Ph: 970-871-6772 · Fax: 970-879-8023 · P.O. Box 775966 · Steamboat Springs, Colorado 80477

Draft Drainage Study & Stormwater Quality Plan for Lot 1 Indian Meadows Development Plan

Address: TBD

Draft: 4/19/2022
Final:

Prepared by: Joe Wiedemeier, P.E.
Four Points Surveying & Engineering

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Steamboat Springs, Colorado 80477
(970) 871-6772

Table of Contents

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 this job site. The City of Steamboat Springs assumes no responsibility for the completeness or accuracy of this document.

CERTIFICATION

I hereby affirm that this Drainage Report for the (name of 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.

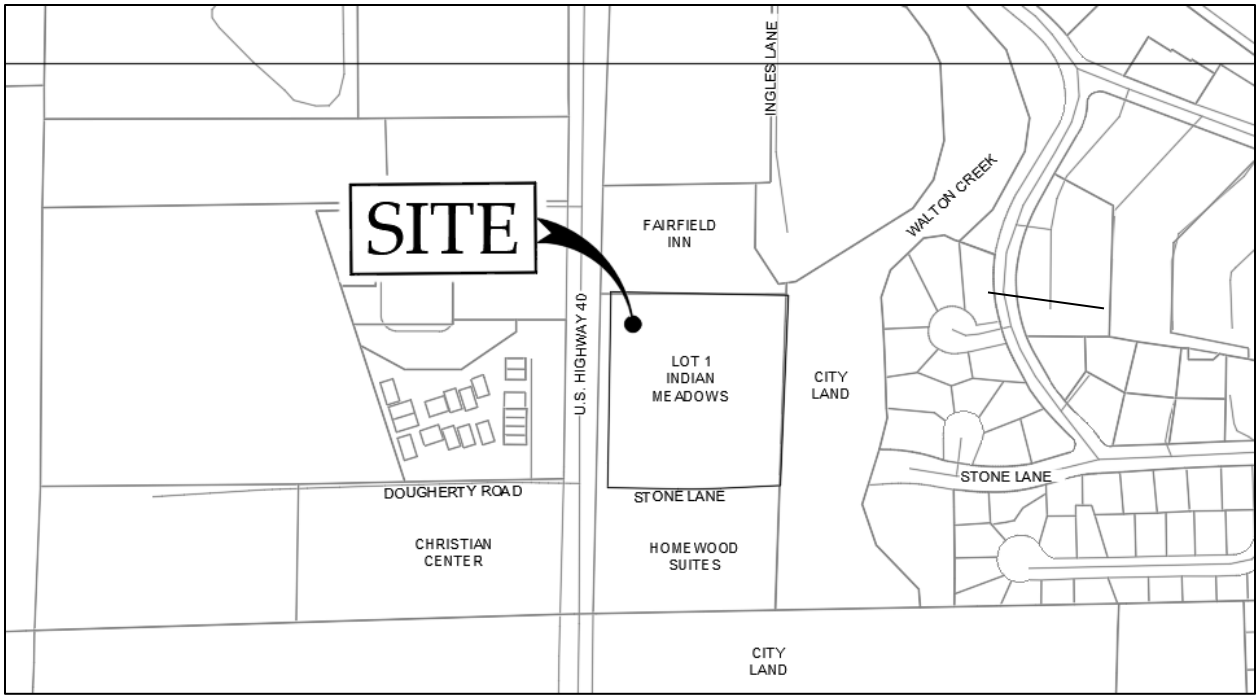
_____
Joe Wiedemeier, P.E.
State of Colorado No. 0054959
Date:_____

1.0 Introduction

This report provides a detailed analysis of existing and proposed post-development drainage conditions and proposed water quality facilities for the proposed development at Lot 1 Indian Meadows. This report includes all data, engineering methods, assumptions, and calculations used by Four Points Surveying and Engineering (Four Points) to design the stormwater drainage system for the Project. Four Points prepared this report and performed engineering for the Project in accordance with the most recent version of the City of Steamboat Springs Drainage Criteria and Engineering Standards.

A. Location

Figure 1: Vicinity Map – Lot 1 Indian Meadows



B. Owner/Developer

Gray Stone, LLC

C. Drainage Reports for Adjacent Developments

Homewood Suites Hotel Final Drainage Study Report, March 2006. Owen Consulting Group, Inc. Larry C. Owen, P.E.

D. Stormwater Quality Purpose, Goal, and Special Requirements

The purpose of the stormwater quality plan is to design a conveyance and treatment system that fits with the proposed Project and provides both functionality and aesthetics. The goal is to treat stormwater runoff from the developed impervious areas per City standards.

2.0 Drainage Criteria and Methodology Used

A. Design Rainfall and Storm Frequency

Design rainfall: NOAA Atlas 14, Volume 8, Version 2 for Steamboat Springs, CO.

- Minor Event (5-year) 24-hour rainfall depth: 1.59 inches
- Major Event (100-year) 24-hour rainfall depth: 2.91 inches

B. Runoff Calculation Methodology

Runoff calculation method: Small basin peak flow runoff was analyzed using the Rational Method, shown in Eq-1.

Rational Method: $\mathbf{Q = CiA}$ (Eq-1)

Where: Q = runoff, CFS
C = runoff coefficient, dimensionless
i = rainfall intensity, inches per hour
A = basin area, acres

C. Stormwater Quality Design Standard

Proposed permanent stormwater treatment facilities will meet total suspended solids (TSS) design standards. TSS calculations were performed for grass lined water quality swales per City drainage engineering standards.

3.0 Existing Conditions

A. Ground Cover, Imperviousness, Topography and Size

- Vacant Lot with bare ground, native grasses, and wetlands vegetation
- 24-foot-wide paved vehicle access and 8-foot-wide pedestrian sidewalk to Fairfield Inn
- 5-10% imperviousness
- Flat to gentle sloping terrain, 5% slopes max
- Total lot size: 3.875 acres

B. Existing Stormwater Systems

Refer to the existing conditions drainage exhibit and existing drainage basin designations. Drainage from EB1 (the portion of the lot to be developed) generally sheet flows west to east across Lot 1. A low spot in the northeast corner appears to be the only defined outfall point. Wetlands are present along much of the eastern property line. No stormwater infrastructure is located within EB1. EB2 generally sheet flows east to west and into the US 40 roadside ditch and wetlands. Flows between EB1 and EB2 are generally split by the existing Fairfield Inn access road. EB3 primarily consists of the Stone Lane right-of-way. Flows are directed into curb and gutter conveyance and into the Homewood Suites stormwater collection network to the south.

C. Notable Features

- Floodplain - FEMA Zone A
- Wetlands present

D. Site Outfall and Ultimate Outfall Locations

EB1 outfalls into Walton Creek and ultimately the Yampa River.

E. USDA NRCS Soil Type

A USDA NRCS Web Soil Survey was performed to determine basic soil characteristics within the project area. Soil types include:

- Slocum Loam → Hydrologic Soil Group Rating: B/D
- Venable → Hydrologic Soil Group Rating: B/D

F. Existing Easements

See existing conditions drainage exhibit for existing easements. There are no dedicated drainage easements within EB1.

G. FEMA Map Review

FEMA flood map No. 08107C0883D effective 2/4/2005 was reviewed. Lot 1 is partially located within a FEMA designated floodplain AKA a special flood hazard area with designation Zone AE. Base flood elevations are identified based on preliminary engineering studies with a sub-consultant. *Note: (insert final floodplain study data for final draft)*

4.0 Proposed Conditions

Lot 1 development is proposed to be done in three phases. The first phase shall consist of installing a new shared cross access road through the lot and subsequent removal of the existing access to Fairfield Inn and a vacation of the existing access and public utility easement. Phase 1 shall also consist of permanent water quality swale along the east property line (WQ Swale #1).

A. Ground Cover, Imperviousness, Topography and Size

- Total area of development is approximately 3.0 acres.
- Finished ground cover will consist of paving, multi-story hotels, landscaping, gravel, stone, and both maintained and unmaintained grasses.
- The proposed grading scheme will direct surface runoff to the proposed water quality swales. Water quality swale #1 (for SB1) will outfall into City land at the historical outfall point.
- Water quality swales for phases 2 and 3 will enter a stormwater collection network and outfall at the same point as water quality swale #1.
- Impervious area: 50%-85% (by basin).
- Area to be treated: 3.06 acres
- Impervious area to be treated: 2.23 acres

B. Proposed Stormwater Systems

Stormwater swales, valley pans, inlets and piping will convey all runoff to the historical outfall point identified as design point No. 1. Sheet flow from the access road and parking lot will be conveyed to one of the permanent water quality swales feeding into the private stormwater collection network. The stormwater collection network will consist of Nyloplast combination curb inlets and area inlets connected via smooth wall PVC or HDEP stormwater pipe. No public stormwater infrastructure is proposed.

Energy grades lines (EGL) and hydraulic grade lines (HGL) were developed for each run of storm sewer to analyze surcharging conditions under the minor and major event flows. The stormwater collection network was designed to handle the minor event without surcharging the system, and will effectively convey the major event without overflowing the water quality swales.

Pipe velocities were analyzed for standards conformance. Storm sewer velocities were analyzed for the major event. Pipe velocity was found to be within the required standards. See Appendix K for a summary table of pipe flow velocities.

C. Outlets: Historic and Proposed Flow

SB1 will outfall into water quality swale #1 along the easterly property line. Flows from the sub-basins in Phase 2 will go through stormwater treatment, enter the storm sewer network and then outfall at design point No. 1. The proposed ultimate outfall point for all developed sub-basins occurs as design point No. 1.

D. Hydraulic Calculations

- Inlet capacity was analyzed using manufacturer capacity curves,
- Conveyance piping was analyzed with AutoCAD Storm Sewer software,
- and drainage swales and culverts were analyzed using AutoCAD Hydroflow Express software.

E. Major and Minor Flow Summary Table

Existing and proposed drainage was analyzed by dividing the lot into existing basins (e.g. EB1) and sub-basins (e.g. SB1). Major and minor flows for each basin are summarized in the following table. Please note that some sub-basins are not associated with Phase 1 Development.

Table 1: Major and Minor Flow Summary Table

Basin Condition	Area (acres)	Impervious Area (%)	Runoff	
			Q_5 (cfs)	Q_{100} (cfs)
EB1	2.96	5%	0.86	5.34
EB2	0.86	8%	0.19	3.37
EB3	0.39	80%	0.57	2.31
SB1	0.31	49%	0.26	1.51
SB2	0.35	90%	0.97	2.38
SB3	0.38	77%	0.52	1.38
SB4	0.15	93%	0.44	1.07
SB5	0.17	94%	0.44	1.07
SB6	0.18	78%	0.31	0.81
SB7	0.08	88%	0.16	0.40

SB8	0.12	67%	0.23	0.65
SB9	0.95	79%	1.69	4.41

F. Proposed Easements

Drainage easements are proposed for the permanent water quality treatment facilities (water quality swales). The drainage easements will be accessible from the proposed 30-foot-wide public access easement and shared cross access road.

G. Off Site Flows

No significant off-site flows exist.

H. Impacts to Downstream Properties

There are no anticipated impacts to downstream properties due to the proposed development.

I. Potential Site Contaminants

- Sediment, sand, grit, and salts
- Vehicular pollutants (Oils, antifreeze, carbon deposits, etc.)

J. On-Site Stormwater Flows

On site flows will originate primarily from the paved cross access road. Flows shall be managed as designed and depicted in the proposed conditions drainage exhibit. Runoff will be treated by permanent BMPs. *Note: The phase 1 and phase 2 parking lot designs are preliminary and may vary accordingly with this report.*

K. Water Quality Design Standard

TSS design standards per City engineering standards.

Table 2: Water Quality Swale Design Variables

Water Quality Feature Design Variables	**Grass Lined Swales – By Sub-Basin**		
	SB1	**SB3**	**SB6**
Design Standard	TSS	TSS	TSS
Design Event	1.25 year	1.25 year	1.25 year
Total Area Treated (acres)	0.31	0.50	0.18
Imperviousness of Area Treated	50%	76%	78%
C Values of Area Treated	0.33	0.56	0.58
Hydrologic Soil Types of Treatment Area	B	B	B
Design Treatment Area (ft^2)	200	100 x 2	100
Total Flat Treatment Area (ft^2)	200	100 x 2	100
Design Flow Rate (cfs)	0.18	0.29	0.14
Design Velocity (ft/sec)	(See appendix)	(See appendix)	(See appendix)

L. Channels

Drainage swales shall be utilized to convey and treat surface runoff from the access road and parking lot. All drainage swales shall be capable of conveying the major event perk flow. See appendices for drainage swale flow calculations.

M. Inlets and Stormwater Pipe

Nyloplast combination curb inlets and area inlets with standard grates are proposed to collect stormwater flows from gutters, swales, and valley pans throughout the site. Each proposed combination curb inlet has the capacity to capture the minor storm event with 100% efficiency. Area inlets were sized to capture the minor event without causing backup conditions. Major events may cause ponding within the swales to occur.

