Colliers Engineering & Design

Drainage Report

April 26, 2024

3550 Chambers Road

Peterson Subdivision Located in the Northwest 1/4 of Section 29, Township 3 South, Range 66 West, of the 6th P.M. City Aurora, Adams County, Colorado

Approved For One Year From This Date

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Aurora Water - Drainage Division **Date**

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Prepared for:

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Project No. 23005107A

Colliers Engineering & Design

Certification

This report for the drainage design of 3550 Chambers Road was prepared by me (or under my supervision) in accordance with the provisions of the Aurora Water Storm Drainage Design and Technical Criteria Manual and was designed to comply with the provisions thereof. I understand that the City of Aurora does not, and will not, assume liability for drainage facilities designed by others.

By: David A. Carpenter, PE
Licensed Professional Engineer
State of Colorado
No. 40140

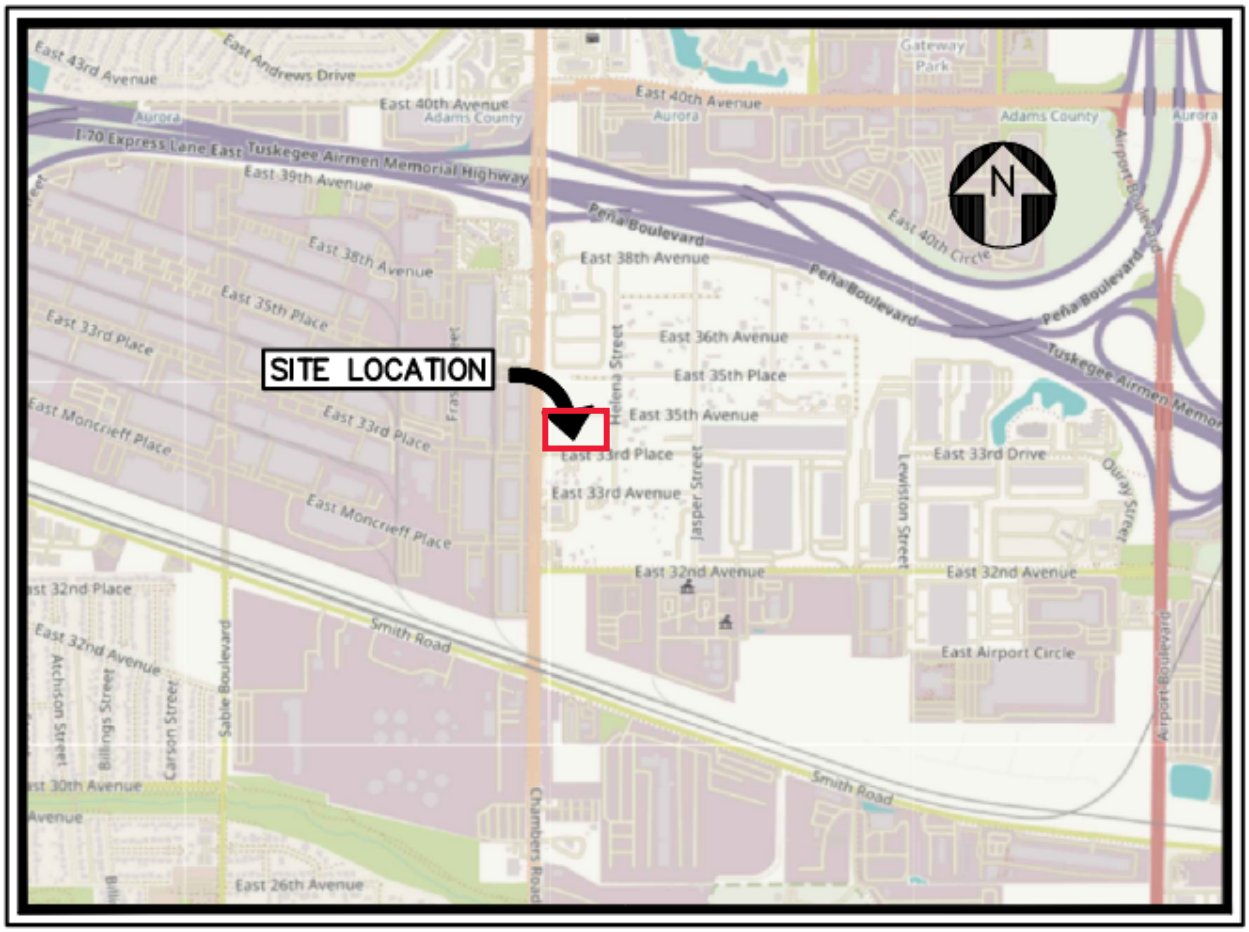
**Advisory Note: PDR approval is required prior to Civil Plan Approval.*

A. INTRODUCTION

Location

a. The project site is known as 3550 Chambers Road and is bounded on the west by Chambers Road, the east by Helena Street, the north by East 35th Avenue, and the south by East 33rd Place. More specifically, it is unplatted land located in the Northwest ¼ Section 29, Township 3 South, Range 66 West, of the Sixth Principal Meridian, City of Aurora, County of Adams, State of Colorado (Site).

b. There are no major drainageways or facilities within or adjacent to the site.



LOCATION MAP
1" = N.T.S.

Proposed Development

a. The Site is currently vacant and approximately 4.2 acres in site. Approximately 0.7 acres will be dedicated as right-of-way for E. 33rd Place, E. 35th Avenue, and Helena Street, leaving approximately 3.5 acres for on-site development. The adjacent half-street cross-sections of

E. 33rd Place, E. 35th Avenue, and Helena Street will be constructed with the overall development. Internal to the site, three structures of differing use are proposed with associated parking, landscaping, and utilities. The westernmost building will be a restaurant, the central building will be a hotel, and the easternmost building will be a convention center and daycare.

Changes to MDR

a. No changes to the MDR are proposed.
b. No conditional approval comments are noted on the MDR.

Variances

a. No variances have been requested.

B. Historic Drainage

Description of Property and Drainage Basin

a. The proposed site is Unplatted and as stated in the Drainage Report for Chambers Road From Smith Road to I-70 (Master Drainage Report) by the City of Aurora (EDN #860101) and is a portion of the Sand Creek Drainage Basin. The proposed site is located within the northern portion of basin B-8 of the Chambers RD., Smith to I-70 Drainage Map by the City of Aurora Engineering Division. The Master Drainage Report and Map can be seen in Appendix C.

   The existing site generally consists of vacant area with native grasses and vegetation. The existing slope condition for the site is 2-25% on average from southeast to northwest toward the intersection of Chambers and East 35th. From there, site flows will be directed north along Chambers where they will be directed toward Existing Concrete Channel located at the intersection of East 38th Avenue and Chambers Road.

   On-site soils consist of Ascalon sandy loam and are classified as Group B as shown in the National Soil Survey report for this site that can be seen in Appendix A. The imperviousness of the existing site is 2%.

b. The FEMA Map (08005C0043K) dated December 17, 2010, show that the proposed site is located within Zone X. The FEMA Firmette can be found in Appendix A. No major drainageways are located within or adjacent to the proposed site.

c. No existing irrigation facilities are located within or adjacent to the proposed site.

d. The existing site is raised above all surrounding roadways. No off-site basins are tributary to the existing site.

e. The proposed on-site detention pond will have one outfall located north of the site within the Chambers R.O.W. and will restrict flows to the allowable 0.5 CFS/Acre as stated in the Drainage Report for Chambers Road From Smith Road to I-70 (EDN # 860101) by City of Aurora Engineering Design Section.

f. No major drainageway planning studies have been provided nor can any be found at the time of this report.

C. Design Criteria

Hydrologic Criteria

All infrastructure will be designed and built in accordance with the criteria outlined in the Aurora Storm Drainage Design and Technical Criteria Manual (Aurora SDDTC) and the Urban Storm Drainage Criteria Manual (USDCM). All storm infrastructure will be designed such that major storm flow depths will not exceed 1 foot and minor storm depths will be within curb height. Inlet calculations can be viewed in Appendix B. Mile High Flood District (MHFD) USDCM Volumes 1, 2, and 3 were used as the design criteria for hydrologic and hydraulic infrastructure design in the drainage calculations for the proposed site.

a. The USDCM Volume 2 and Aurora SDDTC design guidelines state that the following are the return frequencies of the minor and major storms.

   Minor Storm: 2-Year

   Major Storm: 100-Year

b. The design storms have been evaluated as 60-minute rainfall depths taken from NOAA Atlas 14 (found in Appendix A) are as follows:

   Minor Storm: 0.855 inches

   Major Storm: 2.44 inches

c. The project site is less than 90 acres in size; therefore, the Rational Method (i.e., Q=CiA) was used to estimate the excess existing (historic) and developed runoff.
   Where:
   Q = peak discharge (cfs)
   C = runoff coefficient taken from Table 1 from the Aurora SDDTC
   I = rainfall intensity (inches/hour)
   A = drainage basin area (acres)

   The existing and developed runoff coefficients were calculated using the Aurora SDDTC and provide coefficient values for varying pervious and impervious areas. The Aurora SDDTC Table 1 used for this calculation can be found in Appendix B.

   The rainfall intensity data used is from the NOAA Precipitation Frequency Data Server (PFDS).

See Appendix B for Rational Method Flow Calculation worksheet.

d. The Water Quality (WQ)/EURV volume computation was calculated using the MHFD Detention Worksheet. All storm sewer pipes will be analyzed using StormCAD utilizing time of concentration and area multiplied by coefficient values obtained from the Rational Method calculation workbook provided by MHFD. All routing for storm sewer infrastructure will be calculated using StormCAD. All Hydrologic calculations can be found in Appendix B. All storm infrastructure will be designed to convey the 100-year (Major Storm) Storm event.

e. No other design criteria is noted at this time.

Hydraulic Criteria

a. Closed conduits will be designed to convey the 2-year storm event keeping the hydraulic grade line (HGL) within the pipe diameter and the 100-year storm event HGL under the finished surface.

   According to the Existing Drainage Report for the proposed area, the criteria for detention facility sizing is listed as 0.5 CFS/Acre. The system as designed has a flow limitation rather than an impervious or “C” value limitation. The calculation method used for WQ, EURV, and 100-year detention is the use of the MHFD Detention Spreadsheet provided via the MHFD website.

b. The Water Quality (WQ)/EURV volume computation was calculated using the MHFD Detention Worksheet. All storm sewer pipes will be analyzed using StormCAD utilizing time of concentration and area multiplied by coefficient values obtained from the Rational Method calculation workbook provided by MHFD. All routing for storm sewer infrastructure will be calculated using StormCAD. All Hydrologic calculations can be found in Appendix B. All storm infrastructure will be designed to convey the 100-year (Major Storm) Storm event.

c. No drainage way or corridors are proposed with the construction of this project.

d. The entire project is located within FEMA Zone X, and shows that there is no floodway or floodplain impacting the design of this project.

e. The proposed interior site is Private. Included with the design of this project are the construction of public roadway, storm sewer, water and sanitary sewer.

f. No temporary stormwater infrastructure is proposed at this time.

g. MHFD Detention, rational workbook, and inlet spreadsheets were utilized in the design of this site along with StormCAD for pipe flows and routing.

h. No other sources utilized in design.

D. Drainage Plan

General Concept

a. The proposed site drainage patterns have been designed such that flows on-site will drain to the north or the south. Splitting the site into two outfalls that will drain toward the proposed Detention Pond. The existing site is higher in elevation than the existing roadway. Once flows have reached the Detention Pond they will be directed to the outfall structure located on the north end of the pond. Flows entering the outfall structure will be directed to the north and into the proposed drainage swale within the right of way of Chambers road and flow north along the historic path outlined by the Master Drainage Report.
b. According to the Existing Drainage Report for the proposed area, the criteria for detention facility sizing is listed as 0.5 CFS/Acre. The system as designed has a flow limitation rather than an impervious or "C" value limitation. The calculation method used for WQ, EURV, and 100-year detention is the use of the MHFD Detention Spreadsheet provided via the MHFD website.
c. No Public Improvement Plan is in place for the proposed site.
d. The proposed design is in conformance with the proposed site plan, also in review.
e. Off-site drainage tributary to the proposed site is limited to areas affected by the widening of the adjacent local streets included in the development of the site. In the existing condition, these flows are not tributary to the site, however, development of the site requires that these flows be tributary to the on-site Detention Pond and treated prior to continuing along the drainage path. Small portions of these adjacent roadways (UC1) will follow the historic path and be tributary to Chambers Road. The amount of pervious and impervious area tributary to Chambers Road has been significantly reduced, as can be seen in the proposed Drainage Plan that accompanies this report. Emergency flow relief paths for the local streets are to direct these flows off-site.
f. No on-site flows are intended to be directed to adjacent properties. The outfall for the proposed on-site Detention Pond is located within the R.O.W. for Chambers road and will be contained within the R.O.W. Any impact to adjacent property will be noted and communication will take place when necessary.

Specific Details

a. No phasing is proposed for the Preliminary Drainage Report or Plan.

b. The proposed site is divided into seven on-site sub-basins. The sub-basin descriptions can be seen below:

Basin A-1 is 0.91 acres and has a weighted imperviousness of 86.8%. This basin is located along the southern portion of the site and contains the parking, landscaping, and drives. Drainage for Basin A-1 will overland flow to the southwest and be directed toward proposed Inlet A-1 (Type 16). Once within the proposed storm system, flows from this basin will outfall into the proposed on-site Detention Pond located in Basin A-5.

Basin A-1A is 0.06 acres and has a weighted imperviousness of 77.5%. This basin is located south of the event center and consists of concrete pavement and landscape. Drainage for Basin A-1A will overland flow towards one (1) of three (3) 6" x 6" drainage slots within the proposed landscape wall. The drainage slots will direct flow through the proposed curb chases to ultimately be collected by Inlet A-1.

Basin A-2 is 0.62 acres and has a weighted imperviousness of 87.7%. This basin is located centrally on the site and contains the parking, landscaping, and drives. Drainage for Basin A-2 will overland flow to the north and be directed toward proposed Inlet A-2 (Type 16). Once within the proposed storm system, flows from this basin will outfall into the proposed on-site Detention Pond located in Basin A-5.

Basin A-3 is 0.29 acres and has a weighted imperviousness of 79.1%. This basin is located centrally on the site and contains the parking, landscaping, and drives. Drainage for Basin A-3 will overland flow to the north and be directed toward proposed Inlet A-3 (Type 16). Once within the proposed storm system, flows from this basin will outfall into the proposed on-site Detention Pond located in Basin A-5.

Basin A-4 is 0.27 acres and has a weighted imperviousness of 88.4%. This basin is located along the western portion of the site and contains the parking, landscaping, and drives. Drainage for Basin A-4 will overland flow to the north and be directed toward proposed Inlet A-4 (Type 16). Once within the proposed storm system, flows from this basin will outfall into the proposed on-site Detention Pond located in Basin A-5.

Basin A-5 is 0.30 acres and has a weighted imperviousness of 20%. This basin is located along the western portion of the site adjacent to Chambers Road and contains on-site Detention Pond. Drainage for Basin A-5 will be directed via the proposed curbed trickle channel toward the outfall structure (Type C Inlet) Inlet A-5 and will direct flows into the outfall pipes. Once within the outfall pipes, flows will be directed north and into the proposed engineered swale where they will be directed along the intended path as outlined in the Master Drainage Report.

Basin A-6 is 0.12 acres and has a weighted imperviousness of 95%. This basin consists of the entire Restaurant / Drive Thru building. Runoff will drain via roof drains and be piped to outfall into the proposed on-site Detention Pond located in Basin A-5.

Basin A-7 is 0.20 acres and has a weighted imperviousness of 95%. This basin consists of the entire Hotel building. Runoff will drain via roof drains and be piped to outfall into the proposed on-site Detention Pond located in Basin A-5.

Basin A-8 is 0.23 acres and has a weighted imperviousness of 95%. This basin consists of the entire Daycare / Event Center building. Runoff will drain via roof drains and be piped to outfall into the proposed on-site Detention Pond located in Basin A-5.

Basin OS-1 is 0.61 acres and has a weighted imperviousness of 66.7%. This basin is located along the southern portion of the site property boundary and contains the north half of E. 33rd Place R.O.W. Drainage for Basin OS-1 will overland flow to the north and be directed toward proposed Inlet OS-1

(5' Type R Inlet). Once within the proposed storm system, flows from this basin will outfall into the proposed on-site Detention Pond located in Basin A-5.

Basin OS-2 is 0.62 acres and has a weighted imperviousness of 64.9%. This basin is located along the eastern and northern portion of the site property boundary and contains the west half of Helena Street R.O.W. and the southern half of E. 35th Avenue R.O.W. Drainage for Basin OS-2 will overland flow to the north and be directed toward proposed Inlet OS-2 (10' Type R Inlet). Once within the proposed storm system, flows from this basin will outfall into the proposed on-site Detention Pond located in Basin A-5.

Basin OS-3 is 0.26 acres and has a weighted imperviousness of 67.7%. This basin is located along the northern portion of the site property boundary and contains the southern half of E. 35th Avenue R.O.W. Drainage for Basin OS-2 will overland flow to the north and be directed toward proposed Inlet OS-3 (5' Type R Inlet). Once within the proposed storm system, flows from this basin will outfall into the proposed on-site Detention Pond located in Basin A-5.

Basin UC-1 is 0.18 acres and has a weighted imperviousness of 75.6%. This basin is located along the northern portion of the site property boundary and contains the southern half of E. 35th Avenue R.O.W. Drainage for Basin UC-1 will overland flow to the southwest and be directed toward Chambers Road. Once the roadway flows from this basin enter Chambers Road they will follow the existing path and enter the inlet located at the intersection with E. 35th Place.

Off-site basins include portions of E. 35th Avenue, Helena Street, and E. 33rd Place are tributary to the on-site Detention Pond located in Basin A-5.

c. The table below illustrates the required information to perform a rational method calculation:

RUNOFF SUMMARY							
BASIN LABEL	DESIGN POINT	% IMP	AREA (AC)	RUNNOFF COEFFICIENT C (2-YEAR)	RUNNOFF COEFFICIENT C (100-YEAR)	LOCAL (CFS)	
						Q2	Q100
A-1	1	86.8	0.91	0.71	0.83	1.64	5.48
A-1A	1A	77.5	0.06	0.62	0.79	0.11	0.39
A-2	2	87.7	0.62	0.72	0.83	1.29	4.28
A-3	3	79.1	0.29	0.63	0.79	0.48	1.72
A-4	4	88.4	0.27	0.72	0.84	0.57	1.87
A-5	5	20.0	0.30	0.13	0.52	0.08	0.93
A-6	6	95.0	0.12	0.79	0.87	0.27	0.86
A-7	7	95.0	0.20	0.79	0.87	0.46	1.44
A-8	8	95.0	0.23	0.79	0.87	0.52	1.65
OS-1	OS-1	66.7	0.61	0.52	0.74	0.78	3.15
OS-2	OS-2	64.9	0.62	0.50	0.73	0.66	2.74
OS-3	OS-3	67.7	0.26	0.53	0.74	0.38	1.53
UC-1	UC-1	75.6	0.18	0.60	0.78	0.31	1.16

Table 1

d. Using the Mile High Flood District Detention spreadsheet, the water quality capture volume (Zone 1) required is 0.120 acre-feet (5,227 CF), the EURV capture volume (Zone 2) required is 0.275 acre-feet (11,979 CF), the 100-year capture volume (Zone 3) required is 0.193 acre-feet (8,407 CF). The proposed pond exceeds the minimum required volume of 0.588 acre-feet by providing a total volume of 0.662 acre-feet. The emergency spillway overflow weir crest is set at elevation 5369.60' and provides 0.04' of freeboard above the 100-year WSEL at 5369.56'. The top of bank elevation for the pond is set at 5371.10.

The proposed pond design is in conformance with the master drainage study by proposing a release rate less than the maximum allowable rate at 0.5 cfs/acre. The 100-year release rate of the proposed pond over the 4.67-acre site is 2.3 cfs.

One CDOT Type C inlet will be utilized as the outfall structure for the proposed pond. Water entering the pond at Design Points 1A and 4A will be directed toward the Type C inlet via the proposed 4 foot trickle channel located at the bottom of the pond. A water quality plate will provide controlled release of the water quality and EURV flows allowing for the top of the outlet structure to be at the EURV WSEL (5368.42'). The Type C grate has been designed to account for 50% clogging factor.

The design for the pond, outfall structure, overflow spillway, restrictor plate, and trickle channel have been added to this reports Appendix for reference.

e. No off-site water quality SCMs are utilized by the Proposed Site.
f. No culverts are proposed with the design for the Proposed Site.
g. No bridges are proposed with the design for the Proposed Site.
h. The emergency overflow path for all on-site inlets will be directed to the low spots noted on the Preliminary Drainage Plan and area shown by arrows noted in the legend. The grading design on the Proposed Site is such that the emergency overflow for each inlet (A-1, A-2, A-3, and A-4) will overflow into the public R.O.W. and be directed back toward the pond via the Public Inlets (OS-1, OS-2, and OS-3). The Public Inlets emergency overflow path will direct flow into the existing portions of the local streets and along the historic path.
i. The Proposed Chambers Detention Pond design directs outfall flows toward an off-site swale located across E. 35th Avenue. The proposed swale is designed to allow the 100-year storm for the proposed site to be directed toward the inlet located at Design Point 27 as noted in the Chambers Rd,. Smith to I-70 Drainage Map by the City of Aurora Engineering Division. This map can be found in Appendix C. The design for this proposed swale can be found in Appendix B. The proposed off-site trapezoidal swale has a running slope of 0.5%, bottom width of 2', a height of 2', and side slopes at 4:1 maximum. The design storm for the swale is the Proposed Site's 100-year flow (23.18 CFS) and provides a freeboard of 1.15'. The bottom of the swale will be concrete to allow for flows to be directed at the proposed slope to DP 27 as intended, this results in a Mannings N-Value of 0.013. Above the 100-year WSEL the channel will be grass.
j. No regional channels are proposed with this design.
k. Below is a table showing the roadway capacity for areas tributary to the on-site Chambers Detention Pond:

ROADWAY	BASIN	MINOR FLOW DEPTH (FT)	MAJOR FLOW DEPTH (FT)	MINOR STREET SPREAD (FT)	MAJOR STREET SPREAD (FT)
EAST 33RD PLACE	OS-1	0.29	0.39	10.08	19.07
EAST 35TH AVENUE	OS-2	0.27	0.37	8.21	17.10
EAST 35TH AVENUE	OS-3	0.23	0.34	3.45	8.72

l. On-site Water Quality will be provided by the proposed Chambers Detention Pond. This pond will serve as the permanent SCM as outlined in Chapter 11 of the SDDTC. Using the Mile High Flood District Detention spreadsheet, the water quality capture volume (Zone 1) required is 0.120 acre-feet (5,227 CF), the EURV capture volume (Zone 2) required is 0.275 acre-feet (11,979 CF), the 100-year capture volume (Zone 3) required is 0.193 acre-feet (8,407 CF). The pond will adequately provide water quality for all tributary areas.
m. The proposed pond design is in conformance with the master drainage study by proposing a release rate less than the maximum allowable rate at 0.5 cfs/acre. The 100-year release rate of the proposed pond over the 4.67-acre site is 2.3 cfs.
n. No other information is needed.

E. References

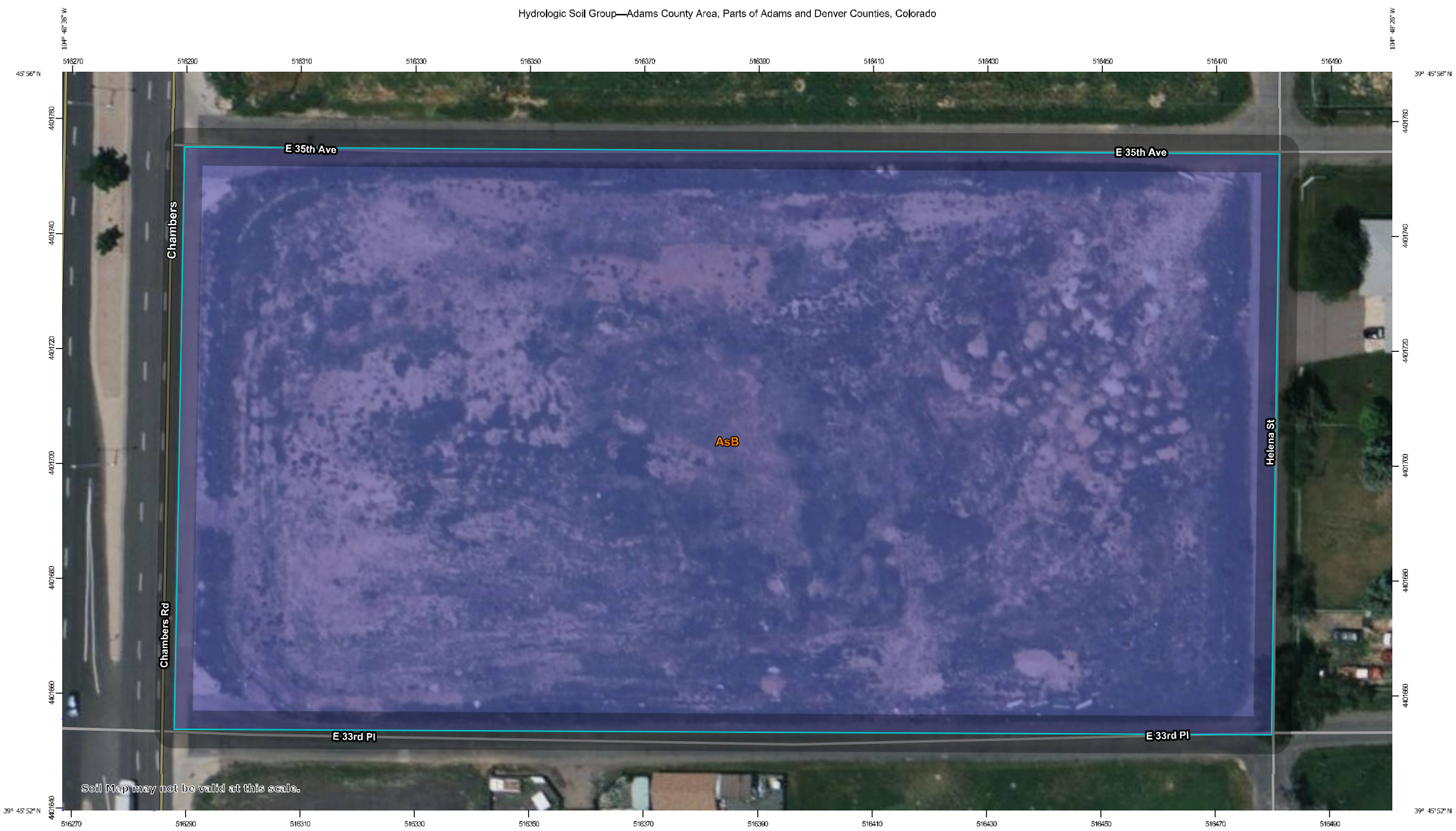
Urban Storm Drainage Criteria Manual: Volumes 1-3, Mile High Flood District, Latest Editions

Storm Drainage Design & Technical Criteria, City of Aurora, Aurora Water, November 2023

Drainage Report For Chambers Road From Smith Road to I-70, By Engineering Design Section City of Aurora, October 1986.

Appendix A

1. Soil, Precipitation, Floodplain, and Airport Buffer Information
    a. NRCS Soils Report
    b. NOAA 14 Rainfall Data
    c. FEMA FiRMette
    d. Airport Detention Pond Buffer Zone (N/A)



Map Scale: 1:626 if printed on B landscape (17" x 11") sheet.

N

Meters: 0 5 10 20 30

Feet: 0 30 60 120 180

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: Adams County Area, Parts of Adams and Denver Counties, Colorado
Survey Area Data: Version 20, Aug 24, 2023

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

Date(s) aerial images were photographed: Jun 9, 2021—Jun 12, 2021

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
AsB	Ascalon sandy loam, 0 to 3 percent slopes	B	4.8	100.0%
Totals for Area of Interest			**4.8**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOAA Atlas 14, Volume 8, Version 2
Location name: Aurora, Colorado, USA*
Latitude: 39.7651°, Longitude: -104.8088°
Elevation: 5372 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.224 (0.180-0.280)	0.275 (0.221-0.345)	0.368 (0.294-0.463)	0.453 (0.360-0.572)	0.582 (0.452-0.774)	0.691 (0.521-0.926)	0.808 (0.589-1.11)	0.936 (0.653-1.32)	1.12 (0.749-1.61)	1.26 (0.821-1.83)
10-min	0.328 (0.263-0.411)	0.403 (0.323-0.506)	0.539 (0.430-0.678)	0.664 (0.527-0.838)	0.853 (0.662-1.13)	1.01 (0.764-1.36)	1.18 (0.862-1.62)	1.37 (0.956-1.93)	1.64 (1.10-2.36)	1.85 (1.20-2.68)
15-min	0.400 (0.321-0.501)	0.492 (0.394-0.617)	0.658 (0.525-0.826)	0.809 (0.642-1.02)	1.04 (0.807-1.38)	1.23 (0.931-1.65)	1.44 (1.05-1.98)	1.67 (1.17-2.35)	1.99 (1.34-2.88)	2.26 (1.47-3.27)
30-min	0.561 (0.450-0.703)	0.687 (0.550-0.862)	0.914 (0.730-1.15)	1.12 (0.890-1.42)	1.44 (1.11-1.90)	1.70 (1.28-2.27)	1.98 (1.44-2.72)	2.29 (1.60-3.22)	2.72 (1.83-3.93)	3.08 (2.00-4.46)
60-min	0.703 (0.563-0.880)	0.855 (0.685-1.07)	1.13 (0.902-1.42)	1.38 (1.10-1.74)	1.77 (1.37-2.35)	2.09 (1.58-2.80)	2.44 (1.78-3.35)	2.82 (1.97-3.97)	3.37 (2.26-4.85)	3.81 (2.48-5.52)
2-hr	0.844 (0.681-1.05)	1.02 (0.824-1.27)	1.34 (1.08-1.68)	1.64 (1.31-2.06)	2.10 (1.64-2.77)	2.48 (1.89-3.30)	2.90 (2.13-3.95)	3.36 (2.36-4.68)	4.01 (2.71-5.73)	4.54 (2.97-6.52)
3-hr	0.924 (0.749-1.14)	1.11 (0.901-1.38)	1.46 (1.18-1.81)	1.78 (1.42-2.22)	2.27 (1.78-2.98)	2.68 (2.05-3.55)	3.13 (2.31-4.24)	3.62 (2.56-5.02)	4.32 (2.94-6.15)	4.90 (3.22-7.00)
6-hr	1.10 (0.897-1.35)	1.32 (1.07-1.62)	1.71 (1.39-2.11)	2.08 (1.68-2.57)	2.63 (2.08-3.41)	3.09 (2.38-4.05)	3.59 (2.67-4.82)	4.14 (2.95-5.68)	4.91 (3.36-6.92)	5.54 (3.68-7.85)
12-hr	1.34 (1.10-1.64)	1.61 (1.32-1.96)	2.08 (1.70-2.54)	2.50 (2.03-3.07)	3.12 (2.48-4.01)	3.64 (2.81-4.71)	4.19 (3.12-5.54)	4.78 (3.42-6.48)	5.60 (3.86-7.79)	6.26 (4.19-8.78)
24-hr	1.63 (1.34-1.97)	1.95 (1.61-2.36)	2.50 (2.05-3.03)	2.97 (2.43-3.62)	3.66 (2.91-4.63)	4.22 (3.27-5.40)	4.80 (3.60-6.28)	5.42 (3.90-7.26)	6.26 (4.34-8.61)	6.94 (4.68-9.63)
2-day	1.91 (1.59-2.30)	2.27 (1.89-2.73)	2.88 (2.38-3.47)	3.40 (2.80-4.11)	4.14 (3.30-5.17)	4.72 (3.69-5.97)	5.33 (4.02-6.89)	5.96 (4.32-7.89)	6.81 (4.76-9.26)	7.48 (5.09-10.3)
3-day	2.07 (1.73-2.47)	2.45 (2.04-2.93)	3.08 (2.56-3.69)	3.62 (3.00-4.36)	4.39 (3.52-5.46)	5.00 (3.92-6.29)	5.62 (4.26-7.23)	6.27 (4.57-8.26)	7.15 (5.02-9.66)	7.84 (5.36-10.7)
4-day	2.19 (1.83-2.61)	2.58 (2.16-3.08)	3.24 (2.70-3.86)	3.80 (3.15-4.55)	4.59 (3.69-5.68)	5.21 (4.10-6.53)	5.85 (4.45-7.49)	6.52 (4.76-8.55)	7.42 (5.22-9.98)	8.12 (5.57-11.1)
7-day	2.50 (2.10-2.95)	2.92 (2.45-3.46)	3.62 (3.03-4.30)	4.22 (3.51-5.02)	5.05 (4.08-6.20)	5.71 (4.52-7.10)	6.39 (4.89-8.11)	7.08 (5.21-9.22)	8.02 (5.69-10.7)	8.75 (6.05-11.8)
10-day	2.78 (2.35-3.27)	3.22 (2.72-3.80)	3.95 (3.32-4.67)	4.57 (3.82-5.42)	5.44 (4.41-6.64)	6.12 (4.86-7.57)	6.81 (5.23-8.61)	7.52 (5.56-9.74)	8.48 (6.04-11.3)	9.22 (6.40-12.4)
20-day	3.60 (3.06-4.20)	4.10 (3.48-4.79)	4.91 (4.16-5.76)	5.59 (4.71-6.58)	6.54 (5.33-7.89)	7.27 (5.80-8.89)	8.00 (6.19-10.0)	8.75 (6.51-11.2)	9.74 (6.99-12.8)	10.5 (7.35-14.0)
30-day	4.25 (3.63-4.94)	4.82 (4.11-5.62)	5.75 (4.89-6.71)	6.52 (5.51-7.63)	7.56 (6.18-9.06)	8.35 (6.69-10.1)	9.14 (7.10-11.3)	9.93 (7.42-12.6)	11.0 (7.90-14.3)	11.7 (8.26-15.5)
45-day	5.04 (4.32-5.83)	5.74 (4.92-6.66)	6.88 (5.87-7.98)	7.79 (6.61-9.08)	9.01 (7.38-10.7)	9.91 (7.97-12.0)	10.8 (8.41-13.3)	11.7 (8.74-14.7)	12.8 (9.23-16.5)	13.6 (9.60-17.9)
60-day	5.68 (4.88-6.55)	6.53 (5.61-7.54)	7.87 (6.74-9.11)	8.94 (7.62-10.4)	10.4 (8.50-12.2)	11.4 (9.16-13.6)	12.4 (9.65-15.1)	13.3 (10.0-16.7)	14.5 (10.5-18.6)	15.3 (10.9-20.1)

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

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

Please refer to NOAA Atlas 14 document for more information.

