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Highlands Ranch, Colorado 80129
www.vermilionpeak.com
720-402-6070

April 25, 2025

City of Aurora
Public Works Department
15151 E. Alameda Parkway
Aurora, CO 80012

**Subject: Lot 2, Block 1, Gartrell Crossing Subdivision Filing No. 2
Preliminary Drainage Letter**

Owner:
Gartrell Rd and Hinsdale Ave LLC
22650 E. Hinsdale Avenue
Aurora, CO 80016

Engineer:
Brian Krombein, PE, PLS
Vermilion Peak Engineering
1745 Shea Center Drive, 4th Floor
Highlands Ranch, CO 80129
720-402-6070

The project site consists of a recently-constructed medical office building with integrated parking lot and landscaped areas located on a 1.66-acre parcel platted as Lot 2, Block 1, Gartrell Crossing Subdivision Filing No. 2. It is located in the SE ¼, Section 25, Township 5 South, Range 66 West of the Sixth Principal Meridian. Vehicular access is provided to S. Gartrell Road and E. Hinsdale Avenue.

According to FEMA flood insurance rate map 08005C0503L, dated February 17, 2017, this property lies within Zone X, which is defined as, "areas determined to be outside the 0.2% annual chance floodplain".

The United States Department of Agriculture Natural Resources Conservation Service soil survey classifies site soils as Renohill-Buick loams, 9 to 20 percent slopes and Renohill-Little-Thedalund complex, 9 to 30 percent slopes. These soils belong to Hydrologic Group D.

The drainage design for the project was addressed in the following three drainage studies:

- "Final Drainage Report for Gartrell / Hinsdale Self-Storage", prepared by Atwell, revised June 2016. (EDN 216119) (Henceforth referred to as the Atwell Report)

- “Saddle Rock East Filing No. 8, Lot 2, Block 1 – Final Drainage, Wolf Chen Dental Drainage Letter”, prepared by George & Associates Consulting Engineers, Inc., January 26, 2024. (EDN 224008) (Henceforth referred to as the George & Associates Letter)
- “Master Drainage Report for Saddle Rock East”, prepared by P.R. Fletcher & Associates in May 1999. (EDN 990129) (Henceforth referred to as the P.R. Fletcher Report)

The proposed parking lot addition will add approximately 3,800 sf of additional impervious area. It is located entirely within Basin A-2 as delineated in the George & Associates Letter. We have determined that the imperviousness of Basin A-2 will increase from 48.7% to 56%, the 2-year runoff rate will increase from 1.1 cfs to 1.4 cfs and the 100-year runoff rate will increase from 5.4 cfs to 6.1 cfs. These flows will continue to drain to the southeast gutter along E. Hinsdale Avenue at Design Point 10. From this location flows will continue southerly in the gutter, approximately 230 feet to the existing 20' Type R inlet in a sump. Runoff then drains through public storm sewer to Pond No. 2 which is located within the Saddle Rock East development. This facility provides stormwater detention and water quality treatment for the project site and is more fully described in the P.R. Fletcher Report.

According to the Atwell Report the project site is located entirely within Basin OS-2. That report assumed a future development with an imperviousness of 95% for Basin OS-2. As mentioned above, we have determined that the imperviousness of Basin A-2 will be 56%. Therefore, we conclude that stormwater runoff generated in Basin A-2 will be significantly less than the downstream storm sewer and detention facility were designed to accommodate. Therefore, no improvements to the downstream drainage system are required.

The proposed site improvements are in compliance with City of Aurora and Mile High Flood District design criteria. As described above, downstream drainage infrastructure is adequate to continue to serve the project site in the proposed condition. The proposed improvements will have no negative impact on offsite properties or drainage systems.

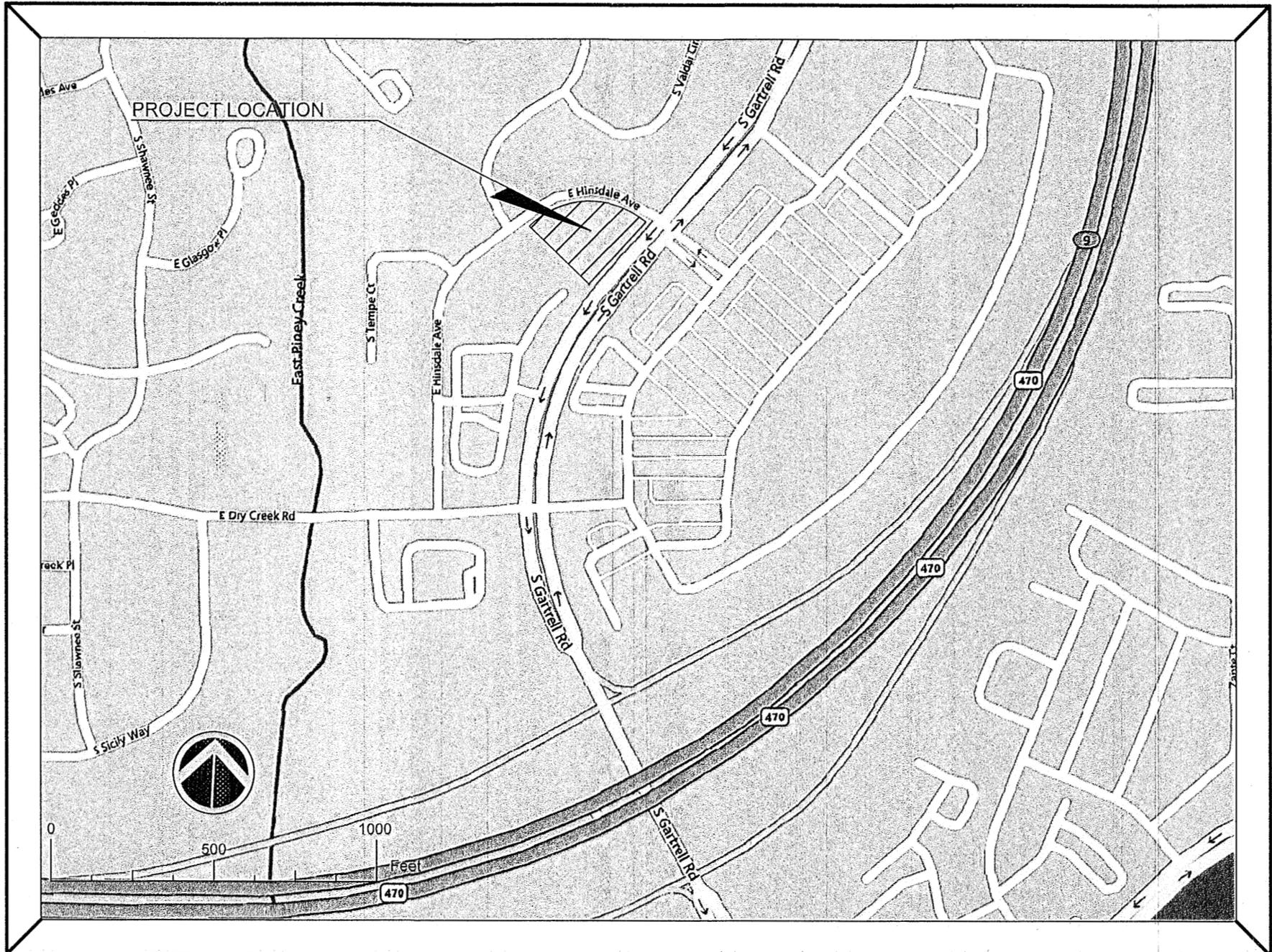
If you have any questions or comments please do not hesitate to contact me.

