Phase III Drainage Report

KING SOOPERS STORE #165
Lot 1, Dawson Trails Filing No. 2, Amendment 4
Castle Rock, CO

PREPARED FOR:
King Soopers, Inc.
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PREPARED BY:
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Tel: (303) 770-8884
Attn: Jennifer Romano, PE

DATE:
December 12, 2025

REVISED:
June 12, 2026

ENGINEER'S STATEMENT

I affirm that this report and plan for the Phase III drainage design for King Soopers Store #165 was prepared by me (or under my direct supervision) in accordance with the provisions of the Town of Castle Rock Drainage Design and Technical Criteria for the owners thereof. I understand that the Town of Castle Rock does not and will not assume liability for drainage facilities designed by others.

Jennifer Romano, PE #44401 Date
For and on behalf of Galloway & Company, LLC

DEVELOPER'S CERTIFICATION

"King Soopers, Inc. hereby certifies that the drainage facilities for King Soopers Store #165 shall be constructed according to the design presented in this report. I understand that the Town of Castle Rock does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that the Town of Castle Rock reviews drainage plans pursuant to the Municipal Code; but cannot, on behalf of King Soopers Store #165, guarantee that final drainage design review will absolve King Soopers, Inc. and/or their successors and/or assigns of future liability for improper design."

Authorized Signature Date
King Soopers, Inc.

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I. INTRODUCTION

LOCATION

King Soopers Store #165 – referred to herein as "site" or "project site" – is located at the southwest corner of Gambel Ridge Boulevard and Dawson Trails Boulevard at Lot 1, Dawson Trails Filing No. 2, Amendment 4 in Castle Rock, Colorado. The project is located in Section 22, Township 8 South, Range 67 West of the 6th P.M., Town of Castle Rock, County of Douglas, State of Colorado. The site consists of vacant land covered by native grasses (80% vegetative density). The site is bounded by Gambel Ridge Boulevard right-of-way to the west and north, Dawson Trails Boulevard right-of-way to the east, and Territorial Road to the north, 1st Street right-of-way to the east, and undeveloped property to the south. A vicinity map is included in Appendix A for reference.

DESCRIPTION OF PROPERTY

The project site covers ±21.5 acres. It is currently zoned Planned Development Plan (PDP); rezoning is not required with this development as grocery, fuel, and retail are allowed commercial uses under the Dawson Trails PDP. The area of disturbance is estimated to be approximately 17.58 acres. The site is currently undeveloped with slopes ranging from 1% to 25%. Existing groundcover consists of native grasses with 80% vegetative cover. The existing site imperviousness is 5%.

According to the USDA Natural Resources Conservation Service (NRCS) Web Soil Survey for Castle Rock Area, Colorado, the site contains a mix of soil types and hydrologic soil groups including:

- Bresser sandy loam, cool, 1 to 3 percent slopes, Hydrologic Soil Group B
- Loamy alluvial sand, Hydrologic Soil Group C
- Sampson loam, Hydrologic Soil Group B

The predominant on-site hydrologic soil group is "C". Group C soils have a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission. Refer to Appendix A for soil survey information.

The project site is not impacted by a FEMA designated floodplain (refer to Appendix A for FEMA FIRMette map).

According to the Geotechnical Report the site generally consists of 4 layers: fill material (sand with varying amounts of clay, silt and gravel), native sand, native clay, and bedrock all with low to moderate swell potential. Groundwater was encountered in two borings between 32 and 35 feet below existing grade. Groundwater is not anticipated to impact the proposed buildings or stormwater facilities.

PROPOSED DEVELOPMENT

Proposed improvements include a King Soopers grocery store, King Soopers fueling facility, three tracts that will be developed as retail and restaurant uses in the future, paved internal driveways, asphalt parking lot, concrete sidewalks, utility infrastructure, and landscaping. Landscaping will consist of mulch, seeded

areas, shrubs, trees, and sod areas consistent with commercial development. The development will be served by three access points from Dawson Trails Boulevard, two access points from Gambel Ridge Boulevard, and one access point from the future public road along the south side of the site.

DRAINAGE STUDIES RELEVANT TO THE SITE

There are several existing drainage studies applicable to the site:

- Crystal Valley Interchange Public Improvement Construction Plans (PICP), Town of Castle Rock Department of Public Works, prepared April 19, 2024. These PICPs outline the hydraulic and roadway design for the new Crystal Valley Parkway interchange including the connection to Dawson Trails Boulevard.

- Phase III Drainage Report for Dawson Trails Boulevard, Filing 1 Infrastructure, CORE Consultants, Inc., approved April 21, 2025. The main objectives of the study were to provide a basis of design for the regional infrastructure and detention facilities for Dawson Trails Filing No. 1.

- Phase III Drainage Report for Dawson Trails Filing No. 2, EMK Consultants, Inc., September 9, 2025. The main objectives of the study were to provide a basis of design for the regional infrastructure and detention facilities for Dawson Trails Filing No. 2.

II. HISTORIC DRAINAGE

OVERALL BASIN DESCRIPTION

The project site lies within the Gambel Ridge Tributary watershed. Per the *Phase III Drainage Report for Dawson Trails Boulevard, Filing 1 Infrastructure* prepared by CORE Consultants, Inc., the site lies within existing major drainage basin EX-1. Flows from Basin EX-1 channelize into the existing Gambel Ridge Tributary and are collected via an existing triple 6’ x 9’ CMPA culvert under the BNSF Railway. From there runoff ultimately discharges to East Plum Creek. Refer to Appendix F for excerpts from this report.

The site is identified as Drainage Basin C-4 in the *Phase III Drainage Report for Dawson Trails Filing No. 2* prepared by EMK Consultants, Inc. Basin C-4 was designed with a build-out imperviousness of 75% and is tributary to Regional Pond C1, which is located immediately east of the site at the southeast corner of Dawson Trails Boulevard and Gambel Ridge Boulevard. Refer to Appendix F for excerpts from this report.

III. DESIGN CRITERIA

REGULATION

The design of the stormwater management system for this project was prepared in accordance with the criteria set forth in the Town of Castle Rock *Storm Drainage Design and Technical Criteria Manual* and the Mile High Flood District *Urban Storm Drainage Criteria Manual*.

HYDROLOGIC CRITERIA

The drainage calculations are based on the Town of Castle Rock *Storm Drainage Design and Technical Criteria Manual*. The design point rainfall values listed below were obtained from Table 6-1 of the SDDTCM for the 60-minute storm duration.

Table 1 – Precipitation Data

1-Hour Point Rainfall Values for the Town of Castle Rock (inches)				
2	**5**	**10**	**50**	**100**
1.06	1.43	1.66	2.26	2.60

The time of concentration for each basin was calculated using the SF-2 form, which is based on the Section 6.3.2 of the SDDTCM and the Mile High Flood District *Urban Storm Drainage Criteria Manual, Chapter 6* (refer to Appendix B for t_c calculations).

The rational method was used to calculate peak flows as the tributary areas are less than 100 acres. The rational method has proven to be accurate for basins of this size and is based on the following formula:

Q = CIA

Where:
Q = Maximum Rate of Runoff (cfs)
C = Runoff Coefficient – the ratio between the runoff volume from an area and the average rainfall depth over a given duration for that area
I = Rainfall Intensity (inches / hour) – for a duration equal to the time of concentration
A = Basin Area (acres)

The runoff coefficients are calculated based on the catchment's soil type, land use, percent imperviousness, and design storm for each basin per Chapter 6, Section 2.5.1 of the MHFD *Urban Storm Drainage Criteria Manual, Volume 1*. Appendix B contains runoff coefficient calculations for all sub-basins. The 2-year runoff coefficient was used to size conveyance-based control measures, the 5-year runoff coefficient was used for the minor storm event, and the 100-year runoff coefficient was used for the major storm event.

HYDRAULIC CRITERIA

Street and Inlet Capacity

Street capacities for minor (5-year) and major (100-year) flows were analyzed using the Mile High Flood District *Street and Inlet Hydraulics* spreadsheet. All driveways internal to the site are assumed to be classified as Local Type I, II, or III streets with a drainage classification of "A" per the SDDTCM. The allowable flow is based on the regulated maximum flow spread and gutter flow line depth, the street longitudinal and transverse slopes, the gutter geometry, the street roughness and any conveyance capacity behind the curb face. In the 5-year storm event flows may not overtop the curb and may spread to the crown of the street. In the 100-year event flows may have a maximum depth of 12 inches at the gutter

flowline. Inlets placed on a continuous grade shall have a maximum spacing of 1,500 feet. Refer to Appendix C for street capacity and inlet calculations.

Storm Sewer

On-site storm sewer pipe sizes will typically range from 8" PVC for roof drains up to 36" RCP for pipes conveying larger areas of the site. All storm sewer pipes located within public easements or private streets shall be RCP. The following criteria were utilized for the storm system design:

Table 2: Storm Design Criteria

Parameter	Requirement
Minimum Cover	18 inches
Manhole Spacing (18" to 36" pipe)	400 feet
Manhole Spacing (> 36" pipe)	500 feet
Maximum Velocity	18 fps (pipes), 15 fps (outfalls)
Minimum Velocity	2 fps
Minimum Slope	0.5%
Manning's N	0.013

The storm sewer system hydraulic analysis was completed using Bentley StormCAD CONNECT. Methods and parameters conform to those recommended in the MHFD *Urban Storm Drainage Criteria Manual*. A calibration model based on Example 6.13 of the MHFD Manual has been provided in Appendix A for reference. The HEC-22 v3 headloss method was utilized, as yielded results that were closest to Example 6.13. A tabular summary of the analysis performed by StormCAD can be found in Appendix C. Pipes have been designed so that the hydraulic grade lines are contained within the pipes for the minor storm event and are at least 1-foot below finish grade for the major storm event.

Drainage Swales

The grass-lined swales within the project have been designed using Bentley Flowmaster. A Manning's coefficient for a rough channel with grass of 0.035 was utilized to analyze the capacity of the swales. The 2-year rainfall event was used to calculate the velocities and Froude numbers of the proposed swales to determine the location and necessity of erosion control blankets. The 100-year rainfall event was then run through the swale to ensure velocities remain below 7.0 fps and overtopping will not occur. Erosion control blankets are used where the Froude Number exceeds 0.8, which includes swales GS-1, GS-2, and GS-3. Refer to Appendix C for calculations.

Detention and Water Quality Facilities

The offsite regional extended detention basin C1 has been designed to account for full spectrum detention, including water quality treatment, for the entirety of the project site at a composite imperviousness of 75%. Since the proposed composite imperviousness of the site is 75.0%, no additional on-site stormwater quality or detention facilities are needed.

Due to higher density of the King Soopers store and fuel center lots, a lower impervious threshold is required for pad lots. Allowable percent imperviousness for pad lots are listed in the table below for reference.

Parcel	Percent Impervious
Lot 1 (King Soopers)	79.0%
Lot 2	69.5%
Lot 3	69.5%
Lot 4 (Key Bank)	65.0%
Lot 5*	69.5%
Lot 6*	69.5%
Lot 7*	69.5%
Lot 8*	69.5%
Lot 9*	69.5%
Lot 10*	69.5%

* The percent imperviousness listed does not include the Private Drive 3 improvements, which are accounted for under the King Soopers parcel.

IV. FOUR STEP PROCESS

The Four Step Process is used to minimize the adverse impacts of urbanization and is a vital component of developing a balanced, sustainable project. Below identifies the approach to the four-step process:

1. **Employ Runoff Reduction Practices**
   The proposed development uses Low Impact Development (LID) practices to reduce runoff at the source. Rather than creating point discharges that are directly connected to impervious areas, runoff is routed through pervious areas to promote infiltration and minimize directly connected impervious areas (MDCIA). Grass buffers and swales are used where practical. Three grass swales (RPA-1, RPA-2, RPA-3) are proposed throughout the site to reduce runoff. RPA-1 is located southeast of the store, has a length of 85 feet, a bottom width of 4 feet, and provides runoff reduction of 28 ft^3. RPA-2 is located northwest of the store, has a length of 189 feet, a bottom width of 16 feet, and provides runoff reduction of 151 ft^3. RPA-3 is located northeast of the store, has a length of 156 feet, a bottom width of 14 feet, and provides runoff reduction of 109 ft^3. The total runoff reduction is 288 ft^3, or 1%.

2. **Treat and Slowly Release Water Quality Capture Volume (WQCV)**
   This step utilizes formalized water quality capture volume to slow the release of runoff from the site. The existing regional full spectrum detention pond will contain WQCV which will be released in no less than 40 hours. The required WQCV for the site is approximately 0.537 acre-feet, which is provided in the regional pond (by others).

3. **Stabilize Stream Channels**
   This step implements stabilization to channels to accommodate developed flows while protecting infrastructure and controlling sediment loading from erosion in the drainageways. No proposed outfalls or connections to drainageways are proposed with this development, so this step is not used.

4. **Implement Source Controls**
   The biggest source control BMP is public education which can be found on the Town of Castle Rock website and discusses topics such as: pet waste, car washing, lawn care, fall leaves, and snow melt and deicer. The landscaping and snow removal is handled completely by the property

management to ensure proper lawn mowing and grassing clipping disposal, lawn aeration, and fertilizer application is being followed. Snow removal will also be handled by the property manager to ensure proper consideration of snow pile placement and use of deicing chemicals. King Soopers has extensive fuel spill prevention and cleanup plans and training for all staff on these procedures. This applies to the fuel center, fuel storage for the generator at the store, etc.

V. DRAINAGE PLAN

GENERAL CONCEPT

The proposed drainage plan for the site consists of five major drainage basins (21.50 acres). The A-series basins consist of runoff from the south side of the King Soopers site that flows to grass swale RPA-1. The B-series basins consist of runoff from the drive aisle along the south side of the King Soopers store, the future outlots south of King Soopers, and a portion of the parking lot on the east side of the King Soopers store. Runoff from these basins are not treated with LID. The C-series basins consist of runoff from the northwest portion of the King Soopers site that flows to grass swale RPA-2. The D-series basins consist of runoff from the King Soopers building roof and a portion of the parking lot on the east side of the King Soopers store that flows to grass swale RPA-3, as well as additional areas that bypass grass swale RPA-3 including the northern outlots and fueling facility pad. The E-series basins consist of runoff that cannot be captured onsite and is routed to a reconstructed roadway inlet in Dawson Trails Boulevard. Two offsite basins (OS-4, OS-5) account for runoff from Gambel Ridge Boulevard that will be routed through the site. The on-site and downstream storm sewer infrastructure have capacity to accommodate this additional runoff per the StormCAD model. Runoff for all proposed basins will flow to regional pond C1, which will provide stormwater quality and detention.

STORMWATER CONVEYANCE FACILITIES

Runoff from the project site will be conveyed through the site through a series of concrete curb and gutter, inlets, gras swales, and storm sewer pipe. All proposed inlets and pipes have adequate capacity for the 100-year storm event. Inlet capacity and StormCAD pipe sizing calculations are provided in Appendix C for reference. On-site runoff will be conveyed to regional detention pond C. Pad lots that will be developed in the future were assumed to have 69.5% imperviousness per the table in Section III. All storm sewer infrastructure stubs to pad lots was sized utilizing 69.5% imperviousness and an assumed time of concentration of 5 minutes.

STORMWATER STORAGE FACILITIES

The existing regional extended detention basin C1 was designed to accommodate developed runoff from the project site with a composite imperviousness of 75% at ultimate buildout. Since the proposed composite site imperviousness is 74.9%, the existing pond is sufficient and no modifications are required.

VI. CONCLUSIONS

COMPLIANCE WITH STANDARDS

The design presented in this Phase III Drainage Report for King Soopers Store #165 has been prepared in accordance with the design standards and guidelines presented in the Town of Castle Rock *Storm Drainage Design and Technical Criteria Manual*, the Mile High Flood District *Urban Storm Drainage Criteria Manual*, and sound engineering principles.

VARIANCES

No variance(s) requested at this time.

DRAINAGE CONCEPT

The proposed improvements will generally maintain existing drainage patterns. This report shows that the design will be adequate for the proposed development. The proposed drainage system is designed to reduce peak runoff, reduce pollutant loads, and safely convey developed runoff to regional detention pond C1. From there runoff will be safely treated and discharged to the receiving watershed with no adverse effects.

VII. REFERENCES

Urban Storm Drainage Criteria Manual, Mile High Flood District, March 2024 (with current revisions).

Storm Drainage Design and Technical Criteria Manual, Town of Castle Rock, February 18, 2025.

Crystal Valley Interchange Public Improvement Construction Plans (PICP), Town of Castle Rock Department of Public Works, April 19, 2024.

Phase III Drainage Report for Dawson Trails Filing 1 Infrastructure, CORE Consultants, Inc., April 21, 2025.

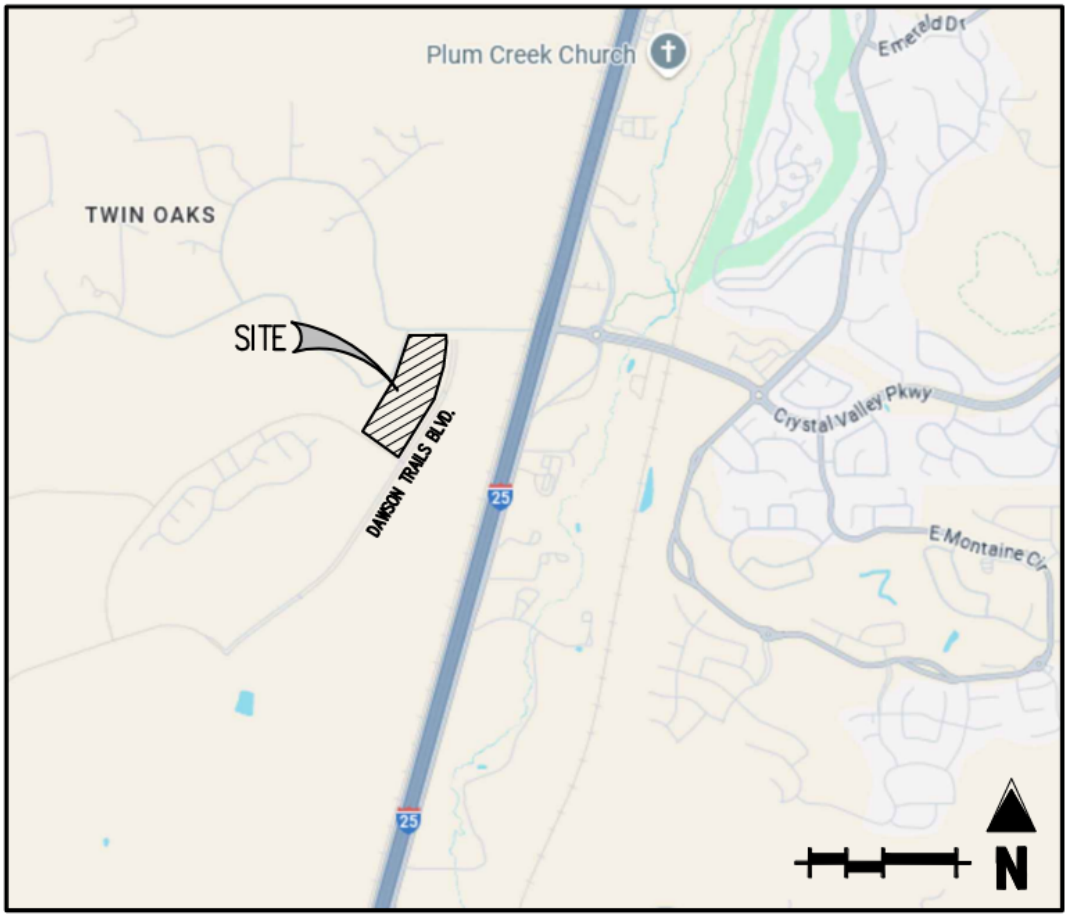
Phase III Drainage Report for Dawson Trails Filing No. 2, EMK Consultants, Inc., December 16, 2024.

Flood Insurance Rate Map – Town of Castle Rock, Community Panel No. 08035C0284G, Effective March 16, 2016.

NRCS Web Soil Survey – Castle Rock Area, Colorado as available through the Natural Resources Conservation Service National Cooperative Soil Survey web site via Web Soil Survey 2.0.

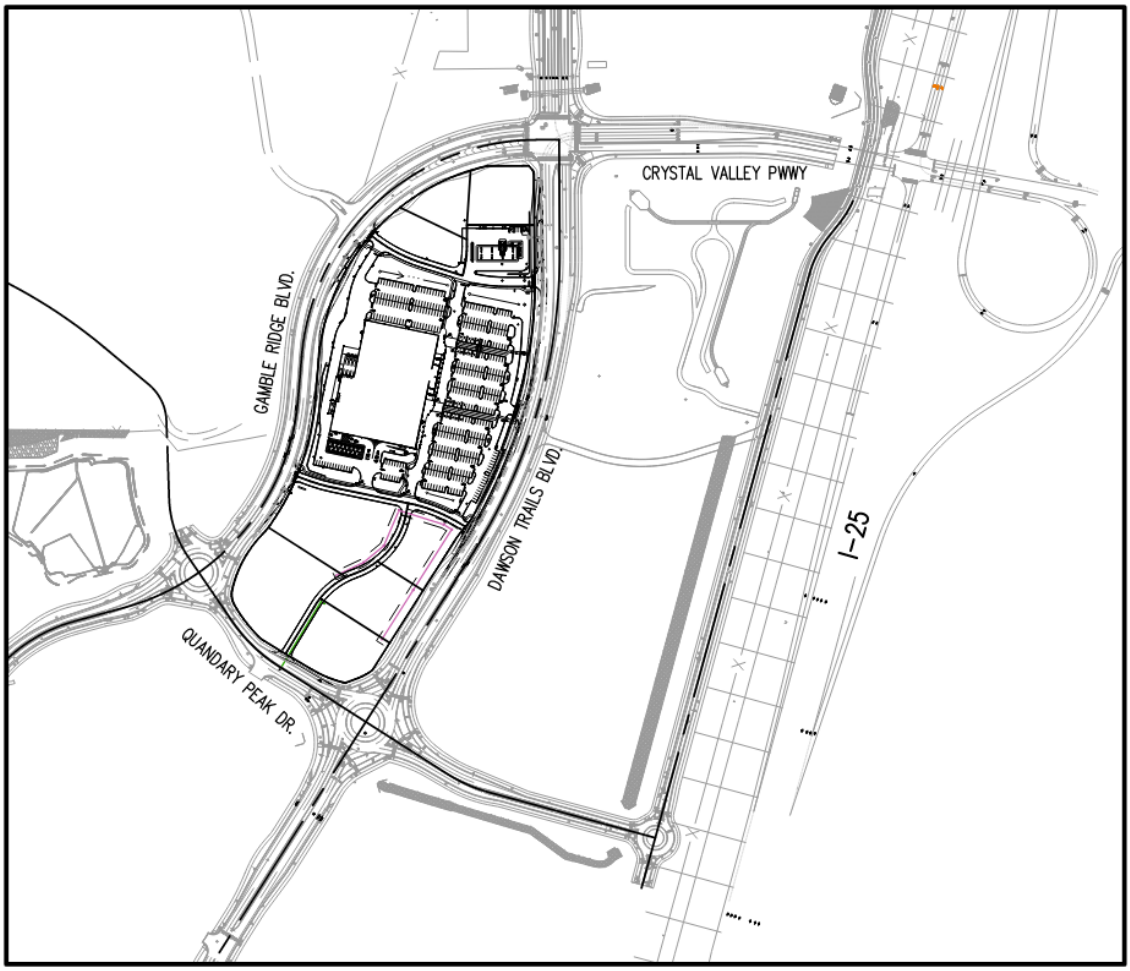
APPENDIX A

EXHIBITS AND FIGURES



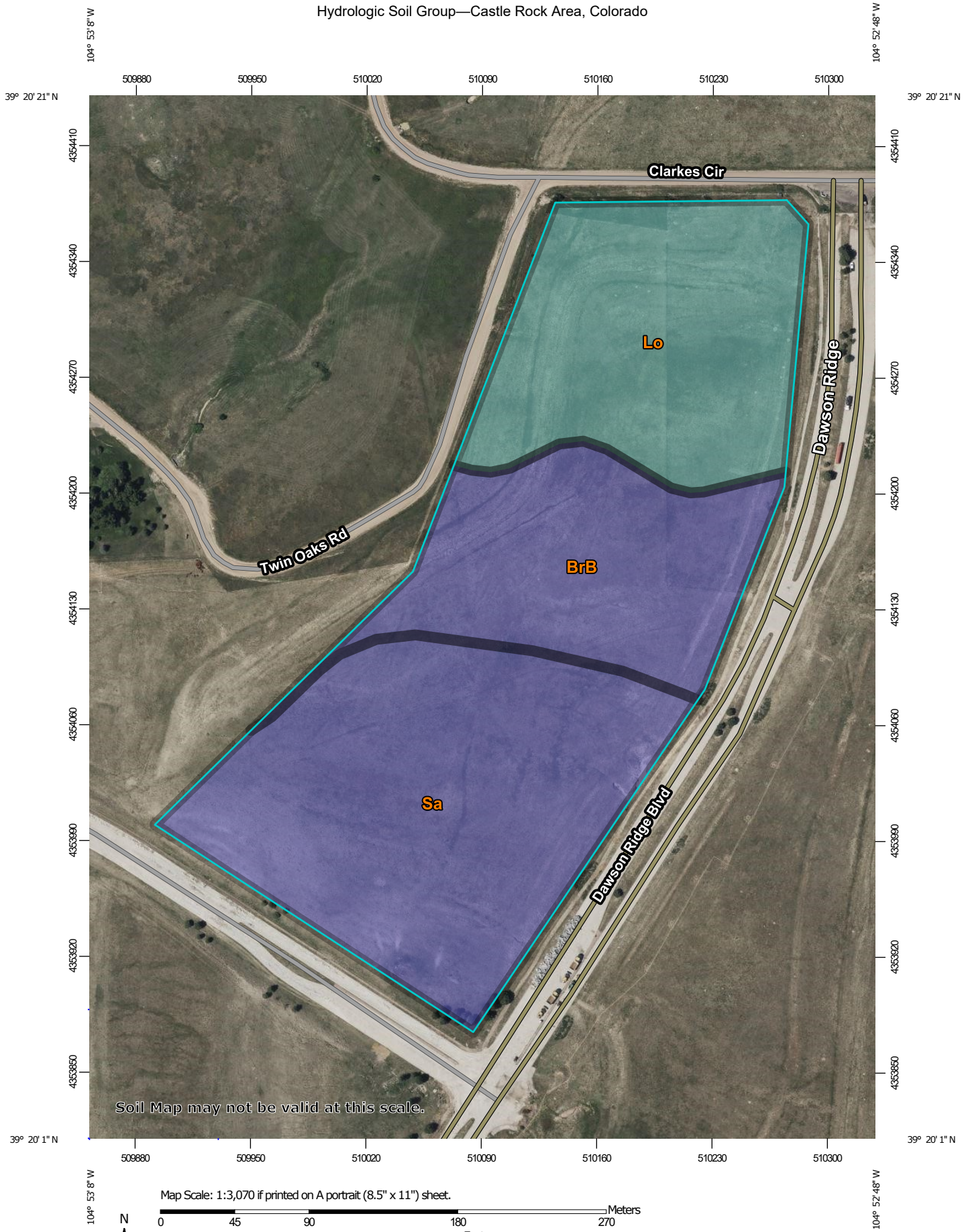
VICINITY MAP

SCALE: 1" = 2000'



SITE MAP

SCALE: 1" = 500'



Map Scale: 1:3,070 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 45 90 180 270

Feet: 0 100 200 400 600

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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 18, Aug 29, 2025

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BrB	Bresser sandy loam, cool, 1 to 3 percent slopes	B	6.1	25.2%
Lo	Loamy alluvial land	C	7.1	29.7%
Sa	Sampson loam	B	10.8	45.0%
Totals for Area of Interest			**24.0**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

National Flood Hazard Layer FIRMette

FEMA

104°53'16"W 39°20'26"N

104°52'38"W 39°19'58"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
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

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

N

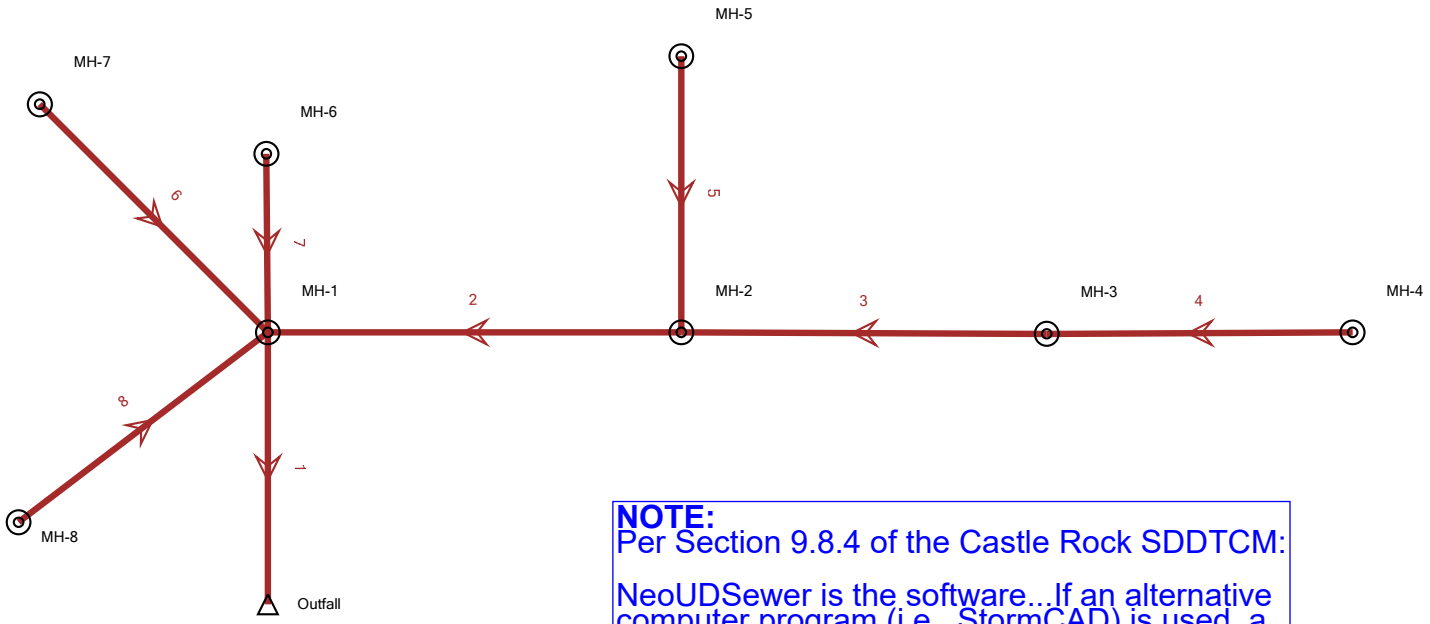
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 12/1/2025 at 9:20 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.

Scenario: Base



NOTE:
Per Section 9.8.4 of the Castle Rock SDDTCM:

NeoUDSewer is the software...If an alternative computer program (i.e., StormCAD) is used, a calibration model based on Example 6.13 in the MHFD Manual must be completed and provided to the Town.

This report shall utilize StormCAD in lieu of NeoUDSewer because that software is no longer supported or maintained.

This appendix includes the calibration model, which is based on Example 6.13 in the MHFD Manual (originally provided in the UDFCD USDCM v1, 2002) as the basis model for NeoUDSewer.

Scenario: HEC-22 3rd Edition
Current Time Step: 0.000 h
FlexTable: Conduit Table

Label	Start Node	Stop Node	Section Type	Diameter (in)	Rise (ft)	Span (ft)	Manning's n	Length (User Defined) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Slope (Calculated) (%)	Flow (cfs)	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Initial Headloss Coefficient (HEC-22, Second Edition)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)
1	MH-1	Outfall	Box	-	4.0	4.0	0.013	410.0	89.32	88.29	0.25	56.70	6.03	91.66	(N/A)	99.00	0.00	91.66	90.13	92.23	91.05
2	MH-2	MH-1	Circle	27.0	-	-	0.013	380.0	92.00	92.38	-0.10	35.60	8.95	9.79	0.000	101.50	99.00	99.51	94.40	100.76	95.79
3	MH-3	MH-2	Arch	-	1.7	2.3	0.013	360.0	95.37	92.49	0.80	24.20	7.90	19.69	0.000	109.00	101.50	105.13	100.78	106.10	101.75
4	MH-4	MH-3	Circle	24.0	-	-	0.013	450.0	102.50	100.25	0.50	9.10	2.90	16.00	0.000	111.00	109.00	107.14	106.42	107.27	106.55
5	MH-5	MH-2	Circle	21.0	-	-	0.013	460.0	103.75	98.23	1.20	14.70	8.09	17.36	0.000	110.00	101.50	105.17	101.02	105.94	101.60
6	MH-7	MH-1	Circle	18.0	-	-	0.013	295.0	99.60	95.17	1.50	13.40	8.27	12.87	0.000	104.00	99.00	100.96	96.46	101.94	97.53
7	MH-6	MH-1	Circle	18.0	-	-	0.013	200.0	95.30	91.30	2.00	2.10	5.94	14.85	0.000	99.90	99.00	95.85	93.14	96.05	93.16
8	MH-8	MH-1	Circle	18.0	-	-	0.013	350.0	92.51	89.88	0.75	1.90	4.07	9.11	0.000	99.75	99.00	93.22	93.14	93.30	93.16

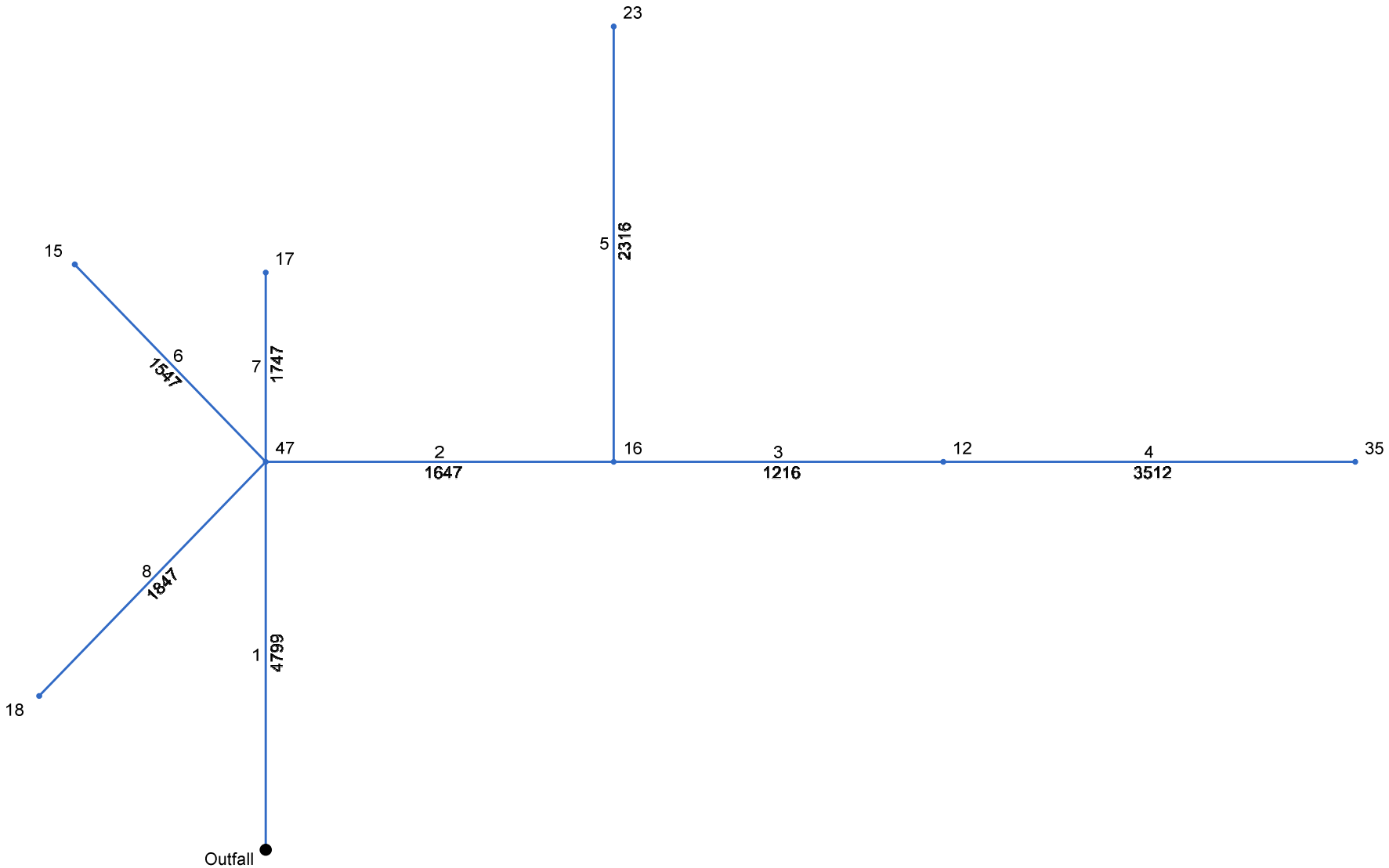
K:_Galloway Discipline Standards\Civil Engineering\~Drainage\Hydraulic Loss Methods Comparison\UDFCD Ex 6_13.stsw

Scenario: HEC-22 3rd Edition
Current Time Step: 0.000 h
FlexTable: Manhole Table

ID	Label	Bolted Cover?	Elevation (Invert in 1) (ft)	Elevation (Invert Out) (ft)	Flow (Total Out) (cfs)	Elevation (Rim) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Headloss Method	Headloss Coefficient (Standard)	HEC-22 Benching Method
32	MH-1	False	92.38	89.32	56.70	99.00	92.59	91.93	93.16	92.50	HEC-22 Energy (Third Edition)	-	Depressed
33	MH-2	False	92.49	92.00	35.60	101.50	100.12	99.76	101.37	101.01	HEC-22 Energy (Third Edition)	-	Depressed
34	MH-3	False	100.25	95.37	24.20	109.00	105.52	105.33	106.49	106.30	HEC-22 Energy (Third Edition)	-	Depressed
35	MH-4	False	(N/A)	102.50	9.10	111.00	107.22	107.17	107.35	107.30	HEC-22 Energy (Third Edition)	-	Depressed
40	MH-5	False	(N/A)	103.75	14.70	110.00	105.97	105.42	106.74	106.19	HEC-22 Energy (Third Edition)	-	Depressed
42	MH-6	False	(N/A)	95.30	2.10	99.90	95.99	95.89	96.19	96.09	HEC-22 Energy (Third Edition)	-	Depressed
44	MH-7	False	(N/A)	99.60	13.40	104.00	101.41	101.17	102.39	102.15	HEC-22 Energy (Third Edition)	-	Depressed
46	MH-8	False	(N/A)	92.51	1.90	99.75	93.31	93.24	93.39	93.32	HEC-22 Energy (Third Edition)	-	Depressed

K:_Galloway Discipline Standards\Civil Engineering\~Drainage\Hydraulic Loss Methods Comparison\UDFCD Ex 6_13.stsw

UDFCD Ex. 6.13 Calib. Model



Project File: UDFCD Ex 6_13.stm	Number of lines: 8	Date: 2/14/2012

Report

Line No.	DnStm Ln No	Inlet ID	Flow Rate (cfs)	Line Size (in)	Line Length (ft)	Line Slope (%)	Invert Up (ft)	Invert Dn (ft)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)	HGL Up (ft)	HGL Dn (ft)	Vel Ave (ft/s)	Capac Full (cfs)	EGL Dn (ft)	EGL Up (ft)	
1	Outfall	47	56.70	48 x 48	410.000	0.25	89.32	88.29	99.00	0.00	91.97	90.13	6.52	91.67	91.05	92.42	
2	1	16	35.60	27	380.000	-0.10	92.00	92.38	101.50	99.00	99.65	94.63	8.95	0.00	95.88	100.90	
3	2	12	24.20	19 x 30	360.000	0.80	95.37	92.49	109.00	101.50	105.35	100.96	7.78	19.61	101.91	106.29	
4	3	35	9.10	24	450.000	0.50	102.50	100.25	111.00	109.00	106.13	105.40	2.90	15.99	105.53	106.26	
5	2	23	14.70	21	460.000	1.20	103.75	98.23	110.00	101.50	105.16 j	99.72	6.92	17.35	100.42	105.94 i	
6	1	15	13.40	18	295.000	1.50	99.60	95.17	104.00	99.00	101.09	96.46	7.93	12.87	97.53	101.99 i	
7	1	17	2.10	18	200.000	2.00	95.30	91.30	99.90	99.00	95.85 j	91.99	3.09	14.85	92.10	96.05 i	
8	1	18	1.90	18	350.000	0.75	92.51	89.88	99.75	99.00	93.04 j	91.99	2.26	9.10	92.01	93.22 i	

UDFCD Ex. 6.13 Calib. Model | Number of lines: 8 | Date: 2/14/2012

NOTES: i Inlet control; ** Critical depth

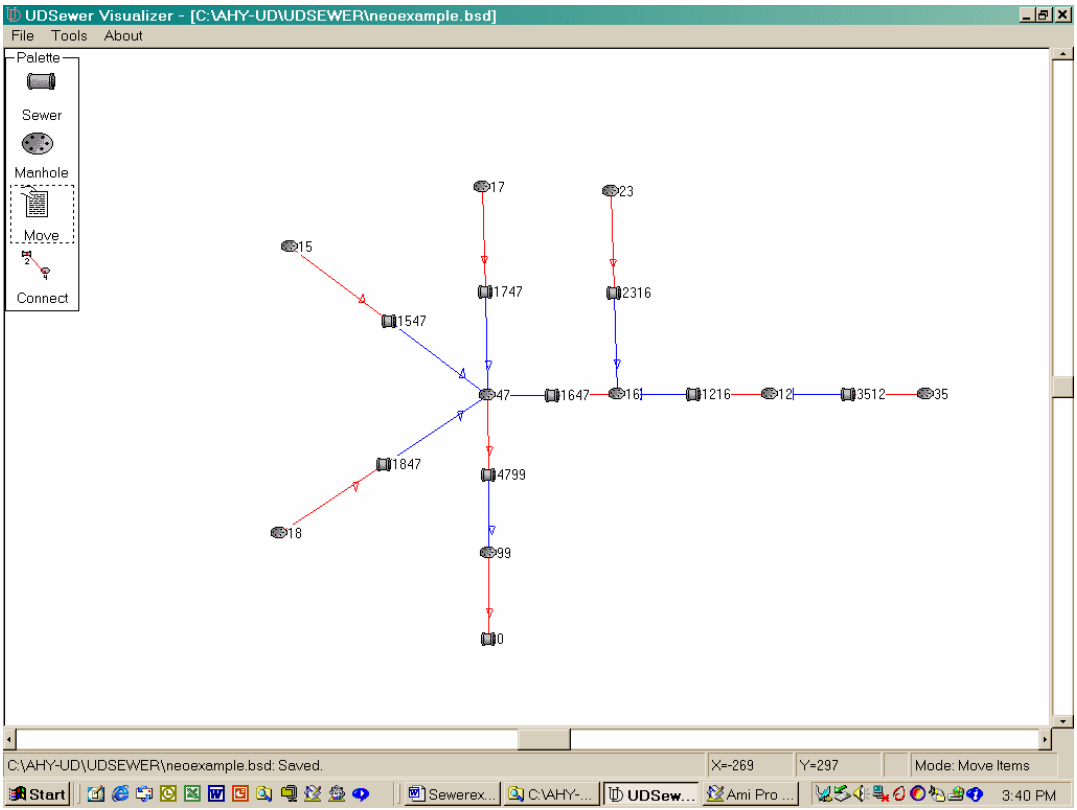
6.13 Example—Storm Sewer Hydrology

This example storm sewer system is based on the hydrology for the Denver, Colorado area. It is developed here to illustrate the solution using the NeoUDSEWER computer software. The storm sewer system is to be designed to fully convey the five-year runoff event. The following formula, taken from the Rainfall Chapter of this Manual, describes design rainfall intensity as a function of storm duration:

$$i = \frac{38.5}{(10 + T_d)^{0.768}}$$

in which i = rainfall intensity in inches per hour and T_d = rainstorm duration in minutes.

The illustration below depicts a layout of the storm sewer system. It is a copy of the input screen from the NeoUDSEWER software. An ID number is assigned to each manhole and to each sewer segment. The ID numbers have to be unique among the manholes in a system and cannot be duplicated, as is the case for sewer ID numbers among the sewers. At a manhole, NeoUDSEWER can accommodate one outgoing sewer and up to four incoming sewers.



Example Storm Sewer System Using Computer Model: NeoUDSEWER

NeoUDSEWER is a storm sewer system sizing and analysis software package. It calculates rainfall and runoff using the Rational Formula method and then sizes circular sewers using Manning's equation. It

has a graphical interface for data entry and editing. NeoUDSEWER can handle a storm sewer system having up to 100 manholes and up to 100 sewers.

Data entry includes project title, rainfall statistics, manhole information, basin hydrology, and sewer network information. Rainfall IDF information can be entered as a table or calculated using the equation given above by entering only a value for the 1-hour depth, P1. The user needs to check all of the default design constraints and criteria and make all necessary changes to these values as needed.

The input parameters for each manhole include the manhole identification number, ground elevation, and incoming and outgoing sewer identification numbers. The hydrologic parameters for the tributary area at a manhole include tributary area, runoff coefficients, overland flow length and slope, local tributary gutter flow length, and gutter flow velocity.

When the local runoff flow rate at a manhole is known, it may be entered (along with non-zero values for local tributary area and local runoff coefficient) to override the flows calculated by the Rational Equation for the local area. NeoUDSEWER will combine the local flow with the upstream flow to calculate the design discharge at the manhole. When the design discharge at a manhole is known for the entire upstream area, the user must enter this discharge (along with total tributary area) and the weighted runoff coefficient to have the program then analyze the EGL and HGL for the system.

A storm sewer is described by its length, slope, upstream crown elevation, Manning's roughness coefficient, shape, bend loss coefficient, and lateral loss coefficient. An existing sewer is identified by the user-defined size and shape. Use of noncircular sewers such as box sewers and arch pipes can be achieved by prescribing their dimensions. However, all new sewers are sized using circular pipes. The program provides suggested commercial sewer sizes for both new and existing sewers. Sewers with flat or negative slope may be analyzed as existing sewers with user-defined sizes provided to the program, along with user-defined tailwater surface elevation at the outlet end. NeoUDSEWER applies open channel hydraulics, culvert hydraulics, and pressure flow hydraulics to calculate the EGL and HGL along the predefined sewer system.

For this example, Table ST-11 provides the watershed hydrologic parameters for the determination of peak design flow rates at the manholes in the system. The design flow can be changed only at a manhole. Sewers 3512, 1216, 1647, and 1547 are treated as existing sewer and their sizes are given in Table ST-12. Other sewer segments are new and will be sized by NeoUDSEWER using circular pipes. In a case that a box conduit is preferred, the sewer may be treated as an existing sewer with a known width. NeoUDSEWER will calculate the water depth and recommend the height for a box sewer. All manholes must have an outgoing pipe except the system outfall pipe (i.e., Manhole 99 in this example) whose outgoing sewer has a pre-assigned ID of zero. For this example, the global Manning's roughness coefficient n = 0.013 was used, and the tailwater surface elevation was set at an elevation of 87 feet.

