



PRELIMINARY DRAINAGE REPORT

The Parklands Village 1, Filing No. 2

Aurora, Colorado

Parklands Village 4 Land CO, LLC

Prepared for:

Parklands Village 4 Land CO, LLC
8678 Concord Center Drive, #220
Englewood, CO 80112
Contact: Thomas Clark
(303)-346-7006

Prepared by:

Liam Shannon, P.E.
Kimley-Horn and Associates, Inc.
6200 South Syracuse Way,
Suite 300
Greenwood Village, CO 80111
(303) 228-2300

Approved For One Year From This Date	
<hr/>	
<hr/>	<hr/>
Aurora Water Drainage Division	Date

Advisory Note – Preliminary Drainage Report is required prior to Civil Plan Approval



Project #: 196480001

Prepared: May 2024

TABLE OF CONTENTS

A. INTRODUCTION	4
1. LOCATION.....	4
2. PROPOSED DEVELOPMENT	5
3. CHANGES TO MDR	5
4. REQUESTED VARIANCES.....	5
B. HISTORIC DRAINAGE	6
1. DESCRIPTION OF PROPERTY AND DRAINAGE BASIN	6
C. DESIGN CRITERIA.....	7
1. HYDROLOGIC CRITERIA	7
2. HYDRAULIC CRITERIA	10
D. DRAINAGE PLAN.....	11
1. GENERAL DETAILS	11
2. SPECIFIC DETAILS	13
E. CONCLUSION	25
1. COMPLIANCE WITH STANDARDS	26
2. SUMMARY OF CONCEPT.....	27
LIST OF REFERENCES	28
Appendix A – NCRS Soils Report, Precipitation, Floodplain, and Airport Buffer Info	
Appendix B – Hydrologic Computations	
Appendix C – Hydraulic Computations	
Appendix D – Supporting Documentation, Drainage Maps	

ENGINEER'S CERTIFICATION

This report and plan for the drainage design of The Parklands Village 1, Filing 2 was prepared by me (or under my direct supervision) in accordance with the provisions of City of Aurora Storm Drainage Design and Technical Criteria and was designed to comply with the provisions thereof.

Liam Shannon, P.E.

Registered Professional Engineer

State of Colorado No. 59528

A. Introduction

The purpose of this preliminary drainage report is to outline the drainage design for the proposed Village 1 Filing 2 Development (The Site or the Project), located at the southeastern corner of Harvest Road and proposed S Kewaunee Street.

The purpose of this report is to demonstrate that the proposed residential project conforms to the established drainage patterns set forth in the *Master Drainage Report for the Parklands Development* (The MDR), EDN #1583566, prepared by CORE Consultants, Inc. approved April 7th, 2023. The drainage design will also conform to the current *City of Aurora Storm Drainage and Technical Criterial Manual* (The Criteria) which supplements the Mile High Flood District *Urban Storm Drainage Criteria Manual* (The Manual).

1. Location

The Parklands Village 1 Filing 2 project is located in Section 20, Township 4 South, Range 65 west of the 6th Principal Meridian, County of Arapahoe, State of Colorado. The site is bounded by proposed Village 1 Filing 1 to the North and South, existing Harvest Road to the West, and proposed S Kewaunee Street to the East. A vicinity map is provided in **Figure 1** below.



Figure 1: Vicinity Map

2. *Proposed Development*

The Site is currently zoned as R2-C (medium density residential) and contains approximately 25.9 acres. The Site is situated in planning areas 1C of the Parklands Master Land Use plan, see **Appendix D**. Planning area 1C has a max density of 207 dwelling units (DUs). Planning area PP-2 is approximately a 0.50 acre(s) proposed pocket park that will be designed/developed with this filing. This development includes all associated infrastructure to support the community. Open space is proposed at various locations within the Parklands community.

This Preliminary Drainage Report includes the preliminary analysis of the drainage related to the site layout and grading of Parklands Village 1, Filing No. 2. A Final Drainage Report for this site will be prepared with future Civil Plan submittals to ensure that storm drainage infrastructure is appropriately hydraulically sized to serve the overall development at full build out.

3. *Changes to MDR*

There are no proposed changes to the MDR.

4. *Requested Variances*

There are no other variances requested at this time for this Preliminary Drainage Report. Any future Variance requests will be coordinated with City of Aurora.

B. Historic Drainage

1. Description of Property and Drainage Basin

a. Existing/Historic Condition Rainfall

Currently, the Site consists of undeveloped land. The existing conditions slope North toward Coal Creek. The Site is currently covered by natural grasses and slopes on Site are roughly between 0% - 10%. According to a NRCS web soil survey report accessed May 9th, 2024, the site consists of hydrologic soil groups C and D soils. The NRCS web soil survey report is referenced in **Appendix A**

The Master Drainage Report identifies four existing drainage basins on the Site; A-3, A-4, and H-1. To maintain consistency throughout this report, existing subbasins H-1 per the MDR has been renamed to O-3. Basin A-3 and A-4 generally flow to the north/northeast and are tributary to Coal Creek. A small portion of the site, existing Basin O-3, sheet flows overland southwest to existing Harvest Road and Jewell Avenue. There is no existing storm infrastructure onsite capturing any flow. See **Figure 2** below for the historic basins located onsite per the Master Drainage Plan. Note that the basin areas and imperviousness are included within **Figure 2**.

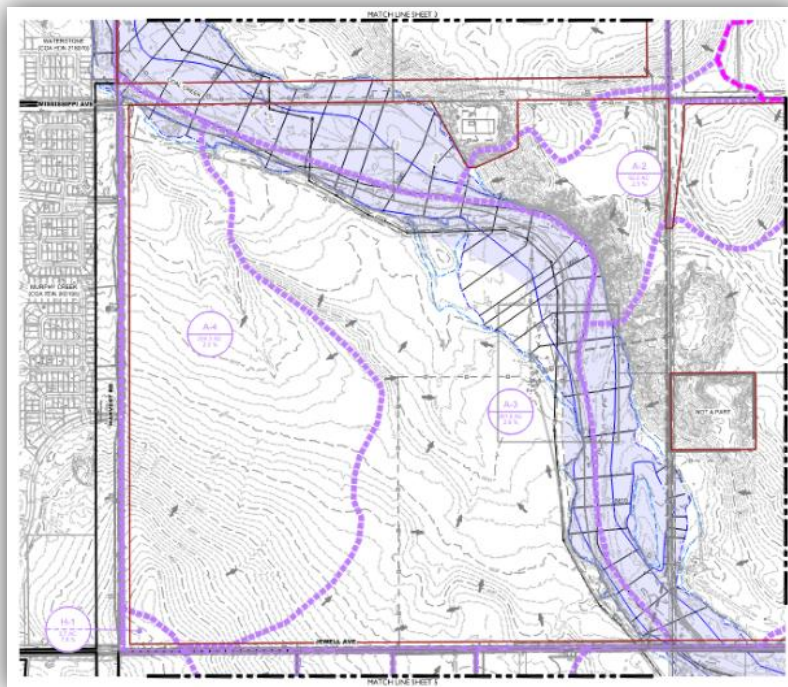


Figure 2: Master Drainage Map - Existing Drainage Patterns (Full size in Appendix A-1)

b. Major Drainageways

Coal Creek is major drainageway that is currently mapped as a Zone AE floodplain. The flood hazard boundaries are shown within the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel 8005C0204K, effective December 17, 2010. A portion of Coal Creek passes through the overall Parklands development as noted in the MDR. Coal Creek is located to the South of the Site. The Site falls within Zone X according to FEMA FIRM maps number 08005C0208L. The FEMA FIRM Map are referenced in Appendix A.

c. Irrigation Facilities

There are no irrigation canals or ditches located on the property.

d. Offsite-Subbasins

The Offsite-subbasins include the future lots to the south of Filing 2 and a portion of offsite-subbasin that will remain draining off-site as shown in historic conditions.

e. Outfalls from the Property

Coal Creek is located to the North of the Site. Flows contributing to Coal Creek will collect in the existing detention facility (Pond A) near the northern boundary of Village 1 Filing 1. Pond A has been constructed as a part of Village 1 Filing 1 to accommodate the full build-out of the Site. Refer to the Village 1 Filing 1 Preliminary Drainage Report (V1F1 PDR) for information regarding the release rate of the outlet structure. Note that the contributing area and imperviousness values for the Site are less than the V1F1 PDR assumed values and therefore the release rate is still in compliance with the V1F1 PDR (see Table A).

f. Relevant Major Drainageway Studies

- First Creek Tributaries (Upstream of I-70) Master Drainageway Plan
 - *Westwood - October 2021*
- Coal Creek Stream Improvements
 - *Wright Water Engineers, Inc – May 2022*

C. Design Criteria**1. *Hydrologic Criteria*****a. Rainfall and Storm Design Frequencies**

According to the Criteria section 6.1.2, the design storms for the Project are the 2-year and 100-year frequency events.

Chapter 5 of the Criteria was used to determine the time of concentrations, rainfall intensities, and runoff coefficients to calculate the peak runoff for each storm event.

b. One-Hour point Precipitation

NOAA Atlas 14 was used to determine the rainfall P1 values for the rainfall intensity values. One-hour rainfall depths used for the calculations at the site are as outlined below in **Table 2** and can be found in **Appendix A**:

Table 1: One-Hour Rainfall Depths from NOAA Atlas 14

Rainfall Depths						
	2-year	5-year	10-year	25-year	50-year	100-year
1-hr	0.86"	1.14"	1.40"	1.79"	2.12"	2.48"

c. Calculation Method

The Standard Form Rational Method computations were conducted for each sub-basin to size the proposed storm sewer infrastructure (inlets, pipe network, drainage channel, etc.) and to check the emergency overflow weir freeboard requirements. The rational method was used to calculate sub-basin run-off coefficients and 2-yr and 100-yr flows. Thirteen land uses were used for the rational method calculations: Paved Streets, Concrete Drive/Walks, Roofs, Gravel (Pedestrian Use), Gravel (Maintenance Paths), Landscaping, Open Water & WQCV, Native Grasses/Open Space, Single-Family (High Density), Multi-Family (Medium Density), Commercial, School, and Neighborhood Parks. Each land use conforms to the land uses provided in Table 5-5 of the Criteria.

See **Table 3** below for the 2-year and 100-year run-off coefficients used in calculations for each proposed land use. The coefficients are based on the NRCS Soil Group C/D and the new City of Aurora Turf New Imperviousness.

Table 2: 2-year & 100-year Coefficients per Land Use Type

Land Use	2-yr coeff.	100-yr coeff.
Paved Street	0.78	0.87
Concrete	0.78	0.87
Roofs	0.78	0.87
Gravel Pedestrian Use	0.30	0.65
Gravel – Maintenance Paths	0.47	0.73
Landscaping	0.14	0.57
WQCV	0.83	0.89
Native Grasses & Open Space	0.03	0.50
Single-Family (High Density)	0.51	0.75
Multi-Family (Medium Density)	0.51	0.75

Commercial	0.65	0.81
School	0.42	0.71
Neighborhood Parks	0.10	0.55

See **Appendix B** for Runoff Coefficient Table and Imperviousness results.

d. Detention Volume Computation Method

The CUHP 2005 v. 2.0.1 model from the MDR was modified for the developed conditions of the specific to Village 1 Filing 1 portion of the development for the hydrologic analysis of Pond A. Subbasin geometry characteristics, including slope and length to centroid were updated utilizing field survey of the Site. Additional nodes and links were added to accurately model the overall basins proposed on page 3 of the Preliminary Drainage Plan.

Pond A was designed in accordance with the Criteria's volume and release rate set in the Master Drainage Report & Plan. The required detention volume was calculated using the MHFD Detention Spreadsheet Version 4.06. Inflows from the SWMM model for the 2 yr and 100 yr storms were overridden into the MHFD spreadsheet and utilized to size the Pond and Outlet Control Structure. The rating curve from the MHFD spreadsheet was then imported into SWMM model to model the pond outfall. The information for the modeling results is found within V1F1 PDR. The Site remains in compliance with the calculations from V1F1 PDR given the reduced tributary area and the lessened imperviousness.

Design Criteria

The "City of Aurora Storm Drainage Design and Technical Criteria", revised November 2023 (the Criteria) and the "Urban Storm Drainage Criteria Manual" Volumes 1, 2, and 3 (The Manual), with latest revisions, were used when preparing the storm calculations. This report is intended to serve as a Site-Specific Preliminary Drainage Report for the Parklands Village 1 Filing 2 Development.

This Preliminary Drainage Report also utilizes previous drainage studies in the area including:

- *Master Drainage Report & Maps for the Parklands Development* (MDR), EDN 223089, approved 04/07/2023
 - *CORE Consultants, Inc. – April 2023*
- *Preliminary Drainage Report & Maps for the Parklands Development* (PDR), EDN 224035, approved on 02/26/2024
 - *Kimley-Horn and Associates – February 2023*

2. Hydraulic Criteria

a. Storm Design Frequencies

The storm sewer layout will be designed horizontally along with inlet locations to gravity-flow in the 2-year storm and to convey the 100-year storm with the HGLs 1 foot below the rim elevations of the storm structures.

b. Detention Facility Sizing Methodology

The Pond A Detention Pond was sized within the Village 1 Filing 1 PDR and includes full-build out conditions for contributing areas. Note that the contributing area and imperviousness values for the Site are less than the V1F1 PDR assumed values and therefore the hydraulic calculations for Pond A and Channel A are still in compliance with the V1F1 PDR (see Table A).

c. Drainageway Sizing Methodology

No Drainageways are proposed in this development.

d. LOMCs Required

No LOMC are required for this proposed development.

e. Infrastructure Maintenance (Public/Private)

The City will be required to maintain proposed public storm infrastructure. The Metro District will be required to maintain the proposed private storm infrastructure.

f. Proposed Temporary Stormwater Infrastructure

No Temporary Stormwater Infrastructure are proposed in this development.

g. Hydraulic Analysis Software

The Pond was hydraulically analyzed utilizing the MHFD-Detention workbook and EPA SWMM version 5.2.

The storm infrastructure pipe will be modeled in AutoCAD Civil 3D Hydraflow Storm Sewers Extension and will be provided within a future Final Drainage Report. The HGLs associated with the 2-year and 100-year storm events will be show in the FDR and Civil Plan package.

The emergency outfall path is outlined in the separate Preliminary Drainage Plan via hallow flow arrows.

h. Outside Resources

No additional outside Resources to reference.

D. Drainage Plan

1. General Details

a. Drainage Concept & Patterns

The proposed design includes routing the developed runoff from the Site through grading and storm drains to the Village 1, Filing 1 proposed storm sewer that outfalls into Pond A. The proposed drainage design is consistent with the design intent of the approved Parklands Master Drainage Report (*EDN 223089*) and the Parklands Village 1 Filing 1 Preliminary Drainage Report (*EDN 224035*). The Pond A will be constructed as a part of Village 1 Filing 1 and it is located near the northern border of V1F1 next to existing Coal Creek. The Site includes a portion of drainage basin A-2 as proposed in the approved MDR.

The entirety of the proposed development will drain toward the existing Pond A to be detained/treated before being released into existing Coal Creek. Per V1F1 PDR, Pond A has a total tributary area of approximately 203 acres with an approximate imperviousness of 69%. The V1F1 PDR accounts for the full build-out of the Site. The Site contains approximately 29.4 acres of tributary area to Pond A. Pond A has been designed to accommodate the entirety of its tributary area. The table below compares the assumed V1F1 PDR tributary areas and imperviousness values between the Village 1 Filing 2 actual values. Note that the contributing area and imperviousness values for the Site are less than the V1F1 PDR assumed values and therefore the hydraulic calculations for Pond A and Channel A are still in compliance with the V1F1 PDR (see Table A).

	Village 1 Filing 1 Assumed Values	Village 1 Filing 2 Actual Values
Area (acre)	24.66	23.54
Imperviousness (%)	64.0	62.2

Table A – Tributary Area and Imperviousness comparison between V1F1 and V1F2

The remaining portion of Pond A's tributary area will be designed and developed in a future Village 1 Drainage Report. Please refer to **Appendix B & C** for hydrologic and hydraulic calculations.

The majority of the stormwater onsite (Basins A5 and A6) will be collected by inlets and flow through pipes to reach Pond A. Basin A5 and A6 drainage (Subbasins A500s and A600s) will flow north.

The overall tributary area of Pond A includes the majority of the Village 1 Filing 1 and a portion of the future Village 1 Filing, which follows the MDR tributary drainage area for Basins A-1 and A-2. Pond A will be constructed to serve the full buildout of Basin A.

A drainage channel, Channel A, was proposed to the northeast of Parklands Village 1, Filing No. 2, consistent to with the MDR. This channel extends to the north and connects to Pond A. Channel A serves to convey drainage for basins A-1 and A-2 to Pond A per the MDR. Channel A was proposed to be constructed as a part of the V1F1 PDR.

b. Conformance to the MDR

This PDR & PDP is in conformance with the improvements set forth in the Master Drainage report.

Note there are slight variations in acreage and imperviousness from the MDR to PDR. This is due to the high level nature of the MDR's delineation along with the Drainage Manual updates from the city between MDR approval and PDR submittals.

c. PIP Conformance

This PDR & PDP is in conformance with the improvements set forth in the approved Public Improvement Plan.

d. Site Plan Conformance

This PDR & PDP is in conformance with the improvements set forth in the Site Plan.

e. Off-site Drainage Conformance

There are four (4) offsite basins draining onto the Site that will ultimately be treated by Pond A: Basins IA-600, IA-602, IA604, and O-3. Basins IA-600 to IA-604 are undeveloped lots south of the site that drain to temporary swales along the north and east ends of the southern parcel(s). Inlets will connect to existing storm line stubs and direct these flows to Pond A. These off-site basins are tributary to Basin A per the approved Master Drainage Report and the V1F1 PDR.

Meanwhile O-3 will sheet flow to curb & gutter to flow offsite following historic drainage patterns upon ultimate buildout.

f. Surrounding Development Coordination

Parklands has been in coordination with the Foundry development to the South Side of Jewell Avenue.

g. Downstream Outfall(s)

Coal Creek is located to the North of the Site. Flows contributing to Coal Creek will be collected in the existing detention facilities (Pond A) that were developed in Village 1 Filing 1 near the northern boundary. The controlled release outlet structure of Pond A will outfall directly into Coal Creek at a rate less than the 100 yr max release rate of 199 cfs and is not anticipated to change from V1F1 PDR given that the V1F2 Site has a reduced tributary area and lessened imperviousness. The proposed drainage pattern follows historical drainage patterns.

h. Proposed Development Effects

There are no adverse effects from this proposed development.

i. Water quality SCMs and Detention Plan

An open channel northeast of the Site and along the eastern boundary of the Village 1 Filing 1 conveys flow north and releases runoff into Pond A following historic drainage patterns. The Pond A outlet structure will detain, treat, and release piped flows of runoff into Coal Creek. Pond A has been designed to release at flow rates required by the Criteria, Manual, and the approved Parklands Master Drainage Report/Plans.

Per the approved Parklands Master Drainage Report, Pond A is a public full-spectrum detention pond and will be maintained by the Aurora Water. Please reference V1F1 PDR for more information.

