Table 4: Measured discharge values (cfs) at each discharge measurement location over the 2021 low-flow season and discharge reported by nearby USGS gauging stations.

| Site | Date | Time | Measured Discharge (cfs) |
|---|---|---|---|
| QM-2 | 6/25/2021 | 8:50 | 175.084 |
| | 7/23/2021 | 9:30 | 43.50 |
| | 8/26/2021 | 12:43 | 8.81 |
| QM -3 | 6/11/2021 | 13:42 | 299.03 |
| | 7/21/2021 | 13:45 | 51.87 |
| | 8/25/2021 | 14:06 | 22.09 |
| QM -5 | 6/25/2021 | 9:52 | 189.347 |
| | 7/23/2021 | 11:50 | 49.96 |
| | 8/26/2021 | 15:38 | 13.95 |
| QM-SW-1 | 6/25/2021 | 7:45 | 168.706 |
| | 7/21/2021 | 9:55 | 49.05 |
| | 8/25/2021 | 9:30 | 27.51 |
| QM-SW-2 | 6/10/2021 | 10:15 | 6.98 |
| | 7/22/2021 | 13:00 | 2.26 |
| | 8/18/2021 | 11:45 | 0.09 |
| QM-SW-3 | 6/4/2021 | 13:32 | 32.73 |
| | 7/22/2021 | 10:55 | 7.16 |
| | 8/18/2021 | 10:12 | 3.44 |
| QM-SW-4 | 6/10/2021 | 13:27 | 44.53 |
| | 7/22/2021 | 14:20 | 7.71 |
| | 8/18/2021 | 13:30 | 5.05 |
| QM-SW-5 | 6/11/2021 | 15:28 | 298.31 |
| | 7/23/2021 | 8:11 | 44.91 |
| | 8/25/2021 | 15:00 | 12.63 |
| QM-SW-6 | 6/11/2021 | 12:17 | 261.93 |
| | 7/22/2021 | 9:00 | 54.04 |
| | 8/26/2021 | 10:43 | 25.15 |
| QM-SW-7 | 6/11/2021 | 11:01 | 293.86 |
| | 7/21/2021 | 11:30 | 55.67 |
| | 8/25/2021 | 10:45 | 27.23 |
| USGS Site #11478500 (Van Duzen near Bridgeville) | 6/4/2021 | 13:30 | 34.4 $^{P}$ |
| | 7/22/2021 | 11:00 | 6.24 $^{P}$ |
| | 8/18/2021 | 10:15 | 3.44 $^{P}$ |
| USGS Site # 11477000 (Eel at Scotia | 6/11/2021 | 12:15 | 233 $^{A}$ |
| | 7/22/2021 | 9:00 | 57.9 $^{A}$ |
| | 8/26/2021 | 10:45 | 26.3 $^{A}$ |

*Note: $^{A}$ USGS-accepted value, $^{P}$ USGS provisional value*

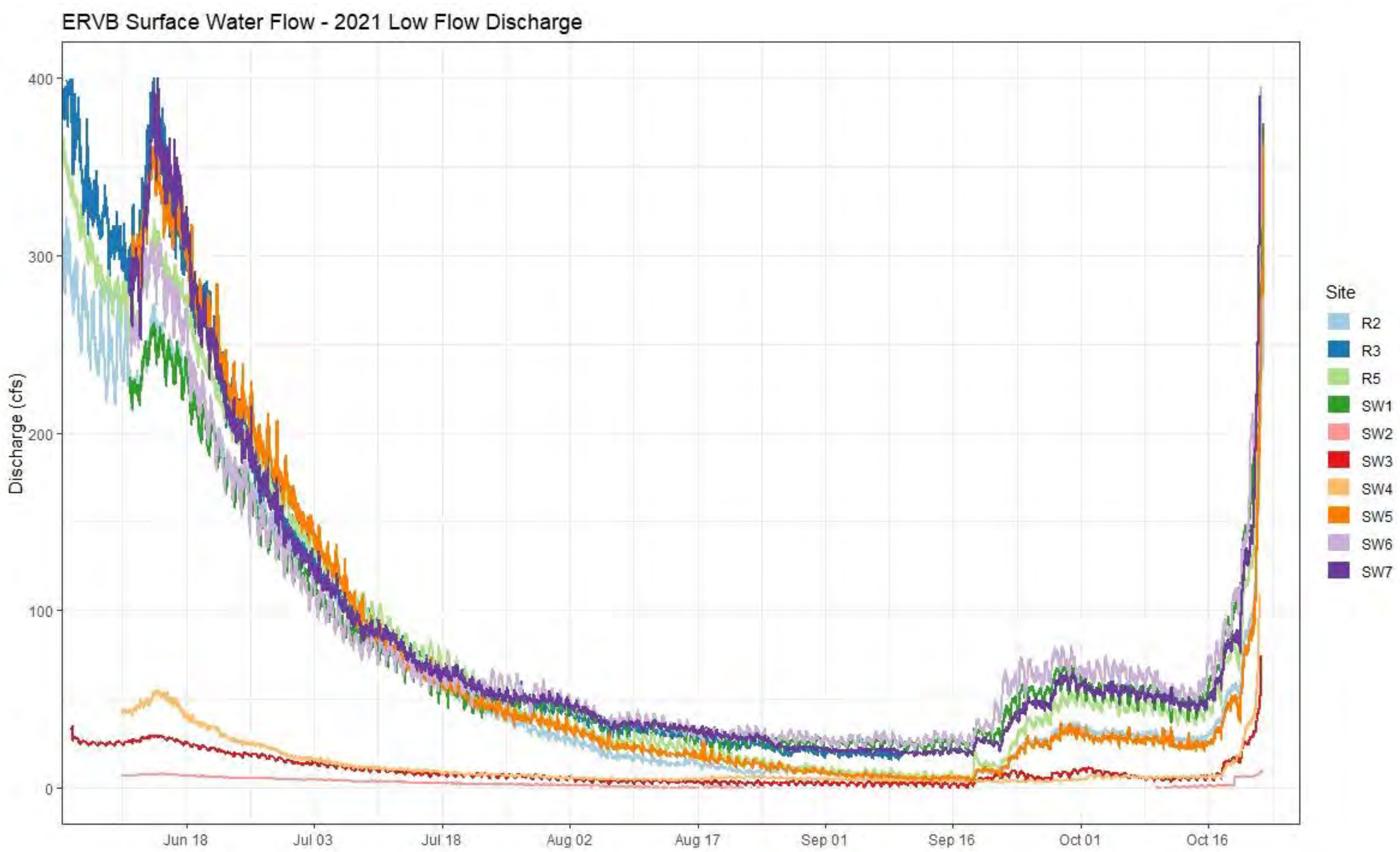
Table 5: 2021 Low-flow rating curve equations and associated standard errors for each discharge measurement location.

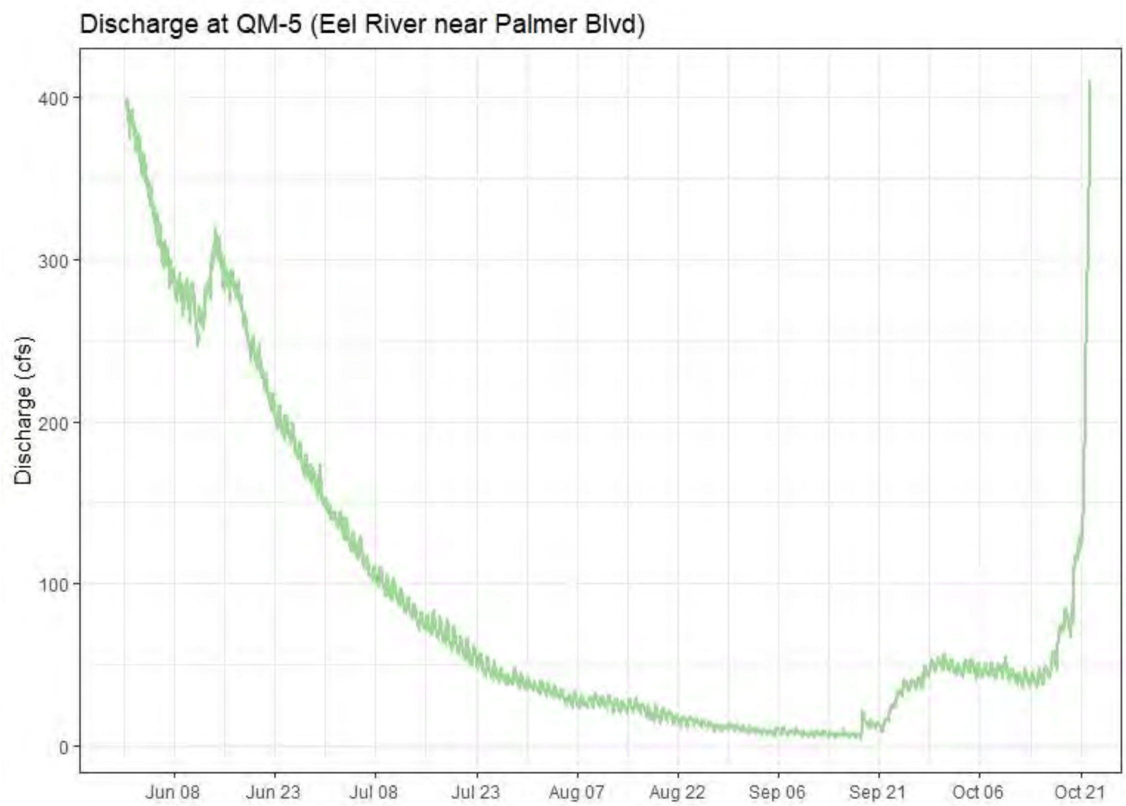
| Surface Water Monitoring Site | Rating Curve | | | Standard Error (%) |
|---|---|---|---|---|
| | C | Offset | n | |
| QM-5 | 213.304 | 0.59 | 1.769 | 0.001 |
| QM-2 | 174.36 | 0.24 | 2.044 | 0.000 |
| QM-3 | 2.404 | 20.782 | 5.895 | 0.005 |
| QM-SW-1 | 28.535 | -0.335 | 3.043 | 0.000 |
| QM-SW-2 | 11.264 | 1.041 | 0.693 | 0.300 |
| QM-SW-3 | 49.316 | 1.89 | 1.08 | 0.029 |
| QM-SW-4 | 49.773 | 0.88 | 2.85 | 0.045 |
| QM-SW-5 | 106.623 | 0.77 | 3.043 | 0.004 |
| QM-SW-6 | 41.876 | 0.65 | 3.724 | 0.000 |
| QM-SW-7 | 0.001 | -1.80 | 9.9 | 0.000 |

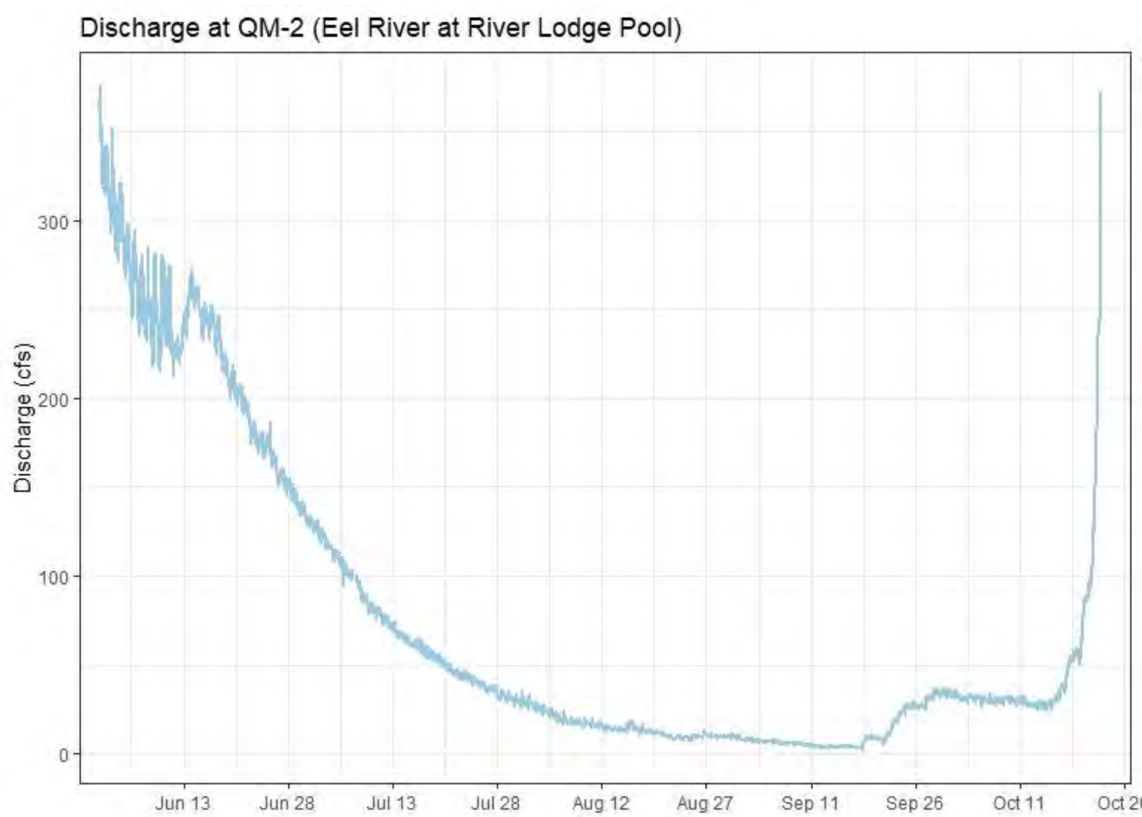
Table 6: Summary statistics (minimum and mean) of discharge records at each discharge measurement location over the 2021 low-flow season.

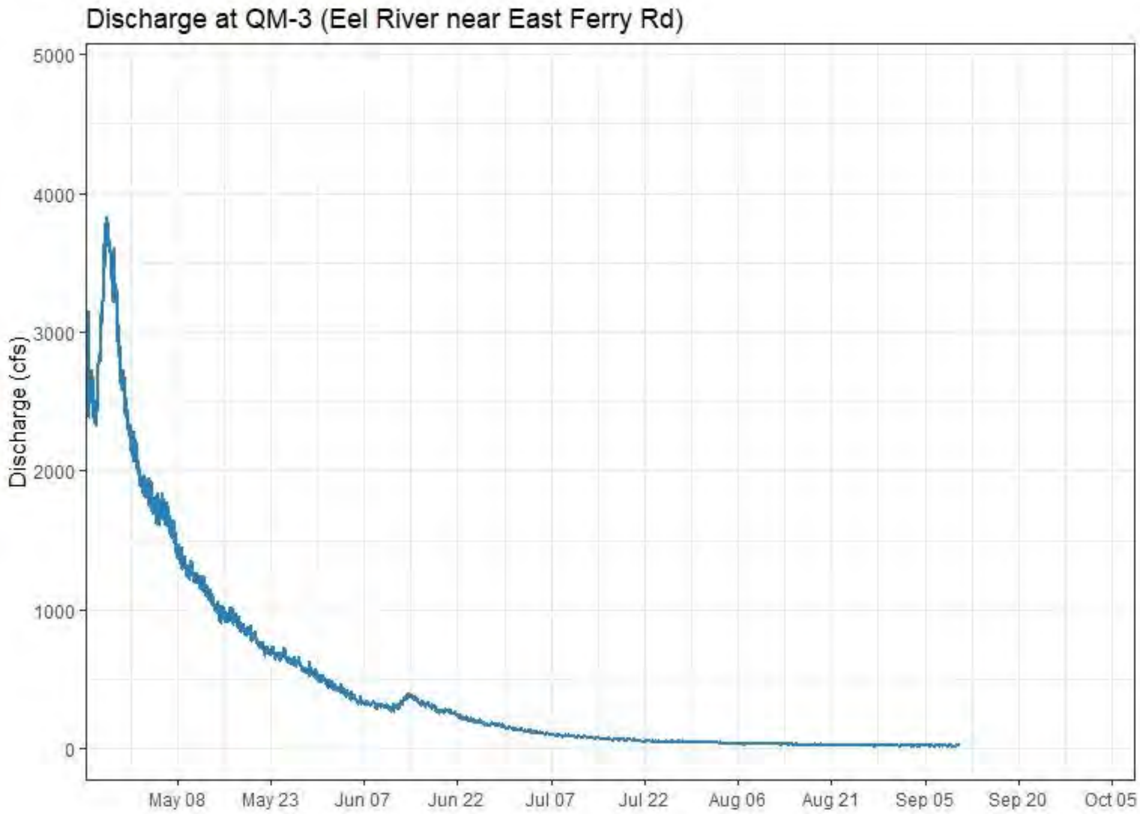
| Site | Beginning of Record | End of Record | Minimum Discharge (cfs) | Date of Minimum | Mean Discharge (cfs) |
|---|---|---|---|---|---|
| QM-5 | 6/3/2021 | 10/22/2021 | 3.76 | 9/18/2021 | 84.89 |
| QM-2 | 6/3/2021 | 10/22/2021 | 2.14 | 9/18/2021 | 70.07 |
| QM-3 | 6/3/2021 | 9/10/2021 | 16.05 | 9/9/2021 | 112.22 |
| QM-SW-1 | 6/11/2021 | 10/22/2021 | 19.27 | 8/27/2021 | 71.70 |
| QM-SW-2 | 6/10/2021 | 10/22/2021 | 0.00 | 8/9/2021 | 3.39 |
| QM-SW-3 | 6/4/2021 | 10/22/2021 | 0.09 | 9/17/2021 | 9.85 |
| QM-SW-4 | 6/10/2021 | 10/22/2021 | 2.79 | 9/21/2021 | 11.76 |
| QM-SW-5 | 6/11/2021 | 10/22/2021 | 3.90 | 9/18/2021 | 68.38 |
| QM-SW-6 | 6/11/2021 | 10/22/2021 | 20.46 | 9/11/2021 | 77.27 |
| QM-SW-7 | 6/11/2021 | 10/22/2021 | 17.83 | 9/17/2021 | 80.46 |

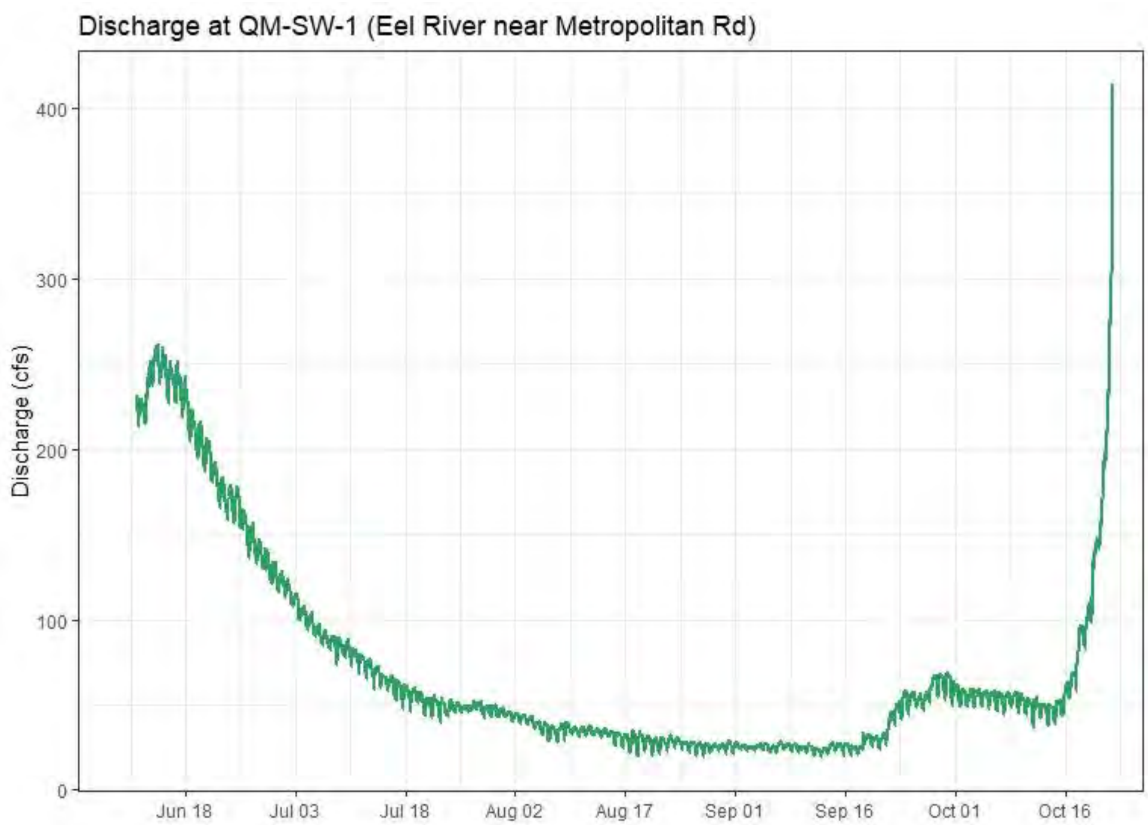
# Appendix C: Hydrographs

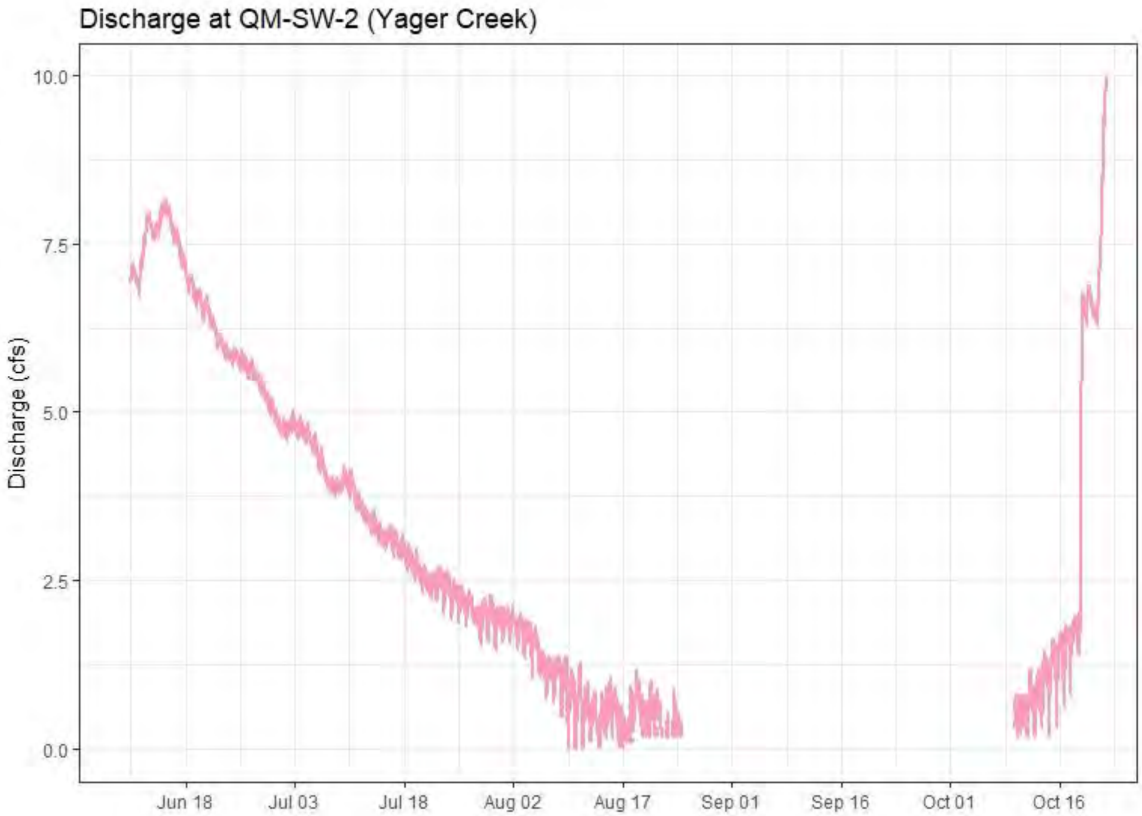


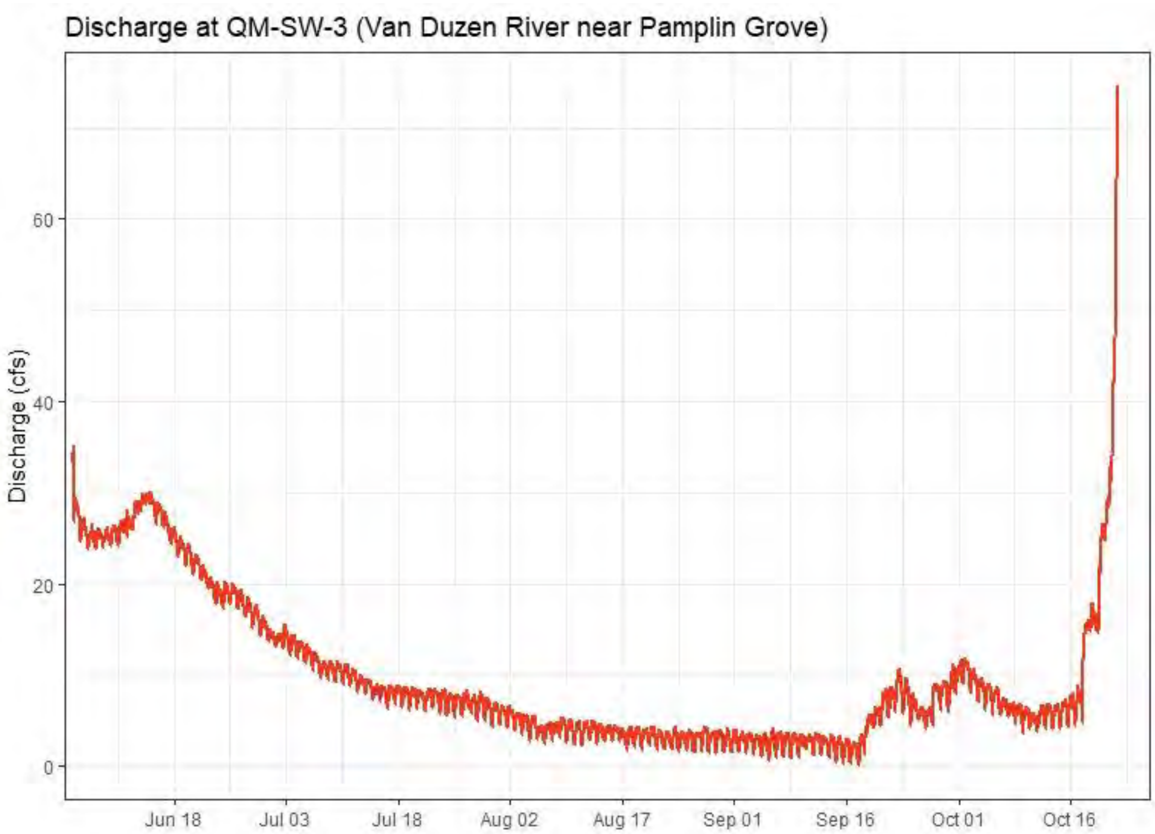

Discharge at QM-5 (Eel River near Palmer Blvd)
Discharge (cfs)
0
100
200
300
400
Jun 08
Jun 23
Jul 08
Jul 23
Aug 07
Aug 22
Sep 06
Sep 21
Oct 06
Oct 21

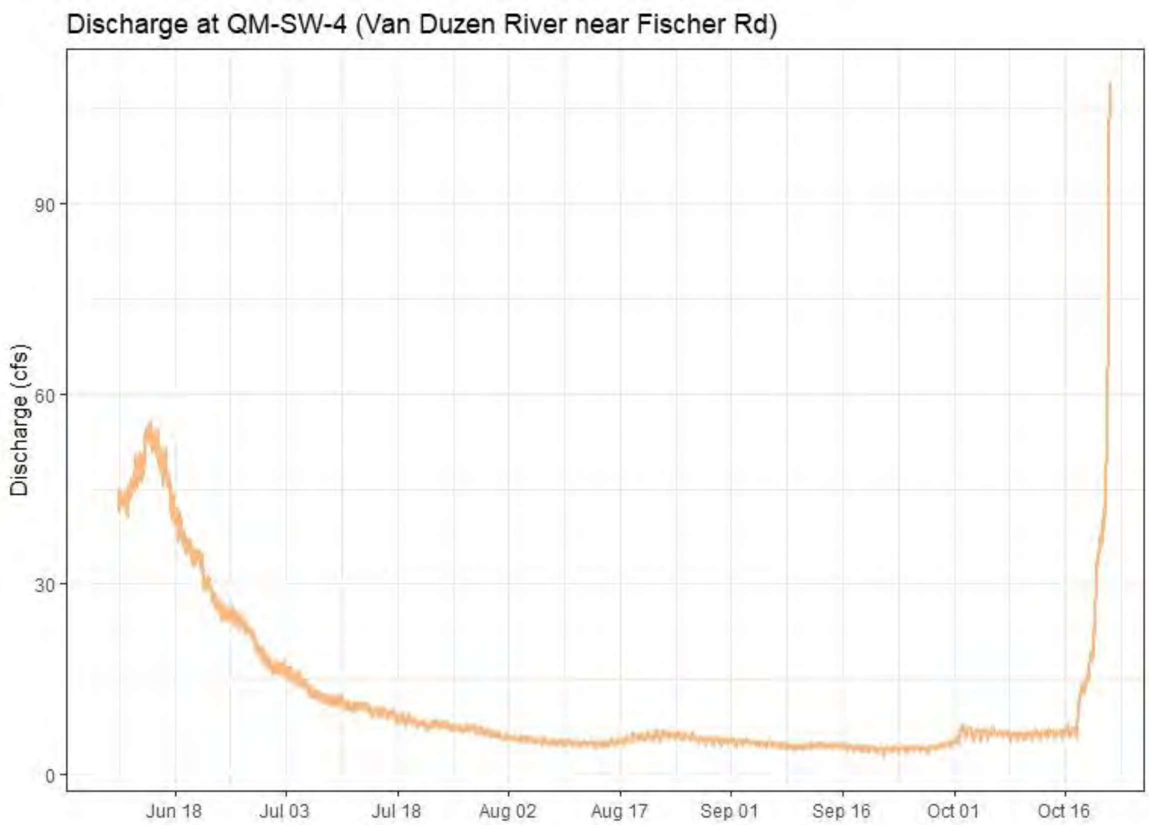

Discharge at QM-2 (Eel River at River Lodge Pool)
Discharge (cfs)
0
100
200
300
Jun 13
Jun 28
Jul 13
Jul 28
Aug 12
Aug 27
Sep 11
Sep 26
Oct 11

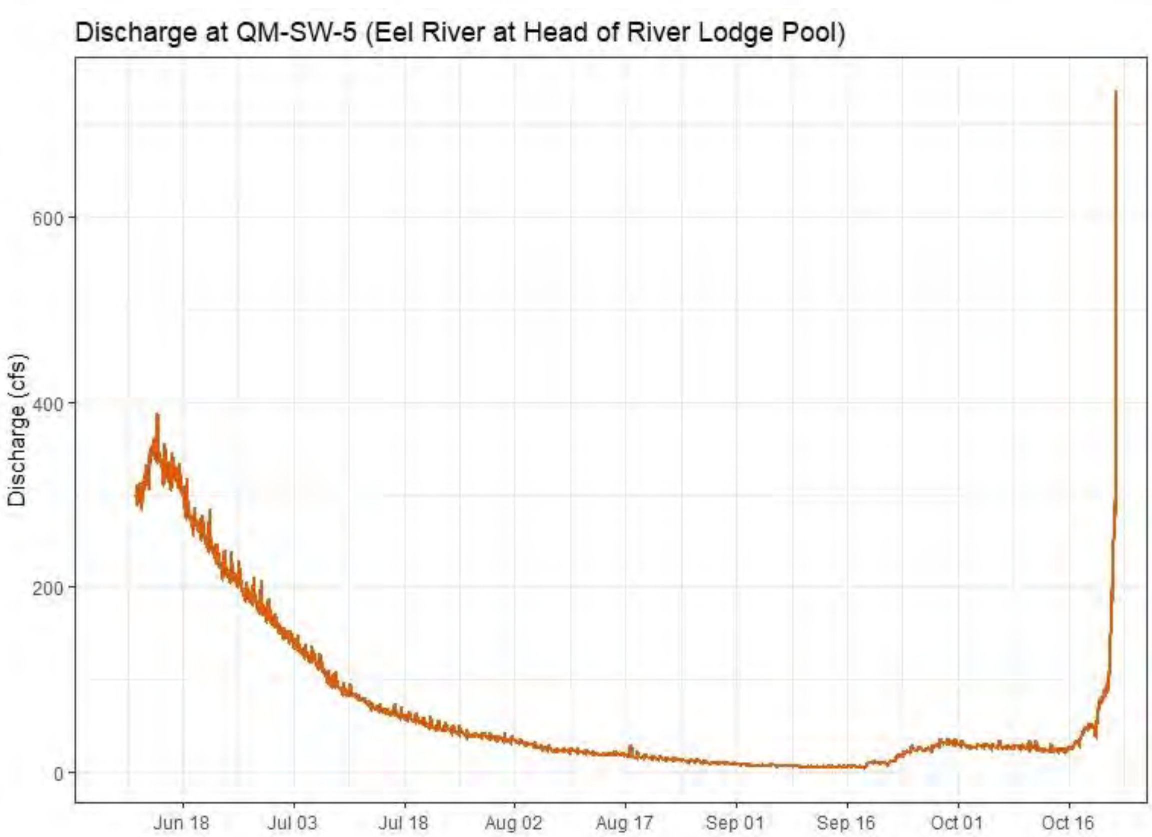

Discharge at QM-3 (Eel River near East Ferry Rd)
Discharge (cfs)
0
1000
2000
3000
4000
5000
May 08
May 23
Jun 07
Jun 22
Jul 07
Jul 22
Aug 06
Aug 21
Sep 05
Sep 20
Oct 05

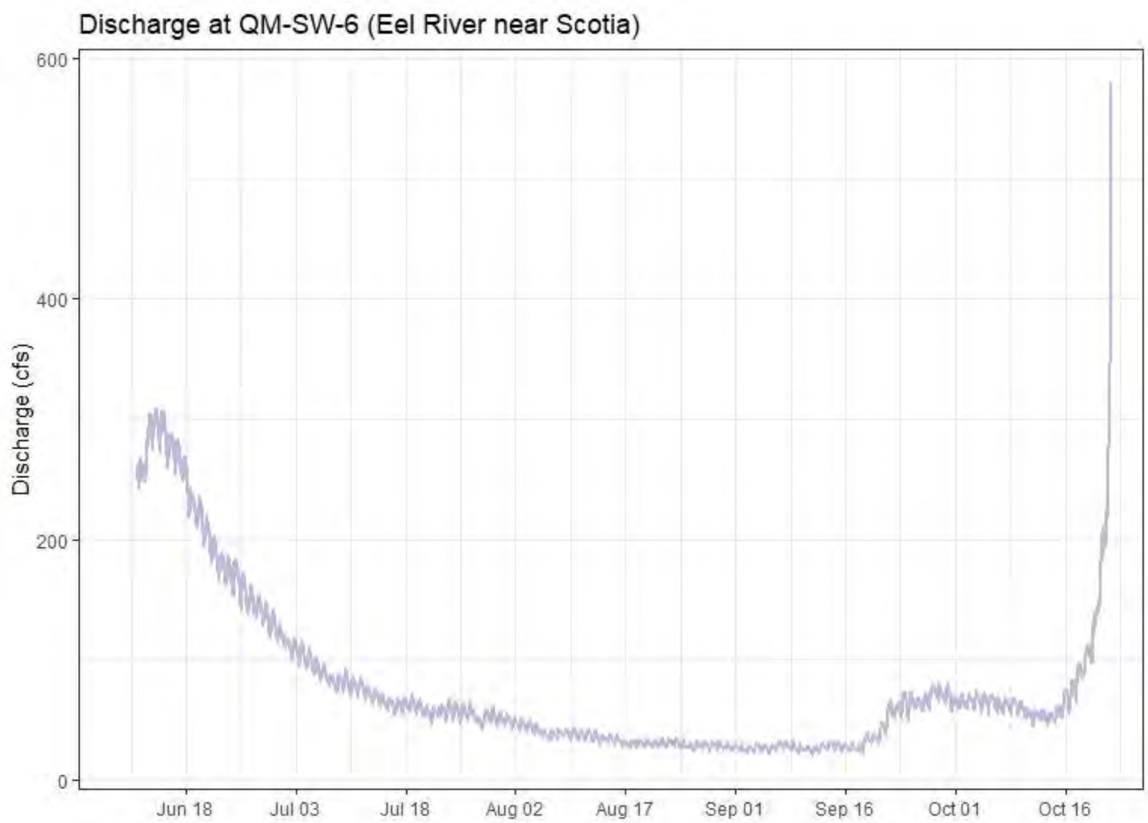

Discharge at QM-SW-1 (Eel River near Metropolitan Rd)
Discharge (cfs)
0
100
200
300
400
Jun 18
Jul 03
Jul 18
Aug 02
Aug 17
Sep 01
Sep 16
Oct 01
Oct 16

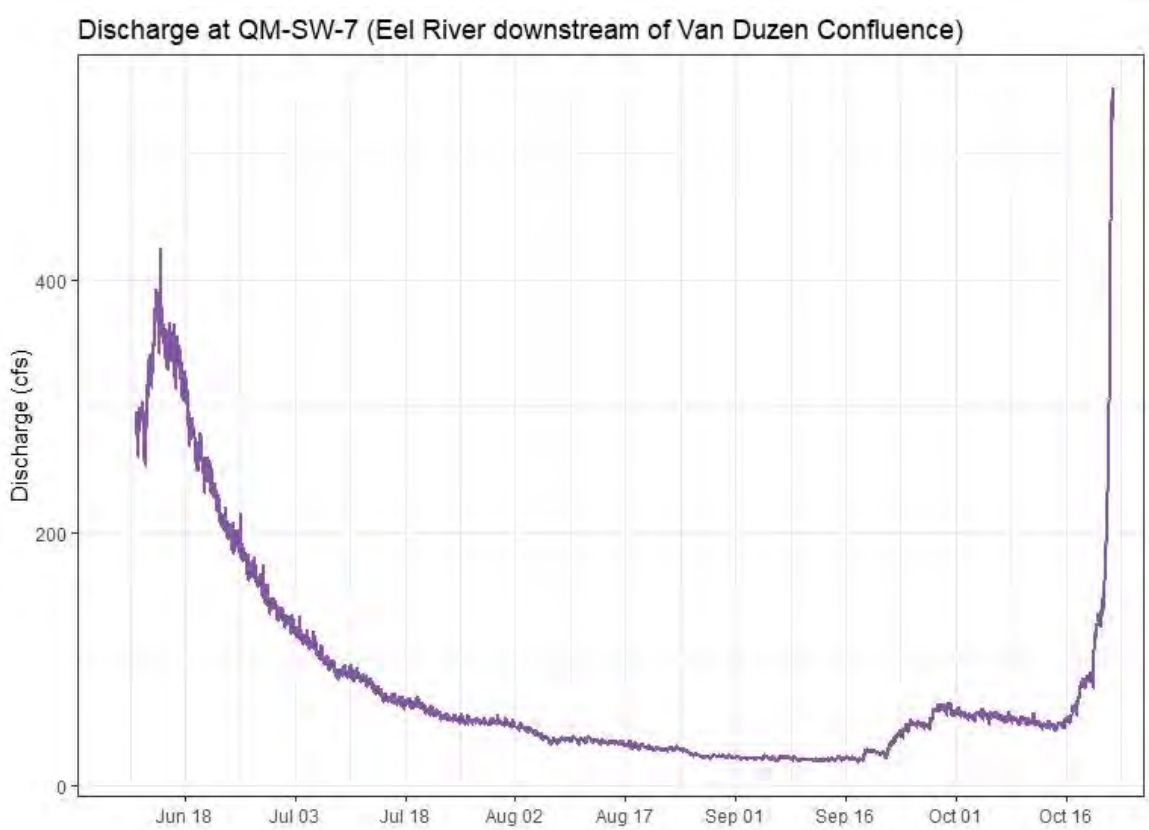

Discharge at QM-SW-2 (Yager Creek)
Discharge (cfs)
10.0
7.5
5.0
2.5
0.0
Jun 18
Jul 03
Jul 18
Aug 02
Aug 17
Sep 01
Sep 16
Oct 01
Oct 16


Discharge at QM-SW-3 (Van Duzen River near Pamplin Grove)
Discharge (cfs)
60
40
20
0
Jun 18
Jul 03
Jul 18
Aug 02
Aug 17
Sep 01
Sep 16
Oct 01
Oct 16


Discharge at QM-SW-4 (Van Duzen River near Fischer Rd)
Discharge (cfs)
0
30
60
90
Jun 18
Jul 03
Jul 18
Aug 02
Aug 17
Sep 01
Sep 16
Oct 01
Oct 16


Discharge at QM-SW-5 (Eel River at Head of River Lodge Pool)
Discharge (cfs)
0
200
400
600
Jun 18
Jul 03
Jul 18
Aug 02
Aug 17
Sep 01
Sep 16
Oct 01
Oct 16


Discharge at QM-SW-6 (Eel River near Scotia)
Discharge (cfs)
600
400
200
0
Jun 18
Jul 03
Jul 18
Aug 02
Aug 17
Sep 01
Sep 16
Oct 01
Oct 16


Discharge at QM-SW-7 (Eel River downstream of Van Duzen Confluence)
Discharge (cfs)
400
200
0
Jun 18
Jul 03
Jul 18
Aug 02
Aug 17
Sep 01
Sep 16
Oct 01
Oct 16

# Attachments

Attachment 1 - R-2_12-21-2020_11-24-2021.xlsx

Attachment 2 - R3_10-31-2016_9-10-2021.xlsx

Attachment 3 - R-5_12-21-2020_11-24-2021.xlsx

Attachment 4 - SW1_06-11-2020_11-24-2021.xlsx

Attachment 5 - SW2_06-10-2020_11-01-2021.xlsx

Attachment 6 - SW3_06-04-2020_11-01-2021.xlsx

Attachment 7 - SW4_06-10-2020_11-01-2021.xlsx

Attachment 8 - SW5_06-11-2020_11-24-2021.xlsx

Attachment 9 - SW6_06-11-2020_11-24-2021.xlsx

Attachment 10 - SW7_06-11-2020_11-24-2021.xlsx

Raw data (attachements 1-10) available on the Humboldt County Groundwater website:

https://humboldtgov.org/2820/Eel-River-Valley-Groundwater-Basin-Resou



Thomas Gast & Associates Environmental Consultants; PO Box 1137, Arcata, California 95518; Office (707) 822-8544
Located in the Historic Jacoby Storehouse on the Arcata Plaza, 4th floor, Suite H

# Terrain Data and Imagery Technical Memorandum (TM-12)

# Technical Memorandum

**July 30, 2021**

| | | | |
|---|---|---|---|
| **To** | Summer Daugherty, Senior Environmental Analyst, Deputy Director, Humboldt County Department of Public Works – Environmental Services | **Tel** | (707) 433-8326 |
| **Copy to** | Hank Seemann, Deputy Director, Humboldt County Department of Public Works-Environmental Services | **Email** | Patrick.sullivan@ghd.com |
| **From** | Patrick Sullivan, GHD | **Ref. No.** | 11217388.1.8 |
| **Subject** | **Terrain Data and Imagery Technical Memorandum** | | |

# Table of Contents



# List of Tables



# List of Figures

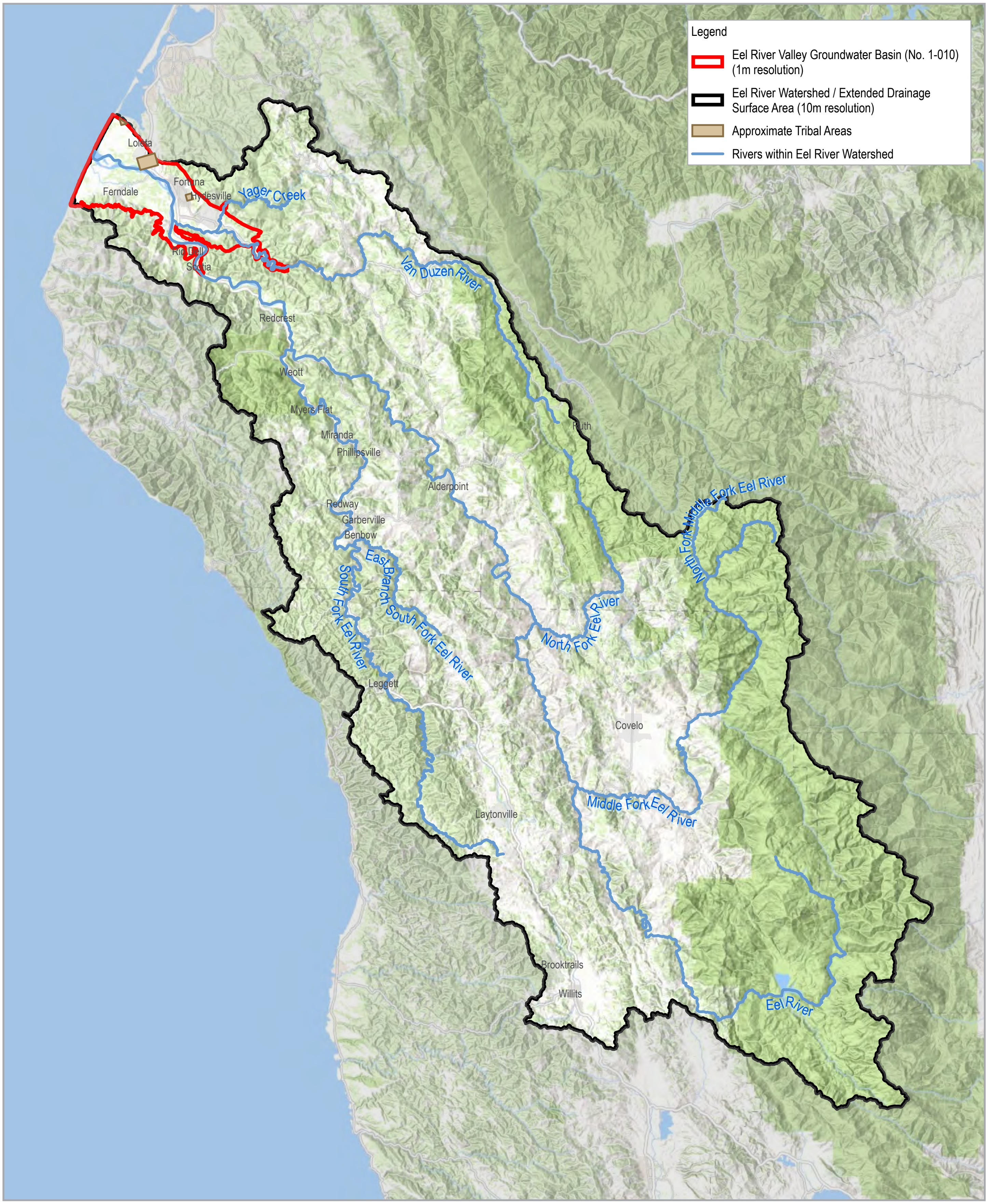
# Technical Memorandum

## 1. Introduction

The Terrain Data and Imagery Technical Memorandum outlines the data and methodologies used to develop a topographical model of the Eel River Valley Basin (ERVB) for inclusion in the Eel River Valley Groundwater Sustainability Plan (GSP).

