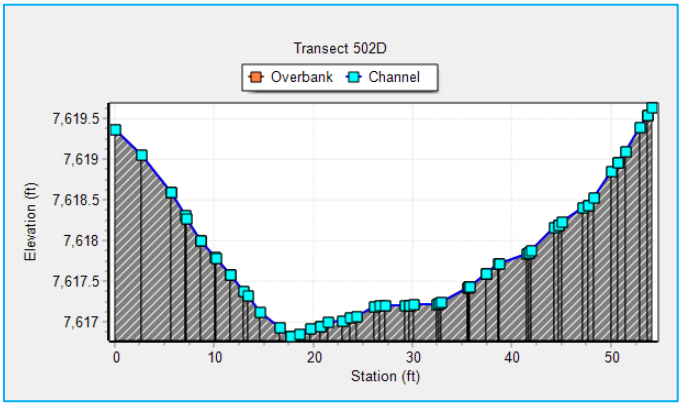

Transect 420B
Overbank
Channel
Elevation (ft)
7,483.5
7,483
7,482.5
7,482
7,481.5
7,481
7,480.5
7,480
7,479.5
0
10
20
30
40
50
60
70
Station (ft)

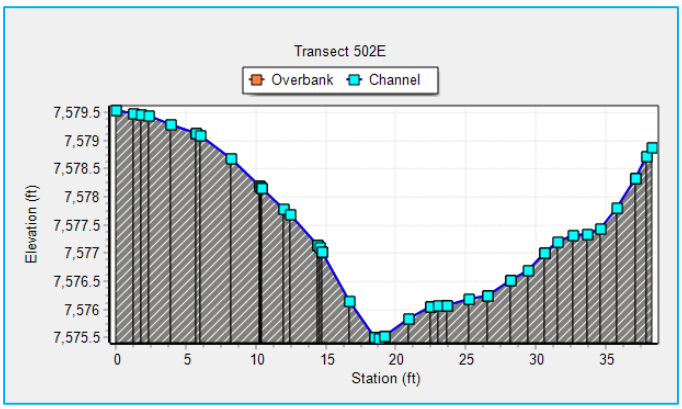

Transect 421
Overbank
Channel
Elevation (ft)
7,574
7,573
7,572
7,571
7,570
7,569
0
10
20
30
40
50
60
Station (ft)

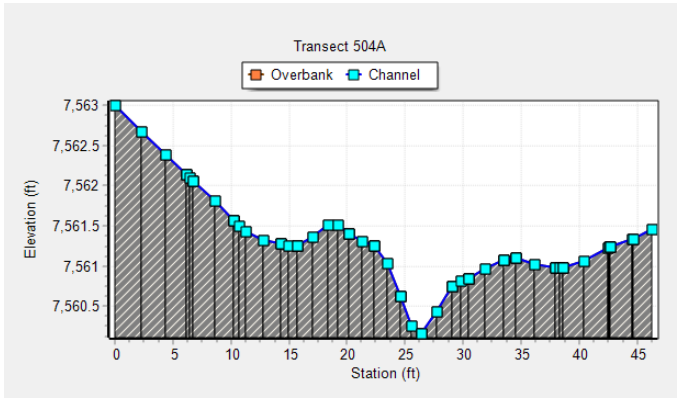

Transect 502A
Overbank
Channel
Elevation (ft)
7,671
7,670
7,669
7,668
7,667
7,666
7,665
7,664
7,663
0
10
20
30
40
50
60
70
80
Station (ft)

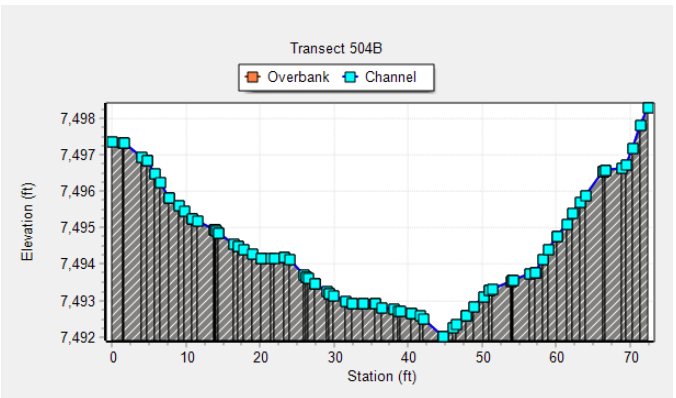

Transect 502B
Overbank
Channel
Elevation (ft)
7,678
7,677
7,676
7,675
7,674
7,673
7,672
7,671
0
20
40
60
80
100
Station (ft)

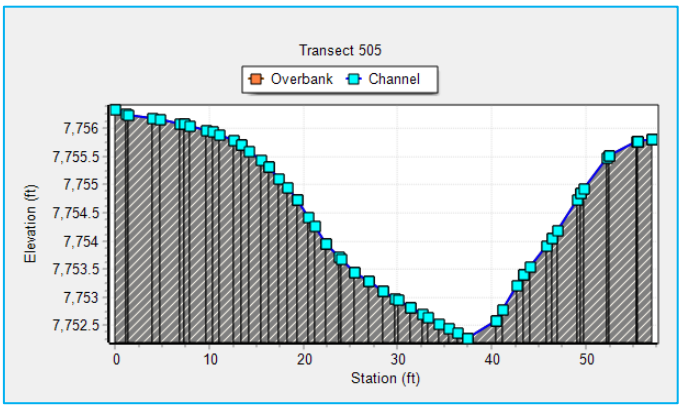

Transect 502C
Overbank
Channel
Elevation (ft)
7,607
7,606
7,605
7,604
7,603
7,602
0
10
20
30
40
50
60
70
80
Station (ft)

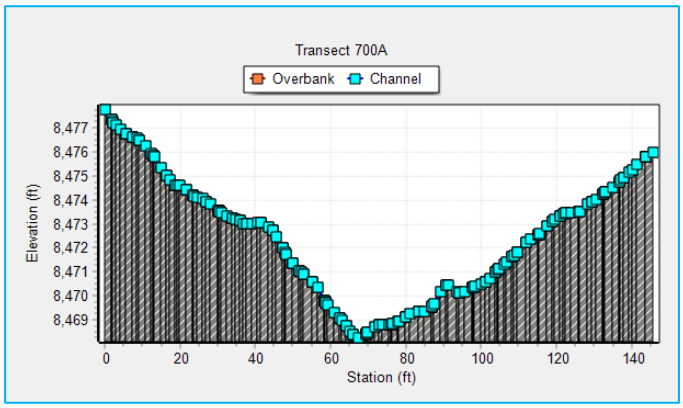

Transect 502D
Overbank
Channel
Elevation (ft)
7,619.5
7,619
7,618.5
7,618
7,617.5
7,617
0
10
20
30
40
50
Station (ft)

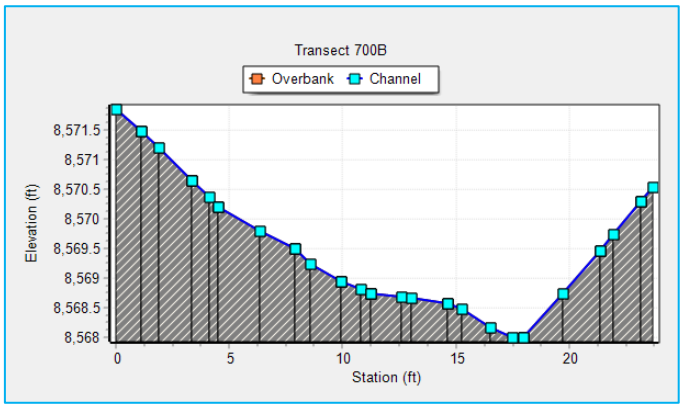

Transect 502E
Overbank
Channel
Elevation (ft)
7,579.5
7,579
7,578.5
7,578
7,577.5
7,577
7,576.5
7,576
7,575.5
0
5
10
15
20
25
30
35
Station (ft)

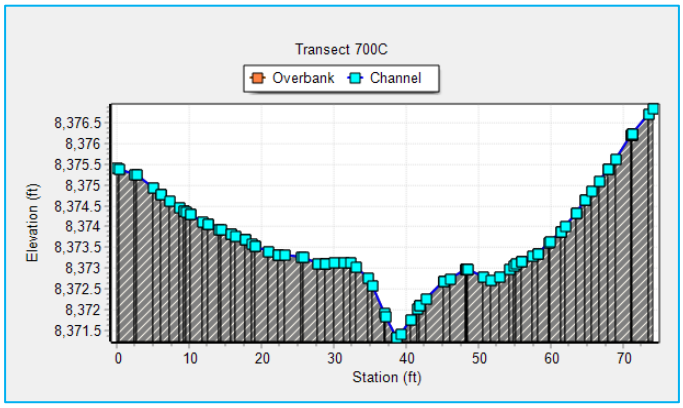

Transect 504A
Overbank
Channel
Elevation (ft)
7,563
7,562.5
7,562
7,561.5
7,561
7,560.5
0
5
10
15
20
25
30
35
40
45
Station (ft)

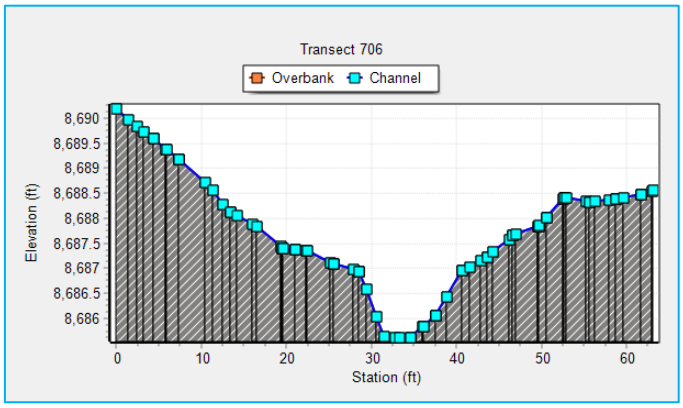

Transect 504B
Overbank
Channel
Elevation (ft)
7,498
7,497
7,496
7,495
7,494
7,493
7,492
0
10
20
30
40
50
60
70
Station (ft)

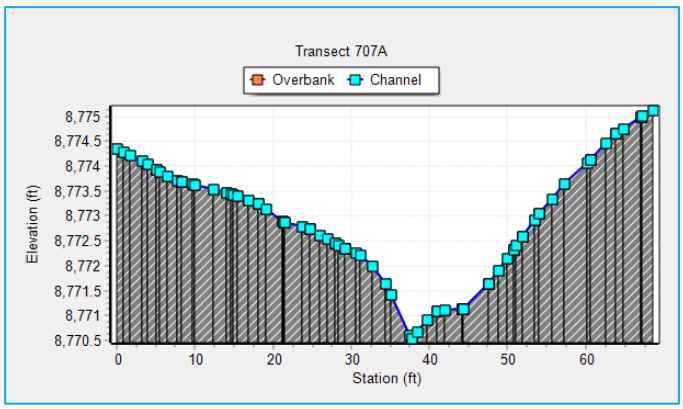

Transect 505
Overbank
Channel
Elevation (ft)
7,756
7,755.5
7,755
7,754.5
7,754
7,753.5
7,753
7,752.5
0
10
20
30
40
50
Station (ft)

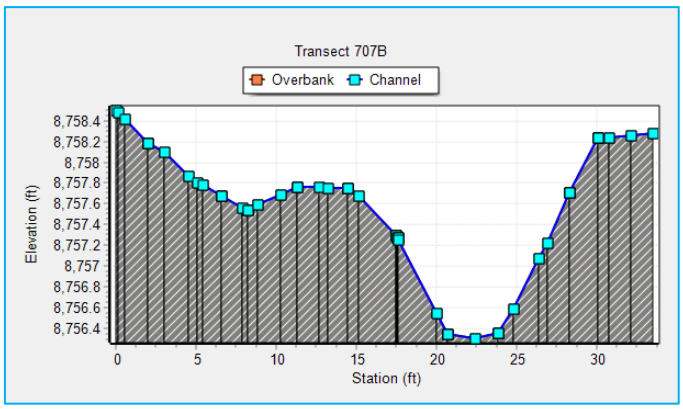


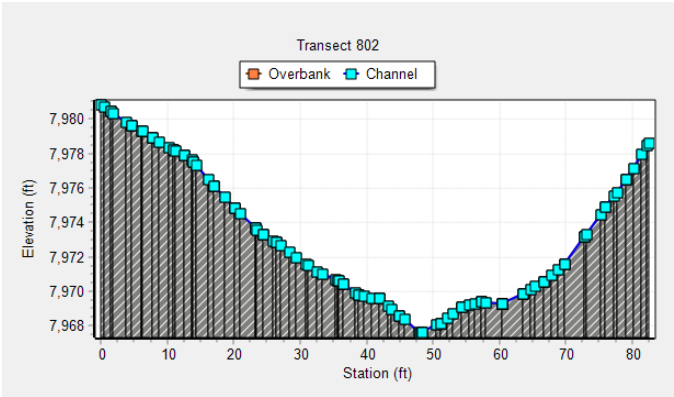


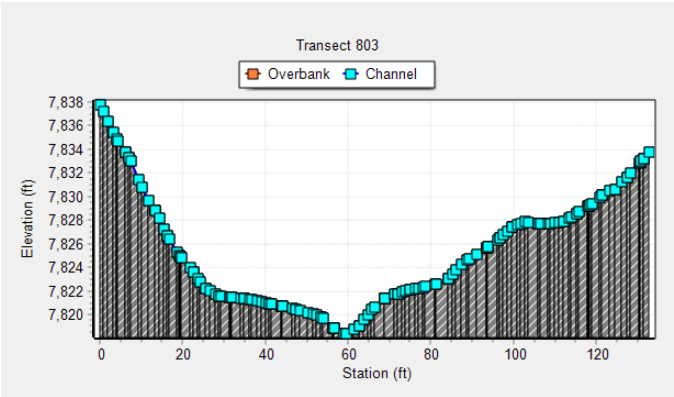




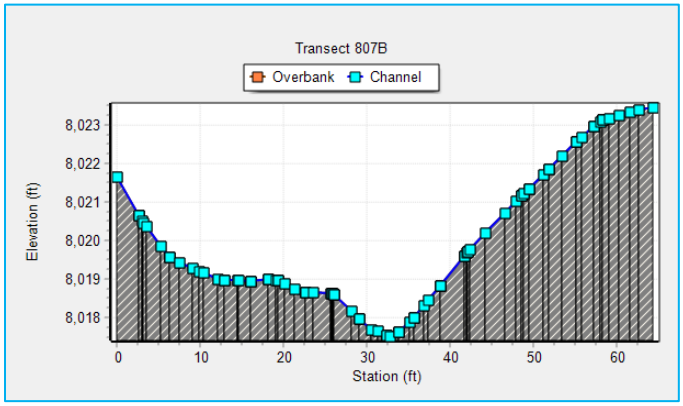








Transect 802 used for Conduit 802 and 807A



Note: "Dummy" Conduits utilized for Links 401, 411, 415, 503, 701, 705, 801

Stagecoach - Proposed Conditions (Linked to CUHP)

Node Inflow Summary

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error %
100	OUTFALL	3.85	3.85	0	01:14	0.191	0.191	0.000
101	OUTFALL	2.32	2.32	0	00:54	0.0838	0.0838	0.000
102	OUTFALL	2.15	2.15	0	00:45	0.0665	0.0665	0.000
103	OUTFALL	0.82	0.82	0	00:38	0.0183	0.0183	0.000
200	JUNCTION	3.57	3.57	0	00:39	0.115	0.115	0.000
201	JUNCTION	2.43	2.43	0	00:38	0.0878	0.0878	0.000
202	JUNCTION	8.17	11.96	0	00:57	0.232	0.485	0.000
203	JUNCTION	1.55	13.70	0	01:23	0.038	0.673	0.000
204	OUTFALL	8.43	11.73	0	02:43	0.337	1.18	0.000
205	OUTFALL	2.59	2.59	0	00:41	0.0503	0.0503	0.000
206	OUTFALL	1.40	1.40	0	00:56	0.0515	0.0515	0.000
207	JUNCTION	4.02	4.02	0	00:39	0.128	0.128	0.000
208	JUNCTION	1.58	4.73	0	00:46	0.0387	0.155	0.000
300	OUTFALL	0.30	0.30	0	00:42	0.00809	0.00809	0.000
301	JUNCTION	0.16	0.16	0	00:41	0.00416	0.00416	0.000

Stagecoach - Proposed Conditions (Linked to CUHP)

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error %
302	JUNCTION	0.35	0.35	0	00:46	0.0114	0.0114	0.000
303	JUNCTION	1.03	1.03	0	00:42	0.0303	0.0469	-0.000
303A	JUNCTION	0.00	0.47	0	00:57	0	0.0158	0.000
304	JUNCTION	3.23	3.44	0	00:43	0.0808	0.129	0.000
305	JUNCTION	0.31	0.31	0	00:44	0.00931	0.00931	0.000
306	JUNCTION	1.07	1.08	0	00:41	0.0237	0.0333	0.000
307	JUNCTION	1.42	2.19	0	00:53	0.0492	0.0841	0.000
308	JUNCTION	2.03	6.90	0	00:54	0.0559	0.271	0.000
309	OUTFALL	5.79	8.59	0	01:25	0.198	0.502	0.000
310	OUTFALL	3.45	3.45	0	00:41	0.104	0.104	0.000
311	OUTFALL	0.54	0.54	0	00:36	0.00925	0.00925	0.000
400	JUNCTION	5.28	5.28	0	00:57	0.22	0.22	0.000
401	JUNCTION	4.81	4.81	0	00:43	0.157	0.157	0.000
402	JUNCTION	1.40	1.40	0	00:38	0.0325	0.0325	0.000
403	JUNCTION	0.76	1.71	0	00:49	0.0169	0.0469	0.000
404	JUNCTION	2.25	2.25	0	00:44	0.0637	0.0637	0.000
405	JUNCTION	2.01	3.35	0	00:56	0.0568	0.11	0.000

Stagecoach - Proposed Conditions (Linked to CUHP)

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error %
406	JUNCTION	2.24	9.45	0	01:07	0.0521	0.373	0.000
406A	JUNCTION	0.00	6.40	0	00:46	0	0.202	0.000
407	JUNCTION	2.53	2.53	0	00:36	0.0694	0.0694	0.000
408	JUNCTION	3.48	5.67	0	00:39	0.0909	0.161	0.000
409	JUNCTION	1.28	10.39	0	01:08	0.0414	0.402	0.000
410	JUNCTION	5.72	26.62	0	01:27	0.124	1.58	0.000
411	JUNCTION	2.90	2.90	0	00:32	0.0745	0.0745	0.000
412	JUNCTION	6.19	29.89	0	01:01	0.151	1.73	0.000
413	JUNCTION	2.70	31.55	0	01:08	0.0854	1.82	0.000
414	JUNCTION	5.81	36.37	0	01:14	0.172	2.1	0.000
415	JUNCTION	2.50	2.50	0	00:49	0.096	0.096	0.000
416	OUTFALL	1.28	35.94	0	01:27	0.0275	2.14	0.000
417	OUTFALL	0.80	0.80	0	00:36	0.0126	0.0126	0.000
418	OUTFALL	0.66	0.66	0	00:33	0.0081	0.0081	0.000
419	JUNCTION	0.90	11.03	0	01:14	0.0386	0.442	0.000
420	JUNCTION	15.72	20.33	0	01:29	0.391	1.15	0.000
421	JUNCTION	4.45	8.62	0	00:50	0.116	0.281	0.000

Stagecoach - Proposed Conditions (Linked to CUHP)

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error %
422	OUTFALL	0.11	0.11	0	00:35	0.00183	0.00183	0.000
500	JUNCTION	0.61	0.61	0	00:41	0.0174	0.0174	0.000
501	JUNCTION	8.70	8.70	0	00:40	0.257	0.257	0.000
502	JUNCTION	4.44	14.79	0	00:57	0.115	0.495	0.000
502A	JUNCTION	0.00	10.53	0	00:52	0	0.341	0.000
502B	JUNCTION	0.00	11.64	0	00:56	0	0.38	0.000
503	JUNCTION	2.33	2.33	0	00:44	0.0713	0.0713	0.000
504	OUTFALL	5.74	18.20	0	01:16	0.189	0.767	0.000
504A	JUNCTION	0.00	16.65	0	00:59	0	0.566	0.000
505	JUNCTION	2.11	10.28	0	00:47	0.0627	0.322	0.000
506	JUNCTION	1.36	1.36	0	00:37	0.0363	0.0363	0.000
600	OUTFALL	1.63	1.63	0	00:57	0.0661	0.0661	0.000
700	OUTFALL	6.38	7.56	0	00:42	0.14	0.391	0.000
700A	JUNCTION	0.00	3.61	0	01:28	0	0.208	0.000
701	JUNCTION	1.30	1.30	0	00:49	0.0427	0.0427	0.000
702	JUNCTION	0.74	0.74	0	00:42	0.03	0.03	0.000
703	JUNCTION	1.16	1.16	0	00:53	0.0649	0.0649	0.000

Stagecoach - Proposed Conditions (Linked to CUHP)

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error %
704	JUNCTION	0.75	0.75	0	00:55	0.0292	0.0292	0.000
705	JUNCTION	0.07	0.07	0	00:47	0.00332	0.00332	0.000
706	JUNCTION	1.89	1.96	0	00:43	0.0503	0.0836	0.000
707	JUNCTION	0.64	2.36	0	01:05	0.0196	0.118	0.000
800	JUNCTION	3.88	3.88	0	01:49	0.259	0.259	0.000
801	JUNCTION	1.05	1.05	0	01:35	0.084	0.084	0.000
802	JUNCTION	5.94	6.59	0	01:54	0.234	0.495	0.000
803	OUTFALL	0.85	7.92	0	02:45	0.0275	0.716	0.000
804	OUTFALL	2.57	2.57	0	00:56	0.0976	0.0976	0.000
805	OUTFALL	1.36	1.36	0	00:58	0.054	0.054	0.000
806	JUNCTION	1.37	1.37	0	00:54	0.053	0.053	0.000
807	JUNCTION	1.38	7.92	0	02:12	0.0285	0.682	0.000

Stagecoach - Proposed Conditions (Linked to CUHP)

Node Inflow Summary

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error %
100	OUTFALL	302.23	302.23	0	01:21	15	15	0.000
101	OUTFALL	145.58	145.58	0	01:03	5.42	5.42	0.000
102	OUTFALL	69.98	69.98	0	00:53	2.2	2.2	0.000
103	OUTFALL	29.22	29.22	0	00:45	0.701	0.701	0.000
200	JUNCTION	40.59	40.59	0	00:48	1.15	1.15	0.000
201	JUNCTION	19.74	19.74	0	00:47	0.57	0.57	0.000
202	JUNCTION	134.12	192.09	0	00:54	3.46	5.52	0.000
203	JUNCTION	113.79	299.77	0	01:06	3.03	9.77	0.000
204	OUTFALL	400.01	581.71	0	01:22	15.9	26.5	0.000
205	OUTFALL	231.61	231.61	0	00:48	5.1	5.1	0.000
206	OUTFALL	135.96	135.96	0	01:04	5.23	5.23	0.000
207	JUNCTION	35.08	35.08	0	00:47	1.01	1.01	0.000
208	JUNCTION	13.60	52.77	0	00:51	0.312	1.46	0.000
300	OUTFALL	24.13	24.13	0	00:50	0.703	0.703	0.000
301	JUNCTION	13.89	13.89	0	00:49	0.401	0.401	0.000

Stagecoach - Proposed Conditions (Linked to CUHP)

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error %
302	JUNCTION	32.33	32.33	0	00:55	1.14	1.14	0.000
303	JUNCTION	32.90	75.23	0	01:00	0.991	2.54	0.000
303A	JUNCTION	0.00	45.65	0	00:56	0	1.54	0.000
304	JUNCTION	29.75	97.65	0	01:02	0.701	3.25	0.000
305	JUNCTION	26.41	26.41	0	00:53	0.857	0.857	0.000
306	JUNCTION	16.25	40.28	0	00:53	0.363	1.22	0.000
307	JUNCTION	13.47	52.16	0	00:58	0.423	1.65	0.000
308	JUNCTION	20.41	165.70	0	01:03	0.527	5.44	0.000
309	OUTFALL	77.62	210.34	0	01:16	2.49	8.07	0.000
310	OUTFALL	46.63	46.63	0	00:48	1.34	1.34	0.000
311	OUTFALL	25.92	25.92	0	00:42	0.51	0.51	0.000
400	JUNCTION	167.52	167.52	0	01:06	6.82	6.82	0.000
401	JUNCTION	95.90	95.90	0	00:52	2.8	2.8	0.000
402	JUNCTION	31.88	31.88	0	00:45	0.764	0.764	0.000
403	JUNCTION	18.76	49.92	0	00:47	0.412	1.18	0.000
404	JUNCTION	77.28	77.28	0	00:52	2.26	2.26	0.000
405	JUNCTION	33.89	108.05	0	00:55	0.934	3.19	0.000

Stagecoach - Proposed Conditions (Linked to CUHP)

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error %
406	JUNCTION	103.61	333.67	0	00:57	2.48	9.71	0.000
406A	JUNCTION	0.00	145.02	0	00:50	0	3.98	0.000
407	JUNCTION	19.03	19.03	0	00:43	0.475	0.475	0.000
408	JUNCTION	20.47	38.83	0	00:44	0.458	0.933	0.000
409	JUNCTION	57.87	390.81	0	00:58	1.93	11.6	0.000
410	JUNCTION	41.84	700.32	0	01:13	0.844	24.7	0.000
411	JUNCTION	13.74	13.74	0	00:40	0.3	0.3	0.000
412	JUNCTION	49.89	726.49	0	01:14	1.13	25.9	0.000
413	JUNCTION	19.69	737.88	0	01:16	0.555	26.4	0.000
414	JUNCTION	38.61	792.65	0	01:22	1.02	29.7	0.000
415	JUNCTION	61.17	61.17	0	00:57	2.27	2.27	0.000
416	OUTFALL	66.47	751.27	0	01:37	1.57	31.3	0.000
417	OUTFALL	56.70	56.70	0	00:42	1.05	1.05	0.000
418	OUTFALL	54.55	54.55	0	00:40	0.823	0.823	0.000
419	JUNCTION	15.47	405.30	0	01:00	0.62	12.3	0.000
420	JUNCTION	104.48	515.51	0	01:08	2.35	16.7	0.000
421	JUNCTION	36.54	71.83	0	00:50	0.88	1.82	0.000

Stagecoach - Proposed Conditions (Linked to CUHP)

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error %
422	OUTFALL	9.38	9.38	0	00:41	0.186	0.186	0.000
500	JUNCTION	20.39	20.39	0	00:49	0.601	0.601	0.000
501	JUNCTION	81.98	81.98	0	00:47	2.23	2.23	0.000
502	JUNCTION	47.37	178.28	0	00:55	1.16	5	0.000
502A	JUNCTION	0.00	119.18	0	00:54	0	3.37	0.000
502B	JUNCTION	0.00	135.93	0	00:55	0	3.83	0.000
503	JUNCTION	64.61	64.61	0	00:52	1.99	1.99	0.000
504	OUTFALL	48.48	276.55	0	01:03	1.43	8.49	0.000
504A	JUNCTION	0.00	241.83	0	00:55	0	6.99	0.000
505	JUNCTION	19.33	100.25	0	00:50	0.528	2.76	0.000
506	JUNCTION	17.53	17.53	0	00:45	0.453	0.453	0.000
600	OUTFALL	115.25	115.25	0	01:06	4.77	4.77	0.000
700	OUTFALL	166.97	399.62	0	01:09	3.83	14.4	0.000
700A	JUNCTION	0.00	215.11	0	01:11	0	7.8	0.000
701	JUNCTION	80.79	80.79	0	00:57	2.76	2.76	0.000
702	JUNCTION	13.32	13.32	0	00:51	0.473	0.473	0.000
703	JUNCTION	25.34	25.34	0	00:56	0.988	0.988	0.000

Stagecoach - Proposed Conditions (Linked to CUHP)

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error %
704	JUNCTION	106.18	106.18	0	01:02	3.67	3.67	0.000
705	JUNCTION	24.84	24.84	0	00:53	0.717	0.717	0.000
706	JUNCTION	39.18	47.14	0	00:54	1.04	1.53	0.000
707	JUNCTION	25.50	175.34	0	01:03	0.811	6.19	0.000
800	JUNCTION	410.93	410.93	0	01:55	26.7	26.7	0.000
801	JUNCTION	80.56	80.56	0	01:31	5.41	5.41	0.000
802	JUNCTION	543.06	755.12	0	01:38	21.8	48.5	0.000
803	OUTFALL	62.05	916.05	0	01:51	2.12	60.5	0.000
804	OUTFALL	150.34	150.34	0	01:05	5.83	5.83	0.000
805	OUTFALL	133.88	133.88	0	01:07	5.49	5.49	0.000
806	JUNCTION	81.59	81.59	0	01:03	3.24	3.24	0.000
807	JUNCTION	39.08	891.47	0	01:44	0.864	58.3	0.000

Proposed Runoff - Overall					
Design Point	Tributary Basin(s)	Direct Runoff (cfs)		Routed Runoff (cfs)	
		Q5	Q100	Q5	Q100
100	100	3.9	302.2	-	-
101	101	2.3	145.6	-	-
102	102	2.2	70.0	-	-
103	103	0.8	29.2	-	-
200	200	3.6	40.6	-	-
201	201	2.4	19.7	-	-
-	202	8.2	134.1	-	-
202	200/201/202/208	-	-	12.0	192.1
-	203	1.6	113.8	-	-
203	200/201/202/203/207	-	-	13.7	299.8
-	204	8.4	400.0	-	-
204	200/201/202/203/204	-	-	11.7	581.7
205	205	2.6	231.6	-	-
206	206	1.4	136.0	-	-
207	207	4.0	35.1	-	-
-	208	1.6	13.6	-	-
208	200/208	-	-	4.7	52.8
300	300	0.3	24.1	-	-
301	301	0.2	13.9	-	-
302	302	0.4	32.3	-	-
-	303	1.0	32.9	-	-
303	301/302/303	-	-	1.0	75.2
-	304	3.2	29.8	-	-
304	301/302/303/304	-	-	3.4	97.7
-	305	0.3	26.4	-	-
305	305/306	-	-	0.3	26.4
-	306	1.1	16.3	-	-
306	305/306	-	-	1.1	40.3
-	307	1.4	13.5	-	-
307	305/306/307	-	-	2.2	52.2
-	308	2.0	20.4	-	-
308	301/302/303/304/305/ 306/307/308	-	-	6.9	165.7
-	309	5.8	77.6	-	-
309	301/302/303/304/305/ 306/307/308/309	-	-	8.6	210.3
310	310	3.5	46.6	-	-
311	311	0.5	25.9	-	-
400	400	5.3	167.5	-	-
401	401	4.8	95.9	-	-
402	402	1.4	31.9	-	-
-	403	0.8	18.8	-	-
403	402/403	-	-	1.7	49.9
404	404	2.3	77.3	-	-
-	405	2.0	33.9	-	-
405	404/405	-	-	3.4	108.1
-	406	2.2	103.6	-	-
406	401/402/403/404/405/406	-	-	9.5	333.7
407	407	2.5	19.0	-	-
-	408	3.5	20.5	-	-
408	407/408	-	-	5.7	38.8
-	409	1.3	57.9	-	-
409	401/402/403/404/405/ 406/409	-	-	10.4	390.8
-	410	5.7	41.8	-	-
410	400/401/402/403/404/405/ 406/407/408/409/410/411/ 419/420/421	-	-	26.6	700.3
411	411	2.9	13.7	-	-
-	412	6.2	49.9	-	-
412	400/401/402/403/404/405/ 406/407/408/409/410/411/ 412/419/420/421	-	-	29.9	726.5
-	413	2.7	19.7	-	-
413	400/401/402/403/404/405/ 406/407/408/409/410/411/ 412/413/419/420/421	-	-	31.6	737.9
-	414	5.8	38.6	-	-
414	400/401/402/403/404/405/ 406/407/408/409/410/411/ 412/413/414/419/420/421	-	-	36.4	792.7
415	415	2.5	61.2	-	-
-	416	1.3	66.5	-	-
416	400/401/402/403/404/405/ 406/407/408/409/410/411/ 412/413/414/415/416/419/ 420/421	-	-	35.9	751.3
417	417	0.8	56.7	-	-
418	418	0.7	54.6	-	-
-	419	0.9	15.5	-	-
419	401/402/403/404/405/ 406/409/419	-	-	11.0	405.3
-	420	15.7	104.5	-	-
420	401/402/403/404/405/406/ 407/408/409/419/420/421	-	-	20.3	515.5
-	421	4.5	36.5	-	-
421	407/408/421	-	-	8.6	71.8
422	422	0.1	9.4	-	-
500	500	0.6	20.4	-	-
501	501	8.7	82.0	-	-
-	502	4.4	47.4	-	-
502	500/501/502/505/506	-	-	14.8	178.3
503	503	2.3	64.6	-	-
-	504	5.7	48.5	-	-
504	500/501/502/503/504/ 505/506	-	-	18.2	276.6
-	505	2.1	19.3	-	-
505	501/505	-	-	10.3	100.3
506	506	1.4	17.5	-	-
600	600	1.6	115.3	-	-
-	700	6.4	167.0	-	-
700	700/701/702/703/704/ 705/706/707	-	-	7.6	399.6
701	701	1.3	80.8	-	-
702	702	0.7	13.3	-	-
703	703	1.2	25.3	-	-
704	704	0.8	106.2	-	-
705	705	0.1	24.8	-	-
-	706	1.9	39.2	-	-
706	702/706	-	-	2.0	47.1
-	707	0.6	25.5	-	-
707	703/704/705/707	-	-	2.4	175.3
800	800	3.9	410.9	-	-
801	801	1.1	80.6	-	-
-	802	5.9	543.1	-	-
802	800/802	-	-	6.6	755.1
-	803	0.9	62.1	-	-
803	800/801/802/803/806/807	-	-	7.9	916.1
804	804	2.6	150.3	-	-
805	805	1.4	133.9	-	-
806	806	1.4	81.6	-	-
-	807	1.4	39.1	-	-
807	800/801/802/806	-	-	7.9	891.5

APPENDIX C – HYDRAULIC CALCULATIONS

CULVERT SIZING TABLE				
Culvert ID	SWMM NODE ID	100 yr. Flow (cfs)	Culvert size (in)	Notes
1a	100	302	54" 2-barrel	
1b	100	302	54" 2-barrel	
2a	--	21	30" 1-barrel	50% of SWMM Basin 200
2b	200	41	36" 1-barrel	
3	201	20	30" 1-barrel	
4	--	203	48" 2-barrel	SWMM Node 202 + 10% of SWMM Basin 203
5	207	35	36" 1-barrel	
6	301	14	24" 1-barrel	
7	303	75	42" 1-barrel	
8a	304	98	36" 2-barrel	
9	305	26	30" 1-barrel	
10a	306	40	36" 1-barrel	
10b	--	40	36" 1-barrel	SWMM Node 305 + 80% of Basin 306
11	307	52	36" 1-barrel	
12a	400	168	48" 2-barrel	
12b	400	168	48" 2-barrel	
13	402	32	30" 1-barrel	
14	404	77	42" 1-barrel	
15	405	108	36" 2-barrel	
16	409	391	60" 2-barrel	
17	419	16	24" 1-barrel	
37	--	25	30" 1-barrel	50% of SWMM Basin 412
18	413	738	8'x8' Box Culvert	
19	414	793	8'x10' Box Culvert	
20	419	405	60" 2-barrel	
21a	420	516	6'x7' Box Culvert	
38	408	39	36" 1-barrel	
22a	421	72	42" 1-barrel	
23a	500	20	30" 1-barrel	
23b	500	20	30" 1-barrel	
24	501	82	42" 1-barrel	
25a	--	120	42" 2-barrel	SWMM Node 505 + 40% of SWMM Basin 502
25b	--	35	30" 1-barrel	SWMM Node 500 + 30% of SWMM Basin 502
25c	--	32	30" 1-barrel	SWMM Node 506 + 30% of SWMM Basin 502
25d	502	178	48" 2-barrel	
26	503	65	42" 1-barrel	
27	--	188	48" 2-barrel	SWMM Node 502 + 20% of SWMM Basin 504
28	505	100	36" 2-barrel	
29	506	18	24" 1-barrel	
30	702	13	24" 1-barrel	
31	703	25	30" 1-barrel	
32	704	106	36" 2-barrel	
33	706	47	36" 1-barrel	
34a	801	81	42" 1-barrel	
34b	801	81	42" 1-barrel	
34c	801	81	42" 1-barrel	
35	--	116	42" 2-barrel	80% of SWMM Basin 101

Generic Culvert Sizing Table*		
Max Allowable Flow (cfs)	Culvert Dimensions	Diameter Selection Above Allowable Flow
20	24" 1-barrel	30" 1-barrel
35	30" 1-barrel	36" 1-barrel
55	36" 1-barrel	42" 1-barrel
85	42" 1-barrel	36" 2-barrel
110	36" 2-barrel	42" 2-barrel
160	42" 2-barrel	48" 2-barrel
230	48" 2-barrel	54" 2-barrel
310	54" 2-barrel	60" 2-barrel
470	60" 2-barrel	6'x7' Box Culvert
520	6'x7' Box Culvert	8'x8' Box Culvert
750	8'x8' Box Culvert	8'x10' Box Culvert
1000	8'x10' Box Culvert	N/A
* See Culvert Sizing calculations for Hw/D and culvert slope assumptions for each culvert size. Culvert slope assumed to be 2% and Hw/D to be 1.5.		

