Drainage Report - Final

Adeles Acres Subdivision

March 2, 2023
(Revised -------)

Prepared by:

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Job No. 2060-001

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Engineer's Certification

I hereby certify that the Drainage Report for the design of **Adeles Acres Subdivision** was prepared by me, or under my direct supervision, in accordance with the provisions of the Grand Junction Municipal Code Title 28 STORMWATER MANAGEMENT MANUAL (SWMM), for the owners thereof. I understand that the **City of Fruita** does not and will not assume liability for drainage facilities designed by others.

Jeff Mace, P.E.
State of Colorado Reg. No. 37343

Developer's Certification

I, _____ hereby certify that the drainage facilities for the **Adeles Acres Subdivision** shall be constructed according to the design presented in this report. I understand that the **City of Fruita** reviews drainage plans but cannot, on behalf of the **Adeles Acres Subdivision** guarantee that the preliminary drainage design review will absolve **Futurado Development LLC** and/or their successors and/or assigns of future liability for improper design.

(THIS PAGE WILL BE SIGNED FOR FINAL SUBMITTAL)

_____ **(Name of Developer)**

_____ **(Authorized Signature)**

_____ **(Date)**

I. Introduction

A. Background

The purpose of this Drainage Report is to identify pre-development and post-development drainage conditions for the proposed Adeles Acres Subdivision. This report identifies the following items with respect to the site:

- existing drainage patterns and issues
- developed drainage patterns
- potential drainage issues resulting from development
- solutions to the potential drainage issues
- design of the various elements of the storm drain system for the site
- water quality requirements for developed runoff
- post construction BMP's

This report is intended to show the full-buildout feasibility of the proposed Adeles Acres Subdivision development project. Any phasing of construction progress shall follow the overall proposed drainage patterns outlined in this report, while providing temporary means to convey runoff to the desired outfall(s), using temporary BMP's as needed.

B. Project Location

The proposed project site is located at the southeast corner of the intersection of 19 Road and J.2 Road in Fruita, Colorado. The current project address is **1024 19 Road, Fruita, CO 81521 (Parcel No. 2697-153-00-181)**. In more legal terms, the project site is in the north half of the SW ¼ of the SW ¼ of Section 15, Township 1 North, Range 2 West of the Ute Meridian, Mesa County, Colorado. Refer to **Figure 1** for the General Location Map of the proposed development.

Access to the project site will be from the south side of J.2 Road at the proposed entrance for the development (proposed Lily Street). Currently, J.2 Road is a two-way gravel road east of 19 Road, and a two-lane paved road west of 19 Road. 19 Road is a two-way paved road with gravel shoulders. The proposed project parcel is occupied by a single residence and shows signs of recent livestock activities. Onsite structures include fencing, small sheds, a garage, a house, and a tall cell phone tower near the northwest corner of the property.

The surrounding area contains a mix of uses, including single family residential and agricultural uses. The proposed project site is zoned Agricultural, along with the parcels located directly to the north, west, south, and northwest. The Palmer Subdivision is located directly to the east and southeast and is zoned Residential.

C. Project Description

The project parcel is approximately 15.01 acres of agricultural use consisting of livestock activities and crop cultivation with a single-family residence present. This parcel is being subdivided into 48 single-family residential lots, with supporting right-of-way (ROW), Homeowner's Association Tracts, and easements for utility and access agreements. The project parcel is bounded on the west by 19 Road, on the North by

J.2 Road, on the east and southeast by the Palmer Subdivision, and on the south by Parcel No. 2697-153-01-001.

Existing vegetation at the proposed project site consists of desert shrubs and brushes in fair condition (~50% cover), along with several cottonwoods and other deciduous trees dispersed across the property. The existing residence has landscaping and a grass lawn around the house. The property is approximately split into thirds by existing wood and wire fencing. The eastern third of the property appears to be undeveloped rangeland with natural desert vegetation. The western third has a large cell phone tower, a residence, several sheds, and mostly bare ground. The middle-third of the property shows signs of livestock activities and/or horse boarding. Web Soil Survey obtained from the NRCS web site shows soils present at the site consist entirely of Fruitland sandy clay loam (0-2% slopes). Fruitland sandy clay loam is classified as Hydrologic Soil Group B. Group B soils have slower infiltration rates than Group A soils, and higher infiltration rates than Group C and Group D soils. NRCS Soil information is included in Appendix A.

The proposed development is entirely within the 117 Major Drainage Basin in Mesa County, CO. The 117 Major Drainage Basin flows to the Colorado River, approximately 1.5 miles south of the site. A graphical representation of the project boundary in relation to the major drainage basins is provided with **Figure 2**. There are no mapped FEMA Floodplains within or adjacent to the project site. A FEMA FIRM Map for the area is available in Appendix A.

D. Previous Investigations

No previous investigations involving the project parcel are known to exist.

II. Drainage System Description

A. Existing Drainage Conditions

Existing topography at the site consistently slopes from northeast to southwest with typical grades ranging between 0.5% and 2.0%. Earthen berms and private irrigation ditches border the project parcel on the north, east, and parts of the southern boundary. These existing features act as drainage boundaries keeping offsite runoff from entering the proposed project parcel and maintaining historic drainage patterns.

A roadside swale on the east side of the 19 Road corridor carries local runoff to the south along the western boundary of the project parcel. Runoff generated from the project area travels from east-to-west and ultimately discharges at the southwest corner of the parcel into the roadside swale. The swale drains south within the 19 Road corridor to an existing irrigation structure at the northeast corner of the J Road & 19 Road intersection. From there, flows are conveyed west and collected into the Grand Valley Drainage District's (GVDD) Coup Drain. All runoff generated from the proposed development is within the 117 Major Drainage Basin in Mesa County, and ultimately tributary to the Colorado River approximately 1.5 miles south of the project site.

For analysis of the existing site conditions, the project area has been evaluated with existing topography and imagery available from the Mesa County GIS website, as well as topographic survey information collected specific to this project. The project area

has been divided into separate sub-basins representing the various flow paths and tributary areas for each identified drainage design point. Two separate sub-basins have been delineated for the existing conditions analysis of the proposed development project. Refer to **Figure 3** for a layout of the existing conditions sub-basins and design points in relation to the project parcel. **Table 1** provides a summary of the existing conditions sub-basins that were delineated and analyzed for this project.

Table 1: Existing Conditions Sub-Basin Information

Sub-Basin ID	Design Point	Area (acres)	Soil Group	Percent Impervious	Design Storm Peak Runoff Rates (cfs)		
					2-Year	10-Year	100-Year
EC-01	E1	14.55	B	5%	0.22	0.94	2.82
EC-02	E2	0.72	B	24%	0.02	0.44	0.89

B. Master Drainage Plan

No "Master Drainage Plan" is known to exist for the subject property.

C. Offsite Tributary Area

Runoff from the south side of the J.2 Road corridor flows into a small existing roadside drainage swale located between the edge of gravel road and the north edge of the concrete irrigation ditch. The swale carries corridor runoff west to the intersection with 19 Road where flows in excess of the roadside swale capacity are captured by the adjacent irrigation ditch and carried west through the culvert crossing underneath 19 Road. Analysis of local runoff contributing to this historic project discharge point is provided in the existing conditions and proposed conditions analysis of this project. Additional flows carried by the existing irrigation ditch have not been quantified as part of this project, as those are considered undeveloped pass-through flows for the project site.

D. Proposed Drainage System Description

The proposed project will include lot grading, vertical curb and gutter, back lot drainage, storm drain, and a detention pond with outlet structure. Runoff from the developed areas will sheet flow to the curb and gutter sections of the proposed road or to the back-lot v-pans. From there, runoff will be directed to storm drain inlets where it will be collected and conveyed through the site to the stormwater pond at the western end of the development. The proposed grading and layout of the subdivision divides the project site into several separate sub-basins used for the developed conditions analysis of the project.

Seven separate sub-basins have been delineated and analyzed for the proposed conditions analysis of the proposed development. Refer to **Figure 4** for a layout of the proposed sub-basins in relation to the project parcel. Design runoff calculations for each of the sub-basins associated with the project have been completed using the Rational method as outlined in section 28.28 in the SWMM. Detailed information about sub-basin breakdown, site imperviousness, and Rational runoff coefficient calculations are provided in Appendix B. **Table 2** provides a summary of the proposed sub-basins that were delineated and analyzed as part of this project.

Table 2: Proposed Conditions Sub-Basin Information

Sub-Basin ID	Design Point	Area (acres)	Soil Group	Percent Impervious	Design Storm Peak Runoff Rates (cfs)		
					2-Year	10-Year	100-Year
DC-01	D1	7.35	B	61%	3.47	6.65	14.66
DC-02	D2	2.05	B	64%	1.16	2.20	4.64
DC-03	D3	1.56	B	55%	0.81	1.62	3.76
DC-04	D4	0.98	B	10%	0.06	0.25	1.54
DC-05	D5	2.62	B	20%	0.26	0.72	2.91
DC-06	D6	0.75	B	19%	0.09	0.26	0.75

The proposed detention pond is a permanent stormwater solution designed to adequately provide water quality and stormwater detention measures for the Adeles Acres Subdivision. The pond is positioned within HOA Tract A of the development. The pond has been designed to hold the required water quality capture volume (WQCV), while providing detention storage for excess runoff during the 10-year and 100-year storm events. **Table 3** provides a summary of calculated water surface elevations and associated stage-storage volumes within the proposed detention pond for each design event.

Table 3: Pond Water Surface Elevation and Volume Summary

Event	Elevation	Volume (ft^3)
Top of Pond	4,545.20	52,287
100-Year WSEL	4,542.66	19,618
Top of Structure	4,542.21	16,881
10-Year WSEL	4,541.42	8,890
Pond/Structure Bottom	4,539.16	0

A Geotechnical Report for the project area was performed by Huddleston-Berry in January 2023. The report includes analysis of two test pit sites in the area of the proposed detention pond. Excerpts from the Geotechnical Report are included in the Appendix. The report shows groundwater to be present at approximately 8 feet below the existing ground surface in the location of the proposed detention pond. The proposed pond bottom has been kept approximately 1.5 feet higher than the discovered groundwater table to prevent seepage.

The project parcel has two separate project discharge points where concentrated stormwater runoff leaves the site. One discharge point is an irrigation ditch at the northwest corner of the parcel where the ditch is piped underneath 19 Road to the west. The second discharge point is near the southwest corner of the parcel where surface flows join the 19 Road roadside drainage swale flowpath on the east side of 19 Road. Should the pond outlet system become clogged or unfunctional, there is adequate freeboard in the proposed pond to hold the runoff from storm events ranging in intensities up to the 100-year storm event. Should the pond ever be overtopped,

proposed and existing grades will direct overflow southwest to the existing historical drainage point at the southwest corner of the parcel. **Table 4** provides the existing and proposed discharge rates for the development. Refer to Figures 3 and 4 for Project Discharge Point locations.

Table 4: Project Discharge Rates

Project Discharge Point ID	Project Discharge Point Location Description	Contributing Design Points to Project Discharge Point	Contributing Sub-basins to Project Discharge Point	Peak Flow at Discharge Point	
				Minor Storm 10-Year (cfs)	Major Storm 100-Year (cfs)
Z1	Existing Conditions - Southwest Property Boundary	E1	EC-01	1.19	9.09
N2	Proposed Conditions - Southwest Property Boundary	D6 & D8	DC-01, DC-02, DC-03, DC-04, DC-05 & DC-06	2.12	9.05
Z2	Existing Conditions - J 2/10 Road Drain Culvert	E2	EC-02	0.64	1.09
N3	Proposed Conditions - J 2/10 Road Drain Culvert	D7	DC-07	0.64	1.10

Per SWMM requirements, the proposed discharge rates for the project have been kept to historic flow rates (existing conditions flow rates). As shown in Table 4, developed conditions and existing conditions peak flows are approximately the same. Although project discharge point N3 shows an increase of 0.01 cfs during the 100-year runoff event, this amount of flow is considered negligible per standard engineering practices.

E. Drainage Facility Maintenance

Ownership and maintenance of the proposed drainage improvements within public ROW shall be by the City of Fruita. All storm drain, the detention pond, and other drainage facilities within Property Owner's Association tracts and easements and will be owned and maintained by the Property Owner's Association. Inspection of the drainage facility and associated BMP's shall be as per Sections 28.16.120 and 28.64.130 of the Stormwater Management Manual (SWMM).

The developed drainage for the site has been designed to minimize maintenance; there are no mechanical items to check and maintain (i.e., pumps). Anticipated maintenance includes periodic (1-2 times per year and as needed after major storm events) clearing of debris from drains, trash racks, and the water quality orifice plate. Periodic sediment removal from the pond and outlet system may be required. The removal frequency will vary depending on the sediment removal loading through the system to the detention pond, but it is unlikely sediment removal would be required more often than once every 5 to 10 years.

III. Drainage Analysis and Design Criteria

A. Regulations

The policy, design criteria, design constraints, methods of analysis, recommendations, and conclusions presented in this report are in conformance with standard engineering practice and the Stormwater Management Manual.

B. Development Criteria

No drainage constraints were noted for this project.

C. Hydrologic Criteria

The hydrologic design criteria presented in this report are in conformance with standard engineering practice and the Stormwater Management Manual, except as noted within the report.

D. Hydraulic Criteria

The hydraulic design criteria presented in this report are in conformance with standard engineering practice and the Stormwater Management Manual, except as noted within the report.

E. Variance from Criteria

No variances from the SWMM are requested for this project.

F. Calculation Methodology

Rational method calculations have been used to model basin runoff for this project. Autodesk Storm and Sanitary Analysis 2022 has been used to model the routing hydraulics. The Mile High Flood District Detention Basin Design Workbook has been used for the Pond modeling and outlet structure design. The Autodesk software and selected methods are all accepted by the regulatory and engineering community and are within standard engineering practice.

G. Calculation and Modeling Results

Analysis results of the proposed site drainage conditions are included in the Appendix and highlighted below.

1. Design Storms

Major and Minor Design Storm Runoff associated with this project has been calculated with the Rational method, as outlined in Section 28.28.100 of the SWMM. Site specific precipitation depth information used for analysis of this project has been downloaded from the NOAA Atlas 14 online server. NOAA Precipitation data is provided in Appendix A. Rational method runoff calculations are provided in Appendix B.

2. Sub-Basins

Two existing sub-basins have been analyzed for the existing conditions analysis of the project site. Seven separate sub-basins have been analyzed for the fully developed conditions analysis of the proposed subdivision. Sub-basin layouts for the existing and

developed conditions, along with design storm peak flows for each sub-basin, are shown on **Figures 3** and **4**, respectively.

3. Storm Drain Pipes

The proposed drainage system requires several storm drain pipes and structures. **Table 5** provides a summary of the proposed storm drain pipes needed for the full buildout of the proposed subdivision. As shown, velocities for all proposed pipes are within SWMM criteria.

Table 5: Proposed Storm Drain Pipes

Pipe ID	Pipe Material	Pipe Diameter (inches)	Pipe Length (ft)	Pipe Slope (%)	2-yr Peak Flow in Pipe (cfs)	2-yr Max Velocity in Pipe (ft/sec)	100-yr Peak Flow in Pipe (cfs)	100-yr Max Velocity in Pipe (ft/sec)	Max Flow Depth/ Total Depth Ratio (ft)
K1-K2	RCP	24.0	60.0	0.50	4.31	3.86	18.13	5.77	1.00
K2-K3	RCP	24.0	119.0	0.50	4.33	3.58	18.13	5.77	1.00
K3-K4	RCP	24.0	31.0	0.50	3.46	2.82	14.60	4.65	1.00
L1-L2	RCP	18.0	115.0	0.50	0.78	2.63	3.67	3.92	0.98
M1-M2	RCP	18.0	101.0	0.40	0.08	1.21	2.28	3.52	0.46
N1-N2	RCP	18.0	85.3	0.40	0.08	1.25	2.29	3.14	0.43
N2-N3	RCP	18.0	685.0	0.40	0.08	1.28	2.33	3.30	0.43
N3-N4	RCP	18.0	645.0	0.40	0.08	1.36	2.32	3.66	0.41
N4-N5	RCP	18.0	475.0	0.30	0.08	1.19	2.31	3.37	0.44
N5-N6	RCP	18.0	451.0	0.30	0.08	1.15	2.31	3.47	0.45

4. Storm Drain Inlets

The proposed drainage system requires several storm drain inlets to collect stormwater runoff. **Table 6** provides a summary of the proposed storm drain inlets for the proposed development during the minor (2-year) and major (100-year) storm events, respectively.

Table 6: Proposed Storm Drain Inlets

Inlet ID	Type	Sump, or On-Grade Min Slope (%)	Grate Elevation (ft)	Max HGL Elevation Attained (ft)	Invert Elevation (ft)	2-Year Peak Flow to Inlet (cfs)	100-Year Peak Flow to Inlet (cfs)
SDCI-K3	Double Inlet	Sump	4,544.12	4,544.09	4,540.67	1.16	4.64
SDCI-K4	Double Inlet	Sump	4,544.12	4,544.55	4,540.82	3.47	14.66
SDCI-L2	Single Inlet	Sump	4,544.35	4,542.69	4,541.25	0.81	3.76

As shown, the hydraulic grade line does not exceed the grate or the allowable ponding depth of any proposed inlets during the 100-year design storm event. All inlet capacities are adequate, per SWMM inlet capacity charts provided in the Appendix. As shown on the capacity charts, Double Curb Inlets have a capacity to capture 15.4

cfs while meeting 100-year design storm criteria, which includes a 1.0-foot ponding depth above the flowline or grate elevation of the inlet (SWMM section 28.44.130). At the low-point of the proposed subdivision road where SDCI-K3 & SDCI-K4 are positioned in the proposed storm system layout, the ponding of water will overtop the road crown before reaching a depth of 0.5 feet and spill into the double inlet on the other side (West side) of the road (SDCI-K3). Developed conditions flow analysis shows that SDCI-K3 would have enough capacity as a single curb inlet to handle the half-street flows directed to it. However, SDCI-K3 has been intentionally oversized to be a double curb inlet at the low-point to provide the extra capture capacity for accepting spill-over flows from the east side of the road. The combined capture capacity at the low point is expected to adequately keep flow/ponding depths within SWMM criteria.

5. Hydraulic Grade Line

The hydraulic grade line (HGL) does not exceed the grate elevations of the proposed inlets (or manholes) during all design storm events, per SWMM criteria. Detailed hydraulic modeling output for each design storm is provided in the Appendix. Profile views of each storm line during the 100-year design storm event are also provided in the Appendix.

6. Street Capacity

Street capacities for the street sections were checked based on the 100-year design storm peak flow rates generated for the maximum combined flow to a half-street section during fully developed conditions. There are no issues with half-street conveyance capacity for each sub-basin, per SWMM Figures 28.44.100(a). See the SWMM half-street capacity sheet provided in the Appendix for more detail.

7. Outlet Protection

Maximum peak discharge rates have been analyzed for all storm outfalls to determine the need for riprap protection. Detailed riprap calculations are provided in the Appendix for the fully developed conditions of the subdivision. Riprap locations and dimensions are shown on the construction plans.

IV. Post Construction Stormwater Management

A. Stormwater Quality Control Measures

The detention pond for this project has been designed to hold the 100-year storm event, including the WQCV, without overtopping. The Mile High Flood District Detention Basin Design Workbook was used to help design the pond outlet structure configuration for this project. The pond acts as an extended detention basin that treats the WQCV and drains the pond within SWMM guidelines. Discharge rates from the pond are metered by the outlet works to not exceed historic conditions. Detention Basin Design Workbook calculations and Pond Drain Times are provided in Appendix B of this report.

B. Stormwater Quality Calculations

The WQCV was determined based on the percent imperviousness of the fully developed subdivision and all areas tributary to the proposed detention pond. WQCV was calculated using Section 28.64.100 in the SWMM. WQCV calculations are provided in Appendix B of this report.

V. Conclusions

A. Compliance with Manual

The policy, design criteria, design constraints, methods of analysis, recommendations, and conclusions presented in this report are in conformance with standard engineering practice and the Stormwater Management Manual.

B. Design Effectiveness

This design will be very effective for controlling runoff from this site and will provide stormwater quality measures.

C. Areas in Flood Hazard Zone

There are no areas within the proposed project site that are classified as Flood Hazard Zones. There are no floodplains within the project area.

D. Variances from Manual

No variances from the manual are requested for this project.

VI. References

1. Grand Junction Municipal Code Title 28 STORMWATER MANAGEMENT MANUAL (SWMM), Title 28 STORMWATER MANAGEMENT MANUAL (codepublishing.com)

2. City of Fruita GIS Website, City Map (fruita-gis.maps.arcgis.com)

3. Mesa County Colorado GIS Website, https://gis.mesacounty.us/ .

4. Natural Resources Conservation Service National Cooperative Soils Survey Website, http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx .

5. FEMA Flood Map Service Center website, https://msc.fema.gov/portal .

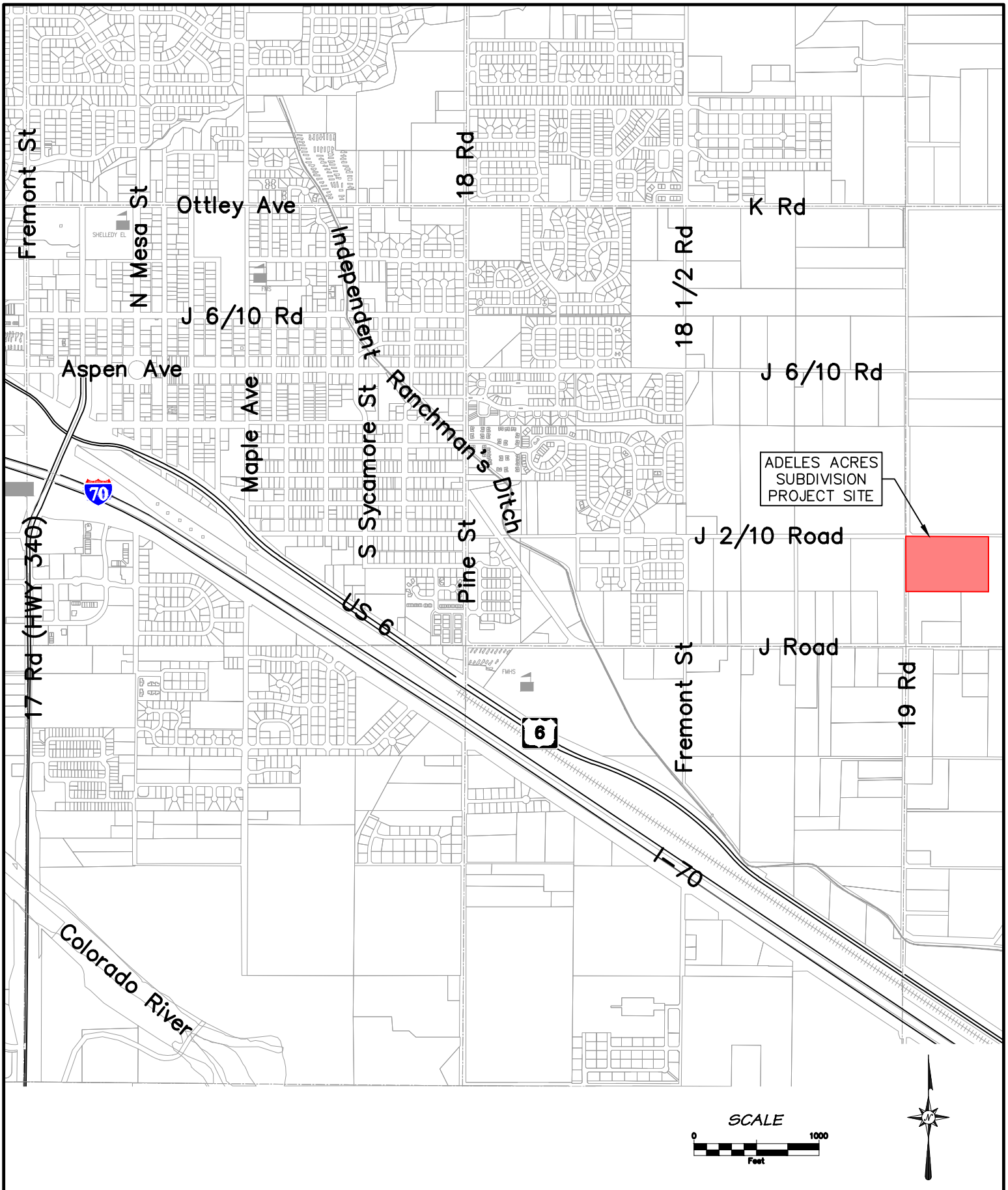
6. Geotechnical and Geologic Hazards Investigation 1024 19 Road, Fruita, Colorado, Project #02594-0001, January 12, 2023, Huddleston-Berry Engineering & Testing, LLC.

7. Urban Storm Drainage Criteria Manual, Volumes 1, 2, & 3; Mile High Flood District, Denver, Colorado; originally published 1969 and revised January 2021.

