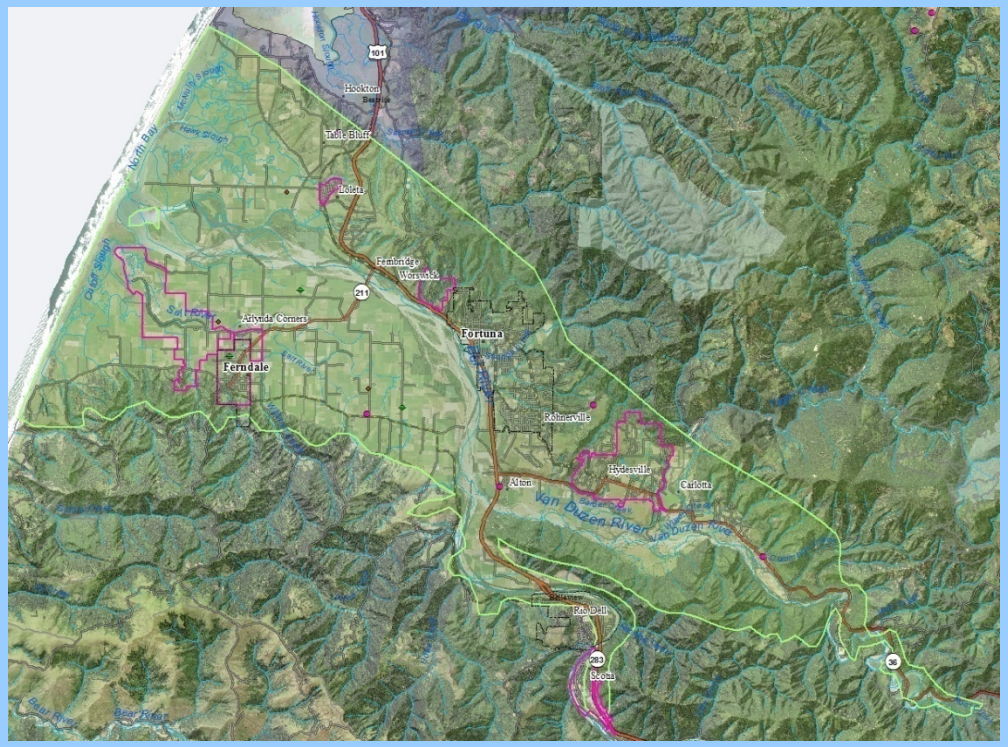
Groundwater Sustainability Plan Alternative for the Eel River Valley Groundwater Basin



Eel River Forum

Riverwalk Lodge, Fortuna

March 22, 2017

Humboldt County

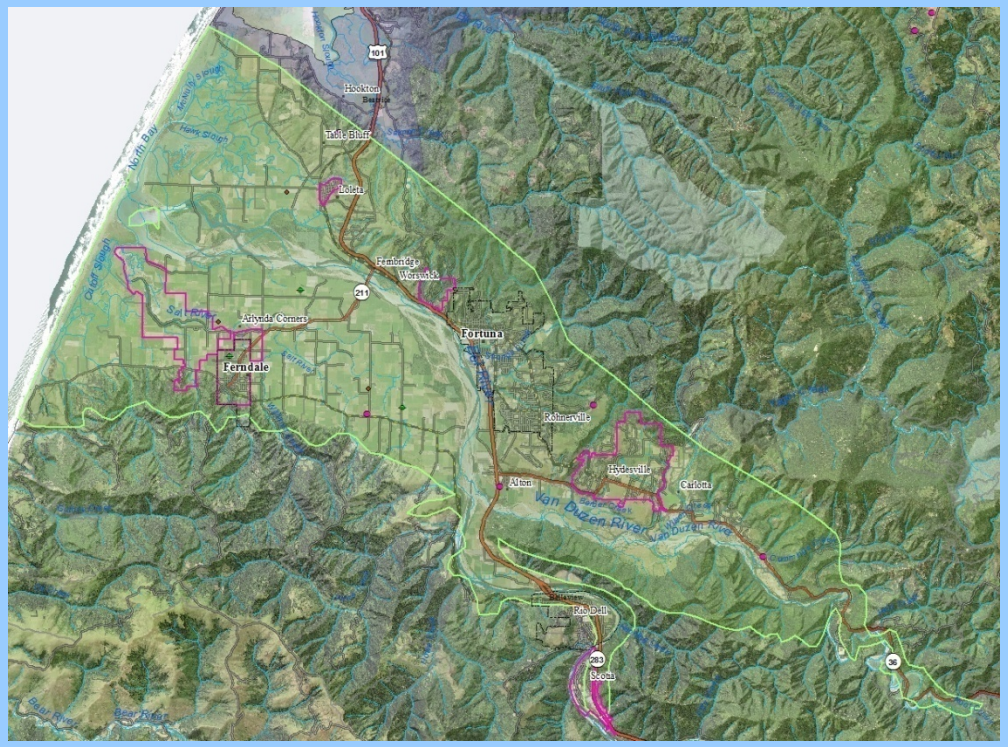
Public Works Department

Hank Seemann, Deputy-Director

Department of Public Works

http://humboldtgov.org/groundwater

Groundwater Sustainability Plan Alternative for the Eel River Valley Groundwater Basin



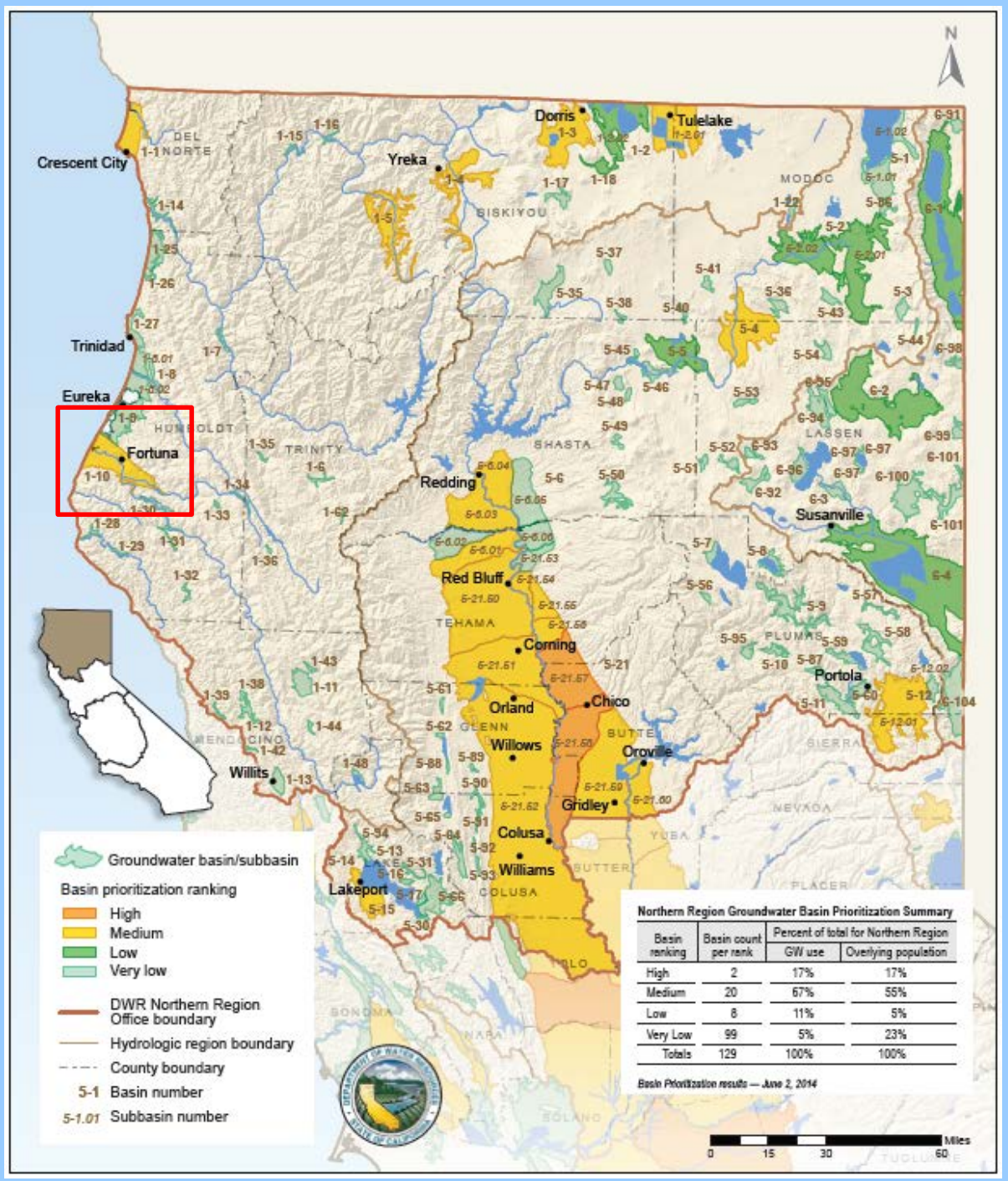
With assistance from:

Agricultural producers
Municipal water suppliers
Department of Water Resources
Eel River Valley Groundwater Working Group
Fisch Drilling
SHN Consulting Engineers and Geologists
Thomas Gast and Associates
Palmer Environmental Consulting Group
Humboldt County Resource Conservation District
UC-Cooperative Extension
USDA-NRCS
Humboldt County Farm Bureau
Don and Cheryl Laffranchi
Pat Higgins
David Sopjes
Eric Stockwell

Department of Public Works

http://humboldtgov.org/groundwater

Ranking of Groundwater Basin Importance – Northern California



Northern Region Groundwater Basin Prioritization Summary

Basin ranking	Basin count per rank	Percent of total for Northern Region	
		GW use	Overlying population
High	2	17%	17%
Medium	20	67%	55%
Low	8	11%	5%
Very Low	99	5%	23%
Totals	129	100%	100%

Basin Prioritization results — June 2, 2014

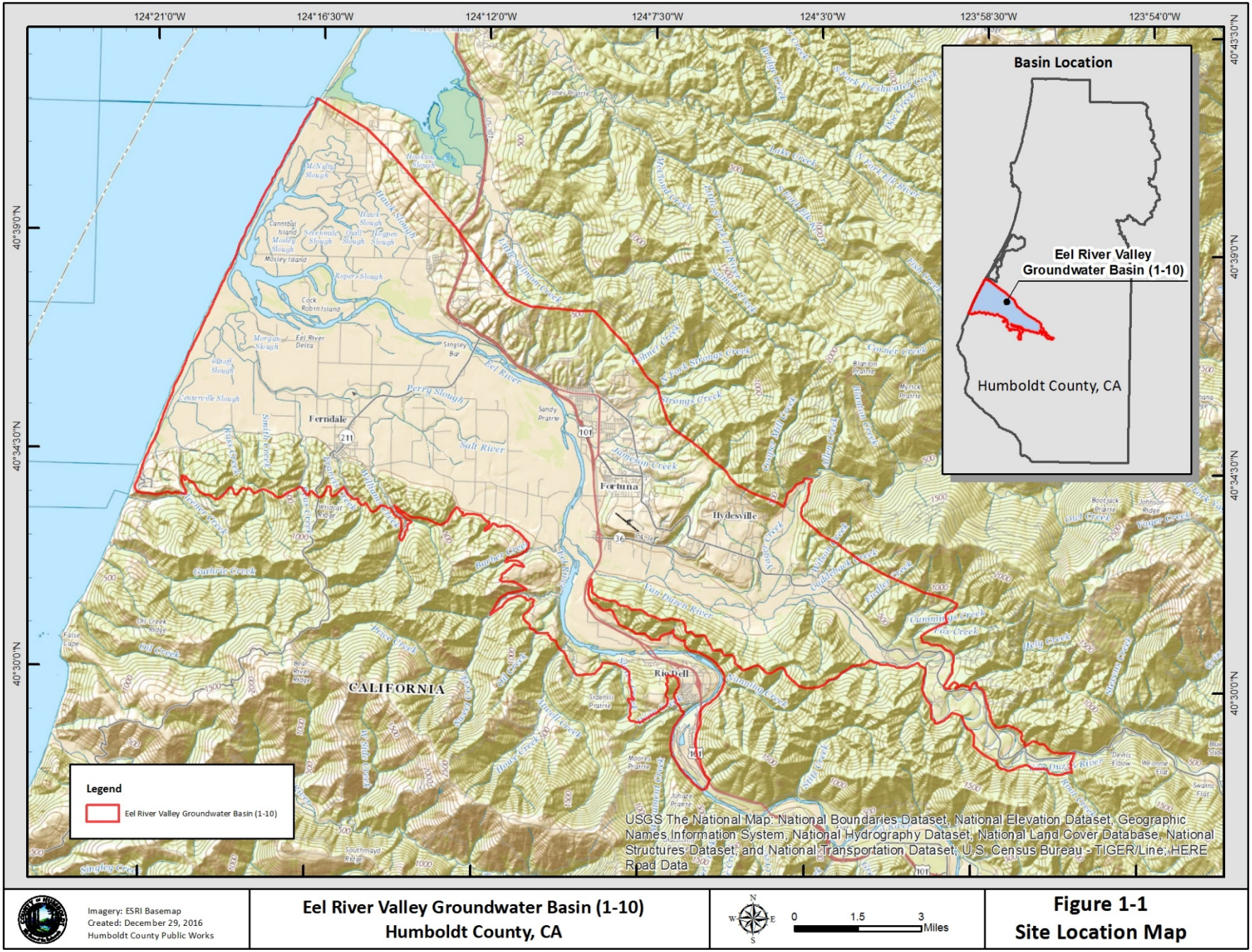
Eight criteria:

1. Population density
2. Population growth
3. Public supply wells
4. Total wells
5. Irrigated acreage
6. Groundwater reliance
7. Documented impacts
8. Other information

Table 3. Data Component Ranking Ranges for CASGEM Groundwater Basin Ranking

Ranking	Ranking Value	Data Components and Ranking Ranges						
		Population		PSW Density	Total Well Density	Irrigated Acreage	Groundwater Reliance	
		Density	Projected Growth				GW Use	% of Total Supply [1]
		per sq.-mi	%	per sq.-mi	per sq. mi	ac/sq.-mi	ac-ft/acre	%
Very Low	0	x < 7	x < 0	x = 0	x = 0	x < 1	x < 0.03	x < 0.1
Low	1	7 ≥ x < 250	0 ≥ x < 6	0 > x < 0.1	0 > x < 2	1 ≥ x < 25	0.03 ≥ x < 0.1	0.1 ≥ x < 20
Moderately Low	2	250 ≥ x < 1000	6 ≥ x < 15	0.1 ≥ x < 0.25	2 ≥ x < 5	25 ≥ x < 100	0.1 ≥ x < 0.25	20 ≥ x < 40
Medium	3	1000 ≥ x < 2500	15 ≥ x < 25	0.25 ≥ x < 0.5	5 ≥ x < 10	100 ≥ x < 200	0.25 ≥ x < 0.5	40 ≥ x < 60
Moderately High	4	2500 ≥ x < 4000	25 ≥ x < 40	0.5 ≥ x < 1.0	10 ≥ x < 20	200 ≥ x < 350	0.5 ≥ x < 0.75	60 ≥ x < 80
High	5	x ≥ 4000	x ≥ 40%	x ≥ 1.0	x ≥ 20	x ≥ 350	x ≥ 0.75	x ≥ 80%

Note:
Population growth is percent growth from 2010 to 2030.
[1] Percent of total water supply (groundwater and surface water) that is provided by groundwater.
x = component data value

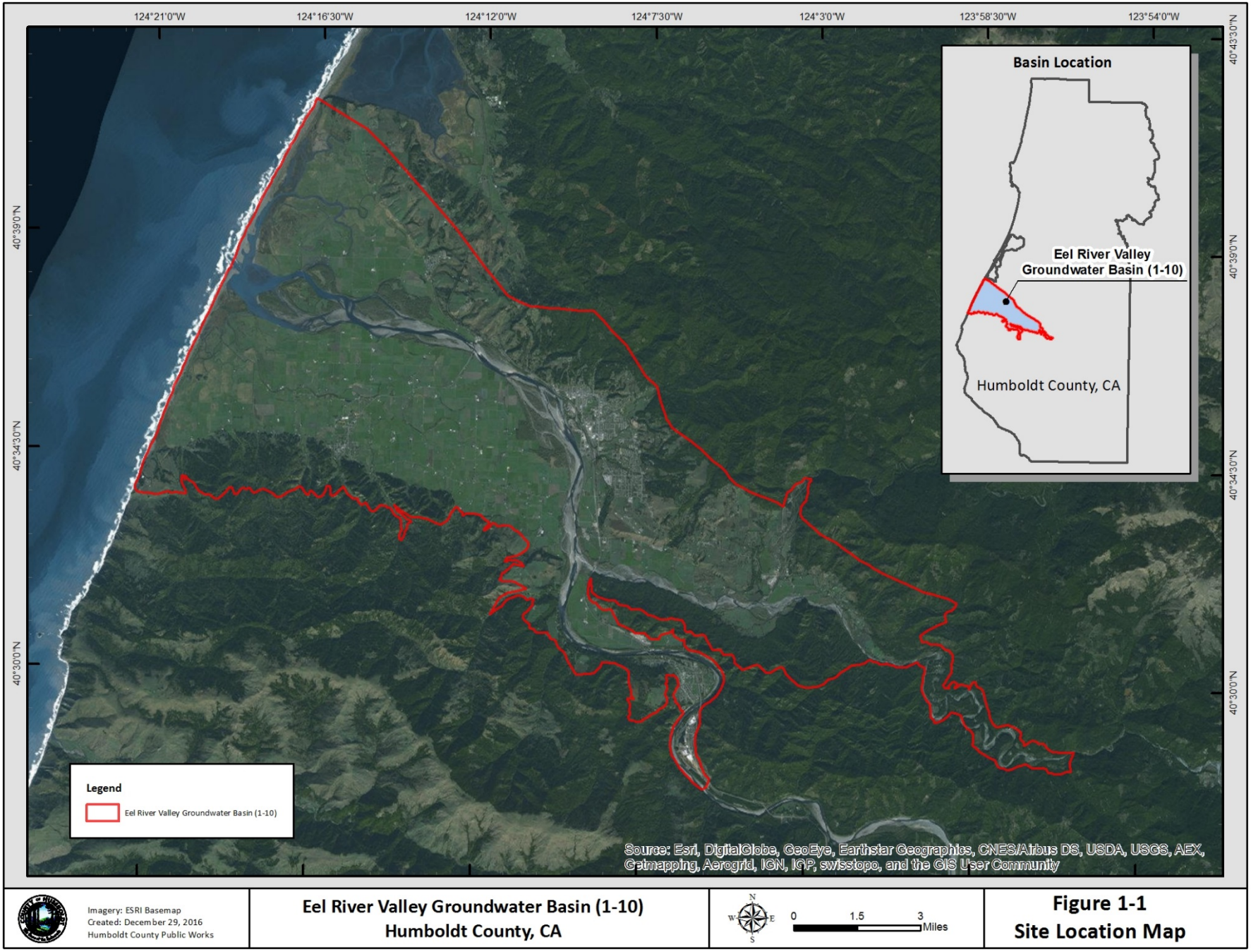


Imagery: ESRI Basemap
Created: December 29, 2016
Humboldt County Public Works

Eel River Valley Groundwater Basin (1-10)
Humboldt County, CA

0 1.5 3 Miles

Figure 1-1
Site Location Map



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Eel River Valley Groundwater Basin (1-10)
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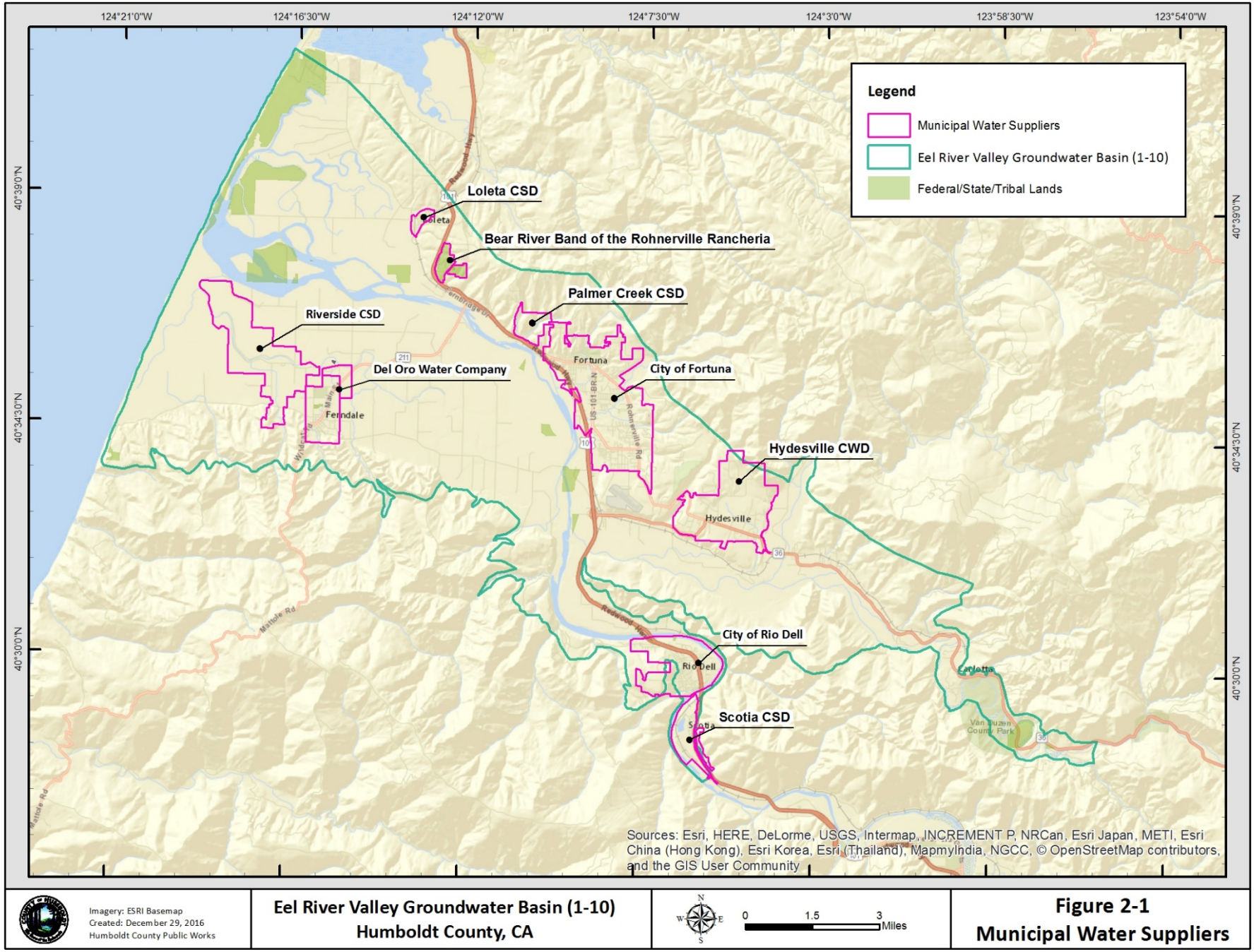
N W E S

0 1.5 3 Miles

Figure 1-1
Site Location Map



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Eel River Valley Groundwater Basin (1-10)
Humboldt County, CA

0 1.5 3 Miles

Figure 2-1
Municipal Water Suppliers

State groundwater policy established by the Sustainable Groundwater Management Act (2014)

Water Code Section 113: It is the policy of the state that groundwater resources be managed sustainably for long-term reliability and multiple economic, social, and environmental benefits for current and future beneficial uses. Sustainable groundwater management is best achieved locally through the development, implementation, and updating of plans and programs based on the best available science.

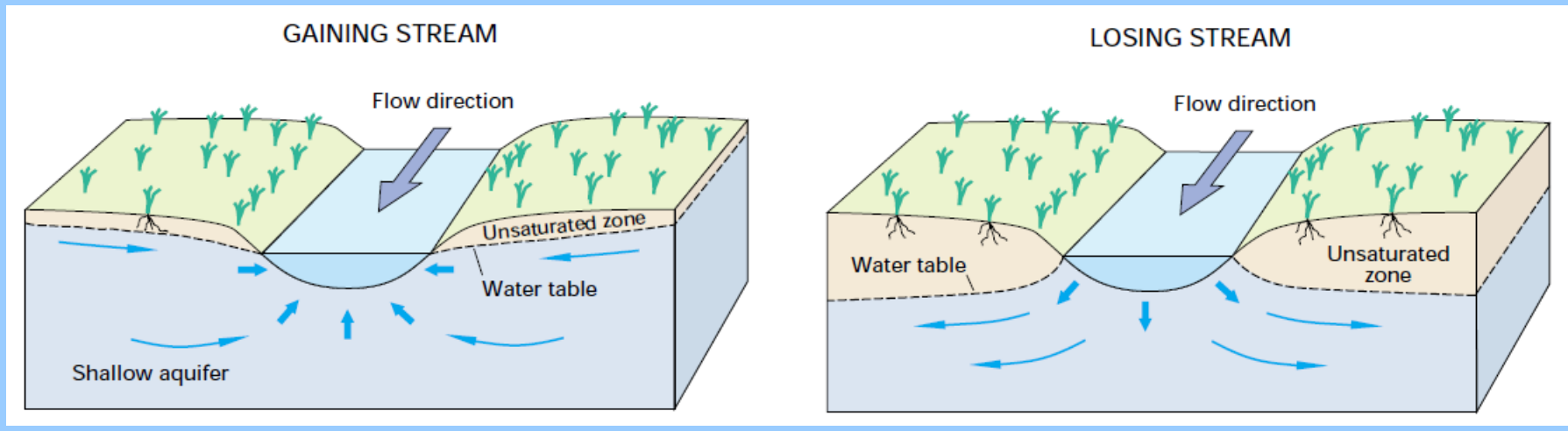
Sustainable groundwater management: the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results

Undesirable results means one or more of the following effects caused by groundwater conditions occurring throughout the basin: [*next slide*]

Six Sustainability Indicators

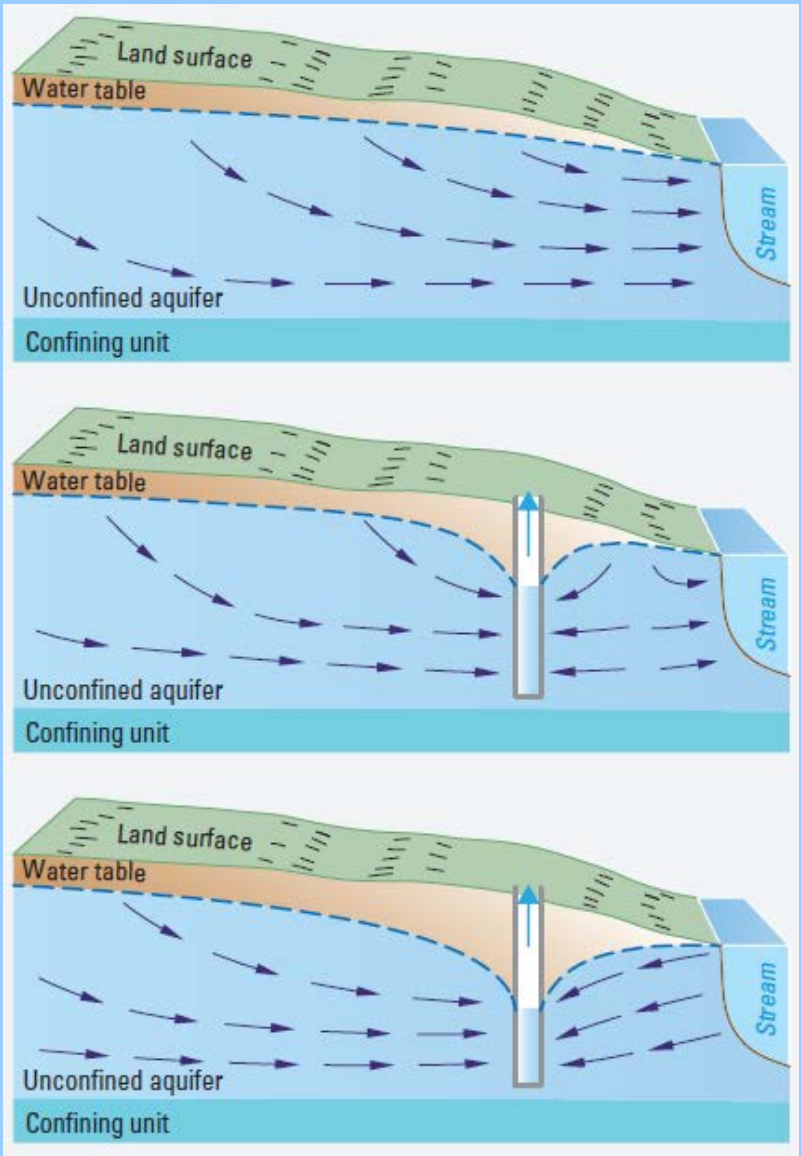
1	Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply
2	Significant and unreasonable reduction of groundwater storage
3	Significant and unreasonable seawater intrusion
4	Significant and unreasonable degraded water quality
5	Significant unreasonable land subsidence
6	Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water