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0.00 cfs

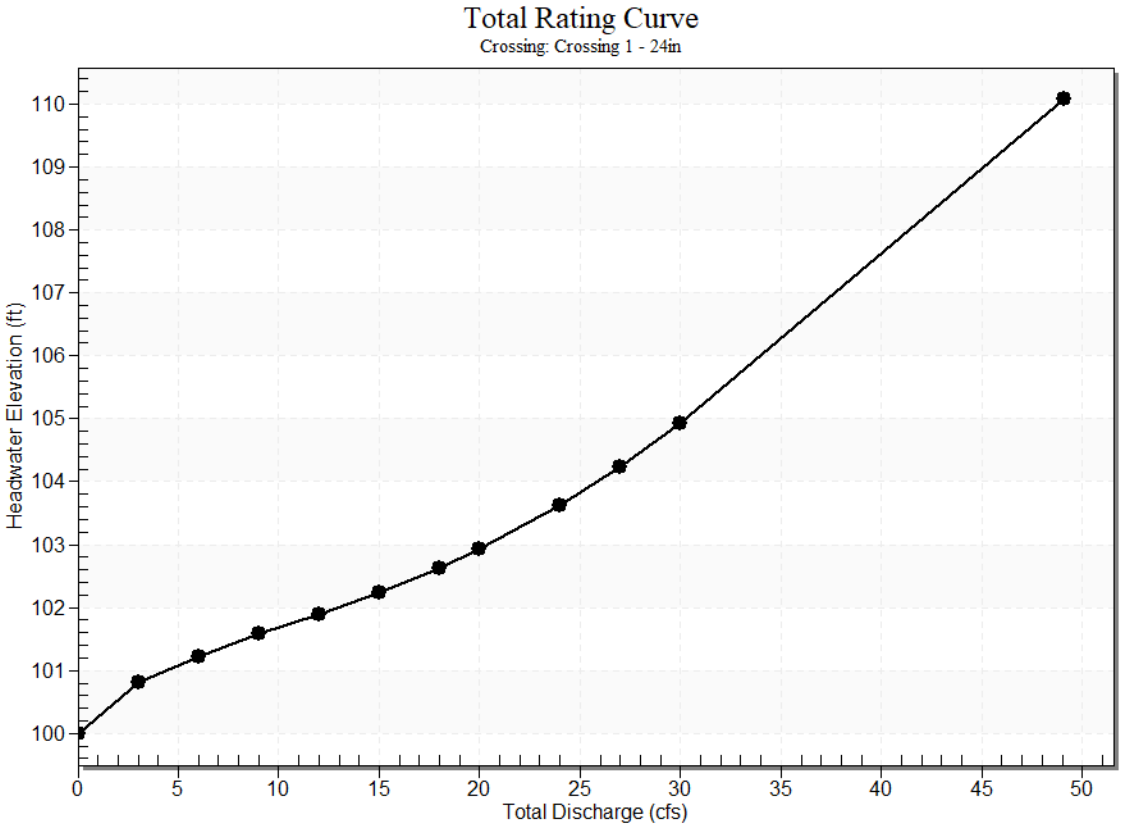
Design Flow: 20.00 cfs

Maximum Flow: 30.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: Crossing 1 - 24in

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
100.00	0.00	0.00	0.00	1
100.82	3.00	3.00	0.00	1
101.23	6.00	6.00	0.00	1
101.58	9.00	9.00	0.00	1
101.90	12.00	12.00	0.00	1
102.24	15.00	15.00	0.00	1
102.63	18.00	18.00	0.00	1
102.92	20.00	20.00	0.00	1
103.62	24.00	24.00	0.00	1
104.24	27.00	27.00	0.00	1
104.93	30.00	30.00	0.00	1
110.00	45.75	45.75	0.00	Overtopping

Rating Curve Plot for Crossing: Crossing 1 - 24in



Culvert Data: Culvert 1

Table 1 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00 cfs	0.00 cfs	100.00	0.00	0.000	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
3.00 cfs	3.00 cfs	100.82	0.82	0.0*	1-S2n	0.40	0.60	0.40	0.34	6.61	2.67
6.00 cfs	6.00 cfs	101.23	1.23	0.0*	1-S2n	0.56	0.87	0.59	0.48	7.83	3.23
9.00 cfs	9.00 cfs	101.58	1.58	0.329	1-S2n	0.69	1.07	0.73	0.58	8.60	3.60
12.00	12.00	101.90	1.90	0.70	1-	0.81	1.24	0.8	0.66	9.17	3.89

cfs	cfs			3	S2n			7			
15.00 cfs	15.00 cfs	102.24	2.24	1.113	5-S2n	0.92	1.40	0.99	0.74	9.63	4.12
18.00 cfs	18.00 cfs	102.63	2.63	1.797	5-S2n	1.02	1.53	1.11	0.80	10.01	4.32
20.00 cfs	20.00 cfs	102.92	2.92	2.078	5-S2n	1.09	1.61	1.19	0.84	10.27	4.44
24.00 cfs	24.00 cfs	103.62	3.62	2.704	5-S2n	1.22	1.73	1.33	0.91	10.79	4.65
27.00 cfs	27.00 cfs	104.24	4.24	3.228	5-S2n	1.33	1.81	1.44	0.96	11.15	4.80
30.00 cfs	30.00 cfs	104.93	4.93	3.800	5-S2n	1.43	1.86	1.55	1.01	11.51	4.93

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

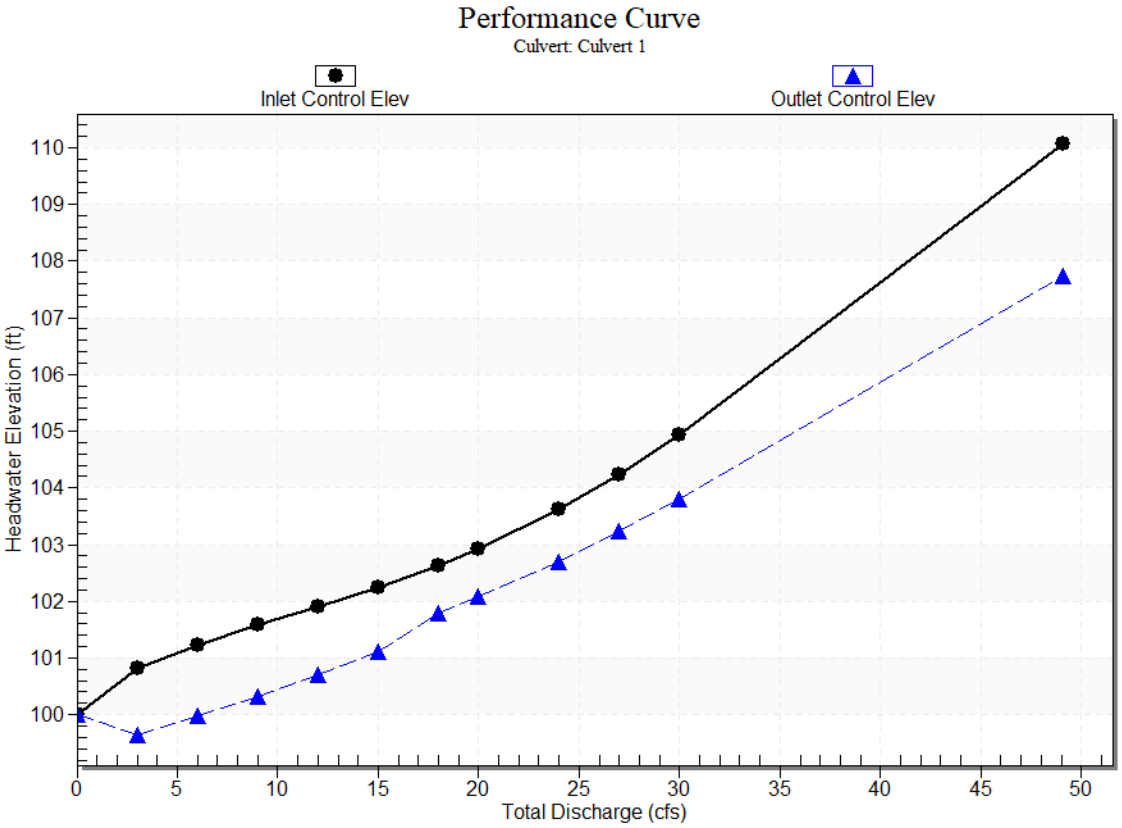
Inlet Elevation (invert): 100.00 ft,

Outlet Elevation (invert): 99.00 ft

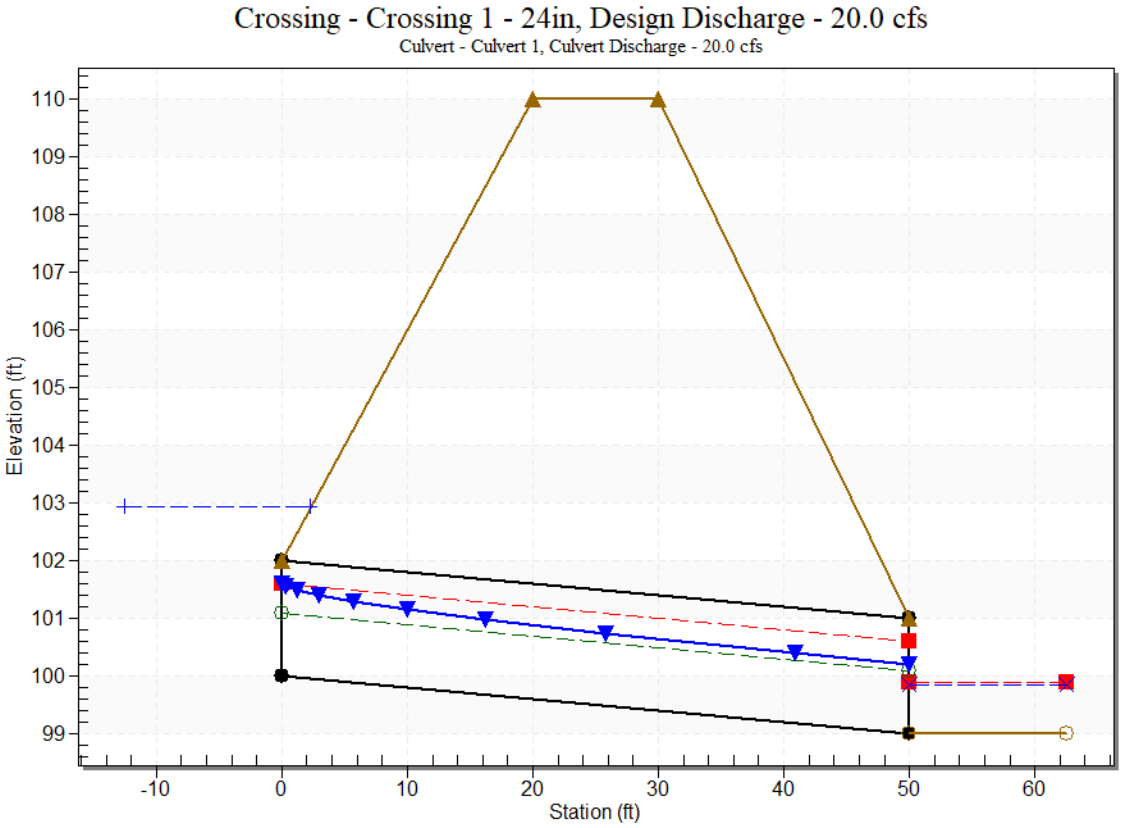
Culvert Length: 50.01 ft,

Culvert Slope: 0.0200

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 100.00 ft

Outlet Station: 50.00 ft

Outlet Elevation: 99.00 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: Crossing 1 - 24in

Table 2 - Downstream Channel Rating Curve (Crossing: Crossing 1 - 24in)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.00	99.00	0.00	0.00	0.00	0.00
3.00	99.34	0.34	2.67	0.42	0.96
6.00	99.48	0.48	3.23	0.59	1.01
9.00	99.58	0.58	3.60	0.72	1.03
12.00	99.66	0.66	3.89	0.83	1.05
15.00	99.74	0.74	4.12	0.92	1.07
18.00	99.80	0.80	4.32	1.00	1.08
20.00	99.84	0.84	4.44	1.05	1.09
24.00	99.91	0.91	4.65	1.14	1.10
27.00	99.96	0.96	4.80	1.20	1.11
30.00	100.01	1.01	4.93	1.26	1.12

Tailwater Channel Data - Crossing 1 - 24in

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 2.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0300

Channel Invert Elevation: 99.00 ft

Roadway Data for Crossing: Crossing 1 - 24in

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 110.00 ft

Roadway Surface: Paved

Roadway Top Width: 10.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0.00 cfs

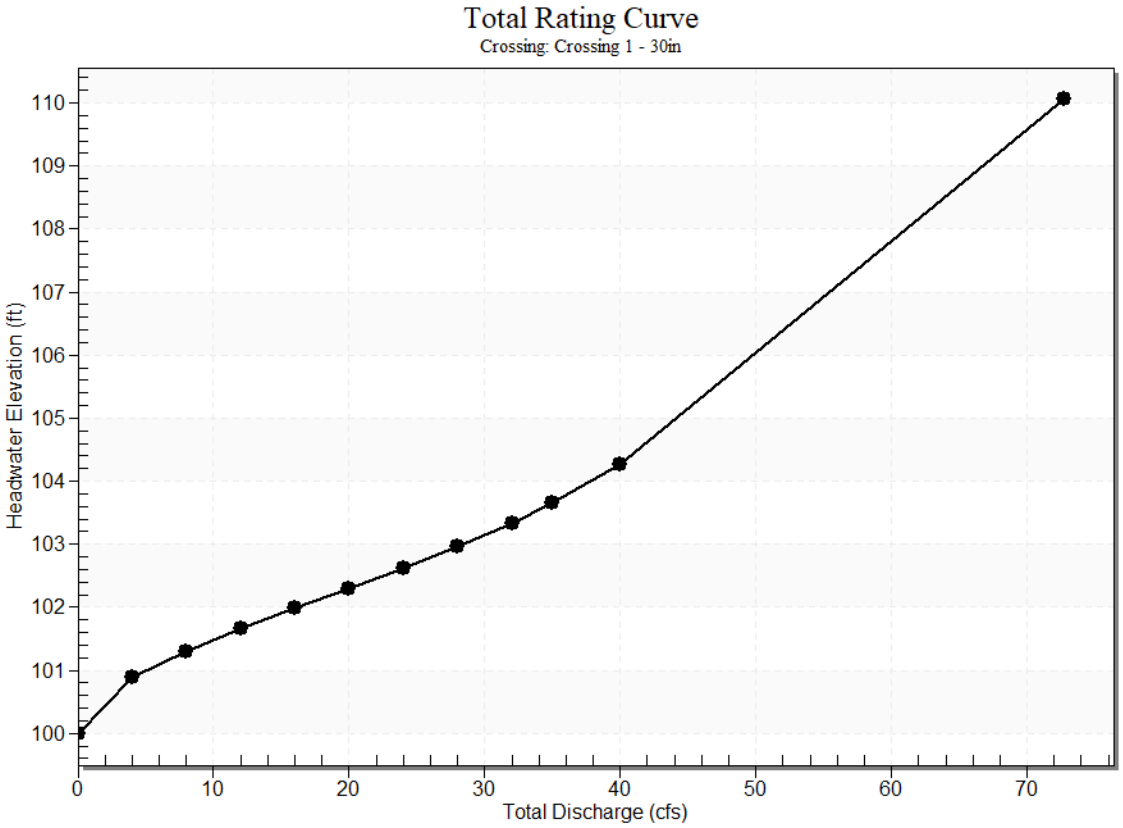
Design Flow: 35.00 cfs

Maximum Flow: 40.00 cfs

Table 3 - Summary of Culvert Flows at Crossing: Crossing 1 - 30in

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
100.00	0.00	0.00	0.00	1
100.89	4.00	4.00	0.00	1
101.29	8.00	8.00	0.00	1
101.67	12.00	12.00	0.00	1
101.99	16.00	16.00	0.00	1
102.30	20.00	20.00	0.00	1
102.61	24.00	24.00	0.00	1
102.96	28.00	28.00	0.00	1
103.34	32.00	32.00	0.00	1
103.66	35.00	35.00	0.00	1
104.27	40.00	40.00	0.00	1
110.00	70.48	70.48	0.00	Overtopping

Rating Curve Plot for Crossing: Crossing 1 - 30in



Culvert Data: Culvert 1

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00 cfs	0.00 cfs	100.00	0.00	0.000	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
4.00 cfs	4.00 cfs	100.89	0.89	0.0*	1-S2n	0.43	0.66	0.44	0.36	6.93	2.84
8.00 cfs	8.00 cfs	101.29	1.29	0.018	1-S2n	0.60	0.94	0.63	0.51	8.20	3.45
12.00 cfs	12.00 cfs	101.67	1.67	0.337	1-S2n	0.74	1.16	0.79	0.62	8.96	3.85
16.00	16.00	101.99	1.99	0.66	1-	0.86	1.35	0.9	0.72	9.49	4.16

cfs	cfs			3	S2n			4			
20.00 cfs	20.00 cfs	102.30	2.30	1.005	1-S2n	0.97	1.52	1.07	0.80	10.01	4.41
24.00 cfs	24.00 cfs	102.61	2.61	1.370	5-S2n	1.07	1.67	1.19	0.87	10.39	4.63
28.00 cfs	28.00 cfs	102.96	2.96	1.759	5-S2n	1.17	1.80	1.31	0.93	10.80	4.82
32.00 cfs	32.00 cfs	103.34	3.34	2.461	5-S2n	1.26	1.93	1.42	0.99	11.13	4.99
35.00 cfs	35.00 cfs	103.66	3.66	2.747	5-S2n	1.33	2.01	1.50	1.03	11.39	5.10
40.00 cfs	40.00 cfs	104.27	4.27	3.264	5-S2n	1.45	2.13	1.63	1.10	11.82	5.28

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

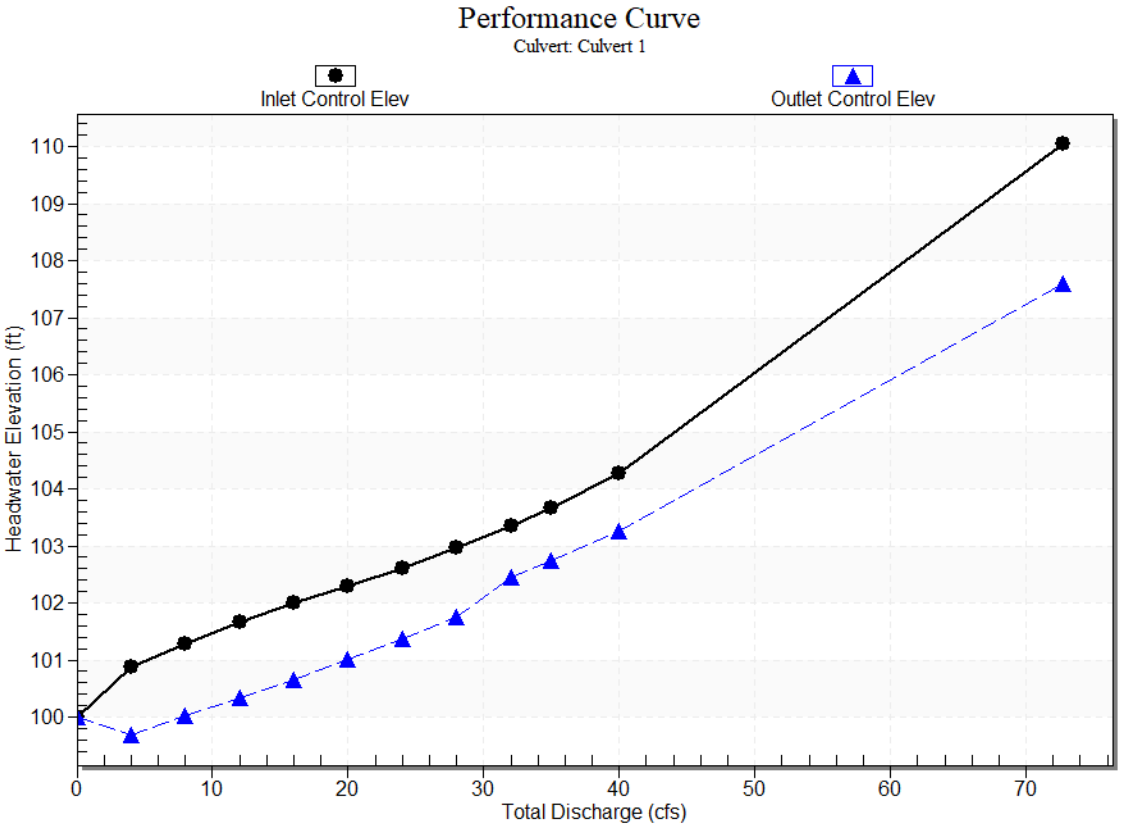
Inlet Elevation (invert): 100.00 ft,

Outlet Elevation (invert): 99.00 ft

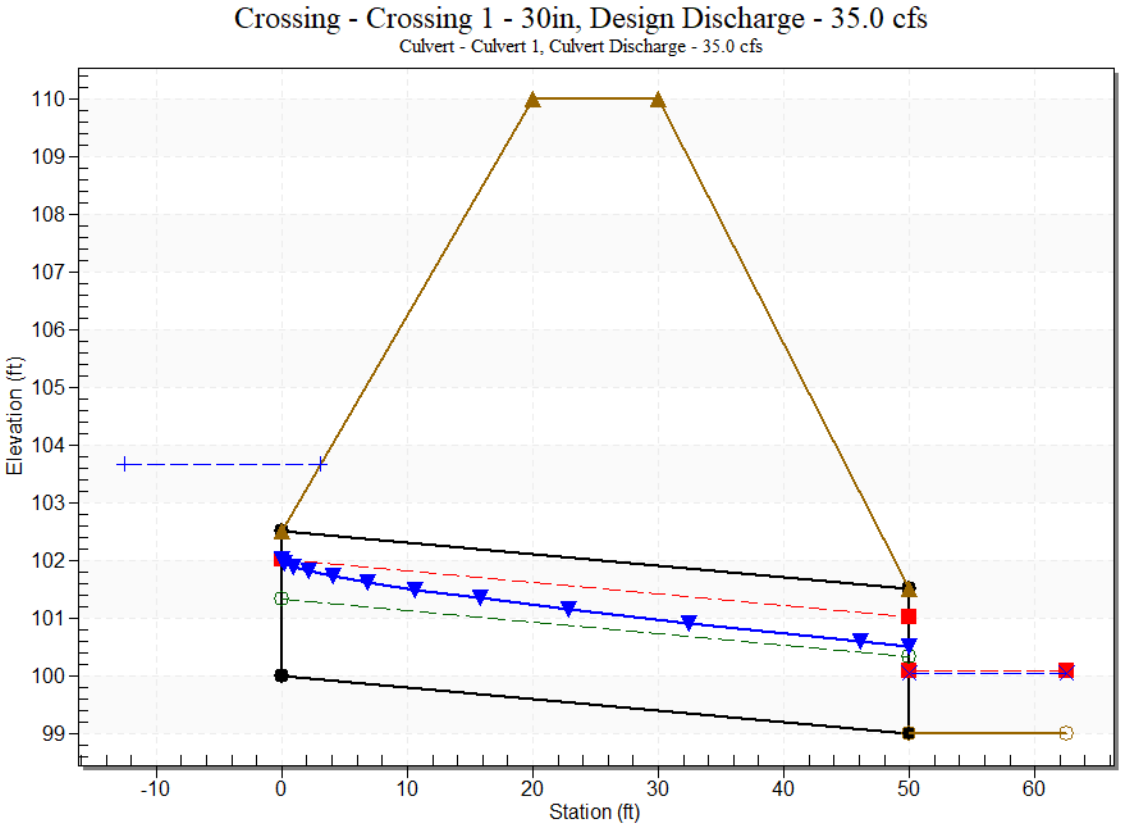
Culvert Length: 50.01 ft,

Culvert Slope: 0.0200

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 100.00 ft

Outlet Station: 50.00 ft

Outlet Elevation: 99.00 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 2.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: Crossing 1 - 30in

Table 4 - Downstream Channel Rating Curve (Crossing: Crossing 1 - 30in)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.00	99.00	0.00	0.00	0.00	0.00
4.00	99.36	0.36	2.84	0.45	0.98
8.00	99.51	0.51	3.45	0.64	1.02
12.00	99.62	0.62	3.85	0.78	1.05
16.00	99.72	0.72	4.16	0.89	1.07
20.00	99.80	0.80	4.41	0.99	1.09
24.00	99.87	0.87	4.63	1.08	1.10
28.00	99.93	0.93	4.82	1.16	1.11
32.00	99.99	0.99	4.99	1.24	1.12
35.00	100.03	1.03	5.10	1.29	1.13
40.00	100.10	1.10	5.28	1.37	1.14

Tailwater Channel Data - Crossing 1 - 30in

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 2.50 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0300

Channel Invert Elevation: 99.00 ft

Roadway Data for Crossing: Crossing 1 - 30in

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 110.00 ft

Roadway Surface: Paved

Roadway Top Width: 10.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0.00 cfs

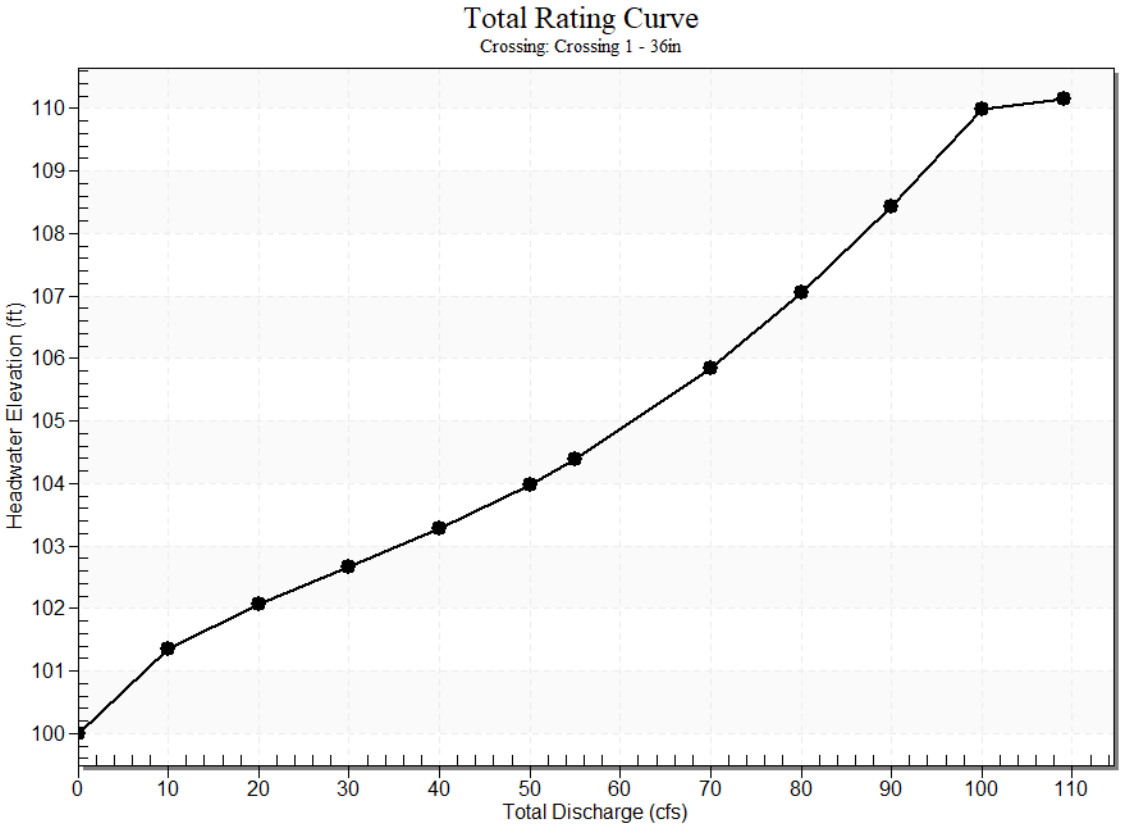
Design Flow: 55.00 cfs

Maximum Flow: 100.00 cfs

Table 5 - Summary of Culvert Flows at Crossing: Crossing 1 - 36in

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
100.00	0.00	0.00	0.00	1
101.36	10.00	10.00	0.00	1
102.07	20.00	20.00	0.00	1
102.67	30.00	30.00	0.00	1
103.27	40.00	40.00	0.00	1
103.97	50.00	50.00	0.00	1
104.38	55.00	55.00	0.00	1
105.85	70.00	70.00	0.00	1
107.05	80.00	80.00	0.00	1
108.42	90.00	90.00	0.00	1
109.99	100.00	100.00	0.00	1
110.00	100.04	100.04	0.00	Overtopping