8. Mile High Flood District Detention Basin Design Workbook, Version 4.05 (January 2022).

FIGURES

1. General Location Map
2. Major Basin & Floodplain Map
3. Existing Conditions Drainage Map
4. Developed Conditions Drainage Plan



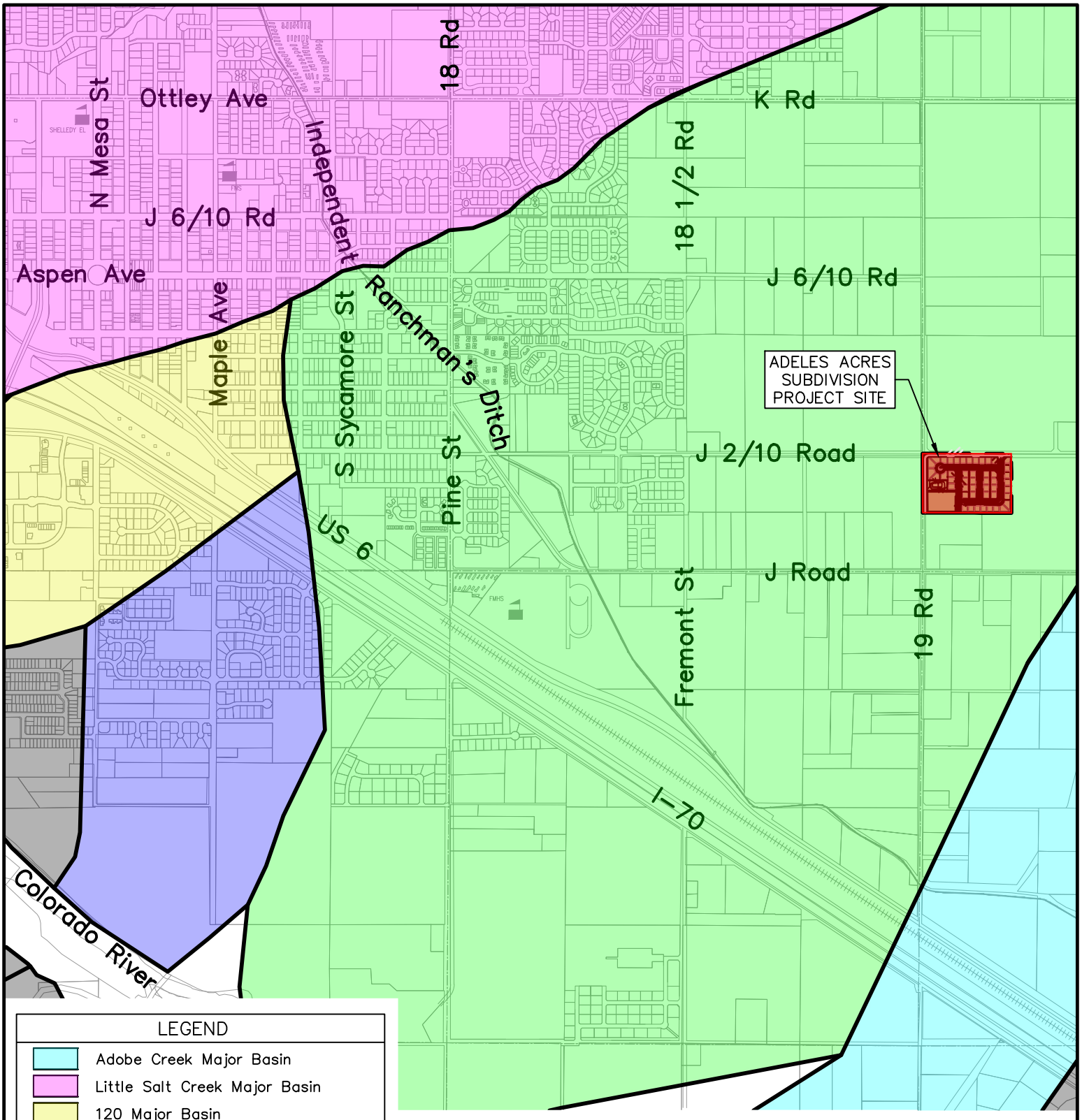
ADELES ACRES SUBDIVISION

GENERAL LOCATION MAP

DATE: 31.JAN.2023

Figure 1

RIVER CITY CONSULTANTS



LEGEND

- Adobe Creek Major Basin
- Little Salt Creek Major Basin
- 120 Major Basin
- 118 Major Basin
- 117 Major Basin
- Project Boundary
- Major Basin Area
- Major Basin Boundary

NOTE:

1. The entire proposed project area is within the 117 Mesa Major Drainage Basin.
2. There are no FEMA Floodplains in or adjacent to the site.

SCALE

0 1,500

Feet

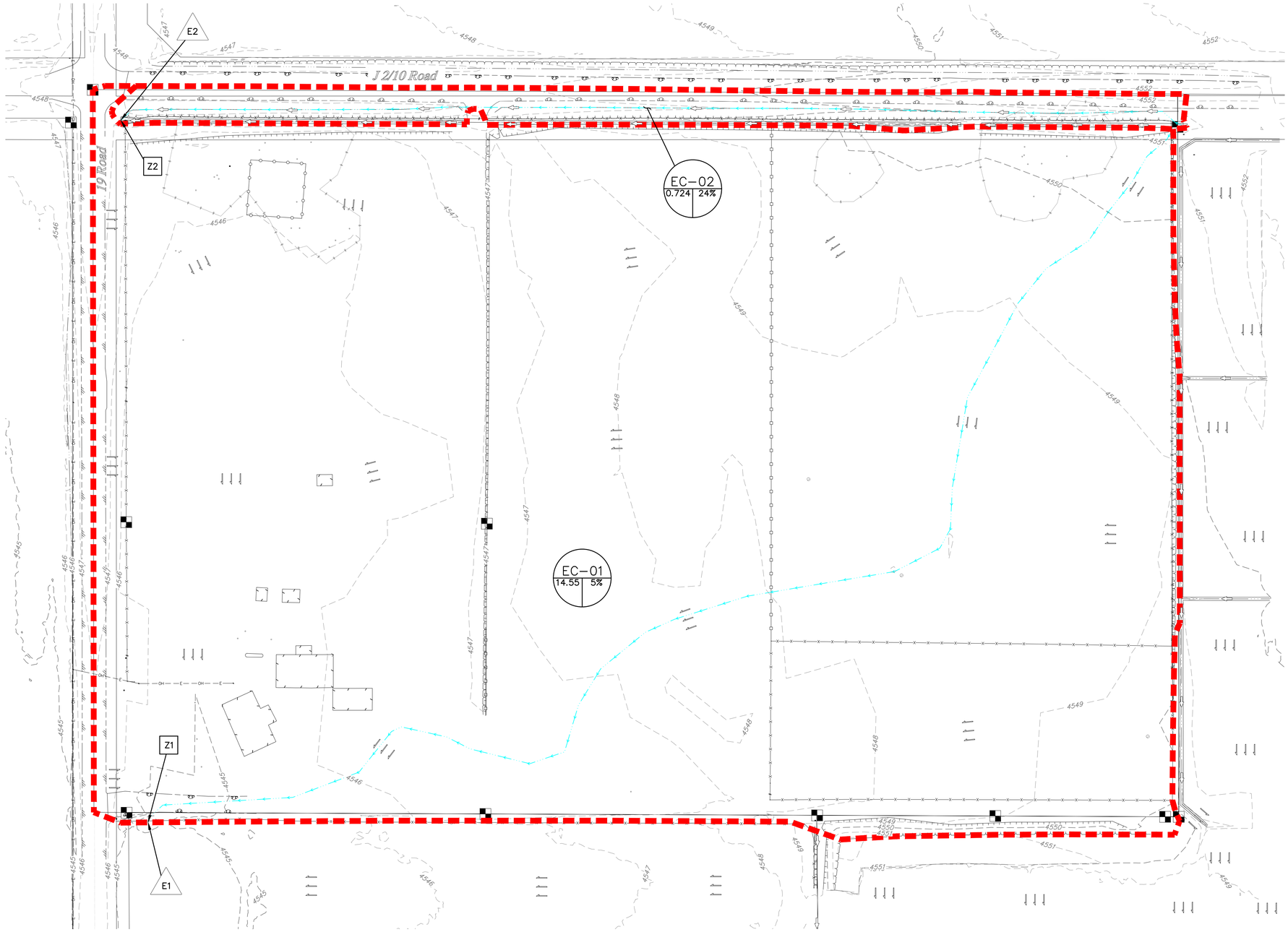
ADELES ACRES SUBDIVISION

MAJOR BASIN & FLOODPLAIN MAP

DATE: 31.JAN.2023

Figure 2

RIVER CITY CONSULTANTS



LEGEND

- A – SUB-BASIN ID
- B – ACREAGE
- C – COMPOSITE PERCENT IMPERVIOUS
- D – DESIGN POINT (SEE TABLE FOR FLOWS)
- E – DISCHARGE POINT LOCATION
- EXISTING SHEET FLOW
- EXISTING CONCENTRATED FLOW
- SUB-BASIN BOUNDARY
- SUB-BASIN FLOWPATH

EXISTING CONDITIONS SUB-BASIN TABLE

Sub-Basin ID	Design Point ID	Area (acres)	Soil Group	Percent Impervious	Design Storm Peak Runoff Rates (cfs)		
					2-Year	10-Year	100-Year
EC-01	E1	14.55	B	5%	0.22	0.94	2.82
EC-02	E2	0.72	B	24%	0.02	0.44	0.89

HISTORIC CONDITIONS PROJECT DISCHARGE RATES

Project Discharge Point ID	Project Discharge Point Location Description	Project Discharge Point Contributing Design Points	Project Discharge Point Contributing Sub-basins	Peak Flow at Discharge Point	
				Minor Storm 10-Year (cfs)	Major Storm 100-Year (cfs)
Z1	Existing Conditions - Southwest Property Boundary	E1	EC-01	0.94	2.82
Z2	Existing Conditions - J 2/10 Road Drain Culvert	E2	EC-02	0.44	0.89

NOTE:

1. EXISTING PARCELS, UTILITIES, AND SURFACE CONTOURS ARE TAKEN FROM MESA COUNTY GIS. THESE ITEMS ARE APPROXIMATE AND FOR INFORMATIONAL PURPOSES ONLY.
2. PERMISSION TO REPRODUCE THESE PLANS IS HEREBY GIVEN TO MESA COUNTY FOR COUNTY PURPOSES ASSOCIATED WITH NEW PLAN REVIEW, APPROVAL, PERMITTING, INSPECTION AND CONSTRUCTION OF WORK.

Project Benchmark
Found 2" Aluminum CapNE Corner
Marked "DH SURVEYS INC"
South of J 1/2 Road
NORTHING: 67185.23
EASTING: 53517.93
ELEVATION: 4551.66
DATUM SOURCE: MCLCS Zone "GVA" (NAVD 88)

SCALE (FEET)
0 50 100
HORIZONTAL
VERTICAL: n/a
CONTOUR INTERVAL: 1 FT

PROJECT PHASE: Preliminary DATE ISSUED:

NO.	DATE	REVISION	BY

S:\PROJECTS\2060 Futurado Development LLC\001 1024 19 Road\Design\Drainage\01-DWG\2060-001 Fig 3 & 4.dwg [Fig3] 3/2/2023 7:03:10 PM

PRELIMINARY

RIVER CITY CONSULTANTS
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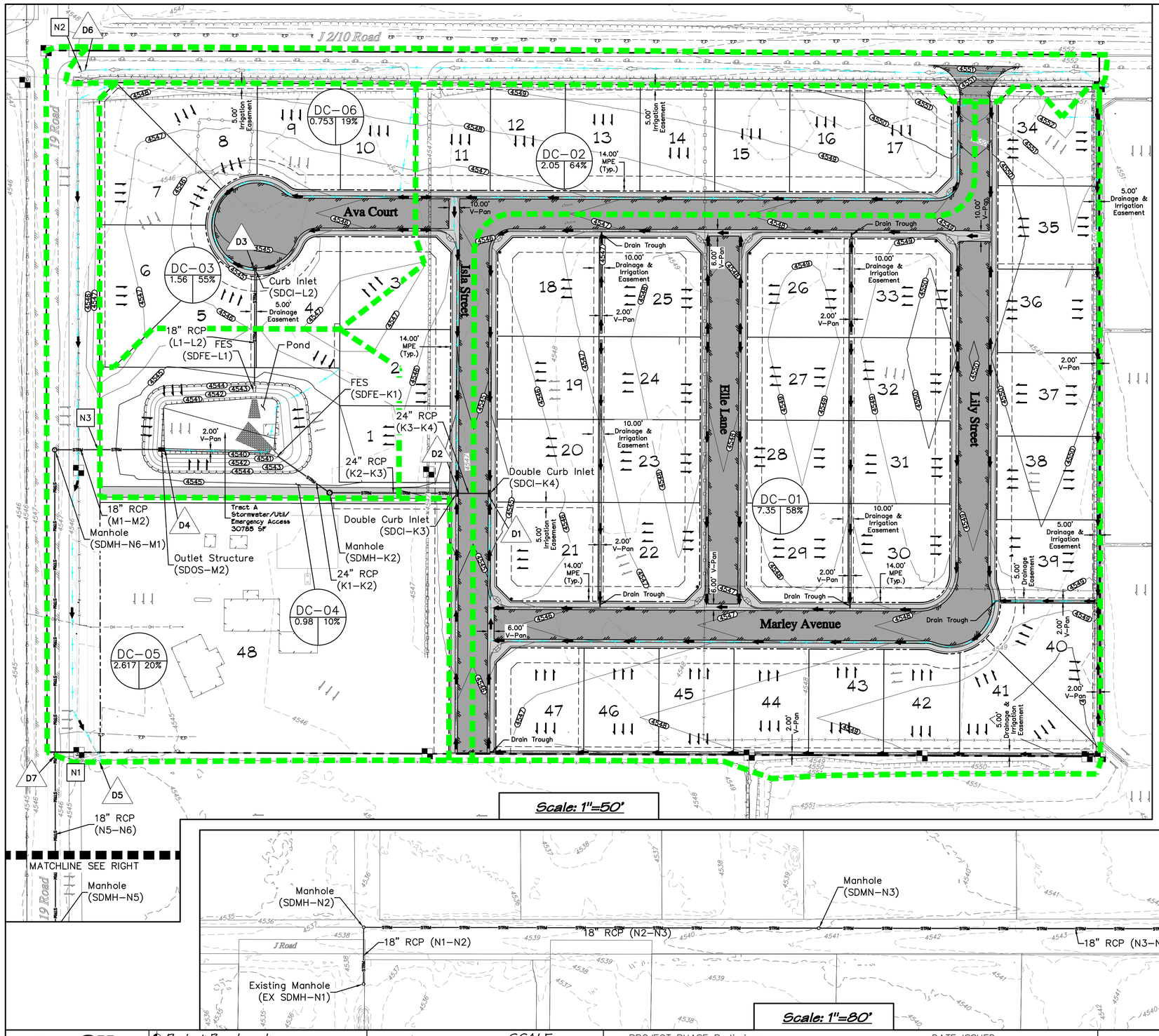
DRAWN BY: ctr PROJECT: 2060-001
CHECKED BY: jwm
ORIGINAL SHEET SIZE: 22 x 34

FUTURADO DEVELOPMENT LLC

Adeles Acres Subdivision

Drainage Map
Existing Drainage Map

F3



LEGEND

- A – SUB-BASIN ID
- B – ACREAGE
- C – COMPOSITE PERCENT IMPERVIOUS
- D – DESIGN POINT (SEE TABLE FOR FLOWS)
- E – PROJECT DISCHARGE POINT
- EXISTING SHEET FLOW
- EXISTING CONCENTRATED FLOW
- PROPOSED SHEET FLOW
- PROPOSED CONCENTRATED FLOW
- SUB-BASIN BOUNDARY
- SUB-BASIN FLOWPATH

DEVELOPED CONDITIONS SUB-BASIN TABLE

Sub-Basin ID	Design Point ID	Area (acres)	NRCS Hydrologic Soil Group	Weighted Percent Impervious	Design Storm Peak Runoff Rates (cfs)		
					2-Year	10-Year	100-Year
DC-01	D1	7.347	B	61%	3.47	6.65	14.66
DC-02	D2	2.050	B	64%	1.16	2.20	4.64
DC-03	D3	1.560	B	55%	0.81	1.62	3.76
DC-04	D4	0.980	B	10%	0.06	0.25	1.54
DC-05	D5	2.620	B	20%	0.26	0.72	2.91
DC-06	D6	0.750	B	19%	0.09	0.26	0.75

DEVELOPED CONDITIONS POND TABLE

Event	Elevation	Volume (ft^3)
Top of Pond	4,545.20	52,287
100-Year WSEL	4,542.66	19,618
10-Year WSEL	4,541.42	8,890
Pond/Structure Bottom	4,539.16	0

DEVELOPED CONDITIONS PROJECT DISCHARGE RATES

Project Discharge Point ID	Project Discharge Point Location Description	Contributing Design Points to Project Discharge Point	Contributing Sub-basins to Project Discharge Point	Peak Flow at Discharge Point	
				Minor Storm 10-Year (cfs)	Major Storm 100-Year (cfs)
N1	Proposed Conditions - Southwest Property	D5	DC-05	0.72	2.81
N2	Proposed Conditions - J 2/10 Road Drain Culvert	D6	DC-06	0.261	0.75
N3	Pond Outlet Pipe	D7	DC-01, DC-02, DC-03 & DC-04	0.12	2.28

NOTES:

1. EXISTING PARCELS, UTILITIES, AND SURFACE CONTOURS ARE TAKEN FROM MESA COUNTY GIS. THESE ITEMS ARE APPROXIMATE AND FOR INFORMATIONAL PURPOSES ONLY.
2. NO BUILDING, STRUCTURE, OR FILL WILL BE PLACED IN THE DETENTION AREAS AND NO CHANGES OR ALTERATIONS AFFECTING THE HYDRAULIC CHARACTERISTICS OF THE DETENTION AREAS WILL BE MADE WITHOUT THE APPROVAL OF THE COUNTY.
3. MAINTENANCE AND OPERATION OF THE DETENTION AND WATER QUALITY AREAS ARE THE RESPONSIBILITY OF PROPERTY OWNER. IF OWNER FAILS IN THIS RESPONSIBILITY, THE COUNTY HAS THE RIGHT TO ENTER THE PROPERTY, MAINTAIN THE DETENTION AREAS, AND BE REIMBURSED FOR COSTS INCURRED.
4. DETENTION POND VOLUMES, ALL DRAINAGE APPURTENANCES, AND BASIN BOUNDARIES SHALL BE VERIFIED. AS-BUILT DRAWINGS SHALL BE PREPARED BY A REGISTERED PROFESSIONAL ENGINEER PRIOR TO ISSUANCE OF CERTIFICATE OF OCCUPANCY FOR ANY STRUCTURE WITHIN THE DEVELOPMENT.
5. PERMISSION TO REPRODUCE THESE PLANS IS HEREBY GIVEN TO MESA COUNTY FOR COUNTY PURPOSES ASSOCIATED WITH NEW PLAN REVIEW, APPROVAL, PERMITTING, INSPECTION AND CONSTRUCTION OF WORK.

Project Benchmark
Found 2" Aluminum CapNE Corner
Marked "DH SURVEYS INC"
South of J 1/2 Road
NORTHING: 67185.23
EASTING: 53517.93
ELEVATION: 4551.66
DATUM SOURCE: MCLCS Zone "GVA" (NAVD 88)

SCALE (FEET)
0 50 100
HORIZONTAL
VERTICAL: n/a
CONTOUR INTERVAL: 1 FT

PROJECT PHASE: Preliminary DATE ISSUED:

NO.	DATE	REVISION	BY

S:\PROJECTS\2060 Futurado Development LLC\001 1024 19 Road\Design\Drainage\01-DWG\2060-001 Fig 3 & 4.dwg [Fig4] 3/2/2023 7:06:22 PM

PRELIMINARY

RIVER CITY CONSULTANTS
215 Pitkin Avenue, Unit 201
Grand Junction, CO 81501
www.rccwest.com
Phone: 970.241.4722
Fax: 970.241.8841

DRAWN BY: ctr PROJECT: 2060-001
CHECKED BY: jwm
ORIGINAL SHEET SIZE: 22 x 34

FUTURADO DEVELOPMENT LLC

Adeles Acres Subdivision
Drainage Map
Proposed Drainage Map

F4

APPENDIX A

Project Site Information

1. FEMA FIRM Panel
2. NRCS Web Soil Survey
3. NRCS K Factor Whole Soil
4. NOAA Atlas 14 Precipitation Depths
5. Geotechnical Report Excerpts

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

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

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

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

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

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

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

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

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

Base map information shown on this FIRM was derived from NAIP color infrared orthophotography produced with a one meter ground resolution from photography dated 2003 or later.

Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

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

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

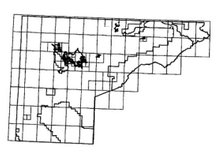
Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The FEMA Map Service Center may also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

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

Mesa County Vertical Datum Offset Table

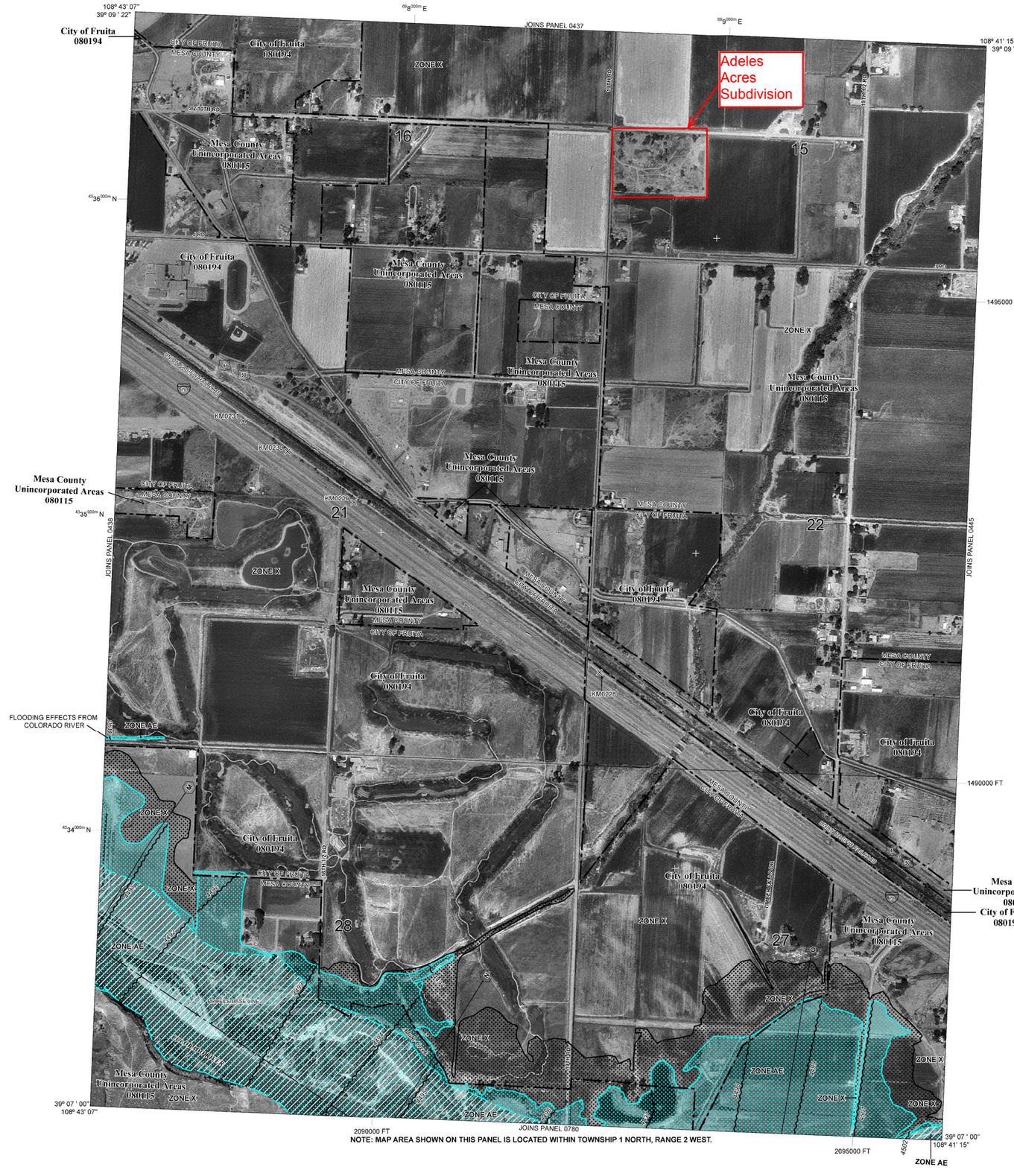
Flooding Source	Vertical Datum Offset (ft)	Flooding Source	Vertical Datum Offset (ft)
Colorado River	3.4		

Example: To convert Colorado River elevations to NAVD 88, 3.4 feet were added to the NGVD 29 elevations.



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard Information and resources are available from local communities and the Colorado Water Conservation Board.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

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

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

- A — A — Cross section line
- 23 — 23 — Transect line
- 45° 02' 08", 93° 02' 12" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
- 4389000m N — 1000-meter Universal Transverse Mercator grid values, zone 12
- 3100000 FT — 5000-foot ticks: Colorado State Plane coordinate system, Central zone (FIPSZONE 0502), Lambert Conformal Conic projection
- DX5510 × — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
July 6, 2010

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

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

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

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0439F

FIRM

FLOOD INSURANCE RATE MAP
MESA COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 439 OF 1725

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
FRUITA, CITY OF	080194	0439	F
MESA COUNTY	080115	0439	F

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

MAP NUMBER
08077C0439F
EFFECTIVE DATE
JULY 6, 2010

Federal Emergency Management Agency

National Flood Hazard Layer FIRMette

FEMA

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

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

N

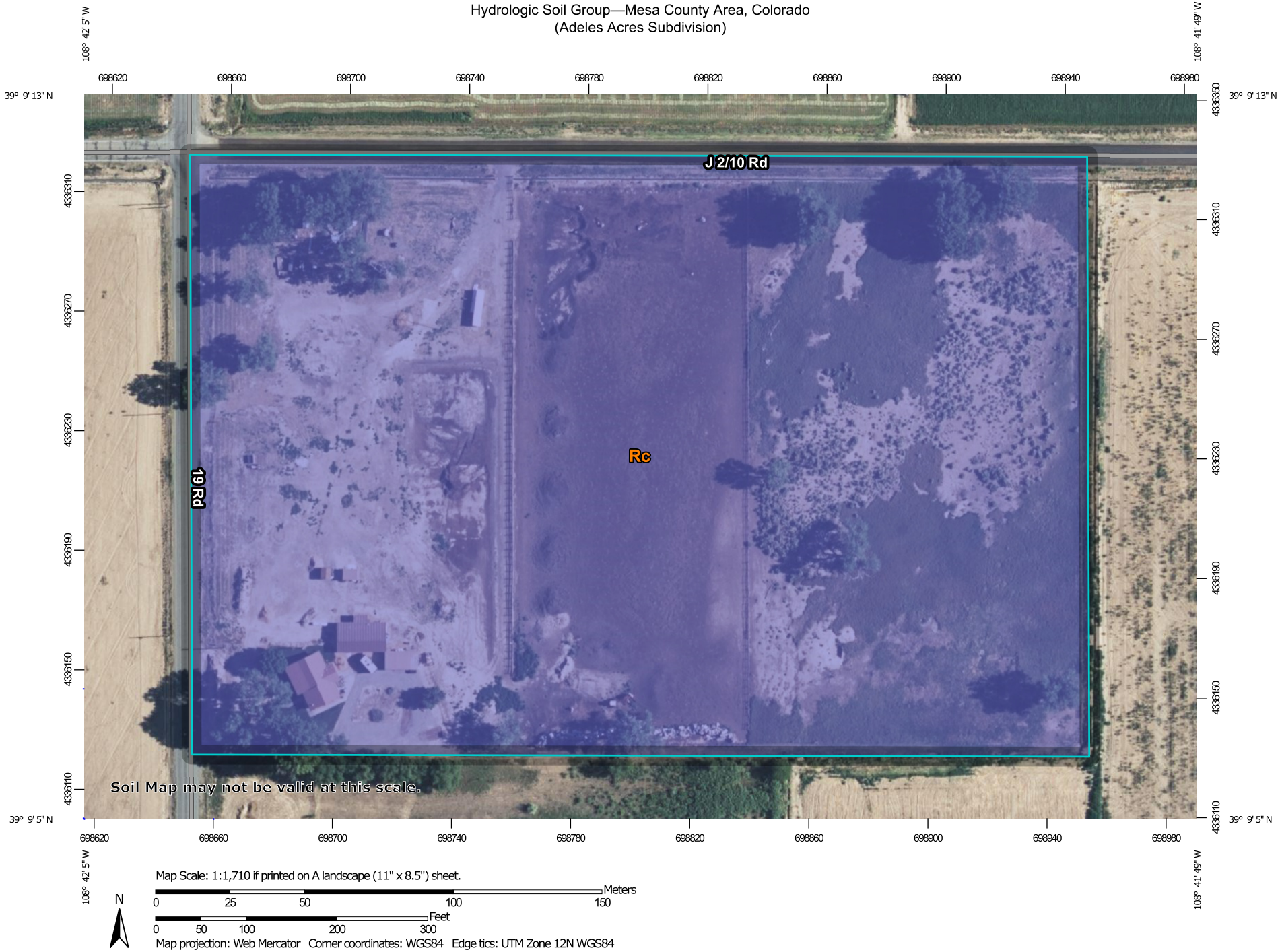
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 10/31/2022 at 12:25 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.