2. *Specific Details*

a. Project Phasing

Phasing of Construction has not been solidified at the time of the Preliminary Drainage report. If phasing is determined with Civil Plans, the associated Final Drainage Reports (FDR) will provide detailed drainage provisions required with each phase.

b. Sub-Basin Description & H. Emergency Overflow Path

A standalone Drainage Area Map has been provided in this submittal, to illustrate the sub-basins proposed with this project. Individual sub-basin details such as runoff, coefficient calculations, tributary area, and imperviousness percentages are provided in **Appendix B**. The 2-year and 100-year peak flows are provided below with full calculations provided in **Appendix B**.

On-Site Basin A Sub-Basins***Sub-basin A-600***

Sub-basin A-600 is located near the northeastern corner of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed sump curb inlet located at design point A600. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed public storm sewer.

Design point A600 is a sump curb inlet, and the emergency overflow path was analyzed in the event of the 100-year storm with the inlet in a fully clogged condition. The stormwater will pond and overtop the alley local high point (edge of alley) allowing water to flow to the next downstream inlet in the event of the 100-year storm in a fully clogged condition. The alley local high point (edge of alley) was analyzed as an irregular broad crested weir with the breakout point at elevation 5624.33', the 100-year storm flow passes over the high point at a depth of 0.26' resulting in an elevation of 5625.93' providing more than one-foot of freeboard to the lowest anticipated adjacent home building FFE (EL. 5625.93'). See Section A-A Emergency Overflow Weir computations in **Appendix C** that have been provided and the Overflow Weir Profile on Sheet 6 of the Preliminary Drainage Plan. The Preliminary Drainage Plan displays the ponding depth that would occur at the inlet in the fully clogged condition prior to the breakout point.

Sub-basin A-602

Sub-basin A-602 is located near the northern side of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade curb inlet located at design point A602. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed public storm sewer.

Sub-basin A-604

Sub-basin A-604 is located near the northern side of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade curb inlet located at design point A604. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed public storm sewer.

Sub-basin A-606

Sub-basin A-606 is located near the northern side of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum

detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade Type 13 inlet located at design point A606. This sub-basin will utilize sheet flow to facilitate flow to proposed area inlet at design point A606.

Sub-basin A-608

Sub-basin A-608 is located near the northern side of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade curb inlet located at design point A608. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed public storm sewer.

Sub-basin A-610

Sub-basin A-610 is located near the northern side of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade curb inlet located at design point A610. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed public storm sewer.

Sub-basin A-612

Sub-basin A-612 is located near the northwestern corner of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade Type 13 inlet located at design point A612. This sub-basin will utilize sheet flow to facilitate flow to proposed area inlet at design point A612.

Sub-basin A-614

Sub-basin A-614 is located near the northwestern corner of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade curb inlet located at design point A614. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed public storm sewer.

Sub-basin A-616

Sub-basin A-616 is located near the northwestern corner of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade curb inlet located at design point A616.

This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed public storm sewer.

Sub-basin A-618

Sub-basin A-618 is located near the western side of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade curb inlet located at design point A618. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed public storm sewer.

Sub-basin A-620

Sub-basin A-620 is located near the western side of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade curb inlet located at design point A620. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed public storm sewer.

Sub-basin A-622

Sub-basin A-622 is located near the center side of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade Type 13 inlet located at design point A622. This sub-basin will utilize sheet flow to facilitate flow to proposed inlet at design point A622.

Sub-basin A-624

Sub-basin A-624 is located near the center side of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade curb inlet located at design point A624. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed public storm sewer.

Sub-basin A-626

Sub-basin A-626 is located near the center side of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade curb inlet located at design point A626. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed public storm sewer.

Sub-basin A-628

Sub-basin A-628 is located near the center side of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade Type 13 inlet located at design point A628. This sub-basin will utilize sheet flow to facilitate flow to proposed inlet at design point A628.

Sub-basin A-630

Sub-basin A-630 is located near the center side of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade curb inlet located at design point A630. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed public storm sewer.

Sub-basin A-632

Sub-basin A-632 is located near the center side of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade curb inlet located at design point A632. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed public storm sewer.

Sub-basin A-634

Sub-basin A-634 is located near the center side of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade Type 13 inlet located at design point A634. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed public storm sewer.

Sub-basin A-636

Sub-basin A-636 is located near the eastern side of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade Type 13 inlet located at design point A636. This sub-basin will utilize sheet flow to facilitate flow to proposed inlet at design point A636.

Sub-basin A-638

Sub-basin A-638 is located near the eastern side of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade Type 13 inlet located at design point A638. This sub-basin will utilize sheet flow to facilitate flow to proposed area inlet at design point A638.

Sub-basin A-640

Sub-basin A-640 is located near the southeastern corner of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade Type 13 inlet located at design point A640. This sub-basin will utilize sheet flow to facilitate flow to proposed area inlet at design point A640.

Sub-basin A-642

Sub-basin A-642 is located near the western side of the Site and is one of the 34 sub-basins on the Site that drains via private storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed sump Type C inlet located at design point A642. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed private storm sewer.

Design point A642 is a sump Type 13 inlet, and the emergency overflow path was analyzed in the event of the 100-year storm with the inlet in a fully clogged condition. The stormwater will pond and overtop the local high point (edge of sidewalk) allowing water to flow to the next downstream inlet in the event of the 100-year storm in a fully clogged condition. The local high point (edge of sidewalk) was analyzed as an irregular broad crested weir with the breakout point at elevation 5632.90', the 100-year storm flow passes over the high point at a depth of 0.37' resulting in an elevation of 5633.27' providing more than one-foot of freeboard to the lowest anticipated adjacent home building FFE (EL. 5637.54'). See Section B-B Emergency Overflow Weir computations in **Appendix C** that have been provided and the Overflow Weir Profile on Sheet 6 of the Preliminary Drainage Plan. The Preliminary Drainage Plan displays the ponding depth that would occur at the inlet in the fully clogged condition prior to the breakout point.

Sub-basin A-644

Sub-basin A-644 is located near the center of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade curb inlet located at design point A644. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed public storm sewer.

Sub-basin A-646

Sub-basin A-646 is located near the center of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade curb inlet located at design point A646. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed public storm sewer.

Sub-basin A-648

Sub-basin A-648 is located near the center of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade curb inlet located at design point A648. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed public storm sewer.

Sub-basin A-650

Sub-basin A-650 is located near the southern side of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade Type 13 inlet located at design point A650. This sub-basin will utilize sheet flow to facilitate flow to proposed area inlet at design point A650.

Sub-basin A-652

Sub-basin A-652 is located near the southern side of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade curb inlet located at design point A652. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed public storm sewer.

Sub-basin A-654

Sub-basin A-654 is located near the southern side of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade curb inlet located at design point A654. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed public storm sewer.

Sub-basin A-656

Sub-basin A-656 is located near the southern side of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade curb inlet located at design point A656. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed public storm sewer.

Sub-basin A-500

Sub-basin A-500 is located near the northeastern corner of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed sump curb inlet located at design point A500. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed public storm sewer.

Sub-basin A-502

Sub-basin A-502 is located near the northeastern corner of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed sump curb inlet located at design point A502. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed public storm sewer.

Sub-basin A-510

Sub-basin A-510 is located near the northern side of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade curb inlet located at design point A510. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed public storm sewer.

Sub-basin A-518

Sub-basin A-518 is located near the southeastern corner of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed on-grade curb inlet located at design point A518. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed public storm sewer.

Sub-basin A-520

Sub-basin A-520 is located near the southeastern corner of the Site and is one of the 34 sub-basins on the Site that drains via public storm drain to the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This

sub-basin flows to the proposed on-grade curb inlet located at design point A520. This sub-basin will utilize sheet flow and curb & gutter to facilitate flow to proposed public storm sewer.

Sub-basin IA-600

Sub-basin IA-600 is the northern portion of future lot that is located to the south of the Site. It is one of the 3 sub-basins that drains via temporary swales to the public storm system that discharges into the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed temporary swale. This sub-basin will utilize sheet flow to facilitate flow to proposed temporary swale.

Sub-basin IA-602

Sub-basin IA-602 is the central portion of future lot that is located to the south of the Site. It is one of the 3 sub-basins that drains via temporary swales to the public storm system that discharges into the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed temporary swale. This sub-basin will utilize sheet flow to facilitate flow to proposed temporary swale.

Sub-basin IA-604

Sub-basin IA-604 is the southern portion of future lot that is located to the south of the Site. It is one of the 3 sub-basins that drains via temporary swales to the public storm system that discharges into the full-spectrum detention Pond A on the northeastern corner of the Site adjacent. This sub-basin flows to the proposed temporary swale. This sub-basin will utilize sheet flow to facilitate flow to proposed temporary swale.

The temporary swales convey drainage for drainage basins IA-600 thru IA-604 to a sump Type 13 inlet located at design point IA-6. The emergency overflow path was analyzed in the event of the 100-year storm with the inlet in a fully clogged condition. The stormwater will pond and overtop the local high point (edge of sidewalk) allowing water to flow to the next downstream inlet in the event of the 100-year storm in a fully clogged condition. The local high point (edge of sidewalk) was analyzed as an irregular broad crested weir with the breakout point at elevation 5634.43', the 100-year storm flow passes over the high point at a depth of 0.72' resulting in an elevation of 5635.07' providing more than one-foot of freeboard to the lowest anticipated adjacent home building FFE (EL. 5636.40'). See Section C-C Emergency Overflow Weir computations in **Appendix C** that have been provided and the Overflow Weir Profile on Sheet 6 of the Preliminary Drainage Plan. The Preliminary Drainage Plan displays the ponding depth that would occur at the inlet in the fully clogged condition prior to the breakout point.

Sub-basin O-3

Sub-basin O-3 is 1.97 acres offsite basin located in the southwestern corner of the Site. This basin contains a portion of proposed Harvest Road, proposed Jewell Avenue, and future commercial super-pad parcel. This sub-basin will utilize sheet flow and curb & gutter to flow offsite following historic drainage patterns upon ultimate buildout. This sub-basin conforms with the design intent of the approved Parklands Master Drainage Report.

c. Impervious Table

RATIONAL CALCULATIONS SUMMARY				
DESIGN POINT	TRIBUTARY BASINS	TRIBUTARY AREA (AC)	PEAK FLOWS (CFS)	
			Q2	Q100
On-Site Subbasins Draining to Basin A6 (Pond A)				
A600	A600	2.02	2.06	9.91
A602	A602	0.13	0.24	0.89
A604	A604	0.66	0.86	3.43
A606	A606	0.32	0.45	1.80
A608	A608	0.13	0.24	0.88
A610	A610	0.73	0.95	3.79
A612	A612	0.40	0.53	2.16
A614	A614	0.13	0.23	0.87
A616	A616	0.58	0.82	3.22
A618	A618	1.80	2.15	8.89
A620	A620	0.28	0.50	1.85
A622	A622	1.39	1.72	6.72
A624	A624	0.47	0.80	3.09
A626	A626	0.28	0.50	1.86
A628	A628	1.54	1.96	7.70
A630	A630	0.47	0.80	3.10
A632	A632	0.27	0.49	1.82
A634	A634	2.08	2.32	9.64
A636	A636	0.57	0.61	2.63
A638	A638	0.54	0.55	2.47
A640	A640	0.89	1.16	4.56
A642	A642	1.10	0.61	5.12
A644	A644	0.15	0.27	1.00
A646	A646	0.15	0.28	1.04
A648	A648	0.41	0.67	2.51
A650	A650	0.87	0.81	3.90
A652	A652	1.29	1.29	5.97

A654	A654	1.08	1.24	5.31
A656	A656	2.81	2.47	11.76
Basin A6 - Total		23.54	27.60	117.89
On-Site Subbasins Draining to Basin A5 (Pond A)				
A500	A500	1.71	2.69	9.70
A502	A502	2.13	2.84	11.27
A510	A510	0.77	1.20	4.52
A518	A518	0.74	1.20	4.44
A520	A520	0.59	1.02	3.66
Basin A5 - Total		5.94	8.96	33.58
Off-Site Subbasins Draining to Temporary Swales				
IA600	IA600	19.69	4.50	54.20
IA602	IA602	23.01	5.09	61.30
IA604	IA604	6.42	1.66	19.96

d. Detention Ponds Location & Outfalls

The proposed drainage of the Site will adhere to the existing drainage pattern of the Site. Pond A will ultimately outfall directly into Coal Creek.

Onsite flows within Basin A will be conveyed via public storm drain to the existing full-spectrum detention Pond A located at the northern boundary of Village 1 Filing 1. Basin A has a total tributary area of 202.6 acres with an imperviousness of 68.6%. Pond A has been sized to attenuate the WQCV, EURV and 100-year events, providing 24.06 acre-feet of storage. Note that the project has a reduced imperviousness and tributary area from the V1F1 PDR report and therefore will also remain in compliance with the approved MDR.

After the water has been detained, Pond A will discharge directly into Coal Creek located immediately to the north of the Site. Note that the maximum allowable release rate of 199 cfs for Pond A will remain be met (per approved Master Drainage Report and V1F1 PDR). Pond A also incorporated the use of forebay structures, trickle channels and micropools that were designed in accordance with the Manual. Pond A was designed to retain the required WQCV for at least 40 hrs along with the required EURV and 100-year for 72 hrs.

e. Offsite Water Quality

All water Quality will be provided onsite.

f. Proposed Culverts

No additional solutions to note.

g. Bridge Concepts

Not Applicable

h. Emergency Overflow paths

Emergency Overflow paths are described in sub-basin descriptions (Section 2.B) above.

i. Swale, Ditch, & Open Channel Concepts

There are four trapezoidal grass swales within or adjacent to the site that have been sized using Bentley's FlowMaster to convey the 100-year design storm. All swales include a 2-foot bottom and maximum side slope of 5:1. The swale computations and geometry are provided within Appendix C and provided within the Overflow Cross Sections on Sheet 6 of the Preliminary Drainage Plan. The descriptions of the swale locations are provided below:

Swale 1 – Swale 1 is located on the western side of the site and receives drainage from basin A642. The drainage flows from the south to the north to design point A642.

Swale 2 – Swale 2 is located on the western side of the site and receives drainage from basin IA600. The drainage flows from the south to the north to design point IA6.

Swale 3– Swale 3 is located on the northeastern side of the parcel located south of the site and receives drainage from basin IA600 and IA602. The drainage flows from the south to the north to design point IA6.

Swale 4– Swale 4 is located on the southeastern side of the parcel located south of the site and receives drainage from basin IA600. The drainage flows from the south to the north to design point IA6.

There is a permanent Open Channel A, in compliance with the MDR, that was used to convey stormwater runoff to Pond A. The proposed channel was detailed

in V1F1 PDR and the site is in compliance due to the reduced tributary areas and imperviousness for this site.

j. Geomorphic analysis

Not Applicable to this Design and Report

k. Table of Street & Alley Capacity

Figure 4 A

ALLOWABLE 2-YR FLOW, HALF STREET CAPACITY

Mountable curb with attached walk: water may spread to back of walk
 Mountable curb with detached walk: water may spread to street crown, no overtopping
 Vertical curb & gutter: maximum 6" water depth at flowline, no curb overtopping
 Reduction Factor applied per Figure ST-2 of USDCM, Volume 1

Slope %	Flow Q in cfs									
	Local I	Local II	Local II Alt	Local III	Collector 2-Lane	Collector 2-Lane Alt	Collector 4-Lane	Arterial 4 Ln Raised Med	Arterial 4-Ln Paint Med	Arterial 6 Lane Raised Median
0.5	6.5	4.9	5.5	8.1	8.1	6.6	8.1	8.1	8.1	8.1
1.0	9.2	6.9	7.8	11.5	11.5	9.3	11.5	11.5	11.5	11.5
1.5	11.3	8.4	9.5	14.0	14.0	11.4	14.0	14.0	14.0	14.0
2.0	13.0	9.7	11.0	16.2	16.2	13.1	16.2	16.2	16.2	16.2
2.5	12.6	9.5	10.7	15.8	15.8	12.8	15.8	15.8	15.8	15.8
3.0	11.9	8.9	10.1	14.9	14.9	12.1	14.9	14.9	14.9	14.9
3.5	11.5	8.6	9.7	14.4	14.4	11.6	14.4	14.4	14.4	14.4
4.0	10.8	8.1	9.2	13.5	13.5	11.0	13.5	13.5	13.5	13.5
4.5	10.5	7.9	8.9	13.1	13.1	10.6	13.1	13.1	13.1	13.1
5.0	10.1	7.5	8.5	12.5	12.5	10.2	12.5	12.5	12.5	12.5
5.5	9.9	7.4	8.4	12.4	12.4	10.0	12.4	12.4	12.4	12.4
6.0	9.7	7.2	8.2	12.1	12.1	9.8	12.1	12.1	12.1	12.1
6.5	9.6	7.2	8.1	12.0	12.0	9.7	12.0	n/a	n/a	n/a
7.0	9.2	6.9	7.8	11.5	11.5	9.3	11.5	n/a	n/a	n/a
7.5	9.3	7.0	7.9	11.6	11.6	9.4	11.6	n/a	n/a	n/a
8.0	9.1	6.8	7.7	11.3	11.3	9.2	11.3	n/a	n/a	n/a

9/20/10

Figure 4 B

ALLOWABLE 100-YR FLOW, FULL WIDTH STREET CAPACITY

12" deep at flowline

Theoretical flows computed by Manning formula

Reduction Factor applied per Figure ST-2 of USDCM, Volume 1

Flow Q in cfs

Slope	Local	Local	Local	Local	Collector	Collector	Collector	Arterial 4 Ln	Arterial 4-Ln	Arterial 6 Lane
%	I	II	II Alt	III	2-Lane	2-Lane Alt	4-Lane	Raised Med	Paint Med	Raised Median
0.5	150	141	148	133	143	121	155	156	157	157
1.0	212	199	209	188	202	171	219	221	222	222
1.5	260	244	256	231	247	209	268	270	272	272
2.0	252	237	248	224	240	203	260	262	264	264
2.5	235	221	231	208	224	189	242	244	246	246
3.0	221	207	217	196	210	178	227	229	231	231
3.5	211	198	207	187	200	170	217	219	220	221
4.0	204	191	201	181	194	164	210	212	213	214
4.5	198	186	195	176	189	160	204	206	207	208
5.0	190	178	187	168	181	153	196	197	198	199
5.5	184	173	181	163	175	148	190	191	193	193
6.0	177	166	174	157	168	142	182	184	185	185
6.5	179	168	176	158	170	144	184	n/a	n/a	n/a
7.0	174	163	171	154	166	140	179	n/a	n/a	n/a
7.5	169	158	166	149	160	136	174	n/a	n/a	n/a
8.0	162	152	160	144	154	131	167	n/a	n/a	n/a

I. Permanent SCMs

No permanent SCMs are proposed in this development.

m. Compliance to the Approved MDP

The associated Village 1 Filling 2 PDP complies to the approved MDP.

n. Other Solutions to Problems Encountered

No others to note.

E. Conclusion**1. *Compliance with Standards***

The project complies with the City of Aurora criteria for storm drainage design. City of Aurora Storm Drainage Design and Technical Criteria and the Urban Storm

Drainage Criteria Manual Volumes 1, 2, and 3 have been adhered to in the design of the storm sewer system as well as Best Management Practices.

