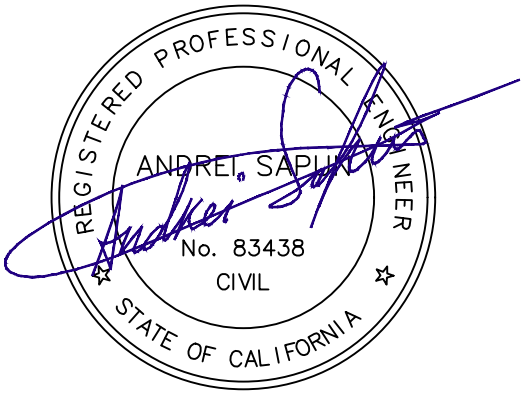
PLNP2022-00074
Gibbons Meadows
Tentative Subdivision Map

LEVEL 2 DRAINAGE STUDY
FOR
5601 GIBBONS DRIVE

Prepared for:
MJM Engineering
6105 Seven Cedars Pl.
Granite Bay, CA 95746
Contact Person: John Masha

APN:
258-0032-030

Control Number:
PLNP2022-00074



4/25/2023

Prepared by:
Andrei Sapun, P.E.
Area West Engineers, Inc
7478 Sandalwood Drive, Suite 400
Citrus Heights, CA 95621
916-725-5551
Andrei@areawesteng.com

Job Number:
22034

Preparation Date:
March 2023

Last Updated On:
April 2023

Watershed: Arcade Creek and Chicken Slough
Vertical Datum: NGVD 29

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1.0 INTRODUCTION

1.1 PURPOSE AND OBJECTIVES

The purpose of this drainage study is to support the 5601 Gibbons Drive Tentative Subdivision Map application to divide a single 4.2-acre lot into twenty lots. This study is not acceptable for design and further study will be required to complete design analysis for improvement plans approval. Current study purpose is to identify the following:

1. Identify drainage infrastructure required for the project and compliance with stormwater quality and low impact development requirements (LID).
2. Identify project overland release discharge location/locations.
3. Confirm that project does not have any adverse impacts to surrounding properties.

1.2 PROJECT DESCRIPTION AND EXISTING CONDITIONS

The project is located within the Carmichael Community in Sacramento County. Project Vicinity Map is provided in Appendix 1. Project goal is to subdivide existing residential property into 20-lot subdivision to match current Community Plan Land Use which is RD-5. Proposed Tentative Map is provided in Appendix 2. Project site consist of vacant lot along with couple residential lots that does not belong to any FEMA flood zone.

1.3 APPLICABLE STANDARDS

Hydrologic and hydraulic calculations under current drainage study shall conform to the Sacramento City/County Drainage Manual Volume 2, dated December 1996. LID and stormwater quality treatment requirements shall conform to the Stormwater Quality Design Manual for the Sacramento Region, dated July 2018.

1.4 PREVIOUS STUDIES

No previous studies available for the project area.

2.0 REGIONAL FLOOD CONTROL

2.1 UPSTREAM IMPACTS

Project site belongs to two watersheds. The north watershed drains to the north towards Orval Way and belongs to Arcade Creek watershed. The south watershed drains to the south towards Gibbons Drive and belongs to Chicken Ranch Slough watershed.

Minor upstream overland release is anticipated entering the site from the end of Liggett Way Road. Project will continue the road and connect it with Orval Way elbow at the north. Project will not obstruct the flow through Project site and therefore no upstream impacts anticipated. Schematics of the offsite watersheds are provided in Appendix 3 on the Existing Watershed Map.

2.2 DOWNSTREAM IMPACTS

Project site will have two discharge locations to two separate watersheds described in previous section. North discharge location will be located at Orval Way elbow identified as Analysis Point A1 on the Existing and Proposed Shed Maps. The second discharge location will be at will be located at Gibbons Drive and identified as Analysis Point A2 on the Existing and Proposed Shed Maps in Appendix 3. Both analysis points were compared for the peak discharge runoff for 100-yr storm event at existing and proposed conditions using Sacramento Hydrologic Calculator (SacCalc), a Microsoft Windows application developed for Sacramento County.

2.2.1 EXISTING CONDITIONS SACCALC MODELING

SacCalc model of existing conditions is provided in Figures 1 below.

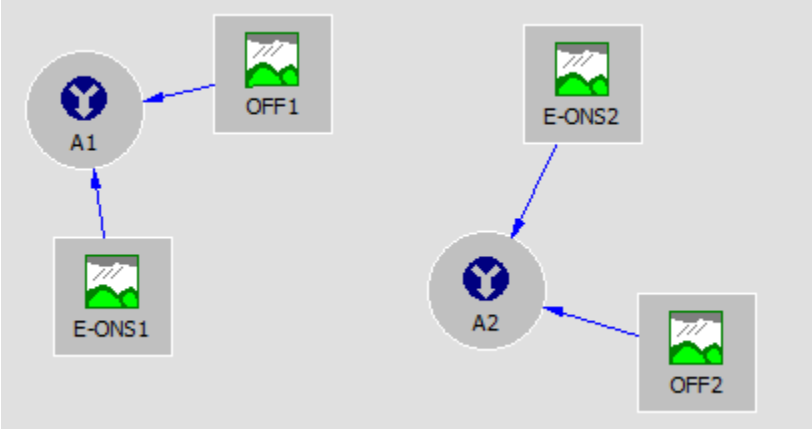


Figure 1 - SacCalcs Model Schematics for Existing Conditions

E-ONS1 represents an existing 1.68-acre portion of the site that drains to the North. E-ONS2 represents an existing 2.48-acre portion of the site that drains to the South. OFF1 represents a 15.77-acre offsite watershed which drains to analysis point A1. OFF2 represents a 13.99-acre watershed which drains to analysis point A2.

Soil type for the project site was selected as Type 'D' as stated in NRCS soil map report for the area. Offsite area watersheds are assumed to be type D as well.

Open space land use was used for E-ONS1 and Residential Land Use for 0.2 du/acre was used for E-ONS2 due to existing house located on the parcel. Land use for the offsite watersheds was based on the County Zoning information for enclosed areas. Basin "n" lag time, infiltration loss rate and infiltration impervious area were selected to be computed.

Hydrologic Zone 2 was used for the Sacramento method. Modeling results are summarized in Table below.

Table 1 - Sacramento Method Results for the Existing Conditions

Watershed, ID	Peak flow, (cfs)	Time of Peak (hours)
E-ONS1	4.7	12:05
E-ONS2	6.0	12:07
OFF1	43	12:06
OFF2	35	12:07
Point A1	48	12:06
Point A2	41	12:07

2.2.2 PROPOSED CONDITIONS SACCALC MODELING

Proposed conditions SacCalc model is provided in Figure below.

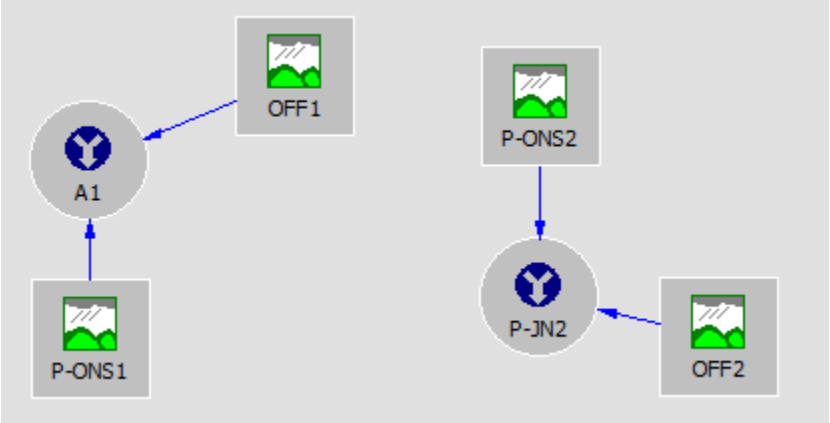


Figure 2 - SacCalcs Model Schematics for Proposed Conditions

The proposed model is like the existing condition model except land use for project site is changed to RD-5 for both North and South sheds. Also, the area of the North and South watersheds was slightly changed from existing conditions since the break point in the future road will be at the proposed lots of boundary. Thus, the north P-ONS1 watershed area is 1.76 acres and south P-ONS2 watershed area is 2.40 acres. Modeling results for the proposed conditions are summarized in the Table below.

Table 2 - Sacramento Method Results for Proposed Conditions

Watershed, ID	Peak flow, (cfs)	Time of Peak (hours)
P-ONS1	5.9	12:03
P-ONS2	7.7	12:03
OFF1	43	12:06
OFF2	35	12:07
Point A1	48	12:05
Point A2	41	12:07

Based on the existing and proposed modeling results for Analysis Points A1 and A2, the project will not have adverse impacts on downstream properties since the peak discharge at analysis points does not change. At the existing and proposed conditions, ultimate peak discharge at analysis point A1 will remain 48 cfs and at point A2 – 41 cfs. Therefore, during 100-yr, the water surface elevation will not be increased by more than 0.1-ft for the proposed conditions. Copy of SacCalc reports are provided in Appendix 5.

