Phase III Drainage Report

For:

Park Meadows – Garage and Retail

8401 Park Meadows Center Dr, Lone Tree, CO 80124

Prepared: 05/03/2024

For:

Park Meadows Mall, LLC/ Park Meadows Anchor Acquisition
8401 Pak Meadows Center Drive
Lone Tree, CO 80124

By:

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CERTIFICATION

I hereby affirm that this Phase III Drainage Report for Park Meadows – Garage and Retail was prepared under my direct supervision in accordance with the provisions of the City of Lone Tree Storm Drainage Criteria for the owners thereof. I understand that the City of Lone Tree does not and will not assume liability for drainage facilities designed by others.

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Mark A. West, P.E., C.F.M.
State of Colorado License No. 38561
On Behalf of Harris Kocher Smith

I. INTRODUCTION

A. SITE LOCATION

The Park Meadows – Garage and Retail (Project) lies within Lot 4-A-1 of the Park Meadows Town Center Filing 1-A, 1st Amendment. The Project is situated in Section 3, Township 6 South, Range 67 West of the 6th Principal Meridian, Douglas County, Colorado. A Vicinity Map is located in Appendix A of this report.

The Project is bounded East County Line Road to the north, South Yosemite Street to the west, State Route 470 to the south, and by Highway 25 to the east. The Park Meadows Mall adjoins many other properties belonging to hotels, restaurants, and retail stores.

B. SITE DESCRIPTION

The Park Meadows – Garage and Retail currently consists of approximately 4.32 acres of existing parking lot. The parking lot has slopes of 1 – 4%, with existing storm sewers generally draining southward, toward detention basin A.

The total area to be developed and total disturbed area is approximately 4.85-acres. There are no known irrigation facilities on, adjacent to, or otherwise impacting the Project. The Project site generally slopes to the southeast. According to the Natural Resources Conservation Service (NRCS) – Web Soil Survey, the underlying soils are primarily RmE Renohill-Buick complex which are classified as Hydrologic Group C/D (see Appendix A).

The site lies within Flood Insurance Rate Map (FIRM) Community Panel Numbers 08035C0034G (effective 3/16/2016), and 08035C0053G (effective 2/17/2017). As shown on these maps in Appendix A, the Site/Project does not lie within a FEMA designated floodplain.

C. PROPOSED PROJECT DESCRIPTION

The Project will be developed as a structured parking garage and two retail buildings. The proposed development will include a pedestrian plaza and numerous vehicle and pedestrian access pathways. Runoff will be conveyed by a series of proposed inlets and storm sewer to the existing storm outfall in the area. Detention Basin A, an existing detention system located south of the site, will manage, and treat flows before discharging to the public system.

D. FLOOD HAZARD AND DRAINAGE STUDIES RELEVANT TO THE SITE

The project area has previously been investigated in drainage reports for the original mall development and a subsequent expansion of the mall to the south. Reports are listed below:

- Phase III Drainage Report for Park Meadows by Paller-Roberts Engineering, revised in April 1995.
- Drainage Report for Park Meadows Mall Expansion, Douglas County, Colorado by National Survey and Engineering as revised November 2006.

As previously noted, this Project is not included in any FEMA designated floodplain. Relevant pages from previous studies are included in Appendix F.

II. HISTORIC DRAINAGE SYSTEM

A. MAJOR BASIN DESCRIPTION

The 1995 Phase III Drainage Report for Park Meadows delineates major drainage basins within the development. This proposed Project lies within Drainage Area “A”, which per the existing drainage report encompasses the southeastern portion of the mall site along with development parcels south of Park Meadows Center Drive, and the Park Meadows Drive roadway itself. This area contains a total of 85.0-acres. Storm line “AA” collects runoff from the development area and conveys to Detention Basin “A”.

The 2006 mall addition expanded the mall southward. To provide water quality, the developer modified Detention Basin “A” located south of Park Meadows Center Drive by adding a paved forebay, a trickle channel, a micropool, and a water quality outlet structure. Relevant pages from previous studies are included in Appendix F.

The proposed Project lies within the Willow Creek Watershed as outlined in the *Willow Creek, Little Dry Creek, and Greenwood Gulch Outfall Systems Planning Study* prepared by CH2MHILL, dated February 2010. Flows from Detention Pond A discharge via an existing 24” RCP southwest to an existing inlet and pipe along E-470. Flows then discharge south and west where they ultimately enter Willow Creek.

III. DRAINAGE FACILITY DESIGN

A. REGULATIONS

The basis for design and analysis of the drainage system and drainage impacts for the Project are the Douglas County Storm Drainage Design and Technical Criteria

Manual (Criteria), most recent updates; and the *Urban Storm Drainage Criteria Manuals* (Mile High Flood District, formerly known as Urban Drainage and Flood Control District), Volumes 1, 2 and 3.

B. HYDROLOGIC CRITERIA

The total area of the Project to be developed is 4.92 acres. The Rational Method is appropriate and was used to calculate peak rates of stormwater runoff. The design storms analyzed for this Project are the 5-year and 100-year for the initial and major storms, respectively. The rainfall intensities of these storms were determined through use of NOAA Atlas 14 Precipitation Frequency Data Server point precipitation frequency for 60-minute duration. The latest MHFD-Detention worksheet was used to determine the current condition of the existing detention pond for the Park Meadows property.

Results of hydrologic analysis are included in Appendix B of this report.

C. HYDRAULIC CRITERIA

Street flow and inlet capacities have been determined based on MHFD-Inlet spreadsheets. Hydraulic grade lines (HGLs) for the minor and major storms were generated utilizing Bentley's StormCAD software. Landscape drain capacities were determined by finding the 100-yr worst case scenario based on tributary area and imperviousness and applied to all similar drains. The ADS capacity calculator spreadsheet and Nyloplast grate inlet capacity charts were used to find the required head based on the calculated 100-yr worst case scenario flow rate. Landscape drain pipes were analyzed using the 100-yr worst case scenario flow rate at each drain within a StormCAD model to ensure the pipes' capacity would allow for 1' of freeboard from the HGL and the proposed ground surface. Refer to Appendix C for calculations.

D. RUNOFF

The proposed Project area is broken into three sub-basins with the prefix "R", nine sub-basins with the prefix "S" and five sub-basins with the prefix "OS" for off-site. Individual sub-basins are described in more detail below.

Sub-basin R1 (1.59-acres) is located on the rooftop of the proposed parking garage. It consists of rooftop surfaces. Runoff from this subbasin will drain through downspouts and roof drains and tie to the proposed and existing storm sewer system routed to Detention Basin "A".

Sub-basin R2 (0.16-acres) is located on the rooftop of a proposed retail building. It consists of rooftop surfaces. Runoff from this subbasin will flow through a roof drain connection and tie into the proposed and existing storm sewer system routed to Detention Basin “A”.

Sub-basin R3 (0.23-acres) is located on the north half of the rooftop of a proposed retail building. It consists of rooftop surfaces. Runoff from this subbasin will flow through a roof drain connection and tie into the proposed and existing storm sewer system routed to Detention Basin “A”.

Sub-basin S1 (0.75-acres for phase 1A, 1.25-acres for phase 1B) is located on the street on the north end of the site. It consists of asphalt, concrete, and pervious surfaces. Runoff is routed to proposed 5’ Type R inlet (sump) via proposed curb and gutter. Runoff from this subbasin will flow through the existing and proposed storm sewer system routed to Detention Basin “A”.

Sub-basin S1a (0.16-acres for phase 1A, 0.09-acres for phase 1B) is located on the street between the existing parking garage and the proposed parking garage. It consists of asphalt, and concrete. Runoff is routed to an existing quad combination Type 13 inlet via curb and gutter for phase 1A and a valley pan for phase 1B. Runoff from this subbasin will flow through the existing storm system routed to Detention Basin “A”.

Sub-basin S1b (0.94-acres for phase 1A,0.22-acres for phase 1B) is located on the street between the existing parking garage and the proposed parking garage. It consists of asphalt and concrete. For phase 1A, runoff is routed to an existing triple combination Type 13 inlet via curb and gutter for phase 1A and a valley pan for phase 1B. Runoff from this subbasin will flow through the existing storm system routed to Detention Basin “A”.

Sub-basin S2 (0.10-acres) is located on the street immediately north of the east entrance to mall. It consists of asphalt, concrete, and pervious surfaces. For phase 1A, runoff is routed to an existing 5’ Type R inlet that will remain for this phase of the project. For phase 1B, runoff is routed to a proposed 5’ Type R inlet that is cast in place over the existing storm network. Runoff from this sub-basin will flow through the existing storm system routed to Detention Basin “A”.

Sub-basin S3 (0.15-acres for phase 1A, 0.36-acres for phase 1B) is located immediately northeast of the east entrance to the mall. It consists of asphalt, concrete, and pervious surfaces. For phase 1A, runoff is routed to an existing 5’ Type R inlet that flows via curb and gutter. For phase 1B, runoff is routed to proposed valley Type 13 inlet (sump) via surface flow. Runoff from this sub-basin will flow through the existing storm system for phase 1A and proposed storm system for phase 1B.

Sub-basin S4 (0.95-acres for phase 1A, 0.62-acres for phase 1B) is located southwest of the proposed parking garage and southeast of the east entrance to the mall. It consists of asphalt, concrete, and pervious surfaces. For phase 1A, runoff is routed to an existing valley Type 13 inlet (sump) that flows through the existing storm system routed to Detention Basin “A”. For phase 1B, runoff is routed to a proposed 5’ Type R inlet that flows through the proposed storm system to Detention Basin “A”.

Sub-basin S5 (0.30-acres) is located southeast of the proposed parking garage. It consists of asphalt, concrete, and pervious surfaces. Runoff is routed to a proposed 5’ Type R inlet (sump) via curb and gutter. Runoff from this sub-basin will flow through the proposed and existing storm system to Detention Basin “A”.

Sub-basin S6 (0.36-acres) is located southeast of the proposed parking garage. It consists of asphalt, concrete, and pervious surfaces. Runoff is routed to a proposed 5’ Type R inlet (sump) via curb and gutter. Runoff from this sub-basin will flow through the proposed and existing storm system to Detention Basin “A”.

Sub-basin S7 (0.40-acres) is located east of the proposed parking garage and includes a portion of Park Meadows Ring Road. It consists of asphalt, concrete, and pervious surfaces. Runoff is routed to a proposed 5’ Type R inlet (on-grade) via surface flow and curb and gutter. Runoff from this sub-basin will flow through the proposed and existing storm system to Detention Basin “A”.

Sub-basin OS1 (0.19-acres) is located south of the east entrance to the mall. It consists of only rooftops. Runoff is routed through roof drains that connect to the existing storm system via a junction structure. Runoff from this sub-basin will flow through the existing and proposed storm system to Detention Basin “A”.

Sub-basin OS2 (0.18-acres) is located south of the east entrance to the mall. It consists of only rooftops. Runoff is routed through roof drains that connect to the existing storm system via a junction structure. Runoff from this sub-basin will flow through the existing and proposed storm system to Detention Basin “A”.

Sub-basin OS3 (0.17-acres) is located south of the east entrance to the mall. It consists of only rooftops. Runoff is routed through roof drains that connect to the existing storm system via a junction structure. Runoff from this sub-basin will flow through the existing and proposed storm system to Detention Basin “A”.

Sub-basin OS4 (0.40-acres) is located south of the east entrance to the mall. It consists of only rooftops. Runoff is routed through roof drains that connect to the existing storm system via a junction structure. Runoff from this sub-basin will flow through the existing and proposed storm system to Detention Basin “A”.

Sub-basin OS5 (1.42-acres) is located south of the proposed parking garage. It consists of only asphalt. Runoff is routed to a proposed 5’ Type R inlet (sump) via surface flow and curb and gutter. Runoff from this sub-basin will flow through the existing storm system to Detention Basin “A”.

Refer to Appendix E for the drainage plans for phase 1A and 1B.

The table below shows the direct runoff values for phase 1A and 1B. Refer to Appendix B for Rational calculations.

Table 1: Direct Runoff Summary Table Phase 1A and 1B

Direct Runoff Summary Table							
Phase 1A				**Phase 1B**			
SUB-BASIN	AREA (AC)	Q_5 (CFS)	Q_{100} (CFS)	SUB-BASIN	AREA (AC)	Q_5 (CFS)	Q_{100} (CFS)
S1	0.75	2.16	4.97	S1	1.25	3.61	8.28
S1a	0.16	0.46	1.06	S1a	0.09	0.26	0.60
S1b	0.94	2.71	6.23	S1b	0.22	0.63	1.46
S2	0.10	0.29	0.66	S2	0.10	0.29	0.66
S3	0.15	0.43	0.99	S3	0.36	1.04	2.39
S4	0.95	2.74	6.29	S4	0.62	1.79	4.11
S5	0.30	0.87	1.99	S5	0.30	0.87	1.99
S6	0.36	1.04	2.39	S6	0.36	1.04	2.39
S7	0.40	1.15	2.65	S7	0.40	1.15	2.65
R1	1.59	4.59	10.53	R1	1.59	4.59	10.53
OS1	0.19	0.55	1.26	R2	0.16	0.46	1.06
OS2	0.18	0.52	1.19	R3	0.23	0.66	1.52
OS3	0.17	0.49	1.13	OS1	0.19	0.55	1.26
OS4	0.40	1.15	2.65	OS2	0.18	0.52	1.19
				OS3	0.17	0.49	1.13
				OS4	0.40	1.15	2.65

E. WATER QUALITY & DETENTION

The area of the Project drains to the existing storm sewer along the mall and eventually to the existing Detention Basin A which was designed to provide detention for the 85-acre contributing area. To accommodate the Water Quality Capture Volume (WQCV) and Excess Urban Runoff Volume (EURV), it is proposed that the outlet structure to Detention Basin “A” be replaced to update the structure and provide the required WQCV and EURV. The update will involve providing the

WQCV and EURV for the entire 85-acre area contributing to the pond. A plan sheet detailing the revised outlet structure is included with the construction plans, and calculations for the revision utilizing the MHFD-Detention workbook are included in Appendix D.

F. STREETS

Although the proposed Site has private drives and surface parking, no public streets are to be constructed internal to the Site. Inlets are proposed to intercept runoff and connect to pipes to convey the flow to the proposed on-site drainage facilities.

Interception rates at all inlets have been calculated based on MHFD-Inlet (v5.02) spreadsheets; copies of these spreadsheet computations are included in the appendix. The MHFD-Inlet spreadsheet calculation for local depression at a curb inlet assumes a 6-inch curb head. Curb inlets are primarily located where the curb is only 4 inches tall; the 2-inch difference is, by default, put into the local depression. Streets were designed to convey runoff in accordance with criteria for local streets.

G. OPEN CHANNEL FLOW

No open channels are proposed with this project.

H. STORM SEWERS AND CULVERTS

The on-site and off-site storm sewer systems have been designed in accordance with Douglas County's criteria. Hydraulic grade lines for the minor and major storms were generated utilizing Bentley StormCAD hydraulic modeling software. Output from the model is included in Appendix C.

IV. CONCLUSIONS

A. IMPACT OF IMPROVEMENTS

All proposed onsite drainage infrastructure shown on the final drainage plan will be designed to convey the major storm event.

B. COMPLIANCE WITH APPLICABLE CRITERIA

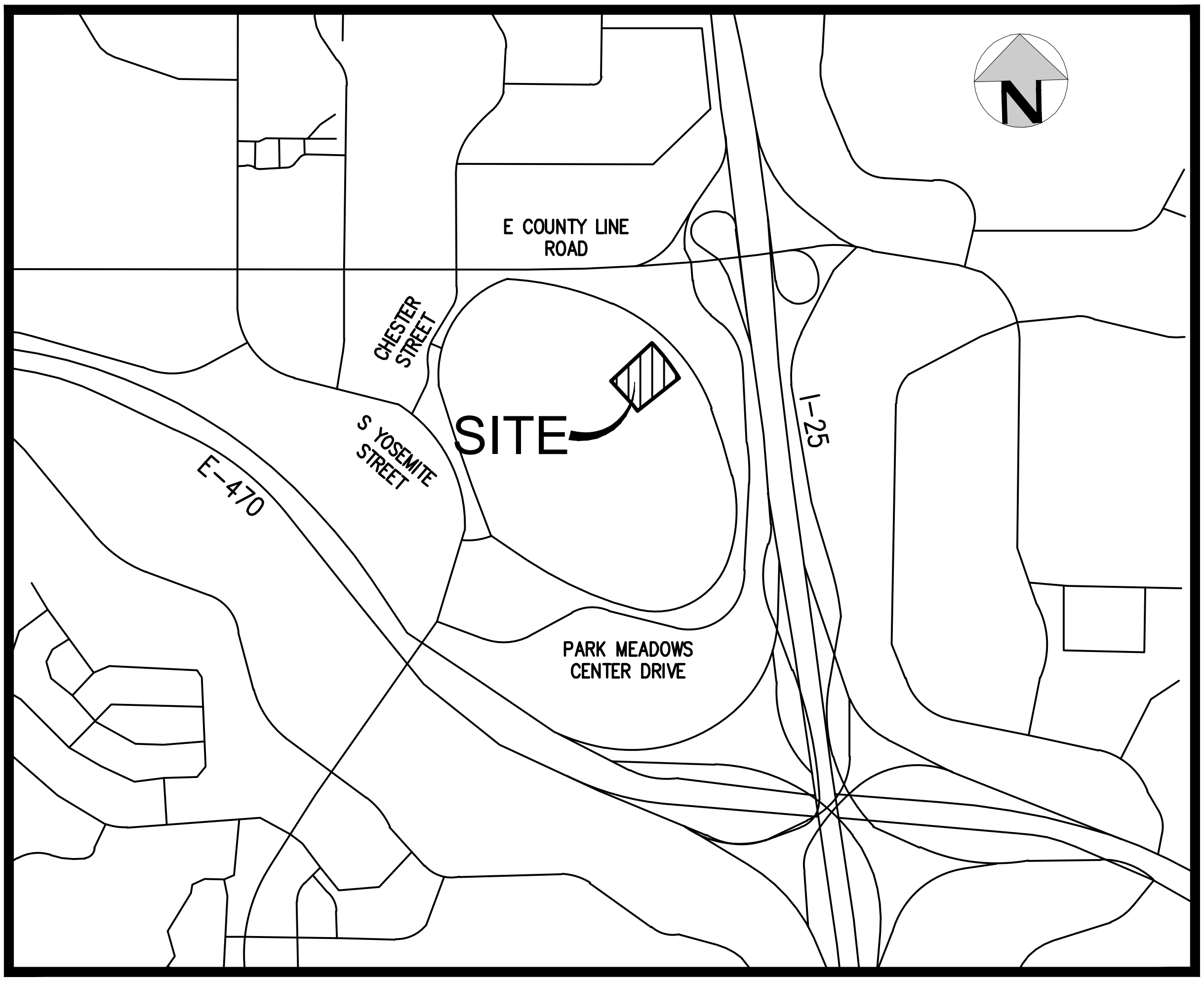
All drainage infrastructure was designed in accordance with the Douglas County Storm Drainage Design and Technical Criteria Manual and Mile High Flood District Manuals.

V. REFERENCES

1. Douglas County Storm Drainage Design and Technical Criteria Manual, and Updates.
2. Urban Storm Drainage Criteria Manual (USDCM), Mile High Flood District (MHFD, formerly known as Urban Drainage and Flood Control District, UDFCD) and Updates.
   - Volume 1, Management, Hydrology and Hydraulics
   - Volume 2, Structures, Storage and Recreation
   - Volume 3, Stormwater Quality
3. Phase III Drainage Report for Park Meadows by Paller-Roberts Engineering, revised in April 1995.
4. Drainage Report for Park Meadows Mall Expansion, Douglas County, Colorado by National Survey and Engineering as revised November 2006.
5. Willow Creek, Little Dry Creek, and Greenwood Gulch Outfall Systems Planning Study by CH2MHILL as prepared February 2010.

APPENDIX A

Vicinity Map
NRCS Soils Report
FEMA Map



Vicinity Map

SCALE: 1"=1000'

United States Department of Agriculture

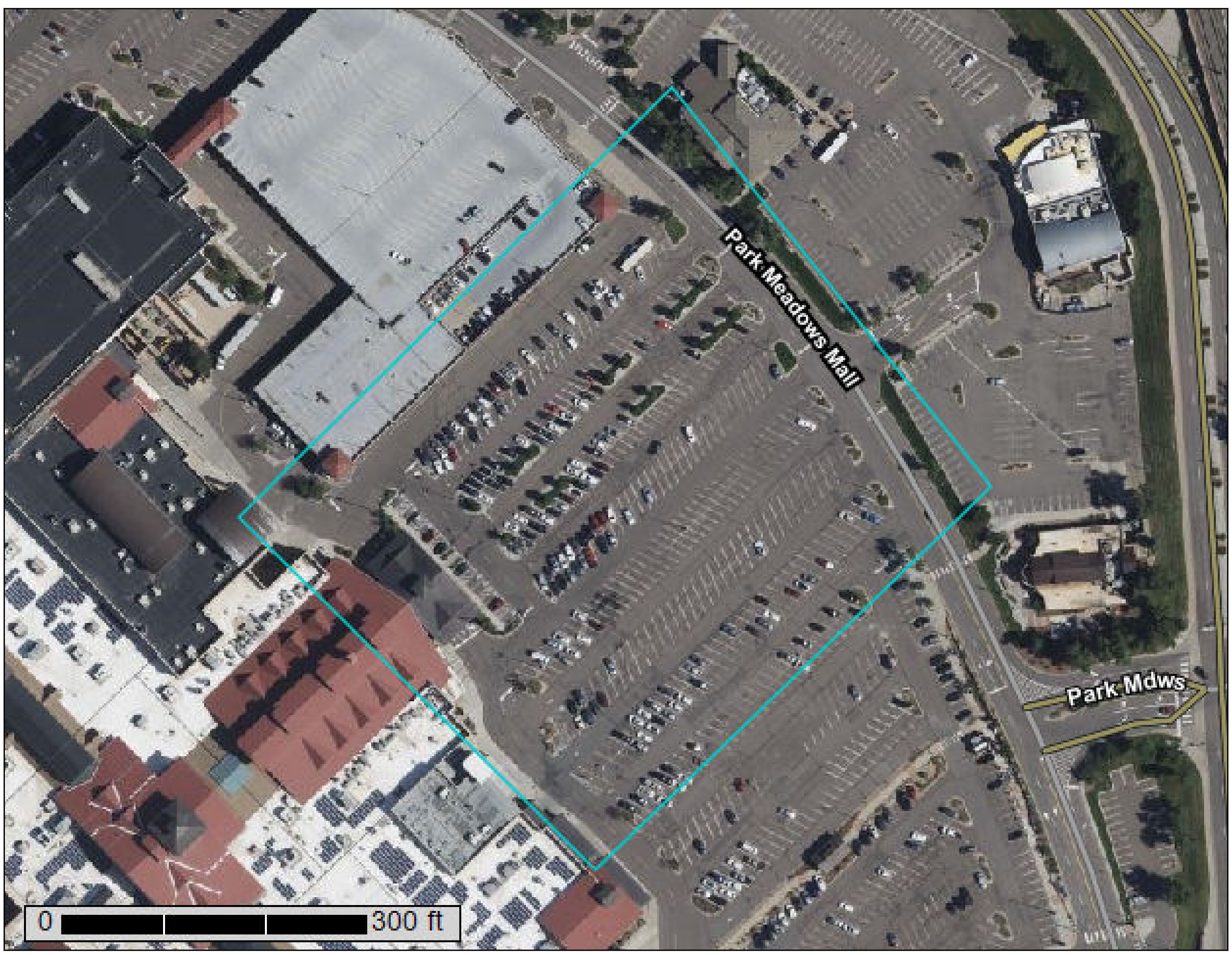
NRCS

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

Castle Rock Area, Colorado



February 20, 2024

Preface

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

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

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

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

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

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

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

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

Soil Map

Map Scale: 1:1,750 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 25, 50, 100, 150

Feet: 0, 50, 100, 200, 300

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

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

Special Point Features

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Castle Rock Area, Colorado
Survey Area Data: Version 16, Aug 24, 2023

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

Date(s) aerial images were photographed: Mar 1, 2023—Sep 1, 2023

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
RmE	Renohill-Buick complex, 5 to 25 percent slopes	6.5	100.0%
Totals for Area of Interest		**6.5**	**100.0%**

Map Unit Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

Castle Rock Area, Colorado

RmE—Renohill-Buick complex, 5 to 25 percent slopes

Map Unit Setting

National map unit symbol: jqzy
Elevation: 5,500 to 6,200 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 120 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Renohill and similar soils: 50 percent
Buick and similar soils: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Renohill

Setting

Landform: Hills
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Weathered, calcareous clayey shale

Typical profile

H1 - 0 to 3 inches: clay loam
H2 - 3 to 12 inches: clay loam
H3 - 12 to 24 inches: clay loam
H4 - 24 to 28 inches: unweathered bedrock

Properties and qualities

Slope: 5 to 25 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: R049XC202CO - Loamy Foothill 14-19 PZ
Hydric soil rating: No

Description of Buick

Setting

Landform: Hills
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian deposits over silty alluvium

Typical profile

H1 - 0 to 4 inches: loam
H2 - 4 to 15 inches: silty clay loam
H3 - 15 to 22 inches: loam
H4 - 22 to 60 inches: sandy clay loam

Properties and qualities

Slope: 5 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: R049XC202CO - Loamy Foothill 14-19 PZ
Hydric soil rating: No

Minor Components

Manzanola

Percent of map unit: 6 percent
Hydric soil rating: No

Satanta

Percent of map unit: 6 percent
Hydric soil rating: No

Fondis

Percent of map unit: 6 percent
Hydric soil rating: No

Aquic haplustolls

Percent of map unit: 2 percent
Landform: Swales
Hydric soil rating: Yes

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National Flood Hazard Layer FIRMette

FEMA

104°52'49"W 39°34'3"N

104°52'11"W 39°33'35"N

Feet

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

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

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

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

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

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

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

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

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

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 2/20/2024 at 1:21 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

APPENDIX B

Hydrologic Calculations

IMPERVIOUSNESS AND RUNOFF COEFFICIENTS CALCULATIONS, PROPOSED DEVELOPMENT

CALC'D BY: GRS
DATE: 11/07/22
REVISED: 05/02/24
NRCS Hydrologic Soil Group: C

PROJECT: Park Meadows Phase 1a
PROJ. NO: 231016

LAND USE TYPES (per MHFD Table 6-3):

STREETS		ROOFS, DRIVES, PARKING, WALKS		LAWN, CLAY OR SANDY SOIL	
% Imp =	100%	% Imp =	90%	% Imp =	2%

		ACRES					RUNOFF COEFFICIENTS PER MHFD USDCM TABLE 6-4	
SUB-BASIN	Areas	STREETS	ROOFS, DRIVES, PARKING, WALKS	LAWN, CLAY OR SANDY SOIL	% Imperv.	Imperv. Acres	C_5=	C_{100}=
S1	0.75				90.00%	0.68	0.77	0.85
S1a	0.16				90.00%	0.14	0.77	0.85
S1b	0.94				90.00%	0.85	0.77	0.85
S2	0.10				90.00%	0.09	0.77	0.85
S3	0.15				90.00%	0.14	0.77	0.85
S4	0.95				90.00%	0.86	0.77	0.85
S5	0.30				90.00%	0.27	0.77	0.85
S6	0.36				90.00%	0.32	0.77	0.85
S7	0.40				90.00%	0.36	0.77	0.85
R1	1.59				90.00%	1.43	0.77	0.85
OS1	0.19				90.00%	0.17	0.77	0.85
OS2	0.18				90.00%	0.16	0.77	0.85
OS3	0.17				90.00%	0.15	0.77	0.85
OS4	0.40				90.00%	0.36	0.77	0.85
OS5	1.42				90.00%	1.28	0.77	0.85
TOTAL	8.06				90.00%	7.25		

MHFD criteria per August 2018 USDCM Vol. 1, check website for updates:

Table 6-4. Runoff coefficient equations based on NRCS soil group and storm return period

NRCS Soil Group	Storm Return Period						
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
A	$C_A= 0.84i^{1.302}$	$C_A= 0.86i^{1.276}$	$C_A= 0.87i^{1.232}$	$C_A = 0.88i^{1.124}$	$C_A = 0.85i+0.025$	$C_A = 0.78i+0.110$	$C_A = 0.65i+0.254$
B	$C_B= 0.84i^{1.169}$	$C_B = 0.86i^{1.088}$	$C_B= 0.81i+0.057$	$C_B = 0.63i+0.249$	$C_B= 0.56i+0.328$	$C_B = 0.47i+0.426$	$C_B = 0.37i+0.536$
C/D	$C_{C/D}= 0.83i^{1.122}$	$C_{C/D}= 0.82i+0.035$	$C_{C/D} = 0.74i+0.132$	$C_{C/D} = 0.56i+0.319$	$C_{C/D} = 0.49i+0.393$	$C_{C/D} = 0.41i+0.484$	$C_{C/D} = 0.32i+0.588$

Where:

i = % imperviousness (expressed as a decimal)

C_A = Runoff coefficient for Natural Resources Conservation Service (NRCS) HSG A soils

C_B = Runoff coefficient for NRCS HSG B soils

$C_{C/D}$ = Runoff coefficient for NRCS HSG C and D soils.

CALCULATED BY: GRS
CHECKED BY: < >
DATE: 11/7/2022

Standard Form SF-1
Time of Concentration

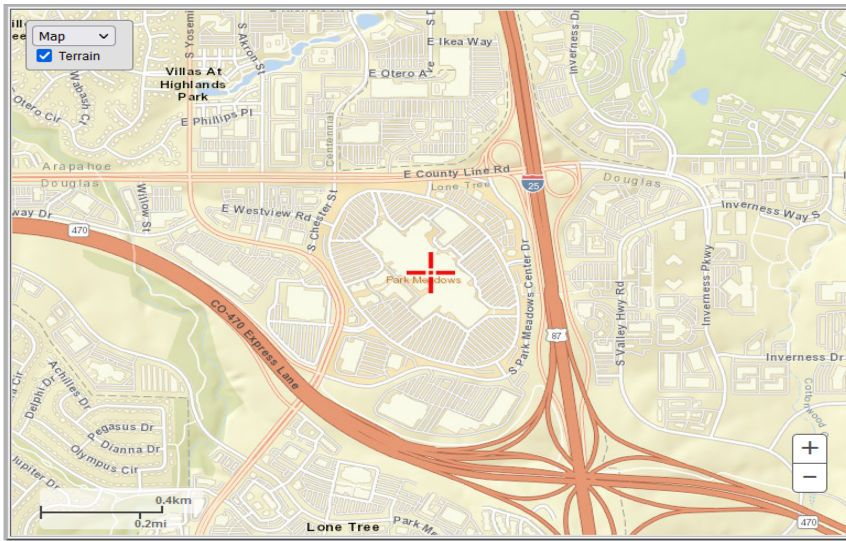
JOB NO: 231016
PROJECT: Park Meadows Phase 1a
REVISED: 5/2/2024

SUB-BASIN DATA			INITIAL/OVERLAND TIME (T_i)			TRAVEL TIME (T_t)					T_c CHECK (URBANIZED BASINS)				FINAL 5 < T_c < 10	REMARKS
SUB-BASIN	AREA (AC)	C_5	LENGTH (FT)	SLOPE %	T_i (MIN)	LENGTH (FT)	SLOPE %	K	VELOCITY (FPS)	T_t (MIN)	COMPOS. $T_c = T_i + T_t$ (MIN)	L_t, TOTAL LENGTH	AVG SLOPE	$T_c = (26-17i)+\frac{L_t}{60(14i+9)\sqrt{S_t}}$	(MIN)	
S1	0.75	0.77	-	-	-	-	-	-		-	-	-	-	-	5.0	Minimum Tc Assumed
S1a	0.16	0.77													5.0	Minimum Tc Assumed
S1b	0.94	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed
S2	0.10	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed
S3	0.15	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed
S4	0.95	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed
S5	0.30	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed
S6	0.36	0.77													5.0	Minimum Tc Assumed
S7	0.40	0.77													5.0	Minimum Tc Assumed
R1	1.59	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed
OS1	0.19	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed
OS2	0.18	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed
OS3	0.17	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed
OS4	0.40	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed
OS5	1.42	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed

1-HR Rainfall

Site Specific (NOAA Atlas 14 PPF Estimates)			Douglas County Criteria	
Return Interval (YR)	1-hour Rainfall		Return Interval (YR	1-hour Rainfall
WQ	0.60	(WQ per MHFD USDCM Vol 3, p 1-9 [29 of 577])	WQ	0.60
1	0.694		1	unknown
2	0.842		2	1.060
5	1.10		5	1.43
10	1.34		10	1.66
25	1.69		25	unknown
50	1.98		50	2.26
100	2.29		100	2.60
500	3.10		500	unknown

https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=co



a) Select location
Move crosshair or double click

b) Click on station icon
Show stations on map

Location information:
Name: Lone Tree, Colorado, USA*
Latitude: 39.5626°
Longitude: -104.8763°
Elevation: 5852 ft **

* Source: ESRI Maps
** Source: USGS

PDS-based 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	**0.224** (0.176-0.287)	**0.278** (0.218-0.355)	**0.370** (0.289-0.475)	**0.451** (0.351-0.582)	**0.569** (0.430-0.770)	**0.665** (0.490-0.912)	**0.766** (0.545-1.08)	**0.873** (0.596-1.27)	**1.02** (0.671-1.53)	**1.14** (0.728-1.73)
10-min	**0.328** (0.258-0.420)	**0.407** (0.319-0.520)	**0.542** (0.424-0.695)	**0.660** (0.513-0.852)	**0.833** (0.630-1.13)	**0.974** (0.718-1.34)	**1.12** (0.799-1.58)	**1.28** (0.873-1.86)	**1.50** (0.983-2.24)	**1.67** (1.06-2.53)
15-min	**0.400** (0.314-0.512)	**0.496** (0.389-0.635)	**0.660** (0.516-0.848)	**0.805** (0.626-1.04)	**1.02** (0.768-1.38)	**1.19** (0.875-1.63)	**1.37** (0.974-1.93)	**1.56** (1.06-2.26)	**1.82** (1.20-2.73)	**2.04** (1.30-3.08)
30-min	**0.544** (0.427-0.696)	**0.674** (0.529-0.862)	**0.896** (0.701-1.15)	**1.09** (0.849-1.41)	**1.38** (1.04-1.86)	**1.61** (1.19-2.21)	**1.85** (1.32-2.61)	**2.11** (1.44-3.06)	**2.47** (1.62-3.70)	**2.76** (1.76-4.17)
60-min	**0.694** (0.545-0.888)	**0.842** (0.661-1.08)	**1.10** (0.863-1.42)	**1.34** (1.04-1.73)	**1.69** (1.28-2.29)	**1.98** (1.46-2.72)	**2.29** (1.63-3.24)	**2.62** (1.80-3.82)	**3.10** (2.04-4.64)	**3.48** (2.22-5.26)
2-hr	**0.844** (0.669-1.07)	**1.01** (0.800-1.28)	**1.31** (1.03-1.66)	**1.58** (1.24-2.02)	**2.00** (1.53-2.70)	**2.35** (1.76-3.20)	**2.73** (1.97-3.82)	**3.14** (2.17-4.52)	**3.72** (2.47-5.52)	**4.20** (2.70-6.27)
3-hr	**0.946** (0.754-1.19)	**1.12** (0.889-1.41)	**1.43** (1.14-1.81)	**1.72** (1.36-2.19)	**2.18** (1.68-2.92)	**2.56** (1.92-3.48)	**2.98** (2.16-4.15)	**3.44** (2.39-4.92)	**4.09** (2.74-6.03)	**4.63** (3.00-6.87)
6-hr	**1.15** (0.924-1.43)	**1.35** (1.08-1.69)	**1.72** (1.38-2.15)	**2.06** (1.64-2.59)	**2.59** (2.02-3.43)	**3.03** (2.30-4.06)	**3.51** (2.57-4.83)	**4.04** (2.84-5.71)	**4.79** (3.24-6.96)	**5.40** (3.54-7.91)
12-hr	**1.40** (1.14-1.73)	**1.67** (1.35-2.06)	**2.13** (1.72-2.64)	**2.55** (2.04-3.17)	**3.16** (2.47-4.12)	**3.66** (2.79-4.83)	**4.20** (3.09-5.68)	**4.77** (3.37-6.63)	**5.57** (3.79-7.96)	**6.20** (4.10-8.97)
24-hr	**1.72** (1.40-2.10)	**2.03** (1.66-2.48)	**2.56** (2.08-3.14)	**3.02** (2.45-3.72)	**3.69** (2.91-4.74)	**4.24** (3.26-5.52)	**4.81** (3.58-6.42)	**5.42** (3.87-7.43)	**6.26** (4.30-8.82)	**6.92** (4.63-9.87)
2-day	**2.06** (1.70-2.49)	**2.38** (1.96-2.88)	**2.92** (2.40-3.55)	**3.40** (2.78-4.15)	**4.11** (3.27-5.22)	**4.69** (3.64-6.03)	**5.29** (3.98-6.97)	**5.94** (4.28-8.04)	**6.83** (4.75-9.51)	**7.55** (5.10-10.6)
3-day	**2.20** (1.83-2.65)	**2.57** (2.13-3.09)	**3.18** (2.63-3.84)	**3.72** (3.06-4.51)	**4.49** (3.58-5.65)	**5.11** (3.98-6.51)	**5.75** (4.34-7.50)	**6.42** (4.65-8.61)	**7.34** (5.12-10.1)	**8.06** (5.48-11.3)
4-day	**2.31** (1.92-2.77)	**2.72** (2.26-3.26)	**3.40** (2.82-4.08)	**3.98** (3.28-4.80)	**4.80** (3.84-6.00)	**5.45** (4.26-6.90)	**6.12** (4.63-7.94)	**6.82** (4.96-9.08)	**7.76** (5.43-10.6)	**8.49** (5.80-11.8)
7-day	**2.64** (2.22-3.14)	**3.10** (2.60-3.68)	**3.86** (3.22-4.60)	**4.50** (3.74-5.38)	**5.40** (4.35-6.68)	**6.11** (4.81-7.66)	**6.84** (5.21-8.77)	**7.58** (5.56-9.99)	**8.59** (6.07-11.6)	**9.37** (6.45-12.9)
10-day	**2.98** (2.52-3.52)	**3.44** (2.90-4.07)	**4.21** (3.54-5.00)	**4.87** (4.07-5.80)	**5.80** (4.70-7.13)	**6.53** (5.18-8.14)	**7.28** (5.58-9.29)	**8.06** (5.94-10.6)	**9.12** (6.47-12.3)	**9.94** (6.88-13.5)
20-day	**3.97** (3.38-4.65)	**4.44** (3.78-5.19)	**5.22** (4.43-6.12)	**5.89** (4.97-6.94)	**6.85** (5.61-8.32)	**7.61** (6.10-9.37)	**8.40** (6.51-10.6)	**9.22** (6.87-11.9)	**10.3** (7.42-13.7)	**11.2** (7.84-15.1)
30-day	**4.74** (4.06-5.51)	**5.27** (4.51-6.13)	**6.16** (5.25-7.18)	**6.90** (5.86-8.08)	**7.95** (6.54-9.57)	**8.77** (7.06-10.7)	**9.60** (7.48-12.0)	**10.5** (7.84-13.4)	**11.6** (8.39-15.3)	**12.5** (8.81-16.7)
45-day	**5.63** (4.84-6.50)	**6.34** (5.45-7.32)	**7.48** (6.41-8.67)	**8.41** (7.18-9.78)	**9.67** (7.97-11.5)	**10.6** (8.58-12.8)	**11.6** (9.04-14.3)	**12.5** (9.39-15.8)	**13.7** (9.92-17.8)	**14.6** (10.3-19.3)
60-day	**6.32** (5.46-7.27)	**7.25** (6.26-8.34)	**8.71** (7.50-10.0)	**9.87** (8.45-11.4)	**11.4** (9.39-13.4)	**12.5** (10.1-14.9)	**13.5** (10.6-16.6)	**14.5** (11.0-18.2)	**15.8** (11.5-20.3)	**16.7** (11.9-21.9)

[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.