Table ST-11—Hydrologic Parameters at Manholes

Manhole ID Number	Ground Elevation Feet	Tributary Area acres	Runoff Coeff.	Overland Slope percent	Overland Length Feet	Gutter Slope percent	Gutter Length Feet
35.00	111.00	3.00	0.90	0.15	250.00	0.49	150.00
12.00	109.00	6.45	0.85	0.25	180.00	1.00	450.00
23.00	110.00	5.00	0.90	1.00	275.00	1.00	450.00
16.00	101.50	0.00	0.00	0.00	0.00	0.00	0.00
15.00	104.00	5.00	0.85	0.50	285.00	2.25	450.00
47.00	99.00	3.00	0.80	0.40	250.00	1.56	255.00
99.00	97.50	0.00	0.00	0.00	0.00	0.00	0.00
17.00	99.90	1.00	0.65	0.10	200.00	0.36	300.00
18.00	99.75	1.20	0.45	0.40	300.00	0.00	0.00

Table ST-12—Vertical Profile Information of Sewers

Sewer ID	Length (feet)	Slope (percent)	Upstream Crown Elevation (feet)	Diameter (inches)	Height or Rise (inches)	Width or Span (inches)	Bend Loss Coef.	Lateral Loss Coef.
3512 (round)	450.00	0.50	104.50	24			0.05	
1216 (arch)	360.00	0.80	97.05		20.00	28.00	0.05	0.25
2316	460.00	1.20	105.50				1.00	
1647 (round)	380.00	- 0.10	94.25	27			0.05	0.25
1547 (round)	295.00	1.50	101.10	18			0.40	
4799 (box)	410.00	0.25	93.32		48.00	48.00	0.05	
1747	200.00	2.00	96.80				1.00	
1847	350.00	0.75	94.00				1.00	

For the input parameters in Tables St-11 and ST-12, Neo-UDSEWER produced the following outputs:

NeoUDS Results Summary

Project Title: CASE STUDY : EXAMPLE ONE
Project Description: STORM SEWER SYSTEM DESIGN: NEW SEWERS WITH EXISTING SEWERS
Output Created On: 8/2/2002 at 9:08:16 AM
Using NeoUDSewer Version 1.1.
Rainfall Intensity Formula **Used.**
Return Period of Flood is 5 **Years.**

A. Sub Basin Information

		Time of Concentration				
Manhole ID #	**Basin Area * C**	**Overland (Minutes)**	**Gutter (Minutes)**	**Basin (Minutes)**	**Rain I (Inch/Hour)**	**Peak Flow (CFS)**
35	2.70	12.2	0.0	0.0	3.36	9.1
12	3.83	5.0	0.0	0.0	6.33	24.2
23	4.50	13.0	0.0	0.0	3.28	14.7
16	0.00	0.0	0.0	0.0	0.00	35.6
15	4.25	14.1	0.0	0.0	3.16	13.4
47	2.40	19.1	0.0	0.0	2.72	6.5
99	1.70	17.2	0.0	0.0	2.87	4.9
17	0.65	12.8	0.0	0.0	3.30	2.1
18	0.54	11.7	0.0	0.0	3.43	1.9

The shortest design rainfall duration is 5 minutes.
For rural areas, the catchment time of concentration is always => 10 minutes.
For urban areas, the catchment time of concentration is always => 5 minutes.
At the first design point, the time constant is <= (10+Total Length/180) in minutes.
When the weighted runoff coefficient => 0.2, then the basin is considered to be urbanized.
When the Overland Tc plus the Gutter Tc does not equal the catchment Tc, the above criteria supercedes the calculated values.

B. Summary of Manhole Hydraulics

Manhole ID #	Contributing Area * C	Rainfall Duration (Minutes)	Rainfall Intensity (Inch/Hour)	Design Peak Flow (CFS)	Ground Elevation (Feet)	Water Elevation (Feet)	Comments
35	2.7	12.2	3.36	9.1	111.00	106.60	
12	6.52	9.6	3.71	24.2	109.00	105.08	
23	4.5	13.0	3.28	14.7	110.00	105.17	
16	11.02	13.4	3.23	35.6	101.50	99.61	
15	4.25	14.1	3.16	13.4	104.00	101.46	
47	18.86	15.6	3.00	56.7	99.00	91.66	
99	0	0.0	0.00	0.0	97.50	87.00	
17	0.65	12.8	3.30	2.1	99.90	95.88	
18	0.54	11.7	3.43	1.9	99.75	93.03	

C. Summary of Sewer Hydraulics

Note: The given depth to flow ratio is 1.

	Manhole ID Number			Calculated	Suggested	Existing	
Sewer ID #	Upstream	Downstream	Sewer Shape	Diameter (Rise) (Inches) (FT)	Diameter (Rise) (Inches) (FT)	Diameter (Rise) (Inches) (FT)	Width (FT)
3512	35	12	Round	19.4	21	24	N/A
1216	12	16	Arch	25.7	27	20	28
2316	23	16	Round	19.8	21	21	N/A
1647	16	47	Round	27.0	27	27	N/A
1547	15	47	Round	18.3	21	18	N/A
4799	47	99	Box	2.3	2	4	4
1747	17	47	Round	8.7	18	18	N/A
1847	18	47	Round	9.9	18	18	N/A

Round and arch sewers are measured in inches.

Box sewers are measured in feet.

Calculated diameter was determined by sewer hydraulic capacity.

Suggested diameter was rounded up to the nearest commercially available size

All hydraulics where calculated using the existing parameters.

If sewer was sized mathematically, the suggested diameter was used for hydraulic calculations.

Sewer ID	Design Flow (CFS)	Full Flow (CFS)	Normal Depth (Feet)	Normal Velocity (FPS)	Critical Depth (Feet)	Critical Velocity (FPS)	Full Velocity (FPS)	Froude Number	Comment
3512	9.1	16.0	1.08	5.3	1.08	5.2	2.9	1	
1216	24.2	20.3	2.00	7.7	1.73	8.4	7.7	N/A	
2316	14.7	17.4	1.24	8.1	1.42	7.0	6.1	1.34	
1647	35.6	35.6	2.25	8.9	2.00	9.5	8.9	N/A	
1547	13.4	12.9	1.50	7.6	1.35	8.0	7.6	N/A	
4799	56.7	91.7	2.34	6.0	1.84	7.7	3.5	0.7	
1747	2.1	14.9	0.38	6.0	0.58	3.4	1.2	2.02	
1847	1.9	9.1	0.46	4.0	0.53	3.3	1.0	1.24	

A Froude number = 0 indicated that a pressured flow occurs.

D. Summary of Sewer Design Information

		Invert Elevation		Buried Depth		
Sewer ID	Slope %	Upstream (Feet)	Downstream (Feet)	Upstream (Feet)	Downstream (Feet)	Comment
3512	0.50	102.50	100.25	6.50	6.75	
1216	0.80	95.37	92.49	11.96	7.34	
2316	1.20	103.75	98.23	4.50	1.52	Sewer Too Shallow
1647	-0.10	92.00	92.38	7.25	4.37	
1547	1.50	99.60	95.17	2.90	2.33	
4799	0.25	89.32	88.29	5.68	5.21	
1747	2.00	95.30	91.30	3.10	6.20	
1847	0.75	92.50	89.88	5.75	7.62	

E. Summary of Hydraulic Grade Line

			Invert Elevation		Water Elevation		
Sewer ID #	Sewer Length (Feet)	Surcharged Length (Feet)	Upstream (Feet)	Downstream (Feet)	Upstream (Feet)	Downstream (Feet)	Condition
3512	450	450	102.50	100.25	106.60	105.08	Pressured
1216	360	360	95.37	92.49	105.08	99.61	Pressured
2316	460	256.58	103.75	98.23	105.17	99.61	Jump
1647	380	380	92.00	92.38	99.61	91.66	Pressured
1547	295	295	99.60	95.17	101.46	91.66	Pressured
4799	410	0	89.32	88.29	91.66	87.00	Subcritical
1747	200	0	95.30	91.30	95.88	91.66	Jump
1847	350	118.29	92.50	89.88	93.03	91.66	Jump

F. Summary of Energy Grade Line

	Upstream Manhole			Juncture Losses				Downstream Manhole	
Sewer ID #	Manhole ID #	Energy Elevation (Feet)	Sewer Friction (Feet)	Bend K Coefficient	Bend Loss (Feet)	Lateral K Coefficient	Lateral Loss (Feet)	Manhole ID #	Energy Elevation (Feet)
3512	35	106.73	0.72	0.05	0.01	0.00	0.00	12	106.00
1216	12	106.00	4.10	0.05	0.05	0.25	1.01	16	100.85
2316	23	105.94	4.51	1.00	0.58	0.00	0.00	16	100.85
1647	16	100.85	8.51	0.05	0.06	0.25	0.05	47	92.23
1547	15	102.35	9.77	0.40	0.36	0.00	0.00	47	92.23
4799	47	92.23	5.23	0.05	0.00	0.00	0.00	99	87.00
1747	17	96.06	3.81	1.00	0.02	0.00	0.00	47	92.23
1847	18	93.20	0.96	1.00	0.02	0.00	0.00	47	92.23

Bend loss = Bend K * Flowing full vhead in sewer.
Lateral loss = Outflow full vhead - Junction Loss K * Inflow full vhead.
A friction loss of 0 means it was negligible or possible error due to jump.
Friction loss includes sewer invert drop at manhole.
Notice: Vhead denotes the velocity head of the full flow condition.
A minimum junction loss of 0.05 Feet would be introduced unless Lateral K is 0.
Friction loss was estimated by backwater curve computations.

G. Summary of Earth Excavation Volume for Cost Estimate

The user given trench side slope is 1.

Manhole ID #	Rim Elevation (Feet)	Invert Elevation (Feet)	Manhole Height (Feet)
35	111.00	102.50	8.50
12	109.00	95.37	13.63
23	110.00	103.75	6.25
16	101.50	92.00	9.50
15	104.00	99.60	4.40
47	99.00	89.32	9.68
99	97.50	88.29	9.21
17	99.90	95.30	4.60
18	99.75	92.50	7.25

	Upstream Trench Width		Downstream Trench Width				
Sewer ID #	On Ground (Feet)	At Invert (Feet)	On Ground (Feet)	At Invert (Feet)	Trench Length (Feet)	Wall Thickness (Inches)	Earth Volume (Cubic Yards)
3512	16.5	4.5	17.0	4.5	450	3.00	1347
1216	27.8	4.8	18.5	4.8	360	3.00	1981
2316	12.3	4.2	6.3	4.2	460	2.75	562
1647	18.2	4.8	12.4	4.8	380	3.25	1031
1547	8.9	3.9	7.7	3.9	295	2.50	272
4799	16.4	6.9	15.5	6.9	410	5.51	1409
1747	9.3	3.9	15.5	3.9	200	2.50	358
1847	14.6	3.9	18.3	3.9	350	2.50	988

Total earth volume for sewer trenches = 7947.8 Cubic Yards. The earth volume was estimated to have a bottom width equal to the diameter (or width) of the sewer plus two times either 1 foot for diameters less than 48 inches or 2 feet for pipes larger than 48 inches.

If the bottom width is less than the minimum width, the minimum width was used.

The backfill depth under the sewer was assumed to be 1 foot.

The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1

APPENDIX B

HYDROLOGIC CALCULATIONS

COMPOSITE % IMPERVIOUS CALCULATIONS

Subdivision: Dawson Trails Filing No. 2, Amd 5
Location: CO, Castle Rock

Project Name: King Soopers Store #165
Project No.: KSS165.20
Calculated By: JKG
Checked By: JRR
Date: 5/5/26

Basin ID	Total Area (ac)	Hardscape & Roof			Landscaping			Bioretention & RPAs			Basins Total Weighted % Imp.
		% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	
A1	1.07	95	0.70	62.0	20	0.37	6.9			0.00	68.9
A2	0.48	95	0.32	62.0	20	0.17	7.0			0.00	69.0
A3	0.35	95	0.20	53.9	20	0.01	0.8	20	0.14	7.90	62.6
B1	1.13	95	0.74	62.7	20	0.38	6.8			0.00	69.5
B2a	1.28	95	0.84	62.7	20	0.43	6.8			0.00	69.5
B2b	1.10	95	0.73	62.7	20	0.37	6.8			0.00	69.5
B3	0.41	95	0.41	95.0	20	0.00	0.0			0.00	95.0
B4a	1.35	95	0.89	62.7	20	0.46	6.8			0.00	69.5
B4b	0.49	95	0.33	62.7	20	0.17	6.8			0.00	69.5
B4c	1.02	95	0.67	62.7	20	0.35	6.8			0.00	69.5
B5	0.23	95	0.23	95.0	20	0.00	0.0			0.00	95.0
B6	0.21	95	0.21	95.0	20	0.00	0.0			0.00	95.0
B7	1.45	95	1.33	87.3	20	0.12	1.6			0.00	88.9
B8	1.20	95	1.09	86.9	20	0.10	1.7			0.00	88.6
C1	1.04	95	0.63	57.4	20	0.41	7.9			0.00	65.3
C2	1.20	95	0.80	63.0	20	0.03	0.5	20	0.37	6.20	69.7
D1	2.30	95	2.30	95.0	20	0.00	0.0			0.00	95.0
D2	1.01	95	0.91	85.4	20	0.10	2.0	20	0.20	4.00	91.4
D3	0.25	95	0.00	0.0	20	0.25	20.0			0.00	20.0
D4a	0.73	95	0.48	62.7	20	0.25	6.8			0.00	69.5
D4b	0.61	95	0.40	62.7	20	0.21	6.8			0.00	69.5
D5	0.70	95	0.65	87.0	20	0.06	1.7			0.00	88.7
D6a	0.41	95	0.32	74.0	20	0.09	4.4			0.00	78.4
D6b	0.24	95	0.18	72.3	20	0.06	4.8			0.00	77.1
D7b	0.91	95	0.54	57.0	20	0.36	8.0			0.00	65.0
D7	0.14	95	0.00	0.0	20	0.14	20.0			0.00	20.0
E1	0.19	95	0.00	0.0	20	0.19	20.0			0.00	20.0
Total On-Site	21.50	95	15.90	70.3	20	5.09	4.7		0.71	0.00	75.0
OS-1	1.51	95	1.27	79.8	20	0.24	3.2			0.00	83.0
OS-2	0.60	95	0.48	76.1	20	0.12	4.0			0.00	80.1
OS-3	1.94	95	1.60	78.6	20	0.34	3.5			0.00	82.1
OS-4	0.38	95	0.38	95.0	20	0.00	0.0			0.00	95.0
OS-5	0.94	95	0.69	69.3	20	0.26	5.4			0.00	74.7
OS-6	0.26	95	0.26	95.0	20	0.00	0.0			0.00	95.0

Galloway

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Dawson Trails Filing No. 2, Amd 5
Location: CO, Castle Rock

Project Name: King Soopers Store #165
Project No.: KSS165.20
Calculated By: JKG
Checked By: JRR
Date: 5/5/26

SUB-BASIN DATA							INITIAL/OVERLAND (Sheet Flow) (T_i)			Shallow Concentrated Flows (T_t)					Tc CHECK		FINAL
BASIN ID	D.A. (AC)	Hydrologic Soils Group	Impervious (%)	C_{100}	C_5	C_2	L (FT)	S (%)	T_i (MIN)	L (FT)	S (%)	Cv	VEL. (FPS)	T_t (MIN)	COMP. T_c (MIN)	Regional T_c (MIN)	T_c (MIN)
A1	1.07	C	68.9	0.77	0.60	0.55	45	1.4	5.5	430	0.5	20.0	1.4	5.1	10.6	19.7	10.6
A2	0.48	C	69.0	0.77	0.60	0.55	45	1.2	5.8	70	2.2	20.0	2.9	0.4	6.2	14.7	6.2
A3	0.35	C	62.6	0.74	0.55	0.49	25	2.0	4.0	85	2.1	15.0	2.2	0.7	4.6	15.9	5.0
B1	1.13	C	69.5	0.77	0.60	0.55											5.0
B2a	1.28	C	69.5	0.77	0.60	0.55											5.0
B2b	1.10	C	69.5	0.77	0.60	0.55											5.0
B3	0.41	C	95.0	0.87	0.81	0.79	30	2.5	2.1	610	3.2	20.0	3.6	2.8	5.0	12.4	5.0
B4a	1.35	C	69.5	0.77	0.60	0.55											5.0
B4b	0.49	C	69.5	0.77	0.60	0.55											5.0
B4c	1.02	C	69.5	0.77	0.60	0.55											5.0
B5	0.23	C	95.0	0.87	0.81	0.79	14	2.0	1.6	500	0.8	20.0	1.8	4.7	6.2	14.0	6.2
B6	0.21	C	95.0	0.87	0.81	0.79	14	2.0	1.6	500	0.8	20.0	1.8	4.7	6.2	14.0	6.2
B7	1.45	C	88.9	0.85	0.76	0.73	220	1.7	7.8	250	2.6	20.0	3.2	1.3	9.1	12.1	9.1
B8	1.20	C	88.6	0.85	0.76	0.73	250	2.8	7.0	140	0.7	20.0	1.6	1.4	8.4	12.3	8.4
C1	1.04	C	65.3	0.75	0.57	0.52	65	2.2	6.0	260	0.7	20.0	1.6	2.7	8.7	17.9	8.7
C2	1.20	C	69.7	0.77	0.60	0.56	130	1.6	8.9	195	2.1	15.0	2.2	1.5	10.4	15.3	10.4
D1	2.30	C	95.0	0.87	0.81	0.79	280	2.0	7.1	370	1.0	20.0	2.0	3.1	10.1	12.6	10.1
D2	1.01	C	91.4	0.86	0.78	0.75	140	2.7	5.0	150	2.1	15.0	2.2	1.2	6.1	11.3	6.1
D3	0.25	C	20.0	0.57	0.20	0.14	30	23.0	3.2	300	2.3	20.0	3.0	1.6	4.8	25.4	5.0
D4a	0.73	C	69.5	0.77	0.60	0.55											5.0
D4b	0.61	C	69.5	0.77	0.60	0.55											5.0
D5	0.70	C	88.7	0.85	0.76	0.73	50	0.9	4.6	195	1.0	20.0	2.0	1.6	6.2	12.4	6.2
D6a	0.41	C	78.4	0.80	0.67	0.63	14	2.3	2.2	500	3.5	20.0	3.7	2.2	4.5	14.9	5.0
D6b	0.24	C	77.1	0.80	0.66	0.62	14	2.3	2.3	500	3.5	20.0	3.7	2.2	4.5	15.1	5.0
D7b	0.91	C	65.0	0.75	0.56	0.51											5.0
D7	0.14	C	20.0	0.57	0.20	0.14	16	5.0	3.9	115	1.0	20.0	2.0	1.0	4.8	24.2	5.0
E1	0.19	C	20.0	0.57	0.20	0.14	11	7.0	2.9	235	2.0	20.0	2.8	1.4	4.2	24.9	5.0
OS-1	1.51	C	83.0	0.82	0.71	0.68	40	2.0	3.6	880	2.0	20.0	2.8	5.2	8.8	16.9	8.8
OS-2	0.60	C	80.1	0.81	0.69	0.65	34	2.0	3.5	380	2.3	20.0	3.0	2.1	5.6	14.5	5.6
OS-3	1.94	C	82.1	0.82	0.70	0.67	40	2.0	3.7	870	2.5	20.0	3.2	4.6	8.3	16.5	8.3
OS-4	0.38	C	95.0	0.87	0.81	0.79	30	2.0	2.3	410	2.5	20.0	3.2	2.2	4.5	11.8	5.0
OS-5	0.94	C	74.7	0.79	0.64	0.60	30	2.0	3.7	760	2.5	20.0	3.2	4.0	7.7	17.4	7.7
OS-6	0.26	C	95.0	0.87	0.81	0.79	30	2.0	2.3	200	2.5	20.0	3.2	1.1	3.4	10.8	5.0

NOTES:
T_i = (0.395*(1.1 - C_5)*(L)^0.5)/((S)^0.33), S in ft/ft
T_t=L/60V (Velocity From Fig. 501)
Velocity V=Cv*S^0.5, S in ft/ft
Tc Regional = (26-17i)+(L/(60(14i+9)S^0.5)), S in ft/ft, i= Imperviousness expressed as decimal
For Urbanized basins a minimum T_c of 5.0 minutes is required.
For non-urbanized basins a minimum T_c of 10.0 minutes is required

Galloway

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Dawson Trails Filing No. 2, Amd 5
Location: CO, Castle Rock
Design Storm: 2-Year

Project Name: King Soopers Store #165
Project No.: KSS165.20
Calculated By: JKG
Checked By: JRR
Date: 5/5/26

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
	A1	A1	1.07	0.55	10.6	0.59	2.81	1.7													Type 16 inlet
	A2a	A2	0.48	0.55	6.2	0.27	3.39	0.9													Type 16 inlet
	A2								10.6	0.86	2.81	2.4									4' dia. MH
	A3	A3	0.35	0.49	5.0	0.17	3.60	0.6	10.6	1.03	2.81	2.9									Rain Garden RPA-1, type C area inlet
		OS-6	0.26	0.79	5.0	0.21	3.60	0.8													
	B1	B1	1.13	0.55	5.0	0.62	3.60	2.2	5.0	0.83	3.60	3.0									Future pad lot
	B2a	B2a	1.28	0.55	5.0	0.70	3.60	2.5	5.0	1.53	3.60	5.5									Future pad lot
	B2	B2b	1.10	0.55	5.0	0.60	3.60	2.2	5.0	2.13	3.60	7.7									Future pad lots, temporary inlet in top of MH and temporary grass swale GS-2
	B3	B3	0.41	0.79	5.0	0.32	3.60	1.2	5.0	2.45	3.60	8.8									Type R inlet
	B4a	B4a	1.35	0.55	5.0	0.74	3.60	2.7													Future pad lot
	B4b	B4b	0.49	0.55	5.0	0.27	3.60	1.0	5.0	1.01	3.60	3.6									Future pad lot
	B4	B4c	1.02	0.55	5.0	0.56	3.60	2.0	5.0	4.02	3.60	14.5									Future pad lots, temporary inlet in top of MH and temporary grass swale GS-3
		OS-4	0.38	0.79	5.0	0.30	3.60	1.1													
	B5	B5	0.23	0.79	6.2	0.18	3.38	1.7	6.2	4.50	3.38	15.2									Type R inlet
	B6	B6	0.21	0.79	6.2	0.17	3.38	0.6	6.2	4.67	3.38	15.8									Type R inlet
	B6a								10.6	5.70	2.81	16.0									4' dia. MH
	B7	B7	1.45	0.73	9.1	1.06	2.97	3.1	10.6	6.76	2.81	19.0									Type R inlet
	B8	B8	1.20	0.73	8.4	0.87	3.06	2.7	10.6	7.63	2.81	21.4									Type R inlet
	C1	C1	1.04	0.52	8.7	0.54	3.02	1.6													Type 16 inlet
	C2	C2	1.20	0.56	10.4	0.67	2.82	1.9	10.4	1.21	2.82	3.4									Grass Swale RPA-2
	D1	D1	2.30	0.79	10.1	1.82	2.85	5.2													King Soopers roof
	D2	D2	1.01	0.75	6.1	0.76	3.40	2.6	10.1	2.58	2.85	7.4									Grass Swale RPA-3
		OS-2	0.60	0.65	5.6	0.39	3.49	1.4													Ex. Dawson Trails Blvd basin, type R inlet
	D3	D3	0.25	0.14	5.0	0.04	3.60	0.1	10.6	10.64	2.81	29.9									Type R inlet
	D4b	D4b	0.61	0.55	5.0	0.33	3.60	1.2													Future pad lot
	D4a	D4a	0.73	0.55	5.0	0.40	3.60	1.4	5.0	0.73	3.60	2.6									Future pad lot
	D4								10.4	1.94	2.82	5.5									5' dia. MH
	D5a	D5	0.70	0.73	6.2	0.51	3.39	1.7													King Soopers fueling facility
	D5								10.4	2.45	2.82	6.9									5' dia. MH
	D6a	D6a	0.41	0.63	5.0	0.26	3.60	0.9													Type R inlet
	D6b	D6b	0.24	0.62	5.0	0.15	3.60	0.5													Type R inlet
	D6								10.4	2.86	2.82	8.1									6' dia. MH
	D7b	D7b	0.91	0.51	5.0	0.46	3.60	1.7													KeyBank

Galloway

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Dawson Trails Filing No. 2, Amd 5
Location: CO, Castle Rock
Design Storm: 2-Year

Project Name: King Soopers Store #165
Project No.: KSS165.20
Calculated By: JKG
Checked By: JRR
Date: 5/5/26

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
	D7	OS-3	1.94	0.67	8.3	1.30	3.08	4.0	10.6	13.96	2.81	39.2									6' dia. MH Ex. Dawson Trails Blvd basin, type 16 inlet
	D7a	D7	0.14	0.14	5.0	0.02	3.60	0.1	10.6	15.28	2.81	42.9									Type 16 inlet
		OS-1	1.51	0.68	8.8	1.02	3.01	3.1													Ex. Dawson Trails Blvd basin, type R inlet
	E1	E1	0.19	0.14	5.0	0.03	3.60	0.1	8.8	1.05	3.01	3.2									Type R inlet
	F1	OS-5	0.94	0.60	7.7	0.56	3.16	1.8													Type R inlet

Galloway

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Dawson Trails Filing No. 2, Amd 5
Location: CO, Castle Rock
Design Storm: 5-Year

Project Name: King Soopers Store #165
Project No.: KSS165.20
Calculated By: JKG
Checked By: JRR
Date: 5/5/26

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
	A1	A1	1.07	0.60	10.6	0.64	3.79	2.4													Type 16 inlet
	A2a	A2	0.48	0.60	6.2	0.29	4.57	1.3													Type 16 inlet
	A2								10.6	0.93	3.79	3.5									4' dia. MH
	A3	A3	0.35	0.55	5.0	0.19	4.85	0.9	10.6	1.12	3.79	4.2									Rain Garden RPA-1, type C area inlet
		OS-6	0.26	0.81	5.0	0.21	4.85	1.0													
	B1	B1	1.13	0.60	5.0	0.68	4.85	3.3	5.0	0.89	4.85	4.3									Future pad lot
	B2a	B2a	1.28	0.60	5.0	0.77	4.85	3.7	5.0	1.66	4.85	8.1									Future pad lot
	B2	B2b	1.10	0.60	5.0	0.66	4.85	3.2	5.0	2.32	4.85	11.3									Future pad lots, temporary inlet in top of MH and temporary grass swale GS-2
	B3	B3	0.41	0.81	5.0	0.33	4.85	1.6	5.0	2.65	4.85	12.9									Type R inlet
	B4a	B4a	1.35	0.60	5.0	0.81	4.85	3.9													Future pad lot
	B4b	B4b	0.49	0.60	5.0	0.30	4.85	1.5	5.0	1.11	4.85	5.4									Future pad lot
	B4	B4c	1.02	0.60	5.0	0.61	4.85	3.0	5.0	4.37	4.85	21.2									Future pad lots, temporary inlet in top of MH and temporary grass swale GS-3
		OS-4	0.38	0.81	5.0	0.31	4.85	1.5													
	B5	B5	0.23	0.81	6.2	0.19	4.56	2.4	6.2	4.87	4.56	22.2									Type R inlet
	B6	B6	0.21	0.81	6.2	0.17	4.56	0.8	6.2	5.04	4.56	23.0									Type R inlet
	B6a								10.6	6.16	3.79	23.3									4' dia. MH
	B7	B7	1.45	0.76	9.1	1.10	4.01	4.4	10.6	7.26	3.79	27.5									Type R inlet
	B8	B8	1.20	0.76	8.4	0.91	4.13	3.8	10.6	8.17	3.79	31.0									Type R inlet
	C1	C1	1.04	0.57	8.7	0.59	4.08	2.4													Type 16 inlet
	C2	C2	1.20	0.60	10.4	0.72	3.81	2.7	10.4	1.31	3.81	5.0									Grass Swale RPA-2
	D1	D1	2.30	0.81	10.1	1.86	3.85	7.2													King Soopers roof
	D2	D2	1.01	0.78	6.1	0.79	4.58	3.6	10.1	2.65	3.85	10.2									Grass Swale RPA-3
		OS-2	0.60	0.69	5.6	0.42	4.71	2.0													Ex. Dawson Trails Blvd basin, type R inlet
	D3	D3	0.25	0.20	5.0	0.05	4.85	0.2	10.6	11.29	3.79	42.8									Type R inlet
	D4b	D4b	0.61	0.60	5.0	0.36	4.85	1.7													Future pad lot
	D4a	D4a	0.73	0.60	5.0	0.44	4.85	2.1	5.0	0.80	4.85	3.9									Future pad lot
	D4								10.4	1.75	3.81	6.7									5' dia. MH
	D5a	D5	0.70	0.76	6.2	0.54	4.57	2.5													King Soopers fueling facility
	D5								10.4	2.29	3.81	8.7									5' dia. MH
	D6a	D6a	0.41	0.67	5.0	0.28	4.85	1.4													Type R inlet
	D6b	D6b	0.24	0.66	5.0	0.16	4.85	0.8													Type R inlet
	D6								10.4	2.73	3.81	10.4									6' dia. MH
	D7b	D7b	0.91	0.56	5.0	0.51	4.85	2.5													KeyBank

Galloway

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Dawson Trails Filing No. 2, Amd 5
Location: CO, Castle Rock
Design Storm: 5-Year

Project Name: King Soopers Store #165
Project No.: KSS165.20
Calculated By: JKG
Checked By: JRR
Date: 5/5/26

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
	D7	OS-3	1.94	0.70	8.3	1.36	4.16	5.7	10.6	14.53	3.79	55.1									6' dia. MH Ex. Dawson Trails Blvd basin, type 16 inlet
	D7a	D7	0.14	0.20	5.0	0.03	4.85	0.1	10.6	15.92	3.79	60.3									Type 16 inlet
		OS-1	1.51	0.71	8.8	1.07	4.07	4.4													Ex. Dawson Trails Blvd basin, type R inlet
	E1	E1	0.19	0.20	5.0	0.04	4.85	0.2	8.8	1.11	4.07	4.5									Type R inlet
	F1	OS-5	0.94	0.64	7.7	0.60	4.26	2.6													Type R inlet

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Dawson Trails Filing No. 2, Amd 5
Location: CO, Castle Rock
Design Storm: 100-Year

Project Name: King Soopers Store #165
Project No.: KSS165.20
Calculated By: JKG
Checked By: JRR
Date: 5/5/26

		DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			
STREET	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
	A1	A1	1.07	0.77	10.6	0.82	6.88	5.6													Type 16 inlet
	A2a	A2	0.48	0.77	6.2	0.37	8.31	3.1													Type 16 inlet
	A2								10.6	1.19	6.88	8.2									4' dia. MH
	A3	A3	0.35	0.74	5.0	0.26	8.82	2.3	10.6	1.45	6.88	10.0									Rain Garden RPA-1, type C area inlet
		OS-6	0.26	0.87	5.0	0.23	8.82	2.0													
	B1	B1	1.13	0.77	5.0	0.87	8.82	7.7	5.0	1.10	8.82	9.7									Future pad lot
	B2a	B2a	1.28	0.77	5.0	0.99	8.82	8.7	5.0	2.09	8.82	18.4									Future pad lot
	B2	B2b	1.10	0.77	5.0	0.85	8.82	7.5	5.0	2.94	8.82	25.9									Future pad lots, temporary inlet in top of MH and temporary grass swale GS-2
	B3	B3	0.41	0.87	5.0	0.36	8.82	3.2	5.0	3.30	8.82	29.1									Type R inlet
	B4a	B4a	1.35	0.77	5.0	1.04	8.82	9.2													Future pad lot
	B4b	B4b	0.49	0.77	5.0	0.38	8.82	3.4	5.0	1.42	8.82	12.5									Future pad lot
	B4	B4c	1.02	0.77	5.0	0.78	8.82	6.9	5.0	5.50	8.82	48.5									Future pad lots, temporary inlet in top of MH and temporary grass swale GS-3
		OS-4	0.38	0.87	5.0	0.33	8.82	2.9													
	B5	B5	0.23	0.87	6.2	0.20	8.29	4.6	6.2	6.03	8.29	50.0									Type R inlet
	B6	B6	0.21	0.87	6.2	0.19	8.29	1.6	6.2	6.22	8.29	51.6									Type R inlet
	B6a								10.6	7.67	6.88	52.8									4' dia. MH
	B7	B7	1.45	0.85	9.1	1.23	7.29	9.0	10.6	8.90	6.88	61.2									Type R inlet
	B8	B8	1.20	0.85	8.4	1.02	7.50	7.7	10.6	9.92	6.88	68.2									Type R inlet
	C1	C1	1.04	0.75	8.7	0.78	7.41	5.8													Type 16 inlet
	C2	C2	1.20	0.77	10.4	0.92	6.92	6.4	10.4	1.70	6.92	11.8									Grass Swale RPA-2
	D1	D1	2.30	0.87	10.1	2.00	7.00	14.0													King Soopers roof
	D2	D2	1.01	0.86	6.1	0.87	8.33	7.2	10.1	2.87	7.00	20.1									Grass Swale RPA-3
		OS-2	0.60	0.81	5.6	0.49	8.57	4.2													Ex. Dawson Trails Blvd basin, type R inlet
	D3	D3	0.25	0.57	5.0	0.14	8.82	1.2	10.6	13.42	6.88	92.3									Type R inlet
	D4b	D4b	0.61	0.77	5.0	0.47	8.82	4.1													Future pad lot
	D4a	D4a	0.73	0.77	5.0	0.56	8.82	4.9	5.0	1.03	8.82	9.1									Future pad lot
	D4								10.4	2.26	6.92	15.6									5' dia. MH
	D5a	D5	0.70	0.85	6.2	0.60	8.31	5.0													King Soopers fueling facility
	D5								10.4	2.86	6.92	19.8									5' dia. MH
	D6a	D6a	0.41	0.80	5.0	0.33	8.82	2.9													Type R inlet
	D6b	D6b	0.24	0.80	5.0	0.19	8.82	1.7													Type R inlet
	D6								10.4	3.38	6.92	23.4									6' dia. MH
	D7b	D7b	0.91	0.75	5.0	0.68	8.82	6.0													KeyBank
	D7								10.6	17.48	6.88	120.3									6' dia. MH

Galloway

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Dawson Trails Filing No. 2, Amd 5
Location: CO, Castle Rock
Design Storm: 100-Year

Project Name: King Soopers Store #165
Project No.: KSS165.20
Calculated By: JKG
Checked By: JRR
Date: 5/5/26

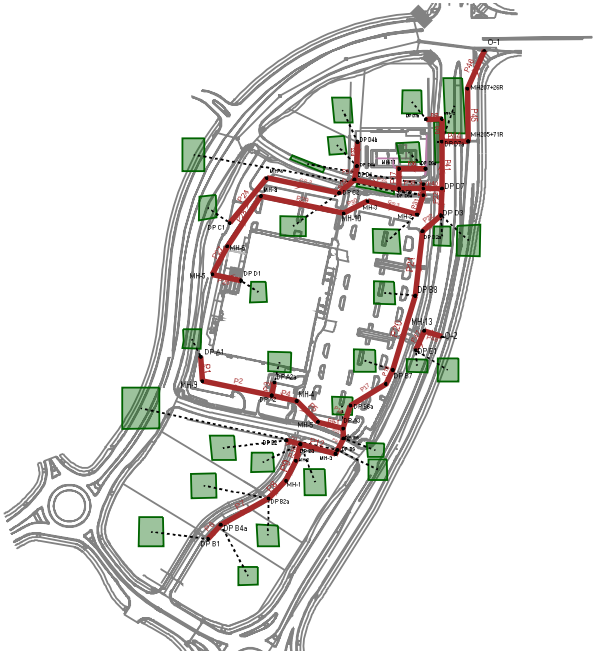
STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
		OS-3	1.94	0.82	8.3	1.59	7.56	12.0													Ex. Dawson Trails Blvd basin, type 16 inlet
	D7a	D7	0.14	0.57	5.0	0.08	8.82	0.7	10.6	19.15	6.88	131.8									Type 16 inlet
		OS-1	1.51	0.82	8.8	1.24	7.39	9.2													Ex. Dawson Trails Blvd basin, type R inlet
	E1	E1	0.19	0.57	5.0	0.11	8.82	1.0	8.8	1.35	7.39	10.0									Type R inlet
	F1	OS-5	0.94	0.79	7.7	0.74	7.75	5.7													Type R inlet

Galloway

APPENDIX C

HYDRAULIC CALCULATIONS

Scenario: 100-Yr



Scenario Summary Report
Scenario: 5-Yr

Scenario Summary

ID	165
Label	5-Yr
Notes	
Active Topology	Base Active Topology
User Data Extensions	Base User Data Extensions
Physical	Base Physical
Boundary Condition	Base Boundary Condition
Initial Settings	Base Initial Settings
Hydrology	5-Yr - Hydrology
Output	Base Output
Infiltration and Inflow	Base Infiltration and Inflow
Rainfall Runoff	5-Yr - Rainfall Runoff
Water Quality	Base Water Quality
Sanitary Loading	Base Sanitary Loading
Headloss	Base Headloss
Operational	Base Operational
Design	Base Design
System Flows	Base System Flows
SCADA	Base SCADA
Energy Cost	Base Energy Cost
Surface Definition	Base Surface Definition
Solver Calculation Options	Base Calculation Options

Gravity Hydraulics

Maximum Network Traversals	5	Structure Loss Mode	Energy Grade
Flow Convergence Test	0.00	Include Conduit Flow Travel Time in Design	True
Flow Profile Method	Backwater Analysis	Save Detailed Headloss Data?	False
Number of Flow Profile Steps	5	Gravity Friction Method	Manning's
Hydraulic Grade Convergence Test	0.00 ft	Use Explicit Depth and Slope Equations?	False
Average Velocity Method	Actual Uniform Flow Velocity	Ignore Pipe Travel Time in Carrier Pipes?	False
Minimum Structure Headloss	0.00 ft	Correct for Partial Area Effects?	False
Governing Upstream Pipe Selection Method	Pipe with Maximum QV		

Inlets

Active Components for Combination Inlets on Grade	Grate and Curb	Neglect Side Flow?	False
Active Components for Combination Inlets In Sag	Grate and Curb	Split Downstream Surface Flow Between Gutters?	False
Neglect Gutter Cross Slope For Side Flow?	False		

Grating Parameters (United Kingdom)

Grating Type	Grating Parameter

Scenario Summary Report
Scenario: 5-Yr

Grating Parameters (United Kingdom)

Grating Type	Grating Parameter
P	30.00
Q	45.00
R	60.00
S	80.00
T	110.00

Pressure Hydraulics

Liquid Label	Water at 20C (68F)	Pressure Friction Method	Hazen-Williams

Rational Method

Use Rational Method Frequency Factors	False	Carryover Modeling Method	As CA (Traditional)
Allow Runoff Coefficient to Exceed 1.0?	False		

Headloss (AASHTO)

Expansion, Ke	0.35	Shaping Adjustment, Cs	0.50
Contraction, Kc	0.25	Non-Piped Flow Adjustment, Cn	1.30

Bend Angle vs. Bend Loss Curve

Bend Angle (degrees)	Bend Loss Coefficient, Kb
0.00	0.00
15.00	0.19
30.00	0.35
45.00	0.47
60.00	0.56
75.00	0.64
90.00	0.70

HEC-22 Energy Losses

Consider Non-Piped Plunging Flow?	True

HEC-22 Energy Losses (Second Edition)

Elevations Considered Equal Within	0.50 ft	Half Bench Submerged Factor	0.95
Flat Unsubmerged Factor	1.00	Full Bench Unsubmerged Factor	0.07
Flat Submerged Factor	1.00	Full Bench Submerged Factor	0.75
Depressed Unsubmerged Factor	1.00	Improved Bench Unsubmerged Factor	0.04
Depressed Submerged Factor	1.00	Improved Bench Submerged Factor	0.38
Half Bench Unsubmerged Factor	0.15		

Scenario Summary Report
Scenario: 5-Yr

HEC-22 Energy Losses (Third Edition)			
Flat Submerged Coefficient	-0.05	Half Bench Unsubmerged Coefficient	-0.85
Flat Unsubmerged Coefficient	-0.05	Full Bench Submerged Coefficient	-0.25
Depressed Submerged Coefficient	0.00	Full Bench Unsubmerged Coefficient	-0.93
Depressed Unsubmerged Coefficient	0.00	Improved Submerged Coefficient	-0.60
Half Bench Submerged Coefficient	-0.05	Improved Unsubmerged Coefficient	-0.98

Modified Rational (United Kingdom)			
Apply Areal Reduction Factor?	False	Pipe Flow Includes Pipe Travel Time?	False
Runoff Routing Coefficient (Cr)	1.30		

Scenario: 5-Yr
Current Time Step: 0.0 h
FlexTable: Catchment Table

ID	Label	Outflow Element	Area (User Defined) (acres)	Runoff Coefficient (Rational)	Time of Concentration (min)	Flow (Total Out) (cfs)	Notes
164	A1	DP A1	1.07	0.60	10.6	2.5	-
173	A2	DP A2a	0.48	0.60	6.2	1.3	-
174	A3	DP A3	0.35	0.51	5.0	0.9	-
175	B1	DP B1	2.46	0.60	5.0	7.2	-
176	B2a	DP B2a	1.04	0.60	5.0	3.1	-
248	B2b	DP B2	0.00	0.60	5.0	0.0	-
177	B3	DP B3	0.41	0.81	5.0	1.6	-
178	B4a	DP B4a	2.86	0.60	5.0	8.4	-
249	B4b	DP B2a	0.00	0.60	5.0	0.0	-
250	B4c	DP B3	0.00	0.60	5.0	0.0	-
179	B5	DP B5	0.23	0.81	6.2	0.9	-
180	B6	DP B6	0.21	0.81	6.2	0.8	-
181	B7	DP B7	1.45	0.76	9.1	4.5	-
184	B8	DP B8	1.20	0.76	8.4	3.8	-
186	C1	DP C1	0.71	0.57	8.7	1.7	-
187	C2	DP C2	1.53	0.62	10.4	3.7	-
185	D1	DP D1	2.30	0.81	10.1	7.2	-
188	D2	MH-2	1.01	0.78	6.1	3.7	-
189	D3	DP D3	0.25	0.20	5.0	0.2	-
190	D4a	DP D4a	0.73	0.60	5.0	2.1	-
229	D4b	DP D4a	0.61	0.60	5.0	1.8	-
191	D5	DP D5a	0.70	0.76	6.2	2.5	-
192	D6a	DP D6a	0.41	0.67	5.0	1.3	-
193	D6b	DP D6b	0.24	0.66	5.0	0.8	-
194	D7	MH-17	0.14	0.20	5.0	0.1	-
234	D7b	DP D7b	0.91	0.54	5.0	2.4	-
182	E1	DP E1	0.19	0.20	5.0	0.2	-
183	OS-1	DP E1	1.51	0.71	8.8	4.4	-
196	OS-2	DP D3	0.60	0.69	5.6	2.0	-
195	OS-3	DP D7a	1.94	0.70	8.3	5.8	-
226	OS-4	DP B5	1.00	0.89	5.0	4.4	-
236	OS-5	DP D6a	0.00	0.64	7.7	0.0	-
258	OS-6	DP B1	0.26	0.81	5.0	1.0	-