2. Summary of Concept

The project's runoff generated within the site will be collected using curb and gutter, swales, sheet flow, storm drain systems, and open channels that will convey stormwater runoff to the proposed Pond A. Stormwater will be detained and released at a rate consistent with MHFD and City of Aurora Criteria Manual directly into Coal Creek. The proposed storm drain system will comply with the applicable master plans and outfall systems planning studies as noted previously in this report.

List of References

Storm Drainage Design and Technical Criteria, City of Aurora; November 2023.

Urban Storm Drainage Criteria Manual, Volumes 1-3, Urban Drainage and Flood Control District, Updated August 2018.

Master Drainage Report (EDN 223089); Core Engineers, October 14th, 2022

Flood Insurance Rate Map, Map Number 08005CO204K, Federal Emergency Management Agency; December 17, 2010.

Flood Insurance Rate Map, Map Number 08005CO212K, Federal Emergency Management Agency; December 17, 2010.

Custom Soil Resource Report, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. May 30, 2023.

Appendix A – NCRS Soils Report, Precipitation, Floodplain, and Airport Buffer Info



United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

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

Custom Soil Resource Report for **Arapahoe County, Colorado**



Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Preface	2
How Soil Surveys Are Made	5
Soil Map	8
Soil Map.....	9
Legend.....	10
Map Unit Legend.....	11
Map Unit Descriptions.....	11
Arapahoe County, Colorado.....	13
BxC—Buick loam, 3 to 5 percent slopes.....	13
FdB—Fondis silt loam, 1 to 3 percent slopes.....	14
RhD—Renohill-Buick loams, 3 to 9 percent slopes.....	15
References	18

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

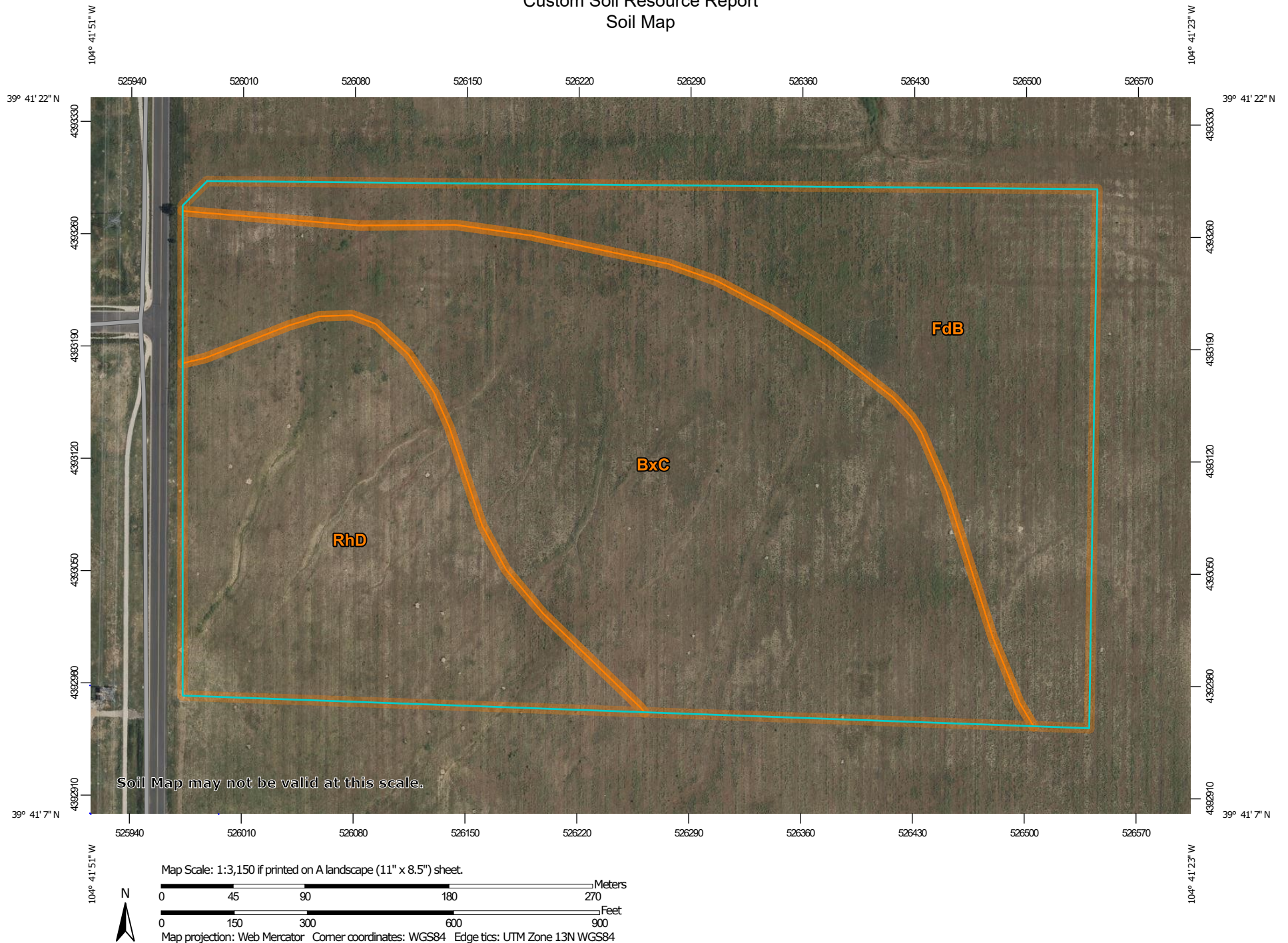
Custom Soil Resource Report

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

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

Custom Soil Resource Report Soil Map




Custom Soil Resource Report

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

 Blowout


 Borrow Pit


 Clay Spot


 Closed Depression

 Gravel Pit


 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water

 Perennial Water

 Rock Outcrop

 Saline Spot

 Sandy Spot

 Severely Eroded Spot


 Sinkhole


 Slide or Slip

 Sodic Spot

 Spoil Area

 Stony Spot


 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

Water Features

 Streams and Canals


Transportation

 Rails


 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Arapahoe County, Colorado
Survey Area Data: Version 19, Aug 24, 2023

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

Date(s) aerial images were photographed: Mar 1, 2023—Sep 1, 2023

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BxC	Buick loam, 3 to 5 percent slopes	22.0	47.5%
FdB	Fondis silt loam, 1 to 3 percent slopes	13.2	28.4%
RhD	Renohill-Buick loams, 3 to 9 percent slopes	11.2	24.2%
Totals for Area of Interest		46.4	100.0%

Map Unit Descriptions

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

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

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

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

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

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

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

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

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

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

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

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

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

Arapahoe County, Colorado

BxC—Buick loam, 3 to 5 percent slopes

Map Unit Setting

National map unit symbol: 34y8
Elevation: 4,700 to 6,200 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 45 to 46 degrees F
Frost-free period: 150 to 170 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Buick and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Buick

Setting

Landform: Drainageways, hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and/or eolian deposits

Typical profile

H1 - 0 to 6 inches: loam
H2 - 6 to 22 inches: clay loam
H3 - 22 to 60 inches: sandy clay loam

Properties and qualities

Slope: 3 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3c
***Hydrologic Soil Group:* C**
Ecological site: R049XB202CO - Loamy Foothill
Hydric soil rating: No

Minor Components

Renohill

Percent of map unit: 5 percent

Custom Soil Resource Report

Hydric soil rating: No

Weld

Percent of map unit: 5 percent

Hydric soil rating: No

Colby

Percent of map unit: 5 percent

Hydric soil rating: No

FdB—Fondis silt loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: 34yh

Elevation: 4,700 to 6,200 feet

Mean annual precipitation: 14 to 16 inches

Mean annual air temperature: 48 to 52 degrees F

Frost-free period: 150 to 170 days

Farmland classification: Prime farmland if irrigated

Map Unit Composition

Fondis and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fondis

Setting

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Silty and/or loamy

Typical profile

H1 - 0 to 7 inches: silt loam

H2 - 7 to 27 inches: clay

H3 - 27 to 60 inches: clay loam

Properties and qualities

Slope: 1 to 3 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 15 percent

Available water supply, 0 to 60 inches: High (about 10.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Custom Soil Resource Report

Land capability classification (nonirrigated): 3c

Hydrologic Soil Group: C

Ecological site: R049XB202CO - Loamy Foothill

Hydric soil rating: No

Minor Components

Weld

Percent of map unit: 10 percent

Hydric soil rating: No

Buick

Percent of map unit: 5 percent

Hydric soil rating: No

RhD—Renohill-Buick loams, 3 to 9 percent slopes

Map Unit Setting

National map unit symbol: 34z0

Elevation: 3,600 to 6,200 feet

Mean annual precipitation: 11 to 16 inches

Mean annual air temperature: 45 to 48 degrees F

Frost-free period: 100 to 170 days

Farmland classification: Not prime farmland

Map Unit Composition

Renohill and similar soils: 65 percent

Buick and similar soils: 25 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Renohill

Setting

Landform: Drainageways

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Loam silty and clayey alluvium

Typical profile

H1 - 0 to 4 inches: loam

H2 - 4 to 18 inches: clay

H3 - 18 to 30 inches: clay loam

H4 - 30 to 34 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 9 percent

Depth to restrictive feature: 20 to 40 inches to paralithic bedrock

Drainage class: Well drained

Runoff class: Medium

Custom Soil Resource Report

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 15 percent

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water supply, 0 to 60 inches: Low (about 5.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: D

Ecological site: R067BY002CO - Loamy Plains

Hydric soil rating: No

Description of Buick

Setting

Landform: Ridges

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Alluvium and/or eolian deposits

Typical profile

H1 - 0 to 4 inches: loam

H2 - 4 to 20 inches: clay loam

H3 - 20 to 60 inches: sandy clay loam

Properties and qualities

Slope: 3 to 8 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 15 percent

Available water supply, 0 to 60 inches: High (about 10.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4c

Hydrologic Soil Group: C

Ecological site: R067BY002CO - Loamy Plains

Hydric soil rating: No

Minor Components

Fondis

Percent of map unit: 5 percent

Hydric soil rating: No

Litle

Percent of map unit: 5 percent

Hydric soil rating: No

References

- American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.
- American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.
- Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.
- Federal Register. July 13, 1994. Changes in hydric soils of the United States.
- Federal Register. September 18, 2002. Hydric soils of the United States.
- Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.
- National Research Council. 1995. Wetlands: Characteristics and boundaries.
- Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262
- Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577
- Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580
- Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.
- United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.
- United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374
- United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. <http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084>

Custom Soil Resource Report

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf



NOAA Atlas 14, Volume 8, Version 2
Location name: Aurora, Colorado, USA*
Latitude: 39.688°, Longitude: -104.693°
Elevation: 5620 ft**

* source: ESRI Maps

** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aerals](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.228 (0.185-0.284)	0.283 (0.229-0.352)	0.381 (0.306-0.475)	0.469 (0.375-0.587)	0.600 (0.467-0.787)	0.709 (0.537-0.938)	0.826 (0.603-1.12)	0.951 (0.666-1.32)	1.13 (0.758-1.60)	1.27 (0.827-1.82)
10-min	0.334 (0.270-0.415)	0.415 (0.335-0.516)	0.558 (0.449-0.695)	0.686 (0.549-0.859)	0.878 (0.685-1.15)	1.04 (0.787-1.37)	1.21 (0.884-1.64)	1.39 (0.974-1.93)	1.65 (1.11-2.34)	1.86 (1.21-2.66)
15-min	0.408 (0.330-0.507)	0.506 (0.409-0.629)	0.680 (0.547-0.848)	0.837 (0.669-1.05)	1.07 (0.835-1.40)	1.27 (0.960-1.68)	1.47 (1.08-1.99)	1.70 (1.19-2.35)	2.02 (1.35-2.86)	2.27 (1.48-3.24)
30-min	0.558 (0.451-0.693)	0.691 (0.558-0.859)	0.926 (0.745-1.16)	1.14 (0.910-1.42)	1.46 (1.13-1.91)	1.72 (1.30-2.27)	2.00 (1.46-2.70)	2.30 (1.61-3.19)	2.73 (1.83-3.87)	3.07 (2.00-4.39)
60-min	0.696 (0.563-0.866)	0.856 (0.691-1.06)	1.14 (0.919-1.42)	1.40 (1.12-1.76)	1.79 (1.40-2.36)	2.12 (1.61-2.81)	2.47 (1.81-3.35)	2.86 (2.00-3.96)	3.40 (2.28-4.82)	3.83 (2.50-5.48)
2-hr	0.835 (0.679-1.03)	1.02 (0.830-1.26)	1.36 (1.10-1.68)	1.66 (1.34-2.07)	2.13 (1.68-2.78)	2.52 (1.93-3.32)	2.95 (2.17-3.96)	3.41 (2.40-4.69)	4.06 (2.75-5.72)	4.59 (3.02-6.50)
3-hr	0.921 (0.752-1.13)	1.12 (0.913-1.38)	1.48 (1.20-1.82)	1.81 (1.46-2.24)	2.31 (1.83-3.01)	2.74 (2.10-3.59)	3.20 (2.37-4.28)	3.70 (2.63-5.07)	4.42 (3.01-6.20)	5.00 (3.30-7.05)
6-hr	1.11 (0.911-1.35)	1.34 (1.10-1.63)	1.75 (1.43-2.14)	2.12 (1.73-2.61)	2.70 (2.14-3.47)	3.18 (2.45-4.12)	3.70 (2.76-4.90)	4.26 (3.04-5.78)	5.06 (3.47-7.03)	5.71 (3.80-7.97)
12-hr	1.36 (1.13-1.65)	1.64 (1.35-1.98)	2.12 (1.75-2.57)	2.55 (2.09-3.11)	3.19 (2.55-4.06)	3.72 (2.89-4.78)	4.29 (3.21-5.62)	4.89 (3.52-6.56)	5.74 (3.97-7.88)	6.42 (4.31-8.89)
24-hr	1.66 (1.38-1.99)	1.99 (1.65-2.39)	2.54 (2.11-3.06)	3.03 (2.49-3.66)	3.73 (2.98-4.67)	4.30 (3.35-5.44)	4.89 (3.68-6.33)	5.51 (3.99-7.31)	6.38 (4.43-8.66)	7.06 (4.77-9.68)
2-day	1.96 (1.64-2.34)	2.33 (1.95-2.78)	2.94 (2.45-3.52)	3.47 (2.88-4.16)	4.22 (3.39-5.22)	4.81 (3.77-6.02)	5.42 (4.11-6.93)	6.05 (4.41-7.93)	6.92 (4.84-9.29)	7.59 (5.18-10.3)
3-day	2.14 (1.80-2.54)	2.52 (2.12-2.99)	3.16 (2.65-3.76)	3.71 (3.09-4.43)	4.49 (3.62-5.53)	5.10 (4.02-6.35)	5.73 (4.36-7.29)	6.38 (4.67-8.32)	7.27 (5.12-9.71)	7.96 (5.46-10.8)
4-day	2.28 (1.92-2.69)	2.67 (2.25-3.16)	3.34 (2.80-3.96)	3.90 (3.26-4.64)	4.70 (3.80-5.77)	5.34 (4.22-6.62)	5.98 (4.57-7.58)	6.66 (4.88-8.64)	7.57 (5.34-10.1)	8.28 (5.69-11.1)
7-day	2.61 (2.21-3.06)	3.04 (2.57-3.57)	3.76 (3.18-4.43)	4.38 (3.67-5.17)	5.24 (4.26-6.37)	5.92 (4.70-7.28)	6.60 (5.07-8.30)	7.32 (5.40-9.42)	8.28 (5.88-10.9)	9.02 (6.24-12.0)
10-day	2.90 (2.47-3.39)	3.36 (2.86-3.94)	4.13 (3.50-4.85)	4.78 (4.02-5.63)	5.68 (4.63-6.88)	6.39 (5.09-7.83)	7.11 (5.48-8.89)	7.84 (5.81-10.0)	8.83 (6.30-11.6)	9.59 (6.67-12.8)
20-day	3.76 (3.22-4.36)	4.30 (3.68-4.99)	5.18 (4.42-6.03)	5.92 (5.01-6.91)	6.92 (5.68-8.29)	7.70 (6.18-9.33)	8.48 (6.59-10.5)	9.27 (6.92-11.7)	10.3 (7.42-13.4)	11.1 (7.80-14.6)
30-day	4.47 (3.84-5.16)	5.09 (4.37-5.88)	6.10 (5.22-7.07)	6.93 (5.90-8.05)	8.05 (6.62-9.57)	8.90 (7.17-10.7)	9.74 (7.59-12.0)	10.6 (7.93-13.3)	11.7 (8.43-15.0)	12.5 (8.81-16.4)
45-day	5.34 (4.60-6.14)	6.11 (5.26-7.02)	7.33 (6.30-8.45)	8.32 (7.10-9.62)	9.62 (7.92-11.3)	10.6 (8.54-12.6)	11.5 (9.01-14.1)	12.4 (9.35-15.5)	13.6 (9.85-17.4)	14.4 (10.2-18.8)
60-day	6.07 (5.24-6.95)	6.98 (6.03-8.00)	8.43 (7.26-9.68)	9.57 (8.20-11.0)	11.1 (9.12-13.0)	12.1 (9.82-14.4)	13.2 (10.3-16.0)	14.2 (10.7-17.6)	15.4 (11.2-19.6)	16.2 (11.6-21.1)

