Final Drainage Report

My Storage

(1930 Highway 6 and 50, Fruita, CO 81521)

March 14, 2023
(Revised --------)

Prepared for:

Johnson Construction
PO Box 1557
Draper, UT 84020

Prepared by:

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Job No. 2119-001

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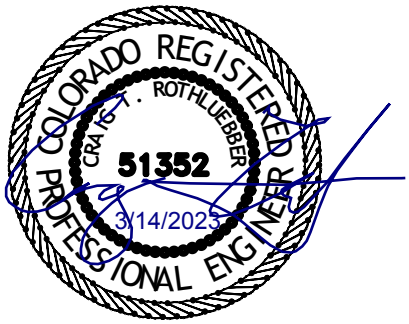
Engineer's Certification

I hereby certify that the Drainage Report for the design of **My Storage** was prepared by me, or under my direct supervision, in accordance with the provisions of the Stormwater Management Manual (dated June 14, 2021) for the owners thereof. I understand that the **City of Fruita** does not and will not assume liability for drainage facilities designed by others.



Craig Rothluebber, P.E.
State of Colorado Reg. No. 51352

Developer's Certification

I, Michael Johnson hereby certify that the drainage facilities for **My Storage** 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 **Johnson Construction** guarantee that the preliminary drainage design review will absolve **Johnson Construction** and/or their successors and/or assigns of future liability for improper design.

Michael Johnson - My Storage Fruita
(Name of Developer)

(Authorized Signature)

3-14-2023
(Date)

I. Introduction

A. Background

The purpose of this Drainage Report is to identify pre-development and post-development drainage conditions for the proposed My Storage development. 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
- stormwater water quality requirements
- post construction BMP's

This report addresses comments and issues identified during the pre-application meeting with the City Staff, as well as comments received from City staff during the review process. This project filing is part of a larger development that will be and has been submitted under separate filings. Proposed drainage patterns and requirements for the combined total development has been considered in the design of this current filing.

B. Project Location

The current project address is 1930 Highway 6 and 50, Fruita, CO (Parcel No. 2697-223-00-073). The proposed project site is located between the locations where Highway 6 and 50 intersect 19 Road and 19 ½ Road in Fruita, CO. In more legal terms, the project site is in the SE ¼ of the SW ¼ of Section 22, Township 1 North, Range 2 West of the Ute Meridian, Mesa County, Colorado. Refer to **Figure 1** for the General Location Map.

Access to the site will be from the north side of Highway 6 and 50 ½ Road at the proposed entrance for the project site. The surrounding area contains a mix of uses including agricultural fields, commercial businesses, and railways. The proposed project site is currently being used as an agricultural field but has recently been rezoned as C-1 as part of the project's approval process. The parcel to the west is currently zoned as C-1. The parcel to the east is unincorporated land under the jurisdiction of Mesa County and is currently zoned as AFT with a planned future land use of C-1 upon annexation. The three parcels to the north of the project site are also unincorporated land under the jurisdiction of Mesa County and currently zoned as AFT. All three parcels have a planned future land use of Rural Residential upon annexation. The parcel on the south side of Highway 6 and 50 is currently zoned as Industrial and consists of active freight railway running northwest to southeast. On the south side of the Industrial parcel is Interstate 70.

C. Project Description

The current project parcel (Parcel No. 2697-223-00-073) is approximately 16.22 acres of agricultural pastureland. This parcel has been subdivided into two separate lots and newly dedicated right of way along the north parcel line as part of the project's approval process. Lot 1 consists of approximately 7.42 acres which will be developed into a storage facility

for RVs, boats, and mini self-storage units. Lot 2 consists of approximately 7.24 acres which will remain agricultural pastureland at this time. This drainage report analyses the total parcel area for both Lots 1 & 2 which totals approximately 16.47 acres.

Lot 1 shall consist of fifteen self-storage buildings and a gravel pad for RV/Boat storage. The majority of the area surrounding the storage facilities will be an impervious asphalt surface and gravel parking surface with approximately 1.16 acres to be landscaped. The proposed detention pond will reside within a proposed drainage easement within Lot 1. There are currently no plans to develop Lot 2, so the proposed detention pond has been sized to service Lot 2 under its existing conditions. If Lot 2 is developed in the future, further drainage analysis will be necessary to determine if the proposed detention pond will need to be enlarged. However, it should be noted that preliminary investigations suggest that the proposed pond has sufficient storage for Lot 2 to be developed with approximately 85% imperviousness. There are no encumbrances anticipated for this project.

Existing vegetation at the proposed project site consists of agricultural pastureland in good condition. According to the NRCS web site, the soils present at the site consist primarily of Fruitland sandy clay loam (0-2% slopes, 80.2% of the site's acreage). The remaining soils present include Turley clay loam (0-2% slopes, 11.9% of the site's acreage) and Sagers silty clay loam (0-2% slopes, 7.9% of the site's acreage). Fruitland is classified as Hydrologic Soil Group B (HSG B). Turley and Sagers are classified as Hydrologic Soil Group C. Group C soils have slower infiltration rates than Groups A and B Soils. For conservancy in calculations, the entire site is analyzed as if it was a HSG C Soil. NRCS Soil information is included in Appendix A.

The proposed development for this filing is located almost entirely within the Adobe Creek Major Drainage Basin. The northeast corner portion of the project parcel exists within the Hunter Wash Major Drainage Basin. Both Major Basins, Adobe Creek and Hunter Wash, drain to the Colorado River approximately 1.0 miles southwest of the site. A graphical representation of the project boundary in relation to the major drainage basins is provided in **Figure 2**. There are no mapped FEMA 100-Year Floodplains within or adjacent to the project site. The project site is within a Zone X, 500-Year, *Area of Minimal Flood Hazard*. A FEMA FIRM Map for the area is available in Appendix A.

D. Previous Investigations

A Phase I Environmental Site Assessment (ESA) was conducted in September 2008 by ERO Resources Corporation for a 48-acre planned development that included the project parcel (approximately 16.22 acres). At the time of the ESA, "[The] assessment has revealed no evidence of recognized environmental conditions in connection with the property except for the numerous solid waste disposal piles and the storage of petroleum products on the property". Excerpts from the ESA are included in Appendix A. No other 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 between 0.5% and 1.0%. The Grand Valley Irrigation Company's (GVIC) *Independent Ranchman's Ditch* borders the project site's entire northern boundary and prevents flows from entering the project site from the north. The grade to the west of the project site slopes away to the west toward Adobe Creek. A roadside ditch travels east to west along Highway 6 and 50 to the south of the project site preventing runoff from entering the project site from the south. Existing topography channels runoff to travel from north to south just outside of the project parcel to the east with minimal off-site runoff entering the project parcel from the east.

Existing ditches are located along the western and southern boundaries of the parcel. These ditches collect runoff from the project site and convey flows offsite to the existing roadside ditch traveling east to west in the right-of-way of Highway 6 and 50. This roadside ditch discharges to Adobe Creek approximately 175-feet to the west of the site.

All runoff leaving the proposed project site eventually flows to the Colorado River located approximately 1.0 miles to the southwest. Refer to **Figure 3** for a layout and of the existing sub-basins covering the proposed project site. **Table 1** provides a summary of the existing sub-basins that were analyzed for this project.

Table 1: Existing Sub-Basins

Sub-Basin ID	Sub-Basin Area (acres)	SCS Curve Number (CN)	Existing Sub-Basin Peak Runoff Rates (cfs)		
			2-Year	10-Year	100-Year
EX-01	14.97	74.0	0.33	0.54	1.76
EX-02	1.39	74.0	0.03	0.05	0.41

B. Master Drainage Plan

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

C. Offsite Tributary Area

Existing topography at the site slopes generally from northeast to southwest. As described in Section II.A. *Existing Drainage Conditions*, surrounding ditches and topography prevent off-site flows from entering the project site from the north, west, or south. Minimal off-site flows enter the project site from the east. Analysis of this flow is provided in the existing and proposed conditions for the project.

D. Proposed Drainage System Description

The proposed project will include lot grading, storm drain, earthen ditches, and a detention pond. Runoff from the developed areas will sheet flow to the area inlets of the storm drain system or to the earthen ditches. From there, runoff will concentrate and then be conveyed through the site to the stormwater pond at the southwest corner of the development. Proposed grading for this project divides the site into six separate sub-basins that are tributary to the proposed stormwater pond. Refer to **Figure 4** for the proposed sub-basin layout and more detailed basin information. **Table 2** provides a summary of the proposed sub-basins that were analyzed for this project.

Table 2: Proposed Sub-Basins

Sub-Basin ID	Sub-Basin Area (acres)	SCS Curve Number (CN)	Proposed Sub-Basin Peak Runoff Rates (cfs)		
			2-Year	10-Year	100-Year
PR-01	7.99	74.0	0.09	0.28	1.29
PR-02	1.55	93.0	0.52	1.49	3.63
PR-03	2.60	91.9	0.76	2.18	5.48
PR-04	1.06	98.0	0.44	1.30	3.12
PR-05	1.24	96.8	0.15	0.56	2.04
PR-06	2.04	83.4	0.33	0.96	2.25

As discussed in Section I.C of this report, there are no plans to further develop Lot 2 at this time. If Lot 2 is developed in the future, further drainage analysis will be necessary to determine if the proposed detention pond will need to be enlarged. However, it should be noted that preliminary investigations suggest that the proposed pond has sufficient storage for Lot 2 to be developed with approximately 85% imperviousness. Water quality calculations and design stage storage information for the pond are provided in Appendix B. Refer to **Figure 4** for the proposed sub-basin layout and more detailed basin information.

The proposed detention pond for My Storage is a permanent stormwater solution. The pond has been designed to hold the water quality capture volume (WQCV) and 100-year storm event for the development of Lot 1 and Lot 2 detention pond design information for this filing is shown in **Table 3**.

Table 3: Water Surface Elevation and Volume Summary

Event	WSEL	Volume (cubic ft)	Peak Q (cfs)
Top of Pond	4520.00	52881	-
100-Year Storm*	4516.39	19340	0.42
10-Year Storm*	4514.74	6007	0.42
WQCV	4515.04	4884	0.09
Bottom of Pond	4513.00	0	-

Table 3 demonstrates that the detention pond is more than large enough to hold the WQCV, the 10-year, and 100-year design storm runoff from the developed area. The SWMM requires that the detention pond collects and holds the 100-year storm volume with at least one foot of freeboard. As designed, the pond will have 3.61 feet of freeboard above the required detention volume. The detention pond is anticipated to be at full capacity upon the full development of this filing.

SWMM requirements dictate that the pond must drain within 48 hours of all storm events up to and including the 100-year storm event. A Geotechnical Report for the project area was performed by Geotechnical Engineering Group in May 2021. The report includes analysis of three pits dug to a depth of 9-9.5 feet below ground surface. The report shows that groundwater was not encountered in any of the test pits at the time of excavation. Because of these findings, the proposed pond bottom has been kept to an approximate depth of 7 feet below the existing ground surface to stay out of the groundwater table. Excerpts from the Geotechnical Report are included in **Appendix A**.

The design depth of the pond is necessary to hold the required storage volumes of the combined fully developed site. Options to gravity fall from the combined pond to the ultimate discharge point have been explored. However, tie-in elevations and existing grades across the overall project parcel prevent a viable gravity fed solution. As such, it is anticipated that the best solution for draining the pond will be by way of a pump system. A low-flow pump (at 40 gpm) and a high-flow pump (at 150 gpm) will drain the pond within the required time. Pond drain time calculations are provided in Appendix B. Should the pump system become clogged or unfunctional, the pond will overflow southwest to the existing historical drainage point (Adobe Creek). Pumping stormwater from the pond in this manner yields a constant discharge rate that is below the historic release rates for the 10-year and 100-year storms. The constant discharge rate will be only 0.06 cfs greater than the historical rate in the proposed 2-year storm condition. The constant discharge rate is required to drain the detention pond during the 100-year storm condition within 48 hours. Upon leaving the detention pond, the pumped flow enters the roadside ditch in the Highway 6 and 50 right-of-way and immediately discharges to Adobe Creek approximately 175-feet to the west without passing thru any downstream parcels. Thus, the slight

increase in discharge of 0.07 cfs from the 2-year storm event is considered negligible. **Table 4** provides the existing and proposed discharge rates for the development.

Table 4: Project Discharge Rates

Design Point ID*	Design Point Condition	Design Point Location	Peak Flow at Design Point		
			2-year Storm (cfs)	10-year Storm (cfs)	100-year Storm (cfs)
EX1	EXISTING	EXISTING	0.33	0.54	1.76
EX2	EXISTING	EXISTING	0.03	0.05	0.41
PR1	PROPOSED	Pond Outlet Pump	0.42	0.42	0.42

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 the City's stormwater pollution prevention Ordinance No. 3824 and 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. Except for the proposed pond pump system, there are no mechanical items to check and maintain. Anticipated maintenance includes periodic (1-2 times per year and as needed after major storm events) clearing of debris from drains and trash racks. The pump system will require more frequent maintenance and upkeep by the Property Owner's Association. Periodic sediment removal from the pond may also 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 (dated June 14, 2021).

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 (dated June 14, 2021), 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 (dated June 14, 2021), except as noted within the report.

E. Variance from Criteria

The only variance from the criteria of the SWMM manual is the slight increase in discharge of 0.06 cfs for the 2-year storm event. The constant discharge rate is required to drain the detention pond during the 100-year storm condition within 48 hours. Upon leaving the detention pond, the pumped flow enters the roadside ditch in the Highway 6 and 50 right-of-way and immediately discharges to Adobe Creek approximately 175-feet to the west without passing thru any downstream parcels. Thus, the slight increase in discharge of 0.06 cfs from the 2-year storm event is considered negligible.

F. Calculation Methodology

Autodesk Storm and Sanitary Analysis 2022 was used to model the basin runoff and perform the routing hydraulics. The following modeling methods were used within the model: the US EPA SWMM, SCS Curve Number, Hydrodynamic, and Hazen-Williams. The Autodesk software and selected methods are all accepted by the regulatory and engineering community and within standard engineering practice.

G. Calculation and Modeling Results

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

- All design storms used for this project had a rainfall duration of 24-hours. Thus, the storm duration used exceeds the 3-hour minimum storm duration stated in Section 28.24.090 of the SWMM. The 100-year 24-hour rainfall value used was 2.01 inches and the 10-year 24-hour rainfall value used was 1.12 inches. The 100-year and 10-year rainfall values used are the values provided in Table 28.24.040(a) of the SWMM.
- Two existing sub-basins, and six separate proposed sub-basins have been analyzed for this project. Design storm peak flows for each of the project's sub-basins are shown on Figures 3 and 4.
- There are six proposed storm drain pipes for this project. Table 2 shows the pipe modeling results for the 2-year 24-hour & 100-year 24-hour storm events.

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)
A1-A2	HDPE	24	42.5	1.00	2.09	4.05	15.63	6.55
A2-A3	HDPE	24	116.4	1.00	1.80	3.54	13.80	5.40
A3-A4	HDPE	24	70.3	0.50	1.66	3.29	11.82	4.61
A4-A5	HDPE	18	219.7	0.50	1.24	3.02	8.99	5.43
A4-A7	HDPE	18	180.8	0.50	0.43	2.25	3.16	3.37
A5-A6	HDPE	18	180.8	0.50	0.51	1.67	3.74	2.90

- The model predicts that the hydraulic grade line (HGL) is below the top of all structures/inlets modeled, or within the allowable ponding depth at gutter flowlines, per SWMM criteria. Profiles of the proposed storm drain system showing the 100-year HGL are provided in Appendix F. Modeling results for the proposed inlets are shown in Table 6. SWMM inlet efficiency charts are provided in Appendix G.

Table 6: Proposed Storm Drain Inlets

Inlet ID	Sump, or On-Grade Min Slope (%)	Grate Elevation (ft)	100-Year Max HGL Elevation (ft)	Invert Elevation (ft)	2-Year Peak Flow to Inlet (cfs)	100-Year Peak Flow to Inlet (cfs)
SDAI-A2	Sump	4519.01	4516.39	4514.49	0.33	0.96
SDAI-A3	Sump	4520.06	4517.06	4515.65	0.15	0.56
SDAI-A5	On-Grade	4521.61	4520.59	4517.60	0.76	2.18
SDAI-A6	On-Grade	4522.52	4520.07	4518.51	0.52	1.49
SDAI-A7	On-Grade	4521.32	4518.10	4517.41	0.44	1.30

- There are no street conveyance capacities to check for the project site. However the proposed driveways within the site have been analyzed to ensure that storage buildings will not be flooded in the 100-year storm event.
- Driveway capacities were checked based on the 100-year 3-hour peak flow rates generated for each sub-basin shown on Figure 4. There are no issues with Driveway capacities. See the Hydraflow Express channel report provided in Appendix G for more detail.
- Riprap protection for outlet pipes have been sized as per the formulas in the SWMM. Calculations for the riprap sizing are included in Appendix G.

IV. Post Construction Stormwater Management

A. Stormwater Quality Control Measures

The detention pond for this filing has been designed to hold the 100-year storm event, including the WQCV, without overtopping. The detention pond will have 2 pumps, low-flow, and high-flow, that will adequately drain the pond within SWMM requirements. Pumping stormwater from the pond in this manor yields a constant discharge rate that is below the historic release rates for the 10-year and 100-year design storms. The constant discharge rate will be only 0.06 cfs greater than the historical rate in the proposed 2-year storm condition.

B. Stormwater Quality Calculations

The WQCV was determined based on the percent imperviousness of the proposed development for this filing. 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 (dated Jun 14, 2021).

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 mapped FEMA 100-Year Floodplains within or adjacent to the project site. The project site is within a Zone X, 500-Year, *Area of Minimal Flood Hazard*. A FEMA FIRM Map for the area is available in Appendix A.

D. Variances from Manual

The only variance from the criteria of the SWMM manual is the slight increase in discharge of 0.06 cfs for the 2-year storm event. The constant discharge rate is required to drain the detention pond during the 100-year storm condition within 48 hours. Upon leaving the detention pond, the pumped flow enters the roadside ditch in the Highway 6 and 50 right-of-way and immediately discharges to Adobe Creek approximately 175-feet to the west without passing thru any downstream parcels. Thus, the slight increase in discharge of 0.06 cfs from the 2-year storm event is considered negligible.

VI. References

1. Stormwater Management Manual, WRC Engineering under the direction of Mesa County Colorado, December 31, 2007.

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

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

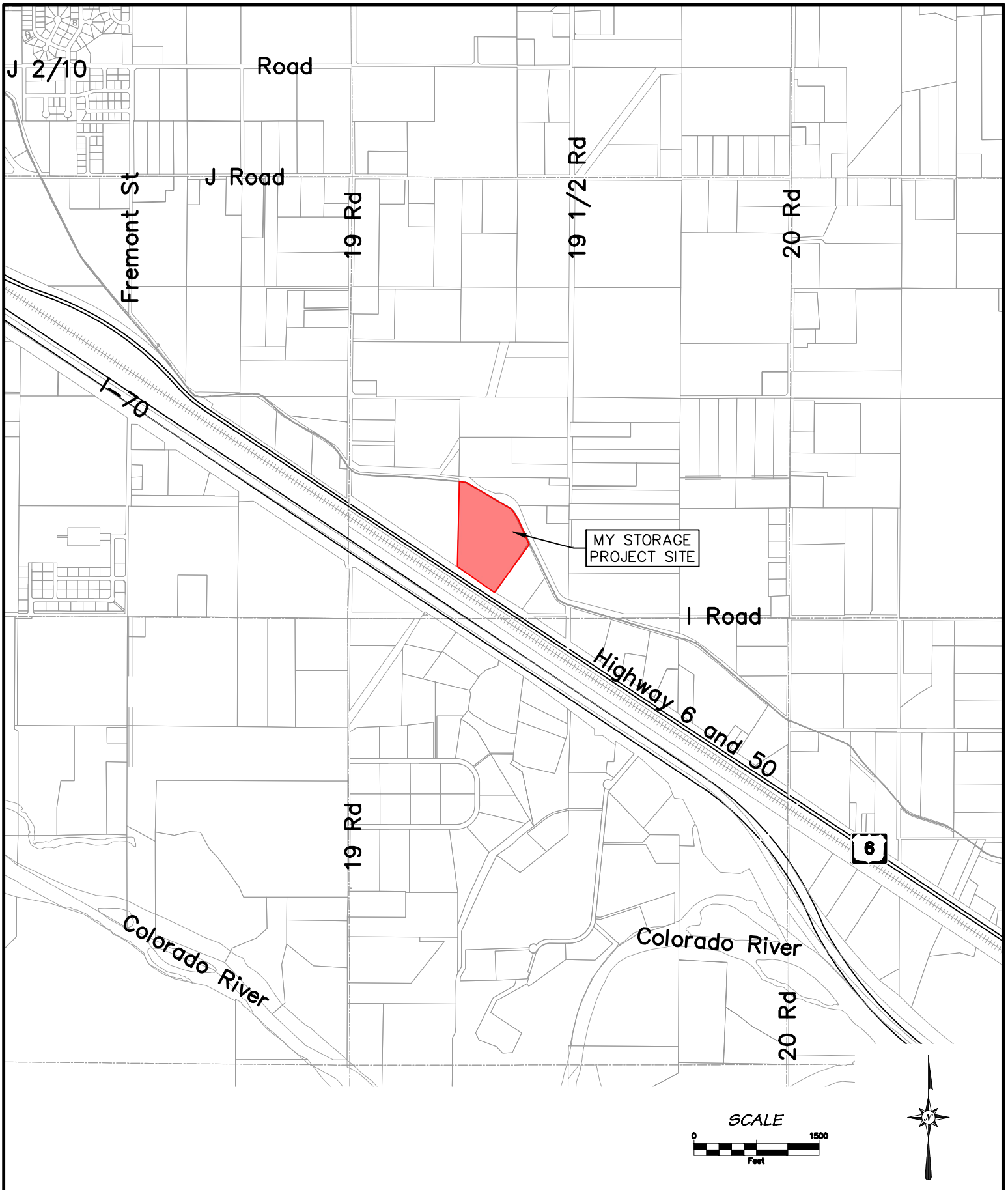
4. Natural Resources Conservation Service National Cooperative Soils Survey Website, http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx .

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

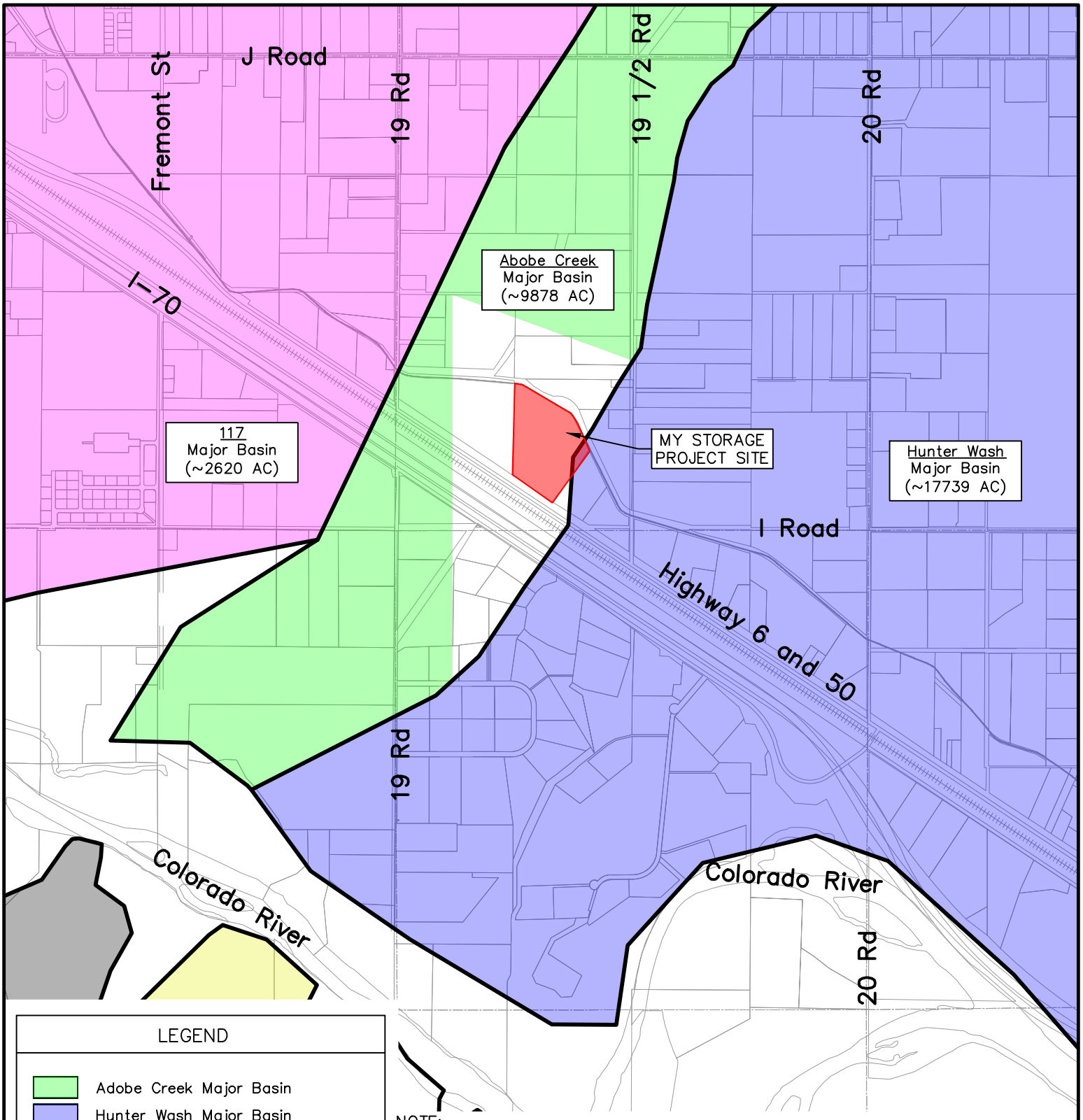
6. Drainage Criteria Manual, Urban Drainage and Flood Control District, Volumes 1, 2, & 3; Denver, Colorado 2001.

FIGURES

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



My Storage GENERAL LOCATION MAP DATE: 13.MARCH.2023	Figure 1	RIVER CITY CONSULTANTS



NOTE:

1. The entire proposed project area is within the Adobe Creek and Hunter Wash Major Drainage Basins. Both drain to the Colorado River.
2. The project site is within a Zone X, 500-YR, Area of Minimal Flood Hazard.

SCALE
0 1500
Feet

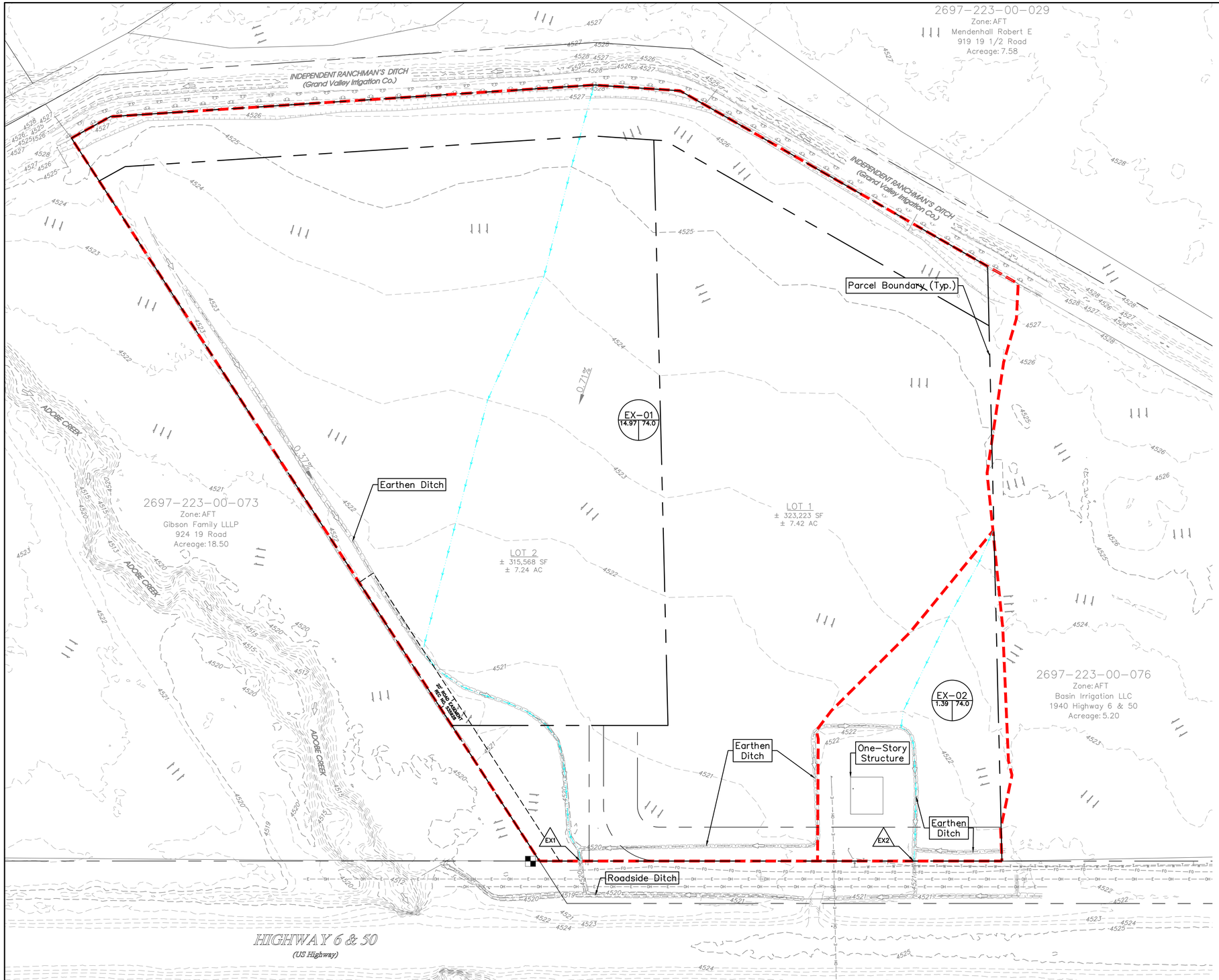
My Storage

MAJOR BASIN & FLOODPLAIN MAP

DATE: 13.MARCH.2023

Figure 2

RIVER CITY CONSULTANTS



LEGEND

- A – SUB-BASIN ID
- B – ACREAGE
- C – COMPOSITE SCS CURVE NUMBER
- D – DESIGN POINT (SEE TABLE FOR FLOWS)
- EXISTING SHEET FLOW
- EXISTING CONCENTRATED FLOW
- SUB-BASIN BOUNDARY
- SUB-BASIN FLOWPATH

EXISTING SUB-BASIN TABLE

Sub-Basin ID	Sub-Basin Area (acres)	SCS Curve Number (CN)	Existing Sub-Basin Peak Runoff Rates (cfs)		
			2-Year	10-Year	100-Year
EX-01	14.970	74.0	0.33	0.54	1.76
EX-02	1.390	74.0	0.03	0.05	0.41

EXISTING DESIGN POINT TABLE

Design Point ID	Design Point Location	Peak Flow at Design Point		
		2-year Storm (cfs)	10-year Storm (cfs)	100-year Storm (cfs)
EX1	EXISTING	0.33	0.54	1.76
EX2	EXISTING	0.03	0.05	0.41

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
CDOT RoW Marker 3.25" Brass Cap
North RoW
US Hwy 6 &50
NORTHING: 61213.39
EASTING: 53795.63
ELEVATION: 4521.13
DATUM SOURCE: MCLCS Zone "GVA" (NAVD 88)

SCALE (FEET)
0 60 120
HORIZONTAL
VERTICAL: n/a
CONTOUR INTERVAL: 1 FT

PROJECT PHASE: ----
DATE ISSUED: 29.March.2023

NO.	DATE	REVISION	BY

S:\PROJECTS\2119 Johnson Construction\001 My Storage 1930 Hwy 6&50\Design\Drainage\01-DWG\2119-001 Fig 3 & 4.dwg [Existing Drainage Map] 3/23/2023 10:13:25 AM

PRELIMINARY

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

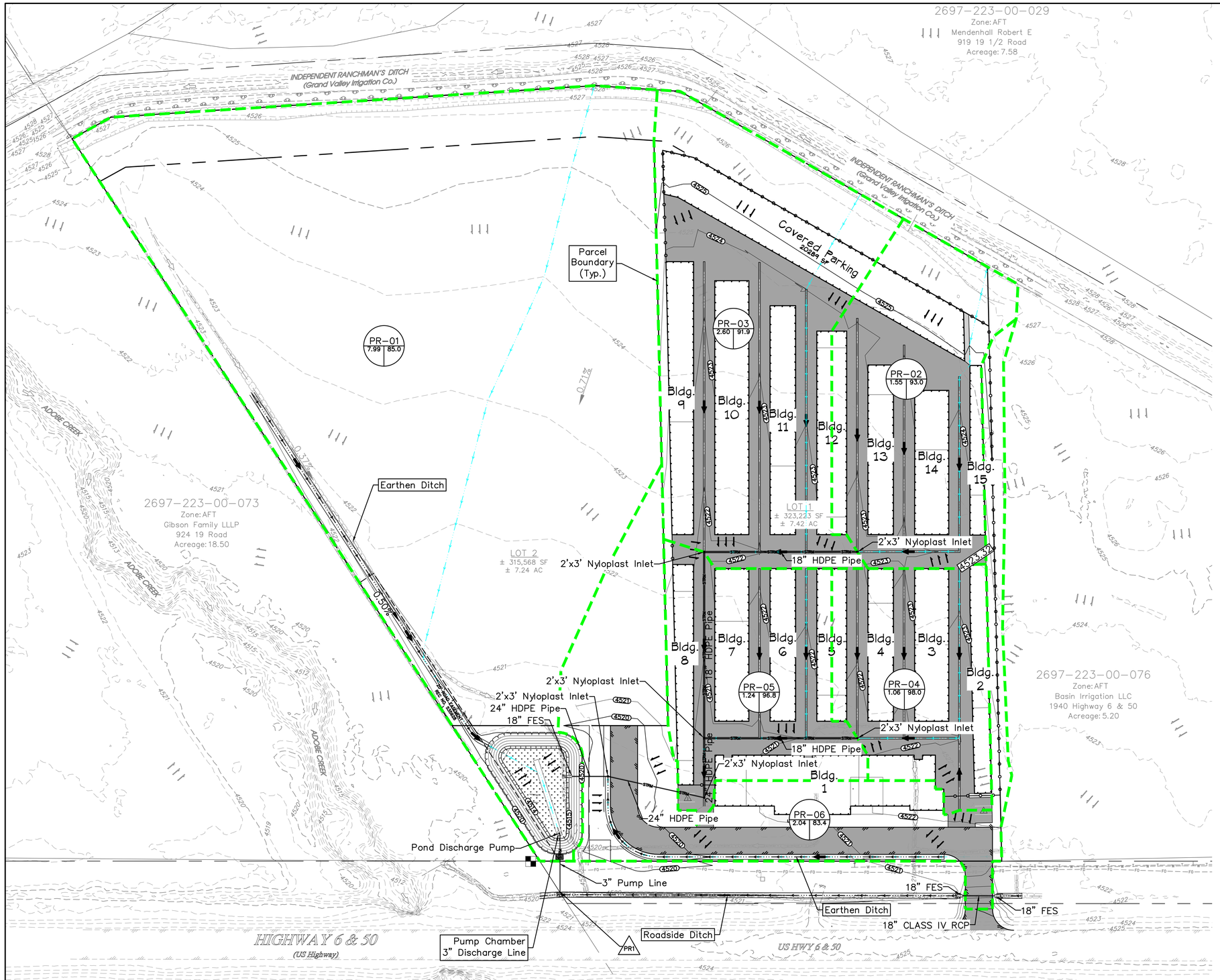
DRAWN BY: ctr | PROJECT: 2119-001
CHECKED BY: idq
ORIGINAL SHEET SIZE: 22 x 34

JOHNSON CONSTRUCTION

My Storage

Drainage Maps
Existing Drainage Map

F3



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- PROPOSED SHEET FLOW
- PROPOSED CONCENTRATED FLOW
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- SUB-BASIN FLOWPATH

PROPOSED DESIGN POINT TABLE

Design Point ID	Design Point Location	Peak Flow at Design Point		
		2-year Storm (cfs)	10-year Storm (cfs)	100-year Storm (cfs)
PR1	South Pond	0.42	0.42	0.42

PROPOSED SUB-BASIN TABLE

Sub-Basin ID	Sub-Basin Area (acres)	SCS Curve Number (CN)	Proposed Sub-Basin Peak Runoff Rates (cfs)		
			2-Year	10-Year	100-Year
PR-01	7.99	74.0	0.09	0.28	1.29
PR-02	1.55	93.0	0.52	1.49	3.63
PR-03	2.60	91.9	0.76	2.18	5.48
PR-04	1.06	98.0	0.44	1.30	3.12
PR-05	1.24	96.8	0.15	0.56	2.04
PR-06	2.04	83.4	0.33	0.96	2.25

PROPOSED POND TABLE

Event	WSEL	Volume (cubic ft)	Peak Q (cfs)
Top of Pond	4520.00	52880.62	-
100-Year Storm*	4516.39	19339.64	0.42
10-Year Storm*	4514.74	6007.28	0.42
WQCV*	4515.04	4883.69	0.42
Bottom of Pond	4513.00	0.00	-

* Values from Storm & Sanitary Analysis Model

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

CDOT RoW Marker 3.25" Brass Cap
North RoW
US Hwy 6 &50
NORTHING: 61213.39
EASTING: 53795.63
ELEVATION: 4521.13
DATUM SOURCE: MCLCS Zone "GVA" (NAVD 88)

SCALE (FEET)
0 60 120
HORIZONTAL
VERTICAL: n/a

PROJECT PHASE: ----
DATE ISSUED: 29.March.2023

NO.	DATE	REVISION	BY

S:\PROJECTS\2119 Johnson Construction\001 My Storage 1930 Hwy 6&50\Design\Drainage\01-DWG\2119-001 Fig 3 & 4.dwg [Proposed Drainage Plan] 3/23/2023 10:16:23 AM

PRELIMINARY

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

DRAWN BY: ctr | PROJECT: 2119-001
CHECKED BY: idq
ORIGINAL SHEET SIZE: 22 x 34

JOHNSON CONSTRUCTION

My Storage

Drainage Maps
Proposed Drainage Plan

F4

APPENDIX A

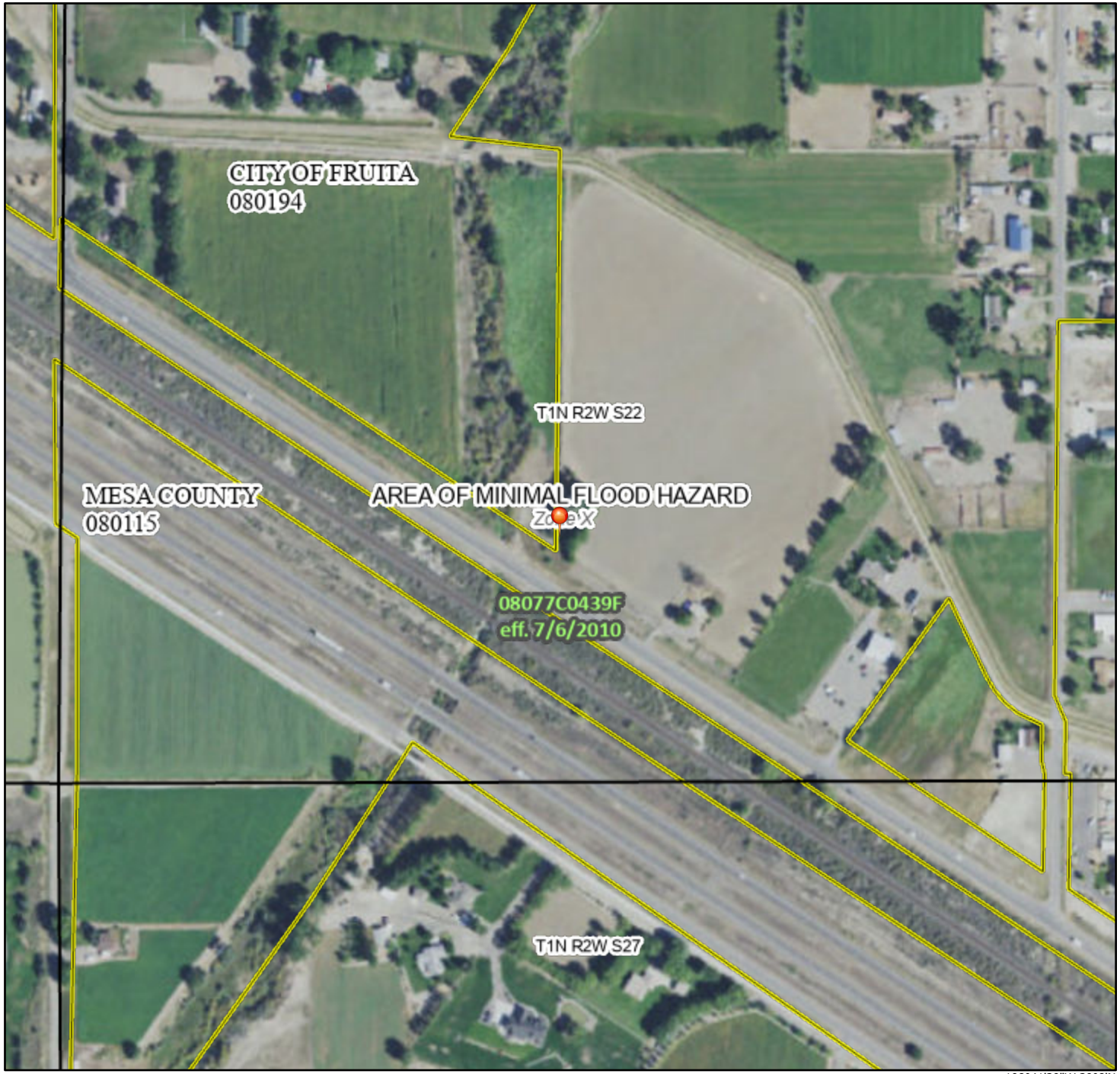
Project Site Information

1. **FEMA Firm Panel**
2. **NRCS Web Soil Survey & K Factor Whole Soil**
3. **Geotechnical Report – Excerpts**
4. **Environmental Site Assessment – Excerpts**

National Flood Hazard Layer FIRMette

FEMA

108°42'6"W 39°8'27"N



108°41'29"W 39°8'N

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

1:6,000

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

Legend

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

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- 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 11/17/2021 at 9:08 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

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, NNGS12
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.