Scenario: 5-Yr
Current Time Step: 0.0 h
FlexTable: Conduit Table

Label	Start Node	Stop Node	Section Type	Diameter (in)	Manning's n	Length (User Defined) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Slope (Calculated) (ft/ft)	Flow (cfs)	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)
CO-13	MH-21	DP D5a	Circle	12.0	0.013	105.3	6,384.11	6,382.00	0.020	0.0	0.00	5.0	6,389.71	6,389.66	6,384.11	6,382.83	6,384.11	6,382.83
CO-14	MH-19	DP D5a	Circle	12.0	0.013	13.5	6,382.72	6,382.00	0.053	0.0	0.00	8.2	6,389.88	6,389.66	6,382.83	6,382.83	6,382.83	6,382.83
GS-1	MH-5	DP A3	Trapezoidal Channel	-	0.030	78.8	6,391.26	6,389.56	0.022	3.4	2.04	321.6	6,393.40	6,389.55	6,391.42	6,389.72	6,391.48	6,389.78
GS-2	MH-4	DP C2	Trapezoidal Channel	-	0.030	219.9	6,391.67	6,388.77	0.013	1.6	1.07	388.9	6,393.81	6,388.77	6,391.75	6,388.85	6,391.77	6,388.87
GS-3	MH-3	MH-2	Trapezoidal Channel	-	0.030	151.9	6,388.30	6,385.16	0.021	6.8	2.44	357.1	6,389.90	6,385.16	6,388.52	6,385.38	6,388.61	6,385.47
P1	DP A1	MH-9	Circle	18.0	0.013	26.3	6,392.73	6,392.60	0.005	2.5	3.76	7.4	6,395.87	6,396.13	6,393.50	6,393.50	6,393.61	6,393.57
P2	MH-9	DP A2	Circle	18.0	0.013	108.8	6,392.60	6,392.05	0.005	2.4	3.78	7.5	6,396.13	6,397.02	6,393.19	6,393.08	6,393.41	6,393.14
P3	DP A2a	DP A2	Circle	18.0	0.013	38.2	6,392.44	6,392.06	0.010	1.3	4.08	10.5	6,397.05	6,397.02	6,393.09	6,393.10	6,393.14	6,393.12
P4	DP A2	MH-4	Circle	18.0	0.013	82.2	6,392.05	6,391.64	0.005	3.5	4.13	7.4	6,397.02	6,398.26	6,392.77	6,392.63	6,393.04	6,392.73
P5	MH-4	MH-5	Circle	18.0	0.013	78.3	6,391.64	6,391.26	0.005	3.5	4.07	7.3	6,398.26	6,393.40	6,392.37	6,391.99	6,392.62	6,392.25
P6	DP B1	DP B4a	Circle	18.0	0.013	56.8	6,402.04	6,400.11	0.034	8.2	10.51	19.4	6,409.14	6,405.28	6,403.15	6,402.20	6,403.69	6,402.53
P7	DP B4a	DP B2a	Circle	24.0	0.013	161.3	6,399.91	6,396.69	0.020	16.6	10.27	32.0	6,405.28	6,401.85	6,401.38	6,398.91	6,402.08	6,399.35
P8	DP B2a	MH-1	Circle	24.0	0.013	73.2	6,396.49	6,394.73	0.024	19.4	11.44	35.0	6,401.85	6,400.00	6,398.07	6,396.48	6,398.89	6,397.07
P9	MH-1	MH-2	Circle	30.0	0.013	66.3	6,394.53	6,393.20	0.020	19.3	10.64	58.1	6,400.00	6,399.47	6,396.02	6,395.12	6,396.64	6,395.42
P10	MH-2	DP B3	Circle	30.0	0.013	51.0	6,393.00	6,391.98	0.020	19.2	10.61	58.0	6,399.47	6,398.92	6,394.49	6,393.04	6,395.11	6,393.74
P11	DP B2	DP B3	Circle	18.0	0.013	-	6,392.92	6,390.63	0.053	0.0	0.00	24.2	6,400.31	6,398.92	6,393.51	6,393.51	6,393.51	6,393.51
P12	DP B3	MH-3	Circle	30.0	0.013	107.6	6,390.63	6,389.31	0.012	20.8	9.05	45.4	6,398.92	6,397.42	6,392.18	6,390.51	6,392.83	6,391.52
P13	MH-3	DP B5	Circle	30.0	0.013	11.1	6,388.09	6,387.83	0.023	20.6	11.46	62.8	6,397.42	6,397.47	6,390.19	6,390.22	6,390.53	6,390.50
P14	DP B5	DP B6	Circle	30.0	0.013	40.3	6,387.63	6,386.99	0.016	25.3	10.47	51.7	6,397.47	6,397.77	6,389.34	6,389.45	6,390.12	6,389.86
P15	DP B6	DP A3	Circle	30.0	0.013	28.3	6,386.79	6,386.25	0.019	26.0	11.30	56.7	6,397.77	6,389.55	6,388.53	6,388.47	6,389.32	6,388.91
P16	DP A3	DP B6a	Circle	30.0	0.013	71.5	6,386.05	6,385.63	0.006	24.1	7.06	31.4	6,389.55	6,395.43	6,388.19	6,388.04	6,388.64	6,388.41
P17	DP B6a	MH-9	Circle	30.0	0.013	122.8	6,385.43	6,384.21	0.010	24.0	8.66	40.9	6,395.43	6,392.53	6,387.10	6,386.47	6,387.83	6,386.84
P19	MH-9	DP B7	Circle	30.0	0.013	47.7	6,384.01	6,383.53	0.010	23.8	8.68	41.1	6,392.53	6,391.60	6,386.08	6,386.03	6,386.55	6,386.40
P20	DP B7	DP B8	Circle	30.0	0.013	191.2	6,383.33	6,381.06	0.012	27.6	9.58	44.7	6,391.60	6,390.67	6,385.12	6,383.34	6,385.96	6,383.83
P21	DP B8	DP D2a	Circle	36.0	0.013	193.4	6,380.87	6,371.89	0.046	30.4	16.13	143.7	6,390.67	6,389.05	6,382.66	6,374.13	6,383.40	6,374.50
P22	DP D2a	DP D3	Circle	36.0	0.013	70.4	6,371.39	6,371.08	0.004	30.2	6.74	44.3	6,389.05	6,382.09	6,373.86	6,373.78	6,374.23	6,374.07
P23	DP D3	DP D7	Circle	36.0	0.013	80.8	6,370.88	6,370.07	0.010	31.6	9.32	66.8	6,382.09	6,379.95	6,373.42	6,373.32	6,373.80	6,373.63
P24(1)	DP C1	MH-22	Circle	18.0	0.013	31.3	6,392.74	6,392.58	0.005	1.7	3.43	7.5	6,396.53	6,396.83	6,393.23	6,393.06	6,393.40	6,393.25
P24(2)	MH-22	MH-4	Circle	18.0	0.013	122.1	6,392.28	6,391.67	0.005	1.7	3.39	7.4	6,396.83	6,393.81	6,392.77	6,392.15	6,392.94	6,392.33
P25	DP C2	DP D4	Circle	24.0	0.013	51.8	6,385.14	6,381.89	0.063	4.8	10.98	56.7	6,388.77	6,391.13	6,385.91	6,383.33	6,386.20	6,383.38
P26	DP D1	MH-5	Circle	24.0	0.013	51.4	6,390.96	6,390.73	0.004	7.2	4.76	15.1	6,397.57	6,397.30	6,392.21	6,392.18	6,392.40	6,392.30
P27	MH-5	MH-6	Circle	24.0	0.013	57.2	6,390.73	6,390.49	0.004	7.2	4.64	14.7	6,397.30	6,397.01	6,391.84	6,391.79	6,392.09	6,391.94
P28	MH-6	MH-8	Circle	24.0	0.013	154.3	6,390.49	6,389.78	0.005	7.2	4.80	15.3	6,397.01	6,396.22	6,391.45	6,391.19	6,391.81	6,391.32
P29	MH-8	MH-10	Circle	24.0	0.013	253.9	6,389.78	6,388.64	0.004	7.0	4.74	15.2	6,396.22	6,394.69	6,390.74	6,389.95	6,391.09	6,390.09
P30	MH-10	MH-3	Circle	24.0	0.013	79.1	6,388.64	6,388.30	0.004	6.8	4.64	14.9	6,394.69	6,389.90	6,389.59	6,389.25	6,389.92	6,389.58
P31	MH-2	DP D6a	Circle	24.0	0.013	58.6	6,375.47	6,374.88	0.010	9.3	6.86	22.7	6,385.16	6,382.03	6,376.56	6,376.02	6,377.00	6,376.30
P32	DP D6a	DP D6	Circle	30.0	0.013	20.9	6,374.38	6,373.76	0.030	10.2	10.22	70.6	6,382.03	6,381.75	6,376.03	6,376.08	6,376.16	6,376.15
P34	DP D4a	DP D4	Circle	18.0	0.013	125.1	6,385.53	6,382.78	0.022	3.9	7.35	15.6	6,389.61	6,391.13	6,386.29	6,383.29	6,386.59	6,383.84
P35	DP D4	DP D5	Circle	24.0	0.013	151.8	6,381.78	6,376.84	0.033	7.6	9.94	40.8	6,391.13	6,385.37	6,382.76	6,378.26	6,383.15	6,378.40
P36	DP D5a	MH-11	Circle	18.0	0.013	79.0	6,381.80	6,380.22	0.020	2.5	6.23	14.9	6,389.66	6,390.51	6,382.40	6,380.63	6,382.62	6,381.24
P37	MH-11	DP D5	Circle	18.0	0.013	53.7	6,379.52	6,377.83	0.031	2.5	7.30	18.6	6,390.51	6,385.37	6,380.11	6,378.20	6,380.33	6,378.64
P38	DP D5	DP D6	Circle	24.0	0.013	72.1	6,376.65	6,373.76	0.040	9.4	11.38	45.3	6,385.37	6,381.75	6,377.75	6,376.03	6,378.19	6,376.17
P39	DP D6b	DP D6	Circle	18.0	0.013	13.4	6,374.17	6,373.76	0.031	0.8	0.44	18.4	6,381.95	6,381.75	6,376.12	6,376.12	6,376.12	6,376.12
P40	DP D6	DP D7	Circle	30.0	0.013	55.8	6,373.56	6,370.87	0.048	20.1	14.76	90.0	6,381.75	6,379.95	6,375.08	6,373.35	6,375.72	6,373.61
P41	DP D7	DP D7a	Circle	42.0	0.013	138.2	6,369.87	6,368.50	0.010	51.2	10.47	100.2	6,379.95	6,378.64	6,372.78	6,372.55	6,373.34	6,372.99
P42(1)	DP D7b	MH-23	Circle	18.0	0.013	27.6	6,371.63	6,371.36	0.010	2.4	4.78	10.4	6,387.38	6,379.73	6,372.90	6,372.89	6,372.93	6,372.92
P42(2)	MH-23	MH-12	Circle	18.0	0.013	19.0	6,371.36	6,371.17	0.010	2.4	1.35	10.5	6,379.73	6,379.00	6,372.87	6,372.86	6,372.90	6,372.89
P43	MH-12	DP D7a	Circle	18.0	0.013	66.8	6,370.42	6,369.75	0.010	2.4	1.34	10.5	6,379.00	6,378.64	6,372.83	6,372.80	6,372.86	6,372.83
P44	DP D7a	MH205+71R	Circle	48.0	0.013	37.6	6,367.81	6,367.68	0.004	57.2	4.55	85.3	6,378.64	6,379.48	6,372.28	6,372.22	6,372.60	6,372.54
P45	MH205+71R	MH207+26R	Circle	54.0	0.013	149.0	6,367.68	6,366.94	0.005	83.9	9.13	138.6	6,379.48	6,380.92	6,370.49	6,370.52	6,371.49	6,371.03
P46	MH207+26R	O-1	Circle	54.0	0.013	123.0	6,366.69	6,366.08	0.005	83.3	9.11	138.5	6,380.92	6,383.30	6,369.36	6,368.60	6,370.48	6,369.88
P47	DP E1	MH-13	Circle	18.0	0.013	62.1	6,383.99	6,382.59	0.022	4.6	7.72	15.7	6,390.64	6,389.26	6,384.81	6,383.92	6,385.14	6,384.04
P48	MH-13	O-2	Circle	18.0	0.013	56.1	6,382.58	6,382.30	0.005	4.6	4.41	7.4	6,389.26	6,389.18	6,383.43	6,383.12	6,383.73	6,383.45

Scenario: 5-Yr
Current Time Step: 0.0 h
FlexTable: Manhole Table

Label	Bolted Cover?	Elevation (Invert in 1) (ft)	Elevation (Invert Out) (ft)	Flow (Total Out) (cfs)	Elevation (Rim) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Headloss Method	Headloss Coefficient (Standard)	HEC-22 Benching Method
DP A1	False	(N/A)	6,392.73	2.5	6,395.87	6,393.54	6,393.53	6,393.65	6,393.64	HEC-22 Energy (Third Edition)	-	Full
DP A2	False	6,392.05	6,392.05	3.5	6,397.02	6,392.85	6,392.83	6,393.11	6,393.09	HEC-22 Energy (Third Edition)	-	Full
DP A2a	False	(N/A)	6,392.44	1.3	6,397.05	6,393.12	6,393.10	6,393.17	6,393.15	HEC-22 Energy (Third Edition)	-	Full
DP A3	False	6,386.25	6,386.05	24.1	6,389.55	6,388.28	6,388.28	6,388.73	6,388.73	HEC-22 Energy (Third Edition)	-	Full
DP B1	False	(N/A)	6,402.04	8.2	6,409.14	6,403.85	6,403.34	6,404.39	6,403.88	HEC-22 Energy (Third Edition)	-	Full
DP B2	False	(N/A)	6,392.92	0.0	6,400.31	6,393.51	6,393.51	6,393.51	6,393.51	HEC-22 Energy (Third Edition)	-	Full
DP B2a	False	6,396.69	6,396.49	19.4	6,401.85	6,398.35	6,398.35	6,399.17	6,399.17	HEC-22 Energy (Third Edition)	-	Full
DP B3	False	6,391.98	6,390.63	20.8	6,398.92	6,392.86	6,392.39	6,393.51	6,393.05	HEC-22 Energy (Third Edition)	-	Full
DP B4a	False	6,400.11	6,399.91	16.6	6,405.28	6,401.70	6,401.63	6,402.40	6,402.33	HEC-22 Energy (Third Edition)	-	Full
DP B5	False	6,387.83	6,387.63	25.3	6,397.47	6,389.62	6,389.62	6,390.39	6,390.39	HEC-22 Energy (Third Edition)	-	Full
DP B6	False	6,386.99	6,386.79	26.0	6,397.77	6,388.90	6,388.81	6,389.69	6,389.60	HEC-22 Energy (Third Edition)	-	Full
DP B6a	False	6,385.63	6,385.43	24.0	6,395.43	6,387.53	6,387.35	6,388.26	6,388.09	HEC-22 Energy (Third Edition)	-	Full
DP B7	False	6,383.53	6,383.33	27.6	6,391.60	6,385.42	6,385.42	6,386.25	6,386.25	HEC-22 Energy (Third Edition)	-	Full
DP B8	False	6,381.06	6,380.87	30.4	6,390.67	6,382.89	6,382.89	6,383.63	6,383.63	HEC-22 Energy (Third Edition)	-	Full
DP C1	False	(N/A)	6,392.74	1.7	6,396.53	6,393.30	6,393.26	6,393.48	6,393.44	HEC-22 Energy (Third Edition)	-	Full
DP C2	False	6,388.77	6,385.14	4.8	6,388.77	6,385.99	6,385.97	6,386.28	6,386.25	HEC-22 Energy (Third Edition)	-	Full
DP D1	False	(N/A)	6,390.96	7.2	6,397.57	6,392.31	6,392.25	6,392.50	6,392.44	HEC-22 Energy (Third Edition)	-	Full
DP D2a	False	6,371.89	6,371.39	30.2	6,389.05	6,373.99	6,373.94	6,374.35	6,374.30	HEC-22 Energy (Third Edition)	-	Full
DP D3	False	6,371.08	6,370.88	31.6	6,382.09	6,373.57	6,373.50	6,373.95	6,373.88	HEC-22 Energy (Third Edition)	-	Full
DP D4	False	6,382.78	6,381.78	7.6	6,391.13	6,382.98	6,382.84	6,383.36	6,383.22	HEC-22 Energy (Third Edition)	-	Full
DP D4a	False	(N/A)	6,385.53	3.9	6,389.61	6,386.41	6,386.35	6,386.71	6,386.65	HEC-22 Energy (Third Edition)	-	Full
DP D5	False	6,376.84	6,376.65	9.4	6,385.37	6,377.90	6,377.86	6,378.35	6,378.30	HEC-22 Energy (Third Edition)	-	Full
DP D5a	False	6,382.00	6,381.80	2.5	6,389.66	6,382.61	6,382.44	6,382.83	6,382.66	HEC-22 Energy (Third Edition)	-	Full
DP D6	False	6,373.76	6,373.56	20.1	6,381.75	6,375.48	6,375.28	6,376.12	6,375.92	HEC-22 Energy (Third Edition)	-	Full
DP D6a	False	6,374.88	6,374.38	10.2	6,382.03	6,376.05	6,376.05	6,376.19	6,376.19	HEC-22 Energy (Third Edition)	-	Full
DP D6b	False	(N/A)	6,374.17	0.8	6,381.95	6,376.12	6,376.12	6,376.12	6,376.12	HEC-22 Energy (Third Edition)	-	Full
DP D7	False	6,370.07	6,369.87	51.2	6,379.95	6,372.95	6,372.89	6,373.50	6,373.45	HEC-22 Energy (Third Edition)	-	Full
DP D7a	False	6,368.50	6,367.81	57.2	6,378.64	6,372.49	6,372.35	6,372.82	6,372.67	HEC-22 Energy (Third Edition)	-	Full
DP D7b	False	(N/A)	6,371.63	2.4	6,387.38	6,372.96	6,372.91	6,373.00	6,372.94	HEC-22 Energy (Third Edition)	-	Full
DP E1	False	(N/A)	6,383.99	4.6	6,390.64	6,385.13	6,384.90	6,385.46	6,385.23	HEC-22 Energy (Third Edition)	-	Full
MH-1	False	6,394.73	6,394.53	19.3	6,400.00	6,396.21	6,396.21	6,396.83	6,396.83	HEC-22 Energy (Third Edition)	-	Full
MH-2	False	6,385.16	6,375.47	9.3	6,385.16	6,377.07	6,376.67	6,377.51	6,377.11	HEC-22 Energy (Third Edition)	-	Full
MH-2	False	6,393.20	6,393.00	19.2	6,399.47	6,394.68	6,394.68	6,395.30	6,395.30	HEC-22 Energy (Third Edition)	-	Full
MH-3	False	6,389.31	6,388.09	20.6	6,397.42	6,390.39	6,390.26	6,390.73	6,390.60	HEC-22 Energy (Third Edition)	-	Full
MH-3	False	6,388.30	6,388.30	6.8	6,389.90	6,388.95	6,388.77	6,389.04	6,388.86	HEC-22 Energy (Third Edition)	-	Full
MH-4	False	6,391.64	6,391.64	3.5	6,398.26	6,392.43	6,392.42	6,392.69	6,392.67	HEC-22 Energy (Third Edition)	-	Full
MH-4	False	6,391.67	6,391.67	1.6	6,393.81	6,391.98	6,391.85	6,392.00	6,391.87	HEC-22 Energy (Third Edition)	-	Full
MH-5	False	6,390.73	6,390.73	7.2	6,397.30	6,392.00	6,391.89	6,392.25	6,392.14	HEC-22 Energy (Third Edition)	-	Full
MH-5	False	6,391.26	6,391.26	3.4	6,393.40	6,391.60	6,391.57	6,391.67	6,391.63	HEC-22 Energy (Third Edition)	-	Full
MH-6	False	6,390.49	6,390.49	7.2	6,397.01	6,391.52	6,391.52	6,391.88	6,391.88	HEC-22 Energy (Third Edition)	-	Full
MH-8	False	6,389.78	6,389.78	7.0	6,396.22	6,390.92	6,390.81	6,391.27	6,391.16	HEC-22 Energy (Third Edition)	-	Full
MH-9	False	6,392.60	6,392.60	2.4	6,396.13	6,393.32	6,393.24	6,393.54	6,393.46	HEC-22 Energy (Third Edition)	-	Full
MH-9	False	6,384.21	6,384.01	23.8	6,392.53	6,386.23	6,386.19	6,386.69	6,386.66	HEC-22 Energy (Third Edition)	-	Full
MH-10	False	6,388.64	6,388.64	6.8	6,394.69	6,389.70	6,389.66	6,390.03	6,389.99	HEC-22 Energy (Third Edition)	-	Full
MH-11	False	6,380.22	6,379.52	2.5	6,390.51	6,380.26	6,380.16	6,380.48	6,380.38	HEC-22 Energy (Third Edition)	-	Full
MH-12	False	6,371.17	6,370.42	2.4	6,379.00	6,372.85	6,372.84	6,372.88	6,372.87	HEC-22 Energy (Third Edition)	-	Full
MH-13	False	6,382.59	6,382.58	4.6	6,389.26	6,383.69	6,383.51	6,383.99	6,383.82	HEC-22 Energy (Third Edition)	-	Full

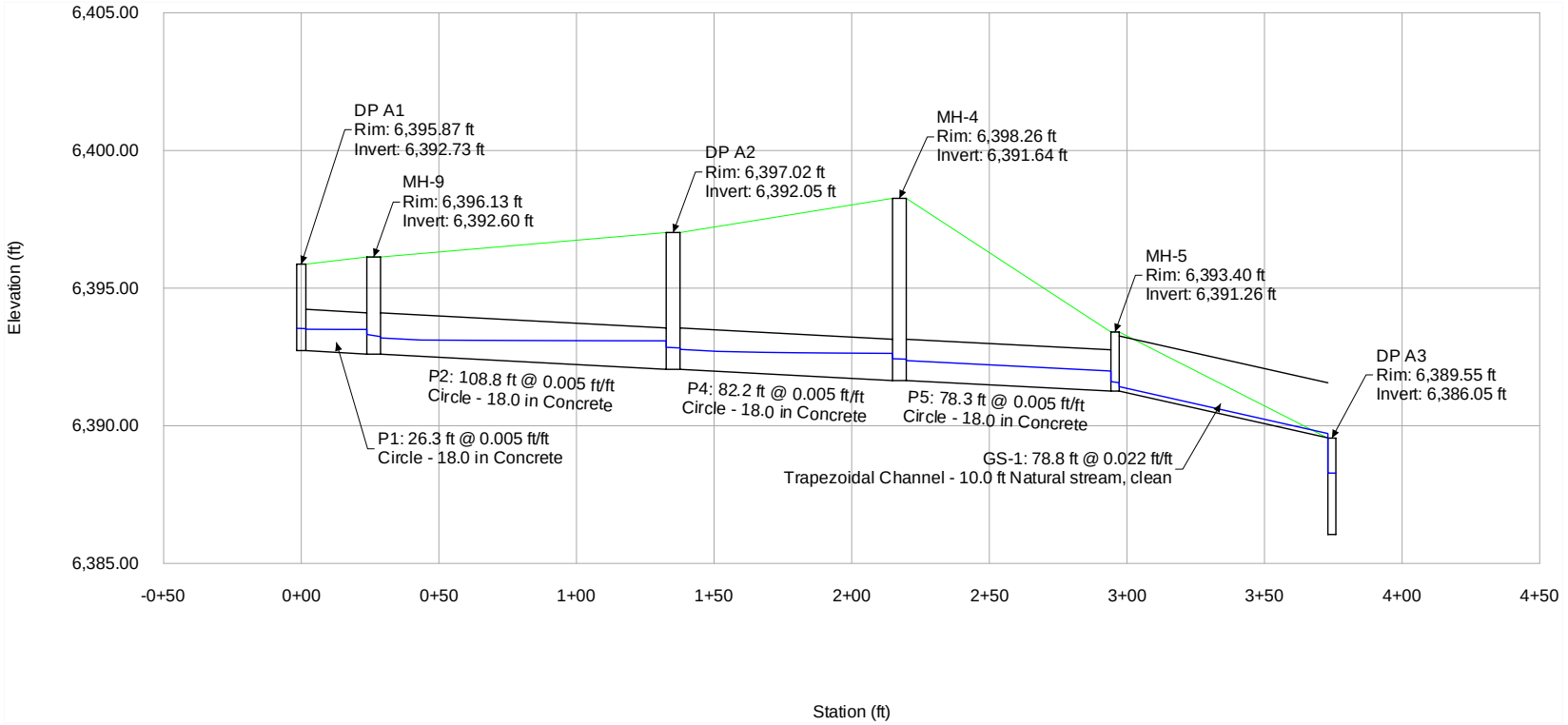
MH-17	False	6,369.85	(N/A)	0.1	6,378.29	(N/A)	(N/A)	(N/A)	(N/A)	HEC-22 Energy (Third Edition)	-	Full
MH-19	False	(N/A)	6,382.72	0.0	6,389.88	6,382.83	6,382.83	6,382.83	6,382.83	HEC-22 Energy (Third Edition)	-	Full
MH-21	False	(N/A)	6,384.11	0.0	6,389.71	(N/A)	(N/A)	(N/A)	(N/A)	HEC-22 Energy (Third Edition)	-	Full
MH-22	False	6,392.58	6,392.28	1.7	6,396.83	6,392.84	6,392.80	6,393.02	6,392.98	HEC-22 Energy (Third Edition)	-	Full
MH-23	False	6,371.36	6,371.36	2.4	6,379.73	6,372.88	6,372.88	6,372.91	6,372.91	HEC-22 Energy (Third Edition)	-	Full
MH205+71R	False	6,367.68	6,367.68	83.9	6,379.48	6,371.41	6,370.82	6,372.42	6,371.82	HEC-22 Energy (Third Edition)	-	Full
MH207+26R	False	6,366.94	6,366.69	83.3	6,380.92	6,369.72	6,369.70	6,370.83	6,370.81	HEC-22 Energy (Third Edition)	-	Full

Scenario: 5-Yr
Current Time Step: 0.0 h
FlexTable: Outfall Table

ID	Label	Elevation (Ground) (ft)	Set Rim to Ground Elevation?	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)
201	O-2	6,389.18	True	6,382.30	Free Outfall	-	6,383.12	4.5
257	O-1	6,383.30	True	6,363.83	Free Outfall	-	6,368.60	82.8

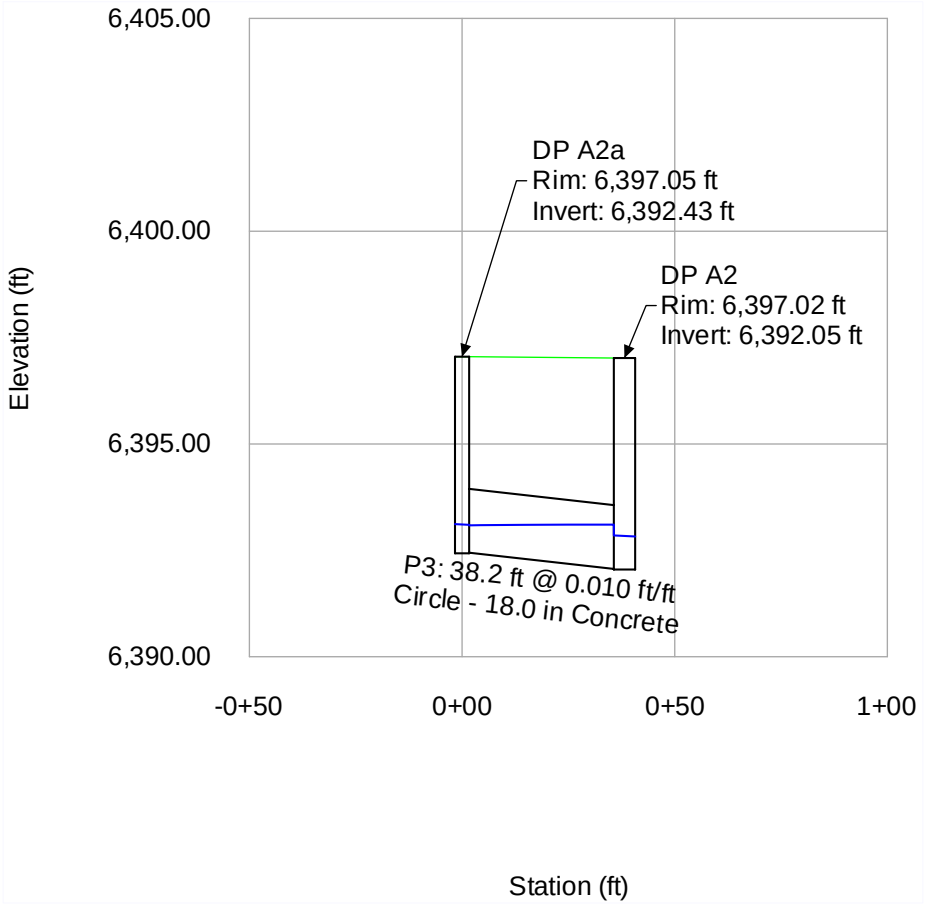
H:\K\King Soopers - City Market\CO, Castle Rock - KSS000165 - Dawson Trails\0CIV\Drain Reports\Prop\StormCAD\KSS165_StormCAD.stsw

Profile Report
Engineering Profile - Line A (KSS165_StormCAD.stsw)

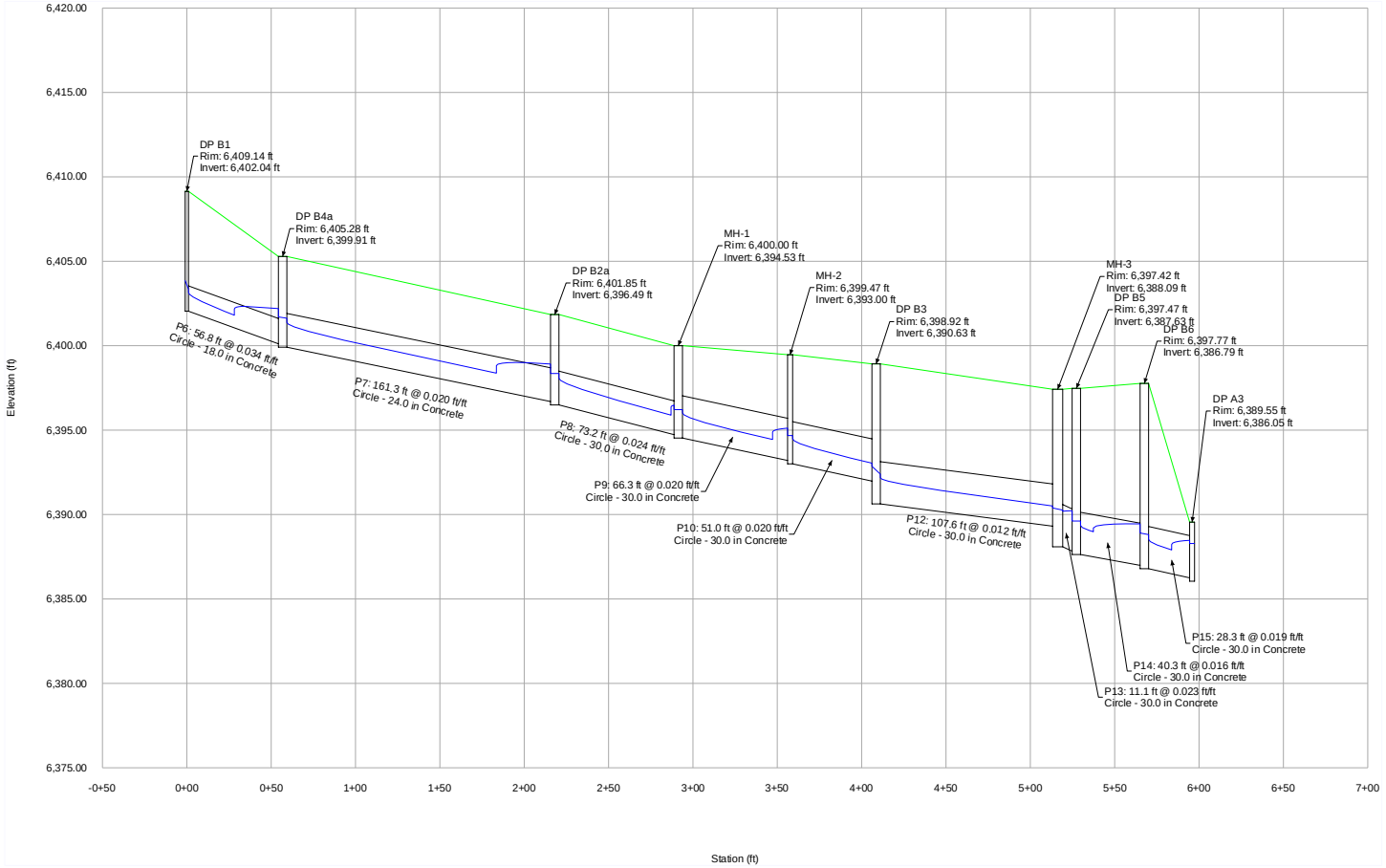


Profile Report

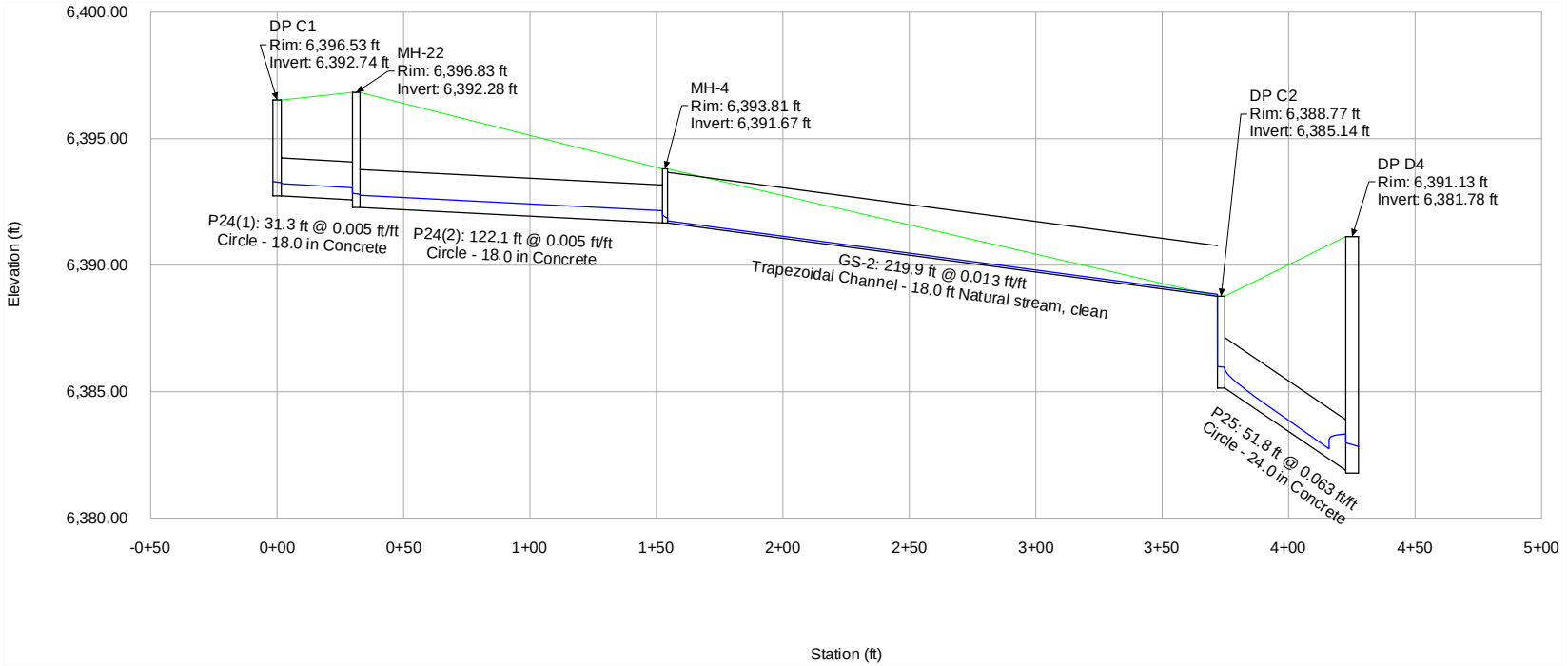
Engineering Profile - Line A2 (KSS165_StormCAD.stsw)



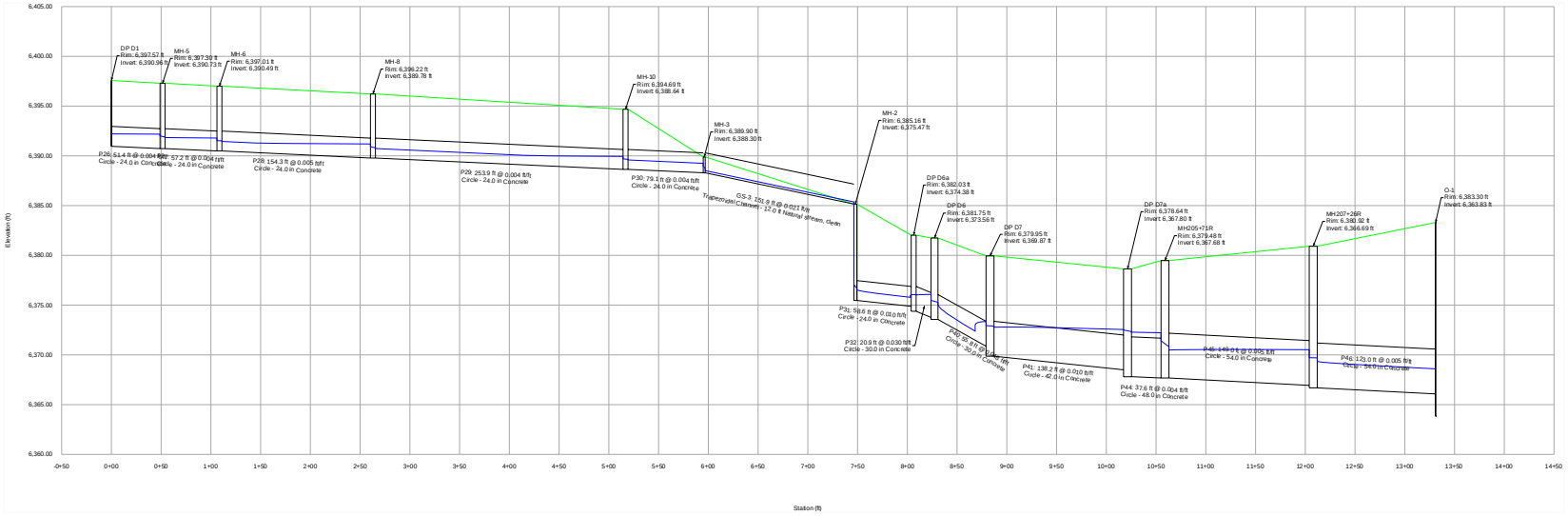
Profile Report
Engineering Profile - Line B (KSS165_StormCAD.stsw)



Profile Report
Engineering Profile - Line C (KSS165_StormCAD.stsw)

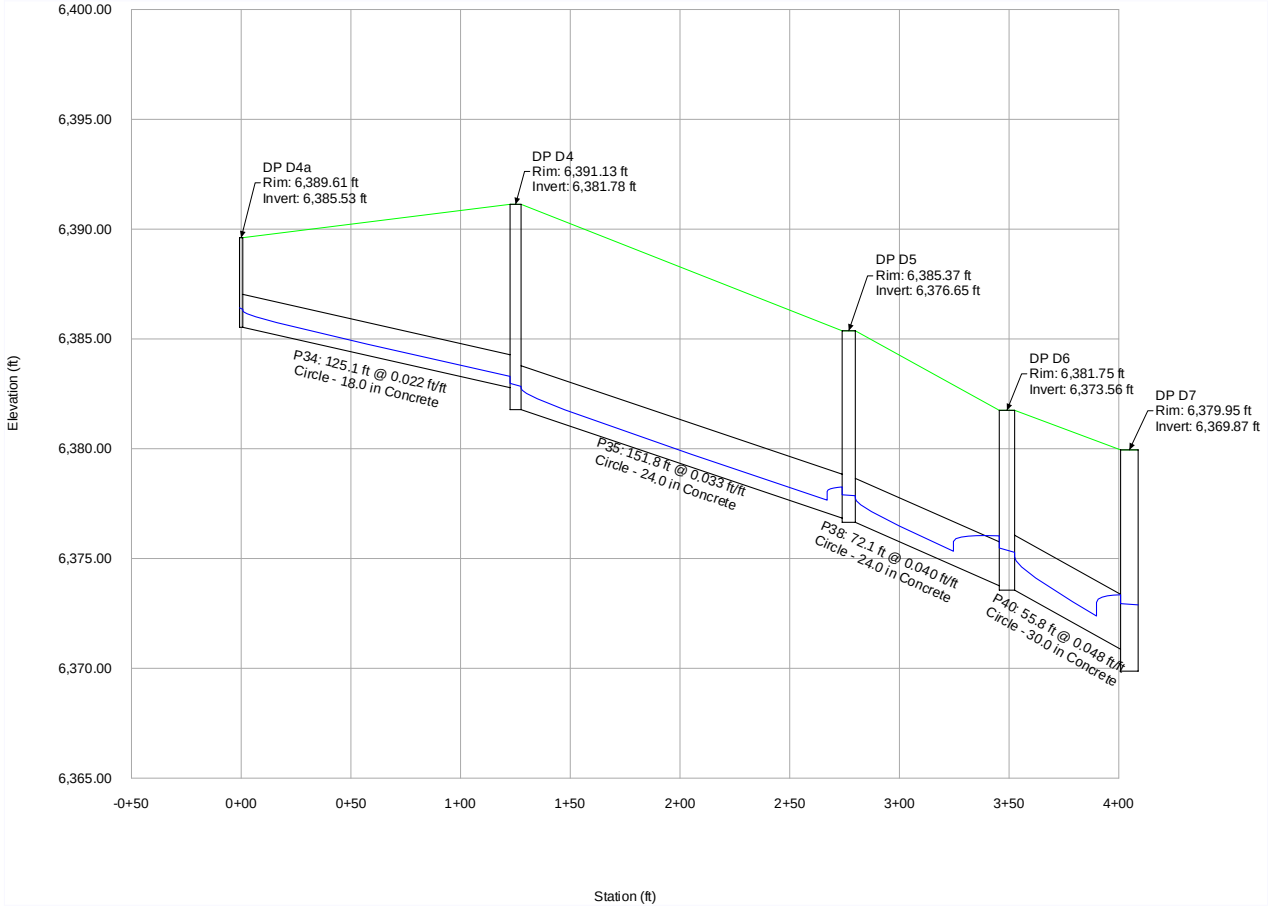


Profile Report
Engineering Profile - Line D (KSS165_StormCAD.stsw)



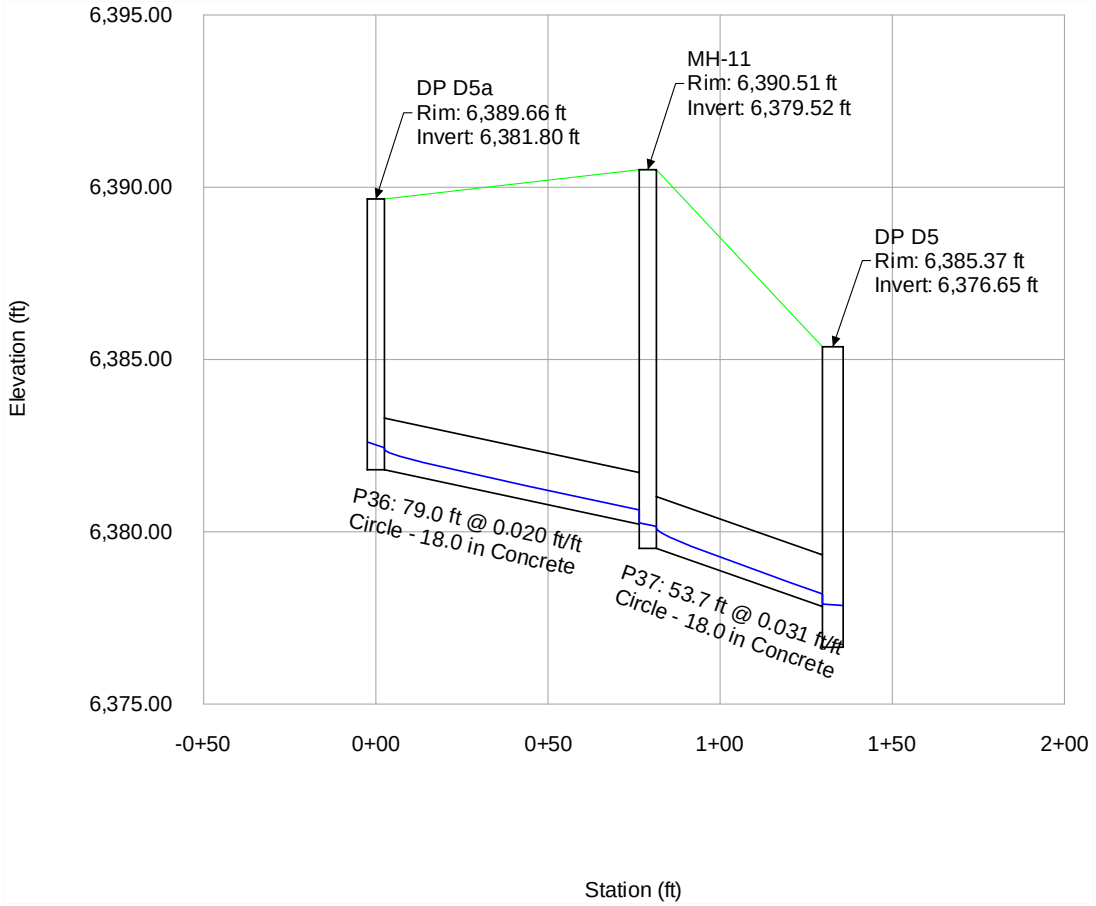
Profile Report

Engineering Profile - Line D2 (KSS165_StormCAD.stsw)



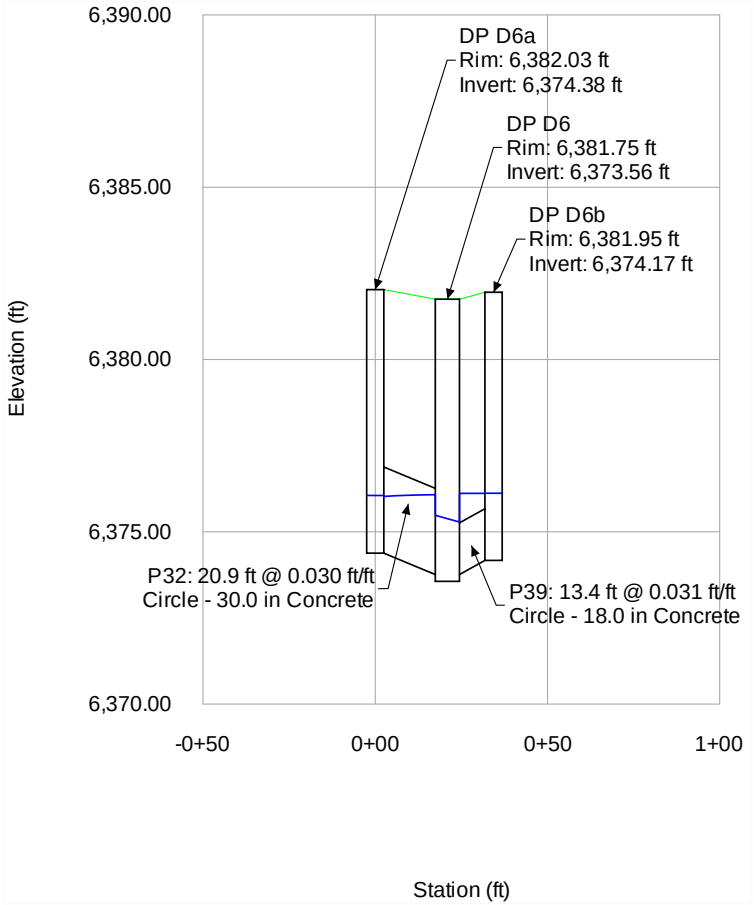
Profile Report

Engineering Profile - Line D3 (KSS165_StormCAD.stsw)



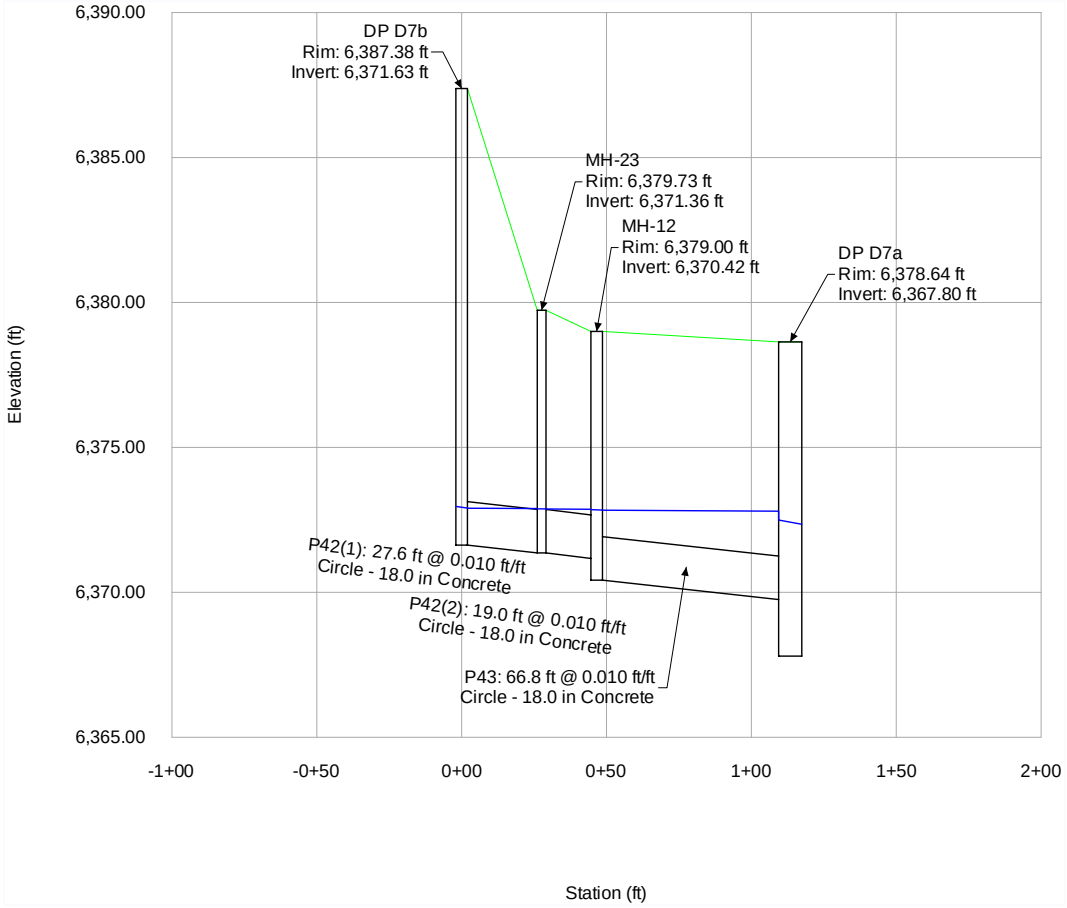
Profile Report

Engineering Profile - Line D4 (KSS165_StormCAD.stsw)