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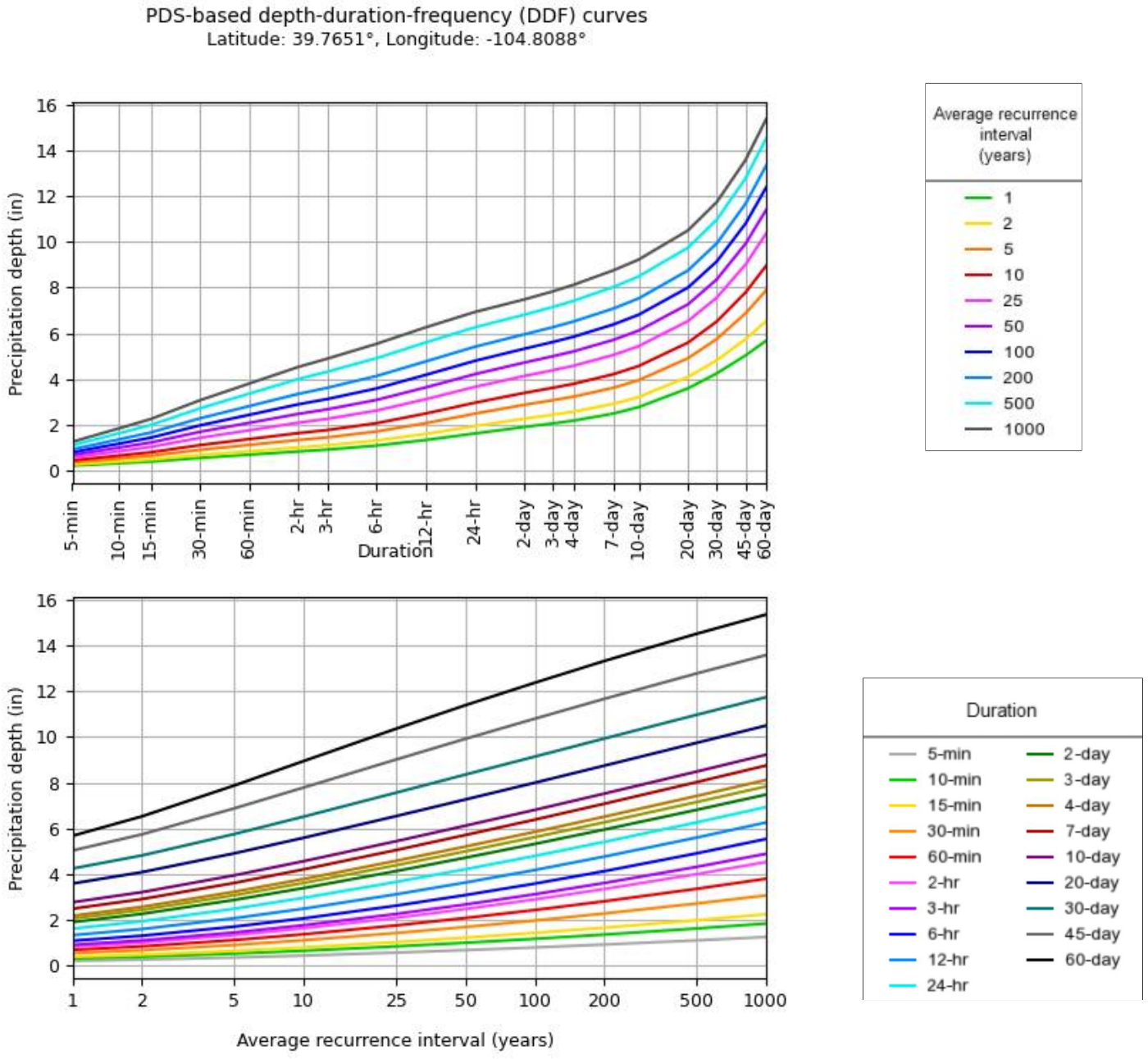
PF graphical



NOAA Atlas 14, Volume 8, Version 2 Created (GMT): Thu Jan 4 18:04:23 2024

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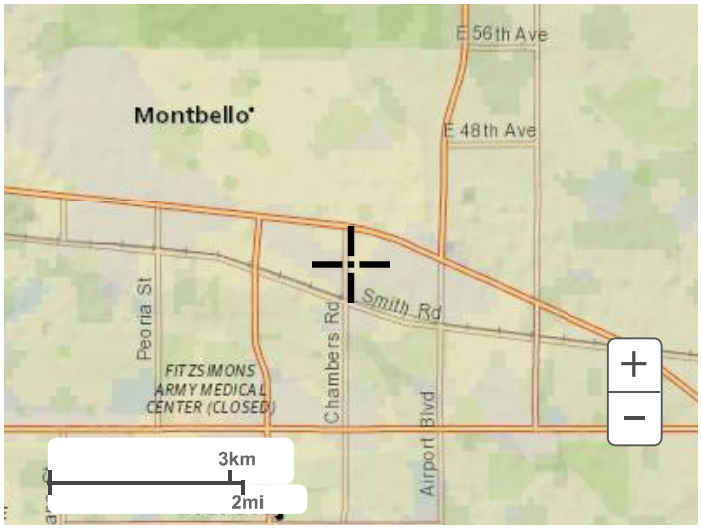
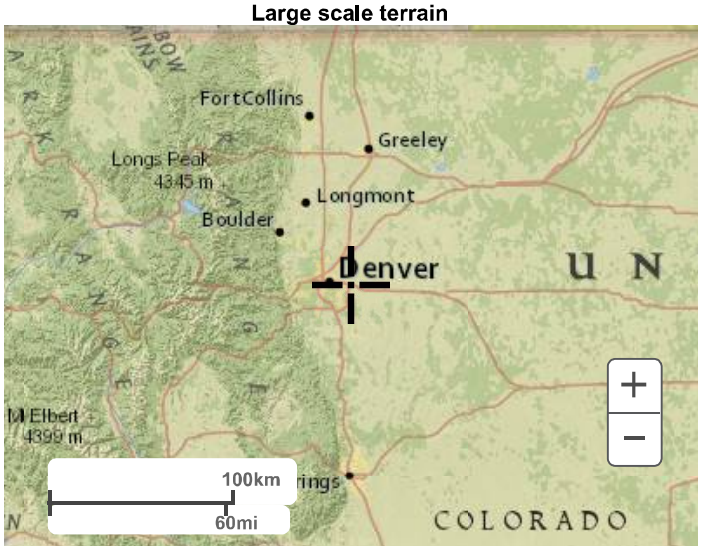
Maps & aerials

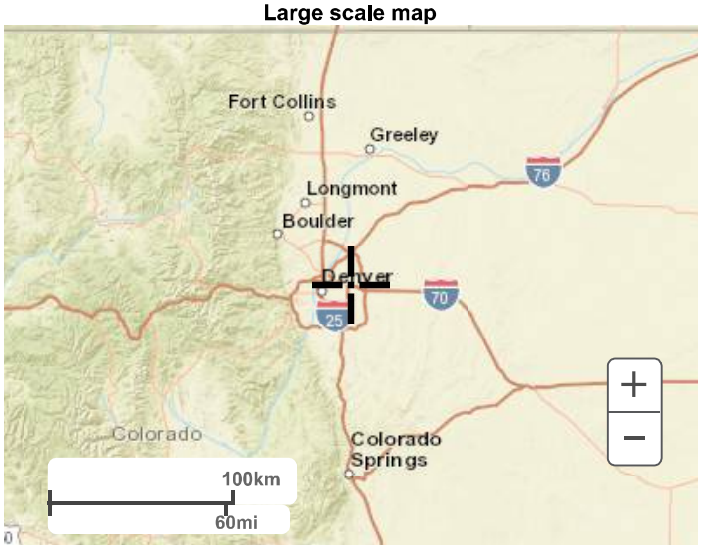
Small scale terrain



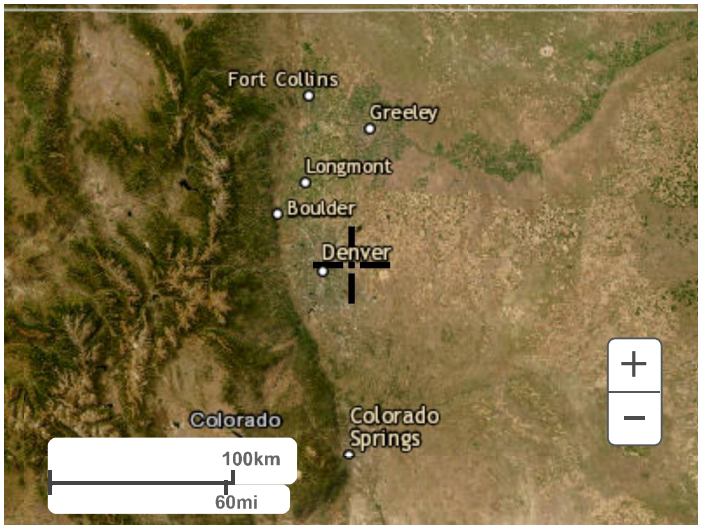
Large scale terrain



Large scale map



Large scale aerial



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

Disclaimer

drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

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

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

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

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

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

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

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

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

Base map information shown on this FIRM was provided by the Arapahoe County and Cities of Aurora and Littleton GIS depts. The coordinate system used for production of the digital FIRM is Universal Transverse Mercator, Zone 13N, referenced to the North American Datum of 1983 and the GRS 80 spheroid, Western Hemisphere.

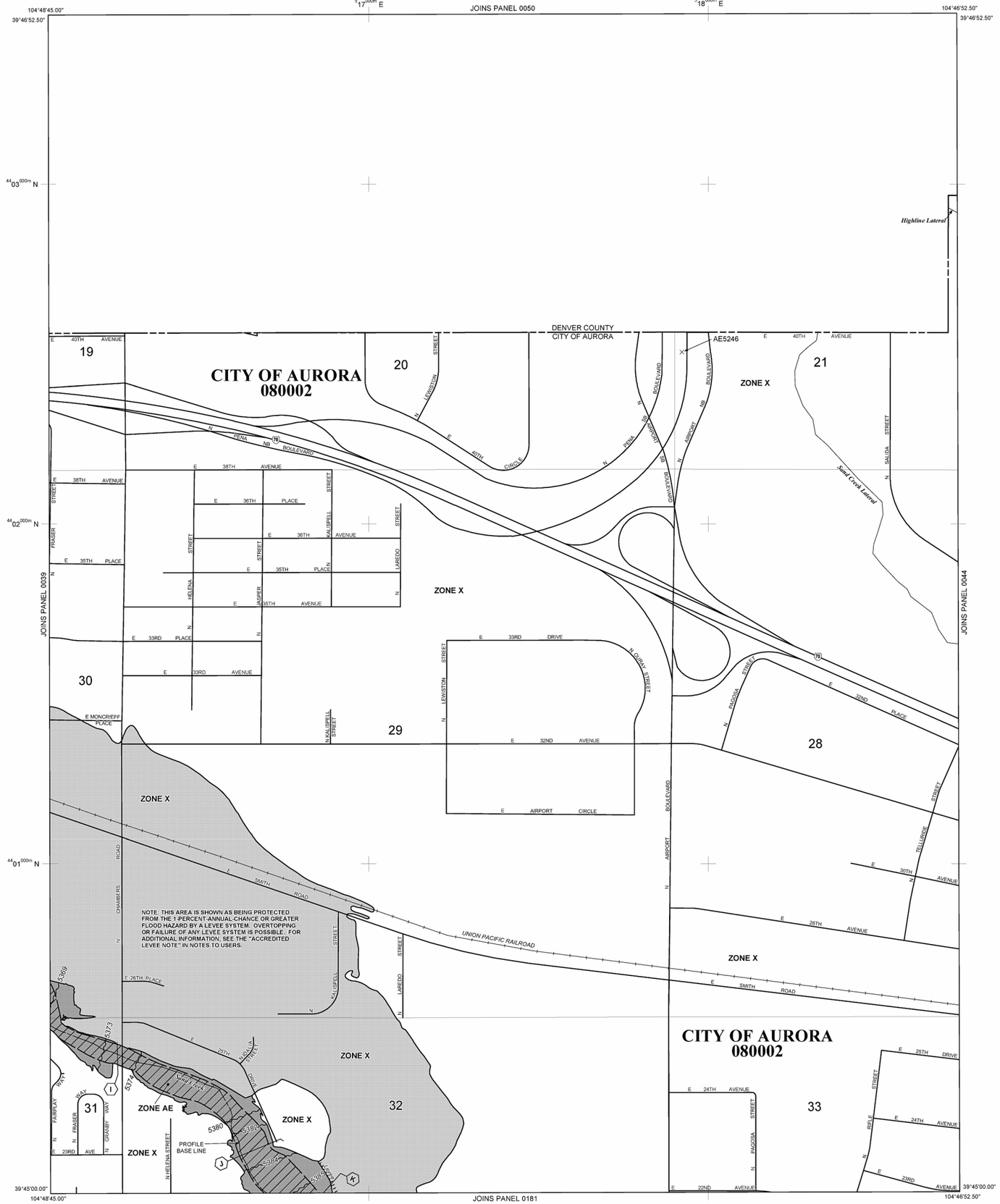
This map reflects more detailed and up- to- date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables *in the Flood Insurance Study report (which contains authoritative hydraulic data)* may reflect stream channel distances that differ from what is shown on this map.

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

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

Contact the **FEMA Map Service Center** at 1- 800- 358- 9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, *a Flood Insurance Study report,* and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1- 800- 358- 9620 and its website at http://www.msc.fema.gov/.

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



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

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

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

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

- A — A — Cross section line
- 23 — 23 — Transect line
- 97°07'30", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4275 000m N — 1000-meter Universal Transverse Mercator grid ticks, zone 13
- 6000000 M — 5000-foot grid ticks: New York State Plane coordinate system, east zone (FIPSZONE 3101), Transverse Mercator
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
April 17, 1989
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
March 4, 1991 December 3, 1993 August 16, 1995
December 17, 2010 - to update map format, to change Special Flood Hazard Areas, and to change Base Flood Elevations.

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

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

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

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0043K

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

PANEL 43 OF 725
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
AURORA, CITY OF	080002	0043	K

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

MAP NUMBER
08005C0043K

MAP REVISED
DECEMBER 17, 2010

Colliers Engineering & Design

Appendix B

2. HYDROLOGIC CALCULATIONS
3. HYDRAULIC CALCULATIONS

Calculation of Peak Runoff using Rational Method

Designer: DBB
Company: Colliers Engineering & Design
Date: 2/26/2024
Project: Chambers Road
Location: 3550 Chambers Road

Version 2.00 released May 2017

Cells of this color are for required user-input
Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

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

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

Computed $t_c = t_i + t_t$

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

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

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

Select UDFCD location for NOAA Atlas 14 Rainfall Depths from the pulldown list OR enter your own depths obtained from the NOAA website (click this link)

	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
1-hour rainfall depth, P1 (in) =	0.86	1.13	1.38	1.77	2.09	2.44	3.37
Rainfall Intensity Equation Coefficients =	a: 28.50	b: 10.00	c: 0.786				

$$I(in/hr) = \frac{a * P_1}{(b + t_c)^c}$$

$$Q(cfs) = CIA$$

Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C							Overland (Initial) Flow Time					Channelized (Travel) Flow Time							Time of Concentration			Rainfall Intensity, I (in/hr)							Peak Flow, Q (cfs)						
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)	Overland Flow Time t_i (min)	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V_t (ft/sec)	Channelized Flow Time t_t (min)	Computed t_c (min)	Regional t_c (min)	Selected t_c (min)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
A-1	0.91	B	88.5	0.72	0.75	0.77	0.80	0.82	0.84	0.86	60.00			0.020	3.89	540.00			0.015	20	2.45	3.67	7.56	14.39	7.56	2.56	3.39	4.13	5.30	6.26	7.31	10.10	1.69	2.31	2.90	3.88	4.68	5.57	7.90
																									5.00	2.90	3.83	4.68	6.00	7.09	8.28	11.43	1.91	2.62	3.28	4.40	5.30	6.31	8.94
A-2	0.62	B	89.8	0.74	0.76	0.78	0.81	0.83	0.84	0.86	35.00			0.015	3.16	192.00			0.015	20	2.45	1.31	4.46	11.95	5.00	2.90	3.83	4.68	6.00	7.09	8.28	11.43	1.32	1.81	2.27	3.03	3.64	4.33	6.13
																									5.00	2.90	3.83	4.68	6.00	7.09	8.28	11.43	1.32	1.81	2.27	3.03	3.64	4.33	6.13
A-3	0.29	B	81.1	0.65	0.68	0.71	0.76	0.78	0.80	0.83	85.00			0.017	5.84	159.00			0.020	20	2.83	0.94	6.77	13.13	6.77	2.66	3.51	4.29	5.50	6.49	7.58	10.47	0.50	0.69	0.88	1.21	1.47	1.77	2.53
																									5.00	2.90	3.83	4.68	6.00	7.09	8.28	11.43	0.55	0.76	0.97	1.32	1.60	1.93	2.76
A-4	0.27	B	89.5	0.73	0.76	0.78	0.81	0.83	0.84	0.86	64.00			0.027	3.54	140.00			0.022	20	2.97	0.79	4.33	11.52	5.00	2.90	3.83	4.68	6.00	7.09	8.28	11.43	0.57	0.79	0.98	1.31	1.58	1.88	2.67
																									5.00	2.90	3.83	4.68	6.00	7.09	8.28	11.43	0.57	0.79	0.98	1.31	1.58	1.88	2.67
A-5	0.30	B	5.0	0.03	0.03	0.10	0.28	0.36	0.45	0.55	50.00			0.100	6.37	210.00			0.005	7	0.49	7.07	13.44	30.25	13.44	2.04	2.70	3.30	4.23	4.99	5.83	8.05	0.02	0.03	0.10	0.36	0.53	0.79	1.34
																									5.00	2.90	3.83	4.68	6.00	7.09	8.28	11.43	0.02	0.04	0.14	0.51	0.76	1.12	1.90
A-6	0.12	B	90.0	0.74	0.76	0.78	0.81	0.83	0.84	0.87																													
																									5.00	2.90	3.83	4.68	6.00	7.09	8.28	11.43	0.26	0.35	0.44	0.59	0.71	0.84	1.19
A-7	0.20	B	90.0	0.74	0.76	0.78	0.81	0.83	0.84	0.87																													
																									5.00	2.90	3.83	4.68	6.00	7.09	8.28	11.43	0.43	0.59	0.73	0.98	1.18	1.40	1.98
A-8	0.23	B	90.0	0.74	0.76	0.78	0.81	0.83	0.84	0.87																													
																									5.00	2.90	3.83	4.68	6.00	7.09	8.28	11.43	0.49	0.67	0.84	1.12	1.35	1.61	2.28
OS-1	0.61	B	63.0	0.49	0.52	0.57	0.64	0.68	0.72	0.77	40.00			0.015	5.81	366.00			0.010	20	2.00	3.05	8.86	18.71	8.86	2.42	3.20	3.91	5.01	5.92	6.91	9.55	0.72	1.01	1.35	1.97	2.45	3.03	4.46
																									5.00	2.90	3.83	4.68	6.00	7.09	8.28	11.43	0.86	1.21	1.61	2.36	2.94	3.63	5.35
OS-2	0.62	B	60.9	0.47	0.50	0.55	0.63	0.67	0.71	0.76	33.00			0.010	6.23	768.00			0.010	20	2.00	6.40	12.63	22.95	12.63	2.10	2.77	3.39	4.35	5.13	5.99	8.27	0.61	0.86	1.15	1.70	2.12	2.63	3.89
																									5.00	2.90	3.83	4.68	6.00	7.09	8.28	11.43	0.84	1.19	1.59	2.35	2.94	3.64	5.38
OS-3	0.26	B	64.1	0.50	0.53	0.57	0.65	0.69	0.72	0.77	40.00			0.020	5.19	150.00			0.020	20	2.83	0.88	6.08	16.09	6.08	2.75	3.63	4.43	5.68	6.71	7.84	10.82	0.35	0.50	0.66	0.96	1.20	1.48	2.17
																									5.00	2.90	3.83	4.68	6.00	7.09	8.28	11.43	0.37	0.53	0.70	1.02	1.26	1.56	2.29
UC-1	0.18	B	74.2	0.59	0.62	0.66	0.71	0.74	0.77	0.81	20.00			0.020	3.09	50.00			0.020	20	2.83	0.29	3.38	13.69	5.00	2.90	3.83	4.68	6.00	7.09	8.28	11.43	0.31	0.43	0.55	0.77	0.95	1.15	1.66
																									5.00	2.90	3.83	4.68	6.00	7.09	8.28	11.43	0.31	0.43	0.55	0.77	0.95	1.15	1.66
POND TOTAL	4.49	B	74.5	0.59	0.62	0.66	0.72	0.74	0.77	0.81	64.00			0.020	5.49	768.00			0.020	20	2.83	4.53	10.02	17.99	10.02	2.31	3.06	3.73	4.79	5.65	6.60	9.11	6.14	8.53	11.03	15.40	18.87	22.88	33.08
TOTAL SITE	4.67	B	74.5	0.59	0.62	0.66	0.72	0.74	0.77	0.81																													
A-1A	0.06	B	70.2	0.55	0.58	0.62	0.69	0.72	0.75	0.79	44.00			0.016	5.30	0.00			0.000	20	0.06	0.00	5.30	14.07	5.30	2.86	3.77	4.61	5.91	6.98	8.15	11.25	0.09	0.13	0.17	0.24	0.30	0.37	0.54
																									5.00	2.90	3.83	4.68	6.00	7.09	8.28	11.43	0.10	0.13	0.18	0.25	0.31	0.37	0.54

% IMPERVIOUS PER AURORA SDDTC

A-1

Building		B	95.0
Landscaping	0.10	B	20.0
Asphalt	0.71	B	95.0
Concrete	0.10	B	95.0
TOTAL	0.91		

% Impervious **86.8 %**

A-2

Building		B	95.0
Landscape	0.06	B	20.0
Asphalt	0.50	B	95.0
Concrete	0.06	B	95.0
TOTAL	0.62		

% Impervious **87.7** %

A-3

Building		B	95.0
Landscape	0.04	B	20.0
Asphalt	0.23	B	95.0
Concrete	0.02	B	95.0
TOTAL	0.29		

% Impervious **79.1**

A-4

Building		B	95.0
Landscape	0.02	B	20.0
Concrete	0.06	B	95.0

Asphalt	0.19	B	95.0

TOTAL 0.27

% Impervious **88.4**

A-5

Building		B	95.0
Landscape	0.30	B	20.0
Concrete		B	95.0
Asphalt		B	95.0

TOTAL 0.30

% Impervious **20.0**

A-6

Building	0.12	B	95.0
Landscape		B	20.0
Concrete		B	95.0
Asphalt		B	95.0

TOTAL 0.12

% Impervious **95.0**

A-7

Building	0.20	B	95.0
Landscape		B	20.0
Concrete		B	95.0
Asphalt		B	95.0

TOTAL 0.20

% Impervious **95.0**

A-8

Building	0.23	B	95.0
Landscape		B	20.0
Concrete		B	95.0
Asphalt		B	95.0
TOTAL	0.23		

% Impervious **95.0**

OS-1

Building		B	95.0
Landscape	0.23	B	20.0
Concrete	0.07	B	95.0
Asphalt	0.31	B	95.0
TOTAL	0.61		

% Impervious **66.7**

OS-2

Building		B	95.0
Landscape	0.25	B	20.0
Concrete	0.06	B	95.0
Asphalt	0.31	B	95.0
TOTAL	0.62		

% Impervious **64.9**

OS-3

Building		B	95.0
Landscape	0.09	B	20.0
Concrete	0.03	B	95.0
Asphalt	0.13	B	95.0

Asphalt	0.15	B	95.0

TOTAL 0.26

% Impervious **67.7**

UC-1

Building		B	95.0
Landscape	0.05	B	20.0
Concrete	0.02	B	95.0
Asphalt	0.11	B	95.0

TOTAL 0.18

% Impervious **75.6**

Total Site

Building	0.55	B	95.0
Landscape	1.16	B	20.0
Concrete	0.47	B	95.0
Asphalt	2.49	B	95.0

TOTAL 4.67

% Impervious **76.4**

Pond Total

Building	0.55	B	95.0
Landscape	1.11	B	20.0
Concrete	0.45	B	95.0
Asphalt	2.38	B	95.0

TOTAL 4.49

% Impervious **76.4**

A-1A

Building		B	95.0
Landscaping	0.01	B	20.0
Asphalt		B	95.0
Concrete	0.05	B	95.0
TOTAL	0.06		

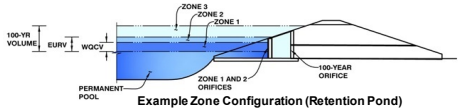
% Impervious **77.5 %**

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Chambers Road

Basin ID: Pond



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	4.67	acres
Watershed Length =	1,050	ft
Watershed Length to Centroid =	560	ft
Watershed Slope =	0.025	ft/ft
Watershed Imperviousness =	76.40%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Aurora - Municipal Center	

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.120	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.395	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.86 in.) =	0.235	acre-feet	0.86	inches
5-yr Runoff Volume (P1 = 1.13 in.) =	0.326	acre-feet	1.13	inches
10-yr Runoff Volume (P1 = 1.38 in.) =	0.419	acre-feet	1.38	inches
25-yr Runoff Volume (P1 = 1.77 in.) =	0.581	acre-feet	1.77	inches
50-yr Runoff Volume (P1 = 2.09 in.) =	0.709	acre-feet	2.09	inches
100-yr Runoff Volume (P1 = 2.44 in.) =	0.857	acre-feet	2.44	inches
500-yr Runoff Volume (P1 = 3.37 in.) =	1.237	acre-feet	3.37	inches
Approximate 2-yr Detention Volume =	0.224	acre-feet		
Approximate 5-yr Detention Volume =	0.310	acre-feet		
Approximate 10-yr Detention Volume =	0.405	acre-feet		
Approximate 25-yr Detention Volume =	0.488	acre-feet		
Approximate 50-yr Detention Volume =	0.532	acre-feet		
Approximate 100-yr Detention Volume =	0.588	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.120	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.275	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.193	acre-feet
Total Detention Basin Volume =	0.588	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

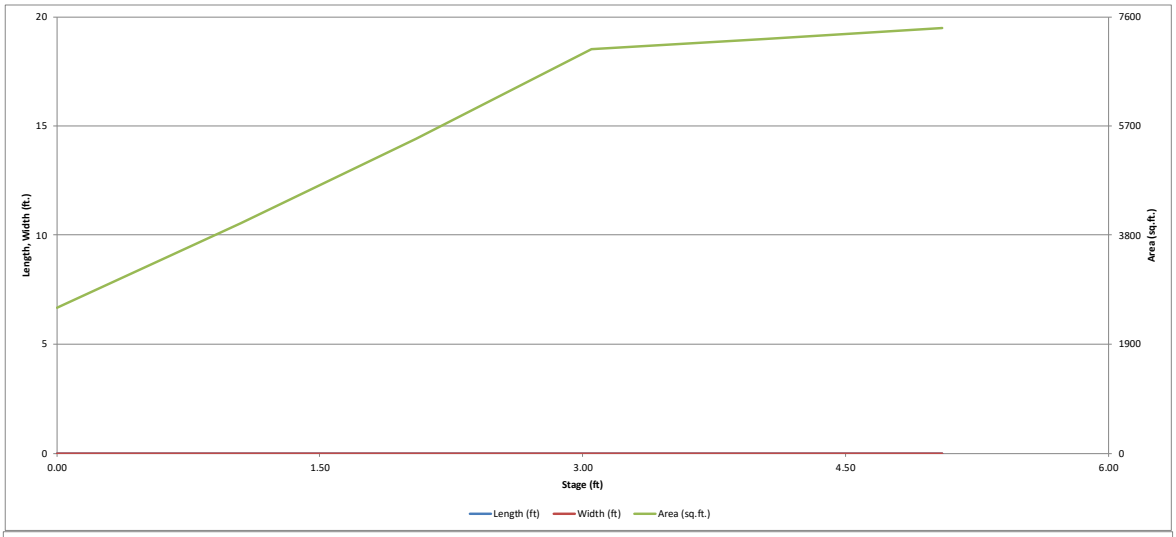
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user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

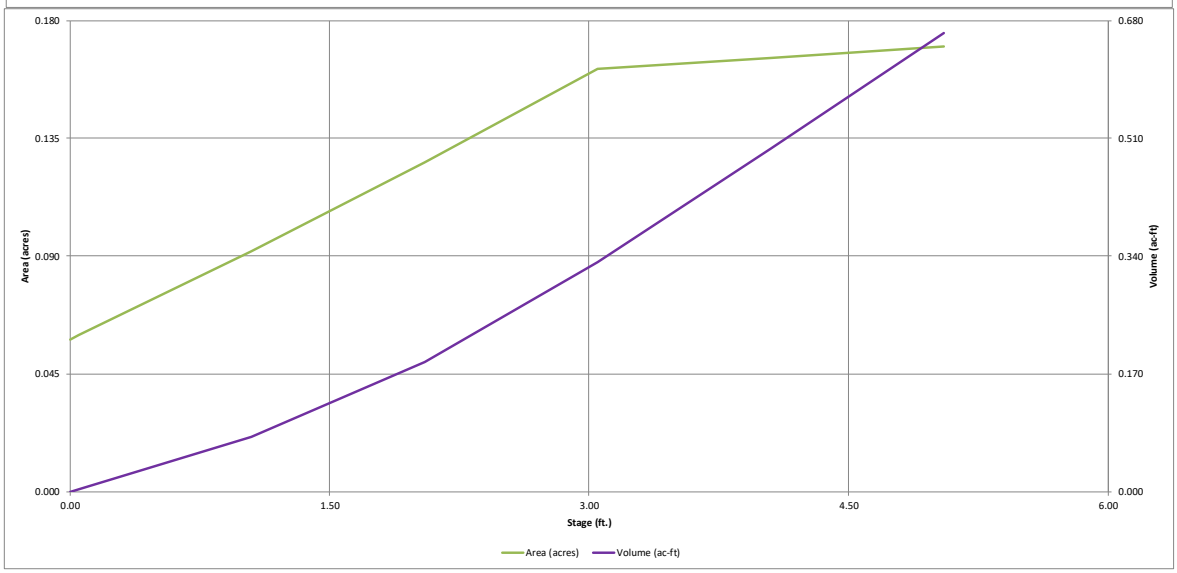
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	2,533	0.058		
5465	--	0.05	--	--	--	2,600	0.060	128	0.003
5466	--	1.05	--	--	--	4,000	0.092	3,428	0.079
5467	--	2.05	--	--	--	5,474	0.126	8,165	0.187
5468	--	3.05	--	--	--	7,030	0.161	14,417	0.331
5469	--	4.05	--	--	--	7,217	0.166	21,541	0.495
5470	--	5.05	--	--	--	7,408	0.170	28,853	0.662