2.3 PROPOSED OVERLAND RELEASE (OR) LOCATION

An overland release route for 100-yr discharge is proposed via proposed 40’ ROW road which will have 26’ wide pavement, gutter, curb, and public sidewalk. It will be two OR discharge locations identified in the Proposed Shed Map in Appendix 3. OR discharge location 1 will located at the road along north boundary line discharging towards Orval Way with peak discharge of 5.9 cfs and OR discharge location 2 will be located right before intersection with Gibbons Drive with peak discharge of 7.7 cfs for 100-yr storm event. Design reports for both OR locations are provided below.

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Apr 24 2023

100YR OVERLAND RELEASE DISCHARGE LOCATION 1 (NGVD29)

User-defined

Invert Elev (ft)	= 117.65
Slope (%)	= 0.80
N-Value	= 0.016

Calculations

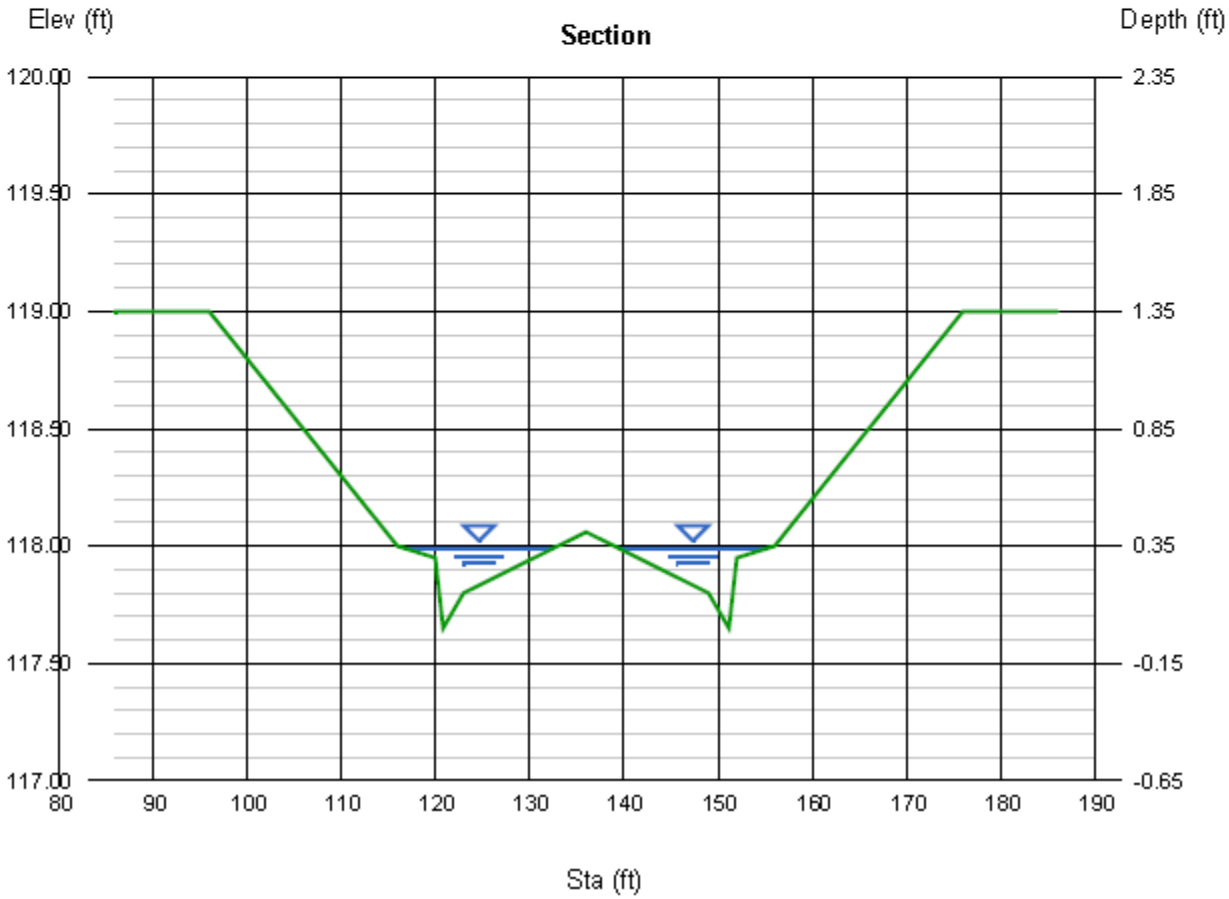
Compute by:	Known Q
Known Q (cfs)	= 5.90

Highlighted

Depth (ft)	= 0.34
Q (cfs)	= 5.900
Area (sqft)	= 3.40
Velocity (ft/s)	= 1.74
Wetted Perim (ft)	= 31.52
Crit Depth, Yc (ft)	= 0.34
Top Width (ft)	= 31.40
EGL (ft)	= 0.39

(Sta, El, n)-(Sta, El, n)...

(96.00, 119.00)-(116.00, 118.00, 0.016)-(120.00, 117.95, 0.016)-(120.83, 117.65, 0.016)-(123.00, 117.80, 0.016)-(136.00, 118.05, 0.016)-(149.00, 117.80, 0.016)-(151.17, 117.65, 0.016)-(152.00, 117.95, 0.016)-(156.00, 118.00, 0.016)-(176.00, 119.00, 0.016)



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Apr 24 2023

100YR OVERLAND RELEASE DISCHARGE LOCATION 2 (NGVD29)

User-defined

Invert Elev (ft)	= 113.65
Slope (%)	= 1.70
N-Value	= 0.016

Calculations

Compute by:	Known Q
Known Q (cfs)	= 7.70

Highlighted

Depth (ft)	= 0.32
Q (cfs)	= 7.700
Area (sqft)	= 2.82
Velocity (ft/s)	= 2.73
Wetted Perim (ft)	= 26.32
Crit Depth, Yc (ft)	= 0.36
Top Width (ft)	= 26.20
EGL (ft)	= 0.44

(Sta, El, n)-(Sta, El, n)...

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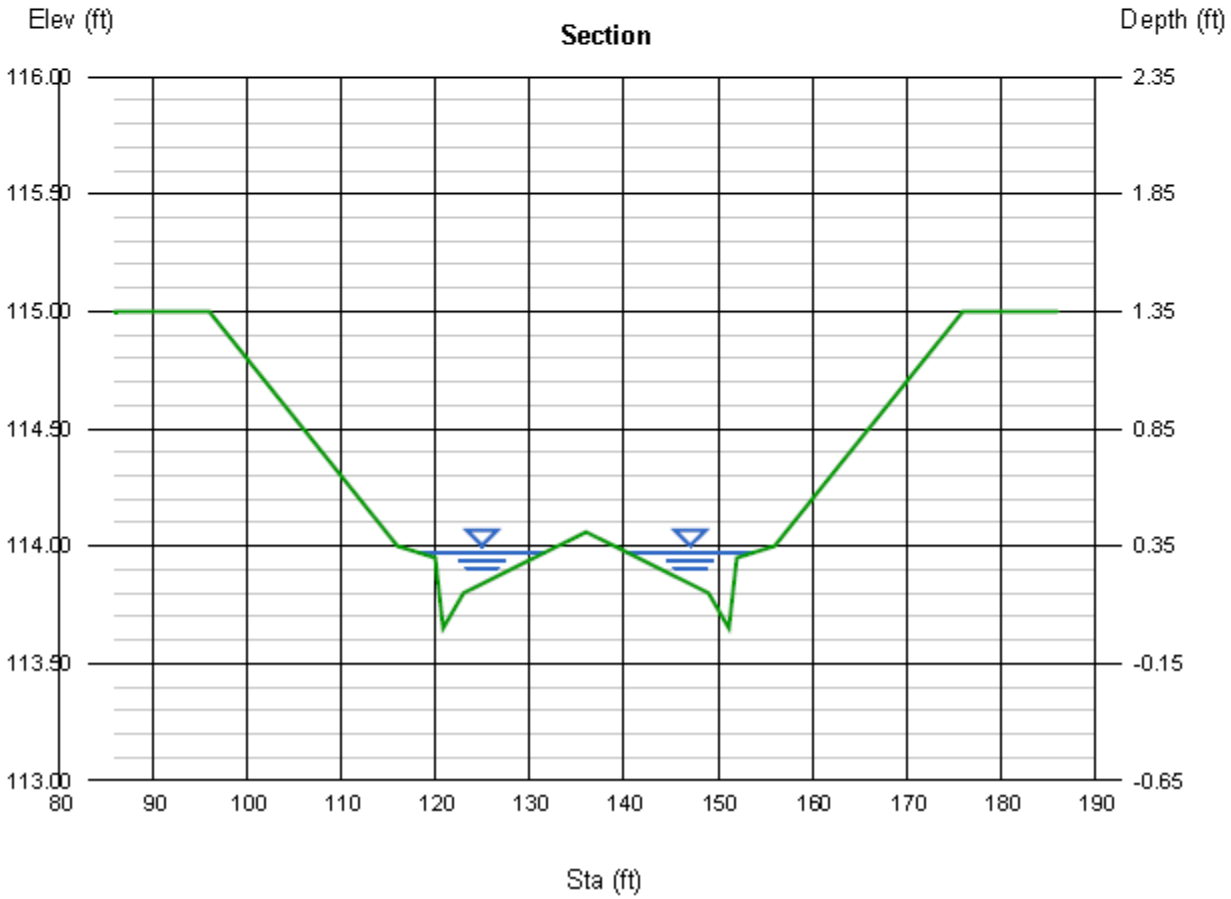