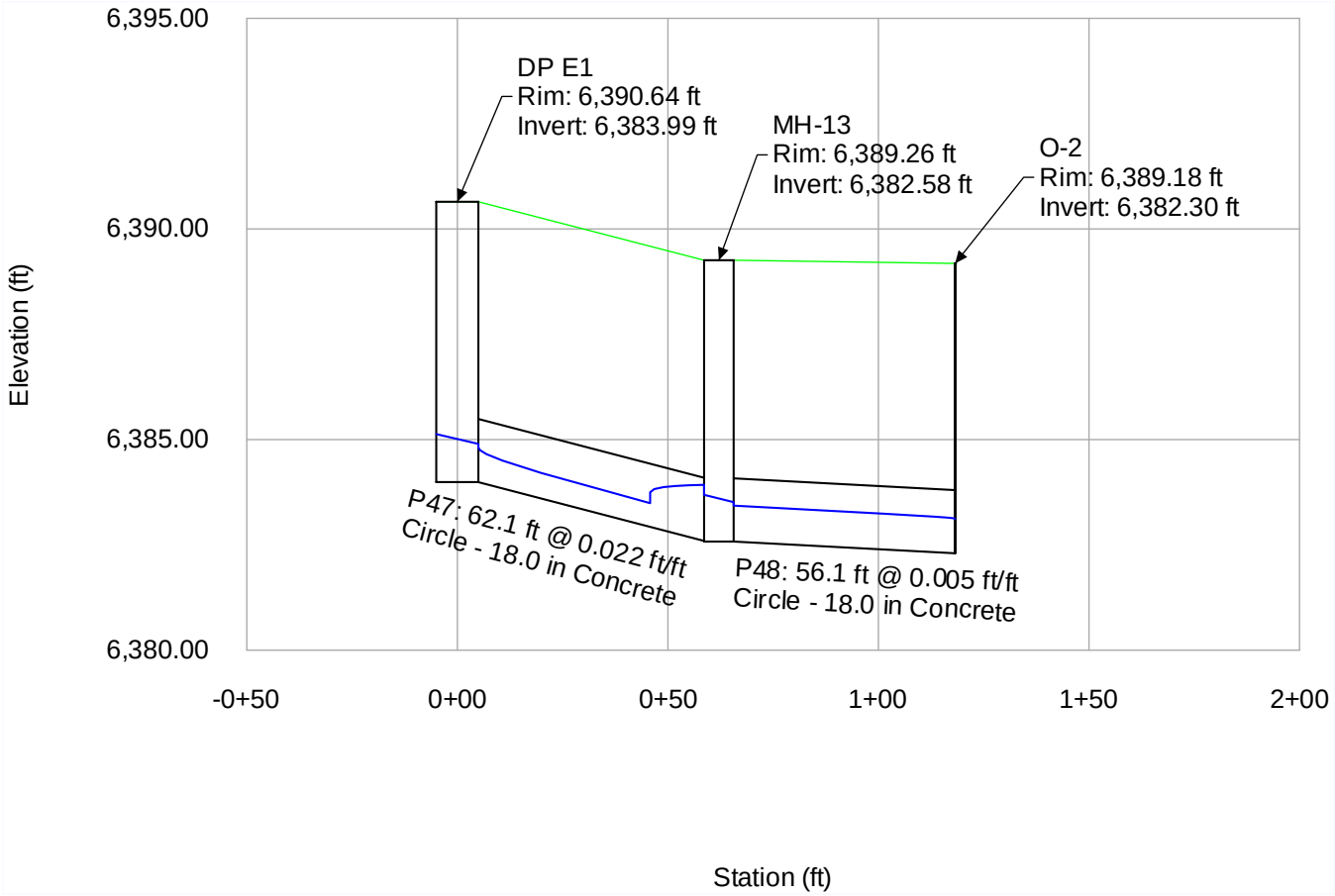
Profile Report

Engineering Profile - Line D5 (KSS165_StormCAD.stsw)



Profile Report

Engineering Profile - Line E (KSS165_StormCAD.stsw)



Scenario Summary Report
Scenario: 100-Yr

Scenario Summary

ID	1
Label	100-Yr
Notes	
Active Topology	Base Active Topology
User Data Extensions	Base User Data Extensions
Physical	Base Physical
Boundary Condition	Base Boundary Condition
Initial Settings	Base Initial Settings
Hydrology	100-Yr - Hydrology
Output	Base Output
Infiltration and Inflow	Base Infiltration and Inflow
Rainfall Runoff	100-Yr - Rainfall Runoff
Water Quality	Base Water Quality
Sanitary Loading	Base Sanitary Loading
Headloss	Base Headloss
Operational	Base Operational
Design	Base Design
System Flows	Base System Flows
SCADA	Base SCADA
Energy Cost	Base Energy Cost
Surface Definition	Base Surface Definition
Solver Calculation Options	Base Calculation Options

Gravity Hydraulics

Maximum Network Traversals	5	Structure Loss Mode	Energy Grade
Flow Convergence Test	0.00	Include Conduit Flow Travel Time in Design	True
Flow Profile Method	Backwater Analysis	Save Detailed Headloss Data?	False
Number of Flow Profile Steps	5	Gravity Friction Method	Manning's
Hydraulic Grade Convergence Test	0.00 ft	Use Explicit Depth and Slope Equations?	False
Average Velocity Method	Actual Uniform Flow Velocity	Ignore Pipe Travel Time in Carrier Pipes?	False
Minimum Structure Headloss	0.00 ft	Correct for Partial Area Effects?	False
Governing Upstream Pipe Selection Method	Pipe with Maximum QV		

Inlets

Active Components for Combination Inlets on Grade	Grate and Curb	Neglect Side Flow?	False
Active Components for Combination Inlets In Sag	Grate and Curb	Split Downstream Surface Flow Between Gutters?	False
Neglect Gutter Cross Slope For Side Flow?	False		

Grating Parameters (United Kingdom)

Grating Type	Grating Parameter

Scenario Summary Report
Scenario: 100-Yr

Grating Parameters (United Kingdom)

Grating Type	Grating Parameter
P	30.00
Q	45.00
R	60.00
S	80.00
T	110.00

Pressure Hydraulics

Liquid Label	Water at 20C (68F)	Pressure Friction Method	Hazen-Williams

Rational Method

Use Rational Method Frequency Factors	False	Carryover Modeling Method	As CA (Traditional)
Allow Runoff Coefficient to Exceed 1.0?	False		

Headloss (AASHTO)

Expansion, Ke	0.35	Shaping Adjustment, Cs	0.50
Contraction, Kc	0.25	Non-Piped Flow Adjustment, Cn	1.30

Bend Angle vs. Bend Loss Curve

Bend Angle (degrees)	Bend Loss Coefficient, Kb
0.00	0.00
15.00	0.19
30.00	0.35
45.00	0.47
60.00	0.56
75.00	0.64
90.00	0.70

HEC-22 Energy Losses

Consider Non-Piped Plunging Flow?	True

HEC-22 Energy Losses (Second Edition)

Elevations Considered Equal Within	0.50 ft	Half Bench Submerged Factor	0.95
Flat Unsubmerged Factor	1.00	Full Bench Unsubmerged Factor	0.07
Flat Submerged Factor	1.00	Full Bench Submerged Factor	0.75
Depressed Unsubmerged Factor	1.00	Improved Bench Unsubmerged Factor	0.04
Depressed Submerged Factor	1.00	Improved Bench Submerged Factor	0.38
Half Bench Unsubmerged Factor	0.15		

Scenario Summary Report
Scenario: 100-Yr

HEC-22 Energy Losses (Third Edition)			
Flat Submerged Coefficient	-0.05	Half Bench Unsubmerged Coefficient	-0.85
Flat Unsubmerged Coefficient	-0.05	Full Bench Submerged Coefficient	-0.25
Depressed Submerged Coefficient	0.00	Full Bench Unsubmerged Coefficient	-0.93
Depressed Unsubmerged Coefficient	0.00	Improved Submerged Coefficient	-0.60
Half Bench Submerged Coefficient	-0.05	Improved Unsubmerged Coefficient	-0.98

Modified Rational (United Kingdom)			
Apply Areal Reduction Factor?	False	Pipe Flow Includes Pipe Travel Time?	False
Runoff Routing Coefficient (Cr)	1.30		

Scenario: 100-Yr
Current Time Step: 0.0 h
FlexTable: Catchment Table

ID	Label	Outflow Element	Area (User Defined) (acres)	Runoff Coefficient (Rational)	Time of Concentration (min)	Flow (Total Out) (cfs)	Notes
164	A1	DP A1	1.07	0.77	10.6	5.7	-
173	A2	DP A2a	0.48	0.77	6.2	3.1	-
174	A3	DP A3	0.35	0.74	5.0	2.3	-
175	B1	DP B1	1.13	0.77	5.0	7.7	-
176	B2a	DP B2a	1.28	0.77	5.0	8.8	-
248	B2b	DP B2	1.10	0.77	5.0	7.5	-
177	B3	DP B3	0.41	0.87	5.0	3.2	-
178	B4a	DP B4a	1.35	0.77	5.0	9.2	-
249	B4b	DP B2a	0.49	0.77	5.0	3.4	-
250	B4c	DP B3	1.02	0.77	5.0	7.0	-
179	B5	DP B5	0.23	0.87	6.2	1.7	-
180	B6	DP B6	0.21	0.87	6.2	1.5	-
181	B7	DP B7	1.45	0.85	9.1	9.1	-
184	B8	DP B8	1.20	0.85	8.4	7.8	-
186	C1	DP C1	1.04	0.75	8.7	5.9	-
187	C2	DP C2	1.20	0.77	10.4	6.5	-
185	D1	DP D1	2.30	0.87	10.1	14.1	-
188	D2	MH-2	1.01	0.86	6.1	7.4	-
189	D3	DP D3	0.25	0.57	5.0	1.3	-
190	D4a	DP D4a	0.73	0.77	5.0	5.0	-
229	D4b	DP D4a	0.61	0.77	5.0	4.2	-
191	D5	DP D5a	0.70	0.85	6.2	5.0	-
192	D6a	DP D6a	0.41	0.80	5.0	2.9	-
193	D6b	DP D6b	0.24	0.80	5.0	1.7	-
194	D7	MH-17	0.14	0.57	5.0	0.7	-
234	D7b	DP D7b	0.91	0.75	5.0	6.1	-
182	E1	DP E1	0.19	0.57	5.0	1.0	-
183	OS-1	DP E1	1.51	0.82	8.8	9.3	-
196	OS-2	DP D3	0.60	0.81	5.6	4.2	-
195	OS-3	DP D7a	1.94	0.82	8.3	12.2	-
226	OS-4	DP B5	0.38	0.87	5.0	2.9	-
236	OS-5	DP D6a	0.00	0.79	7.7	0.0	-
258	OS-6	DP B1	0.00	0.87	5.0	0.0	-

Scenario: 100-Yr
Current Time Step: 0.0 h
FlexTable: Conduit Table

Label	Start Node	Stop Node	Section Type	Diameter (in)	Manning's n	Length (User Defined) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Slope (Calculated) (ft/ft)	Flow (cfs)	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)
CO-13	MH-21	DP D5a	Circle	12.0	0.013	105.3	6,384.11	6,382.00	0.020	0.0	0.00	5.0	6,389.71	6,389.66	6,384.11	6,383.60	6,384.11	6,383.60
CO-14	MH-19	DP D5a	Circle	12.0	0.013	13.5	6,382.72	6,382.00	0.053	0.0	0.00	8.2	6,389.88	6,389.66	6,383.60	6,383.60	6,383.60	6,383.60
GS-1	MH-5	DP A3	Trapezoidal Channel	-	0.030	78.8	6,391.26	6,389.56	0.022	7.9	2.78	321.6	6,393.40	6,389.55	6,391.52	6,389.82	6,391.64	6,397.20
GS-2	MH-4	DP C2	Trapezoidal Channel	-	0.030	219.9	6,391.67	6,388.77	0.013	5.7	1.74	388.9	6,393.81	6,388.77	6,391.85	6,388.95	6,391.89	6,388.99
GS-3	MH-3	MH-2	Trapezoidal Channel	-	0.030	151.9	6,388.30	6,385.16	0.021	13.3	3.12	357.1	6,389.90	6,385.16	6,388.62	6,385.48	6,388.77	6,385.63
P1	DP A1	MH-9	Circle	18.0	0.013	26.3	6,392.73	6,392.60	0.005	5.7	3.24	7.4	6,395.87	6,396.13	6,394.68	6,394.60	6,394.85	6,394.77
P2	MH-9	DP A2	Circle	18.0	0.013	108.8	6,392.60	6,392.05	0.005	5.7	3.23	7.5	6,396.13	6,397.02	6,394.44	6,394.12	6,394.60	6,394.28
P3	DP A2a	DP A2	Circle	18.0	0.013	38.2	6,392.44	6,392.06	0.010	3.1	1.77	10.5	6,397.05	6,397.02	6,394.22	6,394.19	6,394.27	6,394.24
P4	DP A2	MH-4	Circle	18.0	0.013	82.2	6,392.05	6,391.64	0.005	8.1	4.59	7.4	6,397.02	6,398.26	6,393.79	6,393.30	6,394.11	6,393.62
P5	MH-4	MH-5	Circle	18.0	0.013	78.3	6,391.64	6,391.26	0.005	8.0	4.54	7.3	6,398.26	6,393.40	6,392.96	6,392.36	6,393.33	6,392.88
P6	DP B1	DP B4a	Circle	18.0	0.013	56.8	6,402.04	6,400.11	0.034	7.7	10.34	19.4	6,409.14	6,405.28	6,403.12	6,402.24	6,403.62	6,402.54
P7	DP B4a	DP B2a	Circle	24.0	0.013	161.3	6,399.91	6,396.69	0.020	16.9	10.32	32.0	6,405.28	6,401.85	6,401.64	6,400.83	6,402.17	6,401.28
P8	DP B2a	MH-1	Circle	24.0	0.013	73.2	6,396.49	6,394.73	0.024	28.7	9.13	35.0	6,401.85	6,400.00	6,399.49	6,398.31	6,400.78	6,399.61
P9	MH-1	MH-2	Circle	30.0	0.013	66.3	6,394.53	6,393.20	0.020	28.5	5.81	58.1	6,400.00	6,399.47	6,398.44	6,398.12	6,398.97	6,398.65
P10	MH-2	DP B3	Circle	30.0	0.013	51.0	6,393.00	6,391.98	0.020	28.3	5.76	58.0	6,399.47	6,398.92	6,397.81	6,397.57	6,398.33	6,398.09
P11	DP B2	DP B3	Circle	18.0	0.013	-	6,392.92	6,390.63	0.053	7.5	4.26	24.2	6,400.31	6,398.92	6,397.93	6,397.71	6,398.22	6,397.99
P12	DP B3	MH-3	Circle	30.0	0.013	107.6	6,390.63	6,389.31	0.012	45.2	9.21	45.4	6,398.92	6,397.42	6,395.78	6,394.47	6,397.10	6,395.79
P13	MH-3	DP B5	Circle	30.0	0.013	11.1	6,388.09	6,387.83	0.023	44.8	9.14	62.8	6,397.42	6,397.47	6,393.04	6,392.90	6,394.33	6,394.20
P14	DP B5	DP B6	Circle	30.0	0.013	40.3	6,387.63	6,386.99	0.016	49.0	9.98	51.7	6,397.47	6,397.77	6,391.83	6,391.25	6,393.37	6,392.80
P15	DP B6	DP A3	Circle	30.0	0.013	28.3	6,386.79	6,386.25	0.019	50.4	10.27	56.7	6,397.77	6,389.55	6,389.98	6,389.55	6,391.61	6,397.86
P16	DP A3	DP B6a	Circle	30.0	0.013	71.5	6,386.05	6,385.63	0.006	48.6	9.91	31.4	6,389.55	6,395.43	6,395.68	6,394.67	6,397.20	6,396.20
P17	DP B6a	MH-9	Circle	30.0	0.013	122.8	6,385.43	6,384.21	0.010	48.4	9.87	40.9	6,395.43	6,392.53	6,393.37	6,391.66	6,394.88	6,393.17
P19	MH-9	DP B7	Circle	30.0	0.013	47.7	6,384.01	6,383.53	0.010	48.1	9.80	41.1	6,392.53	6,391.60	6,390.48	6,389.82	6,391.97	6,391.31
P20	DP B7	DP B8	Circle	30.0	0.013	191.2	6,383.33	6,381.06	0.012	55.9	11.39	44.7	6,391.60	6,390.67	6,388.24	6,384.69	6,390.26	6,386.70
P21	DP B8	DP D2a	Circle	36.0	0.013	193.4	6,380.87	6,371.89	0.046	61.9	8.75	143.7	6,390.67	6,389.05	6,384.47	6,382.80	6,385.66	6,383.99
P22	DP D2a	DP D3	Circle	36.0	0.013	70.4	6,371.39	6,371.08	0.004	61.1	8.64	44.3	6,389.05	6,382.09	6,381.80	6,381.21	6,382.96	6,382.37
P23	DP D3	DP D7	Circle	36.0	0.013	80.8	6,370.88	6,370.07	0.010	64.7	9.16	66.8	6,382.09	6,379.95	6,379.96	6,379.20	6,381.26	6,380.50
P24(1)	DP C1	MH-22	Circle	18.0	0.013	31.3	6,392.74	6,392.58	0.005	5.9	4.71	7.5	6,396.53	6,396.83	6,393.84	6,393.76	6,394.12	6,393.97
P24(2)	MH-22	MH-4	Circle	18.0	0.013	122.1	6,392.28	6,391.67	0.005	5.9	4.66	7.4	6,396.83	6,393.81	6,393.29	6,392.68	6,393.62	6,393.01
P25	DP C2	DP D4	Circle	24.0	0.013	51.8	6,385.14	6,381.89	0.063	11.5	14.16	56.7	6,388.77	6,391.13	6,386.36	6,384.55	6,386.87	6,384.76
P26	DP D1	MH-5	Circle	24.0	0.013	51.4	6,390.96	6,390.73	0.004	14.1	4.50	15.1	6,397.57	6,397.30	6,393.39	6,393.19	6,393.71	6,393.51
P27	MH-5	MH-6	Circle	24.0	0.013	57.2	6,390.73	6,390.49	0.004	14.0	4.47	14.7	6,397.30	6,397.01	6,392.86	6,392.64	6,393.18	6,392.95
P28	MH-6	MH-8	Circle	24.0	0.013	154.3	6,390.49	6,389.78	0.005	13.9	5.53	15.3	6,397.01	6,396.22	6,392.46	6,391.88	6,392.77	6,392.19
P29	MH-8	MH-10	Circle	24.0	0.013	253.9	6,389.78	6,388.64	0.004	13.7	5.47	15.2	6,396.22	6,394.69	6,391.44	6,390.66	6,391.82	6,390.96
P30	MH-10	MH-3	Circle	24.0	0.013	79.1	6,388.64	6,388.30	0.004	13.4	5.37	14.9	6,394.69	6,389.90	6,390.12	6,389.78	6,390.57	6,390.23
P31	MH-2	DP D6a	Circle	24.0	0.013	58.6	6,375.47	6,374.88	0.010	18.5	5.89	22.7	6,385.16	6,382.03	6,381.98	6,381.59	6,382.52	6,382.13
P32	DP D6a	DP D6	Circle	30.0	0.013	20.9	6,374.38	6,373.76	0.030	20.5	4.18	70.6	6,382.03	6,381.75	6,381.57	6,381.51	6,381.84	6,381.78
P34	DP D4a	DP D4	Circle	18.0	0.013	125.1	6,385.53	6,382.78	0.022	9.2	9.17	15.6	6,389.61	6,391.13	6,386.70	6,384.42	6,387.30	6,384.84
P35	DP D4	DP D5	Circle	24.0	0.013	151.8	6,381.78	6,376.84	0.033	18.5	12.67	40.8	6,391.13	6,385.37	6,383.66	6,382.67	6,384.23	6,383.21
P36	DP D5a	MH-11	Circle	18.0	0.013	79.0	6,381.80	6,380.22	0.020	5.0	2.85	14.9	6,389.66	6,390.51	6,383.37	6,383.19	6,383.49	6,383.31
P37	MH-11	DP D5	Circle	18.0	0.013	53.7	6,379.52	6,377.83	0.031	4.9	2.79	18.6	6,390.51	6,385.37	6,383.04	6,382.92	6,383.16	6,383.05
P38	DP D5	DP D6	Circle	24.0	0.013	72.1	6,376.65	6,373.76	0.040	22.4	7.12	45.3	6,385.37	6,381.75	6,381.91	6,381.20	6,382.70	6,381.99
P39	DP D6b	DP D6	Circle	18.0	0.013	13.4	6,374.17	6,373.76	0.031	1.7	0.97	18.4	6,381.95	6,381.75	6,381.67	6,381.67	6,381.69	6,381.68
P40	DP D6	DP D7	Circle	30.0	0.013	55.8	6,373.56	6,370.87	0.048	43.0	8.75	90.0	6,381.75	6,379.95	6,379.88	6,379.26	6,381.07	6,380.46
P41	DP D7	DP D7a	Circle	42.0	0.013	138.2	6,369.87	6,368.50	0.010	106.3	11.05	100.2	6,379.95	6,378.64	6,377.24	6,375.70	6,379.14	6,377.59
P42(1)	DP D7b	MH-23	Circle	18.0	0.013	27.6	6,371.63	6,371.36	0.010	6.1	3.43	10.4	6,387.38	6,379.73	6,377.42	6,377.33	6,377.61	6,377.52
P42(2)	MH-23	MH-12	Circle	18.0	0.013	19.0	6,371.36	6,371.17	0.010	6.0	3.42	10.5	6,379.73	6,379.00	6,377.22	6,377.16	6,377.41	6,377.34
P43	MH-12	DP D7a	Circle	18.0	0.013	66.8	6,370.42	6,369.75	0.010	6.0	3.40	10.5	6,379.00	6,378.64	6,376.95	6,376.73	6,377.13	6,376.91
P44	DP D7a	MH205+71R	Circle	48.0	0.013	37.6	6,367.81	6,367.68	0.004	120.1	9.56	85.3	6,378.64	6,379.48	6,374.40	6,374.13	6,375.82	6,375.55
P45	MH205+71R	MH207+26R	Circle	54.0	0.013	149.0	6,367.68	6,366.94	0.005	146.8	9.23	138.6	6,379.48	6,380.92	6,372.84	6,372.00	6,374.16	6,373.33
P46	MH207+26R	O-1	Circle	54.0	0.013	123.0	6,366.69	6,366.08	0.005	145.6	9.86	138.5	6,380.92	6,383.30	6,370.52	6,369.62	6,372.10	6,371.45
P47	DP E1	MH-13	Circle	18.0	0.013	62.1	6,383.99	6,382.59	0.022	10.1	9.46	15.7	6,390.64	6,389.26	6,385.21	6,384.70	6,385.88	6,385.21
P48	MH-13	O-2	Circle	18.0	0.013	56.1	6,382.58	6,382.30	0.005	10.1	5.70	7.4	6,389.26	6,389.18	6,384.16	6,383.52	6,384.67	6,384.19

Scenario: 100-Yr
Current Time Step: 0.0 h
FlexTable: Manhole Table

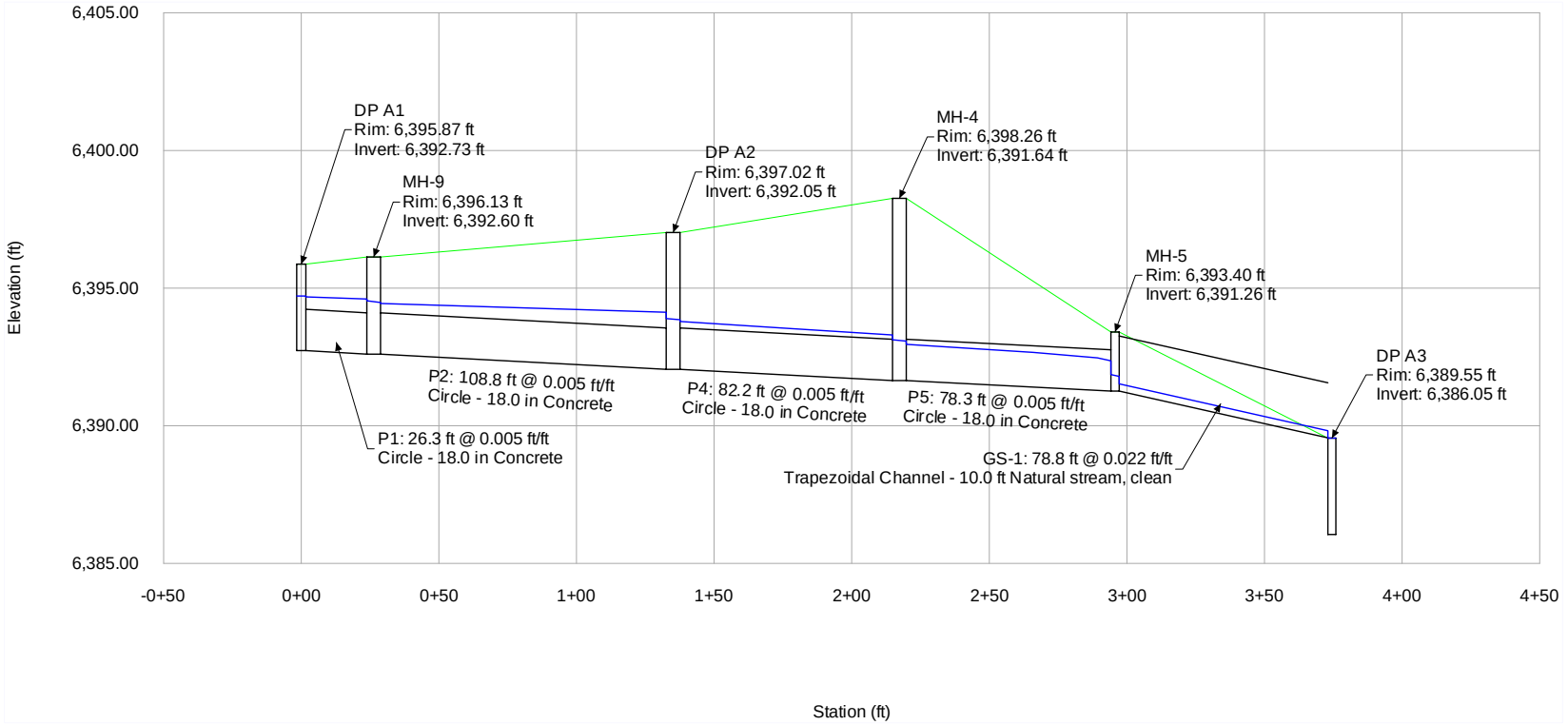
Label	Bolted Cover?	Elevation (Invert in 1) (ft)	Elevation (Invert Out) (ft)	Flow (Total Out) (cfs)	Elevation (Rim) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Headloss Method	Headloss Coefficient (Standard)	HEC-22 Benching Method
DP A1	False	(N/A)	6,392.73	5.7	6,395.87	6,394.71	6,394.71	6,394.88	6,394.88	HEC-22 Energy (Third Edition)	-	Full
DP A2	False	6,392.05	6,392.05	8.1	6,397.02	6,393.89	6,393.85	6,394.22	6,394.18	HEC-22 Energy (Third Edition)	-	Full
DP A2a	False	(N/A)	6,392.44	3.1	6,397.05	6,394.24	6,394.23	6,394.29	6,394.28	HEC-22 Energy (Third Edition)	-	Full
DP A3	False	6,386.25	6,386.05	48.6	6,389.55	6,389.55	6,389.55	6,391.08	6,391.08	HEC-22 Energy (Third Edition)	-	Full
DP B1	False	(N/A)	6,402.04	7.7	6,409.14	6,403.79	6,403.30	6,404.29	6,403.80	HEC-22 Energy (Third Edition)	-	Full
DP B2	False	(N/A)	6,392.92	7.5	6,400.31	6,398.05	6,397.99	6,398.34	6,398.27	HEC-22 Energy (Third Edition)	-	Full
DP B2a	False	6,396.69	6,396.49	28.7	6,401.85	6,399.80	6,399.75	6,401.10	6,401.04	HEC-22 Energy (Third Edition)	-	Full
DP B3	False	6,391.98	6,390.63	45.2	6,398.92	6,396.56	6,396.04	6,397.88	6,397.36	HEC-22 Energy (Third Edition)	-	Full
DP B4a	False	6,400.11	6,399.91	16.9	6,405.28	6,401.88	6,401.82	6,402.42	6,402.36	HEC-22 Energy (Third Edition)	-	Full
DP B5	False	6,387.83	6,387.63	49.0	6,397.47	6,392.13	6,392.13	6,393.68	6,393.68	HEC-22 Energy (Third Edition)	-	Full
DP B6	False	6,386.99	6,386.79	50.4	6,397.77	6,390.54	6,390.30	6,392.18	6,391.94	HEC-22 Energy (Third Edition)	-	Full
DP B6a	False	6,385.63	6,385.43	48.4	6,395.43	6,394.07	6,393.67	6,395.59	6,395.19	HEC-22 Energy (Third Edition)	-	Full
DP B7	False	6,383.53	6,383.33	55.9	6,391.60	6,388.70	6,388.64	6,390.72	6,390.66	HEC-22 Energy (Third Edition)	-	Full
DP B8	False	6,381.06	6,380.87	61.9	6,390.67	6,384.71	6,384.71	6,385.90	6,385.90	HEC-22 Energy (Third Edition)	-	Full
DP C1	False	(N/A)	6,392.74	5.9	6,396.53	6,393.98	6,393.93	6,394.26	6,394.21	HEC-22 Energy (Third Edition)	-	Full
DP C2	False	6,388.77	6,385.14	11.5	6,388.77	6,386.52	6,386.52	6,387.04	6,387.04	HEC-22 Energy (Third Edition)	-	Full
DP D1	False	(N/A)	6,390.96	14.1	6,397.57	6,393.53	6,393.46	6,393.84	6,393.77	HEC-22 Energy (Third Edition)	-	Full
DP D2a	False	6,371.89	6,371.39	61.1	6,389.05	6,382.36	6,382.03	6,383.52	6,383.19	HEC-22 Energy (Third Edition)	-	Full
DP D3	False	6,371.08	6,370.88	64.7	6,382.09	6,380.60	6,380.22	6,381.90	6,381.52	HEC-22 Energy (Third Edition)	-	Full
DP D4	False	6,382.78	6,381.78	18.5	6,391.13	6,384.11	6,383.82	6,384.67	6,384.38	HEC-22 Energy (Third Edition)	-	Full
DP D4a	False	(N/A)	6,385.53	9.2	6,389.61	6,387.04	6,386.91	6,387.63	6,387.50	HEC-22 Energy (Third Edition)	-	Full
DP D5	False	6,376.84	6,376.65	22.4	6,385.37	6,382.21	6,382.07	6,383.00	6,382.86	HEC-22 Energy (Third Edition)	-	Full
DP D5a	False	6,382.00	6,381.80	5.0	6,389.66	6,383.47	6,383.39	6,383.60	6,383.52	HEC-22 Energy (Third Edition)	-	Full
DP D6	False	6,373.76	6,373.56	43.0	6,381.75	6,380.49	6,380.12	6,381.68	6,381.31	HEC-22 Energy (Third Edition)	-	Full
DP D6a	False	6,374.88	6,374.38	20.5	6,382.03	6,381.64	6,381.62	6,381.92	6,381.89	HEC-22 Energy (Third Edition)	-	Full
DP D6b	False	(N/A)	6,374.17	1.7	6,381.95	6,381.67	6,381.67	6,381.69	6,381.69	HEC-22 Energy (Third Edition)	-	Full
DP D7	False	6,370.07	6,369.87	106.3	6,379.95	6,378.08	6,377.62	6,379.98	6,379.52	HEC-22 Energy (Third Edition)	-	Full
DP D7a	False	6,368.50	6,367.81	120.1	6,378.64	6,375.42	6,374.68	6,376.84	6,376.10	HEC-22 Energy (Third Edition)	-	Full
DP D7b	False	(N/A)	6,371.63	6.1	6,387.38	6,377.67	6,377.46	6,377.85	6,377.64	HEC-22 Energy (Third Edition)	-	Full
DP E1	False	(N/A)	6,383.99	10.1	6,390.64	6,385.93	6,385.43	6,386.59	6,386.10	HEC-22 Energy (Third Edition)	-	Full
MH-1	False	6,394.73	6,394.53	28.5	6,400.00	6,398.56	6,398.55	6,399.09	6,399.07	HEC-22 Energy (Third Edition)	-	Full
MH-2	False	6,385.16	6,375.47	18.5	6,385.16	6,382.22	6,382.09	6,382.76	6,382.63	HEC-22 Energy (Third Edition)	-	Full
MH-2	False	6,393.20	6,393.00	28.3	6,399.47	6,397.92	6,397.92	6,398.44	6,398.43	HEC-22 Energy (Third Edition)	-	Full
MH-3	False	6,389.31	6,388.09	44.8	6,397.42	6,393.97	6,393.30	6,395.26	6,394.59	HEC-22 Energy (Third Edition)	-	Full
MH-3	False	6,388.30	6,388.30	13.3	6,389.90	6,389.32	6,389.03	6,389.47	6,389.18	HEC-22 Energy (Third Edition)	-	Full
MH-4	False	6,391.64	6,391.64	8.0	6,398.26	6,393.12	6,393.08	6,393.49	6,393.44	HEC-22 Energy (Third Edition)	-	Full
MH-4	False	6,391.67	6,391.67	5.7	6,393.81	6,392.40	6,392.08	6,392.44	6,392.13	HEC-22 Energy (Third Edition)	-	Full
MH-5	False	6,390.73	6,390.73	14.0	6,397.30	6,393.07	6,392.93	6,393.38	6,393.24	HEC-22 Energy (Third Edition)	-	Full
MH-5	False	6,391.26	6,391.26	7.9	6,393.40	6,391.86	6,391.79	6,391.98	6,391.91	HEC-22 Energy (Third Edition)	-	Full
MH-6	False	6,390.49	6,390.49	13.9	6,397.01	6,392.52	6,392.52	6,392.83	6,392.83	HEC-22 Energy (Third Edition)	-	Full
MH-8	False	6,389.78	6,389.78	13.7	6,396.22	6,391.69	6,391.54	6,392.06	6,391.91	HEC-22 Energy (Third Edition)	-	Full
MH-9	False	6,392.60	6,392.60	5.7	6,396.13	6,394.54	6,394.48	6,394.70	6,394.64	HEC-22 Energy (Third Edition)	-	Full
MH-9	False	6,384.21	6,384.01	48.1	6,392.53	6,391.07	6,390.78	6,392.57	6,392.27	HEC-22 Energy (Third Edition)	-	Full
MH-10	False	6,388.64	6,388.64	13.4	6,394.69	6,390.39	6,390.29	6,390.84	6,390.73	HEC-22 Energy (Third Edition)	-	Full
MH-11	False	6,380.22	6,379.52	4.9	6,390.51	6,383.14	6,383.07	6,383.26	6,383.19	HEC-22 Energy (Third Edition)	-	Full
MH-12	False	6,371.17	6,370.42	6.0	6,379.00	6,377.09	6,376.98	6,377.27	6,377.16	HEC-22 Energy (Third Edition)	-	Full
MH-13	False	6,382.59	6,382.58	10.1	6,389.26	6,384.50	6,384.27	6,385.00	6,384.77	HEC-22 Energy (Third Edition)	-	Full
MH-17	False	6,369.85	(N/A)	0.7	6,378.29	(N/A)	(N/A)	(N/A)	(N/A)	HEC-22 Energy (Third Edition)	-	Full
MH-19	False	(N/A)	6,382.72	0.0	6,389.88	6,383.60	6,383.60	6,383.60	6,383.60	HEC-22 Energy (Third Edition)	-	Full
MH-21	False	(N/A)	6,384.11	0.0	6,389.71	(N/A)	(N/A)	(N/A)	(N/A)	HEC-22 Energy (Third Edition)	-	Full
MH-22	False	6,392.58	6,392.28	5.9	6,396.83	6,393.55	6,393.41	6,393.88	6,393.74	HEC-22 Energy (Third Edition)	-	Full
MH-23	False	6,371.36	6,371.36	6.0	6,379.73	6,377.26	6,377.26	6,377.44	6,377.44	HEC-22 Energy (Third Edition)	-	Full
MH205+71R	False	6,367.68	6,367.68	146.8	6,379.48	6,373.66	6,373.10	6,374.98	6,374.42	HEC-22 Energy (Third Edition)	-	Full
MH207+26R	False	6,366.94	6,366.69	145.6	6,380.92	6,371.22	6,371.10	6,372.80	6,372.69	HEC-22 Energy (Third Edition)	-	Full

Scenario: 100-Yr
Current Time Step: 0.0 h
FlexTable: Outfall Table

ID	Label	Elevation (Ground) (ft)	Set Rim to Ground Elevation?	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)
201	O-2	6,389.18	True	6,382.30	Free Outfall	-	6,383.52	10.0
257	O-1	6,383.30	True	6,363.83	Free Outfall	-	6,369.62	144.7

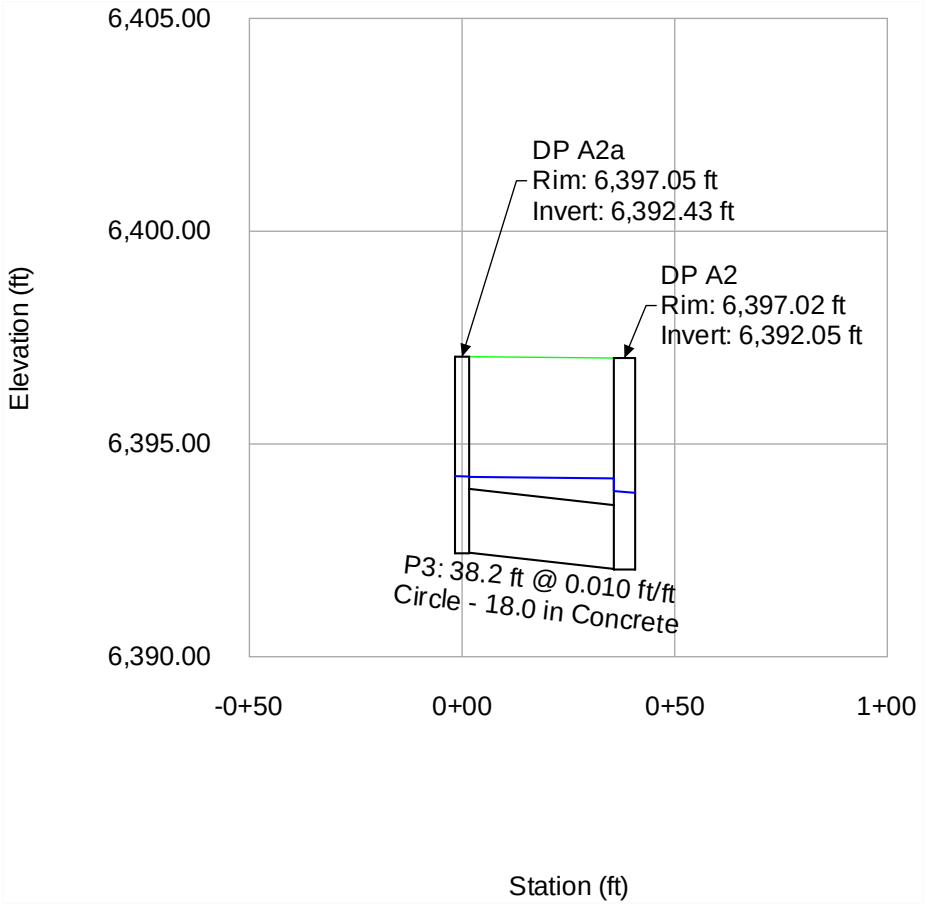
H:\K\King Soopers - City Market\CO, Castle Rock - KSS000165 - Dawson Trails\0CIV\Drain Reports\Prop\StormCAD\KSS165_StormCAD.stsw

Profile Report
Engineering Profile - Line A (KSS165_StormCAD.stsw)

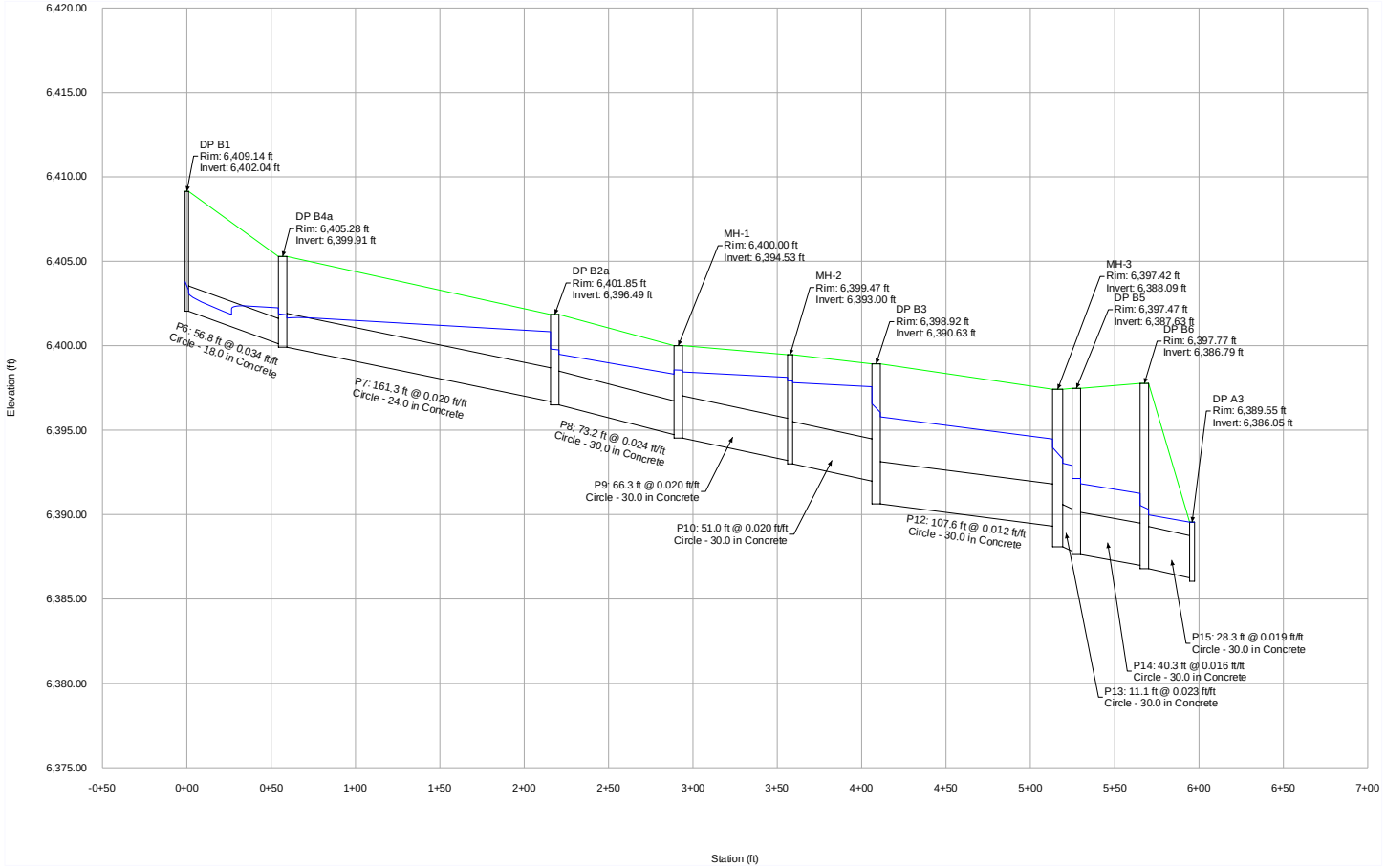


Profile Report

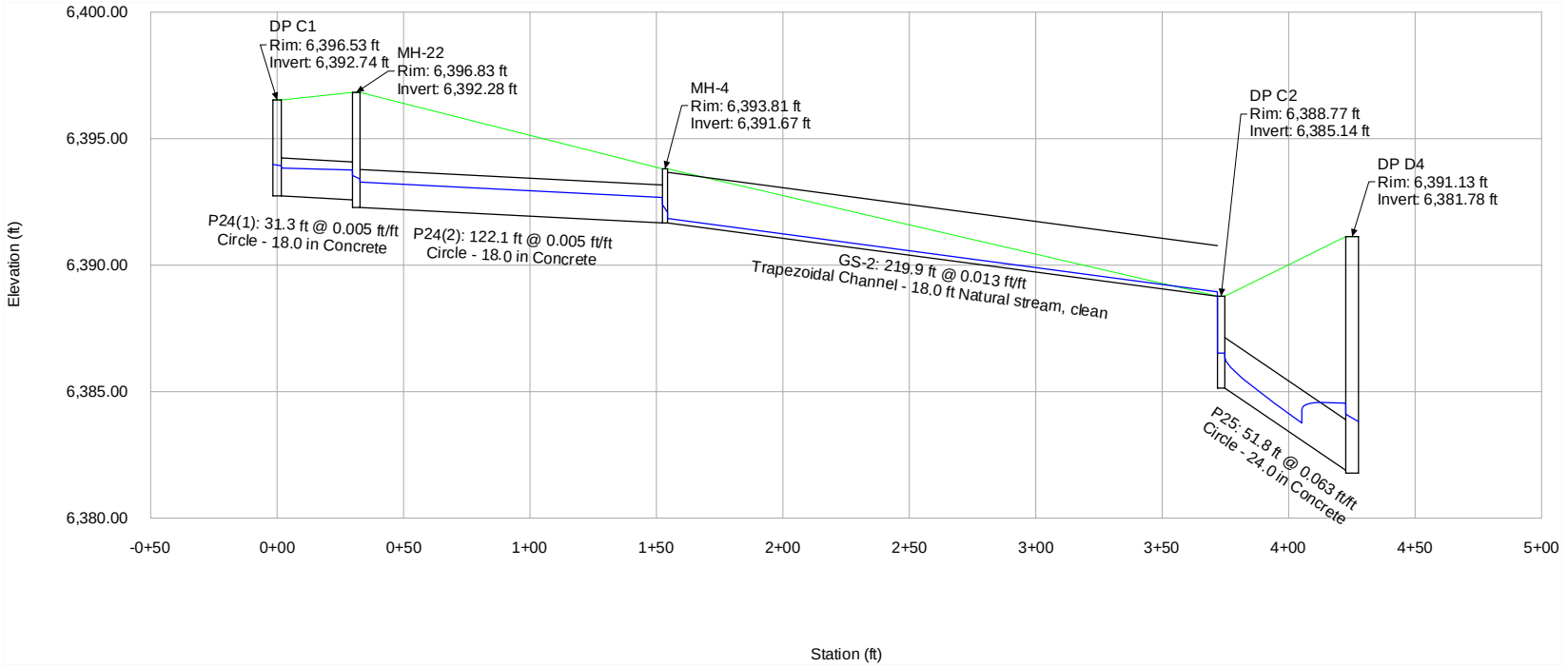
Engineering Profile - Line A2 (KSS165_StormCAD.stsw)