Sincerely,

Brian Krombein, PE, PLS
Vermilion Peak Engineering



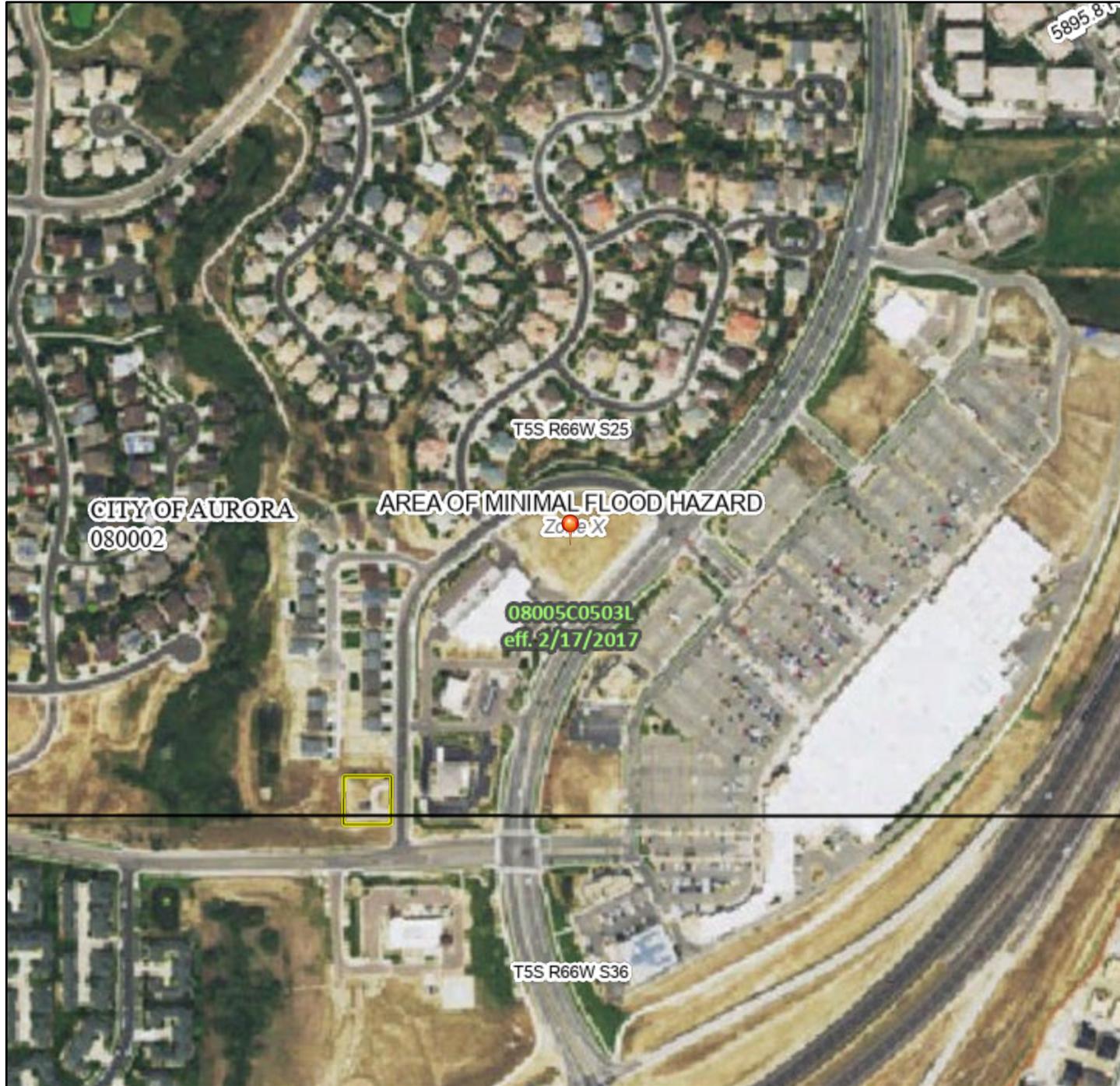
VICINITY MAP



National Flood Hazard Layer FIRMMette



104°43'47"W 39°35'10"N



1:6,000

104°43'10"W 39°34'43"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) <i>Zone A, V, A99</i>
		With BFE or Depth <i>Zone AE, AO, AH, VE, AR</i>
		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 <i>Zone X</i>
		Future Conditions 1% Annual Chance Flood Hazard <i>Zone X</i>
		Area with Reduced Flood Risk due to Levee. See Notes. <i>Zone X</i>
		Area with Flood Risk due to Levee <i>Zone D</i>
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard <i>Zone X</i>
		Effective LOMRs
GENERAL STRUCTURES		Area of Undetermined Flood Hazard <i>Zone D</i>
		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance Water Surface Elevation
		17.5 Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped
		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

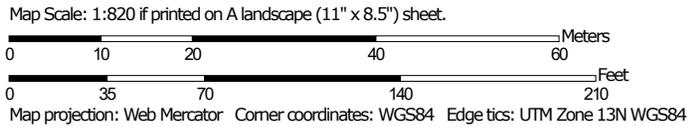
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 4/23/2025 at 4:57 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

Soil Map—Arapahoe County, Colorado



Soil Map may not be valid at this scale.



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 20, Aug 29, 2024

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
RhE	Renohill-Buick loams, 9 to 20 percent slopes	0.5	30.6%
RtE	Renohill-Litle-Thedalund complex, 9 to 30 percent slopes	1.1	69.4%
Totals for Area of Interest		1.6	100.0%

Arapahoe County, Colorado

RhE—Renohill-Buick loams, 9 to 20 percent slopes

Map Unit Setting

National map unit symbol: 34z1

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: 67 percent

Buick and similar soils: 20 percent

Minor components: 13 percent

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

Description of Renohill

Setting

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Clay loamy alluvium

Typical profile

H1 - 0 to 4 inches: loam

H2 - 4 to 14 inches: clay

H3 - 14 to 26 inches: clay loam

H4 - 26 to 30 inches: unweathered bedrock

Properties and qualities

Slope: 9 to 20 percent

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

Drainage class: Well drained

Runoff class: Medium

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 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: D

Ecological site: R067BY008CO - Loamy Slopes

Hydric soil rating: No

Description of Buick

Setting

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Alluvium and/or eolian deposits

Typical profile

H1 - 0 to 5 inches: loam

H2 - 5 to 22 inches: clay loam

H3 - 22 to 60 inches: sandy clay loam

Properties and qualities

Slope: 5 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: R067BY008CO - Loamy Slopes

Hydric soil rating: No

Minor Components

Litle

Percent of map unit: 10 percent

Hydric soil rating: No

Fondis

Percent of map unit: 3 percent

Hydric soil rating: No

Data Source Information

Soil Survey Area: Arapahoe County, Colorado

Survey Area Data: Version 20, Aug 29, 2024

Arapahoe County, Colorado

RtE—Renohill-Little-Thedalund complex, 9 to 30 percent slopes

Map Unit Setting

National map unit symbol: 34z4
Elevation: 3,600 to 6,200 feet
Mean annual precipitation: 11 to 16 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 100 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Renohill and similar soils: 40 percent
Little and similar soils: 32 percent
Thedalund and similar soils: 20 percent
Minor components: 8 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 clayey

Typical profile

H1 - 0 to 3 inches: loam
H2 - 3 to 15 inches: clay
H3 - 15 to 24 inches: clay loam
H4 - 24 to 28 inches: unweathered bedrock

Properties and qualities

Slope: 9 to 30 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: High
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 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: R049XB208CO - Clayey Foothill
Hydric soil rating: No

Description of Little

Setting

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian deposits

Typical profile

H1 - 0 to 3 inches: silty clay loam
H2 - 3 to 30 inches: silty clay
H3 - 30 to 34 inches: weathered bedrock

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Medium
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
Gypsum, maximum content: 2 percent
Maximum salinity: Very slightly saline to moderately saline (2.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water supply, 0 to 60 inches: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: R049XB208CO - Clayey Foothill
Hydric soil rating: No

Description of Thedalund

Setting

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Interbedded residuum weathered from sandstone and shale

Typical profile

H1 - 0 to 5 inches: clay loam
H2 - 5 to 23 inches: loam
H3 - 23 to 27 inches: weathered bedrock

Properties and qualities

Slope: 9 to 30 percent

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

Drainage class: Well drained

Runoff class: High

Capacity of the most limiting layer to transmit water

(Ksat): Moderately low to moderately high (0.06 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