The ERVB topographic model encompasses areas of the ERVB, as defined by the Department of Water Resources (Basin 1-010, DWR Bulletin-118), and adjacent watersheds that contribute surface and groundwater to the basin. Areas within the ERVB include tribal lands of the Wiyot Tribe and Bear River Band of the Rohnerville Rancheria.

Using several surface models and topography data acquired via Light Detection and Ranging (LiDAR), a Digital Elevation Model (DEM) was developed to accurately model the ERVB topography. Three distinct regions comprise the total surface model: Basin Surface, Extended Drainage Surface, and River Cross-sections. Each region has a unique data resolution requirement for use in the various study applications. The Extended Drainage Surface and Basin Surface regions were compiled into a comprehensive DEM for groundwater modeling. The River Cross-sections region was then employed to compare groundwater levels, with recorded river stage, in GSFLOW, a coupled groundwater and surface water FLOW model based on the integration of the U.S. Geological Survey (USGS) Precipitation-Runoff Modeling System (PRMS-V) and the USGS Modular Groundwater Flow Model (MODFLOW-2005 and MODFLOW-NWT). Figure 1 shows the extent of ERVB and the Extended Drainage Surface region.




Paper Size ANSI A

0 3.5 7 10.5 14

Miles

N

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

GHD

**Humboldt County Department of Public Works**
**Eel River Valley Groundwater Sustainability Plan**

| | |
|---|---|
| Project No. | **11217388** |
| Revision No. | **-** |
| Date | **July 2021** |

## Eel River Valley Basin and Extended Drainage Surface Areas

## FIGURE 1

N:\US\Eureka\Projects\561\11217388\GIS\Maps\Deliverables\11217388_TopoBath_Tech_Memo.aprx
Print date: 30 Jul 2021 - 13:14

Data source: NHD, World Topo Base: This work is licensed under the Esri Master License Agreement.View Summary | View Terms of UseAlignment of boundaries is a presentation of the features provided by our data vendors and does not imply endorsement by Esri or any governing authority.Important Note: This item is in beta and is not intended for use in production applications.; Terrain: Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community. Created by: jclark2

# 2. Surface Data Used

The following surface models and topography data were used to develop the composite DEM and river bathymetry model:

*Table 1: Data Sources and Application*

| Application: | Data Source: |
|---|---|
| ERVB Basin Surface | USGS National Map DEM |
| ERVB Basin Surface | Wiyot Tribe and Bear River Band of the Rohnerville Rancheria addendum to National Map DEM |
| Extended Drainage Surface | Hollister J, Shah T, Robitaille A, Beck M, Johnson M (2020). *elevatr: Access Elevation Data from Various APIs*. R package version 0.3.1. (accessed with: R Core Team. 2020. *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing.) |
| River Cross-sections | Stillwater Sciences Bathymetry Survey of Eel and Van Duzen Rivers; River cross-section data also provided by:<br>• Tom Bess Asphalt Company<br>• Jack Noble<br>• Humboldt County |

# 3. Basin Surface

The ERVB Basin Surface was created using a USGS-developed DEM, acquired from the USGS National Map downloader (TNM Download v2.0) with a standard one-meter resolution. Two sets of tiles were downloaded from The Nation Map data downloader. The main tile index consists of 22 tiles with bare earth elevation values referenced to the North American Vertical Datum of 1988 (NAVD88) and covers the majority of the area within the groundwater basin; it was found by selecting the "1 meter DEM" subcategory in the "Elevation Products (3DEP) category" and zooming to the extent of the groundwater basin. This data was collected during 2018 and 2019 as part of the "NoCAL Wildfires B4 2018" collection. The data was originally projected in in NAD 1983 UTM Zone 10N before being reprojected into NAD_1983_StatePlane_California_I_FIPS_0401_Feet during the final mosaic process that incorporated the supplemental tiles.

The supplemental tile index was based on the same LiDAR acquisition of the main tile index, consisting of the Wiyot Tribe (Table Bluff Reservation) and (Bear River Band) Rohnerville Rancheria tribal areas that were clipped out of the one-meter DEMs due to delays in the tribal notification process. These tiles were downloaded separately from The National Map by selecting the "DEM Source OPR" subcategory in the "Elevation Source Data (3DEP)- Kidar, IfSAR" category, and zooming to the extent of each clipped-out area missing from the main tile index. The supplemental tiles were Original Project Resolution (OPR) DEMs but were the same resolution as one-meter (3DEP) DEMs in the main tile index. Requiring definition in a standard projection and then reprojection to align with the data in the main tile index, the supplemental tiles were in a custom projection of NAD83(2011) / Conus Albers.

The final project was a DEM representing bare earth elevation values in Feet (NAVD88), with a pixel type of 32 bit float, at one-meter resolution, and projected in NAD_1983_StatePlane_California_I_FIPS_0401_Feet.

# 4. Extended Drainage Surface

The Extended Drainage Surface region extends approximately 100 miles southeast of the ERVB, encompassing all surface water features that flow into the ERVB. The DEM for the Extended Drainage Surface was based on the same 2019 LiDAR data as the Basin Surface region, obtained using the elevation library (Hollister, et al., 2020) within the R programming language (R Core Team, 2020) with a 10-meter resolution. The Extended Drainage Surface DEM was referenced to NAVD88, NAD83 and projected in the State Plane California Zone I (FIPS 0401) coordinate system.

# 5. River Cross-sections

A groundwater/surface water model was developed for the GSP that simulates the movement of surface and groundwater through the Eel River Basin. The spatial representation of creeks and rivers in the model was derived from the National Hydrologic Model (NHM) and the National Hydrography Dataset (NHD). The NHD (NHDPlus HR) is a high-resolution set of geospatial hydrography data that includes flow-lines and waterbody polygons, watershed boundary datasets, and a 1/3-arc-second 3D Elevation Program DEM. The NHM incorporates information from NHD, as well as the Soil Survey Geographic Database (SSURGO), National Land Cover Database, PRISM rasters, and National Renewable Energy Lab (NREL) solar radiation to develop consistent geospatial data structures to be applied in modelling applications. These are transmitted through an NHM parameter database (NhmParamDb) so that preliminary parameters values can be incorporated directly into PRMS modelling applications. The development of the groundwater/surface water model is presented in the Groundwater Model Construction and Calibration Technical Memorandum (GHD 2021).

The model's representation of the creek and river system was also compared with river cross-section data provided by Stillwater Sciences and the County, who have collected cross-sections for the Van Duzen and Lower Eel Rivers, both located in the ERVB. Cross-section data was collected at multiple locations throughout the Van Duzen and lower Eel River reaches as part of gravel mining activities at various times between 2004 and 2020. The Tom Bess Asphalt Company and Jack Noble supplied full channel cross-sections for the Van Duzen River, while Humboldt County provided Lower Eel River cross-sections located immediately upstream of Fernbridge. All cross-section data was collected in accordance with the protocol contained within the Letters of Permission Procedure for Gravel Extraction in Humboldt County (LOP 2015-1), developed by the U. S. Army Corps of Engineers (USACE) for in-stream gravel extraction operations in the County. The protocol states:

*All survey data must be referenced to State Plane California Zone I (FIPS 0401) coordinate system, NAD83 and NAVD88. Cross-sections must be resurveyed from the same endpoints each year. The endpoints should be located at or above the 100-year flood water surface elevation unless another flood level is agreed upon by agencies and CHERT and far enough from the river's edge to remain consistent from year to year. The maximum distance between any two elevation points along a cross-section shall be 50 feet, including the wetted channel portion. Exception: if ground outside wetted channel is essentially smooth and rises less than 0.5 feet for a distance of 100-feet, distance between points can be increased to 100 feet. All obvious breaks in slope must still be included in order to collect accurate topography that is representative of site conditions. Cross-sections shall be surveyed and drafted consistently so that the right bank (RB) of the river as you face downstream is at the right side of the drafted cross-section. Zero (0) distance in cross-sections shall be at the left bank (LB) endpoint as you face downstream.*

# 6. Composite Surface

A Composite Surface model was created by merging the Basin Surface and the Extended Drainage Surface, referenced to NAVD88 vertical datum and NAD83 horizontal datum, then projected in the State Plane Coordinate System (FIPS 0401). The DEM for the Composite Surface retained one-meter resolution for the Basin Surface and ten-meter resolution for the Extended Drainage Surface.

# 7. Imagery

Imagery in this GSP serves two primary purposes: as background layers in figures, and as inputs for remote sensing analysis.

The imagery used for background layers in figures was sourced through ESRI World Imagery (Clarity). The images are licensed under the ESRI Master License Agreement.

Remote sensing analysis played a key role in the land use characterization process. Aerial images were used to delineate such land use types as impervious, open water, riparian, native vegetation, forest land, and urban vegetation. A detailed discussion of the delineation process can be found in Land Use Technical Memorandum (GHD, 2021). The imagery used for the analysis was 4-band multispectral imagery provided by the 2020 U.S. Department of Agriculture (USDA) National Agriculture Imagery Program (NAIP). Imagery tiles were downloaded from the USGS Geospatial Data server (https://www.usgs.gov/centers/eros). Approximately 325 individual imagery tiles were downloaded for the ERVB, as defined by the CA_Bulletin_118 Groundwater Basins_Eel.shp shapefile. The individual tiles were combined to create a single multiband orthomosaic of the entire extent of the basin (NAIP20_4B_Pro_SPC.tif).

# 8. References


Description of the National Hydrologic Model for Use with the Precipitation-Runoff Modeling System (PRMS). Regan, R. Steven, Steven L. Markstrom, Lauren E. Hay, Roland J. Viger, Parker A. Norton, Jessica M. Driscoll, and Jacob H. LaFontaine. 2018. Reston, VA. Report. http://pubs.er.usgs.gov/publication/tm6B9.

Groundwater Model Construction and Calibration Technical Memorandum. GHD Inc., 2021.

Land Use Technical Memorandum. GHD Inc., 2021.


# 9. Electronic Deliverable Inventory

The following electronic deliverables are attached:

- Appendix A: ERVB Basin Surface DEM
- Appendix B: Extended Drainage Surface DEM
- Appendix C: River Cross-section Bathymetry Data
- Appendix D: Composite Surface DEM

# Water Levels Technical Memorandum
# (TM-13)

Phone: (707) 441-8855 Email: info@shn-engr.com Web: shn-engr.com
812 W. Wabash Avenue, Eureka, CA 95501-2138

# Technical Memorandum

| | |
|---|---|
| **SHN Reference:** | 020091.140 |
| **GHD Reference:** | 11217388. 2.3.1 |
| **Date:** | September 9, 2021 |
| **To:** | Summer Daugherty, Senior Environmental Analyst, Humboldt County Department of Public Works—Environmental Services |
| **Copy To:** | Hank Seemann, Deputy Director, Humboldt County Department of Public Works—Environmental Services |
| **From:** | SHN: Alyssa Troia and Jason Buck<br>GHD: Patrick Sullivan |
| **Subject:** | **Water Levels Technical Memorandum** |

## 1.0 Introduction

### 1.1 Overview

This "Water Levels Technical Memorandum" describes the groundwater elevation data collection efforts within the Eel River Valley Basin (ERVB), and associated findings, for inclusion in the Eel River Valley Groundwater Sustainability Plan (GSP). Data collection efforts included:

1. Measurement of static groundwater levels through the collection of depth-to-water measurements in at least 75 wells within the ERVB, once in Fall 2020 and again in Spring 2021
2. Collection of continuous groundwater levels through the purchase and installation of 35 pressure transducers in County monitoring wells throughout the ERVB

The purpose of this work is to provide data on the seasonal variations of groundwater levels within the principal aquifers of the ERVB, as well as to support the calibration of numerical modelling (currently in development).

### 1.2 Summary of Previous Work and Existing Water Level Data

As far back as the early 1950s, the California Department of Water Resources (DWR) has monitored groundwater levels biannually within nine (9) wells in the ERVB. Of those wells, five (5) continue to be monitored as part of the California Statewide Groundwater Elevation Monitoring (CASGEM) program. These five (5) wells, all located within the lower Eel River Valley, provide the best long-term record of groundwater levels for the ERVB.

As part of a Proposition 1: Sustainable Groundwater Management (SGM) Grant Program, two large-scale depth-to-water (DTW) measurement campaigns were carried out, one in Fall 2016 and one in Spring 2017. Additionally, pressure transducers were installed at multiple locations throughout the ERVB—within five (5) newly developed County monitoring wells, four (4) locations within the Eel River, one (1) location within the Van Duzen River, and three (3) private wells—to continuously monitor the surface water and groundwater levels over the course of the 2017 water year, after which transducers within two (2) of the County monitoring wells and two (2) river stations were left to continue monitoring indefinitely. Biannual DTW measurements have been collected in 14 of the 15 County monitoring wells (nine [9] well locations, six [6] of which are paired wells) and in most municipal wells since Fall 2016 (SHN, 2016). Biannual DTW measurements have not been collected at monitoring well MW-3 due to the well being dry during each monitoring campaign.

# 2.0 Fall 2020 and Spring 2021 Static Groundwater Level Measurement Campaigns

## 2.1 Well Selection

SHN collaborated with the County and the Humboldt County Resource Conservation District (HCRCD) to develop a list of at least 75 targeted wells for groundwater level measurements. In addition to the 15 County monitoring wells (installed in 2016) and the municipal wells, which are currently monitored biannually, private irrigation and domestic wells were accessed through the efforts of the County and HCRCD, who coordinated with volunteer landowners. To maintain consistency with the previous groundwater level measurement campaigns (in Fall 2016 and Spring 2017), a special effort was made to include the wells that had been measured during those events. Additional private wells were sought to fill data gaps in the monitoring well network and to obtain a greater variety of well depths, particularly wells screened below depths of 150 feet, where possible. All wells included in the Fall 2020 and Spring 2021 sampling campaigns are shown on Figures 1 and 2, respectively (Appendix 1).

The geographic area of interest for data collection of static groundwater levels was generally focused on the low-gradient alluvial plains of the Eel and Van Duzen rivers, areas underlain by alluvial deposits of variable thickness that form the primary aquifer within the ERVB. Most wells within the alluvial valleys have total depths of less than 150 feet below ground surface and are screened within either the shallow alluvial aquifer or near-surface occurrences of the Carlotta aquifer (GHD, 2021a). Groundwater within the shallow water-bearing units underlying these alluvial valleys is understood to be laterally connected, allowing groundwater levels to be directly compared across the region.

Deeper wells that are screened within confined or semi-confined portions of the lower alluvial aquifer or the Carlotta aquifer are not common within the alluvial valleys. Wells tapping into these deeper aquifers are mostly found where the shallow alluvium is comprised of thick deposits of silts and clays, such as in the vicinity of Ferndale, along the base of the Wildcat hills, and in portions of the coastal plain near Loleta. Stratigraphy at depth is complex, often laterally discontinuous; unique aquifers in which groundwater levels can be confidently, directly comparable across broad areas is rare.

## 2.2 Field Methods

Two data collection field campaigns were carried out, one in Fall 2020 and one in Spring 2021, scheduled to coincide as closely as possible with the DWR field measurements of CASGEM wells. Though chloride sampling was carried out as part of the same field effort, details of that work are described in the "Saltwater Intrusion Technical Memorandum," prepared under separate cover.

Fieldwork was organized and divided amongst multiple teams, each including at least one (1) staff person from SHN and one (1) staff person from either HCRCD or the County, many of whom had participated in the 2016/2017 campaigns. In general, teams were assigned geographic areas with consideration of familiarity with landowners and access in that area. One team focused on wells that required specialized chloride sampling equipment, and another team focused on visiting the municipal supply wells. An initial overall kick-off meeting with all teams was conducted to review the data collection needs, field equipment, field forms, and review any safety concerns. Daily individual team meetings were subsequently conducted as necessary to review progress and coordinate any changes in assignments.

In preparation for the fieldwork, a tabulated list of wells was developed that included location, ownership and contact information, access and coordination needs, and any known well attributes. Information from the 2016/2017 campaigns was reviewed and incorporated. Each team maintained a copy of the tabulated list of wells and updated information as necessary.

Each team completed daily field reports chronicling the sites visited and activities for the day. Two data collection forms were used during the measurement campaign: 1) a “DTW” sheet to inventory the recorded groundwater level measurements for the day, and 2) a “Well Information” sheet to collect/update the important site-specific information for each well/measurement location. Using Solocator (a geolocation photo application for a phone/tablet), photographs were taken of each well and surrounding area, reference locations for DTW measurements (where necessary), and other relevant site features to aid in ensuring consistency with future measurements.

Groundwater level measurements were collected using a DTW meter equipped with a sensor probe and flat measuring tape. Suspended by the flat tape, the probe was sent down the inside of the well casing; it sounded an alarm when water was registered. The DTW was then read and recorded (to the nearest 0.01 foot) on the flat tape at a measurement reference point typically on the top or side of the well casing (cutout). DTW-measurement reference points were described and the distance from the ground surface to the measurement reference point was recorded.

During the Fall 2020 campaign, each of the municipal water supplier wells were visited to document site conditions and observe DTW measurements. Some of the municipal wells are sealed and DTW data was recorded with fixed or portable acoustic sounders (Riverside Community Service District, Bear River Band of the Rohnerville Rancheria), or a pressure gauge (Del Oro Water Company).

## 2.3 Data Compilation and Processing

All field data sheets were compiled and reviewed for consistency and completeness. Well locations were identified on aerial imagery in ArcGIS with the aid of geolocated photographs collected in the field, as necessary. Final well locations have an estimated accuracy of 10 feet and the latitude and longitude coordinates using the North American Datum 1983 (NAD83; decimal degrees) were exported from ArcGIS, then entered into excel spreadsheets. Ground surface elevations at each well location were referenced on the one-meter digital elevation model (DEM) derived from the United States Geological Survey (USGS) Light Detection and Ranging (LiDAR) dataset collected in July 2018 (GHD, 2021a).

DTW measurements were converted into groundwater surface elevations using the following formula:

**WSE = (GSE + D) – DTW**

Where:
WSE = Water Surface Elevation (ft)
GSE = Ground Surface Elevation (ft)
D = Distance from the ground surface to the measurement reference point (ft)
DTW = Depth to Water (ft)

All groundwater-level data was entered into DWR spreadsheets developed for upload to the CASGEM program. Well information for each location sampled was also compiled along with photographs of well locations, sampling locations, and reference locations.

## 2.4 Fall 2020 Results

The Fall 2020 measurement campaign was conducted during the week of October 26, 2020. DTW measurements were collected in 98 wells, which encompassed 14 County monitoring wells, 23 municipal wells (supply and monitoring), and 61 private wells. An inventory of all wells from which groundwater level measurements were collected during the Fall 2020 campaign is provided as Table 1 (Appendix 2), showing well locations, depths (if known), and the aquifer(s) in which the well is interpreted to be screened. Groundwater level data provided in the table includes the measured DTW (below ground surface) and the calculated groundwater surface elevation (feet referenced to the North American Vertical Datum 1988 [NAVD88]).

For the purposes of comparing aquifer-specific groundwater levels and the preparation of groundwater-elevation contour maps, it was necessary to separate wells screened within the shallow interconnected aquifers from those screened within deeper water-bearing units, confined and semi-confined, of the lower alluvium or the underlying Carlotta formation (GHD, 2021b). Available well completion reports were reviewed for wells known to be deeper than 100 feet to evaluate stratigraphy, depth of well screen, and construction details. Although many deep wells have screened intervals within isolated water bearing zones, typical well-construction practices locally (DWR Database) have included backfilling most of the well's annular space with sand/gravel to within 20 to 50 feet of the ground surface, which effectively hydraulically connects the upper unconfined alluvial aquifer to the deeper confined aquifers within the Carlotta Formation. Where this condition is recorded or suspected, the groundwater levels were not contoured separately. Where well completion reports could not be identified with confidence or where depths are not known, the groundwater level data point was assumed to be associated with the shallow aquifer system.

A groundwater-contour map of Fall 2020 groundwater levels within the shallow interconnected aquifers (Alluvial and near-surface and unconfined Carlotta aquifers) is included as Figure 3 (Appendix 1). The contoured areas were confined to the low-lying alluvial valleys and fluvial terraces. To develop contours, a composite groundwater surface was first generated from the individual elevations at each well in ArcGIS using the nearest neighbor interpolation method. The surface is contoured at 10-foot intervals (NAVD88), and for presentation on the figures, the elevations are also color-graded. The groundwater surface is most accurate where wells are located and interpolated in areas without data. Groundwater elevations from wells that are interpreted to be representative of deeper water-bearing units, both confined and semi-confined, are mapped on Figure 4 (Appendix 1). DTW measurements collected from three (3) CASGEM wells by DWR on October 29, 2020, are also included in Figure 3 (Appendix 1) and Table 1 (Appendix 2).

## 2.5 Spring 2021 Results

The Spring 2021 measurement campaign was conducted during the week of April 5, 2021. DTW measurements were collected in 88 wells, which included 14 County monitoring wells, 18 municipal wells (supply and monitoring), and 56 private wells. Some wells measured in Fall 2020 were not repeated in Spring 2021 due to duplicity (wells immediately adjacent to others), issues with accessibility, discontinued participation, and the fact that not all municipal wells were measured/reported during the Spring timeframe. Additionally, a few new wells were sampled that had not been part of the Fall 2020 campaign. An inventory of all wells from which groundwater level measurements were collected during the Spring 2021 campaign is provided as Table 2 (Appendix 2). A groundwater-contour map of Spring 2021 groundwater levels measured within wells interpreted to be screened in the Alluvial aquifer is included as Figure 5 (Appendix 1) and those interpreted to be screened within deeper aquifers, including lower Alluvial aquifers and/or the Carlotta, is included as Figure 6 (Appendix 1). DTW measurements collected from five (5) CASGEM wells by DWR on March 30, 2021, are also provided in Figures 5 and 6 (Appendix 1 and Table 2 (Appendix 2).

# 3.0 Continuous Groundwater Levels

## 3.1 Well Selection

A network of 23 new County monitoring wells (19 well locations, four [4] of which are paired wells) was installed during the months of April, May, and June 2021. The new wells were not completed in time for inclusion into either static groundwater level measurement campaign, but instead were grouped with wells considered for continuous monitoring. With the addition of the 23 new wells, the County currently has a total of 38 groundwater monitoring wells throughout the ERVB. One (1) of the 2016 County monitoring wells (MW-3d) is observed to remain dry much of the year, leaving 37 candidate wells for the continuous groundwater-level monitoring program. Two (2) of the wells (MW-7s and -7d) have had transducers continuously monitoring groundwater levels since October 2019, so those were left in place, and the remaining 35 candidate wells were chosen to be outfitted with new transducers.

The County monitoring wells provide the best opportunity for collecting high-quality, continuous groundwater elevation data—they have been properly designed and constructed for the purposes of monitoring groundwater levels and have all been installed within the County road right-of-way, making them easy to access for data downloads and maintenance. Continuous groundwater level data from this well network will provide the most value as it has been strategically developed (locations, screened depths) to evaluate groundwater conditions relevant to the sustainability indicators.

## 3.2 Transducer Setup and Installation

Thirty-five (35) transducers were purchased for deployment. The transducers selected for use are the Solinst Levellogger 5 model M30. The M30 is rated for submergence to a total depth 30 meters (98.4 feet) with an accuracy of 0.064 feet. The transducers were programmed using Solinst

Levellogger Software (version 4.5.3) and were set to record data (groundwater level and temperature) on 30-minute intervals. The transducer memory stores 150,000 records and at a 30-minute interval will be capable of storing approximately 8.5 years' worth of data.

Transducers were installed in each well by suspension from a stainless-steel cable connected to the well cap. Cable lengths were designed to ensure that the transducer will remain submerged through observed or anticipated seasonal groundwater fluctuations. A static depth to groundwater was collected within each well using an electronic DTW meter at the time of installation so that groundwater levels can be adjusted to actual groundwater elevations during future data processing and analysis. A table of well locations that are currently being monitored continuously is provided as Table 3 (Appendix 2), and a map showing the well locations is provided as Figure 7 (Appendix 1).

## 3.3 Future Data Retrieval and Processing

The transducer data will be downloaded, processed, and analyzed as necessary to support the final development of the groundwater sustainability plan and into the future at intervals set forth in the monitoring network section of the GSP. The next planned data retrieval for all transducers is in Fall 2021 as part of the biannual DTW measurement campaign for the County monitoring wells. Raw groundwater level data downloaded from each transducer will be barometrically compensated to remove the influence of barometric changes on the level data. Barometric data is being recorded on a Solinst Barologger currently stored in Ferndale and will be used for compensation within the Solinst software. The level data will then be converted to actual groundwater elevations using manual DTW measurements taken in the field during installation and/or during data retrieval. Groundwater elevation data can then be tabulated and plotted on hydrographs for analysis.

# 4.0 Summary of Findings

Review of the groundwater-contour mapping for the alluvial valleys indicates that water consistently flows westward throughout the year. Groundwater gradients are steepest in the Van Duzen River Valley, which reflects the topography through that part of the basin. The Van Duzen River Valley has a relatively steep topographic profile compared to the Eel River Valley, with elevations ranging from approximately 50 feet near the confluence with the Eel River to 300 feet where the Van Duzen River enters the ERVB. The hydraulic gradient between MW-11 and MW-3d (through the alignment of the Van Duzen alluvial valley) is 0.002 ft/ft (feet per foot), whereas the hydraulic gradient between MW-3d and CASGEM Well 23181 (through the alignment of the lower Eel River Valley) is 0.0008 ft/ft.

Changes in groundwater-surface elevations at individual locations between the Fall 2020 and Spring 2021 measurement campaigns range from 0.4 feet to 8.3 feet, with the largest swings occurring within the southeastern portions of the Lower Eel River Valley where groundwater is recharged by both the Eel River and the upland areas on the southern margin of the valley. The 2020 water year (Fall 2020-Spring 2021) is classified as critically dry water year type according to DWR. This range is slightly smaller than that observed during normal rain years when maximum elevation swings are usually above 10 feet.

Appendix 3 presents hydrographs for the five (5) active CASGEM wells and the 2016 County wells. The Fall 2020 and Spring 2021 groundwater-surface elevations measured within the CASGEM wells are some of the lowest on record, due to the particularly dry winters over the last two seasons. In most of the County monitoring wells, this drought condition can be seen reflected in lower-than-normal groundwater levels during the last two spring measurements (on the order of 2 to 4 feet lower than normal), but the drought condition is not as prominently reflected in fall measurements (less than 1 foot below normal). Spring groundwater levels are primarily influenced by the amount of recharge the aquifer(s) receive over the course of the winter season, which is heavily influenced by surface waters of the Eel and Van Duzen Rivers (SHN, 2019). The Fall levels tend to stabilize at a base level that is likely controlled by the groundwater in storage within the adjacent upland areas and the upper portions of the Van Duzen watershed which would be slower to respond to drought conditions.

In conclusion, consecutive dry years may lead to lower-than-normal spring groundwater levels, but an equal lowering of the Fall groundwater levels is not generally observed. This condition is also apparent in the long-term records for many of the CASGEM wells, where the Spring levels vary significantly relative to the magnitude of variations in the Fall.

# 5.0 References

California Department of Water Resources. (NR). "DWR Online Well Completion Report" Database. Red Bluff, CA:DWR Northern Region, accessed at: Well Completion Reports (ca.gov)

GHD Inc. (2021a). Hydrogeologic Concept Model Technical Memorandum. Eureka, CA:GHD

---. (2021b). Terrain Data and Imagery Technical Memorandum. Eureka, CA:GHD.

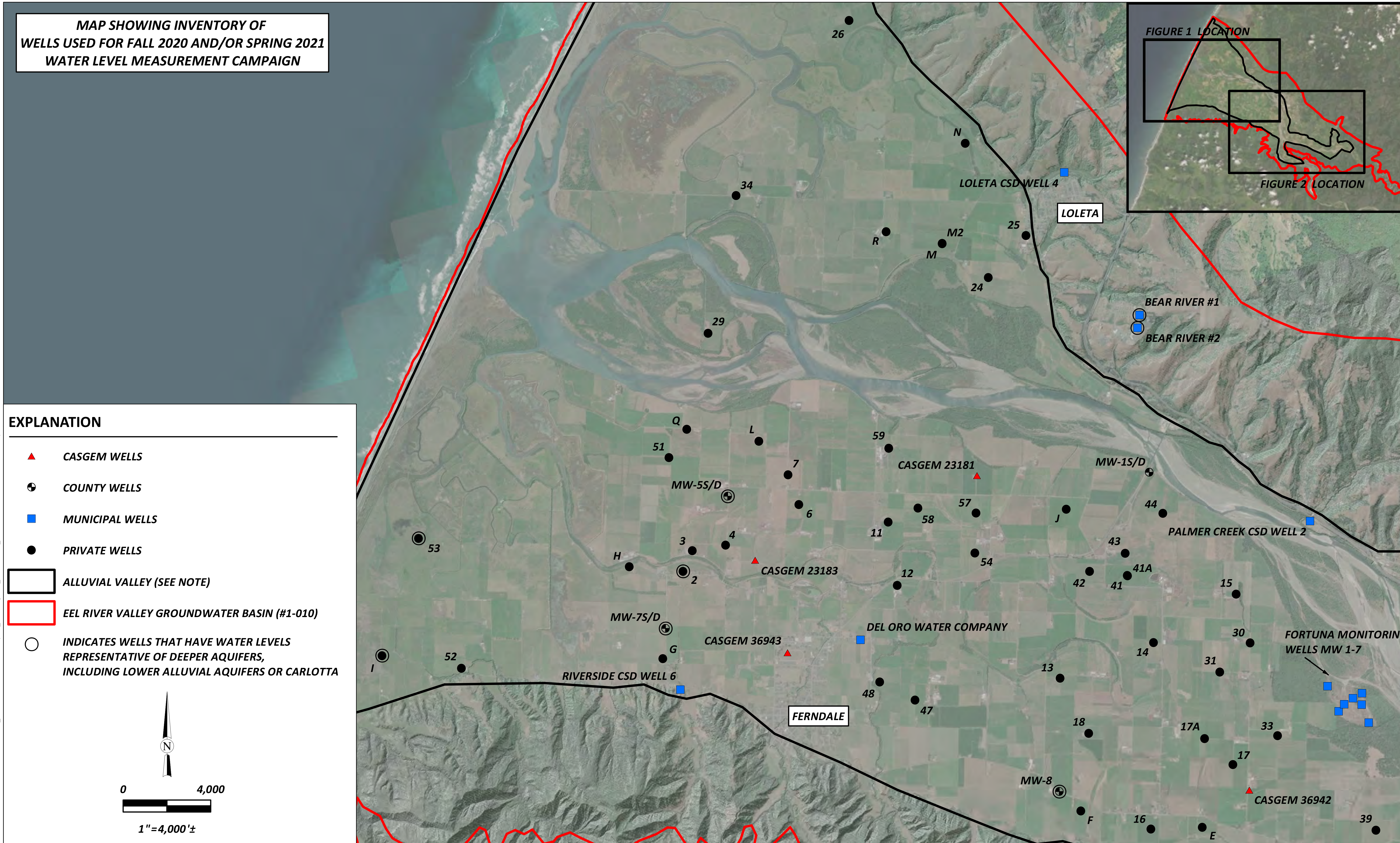
SHN. (2016). "Eel River Valley Groundwater Basin, Sustainability Plan Alternative." Eureka, CA:SHN.

---. (2019). "Preliminary Analysis of Surface Water/Groundwater Interaction Monitoring; Eel River Valley Groundwater Basin." Eureka, CA:SHN.

Appendices:
1. Figures
2. Tables
3. Hydrographs

# Figures 1

**MAP SHOWING INVENTORY OF WELLS USED FOR FALL 2020 AND/OR SPRING 2021 WATER LEVEL MEASUREMENT CAMPAIGN**




## EXPLANATION

- CASGEM WELLS
- COUNTY WELLS
- MUNICIPAL WELLS
- PRIVATE WELLS
- ALLUVIAL VALLEY (SEE NOTE)
- EEL RIVER VALLEY GROUNDWATER BASIN (#1-010)
- INDICATES WELLS THAT HAVE WATER LEVELS REPRESENTATIVE OF DEEPER AQUIFERS, INCLUDING LOWER ALLUVIAL AQUIFERS OR CARLOTTA

N

0 4,000

1"=4,000'±

NOTE: THE LOW-LYING ALLUVIAL AND FLUVIAL TERRACE SURFACES CONSTITUTED THE PRIMARY AREA OF INTEREST FOR THE CURRENT GROUNDWATER LEVELS STUDY

SHN

Humboldt County Public Works
Eel River Valley Groundwater Basin
Humboldt County, California

Wells Used for Fall 2020 and/or Spring 2021 Elevation Measurements
SHN 020091.140

August 2021 | Figure1_EelRiverGSP_WellLocationMAP | Figure 1

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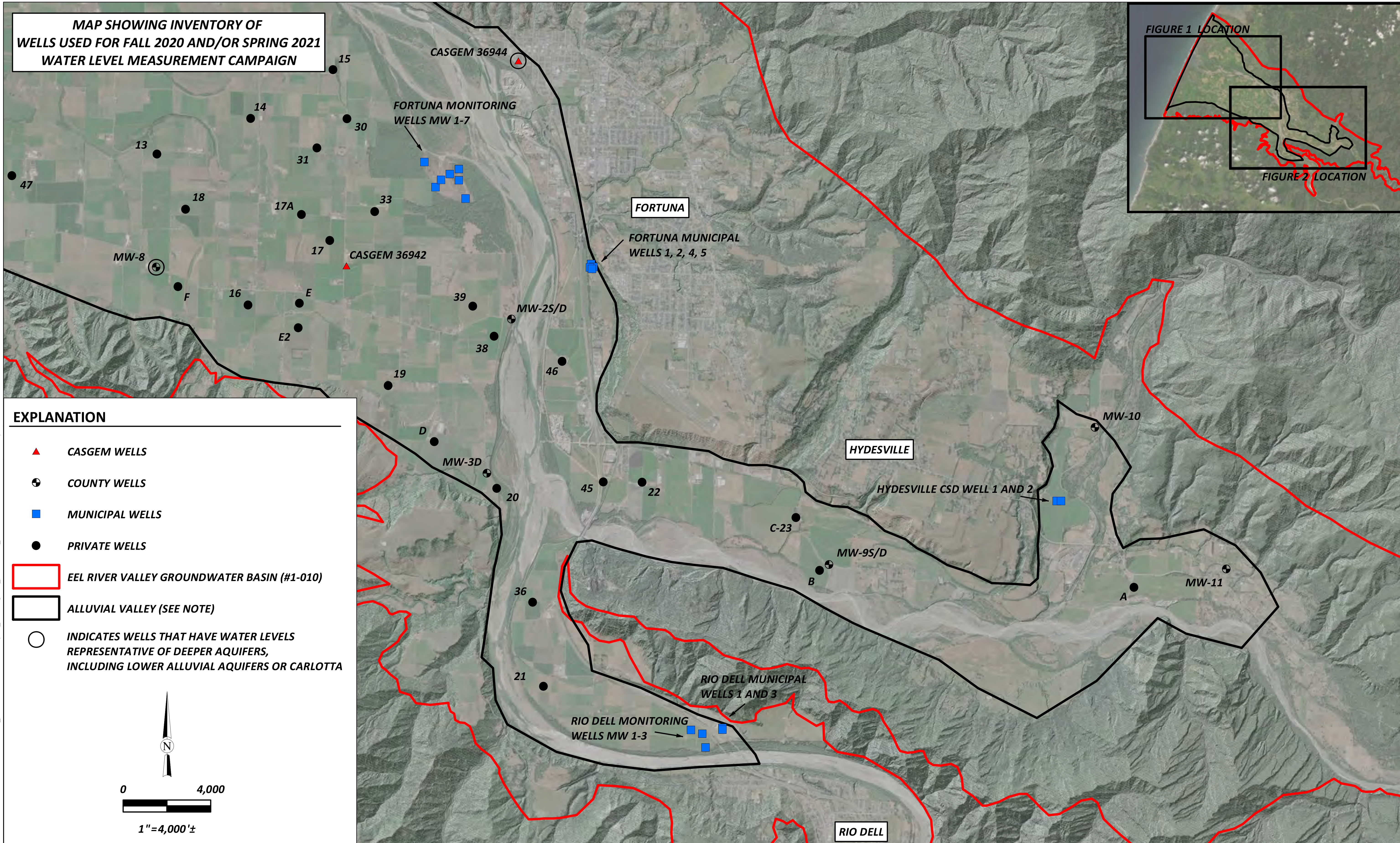


*NOTE: THE LOW-LYING ALLUVIAL AND FLUVIAL TERRACE SURFACES CONSTITUTED THE PRIMARY AREA OF INTEREST FOR THE CURRENT GROUNDWATER LEVELS STUDY*

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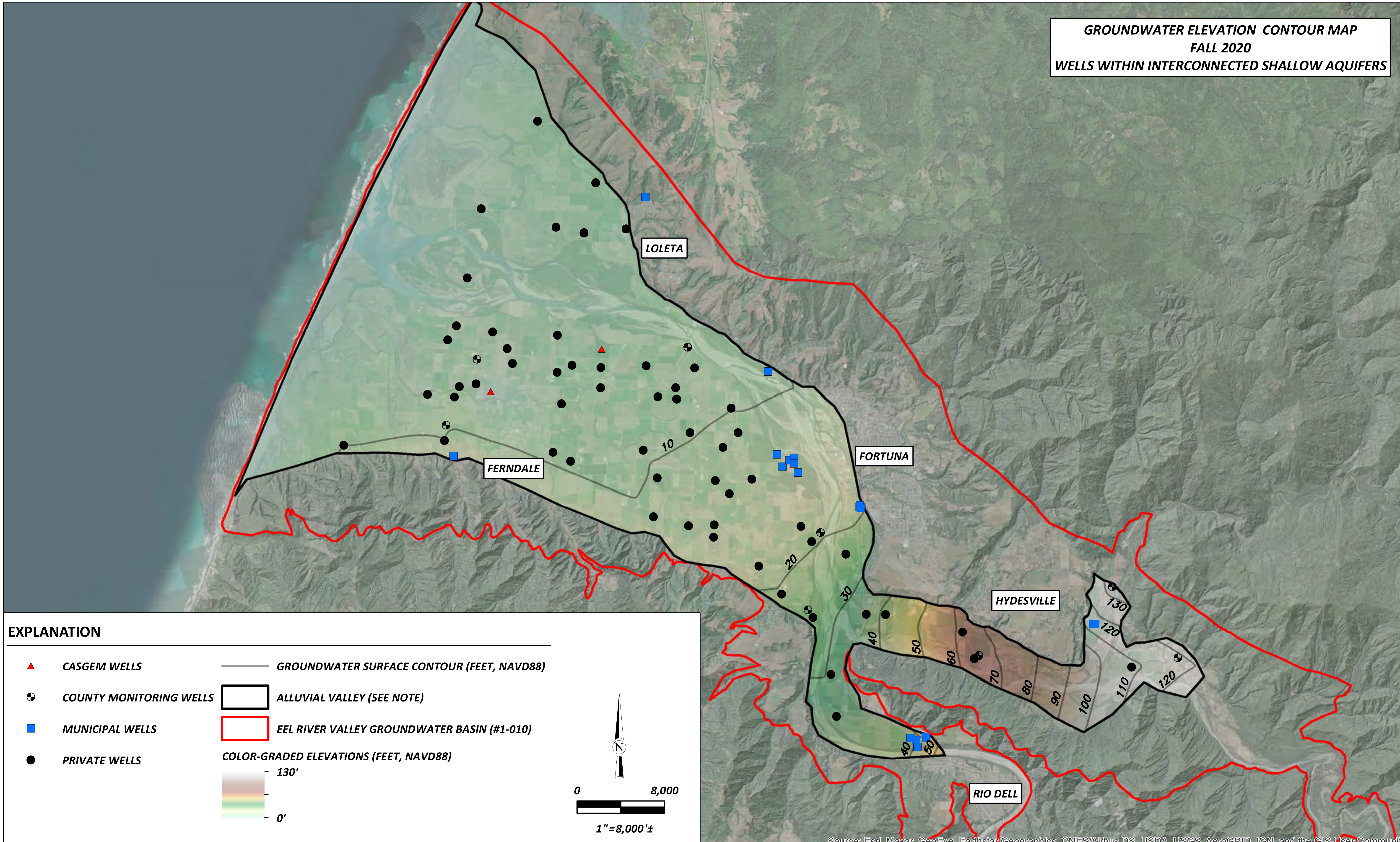
| | | |
|---|---|---|
| SHN | Humboldt County Public Works<br>Eel River Valley Groundwater Basin<br>Humboldt County, California | Wells Used for Fall 2020 and/or Spring 2021<br>Elevation Measurements<br>SHN 020091.140 |
| | August 2021 / Figure2_EelRiverGSP_WellLocationMAP | Figure 2 |




NOTES: -FALL 2020 WATER LEVEL MONITORING CAMPAIGN CONTOUR MAP BASED ON DEPTH TO WATER MEASUREMENTS COLLECTED OCTOBER 26-30, 2020

-THE LOW-LYING ALLUVIAL AND FLUVIAL TERRACE SURFACES CONSTITUTED THE PRIMARY AREA OF INTEREST FOR THE CURRENT GROUNDWATER LEVELS STUDY

SHN

Humboldt County Public Works
Eel River Valley Groundwater Basin
Humboldt County, California

Groundwater Elevation Contour Map
Shallow Aquifers Fall 2020
SHN 020091.140

August 2021 | Figure3_EelRiverGSP_Fall2020_GWC | Figure 3

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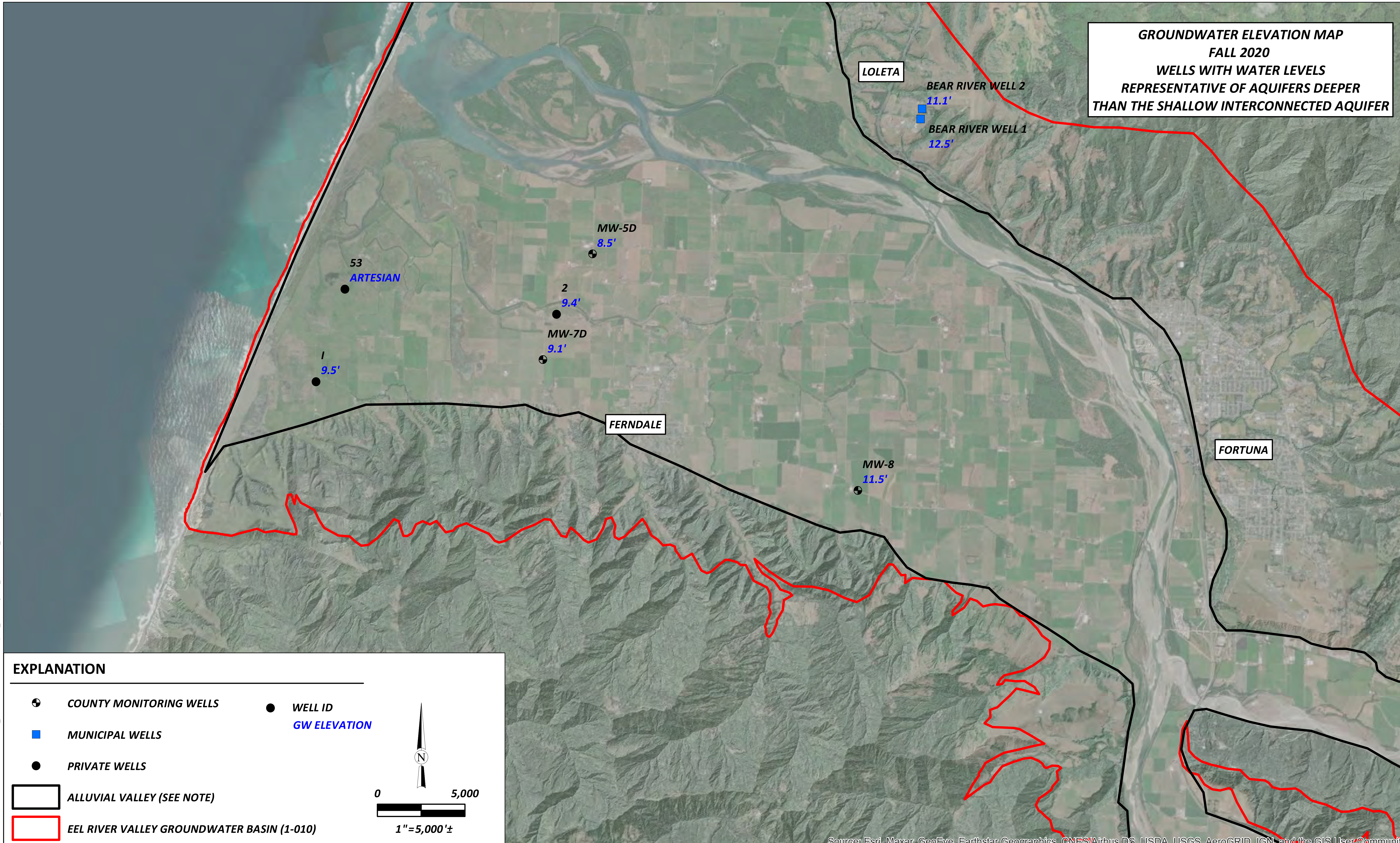


