

PROJECT:

ASTRID SITE DEVELOPMENT PLAN

2410 SKI TRAIL LANE

CITY OF STEAMBOAT SPRINGS, ROUTT COUNTY, STATE OF COLORADO

FINAL DRAINAGE STUDY

PREPARED BY:

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DRAFT 1ST SUBMITTAL: DECEMBER 22, 2022

DRAFT 2ND SUBMITTAL: May 19, 2023

JOB # CO20235



Engineering · Planning · Surveying

CERTIFICATION STATEMENT

I HEREBY AFFIRM THAT THIS DRAINAGE STUDY AND PLAN FOR THE ASTRID SITE DEVELOPMENT PLAN PROJECT WAS PREPARED BY ME (OR UNDER MY DIRECT SUPERVISION) FOR THE OWNERS THEREOF AND IS, TO THE BEST OF MY KNOWLEDGE, IN ACCORDANCE WITH THE PROVISIONS OF THE CITY OF STEAMBOAT SPRINGS STORM DRAINAGE CRITERIA AND APPROVED VARIANCES. I UNDERSTAND THAT THE CITY OF STEAMBOAT SPRINGS DOES NOT AND WILL NOT ASSUME LIABILITY FOR DRAINAGE FACILITIES DESIGNED BY OTHERS.

REGISTERED PROFESSIONAL ENGINEER
STATE OF COLORADO NO.

NOTE

CITY OF STEAMBOAT SPRINGS PLAN REVIEW AND APPROVAL IS ONLY FOR GENERAL CONFORMANCE WITH CITY DESIGN CRITERIA AND THE CITY CODE. THE CITY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSION, AND ELEVATIONS THAT SHALL BE CONFIRMED AND CORRELATED AT THE JOB SITE. THE CITY OF STEAMBOAT SPRINGS ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS OR ACCURACY OF THIS DOCUMENT.

INDEX

ITEM	PAGE
INTRODUCTION	1
DRAINAGE CRITERIA & METHODOLOGY.....	2
EXISTING CONDITIONS.....	3
PROPOSED CONDITIONS	5
POST CONSTRUCTION STORMWATER MANAGEMENT.....	11
CONCLUSIONS.....	11
REFERENCES.....	12

ATTACHMENTS

- Attachment 1: Vicinity Map
- Attachment 2: NRCS Soils Map & Data
- Attachment 3: FEMA Map
- Attachment 4: Site Plan and Storm Sewer Profiles
- Attachment 5: Existing and Proposed Drainage Maps
- Attachment 6: Off-site Basins Map and Calcs (From other reports)
- Attachment 7: Runoff Calculations and Summary Table
- Attachment 8: Storm System Computations
- Attachment 9: Pond Calculations
- Attachment 10: Tables Used for Report
- Attachment 11: Final Drainage Study Checklist (Standard Form No. 3)
- Attachment 12: Exhibit A – Scope Approval Form (Standard Form No. 5)
- Attachment 13: Exhibit B – Storm Water Quality Plan

ASTRID SITE DEVELOPMENT PLAN

FINAL DRAINAGE STUDY

I INTRODUCTION

A. LOCATION

1. The project area is located at 2410 Ski Trail Lane adjacent to Steamboat Resort. The north limits of the site are adjacent to the ski resort and The Edgemont development. The eastern limits are adjacent to the Bear Claw II and Bear Claw Estates developments which has Lot 11B currently under construction. To the south are the Norwegian Log and Ski Inn Condominiums. Finally on the west are the Ski Trail and Elkhorn at Steamboat Condominiums. The project area is in the northeast quarter of the northwest quarter of Section 27, Township 6 North, Range 84 West of the 6th P.M., City of Steamboat Springs, Routt County, Colorado.

B. DESCRIPTION OF PROPERTY

1. The site is approximately 4.33 acres including the existing right-of-way at the location of the access off of Ski Trail Lane. Total Drainage Area including off-site area is approximately 80 acres. Whereas the proposed project disturbance is roughly 3.5 acres.
2. The site is currently undeveloped and ground cover consists mostly of native grass. There is a lot of relief across the site. The upper end of the site near the Edgemont is at an elevation of 7068 and the lower end of the site near Ski Trail Lane is at 6956 for a difference of 112 feet across the site. Slopes vary from approximately 1% to 50%. A gravel ski/resort access currently cuts through the southwest of the site and there is also a tower for the Steamboat Gondola on the southeast portion of the property.
3. The subject property is zoned as Resort Residential Two, High Density. The directly adjacent properties (except for the resort) are zoned either Resort Residential One or Resort Residential Two.
4. According to the Soil Survey, the project area consists entirely of Routt loam, which is poorly drained and Hydrologic Soil Type C. The offsite flows consist mainly of Hydrologic Soil Type C. See soils map in the appendix for more info.
5. Per FEMA FIRM 08107C0883D with an effective date of 02/04/2005, the project is

entirely outside of the floodway/floodplain of Burgess Creek.

6. There are no irrigation facilities on or adjacent to the property.
7. There are approximately 4,370 square feet of delineated wetlands on the site near the access to the site off of Ski Trail Lane. Of which there will be roughly 2,250 square feet of permanent disturbance of wetlands.

C. PROPOSED DEVELOPMENT DESCRIPTION

1. There are seven multi-family/condo buildings proposed on the property as well as associated drives, sidewalk, sanitary sewer, water, storm sewer, dry utilities, landscaping, and a pool and associated building.
2. This report was prepared in conjunction with the Site Development Plans dated 05/19/2023 by Eric Smith Associates and Baseline Engineering for Steamboat Esquiar LP.

D. REFERENCED DRAINAGE REPORTS

1. The "City of Steamboat Springs Citywide Stormwater Master Plan" was referenced in the preparation of this report.
2. The "Addendum to Final Drainage Study for Edgemont and Related Access Improvements for Bear Claw II," by Landmark Consultants, Inc. Dated June 18, 2009
3. The "Draft Drainage Study for Edgemont" by Landmark Consultants, Inc. Dated April 9, 2007, Revised July 7, 2007
4. The "Final Drainage Study for Bear Claw II Sub-division" by Landmark Consultants, Inc. Dated June 19, 2018, Revised February 18, 2019

II DRAINAGE CRITERIA AND METHODOLOGY USED

A. DESIGN RAINFALL AND STORM FREQUENCY

1. In accordance with City Drainage Criteria, the major storm is the 100-year recurrence interval storm and the minor storm is the 5-year recurrence interval storm.
2. The values of 0.82 inches and 1.79 inches for the 5-year storm and 100-year storm respectively were used for the drainage per the City's Drainage Criteria.

B. RUNOFF CALCULATION METHOD

1. The Proposed and Existing basins, including off-site basins are around 80 acres, below the 160 acre maximum for the rational method; therefore the rational method has been used to calculate peak flows for both proposed and existing conditions per section 5.6.2.2 of the City's Engineering Standards.

C. CULVERT, INLET, AND STORM SEWER ANALYSIS

1. Street and Inlet capacities were studied using MHFD-Inlet v5.01, April 2021, by the Mile High Flood District.
2. Hydraflow Storm Sewers Extension for Autodesk Civil 3D, was utilized to create hydraulic models of the storm sewer system.

D. DETENTION DISCHARGE AND STORAGE METHODOLOGY

1. Stormwater detention has been designed using the FAA method as outlined in section 5.11.7.2 in the City's Engineering Standards. The allowable release rates have been determined by using Table 5.11.1 in the City's Engineering Standards which are based on soil groups. The Water Quality Capture Volume was determined from the equation in section 5.12.7.1 of the City's Engineering Standards using a 40-hour drain time.

III EXISTING CONDITIONS (PRE-DEVELOPMENT)

A. ON-SITE DRAINAGE PATTERNS

1. The site is currently undeveloped and covered in native grasses and is roughly 2% impervious. This site is 4.33 acres in size and has roughly 112 feet of fall across the site.
2. There is an existing 24" CMP culvert on the low end of the site near Ski Trail Lane that the entire site and also some off-site basins currently drain to and eventually reaches Burgess Creek approximately 1000 feet to the west of the project. The ultimate outfall location is the Yampa River. This 24" CMP outfall storm is undersized for the existing 100-year flow of 120.6 cfs. This flow has been recalculated with the 2019 NOAA point precipitation values from the updated city Standards. This flow was previously calculated by Landmark in the "Draft Drainage

Study for Edgemont” report the flow was calculated as 106.8 cfs using the old precipitation numbers.

3. There are miscellaneous culverts on the site to convey the off-site flow.
4. There is a gondola tower and associated easement running through the site on the south side of the site that is proposed to remain.
5. Subbasin summary – Refer to the Existing Drainage Basin Map and Runoff Summary table in the appendix for reference.
6. Basin H1
Includes flow from Buildings 2 and 3 of the Ski Inn condos, their adjacent parking lots, sidewalks, and landscape areas. This area flows to the existing 24” CMP outfall pipe
7. Basin H2
Is the main on-site basin and mainly consists of undeveloped land. The existing ski trail acts as the basin barrier and there is a drainage swale adjacent to the trail taking flow to the southeast in a depression and outfalls from a 15” CMP culvert into Basin H1. This basin also includes the 2 lots from the Bear Claw Estates subdivision which is currently under construction. For purposes of this report it will be analyzed as if these lots are undeveloped as they are providing underground detention to reduce flows to predeveloped conditions.
8. Basin H3
Includes the whole Edgemont condo building, pool area, and adjacent drive. This drainage enters the site in two storm sewers and is conveyed down a riprap lined rundown in Basin H2.
9. Basin H4
Contains flow from the Norwegian Log condos, associated parking lot, walks, and landscape areas. This outlets at an 18” CMP culvert that discharges into Basin H1.
10. Basin H5
Includes half of Ski Trail Lane and a small portion of one of the Bear Claw Estates lots. This flow is conveyed though a 15” CMP into Basin H4

B. OFF-SITE DRAINAGE PATTERNS

1. Subbasin Summary – Refer to the Existing Drainage Basin Map and Runoff Summary table in the appendix for reference.

2. Basin OS1

This basin is comprised of flow from residential lots and undeveloped land on the ski resort. It is exactly the same basin as H1 as represented in the “Draft Drainage Study for Edgemont” report by Landmark. The area of 58.55 acres, imperviousness of 5%, and Time of concentration of 31.7 minutes were taken from that report. Just the rainfall intensity was updated per the city’s most current standards. This basin is conveyed under Ski Trail Lane via a 24” CMP into basin H5.

3. Basin OS2

Contains flow from Bear Claw I and II and also upstream from those developments is residential and undeveloped ski resort off-site basins. This basin was copied from the “Addendum to Final Drainage Study for Edgemont and Related Access Improvements for Bear Claw II” study by Landmark. Design Point 18 is at the outlet of the 24” RCP pipe that runs between the two lots on Bear Claw Estates. The area getting to this point is 12.34 acres, imperviousness of 31%, and a time of concentration of 14.4 minutes. Again, the rainfall intensity was updated to use the new values from the city’s standards.

IV PROPOSED CONDITIONS

B. GENERAL

1. The proposed improvements include a large 7 story building with 2 garage floors along the property line adjacent to the ski resort. There are 5 other condo buildings that are 4 stories each and then a pool and associated 2 story building. In addition, there are proposed drives, sidewalk, sanitary sewer, water, storm sewer, dry utilities, and landscaping. The proposed site is approximately 60% impervious and the disturbed area is roughly 3.50 acres of the 4.33 acre site.

C. DRAINAGE PATTERNS & BASINS

1. The proposed drainage patterns will not change significantly from existing drainage conditions and the ultimate outflow locations will remain the same as today. The existing undersized 24” CMP outfall pipe will be replaced by a 36” HDPE pipe which will run throughout the site and convey on-site and off-site flows. The total 100-year historic flow to this pipe is 120.6 cfs and the proposed flow is calculated to be 116.9 cfs with the addition of two detention ponds to help with the increased flow from the increased impervious area. This pipe is directed to Burgess Creek which is approximately 1000 feet to the west of the project. Burgess Creek outfalls into the Yampa River which is the ultimate outfall point for the site. Refer to the Proposed Drainage Basin Map for reference.

2. Sub Basin Summary – Refer to the Proposed Drainage Basin Map and Runoff Summary table in the appendix for reference.

On-site Basins

3. Basin A1
Is the main pond on the site and all A subbasins drain into this detention pond. The total Major Basin A is 2.58 acres.
4. Basin A2
Contains flow from the access drive and is directed to Pond A directly from a type 13 combination curb inlet.
5. Basin A3
Includes drainage from open space and the adjacent roadway. It is collected in a type 13 combination inlet and ties into the flow from Basin A2 and into Pond A.
6. Basin A4
Collects drainage from Building 2 and the adjacent drive and is collected in another type 13 combination inlet the discharges directly into Pond A.
7. Basin A5
Contains flow from Buildings 3 & 7 and adjacent walks and landscape areas and ties directly in to Pond A.
8. Basin A6
This basin includes flow from behind Buildings 2 & 3 and collects flow from the front of Building 1 in a type 13 combination inlet. It is collected in a storm sewer pipe that goes into a manhole that in turn discharges into Pond A.
9. Basin A7
Exclusively contains flow from the access drive and is collected in a Type 13 combination inlet. This flow is directed towards the manhole from Basin A6 where it combines with that flow and is directed to Pond A.
10. Basin A8
Collects flow from the drive down to the lower garage level of Building 1 at a trench drain at the face of the building.
11. Basin A9
Is entirely comprised of flow from the roof of Building 1 which is collected and

routed through the building internally.

12. Basin A10
Includes landscaping area above the retaining wall behind Buildings 1 & 2. This flow is collected in an area inlet and directed to Pond A.
13. Basin B1
Basin B1 includes Pond B and flow from the front of buildings 5 & 6 and the pool. Major Basin B is 0.59 Acres in size.
14. Basin B2
Includes drainage from the back of Buildings 5 & 6 roofs and landscape area behind the buildings.
15. Basin C1
Major Basin C is 0.69 in size and contains undetained flow from the access road to the site. Basin C1 is located at historic design point 1 and is entirely landscaped area and includes Water Quality Pond C.
16. Basin C2
Is exclusively flow from the access drive and is collected in a sag type 13 combination inlet and discharges into Water Quality Pond C.
17. Basin C3
Is comprised of flow from the access drive and the ski trail on the south side of the drive. This flow is collected in a sag type 13 combination inlet and ties into the flow from Basin C2 and discharges into Water Quality Pond C
18. Basin C4
Is upstream of Basin C2 and collects flow from the access drive. It combines with the historic released flow from Pond B and ties into the main storm sewer.
19. Basin C5
Is upstream of Basin C3 and collects flow in a type 13 combination inlet and ties directly into the main storm sewer.

Off-site Basins

20. Basin D1
Basin D1 includes flow from Ski Inn building 2 and associated parking lot which is being improved with these improvements since it currently extends out into the existing right-of-way. A retaining wall will be constructed to allow for more parking

on the southeast edge of the current parking lot. This drainage will be collected in a area inlet and tied into the Basin C3 inlet.

21. Basin D2

Includes flow from Ski Inn condo building 3 and associated parking lot and landscape areas. It extends to the center of Ski Trail Lane. This off-site flow is collected in a flared end section under the realigned ski trail and ties into the main storm sewer.

22. Basin D3

Includes flows from the back of Norwegian Log condo building 2 and landscape areas behind the building. This drains to an existing 18" CMP culvert and then combines with flow from Basin D2.

23. Basin D4

Is comprised of flow from the front of Norwegian Log building 2 and the entire building 1 and their shared parking lot. It also includes from from the center of Ski Trail Lane. This flows to the riprap lined drainageway that was graded to accommodate the offsite flow running through the site.

24. Basin D5

Is the exact same basin as historic Basin H5

25. Basin D6

Includes the currently under construction Bear Claw Estates Sub-division. Both of these lots have proposed underground detention for the buildings and ties into the existing 18" RCP sewer that takes flow from Basin OS2 and runs between the two lots. Therefore, for the purpose of this report it has been treated as an undeveloped parcel of land.

26. Basins H3, OS1, and OS2

Are all unchanged from the historic basins.

D. DETENTION PONDS

1. Pond A is the main detention pond on site and has a capture area of 2.59 acres as well as off-site flow from Basin H3 of 1.9 cfs for the 5-year storm and 5.3 cfs for the 100-year. Pond B has a capture area of 0.59 acres and no bypass flow. Basin C is unable to be detained due to lack of available area and will be free released. However, the discharge will be treated in Water Quality Pond C. According to the city's standards only 5% of the site may be free released and the release rates

from the pond must be reduced accordingly. Basin C is 0.67 acres and 15% of the site. Since there is not adequate real estate for an additional pond and grades make it impossible to use the other ponds, we are proposing to over-size Pond A since it has the off-site flow from Basin H3 and then release the pond at a reduced rate to make up for the free release of Basin C. The release rate from Pond A is also being reduced by the bypass free release flow of the inlets at Basins A2 and A3 of 0.3 cfs for the 5-year storm and 1.9 cfs for the 100-year storm. The ponds were sized using the FAA method as outlined in the city's standards.

2. Pond A

Taking into account over-sizing the pond for the off-site flow from Basin H3 as discussed above, the required volume for the pond is 1714 cubic feet for the 5-year storm and 5214 cubic feet for the 100-year storm. The water quality capture volume (WQCV) was calculated to be 1760 cubic feet. The pond will have vertical walls all around due to constrained area with a bottom slope of 2% and a depth of 3.3 feet for the 100-year storm. The proposed release rate from the pond was calculated to be 0.9 cfs for the 5-year storm and 1.9 cfs for the 100-year storm taking into account the free release and offsite flows as discussed above. See calculations in the appendix for details. The WQCV will be released through an orifice plate over 40 hours. The outlet structure will be built into the retaining wall and tie into the storm sewer in the access road. The emergency spillway was sized for the 100-year flow of Basins A and H3 of 19.2 cfs. The spillway will be a rectangular weir in the retaining wall 6 feet wide and 1 foot high. The spillway will release directly into the access road. A 10 foot wide maintenance access has been provided at a maximum slope of 10%

3. Pond B

The required volumes for Pond B are 325 cubic feet for the 5-year storm and 950 cubic feet for the 100-year storm. The WQCV was calculated to be 385 cubic feet. The pond will have a vertical wall on the south side and a minimum bottom slope of 2% and a depth of 2.0 feet for the 100-year storm. The allowable release rate based on the soil type of C is 0.06 cfs for the 5-year storm and 0.32 cfs for the 100-year storm. The WQCV will be released through an orifice plate over 40 hours. The emergency spillway was sized for the 100-year flow of Basins B of 2.8 cfs. The spillway will be a rectangular weir in the retaining wall 1 foot wide and 1 foot high. The spillway will release directly into the access road.

4. Pond C

Pond C is a Water Quality Pond only and will not provide detention as stated above since Pond A is oversized and the flow leaving the site will remain unchanged. The required WQCV is 424 cubic feet. The slopes of the pond are 3:1 and the bottom has a minimum slope of 2%. The depth of the pond is 2 feet and the WQCV will be released through an orifice plate over 40 hours

5. The ponds will be in drainage easements and will be privately maintained by the HOA that will be formed for this development.

E. ON-SITE STORM CONVEYANCE SYSTEM

1. Per the City of Steamboat Springs Engineering Criteria Chapter 4 - Streets, Section 4.2.1.4, the access drive is classified as a local street. Drainage Criteria for a Collector Street have been followed.
2. Per the City of Steamboat Spring Springs Drainage Criteria, Section 5.8.3.2, for Local Streets, Primary Commercial, & Multifamily Access Roads, the Minor Storm drainage system is to be designed so that the flow depth does not exceed 6 inches at the gutter flowline. The MHFD Inlet Design sheets reflect a 6" flow depth for the minor storm.
3. Per the City of Steamboat Spring Springs Drainage Criteria, Section 5.8.3.2, for Local Streets, Primary Commercial, & Multifamily Access Roads, the Major Storm drainage system is to be designed so that the major storm depth does not exceed 12 inches at the gutter flowline and velocity shall be less than 8 fps. The proposed buildings will be at least 12" above the adjacent flowline of the gutter. Since they are less than the required 24" due to close proximity to the access drive The MHFD inlet design sheets reflect a maximum of 6" depth during the 100yr storm per the standards. The total street capacity (up to 6" depth) varies from 20 cfs to 24.8 cfs depending on the slope. The max calculated velocity is 8.6 fps for Basin C5 which is just slightly over the max of 8 fps due to the steep slopes on the site.
4. The proposed storm sewer systems are sized to convey the minor storm event (5-year) without surcharging and the major storm event (100-year) without overtopping. The Hydraflow Storm Sewer results in the appendix show that the storm drain system is within these criteria.
5. Inlets were designed using the Mile High Flood District inlet spreadsheet and bypass flow was taken into account for all of the inlets. See the appendix for the results. All of the onsite inlets are either area inlets or Type 13 combination inlets with a curb opening and a grate in the gutter.
6. The on-site storm system will be privately maintained by the property owner/HOA.

F. OFF-SITE STORM CONVEYANCE SYSTEM

1. The offsite flow will be conveyed through a drainage way that has a bottom width of 2 feet and side slopes of 2:1 and is 2 feet deep. The off-site flow of 114 cfs will be 1.4 feet deep in the drainageway at 16.6% and will need to be lined with riprap since it has an erosive velocity of 17.4 fps. This will flow to a CDOT type D inlet which has a capacity of 96 cfs at 2 feet deep in a sump condition. The overflow of 18 cfs will flow down the access road which has a minimum capacity of 20 cfs as discussed above.

V POST CONSTRUCTION STORMWATER MANAGEMENT

A. PERMANENT BEST MANAGEMENT PRACTICES

1. The three on-site water quality/detention ponds will serve as a permanent water quality treatment feature. Refer to section D above and Exhibit B, Storm Water Quality Plan for additional details.

VI CONCLUSIONS

A. GENERAL SUMMARY

Historic drainage patterns and flows will be maintained with the proposed Astrid development. On-site imperviousness is being increased from 2% to 60% so two detention ponds are being proposed with included water quality capture volume to keep the flows slightly less than their current/historic rates and not have an adverse impact on adjacent or downstream properties.

The minor and major storms do not exceed a 6" depth in the gutter.

Pipe hydraulic results show that the 5-yr storm is contained within the pipes with no surcharging. The hydraulic results also that that the 100-yr storm is contained without overtopping.

B. COMPLIANCE WITH CRITERIA & VARIANCE REQUESTS

1. The drainage design complies with the City Drainage Criteria and no variance is requested.

C. NEW STORMWATER SYSTEM REQUIREMENTS

1. The storm water system will need to be maintained periodically and after significant storm events to ensure the system continues to function as designed. The Astrid HOA will be required to maintain all stormwater conveyance features.

VI REFERENCES

City of Steamboat Springs Drainage Criteria Section 5.0, Effective September 2007, Updated July 2019.

City of Steamboat Springs Engineering Standards, Chapter 4, Streets, September 2007, Updated July

City of Steamboat Springs Citywide Stormwater Master Plan, Short Elliott Hendrickson Inc., March 2013.

Mile High Flood District Drainage Criteria Manual, Vol. 1, 2 and 3, Urban Drainage and Flood Control District, Denver, Colorado, Current Version.

Addendum to Final Drainage Study for Edgemont and Related Access Improvements for Bear Claw II, Landmark Consultants, Inc., June 18, 2009

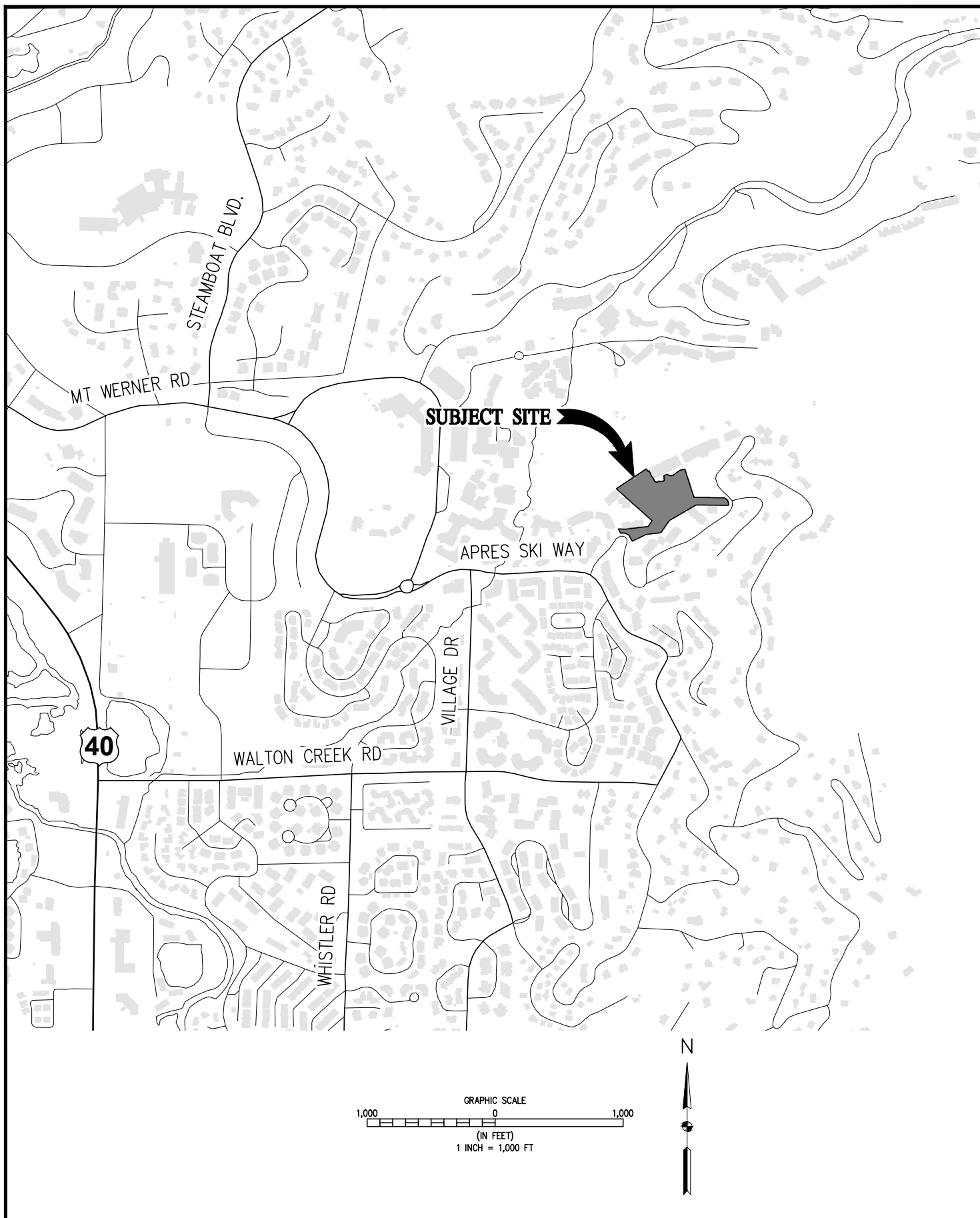
Draft Drainage Study for Edgemont, Landmark Consultants, Inc., April 9, 2007, Revised July 7, 2007

Final Drainage Study for Bear Claw II Sub-division, Landmark Consultants, Inc., June 19, 2018, Revised February 18, 2019

ATTACHMENT 1

VICINITY MAP

C:\CO20235 Astrid-Edgemont Ph2\Drawings\Drainage Maps\Citywide Vicinity Map.dwg, 12/20/2022 11:06:49 AM, Steve Batchelder



BASELINE
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STEAMBOAT ESQUIAR LP

STEAMBOAT SPRINGS

ROUTT COUNTY

ASTRID SITE DEVELOPMENT

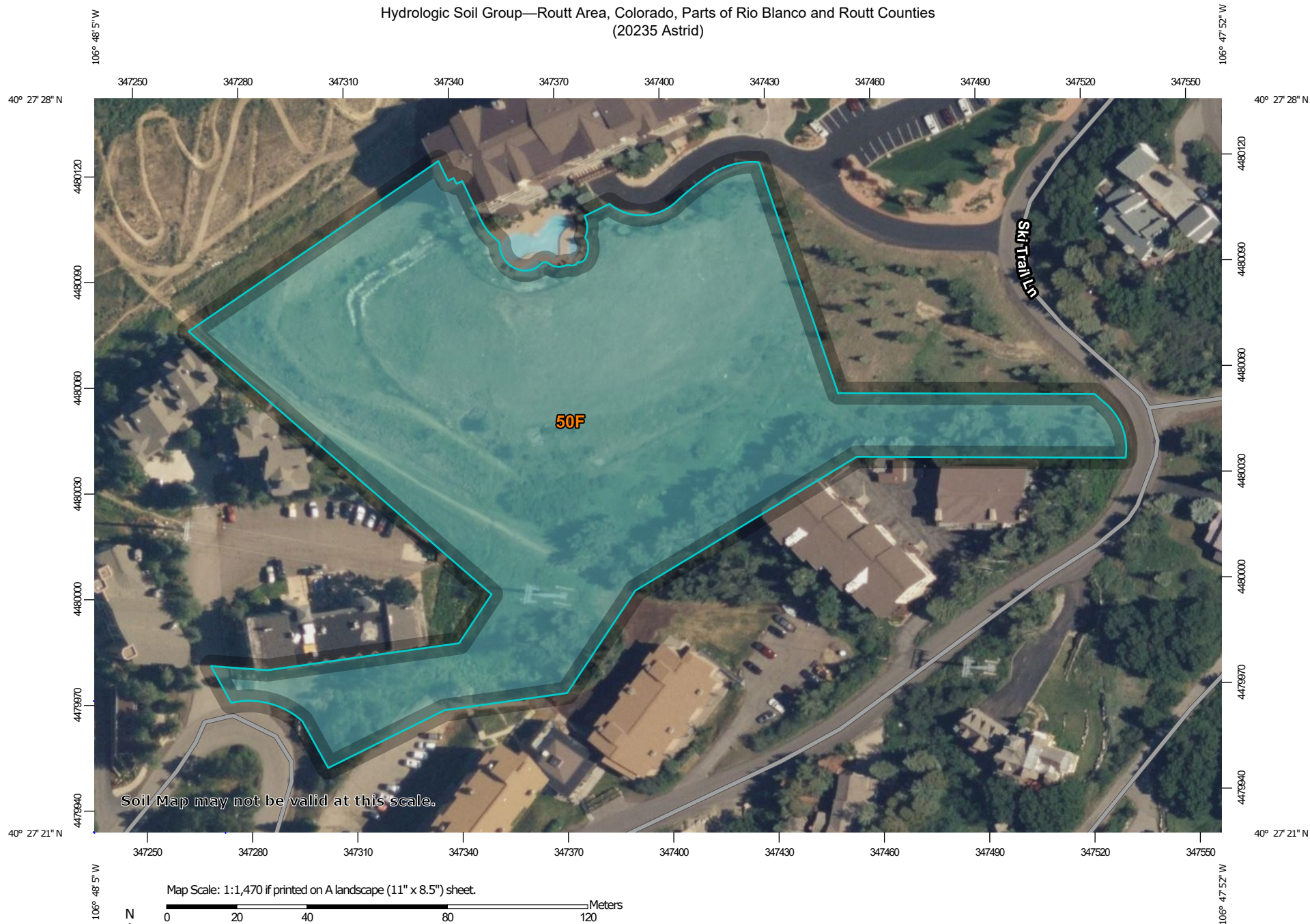
2410 SKI TRAIL LANE
VICINITY MAP

DESIGNED BY	SMB	INITIAL SUBMITTAL	12/22/22
DRAWING SIZE	8.5" X 11"	SURVEY FIRM	LANDMARK, INC.
SURVEY DATE	06/03/22	JOB NO.	C020235
DRAWING NAME	Citywide Vicinity Map.dwg	SHEET	1 OF 1
CHECKED BY	SMB		1

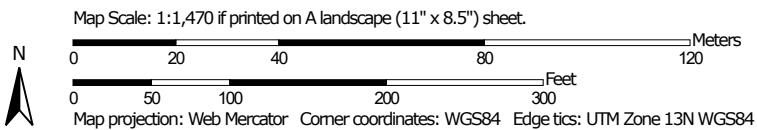
ATTACHMENT 2

NRCS SOILS MAP & DATA

Hydrologic Soil Group—Routt Area, Colorado, Parts of Rio Blanco and Routt Counties (20235 Astrid)



Soil Map may not be valid at this scale.



**Natural Resources
Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

12/6/2022
Page 1 of 4

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Lines

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

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

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: Routt Area, Colorado, Parts of Rio Blanco and Routt Counties
 Survey Area Data: Version 12, Sep 7, 2022

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

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

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
50F	Routt loam, 25 to 65 percent slopes, very stony	C	4.6	100.0%
Totals for Area of Interest			4.6	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

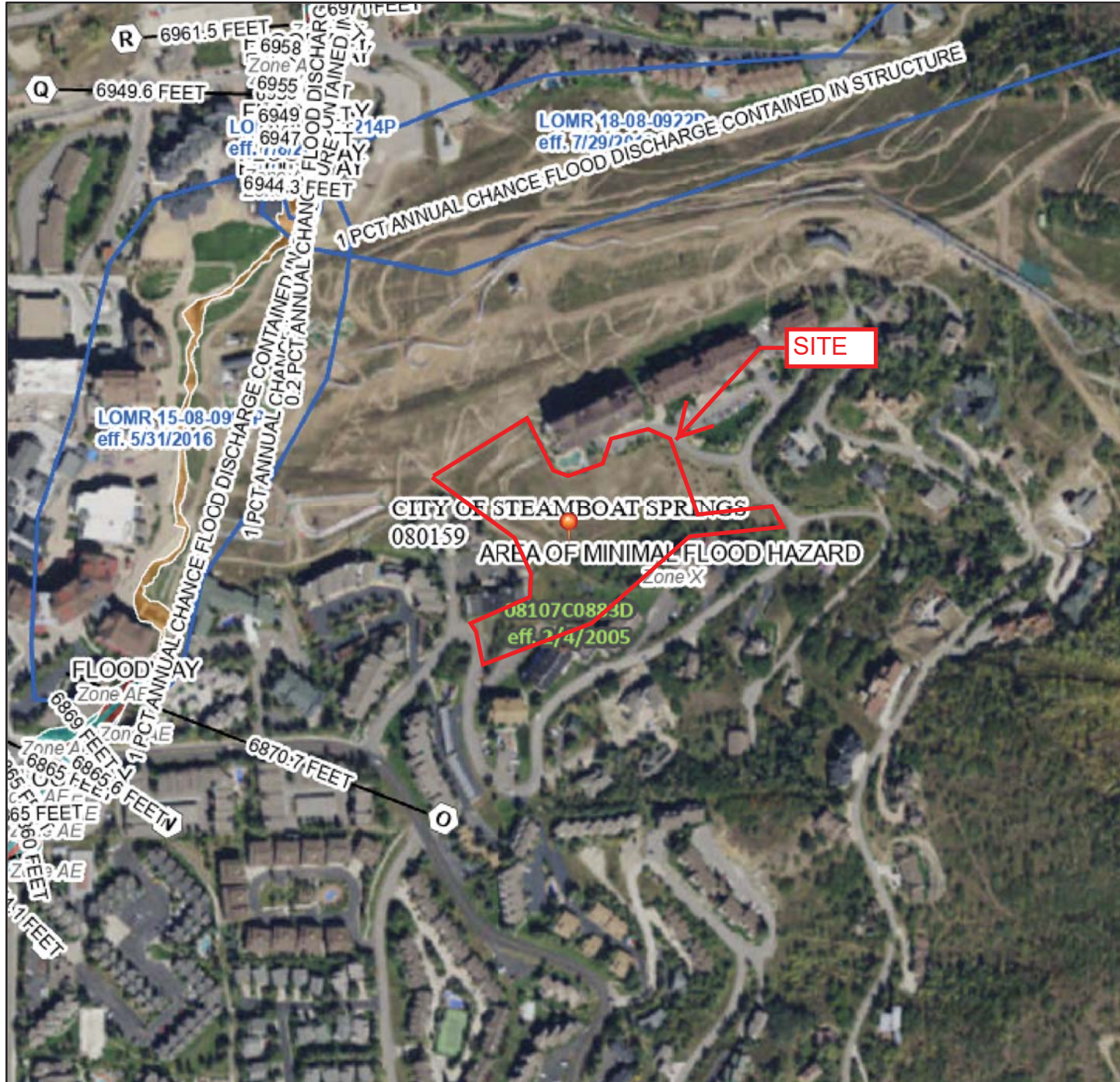
ATTACHMENT 3

FEMA Map

National Flood Hazard Layer FIRMMette



106°48'19"W 40°27'39"N



0 250 500 1,000 1,500 2,000 Feet 1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

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

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs
GENERAL STRUCTURES		Area of Undetermined Flood Hazard Zone D
		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance Water Surface Elevation
		17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
MAP PANELS		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature
		Digital Data Available
		No Digital Data Available
		Unmapped



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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **12/6/2022 at 6:53 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

ATTACHMENT 4

SITE PLAN AND STORM SEWER PROFILES

ATTACHMENT 5

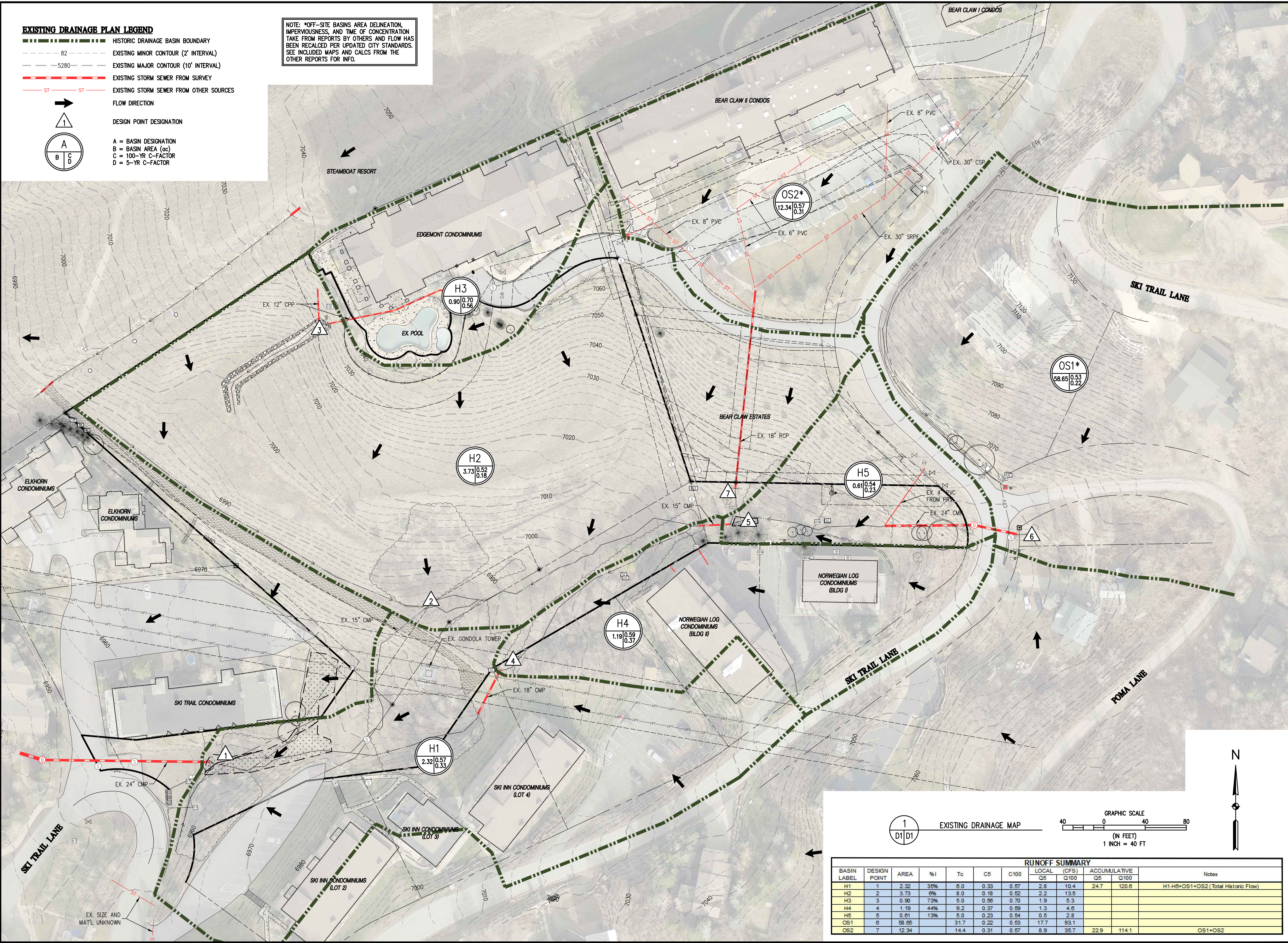
EXISTING AND PROPOSED DRAINAGE MAPS

C:\CO20235 Astrid-Edgemont Ph2\Drawings\Drainage Maps\20235 EX DRAIN.dwg, 12/21/2022 8:17:36 AM, Steve Batchelder

EXISTING DRAINAGE PLAN LEGEND

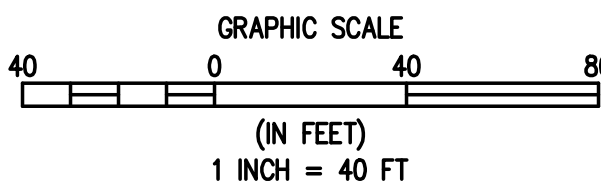
- HISTORIC DRAINAGE BASIN BOUNDARY
- EXISTING MINOR CONTOUR (2' INTERVAL)
- EXISTING MAJOR CONTOUR (10' INTERVAL)
- EXISTING STORM SEWER FROM SURVEY
- EXISTING STORM SEWER FROM OTHER SOURCES
- FLOW DIRECTION
- DESIGN POINT DESIGNATION
- A = BASIN DESIGNATION
- B = BASIN AREA (ac)
- C = 100-YR C-FACTOR
- D = 5-YR C-FACTOR

NOTE: *OFF-SITE BASINS AREA DELINEATION, IMPERVIOUSNESS, AND TIME OF CONCENTRATION TAKE FROM REPORTS BY OTHERS AND FLOW HAS BEEN RECALC'D PER UPDATED CITY STANDARDS. SEE INCLUDED MAPS AND CALCS FROM THE OTHER REPORTS FOR INFO.