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

Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: C

Ecological site: R049XB208CO - Clayey Foothill

Hydric soil rating: No

Minor Components

Buick

Percent of map unit: 5 percent

Hydric soil rating: No

Tassel

Percent of map unit: 3 percent

Hydric soil rating: No

Data Source Information

Soil Survey Area: Arapahoe County, Colorado

Survey Area Data: Version 20, Aug 29, 2024

TABLE 6-8. RUNOFF COEFFICIENTS, C, NRCS HSG C/D

TOTAL OR EFFECTIVE % IMPERVIOUS	NRCS HSG C/D						
	WQE & 2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
2%	0.01	0.05	0.15	0.33	0.40	0.49	0.59
5%	0.03	0.08	0.17	0.35	0.42	0.50	0.60
10%	0.06	0.12	0.21	0.38	0.44	0.52	0.62
15%	0.10	0.16	0.24	0.40	0.47	0.55	0.64
20%	0.14	0.20	0.28	0.43	0.49	0.57	0.65
25%	0.18	0.24	0.32	0.46	0.52	0.59	0.67
30%	0.22	0.28	0.35	0.49	0.54	0.61	0.68
35%	0.26	0.32	0.39	0.52	0.57	0.63	0.70
40%	0.30	0.36	0.43	0.54	0.59	0.65	0.71
45%	0.34	0.40	0.46	0.57	0.62	0.67	0.73
50%	0.38	0.44	0.50	0.60	0.64	0.69	0.75
55%	0.43	0.48	0.54	0.63	0.66	0.71	0.76
60%	0.47	0.52	0.57	0.66	0.69	0.73	0.78
65%	0.51	0.56	0.61	0.68	0.71	0.75	0.79
70%	0.56	0.61	0.65	0.71	0.74	0.77	0.81
75%	0.60	0.65	0.68	0.74	0.76	0.79	0.82
80%	0.65	0.69	0.72	0.77	0.79	0.81	0.84
85%	0.69	0.73	0.76	0.80	0.81	0.83	0.86
90%	0.74	0.77	0.79	0.82	0.84	0.85	0.87
95%	0.79	0.81	0.83	0.85	0.86	0.87	0.89
100%	0.84	0.86	0.87	0.88	0.89	0.89	0.90

IDF Curve Data

2-Year Storm

i = 1 hour point rainfall = 0.97 inches

Duration	Rainfall Intensity = $(28.5 * i / (10+d))^{0.786}$
5	3.3
6	3.1
7	3.0
8	2.9
9	2.7
10	2.6

100-Year Storm

i = 1 hour point rainfall = 2.63 inches

Duration	Rainfall Intensity = $(28.5 * i / (10+d))^{0.786}$
5	8.9
6	8.5
7	8.1
8	7.7
9	7.4
10	7.1

COMPOSITE BASIN COEFFICIENTS

Subdivision Lot 2, Block 1, Gartress Crossing Subdivision Filing No. 2
Location 22650 E. Hinsdale Avenue

Project Name: Wolfe Chen Dental
Project No. 25006
Calculated By: BK
Checked By: BK
Date: 4/25/25

Total Area Basin A-2 0.98 acres

Land Use	Imp.	Area	% Imp.	C ₂	C ₁₀₀
Parking Lot/Roadway	95	0.22	21	* use Table RO-5 to obtain coefficient values.	
Rooftop	95	0.25	24		
Landscape/Open Space	20	0.51	10		
TOTAL		0.98	56	0.44	0.72

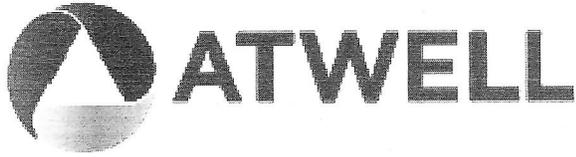
STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision Lot 2, Block 1, Gartress Crossing Subdivision Filing No. 2
Location 22650 E. Hinsdale Avenue

Project Name: Wolfe Chen Dental
Project No. 25006
Calculated By: BK
Checked By: BK
Date: 4/25/25

SUB-BASIN DATA			INITIAL/OVERLAND (T _i)			TRAVEL TIME (T _t)				T _c CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (AC)	C _s	L (FT)	S (%)	T _i (MIN)	L (FT)	S (%)	VEL. (FPS)	T _t (MIN)	COMP. T _c (MIN)	TOTAL LENGTH(FT)	MIN. T _c (MIN)	T _c (MIN)
A-2	0.98	0.49	76	17.6	3.7	200	5.6	1.7	2.0	5.7	276.0	10.4	5.7

NOTES:
 $T_i = (.395 * (1.1 - C_s) * (L)^{0.5}) / (S^{0.33})$
 $T_t = L / 60V$ (Velocity From Fig. 6-4)
 $T_c \text{ Check} = (26 - 17i) + L / \{60(14i + 9)\sqrt{S}\}$



Atwell, LLC
143 Union Blvd., Suite 700
Lakewood, CO 80228
303-462-1100

**Final Drainage Report
for
Gartrell / Hinsdale Self-Storage**

**Gartrell Crossing Subdivision Filing No. 2,
Lot 1, Block 1**

City of Aurora, Colorado

Owner:
Gartrell SS, LLC
7964 Kelty Trail
Franktown, CO 80116
(303) 725-1466
Contact: Alan Westfall

Engineer:
Atwell, LLC
143 Union Blvd, Suite 700
Lakewood, CO 80228
(303) 462-1100
Contact: Jeff French

Project Number 15.14

March 2016
Revised May 2016
Revised June 2016

Approved For One Year From This Date

09.29.16

Approved For One Year From This Date	
09.29.16	
_____	9/23/2016
City Engineer	Date
_____	9/28/2016
Water Department	Date

B. HISTORIC DRAINAGE

1. Overall Basin Description

- a. Apart from adjacent Lot 2, there are no offsite basins from which a significant quantity of storm water runs onto the site. Basins OS-3 and OS-4 include the east half of existing Hinsdale Avenue adjacent to the property. There are no off-site basins identified on Gartrell Road since Gartrell is in superelevation adjacent to the site and all runoff from both halves of the road drains away from the development site and into a separate storm sewer system.
- b. There are no major drainageways or identified floodplains on or adjacent to the development site. A FEMA FIRMette map on panel 08005C0503K with the development site identified is included in the Appendix.

2. Drainage Patterns Through Property

Under the existing condition, nearly all the runoff from Lot 1 (the development site) and adjoining undeveloped Lot 2 drains via overland sheet flow to east gutter of Hinsdale Avenue and ultimately to the existing 20' inlet at the southwest corner of the development site. Basins OS-1 and OS-2 include portions of undeveloped Lot 2. A small strip of existing pavement along the south property boundary drains overland into the commercial lot to the south. The paved drive lane and the drainage features accommodating its run-off were designed and constructed with development of that lot.

3. Outfalls Downstream

The existing 20' inlet on the east side of Hinsdale Avenue to which the site drains is part of a storm sewer system that outfalls into an existing detention pond 450' southwest of the site.

C. DESIGN CRITERIA

1. List of References

- a. The development site lies within a master-planned development and is surrounded by improvements that were developed through multiple phases and filings and over an extended period of time. The design of relevant components of existing infrastructure is detailed in multiple references which are listed as references 3 through 8 in section F. Excerpts from these reports that relate to the design are included in the appendix.
- b. USDCM and the City of Aurora Drainage Criteria have been referenced for hydrologic and hydraulic calculations, methods, and standards.

D. DRAINAGE PLAN

1. General Concept

- a. Offsite drainage from adjoining and undeveloped Lot 2 is tributary to the development site (Lot 1). This area is divided into basins OS-1 and OS-2 on the drainage plan to reasonably approximate how the site developed condition drainage patterns may interact with the project site. Runoff from these basins is analyzed with the assumptions of 95% developed imperviousness for commercial use. OS-1 represents tributary run-on that may be directed toward proposed Basin A in the future. OS-2 is shown to drain directly to Hinsdale Avenue, as it does under existing conditions and in the previously approved drainage study for Saddle Rock East Parcel 15-Hinsdale Avenue (COA# 205006). OS-3 and OS-4 are the east half of Hinsdale Avenue which drain via gutter flow to the existing curb inlet near the southwest corner of the development site. The existing inlet and the Hinsdale Avenue gutter were initially to accommodate the entire area of this study, including on-site basins and OS-1 through OS-4.
- b. All runoff generated from Lots 1 and 2 will be conveyed via overland flow and private on-site storm sewer to an existing inlet in Hinsdale Avenue immediately west of the site. This inlet is designated as Inlet 309A.1 and was designed by Peak Civil Consultants as part of the Hinsdale Avenue construction (COA# 205006), which was approved in 2005. The inlet and connecting storm sewer were designed to accommodate peak 100-year flows of 61.8 cfs from the Saddle Rock East Parcel 15 area, which includes the development site. The proposed development in Lot 1 and assumed maximum build-out of Lot 2 will generate a peak 100-year flow of 25.1 cfs. When this is combined with 100-year peak flows of 6.9 cfs and 6.7 cfs from the two previously developed lots of Parcel 15, the total 100-year peak flow of 38.7 cfs is well within the flow rate accommodated by the Inlet 309A.1 design.
- c. Detention and water quality are accommodated in an existing pond approximately 450ft southwest of the site.
- d. The proposed drainage plan remains consistent with the general concept that was presented in the Preliminary Drainage Letter for this project. Minor changes include adjustments in the basin areas of E/F, OS1 and OS2, and the addition of a swale and area inlet for basin C2. Specific details of the proposed drainage design for each area of the site are presented in section D.2 of this report.