Rating Curve Plot for Crossing: Crossing 1 - 36in



Culvert Data: Culvert 1

Table 3 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00 cfs	0.00 cfs	100.00	0.00	0.000	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
10.00 cfs	10.00 cfs	101.36	1.36	0.056	1-S2n	0.63	1.00	0.67	0.54	8.46	3.62
20.00 cfs	20.00 cfs	102.07	2.07	0.660	1-S2n	0.90	1.43	0.99	0.76	9.80	4.38
30.00 cfs	30.00 cfs	102.67	2.67	1.279	1-S2n	1.11	1.77	1.26	0.92	10.66	4.88
40.00	40.00	103.27	3.27	1.95	5-	1.30	2.06	1.4	1.05	11.3	5.26

cfs	cfs			7	S2n			9		8	
50.00 cfs	50.00 cfs	103.97	3.97	3.054	5-S2n	1.48	2.30	1.71	1.17	12.01	5.57
55.00 cfs	55.00 cfs	104.38	4.38	3.402	5-S2n	1.57	2.41	1.81	1.22	12.32	5.71
70.00 cfs	70.00 cfs	105.85	5.85	4.580	5-S2n	1.82	2.66	2.10	1.36	13.23	6.08
80.00 cfs	80.00 cfs	107.05	7.05	5.478	5-S2n	2.00	2.77	2.28	1.45	13.86	6.29
90.00 cfs	90.00 cfs	108.42	8.42	6.470	5-S2n	2.18	2.85	2.45	1.52	14.54	6.49
100.00 cfs	100.00 cfs	109.99	9.99	7.439	5-S2n	2.40	2.65	2.56	1.60	15.59	6.66

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

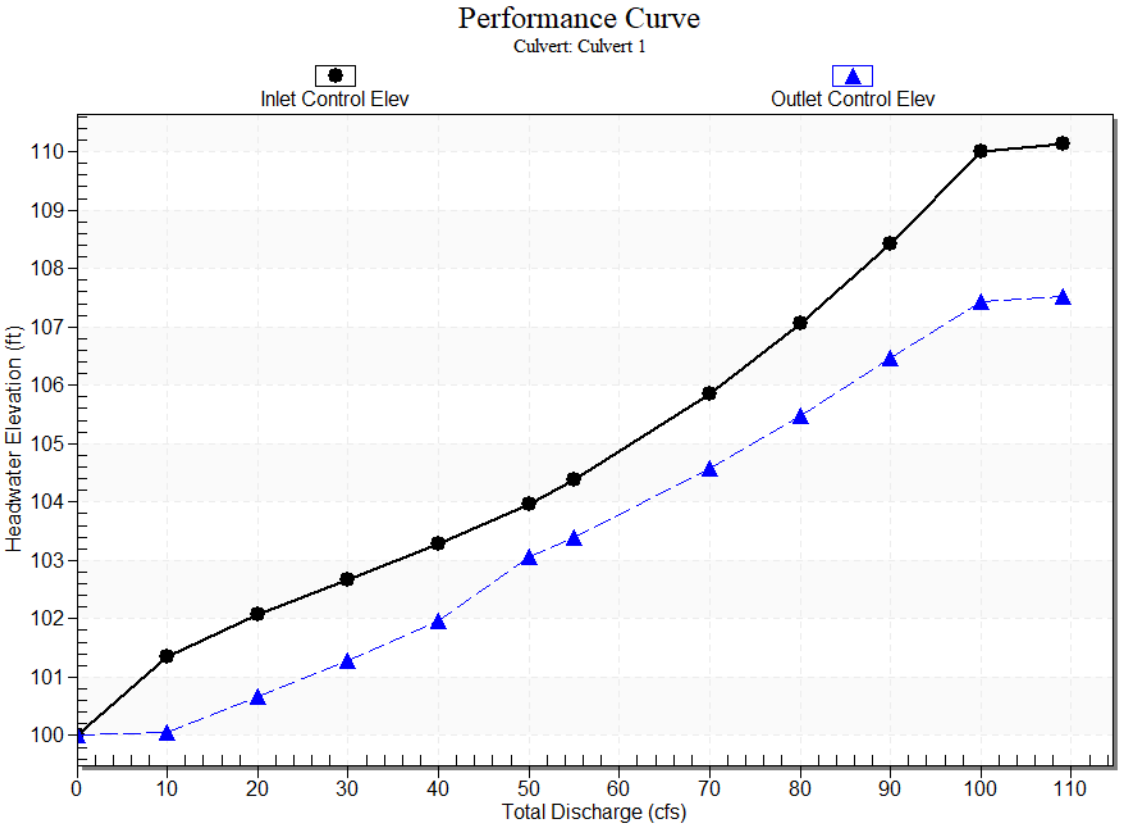
Inlet Elevation (invert): 100.00 ft,

Outlet Elevation (invert): 99.00 ft

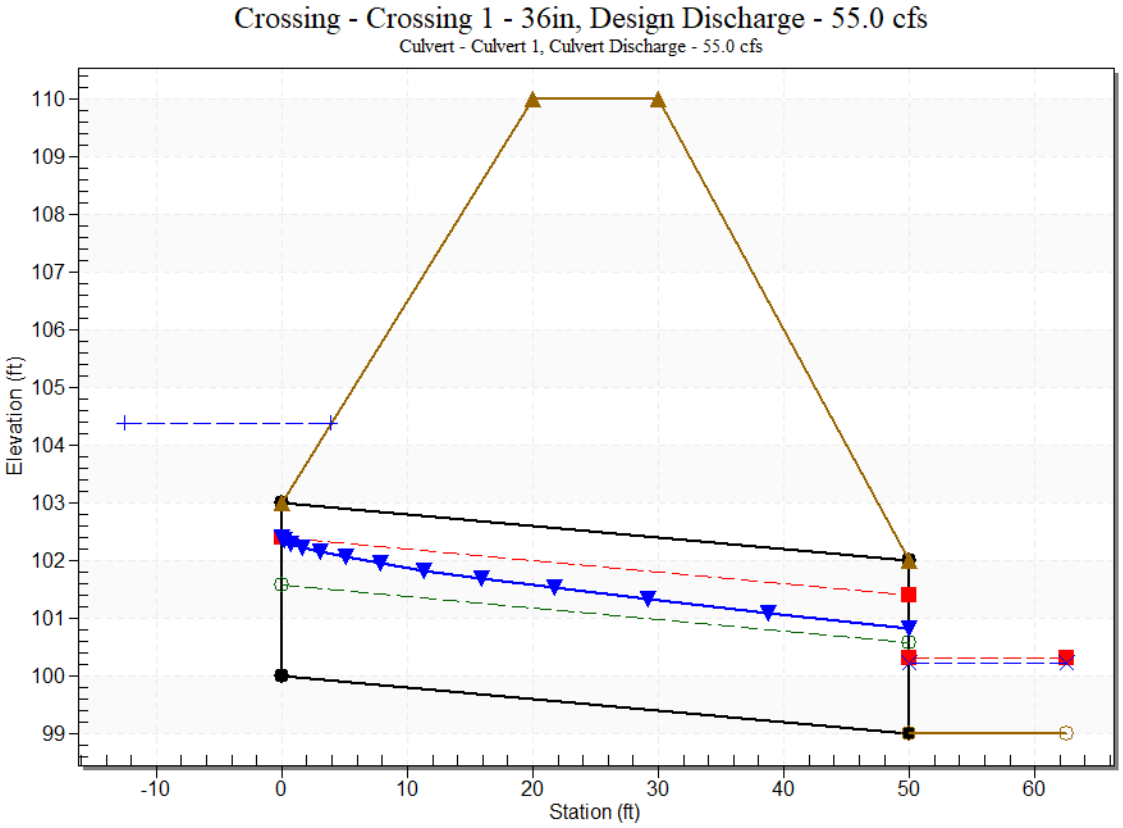
Culvert Length: 50.01 ft,

Culvert Slope: 0.0200

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 100.00 ft

Outlet Station: 50.00 ft

Outlet Elevation: 99.00 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: Crossing 1 - 36in

Table 6 - Downstream Channel Rating Curve (Crossing: Crossing 1 - 36in)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.00	99.00	0.00	0.00	0.00	0.00
10.00	99.54	0.54	3.62	0.67	1.04
20.00	99.76	0.76	4.38	0.95	1.09
30.00	99.92	0.92	4.88	1.15	1.12
40.00	100.05	1.05	5.26	1.32	1.14
50.00	100.17	1.17	5.57	1.46	1.15
55.00	100.22	1.22	5.71	1.52	1.16
70.00	100.36	1.36	6.08	1.70	1.18
80.00	100.45	1.45	6.29	1.81	1.19
90.00	100.52	1.52	6.49	1.90	1.20
100.00	100.60	1.60	6.66	1.99	1.20

Tailwater Channel Data - Crossing 1 - 36in

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 3.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0300

Channel Invert Elevation: 99.00 ft

Roadway Data for Crossing: Crossing 1 - 36in

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 110.00 ft

Roadway Surface: Paved

Roadway Top Width: 10.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0.00 cfs

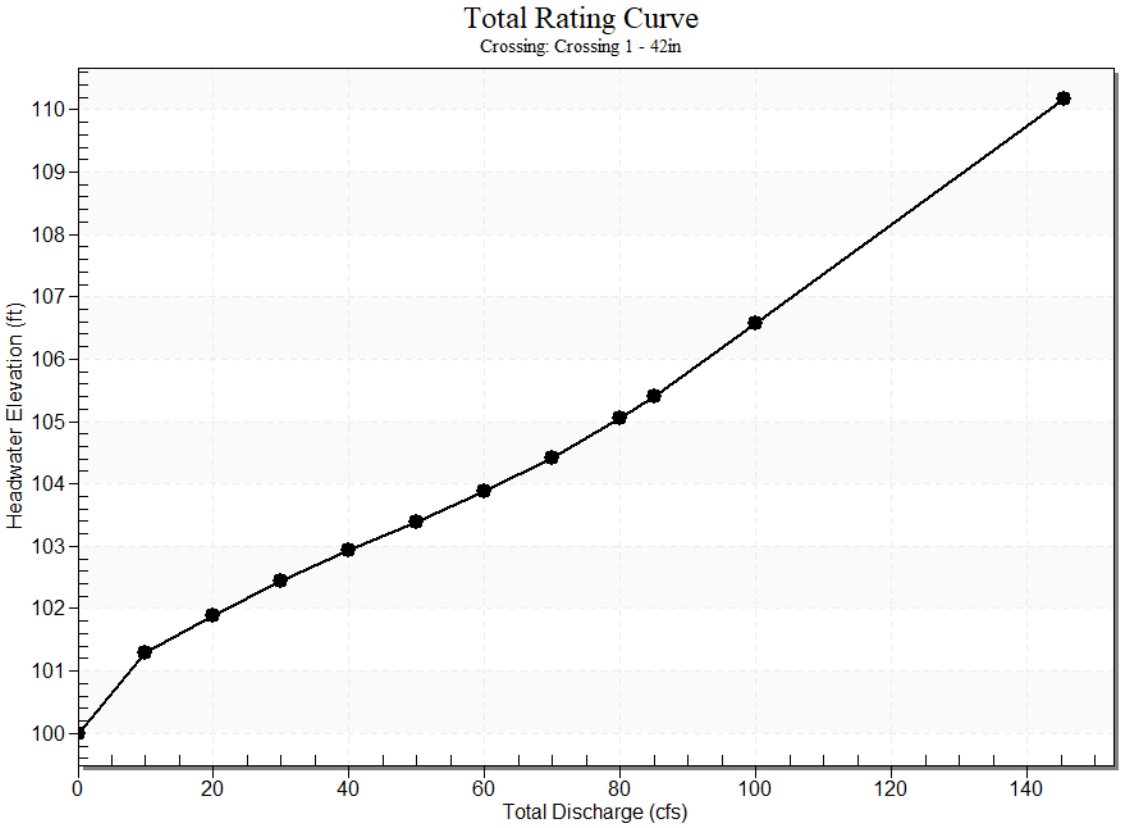
Design Flow: 85.00 cfs

Maximum Flow: 100.00 cfs

Table 7 - Summary of Culvert Flows at Crossing: Crossing 1 - 42in

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
100.00	0.00	0.00	0.00	1
101.29	10.00	10.00	0.00	1
101.90	20.00	20.00	0.00	1
102.45	30.00	30.00	0.00	1
102.93	40.00	40.00	0.00	1
103.39	50.00	50.00	0.00	1
103.88	60.00	60.00	0.00	1
104.42	70.00	70.00	0.00	1
105.05	80.00	80.00	0.00	1
105.39	85.00	85.00	0.00	1
106.57	100.00	100.00	0.00	1
110.00	133.87	133.87	0.00	Overtopping

Rating Curve Plot for Crossing: Crossing 1 - 42in



Culvert Data: Culvert 1

Table 4 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00 cfs	0.00 cfs	100.00	0.00	0.000	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
10.00 cfs	10.00 cfs	101.29	1.29	0.0*	1-S2n	0.60	0.96	0.64	0.51	8.33	3.57
20.00 cfs	20.00 cfs	101.90	1.90	0.486	1-S2n	0.85	1.37	0.94	0.72	9.60	4.34
30.00 cfs	30.00 cfs	102.45	2.45	0.956	1-S2n	1.04	1.69	1.18	0.88	10.47	4.84
40.00	40.00	102.93	2.93	1.43	1-	1.21	1.97	1.4	1.01	11.1	5.23

cfs	cfs			6	S2 n			0		2	
50.00 cfs	50.00 cfs	103.39	3.39	1.943	1-S2 n	1.37	2.21	1.60	1.13	11.68	5.55
60.00 cfs	60.00 cfs	103.88	3.88	2.483	5-S2 n	1.51	2.43	1.78	1.23	12.18	5.82
70.00 cfs	70.00 cfs	104.42	4.42	3.060	5-S2 n	1.65	2.62	1.96	1.32	12.65	6.06
80.00 cfs	80.00 cfs	105.05	5.05	4.025	5-S2 n	1.79	2.79	2.12	1.40	13.10	6.27
85.00 cfs	85.00 cfs	105.39	5.39	4.306	5-S2 n	1.85	2.87	2.20	1.44	13.33	6.37
100.00 cfs	100.00 cfs	106.57	6.57	5.219	5-S2 n	2.05	3.07	2.43	1.55	14.03	6.65

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

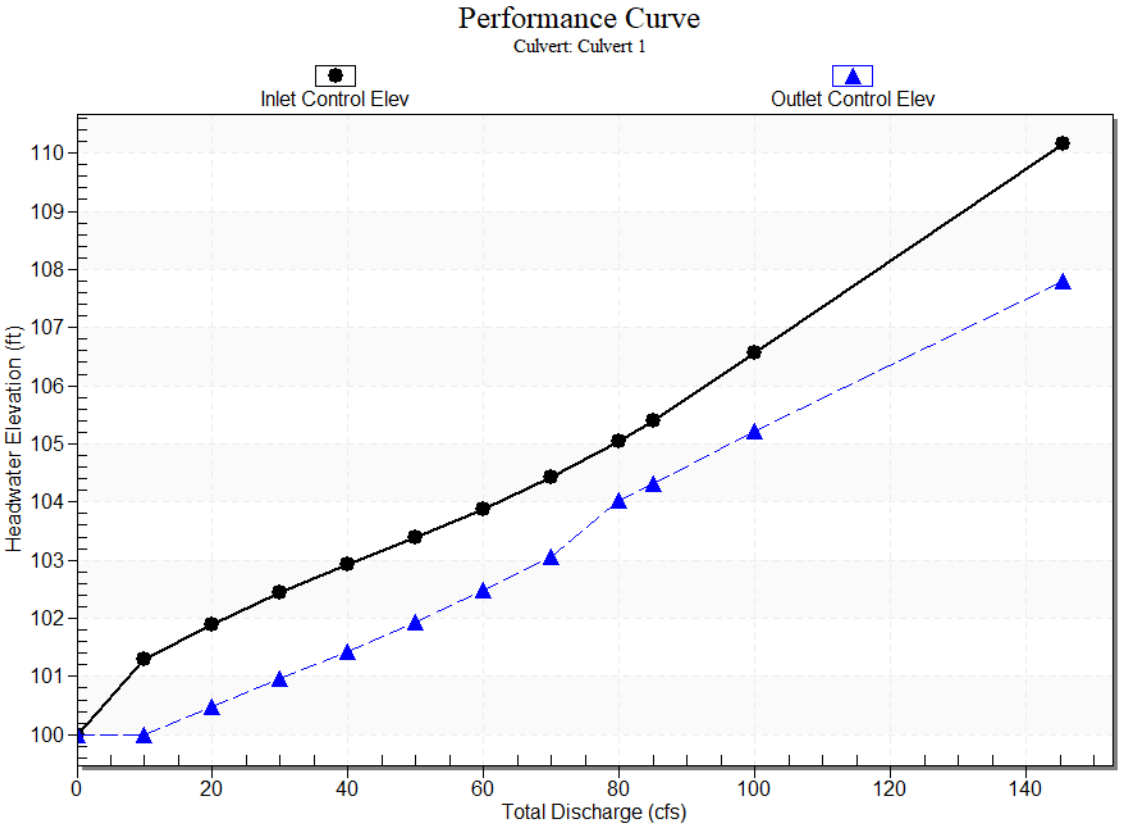
Inlet Elevation (invert): 100.00 ft,

Outlet Elevation (invert): 99.00 ft

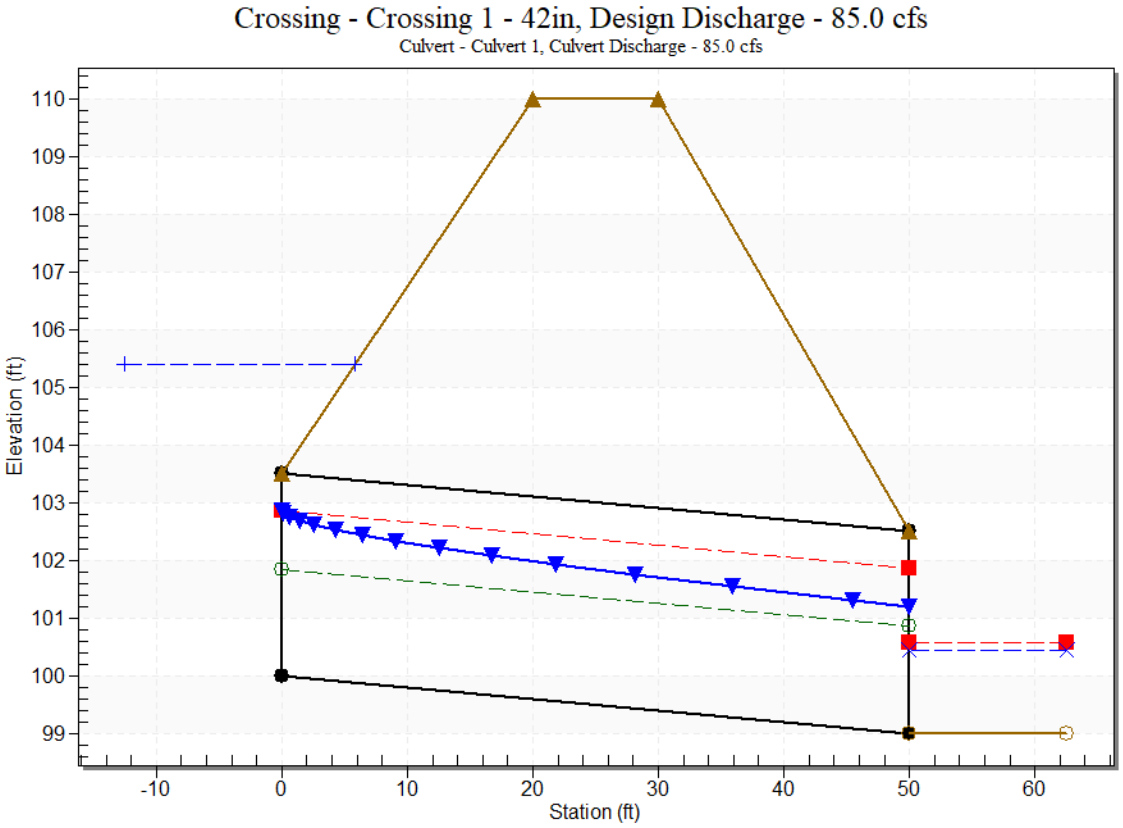
Culvert Length: 50.01 ft,

Culvert Slope: 0.0200

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 100.00 ft

Outlet Station: 50.00 ft

Outlet Elevation: 99.00 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 3.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: Crossing 1 - 42in

Table 8 - Downstream Channel Rating Curve (Crossing: Crossing 1 - 42in)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.00	99.00	0.00	0.00	0.00	0.00
10.00	99.51	0.51	3.57	0.63	1.03
20.00	99.72	0.72	4.34	0.90	1.08
30.00	99.88	0.88	4.84	1.10	1.11
40.00	100.01	1.01	5.23	1.26	1.14
50.00	100.13	1.13	5.55	1.41	1.15
60.00	100.23	1.23	5.82	1.53	1.17
70.00	100.32	1.32	6.06	1.64	1.18
80.00	100.40	1.40	6.27	1.75	1.19
85.00	100.44	1.44	6.37	1.80	1.19
100.00	100.55	1.55	6.65	1.94	1.20

Tailwater Channel Data - Crossing 1 - 42in

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 3.50 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0300

Channel Invert Elevation: 99.00 ft

Roadway Data for Crossing: Crossing 1 - 42in

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 110.00 ft

Roadway Surface: Paved

Roadway Top Width: 10.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0.00 cfs

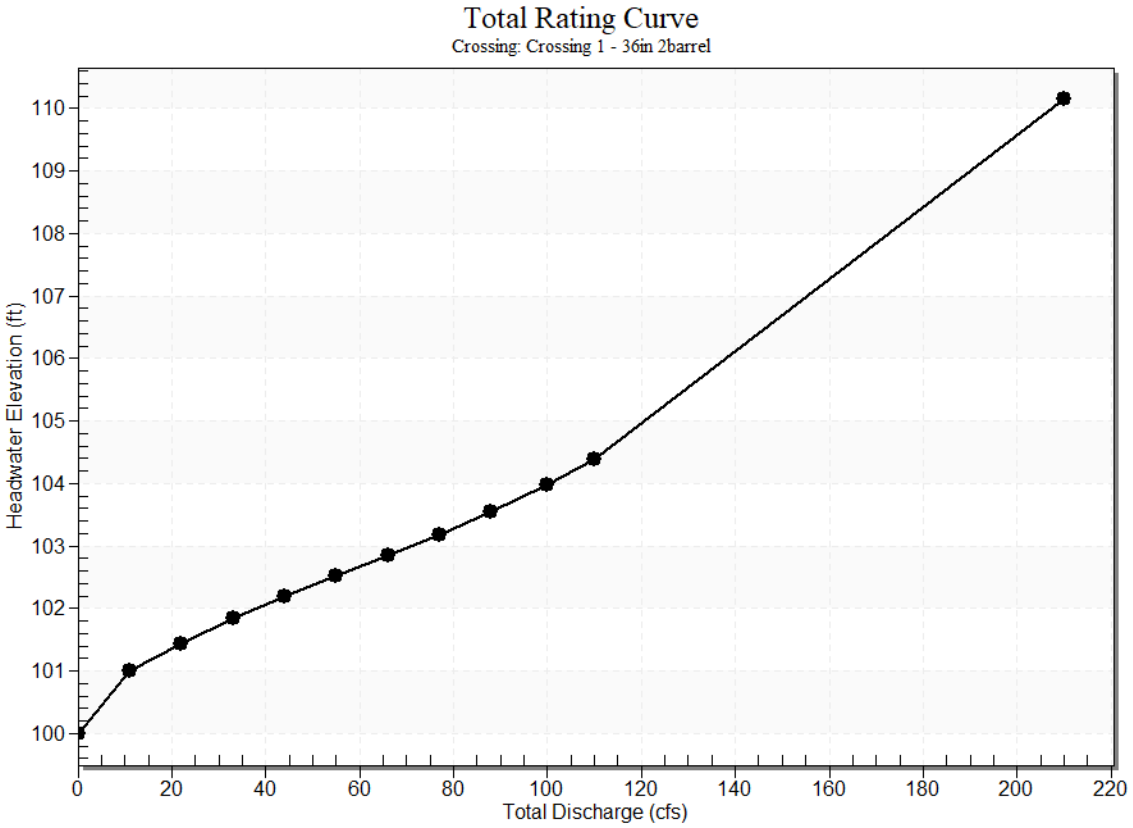
Design Flow: 100.00 cfs

Maximum Flow: 110.00 cfs

Table 9 - Summary of Culvert Flows at Crossing: Crossing 1 - 36in 2barrel

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
100.00	0.00	0.00	0.00	1
100.99	11.00	11.00	0.00	1
101.43	22.00	22.00	0.00	1
101.84	33.00	33.00	0.00	1
102.20	44.00	44.00	0.00	1
102.53	55.00	55.00	0.00	1
102.85	66.00	66.00	0.00	1
103.18	77.00	77.00	0.00	1
103.54	88.00	88.00	0.00	1
103.97	100.00	100.00	0.00	1
104.38	110.00	110.00	0.00	1
110.00	200.08	200.08	0.00	Overtopping

Rating Curve Plot for Crossing: Crossing 1 - 36in 2barrel



Culvert Data: Culvert 1

Table 5 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00 cfs	0.00 cfs	100.00	0.00	0.000	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
11.00 cfs	11.00 cfs	100.99	0.99	0.0*	1-S2n	0.47	0.74	0.49	0.42	7.34	3.42
22.00 cfs	22.00 cfs	101.43	1.43	0.119	1-S2n	0.66	1.05	0.71	0.61	8.63	4.23
33.00 cfs	33.00 cfs	101.84	1.84	0.451	1-S2n	0.81	1.30	0.89	0.76	9.38	4.77
44.00	44.00	102.20	2.20	0.78	1-	0.94	1.51	1.0	0.89	9.98	5.19

cfs	cfs			0	S2n			5			
55.00 cfs	55.00 cfs	102.53	2.53	1.120	1-S2n	1.06	1.70	1.19	1.00	10.49	5.52
66.00 cfs	66.00 cfs	102.85	2.85	1.476	1-S2n	1.17	1.86	1.33	1.09	10.89	5.81
77.00 cfs	77.00 cfs	103.18	3.18	1.851	5-S2n	1.27	2.02	1.46	1.18	11.28	6.07
88.00 cfs	88.00 cfs	103.54	3.54	2.248	5-S2n	1.37	2.16	1.58	1.26	11.63	6.29
100.00 cfs	100.00 cfs	103.97	3.97	3.054	5-S2n	1.48	2.30	1.71	1.35	12.01	6.52
110.00 cfs	110.00 cfs	104.38	4.38	3.402	5-S2n	1.57	2.41	1.81	1.41	12.32	6.69

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

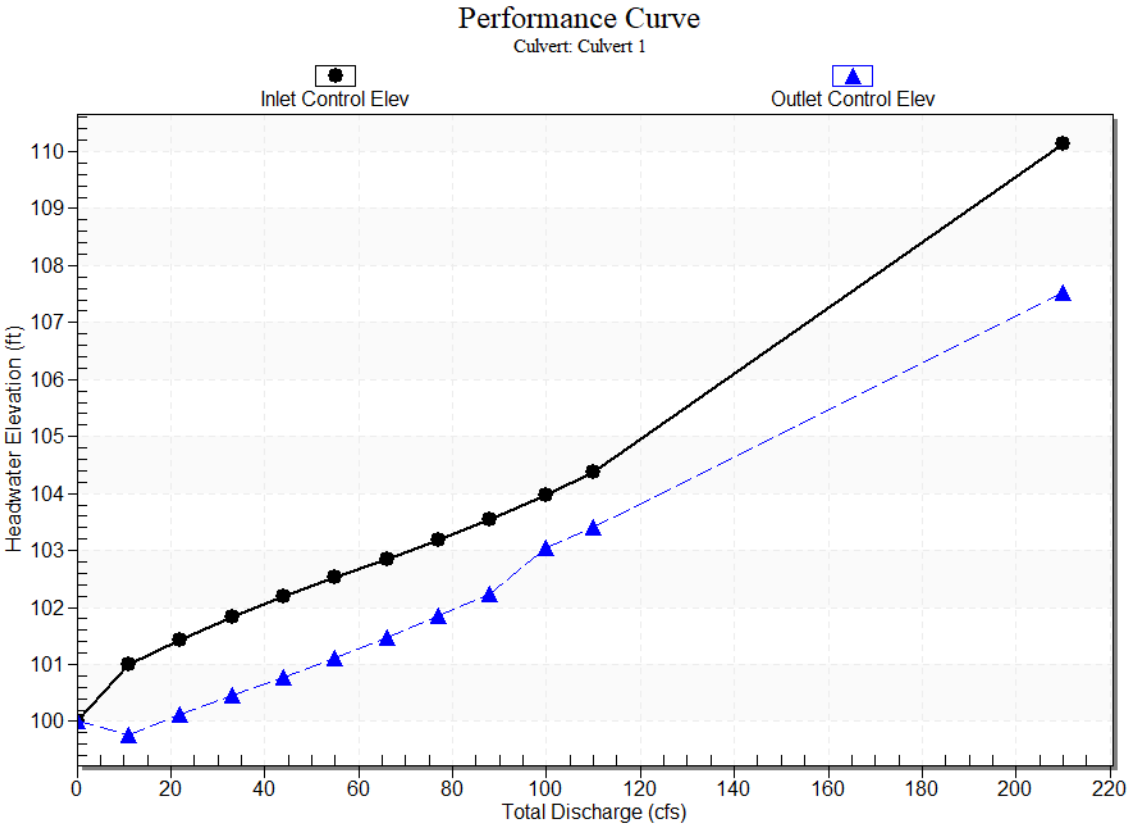
Inlet Elevation (invert): 100.00 ft,

Outlet Elevation (invert): 99.00 ft

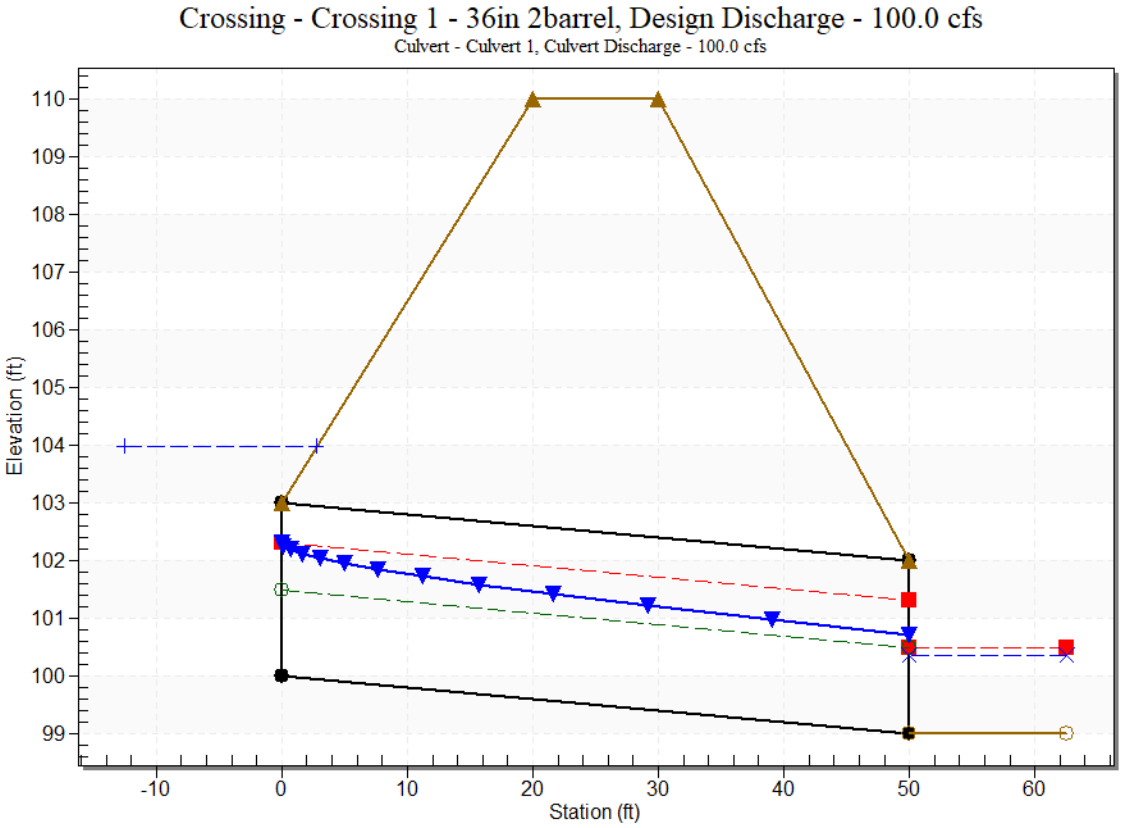
Culvert Length: 50.01 ft,

Culvert Slope: 0.0200

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 100.00 ft

Outlet Station: 50.00 ft

Outlet Elevation: 99.00 ft

Number of Barrels: 2

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: Crossing 1 - 36in 2barrel

Table 10 - Downstream Channel Rating Curve (Crossing: Crossing 1 - 36in 2barrel)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.00	99.00	0.00	0.00	0.00	0.00
11.00	99.42	0.42	3.42	0.52	1.03
22.00	99.61	0.61	4.23	0.77	1.08
33.00	99.76	0.76	4.77	0.95	1.11
44.00	99.89	0.89	5.19	1.11	1.14
55.00	100.00	1.00	5.52	1.24	1.15
66.00	100.09	1.09	5.81	1.37	1.17
77.00	100.18	1.18	6.07	1.48	1.18
88.00	100.26	1.26	6.29	1.58	1.19
100.00	100.35	1.35	6.52	1.68	1.20
110.00	100.41	1.41	6.69	1.76	1.21