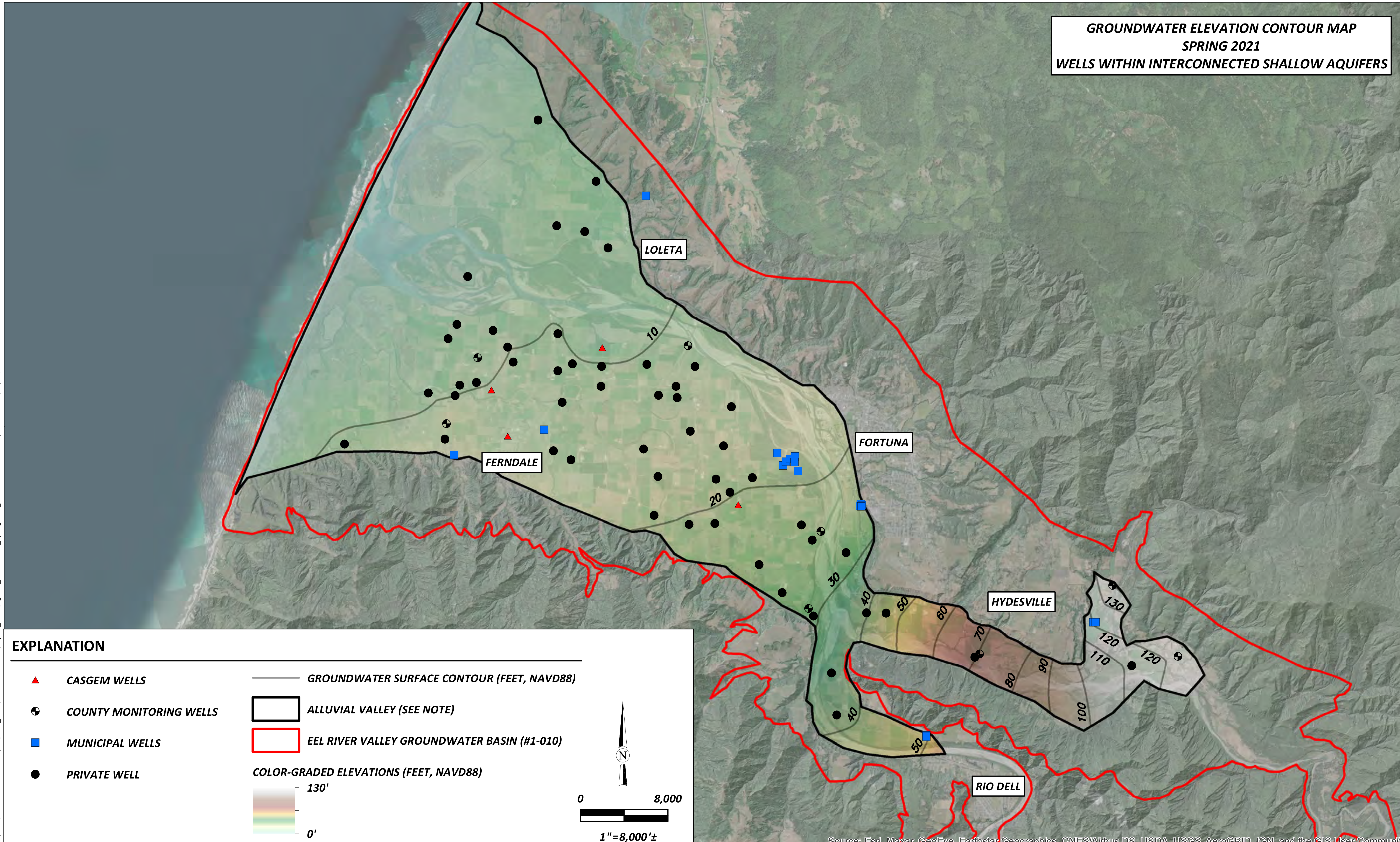

NOTES: -FALL 2020 WATER LEVELS BASED ON DEPTH TO WATER MEASUREMENTS COLLECTED OCTOBER 26-30, 2020
-THE LOW-LYING ALLUVIAL AND FLUVIAL TERRACE SURFACES CONSTITUTED THE PRIMARY AREA OF INTEREST FOR THE CURRENT GROUNDWATER LEVELS STUDY

Humboldt County Public Works
Eel River Valley Groundwater Basin
Humboldt County, California

Groundwater Elevation Map
Deep Aquifers Fall 2020
SHN 020091.140

August 2021 | Figure4_EelRiverGSP_Fall2020_DEEPWELLS | Figure 4

Path: \\eureka\projects\2020\020091-Eel-River-GSP\GIS\PRO_MXD\140-Water-Levels\Report_MXD\Figure4_EelRiverGSP_Fall2020_DEEPWELLS.mxd User Name: pik4d DATE: 8/24/21, 3:09PM




NOTES: -SPRING 2021 WATER LEVEL MONITORING CAMPAIGN CONTOUR MAP BASED ON DEPTH TO WATER MEASUREMENTS COLLECTED APRIL 5-9, 2021

-THE LOW-LYING ALLUVIAL AND FLUVIAL TERRACE SURFACES CONSTITUTED THE PRIMARY AREA OF INTEREST FOR THE CURRENT GROUNDWATER LEVELS STUDY

| | | |
|---|---|---|
| SHN | Humboldt County Public Works<br>Eel River Valley Groundwater Basin<br>Humboldt County, California | Groundwater Elevation Contour Map<br>Shallow Aquifers Spring 2021<br>SHN 020091.140 |
| | August 2021 / Figure5_EelRiverGSP_Spring2021_GWC | Figure 5 |

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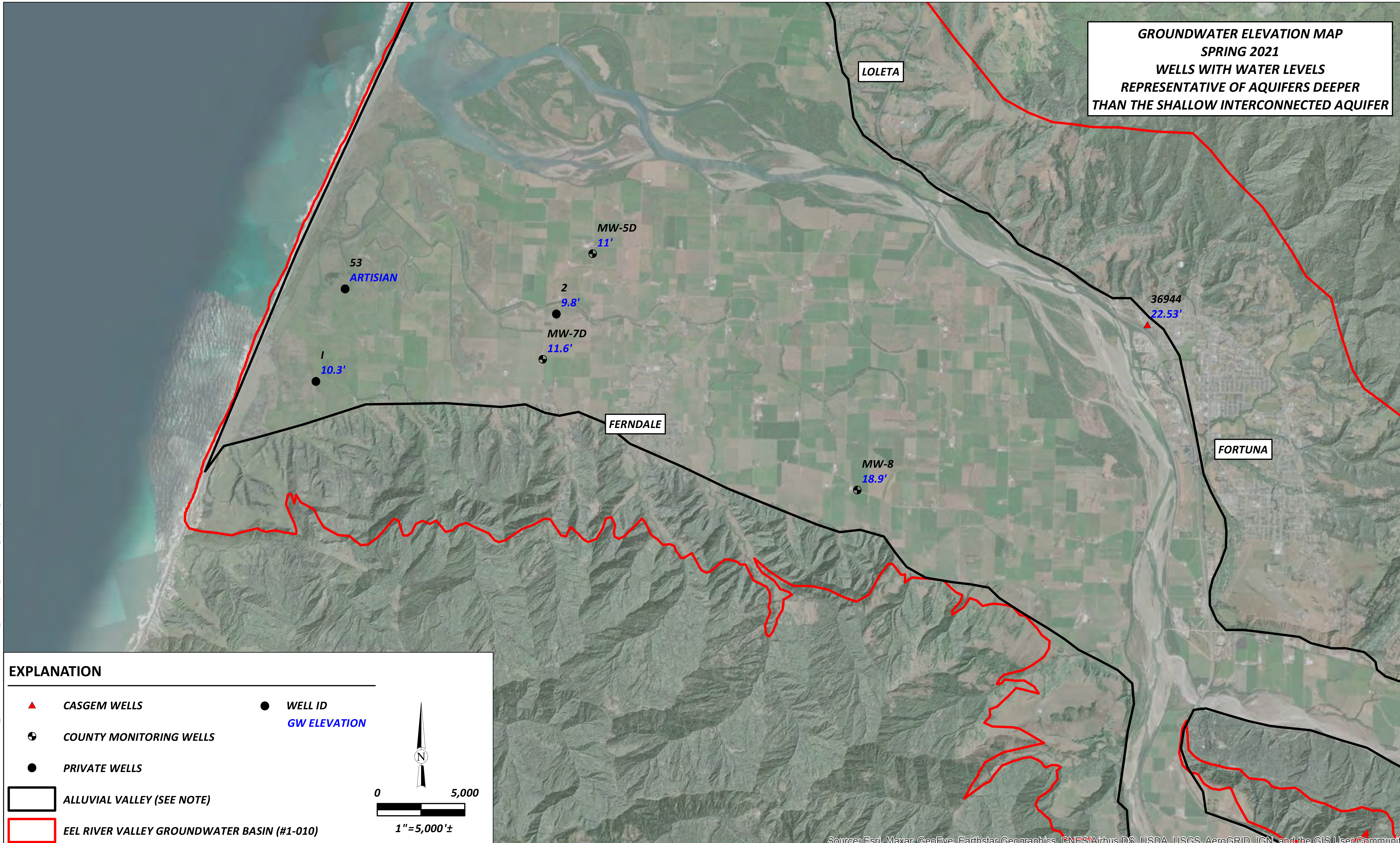
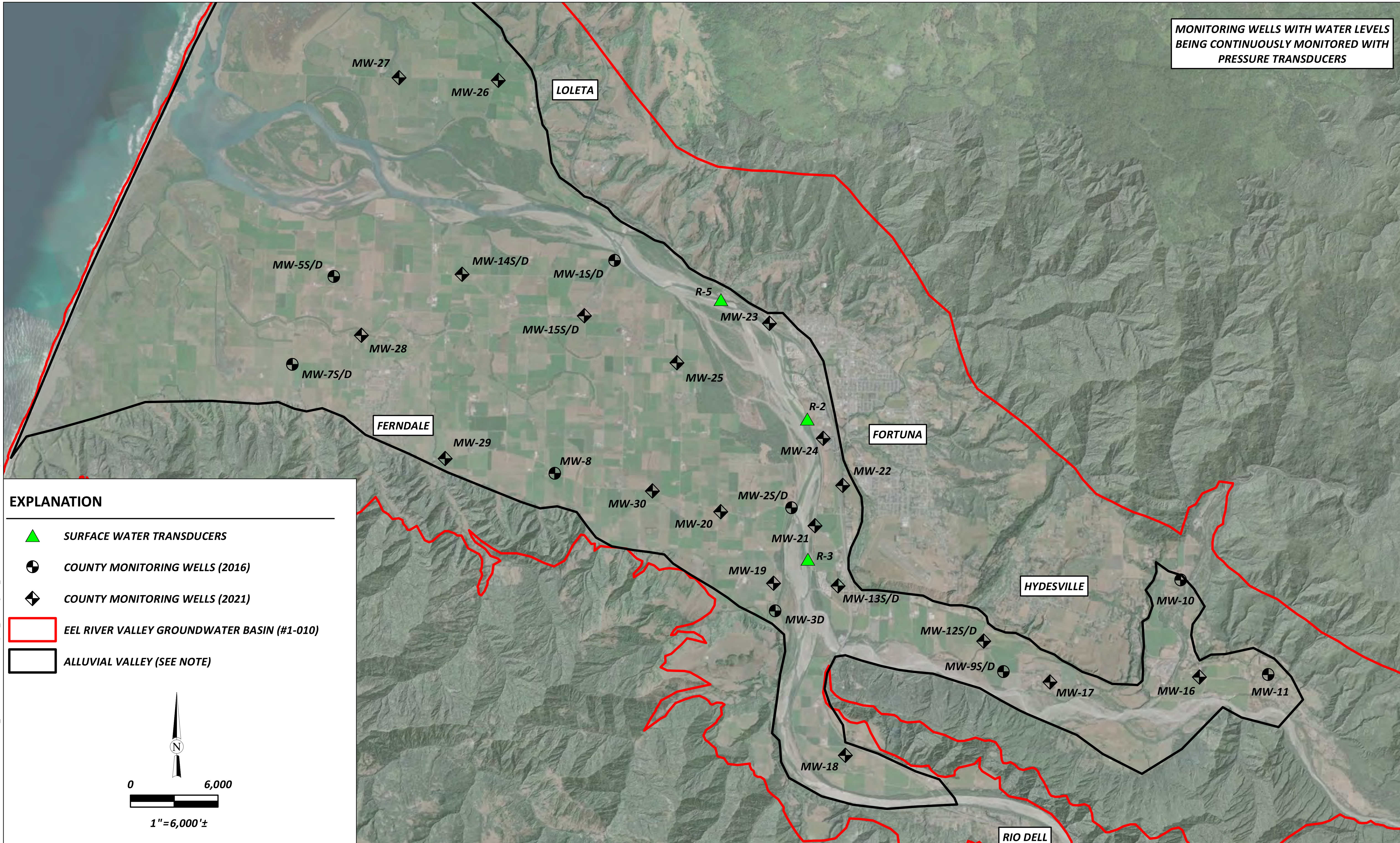



NOTES: -SPRING 2021 WATER LEVELS BASED ON DEPTH TO WATER MEASUREMENTS COLLECTED APRIL 5-9, 2021
-THE LOW-LYING ALLUVIAL AND FLUVIAL TERRACE SURFACES CONSTITUTED THE PRIMARY AREA OF INTEREST FOR THE CURRENT GROUNDWATER LEVELS STUDY

| | | |
|---|---|---|
| Humboldt County Public Works<br>Eel River Valley Groundwater Basin<br>Humboldt County, California | | Groundwater Elevation Map<br>Deep Aquifers Spring 2021<br>SHN 020091.140 |
| August 2021 | Figure6_EelRiverGSP_Spring2021_DEEPWELLS | Figure 6 |




NOTE: THE LOW-LYING ALLUVIAL VALLEY AND FLUVIAL TERRACE SURFACES CONSTITUTED THE PRIMARY AREA OF INTEREST FOR THE CURRENT GROUNDWATER LEVELS STUDY

| | | |
|---|---|---|
| SHN | Humboldt County Public Works<br>Eel River Valley Groundwater Basin<br>Humboldt County, California | County Monitoring Wells with Transducers<br>SHN 020091.140 |
| | August 2021 — Figure7_TransducerLocations | Figure 7 |

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# Tables 2

**Appendix 2 Water Level Tables**

Table 1 and Table 2, below, provide details on the water levels measured in the Fall 2020 and Spring 2021 sampling campaigns, respectively. Table 3 provides details on the transducer installation in the 2016 and 2021 County Monitoring Well networks.

**Table 1**
**Fall 2020 Groundwater Elevations**

| Well ID | Well Location[1] (Lat/Long NAD83) | Well Depth[2] (feet BGS) | Screened Aquifer | Measurement Date & Time | Depth to Water (feet BGS) | Water Surface Elevation (feet NAVD88) |
|---|---|---|---|---|---|---|
| **COUNTY MONITORING WELLS** | | | | | | |
| MW-1s | 40.6097, -124.20513 | 35 | Alluvial | 10/29/2020 10:30 | 23.90 | 8.6 |
| MW-1d | 40.6097, -124.20512 | 60 | Alluvial | 10/28/2020 10:30 | 23.90 | 8.6 |
| MW-2s | 40.56403, -124.15996 | 35 | Alluvial | 10/29/2020 13:39 | 29.60 | 19.3 |
| MW-2d | 40.56403, -124.15996 | 60 | Alluvial | 10/29/2020 13:41 | 29.40 | 19.5 |
| MW-3d | 40.5446, -124.16337 | 60 | Alluvial | 10/29/2020 13:57 | 47.90 | 25.4 |
| MW-5s | 40.60535, -124.27432 | 110 | Alluvial | 10/28/2020 15:30 | 9.13 | 6.2 |
| MW-5d | 40.60535, -124.27432 | 210[3] | L. Alluvial/Carlotta | 10/28/2020 13:30 | 6.88 | 8.5 |
| MW-7s | 40.58859, -124.28398 | 40 | Alluvial | 10/30/2020 9:00 | 4.63 | 15.3 |
| MW-7d | 40.58859, -124.28398 | 240[3] | L. Alluvial/Carlotta | 10/29/2020 16:22 | 10.75 | 9.1 |
| MW-8 | 40.5694, -124.21857 | 150[3] | L. Alluvial/Carlotta | 10/29/2020 13:25 | 31.80 | 11.5 |
| MW-9s | 40.5342, -124.1068 | 25 | Alluvial | 10/29/2020 12:20 | 11.10 | 66.6 |
| MW-9d | 40.5342, -124.1068 | 48 | Alluvial | 10/29/2020 12:22 | 11.40 | 66.3 |
| MW-10 | 40.55221, -124.06362 | 29 | Alluvial/Carlotta | 10/29/2020 12:39 | 20.40 | 134.1 |
| MW-11 | 40.53484, -124.04151 | 46 | Carlotta | 10/29/2020 12:54 | 31.30 | 116.0 |
| MUNICIPAL WELLS | | | | | | |
| City of Rio Dell Well 1 | 40.51345, -124.12369 | 80 | Alluvial | 10/28/2020 10:22 | 42.30 | 40.1 |
| City of Rio Dell Well 3 | 40.5132, -124.12367 | 110 | Alluvial | 10/28/2020 10:29 | 42.90 | 40.7 |
| Rio Dell Infiltration MW 1 | 40.51308, -124.12885 | - | Alluvial | 10/28/2020 10:45 | 46.00 | 39.1 |
| Rio Dell Infiltration MW 2 | 40.51264, -124.12699 | - | Alluvial | 10/28/2020 10:51 | 40.50 | 41.1 |
| Rio Dell Infiltration MW 3 | 40.51092, -124.12641 | - | Alluvial | 10/28/2020 10:58 | 26.00 | 40.7 |
| City of Fortuna Well 1 | 40.57116, -124.14714 | 115 | Alluvial | 10/28/2020 13:14 | 29.60 | 18.3 |
| City of Fortuna Well 2 | 40.57082, -124.14675 | 103 | Alluvial | 10/28/2020 13:20 | 25.20 | 18.8 |
| City of Fortuna Well 4 | 40.57071, -124.14733 | - | Alluvial | 10/28/2020 13:32 | 30.50 | 18.0 |
| City of Fortuna Well 5 | 40.57054, -124.14696 | 100 | Alluvial | 10/28/2020 13:23 | 29.00 | 18.2 |
| Fortuna Disposal MW 1 | 40.58033, -124.17303 | 29 | Alluvial | 10/29/2020 13:34 | 23.68 | 14.8 |
| Fortuna Disposal MW 3 | 40.58201, -124.17074 | 30 | Alluvial | 10/29/2020 13:58 | 23.75 | 14.9 |
| Fortuna Disposal MW 4 | 40.58267, -124.16924 | 29 | Alluvial | 10/29/2020 13:02 | 24.15 | 14.7 |
| Fortuna Disposal MW 5 | 40.58343, -124.17495 | 29 | Alluvial | 10/29/2020 13:40 | 23.94 | 12.8 |
| Fortuna Disposal MW 6 | 40.57899, -124.16802 | 30 | Alluvial | 10/29/2020 13:20 | 27.44 | 15.4 |
| Fortuna Disposal MW 7 | 40.58126, -124.16924 | 29 | Alluvial | 10/29/2020 13:14 | 24.79 | 14.9 |
| Loleta CSD Well 4 | 40.64706, -124.22039 | - | Carlotta | 10/28/2020 12:20 | 8.50 | 10.4 |
| Bear River Well 1 | 40.62777, -124.20765 | 695[3] | Carlotta | 10/28/2020 14:10 | 307.35 | 12.5 |
| Bear River Well 2 | 40.6294, -124.2074 | 695[3] | Carlotta | 10/28/2020 14:41 | 325.80 | 11.1 |
| Del Oro Water Company | 40.58777, -124.25191 | 166[4] | L. Alluvial/Carlotta | 10/26/2020 10:30 | 26.29 | 6.4 |
| Riverside CSD Well 6 | 40.58094, -124.28133 | 105 | Carlotta | 10/27/2020 10:30 | 38.83 | 15.6 |
| Palmer Creek CSD Well 2 | 40.60411, -124.17847 | 65 | Alluvial | 10/27/2020 11:37 | 34.60 | 8.4 |
| Hydesville CSD Well 1 | 40.54288, -124.06969 | 50 | Alluvial/Carlotta | 10/27/2020 12:45 | 18.70 | 115.5 |
| Hydesville CSD Well 2 | 40.54287, -124.06897 | 50 | Alluvial/Carlotta | 10/27/2020 12:50 | 18.10 | 116.3 |
| PRIVATE WELLS | | | | | | |
| 2 | 40.5958, -124.28137 | 260[3] | Carlotta | 10/29/2020 15:38 | 4.77 | 9.4 |
| 3 | 40.59845, -124.27988 | 26 | Alluvial | 10/27/2020 11:00 | 10.71 | 5.6 |
| 4 | 40.59923, -124.27445 | 80 | Alluvial | 10/27/2020 10:28 | 8.44 | 6.4 |
| 6 | 40.60455, -124.26258 | 40 | Alluvial | 10/27/2020 15:18 | 11.45 | 6.0 |
| 7 | 40.60825, -124.26447 | 40 | Alluvial | 10/27/2020 16:14 | 9.27 | 6.3 |
| 11 | 40.60265, -124.2478 | 69 | Alluvial | 10/27/2020 14:15 | 17.07 | 5.6 |
| 12 | 40.59475, -124.24607 | 60 | Alluvial | 10/28/2020 11:20 | 18.93 | 7.5 |
| 13 | 40.58363, -124.21889 | 45 | Alluvial | 10/28/2020 13:33 | 25.98 | 9.8 |
| 14 | 40.58838, -124.20366 | 66 | Alluvial | 10/26/2020 15:45 | 27.41 | 9.7 |
| 15 | 40.59473, -124.19031 | 55 | Alluvial | 10/27/2020 13:11 | 28.32 | 10.0 |
| 16 | 40.56498, -124.20332 | 55 | Alluvial | 10/28/2020 12:13 | 28.95 | 12.3 |
| 17 | 40.57334, -124.19013 | - | Alluvial | 10/26/2020 14:19 | 25.55 | 13.1 |
| 17A | 40.5765, -124.19488 | 100 | Alluvial | 10/26/2020 14:30 | 26.26 | 12.2 |
| 18 | 40.5768, -124.21398 | 41 | Alluvial | 10/28/2020 13:09 | 23.36 | 10.3 |
| 19 | 40.55533, -124.17992 | 100 | Alluvial | 10/28/2020 11:08 | 34.89 | 18.0 |
| 20 | 40.54277, -124.16168 | 110 | Alluvial | 10/27/2020 16:25 | 39.26 | 26.5 |
| 21 | 40.51813, -124.15319 | 60 | Alluvial | 10/26/2020 13:27 | 38.96 | 32.9 |

| Table 1<br>Fall 2020 Groundwater Elevations | | | | | | |
|---|---|---|---|---|---|---|
| **Well ID** | **Well Location[1] (Lat/Long NAD83)** | **Well Depth[2] (feet BGS)** | **Screened Aquifer** | **Measurement Date & Time** | **Depth to Water (feet BGS)** | **Water Surface Elevation (feet NAVD88)** |
| 22 | 40.54399, -124.13783 | 60 | Alluvial | 10/26/2020 12:14 | 26.78 | 42.2 |
| 25 | 40.63903, -124.22633 | 43 | Alluvial | 10/29/2020 11:05 | 28.60 | 3.3 |
| 26 | 40.66543, -124.25638 | 40 | Alluvial | 10/28/2020 15:06 | 0.14 | 5.5 |
| 29 | 40.62574, -124.27822 | 30 | Alluvial | 10/29/2020 9:47 | 10.28 | 4.6 |
| 30 | 40.58866, -124.18779 | 45 | Alluvial | 10/27/2020 13:45 | 25.04 | 10.5 |
| 31 | 40.5849, -124.19264 | 60 | Alluvial | 10/27/2020 13:32 | 26.50 | 11.5 |
| 33 | 40.5771, -124.18288 | - | Alluvial | 10/26/2020 15:00 | 33.23 | 13.5 |
| 34 | 40.64312, -124.2742 | 26 | Alluvial | 10/28/2020 13:48 | 7.56 | 3.7 |
| 36 | 40.52861, -124.15531 | - | Alluvial | 10/27/2020 11:22 | 39.93 | 31.0 |
| 38 | 40.56184, -124.16272 | - | Alluvial | 10/27/2020 14:58 | 32.12 | 19.3 |
| 39 | 40.56554, -124.16636 | - | Alluvial | 10/28/2020 10:50 | 30.18 | 18.0 |
| 41 | 40.5967, -124.20829 | - | Alluvial | 10/28/2020 15:52 | 20.77 | 8.2 |
| 41A | 40.59668, -124.20824 | - | Alluvial | 10/28/2020 15:55 | 20.74 | 8.6 |
| 42 | 40.59712, -124.21448 | - | Alluvial | 10/28/2020 15:30 | 18.20 | 8.3 |
| 43 | 40.59951, -124.20871 | - | Alluvial | 10/28/2020 16:06 | 24.36 | 7.4 |
| 44 | 40.60464, -124.20268 | - | Alluvial | 10/29/2020 10:37 | 22.85 | 7.3 |
| 45 | 40.54392, -124.14421 | - | Alluvial | 10/26/2020 12:40 | 22.57 | 35.1 |
| 46 | 40.55891, -124.15144 | - | Alluvial | 10/27/2020 12:25 | 30.48 | 22.8 |
| 47 | 40.58043, -124.24267 | - | Alluvial | 10/29/2020 12:15 | 29.85 | 8.1 |
| 48 | 40.58258, -124.24852 | - | Carlotta | 10/29/2020 11:20 | 35.15 | 7.9 |
| 51 | 40.61003, -124.28413 | - | Alluvial | 10/26/2020 14:26 | 4.34 | 6.0 |
| 52 | 40.58293, -124.31736 | 180[4] | L. Alluvial/Carlotta | 10/28/2020 10:21 | 22.22 | 10.0 |
| 53 | 40.59888, -124.32502 | 265[3] | Carlotta | - | Artesian | - |
| 54 | 40.59905, -124.23342 | - | Alluvial | 10/26/2020 14:28 | 19.84 | 7.3 |
| 57 | 40.60407, -124.23342 | - | Alluvial | 10/26/2020 13:55 | 15.04 | 6.4 |
| 58 | 40.60449, -124.24299 | - | Alluvial | 10/26/2020 13:06 | 16.29 | 7.0 |
| 59 | 40.61192, -124.24805 | - | Alluvial | 10/26/2020 12:30 | 16.00 | 5.8 |
| A | 40.53229, -124.05658 | 50 | Alluvial/Carlotta | 10/26/2020 11:08 | 11.55 | 107.7 |
| B | 40.53349, -124.10832 | 45 | Alluvial | 10/27/2020 10:45 | 12.25 | 66.0 |
| C-23 | 40.54005, -124.11242 | 80 | Alluvial | 10/26/2020 11:55 | 28.05 | 61.9 |
| D | 40.54844, -124.17214 | 140[4] | Alluvial/Carlotta | 10/27/2020 16:10 | 67.14 | 20.5 |
| E | 40.56538, -124.19488 | 45 | Alluvial | 10/28/2020 11:32 | 34.01 | 12.9 |
| E2 | 40.56227, -124.19498 | - | Alluvial | 10/28/2020 11:50 | 28.02 | 14.2 |
| F | 40.56706, -124.21491 | 50 | Alluvial | 10/28/2020 12:46 | 28.51 | 10.9 |
| G | 40.58478, -124.28431 | 160[4] | Carlotta | 10/27/2020 13:06 | 23.80 | 10.2 |
| H | 40.59622, -124.29022 | 70 | Alluvial | 10/26/2020 15:08 | 8.28 | 5.1 |
| I | 40.58423, -124.33046 | 200[3] | Carlotta | 10/26/2020 11:53 | 0.57 | 9.5 |
| J | 40.60483, -124.21858 | 50 | Alluvial | 10/28/2020 12:45 | 16.90 | 7.4 |
| L | 40.61237, -124.26943 | 40 | Alluvial | 10/27/2020 16:47 | 9.17 | 5.4 |
| M | 40.63779, -124.24012 | - | Alluvial | 10/28/2020 14:20 | 10.80 | 5.0 |
| M2 | 40.63775, -124.24012 | - | Alluvial | 10/28/2020 14:17 | 11.48 | 5.0 |
| N | 40.65039, -124.23674 | 45 | Alluvial | 10/28/2020 14:49 | 3.41 | 5.8 |
| Q | 40.61364, -124.28136 | 60 | Alluvial | 10/26/2020 15:40 | 8.56 | 4.3 |
| R | 40.63905, -124.24939 | 40 | Alluvial | 10/28/2020 15:50 | 7.04 | 4.9 |
| CASGEM WELLS | | | | | | |
| 36943 | 40.58594, -124.26387 | 240[4] | L. Alluvial/Carlotta | 10/29/2020 12:00 | 23.2 | 7.02 |
| 23183 | 40.5974, -124.26960 | 42 | Alluvial | 10/29/2020 12:00 | 10.4 | 5.81 |
| 23181 | 40.60875, -124.23349 | 45 | Alluvial | 10/29/2020 12:00 | 18.0 | 0.22 |

[1]Well locations based on a combination of geo-tagged field photos and aerial imagery.

[2] Well depths are based on well completion reports, if available, or landowner knowledge.

[3] Water levels at this location are interpreted to be associated with lower, confined or semi-confined aquifers.

[4] Screened interval and/or sand/gravel backfill materials intercept shallow water bearing units and therefore water levels are contoured with the shallow interconnected aquifers on Figure 3.

| Table 2<br>Spring 2021 Groundwater Elevations | | | | | | |
|---|---|---|---|---|---|---|
| **Well ID** | **Well Location[1] (Lat/Long NAD83)** | **Well Depth[2] (feet BGS)** | **Screened Aquifer** | **Measurement Date & Time** | **Depth to Water (feet BGS)** | **Water Surface Elevation (feet NAVD88)** |
| **COUNTY MONITORING WELLS** | | | | | | |
| MW-1s | 40.6097, -124.20512 | 35 | Alluvial | 4/5/2021 15:57 | 21.41 | 11.1 |
| MW-1d | 40.6097, -124.20512 | 60 | Alluvial | 4/7/2021 13:40 | 21.17 | 11.4 |
| MW-2s | 40.56403, -124.15996 | 35 | Alluvial | 4/5/2021 14:30 | 26.44 | 22.5 |
| MW-2d | 40.56403, -124.15996 | 60 | Alluvial | 4/7/2021 11:55 | 25.83 | 23.1 |
| MW-3d | 40.5446, -124.16337 | 60 | Alluvial | 4/5/2021 14:00 | 44.82 | 28.4 |
| MW-5s | 40.60535, -124.27432 | 110 | Alluvial | 4/7/2021 10:09 | 6.32 | 9.0 |
| MW-5d | 40.60535, -124.27432 | 210[3] | L. Alluvial/Carlotta | 4/7/2021 9:15 | 4.30 | 11.0 |
| MW-7s | 40.58859, -124.28398 | 40 | Alluvial | 4/6/2021 8:55 | 1.95 | 17.9 |
| MW-7d | 40.58859, -124.28398 | 240[3] | L. Alluvial/Carlotta | 4/6/2021 9:00 | 8.24 | 11.6 |
| MW-8 | 40.5694, -124.21857 | 150[3] | L. Alluvial/Carlotta | 4/6/2021 13:50 | 24.44 | 18.9 |
| MW-9s | 40.5342, -124.1068 | 25 | Alluvial | 4/8/2021 18:05 | 7.34 | 70.4 |
| MW-9d | 40.5342, -124.1068 | 48 | Alluvial | 4/8/2021 18:09 | 7.35 | 70.4 |
| MW-10 | 40.55221, -124.06362 | 29 | Alluvial/Carlotta | 4/8/2021 17:15 | 16.15 | 138.4 |
| MW-11 | 40.53484, -124.04151 | 46 | Carlotta | 4/8/2021 16:47 | 24.63 | 122.7 |
| **MUNICIPAL WELLS** | | | | | | |
| City of Rio Dell Well 1 | 40.51345, -124.12369 | 80 | Alluvial | 4/8/2021 12:00 | 35.30 | 47.1 |
| City of Rio Dell Well 3 | 40.5132, -124.12367 | 110 | Alluvial | 4/8/2021 12:00 | 34.90 | 48.7 |
| City of Fortuna Well 1 | 40.57116, -124.14714 | 115 | Alluvial | 4/7/2021 14:00 | 26.60 | 21.3 |
| City of Fortuna Well 2 | 40.57082, -124.14675 | 103 | Alluvial | 4/7/2021 14:00 | 22.10 | 21.9 |
| City of Fortuna Well 4 | 40.57071, -124.14733 | - | Alluvial | 4/7/2021 14:00 | 27.70 | 20.8 |
| City of Fortuna Well 5 | 40.57054, -124.14696 | 100 | Alluvial | 4/7/2021 14:00 | 26.20 | 21.0 |
| Fortuna Disposal MW 1 | 40.58033, -124.17303 | 29 | Alluvial | 4/9/2021 17:07 | 19.36 | 19.1 |
| Fortuna Disposal MW 2 | 40.58123, -124.17214 | 30 | Alluvial | 4/9/2021 17:32 | 20.11 | 18.5 |
| Fortuna Disposal MW 3 | 40.58202, -124.17074 | 30 | Alluvial | 4/9/2021 17:28 | 19.95 | 18.7 |
| Fortuna Disposal MW 4 | 40.58267, -124.16924 | 29 | Alluvial | 4/9/2021 17:25 | 20.58 | 18.2 |
| Fortuna Disposal MW 5 | 40.58343, -124.17495 | 29 | Alluvial | 4/9/2021 17:38 | 19.61 | 17.1 |
| Fortuna Disposal MW 6 | 40.57899, -124.16802 | 30 | Alluvial | 4/9/2021 17:15 | 23.65 | 19.2 |
| Fortuna Disposal MW 7 | 40.58126, -124.16924 | 29 | Alluvial | 4/9/2021 17:20 | 21.01 | 18.7 |
| Loleta CSD Well 4 | 40.64706, -124.22039 | - | Carlotta | 3/24/2021 12:00 | 6.00 | 12.9 |
| Del Oro Water Company | 40.58777, -124.25191 | 166[4] | L. Alluvial/Carlotta | 4/5/2021 11:30 | 21.09 | 11.6 |
| Riverside CSD Well 6 | 40.58094, -124.28133 | 105 | Carlotta | 4/6/2021 11:00 | 38.07 | 16.3 |
| Hydesville CSD Well 1 | 40.54288, -124.06969 | 50 | Alluvial/Carlotta | 4/8/2021 12:00 | 13.20 | 121.0 |
| Hydesville CSD Well 2 | 40.54287, -124.06897 | 50 | Alluvial/Carlotta | 4/8/2021 12:00 | 12.20 | 122.2 |
| **PRIVATE WELLS** | | | | | | |
| 2 | 40.5958, -124.28137 | 260[3] | Carlotta | 4/5/2021 15:48 | 4.31 | 9.8 |
| 3 | 40.59845, -124.27988 | 26 | Alluvial | 4/5/2021 11:03 | 7.72 | 8.6 |
| 4 | 40.59923, -124.27445 | 80 | Alluvial | 4/5/2021 11:55 | 4.88 | 9.9 |
| 6 | 40.60455, -124.26258 | 40 | Alluvial | 4/5/2021 14:47 | 7.15 | 10.3 |
| 7 | 40.60826, -124.26447 | 40 | Alluvial | 4/5/2021 13:44 | 5.65 | 9.9 |
| 11 | 40.60265, -124.2478 | 69 | Alluvial | 4/5/2021 13:24 | 12.43 | 10.2 |
| 12 | 40.59475, -124.24607 | 60 | Alluvial | 4/7/2021 9:09 | 13.28 | 13.2 |
| 13 | 40.58363, -124.21889 | 45 | Alluvial | 4/5/2021 11:30 | 18.98 | 16.8 |
| 14 | 40.58838, -124.20366 | 66 | Alluvial | 4/7/2021 9:59 | 21.24 | 15.8 |
| 15 | 40.59473, -124.19031 | 55 | Alluvial | 4/7/2021 10:19 | 23.39 | 14.9 |
| 16 | 40.56498, -124.20332 | 55 | Alluvial | 4/5/2021 12:08 | 20.78 | 20.5 |
| 17 | 40.57334, -124.19013 | - | Alluvial | 4/5/2021 13:16 | 19.13 | 19.5 |
| 17A | 40.5765, -124.19488 | 100 | Alluvial | 4/5/2021 13:02 | 19.60 | 18.9 |
| 18 | 40.5768, -124.21398 | 41 | Alluvial | 4/5/2021 11:45 | 15.91 | 17.7 |
| 19 | 40.55533, -124.17992 | 100 | Alluvial | 4/5/2021 15:36 | 29.42 | 23.5 |
| 20 | 40.54277, -124.16168 | 110 | Alluvial | 4/7/2021 11:42 | 36.69 | 29.1 |
| 21 | 40.51813, -124.15319 | 60 | Alluvial | 4/6/2021 14:57 | 34.78 | 37.1 |
| 22 | 40.54399, -124.13783 | 60 | Alluvial | 4/6/2021 13:30 | 22.04 | 46.9 |
| 24 | 40.63378, -124.23233 | 80 | Alluvial | 4/7/2021 11:35 | 12.38 | 7.1 |
| 26 | 40.66543, -124.25638 | 40 | Alluvial | 4/6/2021 13:25 | -0.95 | 6.6 |
| 29 | 40.62574, -124.27822 | 30 | Alluvial | 4/6/2021 14:55 | 11.68 | 3.2 |
| 31 | 40.5849, -124.19264 | 60 | Alluvial | 4/5/2021 14:29 | 20.50 | 17.5 |
| 33 | 40.5771, -124.18288 | - | Alluvial | 4/5/2021 14:04 | 27.50 | 19.2 |
| 36 | 40.52861, -124.15531 | - | Alluvial | 4/6/2021 14:33 | 37.06 | 33.9 |
| 38 | 40.56184, -124.16272 | - | Alluvial | 4/7/2021 11:06 | 28.68 | 22.8 |
| 39 | 40.56554, -124.16636 | - | Alluvial | 4/7/2021 10:49 | 26.10 | 22.1 |
| 41 | 40.5967, -124.20829 | - | Alluvial | 4/6/2021 11:28 | 15.17 | 13.8 |

**Table 2**
**Spring 2021 Groundwater Elevations**

| Well ID | Well Location[1] (Lat/Long NAD83) | Well Depth[2] (feet BGS) | Screened Aquifer | Measurement Date & Time | Depth to Water (feet BGS) | Water Surface Elevation (feet NAVD88) |
|---|---|---|---|---|---|---|
| 41A | 40.59668, -124.20824 | - | Alluvial | 4/6/2021 11:32 | 15.11 | 14.2 |
| 42 | 40.59712, -124.21448 | - | Alluvial | 4/6/2021 11:12 | 12.51 | 14.0 |
| 43 | 40.59951, -124.20871 | - | Alluvial | 4/6/2021 11:40 | 19.05 | 12.8 |
| 44 | 40.60464, -124.20268 | - | Alluvial | 4/6/2021 10:48 | 18.96 | 11.2 |
| 45 | 40.54392, -124.14421 | - | Alluvial | 4/6/2021 13:51 | 18.18 | 39.5 |
| 46 | 40.55891, -124.15144 | - | Alluvial | 4/6/2021 14:10 | 27.32 | 25.9 |
| 47 | 40.58043, -124.24267 | - | Alluvial | 4/5/2021 10:45 | 24.66 | 13.3 |
| 48 | 40.58258, -124.24853 | - | Carlotta | 4/5/2021 16:24 | 30.37 | 12.7 |
| 51 | 40.61003, -124.28413 | - | Alluvial | 4/5/2021 10:23 | 2.39 | 8.0 |
| 52 | 40.58294, -124.31736 | 180[4] | L. Alluvial/Carlotta | 4/5/2021 10:25 | 20.22 | 12.0 |
| 53 | 40.59888, -124.32502 | 265[3] | Carlotta | - | Artesian | - |
| 54 | 40.59905, -124.23342 | - | Alluvial | 4/6/2021 9:19 | 14.64 | 12.5 |
| 57 | 40.60407, -124.23342 | - | Alluvial | 4/6/2021 9:41 | 10.52 | 10.9 |
| 58 | 40.60449, -124.24299 | - | Alluvial | 4/6/2021 10:05 | 11.99 | 11.3 |
| 59 | 40.61192, -124.24805 | - | Alluvial | 4/5/2021 14:24 | 11.35 | 10.5 |
| A | 40.53229, -124.05658 | 50 | Alluvial/Carlotta | 4/6/2021 13:09 | 7.58 | 111.7 |
| B | 40.53349, -124.10832 | 45 | Alluvial | 4/6/2021 12:42 | 8.45 | 69.8 |
| D | 40.54844, -124.17214 | 140[4] | Alluvial/Carlotta | 4/7/2021 11:23 | 62.62 | 25.1 |
| E | 40.56538, -124.19488 | 45 | Alluvial | 4/5/2021 12:40 | 26.40 | 20.5 |
| F | 40.56706, -124.21491 | 50 | Alluvial | 4/5/2021 11:06 | 20.21 | 19.2 |
| G | 40.58478, -124.28431 | 160[4] | Carlotta | 4/6/2021 11:50 | 21.37 | 12.6 |
| H | 40.59622, -124.29022 | 70 | Alluvial | 4/5/2021 14:12 | 6.14 | 7.3 |
| I | 40.58423, -124.33046 | 200[3] | Carlotta | 4/5/2021 16:26 | -0.19 | 10.3 |
| J | 40.60483, -124.21858 | 50 | Alluvial | 4/5/2021 15:25 | 12.14 | 12.1 |
| L | 40.61238, -124.26943 | 40 | Alluvial | 4/6/2021 9:02 | 6.78 | 7.7 |
| M2 | 40.63775, -124.24012 | - | Alluvial | 4/7/2021 11:21 | 9.80 | 6.6 |
| N | 40.65039, -124.23674 | 45 | Alluvial | 4/7/2021 12:42 | 1.86 | 7.3 |
| Q | 40.61364, -124.28136 | 60 | Alluvial | 4/5/2021 13:18 | 6.16 | 6.7 |
| R | 40.63905, -124.24939 | 40 | Alluvial | 4/6/2021 14:05 | 1.90 | 10.1 |
| **CASGEM WELLS** | | | | | | |
| 36942 | 40.5702, -124.18740 | 30 | Alluvial | 3/30/2021 12:00 | 22.80 | 21.43 |
| 36943 | 40.58594, -124.26387 | 240[3] | L. Alluvial/Carlotta | 3/30/2021 12:00 | 19.00 | 11.22 |
| 36944 | 40.59644, -124.15992 | 496[4] | Carlotta | 3/30/2021 12:00 | 33.70 | 22.53 |
| 23183 | 40.5974, -124.26960 | 42 | Alluvial | 3/30/2021 12:00 | 6.10 | 10.11 |
| 23181 | 40.60875, -124.23349 | 45 | Alluvial | 3/30/2021 12:00 | 13.70 | 4.52 |

[1] Well locations based on a combination of geo-tagged field photos and aerial imagery.

[2] Well depths are based on well completion reports, if available, or landowner knowledge.

[3] Water levels at this location are interpreted to be associated with lower, confined or semi-confined aquifers.

[4] Screened interval and/or sand/gravel backfill materials intercept shallow water bearing units and therefore water levels are contoured with the shallow interconnected aquifers on Figure 5.

| Table 3<br>Transducer Locations and Serial Numbers | | |
|---|---|---|
| **MW Location** | **Transducer Serial Number** | **Install Date** |
| MW-1s | 005-2135537 | 5/19/2021 |
| MW-1d | 005-2135526 | 5/19/2021 |
| MW-2s | 005-2135522 | 5/20/2021 |
| MW-2d | 005-2135541 | 5/20/2021 |
| MW-3d | 005-2135540 | 5/20/2021 |
| MW-5s | 005-2135534 | 5/20/2021 |
| MW-5d | 005-2135205 | 5/20/2021 |
| MW-7s | 0012067002 | 10/9/2019 |
| MW-7d | 0102045352 | 10/9/2019 |
| MW-8 | 005-2135196 | 5/20/2021 |
| MW-9s | 005-2135535 | 5/20/2021 |
| MW-9d | 005-2135533 | 5/20/2021 |
| MW-10 | 005-2137984 | 7/8/2021 |
| MW-11 | 005-2137958 | 7/8/2021 |
| MW-12s | 005-2135201 | 6/4/2021 |
| MW-12d | 005-2135524 | 6/4/2021 |
| MW-13s | 005-2135532 | 6/4/2021 |
| MW-13d | 005-2135203 | 6/4/2021 |
| MW-14s | 005-2135190 | 5/28/2021 |
| MW-14d | 005-2135530 | 5/28/2021 |
| MW-15s | 005-2135536 | 5/28/2021 |
| MW-15d | 005-2135520 | 5/28/2021 |
| MW-16 | 005-2135528 | 6/21/2021 |
| MW-17 | 005-2135538 | 6/21/2021 |
| MW-18 | 005-2135539 | 6/24/2021 |
| MW-19 | 005-2135202 | 6/28/2021 |
| MW-20 | 005-2135527 | 6/24/2021 |
| MW-21 | 005-2135192 | 6/24/2021 |
| MW-22 | 005-2135189 | 6/24/2021 |
| MW-23 | 005-2137905 | 6/23/2021 |
| MW-24 | 005-2137989 | 6/24/2021 |
| MW-25 | 005-2137899 | 6/16/2021 |
| MW-26 | 005-2137947 | 6/17/2021 |
| MW-27 | 005-2138153 | 6/24/2021 |
| MW-28 | 005-2137954 | 6/24/2021 |
| MW-29 | 005-2137955 | 6/24/2021 |
| MW-30 | 005-2137906 | 6/24/2021 |

Well locations shown on Figure 7.

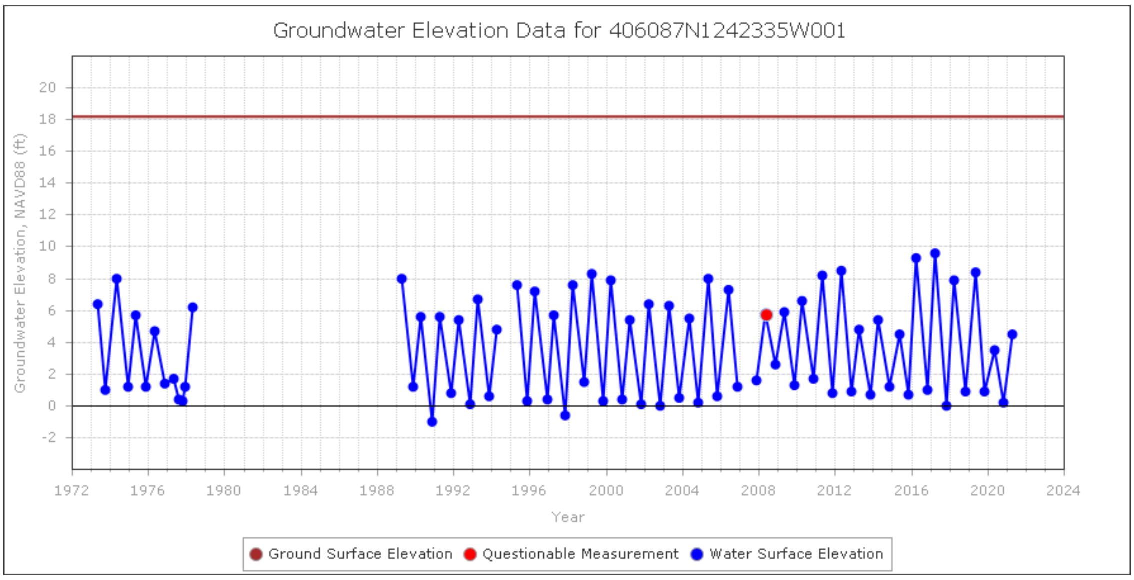
# 3
# Hydrographs

## CASGEM Wells

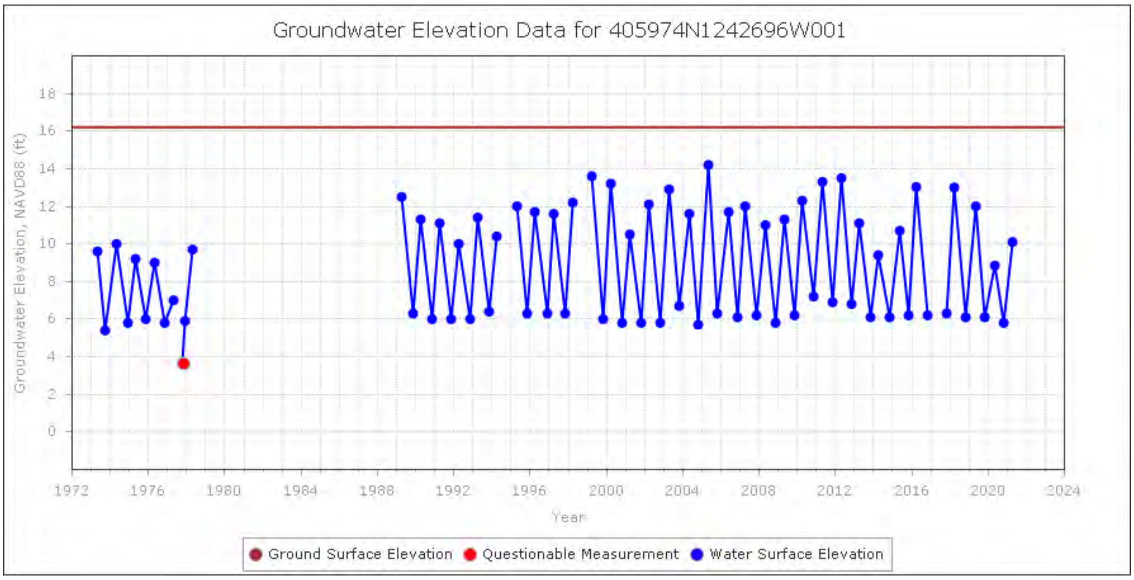
The CASGEM wells represent the best historical records of water levels within the ERVB. There are 9 total wells that have water level records, most of which span multiple decades. There are 5 CASGEM wells currently being monitored by DWR bi-annually (see map below). All CASGEM wells are located within the lower Eel River Valley. Hydrographs for the 5 active CASGEM wells are shown below.