Hydrologic Soil Group—Mesa County Area, Colorado
(Adeles Acres Subdivision)



Map Scale: 1:1,710 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N 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: Mesa County Area, Colorado
Survey Area Data: Version 13, Sep 6, 2022

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

Date(s) aerial images were photographed: Jun 24, 2020—Jul 8, 2020

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
Rc	Fruitland sandy clay loam, 0 to 2 percent slopes	B	15.0	100.0%
Totals for Area of Interest			**15.0**	**100.0%**

Description

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

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

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

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

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

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

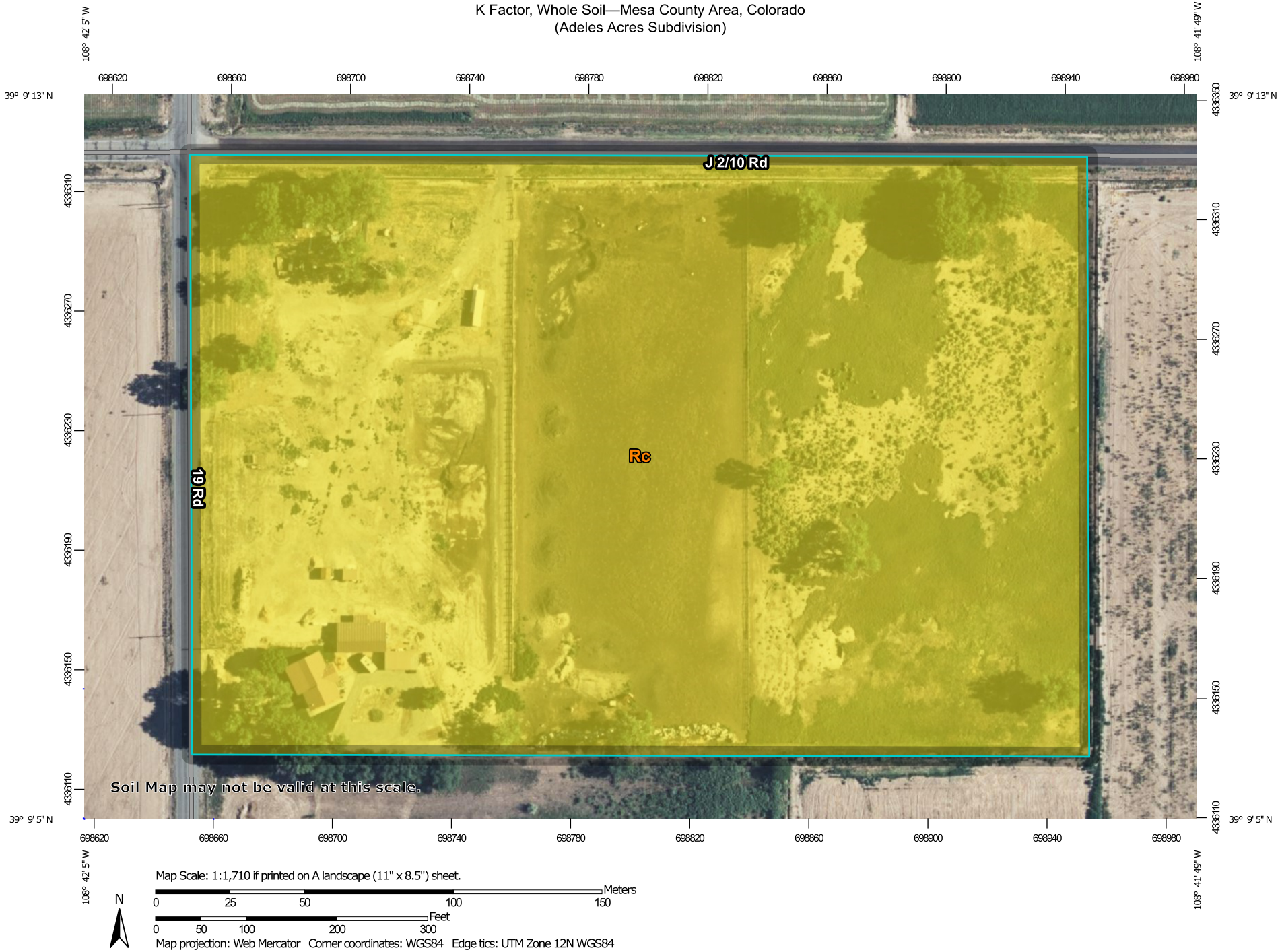
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



Map Scale: 1:1,710 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

MAP LEGEND

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

Soils

Soil Rating Polygons
- .02
- .05
- .10
- .15
- .17
- .20
- .24
- .28
- .32
- .37
- .43
- .49
- .55
- .64
- Not rated or not available

Soil Rating Lines
- .02
- .05
- .10
- .15
- .17
- .20
- .24
- .28
- .32
- .37
- .43
- .49
- .55
- .64
- Not rated or not available

Soil Rating Points
- .02
- .05
- .10
- .15
- .17
- .20
- .24
- .28
- .32
- .37
- .43
- .49
- .55
- .64
- 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: Mesa County Area, Colorado
Survey Area Data: Version 13, Sep 6, 2022

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

Date(s) aerial images were photographed: Jun 24, 2020—Jul 8, 2020

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.

K Factor, Whole Soil

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Rc	Fruitland sandy clay loam, 0 to 2 percent slopes	.17	15.0	100.0%
Totals for Area of Interest			**15.0**	**100.0%**

Description

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

"Erosion factor Kw (whole soil)" indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Factor K does not apply to organic horizons and is not reported for those layers.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Layer Options (Horizon Aggregation Method): Surface Layer (Not applicable)

NOAA Atlas 14, Volume 8, Version 2
Location name: Fruita, Colorado, USA*
Latitude: 39.1525°, Longitude: -108.6993°
Elevation: 4549.09 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.115** (0.093-0.148)	**0.148** (0.120-0.191)	**0.208** (0.167-0.269)	**0.262** (0.209-0.340)	**0.343** (0.266-0.473)	**0.411** (0.309-0.573)	**0.484** (0.349-0.693)	**0.562** (0.386-0.832)	**0.674** (0.442-1.03)	**0.764** (0.484-1.18)
10-min	**0.169** (0.137-0.217)	**0.217** (0.176-0.280)	**0.304** (0.245-0.393)	**0.383** (0.306-0.498)	**0.502** (0.389-0.692)	**0.601** (0.452-0.839)	**0.708** (0.511-1.02)	**0.823** (0.565-1.22)	**0.987** (0.647-1.50)	**1.12** (0.709-1.72)
15-min	**0.206** (0.167-0.265)	**0.265** (0.214-0.342)	**0.371** (0.299-0.480)	**0.467** (0.374-0.607)	**0.612** (0.475-0.844)	**0.733** (0.551-1.02)	**0.863** (0.623-1.24)	**1.00** (0.689-1.48)	**1.20** (0.789-1.84)	**1.36** (0.864-2.10)
30-min	**0.287** (0.232-0.369)	**0.372** (0.301-0.480)	**0.519** (0.418-0.671)	**0.648** (0.518-0.842)	**0.834** (0.643-1.14)	**0.986** (0.738-1.37)	**1.14** (0.822-1.63)	**1.31** (0.897-1.93)	**1.54** (1.01-2.34)	**1.73** (1.09-2.66)
60-min	**0.375** (0.303-0.482)	**0.468** (0.378-0.603)	**0.627** (0.505-0.811)	**0.767** (0.613-0.996)	**0.970** (0.748-1.32)	**1.13** (0.850-1.57)	**1.31** (0.939-1.86)	**1.49** (1.02-2.19)	**1.74** (1.14-2.64)	**1.94** (1.23-2.98)
2-hr	**0.463** (0.379-0.586)	**0.563** (0.461-0.714)	**0.735** (0.599-0.936)	**0.886** (0.717-1.13)	**1.10** (0.863-1.48)	**1.28** (0.973-1.75)	**1.47** (1.07-2.06)	**1.66** (1.16-2.41)	**1.94** (1.28-2.89)	**2.15** (1.38-3.26)
3-hr	**0.522** (0.431-0.656)	**0.616** (0.507-0.774)	**0.779** (0.639-0.982)	**0.923** (0.753-1.17)	**1.14** (0.897-1.51)	**1.31** (1.00-1.77)	**1.50** (1.10-2.08)	**1.70** (1.19-2.44)	**1.97** (1.32-2.93)	**2.20** (1.42-3.30)
6-hr	**0.636** (0.532-0.787)	**0.726** (0.606-0.899)	**0.885** (0.736-1.10)	**1.03** (0.848-1.28)	**1.24** (0.990-1.62)	**1.41** (1.10-1.88)	**1.60** (1.19-2.19)	**1.80** (1.28-2.54)	**2.08** (1.41-3.03)	**2.30** (1.51-3.40)
12-hr	**0.761** (0.644-0.926)	**0.873** (0.737-1.06)	**1.07** (0.897-1.30)	**1.24** (1.03-1.52)	**1.48** (1.20-1.91)	**1.69** (1.32-2.20)	**1.90** (1.43-2.55)	**2.12** (1.53-2.95)	**2.44** (1.68-3.49)	**2.69** (1.79-3.91)
24-hr	**0.894** (0.766-1.07)	**1.03** (0.884-1.24)	**1.27** (1.08-1.53)	**1.48** (1.25-1.78)	**1.78** (1.45-2.25)	**2.02** (1.61-2.60)	**2.28** (1.74-3.01)	**2.55** (1.86-3.47)	**2.92** (2.04-4.11)	**3.22** (2.17-4.60)
2-day	**1.03** (0.896-1.22)	**1.19** (1.03-1.40)	**1.45** (1.26-1.72)	**1.69** (1.45-2.01)	**2.04** (1.69-2.54)	**2.32** (1.87-2.94)	**2.62** (2.03-3.41)	**2.94** (2.17-3.95)	**3.38** (2.39-4.69)	**3.74** (2.56-5.25)
3-day	**1.11** (0.974-1.30)	**1.28** (1.12-1.50)	**1.58** (1.37-1.85)	**1.84** (1.59-2.16)	**2.21** (1.85-2.73)	**2.52** (2.05-3.16)	**2.85** (2.23-3.67)	**3.19** (2.38-4.24)	**3.67** (2.62-5.04)	**4.05** (2.80-5.64)
4-day	**1.18** (1.04-1.37)	**1.36** (1.19-1.58)	**1.67** (1.46-1.94)	**1.94** (1.69-2.27)	**2.34** (1.97-2.86)	**2.66** (2.18-3.30)	**3.00** (2.36-3.83)	**3.35** (2.51-4.42)	**3.85** (2.76-5.24)	**4.24** (2.95-5.85)
7-day	**1.34** (1.20-1.54)	**1.54** (1.37-1.76)	**1.87** (1.65-2.15)	**2.16** (1.89-2.49)	**2.57** (2.18-3.09)	**2.90** (2.39-3.54)	**3.24** (2.58-4.08)	**3.60** (2.73-4.68)	**4.10** (2.97-5.49)	**4.48** (3.15-6.11)
10-day	**1.49** (1.33-1.69)	**1.69** (1.51-1.92)	**2.04** (1.81-2.32)	**2.33** (2.06-2.67)	**2.75** (2.35-3.28)	**3.09** (2.57-3.74)	**3.44** (2.75-4.28)	**3.80** (2.90-4.88)	**4.29** (3.14-5.70)	**4.68** (3.32-6.32)
20-day	**1.89** (1.72-2.11)	**2.14** (1.94-2.38)	**2.54** (2.29-2.84)	**2.88** (2.58-3.24)	**3.36** (2.90-3.92)	**3.74** (3.15-4.43)	**4.12** (3.34-5.02)	**4.51** (3.49-5.68)	**5.03** (3.73-6.55)	**5.44** (3.91-7.20)
30-day	**2.23** (2.04-2.46)	**2.52** (2.30-2.78)	**2.99** (2.72-3.31)	**3.38** (3.05-3.76)	**3.91** (3.41-4.50)	**4.33** (3.67-5.07)	**4.74** (3.87-5.71)	**5.16** (4.02-6.42)	**5.71** (4.27-7.34)	**6.13** (4.45-8.04)
45-day	**2.66** (2.45-2.90)	**3.01** (2.77-3.29)	**3.58** (3.28-3.92)	**4.03** (3.68-4.44)	**4.65** (4.07-5.28)	**5.11** (4.37-5.91)	**5.56** (4.58-6.62)	**6.01** (4.72-7.38)	**6.58** (4.96-8.35)	**7.00** (5.13-9.09)
60-day	**3.03** (2.81-3.28)	**3.44** (3.19-3.74)	**4.09** (3.78-4.46)	**4.61** (4.23-5.04)	**5.30** (4.66-5.95)	**5.80** (4.98-6.64)	**6.28** (5.19-7.39)	**6.74** (5.32-8.20)	**7.32** (5.54-9.20)	**7.74** (5.71-9.96)

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

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

Please refer to NOAA Atlas 14 document for more information.

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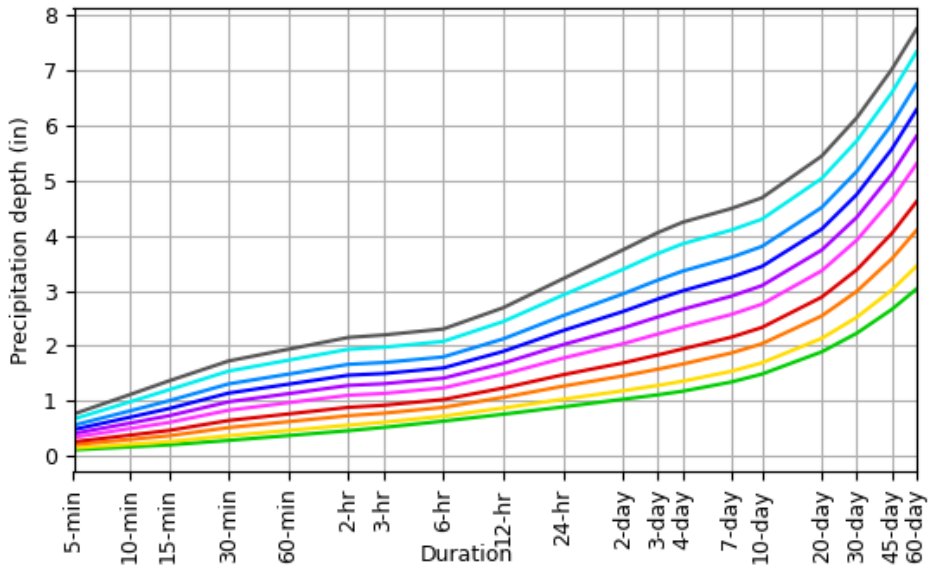
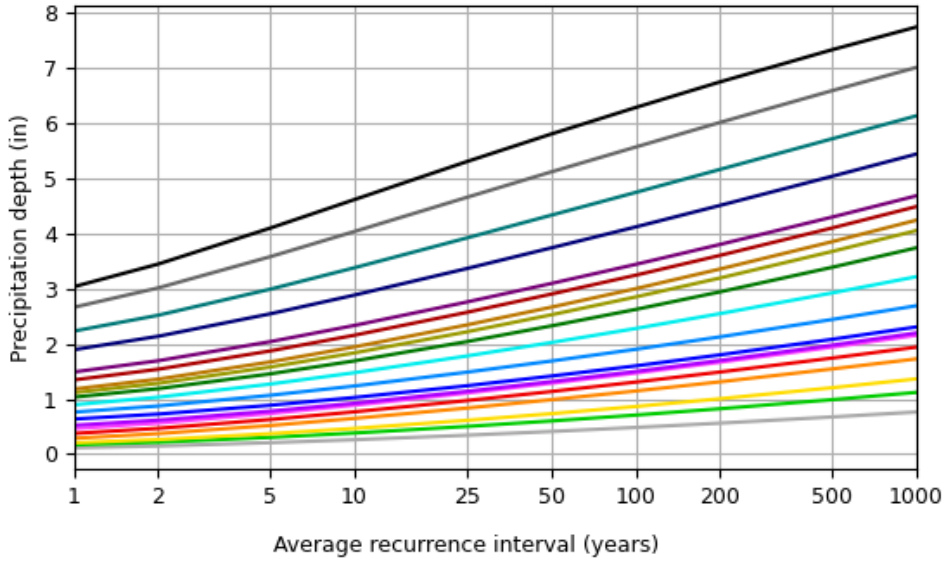
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 39.1525°, Longitude: -108.6993°





NOAA Atlas 14, Volume 8, Version 2

Created (GMT): Mon Oct 31 17:17:23 2022

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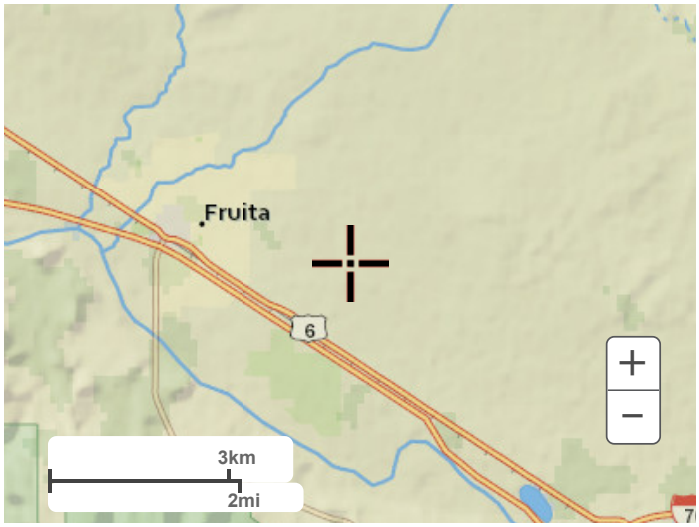
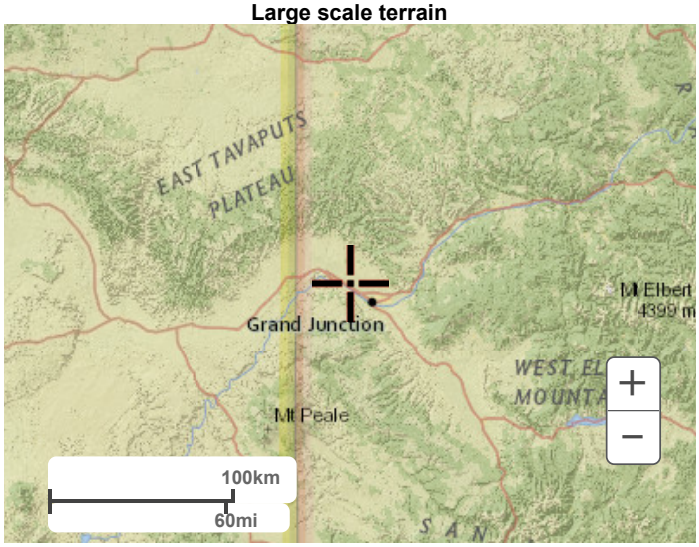
Maps & aerials

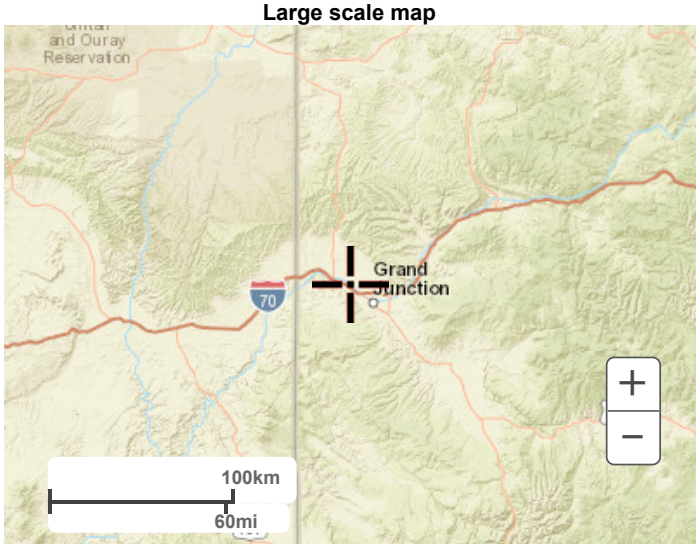
Small scale terrain



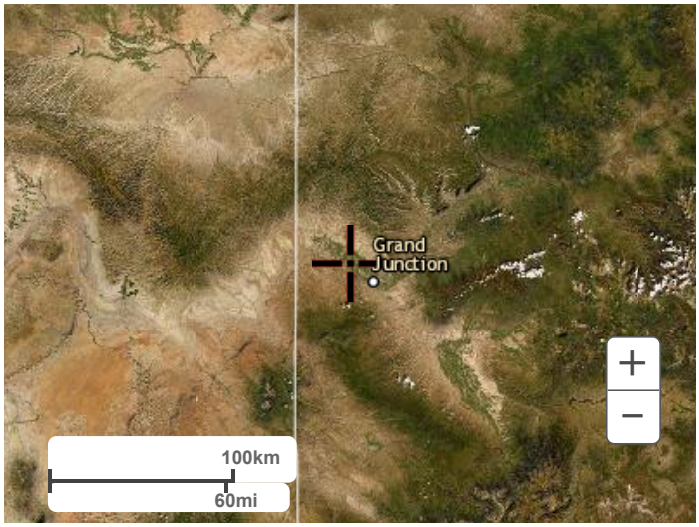
Large scale terrain



Large scale map



Large scale aerial



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

Disclaimer

Huddleston-Berry
Engineering & Testing, LLC

GEOTECHNICAL AND GEOLOGIC HAZARDS INVESTIGATION
1024 19 ROAD
FRUITA, COLORADO
PROJECT#02594-0001

DARRELL CORDOVA
PO BOX 2227
GLENWOOD SPRINGS, COLORADO 81602

JANUARY 12, 2023

Huddleston-Berry Engineering and Testing, LLC
2789 Riverside Parkway
Grand Junction, Colorado 81501

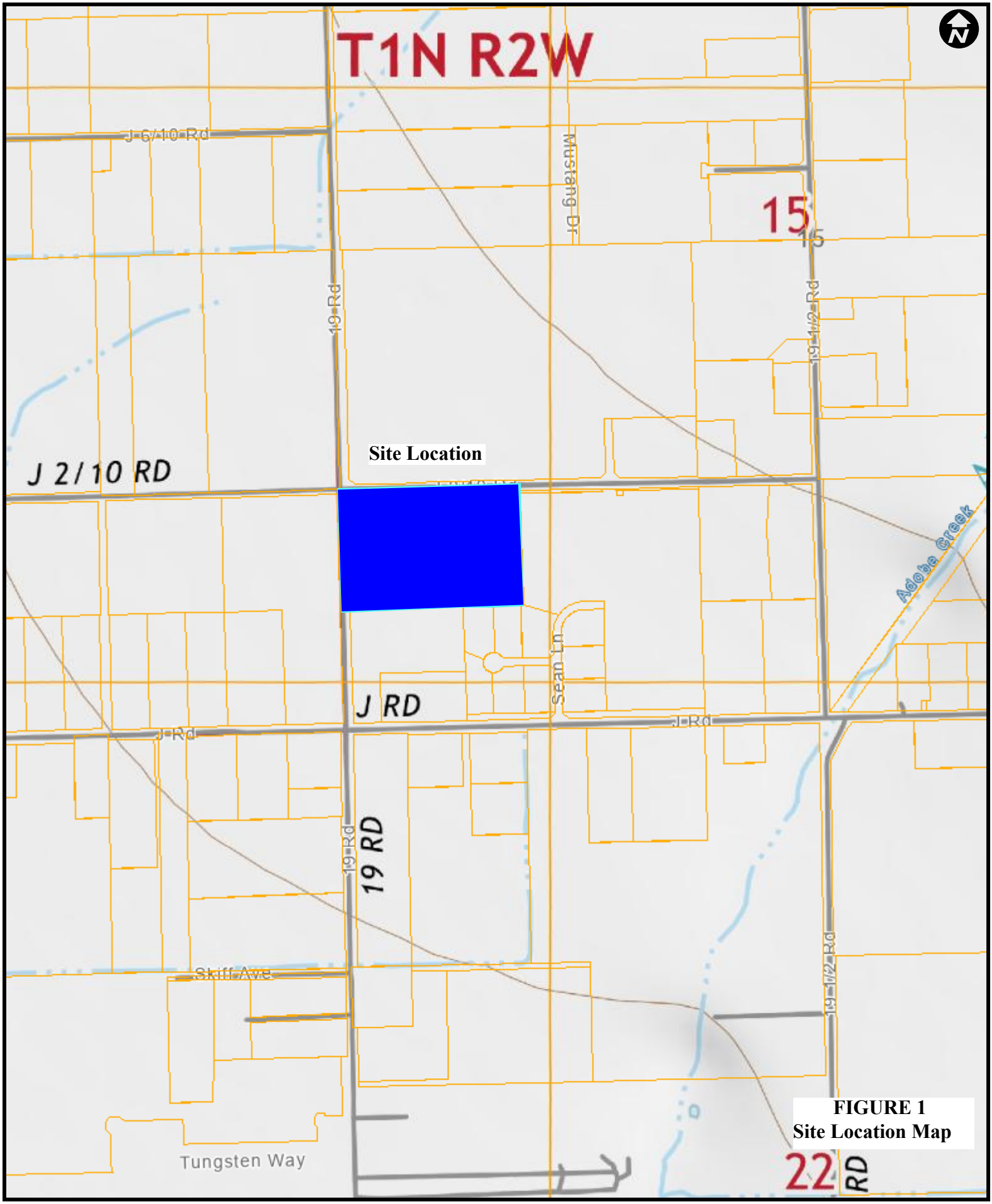


FIGURE 1
Site Location Map

Mesa County Map

0 0.05 0.1 0.2 mi
0 0.075 0.15 0.3 km

Print Date: January 9, 2023

Mesa County, Colorado
GIS/IT Department
gis.mesacounty.us

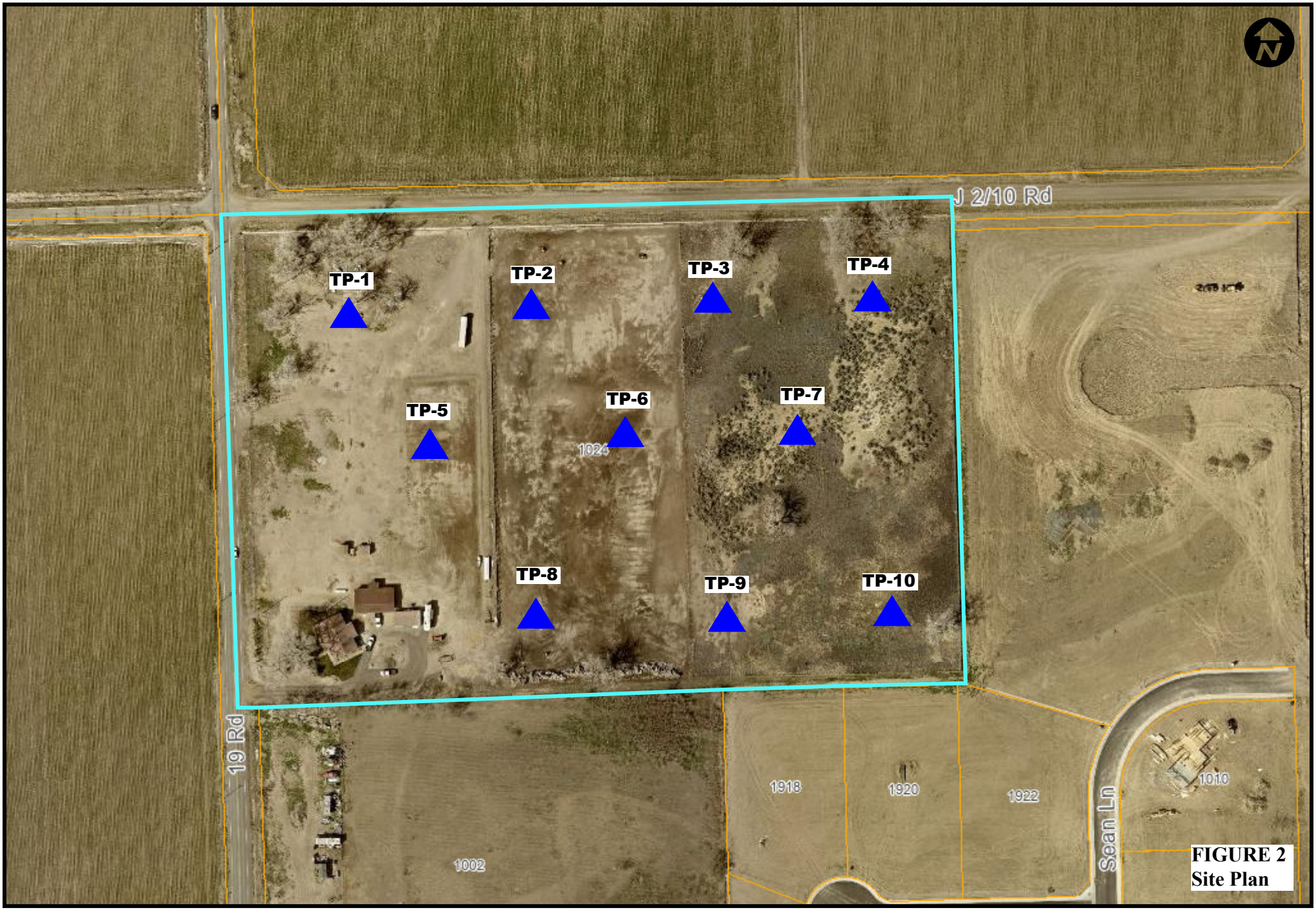


FIGURE 2
Site Plan

Mesa County Map

0 0.015 0.03 0.06 mi
0 0.0175 0.035 0.07 km

Print Date: January 9, 2023

Mesa County, Colorado
GIS/IT Department
gis.mesacounty.us

Huddleston-Berry Engineering & Testing, LLC
2789 Riverside Parkway
Grand Junction, CO 81501
970-255-8005

