PHASE II DRAINAGE REPORT
FOR

RIDGEGATE COUPLET

RIDGEGATE EAST FILING NO. 4 – LOT 2

LONE TREE, COLORADO

Prepared For:

Century Communities
8390 E. Crescent Parkway, Suite 650
Greenwood Village, CO 80111

Prepared By:

Merrick & Company
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(303) 353-3926
Contact: Kellan D. Black, PE
Phone: 303-353-3695
Project No. 65110692

September 10, 2023

ENGINEER'S CERTIFICATION STATEMENT

"This report and plan for the Phase II drainage design of Ridgegate Couplet was prepared by me (or under my direct supervision) in accordance with the provisions of the *City of Lone Tree Storm Drainage Design and Technical Criteria* for the owners thereof. I understand that the City of Lone Tree does not and will not assume liability for drainage and erosion control facilities done by others."

SIGNATURE: _____

Kellan D. Black, PE

Registered Professional Engineer State of Colorado #57201

For and on Behalf of Merrick & Company

DEVELOPER'S CERTIFICATION STATEMENT

"Century Communities. hereby certifies that the drainage facilities for Ridgegate Couplet shall be constructed according to the design presented in this report. I understand that the City of Lone Tree does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that the City of Lone Tree reviews drainage plans pursuant to Lone Tree Municipal Code, Chapter 15, Article 1; but cannot, on behalf of Ridgegate Couplet, guarantee that final drainage design review will absolve Century Communities and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the Site Improvement Plan and/or Final Plan does not imply approval of my engineer's drainage design."

_____

Name of Developer

_____

Authorized Signature

TABLE OF CONTENTS

I. GENERAL LOCATION AND DESCRIPTION

A. SITE LOCATION

This Phase II Drainage Report is being prepared for the proposed residential – multifamily development located west of the intersection of Ridgegate Parkway East and Ridgegate Parkway West, within the Ridgegate Couplet Development (Hereinafter referred to as the "Site"). The project Site consists of Ridgegate East Filing No. 4, Lot 2, Located in the North half of Section 24, Township 6 South, Range 67 West of the Sixth Principal Meridian, County of Douglas, State of Colorado. The Site is bounded by Ridgegate Parkway to the north and south, dedicated ROW for a future road to the east, and Lot 1 to the west. The Site is zoned CTY – Incorporated Areas.

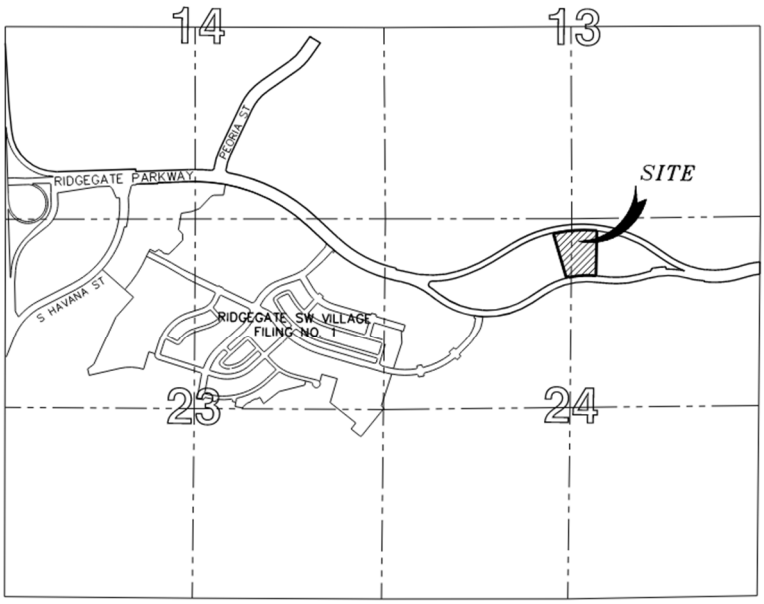


FIGURE 1

B. DESCRIPTION OF PROPERTY

The proposed Site is roughly 5.6 acres. It is anticipated the Site will consist of a single residential multi-family building partially wrapping the proposed on-site parking garage. The proposed building is anticipated to include approximately 327 multi-family dwelling units, a club house and amenity center and a dog park. The Site will also include a paved service drive, surface parking, curb and gutter, hardscaping, and landscaping.

Currently the Site consists of undeveloped land with vegetation consisting of native grasses, weeds, and soils. The proposed improvements will disturb the entire Site with excavation, grading, utility installation, and other construction activities.

There is only one soil type on the Site as identified in the Natural Resources Conservation Service (NRCS) Soils Classification Map: Fondis clay loam, classified as Hydrologic Soil Group C. A copy of the soils classification map is included in Appendix A. Soils classified as Group C have moderately high runoff potential and have lower rates of infiltration than Groups A and B which will result in slightly higher runoff rates.

The existing Site contains slopes generally from west to east. On-site slopes range from 4% to 8% with an approximate 23 feet of fall across the site from west to north.

The Site is located within the City of Lone Tree (080319) according to FEMA's Flood Insurance Rate Map 08035C0064J, dated December 2, 2021. No known major or minor existing irrigation canals or significant geologic features exist on the Site. In addition, no major drainageways exist on the Site. An existing ditch runs south to north through the middle of the Site that will be removed in the final drainage condition. The existing slope on the ditch is roughly 3%.

There is no known contamination on the Site. The contractor will be responsible for monitoring for contamination throughout the construction activities and any required remediation immediately following the discovery.

II. DRAINAGE BASINS AND SUB-BASINS

A. MAJOR DRAINAGE BASINS

The Site is located within the Badger Gulch Drainage Basin. The Badger Gulch Drainage Basin generally flows from southwest to northeast and joins Happy Canyon Creek downstream of the Site and directly south of Lincoln Avenue.

B. MINOR DRAINAGE BASINS

The Site is comprised of 12 on-site drainage basins and 9 off-site drainage basins. The proposed basins and design points are depicted on the associated drainage plan included in Appendix D.

TABLE 1 - PROPOSED SUB-BASIN PEAK FLOWS					
Sub-Basin Name	Design Point	Area (ac)	Imp (%)	5-Yr Peak Flow (cfs)	100-Yr Peak Flow (cfs)
A-1	1	0.85	90.0%	3.2	6.4
A-2	3	0.97	90.0%	3.6	7.3
A-3	5	1.40	90.0%	5.2	10.5
A-4	5	0.30	90.0%	1.1	2.3
A-5	6	0.33	90.0%	1.3	2.5
B-1	1	0.27	33.4%	0.3	1.0
B-2	2	0.45	77.9%	1.5	3.2
B-3	3	0.57	57.8%	1.3	3.4
B-4	4	0.15	31.1%	0.1	0.6
C-1	5	0.07	2.7%	0.0	0.2
C-2	7	0.20	41.0%	0.3	0.8
D-1	8	0.08	33.0%	0.1	0.3
On-Site Subtotal		5.64	72.6%	18.0	38.4
O-1	2	0.07	100.0%	0.3	0.6
O-2	3	0.09	100.0%	0.4	0.7
O-3	4	0.75	70.6%	2.0	4.7
O-4	5	0.41	78.1%	1.2	2.7
O-5	6	0.27	82.0%	0.9	2.0
O-6	7	0.80	78.5%	2.5	5.3
O-7	8	0.82	84.5%	2.6	5.5
**X2-1	X2-1	2.39	85.0%	5.8	13.5
**X2-2	X2-2	2.39	85.0%	5.8	13.5
*TOTAL		13.63	78.5%	39.5	86.8

*TOTAL PEAK FLOWS ARE A SUMMATION OF BASIN FLOWS AND DO NOT ACCOUNT FOR HYDRAULIC ROUTING.
**X2-1 AND X2-2 ARE EXISTING FLOWS INTO STUB PIPES FROM RIDGEGATE FILING NO. 3 PHASE 4 DRAINAGE REPORT DATED OCTOBER 2023

The following basins are conveyed and collected on-site by the proposed drainage infrastructure. Runoff from these basins will be conveyed to the existing pond located northeast of the site where it will be treated for water quality and detention. The only exception is basins D-1 and O-7 which will be conveyed to an existing 10' Type R storm inlet and routed to the existing pond southeast of the site where it will be treated for water quality and detention.

BASIN A-1 (Q5=3.2 cfs, Q100=6.4 cfs)

Basin A-1 is approximately 0.85 acres and consists entirely of the proposed residential multi-family building. Developed runoff from the basin will sheet flow across the rooftop and collected by localized roof drains. The roof drains will tie-in to the proposed on-site storm sewer infrastructure.

BASIN A-2 (Q5=3.6 cfs, Q100=7.3 cfs)

Basin A-2 is approximately 0.97 acres and consists entirely of the proposed parking garage. Developed runoff from the basin will sheet flow across the rooftop and collected by localized roof drains. The roof drains will tie-in to the proposed on-site storm sewer infrastructure.

BASIN A-3 (Q5=5.2 cfs, Q100=10.5 cfs)

Basin A-3 is approximately 1.40 acres and consists entirely of the proposed parking garage. Developed runoff from the basin will sheet flow across the rooftop and collected by localized roof drains. The roof drains will tie-in to the proposed on-site storm sewer infrastructure.

BASIN A-4 (Q5=1.1 cfs, Q100=2.3 cfs)

Basin A-4 is approximately 0.30 acres and consists entirely of the proposed residential multi-family building. Developed runoff from the basin will sheet flow across the rooftop and collected by localized roof drains. The roof drains will tie-in to the proposed on-site storm sewer infrastructure.

BASIN A-5 (Q5=1.3 cfs, Q100=2.5 cfs)

Basin A-5 is approximately 0.33 acres and consists entirely of the proposed residential multi-family building. Developed runoff from the basin will sheet flow across the rooftop and collected by localized roof drains. The roof drains will tie-in to the proposed on-site storm sewer infrastructure.

BASIN B-1 (Q5=0.3 cfs, Q100=1.0 cfs)

Basin B-1 is approximately 0.27 acres and consists of an internal courtyard containing hardscaping and landscaping improvements. Developed runoff will be conveyed to proposed landscape drains and storm sewer infrastructure.

BASIN B-2 (Q5=1.5 cfs, Q100 =3.2 cfs)

Basin B-2 is approximately 0.45 acres and consists of the west access road, parking spaces and a landscaped area. Developed runoff will be conveyed to proposed storm sewer infrastructure.

BASIN B-3 (Q5=1.3 cfs, Q100 =3.4 cfs)

Basin B-3 is approximately 0.57 acres and consists of the west access road, parking spaces and a landscaped area. Developed runoff will be conveyed to proposed storm sewer infrastructure.

BASIN B-4 (Q5=0.1 cfs, Q100=0.6 cfs)

Basin B-4 is approximately 0.15 acres and consists of landscaped area on the northwest side of the site along Ridgegate Parkway (Westbound). Runoff will be collected by an existing storm sewer inlet then routed to the basin located northeast of the Site.

BASIN C-1 (Q5=0.0 cfs, Q100=0.2 cfs)

Basin C-1 is approximately 0.07 acres and consists of landscaped area on the east side of the site along the eastern access road. Developed runoff from the basin will sheet flow across these improvements and

ultimately into an existing storm sewer inlet at the northeast corner of the Site where it will be routed to the basin located northeast of the Site.

BASIN C-2 (Q5=0.3 cfs, Q100=0.8 cfs)

Basin C-2 is approximately 0.20 acres and consists of landscaped area on the northeast side of the site along Ridgegate Parkway (Westbound). Developed runoff from the basin will sheet flow across these improvements to an existing roadside ditch on the south side of Ridgegate Parkway (Westbound). Runoff will be collected by an existing storm sewer inlet then routed to the basin located northeast of the Site.