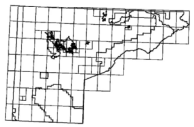
Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The FEMA Map Service Center may also 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

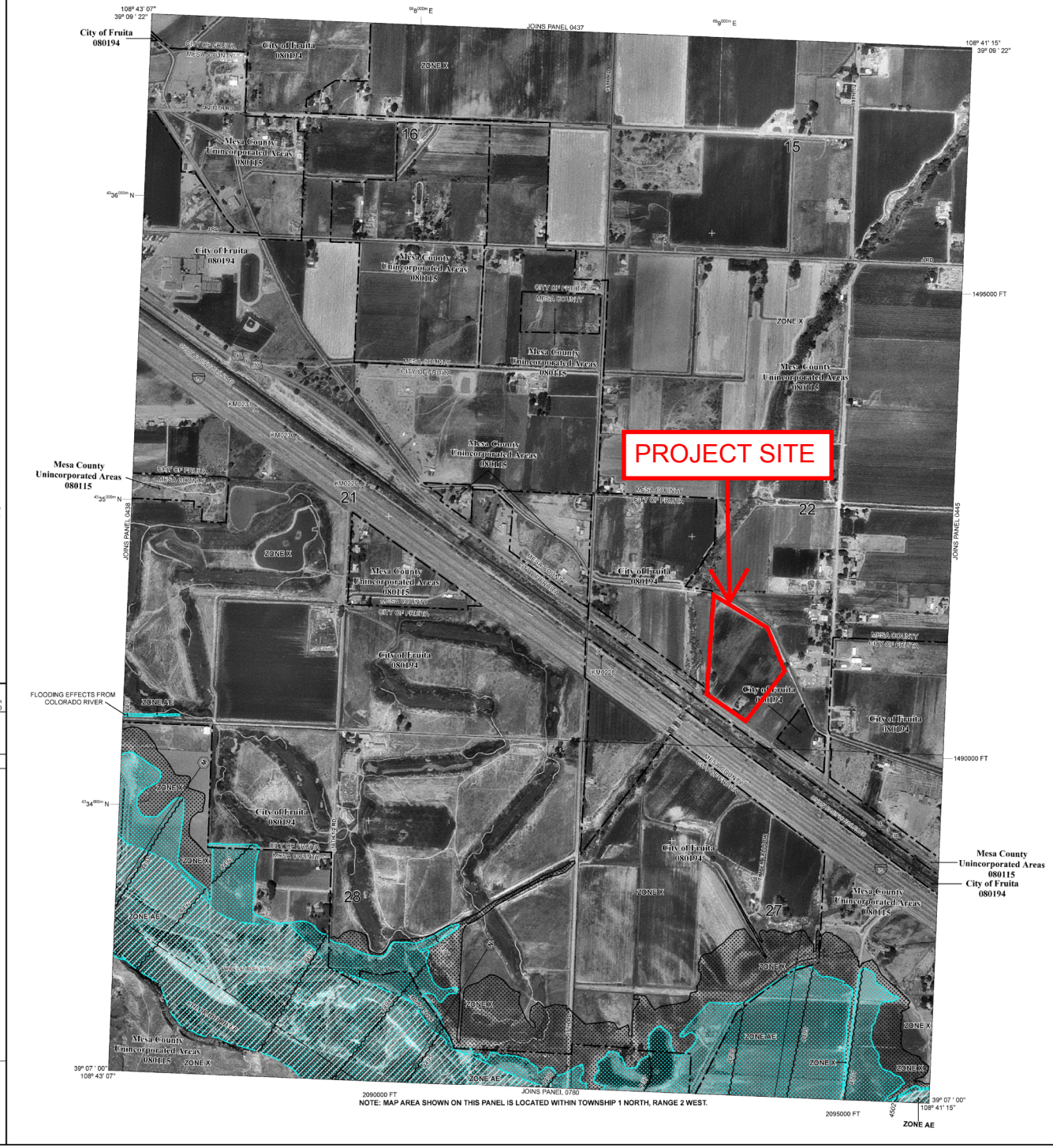
Flooding Source	Vertical Datum Offset (ft)	Flooding Source	Vertical Datum Offset (ft)
Colorado River	3.4		

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 (EL 987) — Base Flood Elevation line and value; 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

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:

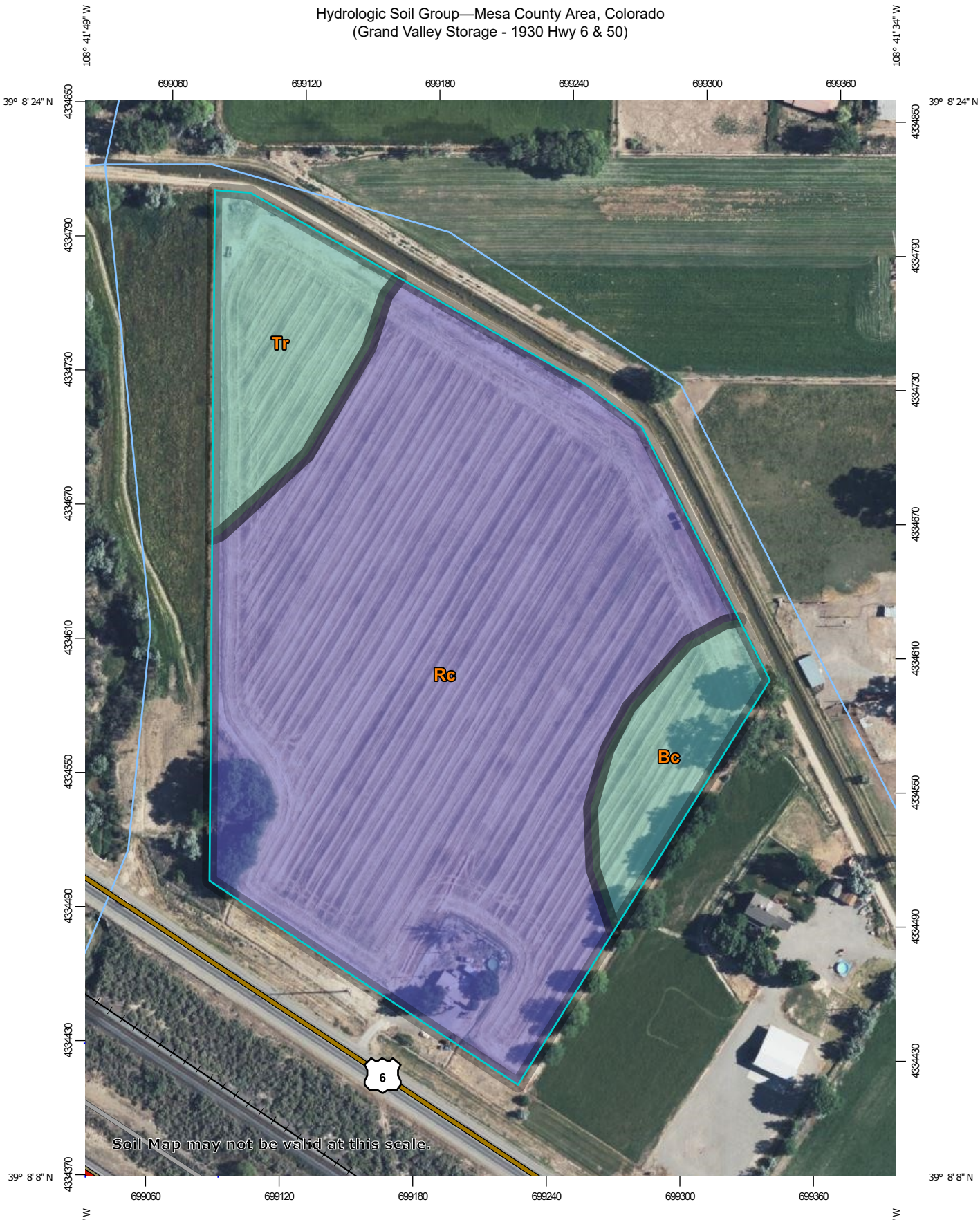
COMMUNITY	NUMBER	PANEL	SUFFIX
FRUITA, CITY OF	080194	0439	F
MESA COUNTY	080115	0439	F

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

Hydrologic Soil Group—Mesa County Area, Colorado
(Grand Valley Storage - 1930 Hwy 6 & 50)



Map Scale: 1:2,350 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

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 12, Sep 2, 2021

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

Date(s) aerial images were photographed: 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
Bc	Sagers silty clay loam, 0 to 2 percent slopes	C	1.3	7.9%
Rc	Fruitland sandy clay loam, 0 to 2 percent slopes	B	13.0	80.2%
Tr	Turley clay loam, 0 to 2 percent slopes	C	1.9	11.9%
Totals for Area of Interest			**16.2**	**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.

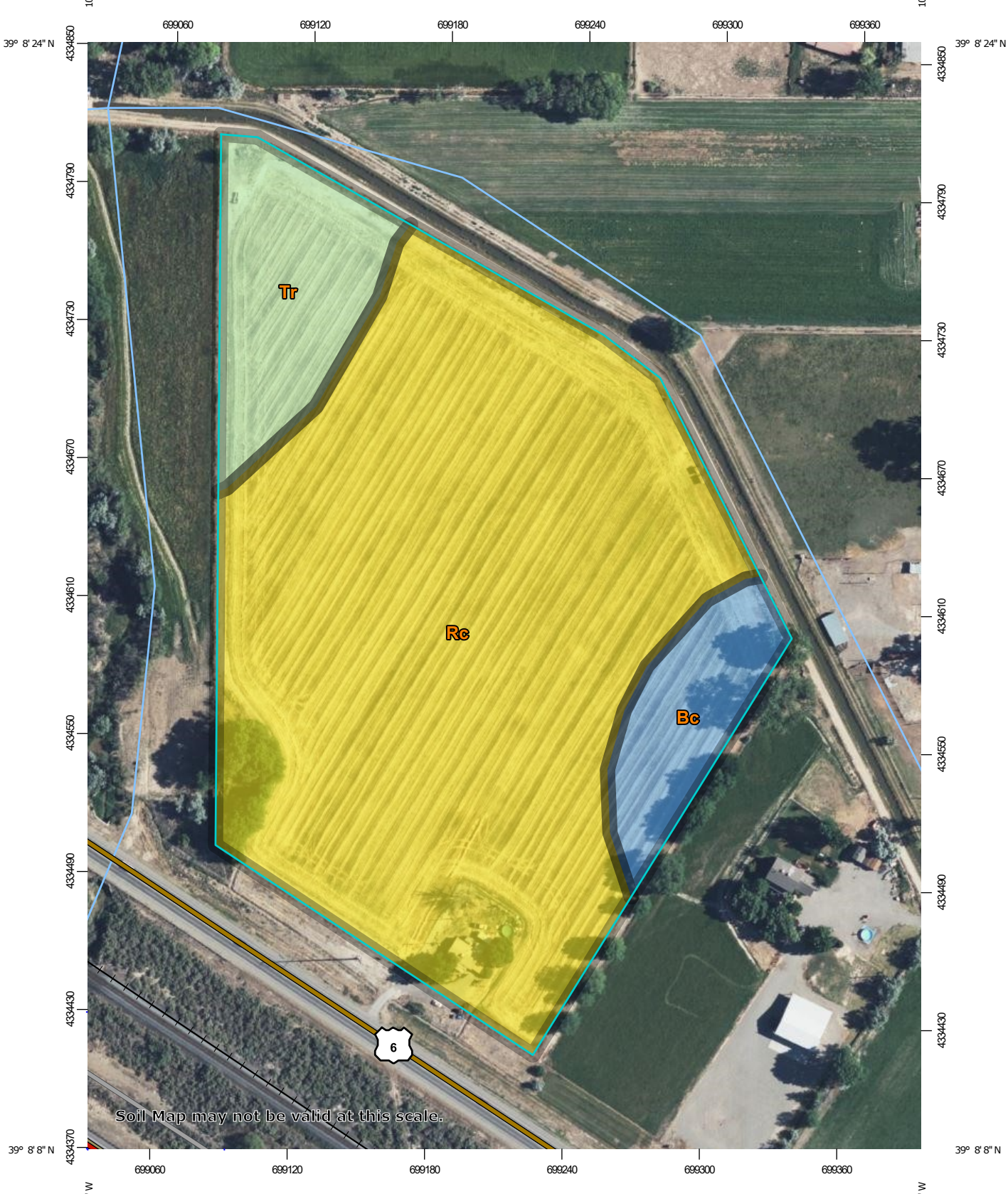
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

K Factor, Whole Soil—Mesa County Area, Colorado
(Grand Valley Storage - 1930 Hwy 6 & 50)



Map Scale: 1:2,350 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

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 12, Sep 2, 2021

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

Date(s) aerial images were photographed: 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
Bc	Sagers silty clay loam, 0 to 2 percent slopes	.43	1.3	7.9%
Rc	Fruitland sandy clay loam, 0 to 2 percent slopes	.17	13.0	80.2%
Tr	Turley clay loam, 0 to 2 percent slopes	.28	1.9	11.9%
Totals for Area of Interest			**16.2**	**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)

Grand Valley Consulting, LLC dba

GEOTECHNICAL ENGINEERING GROUP

PRELIMINARY GEOTECHNICAL INVESTIGATION
1930 Highway 6&50
Fruita, Colorado

Prepared For:

Dwight Johnston
dwightjohnston13@icloud.com

Job No. 4,588

May 13, 2021

(970) 261-3415 • jwithers@geotechnicalgroup.net
3510 Ponderosa Way, Grand Junction, Colorado 81506

SUMMARY OF CONCLUSIONS

1. Subsurface conditions encountered in the three exploratory test pits consisted of silty to clayey sand in TP-1 and TP-2 to the maximum depth explored of 9.5 feet below ground surface and to 4 feet underlain by silty, sandy clay in TP-3 to the maximum depth explored of 9 feet below ground surface. Groundwater was not encountered in the test pits at time of site visit.

2. Construction should not bear on locations or within the zone of influence of the test pits noted on Fig. A-2. Former test pits should be backfilled as described in the "**SITE DEVELOPMENT**" section of the report.

3. Foundation and floor support design should be based upon site and structure specific design level geotechnical investigation. Based on this preliminary investigation, we believe shallow foundations underlain by a prepared soil subgrade and well compacted structural fill may be appropriate. Floor systems typically consist of suspended wood structural systems in finished living areas and floating slabs on grade for unfinished areas such as garages and storage units.

4. Surface drainage should be designed for rapid runoff of surface water away from the proposed structure in each direction. It is very important to control water sources and provide proper drainage as these are common causes of distress.

SITE CONDITIONS

The subject site was located at 1930 Highway 6&50 in Fruita, Colorado. A vicinity map showing the site location is included as Fig. A-1. The subject is a farmed field. The subject site has an existing residence (to be demolished) at the south end of the site. We observed vacant land toward the north and west, existing residence and pasture to the east, and railroad tracks/highway 50 to the south of the site. We observed an irrigation supply ditch approximately 150 feet north of the site and the Colorado River is 0.8 miles south of the site. The subject site is relatively flat and slopes down toward the south at 1-3 percent as measured by hand level and rangefinder.

SITE GEOLOGY

Near site geology was identified on the "Geologic Map of the Fruita Quadrangle Mesa County, Colorado" by Richard Livaccari and James Hodge dated 2009 as alluvial mudflow and fan valley fill deposits (upper Pleistocene and Holocene) with underlying bedrock material mapped as Mancos Shale (upper Cretaceous). We did not find the underlying bedrock strata, to the depth investigated, at time of investigation.

PROPOSED CONSTRUCTION

Proposed construction will consist of removing the existing house in the south portion of the property and replacing it with a new house/office. The house/office will be 1 to 2 stories and be less than 5,000 SF (square feet) in plan. The remainder of the subject site will be constructed with one story storage units with steel framing and sheet metal walls. There will be gravel access lanes between storage units. If proposed construction is different than what is described above, we should be notified so that we can re-evaluate the recommendations given.

SUBSURFACE CONDITIONS

Subsurface conditions at the site were investigated by observing and sampling the soils encountered in three test pits as excavated by others. Location of the exploratory test pits are shown on Fig. A-2. A summary log of the soils found in the exploratory test pits and field penetration resistance tests are presented on Figs. A-3 thru A-5. Subsurface conditions encountered in the three exploratory test pits consisted of silty to clayey sand in TP-1 and TP-2 to the maximum depth explored of 9.5 feet below ground surface. There was also clayey sand from 0 to 4 feet underlain by silty, sandy clay in TP-3 to the maximum depth explored of 9 feet below ground surface. The silty to clayey sand was loose to medium dense, slightly moist and brown. The silty, sandy clay was stiff to

very stiff, moist and brown. Groundwater was not encountered in the test pits at time of site visit.

One clayey sand sample from TP-1 at 1-3 feet depth tested had a moisture content of 6.0 percent and 43 percent passing the No. 200 sieve (silt and clay sized particles). One clayey sand sample from TP-2 at 6-8 feet depth tested had a moisture content of 10.5 percent and 39 percent passing the No. 200 sieve (silt and clay sized particles). One clayey sand sample from TP-3 at 1-3 feet depth tested had a moisture content of 6.8 percent, was non-liquid, non-plastic, and 42 percent passing the No. 200 sieve (silt and clay sized particles). One silty, sandy clay sample from TP-3 at 6 feet depth was tested for one dimensional swell/consolidation characteristics. The sample tested had a moisture content of 23.3 percent, a dry density of 63 pcf, exhibited 0.6 percent swell when wetted under a confining pressure of 500 psf and had an estimated swell pressure of 1,000 psf. Results of laboratory testing are shown in Appendix B and summarized on Table I.