2. Specific Details

- a. The site is divided into 11 on-site sub-basins. Sub-basins A, B1-3, and C1-2 are accommodated by a proposed on-site storm system. Sub-basins D1-2, E1-2 and F drain off site via surface flow to existing drainage infrastructure.

- Basin F includes the east half existing paved drive lane at the south end of the site and drains to the existing eastern drive lane of the property to the south (*Design Point 18*). The combined 100-year flow of 0.8 cfs from F and C1 carryover is larger than the 0.2 cfs that was previously anticipated for that area (Basin OS1 is the previous report). As with Basin E, the receiving gutter and inlet have ample capacity for the additional 0.6 cfs. Ultimately, all runoff for this block flows to the existing storm sewer trunkline in Hinsdale that serves as the outfall for the on-site drainage. Flow calculations from the previously approved report (COA# 211086) and a drainage map for that site are included in the appendix and annotated with the minor impacts that occur with development of this site.
- b. There are no TOD or Urban Center developments on or upstream of the development site.

c. Detention is accommodated in an existing pond approximately 450ft southwest of the site. The proposed development site is located within drainage Basin 309A as defined in the approved Master Drainage Study (COA# 990129). Basin 309A covers Parcel 15 from the GDP, a portion of Parcel 12 from the GDP (COA# 98-2007-1), and an area of the outside of the GDP boundary which is designated for multifamily. The development site lies within Parcel 15, which is designated for commercial use in the Saddle Rock GDP. The corresponding area within Basin 309A assumes an imperviousness of 95%. The actual proposed imperviousness for on-site areas with this Site Plan is 61.3% (see attached calculations), which is within the accommodations of the master drainage design. When a developed imperviousness of 95% is assumed for Lot 2, which is tributary to Lot 1, composite imperviousness increases to 78.9%, which is still within the assumed limits. Together, Lots 1 and 2 of Gartrell Filing No. 2 make up the last remaining undeveloped area of Parcel 15 from the GDP. Detention and water quality for this area are provided in existing Detention Pond 2 located about 450feet southwest of the development site. Detention Pond 2 was designed and constructed as part of the Saddle Rock East Filing No. 1 Improvements. The corresponding Final Drainage Report for Saddle Rock East Filing No. 1 by P.R. Fletcher and Associates, approved September 2000 (COA# 200129), shows land use and imperviousness assumptions for the proposed development site that are consistent with the Master Drainage Study and are the basis of design for Pond 2

- d. Emergency overflow paths for inlets are described in section D.2.a above. No ponds are proposed.
- e. The master-planned nature of the project vicinity and the accommodation of site drainage with existing infrastructure allow design continuity without any major difficulties.
- f. Water quality enhancement is provided in the existing pond off-site. No permanent BMPs are proposed.
- g. Construction activities will disturb less than 3 acres overall and will not be phased. Construction BMPs are detailed in the SWMP plan and SWMP report.

COMPOSITE C-FACTOR & WEIGHTED PERCENT IMPERVIOUSNESS ANALYSIS

GartrellStorage

Atwell, LLC
LCC
Date: May 2016

	<u>Runoff Coefficients</u>				
	<u>C2</u>	<u>C5</u>	<u>C10</u>	<u>C100</u>	<u>I (%)</u>
Paved Area	0.87	0.88	0.90	0.93	100.0%
Roof Area	0.80	0.85	0.90	0.90	90.0%
Concrete Drives/ Walks	0.87	0.87	0.88	0.89	96.0%
Lawns (>7%)	0.25	0.27	0.30	0.35	5.0%
Offsite Commercial	0.87	0.87	0.88	0.89	95.0%
Undeveloped	0.18	0.19	0.20	0.22	5.0%

	Total Area (AC)	Paved Area (AC)	Roof Area (AC)	Drives/ Walks (AC)	Lawns (>7%) (AC)	Offsite Commercial (AC)	Un- developed (AC)	Area Check (AC)	Comp. C2	Comp. C5	Comp. C10	Comp. C100	Comp. I (%)
BASIN													
Historic On-site	2.26	0.17	0.00	0.08	0.00	0.00	2.01	Ok	0.10	0.10	0.10	0.10	10.9%
309A-1	7.23	0.00	0.00	0.00	0.00	7.23	0.00	Ok	0.87	0.87	0.88	0.89	95.0%
OS1	0.29	0.00	0.00	0.00	0.00	0.29	0.00	Ok	0.87	0.87	0.88	0.89	95.0%
OS2	1.32	0.00	0.00	0.00	0.00	1.32	0.00	Ok	0.87	0.87	0.88	0.89	95.0%
OS3	0.35	0.35	0.00	0.00	0.00	0.00	0.00	Ok	0.87	0.88	0.90	0.93	100.0%
OS4	0.27	0.27	0.00	0.00	0.00	0.00	0.00	Ok	0.87	0.88	0.90	0.93	100.0%
A	0.11	0.11	0.00	0.00	0.00	0.00	0.00	Ok	0.87	0.88	0.90	0.93	100.0%
B1	0.53	0.00	0.53	0.00	0.00	0.00	0.00	Ok	0.80	0.85	0.90	0.90	90.0%
B2	0.14	0.00	0.14	0.00	0.00	0.00	0.00	Ok	0.80	0.85	0.90	0.90	90.0%
B3	0.18	0.18	0.00	0.00	0.00	0.00	0.00	Ok	0.87	0.88	0.90	0.93	100.0%
C1	0.32	0.13	0.00	0.00	0.19	0.00	0.00	Ok	0.50	0.52	0.54	0.59	43.6%
C2	0.11	0.00	0.00	0.00	0.11	0.00	0.00	Ok	0.25	0.27	0.30	0.35	5.0%
D1	0.10	0.05	0.00	0.00	0.05	0.00	0.00	Ok	0.56	0.58	0.60	0.64	52.5%
D2	0.37	0.03	0.00	0.00	0.34	0.00	0.00	Ok	0.30	0.32	0.35	0.40	12.7%
E1	0.16	0.08	0.00	0.00	0.08	0.00	0.00	Ok	0.56	0.58	0.60	0.64	52.5%
E2	0.12	0.12	0.00	0.00	0.00	0.00	0.00	Ok	0.87	0.88	0.90	0.93	100.0%
F	0.12	0.06	0.00	0.00	0.06	0.00	0.00	Ok	0.56	0.58	0.60	0.64	52.5%
Composite On-Site Basins	2.26	0.76	0.67	0.00	0.83	0.00	0.00	Ok	0.62	0.65	0.68	0.71	62.1%
Total Tributary Area to Existing Inlet 309A-1	4.09	1.12	0.67	0.00	0.69	1.61	0.00	Ok					80.4%

STANDARD FORM SF-2 TIME OF CONCENTRATION

PROJECT: *Gartrell Storage*
CALCULATED BY: LCC DATE: May-16

SUB-BASIN DATA			INITIAL/OVERLAND TIME (Tc)			TRAVEL TIME (Tt)				Tc CHECK (Urbanized Basins)			FINAL Tc	REMARKS
DESIGN:	AREA (acres)	C _s	LENGTH (ft)	AVG. SLOPE (%)	Ti (min)	LENGTH (ft)	AVG. SLOPE (%)	VEL (fps)	Tt (min)	COMP Tc	TOTAL LENGTH (ft)	Tc=(L/180)+10 (min)	(min)	
Historic On-site	2.3	0.10	300	5.5	17.9	350	2.5	3.2	1.8	19.7	650	13.6	13.6	
309A-1	7.2	0.87						0.0		0.0	0	10.0	5.0	
OS1	0.3	0.87	50	8.0	1.5	350	4.0	4.0	1.5	2.9	400	12.2	5.0	
OS2	1.3	0.87	50	8.0	1.5	250	4.0	4.0	1.0	2.5	300	11.7	5.0	
OS3	0.4	0.88	15	2.0	1.2	450	5.0	4.5	1.7	2.9	465	12.6	5.0	
OS4	0.3	0.88	15	2.0	1.2	320	3.0	3.5	1.5	2.8	335	11.9	5.0	
A	0.1	0.88	35	2.0	1.9	50	0.5	1.4	0.6	2.5	85	10.5	5.0	
B1	0.5	0.85	120	1.0	4.9	120	1.0	2.0	1.0	5.9	240	11.3	5.9	
B2	0.1	0.85	30	1.0	2.5	100	1.0	2.0	0.8	3.3	130	10.7	5.0	
B3	0.2	0.88	30	4.0	1.4	240	0.5	1.4	2.8	4.2	270	11.5	5.0	
C1	0.3	0.52	40	40.0	2.0	130	4.0	4.0	0.5	2.5	170	10.9	5.0	
C2	0.1	0.27	20	8.0	3.4	100	2.5	3.2	0.5	3.9	120	10.7	5.0	
D1	0.1	0.58	50	20.0	2.5	40	4.0	1.4	0.5	3.0	90	10.5	5.0	
D2	0.4	0.32	75	4.0	7.7	320	3.0	3.5	1.5	9.3	395	12.2	9.3	
E1	0.2	0.58	50	7.0	3.5	100	5.0	4.5	0.4	3.9	150	10.8	5.0	
E2	0.1	0.88	200	6.5	3.0	0	0.0	0.0		3.0	200	11.1	5.0	
F	0.1	0.58	57	11.0	3.2	45	1.5	2.4	0.3	3.5	102	10.6	5.0	

