PRELIMINARY DRAINAGE REPORT

FOR

CHERRY CREEK ELEMENTARY NO. 45

CHERRY CREEK SCHOOL DISTRICT

Dedicated to Excellence
Cherry Creek Schools

January 14, 2021

Approved For One Year From This Date	
City Engineer	**Date**
Water Department	**Date**

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January 14, 2021

Ms. Janet Bender, Principal Engineer
City of Aurora
15151 East Alameda Parkway
Aurora, CO 80012

RE: Cherry Creek Elementary No. 45
Cherry Creek School District
Preliminary Drainage Report
JVA No. 3306c

The following Preliminary Drainage Report and attached drainage map have been prepared for the Cherry Creek Elementary No. 45 School, City of Aurora, Colorado. The drainage report and drainage map have been produced in accordance with the City of Aurora Storm Drainage Design and Technical Criteria, Aurora Roadway Specifications, and the Mile High Flood District (MHFD) Urban Storm Drainage Criteria Manual (USDCM), and comply with provisions thereof.

It is our understanding that the information provided herein meets all requirements of the City of Aurora's drainage criteria.

Please contact us if you have any questions regarding this submission.

Sincerely,

JVA, Inc.

John Wojcicki, P.E.
Project Engineer

CONSULTING ENGINEERS

ENGINEER'S STATEMENT:

"I hereby certify that this report and the enclosed plan for the preliminary drainage design of the Cherry Creek Elementary No. 45 School project were prepared under my direct supervision in accordance with the provisions of the City of Aurora Storm Drainage Design and Technical Criteria and the Mile High Flood District (MHFD) Urban Storm Drainage Criteria Manual (USDCM) and supplemental City of Aurora requirements for the owners thereof. I understand that the City of Aurora does not and shall not assume liability for drainage facilities designed by others."

Signature:

_____

Charles R. Hager IV, P.E.
Registered Professional Engineer
State of Colorado No. 37146

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SECTION 1 – INTRODUCTION

GENERAL LOCATION AND DESCRIPTION

The subject property, High Plains Country Club Subdivision Filing No. 2, Tract L, is approximately 9.72 acres of land located in Section 33, Township 5 South, Range 65 West of the 6th PM, City of Aurora, County of Arapahoe, State of Colorado. The located southwest of the intersection with S. Blackstone Parkway and S. Valleyhead Way in Aurora, Colorado. The site is bound by S. Blackstone Parkway to the east, private housing and Valleyhead Way to the north, private housing and E. Canyon Place to the West, and an existing park to the south. A vicinity map can be found in the Appendix. This portion of the subdivision is zoned R-1, Low-Density Single-Family Residential District, with Tract L previously planned for an elementary school.

The development site has been designed to conform to general drainage characteristics as described in the City of Aurora Storm Drainage Design and Technical Criteria, Aurora Roadway Specifications, High Plains Country Club Subdivision Master, Filing No. 1 and 2 Drainage Reports (Project numbers 203020, 204032, 205056), Cherry Creek Schools MS-4 Permit and the Mile High Flood District (MHFD) Urban Storm Drainage Criteria Manual (USDCM). The site will convey drainage into the existing public storm system at the north end of the site. The existing storm sewer was stubbed into the school property site in order to connect to a private storm system that captures and conveys the developed flows downstream. The public storm system flows to a regional detention and water quality pond north of the site.

Cherry Creek School District (CCSD) will utilize their MS-4 program for the inspection and maintenance of the private storm sewer system during and after construction. No City of Aurora Inspection and Maintenance plan has been included as part of this submittal since no improvements occur outside of the school property. No additional easements will be granted for the onsite private storm sewer system for this project.

The primary purpose of this drainage report is to address the proposed development storm runoff characteristics to demonstrate conformance with the City of Aurora Storm Drainage Design and Technical Criteria, Aurora Roadway Specifications, High Plains Country Club Subdivision Master, Filing No. 1 and 2 Drainage Reports, and the Mile High Flood District (MHFD) Urban Storm Drainage Criteria Manual (USDCM).

PROPOSED DEVELOPMENT

The project proposes the construction of new school building (total roof area approximately 1.23 acres), paved parking and drop-off areas, concrete flatwork, play areas and fields, utility infrastructure, and landscaping. The site private storm drainage system will convey drainage to the public storm system in Valleyhead Way by connecting to a storm pipe stubout in the property

provided in High Plains Country Club Subdivision, Filing No. 2 construction. The proposed addition and site improvements will disturb approximately 9.7 acres within the property.

The existing site is naturally vegetated and overlot graded. The existing site is 5% impervious based on the existing soil types. In the previous drainage reports for the site, it was assumed to have a final buildout condition of 50% impervious based on City of Aurora Storm Drainage Design and Technical Criteria, Table 1, Runoff Coefficient and Percents Impervious. The proposed improvements result in an overall developed site imperviousness of 46.5%. The existing downstream public stormwater system was designed to carry the developed flows for a 100-year storm event to an existing regional detention and water quality pond to detain and treat storm runoff generated by the proposed improvements.

SECTION 2 – HISTORIC DRAINAGE

FLOOD HAZARD

FEMA flood insurance rate map number 08005C0508K dated December 17, 2010, locates the development site in zone X, or a 0.2% annual chance flood hazard. A copy of the referenced flood map is included in the appendix.

EXISTING SOILS

Native soils found onsite are classified by the Natural Resource Conservation Service (NRCS) as Fondis Silt Loam and Buick Loam with a Hydrologic Soil Group rating of "C". A copy of the NRCS soils classification map is included in the appendix. The site contains 1% to 35% slopes draining generally to the north and east.

MASTER DRAINAGE PLAN AND PREVIOUS DRAINAGE STUDIES

The High Plains Country Club Subdivision Drainage Reports included an assumed developed drainage design for this site which was previously designated for an elementary school. The reports referenced for this development include; High Plains Country Club Master Drainage Report (Project Number 203020), January 2003, High Plains Country Club Subdivision Filing No. 1 Phase 1 Final Drainage Report (Project Number 204032), December 2003 and High Plains Country Club Subdivision – Filing No. 2 Final Drainage Report (Project Number 205056), April 2005. Select excerpts from these reports are included in the appendix for reference.

High Plains Country Club Master Drainage Report, January 2003 and High Plains Country Club Subdivision Filing No. 1 Phase 1 Final Drainage Report include design pertaining to the regional water quality and detention pond for the site, Pond A. The future elementary school is in Basin 226(A) in the reports and is noted to have an assumed impervious value of 50% and a 100-year runoff coefficient of 0.70 based on City of Aurora Storm Drainage Design and Technical Criteria, Table 1, Runoff Coefficient and Percents Impervious. This basin is in Major Basin A and is tributary to Pond A. These reports note that:

> *"High Plains Country Club will have a regional water quality pond and a Detention/Water Quality Pond (Pond A) to satisfy City of Aurora detention and water quality requirements for Major Basin A in its entirety... Pond A will be designed per City of Aurora criteria to meet water quality and detention requirements…The Final Drainage Report for Basins numbers in the 200's…are assumed to have runoff values equivalent to their final proposed design"*

The High Plains Country Club Subdivision – Filing No. 2 Final Drainage Report, April 2005, further details the design of the elementary school basin and public storm system design. The report notes:

"Basin 226A contains portions of lots in Block 8 of Filing 2 and the area designated as the location of a future elementary school... In the ultimate condition a future elementary school storm sewer system is anticipated to convey runoff from the future elementary school to the stub we have provided out of the Type D inlet at DP 276A. This pipe stub has been sized to convey 100-year ultimate condition runoff from the elementary school site. Should the Type D inlet at DP 276A clog or should an event larger than the 100-year storm occur runoff will spill into South Blackstone Parkway and will be conveyed to the sump inlet at DP 272B."

The calculations of this report show that a 30" RCP stubout that was provided for drainage conveyance from the site was anticipated to convey 47.7 cfs during a 100-year storm event.

Based on the information provided in the reports, it is understood that the proposed site is complying with the Master Drainage Report of the subdivision by the proposed drainage characteristics not exceeding these assumed parameters.

EXISTING FACILITIES AND DRAINAGE PATTERNS

Historic flows within the project area generally sheet flow from southwest to the north and east. An onsite Type D inlet at the northeast corner of the property and curb inlets located in the ROW capture drainage from the project site and convey the water to the downstream regional detention pond which ultimately outfalls to Mutchie Creek. The existing site consists of native landscape with slopes from 1% to 35%. The overall imperviousness of the site before development is 5% based on the existing soil types.

Assumed values of the site when fully developed were used for calculation purposes of the public storm system and regional detention pond. The site was assumed to be 50% impervious, the tributary area in basin 226(A) includes the school site. A 30" RCP is stubbed into the property to connect to a private storm system from the site. The below table summarizes the assumed characteristics of the tributary basin from the previous drainage reports.

Table 1 – Anticipated Drainage Summary

	Property Imperviousness	**Property Area**	**Onsite Storm Tributary Area**	**2-Year Event**		**5-Year Event**	**10-Year Event**	**100-Year Event**	
				C	Q	C	C	C	Q
Anticipated Values	50%	9.7 (AC)	9.3 (AC) Basin 226A	.45	11.1 (cfs)	.50	.60	.70	47.7 (cfs)

OFF-SITE BASINS

A portion of adjacent residential properties drain onto the property. This drainage runoff was included in the calculations for Basin 226A. The historic drainage patterns will be maintained in the developed condition. Runoff from these areas will be conveyed to the downstream storm system northeast of the property, matching historic conditions.

SECTION 3 – DESIGN CRITERIA

REFERENCES

The proposed private storm drainage facilities for the project are designed to comply with the City of Aurora Storm Drainage Design and Technical Criteria and the Mile High Flood District Urban Storm Drainage Criteria Manual (USDCM).

HYDROLOGIC AND HYDRAULIC CRITERIA

The Rational Method (Q=CIA) was used to determine the storm runoff (Q) from the areas tributary to the proposed storm system, with composite runoff coefficients (C) and contributing areas (A) given for design points in sub-basins. Intensity (I) for the various storm events was determined using point rainfall figures from the 2016 USDCM and runoff coefficients for various land usages were obtained from the latest USDCM prescribed methodology. Rainfall, basin coefficients, and other calculated site characteristics are shown in the appendix. Design frequencies are per Aurora Storm Criteria for residential, business, and industrial facility.

Water surface profiles and pipe hydraulic grade line computations will be included in the Final Drainage Report and are performed using Autodesk Storm Sewers software, version year 2020.

SECTION 4 – DEVELOPED (PROPOSED) DRAINAGE

GENERAL CONCEPT

The general drainage concept for the developed site is to convey runoff toward the northeast where feasible and collect in the proposed onsite private storm system. The private storm system is routed to the northeast and connects to the existing 30" RCP storm pipe stubout on the site which routes to the public storm system in Valleyhead Way. The public storm system outfalls to the regional detention pond to the north of the site. The private storm sewer and inlets are designed to contain the generated runoff from the 100-year storm event and has a total outfall flow less than the previously assumed design values.

DRAINAGE DETAILS

Developed drainage conditions were analyzed for conformance to design parameters noted in the previous drainage reports, City of Aurora Storm Drainage Design and Technical Criteria, Aurora Roadway Specifications, and the Mile High Flood District (MHFD) Urban Storm Drainage Criteria Manual (USDCM). Developed site imperviousness is 46.5%.

Onsite inlets and storm sewer pipe were sized to capture and convey the 100-year storm flows below grade. Inlets shown on plan are designed in a sump condition unless otherwise noted. Additionally, overflow paths have been incorporated in the design to convey runoff to the ROW in the event of inlet clogging or storm events larger than the 100-year level.

DEVELOPED DRAINAGE BASINS

The developed site is analyzed in 37 sub-basins as described below for Basins A, B, R Outfall, and OS.

Basin A consists of areas to the north and west of the building. These areas are primarily play courts, fire access drive, sidewalks, bus drop-off, and landscaping. Runoff from Basin A flows collects in the west trunk of the private storm system and is conveyed to the existing storm system to the northeast..

Basin B consists of areas to the south and east of the building. These areas are primarily play fields, parking, parent drop-off, and landscaping. Runoff from Basin B flows collects in the east trunk of the private storm system and is conveyed to the existing storm system to the northeast.

Basin R consists of the building roof. Runoff from Basin R is routed primarily to the Basin B storm system to the east.

Basin OS consists a small portion of landscaping drive and sidewalk that cannot be reasonably captured by the onsite storm system. Runoff from Basin OS sheet flows into the S. Blackstone Parkway ROW and is conveyed in the curb to the existing northeast storm system.

STORMWATER DESIGN CHARACTERISTICS

The site conforms to the overall drainage plan for the subdivision. See below summary table:

Table 2 - Developed Drainage Comparison

	Property Imperviousness	**Property Area**	**Onsite Storm Tributary Area**	**2-Year Event**		**5-Year Event**	**10-Year Event**	**100-Year Event**	
				C	Q	C	C	C	Q
Anticipated Values	50%	9.7 (AC)	9.3 (AC) Basin 226A	.45	11.1 (cfs)	.50	.60	.70	47.7 (cfs)
Actual Values	46.5%	9.7 (AC)	9.5 (AC)	.49	10.7 (cfs)	.50	.52	.55	32.5 (cfs)

The proposed site development runoff is significantly reduced from the initial design values. The values used to design the downstream storm and detention facilitates exceed the actual design so these facilitates are sufficient for this development. Furthermore, more of the site is being captured by the onsite storm system than was previously designed, which reduces the amount of flow being conveyed to right of way also.

SECTION 5 – CONCLUSIONS

The proposed drainage plan has been designed to convey runoff from the 100-year storm event to the public storm sewer following master drainage plan. No adverse downstream conditions are anticipated with this project.

The recommendations of this report are in conformance with all applicable storm drainage regulations. Calculations, a vicinity map, and other reference materials used are attached in the Appendix.

SECTION 6 – REFERENCES

1. "City of Aurora Storm Drainage Design and Technical Criteria", September 2010.

2. "Urban Storm Drainage Criteria Manual," Urban Drainage and Flood Control District, Revised 2018.

3. Web Soil Survey, Natural Resources Conservation Service, United States Department of Agriculture. Online at: http://websoilsurvey.nrcs.usda.gov, accessed October 2020.

4. Flood Insurance Rate Maps, FEMA Map Service Center. Online at: https://msc.fema.gov/, accessed October 2020.

5. High Plains Country Club Master Drainage Report (203020), January 2003

6. High Plains Country Club Subdivision Filing No. 1 Phase 1 Final Drainage Report (204032), December 2003

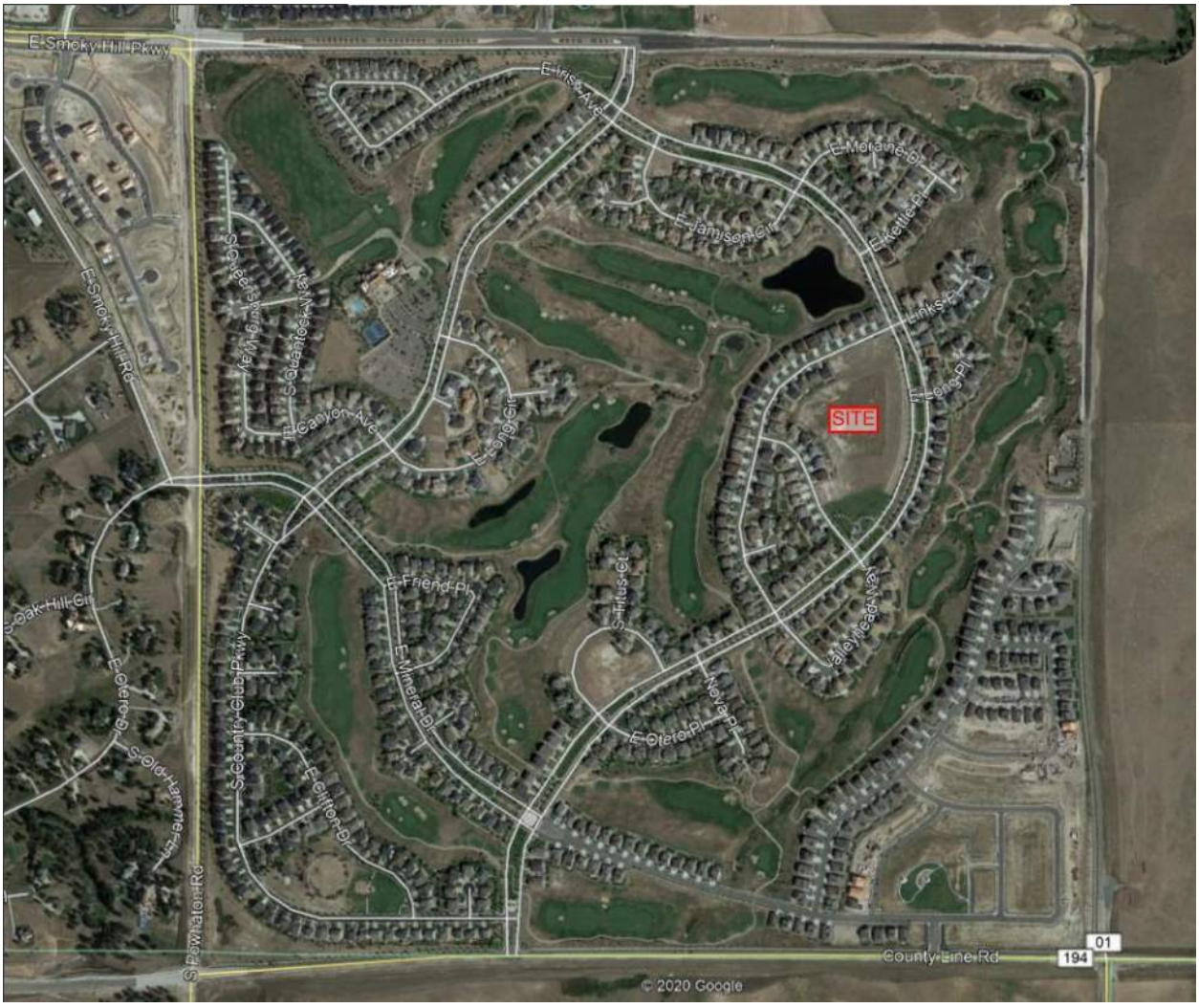
7. High Plains Country Club Subdivision – Filing No. 2 Final Drainage Report (205056), April 2005