Key issue: groundwater/surface water interactions



Source: USGS Circular 1139

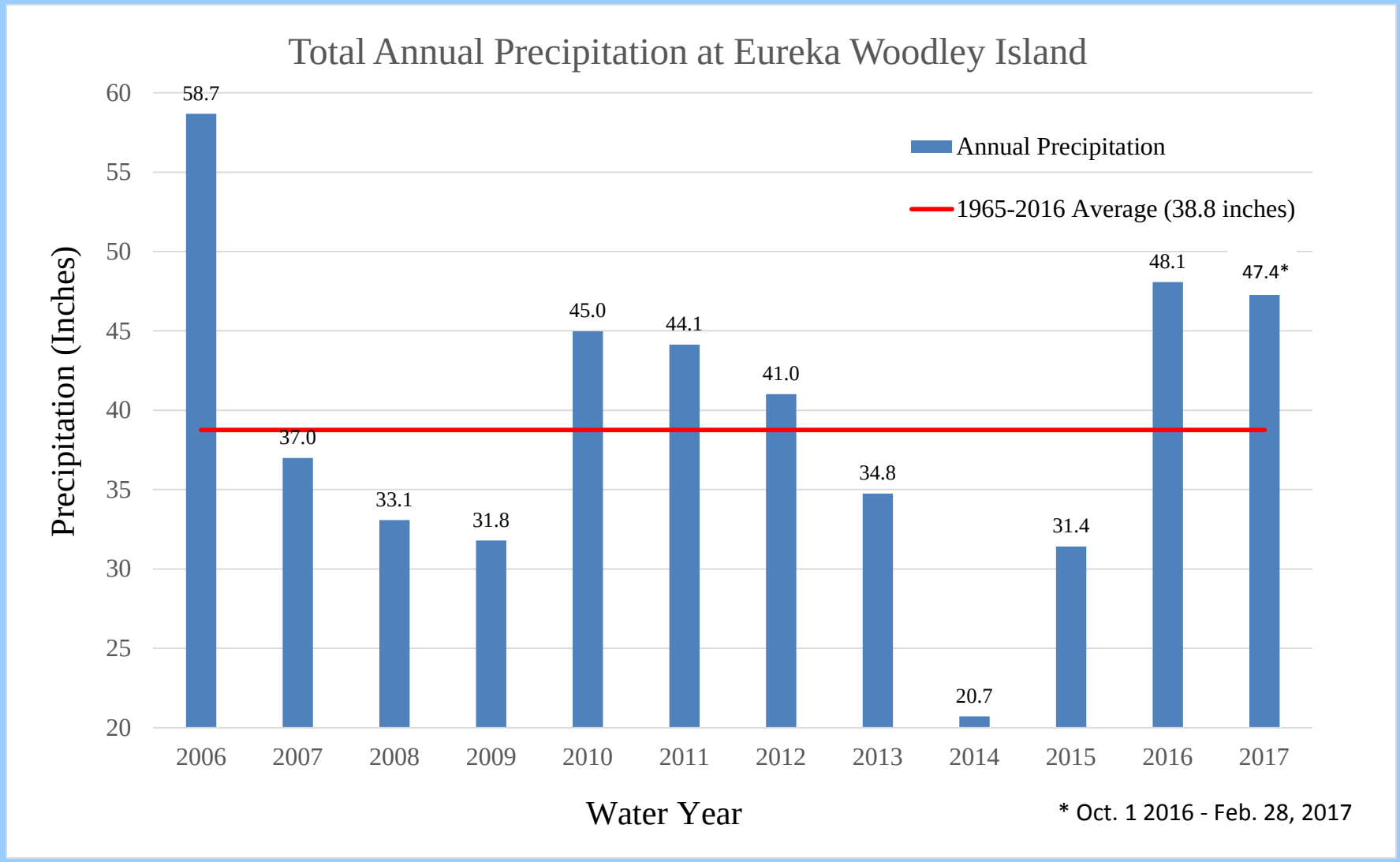
Key issue: effects of groundwater pumping on river flows



Source: USGS Circular 1139

Concern: absence of surface flow in lower Eel River, late summer 2014

Source: David Sopjes (August 29, 2014)


Total Annual Precipitation at Eureka Woodley Island
Precipitation (Inches)
60
55
50
45
40
35
30
25
20
58.7
37.0
33.1
31.8
45.0
44.1
41.0
34.8
20.7
31.4
48.1
47.4*
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
Annual Precipitation
1965-2016 Average (38.8 inches)
Water Year
* Oct. 1 2016 - Feb. 28, 2017

Source: Jason Buck (January 11, 2017)

Timeline

September 2014	Sustainable Groundwater Management Act (SGMA) passed
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Eel River Valley Groundwater Working Group

Stakeholders

- Agricultural producers
- Municipal water suppliers
- Environmental interests
- Domestic users
- Well drillers and equipment suppliers
- Local agencies
- State/federal regulatory agencies
- General public

Conditions for being a Working Group Member

1. Agree to Working Group's purpose and scope
2. Pledge to attend at least half of meetings
3. Agree to follow meeting ground rules

Benefits of being a Working Group Member

1. We acknowledge your representation of a stakeholder interest
2. We will actively solicit your input

Working Group – Updated Purpose/Scope (Sept. 12, 2016)

Purpose: Guide the local response to the Sustainable Groundwater Management Act

1. Provide information and viewpoints regarding groundwater issues in the Eel River Valley.
2. Support the collection and analysis of technical data and information to understand conditions and trends.
3. Discuss selection and formation of a Groundwater Sustainability Agency (GSA), if applicable.
4. Discuss the framework and sustainable management criteria for an Alternative Submittal or future Groundwater Sustainability Plan (GSP).

Scope: The scope of the Working Group is limited to the Eel River Valley.

Spectrum of Public Participation

	Inform	Consult	Involve	Collaborate	Empower
Public participation goal	To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunties and/or solutions.	To obtain public feedback on analysis, alternatives and/or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the devlopment of alternatives and the identification of the preferred solution.	To place final decision-making in the hands of the public.
Promise to the public	We will keep you informed.	We will keep you informed, listen to and acknowledge concerns and aspirations, and provide feedback on how public input influenced the decision.	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will look to you for advice and innovation in formulating solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible.	We will implement what you decide.
Example techniques	• Fact sheets • Web sites • Open houses	• Public comment • Focus groups • Surveys • Public meetings	• Workshops • Deliberate polling	• Citizen advisory committees • Consensus-building • Participatory decision-making	• Citizen juries • Ballots • Delegated decision

Source: Community Water Center (2015)

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Goal for Eel River Valley Groundwater Working Group

Eel River Valley Groundwater Working Group

Working Group Members (as of Sept. 12, 2016)

Ben Dolf	Dave Fisch	Frances Tjarnstrom	John Vevoda	Merritt Perry	Tom Gast
Bob McPherson	Dave Rodrigues	Jay Russ	Joseph Alexandre	Michael Wheeler	Tracy Boobar
Brad Job	Denver Nelson	Jeff Dolf	Katherine Ziemer	Patrick Sullivan	Troy Hubner
Chad Lake	Doreen Hansen	Jeff Stackhouse	Kevin Farmer	Ryan Rice	Yana Valachovic
Cheryl Laffranchi	Emily Afriat-Hyman	Jill Demers	Lee Mora	Stuart Dickey	
Clif Clendenen	Estelle Fennell	John Corbett	Marcus Drumm	Summer Daugherty	

Interested Parties: Anyone else who desires to attend and participate or follow developments

Timeline

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Aug.–Dec. 2016	Well installation, data collection, preliminary analysis
Dec. 30, 2016	Groundwater Sustainability Plan Alternative submitted (Jan. 1 deadline)

Eel River Valley Groundwater Basin Assessment

	Task	2016								2017					
		May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
1	Compilation of Existing Data and Previous Studies														
2	New Data Collection														
	2.1 Exploratory borings														
	2.2 Surface water/groundwater monitoring														
	2.3 Pump tests														
	2.4 Surface water flow measurements														
	2.5 Irrigation pump estimation														
	2.6 Water levels and chloride testing														
3	Conceptualization of Hydrogeology and River-Aquifer Exchange														
4	Water Balance														
5	Stakeholder Involvement / Initial Management Planning														
6	Grant Adminstration														

Updated: September 12, 2016

January 1, 2017: Alternative Submittal

Timeline

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April 1, 2017	End of comment period for GSP Alternative
Later in 2017	DWR to update basin prioritization and decide on GSP Alternative
Jan.–Dec. 2017	Continued data collection and analysis for Basin Assessment

SGMA compliance – three potential pathways

1. DWR changes prioritization level of Eel River Valley groundwater basin from Medium to Low
   - 8 criteria; currently 2.82 points above medium-priority threshold
   - Improved data were acquired on irrigated acreage, groundwater reliance
   - If priority level changes, SGMA activities are optional
2. Groundwater Sustainability Plan Alternative
   - Based on demonstration that basin has been managed sustainably for the last 10 years (no undesirable results)
   - Submitted on December 30, 2016; DWR to review in 2017
   - Requires annual reporting and five-year updates
   - “Local agency” can make submittal; GSA not required
3. Groundwater Sustainability Agency / Sustainability Plan
   - GSA required to prepare, adopt, implement a GSP
   - GSAs need to be established by June 30, 2017 (Plans due January 2022)
   - GSA is public agency, has powers and authorities

CALIFORNIA CODE OF REGULATIONS

TITLE 23. WATERS

DIVISION 2. DEPARTMENT OF WATER RESOURCES

CHAPTER 1.5. GROUNDWATER MANAGEMENT

SUBCHAPTER 2. GROUNDWATER SUSTAINABILITY PLANS

§ 358.2. Alternatives to Groundwater Sustainability Plans

(c) An Alternative submitted to the Department shall include the following information:

(1) An Alternative submitted pursuant to Water Code Section 10733.6(b)(1) shall include a copy of the groundwater management plan.

(2) An Alternative submitted pursuant to Water Code Section 10733.6(b)(2) that is not an adjudicated area described in Water Code Section 10720.8 shall include the following:

(A) Information demonstrating that the adjudication submitted to the Department as an Alternative is a comprehensive adjudication as defined by Chapter 7 of Title 10 of Part 2 of the Code of Civil Procedure (commencing with Section 830).

(B) A copy of the proposed stipulated judgment.

(3) An Alternative submitted pursuant to Water Code Section 10733.6(b)(3) shall provide information that demonstrates the basin has operated within its sustainable yield over a period of at least 10 years. Data submitted in support of this Alternative shall include continuous data from the end of that 10-year period to current conditions.

(d) The entity submitting an Alternative shall explain how the elements of the Alternative are functionally equivalent to the elements of a Plan required by Articles 5 and 7 of this Subchapter and are sufficient to demonstrate the ability of the Alternative to achieve the objectives of the Act.

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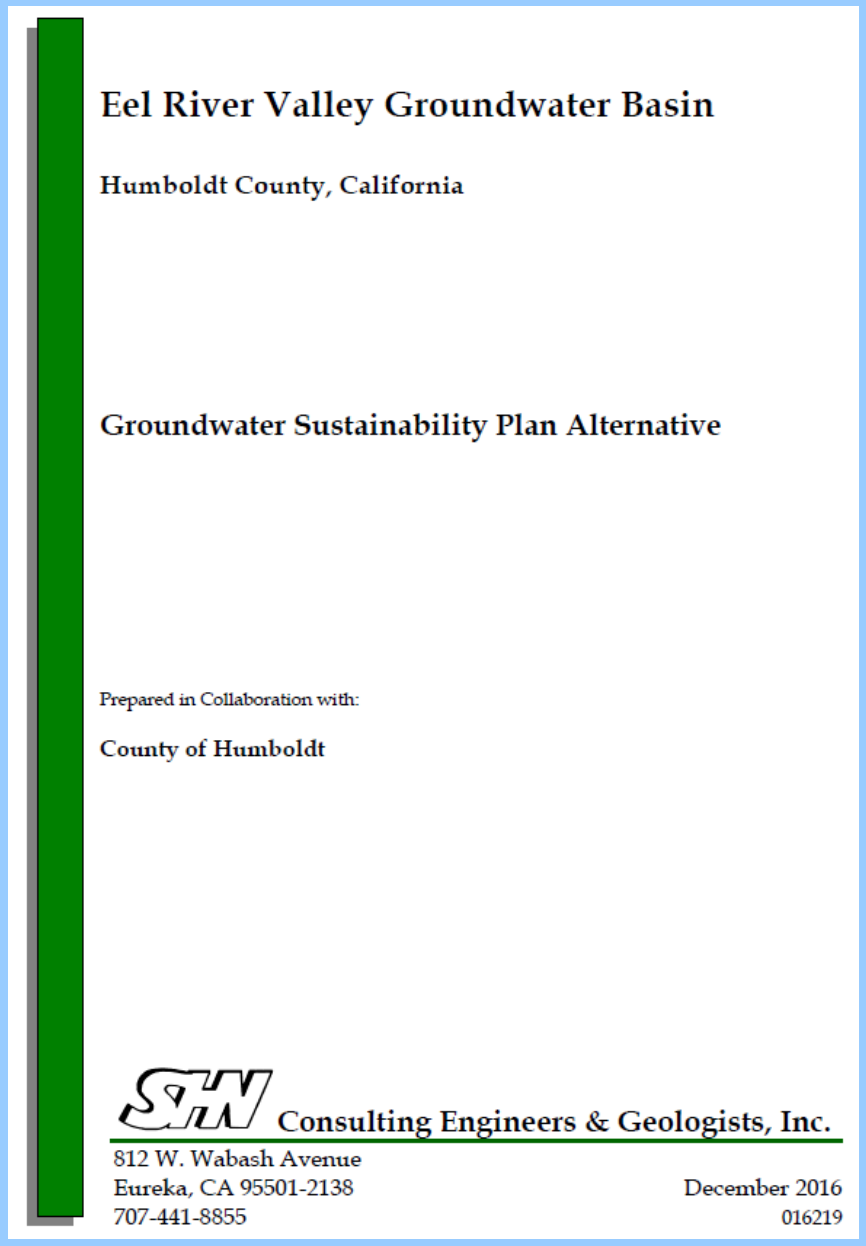
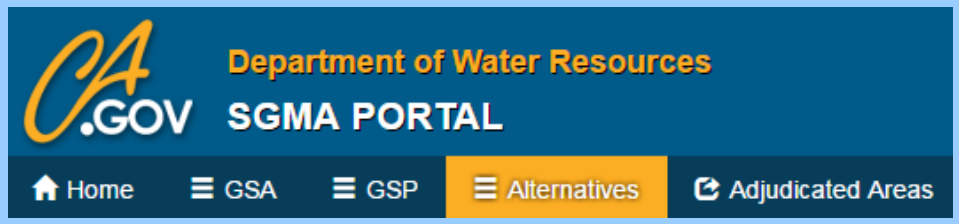
SUBCHAPTER 2. GROUNDWATER SUSTAINABILITY PLANS

Substantial compliance standard

- Supporting information is sufficiently detailed
- Analyses are sufficiently thorough and reasonable
- Any discrepancy would not materially affect achievement of sustainability goal
- Sustainable management criteria are commensurate with level of understanding of the basin setting, based on the level of uncertainty and data gaps





http://sgma.water.ca.gov/portal/alternative/all

Comment period ends April 1, 2017

http://humboldtgov.org/groundwater

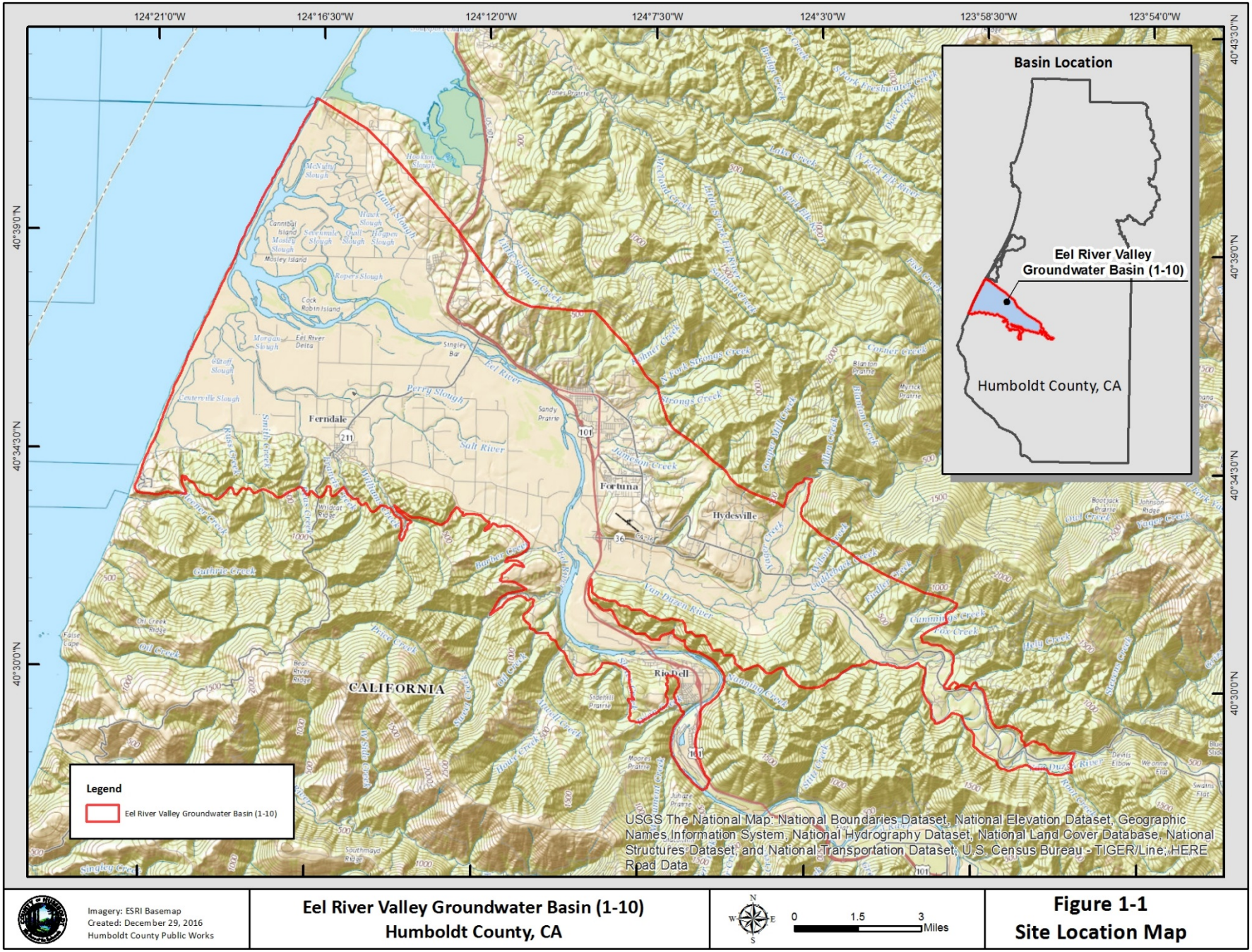


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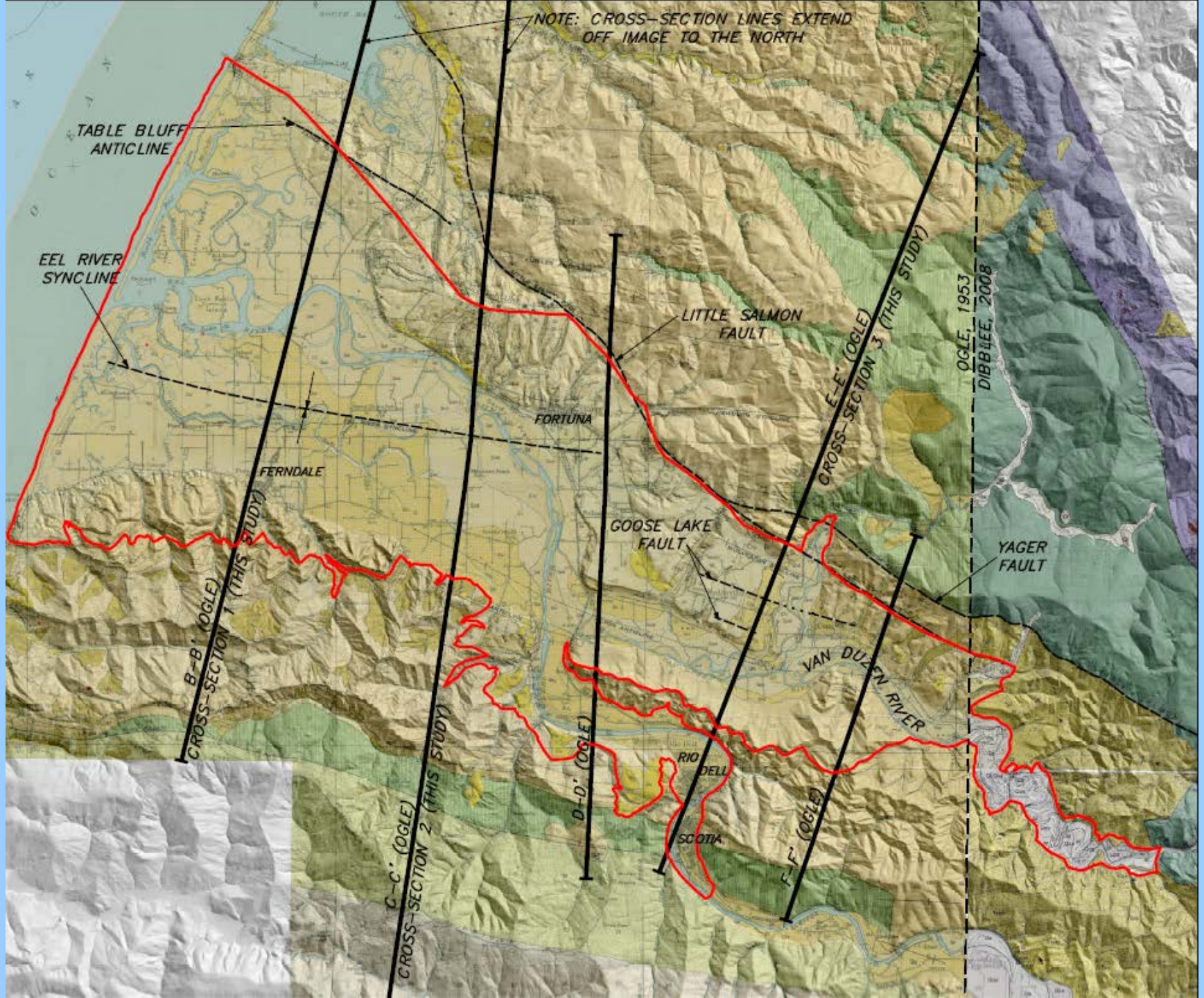
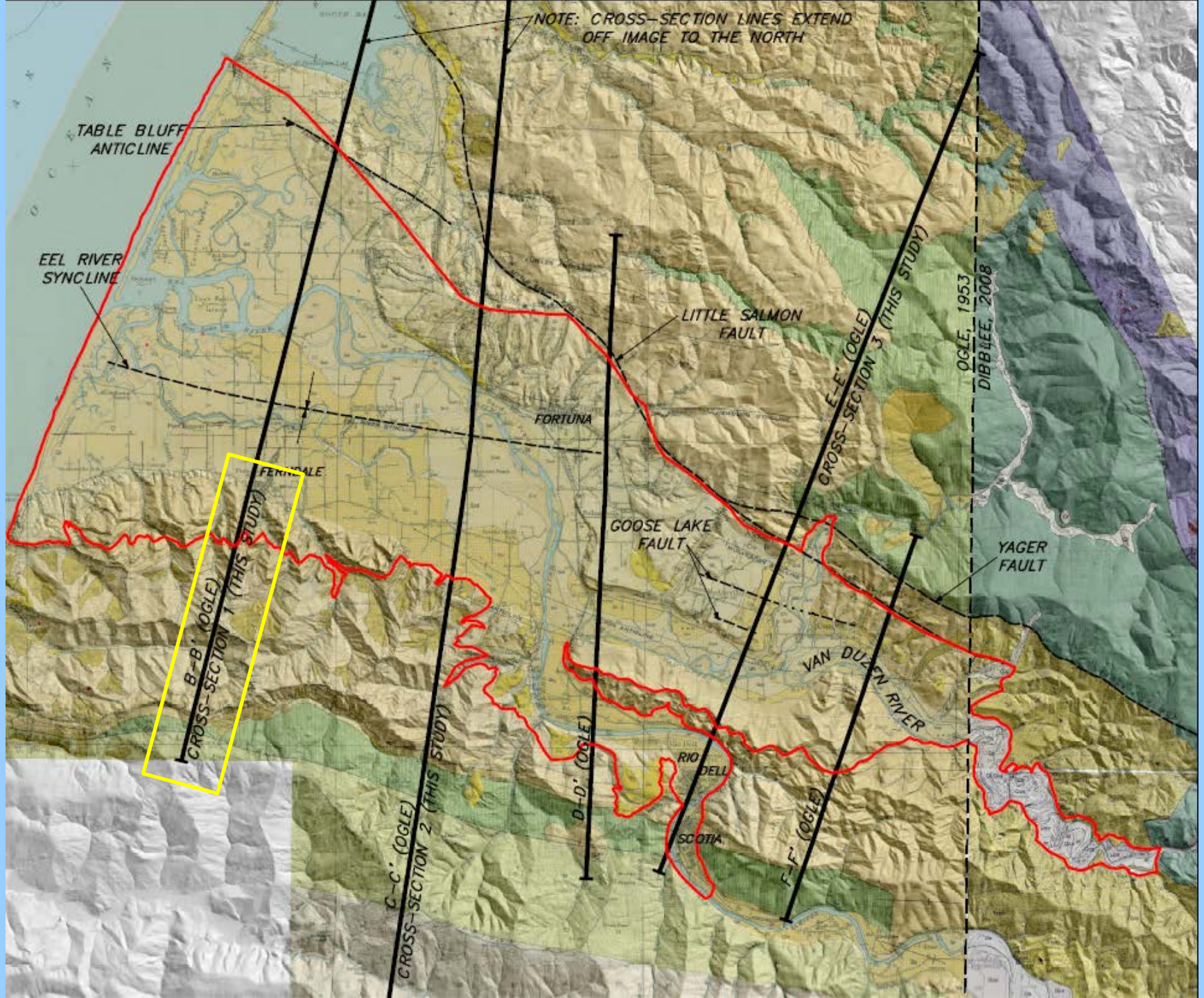
Figure 1-1
Site Location Map


NOTE: CROSS-SECTION LINES EXTEND OFF IMAGE TO THE NORTH
TABLE BLUFF ANTICLINE
EEL RIVER SYNCLINE
LITTLE SALMON FAULT
FORTUNA
FERNDALE
GOOSE LAKE FAULT
YAGER FAULT
VAN DUZEN RIVER
RIO DELL
SCOTIA
B-B' (OGLE)
CROSS-SECTION 1 (THIS STUDY)
C-C' (OGLE)
CROSS-SECTION 2 (THIS STUDY)
D-D' (OGLE)
E-E' (OGLE)
CROSS-SECTION 3 (THIS STUDY)
F-F' (OGLE)
OGLE, 1953
DIBBLEE, 2008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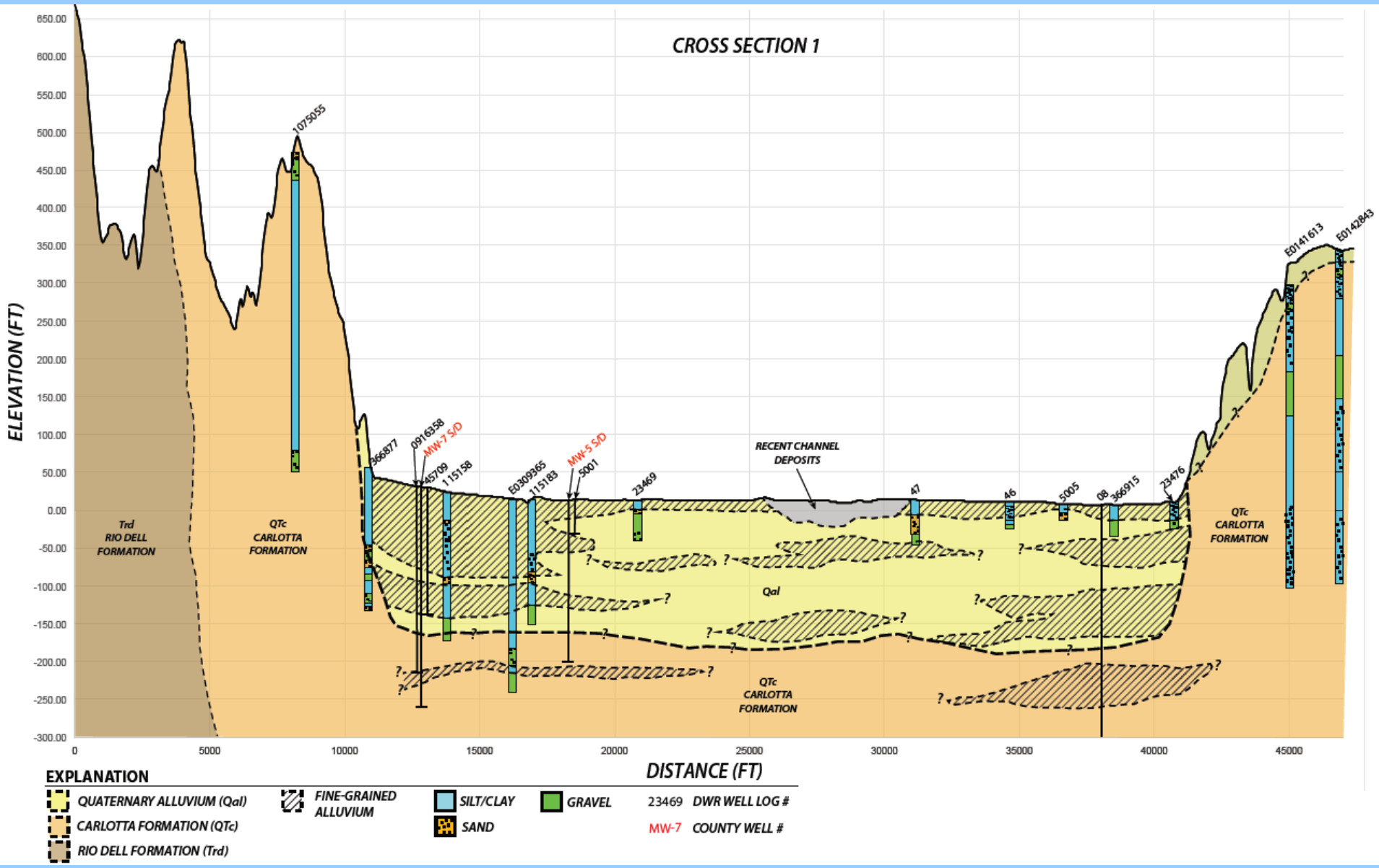
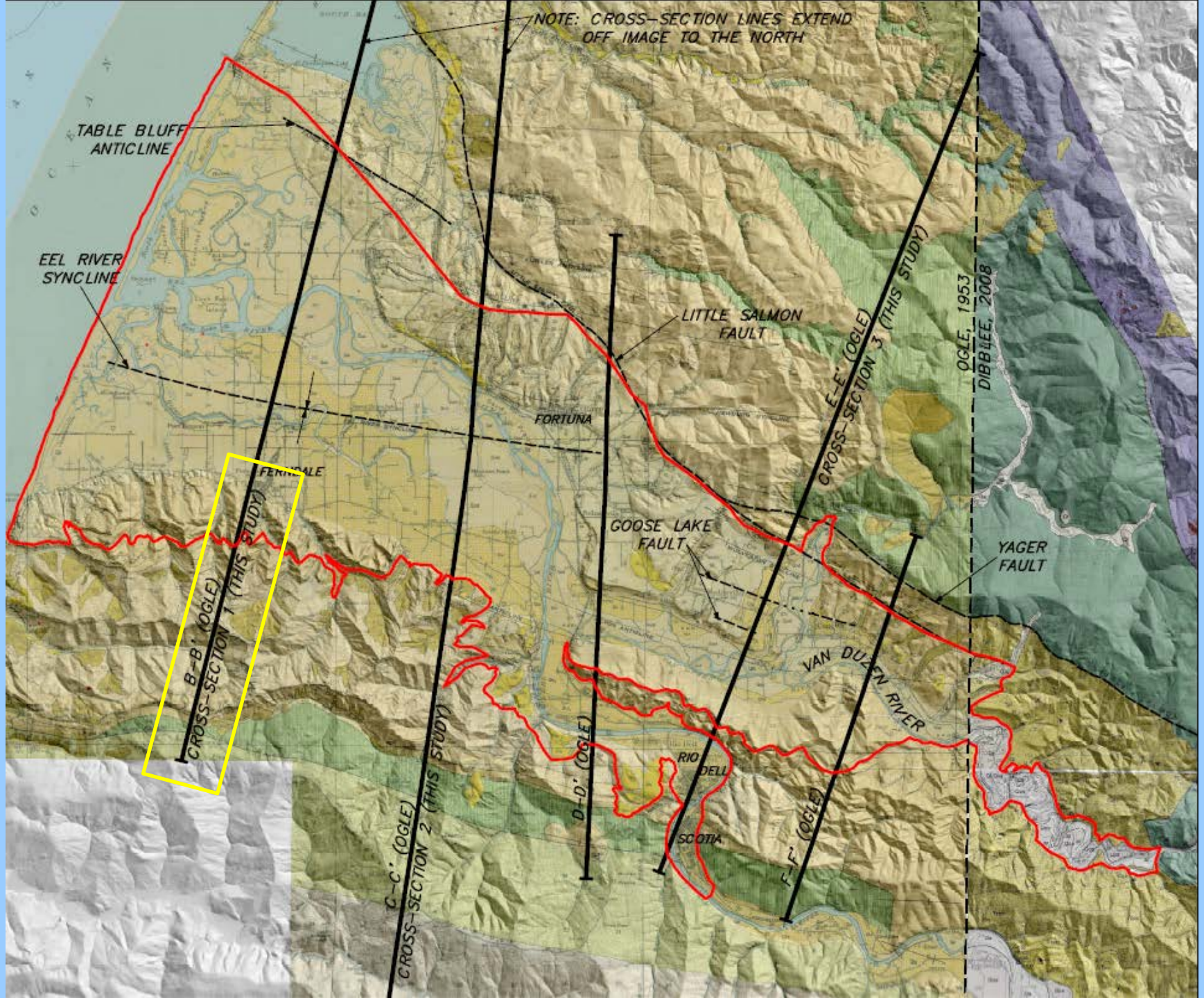