SITE DEVELOPMENT

All development areas should be stripped of organic layers prior to cut or placement of fill. Fill subgrade soils should be scarified a depth of 10-inches, moisture conditioned to within 2 percent of optimum moisture and compacted to at least 95 percent of maximum standard Proctor dry density (ASTM D698). Structural fill material

SURFACE DRAINAGE

Performance of foundations and concrete flatwork is influenced by surface moisture conditions. Risk of wetting foundation soils can be reduced by carefully planned and maintained surface drainage. Surface drainage should be designed to provide rapid runoff of surface water away from the proposed shop. We recommend the following precautions be observed during construction and maintained at all times after the construction is completed.

1. The ground surface surrounding the exterior of the buildings should be sloped to drain away from the buildings in all directions. We recommend a slope of at least 12 inches in the first 10 feet around the structures, where possible. In no case should the slope be less than 6 inches in the first 5 feet. The ground surface should be sloped so that water will not pond adjacent to the structures.

2. Backfill around foundation walls should be moistened and compacted. Clayey backfill soils are suitable for reuse in the upper 24 inches of exterior wall backfill.

3. Roof downspouts and drains should discharge well beyond the limits of all backfill. Splash blocks and downspout extenders should be provided at all discharge points.

4. Landscaping should be carefully designed to minimize irrigation. Plants used close to foundation walls should be limited to those with low moisture requirements; irrigated grass and/or plants should not be located within 5 feet of the foundation. Sprinklers should not discharge within 5 feet of foundations. Irrigation should be limited to the minimum amount sufficient to maintain vegetation; application of more water will increase likelihood of slab and foundation movements.

5. Impervious plastic membranes should not be used to cover the ground surface immediately surrounding the structure. These membranes tend to

GEOTECHNICAL ENGINEERING GROUP

We believe this investigation was conducted in a manner consistent with that level of care and skill ordinarily used by geotechnical engineers practicing in this area at this time. No other warranty, express or implied, is made. If we can be of further service in discussing the contents of this report or the analysis of the influence of the subsurface conditions on the design of the residence, please call.

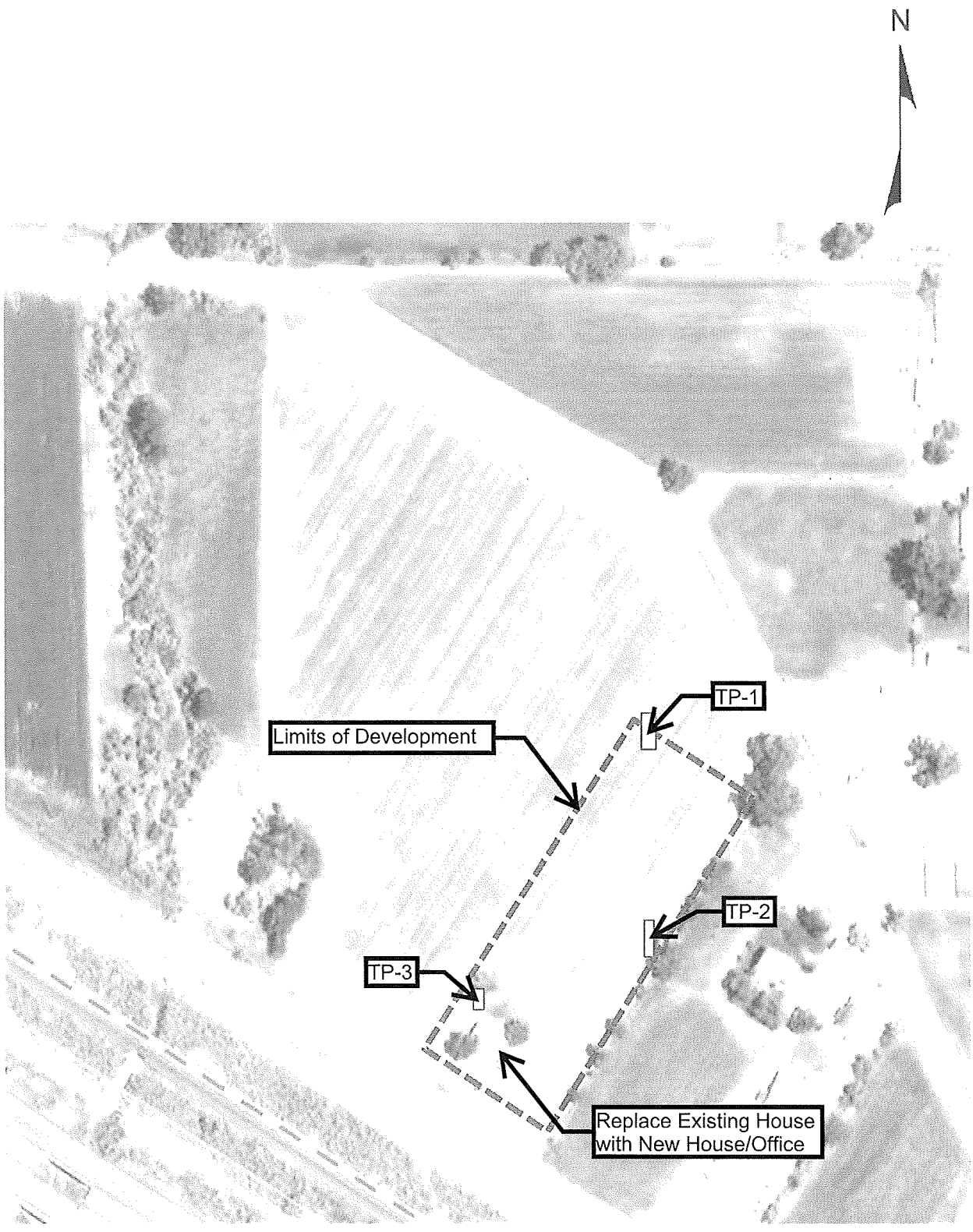
Sincerely,
Grand Valley Consulting, LLC dba
GEOTECHNICAL ENGINEERING GROUP

Chris Hill, E.I.T.
Staff Engineer

Reviewed by:

John Withers, P.E.
Engineer

(1 copy emailed)
Note: This report includes 11 pages text and 3 Appendix. It should not be interpreted except in it's entirety.



NOTE: THIS FIGURE WAS PREPARED BASED ON AN IMAGE FROM BING MAPS. DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

- Indicates location of exploratory pits.

Project Manager: JPW	Project No. 4,588	GEOTECHNICAL ENGINEERING GROUP	LOCATIONS OF EXPLORATORY PITS	FIG No.
Drawn by: CDH	Scale: N.T.S	3510 Piedmont Way Grand Junction, Colorado 81506	1930 Highway 6&50 Fruita, Colorado	A-2
	File Name: BPLAN	PH (970) 261-3415 jshiers@geotechnicalgroup.net		
	Date: 5/5/2021			

LOCATION: See Figure A-2 ELEVATION: -

DRILLER: Client LOGGED BY: JW

DEPTH TO WATER> INITIAL: ▽ NATD AFTER 24 HOURS: ▼ backfill

DATE: 4/22/2021 DEPTH TO CAVING: ⊥ -

SIZE: 4'x17' TOTAL DEPTH 9.5 Ft

Depth (feet)	Description	Graphic	Interval	Sample Type	Blow Counts	Notes
0	Sand, clayey, silty, loose to medium dense, slightly moist and brown (SM-SC)					Bulk sample from 1-3'
			4'	dpt	6/12	
5			6'	dpt	5/12	
						Bulk sample from 6-8'
						Soft less dense with increasing depth
10	Total depth 9.5 feet					

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

Project No.: 4,588
Client: Dwight Johnston
Date: 5/5/2021

GEOTECHNICAL ENGINEERING GROUP
3510 Ponderosa Way, Grand Junction, Colorado 81506
(970) 261-3415

LOG OF EXPLORATORY TEST PIT TP-1

1930 Highway 6&50
Fruita, Colorado

Fig
A-3

LOCATION: See Figure A-2 ELEVATION: -

DRILLER: Client LOGGED BY: JW

DEPTH TO WATER> INITIAL: ▽ NATD AFTER 24 HOURS: ▽ backfill

DATE: 4/22/2021 DEPTH TO CAVING: ⊥ -

SIZE: 4.5'x18' TOTAL DEPTH 9.5 Ft

Depth (feet)	Description	Graphic	Interval	Sample Type	Blow Counts	Notes
0	Sand, clayey, silty, loose, moist and brown (SM-SC)					Bulk sample from 1-4'
			4'	dpt	9/12	
5			6'	dpt	8/12	Bulk sample from 6-8'
						Soft less dense with increasing depth
10	Total depth 9.5 feet					

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

Project No.: 4,588 Client: Dwight Johnston Date: 5/5/2021	GEOTECHNICAL ENGINEERING GROUP 3510 Ponderosa Way, Grand Junction, Colorado 81506 (970) 261-3415	LOG OF EXPLORATORY TEST PIT TP-2 1930 Highway 6&50 Fruita, Colorado	Fig A-4

ERO

Consultants in Natural Resources and the Environment

Phase I Environmental Site Assessment
Adobe Creek Development
Mesa County, Colorado

Prepared for—

Landmark Development
1982 J Road
Fruita, Colorado 81521

Prepared by—

ERO Resources Corporation
1842 Clarkson Street
Denver, Colorado 80218
(303) 830-1188
ERO Project #4208

September 8, 2008

Summary

Landmark Development retained ERO Resources Corporation (ERO) to conduct a Phase I Environmental Site Assessment (ESA) for the Adobe Creek Development property located in Mesa County, Colorado (hereafter called "the property"). ERO performed this ESA according to the "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process" (American Society for Testing Materials E 1527-05 2005) (ASTM). This ESA consists of a review of historical information; federal, state, and local records; interviews with persons knowledgeable of the property; and a site reconnaissance.

The property consists of a 48-acre parcel of land. Historically, the property and surrounding area have been residential and agricultural. Federal, state, and local records indicate no sites or incidents on or near the property are associated with known or suspect recognized environmental conditions except for an adjoining registered aboveground storage tank site located at 934 19½ Road. The tank was closed in 1997 and is unlikely to have adversely affected the property.

During the site reconnaissance, ERO inspected the property by walking the perimeter and traversing the interior. The property was generally rural and residential with associated agricultural fields. Numerous solid waste disposal areas and numerous vehicles and pieces of farm equipment were observed on portions of the property. One square-foot area of petroleum-stained soil beneath an engine block and about a 25 square foot area of petroleum-stained soil located beneath three aboveground storage tanks (ASTs) containing diesel were observed on the 945 19½ Road parcel of the property. Numerous containers and a 55-gallon drum labeled as motor oil were observed in the immediate vicinity of the ASTs. No evidence of leakage was observed around the containers and drum.

ERO performed this Phase I ESA in conformance with the scope and limitations of ASTM Practice E 1527. Any exceptions to, or deletions from, this practice are described in the *Introduction* section of this report. This assessment has revealed no evidence of recognized environmental conditions in connection with the property except for the numerous solid waste disposal piles and the storage of petroleum products on the property. It is ERO's professional opinion that the numerous vehicles and farm equipment stored on the property are not recognized environmental conditions associated with the property because no evidence of leakage of petroleum products from the vehicles and equipment was observed. It is ERO's professional opinion that the stained soils beneath the three ASTs are associated with drips and overfilling that are likely associated with releases of *de minimis* quantities of petroleum products and therefore are not recognized environmental conditions associated with the property. ERO recommends the proper management and disposal of the solid waste piles and ASTs in accordance with Colorado Department of Public Health and Environment regulations. In accordance with the ASTM standard, this ESA is valid if completed within 180 days of the property acquisition or intended transaction.

ERO Resources Corp.
1842 Clarkson Street
Denver, CO 80218
(303) 830-1188
Fax: (303) 830-1199

Adobe Creek Development

Section 22, T1N, R2W, Ute PM
UTM Coordinates: Zone 13N; 698882mE, 4334984mN
Latitude/Longitude: 39.14135N, 108.69876W
USGS Fruita, CO Quad.; Mesa County, Colorado

0 2000 4000 feet

1 Inch = 2,000 Feet

N

Figure 1
Site Location

Prepared for: JeHN Engineering
File: 4208 figure 1.pdf
June 2008

ERO Resources Corp.
1842 Clarkson Street
Denver, CO 80218
(303) 830-1188
Fax: (303) 830-1199

Adobe Creek Development

Solid waste disposal pit

Above ground storage tank

Parcel boundary

0 400 800 Feet

Aerial Photograph: USGS 2005
1 inch equals 400 feet

N

Figure 2
Site Plan

Prepared for: JeHN Engineering
File: 4208 Figure 2.mxd [dlh]
July 2008

Velma Castor, the current property owner of the 1930 Highway 6 and 50 Road parcel, was interviewed by telephone on August 28, 2008. Ms. Castor has owned the property for 23 years. According to Ms. Castor, the property was used by her for farming corn and alfalfa. She was not aware of any environmental problems with the property or in the surrounding area (Castor, pers. comm. 2008).

Marina Schultz, the current property owner of the 941 19½ Road parcel, was interviewed by telephone on September 2, 2008. Ms. Schultz has owned the property since 1987. During her ownership she has used the property for agricultural farming of hay, boarding of horses, and residence. After purchasing the property she had numerous dumpsters of trash removed from the property including the solid waste disposal areas along Adobe Creek. According to Ms. Schultz, the waste included wood, several vehicles, machinery parts, metal, twine, 80 tires, tin, and farm equipment. According to Ms. Schultz, no drums or containers containing chemicals were found within the waste disposal areas. She was not aware of any environmental problems with the property or in the surrounding area (Shultz, pers. comm. 2008).

Sheryl Thompson, the current property owner of the 945 19½ Road parcel, was interviewed by telephone on September 4, 2008. Ms. Thompson has owned the property for 25 years. During her ownership she has used the property for residence and storage. According to Ms. Thompson, her husband Daryl Thompson is a diesel mechanic and installed and has used the three ASTs for diesel storage for the entire duration of their ownership. According to Ms. Thompson, only minor splashes of diesel have been released and no major spills have occurred. She was not aware of any environmental problems with the property or in the surrounding area (Thompson, pers. comm. 2008).

7.0 Findings

The property consists of a 48-acre-parcel of land. Historically, the property and surrounding area have been residential and agricultural.

Federal, state, and local records indicate no known or suspect recognized environmental conditions associated with the property. No known or suspect recognized

environmental conditions were identified in the surrounding area except for the adjoining registered storage tank site located at 934 19½ Road. The site reconnaissance identified numerous solid waste disposal areas on the property, numerous vehicles and pieces of farm equipment on portions of the property, the storage of petroleum products within the three ASTs and an engine block with associated petroleum-stained soils located on the 945 19½ Road parcel.

8.0 Opinion

It is ERO's professional opinion that the adjoining registered storage tank site is not a recognized environmental condition associated with the property because the tank was closed in 1997 and no leaks are reported for the site. It is ERO's professional opinion that the solid waste disposal areas on the property are recognized environmental conditions associated with the property because of the unknown volume and contents of the solid waste. It is ERO's professional opinion that the numerous vehicles and farm equipment stored on the property are not recognized environmental conditions associated with the property because no evidence of leakage of petroleum products from the vehicles and equipment was observed. It is ERO's professional opinion that the storage of petroleum products within the three ASTs located on the 945 19½ Road parcel is a recognized environmental condition associated with the property. It is ERO's professional opinion that the stained soils beneath the engine block and the three ASTs are associated with drips and overfilling that are likely associated with releases of *de minimis* quantities of petroleum products and therefore are not a recognized environmental condition associated with the property.

8.1 Data Gap Summary

ERO reviewed seven historical aerial photographs from 1937 through 2005 at approximately 10-year intervals based on availability. The longest period between photographs was 28 years, between 1966 and 1994. Historical USGS topographic maps from 1962 and 1973 were reviewed. It is ERO's professional opinion that there are no significant historical data gaps that would indicate a release or threatened release of hazardous substances on the property.

Additional informational data gaps encountered as part of this ESA include the following: ERO did not inspect the interior of the buildings in the western portion of the property. It is ERO's professional opinion that the lack of interior inspection does not constitute a significant data gap that may indicate recognized environmental conditions associated with the property. Four of the buildings on the property are residences. The remaining buildings are storage sheds. Although remnants of agricultural supplies such as fertilizers, herbicides or pesticides may be stored in these buildings, their quantities are not likely to be large enough to have adversely affected the property.

Significant Data Gaps. It is ERO's professional opinion that there are no significant data gaps with respect to this ESA.

9.0 Conclusions

ERO performed this Phase I ESA in conformance with the scope and limitations of ASTM Practice E 1527 of the Adobe Creek Development property located in Mesa County, Colorado. Any exceptions to, or deletions from, this practice are described in the *Introduction* section of this report. This assessment has revealed no evidence of recognized environmental conditions in connection with the property except for the numerous solid waste disposal piles and the storage of petroleum products on the property. ERO recommends the proper management and disposal of the solid waste piles and ASTs in accordance with Colorado Department of Public Health and Environment regulations. In accordance with the ASTM standard, this ESA is presumed to be valid if completed within 180 days of the property acquisition or intended transaction.

10.0 Deviations

This Phase I ESA was conducted with no known deviations from the ASTM Standard Practice for Environmental Site Assessments (ASTM 2005).

APPENDIX B

SWMM Calculations

1. **WQCV, Detention Pond Storage Volumes & Release Rate Calculations**

My Storage

Project Information

215 Pitkin, Unit 201
Grand Junction, CO 81501

Historical Conditions			Developed Conditions		
Total Area:	16.470	acres	Total Area:	16.470	acres
Composite Site Imperviousness:	2%		Composite Site Imperviousness:	36%	

Soil Type for project = TYPE	C

Minimum Detention Volumes

SWMM Table 28.56230(a):	Ultimate % Impervious	X_{100}	X_{10}
	< 50%	0.42	0.26
	≥ 50%	0.48	0.38

X_{100} = 0.42 Developed Basin Imperviousness (%) P = 36

X_{10} = 0.26 Tributary Area (Acres) A= 16.47

$K_{100}=(1.78P-0.002P^2-3.56)(X_{100}/900)=$ 0.03

$K_{10}=(0.95P-1.90)(X_{10}/1000)=$ 0.01

100-Year Minimum Detention Volume:

$V_{100}=K_{100}*A=$	**0.44** acre-feet	**19,339.64** ft^3

10-Year Minimum Detention Volume:

$V_{10}=K_{10}*A=$	**0.14** acre-feet	**6,007.28** ft^3

Time to Drain 100-yr Detention Volume

19,339.64 ft^3 =	**144,660.50**	**gal**
(divide by 48 hrs)	**3,013.76**	**gal/hr**
(convert to minutes)	**50.23**	**gal/min**
(convert to cfs)	**0.112**	**cfs to drain over 48hrs**

Allowable Release Rates

SWMM Table 28.56.230(b)

	SOIL GROUP			
FREQUENCY	A	B	C	D
10-Year	0.05	0.09	0.12	0.12
100-Year	0.25	0.43	0.50	0.50

per SWMM Table 28.56.230(b):	cfs/Acre	Allowable Release Rate
10-Year	0.12	**1.98 cfs**
100-Year	0.5	**8.24 cfs**

My Storage

Water Quality Capture Volume (WQCV)

RIVERCITY CONSULTANTS
215 Pitkin, Unit 201
Grand Junction, CO 81501

Calculate WQCV:

WQCV = $k[a(0.91*i^3-1.19*i^2+0.78i)]$

k = $d_6/0.43$ where $d_6 = 0.28$

= 0.28/0.43

= 0.65

a = BMP Drain Time Coefficient (Assumed it is based on 40 hrs)

= 1.00

i = Watershed Imperviousness as a decimal

Description	Area (acres)	Imperviousness (decimal)	A*I
Basin D1	16.47	0.36	5.91
Total	16.47		

= [sum(area*impreviousness)]/total area

= 0.36

WQCV = $0.65[1.0(0.91*0.80^3-1.19*0.80^2+0.78*0.80)]$

= 0.1099 in

Calculate 120% WQCV:

120 % WQCV = 1.2*WQCV

= 0.1319 in

Calculate Required Storage Volume, SV:

SV = (120% WQCV/12)*Tributary Area

= **0.1810 acre-ft**

→ Multiply by 43,560 ft^2/acre **7,884 ft^3**

My Storage
Water Quality Capture Volume (WQCV)

