



PRELIMINARY DRAINAGE STUDY

ANNADALE DEVELOPMENT 3816 ANNADAL LANE SACRAMENTO, CA

APN: 255-0032-005-0000

Hydraulic Zone 2
Watershed: Arcade Park
Planning Application #: PLNP2021-00290
Date: March 10, 2023
Level of Analysis: 3



PREPARED BY:

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1.0 INTRODUCTION

Annadale Development is located at 3816 Annadale lane, it will include construction of 9 duplexes with utilities, parking, and asphalt drive isles. The 0.95-acre project site is bounded by Apartment complexes to the East and North as well as across the street to the West. The south end of the project neighbor's single-family housing. Currently there is a single-family home on the southwest corner of the lot with a shed and driveway.

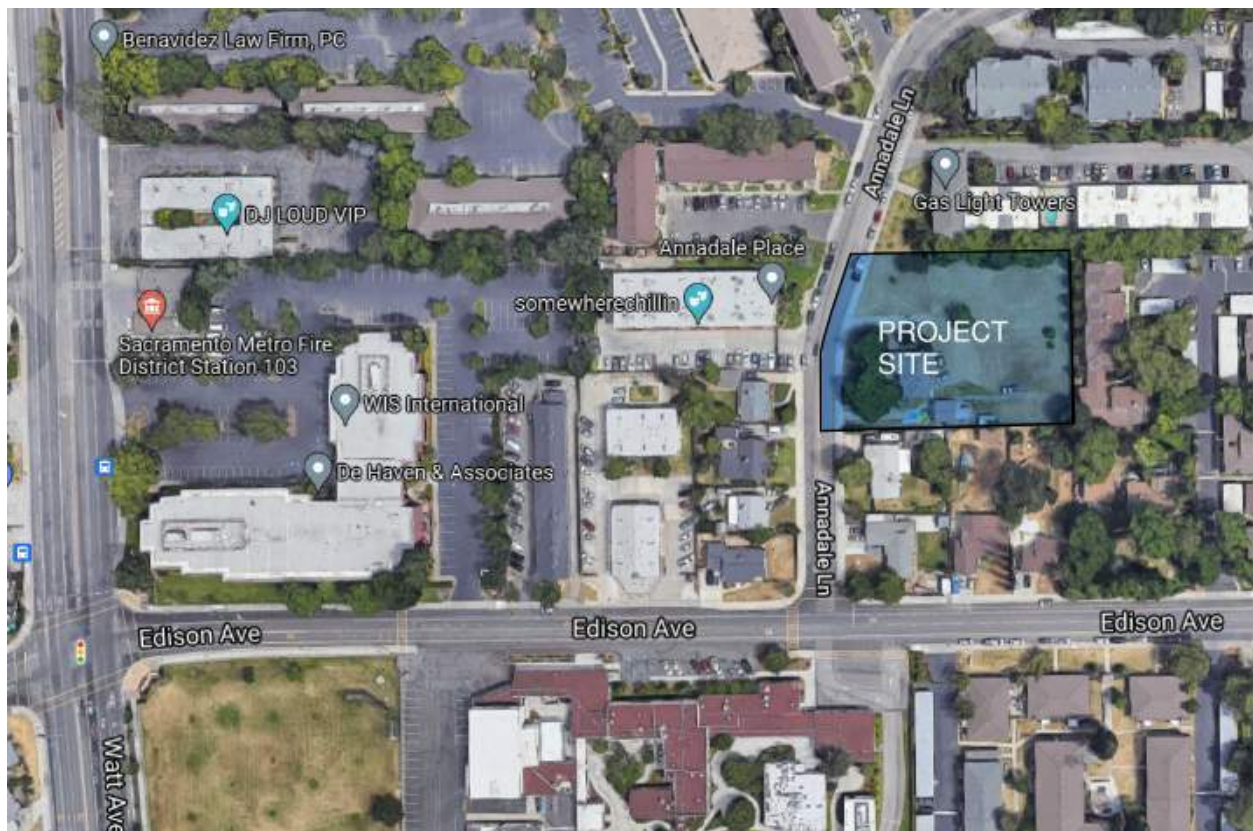


Figure 1: Vicinity Map

2.0 EXISTING CONDITIONS

In the existing condition, stormwater runoff runs in multiple directions. The west portion of the site drains towards Annadale lane while the east portion of the site drains towards the northeast corner of the lot onto the neighboring Apartment complex to the north. The drainage system in the apartment complex to the north drains into the system in Annadale lane which drains north. The

storm water on both the West and East portions of the site is conveyed into the system in Annadale lane via drain inlets which flows north. The existing site consists of approximately 0.12 acres of impervious surfaces and 0.83 acres of pervious area. There is an existing single-family home on site.