CROSS SECTION 1
ELEVATION (FT)
650.00
600.00
550.00
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
-50.00
-100.00
-150.00
-200.00
-250.00
-300.00
0
5000
10000
15000
20000
25000
30000
35000
40000
45000
DISTANCE (FT)
1075055
366877
0916358
MW-7 S/D
45709
115158
E0309365
115183
MW-5 S/D
5001
23469
RECENT CHANNEL DEPOSITS
47
46
5005
08
366915
23476
E0141613
E0142843
Trd
RIO DELL FORMATION
QTc
CARLOTTA FORMATION
Qal
QTc
CARLOTTA FORMATION
QTc
CARLOTTA FORMATION
EXPLANATION
QUATERNARY ALLUVIUM (Qal)
CARLOTTA FORMATION (QTc)
RIO DELL FORMATION (Trd)
FINE-GRAINED ALLUVIUM
SILT/CLAY
SAND
GRAVEL
23469 DWR WELL LOG #
MW-7 COUNTY WELL #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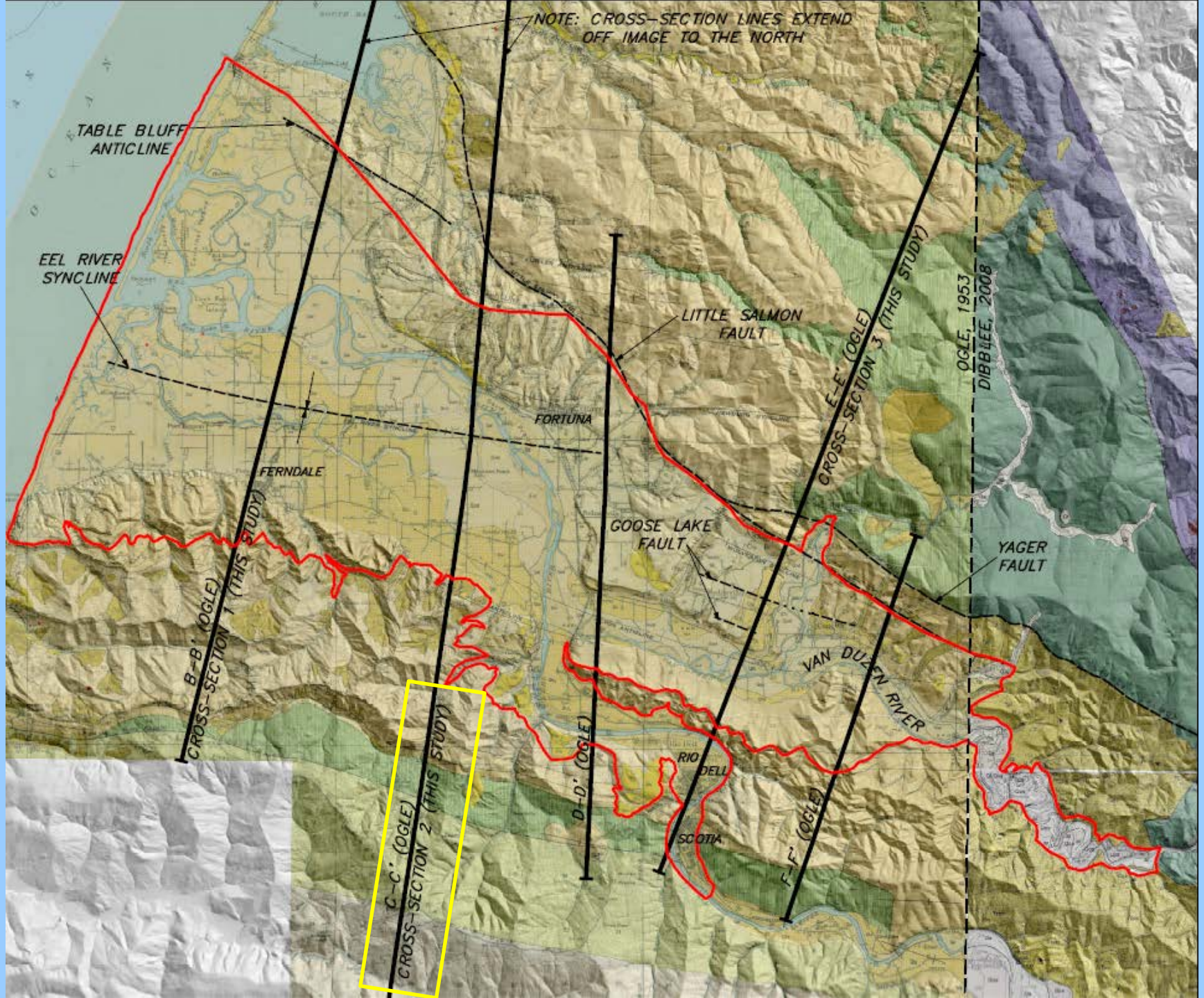
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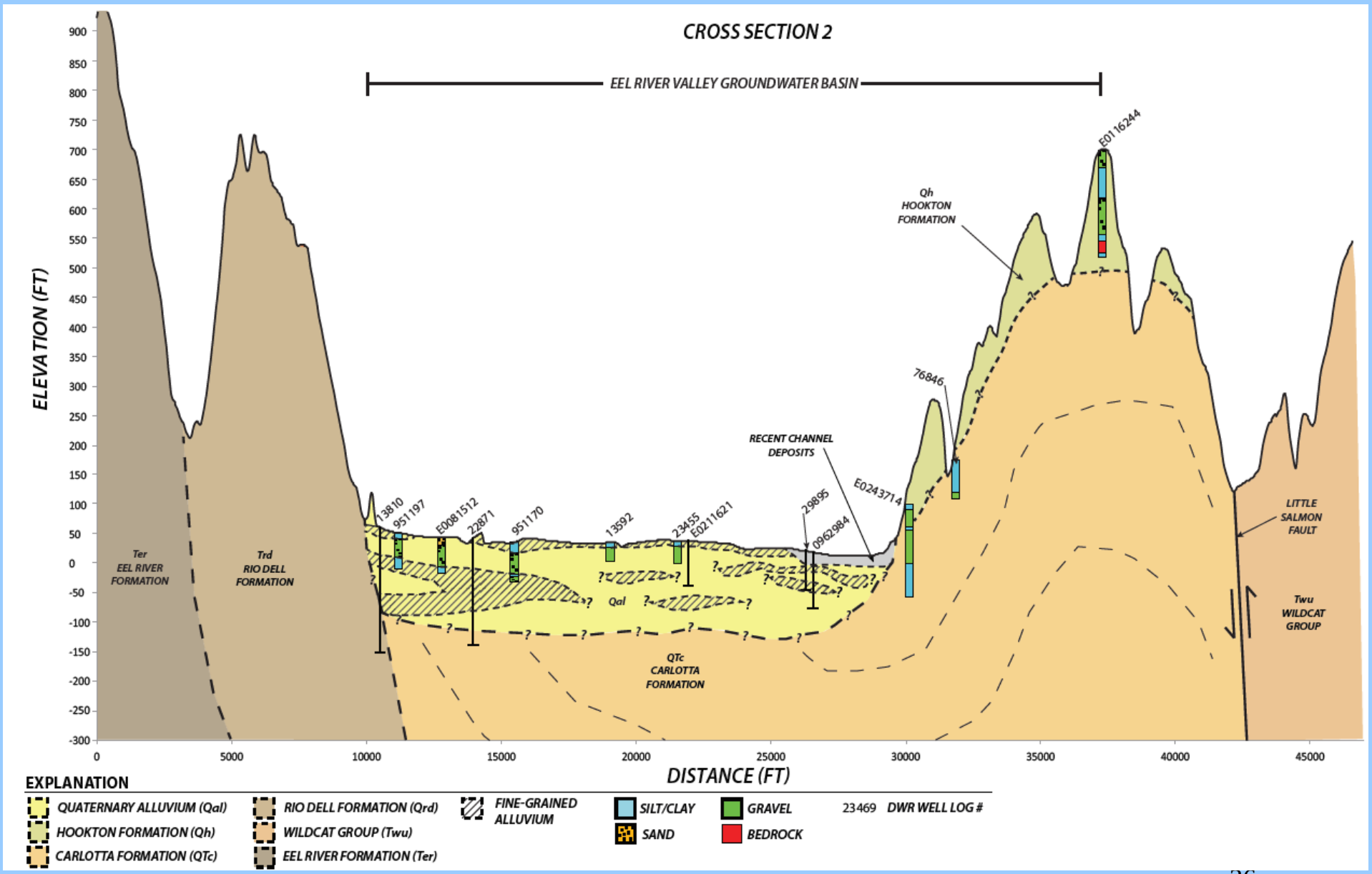
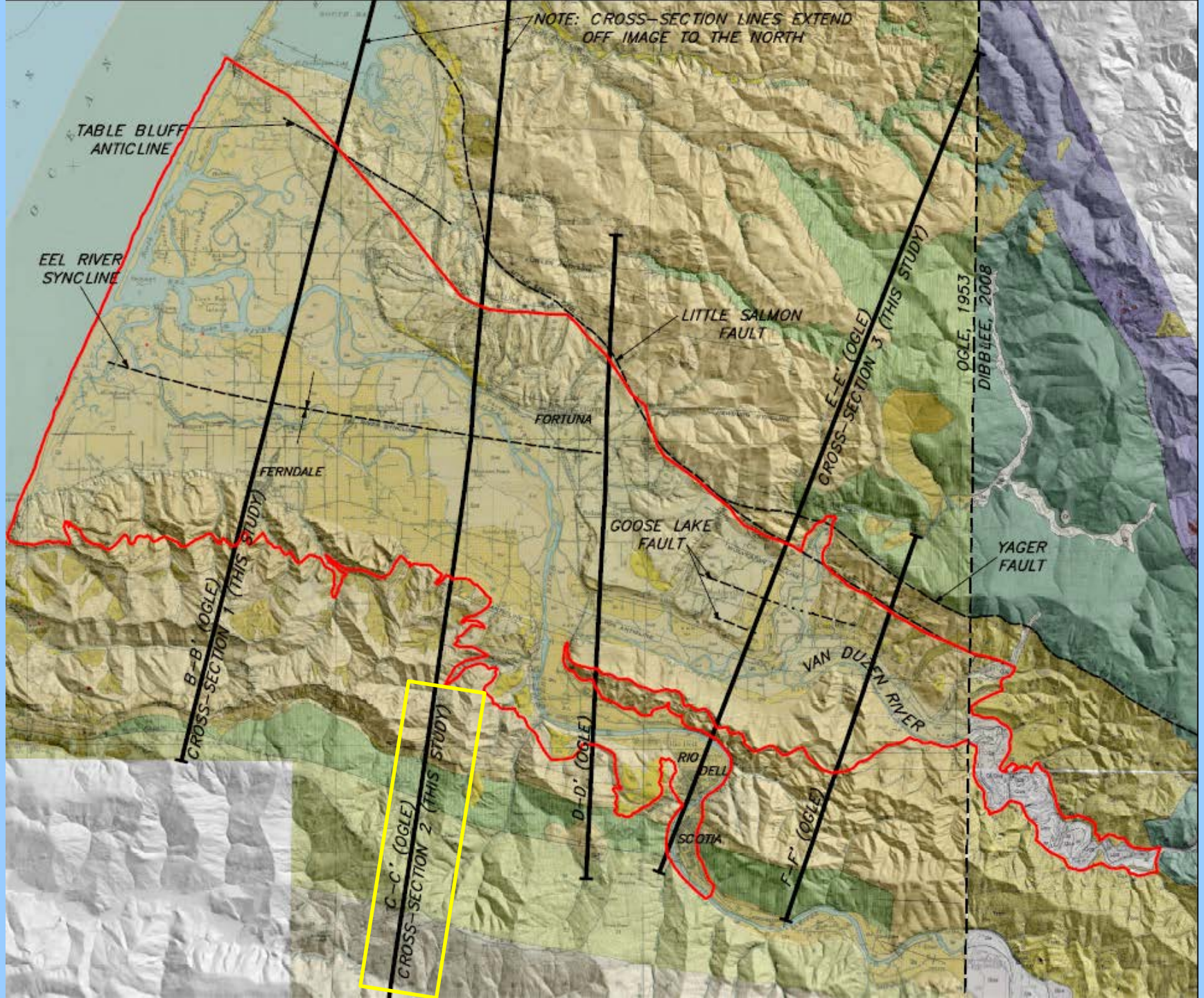
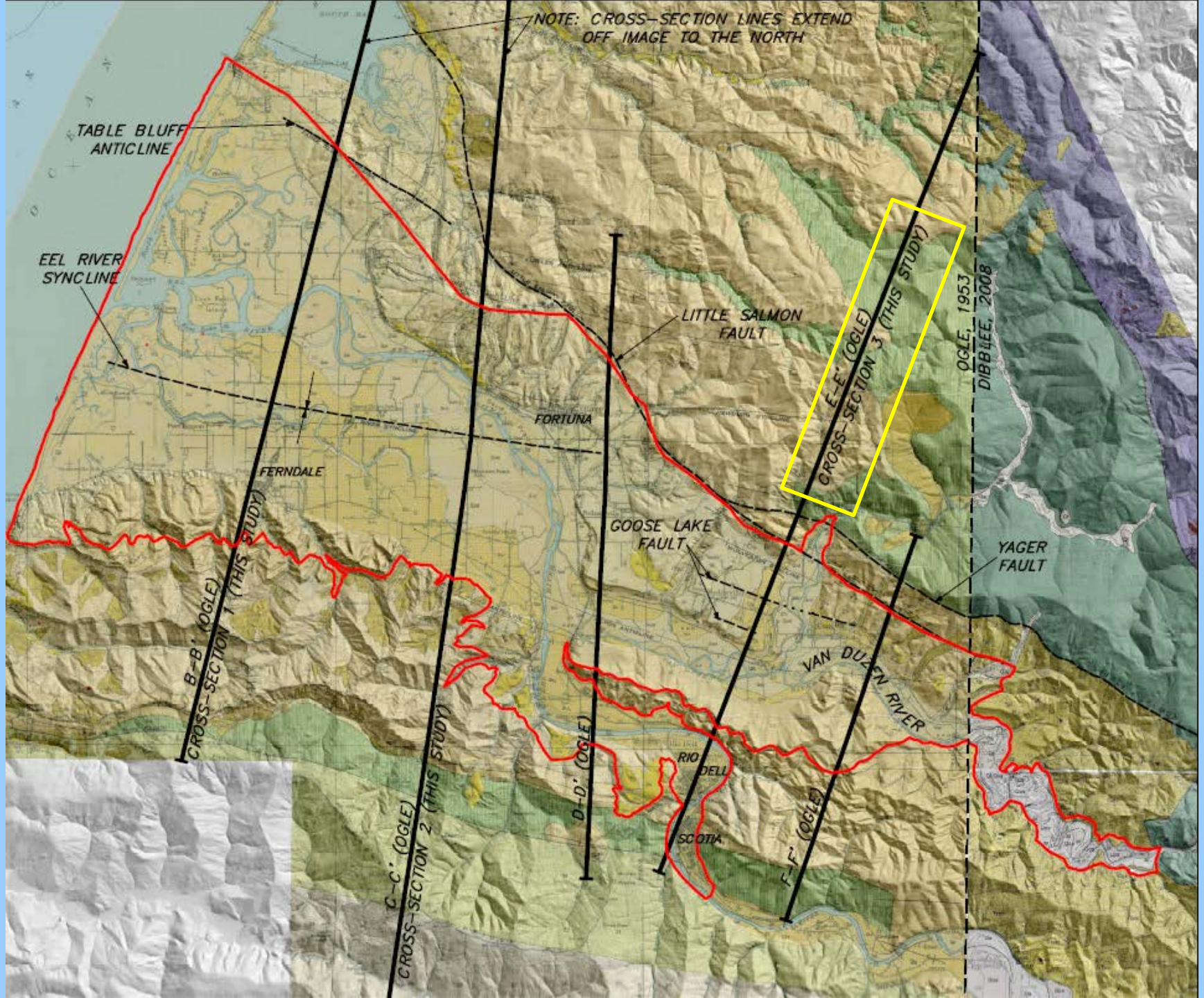
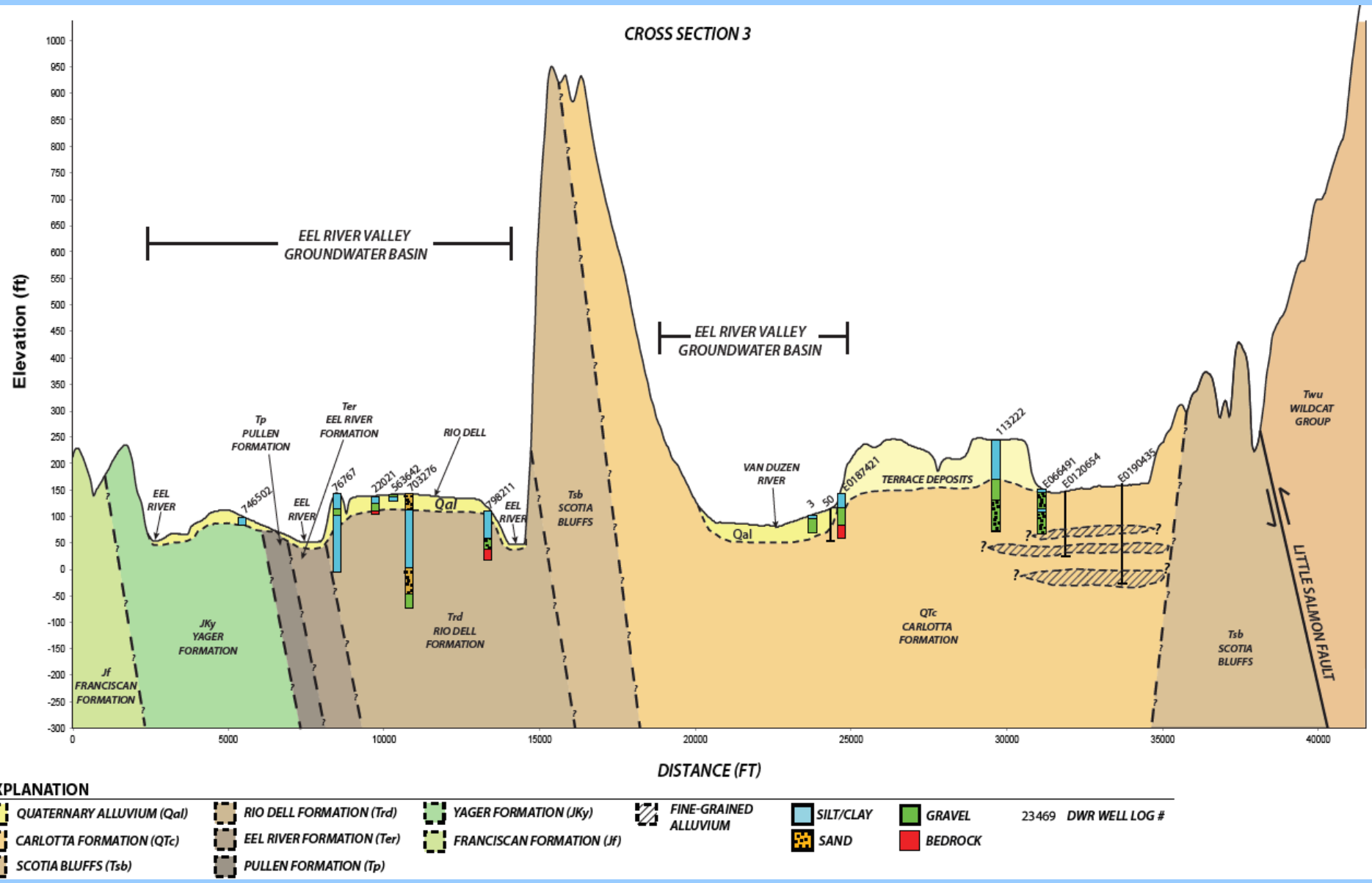
CROSS-SECTION 2 (THIS STUDY)
D-D' (OGLE)
E-E' (OGLE)
CROSS-SECTION 3 (THIS STUDY)
F-F' (OGLE)
OGLE, 1953
DIBBLEE, 2008


CROSS SECTION 2
EEL RIVER VALLEY GROUNDWATER BASIN
ELEVATION (FT)
DISTANCE (FT)
Ter
EEL RIVER
FORMATION
Trd
RIO DELL
FORMATION
Qal
QTc
CARLOTTA
FORMATION
Qh
HOOKTON
FORMATION
RECENT CHANNEL
DEPOSITS
LITTLE
SALMON
FAULT
Twu
WILDCAT
GROUP
13810
951197
E0081512
22871
951170
13592
23455
E0211621
29895
0962984
E0243714
76846
E0116244
EXPLANATION
QUATERNARY ALLUVIUM (Qal)
HOOKTON FORMATION (Qh)
CARLOTTA FORMATION (QTc)
RIO DELL FORMATION (Qrd)
WILDCAT GROUP (Twu)
EEL RIVER FORMATION (Ter)
FINE-GRAINED
ALLUVIUM
SILT/CLAY
SAND
GRAVEL
BEDROCK
23469 DWR WELL LOG #


NOTE: CROSS-SECTION LINES EXTEND OFF IMAGE TO THE NORTH
TABLE BLUFF ANTICLINE
EEL RIVER SYNCLINE
LITTLE SALMON FAULT
FORTUNA
FERNDALE
GOOSE LAKE FAULT
YAGER FAULT
VAN DUZEN RIVER
RIO DELL
SCOTIA
B-B' (OGLE)
CROSS-SECTION 1 (THIS STUDY)
C-C' (OGLE)
CROSS-SECTION 2 (THIS STUDY)
D-D' (OGLE)
E-E' (OGLE)
CROSS-SECTION 3 (THIS STUDY)
F-F' (OGLE)
OGLE, 1953
DIBBLEE, 2008


NOTE: CROSS-SECTION LINES EXTEND OFF IMAGE TO THE NORTH
TABLE BLUFF ANTICLINE
EEL RIVER SYNCLINE
LITTLE SALMON FAULT
FORTUNA
FERNDALE
GOOSE LAKE FAULT
YAGER FAULT
VAN DUZEN RIVER
RIO DELL
SCOTIA
B-B' (OGLE)
CROSS-SECTION 1 (THIS STUDY)
C-C' (OGLE)
CROSS-SECTION 2 (THIS STUDY)
D-D' (OGLE)
E-E' (OGLE)
CROSS-SECTION 3 (THIS STUDY)
F-F' (OGLE)
OGLE, 1953
DIBBLEE, 2008


CROSS SECTION 3
Elevation (ft)
DISTANCE (FT)
EEL RIVER VALLEY GROUNDWATER BASIN
EEL RIVER VALLEY GROUNDWATER BASIN
EEL RIVER
Tp PULLEN FORMATION
Ter EEL RIVER FORMATION
RIO DELL
EEL RIVER
EEL RIVER
746502
76767
22021
563642
703276
798211
Qal
Tsb SCOTIA BLUFFS
VAN DUZEN RIVER
3
50
E0187421
TERRACE DEPOSITS
113222
E066491
E0120654
E0190435
Qal
Twu WILDCAT GROUP
LITTLE SALMON FAULT
JKy YAGER FORMATION
Trd RIO DELL FORMATION
QTc CARLOTTA FORMATION
Tsb SCOTIA BLUFFS
Jf FRANCISCAN FORMATION
EXPLANATION
QUATERNARY ALLUVIUM (Qal)
CARLOTTA FORMATION (QTc)
SCOTIA BLUFFS (Tsb)
RIO DELL FORMATION (Trd)
EEL RIVER FORMATION (Ter)
PULLEN FORMATION (Tp)
YAGER FORMATION (JKy)
FRANCISCAN FORMATION (Jf)
FINE-GRAINED ALLUVIUM
SILT/CLAY
SAND
GRAVEL
BEDROCK
23469 DWR WELL LOG #

