CITY OF DIXON, CALIFORNIA

DIXON INNOVATION CENTER

M&P Project No. 22-0022-00 (v.2)

DRAINAGE STUDY

February 28, 2024

PREPARED BY:

mortonpitalo

600 Coolidge Drive, Suite 140
Folsom, CA 95630
Telephone: (916) 927-2400
Fax: (916) 357-7888

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DRAINAGE STUDY

PROJECT: DIXON INNOVATION CENTER
LOCATION: CITY OF DIXON, CA
DATE: FEBRUARY 28, 2024

1. BACKGROUND

This drainage study provides design standards for storm drain facilities within the proposed Dixon Innovation Center (DIC) project. The project is located on approximately 38-acres within a portion of the City of Dixon in Solano County California (APN 0111-010-080). The project is located within the City of Dixon's Northeast Quadrant Specific Plan (NQSP). NQSP is located south of I-80, north of Vaughn Road, east of N. First Street, and west of Pedrick Road. See **Figure 1** Vicinity Map.

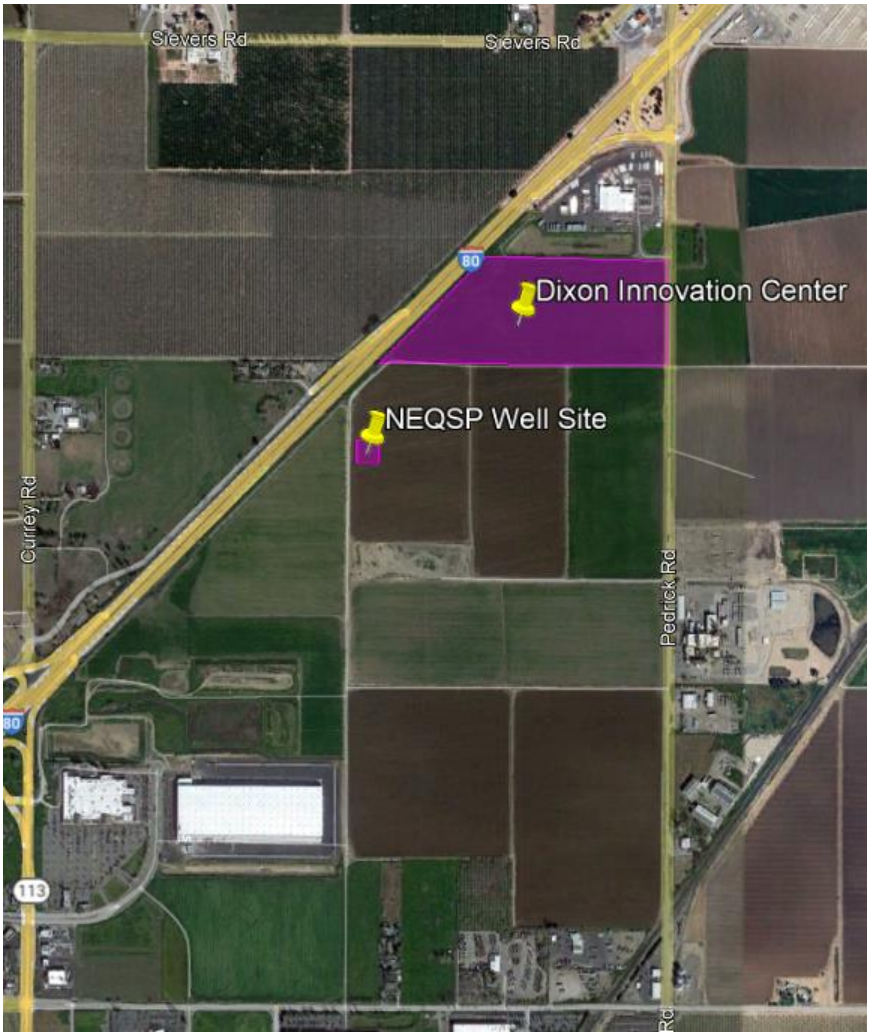


Figure 1 – Vicinity Map

The project is located within FEMA FIRM Panel 06095C0200F (revised date August 2, 2012). The project is located within Zone X, which is an area determined to be outside the 0.2% (500-year) annual chance floodplain.