CALCULATED BY:	GRS	**Standard Form SF-2 (modified)**	JOB NO:	231016
DATE:	11/7/2022	**Storm Drainage System Design**	PROJECT:	Park Meadows Phase 1a
CHECKED BY:	< >	**(Rational Method Procedure)**	DESIGN STORM:	**5** YR
PROJECT MANAGER:	LE	**Proposed Development**	REVISED:	5/2/2024

		DIRECT RUNOFF						TOTAL RUNOFF				PIPE (for preliminary pipe design and travel time)							
SUB-BASIN(s)	DESIGN POINT (DP)	AREA (AC)	RUNOFF COEFF	T_c (min)	C x A (AC)	I (IN/HR)	Q (CFS)	T_c (MIN)	Σ(C x A) (AC)	I (IN/HR)	Q (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE (IN)	QFULL (CFS)	LENGTH (FT)	VELOCITY (FPS)	T_t (min)	REMARKS
R1		1.59	0.77	5.00	1.23	3.73	4.59												Roof drains from pr garage
S1		0.75	0.77	5.00	0.58	3.73	2.16												Direct to ex. quad type 13 inlet in sump
R1 + S1	1	2.34						5.00	1.81	3.73	6.75								
S1a		0.16	0.77	5.00	0.12	3.73	0.46												
DP 1 + S1a	2	2.50						5.00	1.93	3.73	7.21								
S1b		0.94	0.77	5.00	0.73	3.73	2.71												Direct to ex. triple type 13 inlet on grade
S2		0.10	0.77	5.00	0.08	3.73	0.29												Direct to ex. Type R
S3	3	0.15	0.77	5.00	0.12	3.73	0.43												Direct to ex. Type R
DP 3 + S2	4	0.25						5.00	0.19	3.73	0.72								
OS1		0.19	0.77	5.00	0.15	3.73	0.55												Roof drain from ex. retail
OS2		0.18	0.77	5.00	0.14	3.73	0.52												Roof drain from ex. retail
OS3		0.17	0.77	5.00	0.13	3.73	0.49												Roof drain from ex. retail
OS4		0.40	0.77	5.00	0.31	3.73	1.15												Roof drain from ex. retail
OS1 + OS2 + OS3 +OS4	5	0.94						5.00	0.73	3.73	2.71								
S4		0.95	0.77	5.00	0.73	3.73	2.74												Direc to ex valley type 13 in sump
S5		0.30	0.77	5.00	0.23	3.73	0.87												Direct to pr Type R in sump
S6		0.36	0.77	5.00	0.28	3.73	1.04												Direct to pr. Type R on grade
S7		0.40	0.77	5.00	0.31	3.73	1.15												Direct to pr. Type R on grade
S6 + S7	6	0.76						5.00	0.59	3.73	2.19								
OS5		1.42	0.77	5.00	1.10	3.73	4.10												Direct to pr Type R inlet in sump
DP 6 + OS5	7	2.18						5.00	1.69	3.73	6.29								
S4 + S5	8	1.25						5.00	0.97	3.73	3.61								
DP 5 + DP 7 + DP 8	9	4.37						5.00	3.38	3.73	12.60								

CALCULATED BY:	GRS	**Standard Form SF-2 (modified)**	JOB NO:	231016
DATE:	11/7/2022	**Storm Drainage System Design**	PROJECT:	Park Meadows Phase 1a
CHECKED BY:	< >	**(Rational Method Procedure)**	DESIGN STORM:	**100** YR
PROJECT MANAGER:	LE	**Proposed Development**	REVISED:	5/2/2024

		DIRECT RUNOFF						TOTAL RUNOFF				PIPE (for preliminary pipe design and travel time)							
SUB-BASIN(s)	DESIGN POINT (DP)	AREA (AC)	RUNOFF COEFF	T_c (min)	C x A (AC)	I (IN/HR)	Q (CFS)	T_c (MIN)	Σ(C x A) (AC)	I (IN/HR)	Q (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE (IN)	QFULL (CFS)	LENGTH (FT)	VELOCITY (FPS)	T_t (min)	REMARKS
R1		1.59	0.85	5.00	1.36	7.77	10.53												Roof drains from pr garage
S1		0.75	0.85	5.00	0.64	7.77	4.97												Direct to ex. quad type 13 inlet in sump
R1 + S1	1	2.34						5.00	2.00	7.77	15.50								
S1a		0.16	0.85	5.00	0.14	7.77	1.06												
DP 1 + S1a	2	2.50						5.00	2.13	7.77	16.56								
S1b		0.94	0.85	5.00	0.80	7.77	6.23												Direct to ex. triple type 13 inlet on grade
S2		0.10	0.85	5.00	0.09	7.77	0.66												Direct to ex. Type R
S3	3	0.15	0.85	5.00	0.13	7.77	0.99												Direct to ex. Type R
DP 3 + S2	4	0.25						5.00	0.21	7.77	1.66								
OS1		0.19	0.85	5.00	0.16	7.77	1.26												Roof drain from ex. retail
OS2		0.18	0.85	5.00	0.15	7.77	1.19												Roof drain from ex. retail
OS3		0.17	0.85	5.00	0.15	7.77	1.13												Roof drain from ex. retail
OS4		0.40	0.85	5.00	0.34	7.77	2.65												Roof drain from ex. retail
OS1 + OS2 + OS3 +OS4	5	0.94						5.00	0.80	7.77	6.23								
S4		0.95	0.85	5.00	0.81	7.77	6.29												Direc to ex valley type 13 in sump
S5		0.30	0.85	5.00	0.26	7.77	1.99												Direct to pr Type R in sump
S6		0.36	0.85	5.00	0.31	7.77	2.39												Direct to pr. Type R on grade
S7		0.40	0.85	5.00	0.34	7.77	2.65												Direct to pr. Type R on grade
S6 + S7	6	0.76						5.00	0.65	7.77	5.04								
OS5		1.42	0.85	5.00	1.21	7.77	9.41												Direct to pr Type R inlet in sump
DP 6 + OS5	7	2.18						5.00	1.86	7.77	14.44								
S4 + S5	8	1.25						5.00	1.07	7.77	8.28								
DP 5 + DP 7 + DP 8	9	4.37						5.00	3.73	7.77	28.95								

IMPERVIOUSNESS AND RUNOFF COEFFICIENTS CALCULATIONS, PROPOSED DEVELOPMENT

CALC'D BY: GRS
DATE: 11/07/22
REVISED: 05/02/24
NRCS Hydrologic Soil Group: C

PROJECT: Park Meadows Phase 1b
PROJ. NO: 231016

LAND USE TYPES (per MHFD Table 6-3):

STREETS		ROOFS, DRIVES, PARKING, WALKS		LAWN, CLAY OR SANDY SOIL	
% Imp =	100%	% Imp =	90%	% Imp =	2%

SUB-BASIN	Areas	ACRES: STREETS	ACRES: ROOFS, DRIVES, PARKING, WALKS	ACRES: LAWN, CLAY OR SANDY SOIL	% Imperv.	Imperv. Acres	RUNOFF COEFFICIENTS PER MHFD USDCM TABLE 6-4: C_5=	C_{100}=
S1	1.25				90.00%	1.13	0.77	0.85
S1a	0.09				90.00%	0.08	0.77	0.85
S1b	0.22				90.00%	0.20	0.77	0.85
S2	0.10				90.00%	0.09	0.77	0.85
S3	0.36				90.00%	0.32	0.77	0.85
S4	0.62				90.00%	0.56	0.77	0.85
S5	0.30				90.00%	0.27	0.77	0.85
S6	0.36				90.00%	0.32	0.77	0.85
S7	0.40				90.00%	0.36	0.77	0.85
R1	1.59				90.00%	1.43	0.77	0.85
R2	0.16				90.00%	0.14	0.77	0.85
R3	0.23				90.00%	0.21	0.77	0.85
OS1	0.19				90.00%	0.17	0.77	0.85
OS2	0.18				90.00%	0.16	0.77	0.85
OS3	0.17				90.00%	0.15	0.77	0.85
OS4	0.40				90.00%	0.36	0.77	0.85
OS5	1.42				90.00%	1.28	0.77	0.85
TOTAL	8.04				90.00%	7.24		

MHFD criteria per August 2018 USDCM Vol. 1, check website for updates:

Table 6-4. Runoff coefficient equations based on NRCS soil group and storm return period

NRCS Soil Group	Storm Return Period: 2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
A	$C_A = 0.84i^{1.302}$	$C_A = 0.86i^{1.276}$	$C_A = 0.87i^{1.232}$	$C_A = 0.88i^{1.124}$	$C_A = 0.85i+0.025$	$C_A = 0.78i+0.110$	$C_A = 0.65i+0.254$
B	$C_B = 0.84i^{1.169}$	$C_B = 0.86i^{1.088}$	$C_B = 0.81i+0.057$	$C_B = 0.63i+0.249$	$C_B = 0.56i+0.328$	$C_B = 0.47i+0.426$	$C_B = 0.37i+0.536$
C/D	$C_{C/D} = 0.83i^{1.122}$	$C_{C/D} = 0.82i+0.035$	$C_{C/D} = 0.74i+0.132$	$C_{C/D} = 0.56i+0.319$	$C_{C/D} = 0.49i+0.393$	$C_{C/D} = 0.41i+0.484$	$C_{C/D} = 0.32i+0.588$

Where:

i = % imperviousness (expressed as a decimal)

C_A = Runoff coefficient for Natural Resources Conservation Service (NRCS) HSG A soils

C_B = Runoff coefficient for NRCS HSG B soils

$C_{C/D}$ = Runoff coefficient for NRCS HSG C and D soils.

CALCULATED BY: GRS
CHECKED BY: < >
DATE: 11/7/2022

Standard Form SF-1
Time of Concentration

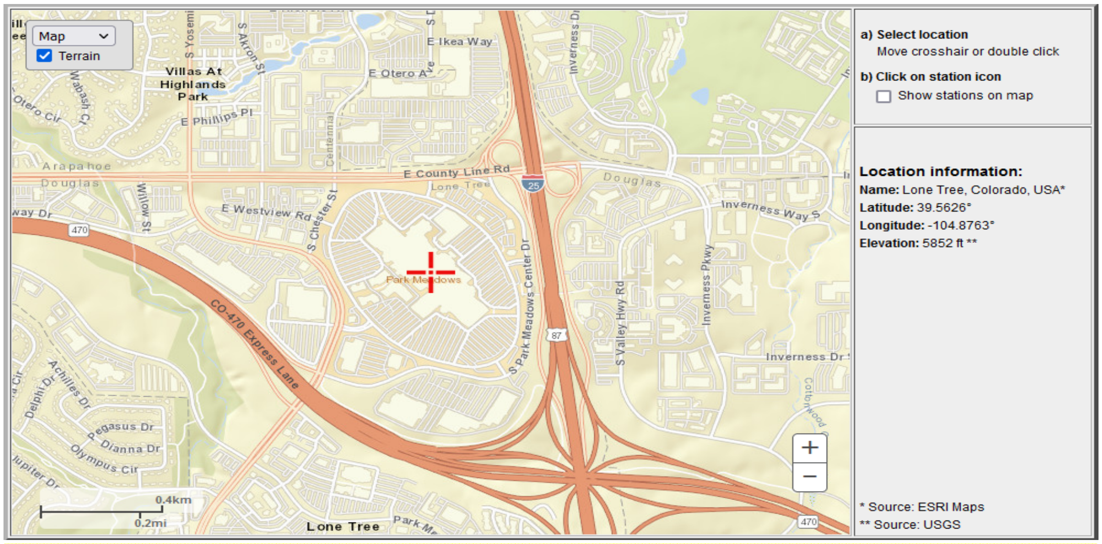
JOB NO: 231016
PROJECT: Park Meadows Phase 1b
REVISED: 5/2/2024

SUB-BASIN DATA			INITIAL/OVERLAND TIME (T_i)			TRAVEL TIME (T_t)					T_c CHECK (URBANIZED BASINS)				FINAL $5 < T_c < 10$	REMARKS
SUB-BASIN	AREA (AC)	C_5	LENGTH (FT)	SLOPE %	T_i (MIN)	LENGTH (FT)	SLOPE %	K	VELOCITY (FPS)	T_t (MIN)	COMPOS. $T_c = T_i + T_t$ (MIN)	L_t, TOTAL LENGTH	AVG SLOPE	$T_c = (26-17i) + \frac{L_t}{60(14i+9)\sqrt{S_t}}$	(MIN)	
S1	1.25	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed
S1a	0.09	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed
S1b	0.22	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed
S2	0.10	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed
S3	0.36	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed
S4	0.62	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed
S5	0.30	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed
S6	0.36	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed
S7	0.40	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed
R1	1.59	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed
R2	0.16	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed
R3	0.23	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed
OS1	0.19	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed
OS2	0.18	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed
OS3	0.17	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed
OS4	0.40	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed
OS5	1.42	0.77	-	-	-	-	-	-	-	-	-	-	-	-	5.0	Minimum Tc Assumed

1-HR Rainfall

Site Specific (NOAA Atlas 14 PPF Estimates)			Douglas County Criteria	
Return Interval (YR)	1-hour Rainfall		Return Interval (YR	1-hour Rainfall
WQ	0.60	(WQ per MHFD USDCM Vol 3, p 1-9 [29 of 577])	WQ	0.60
1	0.694		1	unknown
2	0.842		2	1.060
5	1.10		5	1.43
10	1.34		10	1.66
25	1.69		25	unknown
50	1.98		50	2.26
100	2.29		100	2.60
500	3.10		500	unknown

https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=co



PDS-based 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	**0.224** (0.176-0.287)	**0.278** (0.218-0.355)	**0.370** (0.289-0.475)	**0.451** (0.351-0.582)	**0.569** (0.430-0.770)	**0.665** (0.490-0.912)	**0.766** (0.545-1.08)	**0.873** (0.596-1.27)	**1.02** (0.671-1.53)	**1.14** (0.728-1.73)
10-min	**0.328** (0.258-0.420)	**0.407** (0.319-0.520)	**0.542** (0.424-0.695)	**0.660** (0.513-0.852)	**0.833** (0.630-1.13)	**0.974** (0.718-1.34)	**1.12** (0.799-1.58)	**1.28** (0.873-1.86)	**1.50** (0.983-2.24)	**1.67** (1.06-2.53)
15-min	**0.400** (0.314-0.512)	**0.496** (0.389-0.635)	**0.660** (0.516-0.848)	**0.805** (0.626-1.04)	**1.02** (0.768-1.38)	**1.19** (0.875-1.63)	**1.37** (0.974-1.93)	**1.56** (1.06-2.26)	**1.82** (1.20-2.73)	**2.04** (1.30-3.08)
30-min	**0.544** (0.427-0.696)	**0.674** (0.529-0.862)	**0.896** (0.701-1.15)	**1.09** (0.849-1.41)	**1.38** (1.04-1.86)	**1.61** (1.19-2.21)	**1.85** (1.32-2.61)	**2.11** (1.44-3.06)	**2.47** (1.62-3.70)	**2.76** (1.76-4.17)
60-min	**0.694** (0.545-0.888)	**0.842** (0.661-1.08)	**1.10** (0.863-1.42)	**1.34** (1.04-1.73)	**1.69** (1.28-2.29)	**1.98** (1.46-2.72)	**2.29** (1.63-3.24)	**2.62** (1.80-3.82)	**3.10** (2.04-4.64)	**3.48** (2.22-5.26)
2-hr	**0.844** (0.669-1.07)	**1.01** (0.800-1.28)	**1.31** (1.03-1.66)	**1.58** (1.24-2.02)	**2.00** (1.53-2.70)	**2.35** (1.76-3.20)	**2.73** (1.97-3.82)	**3.14** (2.17-4.52)	**3.72** (2.47-5.52)	**4.20** (2.70-6.27)
3-hr	**0.946** (0.754-1.19)	**1.12** (0.889-1.41)	**1.43** (1.14-1.81)	**1.72** (1.36-2.19)	**2.18** (1.68-2.92)	**2.56** (1.92-3.48)	**2.98** (2.16-4.15)	**3.44** (2.39-4.92)	**4.09** (2.74-6.03)	**4.63** (3.00-6.87)
6-hr	**1.15** (0.924-1.43)	**1.35** (1.08-1.69)	**1.72** (1.38-2.15)	**2.06** (1.64-2.59)	**2.59** (2.02-3.43)	**3.03** (2.30-4.06)	**3.51** (2.57-4.83)	**4.04** (2.84-5.71)	**4.79** (3.24-6.96)	**5.40** (3.54-7.91)
12-hr	**1.40** (1.14-1.73)	**1.67** (1.35-2.06)	**2.13** (1.72-2.64)	**2.55** (2.04-3.17)	**3.16** (2.47-4.12)	**3.66** (2.79-4.83)	**4.20** (3.09-5.68)	**4.77** (3.37-6.63)	**5.57** (3.79-7.96)	**6.20** (4.10-8.97)
24-hr	**1.72** (1.40-2.10)	**2.03** (1.66-2.48)	**2.56** (2.08-3.14)	**3.02** (2.45-3.72)	**3.69** (2.91-4.74)	**4.24** (3.26-5.52)	**4.81** (3.58-6.42)	**5.42** (3.87-7.43)	**6.26** (4.30-8.82)	**6.92** (4.63-9.87)
2-day	**2.06** (1.70-2.49)	**2.38** (1.96-2.88)	**2.92** (2.40-3.55)	**3.40** (2.78-4.15)	**4.11** (3.27-5.22)	**4.69** (3.64-6.03)	**5.29** (3.98-6.97)	**5.94** (4.28-8.04)	**6.83** (4.75-9.51)	**7.55** (5.10-10.6)
3-day	**2.20** (1.83-2.65)	**2.57** (2.13-3.09)	**3.18** (2.63-3.84)	**3.72** (3.06-4.51)	**4.49** (3.58-5.65)	**5.11** (3.98-6.51)	**5.75** (4.34-7.50)	**6.42** (4.65-8.61)	**7.34** (5.12-10.1)	**8.06** (5.48-11.3)
4-day	**2.31** (1.92-2.77)	**2.72** (2.26-3.26)	**3.40** (2.82-4.08)	**3.98** (3.28-4.80)	**4.80** (3.84-6.00)	**5.45** (4.26-6.90)	**6.12** (4.63-7.94)	**6.82** (4.96-9.08)	**7.76** (5.43-10.6)	**8.49** (5.80-11.8)
7-day	**2.64** (2.22-3.14)	**3.10** (2.60-3.68)	**3.86** (3.22-4.60)	**4.50** (3.74-5.38)	**5.40** (4.35-6.68)	**6.11** (4.81-7.66)	**6.84** (5.21-8.77)	**7.58** (5.56-9.99)	**8.59** (6.07-11.6)	**9.37** (6.45-12.9)
10-day	**2.98** (2.52-3.52)	**3.44** (2.90-4.07)	**4.21** (3.54-5.00)	**4.87** (4.07-5.80)	**5.80** (4.70-7.13)	**6.53** (5.18-8.14)	**7.28** (5.58-9.29)	**8.06** (5.94-10.6)	**9.12** (6.47-12.3)	**9.94** (6.88-13.5)
20-day	**3.97** (3.38-4.65)	**4.44** (3.78-5.19)	**5.22** (4.43-6.12)	**5.89** (4.97-6.94)	**6.85** (5.61-8.32)	**7.61** (6.10-9.37)	**8.40** (6.51-10.6)	**9.22** (6.87-11.9)	**10.3** (7.42-13.7)	**11.2** (7.84-15.1)
30-day	**4.74** (4.06-5.51)	**5.27** (4.51-6.13)	**6.16** (5.25-7.18)	**6.90** (5.86-8.08)	**7.95** (6.54-9.57)	**8.77** (7.06-10.7)	**9.60** (7.48-12.0)	**10.5** (7.84-13.4)	**11.6** (8.39-15.3)	**12.5** (8.81-16.7)
45-day	**5.63** (4.84-6.50)	**6.34** (5.45-7.32)	**7.48** (6.41-8.67)	**8.41** (7.18-9.78)	**9.67** (7.97-11.5)	**10.6** (8.58-12.8)	**11.6** (9.04-14.3)	**12.5** (9.39-15.8)	**13.7** (9.92-17.8)	**14.6** (10.3-19.3)
60-day	**6.32** (5.46-7.27)	**7.25** (6.26-8.34)	**8.71** (7.50-10.0)	**9.87** (8.45-11.4)	**11.4** (9.39-13.4)	**12.5** (10.1-14.9)	**13.5** (10.6-16.6)	**14.5** (11.0-18.2)	**15.8** (11.5-20.3)	**16.7** (11.9-21.9)

[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.

CALCULATED BY: GRS
DATE: 11/7/2022
CHECKED BY: <   >
PROJECT MANAGER: LE

Standard Form SF-2 (modified)
Storm Drainage System Design
(Rational Method Procedure)
Proposed Development

JOB NO: 231016
PROJECT: Park Meadows Phase 1b
DESIGN STORM: **5** YR
REVISED: 5/2/2024

SUB-BASIN(s)	DESIGN POINT (DP)	DIRECT RUNOFF						TOTAL RUNOFF				PIPE (for preliminary pipe design and travel time)							REMARKS
		AREA (AC)	RUNOFF COEFF	T_c (min)	C x A (AC)	I (IN/HR)	Q (CFS)	T_c (MIN)	Σ(C x A) (AC)	I (IN/HR)	Q (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE (IN)	QFULL (CFS)	LENGTH (FT)	VELOCITY (FPS)	T_t (min)	
R1		1.59	0.77	5.00	1.23	3.73	4.59												Roof drains from ex garage
S1		1.25	0.77	5.00	0.97	3.73	3.61												Direct to pr type R inlet in sump
R1 + S1	1	2.84						5.00	2.20	3.73	8.19								
S1a		0.09	0.77	5.00	0.07	3.73	0.26												Direct to ex quad combination type 13 inlet
DP 1 + S1a	1a	2.93						5.00	2.26	3.73	8.45								
S1b		0.22	0.77	5.00	0.17	3.73	0.63												Direct to ex triple combination type 13 inlet
S2	2	0.10	0.77	5.00	0.08	3.73	0.29												Direct to pr type R inlet + landscape drains
S3		0.36	0.77	5.00	0.28	3.73	1.04												Direct to pr valley type 13 inlet + landscape drains
R2		0.16	0.77	5.00	0.12	3.73	0.46												Roof drains from pr retail
S3 + R2	3	0.52						5.00	0.40	3.73	1.50								
S4		0.62	0.77	5.00	0.48	3.73	1.79												Direct to pr Type R inlet in sump
DP 3 + S4	4	1.14						5.00	0.88	3.73	3.29								
S5		0.30	0.77	5.00	0.23	3.73	0.87												Direct to ex Type R inlet in sump
S6		0.36	0.77	5.00	0.28	3.73	1.04												Direct to ex Type R inlet in sump
S7		0.40	0.77	5.00	0.31	3.73	1.15												Direct to ex Type R inlet on grade
S6 + S7	5	0.76						5.00	0.59	3.73	2.19								
R3		0.23	0.77	5.00	0.18	3.73	0.66												Roof drain from pr retail
DP 5 + R3	6	0.99						5.00	0.77	3.73	2.86								
OS5		1.42	0.77	5.00	1.10	3.73	4.10												Direct to ex Type R inlet in sump
DP 6 + OS5	7	2.41						5.00	1.86	3.73	6.95								
OS1		0.19	0.77	5.00	0.15	3.73	0.55												Direct to ex junction structure
OS2		0.18	0.77	5.00	0.14	3.73	0.52												Direct to ex junction structure
OS3		0.17	0.77	5.00	0.13	3.73	0.49												Direct to ex junction structure
OS4		0.40	0.77	5.00	0.31	3.73	1.15												Direct to ex junction structure
DP 4 + OS1 + OS2 + OS3 + OS4	8	2.08						5.00	1.46	3.73	5.45								
S5 + DP 7 + DP 8	9	4.79						5.00	3.56	3.73	13.27								

CALCULATED BY:	GRS	JOB NO:	231016
DATE:	11/7/2022	PROJECT:	Park Meadows Phase 1b
CHECKED BY:	< >	DESIGN STORM:	**100** YR
PROJECT MANAGER:	LE	REVISED:	5/2/2024

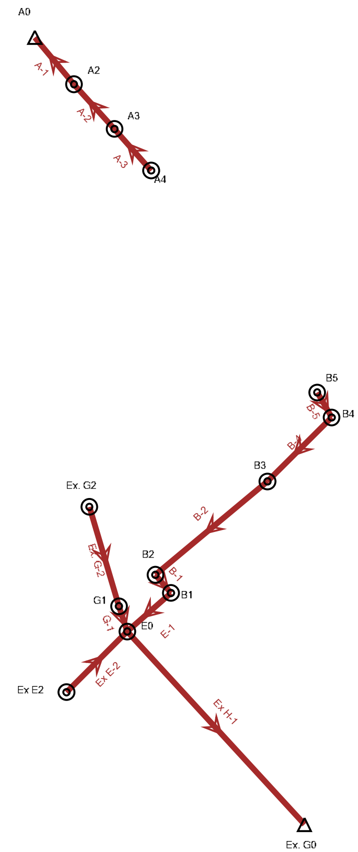
Standard Form SF-2 (modified)
Storm Drainage System Design
(Rational Method Procedure)
Proposed Development

		DIRECT RUNOFF						TOTAL RUNOFF				PIPE (for preliminary pipe design and travel time)							
SUB-BASIN(s)	DESIGN POINT (DP)	AREA (AC)	RUNOFF COEFF	T_c (min)	C x A (AC)	I (IN/HR)	Q (CFS)	T_c (MIN)	Σ(C x A) (AC)	I (IN/HR)	Q (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE (IN)	QFULL (CFS)	LENGTH (FT)	VELOCITY (FPS)	T_t (min)	REMARKS
R1		1.59	0.85	5.00	1.36	7.77	10.53												Roof drains from ex garage
S1		1.25	0.85	5.00	1.07	7.77	8.28												Direct to pr type R inlet in sump
R1 + S1	1	2.84						5.00	2.42	7.77	18.82								
S1a		0.09	0.85	5.00	0.08	7.77	0.60												Direct to ex quad combination type 13 inlet
DP 1 + S1a	1a	2.93						5.00	2.50	7.77	19.41								
S1b		0.22	0.85	5.00	0.19	7.77	1.46												Direct to ex triple combination type 13 inlet
S2	2	0.10	0.85	5.00	0.09	7.77	0.66												Direct to pr type R inlet + landscape drains
S3		0.36	0.85	5.00	0.31	7.77	2.39												Direct to pr valley type 13 inlet + landscape drains
R2		0.16	0.85	5.00	0.14	7.77	1.06												Roof drains from pr retail
S3 + R2	3	0.52						5.00	0.44	7.77	3.45								
S4		0.62	0.85	5.00	0.53	7.77	4.11												Direct to pr Type R inlet in sump
DP 3 + S4	4	1.14						5.00	0.97	7.77	7.55								
S5		0.30	0.85	5.00	0.26	7.77	1.99												Direct to ex Type R inlet in sump
S6		0.36	0.85	5.00	0.31	7.77	2.39												Direct to ex Type R inlet in sump
S7		0.40	0.85	5.00	0.34	7.77	2.65												Direct to ex Type R inlet on grade
S6 + S7	5	0.76						5.00	0.65	7.77	5.04								
R3		0.23	0.85	5.00	0.20	7.77	1.52												Roof drain from pr retail
DP 5 + R3	6	0.99						5.00	0.84	7.77	6.56								
OS5		1.42	0.85	5.00	1.21	7.77	9.41												Direct to ex Type R inlet in sump
DP 6 + OS5	7	2.41						5.00	2.06	7.77	15.97								
OS1		0.19	0.85	5.00	0.16	7.77	1.26												Direct to ex junction structure
OS2		0.18	0.85	5.00	0.15	7.77	1.19												Direct to ex junction structure
OS3		0.17	0.85	5.00	0.15	7.77	1.13												Direct to ex junction structure
OS4		0.40	0.85	5.00	0.34	7.77	2.65												Direct to ex junction structure
DP 4 + OS1 + OS2 + OS3 + OS4	8	2.08						5.00	1.61	7.77	12.52								
S5 + DP 7 + DP 8	9	4.79						5.00	3.92	7.77	30.48								

APPENDIX C

Hydraulic Calculations

Network Schematic
Park Meadows - Phase 1a



FlexTable: Conduit Table

Active Scenario: 5-yr

Park Meadows - Phase 1a

Label	Start Node	Stop Node	Length (User Defined) (ft)	Diameter (in)	Notes	Invert (Start) (ft)	Invert (Stop) (ft)	Slope (Calculated) (ft/ft)	Manning's n	Capacity (Full Flow) (cfs)	System Known Flow (cfs)	Velocity (ft/s)	Depth (Normal) (ft)	Froude Number (Normal)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)
A-1	A2	A0	28.5	15.0	Dual 15" RCP	5,853.93	5,853.64	0.010	0.013	13.04	6.75	5.36	0.64	1.331	5,854.92	5,854.89	5,855.08	5,855.01	5,857.22	5,856.87
A-2	A3	A2	53.6	15.0	15" RCP	5,854.57	5,854.03	0.010	0.013	6.48	4.59	5.73	0.78	1.242	5,855.44	5,854.92	5,855.83	5,855.29	5,859.18	5,857.22
A-3	A4	A3	5.0	15.0	15" PVC	5,854.82	5,854.77	0.010	0.013	6.46	4.59	5.71	0.78	1.236	5,855.69	5,855.58	5,856.08	5,856.04	5,860.26	5,859.18
B-1	B2	B1	10.4	18.0	18" RCP	5,855.32	5,855.20	0.012	0.013	11.28	2.19	4.94	0.45	1.533	5,855.88	5,855.67	5,856.09	5,856.00	5,861.41	5,862.26
B-2	B3	B2	135.2	18.0	18" RCP	5,856.80	5,855.42	0.010	0.013	10.61	2.19	4.73	0.46	1.443	5,857.36	5,855.88	5,857.57	5,856.23	5,861.83	5,861.41
B-4	B4	B3	84.5	18.0	18" RCP	5,857.42	5,857.00	0.005	0.013	7.41	1.15	3.05	0.40	1.006	5,857.82	5,857.62	5,857.96	5,857.66	5,862.65	5,861.83
B-5	B5	B4	26.1	18.0	18" RCP	5,857.75	5,857.62	0.005	0.013	7.41	1.15	3.05	0.40	1.006	5,858.15	5,858.02	5,858.29	5,858.16	5,863.23	5,862.65
E-1	B1	E0	53.1	24.0	24" RCP	5,854.70	5,850.54	0.078	0.013	63.32	6.29	12.87	0.43	4.151	5,855.59	5,850.97	5,855.93	5,853.45	5,862.26	5,860.74
Ex E-2	Ex E2	E0	80.9	36.0	Ex. 36" RCP	5,850.60	5,849.99	0.008	0.013	57.90	2.71	4.19	0.44	1.337	5,851.11	5,850.97	5,851.29	5,851.00	5,861.95	5,860.74
Ex H-1	E0	Ex. G0	248.0	36.0	Ex. 36" RCP	5,849.84	5,847.86	0.008	0.013	59.60	12.60	6.69	0.94	1.432	5,850.97	5,850.86	5,851.39	5,850.91	5,860.74	5,860.46
Ex. G-2	Ex. G2	G1	105.2	18.0	Ex. 18" RCP	5,855.83	5,850.93	0.047	0.013	22.67	2.74	8.66	0.35	3.063	5,856.46	5,851.71	5,856.70	5,851.84	5,859.22	5,860.90
G-1	G1	E0	14.0	18.0	18" RCP	5,850.73	5,850.08	0.046	0.013	22.63	3.61	9.38	0.41	3.074	5,851.46	5,850.97	5,851.74	5,851.14	5,860.90	5,860.74

FlexTable: Outfall Table

Active Scenario: 5-yr

Park Meadows - Phase 1a

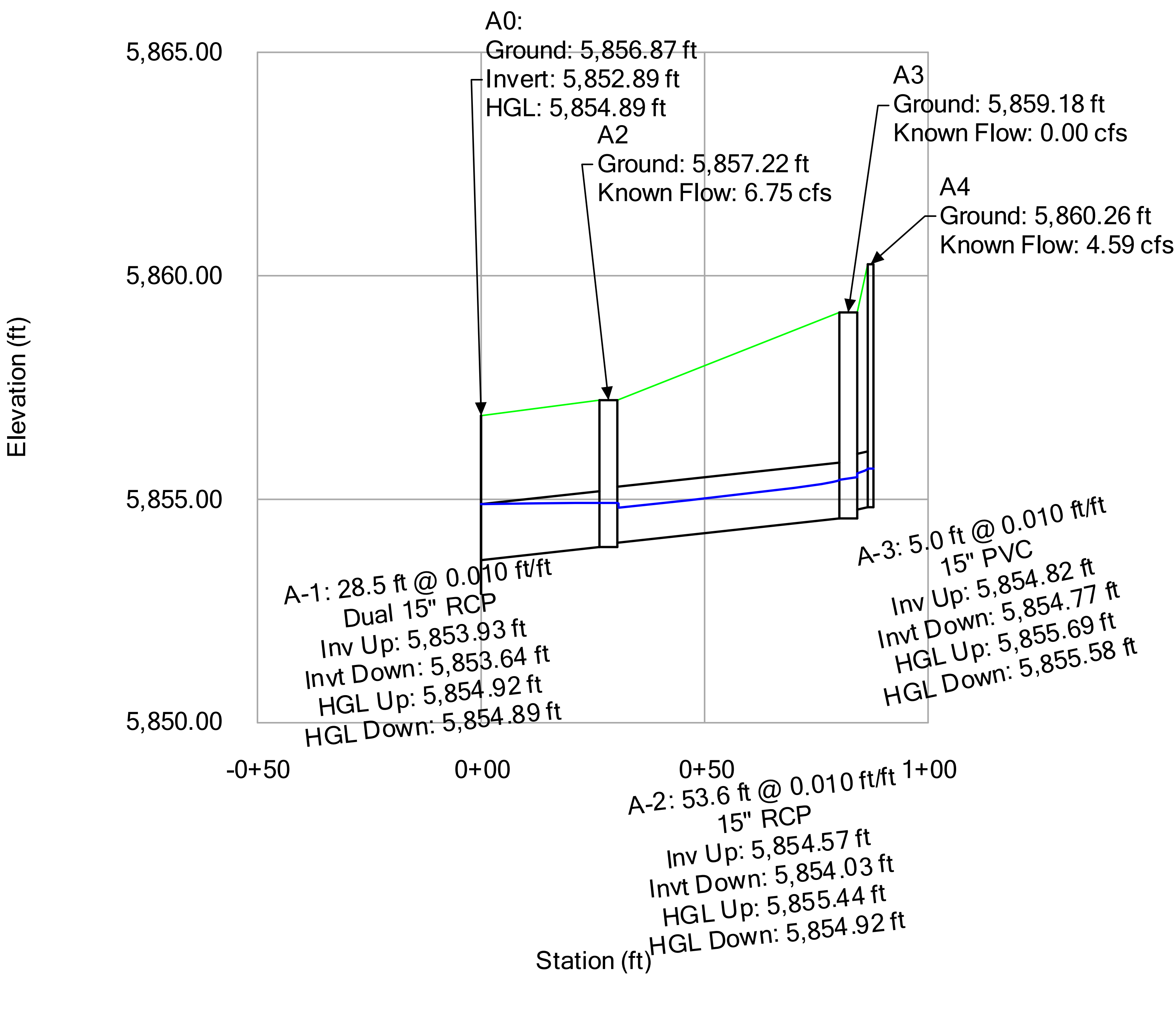
Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)	Notes
Ex. G0	5,860.46	5,847.41	Crown		5,850.86	12.60	Connection Ex. Manhole
A0	5,856.87	5,852.89	Crown		5,854.89	6.75	Ex. Combination Type 13 Triple