N. Culverts

A temporary 24" circular CMP culvert crossing shall be installed with the new cross access construction parallel to the permanent storm sewer. This culvert will remain until Phase 2 of the development of Lot 1 occurs, in which it will then be abandoned in place when the stormwater collection network from Phase 2 is installed and operational.

5.0 Post Construction Stormwater Management

The contractor and owner shall be required to obtain a state general permit for the discharge of construction site stormwater associated with the approximate 3.0 acres of development. The contractor shall be responsible for obtaining this permit prior to construction.

A detailed stormwater management plan prepared by a Colorado professional engineer shall be required for Phases 1, 2, and 3 of construction. The stormwater management plan should take into account the changing topography and conditions of the site throughout the construction process. For example, the cross access road for Phase 1 will require a temporary culvert crossing and during the construction of Phases 2 and 3, drainage patterns will change and ponding will need to be managed accordingly.

Lastly, in should be emphasized that Lot 1 discharges into delineated wetlands on City property that leads directly into Walton Creek a few hundred feet downstream of design point No. 1. This is a sensitive area and temporary stormwater control measures shall be properly implemented, inspected, and maintained throughout the entire construction phase and until at least 80% of final revegetation is achieved for the site.

6.0 Post Construction Stormwater Management

See Operation and Maintenance Plan, OM1.

7.0 Concluding General Summary

Existing drainage patterns will be changed due to the extent of development but the historic outfall point will be maintained under the proposed conditions. The proposed drainage features for the Project includes a combination of sheet flow, channel flow, and a small stormwater collection network to manage stormwater runoff. Treated stormwater will be discharged onto

City Land that leads to Walton Creek. All paved areas of the development will receive water quality treatment via the water quality swales.

A. Compliance

The proposed stormwater drainage system complies with City Drainage Criteria.

B. Historic and Proposed Site Flows

Peak proposed flows will be higher than historic peak flows. However, flows from the site immediately discharge into the Walton Creek floodplain and the increase in peak flow does not affect surrounding base flood elevations. Therefore, detention is not required.

C. Proposed New Stormwater System Requirements

The proposed stormwater system shall effectively convey and treat all flows on site with proper installation and maintenance.

7.0 References

Urban Drainage and Flood Control District Criteria Manual, 2018.

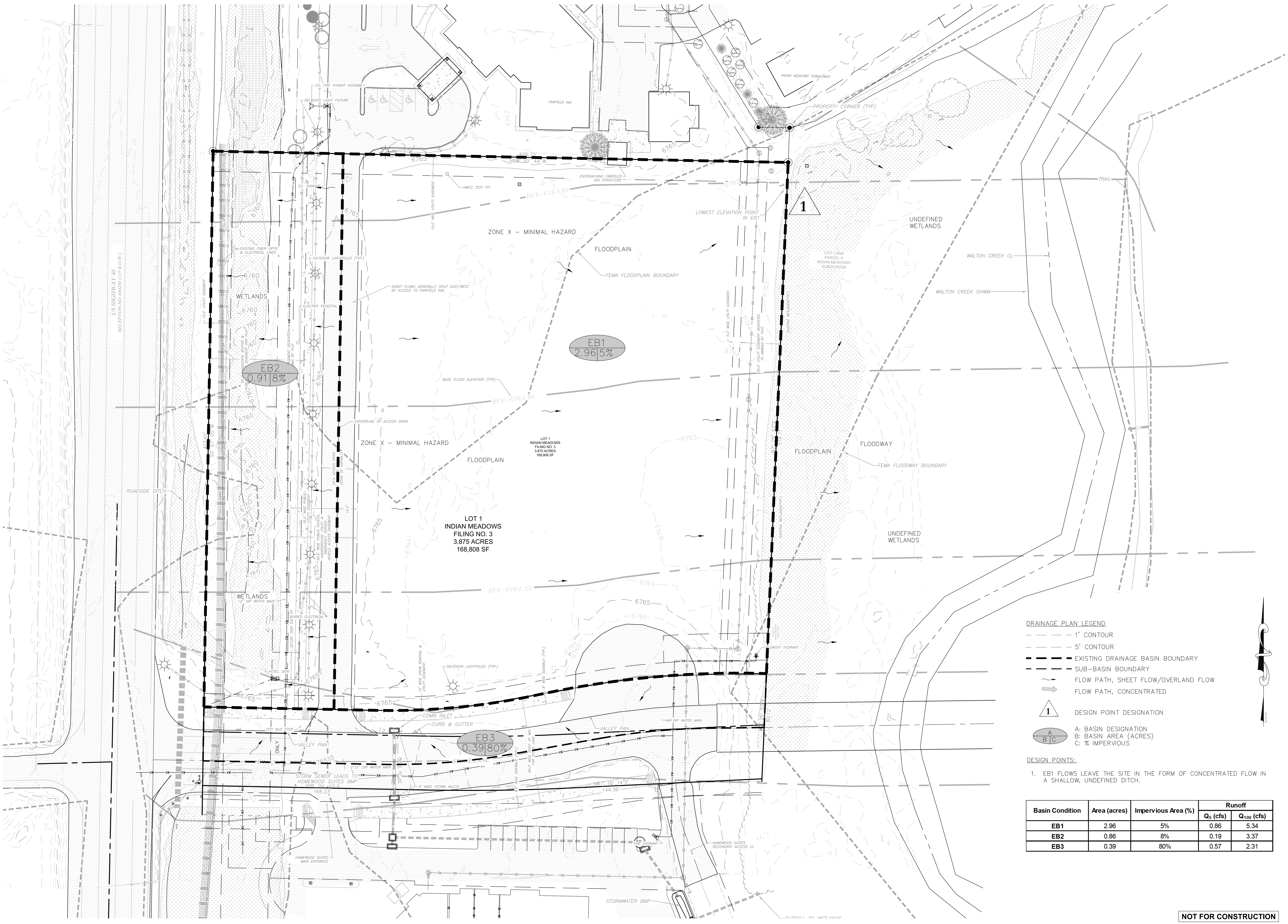
NOAA Precipitation Frequency Server. NOAA Atlas 14, Volume 8, Version 2. www.NOAA.com

City of Steamboat Springs Engineering Drainage Criteria, Latest Version.

8.0 Appendices

A. Existing Conditions Drainage Exhibit, DR1
B. Proposed Conditions Drainage Exhibit, DR2
C. USDA NRCS Web Soil Survey
D. Basin Runoff Calculations
E. TSS Calculations
F. Channel Flow Calculations
G. Inlet Capacity Curves
H. Storm Sewer Capacity Calculations and EGL/HGL profiles
I. Standard forms No. 3, 4, & 5
J. Project Design Sheets
K. Operation and Maintenance Plan for Water Quality Swales

Appendix A: Existing Conditions Drainage Exhibit, DR1



DRAINAGE PLAN LEGEND

- 1' CONTOUR
- 5' CONTOUR
- EXISTING DRAINAGE BASIN BOUNDARY
- SUB–BASIN BOUNDARY
- FLOW PATH, SHEET FLOW/OVERLAND FLOW
- FLOW PATH, CONCENTRATED
- DESIGN POINT DESIGNATION
- A: BASIN DESIGNATION
  B: BASIN AREA (ACRES)
  C: % IMPERVIOUS

DESIGN POINTS:

1. EB1 FLOWS LEAVE THE SITE IN THE FORM OF CONCENTRATED FLOW IN A SHALLOW, UNDEFINED DITCH.

Basin Condition	Area (acres)	Impervious Area (%)	Runoff	
			Q_5 (cfs)	Q_{100} (cfs)
EB1	2.96	5%	0.86	5.34
EB2	0.86	8%	0.19	3.37
EB3	0.39	80%	0.57	2.31

NOT FOR CONSTRUCTION

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P.O. Box 775966
Steamboat Springs, CO 80487
(970)-871-6772
www.fourpointsse.com

INT										
REVISIONS										
DATE										
No.										

LOT 1 INDIAN MEADOWS DEVELOPMENT PLAN

LOT 1, INDIAN MEADOWS FILING NO. 3
STEAMBOAT SPRINGS, CO 80487

HORIZONTAL SCALE

0 30' 60'

SCALE: 1" = 30'

CONTOUR INTERVAL = 1FT

DATE: 11/30/2021
JOB #: 1448-005
DRAWN BY: SDW
DESIGN BY: JLW
REVIEW BY: RL

IF THIS DRAWING IS PRESENTED IN A FORMAT OTHER THAN 24" X 36" THE GRAPHIC SCALE SHOULD BE UTILIZED.

DRAWING:

EXISTING CONDITIONS DRAINAGE

SHEET NO.

C2

CTB: FPSE–BW.CTB

BY: JOE WIEDEMEIER

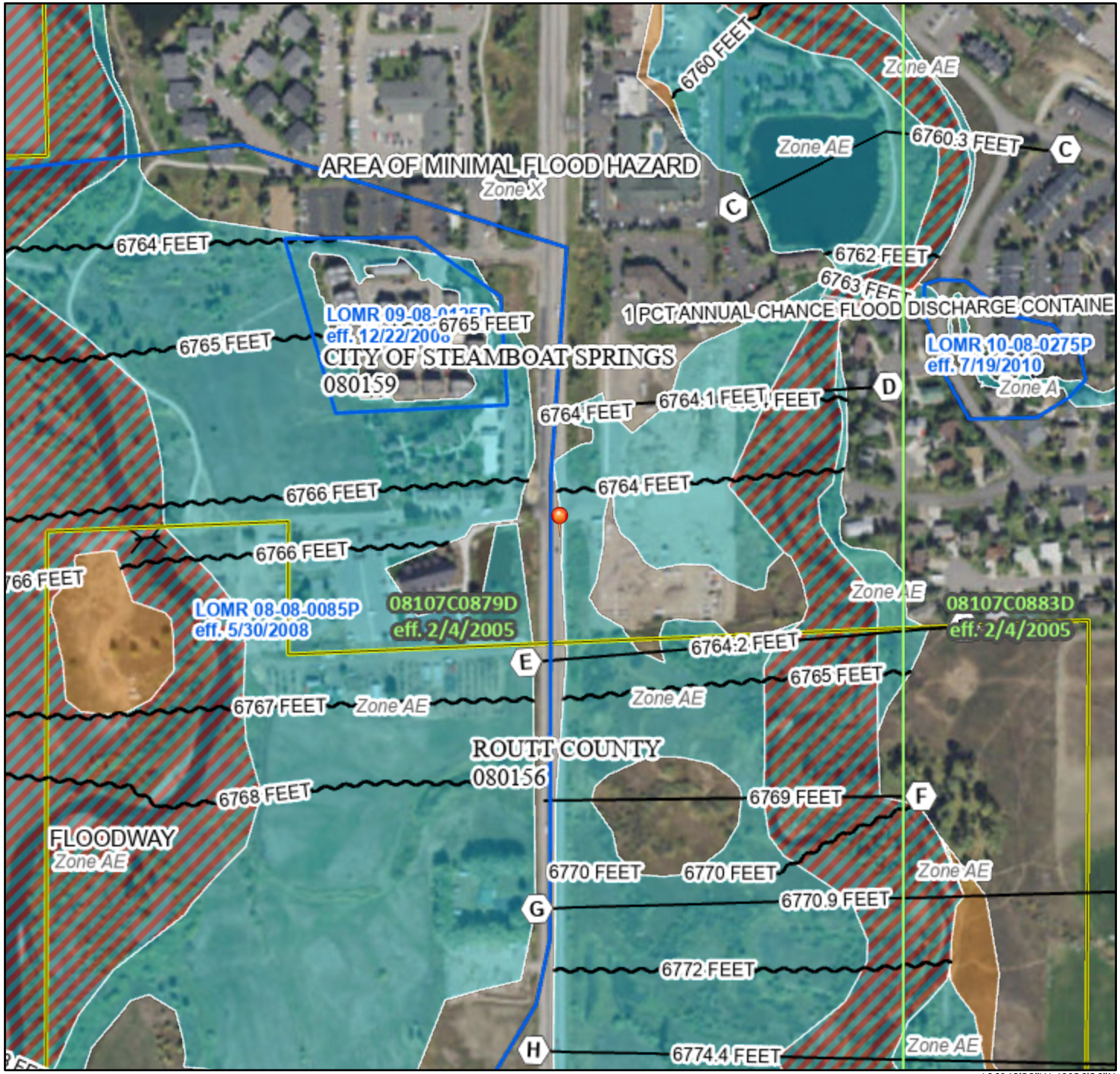
PLOT DATE: 2/4/2022 4:01 PM

DRAWING FILE: P:\1448–005 LOT 1 INDIAN MEADOWS F3 HOTELS\FPSE\DRAINAGE\1448–005 EXISTING CONDITIONS DRAINAGE.DWG

National Flood Hazard Layer FIRMette

FEMA

106°49'15"W 40°26'54"N



106°48'38"W 40°26'26"N

Feet

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

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
- Area of Undetermined Flood Hazard *Zone D*