RiverCity Consultants
215 Pitkin, Unit 201
Grand Junction, CO 81501

Design Stage Storage

Contour Elevation	Contour Area (ft^2)	Depth (ft)	Cumulative Volume (cu. ft)	Contour Elevation
4,513.00	22.28	0.00	0.00	4,513.00
4,513.20	282.21	0.20	30.45	4,513.20
4,513.40	941.30	0.40	152.80	4,513.40
4,513.60	1,989.97	0.60	445.93	4,513.60
4,513.80	3,415.27	0.80	986.45	4,513.80
4,514.00	5,217.14	1.00	1,849.69	4,514.00
4,514.20	5,497.36	1.20	2,921.14	4,514.20
4,514.40	5,687.95	1.40	4,039.67	4,514.40
4,514.60	5,880.47	1.60	5,196.52	4,514.60
4,514.80	6,074.92	1.80	6,392.05	4,514.80
4,515.00	6,271.29	2.00	7,626.68	4,515.00
4,515.20	6,471.48	2.20	8,900.95	4,515.20
4,515.40	6,673.51	2.40	10,215.45	4,515.40
4,515.60	6,877.37	2.60	11,570.54	4,515.60
4,515.80	7,083.06	2.80	12,966.58	4,515.80
4,516.00	7,290.59	3.00	14,403.95	4,516.00
4,516.20	7,502.24	3.20	15,883.23	4,516.20
4,516.40	7,715.65	3.40	17,405.02	4,516.40
4,516.60	7,930.82	3.60	18,969.67	4,516.60
4,516.80	8,147.74	3.80	20,577.52	4,516.80
4,517.00	8,366.43	4.00	22,228.94	4,517.00
4,517.20	8,589.54	4.20	23,924.54	4,517.20
4,517.40	8,814.33	4.40	25,664.92	4,517.40
4,517.60	9,040.80	4.60	27,450.44	4,517.60
4,517.80	9,268.95	4.80	29,281.41	4,517.80
4,518.00	9,498.79	5.00	31,158.18	4,518.00
4,518.20	9,733.32	5.20	33,081.39	4,518.20
4,518.40	9,969.46	5.40	35,051.67	4,518.40
4,518.60	10,207.21	5.60	37,069.34	4,518.60
4,518.80	10,446.57	5.80	39,134.71	4,518.80
4,519.00	10,687.62	6.00	41,248.13	4,519.00
4,519.20	10,981.04	6.20	43,415.00	4,519.20
4,519.40	11,300.16	6.40	45,643.12	4,519.40
4,519.60	11,687.76	6.60	47,941.91	4,519.60
4,519.80	12,320.18	6.80	50,342.70	4,519.80
4,520.00	13,058.94	7.00	52,880.62	4,520.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
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0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00

Water Quality Capture Volume	Elevation	Volume (ft^3)
Low Contour	4,515.00	7,626.68
WQCV WSEL	**4,515.04**	**7,883.69**
High Contour	4,515.20	8,900.95

10-Year Detention Volume	Elevation	Volume (ft^3)
Low Contour	**4,514.60**	**5,196.52**
10-Year WSEL	**4,514.74**	**6,007.28**
High Contour	**4,514.80**	**6,392.05**

100-Year Detention Volume	Elevation	Volume (ft^3)
Low Contour	**4,516.60**	**18,969.67**
100-Year WSEL	**4,516.65**	**19,339.64**
High Contour	**4,516.80**	**20,577.52**

10-Year Detention Volume plus WQCV	Elevation	Volume (ft^3)
Low Contour	**4,515.80**	**12,966.58**
10-Yr + WQCV WSEL	**4,515.93**	**13,890.97**
High Contour	**4,516.00**	**14,403.95**

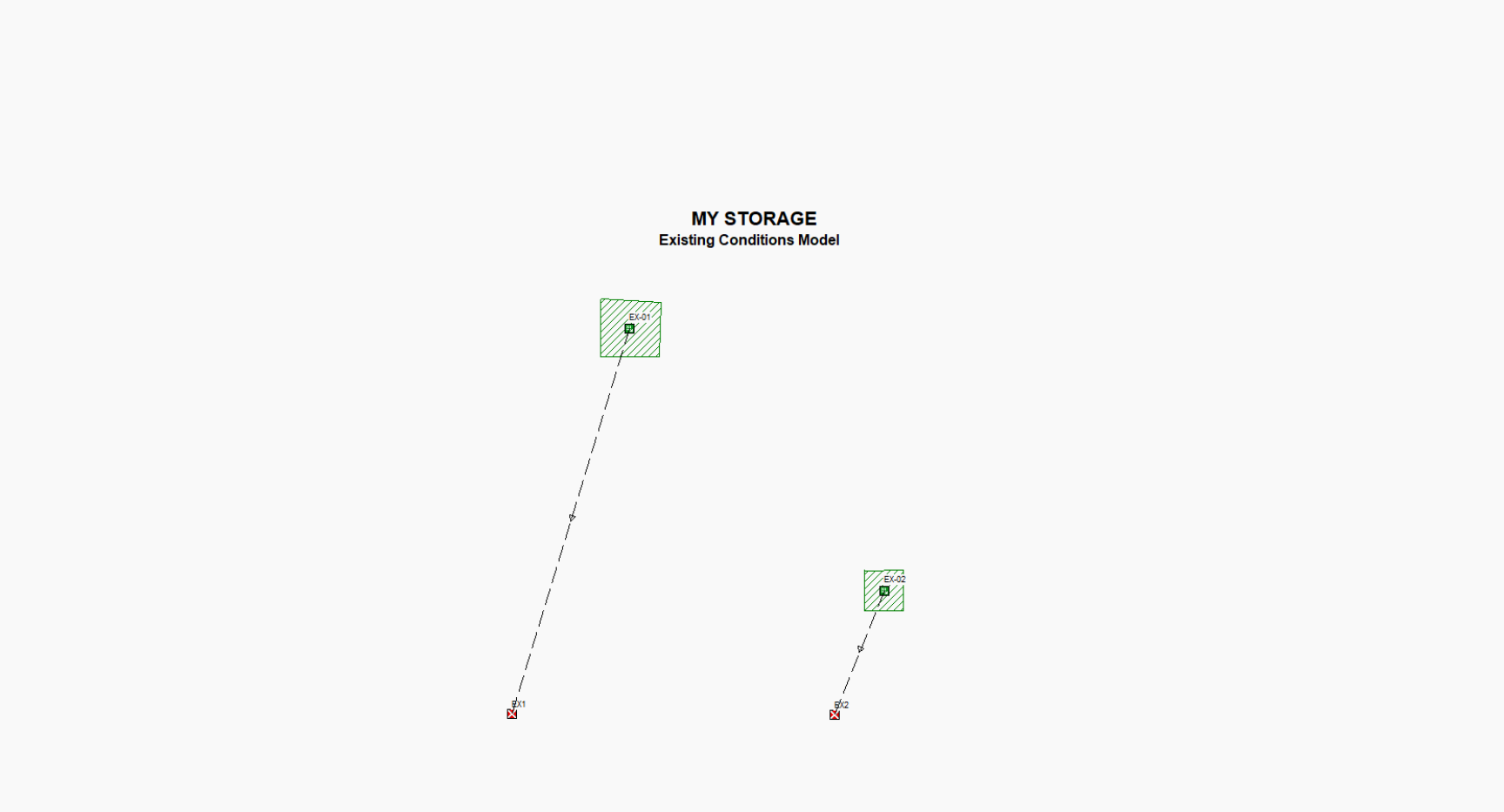
Bottom of Pond
4,513.00

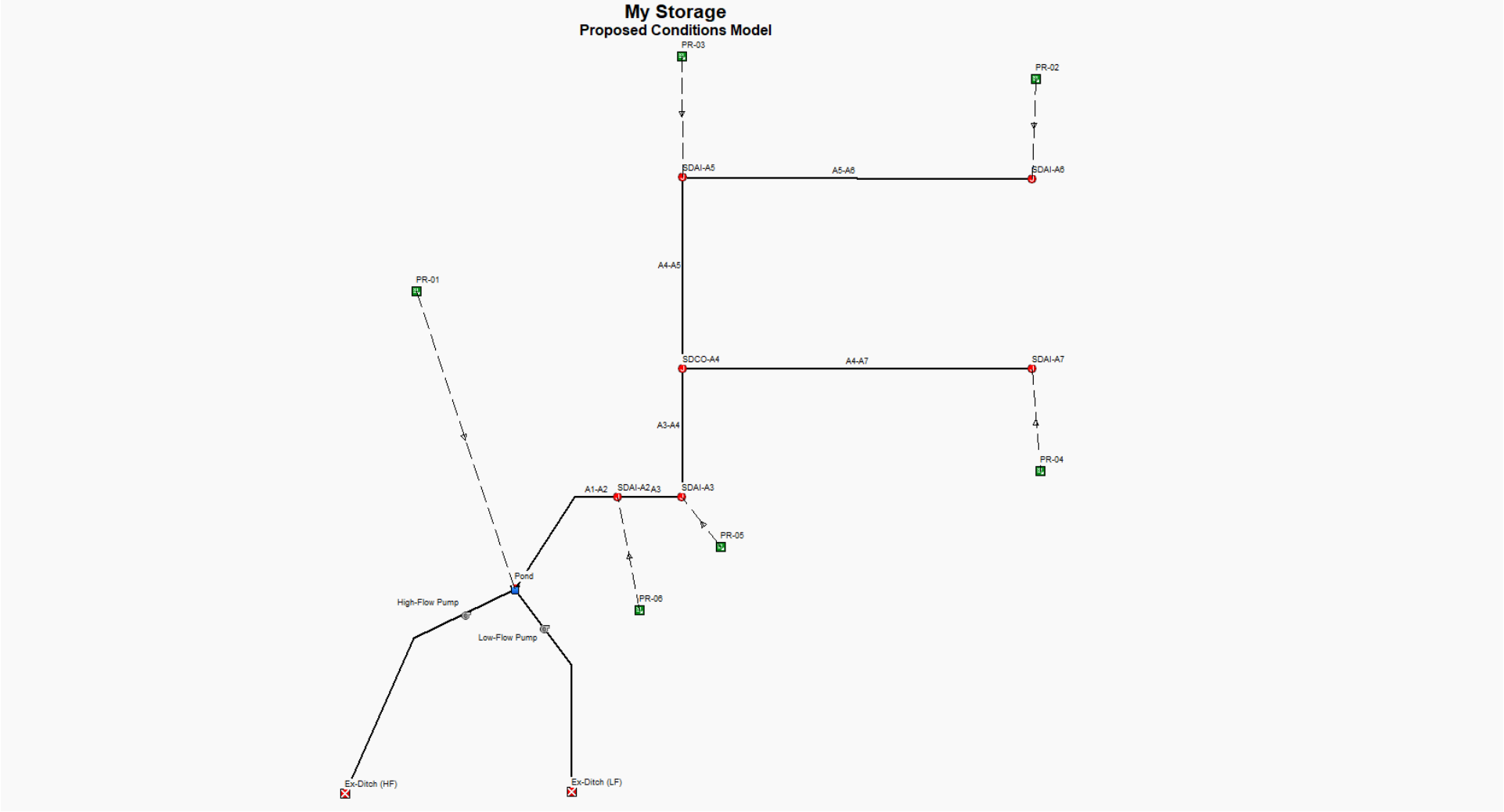
Note: 10 & 100 Yr WSEL were calculated from formulas & values in SWMM Section 28.56

APPENDIX C

Hydrologic + Hydraulic Model Overview

1. **Existing Model Views**
2. **Proposed Model Views**


MY STORAGE
Existing Conditions Model
EX-01
EX-02
EX1
EX2


My Storage
Proposed Conditions Model
PR-03
PR-02
SDAI-A5
A5-A6
SDAI-A6
A4-A5
PR-01
SDCO-A4
A4-A7
SDAI-A7
A3-A4
PR-04
A1-A2
SDAI-A2
A3
SDAI-A3
PR-05
Pond
PR-06
High-Flow Pump
Low-Flow Pump
Ex-Ditch (HF)
Ex-Ditch (LF)

APPENDIX D

Existing Minor & Major Storm Model Results

1. **2-year, 3-hour Existing Model Results**
2. **10-year, 3-hour Existing Model Results**
3. **100-year, 3-hour Existing Model Results**

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

****
Project Description
****
File Name ..... 2119-001 EX Model.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. EPA SWMM
Infiltration Method ..... SCS Curve Number
Storage Node Exfiltration.. Horton, wetted area
Starting Date JUL-04-2017 00:00:00
Ending Date JUL-08-2017 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:00:30
Wet Time Step 00:00:30
Dry Time Step 01:00:00

****
Element Count
****
Number of rain gages 1
Number of subbasins 2
Number of nodes 2
Number of links 0
Number of pollutants 0
Number of land uses 0

****
Subbasin Summary
****

Subbasin ID	Total Area acres	Equiv. Width ft	Imperv. Area %	Average Slope %	Raingage
EX-01	14.97	1780.00	2.00	0.8000	-
EX-02	1.39	810.00	2.00	1.0000	-

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
EX1	OUTFALL	4519.48	4519.48	0.00	
EX2	OUTFALL	4520.45	4520.45	0.00	

****
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	0.641	0.470
Evaporation Loss	0.000	0.000
Infiltration Loss	0.561	0.412
Surface Runoff	0.011	0.008
Final Surface Storage	0.068	0.050
Continuity Error (%)	0.000	

************************* Flow Routing Continuity *************************	Volume acre-ft ---------	Volume Mgallons ---------
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.011	0.004
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.011	0.004
Surface Flooding	0.000	0.000
Evaporation Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

****
Composite Curve Number Computations Report
****

Subbasin EX-01

Soil/Surface Description	Area (acres)	Soil Group	CN

Soil/Surface Description	Area (acres)	Soil Group	CN
Pasture, grassland, or range, Good	14.97	C	74.00
Composite Area & Weighted CN	14.97		74.00

Subbasin EX-02

Soil/Surface Description	Area (acres)	Soil Group	CN
Pasture, grassland, or range, Good	1.39	C	74.00
Composite Area & Weighted CN	1.39		74.00

EPA SWMM Time of Concentration Computations Report

Tc = (0.94 * (L^0.6) * (n^0.6)) / ((i^0.4) * (S^0.3))

Where:

Tc = Time of Concentration (min)
L = Flow Length (ft)
n = Manning's Roughness
i = Rainfall Intensity (in/hr)
S = Slope (ft/ft)

Subbasin EX-01

Flow length (ft):	366.36
Pervious Manning's Roughness:	0.10000
Impervious Manning's Roughness:	0.01500
Pervious Rainfall Intensity (in/hr):	0.15667
Impervious Rainfall Intensity (in/hr):	0.15667
Slope (%):	0.80000
Computed TOC (minutes):	72.02

Subbasin EX-02

Flow length (ft):	74.75
Pervious Manning's Roughness:	0.10000
Impervious Manning's Roughness:	0.01500
Pervious Rainfall Intensity (in/hr):	0.15667
Impervious Rainfall Intensity (in/hr):	0.15667
Slope (%):	1.00000
Computed TOC (minutes):	25.95

Subbasin Runoff Summary

Subbasin ID	Total Rainfall in	Total Runon in	Total Evap. in	Total Infil. in	Total Runoff in	Peak Runoff cfs	Runoff Coefficient	Time of Concentration days hh:mm:ss

EX-01	0.47	0.00	0.00	0.41	0.01	0.33	0.017	0 01:12:01
EX-02	0.47	0.00	0.00	0.41	0.01	0.03	0.017	0 00:25:57

Analysis began on: Mon Mar 13 17:51:49 2023
Analysis ended on: Mon Mar 13 17:51:53 2023
Total elapsed time: 00:00:04

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

****
Project Description
****
File Name ..... 2119-001 EX Model.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. EPA SWMM
Infiltration Method ..... SCS Curve Number
Storage Node Exfiltration.. Horton, wetted area
Starting Date JUL-04-2017 00:00:00
Ending Date JUL-08-2017 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:00:30
Wet Time Step 00:00:30
Dry Time Step 01:00:00

****
Element Count
****
Number of rain gages 1
Number of subbasins 2
Number of nodes 2
Number of links 0
Number of pollutants 0
Number of land uses 0

****
Subbasin Summary
****

Subbasin ID	Total Area acres	Equiv. Width ft	Imperv. Area %	Average Slope %	Raingage
EX-01	14.97	1780.00	2.00	0.8000	-
EX-02	1.39	810.00	2.00	1.0000	-

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
EX1	OUTFALL	4519.48	4519.48	0.00	
EX2	OUTFALL	4520.45	4520.45	0.00	

****
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	1.050	0.770
Evaporation Loss	0.000	0.000
Infiltration Loss	0.962	0.706
Surface Runoff	0.019	0.014
Final Surface Storage	0.068	0.050
Continuity Error (%)	0.000	

************************* Flow Routing Continuity *************************	Volume acre-ft ---------	Volume Mgallons ---------
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.019	0.006
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.019	0.006
Surface Flooding	0.000	0.000
Evaporation Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

****
Composite Curve Number Computations Report
****

Subbasin EX-01

Soil/Surface Description	Area (acres)	Soil Group	CN

Soil/Surface Description	Area (acres)	Soil Group	CN
Pasture, grassland, or range, Good	14.97	C	74.00
Composite Area & Weighted CN	14.97		74.00

Subbasin EX-02

Soil/Surface Description	Area (acres)	Soil Group	CN
Pasture, grassland, or range, Good	1.39	C	74.00
Composite Area & Weighted CN	1.39		74.00

****
EPA SWMM Time of Concentration Computations Report
****

Tc = (0.94 * (L^0.6) * (n^0.6)) / ((i^0.4) * (S^0.3))

Where:

Tc = Time of Concentration (min)
L = Flow Length (ft)
n = Manning's Roughness
i = Rainfall Intensity (in/hr)
S = Slope (ft/ft)

Subbasin EX-01

Flow length (ft):	366.36
Pervious Manning's Roughness:	0.10000
Impervious Manning's Roughness:	0.01500
Pervious Rainfall Intensity (in/hr):	0.25667
Impervious Rainfall Intensity (in/hr):	0.25667
Slope (%):	0.80000
Computed TOC (minutes):	59.11

Subbasin EX-02

Flow length (ft):	74.75
Pervious Manning's Roughness:	0.10000
Impervious Manning's Roughness:	0.01500
Pervious Rainfall Intensity (in/hr):	0.25667
Impervious Rainfall Intensity (in/hr):	0.25667
Slope (%):	1.00000
Computed TOC (minutes):	21.30

****
Subbasin Runoff Summary
****

Subbasin ID	Total Rainfall in	Total Runon in	Total Evap. in	Total Infil. in	Total Runoff in	Peak Runoff cfs	Runoff Coefficient	Time of Concentration days hh:mm:ss

EX-01	0.77	0.00	0.00	0.71	0.01	0.54	0.018	0 00:59:06
EX-02	0.77	0.00	0.00	0.71	0.01	0.05	0.018	0 00:21:18

Analysis began on: Mon Mar 13 17:52:24 2023
Analysis ended on: Mon Mar 13 17:52:28 2023
Total elapsed time: 00:00:04

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

****
Project Description
****
File Name ..... 2119-001 EX Model.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. EPA SWMM
Infiltration Method ..... SCS Curve Number
Storage Node Exfiltration.. Horton, wetted area
Starting Date JUL-04-2017 00:00:00
Ending Date JUL-08-2017 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:00:30
Wet Time Step 00:00:30
Dry Time Step 01:00:00

****
Element Count
****
Number of rain gages 1
Number of subbasins 2
Number of nodes 2
Number of links 0
Number of pollutants 0
Number of land uses 0

****
Subbasin Summary
****

Subbasin ID	Total Area acres	Equiv. Width ft	Imperv. Area %	Average Slope %	Raingage
EX-01	14.97	1780.00	2.00	0.8000	-
EX-02	1.39	810.00	2.00	1.0000	-

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
EX1	OUTFALL	4519.48	4519.48	0.00	
EX2	OUTFALL	4520.45	4520.45	0.00	

****
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	1.963	1.440
Evaporation Loss	0.000	0.000
Infiltration Loss	1.653	1.212
Surface Runoff	0.242	0.178
Final Surface Storage	0.068	0.050
Continuity Error (%)	0.000	

************************* Flow Routing Continuity *************************	Volume acre-ft ---------	Volume Mgallons ---------
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.242	0.079
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.242	0.079
Surface Flooding	0.000	0.000
Evaporation Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