Atwell, LLC

*VEL = C_vS_w^{0.5}

FROM UD Table R0-2

Type of Land Surface	Conveyance Coefficient, C _v
Tillage/Field	5
Short Pasture and Lawns	7
Paved Areas	20

**STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)
DEVELOPED (1 of 2)**

CALCULATED BY: LCC
DATE: May-16
CHECKED BY:

JOB NO: 15.14
PROJECT: Gartrell Storage
DESIGN STORM: 2-year

DESCRIPTION	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE		TRAVEL TIME		REMARKS			
		AREA DESIG.	AREA (Acres)	RUNOFF COEFF	Tc (min)	C A (Acres)	I (in/hour)	Q (cfs)	Tc (min)	(C A) (Acres)	I (in/hour)	Q (cfs)	SLOPE (%)	STREET FLOW (cfs)	DESIGN FLOW (cfs)	SLOPE (%)	PIPE SIZE (in.)	LENGTH (ft)		VELOCITY (fps)	Tt (min)	
Historic On-site		Historic A-E	2.3	0.10	13.6	0.22	2.30	0.5														
Master Drainage		309A-1	7.2	0.87	5.0	6.29	3.29	20.7														
Future Lot to A	1	OS1	0.3	0.87	5.0	0.25	3.29	0.8												OS1 + A		
Inlet A	2	A	0.1	0.87	5.0	0.10	3.29	0.3	5.0	0.35	3.29	1.1										
Building 1 Roof	3	B1	0.5	0.80	5.9	0.42	3.14	1.3														
Building 2 Roof	4	B2	0.1	0.80	5.0	0.11	3.29	0.4														
Slot Drain	5	B3	0.18	0.87	5.0	0.16	3.29	0.5	5.9	0.69	3.14	2.2								B1 - B3		
OS1+A+B	6								5.9	1.04	3.14	3.3										
Inlet C1	7	C1	0.32	0.50	5.0	0.16	3.29	0.5														
Inlet C2	8	C2	0.11	0.25	5.0	0.03	3.29	0.1	5.0	0.19	3.29	0.6								C1 + C2		
OS1+A+B+C	9								5.9	1.23	3.14	3.9									OS1+A+B+C	
Future Lot to Street	10	OS2	1.32	0.87	5.0	1.15	3.29	3.8														
Crosspan at Hinsdale	11	OS3	0.35	0.87	5.0	0.30	3.29	1.0	5.0	1.45	3.29	4.8									OS2 + OS3	
	12	D1	0.10	0.56	5.0	0.06	3.29	0.2														
Existing Inlet in Hinsdale	13	D2	0.37	0.30	9.3	0.11	2.70	0.3														
OS1-4 + A-D	14	OS4	0.27	0.87	5.0	0.23	3.29	0.8	9.3	1.85	2.70	5.0									OS2 - OS4 + D	
	15								9.3	3.08	2.70	8.3										OS1-4 + A-D

2-year P1 = 0.97 inches (UDFCD, Fig. RA-1) $I = 28.5(P1)(10+Tc)^{0.768}$ (Ref. 2, Eq RA-3)

**STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)
DEVELOPED (1 of 2)**

CALCULATED BY: LCC
DATE: May-16
CHECKED BY:

JOB NO: 15.14
PROJECT: Gartrell Storage
DESIGN STORM: 100-year

DESCRIPTION	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE		TRAVEL TIME		REMARKS		
		AREA DESIG.	AREA (Acres)	RUNOFF COEFF	Tc (min)	C A (Acres)	I (in/hour)	Q (cfs)	Tc (min)	(C A) (Acres)	I (in/hour)	Q (cfs)	SLOPE (%)	STREET FLOW (cfs)	DESIGN FLOW (cfs)	SLOPE (%)	PIPE SIZE (in.)	LENGTH (ft)		VELOCITY (fps)	Tt (min)
Historic On-site		Historic A-E	2.3	0.10	13.6	0.23	6.24	1.4													
Master Drainage		309A-1	7.2	0.89	5.0	6.43	8.92	57.4													
Future Lot to A	1	OS1	0.3	0.89	5.0	0.26	8.92	2.3													
Inlet A	2	A	0.1	0.93	5.0	0.10	8.92	0.9	5.0	0.36	8.92	3.2								OS1 + A	
Building 1 Roof	3	B1	0.5	0.90	5.9	0.48	8.50	4.1													
Building 2 Roof	4	B2	0.1	0.90	5.0	0.13	8.92	1.1													
Slot Drain	5	B3	0.18	0.93	5.0	0.17	8.92	1.5	5.9	0.77	8.50	6.6								B1 - B3	
OS1+A+B	6								5.9	1.13	8.50	9.6									OS1+A+B
Inlet C1	7	C1	0.32	0.59	5.0	0.19	8.92	1.7													0.1 Bypass to F C1 + C2
Inlet C2	8	C2	0.11	0.35	5.0	0.04	8.92	0.3	5.0	0.23	8.92	2.0									
OS1+A+B+C	9								5.9	1.36	8.50	11.5									OS1+A+B+C
Future Lot to Street	10	OS2	1.32	0.89	5.0	1.17	8.92	10.5													
Crossspan at Hinsdale	11	OS3	0.35	0.93	5.0	0.33	8.92	2.9	5.0	1.50	8.92	13.4									OS2 + OS3
	12	D1	0.10	0.64	5.0	0.06	8.92	0.6													
Existing Inlet in Hinsdale	13	D2	0.37	0.40	9.3	0.15	7.33	1.1													
OS1-4 + A-D	14	OS4	0.27	0.93	5.0	0.25	8.92	2.2	9.3	1.96	7.33	14.4									OS2 - OS4 + D
	15								9.3	3.32	7.33	24.3									OS1-4 + A-D

100-year P1 = 2.63 inches (UDFCD, Fig. RA-6) $I = 28.5(P1)(10+Tc)^{0.786}$ (Ref. 2, Eq RA-3)

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TABLE 1
RUNOFF COEFFICIENTS AND PERCENTS IMPERVIOUS

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	FREQUENCY			
		2	5	10	100
<u>Business:</u>					
Commercial Areas	95	.87	.87	.88	.89
Neighborhood Areas	85	.60	.65	.70	.80
<u>Residential:</u>					
Single-Family (**)	(*)	.40	.45	.50	.60
Multi-Unit (detached)	60	.45	.50	.60	.70
Multi-Unit (attached)	75	.60	.65	.70	.80
1/2 Acre Lot or Larger	(*)	.30	.35	.40	.60
Apartments	80	.65	.70	.70	.80
<u>Industrial:</u>					
Light Areas	80	.71	.72	.76	.82
Heavy Areas	90	.80	.80	.85	.90
<u>Parks, Cemeteries</u>	5	.10	.10	.35	.60
<u>Playgrounds</u>	10	.15	.25	.35	.65
<u>Schools</u>	50	.45	.50	.60	.70
<u>Railroad Yard Areas</u>	15	.40	.45	.50	.60
<u>Undeveloped Areas:</u>					
Historic Flow Analysis, Greenbelts, Agricultural	2	(See "Lawns")			
Off-Site Flow Analysis (when land use not defined)	45	.43	.47	.55	.65

TABLE 1 (continued)

RUNOFF COEFFICIENTS AND PERCENTS IMPERVIOUS

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	FREQUENCY			
		2	5	10	100
<u>Streets:</u>					
Paved	100	.87	.88	.90	.93
Gravel	40	.15	.25	.35	.65
<u>Concrete Drive and Walks</u>	96	.87	.87	.88	.89
<u>Roofs</u>	90	.80	.85	.90	.90
<u>Lawns, Sandy Soil (A and B Soils):</u>	2				
2% Slope		.05	.06	.08	.10
2-7% Slope		.10	.11	.13	.15
>7% Slope		.15	.16	.18	.20
<u>Lawns, Clay Soil (C and D Soils):</u>	5				
2% Slope		.13	.14	.15	.17
2-7% Slope		.18	.19	.20	.22
>7% Slope		.25	.27	.30	.35

NOTE: These Rational Formula coefficients may not be valid for large basins

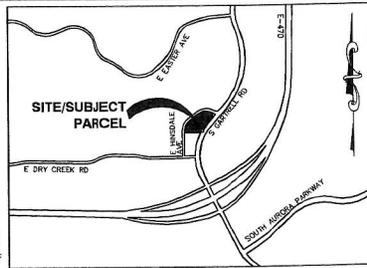
(*)See Figures *RO-3 through RO-5* of USDCM Volume 1 for percent impervious.