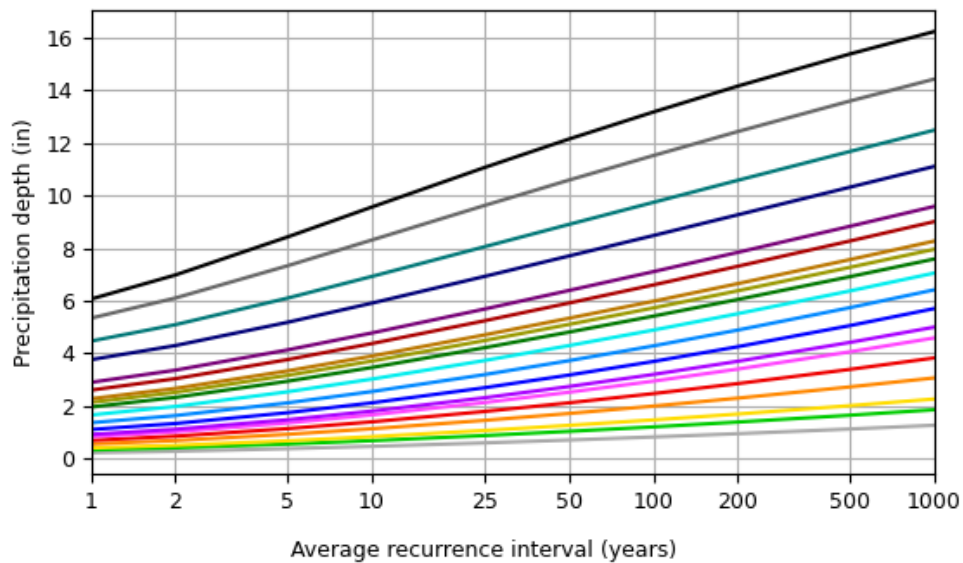
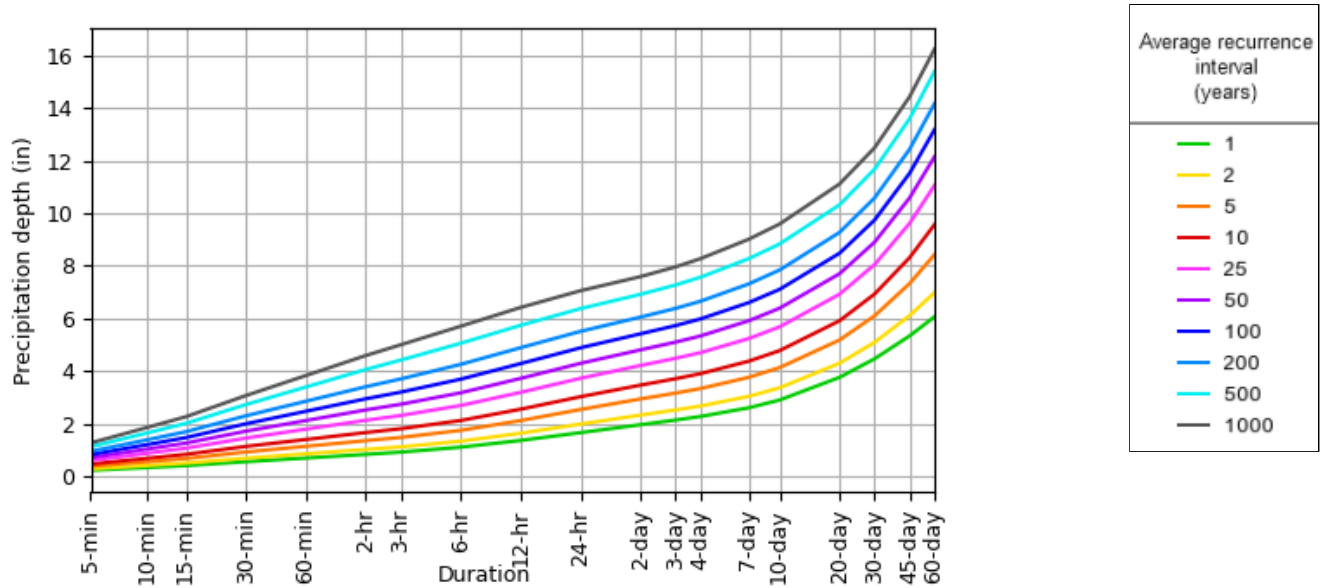
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

[Back to Top](#)

PF graphical

PDS-based depth-duration-frequency (DDF) curves

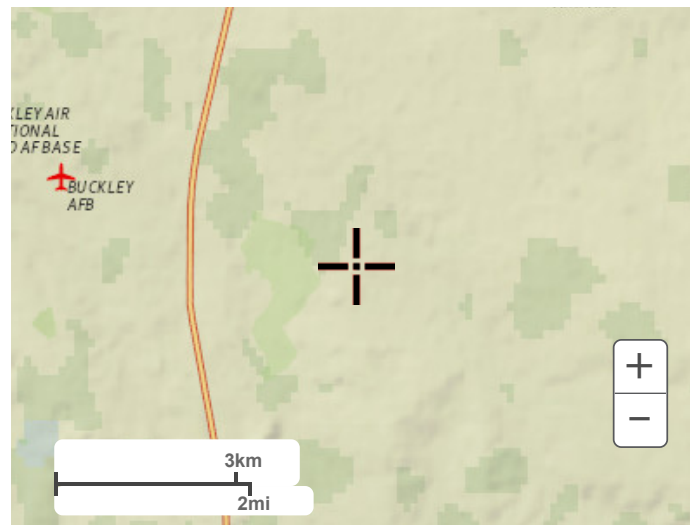
Latitude: 39.6880°, Longitude: -104.6930°



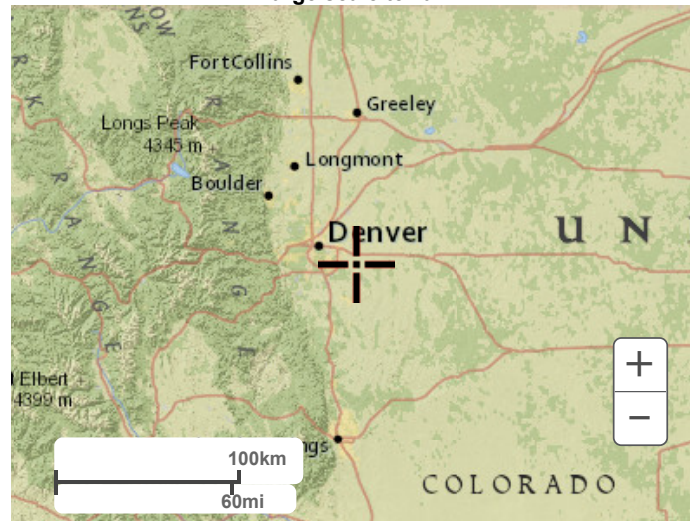
NOAA Atlas 14, Volume 8, Version 2

Created (GMT): Fri Feb 9 00:49:42 2024

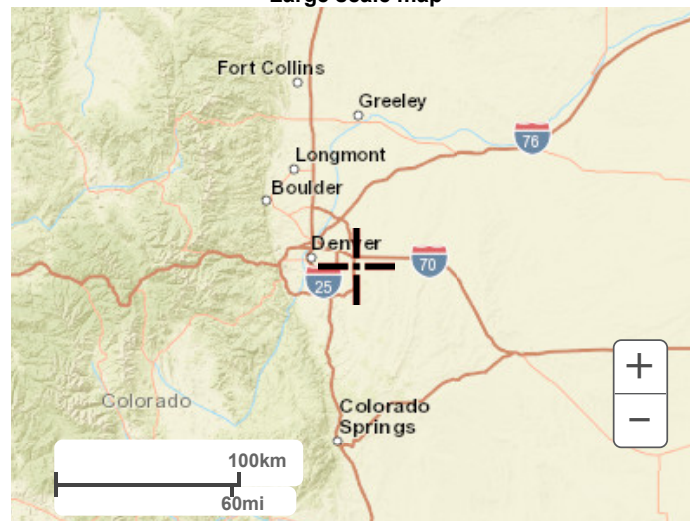
[Back to Top](#)**Maps & aerals****Small scale terrain**



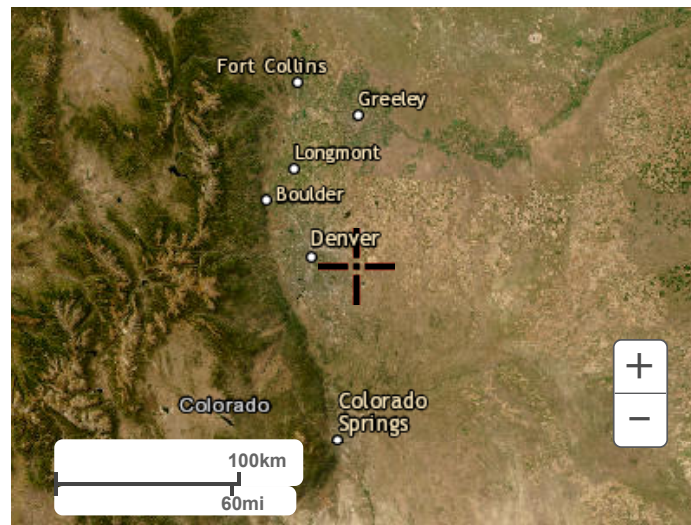
Large scale terrain



Large scale map



Large scale aerial



[Back to Top](#)

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

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 updates or additional flood hazard information.

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

Coastal Base Flood Elevations shown on this map apply only landward of 0.7 North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

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

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

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

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

NGS Information Services
NOAA/NHMS12
National Geodetic Survey
SSM-C-3, #2022
1315 East-West Highway
Silver Spring, MD 20910-3282

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

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

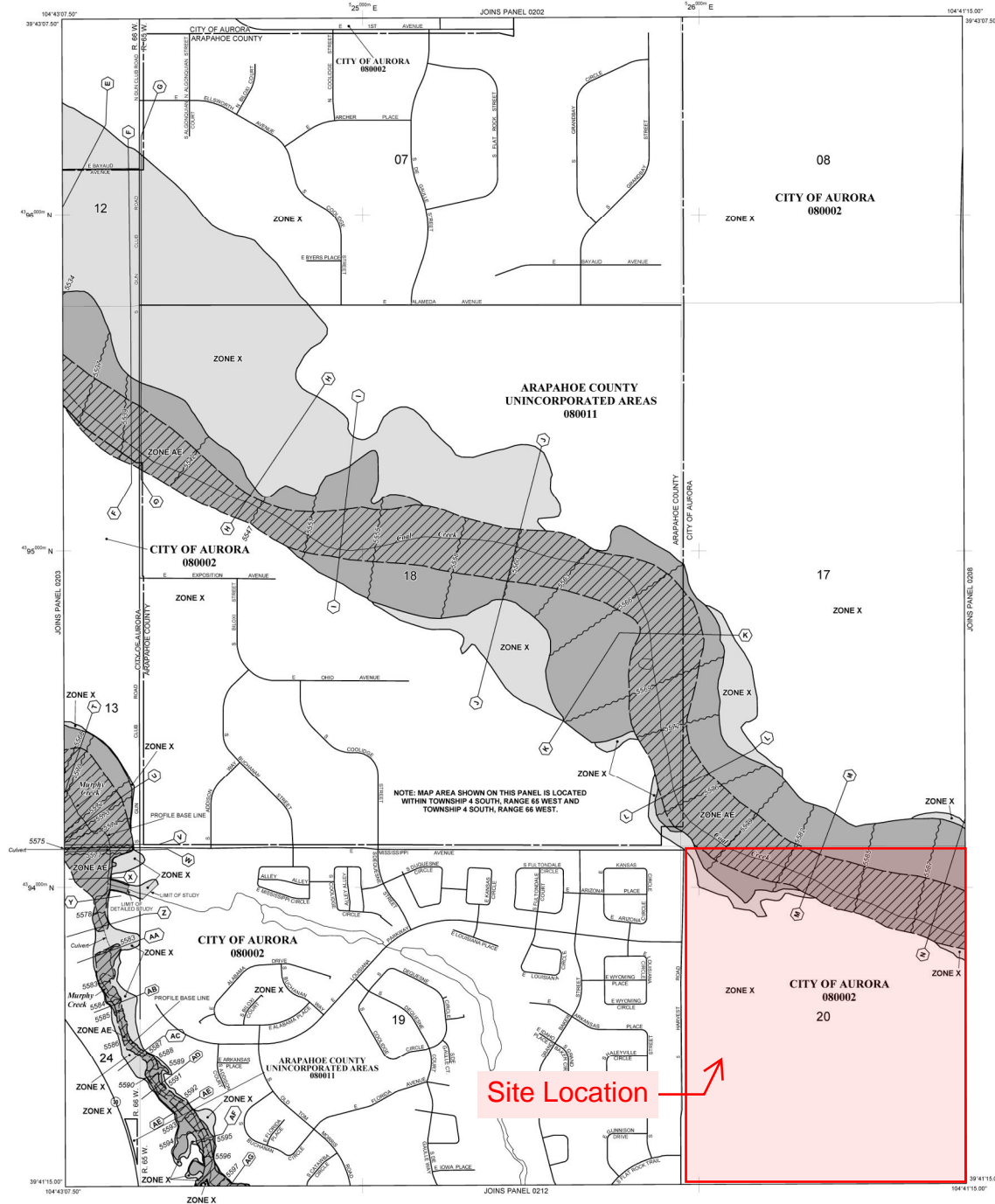
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result,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

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

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

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

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



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHA) 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 equal 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, AV, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.
ZONE AE Base Flood Elevations determined.
ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently identified.

ZONE AV Area to be protected from 1% annual chance flood by a Federal flood control system; 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 (OPA)

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

Floodplain boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary

Boundary dividing Special Flood Hazard Areas of different base flood elevations, flood depths or flood velocities
Base Flood Elevation line and value; elevation in feet
Base Flood Elevation value where uniform within zone; elevation in feet

513 (EL 987)
87°37'30" W 32°32'30" N
6000000 M

Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
1000-meter Universal Transverse Mercator grid ticks; zone 13
5000-foot grid ticks; New York State Plane coordinate system, east zone (FIPSZONE 3101), Transverse Mercator

Bench mark (see explanation in Notes to Users section of this FIRM panel)
MT.5
MAP REPOSITORIES

Refer to Map Repositories list on Map Index.

EFFECTIVE DATE OF COUNTY/STATE FLOOD INSURANCE RATE MAP
April 17, 1989
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
March 1, 1990
December 17, 2010 - to update map format, to change Special Flood Hazard Areas, and to change Base Flood Elevation.

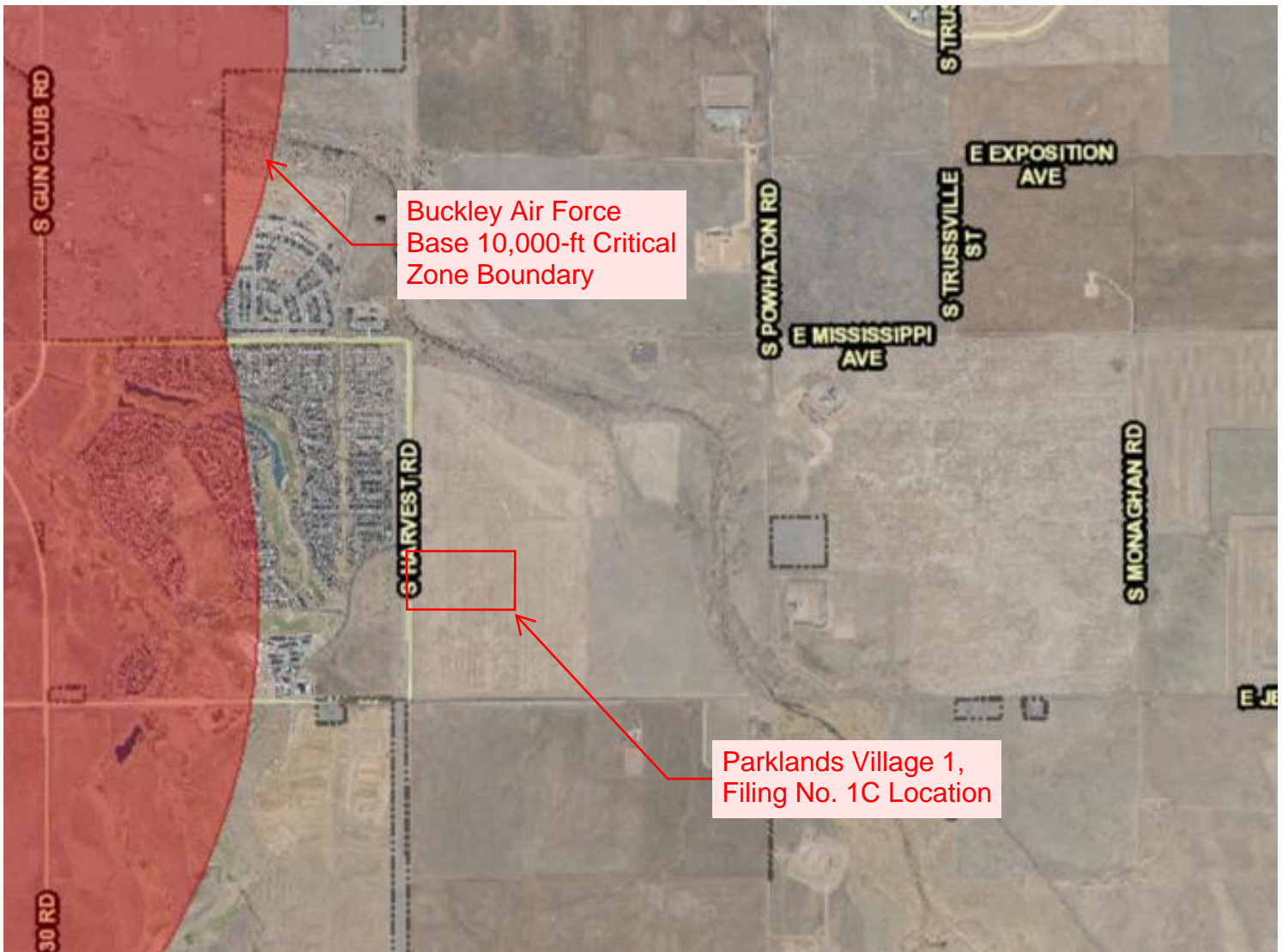
For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-635-6620.

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

NFIP
NATIONAL FLOOD INSURANCE PROGRAM
PANEL 0204K
FIRM
FLOOD INSURANCE RATE MAP
ARAPAHOE COUNTY, COLORADO
AND INCORPORATED AREAS
PANEL 204 OF 725
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
ARAPAHOE COUNTY 080011 0204 K
AURORA, CITY OF 080002 0204 K
Map Number 0800SC0204K
MAP REVISED
DECEMBER 17, 2010
Federal Emergency Management Agency

Buckley Air Force Base
10,000-ft Critical Zone Boundary



Map Not to Scale
GIS Map based on Aurora Open
Data Airport Detention Pond Buffers
Buckley Air Force Base 10,000 ft
Critical Zone

Appendix B – Hydrologic Computations

Table 5-5. Land Use Based Imperviousness Values for Master Planning

Land Use/Density	Recommended Imperviousness* (Roads Included)
Residential	
Rural SFH (0 - 3 du/ac)	35%
Low & Medium-Density SFH (3 - 5 du/ac)	55%
Manufactured Housing (≥ 10 du/ac)	65%
Medium-Density MFH/High Density SFH (5 - 20 du/ac)	65%
High-Density MFH (>20 du/ac)	70%
Commercial	
Low-Density Commercial	65%
Medium- to High-Density Commercial	80%
Urban Core Commercial	90%
Industrial/Institutional	
Schools	55%
Office/Institutional	65%
Industrial Areas	75%
Solar Farm, Gravel Cover ^{*,Δ}	60%
Solar Farm, Grass Cover ^{*,Δ}	45%
Parks and Open Space	
Open Space	5%
Community Parks	25%
Neighborhood Parks	15%
Golf Courses	30%
Cemeteries	25%

* Imperviousness values shown in this table are the minimum imperviousness values for a specific land use for Master Drainage Reports (MDRs) and Master Drainage Plans. For Preliminary Drainage Reports (PDRs), imperviousness values must be calculated based on the surface type per Table 5-6. If the Engineer and/or Master Developer are aware of a proposed product type that would increase the imperviousness values beyond what is in this table, the MDR should take this into account.

Imperviousness values at the PDR stage that exceed those used in the MDR may require an amendment to the MDR (see Chapter 2). If the existing downstream infrastructure has already been constructed based on the lower imperviousness values from the MDR, an increase in imperviousness may not be permitted, or may require approved or in-process plans and/or existing infrastructure to be revised.

* Use these values at the master planning stage when the specific layout of panels is not known. Use the values in Table 5-6 at the site planning and design stages when the orientation of panels relative to contours is known.

Δ Assumes a 1:1 ratio of panels to aisles. See the technical memorandum entitled *Determination of Solar Panel Field Runoff Coefficients and Imperviousness Values* (Earles, Olson, & Howard, 2023) for additional information on procedures to reflect other impervious areas (such as roads and pads that may be part of a solar field) and layouts with wider inter-panel spacing.