3.0 PROPOSED DRAINAGE PATTERNS

The proposed site consists of 0.65 acres of impervious surfaces and 0.3 acres of pervious area. A summary of the drainage basin is included in Appendix A. The 0.95-acre site will drain towards the center into a drain inlet leading to a series of piped flowing to the northwest end of the site. The stormwater will get pumped from the last manhole onsite into a drain inlet just outside the Right of Way. The drain inlet will drain into another drain inlet built within the gutter of Annadale. The system within Annadale drains north within 12" drain pipes.

4.0 STORMWATER CODE COMPLIANCE

The project will comply with the requirements of the "Stormwater Quality Design Manual for the Sacramento Region", dated July 2018; as well as the Sacramento County Improvement Standards, section 9 – Storm Drainage Design. Table 1 summarizes the application of the code requirements for this project.

Requirement	Application to Project	Justification
Stormwater Detention	Detain the 100-year storm based on the precondition 100-year storm max outflow	Per County of Sacramento Improvement Standards Section 9
Storm Drainpipe Sizing	Required	Public & Private Storm Drain conveyance system designed per the Nolte flow (County Improvement standards Section 9)
Stormwater Quality	Storm Drain markings for source control required	New/replaced impervious surface < 1 acre (Table 3-2, SWQ Design Manual) Storm Drain marking for source control required for all sites.

Storm Drainpipe Sizing

Per the County of Sacramento Improvement Standards Section 9, The outflow of the private system into the public road will be sized to release the flow of the existing site as calculated by the Nolte method. SacCalc files have been included in Appendix B showing the Nolte flow for the preconditions of the existing site. The private system does not have county requirements but will be sized to convey the Nolte flow.

Stormwater Detention

The Project site is required to detain the increased flow from a 100-year storm based on max flow from the precondition 100-year storm. SacCalc was used to determine the flow from both the precondition 100-year storm and proposed conditions from a 100-year storm. From SacCalc a hydrograph was created to examine when the flow of the 100-year storm was greater than the max output flow of the 100-year precondition flow and thus needed to be detained. Table 2 summarizes the portion of the 24 hours storm that exceeds the 100-year precondition peak flow.

Time	100-Year Storm preconditions (CFS)	100-year storm postconditions (CFS)
12:00	1.44	1.49
12:05	2.60	2.64
12:10	2.07	2.11
12:15	1.41	1.46

Based on the SacCalc model for the site the max flow output by the 100-year precondition storm occurs at 12:05 and produces 2.60 cfs from the site. From 12:05 to 12:06 the post construction 100 year storm produces more than the max outflow of the 100-year precondition storm and thus will need to be detained. During this time frame the site produces on average 0.04 cfs greater than the max outflow, the total detention needed to store this amount of flow is 4.6 cubic feet. This is an inconsequential amount of storage that is significantly less than the amount of water being conveyed on-site. The total flow produced by the 100-year storm from this site will increase from 0.2 ac-ft to 0.3 ac-ft which is insignificant to the public system. Any type of detention structures will not be necessary.

SacCalc output files have been included in Appendix B showing the pre and post development storm results. These results were calculated using the HEC-1 method.

Stormwater Quality

Per the Stormwater Quality Design Manual for the Sacramento Region, water quality treatment is not required because the project will not create and/or replace an acre or more of impervious surface. Storm drain markings will be added at all drain structures per source control requirements. The trash enclosure will be drained through sewer so as not to contaminate the drainage system.