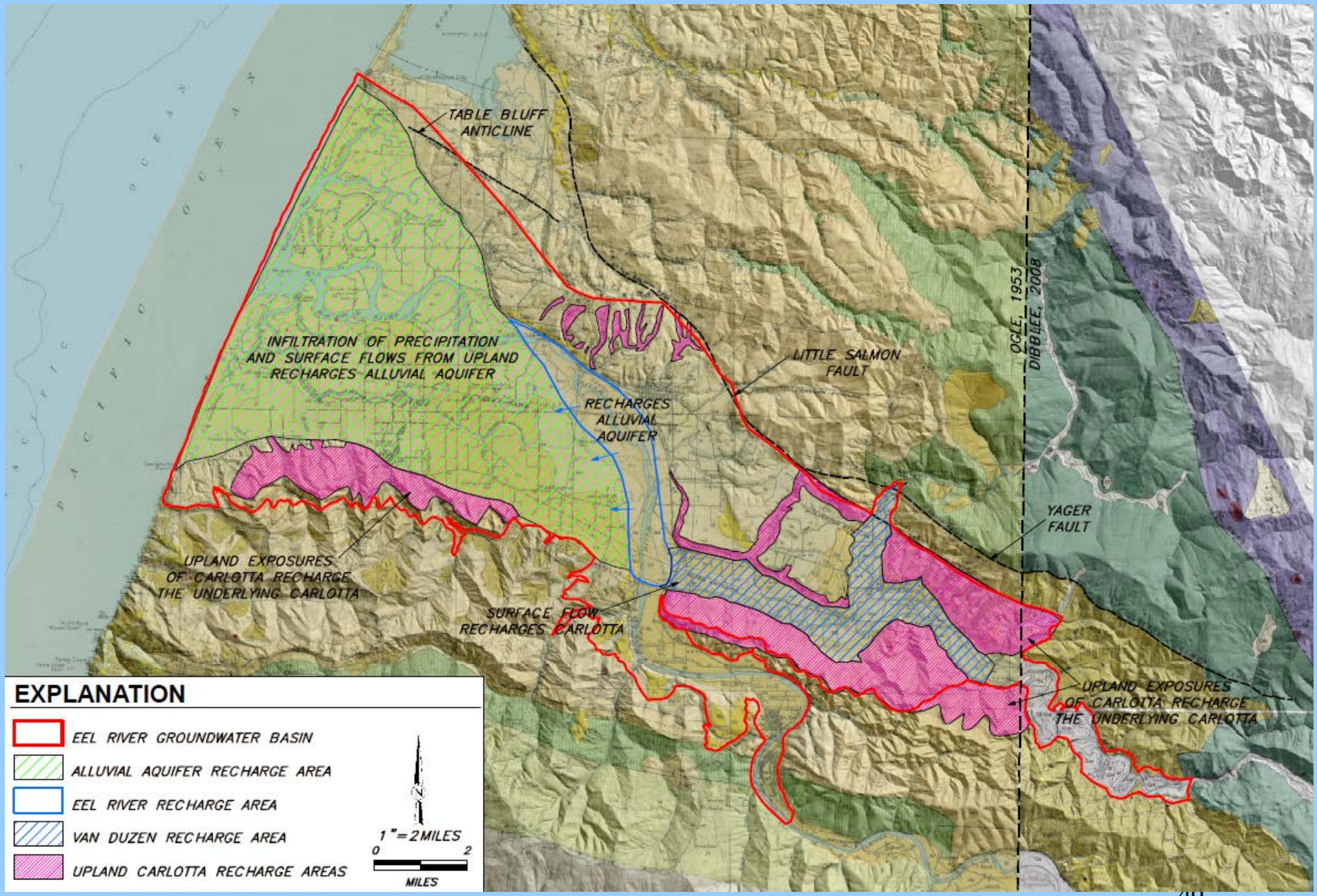
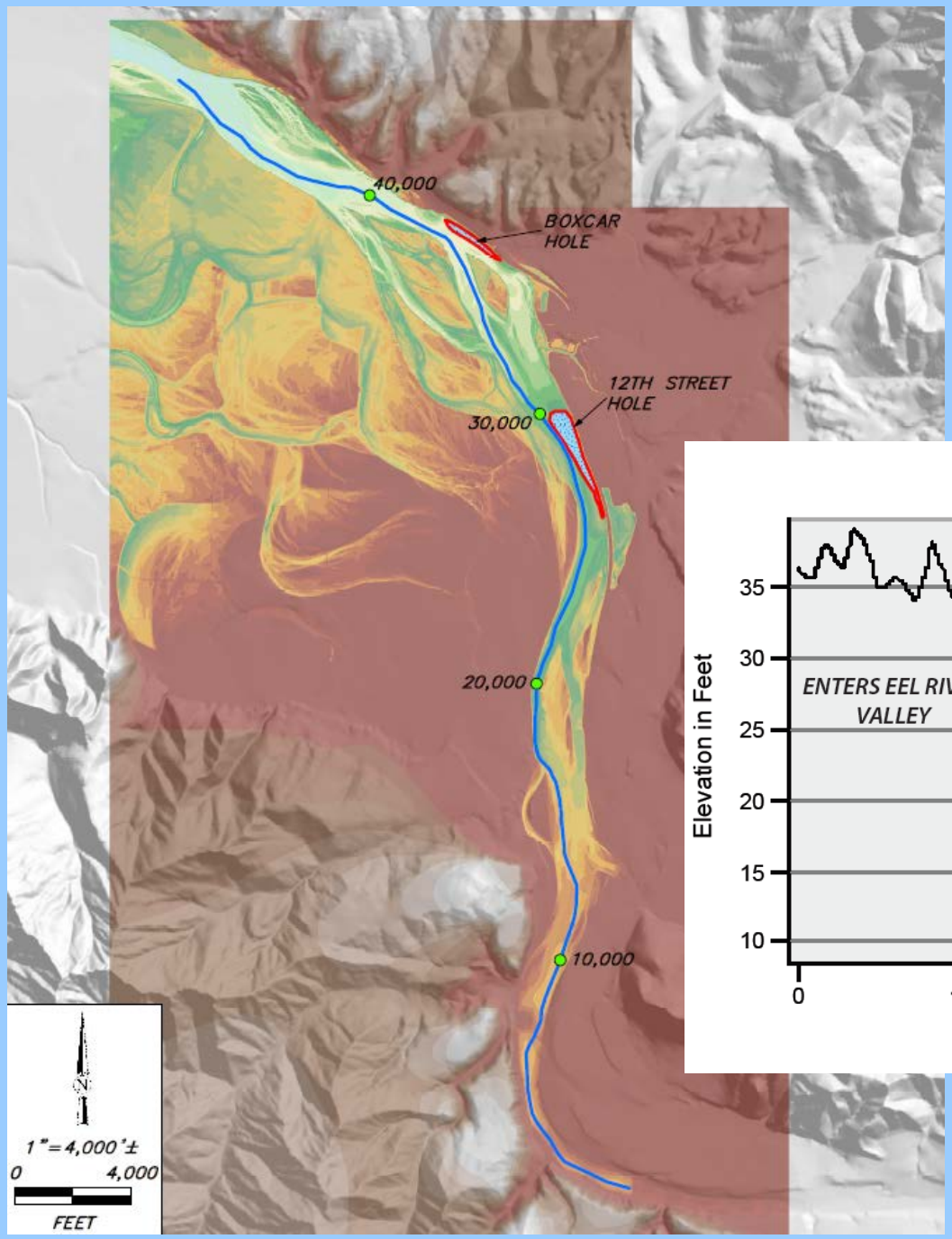
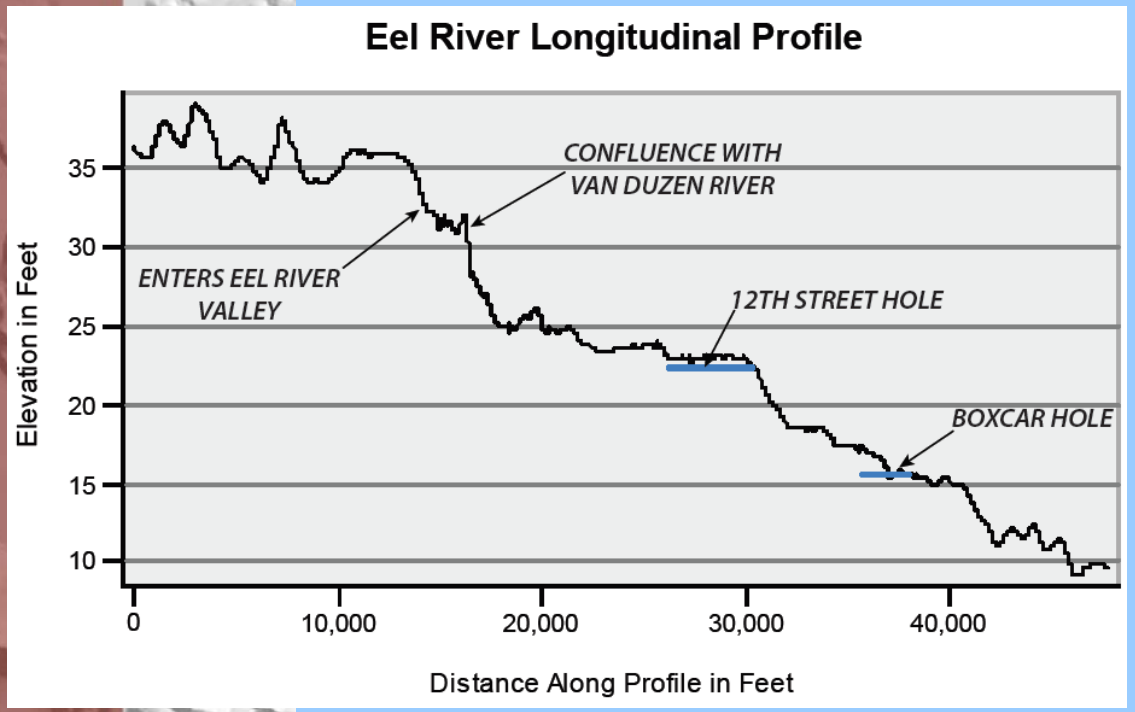
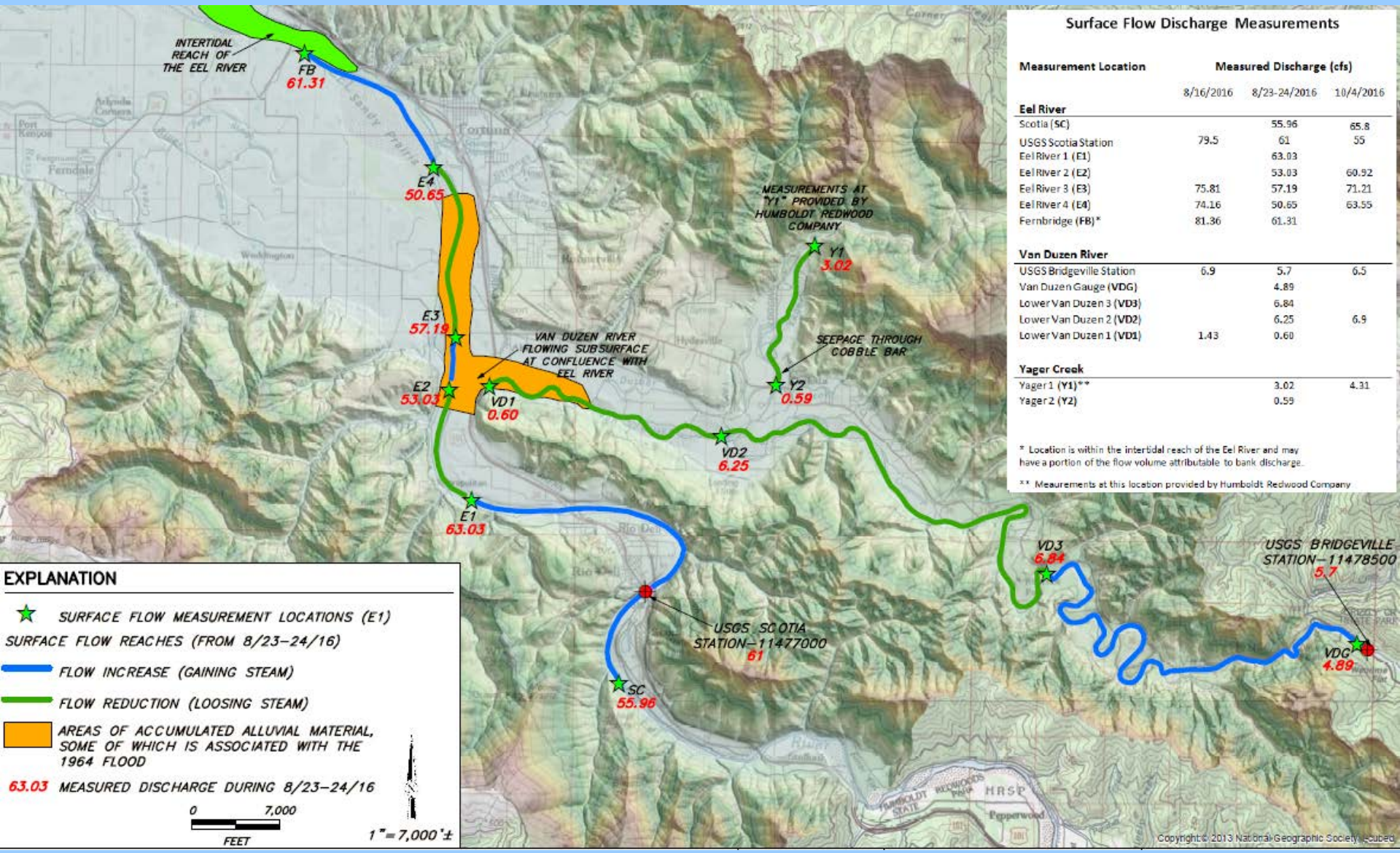


TABLE BLUFF ANTICLINE
INFILTRATION OF PRECIPITATION AND SURFACE FLOWS FROM UPLAND RECHARGES ALLUVIAL AQUIFER
RECHARGES ALLUVIAL AQUIFER
LITTLE SALMON FAULT
OGLE, 1953
DIBBLEE, 2008
YAGER FAULT
UPLAND EXPOSURES OF CARLOTTA RECHARGE THE UNDERLYING CARLOTTA
SURFACE FLOW RECHARGES CARLOTTA
UPLAND EXPOSURES OF CARLOTTA RECHARGE THE UNDERLYING CARLOTTA
EXPLANATION
EEL RIVER GROUNDWATER BASIN
ALLUVIAL AQUIFER RECHARGE AREA
EEL RIVER RECHARGE AREA
VAN DUZEN RECHARGE AREA
UPLAND CARLOTTA RECHARGE AREAS
1"=2 MILES
0
2
MILES





Source: Earthscope (2007)

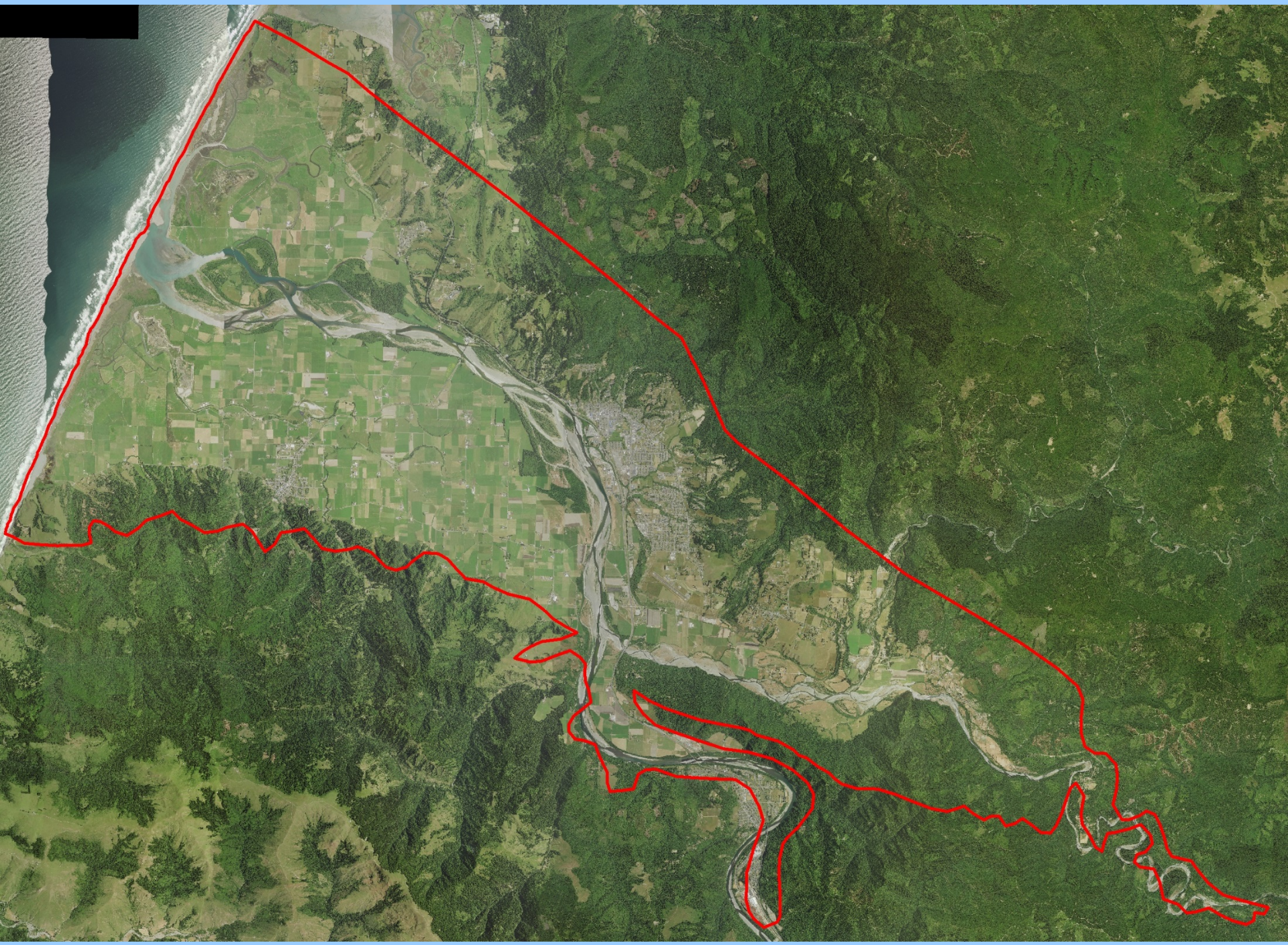


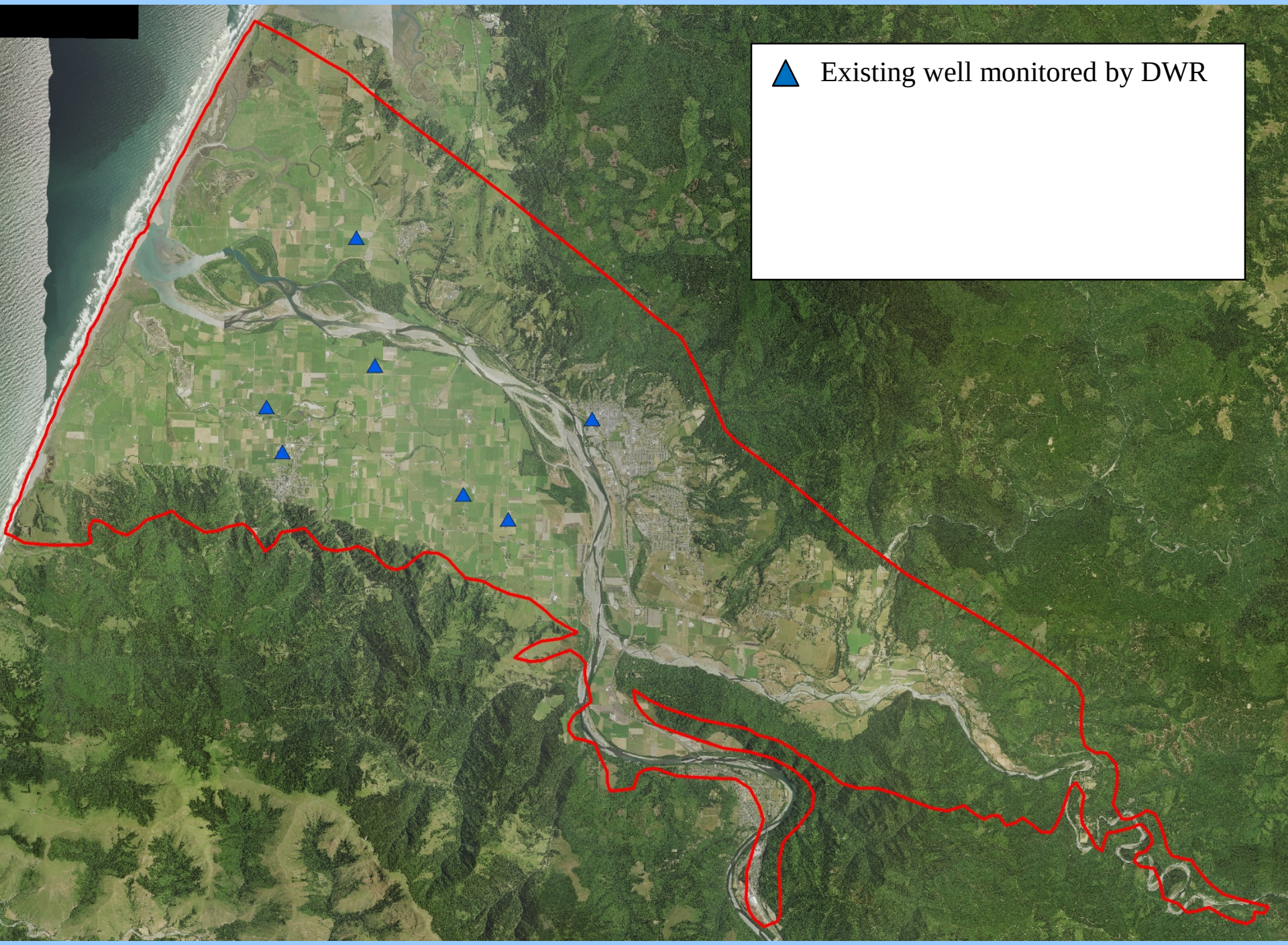
Surface Flow Discharge Measurements

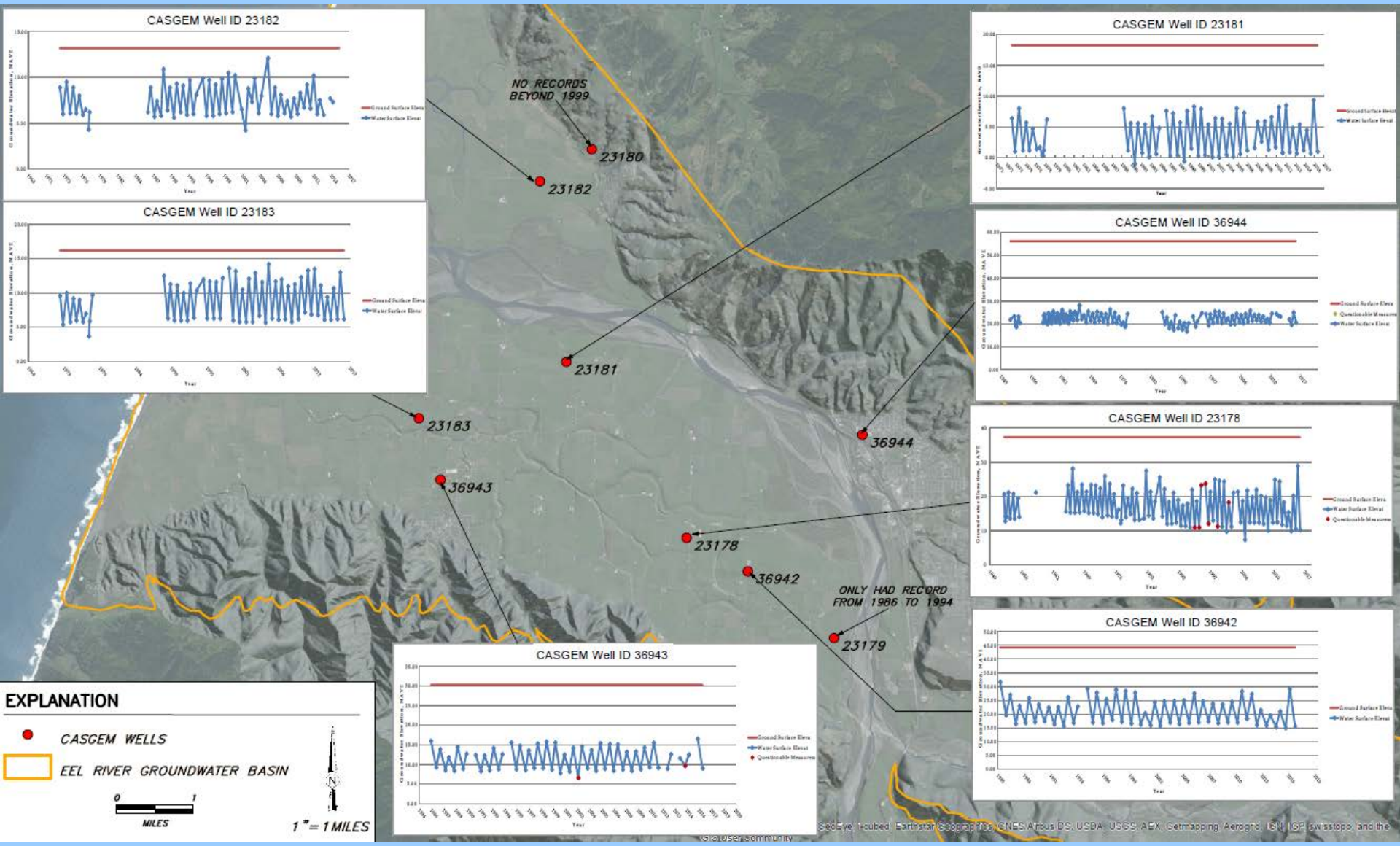
Measurement Location	Measured Discharge (cfs)		
	8/16/2016	8/23-24/2016	10/4/2016
Eel River			
Scotia (SC)		55.96	65.8
USGS Scotia Station	79.5	61	55
Eel River 1 (E1)		63.03	
Eel River 2 (E2)		53.03	60.92
Eel River 3 (E3)	75.81	57.19	71.21
Eel River 4 (E4)	74.16	50.65	63.55
Fernbridge (FB)*	81.36	61.31	
Van Duzen River			
USGS Bridgeville Station	6.9	5.7	6.5
Van Duzen Gauge (VDG)		4.89	
Lower Van Duzen 3 (VD3)		6.84	
Lower Van Duzen 2 (VD2)		6.25	6.9
Lower Van Duzen 1 (VD1)	1.43	0.60	
Yager Creek			
Yager 1 (Y1)**		3.02	4.31
Yager 2 (Y2)		0.59	

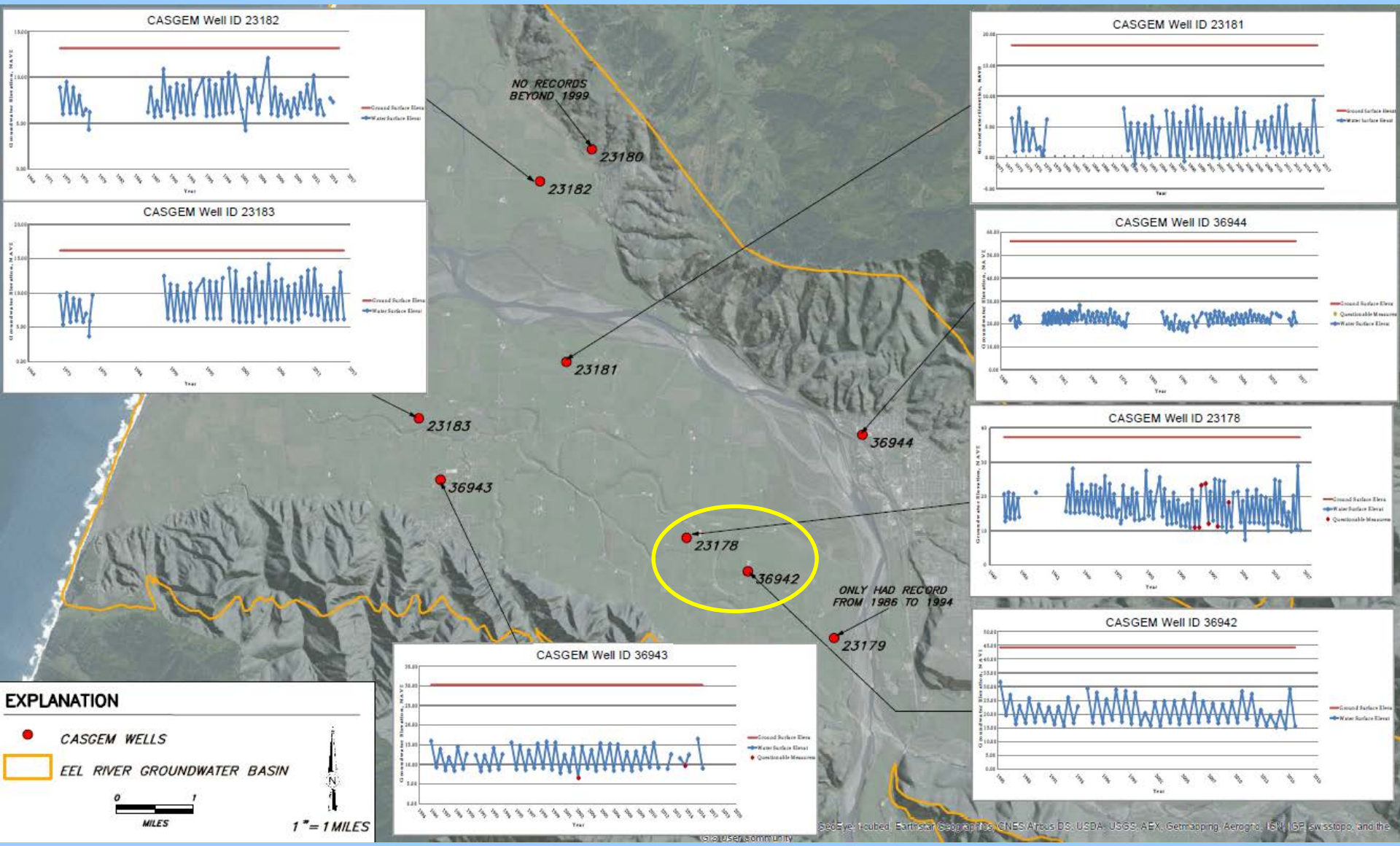
* Location is within the intertidal reach of the Eel River and may have a portion of the flow volume attributable to bank discharge.