Profile Report

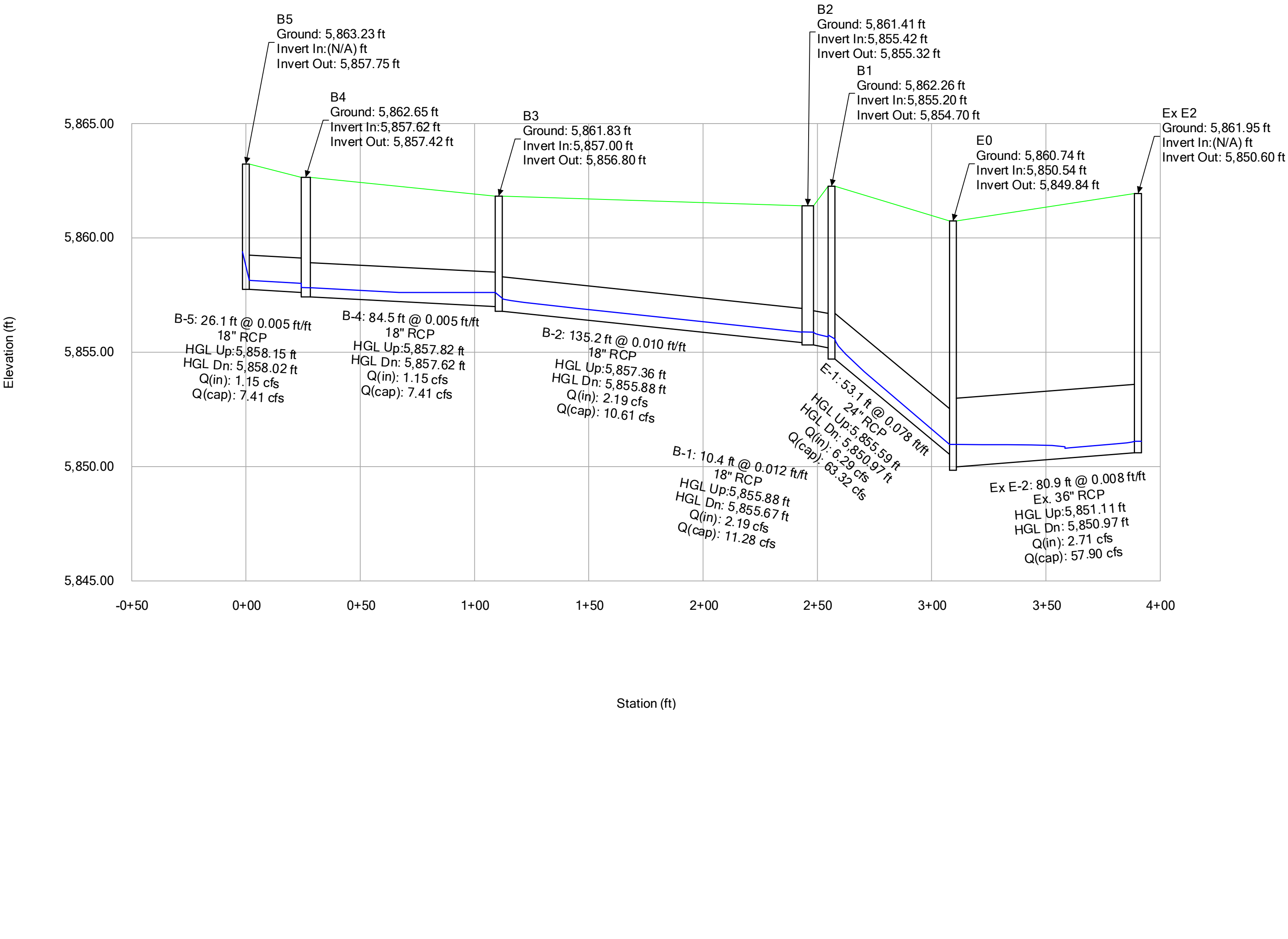
Engineering Profile - Line A (Park Meadows - P1a.stsw)

Active Scenario: 5-yr

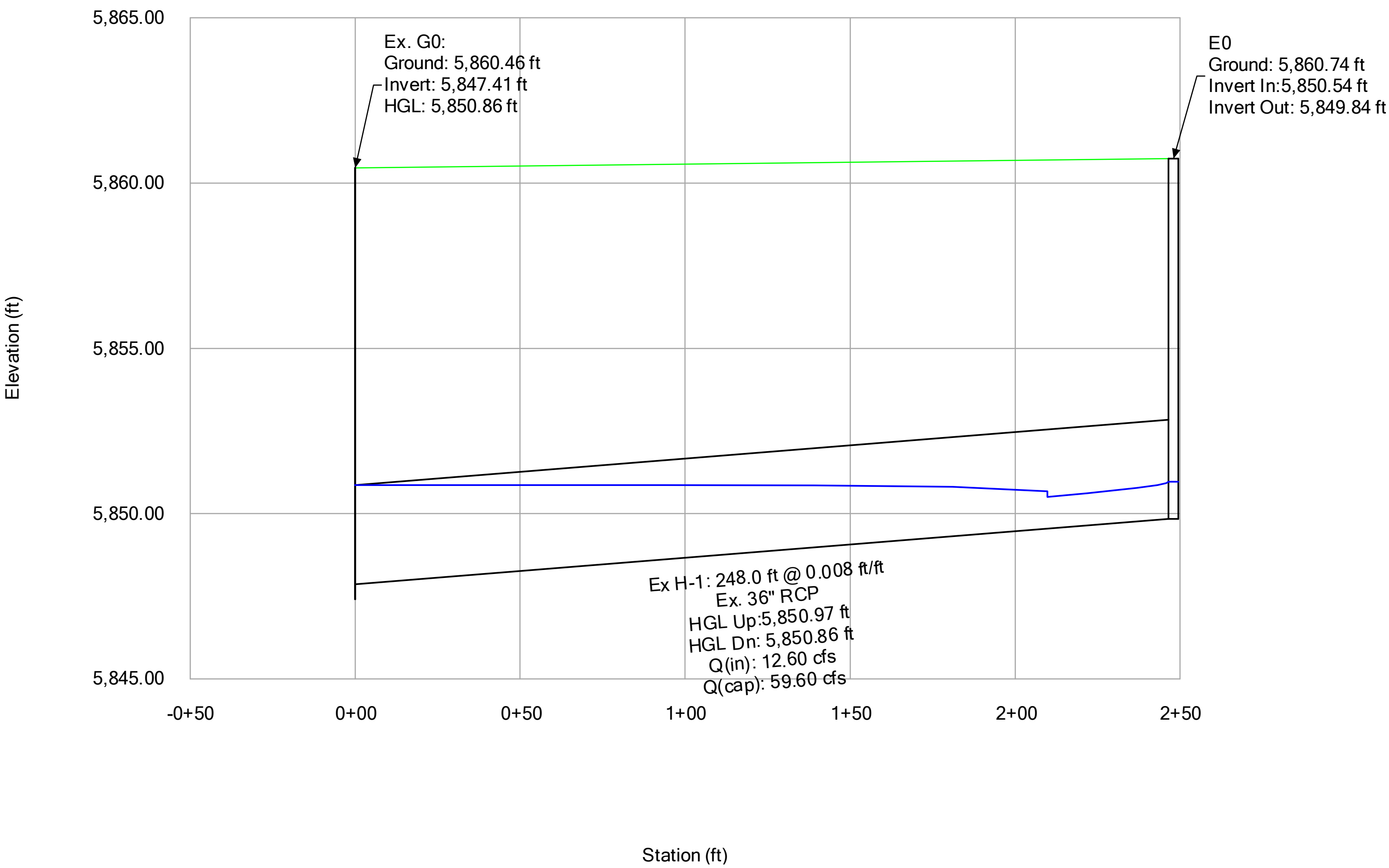
Park Meadows - Phase 1a



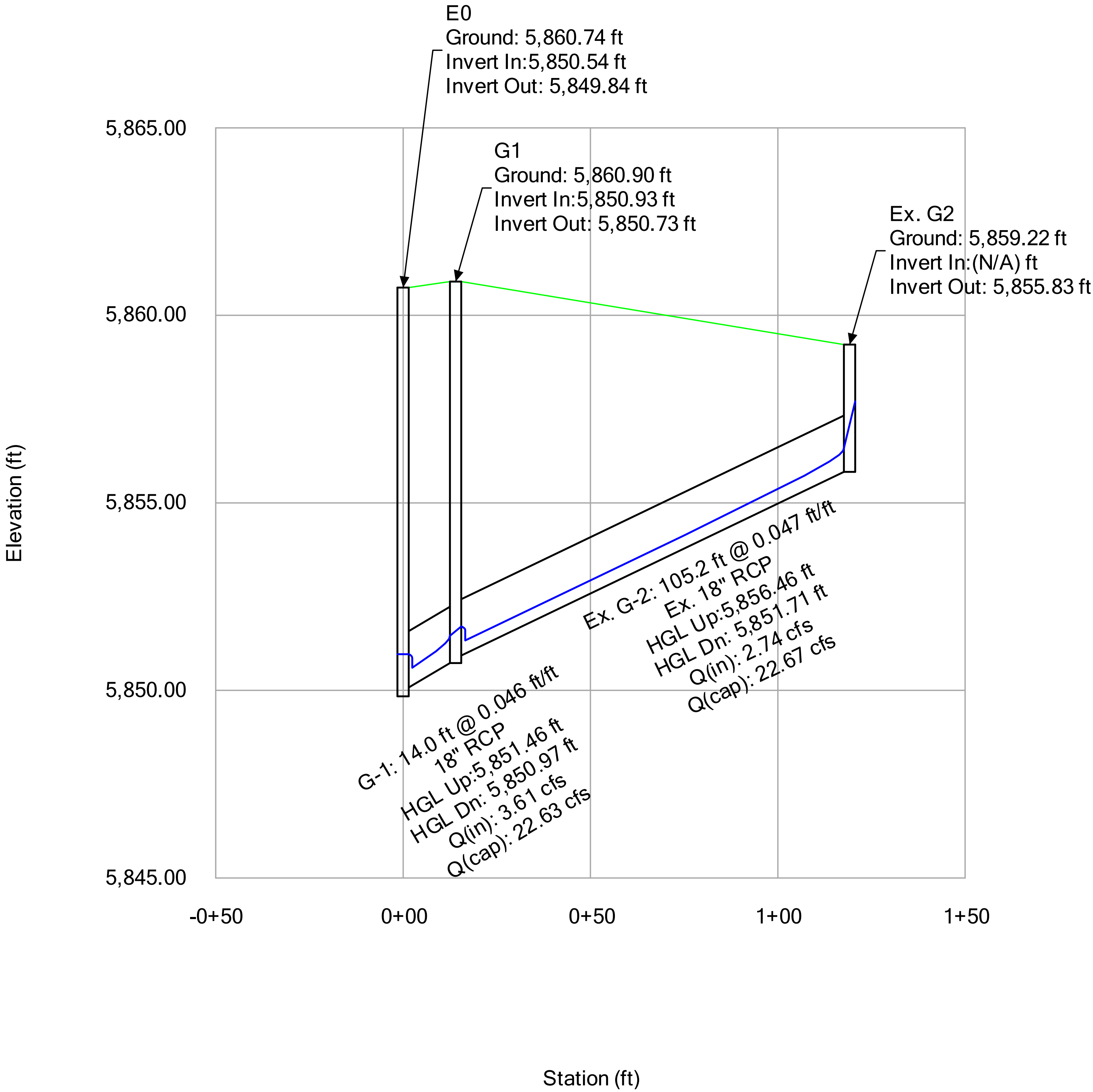
Profile Report
Engineering Profile - Line B (Park Meadows - P1a.stsw)
Active Scenario: 5-yr
Park Meadows - Phase 1a



Profile Report
Engineering Profile - Ex Line H (Park Meadows - P1a.stsw)
Active Scenario: 5-yr
Park Meadows - Phase 1a



Profile Report
Engineering Profile - Line G (Park Meadows - P1a.stsw)
Active Scenario: 5-yr
Park Meadows - Phase 1a



FlexTable: Conduit Table

Active Scenario: 100-yr

Park Meadows - Phase 1a

Label	Start Node	Stop Node	Length (User Defined) (ft)	Diameter (in)	Notes	Invert (Start) (ft)	Invert (Stop) (ft)	Slope (Calculated) (ft/ft)	Manning's n	Capacity (Full Flow) (cfs)	System Known Flow (cfs)	Velocity (ft/s)	Depth (Normal) (ft)	Froude Number (Normal)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)
A-1	A2	A0	28.5	15.0	Dual 15" RCP	5,853.93	5,853.64	0.010	0.013	13.04	10.53	5.91	0.85	0.677	5,855.01	5,854.89	5,855.35	5,855.18	5,857.22	5,856.87
A-2	A3	A2	53.6	15.0	15" RCP	5,854.57	5,854.03	0.010	0.013	6.48	10.53	8.58	(N/A)	1.353	5,856.68	5,855.23	5,857.83	5,856.41	5,859.18	5,857.22
A-3	A4	A3	5.0	15.0	15" PVC	5,854.82	5,854.77	0.010	0.013	6.46	10.53	8.58	(N/A)	1.353	5,857.08	5,856.95	5,858.23	5,858.09	5,860.26	5,859.18
B-1	B2	B1	10.4	18.0	18" RCP	5,855.32	5,855.20	0.012	0.013	11.28	5.04	6.20	0.70	1.484	5,856.44	5,856.46	5,856.64	5,856.61	5,861.41	5,862.26
B-2	B3	B2	135.2	18.0	18" RCP	5,856.80	5,855.42	0.010	0.013	10.61	5.04	5.93	0.73	1.389	5,857.66	5,856.46	5,858.02	5,856.69	5,861.83	5,861.41
B-4	B4	B3	84.5	18.0	18" RCP	5,857.42	5,857.00	0.005	0.013	7.41	2.65	3.84	0.62	0.991	5,858.14	5,858.11	5,858.29	5,858.16	5,862.65	5,861.83
B-5	B5	B4	26.1	18.0	18" RCP	5,857.75	5,857.62	0.005	0.013	7.41	2.65	3.84	0.62	0.991	5,858.37	5,858.24	5,858.60	5,858.47	5,863.23	5,862.65
E-1	B1	E0	53.1	24.0	24" RCP	5,854.70	5,850.54	0.078	0.013	63.32	14.44	16.32	0.65	4.188	5,856.07	5,851.24	5,856.69	5,854.66	5,862.26	5,860.74
Ex E-2	Ex E2	E0	80.9	36.0	Ex. 36" RCP	5,850.60	5,849.99	0.008	0.013	57.90	6.23	5.35	0.66	1.380	5,851.50	5,851.58	5,851.69	5,851.62	5,861.95	5,860.74
Ex H-1	E0	Ex. G0	248.0	36.0	Ex. 36" RCP	5,849.84	5,847.86	0.008	0.013	59.60	28.95	8.37	1.47	1.374	5,851.58	5,850.86	5,852.30	5,851.12	5,860.74	5,860.46
Ex. G-2	Ex. G2	G1	105.2	18.0	Ex. 18" RCP	5,855.83	5,850.93	0.047	0.013	22.67	6.29	10.98	0.54	3.068	5,856.80	5,852.43	5,857.22	5,852.63	5,859.22	5,860.90
G-1	G1	E0	14.0	18.0	18" RCP	5,850.73	5,850.08	0.046	0.013	22.63	8.28	11.82	0.63	3.027	5,851.84	5,851.58	5,852.38	5,851.92	5,860.90	5,860.74

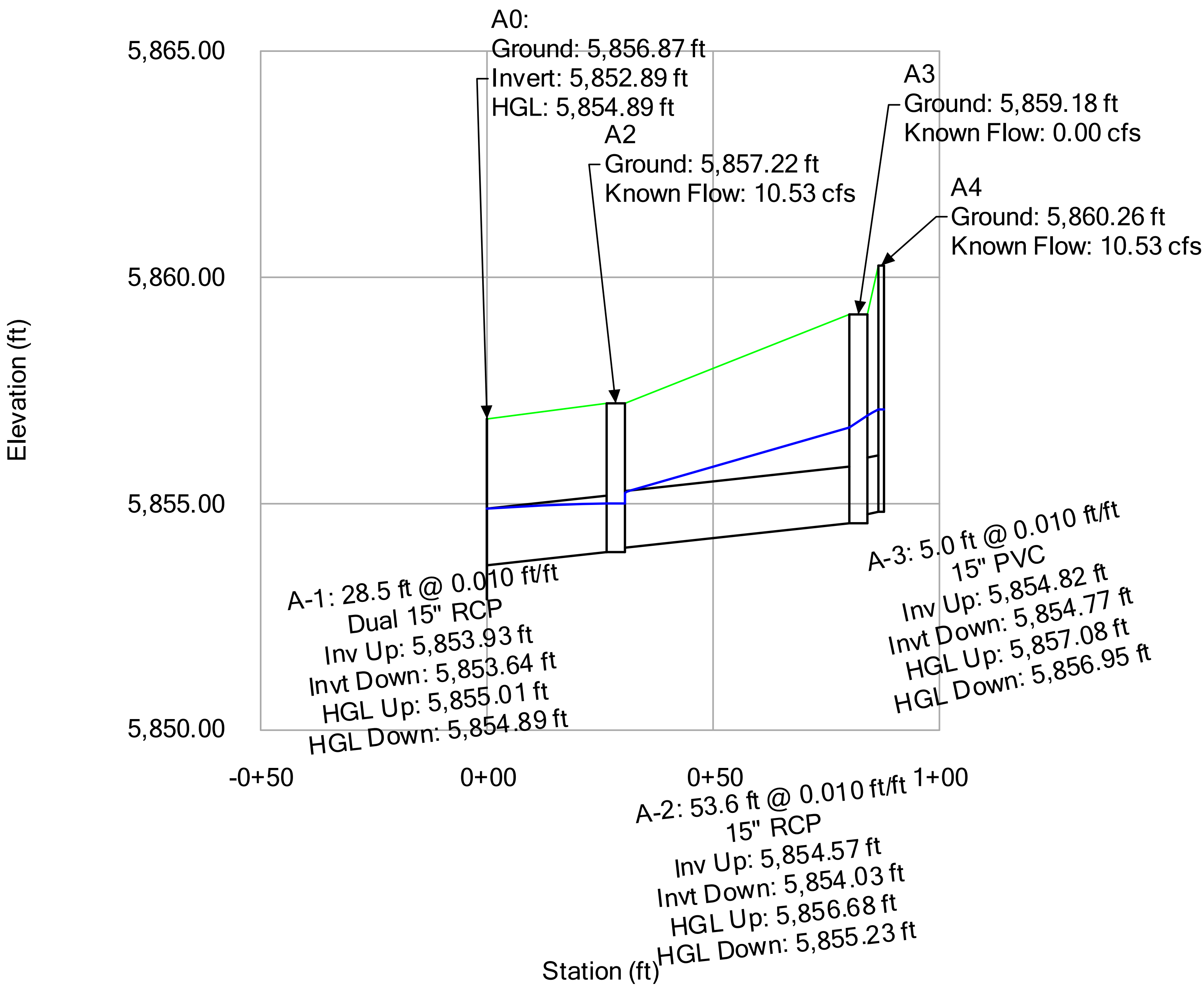
FlexTable: Outfall Table

Active Scenario: 100-yr

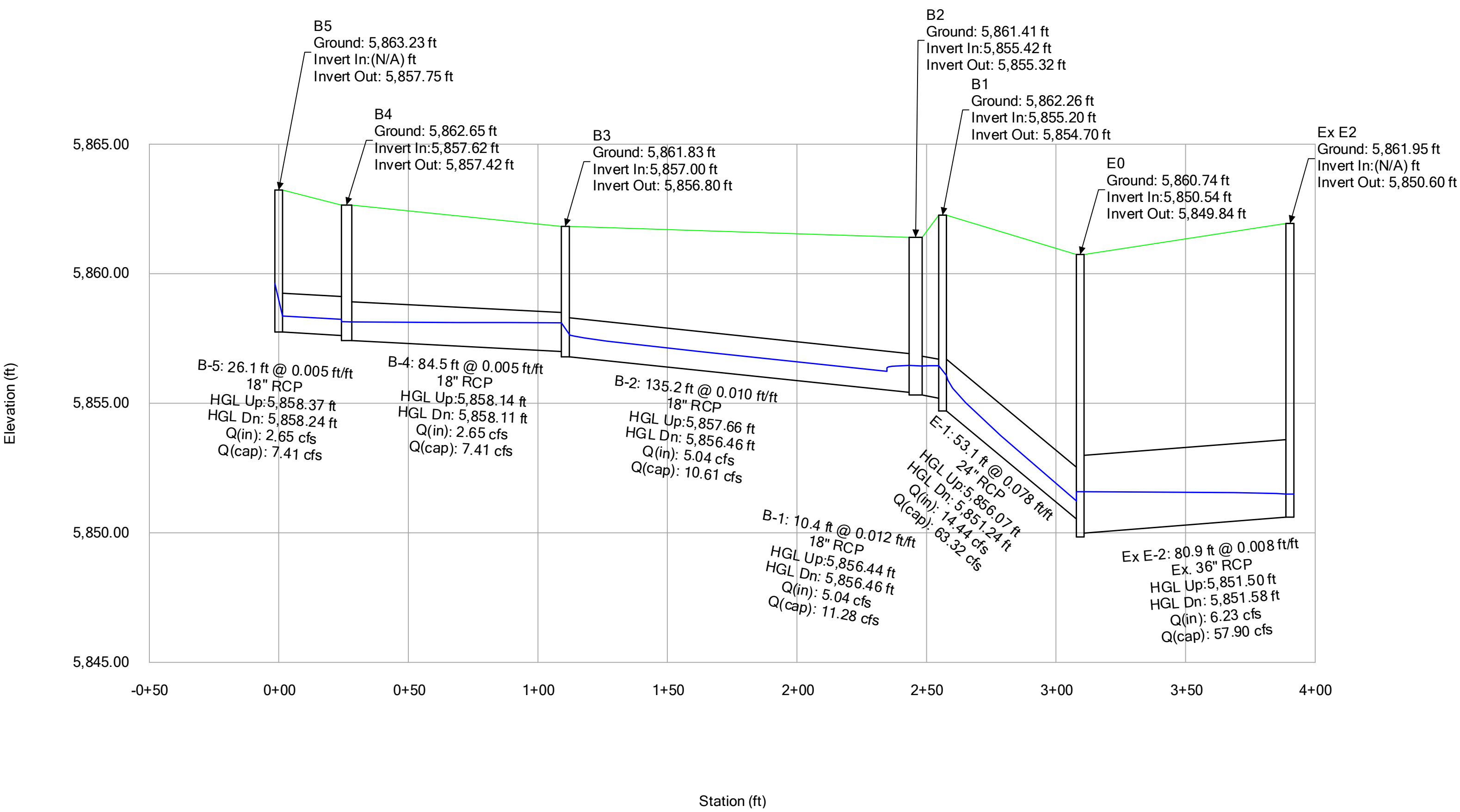
Park Meadows - Phase 1a

Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)	Notes
Ex. G0	5,860.46	5,847.41	Crown		5,850.86	28.95	Connection Ex. Manhole
A0	5,856.87	5,852.89	Crown		5,854.89	10.53	Ex. Combination Type 13 Triple

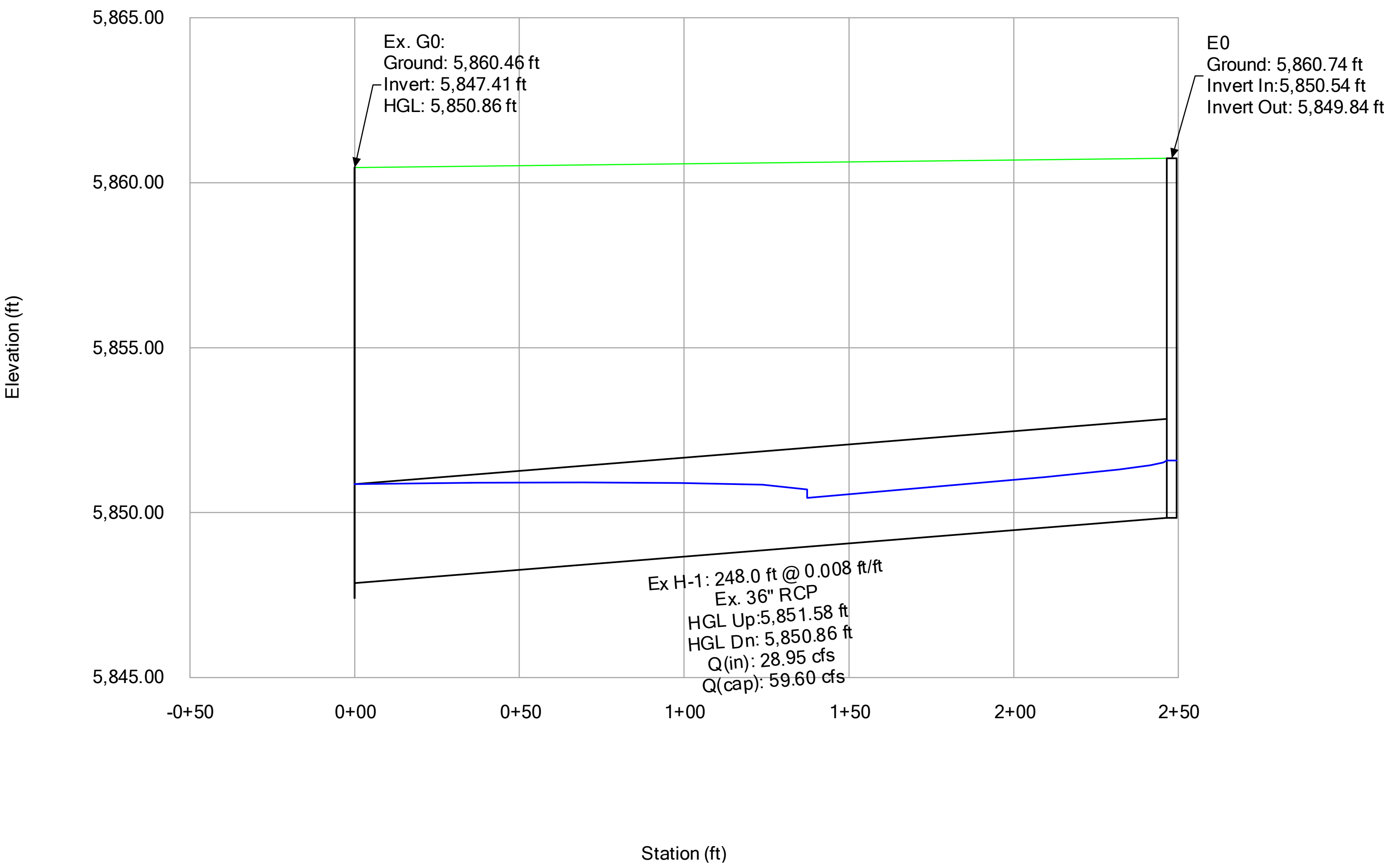
Profile Report
Engineering Profile - Line A (Park Meadows - P1a.stsw)
Active Scenario: 100-yr
Park Meadows - Phase 1a



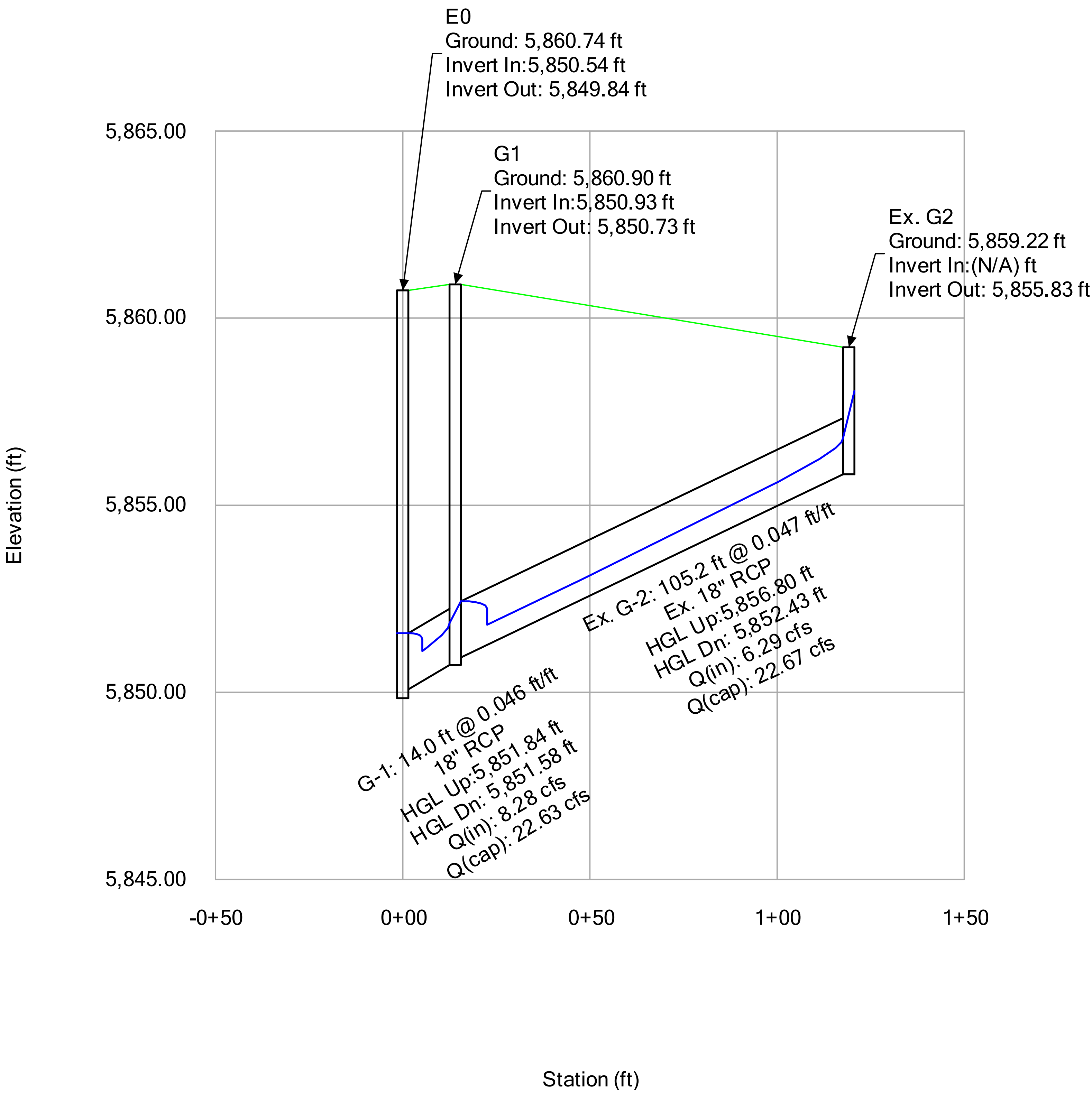
Profile Report
Engineering Profile - Line B (Park Meadows - P1a.stsw)
Active Scenario: 100-yr
Park Meadows - Phase 1a



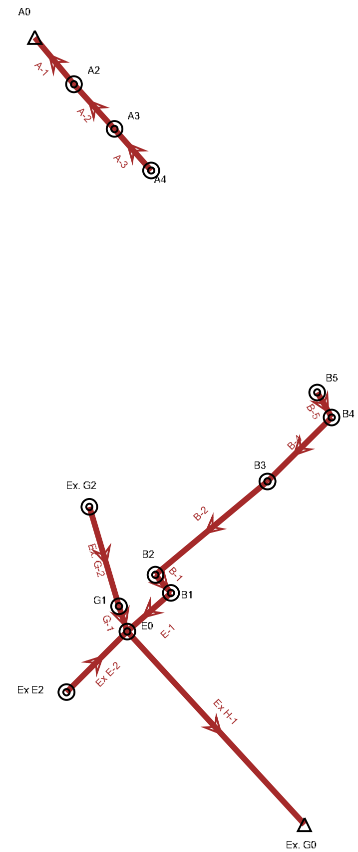
Profile Report
Engineering Profile - Ex Line H (Park Meadows - P1a.stsw)
Active Scenario: 100-yr
Park Meadows - Phase 1a



Profile Report
Engineering Profile - Line G (Park Meadows - P1a.stsw)
Active Scenario: 100-yr
Park Meadows - Phase 1a



Network Schematic
Park Meadows - Phase 1a



FlexTable: Conduit Table

Active Scenario: 5-yr

Park Meadows - Phase 1a

Label	Start Node	Stop Node	Length (User Defined) (ft)	Diameter (in)	Notes	Invert (Start) (ft)	Invert (Stop) (ft)	Slope (Calculated) (ft/ft)	Manning's n	Capacity (Full Flow) (cfs)	System Known Flow (cfs)	Velocity (ft/s)	Depth (Normal) (ft)	Froude Number (Normal)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)
A-1	A2	A0	28.5	24.0	24" RCP	5,853.28	5,853.00	0.010	0.013	22.43	6.75	6.25	0.75	1.475	5,855.01	5,855.00	5,855.10	5,855.07	5,857.22	5,856.87
A-2	A3	A2	53.6	15.0	15" RCP	5,854.57	5,854.03	0.010	0.013	6.48	4.59	5.73	0.78	1.242	5,855.44	5,855.01	5,855.83	5,855.32	5,859.18	5,857.22
A-3	A4	A3	5.0	15.0	15" PVC	5,854.82	5,854.77	0.010	0.013	6.46	4.59	5.71	0.78	1.236	5,855.69	5,855.58	5,856.08	5,856.04	5,860.26	5,859.18
B-1	B2	B1	10.4	18.0	18" RCP	5,855.32	5,855.20	0.012	0.013	11.28	2.19	4.94	0.45	1.533	5,855.88	5,855.67	5,856.09	5,856.00	5,861.41	5,862.26
B-2	B3	B2	135.2	18.0	18" RCP	5,856.80	5,855.42	0.010	0.013	10.61	2.19	4.73	0.46	1.443	5,857.36	5,855.88	5,857.57	5,856.23	5,861.83	5,861.41
B-4	B4	B3	84.5	18.0	18" RCP	5,857.42	5,857.00	0.005	0.013	7.41	1.15	3.05	0.40	1.006	5,857.82	5,857.62	5,857.96	5,857.66	5,862.65	5,861.83
B-5	B5	B4	26.1	18.0	18" RCP	5,857.75	5,857.62	0.005	0.013	7.41	1.15	3.05	0.40	1.006	5,858.15	5,858.02	5,858.29	5,858.16	5,863.23	5,862.65
E-1	B1	E0	53.1	24.0	24" RCP	5,854.70	5,850.54	0.078	0.013	63.32	6.29	12.87	0.43	4.151	5,855.59	5,850.97	5,855.93	5,853.45	5,862.26	5,860.74
Ex E-2	Ex E2	E0	80.9	36.0	Ex. 36" RCP	5,850.60	5,849.99	0.008	0.013	57.90	2.71	4.19	0.44	1.337	5,851.11	5,850.97	5,851.29	5,851.00	5,861.95	5,860.74
Ex H-1	E0	Ex. G0	248.0	36.0	Ex. 36" RCP	5,849.84	5,847.86	0.008	0.013	59.60	12.60	6.69	0.94	1.432	5,850.97	5,850.86	5,851.39	5,850.91	5,860.74	5,860.46
Ex. G-2	Ex. G2	G1	105.2	18.0	Ex. 18" RCP	5,855.83	5,850.93	0.047	0.013	22.67	2.74	8.66	0.35	3.063	5,856.46	5,851.71	5,856.70	5,851.84	5,859.22	5,860.90
G-1	G1	E0	14.0	18.0	18" RCP	5,850.73	5,850.08	0.046	0.013	22.63	3.61	9.38	0.41	3.074	5,851.46	5,850.97	5,851.74	5,851.14	5,860.90	5,860.74