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

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

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

N

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

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

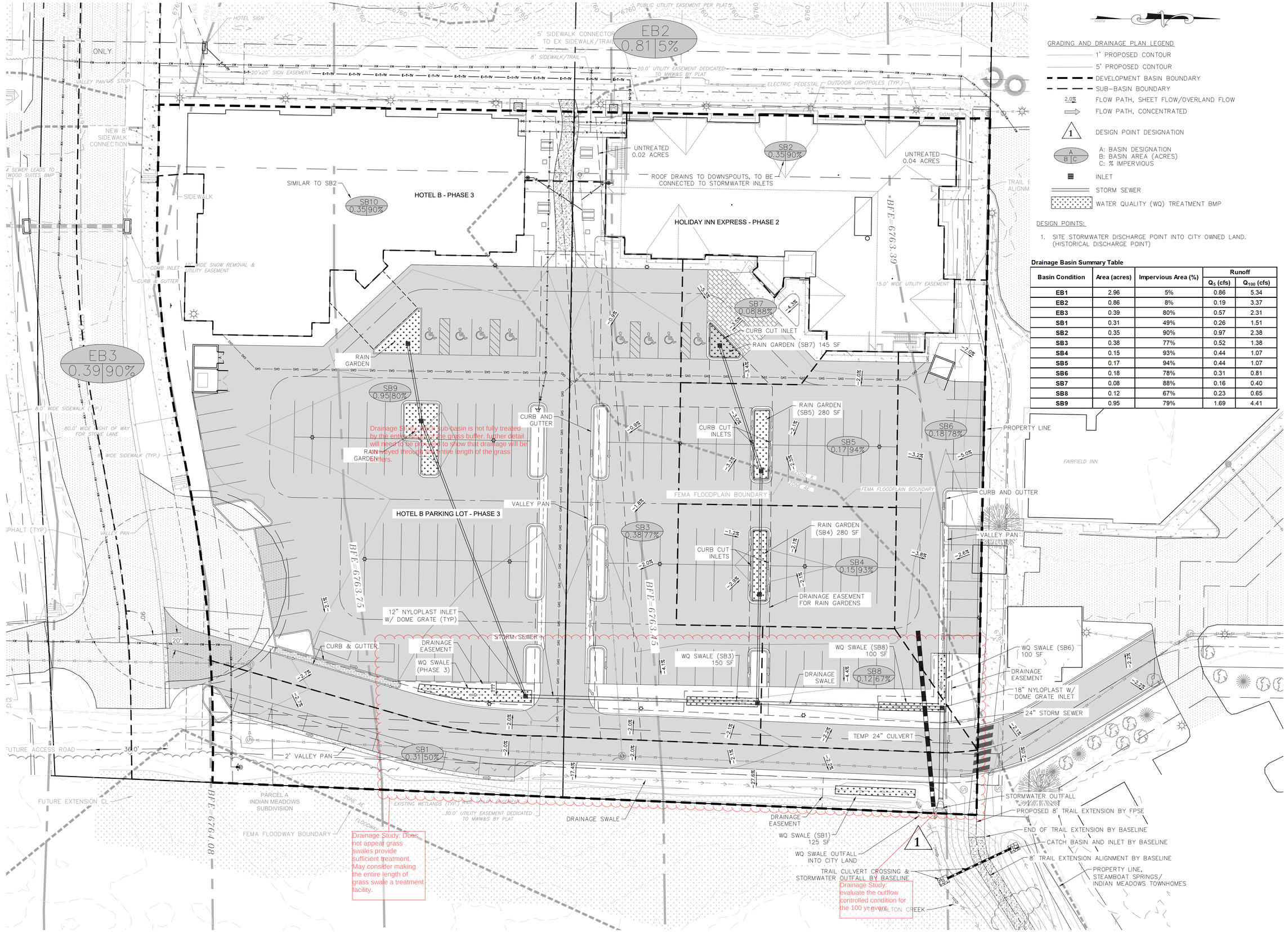
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/13/2021 at 10:50 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

Appendix B: Proposed Conditions Drainage Exhibit, DR2

PLOT DATE: 4/19/2022 5:02 PM BY: JOE WIEDEMEIER CTB: FPSE-BW.CTB

DRAWING FILE: P:\1448-005 LOT 1 INDIAN MEADOWS F3 HOTELS\FPSE\DRAWINGS\1448-005 PROPOSED CONDITIONS DRAWING.DWG



GRADING AND DRAINAGE PLAN LEGEND

- 1' PROPOSED CONTOUR
- 5' PROPOSED CONTOUR
- DEVELOPMENT BASIN BOUNDARY
- SUB-BASIN BOUNDARY
- 2.0% FLOW PATH, SHEET FLOW/OVERLAND FLOW
- FLOW PATH, CONCENTRATED
- 1 DESIGN POINT DESIGNATION
- A / B | C — A: BASIN DESIGNATION; B: BASIN AREA (ACRES); C: % IMPERVIOUS
- INLET
- STORM SEWER
- WATER QUALITY (WQ) TREATMENT BMP

DESIGN POINTS:

1. SITE STORMWATER DISCHARGE POINT INTO CITY OWNED LAND. (HISTORICAL DISCHARGE POINT)

Drainage Basin Summary Table

Basin Condition	Area (acres)	Impervious Area (%)	Runoff	
			Q_5 (cfs)	Q_{100} (cfs)
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No.	DATE	REVISIONS	INT
1	4/19/22	PER 1ST DRT COMMENTS	JLW

LOT 1 INDIAN MEADOWS
PHASE I DEVELOPMENT PLAN

LOT 1, INDIAN MEADOWS FILING NO. 3
STEAMBOAT SPRINGS, CO 80487

HORIZONTAL SCALE

0 20' 40'

SCALE: 1" = 20'

CONTOUR INTERVAL = 1 FT

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REVIEW BY: RL

IF THIS DRAWING IS PRESENTED IN A FORMAT OTHER THAN 24" X 36", THE GRAPHIC SCALE SHOULD BE UTILIZED.

DRAWING: GRADING & DRAINAGE PLAN

SHEET NO.

DR2

Appendix C: USDA NRCS Web Soil Survey

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Routt Area, Colorado, Parts of Rio Blanco and Routt Counties

February 4, 2022

Contents

Soil Map

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

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,080 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 15 30 60 90

Feet
0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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 11, Sep 2, 2021

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

Date(s) aerial images were photographed: May 8, 2012—Oct 5, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
25A	Toponas loam, 0 to 3 percent slopes	0.1	1.4%
49A	Slocum loam, gravelly substratum, 0 to 3 percent slopes	2.6	56.4%
AW	Venable, mucky peat, 0 to 3 percent slopes, frequently flooded	1.9	42.2%
Totals for Area of Interest		**4.5**	**100.0%**

Map Unit Descriptions

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

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

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

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate

pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

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

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

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

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

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

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

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

Routt Area, Colorado, Parts of Rio Blanco and Routt Counties

25A—Toponas loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: k0lf
Elevation: 6,400 to 8,100 feet
Mean annual precipitation: 20 to 24 inches
Mean annual air temperature: 38 to 41 degrees F
Frost-free period: 30 to 70 days
Farmland classification: Not prime farmland

Map Unit Composition

Toponas and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Toponas

Setting

Landform: Flood plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Alluvium derived from sandstone and shale

Typical profile

A1 - 0 to 4 inches: loam
A2 - 4 to 11 inches: loam
A3 - 11 to 17 inches: sandy loam
A4 - 17 to 24 inches: sandy loam
AC - 24 to 29 inches: sandy loam
2Cg - 29 to 60 inches: extremely gravelly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.71 to 2.13 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: NoneRare
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): 6w
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: B/D
Ecological site: R048AY241CO - Mountain Meadow
Hydric soil rating: Yes

Minor Components

Eachuston

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: R048AY241CO - Mountain Meadow
Hydric soil rating: Yes

Slocum

Percent of map unit: 5 percent
Landform: Flood-plain steps
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R048AY241CO - Mountain Meadow
Hydric soil rating: No

49A—Slocum loam, gravelly substratum, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: k0g8
Elevation: 6,490 to 8,690 feet
Mean annual precipitation: 20 to 24 inches
Mean annual air temperature: 38 to 41 degrees F
Frost-free period: 30 to 70 days
Farmland classification: Not prime farmland

Map Unit Composition

Slocum, gravelly substratum, and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Slocum, Gravelly Substratum

Setting

Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Alluvium derived from igneous and sedimentary rock

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 23 inches: loam
Bw - 23 to 30 inches: loam
Cg - 30 to 35 inches: loamy fine sand
2C - 35 to 59 inches: extremely cobbly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.71 to 2.13 in/hr)
Depth to water table: About 18 to 35 inches
Frequency of flooding: NoneRare
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.0 inches)

Interpretive groups

Land capability classification (irrigated): 5c
Land capability classification (nonirrigated): 5c
Hydrologic Soil Group: B/D
Ecological site: R048AY241CO - Mountain Meadow
Hydric soil rating: No

Minor Components

Venable

Percent of map unit: 5 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: R048AY241CO - Mountain Meadow
Hydric soil rating: Yes

AW—Venable, mucky peat, 0 to 3 percent slopes, frequently flooded

Map Unit Setting

National map unit symbol: k0kv
Elevation: 6,490 to 9,180 feet
Mean annual precipitation: 28 to 32 inches
Mean annual air temperature: 35 to 41 degrees F
Frost-free period: 25 to 65 days
Farmland classification: Not prime farmland

Map Unit Composition

Venable, frequently flooded, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Venable, Frequently Flooded

Setting

Landform: Drainageways, flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope

Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Alluvium derived from igneous, metamorphic and sedimentary rock

Typical profile

Oe - 0 to 4 inches: moderately decomposed plant material
A - 4 to 16 inches: loam
AC - 16 to 26 inches: sandy clay loam
Cg - 26 to 43 inches: loamy sand
2Cg - 43 to 59 inches: extremely cobbly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.71 to 2.13 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: NoneFrequent
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): 6w
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: B/D
Ecological site: R048AY241CO - Mountain Meadow
Hydric soil rating: Yes

Minor Components

Riverwash, frequently flooded

Percent of map unit: 10 percent
Hydric soil rating: No

Map Scale: 1:1,080 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 15 30 60 90

Feet
0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil 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 11, Sep 2, 2021

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

Date(s) aerial images were photographed: May 8, 2012—Oct 5, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
25A	Toponas loam, 0 to 3 percent slopes	B/D	0.1	1.4%
49A	Slocum loam, gravelly substratum, 0 to 3 percent slopes	B/D	2.6	56.4%
AW	Venable, mucky peat, 0 to 3 percent slopes, frequently flooded	B/D	1.9	42.2%
Totals for Area of Interest			**4.5**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Appendix D: Basin Runoff Calculations

RATIONAL METHOD RUNOFF ANALYSIS

Job #	1448-005	Date:	March 23, 2022
Job Name	Lot 1 Indian Meadows	Revised:	April 8, 2022
Designed by:	JLW		

Existing Basin 1 (EB1)

BASIN CHARACTERISTICS				TIME OF CONCENTRATION							RESULTS			
	Area, ac	% imp	Soil Type	Overland Flow - Surface Type 1		Overland Flow - Surface Type 2		Channel Flow		Tc, min	Event	C	*i*, in/hr	A, acres	Q, cfs
Landscape	2.86	2%	C	Surface Imperviousness	0.05	Surface Imperviousness	0.02	Land Surface	Paved Areas and Shallow Swales	Minimum	1.25 YR	0.08	0.7	2.96	0.17
Asphalt Parking & Walkways	0.10	100%		Length, ft	300	Length, ft	0	Length, ft	0	Tc, min	2-YR	0.08	1.1	2.96	0.25
Roof	0.00	90%	P2	Slope, percent	1.0000	Slope, percent	30.0000	Slope, ft/ft	2.0000	5.0	5-YR	0.18	1.6	2.96	0.86
Gravel	0.00	40%	1.4	Runoff Coefficient	0.18	Runoff Coefficient	0.162	Conveyance Coefficient	20	Final	10-YR	0.28	2.0	2.96	1.67
Other	0.00	0%						Velocity, ft/s	28.3	Tc, min	25-YR	0.39	2.6	2.96	3.04
	2.96	5%		Ti, min=	28.7	Ti, min=	0.0	Tt, min=	0.0	**28.7**	**100-YR**	**0.52**	**3.5**	**2.96**	**5.34**

Existing Basin 2 (EB2)