BASIN D-1 (Q5=0.1 cfs, Q100=0.3 cfs)

Basin D-1 is approximately 0.08 acres and consists of landscaped area on the northeast side of the site along Ridgegate Parkway (Eastbound). Developed runoff from the basin will sheet flow across these improvements to an existing roadside ditch on the north side of Ridgegate Parkway (Eastbound). Runoff will be collected by an existing storm sewer inlet at the southeast corner of the site then routed to the basin located southeast of the Site.

The following basins are conveyed off-site and collected by existing off-site storm sewer infrastructure.

BASIN O-1 (Q5=0.3 cfs, Q100=0.6 cfs)

Basin O-1 is approximately 0.07 acres and consists of the west access road and accopanying parking spaces. Developed runoff will be conveyed to proposed storm sewer infrastructure.

BASIN O-2 (Q5=0.4 cfs, Q100=0.7 cfs)

Basin O-1 is approximately 0.09 acres and consists of the west access road and accompanying parking spaces. Developed runoff will be conveyed to proposed storm sewer infrastructure.

BASIN O-3 (Q5=2.0 cfs, Q100=4.7 cfs)

Basin O-3 is approximately 0.75 acres consisting of Ridgegate Parkway (Westbound). Developed runoff from the basin will sheet flow across the existing road to an existing roadside ditch on the south side of Ridgegate Parkway (Westbound). Runoff will be collected by an existing storm sewer inlet then routed to the basin located northeast of the Site.

BASIN O-4 (Q5=1.2 cfs, Q100=2.7 cfs)

Basin O-4 is approximately 0.41 acres consisting of existing landscape areas and the existing access road east of the site. Developed runoff from the basin will sheet flow across these features and ultimately into an existing storm sewer inlet at the northeast corner of the Site where it will be routed to the basin located northeast of the Site.

BASIN O-5 (Q5=0.9 cfs, Q100=2.0 cfs)

Basin O-5 is approximately 0.27 acres consisting of existing landscape areas and the existing access road east of the site. Developed runoff from the basin will sheet flow across these features and ultimately into

an existing storm sewer inlet at the northeast corner of the Site where it will be routed to the basin located northeast of the Site.

BASIN O-6 (Q5=2.5 cfs, Q100=5.3 cfs)

Basin O-6 is approximately 0.80 acres consisting of Ridgegate Parkway (Westbound). Runoff from the basin will sheet flow across these features and ultimately into an existing storm sewer inlet at the northeast corner of the Site where it will be routed to the basin located northeast of the Site.

BASIN O-7 (Q5=2.6 cfs, Q100=5.5 cfs)

Basin O-7 is approximately 0.82 acres consisting of Ridgegate Parkway (Eastbound). Runoff from the basin will sheet flow across these features to an existing roadside ditch on the north side of Ridgegate Parkway (Eastbound). Runoff will be collected by an existing storm sewer inlet at the southeast corner of the site then routed to the basin located southeast of the Site.

BASIN X2-1 (Q5=5.8 cfs, Q100=13.5 cfs)

Basin X2-1 is approximately 2.39 acres consisting of half of the property to the west of the Site. The site is currently undeveloped but. was assumed to have the impervious percentage of a multifamily development, 85%. This basin was designed in the *Phase III Drainage Report Ridgegate East Filing No. 3,* dated April 2023. Runoff from this area will tie into a proposed storm pipe stub on the west side of the Site.

BASIN X2-2 (Q5=5.8 cfs, Q100=13.5 cfs)

Basin X2-1 is approximately 2.39 acres consisting of half of the property to the west of the Site. The site is currently undeveloped but. was assumed to have the impervious percentage of a multifamily development, 85%. This basin was designed in the *Phase III Drainage Report Ridgegate East Filing No. 3,* dated April 2023. Runoff from this area will tie into a proposed storm pipe stub on the west side of the Site.

C. DRAINAGE DESIGN CRITERIA

A. REGULATIONS

The *Douglas County Storm Drainage Design and Technical Criteria Manual* (DC Manual) amended July 8, 2008, and the Mile High Flood District (MHFD) *Urban Storm Drainage* (MHFD Manual) (Updated: Vol. 1-Mar. 2017; Vol. 2-Sept. 2017; Vol. 3-Apr. 2018). These documents shall be referred to as the “Manual”.

B. DRAINAGE STUDIES, MASTER PLANS, and SITE CONSTRAINTS

The following Drainage Reports involving the project site were considered in this study:

1. *Phase III Drainage Report for Ridgegate Parkway Expansion – Phase II* prepared by Merrick & Company, dated October 2018.
2. *Phase III Drainage Report Ridgegate East Filing No. 3* prepared by Merrick & Company, dated April 2023.

C. HYDROLOGIC CRITERIA

Five-year and 100-year storm event runoff was calculated using the Rational method. Percent imperviousness values are from Table 6-3 of the *MHFD Manual*.

Runoff coefficients are from Table 6-4 of the *MHFD Manual* using hydrologic soil group C. Times of concentration were based on land use imperviousness values as well as distance and slope of runoff travel. Runoff conveyance coefficients were determined using Table 6-2 from the *Criteria.*

Rainfall intensities (I) for the area are approximated by the equation:

$$I = \frac{28.5P_1}{(10 + Tc)^{0.786}}$$

P_1 represents the 1-hour design rainfall values in inches per table 6-1 Zone 1 of the *DC Manual*. T_c represents the time of concentration in minutes and consists of overland flow time plus travel time. Time of concentration is calculated as the sum of the overland flow time and travel time. Overland flow time is calculated over a maximum 300 foot distance using the FAA equation:

$$T_C = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_O^{0.33}}$$

C_5 = basin composite runoff coefficient for the five-year storm event

L = length of overland flow in feet

S = slope of flow path in percent

T_i = travel time in minutes

Travel time is calculated as the flow time through a length of street gutter or channel by multiplying the average flow velocity by the travel length. The minimum time of concentration used for urbanized basins was 5 minutes.

All hydrological calculations, including a summary of the 5-year and 100-year storm event flows, are provided in Appendix B. Sub-basin maps are also included in Appendix D.

D. HYDRAULIC CRITERIA

Hydraulic calculations in compliance with the Manual for street capacity, inlet calculations, pipe sizes, etc. will be included as part of the Phase III drainage report. Bentley StormCAD will be used to analyze the hydraulic grade line of the stormwater conveyances. The Urban Drainage Inlet Sizing spreadsheet will be used to size proposed site inlets, as well as analyze existing street flow capacity and existing inlet capacity.

E. WATER QUALITY ENHANCEMENT

Per the *Phase III Drainage Report for Ridgegate East Filing No. 3* most of the Site runoff will be treated for water quality by Pond 21 (as referred to in the report). D-1 and O-7 will be treated for water quality by EX WQ Pond E as referenced in the previously mentioned drainage report. Per County and Cherry Creek Basin

Authority criteria, water quality must be provided for no less than 80% of the site. Water quality shall be provided above ground, where possible, by porous landscape detention basins, grass swales and sand filter basins.

The existing above ground basins, Pond 21 and EX WQ Pond E, were designed for the Site's Water Quality Capture Volume (WQCV). An anticipated imperviousness of 85% was assumed for the Site. The proposed imperviousness for the Site will be 73%, therefore, detention and water quality treatment for the Site is accounted for within the existing sand filter basin and underground storage vault.

D. STOMWATER MANAGEMENT FACILITY DESIGN

A. STORMWATER CONVEYANCE FACILITIES

The proposed development developed runoff will generally be collected by private storm sewer infrastructure, some will be routed to existing storm sewer infrastructure. 90% of the Site's developed runoff will be collected and conveyed to the existing water quality basin, Pond 21, where it will receive water quality treatment and detention. Small portions of the Site's developed runoff will be released directly off-site and conveyed to nearby existing storm sewer infrastructure as planned for in the *Phase III Drainage Report for Ridgegate East Filing No. 3*. Basin D-1 and Basin O-5 will be conveyed off-site to an existing storm sewer infrastructure that will carry the runoff to EX WQ Pond E. The other basins conveyed off-site will be conveyed to an existing storm sewer infrastructure and routed to the existing Pond 21, merging with the on-site runoff. Calculations will be provided within the Phase III Drainage Report confirming the conformance of the developed Site runoff with the existing storm infrastructure per the *Lincoln Station Phase III Drainage Report,* as well as zero negative impacts of on-site runoff conveyed off-site to the locations as described above.

B. STORMWATER STORAGE FACILITIES

The majority of on-site developed runoff will be routed to the existing water quality basin where it will receive water quality treatment and 100-year detention. The water quality basin, referred to as Pond 21 in the *Phase III Drainage Report for Ridgegate East Filing No. 3*, is located northeast of the Site. Per the previously mentioned report, Pond 21 is designed to provide 100-year detention so that the peak flow rate of Badger Gulch is not increased. There are no new on-site water quality or detention facilities anticipated. Calculations will be provided within the Phase III Drainage Report confirming the conformance of the developed Site runoff with the existing storm infrastructure per the *Phase III Drainage Report for Ridgegate East Filing No. 3,* as well as zero negative impacts of on-site runoff conveyed off-site to the locations as described above.

C. WATER QUALITY ENHACEMENT BEST MANAGEMENT PRACTICES

The majority of on-site developed runoff will be routed to the existing water quality basin, Pond 21, where it will receive water quality treatment and 100-year detention. The Site will convey the majority of the Site's developed runoff, 90%, to the water quality basin where permanent water quality treatment is provided. The remainder of the runoff will be carried to EX WQ Pond E for water quality treatment. Temporary erosion control measures will be installed during construction to mitigate sediment leaving the site.

D. FLOODPLAIN MODIFICATIONS

It is not anticipated that any floodplain modifications will be required as a result of the development of the proposed Site.

E. POTENTIAL PERMITTING REQUIREMENTS

Douglas County will require a Grading, Erosion, and Sediment Control (GESC) approved plan and permit prior to construction. In addition, a state stormwater discharge permit will be required.

F. GENERAL

All tables, figures, and charts discussed above comply with the *DC Manual* and *MHFD Manual*.

E. CONCLUSIONS

A. COMPLIANCE WITH STANDARDS

The proposed drainage concept complies with the current City of Lone Tree Drainage Criteria, as well as the *DC Manual*, *MHFD Manual*, and Drainage Studies previously mentioned within this report.

B. VARIANCES

No variances were necessary for this report.

C. DRAINAGE CONCEPT

Development of the proposed site will not adversely affect surrounding developments. A majority of the developed site runoff will be captured by proposed inlets. The proposed storm sewer infrastructure will convey developed site runoff to the existing pond, where it will be treated and detained.