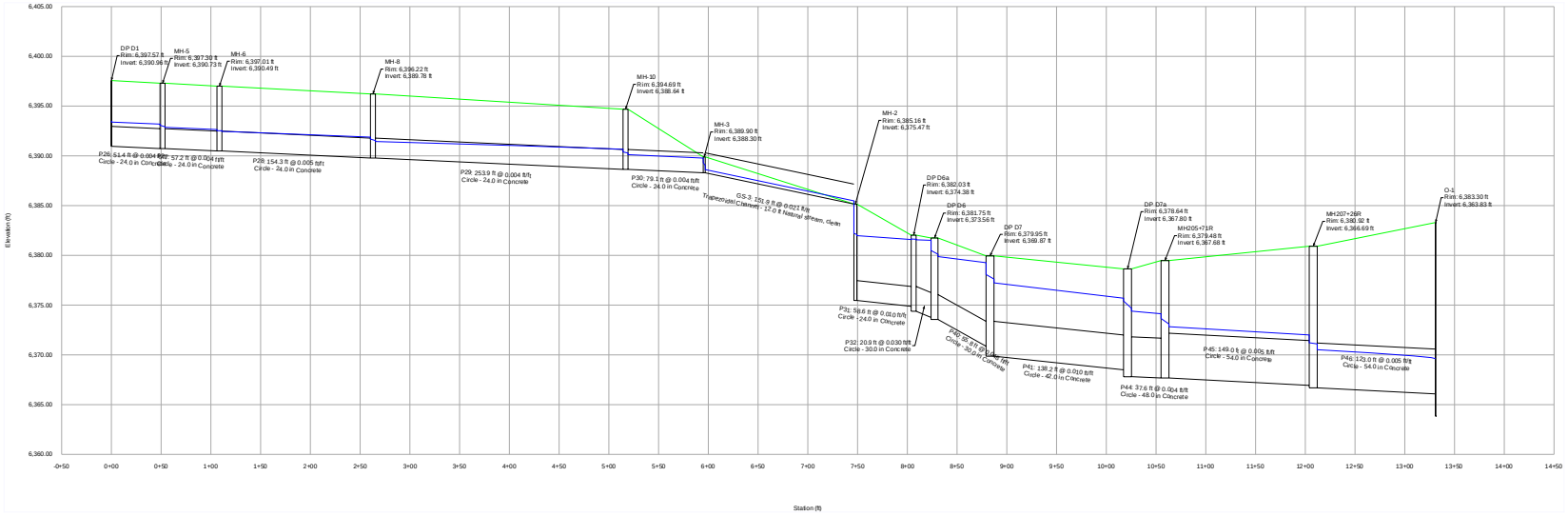
Profile Report
Engineering Profile - Line B (KSS165_StormCAD.stsw)



Profile Report
Engineering Profile - Line C (KSS165_StormCAD.stsw)

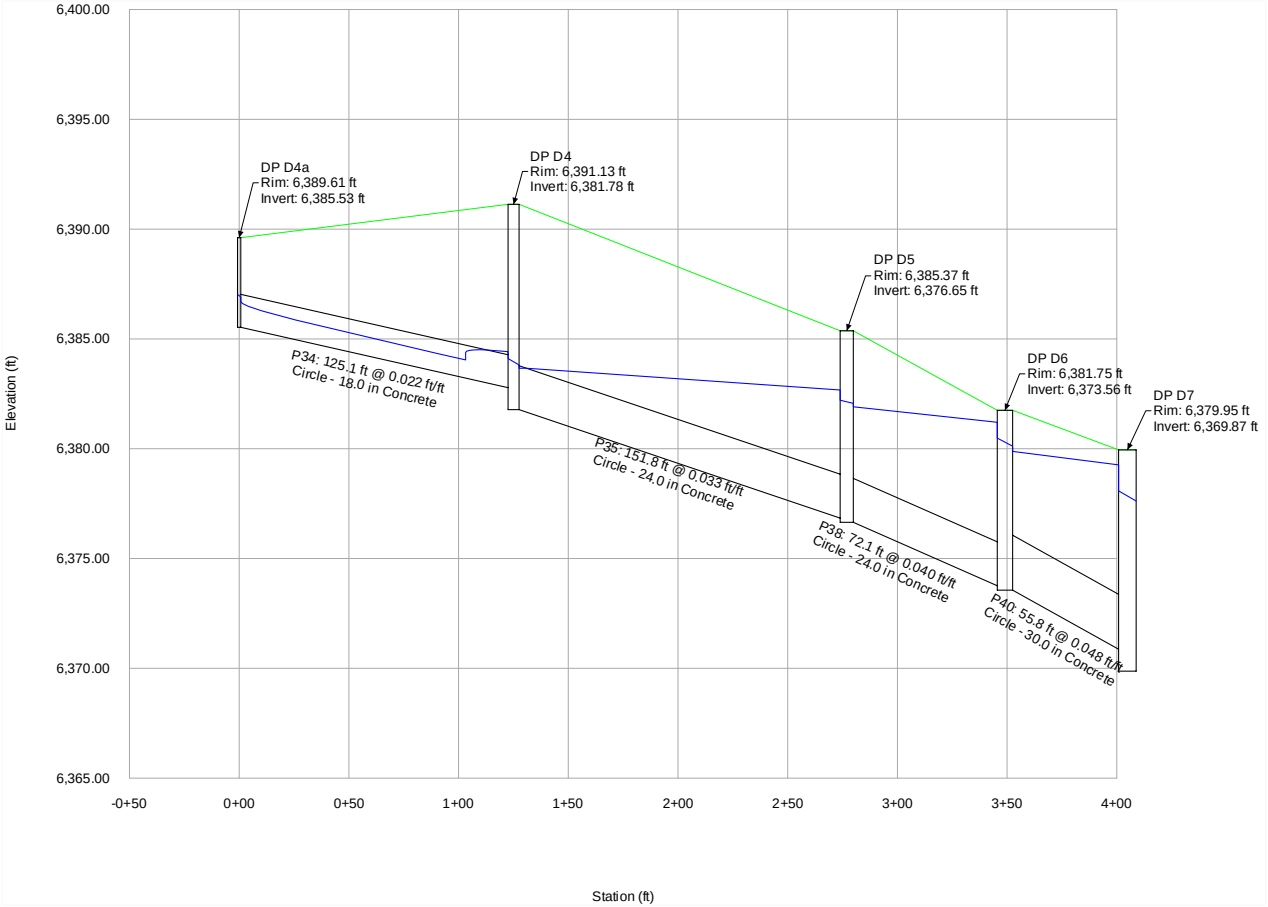


Profile Report
Engineering Profile - Line D (KSS165_StormCAD.stsw)



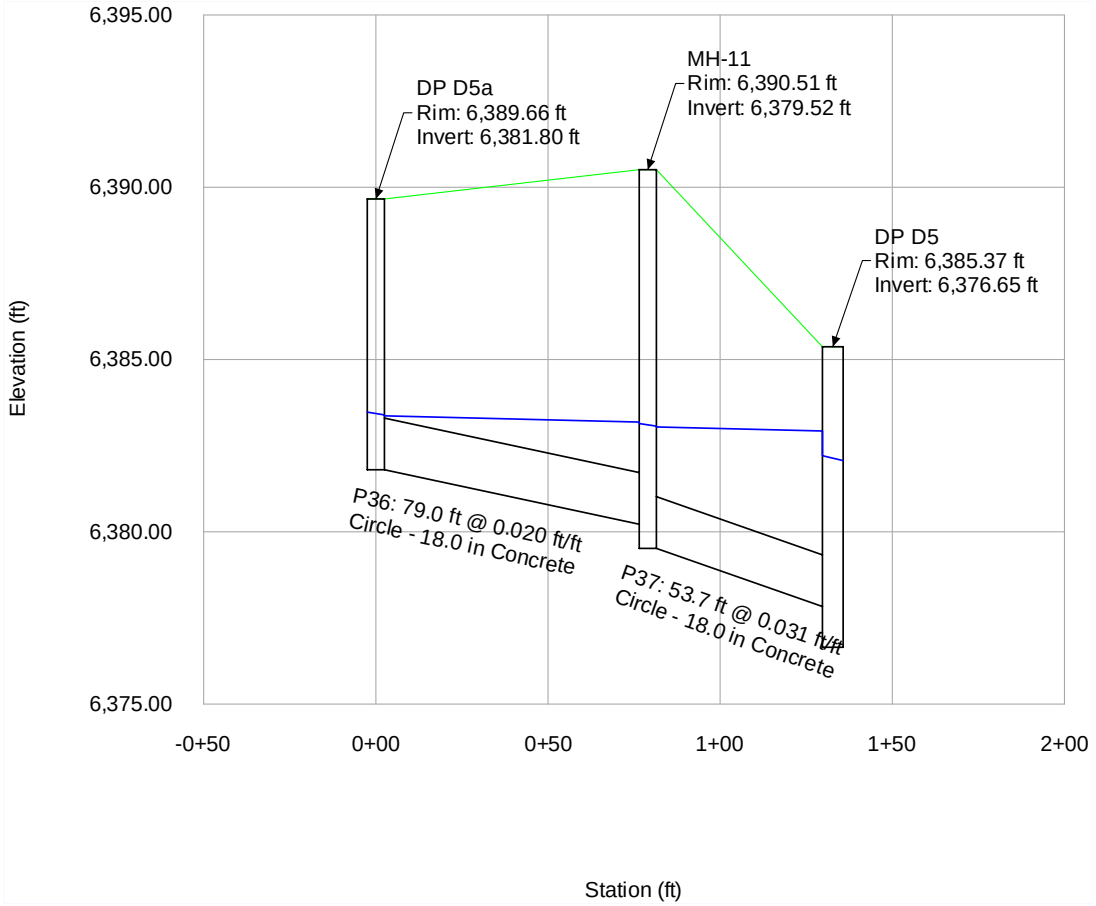
Profile Report

Engineering Profile - Line D2 (KSS165_StormCAD.stsw)



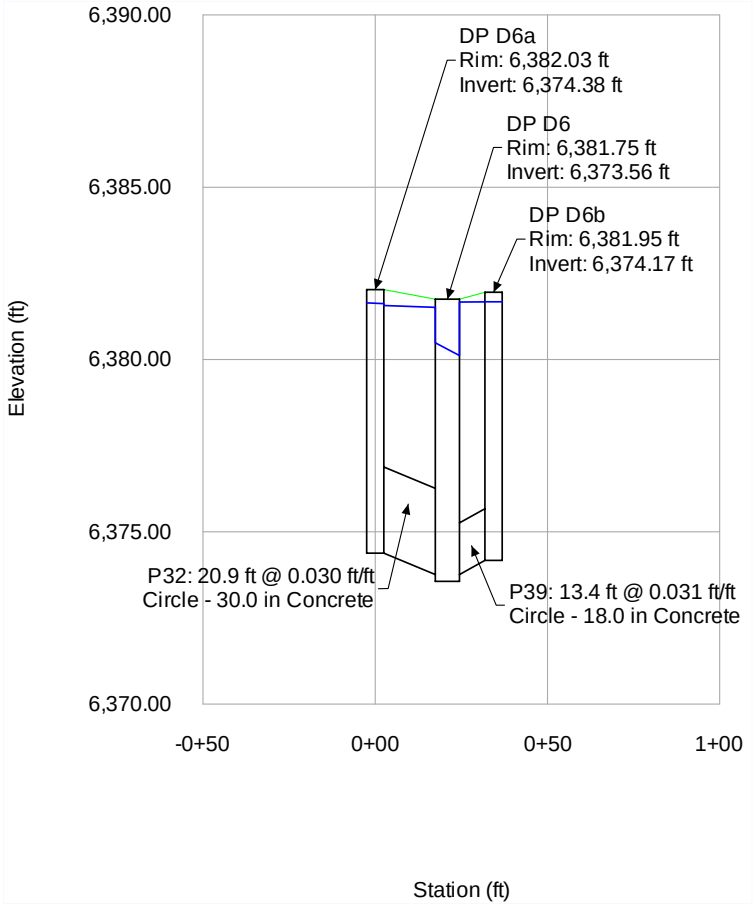
Profile Report

Engineering Profile - Line D3 (KSS165_StormCAD.stsw)



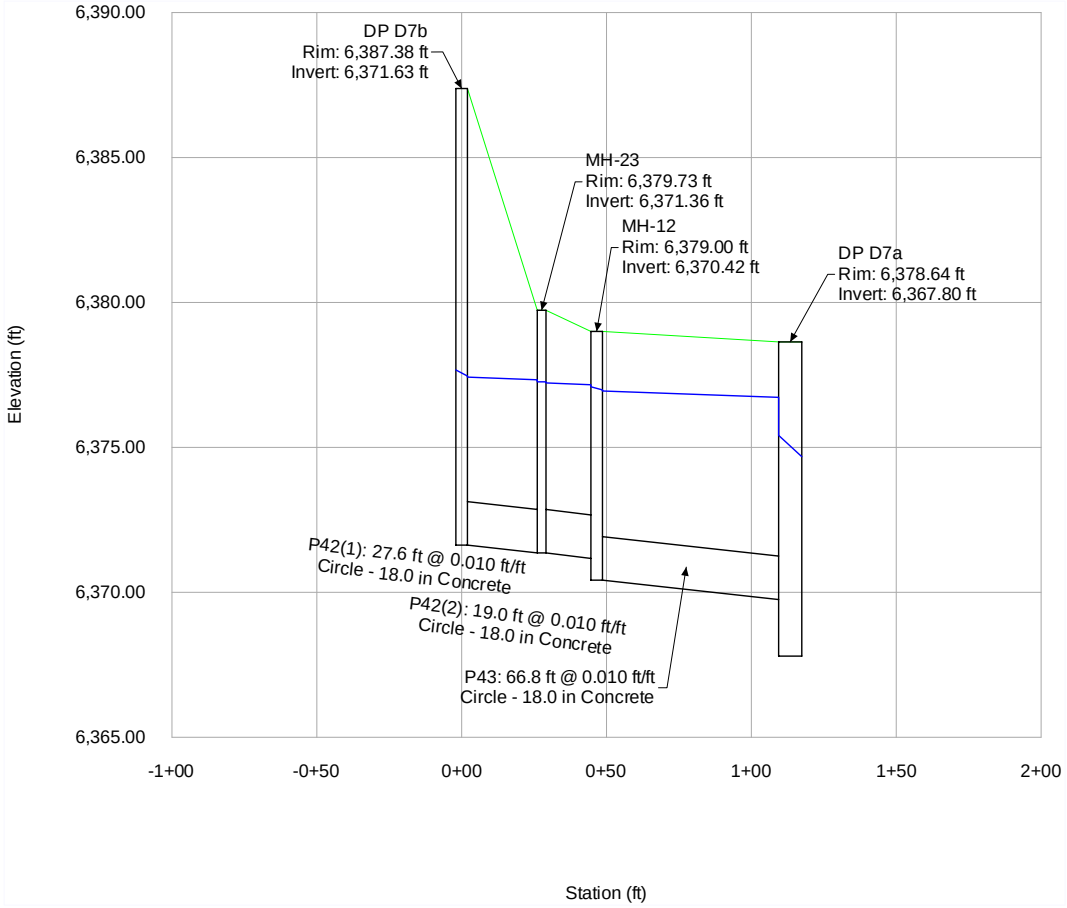
Profile Report

Engineering Profile - Line D4 (KSS165_StormCAD.stsw)



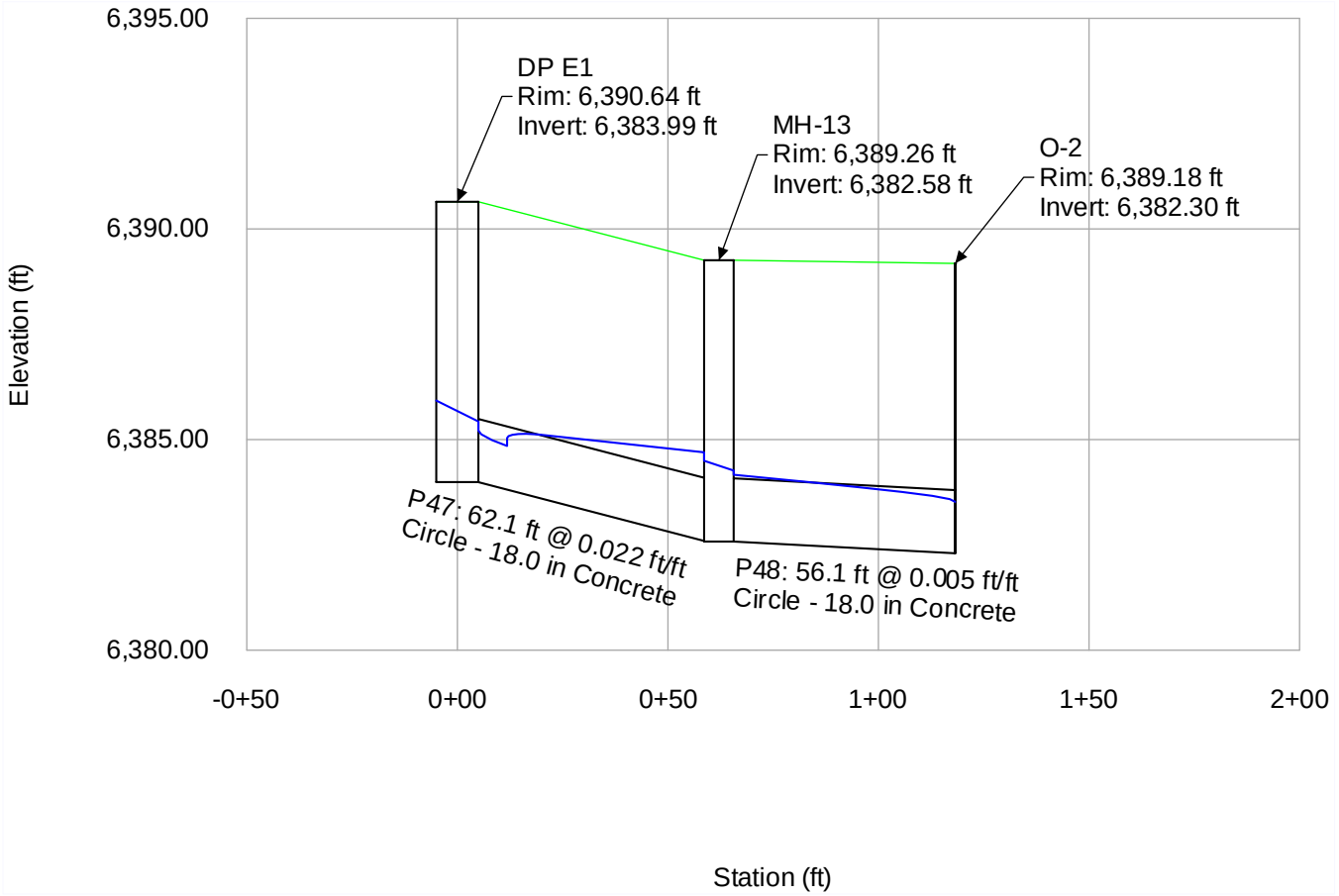
Profile Report

Engineering Profile - Line D5 (KSS165_StormCAD.stsw)



Profile Report

Engineering Profile - Line E (KSS165_StormCAD.stsw)



MHFD-Inlet, Version 6.00 (August 2025)

INLET MANAGEMENT

Project: King Soopers Store #165
Minor: 5-year
Major: 100-year

Worksheet Protected

INLET NAME	Inlet A1	Inlet A2a	Inlet B3	Inlet B5	Inlet B6
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	On Grade	In Sump	In Sump
Inlet Type	Denver No. 16 Combination	Denver No. 16 Combination	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening
Number of Inlet Units	1	1	1	1	1

USER-DEFINED INPUT

User-Defined Peak Flows

Minor Peak Flow, Q (cfs)	2.40	1.30	1.60	1.80	0.80
Major Peak Flow, Q (cfs)	4.40	2.40	2.90	3.40	1.40

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:				Inlet B3	
Bypass Flow Description (Optional):					
Minor Bypass Flow Received, Q_b (cfs)				0.16	
Major Bypass Flow Received, Q_b (cfs)				0.88	

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	2.40	1.30	1.60	1.96	0.80
Major Total Design Peak Flow, Q (cfs)	4.40	2.40	2.90	4.28	1.40
Minor Inlet Interception Capacity, Q_a (cfs)	5.54	5.54	1.44	3.26	3.26
Major Inlet Interception Capacity, Q_a (cfs)	9.12	5.54	2.02	12.26	12.26
Minor Flow Bypassed Downstream, Qb (cfs)	N/A	N/A	0.16	N/A	N/A
Major Flow Bypassed Downstream, Qb (cfs)	N/A	N/A	0.88	N/A	N/A
Minor Flow Capture Percentage, C%	100%	100%	90%	100%	100%
Major Flow Capture Percentage, C%	100%	100%	70%	100%	100%

MHFD-Inlet, Version 6.00 (August 2025)

INLET MANAGEMENT

'roject: King Soopers Store #165
Minor: 5-year
Major: 100-year

Worksheet Protected

INLET NAME	Inlet B7	Inlet B8	Inlet C1	Inlet D3	Inlet D6a
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	In Sump	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	Denver No. 16 Combination	CDOT Type R Curb Opening	CDOT Type R Curb Opening
Number of Inlet Units	2	2	1	1	1

USER-DEFINED INPUT

User-Defined Peak Flows

Minor Peak Flow, Q (cfs)	4.40	3.80	2.40	2.20	1.40
Major Peak Flow, Q (cfs)	8.00	6.80	4.40	4.00	2.50

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:					User-Defined
Bypass Flow Description (Optional):					Inlet F1
Minor Bypass Flow Received, Q_b (cfs)					0.00
Major Bypass Flow Received, Q_b (cfs)					0.60

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	4.40	3.80	2.40	2.20	1.40
Major Total Design Peak Flow, Q (cfs)	8.00	6.80	4.40	4.00	3.10
Minor Inlet Interception Capacity, Q_a (cfs)	10.02	10.02	5.54	1.88	1.33
Major Inlet Interception Capacity, Q_a (cfs)	10.02	10.02	9.12	2.64	2.13
Minor Flow Bypassed Downstream, Qb (cfs)	N/A	N/A	N/A	0.32	0.07
Major Flow Bypassed Downstream, Qb (cfs)	N/A	N/A	N/A	1.36	0.97
Minor Flow Capture Percentage, C%	100%	100%	100%	86%	95%
Major Flow Capture Percentage, C%	100%	100%	100%	66%	69%

MHFD-Inlet, Version 6.00 (August 2025)

INLET MANAGEMENT

'roject: King Soopers Store #165
Minor: 5-year
Major: 100-year

Worksheet Protected

INLET NAME	Inlet D6b	Inlet D7a	Inlet E1	Inlet F1
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	In Sump	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	Denver No. 16 Combination	CDOT Type R Curb Opening	CDOT Type R Curb Opening
Number of Inlet Units	1	2	1	2

USER-DEFINED INPUT

User-Defined Peak Flows

Minor Peak Flow, Q (cfs)	0.80	5.80	0.20	2.60
Major Peak Flow, Q (cfs)	1.40	10.60	0.40	5.70

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:		User-Defined		
Bypass Flow Description (Optional):		Inlet D3, D6a and D6b		
Minor Bypass Flow Received, Q_b (cfs)		0.40		
Major Bypass Flow Received, Q_b (cfs)		2.30		

CALCULATED OUTPUT

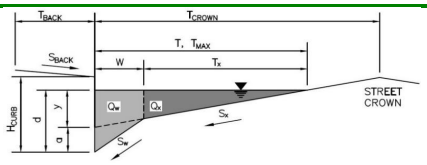
Minor Total Design Peak Flow, Q (cfs)	0.80	6.20	0.20	2.60
Major Total Design Peak Flow, Q (cfs)	1.40	12.90	0.40	5.70
Minor Inlet Interception Capacity, Q_a (cfs)	0.80	7.75	0.20	2.60
Major Inlet Interception Capacity, Q_a (cfs)	1.33	20.18	0.40	5.10
Minor Flow Bypassed Downstream, Qb (cfs)	0.00	N/A	0.00	0.00
Major Flow Bypassed Downstream, Qb (cfs)	0.07	N/A	0.00	0.60
Minor Flow Capture Percentage, C%	100%	100%	100%	100%
Major Flow Capture Percentage, C%	95%	100%	100%	89%

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

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

Project: King Soopers Store #165

Inlet ID: Inlet A1



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	33.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.125	ft/ft
Warning 01 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.035	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	118.0	ft
Gutter Width	W =	1.73	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} =	118.0	118.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

MINOR STORM Allowable Capacity is not applicable to Sump Condition

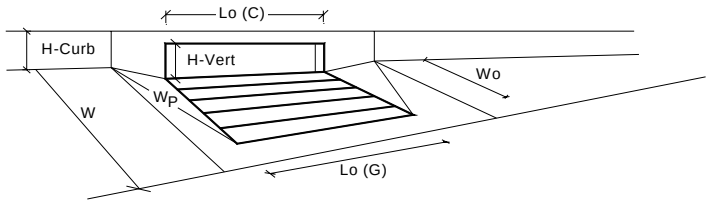
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

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

Warning 01: Manning's n-value does not meet the USDCM recommended design range.

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 6.00 (August 2025)



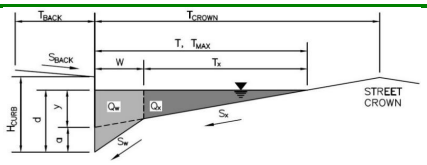
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (Denver No. 16 Combination)	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	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} =	0.31	0.31	
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) =	3.60	3.60	
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	Theta =	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	1.73	1.73	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} =	0.51	1.01	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.36	0.86	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.94	1.00	
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	1.00	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	5.5	9.1	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	2.4	4.4	cfs

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

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

Project: King Soopers Store #165

Inlet ID: Inlet A2a



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	21.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.029	ft/ft
Warning 01 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.035	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	66.0	ft
Gutter Width	W =	1.73	ft
Street Transverse Slope	S_X =	0.011	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} =	66.0	66.0	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

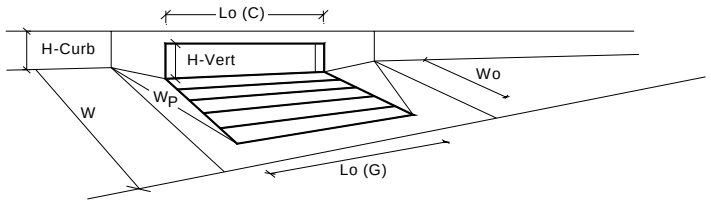
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

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

Warning 01: Manning's n-value does not meet the USDCM recommended design range.

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 6.00 (August 2025)



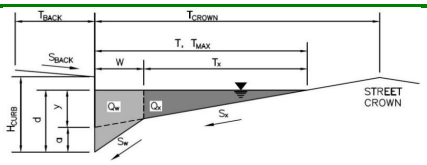
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (Denver No. 16 Combination)	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (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} =	0.31	0.31	
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) =	3.60	3.60	
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	Theta =	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	1.73	1.73	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} =	0.51	0.51	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.36	0.36	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 =	5.5	5.5	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	1.3	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: King Soopers Store #165

Inlet ID: Inlet B3



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.250	ft/ft
Warning 01 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.035	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	30.0	ft
Gutter Width	W =	1.00	ft
Street Transverse Slope	S_X =	0.018	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 =	0.034	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} =	30.0	30.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	26.6	70.0	cfs

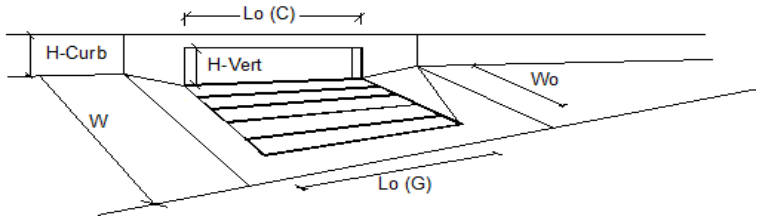
Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.60 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 2.90 cfs on sheet 'Inlet Management'

Warning 01: Manning's n-value does not meet the USDCM recommended design range.

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 6.00 (August 2025)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	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_a =	1.4	2.0	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.2	0.9	cfs
Capture Percentage = Q_a/Q_o	C% =	90	70	%

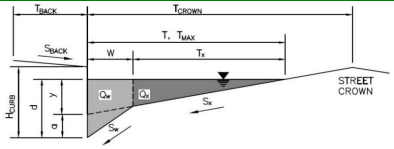
MHFD-Inlet, Version 6.00 (August 2025)

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

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

Project: King Soopers Store #165

Inlet ID: Inlet B5



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	20.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.100	ft/ft
Warning 01 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.035	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	15.0	ft
Gutter Width	W =	1.00	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	

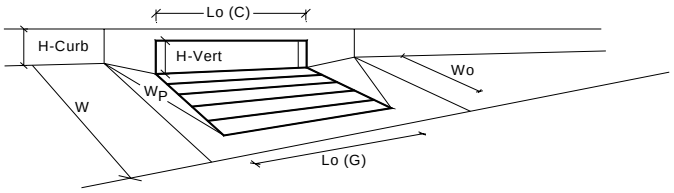
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.0	15.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		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

Warning 01: Manning's n-value does not meet the USDCM recommended design range.

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 6.00 (August 2025)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.4	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) =	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	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_o =	1.00	1.00	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} =	0.28	0.42	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 =	3.3	5.9	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	2.0	4.3	cfs

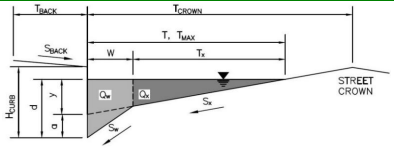
MHFD-Inlet, Version 6.00 (August 2025)

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

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

Project: King Soopers Store #165

Inlet ID: Inlet B6



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	4.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.100	ft/ft
Warning 01 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.035	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	15.0	ft
Gutter Width	W =	1.00	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	

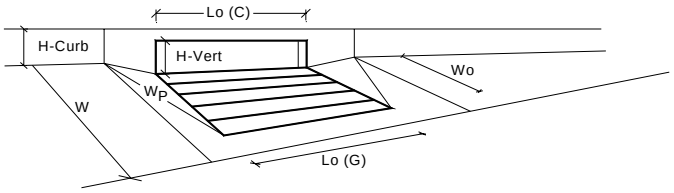
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.0	15.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		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

Warning 01: Manning's n-value does not meet the USDCM recommended design range.

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 6.00 (August 2025)



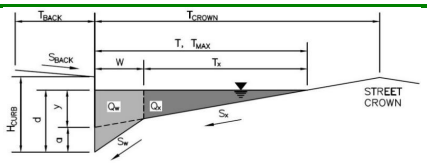
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.4	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) =	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	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_o =	1.00	1.00	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} =	0.28	0.42	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 =	3.3	5.9	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	0.8	1.4	cfs

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

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

Project: King Soopers Store #165

Inlet ID: Inlet B7



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	200.0	ft
Gutter Width	W =	1.00	ft
Street Transverse Slope	S_X =	0.027	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} =	200.0	200.0	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

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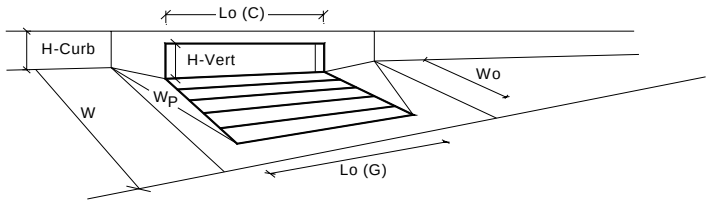


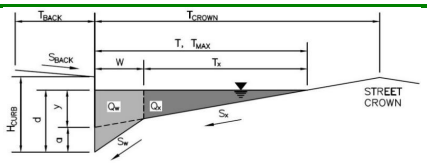
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (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) =	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	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	1.00	1.00	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} =	0.42	0.42	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 =	10.0	10.0	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	4.4	8.0	cfs

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

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

Project: King Soopers Store #165

Inlet ID: Inlet B8



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	200.0	ft
Gutter Width	W =	1.00	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} =	200.0	200.0	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

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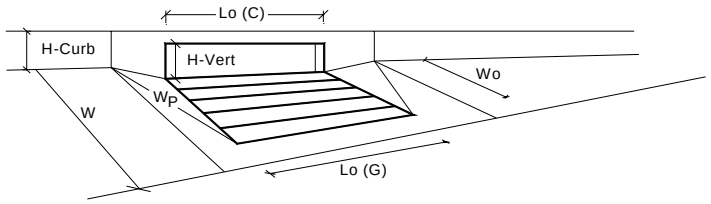


Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (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) =	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	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	1.00	1.00	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} =	0.42	0.42	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 =	10.0	10.0	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	3.8	6.8	cfs

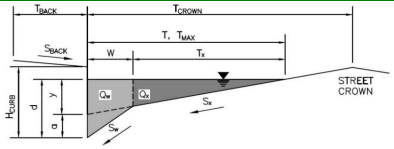
MHFD-Inlet, Version 6.00 (August 2025)

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

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

Project: King Soopers Store #165

Inlet ID: Inlet C1



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	45.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.100	ft/ft
Warning 01 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.035	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	67.0	ft
Gutter Width	W =	1.73	ft
Street Transverse Slope	S_X =	0.019	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	

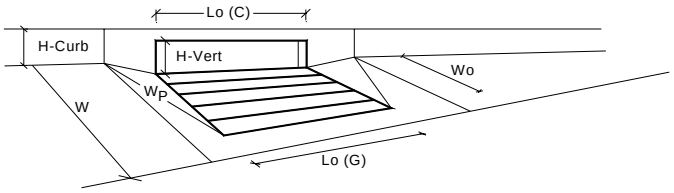
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	67.0	67.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		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

Warning 01: Manning's n-value does not meet the USDCM recommended design range.

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 6.00 (August 2025)



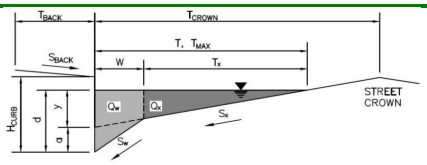
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	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} =	0.31	0.31	
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) =	3.60	3.60	
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	Theta =	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_o =	1.73	1.73	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} =	0.51	0.51	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.36	0.36	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 =	5.5	5.5	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	2.4	4.4	cfs

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

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

Project: King Soopers Store #165

Inlet ID: Inlet D3



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	21.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.040	ft/ft
Warning 01 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.035	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	40.0	ft
Gutter Width	W =	1.00	ft
Street Transverse Slope	S_X =	0.037	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 =	0.019	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} =	40.0	40.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

		Minor Storm	Major Storm	
	Q_{allow} =	16.2	107.9	cfs

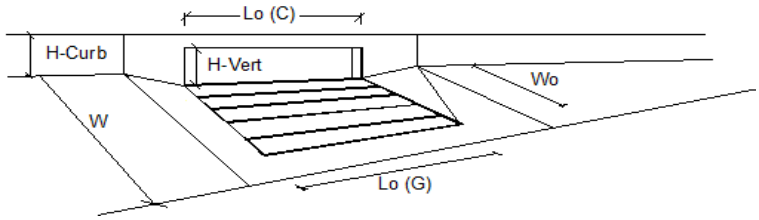
Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.20 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 4.00 cfs on sheet 'Inlet Management'

Warning 01: Manning's n-value does not meet the USDCM recommended design range.

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 6.00 (August 2025)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	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	

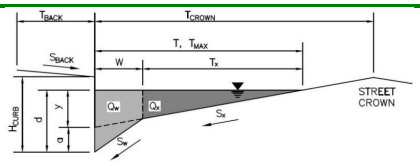
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q_a =	1.9	2.6	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.3	1.4	cfs
Capture Percentage = Q_a/Q_o	C% =	86	66	%

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

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

Project: King Soopers Store #165

Inlet ID: Inlet D6a



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.015	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	ft
Gutter Width	W =	1.00	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 =	0.050	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

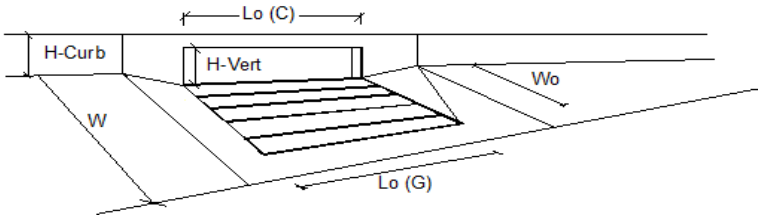
		Minor Storm	Major Storm	
	Q_{allow} =	13.6	106.0	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.40 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 3.10 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 6.00 (August 2025)



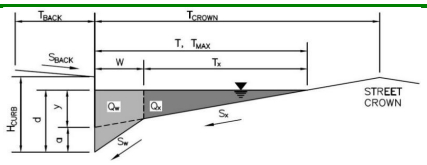
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	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_a =	1.3	2.1	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.1	1.0	cfs
Capture Percentage = Q_a/Q_o	C% =	95	69	%

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

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

Project: King Soopers Store #165

Inlet ID: Inlet D6b



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	ft
Gutter Width	W =	1.00	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 =	0.050	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

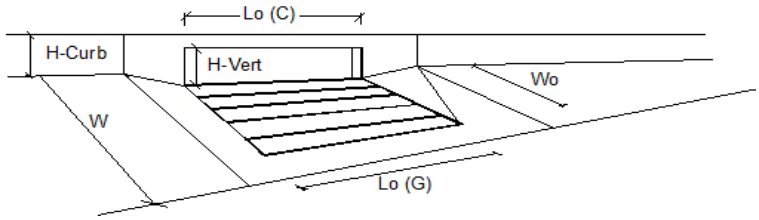
		Minor Storm	Major Storm	
	Q_{allow} =	13.6	81.1	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.80 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 1.40 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 6.00 (August 2025)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	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	

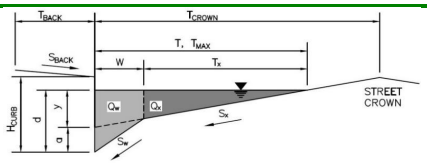
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q_a =	0.8	1.3	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.0	0.1	cfs
Capture Percentage = Q_a/Q_o	C% =	100	95	%

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

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

Project: King Soopers Store #165

Inlet ID: Inlet D7a



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.120	ft/ft
Warning 01 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.035	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	40.0	ft
Gutter Width	W =	1.73	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} =	40.0	40.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

MINOR STORM Allowable Capacity is not applicable to Sump Condition

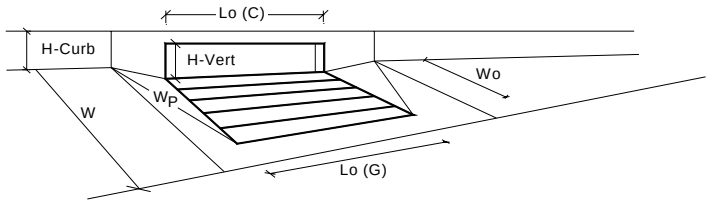
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

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

Warning 01: Manning's n-value does not meet the USDCM recommended design range.

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 6.00 (August 2025)



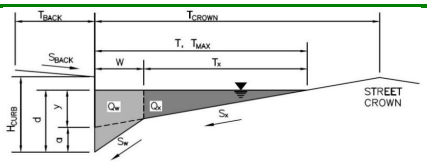
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (Denver No. 16 Combination)	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	10.9	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} =	0.31	0.31	
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) =	3.60	3.60	
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	Theta =	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	1.73	1.73	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} =	0.51	0.92	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.36	0.77	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.71	1.00	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	N/A	N/A	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.71	1.00	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	7.7	20.2	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	6.2	12.9	cfs

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

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

Project: King Soopers Store #165

Inlet ID: Inlet E1



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.120	ft/ft
Warning 01 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.035	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	40.0	ft
Gutter Width	W =	1.00	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 =	0.020	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} =	40.0	40.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

		Minor Storm	Major Storm	
	Q_{allow} =	27.6	138.4	cfs

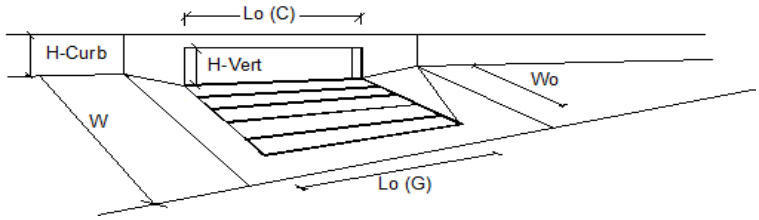
Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.20 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 0.40 cfs on sheet 'Inlet Management'

Warning 01: Manning's n-value does not meet the USDCM recommended design range.