Tailwater Channel Data - Crossing 1 - 36in 2barrel

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 6.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0300

Channel Invert Elevation: 99.00 ft

Roadway Data for Crossing: Crossing 1 - 36in 2barrel

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 110.00 ft

Roadway Surface: Paved

Roadway Top Width: 10.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0.00 cfs

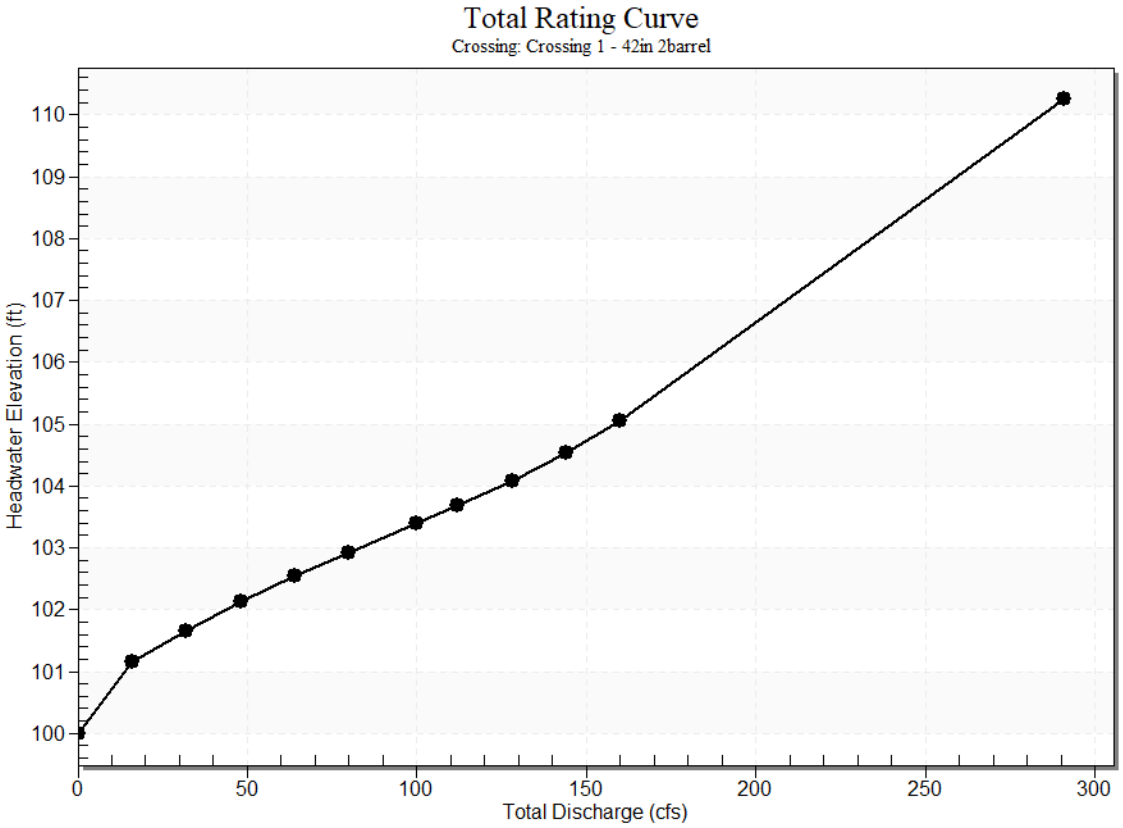
Design Flow: 100.00 cfs

Maximum Flow: 160.00 cfs

Table 11 - Summary of Culvert Flows at Crossing: Crossing 1 - 42in 2barrel

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
100.00	0.00	0.00	0.00	1
101.15	16.00	16.00	0.00	1
101.66	32.00	32.00	0.00	1
102.13	48.00	48.00	0.00	1
102.55	64.00	64.00	0.00	1
102.93	80.00	80.00	0.00	1
103.39	100.00	100.00	0.00	1
103.68	112.00	112.00	0.00	1
104.09	128.00	128.00	0.00	1
104.54	144.00	144.00	0.00	1
105.05	160.00	160.00	0.00	1
110.00	267.73	267.73	0.00	Overtopping

Rating Curve Plot for Crossing: Crossing 1 - 42in 2barrel



Culvert Data: Culvert 1

Table 6 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00 cfs	0.00 cfs	100.00	0.00	0.000	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
16.00 cfs	16.00 cfs	101.15	1.15	0.0*	1-S2n	0.54	0.85	0.57	0.48	7.92	3.74
32.00 cfs	32.00 cfs	101.66	1.66	0.294	1-S2n	0.76	1.22	0.83	0.70	9.21	4.64
48.00 cfs	48.00 cfs	102.13	2.13	0.675	1-S2n	0.93	1.51	1.04	0.87	9.98	5.23
64.00	64.00	102.55	2.55	1.05	1-	1.08	1.75	1.2	1.02	10.6	5.69

cfs	cfs			0	S2 n			3		0	
80.00 cfs	80.00 cfs	102.93	2.93	1.43 6	1- S2 n	1.21	1.97	1.4 0	1.14	11.1 2	6.06
100.0 **0** cfs	100.0 0 cfs	103.39	3.39	1.94 3	1- S2 n	1.37	2.21	1.6 0	1.28	11.6 8	6.45
112.0 **0** cfs	112.0 0 cfs	103.68	3.68	2.26 3	5- S2 n	1.46	2.34	1.7 1	1.36	11.9 8	6.65
128.0 **0** cfs	128.0 0 cfs	104.09	4.09	2.71 0	5- S2 n	1.57	2.51	1.8 5	1.45	12.3 8	6.90
144.0 **0** cfs	144.0 0 cfs	104.54	4.54	3.60 0	5- S2 n	1.68	2.66	1.9 9	1.54	12.7 4	7.13
160.0 **0** cfs	160.0 0 cfs	105.05	5.05	4.02 5	5- S2 n	1.79	2.79	2.1 2	1.62	13.1 0	7.34

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

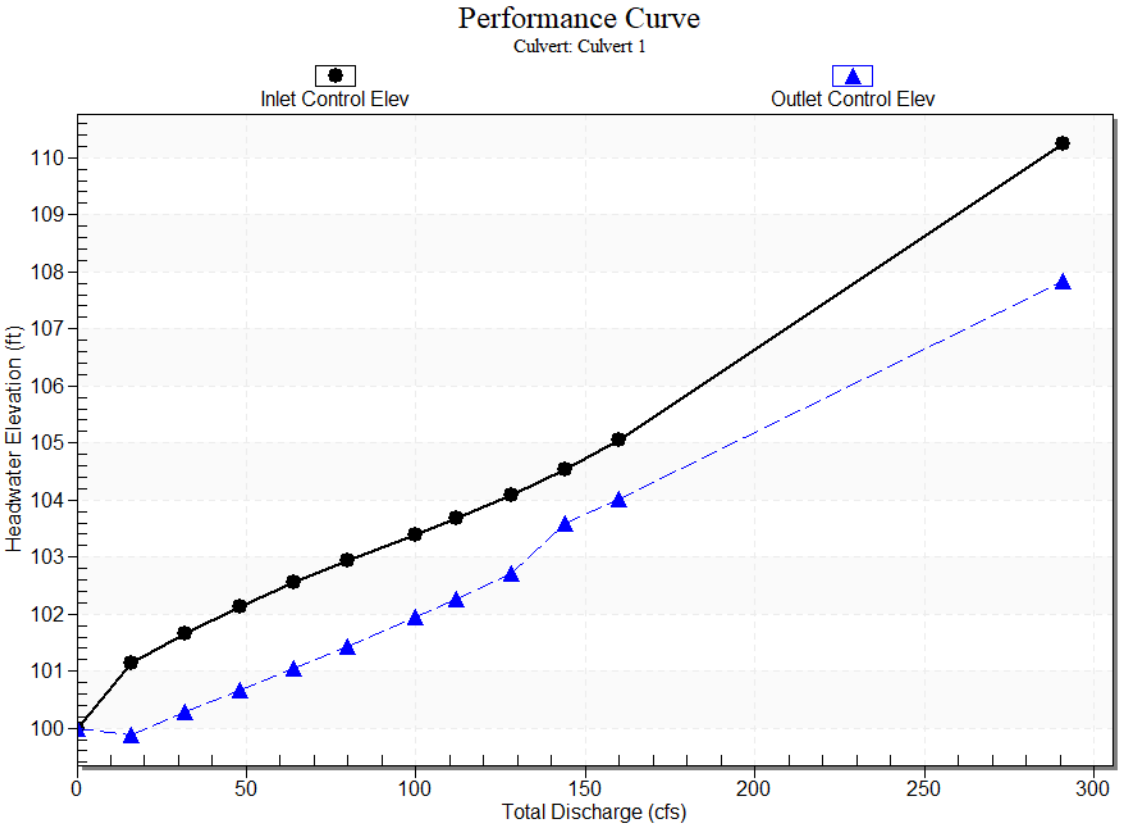
Inlet Elevation (invert): 100.00 ft,

Outlet Elevation (invert): 99.00 ft

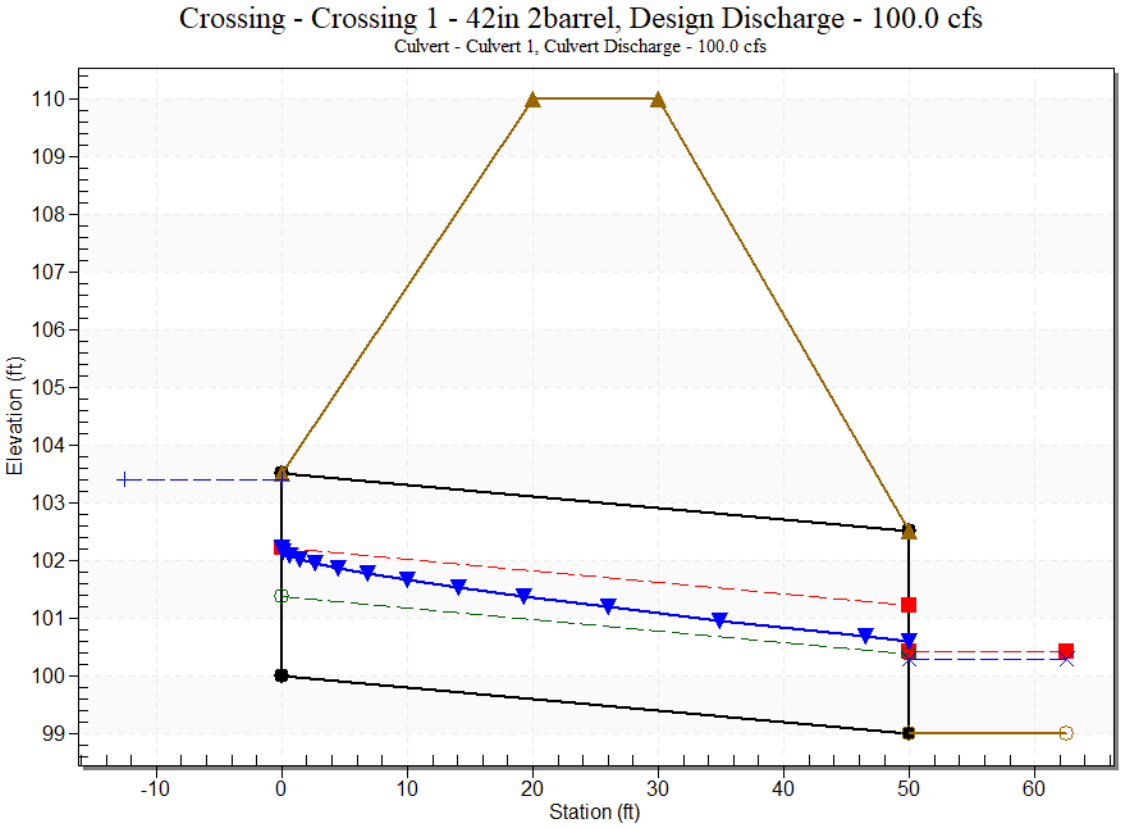
Culvert Length: 50.01 ft,

Culvert Slope: 0.0200

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 100.00 ft

Outlet Station: 50.00 ft

Outlet Elevation: 99.00 ft

Number of Barrels: 2

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 3.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: Crossing 1 - 42in 2barrel

Table 12 - Downstream Channel Rating Curve (Crossing: Crossing 1 - 42in 2barrel)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.00	99.00	0.00	0.00	0.00	0.00
16.00	99.48	0.48	3.74	0.60	1.05
32.00	99.70	0.70	4.64	0.88	1.11
48.00	99.87	0.87	5.23	1.09	1.14
64.00	100.02	1.02	5.69	1.27	1.16
80.00	100.14	1.14	6.06	1.42	1.18
100.00	100.28	1.28	6.45	1.60	1.20
112.00	100.36	1.36	6.65	1.69	1.21
128.00	100.45	1.45	6.90	1.81	1.22
144.00	100.54	1.54	7.13	1.92	1.23
160.00	100.62	1.62	7.34	2.02	1.24

Tailwater Channel Data - Crossing 1 - 42in 2barrel

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 7.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0300

Channel Invert Elevation: 99.00 ft

Roadway Data for Crossing: Crossing 1 - 42in 2barrel

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 110.00 ft

Roadway Surface: Paved

Roadway Top Width: 10.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0.00 cfs

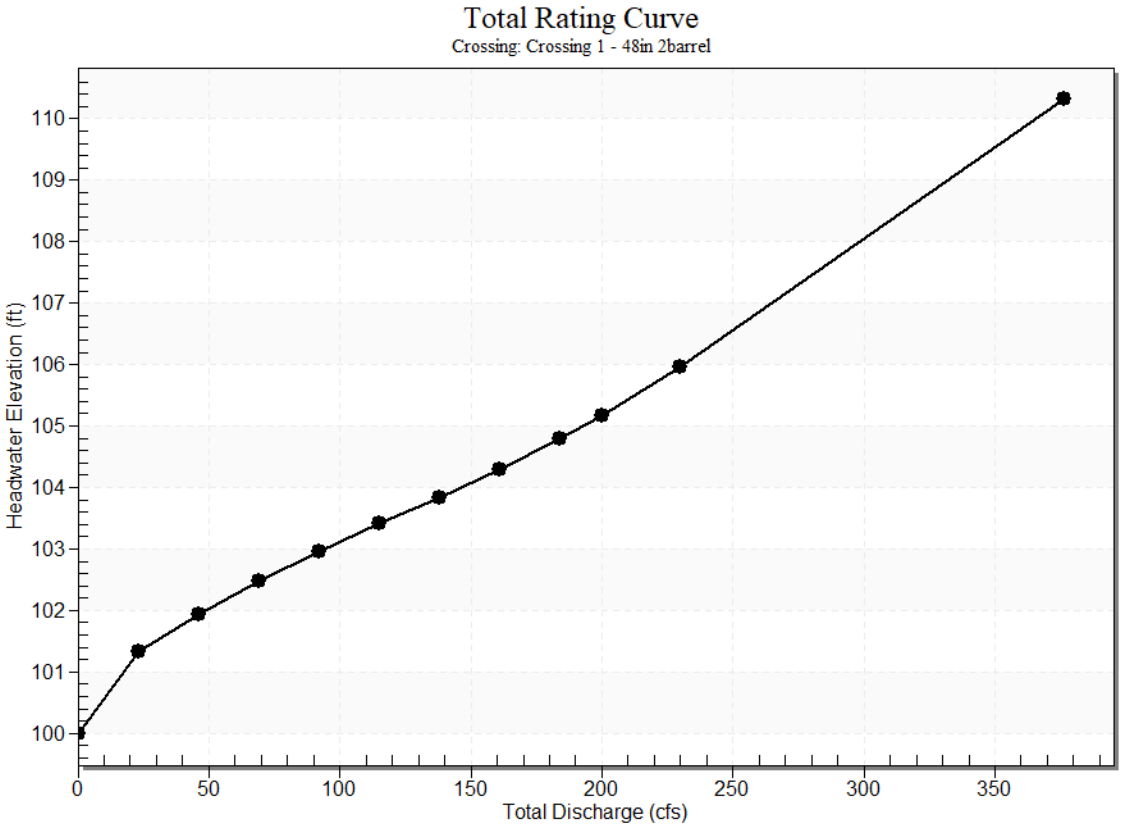
Design Flow: 200.00 cfs

Maximum Flow: 230.00 cfs

Table 13 - Summary of Culvert Flows at Crossing: Crossing 1 - 48in 2barrel

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
100.00	0.00	0.00	0.00	1
101.33	23.00	23.00	0.00	1
101.93	46.00	46.00	0.00	1
102.48	69.00	69.00	0.00	1
102.96	92.00	92.00	0.00	1
103.41	115.00	115.00	0.00	1
103.84	138.00	138.00	0.00	1
104.30	161.00	161.00	0.00	1
104.79	184.00	184.00	0.00	1
105.16	200.00	200.00	0.00	1
105.95	230.00	230.00	0.00	1
110.00	342.47	342.47	0.00	Overtopping

Rating Curve Plot for Crossing: Crossing 1 - 48in 2barrel



Culvert Data: Culvert 1

Table 7 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00 cfs	0.00 cfs	100.00	0.00	0.000	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
23.00 cfs	23.00 cfs	101.33	1.33	0.012	1-S2n	0.62	0.99	0.66	0.74	8.47	4.47
46.00 cfs	46.00 cfs	101.93	1.93	0.503	1-S2n	0.87	1.41	0.97	1.04	9.79	5.40
69.00 cfs	69.00 cfs	102.48	2.48	0.947	1-S2n	1.07	1.75	1.22	1.27	10.60	6.01
92.00	92.00	102.96	2.96	1.38	1-	1.24	2.03	1.4	1.45	11.2	6.48

cfs	cfs			6	S2 n			4		6	
115.00 cfs	115.00 cfs	103.41	3.41	1.838	1-S2 n	1.39	2.28	1.65	1.61	11.80	6.87
138.00 cfs	138.00 cfs	103.84	3.84	2.310	1-S2 n	1.54	2.51	1.83	1.75	12.28	7.20
161.00 cfs	161.00 cfs	104.30	4.30	2.807	5-S2 n	1.67	2.72	2.01	1.87	12.73	7.49
184.00 cfs	184.00 cfs	104.79	4.79	3.330	5-S2 n	1.80	2.91	2.18	1.99	13.15	7.75
200.00 cfs	200.00 cfs	105.16	5.16	4.195	5-S2 n	1.89	3.03	2.29	2.06	13.44	7.92
230.00 cfs	230.00 cfs	105.95	5.95	4.840	5-S2 n	2.05	3.24	2.49	2.19	13.98	8.21

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

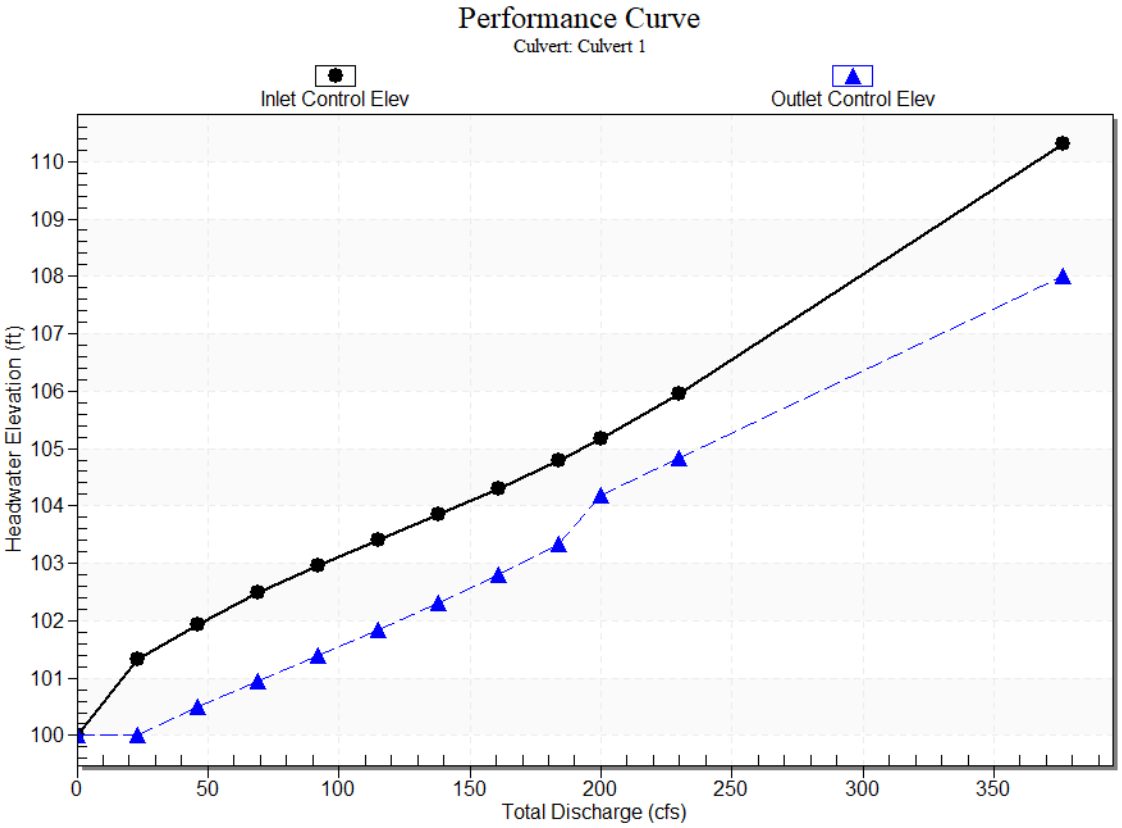
Inlet Elevation (invert): 100.00 ft,

Outlet Elevation (invert): 99.00 ft

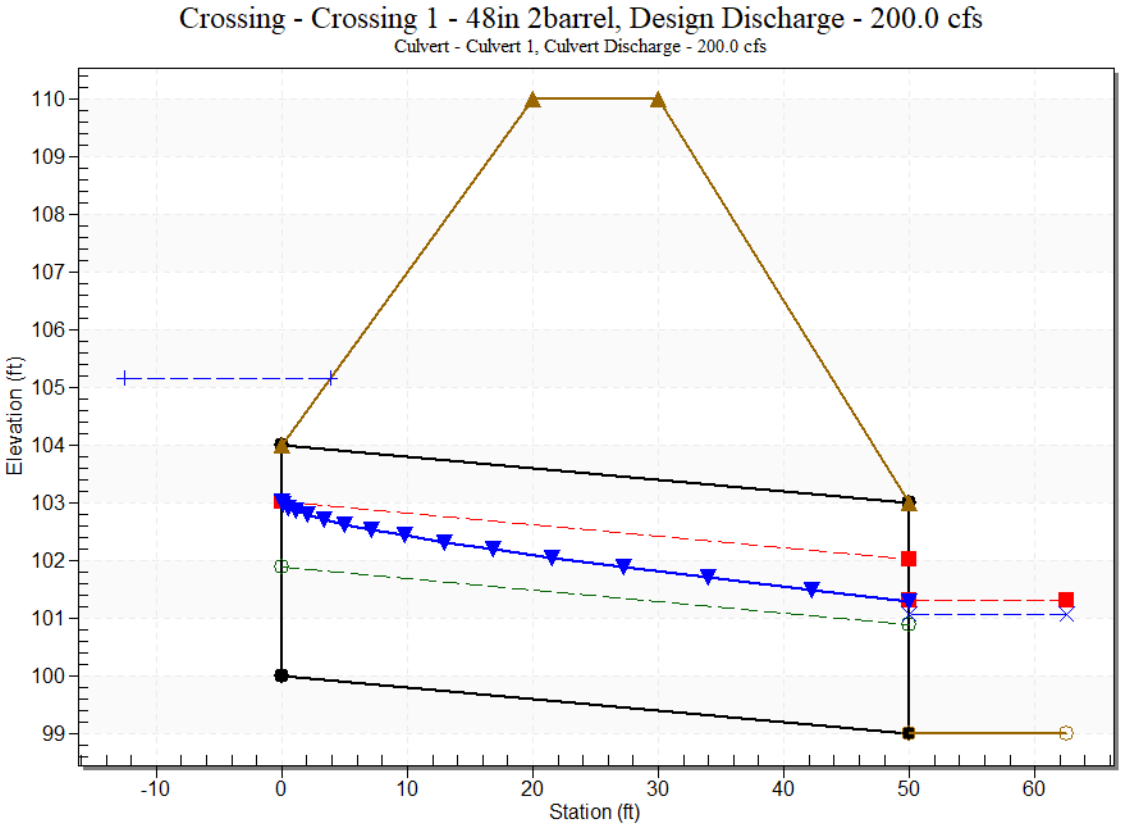
Culvert Length: 50.01 ft,

Culvert Slope: 0.0200

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 100.00 ft

Outlet Station: 50.00 ft

Outlet Elevation: 99.00 ft

Number of Barrels: 2

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 4.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: Crossing 1 - 48in 2barrel

Table 14 - Downstream Channel Rating Curve (Crossing: Crossing 1 - 48in 2barrel)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.00	99.00	0.00	0.00	0.00	0.00
23.00	99.74	0.74	4.47	0.92	1.09
46.00	100.04	1.04	5.40	1.30	1.14
69.00	100.27	1.27	6.01	1.58	1.18
92.00	100.45	1.45	6.48	1.81	1.20
115.00	100.61	1.61	6.87	2.00	1.21
138.00	100.75	1.75	7.20	2.18	1.23
161.00	100.87	1.87	7.49	2.34	1.24
184.00	100.99	1.99	7.75	2.48	1.25
200.00	101.06	2.06	7.92	2.57	1.26
230.00	101.19	2.19	8.21	2.74	1.27

Tailwater Channel Data - Crossing 1 - 48in 2barrel

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0300

Channel Invert Elevation: 99.00 ft

Roadway Data for Crossing: Crossing 1 - 48in 2barrel

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 110.00 ft

Roadway Surface: Paved

Roadway Top Width: 10.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0.00 cfs

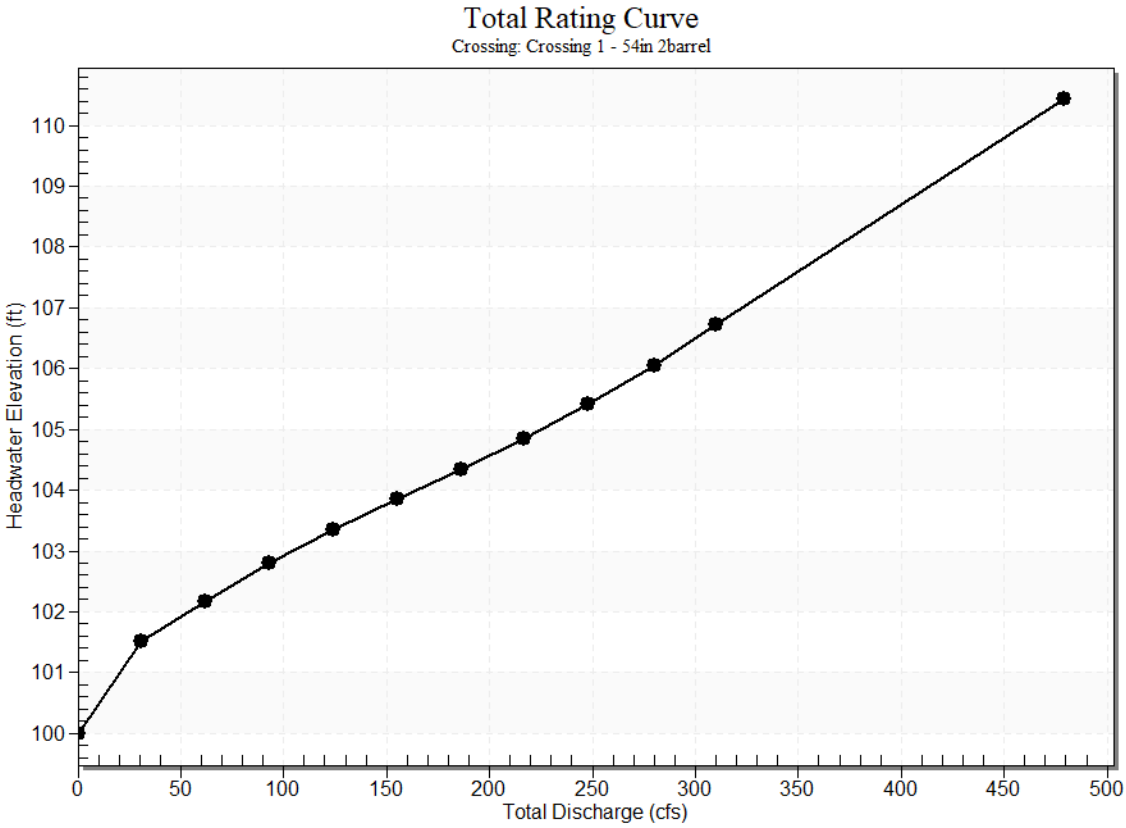
Design Flow: 280.00 cfs

Maximum Flow: 310.00 cfs

Table 15 - Summary of Culvert Flows at Crossing: Crossing 1 - 54in 2barrel

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
100.00	0.00	0.00	0.00	1
101.50	31.00	31.00	0.00	1
102.17	62.00	62.00	0.00	1
102.80	93.00	93.00	0.00	1
103.34	124.00	124.00	0.00	1
103.84	155.00	155.00	0.00	1
104.34	186.00	186.00	0.00	1
104.85	217.00	217.00	0.00	1
105.41	248.00	248.00	0.00	1
106.05	280.00	280.00	0.00	1
106.72	310.00	310.00	0.00	1
110.00	424.12	424.12	0.00	Overtopping

Rating Curve Plot for Crossing: Crossing 1 - 54in 2barrel



Culvert Data: Culvert 1

Table 8 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00 cfs	0.00 cfs	100.00	0.00	0.000	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
31.00 cfs	31.00 cfs	101.50	1.50	0.140	1-S2n	0.69	1.12	0.75	0.86	8.91	4.85
62.00 cfs	62.00 cfs	102.17	2.17	0.694	1-S2n	0.97	1.59	1.10	1.20	10.26	5.84
93.00 cfs	93.00 cfs	102.80	2.80	1.192	1-S2n	1.19	1.97	1.39	1.46	11.12	6.50
124.0	124.0	103.34	3.34	1.68	1-	1.38	2.29	1.6	1.66	11.8	7.00

0 cfs	0 cfs			5	S2 n			4		0	
155.0 **0** cfs	155.0 0 cfs	103.84	3.84	2.19 2	1- S2 n	1.55	2.57	1.8 7	1.84	12.3 7	7.42
186.0 **0** cfs	186.0 0 cfs	104.34	4.34	2.72 1	1- S2 n	1.71	2.83	2.0 9	2.00	12.8 8	7.77
217.0 **0** cfs	217.0 0 cfs	104.85	4.85	3.27 7	5- S2 n	1.86	3.06	2.2 9	2.14	13.3 5	8.09
248.0 **0** cfs	248.0 0 cfs	105.41	5.41	3.86 2	5- S2 n	2.01	3.28	2.4 8	2.27	13.8 1	8.37
280.0 **0** cfs	280.0 0 cfs	106.05	6.05	5.00 9	5- S2 n	2.15	3.48	2.6 7	2.39	14.2 6	8.63
310.0 **0** cfs	310.0 0 cfs	106.72	6.72	5.54 9	5- S2 n	2.29	3.65	2.8 3	2.50	14.6 9	8.86