(**)Up to 5 units per acre. Single-family with more than 5 units per acre, use values for multi-unit/detached

RUNOFF SUMMARY TABLE				
DESIGN POINT	BASIN	COMBINED		
		O2 (CFS)	O100 (CFS)	O100 (CFS)
1	OS1	0.8	2.3	—
2	A	0.3	0.9	1.1
3	B1	1.3	4.1	—
4	B2	0.4	1.1	—
5	B3	0.5	1.5	—
6	OS1+A+B	—	—	3.3
7	C1	0.5	1.7	—
8	C1+C2	—	—	0.6
9	OS1+A+B+C	—	—	3.9
10	OS2	3.8	10.5	—
11	OS3	1.0	2.9	4.8
12	D1	0.2	0.6	—
13	D2	0.3	1.1	—
14	OS4	0.8	2.2	5.0
15	OS1+A+A-D	—	—	8.3
16	E1	0.3	0.9	—
17	E2	0.5	1.0	0.6
18	F	0.2	0.7	—

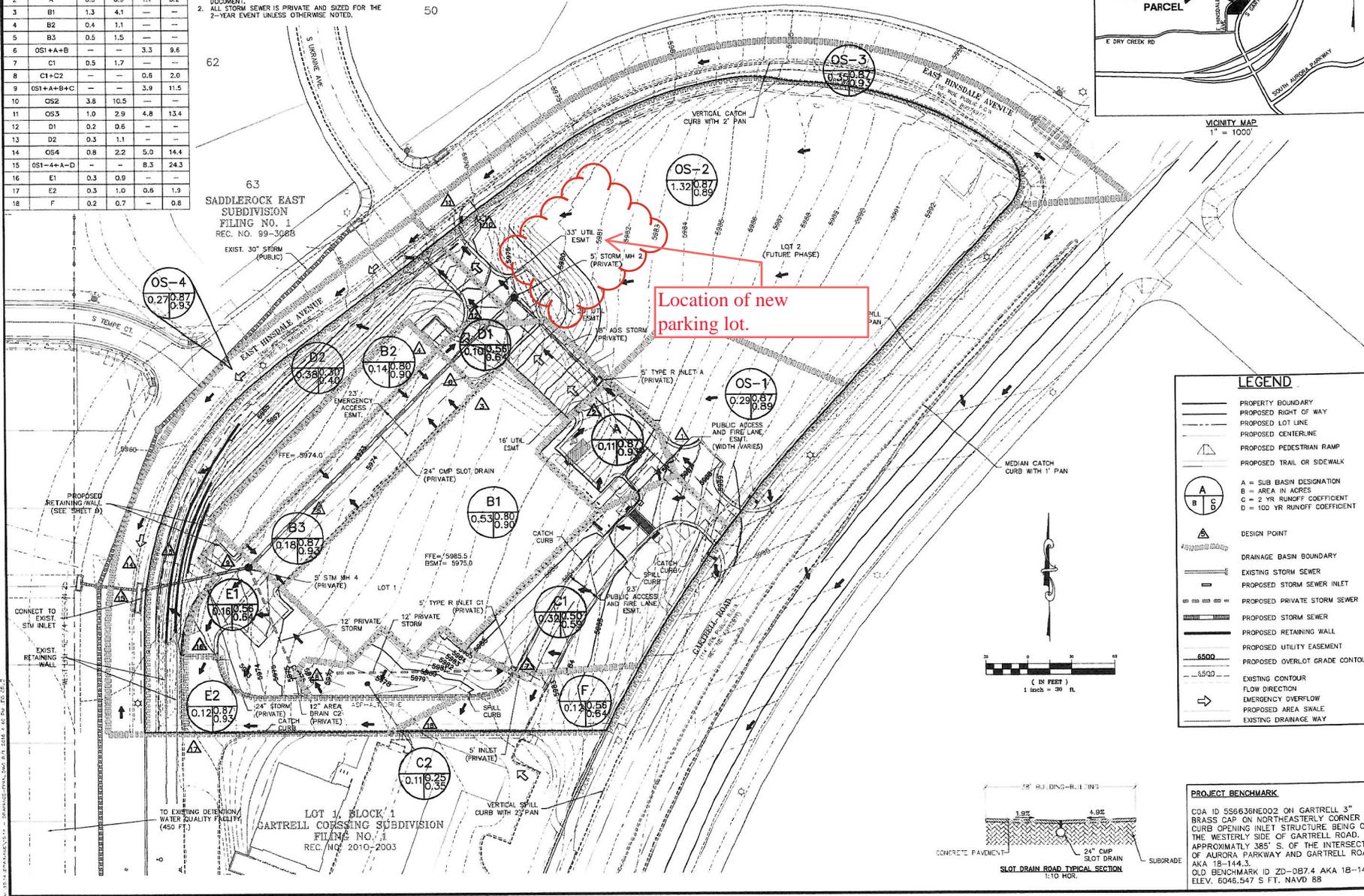
NOTES:
 1. CITY OF AURORA PLAN REVIEW IS ONLY FOR GENERAL CONFORMANCE WITH CITY OF AURORA DESIGN CRITERIA AND THE CITY CODE. THE CITY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, OF DIMENSIONS AND ELEVATIONS WHICH SHALL BE CONFIRMED AND CORRECTED AT THE JOB SITE. THE CITY OF AURORA, THROUGH THE APPROVAL OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.
 2. ALL STORM SEWER IS PRIVATE AND SIZED FOR THE 2-YEAR EVENT UNLESS OTHERWISE NOTED.

GARTRELL CROSSING SUBDIVISION FILING NO. 2 FINAL DRAINAGE PLAN

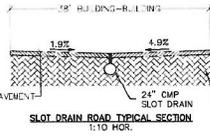


811
 Know what's below.
 Call before you dig.
 THE LOCATION OF EXISTING UTILITIES IS THE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE LOCATION OF ALL UTILITIES PRIOR TO ANY EXCAVATION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS AND APPROVALS FROM THE CITY OF AURORA AND THE UTILITY OWNERS PRIOR TO ANY EXCAVATION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING ALL UTILITIES AND STRUCTURES FROM DAMAGE DURING CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR RESTORING ALL UTILITIES AND STRUCTURES TO ORIGINAL OR BETTER CONDITION AFTER CONSTRUCTION IS COMPLETE.

ATWELL
 866.850.4300 www.atwell-pro.com
 441 LYONS ROAD, SUITE 200, AURORA, CO 80017
 (303) 725-1486
 ALAN WESTFALL



LEGEND	
	PROPERTY BOUNDARY
	PROPOSED RIGHT OF WAY
	PROPOSED LOT LINE
	PROPOSED CENTERLINE
	PROPOSED PEDESTRIAN RAMP
	PROPOSED TRAIL OR SIDEWALK
	DESIGN POINT
	DRAINAGE BASIN BOUNDARY
	EXISTING STORM SEWER
	PROPOSED STORM SEWER INLET
	PROPOSED PRIVATE STORM SEWER
	PROPOSED STORM SEWER
	PROPOSED RETAINING WALL
	PROPOSED UTILITY EASEMENT
	PROPOSED OVERLOT GRADE CONTOUR
	EXISTING CONTOUR
	FLOW DIRECTION
	EMERGENCY OVERFLOW
	PROPOSED AREA SWALE
	EXISTING DRAINAGE WAY

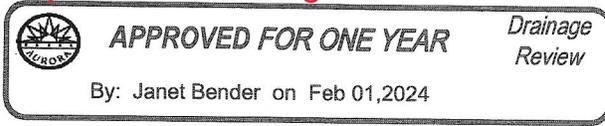


PROJECT BENCHMARK
 COA ID 55636NE002 ON GARTRELL 3" BRASS CAP ON NORTHEASTERLY CORNER OF CURB OPENING INLET STRUCTURE BEING ON THE WESTERLY SIDE OF GARTRELL ROAD, APPROXIMATELY 365' S. OF THE INTERSECTION OF AURORA PARKWAY AND GARTRELL ROAD, AKA 18-144.3, OLD BENCHMARK ID ZD-097.4 AKA 18-144.3, ELEV. 6046.547 S. FT. NAVD 88

GARTRELL SS, LLC
 7884 KELLY TRAIL
 FRANKTON, CO 80116
 (303) 725-1486
 ALAN WESTFALL

GARTRELL SS, LLC
 GARTRELL CROSSING SUBDIVISION FILING NO. 2
 LOT 1, BLOCK 1
 AURORA, COLORADO
 GARTRELL CROSSING SUBDIVISION
 FINAL DRAINAGE PLAN

DATE: 7/24/2016
SCALE: 1" = 30'
PROJECT NO.: 15001155
DATE: 10



224008LTR1
2015-3040
26T

A handwritten signature in black ink that reads 'Janet Bender'.