** Measurements at this location provided by Humboldt Redwood Company

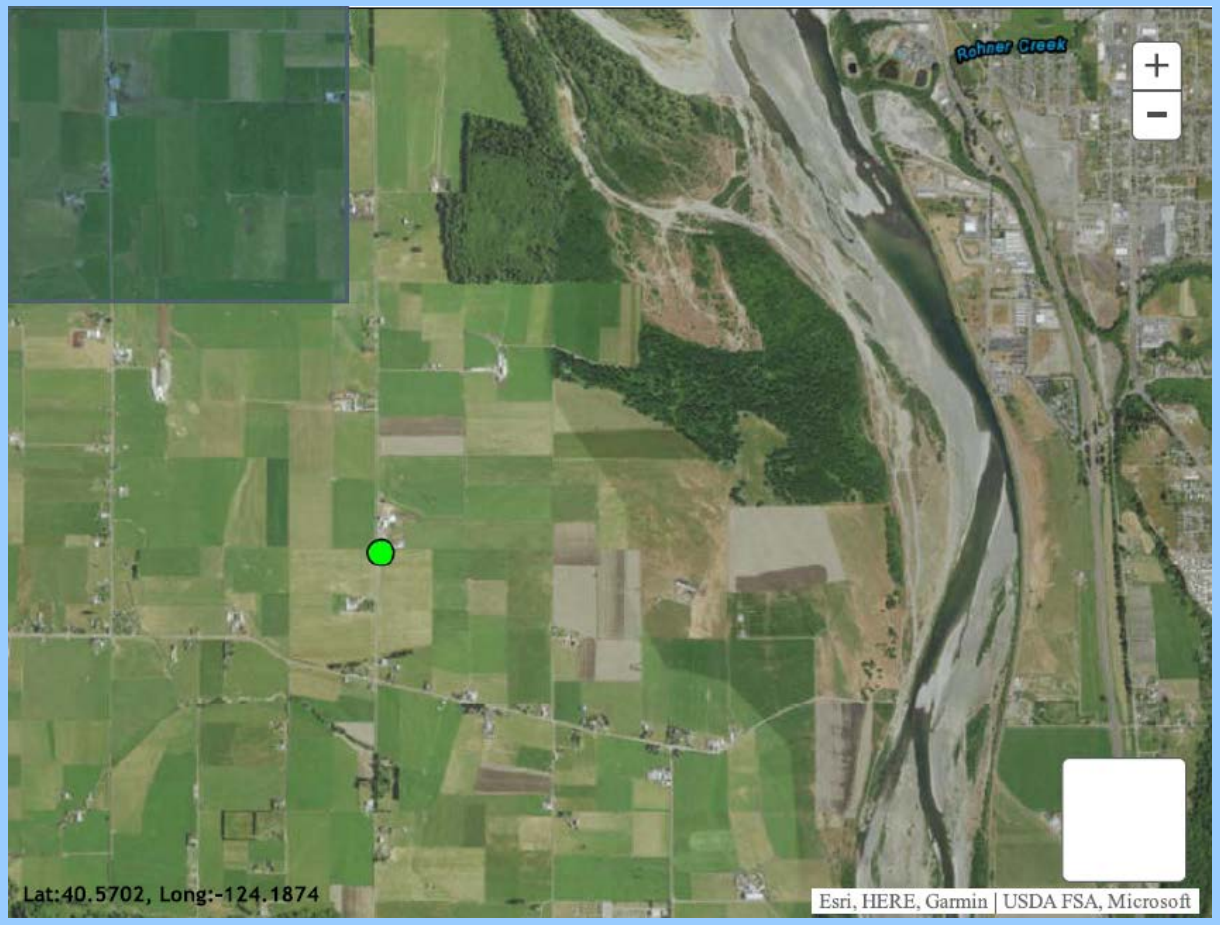



Existing well monitored by DWR

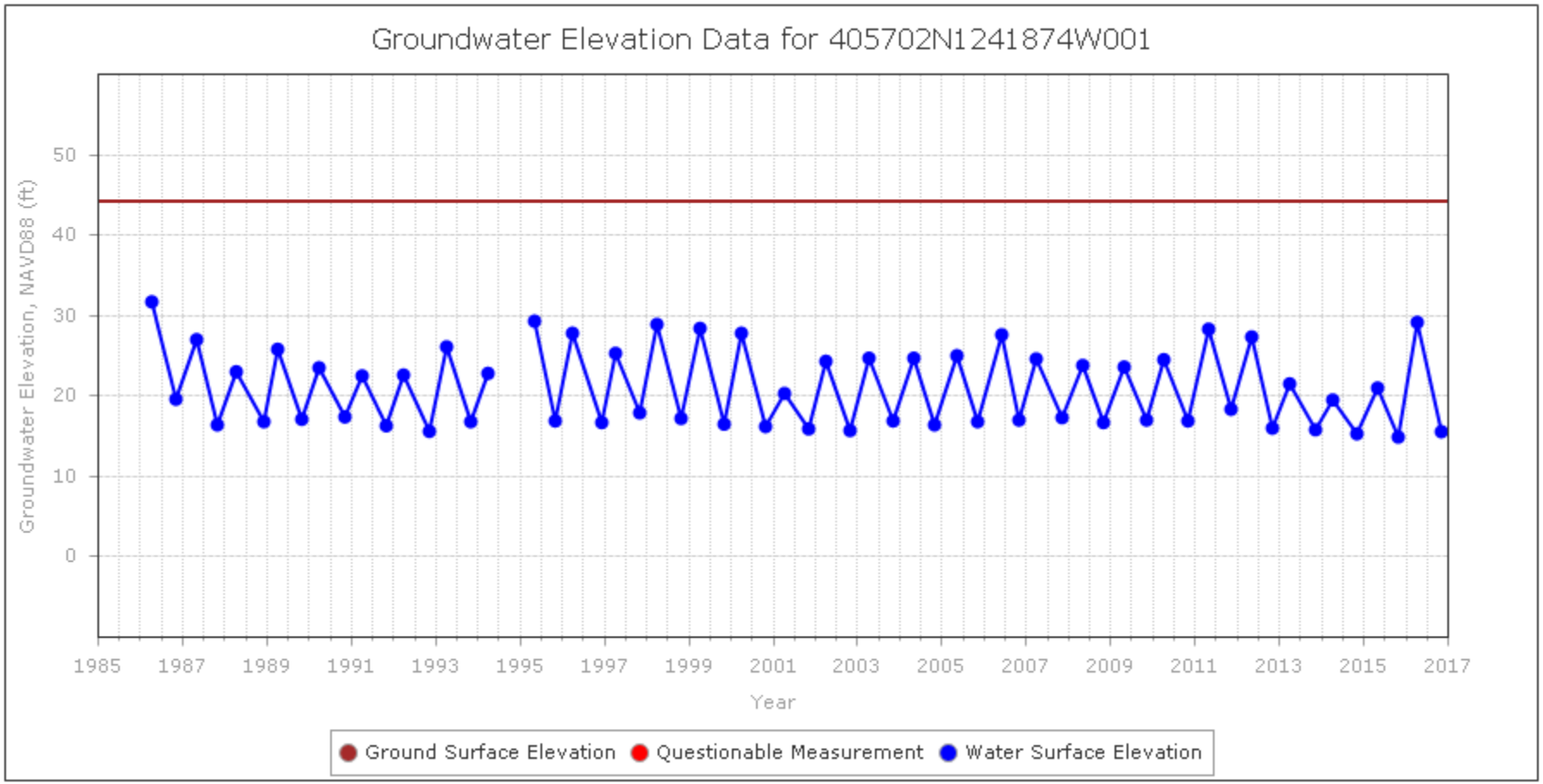

CASGEM Well ID 23182
CASGEM Well ID 23183
CASGEM Well ID 23181
CASGEM Well ID 36944
CASGEM Well ID 23178
CASGEM Well ID 36942
CASGEM Well ID 36943
NO RECORDS BEYOND 1999
23180
23182
23181
23183
36944
36943
23178
36942
ONLY HAD RECORD FROM 1986 TO 1994
23179
EXPLANATION
CASGEM WELLS
EEL RIVER GROUNDWATER BASIN
0
1
MILES
1 " = 1 MILES
N
Ground Surface Elevation
Water Surface Elevation
Questionable Measurement
Year
Groundwater Elevation, NAVD
GIS User Community


CASGEM Well ID 23182
CASGEM Well ID 23183
CASGEM Well ID 23181
CASGEM Well ID 36944
CASGEM Well ID 23178
CASGEM Well ID 36942
CASGEM Well ID 36943
NO RECORDS BEYOND 1999
23180
23182
23181
23183
36944
36943
23178
36942
ONLY HAD RECORD FROM 1986 TO 1994
23179
EXPLANATION
CASGEM WELLS
EEL RIVER GROUNDWATER BASIN
MILES
1 " = 1 MILES
GIS User Community

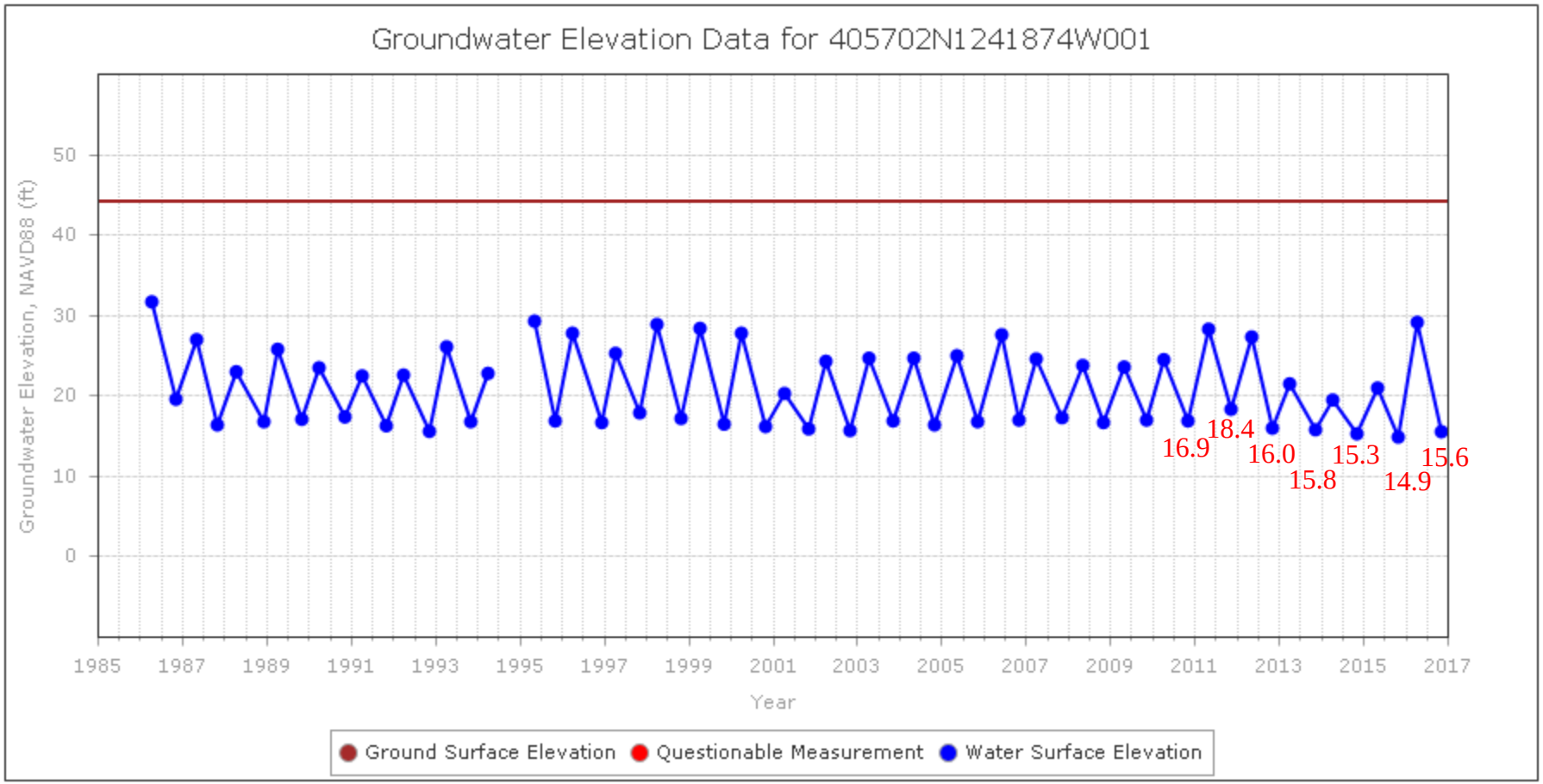
Well No. 36942



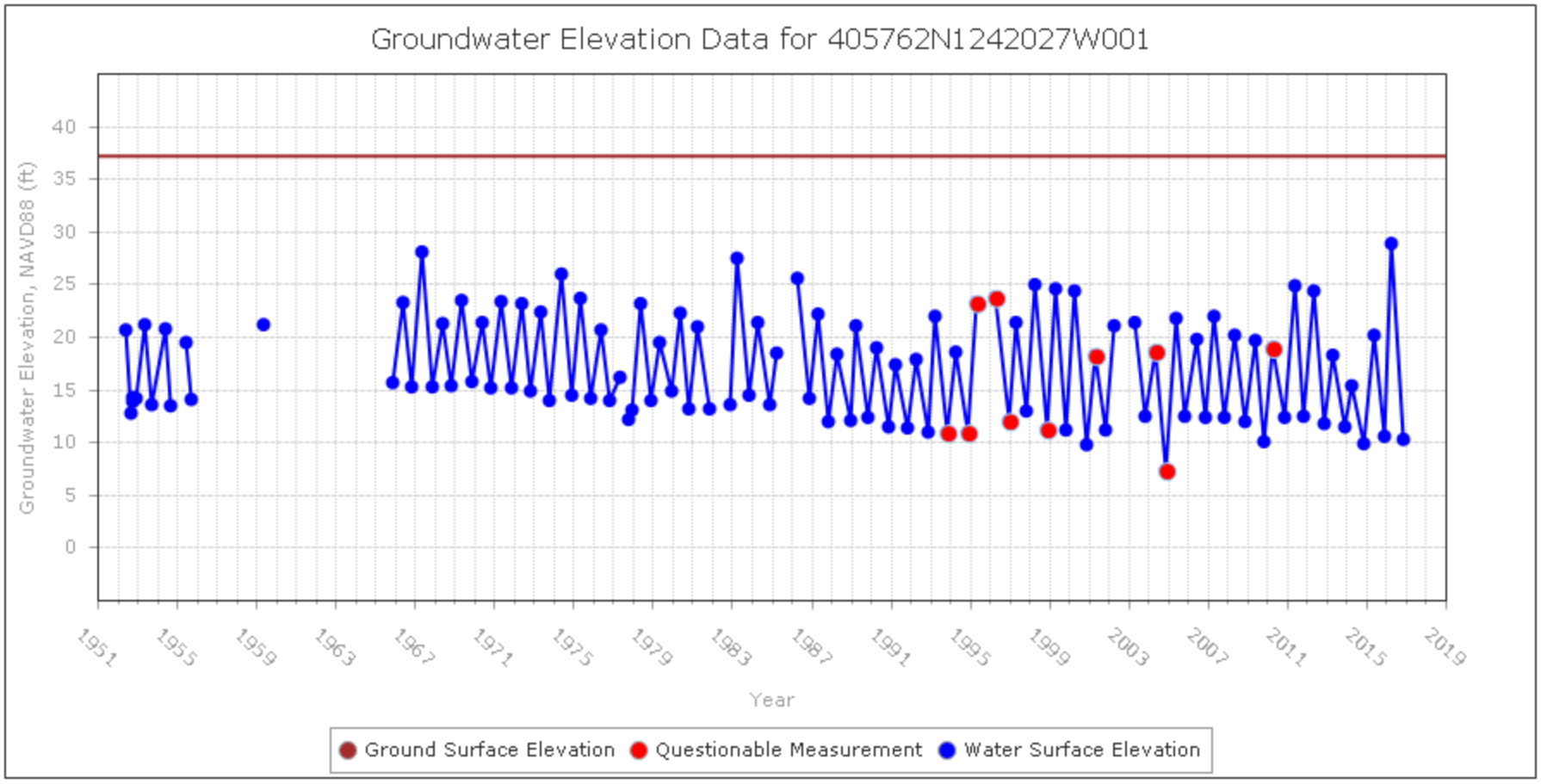
Well No. 36942



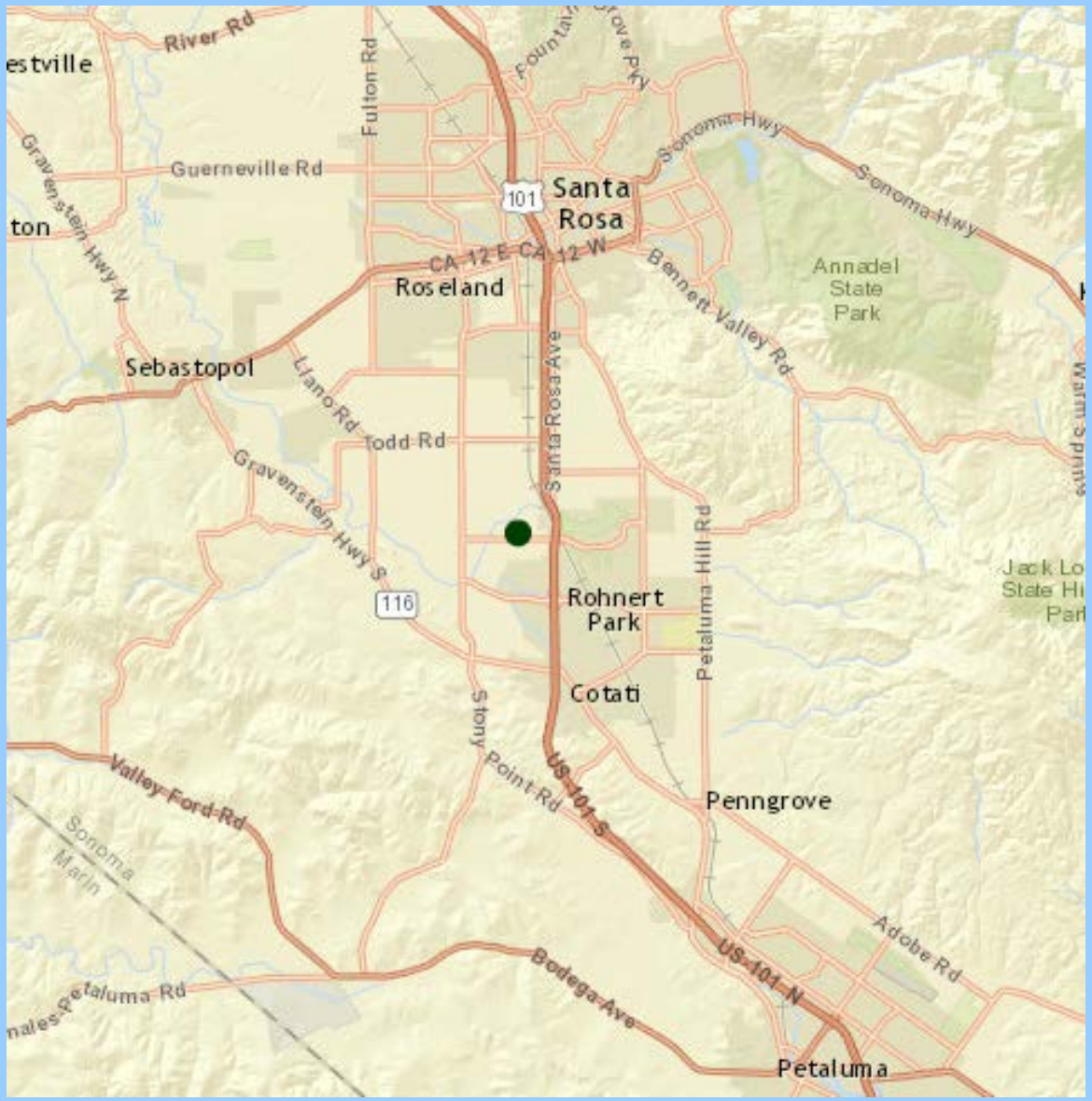
Well No. 36942



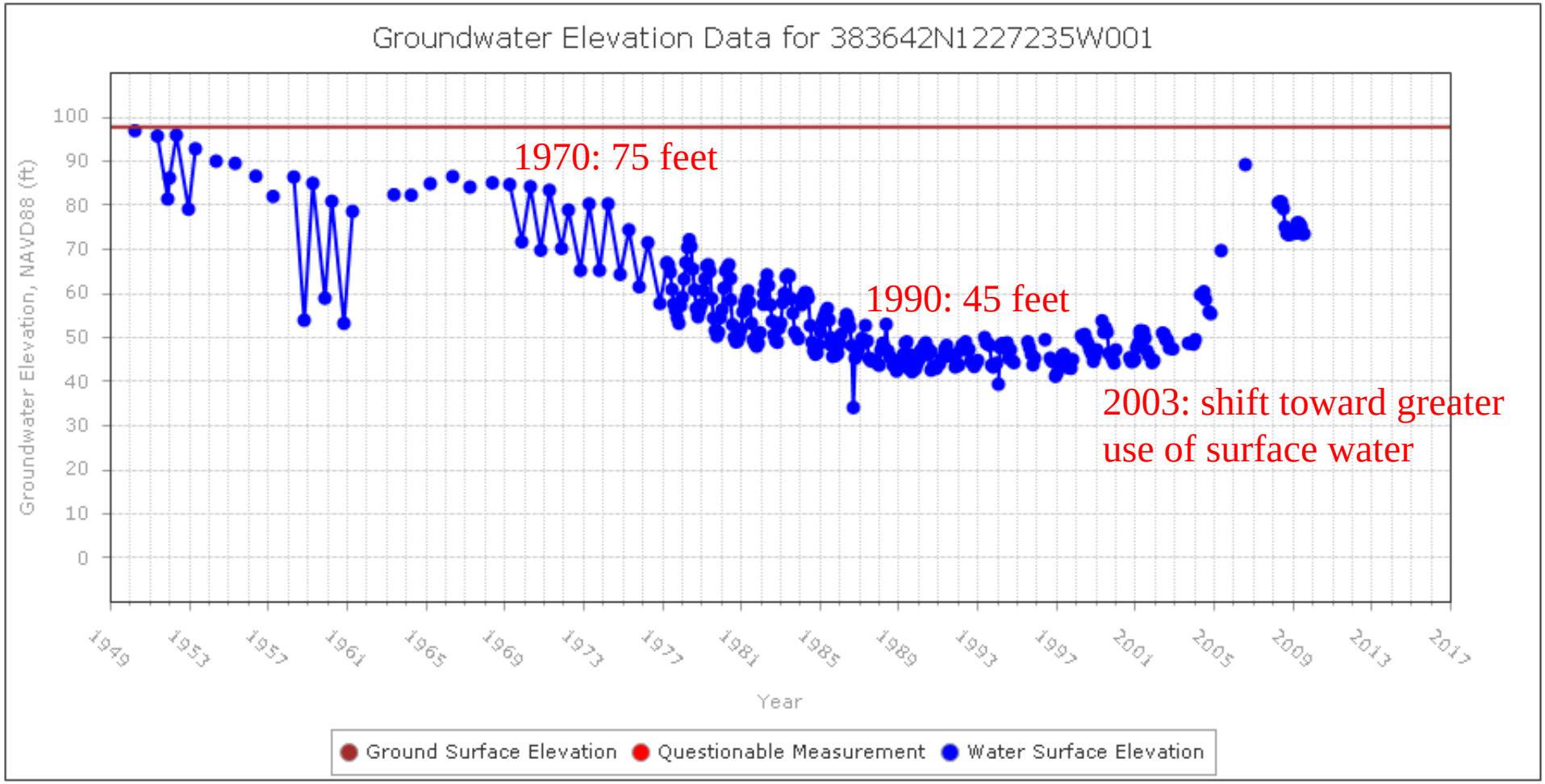
Well No. 23178

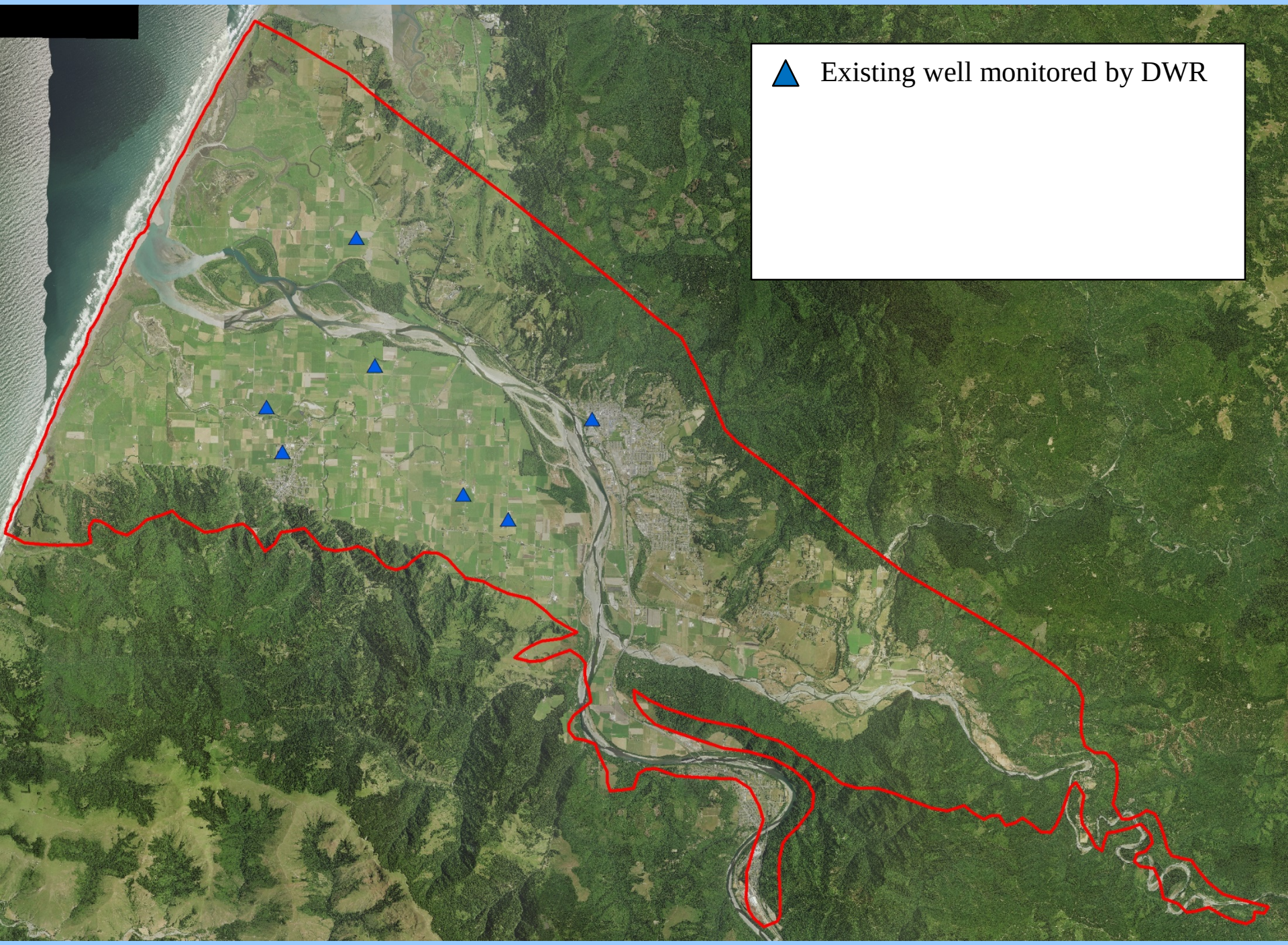


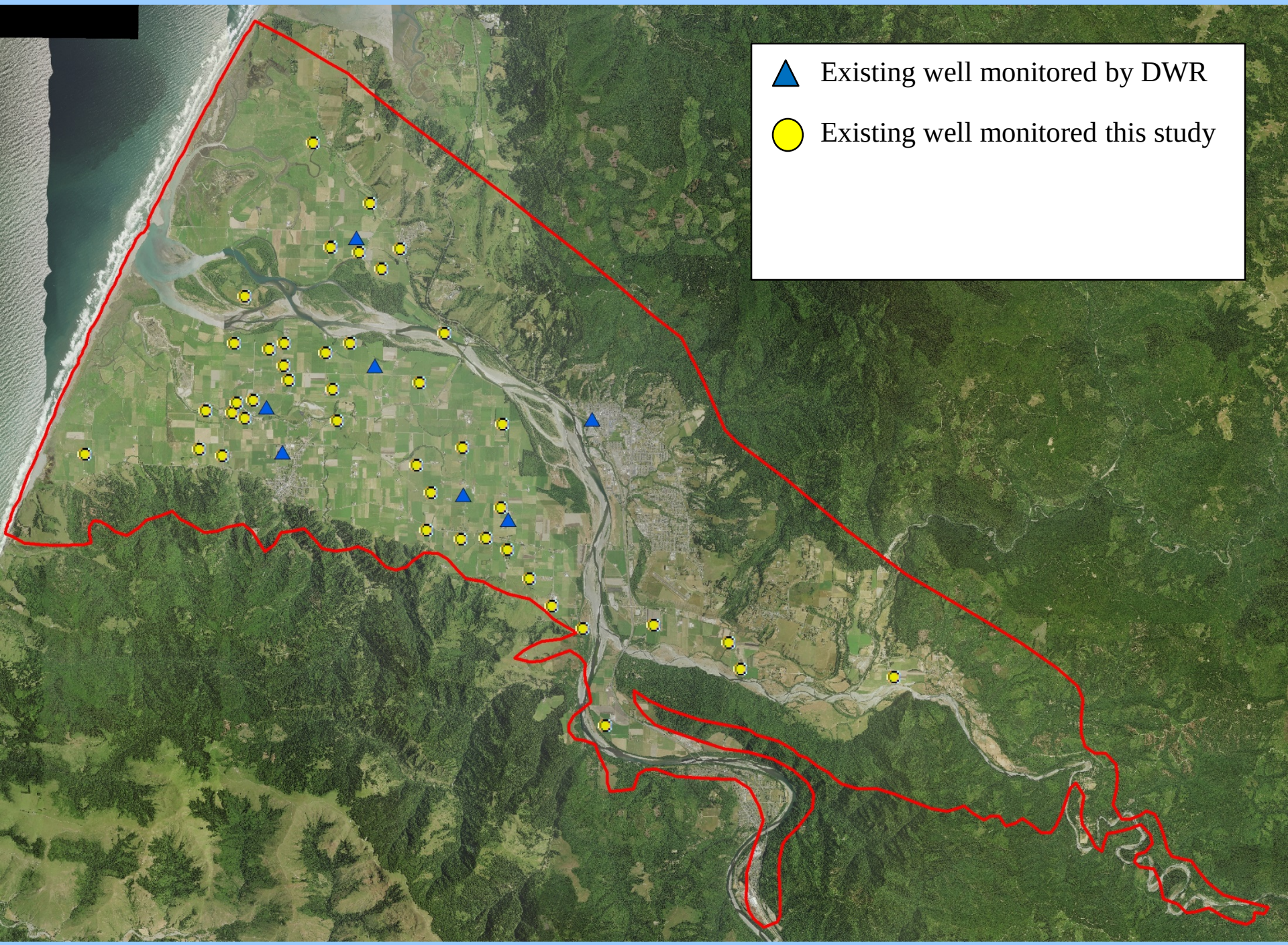
Example of overdraft:
Well near Rohnert Park in Santa Rosa Plain Watershed