TEST PIT NUMBER TP-1

CLIENT Darrell Cordova
PROJECT NAME 1024 19 Road
PROJECT NUMBER 02594-0001
PROJECT LOCATION Fruita, CO
DATE STARTED 12/19/22 **COMPLETED** 12/19/22
GROUND ELEVATION _____ **TEST PIT SIZE** _____
EXCAVATION CONTRACTOR Wiseland
GROUND WATER LEVELS:
EXCAVATION METHOD Trackh/Backhoe
AT TIME OF EXCAVATION 8.0 ft
LOGGED BY TC **CHECKED BY** MAB
AT END OF EXCAVATION 8.0 ft
NOTES _____
AFTER EXCAVATION ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0.0		Sandy SILT with organics (TOPSOIL)										
		Sandy SILT (ml), tan and brown, moist to wet, medium dense to loose										
2.5		**Walls Collapsing below 2'										
		**Hit electrical line running from house northward to internet tower										
5.0												
7.5		Bottom of test pit at 8.0 feet.										

Huddleston-Berry Engineering & Testing, LLC
2789 Riverside Parkway
Grand Junction, CO 81501
970-255-8005

TEST PIT NUMBER TP-5

CLIENT Darrell Cordova
PROJECT NAME 1024 19 Road
PROJECT NUMBER 02594-0001
PROJECT LOCATION Fruita, CO
DATE STARTED 12/19/22 **COMPLETED** 12/19/22
GROUND ELEVATION _____ **TEST PIT SIZE** _____
EXCAVATION CONTRACTOR Wiseland
GROUND WATER LEVELS:
EXCAVATION METHOD Trackh/Backhoe
AT TIME OF EXCAVATION 8.0 ft
LOGGED BY TC **CHECKED BY** MAB
AT END OF EXCAVATION 8.0 ft
NOTES _____
AFTER EXCAVATION ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0.0		Sandy SILT with organics (TOPSOIL)										
		Sandy SILT (ml), tan and brown, moist to wet, loose										
		**Walls Collapsing below 2'										
2.5												
5.0												
7.5												
		Bottom of test pit at 8.0 feet.										

APPENDIX B

Hydrologic Calculations

1. Impervious Calculations – Existing Conditions
2. Rational Method Calculations – Existing Conditions
3. Impervious Calculations – Developed Conditions
4. Rational Method Calculations – Developed Conditions

PROJECT: Adeles Acres
JOB NO.: 2060-001
CALC. BY: CTR
DATE:

Impervious Percentages - from Urban Drainage Table 6-3

Asphalt	100%
Gravel	40%
Drive & Walks	90%
Roofs	90%

Landscape	2%
Land Use 6	0%
Land Use 7	0%
Land Use 8	0%

SOIL TYPE: B (use equation from Table 6-4)

= FORMULA CELLS
= USER INPUT CELLS

COMPOSITE IMPERVIOUSNESS

		Weighted Impervious and C Values					Areas (ac)							
Basin	**Area (ac)**	**Imp.**	**C_2**	**C_5**	**C_{10}**	**C_{100}**	**Asphalt**	**Gravel**	**Drive & Walks**	**Roofs**	**Landscape**	**Land Use 6**	**Land Use 7**	**Land Use 8**
EC-01	14.55	5.5%	0.03	0.04	0.10	0.45	0.21	0.40	0.03	0.13	13.77			
EC-02	0.72	24.5%	0.16	0.19	0.26	0.54	0.00	0.25	0.08	0.00	0.40			

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Rational
Time of Concentration (TOC) Method	Kirpich
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	00:00:00	0:00:00
End Analysis On	00:00:00	0:00:00
Start Reporting On	00:00:00	0:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:00:30	days hh:mm:ss
Reporting Time Step	0 00:00:30	days hh:mm:ss
Routing Time Step	5	seconds

Rainfall Details

Return Period	10 year(s)

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Runoff Coefficient	Average Slope (%)	Flow Length (ft)	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	EX-01	14.55	0.0800	0.2000	1591.00	0.76	0.06	0.89	0.94	0 00:56:10
2	EX-02	0.72	0.3700	0.5000	967.00	0.47	0.17	0.13	0.44	0 00:17:06

Subbasin Hydrology

Subbasin : EX-01

Input Data

Area (ac)	14.55
Weighted Runoff Coefficient	0.08
Average Slope (%)	0.2
Flow Length (ft)	1591

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Open Space, less than 25 years	14.55	B (0-2%)	0.08
Composite Area & Weighted Runoff Coeff.	14.55		0.08

Time of Concentration

TOC Method : Kirpich

Sheet Flow Equation :

Tc = (0.0078 * ((Lf^0.77) * (Sf^-0.385)))

Where :

Tc = Time of Concentration (min)
Lf = Flow Length (ft)
Sf = Slope (ft/ft)

User-Defined TOC override (minutes): 56.17

Subbasin Runoff Results

Total Rainfall (in)	0.76
Total Runoff (in)	0.06
Peak Runoff (cfs)	0.94
Rainfall Intensity	0.81
Weighted Runoff Coefficient	0.08
Time of Concentration (days hh:mm:ss)	0 00:56:10

Subbasin : EX-02

Input Data

Area (ac)	0.72
Weighted Runoff Coefficient	0.37
Average Slope (%)	0.5
Flow Length (ft)	967

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Open Space, less than 25 years	0.39	B (0-2%)	0.08
Streets, less than 25 years	0.33	B (0-2%)	0.71
Composite Area & Weighted Runoff Coeff.	0.72		0.37

Time of Concentration

User-Defined TOC override (minutes): 17.11

Subbasin Runoff Results

Total Rainfall (in)	0.47
Total Runoff (in)	0.17
Peak Runoff (cfs)	0.44
Rainfall Intensity	1.634
Weighted Runoff Coefficient	0.37
Time of Concentration (days hh:mm:ss)	0 00:17:07

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Rational
Time of Concentration (TOC) Method	Kirpich
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	00:00:00	0:00:00
End Analysis On	00:00:00	0:00:00
Start Reporting On	00:00:00	0:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:00:30	days hh:mm:ss
Reporting Time Step	0 00:00:30	days hh:mm:ss
Routing Time Step	5	seconds

Rainfall Details

Return Period	2 year(s)

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Runoff Coefficient	Average Slope (%)	Flow Length (ft)	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	EC-01	14.55	0.0300	0.2000	1591.00	0.46	0.01	0.20	0.22	0 00:56:10
2	EC-02	0.72	0.1600	0.5000	967.00	0.29	0.05	0.03	0.12	0 00:17:06

Subbasin Hydrology

Subbasin : EC-01

Input Data

Area (ac)	14.55
Weighted Runoff Coefficient	0.03
Average Slope (%)	0.2
Flow Length (ft)	1591

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Open Space, less than 25 years	14.55	B (0-2%)	0.03
Composite Area & Weighted Runoff Coeff.	14.55		0.03

Time of Concentration

TOC Method : Kirpich

Sheet Flow Equation :

Tc = (0.0078 * ((Lf^0.77) * (Sf^-0.385)))

Where :

Tc = Time of Concentration (min)
Lf = Flow Length (ft)
Sf = Slope (ft/ft)

User-Defined TOC override (minutes): 56.17

Subbasin Runoff Results

Total Rainfall (in)	0.46
Total Runoff (in)	0.01
Peak Runoff (cfs)	0.22
Rainfall Intensity	0.494
Weighted Runoff Coefficient	0.03
Time of Concentration (days hh:mm:ss)	0 00:56:10

Subbasin : EC-02

Input Data

Area (ac)	0.72
Weighted Runoff Coefficient	0.16
Average Slope (%)	0.5
Flow Length (ft)	967

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Open Space, less than 25 years	0.39	B (0-2%)	0.03
Streets, less than 25 years	0.33	B (0-2%)	0.32
Composite Area & Weighted Runoff Coeff.	0.72		0.16

Time of Concentration

User-Defined TOC override (minutes): 17.11

Subbasin Runoff Results

Total Rainfall (in)	0.29
Total Runoff (in)	0.05
Peak Runoff (cfs)	0.12
Rainfall Intensity	0.997
Weighted Runoff Coefficient	0.16
Time of Concentration (days hh:mm:ss)	0 00:17:07

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Rational
Time of Concentration (TOC) Method	Kirpich
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	00:00:00	0:00:00
End Analysis On	00:00:00	0:00:00
Start Reporting On	00:00:00	0:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:00:30	days hh:mm:ss
Reporting Time Step	0 00:00:30	days hh:mm:ss
Routing Time Step	5	seconds

Rainfall Details

Return Period	100 year(s)

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Runoff Coefficient	Average Slope (%)	Flow Length (ft)	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	EX-01	14.55	0.1400	0.2000	1591.00	1.30	0.18	2.63	2.82	0 00:56:10
2	EX-02	0.72	0.4400	0.5000	967.00	0.80	0.35	0.25	0.89	0 00:17:06

Subbasin Hydrology

Subbasin : EX-01

Input Data

Area (ac)	14.55
Weighted Runoff Coefficient	0.14
Average Slope (%)	0.2
Flow Length (ft)	1591

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Open Space, 25 years or greater	14.55	B (0-2%)	0.14
Composite Area & Weighted Runoff Coeff.	14.55		0.14

Time of Concentration

TOC Method : Kirpich

Sheet Flow Equation :

Tc = (0.0078 * ((Lf^0.77) * (Sf^-0.385)))

Where :

Tc = Time of Concentration (min)
Lf = Flow Length (ft)
Sf = Slope (ft/ft)

User-Defined TOC override (minutes): 56.17

Subbasin Runoff Results

Total Rainfall (in)	1.3
Total Runoff (in)	0.18
Peak Runoff (cfs)	2.82
Rainfall Intensity	1.384
Weighted Runoff Coefficient	0.14
Time of Concentration (days hh:mm:ss)	0 00:56:10

Subbasin : EX-02

Input Data

Area (ac)	0.72
Weighted Runoff Coefficient	0.44
Average Slope (%)	0.5
Flow Length (ft)	967

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
Open Space, 25 years or greater	0.39	B (0-2%)	0.14
Streets, 25 years or greater	0.33	B (0-2%)	0.8
Composite Area & Weighted Runoff Coeff.	0.72		0.44

Time of Concentration

User-Defined TOC override (minutes): 17.11

Subbasin Runoff Results

Total Rainfall (in)	0.8
Total Runoff (in)	0.35
Peak Runoff (cfs)	0.89
Rainfall Intensity	2.79
Weighted Runoff Coefficient	0.44
Time of Concentration (days hh:mm:ss)	0 00:17:07

PROJECT: Adeles Acres
JOB NO.: 2060-001
CALC. BY: CTR
DATE:

RIVERCITY CONSULTANTS

Impervious Percentages - from Urban Drainage Table 6-3

Asphalt	100%
Gravel	40%
Drive & Walks	90%
Roofs	90%

Landscape	2%
Land Use 6	0%
Land Use 7	0%
Land Use 8	0%

SOIL TYPE: B (use equation from Table 6-4)

= FORMULA CELLS
= USER INPUT CELLS

COMPOSITE IMPERVIOUSNESS

		Weighted Impervious and C Values					Areas (ac)							
Basin	**Area (ac)**	**Imp.**	**C_2**	**C_5**	**C_{10}**	**C_{100}**	**Asphalt**	**Gravel**	**Drive & Walks**	**Roofs**	**Landscape**	**Land Use 6**	**Land Use 7**	**Land Use 8**
DC-01	7.35	60.5%	0.47	0.50	0.5470	0.71	1.11	0.00	0.90	2.75	2.58			
DC-02	2.05	65.7%	0.51	0.54	0.59	0.73	0.38	0.00	0.26	0.80	0.61			
DC-03	1.56	54.5%	0.41	0.44	0.50	0.68	0.19	0.00	0.11	0.61	0.65			
DC-04	0.98	9.2%	0.05	0.06	0.13	0.47	0.00	0.00	0.08	0.00	0.90			
DC-05	2.62	20.2%	0.13	0.15	0.22	0.52	0.18	0.45	0.03	0.13	1.84			
DC-06	0.75	19.0%	0.12	0.14	0.21	0.52	0.03	0.26	0.00	0.00	0.46			
Pond	11.93	56.4%	0.43	0.46	0.51	0.69	1.68	0.00	1.35	4.16	4.74			

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Rational
Time of Concentration (TOC) Method	User-Defined
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	00:00:00	0:00:00
End Analysis On	00:00:00	0:00:00
Start Reporting On	00:00:00	0:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:00:30	days hh:mm:ss
Reporting Time Step	0 00:00:30	days hh:mm:ss
Routing Time Step	5	seconds

Rainfall Details

Return Period	100 year(s)

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Runoff Coefficient	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	DC-01	7.35	0.7100	0.79	0.56	4.12	14.66	0 00:16:52
2	DC-02	2.05	0.7300	0.71	0.52	1.06	4.64	0 00:13:40
3	DC-03	1.56	0.6800	0.59	0.40	0.63	3.76	0 00:09:59
4	DC-04	0.98	0.4700	0.64	0.30	0.29	1.54	0 00:11:32
5	DC-05	2.62	0.5200	1.00	0.52	1.37	2.91	0 00:28:07
6	DC-06	0.75	0.5200	0.79	0.41	0.31	1.10	0 00:16:36

Subbasin Hydrology

Subbasin : DC-01

Input Data

Area (ac)	7.35
Weighted Runoff Coefficient	0.71

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	5.21	-	0.71
Composite Area & Weighted Runoff Coeff.	5.21		0.71

Subbasin Runoff Results

Total Rainfall (in)	0.79
Total Runoff (in)	0.56
Peak Runoff (cfs)	14.66
Rainfall Intensity	2.81
Weighted Runoff Coefficient	0.71
Time of Concentration (days hh:mm:ss)	0 00:16:52

Subbasin : DC-02

Input Data

Area (ac)	2.05
Weighted Runoff Coefficient	0.73

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	2.05	-	0.73
Composite Area & Weighted Runoff Coeff.	2.05		0.73

Subbasin Runoff Results

Total Rainfall (in)	0.71
Total Runoff (in)	0.52
Peak Runoff (cfs)	4.64
Rainfall Intensity	3.104
Weighted Runoff Coefficient	0.73
Time of Concentration (days hh:mm:ss)	0 00:13:41

Subbasin : DC-03

Input Data

Area (ac)	1.56
Weighted Runoff Coefficient	0.68

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	1.56	-	0.68
Composite Area & Weighted Runoff Coeff.	1.56		0.68

Subbasin Runoff Results

Total Rainfall (in)	0.59
Total Runoff (in)	0.4
Peak Runoff (cfs)	3.76
Rainfall Intensity	3.545
Weighted Runoff Coefficient	0.68
Time of Concentration (days hh:mm:ss)	0 00:09:59

Subbasin : DC-04

Input Data

Area (ac)	0.98
Weighted Runoff Coefficient	0.47

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.98	-	0.47
Composite Area & Weighted Runoff Coeff.	0.98		0.47

Subbasin Runoff Results

Total Rainfall (in)	0.64
Total Runoff (in)	0.3
Peak Runoff (cfs)	1.54
Rainfall Intensity	3.343
Weighted Runoff Coefficient	0.47
Time of Concentration (days hh:mm:ss)	0 00:11:32

Subbasin : DC-05

Input Data

Area (ac)	2.62
Weighted Runoff Coefficient	0.52

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	2.62	-	0.52
Composite Area & Weighted Runoff Coeff.	2.62		0.52

Subbasin Runoff Results

Total Rainfall (in)	1
Total Runoff (in)	0.52
Peak Runoff (cfs)	2.91
Rainfall Intensity	2.134
Weighted Runoff Coefficient	0.52
Time of Concentration (days hh:mm:ss)	0 00:28:08

Subbasin : DC-06

Input Data

Area (ac)	0.75
Weighted Runoff Coefficient	0.52

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.75	-	0.52
Composite Area & Weighted Runoff Coeff.	0.75		0.52

Subbasin Runoff Results

Total Rainfall (in)	0.79
Total Runoff (in)	0.41
Peak Runoff (cfs)	1.1
Rainfall Intensity	2.832
Weighted Runoff Coefficient	0.52
Time of Concentration (days hh:mm:ss)	0 00:16:37

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Rational
Time of Concentration (TOC) Method	User-Defined
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	00:00:00	0:00:00
End Analysis On	00:00:00	0:00:00
Start Reporting On	00:00:00	0:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:00:30	days hh:mm:ss
Reporting Time Step	0 00:00:30	days hh:mm:ss
Routing Time Step	5	seconds

Rainfall Details

Return Period	10 year(s)

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Runoff Coefficient	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	DC-01	7.35	0.5500	0.46	0.25	1.87	6.65	0 00:16:52
2	DC-02	2.05	0.5900	0.41	0.24	0.50	2.20	0 00:13:40
3	DC-03	1.56	0.5000	0.35	0.17	0.27	1.62	0 00:09:59
4	DC-04	0.98	0.1300	0.38	0.05	0.05	0.25	0 00:11:32
5	DC-05	2.62	0.2200	0.59	0.13	0.34	0.72	0 00:28:07
6	DC-06	0.75	0.2100	0.46	0.10	0.07	0.26	0 00:16:36

Subbasin Hydrology

Subbasin : DC-01

Input Data

Area (ac)	7.35
Weighted Runoff Coefficient	0.55

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	5.21	-	0.55
Composite Area & Weighted Runoff Coeff.	5.21		0.55

Subbasin Runoff Results

Total Rainfall (in)	0.46
Total Runoff (in)	0.25
Peak Runoff (cfs)	6.65
Rainfall Intensity	1.645
Weighted Runoff Coefficient	0.55
Time of Concentration (days hh:mm:ss)	0 00:16:52

Subbasin : DC-02

Input Data

Area (ac)	2.05
Weighted Runoff Coefficient	0.59

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	2.05	-	0.59
Composite Area & Weighted Runoff Coeff.	2.05		0.59

Subbasin Runoff Results

Total Rainfall (in)	0.41
Total Runoff (in)	0.24
Peak Runoff (cfs)	2.2
Rainfall Intensity	1.817
Weighted Runoff Coefficient	0.59
Time of Concentration (days hh:mm:ss)	0 00:13:41

Subbasin : DC-03

Input Data

Area (ac)	1.56
Weighted Runoff Coefficient	0.5

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	1.56	-	0.5
Composite Area & Weighted Runoff Coeff.	1.56		0.5

Subbasin Runoff Results

Total Rainfall (in)	0.35
Total Runoff (in)	0.17
Peak Runoff (cfs)	1.62
Rainfall Intensity	2.076
Weighted Runoff Coefficient	0.5
Time of Concentration (days hh:mm:ss)	0 00:09:59

Subbasin : DC-04

Input Data

Area (ac)	0.98
Weighted Runoff Coefficient	0.13

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.98	-	0.13
Composite Area & Weighted Runoff Coeff.	0.98		0.13

Subbasin Runoff Results

Total Rainfall (in)	0.38
Total Runoff (in)	0.05
Peak Runoff (cfs)	0.25
Rainfall Intensity	1.958
Weighted Runoff Coefficient	0.13
Time of Concentration (days hh:mm:ss)	0 00:11:32

Subbasin : DC-05

Input Data

Area (ac)	2.62
Weighted Runoff Coefficient	0.22

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	2.62	-	0.22
Composite Area & Weighted Runoff Coeff.	2.62		0.22

Subbasin Runoff Results

Total Rainfall (in)	0.59
Total Runoff (in)	0.13
Peak Runoff (cfs)	0.72
Rainfall Intensity	1.25
Weighted Runoff Coefficient	0.22
Time of Concentration (days hh:mm:ss)	0 00:28:08

Subbasin : DC-06

Input Data

Area (ac)	0.75
Weighted Runoff Coefficient	0.21

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.75	-	0.21
Composite Area & Weighted Runoff Coeff.	0.75		0.21

Subbasin Runoff Results

Total Rainfall (in)	0.46
Total Runoff (in)	0.1
Peak Runoff (cfs)	0.26
Rainfall Intensity	1.658
Weighted Runoff Coefficient	0.21
Time of Concentration (days hh:mm:ss)	0 00:16:37

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Rational
Time of Concentration (TOC) Method	User-Defined
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	00:00:00	0:00:00
End Analysis On	00:00:00	0:00:00
Start Reporting On	00:00:00	0:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:00:30	days hh:mm:ss
Reporting Time Step	0 00:00:30	days hh:mm:ss
Routing Time Step	5	seconds

Rainfall Details

Return Period	2 year(s)

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Runoff Coefficient	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	DC-01	7.35	0.4700	0.28	0.13	0.97	3.47	0 00:16:52
2	DC-02	2.05	0.5100	0.25	0.13	0.26	1.16	0 00:13:40
3	DC-03	1.56	0.4100	0.21	0.09	0.14	0.81	0 00:09:59
4	DC-04	0.98	0.0500	0.23	0.01	0.01	0.06	0 00:11:32
5	DC-05	2.62	0.1300	0.36	0.05	0.12	0.26	0 00:28:07
6	DC-06	0.75	0.1200	0.28	0.03	0.03	0.09	0 00:16:36

Subbasin Hydrology

Subbasin : DC-01

Input Data

Area (ac)	7.35
Weighted Runoff Coefficient	0.47

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	5.21	-	0.47
Composite Area & Weighted Runoff Coeff.	5.21		0.47

Subbasin Runoff Results

Total Rainfall (in)	0.28
Total Runoff (in)	0.13
Peak Runoff (cfs)	3.47
Rainfall Intensity	1.004
Weighted Runoff Coefficient	0.47
Time of Concentration (days hh:mm:ss)	0 00:16:52

Subbasin : DC-02

Input Data

Area (ac)	2.05
Weighted Runoff Coefficient	0.51

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	2.05	-	0.51
Composite Area & Weighted Runoff Coeff.	2.05		0.51

Subbasin Runoff Results

Total Rainfall (in)	0.25
Total Runoff (in)	0.13
Peak Runoff (cfs)	1.16
Rainfall Intensity	1.109
Weighted Runoff Coefficient	0.51
Time of Concentration (days hh:mm:ss)	0 00:13:41

Subbasin : DC-03

Input Data

Area (ac)	1.56
Weighted Runoff Coefficient	0.41

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	1.56	-	0.41
Composite Area & Weighted Runoff Coeff.	1.56		0.41

Subbasin Runoff Results

Total Rainfall (in)	0.21
Total Runoff (in)	0.09
Peak Runoff (cfs)	0.81
Rainfall Intensity	1.267
Weighted Runoff Coefficient	0.41
Time of Concentration (days hh:mm:ss)	0 00:09:59

Subbasin : DC-04

Input Data

Area (ac)	0.98
Weighted Runoff Coefficient	0.05

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.98	-	0.05
Composite Area & Weighted Runoff Coeff.	0.98		0.05

Subbasin Runoff Results

Total Rainfall (in)	0.23
Total Runoff (in)	0.01
Peak Runoff (cfs)	0.06
Rainfall Intensity	1.194
Weighted Runoff Coefficient	0.05
Time of Concentration (days hh:mm:ss)	0 00:11:32

Subbasin : DC-05

Input Data

Area (ac)	2.62
Weighted Runoff Coefficient	0.13

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	2.62	-	0.13
Composite Area & Weighted Runoff Coeff.	2.62		0.13

Subbasin Runoff Results

Total Rainfall (in)	0.36
Total Runoff (in)	0.05
Peak Runoff (cfs)	0.26
Rainfall Intensity	0.762
Weighted Runoff Coefficient	0.13
Time of Concentration (days hh:mm:ss)	0 00:28:08

Subbasin : DC-06

Input Data

Area (ac)	0.75
Weighted Runoff Coefficient	0.12

Runoff Coefficient

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.75	-	0.12
Composite Area & Weighted Runoff Coeff.	0.75		0.12