REFERENCES

1. *Phase III Drainage Report for Ridgegate Parkway Expansion – Phase II* prepared by Merrick & Company, dated October 2018.
2. *Phase III Drainage Report Ridgegate East Filing No. 3* prepared by Merrick & Company, dated April 2023.
3. FEMA, *FIRM Panel Map No. 08035C0064J,* Revised December 2, 2021.
4. Urban Drainage and Flood Control District, *Urban Storm Drainage Criteria Manual*, Updated: Vol. 1-August 2018; Vol. 2-September 2017; Vol. 3-April 2018.
5. "Douglas County Storm Drainage Design and Technical Criteria Manual" amended July 8, 2008

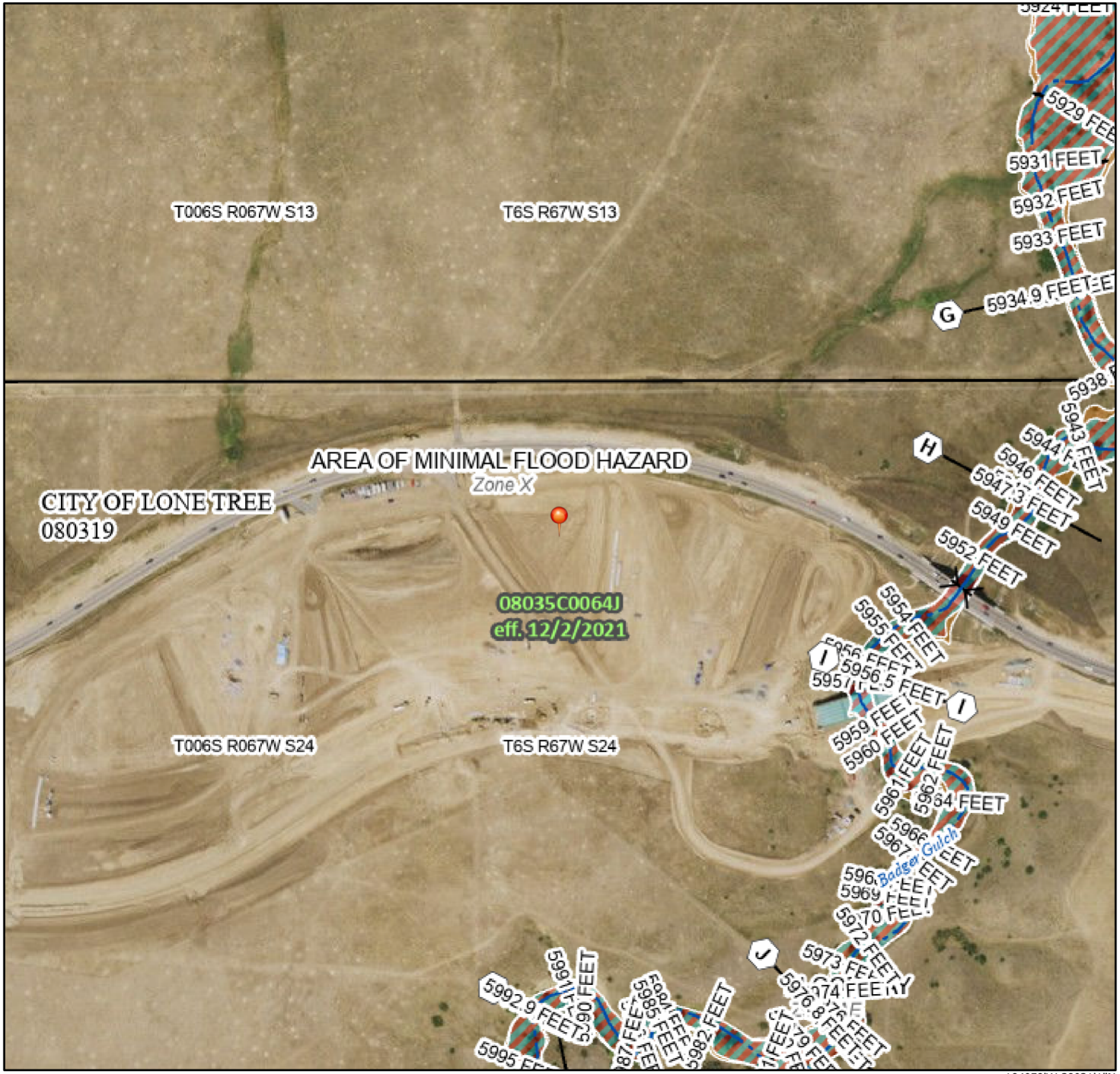
Appendix A

(Supporting Documentation)

National Flood Hazard Layer FIRMette

FEMA

104°50'37"W 39°31'29"N



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

1:6,000

104°50'W 39°31'1"N

Basemap Imagery Source: USGS National Map 2023

Legend

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

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

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

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

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

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

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

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/10/2023 at 10:24 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

Map Scale: 1:3,470 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 150 300 600 900

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

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

Special Point Features

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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: Castle Rock Area, Colorado
Survey Area Data: Version 15, Sep 1, 2022

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

Date(s) aerial images were photographed: Jun 9, 2021—Jun 12, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
FoB	Fondis clay loam, 1 to 3 percent slopes	23.7	45.4%
NeE	Newlin gravelly sandy loam, 8 to 30 percent slopes	28.5	54.6%
Totals for Area of Interest		**52.3**	**100.0%**

Appendix B

(Hydrologic Calculations)

Table 6-3. Recommended percentage imperviousness values

Land Use or Surface Characteristics	Percentage Imperviousness (%)
Business:	
Downtown Areas	95
Suburban Areas	75
Residential lots (lot area only)**:**	
Single-family	
2.5 acres or larger	12
0.75 – 2.5 acres	20
0.25 – 0.75 acres	30
0.25 acres or less	45
Apartments	75
Industrial:	
Light areas	80
Heavy areas	90
Parks, cemeteries	10
Playgrounds	25
Schools	55
Railroad yard areas	50
Undeveloped Areas:	
Historic flow analysis	2
Greenbelts, agricultural	2
Off-site flow analysis (when land use not defined)	45
Streets:	
Paved	100
Gravel (packed)	40
Drive and walks	90
Roofs	90
Lawns, sandy soil	2
Lawns, clayey soil	2

Merrick & Company
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Greenwood Village, CO 80111
Ph: (303) 751-0741

Job Name: Ridgegate Couplet
Job Number: 65111370
Date: 8/2/2023
By: K. Norcia

Ridgegate Couplet

Composite Runoff Coefficient Calculations

Location: Douglas County
Municipality: Douglas County
Minor Design Storm: 5
Major Design Storm: 100
Soil Type: C/D

Runoff Coefficient (UDFCD Vol 1, Chp 6, Sec. 2.5.1)

NRCS Soil Group	Storm Return Period					
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
A	C=0.84i^1.302	C=0.86i^1.276	C=0.87i^1.232	C=0.84i^1.124	C=0.85i+0.025	C=0.78i+0.110
B	C=0.84i^1.169	C=0.86i^1.088	C=0.81i+0.057	C=0.63i+0.249	C=0.56i+0.328	C=0.47i+0.426
C/D	C=0.83i^1.122	C=0.82i+0.035	C=0.74i+0.132	C=0.56i+0.319	C=0.49i+0.393	C=0.41i+0.484

Basin Design Data

		I (%) =	90%	100%	90%	40%	10%	50%	10%	75%	2%			i (%)	Runoff Coeff's			
Basin Name	Design Point	Outfall	A_{Roof} (sf)	A_{Paved} (sf)	A_{Walk} (sf)	A_{Gravel} (compacted) (sf)	A_{Gravel} (uncompacted) (sf)	$A_{Railroad\ Yard\ Areas}$ (sf)	A_{Parks} (sf)	$A_{Suburban\ Lot}$ (sf)	$A_{Iscape\ (C/D\ soil)}$ (sf)	A_{Total} (sf)	A_{Total} (ac)	Imp (%)	C2	C5	C10	C100
A-1	1		36,881									36,881	0.85	90.0%	0.74	0.77	0.80	0.85
A-2	3		42,337									42,337	0.97	90.0%	0.74	0.77	0.80	0.85
A-3	5		61,046									61,046	1.40	90.0%	0.74	0.77	0.80	0.85
A-4	5		13,031									13,031	0.30	90.0%	0.74	0.77	0.80	0.85
A-5	6		14,590									14,590	0.33	90.0%	0.74	0.77	0.80	0.85
B-1	1				4,205						7,591	11,796	0.27	33.4%	0.24	0.31	0.38	0.62
B-2	2			4,634	11,936						3,241	19,811	0.45	77.9%	0.63	0.67	0.71	0.80
B-3	3			8,638	5,950				1,857		8,389	24,834	0.57	57.8%	0.45	0.51	0.56	0.72
B-4	4			1,118	880						4,433	6,431	0.15	31.1%	0.22	0.29	0.36	0.61
C-1	5				23						2,864	2,887	0.07	2.7%	0.01	0.06	0.15	0.50
C-2	7			2,366	1,247						5,136	8,749	0.20	41.0%	0.31	0.37	0.44	0.65
D-1	8			557	588						2,290	3,435	0.08	33.0%	0.24	0.31	0.38	0.62
O-1	2			3,075								3,075	0.07	100.0%	0.83	0.86	0.87	0.89
O-2	3			3,811								3,811	0.09	100.0%	0.83	0.86	0.87	0.89
O-3	4			18,045	5,350						9,229	32,624	0.75	70.6%	0.56	0.61	0.65	0.77
O-4	5			11,306	2,880						3,701	17,887	0.41	78.1%	0.63	0.68	0.71	0.80
O-5	6			8,014	1,957						2,005	11,976	0.27	82.0%	0.66	0.71	0.74	0.82

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Job Name: Ridgegate Couplet
Job Number: 65111370
Date: 8/2/2023
By: K. Norcia

Ridgegate Couplet

Composite Runoff Coefficient Calculations

Location: Douglas County
Municipality: Douglas County
Minor Design Storm: 5
Major Design Storm: 100
Soil Type: C/D

Runoff Coefficient (UDFCD Vol 1, Chp 6, Sec. 2.5.1)

NRCS Soil Group	Storm Return Period					
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
A	C=0.84i^1.302	C=0.86i^1.276	C=0.87i^1.232	C=0.84i^1.124	C=0.85i+0.025	C=0.78i+0.110
B	C=0.84i^1.169	C=0.86i^1.088	C=0.81i+0.057	C=0.63i+0.249	C=0.56i+0.328	C=0.47i+0.426
C/D	C=0.83i^1.122	C=0.82i+0.035	C=0.74i+0.132	C=0.56i+0.319	C=0.49i+0.393	C=0.41i+0.484

Basin Design Data

		I (%) =	90%	100%	90%	40%	10%	50%	10%	75%	2%			i (%)	Runoff Coeff's			
Basin Name	Design Point	Outfall	A_{Roof} (sf)	A_{Paved} (sf)	A_{Walk} (sf)	A_{Gravel} (compacted) (sf)	A_{Gravel} (uncompacted) (sf)	$A_{Railroad\ Yard\ Areas}$ (sf)	A_{Parks} (sf)	$A_{Suburban\ Lot}$ (sf)	$A_{Iscape\ (C/D\ soil)}$ (sf)	A_{Total} (sf)	A_{Total} (ac)	Imp (%)	C2	C5	C10	C100
O-6	7			22,622	4,943						7,101	34,666	0.80	78.5%	0.63	0.68	0.71	0.81
O-7	8			25,715	4,832						5,155	35,702	0.82	84.5%	0.69	0.73	0.76	0.83
TOTAL		0	167,885	109,901	44,791	0	0	0	1,857	0	61,135	385,569	8.85	78.5%	0.63	0.68	0.71	0.81

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Date: 8/2/2023
By: K. Norcia

Ridgegate Couplet

Time of Concentration Calculations

Location: Douglas County
Municipality: Douglas County
Minor Design Storm: 5
Major Design Storm: 100
Soil Type: C/D

$t_i=(0.395(1.1-C_5)(L_t^{0.5}))/(S_o^{0.33})$
$t_t=L_t/(60V_t)$
Urban $t_c=(26-17i)+L_t/(60(14i+9)*(S_O^{.5}))$