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



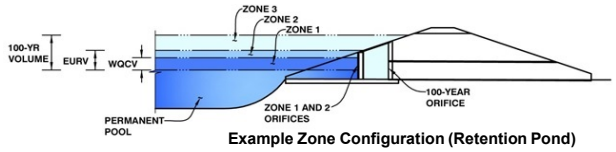


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: Chambers Road

Basin ID: Pond



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.47	0.120	Orifice Plate
Zone 2 (EURV)	3.45	0.275	Orifice Plate
Zone 3 (100-year)	4.61	0.193	Weir&Pipe (Restrict)
Total (all zones)		0.588	

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft²
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	9.028E-03	ft²
Depth at top of Zone using Orifice Plate =	3.42	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	1.30	sq. inches (diameter = 1-1/4 inches)	Elliptical Slot Area =	N/A	ft²

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.14	2.28					
Orifice Area (sq. inches)	1.30	1.30	1.30					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orif

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected
Overflow Weir Front Edge Height, Ho =	3.42	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	3.42	N/A
Overflow Weir Front Edge Length =	3.00	N/A	feet	Overflow Weir Slope Length =	3.00	N/A
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	28.30	N/A
Horiz. Length of Weir Sides =	3.00	N/A	feet	Overflow Grate Open Area w/o Debris =	6.26	N/A
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	3.13	N/A
Debris Clogging % =	50%	N/A	%			

Calculated Parameters for Overflow W

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.22	N/A
Outlet Pipe Diameter =	12.00	N/A	inches	Outlet Orifice Centroid =	0.19	N/A
Restrictor Plate Height Above Pipe Invert =	3.90		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.21	N/A

Calculated Parameters for Outlet Pipe w/ Flow Restriction Pla

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.73	feet
Spillway Crest Length =	4.00	feet	Stage at Top of Freeboard =	6.73	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.17	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	0.66	acre-ft

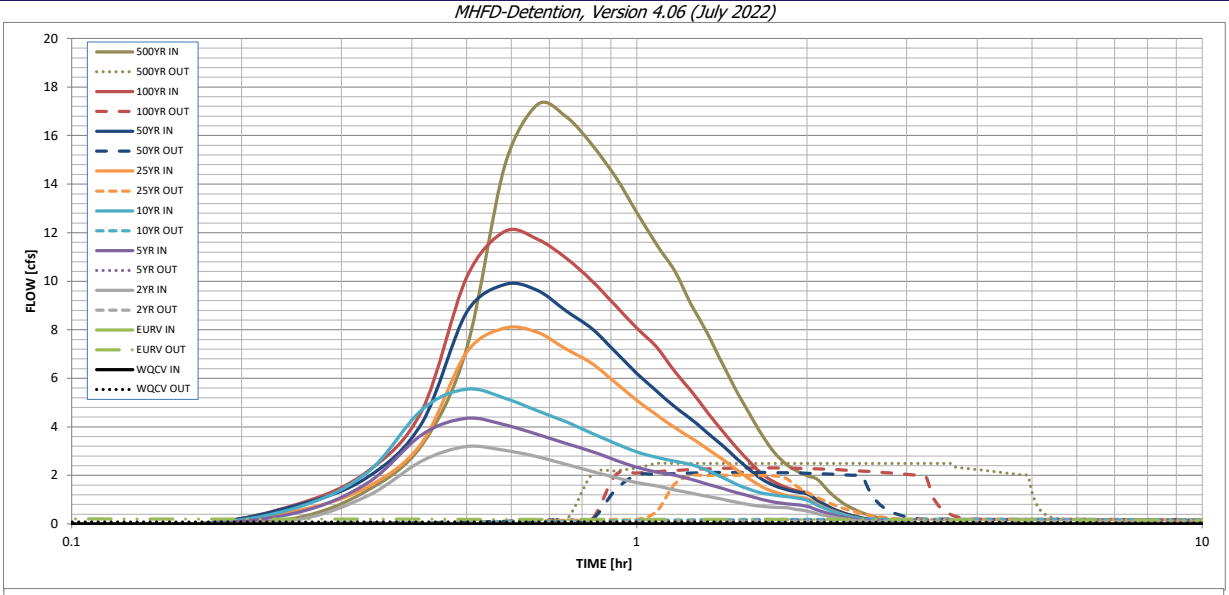
Calculated Parameters for Spillway

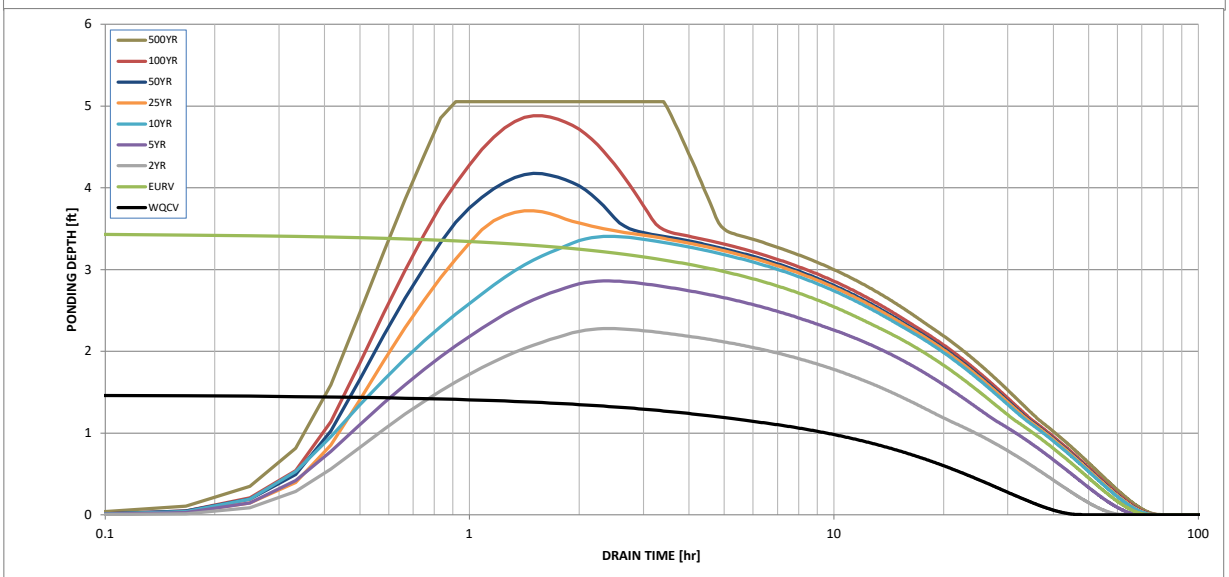
Routed Hydrograph Results — *The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AI*

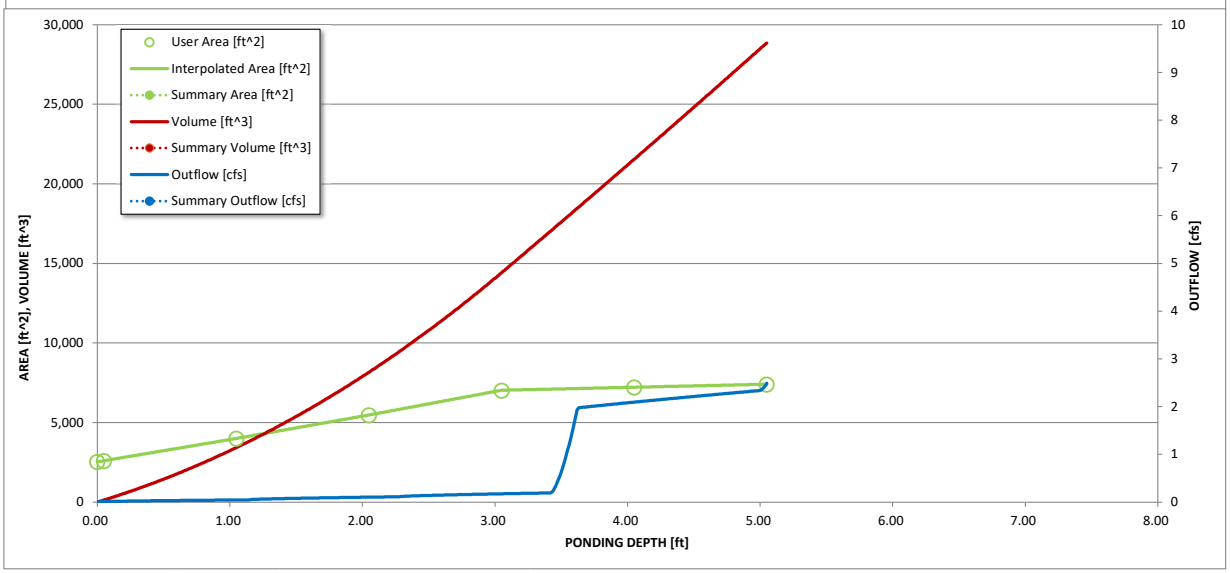
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.86	1.13	1.38	1.77	2.09	2.44
CUHP Runoff Volume (acre-ft) =	0.120	0.395	0.235	0.326	0.419	0.581	0.709	0.857
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.235	0.326	0.419	0.581	0.709	0.857
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.1	0.6	2.1	3.0	4.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A						
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.13	0.45	0.64	0.90
Peak Inflow Q (cfs) =	N/A	N/A	3.2	4.4	5.6	8.1	9.9	12.0
Peak Outflow Q (cfs) =	0.1	0.2	0.1	0.2	0.2	2.0	2.1	2.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.8	0.3	0.9	0.7	0.5
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Plate	Plate	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	0.02	N/A	N/A	N/A	0.3	0.3	0.3
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	40	59	52	57	61	58	57	55
Time to Drain 99% of Inflow Volume (hours) =	**43**	65	56	62	67	66	65	65
Maximum Ponding Depth (ft) =	1.47	3.45	2.28	2.86	3.40	3.72	4.17	4.88
Area at Maximum Ponding Depth (acres) =	0.11	0.16	0.13	0.15	0.16	0.16	0.17	0.17
Maximum Volume Stored (acre-ft) =	0.120	0.396	0.216	0.299	0.388	0.438	0.514	0.634
WSEL=	**5366.42**	**5368.4**						**5369.56**

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

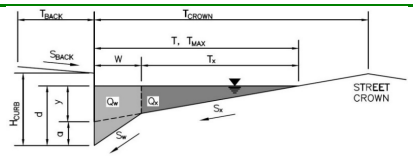
The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26
	0:15:00	0.00	0.00	0.17	0.46	0.67	0.54	0.77	0.80	1.37
	0:20:00	0.00	0.00	1.14	1.67	2.11	1.52	1.91	2.15	3.26
	0:25:00	0.00	0.00	2.60	3.68	4.71	3.35	4.16	4.67	7.21
	0:30:00	0.00	0.00	3.18	4.35	5.56	7.07	8.72	10.15	14.74
	0:35:00	0.00	0.00	3.03	4.08	5.19	8.06	9.86	12.04	17.27
	0:40:00	0.00	0.00	2.77	3.69	4.67	7.90	9.62	11.73	16.76
	0:45:00	0.00	0.00	2.45	3.31	4.20	7.20	8.76	10.94	15.62
	0:50:00	0.00	0.00	2.17	2.98	3.73	6.61	8.04	10.01	14.29
	0:55:00	0.00	0.00	1.91	2.63	3.31	5.81	7.08	8.99	12.83
	1:00:00	0.00	0.00	1.70	2.33	2.96	5.09	6.20	8.07	11.51
	1:05:00	0.00	0.00	1.56	2.14	2.74	4.49	5.48	7.29	10.41
	1:10:00	0.00	0.00	1.40	2.00	2.58	3.96	4.83	6.28	9.01
	1:15:00	0.00	0.00	1.26	1.83	2.44	3.54	4.30	5.45	7.84
	1:20:00	0.00	0.00	1.13	1.64	2.20	3.08	3.75	4.59	6.60
	1:25:00	0.00	0.00	1.01	1.46	1.91	2.66	3.23	3.83	5.49
	1:30:00	0.00	0.00	0.89	1.29	1.64	2.24	2.71	3.15	4.52
	1:35:00	0.00	0.00	0.79	1.15	1.42	1.85	2.23	2.55	3.65
	1:40:00	0.00	0.00	0.72	1.00	1.27	1.53	1.84	2.05	2.94
	1:45:00	0.00	0.00	0.69	0.90	1.18	1.32	1.58	1.72	2.48
	1:50:00	0.00	0.00	0.67	0.84	1.13	1.19	1.42	1.51	2.18
	1:55:00	0.00	0.00	0.60	0.79	1.07	1.10	1.31	1.37	1.99
	2:00:00	0.00	0.00	0.53	0.73	0.98	1.04	1.24	1.27	1.84
	2:05:00	0.00	0.00	0.42	0.58	0.78	0.82	0.98	0.99	1.43
	2:10:00	0.00	0.00	0.33	0.45	0.60	0.63	0.75	0.74	1.07
	2:15:00	0.00	0.00	0.25	0.35	0.46	0.48	0.57	0.56	0.81
	2:20:00	0.00	0.00	0.20	0.27	0.35	0.37	0.44	0.43	0.61
	2:25:00	0.00	0.00	0.15	0.20	0.27	0.28	0.33	0.32	0.46
	2:30:00	0.00	0.00	0.11	0.15	0.20	0.21	0.25	0.24	0.35
	2:35:00	0.00	0.00	0.08	0.11	0.15	0.15	0.18	0.18	0.26
	2:40:00	0.00	0.00	0.06	0.08	0.11	0.12	0.14	0.14	0.20
	2:45:00	0.00	0.00	0.04	0.06	0.08	0.09	0.10	0.10	0.14
	2:50:00	0.00	0.00	0.03	0.04	0.05	0.06	0.07	0.07	0.10
	2:55:00	0.00	0.00	0.02	0.02	0.03	0.04	0.04	0.04	0.06
	3:00:00	0.00	0.00	0.01	0.01	0.02	0.02	0.02	0.02	0.03
	3:05:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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

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

INLET A1



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} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.024	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	20.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.010	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	

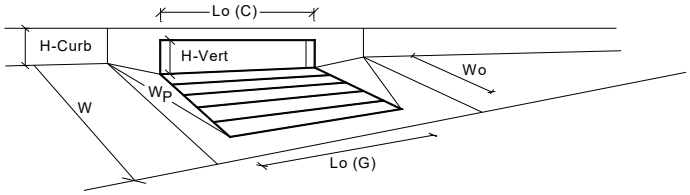
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.0	20.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

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

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



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 =	4.5	6.3	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 =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.66	0.66	

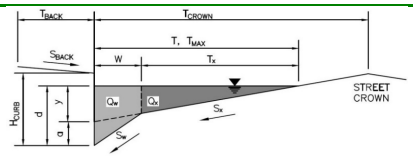
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	0.40	0.55	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.21	0.36	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.53	0.74	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	N/A	N/A	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.53	0.74	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**3.3**	**8.8**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	1.6	5.5	cfs

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

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

INLET A2



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} =	0.080	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.024	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	20.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.015	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	

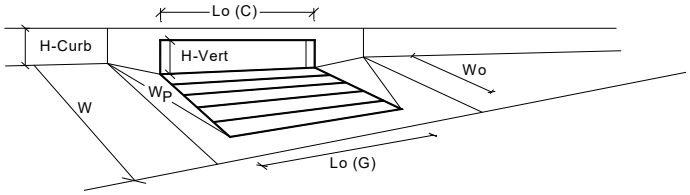
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.0	20.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

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

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)

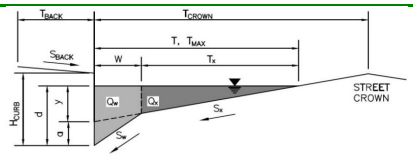


Design Information (Input)		MINOR	MAJOR	
Type of Inlet (Denver No. 16 Combination)	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.0	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 =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.66	0.66	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	0.36	0.52	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.17	0.33	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.63	0.94	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	N/A	N/A	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.63	0.94	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**1.8**	**5.6**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	1.3	4.3	cfs

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

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

INLET A3



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} =	0.080	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.024	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	20.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.010	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} =	10.0	20.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

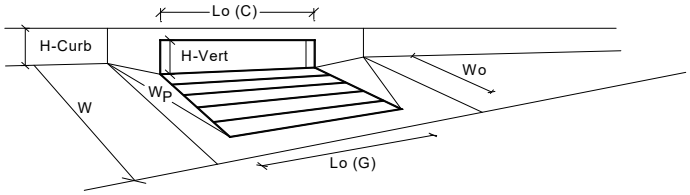
MINOR STORM Allowable Capacity is not applicable to Sump Condition
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	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 5.03 (August 2023)



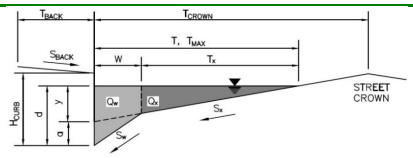
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	3.5	4.6	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 =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.66	0.66	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	0.31	0.41	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.13	0.22	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.55	0.72	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	N/A	N/A	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.55	0.72	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**1.2**	**2.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	0.5	1.7	cfs

MHFD-Inlet, Version 5.03 (August 2023)

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

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

INLET A4



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} =	0.080	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.024	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	20.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.028	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	

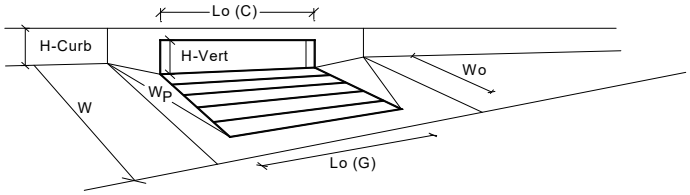
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.0	20.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

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

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



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 =	4.0	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 =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.66	0.66	

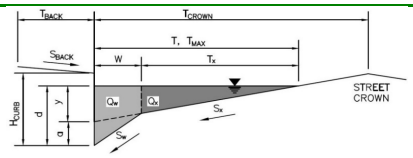
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	0.36	0.52	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.17	0.33	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.63	0.94	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	N/A	N/A	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.63	0.94	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**1.8**	**5.6**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	0.6	1.9	cfs

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

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

INLET OS-1

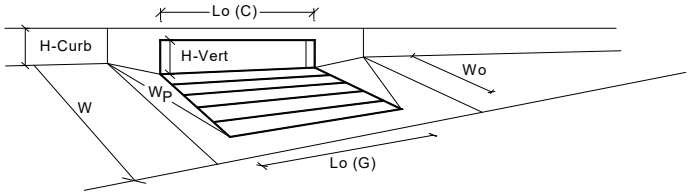


Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.050		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.024		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	20.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.012		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000		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} =	10.0	20.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

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

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)

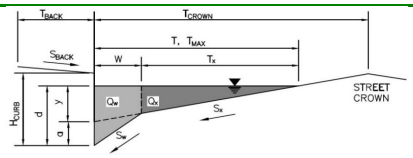


Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	3.3	5.0	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 =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.11	0.25	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} =	0.97	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 =**	**1.0**	**3.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	0.8	3.2	cfs

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

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

INLET OS-2

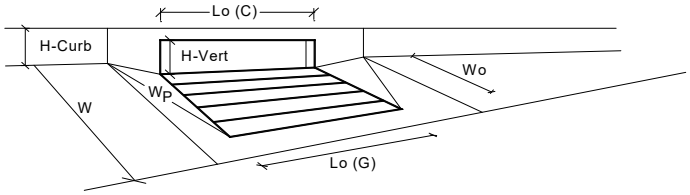


Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.050		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.024		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	20.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.009		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} =	10.0	20.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

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

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)

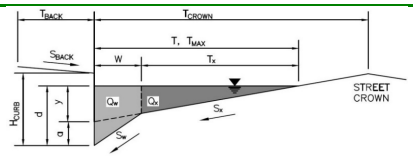


Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.0	5.0	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.17	0.25	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.79	0.87	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**2.5**	**5.0**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	0.7	2.7	cfs

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

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

INLET OS-3



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} =	0.050	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.024	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	20.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.006	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} =	10.0	20.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

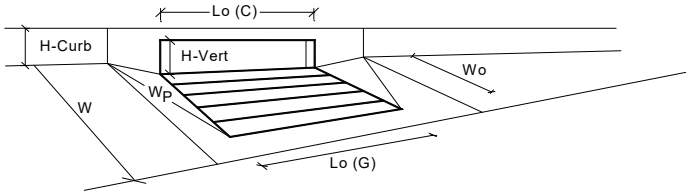
MINOR STORM Allowable Capacity is not applicable to Sump Condition
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	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 5.03 (August 2023)



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 =	3.0	4.0	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 =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.08	0.17	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	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 =**	**0.6**	**1.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	0.4	1.5	cfs

Channel Report

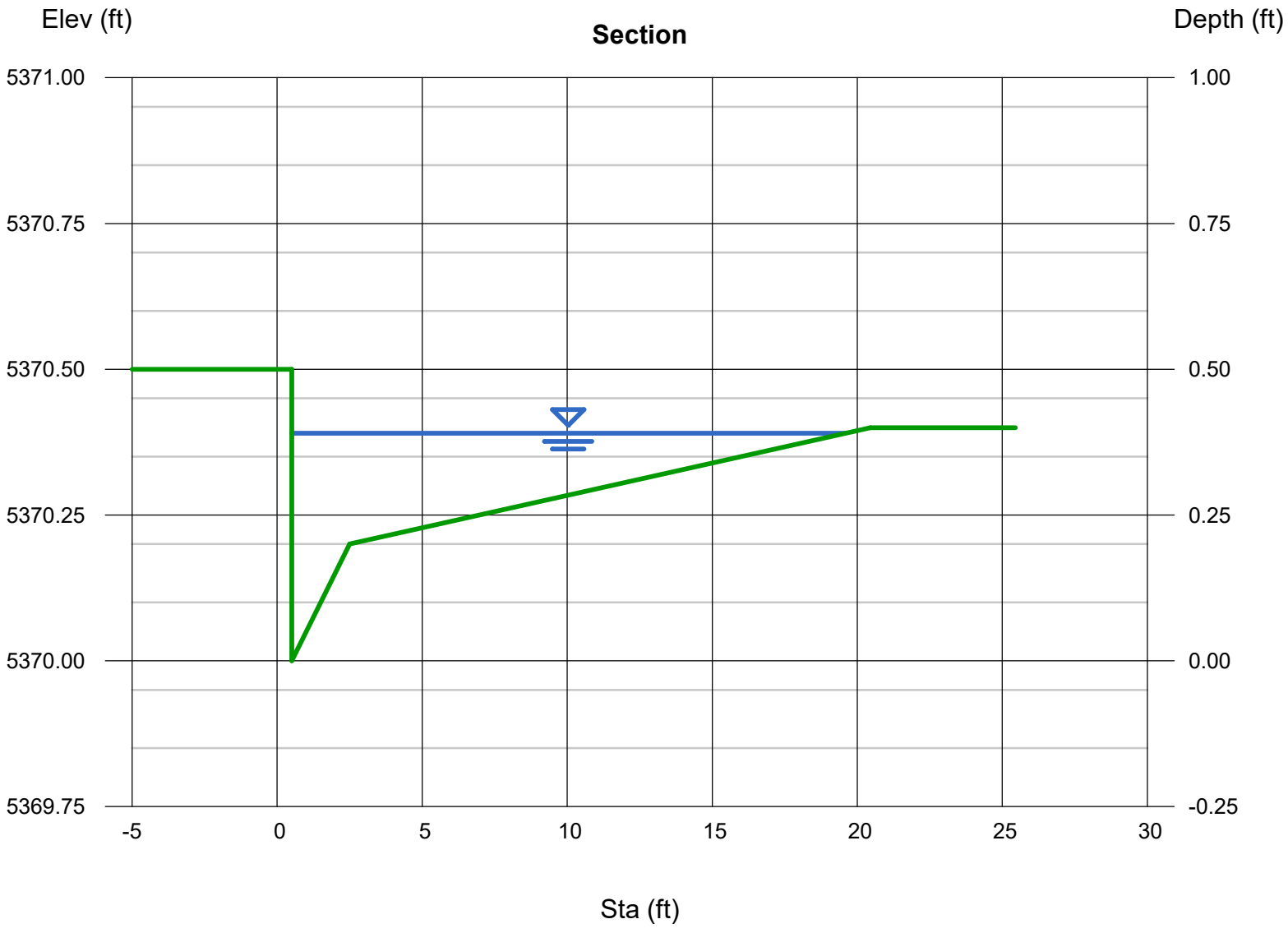
Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Apr 25 2024

E. 33RD PLACE STREET CAPACITY (OS-1)

User-defined		**Highlighted**	
Invert Elev (ft)	= 5370.00	Depth (ft)	= 0.39
Slope (%)	= 0.50	Q (cfs)	= 3.150
N-Value	= 0.016	Area (sqft)	= 2.20
		Velocity (ft/s)	= 1.43
Calculations		Wetted Perim (ft)	= 19.47
Compute by:	Known Q	Crit Depth, Yc (ft)	= 0.37
Known Q (cfs)	= 3.15 100-YEAR CALCULATED FLOW	Top Width (ft)	= 19.07
		EGL (ft)	= 0.42

(Sta, El, n)-(Sta, El, n)...

(0.00, 5370.50)-(0.50, 5370.50, 0.013)-(0.50, 5370.00, 0.013)-(2.50, 5370.20, 0.013)-(20.45, 5370.40, 0.016)



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Apr 25 2024

E. 33RD PLACE STREET CAPACITY (OS-1)

User-defined

Invert Elev (ft)	= 5370.00
Slope (%)	= 0.50
N-Value	= 0.015

Calculations

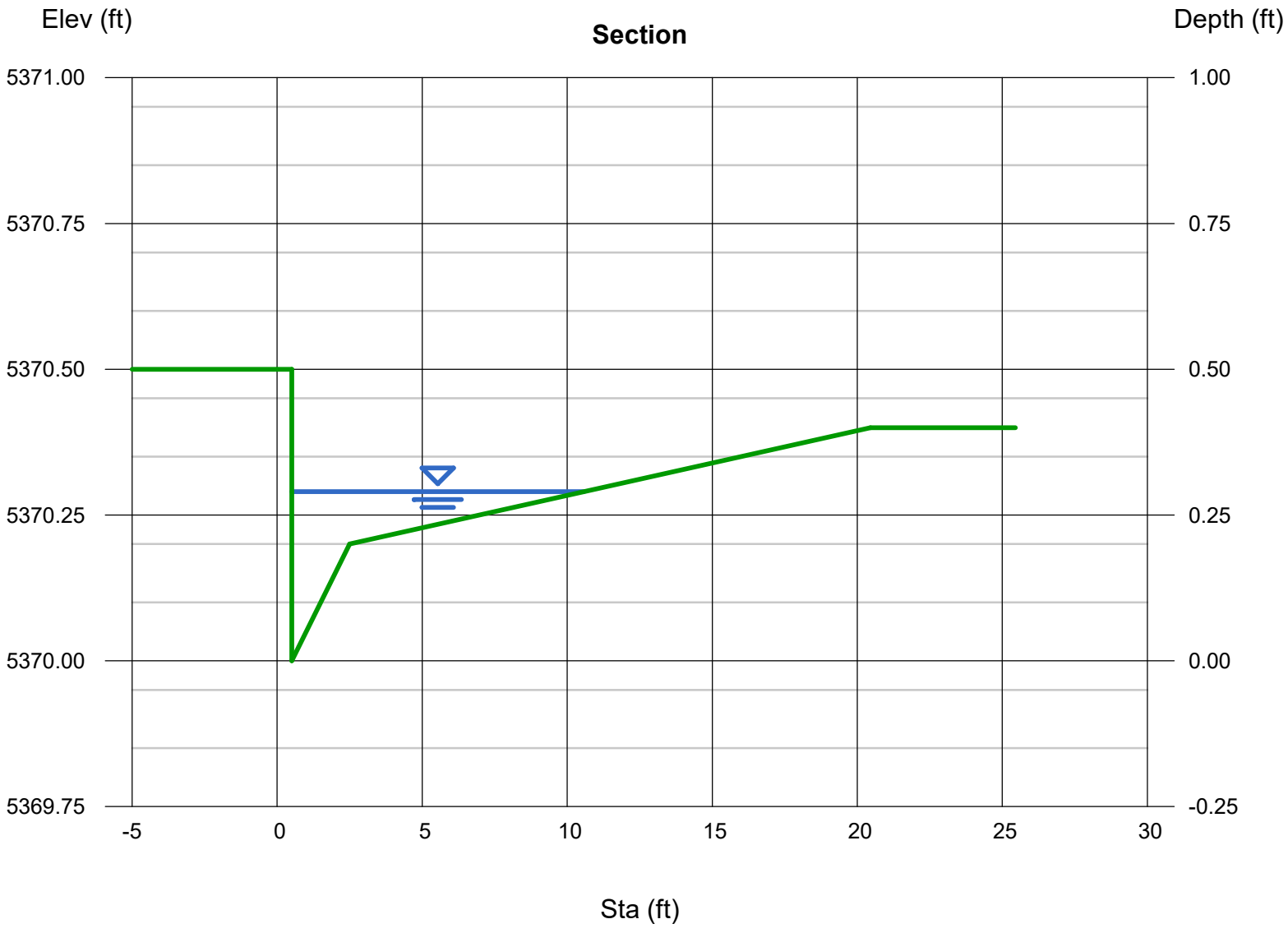
Compute by:	Known Q
Known Q (cfs)	= 0.78 2-YEAR CALCULATED FLOW

Highlighted

Depth (ft)	= 0.29
Q (cfs)	= 0.780
Area (sqft)	= 0.74
Velocity (ft/s)	= 1.05
Wetted Perim (ft)	= 10.38
Crit Depth, Yc (ft)	= 0.27
Top Width (ft)	= 10.08
EGL (ft)	= 0.31

(Sta, El, n)-(Sta, El, n)...

(0.00, 5370.50)-(0.50, 5370.50, 0.013)-(0.50, 5370.00, 0.013)-(2.50, 5370.20, 0.013)-(20.45, 5370.40, 0.016)



Channel Report

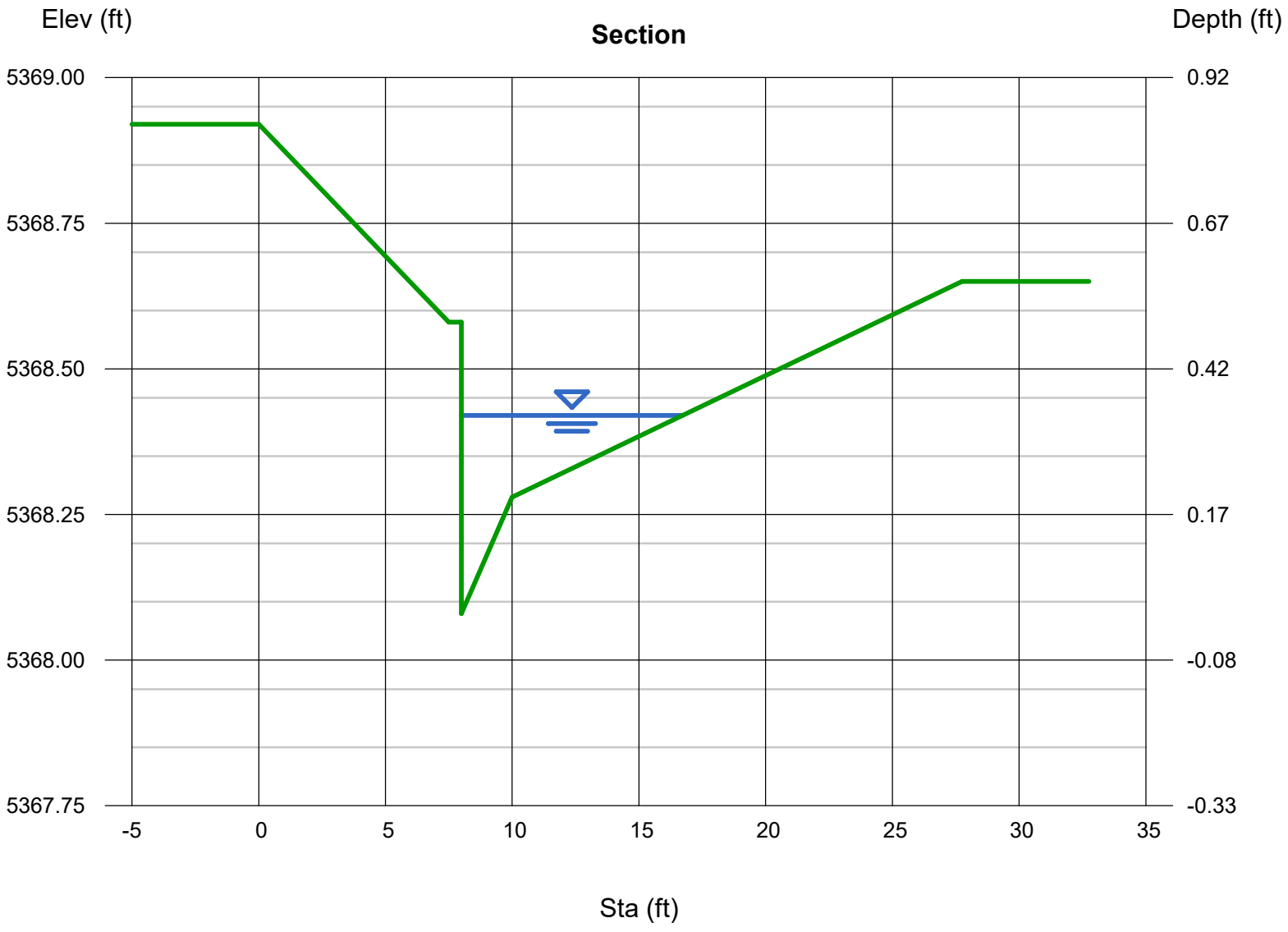
Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Apr 25 2024

E. 35TH PLACE STREET CAPACITY (OS-3)

User-defined		**Highlighted**	
Invert Elev (ft)	= 5368.08	Depth (ft)	= 0.34
Slope (%)	= 0.60	Q (cfs)	= 1.530
N-Value	= 0.015	Area (sqft)	= 0.95
		Velocity (ft/s)	= 1.61
Calculations		Wetted Perim (ft)	= 9.07
Compute by:	Known Q	Crit Depth, Yc (ft)	= 0.33
Known Q (cfs)	= 1.53 100-YEAR CALCULATED FLOW	Top Width (ft)	= 8.72
		EGL (ft)	= 0.38

(Sta, El, n)-(Sta, El, n)...