Subbasin Runoff Results

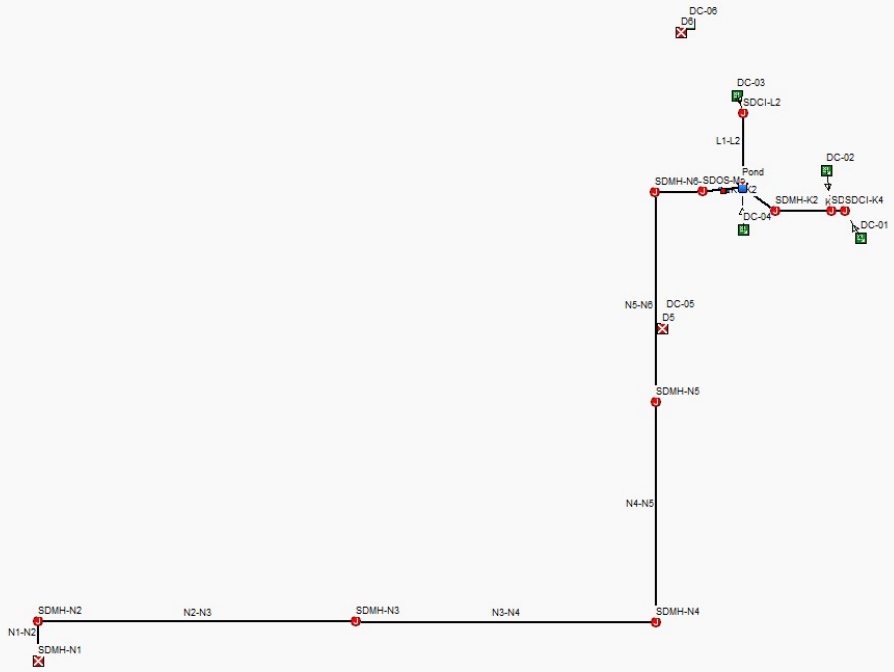
Total Rainfall (in)	0.28
Total Runoff (in)	0.03
Peak Runoff (cfs)	0.09
Rainfall Intensity	1.012
Weighted Runoff Coefficient	0.12
Time of Concentration (days hh:mm:ss)	0 00:16:37

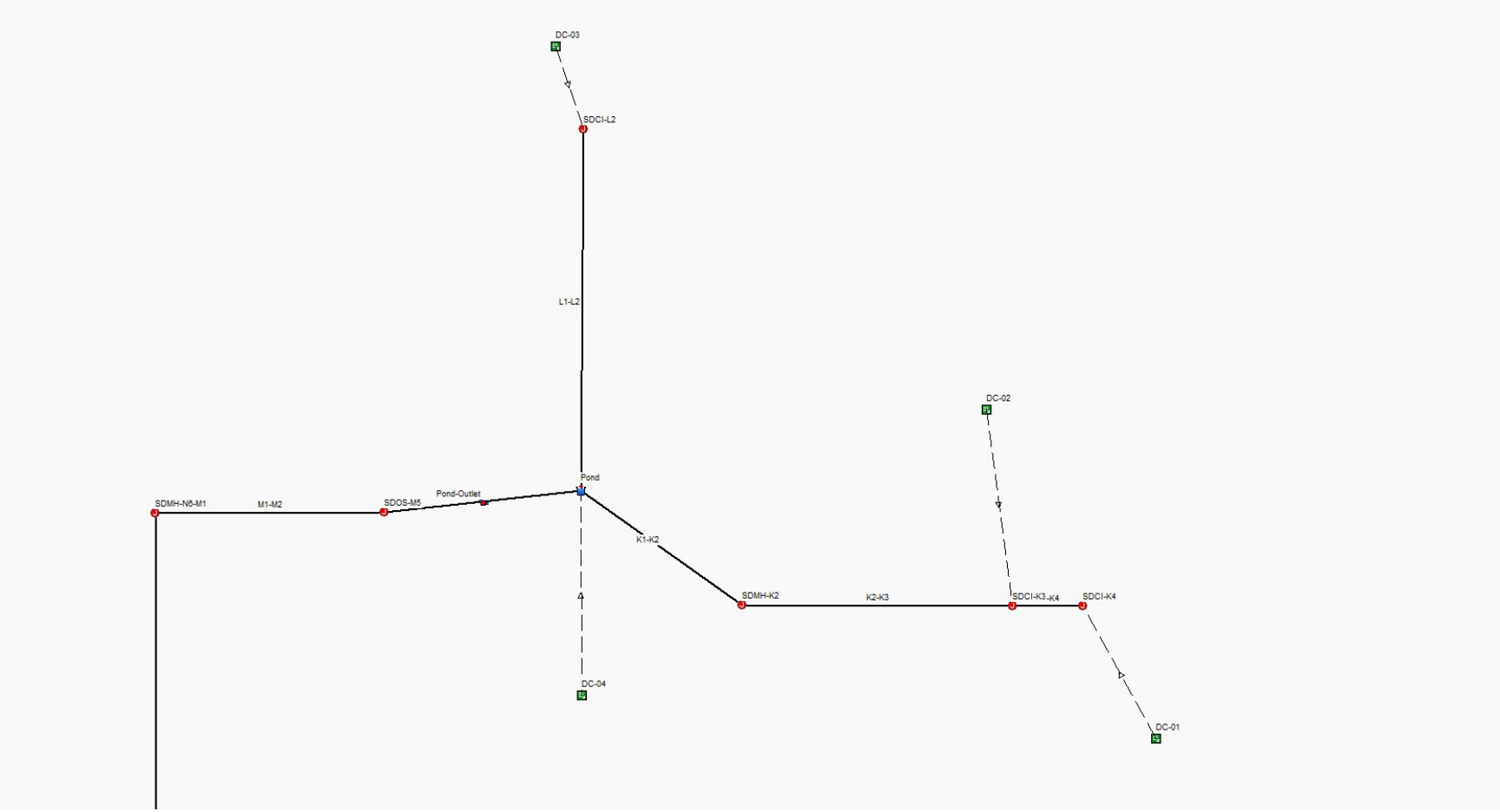
APPENDIX C

Proposed Hydraulic Model Results

1. SSA Developed Conditions Model View(s)
2. 2-Year Design Storm
3. 10-Year Design Storm
4. 100-Year Design Storm
5. Profile Views of Proposed Storm Drain

ADELES ACRES
Proposed Conditions Model




DC-03
SDCI-L2
L1-L2
DC-02
Pond
SDMH-N5-M1
M1-M2
SDOS-M5
Pond-Outlet
K1-K2
SDMH-K2
K2-K3
SDCI-K3
K3-K4
SDCI-K4
DC-04
DC-01

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.4.133 (Build 0)

****
Project Description
****
File Name ..... 2060-001 PR Model - Rational 2-YR.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. Rational
Time of Concentration..... User-Defined
Return Period..... 2 years
Link Routing Method ..... Hydrodynamic
Storage Node Exfiltration.. Horton, wetted area
Starting Date JUL-04-2017 00:00:00
Ending Date JUL-08-2017 00:00:00
Report Time Step 00:00:10

****
Element Count
****
Number of subbasins 6
Number of nodes 14
Number of links 11

****
Subbasin Summary
****

Subbasin ID	Total Area acres
DC-01	7.35
DC-02	2.05
DC-03	1.56
DC-04	0.98
DC-05	2.62
DC-06	0.75

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
SDCI-K3	JUNCTION	4540.67	4544.12	10.00	
SDCI-K4	JUNCTION	4540.82	4544.12	10.00	
SDCI-L2	JUNCTION	4541.25	4544.35	10.00	
SDMH-K2	JUNCTION	4540.07	4546.73	10.00	
SDMH-N2	JUNCTION	4530.60	4537.64	10.00	
SDMH-N3	JUNCTION	4533.31	4540.03	10.00	
SDMH-N4	JUNCTION	4535.89	4544.32	10.00	
SDMH-N5	JUNCTION	4537.36	4546.47	10.00	
SDMH-N6-M1	JUNCTION	4538.76	4547.49	10.00	
SDOS-M5	JUNCTION	4539.16	4546.40	10.00	
D5	OUTFALL	0.00	0.00	0.00	
D6	OUTFALL	0.00	0.00	0.00	
SDMH-N1	OUTFALL	4530.26	4531.76	0.00	

Pond	STORAGE	4539.16	4546.40	0.00	

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
K1-K2	SDMH-K2	Pond	CONDUIT	60.0	0.5000	0.0130
K2-K3	SDCI-K3	SDMH-K2	CONDUIT	119.0	0.5042	0.0130
K3-K4	SDCI-K4	SDCI-K3	CONDUIT	31.0	0.4839	0.0130
L1-L2	SDCI-L2	Pond	CONDUIT	115.0	0.4957	0.0130
M1-M2	SDOS-M5	SDMH-N6-M1	CONDUIT	101.0	0.3960	0.0130
N1-N2	SDMH-N2	SDMH-N1	CONDUIT	85.3	0.3986	0.0130
N2-N3	SDMH-N3	SDMH-N2	CONDUIT	685.0	0.3956	0.0130
N3-N4	SDMH-N4	SDMH-N3	CONDUIT	645.0	0.4000	0.0130
N4-N5	SDMH-N5	SDMH-N4	CONDUIT	475.0	0.3095	0.0130
N5-N6	SDMH-N6-M1	SDMH-N5	CONDUIT	451.0	0.3104	0.0130
Pond-Outlet	Pond	SDOS-M5	OUTLET			

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
K1-K2	CIRCULAR	2.00	2.00	1	3.14	0.50	16.00
K2-K3	CIRCULAR	2.00	2.00	1	3.14	0.50	16.06
K3-K4	CIRCULAR	2.00	2.00	1	3.14	0.50	15.74
L1-L2	CIRCULAR	1.50	1.50	1	1.77	0.38	7.40
M1-M2	CIRCULAR	1.50	1.50	1	1.77	0.38	6.61
N1-N2	CIRCULAR	1.50	1.50	1	1.77	0.38	6.63
N2-N3	CIRCULAR	1.50	1.50	1	1.77	0.38	6.61
N3-N4	CIRCULAR	1.50	1.50	1	1.77	0.38	6.64
N4-N5	CIRCULAR	1.50	1.50	1	1.77	0.38	5.84
N5-N6	CIRCULAR	1.50	1.50	1	1.77	0.38	5.85

****
Transect Summary
****

Transect C&G
Area:

0.0002	0.0007	0.0015	0.0027	0.0042
0.0060	0.0087	0.0126	0.0179	0.0244
0.0323	0.0414	0.0519	0.0637	0.0767

0.0911	0.1069	0.1252	0.1463	0.1700
0.1963	0.2240	0.2518	0.2795	0.3072
0.3349	0.3626	0.3903	0.4180	0.4457
0.4735	0.5012	0.5289	0.5566	0.5843
0.6120	0.6397	0.6674	0.6952	0.7229
0.7506	0.7783	0.8060	0.8337	0.8614
0.8891	0.9169	0.9446	0.9723	1.0000

Hrad:

0.0139	0.0278	0.0417	0.0556	0.0695
0.0834	0.0743	0.0783	0.0869	0.0976
0.1095	0.1222	0.1352	0.1486	0.1622
0.1760	0.1828	0.1855	0.1911	0.1986
0.2076	0.2364	0.2651	0.2937	0.3222
0.3506	0.3789	0.4070	0.4351	0.4630
0.4909	0.5186	0.5462	0.5737	0.6011
0.6284	0.6556	0.6827	0.7097	0.7366
0.7634	0.7901	0.8167	0.8432	0.8696
0.8958	0.9220	0.9481	0.9741	1.0000

Width:

0.0121	0.0241	0.0362	0.0482	0.0603
0.0723	0.1193	0.1662	0.2131	0.2600
0.3069	0.3539	0.4008	0.4477	0.4946
0.5415	0.6133	0.7100	0.8067	0.9033
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Runoff Quantity Continuity	Volume acre-ft	Depth inches
Total Precipitation	0.358	0.280
Continuity Error (%)	0.646	

Flow Routing Continuity	Volume acre-ft	Volume Mgallons
External Inflow	0.000	0.000
External Outflow	0.126	0.041
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.001	

Runoff Coefficient Computations Report

Subbasin DC-01

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	5.21	-	0.47
Composite Area & Weighted Runoff Coeff.	5.21		0.47

Subbasin DC-02

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.

-	2.05	-	0.51
Composite Area & Weighted Runoff Coeff.	2.05		0.51

Subbasin DC-03

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	1.56	-	0.41
Composite Area & Weighted Runoff Coeff.	1.56		0.41

Subbasin DC-04

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.98	-	0.05
Composite Area & Weighted Runoff Coeff.	0.98		0.05

Subbasin DC-05

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	2.62	-	0.13
Composite Area & Weighted Runoff Coeff.	2.62		0.13

Subbasin DC-06

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.75	-	0.12
Composite Area & Weighted Runoff Coeff.	0.75		0.12

****
Subbasin Runoff Summary
****

Subbasin ID	Accumulated Precip in	Rainfall Intensity in/hr	Total Runoff in	Peak Runoff cfs	Weighted Runoff Coeff	Time of Concentration days	Time of Concentration hh:mm:ss
DC-01	0.28	1.00	0.13	3.47	0.470	0	00:16:52
DC-02	0.25	1.11	0.13	1.16	0.510	0	00:13:40
DC-03	0.21	1.27	0.09	0.81	0.410	0	00:09:59
DC-04	0.23	1.19	0.01	0.06	0.050	0	00:11:32
DC-05	0.36	0.76	0.05	0.26	0.130	0	00:28:07
DC-06	0.28	1.01	0.03	0.09	0.120	0	00:16:36

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss

SDCI-K3	0.00	0.81	4541.48	0	00:17	0	0	0:00:00
SDCI-K4	0.00	0.85	4541.67	0	00:17	0	0	0:00:00
SDCI-L2	0.00	0.35	4541.60	0	00:10	0	0	0:00:00
SDMH-K2	0.07	0.83	4540.90	0	00:17	0	0	0:00:00
SDMH-N2	0.03	0.12	4530.72	0	01:06	0	0	0:00:00
SDMH-N3	0.03	0.12	4533.43	0	00:57	0	0	0:00:00
SDMH-N4	0.03	0.12	4536.01	0	00:47	0	0	0:00:00
SDMH-N5	0.03	0.13	4537.49	0	00:38	0	0	0:00:00
SDMH-N6-M1	0.03	0.12	4538.88	0	00:39	0	0	0:00:00
SDOS-M5	0.03	0.12	4539.28	0	00:34	0	0	0:00:00
D5	0.00	0.00	0.00	0	00:00	0	0	0:00:00
D6	0.00	0.00	0.00	0	00:00	0	0	0:00:00
SDMH-N1	0.03	0.11	4530.37	0	01:06	0	0	0:00:00
Pond	0.31	1.61	4540.77	0	00:34	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	hh:mm
SDCI-K3	JUNCTION	1.16	4.34	0	00:17	0.00		
SDCI-K4	JUNCTION	3.47	3.47	0	00:16	0.00		
SDCI-L2	JUNCTION	0.81	0.81	0	00:10	0.00		
SDMH-K2	JUNCTION	0.00	4.33	0	00:17	0.00		
SDMH-N2	JUNCTION	0.00	0.08	0	01:01	0.00		
SDMH-N3	JUNCTION	0.00	0.08	0	00:51	0.00		
SDMH-N4	JUNCTION	0.00	0.08	0	00:43	0.00		
SDMH-N5	JUNCTION	0.00	0.08	0	00:39	0.00		
SDMH-N6-M1	JUNCTION	0.00	0.08	0	00:35	0.00		
SDOS-M5	JUNCTION	0.00	0.08	0	00:34	0.00		
D5	OUTFALL	0.26	0.26	0	00:28	0.00		
D6	OUTFALL	0.09	0.09	0	00:16	0.00		
SDMH-N1	OUTFALL	0.00	0.08	0	01:06	0.00		
Pond	STORAGE	0.06	4.61	0	00:17	0.00		

****
Storage Node Summary
****

Storage Node ID	Maximum Ponded Volume 1000 ft³	Maximum Ponded (%)	Time of Max Ponded days	hh:mm	Average Ponded Volume 1000 ft³	Average Ponded (%)	Maximum Storage Node Outflow cfs	Maximum Exfiltration Rate cfm	Time of Max. Exfiltration hh:mm:ss	Total Exfiltrated Volume 1000 ft³
Pond	4.718	5	0	00:34	0.575	1	0.17	0.00	0:00:00	0.000

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
D5	0.97	0.13	0.26
D6	0.57	0.05	0.09
SDMH-N1	31.88	0.05	0.08
System	11.14	0.22	0.29

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Depth	Total Time Surcharged minutes	Reported Condition
K1-K2	CONDUIT	0 00:17	3.86	1.00	4.31	16.00	0.27	0.43	0	Calculated
K2-K3	CONDUIT	0 00:17	3.58	1.00	4.33	16.06	0.27	0.41	0	Calculated
K3-K4	CONDUIT	0 00:17	2.82	1.00	3.46	15.74	0.22	0.41	0	Calculated
L1-L2	CONDUIT	0 00:10	2.63	1.00	0.78	7.40	0.11	0.23	0	Calculated
M1-M2	CONDUIT	0 00:35	1.21	1.00	0.08	6.61	0.01	0.08	0	Calculated
N1-N2	CONDUIT	0 01:06	1.25	1.00	0.08	6.63	0.01	0.08	0	Calculated
N2-N3	CONDUIT	0 01:01	1.28	1.00	0.08	6.61	0.01	0.08	0	Calculated
N3-N4	CONDUIT	0 00:51	1.36	1.00	0.08	6.64	0.01	0.08	0	Calculated
N4-N5	CONDUIT	0 00:43	1.19	1.00	0.08	5.84	0.01	0.08	0	Calculated
N5-N6	CONDUIT	0 00:39	1.15	1.00	0.08	5.85	0.01	0.08	0	Calculated
Pond-Outlet	OUTLET	0 00:34			0.08					

****
Highest Flow Instability Indexes
****
Link Pond-Outlet (3)

Analysis began on: Thu Mar 2 19:22:40 2023
Analysis ended on: Thu Mar 2 19:22:51 2023
Total elapsed time: 00:00:11

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.4.133 (Build 0)

****
Project Description
****
File Name ..... 2060-001 PR Model - Rational 10-YR.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. Rational
Time of Concentration..... User-Defined
Return Period..... 10 years
Link Routing Method ..... Hydrodynamic
Storage Node Exfiltration.. Horton, wetted area
Starting Date JUL-04-2017 00:00:00
Ending Date JUL-08-2017 00:00:00
Report Time Step 00:00:10

****
Element Count
****
Number of subbasins 6
Number of nodes 14
Number of links 11

****
Subbasin Summary
****

Subbasin ID	Total Area acres
DC-01	7.35
DC-02	2.05
DC-03	1.56
DC-04	0.98
DC-05	2.62
DC-06	0.75

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
SDCI-K3	JUNCTION	4540.67	4544.12	10.00	
SDCI-K4	JUNCTION	4540.82	4544.12	10.00	
SDCI-L2	JUNCTION	4541.25	4544.35	10.00	
SDMH-K2	JUNCTION	4540.07	4546.73	10.00	
SDMH-N2	JUNCTION	4530.60	4537.64	10.00	
SDMH-N3	JUNCTION	4533.31	4540.03	10.00	
SDMH-N4	JUNCTION	4535.89	4544.32	10.00	
SDMH-N5	JUNCTION	4537.36	4546.47	10.00	
SDMH-N6-M1	JUNCTION	4538.76	4547.49	10.00	
SDOS-M5	JUNCTION	4539.16	4546.40	10.00	
D5	OUTFALL	0.00	0.00	0.00	
D6	OUTFALL	0.00	0.00	0.00	
SDMH-N1	OUTFALL	4530.26	4531.76	0.00	

Pond	STORAGE	4539.16	4546.40	0.00	

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
K1-K2	SDMH-K2	Pond	CONDUIT	60.0	0.5000	0.0130
K2-K3	SDCI-K3	SDMH-K2	CONDUIT	119.0	0.5042	0.0130
K3-K4	SDCI-K4	SDCI-K3	CONDUIT	31.0	0.4839	0.0130
L1-L2	SDCI-L2	Pond	CONDUIT	115.0	0.4957	0.0130
M1-M2	SDOS-M5	SDMH-N6-M1	CONDUIT	101.0	0.3960	0.0130
N1-N2	SDMH-N2	SDMH-N1	CONDUIT	85.3	0.3986	0.0130
N2-N3	SDMH-N3	SDMH-N2	CONDUIT	685.0	0.3956	0.0130
N3-N4	SDMH-N4	SDMH-N3	CONDUIT	645.0	0.4000	0.0130
N4-N5	SDMH-N5	SDMH-N4	CONDUIT	475.0	0.3095	0.0130
N5-N6	SDMH-N6-M1	SDMH-N5	CONDUIT	451.0	0.3104	0.0130
Pond-Outlet	Pond	SDOS-M5	OUTLET			

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
K1-K2	CIRCULAR	2.00	2.00	1	3.14	0.50	16.00
K2-K3	CIRCULAR	2.00	2.00	1	3.14	0.50	16.06
K3-K4	CIRCULAR	2.00	2.00	1	3.14	0.50	15.74
L1-L2	CIRCULAR	1.50	1.50	1	1.77	0.38	7.40
M1-M2	CIRCULAR	1.50	1.50	1	1.77	0.38	6.61
N1-N2	CIRCULAR	1.50	1.50	1	1.77	0.38	6.63
N2-N3	CIRCULAR	1.50	1.50	1	1.77	0.38	6.61
N3-N4	CIRCULAR	1.50	1.50	1	1.77	0.38	6.64
N4-N5	CIRCULAR	1.50	1.50	1	1.77	0.38	5.84
N5-N6	CIRCULAR	1.50	1.50	1	1.77	0.38	5.85

****
Transect Summary
****

Transect C&G
Area:

0.0002	0.0007	0.0015	0.0027	0.0042
0.0060	0.0087	0.0126	0.0179	0.0244
0.0323	0.0414	0.0519	0.0637	0.0767

0.0911	0.1069	0.1252	0.1463	0.1700
0.1963	0.2240	0.2518	0.2795	0.3072
0.3349	0.3626	0.3903	0.4180	0.4457
0.4735	0.5012	0.5289	0.5566	0.5843
0.6120	0.6397	0.6674	0.6952	0.7229
0.7506	0.7783	0.8060	0.8337	0.8614
0.8891	0.9169	0.9446	0.9723	1.0000

Hrad:

0.0139	0.0278	0.0417	0.0556	0.0695
0.0834	0.0743	0.0783	0.0869	0.0976
0.1095	0.1222	0.1352	0.1486	0.1622
0.1760	0.1828	0.1855	0.1911	0.1986
0.2076	0.2364	0.2651	0.2937	0.3222
0.3506	0.3789	0.4070	0.4351	0.4630
0.4909	0.5186	0.5462	0.5737	0.6011
0.6284	0.6556	0.6827	0.7097	0.7366
0.7634	0.7901	0.8167	0.8432	0.8696
0.8958	0.9220	0.9481	0.9741	1.0000

Width:

0.0121	0.0241	0.0362	0.0482	0.0603
0.0723	0.1193	0.1662	0.2131	0.2600
0.3069	0.3539	0.4008	0.4477	0.4946
0.5415	0.6133	0.7100	0.8067	0.9033
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Runoff Quantity Continuity	Volume acre-ft	Depth inches
Total Precipitation	0.586	0.459
Continuity Error (%)	0.563	

Flow Routing Continuity	Volume acre-ft	Volume Mgallons
External Inflow	0.000	0.000
External Outflow	0.255	0.083
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.001	

Runoff Coefficient Computations Report

Subbasin DC-01

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	5.21	-	0.55
Composite Area & Weighted Runoff Coeff.	5.21		0.55

Subbasin DC-02

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.