Drainage Division
Aurora Water
26791 E. Quincy Ave
Aurora, CO 80016

**Saddle Rock East Filing No. 8, Lot 2, Block 1 – Final Drainage
Wolf Chen Dental
Drainage Letter
22650 E Hinsdale Ave, Aurora, CO 80016**

To whom it may concern,

The Proposed Dental Office is located within Section 25, Township 5 South, Range 66 West, 6th P.M., Arapahoe County Colorado. The project location is bound by Gartrell Rd. and East Hinsdale Ave. Storm water impacts resulting from the development of this lot have been included in the “Master Drainage Report for Saddle Rock East” (EDN 990129) and the “Final drainage report for Gartrell/Hinsdale Self-Storage Gartrell Crossing Subdivision Filing No. 2, Lot 1, Block 1” (EDN 216119). The site detention was previously addressed as part of the “Final Drainage Report for Saddle Rock East Filing No. 1” (EDN 213090). This letter has been prepared to demonstrate that the proposed development will be in compliance with the previously approved drainage reports, as required as part of the Site Plan review process with the City of Aurora.

Historic Hydrology Drainage

The proposed project is 1.66 acres and is located within Basin 309A of the Master Drainage report and Basins OS-1 and OS-2 of the Gartrell Drainage report. These reports anticipated build out of the lot which was to be developed as a commercial property at an imperviousness rate of 95 percent. The proposed drainage plan is described in those reports. This includes the capture of surface runoff by inlets, the design flows of the underground storm sewer system, and detention and water quality requirements contained in the existing detention facility where the runoff will flow to. All runoff from this site will flow to Pond No. 2 as stated in the master report. The master drainage report also contains historic drainage information which includes the descriptions of the overall basin, drainage patterns through the property and outfalls downstream from the property. The FEMA Flood map shows Flood Zone X being in the project area and having a minimal flood hazard.

When Block 1, Lot 1 of Parcel 15 was developed, improvements were made to Pond No. 2. These improvements were made to bring the pond up to current standards for storm water detention management. During development of lot 1 a forebay, micropool, and access were added to the facility without reduction to overall detention or water quality volumes. The pond was Certified as a part of the Saddle Rock Vistas Subdivision Filing No. 1 (EDN 213090). This project makes no changes to the existing pond.



Per the Final Drainage Report for Gartrell / Hinsdale Self-Storage (Gartrell Crossing Subdivision Filing No. 2, Lot 1, Block 1), the designed imperviousness from this site (Lot 2, Block 1) is 95%. The fully developed site will contain 10,703 sf for the new building, 14,576 sf of asphalt and 12,106 sf of concrete. 2,044 sf of area within the site is part of Basins OS-A and OS-D. These areas are part of a previous project, and no modifications were made to them. However, the impervious areas within the 2,044 sf were added to the calculations for the "Site Area". The total proposed impervious area will be 37,385 sf, which equates to 58.8 percent imperviousness. This is a significant reduction of imperviousness and flows being created by the design and the addition of these impervious areas will not negatively impact the existing system.

Variiances

Due to this parcel being part of a planned out parcel for a regional detention and water quality a variance is formally requested to utilize the existing Pond No. 2 of the Saddle Rock East Master Drainage Report approved EDN 990129 for detention and water quality.

Proposed Hydraulics

Basin A1 consists of the eastern parking area located in the southeast half of the site. This Basin will collect and route stormwater via concrete gutters to a proposed sidewalk chase. The area for Basin A1 is 0.27 acres and the flow equates to 0.5 cfs. This flow will then be routed into Basin A2 via a grass swale.

Basin A2 consists of the building and remaining grass area of the northern part of the site. The building roof will have downspouts that drain to the grass areas. The flow will be routed to a swale which runs the northern part of the property and discharges at Design Point 10 as dictated in previous design reports. The area for Basin A2 is 0.98 acres and the flow equates to 1.1 cfs.

Basin B consists of the southwestern portion of the parking lot. This Basin is also considered Basin OS-1 in the Gartrell Drainage Report. This basin will route storm water along the curb and into an existing inlet located at Design Point 2. The area is 0.29 acres and generates a flow of 0.6 cfs.

Conclusion

The proposed design for the site is in accordance with City of Aurora and Mile High Flood District design criteria. The imperviousness for the site has been reduced by 36.2% from original calculations of the Gartrell Drainage Report and the Final Drainage Report for Gartrell Crossing Subdivision Filing No. 2, Lot 1, Block 1. Because of this, the site will not generate the amount of stormwater that was anticipated. The proposed construction activities will not have a negative impact on downstream infrastructure already in place. The calculated runoff rates from the full site for the 2-year and 100-year events are 3.3 cfs and 13.3 cfs respectively. Below is a Comparison Table for the Previous Design VS Proposed Design for this lot.



COMPARISON TABLE				
BASIN ID	AREA (ACRES)	2 YEAR PEAK FLOW (CFS)	100 YEAR PEAK FLOW (CFS)	IMPERVIOUSNESS (%)
PREVIOUSLY APPROVED SITE (EDN 216119)				
A	0.11	0.3	0.9	100
D1	0.10	0.2	0.6	52.5
OS-1	0.29	0.8	2.3	95
OS-2	1.32	3.8	10.5	95
OS-3	0.35	1.0	2.9	100
TOTAL	2.17	6.1	17.2	94.1
PROPOSED SITE				
A1 (PREVIOUS OS-2)	0.27	0.5	2.0	75.6
A2 (PREVIOUS OS-2)	0.98	1.1	5.4	48.7
A1+A2 (Previous OS-2)	1.26	1.5	7.1	54.6
B (PREVIOUS OS-1)	0.29	0.6	2.1	75.7
C (PREVIOUS OS-2)	0.06	0.1	0.3	40.1
OS-A (PREVIOUS A)	0.11	0.3	0.8	95.0
OS-D (PREVIOUS D1)	0.10	0.1	0.6	62.9
OS-3 (PREVIOUS OS-3)	0.35	0.7	2.4	88.1
TOTAL	2.17	3.3	13.3	64.9

References

1. Aurora Storm Drainage Design and Technical Criteria, City of Aurora, Colorado, November 2023
2. Final Drainage Report for Gartrell/Hinsdale Self-Storage, Gartrell Crossing Subdivision, Filing No.2, Lot 1, Block 1, prepared by Atwell, June 2016 COA Approval #216119)
3. Master Drainage Report for Saddle Rock East, Prepared by P.R. Fletcher & Associates, May 1999 (COA Approval #990129)
4. Urban Storm Drainage Criteria Manual, Urban Drainage and Flood Control District, Revised March 2017

"This electronic plan (or, report) is a facsimile of the signed and sealed pdf plan (or report)."