Sub-Basin Data					Initial Overland Time (t_i)			Travel Time (t_t) t_t=Length/(Velocity x 60)						t_c Comp	tc Urbanized Check ON			t_c Final
Basin Name	Design Point	A_{Total} (ac)	i (%)	C5	Upper most Length (ft)	Slope (%)	t_i (min)	Length (ft)	Slope (%)	Type of Land Surface	C_v	Velocity (fps)	t_t (min)	Time of Conc $t_i + t_t = t_c$	L_t (ft)	S_O (%)	Urban t_c	Min t_c
A-1	1	0.85	90.0%	0.77	40	1.0%	3.8	0	0.0%	Paved areas & shallow paved swales	20	0.0	0.0	3.8	40.0	1.0%	4.7	5.0
A-2	3	0.97	90.0%	0.77	38	1.0%	3.7	0	0.0%	Paved areas & shallow paved swales	20	0.0	0.0	3.7	37.5	1.0%	4.7	5.0
A-3	5	1.40	90.0%	0.77	125	1.0%	6.7	0	0.0%	Paved areas & shallow paved swales	20	0.0	0.0	6.7	125.0	1.0%	5.1	5.1
A-4	5	0.30	90.0%	0.77	23	1.0%	2.9	0	0.0%	Paved areas & shallow paved swales	20	0.0	0.0	2.9	23.0	1.0%	4.6	5.0
A-5	6	0.33	90.0%	0.77	22	1.0%	2.8	0	0.0%	Paved areas & shallow paved swales	20	0.0	0.0	2.8	22.0	1.0%	4.6	5.0
B-1	1	0.27	33.4%	0.31	136	1.5%	14.8	0	0.0%	Paved areas & shallow paved swales	20	0.0	0.0	14.8	136.0	1.5%	13.9	13.9
B-2	2	0.45	77.9%	0.67	50	1.5%	4.8	75	1.5%	Paved areas & shallow paved swales	20	2.4	0.5	5.3	125.0	1.5%	6.9	5.3
B-3	3	0.57	57.8%	0.51	47	3.0%	5.2	155	1.5%	Paved areas & shallow paved swales	20	2.4	1.1	6.2	202.0	1.8%	10.3	6.2
B-4	4	0.15	31.1%	0.29	130	3.0%	11.7	207	3.4%	Paved areas & shallow paved swales	20	3.7	0.9	12.7	337.0	3.2%	14.9	12.7
C-1	5	0.07	2.7%	0.06	134	2.3%	16.8	95	1.5%	Short Pasture and lawns	7	0.9	1.8	18.6	229.0	1.9%	19.8	18.6
C-2	7	0.20	41.0%	0.37	90	1.0%	12.7	236	5.0%	Paved areas & shallow paved swales	20	4.5	0.9	13.5	326.0	3.4%	13.2	13.2
D-1	8	0.08	33.0%	0.31	67	1.0%	11.9	421	4.0%	Short Pasture and lawns	7	1.4	5.0	16.9	488.0	3.4%	15.3	15.3

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Job Name: Ridgegate Couplet
Job Number: 65111370
Date: 8/2/2023
By: K. Norcia

Ridgegate Couplet

Time of Concentration Calculations

Location: Douglas County
Municipality: Douglas County
Minor Design Storm: 5
Major Design Storm: 100
Soil Type: C/D

$t_i=(0.395(1.1-C_5)(L_t^{0.5}))/(S_o^{0.33})$
$t_t=L_t/(60V_t)$
Urban $t_c=(26-17i)+L_t/(60(14i+9)*(S_O^{.5}))$

Sub-Basin Data					Initial Overland Time (t_i)			Travel Time (t_t) t_t=Length/(Velocity x 60)						t_c Comp	tc Urbanized Check ON			t_c Final
Basin Name	Design Point	A_{Total} (ac)	i (%)	C5	Upper most Length (ft)	Slope (%)	t_i (min)	Length (ft)	Slope (%)	Type of Land Surface	C_v	Velocity (fps)	t_t (min)	Time of Conc $t_i + t_t = t_c$	L_t (ft)	S_O (%)	Urban t_c	Min t_c
O-1	2	0.07	100.0%	0.86	29	2.8%	1.7	67	1.5%	Paved areas & shallow paved swales	20	2.4	0.5	2.2	96.0	1.8%	3.3	5.0
O-2	3	0.09	100.0%	0.86	31	2.8%	1.8	180	1.5%	Paved areas & shallow paved swales	20	2.4	1.2	3.0	211.0	1.6%	3.8	5.0
O-3	4	0.75	70.6%	0.61	68	2.5%	5.4	320	3.4%	Paved areas & shallow paved swales	20	3.7	1.4	6.9	388.0	3.2%	8.6	6.9
O-4	5	0.41	78.1%	0.68	100	2.3%	5.9	95	1.5%	Paved areas & shallow paved swales	20	2.4	0.6	6.5	195.0	1.9%	7.1	6.5
O-5	6	0.27	82.0%	0.71	32	2.0%	3.2	307	3.4%	Paved areas & shallow paved swales	20	3.7	1.4	4.6	339.0	3.2%	6.7	5.0
O-6	7	0.80	78.5%	0.68	50	1.0%	5.5	236	5.0%	Paved areas & shallow paved swales	20	4.5	0.9	6.3	286.0	3.9%	7.0	6.3
O-7	8	0.82	84.5%	0.73	207	5.0%	5.7	368	4.0%	Paved areas & shallow paved swales	20	4.0	1.5	7.3	575.0	4.3%	6.8	6.8

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Job Name: Ridgegate Couplet
Job Number: 65111370
Date: 10/9/2023
By: K. Norcia

Ridgegate Couplet

Developed Storm Runoff Calculations

Design Storm : **5 Year**

Point Hour Rainfall (P_1) : **1.43**

$I = (28.5\ P1) / ((10 + TC)^{0.786})$

	Direct Runoff							Total Runoff				Inlets			Pipe					Pipe/Swale Travel Time				
Basin Name	Design Point	Area (ac)	Runoff Coeff	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Total tc (min)	ΣC*A (ac)	I (in/hr)	Q (cfs)	Inlet Type	Q intercepted	Q carryover (Qco)	Pipe Size (in) or equivalent	Pipe Material	Slope (%)	Pipe Flow (cfs)	Approx. Max Pipe Capacity (cfs)	Length (ft)	Velocity (fps)	tt (min)	Total Time (min)	Notes
A-1		0.85	0.77	5.0	0.65	4.85	3.2																	ROOF DRAIN TO TIE INTO AREA INLET (AT DP 1)
B-1		0.27	0.31	13.9	0.08	3.36	0.3					TYPE C INLET	3.5	0.0										CAPTURED BY AREA INLET IN SUMP (AT DP 1)
	1							13.90	0.74	3.36	2.5			-	18 in	RCP	1.0%	2.5	10.53	226	5.9	0.63	14.53	PIPED FROM DP 1 TO DP 2
B-2		0.45	0.67	5.3	0.31	4.78	1.5							-										CAPTURED BY AREA INLET IN SUMP (AT DP 2)
O-1		0.07	0.86	5.0	0.06	4.85	0.3					TYPE 13 VALLEY	1.8	1.9										CAPTURED BY AREA INLET IN SUMP (AT DP 2)
	2							14.53	1.11	3.29	3.6			-										TOTAL TO DP 2
														-	18 in	RCP	1.3%	3.6	11.78	161.9	6.6	0.41	14.94	PIPED FROM DP 2 TO DP 3
X2-1		2.39	0.73	7.5	1.74	3.31	5.8					STUB	5.8	3.5										*EXISTING RUNOFF TO STUB PIPE, SEE NOTE BELOW
	*X2-1							14.94	2.85	3.25	9.2			-										
														-	24 in	RCP	1.0%	9.2	22.68	173.1	7.2	0.40	15.34	PIPE FROM X2-1 TO DP 3
A-2		0.97	0.77	5.0	0.75	4.85	3.6																	ROOF DRAIN TO TIE INTO AREA INLET (AT DP 3)
B-3		0.57	0.51	6.2	0.29	4.57	1.3							-										CAPTURED BY AREA INLET IN SUMP (AT DP 3)
O-2		0.09	0.86	5.0	0.07	4.85	0.4					TYPE 13 VALLEY	5.3	7.4										CAPTURED BY AREA INLET IN SUMP (AT DP 3)
	3							15.34	3.97	3.21	12.7			-										TOTAL TO DP 3
														-	30 in	RCP	1.3%	12.7	45.98	83.8	9.3	0.15	15.49	PIPED FROM DP 3 TO DP 4
X2-2		2.39	0.73	7.5	1.74	3.31	5.8					STUB	5.8	12.4										*EXISTING RUNOFF TO STUB PIPE, SEE NOTE BELOW
	*X2-2							15.49	5.71	3.19	18.2			-										
														-	30 in	RCP	1.0%	18.2	41.13	98.5	8.4	0.20	15.69	PIPE FROM X2-2 TO DP 4
B-4		0.15	0.29	12.7	0.04	3.50	0.1							-										CAPUTRED BY EXISTING AREA INLET IN SUMP (AT DP 4)
O-3		0.75	0.61	6.9	0.46	4.42	2.0					EX TYPE R INLET	2.2	17.5										CAPUTRED BY EXISTING AREA INLET IN SUMP (AT DP 4)
	4							15.69	6.21	3.17	19.7			-										TOTAL TO DP 4
														-	30 in	RCP	1.5%	19.7	50.37	33	10.2	0.05	0.05	FLOW IN EXISTING 36" RCP
A-3		1.40	0.77	5.1	1.08	4.83	5.2							-										ROOF DRAIN TO TIE INTO AREA INLET (AT DP 5)
A-4		0.30	0.77	5.0	0.23	4.85	1.1							-										ROOF DRAIN TO TIE INTO AREA INLET (AT DP 5)
C-1		0.07	0.06	18.6	0.00	2.92	0.0							-										CAPTURED BY AREA INLET IN SUMP (AT DP 5)
O-4		0.41	0.68	6.5	0.28	4.50	1.2					EX TYPE R INLET	7.6	0.0										CAPTURED BY AREA INLET IN SUMP (AT DP 5)
	5							18.60	1.60	2.91	4.7			-										TOTAL TO DP 5
														-	18 in	RCP	1.5%	4.7	12.90	540	7.3	1.24	19.84	PIPED FROM DP 5 TO DP 6
A-5		0.33	0.77	5.0	0.26	4.85	1.3							-										ROOF DRAIN TO TIE INTO AREA INLET (AT DP 6)
O-5		0.27	0.71	5.0	0.19	4.85	0.9					EX TYPE R INLET	2.2	3.6										CAPTURED BY AREA INLET IN SUMP (AT DP 6)
	6							19.84	2.05	2.82	5.8			-										TOTAL TO DP 6
														-	18 in	RCP	1.5%	5.8	12.90	540	7.3	1.24	21.07	PIPED FROM DP 5 TO DP 6
C-2		0.20	0.37	13.2	0.07	3.44	0.3							-										CAPTURED BY AREA INLET IN SUMP (AT DP 7)
O-6		0.80	0.68	6.3	0.54	4.54	2.5					EX TYPE R INLET	2.7	4.6										CAPTURED BY AREA INLET IN SUMP (AT DP 7)
	7							21.07	2.66	2.73	7.3			-										TOTAL TO DP 7
														-	30 in	RCP	0.5%	7.3	29.08	41	5.9	0.12	21.19	FLOW IN EXISTING 30" RCP
D-1		0.08	0.31	15.3	0.02	3.22	0.1							-										CAPTURED BY AREA INLET IN SUMP (AT DP 8)
O-7		0.82	0.73	6.8	0.60	4.44	2.6					EX TYPE R INLET	2.7	0.0										CAPTURED BY AREA INLET IN SUMP (AT DP 8)
	8							15.30	0.62	3.21	2.0			-										TOTAL TO DP 8