(0.00, 5368.92)-(7.50, 5368.58, 0.024)-(8.00, 5368.58, 0.013)-(8.00, 5368.08, 0.013)-(10.00, 5368.28, 0.013)-(27.75, 5368.65, 0.016)



Channel Report

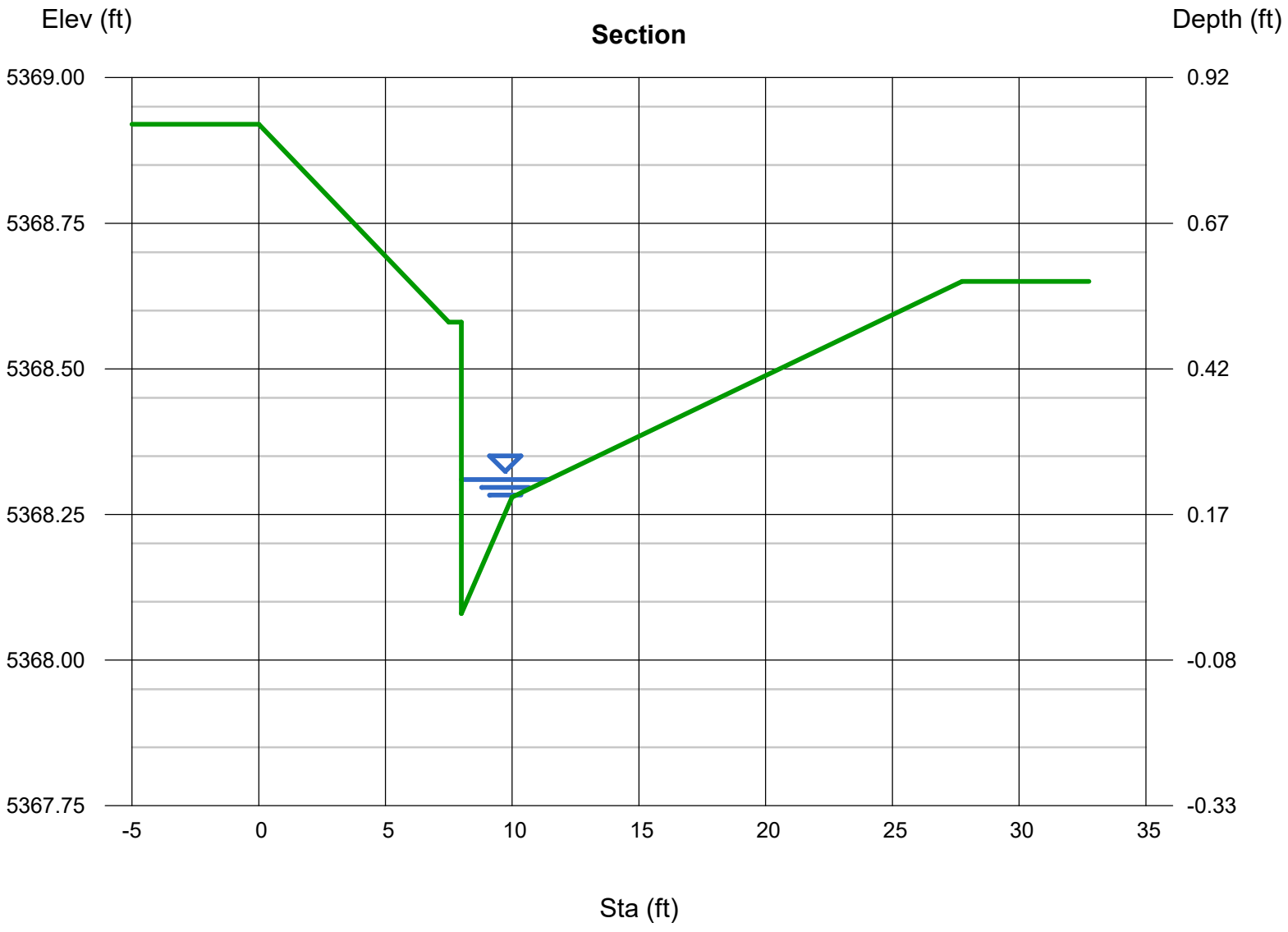
Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Apr 25 2024

E. 35TH PLACE STREET CAPACITY (OS-3)

User-defined		**Highlighted**	
Invert Elev (ft)	= 5368.08	Depth (ft)	= 0.23
Slope (%)	= 0.60	Q (cfs)	= 0.380
N-Value	= 0.014	Area (sqft)	= 0.28
		Velocity (ft/s)	= 1.35
Calculations		Wetted Perim (ft)	= 3.69
Compute by:	Known Q	Crit Depth, Yc (ft)	= 0.22
Known Q (cfs)	= 0.38 2-YEAR CALCULATED FLOW	Top Width (ft)	= 3.45
		EGL (ft)	= 0.26

(Sta, El, n)-(Sta, El, n)...

(0.00, 5368.92)-(7.50, 5368.58, 0.024)-(8.00, 5368.58, 0.013)-(8.00, 5368.08, 0.013)-(10.00, 5368.28, 0.013)-(27.75, 5368.65, 0.016)



Channel Report

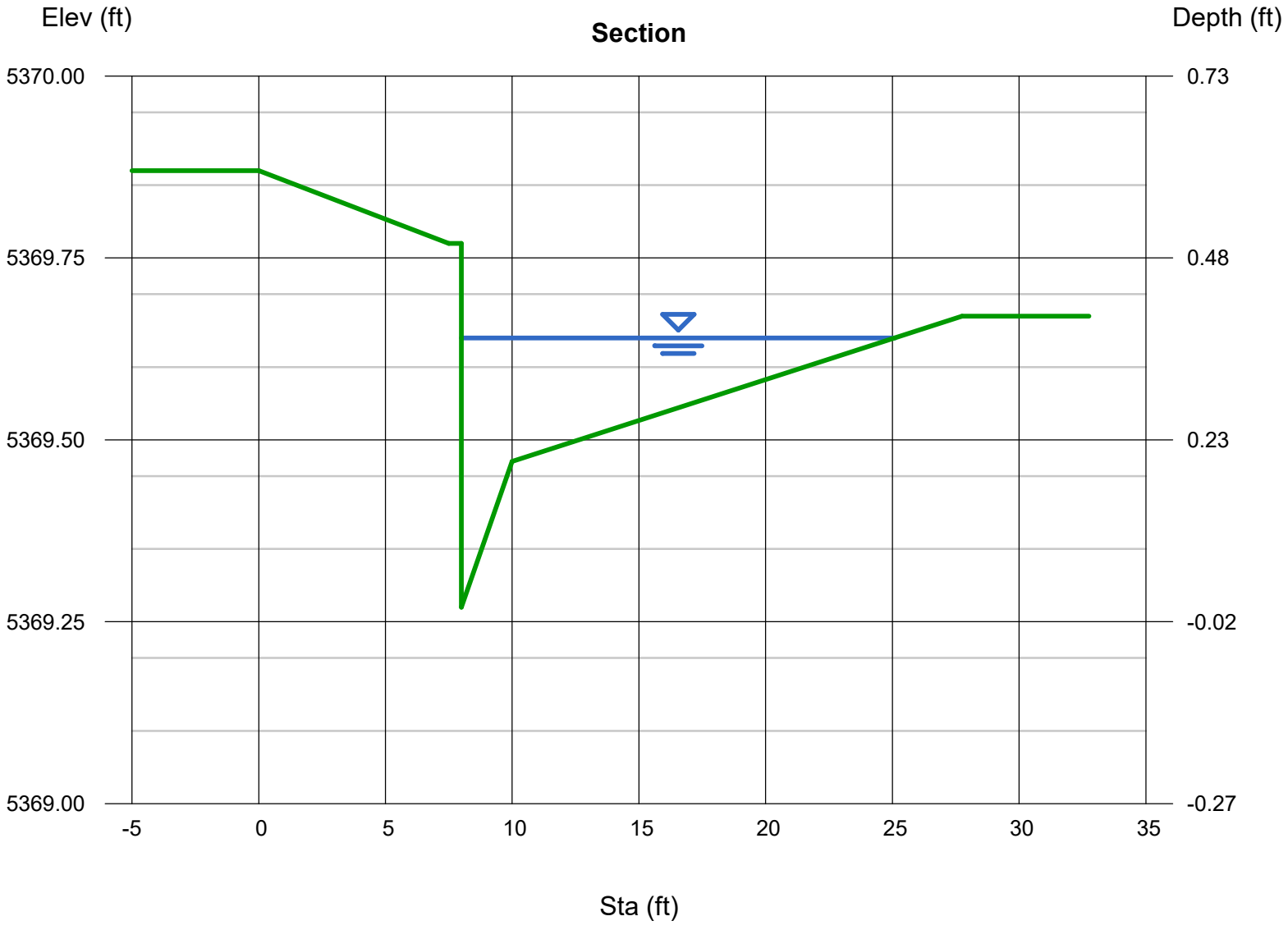
Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Apr 25 2024

E. 35TH PLACE STREET CAPACITY (OS-2)

User-defined		**Highlighted**	
Invert Elev (ft)	= 5369.27	Depth (ft)	= 0.37
Slope (%)	= 0.60	Q (cfs)	= 2.740
N-Value	= 0.016	Area (sqft)	= 1.82
		Velocity (ft/s)	= 1.50
Calculations		Wetted Perim (ft)	= 17.48
Compute by:	Known Q	Crit Depth, Yc (ft)	= 0.36
Known Q (cfs)	= 2.74 100-YEAR CALCULATED FLOW	Top Width (ft)	= 17.10
		EGL (ft)	= 0.41

(Sta, El, n)-(Sta, El, n)...

(0.00, 5369.87)-(7.50, 5369.77, 0.024)-(8.00, 5369.77, 0.013)-(8.00, 5369.27, 0.013)-(10.00, 5369.47, 0.013)-(27.75, 5369.67, 0.016)



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Apr 25 2024

E. 35TH PLACE STREET CAPACITY (OS-2)

User-defined

Invert Elev (ft)	= 5369.27
Slope (%)	= 0.60
N-Value	= 0.015

Calculations

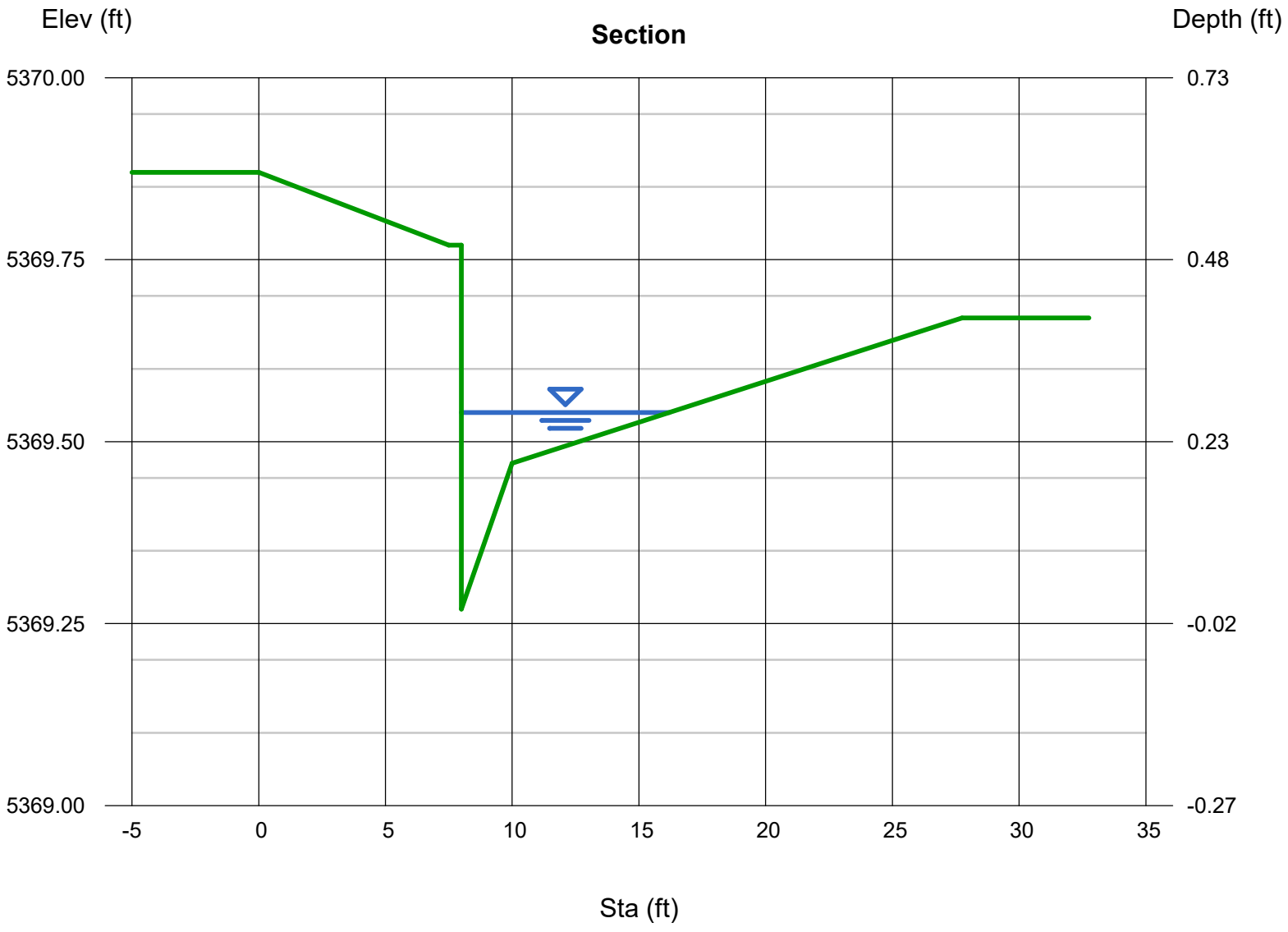
Compute by:	Known Q
Known Q (cfs)	= 0.66 2-YEAR CALCULATED FLOW

Highlighted

Depth (ft)	= 0.27
Q (cfs)	= 0.660
Area (sqft)	= 0.56
Velocity (ft/s)	= 1.19
Wetted Perim (ft)	= 8.49
Crit Depth, Yc (ft)	= 0.26
Top Width (ft)	= 8.21
EGL (ft)	= 0.29

(Sta, El, n)-(Sta, El, n)...

(0.00, 5369.87)-(7.50, 5369.77, 0.024)-(8.00, 5369.77, 0.013)-(8.00, 5369.27, 0.013)-(10.00, 5369.47, 0.013)-(27.75, 5369.67, 0.016)



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Jan 22 2024

DETENTION POND OUTFALL - SWALE

Trapezoidal

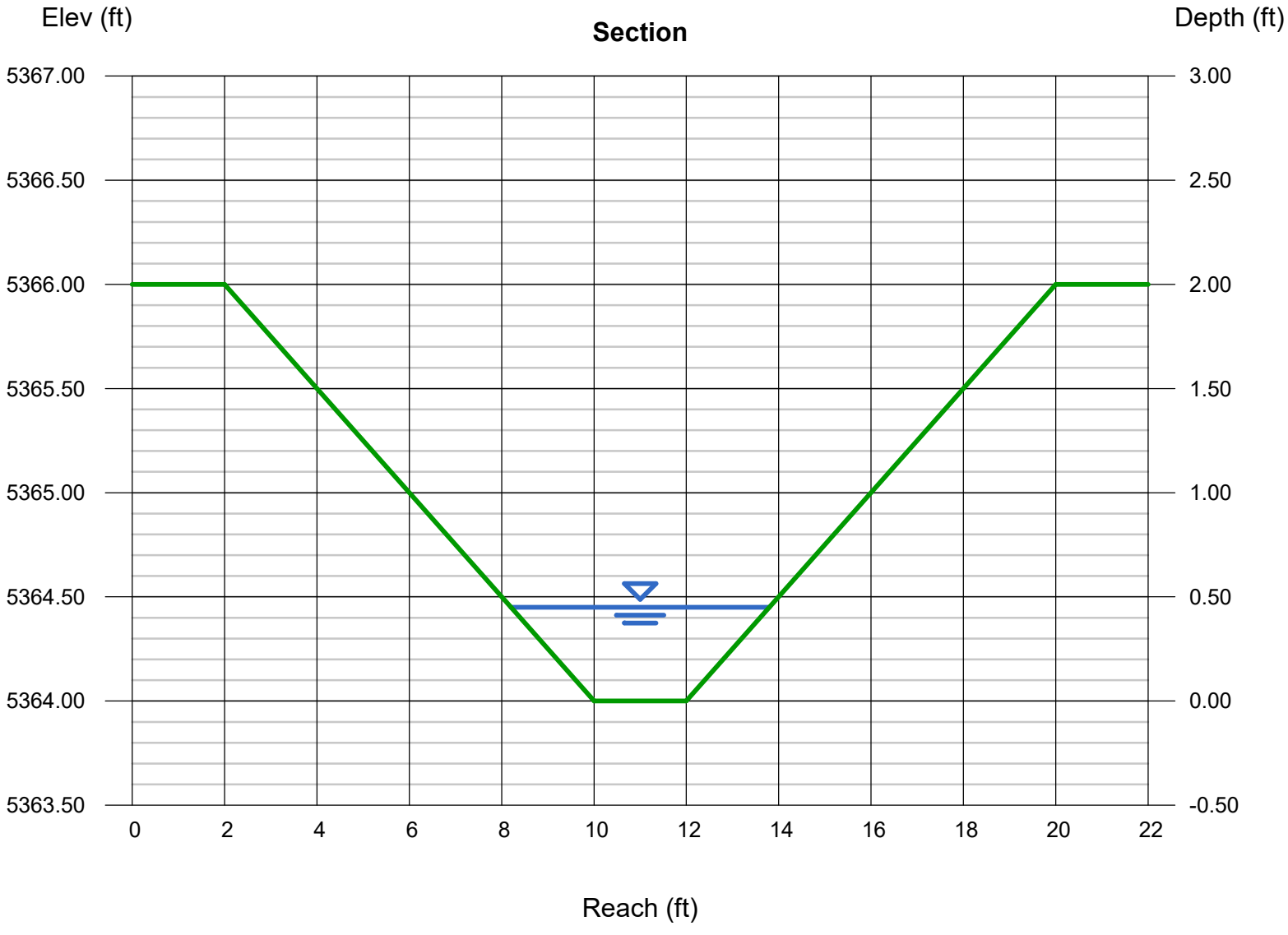
Bottom Width (ft)	= 2.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 5364.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 6.16

Highlighted

Depth (ft)	= 0.45
Q (cfs)	= 6.160
Area (sqft)	= 1.71
Velocity (ft/s)	= 3.60
Wetted Perim (ft)	= 5.71
Crit Depth, Yc (ft)	= 0.49
Top Width (ft)	= 5.60
EGL (ft)	= 0.65



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Jan 22 2024

DETENTION POND OUTFALL - SWALE

Trapezoidal

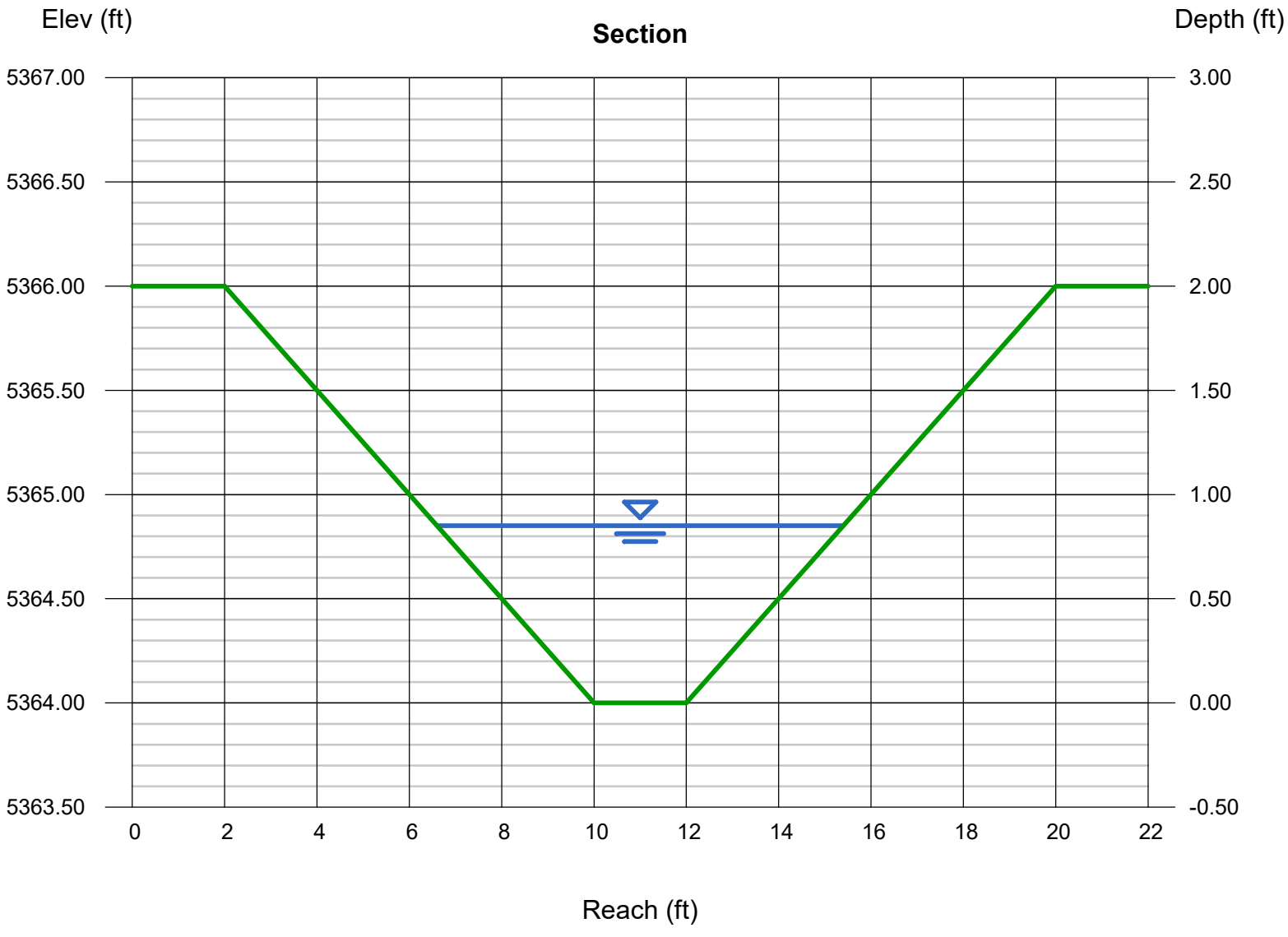
Bottom Width (ft)	= 2.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 5364.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 23.18

Highlighted

Depth (ft)	= 0.85
Q (cfs)	= 23.18
Area (sqft)	= 4.59
Velocity (ft/s)	= 5.05
Wetted Perim (ft)	= 9.01
Crit Depth, Yc (ft)	= 0.95
Top Width (ft)	= 8.80
EGL (ft)	= 1.25



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Feb 1 2024

Concrete Pan

Rectangular

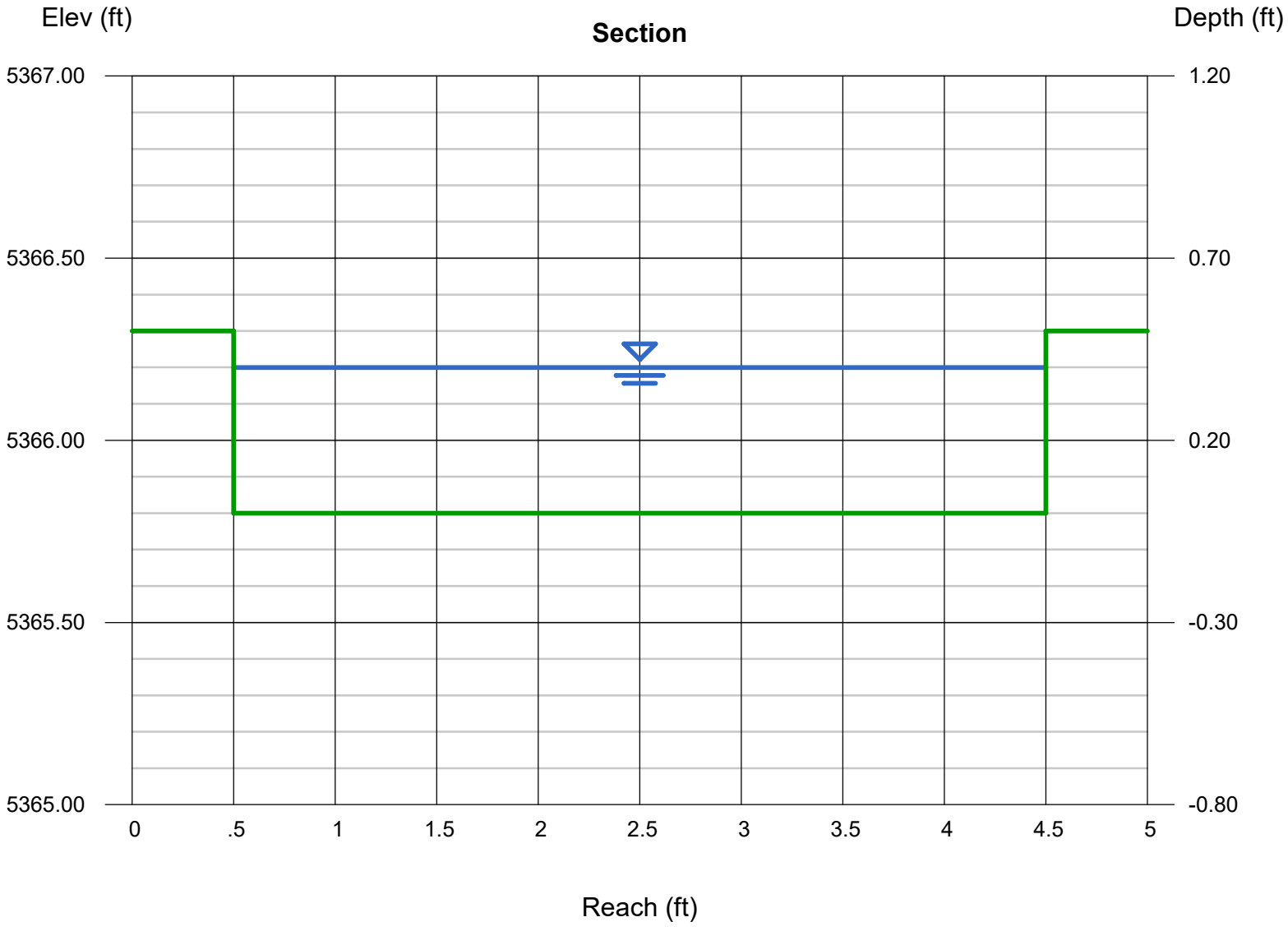
Bottom Width (ft)	= 4.00
Total Depth (ft)	= 0.50
Invert Elev (ft)	= 5365.80
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 6.19

Highlighted

Depth (ft)	= 0.40
Q (cfs)	= 6.190
Area (sqft)	= 1.60
Velocity (ft/s)	= 3.87
Wetted Perim (ft)	= 4.80
Crit Depth, Yc (ft)	= 0.43
Top Width (ft)	= 4.00
EGL (ft)	= 0.63



Weir Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Apr 19 2024

CHAMBERS DETENTION POND OUTFALL

Trapezoidal Weir

Crest	= Sharp
Bottom Length (ft)	= 24.00
Total Depth (ft)	= 1.50
Side Slope (z:1)	= 4.00

Highlighted

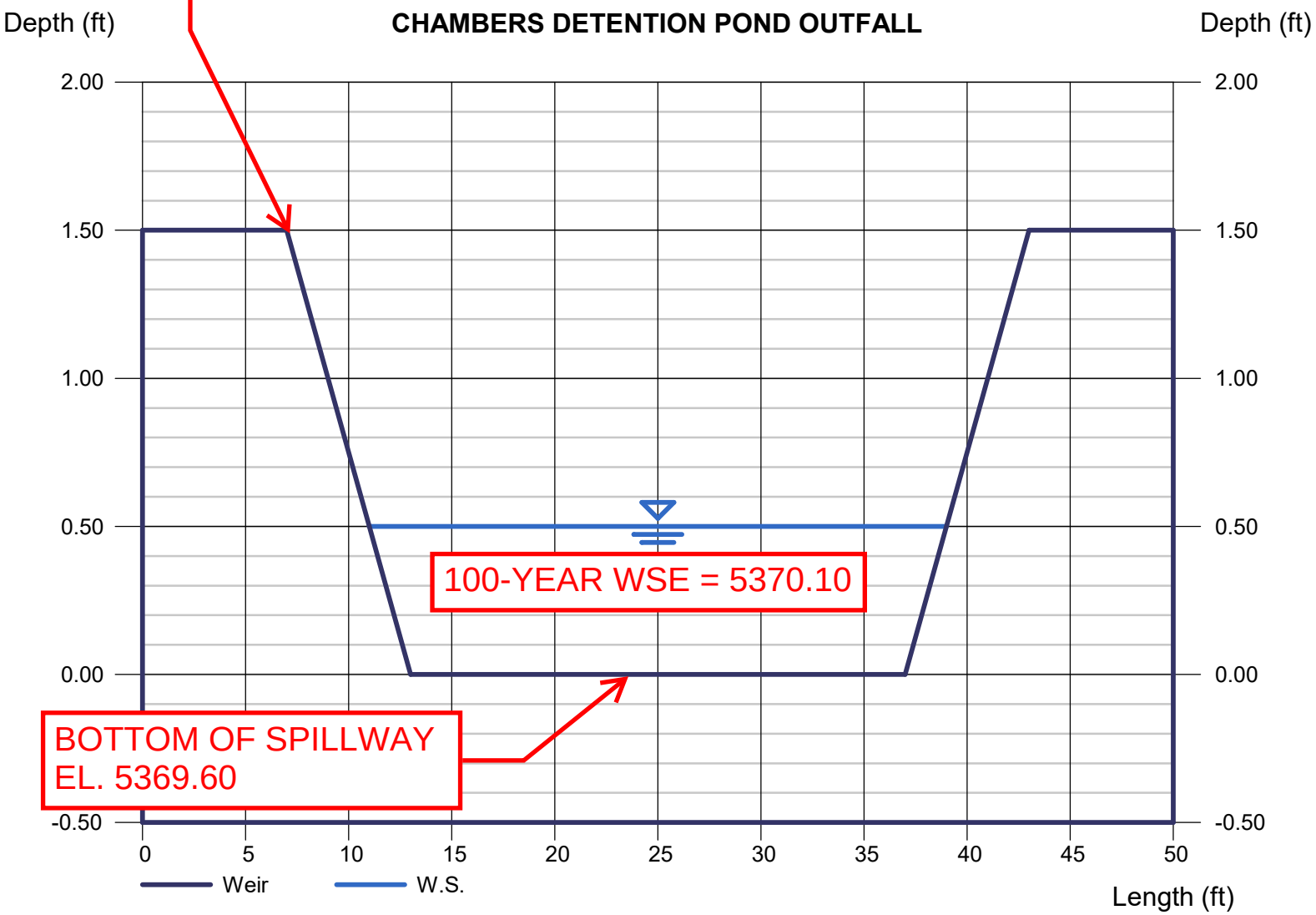
Depth (ft)	= 0.50
Q (cfs)	= 22.88
Area (sqft)	= 13.00
Velocity (ft/s)	= 1.76
Top Width (ft)	= 28.00