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

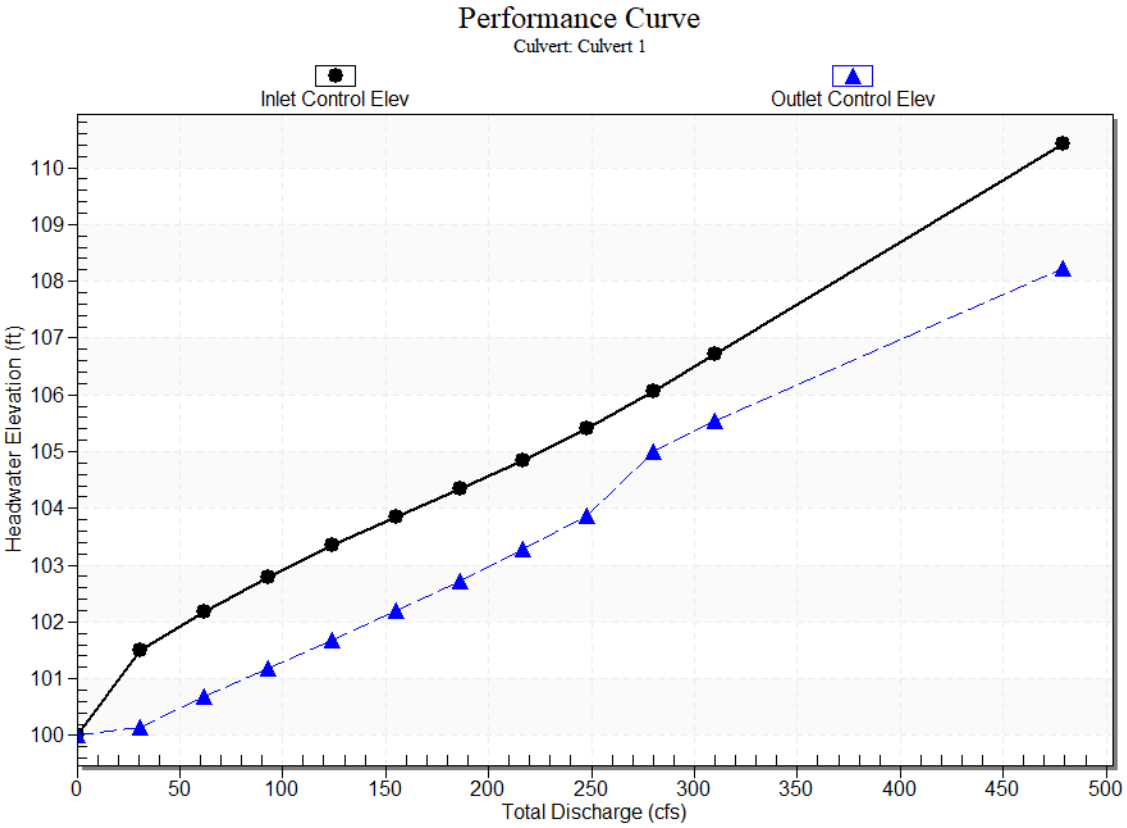
Inlet Elevation (invert): 100.00 ft,

Outlet Elevation (invert): 99.00 ft

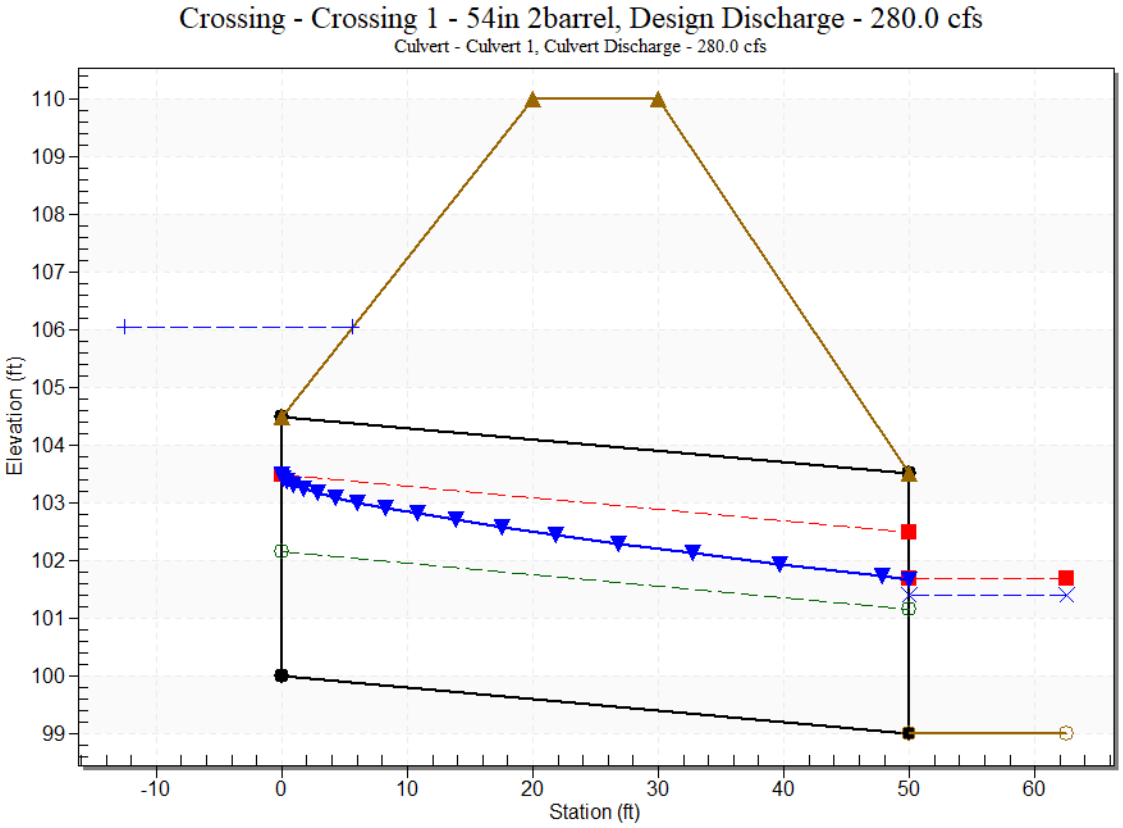
Culvert Length: 50.01 ft,

Culvert Slope: 0.0200

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 100.00 ft

Outlet Station: 50.00 ft

Outlet Elevation: 99.00 ft

Number of Barrels: 2

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 4.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: Crossing 1 - 54in 2barrel

Table 16 - Downstream Channel Rating Curve (Crossing: Crossing 1 - 54in 2barrel)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.00	99.00	0.00	0.00	0.00	0.00
31.00	99.86	0.86	4.85	1.07	1.12
62.00	100.20	1.20	5.84	1.50	1.17
93.00	100.46	1.46	6.50	1.82	1.20
124.00	100.66	1.66	7.00	2.07	1.22
155.00	100.84	1.84	7.42	2.30	1.24
186.00	101.00	2.00	7.77	2.49	1.25
217.00	101.14	2.14	8.09	2.67	1.26
248.00	101.27	2.27	8.37	2.83	1.27
280.00	101.39	2.39	8.63	2.98	1.28
310.00	101.50	2.50	8.86	3.12	1.29

Tailwater Channel Data - Crossing 1 - 54in 2barrel

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0300

Channel Invert Elevation: 99.00 ft

Roadway Data for Crossing: Crossing 1 - 54in 2barrel

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 110.00 ft

Roadway Surface: Paved

Roadway Top Width: 10.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0.00 cfs

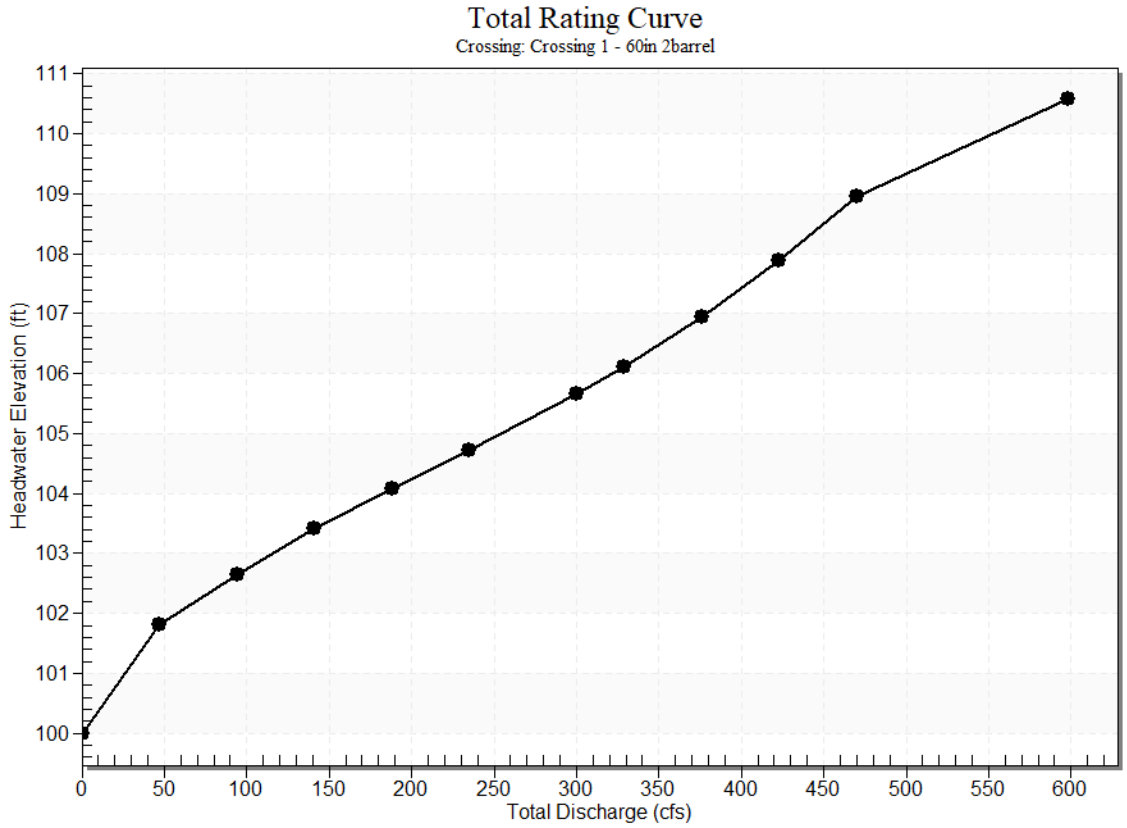
Design Flow: 300.00 cfs

Maximum Flow: 470.00 cfs

Table 17 - Summary of Culvert Flows at Crossing: Crossing 1 - 60in 2barrel

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
100.00	0.00	0.00	0.00	1
101.81	47.00	47.00	0.00	1
102.64	94.00	94.00	0.00	1
103.42	141.00	141.00	0.00	1
104.09	188.00	188.00	0.00	1
104.72	235.00	235.00	0.00	1
105.65	300.00	300.00	0.00	1
106.11	329.00	329.00	0.00	1
106.94	376.00	376.00	0.00	1
107.88	423.00	423.00	0.00	1
108.95	470.00	470.00	0.00	1
110.00	511.66	511.66	0.00	Overtopping

Rating Curve Plot for Crossing: Crossing 1 - 60in 2barrel



Culvert Data: Culvert 1

Table 9 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00 cfs	0.00 cfs	100.00	0.00	0.000	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
47.00 cfs	47.00 cfs	101.81	1.81	0.377	1-S2n	0.82	1.34	0.91	0.74	9.57	4.94
94.00 cfs	94.00 cfs	102.64	2.64	1.066	1-S2n	1.16	1.92	1.35	1.08	11.00	6.11
141.00 cfs	141.00 cfs	103.42	3.42	1.702	1-S2n	1.42	2.37	1.70	1.33	11.94	6.89
188.0	188.0	104.09	4.09	2.34	1-	1.65	2.76	2.0	1.55	12.6	7.48

0 cfs	0 cfs			4	S2 n			2		8	
235.0 **0** cfs	235.0 0 cfs	104.72	4.72	3.01 6	1- S2 n	1.86	3.10	2.3 0	1.74	13.3 2	7.96
300.0 **0** cfs	300.0 0 cfs	105.65	5.65	4.01 0	5- S2 n	2.12	3.51	2.6 6	1.97	14.1 3	8.52
329.0 **0** cfs	329.0 0 cfs	106.11	6.11	4.48 1	5- S2 n	2.23	3.68	2.8 1	2.06	14.4 7	8.74
376.0 **0** cfs	376.0 0 cfs	106.94	6.94	5.81 7	5- S2 n	2.41	3.92	3.0 4	2.20	15.0 2	9.06
423.0 **0** cfs	423.0 0 cfs	107.88	7.88	6.55 1	5- S2 n	2.58	4.14	3.2 6	2.34	15.5 8	9.36
470.0 **0** cfs	470.0 0 cfs	108.95	8.95	7.34 2	5- S2 n	2.76	4.32	3.4 7	2.46	16.1 6	9.63

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

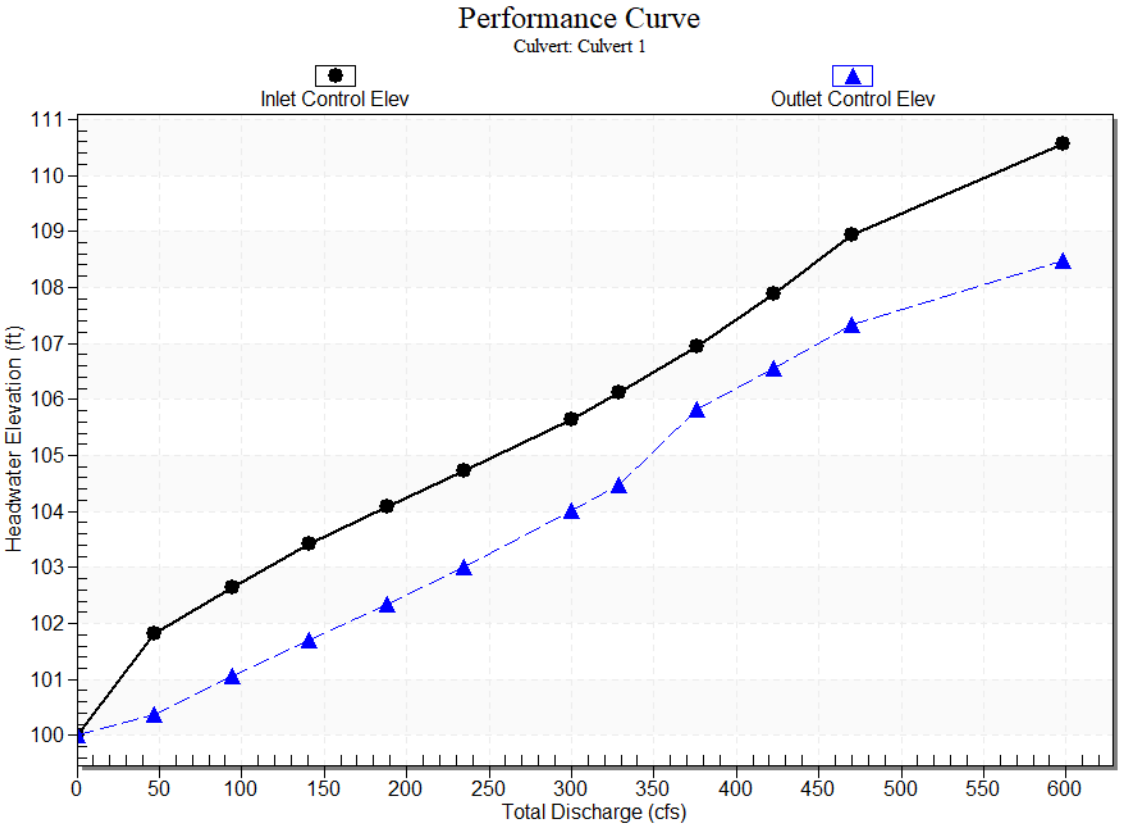
Inlet Elevation (invert): 100.00 ft,

Outlet Elevation (invert): 99.00 ft

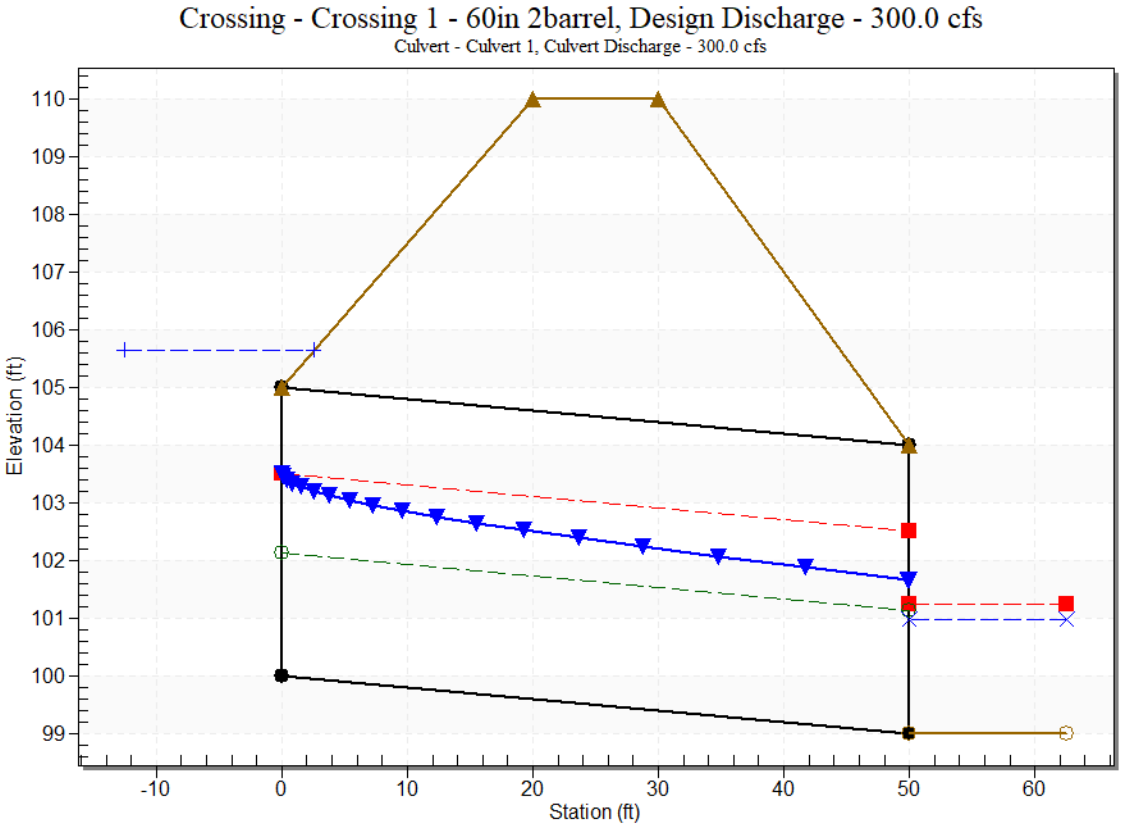
Culvert Length: 50.01 ft,

Culvert Slope: 0.0200

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 100.00 ft

Outlet Station: 50.00 ft

Outlet Elevation: 99.00 ft

Number of Barrels: 2

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 5.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: Crossing 1 - 60in 2barrel

Table 18 - Downstream Channel Rating Curve (Crossing: Crossing 1 - 60in 2barrel)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.00	99.00	0.00	0.00	0.00	0.00
47.00	99.74	0.74	4.94	0.92	1.12
94.00	100.08	1.08	6.11	1.34	1.18
141.00	100.33	1.33	6.89	1.67	1.22
188.00	100.55	1.55	7.48	1.94	1.24
235.00	100.74	1.74	7.96	2.17	1.26
300.00	100.97	1.97	8.52	2.46	1.28
329.00	101.06	2.06	8.74	2.57	1.29
376.00	101.20	2.20	9.06	2.75	1.30
423.00	101.34	2.34	9.36	2.92	1.31
470.00	101.46	2.46	9.63	3.07	1.32

Tailwater Channel Data - Crossing 1 - 60in 2barrel

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 10.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0300

Channel Invert Elevation: 99.00 ft

Roadway Data for Crossing: Crossing 1 - 60in 2barrel

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 110.00 ft

Roadway Surface: Paved

Roadway Top Width: 10.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0.00 cfs

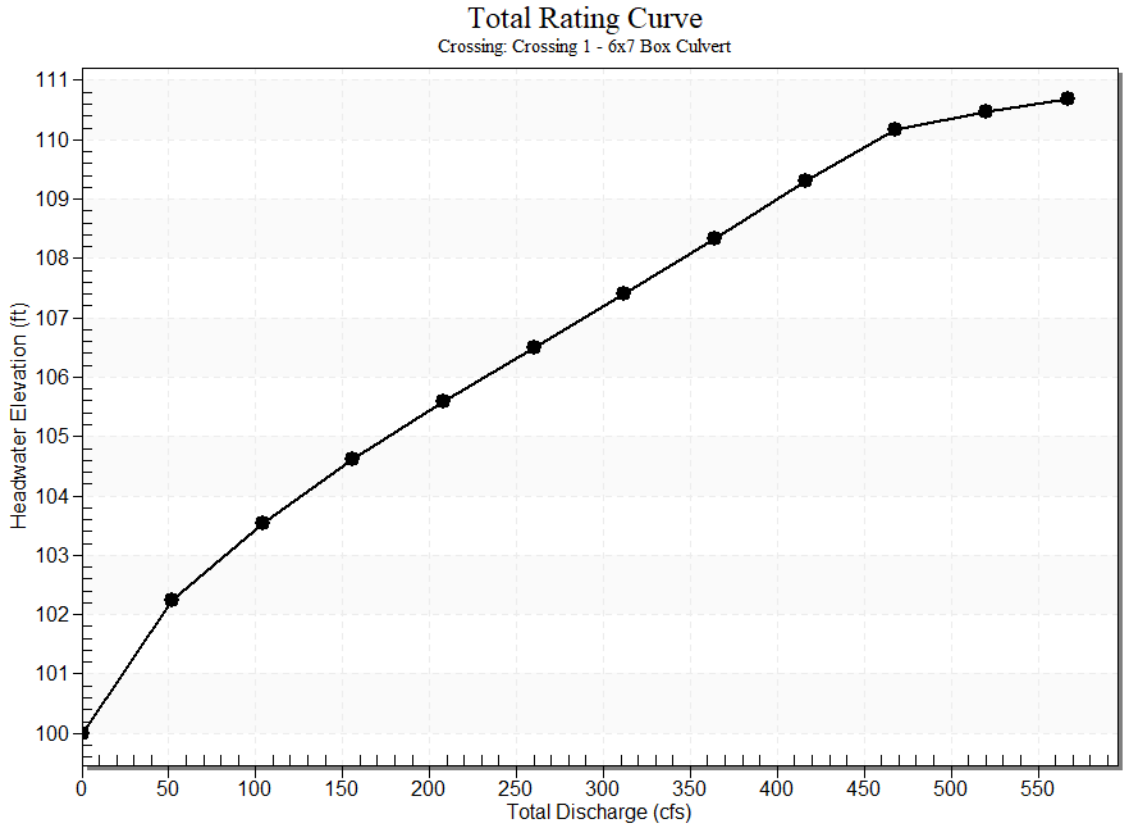
Design Flow: 520.00 cfs

Maximum Flow: 520.00 cfs

Table 19 - Summary of Culvert Flows at Crossing: Crossing 1 - 6x7 Box Culvert

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
100.00	0.00	0.00	0.00	1
102.23	52.00	52.00	0.00	1
103.54	104.00	104.00	0.00	1
104.62	156.00	156.00	0.00	1
105.59	208.00	208.00	0.00	1
106.50	260.00	260.00	0.00	1
107.40	312.00	312.00	0.00	1
108.32	364.00	364.00	0.00	1
109.31	416.00	416.00	0.00	1
110.17	468.00	457.92	10.03	5
110.47	520.00	471.87	48.04	5
110.00	450.01	450.01	0.00	Overtopping

Rating Curve Plot for Crossing: Crossing 1 - 6x7 Box Culvert



Culvert Data: Culvert 1

Table 10 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00 cfs	0.00 cfs	100.00	0.00	0.000	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
52.00 cfs	52.00 cfs	102.23	2.23	0.365	1-S2n	0.71	1.33	0.83	1.11	10.48	5.58
104.00 cfs	104.00 cfs	103.54	3.54	1.259	1-S2n	1.13	2.11	1.41	1.53	12.34	6.69
156.00 cfs	156.00 cfs	104.62	4.62	2.104	1-S2n	1.49	2.76	1.92	1.84	13.54	7.43
208.0	208.0	105.59	5.59	2.95	1-	1.82	3.34	2.4	2.10	14.4	8.00

0 cfs	0 cfs			5	S2 n			0		7	
260.0 **0** cfs	260.0 0 cfs	106.50	6.50	3.83 6	1- S2 n	2.13	3.88	2.8 4	2.32	15.2 4	8.47
312.0 **0** cfs	312.0 0 cfs	107.40	7.40	4.75 9	5- S2 n	2.43	4.38	3.2 7	2.51	15.9 1	8.87
364.0 **0** cfs	364.0 0 cfs	108.32	8.32	5.73 1	5- S2 n	2.73	4.85	3.6 8	2.68	16.5 1	9.23
416.0 **0** cfs	416.0 0 cfs	109.31	9.31	7.60 5	5- S2 n	3.01	5.30	4.0 7	2.84	17.0 4	9.54
468.0 **0** cfs	457.9 2 cfs	110.17	10.1 7	8.30 0	5- S2 n	3.24	5.66	4.3 8	2.99	17.4 4	9.83
520.0 **0** cfs	471.8 7 cfs	110.47	10.4 7	8.54 1	5- S2 n	3.31	5.77	4.4 8	3.12	17.5 7	10.10

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

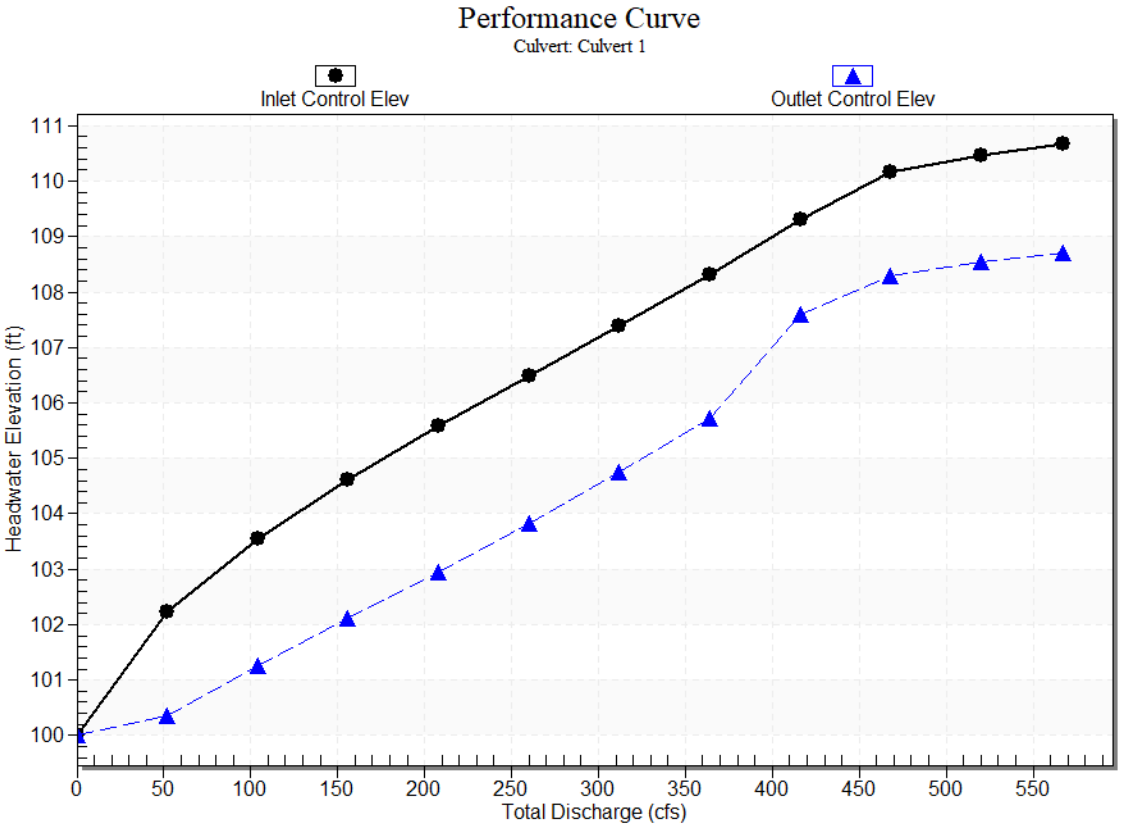
Inlet Elevation (invert): 100.00 ft,

Outlet Elevation (invert): 99.00 ft

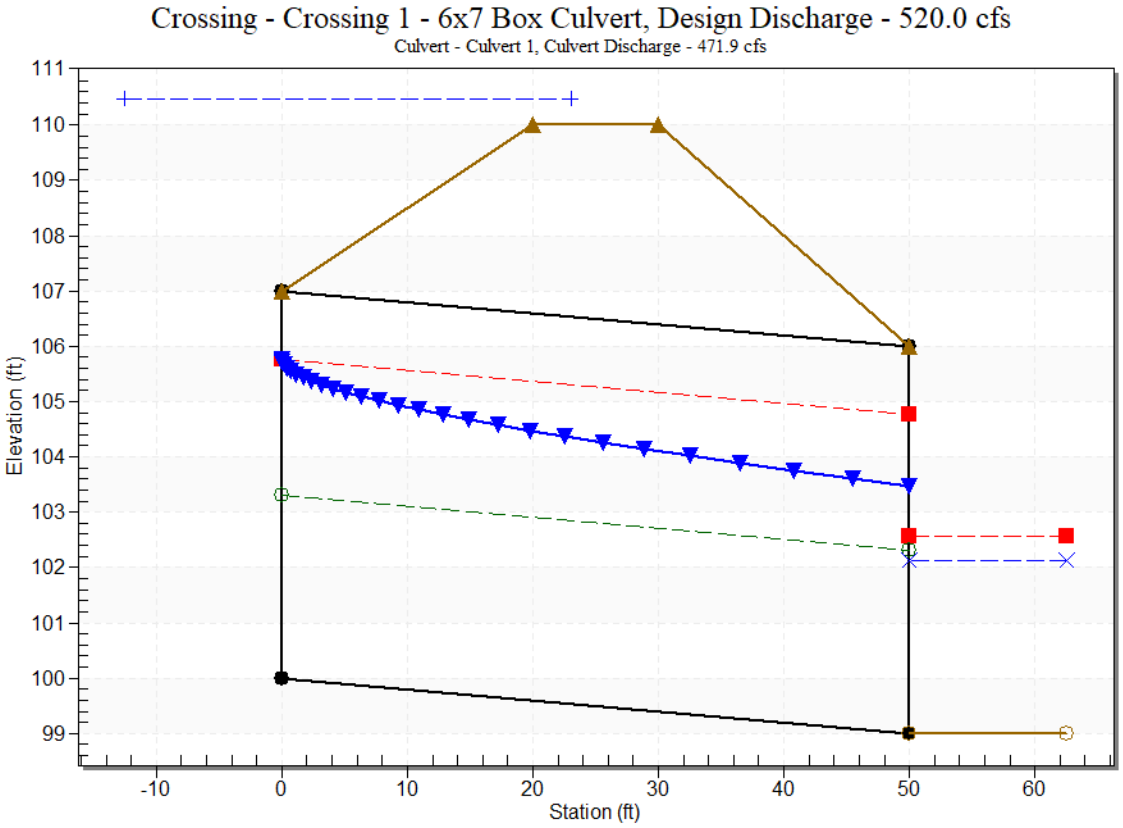
Culvert Length: 50.01 ft,

Culvert Slope: 0.0200

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 100.00 ft

Outlet Station: 50.00 ft

Outlet Elevation: 99.00 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Concrete Box

Barrel Span: 6.00 ft

Barrel Rise: 7.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge (90º) Headwall

Inlet Depression: None

Tailwater Data for Crossing: Crossing 1 - 6x7 Box Culvert

Table 20 - Downstream Channel Rating Curve (Crossing: Crossing 1 - 6x7 Box Culvert)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.00	99.00	0.00	0.00	0.00	0.00
52.00	100.11	1.11	5.58	1.38	1.15
104.00	100.53	1.53	6.69	1.91	1.21
156.00	100.84	1.84	7.43	2.30	1.24
208.00	101.10	2.10	8.00	2.62	1.26
260.00	101.32	2.32	8.47	2.89	1.28
312.00	101.51	2.51	8.87	3.13	1.29
364.00	101.68	2.68	9.23	3.34	1.31
416.00	101.84	2.84	9.54	3.54	1.32
468.00	101.99	2.99	9.83	3.73	1.33
520.00	102.12	3.12	10.10	3.90	1.34

Tailwater Channel Data - Crossing 1 - 6x7 Box Culvert

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0300

Channel Invert Elevation: 99.00 ft

Roadway Data for Crossing: Crossing 1 - 6x7 Box Culvert

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 110.00 ft

Roadway Surface: Paved

Roadway Top Width: 10.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0.00 cfs