APPENDIX A – SITE MAPS

S. BLACKSTONE PARKWAY

AURORA, CO 80016

SECTION 33, TOWNSHIP 5S, RANGE 65



VICINITY MAP

NOT TO SCALE

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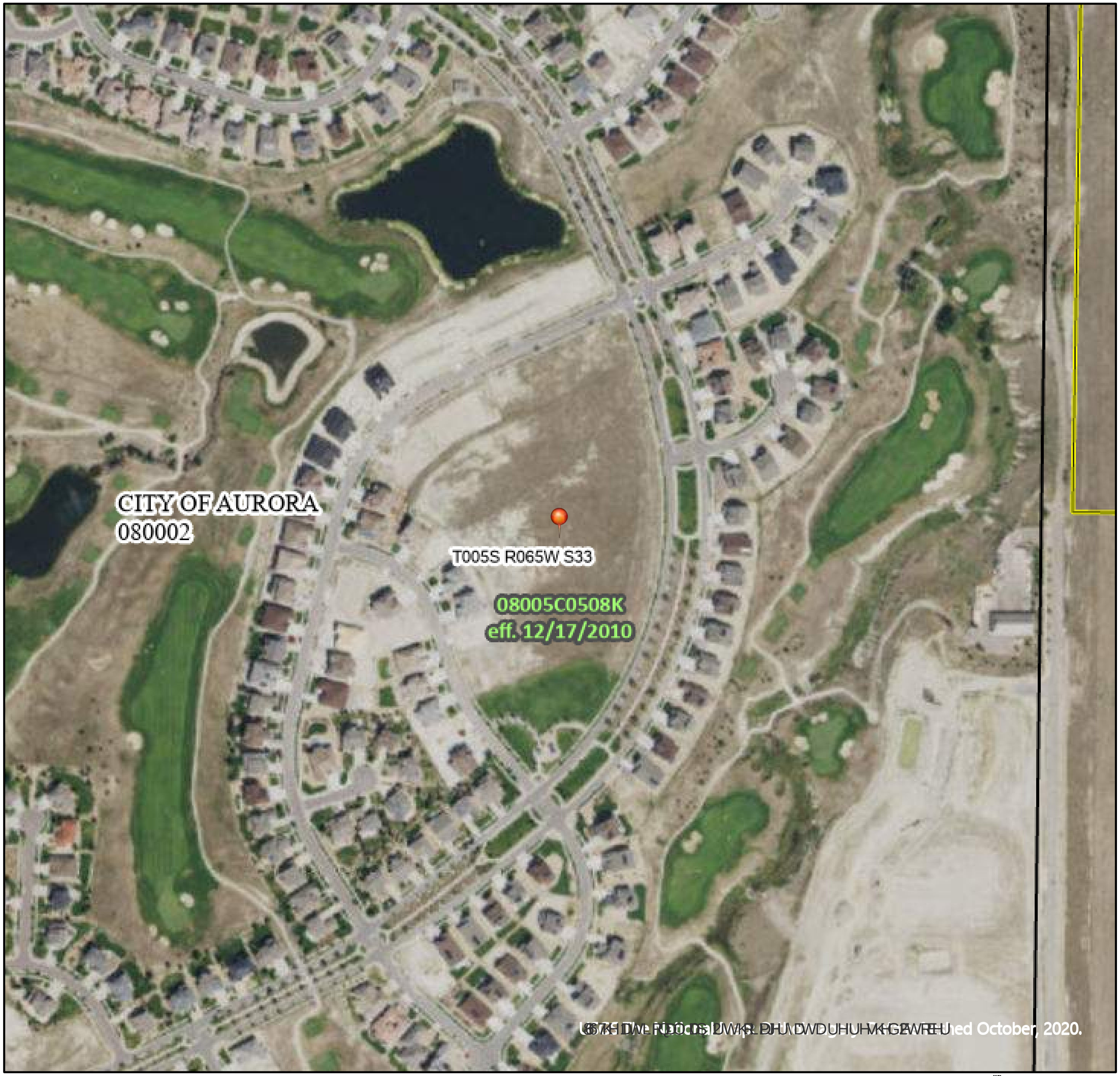

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- &RDVWDO 7UDQVHFW %DVHOLQH
- 3URILOH %DVHOLQH
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- 1R 'LJLWDO 'DWD $YDLODEOH
- 8QPDSSHG

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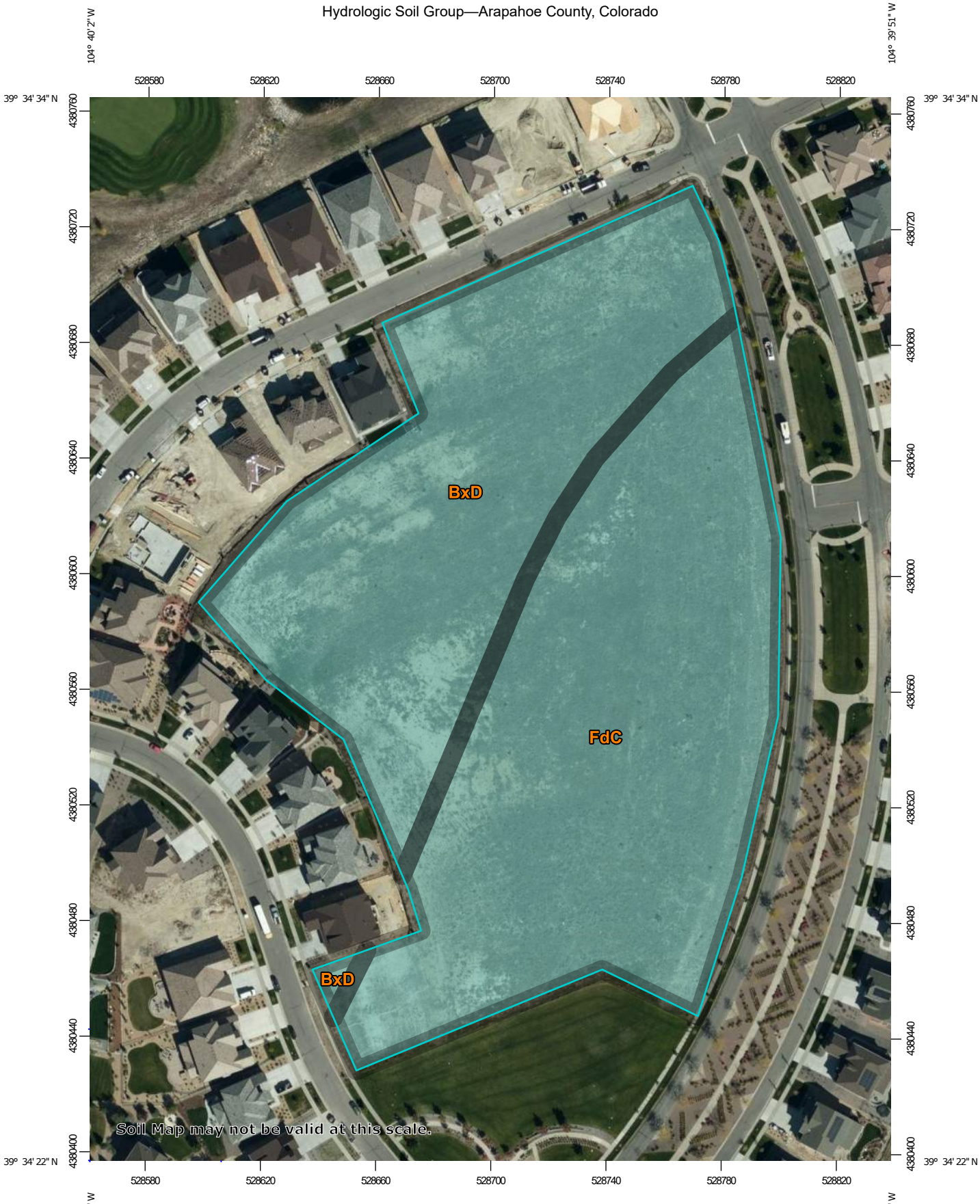

Map Scale: 1:1,790 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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 16, Jun 4, 2020

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

Date(s) aerial images were photographed: Oct 3, 2018—Dec 4, 2018

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BxD	Buick loam, 5 to 9 percent slopes	C	4.2	44.6%
FdC	Fondis silt loam, 3 to 5 percent slopes	C	5.3	55.4%
Totals for Area of Interest			**9.5**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

APPENDIX B – CALCULATIONS

TABLE 1
RUNOFF COEFFICIENTS AND PERCENTS IMPERVIOUS

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	FREQUENCY			
		2	5	10	100
Business:					
Commercial Areas	95	.87	.87	.88	.89
Neighborhood Areas	85	.60	.65	.70	.80
Residential:					
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
Industrial:					
Light Areas	80	.71	.72	.76	.82
Heavy Areas	90	.80	.80	.85	.90
Parks, Cemeteries	5	.10	.10	.35	.60
Playgrounds	10	.15	.25	.35	.65
Schools	50	.45	.50	.60	.70
Railroad Yard Areas	15	.40	.45	.50	.60
Undeveloped Areas:					
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
Streets:					
Paved	100	.87	.88	.90	.93
Gravel	40	.15	.25	.35	.65
Concrete Drive and Walks	96	.87	.87	.88	.89
Roofs	90	.80	.85	.90	.90
Lawns, Sandy Soil (A and B Soils):	2				
2% Slope		.05	.06	.08	.10
2-7% Slope		.10	.11	.13	.15
>7% Slope		.15	.16	.18	.20
Lawns, Clay Soil (C and D Soils):	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

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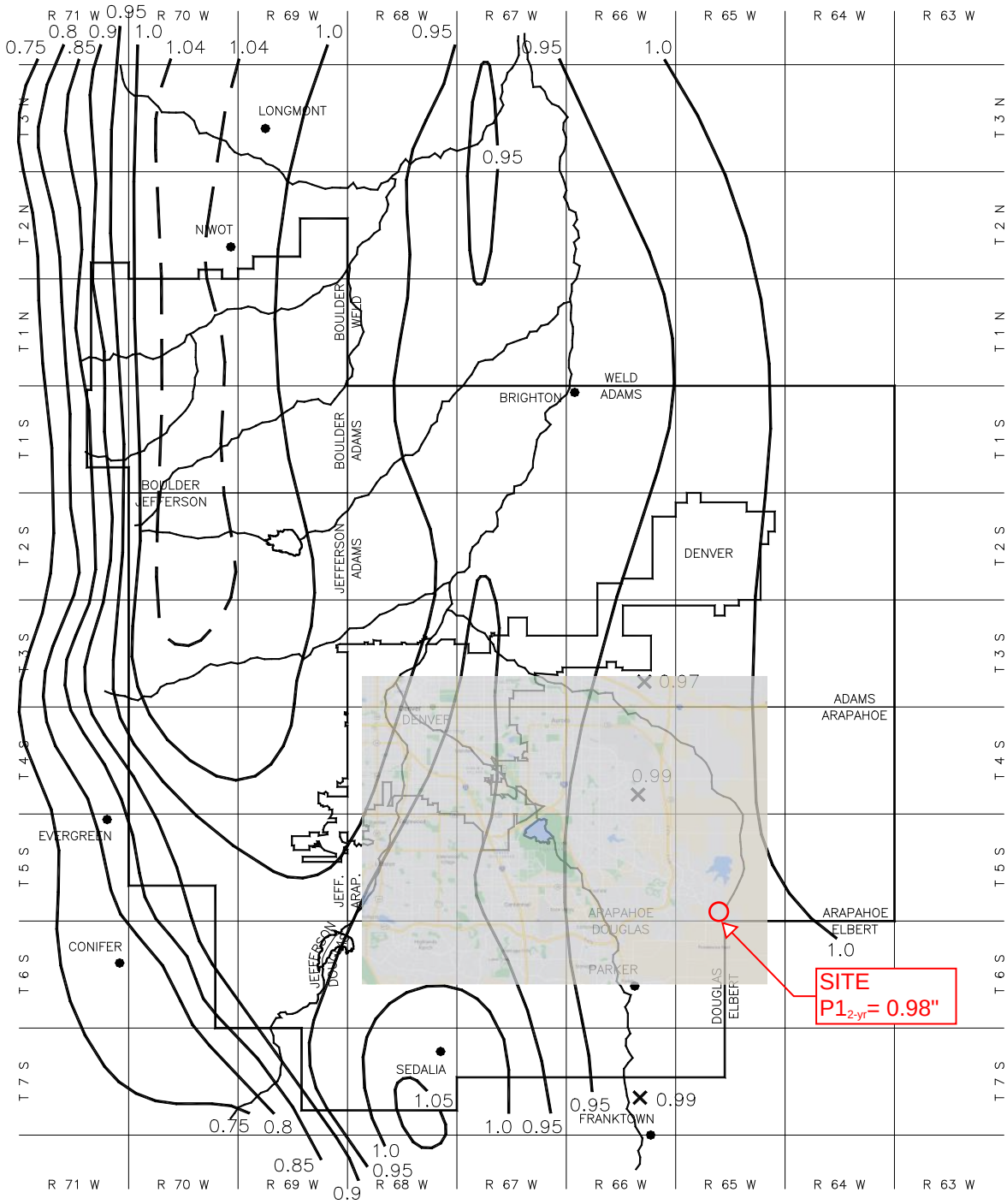