BASIN CHARACTERISTICS				TIME OF CONCENTRATION							RESULTS			
	Area, ac	% imp	Soil Type	Overland Flow - Surface Type 1		Overland Flow - Surface Type 2		Channel Flow		Tc, min	Event	C	*i*, in/hr	A, acres	Q, cfs
Landscape	0.81	2%	C	Surface Imperviousness	0.1	Surface Imperviousness	0	Land Surface	Paved Areas and Shallow Swales	Minimum	1.25 YR	0.10	1.6	0.86	0.13
Asphalt Parking & Walkways	0.05	100%		Length, ft	100	Length, ft	0	Length, ft	0	Tc, min	2-YR	0.10	2.3	0.86	0.19
Roof	0.00	90%	P2	Slope, percent	15.0000	Slope, percent	2.0000	Slope, ft/ft	0.0200	5.0	5-YR	0.20	3.4	0.86	0.58
Gravel	0.00	0%	1.4	Runoff Coefficient	0.21	Runoff Coefficient	0.15	Conveyance Coefficient	20	Final	10-YR	0.29	4.3	0.86	1.08
Other	0.00	0%						Velocity, ft/s	2.8	Tc, min	25-YR	0.40	5.6	0.86	1.94
	0.86	8%		Ti, min=	6.5	Ti, min=	0.0	Tt, min=	0.0	**6.5**	**100-YR**	**0.53**	**7.5**	**0.86**	**3.37**

Existing Basin 3 (EB3)

BASIN CHARACTERISTICS				TIME OF CONCENTRATION							RESULTS			
	Area, ac	% imp	Soil Type	Overland Flow - Surface Type 1		Overland Flow - Surface Type 2		Channel Flow		Tc, min	Event	C	*i*, in/hr	A, acres	Q, cfs
Landscape	0.08	2%	C	Surface Imperviousness	0.8	Surface Imperviousness	0	Land Surface	Paved Areas and Shallow Swales	Minimum	1.25 YR	0.59	1.7	0.39	0.39
Asphalt Parking & Walkways	0.31	100%		Length, ft	50	Length, ft	0	Length, ft	100	Tc, min	2-YR	0.59	2.4	0.39	0.57
Roof	0.00	90%	P2	Slope, percent	2.0000	Slope, percent	2.0000	Slope, ft/ft	0.0200	5.0	5-YR	0.62	3.6	0.39	0.89
Gravel	0.00	0%	1.4	Runoff Coefficient	0.63	Runoff Coefficient	0.15	Conveyance Coefficient	20	Final	10-YR	0.66	4.6	0.39	1.19
Other	0.00	0%						Velocity, ft/s	2.8	Tc, min	25-YR	0.70	6.0	0.39	1.63
	0.39	80%		Ti, min=	4.7	Ti, min=	0.0	Tt, min=	0.6	**5.3**	**100-YR**	**0.74**	**8.0**	**0.39**	**2.31**

Sub Basin 1 (SB1)

BASIN CHARACTERISTICS				TIME OF CONCENTRATION							RESULTS			
	Area, ac	% imp	Soil Type	Overland Flow - Surface Type 1		Overland Flow - Surface Type 2		Channel Flow		Tc, min	Event	C	*i*, in/hr	A, acres	Q, cfs
Landscape	0.16	2%	C	Surface Imperviousness	0.5	Surface Imperviousness	0	Land Surface	Grassed Waterways	Minimum	1.25 YR	0.33	1.7	0.31	0.18
Asphalt Parking & Walkways	0.15	100%		Length, ft	25	Length, ft	0	Length, ft	200	Tc, min	2-YR	0.33	2.5	0.31	0.26
Roof	0.00	90%	P2	Slope, percent	10.0000	Slope, percent	2.0000	Slope, ft/ft	0.0100	5.0	5-YR	0.39	3.7	0.31	0.45
Gravel	0.00	0%	1.4	Runoff Coefficient	0.4	Runoff Coefficient	0.15	Conveyance Coefficient	15	Final	10-YR	0.46	4.7	0.31	0.66
Other	0.00	0%						Velocity, ft/s	1.5	Tc, min	25-YR	0.53	6.0	0.31	0.99
	0.31	49%		Ti, min=	2.9	Ti, min=	0.0	Tt, min=	2.2	**5.1**	**100-YR**	**0.60**	**8.1**	**0.31**	**1.51**

Sub Basin 2 (SB2) - HOTEL A ROOFTOP

BASIN CHARACTERISTICS				TIME OF CONCENTRATION							RESULTS			
	Area, ac	% imp	Soil Type	Overland Flow - Surface Type 1		Overland Flow - Surface Type 2		Channel Flow		Tc, min	Event	C	*i*, in/hr	A, acres	Q, cfs
Landscape	0.00	2%	C	Surface Imperviousness	0.8	Surface Imperviousness	0	Land Surface	Grassed Waterways	Minimum	1.25 YR	0.73	1.7	0.35	0.44
Asphalt Parking & Walkways	0.00	100%		Length, ft	100	Length, ft	0	Length, ft	0	Tc, min	2-YR	0.73	2.5	0.35	0.63

RATIONAL METHOD RUNOFF ANALYSIS

Job #	1448-005	Date:	March 23, 2022
Job Name	Lot 1 Indian Meadows	Revised:	April 8, 2022
Designed by:	JLW		

Roof	0.35	90%	P2	Slope, percent	10.0000	Slope, percent	1.0000	Slope, ft/ft	0.0100	5.0	5-YR	0.75	3.7	0.35	0.97
Gravel	0.00	0%	1.4	Runoff Coefficient	0.63	Runoff Coefficient	0.15	Conveyance Coefficient	15	Final	10-YR	0.77	4.7	0.35	1.28
Other	0.00	0%						Velocity, ft/s	1.5	Tc, min	25-YR	0.80	6.1	0.35	1.72
	0.35	90%		Ti, min=	3.9	Ti, min=	0.0	Tt, min=	0.0	**5.0**	**100-YR**	**0.83**	**8.2**	**0.35**	**2.38**

Sub Basin 3 (SB3)

BASIN CHARACTERISTICS				TIME OF CONCENTRATION								RESULTS			
	Area, ac	% imp	Soil Type	Overland Flow - Surface Type 1		Overland Flow - Surface Type 2		Channel Flow		Tc, min	Event	C	*i*, in/hr	A, acres	Q, cfs
Landscape	0.09	2%	C	Surface Imperviousness	0.75	Surface Imperviousness	0	Land Surface	Grassed Waterways	Minimum	1.25 YR	0.56	1.1	0.38	0.23
Asphalt Parking & Walkways	0.29	100%		Length, ft	250	Length, ft	0	Length, ft	100	Tc, min	2-YR	0.56	1.5	0.38	0.33
Roof	0.00	90%	P2	Slope, percent	1.0000	Slope, percent	1.0000	Slope, ft/ft	0.0100	5.0	5-YR	0.59	2.3	0.38	0.52
Gravel	0.00	0%	1.4	Runoff Coefficient	0.58	Runoff Coefficient	0.15	Conveyance Coefficient	15	Final	10-YR	0.63	2.9	0.38	0.70
Other	0.00	0%						Velocity, ft/s	1.5	Tc, min	25-YR	0.67	3.8	0.38	0.97
	0.38	77%		Ti, min=	14.8	Ti, min=	0.0	Tt, min=	1.1	**15.9**	**100-YR**	**0.72**	**5.1**	**0.38**	**1.38**

Sub Basin 4 (SB4)

BASIN CHARACTERISTICS				TIME OF CONCENTRATION								RESULTS			
	Area, ac	% imp	Soil Type	Overland Flow - Surface Type 1		Overland Flow - Surface Type 2		Channel Flow		Tc, min	Event	C	*i*, in/hr	A, acres	Q, cfs
Landscape	0.01	2%	C	Surface Imperviousness	0.95	Surface Imperviousness	0.4	Land Surface	Grassed Waterways	Minimum	1.25 YR	0.78	1.7	0.15	0.20
Asphalt Parking & Walkways	0.14	100%		Length, ft	75	Length, ft	0	Length, ft	0	Tc, min	2-YR	0.78	2.5	0.15	0.29
Roof	0.00	90%	P2	Slope, percent	2.0000	Slope, percent	10.0000	Slope, ft/ft	0.0100	5.0	5-YR	0.79	3.7	0.15	0.44
Gravel	0.00	0%	1.4	Runoff Coefficient	0.82	Runoff Coefficient	0.35	Conveyance Coefficient	15	Final	10-YR	0.82	4.7	0.15	0.58
Other	0.00	0%						Velocity, ft/s	1.5	Tc, min	25-YR	0.85	6.1	0.15	0.77
	0.15	93%		Ti, min=	3.5	Ti, min=	0.0	Tt, min=	0.0	**5.0**	**100-YR**	**0.87**	**8.2**	**0.15**	**1.07**

Sub Basin 5 (SB5)

BASIN CHARACTERISTICS				TIME OF CONCENTRATION								RESULTS			
	Area, ac	% imp	Soil Type	Overland Flow - Surface Type 1		Overland Flow - Surface Type 2		Channel Flow		Tc, min	Event	C	*i*, in/hr	A, acres	Q, cfs
Landscape	0.01	2%	C	Surface Imperviousness	0.85	Surface Imperviousness	0.4	Land Surface	Grassed Waterways	Minimum	1.25 YR	0.79	1.5	0.17	0.20
Asphalt Parking & Walkways	0.16	100%		Length, ft	150	Length, ft	0	Length, ft	0	Tc, min	2-YR	0.79	2.2	0.17	0.29
Roof	0.00	90%	P2	Slope, percent	2.0000	Slope, percent	10.0000	Slope, ft/ft	0.0100	5.0	5-YR	0.81	3.2	0.17	0.44
Gravel	0.00	0%	1.4	Runoff Coefficient	0.68	Runoff Coefficient	0.35	Conveyance Coefficient	15	Final	10-YR	0.83	4.1	0.17	0.58
Other	0.00	0%						Velocity, ft/s	1.5	Tc, min	25-YR	0.86	5.3	0.17	0.78
	0.17	94%		Ti, min=	7.3	Ti, min=	0.0	Tt, min=	0.0	**7.3**	**100-YR**	**0.88**	**7.1**	**0.17**	**1.07**

Sub Basin 6 (SB6)

BASIN CHARACTERISTICS				TIME OF CONCENTRATION								RESULTS			
	Area, ac	% imp	Soil Type	Overland Flow - Surface Type 1		Overland Flow - Surface Type 2		Channel Flow		Tc, min	Event	C	*i*, in/hr	A, acres	Q, cfs
Landscape	0.04	2%	C	Surface Imperviousness	0.8	Surface Imperviousness	0.4	Land Surface	Grassed Waterways	Minimum	1.25 YR	0.58	1.3	0.18	0.14
Asphalt Parking & Walkways	0.14	100%		Length, ft	250	Length, ft	0	Length, ft	0	Tc, min	2-YR	0.58	1.9	0.18	0.19
Roof	0.00	90%	P2	Slope, percent	2.0000	Slope, percent	10.0000	Slope, ft/ft	0.0100	5.0	5-YR	0.61	2.8	0.18	0.31
Gravel	0.00	0%	1.4	Runoff Coefficient	0.63	Runoff Coefficient	0.35	Conveyance Coefficient	15	Final	10-YR	0.64	3.6	0.18	0.41
Other	0.00	0%						Velocity, ft/s	1.5	Tc, min	25-YR	0.69	4.6	0.18	0.57
	0.18	78%		Ti, min=	10.6	Ti, min=	0.0	Tt, min=	0.0	**10.6**	**100-YR**	**0.73**	**6.1**	**0.18**	**0.81**

Appendix E: TSS Calculations

TSS Removal

BMP Designation SB1 Water Quality Swale

Event Mean TSS Per Table 5.12.3

140 mg/L

Drainage Study: n=1 shall be used for grass swales.

Variable	Value	Unit	
n	1	-	(Turbulance Factor: 1=bad, 5=good)
V_s	0.0059	ft/sec	(Settling Velocity of Particles)
Q	0.18	ft^3/sec	(Applied Flow Rate, 1.25 Yr Peak Flow)
A	125	ft^2	(Area of Treatment)
R	**0.80**	-	(Fraction of solids removed)

TSS Concentration After Treatment

27.47 mg/L Min 80% Removal of Event Mean TSS

Drainage Study: 18.62

TSS Removal

BMP Designation SB3 Water Quality Swale

Event Mean TSS Per Table 5.12.3

140 mg/L

Drainage Study: n=1 shall be used for grass swales.

Variable	Value	Unit	
n	1	-	(Turbulance Factor: 1=bad, 5=good)
V_s	0.0059	ft/sec	(Settling Velocity of Particles)
Q	0.23	ft^3/sec	(Applied Flow Rate, 1.25 Yr Peak Flow)
A	150	ft^2	(Area of Treatment)
R	**0.79**	-	(Fraction of solids removed)

TSS Concentration After Treatment

28.88 mg/L Min 80% Removal of Event Mean TSS

Drainage Study: 49

TSS Removal

BMP Designation SB6 Water Quality Swale

Drainage Study: n=1 shall be used for grass swales.

Event Mean TSS Per Table 5.12.3

140 mg/L

Variable	Value	Unit	
n	1	-	(Turbulance Factor: 1=bad, 5=good)
V_s	0.0059	ft/sec	(Settling Velocity of Particles)
Q	0.14	ft^3/sec	(Applied Flow Rate, 1.25 Yr Peak Flow)
A	100	ft^2	(Area of Treatment)
R	**0.81**	-	(Fraction of solids removed)

TSS Concentration After Treatment

26.85 mg/L Min 80% Removal of Event Mean TSS

Drainage Study: 45

TSS Removal

BMP Designation SB8 Water Quality Swale

Event Mean TSS Per Table 5.12.3

140 mg/L

Drainage Study: n=1 shall be used for grass swales.