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By: K. Norcia

Ridgegate Couplet

Developed Storm Runoff Calculations

Design Storm : **5 Year**

Point Hour Rainfall (P_1) : **1.43**

$I = (28.5\ P1) / ((10 + TC)^{0.786})$

	Direct Runoff							Total Runoff				Inlets			Pipe					Pipe/Swale Travel Time				
Basin Name	Design Point	Area (ac)	Runoff Coeff	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Total tc (min)	ΣC*A (ac)	I (in/hr)	Q (cfs)	Inlet Type	Q intercepted	Q carryover (Qco)	Pipe Size (in) or equivalent	Pipe Material	Slope (%)	Pipe Flow (cfs)	Approx. Max Pipe Capacity (cfs)	Length (ft)	Velocity (fps)	tt (min)	Total Time (min)	Notes
														-	18 in	RCP	1.5%	2.0	12.90	540	7.3	1.24	16.54	FLOW IN EXISTING 18" RCP

*X2-1 AND X2-2 ARE EXISTING FLOWS INTO STUB PIPES FROM RIDGEGATE FILING NO. 3 PHASE 4 DRAINAGE REPORT DATED OCTOBER 2023

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Job Name: Ridgegate Couplet
Job Number: 65111370
Date: 10/9/2023
By: K. Norcia

Ridgegate Couplet

Developed Storm Runoff Calculations

Design Storm : **100 Year**

Point Hour Rainfall (P_1) : **2.60**

$I = (28.5\ P1) / ((10 + TC)^{0.786})$

	Direct Runoff							Total Runoff				Inlets			Pipe					Pipe/Swale Travel Time				
Basin Name	Design Point	Area (ac)	Runoff Coeff	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Total tc (min)	ΣC*A (ac)	I (in/hr)	Q (cfs)	Inlet Type	Q intercepted	Q carryover (Qco)	Pipe Size (in) or equivalent	Pipe Material	Slope (%)	Pipe Flow (cfs)	Approx. Max Pipe Capacity (cfs)	Length (ft)	Velocity (fps)	tt (min)	Total Time (min)	Notes
A-1		0.85	0.85	5.0	0.72	8.82	6.4																	ROOF DRAIN TO TIE INTO AREA INLET (AT DP 1)
B-1		0.27	0.62	13.9	0.17	6.12	1.0					TYPE C INLET	7.4	0.0										CAPTURED BY AREA INLET IN SUMP (AT DP 1)
	1							13.90	0.89	6.10	5.4			-	18 in	RCP	1.0%	5.4	10.53	226	5.9	0.63	14.53	PIPED FROM DP 1 TO DP 2
B-2		0.45	0.80	5.3	0.37	8.68	3.2							-										CAPTURED BY AREA INLET IN SUMP (AT DP 2)
O-1		0.07	0.89	5.0	0.06	8.82	0.6					TYPE 13 VALLEY	3.7	4.2										CAPTURED BY AREA INLET IN SUMP (AT DP 2)
	2							14.53	1.32	5.98	7.9			-										TOTAL TO DP 2
														-	18 in	RCP	1.3%	7.9	11.78	161.9	6.6	0.41	14.94	PIPED FROM DP 2 TO DP 3
X2-1		2.39	0.83	7.5	1.98	6.82	13.5					STUB	13.5	6.0										*EXISTING RUNOFF TO STUB PIPE, SEE NOTE BELOW
	*X2-1							14.94	3.30	5.90	19.5			-										
														-	24 in	RCP	1.0%	19.5	22.68	173.1	7.2	0.40	15.34	PIPE FROM X2-1 TO DP 3
A-2		0.97	0.85	5.0	0.83	8.82	7.3																	ROOF DRAIN TO TIE INTO AREA INLET (AT DP 3)
B-3		0.57	0.72	6.2	0.41	8.30	3.4							-										CAPTURED BY AREA INLET IN SUMP (AT DP 3)
O-2		0.09	0.89	5.0	0.08	8.82	0.7					TYPE 13 VALLEY	11.4	15.5										CAPTURED BY AREA INLET IN SUMP (AT DP 3)
	3							15.34	4.62	5.83	26.9			-										TOTAL TO DP 3
														-	30 in	RCP	1.3%	26.9	45.98	83.8	9.3	0.15	15.49	PIPED FROM DP 3 TO DP 4
X2-2		2.39	0.83	7.5	1.98	6.82	13.5					STUB	13.5	24.8										*EXISTING RUNOFF TO STUB PIPE, SEE NOTE BELOW
	*X2-2							15.49	6.60	5.80	38.3			-										
														-	30 in	RCP	1.0%	38.3	41.13	98.5	8.4	0.20	15.69	PIPE FROM X2-2 TO DP 4
B-4		0.15	0.61	12.7	0.09	6.37	0.6							-										CAPUTRED BY EXISTING AREA INLET IN SUMP (AT DP 4)
O-3		0.75	0.77	6.9	0.58	8.03	4.7					EX TYPE R INLET	5.2	36.7										CAPUTRED BY EXISTING AREA INLET IN SUMP (AT DP 4)
	4							15.69	7.27	5.77	41.9			-										TOTAL TO DP 4
														-	30 in	RCP	1.5%	41.9	50.37	33	10.2	0.05	0.05	FLOW IN EXISTING 36" RCP
A-3		1.40	0.85	5.1	1.20	8.77	10.5							-										ROOF DRAIN TO TIE INTO AREA INLET (AT DP 5)
A-4		0.30	0.85	5.0	0.26	8.82	2.3							-										ROOF DRAIN TO TIE INTO AREA INLET (AT DP 5)
C-1		0.07	0.50	18.6	0.03	5.31	0.2							-										CAPTURED BY AREA INLET IN SUMP (AT DP 5)
O-4		0.41	0.80	6.5	0.33	8.18	2.7					EX TYPE R INLET	15.6	0.0										CAPTURED BY AREA INLET IN SUMP (AT DP 5)
	5							18.60	1.81	5.30	9.6			-										TOTAL TO DP 5
														-	18 in	RCP	1.5%	9.6	12.90	540	7.3	1.24	19.84	PIPED FROM DP 5 TO DP 6
A-5		0.33	0.85	5.0	0.29	8.82	2.5							-										ROOF DRAIN TO TIE INTO AREA INLET (AT DP 6)
O-5		0.27	0.82	5.0	0.23	8.82	2.0					EX TYPE R INLET	4.5	7.4										CAPTURED BY AREA INLET IN SUMP (AT DP 6)
	6							19.84	2.32	5.13	11.9			-										TOTAL TO DP 6
														-	18 in	RCP	1.5%	11.9	12.90	540	7.3	1.24	21.07	PIPED FROM DP 5 TO DP 6
C-2		0.20	0.65	13.2	0.13	6.26	0.8							-										CAPTURED BY AREA INLET IN SUMP (AT DP 7)
O-6		0.80	0.81	6.3	0.64	8.26	5.3					EX TYPE R INLET	6.1	9.3										CAPTURED BY AREA INLET IN SUMP (AT DP 7)
	7							21.07	3.10	4.96	15.4			-										TOTAL TO DP 7
														-	30 in	RCP	0.5%	15.4	29.08	41	5.9	0.12	21.19	FLOW IN EXISTING 30" RCP
D-1		0.08	0.62	15.3	0.05	5.85	0.3							-										CAPTURED BY AREA INLET IN SUMP (AT DP 8)
O-7		0.82	0.83	6.8	0.68	8.07	5.5					EX TYPE R INLET	5.8	0.0										CAPTURED BY AREA INLET IN SUMP (AT DP 8)
	8							15.30	0.73	5.84	4.3			-										TOTAL TO DP 8

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5970 Greenwood Plaza Blvd.
Greenwood Village, CO 80111
Ph: (303) 751-0741

Job Name: Ridgegate Couplet
Job Number: 65111370
Date: 10/9/2023
By: K. Norcia

Ridgegate Couplet

Developed Storm Runoff Calculations

Design Storm : **100 Year**

Point Hour Rainfall (P_1) : **2.60**

$I = (28.5\ P1) / ((10 + TC)^{0.786})$

	Direct Runoff							Total Runoff				Inlets			Pipe					Pipe/Swale Travel Time				
Basin Name	Design Point	Area (ac)	Runoff Coeff	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Total tc (min)	ΣC*A (ac)	I (in/hr)	Q (cfs)	Inlet Type	Q intercepted	Q carryover (Qco)	Pipe Size (in) or equivalent	Pipe Material	Slope (%)	Pipe Flow (cfs)	Approx. Max Pipe Capacity (cfs)	Length (ft)	Velocity (fps)	tt (min)	Total Time (min)	Notes
														-	18 in	RCP	1.5%	4.3	12.90	540	7.3	1.24	16.54	FLOW IN EXISTING 18" RCP

*X2-1 AND X2-2 ARE EXISTING FLOWS INTO STUB PIPES FROM RIDGEGATE FILING NO. 3 PHASE 4 DRAINAGE REPORT DATED OCTOBER 2023

Appendix C

(Hydraulic Calculations)

Scenario Summary Report
Scenario: 5YR
5YR

Scenario Summary

ID	103
Label	5YR
Notes	
Active Topology	Base Active Topology
User Data Extensions	Base User Data Extensions
Physical	Base Physical
Boundary Condition	Base Boundary Condition
Initial Settings	Base Initial Settings
Hydrology	Base Hydrology
Output	Base Output
Infiltration and Inflow	Base Infiltration and Inflow
Rainfall Runoff	Base Rainfall Runoff
Water Quality	Base Water Quality
Sanitary Loading	Base Sanitary Loading
Headloss	Base Headloss
Operational	Base Operational
Design	Base Design
System Flows	5YR
SCADA	Base SCADA
Energy Cost	Base Energy Cost
Solver Calculation Options	Base Calculation Options

Gravity Hydraulics

Maximum Network Traversals	5	Structure Loss Mode	Hydraulic Grade
Flow Convergence Test	0.001	Include Conduit Flow Travel Time in Design	True
Flow Profile Method	Backwater Analysis	Save Detailed Headloss Data?	False
Number of Flow Profile Steps	5	Gravity Friction Method	Manning's
Hydraulic Grade Convergence Test	0.00 ft	Use Explicit Depth and Slope Equations?	False
Average Velocity Method	Actual Uniform Flow Velocity	Ignore Pipe Travel Time in Carrier Pipes?	False
Minimum Structure Headloss	0.00 ft	Correct for Partial Area Effects?	False
Governing Upstream Pipe Selection Method	Pipe with Maximum QV		

Inlets

Active Components for Combination Inlets on Grade	Grate and Curb	Neglect Gutter Cross Slope For Side Flow?	False
Active Components for Combination Inlets In Sag	Grate and Curb	Neglect Side Flow?	False

Scenario Summary Report
Scenario: 5YR
5YR

Grating Parameters (United Kingdom)

Grating Type	Grating Parameter
P	30.000
Q	45.000
R	60.000
S	80.000
T	110.000

Pressure Hydraulics			
Liquid Label	Water at 20C (68F)	Pressure Friction Method	Hazen-Williams

Rational Method			
Use Rational Method Frequency Factors	False	Carryover Modeling Method	As CA (Traditional)
Allow Runoff Coefficient to Exceed 1.0?	False		

Headloss (AASHTO)			
Expansion, Ke	0.350	Shaping Adjustment, Cs	0.500
Contraction, Kc	0.250	Non-Piped Flow Adjustment, Cn	1.300

Bend Angle vs. Bend Loss Curve

Bend Angle (degrees)	Bend Loss Coefficient, Kb
0.00	0.000
15.00	0.190
30.00	0.350
45.00	0.470
60.00	0.560
75.00	0.640
90.00	0.700

HEC-22 Energy Losses	
Consider Non-Piped Plunging Flow?	True

HEC-22 Energy Losses (Second Edition)			
Elevations Considered Equal Within	0.50 ft	Half Bench Submerged Factor	0.950
Flat Unsubmerged Factor	1.000	Full Bench Unsubmerged Factor	0.070
Flat Submerged Factor	1.000	Full Bench Submerged Factor	0.750