-	2.05	-	0.59
Composite Area & Weighted Runoff Coeff.	2.05		0.59

Subbasin DC-03

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	1.56	-	0.50
Composite Area & Weighted Runoff Coeff.	1.56		0.50

Subbasin DC-04

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.98	-	0.13
Composite Area & Weighted Runoff Coeff.	0.98		0.13

Subbasin DC-05

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	2.62	-	0.22
Composite Area & Weighted Runoff Coeff.	2.62		0.22

Subbasin DC-06

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.75	-	0.21
Composite Area & Weighted Runoff Coeff.	0.75		0.21

****
Subbasin Runoff Summary
****

Subbasin ID	Accumulated Precip in	Rainfall Intensity in/hr	Total Runoff in	Peak Runoff cfs	Weighted Runoff Coeff	Time of Concentration days	Time of Concentration hh:mm:ss
DC-01	0.46	1.65	0.25	6.65	0.550	0	00:16:52
DC-02	0.41	1.82	0.24	2.20	0.590	0	00:13:40
DC-03	0.35	2.08	0.17	1.62	0.500	0	00:09:59
DC-04	0.38	1.96	0.05	0.25	0.130	0	00:11:32
DC-05	0.59	1.25	0.13	0.72	0.220	0	00:28:07
DC-06	0.46	1.66	0.10	0.26	0.210	0	00:16:36

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss

SDCI-K3	0.06	1.24	4541.91	0	00:17	0	0	0:00:00
SDCI-K4	0.04	1.31	4542.13	0	00:17	0	0	0:00:00
SDCI-L2	0.00	0.51	4541.76	0	00:10	0	0	0:00:00
SDMH-K2	0.21	1.35	4541.42	0	00:34	0	0	0:00:00
SDMH-N2	0.05	0.14	4530.74	0	01:00	0	0	0:00:00
SDMH-N3	0.04	0.14	4533.45	0	00:52	0	0	0:00:00
SDMH-N4	0.04	0.14	4536.03	0	00:43	0	0	0:00:00
SDMH-N5	0.05	0.15	4537.51	0	00:35	0	0	0:00:00
SDMH-N6-M1	0.05	0.15	4538.91	0	00:27	0	0	0:00:00
SDOS-M5	0.04	0.14	4539.30	0	00:34	0	0	0:00:00
D5	0.00	0.00	0.00	0	00:00	0	0	0:00:00
D6	0.00	0.00	0.00	0	00:00	0	0	0:00:00
SDMH-N1	0.04	0.14	4530.40	0	01:00	0	0	0:00:00
Pond	0.57	2.26	4541.42	0	00:33	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	hh:mm
SDCI-K3	JUNCTION	2.20	8.32	0	00:17	0.00		
SDCI-K4	JUNCTION	6.65	6.65	0	00:16	0.00		
SDCI-L2	JUNCTION	1.62	1.62	0	00:10	0.00		
SDMH-K2	JUNCTION	0.00	8.27	0	00:17	0.00		
SDMH-N2	JUNCTION	0.00	0.12	0	00:55	0.00		
SDMH-N3	JUNCTION	0.00	0.12	0	00:47	0.00		
SDMH-N4	JUNCTION	0.00	0.12	0	00:40	0.00		
SDMH-N5	JUNCTION	0.00	0.12	0	00:30	0.00		
SDMH-N6-M1	JUNCTION	0.00	0.12	0	00:34	0.00		
SDOS-M5	JUNCTION	0.00	0.12	0	00:33	0.00		
D5	OUTFALL	0.72	0.72	0	00:28	0.00		
D6	OUTFALL	0.26	0.26	0	00:16	0.00		
SDMH-N1	OUTFALL	0.00	0.12	0	01:00	0.00		
Pond	STORAGE	0.25	8.85	0	00:16	0.00		

****
Storage Node Summary
****

Storage Node ID	Maximum Ponded Volume 1000 ft³	Maximum Ponded Volume (%)	Time of Max Ponded Volume days	hh:mm	Average Ponded Volume 1000 ft³	Average Ponded Volume (%)	Maximum Storage Node Outflow cfs	Maximum Exfiltration Rate cfm	Time of Max Exfiltration Rate hh:mm:ss	Total Exfiltrated Volume 1000 ft³
Pond	9.036	10	0	00:33	1.492	2	0.32	0.00	0:00:00	0.000

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
D5	0.98	0.36	0.72
D6	0.58	0.13	0.26
SDMH-N1	45.30	0.06	0.12
System	15.62	0.55	0.80

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Depth	Total Time minutes	Reported Condition
K1-K2	CONDUIT	0 00:17	4.44	1.00	8.17	16.00	0.51	0.75	0	Calculated
K2-K3	CONDUIT	0 00:17	4.01	1.00	8.27	16.06	0.51	0.63	0	Calculated
K3-K4	CONDUIT	0 00:17	3.14	1.00	6.64	15.74	0.42	0.64	0	Calculated
L1-L2	CONDUIT	0 00:10	3.16	1.00	1.58	7.40	0.21	0.33	0	Calculated
M1-M2	CONDUIT	0 00:34	1.36	1.00	0.12	6.61	0.02	0.10	0	Calculated
N1-N2	CONDUIT	0 01:00	1.40	1.00	0.12	6.63	0.02	0.09	0	Calculated
N2-N3	CONDUIT	0 00:55	1.44	1.00	0.12	6.61	0.02	0.09	0	Calculated
N3-N4	CONDUIT	0 00:47	1.55	1.00	0.12	6.64	0.02	0.09	0	Calculated
N4-N5	CONDUIT	0 00:40	1.35	1.00	0.12	5.84	0.02	0.10	0	Calculated
N5-N6	CONDUIT	0 00:30	1.30	1.00	0.12	5.85	0.02	0.10	0	Calculated
Pond-Outlet	OUTLET	0 00:33			0.12					

****
Highest Flow Instability Indexes
****
All links are stable.

Analysis began on: Thu Mar 2 19:51:12 2023
Analysis ended on: Thu Mar 2 19:51:23 2023
Total elapsed time: 00:00:11

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.4.133 (Build 0)

****
Project Description
****
File Name ..... 2060-001 PR Model - Rational 100-YR.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. Rational
Time of Concentration..... User-Defined
Return Period..... 100 years
Link Routing Method ..... Hydrodynamic
Storage Node Exfiltration.. Horton, wetted area
Starting Date JUL-04-2017 00:00:00
Ending Date JUL-08-2017 00:00:00
Report Time Step 00:00:10

****
Element Count
****
Number of subbasins 6
Number of nodes 14
Number of links 11

****
Subbasin Summary
****

Subbasin ID	Total Area acres
DC-01	7.35
DC-02	2.05
DC-03	1.56
DC-04	0.98
DC-05	2.62
DC-06	0.75

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
SDCI-K3	JUNCTION	4540.67	4544.12	10.00	
SDCI-K4	JUNCTION	4540.82	4544.12	10.00	
SDCI-L2	JUNCTION	4541.25	4544.35	10.00	
SDMH-K2	JUNCTION	4540.07	4546.73	10.00	
SDMH-N2	JUNCTION	4530.60	4537.64	10.00	
SDMH-N3	JUNCTION	4533.31	4540.03	10.00	
SDMH-N4	JUNCTION	4535.89	4544.32	10.00	
SDMH-N5	JUNCTION	4537.36	4546.47	10.00	
SDMH-N6-M1	JUNCTION	4538.76	4547.49	10.00	
SDOS-M5	JUNCTION	4539.16	4546.40	10.00	
D5	OUTFALL	0.00	0.00	0.00	
D6	OUTFALL	0.00	0.00	0.00	
SDMH-N1	OUTFALL	4530.26	4531.76	0.00	

Pond	STORAGE	4539.16	4546.40	0.00	

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
K1-K2	SDMH-K2	Pond	CONDUIT	60.0	0.5000	0.0130
K2-K3	SDCI-K3	SDMH-K2	CONDUIT	119.0	0.5042	0.0130
K3-K4	SDCI-K4	SDCI-K3	CONDUIT	31.0	0.4839	0.0130
L1-L2	SDCI-L2	Pond	CONDUIT	115.0	0.4957	0.0130
M1-M2	SDOS-M5	SDMH-N6-M1	CONDUIT	101.0	0.3960	0.0130
N1-N2	SDMH-N2	SDMH-N1	CONDUIT	85.3	0.3986	0.0130
N2-N3	SDMH-N3	SDMH-N2	CONDUIT	685.0	0.3956	0.0130
N3-N4	SDMH-N4	SDMH-N3	CONDUIT	645.0	0.4000	0.0130
N4-N5	SDMH-N5	SDMH-N4	CONDUIT	475.0	0.3095	0.0130
N5-N6	SDMH-N6-M1	SDMH-N5	CONDUIT	451.0	0.3104	0.0130
Pond-Outlet	Pond	SDOS-M5	OUTLET			

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
K1-K2	CIRCULAR	2.00	2.00	1	3.14	0.50	16.00
K2-K3	CIRCULAR	2.00	2.00	1	3.14	0.50	16.06
K3-K4	CIRCULAR	2.00	2.00	1	3.14	0.50	15.74
L1-L2	CIRCULAR	1.50	1.50	1	1.77	0.38	7.40
M1-M2	CIRCULAR	1.50	1.50	1	1.77	0.38	6.61
N1-N2	CIRCULAR	1.50	1.50	1	1.77	0.38	6.63
N2-N3	CIRCULAR	1.50	1.50	1	1.77	0.38	6.61
N3-N4	CIRCULAR	1.50	1.50	1	1.77	0.38	6.64
N4-N5	CIRCULAR	1.50	1.50	1	1.77	0.38	5.84
N5-N6	CIRCULAR	1.50	1.50	1	1.77	0.38	5.85

****
Transect Summary
****

Transect C&G
Area:

0.0002	0.0007	0.0015	0.0027	0.0042
0.0060	0.0087	0.0126	0.0179	0.0244
0.0323	0.0414	0.0519	0.0637	0.0767

0.0911	0.1069	0.1252	0.1463	0.1700
0.1963	0.2240	0.2518	0.2795	0.3072
0.3349	0.3626	0.3903	0.4180	0.4457
0.4735	0.5012	0.5289	0.5566	0.5843
0.6120	0.6397	0.6674	0.6952	0.7229
0.7506	0.7783	0.8060	0.8337	0.8614
0.8891	0.9169	0.9446	0.9723	1.0000

Hrad:

0.0139	0.0278	0.0417	0.0556	0.0695
0.0834	0.0743	0.0783	0.0869	0.0976
0.1095	0.1222	0.1352	0.1486	0.1622
0.1760	0.1828	0.1855	0.1911	0.1986
0.2076	0.2364	0.2651	0.2937	0.3222
0.3506	0.3789	0.4070	0.4351	0.4630
0.4909	0.5186	0.5462	0.5737	0.6011
0.6284	0.6556	0.6827	0.7097	0.7366
0.7634	0.7901	0.8167	0.8432	0.8696
0.8958	0.9220	0.9481	0.9741	1.0000

Width:

0.0121	0.0241	0.0362	0.0482	0.0603
0.0723	0.1193	0.1662	0.2131	0.2600
0.3069	0.3539	0.4008	0.4477	0.4946
0.5415	0.6133	0.7100	0.8067	0.9033
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000
1.0000	1.0000	1.0000	1.0000	1.0000

Runoff Quantity Continuity	Volume acre-ft	Depth inches
Total Precipitation	1.001	0.784
Continuity Error (%)	0.359	

Flow Routing Continuity	Volume acre-ft	Volume Mgallons
External Inflow	0.000	0.000
External Outflow	0.641	0.209
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

Runoff Coefficient Computations Report

Subbasin DC-01

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	5.21	-	0.71
Composite Area & Weighted Runoff Coeff.	5.21		0.71

Subbasin DC-02

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.

-	2.05	-	0.73
Composite Area & Weighted Runoff Coeff.	2.05		0.73

Subbasin DC-03

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	1.56	-	0.68
Composite Area & Weighted Runoff Coeff.	1.56		0.68

Subbasin DC-04

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.98	-	0.47
Composite Area & Weighted Runoff Coeff.	0.98		0.47

Subbasin DC-05

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	2.62	-	0.52
Composite Area & Weighted Runoff Coeff.	2.62		0.52

Subbasin DC-06

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.75	-	0.52
Composite Area & Weighted Runoff Coeff.	0.75		0.52

****
Subbasin Runoff Summary
****

Subbasin ID	Accumulated Precip in	Rainfall Intensity in/hr	Total Runoff in	Peak Runoff cfs	Weighted Runoff Coeff	Time of Concentration days	Time of Concentration hh:mm:ss
DC-01	0.79	2.81	0.56	14.66	0.710	0	00:16:52
DC-02	0.71	3.10	0.52	4.64	0.730	0	00:13:40
DC-03	0.59	3.55	0.40	3.76	0.680	0	00:09:59
DC-04	0.64	3.34	0.30	1.54	0.470	0	00:11:32
DC-05	1.00	2.13	0.52	2.91	0.520	0	00:28:07
DC-06	0.79	2.83	0.41	1.10	0.520	0	00:16:36

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss

SDCI-K3	0.18	3.42	4544.09	0	00:17	0	0	0:00:00
SDCI-K4	0.14	3.73	4544.55	0	00:17	0.00	4	0:00:00
SDCI-L2	0.06	1.44	4542.69	0	00:31	0	0	0:00:00
SDMH-K2	0.38	2.72	4542.79	0	00:19	0	0	0:00:00
SDMH-N2	0.07	0.69	4531.29	0	00:41	0	0	0:00:00
SDMH-N3	0.07	0.62	4533.93	0	00:37	0	0	0:00:00
SDMH-N4	0.07	0.63	4536.52	0	00:34	0	0	0:00:00
SDMH-N5	0.07	0.70	4538.06	0	00:31	0	0	0:00:00
SDMH-N6-M1	0.07	0.68	4539.44	0	00:26	0	0	0:00:00
SDOS-M5	0.07	0.70	4539.86	0	00:31	0	0	0:00:00
D5	0.00	0.00	0.00	0	00:00	0	0	0:00:00
D6	0.00	0.00	0.00	0	00:00	0	0	0:00:00
SDMH-N1	0.07	0.61	4530.87	0	00:41	0	0	0:00:00
Pond	0.84	3.50	4542.66	0	00:31	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	Time of Peak Inflow Occurrence hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	Time of Peak Flooding Occurrence hh:mm
SDCI-K3	JUNCTION	4.64	18.13	0	00:17	0.00		
SDCI-K4	JUNCTION	14.66	14.66	0	00:17	0.17	0	00:16
SDCI-L2	JUNCTION	3.76	3.76	0	00:10	0.00		
SDMH-K2	JUNCTION	0.00	18.13	0	00:17	0.00		
SDMH-N2	JUNCTION	0.00	2.33	0	00:38	0.00		
SDMH-N3	JUNCTION	0.00	2.32	0	00:35	0.00		
SDMH-N4	JUNCTION	0.00	2.31	0	00:32	0.00		
SDMH-N5	JUNCTION	0.00	2.31	0	00:28	0.00		
SDMH-N6-M1	JUNCTION	0.00	2.28	0	00:31	0.00		
SDOS-M5	JUNCTION	0.00	2.28	0	00:31	0.00		
D5	OUTFALL	2.91	2.91	0	00:28	0.00		
D6	OUTFALL	1.10	1.10	0	00:16	0.00		
SDMH-N1	OUTFALL	0.00	2.29	0	00:41	0.00		
Pond	STORAGE	1.54	20.35	0	00:14	0.00		

****
Storage Node Summary
****

Storage Node ID	Maximum Ponded Volume 1000 ft³	Maximum Ponded (%)	Time of Max Ponded days	Time of Max Ponded hh:mm	Average Ponded Volume 1000 ft³	Average Ponded (%)	Maximum Storage Node Outflow cfs	Maximum Exfiltration Rate cfm	Time of Max. Exfiltration hh:mm:ss	Total Exfiltrated Volume 1000 ft³
Pond	19.203	21	0	00:31	2.712	3	2.55	0.00	0:00:00	0.000

****
Outfall Loading Summary
****

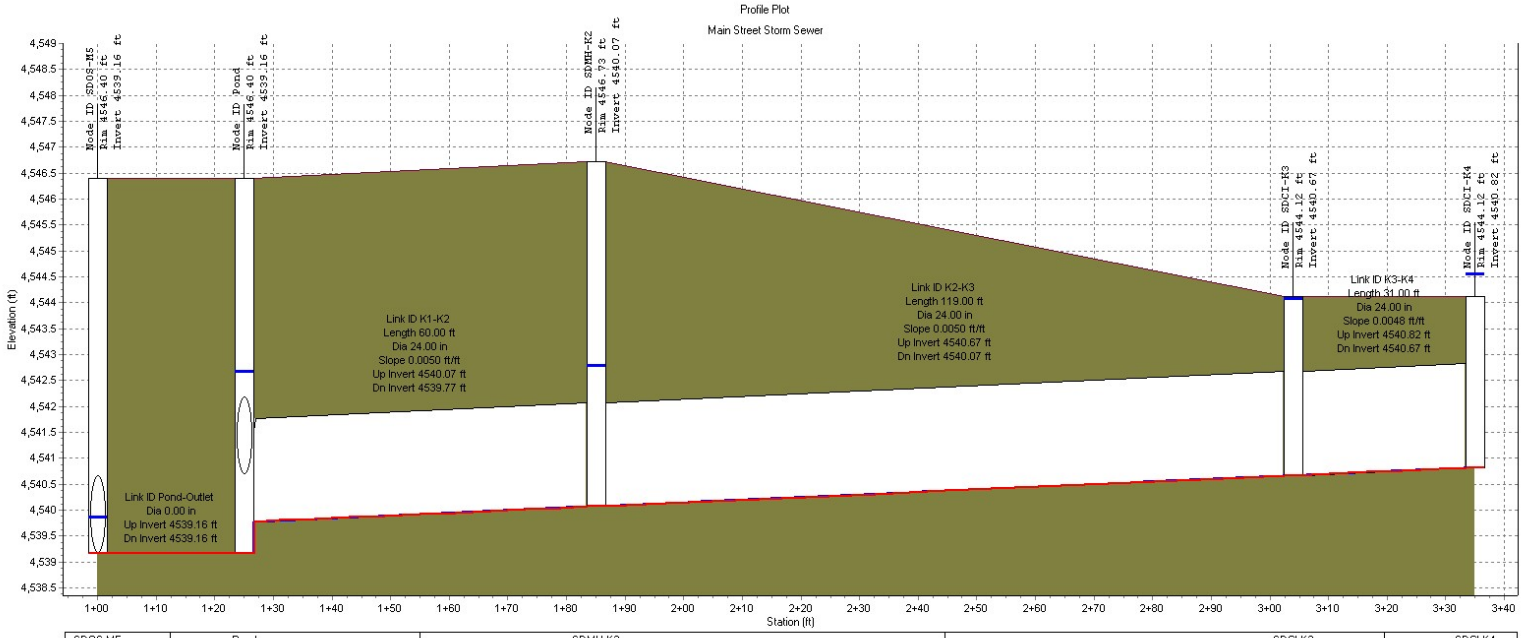
Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
D5	0.98	1.46	2.91
D6	0.58	0.55	1.10
SDMH-N1	55.40	0.11	2.29
System	18.99	2.13	4.08

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Depth	Total Time Surcharged minutes	Reported Condition
K1-K2	CONDUIT	0 00:17	5.77	1.00	18.13	16.00	1.13	1.00	117	SURCHARGED
K2-K3	CONDUIT	0 00:17	5.77	1.00	18.13	16.06	1.13	1.00	18	SURCHARGED
K3-K4	CONDUIT	0 00:17	4.65	1.00	14.60	15.74	0.93	1.00	16	SURCHARGED
L1-L2	CONDUIT	0 00:10	3.92	1.00	3.67	7.40	0.50	0.98	0	Calculated
M1-M2	CONDUIT	0 00:31	3.52	1.00	2.28	6.61	0.35	0.46	0	Calculated
N1-N2	CONDUIT	0 00:41	3.14	1.00	2.29	6.63	0.35	0.43	0	Calculated
N2-N3	CONDUIT	0 00:38	3.30	1.00	2.33	6.61	0.35	0.43	0	Calculated
N3-N4	CONDUIT	0 00:35	3.66	1.00	2.32	6.64	0.35	0.41	0	Calculated
N4-N5	CONDUIT	0 00:32	3.37	1.00	2.31	5.84	0.39	0.44	0	Calculated
N5-N6	CONDUIT	0 00:28	3.47	1.00	2.31	5.85	0.40	0.45	0	Calculated
Pond-Outlet	OUTLET	0 00:31			2.28					

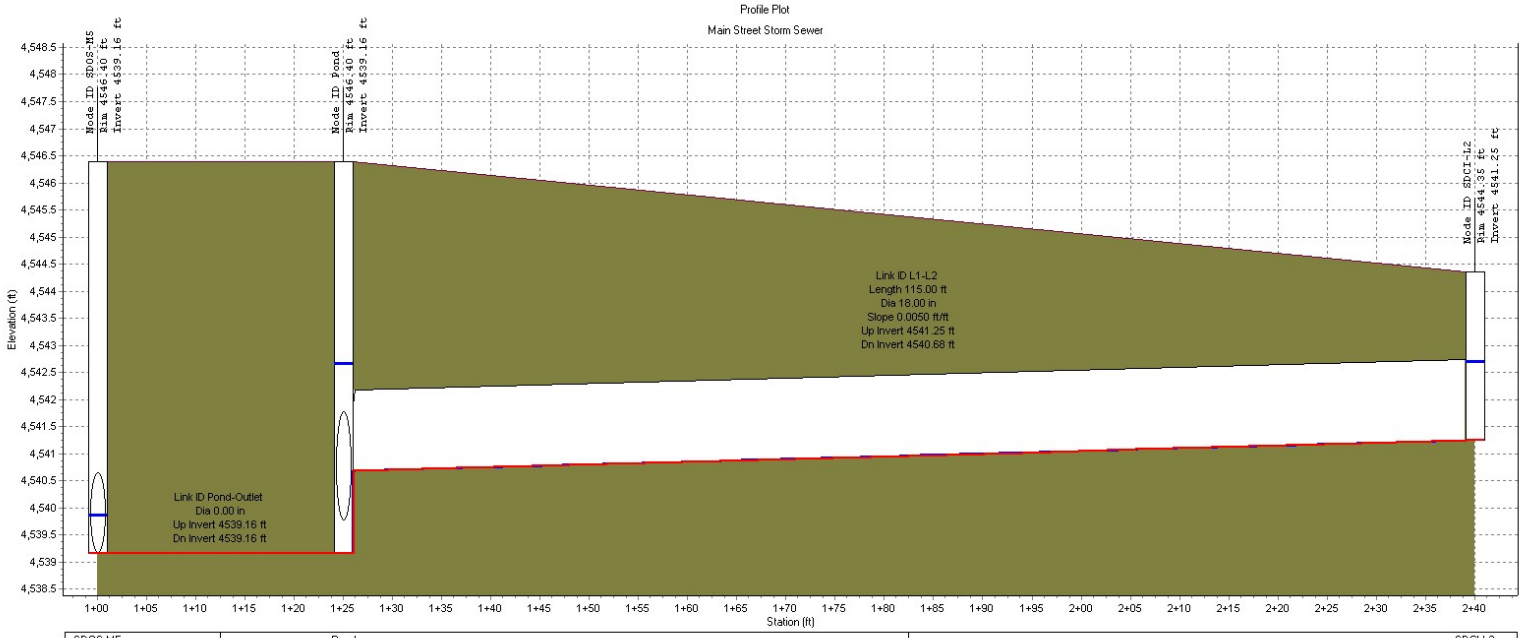
****
Highest Flow Instability Indexes
****
Link Pond-Outlet (2)

Analysis began on: Thu Mar 2 19:33:01 2023
Analysis ended on: Thu Mar 2 19:33:13 2023
Total elapsed time: 00:00:12



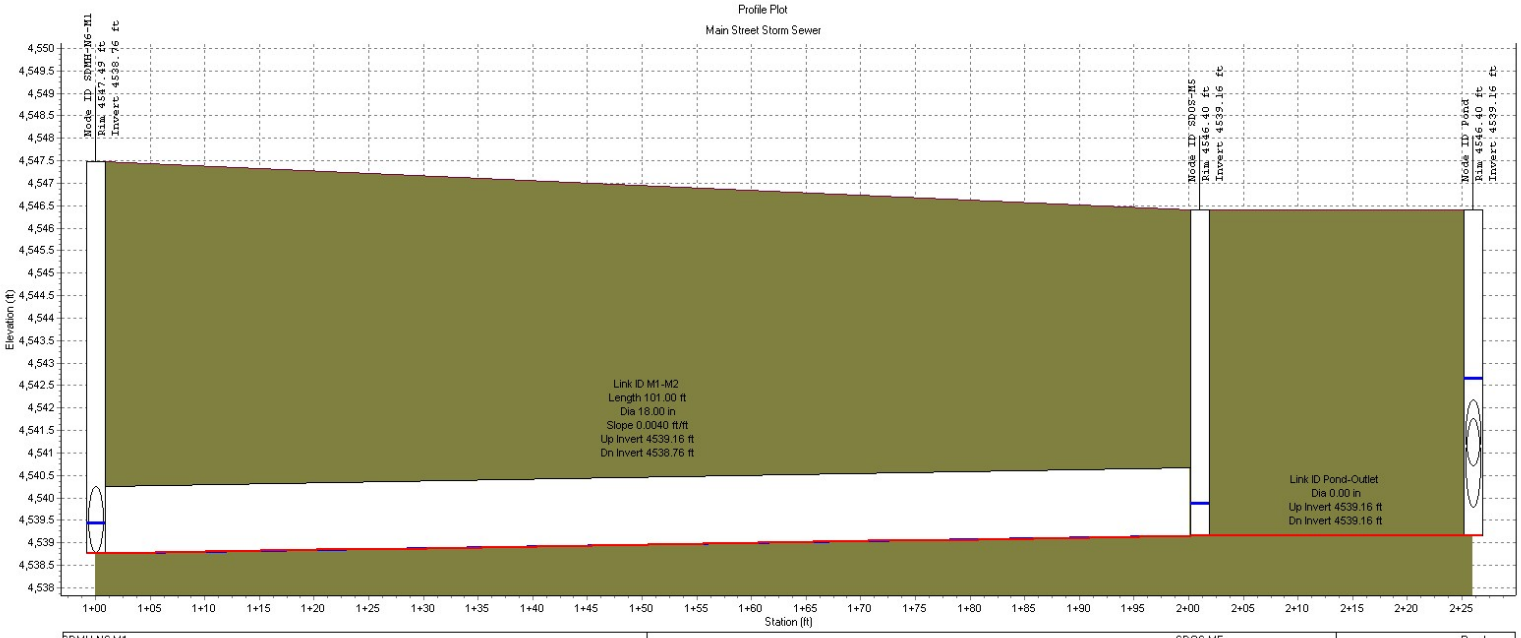
Node ID:	SDOS-M5	Pond	SDMH-K2	SDCI-K3	SDCI-K4
Rim (ft):	4546.40	4546.40	4546.73	4544.12	4544.12
Invert (ft):	4539.16	4539.16	4540.07	4540.67	4540.82
Min Pipe Cover (ft):	0.00		4.66	1.45	1.30
Max HGL (ft):	4539.86	4542.66	4542.79	4544.09	4544.55

Link ID:	Pond-Outlet	K1-K2	K2-K3	K3-K4
Length (ft):		60.00	119.00	31.00
Dia (in):	0.00	24.00	24.00	24.00
Slope (ft/ft):		0.0050	0.0050	0.0048
Up Invert (ft):	4539.16	4540.07	4540.67	4540.82
Dn Invert (ft):	4539.16	4539.77	4540.07	4540.67
Max Q (cfs):	2.28	18.13	18.13	14.60
Max Vel (ft/s):	0.00	5.77	5.77	4.65
Max Depth (ft):	0.00	2.00	2.00	2.00



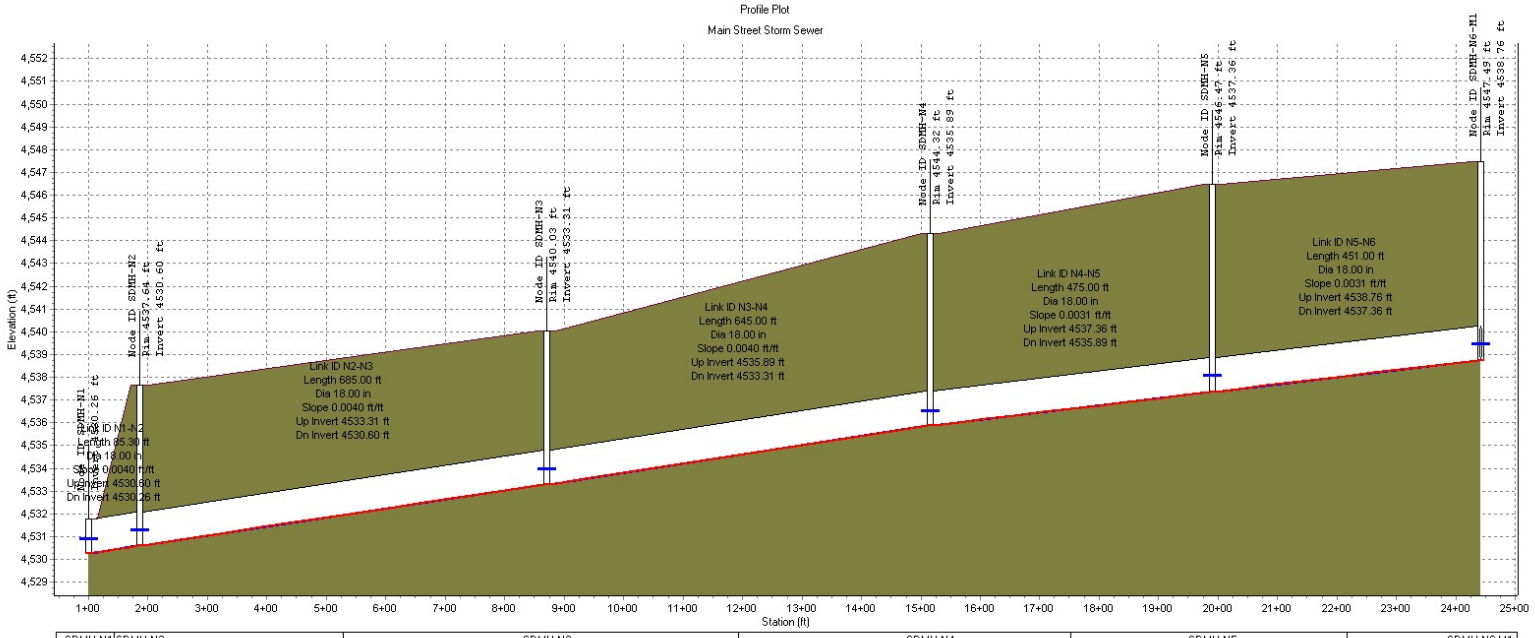
Node ID:	SDOS-M5	Pond	SDCI-L2
Rim (ft):	4546.40	4546.40	4544.35
Invert (ft):	4539.16	4539.16	4541.25
Min Pipe Cover (ft):	0.00		1.60
Max HGL (ft):	4539.86	4542.66	4542.69