**Map showing CASGEM wells currently being monitoring biannually by DWR.**

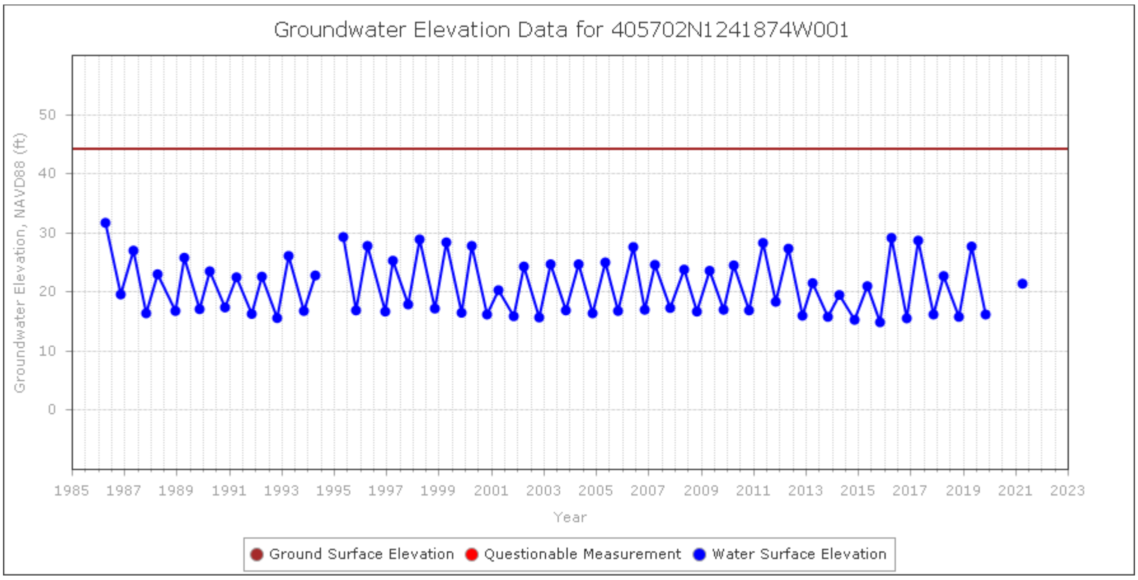
CASGEM Well **23181**



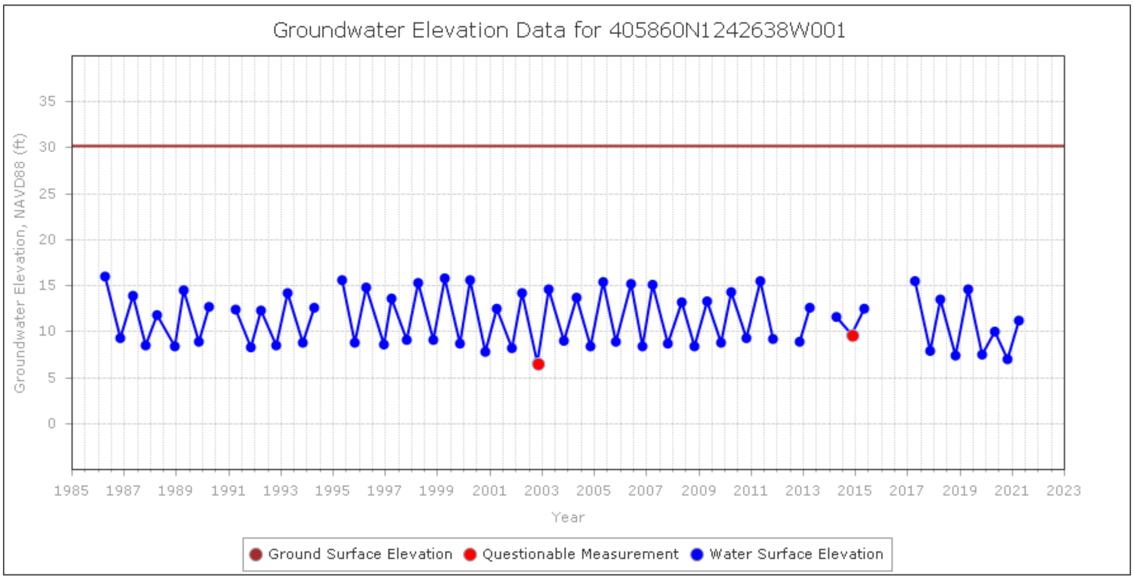
CASGEM Well **23183**



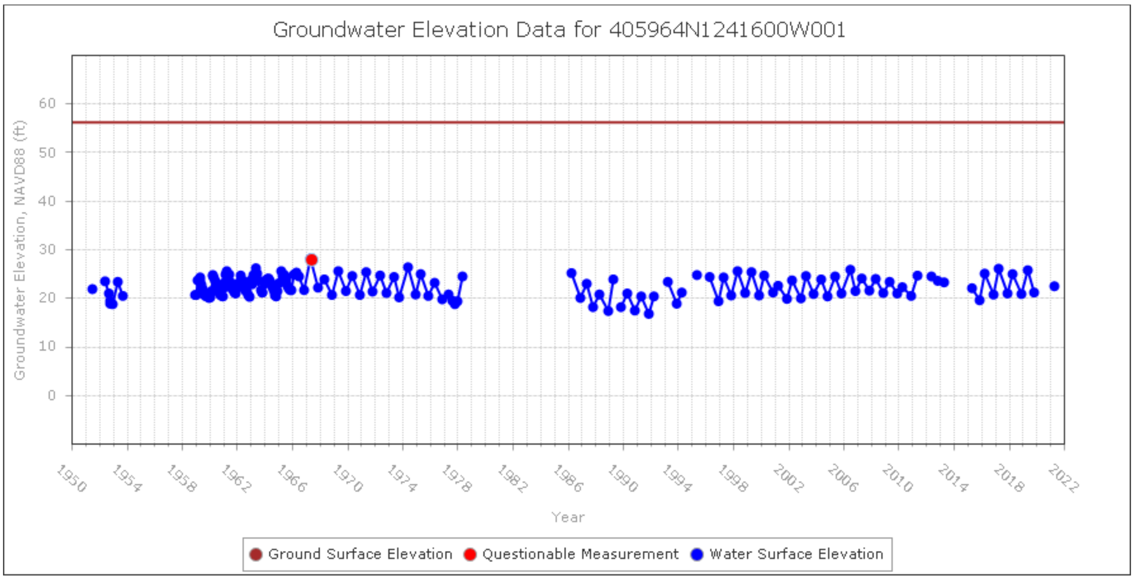

CASGEM Well **36942**



CASGEM Well **36943**

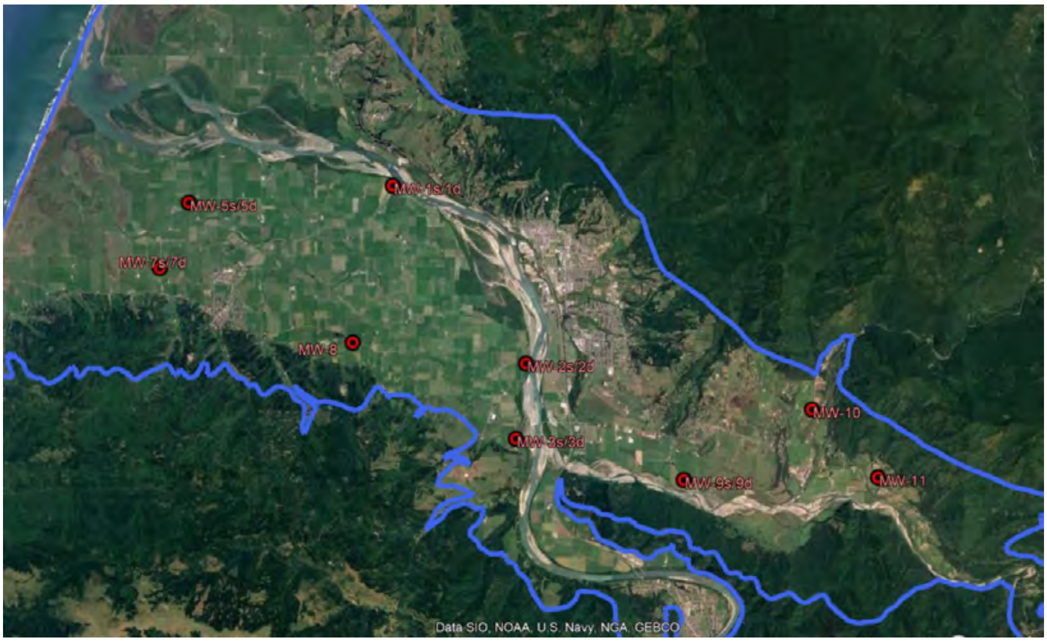



CASGEM Well **36944**



## 2016 County Monitoring Wells

15 monitoring wells (9 locations with 6 dual-well installations) were installed in 2016 and groundwater levels have been measured bi-annually since that time, with some wells that have intervals of continuous monitoring, primarily focused on assessing GW/SW relationships.



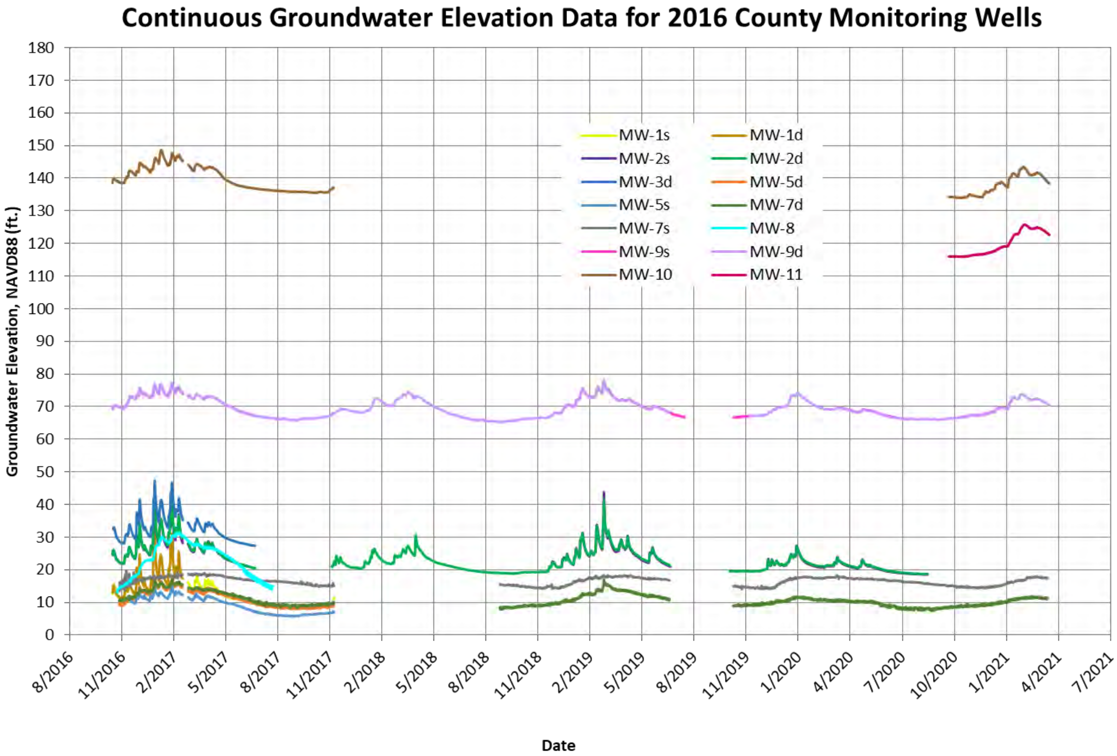

**Map of County monitoring wells installed in Fall 2016**

Table F-1
Eel River Valley Monitoring Well Details
Eel River Valley Groundwater Basin, Groundwater Sustainability Plan Alternative

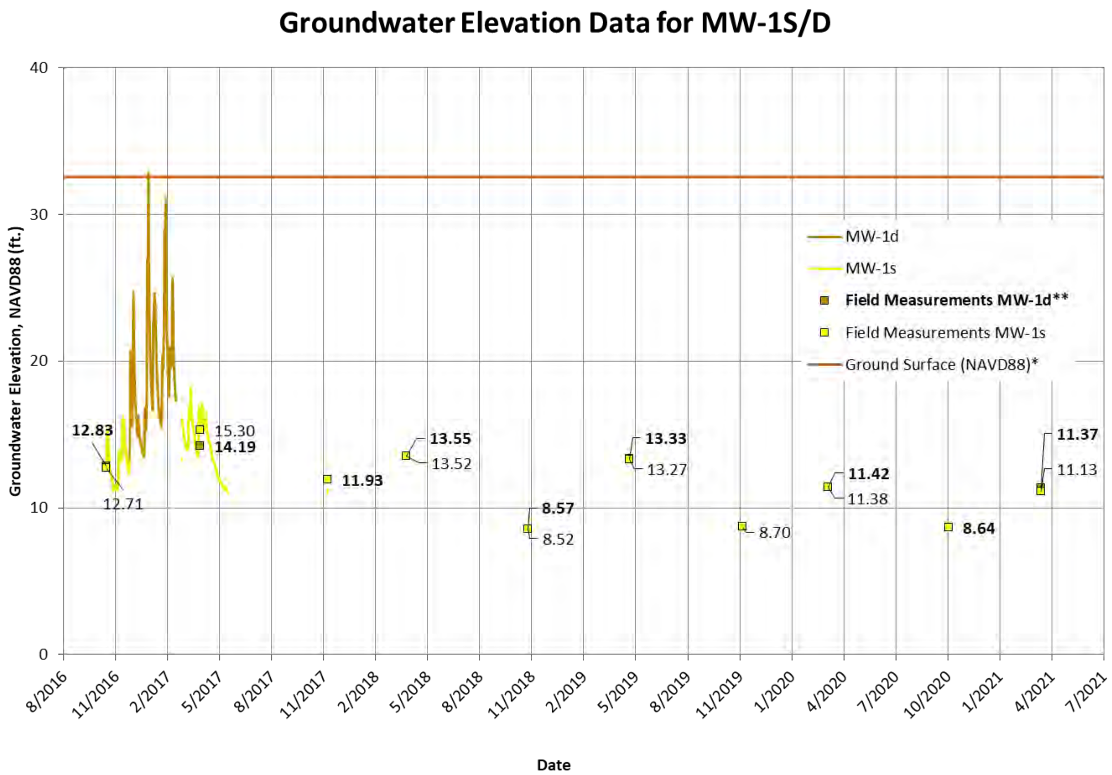
| Monitoring Well ID | Installation Date | Primary Well Purpose | Borehole Depth (feet) | Well Diameter (inches) | Screened Interval (feet BGS[1]) | Ground Surface Elevation (feet NAVD88[2]) | Drilling Method |
|---|---|---|---|---|---|---|---|
| MW-1S | 10/26/16 | SW/GW[3] | 60 | 1 | 30-35 | 23.26 | DP[4]/HSRA[5] |
| MW-1D | | | | | 55-60 | | |
| MW-2S | 10/24/16 | SW/GW | 60 | 1 | 30-35 | 43.89 | DP/HSRA |
| MW-2D | | | | | 55-60 | | |
| MW-3S | 10/26/16 | SW/GW | 56 | 1 | 30-35 | 58.00 | DP/HSRA |
| MW-3D | | | | | 55-60 | | |
| MW-5S | 11/4/16 | chloride testing | 220 | 2 | 100-110 | 13.16 | MUD ROTARY |
| MW-5D | | | | | 200-210 | | |
| MW-7S | 11/2/16 | chloride testing | 300 | 2 | 30-40 | 18.92 | MUD ROTARY |
| MW-7D | | | | | 240-250 | | |
| MW-8 | 10/31/16 | Monitoring[6] | 160 | 2 | 120-130 | 44.16 | MUD ROTARY |
| MW-9S | 10/27/16 | SW/GW | 48 | 1 | 20-25 | 73.59 | DP/HSRA |
| MW-9D | | | | | 43-48 | | |
| MW-10 | 10/28/16 | monitoring | 29 | 1 | 24-29 | 145.96 | DP/SFA[7] |
| MW-11 | 10/28/16 | monitoring | 46 | 1 | 41-46 | 148.76 | DP/HSRA |

1. BGS: below ground surface
2. NAVD88: North American Vertical Datum of 1988
3. SW/GW: surface water-groundwater monitoring
4. DP: direct push continuous core
5. HSRA: hollow stem rotary auger
6. Monitoring: groundwater elevation monitoring
7. SFA: solid flight auger

**2016 County monitoring well network (from 2016 Groundwater Sustainability Plan Alternative)**

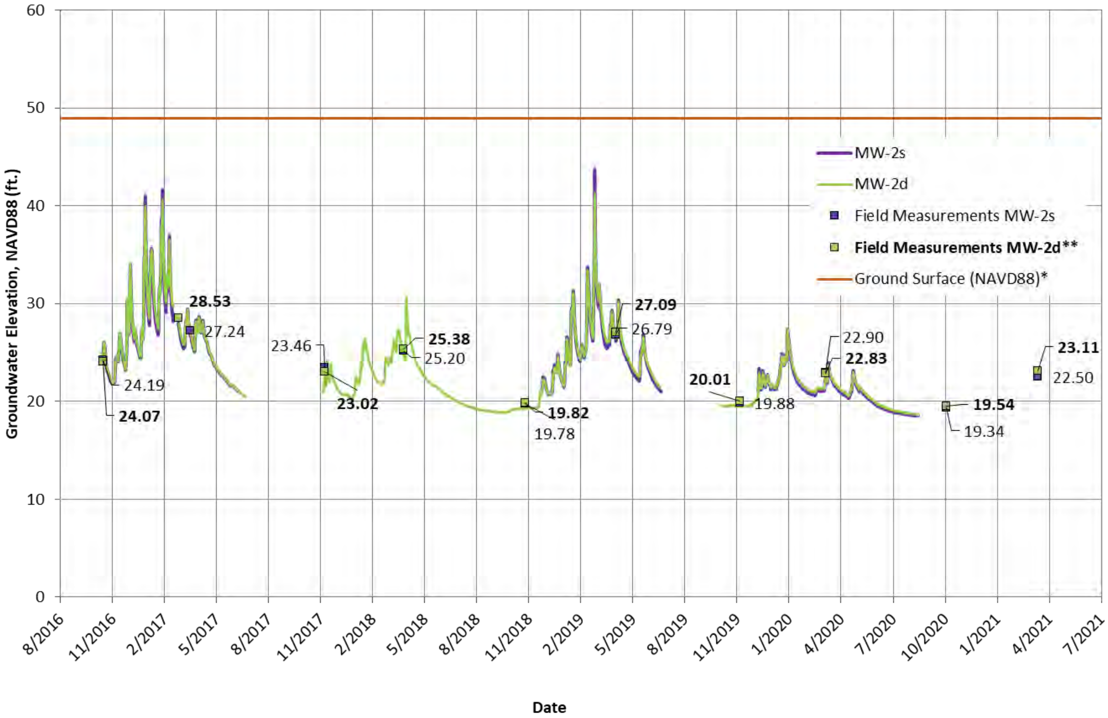



*Ground surface elevation based on project DEM (2018 USGS LiDAR)



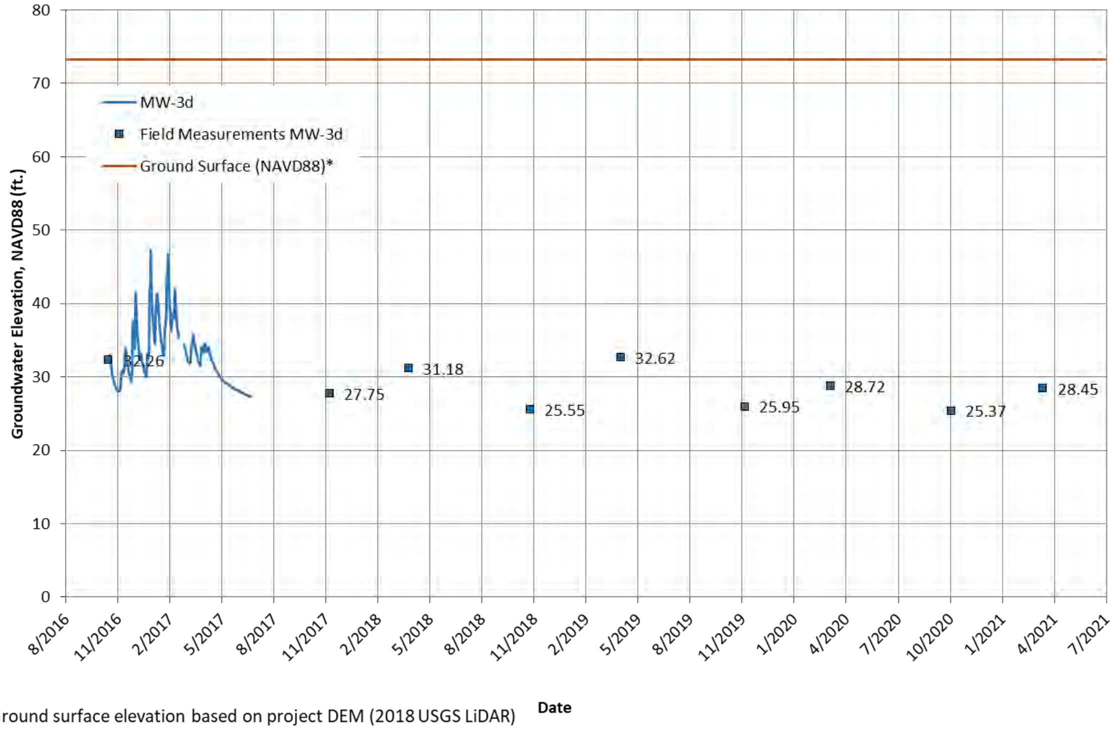

*Ground surface elevation based on project DEM (2018 USGS LiDAR)
**MW-1d field measurement data labels are bolded.

## Groundwater Elevation Data for MW-2S/D

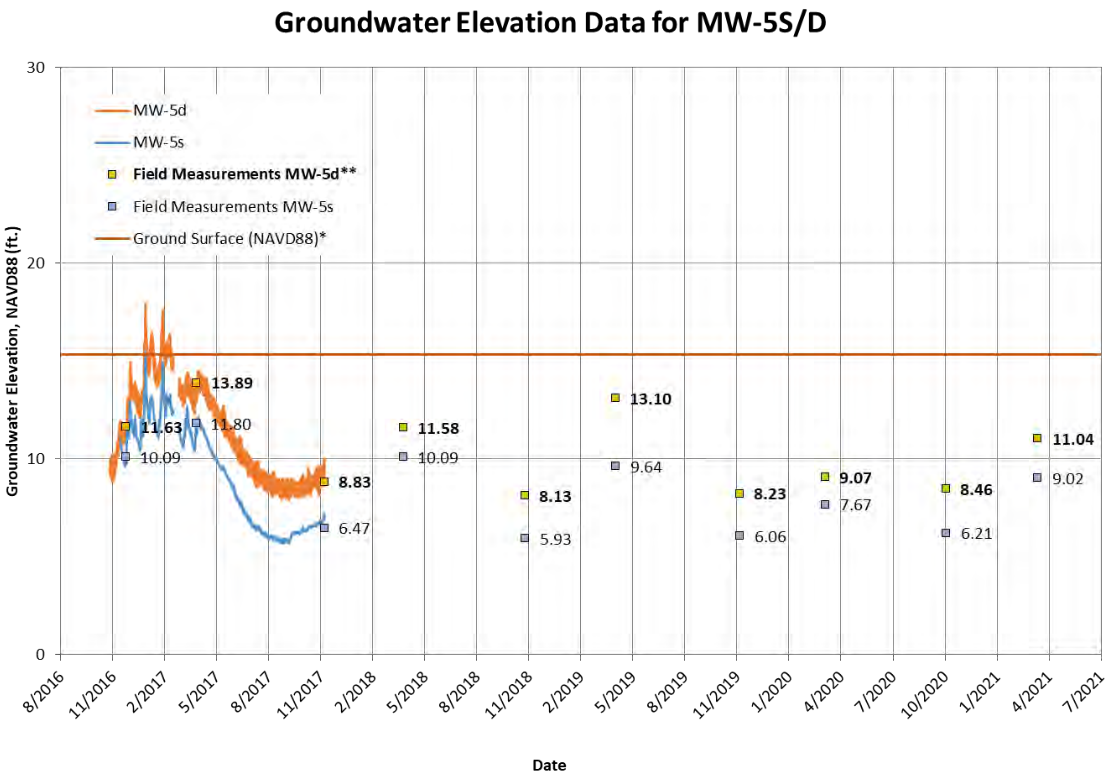



*Ground surface elevation based on project DEM (2018 USGS LiDAR)
**MW-2d field measurement data labels are bolded.

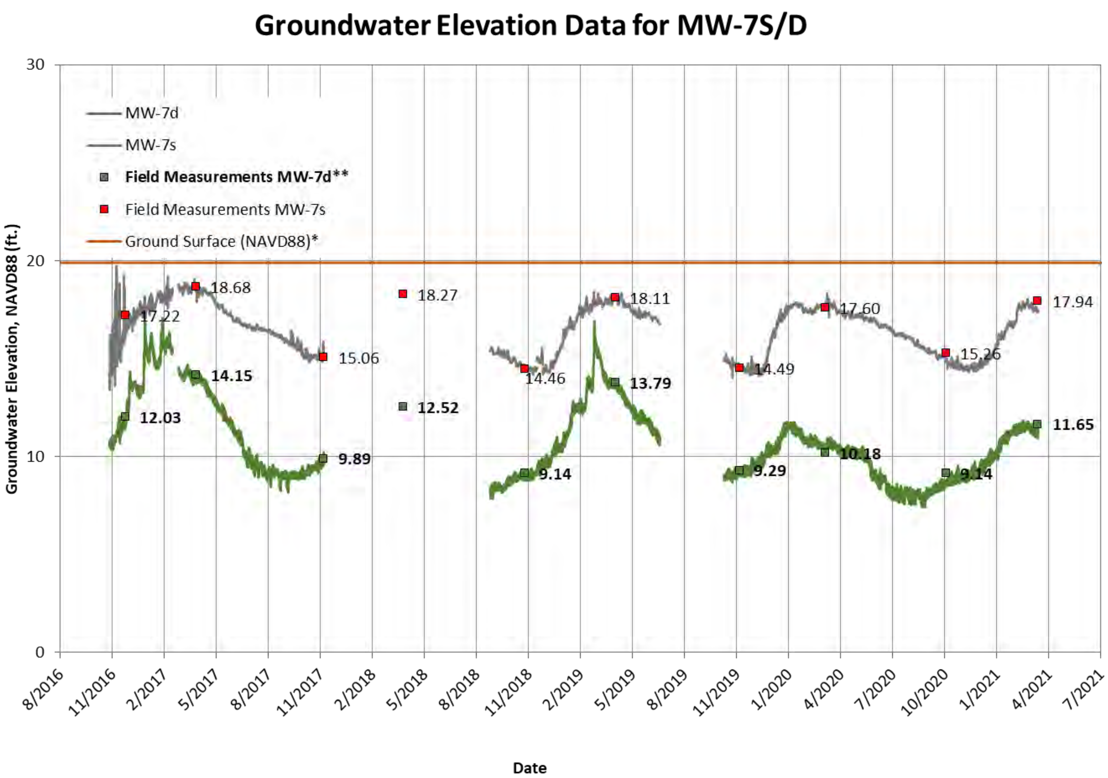
## Groundwater Elevation Data for MW-3D**



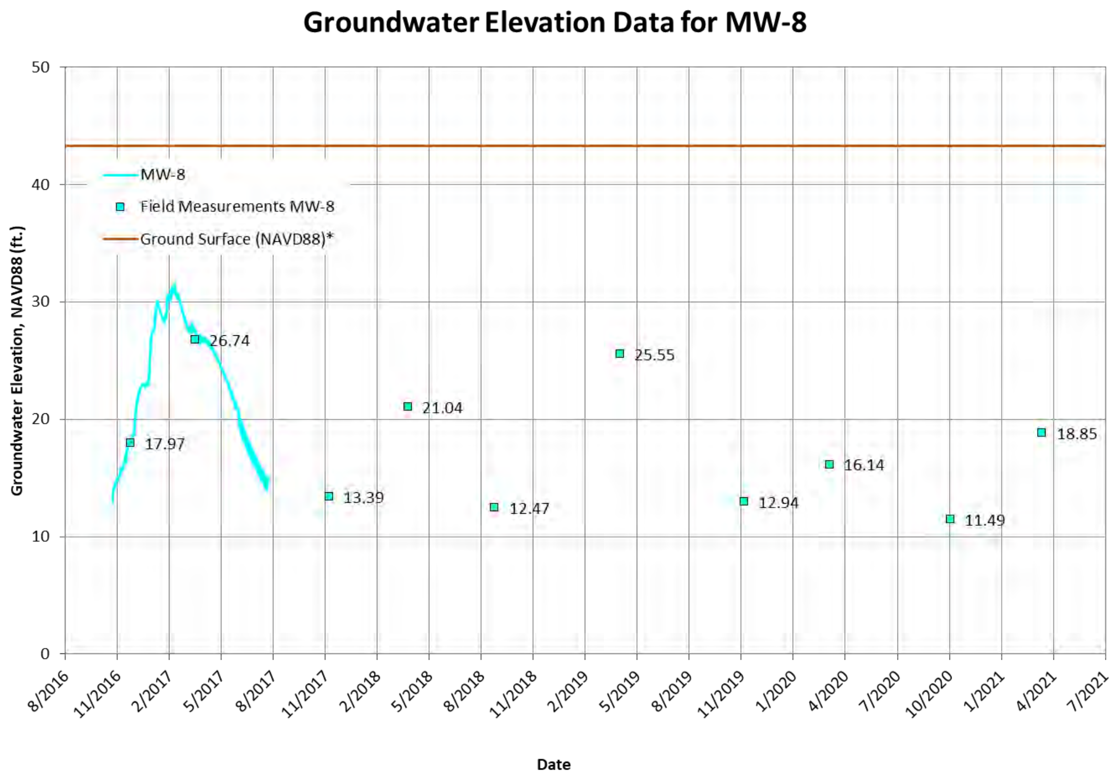

*Ground surface elevation based on project DEM (2018 USGS LiDAR)
**No data is reported for MW-3s because it is typically dry.



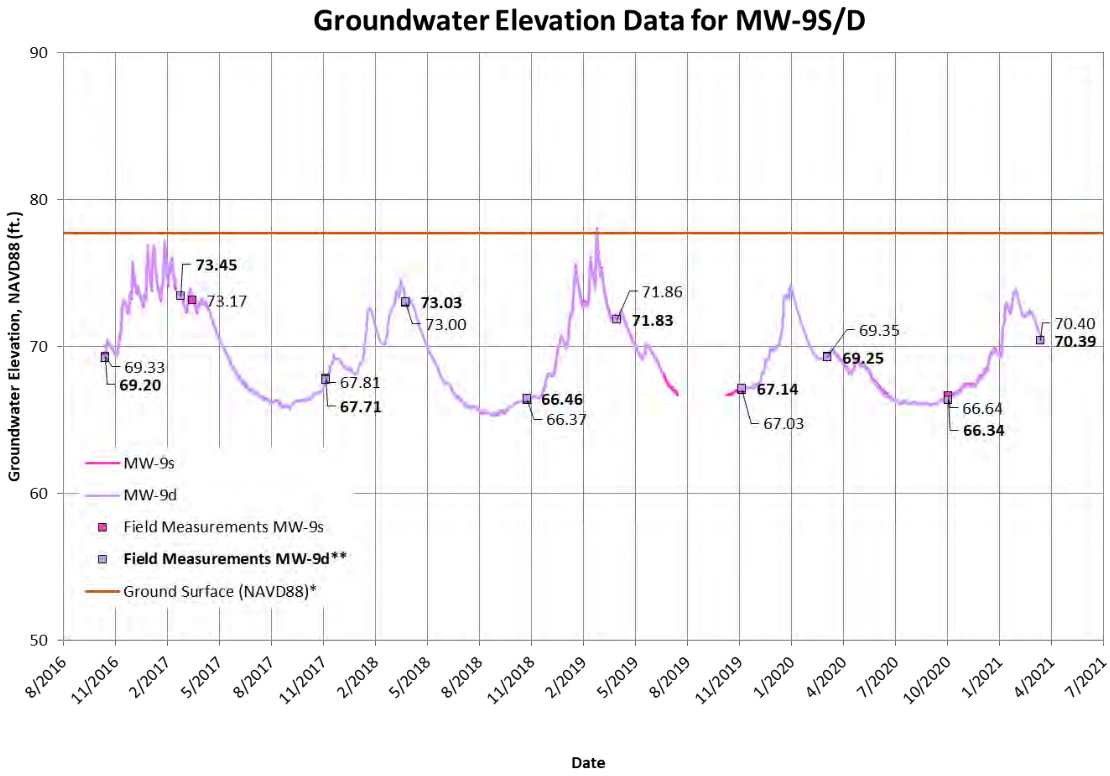

*Ground surface elevation based on project DEM (2018 USGS LiDAR)
**MW-5d field measurement data labels are bolded.



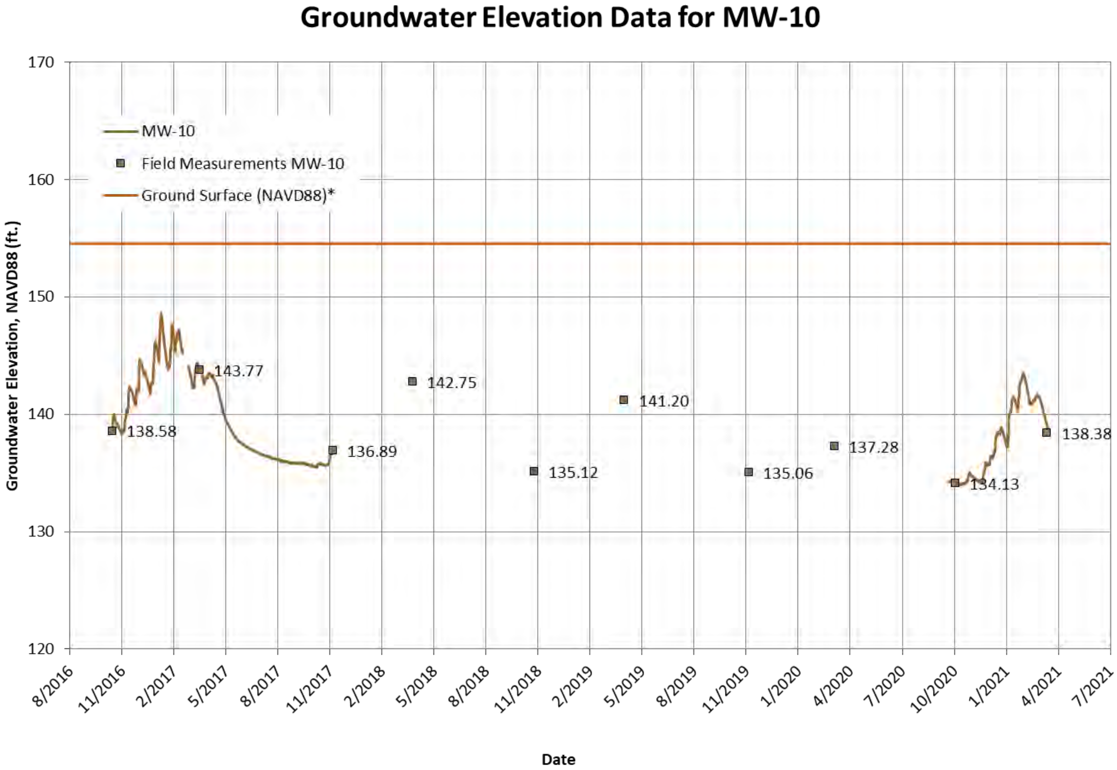

*Ground surface elevation based on project DEM (2018 USGS LiDAR)
**MW-7d field measurement data labels are bolded.



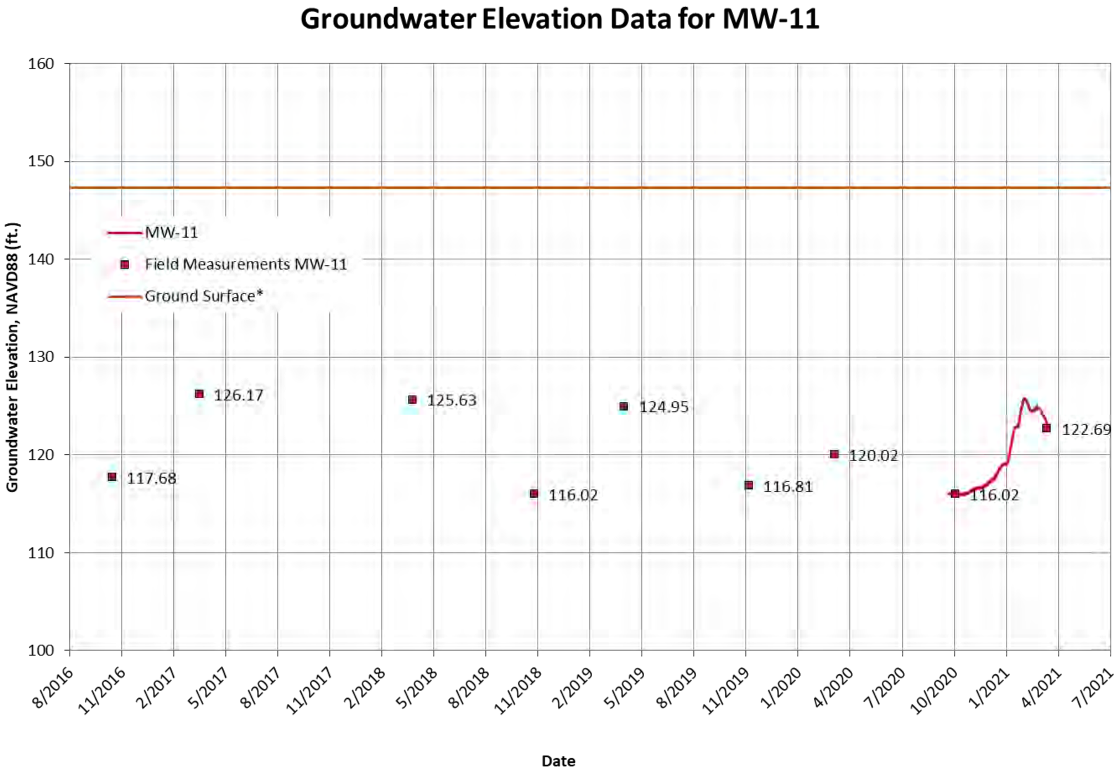

*Ground surface elevation based on project DEM (2018 USGS LiDAR)




*Ground surface elevation based on project DEM (2018 USGS LiDAR)
**MW-9d field measurement data labels are bolded.




*Ground surface elevation based on project DEM (2018 USGS LiDAR)




*Ground surface elevation based on project DEM (2018 USGS LiDAR)

# Water Quality Technical Memorandum (TM-14)

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# Technical Memorandum

| | |
|---|---|
| SHN Reference: | 020091.150 |
| GHD Reference: | 11217388. 2.3.1 |
| Date: | September 20, 2021 |
| To: | Summer Daugherty, Senior Environmental Analyst, Humboldt County Department of Public Works-Environmental Services |
| Copy To: | Hank Seemann, Deputy Director, Humboldt County Department of Public Works-Environmental Services |
| From: | SHN: Mindi Curran and Jason Buck<br>GHD: Patrick Sullivan |
| **Subject:** | **Water Quality Technical Memorandum** |

## 1.0 Introduction

### 1.1 Overview

For inclusion in the Humboldt County Department of Public Works' Eel River Valley Groundwater Sustainability Plan (GSP), this technical memorandum provides a summary of available water quality data for the Eel River Valley Basin (ERVB) (Appendix 1, Figure 1), the results and analysis of water quality sampling conducted in 2021, and an evaluation of groundwater quality areas of concern in the context of Sustainable Groundwater Management Act (SGMA) regulations.

Data collection efforts involved:

1. A comprehensive historical data review to identify areas and constituents of concern, a process which encompasses data collection from the Groundwater Ambient Monitoring and Assessment (GAMA) program database, the North Coast Regional Water Quality Control Board (RWQCB), the State of California's GeoTracker database, and data reported by municipal drinking water suppliers.
2. Coordination with the project team and County for identification of candidate wells for sampling, finalization of the relevant analyte list, and the preparation of a Water Quality Sampling and Analysis Plan.
3. Sample collection at 15 well locations and submittal to a laboratory for analysis.

The purpose of this work is to support the description of general water quality in the hydrogeologic conceptual model (HCM), the characterization of the water quality sustainability indicator, and the development of sustainable management criteria.

### 1.2 Previous Work Done by Others

The U.S. Geological Survey (USGS) and California Department of Water Resources (DWR) conducted reconnaissance investigations of groundwater within Humboldt County, concluding that the quality of water is generally good, with iron being a common constituent found in high concentrations (up to 28 parts per million [ppm]). Elevated chloride concentrations (500 to 1,000 ppm) within wells along the coast and near tidal reaches were noted (Evenson 1959). The water coming from the Carlotta and Wildcat sediments is sometimes unfit for use because of the high iron-oxide and manganese-oxide content (Ogle, 1953).

Groundwater quality in the Northern Coast Ranges (NOCO) study unit was investigated as part of the Priority Basin Project (PBP) of the Groundwater Ambient Monitoring and Assessment (GAMA) Program and the USGS National Water-Quality Assessment Program. The GAMA NOCO study was designed to provide an assessment of the quality of untreated (ambient) groundwater in the primary aquifer system within the study unit. The assessment is based on water quality and ancillary data collected in 2009 by the USGS from 58 sites, as well as on water quality data from the California Department of Public Health (CDPH) database (Mathany and Belitz 2015).

## 1.3 Summary of Work Completed in the Alternative Plan

Water quality data made available online as part of the California State Water Resources Control Board's (SWRCB) GAMA program was compiled and presented in the 2016 Groundwater Sustainability Plan Alternative (SHN 2016). Fifteen (15) constituents were queried and analyzed in the GAMA database to evaluate water quality, including aluminum, arsenic, barium, boron, cadmium, chloride, chromium, lead, mercury, nitrate, selenium, silver, sodium, specific conductance, and total dissolved solids (TDS). Six (6) of the 15 constituents had concentration levels that were detected above method detection limits, including arsenic, chloride, nitrate-N, sodium, specific conductance, and TDS. For the six (6) constituents that were selected for further analysis, all datasets in the database were used to provide an assessment of the average concentration for each constituent for each 10-year period of record (decadal averages). None of the detected constituents were found to be above their respective water quality objectives. Analysis of the data trend for each constituent indicated that there was little to no increase in concentrations in the last 10-year period of record as compared to the entire dataset.

A summary of the decadal averages and findings were included in the groundwater sustainability plan alternative (SHN 2016). In DWR's alternative assessment staff report (DWR 2019), DWR staff expressed concern that decadal averages can make it difficult to identify specific areas or wells that have reoccurring state maximum contaminant levels (MCLs) exceedances. To address this concern, data for the 15 constituents evaluated in the 2016 alternative plan were downloaded again in April 2021 to assess specific exceedances for each constituent. The 2021 GAMA analysis is discussed below in Section 1.4.3.

## 1.4 State Water Board Resources Review

Historical water quality data was reviewed to screen for ERVB-wide groundwater quality concerns that would inform the selection of water quality sample locations and form an understanding of background conditions. Each of the SWRCB resources reviewed are listed below; data reviewed from each source are detailed in subsections below.

SWRCB's online data sources:

- GeoTracker
- Municipal raw water quality through the Safe Drinking Water Information System (SDWIS)
- GAMA program
- Dairy General Order
- Surface Water Ambient Monitoring Program (SWAMP)

- California Environmental Data Exchange Network (CEDEN)
- Dairy Representative Monitoring Program
- the Irrigated Lands Regulatory Program

In addition to online resources, the RWQCB recently released Staff Report for North Coast Hydrologic Region Salt and Nutrient Management Planning Groundwater Basin Evaluation and Prioritization (RWQCB 2020) was reviewed. It should be noted that the staff report includes data reported as part of the Dairy General Order and the GAMA database.

### 1.4.1 GeoTracker

The SWRCB's online reporting resource, GeoTracker, was used to assess the distribution of contaminated or potentially contaminated sites across the ERVB and to identify the constituents of concern that may be present (GeoTracker July 2021). GeoTracker was used to map the locations of underground storage tank (UST) sites and cleanup sites (Appendix 1, Figure 2), as well as permitted facilities comprising land disposal sites, wastewater treatment facilities, and hazardous waste sites that are regulated by the Department of Toxic Substances Control (DTSC) (Appendix 1, Figure 3).

It was found that the highest densities of regulated sites are located in the most populated areas of the ERVB, including in or near the cities of Fortuna, Ferndale, and Rio Dell. The most common type of regulated site was found to be leaking UST (LUST) sites, which could be contributors of petroleum hydrocarbons and volatile organic compounds (VOCs) to groundwater and soil. Most of the GeoTracker sites explored consist of a single property, and contamination is thought to be contained within those properties or limited to surrounding properties.