Robert D George, CO P.E. NO. 56919

01/26/2024

(Date)



PROJECT: Wolfe Chen Dental
 SUBJECT: DEVELOPED TIME OF CONCENTRATION

JOB #: 22-5521
 DATE: 1/25/2024
 BY: JAK

TIME OF CONCENTRATION

Basin No.	Area (acres)	10Yr. co-eff.	TIME (Ti) [Max. 300']					TRAVEL TIME (Tt)							Tc CHECK (Urbanized Basins)			FINAL Tc	Time to Peak**	Remarks
			Elevations		Dist. (ft)	Slope (%)	Ti (min)	Elevations		Dist. (ft)	Slope (%)	Vel. (fps)	Tt (min)	Tc	Length (ft)	Tc (min)	Tc (min)	Peak** Flow		
			Upstream	Downstream				Upstream	Downstream											
A1	0.27	0.69	5993.46	5992.60	26.99	3.2	2.6	5992.60	5989.39	145.51	2.2	20	3.0	0.8	3.5	173	11.0	3.5	5.0	Assume Minimum Tc
A2	0.98	0.49	5993.46	5980.09	76.07	17.6	3.7	5980.09	5968.84	200.38	5.6	7	1.7	2.0	5.8	276	11.5	5.8	5.8	Assume Minimum Tc
B	0.29	0.69	5993.46	5991.62	34.23	5.4	2.5	5991.62	5985.04	149.73	4.4	20	4.2	0.6	3.1	184	11.0	3.1	5.0	Assume Minimum Tc
OS-A	0.11	0.84	5986.47	5985.04	41.38	3.5	2.1	5985.04	5983.05	47.75	4.2	20	4.1	0.2	2.3	89	10.5	2.3	5.0	Assume Minimum Tc
C	0.06	0.43	5994.97	5989.86	108.54	4.7	7.7	5989.86						7.7	109	10.6	7.7	7.7	Assume Minimum Tc	
OS-3	0.35	0.78	5993.62	5992.82	60.01	1.3	4.1	5992.82	5967.79	482.94	5.2	20	4.6	1.8	5.8	543	13.0	5.8	5.8	Assume Minimum Tc
OS-D	0.11	0.60	5983.99	5971.08	106.47	12.1	4.1	5971.08						4.1	106	10.6	4.1	5.0	Assume Minimum Tc	

*Type of Land Surface for Overland Travel Time

VELOCITY COEFFICIENTS

- | | | |
|--|---|-----|
| 1 = Heavy Meadow | 1 | 2.5 |
| 2 = Tillage / Field | 2 | 5 |
| 3 = Short pasture & lawns | 3 | 7 |
| 4 = Nearly bare ground | 4 | 10 |
| 5 = Grassed waterway | 5 | 15 |
| 6 = Paved areas and shallow paved swales | 6 | 20 |

**If the Final T_c is less than 5 the Time to peak flow is assumed to be 5



PROJECT: Wolfe Chen Dental
 SUBJECT: DEVELOPED COMPOSITE RUNOFF FACTORS

JOB #: 22-5521
 DATE: 1/25/2024
 BY: JAK

Basin Name	Square Footage	Acres	Lawns, Clay >7% sf	Lawns, Clay >7% Acres	Lawns, Clay 2-7% sf	Lawns, Clay 2-7% Acres	Concrete Drive/Walks sf	Concrete Drive/Walks Acres	Paved Street sf	Paved Street Acres	Roof sf	Roof Acres	I %	Soil Type "C" Composite Runoff Factors		
														C ₂	C ₁₀	C ₁₀₀
A1	11,987	0.27	0	0.00	3,102	0.07	2,291	0.05	6,574	0.15	0	0.00	75.6	0.62	0.69	0.79
A2	42,815	0.98	24,288	0.56	2,141	0.05	4,694	0.09	1,589	0.04	10,703	0.25	48.7	0.38	0.49	0.58
A1+A2	54,782	1.25	24,288	0.56	5,243	0.12	6,984	0.15	8,163	0.19	10,703	0.25	54.6	0.43	0.54	0.71
B	12,576	0.29	0	0.00	3,232	0.07	3,280	0.08	6,053	0.14	0	0.00	75.7	0.62	0.69	0.79
OS-A	4,944	0.11	0	0.00	0	0.00	0	0.00	4,944	0.11	0	0.00	95.0	0.78	0.84	0.87
B+OS-A	17,520	0.40	0	0.00	3,232	0.07	3,280	0.08	11,007	0.25	0	0.00	81.2	0.66	0.73	0.82
C	2,789	0.06	0	0.00	2,042	0.05	398	0.01	349	0.01	0	0.00	40.1	0.31	0.43	0.65
OS-3	15,401	0.35	0	0.00	1,424	0.03	4,757	0.11	9,219	0.21	0	0.00	88.1	0.72	0.78	0.85
OS-3+C	18,190	0.42	0	0.00	3,466	0.08	5,155	0.12	9,569	0.22	0	0.00	80.7	0.66	0.73	0.81
OS-D	4,210	0.10	0	0.00	1,800	0.04	0	0.00	2,410	0.06	0	0.00	62.9	0.51	0.60	0.74
*Site Area Total:	72,191	1.66	24,288	0.56	10,617	0.24	12,106	0.23	14,876	0.33	10,703	0.25	58.8	0.47	0.54	0.73
Project Area Total:	94,702	2.17	24,288	0.56	13,741	0.32	14,819	0.34	31,160	0.72	10,703	0.25	64.9	0.52	0.61	0.75

Land Use	Imp., I %	**C ₂ = 0.83 ^{1.122}	**C ₁₀ = 0.74i+0.132	**C ₁₀₀ = 0.41i+0.484
Lawns, Clay > 7% Slope	20	0.14	0.28	0.57
Lawns, Clay 2-7% Slope	20	0.14	0.28	0.57
Concrete Drive/Walks	95	0.78	0.84	0.87
Paved Street	95	0.78	0.84	0.87
Roof	95	0.78	0.84	0.87
Undeveloped, Historic	5			

Notes:

*For "Site Area Total" 1,009 sf of OS-A and 1,035 sf of OS-D is part of the site area. These areas are part of the original basins A and D from the Gartrell Drainage report (EDN: 216119). These areas plus A1, A2, B, and C equate to 72,191 sf. Refer to the Drainage Plan for Clarification

**Runoff coefficient Equations are taken from table 5-7 in the 2023 City of Aurora Storm Drainage Design and Technical Criteria Manual



CALCULATED BY:
DATE:
CHECKED BY:

JAK
1/25/24

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

P_{1%} = 0.86

JOB NO:
PROJECT:
DESIGN STORM:

22-5509D
Wolfe Chen Dental
DEVELOPED 2 Year

Basin	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE		TRAVEL TIME			REMARKS
		AREA DESIG	AREA (Acres)	RUNOFF COEFF	T _c (min)	CA (Acres)	I (in/hour)	Q (cfs)	T _c (min)	(CA) (Acres)	I (in/hour)	Q (cfs)	SLOPE (%)	STREET FLOW (cfs)	DESIGN FLOW (cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (ft/s)	
A1		A1	0.27	0.6	3.5	0.17	3.2	0.5												
A2		A2	0.98	0.4	5.8	0.38	2.8	1.1												
	10	A1+A2							5.8	0.5	2.8	1.5								
B	1	B	0.29	0.6	3.1	0.18	3.2	0.6												
OS-A		OS-A	0.11	0.8	2.3	0.09	3.4	0.3												
	2	B+OS-A							3.1	0.3	3.2	0.9								
C		C	0.06	0.3	7.7	0.02	2.6	0.1												
OS-3		OS-3	0.35	0.7	5.8	0.26	2.8	0.7												
	11	OS-3+C							7.7	0.3	2.6	0.7								
OS-D	12	OS-D	0.10	0.5	4.1	0.05	3.1	0.1												



CALCULATED BY: JAK
DATE: 1/25/24
CHECKED BY:

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

P₁₂ 2.46

JOB NO: 22-5509D
PROJECT: Wolfe Chen Dental
DESIGN STORM: DEVELOPED 2 Year

Basin	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME		REMARKS
		AREA (Acres)	RUNOFF COEFF	T _c (min)	C _A (Acres)	I (in/hour)	Q (cfs)	T _c (min)	(C _A) (Acres)	I (in/hour)	Q (cfs)	SLOPE (%)	STREET FLOW (cfs)	RESOR FLOW (cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	T ₁ (min)	
A1		A1	0.27	0.8	3.5	0.22	9.1	2.0												
A2		A2	0.98	0.7	5.8	0.67	8.0	5.4												
	10	A1+A2							5.8	0.9	8.0	7.1								
B		B	0.29	0.8	3.1	0.23	9.3	2.1												
OS-A		OS-A	0.11	0.9	5.0	0.10	8.3	0.8												
	2	B+OS-A							5.0	0.3	8.3	2.7								
C		C	0.06	0.6	7.7	0.04	7.3	0.3												
OS-3		OS-3	0.35	0.8	5.8	0.30	8.0	2.4												
	11	OS-3+C							7.7	0.3	7.3	2.5								
OS-D		OS-D	0.10	0.7	4.1	0.07	8.7	0.6												
	12																			