At the detailed design and site planning phase for a project, more information is known about the proposed site layout, including the location of buildings, asphalt, sidewalks, pervious areas, and other types of ground cover. At the detailed design stage, the engineer should apply the surface-type-based runoff imperviousness values from Table 5-6 in conjunction with area measurements from Computer-Aided Design (CAD) or Geographic Information System (GIS)

Table 5-6. Imperviousness Values for Urban Surfaces for Site and Small Watershed Analysis

Surface Type		Imperviousness
Paved Streets		95%
Concrete Drive and Walks		95%
Roofs		95%
Gravel	No Traffic Areas (pedestrian use)	40%
	Low Traffic Areas (maintenance paths and substations)	60%
	High Traffic Areas (roadways and parking)	80%
Landscaping (including water-wise vegetation, active turf, uncompacted gravel, planting beds, residential artificial turf, etc.)		20%
Artificial Turf (non-residential)	Landscape applications (with subgrade drainage layer)	25 - 45%
	Sport fields with underdrain pipe system	65%
Open Water Areas, including footprint of WQCV		100%
Solar Panels Gravel Cover, Rows Parallel to Contours*		50%
Solar Panels, Gravel Cover, Rows Diagonal to Contours*		60%
Solar Panels, Gravel Cover, Rows Perpendicular to Contours*		75%
Solar Panels, Grass Cover, Rows Parallel to Contours*		10%
Solar Panels, Grass Cover, Rows Diagonal to Contours*		20%
Solar Panels, Grass Cover, Rows Perpendicular to Contours*		45%
Historic Flow Analysis, Undisturbed Native Grasses, Agricultural		5%
Newly Graded Areas		65%

* Assumes a 1:1 ratio of panels to aisles. See the technical memorandum entitled *Determination of Solar Panel Field Runoff Coefficients and Imperviousness Values* (Earles, Olson, & Howard, 2023) for additional information on procedures to reflect other impervious areas (such as roads and pads that may be part of a solar field) and layouts with wider inter-panel spacing.

5.3.2 Runoff Coefficients for Rational Method

Rational Method runoff coefficients shall be determined using the methodology described in Volume 1, Chapter 6: Runoff of the MHFD Manual. The MHFD methodology uses the imperviousness of a drainage area in conjunction with the hydrologic soil group (HSG) to calculate the runoff coefficient. The imperviousness of the land use/surface type draining to the point of interest should be derived from Table 5-5 or Table 5-6 above (depending on the stage of the design). The HSG may be determined using the Natural Resources Conservation Service's (NRCS's) [Web Soil Survey](#) (Natural Resources Conservation Service). These data may be used alongside the tables, charts, and equations in Volume 1, Chapter 6: Runoff of the MHFD Manual to determine runoff coefficients for the Rational Method.

Table 5-7 provides equations for calculating runoff coefficients based on the most up to date information from the MHFD Manual as of the date of publication of this Manual. It is the responsibility of the applicant to confirm that the most current runoff coefficient equations from MHFD are used.

Table 5-7. Runoff Coefficient Equations Based on NRCS Soil Group and Storm Return Period²⁶

NRCS Soil Group	Storm Return Period						
	2-year	5-year	10-year	25-year	50-year	100-year	500-year
A	$C_A = 0.84i^{1.302}$	$C_A = 0.86i^{1.276}$	$C_A = 0.87i^{1.232}$	$C_A = 0.88i^{1.124}$	$C_A = 0.85i + 0.025$	$C_A = 0.78i + 0.110$	$C_A = 0.65i + 0.254$
B	$C_B = 0.84i^{1.169}$	$C_B = 0.86i^{1.088}$	$C_B = 0.81i + 0.057$	$C_B = 0.63i + 0.249$	$C_B = 0.56i + 0.328$	$C_B = 0.47i + 0.426$	$C_B = 0.37i + 0.536$
C/D	$C_{C/D} = 0.83i^{1.122}$	$C_{C/D} = 0.82i + 0.035$	$C_{C/D} = 0.74i + 0.132$	$C_{C/D} = 0.56i + 0.319$	$C_{C/D} = 0.49i + 0.393$	$C_{C/D} = 0.41i + 0.484$	$C_{C/D} = 0.32i + 0.588$

Where:

i = % imperviousness (expressed as a decimal)

C_A = Runoff coefficient for Natural Resources Conservation Service (NRCS) HSG A soils

C_B = Runoff coefficient for NRCS HSG B soils

$C_{C/D}$ = Runoff coefficient for NRCS HSG C and D soils.

²⁶ Table 5-7 is a reproduction of Table 6-4 in Volume 1, Chapter 6: Runoff of the MHFD Manual as of the date of publication of this Manual (Mile High Flood District, latest edition). Note that the most up-to-date equations and methodology per the MHFD Manual shall be used to calculate runoff coefficients.



STANDARD FORM SF-1
RUNOFF COEFFICIENTS - IMPERVIOUS CALCULATION

PROJECT NAME: Parklands - Village 1 Filing No. 2
PROJECT NUMBER: 196480001
CALCULATED BY: BAW
CHECKED BY: LNS

DATE: MAY 2024

SOIL: C/D

		Paved Streets	Concrete Drive and Walks	Roofs	Gravel - Pedestrian Use	Gravel - Maintenance Paths	Landscaping	Open Water & WQCV	Native Grasses & Open Space	Single-Family (High Density)	Multi-Family (Medium Density)	Commerical (Medium to High Density)	School	Neighborhood Parks						
LAND USE:		AREA	AREA	AREA	AREA	AREA	AREA	AREA	AREA	AREA	AREA	AREA	AREA	AREA						
2-YEAR COEFF.		0.78	0.78	0.78	0.30	0.47	0.14	0.83	0.03	0.51	0.51	0.65	0.42	0.10						
5-YEAR COEFF.		0.81	0.81	0.81	0.36	0.53	0.20	0.86	0.08	0.57	0.57	0.69	0.49	0.16						
10-YEAR COEFF.		0.84	0.84	0.84	0.43	0.58	0.28	0.87	0.17	0.61	0.61	0.72	0.54	0.24						
100-YEAR COEFF.		0.87	0.87	0.87	0.65	0.73	0.57	0.89	0.50	0.75	0.75	0.81	0.71	0.55						
IMPERVIOUS %		95%	95%	95%	40%	60%	20%	100%	5%	65%	65%	80%	55%	15%						
DESIGN BASIN	DESIGN POINT	Paved Streets AREA (AC)	Concrete Drive and Walks AREA (AC)	Roofs AREA (AC)	Gravel - Pedestrian Use AREA (AC)	Gravel - Maintenance Paths AREA (AC)	Landscaping AREA (AC)	Open Water & WQCV AREA (AC)	Native Grasses & Open Space AREA (AC)	Single-Family (High Density) AREA (AC)	Multi-Family (Medium Density) AREA (AC)	Commerical (Medium to High Density) AREA (AC)	School AREA (AC)	Neighborhood Parks AREA (AC)	TOTAL AREA (AC)	C(2)	C(5)	C(10)	C(100)	Imp %
On-Site Subbasins to Basin A6																				
A600	A600	0.00	0.45	0.48	0.00	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.52	2.02	0.42	0.47	0.53	0.70	53.1%
A602	A602	0.05	0.04	0.01	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.62	0.66	0.70	0.80	76.4%
A604	A604	0.05	0.23	0.15	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.66	0.56	0.60	0.64	0.76	68.5%
A606	A606	0.00	0.13	0.08	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.55	0.59	0.64	0.76	68.3%
A608	A608	0.05	0.04	0.01	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.62	0.66	0.70	0.80	76.2%
A610	A610	0.05	0.25	0.18	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.73	0.55	0.60	0.64	0.76	68.5%
A612	A612	0.00	0.15	0.11	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.55	0.59	0.63	0.76	67.5%
A614	A614	0.05	0.04	0.01	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.62	0.66	0.69	0.80	75.9%
A616	A616	0.05	0.19	0.15	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.57	0.61	0.65	0.77	70.3%
A618	A618	0.15	0.49	0.46	0.00	0.00	0.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.80	0.53	0.57	0.62	0.75	65.4%
A620	A620	0.13	0.07	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.62	0.66	0.70	0.80	76.3%
A622	A622	0.00	0.46	0.47	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.39	0.57	0.61	0.65	0.77	70.5%
A624	A624	0.15	0.11	0.07	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.47	0.59	0.63	0.67	0.78	72.3%
A626	A626	0.13	0.07	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.62	0.66	0.70	0.80	76.3%
A628	A628	0.00	0.50	0.53	0.00	0.00	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.54	0.57	0.61	0.65	0.77	70.1%
A630	A630	0.15	0.11	0.07	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.47	0.59	0.63	0.67	0.78	72.3%
A632	A632	0.12	0.08	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.63	0.67	0.70	0.80	77.0%
A634	A634	0.00	0.64	0.61	0.00	0.00	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.13	2.08	0.52	0.57	0.61	0.75	64.8%
A636	A636	0.00	0.23	0.09	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.57	0.50	0.54	0.59	0.74	61.8%
A638	A638	0.00	0.18	0.11	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.54	0.47	0.51	0.56	0.72	58.5%
A640	A640	0.11	0.28	0.21	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.57	0.61	0.65	0.77	70.1%
A642	A642	0.00	0.07	0.05	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.10	0.21	0.26	0.34	0.60	28.0%
A644	A644	0.07	0.05	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.63	0.67	0.71	0.80	77.7%
A646	A646	0.07	0.05	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.63	0.67	0.71	0.80	77.7%
A648	A648	0.20	0.11	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.62	0.66	0.70	0.80	76.3%
A650	A650	0.00	0.19	0.20	0.00	0.00	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.87	0.43	0.47	0.53	0.70	53.6%
BASIN A6 TOTAL		1.94	6.28	5.11	0.00	0.00	8.80	0.00	0.00	0.00	0.00	0.00	0.00	1.41	23.54	0.50	0.54	0.59	0.74	62.2%
		8%	27%	22%	0%	0%	37%	0%	0%	0%	0%	0%	0%	6%	100%					
On-Site Subbasins to Basin A5																				
A500	A500	1.01	0.36	0.00	0.00	0.00	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.71	0.65	0.69	0.72	0.81	80.0%
A502	A502	0.78	0.38	0.23	0.00	0.00	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.13	0.56	0.60	0.65	0.77	69.3%
A510	A510	0.33	0.15	0.08	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.77	0.61	0.65	0.69	0.79	75.1%
A518	A518	0.36	0.13	0.00	0.00	0.00	0.12	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.74	0.63	0.67	0.70	0.80	77.3%
A520	A520	0.35	0.12	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.59	0.65	0.69	0.72	0.81	80.0%
Off-Site Subbasins to Temporary Swales																				
IA600	IA600	0.00	0.00	0.00	0.00	0.00	19.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.69	0.14	0.20	0.28	0.57	20.0%
IA602	IA602	0.00	0.00	0.00	0.00	0.00	23.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.01	0.14	0.20	0.28	0.57	20.0%
IA604	IA604	0.00	0.00	0.00	0.00	0.00	6.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.42	0.14	0.20	0.28	0.57	20.0%

STANDARD FORM SF-2
Time of Concentration

PROJECT NAME:		Parklands - Village 1 Filing No. 2										DATE:		MAY 2024	
PROJECT NUMBER:		196480001													
CALCULATED BY:		BAW													
CHECKED BY:		LNS													
SUB-BASIN DATA			INITIAL TIME (T _i)			TRAVEL TIME (T _t)					T _c CHECK (URBANIZED BASINS)			FINAL T _c	
DESIGN	AREA	C5	LENGTH	SLOPE	T _i	LENGTH	SLOPE	C _v	VEL	T _t	COMP.	TOTAL	T _c		
BASIN	Ac		Ft	ft/ft	Min.	Ft.	ft/ft		fps	Min.	t _c	LENGTH	Min.	Min.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(11)	(12)	(13)	(14)	(17)		
On-Site Subbasins to Basin A6															
A600	2.02	0.471	150	0.055	8.0	120	0.010	20.0	2.0	1.0	9.0	270	11.5	9.0	
A602	0.13	0.661	25	0.045	2.4	130	0.030	20.0	3.5	0.6	3.1	155	10.9	5.0	
A604	0.66	0.597	130	0.020	8.3	220	0.020	20.0	2.8	1.3	9.6	350	11.9	9.6	
A606	0.32	0.595	150	0.030	7.9	40	0.030	20.0	3.5	0.2	8.1	190	11.1	8.1	
A608	0.13	0.660	30	0.043	2.7	130	0.035	20.0	3.7	0.6	3.3	160	10.9	5.0	
A610	0.73	0.596	130	0.020	8.4	220	0.020	20.0	2.8	1.3	9.7	350	11.9	9.7	
A612	0.40	0.589	175	0.030	8.6	30	0.040	20.0	4.0	0.1	8.7	205	11.1	8.7	
A614	0.13	0.658	30	0.050	2.6	130	0.043	20.0	4.1	0.5	3.1	160	10.9	5.0	
A616	0.58	0.612	155	0.030	7.7	130	0.043	20.0	4.1	0.5	8.3	285	11.6	8.3	
A618	1.80	0.571	215	0.040	9.0	420	0.047	20.0	4.3	1.6	10.6	635	13.5	10.6	
A620	0.28	0.660	24	0.050	2.3	350	0.047	20.0	4.3	1.3	3.7	374	12.1	5.0	
A622	1.39	0.613	350	0.032	11.4	120	0.043	20.0	4.1	0.5	11.9	470	12.6	11.9	
A624	0.47	0.628	35	0.100	2.4	390	0.039	20.0	3.9	1.7	4.0	425	12.4	5.0	
A626	0.28	0.660	30	0.035	2.9	380	0.039	20.0	3.9	1.6	4.5	410	12.3	5.0	
A628	1.54	0.610	320	0.037	10.4	90	0.031	20.0	3.5	0.4	10.8	410	12.3	10.8	
A630	0.47	0.628	35	0.100	2.4	390	0.030	20.0	3.5	1.9	4.3	425	12.4	5.0	
A632	0.27	0.667	35	0.033	3.2	370	0.030	20.0	3.5	1.8	5.0	405	12.3	5.0	
A634	2.08	0.567	140	0.020	9.2	400	0.013	20.0	2.2	3.0	12.2	540	13.0	12.2	
A636	0.57	0.542	175	0.020	10.7	140	0.014	20.0	2.4	1.0	11.7	315	11.8	11.7	
A638	0.54	0.515	150	0.020	10.4	160	0.014	20.0	2.4	1.1	11.6	310	11.7	11.6	
A640	0.89	0.610	160	0.020	9.0	185	0.014	20.0	2.4	1.3	10.3	345	11.9	10.3	
A642	1.10	0.265	40	0.200	3.6	725	0.040	20.0	4.0	3.0	6.6	765	14.3	6.6	
A644	0.15	0.672	20	0.028	2.5	185	0.025	20.0	3.2	1.0	3.5	205	11.1	5.0	
A646	0.15	0.672	30	0.033	2.9	210	0.030	20.0	3.5	1.0	3.9	240	11.3	5.0	
A648	0.41	0.660	20	0.025	2.7	540	0.012	20.0	2.2	4.1	6.8	560	13.1	6.8	
A650	0.87	0.474	200	0.020	12.9	20	0.033	20.0	3.6	0.1	13.0	220	11.2	11.2	
A652	1.29	0.493	220	0.050	9.6	225	0.026	20.0	3.2	1.2	10.8	445	12.5	10.8	
A654	1.08	0.543	205	0.040	9.2	185	0.026	20.0	3.2	1.0	10.2	390	12.2	10.2	
A656	2.81	0.478	220	0.065	9.1	570	0.012	20.0	2.2	4.3	13.4	790	14.4	13.4	
On-Site Subbasins to Basin A5															
A500	1.71	0.691	35	0.025	3.3	852	0.016	20.0	2.5	5.7	9.0	887	14.9	9.0	
A502	2.13	0.604	35	0.025	4.0	800	0.016	20.0	2.5	5.3	9.3	835	14.6	9.3	
A510	0.77	0.651	77	0.046	4.4	474	0.015	20.0	2.5	3.2	7.5	551	13.1	7.5	
A518	0.74	0.669	33	0.020	3.6	648	0.021	20.0	2.9	3.8	7.4	681	13.8	7.4	
A520	0.59	0.691	33	0.020	3.4	633	0.021	20.0	2.9	3.7	7.1	666	13.7	7.1	
On-Site Subbasins to Temporary Swales															
IA600	19.69	0.199	500	0.023	28.0	1,320	0.033	7.0	1.3	17.4	45.3	1820	20.1	20.1	
IA602	23.01	0.199	500	0.016	31.8	1,550	0.032	7.0	1.3	20.6	52.3	2050	21.4	21.4	
IA604	6.42	0.199	500	0.049	21.7	540	0.037	7.0	1.4	6.6	28.4	1040	15.8	15.8	

STANDARD FORM SF-3
STORM DRAINAGE DESIGN - RATIONAL METHOD 2 YEAR EVENT

PROJECT NAME: Parklands - Village 1 Filing No. 2

DATE: MAY 2024

PROJECT NUMBER: 196480001

P₁ (1-Hour Rainfall) = 0.86

CALCULATED BY: BAW

CHECKED BY: LNS

STORM LINE	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		DESIGN BASIN	AREA (AC)	RUNOFF COEFF	t _c (min)	C*A(ac)	I (in/hr)	Q (cfs)	t _c (max)	S(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs)	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCIT Y	t _t (min)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)

On-Site Subbasins to Basin A6

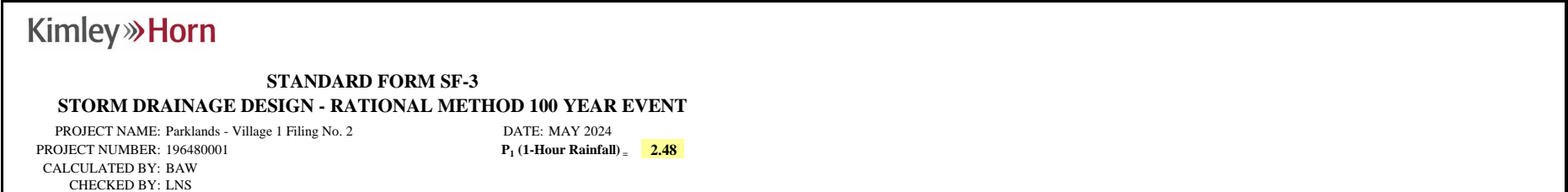
		A600	A600	2.02	0.42	9.01	0.86	2.41	2.06												
		A602	A602	0.13	0.62	5.00	0.08	2.90	0.24												
		A604	A604	0.66	0.56	9.65	0.37	2.35	0.86												
		A606	A606	0.32	0.55	8.06	0.18	2.51	0.45												
		A608	A608	0.13	0.62	5.00	0.08	2.90	0.24												
		A610	A610	0.73	0.55	9.65	0.40	2.35	0.95												
		A612	A612	0.40	0.55	8.72	0.22	2.44	0.53												
		A614	A614	0.13	0.62	5.00	0.08	2.90	0.23												
		A616	A616	0.58	0.57	8.26	0.33	2.49	0.82												
		A618	A618	1.80	0.53	10.57	0.95	2.26	2.15												
		A620	A620	0.28	0.62	5.00	0.17	2.90	0.50												
		A622	A622	1.39	0.57	11.87	0.80	2.16	1.72												
		A624	A624	0.47	0.59	5.00	0.28	2.90	0.80												
		A626	A626	0.28	0.62	5.00	0.17	2.90	0.50												
		A628	A628	1.54	0.57	10.83	0.87	2.24	1.96												
		A630	A630	0.47	0.59	5.00	0.28	2.90	0.80												
		A632	A632	0.27	0.63	5.00	0.17	2.90	0.49												
		A634	A634	2.08	0.52	12.16	1.09	2.13	2.32												
		A636	A636	0.57	0.50	11.73	0.28	2.17	0.61												
		A638	A638	0.54	0.47	11.56	0.25	2.18	0.55												
		A640	A640	0.89	0.57	10.33	0.51	2.28	1.16												
		A642	A642	1.10	0.21	6.61	0.23	2.68	0.61												
		A644	A644	0.15	0.63	5.00	0.09	2.90	0.27												
		A646	A646	0.15	0.63	5.00	0.10	2.90	0.28												
		A648	A648	0.41	0.62	6.76	0.25	2.66	0.67												
		A650	A650	0.87	0.43	11.22	0.37	2.21	0.81												
		A652	A652	1.29	0.45	10.81	0.57	2.24	1.29												
		A654	A654	1.08	0.50	10.17	0.54	2.30	1.24												
		A656	A656	2.81	0.43	13.41	1.21	2.04	2.47												