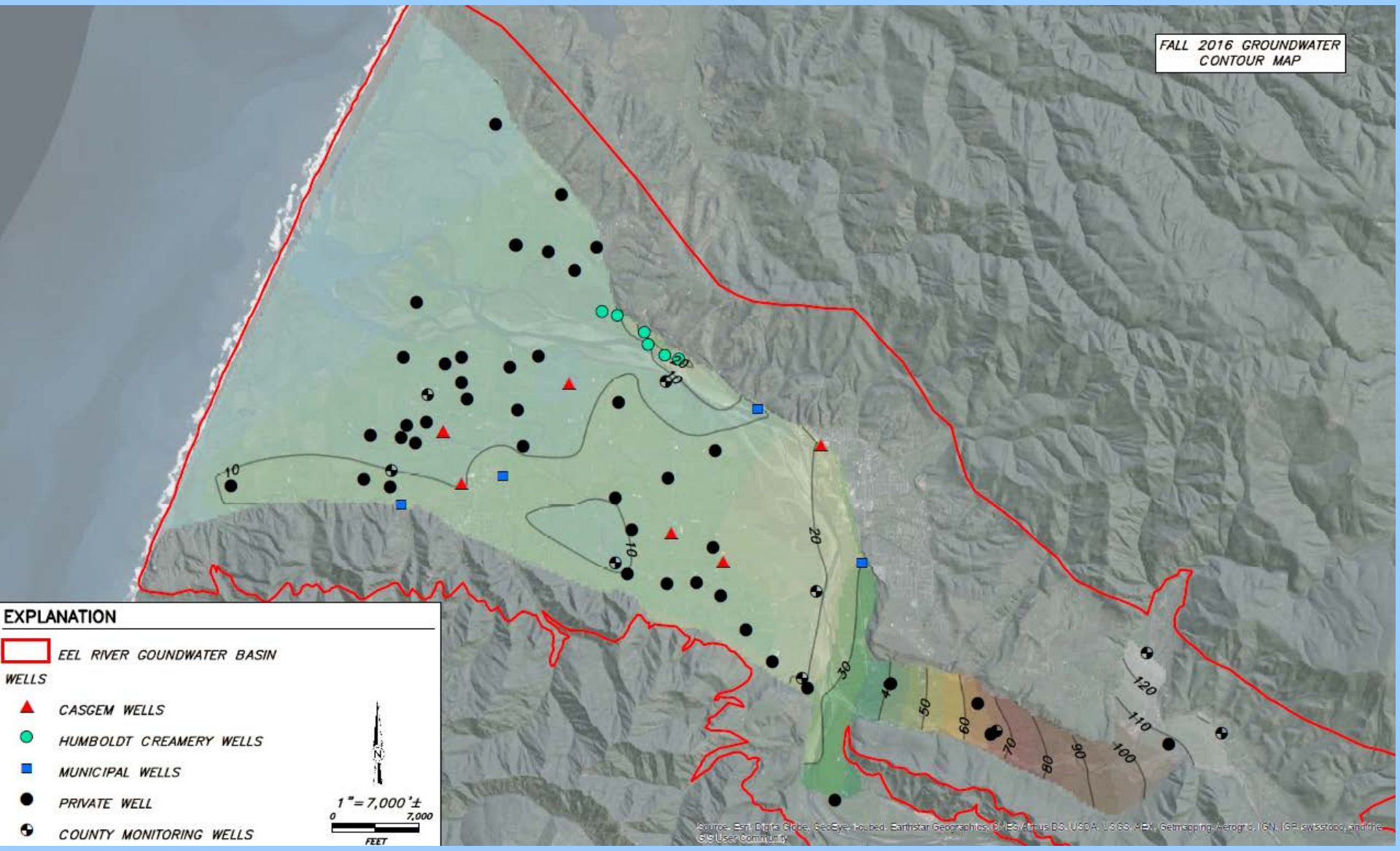


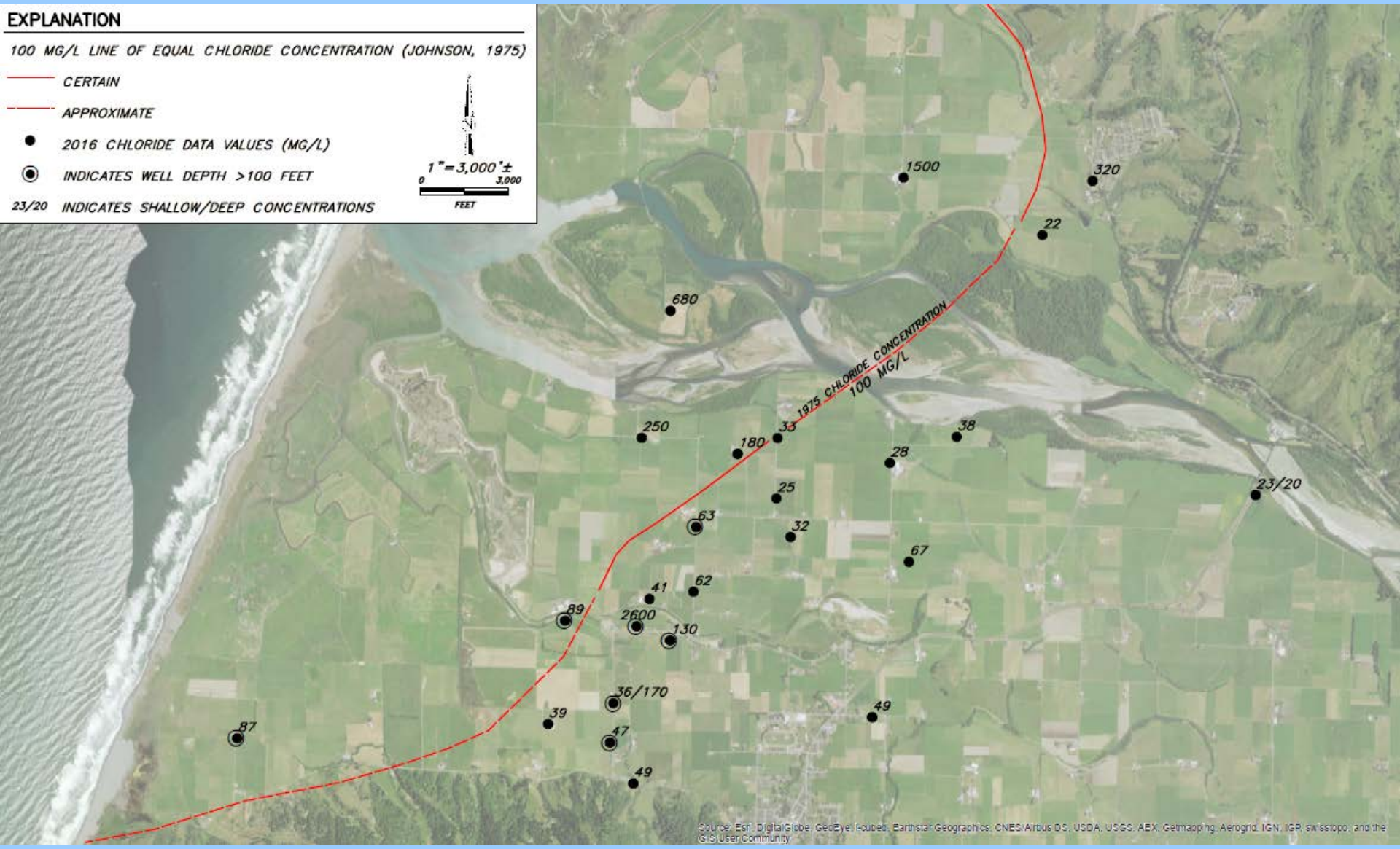
Example of overdraft:
Well near Rohnert Park in Santa Rosa Plain Watershed

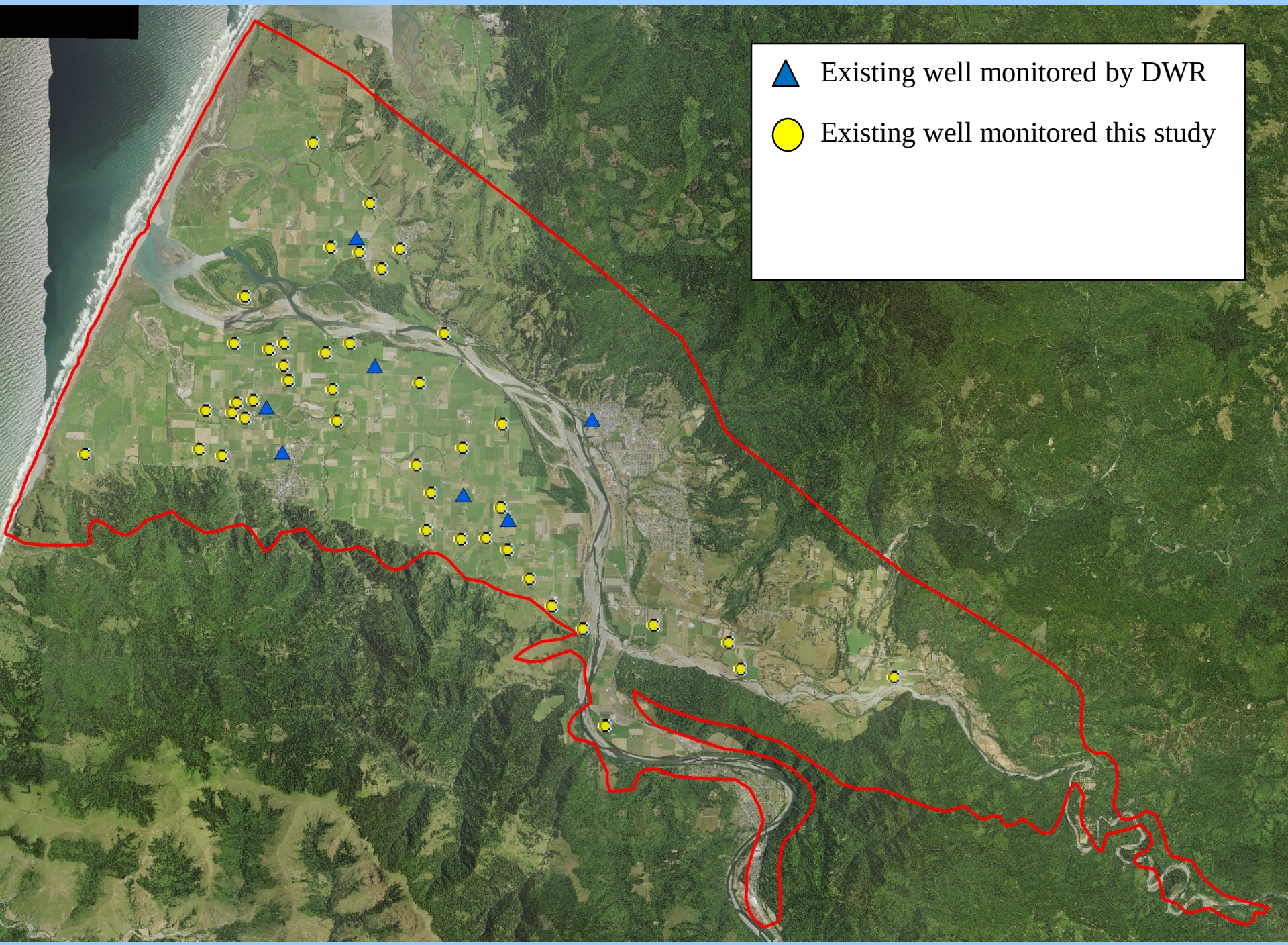


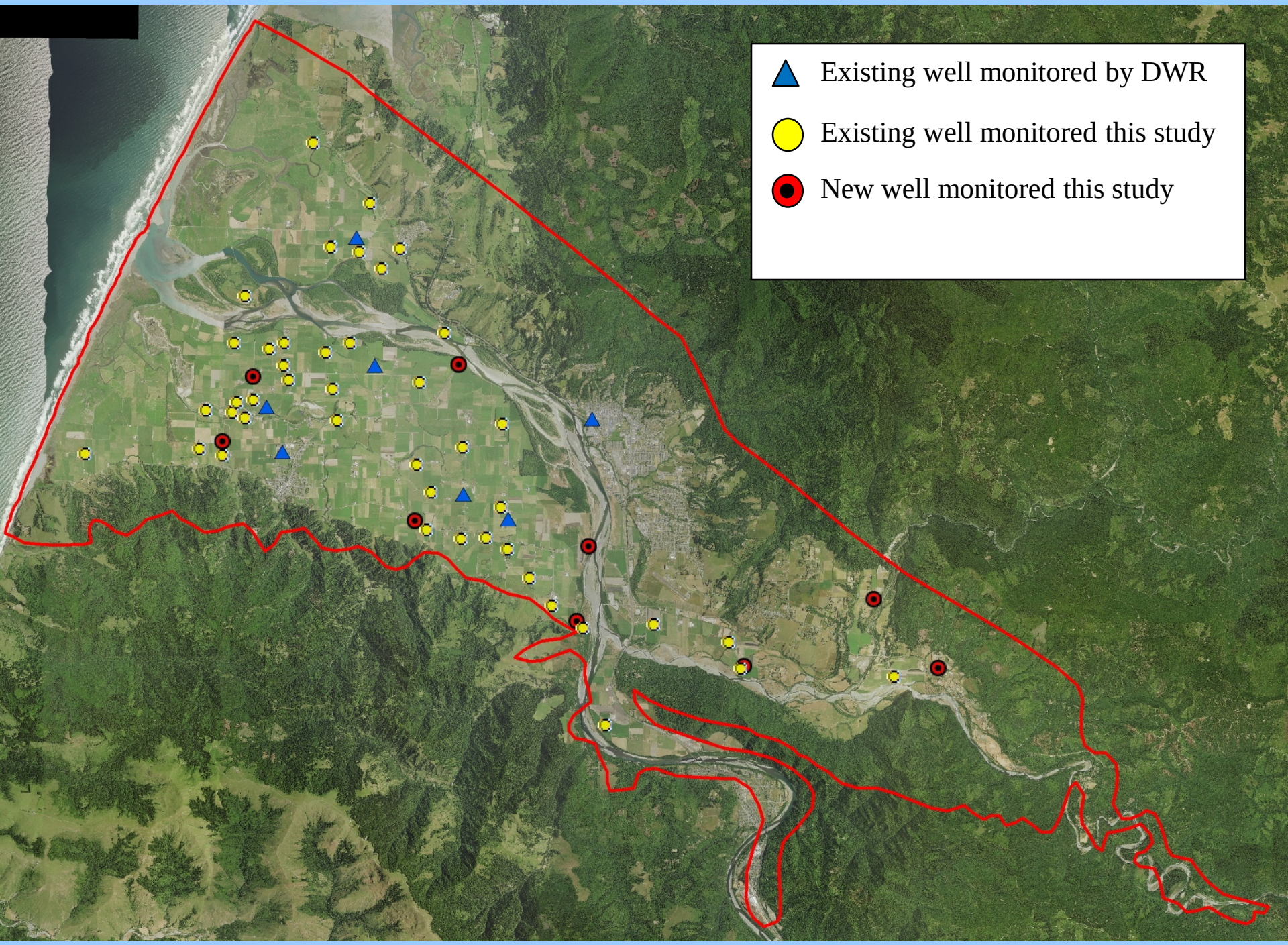

Existing well monitored by DWR


Existing well monitored by DWR
Existing well monitored this study


FALL 2016 GROUNDWATER CONTOUR MAP
EXPLANATION
EEL RIVER GOUNDWATER BASIN
WELLS
CASGEM WELLS
HUMBOLDT CREAMERY WELLS
MUNICIPAL WELLS
PRIVATE WELL
COUNTY MONITORING WELLS
1" = 7,000' ±
0
7,000
FEET
10
20
30
40
50
60
70
80
90
100
110
120


EXPLANATION
100 MG/L LINE OF EQUAL CHLORIDE CONCENTRATION (JOHNSON, 1975)
CERTAIN
APPROXIMATE
2016 CHLORIDE DATA VALUES (MG/L)
INDICATES WELL DEPTH >100 FEET
23/20 INDICATES SHALLOW/DEEP CONCENTRATIONS
1"=3,000'±
0
3,000
FEET
1975 CHLORIDE CONCENTRATION
100 MG/L
1500
320
22
680
250
180
33
38
28
25
23/20
63
32
67
41
62
89
2600
130
36/170
49
39
47
87
49
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community


Existing well monitored by DWR
Existing well monitored this study

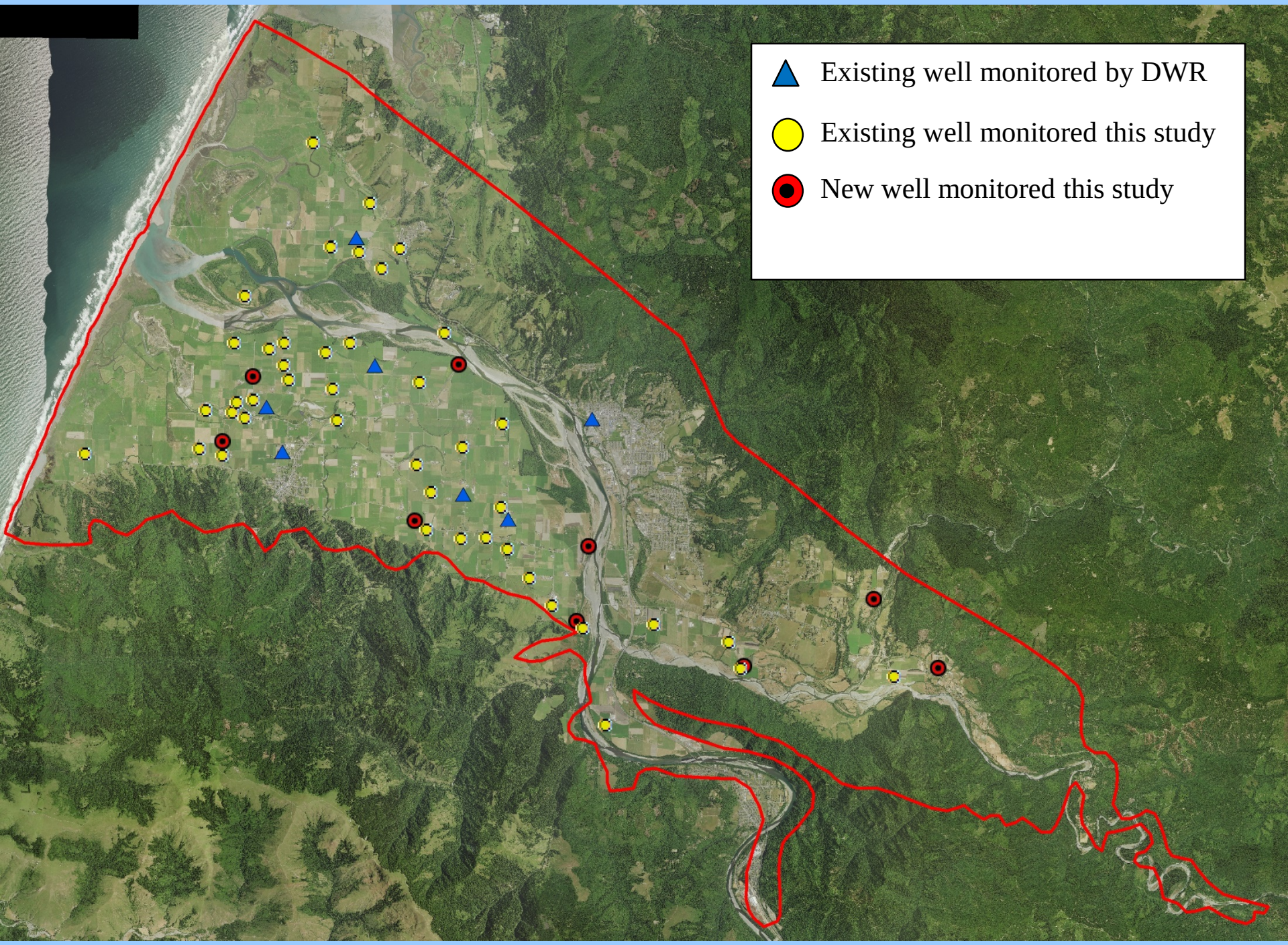

Existing well monitored by DWR
Existing well monitored this study
New well monitored this study

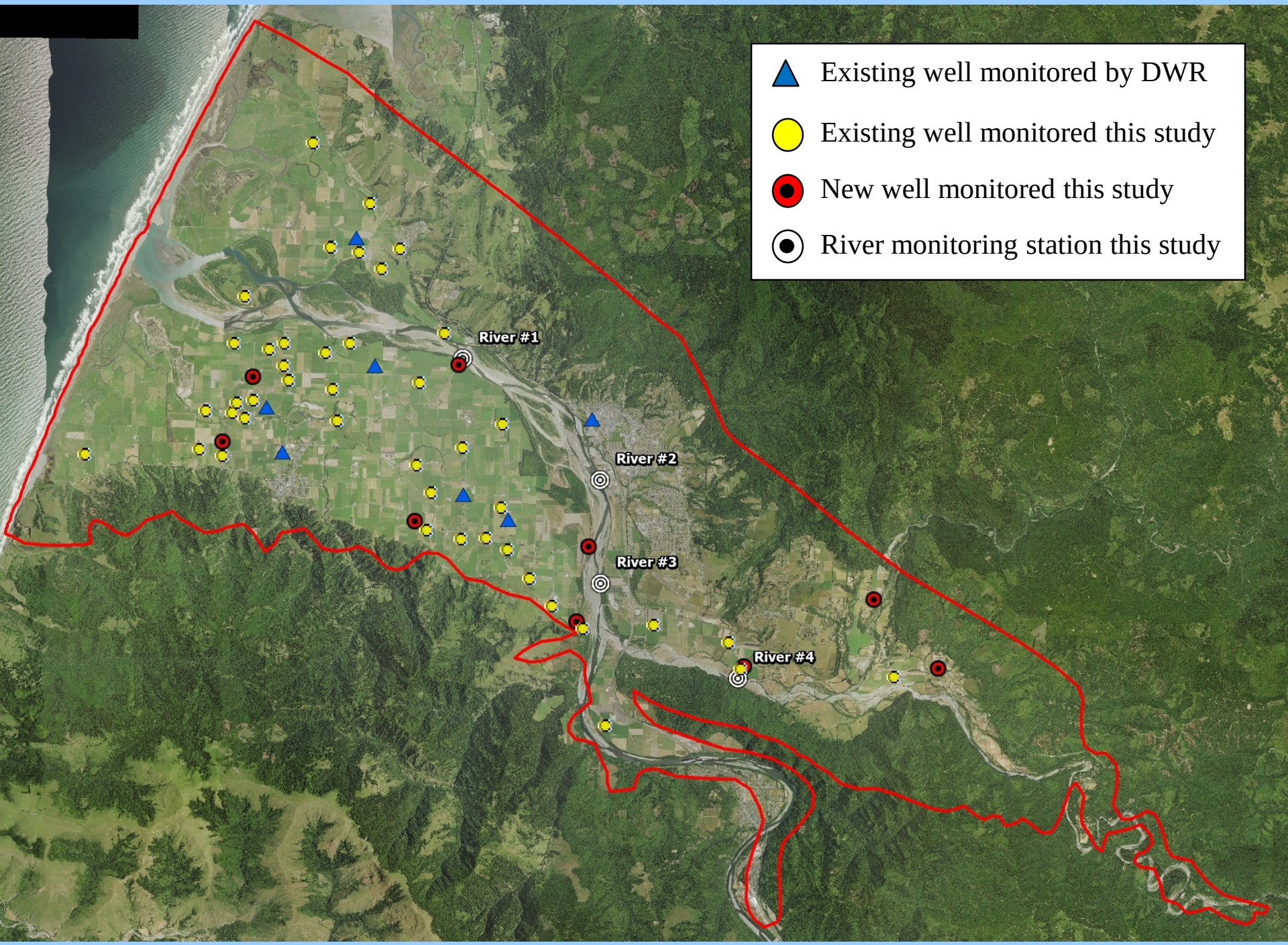
New Groundwater Wells

- Three deep wells with mud rotary drilling rig
- Down to 240 feet below ground surface
- Two of the wells have nested screens (one shallow/one deep)
- Will provide information on connectivity of shallow and deep groundwater, and saltwater intrusion

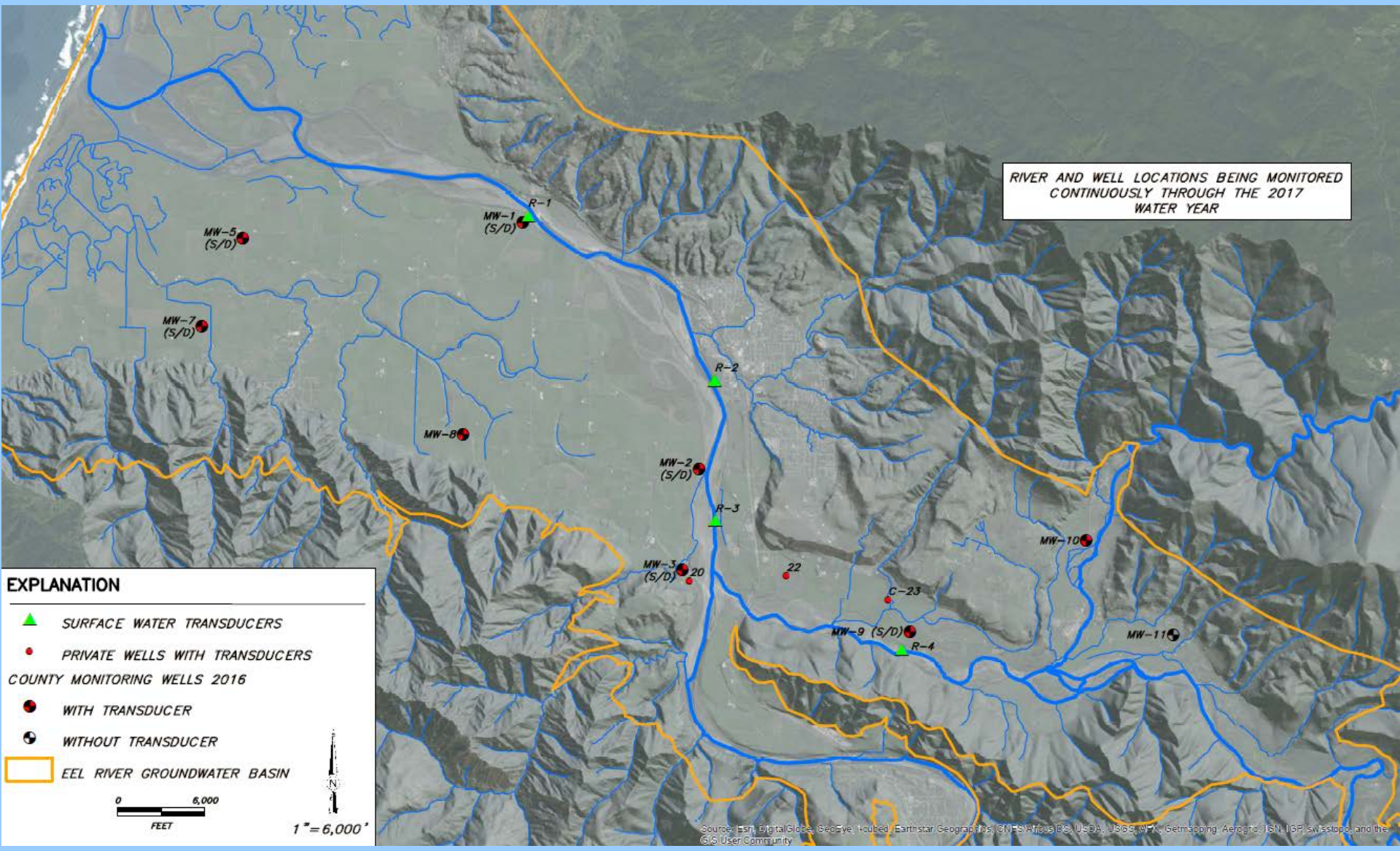
New Groundwater Wells

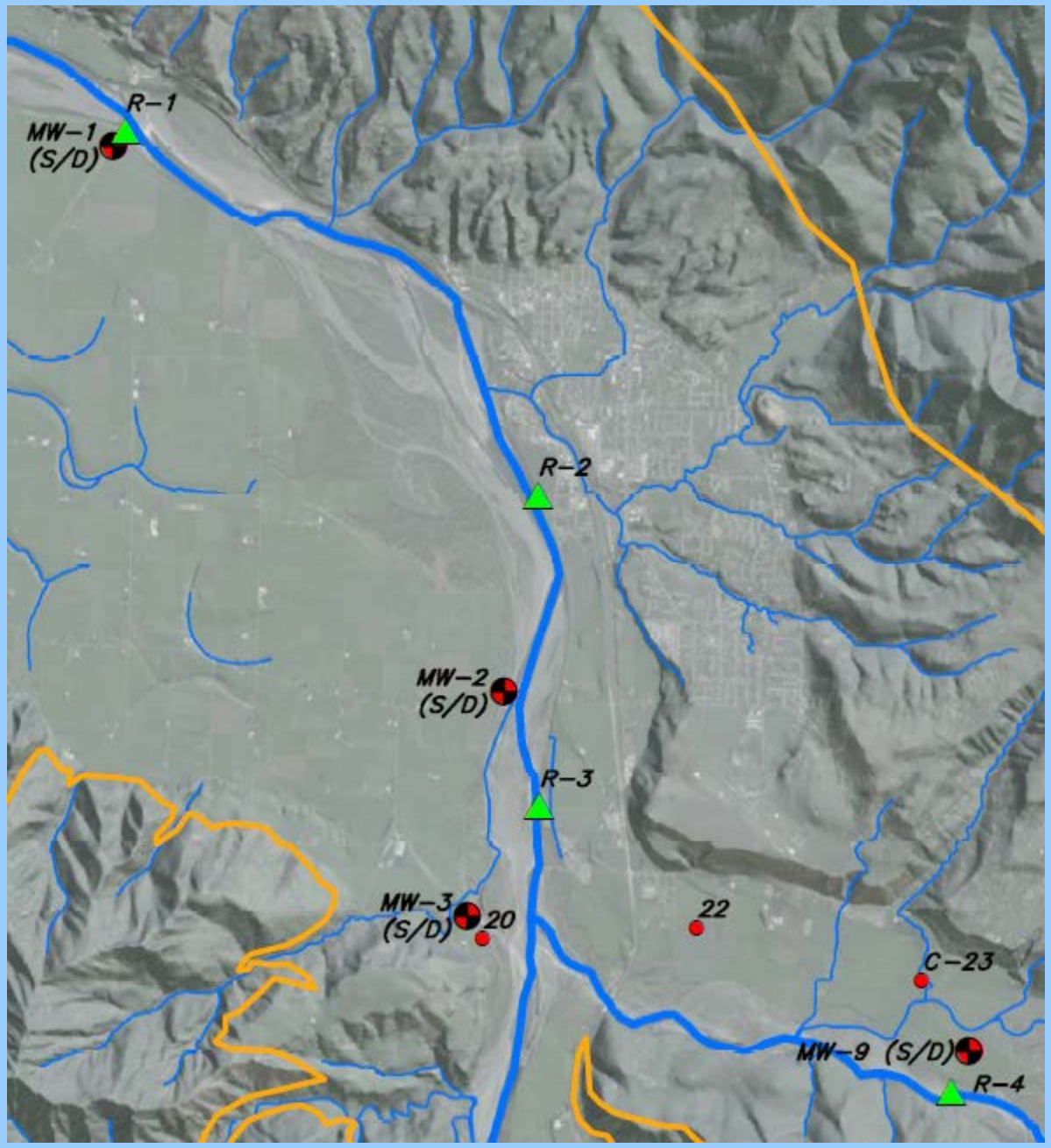
- Six shallow wells with GeoProbe (direct push)
- Down to 60 feet below ground surface
- Four of the six wells have nested screens (one shallow/one deep)
- Will provide information on groundwater/surface water connectivity, spatial distribution of groundwater levels, vertical gradients