5.0 DRAINAGE SYSTEM MAINTENANCE

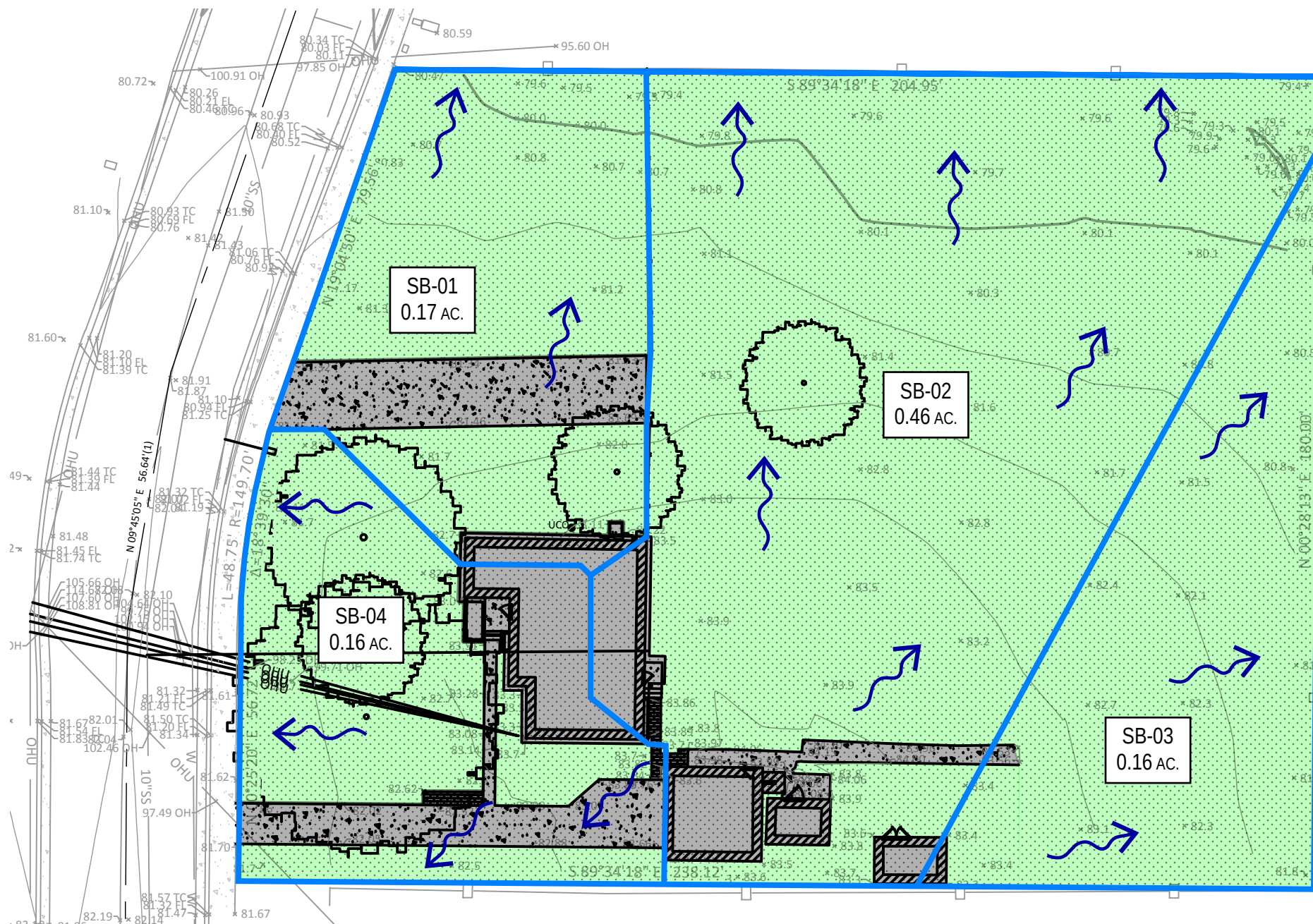
The HOA is responsible for maintenance of the on-site private storm drainage facilities.