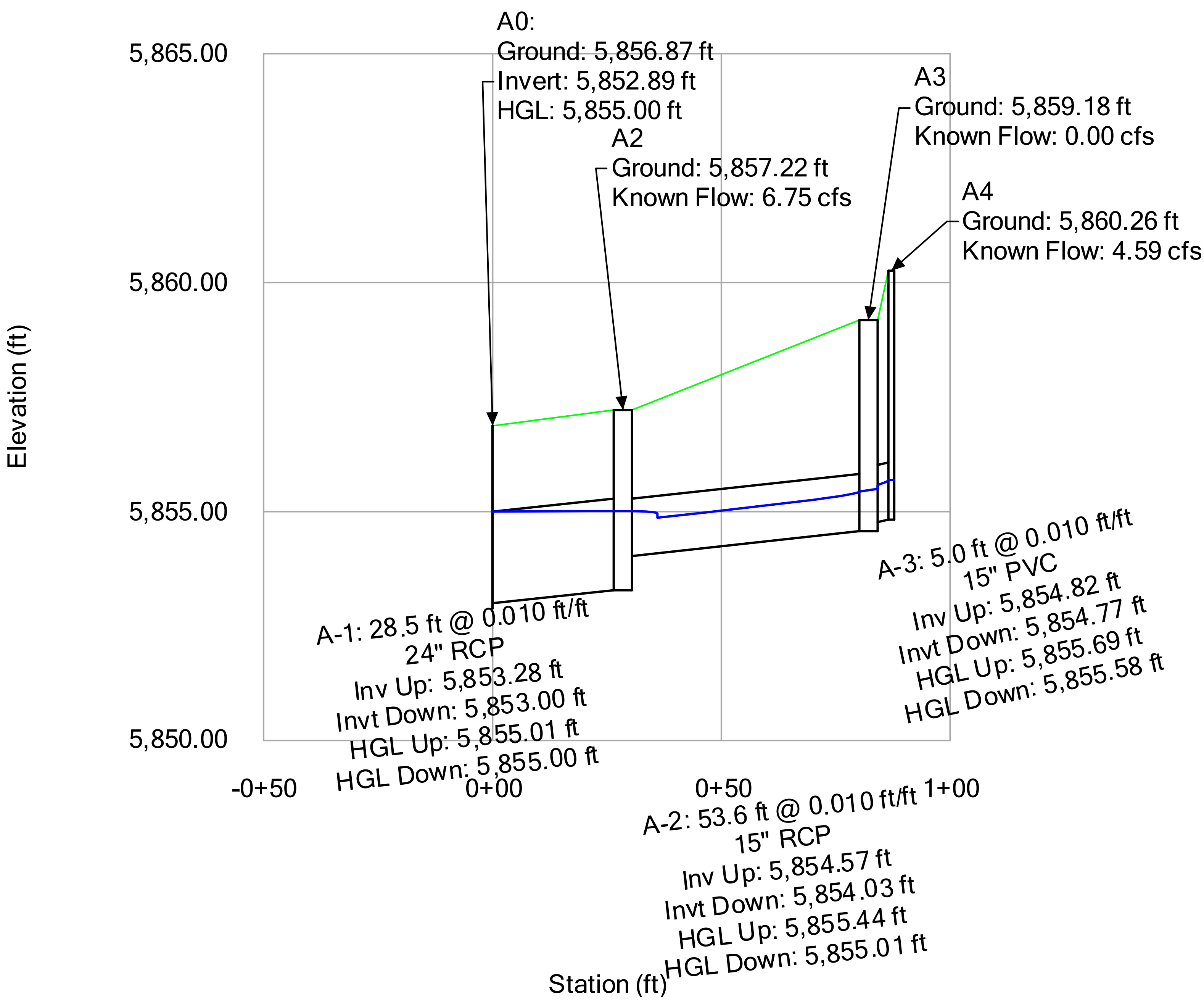
FlexTable: Outfall Table

Active Scenario: 5-yr

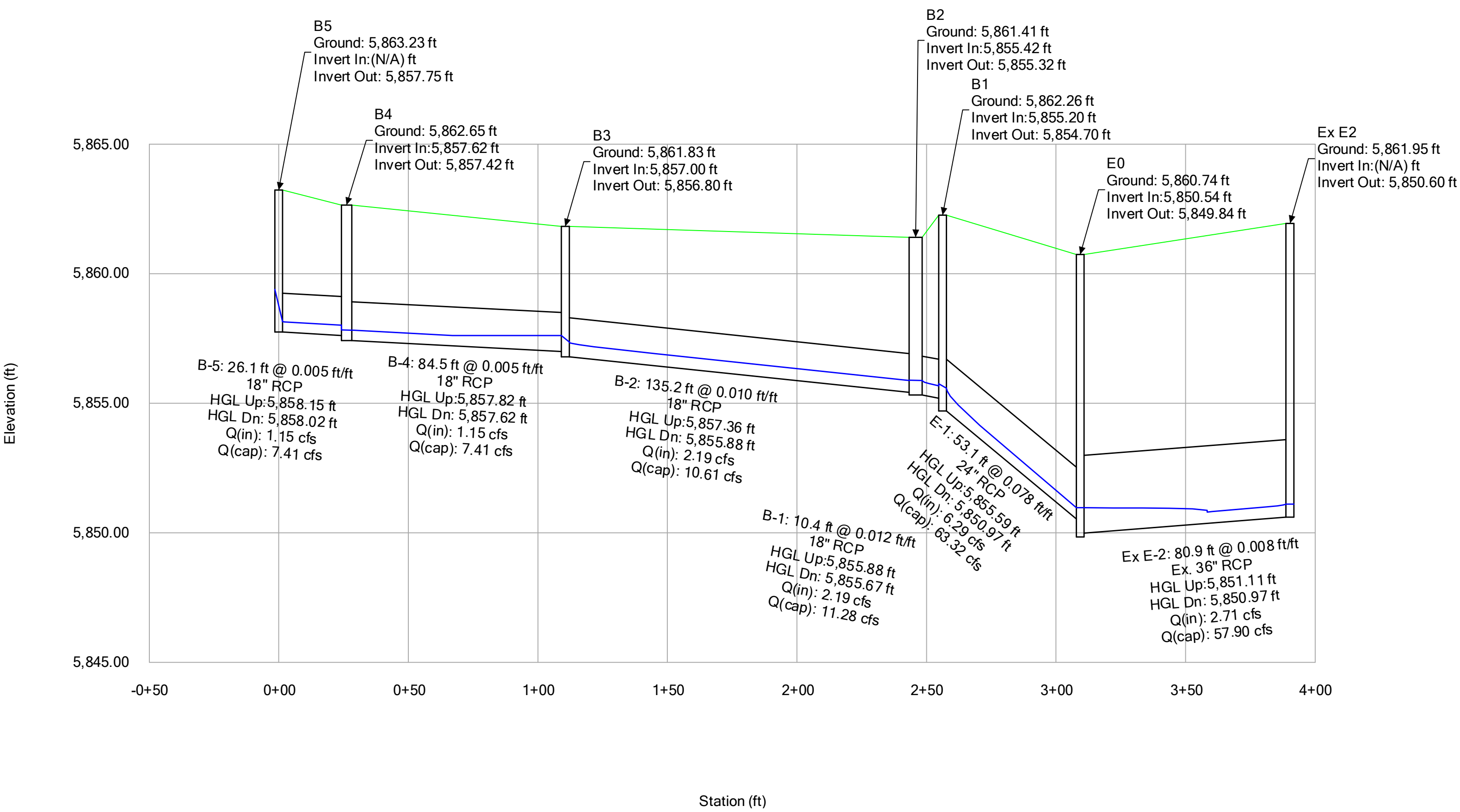
Park Meadows - Phase 1a

Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)	Notes
Ex. G0	5,860.46	5,847.41	Crown		5,850.86	12.60	Connection Ex. Manhole
A0	5,856.87	5,852.89	Crown		5,855.00	6.75	Ex. Combination Type 13 Triple

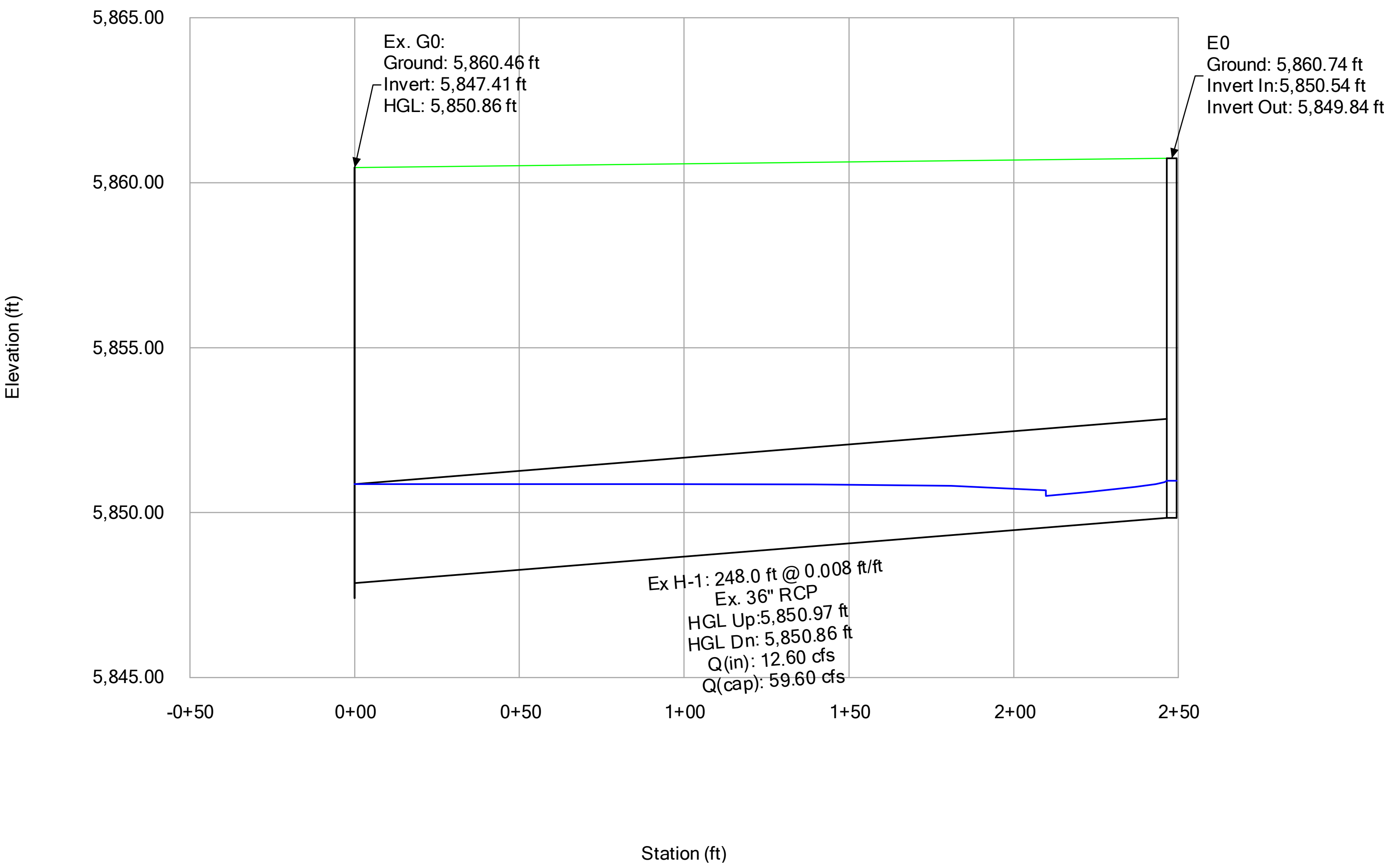
Profile Report
Engineering Profile - Line A (Park Meadows - P1a.stsw)
Active Scenario: 5-yr
Park Meadows - Phase 1a



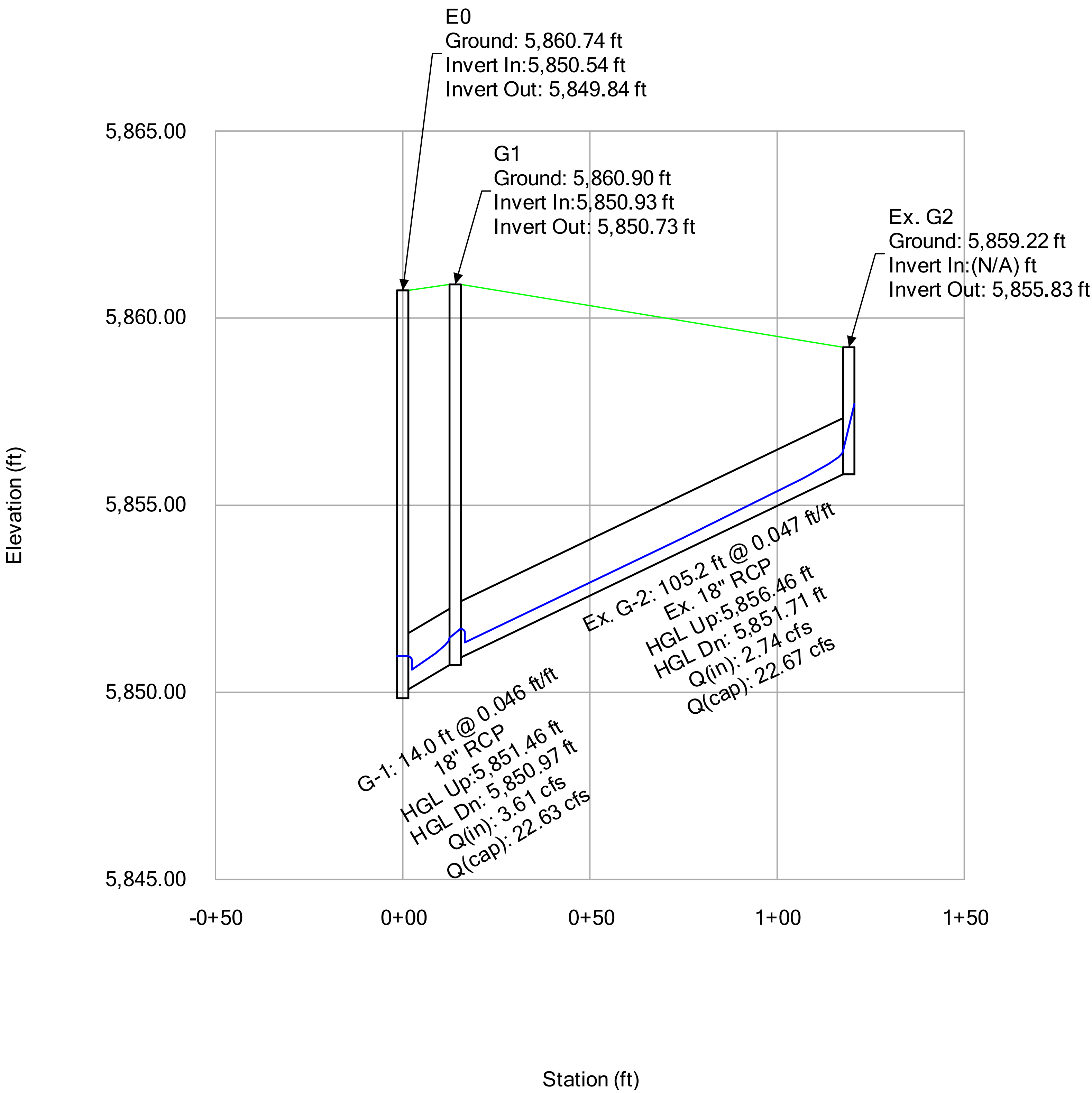
Profile Report
Engineering Profile - Line B (Park Meadows - P1a.stsw)
Active Scenario: 5-yr
Park Meadows - Phase 1a



Profile Report
Engineering Profile - Ex Line H (Park Meadows - P1a.stsw)
Active Scenario: 5-yr
Park Meadows - Phase 1a



Profile Report
Engineering Profile - Line G (Park Meadows - P1a.stsw)
Active Scenario: 5-yr
Park Meadows - Phase 1a



FlexTable: Conduit Table

Active Scenario: 100-yr

Park Meadows - Phase 1a

Label	Start Node	Stop Node	Length (User Defined) (ft)	Diameter (in)	Notes	Invert (Start) (ft)	Invert (Stop) (ft)	Slope (Calculated) (ft/ft)	Manning's n	Capacity (Full Flow) (cfs)	System Known Flow (cfs)	Velocity (ft/s)	Depth (Normal) (ft)	Froude Number (Normal)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)
A-1	A2	A0	28.5	24.0	24" RCP	5,853.28	5,853.00	0.010	0.013	22.43	10.53	7.02	0.96	1.430	5,855.03	5,855.00	5,855.23	5,855.17	5,857.22	5,856.87
A-2	A3	A2	53.6	15.0	15" RCP	5,854.57	5,854.03	0.010	0.013	6.48	10.53	8.58	(N/A)	1.353	5,856.68	5,855.23	5,857.83	5,856.41	5,859.18	5,857.22
A-3	A4	A3	5.0	15.0	15" PVC	5,854.82	5,854.77	0.010	0.013	6.46	10.53	8.58	(N/A)	1.353	5,857.08	5,856.95	5,858.23	5,858.09	5,860.26	5,859.18
B-1	B2	B1	10.4	18.0	18" RCP	5,855.32	5,855.20	0.012	0.013	11.28	5.04	6.20	0.70	1.484	5,856.44	5,856.46	5,856.64	5,856.61	5,861.41	5,862.26
B-2	B3	B2	135.2	18.0	18" RCP	5,856.80	5,855.42	0.010	0.013	10.61	5.04	5.93	0.73	1.389	5,857.66	5,856.46	5,858.02	5,856.69	5,861.83	5,861.41
B-4	B4	B3	84.5	18.0	18" RCP	5,857.42	5,857.00	0.005	0.013	7.41	2.65	3.84	0.62	0.991	5,858.14	5,858.11	5,858.29	5,858.16	5,862.65	5,861.83
B-5	B5	B4	26.1	18.0	18" RCP	5,857.75	5,857.62	0.005	0.013	7.41	2.65	3.84	0.62	0.991	5,858.37	5,858.24	5,858.60	5,858.47	5,863.23	5,862.65
E-1	B1	E0	53.1	24.0	24" RCP	5,854.70	5,850.54	0.078	0.013	63.32	14.44	16.32	0.65	4.188	5,856.07	5,851.24	5,856.69	5,854.66	5,862.26	5,860.74
Ex E-2	Ex E2	E0	80.9	36.0	Ex. 36" RCP	5,850.60	5,849.99	0.008	0.013	57.90	6.23	5.35	0.66	1.380	5,851.50	5,851.58	5,851.69	5,851.62	5,861.95	5,860.74
Ex H-1	E0	Ex. G0	248.0	36.0	Ex. 36" RCP	5,849.84	5,847.86	0.008	0.013	59.60	28.95	8.37	1.47	1.374	5,851.58	5,850.86	5,852.30	5,851.12	5,860.74	5,860.46
Ex. G-2	Ex. G2	G1	105.2	18.0	Ex. 18" RCP	5,855.83	5,850.93	0.047	0.013	22.67	6.29	10.98	0.54	3.068	5,856.80	5,852.43	5,857.22	5,852.63	5,859.22	5,860.90
G-1	G1	E0	14.0	18.0	18" RCP	5,850.73	5,850.08	0.046	0.013	22.63	8.28	11.82	0.63	3.027	5,851.84	5,851.58	5,852.38	5,851.92	5,860.90	5,860.74

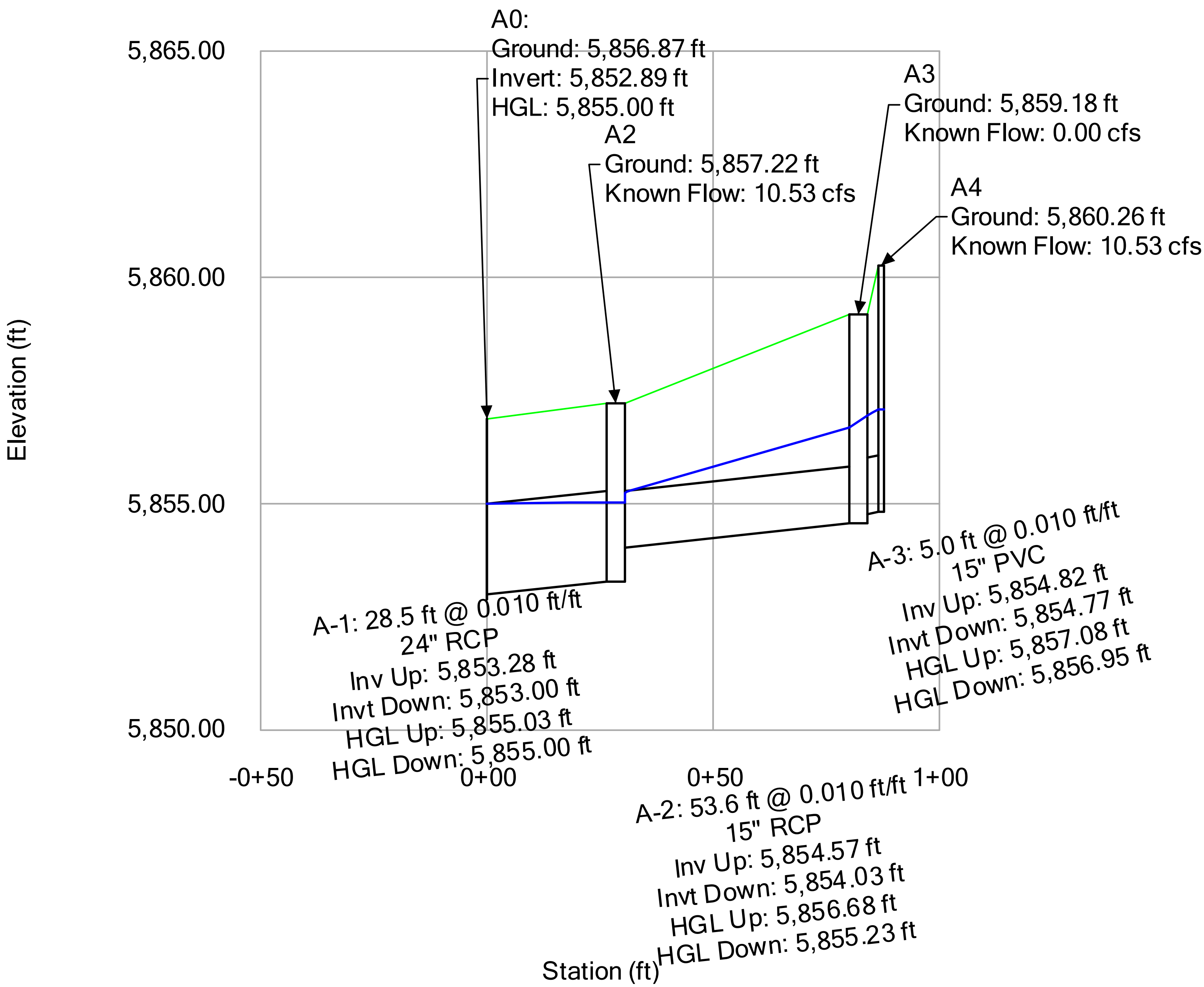
FlexTable: Outfall Table

Active Scenario: 100-yr

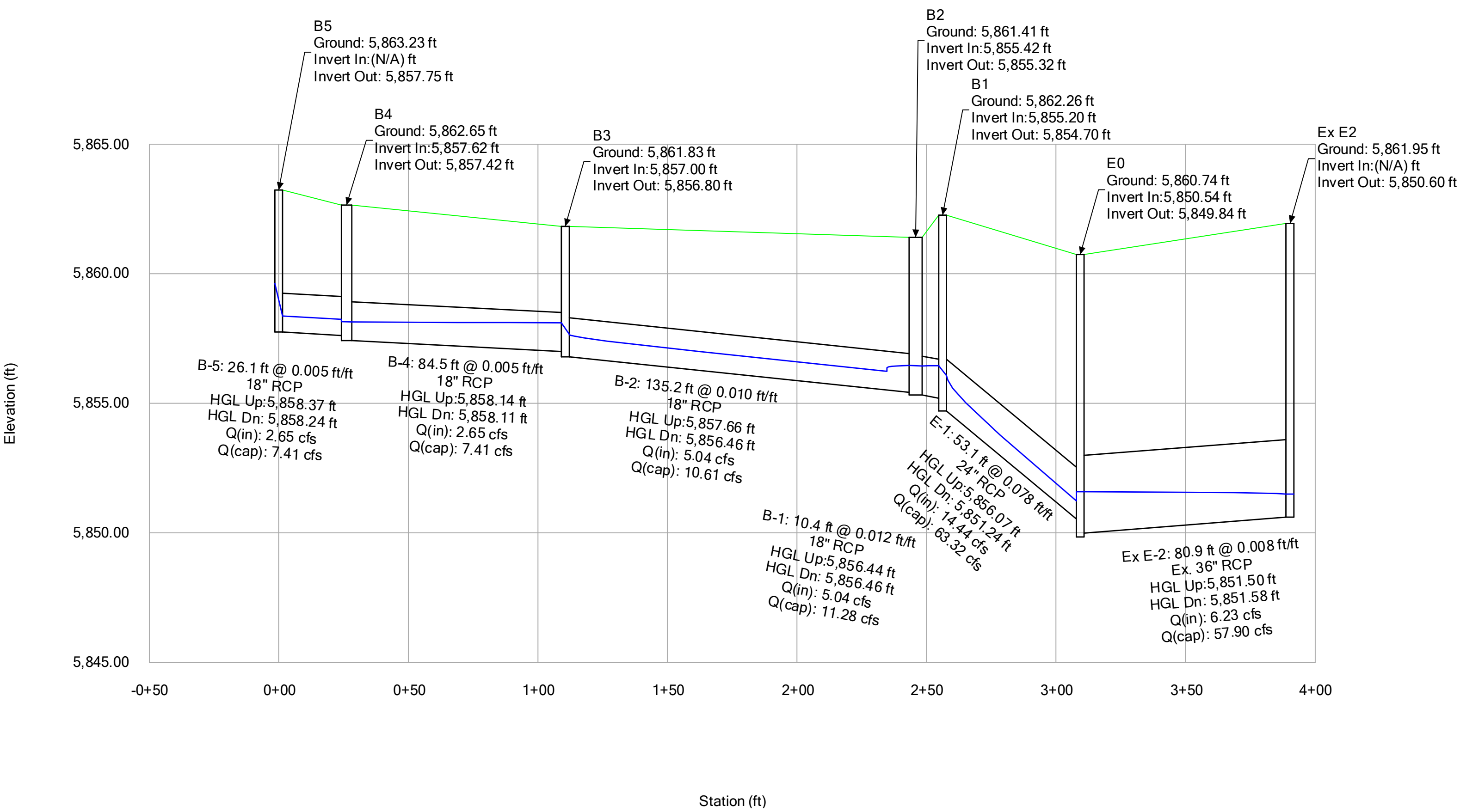
Park Meadows - Phase 1a

Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)	Notes
Ex. G0	5,860.46	5,847.41	Crown		5,850.86	28.95	Connection Ex. Manhole
A0	5,856.87	5,852.89	Crown		5,855.00	10.53	Ex. Combination Type 13 Triple

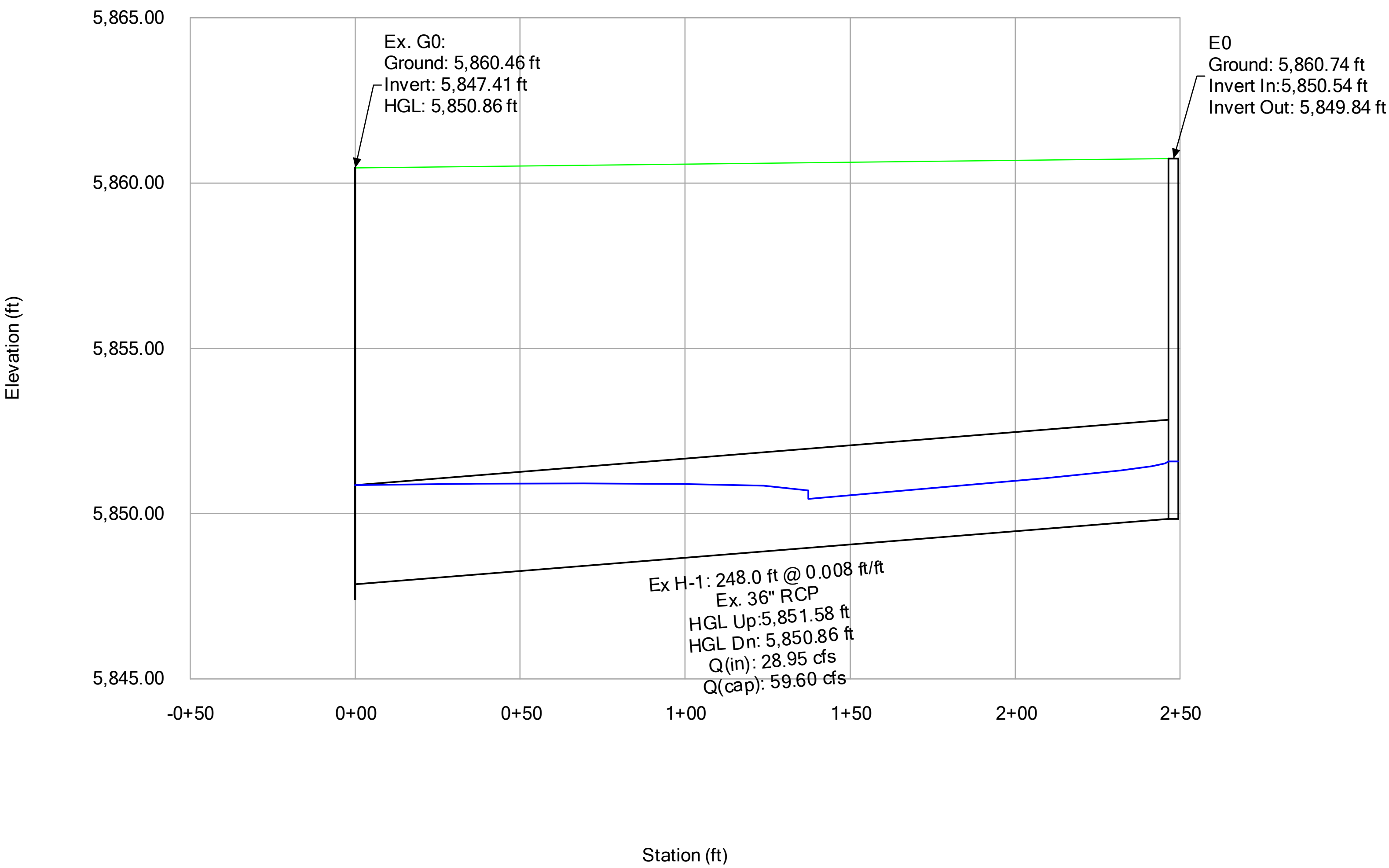
Profile Report
Engineering Profile - Line A (Park Meadows - P1a.stsw)
Active Scenario: 100-yr
Park Meadows - Phase 1a



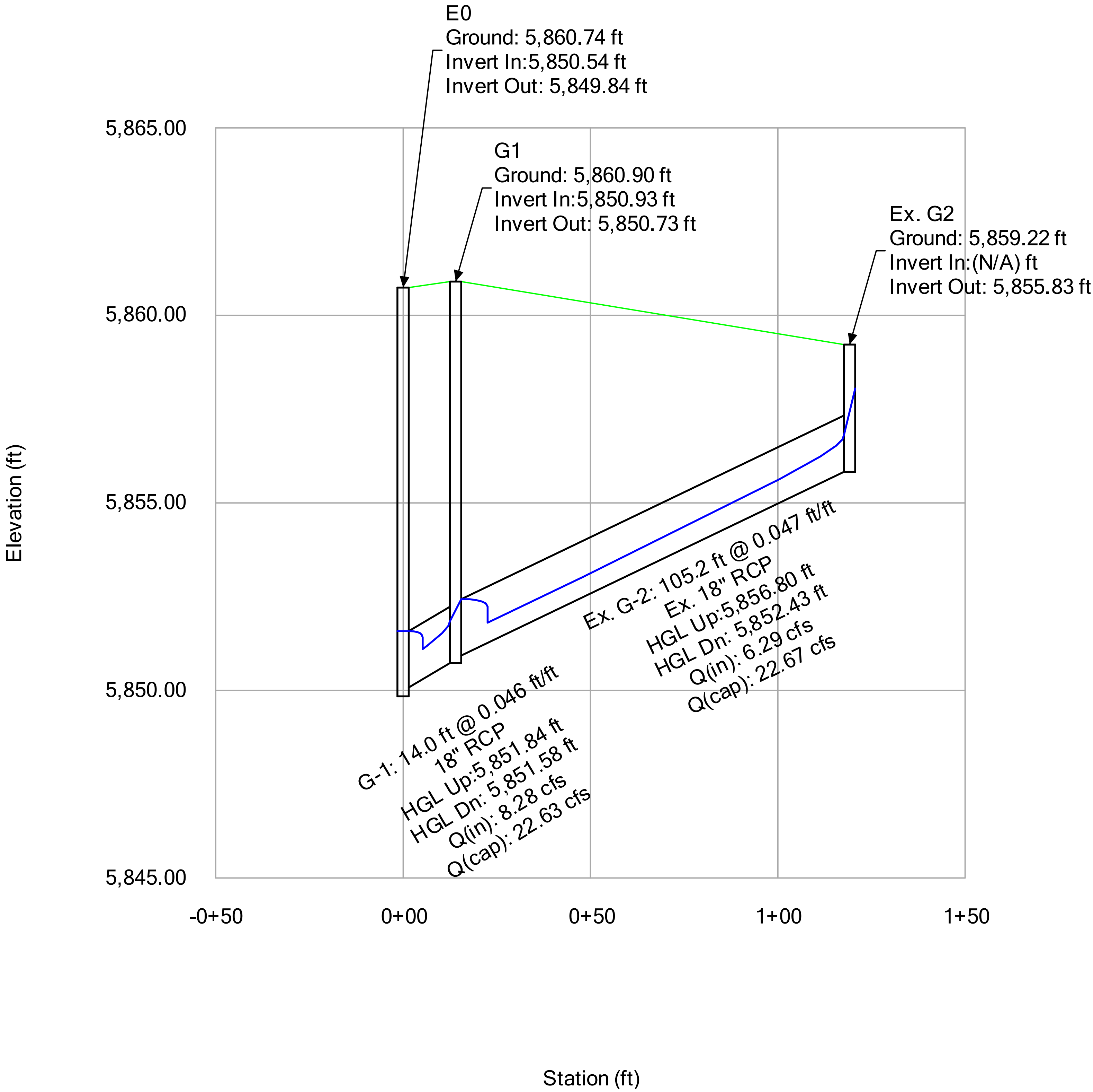
Profile Report
Engineering Profile - Line B (Park Meadows - P1a.stsw)
Active Scenario: 100-yr
Park Meadows - Phase 1a



Profile Report
Engineering Profile - Ex Line H (Park Meadows - P1a.stsw)
Active Scenario: 100-yr
Park Meadows - Phase 1a



Profile Report
Engineering Profile - Line G (Park Meadows - P1a.stsw)
Active Scenario: 100-yr
Park Meadows - Phase 1a



MHFD-Inlet, Version 5.02 (August 2022)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet F2 (Basin S2)	Inlet A2 (Basin S1)	Ex Inlet C1 (Basin S1b)	Ex Inlet A1 (Basin S1a)	Inlet C4 (Basin S3)
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	In Sump	On Grade	In Sump	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT/Denver 13 Combination	CDOT/Denver 13 Combination	CDOT/Denver 13 Valley Grate

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	0.29	3.61	0.63	0.26	1.04
Major Q_{Known} (cfs)	0.66	8.28	1.46	0.60	2.39

Bypass (Carry-Over) Flow from Upstream Inlets must be organized from upstream (left) to downstream (right) in order for bypass flows to be linked.