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 6.00 (August 2025)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	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	

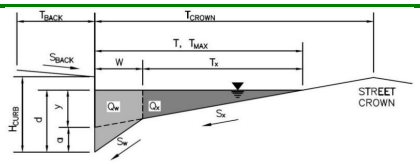
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q_a =	0.2	0.4	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.0	0.0	cfs
Capture Percentage = Q_a/Q_o	C% =	100	100	%

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

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

Project: King Soopers Store #165

Inlet ID: Inlet F1



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0	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} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	40.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.021	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 =	0.014	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} =	20.0	40.0	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)		☐	☐	

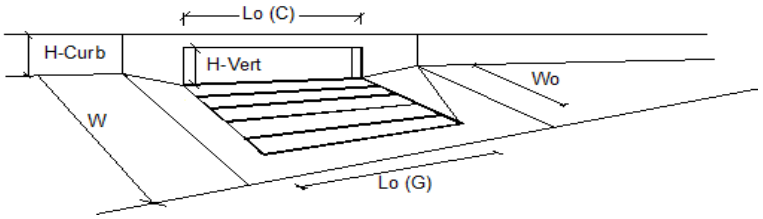
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	15.5	15.5	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.60 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 5.70 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

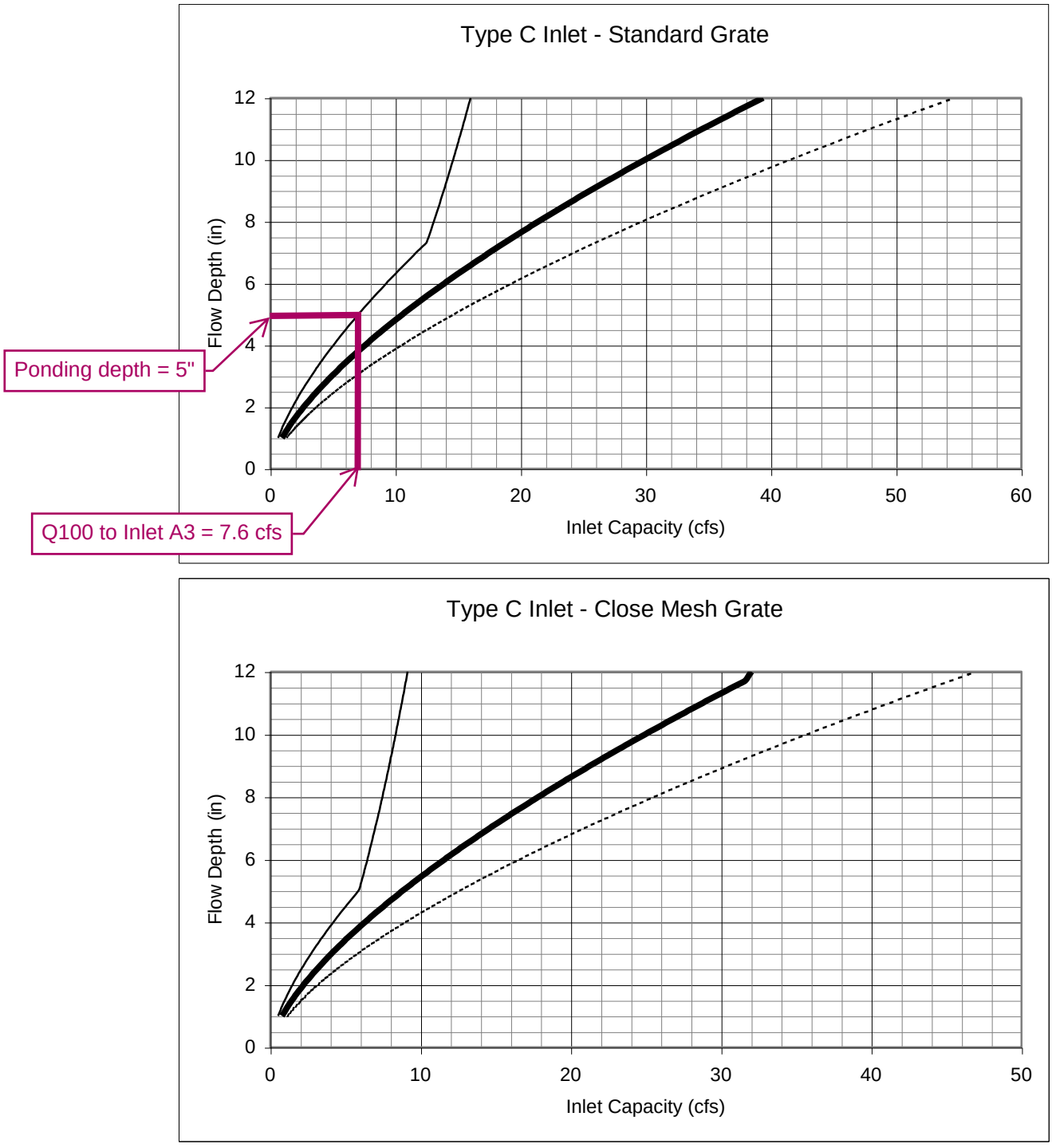
MHFD-Inlet, Version 6.00 (August 2025)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
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_a =	2.6	5.1	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.0	0.6	cfs
Capture Percentage = Q_a/Q_o	C% =	100	89	%

Inlet A3

FIGURE 8-1, INLET CAPACITY CHART SUMP CONDITIONS
AREA (TYPE C) INLET

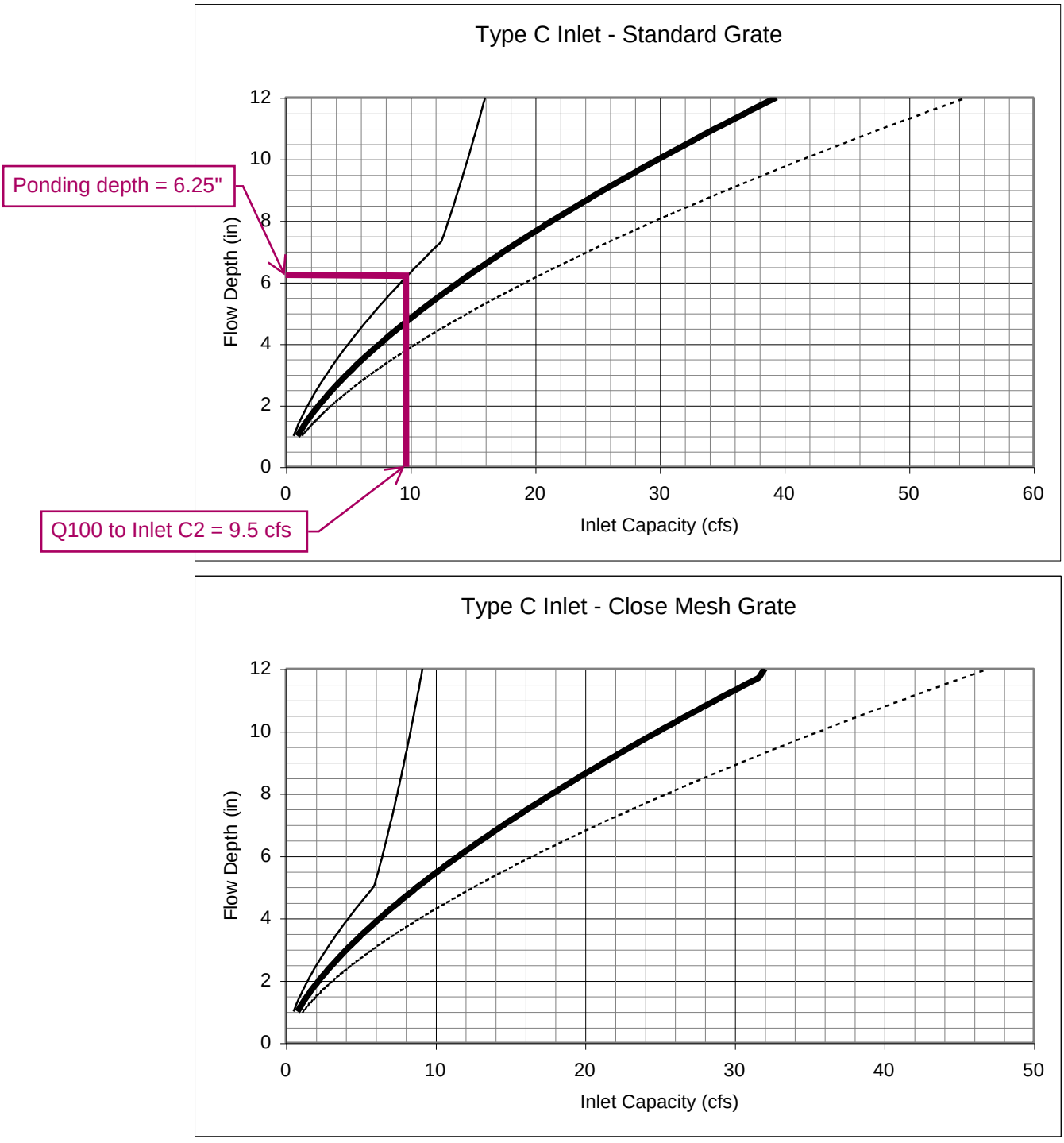


Notes:

1. The Town of Castle Rock standard inlet parameters must apply to use these charts.

Inlet C2

FIGURE 8-1, INLET CAPACITY CHART SUMP CONDITIONS
AREA (TYPE C) INLET

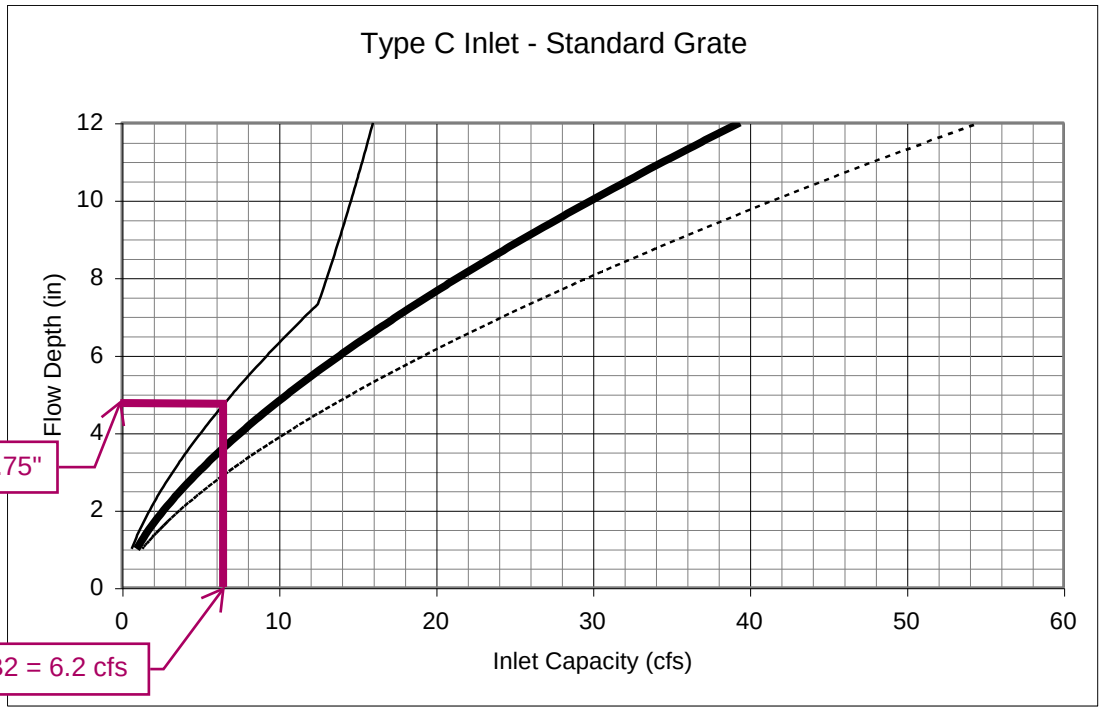


Notes:

1. The Town of Castle Rock standard inlet parameters must apply to use these charts.

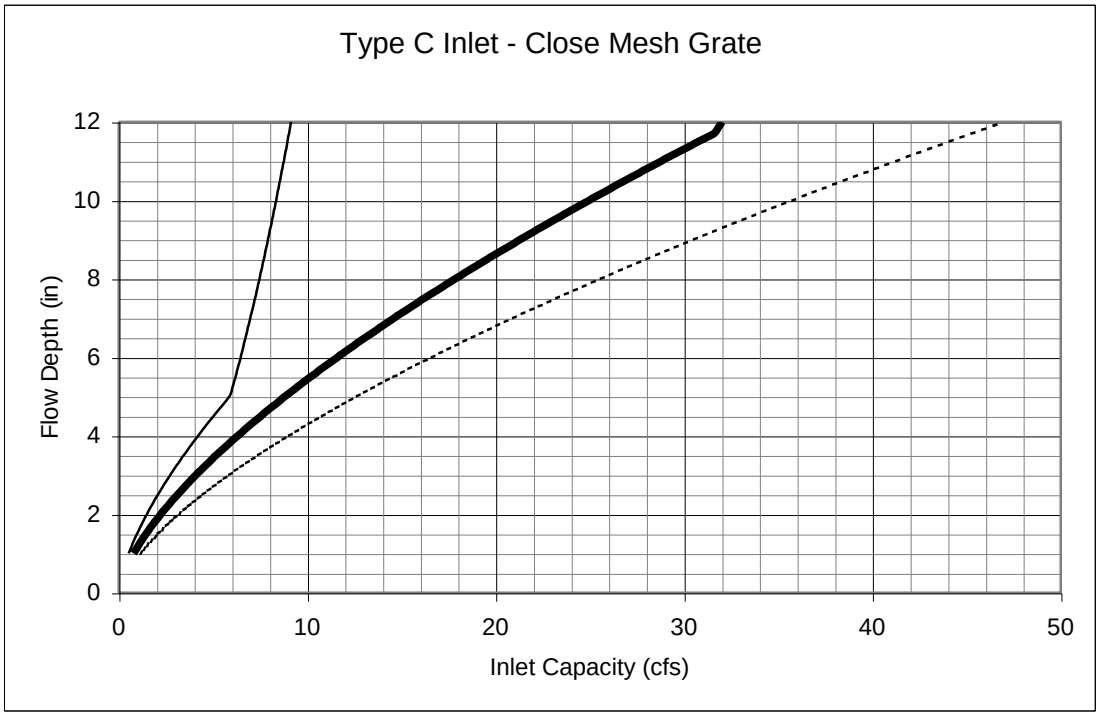
Temp Swale - Inlet B2

FIGURE 8-1, INLET CAPACITY CHART SUMP CONDITIONS
AREA (TYPE C) INLET



Ponding depth = 4.75"

Q100 to Inlet B2 = 6.2 cfs



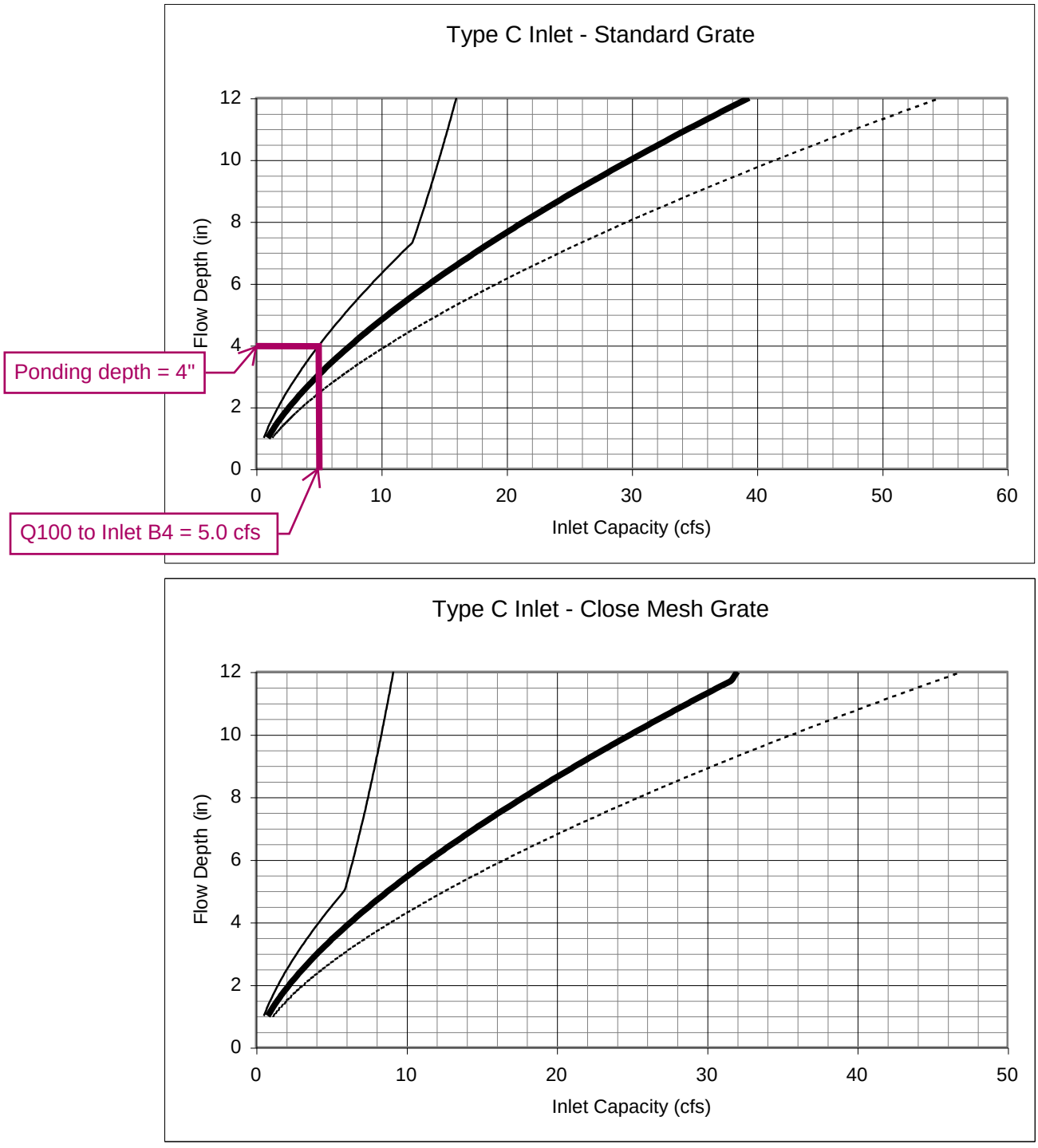
One Grate — Two Grates - - - - - - - - - Three Grates

Notes:

1. The Town of Castle Rock standard inlet parameters must apply to use these charts.

Temp Swale - Inlet B4

FIGURE 8-1, INLET CAPACITY CHART SUMP CONDITIONS
AREA (TYPE C) INLET

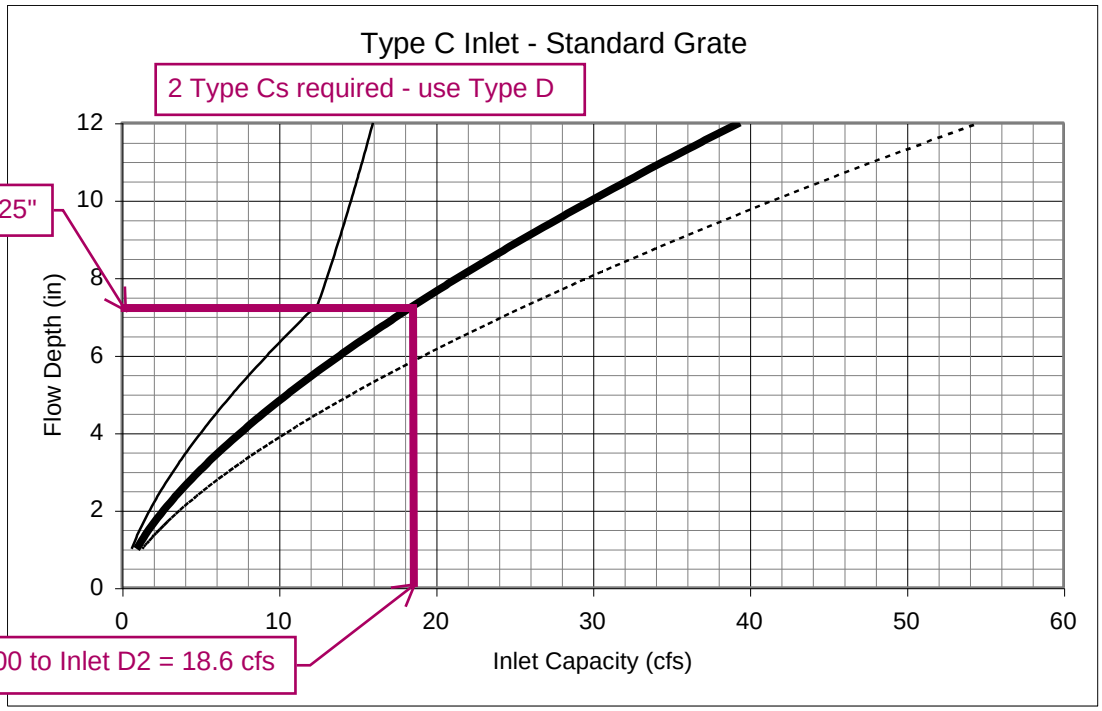


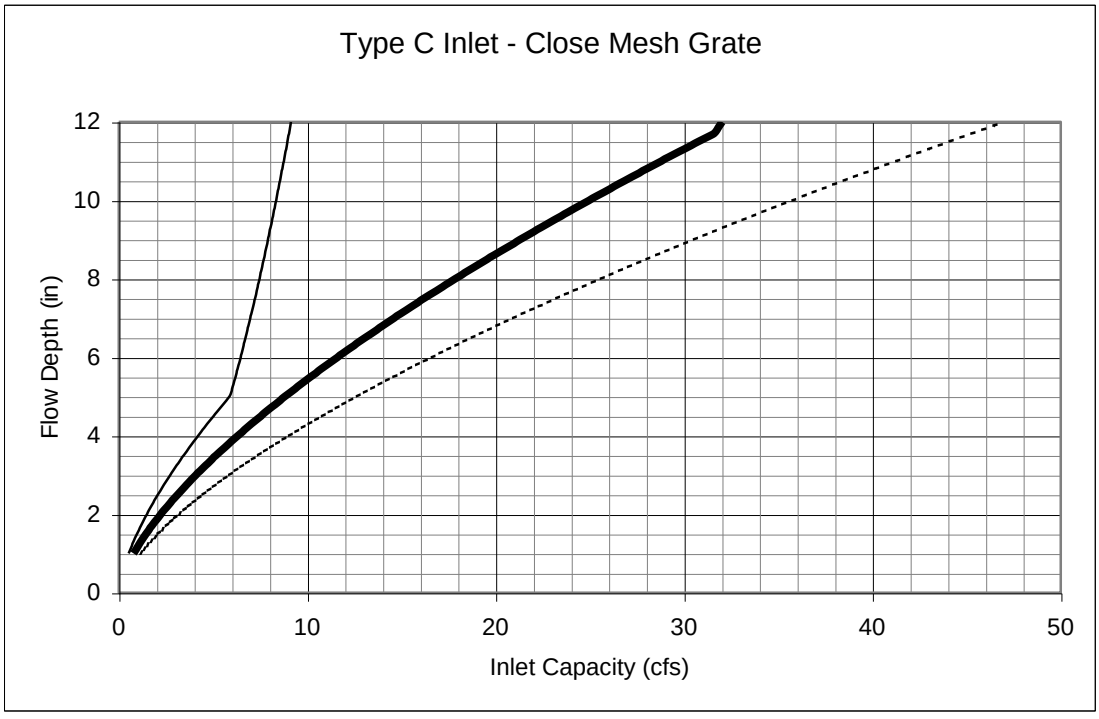
Notes:

1. The Town of Castle Rock standard inlet parameters must apply to use these charts.

Inlet D2

FIGURE 8-1, INLET CAPACITY CHART SUMP CONDITIONS
AREA (TYPE C) INLET





One Grate — Two Grates - - - - - - - - - Three Grates

Notes:

1. **The Town of Castle Rock standard inlet parameters must apply to use these charts.**

Grass Swale RPA-1 | 2-Yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	2.00 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	4.00 ft
Discharge	3.10 cfs

Results

Normal Depth	3.4 in
Flow Area	1.4 ft²
Wetted Perimeter	5.8 ft
Hydraulic Radius	2.8 in
Top Width	5.68 ft
Critical Depth	3.0 in
Critical Slope	3.04 %
Velocity	2.29 ft/s
Velocity Head	0.08 ft
Specific Energy	0.36 ft
Froude Number	0.825
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	3.4 in
Critical Depth	3.0 in
Channel Slope	2.00 %
Critical Slope	3.04 %

Grass Swale RPA-1 | 100-Yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	2.00 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	4.00 ft
Discharge	7.60 cfs

Results

Normal Depth	5.6 in
Flow Area	2.5 ft²
Wetted Perimeter	6.9 ft
Hydraulic Radius	4.3 in
Top Width	6.78 ft
Critical Depth	5.2 in
Critical Slope	2.61 %
Velocity	3.04 ft/s
Velocity Head	0.14 ft
Specific Energy	0.61 ft
Froude Number	0.883
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	5.6 in
Critical Depth	5.2 in
Channel Slope	2.00 %
Critical Slope	2.61 %

Grass Swale RPA-2 | 100-Yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	2.00 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	16.00 ft
Discharge	9.50 cfs

Results

Normal Depth	3.0 in
Flow Area	4.1 ft²
Wetted Perimeter	17.6 ft
Hydraulic Radius	2.8 in
Top Width	17.48 ft
Critical Depth	2.6 in
Critical Slope	3.02 %
Velocity	2.29 ft/s
Velocity Head	0.08 ft
Specific Energy	0.33 ft
Froude Number	0.831
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	3.0 in
Critical Depth	2.6 in
Channel Slope	2.00 %
Critical Slope	3.02 %

Grass Swale RPA-2 | 2-Yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	2.00 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	16.00 ft
Discharge	3.90 cfs

Results

Normal Depth	1.7 in
Flow Area	2.4 ft²
Wetted Perimeter	16.9 ft
Hydraulic Radius	1.7 in
Top Width	16.87 ft
Critical Depth	1.5 in
Critical Slope	3.64 %
Velocity	1.63 ft/s
Velocity Head	0.04 ft
Specific Energy	0.19 ft
Froude Number	0.763
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	1.7 in
Critical Depth	1.5 in
Channel Slope	2.00 %
Critical Slope	3.64 %

Grass Swale RPA-3 | 100-Yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	2.00 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	14.00 ft
Discharge	18.60 cfs

Results

Normal Depth	4.8 in
Flow Area	6.0 ft²
Wetted Perimeter	16.5 ft
Hydraulic Radius	4.4 in
Top Width	16.39 ft
Critical Depth	4.4 in
Critical Slope	2.57 %
Velocity	3.07 ft/s
Velocity Head	0.15 ft
Specific Energy	0.55 ft
Froude Number	0.892
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	4.8 in
Critical Depth	4.4 in
Channel Slope	2.00 %
Critical Slope	2.57 %

Grass Swale RPA-3 | 2-Yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	2.00 %
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	14.00 ft
Discharge	7.60 cfs

Results

Normal Depth	2.8 in
Flow Area	3.4 ft²
Wetted Perimeter	15.5 ft
Hydraulic Radius	2.7 in
Top Width	15.41 ft
Critical Depth	2.5 in
Critical Slope	3.08 %
Velocity	2.21 ft/s
Velocity Head	0.08 ft
Specific Energy	0.31 ft
Froude Number	0.822
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	2.8 in
Critical Depth	2.5 in
Channel Slope	2.00 %
Critical Slope	3.08 %

Temporary Grass Swale GS-1 | 2-Yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	2.00 %
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	0.00 ft
Discharge	1.80 cfs

Results

Normal Depth	5.4 in
Flow Area	0.8 ft²
Wetted Perimeter	3.7 ft
Hydraulic Radius	2.6 in
Top Width	3.63 ft
Critical Depth	5.0 in
Critical Slope	3.13 %
Velocity	2.19 ft/s
Velocity Head	0.07 ft
Specific Energy	0.53 ft
Froude Number	0.809
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	Dry
Profile Headloss	0.00 ft
Downstream Velocity	∞ ft/s
Upstream Velocity	∞ ft/s
Normal Depth	5.4 in
Critical Depth	5.0 in
Channel Slope	2.00 %
Critical Slope	3.13 %

Temporary Grass Swale GS-1 | 100-Yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	2.00 %
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	0.00 ft
Discharge	4.30 cfs

Results

Normal Depth	7.5 in
Flow Area	1.6 ft²
Wetted Perimeter	5.2 ft
Hydraulic Radius	3.7 in
Top Width	5.03 ft
Critical Depth	7.1 in
Critical Slope	2.79 %
Velocity	2.72 ft/s
Velocity Head	0.12 ft
Specific Energy	0.74 ft
Froude Number	0.855
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	Dry
Profile Headloss	0.00 ft
Downstream Velocity	∞ ft/s
Upstream Velocity	∞ ft/s
Normal Depth	7.5 in
Critical Depth	7.1 in
Channel Slope	2.00 %
Critical Slope	2.79 %

Temporary Grass Swale GS-2 | 2-Yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	2.00 %
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	0.00 ft
Discharge	0.80 cfs

Results

Normal Depth	4.0 in
Flow Area	0.4 ft²
Wetted Perimeter	2.8 ft
Hydraulic Radius	1.9 in
Top Width	2.68 ft
Critical Depth	3.6 in
Critical Slope	3.49 %
Velocity	1.79 ft/s
Velocity Head	0.05 ft
Specific Energy	0.38 ft
Froude Number	0.770
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	Dry
Profile Headloss	0.00 ft
Downstream Velocity	∞ ft/s
Upstream Velocity	∞ ft/s
Normal Depth	4.0 in
Critical Depth	3.6 in
Channel Slope	2.00 %
Critical Slope	3.49 %

Temporary Grass Swale GS-2 | 100-Yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	2.00 %
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	0.00 ft
Discharge	1.90 cfs

Results

Normal Depth	5.6 in
Flow Area	0.9 ft²
Wetted Perimeter	3.8 ft
Hydraulic Radius	2.7 in
Top Width	3.70 ft
Critical Depth	5.1 in
Critical Slope	3.11 %
Velocity	2.22 ft/s
Velocity Head	0.08 ft
Specific Energy	0.54 ft
Froude Number	0.813
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	Dry
Profile Headloss	0.00 ft
Downstream Velocity	∞ ft/s
Upstream Velocity	∞ ft/s
Normal Depth	5.6 in
Critical Depth	5.1 in
Channel Slope	2.00 %
Critical Slope	3.11 %

Temporary Grass Swale GS-3 | 2-Yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	2.00 %
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	0.00 ft
Discharge	2.10 cfs

Results

Normal Depth	5.8 in
Flow Area	0.9 ft²
Wetted Perimeter	4.0 ft
Hydraulic Radius	2.8 in
Top Width	3.84 ft
Critical Depth	5.3 in
Critical Slope	3.07 %
Velocity	2.27 ft/s
Velocity Head	0.08 ft
Specific Energy	0.56 ft
Froude Number	0.818
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	5.8 in
Critical Depth	5.3 in
Channel Slope	2.00 %
Critical Slope	3.07 %

Temporary Grass Swale GS-3 | 100-Yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035
Channel Slope	2.00 %
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	0.00 ft
Discharge	5.00 cfs

Results

Normal Depth	8.0 in
Flow Area	1.8 ft²
Wetted Perimeter	5.5 ft
Hydraulic Radius	3.9 in
Top Width	5.32 ft
Critical Depth	7.5 in
Critical Slope	2.74 %
Velocity	2.82 ft/s
Velocity Head	0.12 ft
Specific Energy	0.79 ft
Froude Number	0.863
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 in
Profile Description	Dry
Profile Headloss	0.00 ft
Downstream Velocity	∞ ft/s
Upstream Velocity	∞ ft/s
Normal Depth	8.0 in
Critical Depth	7.5 in
Channel Slope	2.00 %
Critical Slope	2.74 %

North American Green
5401 St. Wendel-Cynthiana Rd.
Poseyville, Indiana 47633
Tel. 800.772.2040
>Fax 812.867.0247
www.nagreen.com
ECMDS v7.0

CHANNEL ANALYSIS

> > > Grass Swale RPA-1

Name	Grass Swale RPA-1
Discharge	7.6
Channel Slope	0.02
Channel Bottom Width	10
Left Side Slope	4
Right Side Slope	4
Low Flow Liner	
Retardence Class	E <2 in
Vegetation Type	Sod Former
Vegetation Density	Poor < 50%
Soil Type	Clay Loam (CL)

Unreinforced Vegetation

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
Unreinforced Vegetation	Straight	7.6 cfs	2.42 ft/s	0.28 ft	0.035	4 lbs/ft2	0.35 lbs/ft2	11.34	STABLE	--
Underlying Substrate	Straight	7.6 cfs	2.42 ft/s	0.28 ft	0.035	2.3 lbs/ft2	0.32 lbs/ft2	7.21	STABLE	--

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CHANNEL ANALYSIS

> > > Grass Swale RPA-2

Name	Grass Swale RPA-2
Discharge	9.5
Channel Slope	0.02
Channel Bottom Width	18
Left Side Slope	4
Right Side Slope	4
Low Flow Liner	
Retardence Class	E <2 in
Vegetation Type	Mix (Sod and Bunch)
Vegetation Density	Poor < 50%
Soil Type	Clay Loam (CL)

Unreinforced Vegetation

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
Unreinforced Vegetation	Straight	9.5 cfs	2.18 ft/s	0.23 ft	0.035	4 lbs/ft2	0.29 lbs/ft2	13.92	STABLE	--
Underlying Substrate	Straight	9.5 cfs	2.18 ft/s	0.23 ft	0.035	1.51 lbs/ft2	0.27 lbs/ft2	5.53	STABLE	--

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CHANNEL ANALYSIS

> > > Grass Swale RPA-3

Name	Grass Swale RPA-3
Discharge	18.6
Channel Slope	0.02
Channel Bottom Width	12
Left Side Slope	4
Right Side Slope	4
Low Flow Liner	
Retardence Class	E <2 in
Vegetation Type	Mix (Sod and Bunch)
Vegetation Density	Poor < 50%
Soil Type	Clay Loam (CL)

Unreinforced Vegetation

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
Unreinforced Vegetation	Straight	18.6 cfs	3.15 ft/s	0.43 ft	0.035	4 lbs/ft2	0.54 lbs/ft2	7.45	STABLE	--
Underlying Substrate	Straight	18.6 cfs	3.15 ft/s	0.43 ft	0.035	1.51 lbs/ft2	0.47 lbs/ft2	3.19	STABLE	--

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CHANNEL ANALYSIS

> > > Temporary Grass Swale GS-1

Name	Temporary Grass Swale GS-1
Discharge	4.3
Channel Slope	0.02
Channel Bottom Width	0
Left Side Slope	4
Right Side Slope	4
Low Flow Liner	
Retardence Class	E <2 in
Vegetation Type	Mix (Sod and Bunch)
Vegetation Density	Poor < 50%
Soil Type	Clay Loam (CL)

Unreinforced Vegetation

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
Unreinforced Vegetation	Straight	4.3 cfs	2.72 ft/s	0.63 ft	0.035	4 lbs/ft2	0.78 lbs/ft2	5.1	STABLE	--
Underlying Substrate	Straight	4.3 cfs	2.72 ft/s	0.63 ft	0.035	1.51 lbs/ft2	0.38 lbs/ft2	3.97	STABLE	--

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ECMDS v7.0

CHANNEL ANALYSIS

> > > Temporary Grass Swale GS-2

Name	Temporary Grass Swale GS-2
Discharge	1.9
Channel Slope	0.02
Channel Bottom Width	0
Left Side Slope	4
Right Side Slope	4
Low Flow Liner	
Retardence Class	E <2 in
Vegetation Type	Mix (Sod and Bunch)
Vegetation Density	Poor < 50%
Soil Type	Clay Loam (CL)

Unreinforced Vegetation

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
Unreinforced Vegetation	Straight	1.9 cfs	2.22 ft/s	0.46 ft	0.035	4 lbs/ft2	0.58 lbs/ft2	6.93	STABLE	--
Underlying Substrate	Straight	1.9 cfs	2.22 ft/s	0.46 ft	0.035	1.51 lbs/ft2	0.28 lbs/ft2	5.39	STABLE	--

North American Green
5401 St. Wendel-Cynthiana Rd.
Poseyville, Indiana 47633
Tel. 800.772.2040
>Fax 812.867.0247
www.nagreen.com
ECMDS v7.0

CHANNEL ANALYSIS

> > > Temporary Grass Swale GS-3

Name	Temporary Grass Swale GS-3
Discharge	5
Channel Slope	0.02
Channel Bottom Width	0
Left Side Slope	4
Right Side Slope	4
Low Flow Liner	
Retardence Class	E <2 in
Vegetation Type	Mix (Sod and Bunch)
Vegetation Density	Poor < 50%
Soil Type	Clay Loam (CL)

Unreinforced Vegetation

Phase	Reach	Discharge	Velocity	Normal Depth	Mannings N	Permissible Shear Stress	Calculated Shear Stress	Safety Factor	Remarks	Staple Pattern
Unreinforced Vegetation	Straight	5 cfs	2.82 ft/s	0.66 ft	0.035	4 lbs/ft2	0.83 lbs/ft2	4.82	STABLE	--
Underlying Substrate	Straight	5 cfs	2.82 ft/s	0.66 ft	0.035	1.51 lbs/ft2	0.4 lbs/ft2	3.76	STABLE	--

APPENDIX D

WATER QUALITY ENHANCEMENT BEST MANAGEMENT PRACTICES

Site Layout

SCM Design, Version 4.02 (June 2025)

Designer: Jessica Greenough
Company: Galloway
Date: April 1, 2026
Project: KSS165
Location: Castle Rock, CO

SITE LAYOUT INFO (User Input in Blue Cells)

Water Quality Event (WQE): 0.60 inches

Outfall ID	RPA1	RPA2	RPA3	Remainder
Total Tributary Area (ft^2)	82,887	97,747	144,111	611,778
Total Tributary Area (ac)	1.90	2.24	3.31	14.04
Imperviousness (%)	67.7%	67.7%	93.9%	73.7%
MS4 Design Standard	Runoff	Runoff	Runoff	None
SCM Type	RPA	RPA	RPA	None

Notes:

OUTFALL RESULTS

SCM Worksheet Name	RPA_RPA1	RPA_RPA2	RPA_RPA3	--
Untreated Area (ft^3)	0	0	0	611,778
Default WQCV (ft^3)	1,830	2,159	5,243	14,926
Optional Override WQCV (ft^3)				
WQCV Reduction (ft^3)	0	151	109	0
Remaining WQCV (ft^3)	1,830	2,007	5,134	14,926
WQCV Reduction (%)	0%	7%	2%	0%
Design WQCV of SCM (ft^3)	0	0	0	0
Pollutant Removal (ft^3)	0	0	0	0
Untreated WQCV (ft^3)	1,830	2,007	5,134	14,926

TOTAL SITE RESULTS (Sums results from all Outfalls)

Total Site Area	936,523	ft^2	21.50	acres
Treated Area	324,745	ft^2	7.46	acres
Untreated Area	611,778	ft^2	14.04	acres
Total Site Imperviousness	75.7%	%		
Default (or Override) WQCV	24,158	ft^3	0.555	acre-feet
Remaining WQCV	23,898	ft^3	0.549	acre-feet
WQCV Reduction	1%	%		
Design WQCV	0	ft^3	0.000	acre-feet
Untreated WQCV	23,898	ft^3	0.549	acre-feet

Confirm with local jurisdiction whether design meets Runoff Reduction Standard

Receiving Pervious Areas (Including Grass Buffers and Grass Swales)

SCM Design, Version 4.02 (June 2025)

Designer: Jessica Greenough
Company: Galloway
Date: April 1, 2026
Project: KSS165
Location: Castle Rock, CO
Outfall ID: RPA1

DESIGN PROCEDURE AND CRITERIA FOR ALL RPAs (User Input in Blue Cells)

1. Apply Four-Cover Land Use Model to Site Layout

Design Point ID	RPA1	SPA	Treated - UIA	RPA1							
Area Type	RPA	SPA	UIA	RPA_Swale							
Downstream Design Point ID	--	RPA1	RPA1	RPA2							
DCIA (ft^2)	--	--		--							
UIA (ft^2)	--	--	54,313	--							
RPA (ft^2)	--	--		340							
SPA (ft^2)	--	28,234		--							

2. Protect the RPA from Traffic

RPA Protection Type	--	--		Slotted Curb							

3. Characterize On-site Topsoil and Determine Suitability for the RPA

HSG A (%)	--	--		0.0%							
HSG B (%)	--	--		0.0%							
HSG C/D (%)	--	--		100.0%							

4. Select Appropriate Vegetation

RPA Vegetation Type	--	--		Seed							
Irrigation Type	--	--		Permanent							

Notes:

GRASS BUFFER ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Define the UIA:RPA pair, Ratio, and Interface Width

Sheet Flow Inflow Feature	--	--		--							
Is Concrete Edger used?	--	--		--							
Spacing between slots (ft)	--	--		--							
Slot Opening Length (in)	--	--		--							
Blind Swale Type	--	--		--							
Spreader Energy Dissipation	--	--		--							
Total Area of UIA:RPA (ft^2)	--	--	--	--							
UIA:RPA Ratio	--	--	--	--							
UIA:RPA Interface Width (ft)	--	--		--							
L / W Ratio of UIA:RPA	--	--	--	--							

2. Buffer Length

Average Buffer Length (ft)	--	--	--	--							

3. Buffer Slope

Average Buffer Slope (ft/ft)	--	--		--							
Effective Distance (ft)	--	--	--	--							
Number of Level Spreaders	--	--	--	--							

4. Provide a Vertical Drop

Vertical Drop (in)	--	--		--							
Mowing Strip Provided?	--	--		--							

5. Calculate Runoff for UIA and RPA Pair

Imperviousness (%)	--	--	--	--							
UIA:RPA Runoff (in)	--	--	--	--							
UIA:RPA Runoff (ft^3)	--	--	--	--							

6. Compare Runoff from UIA:RPA Pair to Runoff from UIA Only

UIA Runoff (ft^3)	--	--	--	--							
Runoff Reduction (ft^3)	--	--	--	--							
Runoff Reduction (%)	--	--	--	--							

Notes:

GRASS SWALE ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Delineate Areas Tributary to Swale											
Total Tributary Area (ft^2)	--	--	--	82,887							
Imperviousness (%)	--	--	--	65.5%							
2. Swale Inflows											
Concentrated Flow Type	--	--		Swale							
Blind Swale Type	--	--		--							
Spreader Energy Dissipation	--	--		--							
Vertical Drop (in)	--	--		--							
Gutter Depression (in)	--	--		--							
Curb Opening Length (ft)	--	--	--	--							
Concrete Sediment Pad	--	--		--							
Min. Forebay Volume (ft^3)	--	--	--	--							
Design Forebay Volume (ft^3)	--	--		--							
Max. Forebay Depth (in)	--	--	--	--							
Design Forebay Depth (in)	--	--		--							
Calculated Notch Width (in)	--	--	--	--							
Design Notch Width (in)	--	--		--							
Drain Time (minutes)	--	--	--	--							
Energy Dissipation Type	--	--		Rock							
3. Swale Cross Section											
Length of Swale (ft)	--	--		85.00							
Bottom Width (ft)	--	--		4.00							
Bottom Area (ft^2)	--	--	--	340							
Side Slopes (horiz/vert)	--	--		4.00							
4. Longitudinal Slope											
Available Slope (ft/ft)	--	--		4.000							
Design Slope (ft/ft)	--	--		0.020							
Total Drop Height (ft)	--	--	--	338.30							
Underdrains Provided?	--	--		NO							
5. Calculate Runoff from Tributary Area											
Tributary Runoff (ft^3)	--	--	--	2,280							
Reduced Trib. Runoff (ft^3)	--	--		2,280							
6. Calculate Runoff Reduction through Swale Bottom											
Volume Infiltrated (ft^3)	--	--	--	28							
Swale Discharge (ft^3)	--	--	--	2,252							
Runoff Reduction (%)	--	--	--	1.2%							
7. Design Discharge											
2-year Discharge, Q2 (cfs)	--	--		2.9							
8. Design Velocity											
Vegetal Retardance Curve	--	--	--	E							
Velocity, V2 (fps)	--	--	--	1.7							
9. Design Flow Depth											
Flow Depth, D2 (ft)	--	--		0.32							
Flow Area, A (ft^2)	--	--	--	1.7							
Wetted Perimeter, P (ft)	--	--	--	6.6							
Top Width, T (ft)	--	--	--	6.6							
Hydraulic Radius, Rh (ft)	--	--	--	0.25							
VR Product (ft^2/sec)	--	--	--	0.44							
Manning's n value	--	--		0.048							
Hydraulic Depth, Dh (ft)	--	--	--	0.26							
Froude Number	--	--	--	0.11							
10. Swale Outflows											
Outflows Considered?	--	--		YES							

Notes:

DESIGN POINT RESULT (Sums results for current column and all upstream design point columns.)

Design Point ID	RPA1	SPA	Treated - UIA	RPA1							
Area Type	RPA	SPA	UIA	RPA_Swale							
Total Area (ft^2)	82,547	28,234	54,313	82,887							
Imperviousness (%)		0.0%	100.0%	65.5%							
Tributary Runoff (ft^3)		0	2,263	2,280							
Runoff Reduction (ft^3)	0	0	0	28							
Runoff Remaining (ft^3)	2,263	0	2,263	2,252							

Total Tributary Area entered on Site Layout Worksheet is: 82,887 square feet

Receiving Pervious Areas (Including Grass Buffers and Grass Swales)

SCM Design, Version 4.02 (June 2025)

Designer: Jessica Greenough
Company: Galloway
Date: April 1, 2026
Project: KSS165
Location: Castle Rock, CO
Outfall ID: RPA2

DESIGN PROCEDURE AND CRITERIA FOR ALL RPAs (User Input in Blue Cells)

1. Apply Four-Cover Land Use Model to Site Layout

Design Point ID	RPA2	SPA	UIARPA	Treated							
Area Type	RPA	SPA	UIA	RPA_Swale							
Downstream Design Point ID	--	RPA2	RPA2	RPA2							
DCIA (ft^2)	--	--	--	--							
UIA (ft^2)	--	--	60,653	--							
RPA (ft^2)	--	--	--	3,024							
SPA (ft^2)	--	34,070	--	--							

2. Protect the RPA from Traffic

RPA Protection Type	--	--	--	Slotted Curb							

3. Characterize On-site Topsoil and Determine Suitability for the RPA

HSG A (%)	--	--	--	0.0%							
HSG B (%)	--	--	--	0.0%							
HSG C/D (%)	--	--	--	100.0%							

4. Select Appropriate Vegetation

RPA Vegetation Type	--	--	--	Seed							
Irrigation Type	--	--	--	Permanent							

Notes:

GRASS BUFFER ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Define the UIA:RPA pair, Ratio, and Interface Width

Sheet Flow Inflow Feature	--	--	--	--							
Is Concrete Edger used?	--	--	--	--							
Spacing between slots (ft)	--	--	--	--							
Slot Opening Length (in)	--	--	--	--							
Blind Swale Type	--	--	--	--							
Spreader Energy Dissipation	--	--	--	--							
Total Area of UIA:RPA (ft^2)	--	--	--	--							
UIA:RPA Ratio	--	--	--	--							
UIA:RPA Interface Width (ft)	--	--	--	--							
L / W Ratio of UIA:RPA	--	--	--	--							

2. Buffer Length

Average Buffer Length (ft)	--	--	--	--							

3. Buffer Slope

Average Buffer Slope (ft/ft)	--	--	--	--							
Effective Distance (ft)	--	--	--	--							
Number of Level Spreaders	--	--	--	--							

4. Provide a Vertical Drop

Vertical Drop (in)	--	--	--	--							
Mowing Strip Provided?	--	--	--	--							

5. Calculate Runoff for UIA and RPA Pair

Imperviousness (%)	--	--	--	--							
UIA:RPA Runoff (in)	--	--	--	--							
UIA:RPA Runoff (ft^3)	--	--	--	--							

6. Compare Runoff from UIA:RPA Pair to Runoff from UIA Only

UIA Runoff (ft^3)	--	--	--	--							
Runoff Reduction (ft^3)	--	--	--	--							
Runoff Reduction (%)	--	--	--	--							

Notes:

GRASS SWALE ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Delineate Areas Tributary to Swale												
Total Tributary Area (ft^2)	--	--	--	3,024								
Imperviousness (%)	--	--	--	0.0%								
2. Swale Inflows												
Concentrated Flow Type	--	--	--	Swale								
Blind Swale Type	--	--	--	--								
Spreader Energy Dissipation	--	--	--	--								
Vertical Drop (in)	--	--	--	--								
Gutter Depression (in)	--	--	--	--								
Curb Opening Length (ft)	--	--	--	--								
Concrete Sediment Pad	--	--	--	--								
Min. Forebay Volume (ft^3)	--	--	--	--								
Design Forebay Volume (ft^3)	--	--	--	--								
Max. Forebay Depth (in)	--	--	--	--								
Design Forebay Depth (in)	--	--	--	--								
Calculated Notch Width (in)	--	--	--	--								
Design Notch Width (in)	--	--	--	--								
Drain Time (minutes)	--	--	--	--								
Energy Dissipation Type	--	--	--	Rock								
3. Swale Cross Section												
Length of Swale (ft)	--	--	--	189.00								
Bottom Width (ft)	--	--	--	16.00								
Bottom Area (ft^2)	--	--	--	3,024								
Side Slopes (horiz/vert)	--	--	--	3.00								
4. Longitudinal Slope												
Available Slope (ft/ft)	--	--	--	0.020								
Design Slope (ft/ft)	--	--	--	0.020								
Total Drop Height (ft)	--	--	--	0.00								
Underdrains Provided?	--	--	--	NO								
5. Calculate Runoff from Tributary Area												
Tributary Runoff (ft^3)	--	--	--	151								
Reduced Trib. Runoff (ft^3)	--	--	--	151								
6. Calculate Runoff Reduction through Swale Bottom												
Volume Infiltrated (ft^3)	--	--	--	151								
Swale Discharge (ft^3)	--	--	--	0								
Runoff Reduction (%)	--	--	--	100.0%								
7. Design Discharge												
2-year Discharge, Q2 (cfs)	--	--	--	3.2								
8. Design Velocity												
Vegetal Retardance Curve	--	--	--	E								
Velocity, V2 (fps)	--	--	--	1.0								
9. Design Flow Depth												
Flow Depth, D2 (ft)	--	--	--	0.19								
Flow Area, A (ft^2)	--	--	--	3.1								
Wetted Perimeter, P (ft)	--	--	--	17.2								
Top Width, T (ft)	--	--	--	17.1								
Hydraulic Radius, Rh (ft)	--	--	--	0.18								
VR Product (ft^2/sec)	--	--	--	0.19								
Manning's n value	--	--	--	0.065								
Hydraulic Depth, Dh (ft)	--	--	--	0.18								
Froude Number	--	--	--	0.07								
10. Swale Outflows												
Outflows Considered?	--	--	--	YES								

Notes:

DESIGN POINT RESULT (Sums results for current column and all upstream design point columns.)

Design Point ID	RPA2	SPA	UIARPA	Treated							
Area Type	RPA	SPA	UIA	RPA_Swale							
Total Area (ft^2)	97,747	34,070	60,653	3,024							
Imperviousness (%)		0.0%	100.0%	0.0%							
Tributary Runoff (ft^3)		0	2,527	151							
Runoff Reduction (ft^3)	151	0	0	151							
Runoff Remaining (ft^3)	2,527	0	2,527	0							

Total Tributary Area entered on Site Layout Worksheet is: 97,747 square feet

Receiving Pervious Areas (Including Grass Buffers and Grass Swales)

SCM Design, Version 4.02 (June 2025)

Designer: Jessica Greenough
Company: Galloway
Date: April 1, 2026
Project: KSS165
Location: Castle Rock, CO
Outfall ID: RPA3

DESIGN PROCEDURE AND CRITERIA FOR ALL RPAs (User Input in Blue Cells)

1. Apply Four-Cover Land Use Model to Site Layout

Design Point ID	RPA3	SPA	UIARPA	Treated								
Area Type	RPA	SPA	UIA	RPA_Swale								
Downstream Design Point ID	--	RPA3	RPA3	RPA3								
DCIA (ft^2)	--	--	--	--								
UIA (ft^2)	--	--	129,560	--								
RPA (ft^2)	--	--	--	2,184								
SPA (ft^2)	--	12,367	--	--								

2. Protect the RPA from Traffic

RPA Protection Type	--	--	--	Slotted Curb								

3. Characterize On-site Topsoil and Determine Suitability for the RPA

HSG A (%)	--	--	--	0.0%								
HSG B (%)	--	--	--	0.0%								
HSG C/D (%)	--	--	--	100.0%								

4. Select Appropriate Vegetation

RPA Vegetation Type	--	--	--	Seed								
Irrigation Type	--	--	--	Permanent								

Notes:

GRASS BUFFER ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Define the UIA:RPA pair, Ratio, and Interface Width

Sheet Flow Inflow Feature	--	--	--	--								
Is Concrete Edger used?	--	--	--	--								
Spacing between slots (ft)	--	--	--	--								
Slot Opening Length (in)	--	--	--	--								
Blind Swale Type	--	--	--	--								
Spreader Energy Dissipation	--	--	--	--								
Total Area of UIA:RPA (ft^2)	--	--	--	--								
UIA:RPA Ratio	--	--	--	--								
UIA:RPA Interface Width (ft)	--	--	--	--								
L / W Ratio of UIA:RPA	--	--	--	--								

2. Buffer Length

Average Buffer Length (ft)	--	--	--	--								

3. Buffer Slope

Average Buffer Slope (ft/ft)	--	--	--	--								
Effective Distance (ft)	--	--	--	--								
Number of Level Spreaders	--	--	--	--								

4. Provide a Vertical Drop

Vertical Drop (in)	--	--	--	--								
Mowing Strip Provided?	--	--	--	--								

5. Calculate Runoff for UIA and RPA Pair

Imperviousness (%)	--	--	--	--								
UIA:RPA Runoff (in)	--	--	--	--								
UIA:RPA Runoff (ft^3)	--	--	--	--								

6. Compare Runoff from UIA:RPA Pair to Runoff from UIA Only

UIA Runoff (ft^3)	--	--	--	--								
Runoff Reduction (ft^3)	--	--	--	--								
Runoff Reduction (%)	--	--	--	--								

Notes:

GRASS SWALE ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Delineate Areas Tributary to Swale												
Total Tributary Area (ft^2)	--	--	--	2,184								
Imperviousness (%)	--	--	--	0.0%								
2. Swale Inflows												
Concentrated Flow Type	--	--	--	Swale								
Blind Swale Type	--	--	--	--								
Spreader Energy Dissipation	--	--	--	--								
Vertical Drop (in)	--	--	--	--								
Gutter Depression (in)	--	--	--	--								
Curb Opening Length (ft)	--	--	--	--								
Concrete Sediment Pad	--	--	--	--								
Min. Forebay Volume (ft^3)	--	--	--	--								
Design Forebay Volume (ft^3)	--	--	--	--								
Max. Forebay Depth (in)	--	--	--	--								
Design Forebay Depth (in)	--	--	--	--								
Calculated Notch Width (in)	--	--	--	--								
Design Notch Width (in)	--	--	--	--								
Drain Time (minutes)	--	--	--	--								
Energy Dissipation Type	--	--	--	Rock								
3. Swale Cross Section												
Length of Swale (ft)	--	--	--	156.00								
Bottom Width (ft)	--	--	--	14.00								
Bottom Area (ft^2)	--	--	--	2,184								
Side Slopes (horiz/vert)	--	--	--	4.00								
4. Longitudinal Slope												
Available Slope (ft/ft)	--	--	--	0.020								
Design Slope (ft/ft)	--	--	--	0.020								
Total Drop Height (ft)	--	--	--	0.00								
Underdrains Provided?	--	--	--	NO								
5. Calculate Runoff from Tributary Area												
Tributary Runoff (ft^3)	--	--	--	109								
Reduced Trib. Runoff (ft^3)	--	--	--	109								
6. Calculate Runoff Reduction through Swale Bottom												
Volume Infiltrated (ft^3)	--	--	--	109								
Swale Discharge (ft^3)	--	--	--	0								
Runoff Reduction (%)	--	--	--	100.0%								
7. Design Discharge												
2-year Discharge, Q2 (cfs)	--	--	--	2.2								
8. Design Velocity												
Vegetal Retardance Curve	--	--	--	E								
Velocity, V2 (fps)	--	--	--	0.9								
9. Design Flow Depth												
Flow Depth, D2 (ft)	--	--	--	0.17								
Flow Area, A (ft^2)	--	--	--	2.5								
Wetted Perimeter, P (ft)	--	--	--	15.4								
Top Width, T (ft)	--	--	--	15.4								
Hydraulic Radius, Rh (ft)	--	--	--	0.16								
VR Product (ft^2/sec)	--	--	--	0.14								
Manning's n value	--	--	--	0.071								
Hydraulic Depth, Dh (ft)	--	--	--	0.16								
Froude Number	--	--	--	0.07								
10. Swale Outflows												
Outflows Considered?	--	--	--	YES								

Notes:

DESIGN POINT RESULT (Sums results for current column and all upstream design point columns.)