Off-Site Subbasins to Basin L1

		A500	A500	1.71	0.65	8.98	1.12	2.41	2.69												
		A502	A502	2.13	0.56	9.33	1.20	2.38	2.84												
		A510	A510	0.77	0.61	7.54	0.47	2.56	1.20												
		A518	A518	0.74	0.63	7.35	0.46	2.59	1.20												
		A520	A520	0.59	0.65	7.08	0.39	2.62	1.02												

Off-Site Subbasins to Temporary Swales

		IA600	IA600	19.69	0.14	20.11	2.69	1.68	4.50												
		IA602	IA602	23.01	0.14	21.39	3.14	1.62	5.09												
		IA604	IA604	6.42	0.14	15.78	0.88	1.89	1.66												K:\DEN_Civil\196480001_Parklands Village 1_\Project Files\Eng\Drainage\Filing 1C\Preliminary Drainage Report\Appendix



STORM DRAINAGE DESIGN - RATIONAL METHOD 100 YEAR EVENT

PROJECT NAME: Parklands - Village 1 Filing No. 2 DATE: MAY 2024

PROJECT NUMBER: 196480001 **P₁ (1-Hour Rainfall) = 2.48**

CALCULATED BY: BAW

CHECKED BY: LNS

PROJECT NUMBER: 196480001 P₁ (1-Hour Rainfall) = 2.48

CALCULATED BY: BAW

CHECKED BY: LNS

PROJECT NUMBER: 196480001 P₁ (1-Hour Rainfall) = 2.48

CALCULATED BY: BAW

CHECKED BY: LNS

PROJECT NUMBER: 196480001 P₁ (1-Hour Rainfall) = 2.48

CALCULATED BY: BAW

CHECKED BY: LNS

PROJECT NUMBER: 196480001 P₁ (1-Hour Rainfall) = 2.48

CALCULATED BY: BAW

CHECKED BY: LNS

PROJECT NUMBER: 196480001 P₁ (1-Hour Rainfall) = 2.48

CALCULATED BY: BAW

CHECKED BY: LNS

[illegible]

On-Site Subbasins to Basin A6

[illegible]

On-Site Subbasins to Basin A5

[illegible]

Off-Site Subbasins to Temporary Swales

[illegible]

PROJECT NAME: Parklands - Village 1 Filing No. 2
 PROJECT NUMBER: 196480001
 CALCULATED BY: BAW
 CHECKED BY: LNS

DATE: MAY 2024

RATIONAL CALCULATIONS SUMMARY

DESIGN POINT	TRIBUTARY BASINS	TRIBUTARY AREA (AC)	PEAK FLOWS (CFS)	
			Q2	Q100
On-Site Subbasins Draining to Basin A6 (Pond A)				
A600	A600	2.02	2.06	9.91
A602	A602	0.13	0.24	0.89
A604	A604	0.66	0.86	3.43
A606	A606	0.32	0.45	1.80
A608	A608	0.13	0.24	0.88
A610	A610	0.73	0.95	3.79
A612	A612	0.40	0.53	2.16
A614	A614	0.13	0.23	0.87
A616	A616	0.58	0.82	3.22
A618	A618	1.80	2.15	8.89
A620	A620	0.28	0.50	1.85
A622	A622	1.39	1.72	6.72
A624	A624	0.47	0.80	3.09
A626	A626	0.28	0.50	1.86
A628	A628	1.54	1.96	7.70
A630	A630	0.47	0.80	3.10
A632	A632	0.27	0.49	1.82
A634	A634	2.08	2.32	9.64
A636	A636	0.57	0.61	2.63
A638	A638	0.54	0.55	2.47
A640	A640	0.89	1.16	4.56
A642	A642	1.10	0.61	5.12
A644	A644	0.15	0.27	1.00
A646	A646	0.15	0.28	1.04
A648	A648	0.41	0.67	2.51
A650	A650	0.87	0.81	3.90
A652	A652	1.29	1.29	5.97
A654	A654	1.08	1.24	5.31
A656	A656	2.81	2.47	11.76
Basin A6 - Total		23.54	27.60	117.89
On-Site Subbasins Draining to Basin A5 (Pond A)				
A500	A500	1.71	2.69	9.70
A502	A502	2.13	2.84	11.27
A510	A510	0.77	1.20	4.52
A518	A518	0.74	1.20	4.44
A520	A520	0.59	1.02	3.66
Basin A5 - Total		5.94	8.96	33.58
Off-Site Subbasins Draining to Temporary Swales				
IA600	IA600	19.69	4.50	54.20
IA602	IA602	23.01	5.09	61.30
IA604	IA604	6.42	1.66	19.96

Appendix C – Hydraulic Computations

V1F2 Swale 1 - West

Project Description	
Friction Method	Manning
Solve For	Formula
	Normal Depth
Input Data	
Roughness Coefficient	0.069
Channel Slope	2.000 %
Left Side Slope	5.000 H:V
Right Side Slope	5.000 H:V
Bottom Width	2.00 ft
Discharge	5.12 cfs
Results	
Normal Depth	7.5 in
Flow Area	3.2 ft ²
Wetted Perimeter	8.4 ft
Hydraulic Radius	4.6 in
Top Width	8.24 ft
Critical Depth	5.0 in
Critical Slope	10.832 %
Velocity	1.60 ft/s
Velocity Head	0.04 ft
Specific Energy	0.66 ft
Froude Number	0.454
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	7.5 in
Critical Depth	5.0 in
Channel Slope	2.000 %
Critical Slope	10.832 %

V1F2 Swale 2 - South

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.069
Channel Slope	2.000 %
Left Side Slope	5.000 H:V
Right Side Slope	5.000 H:V
Bottom Width	2.00 ft
Discharge	54.20 cfs
Results	
Normal Depth	20.8 in
Flow Area	18.5 ft ²
Wetted Perimeter	19.7 ft
Hydraulic Radius	11.3 in
Top Width	19.36 ft
Critical Depth	15.7 in
Critical Slope	7.850 %
Velocity	2.92 ft/s
Velocity Head	0.13 ft
Specific Energy	1.87 ft
Froude Number	0.527
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	20.8 in
Critical Depth	15.7 in
Channel Slope	2.000 %
Critical Slope	7.850 %

V1F2 Swale 3 - East 1

Project Description	
Friction Method	Manning
Solve For	Formula
	Normal Depth
Input Data	
Roughness Coefficient	0.069
Channel Slope	1.680 %
Left Side Slope	5.000 H:V
Right Side Slope	5.000 H:V
Bottom Width	2.00 ft
Discharge	81.27 cfs
Results	
Normal Depth	25.5 in
Flow Area	26.8 ft ²
Wetted Perimeter	23.7 ft
Hydraulic Radius	13.6 in
Top Width	23.23 ft
Critical Depth	18.8 in
Critical Slope	7.436 %
Velocity	3.03 ft/s
Velocity Head	0.14 ft
Specific Energy	2.27 ft
Froude Number	0.498
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	25.5 in
Critical Depth	18.8 in
Channel Slope	1.680 %
Critical Slope	7.436 %

V1F2 Swale 4 - East 2

Project Description	
Friction Method	Manning
Solve For	Formula
	Normal Depth
Input Data	
Roughness Coefficient	0.069
Channel Slope	1.680 %
Left Side Slope	5.000 H:V
Right Side Slope	5.000 H:V
Bottom Width	2.00 ft
Discharge	19.96 cfs
Results	
Normal Depth	14.2 in
Flow Area	9.4 ft ²
Wetted Perimeter	14.1 ft
Hydraulic Radius	8.0 in
Top Width	13.84 ft
Critical Depth	9.9 in
Critical Slope	8.979 %
Velocity	2.13 ft/s
Velocity Head	0.07 ft
Specific Energy	1.25 ft
Froude Number	0.456
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	14.2 in
Critical Depth	9.9 in
Channel Slope	1.680 %
Critical Slope	8.979 %

Figure 4 A

ALLOWABLE 2-YR FLOW, HALF STREET CAPACITY

Mountable curb with attached walk: water may spread to back of walk
 Mountable curb with detached walk: water may spread to street crown, no overtopping
 Vertical curb & gutter: maximum 6" water depth at flowline, no curb overtopping
 Reduction Factor applied per Figure ST-2 of USDCM, Volume 1

Flow Q in cfs										
Slope	Local	Local	Local	Local	Collector	Collector	Collector	Arterial 4 Ln	Arterial 4-Ln	Arterial 6 Lane
%	I	II	II Alt	III	2-Lane	2-Lane Alt	4-Lane	Raised Med	Paint Med	Raised Median
0.5	6.5	4.9	5.5	8.1	8.1	6.6	8.1	8.1	8.1	8.1
1.0	9.2	6.9	7.8	11.5	11.5	9.3	11.5	11.5	11.5	11.5
1.5	11.3	8.4	9.5	14.0	14.0	11.4	14.0	14.0	14.0	14.0
2.0	13.0	9.7	11.0	16.2	16.2	13.1	16.2	16.2	16.2	16.2
2.5	12.6	9.5	10.7	15.8	15.8	12.8	15.8	15.8	15.8	15.8
3.0	11.9	8.9	10.1	14.9	14.9	12.1	14.9	14.9	14.9	14.9
3.5	11.5	8.6	9.7	14.4	14.4	11.6	14.4	14.4	14.4	14.4
4.0	10.8	8.1	9.2	13.5	13.5	11.0	13.5	13.5	13.5	13.5
4.5	10.5	7.9	8.9	13.1	13.1	10.6	13.1	13.1	13.1	13.1
5.0	10.1	7.5	8.5	12.5	12.5	10.2	12.5	12.5	12.5	12.5
5.5	9.9	7.4	8.4	12.4	12.4	10.0	12.4	12.4	12.4	12.4
6.0	9.7	7.2	8.2	12.1	12.1	9.8	12.1	12.1	12.1	12.1
6.5	9.6	7.2	8.1	12.0	12.0	9.7	12.0	n/a	n/a	n/a
7.0	9.2	6.9	7.8	11.5	11.5	9.3	11.5	n/a	n/a	n/a
7.5	9.3	7.0	7.9	11.6	11.6	9.4	11.6	n/a	n/a	n/a
8.0	9.1	6.8	7.7	11.3	11.3	9.2	11.3	n/a	n/a	n/a

Figure 4 B

ALLOWABLE 100-YR FLOW, FULL WIDTH STREET CAPACITY

12" deep at flowline

Theoretical flows computed by Manning formula

Reduction Factor applied per Figure ST-2 of USDCM, Volume 1

Flow Q in cfs

Slope	Local	Local	Local	Local	Collector	Collector	Collector	Arterial 4 Ln	Arterial 4-Ln	Arterial 6 Lane
%	I	II	II Alt	III	2-Lane	2-Lane Alt	4-Lane	Raised Med	Paint Med	Raised Median
0.5	150	141	148	133	143	121	155	156	157	157
1.0	212	199	209	188	202	171	219	221	222	222
1.5	260	244	256	231	247	209	268	270	272	272
2.0	252	237	248	224	240	203	260	262	264	264
2.5	235	221	231	208	224	189	242	244	246	246
3.0	221	207	217	196	210	178	227	229	231	231
3.5	211	198	207	187	200	170	217	219	220	221
4.0	204	191	201	181	194	164	210	212	213	214
4.5	198	186	195	176	189	160	204	206	207	208
5.0	190	178	187	168	181	153	196	197	198	199
5.5	184	173	181	163	175	148	190	191	193	193
6.0	177	166	174	157	168	142	182	184	185	185
6.5	179	168	176	158	170	144	184	n/a	n/a	n/a
7.0	174	163	171	154	166	140	179	n/a	n/a	n/a
7.5	169	158	166	149	160	136	174	n/a	n/a	n/a
8.0	162	152	160	144	154	131	167	n/a	n/a	n/a

Hydraulic Analysis Report

Project Data

Project Title: Parklands Village 1 Filing 2

Designer: Bryce Willaby

Project Date: Friday May 23, 2024

Project Units: U.S. Customary Units

Notes:

Weir Analysis: Overflow Section A - 100 YR (A600)

Input Parameters

Irregular Weir

Coefficient: 3.0000

Irregular Weir Geometry

Station (ft)	Elevation (ft)
0.00	5625.03
91.63	5624.33
160.70	5624.89

Tailwater (above crest): 0.00 ft

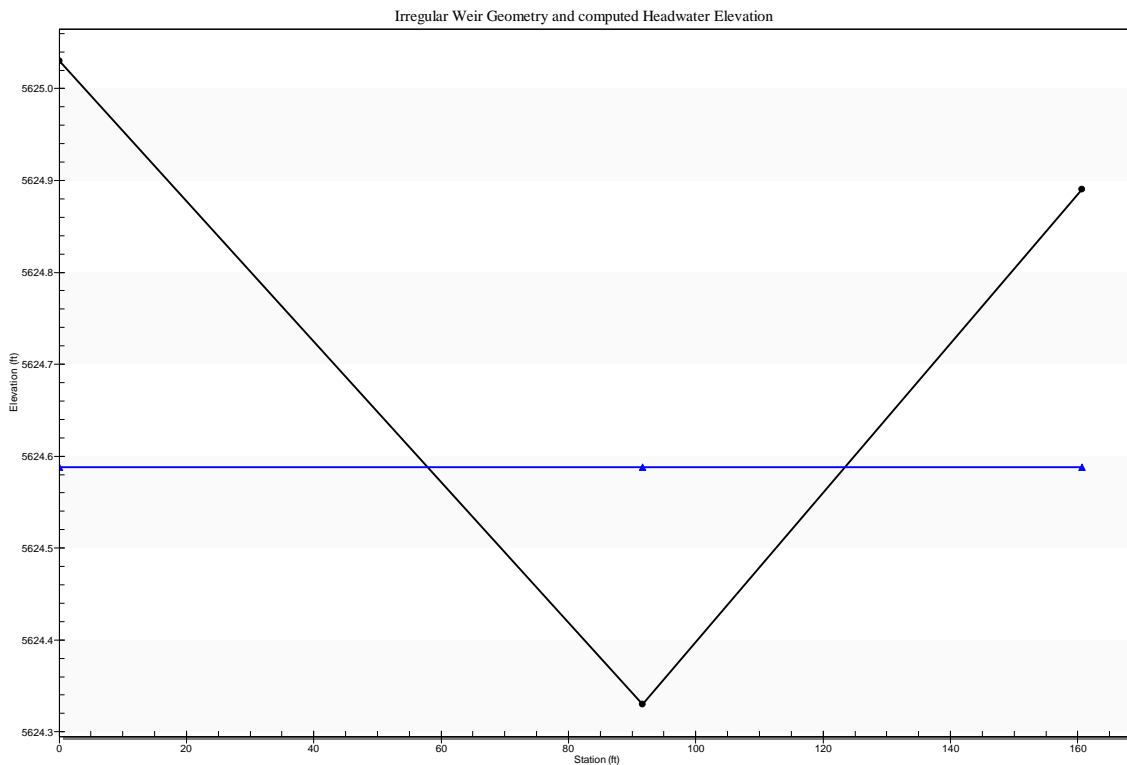
Flow: 9.9100 cfs

Result Parameters

Head: 0.258 ft

Elevation Head: 5624.59 ft

Adjacent Building TOF: 5625.93 ft (FREEBOARD + 1.34 ft)



Weir Analysis: Overflow Section B - 100 YR (A642)

Input Parameters

Irregular Weir

Coefficient: 3.0000

Irregular Weir Geometry

Station (ft)	Elevation (ft)
0.00	5634.00
24.73	5633.43
52.75	5632.9
81.75	5638.21

Tailwater (above crest): 0.00 ft

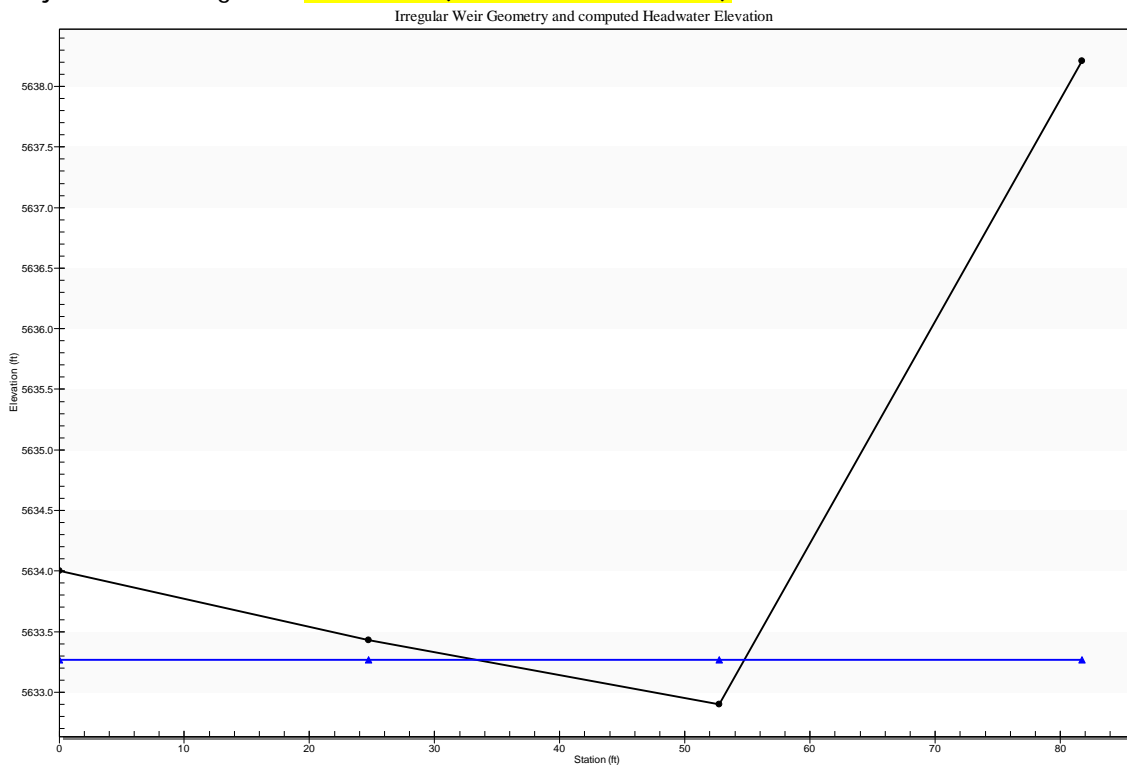
Flow: 5.1200 cfs

Result Parameters

Head: 0.369 ft

Elevation Head: 5633.27 ft

Adjacent Building TOF: 5637.54 ft (FREEBOARD + 4.27 ft)