Figure 5-1. Rainfall depth-duration-frequency: 2-year, 1-hour rainfall

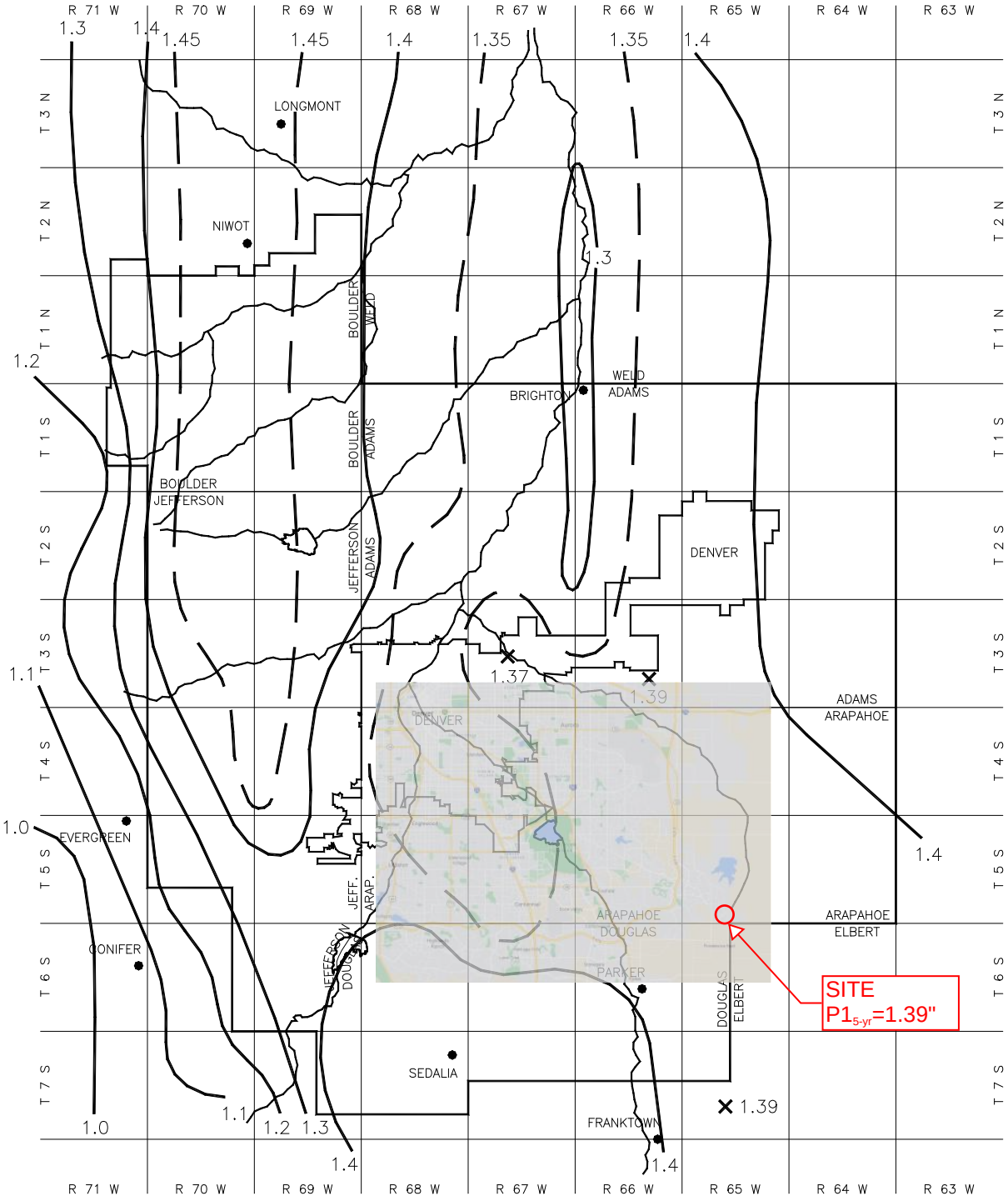

Figure 5-2. Rainfall depth-duration-frequency: 5-year, 1-hour rainfall

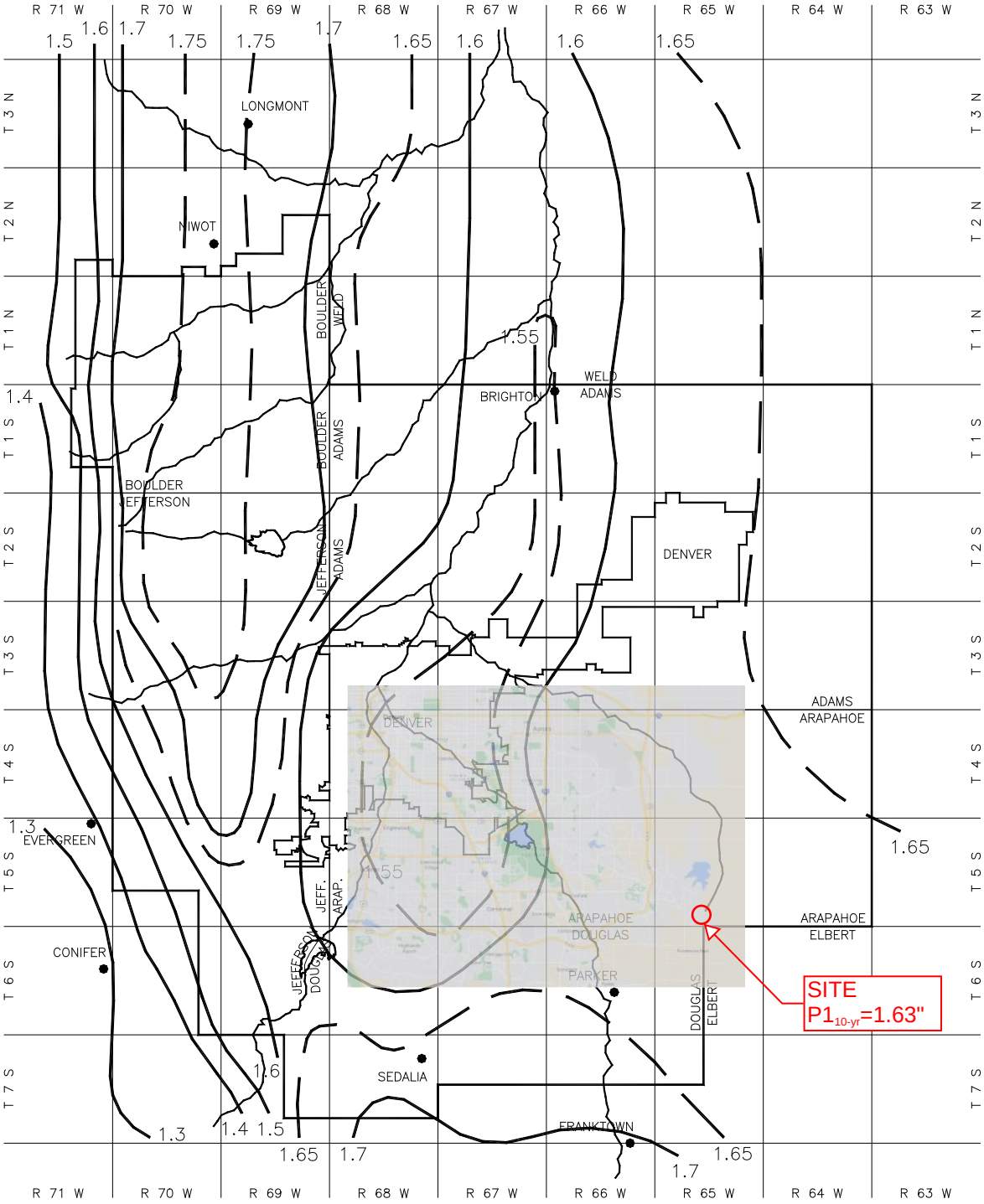

Figure 5-3. Rainfall depth-duration-frequency: 10-year, 1-hour rainfall

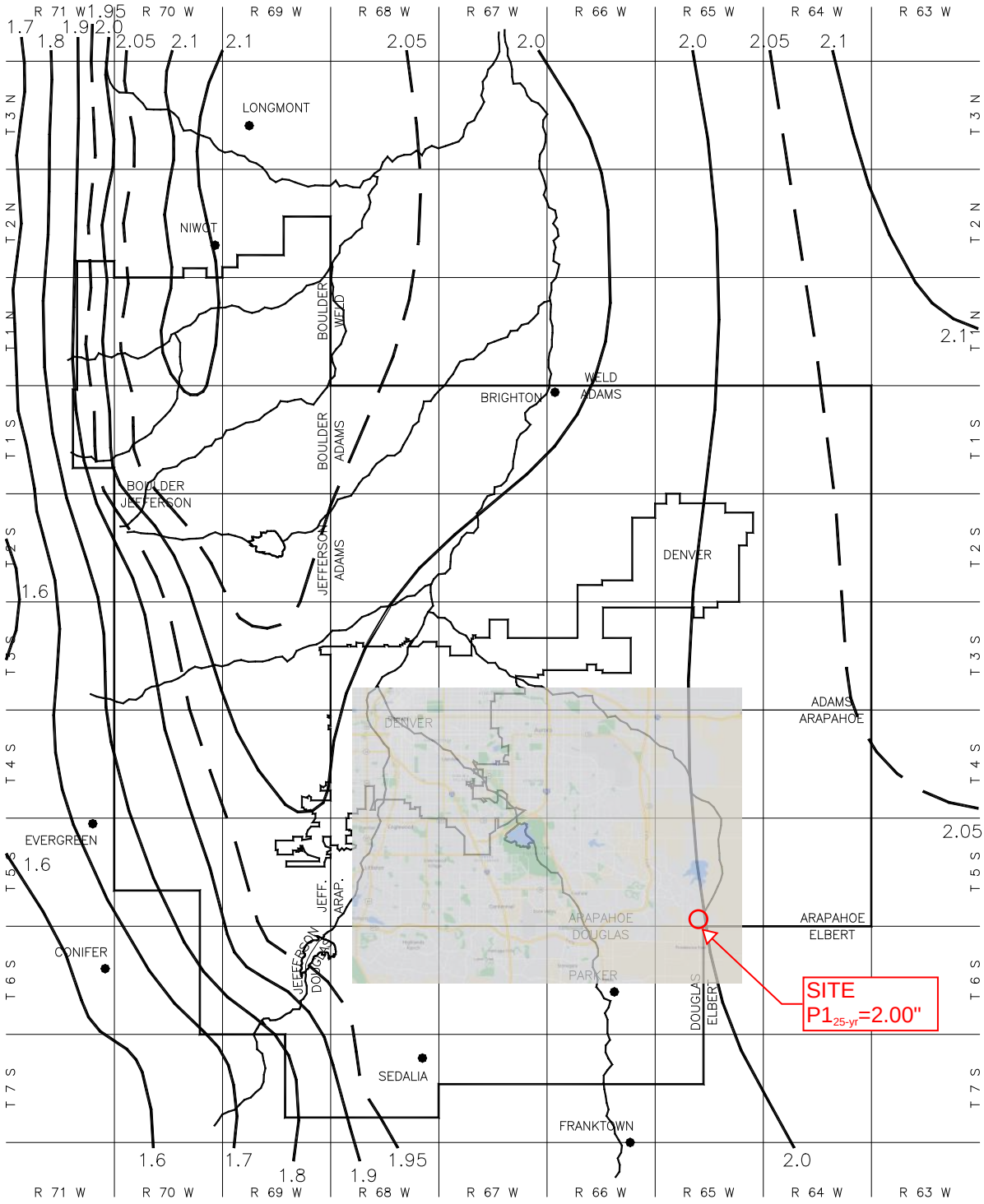

Figure 5-4. Rainfall depth-duration-frequency: 25-Year, 1-hour rainfall

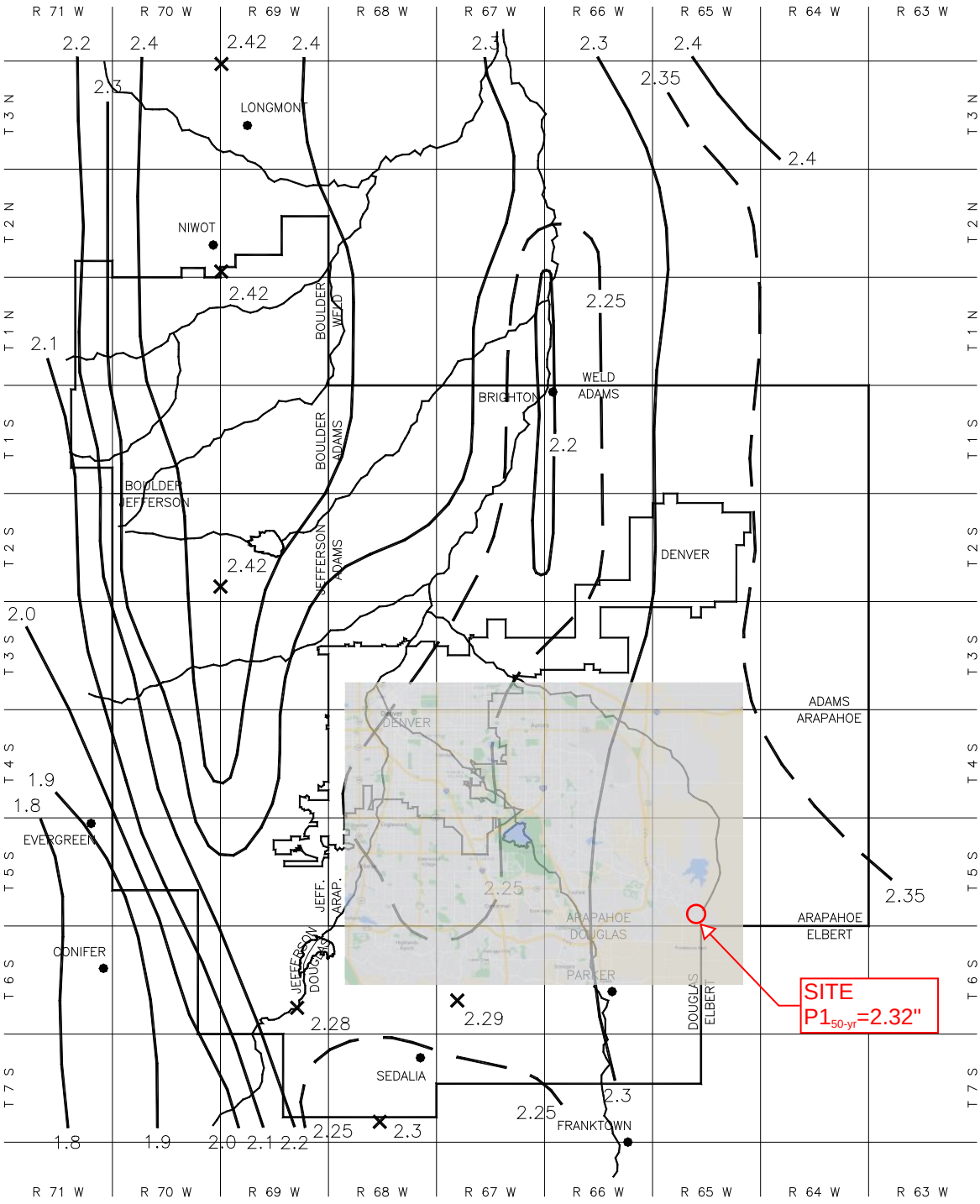

Figure 5-5. Rainfall depth-duration-frequency: 50-year, 1-hour rainfall

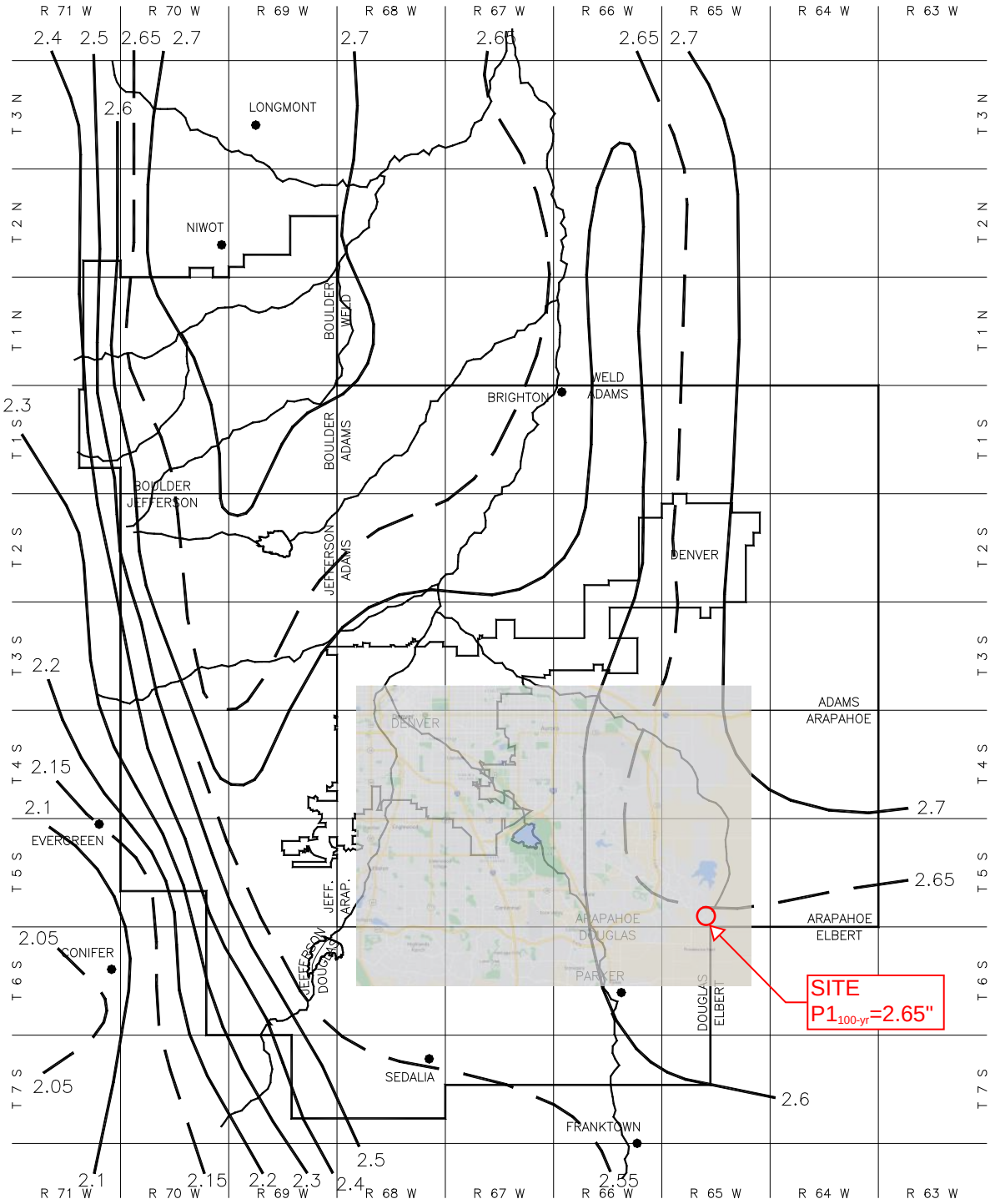

Figure 5-6. Rainfall depth-duration-frequency: 100-year, 1-hour rainfall

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Job Name: CCSD Elementary #45
Job Number: 3306c
Date: 12/10/20
By: JPW

	I%	C2	C5	C10	C100
Streets Paved	100%	0.87	0.88	0.90	0.93
Concrete Drives/Walks	96%	0.87	0.87	0.88	0.89
Roof	90%	0.80	0.85	0.90	0.90
Gravel	40%	0.15	0.25	0.35	0.65
Landscaping (B soil)	2%	0.10	0.11	0.13	0.15
Landscaping (C/D soil)	5%	0.18	0.19	0.20	0.22
Playground	25%	0.42	0.43	0.54	0.64
Artificial Turf	25%	0.42	0.43	0.54	0.64

CCSD Elementary #45

Composite Runoff Coefficient Calculations

Location: Aurora
Minor Design Storm: 2
Major Design Storm: 100
Soil Type: C/D

CA 100yr = 0.78i + 0.11
CB 100yr = 0.47i + 0.426
CC/D 100yr = 0.41i + 0.484)

Basin Design Data

	I (%) =	100%	96%	90%	40%	25%	25%	2%	5%			I (%)	Runoff Coeff's			
Basin Name	Design Point	A_{paved} streets (sf)	$A_{drives/conc}$ (sf)	A_{roof} (sf)	A_{gravel} (sf)	A_{plygnd} (sf)	$A_{art. turf}$ (sf)	$A_{lscape (B soil)}$ (sf)	A_{lscape} (C/D soil) (sf)	A_{Total} (sf)	A_{Total} (ac)	Imp (%)	C2	C5	C10	C100
A1	1		236						20,421	20,657	0.47	6.0%	0.19	0.20	0.21	0.23
A2	2		1,802			6,394			0	8,196	0.19	40.6%	0.52	0.53	0.61	0.69
A3	3								526	526	0.01	5.0%	0.18	0.19	0.20	0.22
A4	4	1,538	3,412						0	4,950	0.11	97.2%	0.87	0.87	0.89	0.90
A5	5								1,255	1,255	0.03	5.0%	0.18	0.19	0.20	0.22
A6	6	4,045	6,005			12,484			1,084	23,618	0.54	55.0%	0.60	0.61	0.67	0.73
A7	7	60	1,490						60	1,610	0.04	92.8%	0.84	0.85	0.86	0.87
A8	8	9,269	3,496						14,163	26,928	0.62	49.5%	0.51	0.52	0.53	0.55
A9	9		6,410						6,439	12,849	0.29	50.4%	0.52	0.53	0.54	0.55
A10	10	5,421	4,951						1,401	11,773	0.27	87.0%	0.79	0.79	0.81	0.83
A11	11								7,103	7,103	0.16	5.0%	0.18	0.19	0.20	0.22
A12	12	8,396	4,024						1,396	13,816	0.32	89.2%	0.80	0.81	0.82	0.85
B1	13		2,536						17,589	20,125	0.46	16.5%	0.27	0.28	0.29	0.30
B2	14		1,842						6,768	8,610	0.20	24.5%	0.33	0.34	0.35	0.36
B3	15								674	674	0.02	5.0%	0.18	0.19	0.20	0.22
B4	16								3,552	3,552	0.08	5.0%	0.18	0.19	0.20	0.22
B5	17	3,981	1,876						39	5,896	0.14	98.1%	0.87	0.87	0.89	0.91
B6	18	23,571	7,789						3,517	34,877	0.80	89.5%	0.80	0.81	0.82	0.85
B7	19		4,222						50,925	55,147	1.27	12.0%	0.23	0.24	0.25	0.27
B8	20		2,371						25,159	27,530	0.63	12.8%	0.24	0.25	0.26	0.28
B9	21	6,088	845						8,502	15,435	0.35	47.5%	0.49	0.50	0.51	0.54
B10	22	998							1,787	2,785	0.06	39.0%	0.43	0.44	0.45	0.47
B11	23	8,020	7,320						2,131	17,471	0.40	86.7%	0.79	0.79	0.81	0.83
B12	24								1,533	1,533	0.04	5.0%	0.18	0.19	0.20	0.22
B13	25		780						6,298	7,078	0.16	15.0%	0.26	0.26	0.27	0.29
B14	26		271						8,888	9,159	0.21	7.7%	0.20	0.21	0.22	0.24
R1	27			2,877						2,877	0.07	90.0%	0.80	0.85	0.90	0.90
R2	28			2,896						2,896	0.07	90.0%	0.80	0.85	0.90	0.90

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	I%	C2	C5	C10	C100
Streets Paved	100%	0.87	0.88	0.90	0.93
Concrete Drives/Walks	96%	0.87	0.87	0.88	0.89
Roof	90%	0.80	0.85	0.90	0.90
Gravel	40%	0.15	0.25	0.35	0.65
Landscaping (B soil)	2%	0.10	0.11	0.13	0.15
Landscaping (C/D soil)	5%	0.18	0.19	0.20	0.22
Playground	25%	0.42	0.43	0.54	0.64
Artificial Turf	25%	0.42	0.43	0.54	0.64

CCSD Elementary #45

Composite Runoff Coefficient Calculations

Location: Aurora
Minor Design Storm: 2
Major Design Storm: 100
Soil Type: C/D

CA 100yr = 0.78i + 0.11
CB 100yr = 0.47i + 0.426
CC/D 100yr = 0.41i + 0.484)

Basin Design Data

	I (%) =	100%	96%	90%	40%	25%	25%	2%	5%			I (%)	Runoff Coeff's			
Basin Name	Design Point	A_{paved} streets (sf)	$A_{drives/conc}$ (sf)	A_{roof} (sf)	A_{gravel} (sf)	A_{plygnd} (sf)	$A_{art. turf}$ (sf)	$A_{lscape (B soil)}$ (sf)	$A_{lscape (C/D soil)}$ (sf)	A_{Total} (sf)	A_{Total} (ac)	Imp (%)	C2	C5	C10	C100
R3	29			6,413						6,413	0.15	90.0%	0.80	0.85	0.90	0.90
R4	30			5,233						5,233	0.12	90.0%	0.80	0.85	0.90	0.90
R5	31			3,282						3,282	0.08	90.0%	0.80	0.85	0.90	0.90
R6	32			6,607						6,607	0.15	90.0%	0.80	0.85	0.90	0.90
R7	33			5,076						5,076	0.12	90.0%	0.80	0.85	0.90	0.90
R8	34			11,567						11,567	0.27	90.0%	0.80	0.85	0.90	0.90
R9	35			8,529						8,529	0.20	90.0%	0.80	0.85	0.90	0.90
OUTFALL	36		1,021						18,461	19,482	0.45	9.8%	0.22	0.23	0.24	0.26
OS	37	1,996	502						5,652	8,150	0.19	33.9%	0.39	0.40	0.41	0.44
TOTAL SITE		73,383	63,201	52,480	0	18,878	0	0	215,323	423,265	9.72	46.5%	0.49	0.50	0.52	0.55

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Job Name: CCSD Elementary #45
Job Number: 3306c
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By: JPW