1
D1/D1

EXISTING DRAINAGE MAP



RUNOFF SUMMARY											
BASIN LABEL	DESIGN POINT	AREA	%I	Tc	C5	C100	LOCAL (CFS)		ACCUMULATIVE		Notes
							Q5	Q100	Q5	Q100	
H1	1	2.32	35%	6.0	0.33	0.57	2.8	10.4	24.7	120.6	H1-H5+OS1+OS2 (Total Historic Flow)
H2	2	3.73	6%	8.0	0.18	0.52	2.2	13.5			
H3	3	0.90	73%	5.0	0.56	0.70	1.9	5.3			
H4	4	1.19	44%	9.2	0.37	0.59	1.3	4.6			
H5	5	0.61	13%	5.0	0.23	0.54	0.5	2.8			
OS1	6	58.65		31.7	0.22	0.53	17.7	93.1			OS1+OS2
OS2	7	12.34		14.4	0.31	0.57	8.9	35.7	22.9	114.1	

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DESIGNED BY

SMB

DATE

PREPARED BY

REVISION DESCRIPTION

STEAMBOAT ESQUIAR LP

ROUTT COUNTY

ASTRID SITE DEVELOPMENT

2410 SKI TRAIL LANE

EXISTING DRAINAGE MAP

STEAMBOAT SPRINGS

PREPARED UNDER THE DIRECT SUPERVISION OF

FOR AND ON BEHALF OF
BASELINE CORPORATION

INITIAL SUBMITTAL 12/22/22

DRAWING SIZE 24" x 36"

SURVEY FIRM SURVEY DATE

LANDMARK, INC. 06/03/22

JOB NO. C020235

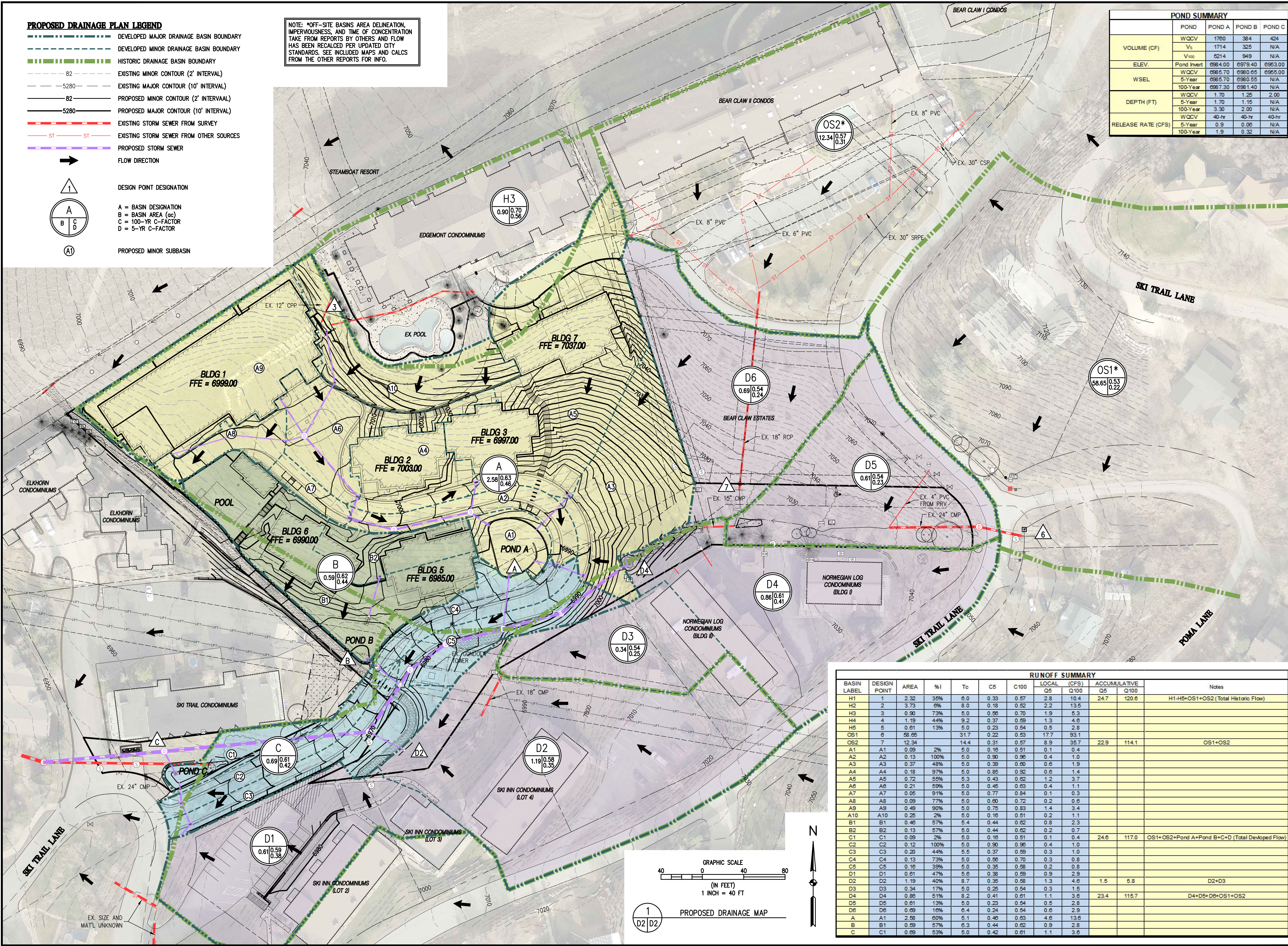
DRAWING NAME

20235 EX DRAIN.dwg

SHEET 1 OF 2

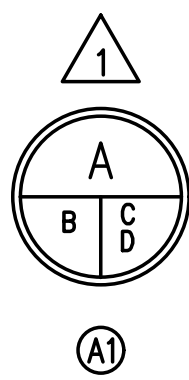
D1

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PROPOSED DRAINAGE PLAN LEGEND

- DEVELOPED MAJOR DRAINAGE BASIN BOUNDARY
- DEVELOPED MINOR DRAINAGE BASIN BOUNDARY
- HISTORIC DRAINAGE BASIN BOUNDARY
- EXISTING MINOR CONTOUR (2' INTERVAL)
- EXISTING MAJOR CONTOUR (10' INTERVAL)
- PROPOSED MINOR CONTOUR (2' INTERVAL)
- PROPOSED MAJOR CONTOUR (10' INTERVAL)
- EXISTING STORM SEWER FROM SURVEY
- EXISTING STORM SEWER FROM OTHER SOURCES
- PROPOSED STORM SEWER
- FLOW DIRECTION



DESIGN POINT DESIGNATION

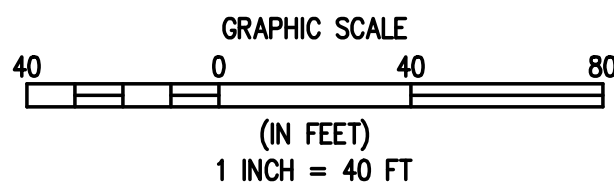
A = BASIN DESIGNATION
B = BASIN AREA (ac)
C = 100-YR C-FACTOR
D = 5-YR C-FACTOR

PROPOSED MINOR SUBBASIN

NOTE: *OFF-SITE BASINS AREA DELINEATION, IMPERVIOUSNESS, AND TIME OF CONCENTRATION TAKE FROM REPORTS BY OTHERS AND FLOW HAS BEEN RECALCULATED PER UPDATED CITY STANDARDS. SEE INCLUDED MAPS AND CALCS FROM THE OTHER REPORTS FOR INFO.

POND SUMMARY				
	POND	POND A	POND B	POND C
VOLUME (CF)	WQCV	1760	384	424
	V _s	1714	325	N/A
	V ₁₀₀	5214	949	N/A
ELEV.	Pond Invert	6984.00	6979.40	6963.00
	WQCV	6985.70	6980.65	6965.00
	5-Year	6985.70	6980.65	N/A
WSEL	100-Year	6987.30	6981.40	N/A
	WQCV	1.70	1.25	2.00
	5-Year	1.70	1.15	N/A
DEPTH (FT)	100-Year	3.30	2.00	N/A
	WQCV	40-hr	40-hr	40-hr
	5-Year	0.9	0.06	N/A
RELEASE RATE (CFS)	100-Year	1.9	0.32	N/A

RUNOFF SUMMARY												
BASIN LABEL	DESIGN POINT	AREA	% I	T _c	C ₅	C ₁₀₀	LOCAL C ₁₀₀ (CFS)	ACCUMULATIVE C ₁₀₀ (CFS)	Notes			
H1	1	2.32	35%	6.0	0.33	0.57	2.8	10.4	H1-H5+OS1+OS2 (Total Historic Flow)			
H2	2	3.73	6%	8.0	0.18	0.52	2.2	13.5				
H3	3	0.90	73%	5.0	0.56	0.70	1.9	5.3				
H4	4	1.19	44%	9.2	0.37	0.59	1.3	4.8				
H5	5	0.61	13%	5.0	0.23	0.54	0.5	2.8				
OS1	6	58.65		31.7	0.22	0.53	17.7	93.1	OS1+OS2			
OS2	7	12.34		14.4	0.31	0.57	8.9	35.7				
A1	A1	0.09	2%	5.0	0.16	0.51	0.1	0.4				
A2	A2	0.13	100%	5.0	0.90	0.96	0.4	1.0				
A3	A3	0.37	48%	5.0	0.39	0.60	0.6	1.9				
A4	A4	0.18	97%	5.0	0.85	0.92	0.6	1.4				
A5	A5	0.72	55%	5.3	0.43	0.62	1.2	3.7				
A6	A6	0.21	59%	5.0	0.45	0.63	0.4	1.1				
A7	A7	0.05	91%	5.0	0.77	0.84	0.1	0.3				
A8	A8	0.09	77%	5.0	0.60	0.72	0.2	0.6				
A9	A9	0.49	90%	5.0	0.75	0.83	1.4	3.4				
A10	A10	0.25	2%	5.0	0.16	0.51	0.2	1.1				
B1	B1	0.46	57%	5.4	0.44	0.62	0.8	2.3				
B2	B2	0.13	57%	5.0	0.44	0.62	0.2	0.7				
C1	C1	0.09	2%	5.0	0.16	0.51	0.1	0.4	OS1+OS2+Pond A+Pond B+C+D (Total Developed Flow)			
C2	C2	0.12	100%	5.0	0.90	0.96	0.4	1.0				
C3	C3	0.20	44%	5.5	0.37	0.59	0.3	1.0				
C4	C4	0.13	73%	5.0	0.55	0.70	0.3	0.8				
C5	C5	0.16	39%	5.0	0.35	0.58	0.2	0.8				
D1	D1	0.61	47%	5.8	0.38	0.59	0.9	2.9				
D2	D2	1.19	40%	8.7	0.35	0.58	1.3	4.6				
D3	D3	0.34	17%	5.0	0.25	0.54	0.3	1.5				
D4	D4	0.86	51%	8.2	0.41	0.61	1.1	3.6				
D5	D5	0.61	13%	5.0	0.23	0.54	0.5	2.8				
D6	D6	0.69	16%	6.4	0.24	0.54	0.6	2.9				
A	A1	2.58	60%	5.1	0.46	0.63	4.6	13.6				
B	B1	0.59	57%	6.3	0.44	0.62	0.9	2.8				
C	C1	0.69	53%	5.0	0.42	0.61	1.1	3.6				



PROPOSED DRAINAGE MAP

BASELINE

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DESIGNED BY

SMB

DRAWN BY

SMB

CHECKED BY

LW

DATE

REVISION DESCRIPTION

REVISIONS PER DWT # COMMENTS

STEAMBOAT ESQUIAR LP

ASTRID SITE DEVELOPMENT

2410 SKI TRAIL LANE

PROPOSED DRAINAGE MAP

FOR AND ON BEHALF OF

BASELINE CORPORATION

INITIAL SUBMITTAL 12/22/22

DRAWING SIZE 24" X 36"

SURVEY FIRM LANDMARK, INC.

SURVEY DATE 06/03/22

JOB NO. C020235

DRAWING NAME 20235 PRO DRAIN.dwg

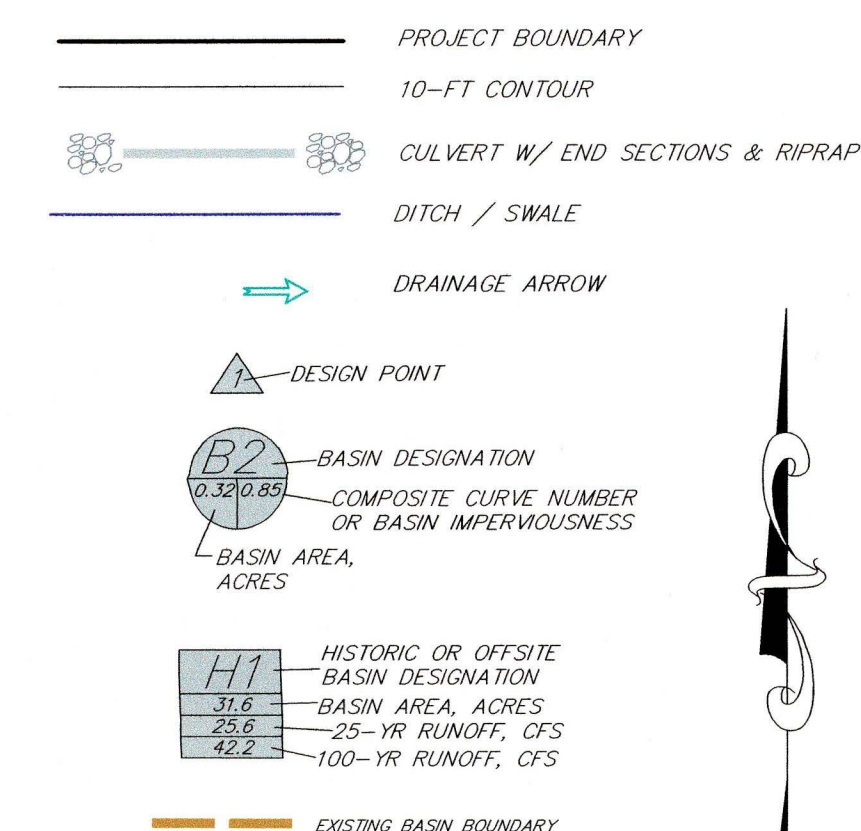
SHEET D OF 2

D2

ATTACHMENT 6

OFF-SITE BASINS MAP AND CALCS (FROM OTHER REPORTS)

LEGEND



Stormwater Peak Flows		
Location	Historical (cfs)	
	25-Year	100-Year
H1	44.9	77.3
H2	11.7	19.1
H3	10.3	16.8
H4	4.3	6.8
H5	5.2	7.3
H6	2.6	3.5
DP3*	64.0	106.8

*Peak flows to DP3 are calculated from a combined basin encompassing sub-basins H1-H6 and do not represent a summation of individual sub-basin flows

NO.	DATE	REVISIONS	INT.

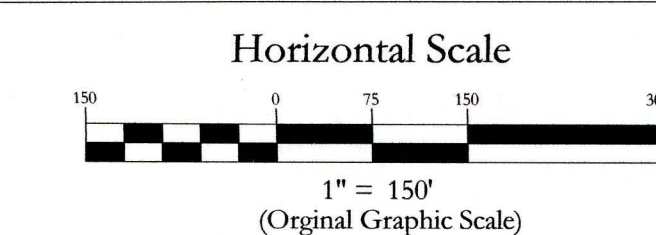
Steamboat Springs, CO

Edgemont Figure 1 Existing Conditions Area Drainage

DATE: 04-06-07 DGN. BY: ADR
JOB NO. 1994-003 DWN. BY: ADR
FILE: Edgemont CHK. BY:

Vertical Scale: 1" = NA

Contour Interval = 10 Feet



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Steamboat Springs, Colorado 80477
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SHEET NO.

1

OF 1

RATIONAL METHOD RUNOFF ANALYSIS

Job # 1994-003
Job Name Edgemont
Designed by: ADR
Checked by:

Date: March 7, 2007
Revised: July 9, 2007



H1 - Existing

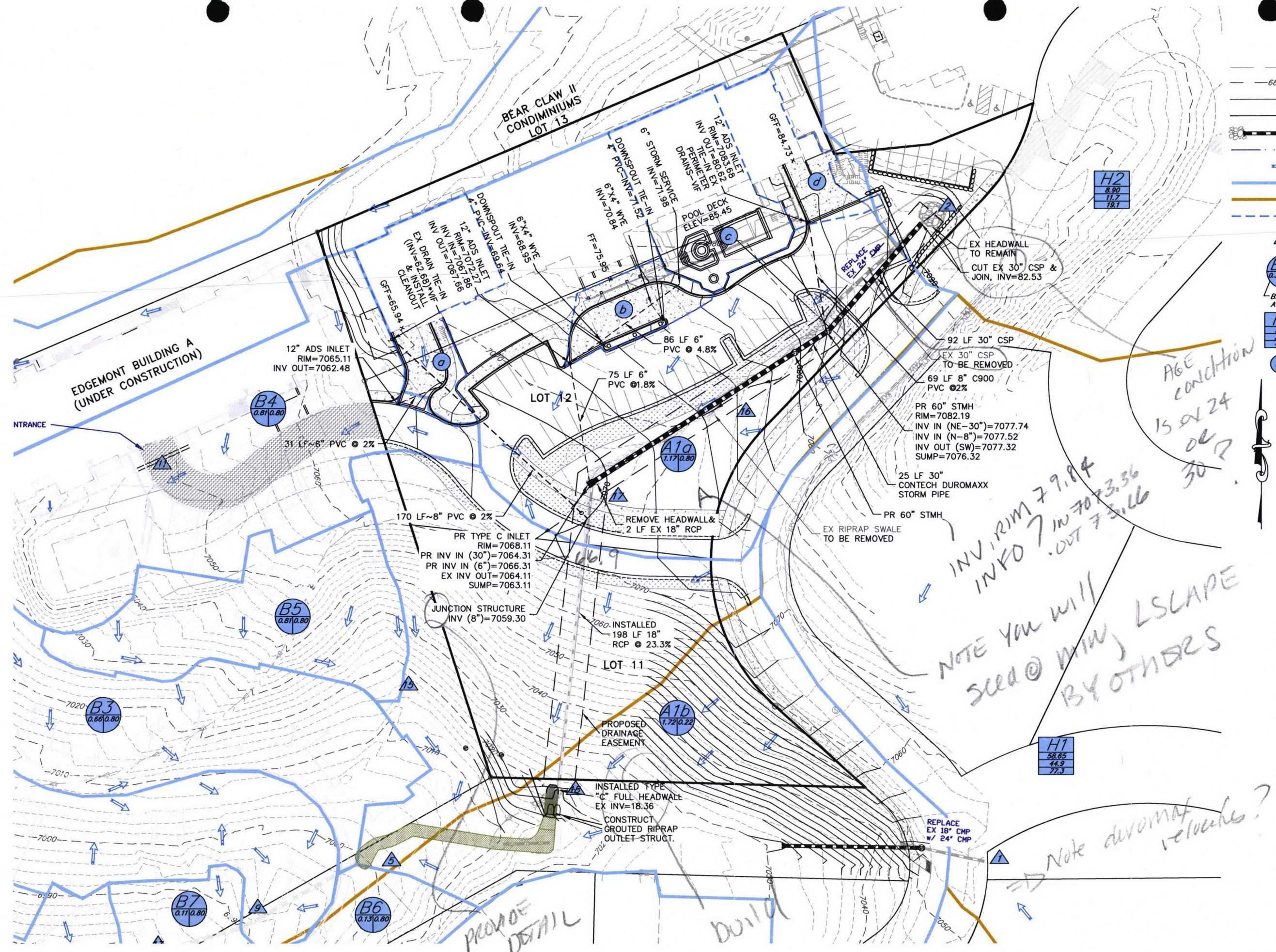
BASIN INPUT				TIME OF CONCENTRATION				RESULTS			
Area, ac	% imp	Soil Type	Sheet Flow	Shallow Flow	Channel Flow	Tc, min	Event	C	i, in/hr	A, acres	Q, cfs
Undeveloped Areas	58.55	5%	Surface Dense Shrubs	Paved, Y/N N	Hyd. Rad., ft 0.20	Minimum	2-YR	0.08	0.9	58.65	4.2
Paved Roads, Parking, Roofs	0.10	100%	Length, ft 300	Length, ft 900	Length, ft 1562	Tc, min	5-YR	0.18	1.3	58.65	14.2
Commercial	0.00	95%	Slope, ft/ft 0.2700	Slope, ft/ft 0.45	Slope, ft/ft 0.33	10.0	10-YR	0.28	1.7	58.65	27.2
Gravel Parking	0.00	40%	Manning's n 0.4	Velocity, ft/s 10.8	Manning's n 0.030	Final	25-YR	0.39	1.9	58.65	44.9
Residential	0.00	80%			Velocity, ft/s 9.8	Tc, min					
	58.65	5%	Ti, min= 27.6	Ts, min= 1.4	Tt, min= 2.7	31.7	100-YR	0.52	2.5	58.65	77.3

H2 - Existing

BASIN INPUT				TIME OF CONCENTRATION				RESULTS			
Area, ac	% imp	Soil Type	Sheet Flow	Shallow Flow	Channel Flow	Tc, min	Event	C	i, in/hr	A, acres	Q, cfs
Undeveloped Areas	7.32	5%	Surface Prairie Grass	Paved, Y/N N	Hyd. Rad., ft 0.20	Minimum	2-YR	0.18	1.4	8.90	2.3
Paved Roads, Parking, Roofs	1.58	100%	Length, ft 300	Length, ft 600	Length, ft 50	Tc, min	5-YR	0.27	2.0	8.90	4.8
Commercial	0.00	90%	Slope, ft/ft 0.2700	Slope, ft/ft 0.35	Slope, ft/ft 0.2	5.0	10-YR	0.35	2.5	8.90	7.9
Gravel Parking	0.00	50%	Manning's n 0.15	Velocity, ft/s 9.5	Manning's n 0.030	Final	25-YR	0.45	2.9	8.90	11.7
Residential	0.00	80%			Velocity, ft/s 7.6	Tc, min					
	8.90	22%	Ti, min= 12.6	Ts, min= 1.0	Tt, min= 0.1	13.8	100-YR	0.56	3.9	8.90	19.1

H3 - Existing

BASIN INPUT				TIME OF CONCENTRATION				RESULTS			
Area, ac	% imp	Soil Type	Sheet Flow	Shallow Flow	Channel Flow	Tc, min	Event	C	i, in/hr	A, acres	Q, cfs
Undeveloped Areas	6.73	5%	Surface Prairie Grass	Paved, Y/N N	Hyd. Rad., ft 0.20	Minimum	2-YR	0.17	1.4	7.94	1.8
Paved Roads, Parking, Roofs	1.20	100%	Length, ft 300	Length, ft 640	Length, ft 0	Tc, min	5-YR	0.26	2.0	7.94	4.1
Commercial	0.00	90%	Slope, ft/ft 0.2700	Slope, ft/ft 0.26	Slope, ft/ft 0.02	5.0	10-YR	0.34	2.5	7.94	6.8
Gravel Parking	0.00	50%	Manning's n 0.15	Velocity, ft/s 8.2	Manning's n 0.030	Final	25-YR	0.44	2.9	7.94	10.3
Residential	0.00	80%			Velocity, ft/s 2.4	Tc, min					
	7.94	19%	Ti, min= 12.6	Ts, min= 1.3	Tt, min= 0.0	13.9	100-YR	0.55	3.8	7.94	16.8



LEGEND

- EX. 2-FT CONTOUR
- EX. 10-FT CONTOUR
- PR. 2-FT CONTOUR
- PR. 10-FT CONTOUR
- CULVERT W/ END SECTIONS & RIPRAP DITCH / SWALE
- DRAINAGE ARROW
- PR. BASIN BOUNDARY
- HISTORIC BASIN BOUNDARY
- REVISED PR BASIN BOUNDARY
- DESIGN POINT
- BASIN DESIGNATION
- COMPOSITE CURVE NUMBER OR BASIN IMPERVIOUSNESS
- BASIN AREA, ACRES
- HISTORIC OR OFFSITE BASIN DESIGNATION
- BASIN AREA, ACRES
- 25-YR RUNOFF, CFS
- 100-YR RUNOFF, CFS
- ADDITIONAL DRAIN BASIN (FOR ADDENDUM)



NO.	DATE	REVISIONS	INT

DB Bear Paw, LLC
Steamboat Springs, CO

Bear Claw II Access Improvements

Revised Drainage Plan

DATE: 06/18/09 DGN BY: DCS
JOB NO. 1188-012 DWN BY: DCS
DVG. NO. 1188-012 DR SURV. BY: LCI

Vertical Scale: 1" = NA

Contour Interval = Feet

Horizontal Scale

1" = 60'



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AGE condition is ex 24 or 30?

INV, RIM 79.84
INFO 7 in 7073.36
OUT 73.66

NOTE you will see @ MIN, LSCAPE BY OTHERS

Note duromaxx velocity?

PROPOSED DETAIL

Build

RATIONAL METHOD RUNOFF ANALYSIS

Job # 1994-003
 Job Name Edgemont
 Designed by: ADR
 Checked by:
 Date: March 7, 2007
 Revised: June 18, 2009
 Revised For: Bear Claw II CD's (revised)
 Revised By: DCS



CIVIL ENGINEERING & SURVEYING
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DP 17=H2+A1.a+b+c+d

BASIN INPUT				TIME OF CONCENTRATION							RESULTS				
	Area, ac	% imp	Soil Type	Sheet Flow		Shallow Flow		Channel Flow		Tc, min	Event	C	i, in/hr	A, acres	Q, cfs
Undeveloped Areas	7.32	5%	C	Surface	Prarie Grass	Paved, Y/N	N	Hyd. Rad., ft	0.20	Minimum	2-YR	0.23	1.4	10.39	3.3
Paved Roads, Parking, Roofs	1.96	100%		Length, ft	300	Length, ft	600	Length, ft	50	Tc, min	5-YR	0.31	2.0	10.39	6.4
Commercial	0.00	95%	P2	Slope, ft/ft	0.2700	Slope, ft/ft	0.35	Slope, ft/ft	0.2	5.0	10-YR	0.38	2.5	10.39	9.9
Gravel Parking	0.00	40%	1.4	Manning's n	0.15	Velocity, ft/s	9.5	Manning's n	0.030	Final	25-YR	0.47	2.9	10.39	14.2
Residential	1.12	80%						Velocity, ft/s	7.6	Tc, min					
10.39 31%				Ti, min= 12.6		Ts, min= 1.0		Tt, min= 0.1		14.2	100-YR	0.57	3.8	10.39	22.5
				Pipe Flow	PIPE	Length, ft	Velocity (ft/s)	Tt, min							
					1	92	9.7	0.2							
					2	25	22.1	0.0							
					3	154	10.0	0.3							

321 gals

DP 18=H2+A1.a+a+b+c+d+A1.b

BASIN INPUT				TIME OF CONCENTRATION							RESULTS				
	Area, ac	% imp	Soil Type	Sheet Flow		Shallow Flow		Channel Flow		Tc, min	Event	C	i, in/hr	A, acres	Q, cfs
Undeveloped Areas	8.74	5%	C	Surface	Prarie Grass	Paved, Y/N	N	Hyd. Rad., ft	0.20	Minimum	2-YR	0.23	1.4	12.34	3.9
Paved Roads, Parking, Roofs	2.43	100%		Length, ft	300	Length, ft	600	Length, ft	50	Tc, min	5-YR	0.31	2.0	12.34	7.5
Commercial	0.00	95%	P2	Slope, ft/ft	0.2700	Slope, ft/ft	0.35	Slope, ft/ft	0.2	5.0	10-YR	0.38	2.5	12.34	11.7
Gravel Parking	0.00	40%	1.4	Manning's n	0.15	Velocity, ft/s	9.5	Manning's n	0.030	Final	25-YR	0.47	2.9	12.34	16.8
Residential	1.17	80%						Velocity, ft/s	7.6	Tc, min					
12.34 31%				Ti, min= 12.6		Ts, min= 1.0		Tt, min= 0.1		14.4	100-YR	0.57	3.8	12.34	26.6
				Pipe Flow	PIPE	Length, ft	Velocity (ft/s)	Tt, min							
					1	92	9.7	0.2							
					2	25	22.1	0.0							
					3	154	10.0	0.3							
					4	198	19.7	0.2							

ATTACHMENT 7

RUNOFF CALCULATIONS AND SUMMARY TABLE



SF-1
RUNOFF COEFFICIENTS

PROJECT NAME: Astrid
PROJECT NUMBER: 20235
CALCULATED BY: SMB
CHECKED BY: CSR

DATE: 5/19/2023

LAND USE:		LAWNS AND GOLF COURSES	ROOF AREA	PAVED AREA	GRAVEL AREA				HYDROLOGIC SOIL TYPE = C						
% IMPERVIOUS		2%	90%	100%	40%	0%	0%	0%							
1.25-YEAR COEFF.		0.01	0.71	0.88	0.25	0.00	0.00	0.00							
2-YEAR COEFF.		0.06	0.73	0.89	0.28	0.00	0.00	0.00							
5-YEAR COEFF.		0.16	0.75	0.90	0.35	0.00	0.00	0.00							
10-YEAR COEFF.		0.26	0.77	0.92	0.42	0.00	0.00	0.00							
100-YEAR COEFF.		0.51	0.83	0.96	0.58	0.00	0.00	0.00							
DESIGN BASIN	DESIGN POINT	LAWNS AND GOLF COURSES (AC)	ROOF AREA (AC)	PAVED AREA (AC)	GRAVEL AREA (AC)				TOTAL AREA (AC)	PERCENT IMPERV. (%)	RUNOFF COEFFICIENTS				
											C _{1.25}	C ₂	C ₅	C ₁₀	C ₁₀₀
H1	1	1.50	0.27	0.54					2.32	35%	0.22	0.25	0.33	0.40	0.57
H2	2	3.59		0.14					3.73	6%	0.03	0.08	0.18	0.28	0.52
H3	3	0.21	0.39	0.30					0.90	73%	0.50	0.52	0.56	0.60	0.70
H4	4	0.66	0.17	0.36					1.19	44%	0.28	0.31	0.37	0.44	0.59
H5	5	0.54	0.07	0.07					0.61	13%	0.09	0.13	0.23	0.31	0.54
HISTORIC BASIN SUBTOTAL		6.51	0.83	1.42	0.00	0.00	0.00	0.00	8.76	26%	0.16	0.20	0.28	0.36	0.56
		74.3%	9.5%	16.2%					100%						
A1	A1	0.09							0.09	2%	0.01	0.06	0.16	0.26	0.51
A2	A2	0.00		0.13					0.13	100%	0.88	0.89	0.90	0.92	0.96
A3	A3	0.18	0.12	0.07					0.37	48%	0.30	0.33	0.39	0.45	0.60
A4	A4	-0.01	0.12	0.07					0.18	97%	0.83	0.84	0.85	0.87	0.92
A5	A5	0.31	0.26	0.16					0.72	55%	0.34	0.37	0.43	0.48	0.62
A6	A6	0.09	0.02	0.10					0.21	59%	0.36	0.40	0.45	0.50	0.63
A7	A7	0.00		0.04					0.05	91%	0.73	0.75	0.77	0.79	0.84
A8	A8	0.02		0.07					0.09	77%	0.54	0.56	0.60	0.64	0.72
A9	A9	0.00	0.49						0.49	90%	0.71	0.73	0.75	0.77	0.83
A10	A10	0.25							0.25	2%	0.01	0.06	0.16	0.26	0.51
DEVELOPED BASIN A SUBTOTAL		0.94	1.01	0.63	0.00	0.00	0.00	0.00	2.58	60%	0.37	0.41	0.46	0.51	0.63
		36.3%	39.3%	24.4%					100%						
B1	B1	0.18	0.18	0.09					0.46	57%	0.35	0.39	0.44	0.49	0.62
B2	B2	0.05	0.08						0.13	57%	0.35	0.39	0.44	0.49	0.62
DEVELOPED BASIN B SUBTOTAL		0.23	0.26	0.09	0.00	0.00	0.00	0.00	0.59	57%	0.35	0.39	0.44	0.49	0.62
		39.2%	44.8%	16.0%					100%						
C1	C1	0.09							0.09	2%	0.01	0.06	0.16	0.26	0.51
C2	C2	0.00		0.12					0.12	100%	0.88	0.89	0.90	0.92	0.96
C3	C3	0.10		0.08	0.02				0.20	44%	0.28	0.31	0.37	0.44	0.59
C4	C4	0.04		0.09					0.13	73%	0.50	0.52	0.56	0.60	0.70
C5	C5	0.10		0.06					0.16	39%	0.25	0.28	0.35	0.42	0.58
DEVELOPED BASIN C SUBTOTAL		0.32	0.00	0.35	0.02	0.00	0.00	0.00	0.69	53%	0.33	0.36	0.42	0.47	0.61
		46.8%		51.0%	2.3%				100%						
D1	D1	0.32	0.09	0.21					0.61	47%	0.29	0.32	0.38	0.45	0.59
D2	D2	0.71	0.17	0.31					1.19	40%	0.25	0.28	0.35	0.42	0.58
D3	D3	0.28	0.05	0.00					0.34	17%	0.11	0.15	0.25	0.33	0.54
D4	D4	0.42	0.07	0.37					0.86	51%	0.32	0.35	0.41	0.47	0.61
D5	D5	0.54		0.07					0.61	13%	0.09	0.13	0.23	0.31	0.54
D6	D6	0.59		0.10					0.69	16%	0.11	0.15	0.24	0.32	0.54
DEVELOPED BASIN D SUBTOTAL		2.87	0.37	1.06	0.00	0.00	0.00	0.00	4.30	34%	0.21	0.24	0.32	0.40	0.57
		66.7%	8.7%	24.6%					100%						
A	A1	0.94	1.01	0.63					2.58	60%	0.37	0.41	0.46	0.51	0.63
B	B1	0.23	0.26	0.09					0.59	57%	0.35	0.39	0.44	0.49	0.62
C	C1	0.32		0.35	0.02				0.69	53%	0.33	0.36	0.42	0.47	0.61
DEVELOPED MAJOR BASIN SUBTOTAL		1.49	1.28	1.08	0.02	0.00	0.00	0.00	3.86	59%	0.35	0.40	0.45	0.50	0.63
		38.6%	33.1%	27.9%	0.4%				100%						



STANDARD FORM SF-2 TIME OF CONCENTRATION

PROJECT NAME: Astrid
PROJECT NUMBER: 20235
CALCULATED BY: SMB
CHECKED BY: CSR

DATE: 5/19/2023

SUB-BASIN DATA			INITIAL TIME (T _i)			TRAVEL TIME (T _t)							FIRST DESIGN POINT T _c CHECK (URBANIZED BASINS)				FINAL T _c	RUNOFF COEFF.	
DESIGN BASIN (1)	AREA Ac (2)	C _s (3)	LENGTH (L ₀) Ft (4)	SLOPE (S) % (5)	T _i Min. (6)	LENGTH Ft. (7)	SLOPE (S _w) % (8)	Land Surface (9)	K (10)	VEL fps (11)	T _t Min. (12)	COMP. T _c (13)	URBAN BASIN? (14)	i (15)	CHANNELIZED LENGTH (16)	T _c = Eq 6-5 Min. (17)	Min. (18)	C ₁₀ (19)	C ₁₀₀ (20)
H1	2.32	0.33	80	25.0%	4.3	490	11.0%	Grassed Waterway	15.0	5.0	1.6	6.0	Yes	0.35	490	21.8	6.0	0.40	0.57
H2	3.73	0.18	140	27.0%	6.6	305	6.0%	Grassed Waterway	15.0	3.7	1.4	8.0	No	0.06			8.0	0.28	0.52
H3	0.90	0.56	50	20.0%	2.6	300	12.0%	Paved Areas	20.0	6.9	0.7	3.3	Yes	0.73	300	14.4	5.0	0.60	0.70
H4	1.19	0.37	250	16.0%	8.4	270	14.0%	Grassed Waterway	15.0	5.6	0.8	9.2	Yes	0.44	270	19.3	9.2	0.44	0.59
H5	0.61	0.23	75	50.0%	3.8	160	10.0%	Grassed Waterway	15.0	4.7	0.6	4.3	No	0.13			5.0	0.31	0.54
DP6-DP1						880	11.0%	Grassed Waterway	15.0	5.0	2.9	2.9					5.0		
A1	0.09	0.16	10	5.0%	3.2	56	2.0%	Short Pasture/Lawn	7.0	1.0	0.9	4.1	No	0.02			5.0	0.26	0.51
A2	0.13	0.90	10	2.0%	0.9	250	5.0%	Paved Areas	20.0	4.5	0.9	1.9	Yes	1.00	250	9.8	5.0	0.92	0.96
A3	0.37	0.39	60	33.0%	3.1	250	15.0%	Grassed Waterway	15.0	5.8	0.7	3.9	Yes	0.48	250	18.4	5.0	0.45	0.60
A4	0.18	0.85	60	10.0%	1.6	180	5.0%	Paved Areas	20.0	4.5	0.7	2.3	Yes	0.97	180	10.1	5.0	0.87	0.92
A5	0.72	0.43	50	6.0%	4.8	180	15.0%	Grassed Waterway	15.0	5.8	0.5	5.3	Yes	0.55	180	17.2	5.3	0.48	0.62
A6	0.21	0.45	10	2.0%	3.0	50	25.0%	Grassed Waterway	15.0	7.5	0.1	3.1	Yes	0.59	50	16.1	5.0	0.50	0.63
A7	0.05	0.77	10	2.0%	1.5	90	5.0%	Paved Areas	20.0	4.5	0.3	1.9	Yes	0.91	90	10.8	5.0	0.79	0.84
A8	0.09	0.60	10	2.0%	2.3	80	14.0%	Paved Areas	20.0	7.5	0.2	2.5	Yes	0.77	80	13.1	5.0	0.64	0.72
A9	0.49	0.75	90	10.0%	2.8	100	2.0%	Paved Areas	20.0	2.8	0.6	3.4	Yes	0.90	100	11.2	5.0	0.77	0.83
A10	0.25	0.16	40	33.0%	3.4	180	6.0%	Grassed Waterway	15.0	3.7	0.8	4.2	No	0.02			5.0	0.26	0.51
B1	0.46	0.44	70	10.0%	4.7	150	6.0%	Grassed Waterway	15.0	3.7	0.7	5.4	Yes	0.57	150	16.9	5.4	0.49	0.62
B2	0.13	0.44	10	5.0%	2.2	50	25.0%	Grassed Waterway	15.0	7.5	0.1	2.3	Yes	0.57	50	16.4	5.0	0.49	0.62
C1	0.09	0.16	15	10.0%	3.1	90	10.0%	Grassed Waterway	15.0	4.7	0.3	3.4	No	0.02			5.0	0.26	0.51
C2	0.12	0.90	10	2.0%	0.9	240	7.0%	Paved Areas	20.0	5.3	0.8	1.7	Yes	1.00	240	9.7	5.0	0.92	0.96
C3	0.20	0.37	60	10.0%	4.8	200	7.0%	Paved Areas	20.0	5.3	0.6	5.5	Yes	0.44	200	19.3	5.5	0.44	0.59
C4	0.13	0.56	10	2.0%	2.5	210	7.0%	Paved Areas	20.0	5.3	0.7	3.2	Yes	0.73	210	14.3	5.0	0.60	0.70
C5	0.16	0.35	10	2.0%	3.5	210	7.0%	Paved Areas	20.0	5.3	0.7	4.1	Yes	0.39	210	20.2	5.0	0.42	0.58
D1	0.61	0.38	120	20.0%	5.3	60	6.0%	Grassed Waterway	15.0	3.7	0.3	5.6	Yes	0.47	60	18.2	5.6	0.45	0.59
D2	1.19	0.35	280	20.0%	8.5	80	12.0%	Grassed Waterway	15.0	5.2	0.3	8.7	Yes	0.40	80	19.5	8.7	0.42	0.58
D3	0.34	0.25	40	20.0%	3.6	140	15.0%	Grassed Waterway	15.0	5.8	0.4	4.0	No	0.17			5.0	0.33	0.54
D4	0.86	0.41	250	16.0%	8.0	80	14.0%	Grassed Waterway	15.0	5.6	0.2	8.2	Yes	0.51	80	17.5	8.2	0.47	0.61
D5	0.61	0.23	75	50.0%	3.8	160	10.0%	Grassed Waterway	15.0	4.7	0.6	4.3	No	0.13			5.0	0.31	0.54
D6	0.69	0.24	140	27.0%	6.2	60	10.0%	Grassed Waterway	15.0	4.7	0.2	6.4	No	0.16			6.4	0.32	0.54
A	2.58	0.46	95	20.0%	4.2	340	10.0%	Paved Areas	20.0	6.3	0.9	5.1	Yes	0.60	340	16.7	5.1	0.51	0.63
B	0.59	0.44	60	5.0%	5.5	175	6.0%	Grassed Waterway	15.0	3.7	0.8	6.3	Yes	0.57	175	17.0	6.3	0.49	0.62
C	0.69	0.42	24	50.0%	1.7	430	7.4%	Paved Areas	20.0	5.4	1.3	3.0	Yes	0.53	430	18.6	5.0	0.47	0.61

$$t_i = 0.395 (1.1 - C_s) L_0^{1/2} / S^{1/3} \quad V = K S_w^{0.5} \quad T_t = \frac{L}{60 V} \quad t_c = (26-17i) + L_t / (60 (14i + 9) \sqrt{(S_t)})$$



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STANDARD FORM SF-3
STORM DRAINAGE DESIGN - RATIONAL METHOD 5-YEAR EVENTPROJECT NAME: Astrid
PROJECT NUMBER: 20235
CALCULATED BY: SMB
CHECKED BY: CSR P_1 (1-Hour Rainfall) = 0.82 in. (5-yr)

DATE: 5/19/2023

STORM LINE	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		DESIGN BASIN	AREA (AC)	RUNOFF COEFF C_p	t_c (min)	C^*A (ac)	I (in/hr)	Q (cfs)	t_c (min)	$\Sigma(C^*A)$ (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs)	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	t_t (min)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	1	H1	2.32	0.33	6.0	0.77	3.61	2.8	34.65	19.26	1.28	24.7									
	2	H2	3.73	0.18	8.0	0.69	3.18	2.2													
	3	H3	0.90	0.56	5.0	0.50	3.86	1.9													
	4	H4	1.19	0.37	9.2	0.44	2.97	1.3													
	5	H5	0.61	0.23	5.0	0.14	3.86	0.5													
	6	OS1	58.65	0.22	31.7	12.90	1.37	17.7													
	7	OS2	12.34	0.31	14.4	3.83	2.33	8.9	31.7	16.73	1.37	22.9									
	A1	A1	0.09	0.16	5.0	0.01	3.86	0.1													
	A2	A2	0.13	0.90	5.0	0.11	3.86	0.4													
	A3	A3	0.37	0.39	5.0	0.15	3.86	0.6													
	A4	A4	0.18	0.85	5.0	0.15	3.86	0.6													
	A5	A5	0.72	0.43	5.3	0.31	3.77	1.2													
	A6	A6	0.21	0.45	5.0	0.09	3.86	0.4													
	A7	A7	0.05	0.77	5.0	0.03	3.86	0.1													
	A8	A8	0.09	0.60	5.0	0.05	3.86	0.2													
	A9	A9	0.49	0.75	5.0	0.37	3.86	1.4													
	A10	A10	0.25	0.16	5.0	0.04	3.86	0.2													
	B1	B1	0.46	0.44	5.4	0.20	3.76	0.8													
	B2	B2	0.13	0.44	5.0	0.06	3.86	0.2													
	C1	C1	0.09	0.16	5.0	0.01	3.86	0.1	34.65	18.39	1.28	24.6									
	C2	C2	0.12	0.90	5.0	0.11	3.86	0.4													
	C3	C3	0.20	0.37	5.5	0.07	3.73	0.3													
	C4	C4	0.13	0.56	5.0	0.07	3.86	0.3													
	C5	C5	0.16	0.35	5.0	0.05	3.86	0.2													
	D1	D1	0.61	0.38	5.6	0.24	3.70	0.9													
	D2	D2	1.19	0.35	8.7	0.41	3.05	1.3	8.74	0.50	3.05	1.5									
	D3	D3	0.34	0.25	5.0	0.08	3.86	0.3													
	D4	D4	0.86	0.41	8.2	0.35	3.14	1.1	32.50	17.39	1.35	23.4									
	D5	D5	0.61	0.23	5.0	0.14	3.86	0.5													
	D6	D6	0.69	0.24	6.4	0.17	3.51	0.6													
	A1	A	2.58	0.46	5.1	1.19	3.83	4.6													
	B1	B	0.59	0.44	6.3	0.26	3.54	0.9													
	C1	C	0.69	0.42	5.0	0.29	3.86	1.1													