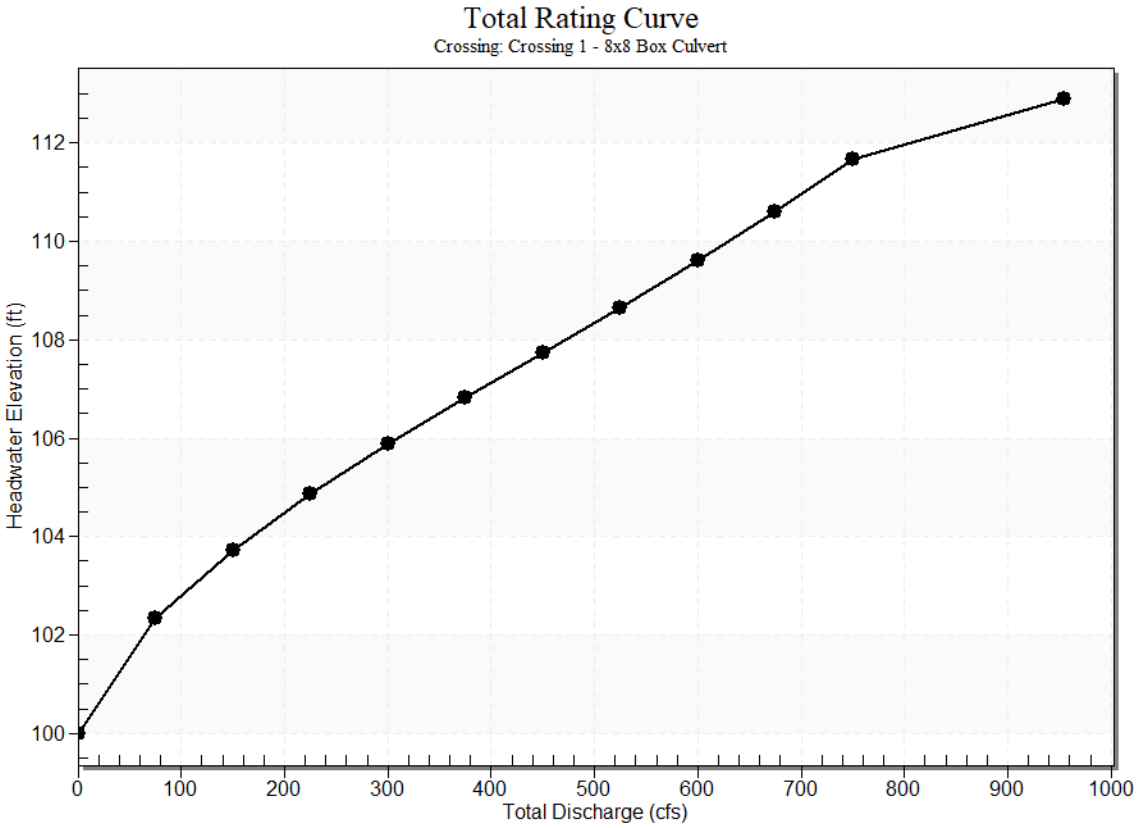
Design Flow: 750.00 cfs

Maximum Flow: 750.00 cfs

Table 21 - Summary of Culvert Flows at Crossing: Crossing 1 - 8x8 Box Culvert

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
100.00	0.00	0.00	0.00	1
102.35	75.00	75.00	0.00	1
103.73	150.00	150.00	0.00	1
104.88	225.00	225.00	0.00	1
105.89	300.00	300.00	0.00	1
106.83	375.00	375.00	0.00	1
107.74	450.00	450.00	0.00	1
108.66	525.00	525.00	0.00	1
109.60	600.00	600.00	0.00	1
110.60	675.00	675.00	0.00	1
111.68	750.00	750.00	0.00	1
112.00	771.23	771.23	0.00	Overtopping

Rating Curve Plot for Crossing: Crossing 1 - 8x8 Box Culvert



Culvert Data: Culvert 1

Table 11 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00 cfs	0.00 cfs	100.00	0.00	0.000	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
75.00 cfs	75.00 cfs	102.35	2.35	0.431	1-S2n	0.73	1.40	0.87	1.32	10.75	6.14
150.00 cfs	150.00 cfs	103.73	3.73	1.353	1-S2n	1.15	2.22	1.48	1.81	12.69	7.36
225.00 cfs	225.00 cfs	104.88	4.88	2.211	1-S2n	1.51	2.91	2.02	2.17	13.94	8.16
300.0	300.0	105.89	5.89	3.06	1-	1.83	3.52	2.5	2.46	14.9	8.78

0 cfs	0 cfs			2	S2n			1		1	
375.00 cfs	375.00 cfs	106.83	6.83	3.930	1-S2n	2.14	4.09	2.98	2.71	15.72	9.30
450.00 cfs	450.00 cfs	107.74	7.74	4.830	1-S2n	2.43	4.61	3.43	2.94	16.42	9.74
525.00 cfs	525.00 cfs	108.66	8.66	5.768	5-S2n	2.71	5.11	3.85	3.14	17.04	10.12
600.00 cfs	600.00 cfs	109.60	9.60	6.750	5-S2n	2.99	5.59	4.26	3.32	17.60	10.47
675.00 cfs	675.00 cfs	110.60	10.60	8.757	5-S2n	3.26	6.05	4.66	3.49	18.11	10.79
750.00 cfs	750.00 cfs	111.68	11.68	9.619	5-S2n	3.52	6.49	5.04	3.64	18.59	11.08

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

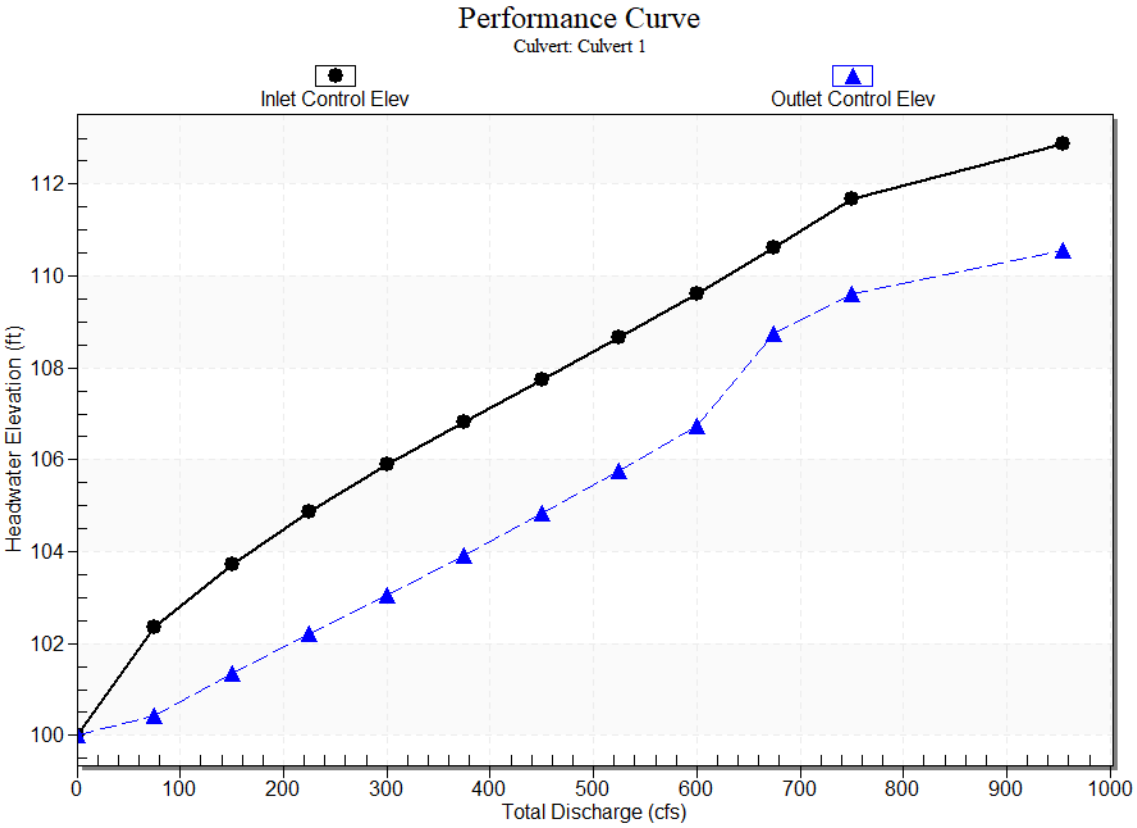
Inlet Elevation (invert): 100.00 ft,

Outlet Elevation (invert): 99.00 ft

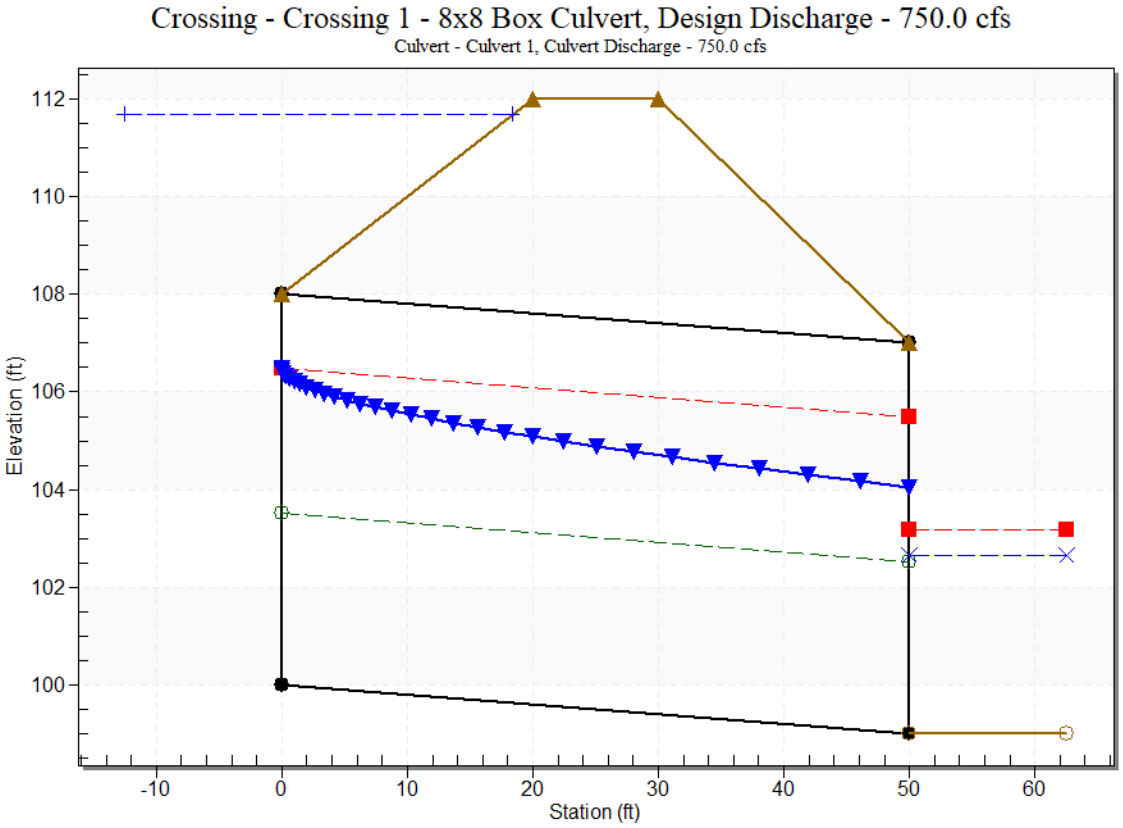
Culvert Length: 50.01 ft,

Culvert Slope: 0.0200

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 100.00 ft

Outlet Station: 50.00 ft

Outlet Elevation: 99.00 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Concrete Box

Barrel Span: 8.00 ft

Barrel Rise: 8.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge (90º) Headwall

Inlet Depression: None

Tailwater Data for Crossing: Crossing 1 - 8x8 Box Culvert

Table 22 - Downstream Channel Rating Curve (Crossing: Crossing 1 - 8x8 Box Culvert)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.00	99.00	0.00	0.00	0.00	0.00
75.00	100.32	1.32	6.14	1.64	1.18
150.00	100.81	1.81	7.36	2.26	1.23
225.00	101.17	2.17	8.16	2.71	1.27
300.00	101.46	2.46	8.78	3.08	1.29
375.00	101.71	2.71	9.30	3.39	1.31
450.00	101.94	2.94	9.74	3.66	1.32
525.00	102.14	3.14	10.12	3.91	1.34
600.00	102.32	3.32	10.47	4.14	1.35
675.00	102.49	3.49	10.79	4.35	1.36
750.00	102.64	3.64	11.08	4.55	1.37

Tailwater Channel Data - Crossing 1 - 8x8 Box Culvert

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0300

Channel Invert Elevation: 99.00 ft

Roadway Data for Crossing: Crossing 1 - 8x8 Box Culvert

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 112.00 ft

Roadway Surface: Paved

Roadway Top Width: 10.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0.00 cfs

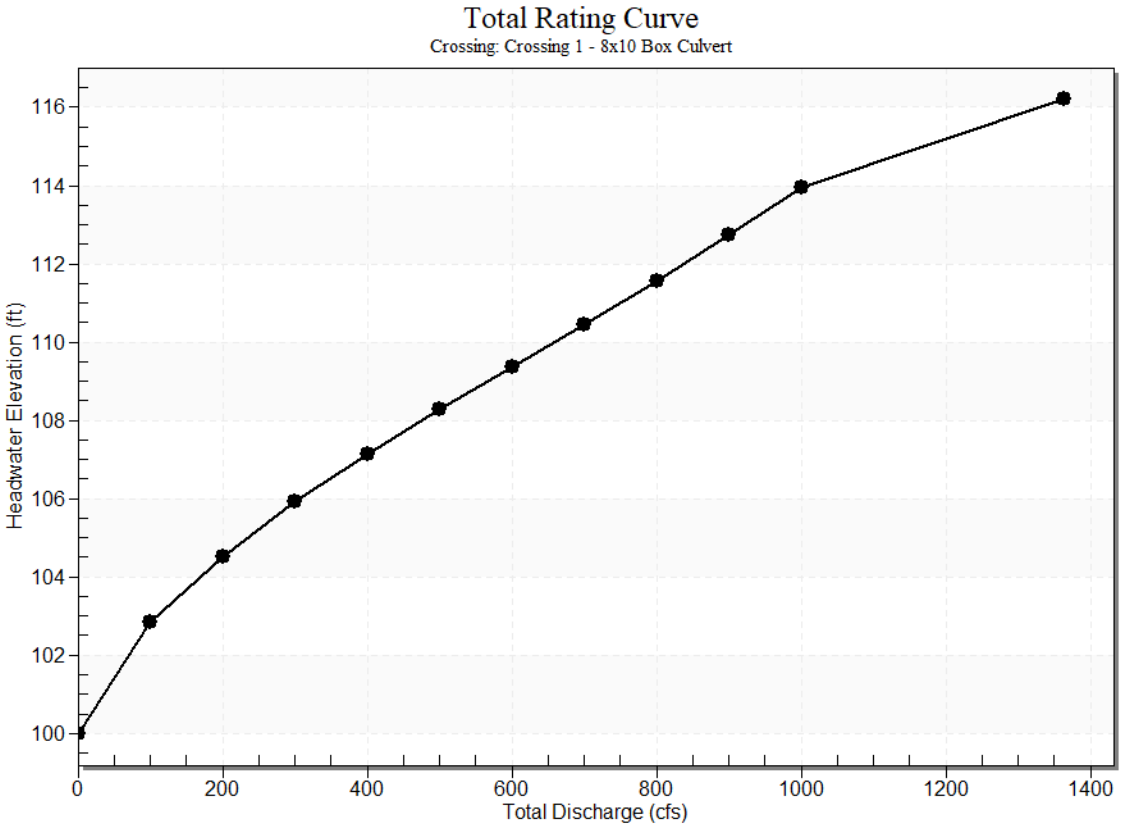
Design Flow: 1000.00 cfs

Maximum Flow: 1000.00 cfs

Table 23 - Summary of Culvert Flows at Crossing: Crossing 1 - 8x10 Box Culvert

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
100.00	0.00	0.00	0.00	1
102.85	100.00	100.00	0.00	1
104.52	200.00	200.00	0.00	1
105.91	300.00	300.00	0.00	1
107.14	400.00	400.00	0.00	1
108.28	500.00	500.00	0.00	1
109.37	600.00	600.00	0.00	1
110.45	700.00	700.00	0.00	1
111.56	800.00	800.00	0.00	1
112.73	900.00	900.00	0.00	1
113.97	1000.00	1000.00	0.00	1
115.00	1077.84	1077.84	0.00	Overtopping

Rating Curve Plot for Crossing: Crossing 1 - 8x10 Box Culvert



Culvert Data: Culvert 1

Table 12 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00 cfs	0.00 cfs	100.00	0.00	0.000	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
100.00 cfs	100.00 cfs	102.85	2.85	0.731	1-S2n	0.88	1.69	1.08	1.51	11.54	6.62
200.00 cfs	200.00 cfs	104.52	4.52	1.840	1-S2n	1.39	2.69	1.84	2.06	13.57	7.92
300.00 cfs	300.00 cfs	105.91	5.91	2.865	1-S2n	1.83	3.52	2.51	2.46	14.91	8.78
400.0	400.0	107.14	7.14	3.87	1-	2.24	4.27	3.1	2.79	15.9	9.45

0 cfs	0 cfs			6	S2n			3		6	
500.00 cfs	500.00 cfs	108.28	8.28	4.904	1-S2n	2.62	4.95	3.71	3.07	16.84	10.00
600.00 cfs	600.00 cfs	109.37	9.37	5.963	1-S2n	2.99	5.59	4.26	3.32	17.60	10.47
700.00 cfs	700.00 cfs	110.45	10.45	7.064	5-S2n	3.34	6.20	4.79	3.54	18.27	10.89
800.00 cfs	800.00 cfs	111.56	11.56	8.213	5-S2n	3.69	6.77	5.29	3.74	18.89	11.26
900.00 cfs	900.00 cfs	112.73	12.73	9.415	5-S2n	4.03	7.33	5.78	3.93	19.45	11.60
1000.00 cfs	1000.00 cfs	113.97	13.97	11.743	5-S2n	4.36	7.86	6.26	4.11	19.97	11.91

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

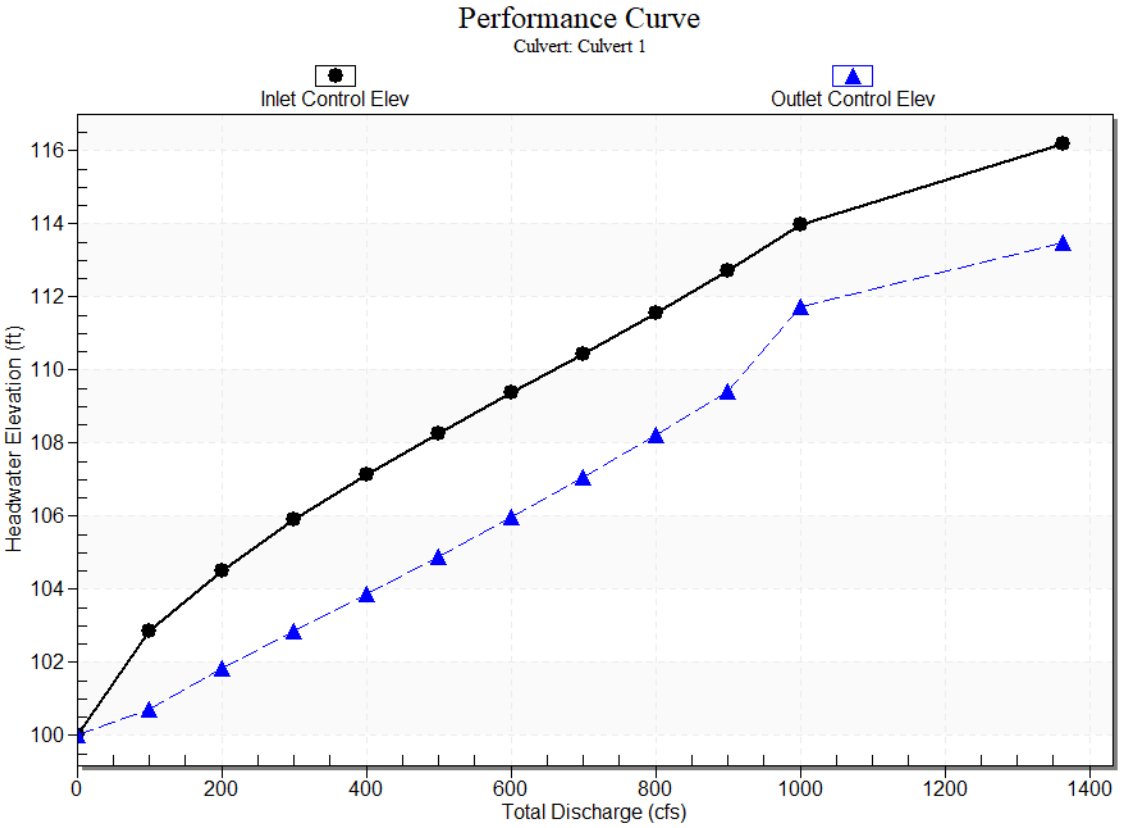
Inlet Elevation (invert): 100.00 ft,

Outlet Elevation (invert): 99.00 ft

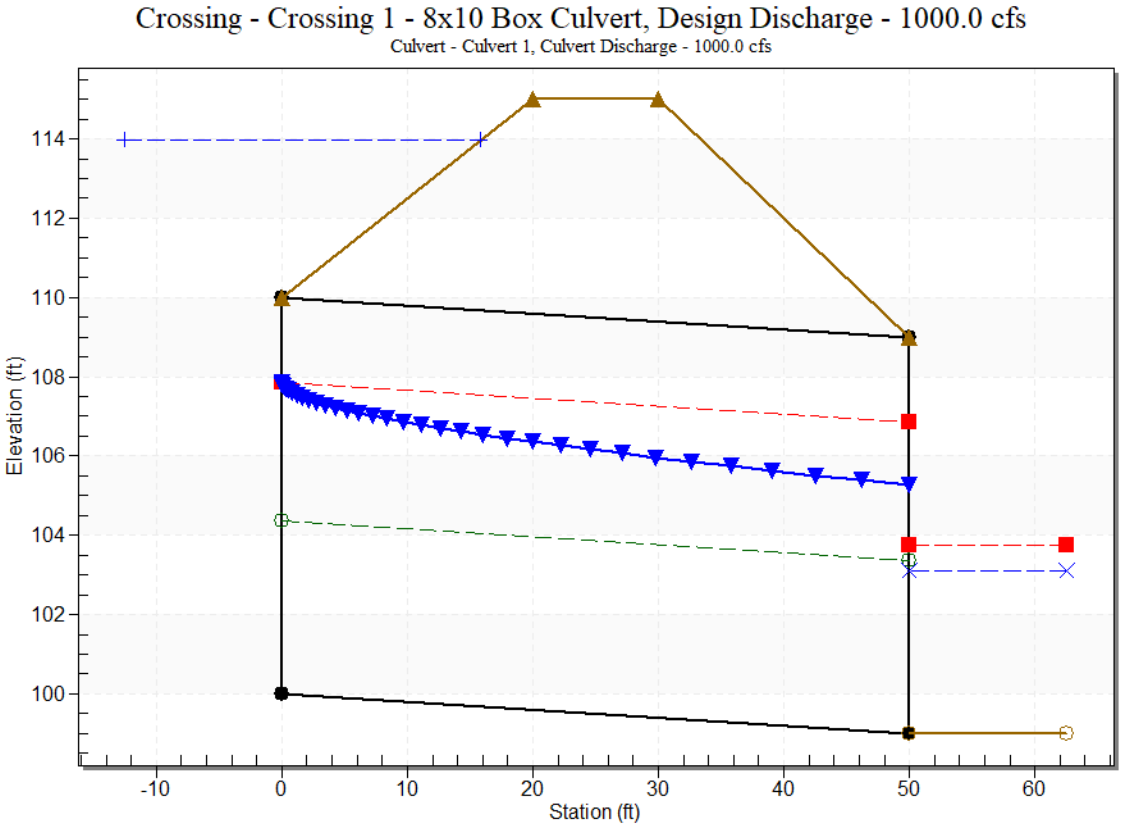
Culvert Length: 50.01 ft,

Culvert Slope: 0.0200

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 100.00 ft

Outlet Station: 50.00 ft

Outlet Elevation: 99.00 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Concrete Box

Barrel Span: 8.00 ft

Barrel Rise: 10.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge (90º) Headwall

Inlet Depression: None

Tailwater Data for Crossing: Crossing 1 - 8x10 Box Culvert

Table 24 - Downstream Channel Rating Curve (Crossing: Crossing 1 - 8x10 Box Culvert)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.00	99.00	0.00	0.00	0.00	0.00
100.00	100.51	1.51	6.62	1.88	1.20
200.00	101.06	2.06	7.92	2.57	1.26
300.00	101.46	2.46	8.78	3.08	1.29
400.00	101.79	2.79	9.45	3.48	1.31
500.00	102.07	3.07	10.00	3.83	1.33
600.00	102.32	3.32	10.47	4.14	1.35
700.00	102.54	3.54	10.89	4.42	1.36
800.00	102.74	3.74	11.26	4.67	1.37
900.00	102.93	3.93	11.60	4.91	1.38
1000.00	103.11	4.11	11.91	5.13	1.39

Tailwater Channel Data - Crossing 1 - 8x10 Box Culvert

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0300

Channel Invert Elevation: 99.00 ft

Roadway Data for Crossing: Crossing 1 - 8x10 Box Culvert

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 115.00 ft

Roadway Surface: Paved

Roadway Top Width: 10.00 ft

Required Water Quality Capture Volume (WQCV) and Allowable Release Rate

TOTAL

BASIN	Design Event	Area (ac)	Impervious	WQCV (acft)	Allowable Release Rate (cfs)*
EX	5YR	16444.96	0.033	33.5	1644.5
	100YR				8880.3
PR	5YR	16444.96	0.05	49.5	1644.5
	100YR				8880.3
REQ'D	5YR	-	-	16.0	1644.5
	100YR				8880.3

**5YR = 0.10 CFS/AC, 100YR = 0.54 CFS/AC*

BASIN 100

BASIN	Design Event	Area (ac)	Impervious	WQCV (acft)	Allowable Release Rate (cfs)*
EX	5YR	1743.21	0.025	2.7	174.3
	100YR				941.3
PR	5YR	1743.21	0.031	3.4	174.3
	100YR				941.3
REQ'D	5YR	-	-	0.6	174.3
	100YR				941.3

**5YR = 0.10 CFS/AC, 100YR = 0.54 CFS/AC*

BASIN 200

BASIN	Design Event	Area (ac)	Impervious	WQCV (acft)	Allowable Release Rate (cfs)*
EX	5YR	2682.55	0.023	3.9	268.3
	100YR				1448.6
PR	5YR	2682.55	0.053	8.5	268.3
	100YR				1448.6
REQ'D	5YR	-	-	4.7	268.3
	100YR				1448.6

**5YR = 0.10 CFS/AC, 100YR = 0.54 CFS/AC*

BASIN 300

BASIN	Design Event	Area (ac)	Impervious	WQCV (acft)	Allowable Release Rate (cfs)*
EX	5YR	708.85	0.089	3.6	70.9
	100YR				382.8
PR	5YR	708.85	0.089	3.6	70.9
	100YR				382.8
REQ'D	5YR	-	-	0.0	70.9
	100YR				382.8

**5YR = 0.10 CFS/AC, 100YR = 0.54 CFS/AC*

BASIN 400

BASIN	Design Event	Area (ac)	Impervious	WQCV (acft)	Allowable Release Rate (cfs)*
EX	5YR	2285.42	0.060	8.1	228.5
	100YR				1234.1
PR	5YR	2285.42	0.097	12.4	228.5
	100YR				1234.1
REQ'D	5YR	-	-	4.3	228.5
	100YR				1234.1

**5YR = 0.10 CFS/AC, 100YR = 0.54 CFS/AC*

BASIN 500

BASIN	Design Event	Area (ac)	Impervious	WQCV (acft)	Allowable Release Rate (cfs)*
EX	5YR	525.64	0.065	2.0	52.6
	100YR				283.8
PR	5YR	525.64	0.139	3.8	52.6
	100YR				283.8
REQ'D	5YR	-	-	1.8	52.6
	100YR				283.8

**5YR = 0.10 CFS/AC, 100YR = 0.54 CFS/AC*

BASIN 600

BASIN	Design Event	Area (ac)	Impervious	WQCV (acft)	Allowable Release Rate (cfs)*
EX	5YR	358.62	0.021	0.5	35.9
	100YR				193.7
PR	5YR	358.62	0.028	0.6	35.9
	100YR				193.7
REQ'D	5YR	-	-	0.2	35.9
	100YR				193.7

**5YR = 0.10 CFS/AC, 100YR = 0.54 CFS/AC*

BASIN 700

BASIN	Design Event	Area (ac)	Impervious	WQCV (acft)	Allowable Release Rate (cfs)*
EX	5YR	1519.78	0.023	2.2	152.0
	100YR				820.7
PR	5YR	1519.78	0.049	4.5	152.0
	100YR				820.7
REQ'D	5YR	-	-	2.3	152.0
	100YR				820.7

**5YR = 0.10 CFS/AC, 100YR = 0.54 CFS/AC*

BASIN 800

BASIN	Design Event	Area (ac)	Impervious	WQCV (acft)	Allowable Release Rate (cfs)*
EX	5YR	6620.89	0.024	10.0	662.1
	100YR				3575.3
PR	5YR	6620.89	0.028	11.5	662.1
	100YR				3575.3
REQ'D	5YR	-	-	1.6	662.1
	100YR				3575.3