Calculations

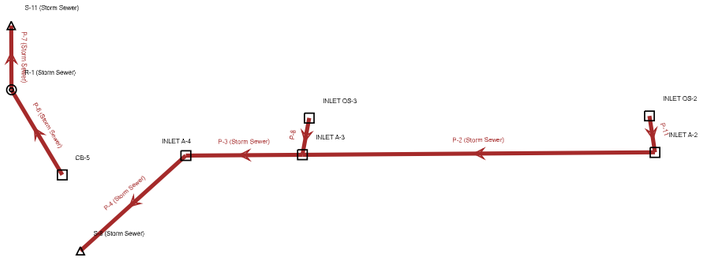
Weir Coeff. Cw	= 2.60
Compute by:	Known Q
Known Q (cfs)	= 22.88

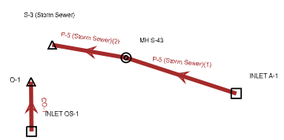
100-YEAR OUTFLOW *PER RATIONAL METHOD CALCULATION WITHIN APPENDIX B

TOP OF SPILLWAY EL. 5371.10



2-YEAR ANALYSIS





Scenario: 2
Current Time Step: 0.000 h
FlexTable: Conduit Table

ID	Label	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Section Type	Diameter (in)	Manning's n	Rise (ft)	Span (ft)	System Known Flow (cfs)	Flow (cfs)	Velocity (ft/s)	Depth (Out) (ft)	Capacity (Full Flow) (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Notes
42	P-2 (Storm Sewer)	INLET A-2	5,366.55	INLET A-3	5,365.57	217.9	0.004	Ellipse	-	0.013	1.2	1.9	0.00	1.97	3.25	0.71	6.80	5,366.99	5,366.28	HERCP
43	P-3 (Storm Sewer)	INLET A-3	5,365.57	INLET A-4	5,365.31	72.0	0.004	Circle	18.0	0.013	-	-	0.00	2.87	3.49	0.67	6.31	5,366.28	5,365.98	RCP
44	P-4 (Storm Sewer)	INLET A-4	5,365.31	S-8 (Storm Sewer)	5,364.95	95.0	0.004	Circle	24.0	0.013	-	-	0.00	3.42	3.67	0.65	13.93	5,365.98	5,365.60	RCP
48	P-6 (Storm Sewer)	CB-5	5,364.86	R-1 (Storm Sewer)	5,364.65	61.1	0.003	Circle	12.0	0.013	-	-	0.10	0.10	1.37	0.15	2.09	5,365.01	5,364.80	RCP
49	P-7 (Storm Sewer)	R-1 (Storm Sewer)	5,364.65	S-11 (Storm Sewer)	5,364.51	39.7	0.003	Circle	12.0	0.013	-	-	0.10	0.10	1.38	0.13	2.11	5,364.80	5,364.64	RCP
70	CO-1	INLET OS-1	5,366.00	O-1	5,365.20	-	0.026	Circle	18.0	0.013	-	-	0.00	0.77	4.87	0.22	16.97	5,366.33	5,365.42	-
72	P-5 (Storm Sewer)(1)	INLET A-1	5,366.32	MH S-43	5,365.78	71.5	0.008	Ellipse	-	0.013	1.2	1.9	0.00	1.76	3.77	0.37	9.08	5,366.74	5,366.15	RCP
73	P-5 (Storm Sewer)(2)	MH S-43	5,365.78	S-3 (Storm Sewer)	5,365.20	46.3	0.013	Ellipse	-	0.013	1.2	1.9	0.00	1.74	4.47	0.32	11.69	5,366.20	5,365.52	RCP
75	P-11	INLET OS-2	5,366.52	INLET A-2	5,366.44	-	0.004	Circle	15.0	0.013	-	-	0.00	0.66	2.33	0.55	3.83	5,367.00	5,366.99	-
77	P-8	INLET OS-3	5,365.76	INLET A-3	5,365.68	-	0.003	Circle	12.0	0.013	-	-	0.00	0.40	2.06	0.60	2.10	5,366.28	5,366.28	-

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Scenario: 2
Current Time Step: 0.000 h
FlexTable: Catch Basin Table

ID	Label	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Inlet Type	Local Known Flow (cfs)	Hydraulic Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)	Notes
50	INLET A-2	5,369.91	5,369.91	Full Capture	0.00	5,366.99	5,366.99	TYPE '16' INLET
51	INLET A-3	5,369.09	5,369.09	Full Capture	0.00	5,366.28	5,366.28	TYPE '16' INLET
52	INLET A-4	5,368.86	5,368.86	Full Capture	0.00	5,365.98	5,365.98	TYPE '16' INLET
54	CB-5	5,366.03	5,366.03	Full Capture	0.10	5,365.01	5,365.01	'C' INLET
56	INLET A-1	5,368.98	5,368.98	Full Capture	0.00	5,366.74	5,366.74	TYPE '16' INLET
68	INLET OS-1	5,369.00	5,369.00	Full Capture	0.00	5,366.33	5,366.33	-
74	INLET OS-2	5,369.28	5,369.28	Full Capture	0.00	5,367.00	5,367.00	-
76	INLET OS-3	5,368.94	5,368.94	Full Capture	0.00	5,366.28	5,366.28	-

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Scenario: 2
Current Time Step: 0.000 h
FlexTable: Manhole Table

ID	Label	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Flow (Total Out) (cfs)	Depth (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Notes
36	R-1 (Storm Sewer)	5,368.02	5,368.02	0.10	0.15	5,364.80	5,364.80	MH
71	MH S-43	5,370.52	5,370.52	1.74	0.42	5,366.20	5,366.20	-

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Scenario: 2
Current Time Step: 0.000 h
FlexTable: Outfall Table

ID	Label	Elevation (User Defined Tailwater) (ft)	Elevation (Ground) (ft)	Boundary Condition Type	Hydraulic Grade (ft)	Flow (Total Out) (cfs)	Notes
38	S-8 (Storm Sewer)	-	5,367.21	Free Outfall	5,365.60	3.37	FES
39	S-11 (Storm Sewer)	-	5,366.80	Free Outfall	5,364.64	0.10	FES
40	S-3 (Storm Sewer)	-	5,366.40	Free Outfall	5,365.52	1.73	FES
69	O-1	-	5,366.00	Free Outfall	5,365.42	0.77	-

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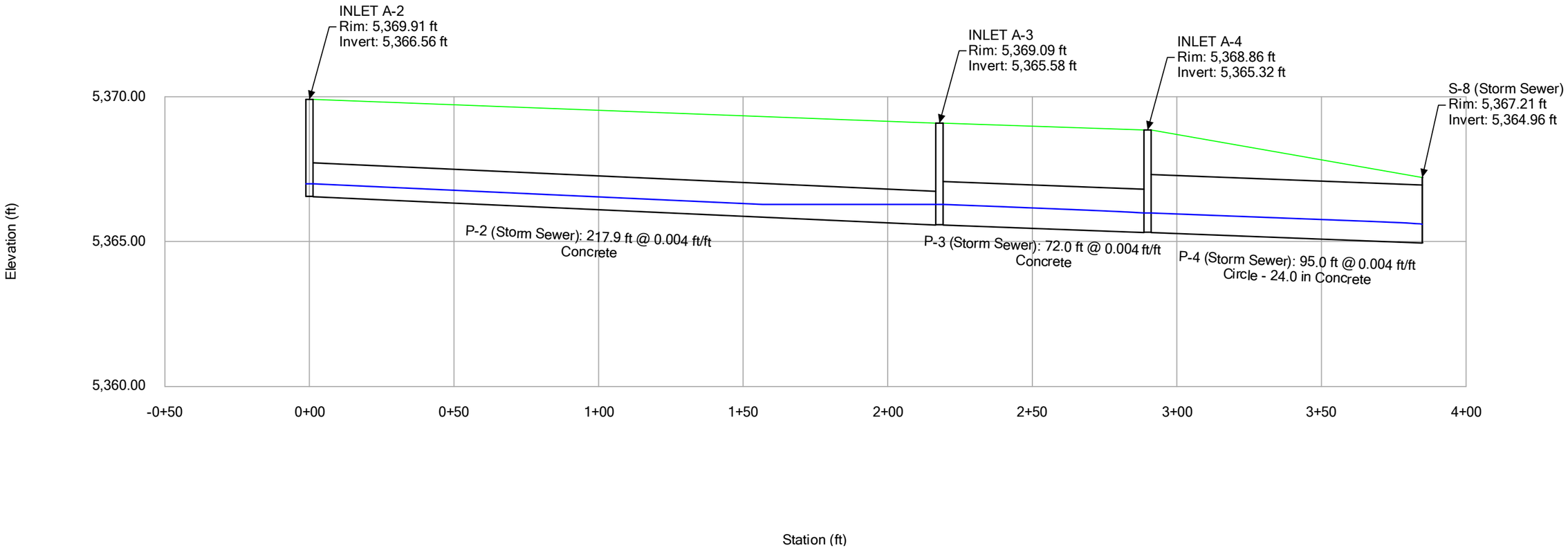
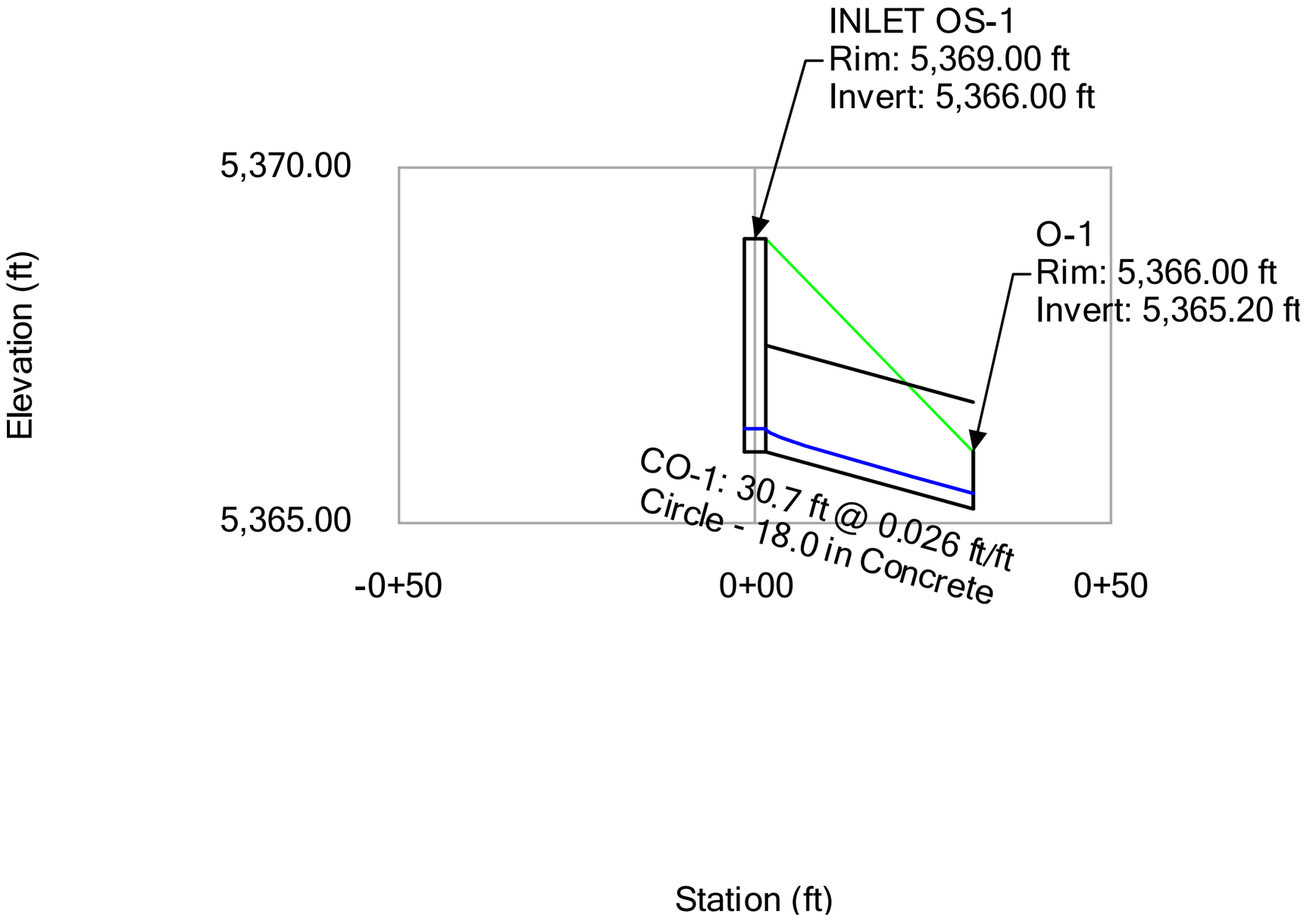
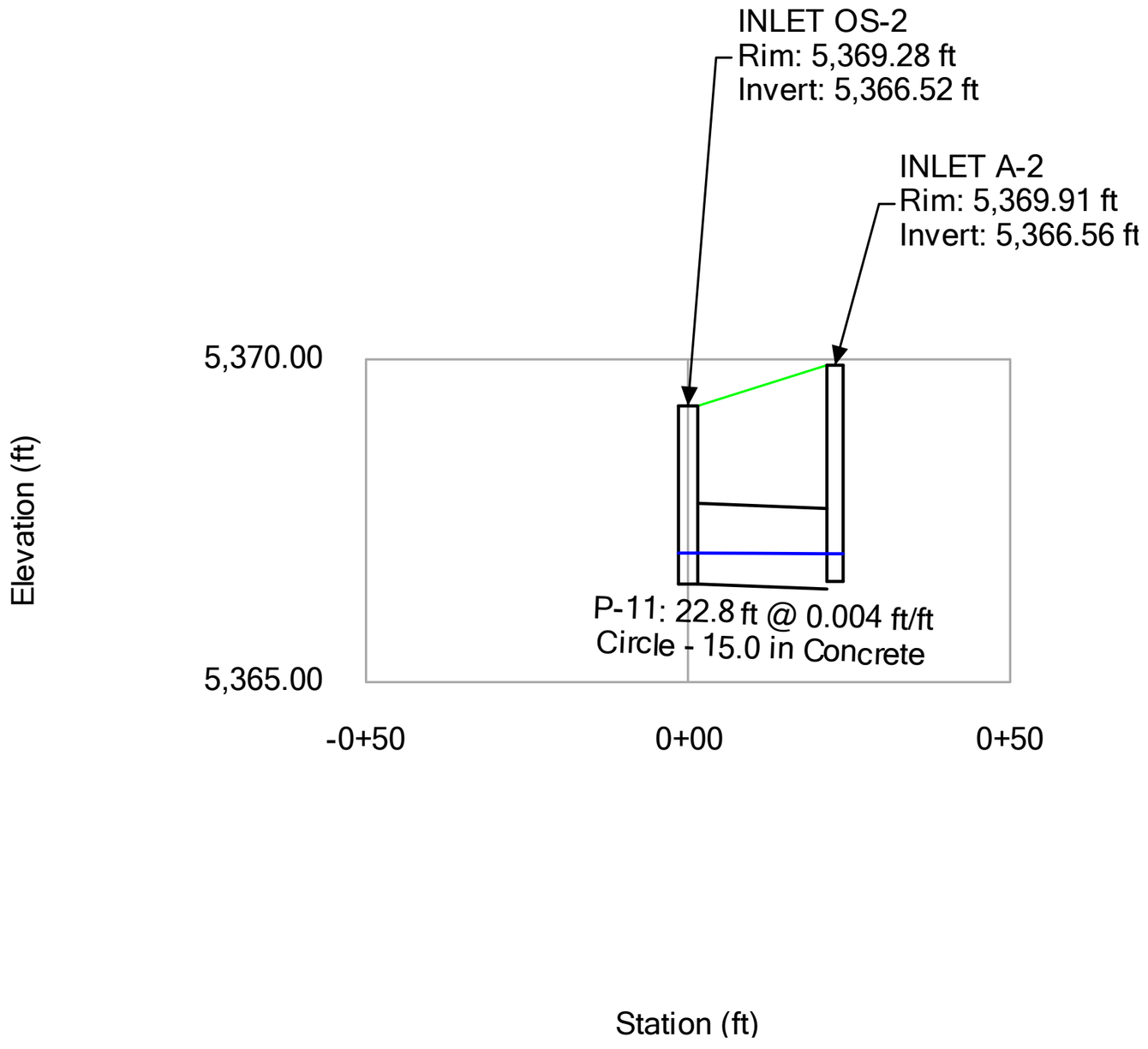
Profile Report
Engineering Profile - A2-POND OUTFALL (3550 CHAMBERS.stsw)



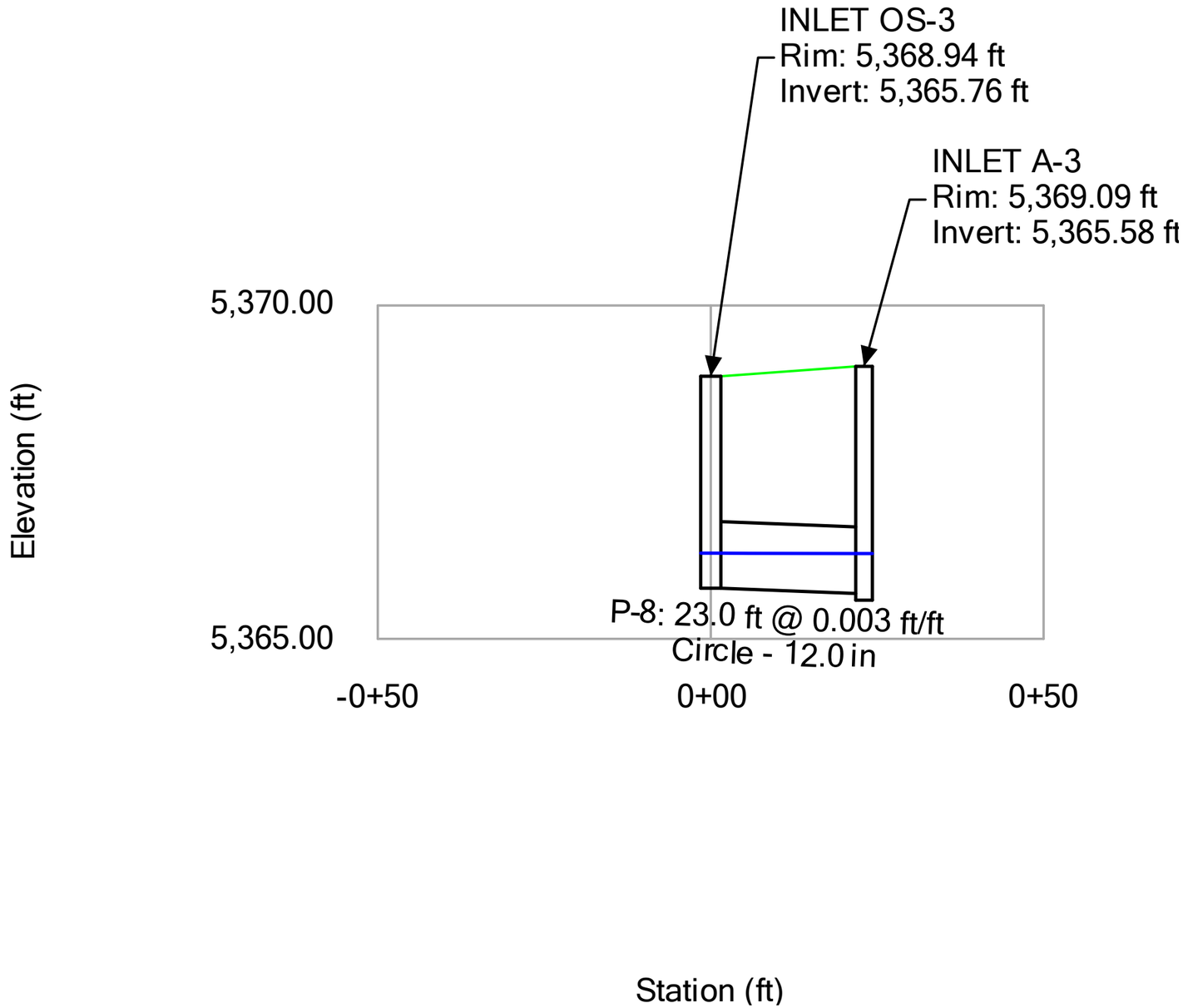
Profile Report
Engineering Profile - OS1-POND OUTFALL (3550 CHAMBERS.stsw)



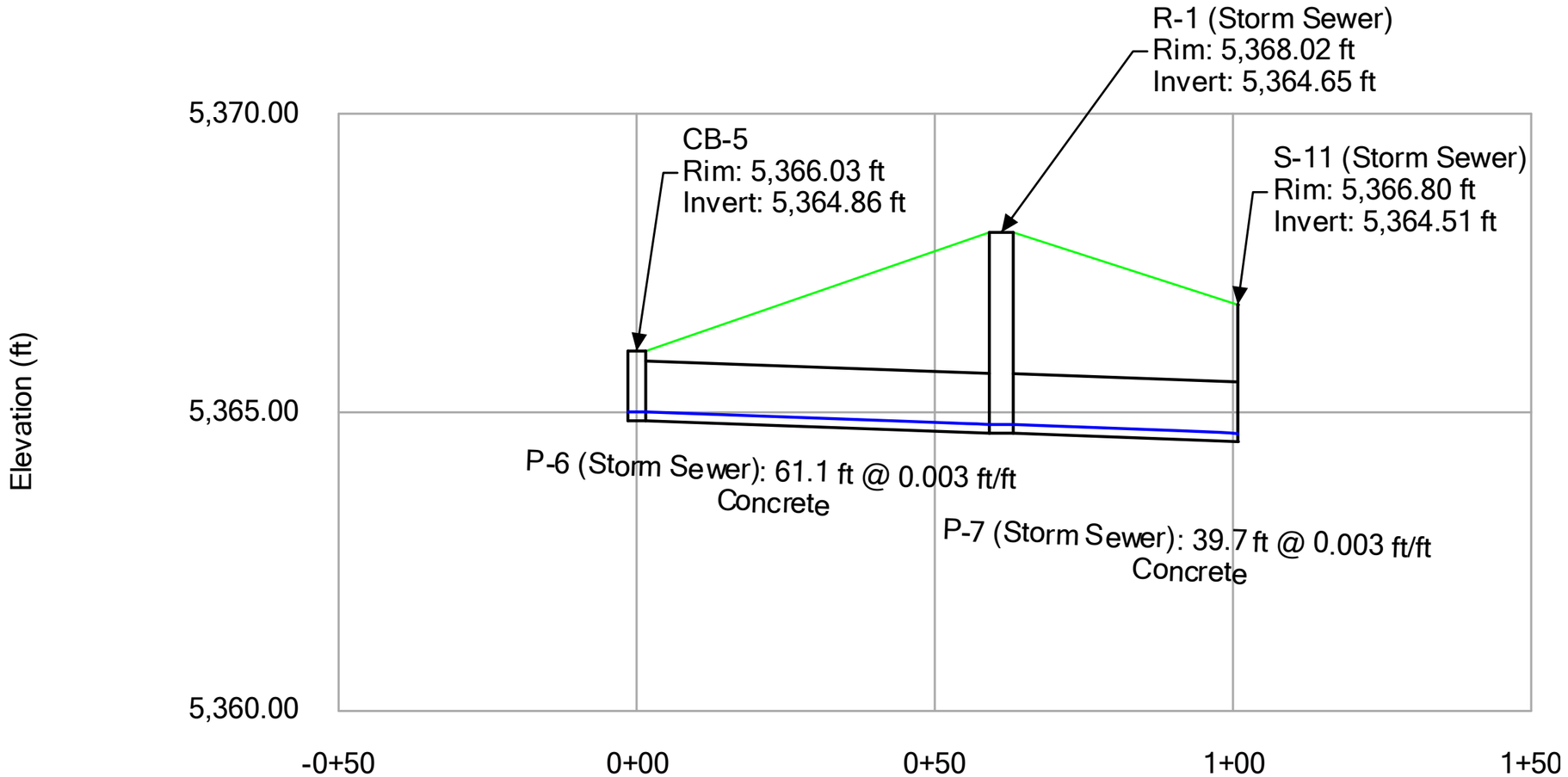
Profile Report
Engineering Profile - OS-2 (3550 CHAMBERS.stsw)



Profile Report
Engineering Profile - OS-3 (3550 CHAMBERS.stsw)

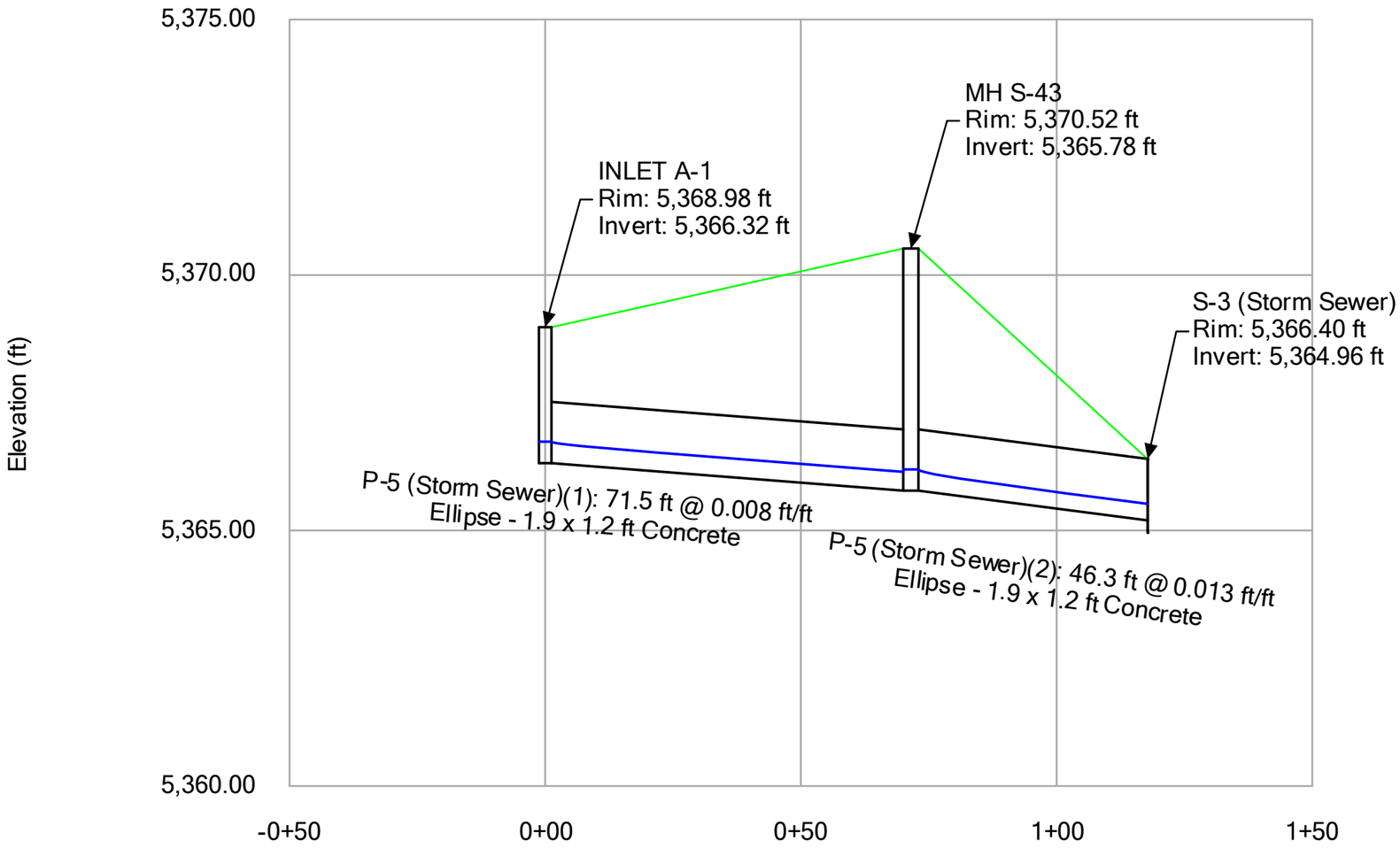


Profile Report
Engineering Profile - POND OUTFALL (3550 CHAMBERS.stsw)

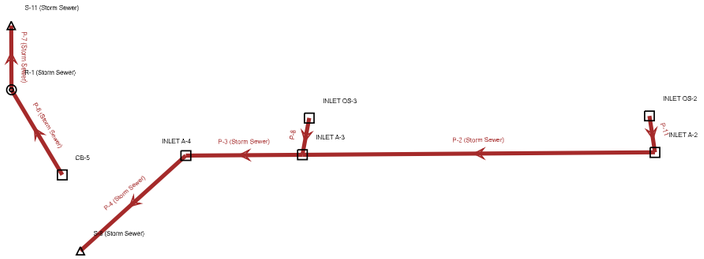


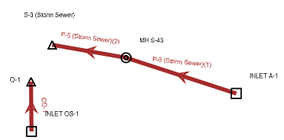
Profile Report

Engineering Profile - A-1 TO POND OUTFALL (3550 CHAMBERS.stsw)



100-YEAR ANALYSIS





Scenario: 100
Current Time Step: 0.000 h
FlexTable: Conduit Table

ID	Label	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Section Type	Diameter (in)	Manning's n	Rise (ft)	Span (ft)	System Known Flow (cfs)	Flow (cfs)	Velocity (ft/s)	Depth (Out) (ft)	Capacity (Full Flow) (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Notes
42	P-2 (Storm Sewer)	INLET A-2	5,366.55	INLET A-3	5,365.57	217.9	0.004	Ellipse	-	0.013	1.2	1.9	0.00	7.01	3.99	1.86	6.80	5,368.48	5,367.43	HERCP
43	P-3 (Storm Sewer)	INLET A-3	5,365.57	INLET A-4	5,365.31	72.0	0.004	Circle	18.0	0.013	-	-	0.00	10.26	5.81	1.43	6.31	5,367.43	5,366.74	RCP
44	P-4 (Storm Sewer)	INLET A-4	5,365.31	S-8 (Storm Sewer)	5,364.95	95.0	0.004	Circle	24.0	0.013	-	-	0.00	12.11	4.99	1.25	13.93	5,366.74	5,366.20	RCP
48	P-6 (Storm Sewer)	CB-5	5,364.86	R-1 (Storm Sewer)	5,364.65	61.1	0.003	Circle	12.0	0.013	-	-	2.30	2.30	2.93	0.81	2.09	5,365.73	5,365.46	RCP
49	P-7 (Storm Sewer)	R-1 (Storm Sewer)	5,364.65	S-11 (Storm Sewer)	5,364.51	39.7	0.003	Circle	12.0	0.013	-	-	2.30	2.30	2.93	0.65	2.11	5,365.46	5,365.16	RCP
70	CO-1	INLET OS-1	5,366.00	O-1	5,365.20	-	0.026	Circle	18.0	0.013	-	-	0.00	3.15	7.34	0.45	16.97	5,366.67	5,365.65	-
72	P-5 (Storm Sewer)(1)	INLET A-1	5,366.32	MH S-43	5,365.78	71.5	0.008	Ellipse	-	0.013	1.2	1.9	0.00	5.92	5.48	0.70	9.08	5,367.11	5,366.48	RCP
73	P-5 (Storm Sewer)(2)	MH S-43	5,365.78	S-3 (Storm Sewer)	5,365.20	46.3	0.013	Ellipse	-	0.013	1.2	1.9	0.00	5.86	6.52	0.61	11.69	5,366.57	5,365.81	RCP
75	P-11	INLET OS-2	5,366.52	INLET A-2	5,366.44	-	0.004	Circle	15.0	0.013	-	-	0.00	2.73	2.23	2.04	3.83	5,368.52	5,368.48	-
77	P-8	INLET OS-3	5,365.76	INLET A-3	5,365.68	-	0.003	Circle	12.0	0.013	-	-	0.00	1.52	1.93	1.75	2.10	5,367.47	5,367.43	-

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Scenario: 100
Current Time Step: 0.000 h
FlexTable: Catch Basin Table