### 1.4.2 Municipal Raw Water Quality Data

Municipal raw water quality data was reviewed online through the SDWIS website (SDWIS July 2021). The SDWIS is a federal reporting service used by to states supervise the public water systems within their jurisdictions to ensure that each system meets state and Environmental Protection Agency (EPA) standards for safe drinking water. Through the SDWIS website, municipal drinking water systems can be searched by county and water quality data can be queried for individual water wells supplying water to each municipal system. Data available includes tabular data that can be downloaded by well or by constituent, as well as consumer confidence reports.

Municipal water suppliers in the ERVB whose data were evaluated include the City of Fortuna, City of Rio Dell, Palmer Creek Community Services District (CSD), Riverside CSD, Loleta CSD, Hydesville CSD, and Del Oro Water Company (Appendix 1, Figure 4). Water quality data available for raw water supplies were evaluated for each of the municipal water suppliers; treated water data were not evaluated. Consumer confidence reports were not reviewed in detail because they present data for treated drinking water, which are not indicative of raw water quality through the ERVB.

Each municipal water supplier reports water quality data for each of their water sources (primarily wells or springs). The water quality data reported varies between municipality and year, but generally includes data for metals, nutrients, salts, VOCs, semi-volatile organic compounds (SVOCs), and alkalinity, among others. It was found that metals (nickel, silver, aluminum, and zinc) and anions (sulfate, chloride, calcium, and magnesium) are commonly detected but do not appear to have increasing trends through time. VOC and SVOC detections appear rare. Based on discussions with RWQCB staff and the release of the RWQCB staff report on salts and nutrients, it is known that TDS and nitrate are constituents of concern in the ERVB. The previous studies discussed in "Section 1.2: Previous Work Done by Others" also indicate that iron and manganese can be found in high concentrations in the ERVB. This is further evidenced by Del Oro Water Company, which uses a filtration system specifically to remove these two constituents. Based on the online data review and for these reasons, TDS, nitrate, iron, and manganese were selected for further analysis. Data for these four constituents were downloaded for each municipal water supplier and evaluated in Excel.

For the municipal data presented in this report, it is important to note that the SWRCB and the SDWIS use secondary MCLs, if they are available, instead of primary MCLs, which address health concerns and are considered to be the upper threshold for acceptable limits. Secondary MCLs address aesthetics such as taste and odor and are often associated with water quality objectives outlined in basin plans. However, not all constituents have been assigned a secondary MCL value. For this report, the MCLs used on the graphs are the MCLs used by the data source from which the data were accessed.

The municipal raw water data do not show any TDS exceedances (500 milligrams per liter [mg/L]) or any nitrate exceedances (10 mg/L) for the period of record. Graphs showing TDS and nitrate concentrations are presented in Appendix 2. Iron and manganese have been reported by Palmer Creek CSD, Del Oro Water Company, and Loleta CSD at levels above secondary MCLs (300 micrograms per liter [ug/L] and 50 ug/L, respectively). Concentrations of iron and manganese have been above the secondary MCLs for the entire period of record, suggesting that the occurrence of these constituents is related to background concentrations from the geologic formations of which the aquifers are comprised, as opposed to being a result of water use. Graphs presenting data for iron and manganese concentrations are also presented in Appendix 2.

### 1.4.3 2021 GAMA Assessment

The Groundwater Ambient Monitoring and Assessment (GAMA) program is California's comprehensive groundwater quality monitoring program that was created by the SWRCB in 2000. The GAMA program is a database effort created from interagency collaboration between the State and Regional Water Boards, DWR, Department of Pesticide Regulations, USGS, and Lawrence Livermore National Laboratory, as well as cooperation with local water agencies and well owners. The SWRCB lists the two primary goals of GAMA as being to improve statewide comprehensive groundwater monitoring and to increase the availability of groundwater quality data to the general public. Data available through the GAMA database come from a variety of sources that are required to report data to the Water Board. Sources include municipalities and water suppliers, waste dischargers, as well as persons/entities required by the Water Board to conduct remediation groundwater monitoring. The data are collected by personnel associated with each source, and therefore are different for each source.

GAMA was used to identify areas within the ERVB that have potential groundwater quality concerns (GAMA April 2021). Three tasks were completed in GAMA to evaluate groundwater quality:

- Task one: The GAMA database was queried to identify exceedances for a chosen set of constituents that could be present in groundwater due to their use in the ERVB for industrial and commercial purposes. These queries helped to determine if there are any areas of the ERVB where industrial or commercial services may be impacting groundwater quality.

- Task two: Data were downloaded from GAMA for the same 15 constituents that were evaluated in the 2016 alternative plan but were used to identify specific exceedances for each constituent instead of using decadal averages. The purpose of this analysis was to evaluate trends through time for the 15 constituents.
- Task three: A comparison of the available dataset over the entire period of record compared to the last 10 years was made for iron, manganese, TDS, and nitrate. This comparison helped to visualize how monitoring for these constituents has changed in the ERVB over time and helped recognize data limitations within the GAMA database.

For task one, the program was queried for a specific set of constituents, for all well types, and for all years of available data. Constituents to be queried were chosen based on local industries and commercial services, as well as constituents of concern commonly associated with those types of services. Gasoline, methyl-tertiary-butyl-ether (MTBE), and naphthalene were chosen because the most common type of regulated facility in GeoTracker are USTs, which are associated with these constituents.

Tetrachloroethene (PCE) and trichloroethene (TCE) were chosen because they are commonly used solvents found at a variety of industrial and manufacturing sites. Arsenic was chosen because it is used as an additive to animal feed, wood preservatives, and pesticides, all of which could have been used in the ERVB. The GAMA evaluation showed that exceedances have occurred for all of these constituents, except for TCE. However, all of the exceedances for PCE, gasoline, MTBE, pentachlorophenol (PCP), and naphthalene have occurred in remediation monitoring wells at sites with known contamination issues. Arsenic was the only one of these constituents that had exceedances at a well that was not a remediation monitoring well. Arsenic exceedances have occurred frequently through time at the Van Ness raw water well, including one exceedance in 2020. The Van Ness raw water well also has relatively high concentrations of iron and manganese that are thought to be background concentrations.

According to the USGS, arsenic occurs naturally as a trace component in many rocks and sediment. It can also be a result of human activities such as mining and various uses in industry, including as an additive in animal feed, as a wood preservative, and as a pesticide (USGS 2021 Arsenic and Groundwater Website). Aside from gravel and aggregate recovery, mining has not been a prevalent industry in the ERVB and is not likely the source of arsenic. As shown in Appendix 3 and discussed below in Section 1.6.4, no pesticide was detected in any County groundwater monitoring well (analytical list 531.1) during the 2021 groundwater quality monitoring event. This suggests that pesticides are not likely a source of groundwater contamination. It is possible that arsenic has been used at local lumber mills as a wood preservative, but there are no lumber mills in the vicinity of Del Oro Water Company, which has the most frequent arsenic detections. For these reasons, it is possible that the arsenic concentrations may also represent background concentrations naturally occurring due to the lithology of the surrounding region.

Sediment sampling has been conducted through the Salt River corridor by the Humboldt County Resource Conservation District (HCRCD) during the Salt River Ecosystem Restoration Project (HCRCD, 2014). Soil sampling occurred in 2007 and 2008 in an effort to determine if excavated sediments were suitable for reuse on nearby agricultural lands. The results of this sampling indicate that levels for organic compounds, heavy metals, pesticides and herbicides, PCBs, and dioxin/furans are well below the human safety limits set by the EPA and the National Oceanic and Atmospheric

Administration (NOAA). The only metal that was found above the reference level was Arsenic. Results of this study support the conclusion that the concentrations of Arsenic in this area may be naturally occurring due to the lithology of the surrounding region.

Task two involved downloading tabular data for the 15 constituents that were evaluated in the 2016 alternative plan: aluminum, arsenic, barium, boron, cadmium, chloride, chromium, lead, mercury, nitrate, selenium, silver, sodium, specific conductance, and TDS. This was also described briefly in Section 1.3. All data available for each constituent for the last 10 years were downloaded and analyzed in Excel to evaluate specific exceedances during the last decade. All results fell below MCLs, except for one (1) TDS result in 2012 and an arsenic result in 2020. Graphs showing the individual detections for each of these constituents are found in Appendix 4. As mentioned above in Section 1.4.2, it is important to note that the SWRCB has not assigned secondary MCLs to all constituents, so there are both primary and secondary MCLs reported in GAMA and on the graphs in Appendix 4.

The third task completed in GAMA included comparing the available dataset over the entire period of record to the available dataset for only the last 10 years. The four primary constituents of concern known to be present across large areas of the ERVB are TDS, nitrate, iron, and manganese. These constituents of concern were queried in GAMA for all wells for the entire period of record and then again for only the last 10 years. There have been exceedances of the primary MCLs for TDS and nitrate at some points during the historical record, but not within the last 10 years. There continues to be exceedances of the secondary MCLs for iron and manganese, which is consistent with historical data from the entire period of record.

There have been fewer wells monitored for the four constituents over the last 10 years than there has been for the rest of the record. This is a notable limitation within the dataset because some of the wells that have exceedances at some point within the record have not had continued monitoring within the last decade. It is also notable that many of the wells monitored during the last 10 years are located along the margins of the ERVB, which limits the amount of available data for the central portion of the ERVB. Maps showing the wells that have available data for each of these constituents for the entire period of record, as well as for only the last 10 years, are also presented in Appendix 4.

### 1.4.4 Regional Salt and Nutrient Management Report

The Staff Report for North Coast Hydrologic Region Salt and Nutrient Management Planning Groundwater Basin Evaluation and Prioritization, 2020 public review draft provides ERVB-wide information on salt and nutrient concentrations (RWQCB 2020). The Eel River Valley has been identified as a high-priority basin for salts (defined as TDS in the report) and nutrients (defined as nitrate in the report).

Based on correspondence with RWQCB staff, the data sources for the staff report include GAMA, the Dairy General Order, and the California Integrated Water Quality System Project (CIWQS) (CIWQS August 2021). Data from the Dairy General Order that were included in the staff report are not available online but were given by the RWQCB upon request, including analytical results for nitrate collected in 2013 and 2014 at dairies across the ERVB. A combination of these results, data in GAMA, and locations of regulated facilities and facility types were the basis of the staff report.

In addition to the nitrate data, shapefiles of facilities regulated by the RWQCB—dairies and animal feeding facilities, cannabis sites, landfills, wastewater treatment facilities, timber harvest locations, etc.—were accessed through the SWRCB's online geographic information system (GIS) services platform and can be viewed in ArcGIS. The general location of these facilities and their distribution across the ERVB are presented in Appendix 1, Figure 5.

RWQCB staff developed priority levels for each basin based on a review and analysis of concentrations of TDS and nitrates, the density of onsite wastewater treatment systems, types of agricultural crops, and the dairy animal count and density. The sampling results presented for nitrates spanned from 2010 to 2020 and was associated with well locations and, therefore, provided an opportunity to evaluate the spatial distribution of exceedances, which primarily occurred within the central portion of the Lower Eel River Valley. The results for TDS, however, were not reported with any spatial reference and, therefore, were not useful for identifying any specific problem areas.

The central portion of the Lower Eel River Valley is presented in the staff report as the area of most concern for nitrate exceedances. The area identified is located near Del Oro Water Company, which historically has had iron, manganese, and arsenic exceedances. Based on these data this area of the ERVB was identified as an area of interest for groundwater quality monitoring and was the basis for water quality well selection, which is described below in Section 1.6.1.

### 1.4.5 Additional State Water Resource Control Board Recommended Online Resources

Additional SWRCB online resources reviewed included the SWAMP, the California Environmental Data Exchange Network (CEDEN), and the Irrigated Lands Regulatory Program.

SWAMP is an online database with water quality information about water resources throughout California, comprising data on drinking water quality, watersheds, wetlands, estuaries, harmful algae blooms, and safe places to recreate (SWAMP 2021). It also includes links to other data portals, such as CEDEN, the Water Quality Goals Database, and other SWRCB databases. The information provided by SWAMP was used to gain a general understanding of water quality, but did not provide additional specific information on water quality in the ERVB that other SWRCB resources had not already provided.

CEDEN is an online database that provides information about California's surface waters, such as streams, lakes, rivers, and coastal areas (CEDEN 2021). The database can be queried by applying several layers of data filters, such as county, program, project, and location station. The database was queried by county and then through the EPA Environmental Monitoring and Assessment Program filter. Several location stations with data exist in tributaries to the Eel River, such as Allen Creek (tributary to Yager Creek), Yager Creek, Brock Creek, the Van Duzen River at Dinsmore, and Price Creek. Although many of these stations are not directly located within the ERVB, the existing data were still explored. It was found that each monitoring station has its own period of record and that the constituents and parameters reported also vary by station. Overall, the CEDEN database did not contribute additional specific information on water quality in the ERVB that other SWRCB resources had not already provided.

The Irrigated Lands Regulatory Program was not used in the water quality evaluation because it is not applicable to the North Coast region.

### 1.4.6 Historical Data Review Conclusions

GAMA and SDWIS databases provide the most comprehensive water quality data for the ERVB, which indicate that the groundwater in the Eel River Valley appears to be of high quality and suitable for the intended municipal and agricultural uses. Furthermore, the water quality trends in the datasets have not shown any significant increase in measured concentrations. The municipal raw water data retrieved from the SDWIS database suggest that concentrations of TDS, iron, and manganese have been reported within the same ranges since the late 1980s. The municipal data and the data retrieved through GAMA do not show increasing trends of these constituents through time, including within the last decade. The findings presented in the RWQCB's staff report on salt and nutrients indicate that elevated levels of nitrate and TDS is an existing condition within portions of the ERVB, which was an important consideration in the development of the selection of wells for the 2021 water quality sampling campaign.

## 1.5 2021 Water Quality Sampling

### 1.5.1 Well Selection

The County has 15 monitoring wells installed in Fall 2016 through DWR Proposition 1 grant funding supporting the development of the alternative plan (SHN 2016). An additional 23 wells were installed in 2021 as part of the project that is funded through a DWR Proposition 68 grant. These 38 wells form the primary network of dedicated monitoring wells for the GSP monitoring program. Unlike many other wells within the ERVB, the construction details and stratigraphy within which the County wells were constructed is known. In addition, all wells are located within the County's right-of-way, providing ease of access for sampling in the future.

As outlined in the grant scope of work, 15 wells were chosen for water quality sampling in 2021 (Appendix 1, Figure 6). The specific justification for choosing each well is outlined in the water quality sampling and analysis plan (SHN 2021). In summary, the locations were chosen to optimize spatial coverage throughout the ERVB and to represent portions of the underlying aquifers (wells screened in shallow and deep sections). Special consideration was given to areas where groundwater use is concentrated and/or has the potential to impact water quality. A substantial distribution (both horizontally and vertically) is necessary to develop a good baseline of water quality conditions for use in the HCM and groundwater conditions section of the GSP.

Eleven (11) of the 15 sample locations are within the lower Eel River Valley to help further characterize the water quality throughout this region of the ERVB, which was identified as an area of concern in the RWQCB staff report on salts and nutrients (RWQCB, 2020). The selected well locations are positioned to characterize water quality upgradient from the area of concern, within the area, and downgradient of the area of concern.

### 1.5.2 Fieldwork

Groundwater quality samples were collected July 7 through 13, 2021. Groundwater samples were collected in accordance with the EPA Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells guidelines (EPA 2017). Following this standard operating procedure ensures that data quality objectives are reached and that each sample is collected in the same manner, allowing for direct comparisons of repeat measurements.

Low flow sampling was completed using either a peristaltic pump or downhole bladder pump and clean tubing. Following low flow sampling procedures, water was pulled directly from the screened interval to ensure that the groundwater collected is fresh from the aquifer formation. Field measurements of temperature, pH, electrical conductance, and turbidity were collected every five (5) minutes until stabilization was achieved (a minimum of three [3] stabilized sets of parameters). Samples were then collected by decanting water directly into laboratory-supplied bottles.

Each day, prior to field sampling, all equipment was calibrated, including the pH, electrical conductance, temperature, and turbidity meters used to perform low flow monitoring for stabilization. Calibration procedures were completed according to manufacturer recommendations. All monitoring and non-dedicated sampling equipment was cleaned using a Liquinox® cleaner wash followed by a distilled water rinse. Cleaning of equipment occurred prior to being transported to the site and between sample collection at consecutive locations.

### 1.5.3 Laboratory Analysis

The scope of work for the grant outlines the specific constituent groups to be analyzed. The broad category analyte groups include metals, nutrients (nitrate), salts (TDS), organochlorine and organophosphorus pesticides, chlorinated herbicides, VOCs, SVOCs, polychlorinated biphenyls (PCBs), microbial contaminants, radioactive constituents, and physical parameters (pH, dissolved oxygen, redox potential, specific conductance, and temperature). Each broad category group contains many individual analytes. The broad category groups, individual analytes, and the analytical testing methods are presented on Table 1 in Appendix 3.

All groundwater quality samples were handled according to proper procedures and sent under chain-of-custody documentation to North Coast Laboratories, a California State-certified analytical laboratory located in Arcata. North Coast Laboratories subcontracted the EPA Method 8270 (SVOCs) analyses and the Gross Alpha analysis, as they do not perform those testing methods.

### 1.5.4 2021 Groundwater Quality Analytical Results

The groundwater quality analytical results for the July 2021 sampling event are presented in Table 2 in Appendix 3. A summary of the July 2021 sampling events is discussed below.

During the July 2021 monitoring event there were no detections for pesticides (method 531.1), chlorinated herbicides (method 615), or for glyphosate herbicide (method 547) at any wells. Endothall herbicide was detected at MW-27 and MW-28, but were below the MCL.

There was no detection of PCB (method 505) or nitrite at any wells. There were no detections of VOCs or SVOCs, except for one VOC detection at MW-15d and one SVOC detection at MW-12d. There was no detection of gasoline at any well, except for MW-28. There was one detection of E. Coli bacteria at MW-27 and there were detections of total coliform bacteria at nine (9) of the monitoring wells. Nitrate was detected in five (5) of the monitoring wells, but all detections were below the MCL. There was no detection that exceeded MCLs for fluoride, sulfate, or chloride, except for the chloride detection of 9,300 mg/L in MW-27 and 860 in MW-18. TDS was detected at every well below the Secondary MCL, except for MW-12d, MW-18, and MW-27. Every well had a detection that exceeded the MCL for alkalinity.

Metals that were not detected in any well include silver, antimony, beryllium, cadmium, thallium, mercury, and hexavalent chromium. Metals that were detected, but only at concentrations below the respective MCLs, include chromium, copper, nickel, selenium, and zinc. Metals that were detected at some wells above the respective MCLs include aluminum, iron, manganese, sodium, and arsenic. There were detections of calcium and magnesium, but there are no MCLs for these metals.

# 2.0 Water Quality SGMA Discussion

The evaluation of water quality in the ERVB supports the description of general water quality in the HCM, the characterization of the water quality sustainability indicators, and the development of sustainable management criteria. Specifically, it is important to identify any water quality degradation that has developed or worsened since January 1, 2015, which is required to be addressed by the GSP. The focus of this is to assess if/where significant and unreasonable impacts to groundwater quality may have been caused or exacerbated by groundwater use or groundwater management projects.

The historical data review outlined above in sections 1.2 through 1.5 used published studies, work completed in 2016 as part of the alternative plan, SWRCB and RWQCB data and online resources, data reported by municipal water suppliers, and data collected from County groundwater monitoring wells. Reviews of these resources indicate that water quality through the ERVB is generally of good quality for its intended uses.

The historical data review provides context for the condition of groundwater quality in the ERVB through time, which provides information on the background water quality, thought to have naturally moderate to high occurrences of TDS, iron, and manganese in specific areas of the ERVB. This is evidenced by the long record of municipal data, which indicate that TDS values have been below the secondary MCL of 500 mg/L, but generally above 100 mg/L at all municipal well locations since at least the mid-1980s. Iron concentrations have been an order of magnitude above the primary MCL of 300 ug/L at Palmer Creek CSD and Del Oro since at least the early 1990s. Manganese concentrations have been above the primary MCL of 50 ug/L at Palmer Creek CSD, Del Oro, and Loleta CSD since at least the late 1980s. The municipal data and the data retrieved from the online GAMA database do not suggest that trends for any of these constituents have been increasing over the last decade, which support the conclusion that these are background concentrations in the ERVB.

The results of the 2021 water quality monitoring support the conclusions of the historical data review. The 2021 monitoring results showed no detections or minor detections for many of the constituent groups, including pesticides, herbicides, PCBs, VOCs, SVOCs, gross alpha (results pending), and hydrocarbons (gasoline). Detections for nitrate were below the MCL for all wells; detections of TDS were all within expected values, except for at MW-27, which had the highest detections of all wells for endothall herbicide, alkalinity, chloride, TDS, total coliform bacteria, calcium, iron, magnesium, manganese, sodium, arsenic, barium, and nickel, and was the only well with a detection of selenium. Overall, the analyte group with the highest detections across wells is metals, and the metals detected with the highest concentrations across wells are calcium, iron, magnesium, manganese, sodium, and barium.

# 3.0 References

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Appendices:
1. Figures
2. Municipal Raw Water Graphs
3. 2021 Groundwater Monitoring Results
4. GAMA Graphs and Images

# Figures 1

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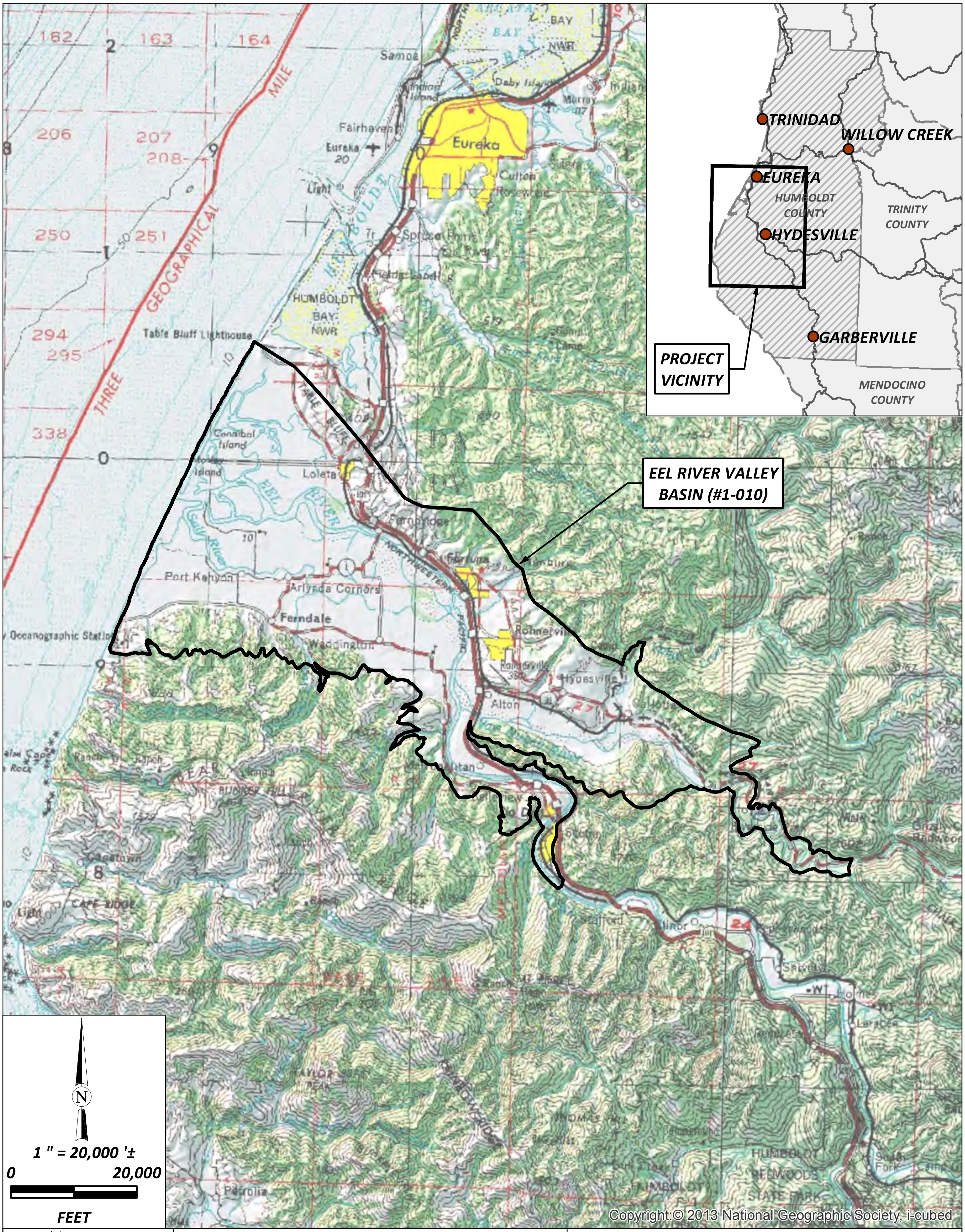
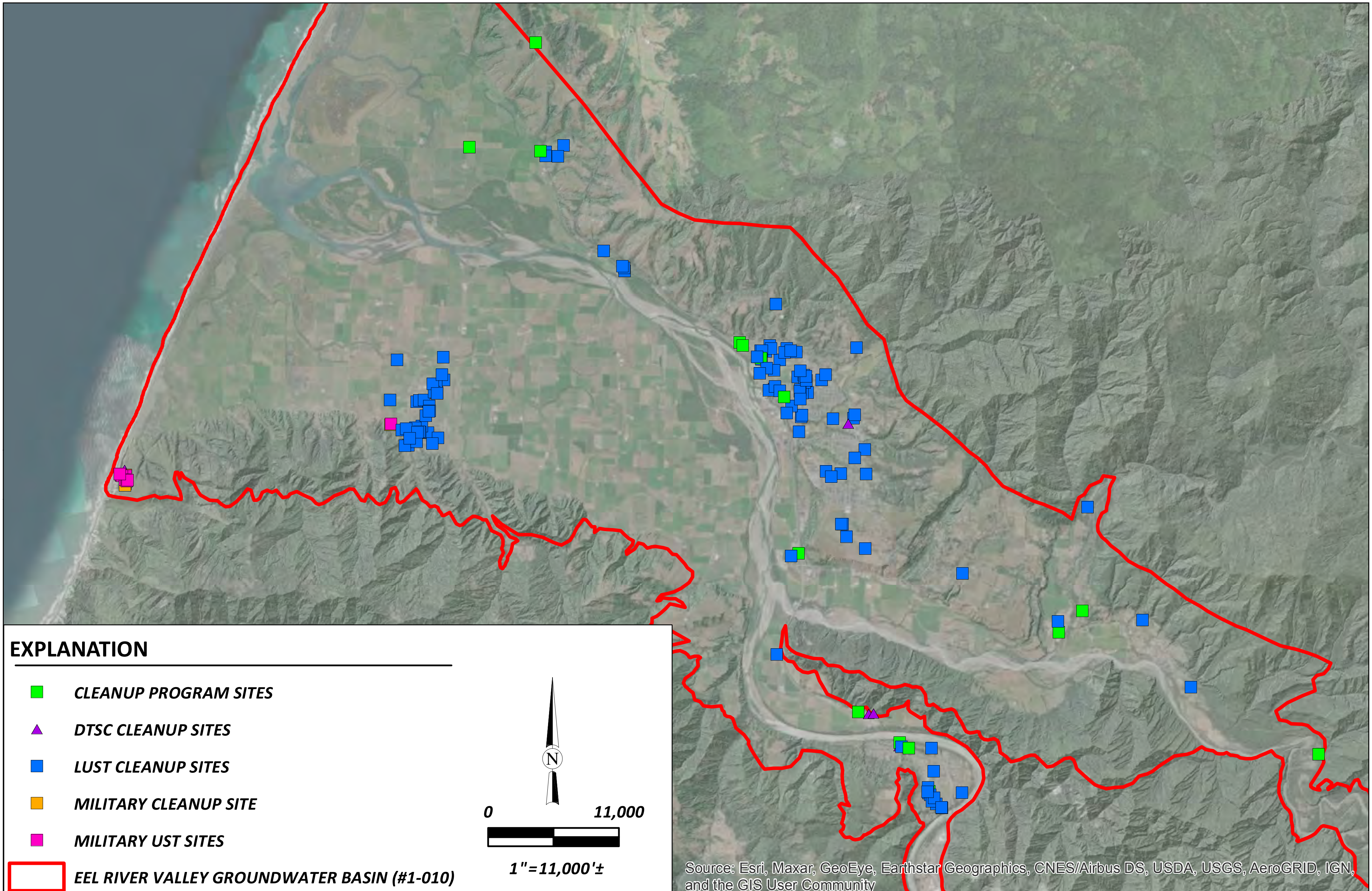


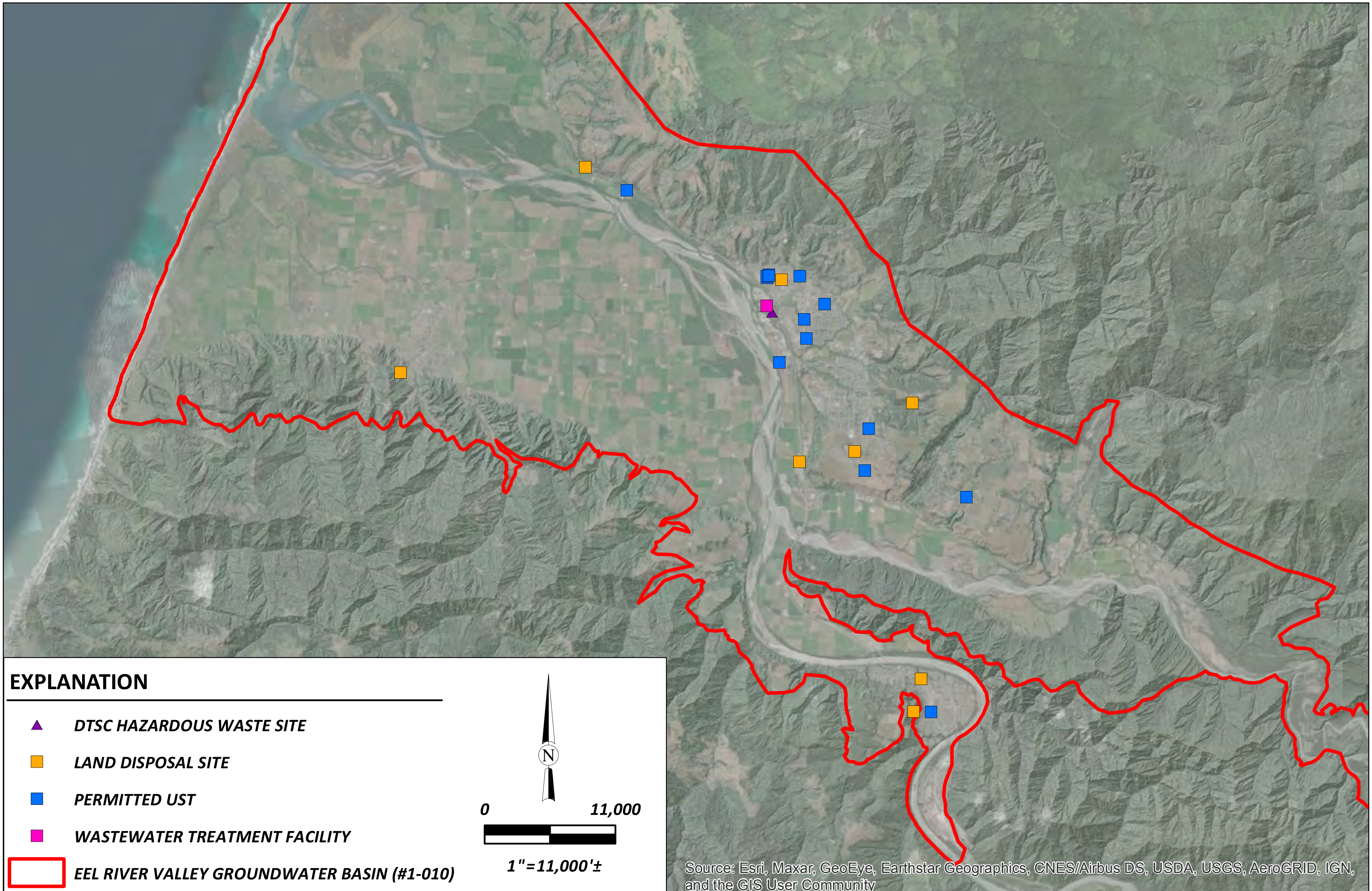

| Humboldt County Public Works<br>Eel River Groundwater Basin<br>Humboldt County, California | | Project Location<br>SHN 020091.150 |
|---|---|---|
| August 2021 | Figure1_ProjectLocationMap | Figure 1 |

Path: \\eureka\projects\2020\020091-Eel-River-GSP\GIS\PROJ_MXD\150-Water-Quality\Figure2_GeotrackerUSTandCleanUpSites.mxd User Name: pix4d DATE: 8/11/21, 3:05PM




| | | | |
|---|---|---|---|
| NOTES: LOCATIONS DOWNLOADED FROM GEOTRACKER WEBSITE | SHN | Humboldt County Public Works<br>Eel River Valley Groundwater Basin<br>Humboldt County, California | GeoTracker UST and Cleanup Sites<br>SHN 020091.150 |
| | | August 2021 / Figure2_GeotrackerUSTandCleanUpSites | Figure 2 |

Path: \\eureka\projects\2020\020091-Eel-River-GSP\GIS\PROJ_MXD\150-Water-Quality\Figure3_GeotrackerPermittedFacilities.mxd User Name: pix4d DATE: 8/11/21, 4:58PM



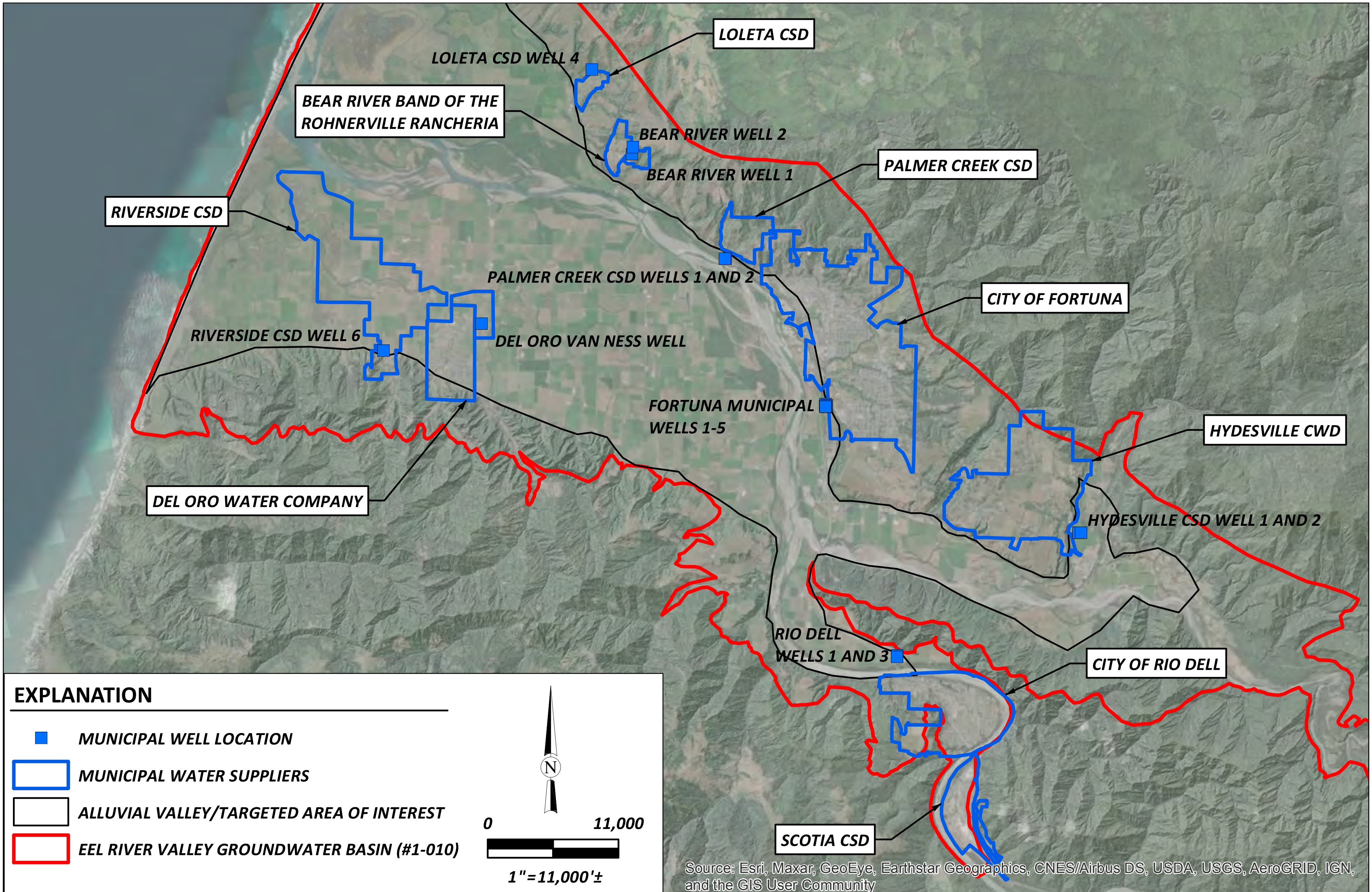

*NOTES: LOCATIONS WERE DOWNLOADED FROM THE GEOTRACKER WEBSITE; IF A LOCATION IS MISSING IT WAS NOT AVAILABLE FOR DOWNLOAD FROM THE GEOTRACKER ONLINE MAP*

Humboldt County Public Works
Eel River Valley Groundwater Basin
Humboldt County, California

GeoTracker Permitted Facilities

SHN 020019.150

August 2021 | Figure3_GeotrackerPermittedFacilities | Figure 3




Humboldt County Public Works
Eel River Valley Groundwater Basin
Humboldt County, California

Eel River Valley Municipal
Water Suppliers and Well Locations
SHN 020091.150

August 2021 | Figure4_MunicipalWellLocations | Figure 4

Path: \\eureka\projects\2020\020091-Eel-River-GSP\GIS\PROJ_MXD\150-Water-Quality\Figure5_RegulatedFacilities.mxd User Name: pix4d DATE: 8/11/21, 3:03PM

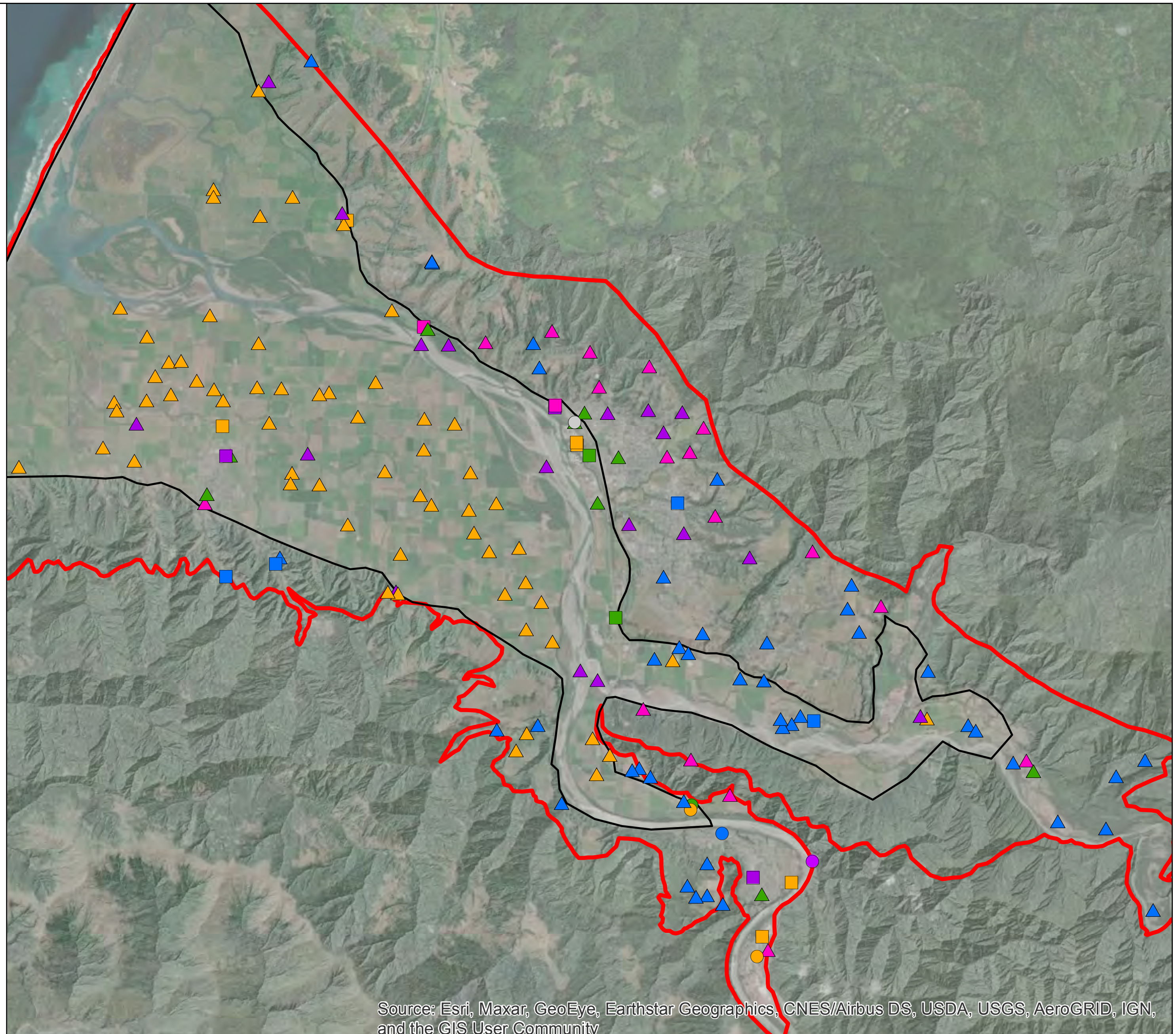
## EXPLANATION

- *ANIMAL FEEDING/DAIRY*
- *CANNABIS SITE*
- *DREDGE/FILL SITE*
- *TIMBER HARVESTING*
- *SERVICE/COMMERCIAL SITE, NEC*
- *WASTEWATER TREATMENT FACILITY*
- *HABITAT RESTORATION AREA*
- *GASOLINE SERVICE STATION*
- *FOOD PROCESSING NEC*
- *SAND AND GRAVEL MINING*
- *SAW MILL*
- *GROUNDWATER CLEANUP SITE*
- *LANDFILL*
- *POWER PLANT*
- *DOMESTIC SITE NEC*
- *TANK FARM*
- *ALLUVIAL VALLEY/ TARGETED AREA OF INTEREST*
- *EEL RIVER GROUNDWATER BASIN (#1-010)*

N

0 12,000

*1"=12,000'±*




*NOTES: LOCATIONS DOWNLOADED FROM CALIFORNIA STATE WATER RESOURCES CONTROL BOARD CIWQS DATABASE*

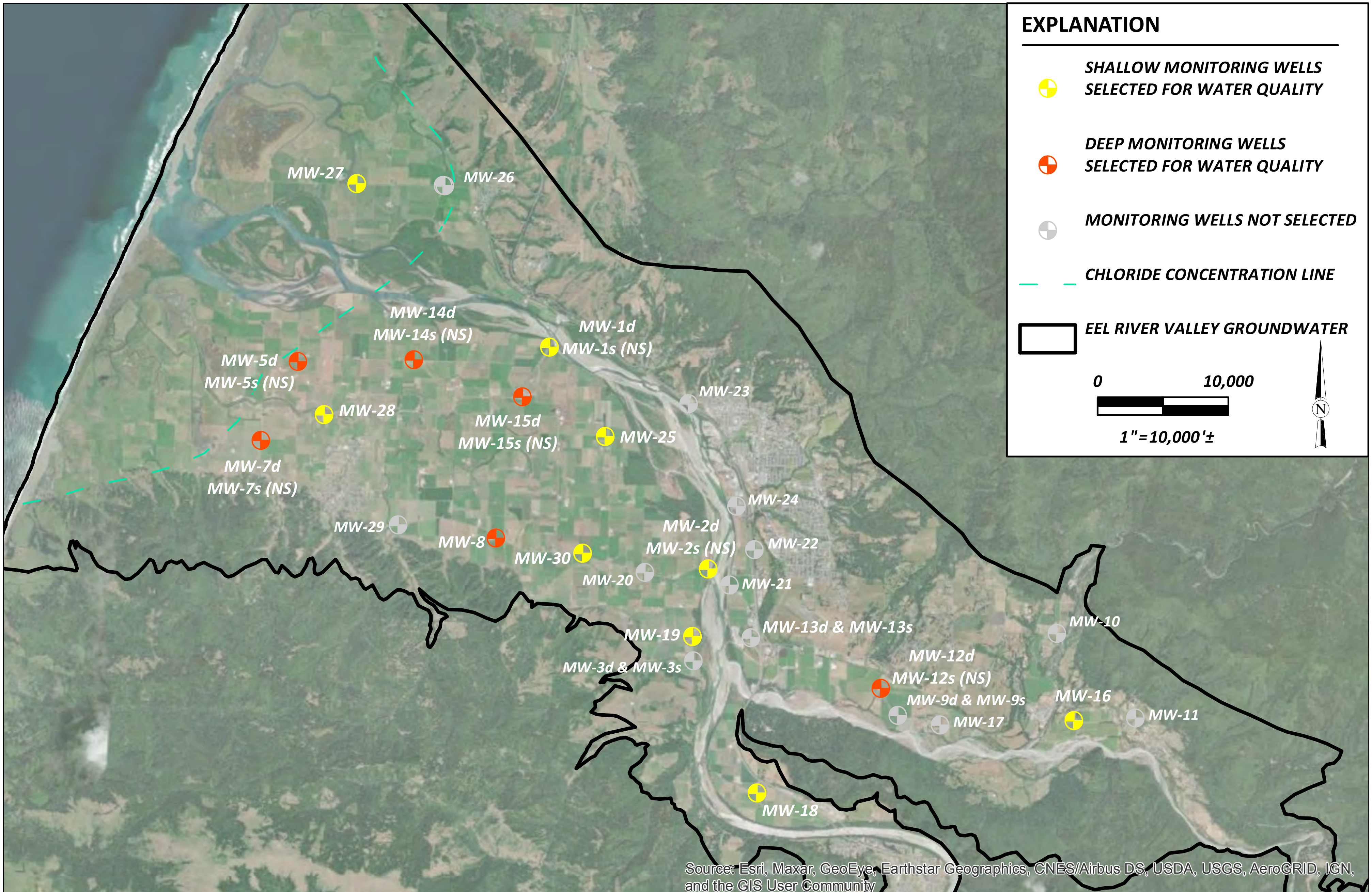
SHN

Humboldt County Public Works
Eel River Valley Groundwater Basin
Humboldt County, California