6.0 CONCLUSION

The Annadale Development project has been designed sufficiently to mitigate the effects the project will have on the surrounding properties and the public storm drain system within Annadale Lane. The project has been designed to detain any excess water produced by the 100-year storm as to as to have no effect on the public system. Source control measures will be taken as noted to mitigate any potential pollutants into the system.

APPENDIX A

Pre/Post Development Shed Maps

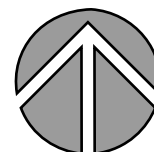


LEGEND

	(E) IMPERVIOUS SURFACE
	(E) PERVIOUS SURFACE
	SUB-BASIN LINE
	FLOW DIRECTION
SB-00 X.XX AC.	SUB-BASIN AREA

SB	Area	Pervious	Impervious
	(AC)	(AC)	(AC)
01	0.17	0.13	0.033
02	0.46	0.42	0.038
03	0.16	0.16	0.001
04	0.16	0.11	0.045
Total	0.95	0.82	0.117

NORTH



SCALE: 1" = 30'
0 30'

kpff

2100-141

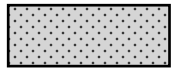
PRE-DEVELOPMENT SHED MAP
3816 ANNADALE LANE
SACRAMENTO, CA 95821

EXH-001

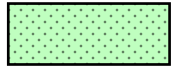
02/24/2023

SEE THIS SHEET FOR CONTINUATION

LEGEND



(E) IMPERVIOUS SURFACE



(E) PERVIOUS SURFACE



SUB-BASIN LINE

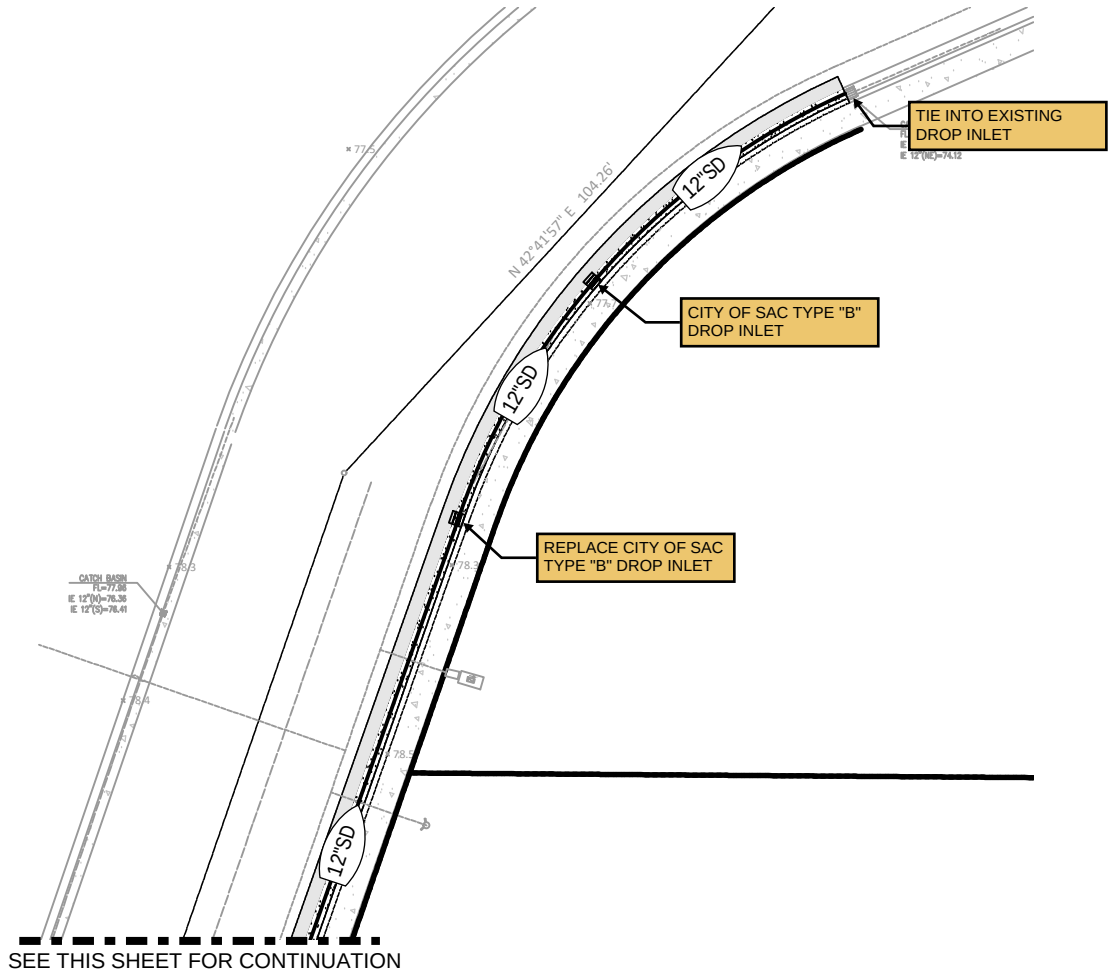
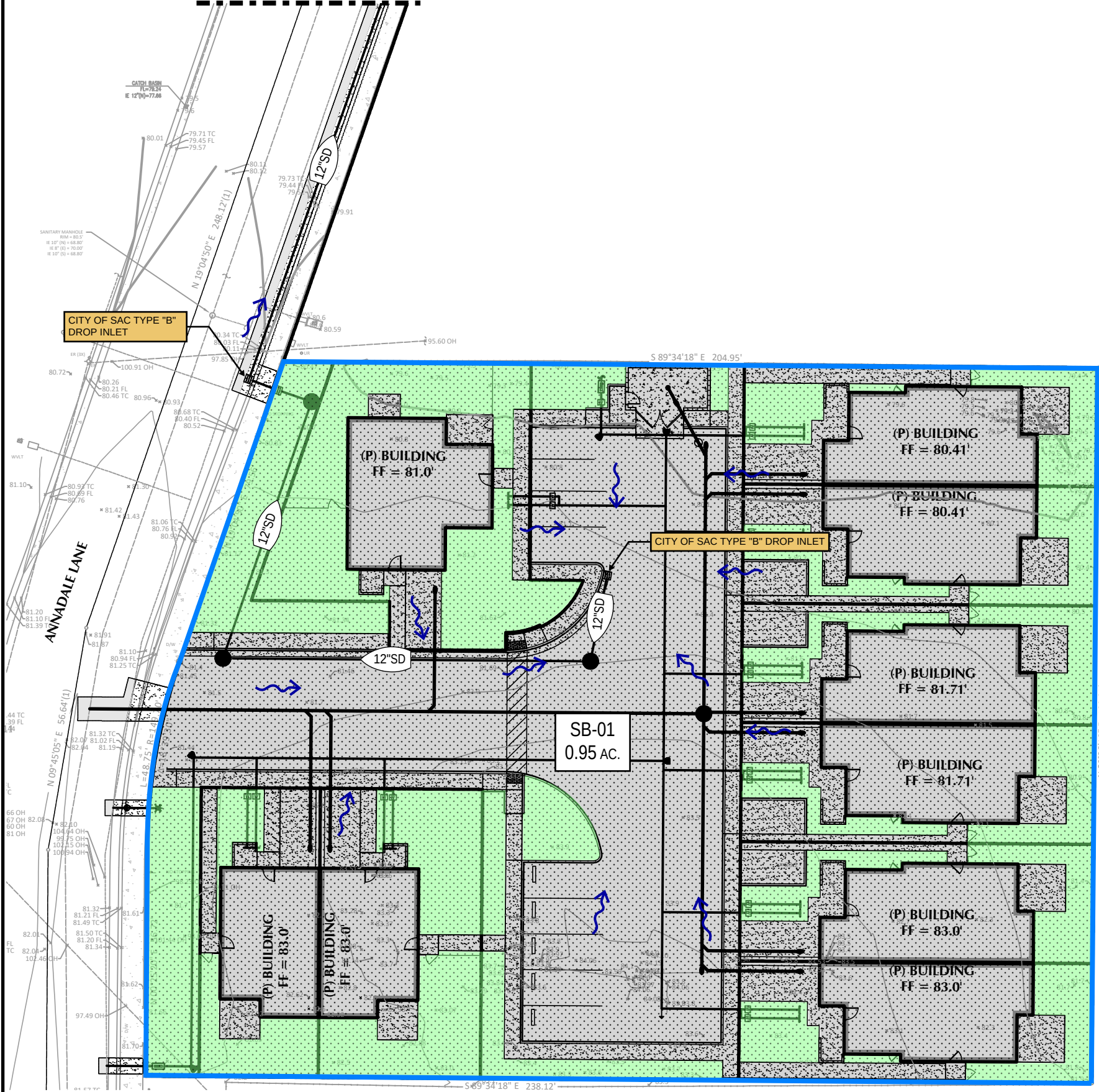


FLOW DIRECTION

SB-00
X.XX AC.