ID	Label	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Inlet Type	Local Known Flow (cfs)	Hydraulic Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)	Notes
50	INLET A-2	5,369.91	5,369.91	Full Capture	0.00	5,368.48	5,368.48	TYPE '16' INLET
51	INLET A-3	5,369.09	5,369.09	Full Capture	0.00	5,367.43	5,367.43	TYPE '16' INLET
52	INLET A-4	5,368.86	5,368.86	Full Capture	0.00	5,366.74	5,366.74	TYPE '16' INLET
54	CB-5	5,366.03	5,366.03	Full Capture	2.30	5,365.73	5,365.73	'C' INLET
56	INLET A-1	5,368.98	5,368.98	Full Capture	0.00	5,367.11	5,367.11	TYPE '16' INLET
68	INLET OS-1	5,369.00	5,369.00	Full Capture	0.00	5,366.67	5,366.67	-
74	INLET OS-2	5,369.28	5,369.28	Full Capture	0.00	5,368.52	5,368.52	-
76	INLET OS-3	5,368.94	5,368.94	Full Capture	0.00	5,367.47	5,367.47	-

Scenario: 100
Current Time Step: 0.000 h
FlexTable: Manhole Table

ID	Label	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Flow (Total Out) (cfs)	Depth (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Notes
36	R-1 (Storm Sewer)	5,368.02	5,368.02	2.30	0.81	5,365.46	5,365.46	MH
71	MH S-43	5,370.52	5,370.52	5.86	0.79	5,366.57	5,366.57	-

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Scenario: 100
Current Time Step: 0.000 h
FlexTable: Outfall Table

ID	Label	Elevation (User Defined Tailwater) (ft)	Elevation (Ground) (ft)	Boundary Condition Type	Hydraulic Grade (ft)	Flow (Total Out) (cfs)	Notes
38	S-8 (Storm Sewer)	-	5,367.21	Free Outfall	5,366.20	11.98	FES
39	S-11 (Storm Sewer)	-	5,366.80	Free Outfall	5,365.16	2.30	FES
40	S-3 (Storm Sewer)	-	5,366.40	Free Outfall	5,365.81	5.83	FES
69	O-1	-	5,366.00	Free Outfall	5,365.65	3.14	-

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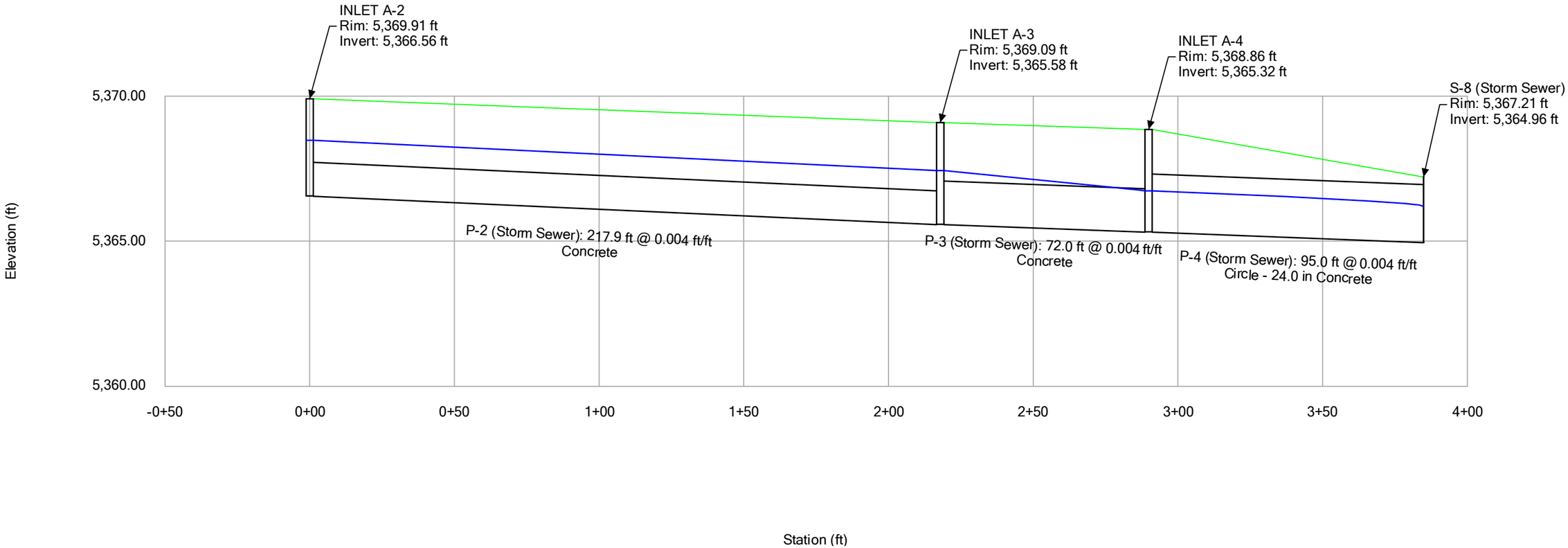
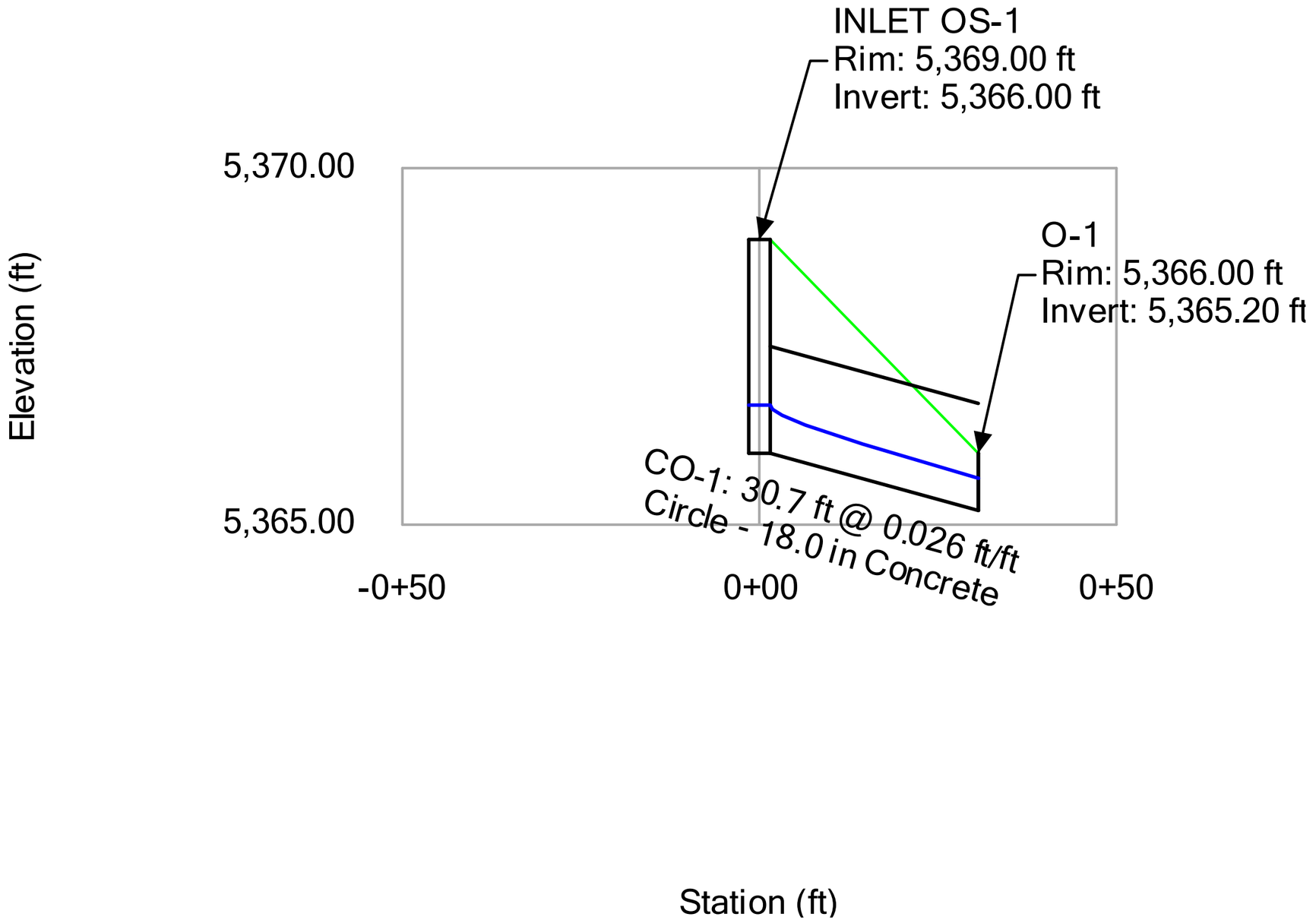
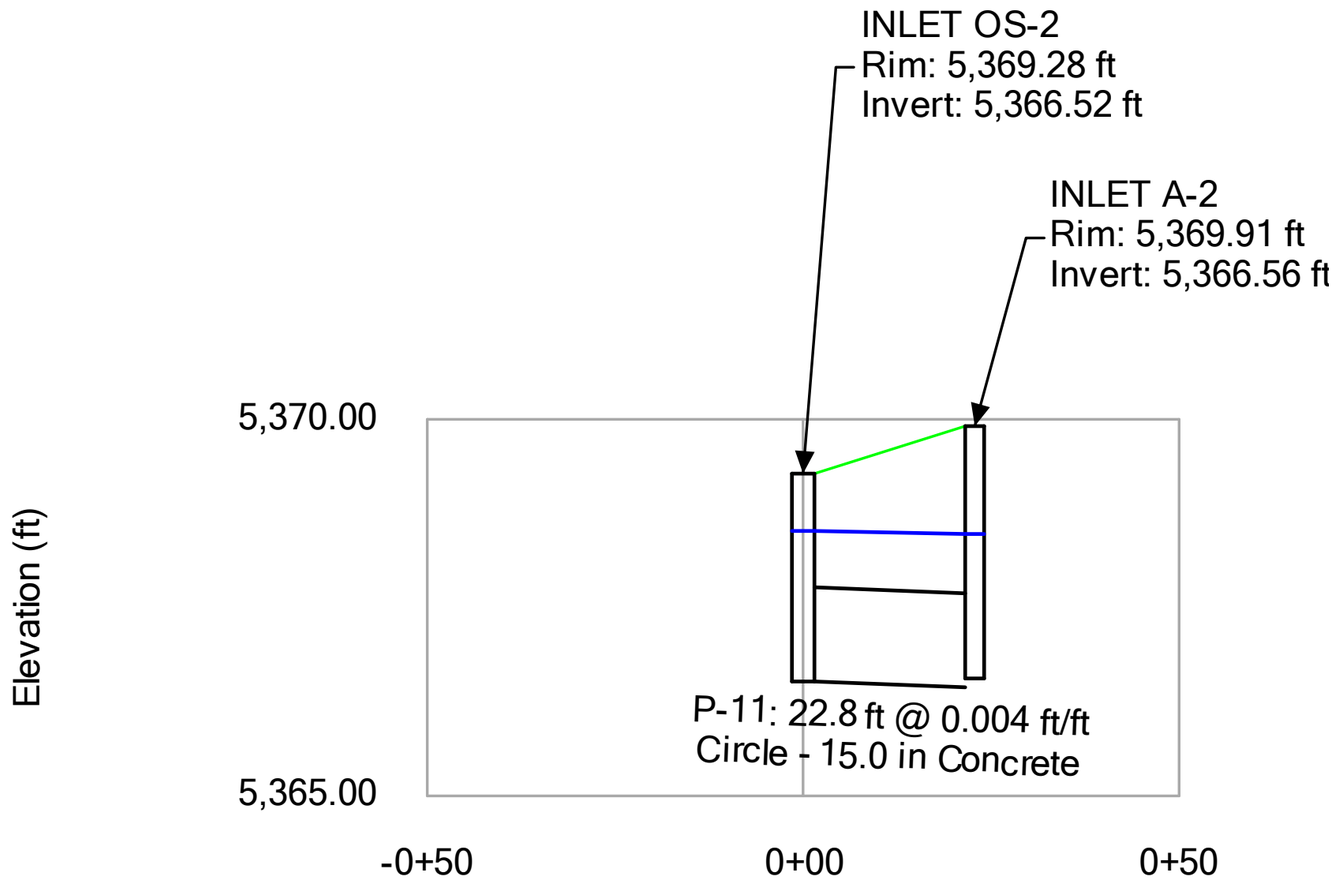
Profile Report
Engineering Profile - A2-POND OUTFALL (3550 CHAMBERS.stsw)



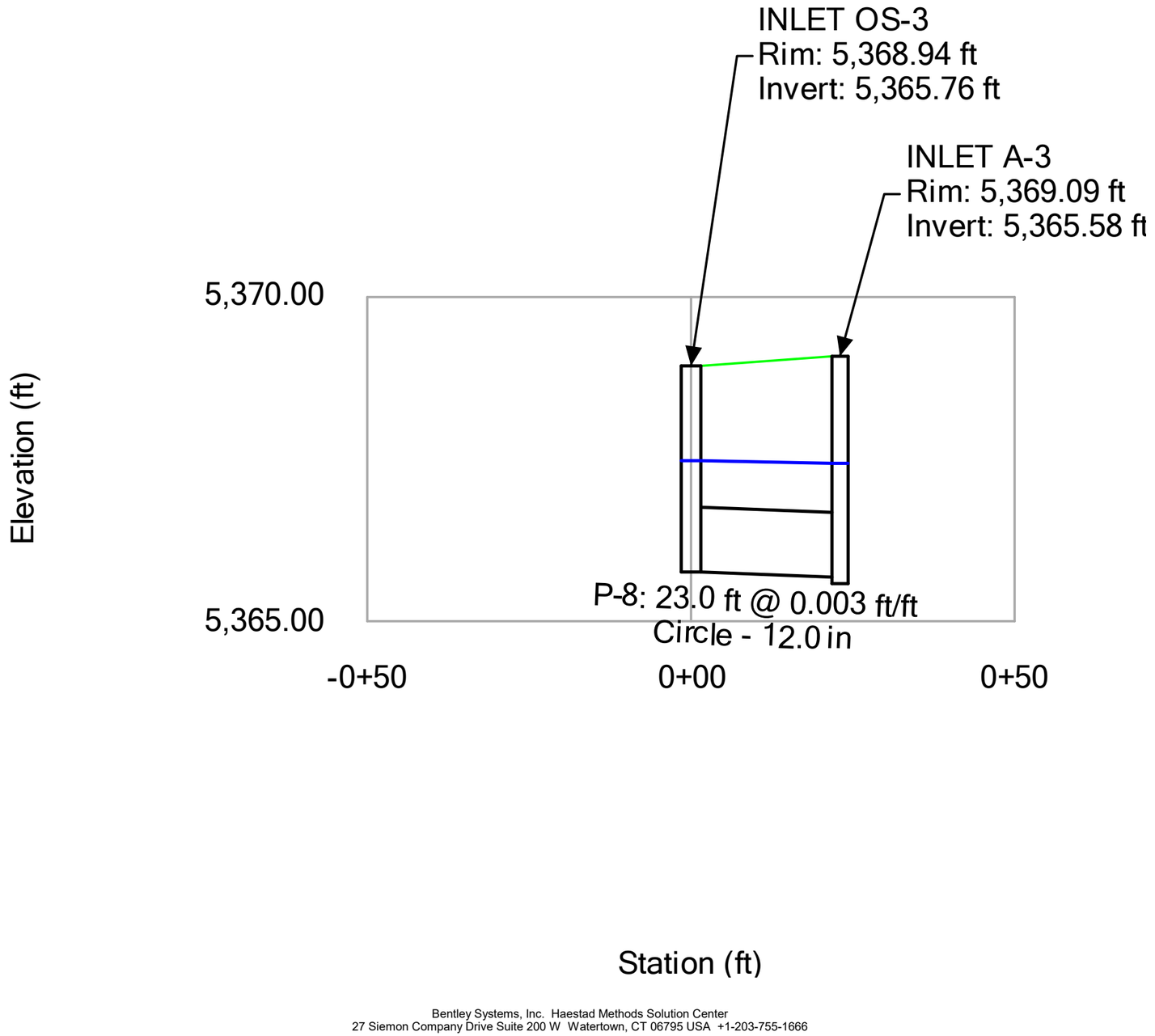
Profile Report
Engineering Profile - OS1-POND OUTFALL (3550 CHAMBERS.stsw)



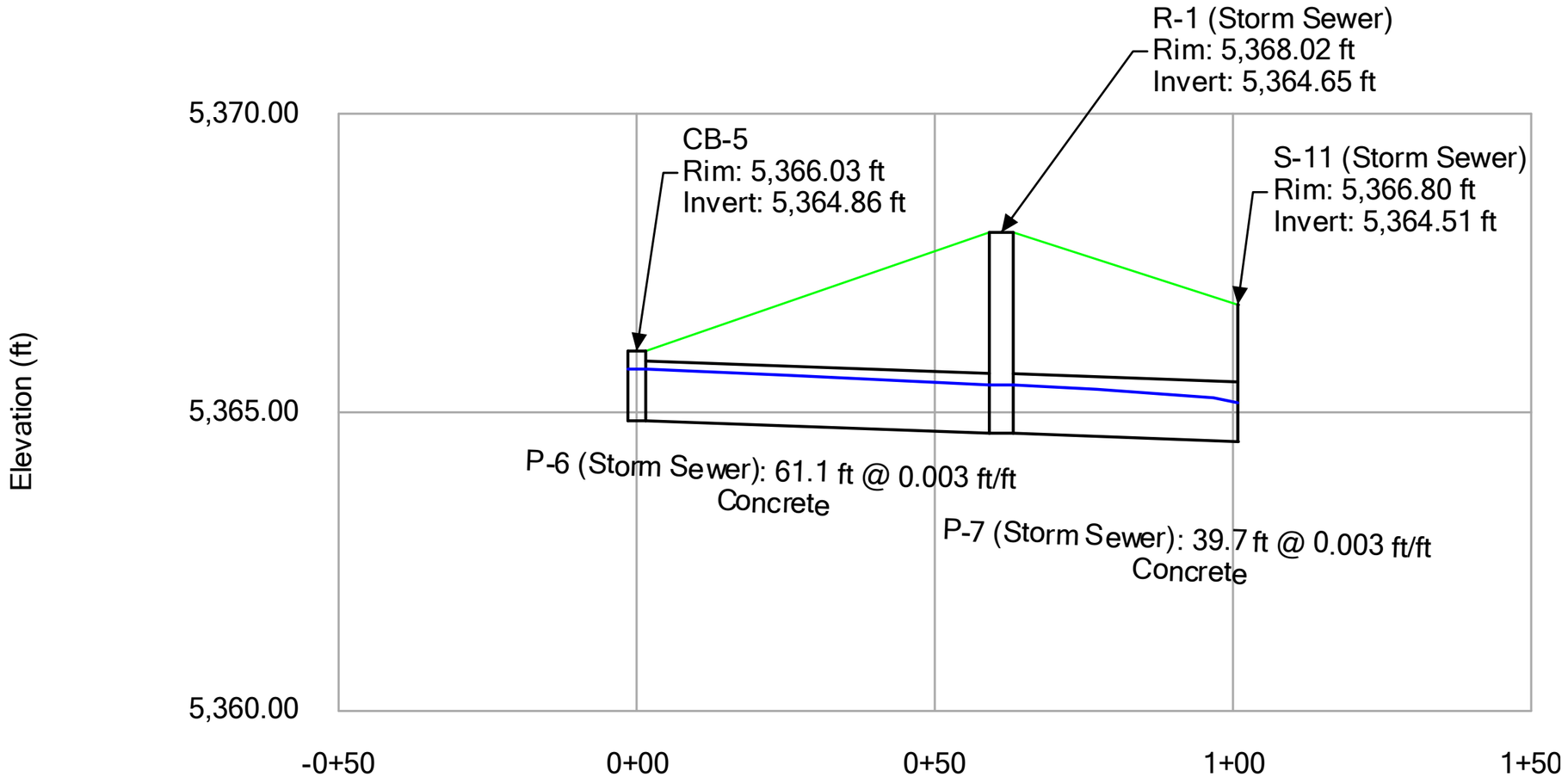
Profile Report
Engineering Profile - OS-2 (3550 CHAMBERS.stsw)



Profile Report
Engineering Profile - OS-3 (3550 CHAMBERS.stsw)

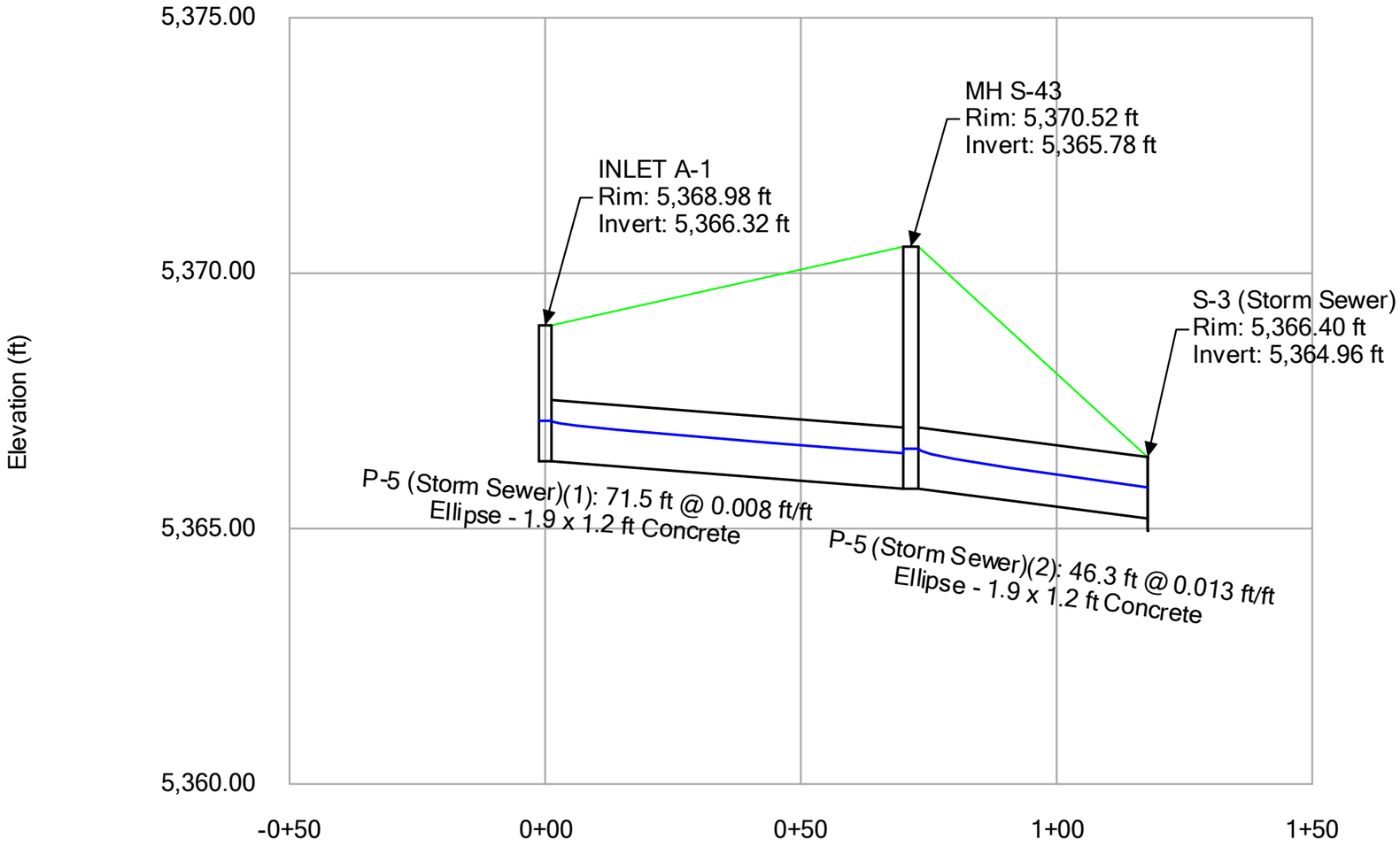


Profile Report
Engineering Profile - POND OUTFALL (3550 CHAMBERS.stsw)



Profile Report

Engineering Profile - A-1 TO POND OUTFALL (3550 CHAMBERS.stsw)



Colliers Engineering & Design

Appendix C

4. Supporting Documentation

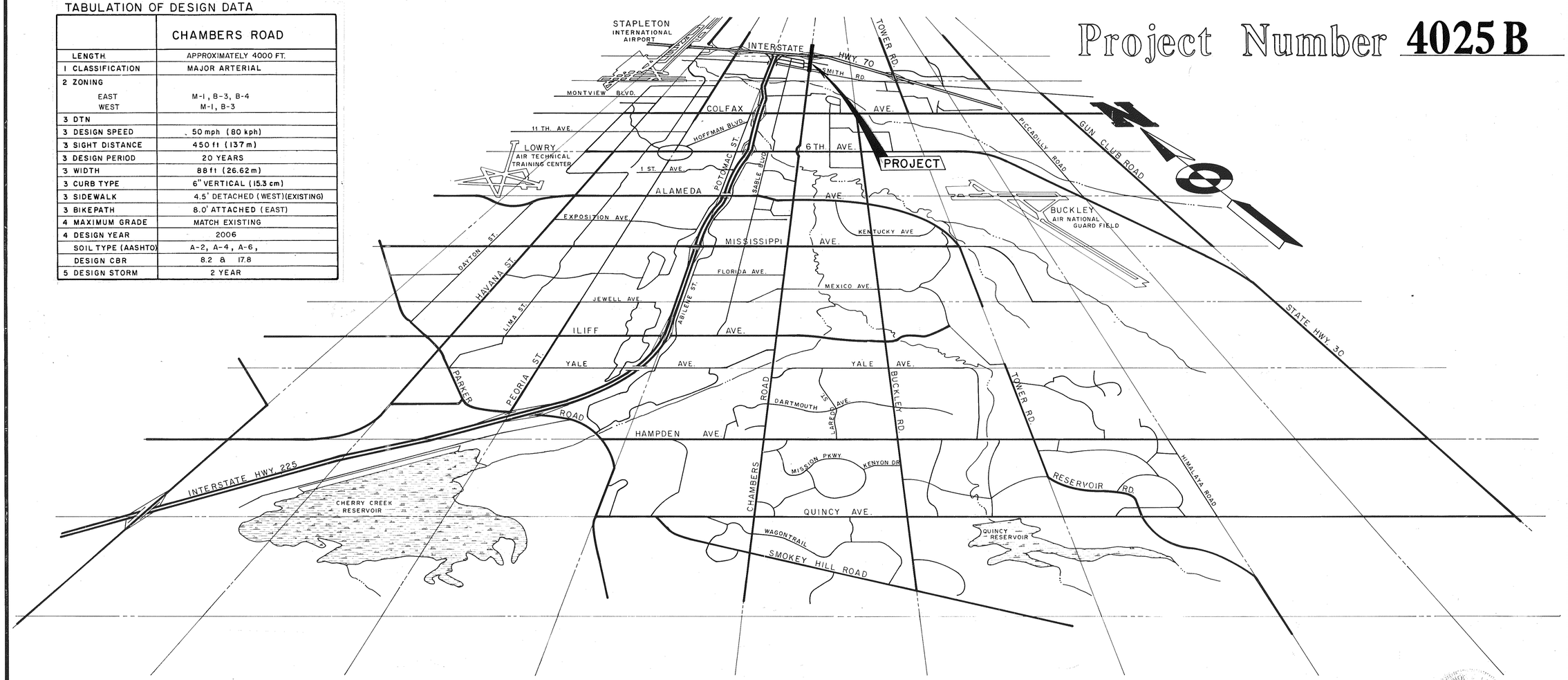
860101

Public Works Department

Project Number **4025 B**

TABULATION OF DESIGN DATA

	CHAMBERS ROAD
LENGTH	APPROXIMATELY 4000 FT.
1 CLASSIFICATION	MAJOR ARTERIAL
2 ZONING	
EAST	M-1, B-3, B-4
WEST	M-1, B-3
3 DTN	
3 DESIGN SPEED	50 mph (80 kph)
3 SIGHT DISTANCE	450 ft (137 m)
3 DESIGN PERIOD	20 YEARS
3 WIDTH	88 ft (26.62 m)
3 CURB TYPE	6" VERTICAL (15.3 cm)
3 SIDEWALK	4.5' DETACHED (WEST)(EXISTING)
3 BIKEPATH	8.0' ATTACHED (EAST)
4 MAXIMUM GRADE	MATCH EXISTING
4 DESIGN YEAR	2006
SOIL TYPE (AASHTO)	A-2, A-4, A-6,
DESIGN CBR	8.2 & 17.8
5 DESIGN STORM	2 YEAR



NOTES:

1. RESOLUTION 7-12-71 : MAP No. TR-500-8 ; AMENDED R74-13 : MAP No. TR-500-38
2. CITY OF AURORA COMPREHENSIVE PLAN AS ADOPTED AND AMENDED BY THE CITY COUNCIL OF AURORA, COLORADO.
3. SECTION 34-21 OF THE CITY CODE OF AURORA, COLORADO.
4. CITY ENGINEERING POLICY: SECTION 2-125, 34-16 AND 41-759 OF THE CITY CODE OF AURORA, COLORADO.
5. STORM DRAINAGE SECTION 17-16, 17-17 AND 17-18 OF THE CITY CODE OF AURORA, COLORADO.

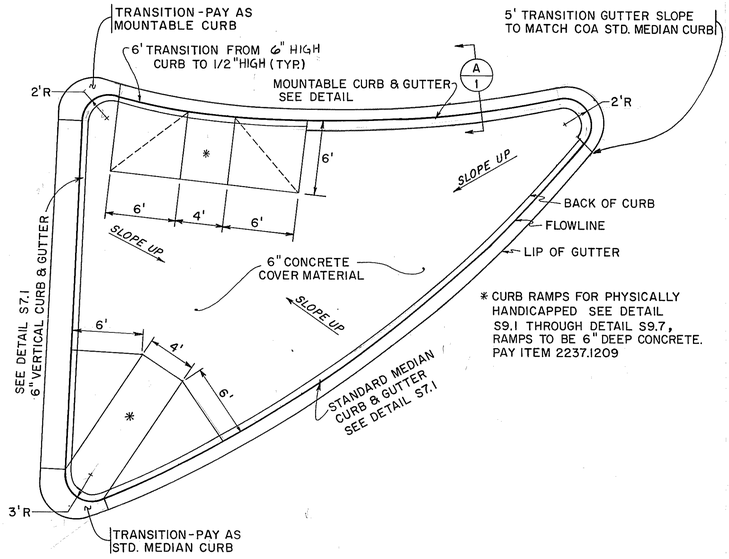
IMPROVEMENT DISTRICT 3-86

EAST HALF CHAMBERS ROAD

smith road to interstate 70

CITY OF AURORA COLORADO

860101



* CURB RAMPS FOR PHYSICALLY HANDICAPPED SEE DETAIL S9.1 THROUGH DETAIL S9.7, RAMPS TO BE 6" DEEP CONCRETE. PAY ITEM 2237.1209

38 th AVE TRAFFIC ISLAND PLAN

LEGEND

- PROPOSED PROJECT
- PROPOSED INLETS: SINGLE, DOUBLE, CURB OPENING
- EXISTING INLETS: SINGLE, DOUBLE, CURB OPENING
- PROPOSED WATER VALVE
- EXISTING WATER VALVE
- EXISTING WATER VALVE TO BE ADJUSTED TO GRADE
- PROPOSED MANHOLE
- EXISTING MANHOLE
- EXISTING MANHOLE TO BE ADJUSTED TO GRADE
- PROPOSED FIRE HYDRANT
- EXISTING FIRE HYDRANT ASSEMBLY
- EXISTING TELEPHONE MANHOLE
- TREE, STUMP
- BUSH, HEDGE
- BUILDING
- CULVERT
- TELEPHONE, POWER, MULTI-USE, LIGHT OR SIGNAL POLE
- RAILROAD TRACK
- BARBED WIRE, CHAIN LINK, WOOD, WIRE MESH (WM), SPLIT RAIL (SR)
- SECTION, 1/4, ETC. CORNER

- R.O.W. — RIGHT-OF-WAY LINE
- —0+00— CENTERLINE
- -----8"G----- EXISTING GAS LINE
- -----8"W----- EXISTING WATERLINE
- ----66"SS---- EXISTING STORM SEWER LINE
- ----24"San---- EXISTING SANITARY SEWER LINE
- -----T----- EXISTING TELEPHONE CABLE
- --UG----T-- EXISTING UNDERGROUND TELEPHONE
- -----P----- EXISTING POWER CABLE
- --UG---P--- EXISTING UNDERGROUND POWER
- ----TV----- EXISTING TELEVISION CABLE
- --UG---TV-- EXISTING UNDERGROUND TELEVISION
- SLOPE EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- TRAFFIC OR OTHER SIGN
- WATER OR GAS METER
- TELEPHONE, TRAFFIC SIGNAL, CABLE TELEVISION OR ELECTRICAL JUNCTION BOX

GENERAL NOTES

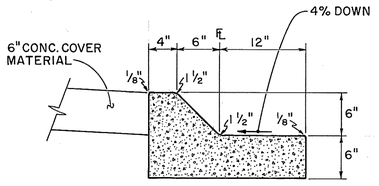
1. All work shall be done in accordance with the standard specifications of the City of Aurora.
2. Utilities are shown on the drawings according to the latest and best information available. However, it shall be the responsibility of the contractor to consult with the owners and field verify locations prior to construction. Call 534-6700 for blue stakes.
3. Unless otherwise noted, any adjustments or relocation of utilities shall be completed by the various utility owners. The contractor will be responsible for coordinating and arranging the relocation or adjustment. See SP-40
4. All traffic control signs shall be relocated by the City. Contact the Traffic Engineer 48 hours before relocation is desired.
5. Traffic control shall be in accordance with the Manual on Uniform Traffic Control Devices and subject to the approval of the City of Aurora Traffic Engineer.
6. Unless otherwise noted, all elevations are flow line.
7. Mail boxes and signs shall be relocated by the contractor. (The cost shall be included in clearing and grubbing.)
8. Valve boxes shall be adjusted to grade by the contractor. Cost shall be included in the cost of excavation.
9. Water meter and wet taps shall be installed by C.O.A. Contractor shall be responsible for all other materials and labor necessary for C.O.A. to make connection.
10. Any layer of bituminous pavement that is to be covered by a succeeding layer shall be completed full width before the next layer is placed.
11. All curb return radii shall be 25 ft. unless otherwise shown.
12. Pay quantities for earthwork shall be as listed in the proposal. Quantities are based on neat lines on the cross-section. No allowance shall be made for shrinkage or swell. Cross-sections are available in the Engineer's office for inspection.
13. Compaction shall be according to specifications Section 7.06. Areas that do not meet the specified moisture density requirements should be scarified wetted or dried and recompacted.
14. Cut and fill slopes shall be 3:1 except in slope paving areas, or as shown on the cross-sections, or authorized by the engineer.
15. For estimating purposes, the following rates of application were used:

    Tack coat at 0.1 gal. per sq. yd.