Regulated Facilities with Active Permits Listed in CIWQS

SHN 020019.150

August 2021 | Figure5_RegulatedFacilities | Figure 5

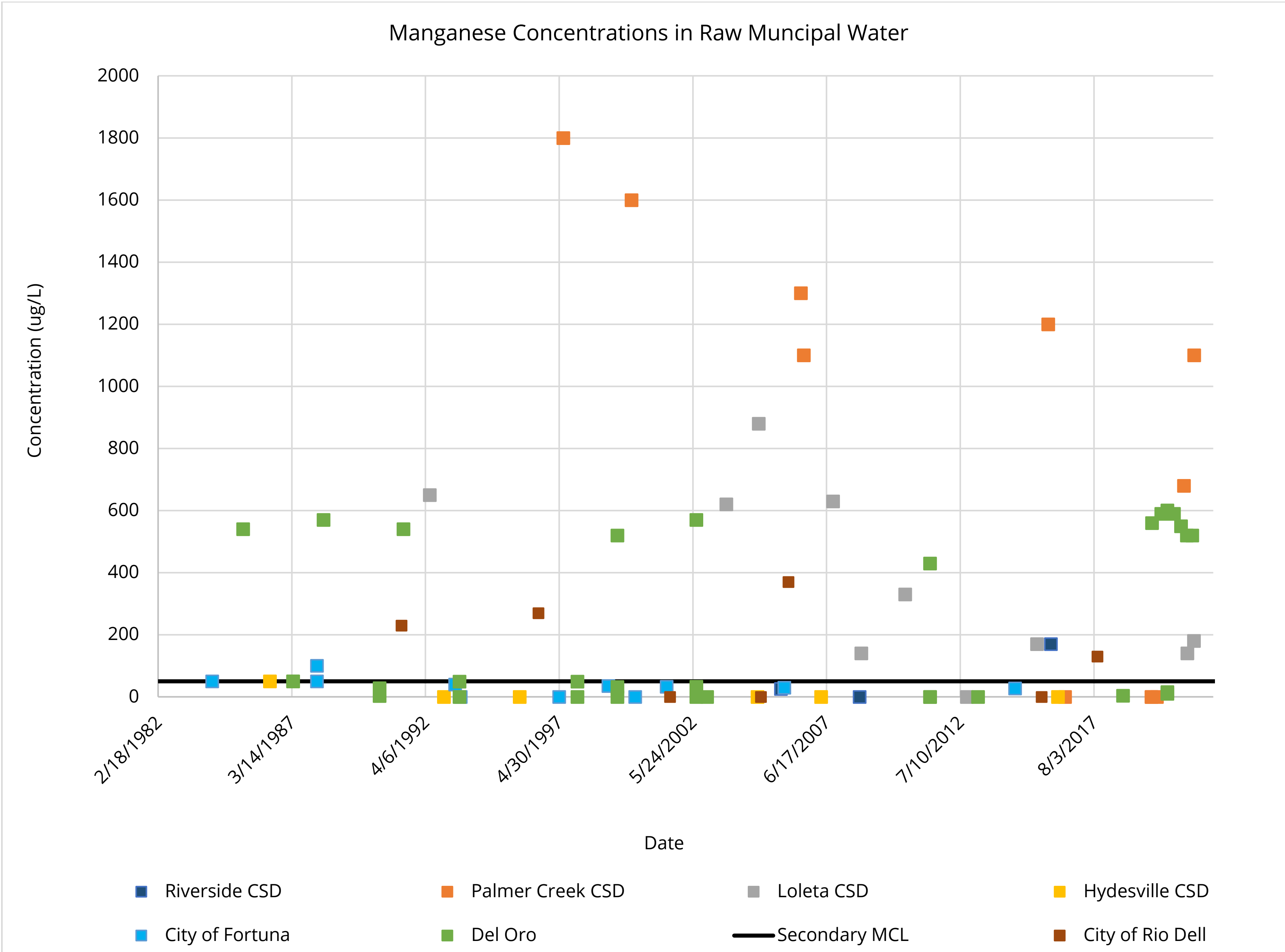



***NOTES:***
***(NS) - NOT SELECTED FOR WATER QUALITY MONITORING***
***DWR- DEPARTMENT OF WATER RESOURCES***

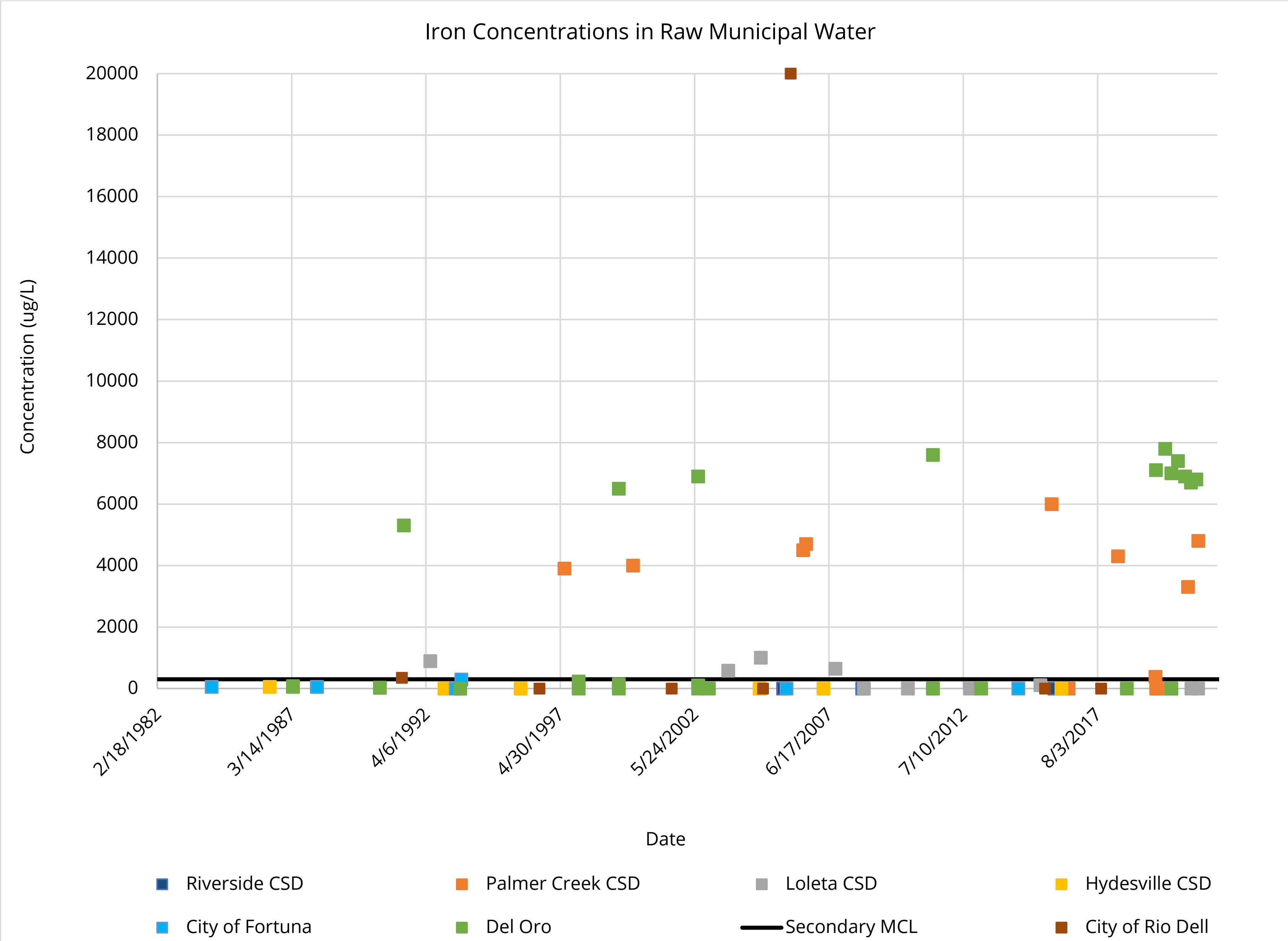
| | | |
|---|---|---|
| Humboldt County Public Works<br>Eel River Valley Groundwater Basin<br>Humboldt County, California | Humboldt County<br>Groundwater Quality Well Locations<br>SHN 020091.150 | |
| August 2021 | Figure6_EelRiverGSP_Water_Quality_Wells | Figure 6 |

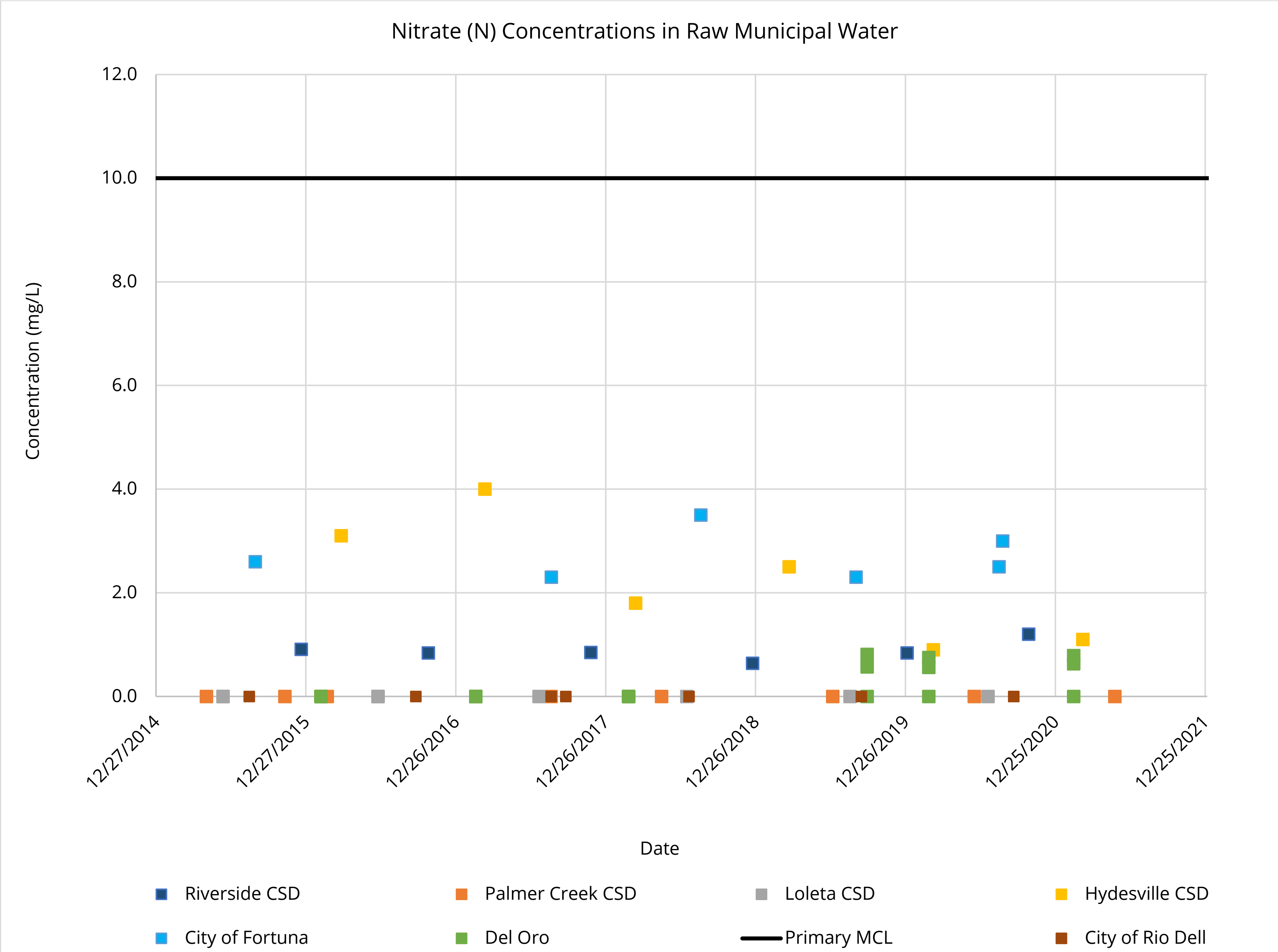
# Municipal Raw Water Graphs

# 2

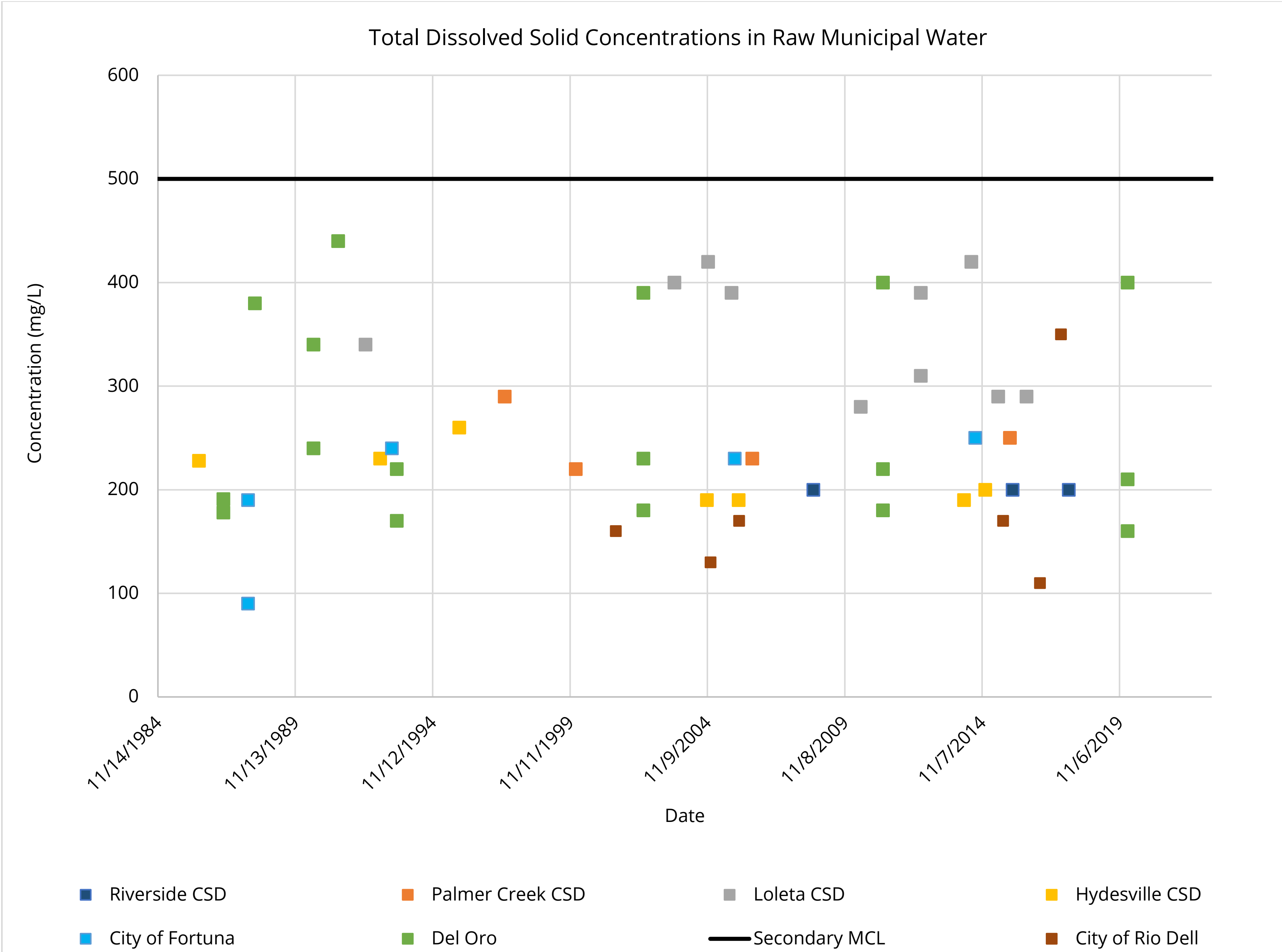


Manganese Concentrations in Raw Muncipal Water
Concentration (ug/L)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
2/18/1982
3/14/1987
4/6/1992
4/30/1997
5/24/2002
6/17/2007
7/10/2012
8/3/2017
Date
Riverside CSD
Palmer Creek CSD
Loleta CSD
Hydesville CSD
City of Fortuna
Del Oro
Secondary MCL
City of Rio Dell


Iron Concentrations in Raw Municipal Water
Concentration (ug/L)
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
2/18/1982
3/14/1987
4/6/1992
4/30/1997
5/24/2002
6/17/2007
7/10/2012
8/3/2017
Date
Riverside CSD
Palmer Creek CSD
Loleta CSD
Hydesville CSD
City of Fortuna
Del Oro
Secondary MCL
City of Rio Dell



Nitrate (N) Concentrations in Raw Municipal Water
Concentration (mg/L)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
12/27/2014
12/27/2015
12/26/2016
12/26/2017
12/26/2018
12/26/2019
12/25/2020
12/25/2021
Date
Riverside CSD
Palmer Creek CSD
Loleta CSD
Hydesville CSD
City of Fortuna
Del Oro
Primary MCL
City of Rio Dell


Total Dissolved Solid Concentrations in Raw Municipal Water
600
500
400
300
200
100
0
Concentration (mg/L)
11/14/1984
11/13/1989
11/12/1994
11/11/1999
11/9/2004
11/8/2009
11/7/2014
11/6/2019
Date
Riverside CSD
Palmer Creek CSD
Loleta CSD
Hydesville CSD
City of Fortuna
Del Oro
Secondary MCL
City of Rio Dell

# 2021 Groundwater Monitoring Results

# 3

| Table 1.<br>Analytical Tests | | | |
|---|---|---|---|
| **Grant Category** | **Laboratory Test ID** | **Test** | **Example Analytes** |
| Metals | ACDDIG | Acid Digestion | Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chromium, Hexavalent Chromium, Cobalt, Copper, Iron, Lead, Manganese, Mercury, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Vanadium, Zinc |
| | CHR6CW | Hexavalent Chromium | |
| | ICPMSW | ICP-MS Metals | |
| | ICPX | ICAP Metals | |
| | MERCW | Mercury | |
| Nutrients | ICNOW | Nitrate and/or Nitrite | Nitrate/Nitrite |
| Salts | ICIONW | Anions by Ion Chromatography | Fluoride, sulfate, chloride (no bromide) |
| | TDS | Total Dissolved Solids | Total dissolved solids |
| Pesticides | 531W | N-methyl-carbamoyloximes and Carbam | 3-hydroxycarbofuran, aldicarb, aldicarb sulfone, aldicarb sulfoxide, carbaryl, carbofuran, methiocarb, methomyl, oxamyl and propoxur |
| Herbicides | 547W | Glyphosate | Glyphosate |
| | 548W | Endothall | Endothall |
| | 615 | Chlorinated Herbicides | 2,4-D, bentazon, dicamba, picloram, triclopyr, MCPA, MCPP, Dinoseb, Dichlorprop, Dalapon, 2,4-DB, 2,4,5-TP (Silvex), 2,4,5-T |
| VOCs (volatile organic compounds) | 8260 List 6 | EPA 8260, oxygenates, scavengers, BTEX, gas | 33 analytes from EPA 8260, 5 oxygenates including MTBE, lead scavengers, benzene, toluene, ethylbenzene, xylenes, gasoline, and chlorinated hydrocarbons |
| SVOCs (semi-volatile organic compounds) | 8270W | EPA 8270 SVOCs | Extended list (70+ analytes) including naphthalene and pentachlorophenol |
| PCB | PCB505 | PCB by microextraction | Polychlorinated biphenyls (PCBs) |
| Microbial | TCQUANT | Coliform Quanti-tray | Coliform and fecal (*e. coli*) bacteria |
| Radioactive | GROALP | Gross Alpha | Alpha particles |
| Physical | ALKW | Alkalinity | alkalinity |
| | Field | pH, Electrical Conductance, and Temperature | Parameters measured in the field at time of sampling and not quantified at the laboratory |

Table 2-1
Historical Groundwater Analytical Results
Eel River Valley Basin, California
(in ug/L, unless noted otherwise )

| Sample Location | Sample Date | EPA 531.1 | Endothall (EPA 548.1) | Glyphosate (EPA 547) | EPA 505 | EPA 615 | Alkalinity (mg/L CaCO$^3$) | Fluoride (mg/L) | Sulfate (mg/L) | Chloride (mg/L) | Nitrate (as N) (mg/L) | Nitrite (as N) (mg/L) | TDS (mg/L) | VOCs (8260B) | SVOCs (8270C) | TPHG | E. Coli (MPN/100mL) | Total Coliform (MPN/100mL) | Gross Alpha (pCi/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MCLs | | Varies | 100 † | 700 † | Varies | Varies | 20[a] | 2† | 250[b] | 250[b] | 10† | 1† | 500[b] | Varies | Varies | 21[c] | -- | -- | 15† |
| MW-1d | 04/07/21 | ND | <45 | <5.0 | ND | ND | 280 | <0.10 | 47 | 25 | 0.73 | <0.10 | 370 | ND | ND | <50 | <1.0 | <1.0 | 1.25±1.48 |
| MW-2d | 04/07/21 | ND | <45 | <5.0 | ND | ND | 99 | <0.10 | 15 | 6.0 | 0.14 | <0.10 | 130 | ND | ND | <50 | <1.0 | <1.0 | 0.517±1.08 |
| MW-5d | 04/07/21 | ND | <45 | <5.0 | ND | ND | 310 | 0.35 | 1.5 | 71 | <0.10 | <0.10 | 470 | ND | ND | <50 | <1.0 | <1.0 | 0.618±1.79 |
| MW-7d | 04/06/21 | ND | <45 | <5.0 | ND | ND | 180 | 0.52 | <1.0 | 120 | <0.10 | <0.10 | 390 | ND | ND | <50 | <1.0 | <1.0 | 0.451±1.25 |
| MW-8 | 04/06/21 | ND | <45 | <5.0 | ND | ND | 160 | 0.24 | 37 | 21 | <0.10 | <0.10 | 250 | ND | ND | <50 | <1.0 | <1.0 | 0.502±1.20 |
| MW-12d | 07/07/21 | ND | <45 | <50 | ND | ND | 82 | 0.37 | 71 | 21 | <0.10 | <0.10 | 520 | ND | Di-n-butyl phthalate=23 | <50 | <1.0 | <1.0 | 0.925±0.655 |
| MW-14d | 07/12/21 | ND | <45 | <5.0 | ND | ND | 72 | 0.14 | 5.1 | 16 | <0.10 | <0.10 | 130 | ND | ND | <50 | <1.0 | 40.4 | 3.00±0.791 |
| MW-15d | 07/12/21 | ND | <45 | <5.0 | ND | ND | 71.0 | 0.2 | 4.4 | 15 | <0.10 | <0.10 | 150 | Chloromethane=0.70 | ND | <50 | <1.0 | 135.4 | 0.888±0.666 |
| MW-16 | 07/07/21 | ND | <45 | <5.0 | ND | ND | 200 | 0.16 | 19 | 27 | 0.36 | <0.10 | 280 | ND | ND | <50 | <1.0 | 12.0 | 0.446±0.905 |
| MW-18 | 07/09/21 | ND | <45 | <5.0 | ND | ND | 350 | <0.10 | 1.2 | 860 | <0.10 | <0.10 B6 | 1,600 | ND | ND | <50 | <1.0 | >2419.6 | 1.62±1.26 |
| MW-19 | 07/13/21 | ND | <45 | <50 | ND | ND | 190 | <0.10 | 43 | 13 | 0.72 | <0.10 | 280 | ND | ND | <50 | <1.0 | 88.0 | 0.742±0.593 |
| MW-25 | 07/08/21 | ND | <45 | <5.0 | ND | ND | 250 | <0.10 | 24 | 12 | 3.4 | <0.10 | 320 | ND | ND | <50 | <1.0 | 38.3 | 0.515±0.929 |
| MW-27 | 07/08/21 | ND | 66 | <50 | ND | ND | 1,000 | <10 B6 | <1.0 | 9,300 | <10 B6 | <10 B6 | 15,000 | ND | ND | <50 | 1 | >2419.6 | 2.24±1.53 |
| MW-28 | 07/08/21 | ND | 57 | <5.0 | ND | ND | 280 | 0.15 | <1.0 | 94 | <0.10 | <1.0 B6, H2 | 450 | ND | ND | 130 G1 | <1.0 | >2419.6 | 2.55±1.26 |
| MW-30 | 07/13/21 | ND | 75 | <50 | ND | ND | 140 | <0.10 | 16 | 18 | <0.10 | <0.10 | 210 | ND | ND | <50 | <1.0 | 196.5 | 0.679±0.436 |

† California Division of Drinking Water Primary Maximum Contaminant Level (https://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.html, accessed 7/21/21)
a. Minimum concentration for Freshwater Aquatic Life Protection. Continuous Concentration (4-day Average) (https://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.html, accessed 7/21/21)
b. California Division of Drinking Water Secondary Maximum Contaminant Level (https://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.html, accessed 7/21/21)
c. EPA Superfund Provisional Cancer Slope Factor (https://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.html, accessed 7/21/21)
--: not available/none
<: "less than" stated laboratory reporting limit
ug/L: micrograms per liter
N: nitorgen
TPHG: Total petroleum hydrocarbons as gasoline, analyzed using EPA Method No. 8260B
pCi/L: Picocuries per liter
B6: The sample was diluted due to the sample matrix.
H2: The holding time was exceeded due to a required dilution.
G1: The sample does not present a peak pattern consistent with that of gasoline. The reported result represents the amount of material in the gasoline range.

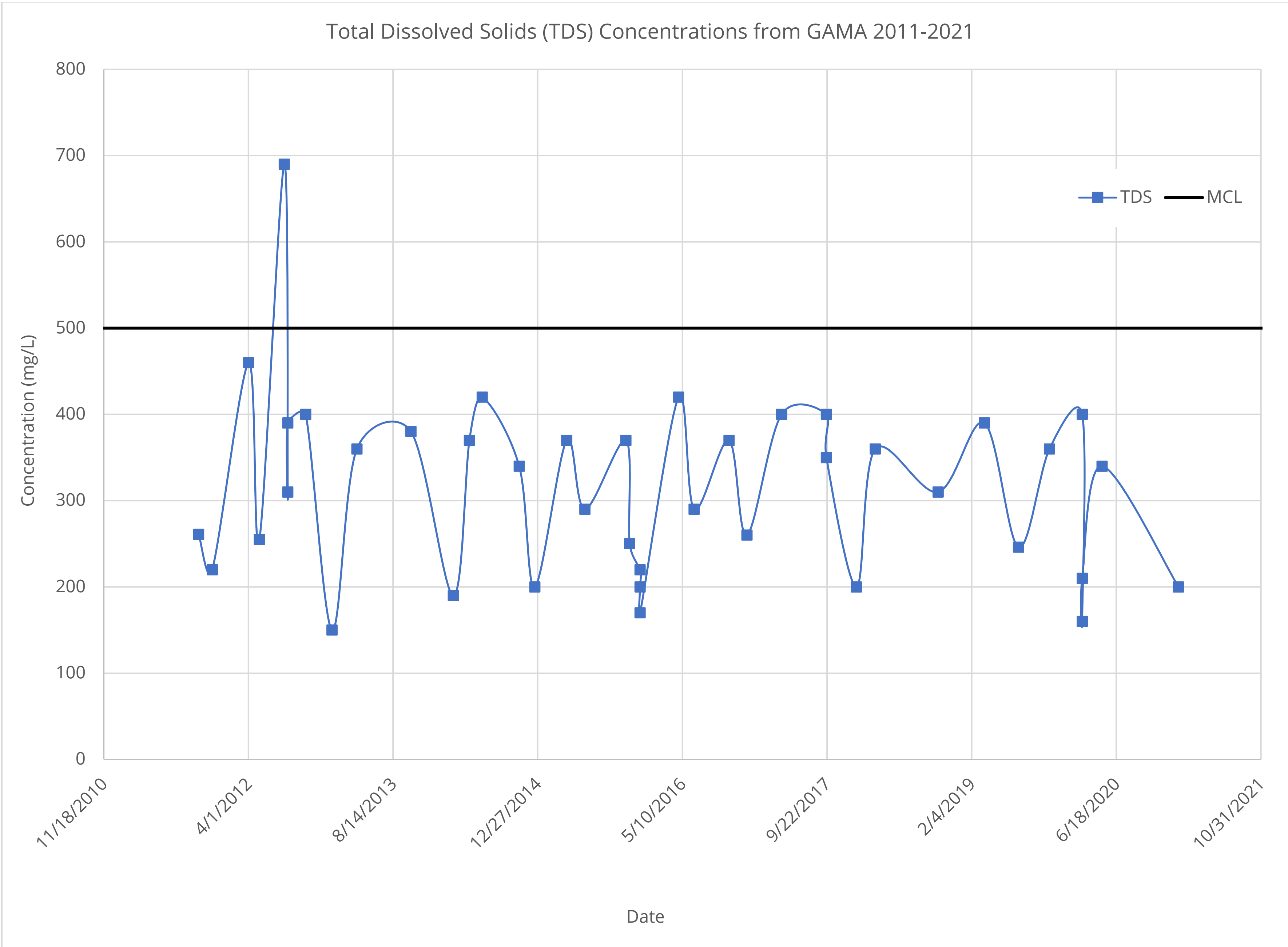
Table 2-2
Historical Groundwater Analytical Results
Eel River Valley Basin, California
(in ug/L, unless noted otherwise )

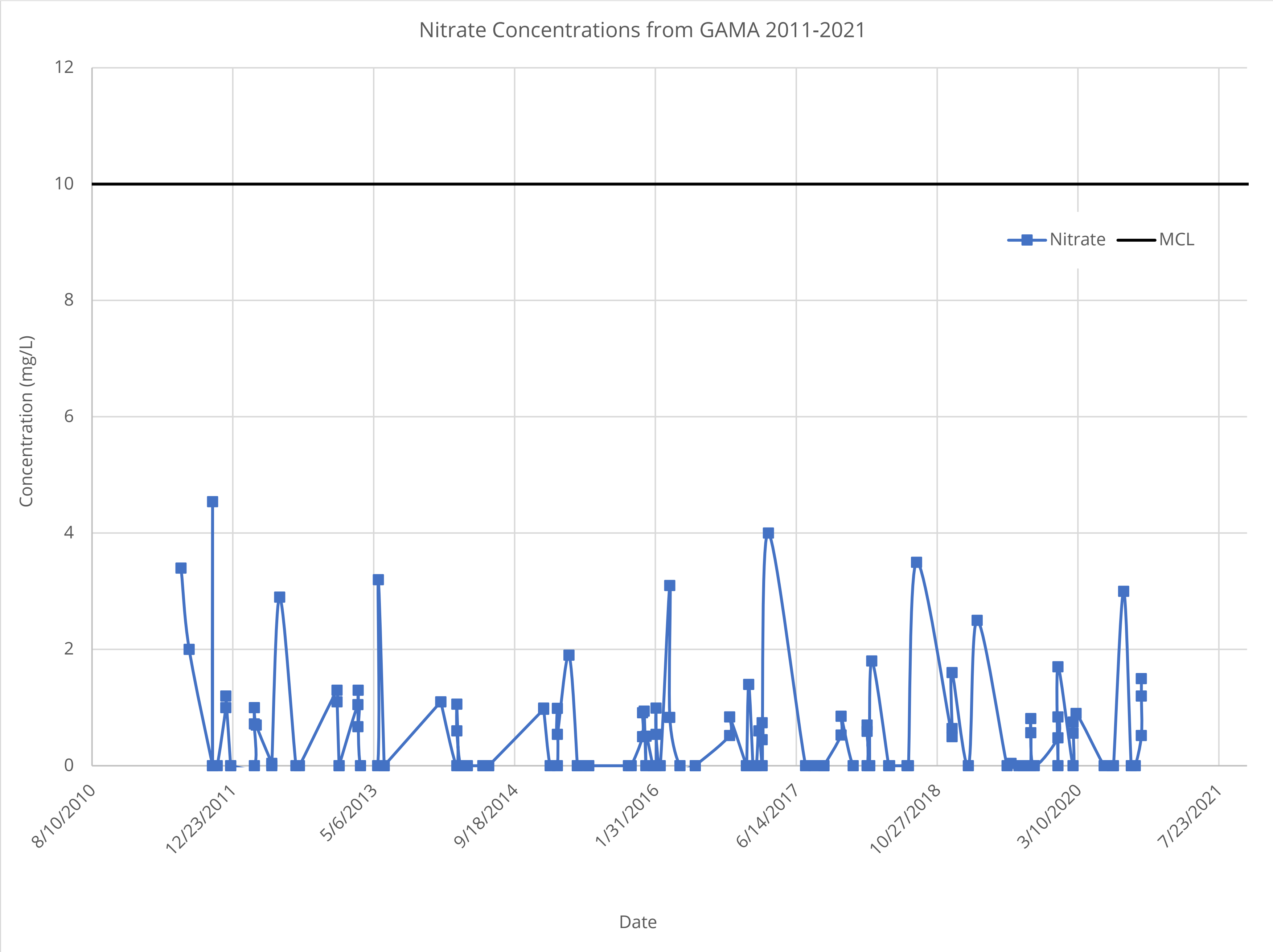
| Sample Location | Sample Date | Aluminum | Calcium | Iron | Mg | Mn | Silver | Sodium | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Copper | Nickel | Selenium | Thallium | Zinc | Mercury | Hexavalent Chromium |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MCLs | | 1,000[†] | -- | 300[b] | -- | 50[b] | 100[b] | 20,000[d] | 6[†] | 10[†] | 1,000[†] | 4[†] | 5[†] | 50[†] | 1,300[†] | 100[†] | 50[†] | 2[†] | 5,000[b] | 0.051[e] | 10[†] |
| MW-1d | 04/07/21 | <50 | 87,000 | 100 | 34,000 | 650 | <10 | 14,000 | <5.0 | <5.0 | 340 | <1.0 | <5.0 | 6.7 | 9.4 | <5.0 | <10 | <5.0 | 55 | <1.0 | <5.0 |
| MW-2d | 04/07/21 | <50 | 32,000 | <50 | 8,300 | 2.3 | <10 | 8,800 | <5.0 | <5.0 | 97 | <1.0 | <5.0 | 6.7 | 9.4 | <5.0 | <10 | <5.0 | 52 | <1.0 | <5.0 |
| MW-5d | 04/07/21 | 410 | 3,500 | 630 | 2,800 | 57 | <10 | 90,000 | <5.0 | <5.0 | 52 | <1.0 | <5.0 | 6.7 | 9.4 | <5.0 | <10 | <5.0 | <10 | <1.0 | <5.0 |
| MW-7d | 04/06/21 | 210 | 35,000 | 7,900 | 36,000 | 2,500 | <10 | 55,000 | <5.0 | 12 | 380 | <1.0 | <5.0 | <5.0 | <5.0 | 5.0 | <10 | <5.0 | <10 | <1.0 | <5.0 |
| MW-8 | 04/06/21 | <50 | 34,000 | <50 | 32,000 | 210 | <10 | 16,000 | <5.0 | <5.0 | 88 | <1.0 | <5.0 | <5.0 | <5.0 | <5.0 | <10 | <5.0 | <10 | <1.0 | <5.0 |
| MW-12d | 07/07/21 | 9,300 | 17,000 | 14,000 | 10,000 | 220 | <10 | 39,000 | <5.0 | 23 | 310 | <1.0 | <5.0 | 25 | 32 | 34 | <10 | <5.0 | 36 | <1.0 | <5.0 |
| MW-14d | 07/12/21 | 1,700 | 15,000 | 1,800 | 4,900 | 34 | <10 | 13,000 | <5.0 | 8.8 | 280 | <1.0 | <5.0 | 5.6 | 5.4 | 8.5 | <10 | <5.0 | 38 | <1.0 | <5.0 |
| MW-15d | 07/12/21 | 4,500 | 17,000 | 3,500 | 5,500 | 59 | <10 | 15,000 | <5.0 | 11 | 300 | <1.0 | <5.0 | <5.0 | <5.0 | 8.2 | <10 | <5.0 | 58 | <1.0 | <5.0 |
| MW-16 | 07/07/21 | 560 | 50,000 | 760 | 22,000 | 1,500 | <10 | 18,000 | <5.0 | <5.0 | 200 | <1.0 | <5.0 | <5.0 | <5.0 | 9.8 | <10 | <5.0 | 19.0 | <1.0 | <5.0 |
| MW-18 | 07/09/21 | 1,900 | 61,000 | 2,400 | 40,000 | 580 | <10 | 400,000 | <5.0 | 12 | 710 | <1.0 | <5.0 | 12.0 | 5.3 | 14.0 | <10 | <5.0 | 11.0 | <1.0 | <5.0 |
| MW-19 | 07/13/21 | 580 | 68,000 | 680 | 16,000 | 51 | <10 | 12,000 | <5.0 | <5.0 | 180 | <1.0 | <5.0 | <5.0 | <5.0 | 5.2 | <10 | <5.0 | <10 | <1.0 | <5.0 |
| MW-25 | 07/08/21 | 540 | 87,000 | 670 | 22,000 | 40 | <10 | 8,900 | <5.0 | <5.0 | 190 | <1.0 | <5.0 | <5.0 | <5.0 | 6.7 | <10 | <5.0 | 11 | <1.0 | <5.0 |
| MW-27 | 07/08/21 | 860 | 450,000 | 68,000 | 630,000 | 3,000 | <10 | 2,700,000 | <5.0 | 26 | 4,700 | <1.0 | <5.0 | 11 | 6.0 | 17 | 23 | <5.0 | 32.0 | <1.0 | <5.0 |
| MW-28 | 07/08/21 | 900 | 43,000 | 15,000 | 45,000 | 1,200 | <10 | 50,000 | <5.0 | <5.0 | 530 | <1.0 | <5.0 | 5.8 | <5.0 | 11 | <10 | <5.0 | <10 | <1.0 | <5.0 |
| MW-30 | 07/13/21 | 950 | 31,000 | 3,500 | 20,000 | 380 | <10 | 10,000 | <5.0 | <5.0 | 410 | <1.0 | <5.0 | 7.5 | 10.0 | 9.7 | <10 | <5.0 | 11.0 | <1.0 | <5.0 |

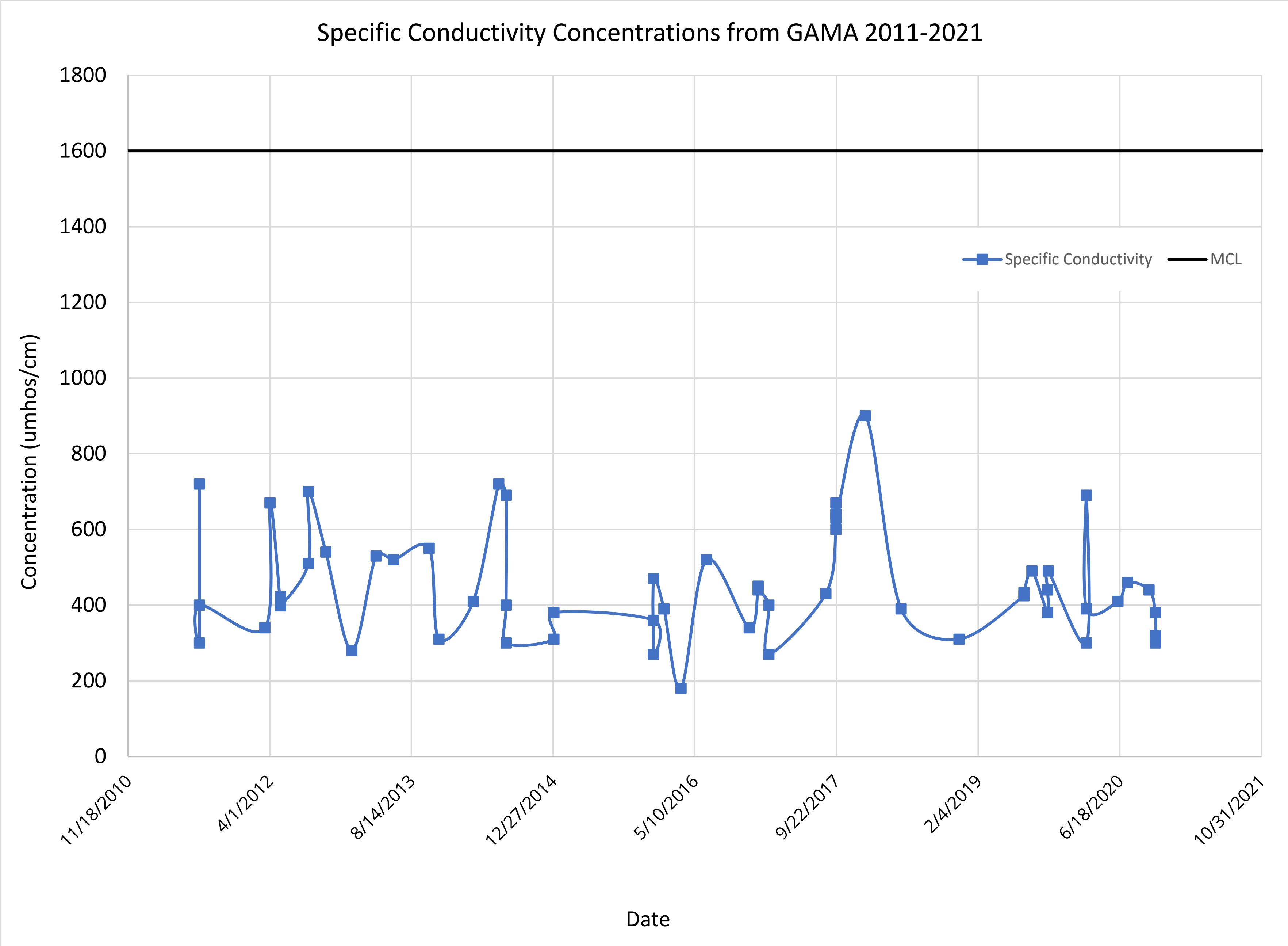
† California Division of Drinking Water Primary Maximum Contaminant Level (https://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.html, accessed 7/21/21)
a. Minimum concentration for Freshwater Aquatic Life Protection. Continuous Concentration (4-day Average) (https://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.html, accessed 7/21/21)
b. California Division of Drinking Water Secondary Maximum Contaminant Level (https://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.html, accessed 7/21/21)
c. EPA Superfund Provisional Cancer Slope Factor (https://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.html, accessed 7/21/21)
d. Guidance level to protect those individuals restricted to a total sodium intake of 500 mg/day. EPA Health Advisory (https://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.html, accessed 7/21/21)
d. California enclosed bays & estuaries - California Toxics Rule Criteria for human health protection (USEPA) (https://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.html, accessed 7/21/21)
--: not available/none
Mg: magnesium
MN: Manganese
<: "less than" stated laboratory reporting limit
ug/L: micrograms per liter

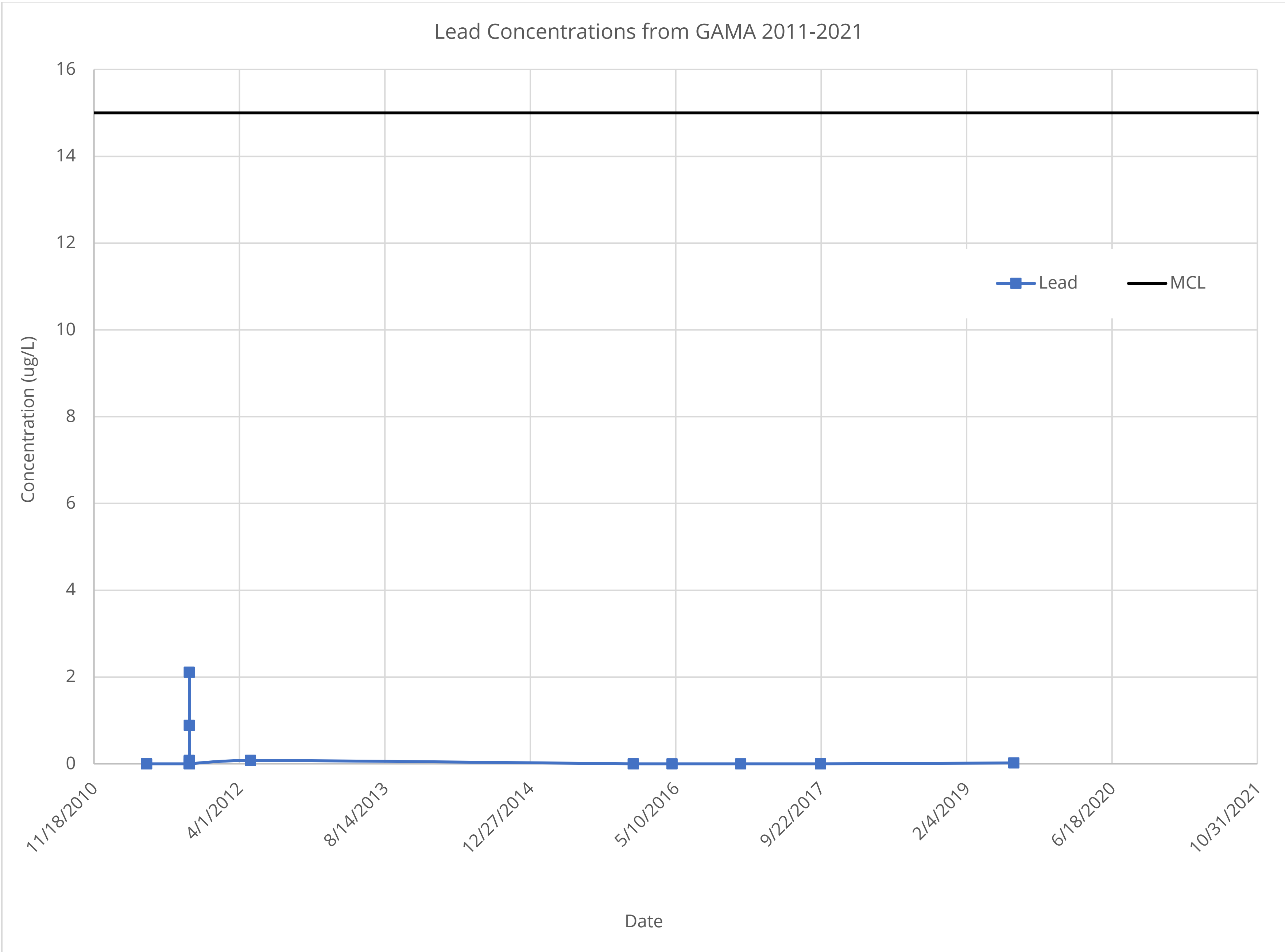
# GAMA Graphs and Images

4

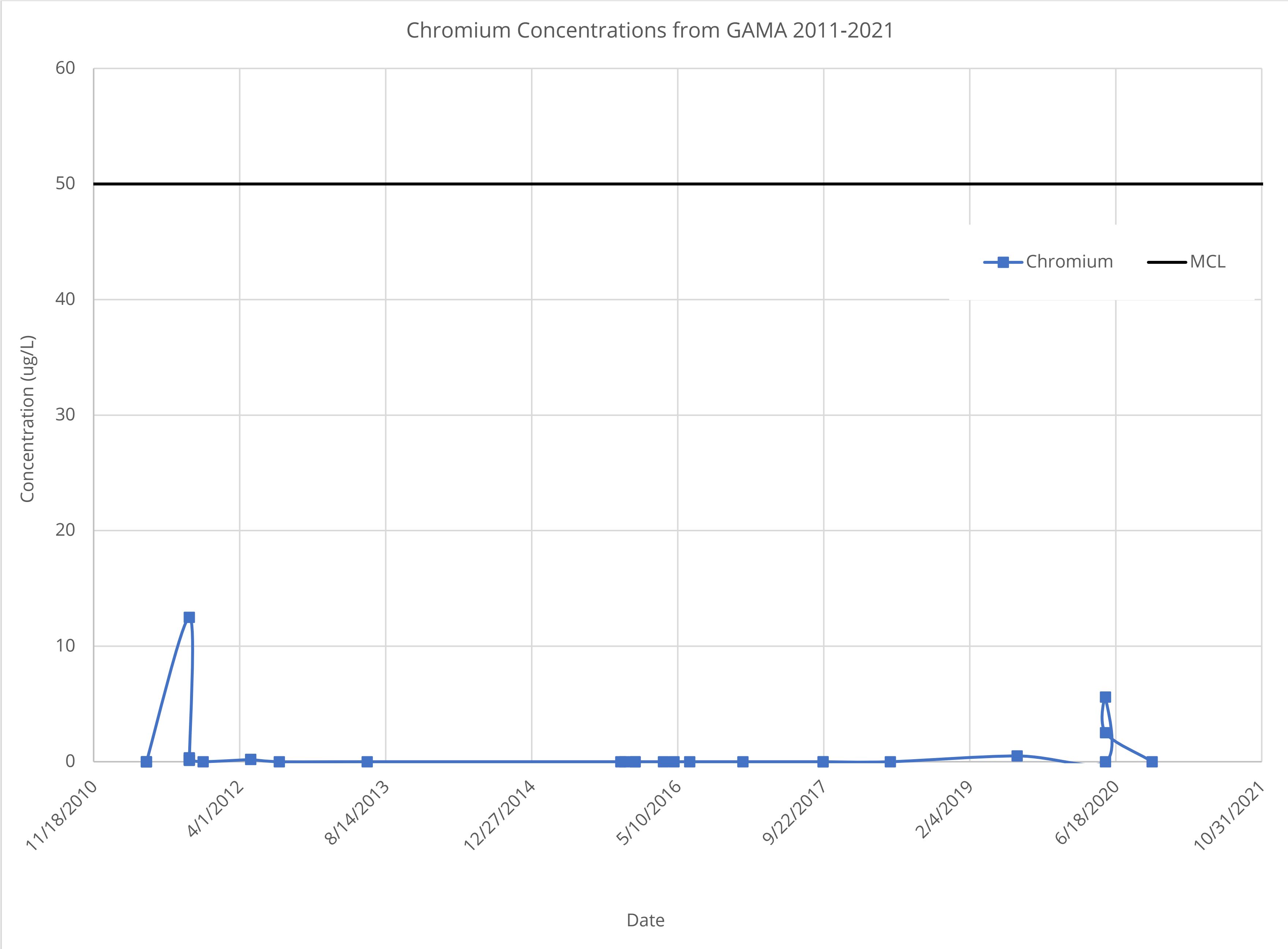

Total Dissolved Solids (TDS) Concentrations from GAMA 2011-2021
Concentration (mg/L)
800
700
600
500
400
300
200
100
0
TDS
MCL
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date