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STANDARD FORM SF-3
STORM DRAINAGE DESIGN - RATIONAL METHOD 100-YEAR EVENTPROJECT NAME: Astrid
PROJECT NUMBER: 20235
CALCULATED BY: SMB
CHECKED BY: CSR P_1 (1-Hour Rainfall) = 1.79 in. (100-yr)

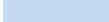
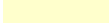
DATE: 5/19/2023

STORM LINE	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		DESIGN BASIN	AREA (AC)	RUNOFF COEFF C ₁₀₀	t _c (min)	C*A(ac)	I (in/hr)	Q (cfs)	t _c (min)	Σ(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs)	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	t _t (min)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	1	H1	2.32	0.57	6.0	1.32	7.88	10.4	34.65	43.04	2.80	120.6									
	2	H2	3.73	0.52	8.0	1.94	6.94	13.5													
	3	H3	0.90	0.70	5.0	0.63	8.42	5.3													
	4	H4	1.19	0.59	9.2	0.70	6.48	4.6													
	5	H5	0.61	0.54	5.0	0.33	8.42	2.8													
	6	OS1	58.65	0.53	31.7	31.08	2.99	93.1													
	7	OS2	12.34	0.57	14.4	7.03	5.08	35.7	31.7	38.12	2.99	114.1									
	A1	A1	0.09	0.51	5.0	0.05	8.42	0.4													
	A2	A2	0.13	0.96	5.0	0.12	8.42	1.0													
	A3	A3	0.37	0.60	5.0	0.22	8.42	1.9													
	A4	A4	0.18	0.92	5.0	0.17	8.42	1.4													
	A5	A5	0.72	0.62	5.3	0.45	8.24	3.7													
	A6	A6	0.21	0.63	5.0	0.13	8.42	1.1													
	A7	A7	0.05	0.84	5.0	0.04	8.42	0.3													
	A8	A8	0.09	0.72	5.0	0.07	8.42	0.6													
	A9	A9	0.49	0.83	5.0	0.41	8.42	3.4													
	A10	A10	0.25	0.51	5.0	0.13	8.42	1.1													
	B1	B1	0.46	0.62	5.4	0.29	8.20	2.3													
	B2	B2	0.13	0.62	5.0	0.08	8.42	0.7													
	C1	C1	0.09	0.51	5.0	0.04	8.42	0.4	34.65	40.94	2.80	117.0									
	C2	C2	0.12	0.96	5.0	0.11	8.42	1.0													
	C3	C3	0.20	0.59	5.5	0.12	8.15	1.0													
	C4	C4	0.13	0.70	5.0	0.09	8.42	0.8													
	C5	C5	0.16	0.58	5.0	0.09	8.42	0.8													
	D1	D1	0.61	0.59	5.6	0.36	8.09	2.9													
	D2	D2	1.19	0.58	8.7	0.69	6.65	4.6	8.7	0.87	6.65	5.8									
	D3	D3	0.34	0.54	5.0	0.18	8.42	1.5													
	D4	D4	0.86	0.61	8.2	0.52	6.86	3.6	32.50	39.34	2.94	115.7									
	D5	D5	0.61	0.54	5.0	0.33	8.42	2.8													
	D6	D6	0.69	0.54	6.4	0.37	7.65	2.9													
	A1	A	2.58	0.63	5.1	1.63	8.36	13.6													
	B1	B	0.59	0.62	6.3	0.37	7.73	2.8													
	C1	C	0.69	0.61	5.0	0.42	8.42	3.6													

PROJECT: Astrid
 JOB NO.: 20235
 CALC. BY: SMB
 CHK BY: CSR

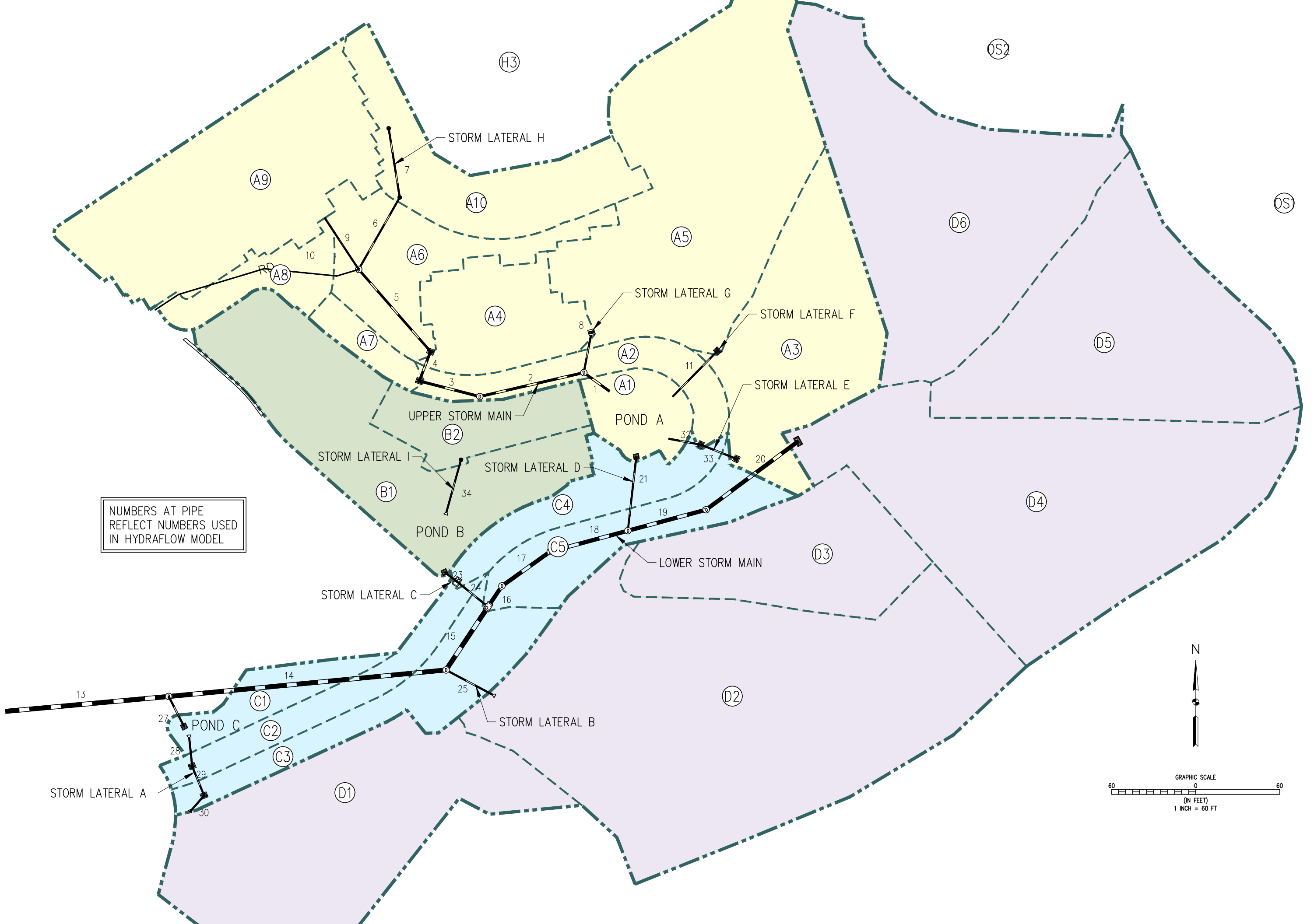


RUNOFF SUMMARY											
BASIN LABEL	DESIGN POINT	AREA	%I	Tc	C5	C100	LOCAL (CFS)		ACCUMULATIVE		Notes
							Q5	Q100	Q5	Q100	
H1	1	2.32	35%	6.0	0.33	0.57	2.8	10.4	24.7	120.6	H1-H5+OS1+OS2 (Total Historic Flow)
H2	2	3.73	6%	8.0	0.18	0.52	2.2	13.5			
H3	3	0.90	73%	5.0	0.56	0.70	1.9	5.3			
H4	4	1.19	44%	9.2	0.37	0.59	1.3	4.6			
H5	5	0.61	13%	5.0	0.23	0.54	0.5	2.8			
OS1	6	58.65		31.7	0.22	0.53	17.7	93.1			OS1+OS2
OS2	7	12.34		14.4	0.31	0.57	8.9	35.7	22.9	114.1	
A1	A1	0.09	2%	5.0	0.16	0.51	0.1	0.4			
A2	A2	0.13	100%	5.0	0.90	0.96	0.4	1.0			
A3	A3	0.37	48%	5.0	0.39	0.60	0.6	1.9			
A4	A4	0.18	97%	5.0	0.85	0.92	0.6	1.4			
A5	A5	0.72	55%	5.3	0.43	0.62	1.2	3.7			
A6	A6	0.21	59%	5.0	0.45	0.63	0.4	1.1			
A7	A7	0.05	91%	5.0	0.77	0.84	0.1	0.3			
A8	A8	0.09	77%	5.0	0.60	0.72	0.2	0.6			
A9	A9	0.49	90%	5.0	0.75	0.83	1.4	3.4			
A10	A10	0.25	2%	5.0	0.16	0.51	0.2	1.1			
B1	B1	0.46	57%	5.4	0.44	0.62	0.8	2.3			
B2	B2	0.13	57%	5.0	0.44	0.62	0.2	0.7			
C1	C1	0.09	2%	5.0	0.16	0.51	0.1	0.4	24.6	117.0	OS1+OS2+Pond A+Pond B+C+D (Total Developed Flow)
C2	C2	0.12	100%	5.0	0.90	0.96	0.4	1.0			
C3	C3	0.20	44%	5.5	0.37	0.59	0.3	1.0			
C4	C4	0.13	73%	5.0	0.56	0.70	0.3	0.8			
C5	C5	0.16	39%	5.0	0.35	0.58	0.2	0.8			
D1	D1	0.61	47%	5.6	0.38	0.59	0.9	2.9			D2+D3
D2	D2	1.19	40%	8.7	0.35	0.58	1.3	4.6	1.5	5.8	
D3	D3	0.34	17%	5.0	0.25	0.54	0.3	1.5			
D4	D4	0.86	51%	8.2	0.41	0.61	1.1	3.6	23.4	115.7	
D5	D5	0.61	13%	5.0	0.23	0.54	0.5	2.8			
D6	D6	0.69	16%	6.4	0.24	0.54	0.6	2.9			
A	A1	2.58	60%	5.1	0.46	0.63	4.6	13.6			
B	B1	0.59	57%	6.3	0.44	0.62	0.9	2.8			
C	C1	0.69	53%	5.0	0.42	0.61	1.1	3.6			

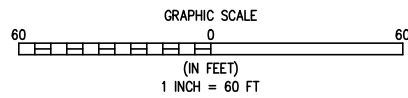
 = FORMULA CELLS
 = USER INPUT CELLS

ATTACHMENT 8

STORM CONVEYANCE COMPUTATIONS



NUMBERS AT PIPE
REFLECT NUMBERS USED
IN HYDRAFLOW MODEL



Storm Sewer Tabulation

100-Year

Page 1

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1	End	22.571	0.00	1.98	0.00	0.00	1.42	0.0	10.3	6.1	8.69	32.22	5.65	18	8.02	6989.44	6991.25	6990.76	6992.39	0.00	6996.62	Pipe - (25)
2	1	76.247	0.00	1.95	0.00	0.00	1.40	0.0	5.6	8.1	11.27	16.09	8.31	18	2.00	6991.45	6992.97	6992.39	6994.25	6996.62	7000.83	Pipe - (64)
3	2	44.549	0.04	1.95	0.96	0.04	1.40	5.0	5.5	8.1	11.36	16.08	7.69	18	2.00	6993.17	6994.06	6994.25	6995.35	7000.83	7002.64	Pipe - (63)
4	3	22.572	0.17	1.91	0.68	0.12	1.36	5.0	5.4	8.2	11.10	16.07	7.52	18	1.99	6994.26	6994.71	6995.35	6995.98	7002.64	7002.67	Pipe - (26)
5	4	77.936	0.00	1.74	0.00	0.00	1.24	0.0	5.3	8.3	10.27	9.89	8.84	15	2.00	6994.91	6996.47	6995.98	6997.66	7002.67	7006.56	Pipe - (30)
6	5	60.623	0.25	1.15	0.51	0.13	0.76	5.0	5.1	8.3	6.32	8.62	10.07	12	5.00	7001.97	7005.00	7002.61	7005.96	7006.56	7021.34	Pipe - (29)
7	6	48.905	0.90	0.90	0.70	0.63	0.63	5.0	5.0	8.4	5.30	12.20	10.98	12	10.00	7017.34	7022.23	7017.80	7023.16	7021.34	7027.00	Pipe - (65)
8	1	57.909	0.03	0.03	0.57	0.02	0.02	5.0	5.0	8.4	0.14	5.46	1.40	12	2.00	6992.14	6993.30	6992.39	6993.46	6996.62	7006.78	Pipe - (24)
9	5	43.976	0.51	0.51	0.83	0.42	0.42	5.0	5.0	8.4	3.56	5.46	6.33	12	2.00	7002.62	7003.50	7003.21	7004.31	7006.56	0.00	Pipe - (97)
10	5	45.000	0.08	0.08	0.79	0.06	0.06	5.0	5.0	8.4	0.53	0.61	2.71	6	1.00	6996.67	6997.12	6997.66	6998.01	7006.56	0.00	Pipe - (96)
11	End	45.591	0.35	0.86	0.78	0.27	0.59	5.0	5.3	8.3	4.91	5.45	6.44	12	2.00	6988.31	6989.22	6989.27	6990.13	0.00	6992.69	Pipe - (23)
12	11	33.560	0.51	0.51	0.63	0.32	0.32	5.1	5.1	8.4	2.69	5.45	4.53	12	2.00	6989.42	6990.09	6990.13	6990.79	6992.69	7004.07	Pipe - (42)
13	End	116.883	0.00	75.98	0.00	0.00	41.19	0.0	32.9	2.9	121.8	188.2	17.27	36	6.78	6939.41	6947.34	6942.39	6950.29	6945.84	6956.49	Pipe - (4)
14	13	169.179	0.00	74.98	0.00	0.00	40.56	0.0	32.8	2.9	120.4	175.0	17.43	36	5.87	6947.54	6957.47	6950.29	6960.42	6956.49	6966.48	Pipe - (5)
15	14	72.312	0.00	73.45	0.00	0.00	39.69	0.0	32.7	2.9	118.1	228.5	17.09	36	10.00	6957.67	6964.90	6960.42	6967.84	6966.48	6973.73	Pipe - (6)
16	15	17.698	0.00	73.16	0.00	0.00	39.51	0.0	32.7	2.9	117.6	140.5	28.00	30	10.00	6967.90	6969.67	6969.65	6972.16	6973.73	6975.44	Pipe - (61)
17	16	47.223	0.00	73.16	0.00	0.00	39.51	0.0	32.6	2.9	117.6	136.5	24.47	30	9.44	6969.87	6974.33	6972.16	6976.82	6975.44	6979.98	Pipe - (9)
18	17	75.504	0.00	73.16	0.00	0.00	39.51	0.0	32.6	2.9	117.8	125.5	24.49	30	7.97	6974.53	6980.55	6976.82	6983.04	6979.98	6986.06	Pipe - (8)
19	18	74.378	0.00	73.16	0.00	0.00	39.51	0.0	32.5	2.9	116.0	88.79	23.64	30	3.99	6980.75	6983.72	6983.25	6988.33	6986.06	6989.94	Pipe - (7)
20	19	52.932	73.16	73.16	0.54	39.51	39.51	32.5	32.5	2.9	116.1	140.5	23.66	30	9.99	6984.19	6989.48	6991.11	6994.73	6989.94	7002.00	Pipe - (66)
21	18	29.426	0.00	0.00	0.00	0.00	0.00	0.0	0.0	2.9	1.90	5.46	3.19	12	2.01	6981.90	6982.49	6983.04	6983.08	6986.06	6985.65	Pipe - (13)
22	15	6.257	0.13	0.13	0.70	0.09	0.09	5.0	5.0	8.4	0.80	5.35	3.94	12	1.92	6969.52	6969.64	6969.78	6970.01	6973.73	6973.52	Pipe - (12)
Project File: New.stm																Number of lines: 34				Run Date: 12/21/2022		
NOTES:Intensity = 87.89 / (Inlet time + 7.84) ^ 0.92; Return period =Yrs. 100 ; c = cir e = ellip b = box																						

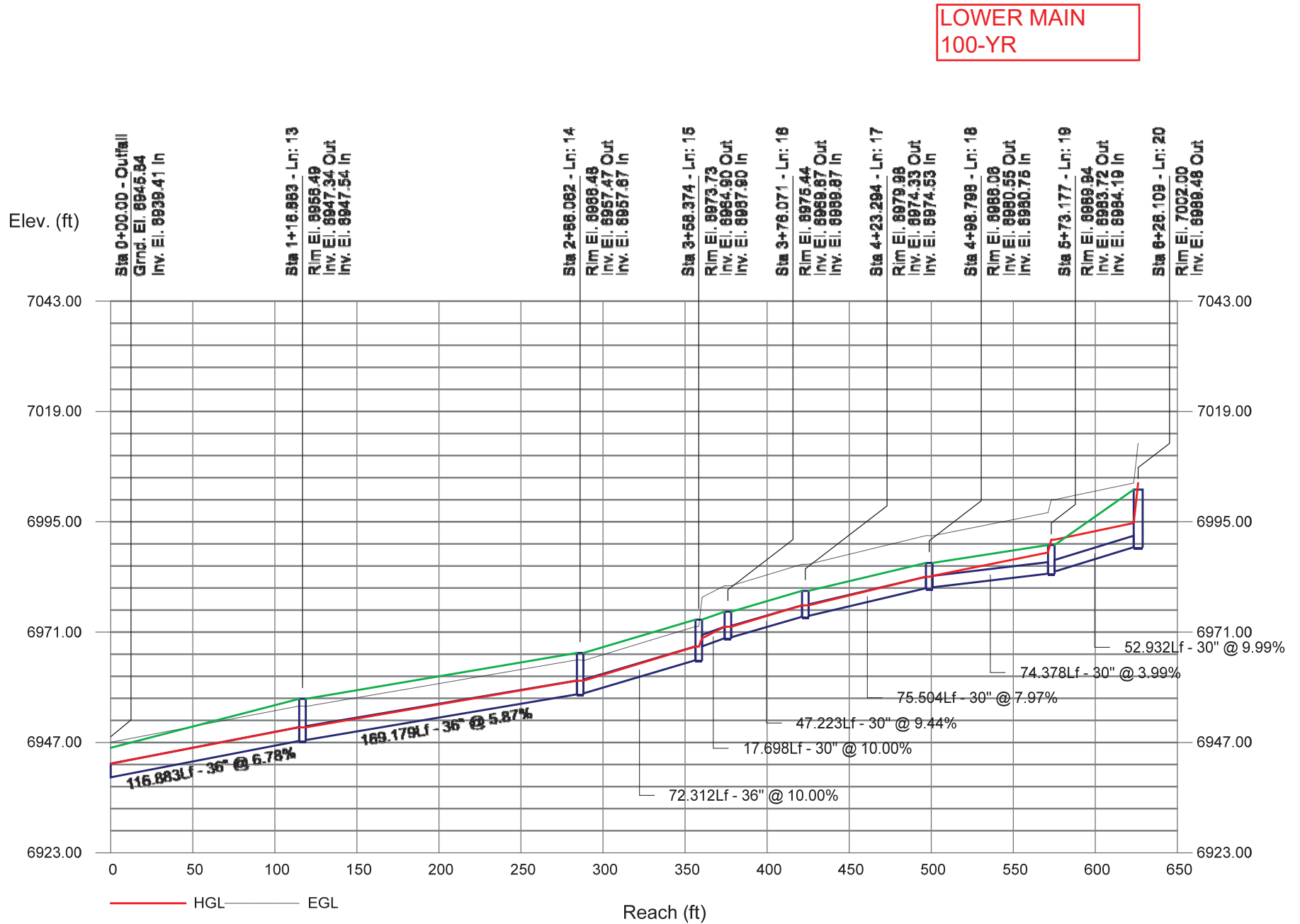
Storm Sewer Tabulation

100-Year

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
23	22	14.706	0.00	0.00	0.00	0.00	0.00	0.0	0.0	8.4	0.03	0.91	1.75	6	2.24	6970.14	6970.47	6970.20	6970.56	6973.52	6980.65	Pipe - (11)
24	15	16.250	0.16	0.16	0.58	0.09	0.09	5.0	5.0	8.4	0.78	5.41	3.93	12	1.97	6969.52	6969.84	6969.78	6970.21	6973.73	6973.52	Pipe - (10)
25	14	33.501	0.00	1.53	0.00	0.00	0.87	0.0	8.8	6.6	5.78	5.46	7.67	12	2.00	6962.22	6962.89	6963.11	6963.84	6966.48	6971.60	Pipe - (22)
26	25	45.586	1.53	1.53	0.57	0.87	0.87	8.7	8.7	6.7	5.82	7.65	9.13	12	3.93	6969.46	6971.25	6970.11	6972.20	6971.60	6972.36	Pipe - (21)
27	13	24.739	0.00	1.00	0.00	0.00	0.63	0.0	6.7	7.5	4.70	5.46	7.06	12	2.00	6950.62	6951.11	6951.33	6952.01	6956.49	6955.70	Pipe - (86)
28	27	28.043	0.12	0.93	0.95	0.11	0.59	5.0	5.1	8.3	4.94	5.45	7.22	12	2.00	6951.31	6951.87	6952.06	6952.78	6955.70	6956.39	Pipe - (3)
29	28	22.499	0.20	0.81	0.59	0.12	0.48	5.0	5.0	8.4	4.01	5.46	6.17	12	2.00	6952.07	6952.52	6952.78	6953.37	6956.39	6956.39	Pipe - (1)
30	29	9.250	0.61	0.61	0.59	0.36	0.36	5.0	5.0	8.4	3.03	5.53	5.23	12	2.05	6952.72	6952.91	6953.37	6953.66	6956.39	6959.47	Pipe - (60)
31	27	39.929	0.07	0.07	0.51	0.04	0.04	5.0	5.0	8.4	0.30	8.53	1.39	12	4.88	6951.31	6953.26	6952.01	6953.49	6955.70	6954.36	Pipe - (85)
32	End	18.203	0.13	0.55	0.96	0.12	0.37	5.0	5.2	8.3	3.10	5.43	4.56	12	1.98	6984.11	6984.47	6984.99	6985.22	0.00	6989.01	Pipe - (14)
33	32	27.494	0.42	0.42	0.59	0.25	0.25	5.0	5.0	8.4	2.09	5.46	4.39	12	2.00	6984.67	6985.22	6985.22	6985.84	6989.01	6989.06	Pipe - (2)
34	End	40.186	0.13	0.13	0.62	0.08	0.08	5.0	5.0	8.4	0.68	5.99	2.03	12	2.41	6983.53	6984.50	6984.20	6984.84	6984.64	6995.00	Pipe - (28)
Project File: New.stm																Number of lines: 34				Run Date: 12/21/2022		
NOTES:Intensity = 87.89 / (Inlet time + 7.84) ^ 0.92; Return period =Yrs. 100 ; c = cir e = ellip b = box																						

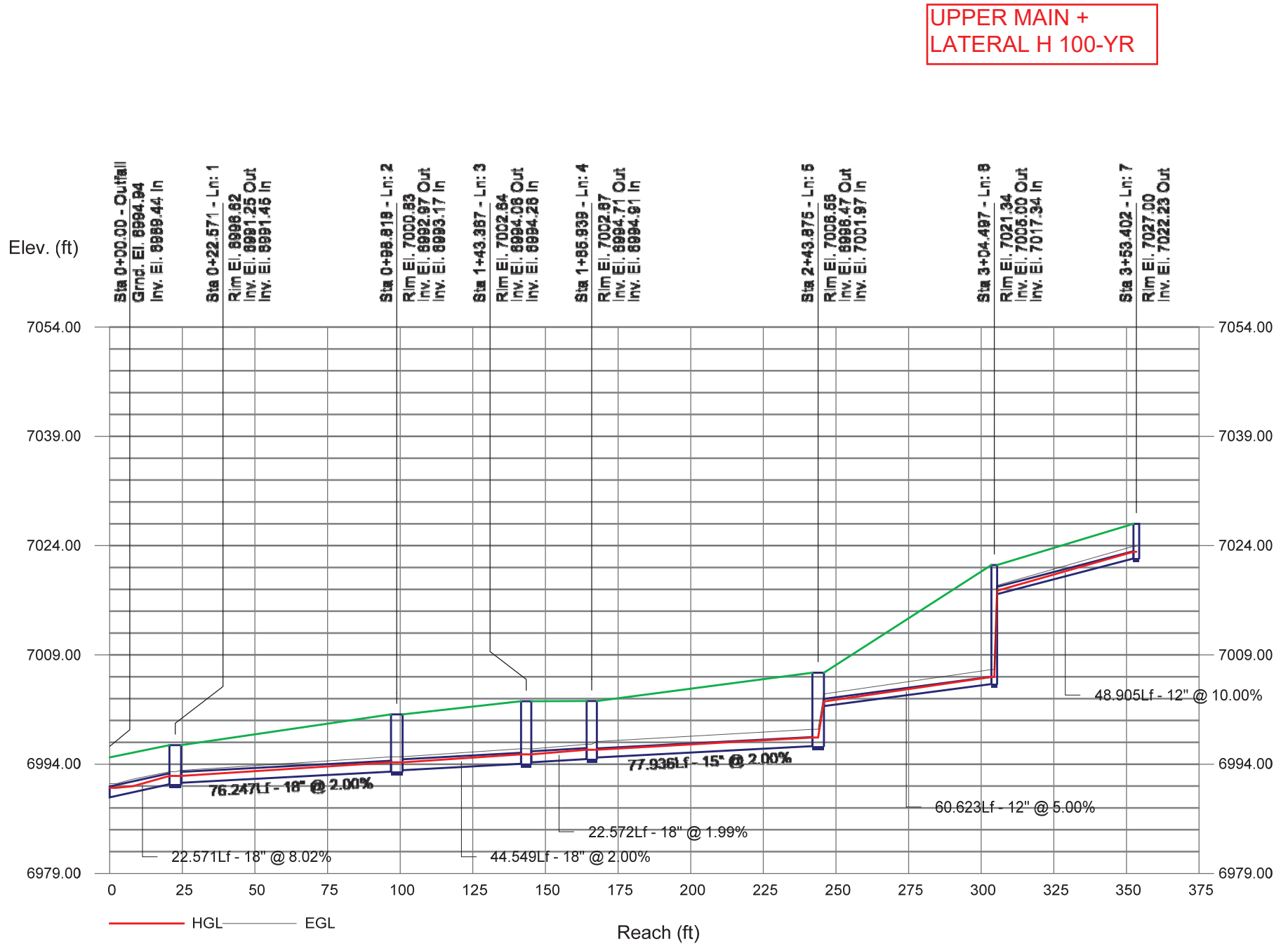
Storm Sewer Profile

Proj. file: New.stm



Storm Sewer Profile

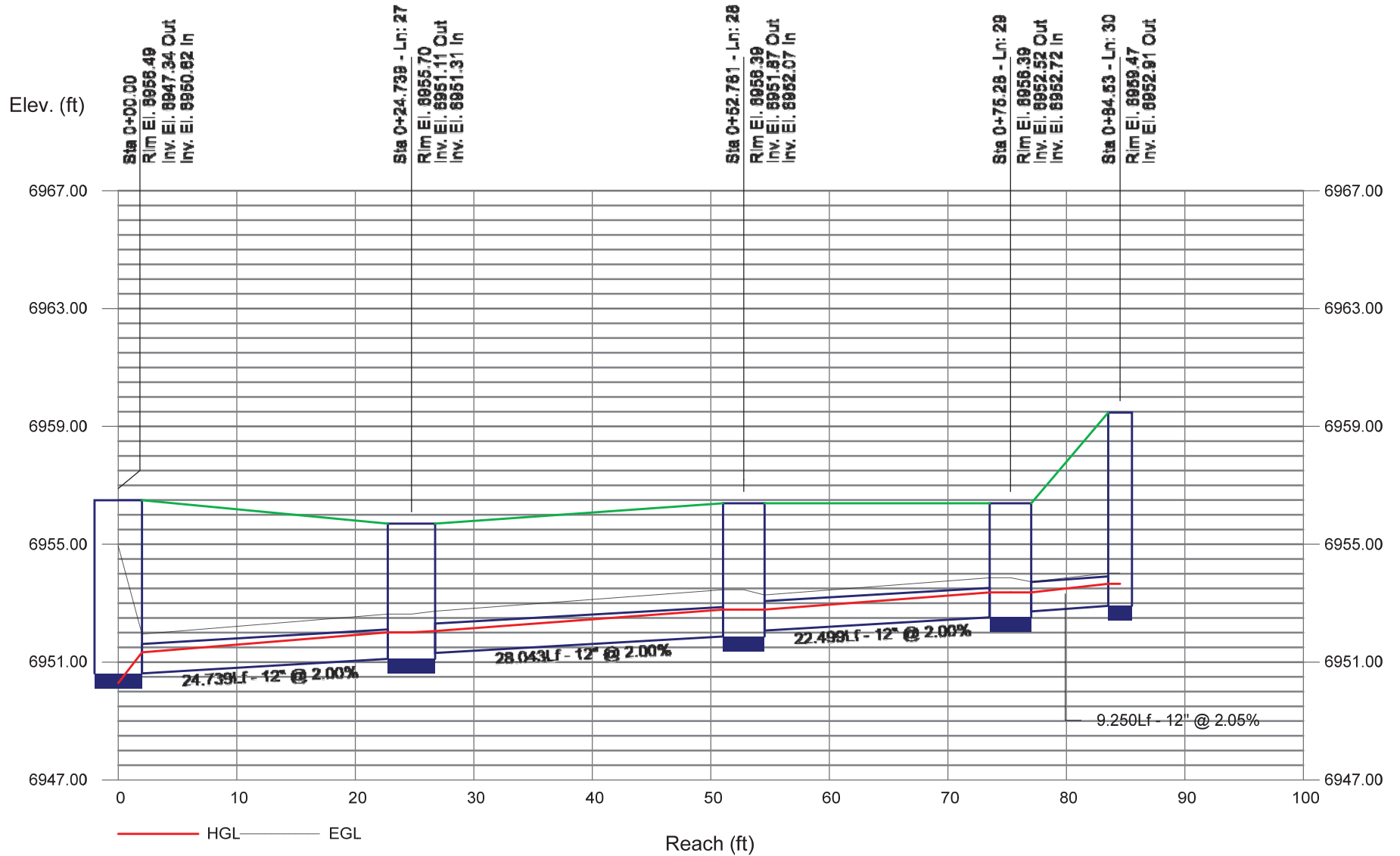
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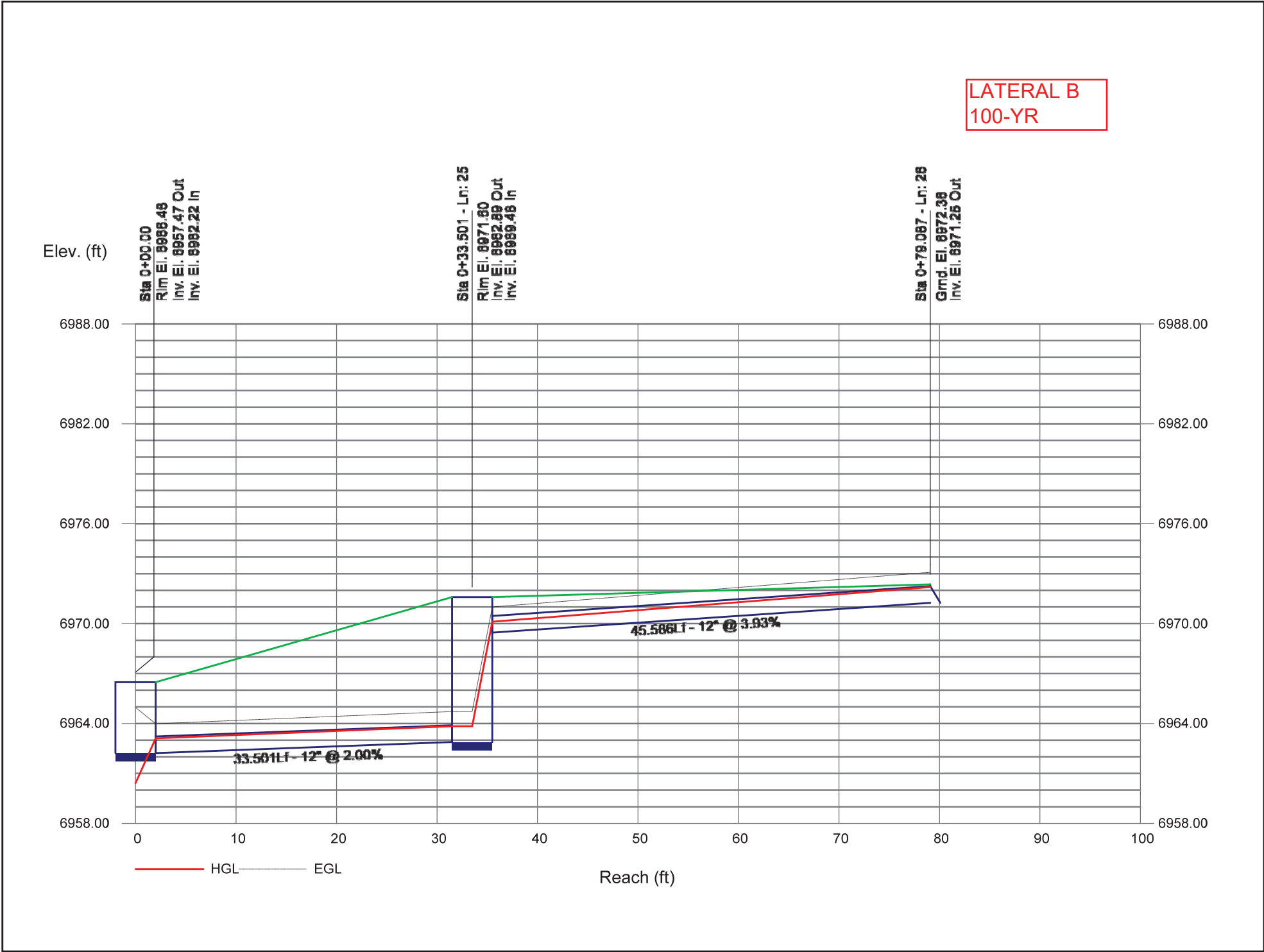
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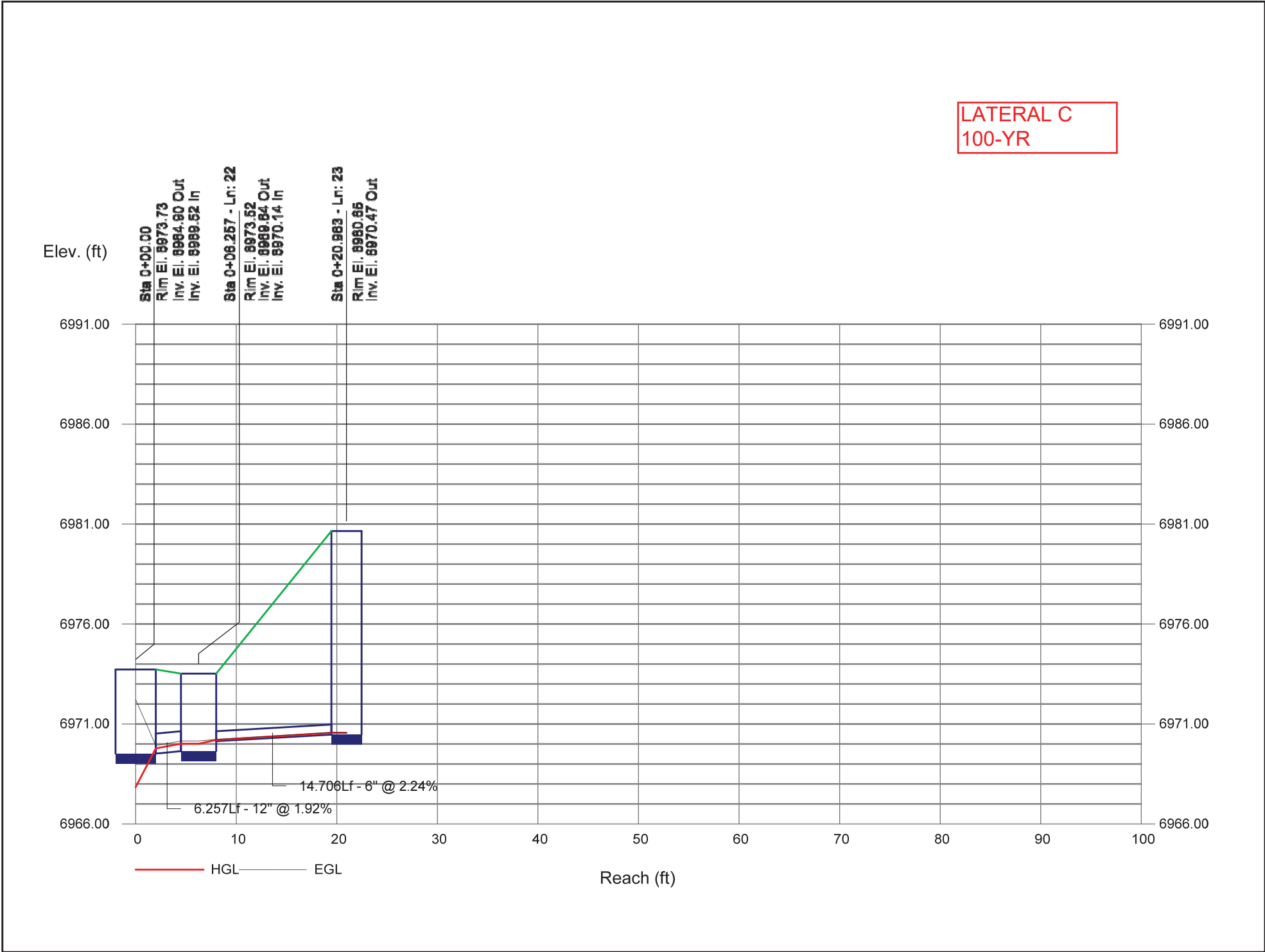
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LATERAL A
100-YR