Scenario Summary Report
Scenario: 5YR
5YR

HEC-22 Energy Losses (Second Edition)			
Depressed Unsubmerged Factor	1.000	Improved Bench Unsubmerged Factor	0.035
Depressed Submerged Factor	1.000	Improved Bench Submerged Factor	0.375
Half Bench Unsubmerged Factor	0.150		

HEC-22 Energy Losses (Third Edition)			
Flat Submerged Coefficient	-0.050	Half Bench Unsubmerged Coefficient	-0.850
Flat Unsubmerged Coefficient	-0.050	Full Bench Submerged Coefficient	-0.250
Depressed Submerged Coefficient	0.000	Full Bench Unsubmerged Coefficient	-0.930
Depressed Unsubmerged Coefficient	0.000	Improved Submerged Coefficient	-0.600
Half Bench Submerged Coefficient	-0.050	Improved Unsubmerged Coefficient	-0.980

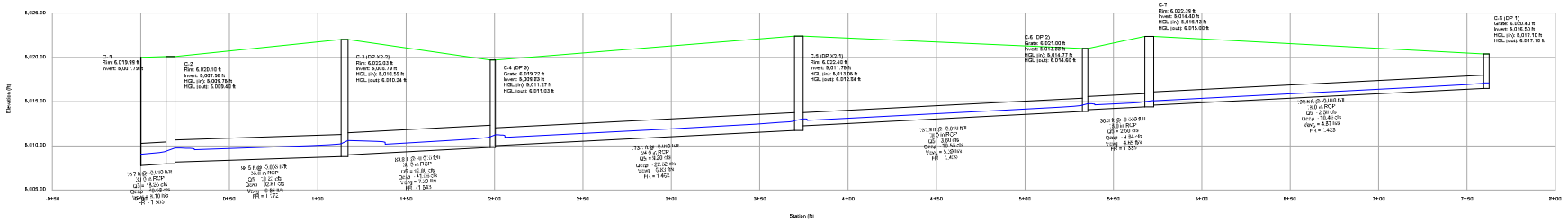
Modified Rational (United Kingdom)			
Apply Areal Reduction Factor?	False	Pipe Flow Includes Pipe Travel Time?	False
Runoff Routing Coefficient (Cr)	1.300		

FlexTable: Conduit Table

5YR

Start Node	Label	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n	Flow (cfs)	Velocity (ft/s)	Depth (Out) (ft)	Capacity (Full Flow) (cfs)	Notes
C-4 (DP 3)		6,010.03	C-5 (DP X2-1)	6,011.76	173.1	-0.010	24.0	0.013	9.20	6.83	1.24	22.62	24" RCP
C-5 (DP X2-1)		6,012.26	C-6 (DP 2)	6,013.88	161.9	-0.010	18.0	0.013	3.60	5.39	0.80	10.50	18" RCP
C-6 (DP 2)		6,014.08	C-7	6,014.40	36.3	-0.009	18.0	0.013	2.50	4.65	0.69	9.84	18" RCP
C-7		6,014.60	C-8 (DP 1)	6,016.50	190.6	-0.010	18.0	0.013	2.50	4.87	0.50	10.49	18" RCP
C-2		6,008.16	C-3 (DP X2-2)	6,008.79	98.5	-0.006	30.0	0.013	18.20	6.86	1.60	32.81	30" RCP
C-3 (DP X2-2)		6,008.99	C-4 (DP 3)	6,009.83	83.8	-0.010	30.0	0.013	12.80	7.39	1.60	41.06	30" RCP
C-1		6,007.79	C-2	6,007.96	16.7	-0.010	30.0	0.013	18.20	8.10	1.26	40.98	30" RCP
X2-2	CO-1	6,009.65	C-3 (DP X2-2)	6,009.29		0.008	12.0	0.013	5.80	7.38	1.31	3.26	
X2-1	CO-2	6,012.43	C-5 (DP X2-1)	6,011.96		0.012	24.0	0.013	5.80	6.39	1.10	24.52	

Profile Report
Engineering Profile - 1370 STRM (1370 Couplet.stsw)
5YR



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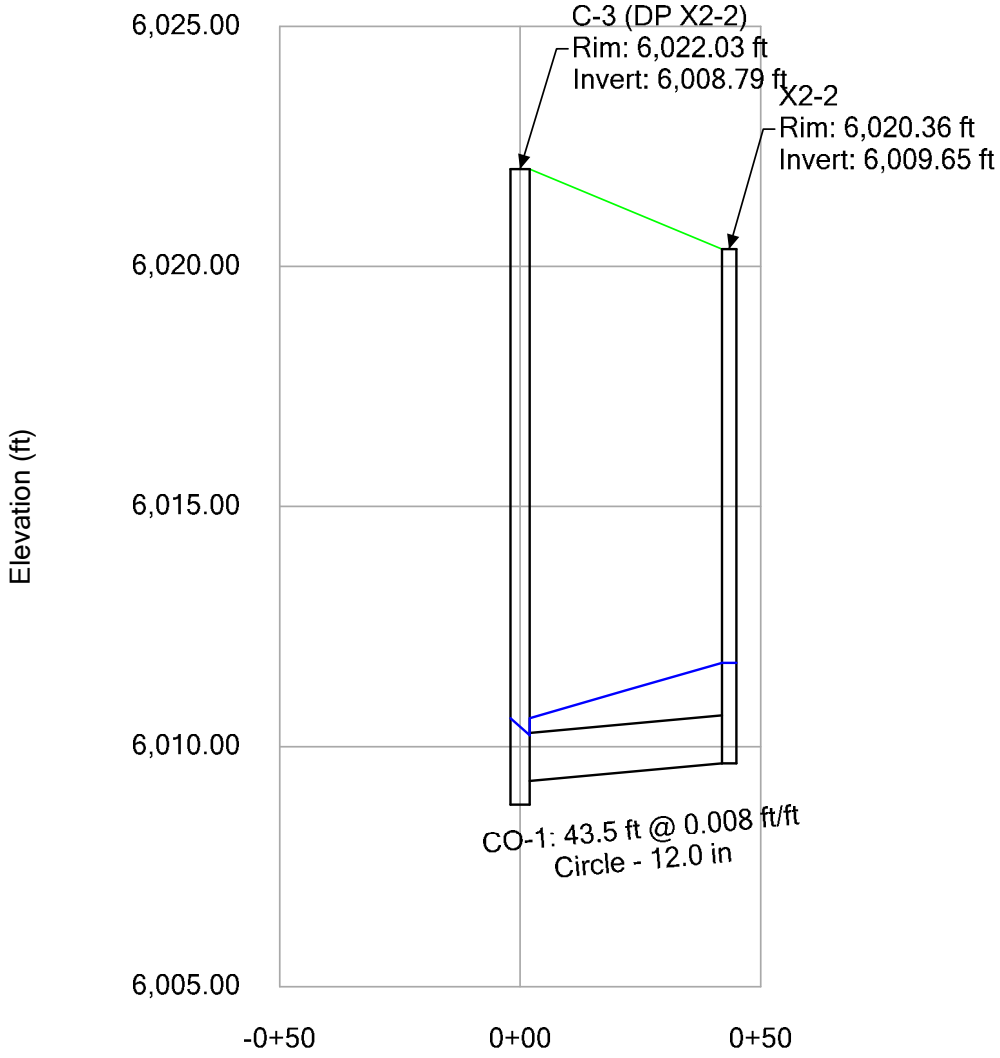
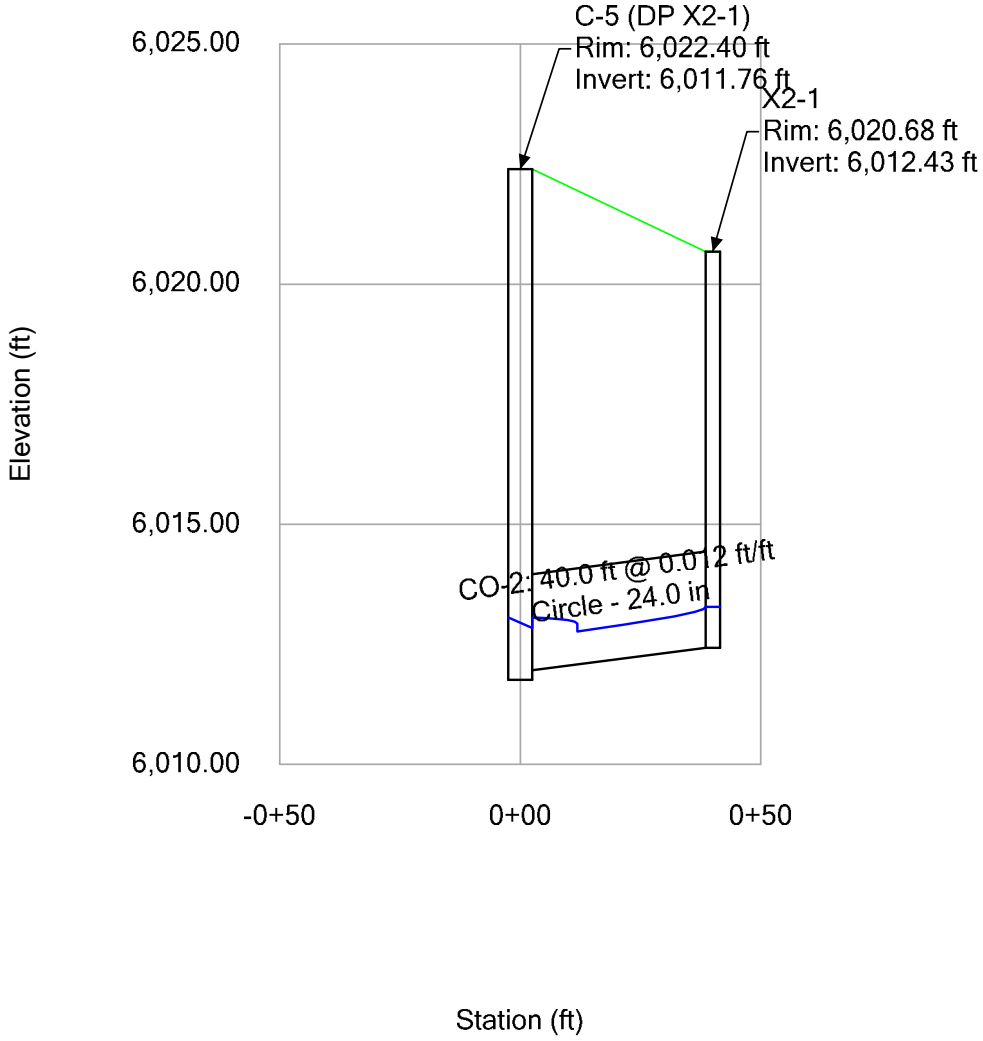
Profile Report
Engineering Profile - ST LINE B (1370 Couplet.stsw)
5YR



Profile Report
Engineering Profile - ST LINE C (1370 Couplet.stsw)
5YR



Scenario Summary Report
Scenario: 100YR
100YR

Scenario Summary

ID	102
Label	100YR
Notes	
Active Topology	Base Active Topology
User Data Extensions	Base User Data Extensions
Physical	Base Physical
Boundary Condition	Base Boundary Condition
Initial Settings	Base Initial Settings
Hydrology	Base Hydrology
Output	Base Output
Infiltration and Inflow	Base Infiltration and Inflow
Rainfall Runoff	Base Rainfall Runoff
Water Quality	Base Water Quality
Sanitary Loading	Base Sanitary Loading
Headloss	Base Headloss
Operational	Base Operational
Design	Base Design
System Flows	100YR
SCADA	Base SCADA
Energy Cost	Base Energy Cost
Solver Calculation Options	Base Calculation Options