2.4 MINIMUM FINISH FLOOR

The minimum finish floor for each parcel is established to provide 1.5 ft clearance above flooding elevation or minimum pad elevation should be at minimum at 1.2 ft above flooding elevation. Per the design reports in previous section, the maximum WSE for north watershed at the discharge location for 100-yr storm event will be 117.99' and for the south watershed the 100-yr WSE at the discharge location will be 113.97' for NGVD29 datum. Min pad elevation for each lots that will belong to north watershed will have to be graded at least at 119.2 feet and for the south watershed min pad elevation will be at 115.2 feet.

3.0 STORMWATER QUALITY

3.1 PROPOSED LAND USE

The proposed project land use is RD-5. The proposed project site's total shed area is 4.16 acres without any common landscape area, drainage basin or drainage corridors.

3.2 LOW IMPACT DEVELOPMENT

Single-family residential projects with more than 1 acre of impervious area are required to include. Low Impact Development (LID) control measures. The estimated project impervious area including buildings, onsite roads and driveways is about 2.1 acres. Project LID credits will be obtained via the following measures:
- Two deciduous trees per lot
- Disconnected roof drains
- Amended soil or mulch beds in the front.

Since the proposed project is infill one and maximum density development, proposed project cannot reach 100 LID points requirements per lot. The proposed lots (typical area of each lot is 0.16 acres) will have 2 deciduous trees per lot and disconnected roof drains that will have a runoff distance through the front landscape area from 20 to 25 ft. In addition, frontage landscape area outside of 20' wide driveway will include amendment soil with approximate area of 600 sqft. Proposed measures as shown in the figure below, will provide 85 LID points out of required 100. Copy of the LID spreadsheet calculations are provided in Appendix 6.

3.3 TREATMENT

Since the proposed single-family residential project is below 20 acres, no treatment is required.

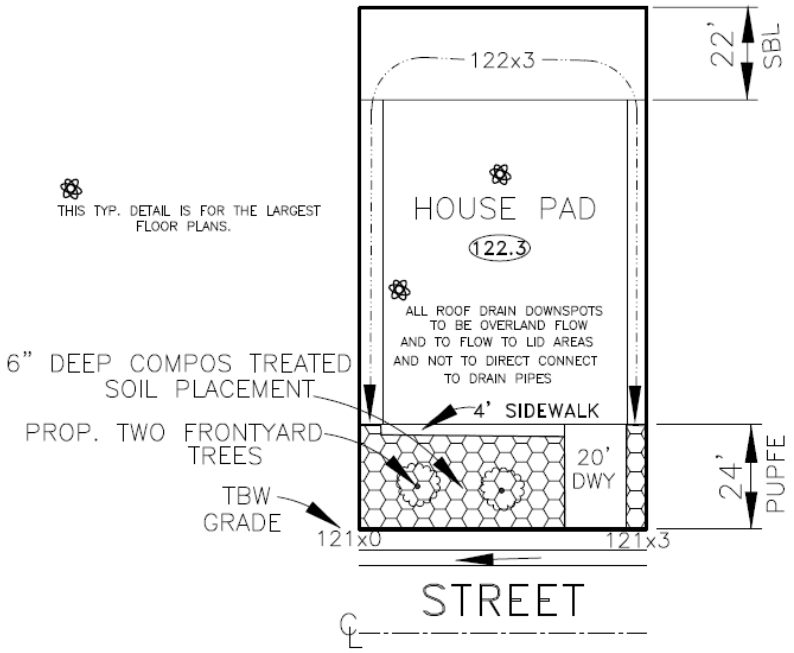


Figure 3 - LID Plan

3.4 HYDROMODIFICATION

Project area is exempt from hydromodification requirements.

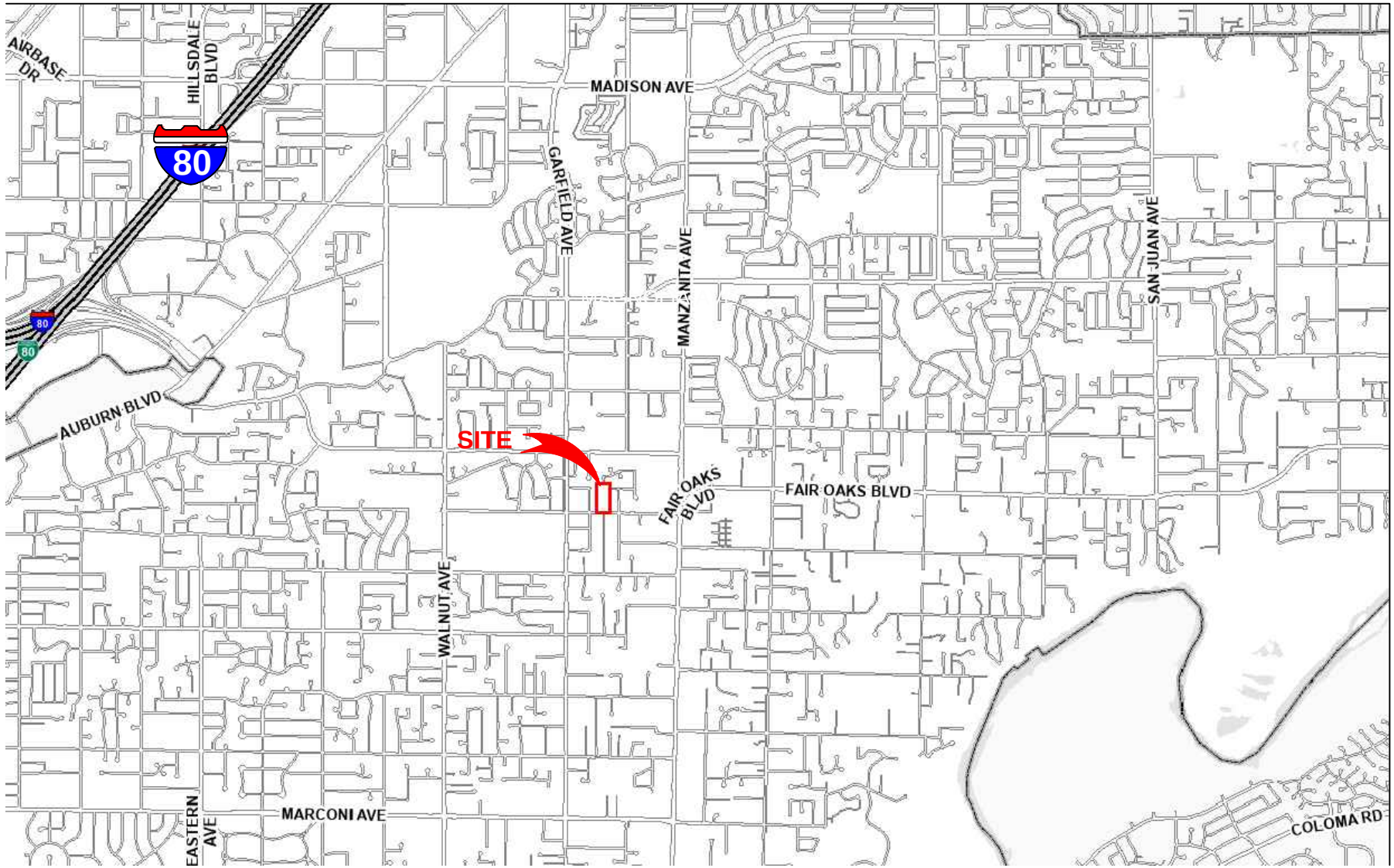
4.0 SUMMARY OF FINDINGS AND CONCLUSION

The purpose of this drainage study was to analyze downstream and upstream impacts to surrounding properties, as well as identify overland release path that will convey stormwater runoff and comply with stormwater quality facilities and low impact development measures (LID). This drainage study is not intended nor acceptable for design purposes. Additional study will be required to complete the design analysis for improvement plans approval.