Existing well monitored by DWR
Existing well monitored this study
New well monitored this study

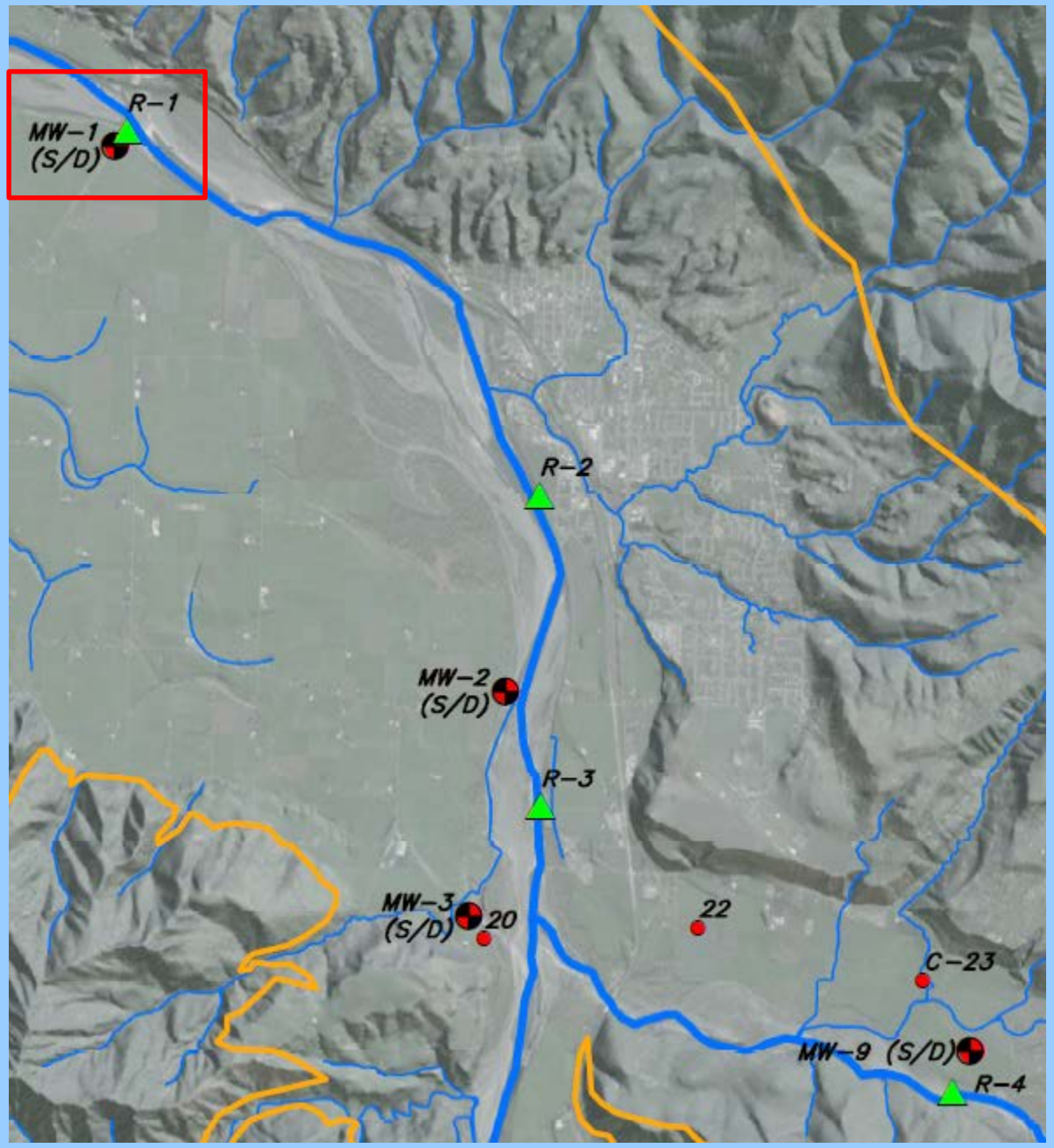

Existing well monitored by DWR
Existing well monitored this study
New well monitored this study
River monitoring station this study
River #1
River #2
River #3
River #4

River monitoring stations

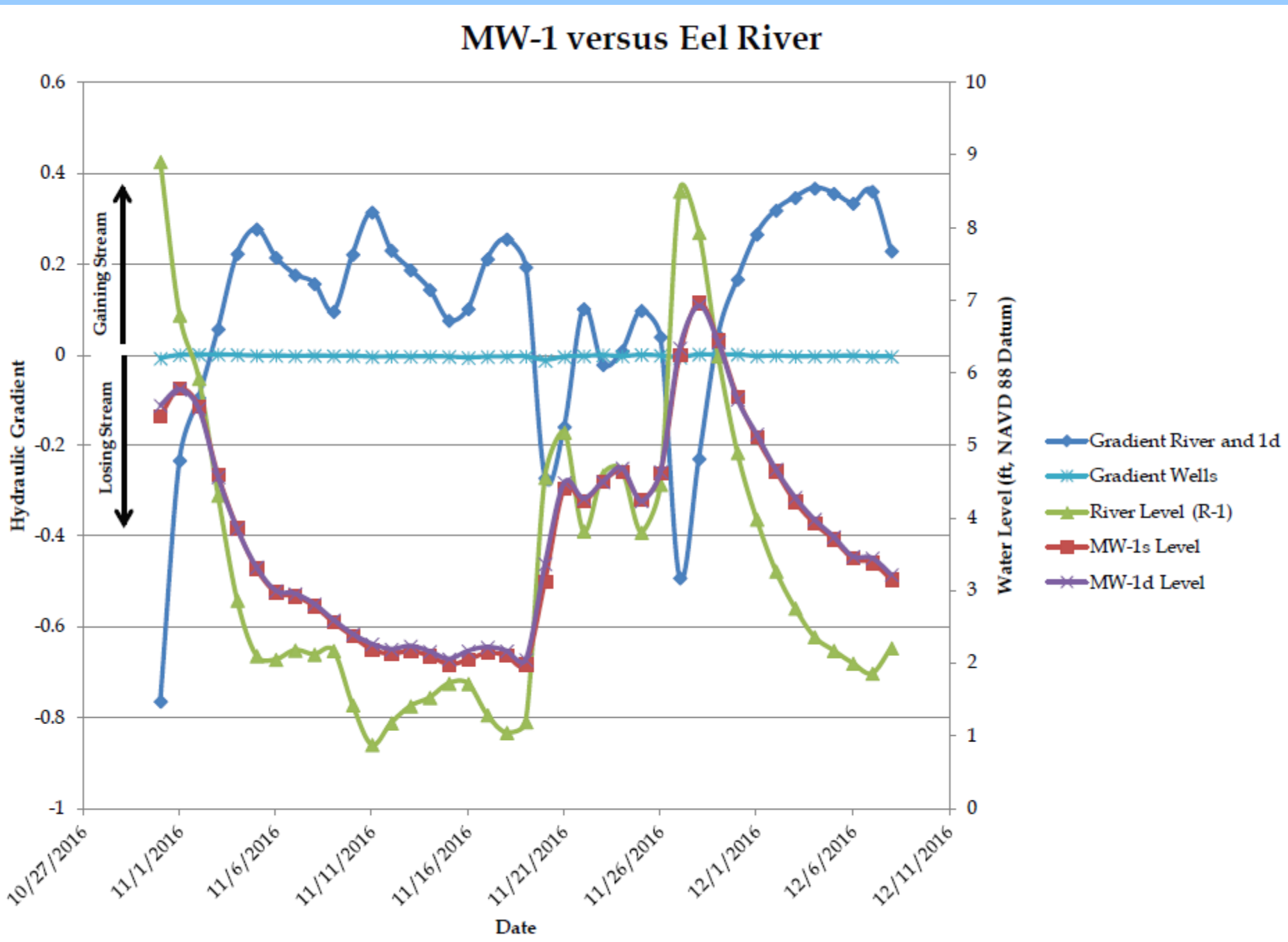

RIVER AND WELL LOCATIONS BEING MONITORED CONTINUOUSLY THROUGH THE 2017 WATER YEAR
R-1
MW-1 (S/D)
MW-5 (S/D)
MW-7 (S/D)
MW-8
R-2
MW-2 (S/D)
R-3
MW-3 (S/D)
20
22
MW-10
C-23
MW-9 (S/D)
R-4
MW-11
EXPLANATION
SURFACE WATER TRANSDUCERS
PRIVATE WELLS WITH TRANSDUCERS
COUNTY MONITORING WELLS 2016
WITH TRANSDUCER
WITHOUT TRANSDUCER
EEL RIVER GROUNDWATER BASIN
0
6,000
FEET
1"=6,000'
N
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, Swisstopo, and the GIS User Community


R–1
MW–1
(S/D)
R–2
MW–2
(S/D)
R–3
MW–3
(S/D)
20
22
C–23
MW–9 (S/D)
R–4

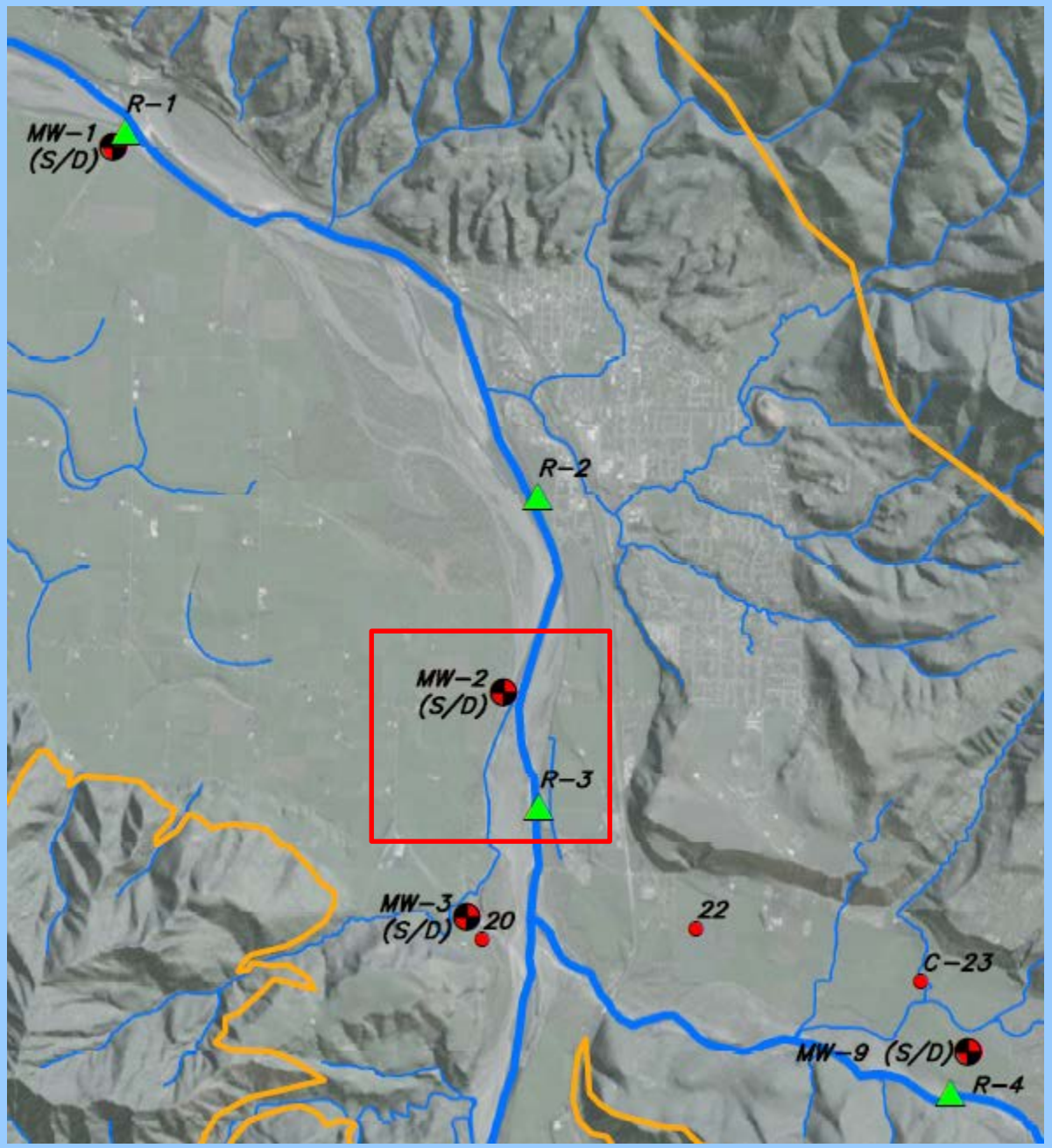
MW-1/R-1


R–1
MW–1
(S/D)
R–2
MW–2
(S/D)
R–3
MW–3
(S/D)
20
22
C–23
MW–9 (S/D)
R–4

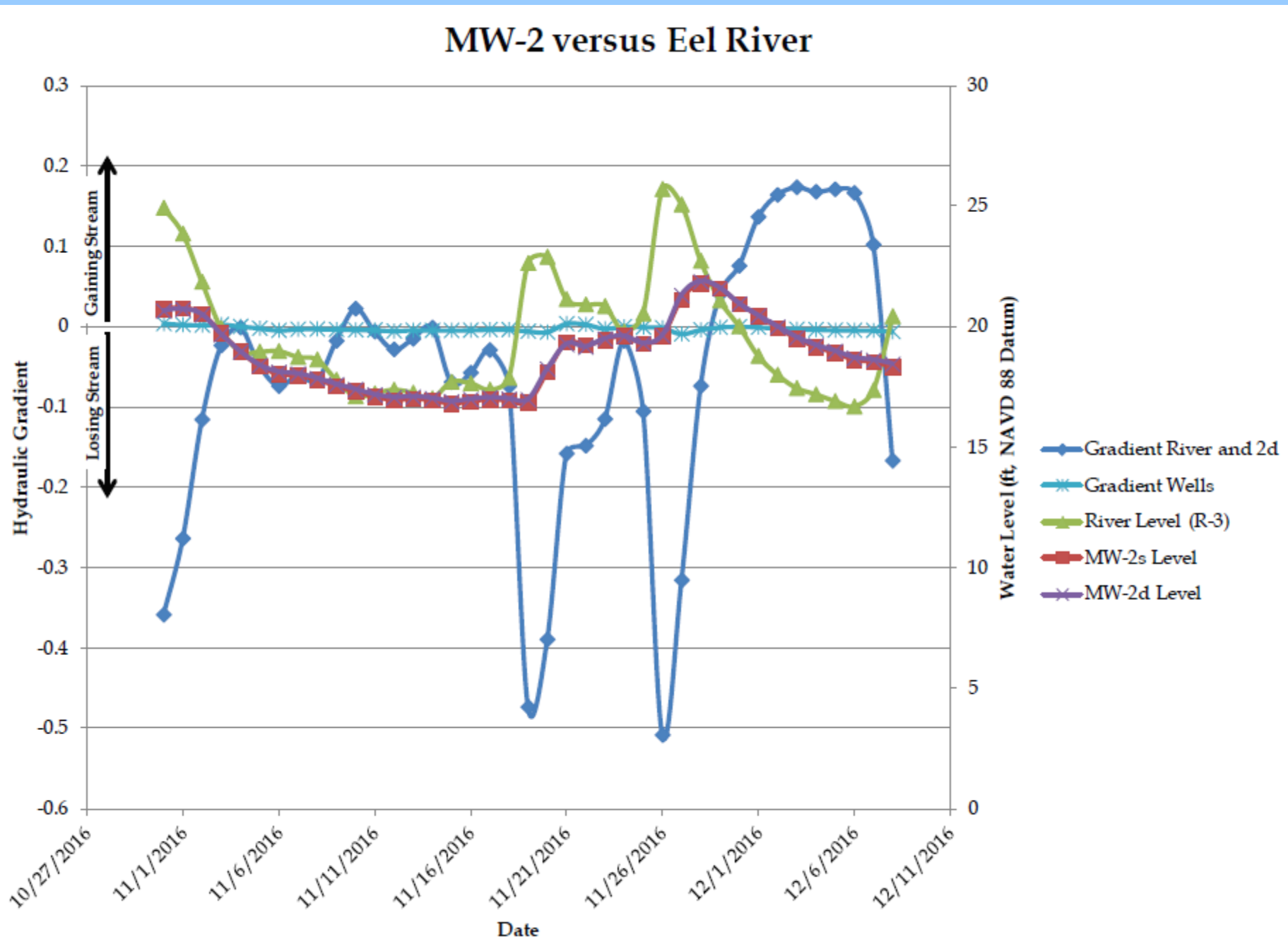

River #1
MW-1s/1d
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community


MW-1 versus Eel River
Hydraulic Gradient
Water Level (ft, NAVD 88 Datum)
Date
Gaining Stream
Losing Stream
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
10
9
8
7
6
5
4
3
2
1
0
10/27/2016
11/1/2016
11/6/2016
11/11/2016
11/16/2016
11/21/2016
11/26/2016
12/1/2016
12/6/2016
12/11/2016
Gradient River and 1d
Gradient Wells
River Level (R-1)
MW-1s Level
MW-1d Level

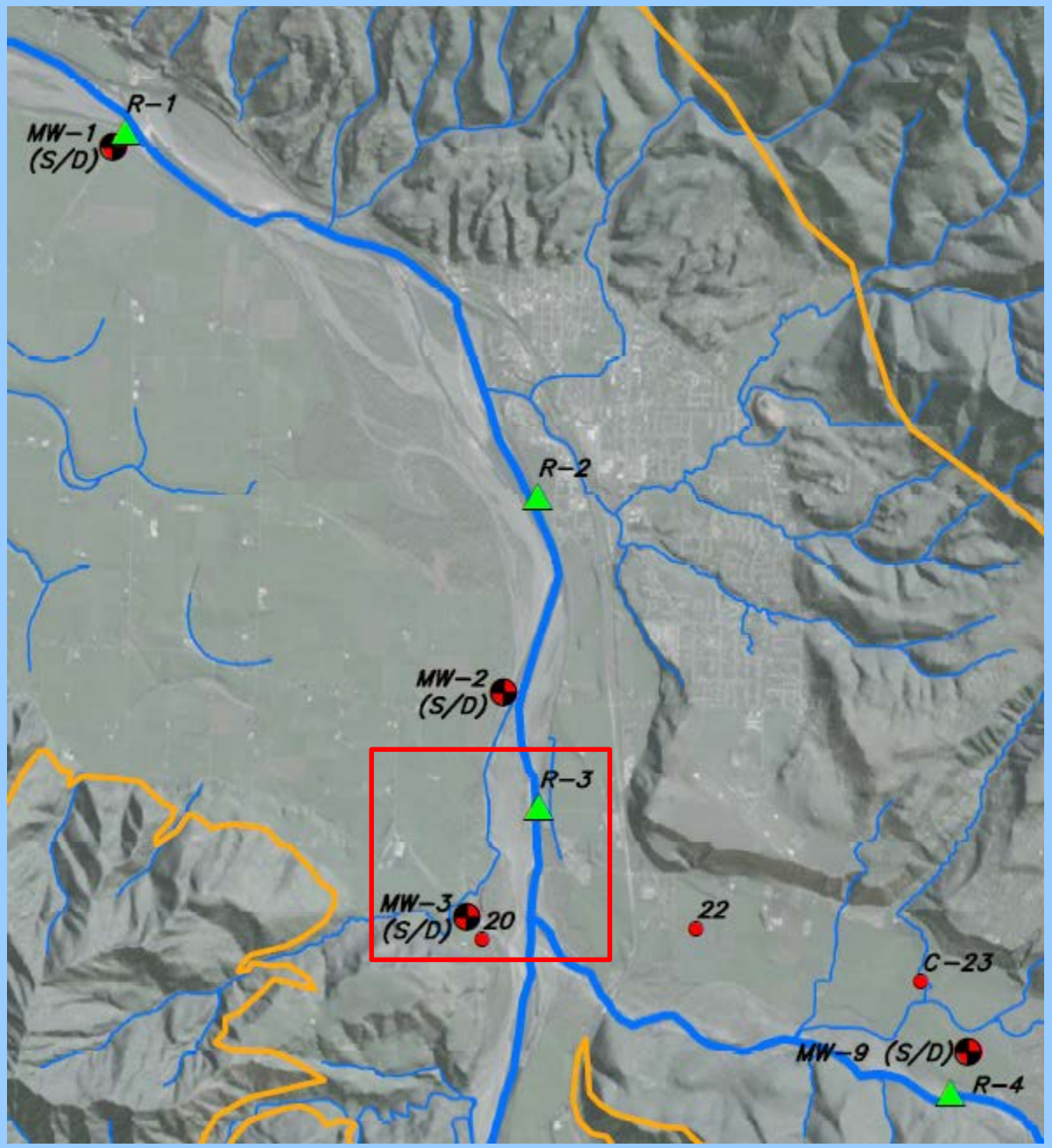
MW-2/R-3


R-1
MW-1
(S/D)
R-2
MW-2
(S/D)
R-3
MW-3
(S/D)
20
22
C-23
MW-9 (S/D)
R-4

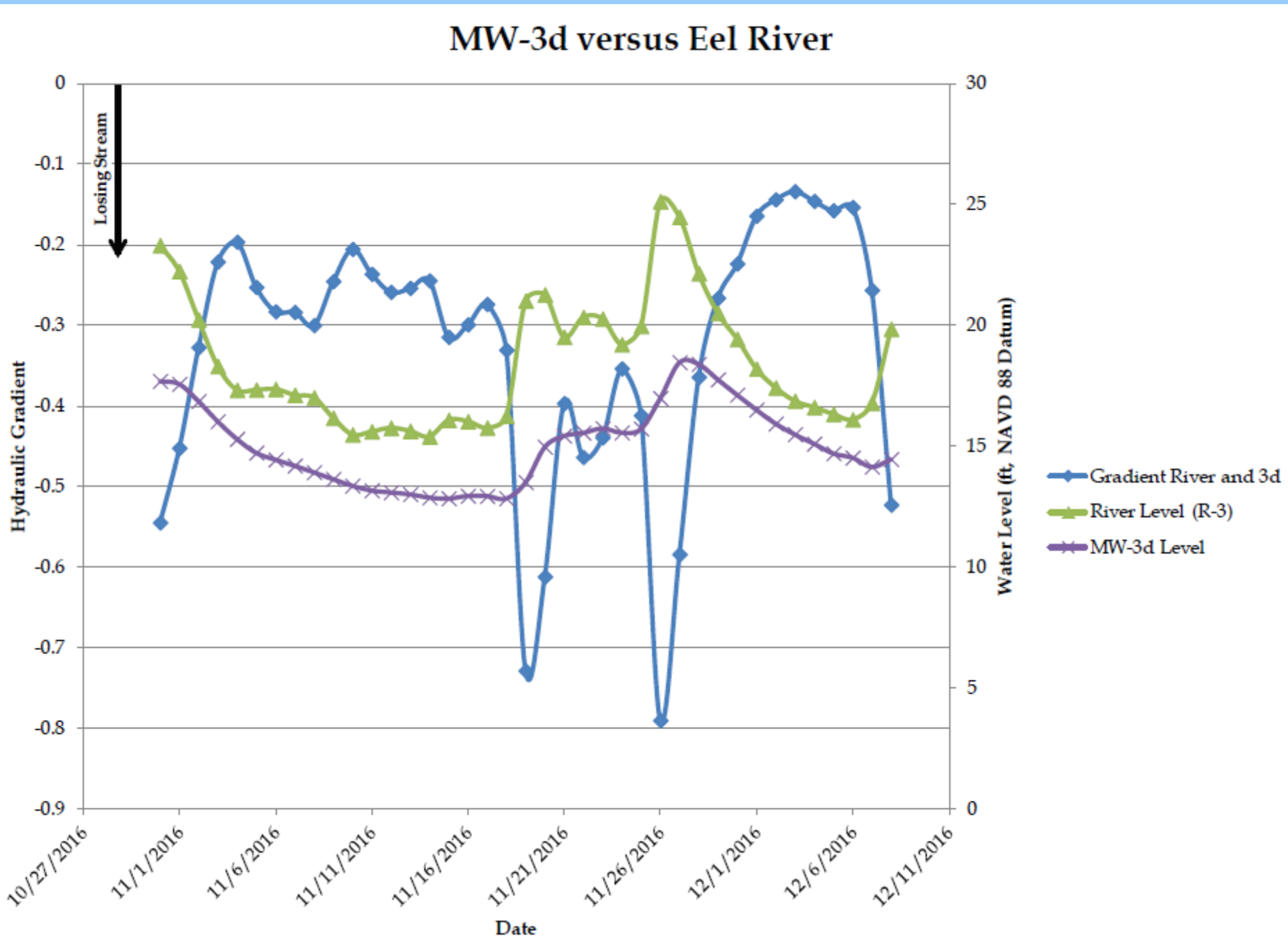

MW-2s/2d
River #3
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community


MW-2 versus Eel River
Hydraulic Gradient
Water Level (ft, NAVD 88 Datum)
Gaining Stream
Losing Stream
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
30
25
20
15
10
5
0
10/27/2016
11/1/2016
11/6/2016
11/11/2016
11/16/2016
11/21/2016
11/26/2016
12/1/2016
12/6/2016
12/11/2016
Date
Gradient River and 2d
Gradient Wells
River Level (R-3)
MW-2s Level
MW-2d Level