CCSD Elementary #45

Time of Concentration Calculations

Location: Aurora
Minor Design Storm: 2
Major Design Storm: 100
Soil Type: C/D

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)	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 $t_i + t_t = t_c$	Total Length (ft)	t_c=(L/180)+ 10 (min)	Min t_c
A1	1	0.47	0.20	37	25.0%	3.4	246	3.2%	Paved areas & shallow paved swales	20	3.6	1.1	4.6	283	11.6	5.0
A2	2	0.19	0.53	110	2.0%	8.7			Paved areas & shallow paved swales	20	0.0	0.0	8.7	110	10.6	8.7
A3	3	0.01	0.19	7	10.0%	2.0	47	2.0%	Grassed waterway	15	2.1	0.4	2.4	54	10.3	5.0
A4	4	0.11	0.87	112	1.9%	3.6			Paved areas & shallow paved swales	20	0.0	0.0	3.6	112	10.6	5.0
A5	5	0.03	0.19	7	10.0%	2.0	40	2.0%	Grassed waterway	15	2.1	0.3	2.4	47	10.3	5.0
A6	6	0.54	0.61	192	1.9%	10.1			Paved areas & shallow paved swales	20	0.0	0.0	10.1	192	11.1	10.1
A7	7	0.04	0.85	45	2.0%	2.5			Paved areas & shallow paved swales	20	0.0	0.0	2.5	45	10.3	5.0
A8	8	0.62	0.52	144	6.2%	7.0	222	2.0%	Grassed waterway	15	2.1	1.7	8.7	366	12.0	8.7
A9	9	0.29	0.53	123	3.0%	8.0	75	3.0%	Grassed waterway	15	2.6	0.5	8.5	198	11.1	8.5
A10	10	0.27	0.79	101	2.5%	4.2	94	5.2%	Paved areas & shallow paved swales	20	4.6	0.3	4.5	195	11.1	5.0
A11	11	0.16	0.19	66	12.0%	5.9			Paved areas & shallow paved swales	20	0.0	0.0	5.9	66	10.4	5.9
A12	12	0.32	0.81	122	3.0%	4.1	66	1.3%	Paved areas & shallow paved swales	20	2.2	0.5	4.6	188	11.0	5.0
B1	13	0.46	0.28	213	7.0%	11.5	42	5.0%	Grassed waterway	15	3.4	0.2	11.7	255	11.4	11.4
B2	14	0.20	0.34	300	6.0%	13.4			Paved areas & shallow paved swales	20	0.0	0.0	13.4	300	11.7	11.7
B3	15	0.02	0.19	7	10.0%	2.0	23	2.0%	Grassed waterway	15	2.1	0.2	2.2	30	10.2	5.0
B4	16	0.08	0.19	17	5.0%	4.0	22	2.0%	Grassed waterway	15	2.1	0.2	4.2	39	10.2	5.0
B5	17	0.14	0.87	48	2.0%	2.3	106	1.0%	Paved areas & shallow paved swales	20	2.0	0.9	3.2	154	10.9	5.0
B6	18	0.80	0.81	241	2.7%	6.0	76	1.3%	Paved areas & shallow paved swales	20	2.2	0.6	6.5	317	11.8	6.5
B7	19	1.27	0.24	300	4.5%	16.5			Paved areas & shallow paved swales	20	0.0	0.0	16.5	300	11.7	11.7
B8	20	0.63	0.25	231	8.6%	11.6	35	2.0%	Grassed waterway	15	2.1	0.3	11.9	266	11.5	11.5
B9	21	0.35	0.50	104	3.2%	7.6	153	2.5%	Paved areas & shallow paved swales	20	3.2	0.8	8.4	257	11.4	8.4
B10	22	0.06	0.44	43	9.0%	3.8	57	2.0%	Paved areas & shallow paved swales	20	2.8	0.3	4.2	100	10.6	5.0
B11	23	0.40	0.79	236	4.2%	5.4			Paved areas & shallow paved swales	20	0.0	0.0	5.4	236	11.3	5.4
B12	24	0.04	0.19	7	10.0%	2.0	51	2.0%	Grassed waterway	15	2.1	0.4	2.4	58	10.3	5.0
B13	25	0.16	0.26	131	7.6%	8.9			Paved areas & shallow paved swales	20	0.0	0.0	8.9	131	10.7	8.9
B14	26	0.21	0.21	52	20.0%	4.3	113	2.0%	Grassed waterway	15	2.1	0.9	5.2	165	10.9	5.2
R1	27	0.07	0.85	40	5.0%	1.7			Paved areas & shallow paved swales	20	0.0	0.0	1.7	40	10.2	5.0
R2	28	0.07	0.85	40	5.0%	1.7			Paved areas & shallow paved swales	20	0.0	0.0	1.7	40	10.2	5.0
R3	29	0.15	0.85	40	5.0%	1.7			Paved areas & shallow paved swales	20	0.0	0.0	1.7	40	10.2	5.0

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Time of Concentration Calculations

Location: Aurora
Minor Design Storm: 2
Major Design Storm: 100
Soil Type: C/D

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)	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 $t_i + t_t = t_c$	Total Length (ft)	t_c=(L/180)+ 10 (min)	Min t_c
R4	30	0.12	0.85	40	5.0%	1.7			Paved areas & shallow paved swales	20	0.0	0.0	1.7	40	10.2	5.0
R5	31	0.08	0.85	40	5.0%	1.7			Paved areas & shallow paved swales	20	0.0	0.0	1.7	40	10.2	5.0
R6	32	0.15	0.85	40	5.0%	1.7			Paved areas & shallow paved swales	20	0.0	0.0	1.7	40	10.2	5.0
R7	33	0.12	0.85	40	5.0%	1.7			Paved areas & shallow paved swales	20	0.0	0.0	1.7	40	10.2	5.0
R8	34	0.27	0.85	40	5.0%	1.7			Paved areas & shallow paved swales	20	0.0	0.0	1.7	40	10.2	5.0
R9	35	0.20	0.85	40	5.0%	1.7			Paved areas & shallow paved swales	20	0.0	0.0	1.7	40	10.2	5.0
OUTFALL	36	0.45	0.23	68	12.0%	5.8	165	2.0%	Grassed waterway	15	2.1	1.3	7.1	233	11.3	7.1
OS	37	0.19	0.40	21	25.0%	2.0			Paved areas & shallow paved swales	20	0.0	0.0	2.0	21	10.1	5.0

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Developed Storm Runoff Calculations

Design Storm : **100 Year**

Point Hour Rainfall (P_1) : **2.65**

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	Q bypass	Pipe Size (in) or equivalent	Pipe Material	Slope (%)	Pipe Flow (cfs)	Max Pipe Capacity (cfs)	Length (ft)	Velocity (fps)	tt (min)	Total Time (min)	Notes
A1	1	0.47	0.23	5.00	0.11	8.98	0.97	5.00	0.11	8.99	0.97	18" Area Drain	0.97			12 in	PVC	2.0%	1.0	7.0	142	5.6	0.42	5.42	
A2	2	0.19	0.69	8.70	0.13	7.55	0.99	8.70	0.13	7.56	0.99	Underdrain	0.99			8 in	PVC	2.0%	1.0	2.4	91	4.3	0.36	9.06	
A3	3	0.01	0.22	5.00	0.00	8.98	0.02	5.00	0.00	8.99	0.02	12" Area Drain	0.02			6 in	PVC	2.0%	0.0	1.1	15	3.5	0.07	5.07	
A4	4	0.11	0.90	5.00	0.10	8.98	0.92	5.00	0.10	8.99	0.92	18" Area Drain	0.92												
	Basins A1-A4							9.06	0.34	7.45	2.56					12 in	PVC	1.5%	2.6	6.1	41	4.8	0.14	9.20	
A5	5	0.03	0.22	5.00	0.01	8.98	0.06	5.00	0.01	8.99	0.06	12" Area Drain	0.06			6 in	PVC	2.0%	0.1	1.1	16	3.5	0.08	5.08	
A6	6	0.54	0.73	10.10	0.40	7.14	2.84	10.10	0.40	7.14	2.84	18" Area Drain	2.84												
	Basins A1-A6							9.20	0.75	7.40	5.54					12 in	PVC	1.5%	5.5	6.1	81	4.8	0.28	9.48	
A7	7	0.04	0.87	5.00	0.03	8.98	0.29	5.00	0.03	8.99	0.29	18" Area Drain	0.29												
	Basins A1-A7							9.48	0.78	7.32	5.71					12 in	PVC	1.5%	5.7	6.1	69	4.8	0.24	9.71	
A8	8	0.62	0.55	8.70	0.34	7.55	2.57	8.70	0.34	7.56	2.58	Valley Inlet	2.58												
	Basins A1-A8							9.71	1.12	7.25	8.13					15 in	PVC	1.5%	8.1	11.0	162	5.6	0.48	10.19	
A9	9	0.29	0.55	8.50	0.16	7.62	1.25	8.50	0.16	7.62	1.25	Valley Inlet	1.25												
	Basins A1-A9							10.19	1.28	7.11	9.14					18 in	RCP	1.5%	9.1	13.8	45	4.9	0.15	10.35	
A10	10	0.27	0.83	5.00	0.22	8.98	2.01	5.00	0.22	8.99	2.01	Combo Inlet	2.01												
	Basins A1-A10							10.35	1.51	7.07	10.67					18 in	RCP	2.8%	10.7	19.0	88	6.7	0.22	10.57	
A11	11	0.16	0.22	5.90	0.04	8.58	0.31	5.90	0.04	8.59	0.31	Valley Inlet	0.31												
	Basins A1-A11							10.57	1.54	7.01	10.83					18 in	RCP	2.7%	10.8	18.5	198	6.6	0.50	11.07	
A12	12	0.32	0.85	5.00	0.27	8.98	2.41	5.00	0.27	8.99	2.41	Combo Inlet	2.41												
	Basins A12							5.00	0.27	8.99	2.41					12 in	PVC	10.0%	2.4	15.7	46	12.5	0.06	5.06	
B1	13	0.46	0.30	11.40	0.14	6.79	0.95	11.40	0.14	6.80	0.96	12" Area Drain	0.96			8 in	PVC	2.0%	1.0	2.4	64	4.3	0.25	11.65	
B2	14	0.20	0.36	11.70	0.07	6.72	0.48	11.70	0.07	6.72	0.48	12" Area Drain	0.48			8 in	PVC	2.0%	0.5	2.4	32	4.3	0.13	11.83	
R1	27	0.07	0.90	5.00	0.06	8.98	0.53	5.00	0.06	8.99	0.53	Roof Drain	0.53			6 in	PVC	2.0%	0.5	1.1	7	3.5	0.03	5.03	
R2	28	0.07	0.90	5.00	0.06	8.98	0.54	5.00	0.06	8.99	0.54	Roof Drain	0.54			6 in	PVC	2.0%	0.5	1.1	7	3.5	0.03	5.03	
B3	15	0.02	0.22	5.00	0.00	8.98	0.03	5.00	0.00	8.99	0.03	(2) 12" Area Drain	0.03			6 in	PVC	2.0%	0.0	1.1	13	3.5	0.06	5.06	
	Basins B1-B3 and R1-R2							11.83	0.34	6.69	2.24					12 in	PVC	2.0%	2.2	7.0	123	5.6	0.37	12.19	
R3	29	0.15	0.90	5.00	0.13	8.98	1.19	5.00	0.13	8.99	1.19	Roof Drain	1.19			6 in	PVC	3.0%	1.2	1.4	10	4.3	0.04	5.04	
R4	30	0.12	0.90	5.00	0.11	8.98	0.97	5.00	0.11	8.99	0.97	Roof Drain	0.97			6 in	PVC	3.0%	1.0	1.4	20	4.3	0.08	5.08	
R5	31	0.08	0.90	5.00	0.07	8.98	0.61	5.00	0.07	8.99	0.61	Roof Drain	0.61			6 in	PVC	3.0%	0.6	1.4	20	4.3	0.08	5.08	
R6	32	0.15	0.90	5.00	0.14	8.98	1.23	5.00	0.14	8.99	1.23	Roof Drain	1.23			6 in	PVC	3.0%	1.2	1.4	20	4.3	0.08	5.08	

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Developed Storm Runoff Calculations

Design Storm : **100 Year**

Point Hour Rainfall (P_1) : **2.65**

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

	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	Q bypass	Pipe Size (in) or equivalent	Pipe Material	Slope (%)	Pipe Flow (cfs)	Max Pipe Capacity (cfs)	Length (ft)	Velocity (fps)	tt (min)	Total Time (min)	Notes
B4	16	0.08	0.22	5.00	0.02	8.98	0.16	5.00	0.02	8.99	0.16	(3) 12" Area Drain	0.16			6 in	PVC	2.0%	0.2	1.1	18	3.5	0.09	5.09	
								Basins B1-B4 and R1-R6								18 in	RCP	1.5%	5.3	13.8	130	4.9	0.44	12.64	
B5	17	0.14	0.91	5.00	0.12	8.98	1.11	5.00	0.12	8.99	1.11	Combo Inlet	1.11												
								Basins B1-B5 and R1-R6								18 in	RCP	1.9%	6.0	15.6	141	5.5	0.43	13.06	
B6	18	0.80	0.85	6.50	0.68	8.33	5.67	6.50	0.68	8.34	5.67	Combo Inlet	5.67												
								Basins B1-B6 and R1-R6								18 in	RCP	4.2%	10.3	23.1	11	8.2	0.02	13.09	
B7	19	1.27	0.27	11.70	0.34	6.72	2.31	11.70	0.34	6.72	2.31	12" Area Drain	2.31			8 in	PVC	5.2%	2.3	3.8	80	6.9	0.19	11.89	
B8	20	0.63	0.28	11.50	0.18	6.77	1.19	11.50	0.18	6.77	1.19	Valley Inlet	1.19												
								Basins B7-B8								18 in	RCP	1.4%	3.5	13.2	270	4.6	0.97	12.86	
B9	21	0.35	0.54	8.40	0.19	7.65	1.45	8.40	0.19	7.65	1.46	Combo Inlet	1.46												
								Basins B1-B9 and R1-R6								18 in	RCP	2.8%	14.9	18.7	67	6.6	0.17	13.03	
B10	22	0.06	0.47	5.00	0.03	8.98	0.27	5.00	0.03	8.99	0.27	Combo Inlet	0.27												
								Basins B1-B10 and R1-R6								18 in	RCP	2.4%	15.0	17.5	22	6.2	0.06	13.09	
B11	23	0.40	0.83	5.40	0.33	8.80	2.92	5.40	0.33	8.80	2.92	Type R Inlet	2.92												
								Basins B1-B11 and R1-R6								18 in	RCP	3.7%	17.1	21.7	33	7.7	0.07	13.16	
R7	33	0.12	0.90	5.00	0.10	8.98	0.94	5.00	0.10	8.99	0.94	Roof Drain	0.94			8 in	PVC	4.0%	0.9	3.4	55	6.0	0.15	5.15	
R8	34	0.27	0.90	5.00	0.24	8.98	2.15	5.00	0.24	8.99	2.15	Roof Drain	2.15			8 in	PVC	4.0%	2.1	3.4	7	6.0	0.02	5.02	
R9	35	0.20	0.90	5.00	0.18	8.98	1.58	5.00	0.18	8.99	1.58	Roof Drain	1.58			6 in	PVC	9.4%	1.6	2.4	7	7.6	0.02	5.02	
B12	24	0.04	0.22	5.00	0.01	8.98	0.07	5.00	0.01	8.99	0.07	12" Area Drain	0.07												
								Basins B12 and R7-R9								12 in	PVC	6.0%	4.7	12.2	140	9.7	0.24	5.39	
B13	25	0.16	0.29	8.90	0.05	7.49	0.36	8.90	0.05	7.50	0.36	Valley Inlet	0.36												
								Basins B1-B13 and R1-R9								24 in	RCP	1.6%	20.8	30.2	160	6.0	0.44	13.60	
B14	26	0.21	0.24	5.20	0.05	8.89	0.45	5.20	0.05	8.90	0.45	Valley Inlet	0.45												
								Basins B1-B14 and R1-R9								24 in	RCP	1.5%	20.8	29.5	131	5.9	0.37	13.98	
OUTFALL	36	0.45	0.26	7.10	0.11	8.10	0.92	7.10	0.11	8.11	0.93	Type D	0.93												
								Basins A1-A12, B1-B14, R1-R9 and Outfall								30 in	RCP	1.5%	32.5	54.0	9	6.9	0.02	14.00	
OS	37	0.19	0.44	5.00	0.08	8.98	0.73	5.00	0.08	8.99	0.73	Sheet Flow			0.73										

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Developed Storm Runoff Calculations

Design Storm : **2 Year**

Point Hour Rainfall (P_1) : **0.98**

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	Q bypass	Pipe Size (in) or equivalent	Pipe Material	Slope (%)	Pipe Flow (cfs)	Max Pipe Capacity (cfs)	Length (ft)	Velocity (fps)	tt (min)	Total Time (min)	Notes
A1	1	0.47	0.19	5.00	0.09	3.32	0.30	5.00	0.09	3.32	0.30	18" Area Drain	0.30			12 in	PVC	2.0%	0.3	7.0	142	5.6	0.42	5.42	
A2	2	0.19	0.52	8.70	0.10	2.79	0.27	8.70	0.10	2.80	0.27	Underdrain	0.27			8 in	PVC	2.0%	0.3	2.4	91	4.3	0.36	9.06	
A3	3	0.01	0.18	5.00	0.00	3.32	0.01	5.00	0.00	3.32	0.01	12" Area Drain	0.01			6 in	PVC	2.0%	0.0	1.1	15	3.5	0.07	5.07	
A4	4	0.11	0.87	5.00	0.10	3.32	0.33	5.00	0.10	3.32	0.33	18" Area Drain	0.33												
							Basins A1-A4	9.06	0.29	2.75	0.79					12 in	PVC	1.5%	0.8	6.1	41	4.8	0.14	9.20	
A5	5	0.03	0.18	5.00	0.01	3.32	0.02	5.00	0.01	3.32	0.02	12" Area Drain	0.02			6 in	PVC	2.0%	0.0	1.1	16	3.5	0.08	5.08	
A6	6	0.54	0.60	10.10	0.33	2.64	0.86	10.10	0.33	2.64	0.86	18" Area Drain	0.86												
							Basins A1-A6	10.10	0.62	2.64	1.63					12 in	PVC	1.5%	1.6	6.1	81	4.8	0.28	10.38	
A7	7	0.04	0.84	5.00	0.03	3.32	0.10	5.00	0.03	3.32	0.10	18" Area Drain	0.10												
							Basins A1-A7	10.38	0.65	2.61	1.70					12 in	PVC	1.5%	1.7	6.1	69	4.8	0.24	10.62	
A8	8	0.62	0.51	8.70	0.31	2.79	0.87	8.70	0.31	2.80	0.88	Valley Inlet	0.88												
							Basins A1-A8	10.62	0.96	2.59	2.49					15 in	PVC	1.5%	2.5	11.0	162	5.6	0.48	11.10	
A9	9	0.29	0.52	8.50	0.15	2.81	0.43	8.50	0.15	2.82	0.44	Valley Inlet	0.44												
							Basins A1-A9	11.10	1.12	2.54	2.84					18 in	RCP	1.5%	2.8	13.8	45	4.9	0.15	11.25	
A10	10	0.27	0.79	5.00	0.21	3.32	0.71	5.00	0.21	3.32	0.71	Combo Inlet	0.71												
							Basins A1-A10	11.25	1.33	2.53	3.36					18 in	RCP	2.8%	3.4	19.0	88	6.7	0.22	11.47	
A11	11	0.16	0.18	5.90	0.03	3.17	0.09	5.90	0.03	3.18	0.09	Valley Inlet	0.09												
							Basins A1-A11	11.47	1.36	2.51	3.41					18 in	RCP	2.7%	3.4	18.5	198	6.6	0.50	11.97	
A12	12	0.32	0.80	5.00	0.25	3.32	0.84	5.00	0.25	3.32	0.84	Combo Inlet	0.84												
							Basins A12	5.00	0.25	3.32	0.84					12 in	PVC	10.0%	0.8	15.7	46	12.5	0.06	5.06	
B1	13	0.46	0.27	11.40	0.12	2.51	0.31	11.40	0.12	2.51	0.31	12" Area Drain	0.31			8 in	PVC	2.0%	0.3	2.4	64	4.3	0.25	11.65	
B2	14	0.20	0.33	11.70	0.06	2.48	0.16	11.70	0.06	2.49	0.16	12" Area Drain	0.16			8 in	PVC	2.0%	0.2	2.4	32	4.3	0.13	11.83	
R1	27	0.07	0.80	5.00	0.05	3.32	0.18	5.00	0.05	3.32	0.18	Roof Drain	0.18			6 in	PVC	2.0%	0.2	1.1	7	3.5	0.03	5.03	
R2	28	0.07	0.80	5.00	0.05	3.32	0.18	5.00	0.05	3.32	0.18	Roof Drain	0.18			6 in	PVC	2.0%	0.2	1.1	7	3.5	0.03	5.03	
B3	15	0.02	0.18	5.00	0.00	3.32	0.01	5.00	0.00	3.32	0.01	(2) 12" Area Drain	0.01			6 in	PVC	2.0%	0.0	1.1	13	3.5	0.06	5.06	
							Basins B1-B3 and R1-R2	11.83	0.30	2.48	0.73					12 in	PVC	2.0%	0.7	7.0	123	5.6	0.37	12.19	
R3	29	0.15	0.80	5.00	0.12	3.32	0.39	5.00	0.12	3.32	0.39	Roof Drain	0.39			6 in	PVC	3.0%	0.4	1.4	10	4.3	0.04	5.04	
R4	30	0.12	0.80	5.00	0.10	3.32	0.32	5.00	0.10	3.32	0.32	Roof Drain	0.32			6 in	PVC	3.0%	0.3	1.4	20	4.3	0.08	5.08	
R5	31	0.08	0.80	5.00	0.06	3.32	0.20	5.00	0.06	3.32	0.20	Roof Drain	0.20			6 in	PVC	3.0%	0.2	1.4	20	4.3	0.08	5.08	
R6	32	0.15	0.80	5.00	0.12	3.32	0.40	5.00	0.12	3.32	0.40	Roof Drain	0.40			6 in	PVC	3.0%	0.4	1.4	20	4.3	0.08	5.08	