Receive Bypass Flow from:	No Bypass Flow Received	Inlet F2 (Basin S2)	No Bypass Flow Received	User-Defined	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0	0.0
	Bypass flow to A2	Emergency overflow to A1		Overflow from A2 & C1	Bypass flow to C2

Watershed Characteristics

Subcatchment Area (acres)					
Percent Impervious					
NRCS Soil Type					

Watershed Profile

Overland Slope (ft/ft)					
Overland Length (ft)					
Channel Slope (ft/ft)					
Channel Length (ft)					

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)					
One-Hour Precipitation, P_1 (inches)					

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)					
One-Hour Precipitation, P_1 (inches)					

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**0.3**	**3.6**	**0.6**	**0.3**	**1.0**
Major Total Design Peak Flow, Q (cfs)	**0.7**	**8.3**	**1.5**	**0.6**	**2.4**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	N/A	-0.1	N/A	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	0.0	N/A	-0.1	N/A	N/A

MHFD-Inlet, Version 5.02 (August 2022)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Ex Inlet B5 (Basin S7)	Ex Inlet B3 (Basin S6)	Ex Inlet G1 (Basin S5)	Inlet C2 (Basin S4)	Ex Inlet B1 (Basin OS5)
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	In Sump	In Sump	In Sump	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.15	1.04	0.87	1.79	4.10
Major Q_{Known} (cfs)	2.65	2.39	1.99	4.11	9.41

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	Ex Inlet B5 (Basin S7)	User-Defined	User-Defined	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.7	0.0	0.0	0.0
		Bypass from ex B5; Bypass flow to C2	Bypass from ex B3	Overflow from C4 & G1	

Watershed Characteristics

Subcatchment Area (acres)					
Percent Impervious					
NRCS Soil Type					

Watershed Profile

Overland Slope (ft/ft)					
Overland Length (ft)					
Channel Slope (ft/ft)					
Channel Length (ft)					

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)					
One-Hour Precipitation, P_1 (inches)					

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)					
One-Hour Precipitation, P_1 (inches)					

CALCULATED OUTPUT

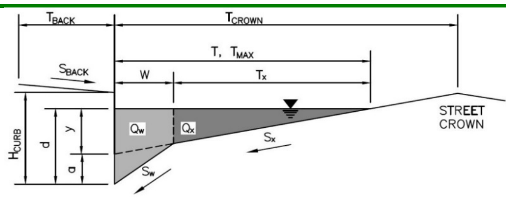
Minor Total Design Peak Flow, Q (cfs)	**1.2**	**1.0**	**0.9**	**1.8**	**4.1**
Major Total Design Peak Flow, Q (cfs)	**2.7**	**3.1**	**2.0**	**4.1**	**9.4**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	N/A	N/A	N/A	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	0.7	N/A	N/A	N/A	N/A

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

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

Project: 231016 - Park Meadows Mixed Use Development Phase 1b

Inlet ID: Inlet F2 (Basin S2)



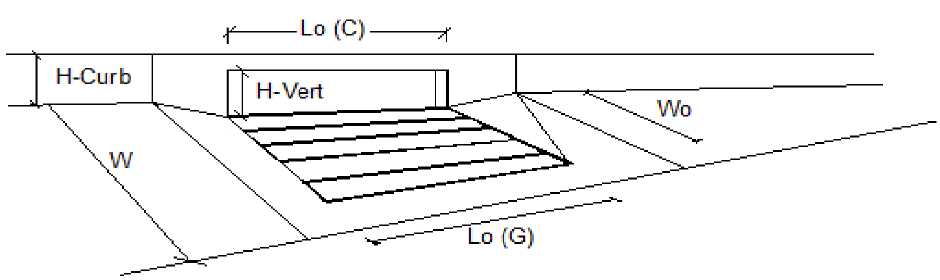
Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	22.7		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.021		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	24.5		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.017		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.021		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	24.5	24.5	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	11.4	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**22.4**	**30.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.29 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 0.66 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



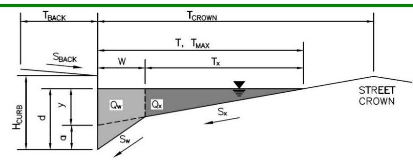
Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.3**	**0.7**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**100**	**%**

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

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

Project: 231016 - Park Meadows Mixed Use Development Phase 1b

Inlet ID: Inlet A2 (Basin S1)



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	32.3	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.025	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

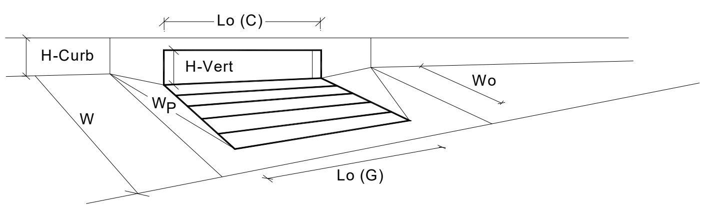
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	32.3	32.3	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

MINOR STORM Allowable Capacity is not applicable to Sump Condition
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

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

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.0	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.33	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.93	0.93	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	

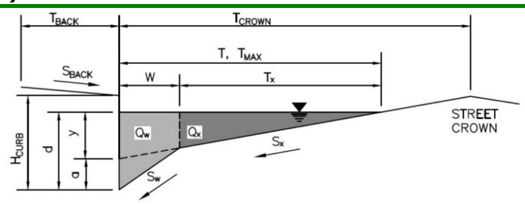
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**8.3**	**8.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	3.6	8.3	cfs

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

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

Project: 231016 - Park Meadows Mixed Use Development Phase 1b

Inlet ID: Ex Inlet C1 (Basin S1b)



Gutter Geometry:

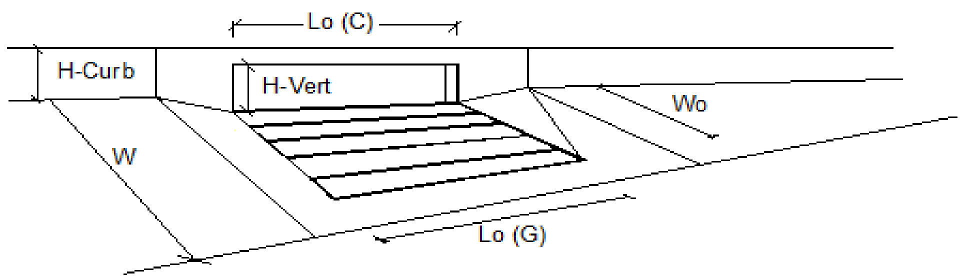
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =			ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =			ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =			
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	31.5		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.024		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.013		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	31.5	31.5	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**14.1**	**14.1**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.63 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 1.46 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT/Denver 13 Combination)	Type =	CDOT/Denver 13 Combination		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	2.0	2.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	3.00	3.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	1.73	1.73	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	0.50	0.50	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.7**	**1.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**-0.1**	**-0.1**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**115**	**105**	**%**

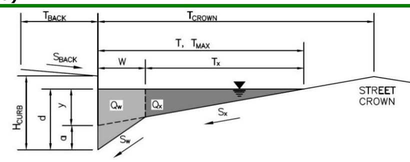
MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project: 231016 - Park Meadows Mixed Use Development Phase 1b

Inlet ID: Ex Inlet A1 (Basin S1a)



Gutter Geometry:

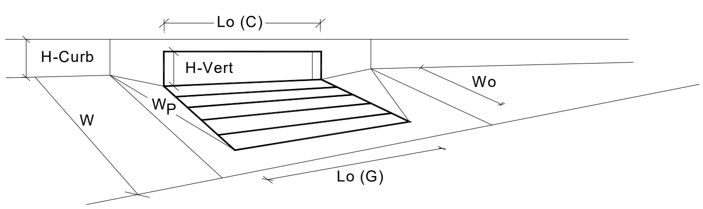
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	30.2	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.022	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	30.2	30.2	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input) CDOT/Denver 13 Combination

		MINOR	MAJOR	
Type of Inlet	Type =	CDOT/Denver 13 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.0	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	3.00	3.00	feet
Width of a Unit Grate	W_o =	1.73	1.73	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	0.43	0.43	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	3.30	3.30	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	0.60	0.60	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	3.00	3.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.50	6.50	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	5.25	5.25	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.66	0.66	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	0.52	0.52	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.33	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.94	0.94	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	N/A	N/A	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.94	0.94	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**5.1**	**5.1**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	0.3	0.6	cfs

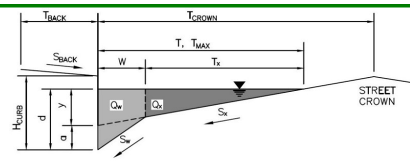
MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project: 231016 - Park Meadows Mixed Use Development Phase 1b

Inlet ID: Inlet C4 (Basin S3)



<u>Gutter Geometry:</u>

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.8	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.017	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	24.2	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.030	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

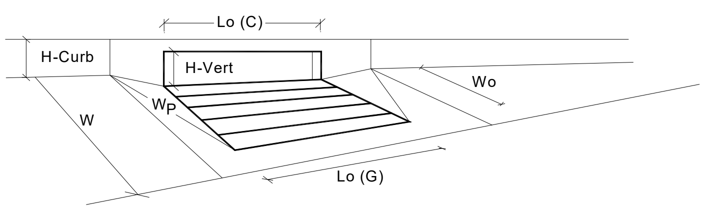
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	24.2	24.2	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.1	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

MINOR STORM Allowable Capacity is not applicable to Sump Condition
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

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

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



<u>Design Information (Input)</u> CDOT/Denver 13 Valley Grate

		MINOR	MAJOR	
Type of Inlet	Type =	CDOT/Denver 13 Valley Grate		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.1	inches
<u>Grate Information</u>		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	3.00	3.00	feet
Width of a Unit Grate	W_o =	1.73	1.73	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	0.43	0.43	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	3.30	3.30	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	0.60	0.60	
<u>Curb Opening Information</u>		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	N/A	N/A	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	N/A	N/A	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	N/A	N/A	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	N/A	N/A	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	N/A	N/A	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	N/A	N/A	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	N/A	N/A	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	N/A	N/A	

<u>Low Head Performance Reduction (Calculated)</u>		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	0.52	0.53	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	N/A	N/A	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.94	0.96	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	N/A	N/A	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	

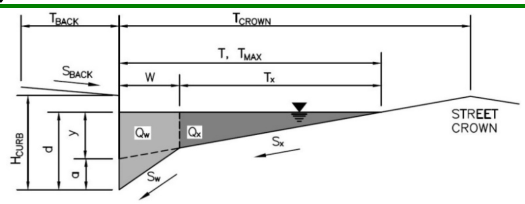
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**2.6**	**2.8**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	1.0	2.4	cfs

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

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

Project: 231016 - Park Meadows Mixed Use Development Phase 1b

Inlet ID: Ex Inlet B5 (Basin S7)

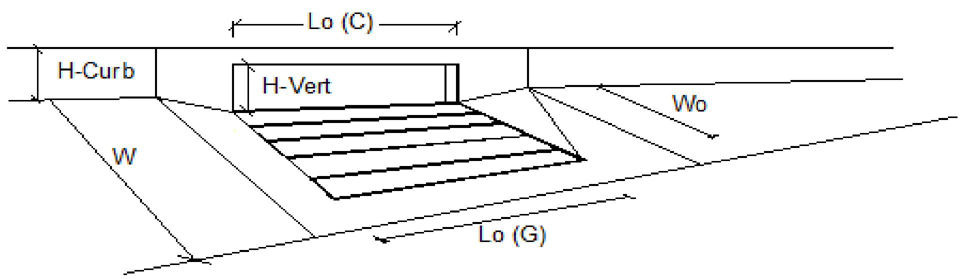


Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	17.5		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.016		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.9		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.012		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.011		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.9	14.9	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.8	5.8	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**3.9**	**3.9**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.15 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 2.65 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



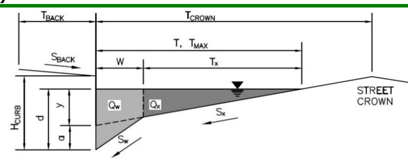
Design Information (Input)		MINOR	MAJOR	
Type of Inlet — CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.1**	**2.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.7**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**99**	**74**	**%**

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

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

Project: 231016 - Park Meadows Mixed Use Development Phase 1b

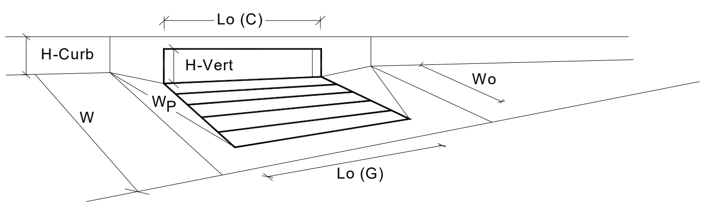
Inlet ID: Ex Inlet B3 (Basin S6)



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.3		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.076		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	26.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	26.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



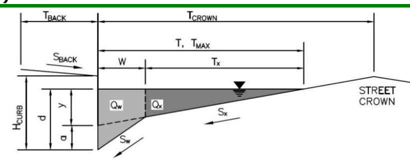
Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	7.8	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.48	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**5.4**	**8.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	1.0	3.1	cfs

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

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

Project: 231016 - Park Meadows Mixed Use Development Phase 1b

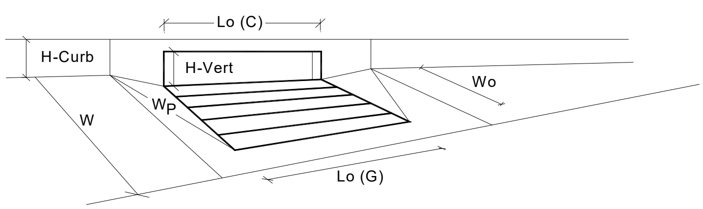
Inlet ID: Ex Inlet G1 (Basin S5)



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	18.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.045		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	43.4		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.034		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	26.5	43.4	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	11.3	inches
Check boxes are not applicable in SUMP conditions		☐	☐	
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	11.3	inches
Grate Information			MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.33	0.77	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**5.4**	**11.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		$Q_{PEAK\ REQUIRED}$ =	0.9	2.0	cfs

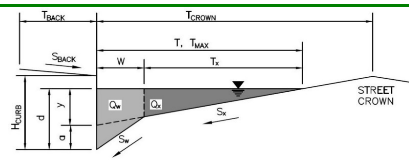
MHFD-Inlet, Version 5.02 (August 2022)

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

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

Project: 231016 - Park Meadows Mixed Use Development Phase 1b

Inlet ID: Inlet C2 (Basin S4)



Gutter Geometry:

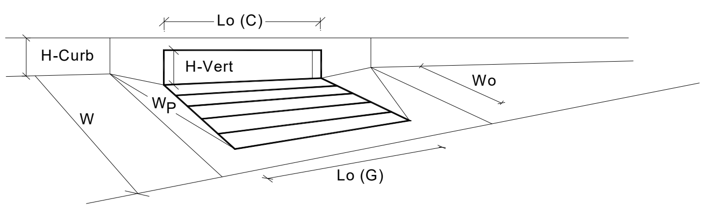
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	23.7	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.040	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	34.3	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.049	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	34.3	34.3	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.83	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	

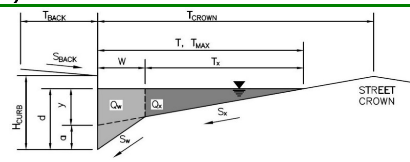
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**5.4**	**12.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	1.8	4.1	cfs

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

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

Project: 231016 - Park Meadows Mixed Use Development Phase 1b

Inlet ID: Ex Inlet B1 (Basin OS5)



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	35.7	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

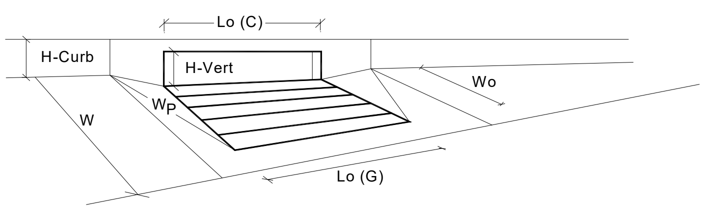
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	35.7	35.7	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

MINOR STORM Allowable Capacity is not applicable to Sump Condition
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

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

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)

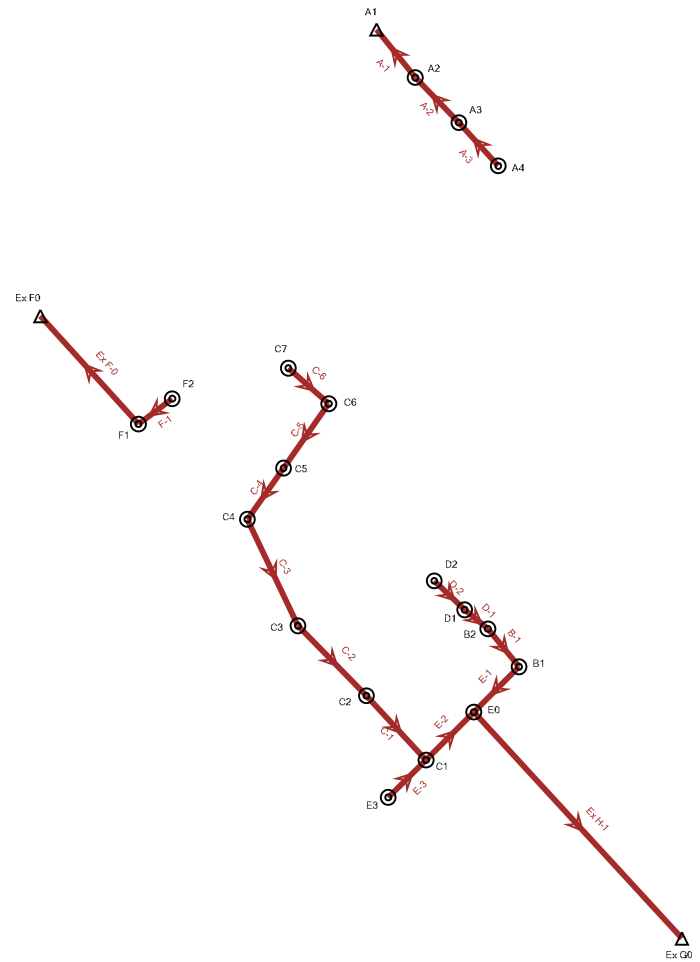


Design Information (Input) — CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	10.1	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.67	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**5.4**	**11.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	4.1	9.4	cfs

Network Schematic
Park Meadows - Phase 1b



Park Meadows - Phase 1b

Active Scenario: 5-yr

FlexTable: Conduit Table

Label	Start Node	Stop Node	Length (User Defined) (ft)	Diameter (in)	Notes	Invert (Start) (ft)	Invert (Stop) (ft)	Slope (Calculated) (ft/ft)	Manning's n	Capacity (Full Flow) (cfs)	System Known Flow (cfs)	Velocity (ft/s)	Depth (Normal) (ft)	Froude Number (Normal)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)
A-1	A2	A1	28.5	15.0	Dual 15" RCP	5,853.93	5,853.64	0.010	0.013	13.04	8.19	5.61	0.72	0.526	5,854.94	5,854.89	5,855.17	5,855.06	5,857.22	5,856.87
A-2	A3	A2	52.1	15.0	15" RCP	5,854.57	5,854.03	0.010	0.013	6.57	4.59	5.79	0.77	1.265	5,855.44	5,854.94	5,855.83	5,855.30	5,859.18	5,857.22
A-3	A4	A3	5.0	15.0	15" PVC	5,854.82	5,854.77	0.010	0.013	6.46	4.59	5.71	0.78	1.236	5,855.69	5,855.58	5,856.08	5,856.04	5,860.26	5,859.18
B-1	B2	B1	10.4	18.0	18" RCP	5,855.32	5,855.20	0.012	0.013	11.28	2.86	5.33	0.52	1.529	5,855.96	5,855.74	5,856.21	5,856.12	5,861.41	5,862.17
C-1	C2	C1	67.9	18.0	18" RCP	5,850.78	5,850.44	0.005	0.013	7.43	3.29	4.08	0.70	0.979	5,851.48	5,851.13	5,851.74	5,851.40	5,860.62	5,861.44
C-2	C3	C2	76.8	18.0	18" RCP	5,853.65	5,852.11	0.020	0.013	14.88	1.50	5.40	0.32	2.003	5,854.11	5,852.43	5,854.28	5,852.88	5,861.39	5,860.62
C-3	C4	C3	92.6	18.0	18" RCP	5,855.60	5,853.75	0.020	0.013	14.85	1.50	5.39	0.32	1.999	5,856.06	5,854.07	5,856.23	5,854.52	5,861.58	5,861.39
C-4	C5	C4	30.2	12.0	12" HDPE	5,856.70	5,856.10	0.020	0.013	5.02	0.46	3.98	0.20	1.857	5,856.98	5,856.30	5,857.08	5,856.55	5,862.05	5,861.58
C-5	C6	C5	83.2	12.0	12" HDPE	5,858.37	5,856.70	0.020	0.013	5.05	0.46	4.00	0.20	1.866	5,858.65	5,856.90	5,858.75	5,857.15	5,863.25	5,862.05
C-6	C7	C6	19.4	12.0	12" HDPE	5,858.77	5,858.37	0.021	0.013	5.12	0.46	4.04	0.20	1.891	5,859.05	5,858.57	5,859.15	5,858.83	5,863.19	5,863.25
D-1	D1	B2	50.2	12.0	12" HDPE	5,858.19	5,857.68	0.010	0.013	3.59	0.66	3.48	0.29	1.345	5,858.53	5,857.97	5,858.65	5,858.16	5,862.76	5,861.41
D-2	D2	D1	17.1	12.0	12" HDPE	5,858.36	5,858.19	0.010	0.013	3.56	0.66	0.84	0.29	1.333	5,859.78	5,859.78	5,859.80	5,859.79	5,863.01	5,862.76
E-1	B1	E0	53.1	24.0	24" RCP	5,854.17	5,850.54	0.068	0.013	59.15	6.95	12.62	0.46	3.893	5,855.11	5,851.01	5,855.47	5,853.34	5,862.17	5,860.64
E-2	C1	E0	54.7	36.0	Ex. 36" RCP	5,850.34	5,850.01	0.006	0.013	51.80	5.45	4.76	0.66	1.234	5,851.07	5,851.07	5,851.33	5,851.16	5,861.44	5,860.64
E-3	E3	C1	26.2	36.0	Ex. 36" RCP	5,850.60	5,850.44	0.006	0.013	52.10	2.70	3.88	0.46	1.209	5,851.11	5,851.07	5,851.29	5,851.17	5,862.02	5,861.44
Ex F-0	F1	Ex F0	118.1	15.0	Ex 15" RCP	5,852.20	5,851.31	0.008	0.013	5.61	0.72	3.14	0.30	1.198	5,852.54	5,852.56	5,852.65	5,852.57	5,861.90	5,860.86
Ex H-1	E0	Ex G0	248.0	36.0	Ex. 363" RCP	5,849.84	5,847.86	0.008	0.013	59.60	13.27	6.79	0.96	1.431	5,851.00	5,850.86	5,851.43	5,850.91	5,860.64	5,860.46
F-1	F2	F1	9.9	12.0	12" RCP	5,854.18	5,852.20	0.200	0.013	15.92	0.29	7.79	0.09	5.440	5,854.40	5,852.54	5,854.48	5,852.57	5,861.99	5,861.90

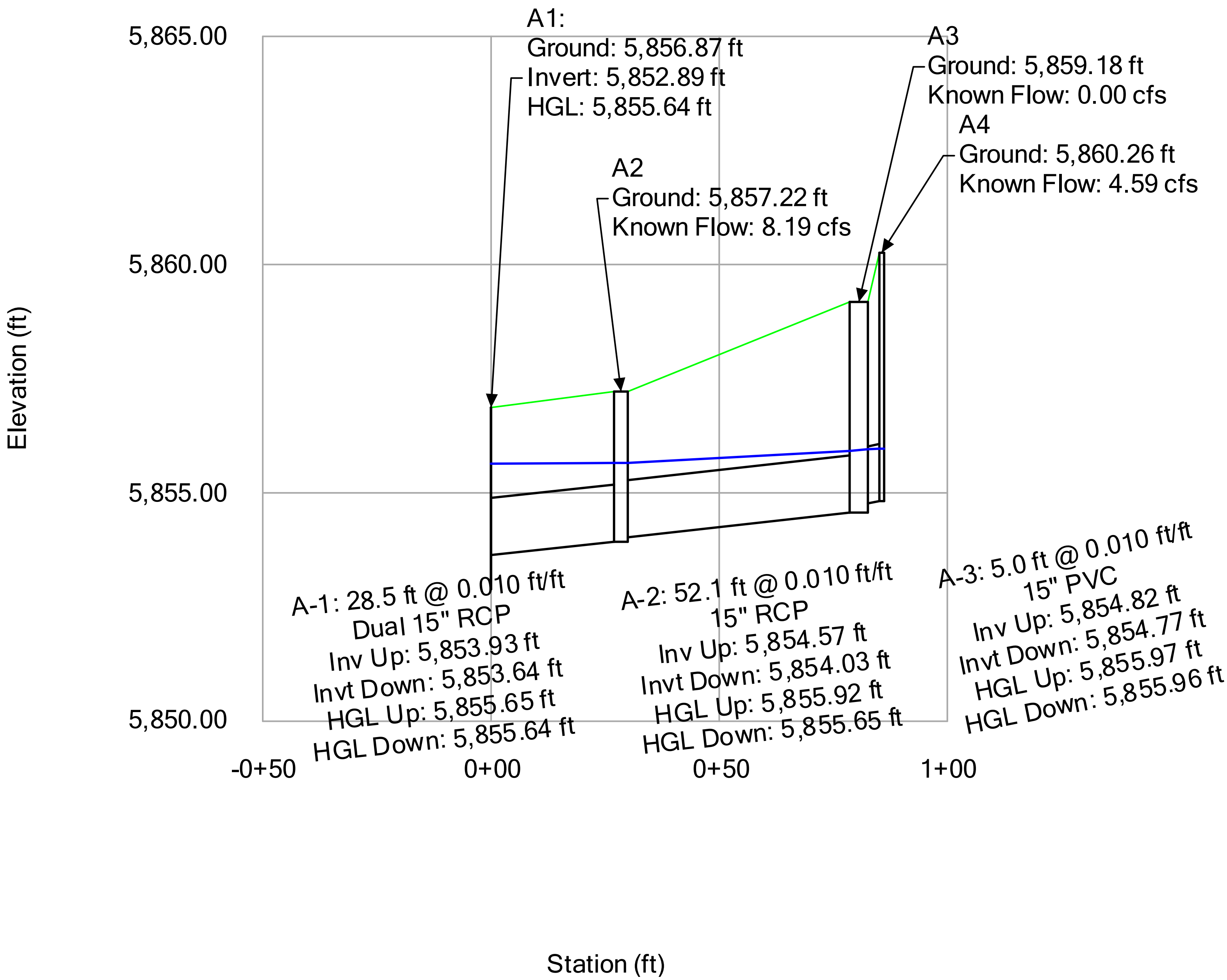
FlexTable: Outfall Table

Active Scenario: 5-yr

Park Meadows - Phase 1b

Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)	Notes
Ex G0	5,860.46	5,847.46	Crown		5,850.86	13.27	Ex. Mahole
Ex F0	5,860.86	5,851.31	Crown		5,852.56	0.72	Ex Manhole
A1	5,856.87	5,852.89	Crown		5,854.89	8.19	Ex. Combination Type 13 Triple

Profile Report
Engineering Profile - Line A (Park Meadows - P1b.stsw)
Active Scenario: 5-yr
Park Meadows - Phase 1b

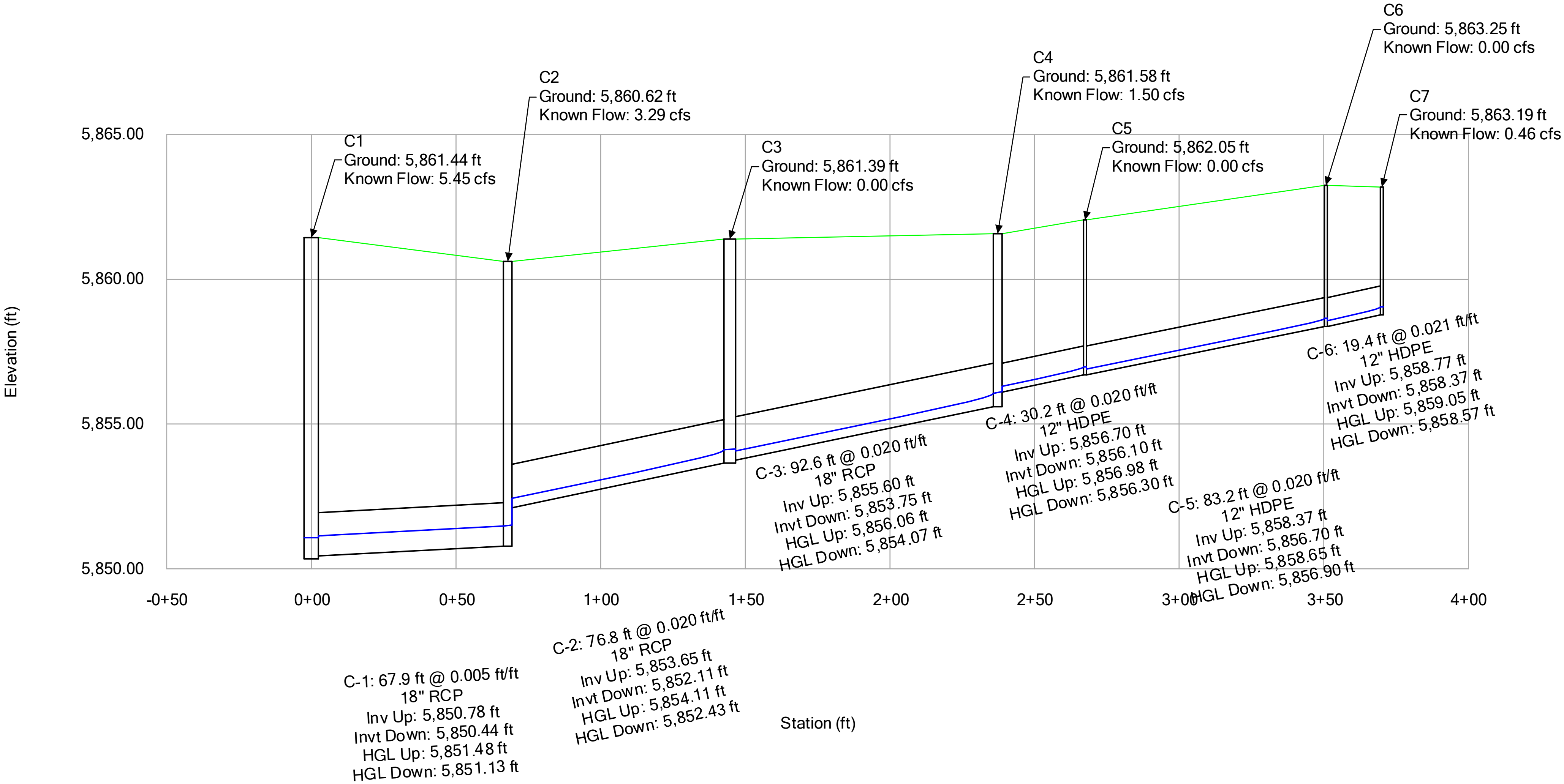


Park Meadows - Phase 1b

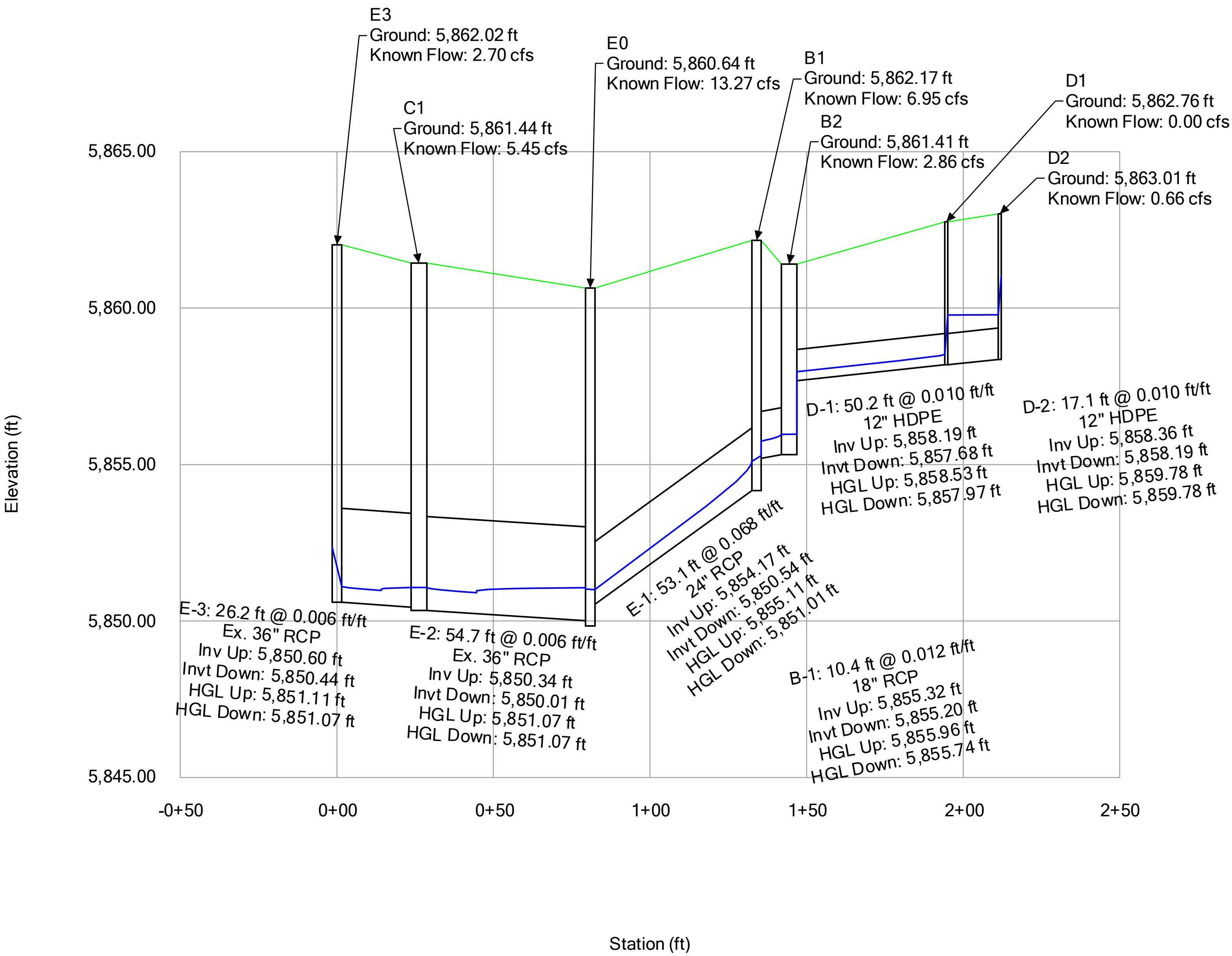
Active Scenario: 5-yr

Profile Report

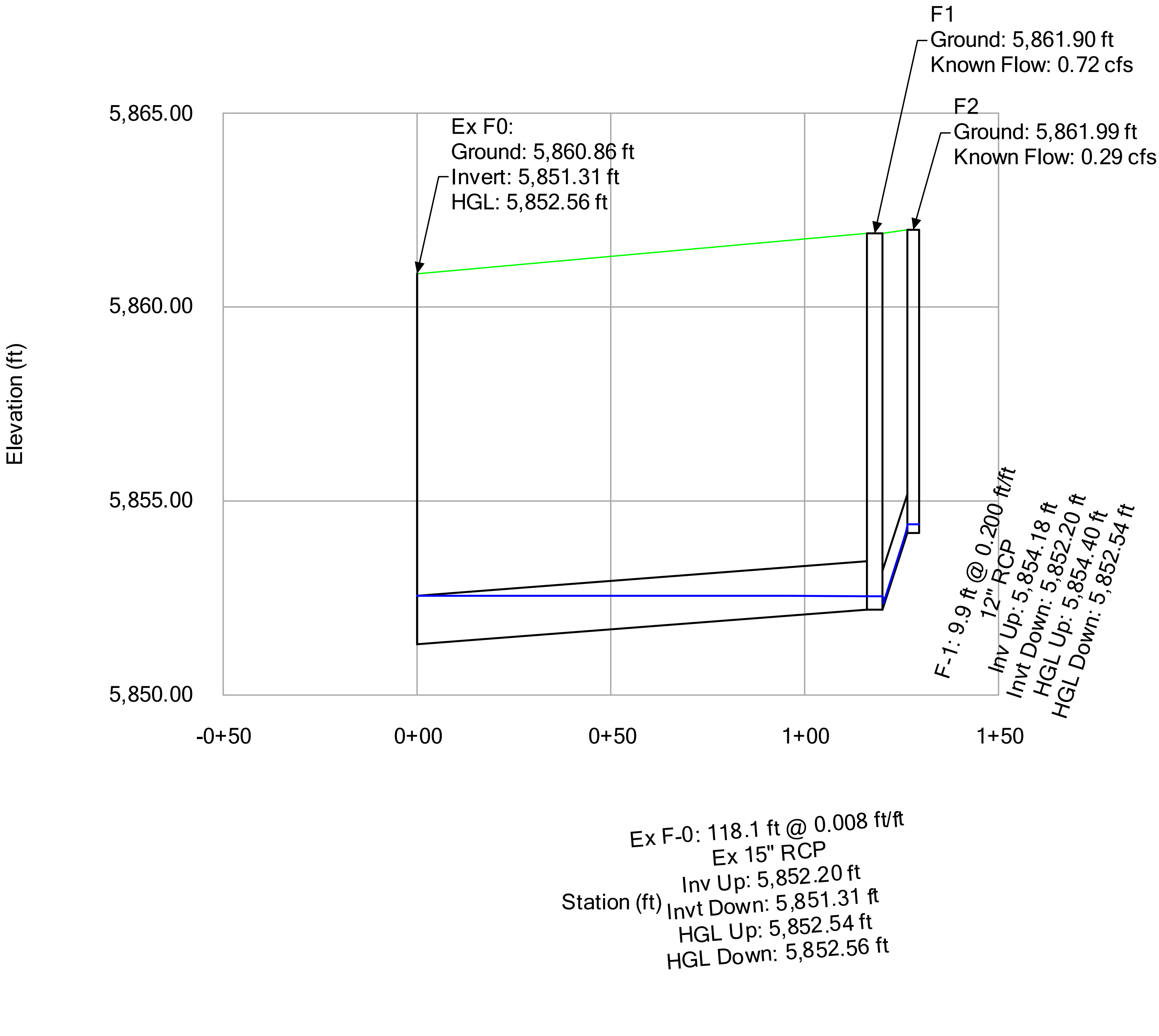
Engineering Profile - Line C (Park Meadows - P1b.stsw)