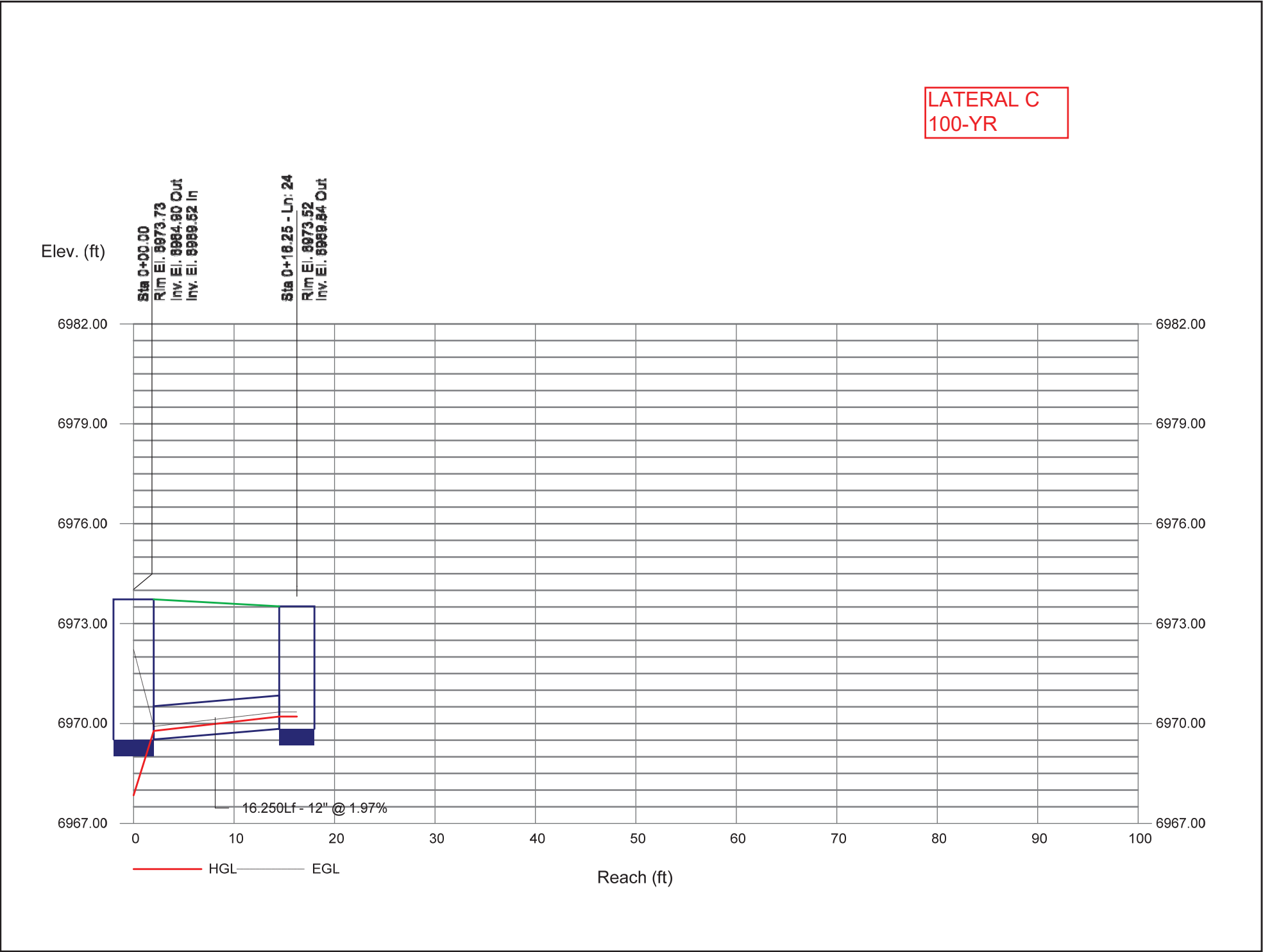


Storm Sewer Profile



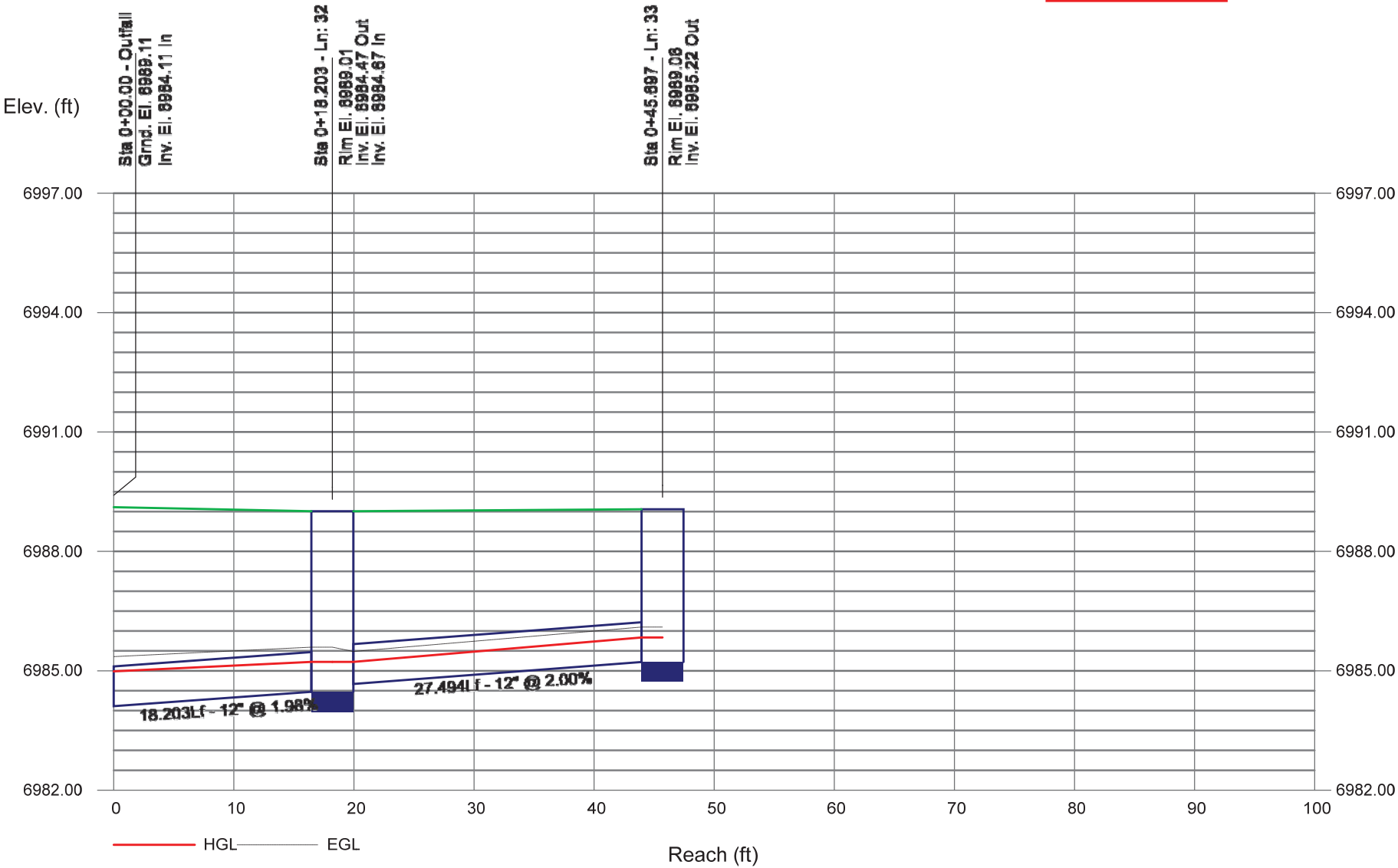


Storm Sewer Profile

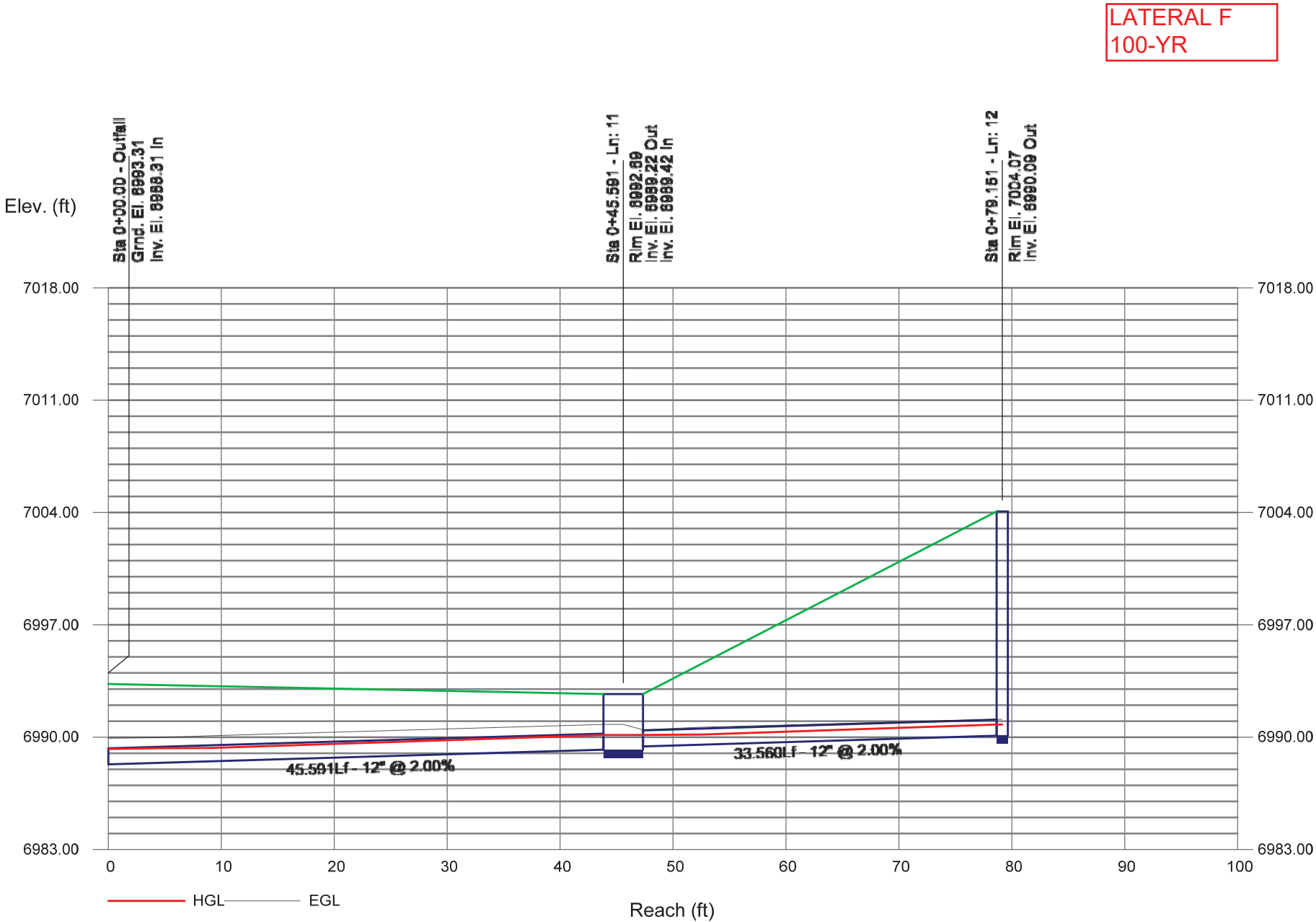


Storm Sewer Profile

LATERAL E
100-YR

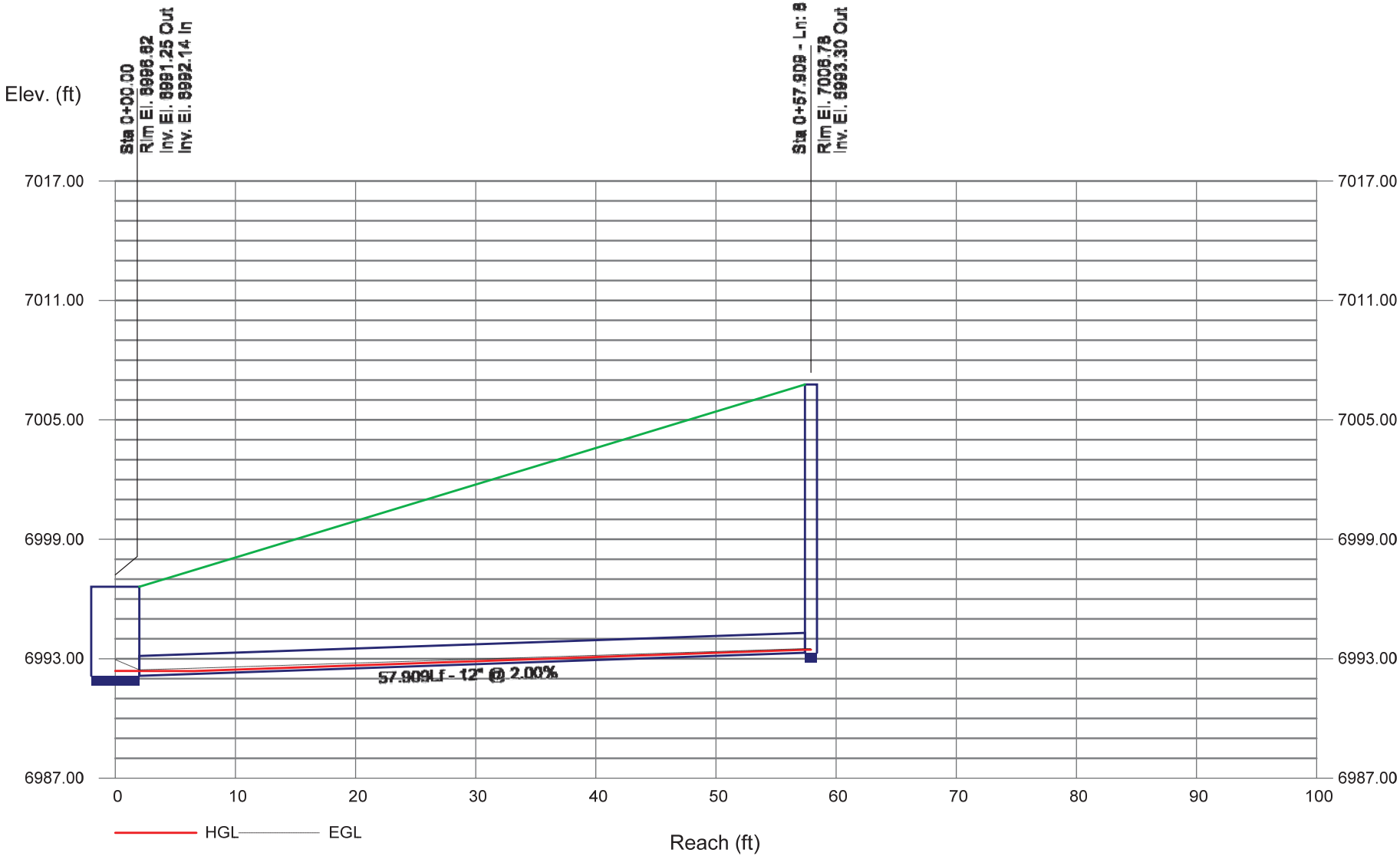


Storm Sewer Profile



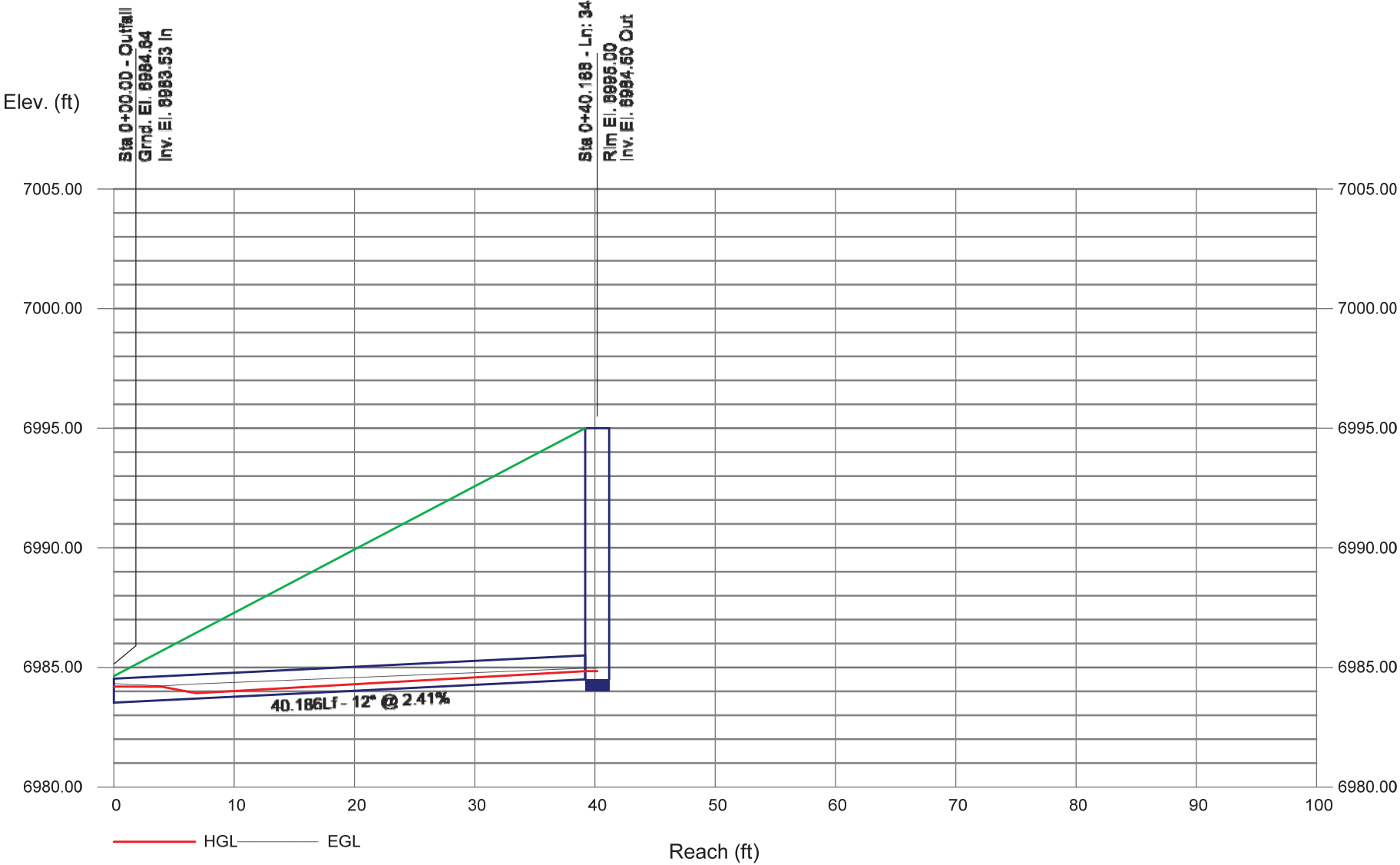
Storm Sewer Profile

LATERAL G
100-YR



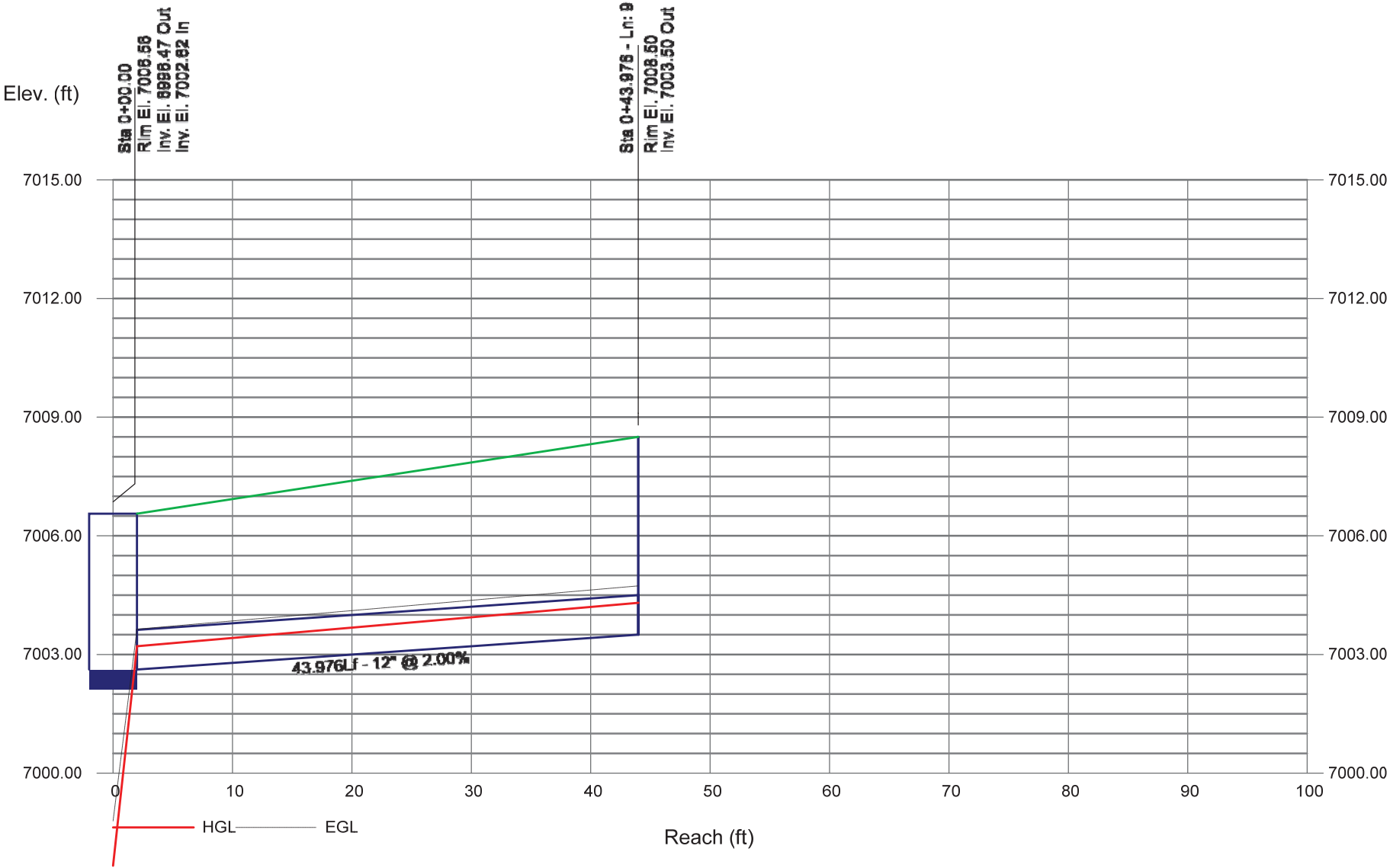
Storm Sewer Profile

LATERAL I
100-YR



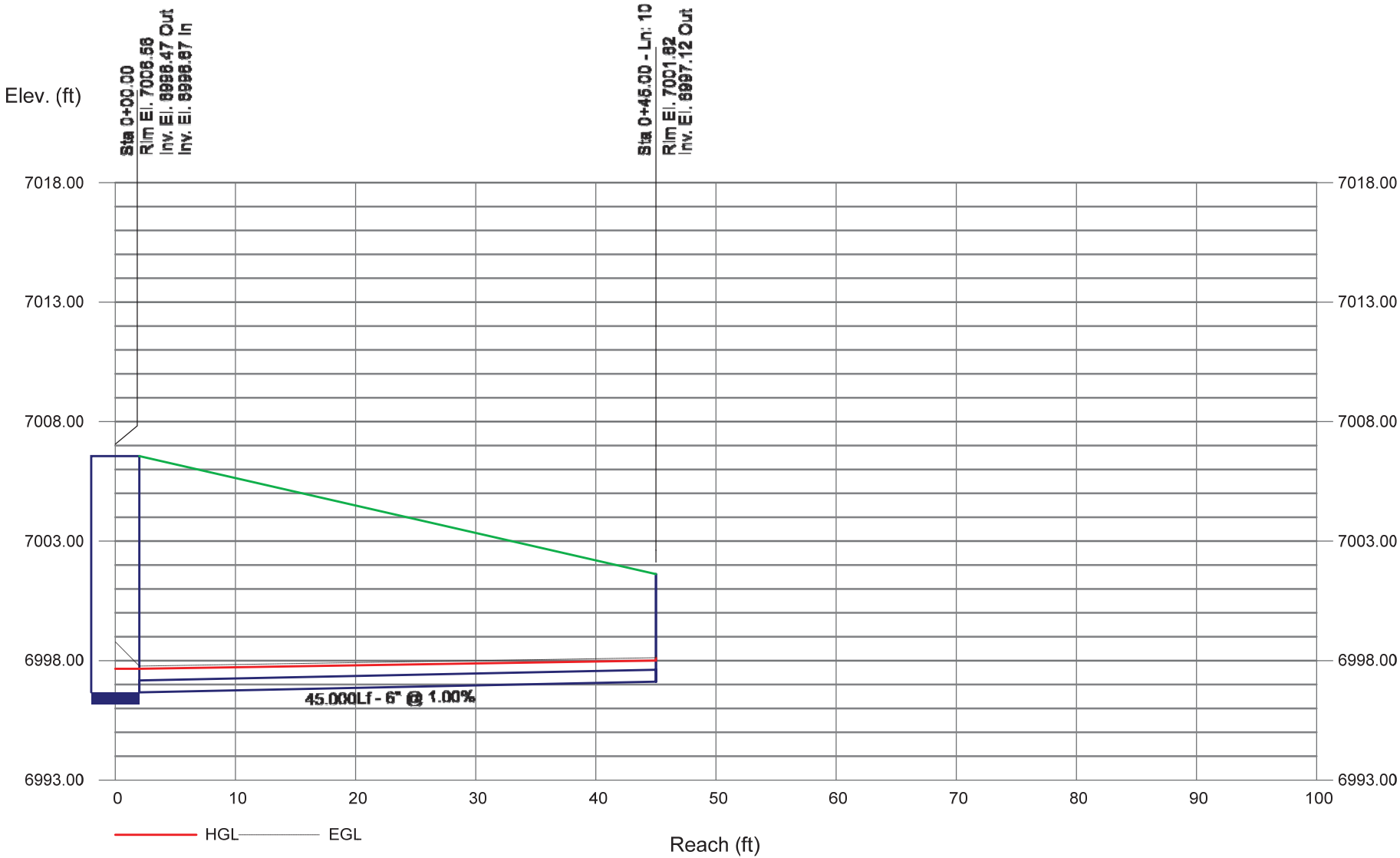
Storm Sewer Profile

BLDG 1 ROOF
100-YR



Storm Sewer Profile

BLDG 1 TRECH
100-YR



Storm Sewer Tabulation

5-YR

Page 1

Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (I) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr (ac)	Total (ac)		Incr (min)	Total (min)	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	22.571	0.00	1.98	0.00	0.00	1.12	0.0	26.1	1.6	1.76	32.22	2.25	18	8.02	6989.44	6991.25	6990.76	6991.75	0.00	6996.62	Pipe - (25)
2	1	76.247	0.00	1.95	0.00	0.00	1.11	0.0	6.7	3.4	3.83	16.09	5.91	18	2.00	6991.45	6992.97	6991.94	6993.72	6996.62	7000.83	Pipe - (64)
3	2	44.549	0.04	1.95	0.90	0.04	1.11	5.0	6.3	3.5	3.91	16.08	5.54	18	2.00	6993.17	6994.06	6993.72	6994.82	7000.83	7002.64	Pipe - (63)
4	3	22.572	0.17	1.91	0.54	0.09	1.07	5.0	6.2	3.6	3.82	16.07	5.38	18	1.99	6994.26	6994.71	6994.82	6995.46	7002.64	7002.67	Pipe - (26)
5	4	77.936	0.00	1.74	0.00	0.00	0.98	0.0	5.7	3.7	3.60	9.89	5.78	15	2.00	6994.91	6996.47	6995.46	6997.24	7002.67	7006.56	Pipe - (30)
6	5	60.623	0.25	1.15	0.16	0.04	0.54	5.0	5.3	3.8	2.05	8.62	6.53	12	5.00	7001.97	7005.00	7002.30	7005.61	7006.56	7021.34	Pipe - (29)
7	6	48.905	0.90	0.90	0.56	0.50	0.50	5.0	5.0	3.9	1.94	12.20	7.68	12	10.00	7017.34	7022.23	7017.61	7022.82	7021.34	7027.00	Pipe - (65)
8	1	57.909	0.03	0.03	0.31	0.01	0.01	5.0	5.0	3.9	0.04	5.46	1.63	12	2.00	6992.14	6993.30	6992.20	6993.38	6996.62	7006.78	Pipe - (24)
9	5	43.976	0.51	0.51	0.75	0.38	0.38	5.0	5.0	3.9	1.47	5.46	4.77	12	2.00	7002.62	7003.50	7002.98	7004.01	7006.56	0.00	Pipe - (97)
10	5	45.000	0.08	0.08	0.69	0.06	0.06	5.0	5.0	3.9	0.21	0.61	1.73	6	1.00	6996.67	6997.12	6997.24	6997.35	7006.56	0.00	Pipe - (96)
11	End	45.591	0.35	0.86	0.67	0.23	0.47	5.0	5.6	3.7	1.74	5.45	3.04	12	2.00	6988.31	6989.22	6989.27	6989.78	0.00	6992.69	Pipe - (23)
12	11	33.560	0.51	0.51	0.46	0.23	0.23	5.1	5.1	3.8	0.90	5.45	3.31	12	2.00	6989.42	6990.09	6989.78	6990.49	6992.69	7004.07	Pipe - (42)
13	End	116.883	0.00	75.98	0.00	0.00	17.89	0.0	34.7	1.3	23.86	188.2	4.87	36	6.78	6939.41	6947.34	6942.39	6948.91	6945.84	6956.49	Pipe - (4)
14	13	169.179	0.00	74.98	0.00	0.00	17.46	0.0	33.8	1.3	23.73	175.0	6.95	36	5.87	6947.54	6957.47	6948.91	6959.04	6956.49	6966.48	Pipe - (5)
15	14	72.312	0.00	73.45	0.00	0.00	16.96	0.0	33.5	1.3	23.25	228.5	6.85	36	10.00	6957.67	6964.90	6959.04	6966.45	6966.48	6973.73	Pipe - (6)
16	15	17.698	0.00	73.16	0.00	0.00	16.83	0.0	33.4	1.3	23.11	140.5	13.96	30	10.00	6967.90	6969.67	6968.59	6971.30	6973.73	6975.44	Pipe - (61)
17	16	47.223	0.00	73.16	0.00	0.00	16.83	0.0	33.2	1.3	23.19	136.5	7.38	30	9.44	6969.87	6974.33	6971.30	6975.97	6975.44	6979.98	Pipe - (9)
18	17	75.504	0.00	73.16	0.00	0.00	16.83	0.0	33.0	1.3	23.32	125.5	7.40	30	7.97	6974.53	6980.55	6975.97	6982.19	6979.98	6986.06	Pipe - (8)
19	18	74.378	0.00	73.16	0.00	0.00	16.83	0.0	32.7	1.3	22.56	88.79	7.21	30	3.99	6980.75	6983.72	6982.19	6985.34	6986.06	6989.94	Pipe - (7)
20	19	52.932	73.16	73.16	0.23	16.83	16.83	32.5	32.5	1.3	22.66	140.5	8.54	30	9.99	6984.19	6989.48	6985.34	6991.10	6989.94	7002.00	Pipe - (66)
21	18	29.426	0.00	0.00	0.00	0.00	0.00	0.0	0.0	2.9	0.90	5.46	3.90	12	2.01	6981.90	6982.49	6982.19	6982.89	6986.06	6985.65	Pipe - (13)
22	15	6.257	0.13	0.13	0.56	0.07	0.07	5.0	5.0	3.9	0.29	5.35	2.94	12	1.92	6969.52	6969.64	6969.68	6969.86	6973.73	6973.52	Pipe - (12)
Project File: 20235 Storm Sewers 5-yr NEW.stm																Number of lines: 34				Run Date: 12/21/2022		
NOTES:Intensity = 40.26 / (Inlet time + 7.84) ^ 0.92; Return period =Yrs. 5 ; c = cir e = ellip b = box																						

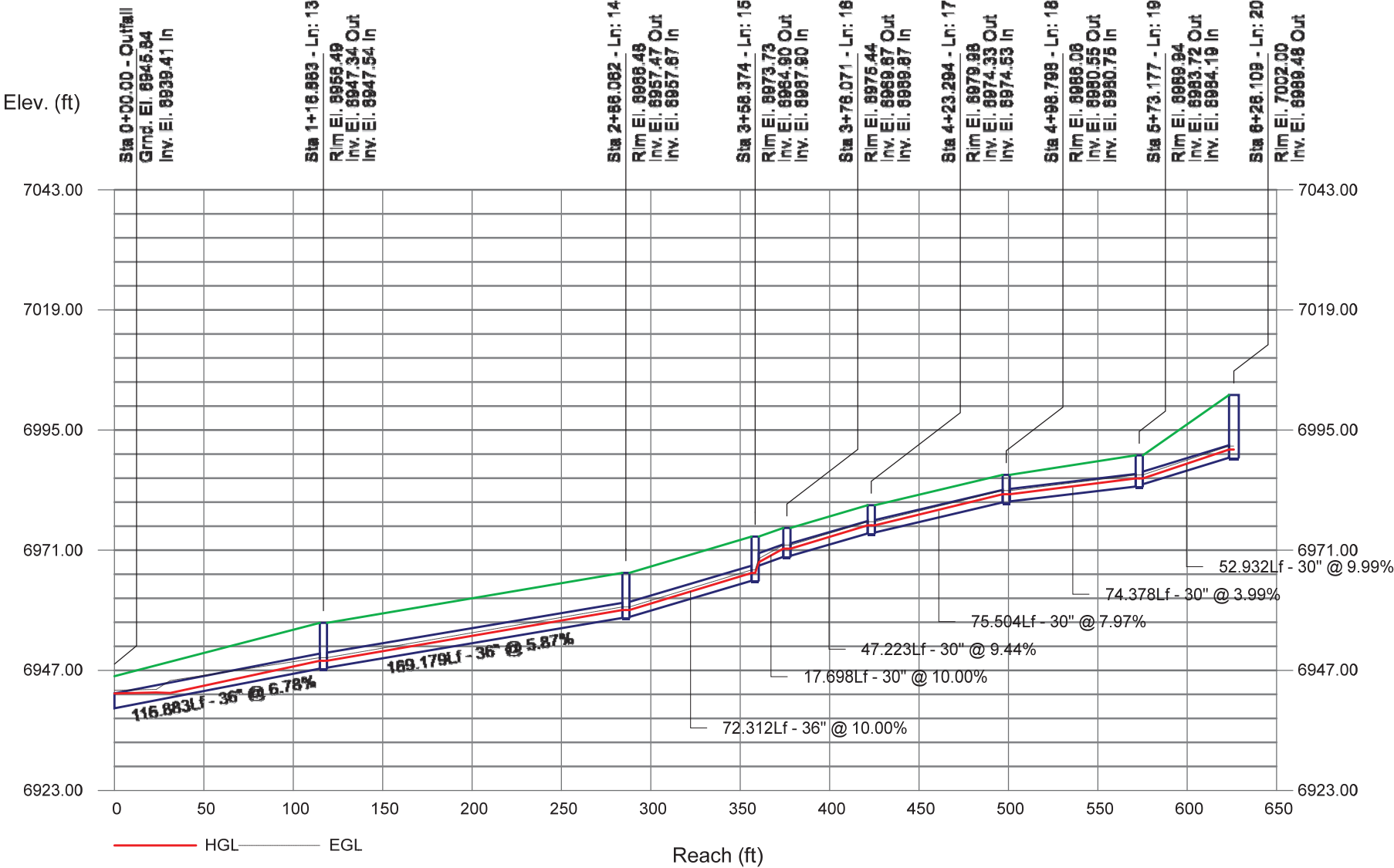
Storm Sewer Tabulation

5-YR

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
23	22	14.706	0.00	0.00	0.00	0.00	0.00	0.0	0.0	8.4	0.01	0.91	1.27	6	2.24	6970.14	6970.47	6970.18	6970.52	6973.52	6980.65	Pipe - (11)
24	15	16.250	0.16	0.16	0.35	0.06	0.06	5.0	5.0	3.9	0.22	5.41	2.72	12	1.97	6969.52	6969.84	6969.66	6970.03	6973.73	6973.52	Pipe - (10)
25	14	33.501	0.00	1.53	0.00	0.00	0.50	0.0	9.1	3.0	1.51	5.46	4.80	12	2.00	6962.22	6962.89	6962.58	6963.41	6966.48	6971.60	Pipe - (22)
26	25	45.586	1.53	1.53	0.33	0.50	0.50	8.7	8.7	3.1	1.54	7.65	5.65	12	3.93	6969.46	6971.25	6969.77	6971.78	6971.60	6972.36	Pipe - (21)
27	13	24.739	0.00	1.00	0.00	0.00	0.43	0.0	17.1	2.1	0.89	5.46	4.10	12	2.00	6950.62	6951.11	6950.89	6951.51	6956.49	6955.70	Pipe - (86)
28	27	28.043	0.12	0.93	0.90	0.11	0.41	5.0	5.4	3.8	1.55	5.45	4.84	12	2.00	6951.31	6951.87	6951.68	6952.40	6955.70	6956.39	Pipe - (3)
29	28	22.499	0.20	0.81	0.37	0.07	0.31	5.0	5.1	3.8	1.17	5.46	4.28	12	2.00	6952.07	6952.52	6952.40	6952.98	6956.39	6956.39	Pipe - (1)
30	29	9.250	0.61	0.61	0.38	0.23	0.23	5.0	5.0	3.9	0.89	5.53	4.13	12	2.05	6952.72	6952.91	6952.99	6953.31	6956.39	6959.47	Pipe - (60)
31	27	39.929	0.07	0.07	0.16	0.01	0.01	5.0	5.0	3.9	0.04	8.53	0.88	12	4.88	6951.31	6953.26	6951.51	6953.34	6955.70	6954.36	Pipe - (85)
32	End	18.203	0.13	0.55	0.90	0.12	0.27	5.0	5.6	3.7	0.99	5.43	2.27	12	1.98	6984.11	6984.47	6984.99	6984.89	0.00	6989.01	Pipe - (14)
33	32	27.494	0.42	0.42	0.36	0.15	0.15	5.0	5.0	3.9	0.58	5.46	3.63	12	2.00	6984.67	6985.22	6984.89	6985.54	6989.01	6989.06	Pipe - (2)
34	End	40.186	0.13	0.13	0.44	0.06	0.06	5.0	5.0	3.9	0.22	5.99	1.24	12	2.41	6983.53	6984.50	6984.20	6984.69	6984.64	6995.00	Pipe - (28)
Project File: 20235 Storm Sewers 5-yr NEW.stm																Number of lines: 34				Run Date: 12/21/2022		
NOTES:Intensity = 40.26 / (Inlet time + 7.84) ^ 0.92; Return period =Yrs. 5 ; c = cir e = ellip b = box																						