Link ID:	Pond-Outlet	L1-L2
Length (ft):		115.00
Dia (in):	0.00	18.00
Slope (ft/ft):		0.0050
Up Invert (ft):	4539.16	4541.25
Dn Invert (ft):	4539.16	4540.68
Max Q (cfs):	2.28	3.67
Max Vel (ft/s):	0.00	3.92
Max Depth (ft):	0.00	1.47



Node ID:	SDMH-N6-M1	SDOS-M5	Pond
Rim (ft):	4547.49	4546.40	4546.40
Invert (ft):	4538.76	4539.16	4539.16
Min Pipe Cover (ft):	7.23	0.00	
Max HGL (ft):	4539.44	4539.86	4542.66

Link ID:	M1-M2	Pond-Outlet
Length (ft):	101.00	
Dia (in):	18.00	0.00
Slope (ft/ft):	0.0040	
Up Invert (ft):	4539.16	4539.16
Dn Invert (ft):	4538.76	4539.16
Max Q (cfs):	2.28	2.28
Max Vel (ft/s):	3.52	0.00
Max Depth (ft):	0.69	0.00



Node ID:	SDMH-N1	SDMH-N2	SDMH-N3	SDMH-N4	SDMH-N5	SDMH-N6-M1
Rim (ft):		4537.64	4540.03	4544.32	4546.47	4547.49
Invert (ft):	4530.26	4530.60	4533.31	4535.89	4537.36	4538.76
Min Pipe Cover (ft):		5.54	5.22	6.93	7.61	7.23
Max HGL (ft):	4530.87	4531.29	4533.93	4536.52	4538.06	4539.44

Link ID:	N1-N2	N2-N3	N3-N4	N4-N5	N5-N6
Length (ft):	85.30	685.00	645.00	475.00	451.00
Dia (in):	18.00	18.00	18.00	18.00	18.00
Slope (ft/ft):	0.0040	0.0040	0.0040	0.0031	0.0031
Up Invert (ft):	4530.60	4533.31	4535.89	4537.36	4538.76
Dn Invert (ft):	4530.26	4530.60	4533.31	4535.89	4537.36
Max Q (cfs):	2.29	2.33	2.32	2.31	2.31
Max Vel (ft/s):	3.14	3.30	3.66	3.37	3.47
Max Depth (ft):	0.65	0.65	0.62	0.66	0.68

APPENDIX D

Proposed Detention Pond

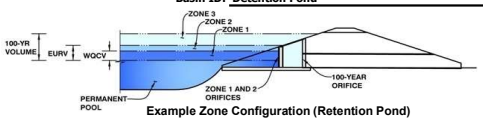
1. Mile High Flood District Detention Basin Design Workbook
    a. Design Information & Stage Storage
    b. Outlet Structure Design
    c. Hydrograph, Drain Time, and Ponding Depth Graphs

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

Project: Adeles Acres Subdivision

Basin ID: Detention Pond



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	11.93	acres
Watershed Length =	910	ft
Watershed Length to Centroid =	455	ft
Watershed Slope =	0.005	ft/ft
Watershed Imperviousness =	56.40%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.223	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.726	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.47 in.) =	0.204	acre-feet	0.47	inches
5-yr Runoff Volume (P1 = 0.63 in.) =	0.290	acre-feet	0.63	inches
10-yr Runoff Volume (P1 = 0.77 in.) =	0.368	acre-feet	0.77	inches
25-yr Runoff Volume (P1 = 0.97 in.) =	0.512	acre-feet	0.97	inches
50-yr Runoff Volume (P1 = 1.13 in.) =	0.644	acre-feet	1.13	inches
100-yr Runoff Volume (P1 = 1.31 in.) =	0.830	acre-feet	1.31	inches
500-yr Runoff Volume (P1 = 1.74 in.) =	1.254	acre-feet	1.74	inches
Approximate 2-yr Detention Volume =	0.218	acre-feet		
Approximate 5-yr Detention Volume =	0.315	acre-feet		
Approximate 10-yr Detention Volume =	0.429	acre-feet		
Approximate 25-yr Detention Volume =	0.515	acre-feet		
Approximate 50-yr Detention Volume =	0.557	acre-feet		
Approximate 100-yr Detention Volume =	0.634	acre-feet		

Define Zones and Basin Geometry

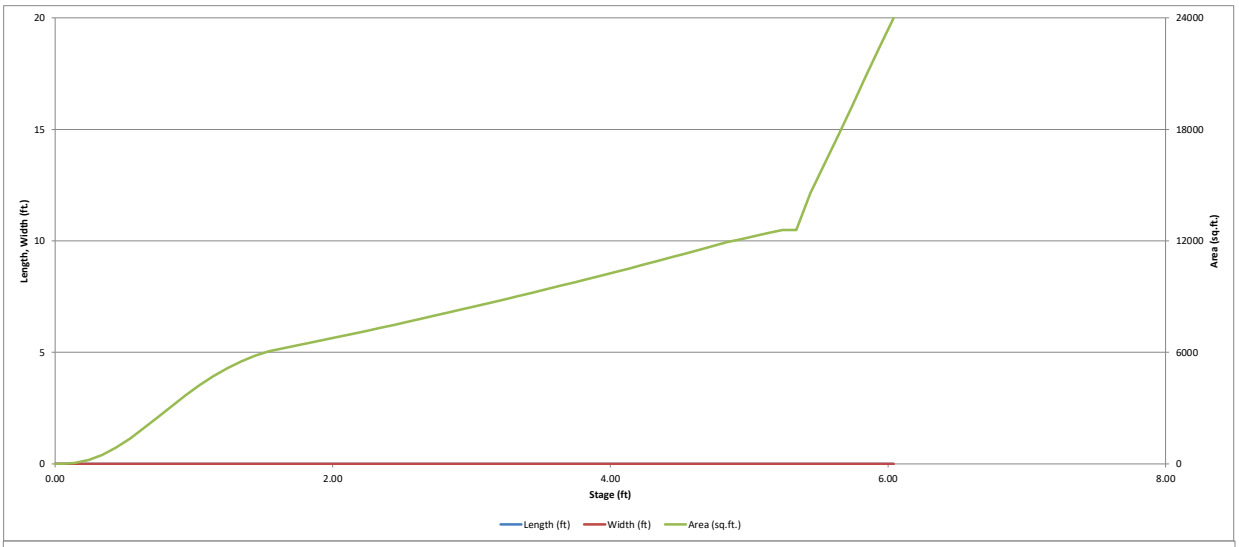
Zone 1 Volume (WQCV) =	0.223	acre-feet
Zone 2 Volume (10-year - Zone 1) =	0.206	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.205	acre-feet
Total Detention Basin Volume =	0.634	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

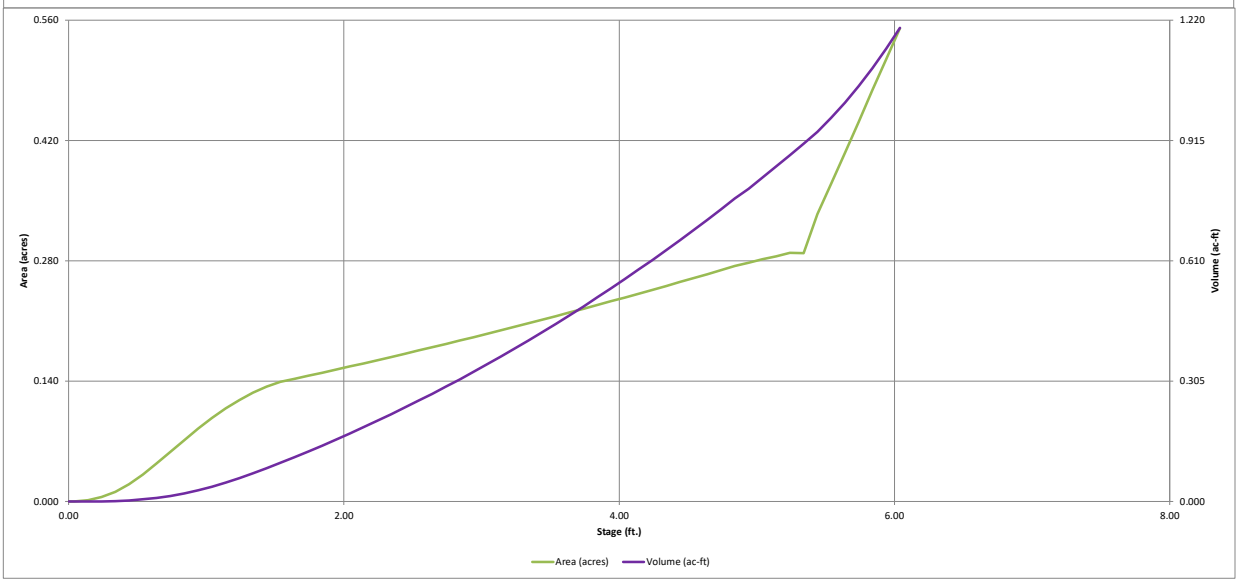
Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	0	0.000		
	--	0.04	--	--	--	4	0.000	0	0.000
	--	0.14	--	--	--	58	0.001	3	0.000
	--	0.24	--	--	--	217	0.005	17	0.000
	--	0.34	--	--	--	489	0.011	52	0.001
	--	0.44	--	--	--	871	0.020	120	0.003
	--	0.54	--	--	--	1,358	0.031	232	0.005
	--	0.64	--	--	--	1,923	0.044	396	0.009
	--	0.74	--	--	--	2,506	0.058	617	0.014
	--	0.84	--	--	--	3,098	0.071	897	0.021
	--	0.94	--	--	--	3,689	0.085	1,237	0.028
	--	1.04	--	--	--	4,235	0.097	1,633	0.037
	--	1.14	--	--	--	4,721	0.108	2,081	0.048
	--	1.24	--	--	--	5,146	0.118	2,574	0.059
	--	1.34	--	--	--	5,512	0.127	3,107	0.071
	--	1.44	--	--	--	5,817	0.134	3,673	0.084
	--	1.54	--	--	--	6,059	0.139	4,267	0.098
	--	1.64	--	--	--	6,218	0.143	4,881	0.112
	--	1.74	--	--	--	6,370	0.146	5,510	0.126
	--	1.84	--	--	--	6,523	0.150	6,155	0.141
	--	1.94	--	--	--	6,679	0.153	6,815	0.156
	--	2.04	--	--	--	6,836	0.157	7,491	0.172
	--	2.14	--	--	--	6,995	0.161	8,182	0.188
	--	2.24	--	--	--	7,155	0.164	8,890	0.204
	--	2.34	--	--	--	7,318	0.168	9,613	0.221
	--	2.44	--	--	--	7,482	0.172	10,353	0.238
	--	2.54	--	--	--	7,647	0.176	11,110	0.255
	--	2.64	--	--	--	7,815	0.179	11,883	0.273
	--	2.74	--	--	--	7,984	0.183	12,673	0.291
	--	2.84	--	--	--	8,155	0.187	13,480	0.309
	--	2.94	--	--	--	8,327	0.191	14,304	0.328
	--	3.04	--	--	--	8,501	0.195	15,145	0.348
	--	3.14	--	--	--	8,677	0.199	16,004	0.367
	--	3.24	--	--	--	8,855	0.203	16,881	0.388
	--	3.34	--	--	--	9,034	0.207	17,775	0.408
	--	3.44	--	--	--	9,215	0.212	18,688	0.429
	--	3.54	--	--	--	9,397	0.216	19,618	0.450
	--	3.64	--	--	--	9,582	0.220	20,567	0.472
	--	3.74	--	--	--	9,768	0.224	21,535	0.494
	--	3.84	--	--	--	9,956	0.229	22,521	0.517
	--	3.94	--	--	--	10,145	0.233	23,526	0.540
	--	4.04	--	--	--	10,336	0.237	24,550	0.564
	--	4.14	--	--	--	10,529	0.242	25,593	0.588
	--	4.24	--	--	--	10,724	0.246	26,656	0.612
	--	4.34	--	--	--	10,920	0.251	27,738	0.637
	--	4.44	--	--	--	11,118	0.255	28,840	0.662
	--	4.54	--	--	--	11,318	0.260	29,962	0.688
	--	4.64	--	--	--	11,519	0.264	31,104	0.714
	--	4.74	--	--	--	11,722	0.269	32,266	0.741
	--	4.84	--	--	--	11,927	0.274	33,448	0.768
	--	4.94	--	--	--	12,098	0.278	34,528	0.793
	--	5.04	--	--	--	12,266	0.282	35,745	0.821
	--	5.14	--	--	--	12,431	0.285	36,978	0.849
	--	5.24	--	--	--	12,592	0.289	38,228	0.878
	--	5.34	--	--	--	12,589	0.289	39,487	0.906
	--	5.44	--	--	--	14,559	0.334	40,825	0.937
	--	5.54	--	--	--	16,104	0.370	42,343	0.972
	--	5.64	--	--	--	17,665	0.406	44,016	1.010
	--	5.74	--	--	--	19,240	0.442	45,845	1.052
	--	5.84	--	--	--	20,859	0.479	47,834	1.098
	--	5.94	--	--	--	22,419	0.515	49,982	1.147
	--	6.04	--	--	--	23,984	0.551	52,287	1.200

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)



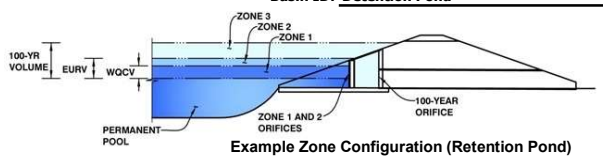


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: **Adeles Acres Subdivision**

Basin ID: **Detention Pond**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.36	0.223	Orifice Plate
Zone 2 (10-year)	3.45	0.206	Rectangular Orifice
Zone 3 (100-year)	4.33	0.205	Weir&Pipe (Restrict)
Total (all zones)		0.634	

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

			Calculated Parameters for Underdrain		
Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

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

			Calculated Parameters for Plate		
Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	6.875E-03	ft^2
Depth at top of Zone using Orifice Plate =	2.36	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	9.40	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	0.99	sq. inches (diameter = 1-1/8 inches)	Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.79	1.57					
Orifice Area (sq. inches)	0.99	0.99	0.99					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected		Calculated Parameters for Vertical Orifice	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	2.36	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.05	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	3.45	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.10	N/A	feet
Vertical Orifice Height =	2.50	N/A	inches				
Vertical Orifice Width =	3.00		inches				

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

	Zone 3 Weir	Not Selected		Calculated Parameters for Overflow Weir	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.05	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	3.05	N/A	feet
Overflow Weir Front Edge Length =	2.92	N/A	feet	Overflow Weir Slope Length =	2.92	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	22.79	N/A	
Horiz. Length of Weir Sides =	2.92	N/A	feet	Overflow Grate Open Area w/o Debris =	5.93	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	5.93	N/A	ft^2
Debris Clogging % =	0%	N/A	%				

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

	Zone 3 Restrictor	Not Selected		Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.26	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.18	N/A	feet
Restrictor Plate Height Above Pipe Invert =	3.69		inches	Half-Central Angle of Restrictor Plate on Pipe =	0.94	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

			Calculated Parameters for Spillway		
Spillway Invert Stage=		ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=		feet
Spillway Crest Length =		feet	Stage at Top of Freeboard =		feet
Spillway End Slopes =		H:V	Basin Area at Top of Freeboard =		acres
Freeboard above Max Water Surface =		feet	Basin Volume at Top of Freeboard =		acre-ft

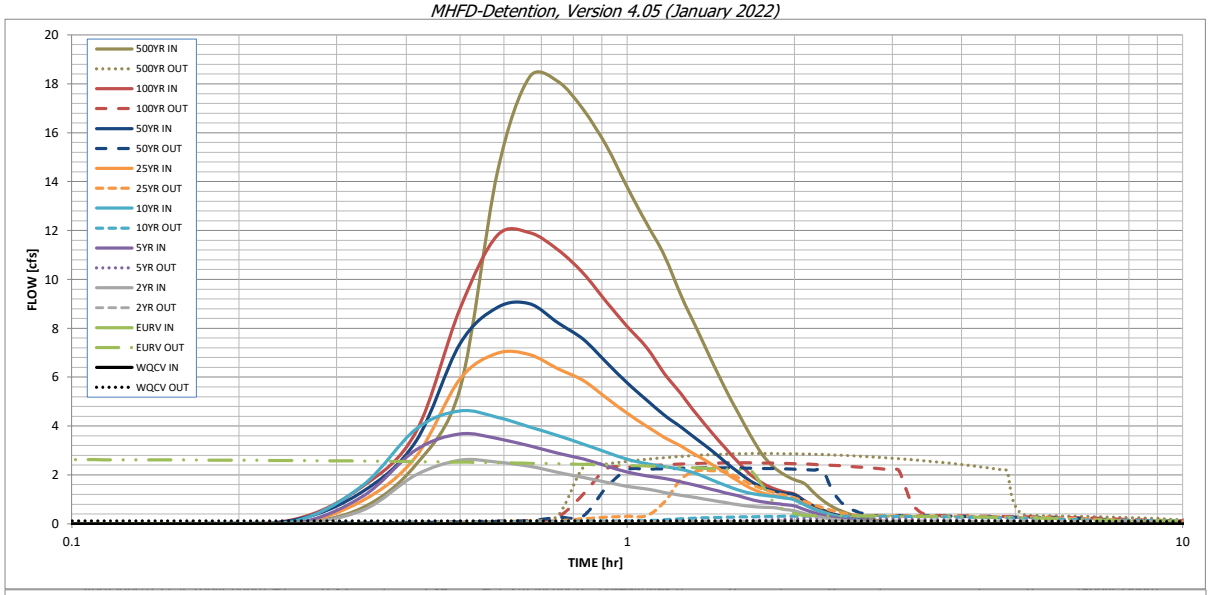
Routed Hydrograph Results

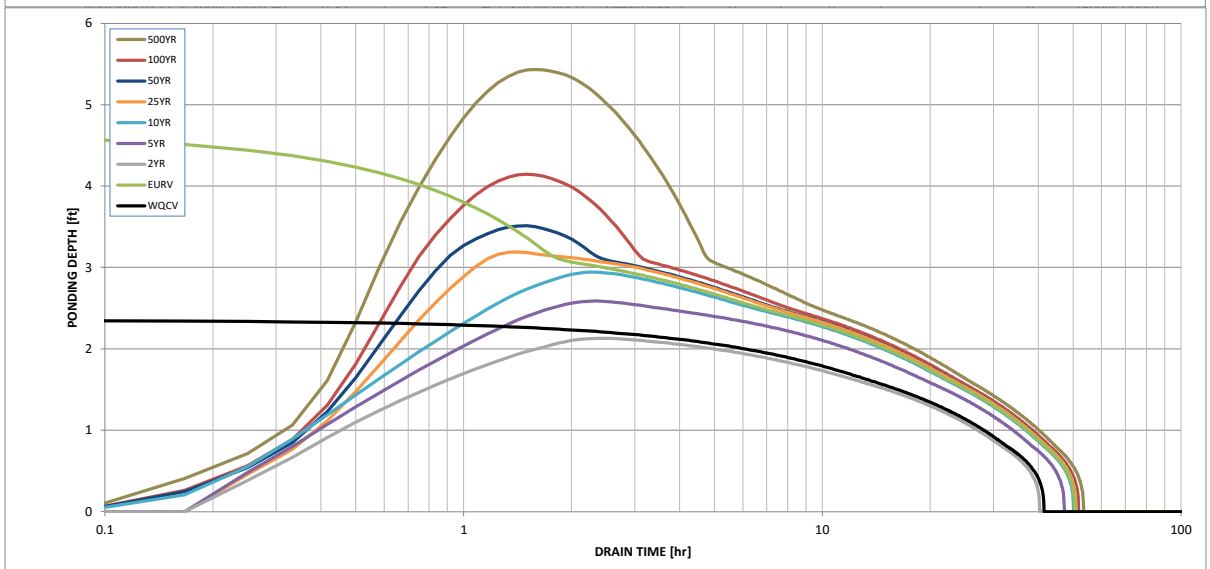
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

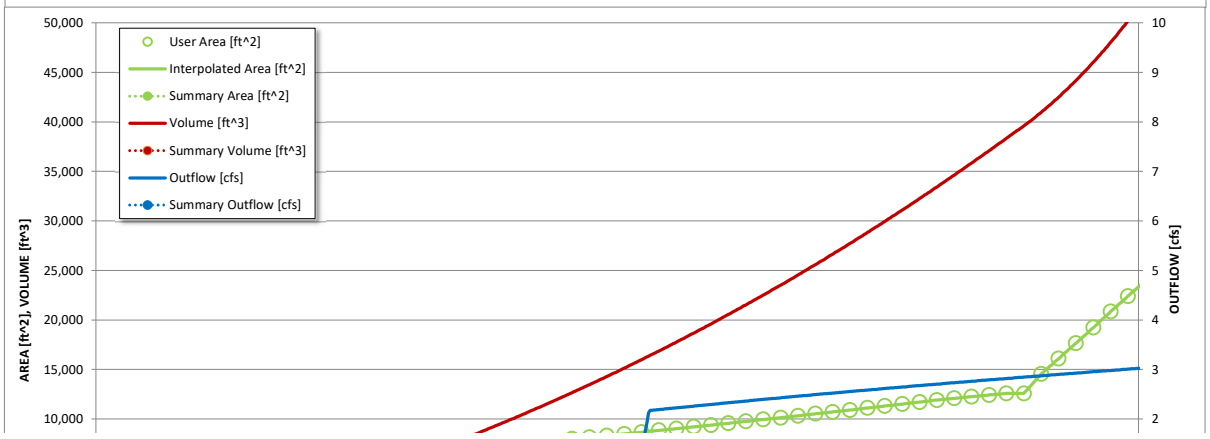
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.47	0.63	0.77	0.97	1.13	1.31	1.74
Structure Controlling Flow =	Vertical Orifice 1	Outlet Plate 1	Plate	Vertical Orifice 1	Vertical Orifice 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	0.35	N/A	N/A	N/A	0.3	0.3	0.3	0.4
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	41	37	43	44	43	42	41	39
Time to Drain 99% of Inflow Volume (hours) =	**40**	47	39	45	48	48	48	47	47

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)







DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:15:00	0.00	0.00	0.00	0.00	0.08	0.00	0.14	0.17	0.65
	0:20:00	0.00	0.00	0.54	1.11	1.56	0.94	1.30	1.52	2.42
	0:25:00	0.00	0.00	2.00	3.03	3.88	2.74	3.38	3.76	5.53
	0:30:00	0.00	0.00	2.60	3.67	4.61	5.92	7.37	8.80	14.34
	0:35:00	0.00	0.00	2.53	3.49	4.36	6.97	8.84	11.80	18.28
	0:40:00	0.00	0.00	2.35	3.18	3.97	6.92	9.00	11.91	18.11
	0:45:00	0.00	0.00	2.10	2.89	3.61	6.35	8.23	11.22	16.95
	0:50:00	0.00	0.00	1.89	2.65	3.26	5.86	7.55	10.25	15.47
	0:55:00	0.00	0.00	1.70	2.37	2.93	5.16	6.61	9.09	13.78
	1:00:00	0.00	0.00	1.53	2.12	2.64	4.52	5.76	8.08	12.29
	1:05:00	0.00	0.00	1.42	1.96	2.46	4.00	5.07	7.22	10.98
	1:10:00	0.00	0.00	1.29	1.85	2.34	3.54	4.44	6.15	9.34
	1:15:00	0.00	0.00	1.17	1.72	2.23	3.18	3.95	5.31	8.00
	1:20:00	0.00	0.00	1.06	1.56	2.05	2.80	3.46	4.48	6.70
	1:25:00	0.00	0.00	0.96	1.41	1.81	2.45	3.01	3.75	5.55
	1:30:00	0.00	0.00	0.87	1.27	1.58	2.08	2.54	3.11	4.54
	1:35:00	0.00	0.00	0.78	1.14	1.39	1.75	2.11	2.52	3.62
	1:40:00	0.00	0.00	0.71	1.00	1.25	1.46	1.75	2.02	2.84
	1:45:00	0.00	0.00	0.68	0.90	1.17	1.27	1.50	1.67	2.33
	1:50:00	0.00	0.00	0.66	0.84	1.12	1.15	1.35	1.45	2.01
	1:55:00	0.00	0.00	0.59	0.79	1.06	1.07	1.25	1.31	1.80
	2:00:00	0.00	0.00	0.53	0.73	0.98	1.02	1.19	1.22	1.65
	2:05:00	0.00	0.00	0.42	0.58	0.78	0.81	0.94	0.95	1.27
	2:10:00	0.00	0.00	0.33	0.45	0.60	0.62	0.72	0.71	0.95
	2:15:00	0.00	0.00	0.25	0.35	0.47	0.48	0.56	0.54	0.71
	2:20:00	0.00	0.00	0.19	0.27	0.36	0.37	0.42	0.41	0.54
	2:25:00	0.00	0.00	0.15	0.20	0.27	0.28	0.32	0.31	0.41
	2:30:00	0.00	0.00	0.11	0.15	0.20	0.21	0.24	0.23	0.31
	2:35:00	0.00	0.00	0.08	0.11	0.15	0.15	0.18	0.17	0.23
	2:40:00	0.00	0.00	0.06	0.08	0.11	0.12	0.13	0.13	0.17
	2:45:00	0.00	0.00	0.04	0.06	0.08	0.09	0.10	0.10	0.13
	2:50:00	0.00	0.00	0.03	0.04	0.06	0.06	0.07	0.07	0.09
	2:55:00	0.00	0.00	0.02	0.03	0.04	0.04	0.04	0.04	0.05
	3:00:00	0.00	0.00	0.01	0.01	0.02	0.02	0.02	0.02	0.03
	3:05:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

APPENDIX E

Street and Inlet Capacity Checks & Riprap Sizing

1. **Half-Street Flow Capacity SWMM Table 28.44.100(a)**
2. **Sump Inlet Capacity SWMM Table 28.44.130**
3. **SWMM Table 28.32.200 & Riprap Calculations**