Weir Analysis: Overflow Section C - 100 YR (IA6)

Input Parameters

Irregular Weir

Coefficient: 3.0000

Irregular Weir Geometry

Station (ft)	Elevation (ft)
44.57	5635.46
117.63	5634.43
206.68	5634.83
237.79	5637.32

Tailwater (above crest): 0.00 ft

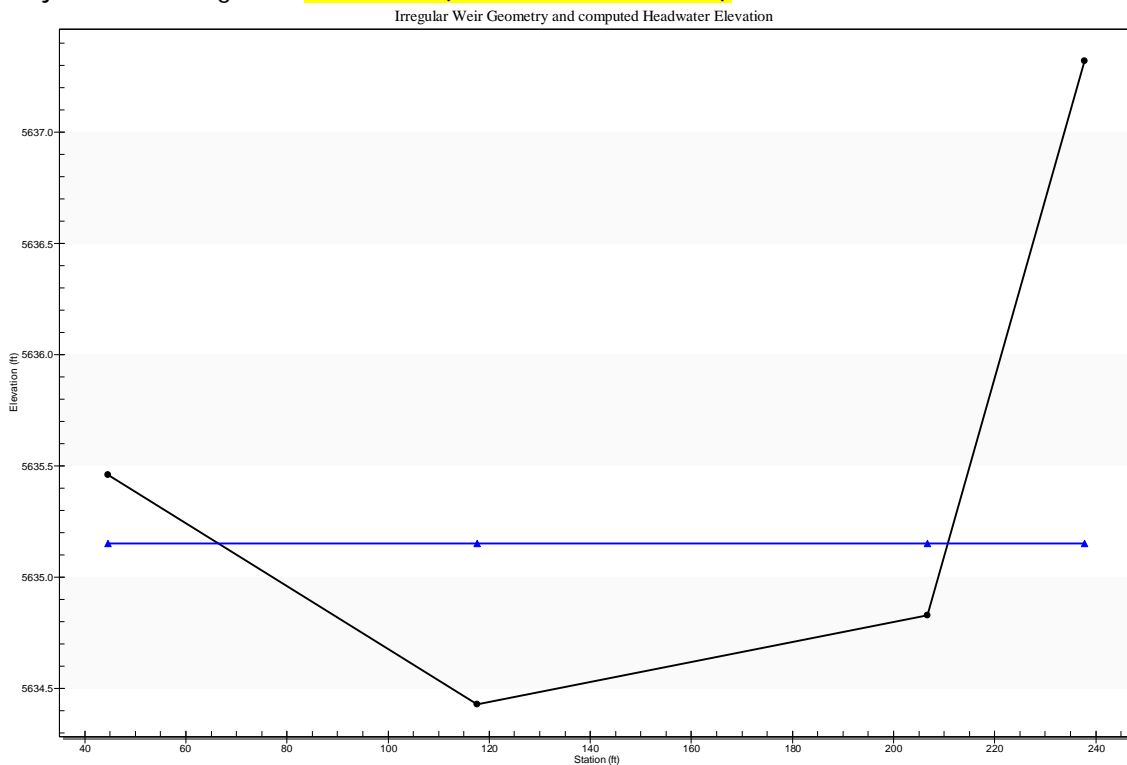
Flow: 135.4700 cfs

Result Parameters

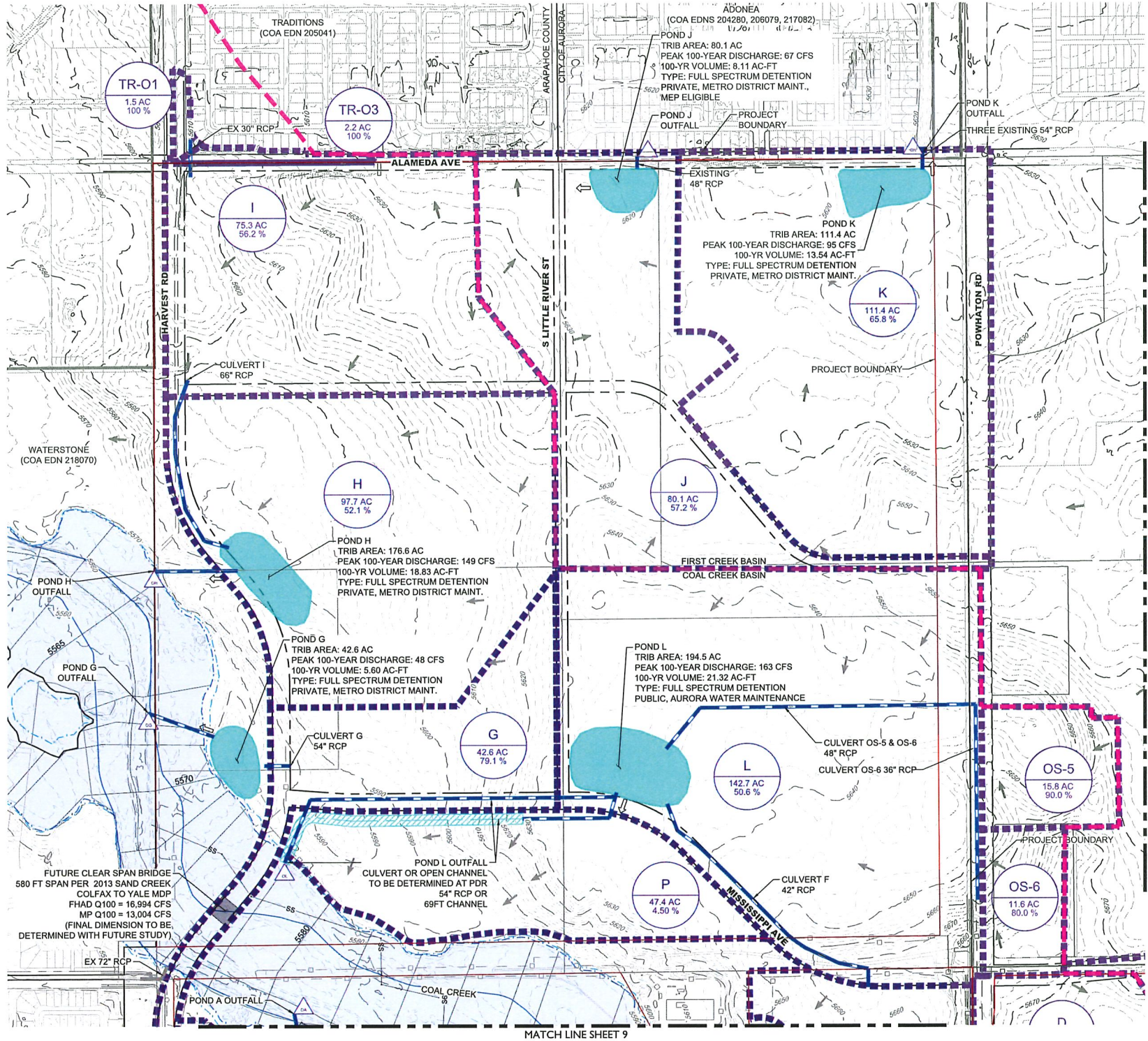
Head: 0.723 ft

Elevation Head: 5635.07 ft

Adjacent Building TOF: 5636.40 ft (FREEBOARD + 1.33 ft)

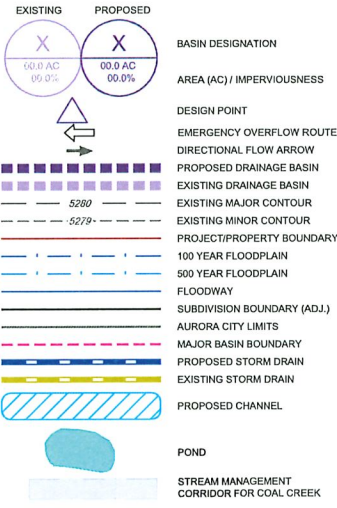
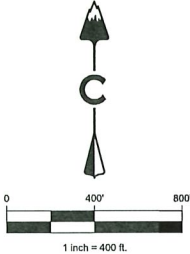
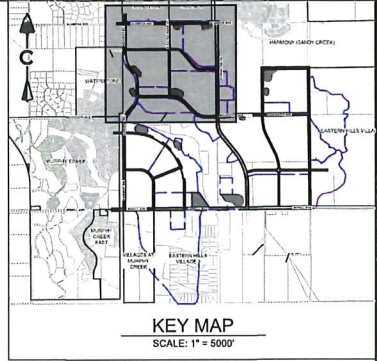


Appendix D – Supporting Documentation, Drainage Maps



MATCH LINE SHEET 9

MATCH LINE SHEET 11



FEMA MAP NOTES

COMMUNITY: CITY OF AURORA
FIRM PANEL: 0805C0204K
EFFECTIVE DATE: 12/17/2010
FIRM PANEL: 0805C0208L
EFFECTIVE DATE: 2/17/2017
FIRM PANEL: 0805C0212K
EFFECTIVE DATE: 12/17/2010
FIRM PANEL: 0805C0216L
EFFECTIVE DATE: 4/18/2018

NOTES

- ALL EMERGENCY OVERFLOWS TO ADJACENT PARCELS SHALL BE COORDINATED WITH IMPACTED PROPERTY OWNERS AT THE TIME OF THE PRELIMINARY DRAINAGE REPORT (PDR). PDR PLANS SHALL SHOW 100-YEAR AND EMERGENCY FLOW RATES TO ADJACENT PROPERTIES AND THE PDR SHALL ADDRESS MITIGATION FOR THE DISCHARGE OF CONCENTRATED FLOWS.
- WORK WITHIN THE 100-YEAR FLOODPLAIN REQUIRES A FLOODPLAIN DEVELOPMENT PERMIT. WORK WITHIN THE FLOODWAY REQUIRES AN APPROVED NO-RISE CERTIFICATION OR CLOMR.
- COAL CREEK STABILIZATION IS AN OBLIGATION OF THIS MDP AND THOSE IMPROVEMENTS ARE CURRENTLY UNDER DESIGN BY OTHERS.
- THE 100-YEAR AND 500-YEAR FLOODPLAIN BOUNDARIES SHOWN ARE A COMPOSITE OF THE WIDEST BOUNDARY INDICATED BY EITHER THE FHAD OR EFFECTIVE FIRM. THE FLOODWAY IS FROM THE EFFECTIVE FIRM. SEE REPORT TEXT FOR ADDITIONAL INFORMATION.

ENGINEER'S STATEMENT
PREPARED UNDER MY SUPERVISION

FACSIMILE
THIS ELECTRONIC PLAN IS A FACSIMILE OF THE SIGNED AND SEALED PDF SET.
ROBERT D. HANSEN, P.E. CFM
DATE: 4/3/2023

ROBERT D. HANSEN, P.E.
COLORADO P.E. 50417

DATE

BENCHMARK

COA ID 495517SE002
ELEVATION US FEET 5679.43 (NAVD 88)

3" DIAM. BRASS CAP STAMPED (C.O.A., BM, 23-60) ATOP THE CONC. BASE FOR THE EAST MOST LEG OF THE ANGLE POINT POWER TOWER ON THE WEST SIDE OF POWHATON ROAD, POWER LINE PROCEEDING WEST, SAID PWR. TWR. NEAR THE MISSISSIPPI LANDLINE. NOTE: ELEVATION

LAND DEVELOPMENT
ENERGY
PUBLIC INFRASTRUCTURE

CORE CONSULTANTS, INC.
3473 S. BROADWAY
ENGLEWOOD, CO 80113
LIVEYOURCORE.COM



DATE	BY	REVISION DESCRIPTION
2/18/2023	RH	0 SIGNATURE SET

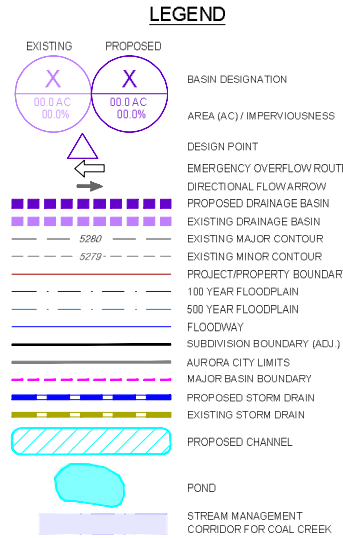
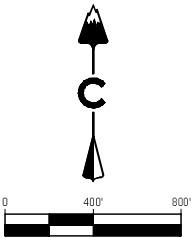
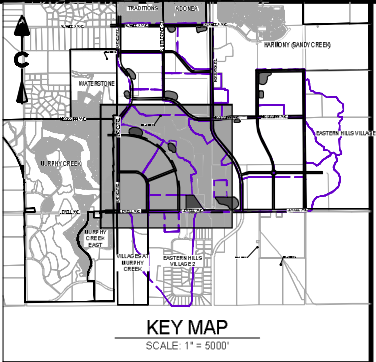
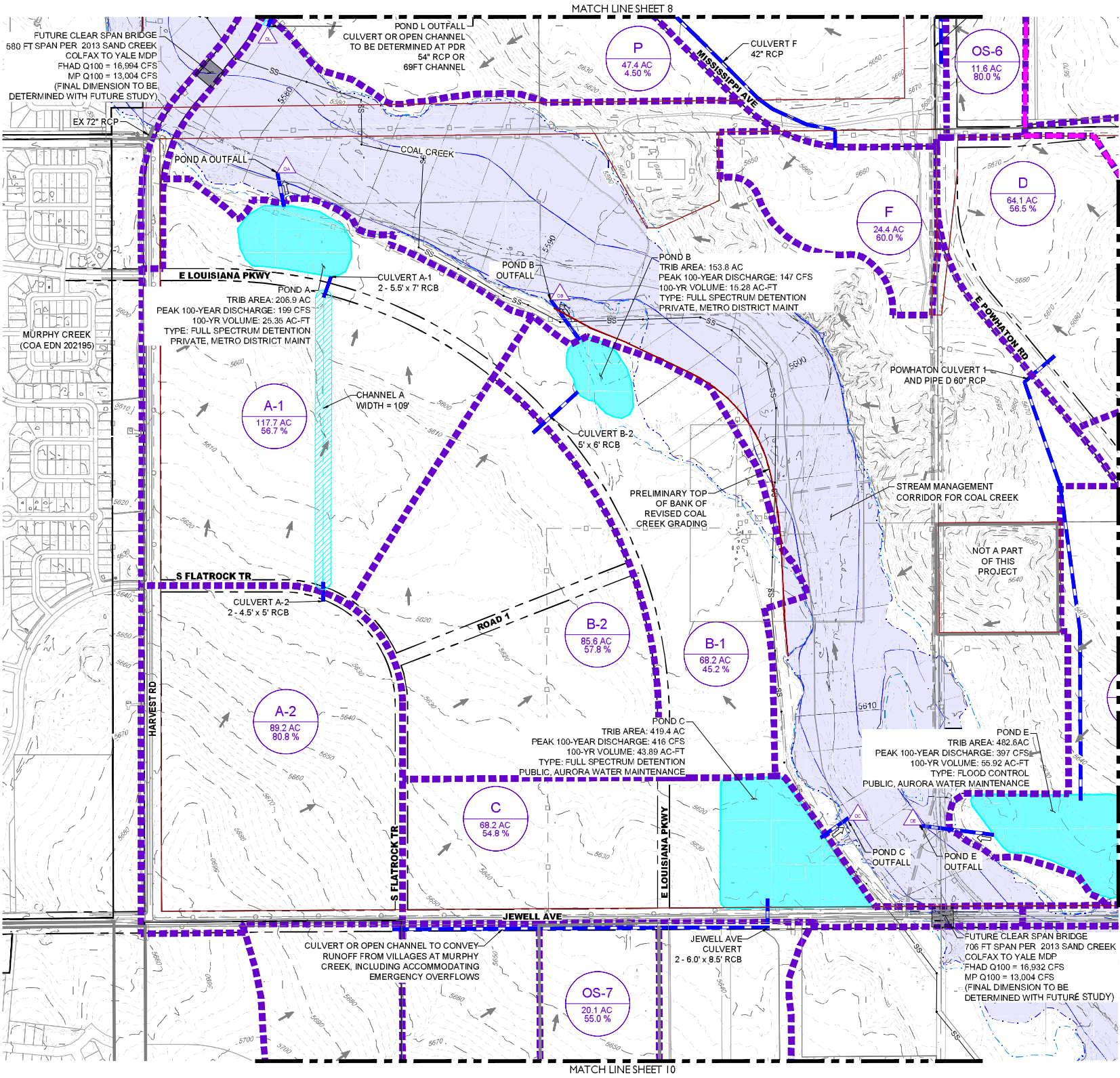
PARKLANDS DEVELOPMENT
AURORA, CO

PROPOSED BASIN 1 OF 4

NOT FOR CONSTRUCTION

DESIGNED BY: CS
DRAWN BY: SO
CHECKED BY: MN

JOB NO.
20-226
SHEET



- FEMA MAP NOTES**
- COMMUNITY: CITY OF AURORA
- FIRM PANEL: 08005C0204K
EFFECTIVE DATE: 12/17/2010
- FIRM PANEL: 08005C0208L
EFFECTIVE DATE: 2/17/2017
- FIRM PANEL: 08005C0213K
EFFECTIVE DATE: 12/17/2010
- FIRM PANEL: 08005C0218L
EFFECTIVE DATE: 4/18/2018
- NOTES**
- ALL EMERGENCY OVERFLOWS TO ADJACENT PARCELS SHALL BE COORDINATED WITH IMPACTED PROPERTY OWNERS AT THE TIME OF THE PRELIMINARY DRAINAGE REPORT (PDR). PDR PLANS SHALL SHOW 100-YEAR AND EMERGENCY FLOW RATES TO ADJACENT PROPERTIES AND THE PDR SHALL ADDRESS MITIGATION FOR THE DISCHARGE OF CONCENTRATED FLOWS.
 - WORK WITHIN THE 100-YEAR FLOODPLAIN REQUIRES A FLOODPLAIN DEVELOPMENT PERMIT. WORK WITHIN THE FLOODWAY REQUIRES AN APPROVED NO-RISE CERTIFICATION OR CLOMR.
 - COAL CREEK STABILIZATION IS AN OBLIGATION OF THIS MDP AND THOSE IMPROVEMENTS ARE CURRENTLY UNDER DESIGN BY OTHERS.
 - THE 100-YEAR AND 500-YEAR FLOODPLAIN BOUNDARIES SHOWN ARE A COMPOSITE OF THE WIDEST BOUNDARY INDICATED BY EITHER THE FHAD OR EFFECTIVE FIRM. THE FLOODWAY IS FROM THE EFFECTIVE FIRM. SEE REPORT TEXT FOR ADDITIONAL INFORMATION.