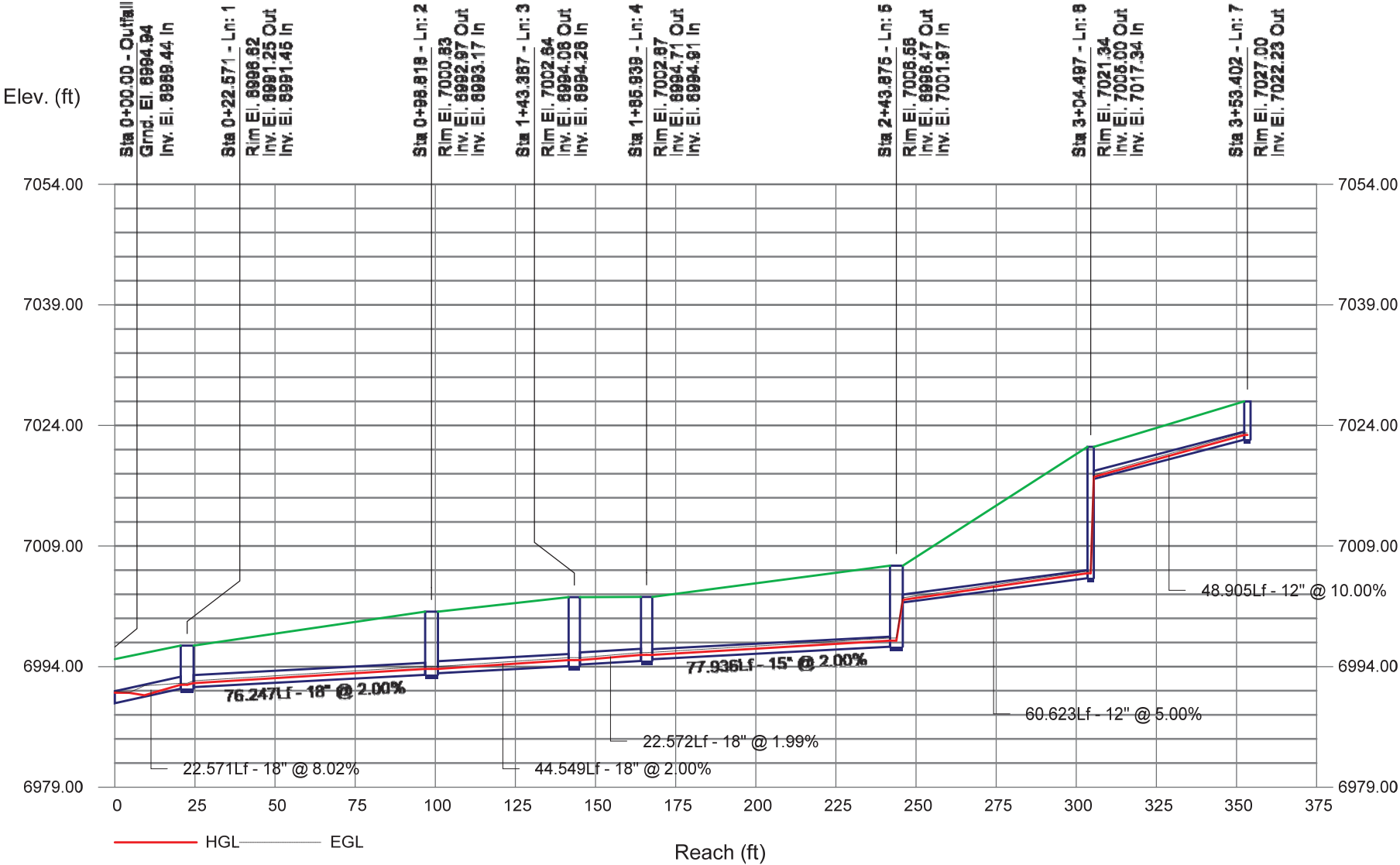
Storm Sewer Profile

LOWER 5-YR



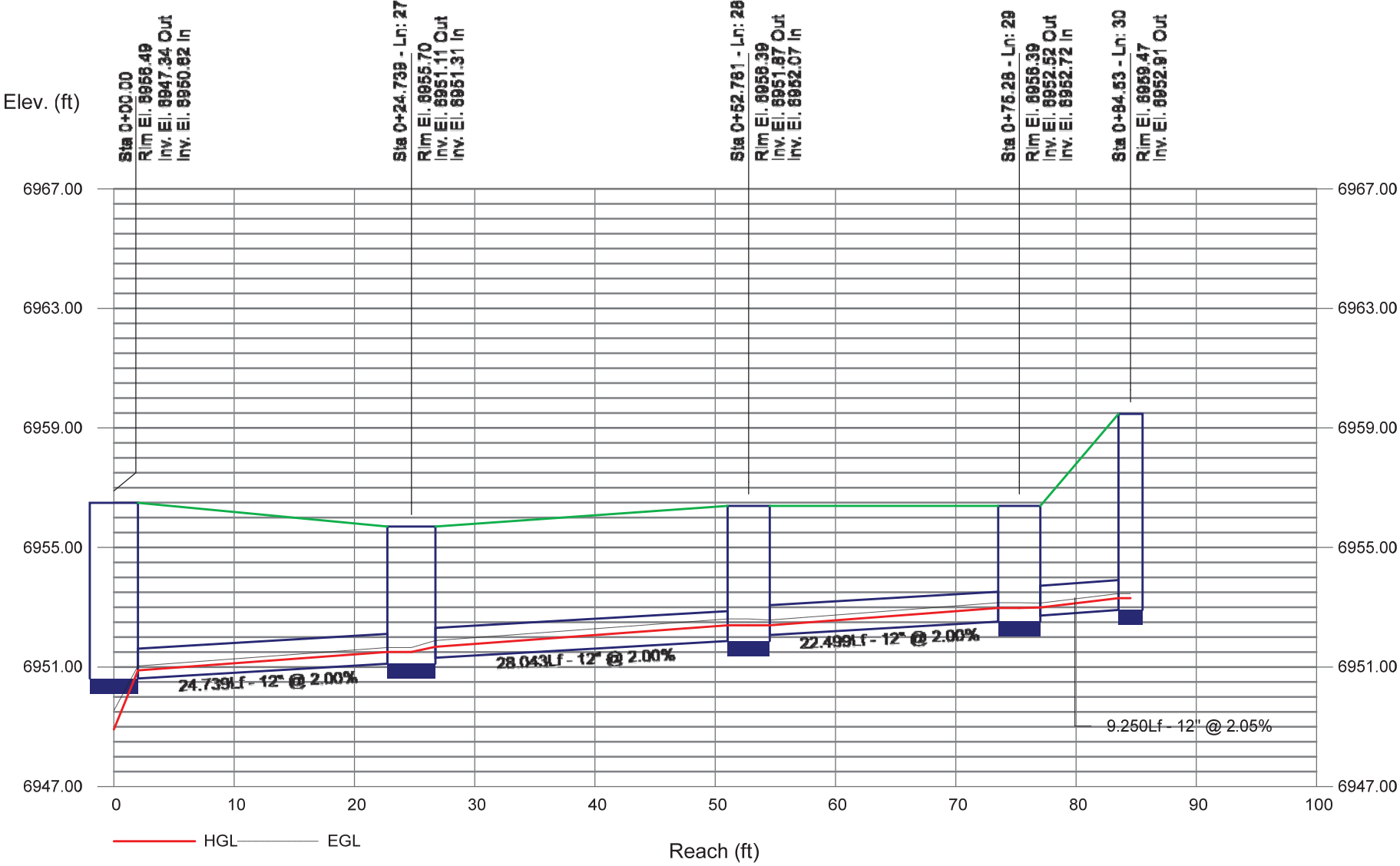
Storm Sewer Profile

UPPER +
LATERAL H 5-YR



Storm Sewer Profile

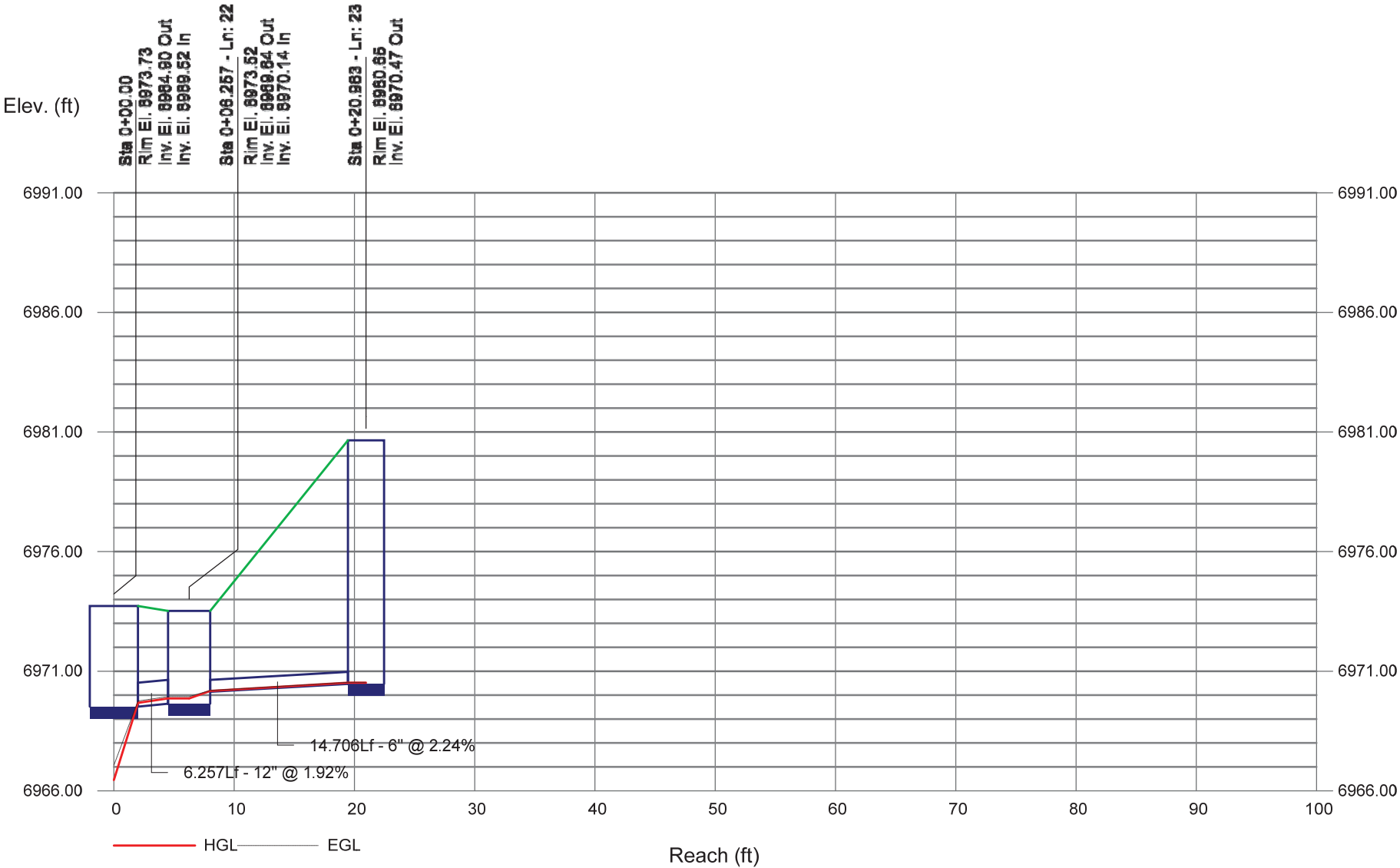
LATERAL A 5-YR

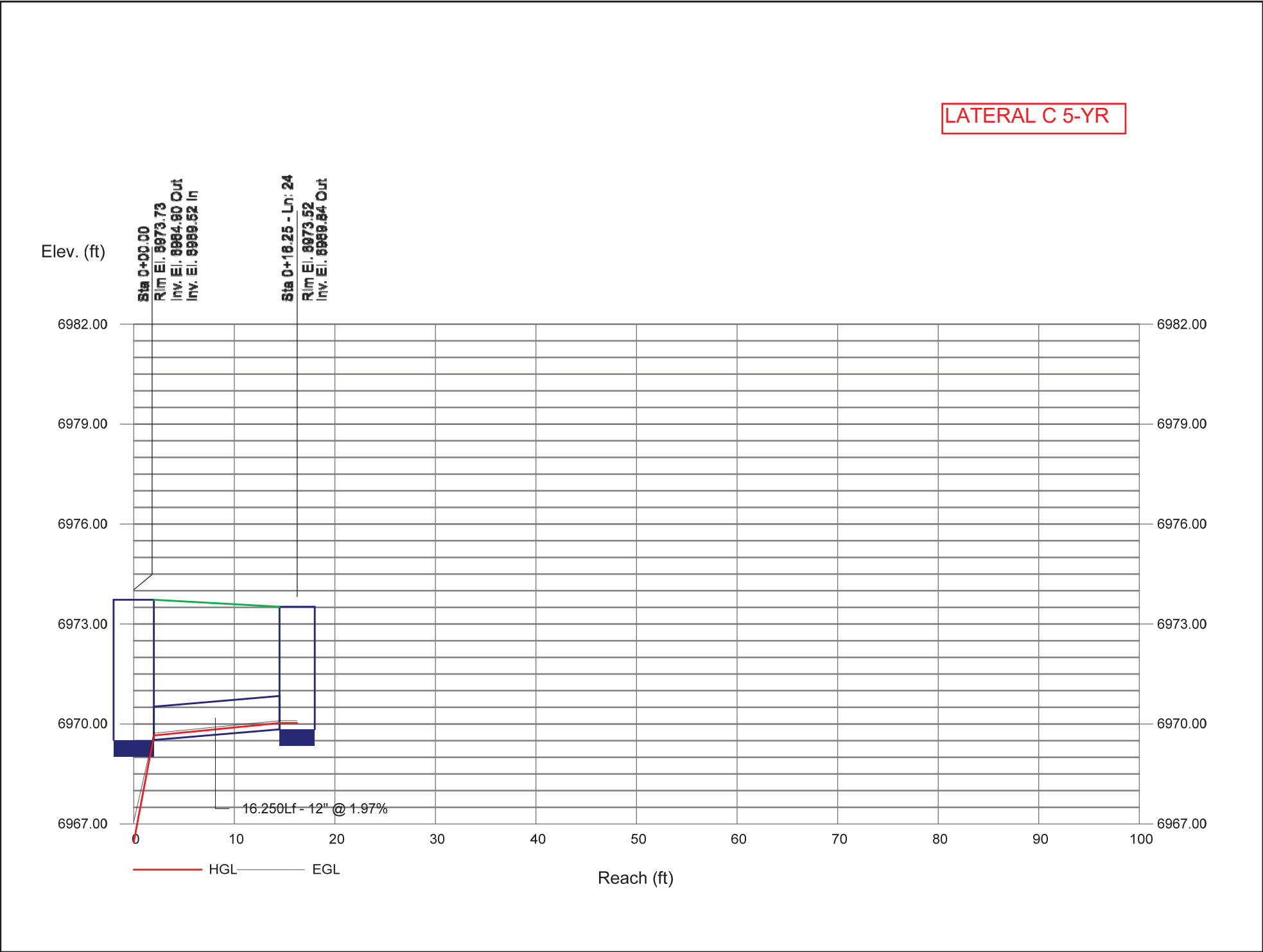


Proj. file: 20235 Storm Sewers 5-yr NEW.stm

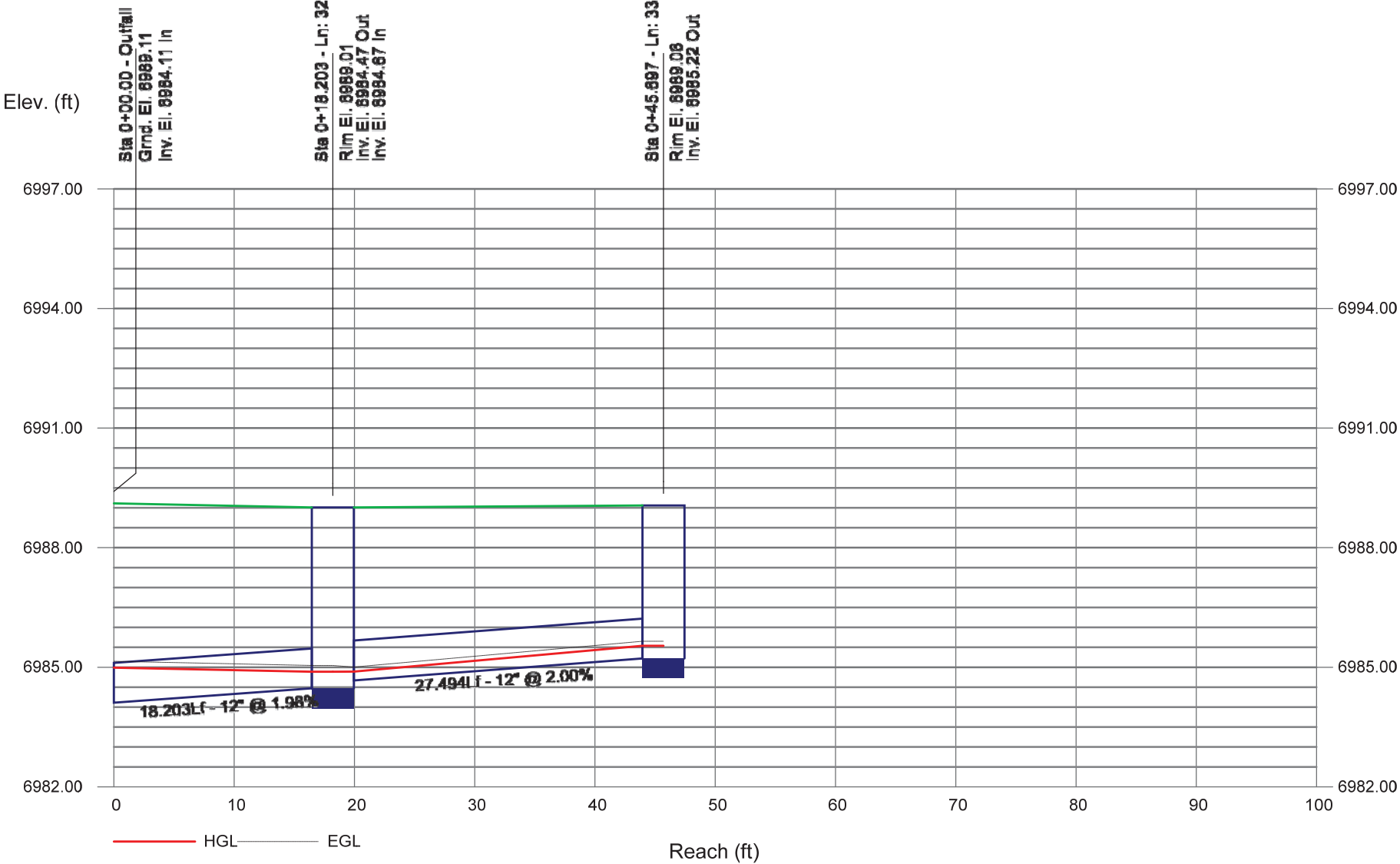


LATERAL C 5-YR

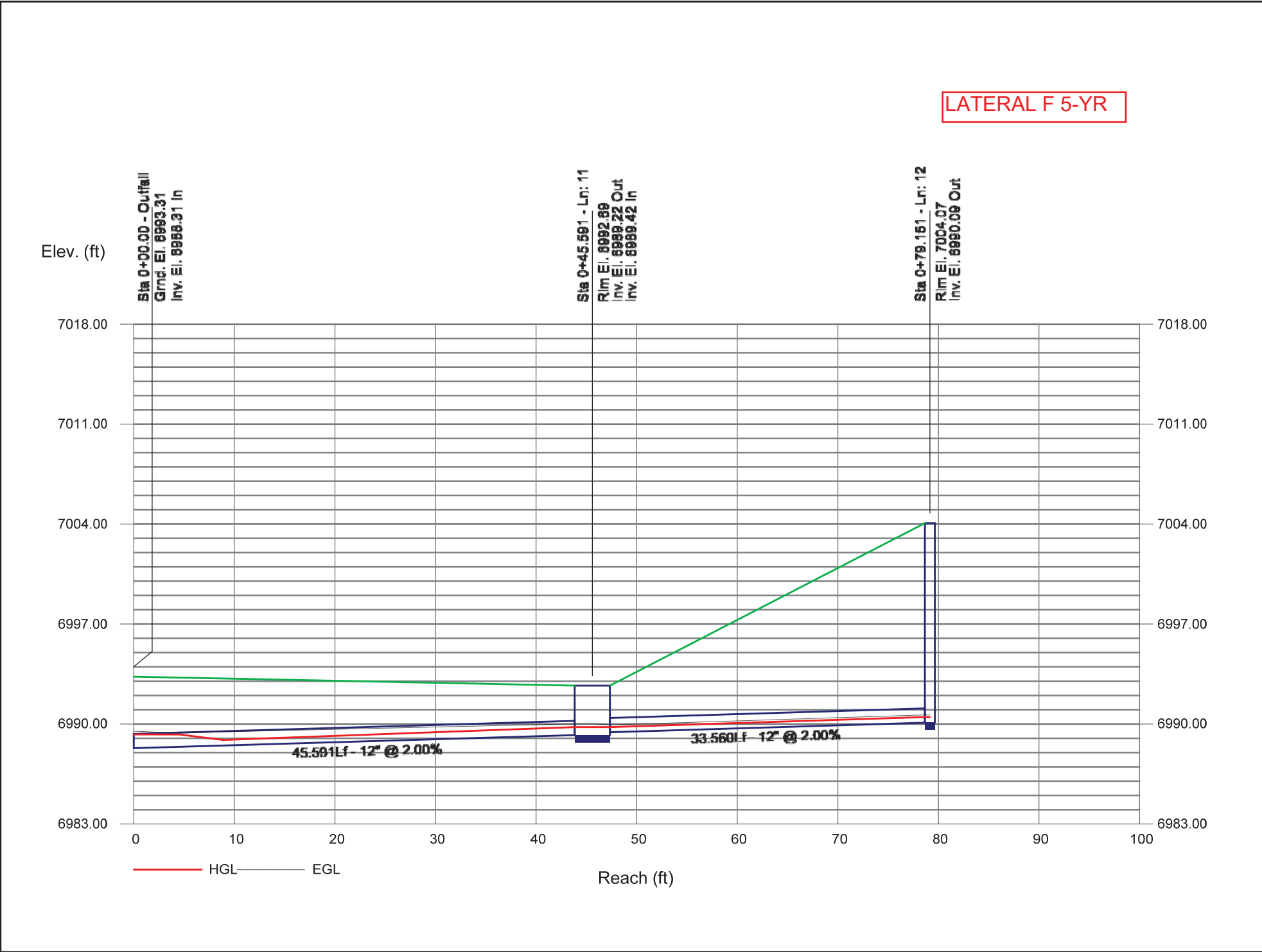


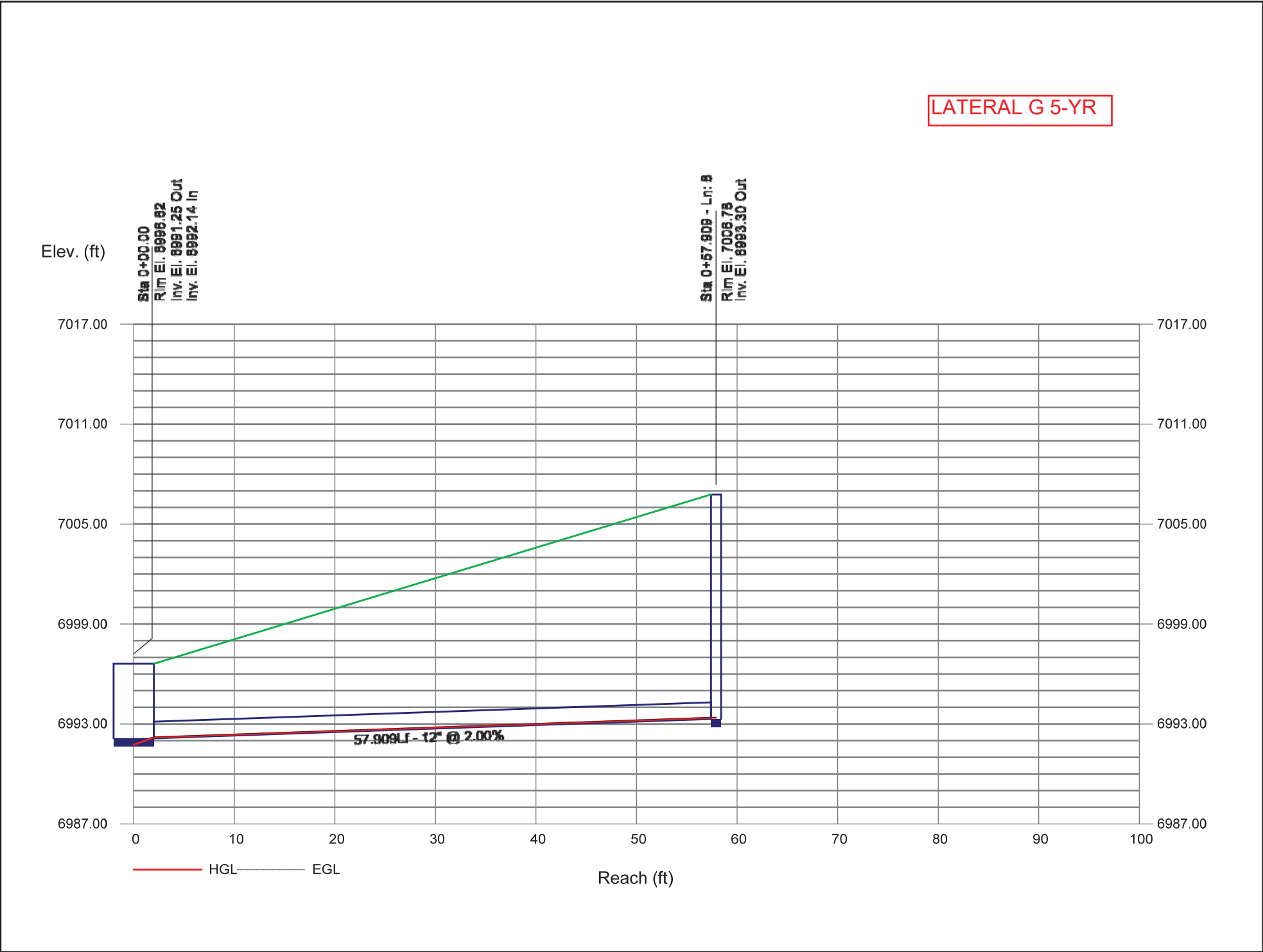


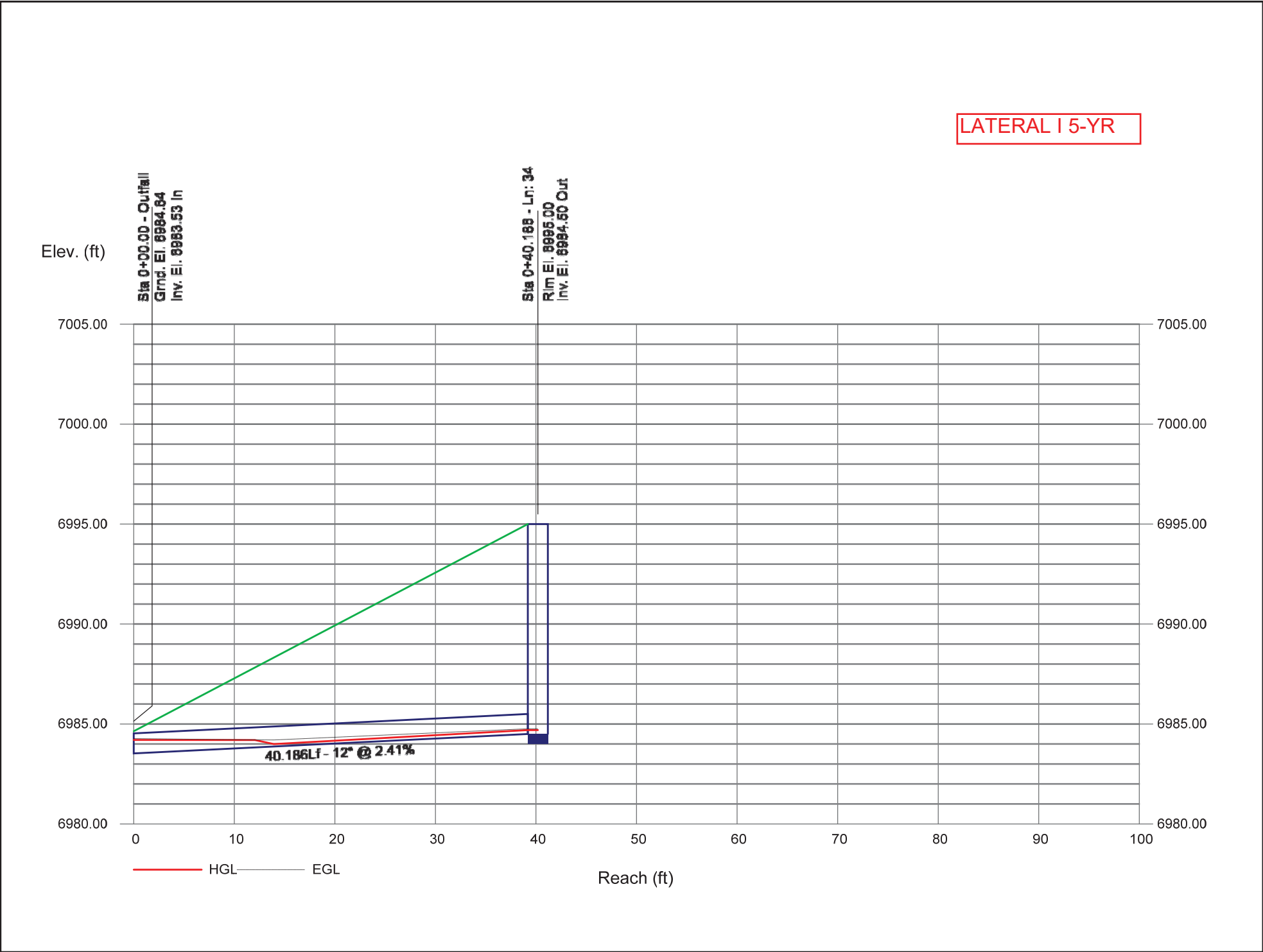
LATERAL E 5-YR



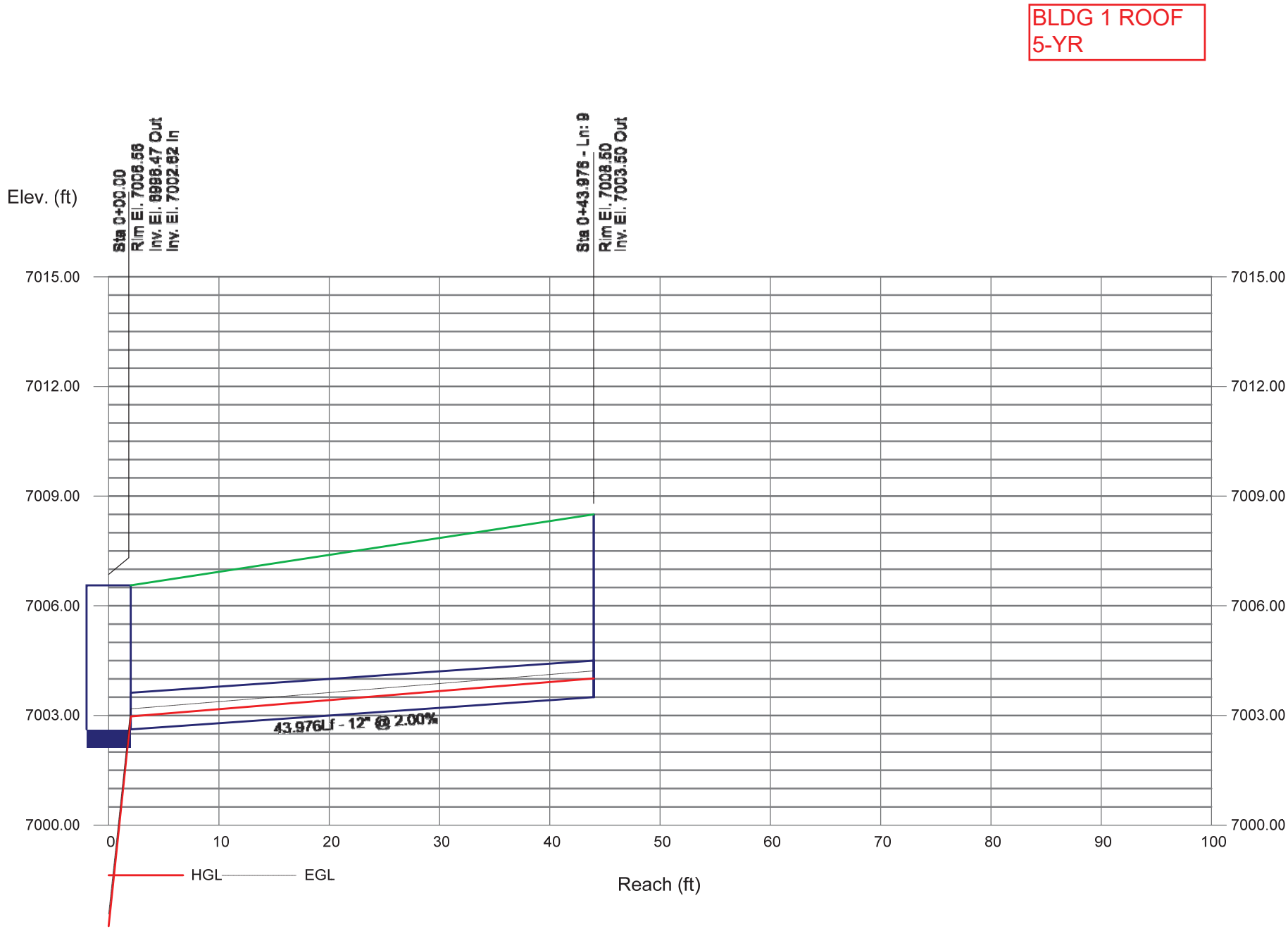
Storm Sewer Profile



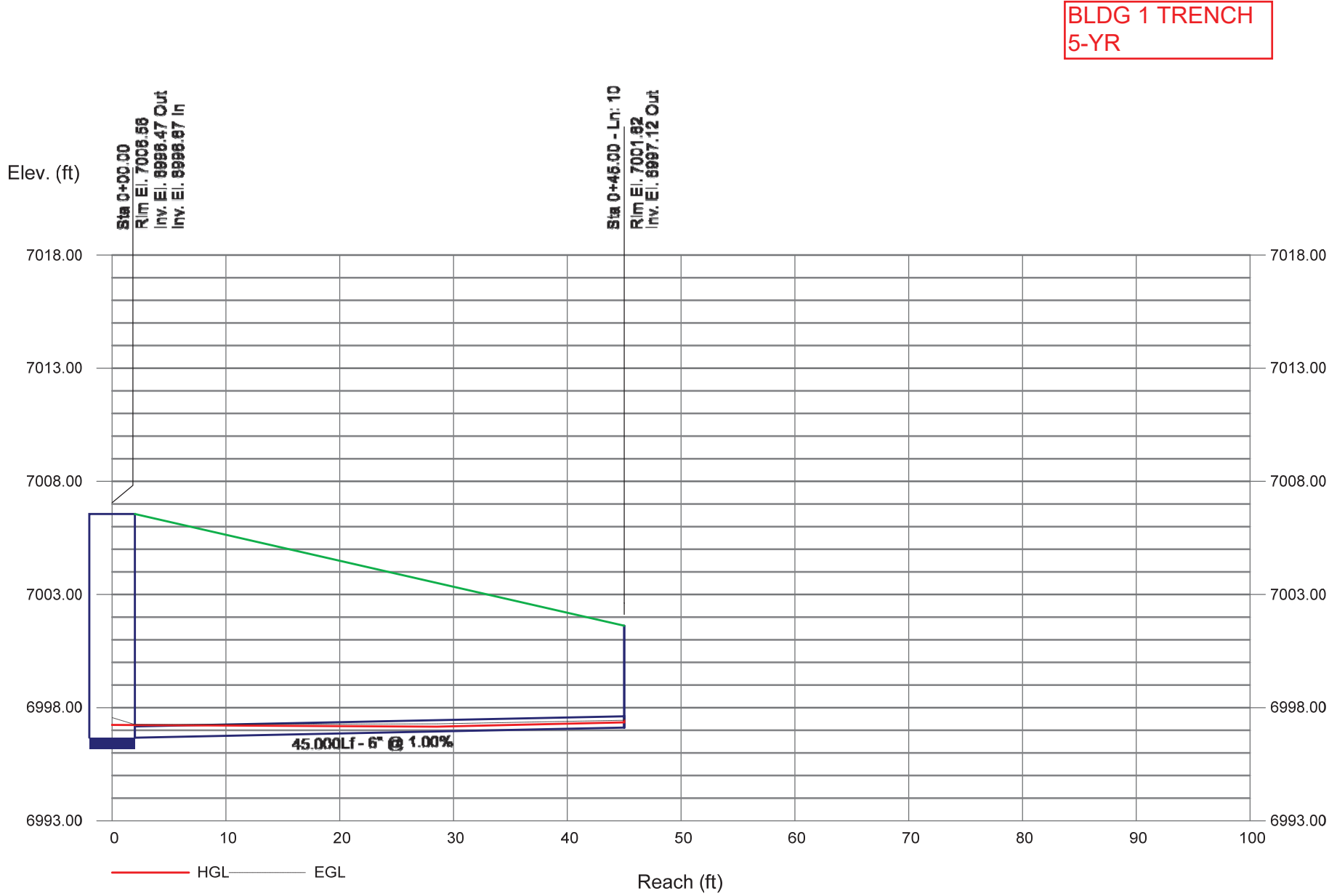




Storm Sewer Profile



Storm Sewer Profile



Channel Report

Half Road Capacity at 4%

Gutter

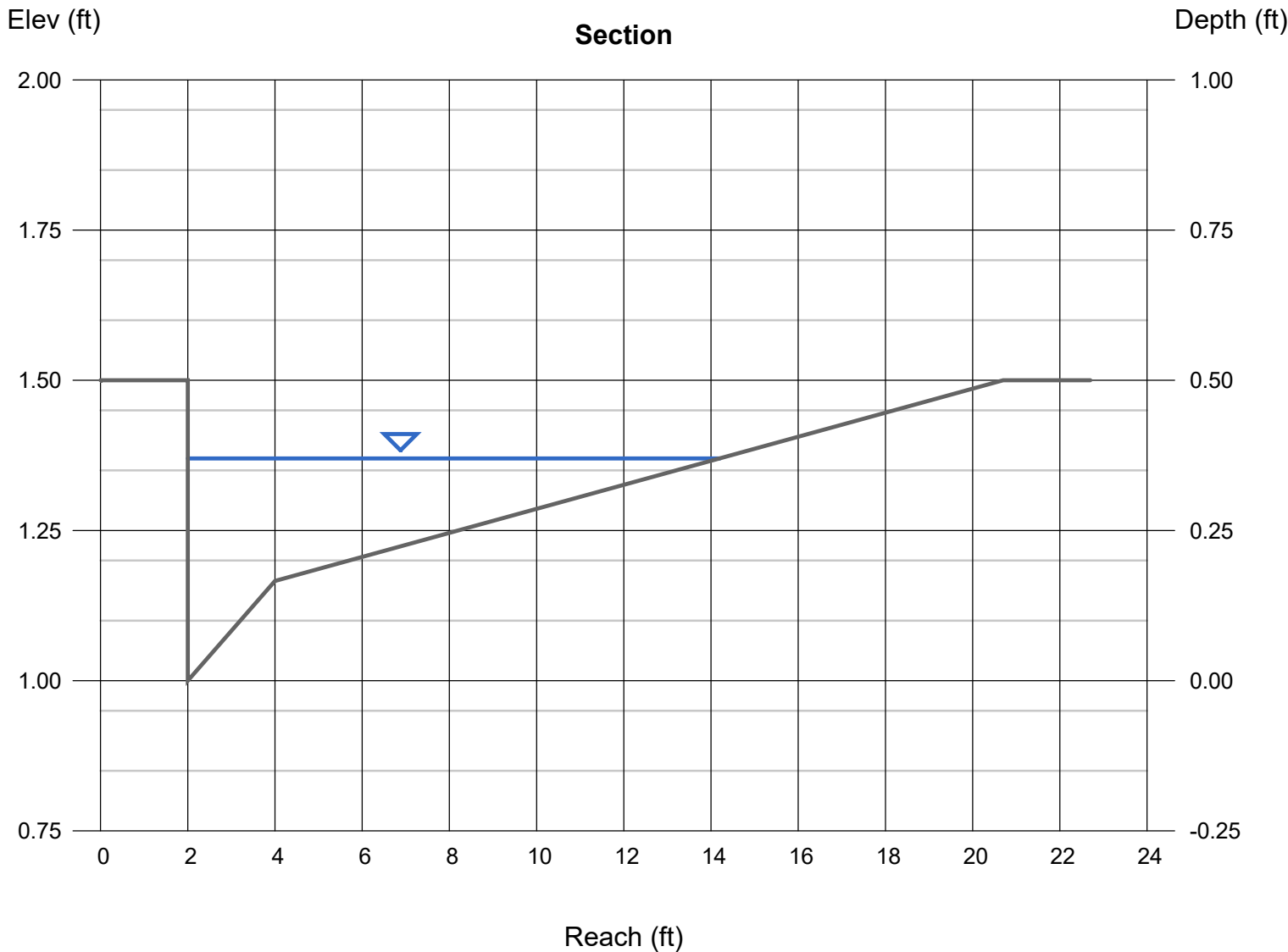
Cross Sl, Sx (ft/ft)	= 0.020
Cross Sl, Sw (ft/ft)	= 0.083
Gutter Width (ft)	= 2.00
Invert Elev (ft)	= 1.00
Slope (%)	= 4.00
N-Value	= 0.015

Highlighted

Depth (ft)	= 0.37
Q (cfs)	= 10.39
Area (sqft)	= 1.61
Velocity (ft/s)	= 6.44
Wetted Perim (ft)	= 12.58
Crit Depth, Yc (ft)	= 0.53
Spread Width (ft)	= 12.20
EGL (ft)	= 1.01

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 0.37



Inlet Report

Off-Site Inlet DP D4

Drop Grate Inlet

Location	= Sag
Curb Length (ft)	= -0-
Throat Height (in)	= -0-
Grate Area (sqft)	= 12.60
Grate Width (ft)	= 6.00
Grate Length (ft)	= 3.00

Gutter

Slope, Sw (ft/ft)	= 0.500
Slope, Sx (ft/ft)	= 0.500
Local Depr (in)	= -0-
Gutter Width (ft)	= 6.00
Gutter Slope (%)	= -0-
Gutter n-value	= -0-

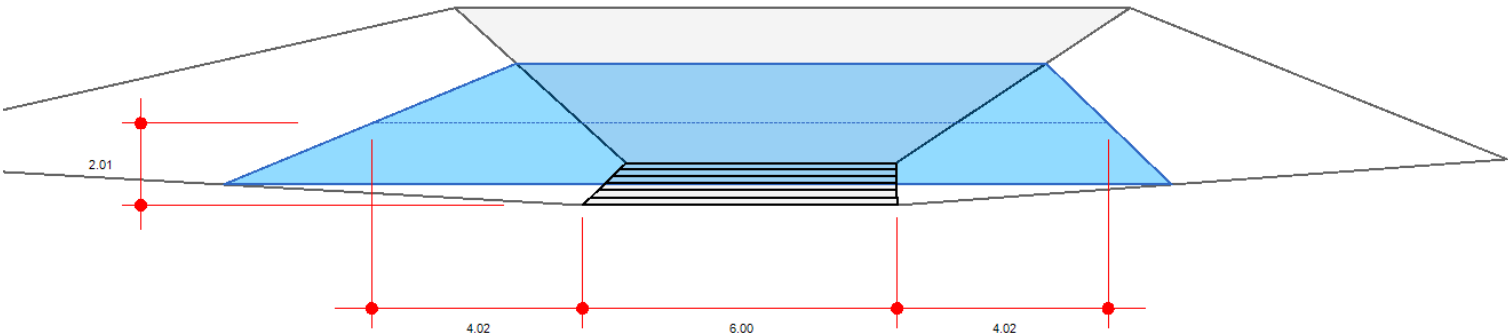
Calculations

Compute by:	Known Q
Q (cfs)	= 96.00

Highlighted

Q Total (cfs)	= 96.00
Q Capt (cfs)	= 96.00
Q Bypass (cfs)	= -0-
Depth at Inlet (in)	= 24.13
Efficiency (%)	= 100
Gutter Spread (ft)	= 14.04
Gutter Vel (ft/s)	= -0-
Bypass Spread (ft)	= -0-
Bypass Depth (in)	= -0-

All dimensions in feet



INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet A8	Inlet A7	Inlet A4
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade
Inlet Type	Denver No. 16 Combination	Denver No. 16 Combination	Denver No. 16 Combination

USER-DEFINED INPUT**User-Defined Design Flows**

Minor Q_{Known} (cfs)	0.4	0.1	0.9
Major Q_{Known} (cfs)	1.0	0.3	2.3

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

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	User-Defined
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.1
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.3

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

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

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	0.4	0.1	1.0
Major Total Design Peak Flow, Q (cfs)	1.0	0.3	2.6
Minor Flow Bypassed Downstream, Q_b (cfs)	0.1	0.0	0.3
Major Flow Bypassed Downstream, Q_b (cfs)	0.3	0.1	1.1

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet A3	Inlet A2	Inlet C5
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade
Inlet Type	Denver No. 16 Combination	Denver No. 16 Combination	Denver No. 16 Combination

USER-DEFINED INPUT**User-Defined Design Flows**

Minor Q_{Known} (cfs)	0.6	0.4	0.2
Major Q_{Known} (cfs)	2.1	1.0	0.8

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	User-Defined	User-Defined	User-Defined
Minor Bypass Flow Received, Q_b (cfs)	0.3	0.0	0.2
Major Bypass Flow Received, Q_b (cfs)	1.1	0.1	1.5

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

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

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	0.9	0.4	0.4
Major Total Design Peak Flow, Q (cfs)	3.2	1.1	2.3
Minor Flow Bypassed Downstream, Q_b (cfs)	0.2	0.1	0.1
Major Flow Bypassed Downstream, Q_b (cfs)	1.5	0.4	1.3

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet C4	Inlet C3	Inlet C2
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	In Sump	In Sump
Inlet Type	Denver No. 16 Combination	Denver No. 16 Combination	Denver No. 16 Combination

USER-DEFINED INPUT**User-Defined Design Flows**

Minor Q_{Known} (cfs)	0.3	0.3	0.4
Major Q_{Known} (cfs)	0.8	1.0	1.0

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	User-Defined	User-Defined	User-Defined
Minor Bypass Flow Received, Q_b (cfs)	0.1	0.1	0.3
Major Bypass Flow Received, Q_b (cfs)	0.4	1.3	0.6

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

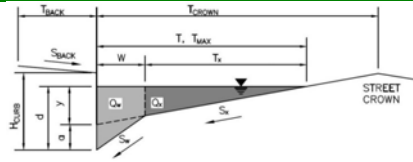
Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	0.4	0.4	0.7
Major Total Design Peak Flow, Q (cfs)	1.2	2.3	1.6
Minor Flow Bypassed Downstream, Q_b (cfs)	0.1	N/A	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	0.6	N/A	N/A

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

Project:

Inlet ID: **Inlet A8****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	0.0	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.015	

$H_{CURB} =$	6.00	inches
$T_{CROWN} =$	12.0	ft
$W =$	2.00	ft
$S_X =$	0.020	ft/ft
$S_W =$	0.083	ft/ft
$S_D =$	0.060	ft/ft
$n_{STREET} =$	0.015	

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	12.0	12.0	ft
$d_{MAX} =$	6.0	6.0	inches
	☐	☐	

MINOR STORM Allowable Capacity is based on Spread Criterion

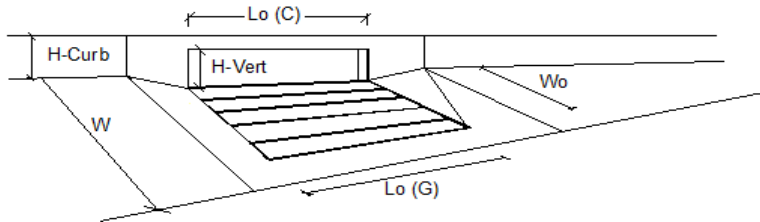
MAJOR STORM Allowable Capacity is based on Spread Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	12.3	12.3	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.36 cfs on sheet 'Inlet Management'**Major storm max. allowable capacity GOOD - greater than the design peak flow of 0.99 cfs on sheet 'Inlet Management'**

INLET ON A CONTINUOUS GRADE

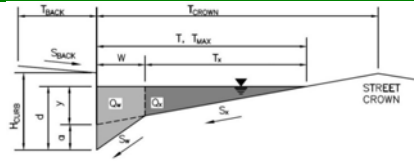
MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	Denver No. 16 Combination	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	2.0	2.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		N_o =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	3.00	3.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	1.73	1.73	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	0.50	0.50	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10	
Street Hydraulics: OK - $Q < Q_{allowable}$ Street Capacity			MINOR		MAJOR
Total Inlet Interception Capacity		Q =	0.3	0.7	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q_o =	0.1	0.3	cfs
Capture Percentage = Q_o/Q_o		$C\%$ =	82	68	%

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

Project:

Inlet ID: **Inlet A7****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	6.0	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.015	

$H_{CURB} =$	6.00	inches
$T_{CROWN} =$	12.0	ft
$W =$	2.00	ft
$S_X =$	0.020	ft/ft
$S_W =$	0.083	ft/ft
$S_D =$	0.060	ft/ft
$n_{STREET} =$	0.015	

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	12.0	12.0	ft
$d_{MAX} =$	6.0	6.0	inches
	☐	☐	

MINOR STORM Allowable Capacity is based on Spread Criterion

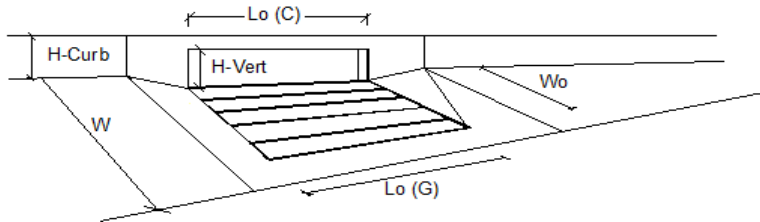
MAJOR STORM Allowable Capacity is based on Spread Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	12.3	12.3	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.14 cfs on sheet 'Inlet Management'**Major storm max. allowable capacity GOOD - greater than the design peak flow of 0.33 cfs on sheet 'Inlet Management'**