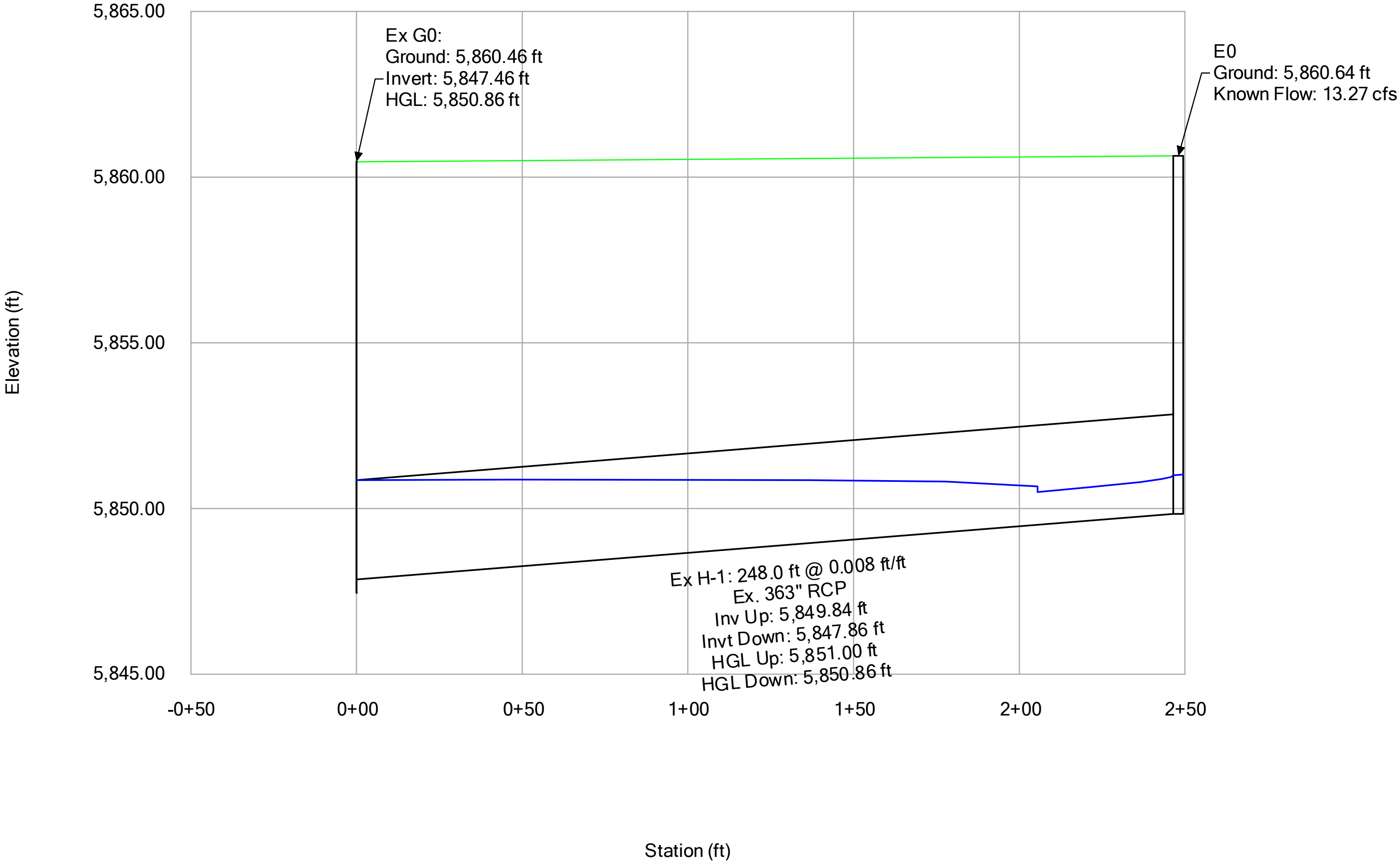
Profile Report
Engineering Profile - Line D (Park Meadows - P1b.stsw)
Active Scenario: 5-yr
Park Meadows - Phase 1b



Profile Report
Engineering Profile - Line F (Park Meadows - P1b.stsw)
Active Scenario: 5-yr
Park Meadows - Phase 1b



Profile Report
Engineering Profile - Ex. Line G (Park Meadows - P1b.stsw)
Active Scenario: 5-yr
Park Meadows - Phase 1b



Park Meadows - Phase 1b

Active Scenario: 100-yr

FlexTable: Conduit Table

Label	Start Node	Stop Node	Length (User Defined) (ft)	Diameter (in)	Notes	Invert (Start) (ft)	Invert (Stop) (ft)	Slope (Calculated) (ft/ft)	Manning's n	Capacity (Full Flow) (cfs)	System Known Flow (cfs)	Velocity (ft/s)	Depth (Normal) (ft)	Froude Number (Normal)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)
A-1	A2	A1	28.5	15.0	Dual 15" RCP	5,853.93	5,853.64	0.010	0.013	13.04	18.82	7.67	(N/A)	1.209	5,855.49	5,854.89	5,856.41	5,855.80	5,857.22	5,856.87
A-2	A3	A2	52.1	15.0	15" RCP	5,854.57	5,854.03	0.010	0.013	6.57	10.53	8.58	(N/A)	1.353	5,856.88	5,855.49	5,858.02	5,856.64	5,859.18	5,857.22
A-3	A4	A3	5.0	15.0	15" PVC	5,854.82	5,854.77	0.010	0.013	6.46	10.53	8.58	(N/A)	1.353	5,857.31	5,857.18	5,858.45	5,858.32	5,860.26	5,859.18
B-1	B2	B1	10.4	18.0	18" RCP	5,855.32	5,855.20	0.012	0.013	11.28	6.56	6.62	0.82	1.433	5,856.31	5,856.08	5,856.75	5,856.66	5,861.41	5,862.17
C-1	C2	C1	67.9	18.0	18" RCP	5,850.78	5,850.44	0.005	0.013	7.43	7.55	4.79	1.25	0.711	5,852.06	5,851.75	5,852.40	5,852.08	5,860.62	5,861.44
C-2	C3	C2	76.8	18.0	18" RCP	5,853.65	5,852.11	0.020	0.013	14.88	3.45	6.85	0.49	2.021	5,854.36	5,852.60	5,854.63	5,853.33	5,861.39	5,860.62
C-3	C4	C3	92.6	18.0	18" RCP	5,855.60	5,853.75	0.020	0.013	14.85	3.45	6.84	0.49	2.016	5,856.31	5,854.24	5,856.58	5,854.97	5,861.58	5,861.39
C-4	C5	C4	30.2	12.0	12" HDPE	5,856.70	5,856.10	0.020	0.013	5.02	1.06	5.07	0.31	1.881	5,857.13	5,856.41	5,857.30	5,856.81	5,862.05	5,861.58
C-5	C6	C5	83.2	12.0	12" HDPE	5,858.37	5,856.70	0.020	0.013	5.05	1.06	5.09	0.31	1.890	5,858.80	5,857.01	5,858.97	5,857.41	5,863.25	5,862.05
C-6	C7	C6	19.4	12.0	12" HDPE	5,858.77	5,858.37	0.021	0.013	5.12	1.06	5.14	0.31	1.917	5,859.20	5,858.68	5,859.37	5,859.07	5,863.19	5,863.25
D-1	D1	B2	50.2	12.0	12" HDPE	5,858.19	5,857.68	0.010	0.013	3.59	1.52	4.38	0.45	1.310	5,858.71	5,858.13	5,858.92	5,858.43	5,862.76	5,861.41
D-2	D2	D1	17.1	12.0	12" HDPE	5,858.36	5,858.19	0.010	0.013	3.56	1.52	1.94	0.46	1.297	5,859.99	5,859.96	5,860.05	5,860.02	5,863.01	5,862.76
E-1	B1	E0	53.1	24.0	24" RCP	5,854.17	5,850.54	0.068	0.013	59.15	15.97	15.99	0.71	3.902	5,855.61	5,851.31	5,856.29	5,854.52	5,862.17	5,860.64
E-2	C1	E0	54.7	36.0	Ex. 36" RCP	5,850.34	5,850.01	0.006	0.013	51.80	12.52	6.03	1.00	1.243	5,851.74	5,851.78	5,851.97	5,851.91	5,861.44	5,860.64
E-3	E3	C1	26.2	36.0	Ex. 36" RCP	5,850.60	5,850.44	0.006	0.013	52.10	6.20	4.96	0.70	1.245	5,851.73	5,851.74	5,851.83	5,851.81	5,862.02	5,861.44
Ex F-0	F1	Ex F0	118.1	15.0	Ex 15" RCP	5,852.20	5,851.31	0.008	0.013	5.61	1.66	3.98	0.47	1.195	5,852.71	5,852.56	5,852.90	5,852.59	5,861.90	5,860.86
Ex H-1	E0	Ex G0	248.0	36.0	Ex. 363" RCP	5,849.84	5,847.86	0.008	0.013	59.60	30.48	8.48	1.52	1.365	5,851.63	5,850.86	5,852.38	5,851.15	5,860.64	5,860.46
F-1	F2	F1	9.9	12.0	12" RCP	5,854.18	5,852.20	0.200	0.013	15.92	0.66	9.98	0.14	5.689	5,854.52	5,852.71	5,854.64	5,852.75	5,861.99	5,861.90

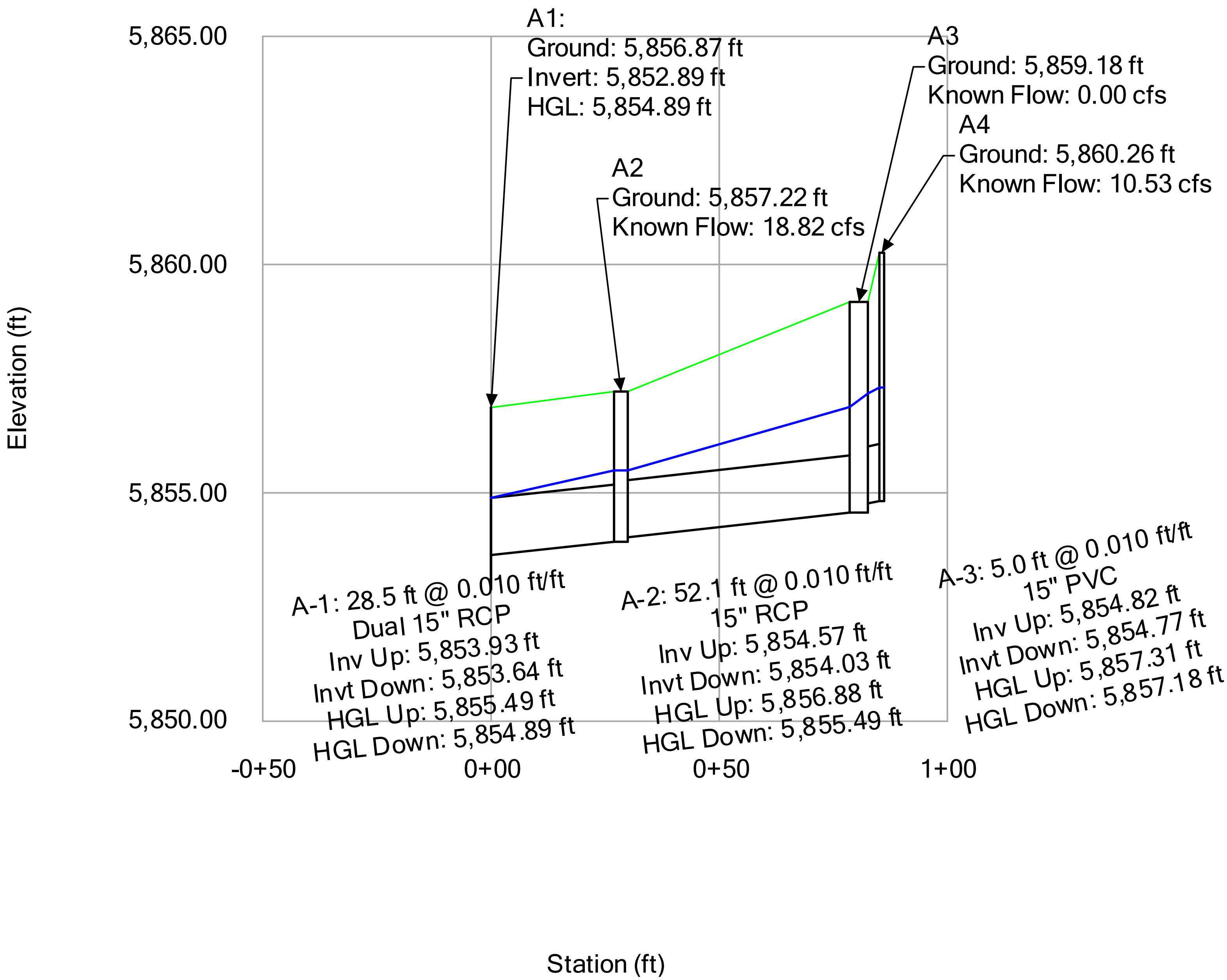
FlexTable: Outfall Table

Active Scenario: 100-yr

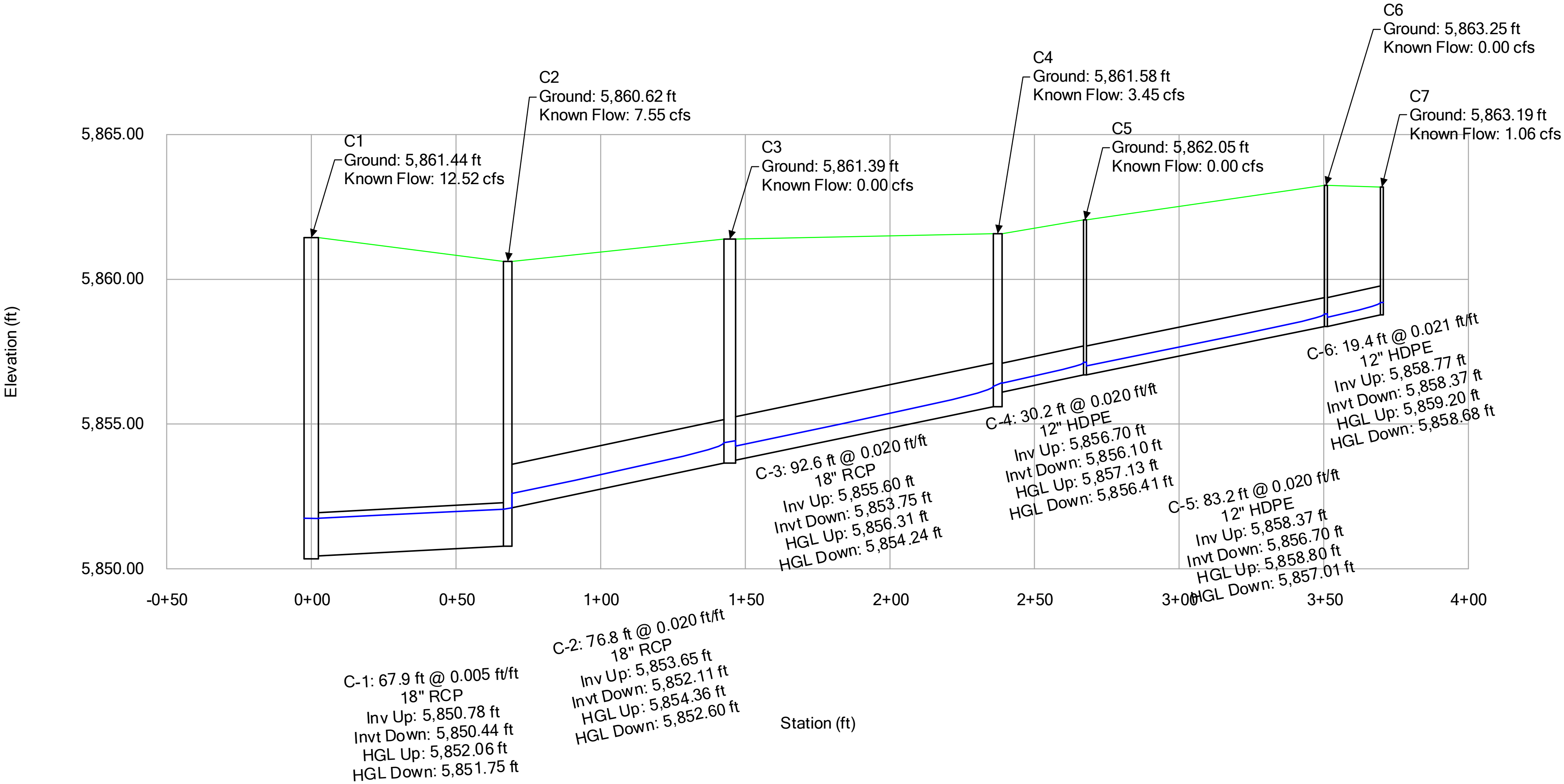
Park Meadows - Phase 1b

Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)	Notes
Ex G0	5,860.46	5,847.46	Crown		5,850.86	30.48	Ex. Mahole
Ex F0	5,860.86	5,851.31	Crown		5,852.56	1.66	Ex Manhole
A1	5,856.87	5,852.89	Crown		5,854.89	18.82	Ex. Combination Type 13 Triple

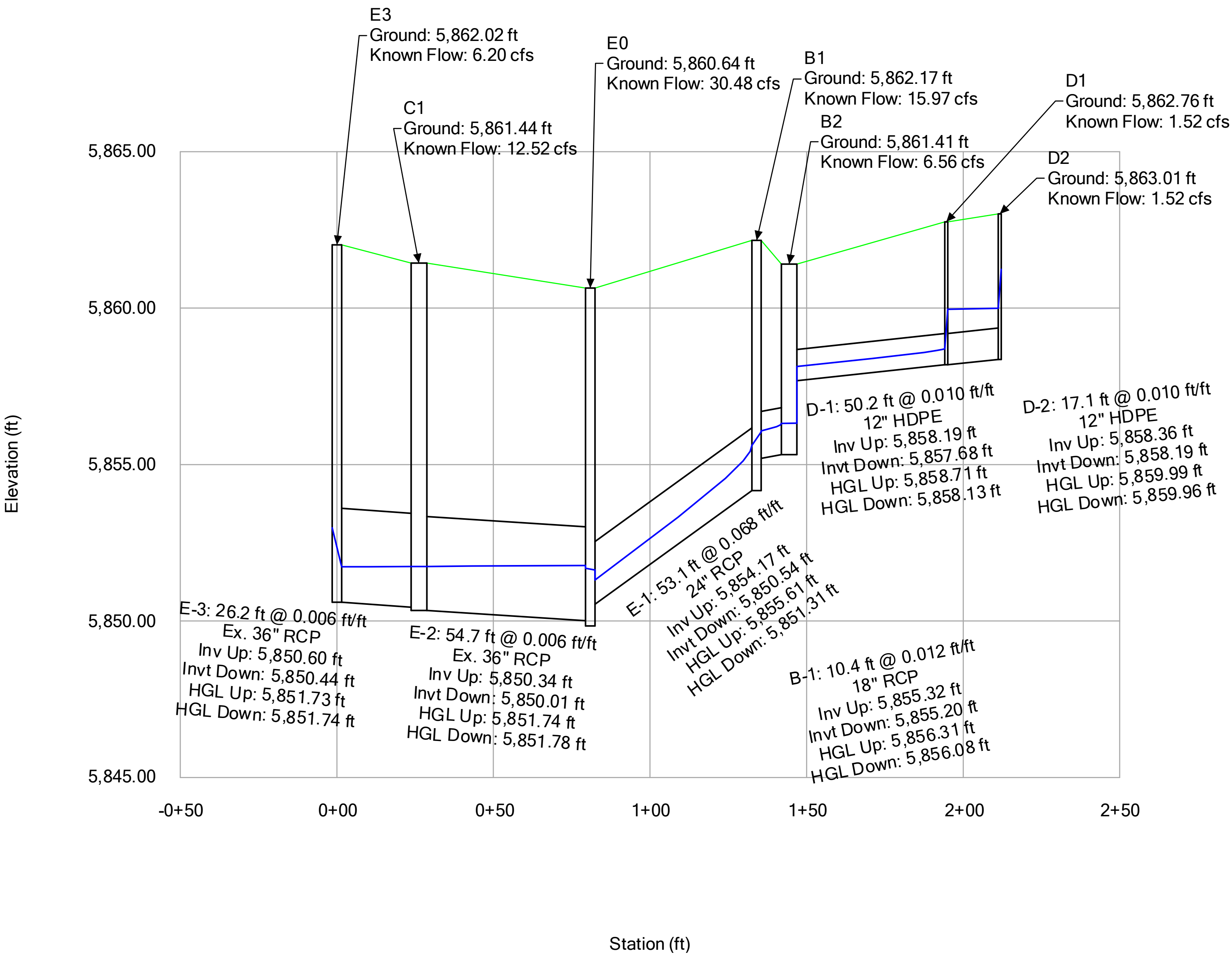
Profile Report
Engineering Profile - Line A (Park Meadows - P1b.stsw)
Active Scenario: 100-yr
Park Meadows - Phase 1b



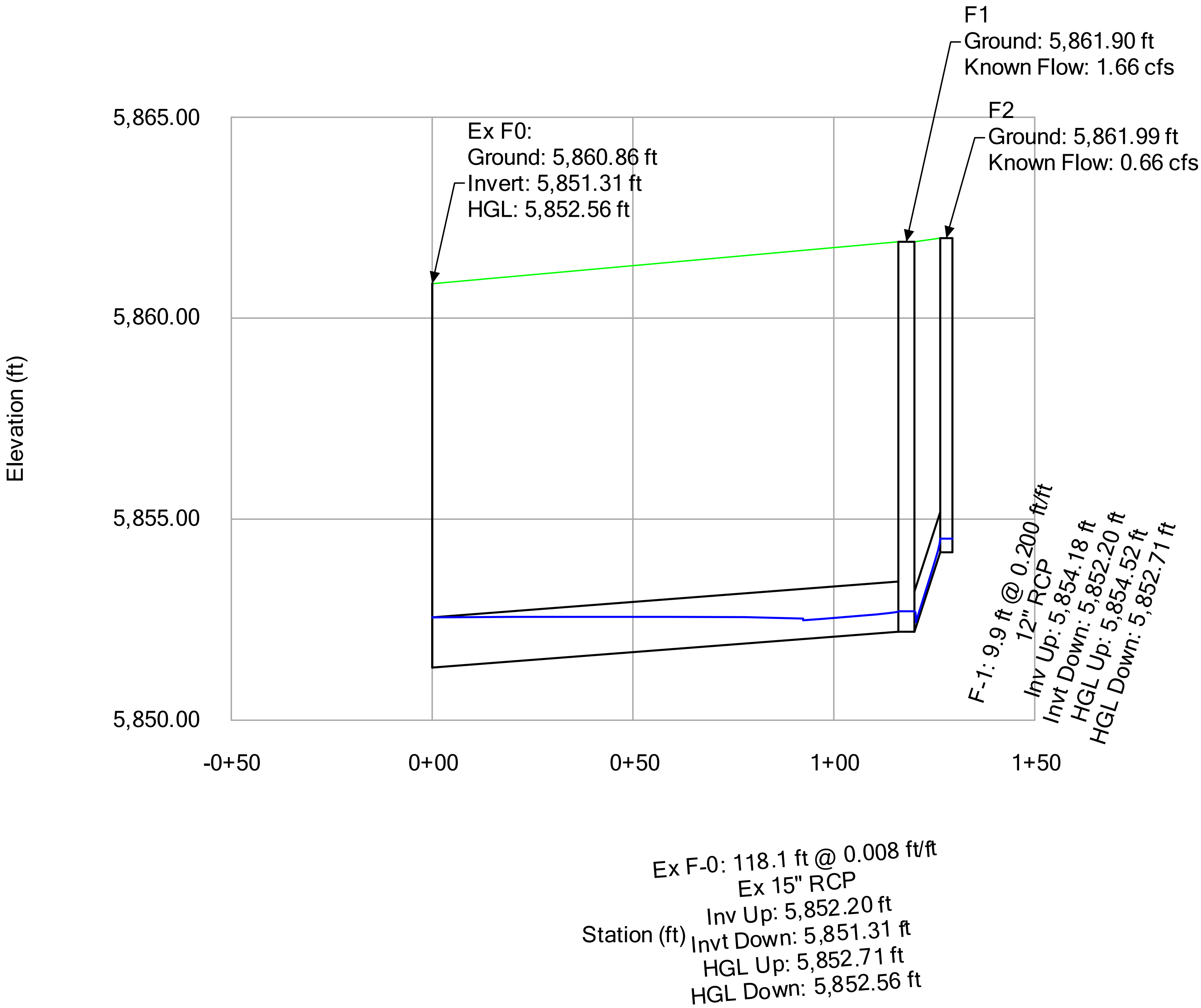
Park Meadows - Phase 1b
Active Scenario: 100-yr
Profile Report
Engineering Profile - Line C (Park Meadows - P1b.stsw)



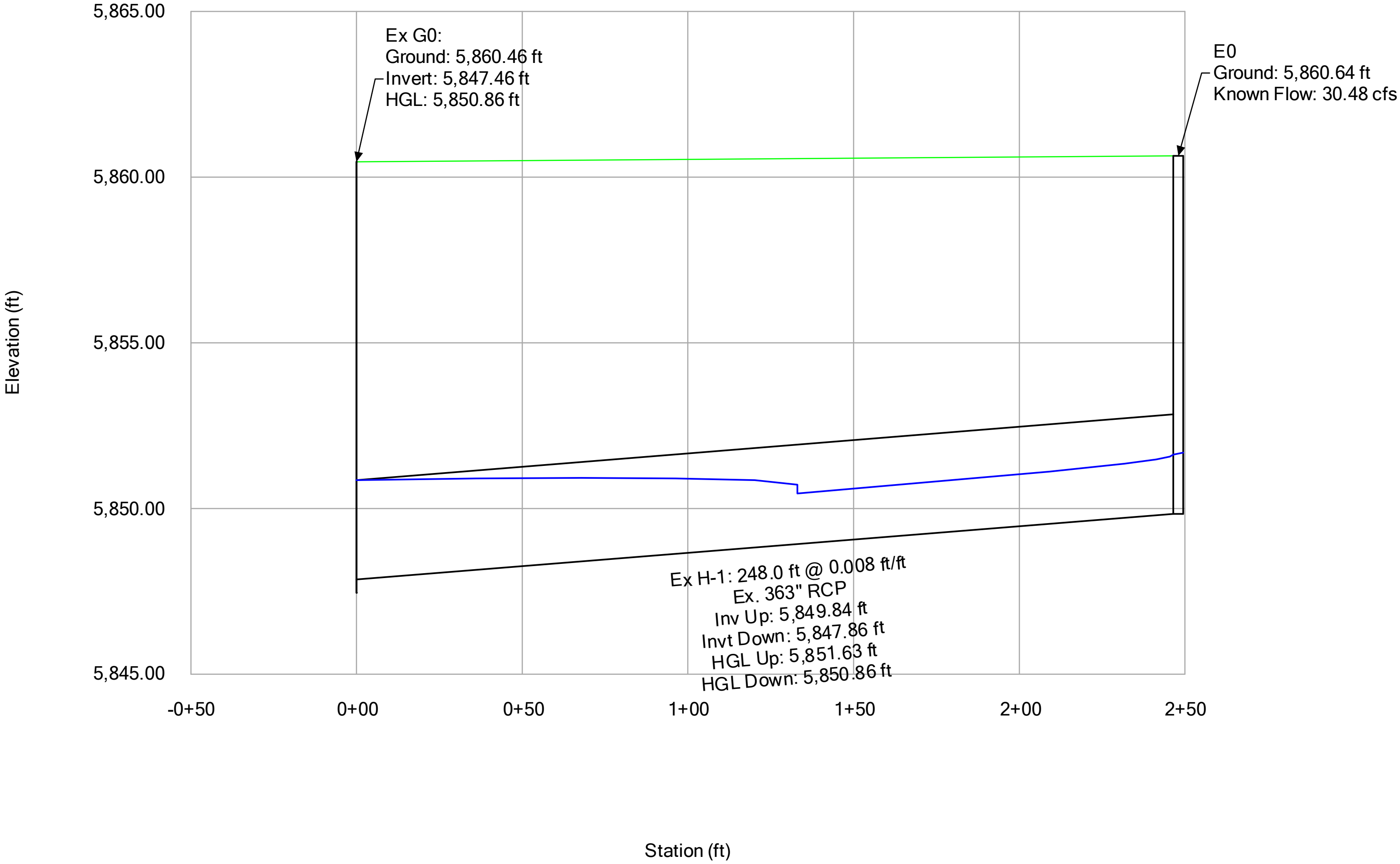
Profile Report
Engineering Profile - Line D (Park Meadows - P1b.stsw)
Active Scenario: 100-yr
Park Meadows - Phase 1b



Profile Report
Engineering Profile - Line F (Park Meadows - P1b.stsw)
Active Scenario: 100-yr
Park Meadows - Phase 1b



Profile Report
Engineering Profile - Ex. Line G (Park Meadows - P1b.stsw)
Active Scenario: 100-yr
Park Meadows - Phase 1b



Project Name:	Park Meadows - Phase 1B Plaza Landscape Drains
	Composite C-Value Computations
	Post-Development Conditions
Project No:	231016
Date:	3/5/2024
Revised:	3/8/2024
Design by:	GRS
Checked by:	
Hydraulic Soil Group:	C/D

BASIN	TOTAL AREA (ACRES)	ROADS / POND SURFACE (100%)	CONCRETE PAVEMENT (90%)	ROOFS (90%)	MULTI-USE REGIONAL (75%)	GRAVEL (40%)	OPEN SPACE C/D SOILS (2.0%)	PERCENT IMPERVIOUS	C_2*	C_5*	C_{10}*	C_{100}*
Worst Case Drain A9	0.11	0.00	0.09	0.00	0.00	0.00	0.02	77.4%	0.77	0.78	0.79	0.80

Table 6-4. Runoff coefficient equations based on NRCS soil group and storm return period

NRCS Soil Group	Storm Return Period						
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
A	$C_A = 0.84i^{1.302}$	$C_A = 0.86i^{1.276}$	$C_A = 0.87i^{1.232}$	$C_A = 0.88i^{1.124}$	$C_A = 0.85i+0.025$	$C_A = 0.78i+0.110$	$C_A = 0.65i+0.254$
B	$C_B = 0.84i^{1.169}$	$C_B = 0.86i^{1.088}$	$C_B = 0.81i+0.057$	$C_B = 0.63i+0.249$	$C_B = 0.56i+0.328$	$C_B = 0.47i+0.426$	$C_B = 0.37i+0.536$
C/D	$C_{C/D} = 0.83i^{1.122}$	$C_{C/D} = 0.82i+0.035$	$C_{C/D} = 0.74i+0.132$	$C_{C/D} = 0.56i+0.319$	$C_{C/D} = 0.49i+0.393$	$C_{C/D} = 0.41i+0.484$	$C_{C/D} = 0.32i+0.588$

Where:

i = % imperviousness (expressed as a decimal)

C_A = Runoff coefficient for Natural Resources Conservation Service (NRCS) HSG A soils

C_B = Runoff coefficient for NRCS HSG B soils

$C_{C/D}$ = Runoff coefficient for NRCS HSG C and D soils.