2. PURPOSE

The main objective of this study is to provide the required drainage improvements necessary to serve the Dixon Innovation Center (DIC) project without an increase in flows or water surface elevations either upstream or downstream of the project consistent with the City's drainage design requirements. No specific on-site site development is proposed with this entitlement. A future first phase of development will be submitted at a later date with a Design Review application.

Per the City's Storm Drain Design Standards, storm drainage systems shall be designed to:

- ✓ *Convey the 10-year storm in the pipe system. This item will be addressed with the on-site pipe network proposed with the first on-site Design Review application.*
- ✓ *Convey the 100-year storm overland without impact to life safety or structure. This item will be addressed with the on-site pipe network proposed with the first on-site Design Review application.*
- ✓ *Retention ponds will be designed to store the 100-year, 4-day storm assuming 25% of the pond is utilized prior to the storm event. Retention ponds shall provide storage using the 100-year monthly design rainfall and utilizing the City of Dixon spreadsheet analysis as shown in Figure 4-2 of the City of Dixon Engineering Design Standards*

3. SITE HYDROLOGY

3.1. PRE-DEVELOPMENT CONDITIONS

There is currently no drainage infrastructure within the Dixon Innovation Center limits. Historically, the site area has been used for agricultural purposes. The area to the north has been hydrologically isolated from the project and is served by an on-site retention basin facility. There is no shed-on to the site and the project topography slopes generally to the east and southeast. See **Appendix A**.

3.2. POST-DEVELOPMENT CONDITIONS

The project will consist of approximately 38-acres of existing farmland which will be developed for Industrial use under a separate Design Review application. A specific development plan is not being considered with this study; rather, this study is identifying the storm drain obligations required to meet the City's drainage design criteria to mitigate off-site impacts. An on-site retention pond has been identified at the west end of the project, sized to meet the ultimate

buildout of the site with an assumed overall site impervious percentage of 85%. See **Appendix B.**

4. ON-SITE HYDROLOGIC ANALYSIS

As part of the future Design Review for development of the project, an on-site hydraulic analysis will be prepared identifying pipes sizes required and routing to meet City of Dixon Engineering Design Standards. Per the City of Dixon Engineering Design Standards, the storm drain system shall be designed to accommodate the 10-year storm event with the hydrologic grade line (HGL) at least 1.0-foot below the gutter flow line elevations. Site grading will be designed to allow on-site 100-year flows to be conveyed overland to the on-site basin without impacting life safety or structures. The proposed on-site storm drain network will be constructed in a manner to allow the system to be rerouted from the on-site basin over to the future public storm drain network in Professional Drive when available.

An additional analysis shall be performed to address 100-year overland release routing to the Professional Drive frontage at such time the on-site retention basin is no longer required.

The following criteria, set forth in the City of Dixon Engineering Design Standards, shall be used to compute the final design of the runoff and verify conformance with the proposed on-site retention basin design.

- Pipe Material RCP.
- Manning's "n" for RCP pipe is 0.013.
- Minimum storm drain main pipe size is 18 inches, the minimum diameter of a lateral from a drainage inlet to a manhole is 12 inches.
- Minimum flow velocity of at least 2.0 feet/sec flowing full.

4.1 DESIGN RUNOFF FOR WATERSHED AREAS FROM 0 TO 100-ACRES

The City of Dixon Drainage Design Standards identifies the use of runoff charts for areas up to 100-acres. These charts, Figures 4-4 & 4-6, are provided in **Appendix C.** Based on the charts, the following project peak flows have been calculated:

- ✓ 10-Year peak flow: 46.0 cfs
- ✓ 100-Year peak flow: 66.0 cfs

For design purposes, this analysis has assumed an 85% impervious percentage for the proposed industrial land use.