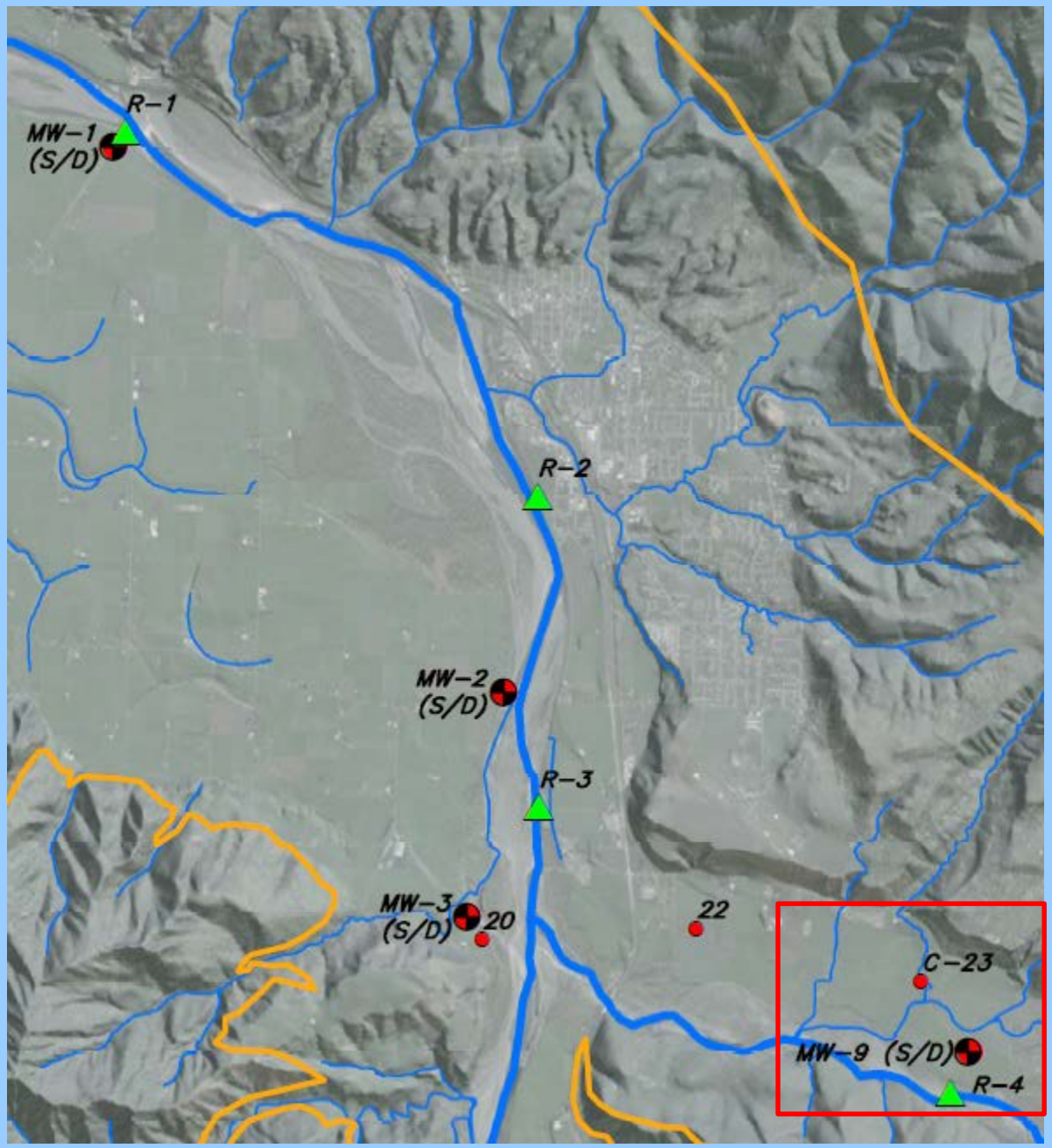
MW-3/R-3


R–1
MW–1
(S/D)
R–2
MW–2
(S/D)
R–3
MW–3
(S/D)
20
22
C–23
MW–9 (S/D)
R–4

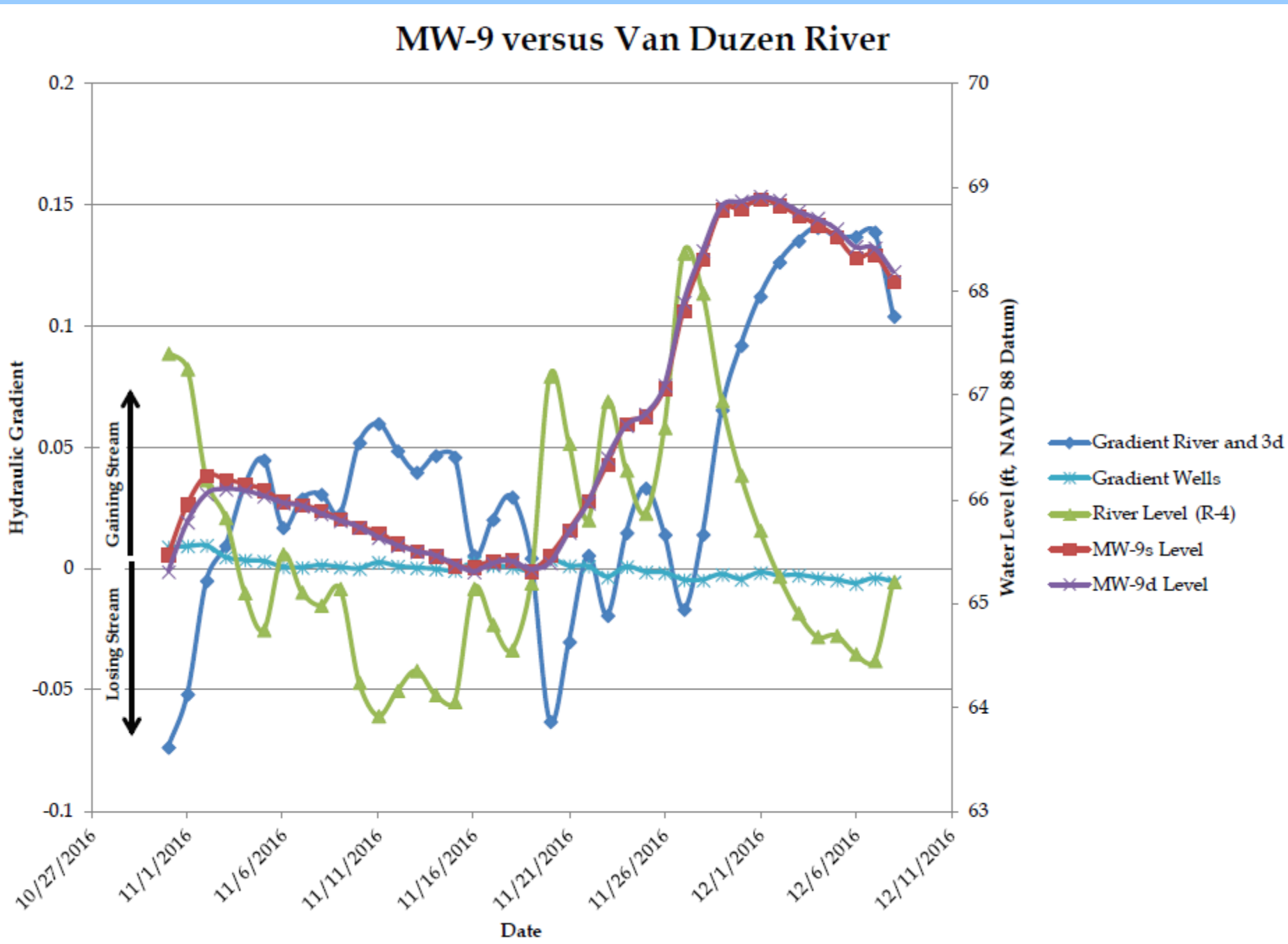

River #3
GRIZZLY BLUFF RD
MW-3s/3d
WEYMOUTH BLUFF RD
BLUE SLIDE RD
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community


MW-3d versus Eel River
Losing Stream
Hydraulic Gradient
Water Level (ft, NAVD 88 Datum)
Date
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
30
25
20
15
10
5
0
10/27/2016
11/1/2016
11/6/2016
11/11/2016
11/16/2016
11/21/2016
11/26/2016
12/1/2016
12/6/2016
12/11/2016
Gradient River and 3d
River Level (R-3)
MW-3d Level

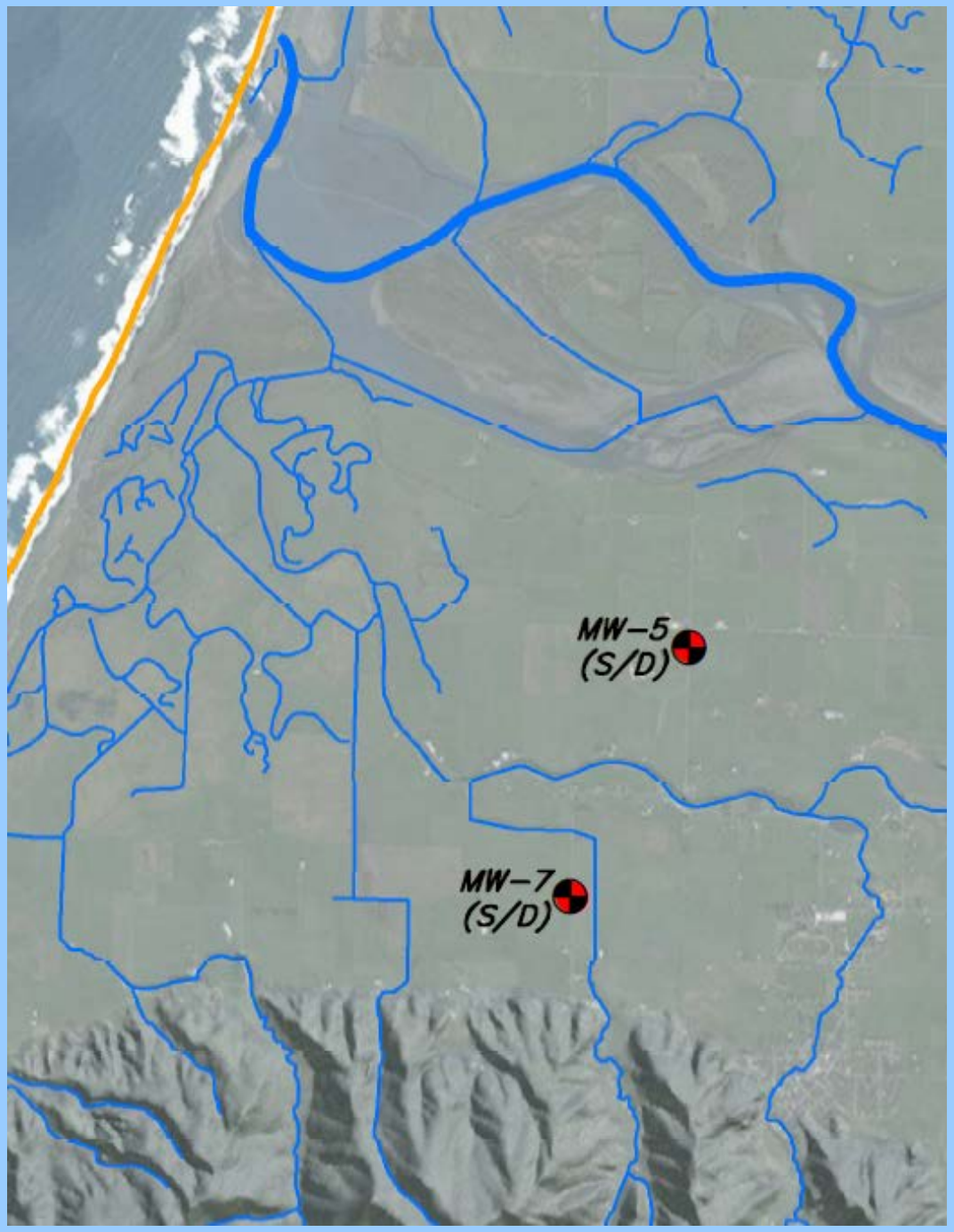
MW-9/R-4


R–1
MW–1
(S/D)
R–2
MW–2
(S/D)
R–3
MW–3
(S/D)
20
22
C–23
MW–9 (S/D)
R–4

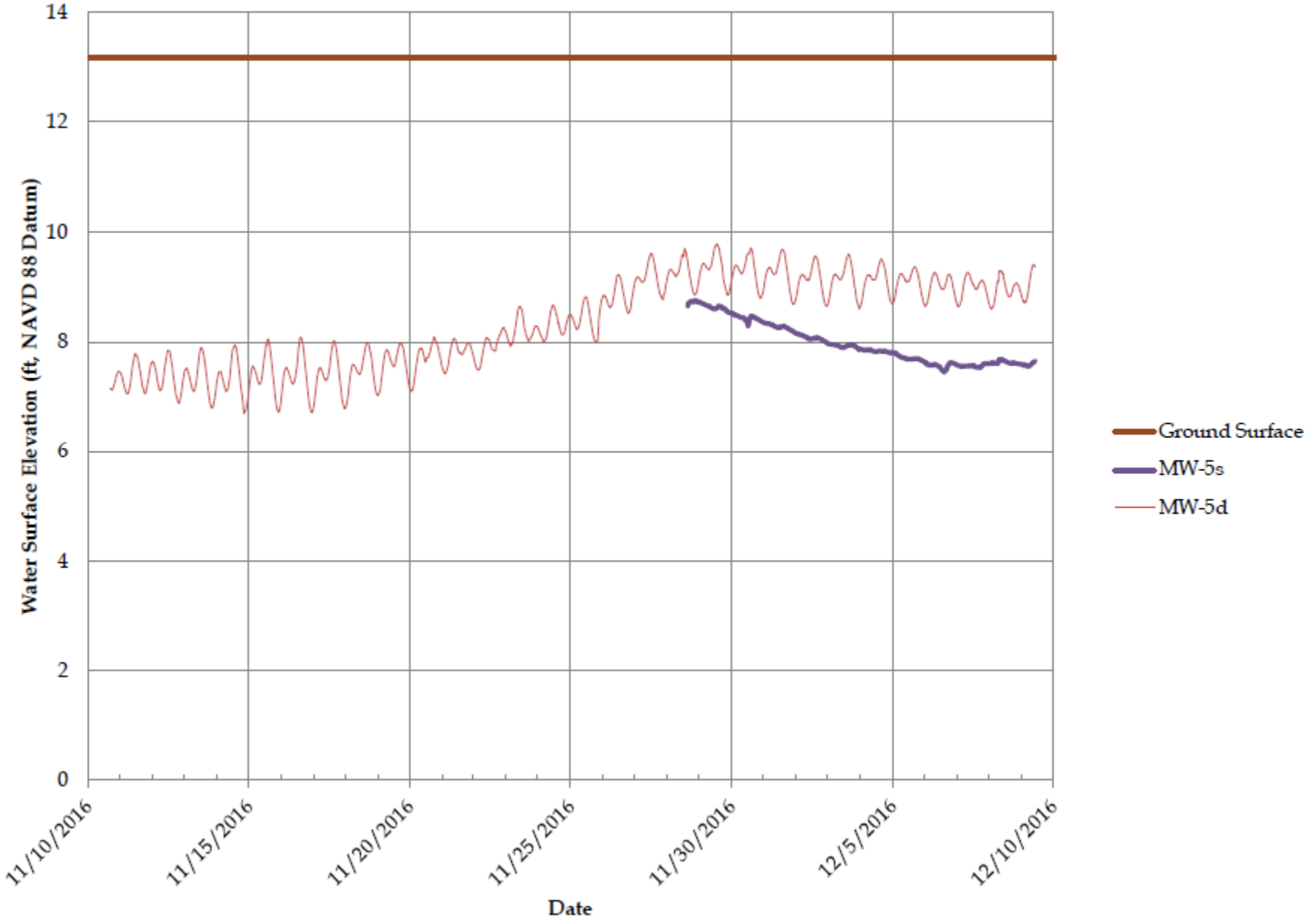

MW-9s/9d
River #4
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

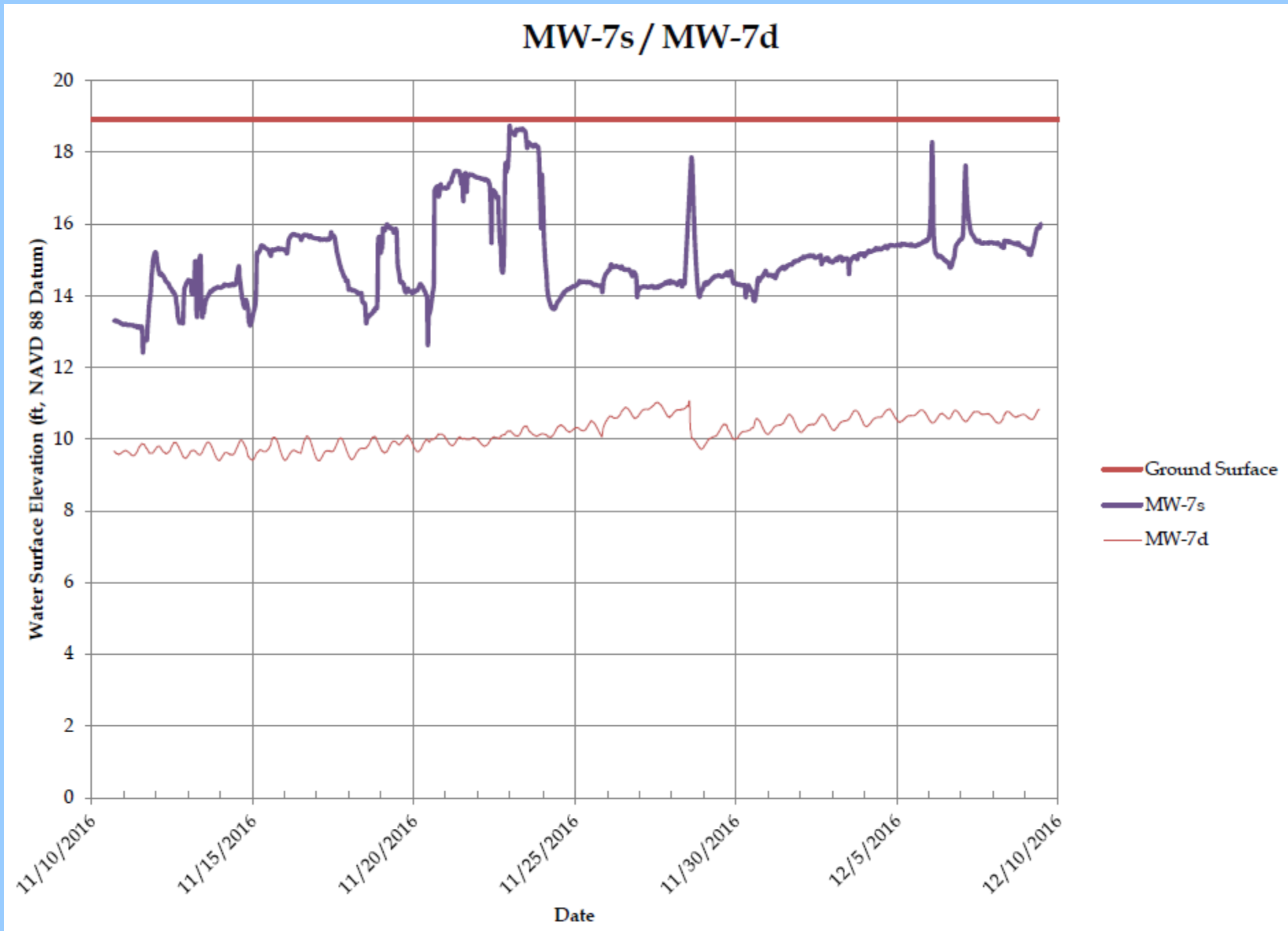

MW-9 versus Van Duzen River
Hydraulic Gradient
Water Level (ft, NAVD 88 Datum)
Date
Gaining Stream
Losing Stream
0.2
0.15
0.1
0.05
0
-0.05
-0.1
70
69
68
67
66
65
64
63
10/27/2016
11/1/2016
11/6/2016
11/11/2016
11/16/2016
11/21/2016
11/26/2016
12/1/2016
12/6/2016
12/11/2016
Gradient River and 3d
Gradient Wells
River Level (R-4)
MW-9s Level
MW-9d Level

MW-5 and MW-7



MW-5s / MW-5d


14
12
10
8
6
4
2
0
Water Surface Elevation (ft, NAVD 88 Datum)
11/10/2016
11/15/2016
11/20/2016
11/25/2016
11/30/2016
12/5/2016
12/10/2016
Date
Ground Surface
MW-5s
MW-5d


MW-7s / MW-7d
Water Surface Elevation (ft, NAVD 88 Datum)
20
18
16
14
12
10
8
6
4
2
0
11/10/2016
11/15/2016
11/20/2016
11/25/2016
11/30/2016
12/5/2016
12/10/2016
Date
Ground Surface
MW-7s
MW-7d

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Eel River Valley Groundwater Basin GIS-Based Water Budget

V2

PECG Project #
160431

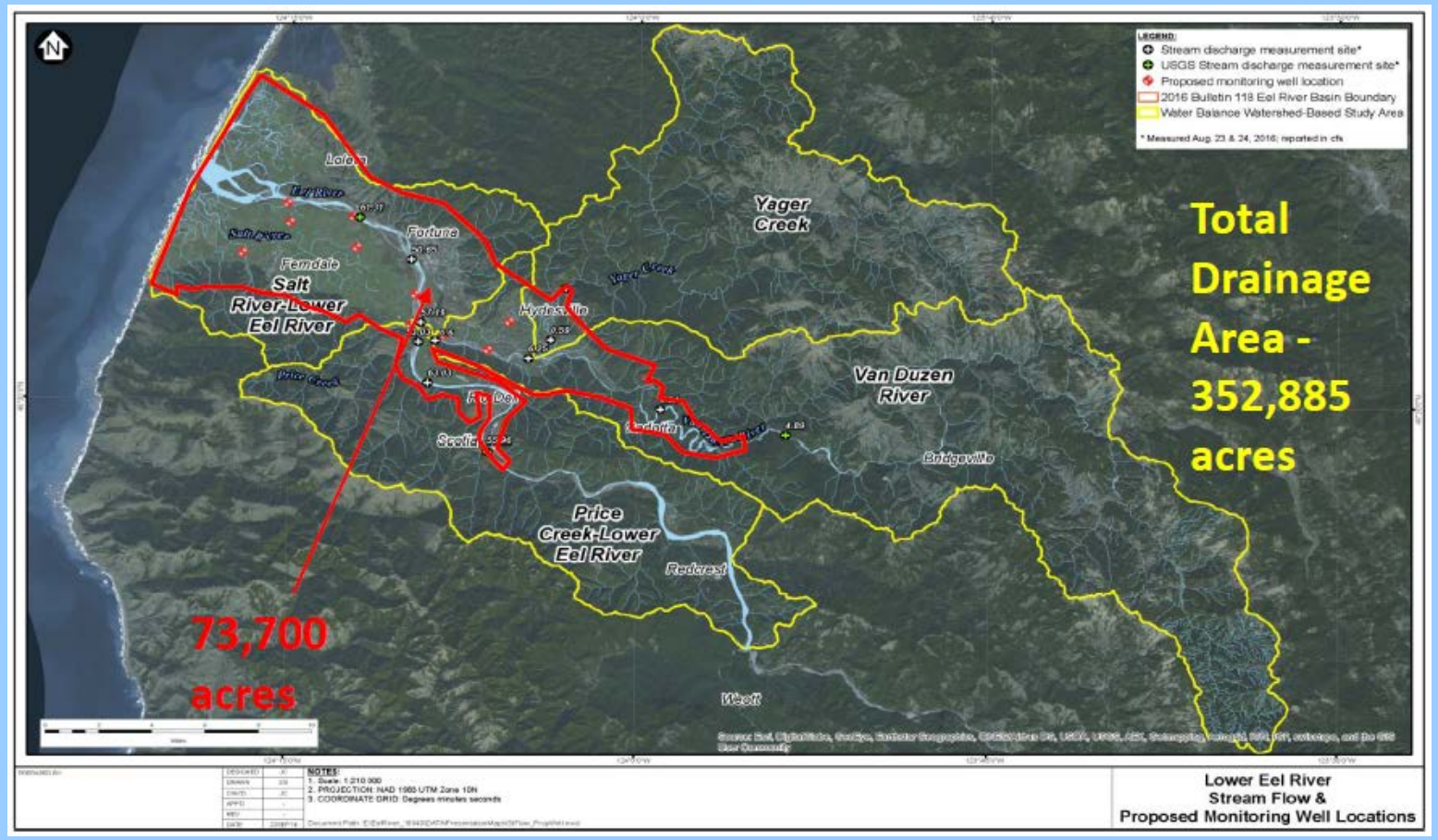
Prepared For
SHN Consulting Engineers

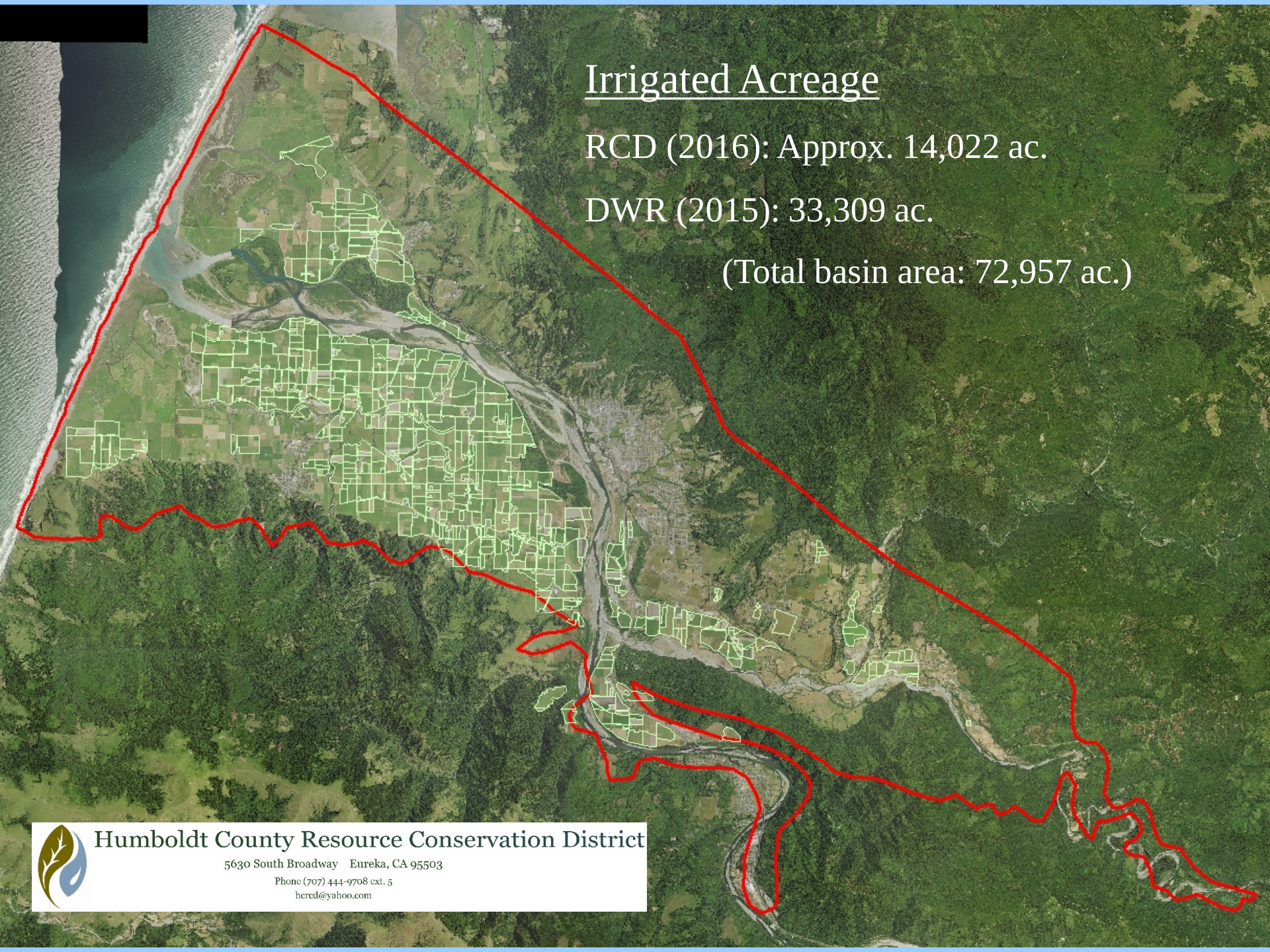
December 30, 2016

Comparison of Water Demand to Average Annual Recharge

Watershed Study Area (352,885 acres)

- *Preliminary Recharge Estimate* – 394,770 acre-feet per year
- Total Water Use – 20,000 acre-feet per year
- Preliminary Water Stress – Approx. 5% of annual recharge is utilized
  - ➢ Low Stress





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Agricultural Irrigation Groundwater Use for the Eel River Valley

Source	Irrigated Land (Acres)	Water Use Volume (Acre-feet)	Water Use Rate (Acre-feet per acre)
DWR (1968)	11,700	18,800	1.0 to 1.7
USGS (1978)	17,300	17,300	1.0
DWR (2003)	-	49,000	-
DWR (2012)	26,800	24,400	0.9 (implied)
RCD (2016)	13,558	10,265 to 16,680 (varies seasonally)	0.8 to 1.2

- RCD (2016) grouped grazed pasture, hay production, alfalfa production
- USDA (2013) provides state-wide average water use rates for California: ranges from 2.0 to 3.8 acre-feet per acre depending on land use

Six Sustainability Indicators

1	Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply
2	Significant and unreasonable reduction of groundwater storage
3	Significant and unreasonable seawater intrusion
4	Significant and unreasonable degraded water quality
5	Significant unreasonable land subsidence
6	Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water

Six Sustainability Indicators (1 of 2)

Sustainability Indicator / Undesirable Result		Evidence
1	Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply	1. Long-term groundwater level data collected by DWR 2. Recent groundwater level data collected by stakeholders
2	Significant and unreasonable reduction of groundwater storage	Same as above
3	Significant and unreasonable seawater intrusion	The position of the seawater/freshwater transition zone mapped in 2016 is comparable to the extent measured by USGS in 1975.

Six Sustainability Indicators (2 of 2)

Sustainability Indicator / Undesirable Result		Evidence
4	Significant and unreasonable degraded water quality	1. State Water Board data for salts and nutrients 2. Absence of large-scale contamination affecting water supplies
5	Significant unreasonable land subsidence	Stable groundwater levels
6	Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water	1. Stable groundwater levels over several decades. 2. Groundwater use represents 4-5% of annual recharge. 3. Groundwater levels were not significantly different in Fall 2014 when the Lower Eel went subsurface. 4. The Lower Eel maintains deep pools. 5. Primary causes of low-flow conditions are flood deposits, upstream diversions 6. No flow-study to define flow requirements for beneficial uses

Conclusions

1. Groundwater is a highly important resource in the Eel River Valley
2. Current and historical groundwater levels are stable
3. No evidence of undesirable results caused by groundwater use; initial data and analysis support demonstration of sustainable use over last 10 years
4. Late-summer low-flows in the Lower Eel and Van Duzen Rivers are a concern
   - Key watershed issues: upstream diversions, sediment deposits, forest composition
   - Groundwater use may have an affect on summer low-flow, but no evidence that groundwater use is causing undesirable results as defined by SGMA
5. Groundwater Sustainability Plan Alternative is appropriate for SGMA compliance
   - GSP Alternative was submitted to DWR on December 30, 2016
   - Comment period ends on April 1, 2017
   - DWR to decide on acceptance of GSP Alternative in mid- to late-2017
   - Basin prioritization will be re-evaluated by DWR in 2017