INLET ON A CONTINUOUS GRADE

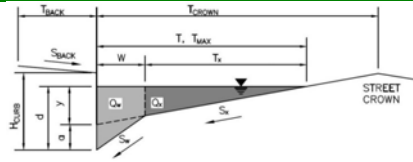
MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	Denver No. 16 Combination	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	2.0	2.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		N_o =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	3.00	3.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	1.73	1.73	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	0.50	0.50	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10	
Street Hydraulics: OK - $Q < Q_{allowable}$ Street Capacity		MINOR		MAJOR	
Total Inlet Interception Capacity		Q =	0.1	0.3	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q_o =	0.0	0.1	cfs
Capture Percentage = Q_o/Q_o		$C\%$ =	92	83	%

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

Project:

Inlet ID: **Inlet A4****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

T_{BACK}	=	0.0	ft
S_{BACK}	=	0.020	ft/ft
n_{BACK}	=	0.015	

H_{CURB}	=	6.00	inches
T_{CROWN}	=	12.0	ft
W	=	2.00	ft
S_x	=	0.020	ft/ft
S_w	=	0.083	ft/ft
S_o	=	0.040	ft/ft
n_{STREET}	=	0.015	

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
T_{MAX}	12.0	12.0	ft
d_{MAX}	6.0	6.0	inches
	☐	☐	

MINOR STORM Allowable Capacity is based on Spread Criterion

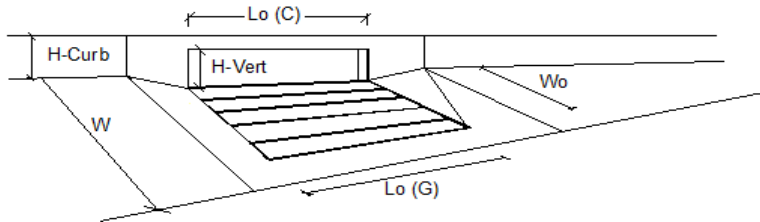
MAJOR STORM Allowable Capacity is based on Spread Criterion

	Minor Storm	Major Storm	
Q_{allow}	10.0	10.0	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.00 cfs on sheet 'Inlet Management'**Major storm max. allowable capacity GOOD - greater than the design peak flow of 2.58 cfs on sheet 'Inlet Management'**

INLET ON A CONTINUOUS GRADE

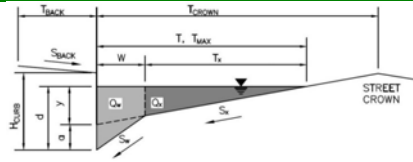
MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	Denver No. 16 Combination	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	2.0	2.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		N_o =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	3.00	3.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	1.73	1.73	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	0.50	0.50	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10	
Street Hydraulics: OK - $Q < Q_{allowable}$ Street Capacity			MINOR		MAJOR
Total Inlet Interception Capacity		Q =	0.7	1.5	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q_o =	0.3	1.1	cfs
Capture Percentage = Q_o/Q_o		$C\%$ =	67	58	%

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

Project:

Inlet ID: **Inlet A3****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

T_{BACK}	=	0.0	ft
S_{BACK}	=	0.020	ft/ft
n_{BACK}	=	0.015	

H_{CURB}	=	6.00	inches
T_{CROWN}	=	12.0	ft
W	=	2.00	ft
S_X	=	0.020	ft/ft
S_W	=	0.083	ft/ft
S_D	=	0.040	ft/ft
n_{STREET}	=	0.015	

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
T_{MAX}	12.0	12.0	ft
d_{MAX}	6.0	6.0	inches
	☐	☐	

MINOR STORM Allowable Capacity is based on Spread Criterion

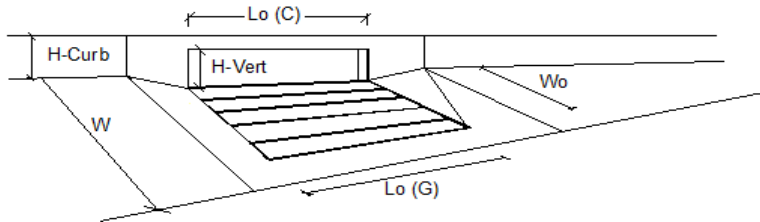
MAJOR STORM Allowable Capacity is based on Spread Criterion

	Minor Storm	Major Storm	
Q_{allow}	10.0	10.0	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.89 cfs on sheet 'Inlet Management'**Major storm max. allowable capacity GOOD - greater than the design peak flow of 3.19 cfs on sheet 'Inlet Management'**

INLET ON A CONTINUOUS GRADE

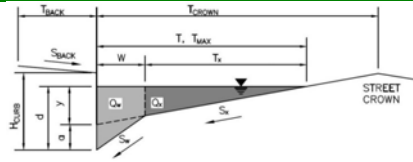
MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	Denver No. 16 Combination	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL} =$	2.0	2.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		$N_0 =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		$L_0 =$	3.00	3.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$W_0 =$	1.73	1.73	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G) =$	0.50	0.50	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C) =$	0.10	0.10	
Street Hydraulics: OK - $Q < \text{Allowable Street Capacity}$		MINOR		MAJOR	
Total Inlet Interception Capacity		$Q =$	0.7	1.7	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_o =$	0.2	1.5	cfs
Capture Percentage = Q_o/Q_o		$C\% =$	78	53	%

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

Project:

Inlet ID: **Inlet A2****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	6.0	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.015	

$H_{CURB} =$	6.00	inches
$T_{CROWN} =$	12.0	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_w =$	0.083	ft/ft
$S_o =$	0.040	ft/ft
$n_{STREET} =$	0.015	

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	12.0	12.0	ft
$d_{MAX} =$	6.0	6.0	inches
	☐	☐	

MINOR STORM Allowable Capacity is based on Spread Criterion

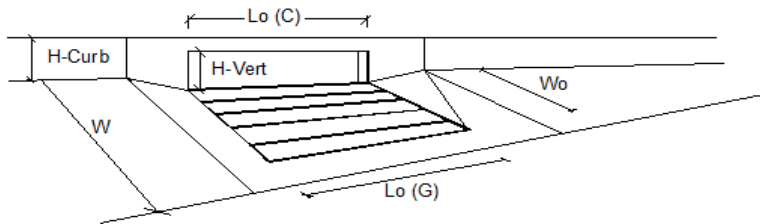
MAJOR STORM Allowable Capacity is based on Spread Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	10.0	10.0	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.40 cfs on sheet 'Inlet Management'**Major storm max. allowable capacity GOOD - greater than the design peak flow of 1.10 cfs on sheet 'Inlet Management'**

INLET ON A CONTINUOUS GRADE

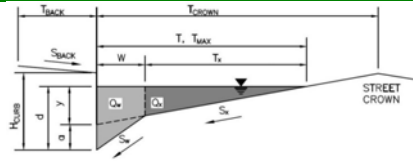
MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	Denver No. 16 Combination	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	2.0	2.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		N_o =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	3.00	3.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	1.73	1.73	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	0.50	0.50	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10	
Street Hydraulics: OK - $Q < Q_{allowable}$ Street Capacity			MINOR		MAJOR
Total Inlet Interception Capacity		Q =	0.3	0.7	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q_o =	0.1	0.4	cfs
Capture Percentage = Q_o/Q_o		$C\%$ =	87	62	%

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

Project:

Inlet ID: **Inlet C5****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	0.0	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.015	

$H_{CURB} =$	6.00	inches
$T_{CROWN} =$	12.0	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_w =$	0.083	ft/ft
$S_o =$	0.100	ft/ft
$n_{STREET} =$	0.015	

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	12.0	12.0	ft
$d_{MAX} =$	6.0	6.0	inches
	☐	☐	

MINOR STORM Allowable Capacity is based on Depth Criterion

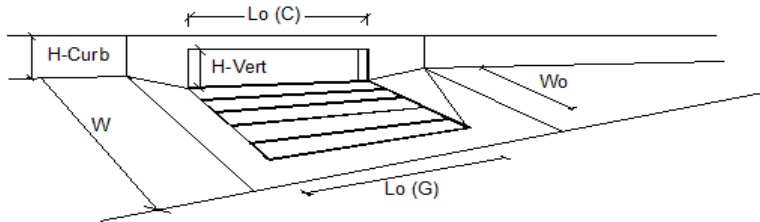
MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	12.4	12.4	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.40 cfs on sheet 'Inlet Management'**Major storm max. allowable capacity GOOD - greater than the design peak flow of 2.30 cfs on sheet 'Inlet Management'**

INLET ON A CONTINUOUS GRADE

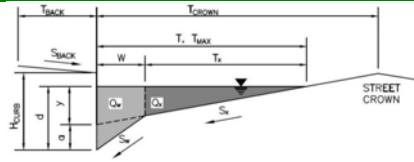
MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	Denver No. 16 Combination	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL} =$	2.0	2.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		$N_0 =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		$L_0 =$	3.00	3.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$W_0 =$	1.73	1.73	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G) =$	0.50	0.50	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C) =$	0.10	0.10	
Street Hydraulics: OK - $Q < Q_{allowable}$ Street Capacity		MINOR		MAJOR	
Total Inlet Interception Capacity		$Q =$	0.3	1.0	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_o =$	0.1	1.3	cfs
Capture Percentage = Q_o/Q_o		$C\% =$	71	43	%

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

Project:

Inlet ID: **Inlet C4****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	6.0	ft
$S_{BACK} =$	0.020	ft/ft
$n_{BACK} =$	0.015	

$H_{CURB} =$	6.00	inches
$T_{CROWN} =$	12.0	ft
$W =$	2.00	ft
$S_X =$	0.020	ft/ft
$S_W =$	0.083	ft/ft
$S_D =$	0.100	ft/ft
$n_{STREET} =$	0.015	

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	12.0	12.0	ft
$d_{MAX} =$	6.0	6.0	inches
	☐	☐	

MINOR STORM Allowable Capacity is based on Depth Criterion

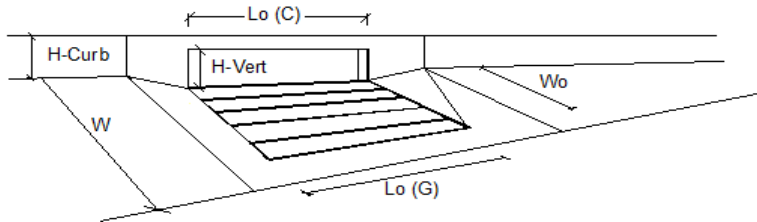
MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	12.4	12.4	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.40 cfs on sheet 'Inlet Management'**Major storm max. allowable capacity GOOD - greater than the design peak flow of 1.20 cfs on sheet 'Inlet Management'**

INLET ON A CONTINUOUS GRADE

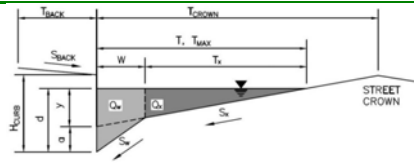
MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	Denver No. 16 Combination	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	2.0	2.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		N_0 =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_0 =	3.00	3.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_0 =	1.73	1.73	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	0.50	0.50	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10	
Street Hydraulics: OK - $Q < Q_{allowable}$ Street Capacity					
Design Discharge for Half of Street (from Inlet Management)		Q_0 =	0.4	1.2	cfs
Water Spread Width		T =	1.3	2.0	ft
Water Depth at Flowline (outside of local depression)		d =	1.8	2.0	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_0 =	1.000	1.000	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.0	0.0	cfs
Discharge within the Gutter Section W		Q_w =	0.4	1.2	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W		A_w =	0.00	0.17	sq ft
Velocity within the Gutter Section W		V_w =	0.0	7.2	fps
Water Depth for Design Condition		d_{LOCAL} =	3.8	4.0	inches
Grate Analysis (Calculated)					
Total Length of Inlet Grate Opening		L =	3.00	3.00	ft
Ratio of Grate Flow to Design Flow		$E_{0-GRATE}$ =	0.992	0.981	
Under No-Clogging Condition					
Minimum Velocity Where Grate Splash-Over Begins		V_0 =	1.86	1.86	fps
Interception Rate of Frontal Flow		R_f =	0.68	0.52	
Interception Rate of Side Flow		R_s =	0.07	0.05	
Interception Capacity		Q_i =	0.3	0.6	cfs
Under Clogging Condition					
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoeff =	1.00	1.00	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	0.50	0.50	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	1.50	1.50	ft
Minimum Velocity Where Grate Splash-Over Begins		V_0 =	1.07	1.07	fps
Interception Rate of Frontal Flow		R_f =	0.60	0.45	
Interception Rate of Side Flow		R_s =	0.02	0.01	
Actual Interception Capacity		Q_a =	0.2	0.5	cfs
Carry-Over Flow = $Q_0 - Q_a$ (to be applied to curb opening or next d/s inlet)		Q_b =	0.2	0.7	cfs
Curb Opening or Slotted Inlet Analysis (Calculated)					
Equivalent Slope S_e		S_e =	0.166	0.166	ft/ft
Required Length L_T to Have 100% Interception		L_T =	2.06	4.27	ft
Under No-Clogging Condition					
Effective Length of Curb Opening or Slotted Inlet (minimum of L , L_T)		L =	2.06	3.00	ft
Interception Capacity		Q_i =	0.0	0.1	cfs
Under Clogging Condition					
Clogging Coefficient		CurbCoeff =	1.00	1.00	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.17	0.17	
Effective (Unclogged) Length		L_e =	2.06	2.50	ft
Actual Interception Capacity		Q_a =	0.0	0.1	cfs
Carry-Over Flow = $Q_{0(GRATE)} - Q_a$		Q_b =	0.1	0.6	cfs
Summary					
Total Inlet Interception Capacity		Q =	0.3	0.6	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q_b =	0.1	0.6	cfs
Capture Percentage = Q_a/Q_0		C% =	71	52	%

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

Project:

Inlet ID: **Inlet C3****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

T_{BACK}	=	0.0	ft
S_{BACK}	=	0.020	ft/ft
n_{BACK}	=	0.015	

H_{CURB}	=	6.00	inches
T_{CROWN}	=	12.0	ft
W	=	2.00	ft
S_x	=	0.020	ft/ft
S_w	=	0.083	ft/ft
S_o	=	0.000	ft/ft
n_{STREET}	=	0.015	

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
T_{MAX}	12.0	12.0	ft
d_{MAX}	6.0	6.0	inches
	☐	☐	

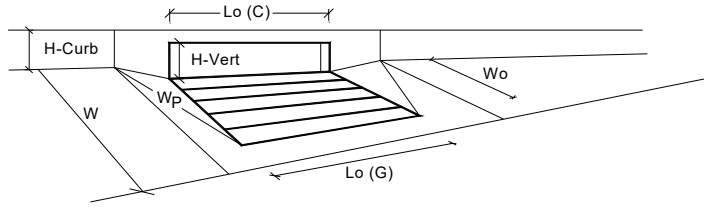
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow}	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

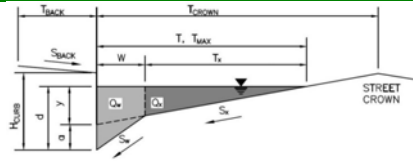
MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	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 =	4.4	4.4	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 (see USDCM Figure ST-5)		Theta =	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W _p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C _f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C _w (C) =	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C _o (C) =	0.66	0.66	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d _{Grate} =	0.39	0.39	ft
Depth for Curb Opening Weir Equation		d _{Curb} =	0.20	0.20	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF _{Grate} =	0.69	0.69	
Curb Opening Performance Reduction Factor for Long Inlets		RF _{Curb} =	N/A	N/A	
Combination Inlet Performance Reduction Factor for Long Inlets		RF _{Combination} =	0.69	0.69	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q _a =	2.4	2.4	cfs
		Q _{PEAK REQUIRED} =	0.4	2.3	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

Project:

Inlet ID: **Inlet C2****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

T_{BACK}	=	6.0	ft
S_{BACK}	=	0.020	ft/ft
n_{BACK}	=	0.015	

H_{CURB}	=	6.00	inches
T_{CROWN}	=	12.0	ft
W	=	6.00	ft
S_x	=	0.020	ft/ft
S_w	=	0.083	ft/ft
S_o	=	0.000	ft/ft
n_{STREET}	=	0.015	

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
T_{MAX}	12.0	12.0	ft
d_{MAX}	6.0	6.0	inches
	☐	☐	

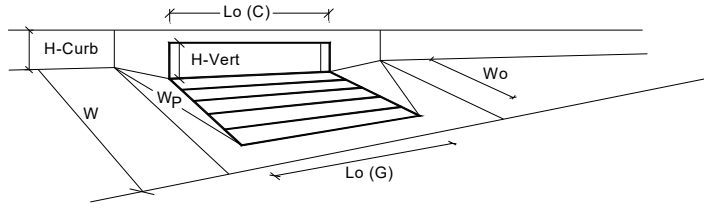
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow}	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	Denver No. 16 Combination	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)		a _{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	6.0	inches
Grate Information			MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate		L _o (G) =	3.00	3.00	feet
Width of a Unit Grate		W _o =	1.73	1.73	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A _{ratio} =	0.31	0.31	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C _f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C _w (G) =	3.60	3.60	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C _o (G) =	0.60	0.60	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L _o (C) =	3.00	3.00	feet
Height of Vertical Curb Opening in Inches		H _{vert} =	6.50	6.50	inches
Height of Curb Orifice Throat in Inches		H _{throat} =	5.25	5.25	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W _p =	6.00	6.00	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} =	0.57	0.57	ft
Depth for Curb Opening Weir Equation		d _{Curb} =	0.02	0.02	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF _{Grate} =	0.94	0.94	
Curb Opening Performance Reduction Factor for Long Inlets		RF _{Curb} =	N/A	N/A	
Combination Inlet Performance Reduction Factor for Long Inlets		RF _{Combination} =	0.94	0.94	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q _a =	2.8	2.8	cfs
		Q _{PEAK REQUIRED} =	0.7	1.6	cfs

Channel Report

OFF-SITE DITCH

Trapezoidal

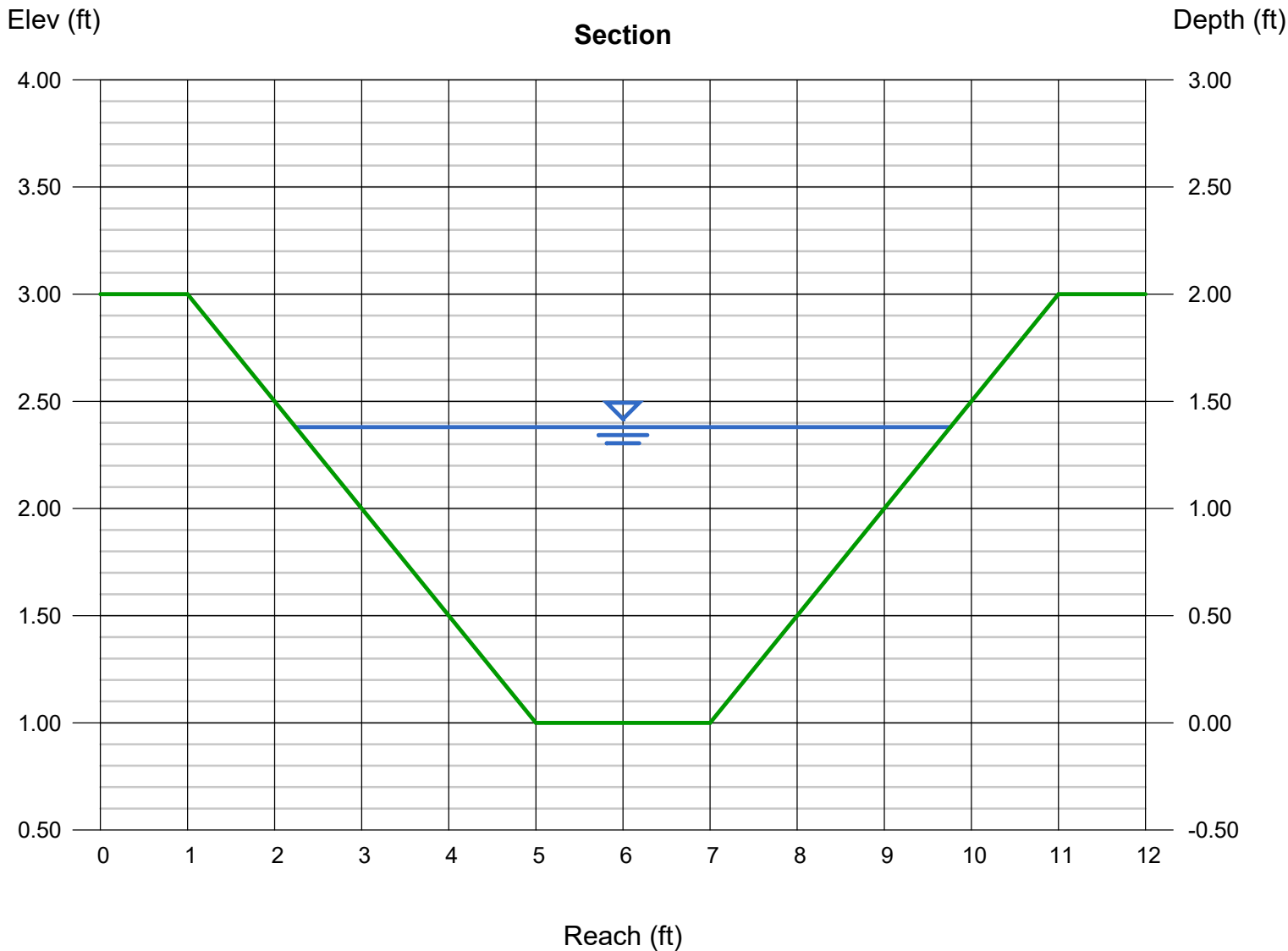
Bottom Width (ft) = 2.00
Side Slopes (z:1) = 2.00, 2.00
Total Depth (ft) = 2.00
Invert Elev (ft) = 1.00
Slope (%) = 16.60
N-Value = 0.030

Highlighted

Depth (ft) = 1.38
Q (cfs) = 114.00
Area (sqft) = 6.57
Velocity (ft/s) = 17.35
Wetted Perim (ft) = 8.17
Crit Depth, Yc (ft) = 2.00
Top Width (ft) = 7.52
EGL (ft) = 6.06

Calculations

Compute by: Known Q
Known Q (cfs) = 114.00



ATTACHMENT 9
POND CALCULATIONS



STORM STORAGE CALCULATIONS DETENTION POND A

PROJECT NAME: Astrid
PROJECT NUMBER: 20235
CALCULATED BY: SMB
CHECKED BY: CSR

DATE: 5/19/2023

%I = 60.5%

EQUATION: $Q_5 = 0.10 A$
EQUATION: $Q_{100} = 0.54 A$

5-YR STORM CALCULATIONS

EQUATION: $V_i5 = C_{IA} \cdot T_c \cdot 60$

EQUATION: $V_o5 = Q_5 \cdot T_c \cdot 60$
EQUATION: $V_5 = V_i5 - V_o5$

100-YR STORM CALCULATIONS

EQUATION: $V_i100 = C_{IA} \cdot T_c \cdot 60$

EQUATION: $V_o100 = Q_{100} \cdot T_c \cdot 60$
EQUATION: $V_{100} = V_i100 - V_o100$

WATER QUALITY STORAGE VOL.

$$WQCV = 0.79Aa(0.9I^3 - 1.19I^2 + 0.78I)/12$$

Onsite Area =	4.33	ACRES	Tc =	5.1	MIN
Pond A Area =	2.58	ACRES	Basin A Q5 =	4.6	CFS
Total 5-yr Release =	0.4	CFS	Basin A Q100 =	13.6	CFS
Total 100-yr Release =	2.3	CFS	Basin H3 Bypass Q5 =	1.9	CFS
			Basin H3 Bypass Q100 =	5.3	CFS
Pond A 5-yr Release =	0.9	CFS	Basin C Free Release Q5 =	1.1	CFS
Pond A 100-yr Release =	1.9	CFS	Basin C Free Release Q100 =	3.6	CFS
(Total Release + H3 - C - Pond B - A2 and A3)			Pond B Release Q5 =	0.1	CFS
			Pond B Release Q100 =	0.3	CFS
			Basin A2 + A3 Inlet Bypass Q5 =	0.3	CFS
			Basin A2 + A3 Inlet Bypass Q100 =	1.9	CFS

VI5 =	1989 CF	(Basin A + H3)
RELEASE @ Q5 =	0.9 CFS	(Total Release + H3 - C - Pond B - A2 & A3)
Vo5 =	275 CF	
V5 =	1714 CF	

V100 =	5781 CF	(Basin A + H3)
RELEASE @ Q100 =	1.9 CFS	(Total Release + H3 - C - Pond B - A2 & A3)
Vo100 =	567 CF	
V100 =	5214 CF	

Drain Time Coefficient, a
40 hours 1.00

WQCV = 0.040 AC-FT
= 1760 CF

TOTAL REQUIRED VOLUME = 5214 CF (100-yr including WQCV)

PROJECT : Astrid
PROJECT NO. : 20235

PROJECT LOCATION: Pond A

DATE : 12/19/2022
BY : SMB

Provided Volume

Stage (ft)	Contour Elevation (ft)	Area (ft ²)	$\frac{1}{3} (A1 + A2 + (A1A2)^{1/2}) D$	Total Volume (ft ³)	Total Volume (ac-ft)
0.00	6984.00	0		0.0	0.000
1.00	6985.00	1,484	494.7	494.7	0.011
2.00	6986.00	2,160	1,811.5	2,306.1	0.053
3.00	6987.00	2,308	2,233.6	4,539.7	0.104
4.00	6988.00	2,335	2,321.5	6,861.2	0.158

	WSEL	Depth (ft)	Area (ft ²)	Volume (ft ³)	Volume (ac-ft)
WQCV =	6985.70	1.70	1,957.20	1,762.69	0.040
EURV =					
2-yr =					
5-yr =	6985.70	1.70	1,957.20	1,762.69	0.040
10-yr =					
100-yr =	6987.30	3.30	2,316.10	5,236.16	0.120

 = FORMULA CELLS
 = USER INPUT CELLS

Weir Report

Pond A Emergency Spillway

Rectangular Weir

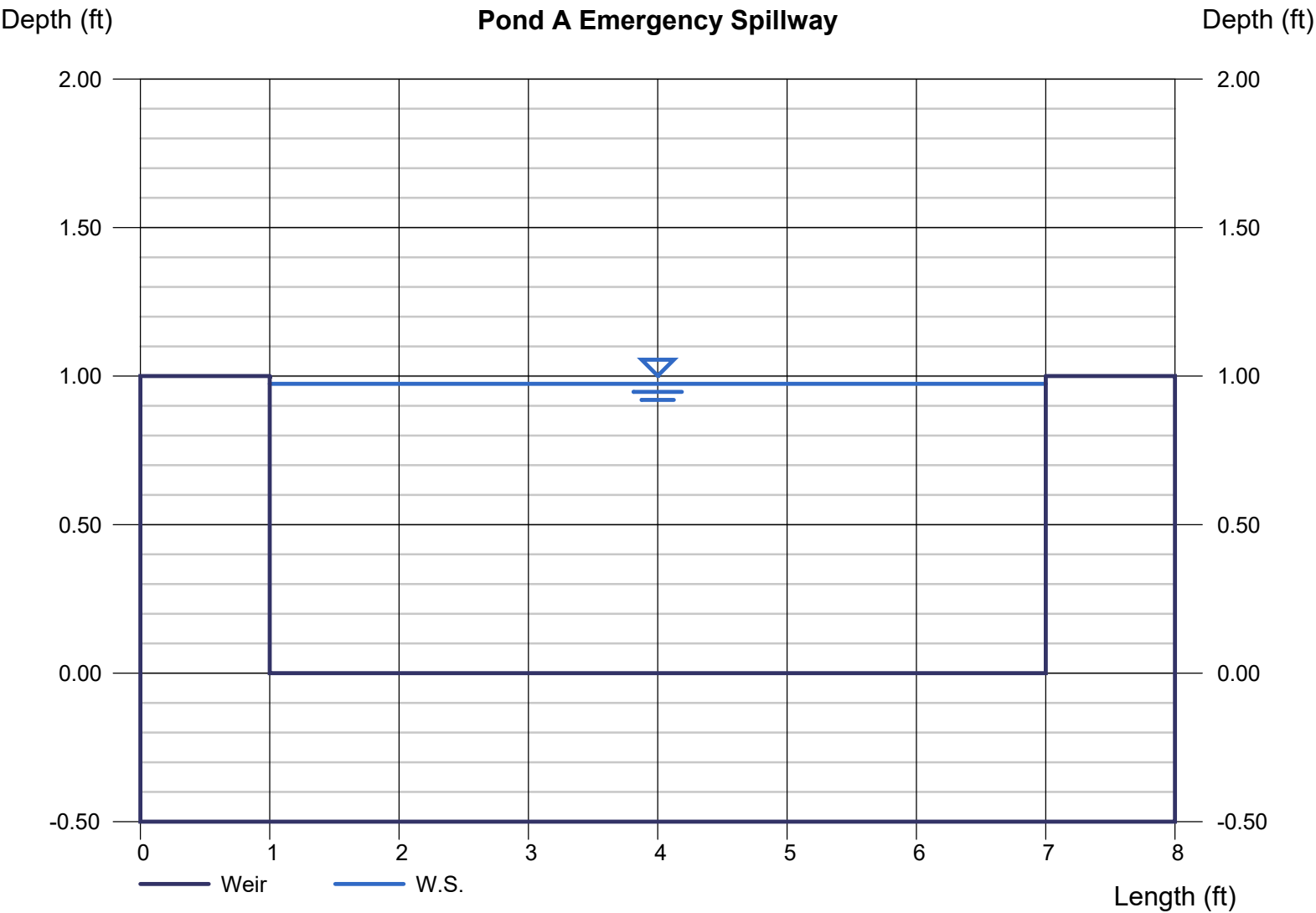
Crest = Sharp
Bottom Length (ft) = 6.00
Total Depth (ft) = 1.00

Calculations

Weir Coeff. Cw = 3.33
Compute by: Known Q
Known Q (cfs) = 19.20

Highlighted

Depth (ft) = 0.97
Q (cfs) = 19.20
Area (sqft) = 5.84
Velocity (ft/s) = 3.29
Top Width (ft) = 6.00





STORM STORAGE CALCULATIONS DETENTION POND B

PROJECT NAME: Astrid
PROJECT NUMBER: 20235
CALCULATED BY: SMB
CHECKED BY: CSR

DATE: 12/21/2022

CALCULATED % IMPERVIOUSNESS =

DESIGN DRAINAGE AREA

Pond B Area = 0.59

ACRES

57.1%

Tc = 6.3

MIN

Q5 = 0.93

Q100 = 2.85

5-YR STORM CALCULATIONS

EQUATION: $V_{i5} = CIA \cdot T_c \cdot 60$

EQUATION: $Q_5 = 0.10 A$

EQUATION: $V_{o5} = Q_5 \cdot T_c \cdot 60$

EQUATION: $V_5 = V_{i5} - V_{o5}$

$V_{i5} = 347$ CF

RELEASE @ $Q_5 = 0.06$ CFS

$V_{o5} = 22$ CF

$V_5 = 325$ CF

100-YR STORM CALCULATIONS

EQUATION: $V_{i100} = CIA \cdot T_c \cdot 60$

EQUATION: $Q_{100} = 0.54 A$

EQUATION: $V_{o100} = Q_{100} \cdot T_c \cdot 60$

EQUATION: $V_{100} = V_{i100} - V_{o100}$

$V_{i100} = 1069$ CF

RELEASE @ $Q_{100} = 0.32$ CFS

$V_{o100} = 120$ CF

$V_{100} = 949$ CF

WATER QUALITY STORAGE VOL.

Drain Time Coefficient, a

40 hours 1.00

WQCV = 0.009 AC-FT

= 384 CF

$$WQCV = 0.79Aa(0.91I^3 - 1.19I^2 + 0.78I)/12$$

TOTAL REQUIRED VOLUME = 949 CF (100-yr including WQCV)

PROJECT : Astrid
PROJECT NO. : 20235

PROJECT LOCATION: Pond B

DATE : 12/19/2022
BY : SMB

Provided Volume

Stage (ft)	Contour Elevation (ft)	Area (ft ²)	$\frac{1}{3} (A_1 + A_2 + (A_1 A_2)^{1/2}) D$	Total Volume (ft ³)	Total Volume (ac-ft)
0.00	6979.40	0		0.0	0.000
0.60	6980.00	200	40.0	40.0	0.001
1.60	6981.00	1,026	559.7	599.7	0.014
2.60	6982.00	1,061	1,043.5	1,643.1	0.038
3.60	6983.00	1,666	1,352.2	2,995.3	0.069

	WSEL	Depth (ft)	Area (ft ²)	Volume (ft ³)	Volume (ac-ft)
WQCV =	6980.65	1.25	736.90	403.78	0.009
EURV =					
2-yr =					
5-yr =	6980.55	1.15	654.30	347.81	0.008
10-yr =					
100-yr =	6981.40	2.00	1,040.00	1,017.04	0.023

= FORMULA CELLS
 = USER INPUT CELLS

Weir Report

Pond B Emergency Spillway

Rectangular Weir

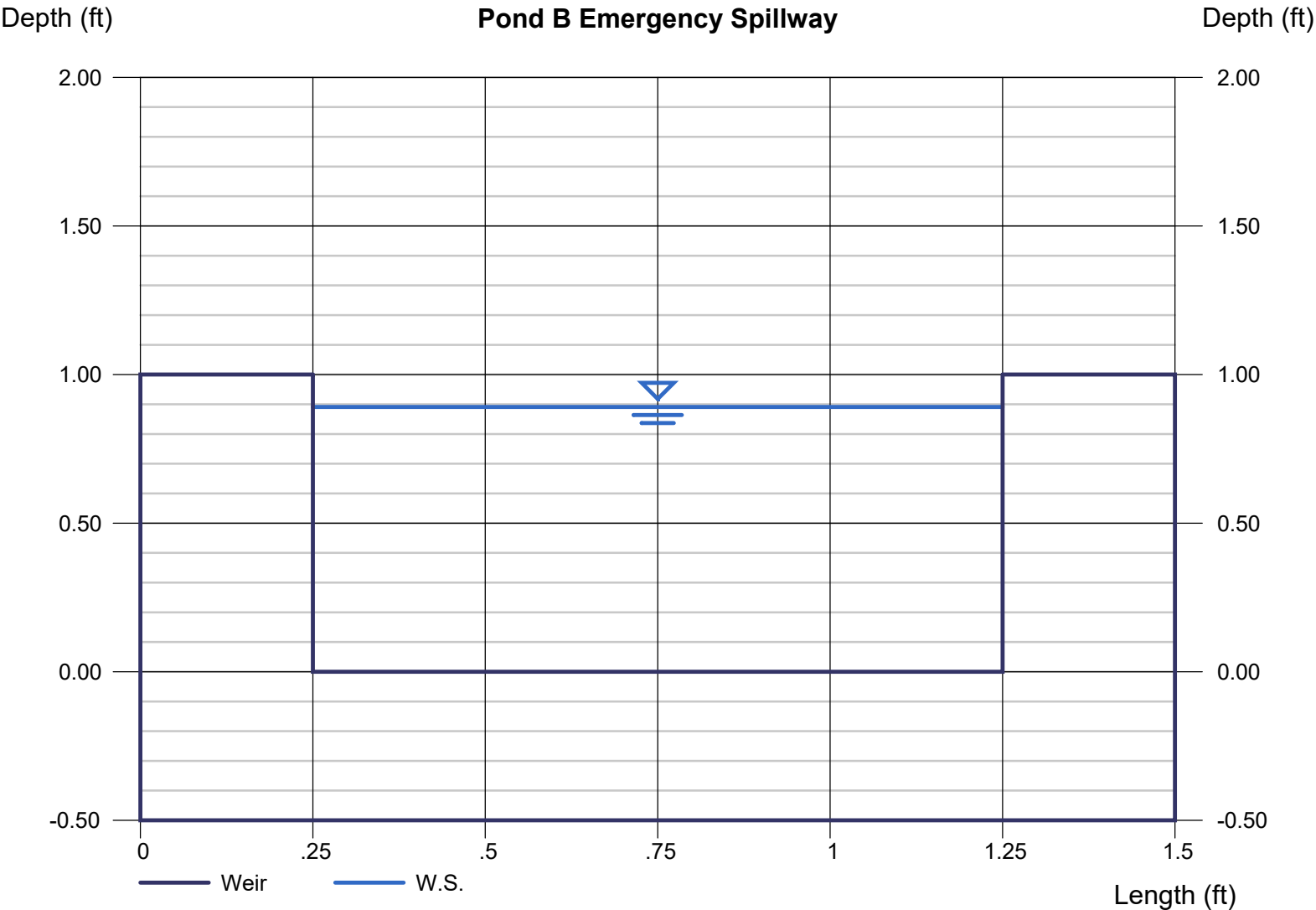
Crest = Sharp
Bottom Length (ft) = 1.00
Total Depth (ft) = 1.00

Calculations

Weir Coeff. Cw = 3.33
Compute by: Known Q
Known Q (cfs) = 2.80

Highlighted

Depth (ft) = 0.89
Q (cfs) = 2.800
Area (sqft) = 0.89
Velocity (ft/s) = 3.14
Top Width (ft) = 1.00





100-Year Orifice Plate on Outlet Pipe from Pond Outlet Structure

PROJECT NAME: Astrid
PROJECT NUMBER: CO20233
CALCULATED BY: SMB
CHECKED BY: MB

DATE: 12/21/2022

POND	PONDING DEPTH (FT)	OUTLET PIPE DIAMETER (FT)	OUTLET PIPE RADIUS (FT)	ORIFICE PLATE HEIGHT (IN)	ORIFICE PLATE HEIGHT (FT)	ORIFICE AREA (SQFT)	DEPTH TO OUTLET INVERT (FT)	ANGLE	CENTROID (FT)	EFFECTIVE HEAD (FT)	RELEASE RATE (CFS)
A	3.1	1	0.5	3.5	0.292	0.191	1.5	2.28	0.17	4.43	1.9
B	2	0.5	0.25	1	0.083	0.022	8.9	1.68	0.05	10.85	0.3

5.14.1 Orifices

Multiple orifices may be used in a detention facility, and the hydraulics of each can be superimposed to develop the outlet-rating curve. For a single orifice or a group of orifices, orifice flow can be determined using Equation 12-7.

$$Q = C_o A_o (2gH_o)^{0.5}$$

Equation 12-7

Where:

Q = the orifice flow rate through a given orifice (cfs)

C_o = discharge coefficient (0.60 recommended for square-edge orifices)

A_o = area of orifice (ft²)

H_o = effective head on each orifice opening (ft)

g = gravitational acceleration constant (32.2 ft/sec²)

If the orifice discharges as a free outfall, the effective head is measured from the centroid of the orifice to the upstream water surface elevation. If the downstream jet of the orifice is submerged, then the effective head is the difference in elevation between the upstream and downstream water surfaces.



STORM STORAGE CALCULATIONS DETENTION POND B

PROJECT NAME: Astrid
PROJECT NUMBER: 20235
CALCULATED BY: SMB
CHECKED BY: CSR

DATE: 5/19/2023

CALCULATED % IMPERVIOUSNESS =

DESIGN DRAINAGE AREA

Pond B Area = 0.69

ACRES

52.8%

Tc = 6.3

MIN

Q5 = 0.93

Q100 = 2.85

5-YR STORM CALCULATIONS

EQUATION: $V_{i5} = CIA \cdot T_c \cdot 60$

EQUATION: $Q_5 = 0.10 A$

EQUATION: $V_{o5} = Q_5 \cdot T_c \cdot 60$

EQUATION: $V_5 = V_{i5} - V_{o5}$

$V_{i5} =$ CF

RELEASE @ $Q_5 =$ CFS

$V_{o5} =$ CF

$V_5 =$ NA CF

100-YR STORM CALCULATIONS

EQUATION: $V_{i100} = CIA \cdot T_c \cdot 60$

EQUATION: $Q_{100} = 0.54 A$

EQUATION: $V_{o100} = Q_{100} \cdot T_c \cdot 60$

EQUATION: $V_{100} = V_{i100} - V_{o100}$

$V_{i100} =$ CF

RELEASE @ $Q_{100} =$ CFS

$V_{o100} =$ CF

$V_{100} =$ NA CF

WATER QUALITY STORAGE VOL.

$$WQCV = 0.79Aa(0.91I^3 - 1.19I^2 + 0.78I)/12$$

Drain Time Coefficient, a

40 hours 1.00

WQCV = 0.010 AC-FT

= 424 CF

TOTAL REQUIRED VOLUME = 424 CF (WQCV Only)

PROJECT : Astrid
PROJECT NO. : 20235

PROJECT LOCATION: Pond C

DATE : 5/18/2023
BY : SMB

Provided Volume

Stage (ft)	Contour Elevation (ft)	Area (ft ²)	$\frac{1}{3} (A_1 + A_2 + (A_1 A_2)^{1/2}) D$	Total Volume (ft ³)	Total Volume (ac-ft)
0.00	6953.00	41		0.0	0.000
1.00	6954.00	219	118.3	118.3	0.003
2.00	6955.00	513	355.7	474.0	0.011
3.00	6956.00	909	701.6	1,175.6	0.027

	WSEL	Depth (ft)	Area (ft ²)	Volume (ft ³)	Volume (ac-ft)
WQCV =	6955.00	2.00	513.00	473.98	0.011
EURV =					
2-yr =					
5-yr =					
10-yr =					
100-yr =					

 = FORMULA CELLS
 = USER INPUT CELLS

PROJECT: Astrid
 JOB NO.: 20235
 CALC. BY: SMB
 CHK BY: CSR



POND SUMMARY

	POND	POND A	POND B	POND C
VOLUME (CF)	WQCV	1760	384	424
	V ₅	1714	325	N/A
	V ₁₀₀	5214	949	N/A
ELEV.	Pond Invert	6984.00	6979.40	6953.00
WSEL	WQCV	6985.70	6980.65	6955.00
	5-Year	6985.70	6980.55	N/A
	100-Year	6987.30	6981.40	N/A
DEPTH (FT)	WQCV	1.70	1.25	2.00
	5-Year	1.70	1.15	N/A
	100-Year	3.30	2.00	N/A
RELEASE RATE (CFS)	WQCV	40-hr	40-hr	40-hr
	5-Year	0.9	0.06	N/A
	100-Year	1.9	0.32	N/A

ATTACHMENT 10

TABLES USED FOR REPORT

5.5.1 INTRODUCTION

Presented in this Section are design rainfall data for the minor and major storm events. These data are used to determine storm runoff peak flows and volumes in conjunction with the runoff models described in Section 5.6, Storm Runoff. All hydrologic analyses for Steamboat Springs shall utilize the rainfall data presented in this Section for calculating storm runoff.