Project Name:	Park Meadows - Phase 1B Plaza Landscape Drains
Project No:	231016
Date:	3/5/2024
Revised:	3/8/2024
Designed By:	GRS
Checked By:	0

STANDARD FORM SF-1
TIME OF CONCENTRATION

SUB-BASIN DATA			INITIAL/OVERLAND TIME (T_i)			TRAVEL TIME (T_t)					Tc CHECK (URBANIZED BASINS)			FINAL	REMARKS
BASIN	AREA (AC)	C_5	LENGTH (FT)	SLOPE %	Ti (MIN)	LENGTH (FT)	SLOPE %	C_v	VELOCITY (FPS)	Tt (MIN)	COMPOS. Tc (MIN)	TOTAL LENGTH	Tc = (L/180) + 10 (MIN)	Tc (MIN)	
Worst Case Drain A9	0.11	0.78			0.00			20.00	0.00	0.00	0.00	-	0.00	5.00	Minimum Tc used for conservative design

MHFD USDCM Volume I:

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{\sqrt[3]{S}}$$

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

1-HR Rainfall

Park Meadows - Phase 1B Plaza Landscape Drains

Return Interval (YR)	1-hour Rainfall	
2	**0.842**	Source:
5	**1.10**	COA SDDTC NOAA Atlas 2
10	**1.34**	Precipitation Data Figures
100	**2.29**	*(See Report Appendix)*

Tc	2YR	5YR	10YR	100YR
5	2.856	3.731	4.545	7.767
6	2.715	3.546	4.320	7.383
7	2.588	3.381	4.119	7.040
8	2.475	3.233	3.938	6.730
9	2.372	3.098	3.774	6.450
10	2.278	2.976	3.625	6.195
11	2.192	2.864	3.489	5.962
12	2.114	2.761	3.364	5.748
13	2.041	2.666	3.248	5.551
14	1.974	2.579	3.141	5.368
15	1.912	2.497	3.042	5.199
16	1.853	2.421	2.950	5.041
17	1.799	2.351	2.864	4.894
18	1.749	2.284	2.783	4.756
19	1.701	2.222	2.707	4.626
20	1.656	2.164	2.636	4.505

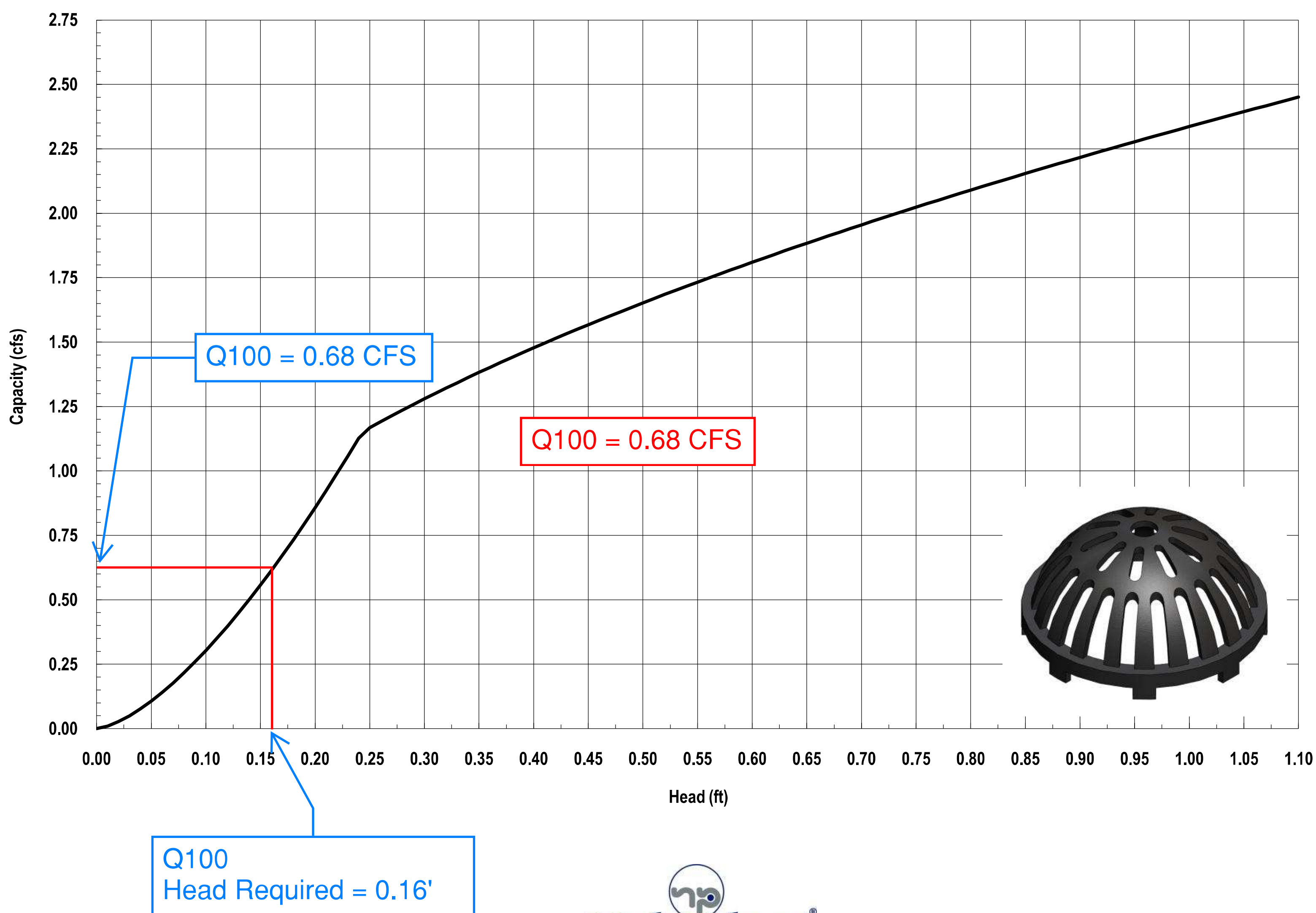
DATE:	03/05/24	STANDARD FORM SF-2	PROJECT NO:	231016
REVISED:	3/8/2024	100-YR	PROJECT:	Park Meadows - Phase 1B Plaza Landscape Drains
DESIGN BY:	GRS	STORM DRAINAGE SYSTEM DESIGN	DESIGN STORM:	100 YR
CHECKED BY:	SDM	(RATIONAL METHOD PROCEDURE)	P1:	2.29 IN

SDDTC Equation 5.5: $I = \frac{28.5\,P_1}{(10 + T_c)^{0.786}}$

		DIRECT RUNOFF						TOTAL RUNOFF				STREET/INLET					STORM SEWER PIPE				TRAVEL TIME			
BASIN (s)	DESIGN POINT	AREA (AC)	RUNOFF COEFF	T_c (min)	C x A (AC)	I (IN/HR)	DIRECT RUNOFF, Q (CFS)	T_c (MIN)	Σ(C x A) (AC)	I (IN/HR)	TOTAL RUNOFF, Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	INLET DESIGN FLOW (CFS)	STREET OR INLET INTERCEPTION (CFS)	CARRYOVER (CFS)	DESIGN FLOW (CFS)	PIPE SLOPE (%)	PIPE SIZE (IN)	QFULL (CFS)	LENGTH (FT)	VELOCITY (FPS)	T_t (min)	REMARKS
Worst Case Drain A9		0.11	0.80	5.00	0.09	7.77	0.68																	

PARK MEADOWS - P1B RETAIL LANDSCAPE DRAINS

Nyloplast 12" Dome Grate Inlet Capacity Chart



Nyloplast®
3130 Verona Avenue • Buford, GA 30518
(866) 888-8479 / (770) 932-2443 • Fax: (770) 932-2490

Sub-Area	Drain Name	Drain Size	Rim Elevation (ft)	High Point Elevation Near Drain (ft)	Adjacent Door Elevation	Available Head Before Overtopping	Drain Capacity (No freeboard)	Approx. Q100	Required Head for Q100	Approx. 100-YR WSEL	100 Year Capacity Check	Notes
Retail Area Phase 1B	A1	12"	5860.75	5861.03	6861.03	0.28	1.24	0.68	0.16	5860.91	GOOD	
	A2	12"	5861.00	5861.20	5861.20	0.20	0.86	0.68	0.16	5861.16	GOOD	
	A3	12"	5861.51	5862.06	5862.06	0.55	1.73	0.68	0.16	5861.67	GOOD	
	A4	12"	5863.03	5863.31	5863.31	0.28	1.24	0.68	0.16	5863.19	GOOD	
	A5	12"	5861.39	5861.66	5861.66	0.27	1.21	0.68	0.16	5861.55	GOOD	
	A6	12"	5861.94	5862.3	5862.3	0.36	1.40	0.68	0.16	5862.10	GOOD	
	A7	12"	5863.06	5863.12	5863.12	0.06	0.14	0.68	0.16	5863.22	EXCEEDED	Raised bed, Q100 much smaller than worst case scenario
	A8	12"	5862.15	5862.4	5862.4	0.25	1.17	0.68	0.16	5862.31	GOOD	
	A9	12"	5861.75	5861.95	5861.95	0.20	0.86	0.68	0.16	5861.91	GOOD	
	A10	12"	5862.58	5862.93	5862.93	0.35	1.38	0.68	0.16	5862.74	GOOD	
	A11	12"	5862.2	5862.44	5862.44	0.24	1.13	0.68	0.16	5862.36	GOOD	
	A12	12"	5862.27	5862.48	5862.48	0.21	0.92	0.68	0.16	5862.43	GOOD	

APPENDIX D

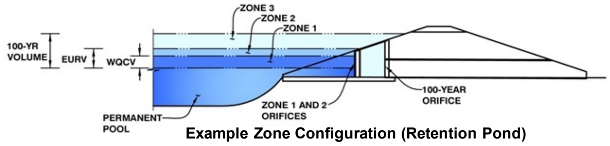
Water Quality and Detention Calculations

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

Project: Park Meadows

Basin ID: Basin A (Entire Contributing Basin)



Example Zone Configuration (Retention Pond)

Depth Increment = ft

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	85.50	acres
Watershed Length =	2,675	ft
Watershed Length to Centroid =	1,300	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	95.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Lone Tree - Municipal Court	

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	3.187	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	8.089	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.84 in.) =	5.400	acre-feet		inches
5-yr Runoff Volume (P1 = 1.1 in.) =	7.369	acre-feet		inches
10-yr Runoff Volume (P1 = 1.33 in.) =	9.101	acre-feet		inches
25-yr Runoff Volume (P1 = 1.68 in.) =	11.777	acre-feet		inches
50-yr Runoff Volume (P1 = 1.97 in.) =	13.985	acre-feet		inches
100-yr Runoff Volume (P1 = 2.28 in.) =	16.367	acre-feet		inches
500-yr Runoff Volume (P1 = 3.07 in.) =	22.393	acre-feet		inches
Approximate 2-yr Detention Volume =	5.187	acre-feet		
Approximate 5-yr Detention Volume =	7.162	acre-feet		
Approximate 10-yr Detention Volume =	8.631	acre-feet		
Approximate 25-yr Detention Volume =	10.085	acre-feet		
Approximate 50-yr Detention Volume =	10.719	acre-feet		
Approximate 100-yr Detention Volume =	11.389	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	3.187	acre-feet
Zone 2 Volume (EURV - Zone 1) =	4.903	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	3.300	acre-feet
Total Detention Basin Volume =	11.389	acre-feet

	Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
5815.25	**Top of Micropool**	--	0.00	--	--	--	2,000	0.046		
	5816	--	0.75	--	--	--	4,956	0.114	2,608	0.060
		--	1.75	--	--	--	16,274	0.374	13,223	0.304
		--	2.75	--	--	--	22,159	0.509	32,440	0.745
		--	3.75	--	--	--	33,927	0.779	60,483	1.388
	5820	--	4.75	--	--	--	36,309	0.834	95,601	2.195
		--	5.75	--	--	--	38,971	0.895	133,241	3.059
		--	6.75	--	--	--	41,615	0.955	173,534	3.984
		--	7.75	--	--	--	44,357	1.018	216,520	4.971
		--	8.75	--	--	--	47,183	1.083	262,290	6.021
	5825	--	9.75	--	--	--	50,305	1.155	311,034	7.140
		--	10.75	--	--	--	53,497	1.228	362,935	8.332
		--	11.75	--	--	--	56,810	1.304	418,088	9.598
		--	12.75	--	--	--	60,210	1.382	476,598	10.941
		--	13.75	--	--	--	63,788	1.464	538,597	12.364
	5830	--	14.75	--	--	--	72,067	1.654	606,525	13.924
		--	15.75	--	--	--	77,290	1.774	681,203	15.638
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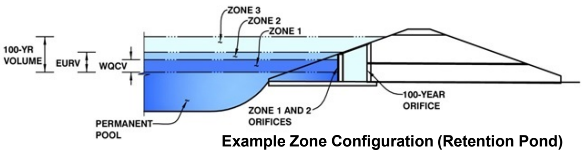
DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: Park Meadows

Basin ID: Basin A (Entire Contributing Basin)



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	5.90	3.187	Orifice Plate
Zone 2 (EURV)	10.56	4.903	Orifice Plate
Zone 3 (100-year)	13.08	3.300	Weir&Pipe (Restrict)
	Total (all zones)	11.389	

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

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

Calculated Parameters for Underdrain

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

Calculated Parameters for Plate

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	9.028E-02	ft^2
Depth at top of Zone using Orifice Plate =	10.93	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	13.00	sq. inches (use rectangular openings)	Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	3.60	7.20					
Orifice Area (sq. inches)	13.00	13.00	13.00					

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

User Input: Vertical Orifice (Circular or Rectangular)

Calculated Parameters for Vertical Orifice

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

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

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	10.66	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	11.99	N/A	feet
Overflow Weir Front Edge Length =	8.00	N/A	feet	Overflow Weir Slope Length =	4.22	N/A	feet
Overflow Weir Grate Slope =	3.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	7.47	N/A	
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	23.48	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	11.74	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

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

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.38	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	3.14	N/A	ft^2
Outlet Pipe Diameter =	24.00	N/A	inches	Outlet Orifice Centroid =	1.00	N/A	feet
Restrictor Plate Height Above Pipe Invert =	24.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Calculated Parameters for Spillway

Spillway Invert Stage=	14.22	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	1.81	feet
Spillway Crest Length =	35.00	feet	Stage at Top of Freeboard =	17.03	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.77	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	15.64	acre-ft

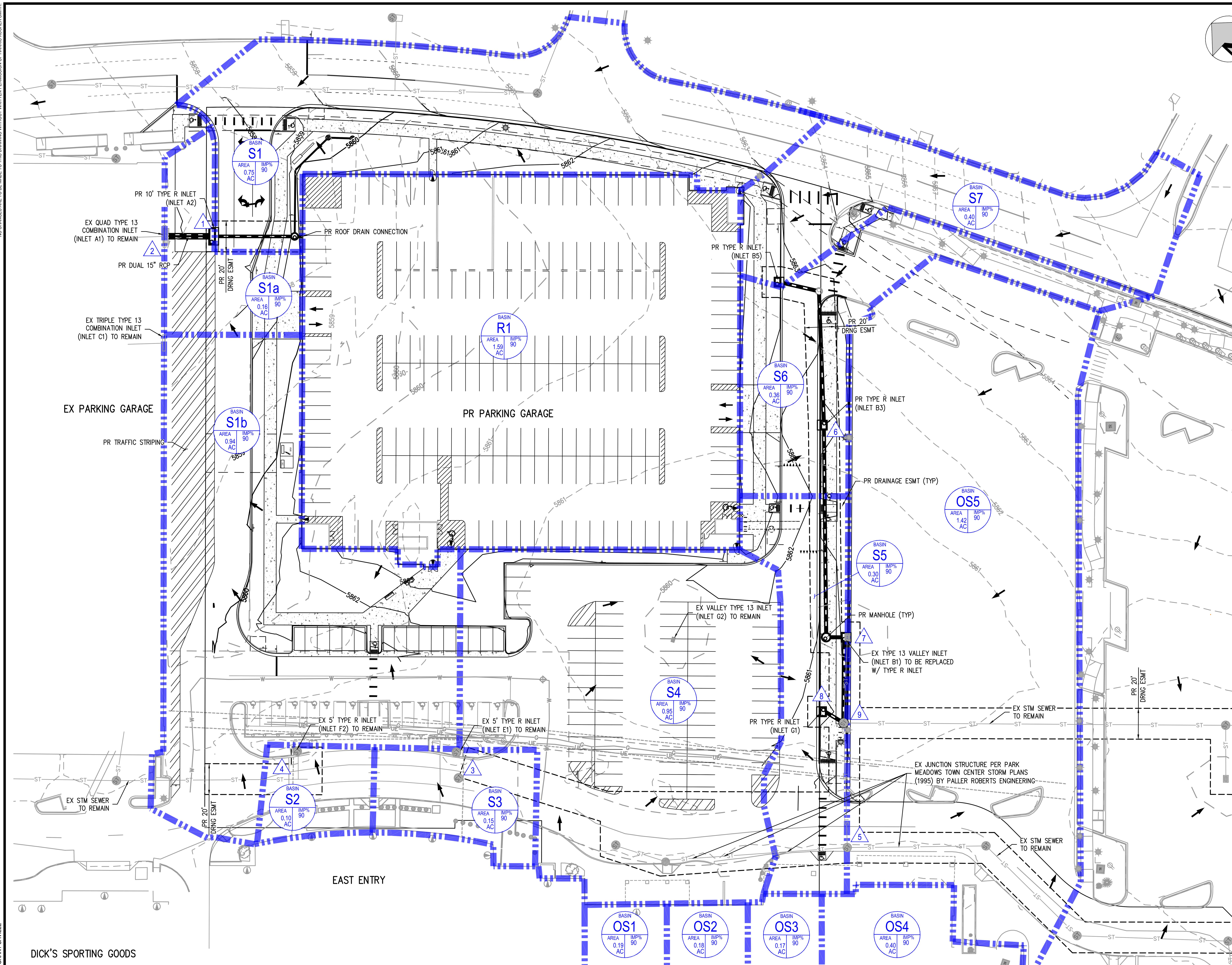
Routed Hydrograph Results

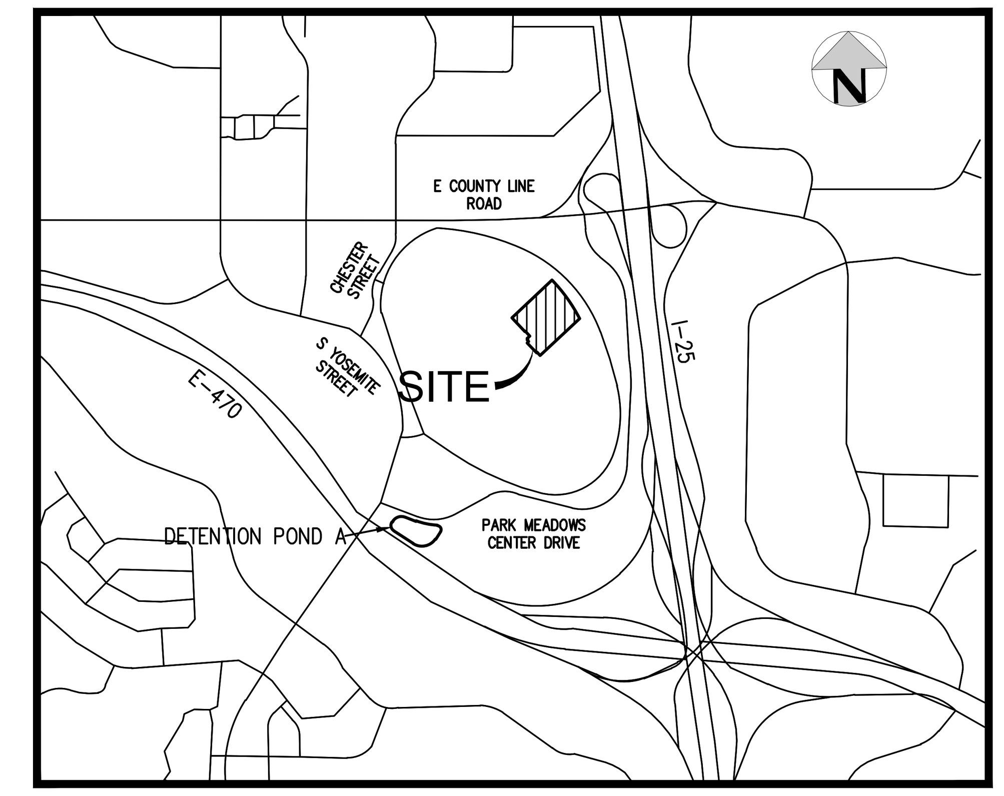
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.84	1.10	1.33	1.68	1.97	2.28	3.07
CUHP Runoff Volume (acre-ft) =	3.187	8.089	5.400	7.369	9.101	11.777	13.985	16.367	22.393
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	5.400	7.369	9.101	11.777	13.985	16.367	22.393
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.9	8.4	22.2	56.6	77.7	104.8	163.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.10	0.26	0.66	0.91	1.23	1.92
Peak Inflow Q (cfs) =	N/A	N/A	101.2	133.9	160.5	212.2	251.1	300.4	408.3
Peak Outflow Q (cfs) =	1.7	3.4	2.5	3.1	4.1	16.3	27.7	45.5	155.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.2	0.3	0.4	0.4	0.9
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.5	1.0	1.8	2.3
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	59	51	57	62	63	62	61	58
Time to Drain 99% of Inflow Volume (hours) =	**41**	63	54	61	67	68	68	68	67
Maximum Ponding Depth (ft) =	5.90	10.56	7.84	9.57	10.95	12.34	13.10	14.06	15.13
Area at Maximum Ponding Depth (acres) =	0.90	1.21	1.02	1.14	1.24	1.35	1.41	1.52	1.70
Maximum Volume Stored (acre-ft) =	3.194	8.100	5.063	6.922	8.579	10.368	11.416	12.812	14.544
	5821.15	5825.81						5829.31	

APPENDIX E

Drainage Plans





VICINITY MAP
SCALE: 1"=1000'

LEGEND:

- BASIN BOUNDARY
- PROPOSED STORM SEWER W/ MH & INLET
- DRAINAGE FLOW
- PROPOSED CONTOURS
- EXISTING CONTOURS
- EXISTING STORM SEWER W/ MH & INLET

BASIN DESIGNATION — BASIN OS 1; BASIN SIZE IN ACRES — AREA 1.23 AC; BASIN IMPERVIOUSNESS — IMPERV. 2%
1 — BASIN DESIGN POINT

DIRECT RUNOFF SUMMARY TABLE			
SUB-BASIN	AREA (AC)	Q5 (CFS)	Q100 (CFS)
S1	0.75	2.16	4.97
S1a	0.16	0.46	1.06
S1b	0.94	2.71	6.23
S2	0.10	0.29	0.66
S3	0.15	0.43	0.99
S4	0.95	2.74	6.29
S5	0.30	0.87	1.99
S6	0.36	1.04	2.39
S7	0.40	1.15	2.65
R1	1.59	4.59	10.53
OS1	0.19	0.55	1.26
OS2	0.18	0.52	1.19
OS3	0.17	0.49	1.13
OS4	0.40	1.15	2.65
OS5	1.42	4.10	9.41

BENCHMARK:

BENCHMARK IS DOUGLAS COUNTY CONTROL POINT 2113021 STAMPED" 2.113021 DC GIS" WITH A PUBLISHED ELEVATION OF 5914.49 FT (NAVD88).

CITY OF LONE TREE

DATE

THESE CONSTRUCTION DRAWINGS HAVE BEEN REVIEWED BY DOUGLAS COUNTY FOR STREET & DRAINAGE IMPROVEMENTS ONLY.

ENGINEERING DIVISION ACCEPTANCE BLOCK

FILEPATH: P:\2023\231016\ENGINEERING\DRAINAGE\DRAINAGE PLAN - P1A.DWG LAYOUT: MAJOR DRAINAGE PLAN 1A
XREFs: cd-stamp, e-base, e-legal, e-util, lone tree acceptance block - street & drainage, p-base, p-base-ph1b[U], p-legal, p-util, p-util-ph1b[U], vicmap
PLOTTED: MON 05/06/24 4:13:03P BY GRANT SAVILLE

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

SCALE: 1" = 30'

DESIGNED BY: LME
CHECKED BY: JDO
DRAWN BY: BS

ISSUE DATE: 03-29-2024

DATE	REVISION COMMENTS
04-05-2024	BID ADDENDUM
05-03-2024	95% PERMIT SET

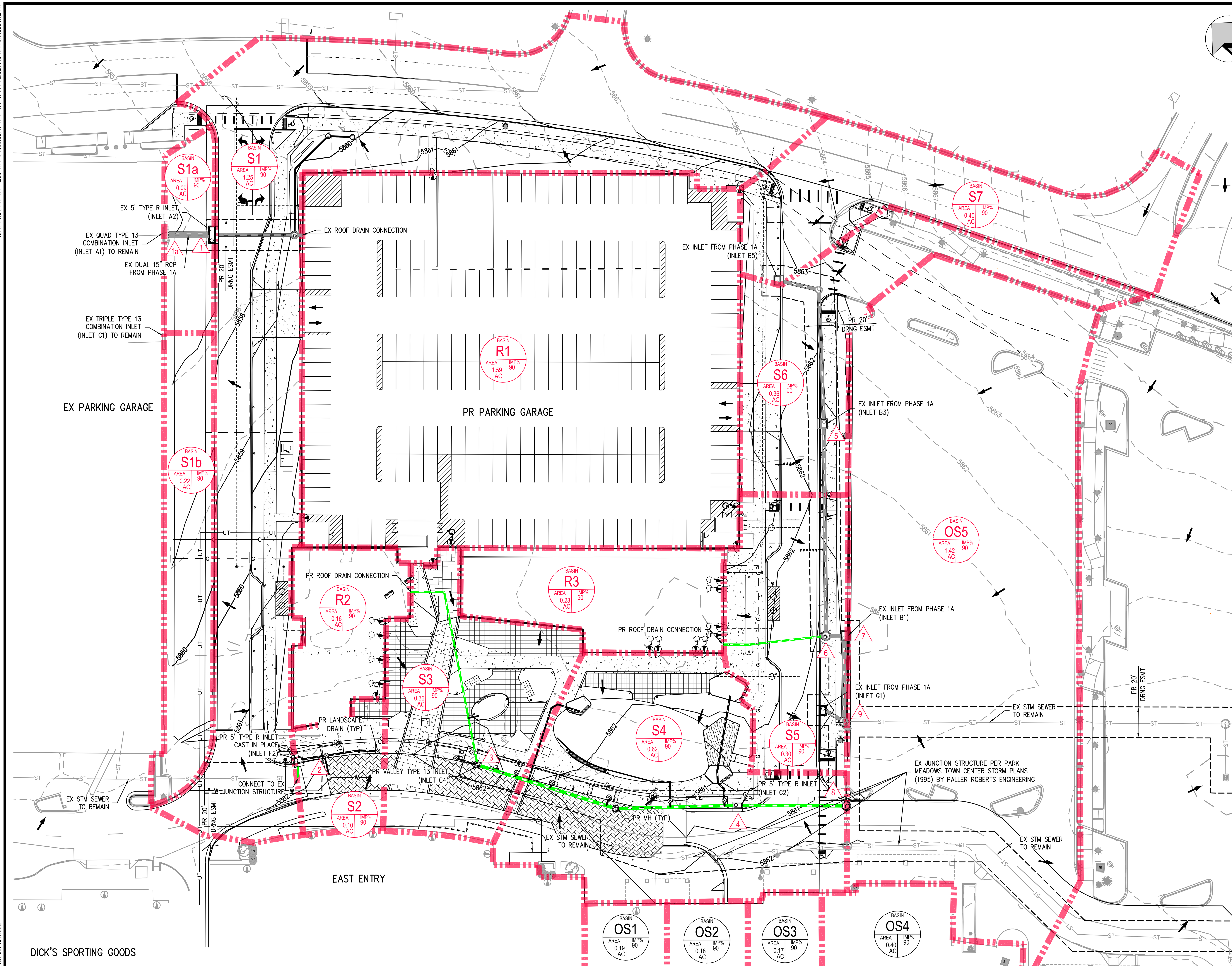
HARRIS KOCHER SMITH
1120 Lincoln Street, Suite 1000
Denver, Colorado 80203
P: 303.623.6300 F: 303.623.6311
HarrisKocherSmith.com

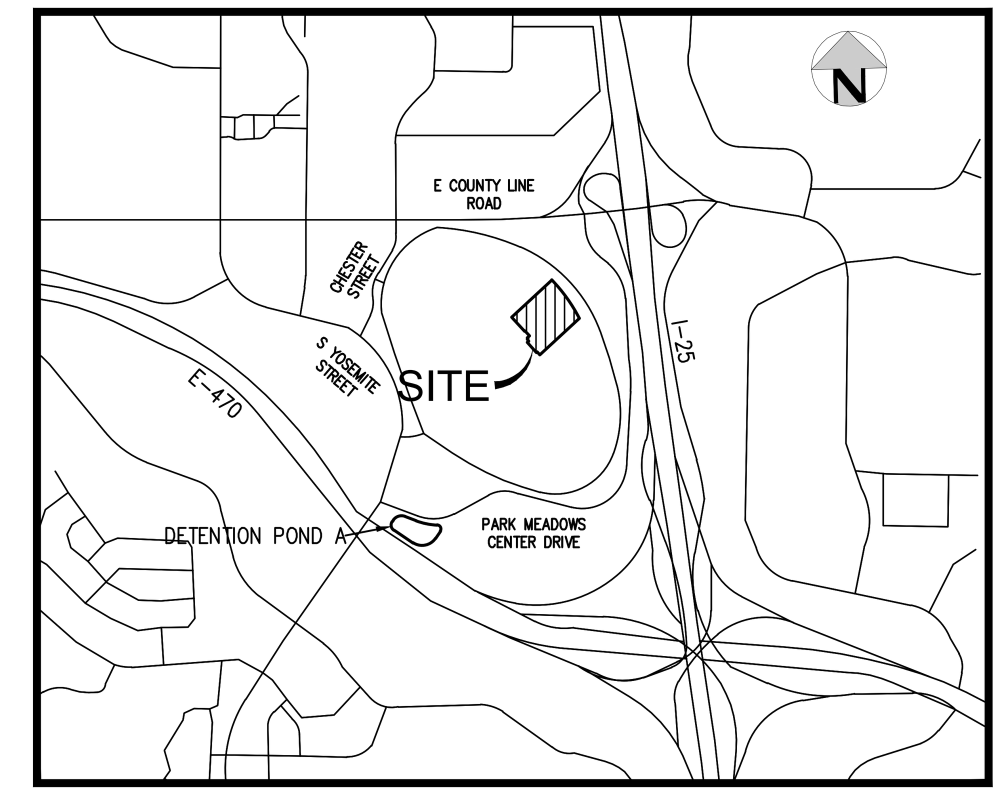
PARK MEADOWS MALL, LLC /
PARK MEADOWS ANCHOR ACQUISITION, LLC

PARK MEADOWS - GARAGE AND RETAIL
MAJOR DRAINAGE PLAN 1A

PRELIMINARY NOT FOR CONSTRUCTION

PROJECT #: 231016
SHEET NUMBER
ST3





VICINITY MAP
SCALE: 1"=1000'

LEGEND:

- BASIN BOUNDARY
- PROPOSED STORM SEWER W/ MH & INLET
- DRAINAGE FLOW
- PROPOSED CONTOURS
- EXISTING CONTOURS
- EXISTING STORM SEWER W/ MH & INLET

BASIN DESIGNATION — OS 1
BASIN SIZE IN ACRES — AREA 1.23 AC
BASIN IMPERVIOUSNESS — IMPERV. 2%
1 — BASIN DESIGN POINT

DIRECT RUNOFF SUMMARY TABLE			
SUB-BASIN	AREA (AC)	Q5 (CFS)	Q100 (CFS)
S1	1.25	3.61	8.28
S1a	0.09	0.26	0.60
S1b	0.22	0.63	1.46
S2	0.10	0.29	0.66
S3	0.36	1.04	2.39
S4	0.62	1.79	4.11
S5	0.30	0.87	1.99
S6	0.36	1.04	2.39
S7	0.40	1.15	2.65
R1	1.59	4.59	10.53
R2	0.16	0.46	1.06
R3	0.23	0.66	1.52
OS1	0.19	0.55	1.26
OS2	0.18	0.52	1.19
OS3	0.17	0.49	1.13
OS4	0.40	1.15	2.65
OS5	1.42	4.10	9.41

BENCHMARK:

BENCHMARK IS DOUGLAS COUNTY CONTROL POINT 2113021 STAMPED" 2.113021 DC GIS" WITH A PUBLISHED ELEVATION OF 5914.49 FT (NAVD88).

CITY OF LONE TREE

DATE

THESE CONSTRUCTION DRAWINGS HAVE BEEN REVIEWED BY DOUGLAS COUNTY FOR STREET & DRAINAGE IMPROVEMENTS ONLY.

ENGINEERING DIVISION ACCEPTANCE BLOCK

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PLOTTED: MON 05/06/24 4:12:44P BY: GRANT SAVILLE

811
Know what's below. Call before you dig.

30 0 30 60
SCALE: 1" = 30'

DESIGNED BY: LME
CHECKED BY: JDO
DRAWN BY: BS

ISSUE DATE: 03-29-2024

DATE	REVISION COMMENTS
04-05-2024	BID ADDENDUM
05-03-2024	95% PERMIT SET

HARRIS KOCHER SMITH
1120 Lincoln Street, Suite 1000
Denver, Colorado 80203
P: 303.623.6300 F: 303.623.6311
HarrisKocherSmith.com

PARK MEADOWS MALL, LLC /
PARK MEADOWS ANCHOR ACQUISITION, LLC

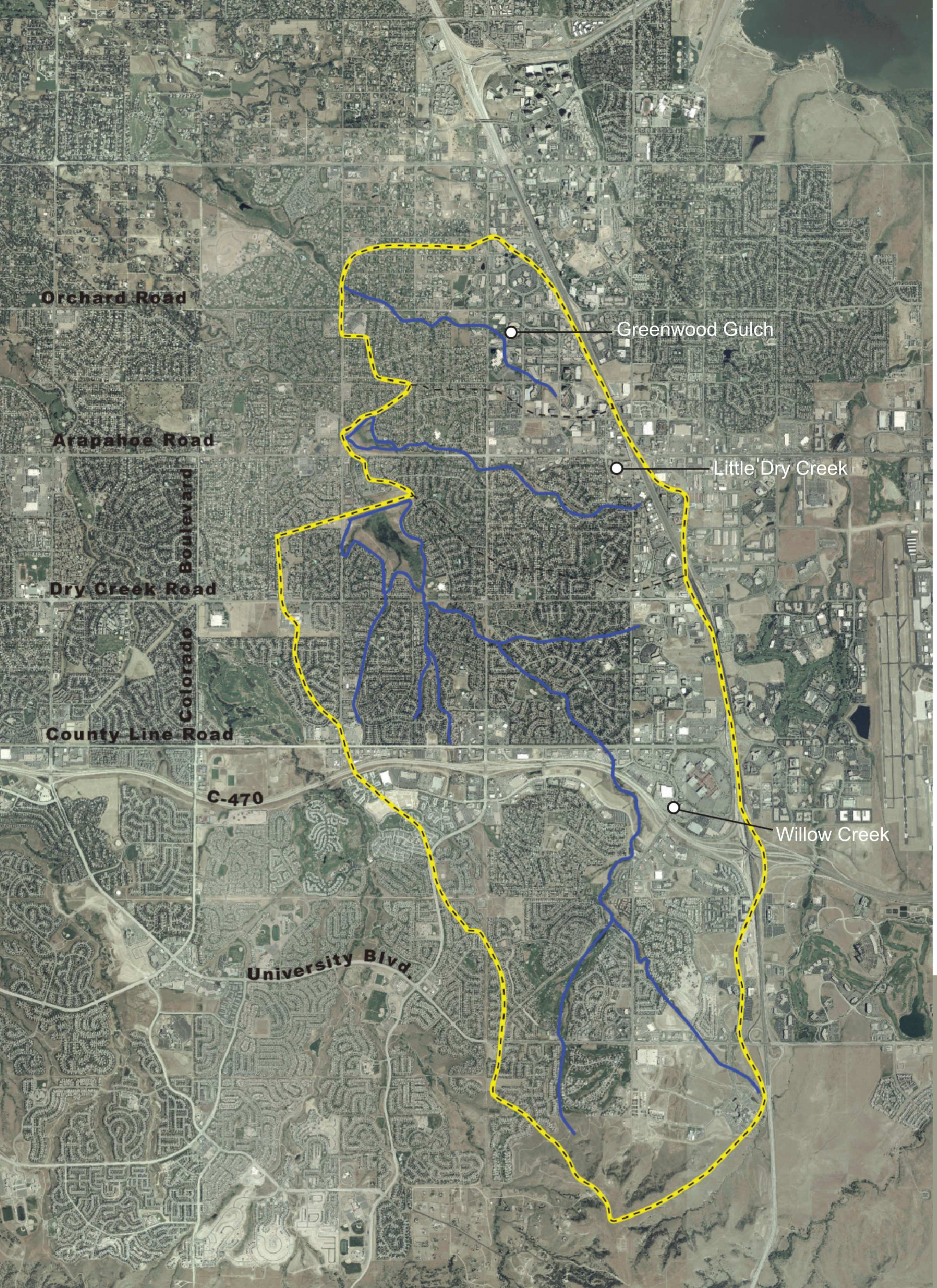
PARK MEADOWS - GARAGE AND RETAIL
MAJOR DRAINAGE PLAN PHASE 1B

PRELIMINARY NOT FOR CONSTRUCTION

PROJECT #: 231016
SHEET NUMBER
ST10

APPENDIX F

Supporting Documents



Willow Creek, Little Dry Creek, and Greenwood Gulch Outfall Systems Planning Study

Planning Report

February 2010

Prepared for

Southeast Metro Stormwater Authority

CITY OF LONE TREE

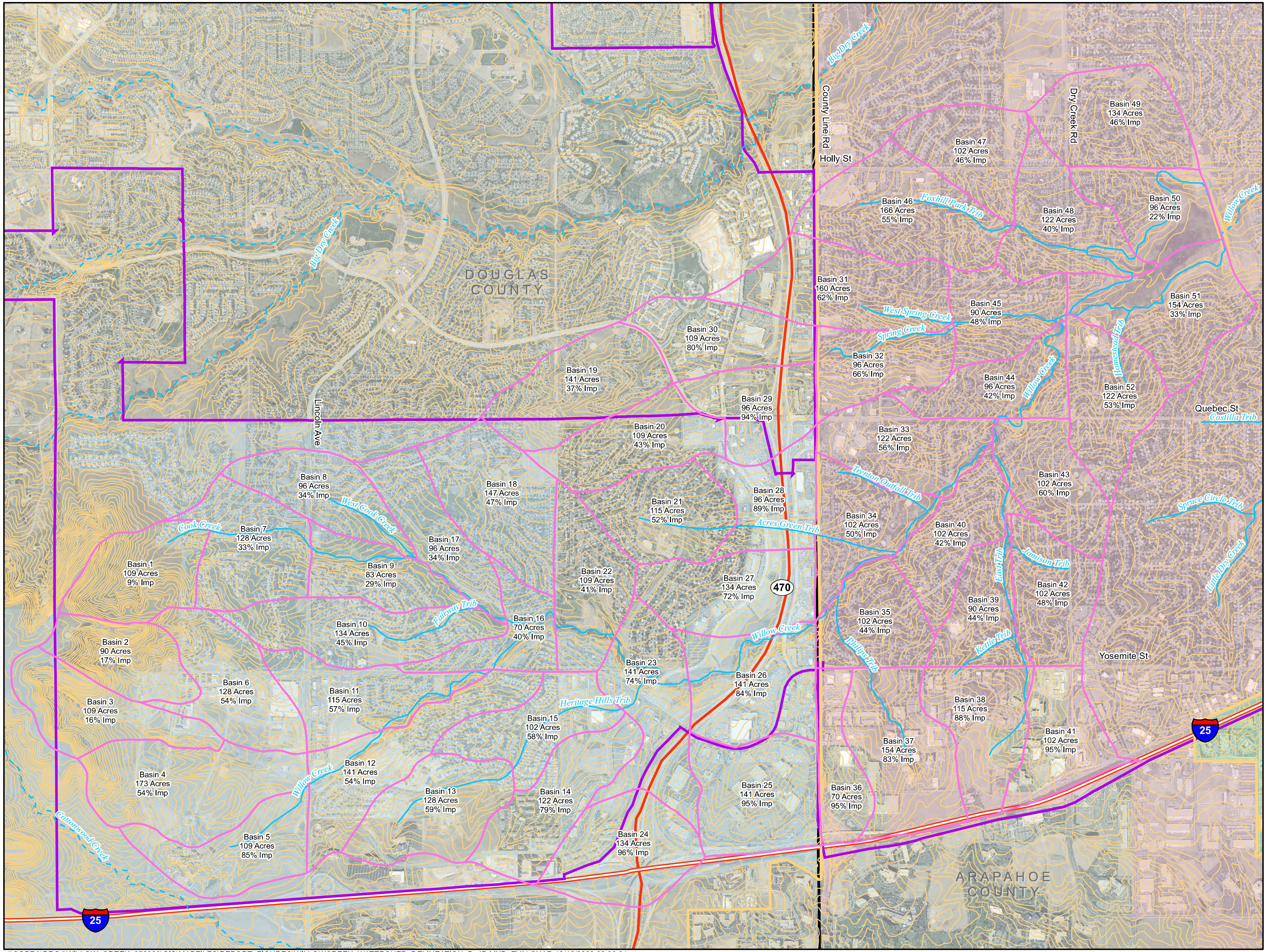
DOUGLAS COUNTY COLORADO

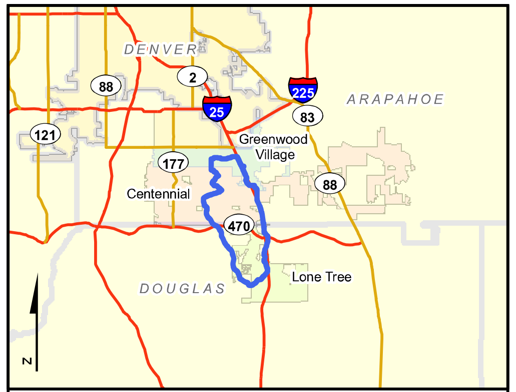
South Suburban PARKS AND RECREATION

Prepared by

CH2MHILL

9191 South Jamaica Street
Englewood, CO 80112-5946





Watershed Location

Willow Creek, Litte Dry Creek, and Greenwood Gulch Outfall Systems Planning Study