Variable	Value	Unit	
n	1	-	(Turbulance Factor: 1=bad, 5=good)
V_s	0.0059	ft/sec	(Settling Velocity of Particles)
Q	0.1	ft^3/sec	(Applied Flow Rate, 1.25 Yr Peak Flow)
A	100	ft^2	(Area of Treatment)
R	**0.86**	-	(Fraction of solids removed)

TSS Concentration After Treatment

20.29 mg/L Min 80% Removal of Event Mean TSS

Drainage Study: 43.26

Appendix F: Channel Flow Calculations

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Mar 28 2022

WQ Swale #3 (SB3) - Major Event Peak Flow

Trapezoidal

Bottom Width (ft)	= 4.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 100.00
Slope (%)	= 1.00
N-Value	= 0.050

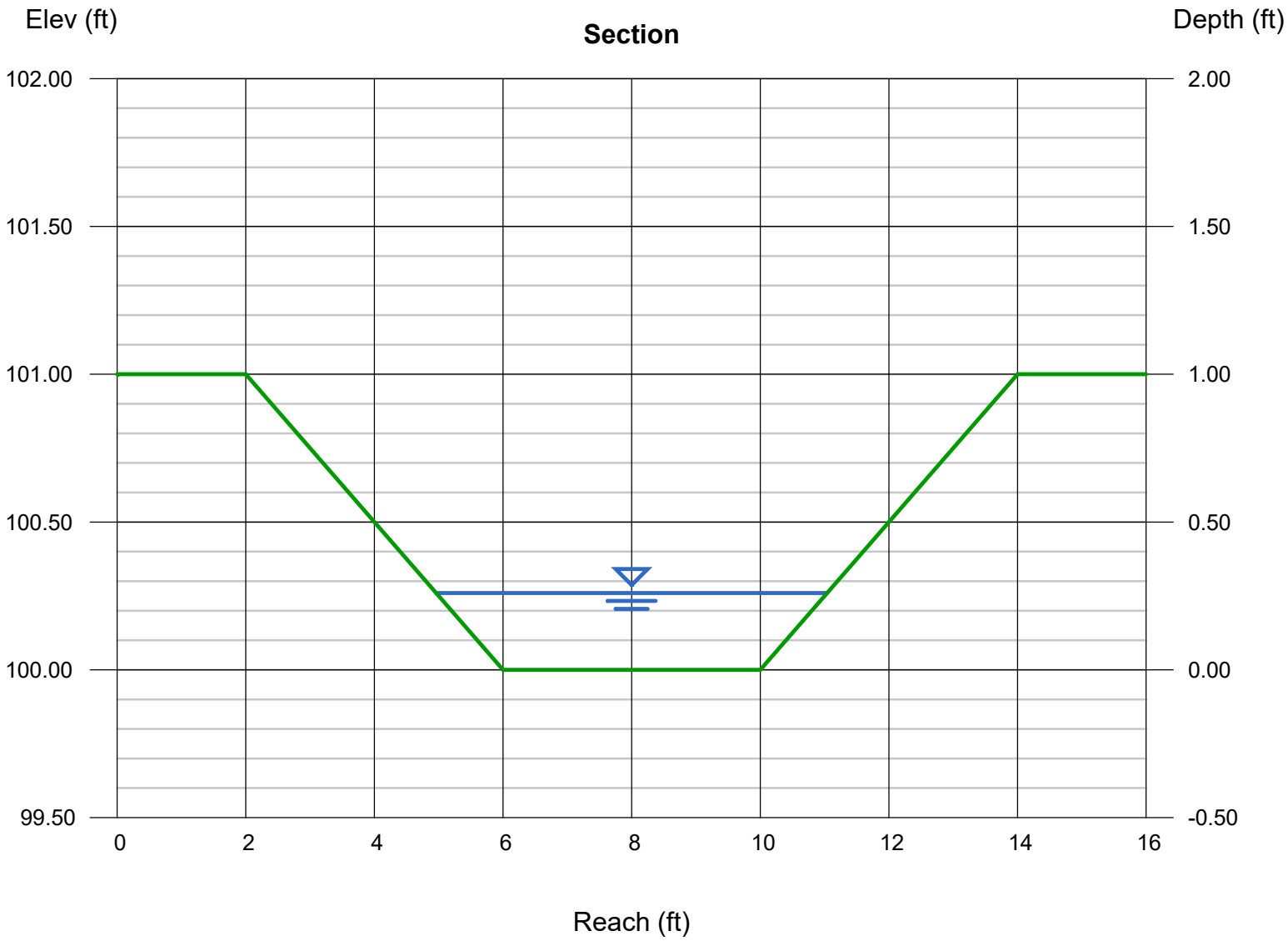
Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.38

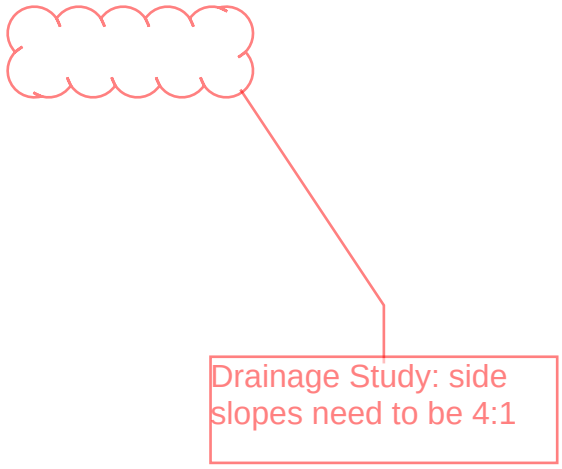
Highlighted

Depth (ft)	= 0.26
Q (cfs)	= 1.380
Area (sqft)	= 1.31
Velocity (ft/s)	= 1.05
Wetted Perim (ft)	= 6.14
Crit Depth, Yc (ft)	= 0.15
Top Width (ft)	= 6.08
EGL (ft)	= 0.28

Drainage Study: side slopes need to be 4:1

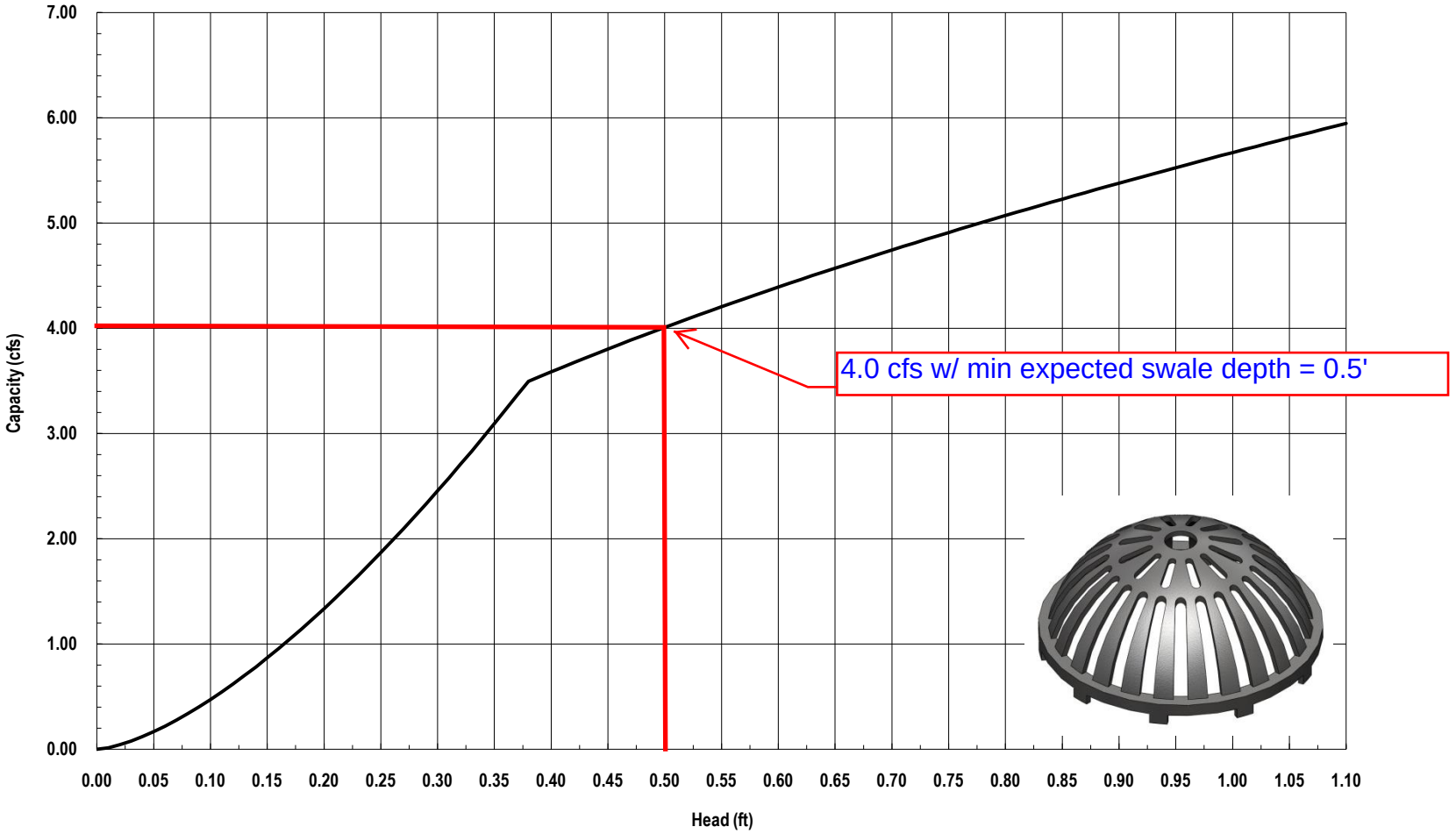


Appendix G: Inlet Capacity Curves



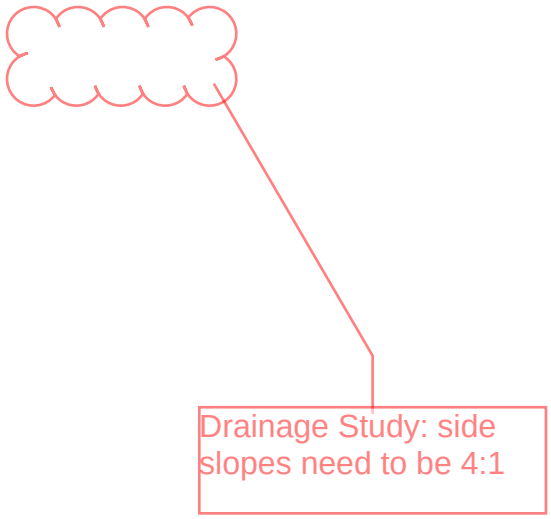
Drainage Study: side slopes need to be 4:1

Nyloplast 18" Dome Grate Inlet Capacity Chart



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

Appendix H: Storm Sewer Capacity Calculations & EGL/HGL Profiles



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Apr 20 2022

24-inch Outfall Pipe - for Major Event

Invert Elev Dn (ft)	=	6760.00
Pipe Length (ft)	=	45.00
Slope (%)	=	0.51
Invert Elev Up (ft)	=	6760.23
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

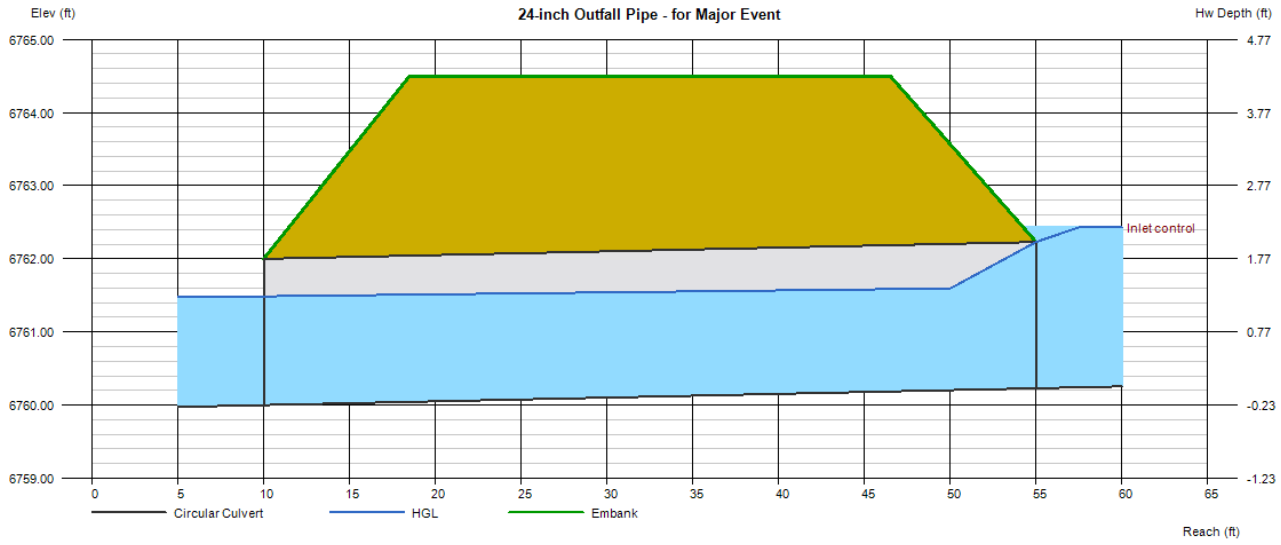
Top Elevation (ft)	=	6764.50
Top Width (ft)	=	28.00
Crest Width (ft)	=	5.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	14.55
Tailwater Elev (ft)	=	Normal