5.5.2 RAINFALL ANALYSIS

For the City of Steamboat Springs, rainfall analysis shall be completed by using Equation 1 in this Section or by using the Colorado Urban Hydrograph Procedure (CUHP) developed by the Urban Drainage and Flood Control District. Rainfall data is generally based on NOAA Atlas 14, Volume 8. A detailed memo regarding the evaluation of NOAA Atlas 14 is available from the City upon request. To develop design flow rates, Equation 1 is used with the Rational Method and CUHP is used with SWMM or PCSWMM and HEC-1 or HEC-HMS. These runoff methodologies are discussed in Section 5.6, Storm Runoff.

5.5.3 INTENSITY-DURATION-FREQUENCY CURVES

Equation 1 shall be used to calculate rainfall intensity for a given time of concentration or to develop intensity-duration-frequency curves for the Rational Method for runoff analysis. The 1-hour rainfall depths from NOAA Atlas 14 for Steamboat Springs (station ID 05-7936) are used in Equation 1 for the durations and return periods of interest. Equation 1 was developed using data from NOAA Atlas 14. A detailed memo on the development of the equation is available from the City upon request.

$$I = P_1 \times \frac{49.1}{(T_d + 7.84)^{0.919}} \quad (1)$$

Where:

I = rainfall intensity (inches per hour)

P_1 = 1-hour rainfall depth (inches)

T_d = storm duration (minutes)

Rainfall intensities as a function of various storm durations and recurrence intervals are provided in Table 5.5.1 for reference. These values were calculated using Equation 1. Table 5.5.1 includes a 1-hour rainfall depth and intensities as a function of storm duration for the 80th percentile storm event (the event having a 1.25-year return period) to be used to design permanent stormwater treatment facilities using the TSS design standard. The values in Table 5.5.1 are subject to revision and users of these Engineering Standards are encouraged to check for updates.

Table 5.5.1.P1 and Intensity-Duration-Frequency Values

Return Period	P1	Rainfall Intensity for Storm Duration				
		5-min	10-min	15-min	30-min	60-min
1.25-year	0.38	1.79	1.33	1.06	0.66	0.39
2-year	0.55	2.58	1.90	1.52	0.95	0.56
5-year	0.82	3.84	2.84	2.26	1.42	0.83
10-year	1.04	4.89	3.61	2.88	1.81	1.06
25-year	1.34	6.30	4.66	3.71	2.33	1.36
50-year	1.57	7.38	5.46	4.35	2.73	1.60
100-year	1.79	8.42	6.22	4.96	3.12	1.82
500-year	2.31	10.86	8.03	6.40	4.02	2.35

CITY OF STEAMBOAT SPRINGS ENGINEERING STANDARDS

$$t_c = t_i + t_t \quad (1)$$

Where:

- t_c = time of concentration (min)
- t_i = initial or overland flow time (min)
- t_t = travel time in the ditch, channel, gutter, storm drain, etc. (min)

The initial or overland flow time, t_i , may be calculated using the following equation:

$$t_i = 0.395 (1.1 - C_5) L_o^{1/2} / S^{1/3} \quad (2)$$

Where:

- t_i = initial or overland flow time (min)
- C_5 = runoff coefficient for 5-year return period
- L_o = length of overland flow, (ft, 300 max)
- S = average slope along the initial flow path (percent)

Equation 2 was developed for use with the Rational Method. The 5-year runoff coefficient, C_5 , is presented in Table 5.6.1, [along with C values for other return periods](#).

Table 5.6.1. Design Runoff Coefficients

Percent Impervious	Runoff Coefficients, C_x						
	1.25-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
0%	0.003	0.04	0.15	0.25	0.37	0.44	0.50
5%	0.03	0.08	0.18	0.28	0.39	0.46	0.52
10%	0.06	0.11	0.21	0.30	0.41	0.47	0.53
15%	0.10	0.14	0.24	0.32	0.43	0.49	0.54
20%	0.13	0.17	0.26	0.34	0.44	0.50	0.55
25%	0.16	0.20	0.28	0.36	0.46	0.51	0.56
30%	0.18	0.22	0.30	0.38	0.47	0.52	0.57
35%	0.22	0.25	0.33	0.40	0.48	0.53	0.57
40%	0.25	0.28	0.35	0.42	0.50	0.54	0.58
45%	0.28	0.31	0.37	0.44	0.51	0.55	0.59
50%	0.31	0.34	0.40	0.46	0.53	0.57	0.60
55%	0.34	0.37	0.43	0.48	0.55	0.58	0.62
60%	0.36	0.41	0.46	0.51	0.57	0.60	0.63
65%	0.42	0.45	0.49	0.54	0.59	0.62	0.65
70%	0.47	0.49	0.53	0.57	0.62	0.65	0.68
75%	0.52	0.54	0.58	0.62	0.66	0.68	0.71
80%	0.58	0.60	0.63	0.66	0.70	0.72	0.74
85%	0.64	0.66	0.68	0.71	0.75	0.77	0.79
90%	0.71	0.73	0.75	0.77	0.80	0.82	0.83
95%	0.79	0.80	0.82	0.84	0.87	0.88	0.89
100%	0.88	0.89	0.90	0.92	0.94	0.95	0.96

The overland flow length, L_o , is generally defined as the length over which the flow characteristics appear as sheet flow or very shallow flow in broad, grassed swales. Changes in land slope, surface characteristics, and small drainage ditches or gullies will tend to force the overland flow into a

CITY OF STEAMBOAT SPRINGS ENGINEERING STANDARDS

combined flow condition, which results in higher flow velocities and shorter travel times. The initial flow time in both urban and non-urban areas shall be limited to the time to travel 300 feet.

For watersheds longer than 300 feet, the travel time, t_t , must be added to the overland flow time. Travel time can be calculated using Manning's equation and the hydraulic properties of the storm drain, gutter, swale, ditch, or channel or can be approximated using Equation 3 for average velocity and Table 5.6.2 for the conveyance factor:

$$V = K S_w^{0.5} \quad (3)$$

Where:

V = velocity (fps)

S_w = watercourse slope (ft/ft)

K = conveyance factor

The minimum conveyance factor, K , that shall be used for a developed site shall be 7, corresponding to short pasture and lawns.

Table 5.6.2. Travel Time Conveyance Factors

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

Reference: UDFCD (2016)

The time of concentration, t_c is the sum of the initial flow time, t_i and the travel time, t_t . The minimum recommended t_c for non-urban watersheds is 10 minutes.

Urbanized Watersheds

Overland flow in urbanized watersheds can occur from the back of the lot to the street, in parking lots, in landscape areas, or within park areas and can be calculated using the procedure described for non-urbanized watersheds. Travel time, t_t , to the first design point or inlet is often determined based on the conveyance coefficient for paved areas and shallow swales but can be estimated using Manning's equation.

The time of concentration for the first design point in an urbanized watershed shall not exceed the time of concentration calculated using Equation 4, which was developed using rainfall/runoff data collected in urbanized regions (USDCM, 2016).

$$t_c = (26-17i) + L_t / (60 (14i + 9) \sqrt{S_t}) \quad (4)$$

Where:

t_c = minimum time of concentration for the first design point (min)

L_t = length of channelized flow path (ft)

i = imperviousness as a decimal

S_t = slope of the channelized flow path (ft)

CITY OF STEAMBOAT SPRINGS ENGINEERING STANDARDS

Table 5.6.3. Recommended Imperviousness Values

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

Reference: UDFCD (2016)

*Downtown and Base Area Commercial defined as CO, G1, and G2 zoned parcels

5.6.2.3 HEC Models

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

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

City of Steamboat Springs Engineering Standards

5.11.1 INTRODUCTION

The main purpose of a detention basin is to store runoff and reduce peak discharge by allowing flow to be discharged at a slower, more controlled rate. This controlled discharge rate is the lesser of available downstream capacity and historic site runoff rates. Detention helps to control flood peaks in urbanized areas. Use of detention includes individual site options such as a channel or small landscaped basin and regional options serving multiple sites such as construction of a large pond or reservoir.

5.11.2 DETENTION VERSUS RETENTION

Stormwater storage reservoirs are either detention or retention basins. A detention basin detains water temporarily, releasing it slowly through a pipe or channel. Because of its ability to release flow during inflow, the required storage volume is reduced. Detention basins also have a positive means of outflow, eliminating problems that come with a residual pool. Alternately, a retention basin retains water without any release during inflow. Once the storm event is over, basin drainage may occur due to evaporation and percolation into the soil. The use of retention basins is not permitted within the City of Steamboat Springs.

5.11.3 HISTORIC AND PRE-DEVELOPMENT FLOWS

Historic runoff from a site is generally the amount of runoff a site produced during a given storm prior to anything being constructed on the site. When there is no construction on a site (i.e., no man-made imperviousness), and the Rational Method is being used to determine peak runoff, historic flow rates shall be calculated using the flow rates listed in [Table 5.11.1](#).

For the purposes of these criteria, when a site already has improvements constructed upon it, defined as a "Pre-development" condition, that construction may be considered part of the site's historic condition and historic flows for these sites shall be computed based on a composite C value determined in accordance with Section 5.6, Storm Runoff. Prior to any redevelopment of a parcel, any previous detention identified as part of the prior development proposal shall be factored into the runoff calculations for the site in question and accounted for with the revised runoff characteristics in order to preserve the pre-development runoff rates as identified in any previous drainage studies. If a HEC model of the watershed exists, it can be used to generate historic runoff rates by changing the imperviousness of the watershed to historic conditions (as defined above) as specified in Section 5.6, Storm Runoff.

Total allowable peak runoff rates from a developed, redeveloped, or significantly remodeled site shall be the pre-development flow rates for the minor and major design storm events.

Table 5.11.1 Historic Flow Rates (cfs/acre)

CONTROL FREQUENCY	SOIL GROUP		
	A	B	C and D
Minor Storm	0.04	0.08	0.10
Major Storm	0.27	0.46	0.54

The predominant soil group for the watershed area tributary to the detention pond shall be used for determining the historic flow rates. Information on the soils in Steamboat Springs can be found in published SCS Soil Surveys.

CITY OF STEAMBOAT SPRINGS ENGINEERING STANDARDS

Calculating the WQCV is required to design a facility that meets the WQCV standard. Two variables are required to calculate the WQCV. The first is the total imperviousness of the area being considered. Sometimes this area is the area draining to the treatment facility. Other times, the WQCV for the entire site must first be calculated as part of the calculations required to meet another design standard. Recommended imperviousness values are in Section 5.6. The total imperviousness of a site can be determined by taking an area-weighted average of the different imperviousness values for the site. Total imperviousness can also be adjusted to an effective imperviousness if certain practices are implemented as part of the site design. Effective imperviousness applicability and calculations are discussed below the calculation for the WQCV.

The second variable is the design drain time of the treatment facility. Recommendations for design drain time for different types of WQCV treatment facilities can be found in Volume 3 of the USDCM. The most commonly used WQCV facility is an extended detention basin, for which the recommended drain time is 40 hours. WQCV drain time coefficients are in Table 5.12.2 below. The general equation to calculate the WQCV in Steamboat Springs is expressed as:

$$WQCV = 0.79Aa(0.91I^3 - 1.19I^2 + 0.78I)/12 \quad (1)$$

Where:

WQCV = water quality capture volume (acre-feet)

a = WQCV drain time coefficient

i = imperviousness as a decimal percentage

A = area draining to the treatment facility in acres

Table 5.12.2. Drain Time Coefficients for WQCV Calculations

Drain Time	Coefficient, a
12 hours	0.8
24 hours	0.9
40 hours	1.0

The WQCV equation was initially developed based on rainfall data from the Denver metro area. However, the precipitation depth of the average runoff producing storm in Steamboat Springs is 0.34 while in Denver it is 0.43. The WQCV equation above includes a coefficient of 0.79 to adjust the equation for use in Steamboat Springs. A map showing the variance in the average runoff producing storm across Colorado is shown as Figure 5.12.2.

Effective Imperviousness

The imperviousness value used in the WQCV calculation for sites that implement low impact development (LID) principles such as green infrastructure and MDCIA may be reduced to reflect the site's effective imperviousness. The effective imperviousness is dependent on the level of MDCIA implemented for high-level planning applications. Level 1 includes designing impervious surfaces to drain over a grass buffer or other pervious surface prior to reaching any stormwater conveyance system. Level 2 is an enhancement to Level 1 and includes eliminating curb and gutter or using slotted curbs; low-velocity pervious grass- or rock-lined swales instead of storm sewers, and pervious street shoulders. Guidance on calculating effective imperviousness for Level 1 and Level 2 MDCIA can be found in Volume 3 of the USDCM.

ATTACHMENT 11

FINAL DRAINAGE STUDY CHECKLIST (STANDARD FORM NO. 3)

CITY OF STEAMBOAT SPRINGS ENGINEERING STANDARDS

Standard Form No. 3 Final Drainage Study Checklist

Instructions:

1. The applicant shall identify with a "check mark" if information is provided with letter. If applicant believes information is not required, indicate with "N/A" and attach separate sheet with explanation.
2. The reviewer will determine if information labeled "N/A" is required and whether additional information must be submitted.

I. General

- ☒ A. Report typed and legible in 8½" x 11" format.
- ☒ B. Report bound (comb, spiral, or staple – no notebook).
- ☒ C. Drawings that are 8½ x 11 or 11 x 17 bound within report, larger drawings (up to 24 x 36) included in a pocket attached to the report. Drawings shall be at an appropriate size and scale to be legible and include project area.

II. Cover

- ☒ A. Report Type – Final Drainage Study.
- ☒ B. Project Name, Subdivision, Original Date, Revision Date.
- ☒ C. Preparer's name, firm, address, phone number.
- ☒ D. "DRAFT" for 1st submittal and revisions; "FINAL" once approved.

III. Title Sheet

- ☒ A. Table of Contents.
- ☒ B. Certification, PE Stamp, signature, and date from licensed Colorado PE.
- ☒ C. Note: City of Steamboat Springs plan review and approval is only for general conformance with City design criteria and the City code. The City is not responsible for the accuracy and adequacy of the design, dimensions, and elevations that shall be confirmed and correlated at the job site. The City of Steamboat Springs assumes no responsibility for the completeness or accuracy of this document.

IV. Introduction

- ☒ A. Description of site location, size in acres, existing and proposed land use, and any pertinent background info.
- ☒ B. Reference planning application type and plan set date and preparer.
- ☒ C. Identify drainage reports for adjacent development.

V. Drainage Criteria and Methodology Used

- ☒ A. Identify design rainfall and storm frequency.
- ☒ B. Identify the runoff calculation method used.
- ☒ C. Identify culvert and storm sewer design methodology.
- ☒ D. Identify detention discharge and storage methodology.
- ☐ N/A E. Discuss HEC-HMS methodologies and parameters, if HEC-HMS is used.

CITY OF STEAMBOAT SPRINGS ENGINEERING STANDARDS

VI. Existing Conditions (Pre-Development/Historic)

- ☒ A. Indicate ground cover, imperviousness, topography, and size of site (acres).
- ☒ B. Describe existing stormwater system (sizes, materials, etc.).
- ☒ C. Describe other notable features (canals, major utilities, etc.).
- ☒ D. Note site outfall locations and ultimate outfall location (typically Yampa River).
- ☒ E. Note capacity of existing system and identify any constraints.
- ☒ F. Identify NRCS soil type.
- ☒ G. Discuss any existing easements.
- ☒ H. Identify the FEMA Map reviewed, if site is in floodplain/way, and zone designation.

VII. Proposed Conditions

- ☒ A. Indicate ground cover, imperviousness, topography, and disturbed area (acres).
- ☒ B. Describe proposed stormwater system (sizes, materials, etc.).
- ☒ C. Describe proposed outlets and indicate historic and proposed flow for each.
- ☒ D. Include calculations for all culverts, ditches, ponds, etc. in appendix.
- ☒ E. Include a summary table for the 5- and 100-year events showing historic flow and proposed flow for total site and each basin.
- ☒ F. Discuss proposed easements.
- ☒ G. Describe off-site flows to be passed thru site.
- ☒ H. Summarize any impacts to downstream properties or indicate none. Reference CLOMR/LOMR and impacts.
- I. Detention Ponds.
 - ☒ 1. Indicate pond volume and area (size and depth) requirement.
 - ☒ 2. Indicate release rates.
 - ☒ 3. Discuss outfall design, location, and overflow location.
 - ☒ 4. Discuss maintenance requirements.
- J. Curb and Gutter
 - ☒ 1. Indicate gutter capacity.
 - ☒ 2. Indicate curb capacity.
 - ☒ 3. Indicate design velocity
 - ☒ 4. Indicate design depth of flow in street.
- K. Culverts
 - ☒ 1. Indicate whether each culvert is under inlet or outlet control.
 - ☒ 2. Show that headwater is less than the maximum allowable.
 - ☒ 3. Indicate design velocity.
 - ☒ 4. Indicate required and provided flow rates.
 - ☒ 5. Discuss whether outlet protection is required and what will be used.
- L. Inlets
 - ☒ 1. Indicate inlet capacity.
 - ☒ 2. Indicate the type of inlet(s) used.
- M. Channels
 - ☒ 1. Indicate design velocity (and type of dissipation if required).
 - ☒ 2. Indicate required and provided flow capacity.
 - ☒ 3. Show critical cross-section(s) including water surface.
- N. Site Discharge
 - ☒ 1. Discuss use and design of detention to ensure discharge is less than or equal to historic flow.
 - ☒ 2. Provide documentation that downstream facilities are adequate and no adverse impacts to downstream property owners (i.e. no rise certification)

CITY OF STEAMBOAT SPRINGS ENGINEERING STANDARDS

VIII. Post Construction Stormwater Management

- ☒ A. Discuss in general terms which permanent BMP practices will be used to control pollutant and sediment discharge after construction is complete. Exhibit A, Storm Water Quality Plan shall be attached that will give details (see separate checklist)

IX. Conclusions

- ☒ A. Provide general summary.
- ☒ B. Note if site complies with criteria and any variances to criteria.
- ☒ C. Indicate if peak proposed flow is less than, equal to, or greater than peak historic flow for each outfall, design point, and for the total site.
- ☒ D. List proposed new stormwater system requirements.

X. References

- ☒ A. Provide a reference list of all criteria, master plans, drainage reports and technical information used.

XI. Tables

- ☒ A. Include a copy of all tables prepared for the study.

XII. Figures

- ☒ A. Vicinity Map.
- ☒ B. Site Plan (include the horizontal and vertical datum used and all benchmarks).
- C. Existing conditions.
 - ☒ 1. Delineate existing basin boundaries.
 - ☒ 2. Delineate offsite basins impacting the site.
 - ☒ 3. Show existing and proposed topography at an interval of at least 2-ft.
 - ☒ 4. Show existing runoff flow arrows.
 - ☒ 5. Show existing stormwater features (structures, sizes, materials, etc.).
 - N/A 6. Show floodplain limits and information.
 - ☒ 7. For each basin show bubble with basin number, acreage and % impervious.
 - ☒ 8. For each outlet show bubble with acreage and historic flow and proposed flow or provide information in summary table on figure.
- D. Proposed Conditions
 - ☒ 1. Delineate proposed basin boundaries.
 - ☒ 2. Show proposed runoff flow arrows.
 - ☒ 3. Show existing and proposed topography at an interval of at least 2-ft.
 - ☒ 4. For each basin show bubble with basin number, acreage and percent impervious or provide a summary table or figure.
 - ☒ 5. For each outlet show bubble with acreage, historic flow, and proposed flow or provide a summary table or figure.
 - N/A 6. Show floodplain limits and information.
 - ☒ 7. Show proposed building footprints and FFE for commercial and multi-family
 - ☒ 8. Show property lines and easements (existing and proposed).
 - ☒ 9. Label public and private facilities. A general note can be placed on the plans in lieu of labeling all facilities, if applicable.

CITY OF STEAMBOAT SPRINGS ENGINEERING STANDARDS

XIII. Appendices

- ☒ A. Runoff Calculations.
- ☒ B. Culvert Calculations.
- ☒ C. Pond Calculations.
- ☒ D. Other Calculations.

Acknowledgements

Standard Form No. 3 was prepared by: Steve Batchelder

12/19/2022

Date

Include Attachment A – Scope Approval Form (see Standard Form No. 5)

Include Attachment B – Storm Water Quality Plan (see Standard Form No. 4)

ATTACHMENT 12

EXHIBIT A – SCOPE APPROVAL FORM (STANDARD FORM NO. 5)

CITY OF STEAMBOAT SPRINGS ENGINEERING STANDARDS

Standard Form No. 5 Drainage and Stormwater Treatment Scope Approval Form

Prior to starting a development plan and before the first drainage submittal, a Drainage and Stormwater Treatment Scope Approval Form must be submitted for review and signed by the City Engineer. A signed form shall also be included in every drainage submittal as Attachment A. This Scope Approval Form is for City requirements only. Values may be approximate. The City encourages supporting calculations and figures to be attached.

Project Information	
Project name:	Astrid Site Development
Project location:	2410 Ski Trail Lane
Developer name/contact info:	Steamboat Esquiar LP, W. Brodie Sherman brodie@fusefv.com
Drainage engineer name/contact info:	Steve Batchelder steve@baselinecorp.com
Application Type:	Development Plan
Proposed Land Use:	A mix of resort multifamily structures.
Project Site Parameters	
Total parcel area (acres):	4.33
Disturbed area (acres):	3.46
Existing impervious area (acres, if applicable):	0.13 Acre (3% IMP)
Proposed new impervious area (acres):	1.98 Acre
Proposed total impervious area (acres):	2.11 Acre (61% IMP)
Proposed number of project outfalls:	1
Number of additional parking spaces:	95+/- (Garage spaces)
Description and site percentage of existing cover/land use(s):	Most of the site is undeveloped native grasses.
Description and site percentage of proposed cover/land use(s):	Multi-family condos and associated drives, walks, landscape, and pool over approx 85% of the site.
Expected maximum proposed conveyance gradient (%):	10%
Description of size (acres) and cover/land use(s) of offsite areas draining to the site	71 acres of residential/condos and ski resort at 9.5% Imp.

CITY OF STEAMBOAT SPRINGS ENGINEERING STANDARDS

Type of Study Required:

- ☐ Drainage Letter
 ☐ Conceptual Drainage Study
☒ Final Drainage Study
 ☐ Stormwater Quality Plan

Hydrologic Evaluation:

- ☒ Rational Method
 ☐ CUHP/SWMM
 ☐ HEC-HMS
 ☐ Other _____

Project Drainage	
Number of subbasins to be evaluated:	3 on-site 2 off-site
Presence of pass through flow (circle):	YES ☒ NO ☐
Description of proposed stormwater conveyance on site:	Storm Sewer and Detention Ponds. Routing off-site flow through ditches and storm sewer to historical discharge point
Project includes roadway conveyance as part of design evaluation (circle):	YES ☒ NO ☐
Description of conveyance of site runoff downstream of site, identify any infrastructure noted in Stormwater Master Plan noted as lacking capacity for minor or major storm event:	The site outlets near Ski Trail Lane in storm sewer to Burgess Creek. Per the Master Plan there are various problem areas in Burgess Creek downstream from the site some of which have already been addressed.
Detention expected onsite (circle):	YES ☒ NO ☐
Presence of Floodway or Floodplain on site (circle):	YES ☐ NO ☒
Anticipated modification of Floodway or Floodplain proposed (circle):	YES ☐ NO ☒
Describe culvert or storm sewer conveyance evaluative method:	Hydraflow Storm Sewer Extension for Autodesk Civil 3D

Permanent Stormwater Treatment Facility Design Standard (check all that apply with only one standard per tributary basin):

- ☒ WQCV Standard
 ☐ TSS Standard
 ☐ Infiltration Standard
☐ Constrained Redevelopment WQCV Standard
☐ Constrained Redevelopment TSS Standard
☐ Constrained Redevelopment Infiltration Standard
☐ Does not Require Permanent Stormwater Treatment (attach Exclusion Tracking Form)

CITY OF STEAMBOAT SPRINGS ENGINEERING STANDARDS

Project Permanent Stormwater Treatment	
Justification of choice of proposed design standard, including how the site meets the constrained redevelopment standard, infiltration test results, etc.:	N/A
Concept-level permanent stormwater treatment facility design details (type, location of facilities, proprietary structure selection, treatment train concept, etc.):	Extended Detention Basin, WQCV
Proposed LID measures to reduce runoff volume:	N/A
Will treatment evaluation include off-site, pass through flow (circle):	YES ☒ NO ☐

Approvals

Baseline Engineering, Steve Batchelder 12/8/22 303-324-2624

Prepared By: _____ Date _____ Phone number _____
(Insert drainage engineer name & firm)

Approved By:

See Attached Approval Letter

Printed Name: _____ Date _____
City Engineer



December 13, 2022

Baseline Engineering
1169 Hilltop Ln Suite 204
Steamboat Springs, CO 80487

RE: Approval Letter for Preconsultation - Drainage Scope Approval Form or Waiver Request for Astrid Site Development (PL20220630)

Dear Baseline Engineering,

The following are approved:

1. Drainage & Stormwater Treatment Scope Approval Form

If you have any questions or concerns please contact me at (970) 871-8271 or via email at esoltis@steamboatsprings.net.

Sincerely,

A handwritten signature in black ink, appearing to read "Emrick Soltis", with a long, sweeping horizontal line extending to the right.

Emrick Soltis, P.E.
Community Development Engineer

ATTACHMENT 13

EXHIBIT B – STROM WATER QUALITY PLAN

PROJECT:

ASTRID SITE DEVELOPMENT PLAN

2410 SKI TRAIL LANE

CITY OF STEAMBOAT SPRINGS, ROUTT COUNTY, STATE OF COLORADO

STORMWATER QUALITY PLAN

PREPARED BY:

BASELINE ENGINEERING CORPORATION

STEVE BATCHELDER, PE

1169 HILLTOP PARKWAY, SUITE 204

STEAMBOAT SPRINGS, COLORADO 80487

970-879-1825

DRAFT 1ST SUBMITTAL: DECEMBER 22, 2022

DRAFT 2ND SUBMITTAL: May 19, 2023

JOB # CO20235



Engineering · Planning · Surveying

INDEX

ITEM	PAGE
INTRODUCTION	1
DRAINAGE CRITERIA & METHODOLOGY.....	3
PROPOSED CONDITIONS	3
BMP SUMMARY & MAINTENANCE REQUIREMENTS.....	5

ATTACHMENTS

- Attachment 1: Stormwater Quality Plan Checklist (Standard Form No. 4)
- Attachment 2: Project Sheet and Design Checklist
- Attachment 3: Ownership and Maintenance Plan

CERTIFICATION STATEMENT

I HEREBY AFFIRM THAT THIS STORMWATER QUALITY PLAN FOR ASTRID SITE DEVELOPMENT PROJECT WAS PREPARED BY ME (OR UNDER MY DIRECT SUPERVISION) FOR THE OWNERS THEREOF AND IS, TO THE BEST OF MY KNOWLEDGE, IN ACCORDANCE WITH THE PROVISIONS OF THE CITY OF STEAMBOAT SPRINGS STORM DRAINAGE CRITERIA AND APPROVED VARIANCES. I UNDERSTAND THAT THE CITY OF STEAMBOAT SPRINGS DOES NOT AND WILL NOT ASSUME LIABILITY FOR DRAINAGE FACILITIES DESIGNED BY OTHERS.

REGISTERED PROFESSIONAL ENGINEER

STATE OF COLORADO NO.

NOTE

CITY OF STEAMBOAT SPRINGS PLAN REVIEW AND APPROVAL IS ONLY FOR GENERAL CONFORMANCE WITH CITY DESIGN CRITERIA AND THE CITY CODE. THE CITY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS, AND ELEVATIONS THAT SHALL BE CONFIRMED AND CORRELATED AT THE JOB SITE. THE CITY OF STEAMBOAT SPRINGS ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS OR ACCURACY OF THIS DOCUMENT.

ASTRID SITE DEVELOPMENT PLAN

STORMWATER QUALITY PLAN

I INTRODUCTION

A. LOCATION

1. The project area is located at 2410 Ski Trail Lane adjacent to Steamboat Resort. The north limits of the site are adjacent to the ski resort and The Edgemont development. The eastern limits are adjacent to the Bear Claw II and Bear Claw Estates developments which has Lot 11B currently under construction. To the south are the Norwegian Log and Ski Inn Condominiums. Finally on the west are the Ski Trail and Elkhorn at Steamboat Condominiums. The project area is in the northeast quarter of the northwest quarter of Section 27, Township 6 North, Range 84 West of the 6th P.M., City of Steamboat Springs, Routt County, Colorado.

B. DESCRIPTION OF PROPERTY

1. The site is approximately 4.33 acres including the existing right-of-way at the location of the access off of Ski Trail Lane. Total Drainage Area including off-site area is approximately 80 acres. Whereas the proposed project disturbance is roughly 3.5 acres.
2. The site is currently undeveloped and ground cover consists mostly of native grass. There is a lot of relief across the site. The upper end of the site near the Edgemont is at an elevation of 7068 and the lower end of the site near Ski Trail Lane is at 6956 for a difference of 112 feet across the site. Slopes vary from approximately 1% to 50%. A gravel ski/resort access currently cuts through the southwest of the site and there is also a tower for the Steamboat Gondola on the southeast portion of the property.
3. The subject property is zoned as Resort Residential Two, High Density. The directly adjacent properties (except for the resort) are zoned either Resort Residential One or Resort Residential Two.
4. According to the Soil Survey, the project area consists entirely of Routt loam, which is poorly drained and Hydrologic Soil Type C. The offsite flows consist mainly of Hydrologic Soil Type C. See soils map in the appendix for more info.
5. Per FEMA FIRM 08107C0883D with an effective date of 02/04/2005, the project is

entirely outside of the floodway/floodplain of Burgess Creek.

6. There are no irrigation facilities on or adjacent to the property.
7. There are approximately 4,370 square feet of delineated wetlands on the site near the access to the site off of Ski Trail Lane. Of which there will be roughly 2,250 square feet of permanent disturbance of wetlands.

C. PURPOSE OF THIS STORMWATER QUALITY PLAN

1. This plan is meant to identify site-generated stormwater flow and potential site contaminants, including sediment. The Stormwater Quality Plan presents the design details for all permanent stormwater treatment facilities required to minimize the potential for pollutants to leave the site in accordance with the City's MS4 permit.
2. The site is over an acre so a permanent stormwater quality facility is required.
3. There are six multi-family/condo buildings proposed on the property as well as associated drives, sidewalk, sanitary sewer, water, storm sewer, dry utilities, landscaping, and a pool and associated building.
4. This report was prepared in conjunction with the Site Development Plans dated 05/19/2023 by Eric Smith Associates and Baseline Engineering for Steamboat Esquiar LP.

D. REFERENCED DRAINAGE REPORTS

1. The "City of Steamboat Springs Citywide Stormwater Master Plan" was referenced in the preparation of this report.
2. The "Addendum to Final Drainage Study for Edgemont and Related Access Improvements for Bear Claw II," by Landmark Consultants, Inc. Dated June 18, 2009
3. The "Draft Drainage Study for Edgemont" by Landmark Consultants, Inc. Dated April 9, 2007, Revised July 7, 2007
4. The "Final Drainage Study for Bear Claw II Sub-division" by Landmark Consultants, Inc. Dated June 19, 2018, Revised February 18, 2019

II DRAINAGE CRITERIA AND METHODOLOGY USED

A. DESIGN RAINFALL AND STORM FREQUENCY

1. In accordance with City Drainage Criteria, the major storm is the 100-year recurrence interval storm and the minor storm is the 5-year recurrence interval storm.
2. The values of 0.82 inches and 1.79 inches for the 5-year storm and 100-year storm respectively were used for the drainage per the City's Drainage Criteria.

B. RUNOFF CALCULATION METHOD

1. The Proposed and Existing basins, including off-site basins are around 80 acres, below the 160 acre maximum for the rational method; therefore the rational method has been used to calculate peak flows for both proposed and existing conditions per section 5.6.2.2 of the City's Engineering Standards.

C. CULVERT, INLET, AND STORM SEWER ANALYSIS

1. Street and Inlet capacities were studied using MHFD-Inlet v5.01, April 2021, by the Mile High Flood District.
2. Hydraflow Storm Sewers Extension for Autodesk Civil 3D, was utilized to create hydraulic models of the storm sewer system.

D. DETENTION DISCHARGE AND STORAGE METHODOLOGY

1. Stormwater detention has been designed using the FAA method as outlined in section 5.11.7.2 in the City's Engineering Standards. The allowable release rates have been determined by using Table 5.11.1 in the City's Engineering Standards which are based on soil groups. The Water Quality Capture Volume was determined from the equation in section 5.12.7.1 of the City's Engineering Standards using a 40-hour drain time.

III PROPOSED CONDITIONS

A. DRAINAGE PATTERNS & BASINS

1. The proposed improvements include a large 7 story building with 2 garage floors

along the property line adjacent to the ski resort. There are 5 other condo buildings that are 4 stories each and then a pool and associated 2 story building. In addition, there are proposed drives, sidewalk, sanitary sewer, water, storm sewer, dry utilities, and landscaping. The proposed site is approximately 60% impervious and the disturbed area is roughly 3.50 acres of the 4.33 acre site.

2. There are two Major Basins that will be treated and one that due to grading constraint will be treated, but not able to detain the 100-year storm event. The drainage basins to be treated are Basin A which is 2.58 acres in size and Basin B which is 0.59 acres. The portion of the site that will remain untreated is Basin C which is 0.69 acres or 15.5% of the entire site which is under the 20% requirement of the site that can be untreated.

B. POTENTIAL SITE CONTAMINANTS

1. The potential site contaminants during construction will include sediment, asphalt pavement, fuel spills during vehicle refueling, fluids from leaking vehicles, off-site vehicle tracking, and concrete.
2. The potential site contaminants after construction is complete will include sediment, fluids from leaking vehicles, and landscaping products.

C. DETENTION/WATER QUALITY PONDS

1. Pond A is the main detention pond on site and has a capture area of 2.59 acres as well as off-site flow from Basin H3 of 1.9 cfs for the 5-year storm and 5.3 cfs for the 100-year. Pond B has a capture area of 0.59 acres and no bypass flow. Basin C is unable to be detained due to lack of available area and will be free released. According to the city's standards only 5% of the site may be free released and the release rates from the pond must be reduced accordingly. Basin C is 0.67 acres and 15% of the site. Since there is not adequate real estate for an additional pond and grades make it impossible to use the other ponds, we are proposing to over-size Pond A since it has the off-site flow from Basin H3 and then release the pond at a reduced rate to make up for the free release of Basin C. The release rate from Pond A is also being reduced by the bypass free release flow of the inlets at Basins A2 and A3 of 0.3 cfs for the 5-year storm and 1.9 cfs for the 100-year storm. The ponds were sized using the FAA method as outlined in the city's standards.
2. Pond A
Taking into account over-sizing the pond for the off-site flow from Basin H3 as discussed above, the required volume for the pond is 1730 cubic feet for the 5-

year storm and 5200 cubic feet for the 100-year storm. The water quality capture volume (WQCV) was calculated to be 1810 cubic feet. The pond will have vertical walls all around due to constrained area with a bottom slope of 2% and a depth of 3.1 feet for the 100-year storm. The proposed release rate from the pond was calculated to be 0.9 cfs for the 5-year storm and 1.9 cfs for the 100-year storm taking into account the free release and offsite flows as discussed above. See calculations in the appendix for details. The WQCV will be released through an orifice plate over 40 hours. The outlet structure will be built into the retaining wall and tie into the storm sewer in the access road. The emergency spillway was sized for the 100-year flow of Basins A and H3 of 19.2 cfs. The spillway will be a rectangular weir in the retaining wall 6 feet wide and 1 foot high. The spillway will release directly into the access road.

3. Pond B

The required volumes for Pond B are 325 cubic feet for the 5-year storm and 950 cubic feet for the 100-year storm. The WQCV was calculated to be 385 cubic feet. The pond will have a vertical wall on the south side and a minimum bottom slope of 2% and a depth of 2.0 feet for the 100-year storm. The allowable release rate based on the soil type of C is 0.06 cfs for the 5-year storm and 0.32 cfs for the 100-year storm. The WQCV will be released through an orifice plate over 40 hours. The emergency spillway was sized for the 100-year flow of Basins B of 2.8 cfs. The spillway will be a rectangular weir in the retaining wall 1 foot wide and 1 foot high. The spillway will release directly into the access road.

4. Pond C

Pond C is a Water Quality Pond only and will not provide detention as stated above since Pond A is oversized and the flow leaving the site will remain unchanged. The required WQCV is 424 cubic feet. The slopes of the pond are 3:1 and the bottom has a minimum slope of 2%. The depth of the pond is 2 feet and the WQCV will be released through an orifice plate over 40 hours.

5. The ponds will be in drainage easements and will be privately maintained by the HOA that will be formed for this development.

D. CONSTRUCTION PHASING

1. There will be 4 phases of construction. All three detention/water quality ponds are in the first phase and will need to be in place to catch runoff before it leaves the site.

IV OPERATION AND MAINTENANCE PLAN REQUIREMENTS

A. POST CONSTRUCTION STORMWATER QUALITY FEATURES

1. The Detention/Water Quality ponds will need to be maintained on a regular basis to ensure that the sediment build up does not impact how the pond is meant to function.

B. CONSTRUCTION BMP'S

1. Construction BMP's will include a stabilized vehicle tracking control pad, silt fence or sediment control logs, inlet and outlet control, ditch check dams, and concrete washout area.
2. A Construction SWMP will be submitted under separate cover prior to construction.

C. MAINTENANCE SCHEDULE & RESPONSIBILITY

1. Maintenance during construction will be performed by the General Contractor or his designee. Inspections on construction BMPs should be performed every 14 days and immediately following storm events. An inspection report shall be prepared for each inspection. Maintenance shall be performed as identified in the inspection report.
2. Once construction is complete, the owner will be responsible for maintenance of the storm water conveyance and treatment features within the Property. Storm sewer system components shall be inspected, repaired, and cleaned on a routine basis to ensure the system functions as intended. See below for the minimum required inspection and maintenance schedule

EXTENDED DETENTION BASIN

Activity	Required Frequency
Inspection for debris at outlet, sediment in the forebay, and damage to structures or embankments; maintain or repair as necessary	Twice annually
Remove sediment from forebay, trickle channel(s), and micropool; aeration of vegetated areas	Annually
Mowing	As needed to maintain 6" height and control weeds
Irrigation and application of fertilizer,	As needed to maintain vegetative

herbicide, and pesticide	health

Notes: Maintenance frequency is highly dependent on construction activity within the tributary area, associated erosion control measures, and the design of the facility. More frequent removal of accumulated sediment may be required, but detention basins are generally low maintenance facilities.

ATTACHMENT 1

STORMWATER QUALITY PLAN CHECKLIST (STANDARD FORM NO. 4)

CITY OF STEAMBOAT SPRINGS ENGINEERING STANDARDS

Standard Form No. 4 Stormwater Quality Plan Checklist

This list is not an exhaustive list of every possible item that may be required or requested in a Stormwater Quality Plan but provides a general guideline for preparation of the Stormwater Quality Plan.

Instructions:

1. The applicant shall identify with a "check mark" if information is provided within the Stormwater Quality Plan. If applicant believes information is not required, indicate with "N/A" and attach separate sheet with explanation. If information is included with the associated drainage letter or study, indicated with a "D."
2. The reviewer will determine if information labeled "N/A" is required and whether additional information must be submitted.

I. General

- ☒ A. Report typed and legible in 8½" x 11" format.
- ☒ B. Report bound (comb, spiral, or staple – no notebook) and in digital PDF format.
- ☒ C. Drawings that are 11" x 17" bound within letter, larger drawings (up to 24" x 36") included in a pocket attached to the letter, and a digital PDF copy. Drawings shall be at an appropriate size and scale to be legible and include project area.

II. Cover

- ☒ A. Report Type – Stormwater Quality Plan.
- ☒ B. Project Name, Subdivision or Development, Original Date, Revision Date.
- ☒ C. Preparer's name, firm, address, and phone number.
- ☒ D. "DRAFT" for 1st submittal and revisions; "FINAL" once approved.

III. Title Sheet

- ☒ A. Table of Contents.
- ☒ B. Certification, PE Stamp, signature and date from licensed Colorado PE (for Final).
- ☒ C. Note: City of Steamboat Springs plan review and approval is only for general conformance with City design criteria and City code. The City is not responsible for the accuracy and adequacy of the design, dimensions, and elevations that shall be confirmed and correlated at the job site. The City of Steamboat Springs assumes no responsibility for the completeness or accuracy of this document.

IV. Introduction and Background

- ☒ A. Description of site location, study limits, size in acres, existing and proposed land use, soil data, permeability of the site, drainage patterns, and any pertinent background info.
- ☒ B. State purpose and goal of Stormwater Quality Plan and report along with any special requirements of the desired outcome.
- ☒ C. List any project stakeholders and/or requestors.
- ☒ D. Describe the background of the flooding source and any previous studies.

CITY OF STEAMBOAT SPRINGS ENGINEERING STANDARDS

V. Design Criteria and Methodology Used

- ☒ A. Identify design rainfall and storm frequency used to design permanent stormwater treatment facilities.
- ☒ B. Identify the runoff calculation method used to design permanent stormwater treatment facilities.
- ☒ C. Identify the standard the design will meet and the means and methodologies by which it will use to meet the standard.
- ☒ D. Provide all details supporting the use of the selected design standard.

VI. Proposed Conditions

- ☒ A. Identify total site area, total site imperviousness, area to be treated, and impervious area to be treated. Include justification for treating less than the total site area.
- ☒ B. Describe potential site contaminant sources including sediment.
- ☒ C. Identify source and quantity of on-site and off-site stormwater flows that need to be managed and how they will be managed.
- ☒ D. For each permanent treatment facility, identify the design standard, MDCIA level (if applicable), area treated (& percentage of total), imperviousness of area treated, C values of area treated, soil types, and all pertinent data for design.
- ☒ E. Volume based facilities: Provide total storage pond volume, WQCV, drain time, release rate, sediment storage, outlet & overflow structures, area and depth of pond, micropool, forebays, etc. (include all calculations in the appendix).
- ☐ N/A F. Flow based facilities: Provide design flow rate and all treatment calculations and how flows larger than the water quality design flow rate will be handled. If proprietary facilities are proposed, provide the justification and sizing requirements from manufacturer.
- ☒ G. If stormwater detention is provided, discuss how water quality is provided within the detention facility. No underground detention is allowed.

VII. Operation and Maintenance Plan Requirements

See template O&M plan and guidance document.

- ☒ A. Describe general project information, facility description, ROW and access information, vegetation management, hydraulic design parameters, environmental permitting, snow and ice control, and additional pertinent information in the notes.
- ☒ B. Indicate, describe, and detail the permanent stormwater treatment facilities.
- ☒ C. Include section details where necessary of the permanent treatment facilities.
- ☒ D. Provide an inspection and maintenance schedule and procedure of permanent treatment facilities and who is responsible for them.
- ☒ E. Identify design specifications for construction.