ADELES ACRES SUBDIVISION

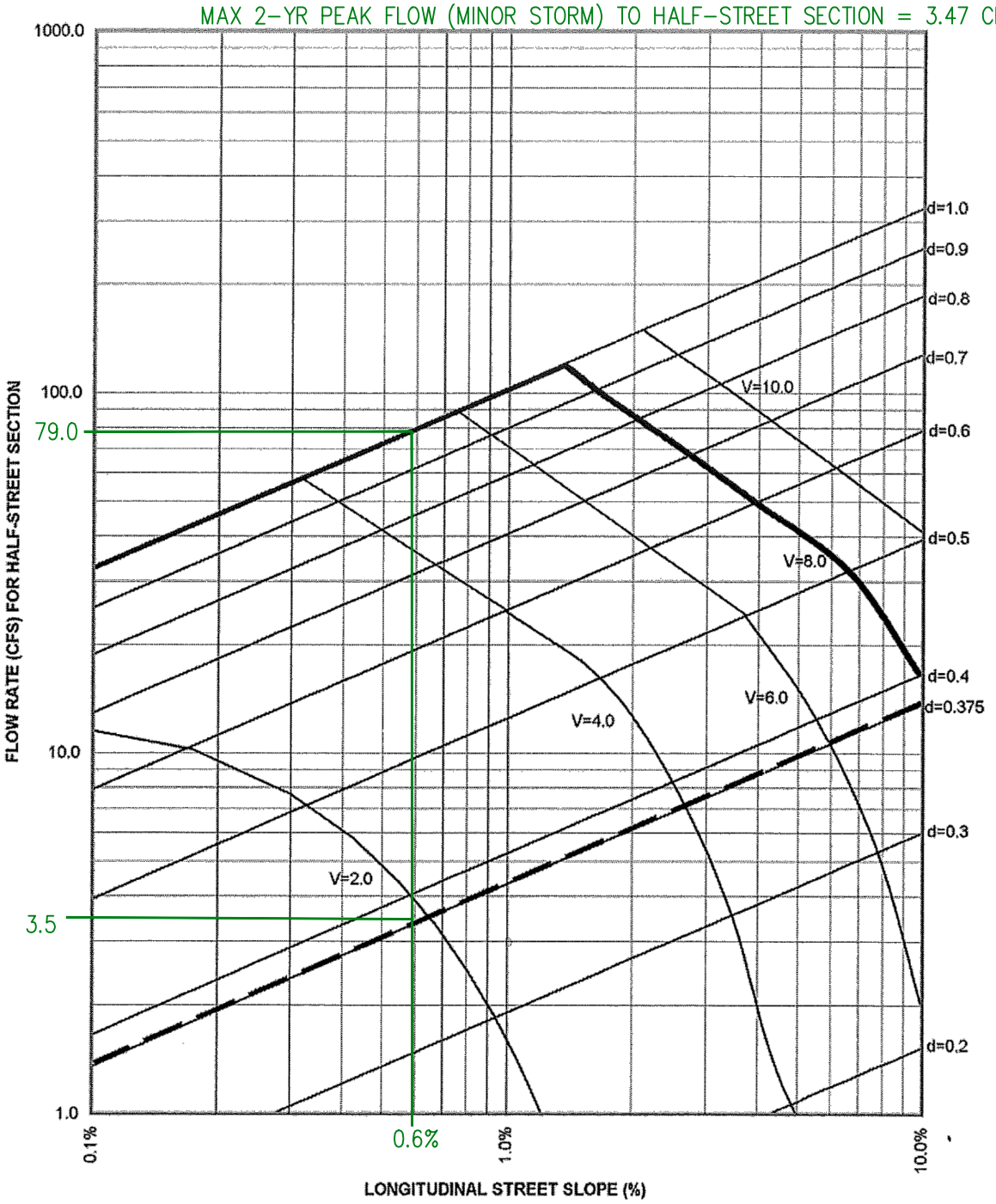
STORMWATER MANAGEMENT MANUAL

HALF-STREET FLOW CAPACITY
(RESIDENTIAL, MOUNTABLE CURB)

MINIMUM STREET SLOPE = 0.6%

MAX 100-YR PEAK FLOW (MAJOR STORM) TO HALF-STREET SECTION = 14.66 CFS

MAX 2-YR PEAK FLOW (MINOR STORM) TO HALF-STREET SECTION = 3.47 CFS



DESIGN LIMITS

- MINOR STORM
- MAJOR STORM

∴ STREET CAPACITY IS ADEQUATE

Revision	Date
ORIGINAL ISSUE	3/27/06

WRC ENGINEERING INC.

REFERENCE:

SWMM Table 28.44.100(a)

STORMWATER MANAGEMENT MANUAL

Maximum Inlet Capacities
Sump or Sag Condition

	INLET TYPE	6-INCH VERTICAL CURB					
		SINGLE		DOUBLE		TRIPLE	
		2-YR	100-YR	2-YR	100-YR	2-YR	100-YR
2-INCH CURB-OPENING DEPRESSION	COMBINATION INLET (TYPE D GRATES)	9.8	12.4	14.7	20.1	19.6	27.8
	COMBINATION INLET (TYPE R GRATES)	9.8	11.1	14.7	18.8	19.6	26.5
	CURB-OPENING INLET CAPACITY	7.7	10.3	12.7	20.6	15.0	30.9
NO CURB-OPENING DEPRESSION	COMBINATION INLET (TYPE D GRATES)	6.4	9.3	9.5	14.2	12.7	19.1
	COMBINATION INLET (TYPE R GRATES)	5.1	8.1	9.5	13.0	12.7	17.9
	CURB-OPENING INLET CAPACITY	4.1	6.5	8.3	13.1	12.4	19.6

SDCI-L2 IS A SINGLE CURB INLET,
SDCI-K3 & SDCI-K4 ARE DOUBLE CURB INLETS

	INLET TYPE	4.5-INCH MOUNTABLE CURB					
		SINGLE		DOUBLE		TRIPLE	
		2-YR	100-YR	2-YR	100-YR	2-YR	100-YR
2-INCH CURB-OPENING DEPRESSION	COMBINATION INLET (TYPE D GRATES)	7.2	10.8	10.8	16.8	14.4	22.7
	COMBINATION INLET (TYPE R GRATES)	7.2	9.4	10.8	15.4	14.4	21.4
	CURB-OPENING INLET CAPACITY	5.6	8.0	9.3	16.0	11.0	23.9
NO CURB-OPENING DEPRESSION	COMBINATION INLET (TYPE D GRATES)	4.1	7.8	6.2	10.9	8.3	14.1
	COMBINATION INLET (TYPE R GRATES)	4.1	6.5	6.2	9.7	8.3	12.8
	CURB-OPENING INLET CAPACITY	2.3	4.2	4.7	8.5	7.0	12.7

MAX 2-YR PEAK FLOW TO SINGLE CURB INLET IN SUMP = 0.81 CFS
MAX 100-YR PEAK FLOW TO SINGLE CURB INLET IN SUMP = 3.71 CFS

See Chart Legend (Figure 1113) for standard inlet lengths.

MAX 2-YR PEAK FLOW TO DOUBLE CURB INLET IN SUMP = 3.47 CFS
MAX 100-YR PEAK FLOW TO DOUBLE CURB INLET IN SUMP = 14.66 CFS

Inlet capacities shown above are based upon the following:
1. Type D grate used for calculation is Neenah model R-3577.
2. Type R grate used for calculation is Neenah model R-3289-C.
3. Angled- and curved-vane grates are not allowed for sump or sag design conditions.
4. Capacities shown are based upon maximum ponding depths for the 2-year and 100-year storm events:
   a. 2-year event maximum ponding depth: curb height
   b. 100-year event maximum ponding depth: 1.0 foot
5. Combination inlets are preferred for sump or sag conditions. Curb-opening inlets without grates are allowed.
6. Grate-only inlets are not allowed for sump or sag conditions.

∴ INLET CAPACITIES ARE ADEQUATE

Revision	Date
ORIGINAL ISSUE	3/27/06
REVISED CALCULATIONS	12/20/07

WRC ENGINEERING, INC.

REFERENCE: HEC-12, FHWA
WATER-RESOURCES ENGINEERING, LINSLEY (1992)
GRAND JUNCTION STANDARD DETAILS

SWMM Table
28.44.130

STORMWATER MANAGEMENT MANUAL

MAXIMUM PERMISSIBLE MEAN CHANNEL VELOCITY

MATERIAL / LINING	MAXIMUM PERMISSIBLE MEAN VELOCITY (FPS)
NATURAL AND IMPROVED UNLINED CHANNELS	
Erosive Soils:	
Loams, Sands, Noncolloidal Silts	3.0
Less Erosive Soils:	
Clays, Shales, Cobbles, Gravel	5.0
FULLY-LINED CHANNELS	
Unreinforced Vegetation	5.5
Loose Riprap	
Angular Rock	15.0
Semi-Angular Rock	12.0
Rounded Rock	See Note #4
Grouted Riprap	15.0
Gabions	15.0
Soil Cement	15.0
Concrete	20.0

NOTES:

1. For composite lined channels, us the lowest of the maximum mean velocities for the materials used in the composite lining.
2. Deviations from the above values are only allowed with appropriate engineering analysis and/or suitable agreements for maintenance responsibilities.
3. Maximum permissible velocities based upon non-clear water conditions.
4. Suitability of rounded rock as loose riprap material shall be determined by rock particle resistance to movement as a result of shear forces as calculated with a factor of safety of 1.5.

MAX DISCHARGE VELOCITY FROM PIPES:

Pipe K1–K2 = 5.77 FT/S ∴ RIPRAP IS REQUIRED

Pipe L1–L2 = 3.92 FT/S ∴ RIPRAP IS REQUIRED

Revision	Date
ORIGINAL ISSUE	3/27/06

WRC ENGINEERING, INC.

REFERENCE:
NATURAL-MODIFIED FROM FORTIER AND SCOBEY, 1926
FULLY LINED-VARIOUS RESOURCES

SWMM Table
28.32.200

Adeles Acres Subdivision

FES SDFE-K1 Outfall to Detention Pond

RIP-RAP OUTLET PROTECTION SIZING

REQUIRED INFORMATION:

V =	5.77	ft/sec	Velocity (See Table 805 in the SWMM to verify rip-rap is required)
Q =	18.13	ft^3/sec	Pipe Discharge
D_o =	2.00	ft	Maximum Inside Culvert Width
TW =	2.00	ft	Tailwater Depth (Use normal depth in pipe if unknown)

*See Figure 1209 of the SWMM for a Rip-Rap Mat Diagram

$D_{50} = (0.02 * Q^{4/3}) / (TW * D_O)$ D_{50} = Median rock size (ft)

D_{50} = **0.24** ft 2.9 inches (Use minimum of 6 inch rock)

If TW < D_o/2:

DETERMINE REQUIRED APRON LENGTH, L_a:

L_a = $[(1.8 * Q) / (D_o^{3/2})] + 7D_o$

L_a = 25.54

DETERMINE REQUIRED APRON TOP WIDTH, W_T:

W_T = $3.0*D_o$

W_T = 6.00

DETERMINE REQUIRED APRON BOTTOM WIDTH, W_B:

W_B = $3.0*D_o + L_a$

W_B = 31.54

D_{50} =	6	inches
L_a =	33.75	feet
W_T =	6	feet
W_B =	19.5	feet

If TW ≥ D_o/2:

DETERMINE REQUIRED APRON LENGTH, L_a:

L_a = $[(3.0 * Q) / (D_o^{3/2})] + 7D_o$

L_a = 33.23

DETERMINE REQUIRED APRON TOP WIDTH, W_T:

W_T = $3.0*D_o$

W_T = 6.00

DETERMINE REQUIRED APRON BOTTOM WIDTH, W_B:

W_B = $3.0*D_o + 0.4*L_a$

W_B = 19.29

Area=	430.31	ft^2
=	47.81	yds^2
Volume=	15.94	yds^3

(Depth = 2 x D_{50})

Adeles Acres Subdivision

FES SDFE-L1 Outfall to Detention Pond

RIP-RAP OUTLET PROTECTION SIZING

REQUIRED INFORMATION: ***Rirap NOT required at this location, due to low velocity.

V =	3.92	ft/sec	Velocity (See Table 805 in the SWMM to verify rip-rap is required)
Q =	3.67	ft^3/sec	Pipe Discharge
D_o =	1.50	ft	Maximum Inside Culvert Width
TW =	1.47	ft	Tailwater Depth (Use normal depth in pipe if unknown)

*See Figure 1209 of the SWMM for a Rip-Rap Mat Diagram

$D_{50} = (0.02 * Q^{4/3}) / (TW * D_O)$ D_{50} = Median rock size (ft)

D_{50} = **0.05** ft 0.6 inches (Use minimum of 6 inch rock)

D_{50} =	6 inches

If TW < D_o/2:

DETERMINE REQUIRED APRON LENGTH, L_a:

L_a = $[(1.8 * Q) / (D_o^{3/2})] + 7D_o$

L_a = 14.10

L_a =	16.5 feet

DETERMINE REQUIRED APRON TOP WIDTH, W_T:

W_T = $3.0*D_o$

W_T = 4.50

W_T =	4.5 feet

DETERMINE REQUIRED APRON BOTTOM WIDTH, W_B:

W_B = $3.0*D_o + L_a$

W_B = 18.60

W_B =	11.25 feet

If TW ≥ D_o/2:

Area=	129.94	ft^2
=	14.44	yds^2
Volume=	4.81	yds^3

(Depth = 2 x D_{50})

DETERMINE REQUIRED APRON LENGTH, L_a:

L_a = $[(3.0 * Q) / (D_o^{3/2})] + 7D_o$

L_a = 16.49

DETERMINE REQUIRED APRON TOP WIDTH, W_T:

W_T = $3.0*D_o$

W_T = 4.50

DETERMINE REQUIRED APRON BOTTOM WIDTH, W_B:

W_B = $3.0*D_o + 0.4*L_a$

W_B = 11.10

APPENDIX F

SWMM Checklists

1. Checklist 302
2. Checklist 303

Table 302
Stormwater Management Manual
Drainage Report Checklist

Instructions:
1. Applicant to identify with a "check-mark" if information is provided with report. 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 information must be submitted.
3. Those items noted with an "asterisk" are not typically required for conceptual/ preliminary report. Applicant shall confirm this with local jurisdiction.
4. Submit three (3) copies of report and include copy of check list bound with report.

TITLE PAGE

A. Type of report (Conceptual/Preliminary or Final Drainage Report).
B. Project Name.
C. Preparer name, firm, address, number, and date.
D. Professional Engineer's seal of preparer.
E. Certifications (see SWMM Section 303.1)

I. INTRODUCTION

A. Background
- ✓ 1. Identify report preparer and purpose.
- ✓ 2. Identify date of letter with previous County comments.

B. Project Location
- ✓ 1. Identify Township, Range, and Section.
- ✓ 2. Identify adjacent street and subdivision names.
- ✓ 3. Reference to General Location Map.

C. Property Description
- ✓ 1. Identify area in acres of entire contiguous ownership.
- ✓ 2. Describe existing ground cover, vegetation, soils, topography and slopes.
- ✓ 3. Describe existing drainage facilities, such as channels, detention areas, or structures.
- ✓ 4. Describe existing irrigation facilities, such as ditches, head-gates, or diversions.
- ✓ 5. Identify proposed types of land use and encumbrances.

D. Previous Investigations
- ✓ 1. Identify drainage master plans that include the project area, including floodplain studies.
- N/A 2. Identify drainage reports for adjacent development.

II. DRAINAGE SYSTEM DESCRIPTION

A. Existing Drainage Conditions
- ✓ 1. Describe existing topography and provide map with contours extending a minimum of 100 feet beyond property limits.
- ✓ 2. Identify major drainageway or outfall drainageway and describe map showing location of proposed development within the drainageways.
- ✓ 3. Identify pre-developed drainage patterns and describe map showing pre-developed sub-basins and concentrated discharge locations. Provide calculations of pre-developed peak flows entering and leaving the site.

B. Master Drainage Plan
- N/A 1. Describe location of the project relative to a previously prepared master drainage plan, including drainage plans prepared for adjacent development.

C. Offsite Tributary Area

✓ 1. Identify all offsite drainage basins that are tributary to the project.
✓ 2. Identify assumptions regarding existing and future land use and effects of offsite detention on peak flows.

D. Proposed Drainage System Description

✓ 1. Identify how offisite stormwater is collected and conveyed through the site and ultimately to the receiving water(s).
✓ 2. Identify sub-basins and describe, in general terms, how onsite stormwater is collected and conveyed through the site for each location where stormwater is discharged from the site.
✓* 3. Describe detention volumes, release rates and pool elevations.
✓* 4. Identify the difference in elevation between pond invert and the groundwater table.
✓ 5. Describe how stormwater is discharged from the site, including both concentrated and dispersed discharges and rates.
✓ 6. Describe stormwater quality facilities.
✓* 7. Describe maintenance access aspects of design.
✓* 8. Describe easements and tracts for drainage purposes, including limitation on use.

E. Drainage Facility Maintenance

✓* 1. Identify responsible parties for maintenance of each drainage and water quality facility.
✓* 2. Identify general maintenance activities and schedules.

III. DRAINAGE ANALYSIS AND DESIGN CRITERIA

A. Regulations

✓ 1. Identify that analysis and design was prepared in accordance with the provisions of the Manual.
✓ 2. Identify other regulations or criteria which have been used to prepare analysis and design.

B. Development Criteria

✓ 1. Identify drainage constraints placed on the project, such as by a major drainage study, floodplain study or other drainage reports relevant to the project.
N/A 2. Identify drainage constraints placed on the project, such as from major street alignments, utilities, existing structures, and other developments.

C. Hydrologic Criteria

(If Manual was followed without deviation, then a statement to that effect is all that is required. Otherwise provide the following information where the criteria used deviates from the Manual.)

✓ 1. Identify developed storm runoff peak flows and volumes and how they were determined, including rainfall intensity or design storm.
✓ 2. Identify which storm events were used for minor and major flood analysis and design.
✓ 3. Identify how and why any other deviations from the Manual occurred.

D. Hydraulic Criteria

(If Manual was followed without deviation, then a statement to that effect is all that is required. Otherwise provide the following information where the criteria used deviates from the Manual.)

✓* 1. Identify type(s) of streets within and adjacent to development and source for allowable street capacity.
✓* 2. Identify which type(s) of storm inlets were analyzed or designed and source for allowable capacity.
3. Identify which type of storm sewers which were analyzed or designed and

✓ * Manning's n-values used.

4. Identify which method was used to determine detention volume requirements and how allowable release rates were determined. ✓ *

5. Identify how the capacity of open channels and culverts were determined. N/A *

6. Identify any special analysis or design requirements not contained with the Manual. N/A *

7. Identify how and why any other deviations from the Manual occurred. ✓

E. Variance from Criteria

1. Identify any provisions of the Manual for which a variance is requested. ✓

2. Identify pre-existing conditions which cause the variance request. ✓

***IV. POST CONSTRUCTION STORMWATER MANAGEMENT. See Manual Section 1600 for requirements.**

Note: This section of the Final Drainage Report identifies additional information required by Mesa County's, City of Grand Junction's, and Town of Palisade's, Permit for Stormwater Discharges Associated with Municipal Separate Storm Sewer Systems (MS4s), permit No. COR-090000. The Final Drainage Plan and the Construction SWMP (see SWMM Section 1500) meets the requirements of the MS4s Permit. In general, this section identifies permanent BMP practices to control the discharge of pollutants after construction is complete.

*A. Stormwater Quality Control Measures

1. Describe the post-construction BMPs to control discharge of pollutants from the project site. N/A *

2. If compensating detention is provided, discuss practices to address water quality from area not tributary to detention area. N/A *

3. If underground detention is proposed, discuss how water quality facilities will be provided on the surface. N/A *

4. If proprietary BMPs are proposed, provide the justification and sizing requirements (see SWMM Section 1603.3). N/A

*B. Calculations

1. Provide methods and calculations for WQCV, sediment storage, and water quality outlet structure. ✓

V. CONCLUSIONS

A. Compliance with Manual

Compliance with Manual and other approved documents, such as drainage plans and floodplain studies. ✓

B. Design Effectiveness

Effectiveness of drainage design to control impacts of storm runoff. ✓

C. Areas in Flood Hazard Zone

Meet requirements of Floodplain Regulations: Mesa County Land Development Code, Section 7.13; City of Grand Junction Zoning and Development Code, Section 7.1. ✓

D. Variances from Manual

Applicant shall identify any requested variances and provide basis for approving variance. If no variances are requested, applicant shall state that none are requested. ✓

VII. REFERENCES

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

TABLES

Include copy of all tables prepared for report. ✓

FIGURES

A. General Location Map (See Section 303.2a) ✓

✓ B. Flood Plain Information
✓ C. Drainage Plan (See Section 303.2b)
✓ D. Other pertinent figures.

APPENDICIES

A. DESIGN CHARTS
1. Provide copy of all design charts (i.e.: tables, figures, charts from other criteria) used for the report. ✓

B. HYDROLOGIC CALCULATIONS (see Manual Sections 600 and 700)
1. Land use assumptions for off-site runoff calculations. ✓
2. Time of concentration and runoff coefficients for pre-existing and post development conditions. ✓
3. Pre-developed hydrologic computations. ✓
4. Developed conditions hydrologic computations. ✓

C. HYDRAULIC CALCULATIONS
1. Capacity of existing channels, streets, storm sewers, inlets, culverts and other facilities. N/A
2. Calculations for existing storm sewer and open channel. N/A
3. Irrigation ditch flows and ditch system capacity. N/A
4. Detention pond design (see Manual, Section 1400 for requirements). ✓*
   a. Storage volume, release rates, and pool elevations for 10-year and 100-year storm. ✓*
   b. Outlet structure dimensions, orifice diameter, weir lengths, pipe headwater and other data. ✓*
   c. Outlet velocity and energy dissipation requirements. ✓*
   d. Routing of outlet flows and emergency spillway flows. ✓*
5. Street capacity calculations, if data in Manual not used (see Section 1100). ✓*
6. Storm inlet capacity calculations, if data in Manual not used (see Section 1100). ✓*
7. Storm sewer capacity calculations, if data in Manual not used (see Section 1000). ✓*
8. Channel capacity calculations, if data in Manual not used (see Section 800). N/A*
9. Culvert capacity calculations (see Manual, Section 1200). N/A*
10. Other hydraulic structure calculations (see Manual, Section 900).

D. STORMWATER QUALITY CALCULATIONS
1. Water Quality Capture Volume (WQCV). ✓
2. Storage volume for sediment volume and pool elevations for WQCV. ✓*
3. Outlet calculations for required area per row, diameter of individual holes, number of holes per row, and number of holes per column. ✓*

✓ **CERTIFICATION – PROFESSIONAL ENGINEER'S SEAL AND SIGNATURE**

ACKNOWLEDGEMENTS

Drainage Report checklist was prepared by: *Craig Rothluebber, PE*

Table 303
Stormwater Management Manual

Drainage Plan Checklist

Instructions:
1. Applicant to identify with a "check-mark" if information is provided. If applicant believes information is not required, indicate with "n/a".
2. County will determine if information labeled "n/a" is required and whether information must be submitted.

I. EXISTING FACILITIES

- ✓ A. Contours at two foot intervals, based on USGS datum. Contours to extend at least 50 feet past property line.
- ✓(see plans) B. Location and elevation of USGS benchmarks or benchmarks referenced to USGS.
- ✓ C. Property lines.
- ✓ D. Drainage easements.
- ✓ E. Street names.
- ✓ F. Major and minor channels and floodplains.
- ✓ G. A historic drainage plan including historic basin boundaries and flow paths.

II. PROPOSED FACILITIES

- ✓ A. Contours at two-foot intervals, based on USGS datum.
- ✓ B. Property lines.
- ✓ C. Drainage easements.
- ✓ D. Street names and grades.
- ✓ E. Right of way and easement.
- ✓(see plans) F. Finished floor elevations for protection from major storm run-off.
- ✓ G. Detention pond information:
  - ✓(see plans) 1. Location of each detention pond with site at 1"=50' scale or larger with 2-foot contour intervals.
  - ✓(see plans) 2. Inlet and outlet structure, and trickle channel design details.
  - ✓(see plans) 3. Details of emergency spillway and channel.
  - ✓(see plans) 4. Landscape information, including side slopes, vegetation and planting requirements.
  - ✓(see plans) 5. Details of water quality outlet structure.
- N/A H. Channel Information:
  - N/A 1. Profiles with existing and proposed grades.
  - ✓(see plans) 2. Cross sections on 100-foot stations showing existing and proposed topography and required rights of way.
  - N/A 3. Locations and size of all existing and proposed structures.
  - N/A 4. Locations and profiles of adjacent utilities.
  - 5. Typical channel section and lining details.
- I. Storm sewer information:
  - ✓(see plans) 1. Alignment and location of manholes, inlets, and outlet structures.
  - ✓(see plans) 2. Profile of invert and pipe crown.
  - ✓(see plans) 3. Invert elevations at manholes and inlets.
  - ✓(see plans) 4. Lengths and grades between manholes and inlets.
  - ✓(see plans) 5. Locations and elevations of utilities adjacent to and crossing storm sewer.
  - ✓(see plans) 6. Easement and other O&M access geometry.
  - 7. Outlet details, such as end sections, headwall and wingwalls, erosion control, and vegetation.
- ✓(see plans) J. Street cross sections with design 100-year flood depth.
- ✓(see plans) K. Other drainage related structures and facilities, including underdrains and sump pump discharge lines.
- N/A L. Other permanent BMP measures to control pollutant discharges to the County's MS4 system.

III. HYDRAULIC AND HYDROLOGIC INFORMATION

A. Routing and accumulative runoff peaks at upstream and downstream ends of the site and at various critical points onsite for initial and major storms. Inflow and outflow from each subbasin shall be shown for both initial and major storms. ✓

B. Street cross sections showing 100-year flood levels. ✓(see plans)

C. Major and minor channels and floodplains. ✓

D. Detention pond data:

1. Release rates for 10- and 100-year storm events. ✓
2. Required and provided volumes for 10- and 100-year storm events. ✓
3. Design depths for 10- and 100-year storm events. ✓
4. Water quality capture volume and pool elevation. ✓

E. Channel data:

1. Water surface profiles. N/A
2. Representative 100-year flow velocity and Froude number. N/A

F. Storm sewer data:

1. Profile of water surface for design flow rate. ✓
2. Peak flows for design flow, 2-year and 100-year storm events. ✓

IV. STANDARD NOTES

A. No building, structure, or fill will be placed in the detention areas and no changes or alterations affecting the hydraulic characteristics of the detention areas will be made without the approval of the County. ✓

B. Maintenance and operation of the detention and water quality areas is the responsibility of property owner. If owner fails in this responsibility, the County has the right to enter the property, maintain the detention areas, and be reimbursed for costs incurred. ✓

C. Detention pond volumes, all drainage appurtenances, and basin boundaries shall be verified. As-built drawings shall be prepared by a registered professional engineer prior to issuance of certificate of occupancy for any structure within the development. ✓

D. Permission to reproduce these plans is hereby given to Mesa County for County purposes associated with plan review, approval, permitting, inspection and construction of work. ✓

V. PROFESSIONAL ENGINEER'S SEAL AND SIGNATURE

VI. OTHER

A. Horizontal and vertical control information and ties to existing and proposed features. ✓(see plans)

ACKNOWLEDGEMENTS

Drainage Plan checklist was prepared by: *Craig Rothluebber, PE*