****
Composite Curve Number Computations Report
****

Subbasin EX-01

Soil/Surface Description	Area (acres)	Soil Group	CN

Soil/Surface Description	Area (acres)	Soil Group	CN
Pasture, grassland, or range, Good	14.97	C	74.00
Composite Area & Weighted CN	14.97		74.00

Subbasin EX-02

Soil/Surface Description	Area (acres)	Soil Group	CN
Pasture, grassland, or range, Good	1.39	C	74.00
Composite Area & Weighted CN	1.39		74.00

EPA SWMM Time of Concentration Computations Report

Tc = (0.94 * (L^0.6) * (n^0.6)) / ((i^0.4) * (S^0.3))

Where:

Tc = Time of Concentration (min)
L = Flow Length (ft)
n = Manning's Roughness
i = Rainfall Intensity (in/hr)
S = Slope (ft/ft)

Subbasin EX-01

Flow length (ft):	366.36
Pervious Manning's Roughness:	0.10000
Impervious Manning's Roughness:	0.01500
Pervious Rainfall Intensity (in/hr):	0.48000
Impervious Rainfall Intensity (in/hr):	0.48000
Slope (%):	0.80000
Computed TOC (minutes):	46.01

Subbasin EX-02

Flow length (ft):	74.75
Pervious Manning's Roughness:	0.10000
Impervious Manning's Roughness:	0.01500
Pervious Rainfall Intensity (in/hr):	0.48000
Impervious Rainfall Intensity (in/hr):	0.48000
Slope (%):	1.00000
Computed TOC (minutes):	16.58

Subbasin Runoff Summary

Subbasin ID	Total Rainfall in	Total Runon in	Total Evap. in	Total Infil. in	Total Runoff in	Peak Runoff cfs	Runoff Coefficient	Time of Concentration days hh:mm:ss

EX-01	1.44	0.00	0.00	1.22	0.17	1.76	0.121	0 00:46:00
EX-02	1.44	0.00	0.00	1.17	0.22	0.41	0.153	0 00:16:34

Analysis began on: Mon Mar 13 17:52:54 2023
Analysis ended on: Mon Mar 13 17:52:59 2023
Total elapsed time: 00:00:05

APPENDIX E

Proposed Minor Storm Model Results

1. **2-year, 3-hour Proposed Model Results**
2. **10-year, 3-hour Proposed Model Results**

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

****
Project Description
****
File Name ..... 2119-001 PR Model.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. EPA SWMM
Infiltration Method ..... SCS Curve Number
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
Antecedent Dry Days 0.0
Report Time Step 00:00:30
Wet Time Step 00:00:30
Dry Time Step 01:00:00
Routing Time Step ..... 1.00 sec

****
Element Count
****
Number of rain gages 1
Number of subbasins 6
Number of nodes 9
Number of links 8
Number of pollutants 0
Number of land uses 0

****
Subbasin Summary
****

Subbasin ID	Total Area acres	Equiv. Width ft	Imperv. Area %	Average Slope %	Raingage
PR-01	7.99	1500.00	2.00	0.8200	-
PR-02	1.55	640.00	74.00	0.7500	-
PR-03	2.60	760.00	69.00	0.7500	-
PR-04	1.06	550.00	94.00	0.5000	-
PR-05	1.24	630.00	25.00	0.5000	-
PR-06	2.04	730.00	34.00	0.5000	-

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
SDAI-A2	JUNCTION	4514.49	4519.01	10.00	
SDAI-A3	JUNCTION	4515.65	4520.06	10.00	
SDAI-A5	JUNCTION	4517.60	4521.61	10.00	
SDAI-A6	JUNCTION	4518.51	4522.52	10.00	
SDAI-A7	JUNCTION	4517.41	4521.32	10.00	
SDCO-A4	JUNCTION	4516.01	4520.41	10.00	
Ex-Ditch (HF)	OUTFALL	4518.35	4518.35	0.00	

Ex-Ditch (LF)	OUTFALL		4518.35	4518.35	0.00
Pond	STORAGE		4508.50	4519.90	10.00

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
A1-A2	SDAI-A2	Pond	CONDUIT	42.5	1.0118	0.0130
A2-A3	SDAI-A3	SDAI-A2	CONDUIT	116.4	0.9966	0.0130
A3-A4	SDCO-A4	SDAI-A3	CONDUIT	70.3	0.5125	0.0130
A4-A5	SDAI-A5	SDCO-A4	CONDUIT	219.7	0.4961	0.0130
A4-A7	SDAI-A7	SDCO-A4	CONDUIT	180.8	0.4979	0.0130
A5-A6	SDAI-A6	SDAI-A5	CONDUIT	180.8	0.5035	0.0130
High-Flow Pump	Pond	Ex-Ditch (HF)	TYPE1 PUMP			
Low-Flow Pump	Pond	Ex-Ditch (LF)	TYPE1 PUMP			

****
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
A1-A2	CIRCULAR	2.00	2.00	1	3.14	0.50	22.76
A2-A3	CIRCULAR	2.00	2.00	1	3.14	0.50	22.58
A3-A4	CIRCULAR	2.00	2.00	1	3.14	0.50	16.19
A4-A5	CIRCULAR	1.50	1.50	1	1.77	0.38	7.40
A4-A7	CIRCULAR	1.50	1.50	1	1.77	0.38	7.41
A5-A6	CIRCULAR	1.50	1.50	1	1.77	0.38	7.45

****
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	0.645	0.470
Evaporation Loss	0.000	0.000
Infiltration Loss	0.390	0.284
Surface Runoff	0.110	0.080
Final Surface Storage	0.145	0.106
Continuity Error (%)	-0.004	

************************* Flow Routing Continuity *************************	Volume acre-ft ---------	Volume Mgallons ---------
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.110	0.036
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.950	0.309
Surface Flooding	0.000	0.000
Evaporation Loss	0.000	0.000
Initial Stored Volume	0.842	0.274
Final Stored Volume	0.002	0.001
Continuity Error (%)	0.000	

****
Composite Curve Number Computations Report
****

Subbasin PR-01

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved parking & roofs	0.00	C	98.00
Gravel roads	0.00	C	89.00
> 75% grass cover, Good	0.00	C	74.00
Row crops, straight row, Good	7.99	C	74.00
Composite Area & Weighted CN	7.99		74.00

Subbasin PR-02

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved parking & roofs	1.13	C	98.00
Gravel roads	0.15	C	89.00
> 75% grass cover, Good	0.26	C	74.00
Row crops, straight row, Good	0.00	C	85.00
Composite Area & Weighted CN	1.55		93.02

Subbasin PR-03

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved parking & roofs	1.74	C	98.00
Gravel roads	0.31	C	89.00
> 75% grass cover, Good	0.55	C	74.00
Row crops, straight row, Good	0.00	C	85.00
Composite Area & Weighted CN	2.60		91.88

Subbasin PR-04

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved parking & roofs	1.06	C	98.00
Gravel roads	0.00	C	89.00
> 75% grass cover, Good	0.00	C	74.00
Row crops, straight row, Good	0.00	C	85.00
Composite Area & Weighted CN	1.06		98.00

Subbasin PR-05

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved parking & roofs	1.18	C	98.00
Gravel roads	0.00	C	89.00
> 75% grass cover, Good	0.06	C	74.00
Row crops, straight row, Good	0.00	C	85.00
Composite Area & Weighted CN	1.24		96.80

Subbasin PR-06

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved parking & roofs	0.69	C	98.00
Gravel roads	0.00	C	89.00
> 75% grass cover, Good	1.18	C	74.00
Row crops, straight row, Good	0.67	C	85.00
Composite Area & Weighted CN	2.55		83.43

****
EPA SWMM Time of Concentration Computations Report
****

Tc = (0.94 * (L^0.6) * (n^0.6)) / ((i^0.4) * (S^0.3))

Where:

Tc = Time of Concentration (min)

L = Flow Length (ft)
n = Manning's Roughness
i = Rainfall Intensity (in/hr)
S = Slope (ft/ft)

Subbasin PR-01

Flow length (ft):	232.04
Pervious Manning's Roughness:	0.10000
Impervious Manning's Roughness:	0.01500
Pervious Rainfall Intensity (in/hr):	0.15667
Impervious Rainfall Intensity (in/hr):	0.15667
Slope (%):	0.82000
Computed TOC (minutes):	54.35

Subbasin PR-02

Flow length (ft):	105.50
Pervious Manning's Roughness:	0.10000
Impervious Manning's Roughness:	0.01500
Pervious Rainfall Intensity (in/hr):	0.15667
Impervious Rainfall Intensity (in/hr):	0.15667
Slope (%):	0.75000
Computed TOC (minutes):	15.69

Subbasin PR-03

Flow length (ft):	149.03
Pervious Manning's Roughness:	0.10000
Impervious Manning's Roughness:	0.01500
Pervious Rainfall Intensity (in/hr):	0.15667
Impervious Rainfall Intensity (in/hr):	0.15667
Slope (%):	0.75000
Computed TOC (minutes):	21.46

Subbasin PR-04

Flow length (ft):	83.96
Pervious Manning's Roughness:	0.10000
Impervious Manning's Roughness:	0.01500
Pervious Rainfall Intensity (in/hr):	0.15667
Impervious Rainfall Intensity (in/hr):	0.15667
Slope (%):	0.50000
Computed TOC (minutes):	10.70

Subbasin PR-05

Flow length (ft):	85.74
Pervious Manning's Roughness:	0.10000
Impervious Manning's Roughness:	0.01500
Pervious Rainfall Intensity (in/hr):	0.15667
Impervious Rainfall Intensity (in/hr):	0.15667
Slope (%):	0.50000
Computed TOC (minutes):	29.55

Subbasin PR-06

Flow length (ft):	121.73
Pervious Manning's Roughness:	0.10000
Impervious Manning's Roughness:	0.01500
Pervious Rainfall Intensity (in/hr):	0.15667
Impervious Rainfall Intensity (in/hr):	0.15667
Slope (%):	0.50000
Computed TOC (minutes):	33.77

****
Subbasin Runoff Summary
****

Subbasin ID	Total Rainfall in	Total Runon in	Total Evap. in	Total Infil. in	Total Runoff in	Peak Runoff cfs	Runoff Coefficient	Time of Concentration days hh:mm:ss
PR-01	0.47	0.00	0.00	0.41	0.00	0.09	0.010	0 00:54:21
PR-02	0.47	0.00	0.00	0.11	0.18	0.52	0.386	0 00:15:41
PR-03	0.47	0.00	0.00	0.13	0.17	0.76	0.360	0 00:21:27
PR-04	0.47	0.00	0.00	0.01	0.24	0.44	0.506	0 00:10:42
PR-05	0.47	0.00	0.00	0.25	0.11	0.15	0.234	0 00:29:33
PR-06	0.47	0.00	0.00	0.28	0.08	0.33	0.177	0 00:33:46

****
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 Flooded Time minutes	Retention Time hh:mm:ss
SDAI-A2	0.01	0.48	4514.97	0	01:36	0	0	0:00:00
SDAI-A3	0.01	0.40	4516.05	0	01:36	0	0	0:00:00
SDAI-A5	0.01	0.43	4518.03	0	01:36	0	0	0:00:00
SDAI-A6	0.00	0.27	4518.78	0	01:35	0	0	0:00:00
SDAI-A7	0.00	0.25	4517.66	0	01:35	0	0	0:00:00
SDCO-A4	0.01	0.47	4516.48	0	01:36	0	0	0:00:00
Ex-Ditch (HF)	0.00	0.00	4518.35	0	00:00	0	0	0:00:00
Ex-Ditch (LF)	0.00	0.00	4518.35	0	00:00	0	0	0:00:00
Pond	1.61	5.62	4514.12	0	02:11	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
SDAI-A2	JUNCTION	0.33	2.10	0	01:36	0.00		
SDAI-A3	JUNCTION	0.15	1.80	0	01:36	0.00		
SDAI-A5	JUNCTION	0.76	1.27	0	01:35	0.00		
SDAI-A6	JUNCTION	0.52	0.52	0	01:34	0.00		
SDAI-A7	JUNCTION	0.44	0.44	0	01:35	0.00		
SDCO-A4	JUNCTION	0.00	1.66	0	01:36	0.00		
Ex-Ditch (HF)	OUTFALL	0.00	0.33	0	00:00	0.00		
Ex-Ditch (LF)	OUTFALL	0.00	0.09	0	00:00	0.00		
Pond	STORAGE	0.09	2.15	0	01:36	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	37.279	26	0 02:11	7.328	5	0.42	0.00	0:00:00	0.000

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
Ex-Ditch (HF)	20.89	0.33	0.33
Ex-Ditch (LF)	56.01	0.09	0.09
System	38.45	0.42	0.42

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow	Maximum Velocity	Length Factor	Peak Flow during	Design Flow	Ratio of Maximum	Ratio of Total	Reported Time	Condition

		Occurrence	Attained		Analysis	Capacity	/Design Flow	Surcharged
		days	hh:mm	ft/sec	cfs	cfs	Flow	Depth minutes
A1-A2	CONDUIT	0	01:36	4.05	1.00	2.09	22.76	0.09 0.22 0 Calculated
A2-A3	CONDUIT	0	01:36	3.54	1.00	1.80	22.58	0.08 0.22 0 Calculated
A3-A4	CONDUIT	0	01:36	3.29	1.00	1.66	16.19	0.10 0.22 0 Calculated
A4-A5	CONDUIT	0	01:36	3.02	1.00	1.24	7.40	0.17 0.28 0 Calculated
A4-A7	CONDUIT	0	01:36	2.25	1.00	0.43	7.41	0.06 0.16 0 Calculated
A5-A6	CONDUIT	0	01:35	1.67	1.00	0.51	7.45	0.07 0.23 0 Calculated
High-Flow Pump	PUMP	0	00:00			0.33		1.00 1203
Low-Flow Pump	PUMP	0	00:00			0.09		1.00 3226

****
Flow Classification Summary
****

	--- Fraction of Time in Flow Class ----						Avg.	Avg.
Link	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Froude Number	Flow Change
A1-A2	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.21	0.0000
A2-A3	0.00	0.61	0.00	0.36	0.03	0.00	0.00	0.14	0.0000
A3-A4	0.00	0.00	0.00	0.99	0.01	0.00	0.00	0.14	0.0000
A4-A5	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.15	0.0000
A4-A7	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.10	0.0000
A5-A6	0.00	0.58	0.00	0.42	0.00	0.00	0.00	0.04	0.0000

****
Time-Step Critical Elements
****
None

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

****
Routing Time Step Summary
****
Minimum Time Step : 1.00 sec
Average Time Step : 1.00 sec
Maximum Time Step : 1.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 2.00

Analysis began on: Mon Mar 13 18:26:09 2023
Analysis ended on: Mon Mar 13 18:26:17 2023
Total elapsed time: 00:00:08

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

****
Project Description
****
File Name ..... 2119-001 PR Model.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. EPA SWMM
Infiltration Method ..... SCS Curve Number
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
Antecedent Dry Days 0.0
Report Time Step 00:00:30
Wet Time Step 00:00:30
Dry Time Step 01:00:00
Routing Time Step ..... 1.00 sec

****
Element Count
****
Number of rain gages 1
Number of subbasins 6
Number of nodes 9
Number of links 8
Number of pollutants 0
Number of land uses 0

****
Subbasin Summary
****

Subbasin ID	Total Area acres	Equiv. Width ft	Imperv. Area %	Average Slope %	Raingage
PR-01	7.99	1500.00	2.00	0.8200	-
PR-02	1.55	640.00	74.00	0.7500	-
PR-03	2.60	760.00	69.00	0.7500	-
PR-04	1.06	550.00	94.00	0.5000	-
PR-05	1.24	630.00	25.00	0.5000	-
PR-06	2.04	730.00	34.00	0.5000	-

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
SDAI-A2	JUNCTION	4514.49	4519.01	10.00	
SDAI-A3	JUNCTION	4515.65	4520.06	10.00	
SDAI-A5	JUNCTION	4517.60	4521.61	10.00	
SDAI-A6	JUNCTION	4518.51	4522.52	10.00	
SDAI-A7	JUNCTION	4517.41	4521.32	10.00	
SDCO-A4	JUNCTION	4516.01	4520.41	10.00	
Ex-Ditch (HF)	OUTFALL	4518.35	4518.35	0.00	

Ex-Ditch (LF)	OUTFALL		4518.35	4518.35	0.00
Pond	STORAGE		4508.50	4519.90	10.00

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
A1-A2	SDAI-A2	Pond	CONDUIT	42.5	1.0118	0.0130
A2-A3	SDAI-A3	SDAI-A2	CONDUIT	116.4	0.9966	0.0130
A3-A4	SDCO-A4	SDAI-A3	CONDUIT	70.3	0.5125	0.0130
A4-A5	SDAI-A5	SDCO-A4	CONDUIT	219.7	0.4961	0.0130
A4-A7	SDAI-A7	SDCO-A4	CONDUIT	180.8	0.4979	0.0130
A5-A6	SDAI-A6	SDAI-A5	CONDUIT	180.8	0.5035	0.0130
High-Flow Pump	Pond	Ex-Ditch (HF)	TYPE1 PUMP			
Low-Flow Pump	Pond	Ex-Ditch (LF)	TYPE1 PUMP			

****
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
A1-A2	CIRCULAR	2.00	2.00	1	3.14	0.50	22.76
A2-A3	CIRCULAR	2.00	2.00	1	3.14	0.50	22.58
A3-A4	CIRCULAR	2.00	2.00	1	3.14	0.50	16.19
A4-A5	CIRCULAR	1.50	1.50	1	1.77	0.38	7.40
A4-A7	CIRCULAR	1.50	1.50	1	1.77	0.38	7.41
A5-A6	CIRCULAR	1.50	1.50	1	1.77	0.38	7.45

****
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	1.057	0.770
Evaporation Loss	0.000	0.000
Infiltration Loss	0.634	0.461
Surface Runoff	0.276	0.201
Final Surface Storage	0.148	0.108
Continuity Error (%)	-0.009	

************************* Flow Routing Continuity *************************	Volume acre-ft ---------	Volume Mgallons ---------
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.276	0.090
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	1.116	0.364
Surface Flooding	0.000	0.000
Evaporation Loss	0.000	0.000
Initial Stored Volume	0.842	0.274
Final Stored Volume	0.002	0.001
Continuity Error (%)	0.002	

****
Composite Curve Number Computations Report
****

Subbasin PR-01

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved parking & roofs	0.00	C	98.00
Gravel roads	0.00	C	89.00
> 75% grass cover, Good	0.00	C	74.00
Row crops, straight row, Good	7.99	C	74.00
Composite Area & Weighted CN	7.99		74.00

Subbasin PR-02

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved parking & roofs	1.13	C	98.00
Gravel roads	0.15	C	89.00
> 75% grass cover, Good	0.26	C	74.00
Row crops, straight row, Good	0.00	C	85.00
Composite Area & Weighted CN	1.55		93.02

Subbasin PR-03

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved parking & roofs	1.74	C	98.00
Gravel roads	0.31	C	89.00
> 75% grass cover, Good	0.55	C	74.00
Row crops, straight row, Good	0.00	C	85.00
Composite Area & Weighted CN	2.60		91.88

Subbasin PR-04

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved parking & roofs	1.06	C	98.00
Gravel roads	0.00	C	89.00
> 75% grass cover, Good	0.00	C	74.00
Row crops, straight row, Good	0.00	C	85.00
Composite Area & Weighted CN	1.06		98.00

Subbasin PR-05

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved parking & roofs	1.18	C	98.00
Gravel roads	0.00	C	89.00
> 75% grass cover, Good	0.06	C	74.00
Row crops, straight row, Good	0.00	C	85.00
Composite Area & Weighted CN	1.24		96.80

Subbasin PR-06

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved parking & roofs	0.69	C	98.00
Gravel roads	0.00	C	89.00
> 75% grass cover, Good	1.18	C	74.00
Row crops, straight row, Good	0.67	C	85.00
Composite Area & Weighted CN	2.55		83.43

****
EPA SWMM Time of Concentration Computations Report
****

Tc = (0.94 * (L^0.6) * (n^0.6)) / ((i^0.4) * (S^0.3))

Where:

Tc = Time of Concentration (min)

L = Flow Length (ft)
n = Manning's Roughness
i = Rainfall Intensity (in/hr)
S = Slope (ft/ft)