4.2 RETENTION BASIN DESIGN

The on-site retention basin, designed per City standards DS4-9, will be utilized to retain on-site stormwater accumulations. The retention pond was sized to accommodate ultimate buildout of

the site per the spreadsheet "Retention Pond Sizing" obtained from the city, per City of Dixon Engineering Design Standards, Section DS4-9 – Retention Pond Criteria. See **Appendix D.** Soil infiltration rates were obtained immediately adjacent to the site with infiltration rates of 0.5 in/day up to 11.0 in/day. An average of the various test location infiltration rates was calculated and a safety factor of 3.0 was applied to achieve a preliminary design infiltration rate of 2 inches per day. See **Appendix E** for Retention Basin sizing spreadsheet**.**

The proposed basin will provide a minimum of 42.1 acre-feet of storage with a design percolation rate of 2 inches per day, although there is evidence that a higher infiltration rate can be expected. The retention basin is proposed to be approximately 11 feet deep with no outfall. The proposed basin will remain in operation until an NEQSP piped drainage solution is available to accommodate on-site flows to a regional basin facility.

Design results were as follows:

- ✓ Pond Area: 5.16 acres (13% of the gross project area)
- ✓ Pond Depth: 11 feet including 1 foot of freeboard
- ✓ Pond Side Slopes: 4:1
- ✓ Max Pond Storage: 42.1 ac-ft

5. SUMMARY OF RESULTS

5.1 On-Site Drainage Pipe Network

The drainpipe network will be designed with the first Design Review application.

5.2 Basin Sizing

A new on-site retention basin will be constructed to mitigate the drainage impacts of the Dixon Innovation Center Project. The retention basin will provide 42.1 acre-feet of storage at a pond depth of 11 feet including a minimum of 1-foot of freeboard.

With the installation of the on-site retention basin, there will be no increase in peak flow and/or water surface elevations up shed or down shed of the project site.

5.2 NPDES Permitting

A Storm Water Pollution Prevention Plan (SWPPP) will be prepared in conformance with the State Water Resources Control Board's latest General Construction Permit Guidelines. The SWPPP will be implemented during the construction phases of the project.

6. REFERENCES

City of Dixon Engineering Design Standards, 2022

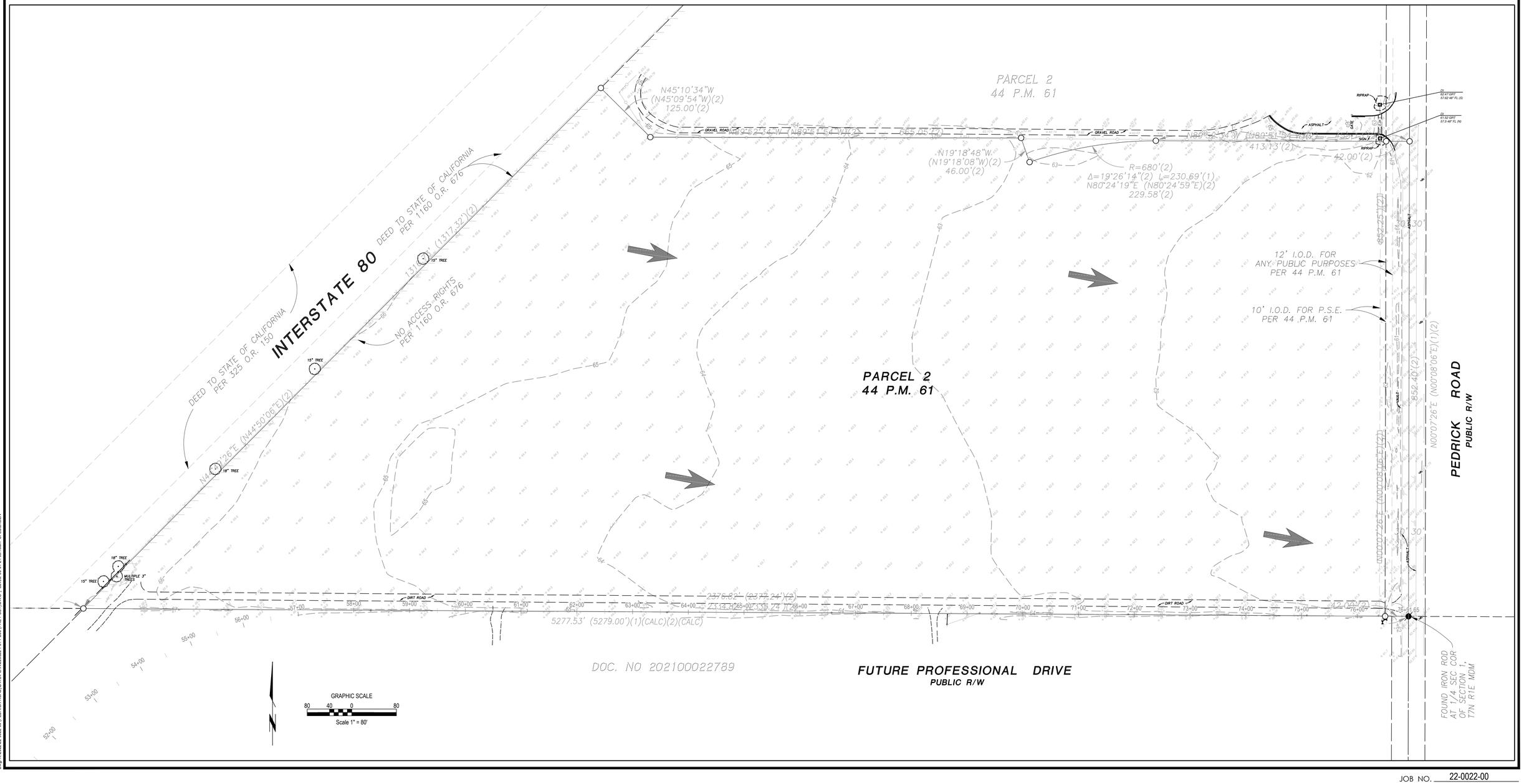
"Solano County Hydrology Manual", Solano County Water Agency, June 1999