Design Point ID	RPA3	SPA	UIARPA	Treated							
Area Type	RPA	SPA	UIA	RPA_Swale							
Total Area (ft^2)	144,111	12,367	129,560	2,184							
Imperviousness (%)		0.0%	100.0%	0.0%							
Tributary Runoff (ft^3)		0	5,398	109							
Runoff Reduction (ft^3)	109	0	0	109							
Runoff Remaining (ft^3)	5,398	0	5,398	0							

Total Tributary Area entered on Site Layout Worksheet is: 144,111 square feet

APPENDIX E

CASTLE ROCK DRAINAGE REPORT CHECKLIST

Castle Rock Water
175 Kellogg Court, Castle Rock CO 80109
720-733-6000

Phase III Drainage Report Checklist

The Phase III Drainage Report must be in conformance with the latest Town of Castle Rock Storm Drainage Design and Technical Criteria Manual available on the Town's website.

The Phase III Drainage Report must be signed and sealed by a Professional Engineer licensed in the State of Colorado. The purpose of the Phase III Drainage Report is to update the concepts, and to present the design details on construction plans for the drainage facilities discussed in the Phase II Drainage Report.

The preparer should contact and work with the Town Stormwater Engineering Staff regarding any design, master planning and existing system questions (720-733-6000). The following outline sets forth the **required minimum** content to be provided in the Phase III Drainage Report that shall be submitted with the Planned Development Plan or Straight Zoning documents. A copy of this checklist must be submitted with the Phase III Drainage Report.

Please see Chapter 4 of the Town of Castle Rock Storm Drainage Design and Technical Criteria Manual for additional details and information. Please check off the following items to assure your report is complete. Appropriate notations shall be provided with the checklist. For example, if a specific item is not addressed or not applicable, an explanation needs to be provided.

Included	N/A	
		I. COVER SHEET
X		A. Name of Project, including legal name of development
		B. Address Will be added once an address is assigned
X		C. Owner
X		D. Developer Same as owner
X		E. Engineer
X		F. Submittal date and revision dates as applicable
		II. GENERAL LOCATION AND DESCRIPTION
X		A. Site Location
X		B. Description of Property and Land Use
		III. DRAINAGE BASIN AND SUB-BASINS
X		A. Major Drainage Basins
X		B. Minor Drainage Basins
		IV. DRAINAGE DESIGN CRITERIA
X		A. Regulations
X		B. Drainage Studies, Master Plans, Site Constraints
X		C. Hydrology
X		D. Hydraulics
X		E. Water Quality Enhancement

Phase III Drainage Report Checklist

Included	N/A	
		V. STORMWATER MANAGEMENT FACILITY DESIGN
X		A. Stormwater Conveyance Facilities
X		B. Stormwater Storage Facilities
X		C. Water Quality Enhancement Best Management Practices
	X	D. Floodplain Modification
	X	E. Additional Permitting Requirements
X		F. General
		VI. CONCLUSIONS
X		A. Compliance with Standards
X		B. Variances
X		C. Drainage Concept
X		**VII. REFERENCES**
		VIII. APPENDICES
X		A. Hydrologic Computations
X		B. Hydraulic Computations
X		C. Water Quality Enhancement Best Management Practices
X		D. Referenced Information
	X	**OVERALL DRAINAGE PLAN (IN POCKET)**
X		**DETAILED DRAINAGE PLANS (IN POCKET)**

Notes/Comments:

APPENDIX F

MS4 APPLICATION & WQ QUESTIONNAIRE

Summary of Water Quality Conformance to MS4 Permit

The purpose of this worksheet is to document conformance with the Town of Castle Rock's MS4 permit with regard to permanent water quality on land disturbance projects.

Project Name King Sooper Dawson Trails

Project Owner ACM Dawson Trails VIII JV LLC

Project Location Dawson Trails PD - E-2 Planning Area

ToCR Project Number _____

Total Site Area 21.45 **acres**

Total Size of Common Plan of Development 21.45 **acres**

Check all that apply:

- ☑ **Project within Plum Creek Basin**
- ☐ **Project within Cherry Creek Basin**

Estimated construction completion date July 2027

---

1. The water quality control measure(s) for applicable development sites shall meet one of the following base design standards as per the SDDTCM Section 14.4. Please select all design standards that were applied to meet conformance with the MS4 on this site.

   - ❒ WQCV standard
   - ❒ Pollutant removal standard
   - ☑ Runoff reduction standard
   - ❒ Applicable site draining to regional WQVC control measure (accepts drainage prior to discharging to WOTS)
   - ☑ Applicable site draining to regional WQVC control facility (with receiving pervious area control measure upstream of WOTS)
   - ❒ Constrained redevelopment sites standard
     - Imperviousness of existing site _____/_____(Imp. Ac/Site Ac) =____%
     - Variance required TCV No. _____
   - ❒ Existing control measure with WQCV per previous criteria standards
     - Reference Construction Permit No. _____
   - ❒ Cherry Creek Basin only, choose one: ☐ Tier 1 ☐ Tier 2 ☐ Tier 3
   - ❒ No control measures provided (See Permanent WQ Worksheet for applicability)

Summary of Water Quality Conformance to MS4 Permit

2. Was an exclusion to water quality applied as per SDDTCM Section 13.1.5? ☐ Yes ☑ No

   i. If yes, please select all that apply, provide total excluded impervious area(s) and submit variance, as applicable: TCV No. _____

   ❒ Pavement management site

   Excluded impervious area: _____ acres

   ❒ Excluded roadway redevelopment

   Excluded impervious area: _____ acres

   ❒ Excluded existing roadway areas

   Excluded impervious area: _____ acres

   ❒ Above ground and below ground utilities

   ❒ Large lot single family home

   ❒ Non-residential and non-commercial infiltration

   Excluded impervious area: _____ acres

   ❒ Land disturbance for land to remain undeveloped

   Excluded impervious area: _____ acres

   ❒ Stream Stabilization Sites

   Excluded impervious area: _____ acres

   ❒ Trails

   Excluded impervious area: _____ acres

   ❒ Oil and Gas Exploration

3. For Development and Redevelopment sites, following any exclusions claimed above, was any portion of the site excluded up to 20% of the site and not to exceed one acre? ☐ Yes ☑ No

   If yes, complete the following:

   Excluded area: _____ acres

   Total Site area: _____ acres, _____ % site excluded

4. For Constrained sites, was any portion of the site excluded up to 50% of the site and not to exceed 50% of the impervious area? ☐ Yes ☑ No

   If yes, complete the following:

   Excluded area: _____ acres

   Excluded impervious area: _____ acres

   Total Site area: _____ acres, _____ % site excluded

   Total Impervious area: _____ acres, _____ % impervious excluded

Permanent Water Quality Determination Worksheet (Taken from 2019 SDDTCM Sections 13.1.4 and 13.1.5)

Project:		**Project#**		**Applicant:**
Section	**Questions**	**Response**	**Check those that apply**	**Instructions**
1	**Non-applicable Sites**			
1.1	Will the project result in a temporary disturbance of greater than one acre?	No	☐	Proceed to section 1.2.
		Yes	✔	Proceed to section 2.
1.2	Is the project part of a larger common plan of development or sale where multiple separate and distinct construction activities may be taking place at different times on different schedules, but remain related and are within 1/4 mile of each other? (A common plan of development will generally be documented on a site development plan, master plan, or equivalent, for the property/project)	No	☐	Proceed to section 1.3.
		Yes	✔	Proceed to section 2.
1.3	Is the project within the Cherry Creek Watershed?	Yes	☐	Permanent water quality control measures may be required. Refer to Water Qualtiy Control Regulation 72.7 for details and allowable exclusions.
		No	✔	Permanent water quality control measures are not required.
2	**Applicable Site Types and Exclusions by Variance**			
2.1	Does the project have more than 35% impervious area on the existing site?	No	✔	Project is an applicable Development Site. Proceed to section 3.
		Yes	☐	Proceed to 2.2.
2.2	Does the project have greater than 75% impervious area on the existing site?	No	✔	Project is an applicable Redevelopment Site. Proceed to section 3.
		Yes	☐	Project is an applicable Constrainted Redevelopment Site. Proceed to 2.3.
2.3	Will 100% of the runoff from the existing and proposed site be captured and treated using one or more of the allowable design standards for permanent water quality?	Yes	☐	No further action required.
		No	✔	Proceed to 2.4.
2.4	Do any other water quality exclusions apply to the site?	No	✔	Portions of the project are excluded. Proceed with design in accordance with Constrained Redevelopment standards and apply for **variance** for Constrained Redevelopment Sites.
		Yes	☐	Proceed to section 3. Following approval of other exclusions, design remaining site in accordance with Constrained Redevelopment standards and apply for **variance** for Constrained Redevelopment Sites.
3	**Applicable Sites with Other Exclusions by Variance** N/A			
3.1	**Category 1: Roadways, bridges and trails only**			
3.1.1	Is the project a bike or pedestrian trail?	Yes	☐	Proceed to next line.
		No	☐	Proceed to 3.1.2.
	Is the trail for a roadway?	Yes	☐	Proceed to 3.1.2.
		No	☐	Project is excluded. Submit **variance** for Trails Excluded from Permanent Water Quality Requirements.
3.1.2	Is the project primarily used for parking or access to parking?	Yes	☐	This exclusion does not apply. Permanent water quality is required.
		No	☐	Proceed to 3.1.3.
3.1.3	Does the project add impervious area?	No	☐	Project is excluded. Submit **variance** for Pavement Management Sites Excluded from Permanent Water Quality Requirements.
		Yes	☐	Proceed to 3.1.4.

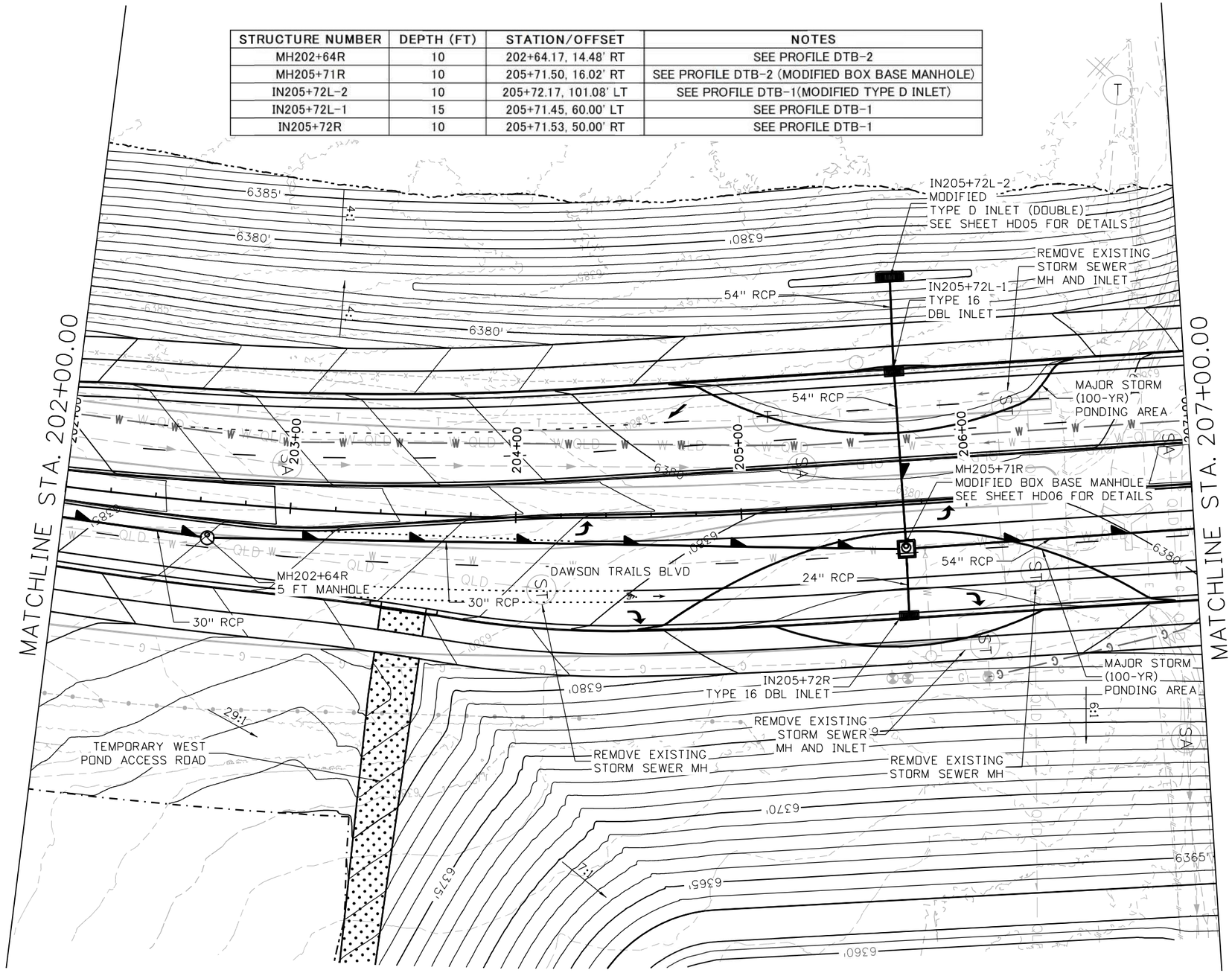
Section	Questions	Response	Check those that apply	Instructions
3.1.4	Does the project add more than 8.25 feet of paved width at any location to the existing roadway?	No	☐	Project is excluded. Submit **variance** for Roadway Redevelopment Sites Excluded from Permanent Water Quality Requirements.
		Yes	☐	Proceed to next line.
	Does the project add more than one acre of paved area per mile to an existing roadway?	No	☐	Project is excluded. Submit **variance** for Roadway Redevelopment Sites Excluded from Permanent Water Quality Requirements.
		Yes	☐	Proceed to next line.
	Does the project increase the width by two times or more, on average, of the original roadway area?	No	☐	Existing areas of site are excluded only. Submit **variance** for Existing Roadway Surfaces Only Excluded from Permanent Water Quality Requirements.
		Yes	☐	This exclusion does not apply. Permanent water quality is required.
3.2	**Category 2: Non-residential and non-commercial projects only** N/A			
3.2.1	Is the project associated with oil and gas exploration, production, processing, or treatment operations or transmission facilities, including activities necessary to prepare a site for drilling and the movement and placement of drilling equipment?	Yes	☐	Project is excluded. Submit **variance** for Oil and Gas Exploration Sites Excluded from Permanent Water Quality Requirements.
		No	☐	Proceed to 3.2.2.
3.2.2	Is the project for stream stabilization?	Yes	☐	Project is excluded. Submit **variance** for Stream Stabilization Sites Excluded from Permanent Water Quality Requirements.
		No	☐	Proceed to 3.2.3.
3.2.3	Is the project for installation or maintenance of aboveground or underground utilities or infrastructure that does not permanently alter the terrain, ground cover, or drainage patterns from those present prior to the construction activity including activities to install, replace or maintain utilities under roadways or other paved areas that return the surface to the same condition?	Yes	☐	Project is excluded. Submit **variance** for Aboveground and Underground Utilities Excluded from Permanent Water Quality Requirements.
		No	☐	Proceed to 3.2.4.
3.2.4	Is the project on undeveloped land (land with no human-made structures such as buildings or pavement) that will remain undeveloped after the project?	Yes	☐	Project is excluded. Submit **variance** for Sites with Land Disturbances to Undeveloped Land that will Remain Undeveloped Excluded from Permanent Water Quality Requirements.
		No	☐	Proceed to 3.2.5.
3.2.5	Will the post-project condition result in surface water discharge during the 80th percentile storm runoff event?	No	☐	Project is excluded. Submit **study** along with **variance** for Non-residential and Non-commercial Infiltration Conditions Excluded from Permanent Water Quality Requirements.
		Yes	☐	This exclusion does not apply. Permanent water quality is required.
3.3	**Category 3: Residential, Agricultural and Commercial projects**			
3.3.1	Is the project a single-family residential lot, or agricultural zoned lands, greater than or equal to 2.5 acres in size per dwelling unit?	Yes	☐	Proceed to next line.
		No	✔	Proceed to 3.3.2.
	Is the project site greater than 10% impervious?	No	☐	Project is excluded. Submit **variance** for Large Lot Single Family Sites Excluded from Permanent Water Quality Requirements.
		Yes	✔	Proceed to next line.
	Is the project site greater than 20% impervious?	Yes	✔	This exclusion does not apply. Permanent water quality is required.
		No	☐	Proceed to next line.
	Will the post-project condition result in surface water discharge during the 80th percentile storm runoff event?	No	☐	Project is excluded. Submit **study** along with **variance** for Large Lot Single Family Sites Excluded from Permanent Water Quality Requirements.
		Yes	✔	This exclusion does not apply. Permanent water quality is required.

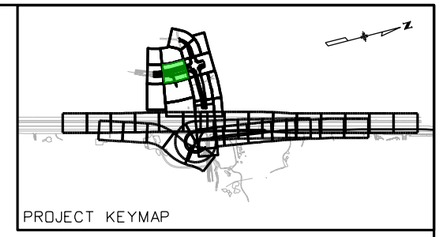
Section	Questions	Response	Check those that apply	Instructions
3.3.2	Will 100% of the runoff from the residential or commercial site be captured?	Yes	✔	This exclusion does not apply. Permanent water quality is required.
		No	☐	Proceed to next line.
	Is all or a portion of the site undeveloped or will it remain undeveloped after construction?	Yes	✔	This portion of the project is excluded. Submit **variance** for Sites with Land Disturbance to Undeveloped Land that will Remain Undeveloped Excluded from Permanent Water Quality Requirements. Proceed to next line.
		No	☐	Proceed to next line.
	Is the remaining untreated impervious area greater than 20% of the site?	Yes	☐	This exclusion does not apply. Permanent water quality is required.
		No	✔	Proceed to next line.
	Is the remaining untreated impervious area greater than one acre?	Yes	☐	This exclusion does not apply. Permanent water quality is required.
		No	✔	Proceed to next line.
	Is it practicable to capture runoff from portions of the site that will not drain to a control measure?	No	☐	Document justification demonstrating that it is not practicable to capture runoff from this portion of the site in the **drainage report**. No further action is needed.
		Yes	✔	This exclusion does not apply. Permanent water quality is required.

APPENDIX G

EXCERPTS FROM PREVIOUS REPORTS

STRUCTURE NUMBER	DEPTH (FT)	STATION/OFFSET	NOTES
MH202+64R	10	202+64.17, 14.48' RT	SEE PROFILE DTB-2
MH205+71R	10	205+71.50, 16.02' RT	SEE PROFILE DTB-2 (MODIFIED BOX BASE MANHOLE)
IN205+72L-2	10	205+72.17, 101.08' LT	SEE PROFILE DTB-1(MODIFIED TYPE D INLET)
IN205+72L-1	15	205+71.45, 60.00' LT	SEE PROFILE DTB-1
IN205+72R	10	205+71.53, 50.00' RT	SEE PROFILE DTB-1





0' 12' 25' 50'

NOTES

DRAINAGE LEGEND

KXXXX#S
- STRUCTURE ID
- LEFT/RIGHT SIDE OF ALIGNMENT
- NUMERIC IDENTIFIER
- TRUNCATED MAINLINE STATION
- STRUCTURE TYPE

- TOP OF CUT
- TOE OF SLOPE
- PROPOSED STORM SEWER
- EXISTING FLOODPLAIN
- PROPOSED FLOODPLAIN
- FEMA REGULATORY FLOODPLAIN
- EXISTING STORM SEWER
- RIPRAP
- WETLANDS
- PMJM AREAS
- WEST POND ACCESS ROAD

Know what's below. Call before you dig.

COLORADO LICENSED
JORDAN DIEMER
54933
10-31-23
PROFESSIONAL ENGINEER

FINAL DESIGN - FOR CONSTRUCTION

Print Date: 10/11/2023
File Name: 24262-P2_015-04_SHR_HYD02.dgn
Horiz. Scale: 1" = 50' Vert. Scale: As Noted

shrewsberry

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Sheet Revisions		
Date:	Comments	Init.

TOWN OF CASTLE ROCK COLORADO

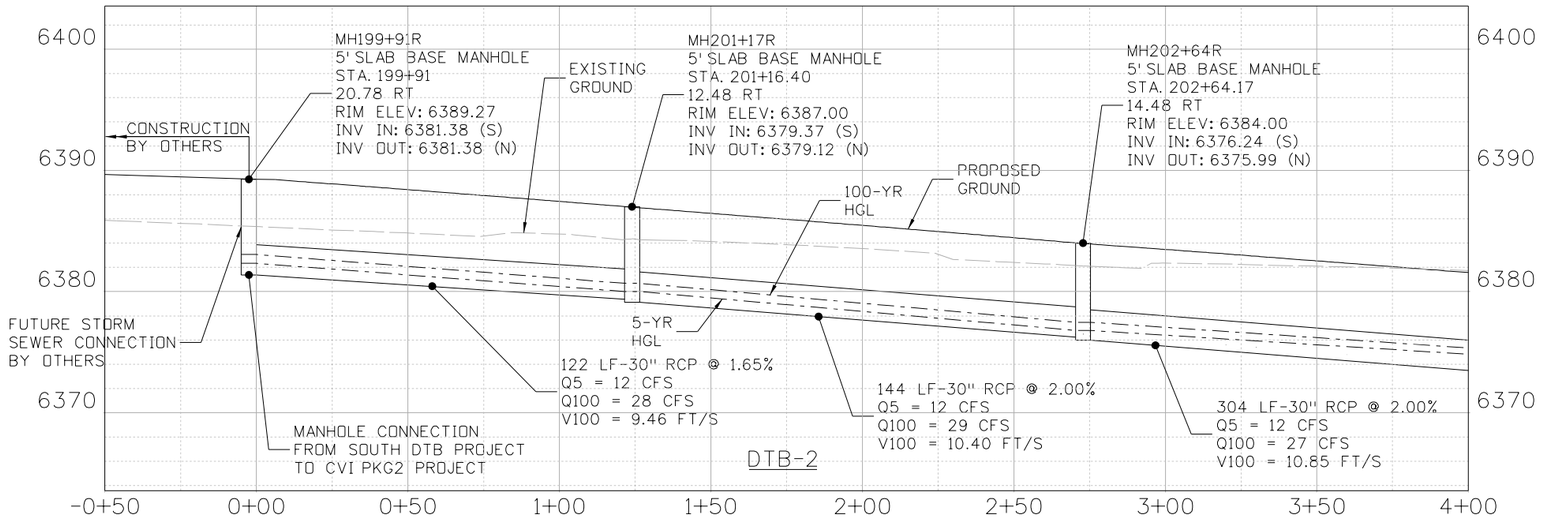
PUBLIC WORKS DEPT.
4175 NORTH CASTLETON CT.
CASTLE ROCK, CO 80109
PHONE 303 660-1020
FAX 303 660-1025

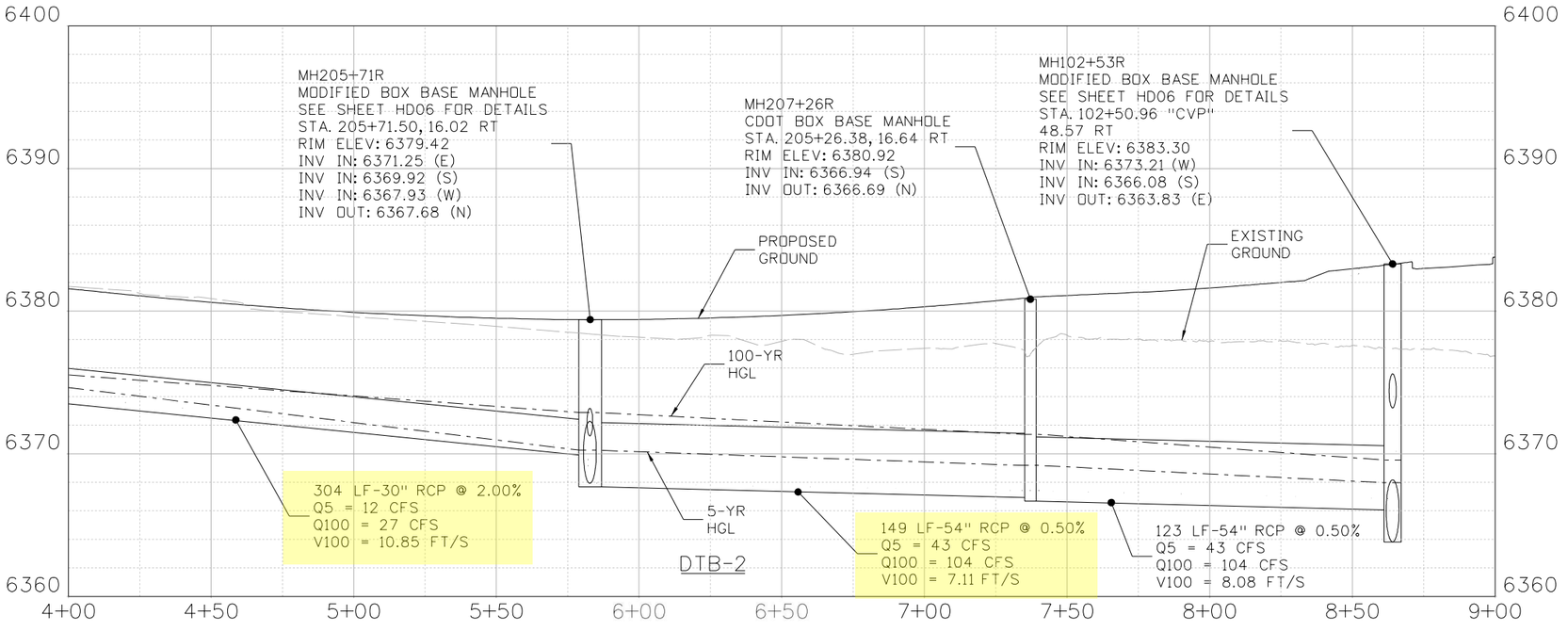
As Constructed
No Revisions:
Revised:
Void:

CRYSTAL VALLEY INTERCHANGE-PACKAGE 2
HYDRAULICS PLAN
DAWSON TRAILS BOULEVARD
STA 202+00 TO 207+00

Designer:HSB
Detailer: HSB
Sheet Subset:HYD PLAN
Structure Numbers
Subset Sheets: HY02 of 53

Project No./Code
NHPP 0252-518
25846
Sheet Number 275





COLORADO LICENSED
JORDAN DIEMER
54933
10-31-23
PROFESSIONAL ENGINEER

FINAL DESIGN - FOR CONSTRUCTION

Print Date: 10/11/2023	Sheet Revisions		
File Name: 24262-P2_015-03_SHR_HY02.dgn	Date:	Comments	Init.
Horiz. Scale: 1" = 50' Vert. Scale: As Noted			
shrewsberry			

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CRYSTAL VALLEY INTERCHANGE-PACKAGE 2
HYDRAULIC PROFILES
DTB-2

Designer:HSB
Detailer: HSB
Sheet Subset:HYD PROF
Structure Numbers
Subset Sheets: HP02 of 21

Project No./Code
NHPP 0252-518
25846
Sheet Number 328

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PHASE III DRAINAGE REPORT

FOR

DAWSON TRAILS FILING NO. 2
TOWN OF CASTLE ROCK, COLORADO
PROJECT NO. CD23-0045

Prepared for:

ACM Dawson Trails JV LLC
4100 Mississippi Ave, Ste 500
Glendale, CO 80246
Contact: Lawrence Jacobson
Phone: 303-984-9800

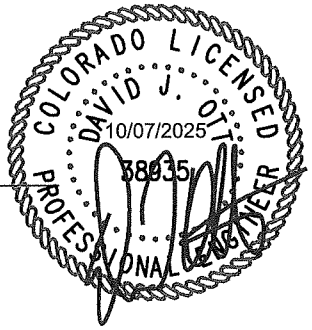
Prepared by:

EMK Consultants, Inc.
7006 S. Alton Way, Bldg F
Centennial, CO 80112
Contact: Eric R. McDaniel
Phone: 303-694-1520
EMK Job No 13466

September 9, 2025

Engineer's Statement:

I affirm that this report and plan for the Phase III drainage design of Dawson Trails Filing No. 2 was prepared by me (or under my direct supervision) in accordance with the provisions of the Town of Castle Rock Drainage Design and Technical Criteria for the owners thereof. I understand that the Town of Castle Rock does not and will not assume liability for drainage facilities designed by others.



David J. Ott, P.E.
Colorado Professional Engineer
License #38935

DEVELOPMENT SERVICES
APPROVED
By tkucewesky
on 10/21/2025
Approved-CD23-0045 Ph III Drn Rpt.pdf
Record Document on File

Developer's Statement:

ACM Dawson Trails JV LLC hereby certifies that the drainage facilities for Dawson Trails Filing No. 2 shall be constructed according to the design presented in this report. I understand that the Town of Castle Rock does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that the Town of Castle Rock reviews drainage plans pursuant to the Municipal Code; but cannot, on behalf of Dawson Trails Filing No. 2 , guarantee that final drainage design review will absolve ACM Dawson Trails JV LLC and/or their successors and/or assigns of future liability for improper design.

Lawrence Jacobson
Owner/Developer

oriented use. The area is assigned a build-out imperviousness of 71.4% for hydrologic analysis. This basin is tributary to the Regional Pond C1 and has been accounted for in its sizing. Release rates from Pond C1 have been coordinated with the design of the Gambel Ridge Tributary as to release at acceptable rates. This avoids any capacity issues in crossing the railroad in following historic drainage patterns. No impacts to wetlands or water rights are anticipated as a result of this inter-watershed transfer. Interim discharge from this basin continues east to culverts under I-25 and the railroad via sheet flow.

Basin C-3 *(19.6 acres | 70% Impervious | Q100 = 57.9 cfs)*
Major Basin C-3 is bounded by Dawson Trails Boulevard on the west, Crystal Valley Parkway on the north, Ike Street on the east, and Quandary Peak Drive on the South. It is designated within Planning area F3 in the development plan. Non-residential and residential uses are permitted within the development parcel, with a specific anticipation of commercial oriented use. The area is assigned a build-out imperviousness of 70% for hydrologic analysis. This basin is tributary to the Regional Pond C1 and has been accounted for in its sizing.

Basin C-4 *(20.6 acres | 75% Impervious | Q100 = 43.8 cfs)*
Major Basin C-4 is bounded by Dawson Trails Boulevard on the east, Arterial A on the north and west, and Quandary Peak Drive on the south. It is designated within Planning area E2 in the development plan. Non-residential and residential uses are permitted within the development parcel, with a specific anticipation of commercial oriented use. The area is assigned a build-out imperviousness of 75% for hydrologic analysis. This basin is tributary to the Regional Pond C1 and has been accounted for in its sizing.

Basin C-5 *(24.2 acres | 80% Impervious |Q100 = 50 cfs)*
Major Basin C-5 includes the road rights-of-way for Arterial A, Dawson Trails Boulevard, Crystal Valley Parkway and the western segment of Quandary Peak Drive. Specific sub-areas of Basin C-5 are further detailed in Section II.B of this report, along with the proposed drainage improvements for the included roadways. The area is assigned a build-out imperviousness of 80% for hydrologic analysis. This basin is tributary to the Regional Pond C1 and has been accounted for in its sizing.

Basin C-6 *(8.4 acres | 80% Impervious | Q100 = 15 cfs)*
Major Basin C-6 includes the road rights-of-way for Ike Street and the eastern segment of Quandary Peak Drive. Specific sub-areas of Basin C6 are further detailed in Section II.B of this report, along with the proposed drainage improvements for the included roadways. The area is assigned a build-out imperviousness of 80% for hydrologic analysis. This basin is tributary to the Regional Pond C1 and has been accounted for in its sizing.

North Dawson Tributary Watershed: On-site Basins used in CUHP/SWMM Analysis:
[Proposed Overall SWMM Map 1]

Basin A-1 *(13.4 acre | 12% Impervious| Q100 = 27.0 cfs)*
Major Basin A-1 is bounded by development parcels to the north, Dawson Trails Boulevard to the west, The CORE Electric substation to the south, and the BNSF Railraod to the east. Major Basin A-1 contains the Regional Flood Control Pond A1 and associated open space. Basin A-1 is located within the planning area OSP-4 in the development plan. This area has an anticipated use of open space and landscape features. The area is assigned a build out imperviousness of 12% for hydrologic analysis. Flows from this basin

B6.21 *(8.15 acres | 90% Impervious | Q100 = 9.8 cfs)* and
B6.22 *(1.20 acres | 90% Impervious | Q100 = 9.3 cfs)*
Sub-basins B6.21 and B6.22 contain the south and north halves of Gambel Ridge Blvd., respectively, between road stations 34+75 and 47+25. The areas surface drain via curb/gutter to a pair of on-grade curb inlets on Gambel Ridge Blvd. at 47+25. B6.21 and B6.22 accept bypass flows from B6.11 and B6.12, respectively. B6.22 is designed for full capture of major and minor storm gutter flows upstream of the planned intersection.

B6.20 *(6.69 acres | 2% Impervious | Q100 = 14.7 cfs)*
Sub-basin B6.20 includes the hillside south of sub-basin B6.21. Runoff from the slope is collected in a swale and captured in area inlet B6.20

B6.31 *(4.87 acres | 90% Impervious | Q100 = 8.8 cfs)* and
B6.32 *(0.83 acres | 90% Impervious | Q100 = 6.5 cfs)*
Sub-basins B6.31 and B6.32 contain the south and north halves of Gambel Ridge Blvd., respectively, between road stations 47+25 and 56+00. The areas surface drain via curb/gutter to a pair of on-grade curb inlets on Gambel Ridge Blvd. at 56+00.

B6.30 *(3.65 acres | 2% Impervious | Q100 = 9.1 cfs)*
Sub-basin B6.30 includes the hillside south of sub-basin B6.31. Runoff from the slope is collected in a swale and captured in area inlet B6.30

B6.41 *(1.63 acres | 90% Impervious | Q100 = 5.7 cfs)* and
B6.42 *(0.49 acres | 90% Impervious | Q100 = 4.4 cfs)*
Sub-basins B6.41 and B6.42 contain the south and north halves of Gambel Ridge Blvd., respectively, between road stations 56+00 and 61+00. The areas surface drain via curb/gutter to a pair of on-grade curb inlets on Gambel Ridge Blvd. at 61+00. B6.41 and B6.42 accept bypass flows from B6.31 and B6.32, respectively. B6.42 is designed for full capture of major and minor storm gutter flows upstream of a planned intersection.

B6.40 *(0.87 acres | 2% Impervious | Q100 = 2.7 cfs)*
Sub-basin B6.40 includes the hillside south of sub-basin B6.41. Runoff from the slope is collected in a swale and captured in area inlet B6.40

B6.51 *(0.66 acres | 90% Impervious | Q100 = 4.9 cfs)* and
B6.52 *(0.63 acres | 90% Impervious | Q100 = 4.8 cfs)*
Sub-basins B6.09 and B6.10 contain the south and north halves of Gambel Ridge Blvd., respectively, between road stations 61+00 and 65+50. The areas surface drain via curb/gutter to a pair of on-grade curb inlets on Gambel Ridge Blvd. at 65+50. B6.52 also includes the adjacent hillside and accepts bypass flows from B6.41. B6.51 and B6.52 are designed for full capture of major and minor storm gutter flows before routing to Pond B1.

Basin C5 sub-basins (Rational Method Analysis): [Proposed Detailed Drainage Maps 6-7, 12]

Basin C5 is defined as the areas of road-right-of way, including Dawson Trails Boulevards and roadways west, that are tributary to regional Pond C1.

C5.01 *(2.61 acres | 90% Impervious | Q100 = 9.6 cfs)* and
C5.02 *(2.11 acres | 90% Impervious | Q100 = 9.6 cfs)*

Sub-basins C5.01 and C5.02 contain the north and south halves of Arterial A, respectively, between road stations 65+50 and 81+50. The areas surface drain via curb/gutter to a pair of on-grade curb inlets on Arterial A at 81+50. C5.01 is designed for full capture of major and minor storm gutter flows upstream of the intersection with Twin Oaks Drive

C5.03 *(1.36 acres | 90% Impervious | Q100 = 10.1 cfs)* and
C5.04 *(1.22 acres | 90% Impervious | Q100 = 9.0 cfs)*
Sub-basins C5.03 and C5.04 contain the north and south halves of Arterial A, respectively, between road stations 81+50 and 88+45. The areas surface drain via curb/gutter to a pair of on-grade curb inlets on Arterial A at 88+45. C5.03 and C5.04 accept bypass flows from C5.01 and C5.02, respectively. Both inlets are designed for full capture of major and minor storm gutter flows upstream of the intersection with Dawson Trails Boulevard

C5.11 *(1.56 acres | 90% Impervious | Q100 = 9.6 cfs)* and
C5.12 *(1.56 acres | 90% Impervious | Q100 = 9.6 cfs)*
Sub-basins C5.11 and C5.12 contain the west and east halves of Dawson Trails Boulevard, respectively, between the high point at road stations 148+33 and road station 160+00. The areas surface drain via curb/gutter to a pair of on-grade curb inlets just south of the Dawson Trails Boulevard/Quandary Peak Drive roundabout. Inlet C5.12 is previously constructed with the Dawson Trails Boulevard project (CIP22-0012). Inlet C5.11 is proposed with this project but its flows are accounted for by the Dawson Trails storm sewer design.

C5.13 *(1.80 acres | 90% Impervious | Q100 = 13.6 cfs)* and
C5.14 *(0.76 acres | 90% Impervious | Q100 = 5.7 cfs)*
Sub-basins C5.13 and C5.14 contain the north and south halves of Quandary Peak Drive, respectively, between Arterial A and Dawson Trails Boulevard. C5.13 also receives bypass flow from C5.14. The areas surface drain via curb/gutter to a pair of sump inlets just west of the Dawson Trails Boulevard/Quandary Peak Drive roundabout.

C5.15 *(1.81 acres | 90% Impervious | Q100 = 11.3 cfs)* and
C5.16 *(1.65 acres | 90% Impervious | Q100 = 8.3 cfs)*
Sub-basins C5.15 and C5.16 contain the west and east halves of Dawson Trails Boulevard, respectively, between the Quandary Peak Drive roundabout and road station 174+75. The areas surface drain via curb/gutter to a pair of existing on-grade curb inlets at174+75. Inlets C5.15 and C5.16 mark the northern limits of Dawson Trails Boulevard construction with the Filing 2 project, and are designed to fully capture roadway runoff before leaving the project limits.

Basin C6 sub-basins (Rational Method analysis): [Proposed Detailed Drainage Map 7]

Basin C6 is defined as the areas of road-right-of way east of Dawson Trails Boulevards that are tributary to regional Pond C1.

C6.01 *(1.89 acres | 90% Impervious | Q100 = 13.3 cfs)* and
C6.02 *(1.13 acres | 90% Impervious | Q100 = 8.3 cfs)*
Sub-basins C6.01 and C6.02 contain the north and south halves of Quandary Peak Drive, respectively, between Dawson Trails Boulevard and Ike Street. The areas surface drain

all flow can be released via the main stem of the North Dawson Tributary or the main stem of the Gambel Ridge tributary. Impacts to water rights or wetlands are not anticipated with this basin transfer.

5. Mile High Flood District drainage policy states that the maximum allowable 100-year release rate from detention ponds is 0.9 of the pre-development peak 100-year flows. However, to account for upstream drainageway flows while meeting the constraint described in (4) above, 100-year detention release rates will need to be further restricted beyond 0.9 of pre-development peak to ensure existing capacities downstream are not exceeded. The railway crossings and I-25 culverts are the governing restriction for the detention ponds in this project.

Drainage components specifically integrated with the Crystal Valley Interchange:
Two components of the Crystal Valley Interchange are key elements of the Gambel Ridge Watershed as it relates Filing 2 drainage design. These elements—the Gambel Ridge Channel Improvements and Regional Pond C1—are explained as follows:

Gambel Ridge Channel Improvements (by others)
The runoff analysis in the Gambel Ridge and Douglas Lane Tributary Master Plan [Ref. G] indicates that Gambel Ridge Tributary will see an increase of flow under developed conditions, and that channel stabilization improvements will be warranted.

The design of the Gambel Ridge Tributary improvements is not within the scope of the Filing 2 project or within the scope of this drainage report.

Improvements to the 1,000-foot segment of Gambel Ridge Tributary between the BNSF right-of-way and Dawson Trails Boulevard are included in the design of the Crystal Valley Interchange by Jacobs Engineering Group. The appendices contain design calculations from the Crystal Valley Interchange project relevant to this project.

Regional Pond C1 (by others)
Pond C1 is located immediately south of Crystal Valley Parkway, between Dawson Trails Boulevard and Intestate 25. Because Pond C1 is responsible for detention and water quality treatment of the segment of Crystal Valley Parkway between Dawson Trails Boulevard and Interstate 25, its design is programmed with the Crystal Valley Interchange project, by Jacobs Engineering Group. However, Pond C1 also plays an important role in the Dawson Trails Filing No. 2 drainage design because it provides detention and water quality treatment for development parcels in the lower part of the Gambel Ridge watershed. Land use assumptions for basins tributary to Pond C1 within Filing 2 fit within the assumptions of the Pond C1 design in the CVI project.