Highlighted

Qtotal (cfs)	=	14.55
Qpipe (cfs)	=	14.55
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.81
Veloc Up (ft/s)	=	6.30
HGL Dn (ft)	=	6761.49
HGL Up (ft)	=	6761.61
Hw Elev (ft)	=	6762.43
Hw/D (ft)	=	1.10
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Apr 13 2022

24-inch Outfall Pipe - 100-year Flooding Condition for Major Event

Invert Elev Dn (ft)	=	6760.00
Pipe Length (ft)	=	45.00
Slope (%)	=	0.51
Invert Elev Up (ft)	=	6760.23
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

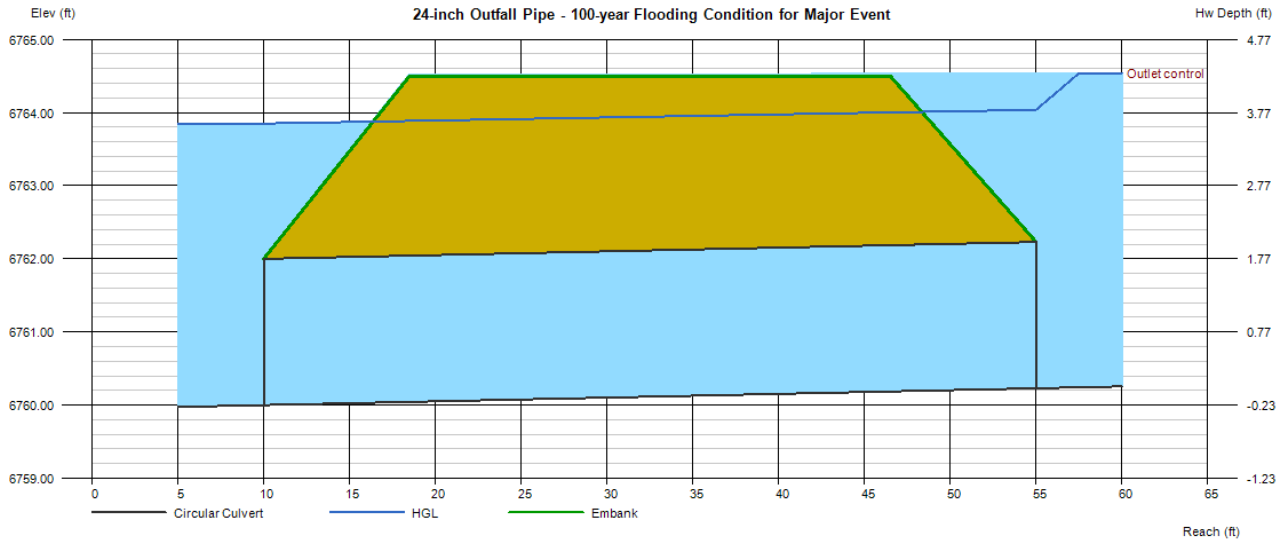
Top Elevation (ft)	=	6764.50
Top Width (ft)	=	28.00
Crest Width (ft)	=	5.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	14.55
Tailwater Elev (ft)	=	6763.85

Highlighted

Qtotal (cfs)	=	14.55
Qpipe (cfs)	=	14.54
Qovertop (cfs)	=	0.01
Veloc Dn (ft/s)	=	4.63
Veloc Up (ft/s)	=	4.63
HGL Dn (ft)	=	6763.85
HGL Up (ft)	=	6764.04
Hw Elev (ft)	=	6764.54
Hw/D (ft)	=	2.15
Flow Regime	=	Outlet Control



Hydraulic Grade Line Computations

MINOR EVENT FLOWS

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(%)	(ft)	(K)	(ft)
1	24	5.73	6760.01	6760.93	0.92	1.26	4.06	0.32	6761.25	0.000	49.535	6760.26	6761.10 j	0.84**	1.26	4.54	0.32	6761.43	0.000	0.000	n/a	1.50	n/a
2	18	5.19	6760.26	6761.14	0.88*	1.07	4.84	0.36	6761.50	0.000	91.758	6760.72	6761.60	0.88**	1.07	4.84	0.36	6761.96	0.000	0.000	n/a	1.50	n/a
3	12	2.01	6760.72	6761.60	0.88	0.73	2.75	0.12	6761.72	0.245	53.842	6760.99	6761.71	0.72	0.60	3.34	0.17	6761.88	0.366	0.306	0.165	0.50	0.09
4	12	1.57	6761.00	6761.79	0.79	0.67	2.35	0.09	6761.88	0.177	61.270	6761.31	6761.89	0.58	0.47	3.35	0.17	6762.06	0.416	0.297	0.182	0.57	0.10
5	12	1.13	6761.31	6761.99	0.68	0.34	2.00	0.06	6762.05	0.134	65.557	6761.63	6762.08 j	0.45**	0.35	3.25	0.16	6762.25	0.477	0.306	0.200	1.00	0.16
6	12	2.66	6760.72	6761.60	0.88	0.73	3.65	0.21	6761.80	0.430	115.214	6761.30	6762.10	0.80	0.67	3.97	0.24	6762.34	0.503	0.466	0.537	1.43	0.35
7	12	0.97	6761.30	6762.45	1.00	0.79	1.24	0.02	6762.47	0.063	184.481	6762.24	6762.71	0.47	0.36	2.69	0.11	6762.82	0.318	0.191	0.352	1.00	0.11

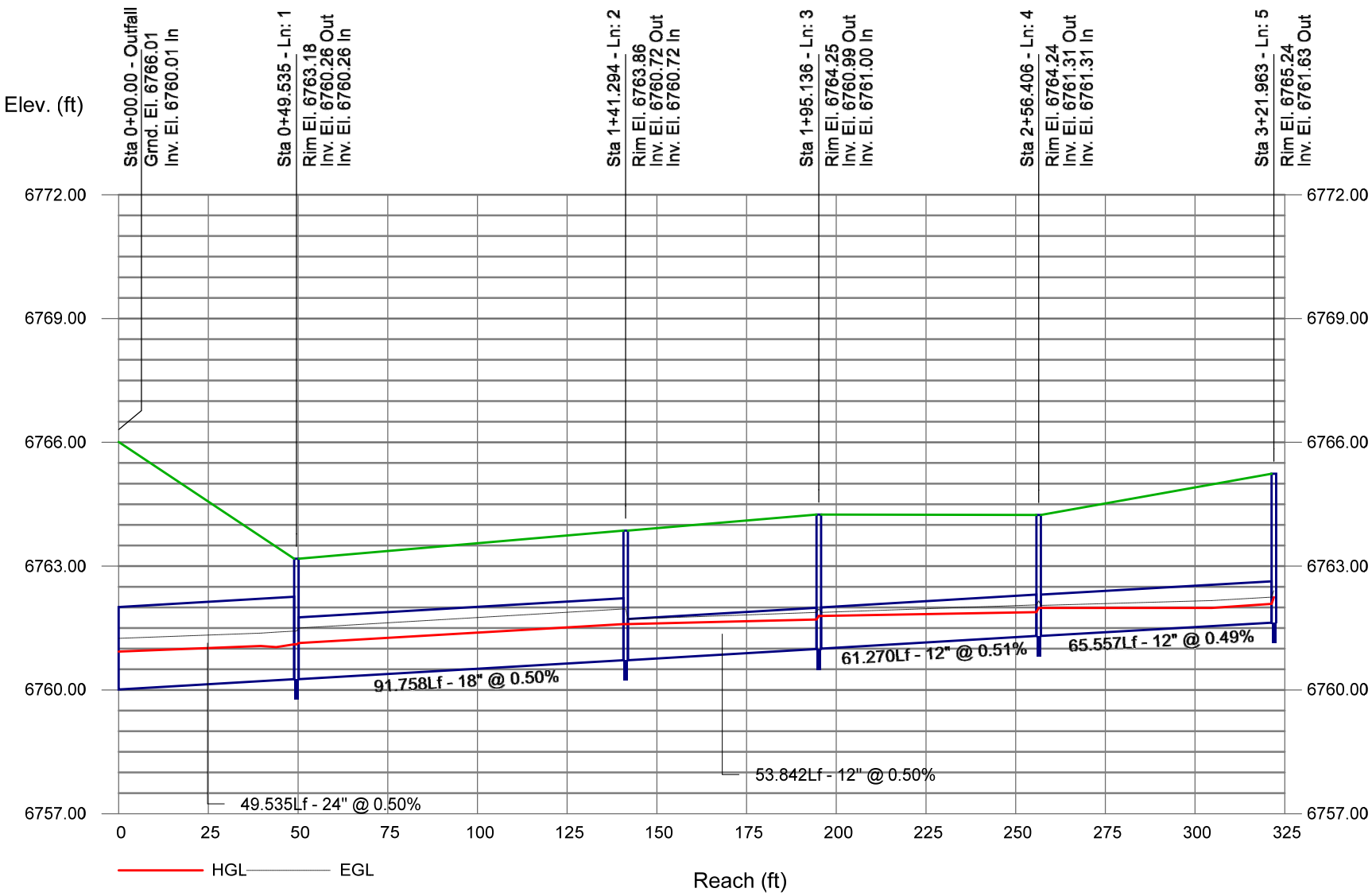
Project File: NETWORK_3-28-22_MINOR.stm | Number of lines: 7 | Run Date: 3/28/2022

Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

Storm Sewer Profile

is it? MINOR EVENT FLOWS

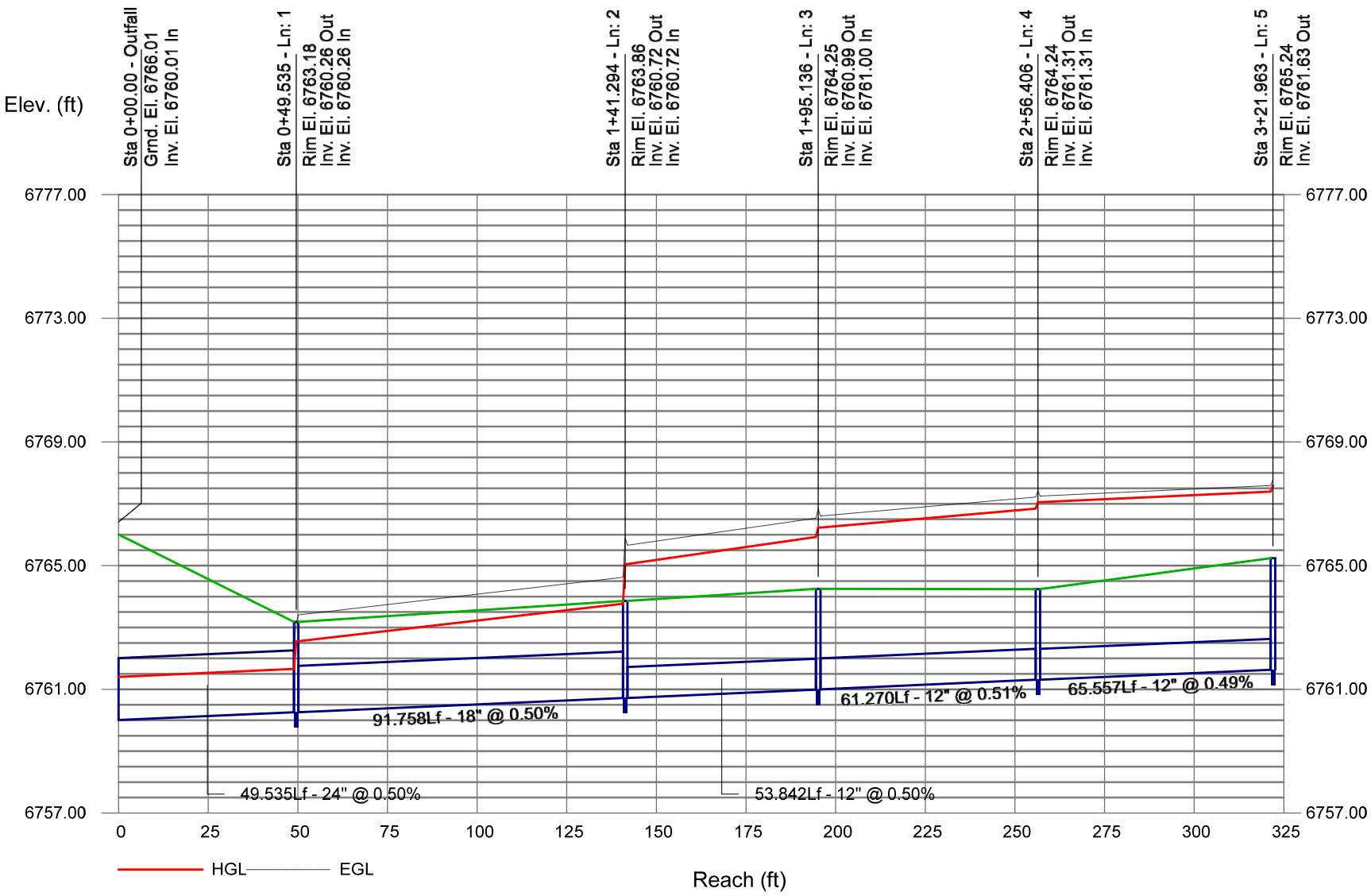
Proj. file: NETWORK_3-28-22_MINOR.stm



Storm Sewer Profile

MAJOR EVENT FLOWS

Proj. file: NETWORK_3-28-22_MAJOR.stm



Appendix I: Standard forms No. 3, 4, & 5

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

x A. Report typed and legible in 8½" x 11" format.
x B. Report bound (comb, spiral, or staple – no notebook).
x 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