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Developed Storm Runoff Calculations

Design Storm : **2 Year**

Point Hour Rainfall (P_1) : **0.98**

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

	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	Q bypass	Pipe Size (in) or equivalent	Pipe Material	Slope (%)	Pipe Flow (cfs)	Max Pipe Capacity (cfs)	Length (ft)	Velocity (fps)	tt (min)	Total Time (min)	Notes
B4	16	0.08	0.18	5.00	0.01	3.32	0.05	5.00	0.01	3.32	0.05	(3) 12" Area Drain	0.05			6 in	PVC	2.0%	0.0	1.1	18	3.5	0.09	5.09	
								Basins B1-B4 and R1-R6								18 in	RCP	1.5%	1.7	13.8	130	4.9	0.44	12.64	
B5	17	0.14	0.87	5.00	0.12	3.32	0.39	5.00	0.12	3.32	0.39	Combo Inlet	0.39												
								Basins B1-B5 and R1-R6								18 in	RCP	1.9%	2.0	15.6	141	5.5	0.43	13.06	
B6	18	0.80	0.80	6.50	0.64	3.08	1.97	6.50	0.64	3.08	1.98	Combo Inlet	1.98												
								Basins B1-B6 and R1-R6								18 in	RCP	4.2%	3.5	23.1	11	8.2	0.02	13.09	
B7	19	1.27	0.23	11.70	0.29	2.48	0.73	11.70	0.29	2.49	0.73	12" Area Drain	0.73			8 in	PVC	5.2%	0.7	3.8	80	6.9	0.19	11.89	
B8	20	0.63	0.24	11.50	0.15	2.50	0.38	11.50	0.15	2.50	0.38	Valley Inlet	0.38												
								Basins B7-B8								18 in	RCP	1.4%	1.1	13.2	270	4.6	0.97	12.86	
B9	21	0.35	0.49	8.40	0.17	2.83	0.49	8.40	0.17	2.83	0.49	Combo Inlet	0.49												
								Basins B1-B9 and R1-R6								18 in	RCP	2.8%	4.9	18.7	67	6.6	0.17	13.25	
B10	22	0.06	0.43	5.00	0.03	3.32	0.09	5.00	0.03	3.32	0.09	Combo Inlet	0.09												
								Basins B1-B10 and R1-R6								18 in	RCP	2.4%	5.0	17.5	22	6.2	0.06	13.31	
B11	23	0.40	0.79	5.40	0.32	3.25	1.02	5.40	0.32	3.26	1.03	Type R Inlet	1.03												
								Basins B1-B11 and R1-R6								18 in	RCP	3.7%	5.7	21.7	33	7.7	0.07	13.39	
R7	33	0.12	0.80	5.00	0.09	3.32	0.31	5.00	0.09	3.32	0.31	Roof Drain	0.31			8 in	PVC	4.0%	0.3	3.4	55	6.0	0.15	5.15	
R8	34	0.27	0.80	5.00	0.21	3.32	0.71	5.00	0.21	3.32	0.71	Roof Drain	0.71			8 in	PVC	4.0%	0.7	3.4	7	6.0	0.02	5.02	
R9	35	0.20	0.80	5.00	0.16	3.32	0.52	5.00	0.16	3.32	0.52	Roof Drain	0.52			6 in	PVC	9.4%	0.5	2.4	7	7.6	0.02	5.02	
B12	24	0.04	0.18	5.00	0.01	3.32	0.02	5.00	0.01	3.32	0.02	12" Area Drain	0.02												
								Basins B12 and R7-R9								12 in	PVC	6.0%	1.5	12.2	140	9.7	0.24	5.39	
B13	25	0.16	0.26	8.90	0.04	2.77	0.12	8.90	0.04	2.77	0.12	Valley Inlet	0.12												
								Basins B1-B13 and R1-R9								24 in	RCP	1.6%	6.9	30.2	160	6.0	0.44	13.83	
B14	26	0.21	0.20	5.20	0.04	3.28	0.14	5.20	0.04	3.29	0.14	Valley Inlet	0.14												
								Basins B1-B14 and R1-R9								24 in	RCP	1.5%	6.9	29.5	131	5.9	0.37	14.20	
OUTFALL	36	0.45	0.22	7.10	0.10	2.99	0.29	7.10	0.10	3.00	0.29	Type D	0.29												
								Basins A1-A12, B1-B14, R1-R9 and Outfall								30 in	RCP	1.5%	10.7	54.0	9	6.9	0.02	14.22	
OS	37	0.19	0.39	5.00	0.07	3.32	0.24	5.00	0.07	3.32	0.24	Sheet Flow			0.24										

APPENDIX C – REFERENCES

Major Basin A Tributary

The bulk of the Site is located within Major Basin A, as identified by the "100's", "200's" and "300's" sub-basins designations, as shown on the Master Drainage Map in the back pocket. Historically, Major Basin A is 816.6 acres in size with approximately 277.3 acres of the Major Basin via off-Site basins. The proposed Major Basin A will be approximately 758.8 acres in size. A well-defined channel named Mutchie Creek divides the basin from the south to the northeast. The headwaters of the creek are located south of the Douglas County Line. Nearly 200 acres from within Douglas County are tributary to Mutchie creek. The main branch of the creek crosses onto the Site near the center of the southern property boundary. The creek meanders to the northeast corner of the property. The runoff from Major Basin A historically feeds shallow swales that drain into Mutchie Creek. One small offshoot runs diagonally from the southwest to the northeast across the Site. Offsite areas from the east and north also drain onto the Site, primarily as sheet flow. Mutchie creek leaves the property and enters Coal Creek from the left bank. The confluence is roughly 1.5 miles from the property boundary.

Major Basin A was part of the area studied in the *Upper Sand Creek Basin, Outfall Planning Study, and Preliminary Design by Kiowa Engineering Corporation in August 1990* (Reference 4). The report studied the watershed for Coal Creek that becomes Sand Creek nearly ten miles north of the Site. The *Flood Insurance Rate Map* (Reference 11) shows no delineated flood zones for the Site.

High Plains Country Club will have a Regional Water Quality Pond (RWQ-1) and a Detention/Water Quality Pond (Pond "A") to satisfy the City of Aurora detention and water quality requirements for Major Basin A in its entirety.

There are no irrigation facilities within 100 feet of the portion of the Site identified as Major Basin A.

Major Basin B Tributary

The portion of the Site within the Senac tributary is identified as Major Basin B. Major Basin B consists of sub-basins in the "400's" designation, as shown on the Master Drainage Map in the back pocket. Historically, Major Basin B is approximately 76.7 acres in size. The proposed Major Basin B will be approximately 85.5 acres in size. The runoff from Major Basin B historically sheet flows to small channels that meander to the northwest corner of the Site. Major Basin B is part of the headwaters for Senac Creek, which feeds the Aurora Reservoir approximately 1.4 miles downstream of the Site. There are no irrigation facilities within 100 feet of the portion of the Site identified as Major Basin B.

The *Flood Insurance Rate Map* (Reference 11) for the Site shows no delineated flood zones. The concurrent study titled *US Home Southeast Properties Master Drainage Report by McLaughlin Water Engineers, Ltd* (Reference 13) was referenced during the design and concept for the Site.

Major Basin B will have a Detention Pond (Pond "B"), in the northwest corner, designed to satisfy the requirements outlined in References 1, 2, 3 and 13. Water Quality for Major Basin B will occur by controlling the 10-year – 1-hour with a 2-hour temporal distribution storm release rate over a 96 hour period.

Major Basin C

A small portion of the southwest corner of the Site is tributary to Sampson Gulch and is identified as Major Basin C. Sub-basins with the "500's" designation constitute Major Basin C (Refer to Master Drainage Map, back pocket). Historically, Major Basin C is approximately 21.5 acres in size. The proposed Major Basin C will be approximately 35.1 acres in size. Runoff from Major Basin C will flow to the southwest corner of the Site and have peak flows attenuated in Detention Pond "C" prior to conveyance to Sampson Gulch. Sampson Gulch then meanders northwest until the convergence with Piney Creek approximately 1 mile downstream. Major Basin C is within the headwaters for Sampson Gulch. There are no irrigation facilities within 100 feet of the portion of the Site identified as Major Basin C.

Several studies of the Piney Creek watershed have been published. The Flood Hazard Area Delineation, Piney Creek Tributary have been used as references.

There are no Federal Emergency Management Agency, FEMA, delineated flood zones located on the Site. Refer to the FIRM panel in Appendix A.

IV. Drainageway Public Improvements

The development of the Site will require private and public drainage improvements for the safe collection and conveyance of stormwater runoff. Runoff within proposed developed areas will be initially carried in the streets of the development. Storm drain systems will be located where the street capacities are exceed. The storm sewer will be located within the street right of ways and designated easements. Drainage channels will be designed to convey flowrates from the major storm event (100-year).

Improvements to the existing drainageways will occur as necessary to augment public safety. Public improvements will meet the requirements of the City of Aurora and Urban Drainage Flood Control District. Stabilization measures, including drop structures and

toe protection, will be used to protect existing channel conditions and minimize channel erosion under developed conditions. Native vegetation and best management practices will also be used for all channel improvements.

Channel improvements within Mutchie Creek will be constructed in accordance with the High Plains Public Improvements Phasing Report and exhibits. The 18-hole golf course is anticipated to be constructed with Phase 1, refer to the *Framework and Development Plan for High Plains Country Club* (Reference 12) for further description of construction phasing. Drainage improvements to support the golf course development will be constructed concurrent with the golf course construction. Storm sewers will be phased to ensure a stable conveyance of runoff into the major drainageways. Stream and bank stabilization features will be constructed in phases as necessary. As areas are disturbed, detention and water quality ponds will be constructed to control sedimentation. Bank protection for unstable areas of a channel will be implemented as required to protect the integrity of the channel.

V. Water Quality Treatment

The development of the Site will coincide with the construction of water quality facilities as guided by *Urban Drainage and Flood Control District in Volume 3 of Urban Storm Drainage Criteria Manual (USDCM)* (Reference 2) and the *USHome Southeast Properties Master Drainage Report* (Reference 13). Each planned water quality facility will support the entire area tributary to the pond and attain a regional approach. Runoff from the basins will be delivered to the facilities via natural channels and constructed infrastructure.

Erosion control Best Management Practices (BMPs) will be utilized to control and minimize sediment laden runoff from entering major drainageways. BMPs will include but are not limited to; seeding, mulching, temporary sediment ponds, construction phasing and rough cut street control.

Major Basin A

The High Plains Regional Water Quality Pond (RWQ-1), located in the northeast corner of the Site and Detention Pond "A", adjacent to Golf Course Hole 10, will be sized to satisfy the detention requirements for the onsite area of Major Basin A and all upstream water quality requirements. Pond "A" will be oversized and the release rate attenuated to insure flows leaving the Site at Design Point 178 are below historic conditions. The over-detention within Pond "A" allows basins directly tributary to Mutchie Creek to flow un-detained through the Site.

A three-stage outlet structure will be constructed with Pond "A" to control flow for water quality as well as detention for the 10 and 100-year storm events. Regional Water Quality Pond RWQ-1 will provide water quality for the portion of Major Basin A which is directly tributary to Mutchie Creek, off-site areas to the south, and the effective area corresponding to the maximum release rate during the water quality event from Pond "A". Refer to the Specific Details Section of this report for further discussion.

Major Basin B

Major Basin B is located within the Senac Creek tributary basin that historically drains to the Aurora Reservoir. The Aurora Reservoir is a recreational facility that provides drinking water to the City of Aurora. Water quality of runoff from Major Basin B is of serious concern. A concurrent study, *US Home Southeast Properties Master Drainage Report* (Reference 13), made recommendations to water quality design for tributaries to Senac Creek. Those recommendations specific to Major Basin B and the determined water quality concepts presented in the Aurora Reservoir Water Quality Criteria will be adhered to. Detention Pond "B" will be constructed in the northwest corner of the Site and will release the 10-year – 1-hour storm temporally distributed over 2-hours over a 96-hour period. Pond "B" has been sized to release the 100-year event below historic conditions.

The SWMM model for this basin was used to calculate the required detention volume for this basin. The SWMM model is summarized in this report and compiled in the technical appendix that accompanies this report. Refer to the Specific Details Section of this report for a detailed water quality summary

Outfall from the Site will be to the north under the planned Smoky Hill Road. Martin/Martin Inc. has acknowledged acceptance of this point source in the *South Shore Master Drainage Report* (Reference 10).

Major Basin C

Major Basin C is located in the Sampson Gulch Tributary, which ultimately drains to Piney Creek. BMPs will be utilized during interim conditions to control sediment-laden runoff and erosion. The area is tributary to the Tallyn's Reach Regional Water Quality facility. The regional facility was sized to support all upstream water quality requirements. Please refer to the *Final Drainage Report for Tallyn's Reach Regional Water Quality Pond by Stantec Consulting Inc.* (Reference 6). Pond "C" was sized to attenuate peak flow below historic conditions for the 10-year and 100-year events prior to conveyance off-site.

200's are within the Site, but all Basins tributary to Pond A are included in this report so that we may complete the design for the Pond A outlet structures. The Final Drainage Report for Basins numbered in the 200's not located within the Site will be prepared with those future Filings but for the purposes of this report are assumed to have runoff values equivalent to their final proposed design. In the ultimate condition Basin 313A will be tributary to the future Pond D. Pond D will outfall into Mutchie Creek. In the interim condition, prior to the construction of Pond D, Basin 313A will be tributary to Pond A. Inlets will be provided at Design Points 263A, 263B, 263C, 269A, 269B, 274A and 274B. Inlets will also be provided at the North and West collector-collector intersections to pick up trickle flows. These trickle flow inlets are assumed to pick up only nuisance flows and therefore do not have an associated design point or drainage basin.

Basin 208 is within future Filing No. 1 - Phase 2 of the High Plains Country Club Subdivision. Basin 208 contains portions of lots in Block 9, portions of future South Shady Grove Way and all of future East Nichols Place. Runoff from Basin 208 will be collected in the curb and gutter along future South Shady Grove Way and future East Nichols Place and conveyed to the future sump inlet at DP 258. An emergency overflow swale to Basin 212 will be provided at DP 258. In the interim condition, prior to the construction of future Filing No. 1 – Phase 2, runoff from DP 258 will be conveyed to Pond A via a temporary swale. In the ultimate condition, from DP 258 the runoff will be conveyed via future storm sewer to DP J3.

Basin 209 is within future Filing No. 1 - Phase 2 of the High Plains Country Club Subdivision. Basin 209 contains portions of lots in Block 9, portions of future South Shady Grove Way, portions of future East Clifton Drive and all of future East Nova Place. Runoff from Basin 209 will be collected in the curb and gutter along future East Clifton Drive, future South Shady Grove Way and future East Nova Place and conveyed to the future sump inlet at DP 259. An emergency overflow swale to Basin 212 will be provided at DP 259. In the interim condition, prior to the construction of future Filing No. 1 – Phase 2, runoff from DP 259 will be conveyed to Pond A via a temporary swale. In the ultimate condition, from DP 259 the runoff will be conveyed via storm sewer to DP J3. From DP J3 the runoff will be conveyed via storm sewer to DP 262.

Basin 212 is within future Filing No. 1 - Phase 2 of the High Plains Country Club Subdivision. Basin 212 contains portions of lots in Blocks 7 and 9 and most of future Golf hole No 7. In the interim condition, prior to the construction of future Filing No. 1 – Phase 2, runoff from Basin 212 will be collected in a temporary swale and conveyed to Pond A. In the ultimate condition, the runoff from Basin 212 will be collected in the future golf course storm sewer system and conveyed to the future sump inlet at DP 262. An emergency overflow swale to Basin 213D will be provided at DP 262. From DP 262 the runoff will be conveyed via future storm sewer to DP 263D.

EXCERPT FROM:

DEVELOPMENT PARCEL DATA

RUNOFF COEFFICIENTS
& IMPERVIOUS VALUES

DESCRIPTION	LAND USE	C2	C5	C100	I (%)	City of Aurora Equivalent (See Table 1)
Traditional						
Residential	SFD (T) Low	0.40	0.45	0.60	44	Res: Single-Family
Residential	SFD (T) Med	0.40	0.45	0.60	49	Res: Single-Family
Townhome	SFA (T) Cluster	0.60	0.65	0.80	75	Res: Multi-Unit (Attached)
Multi-Family	MF (R/T)	0.65	0.70	0.80	80	Res: Apartments
Commercial		0.87	0.87	0.89	95	Bus: Commercial Areas
Golf	Defined in Ref 1	0.18	0.19	0.22	5	Lawns: Clayey Soil
Off Site	Defined in Ref 1	0.25	0.27	0.35	5	Undeveloped Areas
Roadway		0.87	0.88	0.93	100	Streets: Paved
Clubhouse		0.45	0.50	0.70	50	Schools
Open Space	2-7% Slope	0.18	0.19	0.22	5	Lawns: Clayey Soil
Elem. School		0.45	0.50	0.70	50	Schools

City of Aurora Equivalent Taken from the City of Aurora Storm Drainage Design and Technical Criteria Manual.

Imperviousness values 'not defined' in the City of Aurora Manual are from Urban Drainage and Flood Control District, Urban Storm Drainage Criteria Manual or as defined in the Master Drainage Report for High Plains (reference 1).

V:\52870\active\00001\870\Filing 1\Drng\Final_phase_1\[Rational Calcs High Plains-F1-P1.xls]Parcel Data

II. Historic Drainage & Existing Improvements

A. Historic Drainage

The Site is contained entirely within the Mutchie Creek tributary basin, Historic Major Basin H1 (see Historic Major Basin Map in Appendix A). Major basin H1 drains to Mutchie Creek. The historic drainage pattern is comparable to the planned drainage pattern for the Site. Historic basin H1 corresponds to developed Major Basin A. Mutchie Creek leaves the High Plains Country Club property near the northeast corner of Section 33 and enters Coal Creek from the left bank. The confluence is roughly 1.5 miles from the property boundary. No irrigation ditches or canals traverse the Site. There are no Federal Emergency Management Agency, FEMA, delineated flood zones located within the Site (see Reference 3). Historically, the Site receives runoff from other areas of the High Plains Country Club Subdivision property. Runoff from these portions of the High Plains Country Club Subdivision property has been accounted for in hydraulic calculations within this report. Runoff from other offsite areas, south of County Line Road, within Major Basin A, is conveyed within Mutchie Creek. Mutchie Creek is adjacent to the Site.