SUB-BASIN AREA

SB	Area	Pervious	Impervious
	(AC)	(AC)	(AC)
01	0.95	0.30	0.65



NORTH

SCALE: 1" = 30'
0 30'



kpff

2100-141

POST DEVELOPMENT SHED MAP
3816 ANNADALE LANE
SACRAMENTO, CA 95821

EXH-002

02/24/2023

APPENDIX B

SacCalc Input & Output

Nolte method results
(Project: 2100-141 Annadale)
(Hydrologic zone 2)

ID	Drainage area (acres)	Impervious area (%)	Design Q (cfs)
WS001	0.95	80.00	0.42

Nolte Method Input

Sacramento Hydrologic Calculator

Project **Method** Rainfall Watershed

Nolte method

☒ Export peaks to StormCAD (Excel workbook)
☐ Calculate only; no export

Hydrologic zone: **2** [Show map](#)

Sacramento County HEC-1 method

Start date and time: **1/1/2000 12:00 AM**

☐ Export peaks to StormCAD (Excel workbook)
☐ Export hydrographs to PondPack
☐ Export hydrographs to XP-SWMM
☐ Export hydrographs to Microsoft Excel
☐ No export; just run HEC-1 ☐ Just create HEC-1 input file

Type of storm:
☒ Design storm
☐ Historical storm

[Help](#)

Watershed Properties (Nolte Method)

General

Identification: **WS001** Comments:

Area, acres: **0.95**

Land use	Imper. area
Commercial, Offices, RD-30	90%
Intensive Industrial	85%
Apartments, RD-20, High Density Land	80%
Mobile Home Park, RD-15	75%
RD-10	70%
RD-7	60%
RD-5, Medium Density Land	50%
RD-4	40%
RD-3	30%
RD-2	25%
RD-1, Rural, Low Density Land	20%

Given in: ☒ fraction or % ☐ absolute area

[OK](#) [Cancel](#) [Help](#)

[View HEC-1 output](#)

Sacramento method results
(Project: 2100-141 Annadale pre project)
(100-year, 1-day rainfall)

ID	Peak flow (cfs)	Time of peak (hours)	Basin area (sq. mi)	Peak stage (feet)	Peak storage (ac-ft)	Diversion volume (ac-ft)
WS001	2.6	12:05	.00			

100-year Precondition Input

Sacramento Hydrologic Calculator

Project | **Method** | Rainfall | Watershed

Nolte method:

☐ Export peaks to StormCAD (Excel workbook)

☐ Calculate only; no export

Hydrologic zone: 2 [Show map](#)

Sacramento County HEC-1 method

Start date and time: 1/1/2000 12:00 AM

☐ Export peaks to StormCAD (Excel workbook)

☐ Export hydrographs to PondPack

☐ Export hydrographs to XP-SWMM

☒ Export hydrographs to Microsoft Excel

☐ No export; just run HEC-1 ☐ Just create HEC-1 input file

Type of storm:

☒ Design storm

☐ Historical storm

[Help](#)

Sacramento Hydrologic Calculator

Project | **Method** | Rainfall | Watershed

Properties

Project type: Sacramento County HEC-1 method

Project title: 2100-141 Annadale pre project

Prepared by: [Show map](#) Date: 1/28/2022

Comments:

Project file: X:\2021-Civil Projects\2100-141 - Annadale Development (Hausman)\CIVIL\REPORTS\Drainage Report\CALC\Detention Sizing\pre

Save output/export files in: X:\2021-Civil Projects\2100-141 - Annadale Development (Hausman)\CIV