Subbasin PR-01

Flow length (ft):	232.04
Pervious Manning's Roughness:	0.10000
Impervious Manning's Roughness:	0.01500
Pervious Rainfall Intensity (in/hr):	0.25667
Impervious Rainfall Intensity (in/hr):	0.25667
Slope (%):	0.82000
Computed TOC (minutes):	44.61

Subbasin PR-02

Flow length (ft):	105.50
Pervious Manning's Roughness:	0.10000
Impervious Manning's Roughness:	0.01500
Pervious Rainfall Intensity (in/hr):	0.25667
Impervious Rainfall Intensity (in/hr):	0.25667
Slope (%):	0.75000
Computed TOC (minutes):	12.88

Subbasin PR-03

Flow length (ft):	149.03
Pervious Manning's Roughness:	0.10000
Impervious Manning's Roughness:	0.01500
Pervious Rainfall Intensity (in/hr):	0.25667
Impervious Rainfall Intensity (in/hr):	0.25667
Slope (%):	0.75000
Computed TOC (minutes):	17.61

Subbasin PR-04

Flow length (ft):	83.96
Pervious Manning's Roughness:	0.10000
Impervious Manning's Roughness:	0.01500
Pervious Rainfall Intensity (in/hr):	0.25667
Impervious Rainfall Intensity (in/hr):	0.25667
Slope (%):	0.50000
Computed TOC (minutes):	8.79

Subbasin PR-05

Flow length (ft):	85.74
Pervious Manning's Roughness:	0.10000
Impervious Manning's Roughness:	0.01500
Pervious Rainfall Intensity (in/hr):	0.25667
Impervious Rainfall Intensity (in/hr):	0.25667
Slope (%):	0.50000
Computed TOC (minutes):	24.25

Subbasin PR-06

Flow length (ft):	121.73
Pervious Manning's Roughness:	0.10000
Impervious Manning's Roughness:	0.01500
Pervious Rainfall Intensity (in/hr):	0.25667
Impervious Rainfall Intensity (in/hr):	0.25667
Slope (%):	0.50000
Computed TOC (minutes):	27.72

****
Subbasin Runoff Summary
****

Subbasin ID	Total Rainfall in	Total Runon in	Total Evap. in	Total Infil. in	Total Runoff in	Peak Runoff cfs	Runoff Coefficient	Time of Concentration days hh:mm:ss
PR-01	0.77	0.00	0.00	0.71	0.01	0.28	0.014	0 00:44:36
PR-02	0.77	0.00	0.00	0.14	0.45	1.49	0.585	0 00:12:52
PR-03	0.77	0.00	0.00	0.18	0.42	2.18	0.548	0 00:17:36
PR-04	0.77	0.00	0.00	0.01	0.54	1.30	0.697	0 00:08:47
PR-05	0.77	0.00	0.00	0.25	0.38	0.56	0.496	0 00:24:15
PR-06	0.77	0.00	0.00	0.47	0.19	0.96	0.244	0 00:27:43

****
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 Flooded Time minutes	Retention Time hh:mm:ss
SDAI-A2	0.01	0.87	4515.36	0	01:26	0	0	0:00:00
SDAI-A3	0.01	0.72	4516.37	0	01:26	0	0	0:00:00
SDAI-A5	0.01	0.78	4518.38	0	01:25	0	0	0:00:00
SDAI-A6	0.00	0.45	4518.96	0	01:25	0	0	0:00:00
SDAI-A7	0.01	0.44	4517.85	0	01:25	0	0	0:00:00
SDCO-A4	0.01	0.86	4516.87	0	01:25	0	0	0:00:00
Ex-Ditch (HF)	0.00	0.00	4518.35	0	00:00	0	0	0:00:00
Ex-Ditch (LF)	0.00	0.00	4518.35	0	00:00	0	0	0:00:00
Pond	1.89	6.24	4514.74	0	02:23	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
SDAI-A2	JUNCTION	0.96	5.94	0	01:26	0.00		
SDAI-A3	JUNCTION	0.56	5.13	0	01:25	0.00		
SDAI-A5	JUNCTION	2.18	3.64	0	01:25	0.00		
SDAI-A6	JUNCTION	1.49	1.49	0	01:24	0.00		
SDAI-A7	JUNCTION	1.30	1.30	0	01:24	0.00		
SDCO-A4	JUNCTION	0.00	4.71	0	01:25	0.00		
Ex-Ditch (HF)	OUTFALL	0.00	0.33	0	00:00	0.00		
Ex-Ditch (LF)	OUTFALL	0.00	0.09	0	00:00	0.00		
Pond	STORAGE	0.28	6.08	0	01:26	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	43.849	30	0	02:23	9.418	6	0.42	0.00	0:00:00	0.000

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
Ex-Ditch (HF)	25.83	0.33	0.33
Ex-Ditch (LF)	60.94	0.09	0.09
System	43.38	0.42	0.42

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow	Maximum Velocity	Length Factor	Peak Flow during	Design Flow	Ratio of Maximum	Ratio of Total	Reported Time	Condition

		Occurrence	Attained		Analysis	Capacity	/Design Flow	Surcharged
		days	hh:mm	ft/sec	cfs	cfs	Flow	Depth minutes
A1-A2	CONDUIT	0	01:26	5.22	1.00	5.93	22.76	0.26
0.39	0 Calculated							
A2-A3	CONDUIT	0	01:26	4.41	1.00	5.13	22.58	0.23
0.40	0 Calculated							
A3-A4	CONDUIT	0	01:26	4.08	1.00	4.71	16.19	0.29
0.39	0 Calculated							
A4-A5	CONDUIT	0	01:26	3.97	1.00	3.47	7.40	0.47
0.50	0 Calculated							
A4-A7	CONDUIT	0	01:25	3.02	1.00	1.25	7.41	0.17
0.28	0 Calculated							
A5-A6	CONDUIT	0	01:25	2.24	1.00	1.47	7.45	0.20
0.41	0 Calculated							
High-Flow Pump	PUMP	0	00:00			0.33		1.00
1488								
Low-Flow Pump	PUMP	0	00:00			0.09		1.00
3510								

****
Flow Classification Summary
****

	--- Fraction of Time in Flow Class ----						Avg.	Avg.
Link	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Froude Number	Flow Change
A1-A2	0.00	0.00	0.00	0.06	0.00	0.00	0.94	0.14	0.0000
A2-A3	0.00	0.61	0.00	0.37	0.01	0.00	0.00	0.14	0.0000
A3-A4	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.14	0.0000
A4-A5	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.15	0.0000
A4-A7	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.11	0.0000
A5-A6	0.00	0.58	0.00	0.42	0.00	0.00	0.00	0.04	0.0000

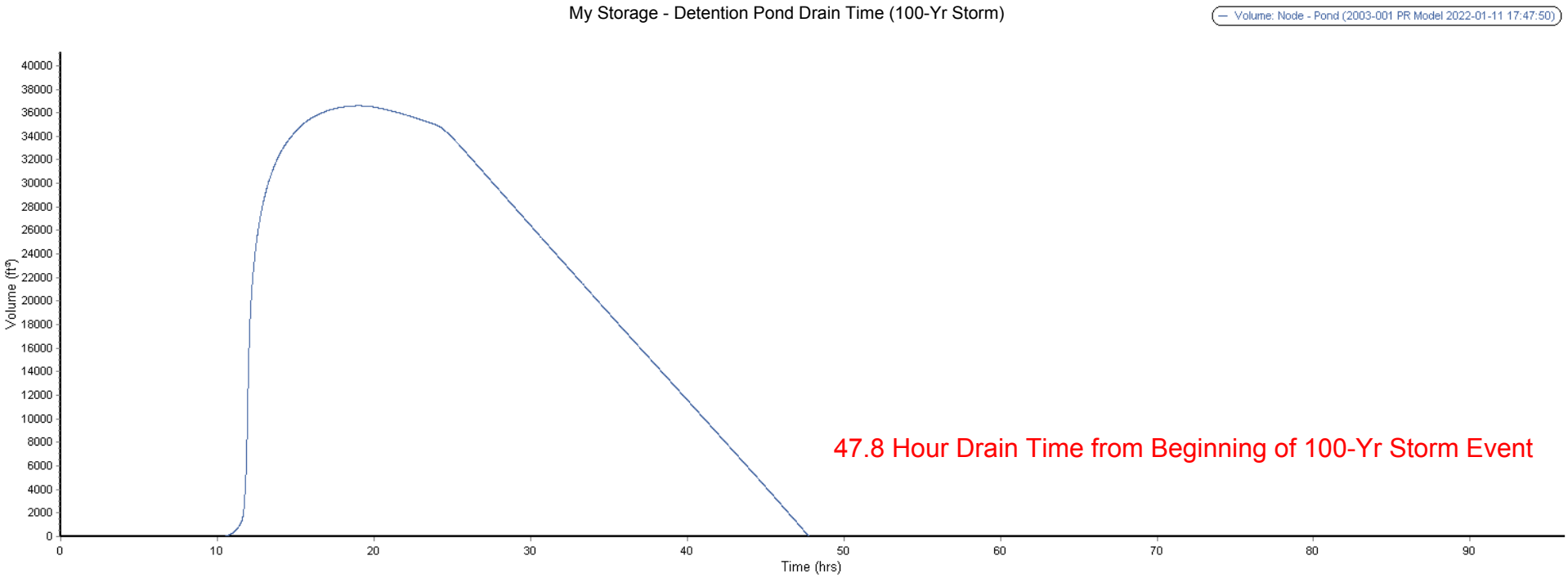
****
Time-Step Critical Elements
****
None

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

****
Routing Time Step Summary
****
Minimum Time Step : 1.00 sec
Average Time Step : 1.00 sec
Maximum Time Step : 1.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 2.00

Analysis began on: Mon Mar 13 18:28:03 2023
Analysis ended on: Mon Mar 13 18:28:10 2023
Total elapsed time: 00:00:07

My Storage - Detention Pond Drain Time (100-Yr Storm)



47.8 Hour Drain Time from Beginning of 100-Yr Storm Event

APPENDIX F

Proposed Major Storm Model Results

1. **100-year, 3-hour Proposed Model Results**
2. **Profile Views of Proposed Storm Drain**

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

****
Project Description
****
File Name ..... 2119-001 PR Model.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. EPA SWMM
Infiltration Method ..... SCS Curve Number
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
Antecedent Dry Days 0.0
Report Time Step 00:00:30
Wet Time Step 00:00:30
Dry Time Step 01:00:00
Routing Time Step ..... 1.00 sec

****
Element Count
****
Number of rain gages 1
Number of subbasins 6
Number of nodes 9
Number of links 8
Number of pollutants 0
Number of land uses 0

****
Subbasin Summary
****

Subbasin ID	Total Area acres	Equiv. Width ft	Imperv. Area %	Average Slope %	Raingage
PR-01	7.99	1500.00	2.00	0.8200	-
PR-02	1.55	640.00	74.00	0.7500	-
PR-03	2.60	760.00	69.00	0.7500	-
PR-04	1.06	550.00	94.00	0.5000	-
PR-05	1.24	630.00	25.00	0.5000	-
PR-06	2.04	730.00	34.00	0.5000	-

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
SDAI-A2	JUNCTION	4514.49	4519.01	10.00	
SDAI-A3	JUNCTION	4515.65	4520.06	10.00	
SDAI-A5	JUNCTION	4517.60	4521.61	10.00	
SDAI-A6	JUNCTION	4518.51	4522.52	10.00	
SDAI-A7	JUNCTION	4517.41	4521.32	10.00	
SDCO-A4	JUNCTION	4516.01	4520.41	10.00	
Ex-Ditch (HF)	OUTFALL	4518.35	4518.35	0.00	

Ex-Ditch (LF)	OUTFALL		4518.35	4518.35	0.00
Pond	STORAGE		4508.50	4519.90	10.00

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
A1-A2	SDAI-A2	Pond	CONDUIT	42.5	1.0118	0.0130
A2-A3	SDAI-A3	SDAI-A2	CONDUIT	116.4	0.9966	0.0130
A3-A4	SDCO-A4	SDAI-A3	CONDUIT	70.3	0.5125	0.0130
A4-A5	SDAI-A5	SDCO-A4	CONDUIT	219.7	0.4961	0.0130
A4-A7	SDAI-A7	SDCO-A4	CONDUIT	180.8	0.4979	0.0130
A5-A6	SDAI-A6	SDAI-A5	CONDUIT	180.8	0.5035	0.0130
High-Flow Pump	Pond	Ex-Ditch (HF)	TYPE1 PUMP			
Low-Flow Pump	Pond	Ex-Ditch (LF)	TYPE1 PUMP			

****
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
A1-A2	CIRCULAR	2.00	2.00	1	3.14	0.50	22.76
A2-A3	CIRCULAR	2.00	2.00	1	3.14	0.50	22.58
A3-A4	CIRCULAR	2.00	2.00	1	3.14	0.50	16.19
A4-A5	CIRCULAR	1.50	1.50	1	1.77	0.38	7.40
A4-A7	CIRCULAR	1.50	1.50	1	1.77	0.38	7.41
A5-A6	CIRCULAR	1.50	1.50	1	1.77	0.38	7.45

****
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	1.978	1.440
Evaporation Loss	0.000	0.000
Infiltration Loss	1.009	0.734
Surface Runoff	0.818	0.595
Final Surface Storage	0.151	0.110
Continuity Error (%)	-0.010	

Flow Routing Continuity	Volume acre-ft	Volume Mgallons
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.818	0.266
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	1.658	0.540
Surface Flooding	0.000	0.000
Evaporation Loss	0.000	0.000
Initial Stored Volume	0.842	0.274
Final Stored Volume	0.002	0.001
Continuity Error (%)	0.005	

****
Composite Curve Number Computations Report
****

Subbasin PR-01

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved parking & roofs	0.00	C	98.00
Gravel roads	0.00	C	89.00
> 75% grass cover, Good	0.00	C	74.00
Row crops, straight row, Good	7.99	C	74.00
Composite Area & Weighted CN	7.99		74.00

Subbasin PR-02

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved parking & roofs	1.13	C	98.00
Gravel roads	0.15	C	89.00
> 75% grass cover, Good	0.26	C	74.00
Row crops, straight row, Good	0.00	C	85.00
Composite Area & Weighted CN	1.55		93.02

Subbasin PR-03

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved parking & roofs	1.74	C	98.00
Gravel roads	0.31	C	89.00
> 75% grass cover, Good	0.55	C	74.00
Row crops, straight row, Good	0.00	C	85.00
Composite Area & Weighted CN	2.60		91.88

Subbasin PR-04

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved parking & roofs	1.06	C	98.00
Gravel roads	0.00	C	89.00
> 75% grass cover, Good	0.00	C	74.00
Row crops, straight row, Good	0.00	C	85.00
Composite Area & Weighted CN	1.06		98.00

Subbasin PR-05

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved parking & roofs	1.18	C	98.00
Gravel roads	0.00	C	89.00
> 75% grass cover, Good	0.06	C	74.00
Row crops, straight row, Good	0.00	C	85.00
Composite Area & Weighted CN	1.24		96.80

Subbasin PR-06

Soil/Surface Description	Area (acres)	Soil Group	CN
Paved parking & roofs	0.69	C	98.00
Gravel roads	0.00	C	89.00
> 75% grass cover, Good	1.18	C	74.00
Row crops, straight row, Good	0.67	C	85.00
Composite Area & Weighted CN	2.55		83.43

****
EPA SWMM Time of Concentration Computations Report
****

Tc = (0.94 * (L^0.6) * (n^0.6)) / ((i^0.4) * (S^0.3))

Where:

Tc = Time of Concentration (min)

L = Flow Length (ft)
n = Manning's Roughness
i = Rainfall Intensity (in/hr)
S = Slope (ft/ft)

Subbasin PR-01

Flow length (ft):	232.04
Pervious Manning's Roughness:	0.10000
Impervious Manning's Roughness:	0.01500
Pervious Rainfall Intensity (in/hr):	0.48000
Impervious Rainfall Intensity (in/hr):	0.48000
Slope (%):	0.82000
Computed TOC (minutes):	34.72

Subbasin PR-02

Flow length (ft):	105.50
Pervious Manning's Roughness:	0.10000
Impervious Manning's Roughness:	0.01500
Pervious Rainfall Intensity (in/hr):	0.48000
Impervious Rainfall Intensity (in/hr):	0.48000
Slope (%):	0.75000
Computed TOC (minutes):	10.03

Subbasin PR-03

Flow length (ft):	149.03
Pervious Manning's Roughness:	0.10000
Impervious Manning's Roughness:	0.01500
Pervious Rainfall Intensity (in/hr):	0.48000
Impervious Rainfall Intensity (in/hr):	0.48000
Slope (%):	0.75000
Computed TOC (minutes):	13.71

Subbasin PR-04

Flow length (ft):	83.96
Pervious Manning's Roughness:	0.10000
Impervious Manning's Roughness:	0.01500
Pervious Rainfall Intensity (in/hr):	0.48000
Impervious Rainfall Intensity (in/hr):	0.48000
Slope (%):	0.50000
Computed TOC (minutes):	6.84

Subbasin PR-05

Flow length (ft):	85.74
Pervious Manning's Roughness:	0.10000
Impervious Manning's Roughness:	0.01500
Pervious Rainfall Intensity (in/hr):	0.48000
Impervious Rainfall Intensity (in/hr):	0.48000
Slope (%):	0.50000
Computed TOC (minutes):	18.88

Subbasin PR-06

Flow length (ft):	121.73
Pervious Manning's Roughness:	0.10000
Impervious Manning's Roughness:	0.01500
Pervious Rainfall Intensity (in/hr):	0.48000
Impervious Rainfall Intensity (in/hr):	0.48000
Slope (%):	0.50000
Computed TOC (minutes):	21.58

****
Subbasin Runoff Summary
****

Subbasin ID	Total Rainfall in	Total Runon in	Total Evap. in	Total Infil. in	Total Runoff in	Peak Runoff cfs	Runoff Coefficient	Time of Concentration days hh:mm:ss
PR-01	1.44	0.00	0.00	1.20	0.19	1.29	0.130	0 00:34:43
PR-02	1.44	0.00	0.00	0.17	1.09	3.63	0.758	0 00:10:01
PR-03	1.44	0.00	0.00	0.22	1.05	5.48	0.728	0 00:13:42
PR-04	1.44	0.00	0.00	0.01	1.21	3.12	0.838	0 00:06:50
PR-05	1.44	0.00	0.00	0.25	1.02	2.04	0.712	0 00:18:52
PR-06	1.44	0.00	0.00	0.67	0.66	2.25	0.459	0 00:21:34

****
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 Flooded Time minutes	Retention Time hh:mm:ss
SDAI-A2	0.22	1.90	4516.39	0	03:23	0	0	0:00:00
SDAI-A3	0.05	1.41	4517.06	0	01:25	0	0	0:00:00
SDAI-A5	0.02	2.99	4520.59	0	01:20	0	0	0:00:00
SDAI-A6	0.01	1.56	4520.07	0	01:25	0	0	0:00:00
SDAI-A7	0.01	0.69	4518.10	0	01:20	0	0	0:00:00
SDCO-A4	0.02	1.66	4517.67	0	01:25	0	0	0:00:00
Ex-Ditch (HF)	0.00	0.00	4518.35	0	00:00	0	0	0:00:00
Ex-Ditch (LF)	0.00	0.00	4518.35	0	00:00	0	0	0:00:00
Pond	3.03	7.89	4516.39	0	03:23	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
SDAI-A2	JUNCTION	2.25	15.66	0	01:25	0.00		
SDAI-A3	JUNCTION	2.04	13.83	0	01:25	0.00		
SDAI-A5	JUNCTION	5.48	8.99	0	01:25	0.00		
SDAI-A6	JUNCTION	3.63	3.63	0	01:24	0.00		
SDAI-A7	JUNCTION	3.12	3.12	0	01:20	0.00		
SDCO-A4	JUNCTION	0.00	11.87	0	01:25	0.00		
Ex-Ditch (HF)	OUTFALL	0.00	0.33	0	00:00	0.00		
Ex-Ditch (LF)	OUTFALL	0.00	0.09	0	00:00	0.00		
Pond	STORAGE	1.29	16.02	0	01:25	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	66.037	45	0 03:23	18.675	13	0.42	0.00	0:00:00	0.000