No adverse impact is anticipated to the surrounding properties upstream and downstream of the development. Proposed public road will be used as the overland release discharge from project site. Project LID requirements will be met to the maximum extent practicable on all residential lots with front yard amended soil, mulch beds, deciduous trees and disconnected roof drains.

Appendix 1 - Project Vicinity Map

EXHIBIT 1 - PROJECT VICINITY MAP



area west engineers, inc.
ENGINEERING - SURVEYING - PLANNING
7478 SANDALWOOD DRIVE, SUITE 400
CITRUS HEIGHTS, CA 95621
(916) 725-5551 (916) 725-5808 (FAX)
AWE@AREAWESTENG.COM

PROJECT VICINITY MAP EXHIBIT FOR:
5601 GIBBONS DRIVE,
SACRAMENTO COUNTY, CALIFORNIA

SCALE	22034
HORIZ.: NONE	
VERT.: NONE	SHEET 1 OF 1
DATE: MARCH 2023	

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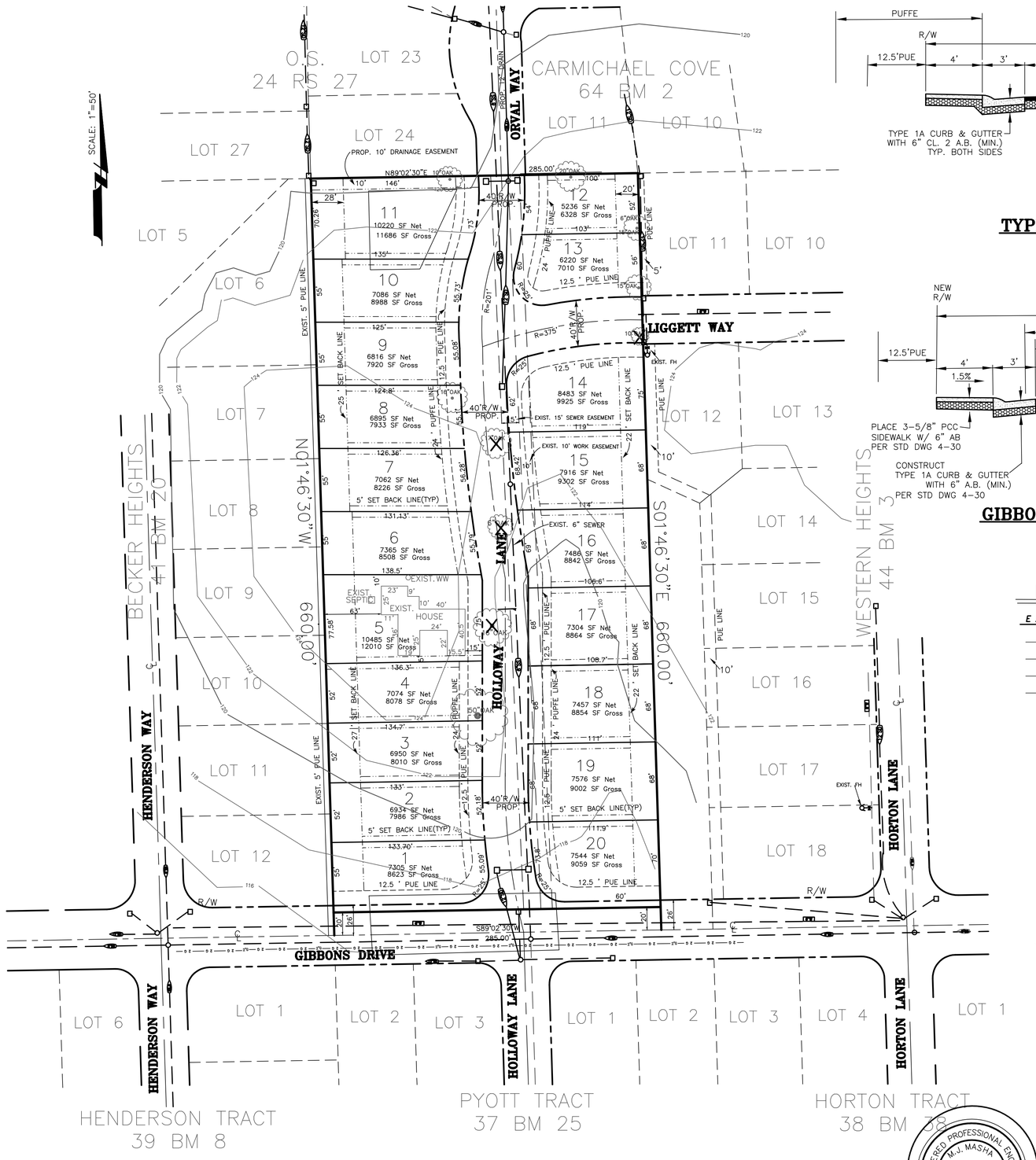
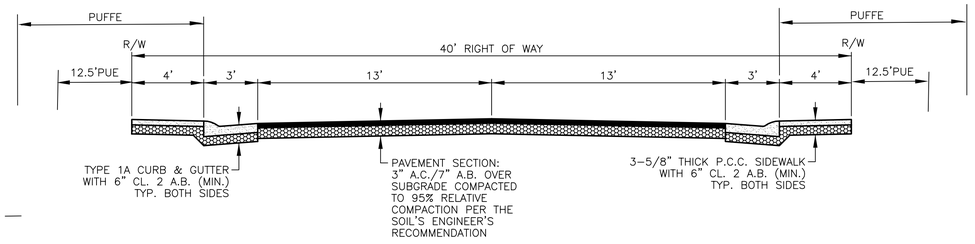
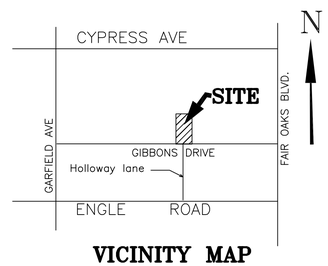
Appendix 2 – Tentative Subdivision Map



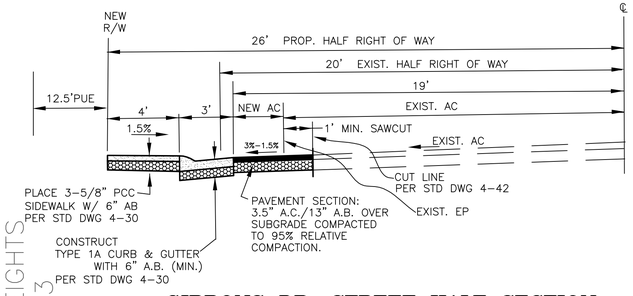


TYPICAL STREET CROSS SECTION – 40' ROW



VICINITY MAP

NTS



GIBBONS DR. STREET HALF SECTION

NTS

LEGEND

EXISTING	DESCRIPTION
12"SD	STORM DRAIN PIPE & SIZE
6"SS	SANITARY SEWER PIPE & SIZE
8"W	DOMESTIC WATER PIPE & SIZE
2"G	NATURAL GAS PIPE & SIZE
	MANHOLE
	DRAIN INLET
	FIRE HYDRANT
PP	POWER POLE
	FLOW DIRECTION
	TREES TO BE REMOVED
	EXIST. FIRE HYDRANT
124	EXIST. CONTOUR
R/W	RIGHT OF WAY
PUE	PUBLIC UTILITY EASEMENT
SSMH	SANIT SEWER MANHOLE
SDMH	STORM DRAIN MANHOLE
	DRAINAGE FLOW DIRECTION
	POWER POLE
DWY	DRIVE WAY
	BUILDING SETBACK LINE
	PUFFE SET BACK LINE

TENTATIVE SUBDIVISION MAP FOR :

GIBBONS MEADOWS

5601 GIBBONS DRIVE
THE WEST 285 FEET OF LOT 51
OAKVALE FIELD 19 BM 46
COUNTY OF SACRAMENTO, CA.
APN: 258-0032-030-0000

OWNER:	RAVI ALURU 5601 GIBBONS DR. CARMICHAEL, CA. 95608 PHONE: 720-434-8900
APPLICANT/ENGINEER:	MJM ENGINEERING 6105 SEVEN CEDARS PL GRANITE BAY, CA. 95746 PHONE: 916-791-2131
A.P.N.	258-0032-030-0000
AREA	4.19 ACRES GROSS
EXISTING ZONING	RD-5
PROPOSED ZONING	RD-5
PROPOSED USE	20 SINGLE FAMILY HOMES
EXISTING USE	VACANT
PROPOSED IMPROVEMENTS	SACRAMENTO COUNTY STANDARDS
WATER SUPPLY	SACRAMENTO COUNTY STANDARDS
SEWAGE DISPOSAL	SACRAMENTO SUB. WATER DIST
STORM DRAINAGE	SACRAMENTO COUNTY
FIRE PROTECTION	SACRAMENTO COUNTY
SCHOOL DISTRICT	SACTO METRO FIRE DISTRICT
PARK DIST.	CARMICHAEL SCHOOL DIST.
ELECTERICITY	CARMICHAEL PARK & RECREATION DISTRICT
GAS	SMUD
TELEPHONE	PG&E
PARCEL DESCRIPTION	ATT THE WEST285' OF LOT 51, 19 BM 46, SACRAMENTO COUNTY RECORDS