APPENDIX A

PROJECT INFORMATION & HYDROLOGIC COMPUTATIONS

VICINITY MAP
HYDROLOGIC SOIL GROUP
FLOODPLAIN MAPS
EXISTING CUHP CALCULATIONS
PROPOSED CUHP CALCULATIONS
PROPOSED SWMM ANALYSIS
RATIONAL METHOD CALCULATIONS

GAMBEL RIDGE TRIBUTARY

CUHP MODEL RESULTS

INTERIM BUILDOUT CONDITION

CUHP SUBCATCHMENTS

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

								Maximum Depression Storage (Watershed inches)		Horton's Infiltration Parameters			DCIA
Subcatchment Name	EPA SWMM Target Node	Raingage	Area (mi^2)	Length to Centroid (mi)	Length (mi)	Slope (ft/ft)	Percent Imperviousness	Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/seconds)	Final Rate (in/hr)	Level 0, 1, or 2
H-1	J_H1	100-year	0.0725514	0.221212121	0.5210227	0.058	2	0.4	0.1	3.7	0.0018	0.5	0
H-2	J_H2	100-year	0.1187964	0.357386364	0.7441288	0.045	2	0.35	0.05	3.5	0.0018	0.5	0
H-3	J_H3	100-year	0.0086165	0.098863636	0.1977273	0.033	45	0.35	0.05	3	0.0018	0.5	0
H-4	J_H4	100-year	0.0126001	0.131439394	0.2606061	0.045	45	0.35	0.05	3	0.0018	0.5	0
H-5	J_H5	100-year	0.0614924	0.2	0.4005682	0.036	45	0.35	0.05	3.1	0.0018	0.5	0
H-6	J_H6	100-year	0.0394709	0.359469697	0.7189394	0.045	32.6	0.35	0.1	3	0.0018	0.5	0
H-7	J_H7	100-year	0.0100076	0.052840909	0.1988636	0.031	51.5	0.35	0.05	4.2	0.0018	0.6	0
H-8	J_H8	100-year	0.0165493	0.225776932	0.4346471	0.0533	2	0.4	0.01	3	0.0018	0.5	0
C-1	J_C1	100-year	0.0570767	0.16969697	0.4077652	0.06321412	75	0.35	0.1	4	0.0018	0.6	0
C-2	J_C2	100-year	0.0760191	0.226704545	0.4401515	0.022934596	75	0.35	0.1	3.3	0.001745	0.5	0
C-3	J_C3	100-year	0.0508346	0.219128788	0.4765152	0.019475358	75	0.35	0.1	3.4	0.0018	0.5	0
C-4	J_C4	100-year	0.033502	0.130681818	0.3314394	0.024257143	75	0.35	0.1	3.7	0.0018	0.5	0
C-5	J_C5	100-year	0.0377594	0.358522727	0.7168561	0.018124174	80.4	0.35	0.1	3.7	0.0018	0.5	0
C-6	J_C6	100-year	0.0130523	0.21969697	0.5893939	0.01722365	80.4	0.35	0.1	4.2	0.001714589	0.6	0
C-7	J_C7	100-year	0.0210999	0.148674242	0.2666667	0.011576705	88.6	0.35	0.1	4.4	0.001010314	0.9	0
C-8	J_C8	100-year	0.030106	0.130492424	0.2907197	0.015	95	0.35	0.1	4.5	0.001	0.9	0
C-9	J_C9	100-year	0.0066354	0.131439394	0.2712121	0.02	2	0.35	0.05	3	0.0018	0.5	0
OS-1	J_O1	100-year	0.1084434	0.422916667	0.7518939	0.066	8.7	0.4	0.05	4.1	0.0018	0.6	0
OS-2	J_O2	100-year	0.1579448	0.522727273	0.9541667	0.059	3.9	0.4	0.05	4.2	0.0018	0.6	0
OS-3	J_O3	100-year	0.1543167	0.297727273	0.8047348	0.059	10.4	0.4	0.05	3	0.0018	0.5	0
OS-4	J_O4	100-year	0.0394811	0.148106061	0.4035985	0.057	11.5	0.4	0.05	3	0.0018	0.5	0

INTERIM BUILDOUT CONDITION - 100 YEAR STORM EVENT

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

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
H-1		0.156	0.144	35.8	5.45	18.6	3.85	9.1	61	168,551	1.53	257,995	45.0	66	257,577	1.43
H-2		0.156	0.179	45.5	7.77	23.7	5.49	13.0	78	275,988	1.59	438,879	50.0	96	438,634	1.26
H-3		0.091	0.060	24.3	2.63	12.7	1.86	4.4	11	20,018	2.13	42,550	40.0	12	41,629	2.24
H-4		0.091	0.071	24.9	2.87	13.0	2.03	4.8	15	29,273	2.13	62,222	40.0	18	61,250	2.23
H-5		0.091	0.146	19.4	3.67	10.1	2.59	6.1	95	142,859	2.12	303,242	35.0	106	301,391	2.69
H-6		0.098	0.098	51.8	5.39	27.0	3.81	9.0	23	91,699	1.96	180,024	50.0	33	179,860	1.30
H-7		0.088	0.069	15.5	2.32	8.1	1.64	3.9	19	23,250	2.12	49,276	35.0	19	47,053	2.95
H-8		0.156	0.074	65.8	5.23	34.2	3.70	8.7	8	38,447	1.57	60,277	55.0	10	60,204	0.92
C-1		0.079	0.174	11.4	3.03	6.0	2.14	5.0	150	132,601	2.42	320,554	35.0	141	312,291	3.86
C-2		0.079	0.198	15.3	3.82	7.9	2.70	6.4	149	176,608	2.45	433,560	35.0	168	431,561	3.46
C-3		0.079	0.165	19.5	3.96	10.1	2.80	6.6	78	118,099	2.46	290,053	35.0	95	288,347	2.93
C-4		0.079	0.137	14.6	3.03	7.6	2.14	5.1	69	77,832	2.45	190,843	35.0	74	186,479	3.45
C-5		0.077	0.147	33.6	5.29	17.5	3.74	8.8	34	87,723	2.52	220,908	45.0	50	220,635	2.08
C-6		0.077	0.091	39.5	4.26	20.5	3.01	7.1	10	30,323	2.49	75,389	45.0	15	75,187	1.83
C-7		0.075	0.115	19.0	3.17	9.9	2.24	5.3	33	49,019	2.53	124,250	35.0	41	122,947	3.01
C-8		0.074	0.136	14.4	3.01	7.5	2.13	5.0	63	69,942	2.66	186,018	35.0	70	181,518	3.61
C-9		0.156	0.049	77.2	4.40	40.2	3.11	7.3	3	15,415	1.62	24,918	60.0	4	24,888	0.83
OS-1		0.134	0.150	46.5	6.86	24.2	4.84	11.4	70	251,936	1.50	377,209	50.0	81	377,215	1.17
OS-2		0.150	0.196	50.7	9.14	26.3	6.46	15.2	94	366,937	1.44	526,741	55.0	108	526,352	1.07
OS-3		0.128	0.169	35.3	6.07	18.3	4.29	10.1	131	358,509	1.66	596,421	45.0	153	596,044	1.55
OS-4		0.125	0.090	33.6	3.81	17.4	2.69	6.4	35	91,722	1.68	153,820	45.0	40	153,345	1.58

ULTIMATE BUILDOUT CONDITION

CUHP SUBCATCHMENTS

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

								Maximum Depression Storage (Watershed inches)		Horton's Infiltration Parameters			DCIA
Subcatchment Name	EPA SWMM Target Node	Raingage	Area (acre)	Length to Centroid (ft)	Length (ft)	Slope (ft/ft)	Percent Imperviousness	Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/seconds)	Final Rate (in/hr)	Level 0, 1, or 2
H-1	J_H1	2-year	46.432874	1168	2751	0.058	7.8	0.4	0.1	3.7	0.0018	0.5	0
H-2	J_H2	2-year	76.029706	1887	3929	0.045	28.2	0.35	0.05	3.5	0.0018	0.5	0
H-3	J_H3	2-year	5.5145776	522	1044	0.033	45	0.35	0.05	3	0.0018	0.5	0
H-4	J_H4	2-year	8.0640496	694	1376	0.045	45	0.35	0.05	3	0.0018	0.5	0
H-5	J_H5	2-year	39.355119	1056	2115	0.036	45	0.35	0.05	3.1	0.0018	0.5	0
H-6	J_H6	2-year	25.261364	1898	3796	0.045	32.6	0.35	0.1	3	0.0018	0.5	0
H-7	J_H7	2-year	6.4048898	279	1050	0.031	51.5	0.35	0.05	4.2	0.0018	0.6	0
H-8	J_H8	2-year	10.591578	1192	2295	0.053	2	0.4	0.01	3	0.0018	0.5	0
C-1	J_C1	2-year	36.529109	896	2153	0.063	75	0.35	0.1	4	0.0018	0.6	0
C-2	J_C2	2-year	48.652227	1197	2324	0.023	75	0.35	0.1	3.3	0.001745	0.5	0
C-3	J_C3	2-year	32.53416	1157	2516	0.019	75	0.35	0.1	3.4	0.0018	0.5	0
C-4	J_C4	2-year	21.441253	690	1750	0.024	75	0.35	0.1	3.7	0.0018	0.5	0
C-5	J_C5	2-year	24.166001	1893	3785	0.018	80.4	0.35	0.1	3.7	0.0018	0.5	0
C-6	J_C6	2-year	8.3534605	1160	3112	0.017	80.4	0.35	0.1	4.2	0.001714589	0.6	0
C-7	J_C7	2-year	13.503926	785	1408	0.012	88.6	0.35	0.1	4.4	0.001010314	0.9	0
C-8	J_C8	2-year	19.267837	689	1535	0.015	95	0.35	0.1	4.5	0.001	0.9	0
C-9	J_C9	2-year	4.2466253	694	1432	0.020	2	0.35	0.05	3	0.0018	0.5	0
OS-1	J_O1	2-year	69.403792	2233	3970	0.066	8.7	0.4	0.05	4.1	0.0018	0.6	0
OS-2	J_O2	2-year	101.08469	2760	5038	0.059	3.9	0.4	0.05	4.2	0.0018	0.6	0
OS-3	J_O3	2-year	98.762718	1572	4249	0.059	10.4	0.4	0.05	3	0.0018	0.5	0
OS-4	J_O4	2-year	25.267883	782	2131	0.057	11.5	0.4	0.05	3	0.0018	0.5	0

ULTIMATE BUILDOUT CONDITION - 2 YEAR STORM EVENT

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

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
H-1		0.140	0.130	35.5	5.05	18.5	3.57	8.4	61	168,551	0.07	11,034	40.0	3	11,009	0.06
H-2		0.104	0.141	38.7	5.68	20.1	4.01	9.5	92	275,988	0.32	88,762	40.0	21	88,680	0.27
H-3		0.092	0.059	24.8	2.63	12.9	1.86	4.4	10	20,018	0.52	10,368	35.0	3	10,151	0.53
H-4		0.092	0.070	25.4	2.88	13.2	2.03	4.8	15	29,273	0.52	15,161	35.0	4	14,940	0.53
H-5		0.092	0.144	19.8	3.68	10.3	2.60	6.1	93	142,859	0.52	73,722	30.0	25	73,175	0.64
H-6		0.100	0.095	54.0	5.44	28.1	3.85	9.1	22	91,699	0.37	33,623	40.0	6	33,596	0.23
H-7		0.089	0.068	15.8	2.32	8.2	1.64	3.9	19	23,250	0.54	12,647	30.0	5	12,098	0.73
H-8		0.157	0.074	65.8	5.25	34.2	3.71	8.8	8	38,447	0.04	1,465	45.0	0	1,464	0.03
C-1		0.079	0.173	11.5	3.03	6.0	2.14	5.1	149	132,601	0.78	103,829	30.0	45	101,107	1.24
C-2		0.079	0.197	15.4	3.83	8.0	2.70	6.4	148	176,608	0.80	141,348	30.0	54	140,725	1.12
C-3		0.079	0.164	19.6	3.97	10.2	2.81	6.6	78	118,099	0.80	94,626	30.0	31	94,031	0.94
C-4		0.079	0.136	14.7	3.04	7.6	2.15	5.1	68	77,832	0.80	62,147	30.0	24	60,766	1.12
C-5		0.077	0.146	33.8	5.29	17.6	3.74	8.8	34	87,723	0.86	75,055	35.0	16	74,963	0.68
C-6		0.077	0.091	39.7	4.27	20.7	3.02	7.1	10	30,323	0.84	25,500	40.0	5	25,432	0.58
C-7		0.075	0.115	19.0	3.18	9.9	2.25	5.3	33	49,019	0.92	45,075	30.0	15	44,607	1.08
C-8		0.074	0.136	14.5	3.01	7.5	2.13	5.0	62	69,942	1.00	70,115	30.0	27	68,423	1.38
C-9		0.157	0.049	77.2	4.42	40.2	3.13	7.4	3	15,415	0.09	1,340	45.0	0	1,338	0.05
OS-1		0.139	0.154	46.7	7.03	24.3	4.96	11.7	70	251,936	0.07	16,883	40.0	4	16,884	0.05
OS-2		0.152	0.199	50.7	9.25	26.4	6.54	15.4	93	366,937	0.03	10,527	45.0	2	10,520	0.02
OS-3		0.132	0.173	35.5	6.21	18.4	4.39	10.4	131	358,509	0.11	40,206	40.0	11	40,179	0.11
OS-4		0.128	0.092	33.8	3.87	17.6	2.74	6.5	35	91,722	0.12	11,260	40.0	3	11,229	0.13

ULTIMATE BUILDOUT CONDITION - 5 YEAR STORM EVENT

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

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
H-1		0.139	0.129	35.4	5.01	18.4	3.54	8.4	61	168,551	0.32	54,347	40.0	15	54,227	0.33
H-2		0.103	0.143	37.8	5.65	19.7	3.99	9.4	94	275,988	0.62	171,597	40.0	40	171,306	0.53
H-3		0.091	0.060	24.6	2.63	12.8	1.86	4.4	10	20,018	0.85	16,973	30.0	5	16,614	0.90
H-4		0.091	0.071	25.2	2.87	13.1	2.03	4.8	15	29,273	0.85	24,820	30.0	7	24,439	0.89
H-5		0.091	0.145	19.6	3.68	10.2	2.60	6.1	94	142,859	0.84	120,707	30.0	43	119,890	1.09
H-6		0.099	0.096	53.1	5.42	27.6	3.83	9.0	22	91,699	0.68	62,565	40.0	11	62,507	0.43
H-7		0.088	0.068	15.7	2.32	8.1	1.64	3.9	19	23,250	0.86	19,981	30.0	8	19,101	1.20
H-8		0.157	0.074	65.8	5.25	34.2	3.71	8.7	8	38,447	0.29	11,330	45.0	2	11,317	0.19
C-1		0.079	0.173	11.5	3.03	6.0	2.14	5.0	149	132,601	1.14	151,819	30.0	67	147,868	1.82
C-2		0.079	0.197	15.3	3.82	8.0	2.70	6.4	149	176,608	1.17	207,162	30.0	80	206,234	1.64
C-3		0.079	0.165	19.5	3.97	10.2	2.80	6.6	78	118,099	1.17	138,658	30.0	45	137,811	1.38
C-4		0.079	0.136	14.7	3.04	7.6	2.15	5.1	69	77,832	1.17	91,068	30.0	35	89,021	1.63
C-5		0.077	0.146	33.7	5.29	17.5	3.74	8.8	34	87,723	1.24	108,383	35.0	23	108,251	0.96
C-6		0.077	0.091	39.6	4.26	20.6	3.01	7.1	10	30,323	1.21	36,726	35.0	7	36,629	0.82
C-7		0.075	0.115	19.0	3.18	9.9	2.25	5.3	33	49,019	1.28	62,765	30.0	20	62,111	1.48
C-8		0.074	0.136	14.5	3.01	7.5	2.13	5.0	62	69,942	1.39	97,150	30.0	36	94,804	1.85
C-9		0.157	0.049	77.2	4.42	40.2	3.12	7.4	3	15,415	0.34	5,297	45.0	1	5,290	0.19
OS-1		0.137	0.152	46.6	6.95	24.2	4.91	11.6	70	251,936	0.26	64,435	40.0	15	64,438	0.22
OS-2		0.152	0.198	50.7	9.21	26.4	6.51	15.3	93	366,937	0.20	72,312	45.0	17	72,264	0.17
OS-3		0.130	0.171	35.4	6.15	18.4	4.35	10.3	131	358,509	0.39	139,202	40.0	39	139,114	0.40
OS-4		0.126	0.090	33.7	3.84	17.5	2.71	6.4	35	91,722	0.40	36,795	35.0	10	36,688	0.41

ULTIMATE BUILDOUT CONDITION - 100 YEAR STORM EVENT

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

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
H-1		0.137	0.127	35.4	4.96	18.4	3.50	8.3	62	168,551	1.60	269,381	45.0	69	268,785	1.48
H-2		0.102	0.146	36.6	5.61	19.0	3.96	9.3	97	275,988	1.90	524,509	45.0	125	523,680	1.64
H-3		0.091	0.060	24.3	2.63	12.7	1.86	4.4	11	20,018	2.13	42,550	40.0	12	41,629	2.24
H-4		0.091	0.071	24.9	2.87	13.0	2.03	4.8	15	29,273	2.13	62,222	40.0	18	61,250	2.23
H-5		0.091	0.146	19.4	3.67	10.1	2.59	6.1	95	142,859	2.12	303,242	35.0	106	301,391	2.69
H-6		0.098	0.098	51.8	5.39	27.0	3.81	9.0	23	91,699	1.96	180,024	50.0	33	179,860	1.30
H-7		0.088	0.069	15.5	2.32	8.1	1.64	3.9	19	23,250	2.12	49,276	35.0	19	47,053	2.95
H-8		0.156	0.074	65.8	5.23	34.2	3.70	8.7	8	38,447	1.57	60,277	55.0	10	60,204	0.92
C-1		0.079	0.174	11.4	3.03	6.0	2.14	5.0	150	132,601	2.42	320,554	35.0	141	312,291	3.86
C-2		0.079	0.198	15.3	3.82	7.9	2.70	6.4	149	176,608	2.45	433,560	35.0	168	431,561	3.46
C-3		0.079	0.165	19.5	3.96	10.1	2.80	6.6	78	118,099	2.46	290,053	35.0	95	288,347	2.93
C-4		0.079	0.137	14.6	3.03	7.6	2.14	5.1	69	77,832	2.45	190,843	35.0	74	186,479	3.45
C-5		0.077	0.147	33.6	5.29	17.5	3.74	8.8	34	87,723	2.52	220,908	45.0	50	220,635	2.08
C-6		0.077	0.091	39.5	4.26	20.5	3.01	7.1	10	30,323	2.49	75,389	45.0	15	75,187	1.83
C-7		0.075	0.115	19.0	3.17	9.9	2.24	5.3	33	49,019	2.53	124,250	35.0	41	122,947	3.01
C-8		0.074	0.136	14.4	3.01	7.5	2.13	5.0	63	69,942	2.66	186,018	35.0	70	181,518	3.61
C-9		0.156	0.049	77.2	4.40	40.2	3.11	7.3	3	15,415	1.62	24,918	60.0	4	24,888	0.83
OS-1		0.134	0.150	46.5	6.86	24.2	4.84	11.4	70	251,936	1.50	377,209	50.0	81	377,215	1.17
OS-2		0.150	0.196	50.7	9.14	26.3	6.46	15.2	94	366,937	1.44	526,741	55.0	108	526,352	1.07
OS-3		0.128	0.169	35.3	6.07	18.3	4.29	10.1	131	358,509	1.66	596,421	45.0	153	596,044	1.55
OS-4		0.125	0.090	33.6	3.81	17.4	2.69	6.4	35	91,722	1.68	153,820	45.0	40	153,345	1.58

Appendix D - Referenced Material

Gambel Ridge and Douglas Lane FHAD

Gambel Ridge and Douglas Lane Master Plan

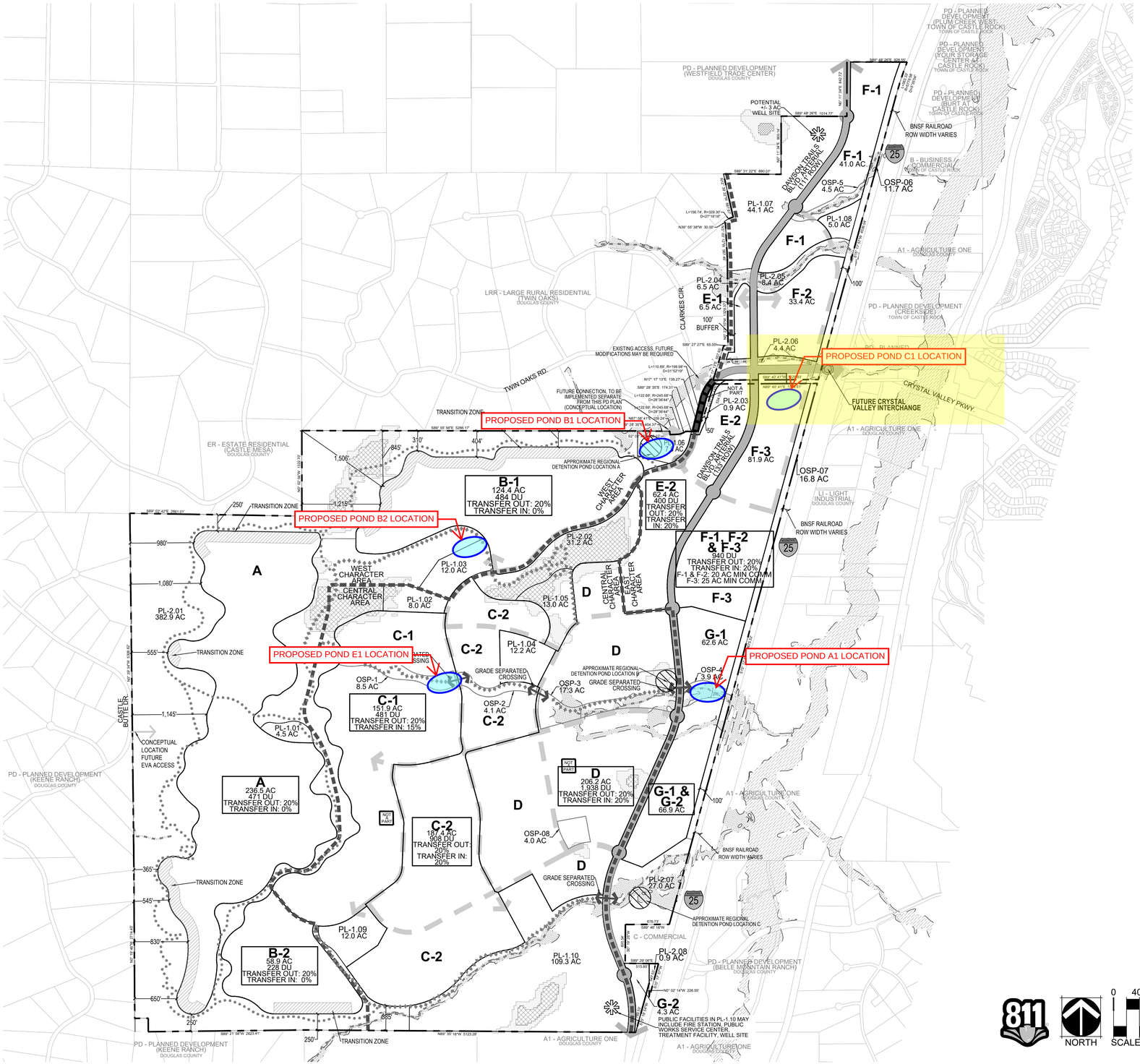
North and South Dawson Watershed Master Plan

DAWSON TRAILS

PLANNED DEVELOPMENT PLAN AND ZONING REGULATIONS

(AN AMENDMENT TO THE DAWSON RIDGE PRELIMINARY P.U.D SITE PLAN AND A PORTION OF THE WESTFIELD TRADE CENTER PRELIMINARY P.U.D. SITE PLAN)

TWO PARCELS OF LAND BEING ALL OF SECTION 28 AND PORTIONS OF SECTIONS 15, 21, 22, 27, 29, 32, 33 & 34, TOWNSHIP 8 SOUTH, RANGE 67 WEST OF THE SIXTH PRINCIPAL MERIDIAN, TOWN OF CASTLE ROCK, COUNTY OF DOUGLAS, STATE OF COLORADO



OPEN SPACE AND PUBLIC LAND SUMMARY

	ACREAGE	% OF TOTAL
PUBLIC LAND		
PL-1 (DEDICATED TO TOWN)	227.6	**11.0%**
OPEN SPACE		
PL-2 (DEDICATED TO TOWN)	462.2	22.4%
OSP (PRIVATE)	70.8	3.4%
SUBTOTAL	*533.0*	*25.8%*
FUTURE OPEN SPACE (1)	215.0	10.4%
OPEN SPACE TOTAL	**748.0**	**36.2%**
OPEN SPACE AND PUBLIC LAND TOTAL	**975.6**	**47.3%**

NOTE: (1) FUTURE OPEN SPACE DESIGNATION (PL-1, PL-2, OSP) TO BE DETERMINED AT TIME OF PLAT.

LEGEND

- PROPERTY BOUNDARY
- PLANNING AREA BOUNDARY
- CHARACTER AREA BOUNDARY
- MAJOR DRAINAGEWAY
- TRANSITION ZONE
- MODERATE SKYLINE
- MINOR SKYLINE
- 100 YEAR FLOODPLAIN (TOWN OF CASTLE ROCK)
- PROPOSED ARTERIAL RIGHT OF WAY
- FUTURE COLLECTOR RIGHT OF WAY
- 5' NATURAL SURFACE TRAIL
- 10' HARD SURFACE TRAIL
- 100 YEAR FLOODPLAIN (FEMA)

CHECKED BY: MB, SW
DRAWN BY: DJ, JR

PLANNER/LANDSCAPE ARCHITECT
NORRIS DESIGN
Planning | Landscape Architecture | Branding
1101 Bannock Street
Denver, Colorado 80204
P 303.892.1166
www.norris-design.com

APPLICANT:
WESTSIDE INVESTMENT PARTNERS
4100 E. MISSISSIPPI AVE
SUITE 500
DENVER, CO 80246
303-984-9800

ENGINEER & SURVEYOR:
CORE CONSULTANTS, INC.
LIVEYOURCORE.COM
CORE CONSULTANTS
3473 S. BROADWAY
ENGLEWOOD, CO 80113
303-730-5960

DAWSON TRAILS

DAWSON TRAILS
PLANNED DEVELOPMENT PLAN AND ZONING REGULATIONS
(AN AMENDMENT TO THE DAWSON RIDGE PRELIMINARY P.U.D SITE PLAN AND A PORTION OF THE WESTFIELD TRADE CENTER PRELIMINARY P.U.D. SITE PLAN)

DATE:
PDP-01 07/08/2021
PDP-02 12/03/2021
PDP-03 04/13/2022
PDP-04 05/27/2022
PDP-05 06/09/2022

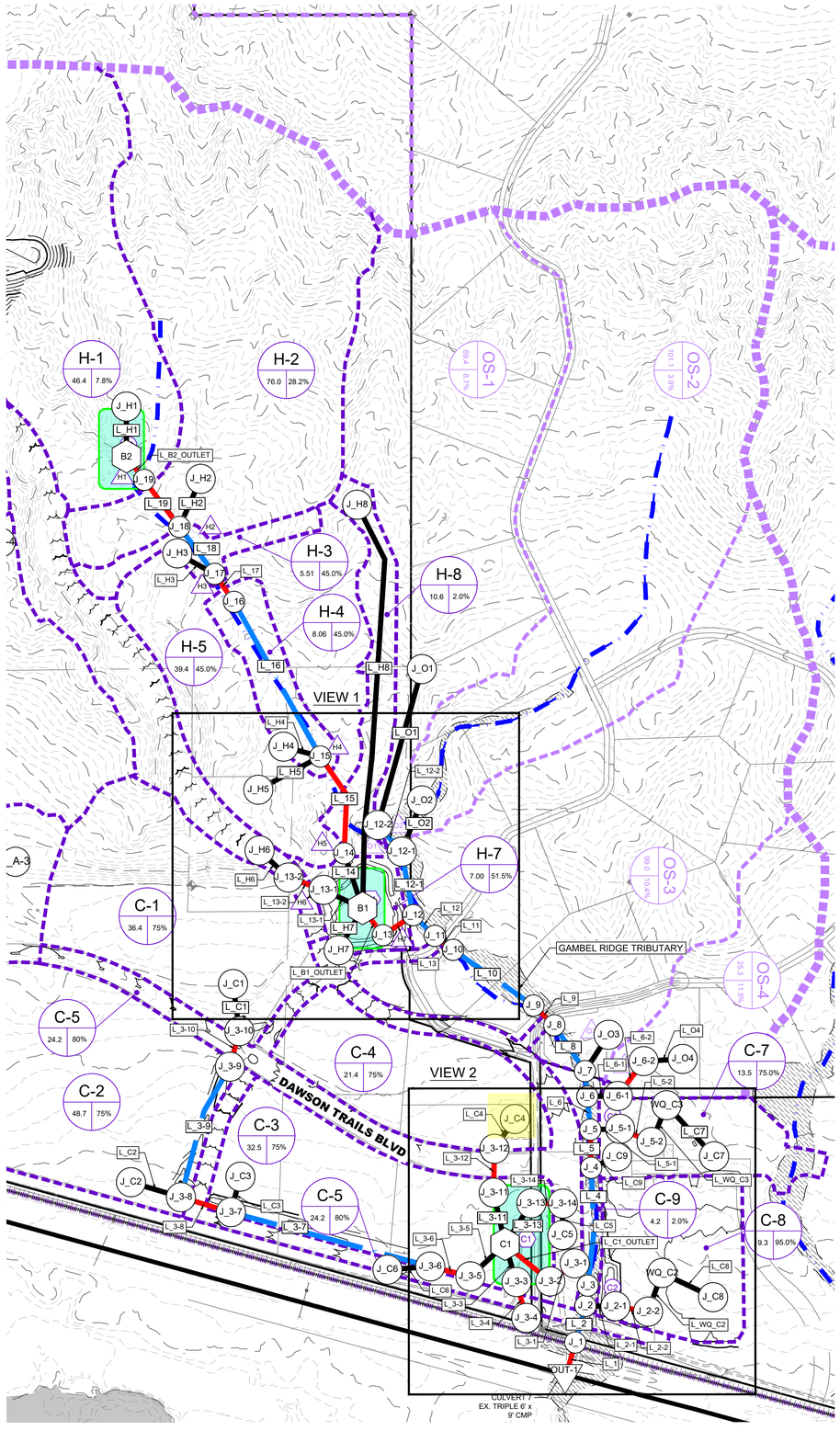
SHEET TITLE:
OVERALL PD PLAN

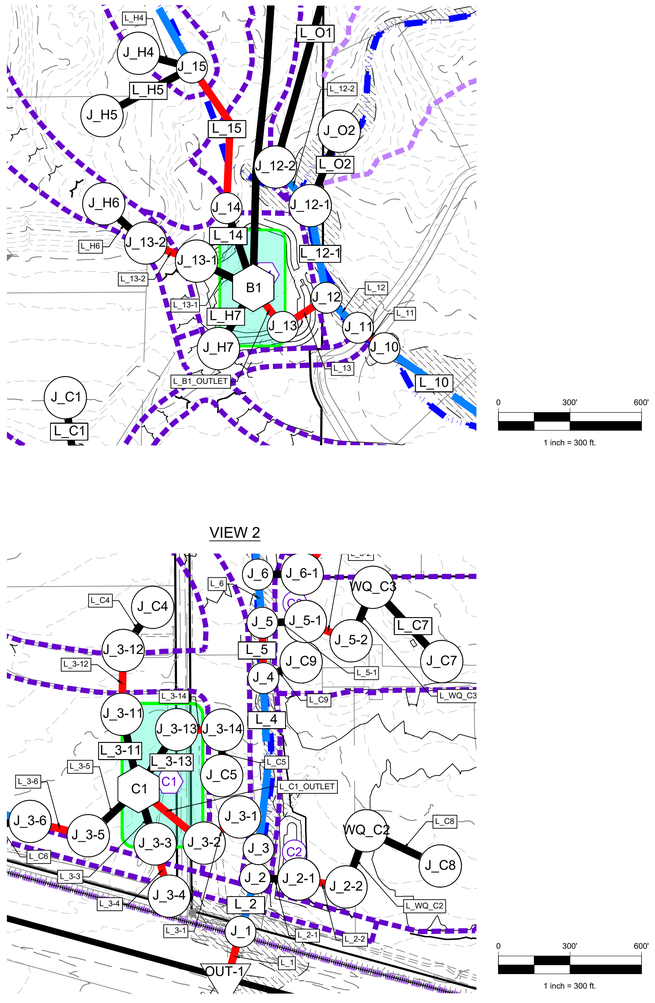
SHEET 3 OF 20

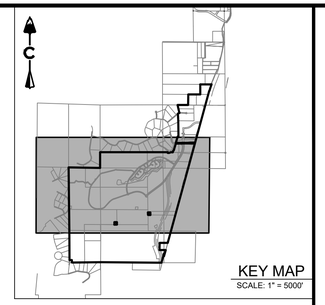
811

NORTH

0 400 800 1,600
SCALE 1" = 800'







LEGEND

- OUTFALL DESIGNATION
- DESIGN POINT/JUNCTION DESIGNATION
- POND DESIGNATION
- PIPE/CHANNEL DESIGNATION
- JUNCTION/NODE DESIGNATION
- DUMMY LINK
- PROPOSED STORM SEWER
- PROPOSED CHANNEL

0 400' 800'

1 inch = 400 ft.

LEGEND

EXISTING	PROPOSED	
X 00.0 00.0%	X 00.0 00.0%	BASIN DESIGNATION / AREA (AC) / IMPERVIOUSNESS
X	X	DESIGN POINT
		DIRECTIONAL FLOW ARROW
		EMERGENCY OVERFLOW ROUTE
		PROPOSED DRAINAGE BASIN
		EXISTING DRAINAGE BASIN
	5280	PROPOSED MAJOR CONTOUR
	5279	PROPOSED MINOR CONTOUR
5280		EXISTING MAJOR CONTOUR
5279		EXISTING MINOR CONTOUR
		EASEMENT
		RIGHT OF WAY (R.O.W.)
		CENTERLINE
		PROJECT BOUNDARY
		PROPOSED STORM & STUB OUT
		EXISTING STORM & STUB OUT
		100-YEAR FEMA FLOODPLAIN
		100-YEAR TOWN FLOODPLAIN

NOTES:

1. DRAINAGE BASINS AND POND LOCATIONS ARE APPROXIMATE.
2. POND CONFIGURATIONS AND LOCATIONS ARE CONCEPTUAL AND MAY CHANGE DUE TO FIELD CONDITIONS AND/OR FINAL SITE CONFIGURATIONS.
3. THE SITE LIES WITHIN FEMA FLOOD ZONE X.
4. TOWN 100-YEAR FLOODPLAINS ASSOCIATED WITH THE SOUTH DAWSON, NORTH DAWSON, GAMBEL RIDGE, AND GAMBEL RIDGE NORTH TRIBUTARIES WILL BE RE-EVALUATED BY A FLOODPLAIN MODIFICATION STUDY.
5. EFFORTS WILL BE MADE TO STABILIZE, PROTECT, AND PRESERVE THE MAJOR DRAINAGEWAYS ON-SITE. IMPACTS WILL BE LIMITED TO IMPROVEMENTS IN THE AREAS OF DISCHARGES FROM THE PROPOSED DETENTION FACILITIES AND AS IDENTIFIED IN THE MASTER DRAINAGE PLANS FOR THE DRAINAGEWAYS. THE IMPROVEMENTS WILL CONFORM TO THE TOWN OF CASTLE ROCK STORM DRAINAGE DESIGN AND TECHNICAL CRITERIA MANUAL. THESE IMPROVEMENTS WILL BE DESIGNED TO MITIGATE EROSION AND PRESERVE THE NATURAL CHARACTER AND HISTORICAL DRAINAGE PATTERNS TO THE GREATEST EXTENT FEASIBLE.
6. THE INTERCHANGE AT TERRITORIAL ROAD, CRYSTAL VALLEY PARKWAY, AND I-25 (CVI) IS A TOWN, COUNTY AND STATE PROJECT. CHANNEL IMPROVEMENTS FOR THE GAMBLE RIDGE MAJOR DRAINAGEWAY THROUGH THE SITE WILL BE PART OF THE CVI PROJECT.

CORE CONSULTANTS. INC.
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LAND DEVELOPMENT | ENERGY | PUBLIC INFRASTUCTURE

CORE

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

#	REVISION DESCRIPTION	DATE	BY
1	1ST SUBMITTAL	10/09/2023	JCK

DAWSON TRAILS - FILING 2 INFRASTRUCTURE

CASTLE ROCK, COLORADO

PHASE III DRAINAGE REPORT

PROPOSED BASIN D SWMM MAP

NOT FOR CONSTRUCTION

DESIGNED BY: JCK
DRAWN BY: EKT
CHECKED BY: ____

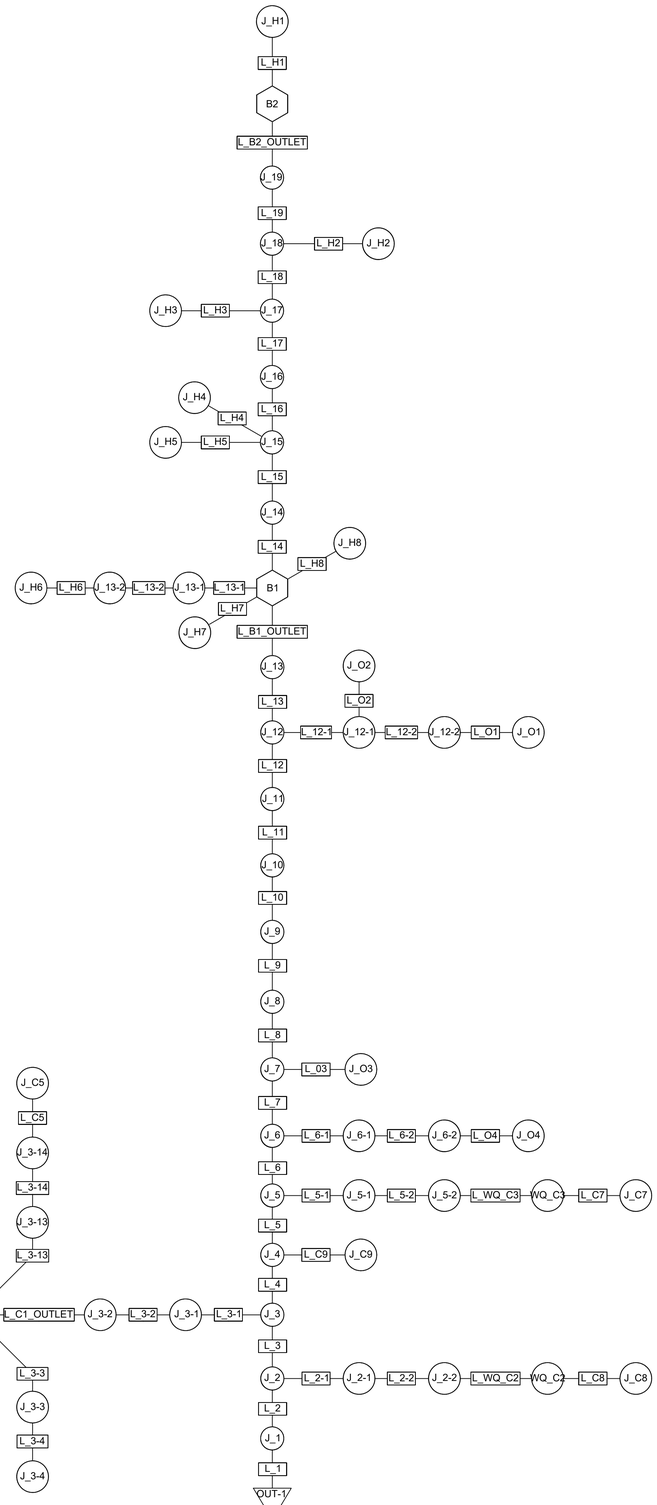
JOB NO. 20-224

SHEET 1 OF 1

2022-10-25 (9:44 AM) Emily Townsend X:\20-224 Dawson\Civil\CAD\Plans_Overall\Master Drainage Report Proposed Overall SWMM Map - Master.dwg

2021-09-11 (4:30 PM) X:\20-224 Dawson\Civil\CAD\Plans_Overall\Master Drainage Report Proposed Overall SWMM Map - Master.dwg

GAMBEL RIDGE TRIBUTARY



LEGEND

- X — OUTFALL DESIGNATION
- X — DESIGN POINT/JUNCTION DESIGNATION
- X — POND DESIGNATION
- X — PIPE/CHANNEL DESIGNATION
- X — JUNCTION/NODE DESIGNATION

0 400' 800'

1 inch = 400 ft.

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

#	REVISION DESCRIPTION	DATE	BY
1	1ST SUBMITTAL	10/09/2023	JCK

DAWSON TRAILS - FILING 2 INFRASTRUCTURE
CASTLE ROCK, COLORADO

PHASE III DRAINAGE REPORT
SWMM LINK TREE DIAGRAM

NOT FOR CONSTRUCTION

DESIGNED BY: JCK
DRAWN BY: EKT
CHECKED BY: ____

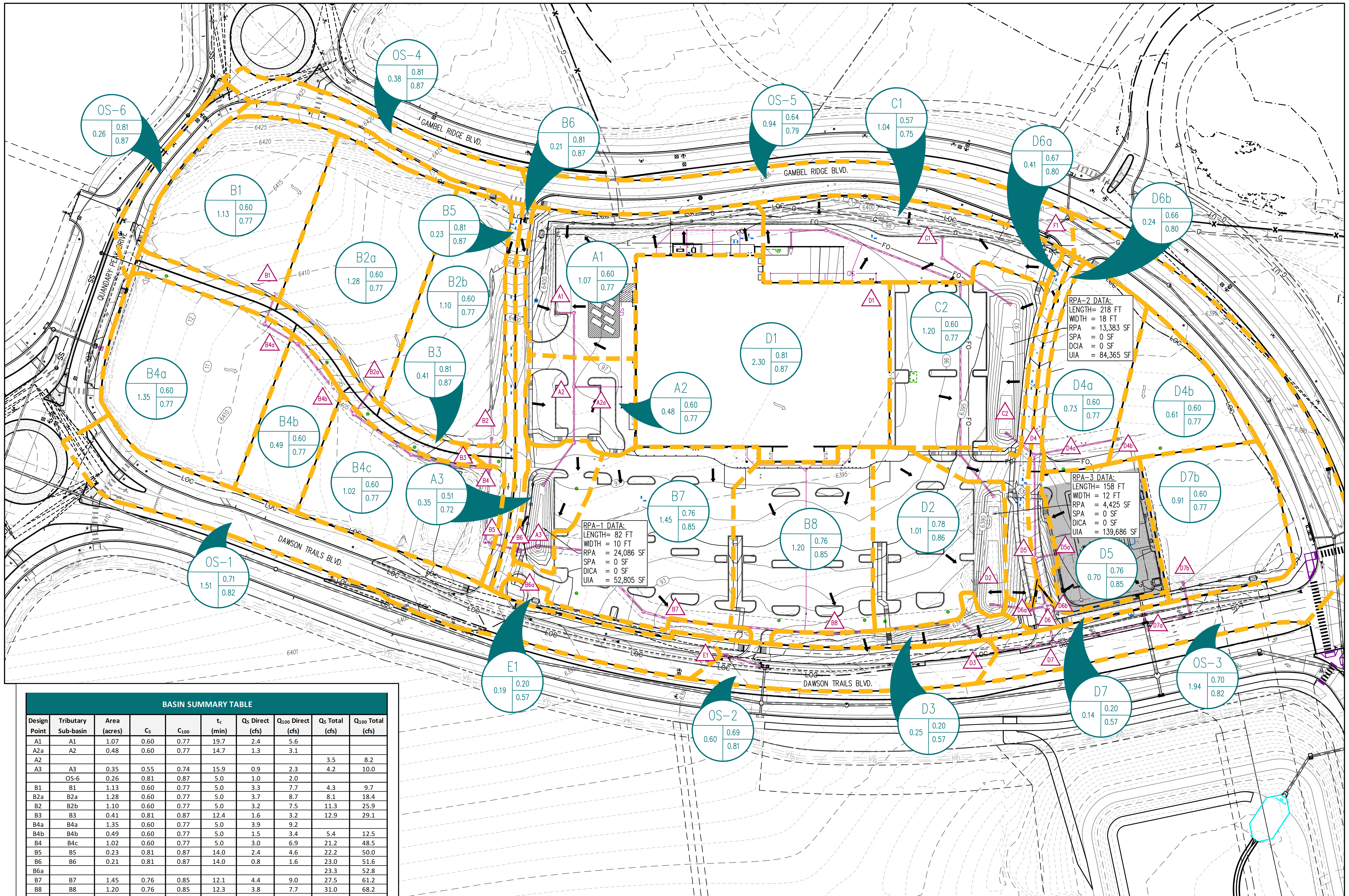
JOB NO. 20-224

SHEET 1 OF 1

2022-10-25 (9:44 AM) Justin Keller X:\20-224 Dawson\Civil\CAD\Plans_Overall\Master Drainage Report Proposed Overall SWMM Link Tree Map - Master.dwg
2021-09-11 (4:30 PM) X:\20-224 Dawson\Civil\CAD\Plans_Overall\Master Drainage Report Proposed Overall SWMM Link Tree Map - Master.dwg

APPENDIX H

DRAINAGE MAP



BASIN SUMMARY TABLE

Design Point	Tributary Sub-basin	Area (acres)	C_5	C_{100}	t_c (min)	Q_5 Direct (cfs)	Q_{100} Direct (cfs)	Q_5 Total (cfs)	Q_{100} Total (cfs)
A1	A1	1.07	0.60	0.77	19.7	2.4	5.6		
A2a	A2	0.48	0.60	0.77	14.7	1.3	3.1		
A2								3.5	8.2
A3	A3	0.35	0.55	0.74	15.9	0.9	2.3	4.2	10.0
	OS-6	0.26	0.81	0.87	5.0	1.0	2.0		
B1	B1	1.13	0.60	0.77	5.0	3.3	7.7	4.3	9.7
B2a	B2a	1.28	0.60	0.77	5.0	3.7	8.7	8.1	18.4
B2	B2b	1.10	0.60	0.77	5.0	3.2	7.5	11.3	25.9
B3	B3	0.41	0.81	0.87	12.4	1.6	3.2	12.9	29.1
B4a	B4a	1.35	0.60	0.77	5.0	3.9	9.2		
B4b	B4b	0.49	0.60	0.77	5.0	1.5	3.4	5.4	12.5
B4	B4c	1.02	0.60	0.77	5.0	3.0	6.9	21.2	48.5
B5	B5	0.23	0.81	0.87	14.0	2.4	4.6	22.2	50.0
B6	B6	0.21	0.81	0.87	14.0	0.8	1.6	23.0	51.6
B6a								23.3	52.8
B7	B7	1.45	0.76	0.85	12.1	4.4	9.0	27.5	61.2
B8	B8	1.20	0.76	0.85	12.3	3.8	7.7	31.0	68.2
C1	C1	1.04	0.57	0.75	17.9	2.4	5.8		
C2	C2	1.20	0.60	0.77	15.3	2.7	6.4	5.0	11.8
D1	D1	2.30	0.81	0.87	12.6	7.2	14.0		
D2	D2	1.01	0.78	0.86	11.3	3.6	7.2	10.2	20.1
	OS-2	0.60	0.69	0.81	14.5	2.0	4.2		
D3	D3	0.25	0.20	0.57	25.4	0.2	1.2	42.8	92.3
D4b	D4a	0.73	0.60	0.77	0.0	2.1	4.9		
D4								6.7	15.6
D5a	D5	0.70	0.76	0.85	12.4	2.5	5.0		
D5								8.7	19.8
D6a	D6a	0.41	0.67	0.80	14.9	1.4	2.9		
D6b	D6b	0.24	0.66	0.80	15.1	0.8	1.7		
D6								10.4	23.4
D7								55.1	120.3
	OS-3	1.94	0.70	0.82	16.5	5.7	12.0		
D7a	D7	0.14	0.20	0.57	24.2	0.1	0.7	60.3	131.8
	OS-1	1.51	0.71	0.82	16.9	4.4	9.2		
E1	E1	0.19	0.20	0.57	24.9	0.2	1.0	4.5	10.0
F1	OS-5	0.94	0.64	0.79	17.4	2.6	5.7		

DRAINAGE LEGEND

PROPERTY BOUNDARY LINE
ADJACENT PROPERTY BOUNDARY LINE
RIGHT OF WAY BOUNDARY LINE
ROAD CENTERLINE
EXISTING EASEMENT LINE
PROPOSED EASEMENT LINE
SD — EXISTING STORM SEWER (LESS THAN 12"ø)
SD — EXISTING STORM SEWER (12"ø AND LARGER)
SD — PROPOSED STORM SEWER (LESS THAN 12"ø)
SD — PROPOSED STORM SEWER (12"ø AND LARGER)
5460 — EXISTING MAJOR CONTOUR
52 — EXISTING MINOR CONTOUR
5465 — PROPOSED MAJOR CONTOUR
66 — PROPOSED MINOR CONTOUR
MAJOR BASIN BOUNDARY LINE
5 — DESIGN POINT
EXISTING FLOW ARROW
PROPOSED FLOW ARROW
100 — BASIN DESIGNATION
0.00 — 5-YEAR RUNOFF COEFFICIENT
0.00 — 100-YEAR RUNOFF COEFFICIENT
0.00 — BASIN AREA IN ACRES

N

0 20 50 100
SCALE: 1"=100'

Galloway
5500 Greenwood Plaza Blvd., Suite 200
Greenwood Village, CO 80111
303.770.8884
GallowayUS.com

PRELIMINARY
NOT FOR BIDDING
NOT FOR CONSTRUCTION

CONSTRUCTION DOCUMENT
LOT 1, DAWSON TRAILS FILING No. 2, AMENDMENT 4

KING SOOPERS #165

CRYSTAL VALLEY PKWY & DAWSON TRAILS BLVD
CASTLE ROCK, COLORADO

#	Date	Issue / Description	Init.
A	12/29/25	1st CD Submittal	JRR
B	4/8/26	2nd CD Submittal	JRR
C	6/12/26	3rd CD Submittal	JRR

Project No:	KSS000165
Drawn By:	RDG
Checked By:	JRR
Date:	12/05/25

DRAINAGE MAP