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

III. Title Sheet

x A. Table of Contents.
____ B. Certification, PE Stamp, signature, and date from licensed Colorado PE.
x 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

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

V. Drainage Criteria and Methodology Used

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

VI. Existing Conditions (Pre-Development/Historic)

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

VII. Proposed Conditions

x A. Indicate ground cover, imperviousness, topography, and disturbed area (acres).
x B. Describe proposed stormwater system (sizes, materials, etc.).
x C. Describe proposed outlets and indicate historic and proposed flow for each.
x D. Include calculations for all culverts, ditches, ponds, etc. in appendix.
x E. Include a summary table for the 5- and 100-year events showing historic flow and proposed flow for total site and each basin.
x F. Discuss proposed easements.
x G. Describe off-site flows to be passed thru site.
n/a H. Summarize any impacts to downstream properties or indicate none. Reference CLOMR/LOMR and impacts.

I. Detention Ponds.
n/a 1. Indicate pond volume and area (size and depth) requirement.
n/a 2. Indicate release rates.
n/a 3. Discuss outfall design, location, and overflow location.
n/a 4. Discuss maintenance requirements.

J. Curb and Gutter
n/a 1. Indicate gutter capacity.
n/a 2. Indicate curb capacity.
n/a 3. Indicate design velocity
n/a 4. Indicate design depth of flow in street.

K. Culverts
x 1. Indicate whether each culvert is under inlet or outlet control.
x 2. Show that headwater is less than the maximum allowable.
x 3. Indicate design velocity.
x 4. Indicate required and provided flow rates.
x 5. Discuss whether outlet protection is required and what will be used.

L. Inlets
x 1. Indicate inlet capacity.
x 2. Indicate the type of inlet(s) used.

M. Channels
x 1. Indicate design velocity (and type of dissipation if required).
x 2. Indicate required and provided flow capacity.
x 3. Show critical cross-section(s) including water surface.

N. Site Discharge
n/a 1. Discuss use and design of detention to ensure discharge is less than or equal to historic flow.
x 2. Provide documentation that downstream facilities are adequate and no adverse impacts to downstream property owners (i.e. no rise certification)

VIII. Post Construction Stormwater Management

x 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

x A. Provide general summary.
x B. Note if site complies with criteria and any variances to criteria.
x 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.
x D. List proposed new stormwater system requirements.

X. References

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

XI. Tables

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

XII. Figures

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

XIII. Appendices

x A. Runoff Calculations.
x B. Culvert Calculations.
n/a C. Pond Calculations.
x D. Other Calculations.

Acknowledgements

Standard Form No. 3 was prepared by: Joe Wiedemeier, PE 2-10-2022
Date

Include Attachment A – Scope Approval Form (see Standard Form No. 5)
Include Attachment B – Storm Water Quality Plan (see Standard Form No. 4)

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

x A. Report typed and legible in 8½" x 11" format.
x B. Report bound (comb, spiral, or staple – no notebook) and in digital PDF format.
x 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

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

III. Title Sheet

x A. Table of Contents.
_____ B. Certification, PE Stamp, signature and date from licensed Colorado PE (for Final).
x 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

x 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.
x B. State purpose and goal of Stormwater Quality Plan and report along with any special requirements of the desired outcome.
x C. List any project stakeholders and/or requestors.
x D. Describe the background of the flooding source and any previous studies.

V. Design Criteria and Methodology Used

X A. Identify design rainfall and storm frequency used to design permanent stormwater treatment facilities.

X B Identify the runoff calculation method used to design permanent stormwater treatment facilities.

X C. Identify the standard the design will meet and the means and methodologies by which it will use to meet the standard.

X D. Provide all details supporting the use of the selected design standard.

VI. Proposed Conditions

X 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.

X B. Describe potential site contaminant sources including sediment.

X C. Identify source and quantity of on-site and off-site stormwater flows that need to be managed and how they will be managed.

X 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.

n/a 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).

X 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.

n/a 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.

X 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.

X B. Indicate, describe, and detail the permanent stormwater treatment facilities.

x C Include section details where necessary of the permanent treatment facilities.

x D. Provide an inspection and maintenance schedule and procedure of permanent treatment facilities and who is responsible for them.

X E. Identify design specifications for construction.

Acknowledgements

Standard Form No. 4 prepared by: Joe Wiedemeier, PE 2-10-2022
Date

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

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:	Lot 1 Indian Meadows (Name subject to change)
Project location:	Lot 1 Indian Meadows
Developer name/contact info:	GRAY STONE, LLC
Drainage engineer name/contact info:	Joe Wiedemeier, PE FPSE
Application Type:	Development Plan
Proposed Land Use:	Hotel - Commercial

Project Site Parameters	
Total parcel area (acres):	3.875
Disturbed area (acres):	3.5
Existing impervious area (acres, if applicable):	0.25
Proposed new impervious area (acres):	2.5
Proposed total impervious area (acres):	2.5
Proposed number of project outfalls:	3
Number of additional parking spaces:	160+-
Description and site percentage of existing cover/land use(s):	Vacant except for paved access roads Sparse vegetation and bare ground Wetlands located along the east property line
Description and site percentage of proposed cover/land use(s):	Commercial Development (2) new hotels and all associated infrastructure
Expected maximum proposed conveyance gradient (%):	5%
Description of size (acres) and cover/land use(s) of offsite areas draining to the site	Minimal off site areas draining to the site.

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 main basins, multiple sub basins
Presence of pass through flow (circle):	YES (NO)
Description of proposed stormwater conveyance on site:	See drainage exhibit, DR1. Sheet flow, curb/gutter combo (rollback curbs), inlets, swales, WQ features
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:	Runoff from DB1 basin will outfall along the east property line and in the form of concentrated flow at the NE property corner.
Detention expected onsite (circle):	YES (NO) Per hydraulic study of Walton Creek/Yampa
Presence of Floodway or Floodplain on site (circle):	(YES) NO Floodplains associated with the site
Anticipated modification of Floodway or Floodplain proposed (circle):	(YES) NO Floodplain development proposed
Describe culvert or storm sewer conveyance evaluative method:	mannings for partial flow, inlet and outlet control for full flow conditions

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)

Project Permanent Stormwater Treatment	
Justification of choice of proposed design standard, including how the site meets the constrained redevelopment standard, infiltration test results, etc.:	Possibly both WQCV and TSS standards for a treatment train configuration. Otherwise one of the two will be used. Perhaps one large sand filter to treat all runoff.
Concept-level permanent stormwater treatment facility design details (type, location of facilities, proprietary structure selection, treatment train concept, etc.):	Combination of water quality swales, rain gardens, and sand filtration. Facilities will be combined into the parking lot design and primarily along the east property line and NE property corner (sand filter location). Water quality swale along the East edge of parkign lot.
Proposed LID measures to reduce runoff volume:	Possible rain gardens designed into the landscape islands in the parking lot.
Will treatment evaluation include off-site, pass through flow (circle):	YES (NO)

Approvals

Joe Wiedemeier, PE FPSE 10-13-2021 515-451-5377

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

Approved By:

APPROVED
to be generally in
accordance with
CITY ENGINEERING
STANDARDS
12/17/2021

Printed Name:
City Engineer

Date

Appendix J: Project Design Sheets

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: Lot 1 Indian Meadows Development Plan- Phase 1 Cross Access Road	
Project Location: Legal: Lot 1 Indian Meadows F3 (Address TBD)	
Submitted Date:	Submitted By: Joe Wiedemeier
Acreage Disturbed: 0.60	
Existing Impervious: 5-10%	New Net Impervious: 75-80%
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)

Design Standard	*Quantity*	*Tributary Area*	*Location/Identifying information*
WQCV			
Pollutant Removal	(4)	0.50 acres	Water Quality Swales along the New Cross Access Road
Runoff Reduction			

DESIGN CHECKLIST – Pollutant Removal (TSS) Standard

POLLUTANT REMOVAL STANDARD Criteria

Treatment facilities must be designed to provide treatment of the 80th percentile storm event. The treatment facilities shall be designed to treat stormwater runoff in a manner expected to reduce the event mean concentration of total suspended solids (TSS), at a minimum, to a median value of 30mg/L or less for 100% of the site. Substantiating data must meet criteria in Volume 3 of the USDCM and be included in the submittal. All runoff from the site shall be captured. 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 t and it is not practicable to construct a separate treatment facility for those same portions of the site.

Complete checklist if using the Pollutant Removal Standard to meet Design Standard requirements.

Project Name: Lot 1 Indian Meadows Development Plan- Phase 1 Cross Access Road			
Preparer	**City**	**Requirements**	
		Facilities provide treatment of the 80th percentile storm event. The facilities treat stormwater runoff in a manner expected to reduce the event mean concentration of total suspended solids (TSS) to a median value of 30mg/L or less for 100% of the site.	
		Facility Type: WQ Swale	Facility Location: Along cross access road
		Storm event: 1.25 year	
		TSS mg/L reduction: varies, < 30 mg/L	
		% of site treated: 0.51 acres	
		See Drainage Report section: 4	

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):	
		16 %	0.08 Size (acres)
		Provide explanation of why the excluded area is impractical to treat: Areas not receiving water quality treatment for Phase 1 includes the area along the east property line that does not drain into the swale along the east side of the new cross access road.	
		Provide explanation of why another facility is not practicable for the untreated area: It is not required because the runoff area is not paved and will not contain pollutants.	

Appendix K: Operation and Maintenance Plan for Water Quality Swales

OPERATION AND MAINTENANCE PLAN
-
PERMANENT STORM WATER QUALITY BMPs for the HOTELS AT LOT 1 INDIAN MEADOWS

1. GENERAL PROJECT INFORMATION

A. (ADDRESS TBD), STEAMBOAT SPRINGS, ROUTT COUNTY, COLORADO.

2. GENERAL FACILITY DESCRIPTION

THE FACILITIES ASSOCIATED WITH THIS DEVELOPMENT ARE GRASS-LINED WATER QUALITY (WQ) SWALES AND BIO-RETENTION (RAIN GARDEN) THAT ARE CAPABLE OF TREATING RUNOFF FOR TOTAL SUSPENDED SOLIDS (TSS) AND OTHER POLLUTANTS COMMONLY DERIVED FROM VEHICLES AND OTHER MOTORIZED EQUIPMENT. THESE STORM WATER BEST MANAGEMENTS PRACTICES (BMPs) WERE DESIGNED AND ENGINEERED ACCORDING TO STEAMBOAT SPRINGS STANDARDS AND SPECIFICATIONS.

3. INSPECTION & MAINTENANCE FREQUENCY & PROCEDURE

A. THE FOLLOWING TABLES PROVIDES AN INSPECTION AND MAINTENANCE SCHEDULE FOR THE PROPOSED BMPs:

Grass Lined Water Quality Swale Inspection and Maintenance Schedule	
Activity	**Required Frequency**
Inspection for uniform cover, sediment accumulation, rill and gully development, and impacts from foot or vehicle traffic; maintain as necessary. Debris and litter removal.	Twice annually
Aeration practices	None required. Swales will be outfitted with a turf reinforcement matting that will provide a growing medium for grasses. Aeration would damage the turf reinforcement matting and should not be performed.
Mowing	As needed to maintain ~6" height
Irrigation and application of fertilizer, herbicide, and pesticide	As needed to maintain vegetative health.