NOTE:
FOR OAK TREES:
SEE ARBORIST REPORT

Utility Representative

Utility	Representative	Telephone
Electricity: SMUD	TONY DIAZ	916-732-7347
Gas: PG&E	LARRY HAUGEN	916-386-5308
Telephone: AT&T	Michael Pierce	916-453-7163
Water: Sacramento SUB.	Tommy Multon	916-679-3345
Fire: Sacto Metro	DIANA SCHMIDT	916-859-4323
Sewer: Sacramento County	RAY VASSELI	916-876-6140
Drainage: Sacramento County	Eugene Balinski	916- 874-1765
Cable TV: COMCAST	Kip Miller	916-376-7783
U.S.A.		1-800 227-2600

Revisions	No.	DESCRIPTION	Appr. By:	Date

BENCH MARK

B.M. 18-043 ELEV. 99.00

7/8" METAL DISK STAMPED "CO B.M. 18-43" LOCATED IN TOP OF ROLL CURB , CENTER OF CURB RETURN @ NORTHWEST CORNER OD GARFIELD AND CANFIELD AVE. APPROX 0.10 MLE SOUTH OF WHITNEY AVE. NAVD 88

Submitted By:

REGISTERED PROFESSIONAL ENGINEER M.J. MASHA RCE 30660 CIVIL STATE OF CALIFORNIA

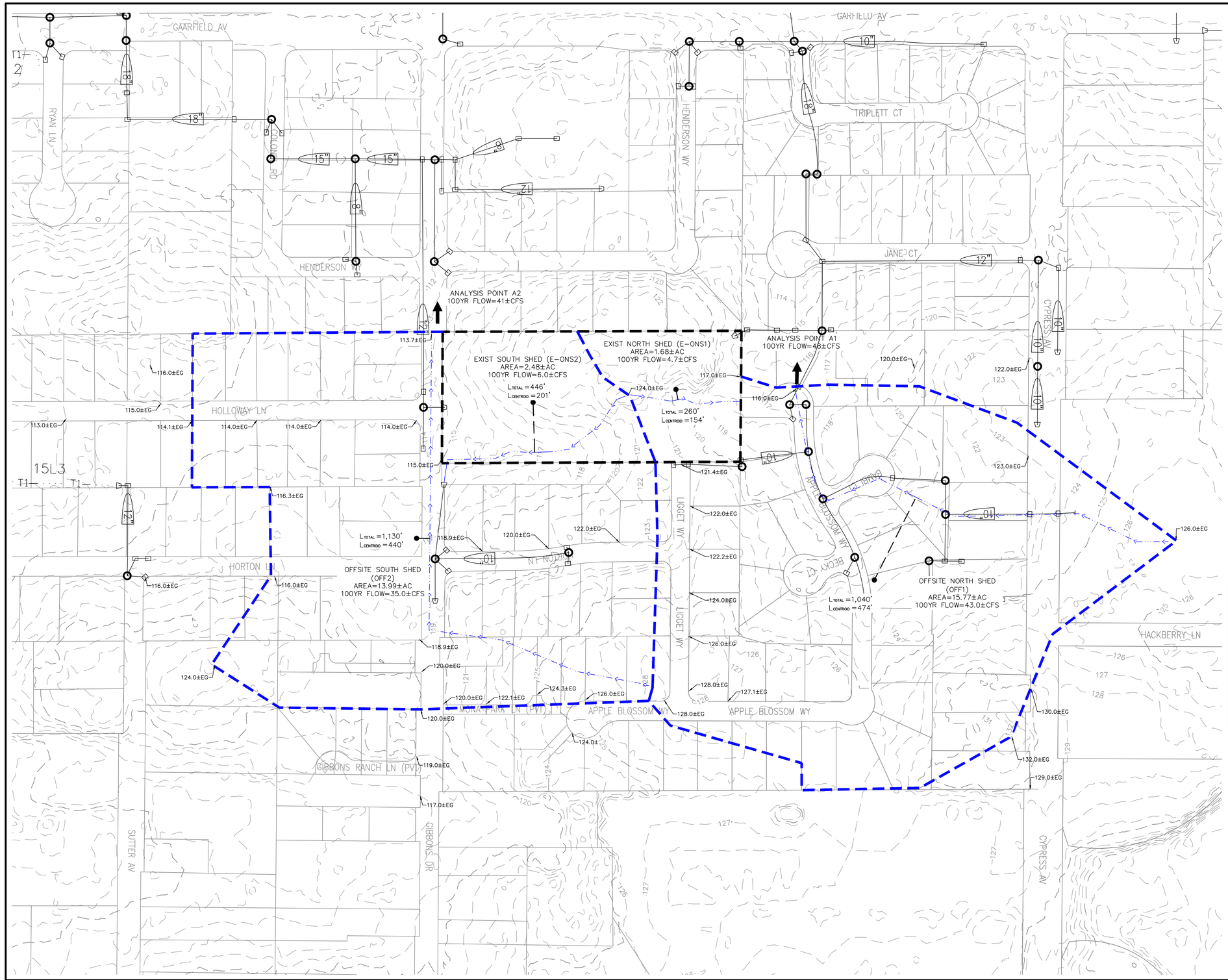
John Masha, R.C.E. 30660

MJM ENGINEERING
6105 Seven Cedars Pl.
Granite Bay, Ca. 95746
Tel. (916) 791-2131
mjmasha@att.net

TENTATIVE SUBDIVISION MAP FOR:
GIBBONS MEADOWS
5601 GIBBONS DRIVE
Sacramento County, Califorina

Scale:	1"=50'
Drawn By:	MJM
Checked By:	MJM
Date:	NOV. 2021
Job No.	21-018
SHEET NO.	1 OF 1

Appendix 3 – Existing and Proposed Shed Maps



SHED MAP LEGEND

- SHED BOUNDARY
- PROJECT SITE
- LONGEST WATER PATH
- SHED CENTROID

NORTH

AREA WEST ENGINEERS, INC.

SCALE: 1" = 100'

GRAPHIC SCALE

0 50 100 200

(IN FEET)

Sacramento method results
(Project: 22034)
(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)
E-ONS1	4.7	12:05	.00			
OFF1	43.	12:06	.02			
A1	48.	12:06	.03			
E-ONS2	6.0	12:07	.00			
OFF2	35.	12:07	.02			
A2	41.	12:07	.03			

PREPARED UNDER THE DIRECTION OF:
REGISTERED PROFESSIONAL ENGINEER
ANDREI SAPUN
No. 85438
CIVIL
STATE OF CALIFORNIA
NOTE: DO NOT USE FOR CONSTRUCTION UNLESS SIGNED BY THE ENGINEER

PRELIMINARY

BENCHMARK N/A ELEVATION N/A
SACRAMENTO COUNTY LIDAR CONTOURS.

RECORD DRAWINGS
ENGR. INIT. DATE

DESIGNED BY: AS
DRAFTED BY: AS
CHECKED BY: RR

DRAINAGE STUDY
FOR
5601 GIBBONS DRIVE
EXISTING SHED MAP
SACRAMENTO COUNTY STATE OF CALIFORNIA

AREA WEST ENGINEERS, INC.
ENGINEERING - SURVEYING - PLANNING
7478 SANDALWOOD DRIVE, SUITE 400
CITRUS HEIGHTS, CA 95621
(916) 725-5551 (916) 725-5808 (FAX)
AWE@AREAWESTENG.COM