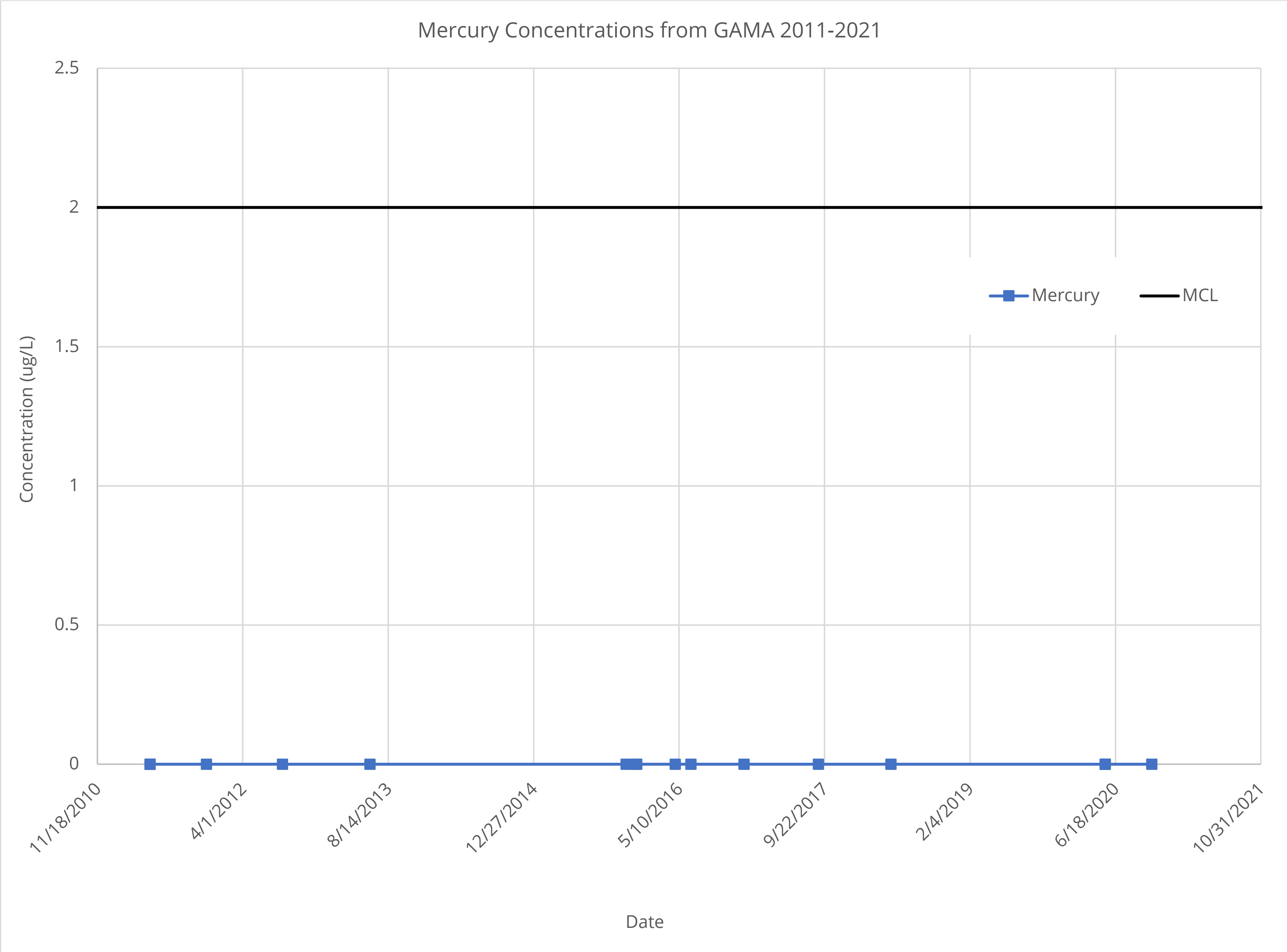

Nitrate Concentrations from GAMA 2011-2021
Concentration (mg/L)
Date
Nitrate
MCL
12
10
8
6
4
2
0
8/10/2010
12/23/2011
5/6/2013
9/18/2014
1/31/2016
6/14/2017
10/27/2018
3/10/2020
7/23/2021

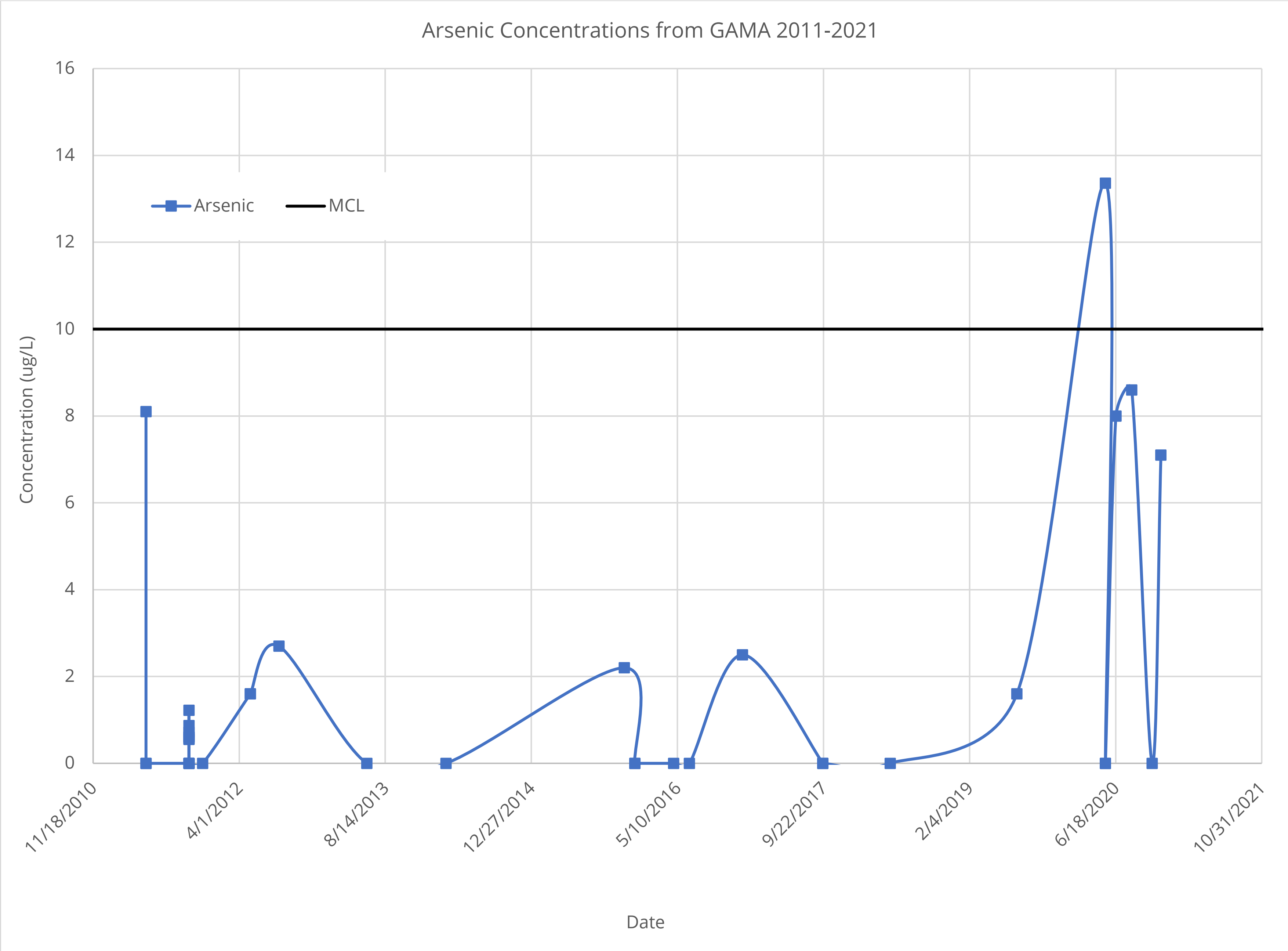

Specific Conductivity Concentrations from GAMA 2011-2021
Concentration (umhos/cm)
0
200
400
600
800
1000
1200
1400
1600
1800
Specific Conductivity
MCL
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date

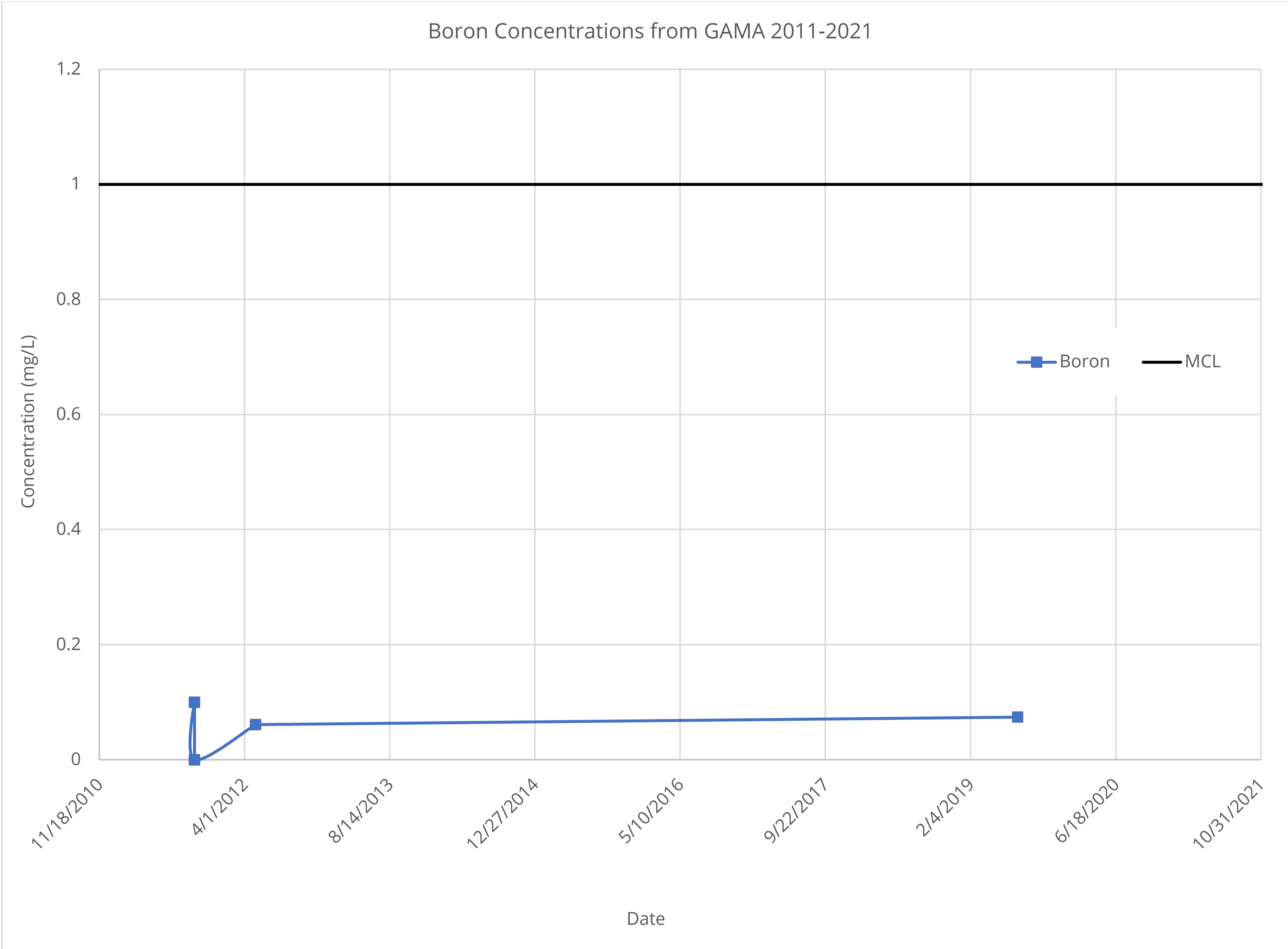


Lead Concentrations from GAMA 2011-2021
16
14
12
10
8
6
4
2
0
Concentration (ug/L)
Lead
MCL
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date

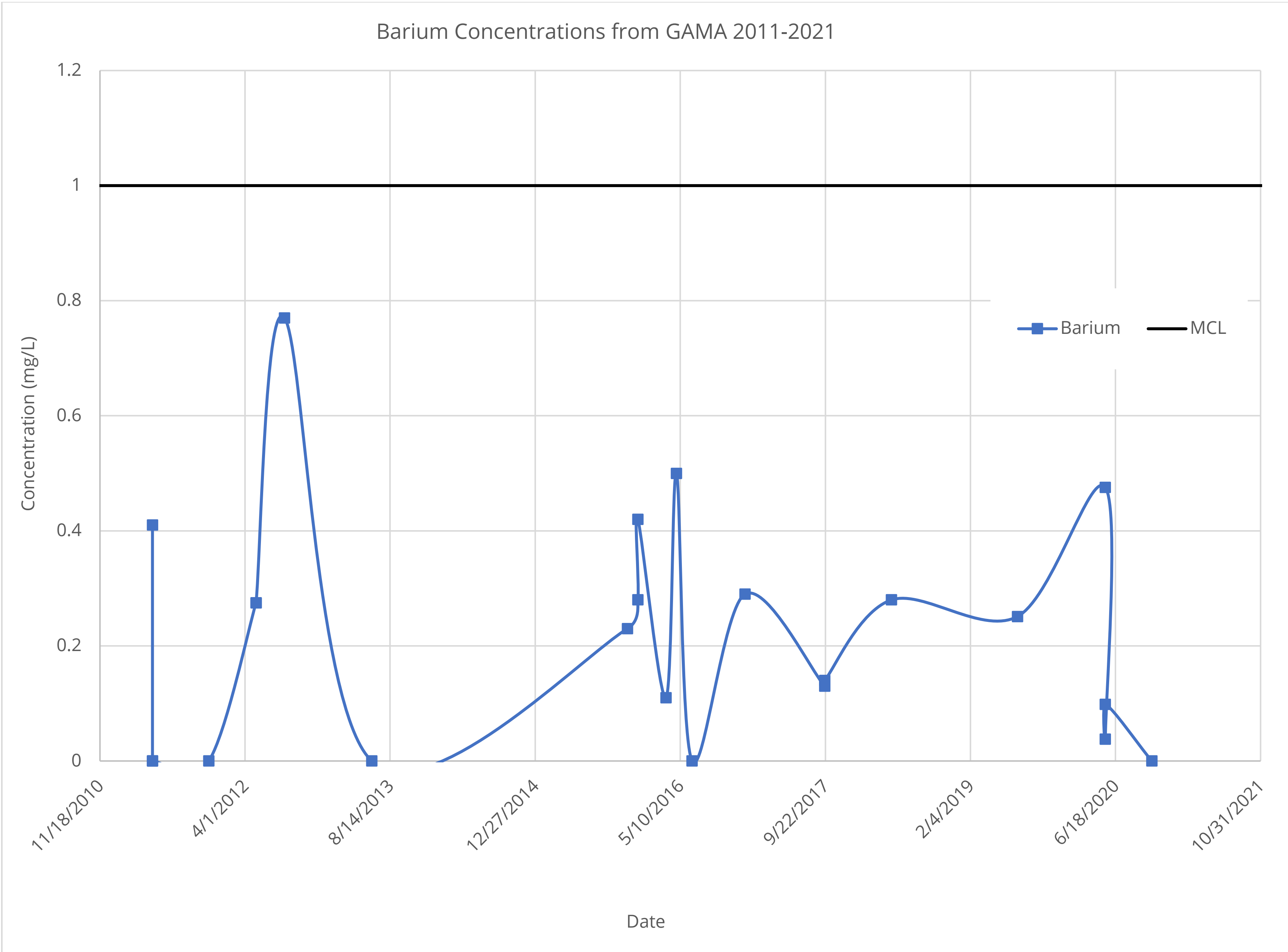

Chromium Concentrations from GAMA 2011-2021
60
50
40
30
20
10
0
Concentration (ug/L)
Chromium
MCL
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date


Mercury Concentrations from GAMA 2011-2021
2.5
2
1.5
1
0.5
0
Concentration (ug/L)
Mercury
MCL
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date

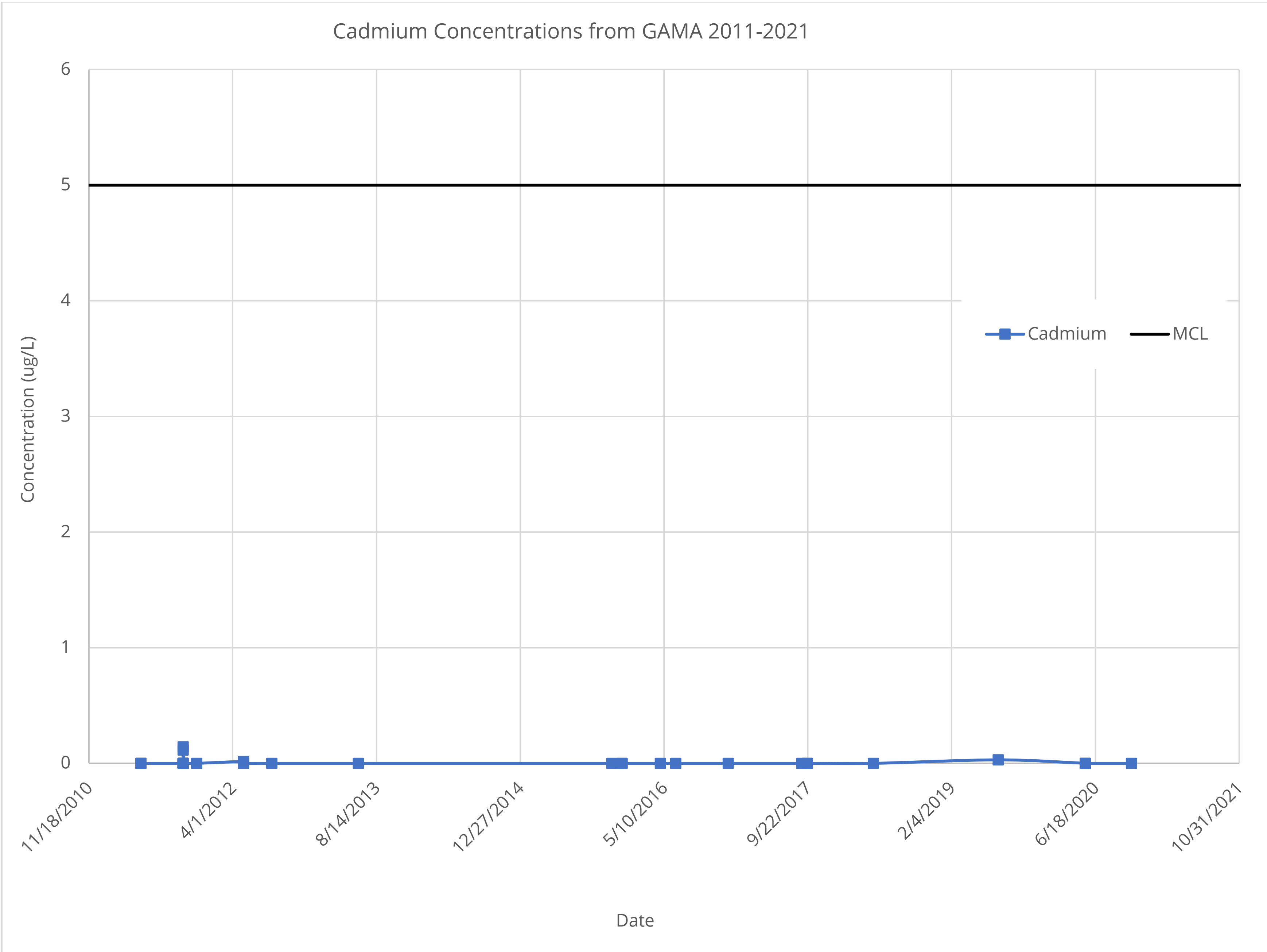

Arsenic Concentrations from GAMA 2011-2021
Arsenic
MCL
Concentration (ug/L)
16
14
12
10
8
6
4
2
0
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date



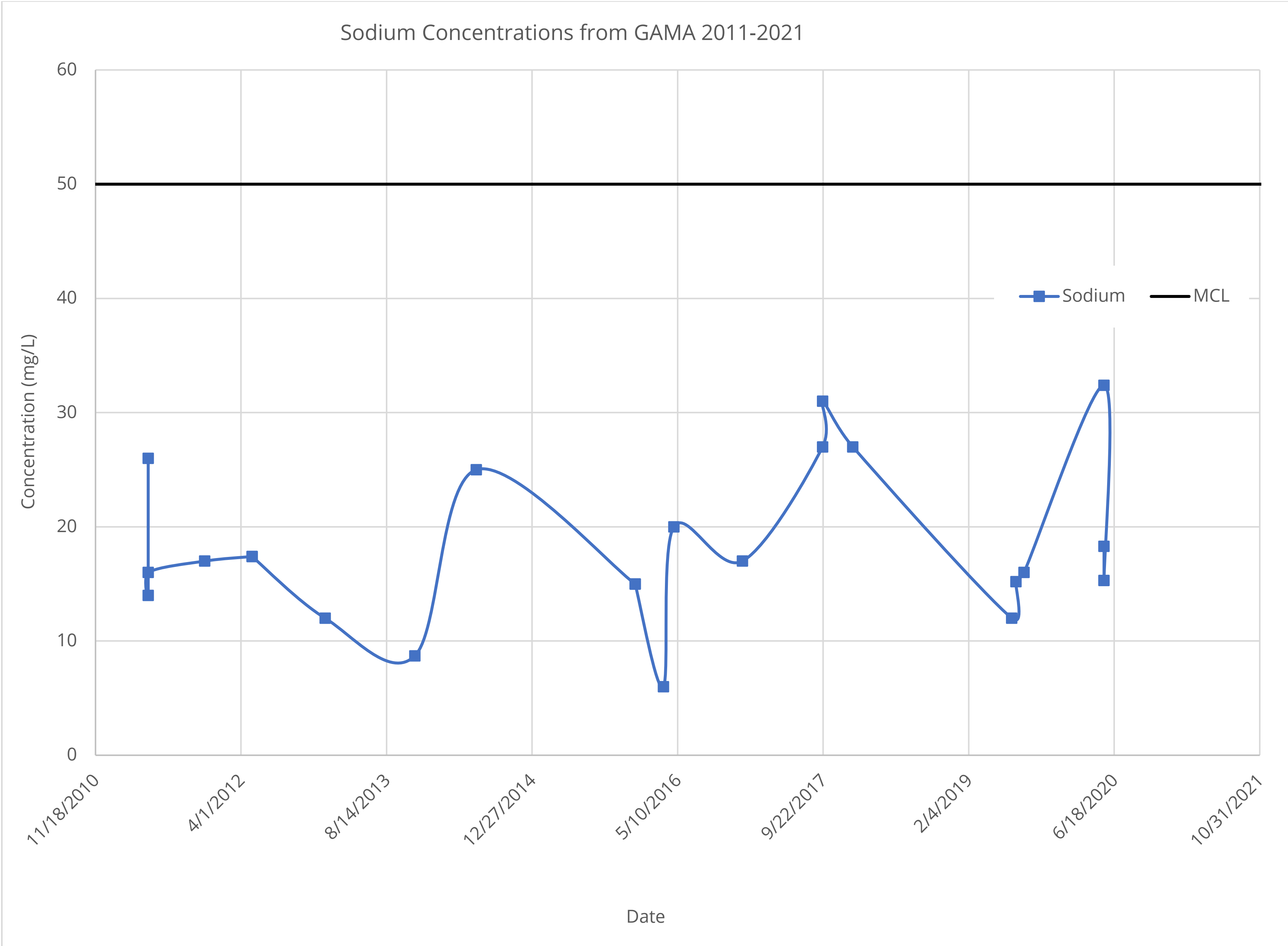
Boron Concentrations from GAMA 2011-2021
Concentration (mg/L)
1.2
1
0.8
0.6
0.4
0.2
0
Boron
MCL
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date

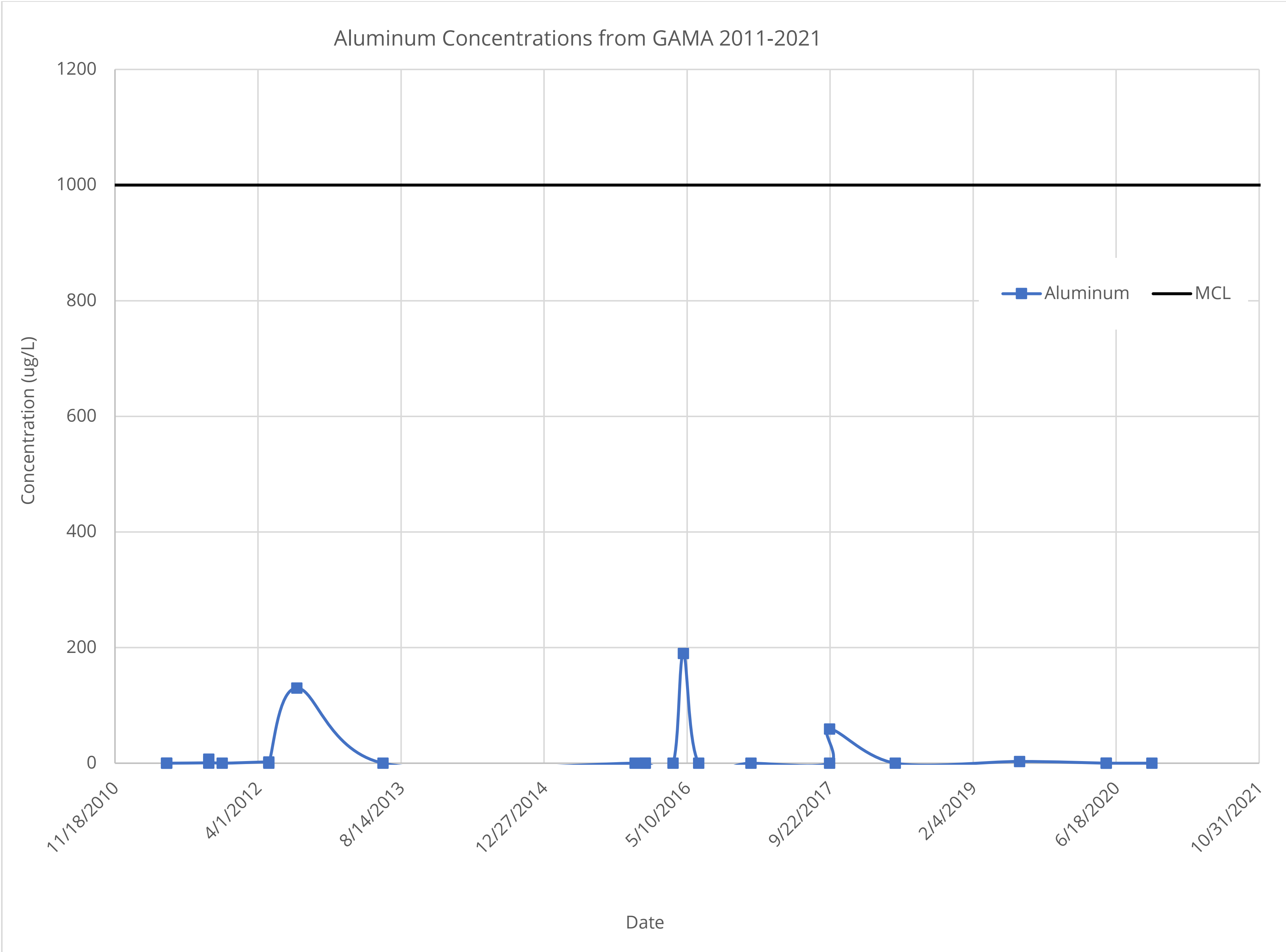


Barium Concentrations from GAMA 2011-2021
1.2
1
0.8
0.6
0.4
0.2
0
Concentration (mg/L)
Barium
MCL
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date

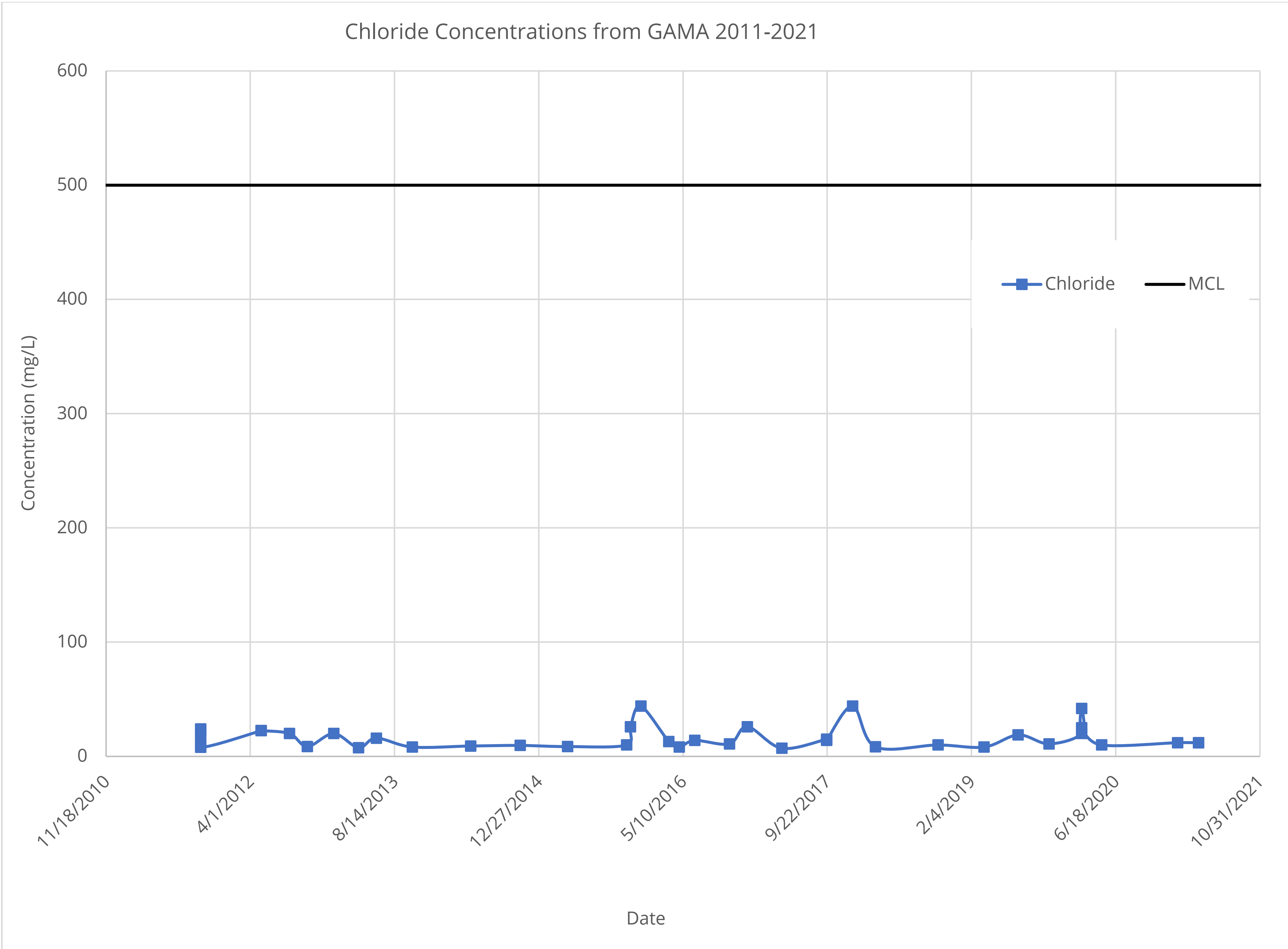


Cadmium Concentrations from GAMA 2011-2021
6
5
4
3
2
1
0
Concentration (ug/L)
Cadmium
MCL
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date

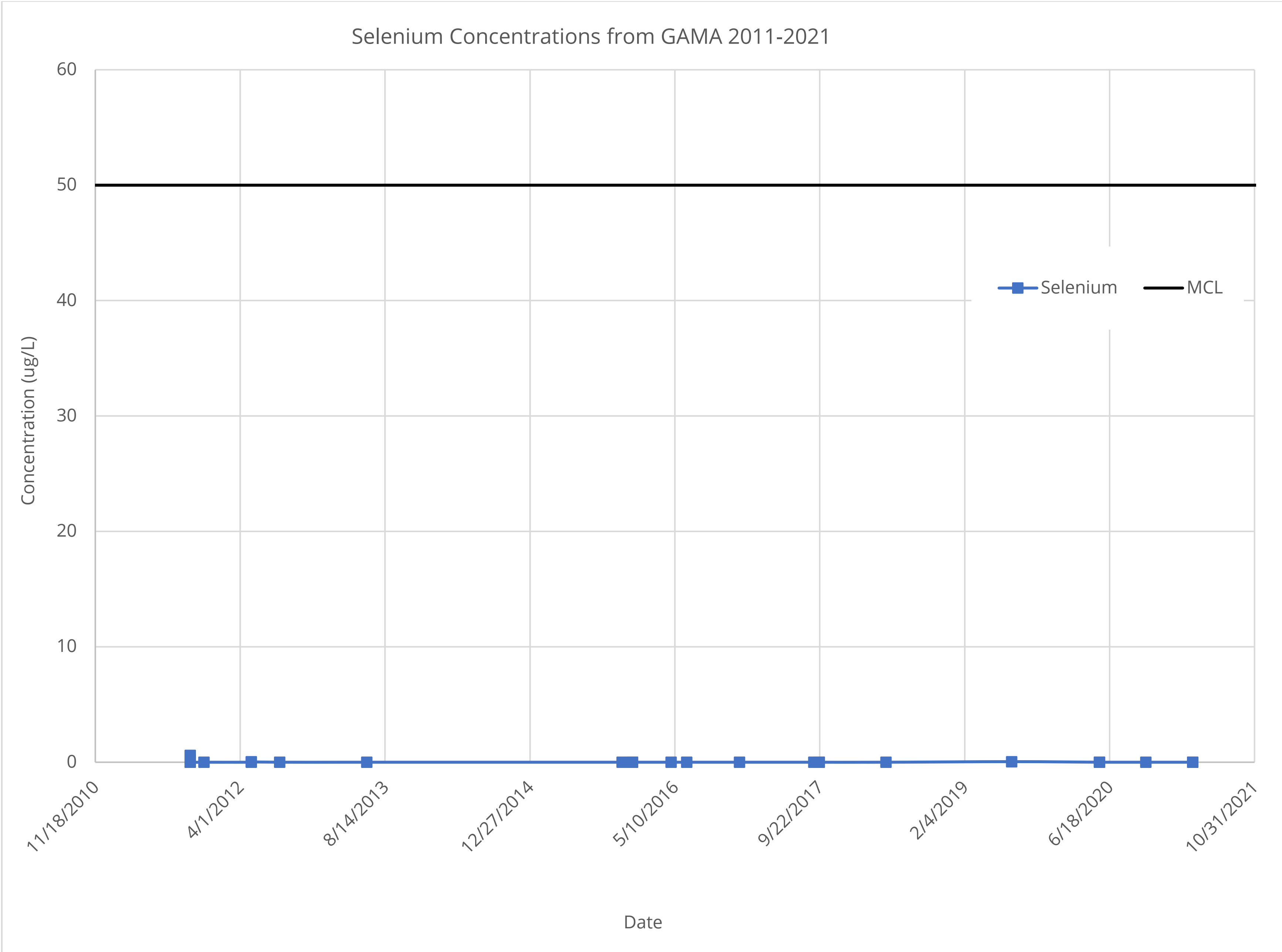

Sodium Concentrations from GAMA 2011-2021
Concentration (mg/L)
0
10
20
30
40
50
60
Sodium
MCL
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date



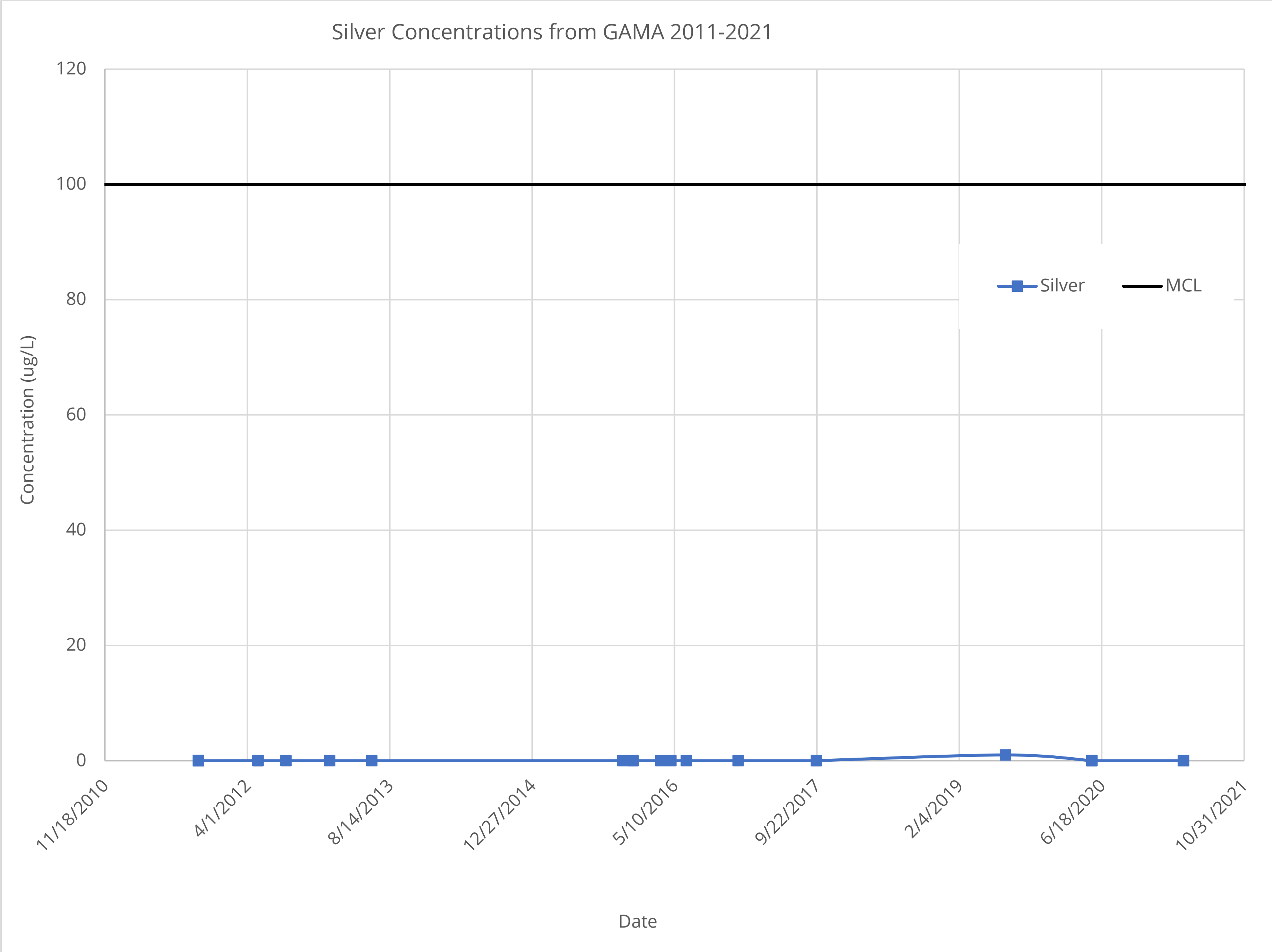
Aluminum Concentrations from GAMA 2011-2021
1200
1000
800
600
400
200
0
Concentration (ug/L)
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date
Aluminum
MCL



Chloride Concentrations from GAMA 2011-2021
600
500
400
300
200
100
0
Concentration (mg/L)
Chloride
MCL
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date




\\192.168.10.5\projects\2020\020091-Eel-River-GSP\150-Water-Quality\Rpts\WQTM\App3-GAMA\Appendix-3-GAMA-Maps&Graphs.docx


Silver Concentrations from GAMA 2011-2021
120
100
80
60
40
20
0
Concentration (ug/L)
Silver
MCL
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date

**Total dissolved solids (TDS) concentrations across the Eel River Valley included in the GAMA database.**

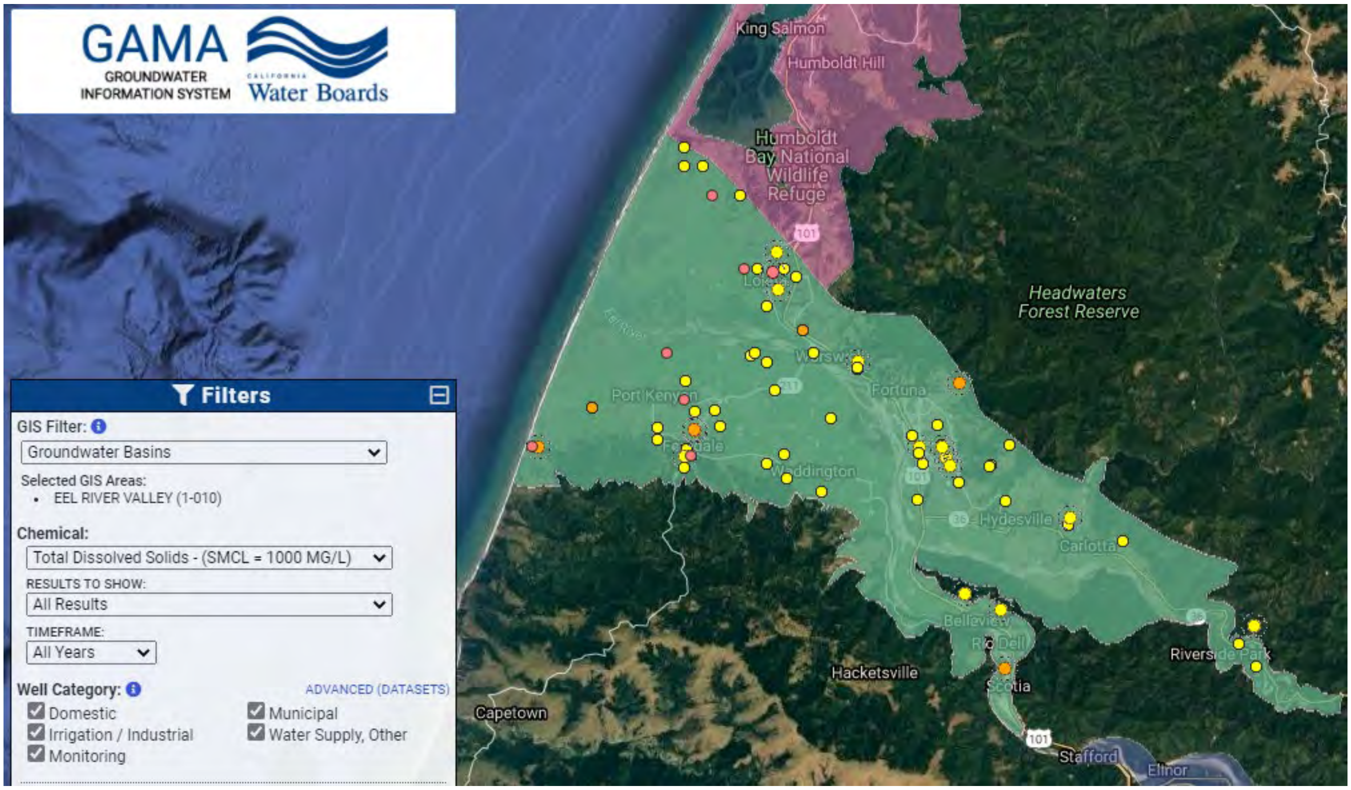



Image 1, Top: Wells with available data for TDS concentrations for all years.