[File...](#) [Save](#) [Run](#) [Report](#) [Help](#)

Watershed Wizard - Watershed Properties [WS001]

General

Identification: WS001 Comments:

☒ Send hydrograph to output file

Area: 0.947 ☒ acres ☐ sq mi

Mean elevation: 83 ft

Precipitation zone: 2 [Show map](#)

Lag

☒ Compute from travel time, or ☐ compute with basin "n", or ☐ specify: 0 minutes

Infiltration: loss rate

☒ Compute loss rate, or ☐ specify loss rate: 0 in/hr

Infiltration: impervious area

☐ Compute % impervious area, or ☒ specify impervious area: 12 %

[Undo](#) [Back](#) [Next >](#) [Finish](#) [Help](#)

Watershed Wizard - Land Use and Soil Group [WS001]

Land use	Imper. area	Soil group		
		B	C	D
Residential: 6-8 du/acre, LDR, School	50%			
Residential: 4-6 du/acre	40%			
Residential: 3-4 du/acre	30%			
Residential: 2-3 du/acre	25%			
Residential: 1-2 du/acre	20%			
Residential: 0.5-1 du/acre	15%			
Residential: 0.2-0.5 du/acre, Ag Res	10%			100.000
Open Space, Grassland, Ag	5%			
Open Space, Woodland, Natural	2%			
Dense Oak, Shrubs, Vines	1%			

Specified as: ☒ percentage, or ☐ absolute area

[Undo](#) [Back](#) [Next >](#) [Finish](#) [Help](#)

[View HEC-1 output](#)

Sacramento method results
(Project: 2100-141 Annadale pre project)
(100-year, 1-day rainfall)

ID	Peak flow (cfs)	Time of peak (hours)	Basin area (sq. mi)	Peak stage (feet)	Peak storage (ac-ft)	Diversion volume (ac-ft)
WS001	2.6	12:05	.00			
DE001	.0	0:00	.00		.2	

100-year Post condition Input

Sacramento Hydrologic Calculator

Project Method Rainfall Watershed

Notle method

☐ Export peaks to StormCAD (Excel workbook)

☐ Calculate only; no export

Hydrologic zone: 2 Show map

Sacramento County HEC-1 method

Start date and time: 1/1/2000 12:00 AM

Type of storm

☒ Design storm

☐ Historical storm

☐ Export peaks to StormCAD (Excel workbook)

☐ Export hydrographs to PondPack

☐ Export hydrographs to X-P-SWMM

☒ Export hydrographs to Microsoft Excel

☐ No export; just run HEC-1 ☐ Just create HEC-1 input file

Help

Sacramento Hydrologic Calculator

Project Method Rainfall Watershed

Design storm

500 yr ☐ ☐ ☐ ☐ ☐ ☐

200 yr ☐ ☐ ☐ ☐ ☐ ☐

100 yr ☐ ☒ ☐ ☐ ☐ ☐

50 yr ☐ ☐ ☐ ☐ ☐ ☐

25 yr ☐ ☐ ☐ ☐ ☐ ☐

10 yr ☐ ☐ ☐ ☐ ☐ ☐

5 yr ☐ ☐ ☐ ☐ ☐ ☐

2 yr ☐ ☐ ☐ ☐ ☐ ☐

Duration: 6h 12h 24h 36h 5d 10d

Adjustments

☒ Use total watershed area for the storm area

☐ Specify storm area: 0 sq mi

☒ Use frequency factor

Help

Watershed Wizard - Watershed Properties [WS001]

General

Identification: WS001 Comments:

☒ Send hydrograph to output file

Area: 0.947 ☒ acres ☐ sq mi

Mean elevation: 83 ft Precipitation zone: 2 Show map

Lag

☒ Compute from travel time, or ☐ compute with basin "n", or ☐ specify: 0 minutes

Infiltration: loss rate

☒ Compute loss rate, or ☐ specify loss rate: 0 in/hr

Infiltration: impervious area

☐ Compute % impervious area, or ☒ specify impervious area: 80 %

Undo < Back Next > Finish Help

Watershed Wizard - Land Use and Soil Group [WS001]