REVISIONS

#	DESCRIPTION	ENGR. INIT.	APPROVAL	
			APPROVED BY	DATE

SCALE
HORIZ.: 1"=50'
VERT.: N/A
DATE: MARCH 2023

JOB NO. 22034
SHEET 1 OF 1

NOT FOR CONSTRUCTION ; FOR REVIEW AND COMMENT ONLY

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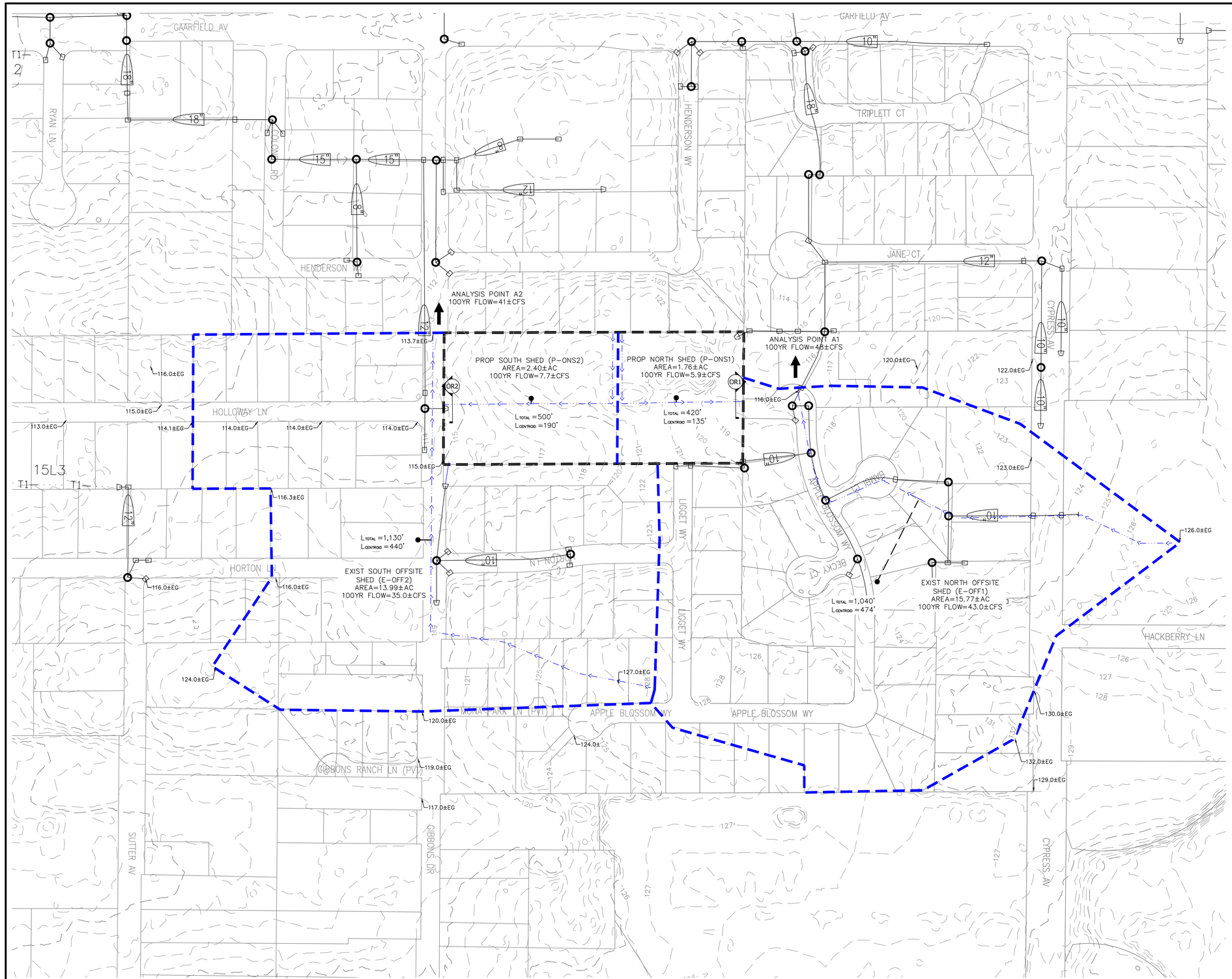

SHED MAP LEGEND

- SHED BOUNDARY
- PROJECT SITE
- LONGEST WATER PATH
- SHED CENTROID

NORTH

AREA WEST ENGINEERS, INC.

SCALE: 1" = 100'

GRAPHIC SCALE

0 50 100 200

(IN FEET)

Sacramento method results
(Project: 22034)
(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)
P-ONS1	5.9	12:03	.00			
OFF1	43.	12:06	.02			
A1	48.	12:05	.03			
P-ONS2	7.7	12:03	.00			
OFF2	35.	12:07	.02			
A2	41.	12:07	.03			

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C 85438
CIVIL
STATE OF CALIFORNIA

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PRELIMINARY

BENCHMARK N/A ELEVATION N/A
SACRAMENTO COUNTY LIDAR CONTOURS.

RECORD DRAWINGS

ENGR. INIT. DATE

DESIGNED BY: AS
DRAFTED BY: AS
CHECKED BY: RR

DRAINAGE STUDY
FOR
5601 GIBBONS DRIVE
PROPOSED SHED MAP
SACRAMENTO COUNTY STATE OF CALIFORNIA

AWE
AREA WEST ENGINEERS, INC.
ENGINEERING - SURVEYING - PLANNING
7478 SANDALWOOD DRIVE, SUITE 400
CITRUS HEIGHTS, CA 95621
(916) 725-5551 (916) 725-5808 (FAX)
AWE@AREAWESTENG.COM

REVISIONS

#	DESCRIPTION	ENGR. INIT.	APPROVAL APPROVED BY	APPROVAL DATE

SCALE
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VERT.: N/A
DATE: APRIL 2023

JOB NO. 22034
SHEET 1 OF 1

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Appendix 4 – NRCS Soil Report

United States Department of Agriculture

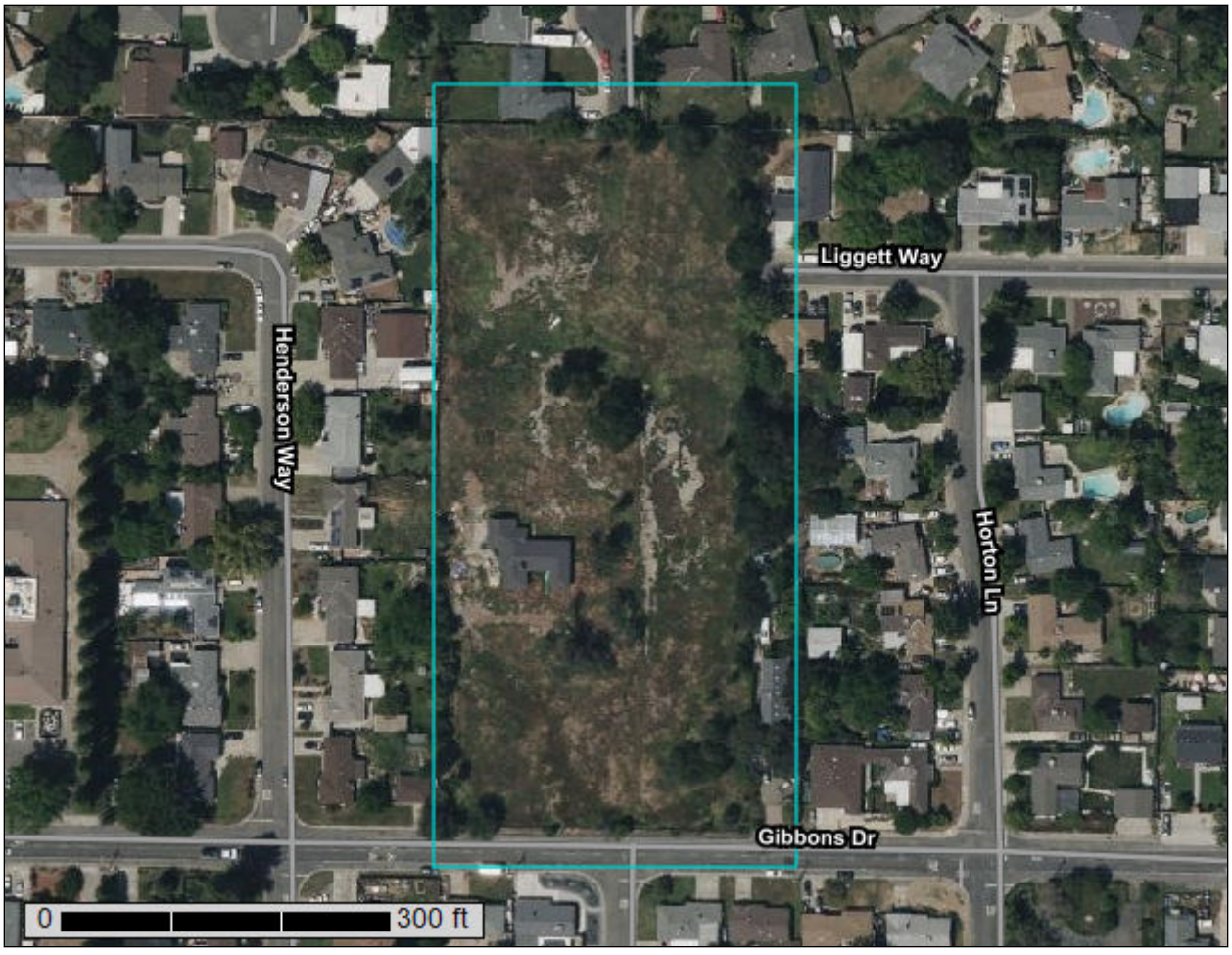
NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Sacramento County, California

22034



March 23, 2023

Preface

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

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

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

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

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

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

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Contents

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

Map Scale: 1:1,270 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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 22, Sep 1, 2022