**5YR = 0.10 CFS/AC, 100YR = 0.54 CFS/AC*

Proposed Pond Summary

Required vs. Proposed Volume

Existing				*Proposed*				*Required*			*Provided*			
Design Point	Tributary Basin(s)	Direct Inflow (ac-ft)	Total Inflow (ac-ft)	Design Point	Tributary Basin(s)	Direct Inflow (ac-ft)	Total Inflow (ac-ft)	Detention Volume (ac-ft)	WQCV Volume (ac-ft)	Total Volume (ac-ft)	Pond #	Depth (ft)	Area (ac)	Volume (ac-ft)
100	100	45.7	45.7	100	100	46.0	46.0	0.3	0.6	1.5	100	6	0.25	1.5
101	101	16.4	16.4	101	101	16.6	16.6	0.2		-	*Provided in Pond 100*			
102	102	6.4	6.4	102	102	6.8	6.8	0.3		-	*Provided in Pond 100*			
103	103	2.2	2.2	103	103	2.2	2.2	0.0		-	*Provided in Pond 100*			
200	200	2.1	2.1	200	200	3.5	3.5	1.5	4.7	-	*Provided in Pond 202*			
201	201	0.9	0.9	201	201	1.7	1.7	0.8		-	*Provided in Pond 202*			
202	200/201/202	9.1	12.3	202	200/201/202/208	10.6	16.9	4.7		7.0	202	6	1.16	7.0
203	200/201/202/203	11.7	24.5	203	200/201/202/203/207/208	9.3	30.0	5.5		-	*Provided in Pond 204*			
204	200/201/202/203/204	47.3	74.3	204	200/201/202/203/204/207/208	48.8	81.3	7.1		4.7	204	6	0.79	4.7
205	205	15.7	15.7	205	205	15.7	15.7	-		-	-			
206	206	16.1	16.1	206	206	16.1	16.1	-		-	-			
-	-	-	-	207	207	3.1	3.1	*See DP 204*		-	*Provided in Pond 204*			
-	-	-	-	208	200/208	1.0	4.5	*See DP 202*		-	*Provided in Pond 202*			
300	300	2.2	2.2	300	300	2.2	2.2	-	0.0	-	-	-	-	-
301	301	1.2	1.2	301	301	1.2	1.2	-		-	-	-	-	-
302	302	3.5	3.5	302	302	3.5	3.5	-		-	-	-	-	-
303	301/302/303	3.0	7.8	303	301/302/303	3.0	7.8	-		-	-	-	-	-
304	301/302/303/304	2.2	10.0	304	301/302/303/304	2.2	10.0	-		-	-	-	-	-
305	305	2.6	2.6	305	305	2.6	2.6	-		-	-	-	-	-
306	305/306	1.1	3.7	306	305/306	1.1	3.7	-		-	-	-	-	-
307	305/306/307	1.3	5.1	307	305/306/307	1.3	5.1	-		-	-	-	-	-
308	301/302/303/304/305/ 306/307/308	1.6	16.7	308	301/302/303/304/305/ 306/307/308	1.6	16.7	-		-	-	-	-	-
309	301/302/303/304/305/ 306/307/308/309	7.6	24.8	309	301/302/303/304/305/ 306/307/308/309	7.6	24.8	-		-	-	-	-	-
310	310	4.1	4.1	310	310	4.1	4.1	-		-	-	-	-	-
311	311	1.6	1.6	311	311	1.6	1.6	-		-	-	-	-	-
400	400	20.6	20.6	400	400	20.9	20.9	0.4	4.3	4.3	400	6	0.72	4.3
401	401	7.2	7.2	401	401	8.6	8.6	1.4		-	*Provided in Pond 400*			
402	402	2.1	2.1	402	402	2.3	2.3	0.2		-	*Provided in Pond 400*			
403	402/403	1.1	3.3	403	402/403	1.3	3.6	0.4		-	*Provided in Pond 400*			
404	404	6.5	6.5	404	404	6.9	6.9	0.4		-	*Provided in Pond 400*			
405	404/405	2.5	9.1	405	404/405	2.9	9.8	0.7		-	*Provided in Pond 400*			
406	401/402/403/404/405/406	7.3	27.0	406	401/402/403/404/405/406	7.6	29.8	2.8		-	*Provided in Pond 400*			
407	407	1.1	1.1	407	407	1.5	1.5	0.4		-	*Provided in Pond 408*			
408	407/408	3.2	4.3	421	407/408/421	2.7	5.6	1.3		2.3	408	6	0.39	2.3
409	401/402/403/404/405/ 406/407/408/409	13.1	44.8	420	401/402/403/404/405/406/ 407/408/409/419/420/421	7.2	51.3	6.4		0.9	409	6	0.15	0.9
410	400/401/402/403/404/405/ 406/407/408/409/410/411	2.5	68.7	410	400/401/402/403/404/405/ 406/407/408/409/410/411/ 419/420/421	2.6	75.8	7.1		-	*Provided in Pond 416*			
411	411	0.8	0.8	411	411	0.9	0.9	-		-	*Provided in Pond 416*			
412	400/401/402/403/404/405/ 406/407/408/409/410/411/412	3.5	72.1	412	400/401/402/403/404/405/ 406/407/408/409/410/411/ 412/419/420/421	3.5	79.5	7.4		-	*Provided in Pond 416*			
413	400/401/402/403/404/405/ 406/407/408/409/410/411/ 412/413	1.7	74.0	413	400/401/402/403/404/405/ 406/407/408/409/410/411/ 412/413/419/420/421	1.7	81.0	7.1		-	*Provided in Pond 416*			
414	400/401/402/403/404/405/ 406/407/408/409/410/411/ 412/413/414	3.1	84.1	414	400/401/402/403/404/405/ 406/407/408/409/410/411/ 412/413/414/419/420/421	3.1	91.1	7.1		-	*Provided in Pond 416*			
415	415	7.0	7.0	415	415	7.0	7.0	-		-	-	-	-	-
416	400/401/402/403/404/405/ 406/407/408/409/410/411/ 412/413/414/415/416	4.8	89.0	416	400/401/402/403/404/405/ 406/407/408/409/410/411/ 412/413/414/415/416/419/ 420/421	4.8	96.1	7.1		0.6	416	6	0.10	0.6
417	417	3.2	3.2	417	417	3.2	3.2	0.0		-	*Provided in Pond 416*			
418	418	2.5	2.5	418	418	2.5	2.5	0.0		-	*Provided in Pond 416*			
-	-		-	419	401/402/403/404/405/ 406/409/419	1.9	37.7	*See DP 409/420*		-	-	-	-	-
-	-		-	408	407/408	1.4	2.9	*See DP 408/421*		-	*Provided in Pond 408*			
-	-		-	409	401/402/403/404/405/ 406/409	5.9	35.6	*See DP 409/420*		-	-	-	-	-
422	422	0.6	0.6	422	422	0.6	0.6	0.0						
500	500	1.8	1.8	500	500	1.8	1.8	0.1	1.8	-	*Provided in Pond 502*			
501	501	5.4	5.4	501	501	6.8	6.8	1.4		-	*Provided in Pond 502*			
502	500/501/502	5.5	12.8	502	500/501/502/505/506	3.6	15.3	2.5		4.7	502	6	0.79	4.7
503	503	5.8	5.8	503	503	6.1	6.1	0.3		-	*Provided in Pond 502*			
504	500/501/502/503/504	4.4	23.2	504	500/501/502/503/504/505/506	4.4	26.1	2.9		-	*Provided in Pond 502*			
-	-		-	505	501/505	1.6	8.5	*See DP 502*		-	-	-	-	-
-	-		-	506	506	1.4	1.4			-	-	-	-	-
600	600	14.5	14.5	600	600	14.6	14.6	0.2	0.2	0.4	600A	6	0.04	0.2
											600B	6	0.04	0.2
700	700/701	28.0	36.5	700	700/701/702/703/704/ 705/706/707	11.8	44.2	7.7	2.3	14.0	700A	6	2.34	14.0
701	701	8.4	8.4	701	701	8.5	8.5	*See DP 700*		-	-	-	-	-
-	-	-	-	702	702	1.5	1.5			-	-	-	-	-
-	-	-	-	703	703	3.0	3.0			-	-	-	-	-
-	-	-	-	704	704	11.3	11.3			-	-	-	-	-
-	-	-	-	705	705	2.2	2.2			-	-	-	-	-
-	-	-	-	706	702/706	3.2	4.7			-	-	-	-	-
-	-	-	-	707	703/704/705/707	2.5	19.0			-	-	-	-	-
800	800	81.9	81.9	800	800	81.9	81.9	-	1.6	-	-	-	-	-
801	801	15.3	15.3	801	801	16.6	16.6	-		-	-	-	-	-
802	800/801/802	78.6	176.2	802	800/802	66.9	148.8	-		-	-	-	-	-
803	800/801/802/803	6.5	183.2	803	800/801/802/803/806/807	6.5	185.7	2.5		-	*Provided in Pond 700*			
804	804	17.7	17.7	804	804	17.9	17.9	-		-	-	-	-	-
805	805	16.8	16.8	805	805	16.8	16.8	-		-	-	-	-	-
-	-	-	-	806	806	9.9	9.9	*See DP 803*		-	-	-	-	-
-	-	-	-	807	800/801/802/806	2.7	178.9			-	-	-	-	-

APPENDIX E – WATER QUALITY BMP EXAMPLES

APPENDIX E –SCM/PCM TOOL KIT

1 Regional BMPs

1.1 Extended Detention Basin

Description

An extended detention basin (EDB) is a downstream feature often in a row of features. An EDB will detain and slowly release stormwater over a 40 hour drain time, allowing time for sediments to settle at the bottom. They are not designed to have a lot of water and can be referred to as “dry ponds”. EDBs can be used in conjunction with full spectrum detention which provides flood control. Micropools are also used in conjunction with EDBs and allow water to flow through a submerged portion of a trash rack to reach the openings in the orifice.

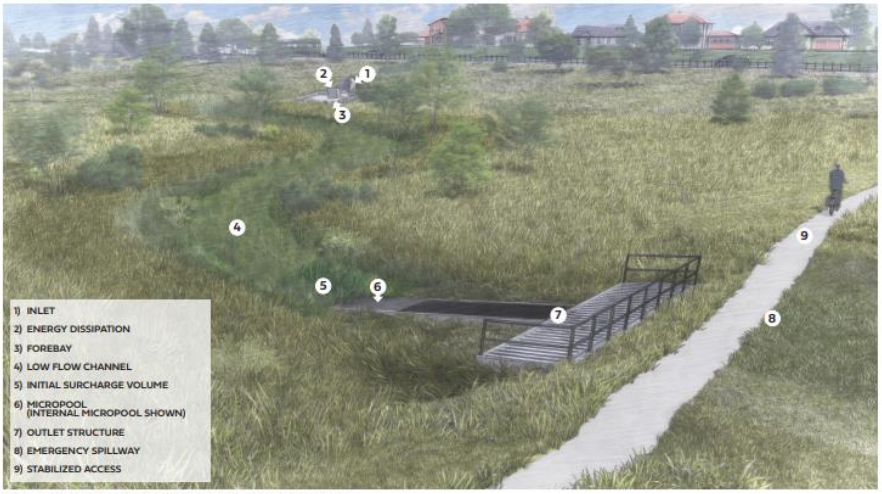


Figure EDB-1. Extended Detention Basin Components

TABLE EDB-2. EDB COMPONENTS

COMPONENT	INTENT
Inlet	Allows stormwater to enter the SCM. Maximize distance between inlet(s) and outlet to minimize short-circuiting and increase hydraulic residence time.
Energy Dissipation	Reduces the velocity and energy of runoff entering the SCM through roughness and/or structural measures to promote sedimentation in the forebay.
Forebay	Facilitates removal of trash and coarse sediments in an accessible location to reduce the frequency of sediment removal in the main body of the EDB.
Low Flow Channel	Conveys low flows from the inlets to the outlet structure, limiting the inundation area of frequent flows to facilitate maintenance operations.
Initial Surcharge Volume	Stores runoff from frequently occurring events in an area with hydrophytic vegetation adapted to frequent and prolonged inundation.
Micropool	Reduces potential clogging at the outlet by providing a flow path below the permanent water surface elevation to the orifice plate even when the trash rack becomes clogged above the water surface.
Outlet Structure	Releases the WQCV through control orifices over a 40-hour drain time and conveys runoff from larger events to downstream conveyance system.
Emergency Spillway	Discharges flows exceeding design events or flows during plugged outlet conditions to downstream conveyance system while protecting embankment stability.
Stabilized Access	Provides maintenance access to components of the EDB.

Source: MHFD – USDCM – Volume 3

Operation and Maintenance (O&M):

Maintenance for an EDB will include cleaning sediment and debris from its forebays, removing debris from outlet structure orifices and installing/cleaning trash racks (if necessary), vegetation management, and lastly removing any accumulated sediment from channels with low base flow. Micropools can also be used to help reduce clogging of any orifices.

APPENDIX E –SCM/PCM TOOL KIT

1.2 Constructed Wetlands

Description

A constructed wetland includes a permanent pool of water that is above the designed capacity. This designed capacity will capture and slowly release the water quality capture volume (WQCV) over a period of 24 hours. The stormwater during each runoff event will mix with the permanent water, allowing for a reduced drain tome in comparison to the extended detention basin. A constructed wetland will also remove soluble pollutants through natural processes. A constructed wetland does require water rights since evaporation of the permanent pool will cause depletion in water flows downstream of what would be flowing past the wetland.

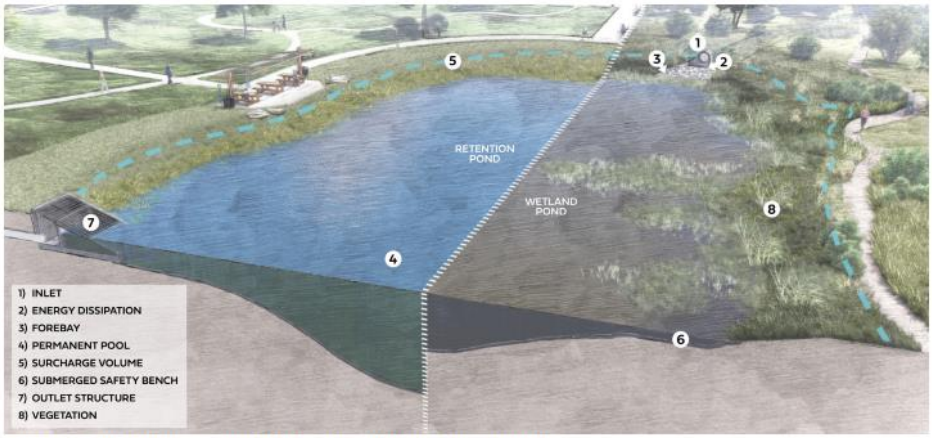


Figure RP/CWP-1. Retention Pond and Constructed Wetland Pond Components

TABLE RP/CWP-2. RP/CWP COMPONENTS

COMPONENT	INTENT
Inlet	Allows stormwater to enter the SCM.
Energy Dissipation	Protects against erosion when inlet is elevated above the permanent pool.
Forebay	Facilitates removal of trash and coarse sediments. This is the primary location for sediment removal.
Permanent Pool	Provides for quiescent sedimentation and biochemical processes that remove or transform pollutants between runoff events.
Surcharge Volume	Provides the WQCV for slow release through the outlet.
Submerged Safety Bench	Minimizes safety hazard of people inadvertently stepping into deep water or onto steep, wet slope.
Outlet Structure	Ensures slow release of water to provide treatment and reduce erosion in the receiving stream.
Vegetation	Filters runoff, provides biological uptake of pollutants, creates habitat, and mediates biochemical reactions in the soil.

Source: MHFD – USDCM – Volume 3

Operation and Maintenance (O&M)

A constructed wetland will need to be designed in such a way that there is pretreatment for trash and coarse sediment upstream of the permanent pool via a forebay that is elevated and accessible. Removal of sediment will need to occur periodically, maintaining a set depth and volume. This will reduce internal nutrient loading and help with algae blooms. These algae blooms can be managed through fertilizer management methods such as reducing the amount used, using phosphorus-free fertilizer, and using irrigation management. Lastly, when removing sediment from a constructed wetland, dewatering is typically required and should be considered. Inspect the channel at least annually.

APPENDIX E –SCM/PCM TOOL KIT

1.3 Retention Pond

Description

Retention ponds are very similar to constructed wetlands and requires slightly different maintenance. Retention ponds release the water quality capture volume over half the time, in 12 hours. A retention pond will still have a permanent pool, use natural processes to remove soluble pollutants, and require water rights.

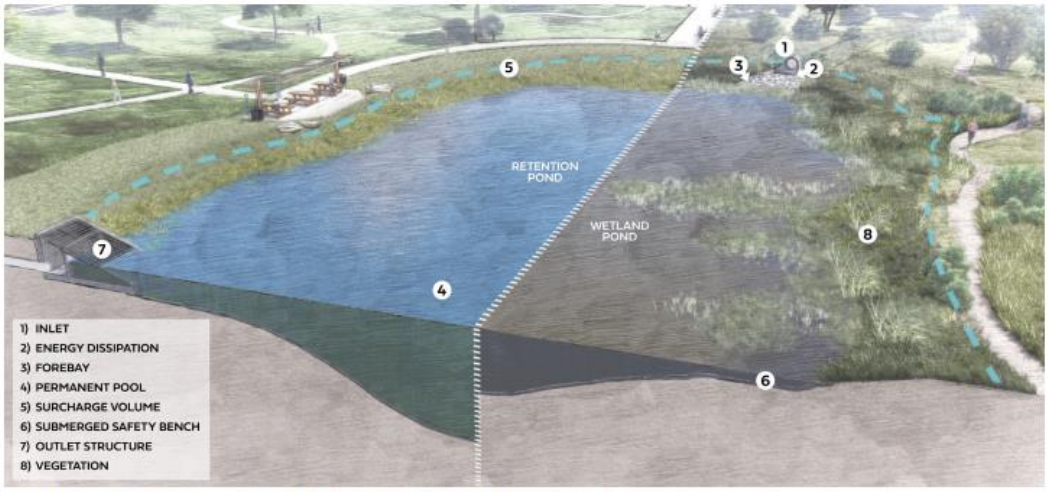


Figure RP/CWP-1. Retention Pond and Constructed Wetland Pond Components

TABLE RP/CWP-2. RP/CWP COMPONENTS

COMPONENT	INTENT
Inlet	Allows stormwater to enter the SCM.
Energy Dissipation	Protects against erosion when inlet is elevated above the permanent pool.
Forebay	Facilitates removal of trash and coarse sediments. This is the primary location for sediment removal.
Permanent Pool	Provides for quiescent sedimentation and biochemical processes that remove or transform pollutants between runoff events.
Surcharge Volume	Provides the WQCV for slow release through the outlet.
Submerged Safety Bench	Minimizes safety hazard of people inadvertently stepping into deep water or onto steep, wet slope.
Outlet Structure	Ensures slow release of water to provide treatment and reduce erosion in the receiving stream.
Vegetation	Filters runoff, provides biological uptake of pollutants, creates habitat, and mediates biochemical reactions in the soil.

Source: MHFD – USDCM – Volume 3

Operation and Maintenance (O&M)

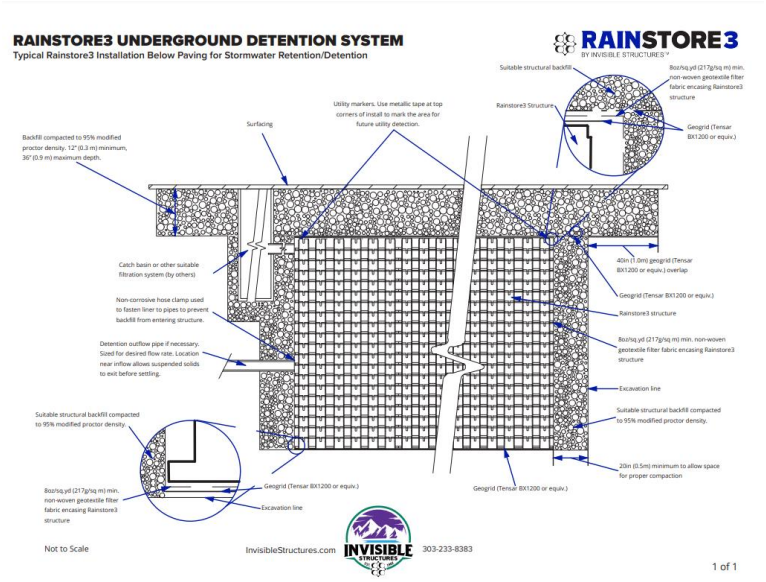
Inspect the pond at least annually. Note the amount of sediment in the forebay and look for debris at the outlet structure. Remove debris and litter from the pond as needed. This includes floating debris that could clog the outlet or overflow structure. Mosquito control may be necessary if the BMP is located in proximity to outdoor amenities. The most effective mosquito control programs include weekly inspection for signs of mosquito breeding with treatment provided when breeding is found. These inspections and treatment can be performed by a mosquito control service and typically start in mid-May and extend to mid-September. The use of larvicidal briquettes or "dunks" is not recommended for ponds due to their size and configuration.

APPENDIX E –SCM/PCM TOOL KIT

1.4 Underground BMPs

Description

Underground BMPs will vary as a BMP is a “best management practice”. For this reason, an underground BMP may refer to any source control measure (SCM) that is primarily located beneath the surface. One example could be (but is not limited to) an underground infiltration system, which could be located beneath a parking lot.



Source: Invisible Structures

Operation and Maintenance (O&M):

Underground BMPs will typically require frequent inspections, starting quarterly in the first two years, twice a year after two years, and any time a storm event occurs over 6 inches. Here these BMPs will be inspected for debris and pollutants, using indicators such as visuals or odors to help accomplish this. Filters should be inspected twice a year and replaced at no more than three years of age. They should be inspected to the following MHFD criteria and by manufacturer specifications:

- If there is more than 4 inches of accumulated sediment on the vault floor.
- If there is more than ¼ inch of accumulation on the top of the cartridge.
- If there is more than 4 inches of standing water in the cartridge bay for more than 24 hours after the end of a rain event.
- If the pore space between media granules is full.
- If inspection is conducted during an average rainfall event and the system remains in bypass condition (water over the internal outlet baffle wall or submerged cartridges).
- If hazardous material release (automotive fluids or other) is reported.
- If pronounced scum line (≥ 1/4" thick) is present above top cap.
- If system has not been maintained for three years.

APPENDIX E –SCM/PCM TOOL KIT

2 Low Impact Development (LID) Techniques – Site Development

2.1 Receiving Pervious Area (RPA)

Description

The receiving pervious area is a space which receives runoff from the unconnected impervious area (UIA) and then allows that runoff to infiltrate. A good example of this would be a strip of vegetation within a parking lot that is at a lower elevation to allow runoff to drain to it. A lawn next to a sidewalk could be an example but, in many cases, will be a separate pervious area (SPA) since it will not receive runoff from the sidewalk. An RPA should be isolated from traffic, so it is very common to see a curb and gutter which is slotted or has another outlet structure to the RPA. Signage may also be used in the case where a curb and gutter would not work.

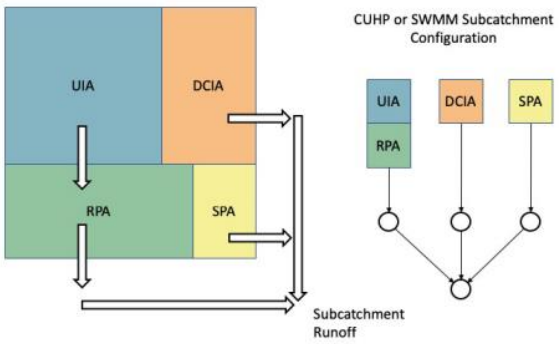


Figure 3-2. Four Component Land Use Model

Photograph 3-1. Separate Pervious Area (SPA) is permeable but does not receive runoff from impervious areas, such as the tree lawn in this photo. The drive and street are examples of DCIA.

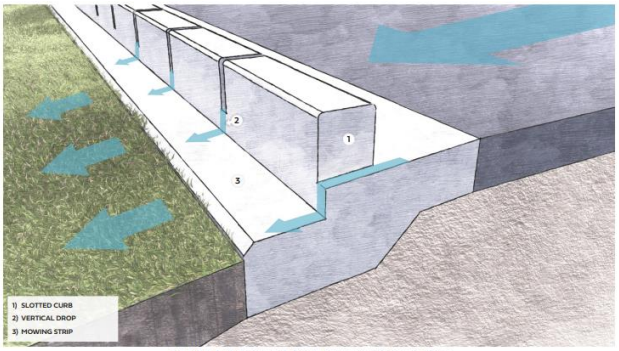


FIGURE 4-9. SLOTTED CURB DESIGN COMPONENTS

Source: MHFD – USDCM – Volume 3

Operation and Maintenance (O&M)

Cleaning an RPA is easy but can vary case by case. Most RPAs will be able to have routine trash pickup, mowing, and maintenance. In cases where it may become too wet to mow without causing damage to vegetation, underdrain systems may be installed to help with the moisture content of the soil. Snow considerations should also be made as snowmelt may cause salt and sand to be deposited into the RPA, which would need to be watched and maintained as to not negatively impact the area.

APPENDIX E –SCM/PCM TOOL KIT

2.2 Permeable Pavement

Description

Permeable pavement refers to several techniques in which alternatives to paved areas are used to reduce the imperviousness of an area. The basic idea for permeable pavement is to allow water to filtrate into the developed area in which a typically paved area would runoff instead. Permeable pavements can be used as RPAs but are often designed to store the water quality capture volume (WQCV). One use for these could be in alleyways where RPAs aren't a feasible option. For permeable pavement to work properly, the area must have sheet flow. Typically, permeable pavement may also have other infrastructure associated with them, such as overflow weirs, where ponding may occur.

Types of permeable pavement that the MHFD includes are permeable interlocking concrete pavement (PICP), concrete grid pavement (CGP), porous gravel pavement (PGP) and reinforced grass pavement (RGP). The last of these, RGP, is used mostly in fire lanes or in area to reduce the impervious area but does not always provide treatment of the WQCV.

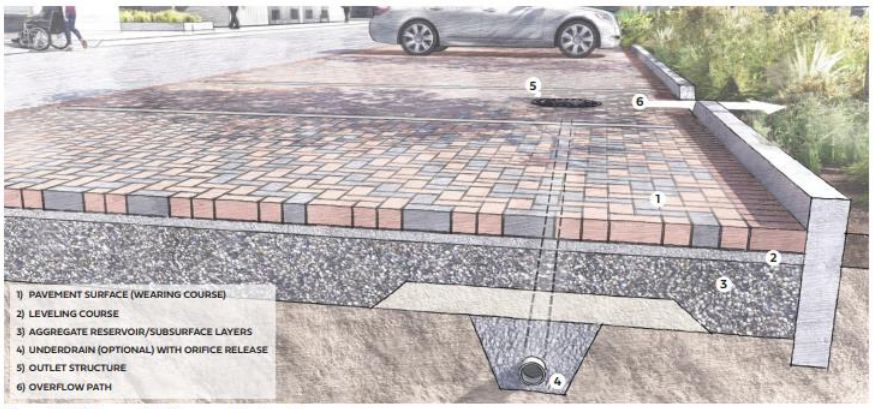


Figure PPS-1. Permeable Pavement System Components

Photograph PPS-3. PICP in downtown Ft. Morgan, CO. Note soldier course of light-colored pavers where PICP meets conventional pavement. Photo: SEH and the City of Ft. Morgan.

Source: MHFD – USDCM – Volume 3

Operation and Maintenance (O&M)

Permeable pavement is not typically suited for areas with lots of pollutants. Fast food, petrol stations, areas of high sediment runoff, and so forth. Since sediment can cause issues for permeable pavement, areas that store any loose materials, an area with a steep slope, or an area with little to no vegetation are not suitable for permeable pavement. Items such as leaves, or larger pieces of debris will need maintenance often to keep the permeable pavement functional. Snow removal is also important for permeable pavement, since sand should not be deposited on or around the area where the pavement lies. Since many factors can affect permeable pavement, periodic testing of the pavement's capacity to infiltrate is important to determine the need for maintenance.

APPENDIX E –SCM/PCM TOOL KIT

2.3 Green Roofs

Description

Green roofs are a type of rooftop systems that reduce imperviousness of an area, specifically though the use of vegetated systems. These will specifically reduce volumes and rates of runoff in an area. Green roofs are different than blue roofs, which act as stormwater detention areas. These two types of roofs can be combined, so some designs may have a "blue-green roof". Green roofs have two subtypes, extensive and intensive. Extensive roofs allow there to be 6 inches of substrate, while intensive may have from 6 inches to several feet. Intensive roofs do this using a wide variety of plants and are more akin to gardens. Due to the lack of variety and depth of extensive roofs, they are typically cheaper and better suited for the structural design needs of a building.

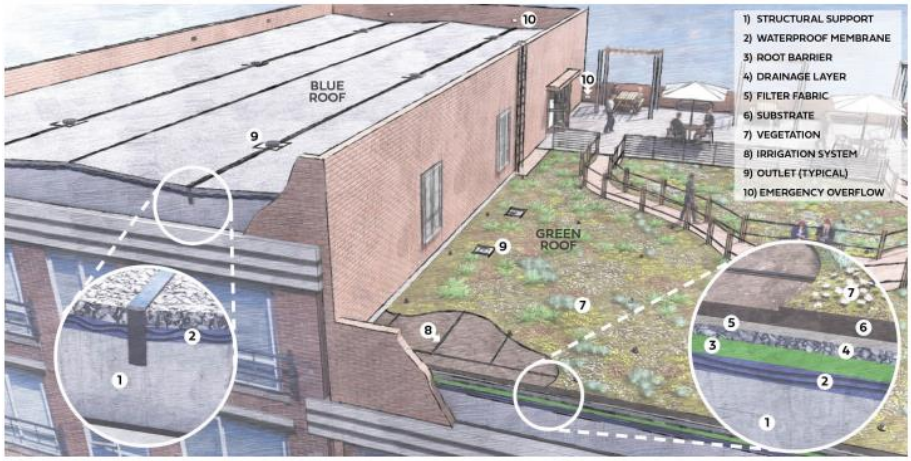


Figure GR-1. Green Roof and Blue Roof Components

TABLE GR-2. GR COMPONENTS

COMPONENT	INTENT
Structural Support	Roof structure that supports the substrate, vegetation, and live loads associated with rainfall, snow, people, and equipment.
Waterproof Membrane	Prevents water from entering the building.
Root Barrier	Protects the waterproof membrane by preventing roots from reaching the membrane. (Note: In some proprietary products, root barriers may be integrated into the product with the drainage layer.)
Drainage Layer	Drains the rooftop system to the outlet. This is sometimes an aggregate layer or a proprietary product.
Filter Fabric	This prevents fine soil and substrate from being washed out into the drainage layer.
Substrate (Growing Media)	Provides a growing media for the rooftop vegetation. Although the substrate is typically not "soil," the terms *soil matrix, soil media* and *growth substrate* are sometimes used.
Vegetation	Provides evapotranspiration to reduce runoff volumes, aesthetic appeal, ecosystem services and a cooling effect for the building. Native/adapted, drought-tolerant grasses, perennials, and shrubs with relatively shallow root depths are possibilities for roof plantings.
Irrigation System	Supports vegetative health of green roofs. Even vegetation with low water requirements will require supplemental irrigation in the metro Denver area.
Outlet(s)	Provides outlet for detained flows to drain from the rooftop. Orifice controls are not required for green roofs designed to treat the WQCV but could be used to detain larger volumes. Orifice controls are required for blue roofs.

Source: MHFD – USDCM – Volume 3

Operation and Maintenance (O&M)

Pollutants and other debris can often impact the effectiveness of the irrigation and drainage systems. For this reason, cleanouts should be inspected and maintained frequently. Breaking up ice formations may be required for green roofs, but these more commonly impact blue roofs. Other weather-related factors may be of importance, as green roofs should be designed to be functional long term to avoid replanting and other maintenance items.

APPENDIX E –SCM/PCM TOOL KIT

2.4 Grass Buffers

Description

Grass buffers are commonly used in conjunction with receiving pervious areas. Grass buffers are strips of dense vegetation, typically grass, which are designed to bring in sheet flows from developed areas. Grass buffers will provide filtration of sediment. Grass buffers are similar to grass swales but are designed for sheet flow rather than concentrated flow. They can be used together along with RPAs to create the most effective combination.

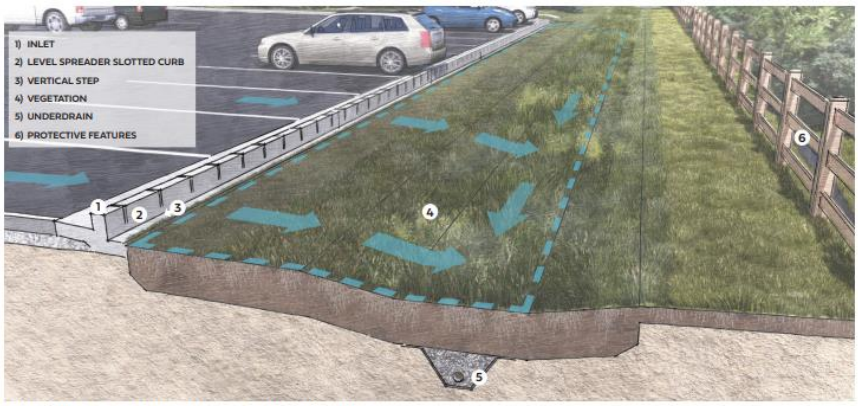


Figure RPA-1. Grass Buffer and Grass Swale Components

Photograph RPA-4. Grass buffers can be used to manage runoff from parking lots, multi-use paths, roadways, or roof areas, provided the flow is distributed in a uniform manner over the width of the buffer. Native grasses provide a more natural appearance. Photo: WWE.

Source: MHFD – USDCM – Volume 3

Operation and Maintenance (O&M)

Maintenance of grass buffers match other RPAs, including periodic maintenance and removal of sediment. See section 2.1 for more information.

APPENDIX E –SCM/PCM TOOL KIT

2.5 Grass Swales

Description

Grass swales are dense areas of vegetation with a broad cross-section that bring in concentrated flow for infiltration. Grass swales may also reduce erosion in many cases. Grass swales are like grass buffers but work with concentrated flows instead of sheet flows. Grass swales may also use check dams to reduces slopes and ultimately velocities, encouraging settling of particles and increasing infiltration. Grass swales are also used in conjunction with RPAs and are the most effective when combined with both RPAs and grass buffers.

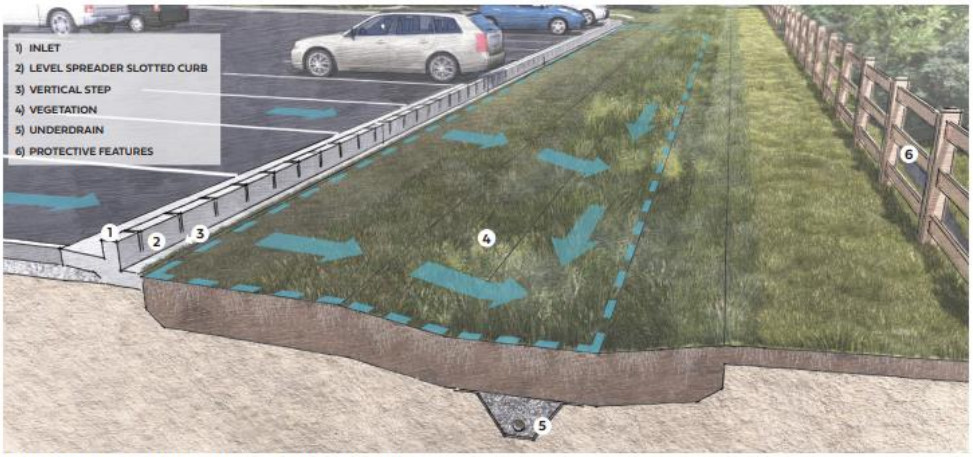


Figure RPA-1. Grass Buffer and Grass Swale Components

Photograph RPA-3. This grass swale provides treatment of runoff from a parking lot, portions of the building, and sidewalks at a healthcare facility. Photo: WWE.

Source: MHFD – USDCM – Volume 3

Operation and Maintenance (O&M)

Maintenance of grass swales match other RPAs, including periodic maintenance and removal of sediment. See section 2.1 for more information.