Acknowledgements

Standard Form No. 4 prepared by: Steve Batchelder 12/21/22
Date

Include appropriate Project Sheet(s) and Design Checklist(s) (See Section 5.12)
Include this form as part of the Stormwater Quality Plan.

ATTACHMENT 2

PROJECT SHEET AND DESIGN CHECKLIST

CITY OF STEAMBOAT SPRINGS ENGINEERING STANDARDS

PROJECT SHEET – BASE DESIGN STANDARDS (Site is not constrained)

Complete a Project Sheet for each project that includes Permanent Stormwater Treatment Facilities.

SITE INFORMATION

Project Name: Astrid Site Development Plan		
Project Location: 2410 Ski Trail Lane		
Submitted Date: 12/22/22	Submitted By: Baseline Engineering	
Acreage Disturbed: 4.33 acres		
Existing Impervious: 2%	New Net Impervious: 60%	
Review Date:	Reviewed By:	
Preparer	City	Requirements
✓		Design Details are included for all Treatment Facilities
		List or include a description of any source controls or other non-structural practices:

DESIGN STANDARDS

Multiple Design Standards may be used on a site, as necessary, to meet the requirements, but only one Design Standard may be used for each treatment facility's tributary area. Evaluation of suitability of permanent stormwater treatment facilities is based on meeting the specified Design Standard and ease of long-term maintenance. Facilities must be designed in accordance with the most current versions of the City's Engineering Standards and Volume 3 of the USDCM and meet the specific requirements for each Design Standard used.

1. Indicate below, which Design Standard(s) will be used for the project, and
2. Complete a separate, corresponding Design Standards checklist for each facility (e.g., WQCV)

<i>Design Standard</i>	<i>Quantity</i>	<i>Tributary Area</i>	<i>Location/Identifying information</i>
WQCV	2570 CF	3.86 AC	Ponds A, B, & C
Pollutant Removal			
Runoff Reduction			

CITY OF STEAMBOAT SPRINGS ENGINEERING STANDARDS

DESIGN CHECKLIST – Water Quality Capture Volume (WQCV) Standard

WQCV STANDARD Criteria

Treatment facilities must be designed to provide treatment and/or infiltration of the WQCV for 100% of the site. Under certain conditions, up to 20% of the site may be excluded, not to exceed 1 acre. This may apply if it is not practicable to capture runoff from portions of the site and where it is not practicable to construct a separate treatment facility for those same portions of the site.

Complete checklist if using the WQCV Standard to meet Design Standard requirements.

Project Name: Astrid Site Development Plan		
Preparer	City	Requirements
NO		Facilities provide treatment and/or infiltration of the WQCV for 100% of the site
		% of site treated: 92.5%
		Facility Type: Extended Det. Basin Facility Location: Ponds A, B, & C
		See Drainage Report section:

If less than 100% of the site is treated, complete the following:

Preparer	City	Requirements				
		% of site not treated by control measures (not to exceed 20% or 1 acre):				
		<table border="1"> <tr> <td>7.5</td> <td>%</td> <td>0.29 (Basins C4 and C5)</td> <td>Size (acres)</td> </tr> </table>	7.5	%	0.29 (Basins C4 and C5)	Size (acres)
7.5	%	0.29 (Basins C4 and C5)	Size (acres)			
		Provide explanation of why the excluded area is impractical to treat: The inlets for these basins are adjacent to the storm sewer main and instead of tying directly into the main a separate storm sewer would be required to reach pond C downstream.				
		Provide explanation of why another facility is not practicable for the untreated area: There is not sufficient room for another facility. Pond C has been added to treat most of the IPA prior to being discharged offsite.				

ATTACHMENT 3

OWNERSHIP AND MAINTENANCE PLAN

A map showing the location of the subject site. The site is a shaded area on the right side of the map. A thick black arrow points from the text "SUBJECT SITE" to the shaded area. To the left of the site, the text "MT WERNER CIR" is written vertically. Below the site, the text "APRES SKI WAY" is written horizontally. The map includes various lines representing roads and boundaries.

NOTES:

1. FOR ADDITIONAL DESIGN INFORMATION, REFER TO THE CONSTRUCTION PLANS FOR THIS PROJECT.
2. SEE DETAILED NOTES ON THE SECOND SHEET OF THIS PLAN FOR ALL MAINTENANCE REQUIREMENTS.

6.0'

TOP OF WALL ELEV. = 6988.3

SPILLWAY ELEV. = 6987.3

Technical drawing of a pond layout. The pond is an irregular shape with a thick black outline. Inside the pond, there is a curved line representing a spillway. Two outlet pipes are shown: one at the bottom left and one at the top right, both labeled "12" HDPE OUTLET PIPE". A spillway is shown at the bottom right, labeled "6' WIDE OVERFLOW SPILLWAY IN RETAINING WALL. SEE DETAIL THIS SHEET.". The drawing includes contour lines and elevations: 6985, 6990, 87, 88, 89, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880,

12" x 24" x 1/4" STEEL ORIFICE PLATE

3.4"

12" HDPE OUTLET

Diagram illustrating the cross-section of a water control structure, showing various elevations and components:

- SPILLWAY (100 YEAR WSEL)=6987.3**: Elevation of the spillway crest.
- TOP OF WALL=6988.3**: Elevation of the top of the structure wall.
- WQCV=6985.7**: Elevation of the Water Quality Control Valve.
- TRASHRACK**: A vertical structure for filtering debris.
- WATER QUALITY ORIFICE PLATE MIN 1/4" THICK (SEE DETAIL)**: A plate for water quality measurement.
- 3.0'**: Horizontal distance from the trashrack to the orifice plate.
- FLOW DIRECTION**: Indicated by an arrow pointing right.
- POND INVERT=6984.0**: Elevation of the pond invert.
- STRUCTURE INVERT=6982.5**: Elevation of the structure invert.
- 12" HDPE**: A 12-inch diameter High-Density Polyethylene pipe.

BASELINE
Engineering • Planning • Surveying

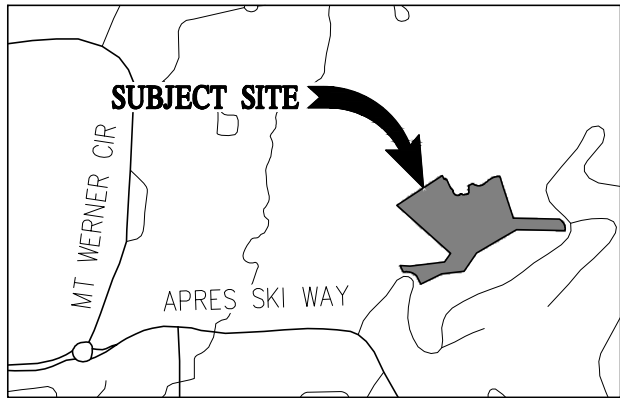
1188 HILLTOP PKWY, SUITE 204 • STEAMBOAT SPRINGS, CO 80447
P. 970.878.1825 • F. 303.940.3659 • www.baselinecorp.com

REVISION DESCRIPTION	PREPARED BY	DATE	DESIGNED BY SMB
			DRAWN BY SMB
			CHECKED BY MB

STEAMBOAT SPRINGS	STEAMBOAT ESQUAIR LP	ROUTE COUNTY
ASTRID SITE DEVELOPMENT PLAN 4210 SKI TRAIL LANE OWNERSHIP & MAINTENANCE PLAN -- POND A		

INITIAL SUBMITTAL	12/22/22
DRAWING SIZE	11" X 17"
SURVEY FIRM	SURVEY DATE
LANDMARK CONS.	06/03/22
JOB NO.	C020235
DRAWING NAME	
020235 PRO DRAIN.dwg	
SHEET 1	OF 4
OM1	

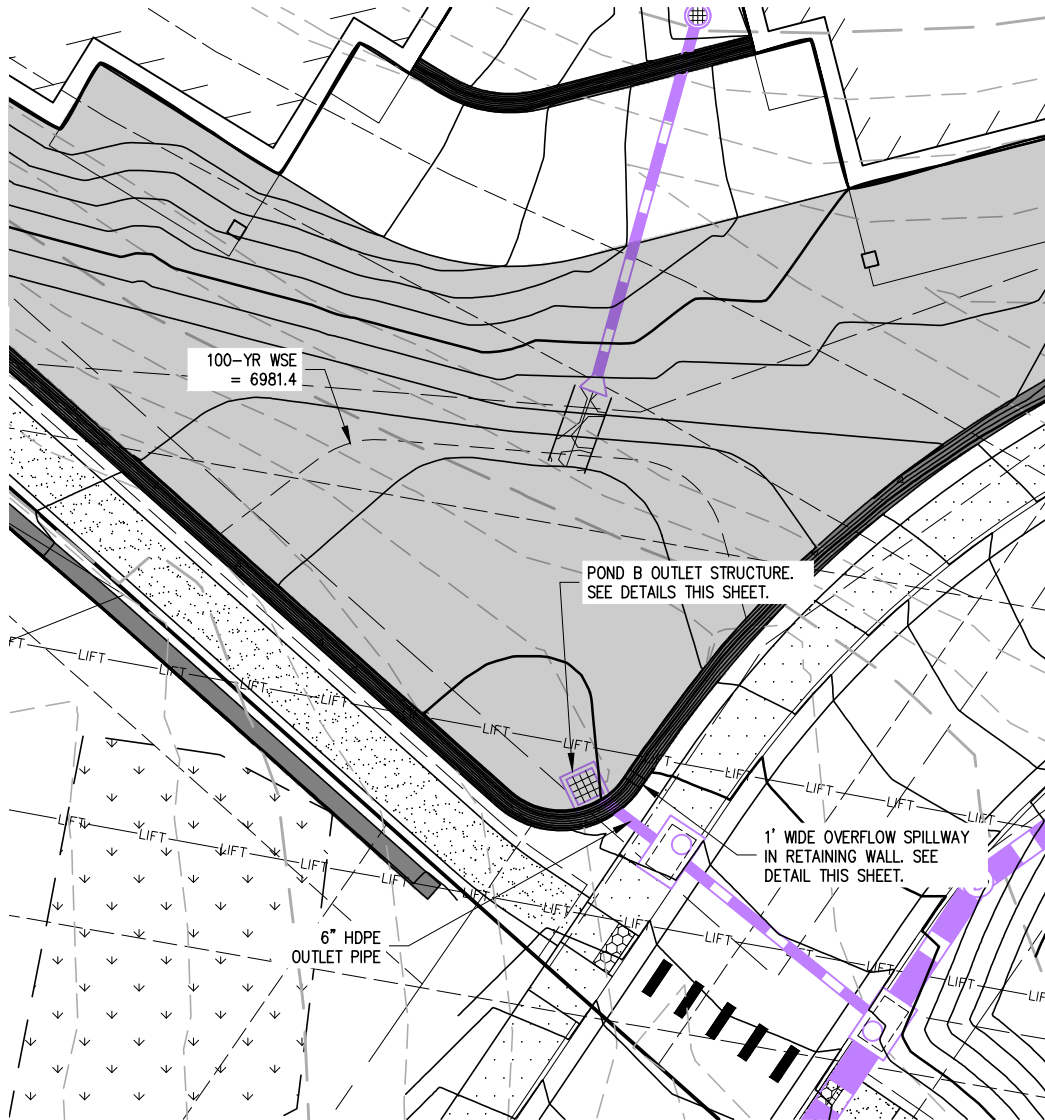
O:\C020235 Astrid-Edgemont Ph2\Drawings\Drainage Maps\20235 PRO DRAIN.dwg, 5/19/2023 2:22:10 PM, Steve Batchelder



VICINITY MAP
SCALE: 1" = 1000'

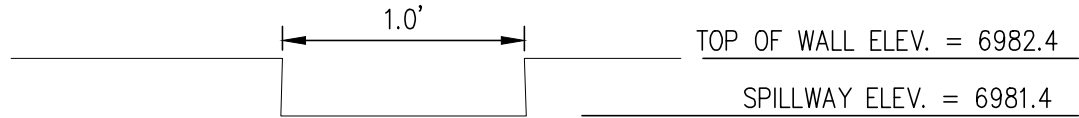
- NOTES:
1. FOR ADDITIONAL DESIGN INFORMATION, REFER TO THE CONSTRUCTION PLANS FOR THIS PROJECT.
 2. SEE DETAILED NOTES ON THE SECOND SHEET OF THIS PLAN FOR ALL MAINTENANCE REQUIREMENTS.

LEGEND
AREA TO BE MOWED
(SEE NOTE 4 NEXT SHEET)

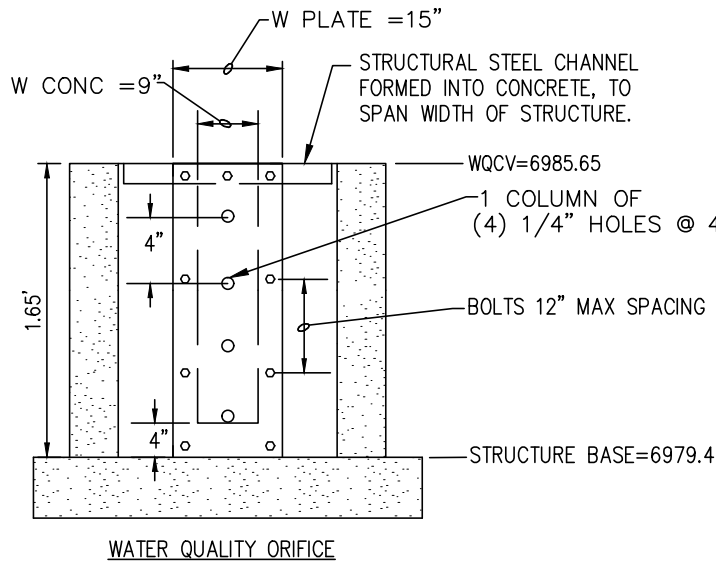


1 POND B EXTENDED DETENTION BASIN PLAN
GRAPHIC SCALE
(IN FEET)
1 INCH = 20 FT

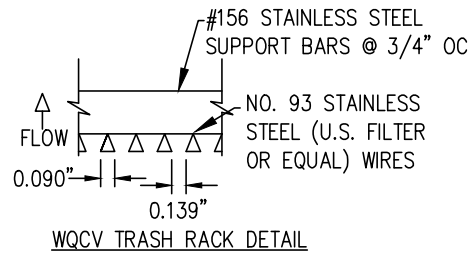
ASTRID SITE DEVELOPMENT PLAN
EXTENDED DETENTION BASIN
DRAFT OWNERSHIP AND MAINTENANCE PLAN
CONSTRUCTED IN [MONTH, YEAR]



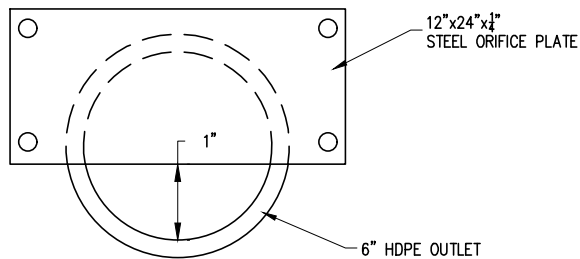
2 EMERGENCY SPILLWAY DETAIL
NO SCALE



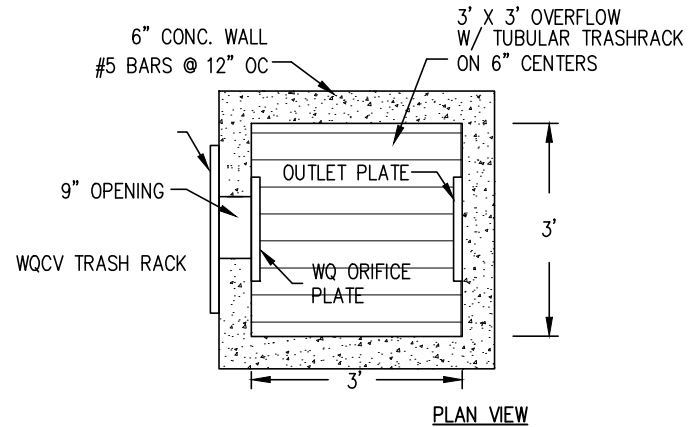
WATER QUALITY ORIFICE



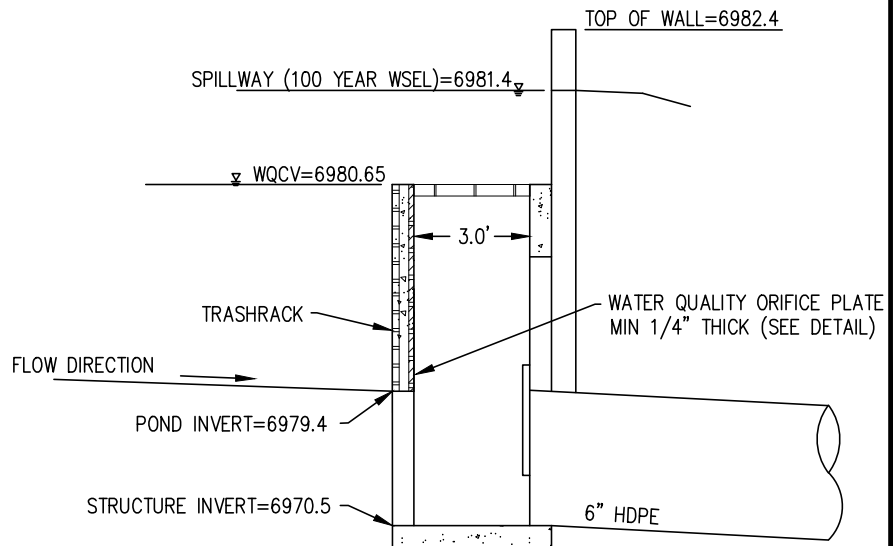
WQCV TRASH RACK DETAIL



4 100-YEAR ORIFICE PLATE
NOT TO SCALE



PLAN VIEW



3 WATER QUALITY POND OUTLET STRUCTURE
NO SCALE

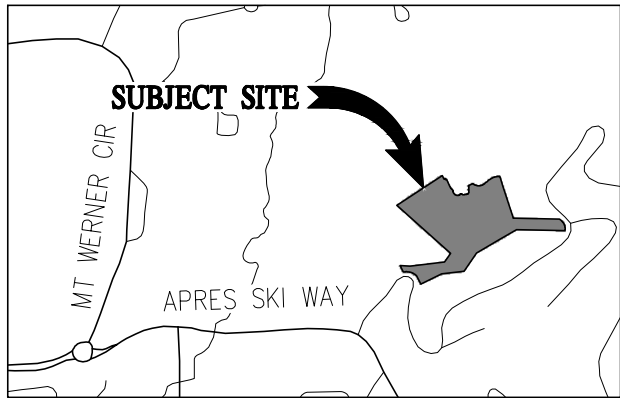
- DETAIL NOTES:
1. OVERFLOW TRASH RACKS SHALL BE MOUNTED USING STAINLESS STEEL HARDWARE AND PROVIDED WITH HINGED AND LOCKABLE OR BOLTABLE ACCESS PANELS.
 2. OVERFLOW TRASH RACKS SHALL BE STAINLESS STEEL, ALUMINUM, OR STEEL. STEEL TRASH RACKS SHALL BE DIP GALVANIZED AND MY BE HOT POWDER COATED AFTER GALVANIZING.
 3. WATER QUALITY CAPTURE VOLUME WELL-SCREEN TRASH RACKS SHALL BE STAINLESS STEEL AND SHALL BE ATTACHED BY INTERMITTENT WELDS ALONG THE EDGE OF THE MOUNTING FRAME.

DESIGNED BY	SMB	
DRAWN BY	SMB	
CHECKED BY	MB	
REVISION DESCRIPTION	DATE	PREPARED BY

STEAMBOAT SPRINGS	ROUITT COUNTY
ASTRID SITE DEVELOPMENT PLAN	OWNERSHIP & MAINTENANCE PLAN - POND B
4210 SKI TRAIL LANE	

INITIAL SUBMITTAL	12/22/22
DRAWING SIZE	11" X 17"
SURVEY FIRM	SURVEY DATE
LANDMARK CONS.	06/03/22
JOB NO.	C020235
DRAWING NAME	20235 PRO DRAIN.dwg
SHEET	2 OF 4

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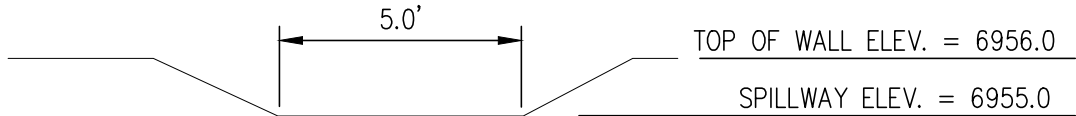


VICINITY MAP
SCALE: 1" = 1000'

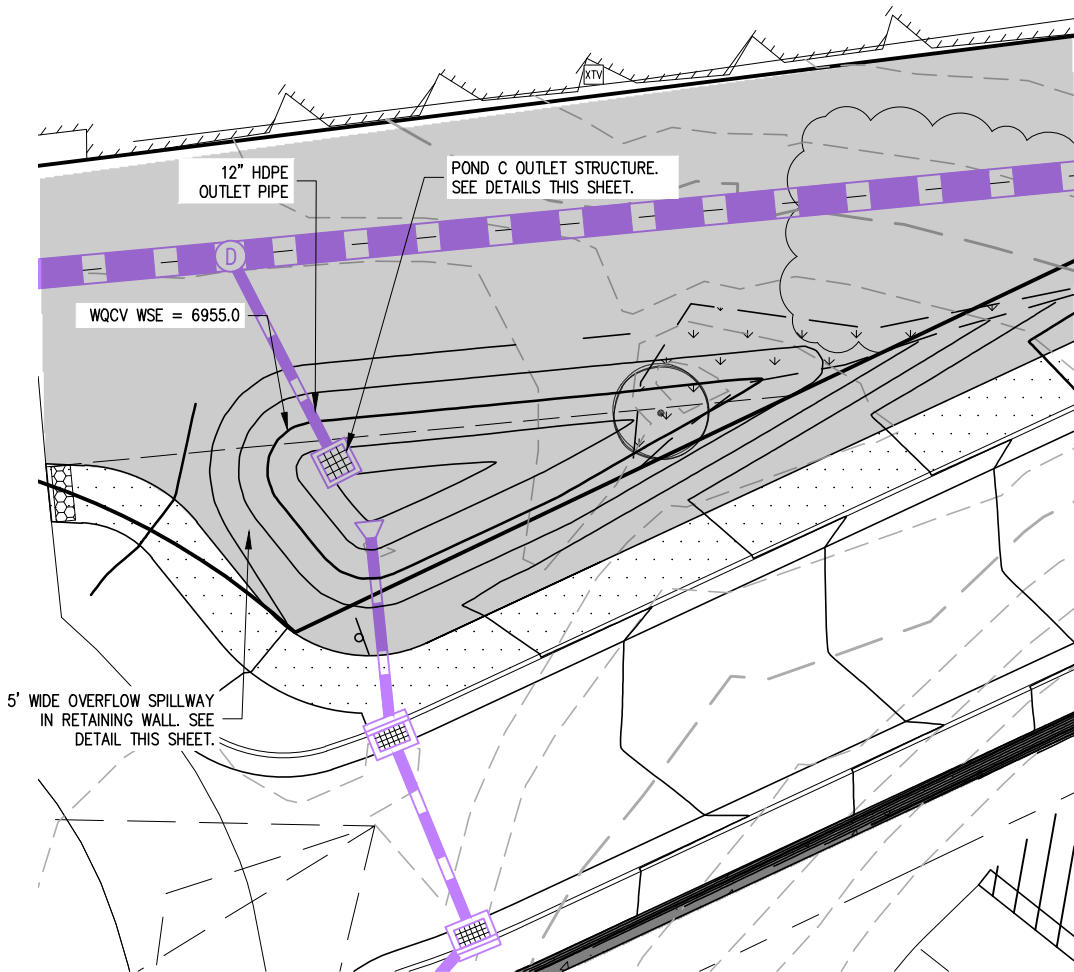
- NOTES:
1. FOR ADDITIONAL DESIGN INFORMATION, REFER TO THE CONSTRUCTION PLANS FOR THIS PROJECT.
2. SEE DETAILED NOTES ON THE SECOND SHEET OF THIS PLAN FOR ALL MAINTENANCE REQUIREMENTS.

LEGEND
AREA TO BE MOWED
(SEE NOTE 4 NEXT SHEET)

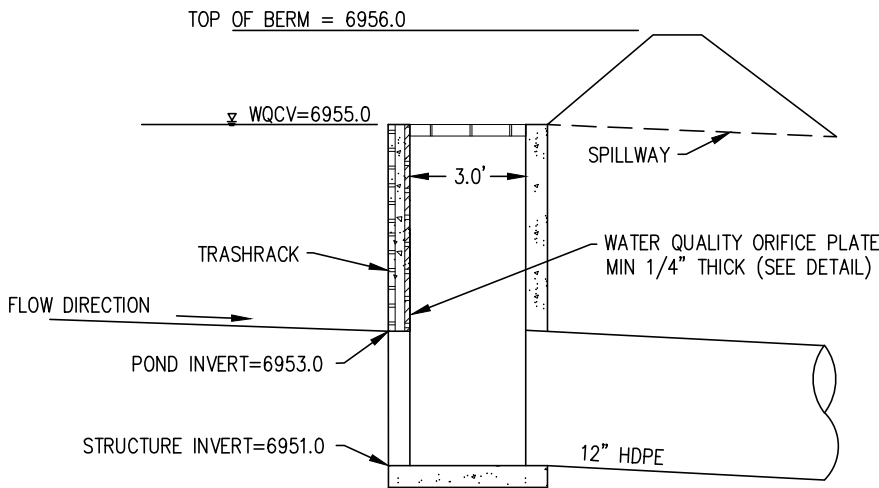
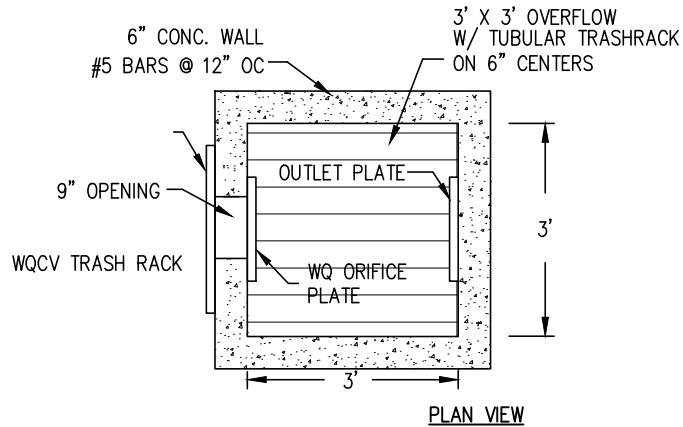
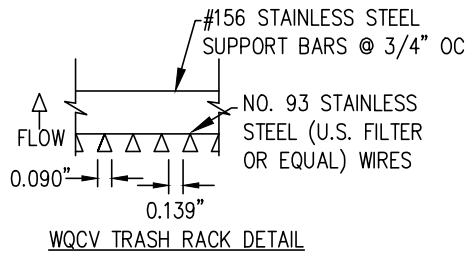
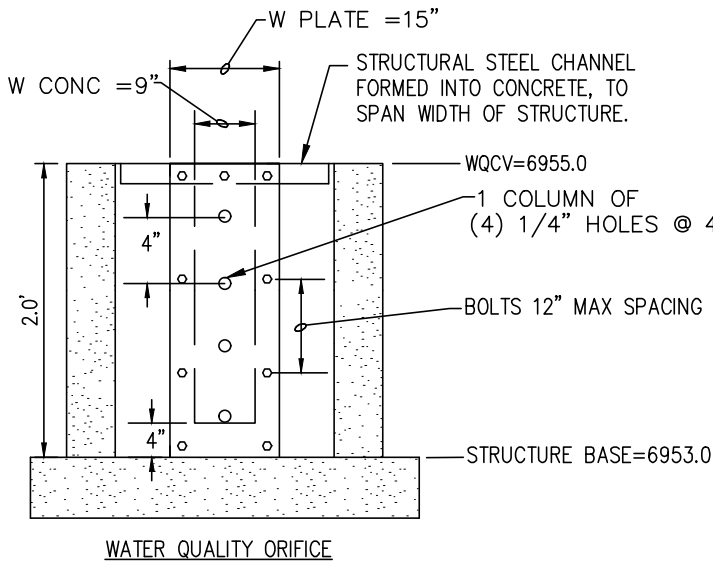
ASTRID SITE DEVELOPMENT PLAN
EXTENDED DETENTION BASIN
DRAFT OWNERSHIP AND MAINTENANCE PLAN
CONSTRUCTED IN [MONTH, YEAR]



2 EMERGENCY SPILLWAY DETAIL
NO SCALE



1 POND B EXTENDED DETENTION BASIN PLAN
GRAPHIC SCALE
(IN FEET)
1 INCH = 20 FT



3 WATER QUALITY POND OUTLET STRUCTURE
NO SCALE

- DETAIL NOTES:
1. OVERFLOW TRASH RACKS SHALL BE MOUNTED USING STAINLESS STEEL HARDWARE AND PROVIDED WITH HINGED AND LOCKABLE OR BOLTABLE ACCESS PANELS.
2. OVERFLOW TRASH RACKS SHALL BE STAINLESS STEEL, ALUMINUM, OR STEEL. STEEL TRASH RACKS SHALL BE DIP GALVANIZED AND MY BE HOT POWDER COATED AFTER GALVANIZING.
3. WATER QUALITY CAPTURE VOLUME WELL-SCREEN TRASH RACKS SHALL BE STAINLESS STEEL AND SHALL BE ATTACHED BY INTERMITTENT WELDS ALONG THE EDGE OF THE MOUNTING FRAME.

DESIGNED BY	SMB
DRAWN BY	SMB
CHECKED BY	MB
REVISION DESCRIPTION	DATE

STEAMBOAT ESQUAIR LP	ROUTT COUNTY
ASTRID SITE DEVELOPMENT PLAN	OWNERSHIP & MAINTENANCE PLAN - POND C
4210 SKI TRAIL LANE	
STEAMBOAT SPRINGS	
INITIAL SUBMITTAL	12/22/22
DRAWING SIZE	11" X 17"
SURVEY FIRM	
LANDMARK CONS.	06/03/22
JOB NO.	C020235
DRAWING NAME	20235 PRO DRAIN.dwg
SHEET	3 OF 4
OM3	

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ASTRID SITE DEVELOPMENT PLAN
EXTENDED DETENTION BASIN
DRAFT OWNERSHIP AND MAINTENANCE PLAN
CONSTRUCTED IN (MONTH, YEAR)

1. GENERAL PROJECTION INFORMATION

A. LOCATED AT 2410 SKI TRAIL LANE. SUBDIVISION & LEGAL NAME =

PARCEL 1:

LOT 1, BEAR CLAW III SUBDIVISION, COUNTY OF ROUTT, STATE OF COLORADO;
EXCEPTING THEREFROM THAT PORTION LYING WITHIN THE MAP OF EDMONT
CONDOMINIUM – BUILDING A RECORDED DECEMBER 16, 2009 UNDER RECEPTION NO.
694320.

PARCEL 2:

THAT PORTION OF THE "OUT LOT" ABUTTING LOT 8, BLOCK 2, SKI TRAIL
SUBDIVISION, FILING NO. 3 AND EXTENDING EASTERLY FROM THE WESTERLY LINE OF
SAID LOT 8, EXTENDED SOUTHERLY TO THE NORTHERLY LINE OF SKI TRAIL LANE,

PARCEL 3:

OUTLOT, SKI TRAIL SUBDIVISION FILING NO. 3

CITY OF STEAMBOAT SPRINGS, COUNTY OF ROUTT, STATE OF COLORADO

B. RECEIVING WATER: BURGESS CREEK

C. PROPERTY OWNER(S) NAME = STEAMBOAT ESQUIAR LP; CONTACT NAME ADDRESS,
PHONE NUMBER & EMAIL = W. BRODIE SHERMAN 4265 SAN FELIPE, STE #970,
HOUSTON, TX 77027, BRODIE@FUSEFV.COM

D. AGENCY RESPONSIBLE FOR MAINTENANCE NAME, CONTACT NAME, ADDRESS, PHONE
NUMBER, & EMAIL; STEAMBOAT ESQUIAR LP (SAME AS ABOVE)

E. DESIGN ENGINEER, CONTACT NAME, ADDRESS, PHONE NUMBER, EMAIL, & PE
LICENCE NUMBER = BASELINE ENGINEERING, STEVE BATCHELDER, 1169 HILLTOP
PKWY, SUITE 204, STEAMBOAT SPRINGS, 970-879-1825,
STEVE@BASELINECORP.COM, PE # 37112

2. GENERAL FACILITY DESCRIPTION

THIS FACILITY IS AN EXTENDED DETENTION BASIN THAT WILL CAPTURE AND TREAT
THE STORMWATER QUALITY CAPTURE VOLUME. THE FACILITY HAS BEEN ADOPTED
AND APPROVED BY CITY OF STEAMBOAT SPRINGS AS PART OF THE ASTRID SITE
DEVELOPMENT PLAN PROJECT. IT WILL RECEIVE RUNOFF FROM 3.18 ACRES AND WILL
OCCUPY A PARCEL OF 0.10 ACRES THAT WILL BE USED TO CAPTURE AND TREAT
THE STORMWATER QUALITY CAPTURE VOLUME AND PROVIDE FOR MAINTENANCE AND
ACCESS OPERATIONAL ACTIVITIES.

3. INSPECTION & MAINTENANCE FREQUENCY & PROCEDURE

A. THE FOLLOWING ITEMS SHOULD BE INSPECTED: TWICE ANNUALLY = OUTLET
STRUCTURE FOR DEBRIS AND DAMAGE TO OUTLET STRUCTURE AND EMBANKMENTS;
ANNUALLY = REMOVE SEDIMENT FROM BOTTOM OF DETENTION BASIN AND AERATE
VEGETATED AREAS; AS NEEDED = MOW TO MAINTAIN 6" GRASS HEIGHT AND
CONTROL WEEDS;AS NEEDED = REPAIR IRRIGATION AND APPLY FERTILIZER,
HERBICIDE, AND PESTICIDE. . ITEMS SHOULD BE MAINTAINED, REPAIRED, OR
REPLACED AS NEEDED. AN INSPECTION FORM SHALL BE COMPLETED AFTER EACH
INSPECTION.

B. REVISIONS TO MAINTENANCE FREQUENCY:

DATES / REASONS FOR CHANGES:

C. TRAFFIC CONTROL SHALL ONLY INCLUDE ENSURING VEHICLES ARE NOT PARKED IN
THE STREET AT POINTS NEEDED TO ACCESS THE DETENTION BASIN. THE HOA WILL
BE RESPONSIBLE.

D. THE FACILITY DOES NOT REQUIRE CONFINED SPACE ENTRY PROCEDURES.

E. DEWATERING AND WATER CONTROL

CLEANING THE OUTLET STRUCTURE AND BOTTOM OF DETENTION BASIN MAY
REQUIRE DEWATERING. A TRASH PUMP WILL BE REQUIRED. WATER WILL NEED TO
BE PUMPED INTO A WATER TRUCK AND DISPOSED OF AT A PROPER FACILITY TO
ACCEPT THIS WATER SO THAT A PERMIT IS NOT REQUIRED. IF DEWATERING IS
CONDUCTED IN ACCORDANCE WITH THE PROCEDURES SPECIFIED HEREIN, A
DEWATERING PERMIT SHOULD NOT BE REQUIRED.

F. SEDIMENT, DEBRIS, & TRASH REMOVAL & DISPOSAL
REMOVAL SHALL BE CONDUCTED TWICE ANNUALLY AT A MINIMUM OR WHEN
SEDIMENT REACHES 6 INCHES IN THE OUTLET STRUCTURE OF BOTTOM OF DETENTION
BASIN. REMOVAL SHALL BE CONDUCTED AS NEEDED, BUT ESPECIALLY WHEN ANY
DEBRIS BLOCKS FLOW AT THE OUTLET STRUCTURE. SEDIMENT AND DEBRIS SHALL BE
REMOVED BY SHOVEL OR A VACUUM TRUCK AND DISPOSED OF AT A LANDFILL
OR GRAVEL PIT THAT ACCEPT THESE WASTES OR IF SMALL VOLUMES IN REFUSE
CONTAINER. THE LONGEST DISTANCE BETWEEN THE EDGE OF AN ACCESS ROAD AND
THE FAR CORNER OF A STRUCTURE REQUIRING SEDIMENT REMOVAL IS 50 FEET.

G. VEGETATION MANAGEMENT
SEE SECTION 4 OF THE NOTES ON THIS SHEET.

H. WETLAND AREAS ARE NOT ANTICIPATED ON SITE. SEE SECTION 8.0 OF THE NOTES
ON THIS SHEET.

I. MATERIALS TESTING OF SEDIMENT REMOVED FROM SITE IS NOT REQUIRED.

J. TEMPORARY BEST MANAGEMENT PRACTICES SUCH AS INLET CONTROL AT THE
OUTLET STRUCTURE SHALL BE REMOVED ONCE VEGETATION IS ESTABLISHED.

4. EQUIPMENT, STAFFING, AND VEGETATION MANAGEMENT

A. EQUIPMENT REQUIRED:VACUUM TRUCK, SHOVEL, AERATOR, MOWER.

B. STAFFING: THE HOA & LANDSCAPE CONTRACTOR WILL BE ABLE TO MAINTAIN
TREATMENT FACILITY.

C. SEED: [TBD] SEED MIXES HAVE BEEN PLANTED AT THE SITE. THE [TBD.] SEED MIX
HAS BEEN PLANTED WITHIN THE DETENTION BASIN. SEED MIXES ARE AS FOLLOWS:

BOTANICAL NAME	COMMON NAME	LBS PURE LIVE SEED/AC
[SEED MIX NAME]:		
Xxxxx xxxxxxxxxxxxxx	Xxxxxx Xxxxxx	X.X
[REPEAT AS NECESSARY TO INCLUDE ALL MIX SPECIES]		

[REPEAT AS NECESSARY TO INCLUDE ALL MIXES IF NOT CITY STANDARD
SPECIFICATION]

ANY AREAS THAT LACKING VEGETATION SHALL BE RESEEDED WITH THE ABOVE
LISTED SEED MIX AND MULCHED.

D. MOWING: THE EXTENDED DETENTION BASIN SHALL BE MOWED TO A HEIGHT OF 6" AT
COMPLETION OF CONSTRUCTION, REQUIRED MOW AREA WAS ESTIMATED TO BE X.X
ACRES

E. WEEDS & UNDESIRABLE VEGETATION: WEEDS SHALL BE MOWED. NO WEED KILLER
SHALL BE USED ON THE SITE. NOXIOUS WEEDS AND OTHER UNDESIRABLE
VEGETATION SHALL BE REMOVED BY HAND TOOLS AND MOWING.

5. SNOW AND ICE CONTROL

FACILITY IS NOT LOCATED WITHIN A SNOW STORAGE AREA.

6. RIGHT-OF-WAY, ADJACENT OWNERSHIP, & ACCESS

A. RIGHT-OF-WAY DESCRIPTION:SKI TRAIL LANE AND THE ACCESS TO THE SITE IS
CLOSEST RIGHT-OF-WAY TO THE MAINTENANCE ACCESS.

B. ADJACENT OWNERSHIP: THE ADJACENT PROPERTIES ARE SKI TRAIL CONDOS,
ELKHORN CONDOS, THE STEAMBOAT RESORT, EDMONT CONDOS, BEAR CLAW II,
BEAR CLAW ESTATES, NORWEGIAN CONDOS, AND THE SKI INN CONDOS.

C. ACCESS INFORMATION AND DETAILS:ACCESS IS FROM SKI TRAIL LANE TO THE
PRIVATE PROJECT ACCESS..

D. MAINTENANCE OPERATIONS WILL NOT IMPACT OR OBSTRUCT RIGHT-OF-WAY AND A
RIGHT-OF-WAY PERMIT IS NOT REQUIRED.

7. HYDRAULIC DESIGN

A. FLOW RATES (CFS):

	POND A		POND B	
	INFLOW	OUTFLOW	INFLOW	OUTFLOW
WQ EVENT:	1.7 CFS	0.4 CFS	0.3 CFS	0.1 CFS
5-YEAR:	4.6 CFS	0.9 CFS	0.9 CFS	0.1 CFS
100-YEAR:	13.6 CFS	1.9 CFS	2.8 CFS	0.3 CFS

	POND C	
	INFLOW	OUTFLOW
WQ EVENT:	0.4 CFS	0.1 CFS
5-YEAR:	1.1 CFS	1.1 CFS
100-YEAR:	3.6 CFS	3.6 CFS

B. VOLUMES, DEPTHS, & WSELS:

ITEM	VOLUME	WSEL	DEPTH	INVERT
POND A	5200 CF	6987.3	3.3'	6984.0

EMERGENCY SPILLWAY	N/A	6988.3	1.0'	6987.1
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WQCV DRAIN TIME = 40 HOURS

POND B	950 CF	6981.4	2.0'	6979.4
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EMERGENCY SPILLWAY	N/A	6982.4	1.0'	6981.4
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POND C	425 CF	6655.0	2.0'	6653.0
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EMERGENCY SPILLWAY	N/A	6656.0	1.03	6655.0
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8. SENSITIVE AREAS, WETLANDS, & PERMITS

THE SITE HAS 0.1 ACRES OF WETLANDS LOCATED AT THE ENTRANCE TO THE SITE
OFF OF SKI TRAIL LANE. NO PORTION OF THE SITE IS LOCATED IN THE BURGESS
CREEK FLOODWAY AND FLOODPLAIN.

9. MISCELLANEOUS INFORMATION

A. PROJECT SURVEY:

EXISTING CONDITIONS TOPOGRAPHIC SURVEY WAS PREPARED BY LANDMARK
CONSULTANTS BASED ON INFORMATION GATHERED JUNE 3, 2022. SITE BENCHMARK:
A RECOVERED NO.5 REBAR WITH ALUMINUM CAP STAMPED "LS 29039", HAVING AN
ELEVATION OF 6986.18' BASED ON THE NORTH AMERICAN VERTICAL DATUM OF 1988
(NAVD88) AT THE WESTERN MOST PROPERTY CORNER ADJACENT WITH THE SKI
RESORT.



1169 HILLTOP PKWY SUITE 204 • STEAMBOAT SPRINGS, CO 80477
P. 970.879.1825 • F. 903.940.0659 • www.baselinecorp.com

DESIGNED BY	SMB
DRAWN BY	SMB
CHECKED BY	MB

REVISION	DESCRIPTION	PREPARED BY	DATE

STEAMBOAT ESQUIAR LP	ROUTT COUNTY
STEAMBOAT SPRINGS	ASTRID SITE DEVELOPMENT PLAN 4210 SKI TRAIL LANE OWNERSHIP AND MAINTENANCE PLAN NOTES

INITIAL SUBMITTAL	12/22/22
DRAWING SIZE	11" X 17"
SURVEY FIRM	SURVEY DATE
LANDMARK CONS.	06/03/22
JOB NO.	C020235
DRAWING NAME	O&M NOTES.dwg
SHEET	4 OF 4

OM4