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

Date(s) aerial images were photographed: Apr 23, 2022—Apr 24, 2022

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
229	Urban land-Xerarents-Fiddyment complex, 0 to 8 percent slopes	5.4	100.0%
Totals for Area of Interest		**5.4**	**100.0%**

Map Unit Descriptions

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

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

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

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

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

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

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

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

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

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

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

Sacramento County, California

229—Urban land-Xerarents-Fiddyment complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: hhqc
Elevation: 0 to 2,500 feet
Mean annual precipitation: 19 inches
Mean annual air temperature: 61 degrees F
Frost-free period: 230 to 300 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 40 percent
Xerarents and similar soils: 30 percent
Fiddyment and similar soils: 15 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Typical profile

H1 - 0 to 6 inches: variable

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Description of Xerarents

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 60 inches: variable

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Ecological site: R017XY905CA - Dry Alluvial Fans and Terraces
Hydric soil rating: No

Description of Fiddyment

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 8 inches: fine sandy loam
H2 - 8 to 15 inches: loam
H3 - 15 to 28 inches: sandy clay loam
H4 - 28 to 40 inches: indurated
H5 - 40 to 50 inches: weathered bedrock

Properties and qualities

Slope: 1 to 8 percent
Depth to restrictive feature: 28 to 40 inches to duripan; 40 to 50 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: R017XY902CA - Duripan Vernal Pools
Hydric soil rating: No

Minor Components

Kaseberg

Percent of map unit: 7 percent
Hydric soil rating: No

Orangevale

Percent of map unit: 6 percent
Hydric soil rating: No

Unnamed, shallow

Percent of map unit: 2 percent
Hydric soil rating: No

Appendix 5 – SacCalc Reports

Sacramento Hydrologic Calculator Report

March 24, 2023 8:32

Project Title: 22034
Comments: EXISTING MODEL FOR 5601 GIBBONS DRIVE ...REVISION DATE - 03/10/2023
Prepared by: AWE
Method: Sacramento County HEC-1 method
Date: 8/18/2022

Watershed Hydrologic Summary Data

Watershed	Area (acres)	Mean Elevation (ft)	Lag Times		Basin "n"		Loss Rates		Percent Impervious	
			Method	Lag Time (min)	Method	Basin "n"	Method	Loss Rate (in/hr)	Method	Impervious Area (%)
E-ONS1	1.68	120.5	Basin "n"	-	Computed	-	Computed	-	Computed	-
E-ONS2	2.48	120	Basin "n"	-	Computed	-	Computed	-	Computed	-
OFF1	15.77	124	Basin "n"	-	Computed	-	Computed	-	Computed	-
OFF2	13.99	121	Basin "n"	-	Computed	-	Computed	-	Computed	-

Basin “n” Method Data for Lag Time Computation

Watershed	Channel Length (ft)	Centroid Length (ft)	Slope (ft/ft)	Channelization	Land Use Impervious Area Percent (% or acres)																
					95	90	85	80	75	70	60	50	40	30	25	20	15	10	5	2	1	1*
E-ONS1	234	154	0.03	Undeveloped																100		
				Developed																0		
E-ONS2	400	201	0.02	Undeveloped															100			
				Developed															0			
OFF1	936	474	0.015	Undeveloped				0			0		0									
				Developed				19			71		10									
OFF2	1020	440	0.012	Undeveloped									0									
				Developed									100									

Refer to the Drainage manual for Land Use Impervious Area Percent

*Dense Oaks, Shrubs, Vines

Infiltration Loss Rate Data

Watershed	Soil Cover Group	Land Use Impervious Area Percent (% or acres)																	
		95	90	85	80	75	70	60	50	40	30	25	20	15	10	5	2	1	1*
E-ONS1	B																		
	C																		
	D																100		
E-ONS2	B																		
	C																		
	D															100			
OFF1	B																		
	C																		
	D				19			71		10									
OFF2	B																		
	C																		
	D									100									

Refer to the help file for Land Use Impervious Area Percent

*Dense Oaks, Shrubs, Vines

View HEC-1 output

Sacramento method results
(Project: 22034)
(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)
E-ONS1	4.7	12:05	.00			
OFF1	43.	12:06	.02			
A1	48.	12:06	.03			
E-ONS2	6.0	12:07	.00			
OFF2	35.	12:07	.02			
A2	41.	12:07	.03			

Sacramento Hydrologic Calculator Report

April 25, 2023 8:59

Project Title: 22034
Comments: PROPOSED MODEL FOR 5601 GIBBONS DRIVE ...REVISION DATE - 04/24/2023
Prepared by: AWE
Method: Sacramento County HEC-1 method
Date: 8/18/2022

Watershed Hydrologic Summary Data

Watershed	Area (acres)	Mean Elevation (ft)	Lag Times		Basin "n"		Loss Rates		Percent Impervious	
			Method	Lag Time (min)	Method	Basin "n"	Method	Loss Rate (in/hr)	Method	Impervious Area (%)
P-ONS1	1.76	120.5	Basin "n"	-	Computed	-	Computed	-	Specified	2
P-ONS2	2.4	120	Basin "n"	-	Computed	-	Computed	-	Computed	-
E-OFF1	15.77	124	Basin "n"	-	Computed	-	Computed	-	Computed	-
E-OFF2	13.99	121	Basin "n"	-	Computed	-	Computed	-	Computed	-

Basin “n” Method Data for Lag Time Computation

Watershed	Channel Length (ft)	Centroid Length (ft)	Slope (ft/ft)	Channelization	Land Use Impervious Area Percent (% or acres)																
					95	90	85	80	75	70	60	50	40	30	25	20	15	10	5	2	1	1*
P-ONS1	396	140	0.011	Undeveloped									0									
				Developed									100									
P-ONS2	450	190	0.012	Undeveloped									0									
				Developed									100									
E-OFF1	936	474	0.015	Undeveloped				0			0		0									
				Developed				19			71		10									
E-OFF2	1020	440	0.012	Undeveloped									0									
				Developed									100									

Refer to the Drainage manual for Land Use Impervious Area Percent

*Dense Oaks, Shrubs, Vines

Infiltration Loss Rate Data

Watershed	Soil Cover Group	Land Use Impervious Area Percent (% or acres)																	
		95	90	85	80	75	70	60	50	40	30	25	20	15	10	5	2	1	1*
P-ONS1	B																		
	C																		
	D									100									
P-ONS2	B																		
	C																		
	D									100									
E-OFF1	B																		
	C																		
	D				19			71		10									
E-OFF2	B																		
	C																		
	D									100									

Refer to the help file for Land Use Impervious Area Percent

*Dense Oaks, Shrubs, Vines

View HEC-1 output

Sacramento method results
(Project: 22034)
(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)
P-ONS1	5.9	12:03	.00			
E-OFF1	43.	12:06	.02			
P-JN1	48.	12:05	.03			
P-ONS2	7.7	12:03	.00			
E-OFF2	35.	12:07	.02			
P-JN2	41.	12:07	.03			

Appendix 6 – LID Spreadsheet

Appendix D-1: Residential Sites: Low Impact Development (LID) Credits and Treatment BMP Sizing Calculations

Name of Drainage Shed: Proposed North Shed
Location of project: Sacramento

Fill in Blue Highlighted boxes

Step 1 - Open Space and Pervious Area Credits

Is your project within the drainage area of a common drainage plan that includes open space? If not, skip to 1 b.

1 a. Common Drainage Plan Area		acres	A_{CDP}	
Common Drainage Plan Open Space (Off-project)	0	acres	A_{OS}	see area example below
a. Natural storage reservoirs and drainage corridors	0	acres		
b. Buffer zones for natural water bodies	0	acres		
c. Natural areas including existing trees, other vegetation, and soil	0	acres		
d. Common landscape area/park	0	acres		
e. Regional Flood Control/Drainage basins	0	acres		
1 b. Project Drainage Shed Area (Total)	0.16	acres	A	
Project-Specific Open Space (In-project, communal)**	0.00	acres	A_{PSOS}	see area example below
a. Natural storage reservoirs and drainage corridors	0.00	acres		
b. Buffer zones for natural water bodies	0.00	acres		
c. Natural areas including existing trees, other vegetation, and soil	0.00	acres		
d. Landscape area/park	0.00	acres		
e. Flood Control/Drainage basins	0.00	acres		

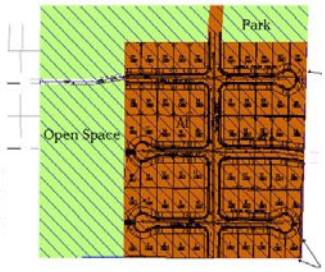
** Doesn't include impervious areas within individual lots and surrounding individual units. That is accounted for below using Form D-1a in Step 2.