Gravity Hydraulics

Maximum Network Traversals	5	Structure Loss Mode	Hydraulic Grade
Flow Convergence Test	0.001	Include Conduit Flow Travel Time in Design	True
Flow Profile Method	Backwater Analysis	Save Detailed Headloss Data?	False
Number of Flow Profile Steps	5	Gravity Friction Method	Manning's
Hydraulic Grade Convergence Test	0.00 ft	Use Explicit Depth and Slope Equations?	False
Average Velocity Method	Actual Uniform Flow Velocity	Ignore Pipe Travel Time in Carrier Pipes?	False
Minimum Structure Headloss	0.00 ft	Correct for Partial Area Effects?	False
Governing Upstream Pipe Selection Method	Pipe with Maximum QV		

Inlets

Active Components for Combination Inlets on Grade	Grate and Curb	Neglect Gutter Cross Slope For Side Flow?	False
Active Components for Combination Inlets In Sag	Grate and Curb	Neglect Side Flow?	False

Scenario Summary Report
Scenario: 100YR
100YR

Grating Parameters (United Kingdom)

Grating Type	Grating Parameter
P	30.000
Q	45.000
R	60.000
S	80.000
T	110.000

Pressure Hydraulics			
Liquid Label	Water at 20C (68F)	Pressure Friction Method	Hazen-Williams

Rational Method			
Use Rational Method Frequency Factors	False	Carryover Modeling Method	As CA (Traditional)
Allow Runoff Coefficient to Exceed 1.0?	False		

Headloss (AASHTO)			
Expansion, Ke	0.350	Shaping Adjustment, Cs	0.500
Contraction, Kc	0.250	Non-Piped Flow Adjustment, Cn	1.300

Bend Angle vs. Bend Loss Curve

Bend Angle (degrees)	Bend Loss Coefficient, Kb
0.00	0.000
15.00	0.190
30.00	0.350
45.00	0.470
60.00	0.560
75.00	0.640
90.00	0.700

HEC-22 Energy Losses	
Consider Non-Piped Plunging Flow?	True

HEC-22 Energy Losses (Second Edition)			
Elevations Considered Equal Within	0.50 ft	Half Bench Submerged Factor	0.950
Flat Unsubmerged Factor	1.000	Full Bench Unsubmerged Factor	0.070
Flat Submerged Factor	1.000	Full Bench Submerged Factor	0.750

Scenario Summary Report
Scenario: 100YR
100YR

HEC-22 Energy Losses (Second Edition)			
Depressed Unsubmerged Factor	1.000	Improved Bench Unsubmerged Factor	0.035
Depressed Submerged Factor	1.000	Improved Bench Submerged Factor	0.375
Half Bench Unsubmerged Factor	0.150		

HEC-22 Energy Losses (Third Edition)			
Flat Submerged Coefficient	-0.050	Half Bench Unsubmerged Coefficient	-0.850
Flat Unsubmerged Coefficient	-0.050	Full Bench Submerged Coefficient	-0.250
Depressed Submerged Coefficient	0.000	Full Bench Unsubmerged Coefficient	-0.930
Depressed Unsubmerged Coefficient	0.000	Improved Submerged Coefficient	-0.600
Half Bench Submerged Coefficient	-0.050	Improved Unsubmerged Coefficient	-0.980

Modified Rational (United Kingdom)			
Apply Areal Reduction Factor?	False	Pipe Flow Includes Pipe Travel Time?	False
Runoff Routing Coefficient (Cr)	1.300		

FlexTable: Conduit Table

100YR

Start Node	Label	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n	Flow (cfs)	Velocity (ft/s)	Depth (Out) (ft)	Capacity (Full Flow) (cfs)	Notes
C-4 (DP 3)		6,010.03	C-5 (DP X2-1)	6,011.76	173.1	-0.010	24.0	0.013	19.40	6.18	2.77	22.62	24" RCP
C-5 (DP X2-1)		6,012.26	C-6 (DP 2)	6,013.88	161.9	-0.010	18.0	0.013	7.90	6.52	2.11	10.50	18" RCP
C-6 (DP 2)		6,014.08	C-7	6,014.40	36.3	-0.009	18.0	0.013	5.40	5.70	1.37	9.84	18" RCP
C-7		6,014.60	C-8 (DP 1)	6,016.50	190.6	-0.010	18.0	0.013	5.40	5.98	1.00	10.49	18" RCP
C-2		6,008.16	C-3 (DP X2-2)	6,008.79	98.5	-0.006	30.0	0.013	38.40	7.82	2.60	32.81	30" RCP
C-3 (DP X2-2)		6,008.99	C-4 (DP 3)	6,009.83	83.8	-0.010	30.0	0.013	27.00	5.50	3.21	41.06	30" RCP
C-1		6,007.79	C-2	6,007.96	16.7	-0.010	30.0	0.013	38.40	9.49	1.98	40.98	30" RCP
X2-2	CO-1	6,009.65	C-3 (DP X2-2)	6,009.29		0.008	12.0	0.013	13.50	17.19	2.91	3.26	
X2-1	CO-2	6,012.43	C-5 (DP X2-1)	6,011.96		0.012	24.0	0.013	13.50	4.30	2.41	24.52	

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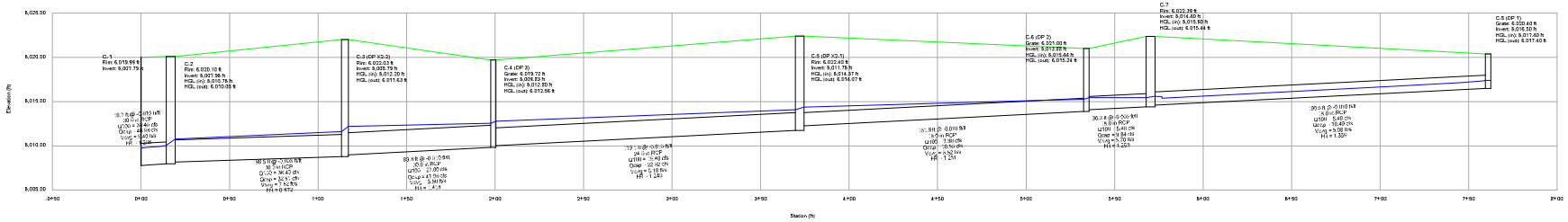
Profile Report
Engineering Profile - 1370 STRM (1370 Couplet.stsw)
100YR



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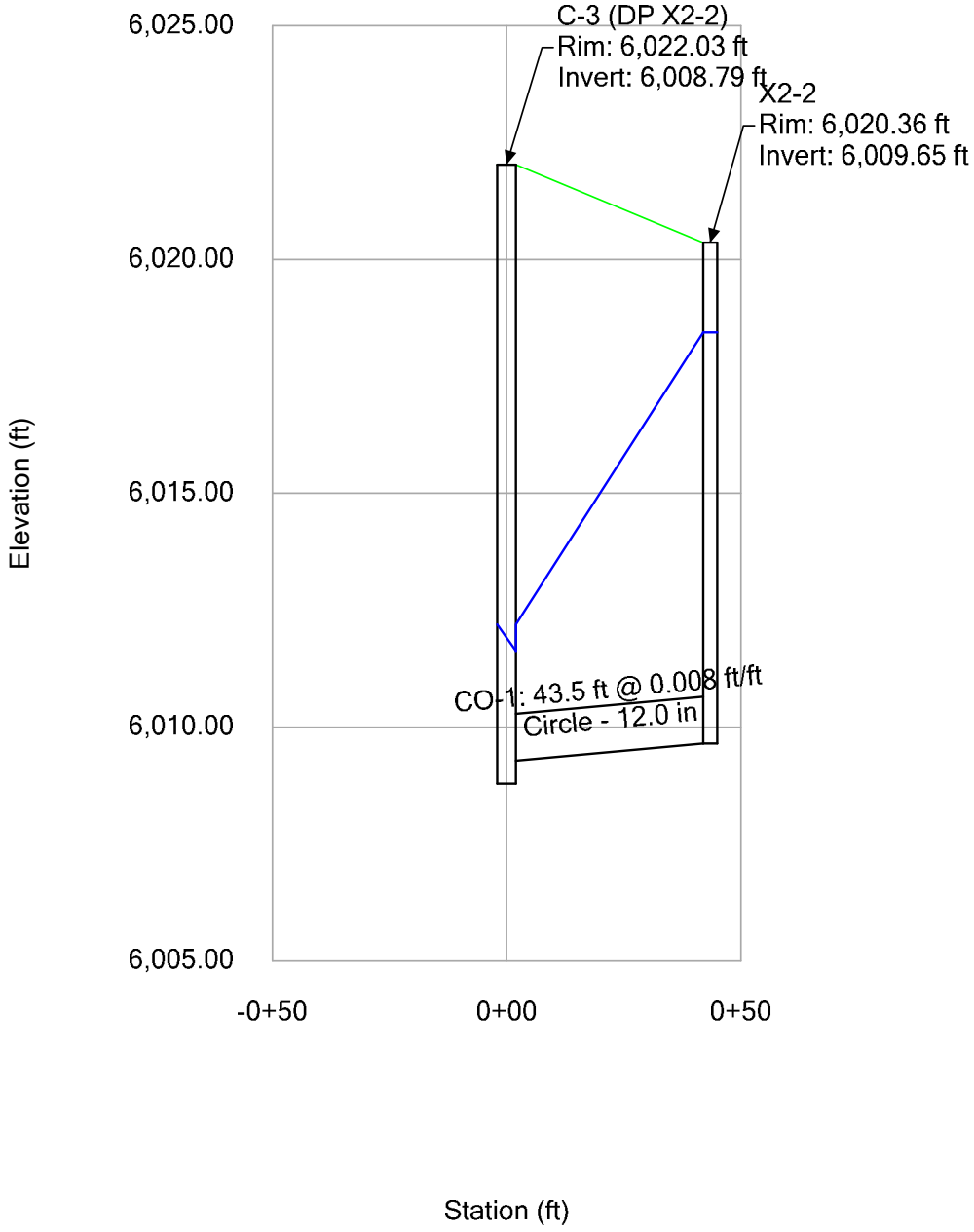
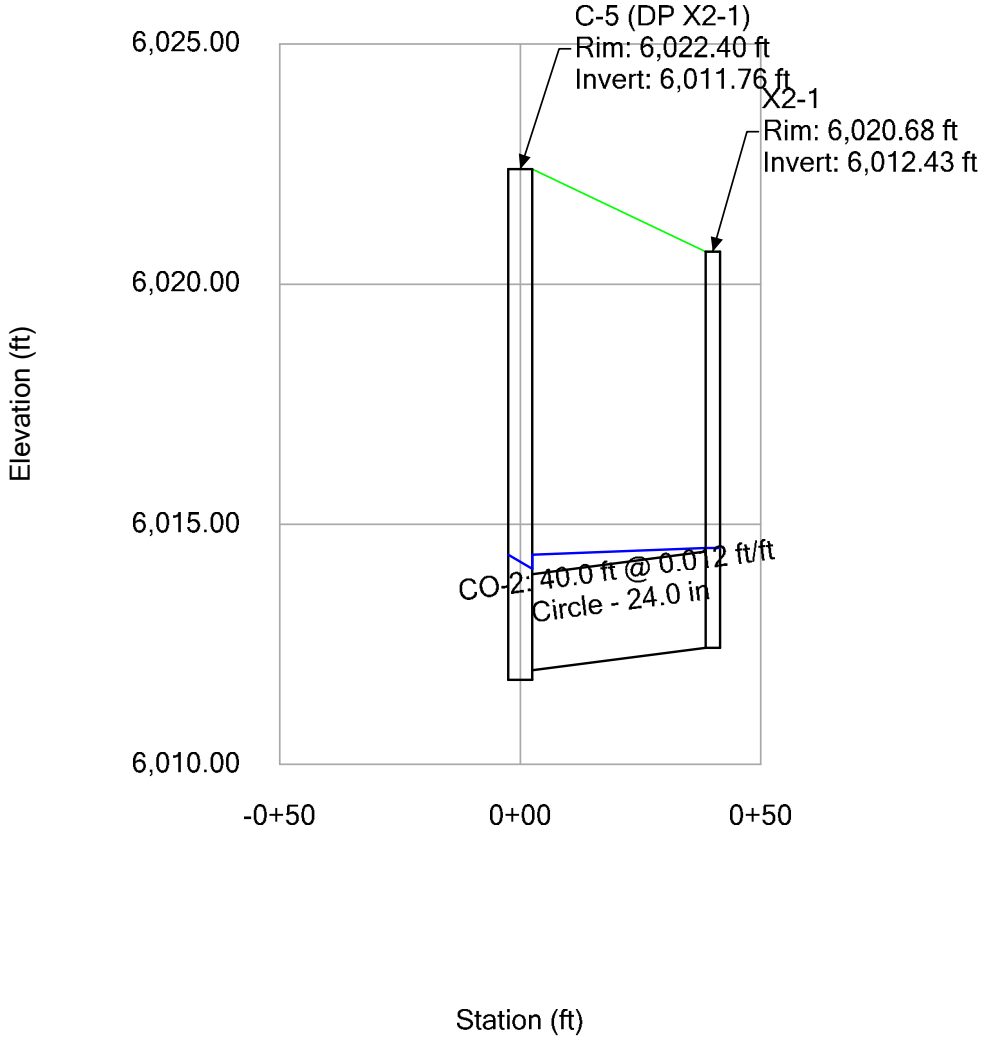
Profile Report
Engineering Profile - ST LINE B (1370 Couplet.stsw)
100YR