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
Ex-Ditch (HF)	41.97	0.33	0.33
Ex-Ditch (LF)	77.08	0.09	0.09
System	59.52	0.42	0.42

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow	Maximum Velocity	Length Factor	Peak Flow during	Design Flow	Ratio of Maximum	Ratio of Total	Reported Time	Condition

		Occurrence	Attained		Analysis	Capacity	/Design Flow	Surcharged
		days	hh:mm	ft/sec	cfs	cfs	Flow	Depth minutes
A1-A2	CONDUIT	0	01:25	6.55	1.00	15.63	22.76	0.69
0.98	0 Calculated							
A2-A3	CONDUIT	0	01:25	5.40	1.00	13.80	22.58	0.61
0.76	0 Calculated							
A3-A4	CONDUIT	0	01:25	4.61	1.00	11.82	16.19	0.73
0.77	0 Calculated							
A4-A5	CONDUIT	0	01:25	5.43	1.00	8.99	7.40	1.22
0.89	0 > CAPACITY							
A4-A7	CONDUIT	0	01:20	3.37	1.00	3.16	7.41	0.43
0.60	0 Calculated							
A5-A6	CONDUIT	0	01:25	2.90	1.00	3.74	7.45	0.50
1.00	1 SURCHARGED							
High-Flow Pump	PUMP	0	00:00			0.33		1.00
2417								
Low-Flow Pump	PUMP	0	00:00			0.09		1.00
4440								

****
Flow Classification Summary
****

	--- Fraction of Time in Flow Class ----						Avg.	Avg.
		Up	Down	Sub	Sup	Up	Down	Froude	Flow
Link	Dry	Dry	Dry	Crit	Crit	Crit	Crit	Number	Change
A1-A2	0.00	0.00	0.00	0.23	0.00	0.00	0.77	0.05	0.0000
A2-A3	0.00	0.61	0.00	0.38	0.00	0.00	0.00	0.04	0.0000
A3-A4	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.09	0.0000
A4-A5	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.15	0.0000
A4-A7	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.11	0.0000
A5-A6	0.00	0.58	0.00	0.42	0.00	0.00	0.00	0.04	0.0000

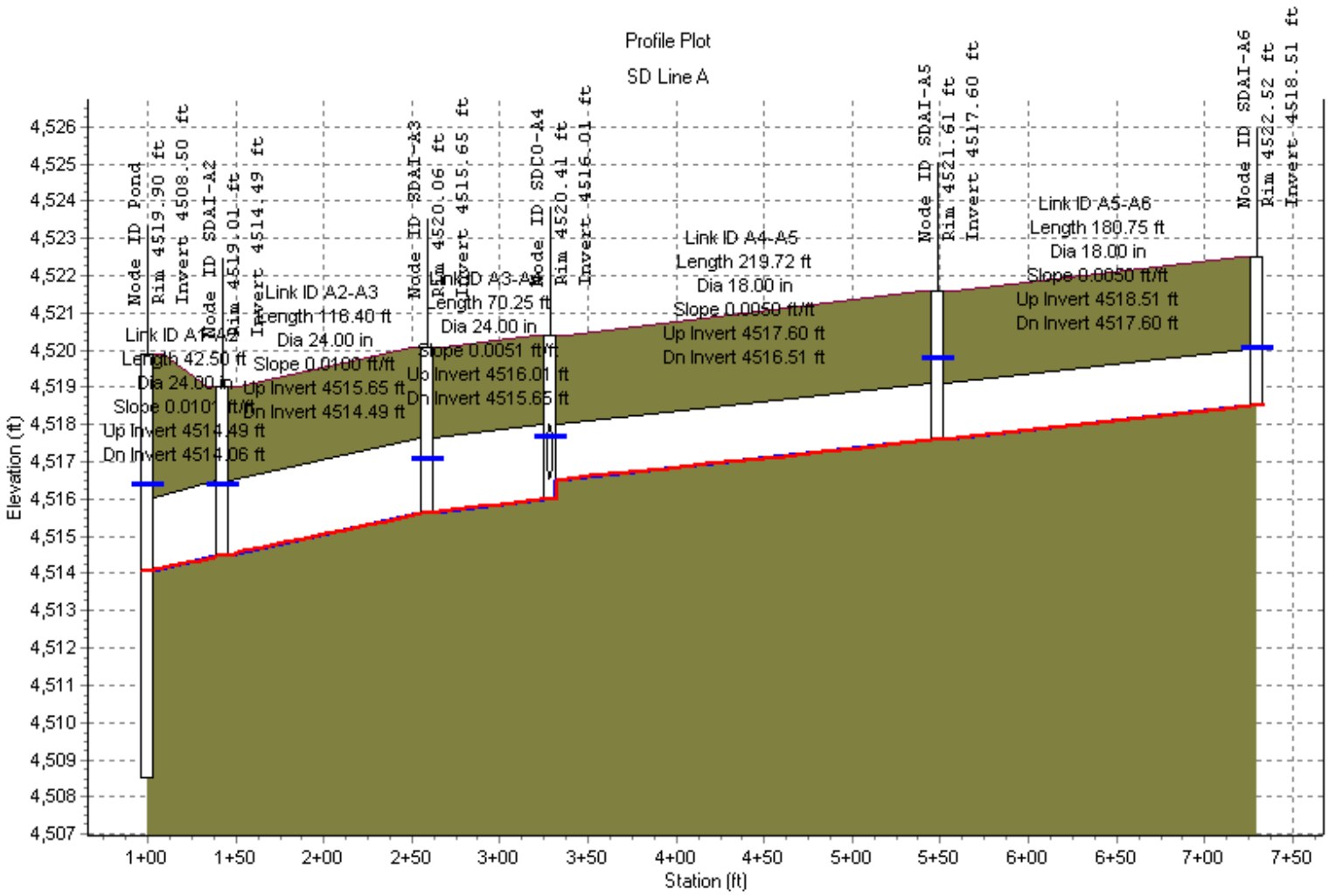
****
Time-Step Critical Elements
****
None

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

****
Routing Time Step Summary
****

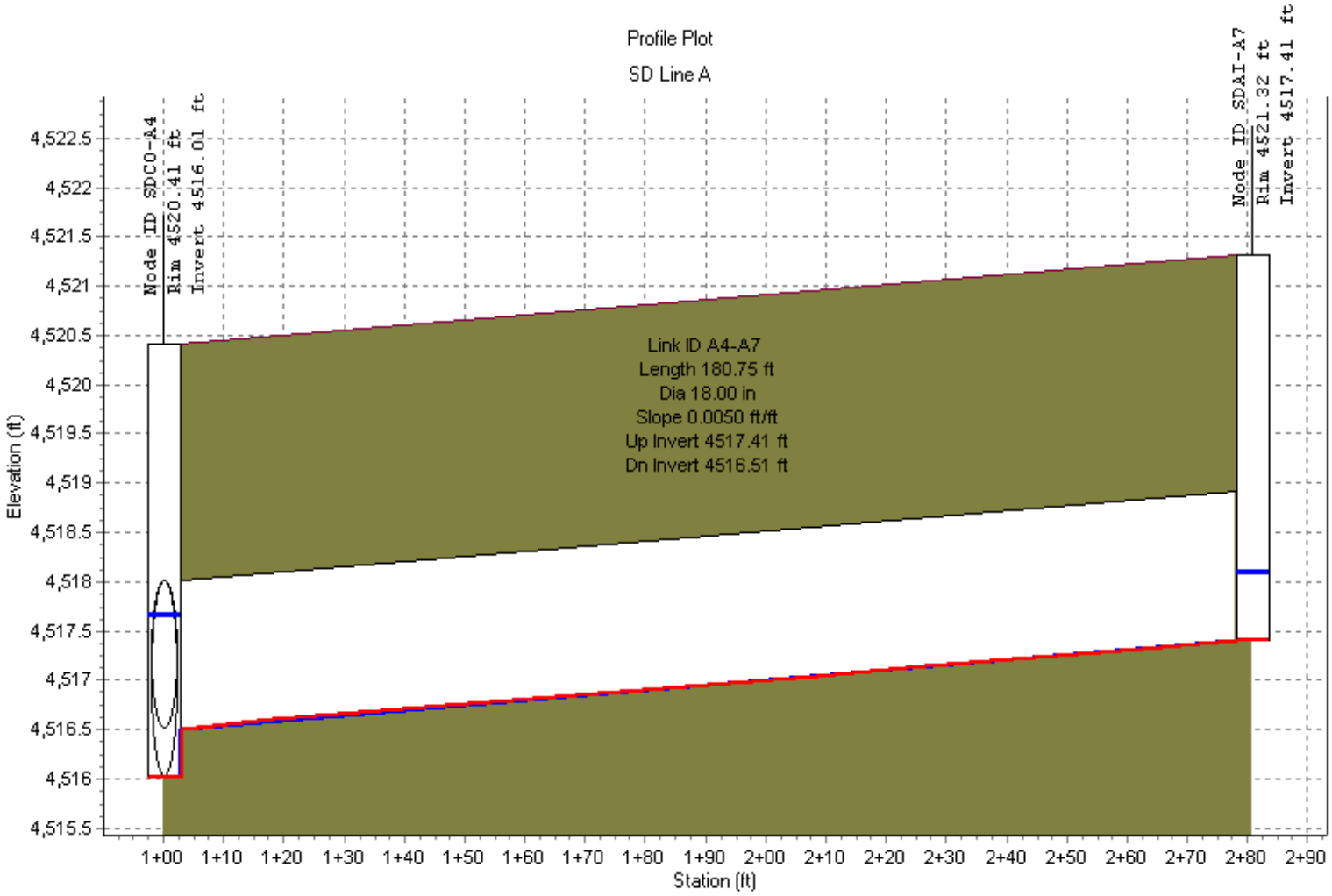
Minimum Time Step	:	1.00 sec
Average Time Step	:	1.00 sec
Maximum Time Step	:	1.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00

Analysis began on: Mon Mar 13 18:29:49 2023
Analysis ended on: Mon Mar 13 18:29:56 2023
Total elapsed time: 00:00:07



Node ID:	Pond	SDAI-A2	SDAI-A3	SDCO-A4	SDAI-A5	SDAI-A6
Rim (ft):	4519.90	4519.01	4520.06	4520.41	4521.61	4522.52
Invert (ft):	4508.50	4514.49	4515.65	4516.01	4517.60	4518.51
Min Pipe Cover (ft):		2.52	2.41	2.40	2.51	2.51
Max HGL (ft):	4516.39	4516.39	4517.06	4517.67	4520.59	4520.07

Link ID:	A1-A2	A2-A3	A3-A4	A4-A5	A5-A6
Length (ft):	42.50	116.40	70.25	219.72	180.75
Dia (in):	24.00	24.00	24.00	18.00	18.00
Slope (ft/ft):	0.0101	0.0100	0.0051	0.0050	0.0050
Up Invert (ft):	4514.49	4515.65	4516.01	4517.60	4518.51
Dn Invert (ft):	4514.06	4514.49	4515.65	4516.51	4517.60
Max Q (cfs):	15.63	13.80	11.82	8.99	3.74
Max Vel (ft/s):	6.55	5.40	4.61	5.43	2.90
Max Depth (ft):	1.95	1.52	1.53	1.33	1.50



Node ID:	SDCO-A4		SDAI-A7
Rim (ft):	4520.41		4521.32
Invert (ft):	4516.01		4517.41
Min Pipe Cover (ft):	2.40		2.41
Max HGL (ft):	4517.67		4518.10
Link ID:		A4-A7	
Length (ft):		180.75	
Dia (in):		18.00	
Slope (ft/ft):		0.0050	
Up Invert (ft):		4517.41	
Dn Invert (ft):		4516.51	
Max Q (cfs):		3.16	
Max Vel (ft/s):		3.37	
Max Depth (ft):		0.90	

APPENDIX G

Street and Inlet Capacity Checks & Riprap Sizing

1. **Inlet Capacity Check**
2. **SWMM Table 805**
3. **Driveway Capacity Check**
4. **Riprap Sizing**

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Mar 13 2023

Driveway Capacity

User-defined

Invert Elev (ft)	= 100.00
Slope (%)	= 0.50
N-Value	= 0.012

Calculations

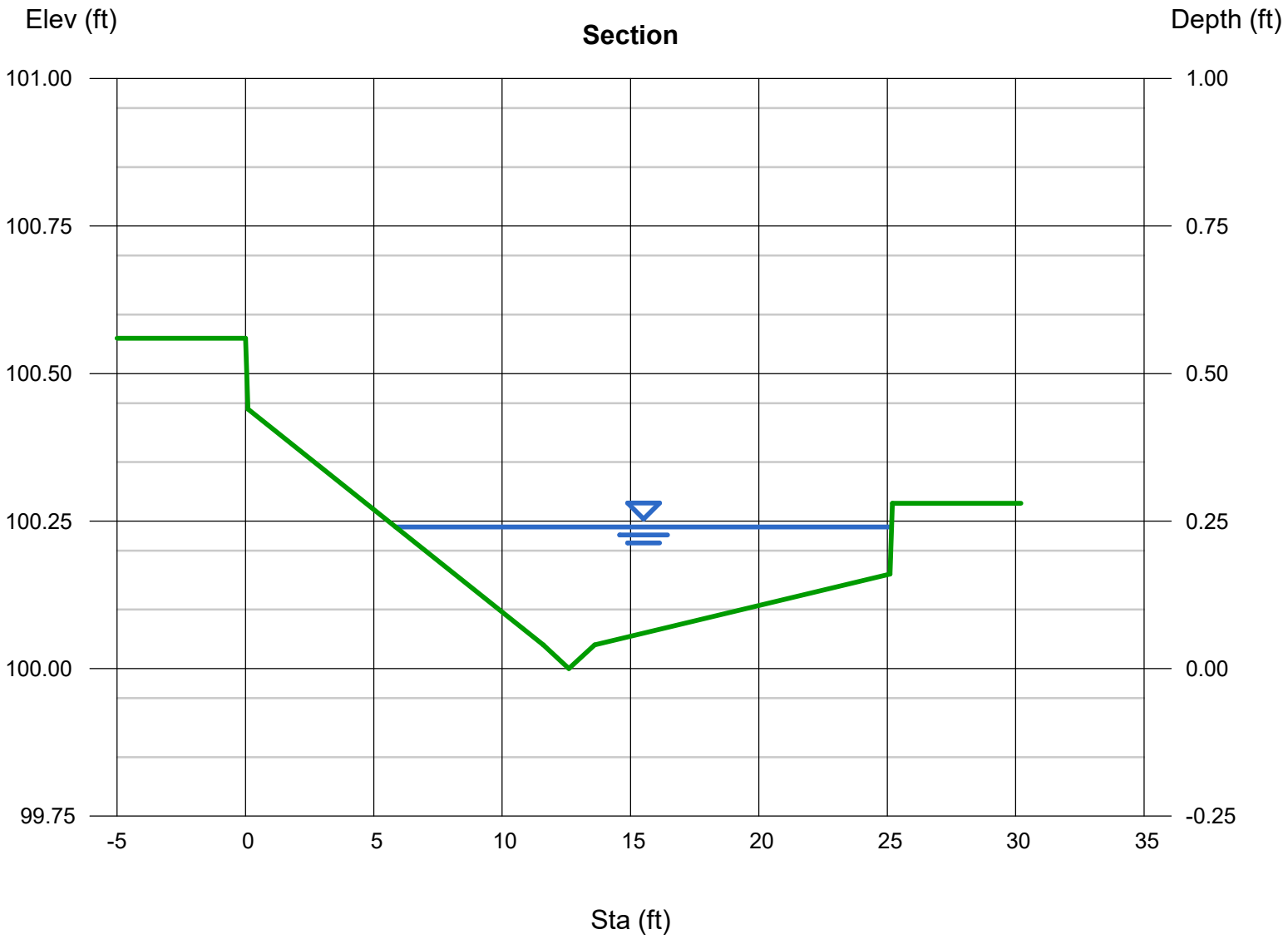
Compute by:	Known Q
Known Q (cfs)	= 5.48

Highlighted

Depth (ft)	= 0.24
Q (cfs)	= 5.480
Area (sqft)	= 2.63
Velocity (ft/s)	= 2.09
Wetted Perim (ft)	= 19.36
Crit Depth, Yc (ft)	= 0.24
Top Width (ft)	= 19.32
EGL (ft)	= 0.31

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

(0.00, 100.56)-(0.10, 100.44, 0.012)-(11.60, 100.04, 0.012)-(12.60, 100.00, 0.012)-(13.60, 100.04, 0.012)-(25.10, 100.16, 0.012)-(25.20, 100.28, 0.012)



Nyloplast Inlet Capacity Table

DISCLAIMER: SAFETY FACTORS ARE NOT INCLUDED IN THESE CALCULATIONS. ACTUAL CALCULATIONS SHOULD BE CARRIED OUT AND VERIFIED BY THE DESIGN ENGINEER TAKING INTO ACCOUNT ALL LOCAL CONDITIONS. NYLOPLAST RECOMMENDS USING A MINIMUM SAFETY FACTOR OF 1.25 FOR PAVED AREAS AND 2.0 FOR TURF AREAS. ADS/NYLOPLAST IS NOT RESPONSIBLE FOR MISUSE OF THIS TOOL.

Input	
Type of Grate	2'x3' Road & Highway
Head (ft)	0.28

Properties	
Orifice Flow Area (in)	**432.28**
Orifice Flow Area (ft)	**3.00**
Weir Flow Perimeter (in)	**108.22**
Weir Flow Perimeter (ft)	**9.02**

Solution	
Capacity (cfs)	**5.69**
Capacity (gpm)	**2555.02**

$$Q_{weir} = CLH^{3/2}$$

$C = 3.33\ Weir\ Discharge\ Coefficient$

$L = Perimeter\ of\ Grate\ Opening\ (ft)$

$H = Flow\ Height\ of\ Water\ Surface\ Above\ Weir\ (ft)$

$$Q_{orifice} = CA\sqrt{2gh}$$

$C = 0.60\ Orifice\ Discharge\ Coefficient$

$A = Area\ of\ the\ Orifice\ (ft^2)$

$g = Gravitational\ Constant\ \left(32.2\frac{ft}{s^2}\right)$

$H = Depth\ of\ Water\ Above\ Center\ of\ Orifice\ (ft)$

MAX 2-YR PEAK FLOW = 2.18 CFS

MAX 100-YR PEAK FLOW = 5.48 CFS

REV 2.1.21

MY STORAGE

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 (A1–A2)= 6.55 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

TABLE 805

My Storage

FES A1 Outfall to Pond

RIP-RAP OUTLET PROTECTION SIZING

REQUIRED INFORMATION:

V =	6.55	ft/sec	Velocity (See Table 805 in the SWMM to verify rip-rap is required)
Q =	15.61	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} = **0.20** ft 2.3 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 = 23.93

L_a =	30.6 feet

DETERMINE REQUIRED APRON TOP WIDTH, W_T:

W_T = $3.0*D_o$

W_T = 6.00

W_T =	6 feet

DETERMINE REQUIRED APRON BOTTOM WIDTH, W_B:

W_B = $3.0*D_o + L_a$

W_B = 29.93

W_B =	18.25 feet

If TW ≥ D_o/2:

Area=	371.03	ft^2
=	41.23	yds^2
Volume=	13.74	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 = 30.56

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 = 18.22

APPENDIX G

SWMM Checklists

1. **Drainage Report Checklist**
2. **Drainage Plan Checklist**

MY STORAGE

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.
N/A * 5. Identify how the capacity of open channels and culverts were determined.
6. Identify any special analysis or design requirements not contained with the
N/A * Manual.
✓ 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
N/A * project site.
2. If compensating detention is provided, discuss practices to address water
N/A * quality from area not tributary to detention area.
3. If underground detention is proposed, discuss how water quality facilities will be
N/A * provided on the surface.
4. If proprietary BMPs are proposed, provide the justification and sizing
N/A requirements (see SWMM Section 1603.3).

*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

N/A 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.
✓ * 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.
N/A * 5. Street capacity calculations, if data in Manual not used (see Section 1100).
N/A * 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).
N/A * 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*

MY STORAGE

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

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

F. Storm sewer data:

1. ✓ Profile of water surface for design flow rate.
2. ✓ Peak flows for design, 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. ✓(see plans) Horizontal and vertical control information and ties to existing and proposed features.

ACKNOWLEDGEMENTS

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