"Drainage Alternatives for the NEQ, City of Dixon", West Yost & Associates, June 2020

APPENDIX A:

Pre-Development Drainage Watershed Map

EXHIBIT A
DIXON INNOVATION CENTER
PROJECT PRE-DEVELOPMENT DRAINAGE WATERSHED EXHIBIT (24.0228)



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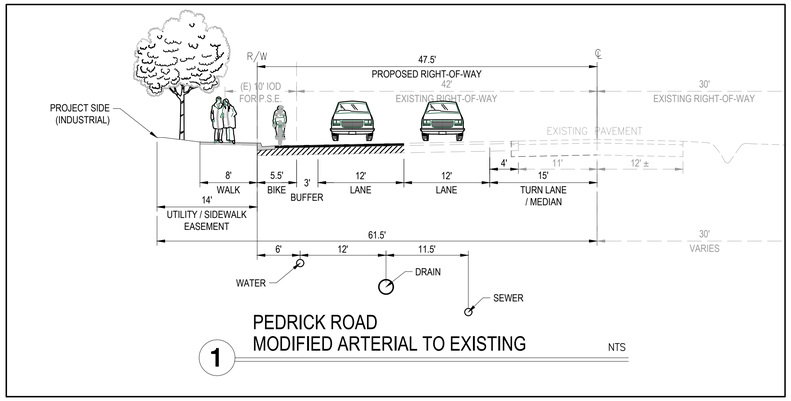
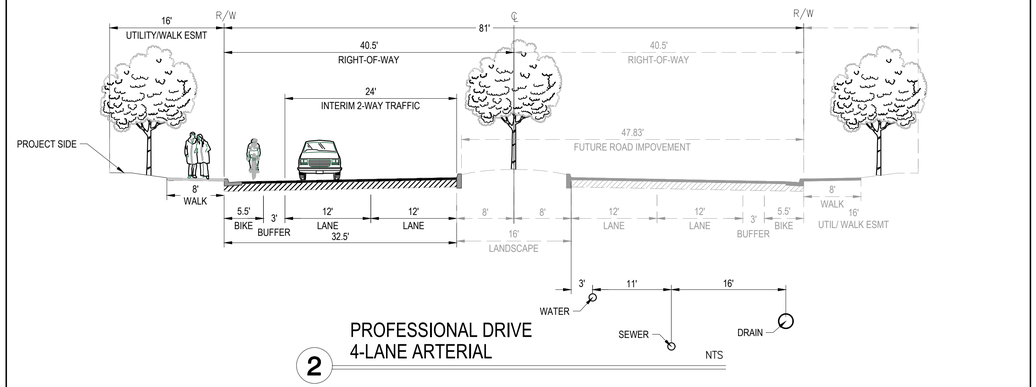
APPENDIX B:

Post-Development Drainage Watershed Map



PEDRICK ROAD
MODIFIED ARTERIAL TO EXISTING

1 NTS



PROFESSIONAL DRIVE
4-LANE ARTERIAL

2 NTS

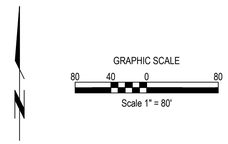
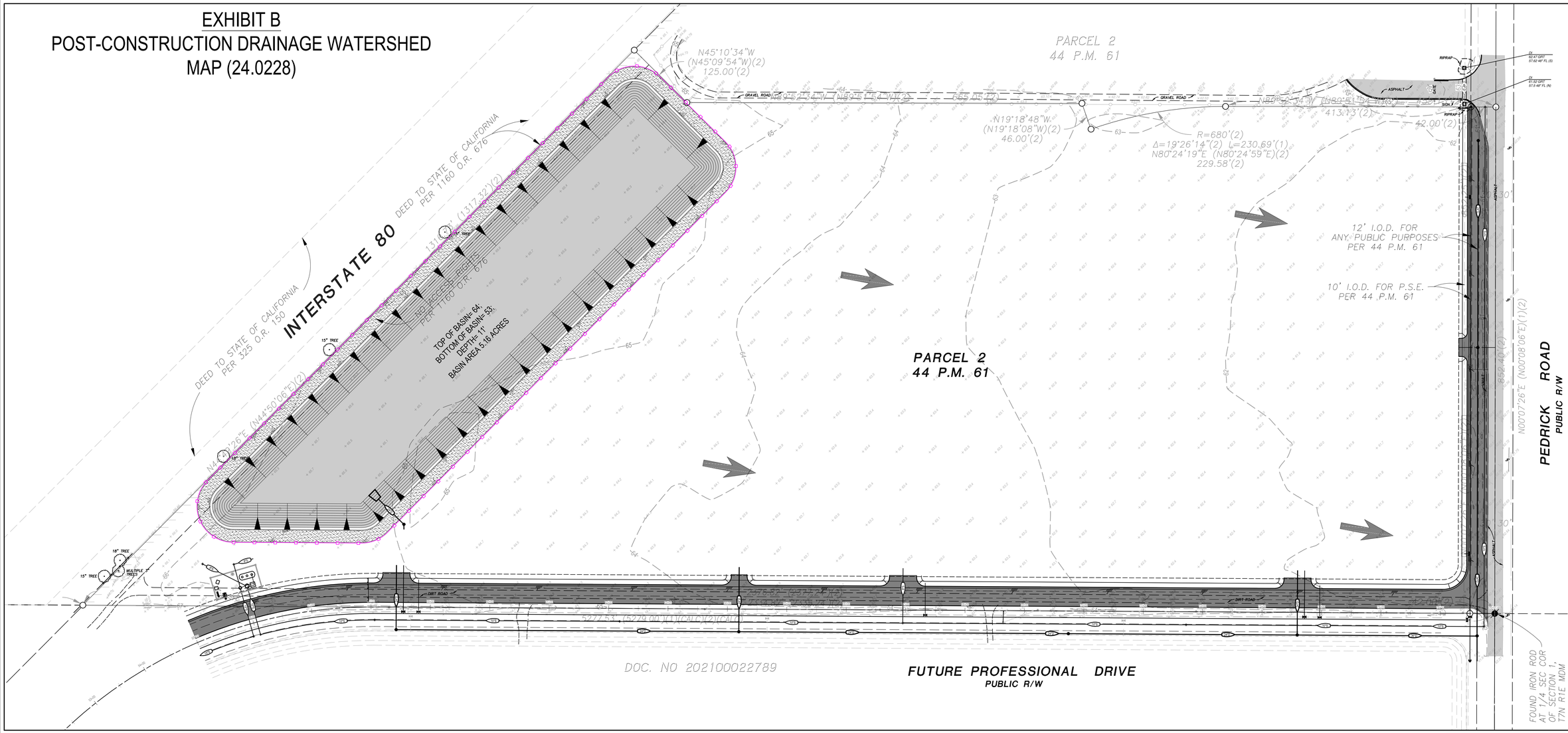


EXHIBIT B
POST-CONSTRUCTION DRAINAGE WATERSHED MAP (24.0228)