B. Existing Improvements

Storm sewer improvements within the High Plains Country Club Subdivision property are currently under construction. These improvements include the storm sewer systems and Detention/Water Quality Pond designs proposed in the *High Plains Country Club Subdivision Filing 1 Phase 1 Final Drainage Report* (Reference 7), the *High Plains Country Club Subdivision Filing 1 Phase 2 Final Drainage Report* (Reference 8), the *High Plains Country Club Subdivision Filing No. 1 Arterial Roads Final Drainage Report* (Reference 6), the *High Plains Country Club Subdivision Golf Course Storm Sewer Crossing Plans* (Reference 10) and the *Mutchie Creek Hydraulic Analysis and Stabilization Plan* (Reference 9).

Existing Pond 'A' is located in the northeast portion of the Site, west of South Blackstone Parkway, south of East Jamison Circle and north of South Valleyhead Way, near the Golf Course Hole 10 green. Basins located within the High Plains Country Club Subdivision property numbered in the 200's drain to existing Detention/Water Quality Pond 'A'. Detention and Water Quality for Basins numbered in the 200's is provided in existing Pond 'A'. The Pond 'A' detention outfall discharges into Morrish Gulch, which is tributary to Pond 'D'. The Pond 'A' Water Quality outfall discharges into Mutchie Creek, downstream of the Pond 'D' Water Quality outlet control structure. The final calculations for Pond 'A' are provided in the *High Plains Country Club Subdivision Filing 1 Phase 1 Final Drainage Report* (Reference 7).

Existing Pond 'D' is located in the extreme northeast corner of the High Plains Country Club Subdivision property, southwest of the future intersection of South Monaghan Road and East Smoky Hill Road, near Golf Course Hole 16. Basins numbered in the 100's and 300's drain to Detention/Water Quality Pond 'D'. Detention and Water quality for Basins numbered in the

100's and 300's is provided in Pond 'D'. Pond 'D' discharges to Mutchie Creek. The final calculations for Pond 'D' are provided in the *Mutchie Creek Hydraulic Analysis and Stabilization Plan* (Reference 9).

III. Design Criteria

A. References

The *Master Drainage Report for High Plains Country Club* (Reference 4), the *High Plains Country Club Subdivision Filing No. 1 Arterial Roadways Final Drainage Report* (Reference 6), the *High Plains Country Club Subdivision Filing 1 Phase 1 Final Drainage Report* (Reference 7), the *High Plains Country Club Subdivision Filing 1 Phase 2 Final Drainage Report* (Reference 8), the *High Plains Country Club Subdivision Golf Course Storm Sewer Crossings Final Drainage Report* (Reference 10), the *Mutchie Creek Hydraulic Analysis and Stabilization Plan* (Reference 9) and the *High Plains Country Club Subdivision Filing No. 2 Preliminary Drainage Report* (Reference 11) (all prepared by Stantec Consulting, Inc.) were consulted during the preparation of this report.

The *City of Aurora* (COA), *Storm Drainage Design and Technical Criteria* (Reference 1), and the *Urban Drainage and Flood Control District* (UDFCD), *Urban Storm Drainage Criteria Manual* (USDCM) (Reference 2) were the major technical references for this analysis.

As shown on the *Flood Insurance Rate Map for Arapahoe County; Panel 510 of 725* (Reference 3), Mutchie Creek does not have a FEMA regulated floodplain. The Site is entirely outside of any Federal Emergency Management Agency delineated 100-year floodplain.

B. Hydrologic Criteria

Hydrologic analyses were performed using the Rational Formula. Rainfall intensities were taken from Figure 3 of the *City of Aurora (COA), Storm Drainage Design and Technical Criteria Manual* (Reference 1). The proposed minor Basin characteristics were developed and used for the computation of peak flow rates and for the hydraulic calculations. The time of concentration calculations and peak flow rate calculations for each minor Basin are presented in Appendix B. Design frequencies analyzed are the 2-year (minor) storm and the 100-year (major) storm event.

C. Hydraulic Criteria

Analysis of curb and gutter flow was computed using guidance from the COA, *Storm Drainage Design and Technical Criteria Manual* and the UDFCD, *Urban Storm Drainage Criteria Manual* (References 1 & 2). Street capacities were calculated from figures 6A and 6B of the *City of Aurora (COA), Storm Drainage Design and Technical Criteria* (Reference 1) based on street

the 100-year storm event is assumed to be equivalent to the calculated 2-year partial capture rate. Bypass runoff will be conveyed to DP 275B via the curb and gutter along South Blackstone Parkway.

Basin 225B contains portions of lots in Block 7 of Filing 2, portions of South Blackstone Parkway and portions of South Valleyhead Way. Runoff from Basin 225B will be collected by the curb and gutter along South Blackstone Parkway and South Valleyhead Way and conveyed to the on-grade inlet at DP 275B. For the major and minor storm event the runoff from Basin 225B will be partially captured in the on-grade inlet at DP 275B and conveyed via storm sewer to DP J27. From DP J27 the runoff will be conveyed via storm sewer to DP 272B. The partial capture rate for this on-grade inlet during the 100-year storm event is assumed to be equivalent to the calculated 2-year partial capture rate. Bypass runoff will be conveyed to the sump inlet at DP 272B via the curb and gutter along South Blackstone Parkway.

Basin 226A contains portions of lots in Block 8 of Filing 2 and the area designated as the location of a future elementary school. In the interim condition, prior to the construction of the school, runoff from Basin 226A will be collected by temporary swales and conveyed to a Type D inlet at DP 276A. The Type D inlet at DP 276A will capture flows during the interim condition, prior to the construction of the future elementary school, and convey these flows to DP 275A. In the ultimate condition a future elementary school storm sewer system is anticipated to convey runoff from the future elementary school to the stub we have provided out of the Type D inlet at DP 276A. This pipe stub has been sized to convey 100-year ultimate condition runoff from the elementary school site. Should the Type D inlet at DP 276A clog or should an event larger than the 100-year storm occur runoff will spill into South Blackstone Parkway and will be conveyed to the sump inlet at DP 272B.

Basin 226B contains portions of lots in Block 9 of Filing 2, portions of South Blackstone Parkway, portions of East Canyon Place and the anticipated neighborhood area park area. Runoff from Basin 226B will be collected in the curb and gutter along South Blackstone Parkway and East Canyon Place and conveyed to the on-grade inlet at DP 276B. For the major and minor storm event the runoff from Basin 226B will be partially captured in the on-grade inlet at DP 276B and conveyed via storm sewer to DP 275A. The partial capture rate for this on-grade inlet during the 100-year storm event is assumed to be equivalent to the calculated 2-year partial capture rate. Bypass runoff will be conveyed to DP 275A via the curb and gutter along South Blackstone Parkway.

3. Storm Sewer Systems 'H'

Storm sewer system 'H' is located within East Nova Circle, South Titus Court and Golf Course Holes 2 & 8. Storm sewer system 'H' conveys runoff from Basin 215, storm sewer system 'I', Basins 216B, 216C, 216D and, during the 100-year storm event only, from existing Basin 216A, to Pond 8A. Runoff from Basins 216A through 216D will be conveyed in the east

EXCERPT FROM: **High Plains Country Club - Filing No. 2**

V:\52870\active\00001\870\Filing 2\dmg\final\rational_calcs_final_f2_2nd.xls]Composite I

Stantec

Job No. 187003319
Date 4/26/2005
Calculated TJS

		Parcel Imperviousness																
Basin	Area (acres)	School/Rec Center/Club House 50	Street, Paved 100	Open Sp. 2-7% slope 5	Road ROW Open Space 5	Parcel A 75	Parcel B 49	Parcel C 44	Parcel G 44	Parcel I 49	Parcel J 44	Parcel K 49	Parcel L 49	Parcel M 44	Parcel N 44	Parcel O 44	Parcel P 44	Composite Imperviousness
223C	5.85	0.00	0.13	0.01	0.23	0.00	0.00	1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.47	43.7
224C ☼	13.48	0.00	0.00	11.06	0.00	0.65	1.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.1
225A	8.04	0.13	0.18	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.57	0.00	0.00	0.00	44.5
225B	5.11	0.00	0.32	0.04	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.00	3.81	0.00	0.00	0.00	43.7
226A	9.28	8.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.68	0.00	0.00	0.00	49.6
226B	9.30	0.98	1.00	1.40	2.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.87	0.00	0.00	0.00	36.2
313A ☼	0.76	0.00	0.38	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	52.2
313B	2.42	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.42	0.00	44.1
313C	4.27	0.00	0.29	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.48	0.00	43.3
313D	5.28	0.00	0.57	0.12	1.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.46	0.00	40.8

☼ - Basin lies within existing Filing No. 1 and is shown here for information only.

EXCERPT FROM:

HIGH PLAINS COUNTRY CLUB DEVELOPMENT PARCEL DATA

SUBDIVISION: High Plains Country Club
CALCULATED BY: TJS
JOB NO: 187003319
DATE: 4/26/2005

COMPOSITE "C" CALCULATION

		2 Year Calculation																
		Area Type																
Basin	Area (acres)	School/Rec Center/Club House 0.45	Street, Paved 0.87	Open Sp. 2-7% slope 0.18	Road ROW Open Space 0.25	Parcel A 0.60	Parcel B 0.40	Parcel C 0.40	Parcel G 0.40	Parcel I 0.40	Parcel J 0.40	Parcel K 0.40	Parcel L 0.40	Parcel M 0.40	Parcel N 0.40	Parcel O 0.40	Parcel P 0.40	C2
225A	8.04	0.13	0.18	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.57	0.00	0.00	0.00	0.41
225B	5.11	0.00	0.32	0.04	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.00	3.81	0.00	0.00	0.00	0.41
226A	9.28	8.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.68	0.00	0.00	0.00	0.45
226B	9.30	0.98	1.00	1.40	2.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.87	0.00	0.00	0.00	0.39
313A ☼	0.76	0.00	0.38	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.56
313B	2.42	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.42	0.00	0.40
313C	4.27	0.00	0.29	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.48	0.00	0.41
313D	5.28	0.00	0.57	0.12	1.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.46	0.00	0.41

☼ - Basin lies within existing Filing No. 1 and is shown here for information only.

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EXCERPT FROM:

HIGH PLAINS COUNTRY CLUB DEVELOPMENT PARCEL DATA

SUBDIVISION High Plains Country Club
CALCULATED BY TJS
JOB NO 187003319
DATE 4/26/2005

COMPOSITE "C" CALCULATION

		5 Year Calculation																
		Area Type																
Basin	Area (acres)	School/Rec Center/Club House 0.50	Street, Paved 0.88	Open Sp. 2-7% slope 0.19	Road ROW Open Space 0.27	Parcel A 0.65	Parcel B 0.45	Parcel C 0.45	Parcel G 0.45	Parcel I 0.45	Parcel J 0.45	Parcel K 0.45	Parcel L 0.45	Parcel M 0.45	Parcel N 0.45	Parcel O 0.45	Parcel P 0.45	C5
225A	8.04	0.13	0.18	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.57	0.00	0.00	0.00	0.46
225B	5.11	0.00	0.32	0.04	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.00	3.81	0.00	0.00	0.00	0.46
226A	9.28	8.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.68	0.00	0.00	0.00	0.50
226B	9.30	0.98	1.00	1.40	2.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.87	0.00	0.00	0.00	0.42
313A ☼	0.76	0.00	0.38	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57
313B	2.42	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.42	0.00	0.45
313C	4.27	0.00	0.29	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.48	0.00	0.46
313D	5.28	0.00	0.57	0.12	1.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.46	0.00	0.45

☼ - Basin lies within existing Filing No. 1 and is shown here for information only.

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EXCERPT FROM:

STANDARD FORM SF-2
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

V:\52870\active\00001\870\Filing 2\dmg\final\[rational_calcs_final_f2_2nd.xls]R2

DESIGN STORM: 2 -YEAR

CALCULATED BY: TJS
CHECKED BY: PJS

PROJECT: High Plains Country Club - Filing No. 2
SUBDIVISION: Parcels J through P

JOB NO: 187003319
LOCATION: Major Basin A

LOCATION	DESIGN POINT	AREA DESIG.	DIRECT RUNOFF AREA (Acres)	DIRECT RUNOFF RUNOFF COEFF	DIRECT RUNOFF Tc (min)	DIRECT RUNOFF C A (Acres)	DIRECT RUNOFF I (in/hour)	DIRECT RUNOFF Q (cfs)	TOTAL RUNOFF Tc (min)	TOTAL RUNOFF (C A) (Acres)	TOTAL RUNOFF I (in/hour)	TOTAL RUNOFF Q (cfs)	STREET SLOPE (%)	STREET STREET FLOW (cfs)	PIPE DESIGN FLOW (cfs)	PIPE SLOPE (%)	PIPE PIPE SIZE	TRAVEL TIME LENGTH (ft)	TRAVEL TIME VELOCITY (fps)	TRAVEL TIME Tt (min)	REMARKS
Storm Sewer System 'B'																					
224C ◇	274C		13.48	0.23	17.6	3.09	2.07	6.4							6.4	1.9	24	2066	6.6	5.2	Pipe flow to J29
223B	273B		7.42	0.41	12.5	3.05	2.54	7.8							7.8	2.6	24	17	7.7	0.0	Pipe flow to J29
	J29	223B, 224C	20.89	0.29					23.0	6.14	1.79	11.0			11.0	2.1	30	17	8.7	0.0	Pipe flow to DP 273C
223A ◇	273A		2.06 +	0.43 +	11.1 +	0.88	2.72	2.4					2.9	2.4				1300	3.4	6.4	Gutter flow to DP 273C
223C	273C		5.85	0.40	12.5	2.37	2.55	6.0													Gutter flow to DP 273C
	273C	223A, 223C	7.91	0.41					17.5	3.24	2.10	6.8									Total Gutter flow at DP 273C
	273C	223A - 223C, 224C	28.80	0.33					23.1	9.38	1.79	16.8			16.8	9.5	30	219	19.7	0.2	Pipe flow to Pond A
Storm Sewer System 'E'																					
226A	276A		9.28	0.45	11.4	4.14	2.68	11.1							11.1	1.5	30	42	7.3	0.1	Pipe flow to DP 275A
226B	276B		9.30	0.39	20.6	3.62	1.90	6.9							6.9	4.3	18	28	7.7	0.1	Pipe flow to DP 275A
225A	275A		8.04	0.41	13.9	3.28	2.40	1.9 * 7.9													Gutter flow to DP 275A
	275A	225A, 226A, 226B	26.63	0.41					20.7	11.05	1.90	20.9			20.9	1.8	36	37	9.1	0.1	Pipe flow to DP 275B
225B	275B		5.11	0.41	19.4	2.11	1.97	5.9 ** 4.2													Gutter flow to DP 275B
	275B	225A, 225B, 226A, 226B	31.74	0.41					20.7	13.16	1.89	1.9 * 24.9			26.8	1.7	36	282	9.2	0.5	Pipe flow to DP J27
222A	272A		0.85	0.50	6.6	0.33	3.49	1.1							1.1	1.0	30	76	5.9	0.2	Pipe flow to DP J27
	J27	222A, 225A, 225B, 226A, 226B	32.39	0.42					21.2	13.49	1.87	25.2			25.2	1.9	36	12	9.9	0.0	Pipe flow to DP 272B
222B	272B		1.52	0.48	8.2	0.72	3.17	6.1 *** 2.3							8.4						Gutter flow to DP 272B
	272B	222A, 222B, 225A 225B, 226A, 226B	33.92	0.42					21.3	14.21	1.87	26.5			26.5	6.4	36	70	19.1	0.1	Pipe flow to Pond A
Storm Sewer System 'H'																					
	265	208, 209, 212, 213A-E, 218 214A, 214B, 215	76.27 ◊	0.31 ◊					22.2 ◊	24.30	1.82	44.4			44.4	1.5	30	343	7.3	0.8	Pipe flow to DP J25 from Pond 2
216B	266B		4.23	0.42	10.5	1.76	2.80	4.9							4.9	3.5	24	37	9.2	0.1	Pipe flow to DP J26
216C	266C		2.27	0.41	14.5	0.93	2.35	2.2							2.2	6.7	18	34	9.8	0.1	Pipe flow to DP J26
	J26	216B, 216C	6.50	0.41					14.5	2.69	2.34	6.3			6.3	2.5	24	396	7.6	0.9	Pipe flow to DP 266D
216D	266D		2.06	0.40	9.1	0.83	3.01	2.5													Gutter flow to DP 266D
	266D	216B, 216C, 216D	8.56	0.41					15.4	3.52	2.27	8.0			8.0	7.3	30	305	17.1	0.3	Pipe flow to DP J25
	J25	208, 209, 212, 213A-E, 216B-D 214A, 214B, 215, 218	86.84	0.32					23.0	27.63	1.79	49.8			49.8	2.2	36	382	10.6	0.6	Pipe flow to Pond 8A, DP 270

EXCERPT FROM:

HIGH PLAINS COUNTRY CLUB DEVELOPMENT PARCEL DATA

SUBDIVISION: High Plains Country Club
CALCULATED BY: TJS
JOB NO: 187003319
DATE: 4/26/2005

COMPOSITE "C" CALCULATION

		100 Year Calculation																
		Area Type																
Basin	Area (acres)	School/Rec Center/Club House 0.70	Street, Paved 0.93	Open Sp. 2-7% slope 0.22	Road ROW Open Space 0.35	Parcel A 0.80	Parcel B 0.60	Parcel C 0.60	Parcel G 0.60	Parcel I 0.60	Parcel J 0.60	Parcel K 0.60	Parcel L 0.60	Parcel M 0.60	Parcel N 0.60	Parcel O 0.60	Parcel P 0.60	C100
225A	8.04	0.13	0.18	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.57	0.00	0.00	0.00	0.60
225B	5.11	0.00	0.32	0.04	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.00	3.81	0.00	0.00	0.00	0.59
226A	9.28	8.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.68	0.00	0.00	0.00	0.69
226B	9.30	0.98	1.00	1.40	2.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.87	0.00	0.00	0.00	0.53
313A ☼	0.76	0.00	0.38	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.64
313B	2.42	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.42	0.00	0.60
313C	4.27	0.00	0.29	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.48	0.00	0.59
313D	5.28	0.00	0.57	0.12	1.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.46	0.00	0.57

☼ - Basin lies within existing Filing No. 1 and is shown here for information only.