ENGINEER'S STATEMENT
PREPARED UNDER MY SUPERVISION

FACSIMILE
THIS ELECTRONIC PLAN IS A FACSIMILE OF THE SIGNED AND SEALED PDF SET

Robert D. Hansen 4/3/2023
ROBERT D. HANSEN, PE, CFM DATE

ROBERT D. HANSEN, P.E.
COLORADO P.E. 50417
FOR AND ON BEHALF OF CORE CONSULTANTS LLC

DATE

DESIGNED BY: CS
DRAWN BY: SO
CHECKED BY: MN

JOB NO.
20-226

SHEET
9

BENCHMARK

COA ID: 458517SE002

ELEVATION US FEET: 6879.43 (NAVD 88)

3" DIAM. BRASS CAP STAMPED (C.O.A., BM, 23-80) ATOP THE CONC. BASE FOR THE EAST MOST LEG OF THE ANGLE POINT POWER TOWER ON THE WEST SIDE OF POWHATON ROAD, POWER LINE PROCEEDING WEST. SAID PWR. TWR. NEAR THE MISSISSIPPI LANDLINE. NOTE: ELEVATION TAKEN AT PUNCH MARK AT CENTER

CORE

3473 S. BROADWAY
ENGLEWOOD, CO 80113
303.703.4444
LIVE! YOUR CORE.COM

LAND DEVELOPMENT
ENERGY
PUBLIC INFRASTRUCTURE

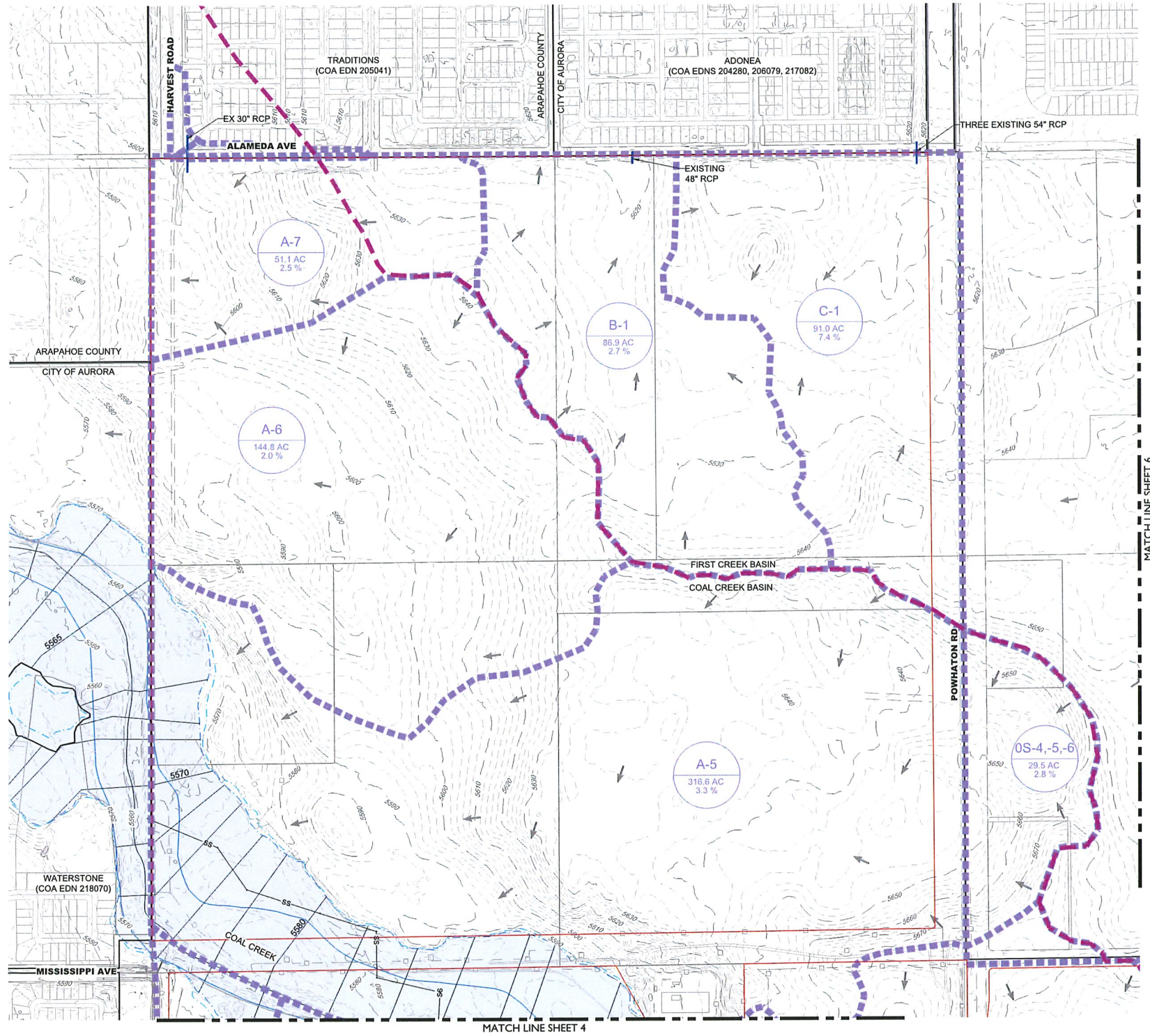
811
Know what's below.
Call before you dig.

DATE	BY	REVISION DESCRIPTION
2/18/2023	RH	01 SIGNATURE SET

PARKLANDS DEVELOPMENT
AURORA, CO

PROPOSED BASIN 2 OF 4

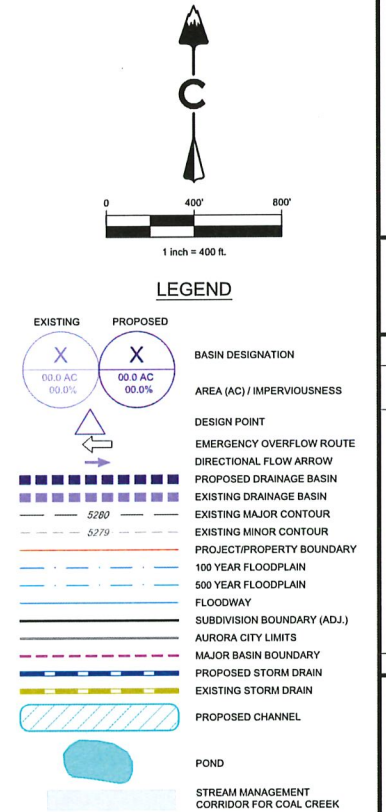
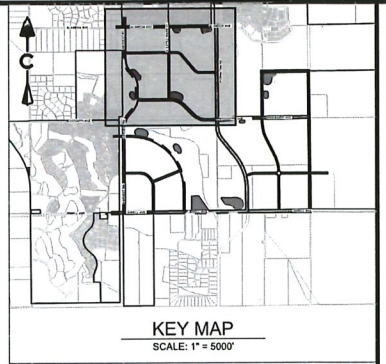
NOT FOR CONSTRUCTION



BENCHMARK

COA ID 4S6517SE002
ELEVATION US FEET 5679.43 (NAVD 88)

3" DIAM. BRASS CAP STAMPED (C.O.A., BM, 23-60) ATOP THE CONC. BASE FOR THE EAST MOST LEG OF THE ANGLE POINT POWER TOWER ON THE WEST SIDE OF POWHATON ROAD, POWER LINE PROCEEDING WEST, SAID PWR. TWR. NEAR THE MISSISSIPPI LANDLINE. NOTE: ELEVATION



FEMA MAP NOTES

COMMUNITY: CITY OF AURORA

FIRM PANEL: 08005C0204K
EFFECTIVE DATE: 12/17/2010

FIRM PANEL: 08005C0208L
EFFECTIVE DATE: 2/17/2017

FIRM PANEL: 08005C0212K
EFFECTIVE DATE: 12/17/2010

FIRM PANEL: 08005C0216L
EFFECTIVE DATE: 4/18/2018

NOTES

1. ALL EMERGENCY OVERFLOWS TO ADJACENT PARCELS SHALL BE COORDINATED WITH IMPACTED PROPERTY OWNERS AT THE TIME OF THE PRELIMINARY DRAINAGE REPORT (PDR). PDR PLANS SHALL SHOW 100-YEAR AND EMERGENCY FLOOD RATES TO ADJACENT PROPERTIES AND THE PDR SHALL ADDRESS MITIGATION FOR THE DISCHARGE OF CONCENTRATED FLOWS.
2. WORK WITHIN THE 100-YEAR FLOODPLAIN REQUIRES A FLOODPLAIN DEVELOPMENT PERMIT. WORK WITHIN THE FLOODPLAIN REQUIRES AN APPROVED NO-RISE CERTIFICATION OR CLOMR.
3. COAL CREEK STABILIZATION IS AN OBLIGATION OF THIS MDP AND THOSE IMPROVEMENTS ARE CURRENTLY UNDER DESIGN BY OTHERS.
4. THE 100-YEAR AND 500-YEAR FLOODPLAIN BOUNDARIES SHOWN ARE A COMPOSITE OF THE WEST BOUNDARY INDICATED BY EITHER THE FHQD OR EFFECTIVE FIRM. THE FIRM MAY BE FROM THE SAME FIRM OR DIFFERENT FIRM. SEE REPORT TEXT FOR ADDITIONAL INFORMATION.

ENGINEER'S STATEMENT
PREPARED UNDER MY SUPERVISION

FACSIMILE
THIS ELECTRONIC PLAN IS A FACSIMILE
OF THE SIGNED AND SEALED PDF SET.

 4/3/2023
ROBERT D. HANSEN, PE, CFM DATE

ROBERT D. HANSEN, P.E.
COLORADO P.E. 50417

DATE _____

NOT FOR
CONSTRUCTION

DESIGNED BY: CS
DRAWN BY: SO
CHECKED BY: MN

JOB NO.
20-226

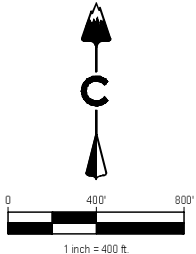
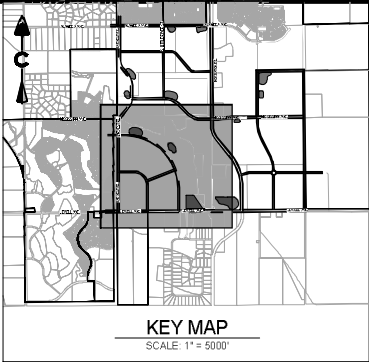
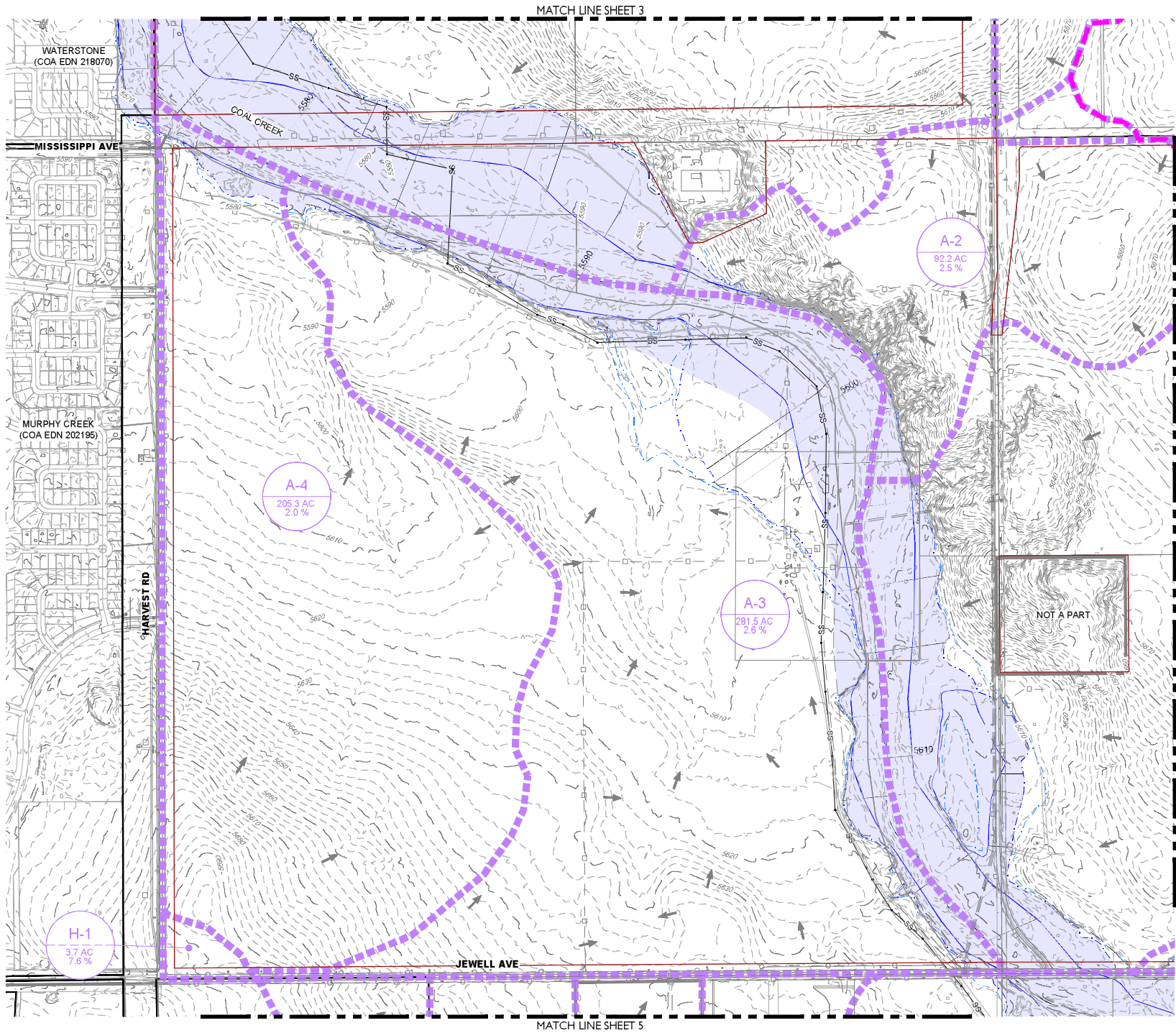
SHEET
2

PARKLANDS DEVELOPMENT
AURORA, CO

EXISTING BASIN 1 OF 4

#	KEY PERSON DISCOUNT MON	D/L	D/T
0	SIGNATURE SET	2/18/2023	RH

CORE CONSULTANTS, INC.
3473 S. BROADWAY
ENGLEWOOD, CO 80113
303.703.4444
LIVEYOURCORE.COM



LEGEND

EXISTING	PROPOSED	BASIN DESIGNATION
X	X	AREA (AC) / IMPERVIOUSNESS
		DESIGN POINT
		EMERGENCY OVERFLOW ROUTE
		DIRECTIONAL FLOW ARROW
		PROPOSED DRAINAGE BASIN
		EXISTING DRAINAGE BASIN
		EXISTING MAJOR CONTOUR
		EXISTING MINOR CONTOUR
		PROJECT/PROPERTY BOUNDARY
		100 YEAR FLOODPLAIN
		500 YEAR FLOODPLAIN
		FLOODWAY
		SUBDIVISION BOUNDARY (ADJ.)
		AURORA CITY LIMITS
		MAJOR BASIN BOUNDARY
		PROPOSED STORM DRAIN
		EXISTING STORM DRAIN
		PROPOSED CHANNEL
		POND
		STREAM MANAGEMENT CORRIDOR FOR COAL CREEK

FEMA MAP NOTES

COMMUNITY: CITY OF AURORA

FIRM PANEL: 08005C0204K
EFFECTIVE DATE: 12/17/2010

FIRM PANEL: 08005C0208L
EFFECTIVE DATE: 2/17/2017

FIRM PANEL: 08005C0213K
EFFECTIVE DATE: 12/17/2010

FIRM PANEL: 08005C0218L
EFFECTIVE DATE: 4/18/2018

- NOTES**
- ALL EMERGENCY OVERFLOWS TO ADJACENT PARCELS SHALL BE COORDINATED WITH IMPACTED PROPERTY OWNERS AT THE TIME OF THE PRELIMINARY DRAINAGE REPORT (PDR). PDR PLANS SHALL SHOW 100-YEAR AND EMERGENCY FLOW RATES TO ADJACENT PROPERTIES AND THE PDR SHALL ADDRESS MITIGATION FOR THE DISCHARGE OF CONCENTRATED FLOWS.
 - WORK WITHIN THE 100-YEAR FLOODPLAIN REQUIRES A FLOODPLAIN DEVELOPMENT PERMIT. WORK WITHIN THE FLOODWAY REQUIRES AN APPROVED NO-RISE CERTIFICATION OR CLOMR.
 - COAL CREEK STABILIZATION IS AN OBLIGATION OF THIS MDP AND THOSE IMPROVEMENTS ARE CURRENTLY UNDER DESIGN BY OTHERS.
 - THE 100-YEAR AND 500-YEAR FLOODPLAIN BOUNDARIES SHOWN ARE A COMPOSITE OF THE WIDEST BOUNDARY INDICATED BY EITHER THE FHAD OR EFFECTIVE FIRM. THE FLOODWAY IS FROM THE EFFECTIVE FIRM. SEE REPORT TEXT FOR ADDITIONAL INFORMATION.

ENGINEER'S STATEMENT
PREPARED UNDER MY SUPERVISION

FACSIMILE
THIS ELECTRONIC PLAN IS A FACSIMILE OF THE SIGNED AND SEALED PDF SET

Robert D. Hansen 4/3/2023
ROBERT D. HANSEN, PE, CFM DATE

ROBERT D. HANSEN, P.E.
COLORADO P.E. 50417
FOR AND ON BEHALF OF CORE CONSULTANTS LLC

DATE

BENCHMARK

COA ID: 458517SE002
ELEVATION US FEET: 6879.43 (NAVD 88)

3" DIAM. BRASS CAP STAMPED (C.O.A., BM, 23-80) ATOP THE CONC. BASE FOR THE EAST MOST LEG OF THE ANGLE POINT POWER TOWER ON THE WEST SIDE OF POWHATON ROAD, POWER LINE PROCEEDING WEST. SAID PWR. TWR. NEAR THE MISSISSIPPI LANDLINE. NOTE: ELEVATION TAKEN AT PUNCH MARK AT CENTER

CORE

CORE CONSULTANTS, INC.
3473 S. BROADWAY
ENGLEWOOD, CO 80113
303.703.4444
LIVE!@CORE.COM

LAND DEVELOPMENT
ENERGY
PUBLIC INFRASTRUCTURE

811
Know what's below.
Call before you dig.

#	REVISION DESCRIPTION	DATE	BY	CHK
0	SIGNATURE SET	2/18/2023	RH	

PARKLANDS DEVELOPMENT
AURORA, CO

EXISTING BASIN 2 OF 4

NOT FOR CONSTRUCTION

DESIGNED BY: JCS	JOB NO. 20-226
DRAWN BY: SO	SHEET 4
CHECKED BY: JMN	