Profile Report
Engineering Profile - ST LINE C (1370 Couplet.stsw)
100YR



Appendix D

(Site Maps)

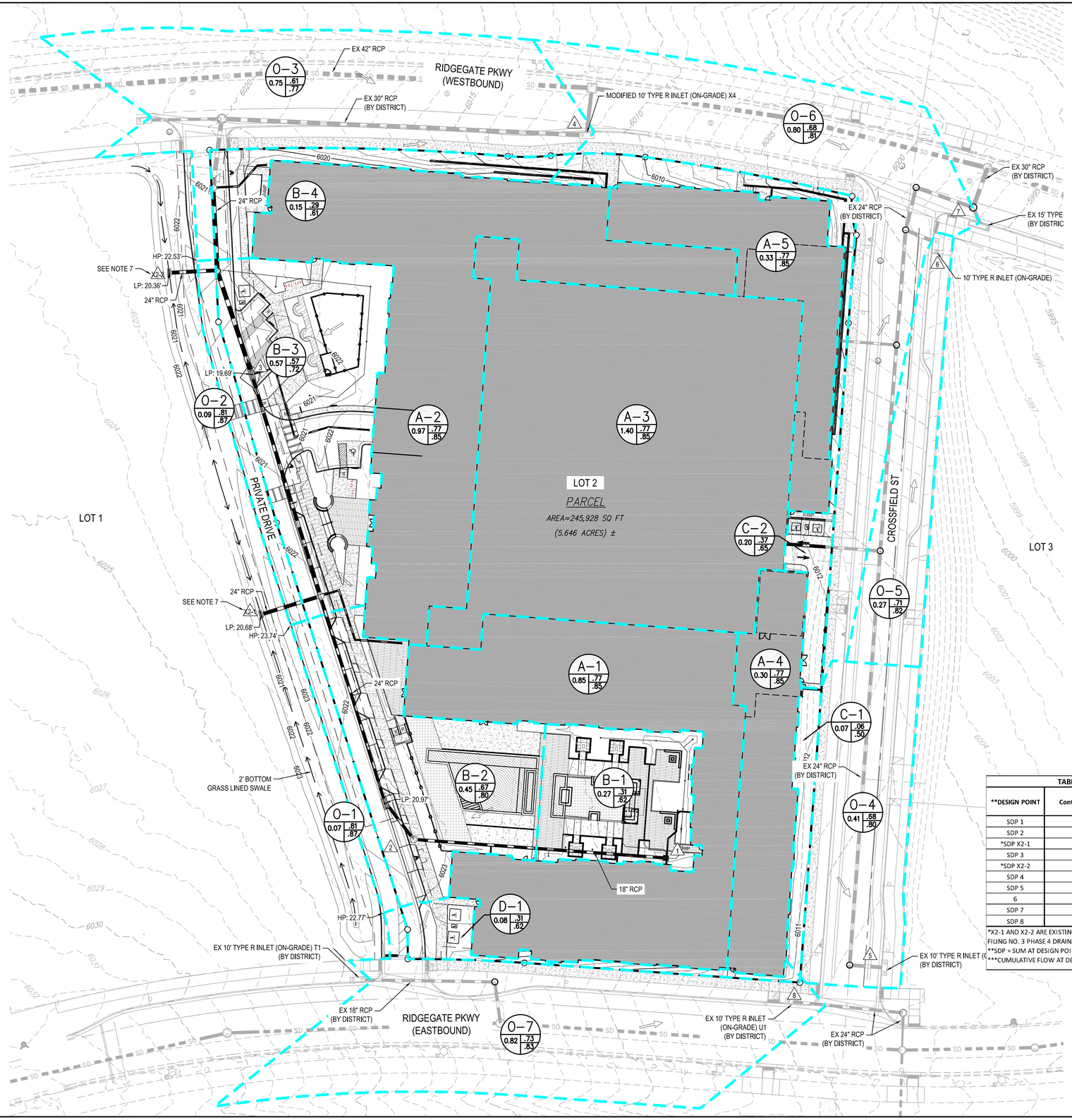


TABLE 1 - PROPOSED SUB-BASIN PEAK FLOWS

Sub-Basin Name	Design Point	Area (ac)	Imp (%)	5-Yr Peak Flow (cfs)	100-Yr Peak Flow (cfs)
A-1	1	0.85	90.0%	3.2	6.4
A-2	3	0.97	90.0%	3.6	7.3
A-3	5	1.40	90.0%	5.2	10.5
A-4	5	0.30	90.0%	1.1	2.3
A-5	6	0.33	90.0%	1.3	2.5
B-1	1	0.27	33.4%	0.3	1.0
B-2	2	0.45	77.9%	1.5	3.2
B-3	3	0.57	57.8%	1.3	3.4
B-4	4	0.15	31.1%	0.1	0.6
C-1	5	0.07	2.7%	0.0	0.2
C-2	7	0.20	41.0%	0.3	0.8
D-1	8	0.08	33.0%	0.1	0.3
On-Site Subtotal		5.64	72.6%	18.0	38.4
O-1	2	0.07	100.0%	0.3	0.6
O-2	3	0.09	100.0%	0.4	0.7
O-3	4	0.75	70.6%	2.0	4.7
O-4	5	0.41	78.1%	1.2	2.7
O-5	6	0.27	82.0%	0.9	2.0
O-6	7	0.80	78.5%	2.5	5.3
O-7	8	0.82	84.5%	2.6	5.5
**X2-1	X2-1	2.39	85.0%	5.8	13.5
**X2-2	X2-2	2.39	85.0%	5.8	13.5
*TOTAL		13.63	78.5%	39.5	86.8

*TOTAL PEAK FLOWS ARE A SUMMATION OF BASIN FLOWS AND DO NOT ACCOUNT FOR HYDRAULIC ROUTING.
**X2-1 AND X2-2 ARE EXISTING FLOWS INTO STUB PIPES FROM RIDGEGATE FILING NO. 3 PHASE 4 DRAINAGE REPORT DATED OCTOBER 2023

NOTES:

1. CONTRACTOR TO FIELD VERIFY VERTICAL AND HORIZONTAL LOCATIONS OF ALL EXISTING UTILITIES.
2. CONTRACTOR COORDINATE WITH XCEL ENERGY FOR GAS & ELECTRIC SERVICE.
3. CONTRACTOR TO REFER TO GESC PLANS FOR BMPS.
4. SEE SHEET C5.0-C5.1 FOR STORM PLAN AND PROFILES.
5. SEE SHEET C2.0 FOR WATER IMPROVEMENTS.
6. SEE SHEET C2.0 FOR SANITARY SEWER IMPROVEMENTS.
7. DESIGN POINTS X2-1 AND X2-2 REPRESENT BASIN X-2 (FROM THE *PHASE III DRAINAGE REPORT RIDGEGATE FILING NO. 3*, DATED OCTOBER 2023) DIVIDED EVENLY INTO EACH OF THE TYPE D STORM INLETS.

LEGEND

- 5995 — EXISTING MAJOR CONTOUR
- 5994 — EXISTING MINOR CONTOUR
- EXISTING CURB AND GUTTER W/RAMP
- ST EX SD — EXISTING STORM
- 5995 — PROPOSED MAJOR CONTOUR
- 5994 — PROPOSED MINOR CONTOUR
- PROPOSED RAIL
- PROPOSED STORM
- DRAINAGE BASIN BOUNDARY
- 1 — DESIGN POINT
- FLOW ARROWS

A2 0.10 .44 .59
- BASIN IDENTIFICATION
- BASIN C5 VALUE
- BASIN C100 VALUE
- BASIN AREA (ACRES)

N

40' 0 20' 40' 80'
1" = 40' HOR.

TABLE 2 - DESIGN POINT SUMMARY

**DESIGN POINT	Contributing Basin(s)	Contributing Area (ac)	***5 YR RUNOFF (CFS)	***100 YR RUNOFF (CFS)
SDP 1	A-1, B-1	0.27	2.5	5.4
SDP 2	B-2, O-1	0.53	3.6	7.9
*SDP X2-1	X2-1	2.39	9.2	19.5
SDP 3	A-2, B-3, O-2	0.66	12.7	26.9
*SDP X2-2	X-2-2	2.39	18.2	38.3
SDP 4	B-4, O-3	0.90	19.70	41.94
SDP 5	C-1, O-4	0.48	4.7	9.6
6	O-5	0.27	5.8	11.9
SDP 7	C-2, O-6	1.00	7.3	15.4
SDP 8	D-1, O-7	0.90	2.0	4.3

*X2-1 AND X2-2 ARE EXISTING FLOWS INTO TWO TYPE D INLETS FROM RIDGEGATE FILING NO. 3 PHASE 4 DRAINAGE REPORT DATED OCTOBER 2023
**SDP = SUM AT DESIGN POINT
***CUMULATIVE FLOW AT DESIGN POINT

CITY OF LONE TREE APPROVAL

CITY ENGINEER

DATE

THESE CONSTRUCTION PLANS HAVE BEEN REVIEWED BY THE CITY OF LONE TREE FOR GESC IMPROVEMENTS ONLY.

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REV	REVISION DESCRIPTION	DATE	CHND	CHKD	APPR

RIDGEGATE COUPLET
LONE TREE, COLORADO
ON-SITE IMPROVEMENT PLANS

TITLE

ISSUED FOR REVIEW
FOR AND ON BEHALF OF MERRICK & COMPANY

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JOB NUMBER 65121370
DATE 8/7/2023
SHEET 4 of 4

File Location:O:\DEN\Projects\1370-00 Century Couplet\DESIGN\Drainage\Basin Maps\1370-DA Map.dwg Plot Date: 10/10/2023 1:23 PM Last Saved By: KBLACK