V:\52870\active\00001\870\Filing 2\dmg\final\[rational_calcs_final_f2_2nd.xls]Composite C

EXCERPT FROM:

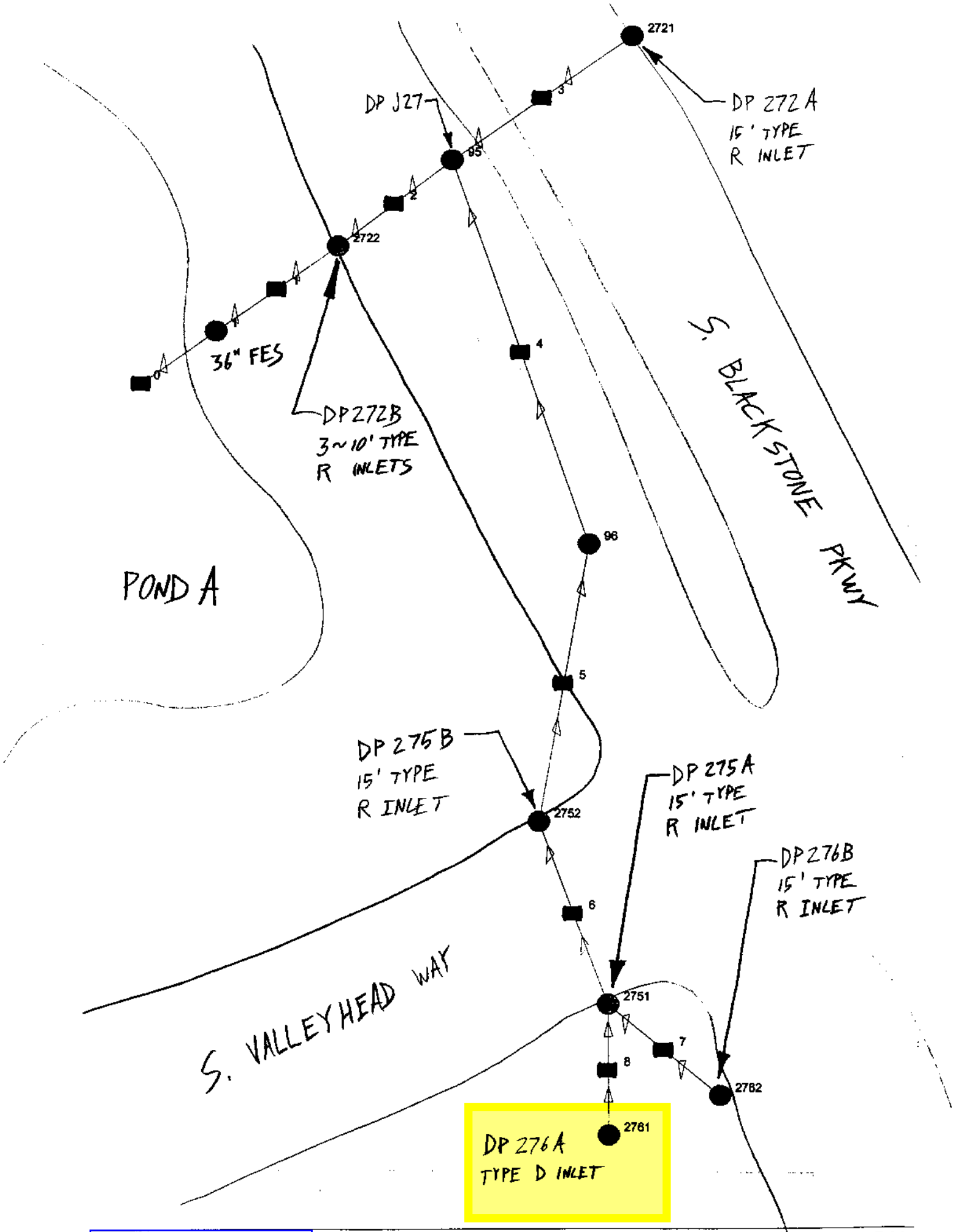
STANDARD FORM SF-2
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

V:\52870\active\00001\870\Filing 2\dmg\final\[rational_calcs_final_f2_2nd xls]R100

DESIGN STORM: 100 -YEAR

CALCULATED BY: *BMM & TJS*
CHECKED BY: *PJS*
PROJECT: High Plains Country Club - Filing No. 2
SUBDIVISION: Parcels J through P
JOB NO: 187003319
LOCATION: Major Basin A

		DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			
LOCATION	DESIGN POINT	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	LENGTH (ft)	VELOCITY (fps)	Tt (min)	REMARKS
Storm Sewer System 'B'																					
224C ♀	274C		13.48	0.30	17.8	4.01	5.72	22.9													
															22.9	1.9	24	2066	6.6	5.2	Pipe flow to J29
223B	273B		7.42	0.59	12.5	4.38	7.04	30.9													
															30.9	2.6	24	17	7.7	0.0	Pipe flow to J29
	J29	223B, 224C	20.89	0.40					23.0	8.39	4.89	41.0									
															41.0	2.1	30	17	8.7	0.0	Pipe flow to DP 273C
223A ♀	273A		2.06 +	0.55 +	11.1 +	1.14	7.53	8.6													
													2.8	8.6				1300	3.4	6.5	Gutter flow to DP 273C
223C	273C		5.85	0.60	12.5	3.49	7.06	24.7													
																					Gutter flow to DP 273C
	273C	223A, 223C	7.91	0.59					17.6	4.63	5.78	26.7									Total Gutter flow at DP 273C
	273C	223A - 223C, 224C	28.80	0.45					23.1	13.02	4.89	63.6			63.6	9.5	30	219	19.7	0.2	Pipe flow to Pond A
Storm Sewer System 'E'																					
226A	276A		9.28	0.69	11.4	6.43	7.41	47.7													
															47.7	1.5	30	42	7.3	0.1	Pipe flow to DP 275A
226B	276B		9.30	0.53	20.6	4.96	5.19	25.8													
															5.0	4.3	18	26	7.7	0.1	Pipe flow to DP 275A
225A	275A		8.04	0.60	13.9	4.85	6.84	32.3					1.3	20.6				31	2.3	0.2	Bypass gutter flow to DP 275A
																					Gutter flow to DP 275A
			Σ 26.63	Σ 0.61					20.8	16.25	5.16	Σ 83.6									
			▼ 15.54	▼ 0.57					20.8	8.86	5.16	45.7									
	275A	225A, 226A, 226B	▼ 12.05	▼ 0.66					20.7	7.96	5.18	41.3	0.0	45.7				34	0.2	2.8	Bypass gutter flow to DP 275B
															41.3	1.6	36	37	9.1	0.1	Pipe flow to DP 275B
225B	275B		5.11	0.69	19.4	3.03	5.43	16.5													
																					Gutter flow to DP 275B
			Σ 31.74	Σ 0.61					23.7	19.28	4.82	Σ 92.9									
			▼ 20.85	▼ 0.58					23.7	11.89	4.82	57.2									
	275B	225A, 225B, 226A, 226B	▼ 13.27	▼ 0.66					20.7	8.69	5.17	45.0	1.5	57.2				287	2.4	2.0	Bypass gutter flow to DP 272B
															45.0	1.7	36	282	9.2	0.5	Pipe flow to DP J27
			13.37 ∞	0.56 ∞	30.6 ∞	7.52 ∞	4.16 ∞	31.3 ∞													
222A	272A		0.65	0.59	6.6	0.38	9.72	3.7													
															31.3	1.0	30	76	5.9	0.2	Pipe flow to DP J27
	J27	222A, 225A, 225B, 226A, 226B	26.63	0.61					30.8	16.21	4.14	67.2									
															67.2	1.9	36	12	9.9	0.0	Pipe flow to DP 272B
222B	272B		1.52	0.56	8.2	0.86	8.80	7.6													
																					Gutter flow to Dp 272B
			▼ 23.42 ∞	▼ 0.58 ∞	31.0 ∞	13.58 ∞	4.13 ∞	56.1 ∞													
	272B	222B, 225A, 225B, 226B	22.18	0.57					25.6	12.74	4.61	58.7									Total gutter flow at DP 272B
		222A, 222B, 225A																			
	272B	225B, 226A, 226B	48.81	0.59					30.8	28.96	4.14	119.9									
															119.9	6.4	36	70	19.1	0.1	Pipe flow to Pond A


2721
DP J27
95
DP 272A
15' TYPE
R INLET
3
2
2722
36" FES
0
1
DP 272B
3~10' TYPE
R INLETS
4
S. BLACKSTONE PKWY
96
POND A
5
DP 275B
15' TYPE
R INLET
2752
DP 275A
15' TYPE
R INLET
DP 276B
15' TYPE
R INLET
6
S. VALLEYHEAD WAY
2751
7
8
2782
2761
DP 276A
TYPE D INLET

NeoUDS Results Summary

EXCERPT FROM:

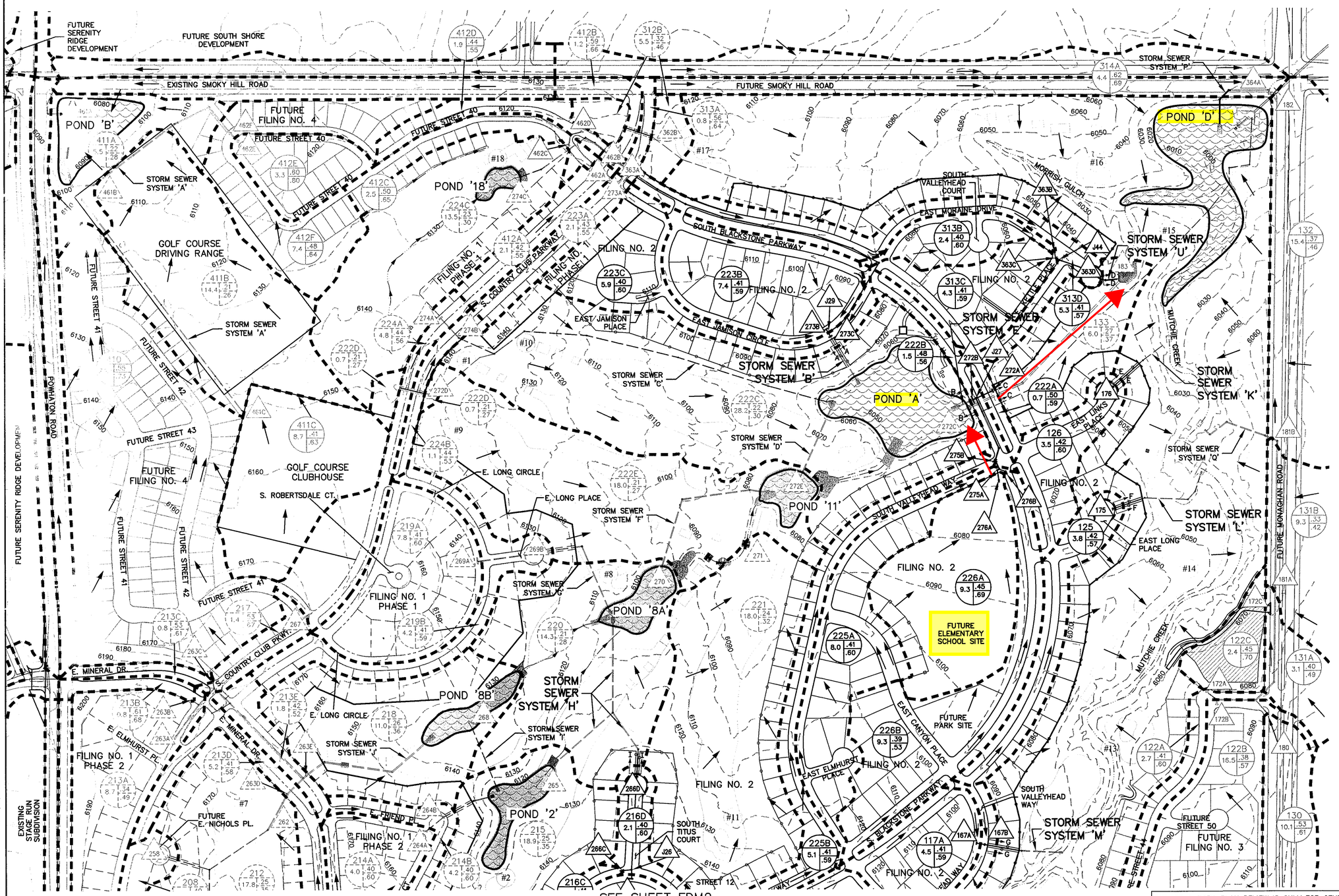
Project Title: High Plains Country Club - Filing No. 2
Project Description: Storm Sewer System 'E'
Output Created On: 4/27/2005 at 9:36:22 PM
Using NeoUDSewer Version 1.5.
Rainfall Intensity Formula **Used.**
Return Period of Flood is 100 **Years.**

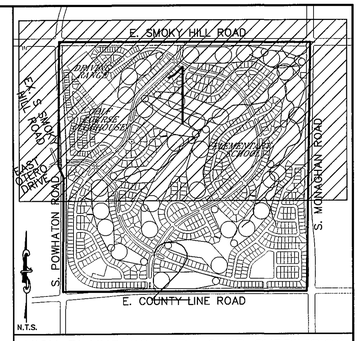
Sub Basin Information

		Time of Concentration				
Manhole ID #	**Basin Area * C**	**Overland (Minutes)**	**Gutter (Minutes)**	**Basin (Minutes)**	**Rain I (Inch/Hour)**	**Peak Flow (CFS)**
1	28.80	29.9	0.0	0.0	4.16	119.9
95	16.24	30.3	0.0	0.0	4.14	67.2
2721	7.49	29.7	0.0	0.0	4.18	31.3
96	8.76	20.6	0.0	0.0	5.14	45.0
2752	8.76	676.2	0.0	0.0	0.45	3.9
2751	7.95	596.9	0.0	0.0	0.49	3.9
2762	0.70	10.2	0.0	0.0	7.12	5.0
2761	6.40	9.0	0.0	0.0	7.45	47.7
2722	28.80	89.1	0.0	0.0	2.04	58.7

The shortest design rainfall duration is 5 minutes.
For rural areas, the catchment time of concentration is always => 10 minutes.
For urban areas, the catchment time of concentration is always => 5 minutes.
At the first design point, the time constant is <= (10+Total Length/180) in minutes.
When the weighted runoff coefficient => 0.2, then the basin is considered to be urbanized.
When the Overland Tc plus the Gutter Tc does not equal the catchment Tc, the above criteria supersedes the calculated values.

205056 78





HIGH PLAINS COUNTRY CLUB SUBDIVISION
KEY MAP

200 0 200 400
(IN FEET)
1 inch = 200 ft.

BENCHMARK:
CITY OF AURORA BENCHMARK SH–107.5:
3" DIA. BRASS CAP ATOP A 30" LONG STEEL PIPE IN CONCRETE 1 FT. SWLY OF NELY R.O.W. FE. FOR SMOKY HILL ROAD & 3.9. FT. NWLY OF A FE. CORNER, AND ALSO 185 FT. NWLY FROM N. JAMISON CIRCLE CENTERLINE GOING W. OF SMOKY HILL ROAD
CITY OF AURORA ELEVATION = 6156.367 FT.

LEGEND

EXISTING BASIN
DESIGN POINT — 210A
MINOR BASIN BASIN I.D. — 30B
DRAINAGE AREA (ACRES) — 4.7
RUNOFF COEFFICIENTS — MINOR STORM .65 — MAJOR STORM .80

PROPOSED BASIN
DESIGN POINT — 210A
MINOR BASIN BASIN I.D. — 30B
DRAINAGE AREA (ACRES) — 4.7
RUNOFF COEFFICIENTS — MINOR STORM .65 — MAJOR STORM .80

FUTURE BASIN
DESIGN POINT — 210A
MINOR BASIN BASIN I.D. — 30B
DRAINAGE AREA (ACRES) — 4.7
RUNOFF COEFFICIENTS — MINOR STORM .65 — MAJOR STORM .80

GOLF COURSE HOLE NUMBER — #10

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 CORRELATED AT THE JOBSITE. THE CITY OF AURORA THROUGH THE APPROVAL OF THIS DOCUMENT ASSUMES NO OTHER RESPONSIBILITY OTHER THAN AS STATED ABOVE FOR COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.

5-25-05

CITY ENGINEER — DATE 5-18-05

UTILITIES DEPARTMENT — DATE 5-19-05

No.	Description	Date	By
3	PER COA & IN-HOUSE COMMENTS	4/25/05	TJS
2	PER COA & IN-HOUSE COMMENTS	3/16/05	SBM
1	PER COA & IN-HOUSE COMMENTS	2/2/05	TJS

Revisions

Designed By: TJS
Cad Opr.: SBM
Checked By: PJS
Scale: 1" = 200'

Stantec

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Denver, CO
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Fax. 303.758.4828
www.stantec.com
CONTACT: Paul Sobania

COLORADO REGISTERED PAUL JOSEPH SOBANIA PROFESSIONAL ENGINEER 33922 4/25/05

DEVELOPER

LENNAR COLORADO, LLC
David Snow
9990 Park Meadows Drive
Lonetree, Colorado 80124

Phone: (303) 754–0600

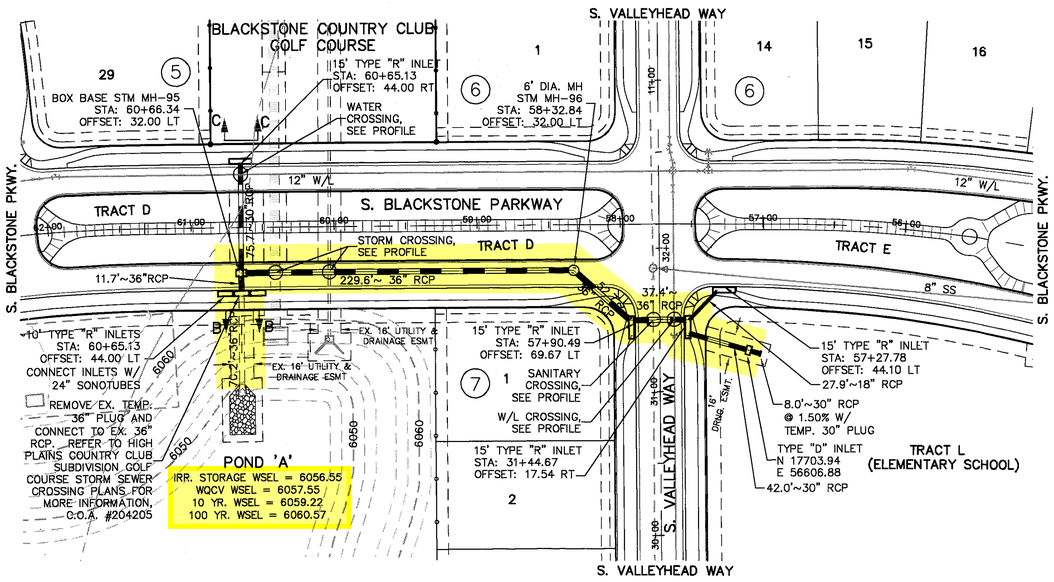
HIGH PLAINS COUNTRY CLUB SUBDIVISION - FILING NO. 2

OVERALL FINAL DRAINAGE MAP

Project No. 187003319
Date 1/12/05
Sheet 78 / FDM1

V:\52870\active\60001819\Fling 2\engineer\03219c-101fr.dwg, FDM1, 4/26/2005 9:47:10 AM, azlatkin, OCE-Mylar.pc3, 1:1

205056 50



NOTES:

ALL STORM SEWER PIPE SHALL BE BEDDED WITH CLASS B ALTERNATE BEDDING PER CITY OF AURORA STANDARD DETAIL #101. ALL STORM SEWER MANHOLES SHALL BE 5 FT. DIAMETER (TYPICAL) UNLESS LABELED OTHERWISE.

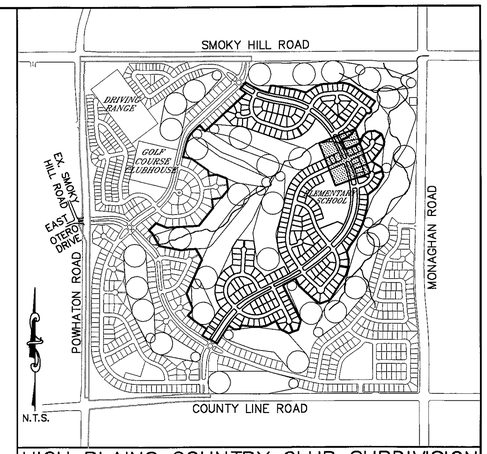
ALL STORM SEWER PIPES ARE PUBLIC UNLESS OTHERWISE NOTED.