Land use	Imper. area	Soil group		
		B	C	D
Highways, Parking	95%			
Commercial, Offices	90%			
Intensive Industrial	85%			
Apartments, HDR	80%			100,000
Mobile Home Park	75%			
Condominiums, MDR	70%			
Residential: 8-10 du/acre, Ext Indust	60%			
Residential: 6-8 du/acre, LDR, School	50%			
Residential: 4-6 du/acre	40%			
Residential: 3-4 du/acre	30%			
Residential: 2-3 du/acre	25%			

Specified as: ☒ percentage, or ☐ absolute area

Undo < Back Next > Finish Help

APPENDIX C

Grading Plan

PRELIMINARY
NOT FOR
CONSTRUCTION

**ANNADALE PROJECT
3816 ANNADALE LANE
SACRAMENTO, CA 95821**

PRELIMINARY GRADING & UTILITY PLAN

[illegible]

Drawing No.

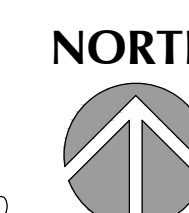
C3.0

- ① PROPOSED CONCRETE CURB
- ② PROPOSED CONCRETE ROLLED CURB & CUTTER
- ③ PROPOSED CONCRETE SIDEWALK
- ④ PROPOSED AREA DRAIN
- ⑤ PROPOSED CONCRETE ROLLED CURB
- ⑥ PROPOSED HEAVY DUTY AC PAVEMENT
- ⑦ PROPOSED CONCRETE PAVEMENT
- ⑧ PROPOSED ACCESSIBLE RAMP
- ⑨ PROPOSED ACCESSIBLE PATH OF TRAVEL STRIPING
- ⑩ PROPOSED DRAIN INLET
- ⑪ SANITARY SEWER POINT OF CONNECTION
- ⑫ PROPOSED SANITARY SEWER CLEANOUT
- ⑬ PROPOSED SANITARY SEWER MANHOLE
- ⑭ DOMESTIC WATER POINT OF CONNECTION
- ⑮ PROPOSED WATER METER FOR DOMESTIC WATER SERVICE
- ⑯ FIRE SERVICE POINT OF CONNECTION
- ⑰ PROPOSED FIRE HYDRANT
- ⑱ PROPOSED DOMESTIC WATER SINGLE CHECK VALVE
- ⑲ PROPOSED THRUST BLOCKS
- ⑳ PROPOSED AIR RELEASE VALVE
- ㉑ PROPOSED STORM DRAIN MANHOLE
- ㉒ PROPOSED WHEELSTOP
- ㉓ PROPOSED IRRIGATION METER AND BACKFLOW DEVICE
- ㉔ PROPOSED FENCE
- ㉕ PROPOSED LIFT STATION
- ㉖ PROPOSED GATE VALVE
- ㉗ PROPOSED MAILBOX

APN: 255-0032-006-0000

SEE THIS SHEET FOR CONTINUATION

SCALE 1 INCH = 20 FEET



APPENDIX D

Hydrologic Soil Group Map

Soil Map

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

Custom Soil Resource Report Soil Map



Custom Soil Resource Report

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

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

Special Point Features

-  Blowout
-  Borrow Pit
-  Clay Spot
-  Closed Depression
-  Gravel Pit
-  Gravelly Spot
-  Landfill
-  Lava Flow
-  Marsh or swamp
-  Mine or Quarry
-  Miscellaneous Water
-  Perennial Water
-  Rock Outcrop
-  Saline Spot
-  Sandy Spot
-  Severely Eroded Spot
-  Sinkhole
-  Slide or Slip
-  Sodic Spot

-  Spoil Area
-  Stony Spot
-  Very Stony Spot
-  Wet Spot
-  Other
-  Special Line Features

Water Features

-  Streams and Canals

Transportation

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

Background

-  Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

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

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

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

Soil Survey Area: Sacramento County, California
Survey Area Data: Version 20, Sep 3, 2021

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

Date(s) aerial images were photographed: May 11, 2019—May 12, 2019

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
227	Urban land	1.0	100.0%
Totals for Area of Interest		1.0	100.0%