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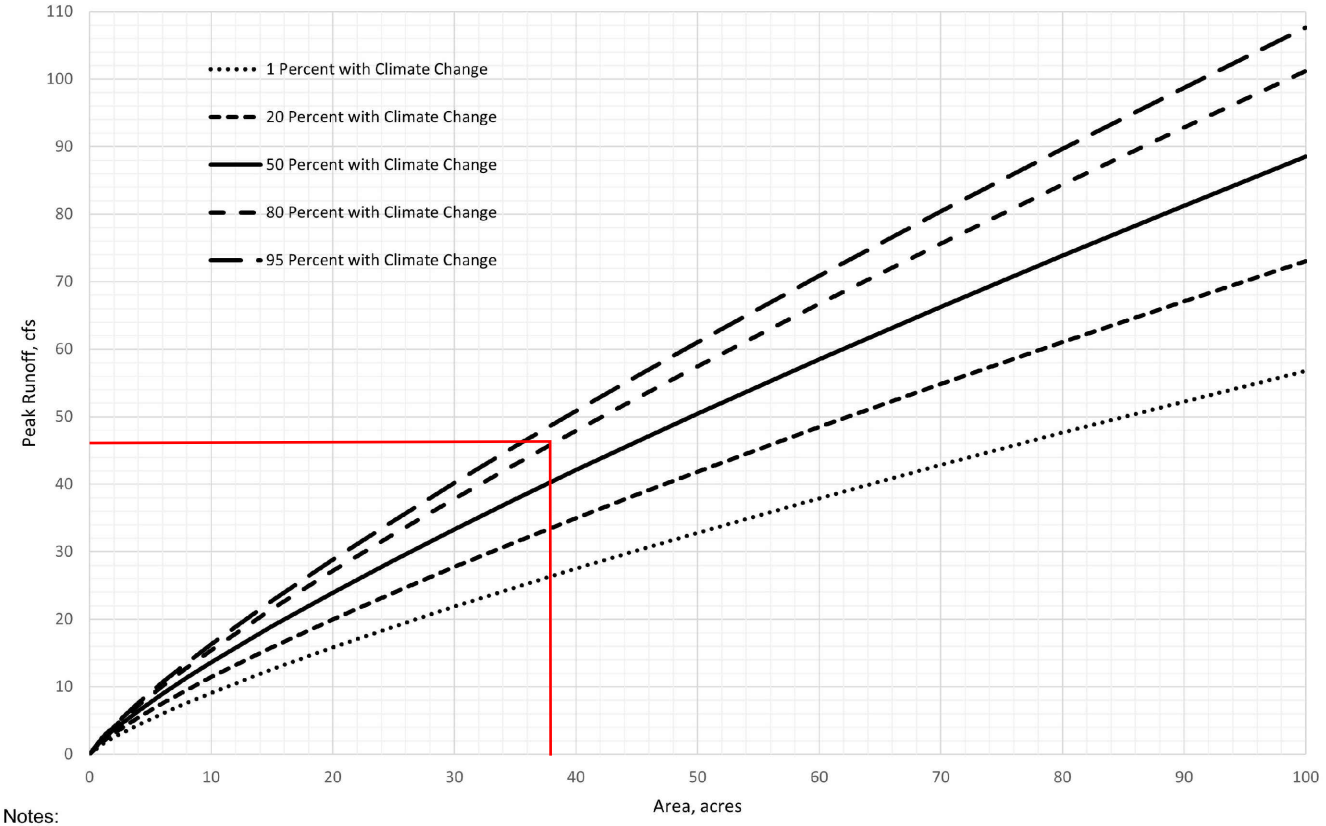
APPENDIX C:

City Design Charts



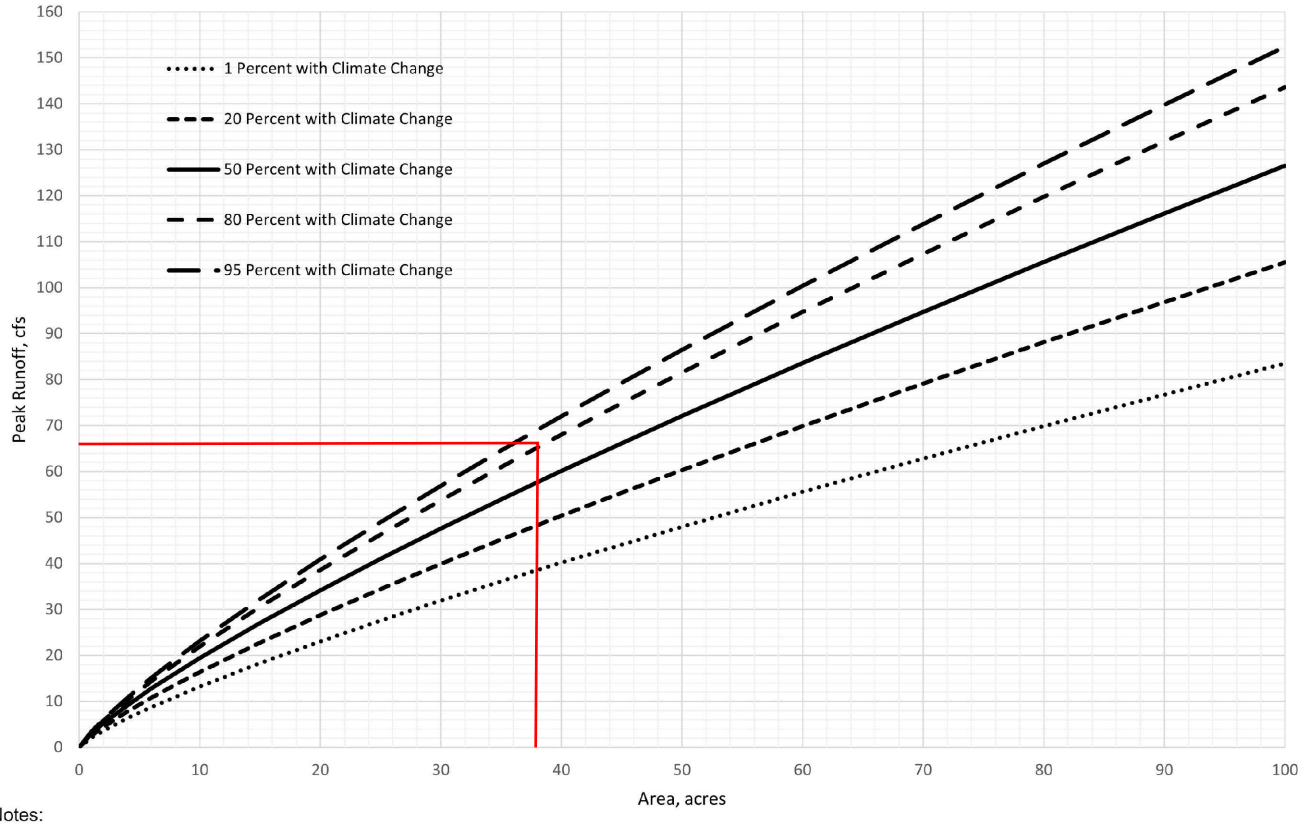
Notes:
These runoff curves for developed land were generated with the Sacramento Method in XPSWMM, as follows:
- Hydrologic soil group (HSG) D was used (for the high clay content and for compaction during construction activities).
- The watershed is fullly developed (for the channelization data).
- An average ground slope of 0.001 was used.
- The lag time parameters were calculated as length of waterhsed, $L = 737.9 * A^{0.5}$ where A = area (in acres), and $L_c = 0.5 * L$.

CITY OF DIXON
ENGINEERING
DESIGN STANDARD

Approved: March 2022

10-YEAR PEAK FLOW
80 - 640 ACRES

FIG. 4-4



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CITY OF DIXON
ENGINEERING
DESIGN STANDARD

Approved: March 2022

100-YEAR PEAK FLOW
80 - 640 ACRES

FIG. 4-6

APPENDIX D:

Post-Development On-Site Retention Basin Layout

EXHIBIT D
DIXON INNOVATION CENTER
POST-DEVELOPMENT ON-SITE RETENTION BASIN
LAYOUT (24.0228)

GRAPHIC SCALE
40 20 0 40 80
1 in = 40 ft

DEED TO STATE OF CALIFORNIA
PER 325 O.R. 150

INTERSTATE 80

DEED TO STATE OF CALIFORNIA
PER 1160 O.R. 676

N44°50'26"E (N44°50'06"E)(2)