APPENDIX E –SCM/PCM TOOL KIT

2.6 Bioretention (Rain Gardens)

Description

Bioretention systems are engineered landscapes which are depressed into the land, to capture and filter/infiltrate the water quality capture volume (WQCV). If designed and constructed properly, the MHFD strongly recommends the use of bioretention as a SCM due to their effectiveness in stormwater treatment, reduction in runoff volume and flow rates, and their benefits to the community in terms of green spaces. Bioretention system can also be designed for storm events larger than the WQCV can allow using the MHFD Storage Chapter.

Figure BR-1. Bioretention System Components

TABLE BR-2. BR COMPONENTS

COMPONENT	INTENT
Inlet	Allows stormwater to enter the SCM.
Forebay	Facilitates removal of trash and coarse sediments, providing pretreatment for the SCM.
Energy Dissipation	Minimizes potential for erosion of media surface.
Storage Volume	Provides temporary storage needed to attenuate design flows.
Engineered Media	Supports plant growth and reduces pollutants by filtering and through other biological treatment processes.
Vegetation	Helps maintain infiltration over time through root penetration of media, increases evapotranspiration and biological uptake of pollutants, aerates media, catalyzes soil ecology, and creates an attractive SCM.
Underdrain with Orifice Release	For partial and no infiltration systems, collects and slowly releases the WQCV over 12 hours to reduce erosion in the receiving stream and enhance treatment by increasing contact time with the media.
Outlet Structure	Safely conveys stormwater flows that exceed the design volume. For bioretention systems that detain the EURV and/or 100-year flow, surface outlet structures will have additional orifice controls for surface discharge rather than infiltration through the media.

Source: MHFD – USDCM – Volume 3

Operation and Maintenance (O&M)

To avoid clogging, the bioretention area requires a stable watershed. If there is a lot of sediment within the watershed, treatment should occur before the runoff reaches the bioretention area. Maintenance itself will need to be frequent, especially due to the aesthetic nature of bioretention. Since leaves and sticks can become an issue, both in terms of aesthetics and efficiency of the area, tree trimming could be included as one step in maintenance as to reduce this issue. Rock mulch can cause urban heat island effects, and is much harder to maintain and clean, so should be in places with resilient vegetation to assist with longevity of the design.

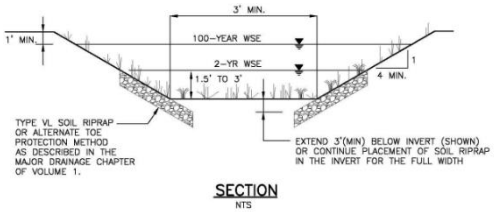
APPENDIX E –SCM/PCM TOOL KIT

2.7 Constructed Wetland Channel

Description

A constructed wetland channel is very similar to a constructed wetland. The goal by using the vegetation in a constructed wetland channel is to slow down runoff, allowing more time for both biological growth and the settlement of sediment. A constructed wetland channel is best when a baseflow can be calculated and anticipated. Loamy soils will also need to be present, in order to allow plants to take root and grow.

Photograph CWC-1: Constructed wetland channels treat stormwater through straining, settling, and biological processes.



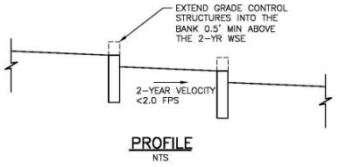


Figure CWC-1. Constructed Wetland Channel Plan and Section

Source: MHFD – Constructed Wetland Channel – T-9

Operation and Maintenance (O&M)

Constructed wetland channels require routine sediment removal. This will lie somewhere within the range of 10 to 20 years. Vegetation can be removed in order to keep the volume consistent throughout the years. This may cause more erosion to take place, so there is no set timeline for this maintenance to occur. Cattail removal will also have to occur more frequently and should take place during the late summer.

APPENDIX E –SCM/PCM TOOL KIT

2.8 Sand Filters

Description

Sand filters are used to treat runoff through filtration, providing infiltration in cases when unlined systems are present. Runoff will collect during a storm event in a surcharge zone and infiltrate into the sand bed. An underdrain will release this captured water into channels, swales, or nearby storm drains. A sand filter may be used in cases in which bioretention would be used, with their main difference being their affinity for vegetation growth. A sand filter may also be designed for a 100-year flood storage volume but can be a challenge to maintain. In this case, sand filters should only be used if surface treatment is not feasible.

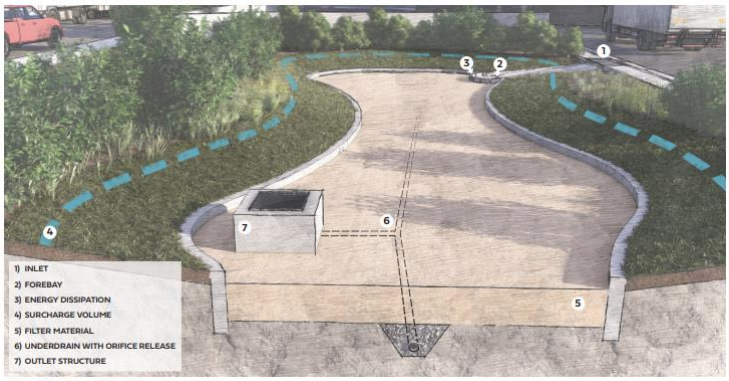


Figure SF-1. Sand Filter Components

TABLE SF-2. SF COMPONENTS

COMPONENT	INTENT
Inlet	Allows stormwater to enter the SCM.
Forebay	Facilitates removal of trash and coarse sediments.
Energy Dissipation	Minimizes potential for erosion of sand filter surface. Often incorporated into forebay.
Surcharge Volume	Provides temporary storage volume needed for attenuation of design flows.
Filter Material	Removes pollutants in runoff by filtration through porous media (sand).
Underdrain with Orifice Release	Collects and slowly releases the WQCV over 12 hours to reduce erosion in the receiving stream and enhance treatment by increasing contact time with the media.
Outlet Structure	Conveys stormwater flows that exceed the design volume.

Source: MHFD – USDCM – Volume 3

Operation and Maintenance (O&M)

Coarse sediments and trash will be collected inside of forebays for removal during maintenance. Cleanouts will also be used during maintenance to allow for camera inspection as well as post-construction inspections.

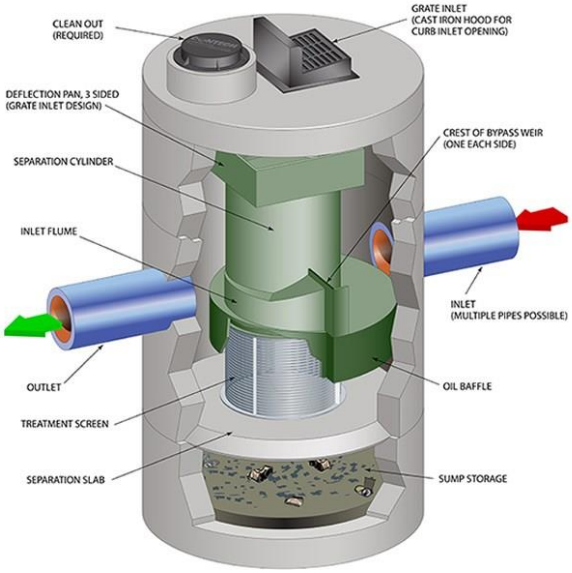
APPENDIX E –SCM/PCM TOOL KIT

3 Manufactured SCMs

3.1 Hydrodynamic Separator

Description

Hydrodynamic separators (HDSs) are a type of manufactured treatment devices (MTDs). MTDs goals are to reduce targeted pollutants. Hydrodynamic separators are a type of sedimentation MTDs, intended to use forces to suspend, trap and retain suspended sediments. Hydrodynamic separators are another good example of underground BMPs.



Source: S3 Stormwater Solution Source, LLC – Hydrodynamic Separators

Operation and Maintenance (O&M)

Hydrodynamic separators must be maintained frequently. This frequency is dependent on the volume of sediment in which the hydrodynamic separator can store. To remove the sediment, a vacuum must be used. Vacuuming should occur at least once annually and more frequently based on inspections as per underground BMP requirements (see section 1.4).

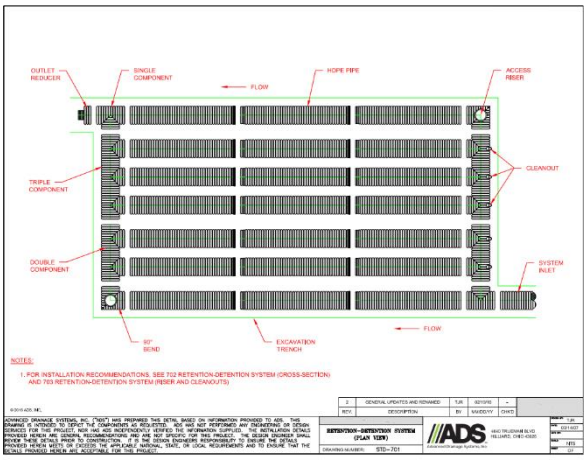
APPENDIX E –SCM/PCM TOOL KIT

3.2 Underground Detention Chambers/Vaults

Description

Underground detention vaults are one form of underground BMP from section 1.4. These vaults or chambers are used to store runoff from a storm to manage and control the volume. The use of these detention facilities is to help with the effects of runoff like erosion and flooding. Since these facilities are located below grade, any risks associated with open ponds are reduced. There are two types of underground detention vaults, concrete chambers and HDPE pipe. The concrete chambers and HDPE pipe can be both infiltration based, or detention based. The HDPE pipe has a design life of at least 75 years.

Source: StormTrap – Ohio Department of Transportation



ADS – Landmax Stormwater Management System

Operation and Maintenance (O&M)

Maintenance varies depending on solution and company, but many have designed solutions to assist with the underground BMP guidelines. See section 1.4 for more information on underground BMP pollutant removal and maintenance.

APPENDIX E –SCM/PCM TOOL KIT

4 SCM/PCMs and WQ Measures for Linear Roadways

4.1 Sand Filters

For all sand filters, please refer to section 2.8 for basic information.

No-Infiltration Sand Filters

Description

No-infiltration sand filters include an underdrain to the typical sand filter. This underdrain has an impermeable liner preventing infiltration of stormwater into the soils before the sand filter. These should be used for three reasons:

- The site could receive toxic pollutants via stormwater runoff and infiltration could result in contamination of groundwater.
- The site is located over contaminated soils and infiltration could mobilize these contaminants.
- The site is located over potentially expansive soils or bedrock that could swell due to infiltration and potentially damage adjacent structures.

Source: CDOT – Drainage Design Manual (2019) – Chapter 16

The no-infiltration sand filter should be made of a PVC geomembrane layer. It should be at least 30 mm thick and should extend to the top of the underdrain layer. Lastly, it should have 9 to 12 inches of cover wherever attached to a wall to help with UV deterioration.

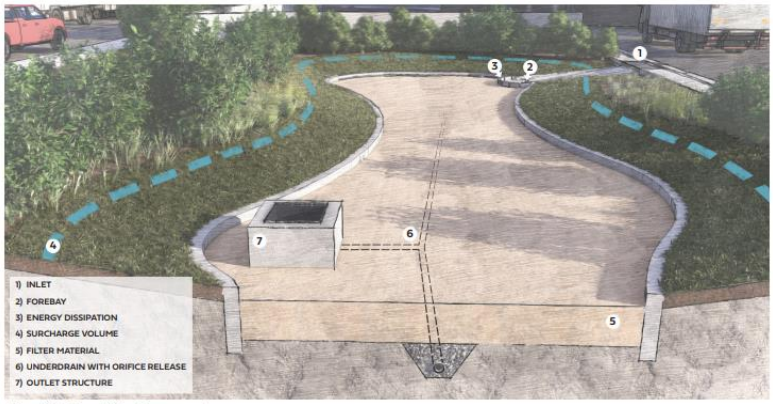


Figure SF-1. Sand Filter Components

Source: MHFD – USDCM – Volume 3

Operation and Maintenance (O&M)

Sand filters should be inspected annually or semi-annually to identify clogs or excess sediment. The infiltration rate should also be tested to determine if the surface material will need to be replaced. Other maintenance will match that of a typical sand-filter. Refer to section 2.8 for pollutant removal and general information.

APPENDIX E –SCM/PCM TOOL KIT

Partial Infiltration Sand Filters

Description

Similarly to the no-infiltration sand filter, the partial infiltration sand filter includes an underdrain to the sand filter. Unlike it though, the partial infiltration sand filter does not include any type of impermeable liner, allowing some infiltration to occur. For CDOT, this is the most likely filter as in many cases the soil cannot drain the WQCV in 6 hours or less. In partial infiltration sand filters, the outlet structure should drain the design volume over a period of 12 hours.

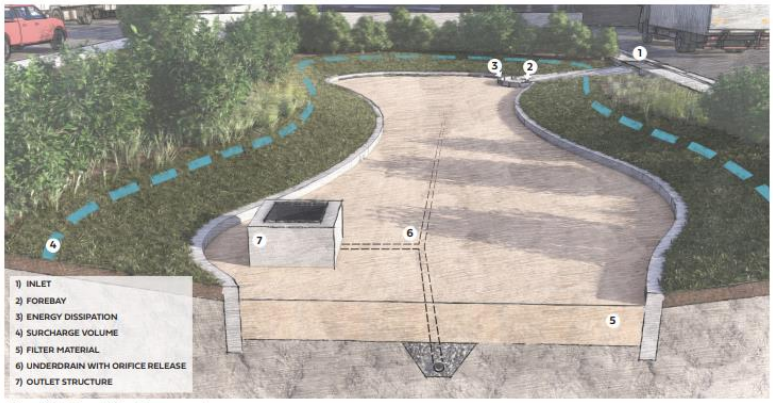


Figure SF-1. Sand Filter Components

Source: MHFD – USDCM – Volume 3

Operation and Maintenance (O&M)

Sand filters should be inspected annually or semi-annually to identify clogs or excess sediment. The infiltration rate should also be tested to determine if the surface material will need to be replaced. Other maintenance will match that of a typical sand-filter. Refer to section 2.8 for pollutant removal and general information.

APPENDIX E –SCM/PCM TOOL KIT

Full Infiltration Sand Filters

Description

A full infiltration sand filter will have all the water within the WQCV drain within 6 hours as required. This system leads to the longest-term functionality, as another drain and liner are not necessary. In certain cases, an outlet drain may be inserted with a gate or value to allow follow and drainage to be changed at any point in time.

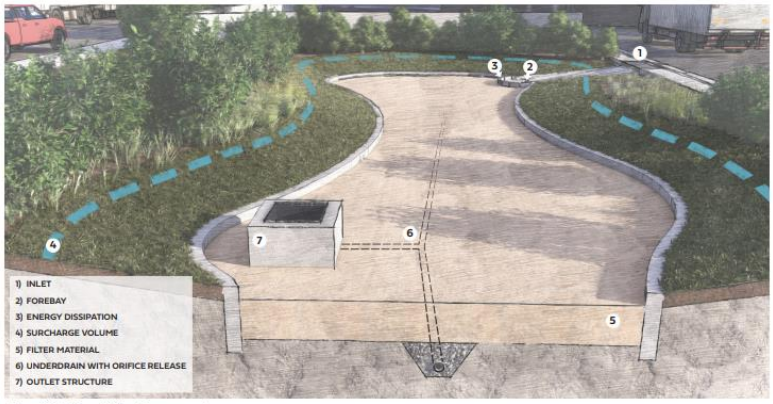


Figure SF-1. Sand Filter Components

Source: MHFD – USDCM – Volume 3

Operation and Maintenance (O&M)

Sand filters should be inspected annually or semi-annually to identify clogs or excess sediment. The infiltration rate should also be tested to determine if the surface material will need to be replaced. Other maintenance will match that of a typical sand-filter. Refer to section 2.8 for pollutant removal and general information.

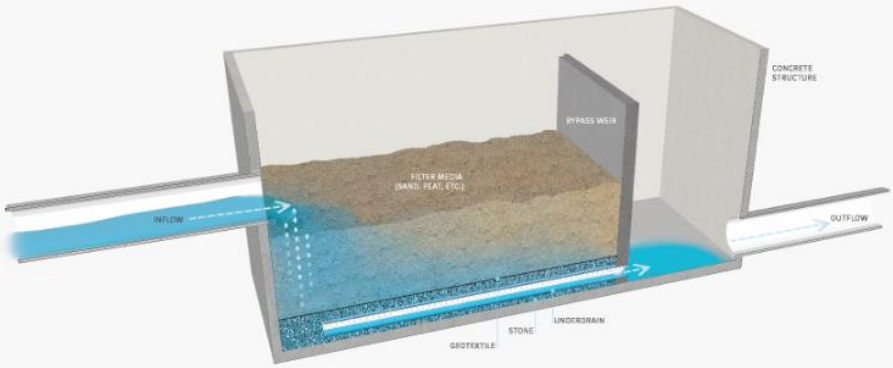
APPENDIX E –SCM/PCM TOOL KIT

4.2 Media Filter Permeable Pavement

Description

Media filter drains are the original concept behind media filter permeable pavement. Media filter drains are used for treatment of sheet flow. An important note to be aware of is that another name for these is also ecology embankment. Media filters can only be used where the slope is at 4H:1V or less and if roadway is at a longitudinal slope of 5% or less. This media filter in tandem with a typical permeable pavement creates the media filter permeable pavement. Below is a visual representation of how media filters work, as well as the image used in section 2.2 to show how permeable pavement works.

Figure 4.9-1: Media Filter with Typical Features



Source: Philadelphia Water Department – 4.9 Media Filters

Operation and Maintenance (O&M)

Maintenance will be like that of permeable pavement in section 2.2. Extra time will need to be spent to make sure the media filter is not damaged during routine inspections.

APPENDIX E –SCM/PCM TOOL KIT

4.3 Dispersion Berms / Level Spreaders

Description

Dispersion berms are intended to replicate the effect of natural dispersion. To accomplish this a conveyance system will bring concentrated flows to a level spreader which directs runoff into a dispersion area, mimicking sheet flow. The dispersion area typically requires compost-amended soils and denser than normal vegetation to accomplish this.

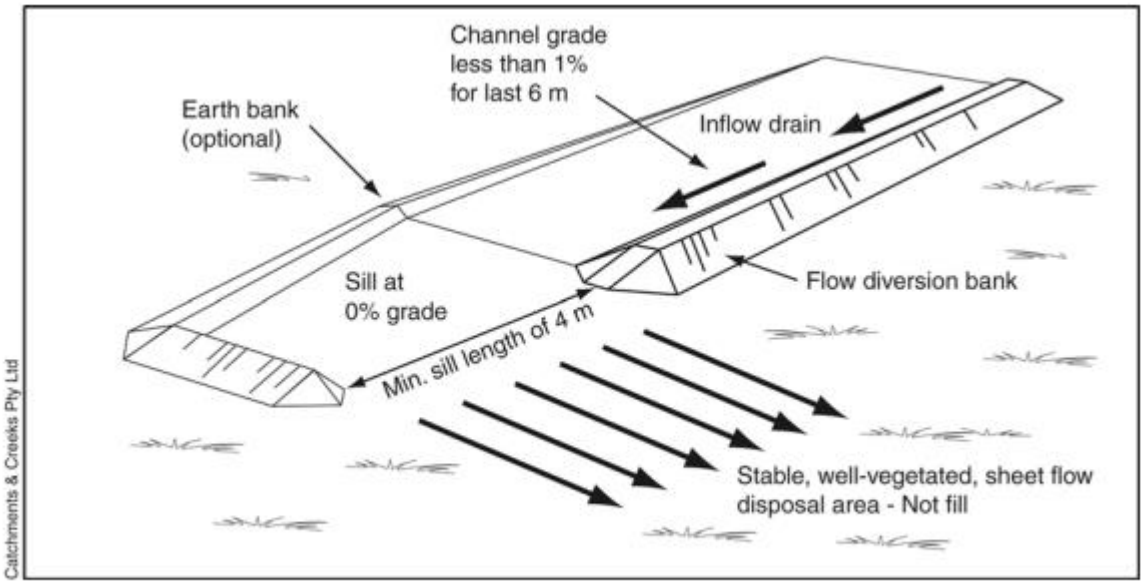


Figure 2 – Typical layout of level spreader

Source: Catchments & Creeks Pty Ltd – Level Spreaders

Operation and Maintenance (O&M)

Trash and debris need to be removed routinely, and moving and removal of vegetation will be required. Removing deposited sediments will also be necessary, ensuring an even distribution over areas of flow and dispersion.

APPENDIX E –SCM/PCM TOOL KIT

4.4 Soil Amendments

Description

Soil amendments are used to make soil more suitable for the growth of vegetation. These include items such as soil conditioners, soil fertilizers, and compost amendments. Compost is often used as a soil conditioner due to its high cation exchange capacity, trapping and dissolving heavy metals. It will also remove oil, grease, and other items from any highway runoff.

Example of Soil Amendments - Fertilizers

Source: Michigan State University – MSU Extension Agrifood Safety – Soil Amendments

Operation and Maintenance (O&M)

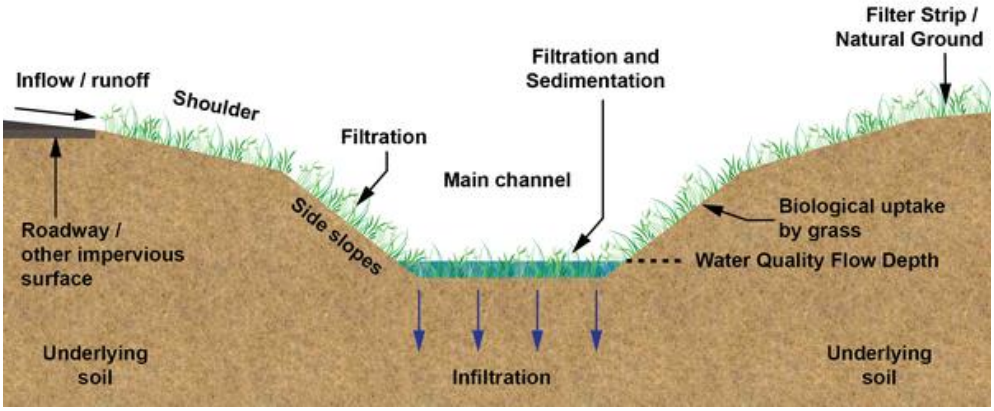
Maintenance includes typical trash removal from any area with soil amendments. To do this, it is important to not impact the soil with any heavy machinery, which would affect infiltration and water holding capacity. Soil amendments can clog soil with sediments, after which vegetation and soil would also need to be replaced. After large storms or long durations of wet events, soil should be observed for excessive ponding, indicating if the soil should be replaced.

APPENDIX E –SCM/PCM TOOL KIT

4.5 Treatment Swales

Description

Treatment swales are open channels that are shallow and above grade that aid in the treatment in stormwater runoff. To achieve this they use sedimentation, filtration and infiltration as water is moved through a vegetated surface and the topsoil layer. Vegetation is required for any hydrologic soil group unless the group is classified as A. The roots of the vegetation in groups B, C and D help the water infiltrate into the ground. Underdrains may be installed, only if the swale does not meet the design requirements.



Source: North Carolina State University – Swale Terminology for Urban Stormwater Treatment

Operation and Maintenance (O&M)

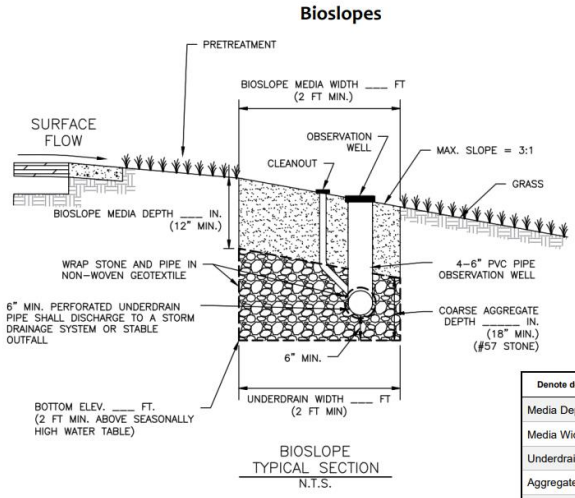
Typically, swales are low cost, low maintenance, and are effective at pollutant removal. In most cases, trash and debris need to be removed periodically. Mowing along the channel may be necessary if the bottom vegetation is too dense but should not occur unless necessary. Mowing the edges of the swale along the road or outside of the invert is recommended.

APPENDIX E –SCM/PCM TOOL KIT

4.6 Bioslopes/Bioretention/Biofiltration Swales

Description

These are types of permanent water quality control measures, and they require a lot of maintenance. Their vegetation needs to be closely managed, specifically by a licensed landscape architect to ensure that the structures are properly constructed and maintained. Irrigation will need to be installed as well if base flows are not present.



Denote design parameters in box below	
Media Depth	in
Media Width	ft
Underdrain Width	ft
Aggregate Depth	in
Groundwater Elevation	ft
Bottom Elevation	ft

City of Augusta GA Bioslope Design Form – Version: July 2020 Page **3** of **3**

Source: City of Augusta GA – Bioslope Design Procedure Form

Operation and Maintenance (O&M)

These structures require that an operation and maintenance plan is created for each individual or group. This plan is to be created by the licensed landscape architect.

APPENDIX E –SCM/PCM TOOL KIT

5 Regenerative Stormwater Conveyance (WV DEP)

Description

Regenerative Stormwater Conveyance (RSC) is an innovative approach to provide stormwater treatment, infiltration, and conveyance within one system. It has been used as an ecosystem restoration practice for eroded or degraded outfalls and drainage channels. RSC utilizes a series of shallow aquatic pools, riffle weir grade controls, native vegetation and underlying sand and woodchip beds to treat, detain, and convey storm flow. It can be used in places where grades make traditional stormwater practices difficult to implement. RSC Systems combine features and treatment benefits of Swales, Infiltration, Filtering and Wetland practices. In addition, they are designed to convey flows associated with extreme floods (i.e., 100-year storm) in a non-erosive manner, which results in a reduction of channel erosion impacts commonly encountered at conventional stormwater outfalls and headwater stream channels.

RSC can be used to: Manage the first one inch of rainfall on-site, Reduce pollutant loads to meet water quality targets (total maximum daily loads or TMDLs), Meet partial or full storage requirements for local stormwater detention standards, Retrofit existing developed areas, especially areas with eroded and degraded (entrenched) outfalls, ditches, and ephemeral or intermittent gullies that discharge to waterbodies RSC can be blended into the landscape design for many sites.

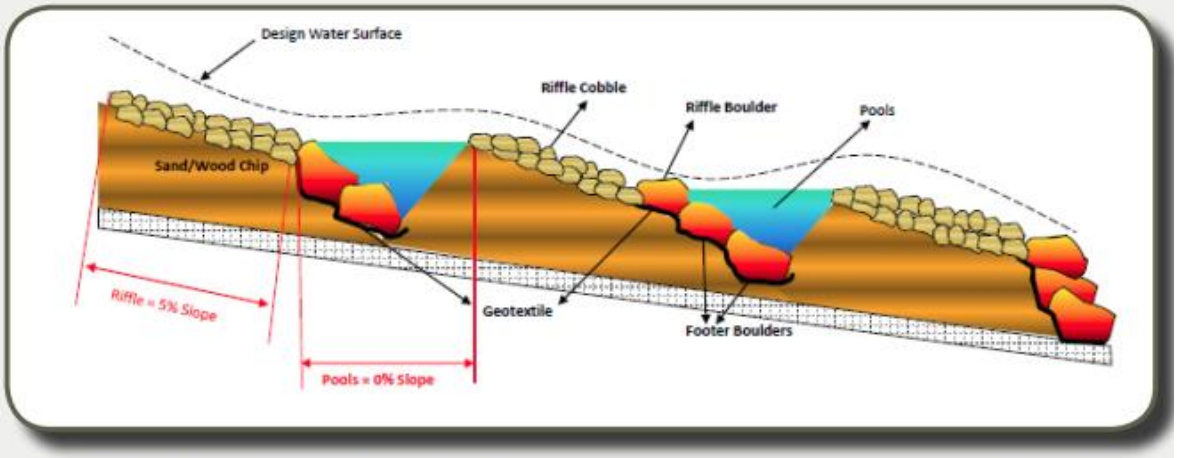


Figure RSC-2. Schematic Profile for Regenerative Stormwater Conveyance System (Source: Anne Arundel County, 2011)

APPENDIX E –SCM/PCM TOOL KIT

Operation and Maintenance (O&M)

Maintenance Tasks	Frequency
▪ For the first 6 months following construction, the practice and drainage area should be inspected at least twice after storm events that exceed 1/2 inch of rainfall. ▪ Check for erosion or "end-cutting" of weirs and riffle structures. ▪ Check for stable water levels in pools. ▪ Conduct any needed repairs or stabilization. ▪ Inspectors should look for bare or eroding areas in the contributing drainage area or around the RSC channel, and make sure they are immediately stabilized with grass cover. ▪ One-time, spot fertilization may be needed for initial plantings. ▪ Watering is needed once a week during the first 2 months, and then as needed during first growing season (April-October), depending on rainfall. ▪ Remove and replace dead plants. Up to 10% of the plant stock may die off in the first year, so construction contracts should include a care and replacement warranty to ensure that vegetation is properly established and survives during the first growing season following construction.	Upon establishment
▪ Routine maintenance of vegetation: weeding, pruning, etc. ▪ Trash removal	Approximately 4 times a year
▪ Add reinforcement planting to maintain desired the vegetation density ▪ Remove any dead or diseased plants ▪ Stabilize the contributing drainage area to prevent erosion	As needed
▪ Conduct a maintenance inspection ▪ Check structural stability of weirs, riffles, pools; check for desired water level in pools ▪ Prune trees and shrubs ▪ Remove invasive plants using recommended control methods ▪ Remove sediment in pre-treatment cells and inflow points	Annually
▪ Remove sediment in pools if necessary ▪ Repair any structural damage to weirs, riffles, pools, or tie-in to downstream channel	Once every 2 to 3 years

Source: WV Stormwater Management & Design Guidance Manual

APPENDIX E –SCM/PCM TOOL KIT

REFERENCES:

ADS – Landmax Stormwater Management System – 701 Retention-Detention System Plan View
https://assets.adspipe.com/m/1116179ecc6d5382/original/701-Retention-Detention-System-Plan-View-Detail.pdf?_gl=1*1ik5uzj*_gcl_au*NDg4Mjk0ODMwLjE3MjEyMzgzMDY.*_ga*MjM2OTA2ODYyLjE3MjEyMzgzMDY.*_ga_1TPLC9D3R7*MTcyMTIzODMwNi4xLjEuMTcyMTIzOTU0Ny4yNS4wLjA.

Catchments & Creeks Pty Ltd – Level Spreaders
https://www.austieca.com.au/documents/item/312

CDOT – Drainage Design Manual (2019) – Chapter 16
https://www.codot.gov/business/hydraulics/drainage-design-manual/chapter16_permanentwaterquality.pdf

City of Augusta GA – Bioslope Design Procedure Form
https://www.augustaga.gov/DocumentCenter/View/14862/H2-DPF_Bioslope

Invisible Structures - Rainstore3 Underground Detention System Detail
https://invisiblestructures.com/media/q4fnoax4/rs3detentiondetail24.pdf

MHFD - Constructed Wetland Channel – T-9
https://www.mhfd.org/wp-content/uploads/2014/07/T-09-Constructed-Wetland-Channel.pdf

MHFD – USDCM – Volume 3 (Updated March 2024)
https://mhfd.org/wp-content/uploads/2024/06/01_USDCM-Volume-3.pdf

Michigan State University – MSU Extension Agrifood Safety – Soil Amendments
https://www.canr.msu.edu/agrifood_safety/Produce-Safety-Resources/soil-amendments

North Carolina State University – Swale Terminology for Urban Stormwater Treatment
https://content.ces.ncsu.edu/swale-terminology-for-urban-stormwater-treatment

Pennsylvania Stormwater Best Management Practices Manual – Chapter 6
https://greenport.pa.gov/elibrary/GetDocument?docId=7662&DocName=CHAPTER%206.4.10%20BMP%20INFILTRATION%20BERM%20AND%20RETENTIVE%20GRADING.PDF%20%20%3Cspan%20style%3D%22color%3Agreen%3B%22%3E%3C%2Fspan%3E%20%3Cspan%20style%3D%22color%3Ablue%3B%22%3E%3C%2Fspan%3E

Philadelphia Water Department – 4.9 Media Filters
https://water.phila.gov/development/stormwater-plan-review/manual/chapter-4/4-9-media-filters/#:~:text=Media%20filters%20(also%20referred%20to,%2C%20hydrocarbons%2C%20and%20other%20pollutants.

S3 Stormwater Solution Source, LLC – Hydrodynamic Separators
https://www.s3usa.com/products/treatment/hydrodynamic-separators

StormTrap – Ohio Department of Transportation
https://stormtrap.com/project/ohio-department-of-transportation-cso-reduction-project/

West Viriginia Stormwater Management & Design Guidance Manual – Regenerative Stormwater Conveyance System (RSC)
https://dep.wv.gov/WWE/Programs/stormwater/MS4/Documents/Specification_4.2.7_Regenerative_Stormwater_Conveyance_WV-SW-Manual-11-2012.pdf