CONTRACTOR TO MAINTAIN A MINIMUM OF 0.5% GRADE AT STREET FLOWLINE INTO INLET.

FLOWLINE ELEVATION FOR INLETS ARE BASED ON STREET FLOWLINE PROFILE. CONTRACTOR SHALL ADJUST THROAT FLOWLINE BASED ON C.O.A. DETAIL #S12.7 ON ALL STORM SEWER.

CONTRACTOR SHALL RE-ESTABLISH EROSION CONTROL FEATURES FROM SWALE AT STORM SEWER OUTFALL AND EMERGENCY OVERFLOW LOCATIONS TO EXISTING EROSION CONTROL FEATURES DOWNSTREAM.

SEE SHEET STM8 FOR SPILLWAY SECTIONS DETAIL



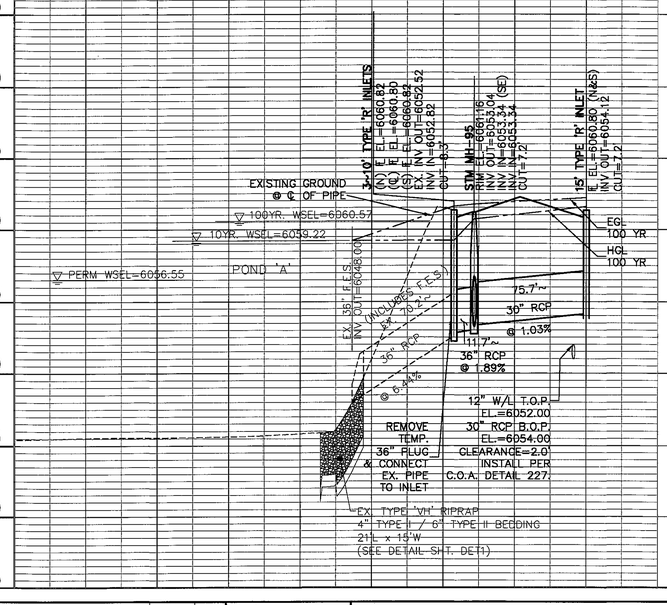
HIGH PLAINS COUNTRY CLUB SUBDIVISION FILING NO. 2
KEY MAP

BENCHMARK:
CITY OF AURORA BENCHMARK SH-107.5:
3" DIA. BRASS CAP ATOP A 30" LONG STEEL PIPE IN CONCRETE 1 FT. SWLY OF NELY R.O.W. FE. FOR SMOKY HILL ROAD & 3.9. FT. NWLY OF A FE. CORNER, AND ALSO 185 FT. NWLY FROM N. JAMISON CIRCLE CENTERLINE GOING W. OF SMOKY HILL ROAD
CITY OF AURORA ELEVATION = 6156.367 FT.

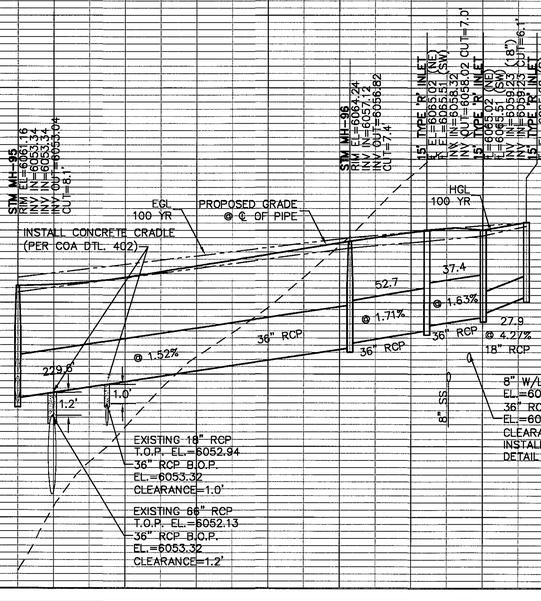
50 0 50 100
(IN FEET)
1 inch = 50 ft.

CALL UNCC
TWO WORKING DAYS
BEFORE YOU DIG
1-800-922-1987
METRO DENVER AREA
UTILITY NOTIFICATION CENTER OF COLORADO

STORM SEWER SYSTEM 'E'

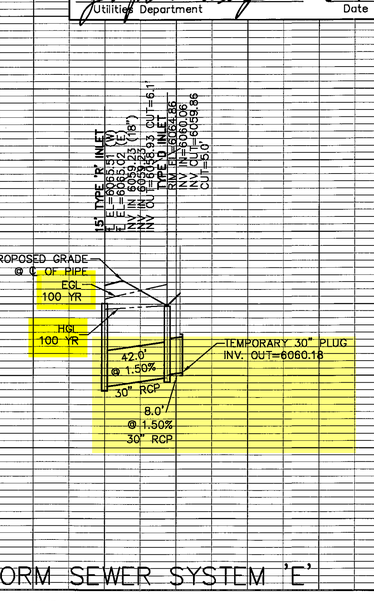


STORM SEWER SYSTEM 'E'



Approved One Year From This Date
5-25-05

City Engineer — Date 5-12-05
Utilities Department — Date 5-19-05



STORM SEWER SYSTEM 'E'

No.	Description	Date	By
2	PER C.O.A. AND IN-HOUSE COMMENTS	3-16-05	PAR
1	PER C.O.A. AND IN-HOUSE COMMENTS	2-2-05	TJS

Revisions

Designed By TJS
Cad Opr. PAR
Checked By PJS
Scale 1"=50' HORZ 1"=5' VERT.

Stantec
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www.stantec.com
CONTACT: Sue Sibel

COLORADO REGISTERED ISAAC B. SIBEL 29615 PROFESSIONAL ENGINEER 5-11-05

DEVELOPER
LENNAR COLORADO, LLC
David Snow
9990 Park Meadows Drive
Lonetree, Colorado 80124
Phone: (303) 754-0600

HIGH PLAINS COUNTRY CLUB SUBDIVISION - FILING NO. 2

S. BLACKSTONE PARKWAY
STORM SEWER PLAN & PROFILE

Project No. 187003319
Date 1/12/05
Sheet 50 / STM3

20.5056

83

EXISTING GOLF COURSE DRAINAGE SYSTEM (TYP.)

STORM SEWER SYSTEM 'D'

EX. 36" STM (Q2)

EX. GOLF COURSE GRASSING BOUNDARY (TYP.)

EX. TYPE M RIPRAP RUNDOWN

EXISTING PLANTED TYPE 'M' RIPRAP

EX. GOLF COURSE GREEN (TYP.)

EXISTING GOLF COURSE CHANNEL

EXISTING GROUTED TYPE 'M' RIPRAP

EX. 2 – TYPE 'D' INLETS

EXISTING 35' DRAINAGE EASEMENT

EXISTING RIPRAP OUTLET PROTECTION

EX. 36" FES

EX. 36" STM (Q2)

EX. CONCRETE HEADWALL & 8" PVC (PRIVATE)

POND 11 PERMANENT WSEL=6074.00

EX. 8" STM (PRIVATE)

EXISTING OVERFLOW SPILLWAY

EXISTING STILLING BASIN PERM. WSEL=6068.30

EXISTING TYPE 'M' RIPRAP RUNDOWN

EXISTING GOLF CART PATH

EXISTING RIPRAP OUTLET PROTECTION

EX. 36" FES

3–10' TYPE R INLETS

36" STM (Q100)

10' UTILITY EASEMENT

OVERFLOW SPILLWAY

SEE SHEET FDM5

(IN FEET) 1 inch = 50 ft.

EAST LINKS PLACE

TRACT D

15' TYPE R INLET

36" STM (Q100)

18" STM (Q2)

15' TYPE R INLET

SOUTH VALLEYHEAD WAY

30" STM (Q100)

TYPE D INLET

36" STM (Q100)

TRACT E

SOUTH BLACKSTONE PARKWAY

TRACT L

10' UTILITY EASEMENT

EAST LONG PLACE

FUTURE ELEMENTARY SCHOOL SITE

TEMPORARY SWALE

TRACT K

EXISTING GOLF CART PATH

FILING NO. 2

SOUTH VALLEYHEAD WAY

EAST CANYON PLACE

TRACT F

TEMPORARY SWALE

10' UTILITY EASEMENT

FILING NO. 2

SEE SHEET FDM7

4' UTILITY EASEMENT
6' GAS EASEMENT

8' UTILITY EASEMENT

222A 0.7 .50 .59

222B 4.5 .48 .56

222C 28.2 .22 .30

222E 18.0 .21 .27

272E

225B 5.1 .41 .59

275B

275A

276B

276A

225A 8.0 .41 .60

226A 9.3 .45 .69

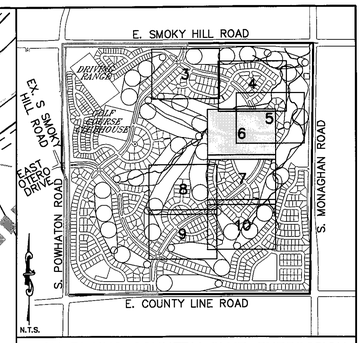
126 3.5 .42 .60

125 3.8 .42 .57

221 18.0 .24 .32

271

272C



HIGH PLAINS COUNTRY CLUB SUBDIVISION

KEY MAP

NOTE: ALL PROPOSED STORM SEWER IS PUBLIC & SIZED FOR THE 100 YEAR EVENT UNLESS NOTED OTHERWISE.

BENCHMARK:
CITY OF AURORA BENCHMARK SH–107.5:
3" DIA. BRASS CAP ATOP A 30" LONG STEEL PIPE IN CONCRETE 1 FT. SWLY OF NELY R.O.W. FE. FOR SMOKY HILL ROAD & 3.9. FT. NWLY OF A FE. CORNER, AND ALSO 185 FT. NWLY FROM N. JAMISON CIRCLE CENTERLINE GOING W. OF SMOKY HILL ROAD
CITY OF AURORA ELEVATION = 6156.367 FT.

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LEGEND

EXISTING BASIN

DESIGN POINT — 210A

MINOR BASIN BASIN I.D. — 30B

DRAINAGE AREA (ACRES) — 4.7

RUNOFF COEFFICIENTS — .65 MINOR STORM, .80 MAJOR STORM

PROPOSED BASIN

DESIGN POINT — 210A

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RUNOFF COEFFICIENTS — .65 MINOR STORM, .80 MAJOR STORM

FUTURE BASIN

DESIGN POINT — 210A

MINOR BASIN BASIN I.D. — 30B

DRAINAGE AREA (ACRES) — 4.7

RUNOFF COEFFICIENTS — .65 MINOR STORM, .80 MAJOR STORM

PROJECT BOUNDARY

MINOR BASIN BOUNDARY

EXISTING GRADE CONTOUR — 6210 / 6208

PROPOSED DRAINAGEWAY/SWALE

PUBLIC DRAINAGE EASEMENT

PROPOSED STORM SEWER W/ INLET

FUTURE STORM SEWER (TYP)

GOLF COURSE HOLE NUMBER — #10

FLOW ARROW

OVERFLOW PATH

APPROVED FOR ONE YEAR FROM THIS DATE

5-25-05

CITY ENGINEER — DATE 5-12-05

UTILITIES DEPARTMENT — DATE 5-19-05

No.	Description	Date	By
3	PER COA & IN–HOUSE COMMENTS	4/25/05	TJS
2	PER COA & IN–HOUSE COMMENTS	3/16/05	SBM
1	PER COA & IN–HOUSE COMMENTS	2/2/05	TJS

Revisions

Designed By: TJS
Cad Opr.: SBM
Checked By: PJS
Scale: 1" = 50'

Stantec

Stantec Consulting Inc.
2135 South Cherry St. Ste 310
Denver, CO
80222
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Fax. 303.758.4828
www.stantec.com
CONTACT: Paul Sobania

COLORADO REGISTERED — MICHAEL B. UNGER — 36685 — PROFESSIONAL ENGINEER — 5–11–05

DEVELOPER

LENNAR COLORADO, LLC
David Snow
9990 Park Meadows Drive
Lonetree, Colorado 80124

Phone: (303) 754–0600

HIGH PLAINS COUNTRY CLUB SUBDIVISION - FILING NO. 2

FINAL DRAINAGE MAP

Project No. 187003319 C–102DR
Date 1/12/05
Sheet 83 / FDM6

83

20.5056

205056 84

SEE SHEET FDM6

SEE SHEET FDM8

SEE SHEET FDM10

(IN FEET)
1 inch = 50 ft.

EAST CANYON PLACE

SOUTH VALLEYHEAD WAY

SOUTH BLACKSTONE PARKWAY

EAST ELMHURST PLACE

TRACT K

TRACT L

TRACT R

TRACT F

TRACT G

TRACT H

TRACT O

TEMPORARY SWALE

FUTURE PARK SITE

FILING NO. 2

EXISTING GOLF CART PATH

EXISTING GOLF COURSE DRAINAGE SYSTEM (TYP.)

STORM SEWER SYSTEM 'M'

MUTCHIE CREEK

EXISTING LOW TAIL WATER BASIN

EXIST. LOW WATER CROSSING LWC-8
REFER TO MUTCHIE CREEK STREAM AND BANK STABILIZATION CONSTRUCTION PLANS (C.O.A. #204256)

EMERGENCY OVERFLOW SWALE

8' UTILITY EASEMENT

4' UTILITY EASEMENT
6' GAS EASEMENT

10' UTILITY EASEMENT

16' UTILITY EASEMENT

16' DRAINAGE AND UTILITY EASEMENT

8' TYPE R INLET

10' TYPE R INLET

24" STM (Q100)

EX. 24" STM (Q100)

EX. 24" FES

225A 8.0 .41 .60

225B 5.1 .41 .59

226A 9.3 .45 .69

226B 9.3 .39 .53

125 3.8 .42 .57

221 18.0 .24 .32

167A

167B

117A 4.5 .41 .59

117B 3.5 .42 .60

E. SMOKY HILL ROAD
EX. S. SMOKY HILL ROAD
EAST OTERO DRIVE
S. POWHATON ROAD
S. MONAGHAN ROAD
E. COUNTY LINE ROAD
N.T.S.

14

HIGH PLAINS COUNTRY CLUB SUBDIVISION
KEY MAP

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FUTURE BASIN

DESIGN POINT — 210A
MINOR BASIN I.D. — 30B
DRAINAGE AREA (ACRES) — 4.7
RUNOFF COEFFICIENTS — MINOR STORM .65 / MAJOR STORM .80

PROJECT BOUNDARY
MINOR BASIN BOUNDARY
EXISTING GRADE CONTOUR — 6210 / 6208
PROPOSED DRAINAGEWAY/SWALE
PUBLIC DRAINAGE EASEMENT
PROPOSED STORM SEWER W/ INLET
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HIGH PLAINS COUNTRY CLUB SUBDIVISION - FILING NO. 2

FINAL DRAINAGE MAP

Project No. 187003319 C-102DR
Date 1/12/05
Sheet 84 / FDM7

DRAINAGE MAP LEGEND

- EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR
- PROPOSED INDEX CONTOUR
- PROPOSED INTERMEDIATE CONTOUR
- EXISTING SPOT ELEVATION
- PROPOSED SPOT ELEVATION
- HISTORIC DRAINAGE BASIN BOUNDARY (MAJOR BASIN)
- HISTORIC DRAINAGE BASIN BOUNDARY (SUB BASIN)
- DEVELOPED DRAINAGE BASIN BOUNDARY (MAJOR BASIN)
- DEVELOPED DRAINAGE BASIN BOUNDARY (SUB BASIN)
- DIRECTION OF FLOW (HISTORIC)
- DIRECTION OF FLOW (DEVELOPED)
- BASIN DESIGN POINT
- DRAINAGE BASIN IDENTIFICATION BUBBLE

A = DEVELOPED BASIN DESIGNATION
.50 = 100-YR RUNOFF COEFFICIENT
1.0 = AREA ACRES

REGIONAL DETENTION AND WATER QUALITY POND

CCSD ES #45
FFE VARIES (6086.00' = ARCH 100'-0")

FFE = 6087.50
FFE = 6087.00
FFE = 6084.50
FFE = 6083.00

E CANYON PLACE
S VALLEYHEAD WAY
S BLACKSTONE PKWY
E LONG PLACE

DEVELOPED DRAINAGE BASINS SUMMARY

BASIN	DP	AREA	C2	C100	Q2	Q100
A1	1	0.47	0.19	0.23	0.30	0.97
A2	2	0.19	0.52	0.70	0.27	0.99
A3	3	0.01	0.18	0.22	0.01	0.02
A4	4	0.11	0.87	0.90	0.33	0.92
A5	5	0.03	0.18	0.22	0.02	0.06
A6	6	0.54	0.60	0.73	0.86	2.84
A7	7	0.04	0.84	0.87	0.10	0.29
A8	8	0.62	0.51	0.55	0.88	2.58
A9	9	0.30	0.52	0.55	0.44	1.25
A10	10	0.27	0.79	0.83	0.71	2.01
A11	11	0.16	0.18	0.22	0.09	0.31
A12	12	0.32	0.80	0.85	0.84	2.41
B1	13	0.46	0.27	0.30	0.31	0.96
B2	14	0.20	0.33	0.36	0.16	0.48
B3	15	0.02	0.18	0.22	0.01	0.03
B4	16	0.08	0.18	0.22	0.05	0.16
B5	17	0.14	0.87	0.91	0.39	1.11
B6	18	0.80	0.80	0.85	1.98	5.67
B7	19	1.27	0.23	0.27	0.73	2.31
B8	20	0.63	0.24	0.28	0.38	1.19
B9	21	0.35	0.49	0.54	0.49	1.46
B10	22	0.06	0.43	0.47	0.09	0.27
B11	23	0.40	0.79	0.83	1.03	2.92
B12	24	0.04	0.18	0.22	0.02	0.07
B13	25	0.16	0.26	0.29	0.12	0.36
B14	26	0.21	0.20	0.24	0.14	0.45
R1	27	0.07	0.80	0.90	0.18	0.53
R2	28	0.07	0.80	0.90	0.18	0.54
R3	29	0.15	0.80	0.90	0.39	1.19
R4	30	0.12	0.80	0.90	0.32	0.97
R5	31	0.08	0.80	0.90	0.20	0.61
R6	32	0.15	0.80	0.90	0.40	1.23
R7	33	0.12	0.80	0.90	0.31	0.94
R8	34	0.27	0.80	0.90	0.71	2.15
R9	35	0.20	0.80	0.90	0.52	1.58
OUTFALL	36	0.45	0.22	0.26	0.29	0.93
OS	37	0.19	0.39	0.44	0.24	0.73

40 0 40 80
SCALE IN FEET

JVA, Inc. 1319 Spruce Street
Boulder, CO 80302 303.444.1951
www.jvajva.com
Boulder • Fort Collins • Winter Park
Glenwood Springs • Denver

NO	DATE	DES'D	DWN	REVISION DESCRIPTION

DESIGNED BY: QDH/JPW
DRAWN BY: QDH/JPW
CHECKED BY: CRH/HMM
JOB #: 3306c
DATE: 2020

CHERRY CREEK SCHOOL DISTRICT
CHERRY CREEK ELEMENTARY #45
S. BLACKSTONE PARKWAY, AURORA, CO

DEVELOPED DRAINAGE PLAN

SHEET NO.
FIG 1