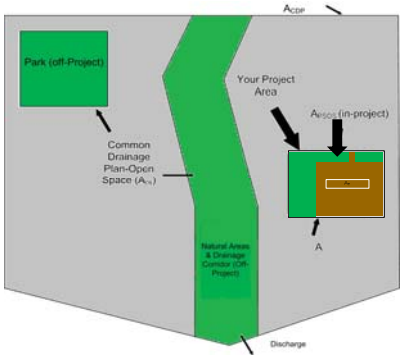
Area with Runoff Reduction Potential	$A - A_{PSOS}$ =	0.16	acres	A_T
Number of Units in A_T		1		
Number of units per acre in A_T	DU/A_T =	7	DUA	
Assumed Initial Impervious Fraction of A_T (determined using Table D-1a)		0.5	I	

Open Space & Pervious Area LID Credit (Step 1)
$(A_{OS}/A_{CDP}+A_{PSOS}/A)x100$ = 0 pts

Table D-1a

Dwelling units per acre	Imperviousness
1	0.17
2	0.25
3,4	0.35
5,6	0.40
7	0.50
8,9	0.55
10-14	0.60
15-20	0.70





Step 2 - Runoff Reduction Credits

Runoff Reduction Measures		Effective Area Managed (A_C)	
Disconnected Roof Drains (see Fact Sheet)	use Form D-1a for credits →	0.03	acres
Disconnected Pavement (see Fact Sheet)	use Form D-1b for credits →	0.00	acres
Interceptor Trees (see Fact Sheet)	use Form D-1c for credits →	0.00	acres
Alternative Driveway Design (see Fact Sheet)	use Form D-1d for credits →	0.00	acres
Total Effective Area Managed (Credit Area)	A_C	0.03	acres EAM

Runoff Reduction Credit (Step 2) $(A_C / A_T)*100$ = 16 pts

Form D-1a: Disconnected Roof Drains Worksheet

See Fact Sheet for more information regarding Disconnected Roof Drain credit guidelines

Effective Area Managed (A_C)

1. Determine efficiency Multiplier

Runoff is directed to a dispersal trench or dry well (Type A and B soils only)		1.00
Runoff is directed across landscaping, determine setback		
25 ft +	Use multiplier of	1.00
≥ 20 and < 25 ft	Use multiplier of	0.90
≥ 15 and < 20 ft	Use multiplier of	0.70
≥ 10 and < 15 ft	Use multiplier of	0.45
≥ 5 and < 10 ft	Use multiplier of	0.25

Efficiency Multiplier → 0.90 Box J1

2. Determine percentage of roof drains disconnected → 100.0% Box J2

3. Select project density in dwelling units per acre:

1	Use reduction factor of	0.08
2	Use reduction factor of	0.13
3,4	Use reduction factor of	0.19
5,6	Use reduction factor of	0.23
7	Use reduction factor of	0.29
8,9	Use reduction factor of	0.33
10-14	Use reduction factor of	0.37
15-20	Use reduction factor of	0.44

Reduction Factor → 0.29 Box J3

4. Determine Area Managed

Multiply Box J3 by A_T, and enter the result in Box J4: 0.0 acres Box J4

5. Multiply Boxes J1, J2 and J4, and enter 60% of the Result in Box J: 0.0 acres Box J

This is the amount of area credit to enter into the "Disconnected Roof Drains" Box of Form D-1

Form D-1b: Disconnected Pavement Worksheet

See Fact Sheet for more information regarding NDC Pavement credit guidelines

Effective Area Managed (A_C)

Divided Sidewalks

1. Determine percentage of units with divided Sidewalks: Box K1

Multiply Box K1, A_T, and 0.04 and enter 60% of the result in Box K: 0.00 acres Box K

This is the amount of area credit to enter into the "Disconnected Pavement" Box of Form D-1

Form D-1c: Interceptor Tree Worksheet

See Fact Sheet for more information regarding Interceptor Tree credit guidelines

Effective Area Managed (A_C)

New Evergreen Trees

1. Enter number of new evergreen trees that qualify as Interceptor Trees in Box L1: trees Box L1

2. Multiply Box L1 by 200 and enter result in Box L2: 0 sq. ft. Box L2

New Deciduous Trees

3. Enter number of new deciduous trees that qualify as Interceptor Trees in Box L3: 2 trees Box L3

4. Multiply Box L3 by 100 and enter result in Box L4: 200 sq. ft. Box L4

Existing Tree Canopy

5. Enter square footage of existing tree canopy that qualifies as Existing Tree canopy in Box L5: sq. ft. Box L5

6. Multiply Box L5 by 0.5 and enter the result in Box L6: 0 sq. ft. Box L6

Total Interceptor Tree Credits

Add Boxes L2, L4, and L6 and enter it into Box L7: 200 sq. ft. Box L7

Divide Box L7 by 43,560 and multiply by 20% to get effective area managed and enter the result in Box L8: 0.00 acres Box L8

This is the amount of area credit to enter into the "Interceptor Trees" Box of Form D-1

Form D-1d: Alternative Driveway Design

See Fact Sheet for more information regarding Alternative Driveway Design credit guidelines

1. Select type of driveway

Pervious Driveway:	Multiplier:
Cobblestone Block P	0.40
Pervious Concrete/A	0.60
Modular Block Porous Pavement	0.75
Porous Gravel	
Not Directly-connected	1.00

Box M1

2. Determine percentage of units with Alternative Driveways: Box M2

4. Multiply Boxes M1, M2, A_T and 0.04, and enter the result in Box M: 0.00 acres

This is the amount of area credit to enter into the "Alternative Driveway Design" Box of Form D-1

Step 3 - Runoff Management Credits

Capture and Use Credits

Impervious Area Managed by Rain barrels, Cisterns, and automatically-emptied systems

(see Fact Sheet) _____ enter gallons, for simple rain barrels — 0.00 acres

Automated-Control Capture and Use System

(see Fact Sheet, then enter impervious area managed by the system) — 0.00 acres

Bioretention/Infiltration Credits

Impervious Area Managed by Bioretention BMPs

(see Fact Sheet)

Bioretention Area _____ sq ft
Subdrain Elevation _____ inches
Ponding Depth, inches _____ inches — 0.00 acres

Impervious Area Managed by Infiltration BMPs

(see Fact Sheet)

Drawdown Time, hrs _____ drawdown_hrs_inf
Soil Infiltration Rate, in/hr _____ soil_inf_rate

Sizing Option 1: Capture Volume, acre-ft _____ capture_vol_inf — 0.00 acres

Sizing Option 2: Infiltration BMP surface area, sq ft _____ soil_surface_area — 0.00 acres

Basin or trench? Basin — approximate BMP depth 0.00 ft

Impervious Area Managed by Amended Soil or Mulch Beds

(see Fact Sheet) Mulched Infiltration Area, sq ft 600 mulch_area — 0.06 acres

Total Effective Area Managed by Capture-and-Use/Bioretention/Infiltration BMPs — 0.06 A_{LIDc}

Runoff Management Credit (Step 3) A_{LIDC}/A_T*200 = 68.6 pts

Total LID Credits (Step 1+2+3) Warning: More LID Is Required 85.0

Does project require hydromodification management? If yes, proceed to using SacHM.

Adjusted Area for Flow-Based, Non-LID Treatment $A_T - A_C - A_{LIDC}$ = 0.08 A_{AT}

Adjusted Impervious Fraction of A for Volume-Based, Non-LID Treatment $(A_T*I-A_C-A_{LIDC}) / A$ = 0.000 I_A

STOP: No additional treatment needed

Step 4a Treatment - Flow-Based (Rational Method)

Form D-1e

Calculate treatment flow (cfs): Flow = Runoff Coefficient x Rainfall Intensity x Adjusted Treatment Area

Determine C Factor using Table D-1b — C

Determine i using Table D-1c (Rainfall Intensity) — 0.18 — i

A_{AT} from Step 2 — 0.08 — A_{AT}

Flow = C * i * A_{AT} — 0.00 cfs

TABLE D-1b

Development Type	Runoff Coefficient (Rational), C
Single-family areas	0.50
Multi-units, detached	0.60
Apartment dwelling areas	0.70
Multi-units, attached	0.75
User Specified	0.00

Table D-1c

Rainfall Intensity		
Roseville	i = 0.20	in/hr
Sacramento	i = 0.18	in/hr
Folsom	i = 0.20	in/hr

Step 4b Treatment - Volume-Based (ASCE-WEF)

Calculate water quality volume (Acre-Feet): WQV = Area x Maximized Detention Volume (P_0)

Obtain A from Step 1 — 0.16 — A — _____ hrs — Specified Draw Down time

Obtain P_0: Maximized Detention Volume from figures E-1 to E-4 in Appendix E of this manual using I_A from Step 2. — 0.00 — P_0

Calculate treatment volume (acre-ft):

Treatment volume = A x (P_0 / 12) — 0.00 Acre-Feet

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