Legend

- Studied Stream Reaches
- Non Studied Streams Reaches
- USGS 10ft Contours
- SEMSWA Service Area
- SSPRD Boundary
- County Boundary

Watershed

- Willow Creek

Municipalities

- Centennial
- Greenwood Village
- Lone Tree

W S N E

0 1,000 2,000
Feet

WILLOW CREEK BASIN DELINEATION FIGURE B-4B

CH2MHILL

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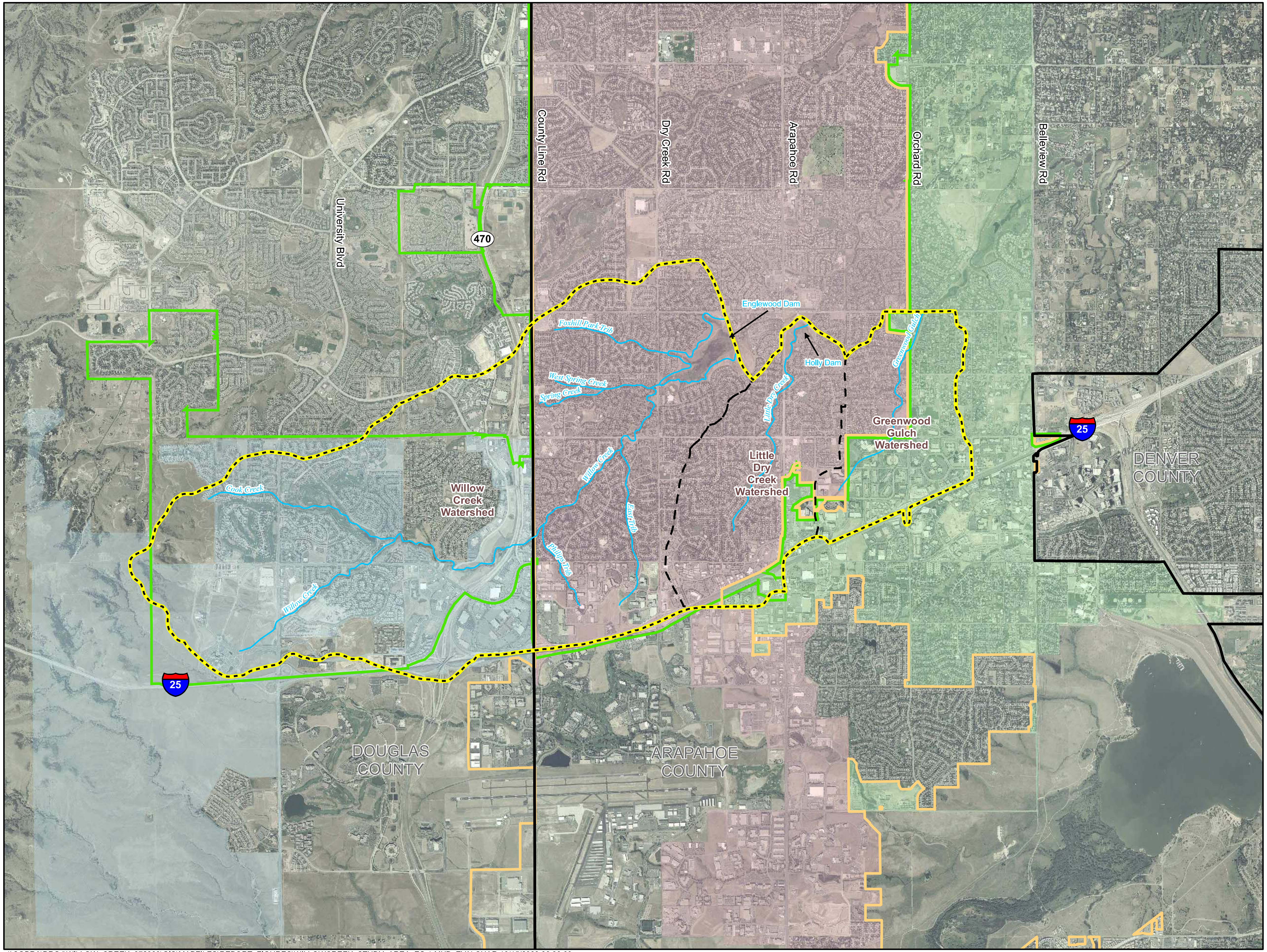
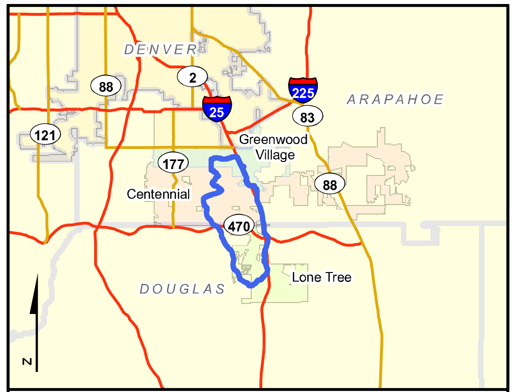




Watershed Location

Willow Creek, Little Dry Creek, and Greenwood Gulch Outfall Systems Planning Study

Legend

- Perennial Streams and Creeks
- Study Area
- Watershed Boundary
- SEMSWA Service Area
- SSPRD Boundary
- County Boundary

Municipalities

- Centennial
- Greenwood Village
- Lone Tree

Note: Urban Drainage and Flood Control District Service Area encompasses entire mapped area shown

W S N E

0 2,000 4,000
Feet

**WILLOW CREEK,
LITTLE DRY CREEK,
AND GREENWOOD GULCH
STUDY AREA
FIGURE ES-1**

CH2MHILL

\\COBRA\PROJ\WILLOW_CREEK_372380\GIS\MAPFILES\REPORT_FIGURES\WILLOWCREEK_STUDY_AREA_ES-1.MXD ZVALCHAR 10/15/2009 08:30:09

Repair Alternative Commentary Page 7

Willow Creek - Willow Creek Part to Park Meadows Drive (Station 130+00 to Station 200+00)

Acres Green Tributary

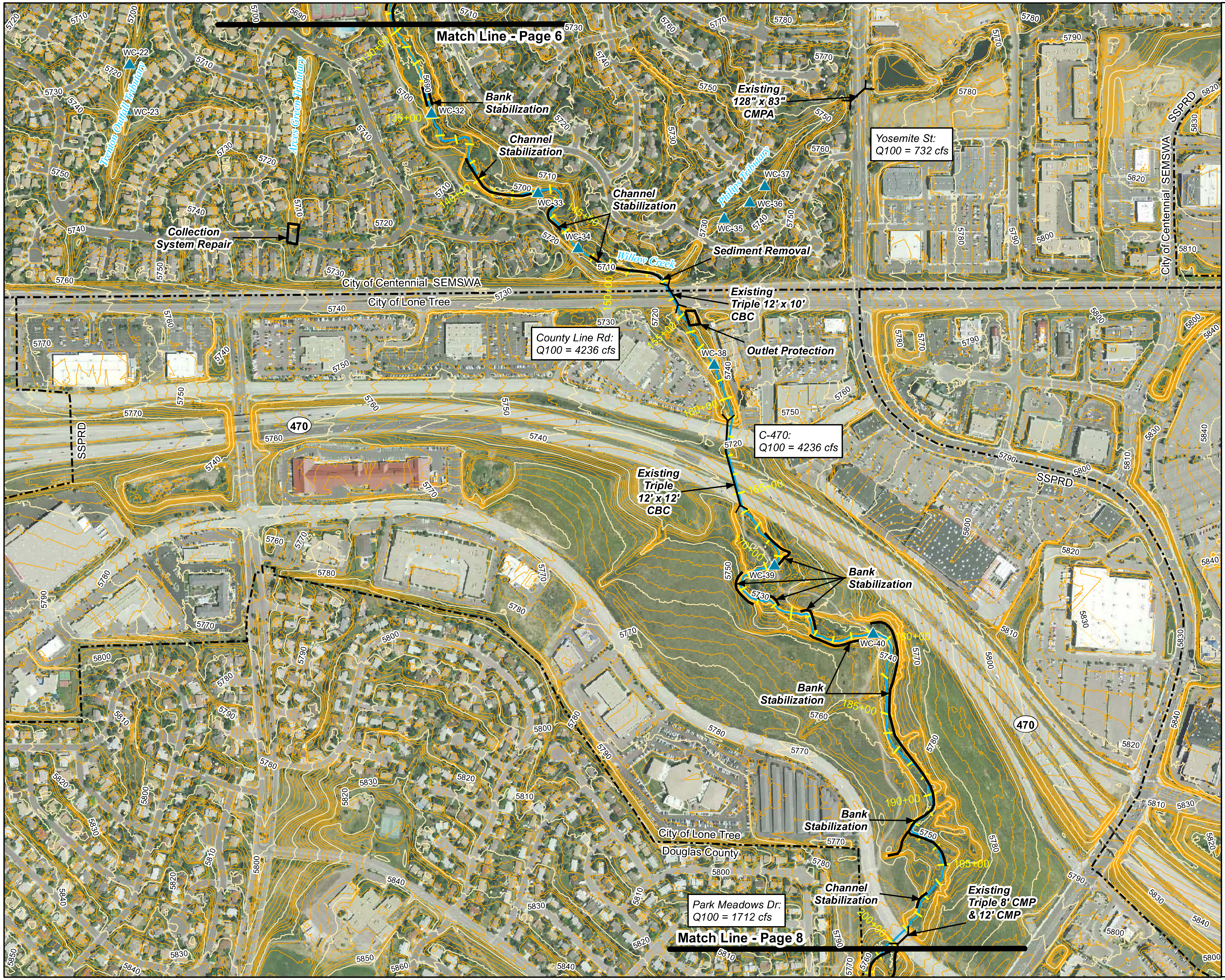
Reach Description - Willow Creek, UDFCD Drainageway ID 5402, has the largest contributing area to the downstream project limit of Holly Street. In general, flow in the Willow Creek watershed is from the south to the north and has approximately 15.4 miles of stream length including tributaries. The Willow Creek drainageway includes a series of tributary streams that make up the stream network for the watershed. The channel continues toward the northwest and parallels the north side of the Willow Creek Park. The channel through this reach is similar to the channel immediately upstream with large trees and mature vegetation. Willow Creek crosses Mineral Drive and flows toward the Quebec Street crossing and the confluence with the East Tributary. The reach between Mineral Drive and Quebec Street also has very mature vegetation and large trees. There are locations of bank erosion mostly located at the outside of channel bends. The channel grade has been stabilized by a large concrete baffle shoot drop structure located downstream of the confluence with the East Tributary.

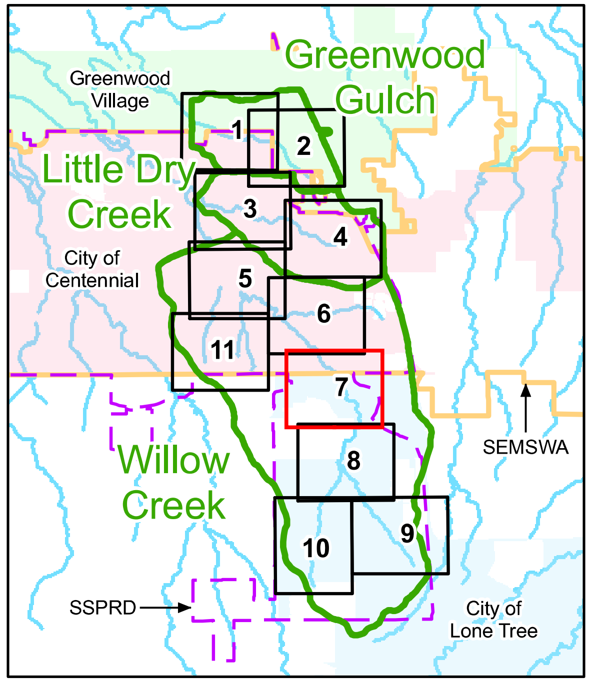
The East Tributary to Willow Creek flows from east to west and originates in the Panorama Park office park. The runoff from the commercial area is collected in the Panorama Park stormwater detention pond just east of Yosemite Street. The pond discharges to the East Tributary into a linear park that is bordered by single family homes. For much of the channel between Yosemite and Rosemary Way the low flow channel is boulder lined, and the overbanks are maintained turf grass. Through this reach there are multiple pedestrian crossings of the channel as well as grouted boulder drop structures. Downstream of the Rosemary Way crossing the channel parallels Jamison Drive and is no longer in a linear park. The channel between the confluence with the main stem of Willow Creek and Rosemary Way is trapezoidal in shape with an approximately 8' wide bottom and native grass lined channel banks. There are a few drop structures that are providing channel grade control through this reach.

Willow Creek Repair Alternative Improvements - Channel bank stabilization is required in multiple locations of Willow Creek, most frequently along the outside of channel bends, the existing grade control structures . Sediment deposition needs to be removed at the outfall of the County Line box culvert. Outfall protection is required at the pipe outfall from the eastern collection system just upstream of County Line Road.

Acres Green Tributary Repair Alternative Improvements - Perform a collection system repair at Phillips Circle to increase the capacity.

Drainageway	Jurisdiction	Item	Unit	Quantity	Unit Cost	Total Cost	Reach Cost
Acres Green Tributary	Centennial/SEMSWA	Increase Collection System Capacity	LS	1	$ 50,000	$ 50,000	
		Mobilization Costs (5% of Drainageway Costs)				$ 2,500	
		Utility Costs (5% of Drainageway Costs)				$ 2,500	
		Contingency (30%)				$ 16,500	
		Engineering, Admin, Legal Services (20%)				$ 11,000	**$ 82,500**
Willow Creek (STA 130+00 to 153+00)	Centennial/SEMSWA	Soil Riprap Armoring	CY	500	$ 65	$ 32,500	
		Earthwork (Haul off site)	CY	950	$ 20	$ 19,000	
		Revegetation	AC	0.25	$ 2,500	$ 625	
		Low Flow Channel Repair	LF	1000	$ 100	$ 100,000	
		Mobilization Costs (5% of Drainageway Costs)				$ 7,606	
		Utility Costs (5% of Drainageway Costs)				$ 7,606	
		Contingency (30%)				$ 50,201	
		Engineering, Admin, Legal Services (20%)				$ 33,468	
		Operations & Maintenance (50-years)	LS	1	$ 107,900	$ 107,900	**$ 358,906**
Willow Creek (STA 153+00 to 200+00)	City of Lone Tree	Low Flow Channel Repair	LF	250	$ 100	$ 25,000	
		Water Quality Outlet Structure	EA	1	$ 20,000	$ 20,000	
		Earthwork (Haul off site)	CY	41000	$ 20	$ 820,000	
		Soil Riprap Armoring	CY	10900	$ 65	$ 708,500	
		Outlet Protection	EA	1	$ 25,000	$ 25,000	
		Revegetation	AC	4.5	$ 2,500	$ 11,250	
		Mobilization Costs (5% of Drainageway Costs)				$ 80,488	
		Utility Costs (5% of Drainageway Costs)				$ 80,488	
		Contingency (30%)				$ 531,218	
		Engineering, Admin, Legal Services (20%)				$ 354,145	
		Operations & Maintenance (50-years)	LS	1	$ 218,100	$ 218,100	**$ 2,874,188**





LEGEND

- Jurisdictional Boundary
- Watershed Boundary
- Existing Detention

Existing Drop Structures

- Greenwood Gulch
- Little Dry Creek
- Willow Creek

Alternatives

- Repair Alternative

N W E S

0 250 500
Feet

Repair Alternative Willow Creek

Acres Green Tributary

Trenton Outfall Tributary

Phillips Tributary

Repair Alternative   Commentary Page 8

Willow Creek - Park Meadows Drive to Upstream of Yosemite Street (Station 200+00 to Station 268+00)

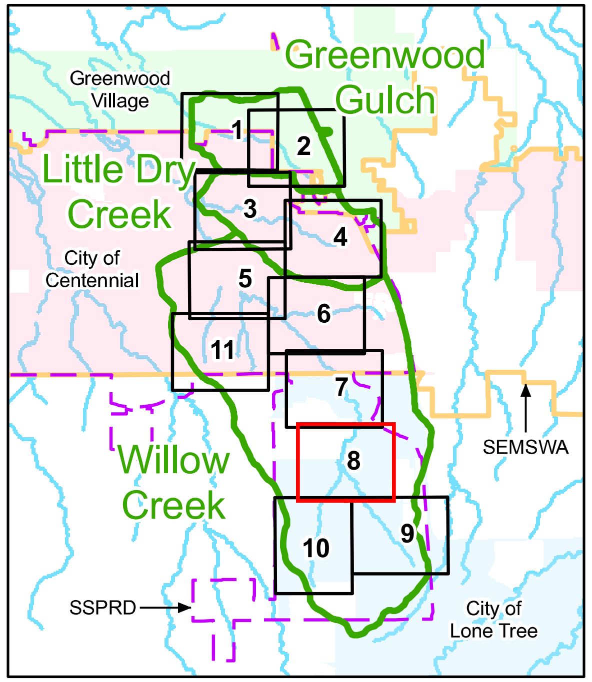
Cook Creek - Station 0+00 to Station 25+00

Reach Description - Cook Creek is an approximately 1.6 mile long tributary to Willow Creek located entirely in the City of Lone Tree. The upper reaches of Cook Creek are bordered by single family residential development. In the past, the channel was been improved with grouted boulder drop structures and turf grass overbanks. Much of the channel travels through Lone Tree Golf Course, where the channel is characterized by dense willows along the water edge and a series of drop structures to control the grade. The channel flows into a large storm water detention pond that has a large permanent pool and is a feature on the golf course. The outfall of the pond passes under Lone Tree Parkway and discharges adjacent to the Lone Tree Civic Center. Cook Creek continues to the north through an open space area and confluences with the main stem of Willow Creek at Cook Creek Park located North of Lone Tree Parkway and West of Yosemite St. The Main Stem of Willow Creek has a bike trail that parallels the channel from this reach to the downstream limits of the study at Englewood Dam. The channel through this reach is deep and narrow with locations of low flow channel degradation and bank erosion. Vegetation in this reach is mature with various tree species, willows, and native grasses. The channel continues to the north and crosses both Maximus Drive and Park Meadows Drive. As the channel leaves the open space and enters a more urbanized setting the vegetation along the channel is characterized by more grasses and fewer willows and trees.

Cook Creek Repair Alternative Improvements - Stabilize the channel banks between stations 25+00 to 30+00. Complete costs for this repair are included on Sheet 10. Only O&M costs are accounted for on this sheet.

Willow Creek Repair Alternative Improvements - Repair the channel between stations 247+30 and 249+30. Install a water quality outlet structure at the existing Willow Creek Regional Pond outlet. Stabilize the bank between stations 263+10 and 264+90 and between stations 266+20 and 267+50. Stabilize the low flow channel between stations 203+00 and 206+55, 209+20 and 210+60, and between stations 228+50 and 230+30. Stabilize the bank between stations 212+50 and 216+00, including the tributary coming in from the southwest at station 215+00. Stabilize the banks between stations 218+00 and 220+00, and between stations 220+90 and 222+30. Stabilize the low flow channel between stations 200+00 and 203+00, including the Heritage Hills Tributary. Stabilize the bank between stations 223+00 and 224+45, and between stations 230+50 and 232+30. Stabilize the low flow channel between stations 234+00 and 238+40.

Drainageway	Jurisdiction	Item	Unit	Quantity	Unit Cost	Total Cost	Reach Cost
Cook Creek (STA 0+00 to 26+00)	City of Lone Tree	Operations and maintenance (50 years)	LS	1	$ 122,000	$ 122,000	**$ 122,000**
Willow Creek (STA 203+00 to 232+00)	Douglas County	Low Flow Channel Repair	LF	1650	$ 100	$ 165,000	
		Earthwork (Haul off site)	CY	13500	$ 20	$ 270,000	
		Soil Riprap Armoring	CY	4500	$ 65	$ 292,500	
		Revegetation	AC	2	$ 2,500	$ 5,000	
		Mobilization Costs (5% of Drainageway Costs)				$ 36,625	
		Utility Costs (5% of Drainageway Costs)				$ 36,625	
		Contingency (30%)				$ 241,725	
		Engineering, Admin, Legal Services (20%)				$ 161,150	
		Operations & Maintenance (50-years)	LS	1	$ 136,000	$ 136,000	**$ 1,344,625**
Willow Creek (STA 232+00 to 268+00)	City of Lone Tree	Low Flow Channel Repair	LF	600	$ 100	$ 60,000	
		Earthwork (Haul off site)	CY	2970	$ 20	$ 59,400	
		Soil Riprap Armoring	CY	1155	$ 65	$ 75,075	
		Revegetation	AC	0.5	$ 2,500	$ 1,250	
		Water Quality Outlet Structure	EA	1	$ 20,000	$ 20,000	
		Mobilization Costs (5% of Drainageway Costs)				$ 10,786	
		Utility Costs (5% of Drainageway Costs)				$ 10,786	
		Contingency (30%)				$ 71,189	
		Engineering, Admin, Legal Services (20%)				$ 47,460	
		Operations & Maintenance (50-years)	LS	1	$ 168,900	$ 168,900	**$ 524,846**



LEGEND

- Jurisdictional Boundary
- Watershed Boundary
- Existing Detention

Existing Drop Structures

- Greenwood Gulch
- Little Dry Creek
- Willow Creek

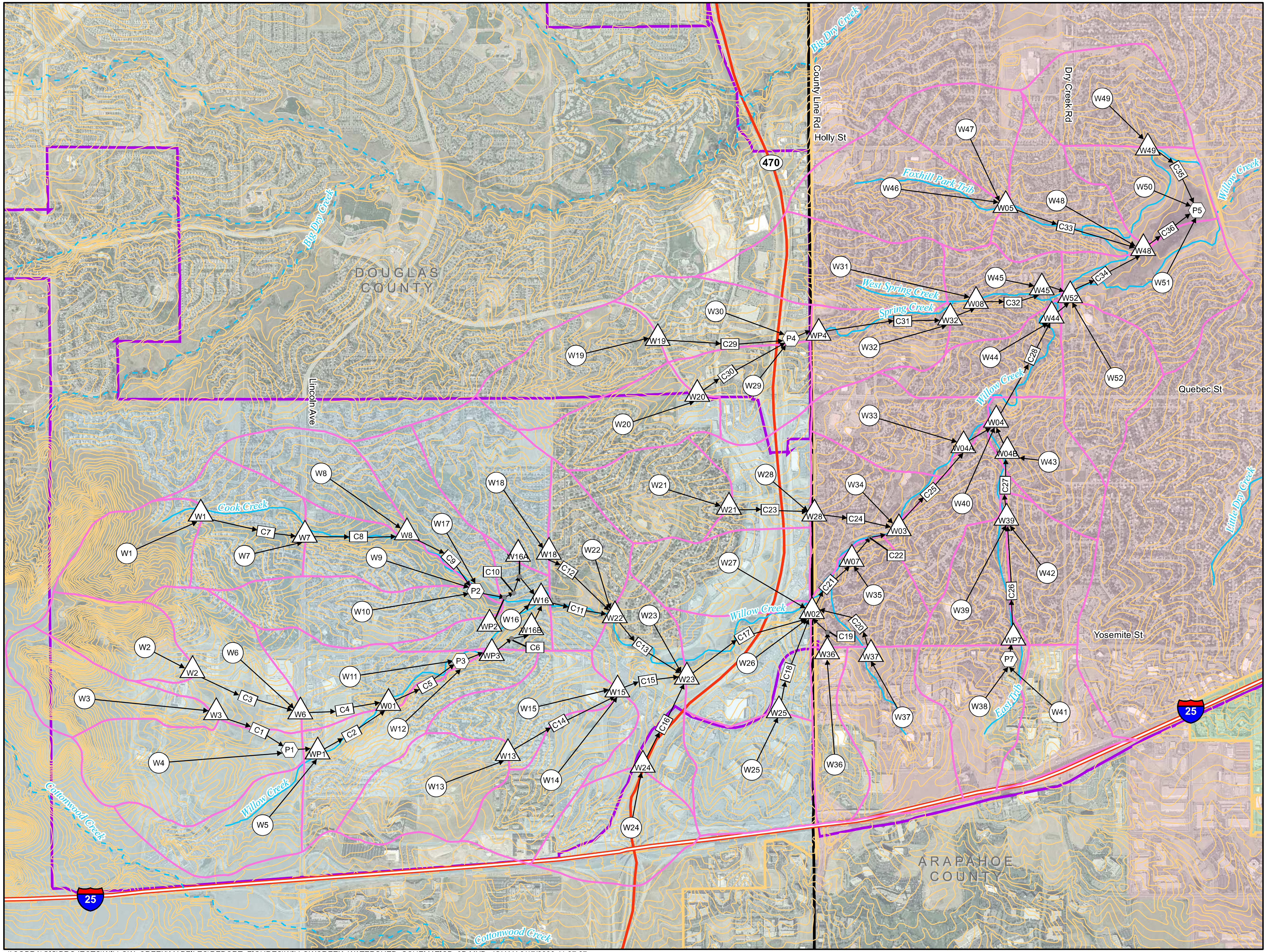
Alternatives

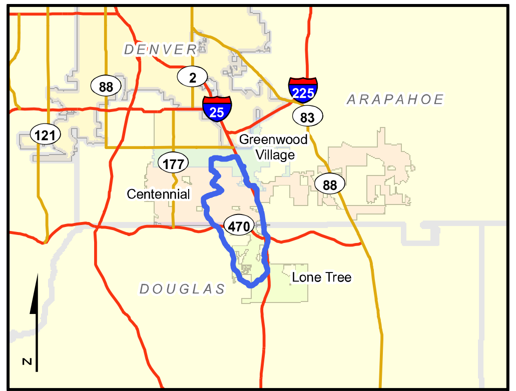
- Repair Alternative

Repair Alternative
Willow Creek
Heritage Hills Tributary
Fairway Tributary
Cook Creek
Page 8

0 250 500
Feet

CH2MHILL





Watershed Location

Willow Creek, Litte Dry Creek, and Greenwood Gulch Outfall Systems Planning Study

Legend

- Studied Stream Reaches
- Non Studied Stream Reaches
- USGS 10ft Contours
- County Boundary
- SEMSWA Service Area
- SSPRD Boundary

Watershed

- Willow Creek

Municipalities

- Centennial
- Greenwood Village
- Lone Tree

- Conveyance Element
- Pond
- Flow Junction
- Flow Direction
- Basin

W N E S

0 1,000 2,000
Feet

WILLOW CREEK MODEL SCHEMATIC FIGURE B-6B

CH2MHILL

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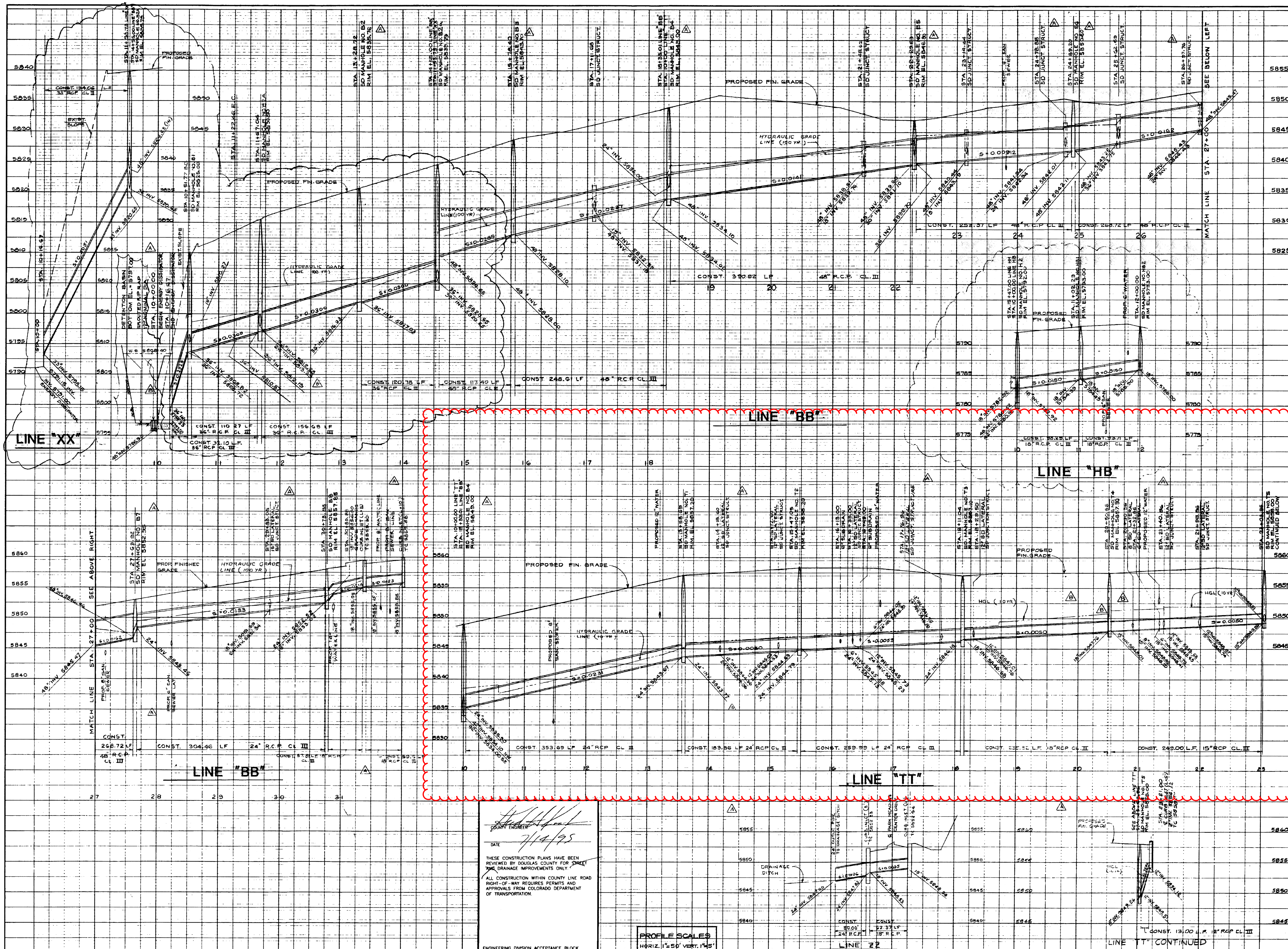


COUNTY ENGINEER

DATE 7/14/95

THESE CONSTRUCTION PLANS HAVE BEEN REVIEWED BY DOUGLAS COUNTY FOR ~~STREET AND~~ DRAINAGE IMPROVEMENTS ONLY.

ALL CONSTRUCTION WITHIN COUNTY LINE ROAD RIGHT-OF-WAY REQUIRES PERMITS AND APPROVALS FROM COLORADO DEPARTMENT OF TRANSPORTATION.

ENGINEERING DIVISION ACCEPTANCE BLOCK

NO.	DATE	REVISION	DATE	ISSUED FOR
			7-13-95	COUNTY APPROVAL
			6-6-95	3RD PLAN CHECK
			4-27-95	CONSTRUCTION
C	7-6-95	SUPPLEMENT C	4-7-95	SECOND PLAN CHECK
B	6-14-95	SUPPLEMENT B	3-17-95	BIDDING
A	4-27-95	SUPPLEMENT A	2-15-95	FIRST PLAN CHECK

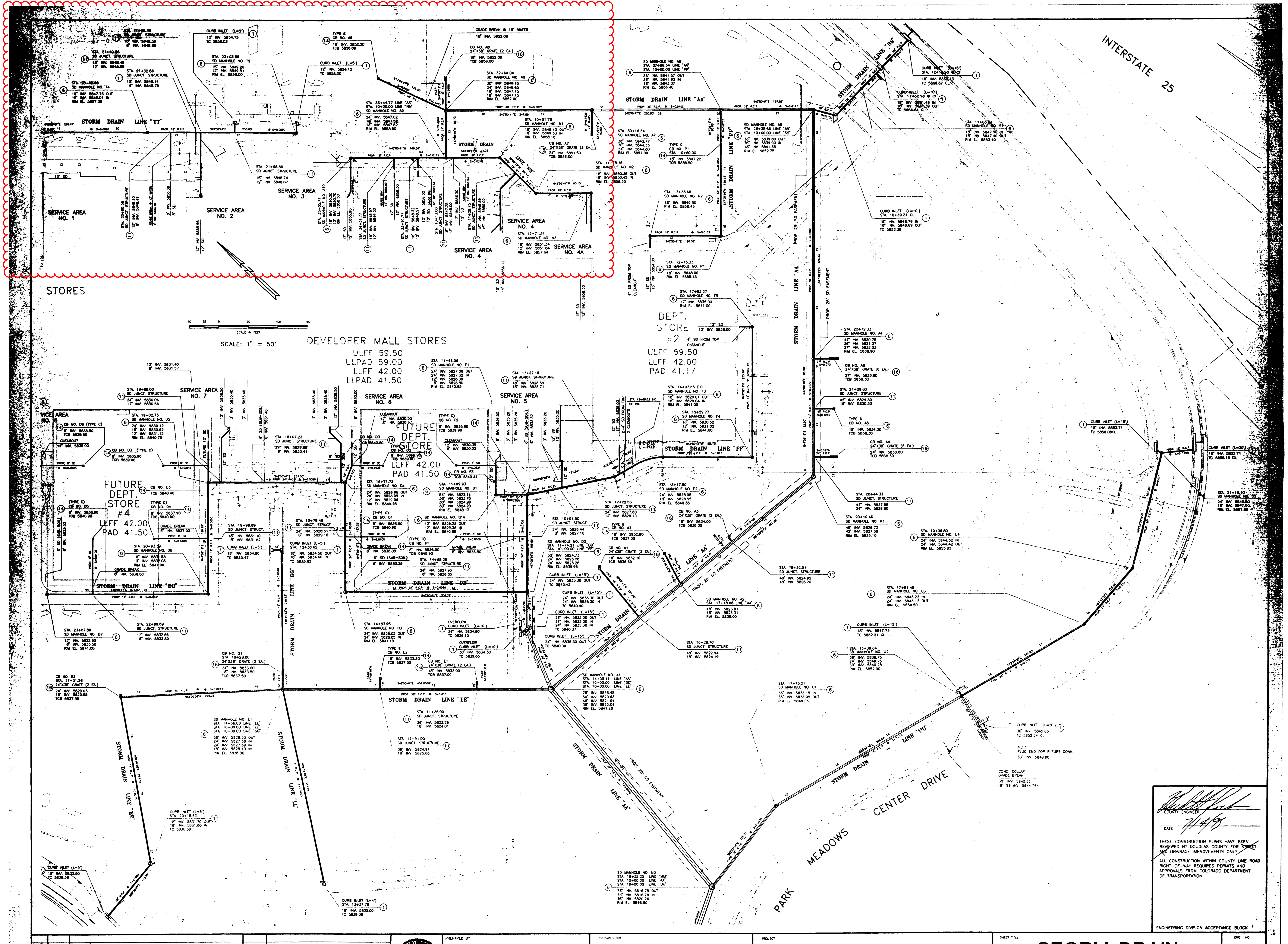
PREPARED BY
PALLER-ROBERTS ENGINEERING, INC.
CONSULTING CIVIL ENGINEERS
5701 SLAUSON AVENUE
SUITE 208
CULVER CITY, CALIFORNIA, 90230
PHONE (310) 641-1853

PREPARED FOR
PARK MEADOWS MALL, LTD.
c/o THE HAHN COMPANY
4350 LA JOLLA VILLAGE DRIVE
SUITE 700
SAN DIEGO, CALIFORNIA, 92122-1233
TELE. (619) 546-1001

PROJECT
PARK MEADOWS
DOUGLAS COUNTY, COLORADO

SHEET TITLE
STORM DRAIN PROFILES

DWG. NO.
SD-8



		7-13-95	COUNTY APPROVAL
		6-06-95	3rd PLAN CHECK
7-06-95	SUPPLEMENT C	4-27-95	CONSTRUCTION
6-14-95	SUPPLEMENT B	4-07-95	2nd PLAN CHECK
4-27-95	SUPPLEMENT A	2-15-95	PLAN CHECK
DATE	REVISION	DATE	ISSUED FOR

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PROJECT
PARK MEADOWS
DOUGLAS COUNTY, COLORADO

SHEET TITLE
STORM DRAIN
LINES "AA","DD","EE","FF","GG","LL","SS" AND "UU"

DWG. NO.
SD-3