Rain Garden Inspection and Maintenance Schedule	
Activity	**Required Frequency**
Inspection for uniform mulch cover, plant health, sediment accumulation, rill and gully development, and impacts from foot or vehicle traffic; maintain as necessary. Debris, sediment, and litter removal.	Twice annually. Typcailly performed in the spring and fall periods.
Inspect curb cut inlets and storm inlets. Ensure inlets are functioning properly and free of sediment buildup, debris, trash, etc.	Twice annually. Typcailly performed in the spring and fall periods.
Weeding and Mulching. Pull intrusive weeds. Apply a shredded hardwood much 2"-3" deep AFTER the afformentioned activties are completed.	Once annually. Typically performed in the spring.
Irrigation and watering.	Rain gardens are outfitted with irrigation. Ensure irrigation heads are working properly. Adjust irrigation schedule accordingly based on moisture conditions. Watering frequency is vital for first few years of vegetation establishment. At a minimu, rain gardens should be irrigated for 2 mins for grasses and shrubs and 5 minutes for trees at least two times per week durign the growing season. (Spring/Summer/Early Fall)
Pruning may be performed on well established shrubs and trees by qualified personell.	As needed.

B. INLET INSPECTION AND MAINTENANCE: ALL PRIVATE STORMWATER INLETS ARE OUTFITTED W/ 12" SUMPS. INLETS AND SUMPS SHOULD BE INSPECTED AND MAINTAINED ONCE ANNUALLY FOR BLOCKAGE AND SEDIMENT BUILDUP IN THE SUMP. SEDIMENT SHOULD BE REMOVED FROM SUMPS IF THE DEPTH EXCEEDS 6". DAMAGED INLETS SHOULD BE REPAIRED OR REPLACED IMMEDIATELY.

4. EQUIPMENT, STAFFING AND VEGETATION MANAGEMENT

A. EQUIPMENT:
A.A. VEGETATION MAINTENANCE TOOLS SUCH AS A LAWNMOWER, WEED WHACKER, AND BLOWER.
A.B. SEDIMENT AND DEBRIS REMOVAL TOOLS SUCH AS RAKES, SHOVELS, BUCKETS, BLOWERS, AND/OR LANDSCAPING VACUUM.

B. STAFFING: TBD BY OWNER

C. SEEDING: WQ SWALES WILL BE INSTALLED W/ PROPER SEEDING AND FERTILIZER TO ESTABLISH GROWTH. ANY BARE AREAS THAT APPEAR DURING THE WQ SWALE LIFE CYCLE SHOULD BE RE-SEEDED AS NECESSARY W/ NATIVE SEED MIX.

D. MOWING: VEGETATION HEALTH SHOULD BE MAINTAINED IN AND AROUND THE WQ SWALES WITH REGULAR MOWING AND WEEDEATING. THE REQUIRED MOW AREA POST-CONSTRUCTION FOR THE ENTIRE SITE WAS ESTIMATED TO BE 0.25 ACRES.

E. UNDESIRABLE VEGETATION AND WEEDS: UNDESIRABLE VEGETATION AND NOXIOUS WEEDS SHOULD BE REMOVED REGULARLY BY THE LANDSCAPING STAFF. WEEDS SHOULD BE MOWED OR REMOVED BY HAND.

5. SNOW AND ICE CONTROL

THE GRASS LINED WQ SWALES WILL SERVE AS A SNOW STORAGE AREAS DURING THE WINTER MONTHS. SNOW CAN BE PLOWED INTO THE SWALES. PLOW OPERATORS SHALL TAKE CARE NOT TO DAMAGE OR DISTURB THE FINISHED GRADE OF THE SWALES OR THE INSTALLED TRM AND UNDERDRAIN FEATURES. PLOW OPERATORS SHALL TAKE CARE NOT TO DAMAGE STORMWATER INLET GRATES.

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

A. ACCESS INFORMATION AND DETAILS: ACCESS FROM THE SHARED PRIVATE ACCESS RUNNING NORTH-SOUTH OFF STONE LANE. .

B. MAINTENANCE OPERATIONS WILL REQUIRE TEMPORARY OBSTRUCTION OF THE PRIVATE SHARED CROSS ACCESS ROAD TO FAIRFIELD INN FOR MAINTENANCE OPERATIONS. A RIGHT-OF-WAY PERMIT SHOULD NOT BE REQUIRED FOR TEMPORARY OBSTRUCTIONS BUT IT SHOULD BE NOTED THAT TRAFFIC WILL LIKELY NEED TO MANAGED FOR A ONE-WAY SCENARIO IF A SERVICE VEHICLE AND EQUIPMENT IS TO PARK ON THE CROSS ACCESS ROAD SHOULDER. MAINTENANCE CREWS SHOULD PLACE MUTCD APPROVED TRAFFIC CONTROL DEVICES (ORANGE CONES AND/OR BARRICADES) AROUND ALL VEHICLES AND EQUIPMENT THAT ARE TEMPORARILY WITHIN THE 30-FOOT ACCESS EASEMENT.

7. HYDRAULIC DESIGN OF WATER QUALITY SWALES

A. WQ SWALE #1 FLOW RATES (CFS)
A.A. DESIGN EVENT (1.25 YEAR) 1.23 CFS
A.B. MINOR EVENT (5-YEAR) 2.80 CFS
A.C. MAJOR EVENT (100-YEAR) 7.56 CFS

B. WQ SWALE #2 FLOW RATES (CFS)
B.A. DESIGN EVENT (1.25 YEAR) 0.54 CFS
B.B. MINOR EVENT (5-YEAR) 1.22 CFS
B.C. MAJOR EVENT (100-YEAR) 3.18 CFS

C. WQ SWALE #3 FLOW RATES (CFS)
C.A. DESIGN EVENT (1.25 YEAR) 0.54 CFS
C.B. MINOR EVENT (5-YEAR) 1.22 CFS
C.C. MAJOR EVENT (100-YEAR) 3.18 CFS

D. WQ SWALE #4 FLOW RATES (CFS)
D.A. DESIGN EVENT (1.25 YEAR) 0.54 CFS
D.B. MINOR EVENT (5-YEAR) 1.22 CFS
D.C. MAJOR EVENT (100-YEAR) 3.18 CFS

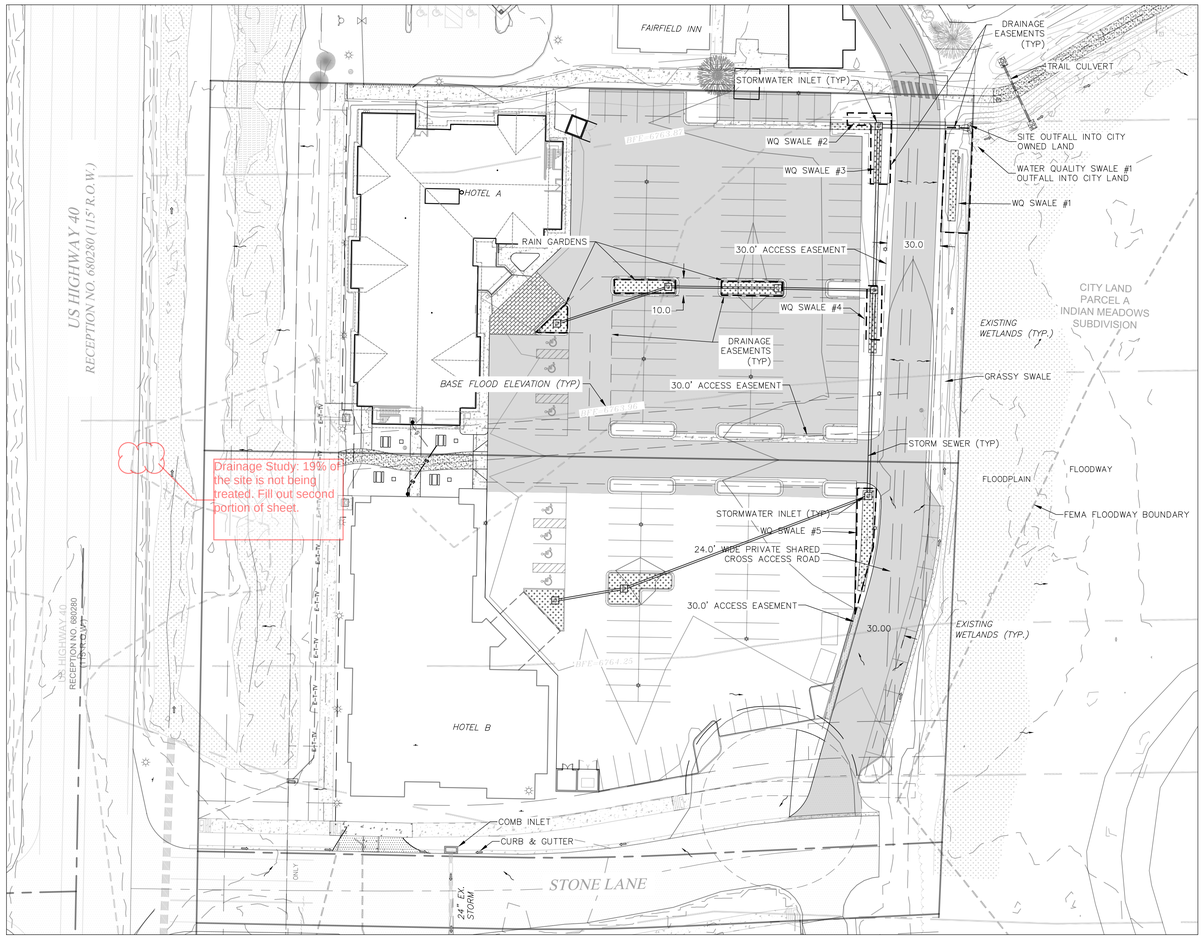
8. SENSITIVE AREA, WETLANDS & PERMITS

C. WETLANDS ARE PRESENT ON CITY OWNED LAND JUST ALONG THE EASTERLY PROPERTY LINE AND WHERE DRAINAGE FROM THE HOTEL PARKING LOTS ULTIMATELY OUTFALLS. WETLANDS SHOULD NOT BE DISTURBED AND SEDIMENT AND DEBRIS FROM MAINTENANCE OPERATIONS SHALL NOT BE DISCARDED INTO WETLANDS.

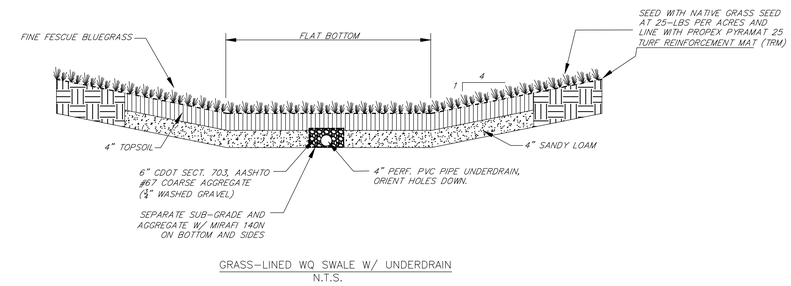
9. MISCELLANEOUS INFORMATION

A. PROJECT SURVEY: EXISTING CONDITIONS AND TOPOGRAPHIC SURVEY WAS PREPARED BY FOUR POINTS SURVEYING & ENGINEERING. ANY QUESTIONS COMMENTS OR CONCERNS REGARDING THIS OPERATION AND MAINTENANCE PLAN SHOULD BE CONVEYED TO FOUR POINTS SURVEYING AND ENGINEERING AND THE ENGINEER OF RECORD.

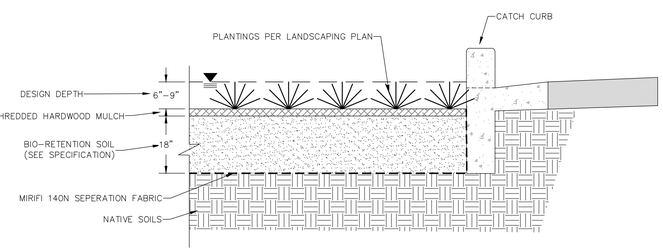
10. BMP DETAILS (SEE BELOW)



PROPOSED CONDITIONS SITE PLAN



GRASS-LINED WQ SWALE W/ UNDERDRAIN
N.T.S.



BIO-RETENTION/RAIN GARDEN DETAIL
N.T.S.

DRAFT - NOT FOR PRODUCTION

FOUR POINTS SURVEYING ENGINEERING

No.	DATE	REVISIONS	INT
1.	4/15/22	PER 1ST DRT COMMENTS 4/5/22	JLW

LOT 1 INDIAN MEADOWS
PHASE II DEVELOPMENT PLAN
LOT 1, INDIAN MEADOWS FILING NO. 3
STEAMBOAT SPRINGS, CO 80487

HORIZONTAL SCALE
0 40' 80'
SCALE: 1" = 40'

DATE: 4/14/2022
JOB #: 1448-005
DRAWN BY: SDW
DESIGN BY: JLW
REVIEW BY: RL

IF THIS DRAWING IS PRESENTED IN A FORMAT OTHER THAN 24" X 36", THE GRAPHIC SCALE SHOULD BE UTILIZED.

DRAWING:
OPERATION AND MAINTENANCE PLAN

SHEET NO.
OM1