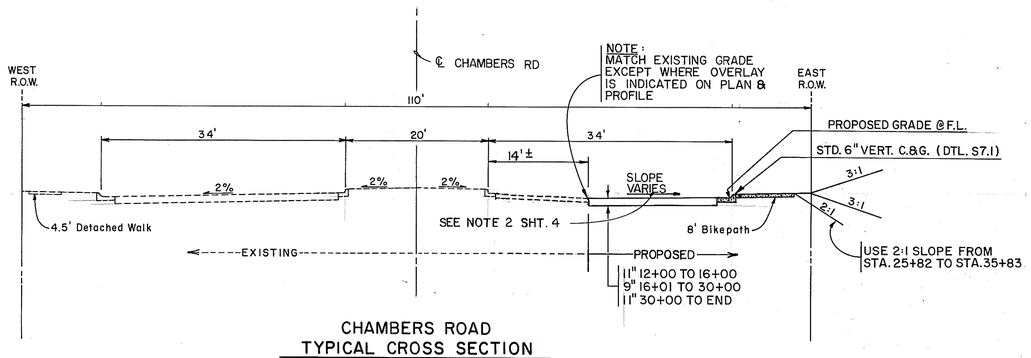
    Asphalt at 110 lb. per sq. yd @ 1" or 18.18 sq. yd per ton @ 1" deep

    Gravel at 1.8 tons per cu. yd.
16. Tack coat shall not be measured and paid for separately but shall be included in the price of asphalt.
17. All R.C.P. shall be Class III unless otherwise specified.
18. Contractor is to submit shop drawings for all special inlets.
19. All fire hydrants will be located not less than 3' nor more than 8.5' from flow line of curb to front outlet nut on the street side. Minimum clearance on all other sides will be 5'.
20. Pipe beddings will be as follows:

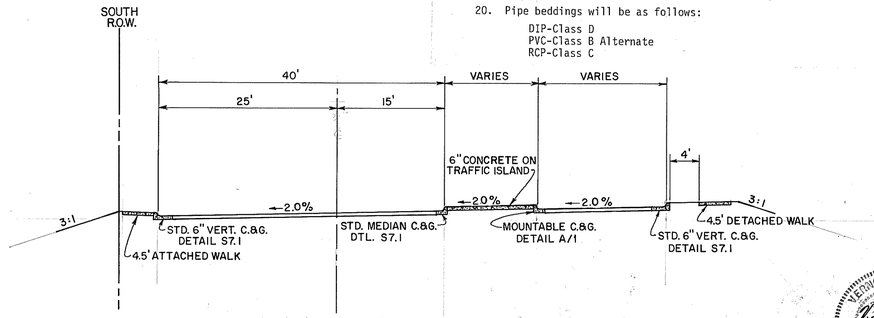
    DIP-Class D
    PVC-Class B Alternate
    RCP-Class C



A/1 6" MOUNTABLE CURB
NOT TO SCALE



CHAMBERS ROAD
TYPICAL CROSS SECTION
SCALE 1" = 10'



38th AVE. at TRAFFIC ISLAND
TYPICAL CROSS SECTION
SCALE 1" = 10'

VERNON E. TRAVER
REGISTERED
12937
5-30-88
PROFESSIONAL ENGINEER
STATE OF COLORADO

DEC. 86

REVISIONS	CITY OF AURORA ENGINEERING DIVISION	
	1470 South Havana St. Aurora, Colorado 80012 Phone 695-7300	DESIGNED BY R.F.H.
	IMPROVEMENT DISTRICT 3-86	DRAWN BY D. MEISE
	E.1/2 CHAMBERS RD., SMITH RD. to I-70	CHECKED BY
		SCALE As Shown
		PROJECT NUMBER 4025B
	CITY ENGINEER — DATE 11/26/86	SHEET 1 of 8

860121

860101

DRAINAGE

SHEET NO.	LOCATION (STATION)	PIPE C.M.P. D	PIPE C.M.P. Q	PIPE R.C.P. D	PIPE R.C.P. Q(FT)	FLARED END SECTION C.M.P. D	FLARED END SECTION C.M.P. Q	FLARED END SECTION R.C.P. D	FLARED END SECTION R.C.P. Q	INLET SIZE (FT)	INLET Q	M.H. D	M.H. Q
4	14+90	—	—	27	18	—	—	—	—	4	1	—	—
4	14+90 TO 18+73	—	—	36	379	—	—	—	—	—	—	6	1
4	14+90, 18+73	—	—	18	28	—	—	—	—	—	—	—	—
4	18+73 TO 19+53	—	—	36	75	—	—	—	—	9	1	—	—
4	19+53 TO 23+48	—	—	36	385	—	—	—	—	—	—	6	1
4	23+48 TO 24+70	—	—	33	119	—	—	—	—	—	—	—	—
5	24+70 TO 25+39	—	—	33	91	—	—	—	—	—	—	6	1
		—	—	—	—	—	—	—	—	—	—	—	—
		—	—	—	—	—	—	—	—	—	—	—	—
		—	—	—	—	—	—	—	—	—	—	—	—
5	25+40 TO 25+82			18	60			33	1				
		—	—	—	—	—	—	—	—	—	—	—	—
		—	—	—	—	—	—	—	—	—	—	—	—
		—	—	—	—	—	—	—	—	—	—	—	—
5	35+83 TO 39+70	—	—	27	376	—	—	—	—	11	1	6	1
5	27+56, 28+93, 30+15, 32+24	—	—	—	—	18	210	—	—	—	—	—	—
5		—	—	—	—	—	—	—	—	—	—	—	—
6	39+70 TO 40+49	—	—	27	75	—	—	—	—	8	1	—	—
6	40+49 TO 42+59	—	—	33	198	—	—	—	—	—	—	6	1
		—	—	—	—	—	—	—	—	—	—	—	—
		—	—	—	—	—	—	—	—	—	—	—	—
6	42+59	—	—	*	18	—	—	—	—	5	1	—	—
		—	—	—	—	—	—	—	—	—	—	—	—
6	44+20 TO 42+59	—	—	18	240	—	—	—	—	—	—	5	1
4	SPECIAL LATERAL-24"RCP & GRATE	—	—	24	13	—	—	—	—	—	—	—	—

*2×4 R.C.BOX

CONCRETE WORK

SHEET NO.	LOCATION (STATION)	VERT. C&G LF	MEDIAN CURB LF	HANDI-CAP RAMPS	4.5' WALK LF	8' WALK LF	6" CURB CUT SF
4	13+55 TO 18+50	542	703	2	—	502	462
4	19+50 TO 24+70	551	110	—	—	511	—
5	24+70 TO 25+42	87	—	—	—	47	—
5	25+82 TO 28+73	237	—	2	—	197	462
5	29+13 TO 32+04	219	—	2	—	219	231
5	32+44 TO 39+70	669	—	2	—	668	231
	36+00			1-MID. BLK.			
6	39+70 TO 43+74	346.4	118	2	—	267	483 A
6	38th AVE.	164	—	11 MID. BLK.	209	—	—
6	TRAFFIC ISLAND *	35	72	2 MID. BLK.	—	—	—
		2851		11 + 4 MID. BLK.	209	2411	1386
							483 A
4-6	MISC. REPAIR		30				
			1033				

* MOUNTABLE DTL. A/1 65'

A 10" CURB CUT - 483 SQ. FT.

SURFACING

SHEET	LOCATION (STATION)	HBP GRAD. E 9" S.Y.	HBP GRAD. E 11" S.Y.	HBP GRAD. E 6" S.Y.	TYPE II BASE 5" S.Y.	TYPE II BASE 6" S.Y.	TYPE II BASE 7" S.Y.	TYPE II BASE 8.5" S.Y.	4" ASPHALT CURB L.F.
4	12+33 TO 13+60		642						
4	13+60 TO 16+00		480						
4	16+00 TO 18+50	500		67					
4	18+50 TO 24+70	1469							
4	18+75								25
5	24+70 TO 30+00	1309				226			
5	30+00 TO 39+70		2016.0						
	45+81		1472.0						
6	39+70 TO 44+22			974		180			
6									
4-6	13+65 TO 47+65		393						
4	16+52 DRIVE					45			
4	18+00 "					55			
5	27+56 "					40			
5	30+15 "					45			
5	37+95 "					30			
6	40+92		120						
6	42+50 TO 44+00		190						
		3278	5003	1351		621			25

MISCELLANEOUS

SHEET NO.	LOCATION (STATION)	ITEM	QUANTITY
4-6	11+00 & 44+00 (SEE DWG.)	PROJECT SIGNS	2 EA.
4	16+37, 17+65, 22+47, 23+77	MEDIAN PLANTER	4 EA.
5	25+07, 26+37, 31+88 33+40, 39+40	MEDIAN PLANTER	5 EA.
5	26+60	CONCRETE	53 S.Y.
5	33rd Pl., 35th Ave.	CROSS PAN	1606 S.F.
4	12+33 TO 14+00	OVERLAY	334 S.Y.
5	24+75 TO 26+60	OVERLAY	150 S.Y.
5	28+50 TO 29+25	OVERLAY	66 S.Y.
6	42+32 TO 43+75	OVERLAY	370 S.Y.
4-6	27+00 TO 43+40	4" CONC. MED. COVER	936 S.Y.
6	44+54	6" CONC. TRAFFIC ISLAND COVER	72 S.Y.
6	45+00	RIP RAP	140 S.F.
4	20+55 & 21+40	F&I STRAND WIRE	22 L.F.
4	22+30 TO 23+20	F&I STRAND WIRE	100 L.F.
6	38+60 TO 40+70	F&I STRAND WIRE	105 L.F.
5	39+00 TO 40+60	F&I STRAND WIRE	150 L.F.

EARTHWORK

LOCATION (STATION)	EXCAVATION (C.Y.)	EMBANKMENT (C.Y.)
12+33 TO 18+50	187.0	766.4
18+50 TO 29+00	826.8	313.6
29+00 TO 35+00	248.1	486.1
35+00 TO 45+81	1523.2	318.0
38th AVE. DITCH WORK	616.9	—0—
	50	
	3452.0	1884.1

SANITARY SEWER

SHEET NO	LOCATION (STATION)	PIPE D	PIPE Q(FT.)	MANHOLE D	MANHOLE Q
4	18+95*	8	37	4	1
4	18+95 TO 21+55	8	258	4	1
4	21+55 TO 24+70	8	314	—	—
5	24+70 TO 25+50	8	80	—	—
5	25+50	8	35	4	1
5	25+50 TO 28+88	8	337	—	—
5	28+88* **	12	96	4	1
5	32+28*	12	96	4	1
5	36+28*	12	75	4	1
	TOTALS	8	1061		
		12	267		

* WATER TIGHT CAP (INCLUDED IN COST OF PIPE)
** DROP MANHOLE

WATER

LOCATION (STATION)	ITEM	PIPE D	PIPE Q	VALVE D	VALVE TYPE
19+31	FIRE HYDRANT ASS'Y. & WET TAP	—	—	6"	GATE
32+33	EXTEND 8" C.I.P.	8"	23	2"	B.O.
32+51	FIRE HYDRANT ASS'Y. & 8"×6" TEE	—	—	6"	GATE
36+44	WET TAP 16"×8" & EXTEND 8" DIP	8"	75	8"	GATE
41+20	RESET FIRE HYDRANT	—	—	—	—
29+00	EXTEND 8" DIP	8"	95	2"	B.O.
29+03	WET TAP 16"×8"	—	—	8"	GATE
44+00±	RELOCATE WATER METER-ONE	—	—	—	—
36+40				2"	B.O.
			193		

REMOVALS

SHEET NO	ITEM	QUANTITY
4	REMOVE C.M.P.	40 L.F.
4-6	REMOVE MEDIAN ROCK	2000 S.Y.
4	REMOVE BARB WIRE FENCE	140 L.F.
4	REMOVE WIRE MESH FENCE	25 L.F.
4	REMOVE MEDIAN C&G.	813 L.F.
5	REMOVE C.M.P.	62 L.F.
5	REMOVE CONC. DRIVE	792 S.F.
5	REMOVE CHAIN LINK FENCE	115 L.F.
5	REMOVE WIRE MESH FENCE	50 L.F.
5	REMOVE BARB WIRE FENCE	250 L.F.
6	REMOVE MEDIAN C&G.	118 L.F.
6	REMOVE SPLIT RAIL FENCE	40 L.F.
6	REMOVE ASPHALT	528 S.Y.
6	REMOVE SIDEWALK	160 L.F.
6	REMOVE EXIST. AREA INLET	1 EA.
6	REMOVE 18" RCP	10 L.F.
6	REMOVE 45×29 STUB	5 EA.
6	" CHAIN LINK FENCE	100 L.F.

RELOCATE FENCE

SHEET NO	ITEM	QUANTITY (FT.)
4	WIRE MESH-PRIOR TO CONSTR.	310
4	WIRE MESH-AFTER CONSTR.	310
4	BARB WIRE-PRIOR TO CONSTR.	22
4	WIRE MESH-PRIOR TO CONSTR.	11
4	WIRE MESH-AFTER CONSTR.	11
4	BARB WIRE-PRIOR TO CONSTR.	100
4	STRAND WIRE AFTER CONSTR	100
5	CHAIN LINK-PRIOR TO CONSTR.	130
5	CHAIN LINK-AFTER CONSTR.	130
5	WIRE MESH-PRIOR TO CONSTR.	22
5	WIRE MESH-AFTER CONSTR.	22
5	BARB WIRE-PRIOR TO CONSTR.	150
5	BARB WIRE-PRIOR TO CONSTR.	150
6	BARB WIRE-PRIOR TO CONST.	105
6	SPLIT RAIL-PRIOR TO CONST.	120
6	SPLIT RAIL-AFTER CONST.	120
6	CHAIN LINK-PRIOR TO CONSTR.	150

VERNON E. TARBET REGISTERED PROFESSIONAL ENGINEER 12937 5-29-81 STATE OF COLORADO

DEC. 86

REVISIONS

CITY OF AURORA ENGINEERING DIVISION
1470 South Havana St.
Aurora, Colorado 80012
Phone 695-7300

IMPROVEMENT DISTRICT 3-86
E.1/2 CHAMBERS RD., SMITH RD. to I-70

CITY ENGINEER — DATE 11/26/86

DESIGNED BY R.H.
DRAWN BY T.R.H.
CHECKED BY
SCALE
PROJECT NUMBER 4025.B
SHEET 2 of 8

860101

860101 3/8

SUMMARY OF APPROXIMATE QUANTITIES

CONTRACT ITEM No.	CONTROL ITEM No.	ITEM DESCRIPTION	UNIT	QUANTITY	MEASUREMENT & PAYMENT REFERENCE SPECS.
1	1601.0000	POTHOLE	EA.	10	20.30
2	2111.0000	CLEARING & GRUBBING	L.S.	1	7.09
3	2113.0000	EXCAVATION	C.Y.	5336	7.09
4	2211.0610	REMOVE MEDIAN CURB	L.F.	931	"
5	2213.0900	REMOVE CONCRETE SIDEWALK & CURB CUT	L.F.	160	"
6	2218.0000	REMOVE CONCRETE DRIVEWAY	S.F.	792	"
7	2231.0610	FURNISH & INSTALL MEDIAN C. & G.	L.F.	1033	11.16 & S.P. 37
9	2232.9000	F&I SR. CONC. CURB/MOUNTABLE CURB	L.F.	65	11.16
8	2231.0620	FURNISH & INSTALL 6" VERTICAL C&G	L.F.	2851	"
10	2233.0450	FURNISH & INSTALL 4.5' SIDEWALK	L.F.	209	"
11	2233.0800	FURNISH & INSTALL 8' WIDE BIKEPATH	L.F.	2411	"
12	2234.0006	F. & I. CURB CUT/6" THICK	S.F.	1386	"
13	2234.0010	F. & I. CURB CUT/10" THICK	S.F.	483	"
14	2235.0000	F.&I. COA STD. CROSSPAN	SF.	1606	"
15	2237.0025	F. & I. HANDICAP RAMP/25'R	EA.	11	"
16	2237.1299	F. & I. HANDICAP RAMP/MIDBLOCK	EA.	4	11.16 & S.P.16
17	2238.0160	F. &I. CONC. DRIVE/6" THICK	S.F.	470	11.16
18	2312.8040	REMOVE ASPHALT SURF. (DRIVEWAYS)	S.Y.	528	7.09
19	2331.2060	F. & I. TYPE II GRAVEL BASE/6"	S.Y.	621	9.06
20	2332.6060	F. & I. H.B.P./GRADE "E"/6"	S.Y.	1351	9.06 & S.P. 32,38
21	2332.6090	F. & I. H.B.P./GRADE "E"/9"	S.Y.	3278	9.06 & S.P. 20,32
22	2332.6110	F. & I. H.B.P./GRADE "E"/11"	S.Y.	5003	"
23	2333.7015	F. & I. OVERLAY/GRADE "EX"/1.5"	S.Y.	1555	9.06 & S.P. 32
24	2431.0000	F. & I. ASPHALT CURB	L.F.	25	9.06
25	2511.2000	REMOVE FENCE/BARBED/STRAND WIRE	L.F.	493	S.P. 36
28	2516.0000	REMOVE FENCE/WIRE MESH	L.F.	20	"
26	2512.0000	REMOVE FENCE/CHAIN LINK	L.F.	202	"
27	2514.0000	REMOVE FENCE/SPLIT RAIL	L.F.	37	"
29	2521.2000	RESET FENCE/BARBED WIRE	L.F.	377	"
32	2526.0000	RESET FENCE/WIRE MESH	L.F.	686	"
30	2522.0000	RESET FENCE/CHAIN LINK	L.F.	410	21.04 & S.P. 36
31	2529.0000	RESET FENCE/SPLIT RAIL	L.F.	240	SP. 36
33	2531.0000	F&I FENCE/SMOOTH WIRE	L.F.	371	21.04 & S.P. 36

34	3010.0000	REMOVE DRAINAGE PIPES & STRUCTURE	L.S.	1	7.09
35	3133.1831	F. & I. 18" R.C.P./CL. 3	L.F.	327	17.02
40	3139.2431	F. & I. 24" R.C.P./CL. 3	L.F.	11	17.02 & S.P. 39
36	3133.2731	F. & I. 27" R.C.P./CL. 3	L.F.	480	17.02
38	3133.3331	F. & I. 33" R.C.P./CL. 3	L.F.	408	"
39	3133.3631	F. & I. 36" R.C.P./CL. 3	L.F.	839	"
37	3133.3308	F. & I. 33" END SECTION	EA.	1	"
41	3210.0000	REMOVE EXISTING C.M.P.	L.F.	102	"
42	3230.1800	F. & I. CMP - 18" DIAMETER	L.F.	210	"
43	3331.0802	F. & I. PVC SAN. SEWER/8"/6'-10' DEEP	L.F.	350	17.02
44	3331.0803	F. & I. PVC SAN. SEWER/8"/11'-15' DEEP	L.F.	753	"
45	3331.1203	F. & I. PVC SAN. SEWER/12"/11'-15' DEEP	L.F.	71	"
46	3331.1204	F. & I. PVC SAN. SEWER/12"/16'-20' DEEP	L.F.	180	"
47	3431.1040	F. & I. CURB OPENING INLET/4'	EA.	1	17.02
48	3431.1050	F. & I. CURB OPENING INLET/5'	EA.	1	"
49	3431.1080	F. & I. CURB OPENING INLET/8'	EA.	1	"
50	3431.1090	F. & I. CURB OPENING INLET/9'	EA.	1	"
51	3431.1110	F. & I. CURB OPENING INLET/11'	EA.	1	"
52	3432.1051	MANHOLE/5'ϕ/0-5' DEEP	EA.	1	17.02
53	3432.1061	MANHOLE/6'ϕ/0-5' DEEP	EA.	5	"
70	5231.0422	F. & I. CONC. BOX 2'X4'X 0' TO 5' DEEP	L.F.	18	"
54	3531.1918	R.I.P. RAP/CLASS III/18" DEEP	S.F.	140	18.05
55	3632.1043	F. & I. SAN. 4'ϕ/10'-15' DEEP/M.H.	EA.	4	17.02
56	3632.1044	F. & I. SAN. 4'ϕ/16'-20' DEEP/M.H.	EA.	2	"
57	3734.1231	F&I CONC. ENCASEMT. (DETAIL 101)	L.F.	60	17.02 & S.P. 27
58	3734.3000	F&I CONC. CRADLE (DETAIL 401)	EA.	10	17.02 & S.P. 26
59	4530.0832	F. & I. 8" D.I.P./6'-10' DEEP/CL 50	L.F.	193	17.02 & S.P. 28
60	4631.0110	F. & I. 6" GATE VALVE/CL 50	EA.	2	" NOTE 1
61	4631.0210	F. & I. 8" GATE VALVE/CL 50	EA.	2	" NOTE 1
66	4732.0000	RESET FIRE HYDRANT ASSY.	EA.	1	"
68	4732.0000	F. & I. FIRE HYDRANT ASSY.	EA.	2	"
62	4634.0032	F. & I. 2" BLOWOFF ASSY W/ VAULT	EA.	3	"
			EA.	12	"
67	4725.0000	RESET WATER METER	EA.	1	S.P. 23 & 17.02
69	4833.5210	F. & I. 8" X 6" TEE/DIP/CL 50	EA.	1	17.02
64	4637.5310	F. & I. 12" X 6" WET TAP NOTE 2	EA.	1	"
65	4637.5420	F. & I. 16" X 8" WET TAP NOTE 2	EA.	2	"
63	4637.5210	F. & I. 8" X 6" WET TAP NOTE 2	EA.	1	"
72	7132.0000	F. & I. SOD	S.F.	10,900	S.P. 35 & 14.06
71	7131.1000	F. & I. SEED/C.O.A. MIX "A"	AC.	1	13.07
73	7313.0000	REMOVE MED. COVER MAT'L. /2"	S.Y.	2000	ALT. NO. 1 & 15.04 SP. 9

CONTRACT ITEM No.	CONTROL ITEM No.	ITEM DESCRIPTION	UNIT	QUANTITY	MEASUREMENT & PAYMENT REFERENCE SPECS.
74	7433.0004	F. & I. 4" CONC. MEDIAN COVER	S.Y.	936	15.04 & S.P. 31
75	7433.0006	F. & I. 6" CONC. MEDIAN COVER	S.Y.	72	"
ALT. No. 1	7631.1050	F. & I. MEDIAN PLANTER/50'	EA.	9	16.04 & S.P. 34
77	8223.2000	RELOCATE & REVISE PROJECT SIGN	EA.	2	S.P. 14
78	8470.0000	CONSTRUCTION TRAFFIC CONTROL	L.S.	1	S.P. 13
76	8133.1000	TRAFFIC SIGNAL CONDUIT	L.F.	600	22.07 & S.P. 25

NOTES
1. VALVE & VALVE BOX INCLUDED IN WET TAP RE: SP-23
2. CITY OF AURORA FORCES PERFORM ALL IN-LINE WET TAPS~RE: SP. 23

VERNON E. TABERT
REGISTERED
12937
5-29-86
PROFESSIONAL ENGINEER
STATE OF COLORADO

DEC. 86

CITY OF AURORA ENGINEERING DIVISION
1470 South Havana St.
Aurora, Colorado 80012
Phone 695-7300

IMPROVEMENT DISTRICT 3-86
CHAMBERS RD., SMITH RD. to I-70

CITY ENGINEER — 11/26/86 DATE

DESIGNED BY: R.F.H.
DRAWN BY: D. MEISE
CHECKED BY:
SCALE: As Shown
PROJECT NUMBER: 4025B
SHEET: 3 of 8

860101

860101 4/8
NOTES
1. EXISTING MEDIAN CURB TO BE REPAIRED ACCORDING TO DTL. WHERE DIRECTED BY ENGINEER.
2. VARY 2% CROSS SLOPE AS NECESSARY TO MATCH EXIST. ASPHALT (4% MAX., 1.5% MIN.)—AT LARGE SLOPE CHANGES SEE PLANS FOR OVERLAYS.
KEY MAP
NOT TO SCALE
CHAMBERS ROAD
U.P.R.R. R.O.W.
CHASE PIPELINE CO.
CENTERLINE SMITH ROAD
LOT 3 BLOCK 9 UPLAND PARK
STA. 16+37 50' MEDIAN PLANTER (SEE C.O.A. STD. DTL. S15.2)
TRAFFIC CONDUIT TO BE PLACED ALONG R.C.P.—12" MIN. COVER THIS LOCATION ONLY
P/O LOT 2 BLOCK 10 UPLAND PARK
LOT 1 ALDRED SUBDIVISION
UNPLATTED
P/O N 1/2 ; SW 1/4, SW 1/4, NW 1/4, SECTION 29, T3S, R66W
PROPOSED 12' CURB CUTS (CENTER ON EXIST. DRIVES)
Why they didn't update this with all of this work going on...
MATCHLINE
C.O.A. BENCHMARK #9-09 (C-40) ELEVATION 5387.79 CHISLED SQUARE "□", TOP OF EAST WING WALL AT SOUTHEAST CORNER OF CHAMBERS RD. BRIDGE OVER I-70.
122' AT -1.05%
200' VERT. CURVE K = 130'
145' AT 0.48%
300' AT 0.38%
300' AT 0.47%
150' AT 0.43%
EXISTING LIP OF MEDIAN
EXIST. FL
EXIST. EDGE OF OIL
TRAFFIC CONDUIT TO 45° DOWN UNDER BOTH R.C.P.'S @ NO ADDITIONAL COST TO THE CITY
CONTRACTOR TO COORDINATE RELOCATION OF 2" GAS
⊗ DENOTES POTHOLE LOCATION
NOTE: ALLOWABLE MAXIMUM INITIAL PIPE DEFLECTION IN SANITARY SEWER IMMEDIATELY AFTER INSTALLATION, BACKFILL, & COMPACTION SHALL NOT EXCEED 5% OF THE BASE INSIDE PIPE DIA.
48 hours before you dig, CALL FOR THE BLUE STAKES
534-6700
Gas, Electric, Telephone, CATV and Panhandle Eastern Pipeline Locations
AS CONSTRUCTED (STORM SEWER) ONLY
EXTENSION NO. 87-14SS
APPROVED 3-8-88
Traffic Engineer 12/4/86 Date
Director of Utilities Date
CITY OF AURORA ENGINEERING DIVISION
1470 South Havana St.
Aurora, Colorado 80012
Phone 695-7300
IMPROVEMENT DISTRICT 3-86
E 1/2 CHAMBERS RD., SMITH RD. to I-70
PLAN and PROFILE
CITY ENGINEER
DEC. 86
DESIGNED BY R.F.H.
DRAWN BY D. MEISE
SCALE 1"=50' H 1"=5' V.
PROJECT NUMBER 4025B
SHEET 4 of 8
STATE OF COLORADO
10+00
12+00
14+00
16+00
18+00
20+00
22+00
24+00
860101

8601015/8

NOTE: VARY 2% CROSS SLOPE AS NECESSARY TO MATCH EXISTING ASPHALT (4% MAX. 1.5% MIN.) AT LARGE SLOPE CHANGES SEE PLAN FOR OVERLAYS

NOTE: EXISTING MEDIAN CURB TO BE REPAIRED ACCORDING TO DTL. WHERE DIRECTED BY THE ENGINEER.

LOT 2 BLOCK II UPLAND PARK

LOT 2 BLOCK I UNION PACIFIC LAND RESOURCES CORP. SUBDIVISION FILING NO. 1

KEY MAP — NOT TO SCALE

STUB EAST FROM I-70 w/10"Ø RCP & FES

MATCHLINE STA. 24+70 FL EL 67.07

MATCHLINE STA. 39+70 INV. 57.64

CHAMBERS ROAD

N 1/2 NW 1/4 SW 1/4 NW 1/4 Section 29, T3S, R66W

C.O.A. BENCHMARK #9-09 (C-40) ELEVATION 5387.79
CHISLED SQUARE "□", TOP OF EAST WING WALL AT SOUTHEAST CORNER OF CHAMBERS RD. BRIDGE OVER I-70.

SAN. SEWER PROFILE STA.28+88

SAN. SEWER PROFILE STA.32+28

SAN. SEWER PROFILE STA.36+29

PARTIAL PROFILE OF EXIST. UTILITIES (TYP.)

◎ DENOTES POTHOLE LOCATION

NOTE: ALL WATER MAINS & SANITARY SEWERS SHALL BE PLACED A MIN. 2' CLR OF 20" GAS LINE. - TYPICAL

TEST PIT #10 SAND, silty, clayey, moist

TEST PIT #11 CLAY, silty, very sandy, moist

AS CONSTRUCTED (STORM SEWER ONLY)
EXTENSION NO. 87-14 SS
APPROVED 3-8-88 DEC. 86

VERNON E. TABLET — REGISTERED — 12937 — 5-29-86 — PROFESSIONAL ENGINEER — STATE OF COLORADO

48 hours before you dig, CALL FOR THE BLUE STAKES
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CITY OF AURORA ENGINEERING DIVISION
1470 South Havana St.
Aurora, Colorado 80012
Phone 695-7300

IMPROVEMENT DISTRICT 3-86
E.1/2 CHAMBERS RD., SMITH RD. to I-70
PLAN and PROFILE

TRAFFIC ENGINEER — DATE 12/4/86
DIRECTOR OF UTILITIES — DATE 12/2/86
CITY ENGINEER — DATE 11/26/86

DESIGNED BY R.F.H.
DRAWN BY D. MEISE
CHECKED BY
SCALE 1"=50' H 1"=5' V.
PROJECT NUMBER 4025 B
SHEET 5 of 8

8601015

860101 6/8

SCALE – FEET 0 50' 100' 150'

KEY MAP

NOT TO SCALE

CURVE DATA						
	Δ°	R(FT.)	L(FT.)	D°	T (FT.)	E (FT.)
①	72.54	25.00	31.65	229.18	18.34	6.01
②	106.87	3.00	5.60	1909.86	4.04	2.04
③	47.50	180.00	149.23	31.83	79.20	16.65
④	23.87	165.00	68.74	34.72	34.88	3.65
⑤	38.27	90.00	60.11	63.66	31.23	5.26
⑥	108.00	2.00	3.77	2864.79	2.75	1.40
⑦	115.07	40.00	80.33	143.24	62.87	34.52
⑧	30.04	205.00	107.5	27.95	55.00	7.25

C.O.A. BENCHMARK #9-09 (C-40) ELEVATION 5387.79
CHISLED SQUARE "D", TOP OF EAST WING WALL AT SOUTHEAST CORNER OF CHAMBERS RD. BRIDGE OVER I-70.