1317.73' (1317.32')(2)

15" TREE

15" TREE

NO ACCESS RIGHTS
PER 1160 O.R. 676

TOP OF BASIN= 64;
BOTTOM OF BASIN= 53;
DEPTH= 11'
BASIN AREA 5.16 ACRES

CLR

1' FREEBOARD

INLET STRUCTURE: TO BE REMOVED
WITH DRAINAGE CONNECTION TO
NEQSP REGIONAL DRAINAGE
NETWORK

REROUTE DRAINAGE TO PUBLIC
FRONTAGE NETWORK WHEN
AVAILABLE

20' ACCESS ROAD

4:1 SIDE SLOPE

PERIMETER FENCE

CMU

DIRT ROAD

N45°10'34"W
(N45°09'54"W)(2)
125.00'(2)

GRAVEL ROAD

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APPENDIX E:

On-Site Retention Pond Calculations

Dixon Innovation Center
Preliminary Pond Sizing

Rainfall-Runoff Analysis

Impervious Acreage:	32.64	85%
Pervious Acreage:	5.76	
Total Acreage:	**38.4**	

Date	Design Rainfall	Impervious Area Runoff	Effective Rainfall	Pervious Runoff	Total Runoff
	in	ac-ft	in	ac-in	ac-ft
October	0.33	0.90	0.00	0.00	0.90
November	4.21	11.45	1.55	0.74	12.20
December	2.86	7.78	0.76	0.36	8.14
January	12.86	34.98	5.61	2.69	37.67
February	8.61	23.42	6.60	3.17	26.59
March	9.62	26.17	4.73	2.27	28.44
April	1.43	3.89	0.06	0.03	3.92
May	0.67	1.82	0.00	0.00	1.82
June	0.71	1.93	0.00	0.00	1.93
July	0.35	0.95	0.00	0.00	0.95
August	0.00	0.00	0.00	0.00	0.00
September	0.00	0.00	0.00	0.00	0.00
Total	**41.65**	**113.29**	**19.31**	**9.27**	**122.56**
Maximum	**12.86**	**34.98**	**6.60**	**3.17**	**37.67**

Retention Basin Water Balance Analysis

Retention Pond Area (acres):	5.16	25% of Maximum Volume (ac-ft):	10.5
Retention Pond Depth (ft)	11.0		
Retention Pond Side Slope (_H:1V)	4		

Start-of-Month Volume of Stored Water	Water Surface Area	Water Depth	Potential Unit Evaporation Rate	Potential Evaporation Loss	Potential Unit Percolation Loss [(a)]	Potential Percolation Loss	Total Loss	End-of-Month Volume of Stored Water
ac-ft	ac	ft	in	ac-ft	in	ac-ft	ac-ft	ac-ft
0.00	0.0	0.0	4.03	0.00	62.00	0.00	0.00	0.90
0.90	3.5	0.3	2.10	0.61	60.00	17.32	0.90	12.20
12.20	3.9	3.3	1.55	0.50	62.00	20.18	12.20	8.14
8.14	3.8	2.3	1.55	0.49	62.00	19.41	8.14	37.67
37.67	4.8	9.1	2.24	0.90	56.00	22.56	23.46	40.80
40.80	5.0	9.8	3.72	1.54	62.00	25.59	27.13	42.11
42.11	5.0	10.0	5.10	2.12	60.00	24.94	27.06	18.97
18.97	4.2	5.0	6.82	2.37	62.00	21.53	18.97	1.82
1.82	3.5	0.5	7.80	2.27	60.00	17.47	1.82	1.93
1.93	3.5	0.6	8.68	2.54	62.00	18.12	1.93	0.95
0.95	3.5	0.3	7.75	2.24	60.00	17.32	0.95	0.00
0.00	0.0	0.0	5.70	0.00	62.00	0.00	0.00	0.00
			57.04	**15.57**	**730.00**	**204.45**	**122.56**	
42.1	**5.0**	**10.0**	**8.68**	**2.54**	**62.00**	**25.59**	**27.13**	**42.1**

(a) These percolation rates are based on on-site testing and reflect 20% of the calculated percolation rate witnessed during field tesing.

Infiltration Rate (in/day): 2

Depth: 10.0