LEGEND
- 6" TYPE II GRAVEL
- 11" FULL DEPTH HBP
- 6" FULL DEPTH HBP
- 1" AVG HBP OVERLAY

(X) DENOTES POTHOLE LOCATION

NOTE STA 43+79 STOP PROPOSED GRADE. THIS PROJECT ASSUMES C.D.O.H.'s I-70 BRIDGE WORK IS COMPLETED. CONTRACTOR SHALL MATCH EXISTING GRADES, 2% CROSS SLOPE, ETC. IF C.D.O.H. HAS NOT FINISHED THEIR WORK THE CONTR. SHALL CONTACT THE ENGR. FOR DIRECTIONS TO MATCH EXISTING GRADES.

PROFILE OF 38th AVE. NORTH FLOWLINE

PROFILE OF 38th AVE. SOUTH FLOWLINE

AS CONSTRUCTED
EXTENSION NO. 87-1455
APPROVED 3-8-88

VERNON E. TABER — REGISTERED — 12937 — 5-24-88 — PROFESSIONAL ENGINEER — STATE OF COLORADO

48 hours before you dig, CALL FOR THE BLUE STAKES
534-6700
Gas, Electric, Telephone, CATV and Panhandle Eastern Pipeline Locations
DEC. 86

REVISIONS	

CITY OF AURORA ENGINEERING DIVISION
1470 South Havana St.
Aurora, Colorado 80012
Phone 695-7300

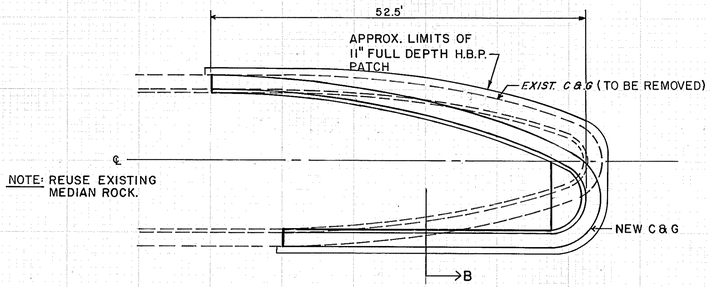
IMPROVEMENT DISTRICT 3-86
E.1/2 CHAMBERS RD., SMITH RD. to I-70
PLAN and PROFILE

DESIGNED BY	R.F.H.
DRAWN BY	D. MEISE
CHECKED BY	
SCALE	1"=50' H. 1"=5' V.
PROJECT NUMBER	4025B
SHEET	6 of 8

Traffic Engineer — 12/4/86 Date
Director of Utilities — 12/4/86 Date
CITY ENGINEER — 11/26/86 DATE

860101

860101 7/8

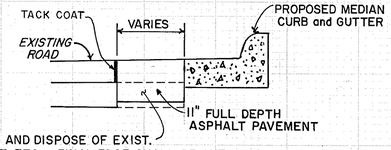


A 7 REWORK BULLET NOSE MEDIAN

(REFER TO STANDARD RAISED MEDIAN DETAIL S 2.2 FOR DETAILS NOT SHOWN.) 1"=10'

NOTES: 1. COST OF REMOVAL OF ANY ASPHALT OR BASE NECESSARY TO PLACE NEW CURB SHALL BE INCLUDED IN THE PRICE OF MEDIAN CURB REMOVAL.

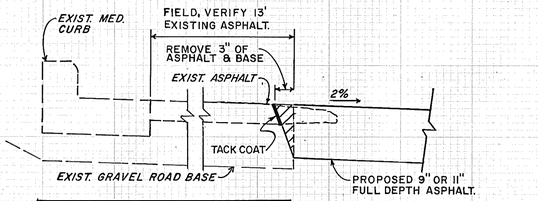
2. COST OF TACK COAT AND SAWCUTTING EXISTING ASPHALT SHALL BE INCLUDED IN THE PRICE OF FURNISH AND INSTALL MEDIAN CURB.



REMOVE AND DISPOSE OF EXIST. ASPHALT, ETC. FINAL EDGE SHALL BE CUT STRAIGHT WITH A SAW AND TACK COATED.

B 7 TYPICAL 11" THICK ASPHALT PATCH

(WHERE CURB & GUTTER REMOVAL & REPLACEMENT IS REQUIRED)
N.T.S.

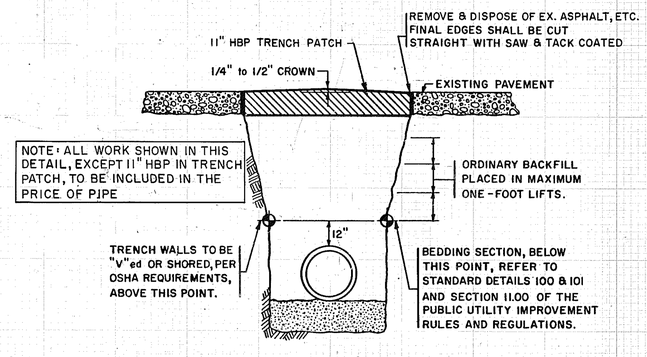


COST OF TACK COAT AND SAWCUTTING ASPHALT TO BE INCLUDED IN THE PRICE OF ASPHALT

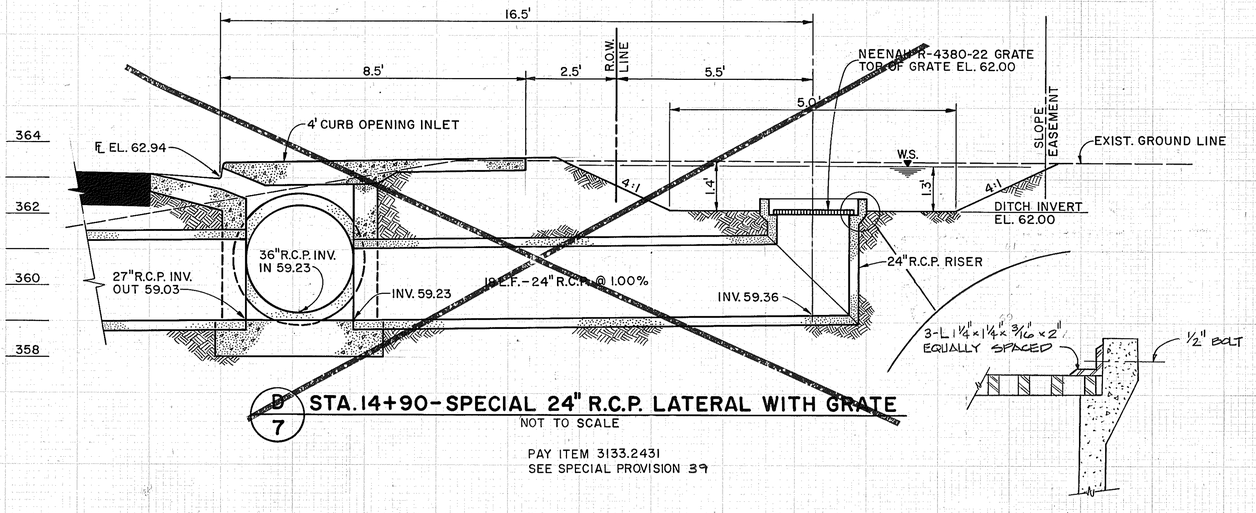
11" — STA. BEGINNING TO 16+00
9" — STA. 16+00 TO 30+00
11" — STA. 30+00 TO END

C 7 TYPICAL DETAIL AT EXISTING ASPHALT

N.T.S.



E 7 TYP TRENCH PATCH



D 7 STA. 14+90 - SPECIAL 24" R.C.P. LATERAL WITH GRATE

NOT TO SCALE

PAY ITEM 3133.2431
SEE SPECIAL PROVISION 39

AS CONSTRUCTED
EXTENSION NO. 87-14 SS
APPROVED 3-8-88

VERNON E. TABERT
12937
12-31-86
REGISTERED PROFESSIONAL ENGINEER
STATE OF COLORADO

DIRECTOR OF UTILITIES — DATE 12/2/86

CITY ENGINEER — DATE 11/26/86

DEC. 86

CITY OF AURORA ENGINEERING DIVISION
1470 South Havana St.
Aurora, Colorado 80012
Phone 695-7300

IMPROVEMENT DISTRICT 3-86
E.1/2 CHAMBERS RD., SMITH RD. to I-70
DETAILS

REVISIONS	DESIGNED BY R.H.
	DRAWN BY r.h.
	CHECKED BY
	SCALE AS SHOWN
	PROJECT NUMBER 4025B
	SHEET 7 of 8

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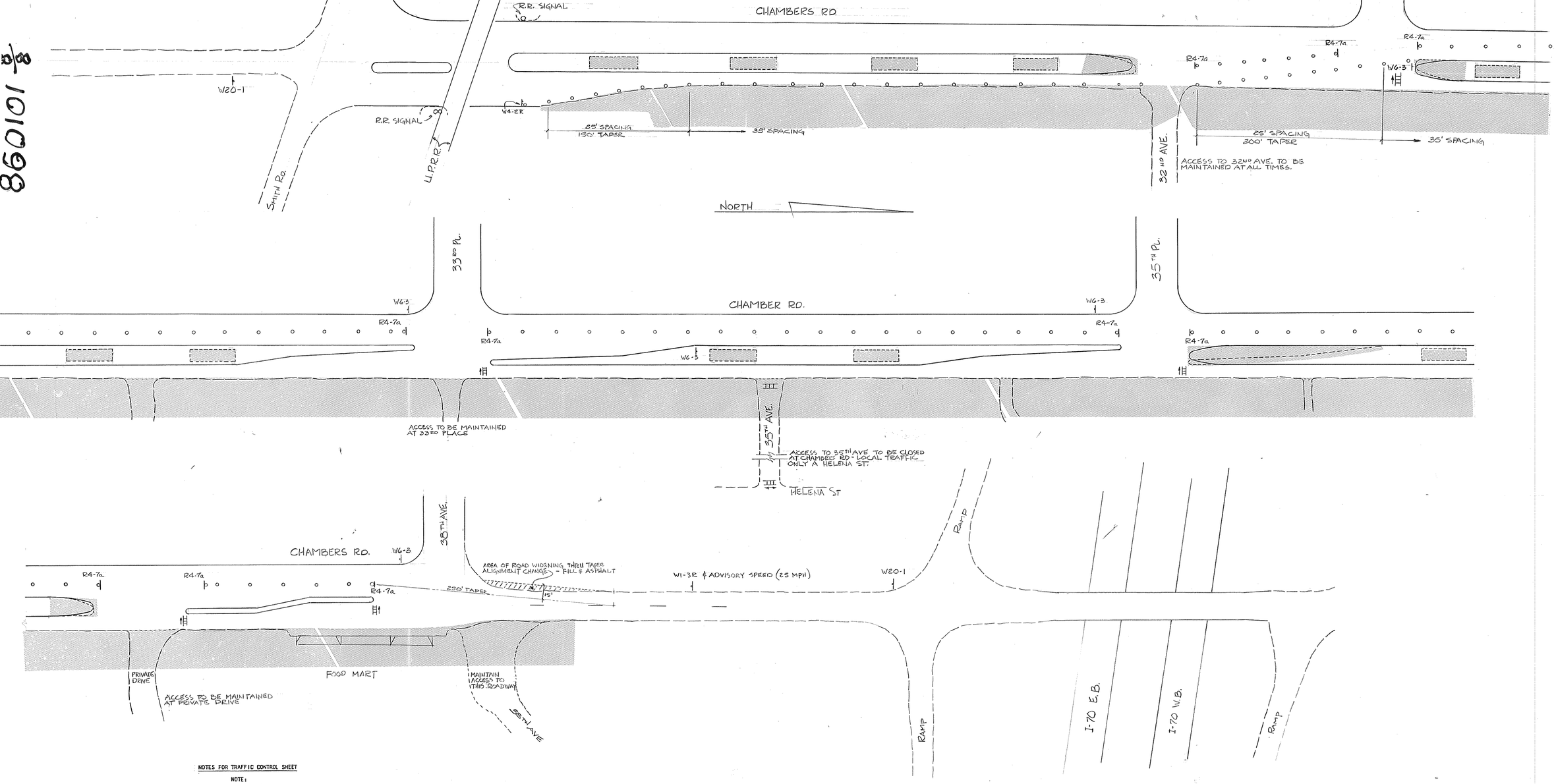

NOTES FOR TRAFFIC CONTROL SHEET

NOTE:

1) City of Aurora Traffic Engineering (695-7333) shall be notified 72 hours in advance of any work within City R.O.W.

2) Traffic shall not be transferred until all signs and barricades are approved by the Traffic Engineer or his representative.

✳ 3) Signs and barricades shown on this drawing are a general guide only. The Traffic Engineer shall review traffic flow during construction and may require the placement of additional signs and barricades.

4) The Contractor shall place all traffic control devices so as to maintain a minimum lane width of 11 feet.

5) Any cut or fill 2 inches or greater in depth within 5 feet of a traffic lane will require vertical panels for edgeline delineation.

6) Vertical panel stripes will be sloped downward to the side on which traffic is directed.

7) Each vertical panel used for edgeline delineation and channelization shall be equipped with a steady burning light.

8) The Contractor shall appoint a traffic control person that will periodically monitor the construction area including a final inspection at the end of the work day to verify that all traffic control devices are properly located and operational.

✳ 9) The Contractor shall provide access to all existing driveways, businesses, and homes in the project area.

10) Traffic control devices shall be used in conformance with the Manual on Uniform Traffic Control Devices.

11. ▨ INDICATES WORK AREAS (APPROXIMATE)
12. MEDIAN & PLANTER CONSTRUCTION TO BE CONSTRUCTED AFTER STREET IMPROVEMENTS SOUTH OF 32ND AVE.
13. DURING TIME FRAME OF THIS CONTRACT, CDOH WILL INITIATE PHASE ONE OF CHAMBERS RD & I-70 BRIDGE PROJECT ALSO IMPACTING TRAFFIC FLOW THRU INTERSECTION OF CHAMBERS & 38TH AVE. CONTRACTOR IS RESPONSIBLE FOR COORDINATION TO ASSURE CONTINUED TRAFFIC FLOW.
14. SPACING OF VERTICAL PANELS TO BE 25' THRU TAPERS AND 35' THRU STRAIGHT RUN AREAS.

MUTCD NO.	DESCRIPTION
W20-1	ROAD CONSTRUCTION AHEAD
W9-2R	LANE ENDS - MERGE RIGHT
W4-2L	"SYMBOLIC" - LEFT LANE ENDS
W4-2R	"SYMBOLIC" - RIGHT LANE ENDS
R4-7a	KEEP RIGHT
W6-3	SYMBOLIC - TWO WAY
W1-3L	REVERSE TURN
W9-2L	LANE ENDS - MERGE LEFT
W1-3R	REVERSE TURN

SYMBOL	DESCRIPTION
○	VERTICAL PANEL - STEADY BURN LIGHTS
⊢	INDICATES TEMPORARY CONST. SIGNS
⊢⊢	INDICATES TYPE III BARRICADE WITH
	ROAD CLOSED AND APPROPRIATE ARROW

860101 DEC. 86

REVISIONS

CITY OF AURORA TRAFFIC DIVISION
1470 South Havana St.
Aurora, Colorado 80012
Phone 695-7333

TRAFFIC CONTROL
CHAMBERS RD., SMITH RD. TO I-70

Nathan Fickle — 9/9/86
TRAFFIC ENGINEER — DATE

DESIGNED BY
DRAWN BY RWB
CHECKED BY
SCALE 1"=50'
PROJECT # WORK 4025B
SHEET 8 OF 8

DESIGNED BY D.Z. | DRAWN BY L.B. | CHECKED BY | SCALE 1"=200' | PROJECT No. 4025.B | SHEET ___ OF ___

CITY OF AURORA ENGINEERING DIVISION
1470 South Havana Street
Aurora, Colorado 80012
Phone 695-7300

CHAMBERS RD., SMITH to I-70
DRAINAGE MAP

11/26/86 DATE

CITY ENGINEER

REVISIONS

12/2/86 DATE

DIRECTOR OF UTILITIES

INTERSTATE 70

CHAMBERS ROAD

HELENA STREET

JASPER STREET

KALISPELL STREET

LARADO STREET

38th AVENUE

36th AVENUE

35th PLACE

35th AVENUE

33rd PLACE

33rd AVENUE

32nd AVENUE

BASIN B

BASIN A

NORTH SATELLITE SUBD

U. P. R. R.

SMITH ROAD

A=22,000 SF
D=1.5 FT.
V=32,300 CF

A=16,000 SF
D=1.5 FT.
V=24,000 CF

DP-1

DP-2

OUTLET STRUCT.

INLET STRUCTURE

DITCH FLOW 30.44 C.F.S.

STORAGE 134,713 C.F.
← DET. POND
A=87,900 SF D=1.53 FT.

B-10 6.7 | B-7 10.0 | B-4 10.1 | B-1 26.9 | B-9 5.2 | B-6 8.1 | B-3 8.2 | B-2 6.6 | B-5 12.0 | B-8 13.6 | A-5 4.4 | A-3 11.4 | A-1 14.3 | A-6 11.2 | A-4 8.8 | A-2 13.0 | A-8 6.0 | A-7 5.8 | A-9 24.6 | A-11 35.8 | A-10 12.1

LEGEND

- BASIN BOUNDARY
- SUB-BASIN BOUNDARY
- SUB-SUB-BASIN BOUNDARY
- A-1 / 14.3 ← SUB-BASIN NUMBER / SUB-BASIN AREA
- NORTH SATELLITE SUBDIVISION BOUNDARY
- (53) DESIGN POINT

200 0 200 400
SCALE IN FEET

bullet points are enough
the site flows are held back.

VERNON E. TABERT
REGISTERED
12937
11/26/86
PROFESSIONAL ENGINEER
STATE OF COLORADO

101098

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IJ

C

IJ
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860101

DRAINAGE REPORT

FOR

CHAMBERS ROAD

FROM

SMITH ROAD TO I-70

PROJECT NUMBER 4025A

APPROVED BY:

KW 11-26-86

DIRECTOR OF PUBLIC WORKS

11/26/86

DATE

LLS 12-1-86

DIRECTOR OF UTILITIES

12/2/86

DATE

PREPARED BY:

ENGINEERING DESIGN SECTION
CITY OF AURORA
OCTOBER, 1986

VERNON E. TABERT
REGISTERED
12937
11-26-86
PROFESSIONAL ENGINEER
STATE OF COLORADO

ECS.0015

SCOPE AND PURPOSE

This report has been written to outline the final drainage requirements for Chambers Road from Smith Road to I-70. All runoff flows and design points used in this report were obtained from the Preliminary Drainage Report for Peterson Subdivision prepared by Daniel Zelem, City of Aurora Engineering Design Section.

The drainage for the east side of Chambers Road is presently handled in the existing storm sewer and inlets along the west side of the road. This report will address the inlet and pipe requirements for the east half of Chambers Road and detention pond releases and overland flows from Peterson Subdivision.

All computations in this study are based on the City of Aurora's Storm Drainage Design and Technical Criteria Manual.

INTRODUCTION

This improvement district will construct the remaining curb, gutter and 18' of pavement along the east side of Chambers Road. The grades on Chambers are very flat, averaging 0.40% north and south. A high point in the proposed grade will occur at 33rd Ave. which roughly coincides with the dividing line of Basin A and B. Flows on Chambers will then be divided north and south from this point.

Basin A as presented in the Peterson Subdivision Preliminary Report will be storm sewered by development and the runoff carried by 33" R.C.P. in 33rd Ave. A stub out at the Chambers and 33rd Ave. intersection has been provided for this future use. The water will then be carried south in the storm sewer in Chambers Road to a low point on the road at design point 54. The existing 27" R.C.P. will not have sufficient capacity for the design flow and will back up through a 24" lateral and grate that will be constructed in this project. The overflow will then continue south in a grass-lined ditch to the existing 43"x27" C.M.P. and site of the future detention pond (Design Point 62).

Basin B as presented in the Peterson Subdivision Preliminary Report will be storm sewered to the north. The east half of Basin B will be storm sewered north to detention pond No. 1 on 38th Ave. The water will be released to the west in an open ditch where some of the waters will be diverted into detention pond No. 2. The remaining release will continue west and enter the 24" R.C.P. culvert under Chambers.

This project will provide the 18" R.C.P. release pipe from detention pond No. 2 to design pt. 34 where it will tie into the existing 29"x45" H.E.R.C.P. The west half of Basin B will be storm sewered north down Helena St. then east to Chambers through an existing utility easement. The storm sewer will then tie into the existing 29"x45" H.E.R.C.P. at design point 34.

Runoff from Chambers Road north of 38th Ave. will drain south down Chambers to the northeast curb return of 38th Ave. and flow east around the curb return where it will find its way into the 24" R.C.P. to be installed with the Highway Department's project. The 24" culvert is to be installed under Chambers north of 38th Ave. and outfall into a ditch on the west side of Chambers.

DESIGN DRAINAGE

All inlets in this report were designed exclusively for the 100-year street runoff. No overland flows are assumed to reach the street.

Drainage for Basin A will begin to be picked up by the proposed 33" R.C.P. in 33rd Ave. The 33" R.C.P. in Chambers Road was sized based upon design grades and developed flows as shown in the Preliminary Drainage Report for Peterson Subdivision. The inlet at design pt. 52 is a continuous grade inlet. An 18" R.C.P. stub has been provided at this intersection for future use as outlined in the preliminary report. The storm sewer than continues south as a 36" R.C.P. to the low point at design pt. 54. The outlet at this point is a 27" R.C.P., and as stated previously, is not adequate for the design flow. The inlet at design pt. 54 is a sump inlet and a bubble up will be provided out the back. An 8 ft. flat bottom ditch with 4:1 side slopes will be built from design pt. 54 to the existing 43"x27" C.M.P. and future detention pond.

Drainage for Basin B will begin to be picked up at design pt. 27. The 100-year depth of flow here will require an inlet. The inlet was designed as a continuous grade inlet. At the intersections of 33rd Place and 35th Ave., crosspans will be built to conduct the street flows.

A 24" storm sewer will then proceed north to design pt. 31. The 8' inlet was designed as a continuous grade inlet. A 27" R.C.P. stub from manhole #5 will be provided at this location for future use. The storm sewer then continues a short distance to design pt. 34 where a 5' sump inlet will pick up the 100-year street flows. The inlet is oversized due to the size required for the outlet conduit.

In overviewing the entire Peterson Subdivision drainage, the existing 29"x45" H.E.R.C.P. for Basin B and the existing 27" R.C.P. and 43"x27" C.M.P. for Basin A are effectively metering the release rate for the subdivision. This limits the size of the storm sewer along Chambers to what is shown. This also places the detention requirement of .5 C.F.S./acre on all development in the area, as is spelled out in the preliminary report.

AURORA PUBLIC WORKS
ENGINEERING DIVISION

Project CHAMBERS SMITH - I-70 Number _____

Computed By R.D. Date 7-18-84 Sheet 1 of ___

DESIGN PT. 52 32ND AVE. (C.G. INLET)

AREA = $\frac{(25+00.2 - 19+00.2)(55)}{43560}$ = .84 AC.

S = .45 AVE. Q_{100} = 4.5 C.F.S. D = .46

a = 3" $\frac{Q_a}{1-a}$ = .40 $L_a = \frac{4.5}{.40}$ = 11.25'

$\frac{L}{L_a} = \frac{9}{11.25}$ = .80 $\frac{A}{y} = \frac{.25}{.46}$ = .54 $\frac{Q_I}{Q_A}$ = .90

Q_I = 4.5 (.9) = 4 C.F.S. .5 C.F.S. BYPASS

USE 9' C.D. INLET

DESIGN PT. 54 STA. 14+91.2 (SUMP INLET)

AREA = $\frac{(19+00.2 - 11+50)(55)}{43560}$ = .95

S = .45 AVE. Q_{100} = 5.7 C.F.S. + .5 = 6.2 C.F.S. D = .50

H = .75' h = .5' H/h = 1.5

Q/L = 1.75 L = $\frac{6.2}{1.75}$ = 3.5

USE 4' C.D. INLET

DESIGN PT. 27 STA. 36+34.5 (C.G. INLET)

AREA = $\frac{(25+00.2 - 36+34.5)(55)}{43560}$ = 1.35

S = .40 AVE. Q_{100} = 6.2 C.F.S. D = .51

a = 3" $\frac{A}{y} = \frac{.25}{.51}$ = .47 $\frac{Q_a}{1-a}$ = .45 $L_a = \frac{6.2}{.45}$ = 13.8

$\frac{L}{L_a} = \frac{11}{13.8}$ = .80 Q_I = 6.2 (.90) = 5.6 .6 C.F.S. BYPASS

USE 11' C.D. INLET

AURORA PUBLIC WORKS
ENGINEERING DIVISION

Project CHAMBERS-SMITH-I-70 Number _____

Computed By R.D. Date _____ Sheet 2 of ___

DESIGN PT. 34 35 AVE. (SUMP INLET)

AREA = $\frac{200(45)+(44+05-42+57)(55)+(42+57-40+92)(55)}{43560}$ = .60 AC.

S = .41% Q_{100} = 3.7 + .5 BYPASS = 4.2 C.F.S.

H = .75' h = .5' H/h = 1.5

Q/L = 1.75 $L = \frac{4.2}{1.75} = 2.4$

BECAUSE OF TRUNK LINE USE | 5' C.C. INLET |

DESIGN PT. 31 STA. 42+92 (C.G. INLET)

AREA = $\frac{(42+92-32+34.5)(55)}{43560}$ = .55 AC.

S = .41 Q_{100} = 3.5 + .6 BYPASS = 4.1 D = .45

R = 3" $\frac{a}{d} = \frac{.25}{.45} = .56$ $\frac{Q_a}{L_a} = .39$ $L_a = \frac{4.1}{.39} = 10.5$

$\frac{L}{L_a} = \frac{8}{10.5} = .76$ Q_i = .85(4.1) = 3.6 .5 BYPASS

USE 8' C.C. INLET

DESIGN PT. 4 35TH AVE.

AREA = $\frac{(50+05-44+14)(2.5)+(15-2)(25)}{43560}$ = .84 AC.

S = 3.1% Q_{100} = 6.2 C.F.S. D = .35

RUNOFF WILL BE ALLOWED TO FLOW AROUND NORTHEAST CURB RETURN OF 35TH AVE. AND INTO DITCH TO EXIST. 24" R.C.P. RIP-RAP PROTECTION WILL BE PROVIDED OFF THE END OF THE RETURN.

SUBDIVISION CHAMBERS RD.
LOCATION SMITH TO I-70
DESIGN STORM 100 YR RECURRENCE INTERVAL
COMPUTATIONS BY _____ DATE _____
SUBMITTED BY _____ DATE _____
(Engineering Firm)

CITY OF AURORA, COLORADO
STORM DRAINAGE SPECIFICATIONS

RUNOFF COMPUTATIONS
(Rational Method)

INLET DESIGN

PAGE ____ OF ____

Design Point	Area Designation	A (Acres)	c	c_f	$\bar{c} = (c \times c_f)$	$A \cdot \bar{c}$	$\Sigma A \cdot \bar{c}$	to (min)	I (in/hr)	$Q = (\Sigma A \cdot \bar{c}) \times i$ cfs	Slope (S)	Length L (feet)	VEL* V fps	t_f (min.)	Remarks
52	A,	.24	.13			.75		12	5.5	4.5	.45AVE	662	1.5	7.3	T_c = 5 M. INITIAL + 7.3 = 12.3 M.
54	B,	.95	.13			.22		11.4	6.5	5.7	.45AVE	401	1.5	4.5	T_c = 5M. INITIAL + 4.5 = 11.5 M.
27	C,	1.34	.13			1.24		16.1	4.9	6.2	.40AVE	1072	1.5		T_c = 5 M. INITIAL + 11.9 = 16.9 M.
3.1	E,	.60	.73			.54		4	6.6	3.7	.41	340	1.5	3.8	T_c = 5 M. INITIAL + 4 = 7 M
31	D,	.58	.93			.54		10.1	6.3	3.5	.41	458	1.5	5.1	T_c = 5.0 INIT. + 5.1 = 10.1 M.
4	F,	.84	.71			.72		7	8.0	6.2	5.7	584	5	2.0	T_c = 5 M. INIT. + 2.0 = 7 M

*These values must be substantiated with additional computations or use of appropriate charts, etc.

CHAMBERS RD.
SMITH RD. TO I-70

PIPE COMPUTATIONS
M = .013

From	To	Inc. Area	Total Area	C	CA	ΣCA	T.C.	I	Q	Pipe Size	Pipe Slope	Pipe Vel.	L	Inc. T.C.
		Ac.	Ac.				min.	In/hr	cfs	in.	%	fps	ft	min.
49	50								31.5	??	.38	5.3	187	
50	52								34.2	36	.38	6.6	385	
52	54								38.7	36	.38	6.3	378	
27	31								13.7	27	.30	4.8	452	
31	34								27.8	33	.40	6.3	198	
34	EXIST. M.H.								31.2	1'x2' R.C.B.	.40	6.2	18	

AURORA PUBLIC WORKS
ENGINEERING DIVISION

Project CHAMBERS SMITH TO I-70 Number _____

Computed By R.D. Date 9-18-96 Sheet __ of __

DITCH DESIGN D.P. 54 TO PROPOSED POND

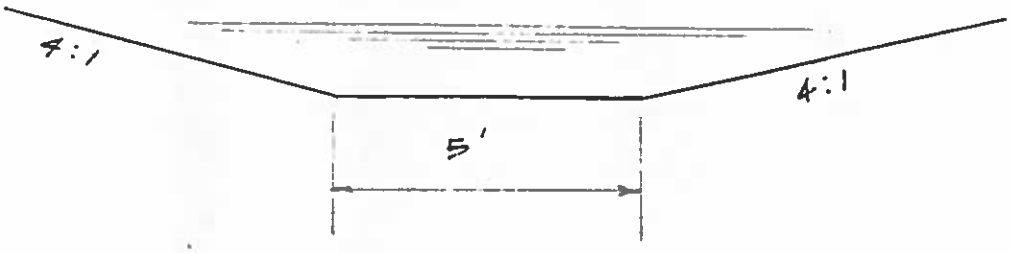
TRY 5' F.B.V. BOTTOM 4:1 SIDE SLOPES

S = 0.32 % n = .04 F = 1.4 FT.

$A = 5(1.4) + 2\left[\frac{(1.4)(5.6)}{2}\right] = 14.5$ FT.²

$WP = 2\sqrt{33.52} + 5 = 16.5$

$Q = \frac{1.49}{.04}(14.8)(.9)^{\frac{2}{3}}(.0032)^{1/2} = 30.8$ C.F.S. > 30.4 C.F.S. → O.K.



1

ROUTING SLIP/CHECK LIST
READ CAREFULLY

TITLE CHAMBERS RD SMITH RD TO I-70

CONSULTANT COA - RICK HUNTZE PH# 6957318

DEVELOPER _____ PH# _____

860101

TYPE:							
T	PLAN	(RO)	PD	BR	PLT	USE
C	DESC	WA	FD	OT	PUD	ADM
(M)		SA	GT		PBG	LAN

DATE RECEIVED ~~2-5~~ 2-18 10/28/86 11/21/86

DATE CONSULTANT CONTACTED FOR PICK-UP 3/14/86 ~~11-18-86~~ 12/5/86

ENGINEERING	Checked	tt BSL ID	Date 11-17-86 11/18 11-26-86
TRAFFIC	Checked	G R	3-14-86 12-4-86
FIRE	Checked	JC	Date 3-14-86
UTILITIES	Checked	ABS LB	Date 3-7-86 12-1-86

RESUBMITTAL STATUS:
Submit checkprints of corrected plans for additional review _____
Submit mylar sepias of corrected plans for approval _____
Submit mylar sepias of plans for approval _____

All submittals shall be routed through the Engineering Services Section.

The normal time for review shall be 20 working days per submittal. The normal time for final approval signatures shall be 10 working days. The consultant will be notified by phone when the plans are ready for pick-up.

After all approval signatures are obtained, the mylar(s) shall become property of the City.

Plans returned to the Engineering Services Section for further review and/or approval without the routing slip/check list and check prints will be returned to the consultant without further review until they are included.

Plans are reviewed on a first come - first serve basis only.

Plans returned to the consultant for lack of adequate information or conflicts with City of Aurora design criteria will be subject to further review once resubmitted to the Engineering Services Section.

Appendix D

5. DIGITAL DATA

Colliers Engineering & Design

Colliers Engineering & Design is a trusted provider of multi-discipline engineering, design and consulting services providing customized solutions for public and private clients through a network of offices nationwide.

For a full listing of our office locations, please visit colliersengineering.com

1 877 627 3772

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Infrastructure • Geotechnical/Environmental • Telecommunications • Utilities/Energy