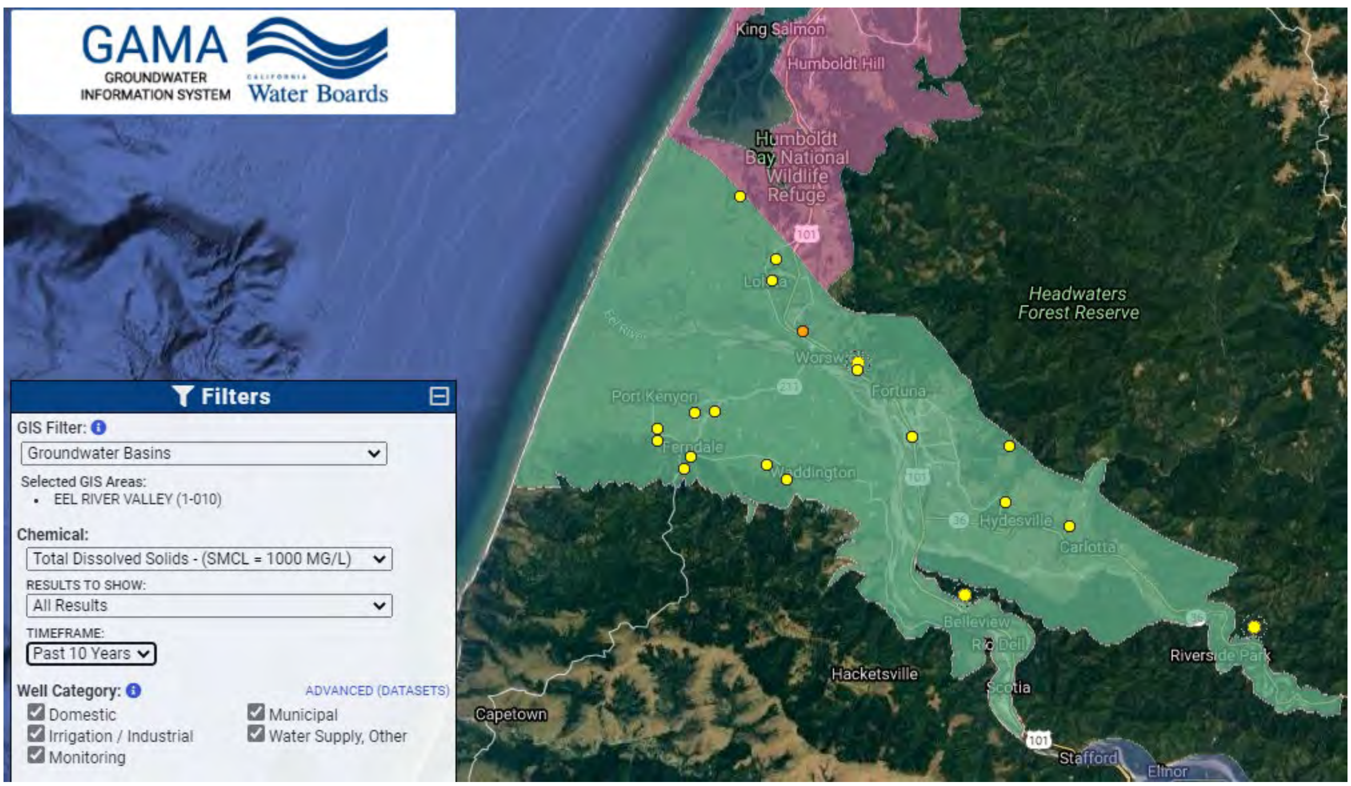



Image 1, Bottom: Wells with available data for TDS concentrations for the past 10 years.

Nitrate (N) concentrations across the Eel River Valley included in the GAMA database

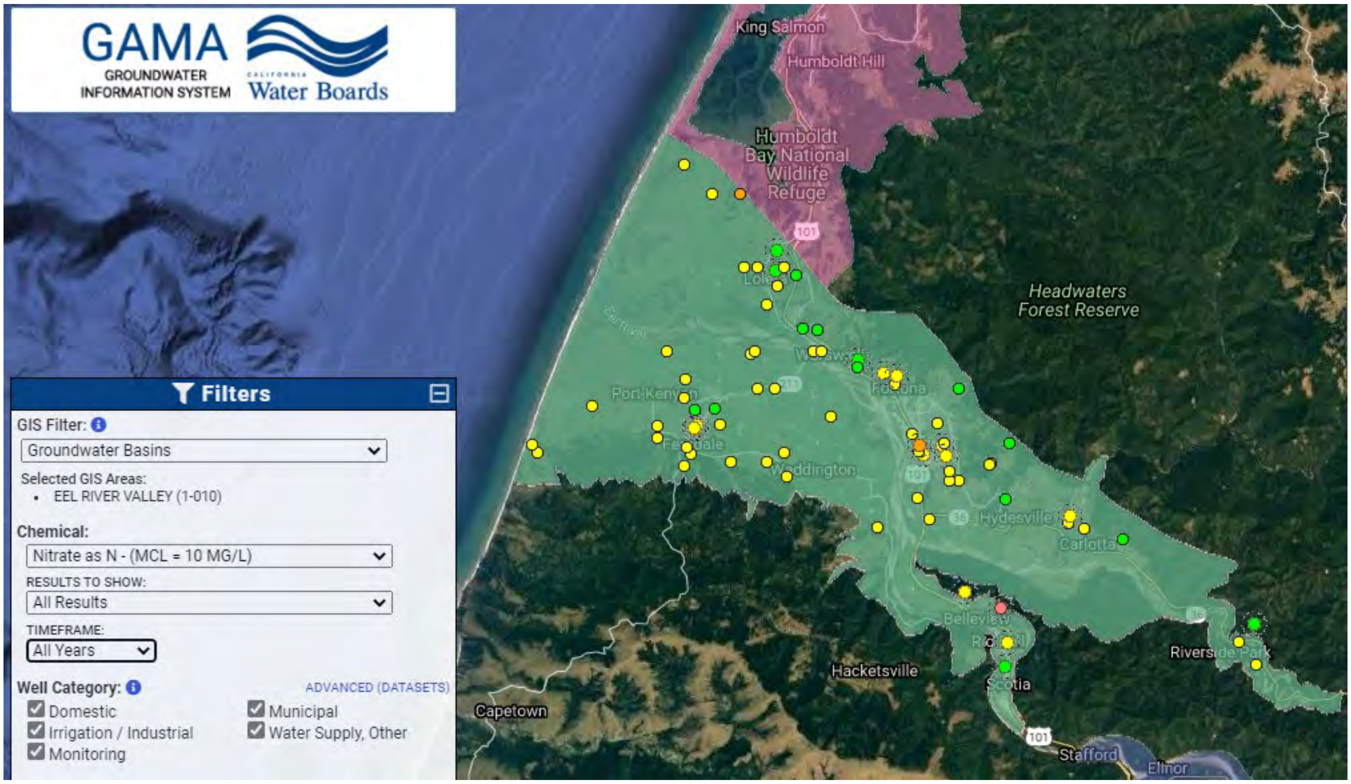


Image 2, Top: Wells with available data for nitrate concentrations for all years.

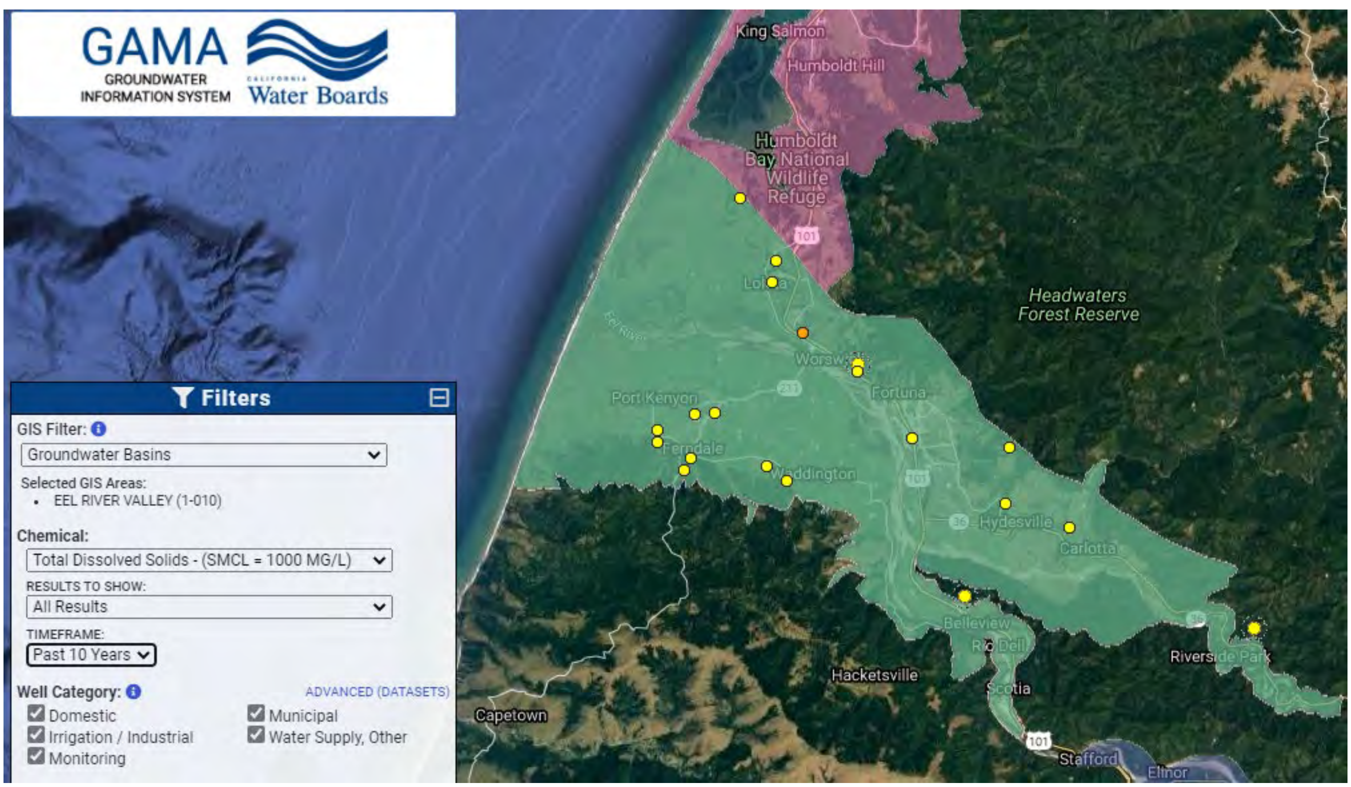


Image 2, Bottom: Wells with available data for nitrate concentrations for the past 10 years.

Iron concentrations across the Eel River Valley included in the GAMA database.

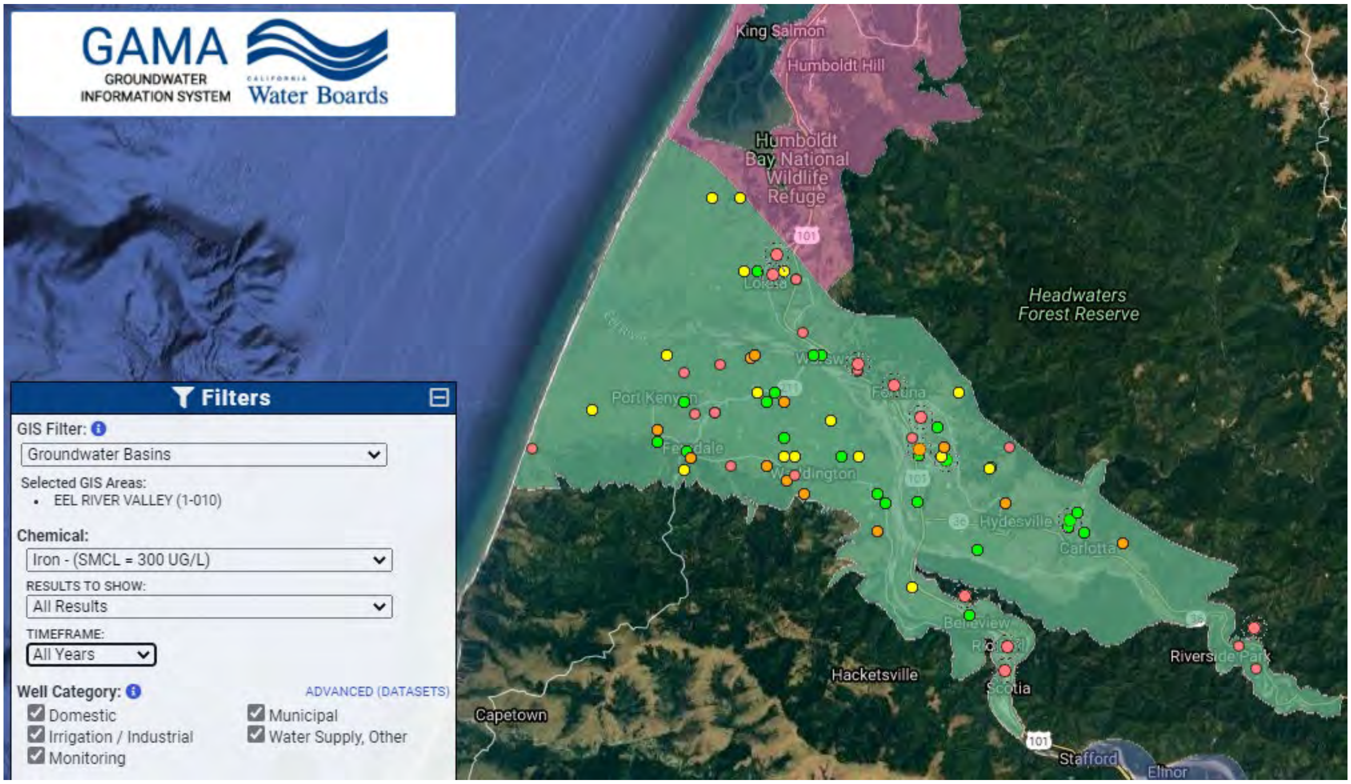



Image 3, Top: Wells with available data for iron concentrations for all years.

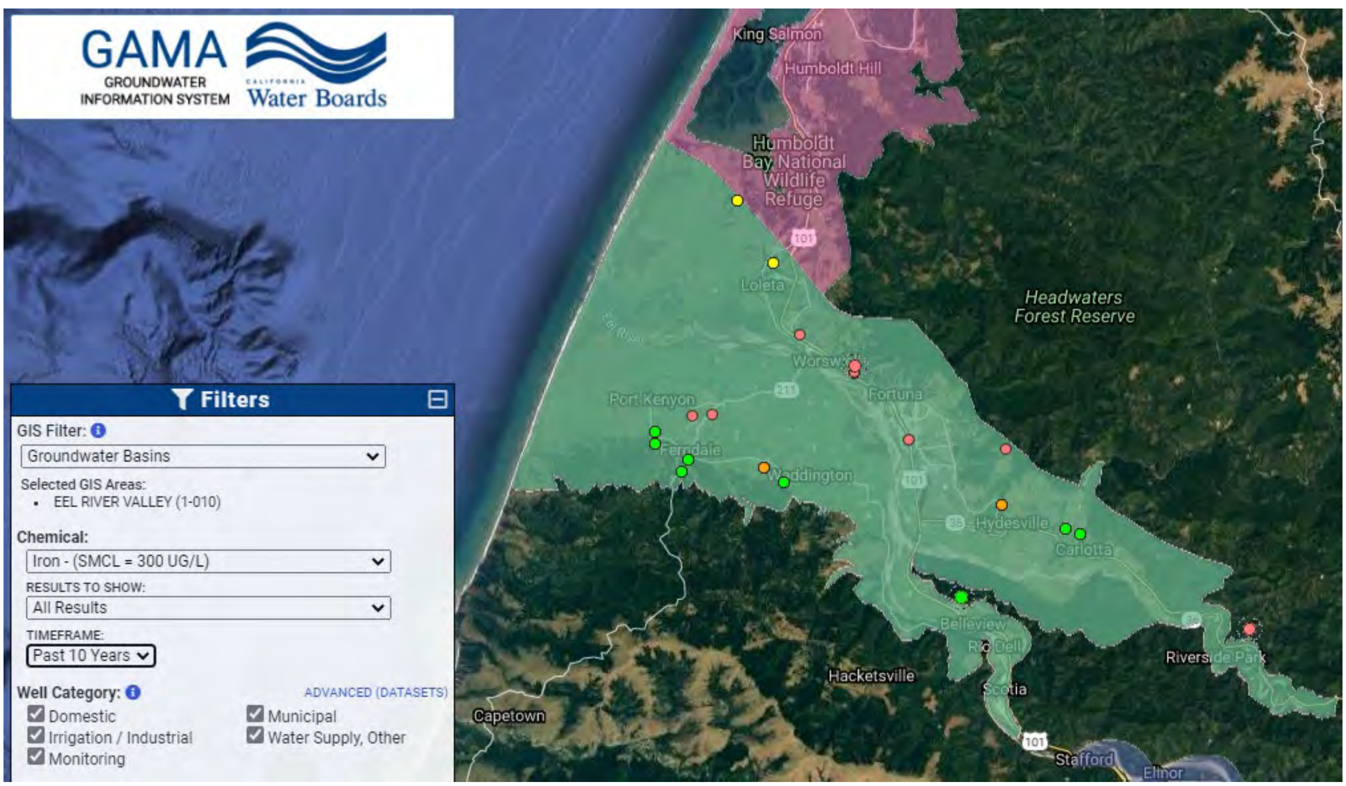



Image 3, Bottom: Wells with available data for iron concentrations for the past 10 years.

Manganese concentrations across the Eel River Valley included in the GAMA database.

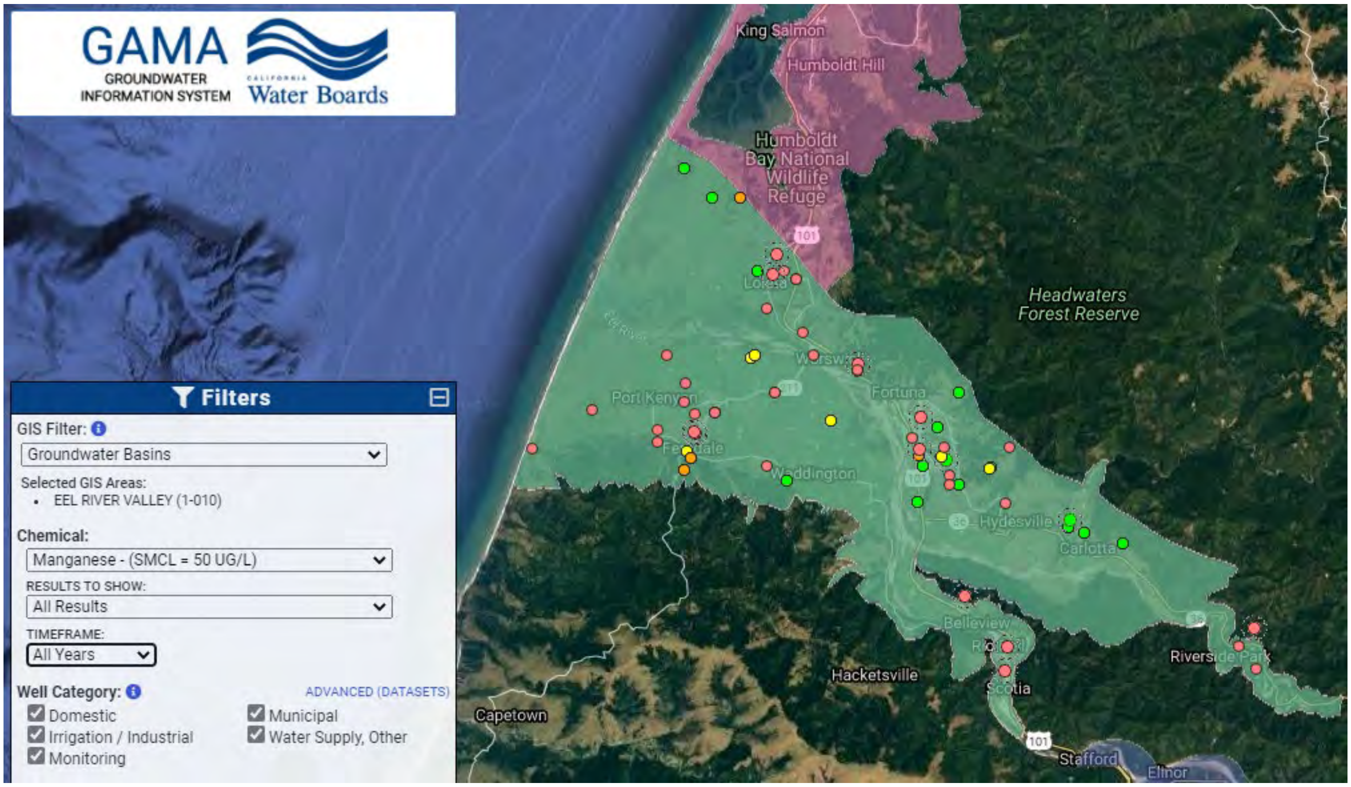



Image 4, Top: Wells with available data for manganese concentrations for all years.

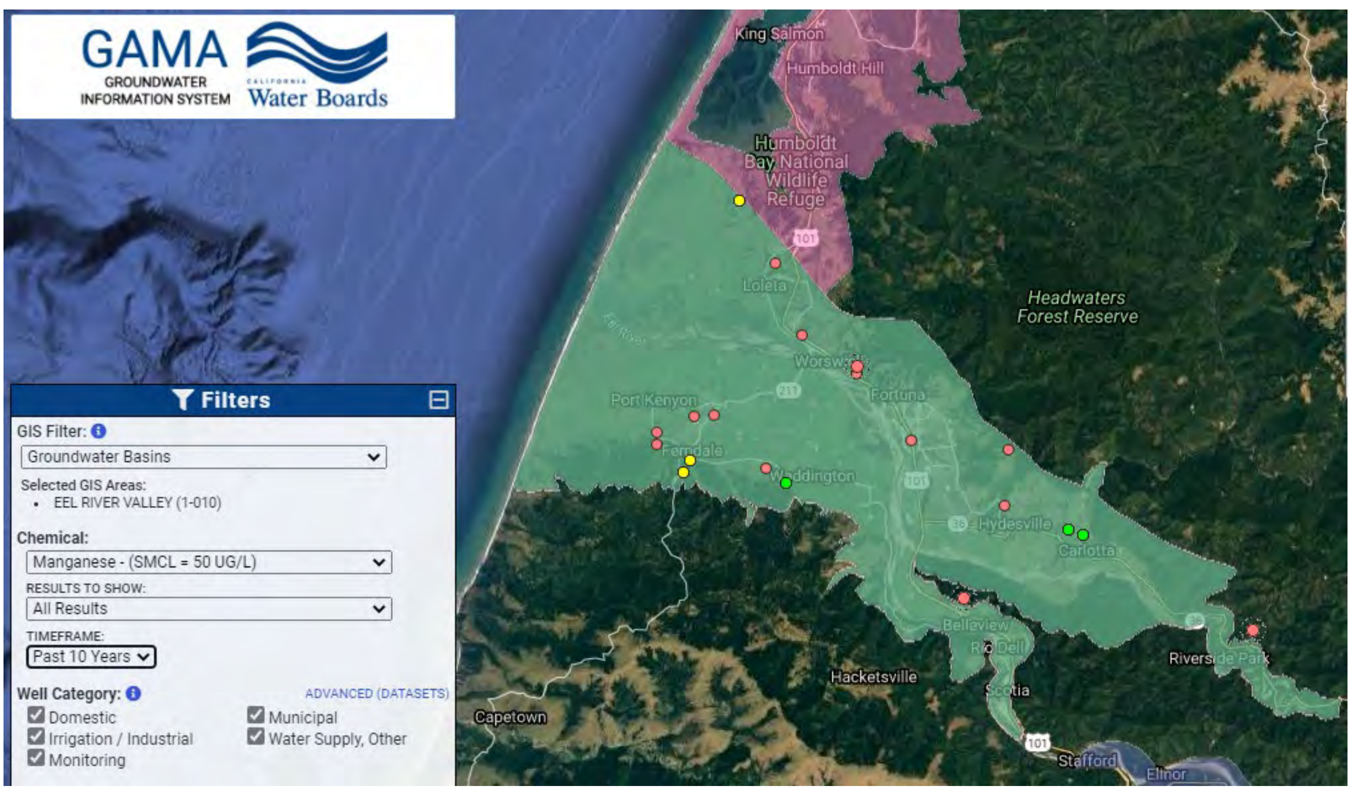



Image 4, Bottom: Wells with available data for manganese concentrations for the past 10 years.

# Water Use Technical Memorandum (TM-15)

# Water Use Estimates

## For Eel River Valley Groundwater Basin

Humboldt County Department of Public Works

January 11, 2022

**GHD**
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→ **The Power of Commitment**

# Contents



# Table Index

# Appendices

# 1. Introduction

## 1.1 Purpose

The purpose of this technical memorandum (TM) is to summarize the water use components of the Eel River Valley Groundwater Basin (ERVB) water budget, to be included in the Groundwater Sustainability Plan (GSP). The summary comprises data sources, monitored/recorded values, and an overview of derivation methodology. This technical memorandum focuses on consumptive surface and groundwater uses via inflows and outflows (inputs and outputs) of the ERVB's water budget. Non-consumptive elements of the water budget, such as streamflow, precipitation, and non-consumptive groundwater infiltration, are included in the water budget and discussed in Section 5 of the GSP.

## 1.2 Water Use Components

Consumptive surface water and groundwater elements of the water budget result from municipal, domestic, commercial, industrial, agricultural, and cannabis uses. Herein, consumptive uses for both surface water and groundwater are referred to as outflows or inflows. Evapotranspiration is a key component of the water budget. Evapotranspiration from urban landscape land uses is considered a surface water consumptive use, while evapotranspiration from irrigated crops is considered a groundwater consumptive use.

Surface water outflows consist of direct withdrawals for irrigation and municipal diversions. Surface water inflows consist of municipal returns of wastewater effluent discharge. Surface water consumption is a very small portion of the ERVB's overall surface water outflow budget, at 0.01% or less (Table 1). Similarly, surface water inflow (returns) are also very small portions of the overall surface water subsection of the water budget for the Basin at 0.01% for the 2011-2020 period. Evapotranspiration from surface water (urban landscape consumptive uses) encompasses a higher portion of the surface water outflow subsection of the water budget, at 0.39%.

*Table 1. Summary of proportion of the surface water subsection of the Basin's water budget for surface water use components, 2011-2020*

| **Surface Water Component** | **Irrigation Diversions from Surface Waters** | **Municipal Diversions from Rio Dell and Scotia** | **Evapotranspiration from Surface Water (Urban Landscape)** | **Municipal Wastewater Effluent Returns** |
|---|---|---|---|---|
| **Water Budget Component** | Surface Water Outflow | Surface Water Outflow | Surface Water Outflow | Surface Water Inflow |
| **Approximate Percent of Water Budget** | < 0.001% | 0.01% | 0.39% | 0.01% |

Groundwater outflows result from pumping and evapotranspiration. Groundwater outflow from pumping includes municipal, domestic, commercial, industrial, agriculture irrigation, and cannabis uses. Groundwater pumping from the 2011 through 2020 period totals a slightly larger portion of all groundwater outflows in the groundwater subsection of the Basin's water budget, at 5.05% (Table 2). Evapotranspiration from groundwater (irrigated crops) results in the highest portion of the groundwater outflow subsection of the water budget compared to other consumptive groundwater uses, at 16.46%.

Groundwater inflow includes municipal returns of wastewater effluent discharge, as well as non-municipal infiltration returns from domestic and commercial users but exclude irrigation water returns. Groundwater inflow (returns) is proportionally smaller, totaling 0.46% of all groundwater inflow in the groundwater inflow subsection of the water budget and result from wastewater effluent infiltration (Table 3).

*Table 2. Summary of proportion of groundwater subsection of the Basin's water budget for groundwater use outflow components, 2011-2020*

| Groundwater Component | Municipal Pumping | Domestic Pumping | Commercial / Industrial Pumping | Irrigation Pumping | Cannabis Pumping | Evapotranspiration from Groundwater | Total |
|---|---|---|---|---|---|---|---|
| **Approximate Percent of Water Budget** | 0.6% | 0.14% | 0.01% | 4.27% | 0.03% | 16.46% | **35.47%** |

*Table 3. Summary of proportion of groundwater subsection of the Basin's water budget for groundwater use inflow components, 2011-2020*

| Groundwater Component | Municipal Wastewater Effluent | Non-Municipal Wastewater Effluent | Total |
|---|---|---|---|
| **Approximate Percent of Water Budget** | 0.31% | 0.15% | **0.46%** |

## 1.2.1 Surface Water

Within the Basin's water budget, surface water uses are described as both outflows and inflows (outputs and inputs). Direct agriculture irrigation diversions are derived from land use estimates for surface water irrigated crops and water use estimates per acre, as shown in the Agriculture Water Use TM, and are the smallest surface water outflow component of the water budget (< 0.001%, see Table 1), ranging from 63 to 88 acre-feet annually. Municipal pumping by the City of Rio Dell and the Scotia Community Services District (CSD) is also a small component of surface water outflow (< 1,000 acre-feet annually) and approximately 0.01% of the water budget (Table 1). The city and CSD provided measured surface water use data for input into the water budget.

Surface water returns (inflow) from wastewater effluent from Ferndale, Fortuna, Loleta, Rio Dell, and Scotia are also included in the water budget, averaging 833 acre-feet annually between 2011 and 2020. The combined wastewater effluent is a very small component of the surface water inflow water budget (0.01%, Table 1).

## 1.2.2 Groundwater

Within the Basin's water budget, groundwater water uses are described as both outflows and inflows (outputs and inputs). Consumptive groundwater use in the Basin is driven by groundwater pumping, which is categorized as an outflow in the water budget. Groundwater outflow in the Eel River Valley basin is accounted for in the water budget and includes pumping for municipal, domestic, agriculture irrigation, and cannabis uses, Bear River Band of the Rohnerville Rancheria, Del Oro (Ferndale), City of Fortuna, Hydesville Water Service District, Loleta CSD, Palmer Creek CSD, City of Rio Dell, Palmer Creek CSD, Riverside CSD, and unincorporated areas in Humboldt County. Groundwater outflows from service providers were input into the water budget from service provider recordkeeping. Municipal and irrigation uses are smaller groundwater outflow components of the water budget and show less variability among water year types. Combined, groundwater pumping totals 5.05% of all groundwater outflow in the ERVB's water budget, with the largest portion attributable to agriculture irrigation pumping (4.27%, Table 2). Groundwater use components of the ERVB's groundwater outflow water budget that result in groundwater returns include municipal and non-municipal wastewater effluent via land application or infiltration but exclude agricultural irrigation return flows. Combined wastewater effluent returns are also very small components of the ERVB's groundwater inflow budget, totaling approximately 0.46% (Table 3).

# 2. Surface Water Components

Consumptive surface water inflows and outflows captured in the ERVB's water budget include irrigation diversions, municipal diversions, and municipal wastewater effluent returns.

## 2.1 Irrigation Diversions

Within the water budget, irrigation diversions are considered surface water outflows. Within the ERVB, only four (4) parcels, totaling 126.3 acres of grazed pasture, use direct surface water diversion for agriculture irrigation purposes. The parcels are irrigated with a traveling gun, and the water source is Oil Creek, a tributary to the Eel River.

Surface water diversion for agriculture irrigation is a relatively small portion of the consumptive surface water use components in the water budget, averaging 117 acre-feet annually (Table 4). At 0.32 acre-feet per day, the equivalent annual average discharge withdrawn from surface waters is approximately 0.16 cubic feet per second (cfs). Diversions were lowest during the two Wet water years, in 2011 and 2017. The volume of water for this component was based upon mapped irrigation area and the annual irrigation water demand estimate, which was determined by the Humboldt County Resource Conservation District (RCD) and the County Department of Public Works (DPW) using flow meter data from several irrigated facilities during 2021. Demand rates are presented as a volume of water per land area.

*Table 4. Total annual irrigation surface water diversion within the ERVB in acre-feet*

| 2011 *Wet* | 2012 *Below Normal* | 2013 *Below Normal* | 2014 *Critical* | 2015 *Dry* | 2016 *Above Normal* | 2017 *Wet* | 2018 *Above Normal* | 2019 *Below Normal* | 2020 *Dry* | 2011-2020 Average |
|---|---|---|---|---|---|---|---|---|---|---|
| 101 | 114 | 114 | 152 | 126 | 114 | 101 | 114 | 114 | 126 | 117 |

## 2.2 Municipal Diversions

Within the ERVB's water budget, municipal diversion is considered surface water outflow. The municipalities of Rio Dell and Scotia both pump water from the Eel River, via their water treatment plants, to supply their potable water demand. Water production records were provided by the municipalities. Data from Scotia is based on water use rates from the Town of Scotia CSD Municipal Service Review (Humboldt County DPW 2010). Scotia's annual average water usage is estimated to be 543 acre-feet. Monthly use estimates are made using scaled monthly records from the City of Fortuna's water usage as a point of reference.

From 2010 to 2020, total municipal diversion from the City of Rio Dell and Scotia CSD averaged 824 acre-feet annually (Table 5). At 2.26 acre-feet per day, the equivalent annual average discharge withdrawn from surface waters is approximately 1.14 cfs. Usage does not substantially vary based on water year conditions. Municipal diversion of surface waters represents a very small component of surface water outflow in the overall ERVB water budget, at 0.1%.

*Table 5. Total annual municipal surface water diversion within the ERVB in acre-feet*

| 2011 *Wet* | 2012 *Below Normal* | 2013 *Below Normal* | 2014 *Critical* | 2015 *Dry* | 2016 *Above Normal* | 2017 *Wet* | 2018 *Above Normal* | 2019 *Below Normal* | 2020 *Dry* | 2011-2020 Average |
|---|---|---|---|---|---|---|---|---|---|---|
| 847 | 857 | 893 | 837 | 797 | 816 | 805 | 809 | 765 | 812 | 824 |

## 2.3 Municipal Wastewater Effluent Discharge to Surface Waters

Within the ERVB's water budget, municipal wastewater effluent discharge (returns) to the river is considered a surface water inflow. The water budget sums wastewater effluent returns from the communities of Rio Dell, Loleta, Scotia, Ferndale, Fortuna, and Palmer CSD (included with Fortuna).

Wastewater flows are estimated as a percentage of water use relative to streamflow in the Eel River. Municipal discharge to the Eel River is only allowable during periods of higher flows. Discharge records from the City of Fortuna help determine when effluent discharge to the river occurred or when effluent discharge was attributed to land application or infiltration (groundwater) discharge. Over the 2010 through 2020 period, total municipal effluent wastewater returns from the communities of Rio Dell, Loleta, Scotia, Ferndale, Fortuna, and Palmer CSD averaged 833 acre-feet. It should be noted that wastewater effluent includes water that was originally from both surface water diversion and groundwater. At 2.28 acre-feet per day, the equivalent annual average discharge return to surface waters is approximately 1.15 cfs. Return flows from municipal wastewater effluent do not substantially vary based on water year conditions.

*Table 6. Total annual municipal wastewater effluent discharge to surface waters in acre-feet*

| **2011** *Wet* | **2012** *Below Normal* | **2013** *Below Normal* | **2014** *Critical* | **2015** *Dry* | **2016** *Above Normal* | **2017** *Wet* | **2018** *Above Normal* | **2019** *Below Normal* | **2020** *Dry* | **2011-2020 Average** |
|---|---|---|---|---|---|---|---|---|---|---|
| 838 | 823 | 872 | 869 | 810 | 797 | 793 | 822 | 814 | 897 | 833 |

# 3. Groundwater Components

Consumptive groundwater outflow in the ERVB's water budget include pumping from municipal, domestic, commercial, industrial, agriculture irrigation, and cannabis water users. It should be noted that permitted cannabis water supply within the ERVB is primarily from groundwater, though within the larger watershed, but outside of the ERVB, surface water sources are more commonly used. These diversions of surface water from outside of the ERVB would be reflected in U.S. Geological Survey (USGS) stream flow gauges at the ERVB boundaries (Bridgeville and Scotia gauges). Groundwater inflows are limited to municipal wastewater effluent returns via land application and infiltration, as well as non-municipal and domestic wastewater effluent return (septic leach fields).

## 3.1 Municipal Pumping

Within the ERVB's water budget, municipal groundwater pumping is a groundwater outflow, estimated based on available records, which vary by entity. Municipal water suppliers provided groundwater usage in a monthly or annual format. Municipal pumping ranges from 1,599 to 1,832 acre-feet annually (Table 7). Data provided by each municipality or CSD for incorporation into the ERVB's water budget is summarized as follows:

- Loleta CSD – annual groundwater production based on monthly water usage from 2015 through 2020; usage from 2011 through 2015 based on monthly average values of the 2015 through 2020 data
- Palmer Creek CSD – annual groundwater production from 2010 through 2020 summed from monthly production records
- Bear River Band of the Rohnerville Rancheria– annual groundwater production summed monthly from production records for the Tish Non and Spring Hill water production facilities, from 2014 through 2020

- City of Fortuna – annual groundwater production summed monthly from production records from municipal wells for the 2010 through 2020 period
- City of Rio Dell – groundwater production commenced in 2018; annual groundwater production data provided in gallons for 2018, 2019, and 2020 only; usage for 2011 through well production in 2018 was set at zero acre-feet
- Hydesville Community Water District – annual groundwater production summed monthly production records for 2010 through 2020
- Del Oro Water Company (Ferndale) – annual groundwater production summed monthly from production records for the Low Springs, High Springs, and Van Ness wells for 2010 through 2020
- Riverside CSD – annual groundwater production based on average annual water usage from 2005 through 2007, 2009 through 2013, and 2015; water use records for 2008, 2014, or 2016 through 2020 were unavailable; average annual usage modeled in place of unavailable pumping data, converted to monthly data based on the usage patterns of other ERVB municipalities that kept monthly usage records, as usage was not equivalent across all months

***Table 7. Total annual municipal groundwater pumping in acre-feet***

| **2011** *Wet* | **2012** *Below Normal* | **2013** *Below Normal* | **2014** *Critical* | **2015** *Dry* | **2016** *Above Normal* | **2017** *Wet* | **2018** *Above Normal* | **2019** *Below Normal* | **2020** *Dry* | **2011-2020 Average** |
|---|---|---|---|---|---|---|---|---|---|---|
| 1,772 | 1,727 | 1,764 | 1,814 | 1,599 | 1,660 | 1,673 | 1,729 | 1,758 | 1,832 | 1,733 |

## 3.2 Domestic (Non-Municipal) Pumping

Within the ERVB's water budget, domestic (residential wells) groundwater pumping is a groundwater outflow. Total non-municipal domestic pumping is estimated at 414 acre-feet annually, for all years, for parcels that are outside of municipal water supply systems. The amount of water pumped is based upon the number of dwelling units for the given parcels. Water use for the parcel is based upon data from several sources and includes land use zoning, parcel improvements, and parcel size. Six datasets were used to create the water/wastewater demand:

- Assessor Parcel data was received from the County of Humboldt in January 2021
- CSD boundaries were downloaded from the county GIS data portal and dated August 2020
- Del Oro Water Company and Riverside CSD boundaries were provided by Humboldt County in March 2021
- Bear River Band of the Rohnerville Rancheria parcels were identified using County parcel data
- City boundaries were downloaded from the county GIS data portal and dated July 2019
- Building outlines were provided by the County of Humboldt in March 2021

The city, CSD, and tribal boundaries are spatially joined to the parcel data based on the center point of each parcel boundary. For example, if the center point of a parcel falls within a city boundary, even though the entire boundary is not contained in the city boundary, then the parcel is considered within the city. In places where a CSD and city boundary overlap, both entities are listed. This produces a layer of parcels that note which entity may be providing water or wastewater services.

To calculate total square footage of buildings within each parcel, the building footprint layer is associated by the Assessor Parcel Number (APN). This gives a general sense of building sizes within each parcel.

Once all the layers are joined, data is exported from GIS to excel, and from there further assumptions can be made about water and wastewater demand. To determine which parcels, include domestic groundwater pumping, the following GIS analysis starts with all parcels in the entire ERVB:

1. Exclude all parcels with the word "vacant" in the description AND are assigned an improved value less than $5,000
2. Exclude roads, streets, etc.; these parcels had a value of "no" under the parcel attribute in the original parcel shapefile and were excluded on that basis
3. Determine the building footprint size on each parcel; the area is the sum of all buildings on the parcel (completed in GIS)
4. Initially, parcels within the Palmer Creek CSD areas were retained, but later excluded because the Palmer CSD provides water, and wastewater goes to the Fortuna wastewater treatment plant (WWTP), to avoid double counting with municipal data
5. Remove all non-residential parcels with buildings that would not have septic loads, such as storage sheds or hay barns; these are denoted as parcels with building footprint AND improved value equaling 0
6. Remove non-residential parcels with no buildings (description = Rural, Agricultural, Misc Imps, Unrestricted), as recommended by Humboldt County Planning Director John Ford, given undeveloped parcels would not result in any domestic water demand
7. Remove residential parcels with improvement values of less than $5,000, as recommended by Humboldt County Planning Director, John Ford, given unimproved parcels (<$5,0000) would not result in any domestic water demand

The pumping rates per parcel were based upon the number of dwelling units assigned to each parcel, the number of people per dwelling unit, and water demand per person. There were 1,498 parcels that had or had the potential to have a domestic dwelling. The number of dwelling units for each parcel was assigned based upon the zoning, zoning description and parcel improvements. Dwelling units per parcel ranged from 1 to 10. It was assumed that there were 2.4 persons per dwelling unit. This value was based upon the US Census website for Humboldt County. The water use per person was assumed to be 100 gallons per day per person. This value is conservative and is consistent with USGS Estimated Use of Water in the United States in 2015 (USGS 2017). This resulted in 240 gallons per dwelling unit per day. The yearly domestic water demand was calculated by multiplying the number of dwelling units per parcel by the water demand per dwelling unit by the number of days in the year. The yearly domestic water demand per parcel ranged from 0.27 to 2.69 acre-feet per year. The total domestic water demand is calculated by summing up the yearly domestic water demand for all selected parcels. This resulted in 414-acre feet per year for the basin.

## 3.3 Commercial and Industrial Pumping

Within the ERVB's water budget, commercial and industrial groundwater pumping is considered groundwater outflow for parcels that are outside of municipal water supply systems. Commercial and industrial users comprise public lands, schools, community buildings, motels, restaurants, heavy industry, wood products, miscellaneous commercial, and light industrial. The pumping for these parcels is estimated at 34 acre-feet annually for all years. Water use for the parcel is based upon land use zoning, parcel improvements, and parcel size. The GIS analysis used to determine domestic groundwater pumping is also applied to determine commercial and industrial pumping. As an exception, non-residential parcels are retained in the analysis and residential parcels excluded. Parcels identified as agriculturally irrigated parcels in the Humboldt County RCD irrigated acres databased are also excluded.

With commercial and industrial parcels identified, a pumping rate based on the equivalent number of dwelling units is applied to each unique parcel. The equivalent dwelling unit values are determined based on the building square footage. The County planning department provided water consumption per day per square foot (sf) of building for various types of zoning, as summarized in Table 8. The total water use per parcel ranges from 0.1 to 4.13 acre-feet per year. The data was provided as Excel files that were exported from the County parcels database.

*Table 8. Commercial and industrial water use per square foot*

| Description | Assumed Building Category | Water Use (gallons per thousand sq ft per day) |
|---|---|---|
| **Comm – Motel, Rest, Serv Stn** | Lodging | 189 |
| **Commercial Golf Course** | Other | 48.9 |
| **Commercial Mini-Warehouse** | Warehouse and Storage | 9.3 |
| **Commercial Office** | Office | 40 |
| **Commercial Retail, 2000 and above** | Mercantile | 34.3 |
| **Commercial Retail, to 1999 square feet** | Mercantile | 34.3 |
| **Commercial Warehouse** | Warehouse and Storage | 9.3 |
| **Commercial, Garage** | Warehouse and Storage | 9.3 |
| **Commercial, Misc** | Other | 48.9 |
| **Common Area, Commercial** | Other | 48.9 |
| **Full-Service Restaurant** | Fast Food or Small Restaurant | 68 |
| **Heavy Industrial, Wood Product** | Other | 48.9 |
| **Industrial – Light** | Other | 48.9 |
| **Misc Light Industrial** | Other | 48.9 |
| **Public Land, Schools, Non-Taxable Entities** | Other | 48.9 |
| **Public Utilities** | Other | 48.9 |

## 3.4 Agriculture Irrigation Pumping

Within the ERVB's water budget, groundwater pumping for irrigation is considered groundwater outflow. Irrigation pumping from groundwater is based upon mapped irrigation areas and the annual irrigation water demand estimate using direct measurement data, as documented in the Agricultural Water Use TM (Humboldt County 2021). Humboldt County determined the annual estimate using flow meter data from several irrigated facilities (Humboldt County, November 2021). These demand rates vary by water year type and are presented as a volume of water per land area. Irrigation pumping ranges from 10,694 to 14,848 acre-feet annually, higher during drier water year types (Table 9).

*Table 9. Total annual irrigation groundwater pumping in acre-feet*

| 2011 *Wet* | 2012 *Below Normal* | 2013 *Below Normal* | 2014 *Critical* | 2015 *Dry* | 2016 *Above Normal* | 2017 *Wet* | 2018 *Above Normal* | 2019 *Below Normal* | 2020 *Dry* | 2011-2020 Average |
|---|---|---|---|---|---|---|---|---|---|---|
| 10,694 | 12,196 | 12,196 | 14,848 | 13,522 | 11,754 | 10,694 | 11,754 | 12,196 | 13,522 | 12,338 |

# 3.5 Cannabis Pumping

Within the ERVB's water budget, groundwater pumping for cannabis cultivation is considered a groundwater outflow. Water demand for cannabis irrigation is assumed to come from groundwater wells, developed by estimating the number of plants and irrigated areas based upon permitted cannabis cultivation sites within the ERVB as provided by the Humboldt County Planning and Building Department. In 2020, the Basin included approximately 50 sites with cannabis permits, primarily for outdoor or mixed-light cultivation. The indoor growing season was assumed to be year-round and the outdoor irrigation period was assumed to extend from June through October. Water demand per plant estimates is evaluated from several sources. Demand rates range from one (1) to 15 gallons per plant per day. For this analysis, a value of six (6) gallons per plant per day are used for outdoor plants (Bauer et al. 2015). Indoor cannabis has a much lower demand of 0.5 gallons per plant per day (Mills 2012). The demand for unpermitted cannabis sites is estimated as an additional 30% of the permitted demand. This is based upon California Department of Fish and Wildlife (CDFW) estimates for other north coast basins (Bauer et al. 2015). Cannabis pumping is assumed to be 98 acre-feet annually for all years, independent of water year type and including the additional 30% from unpermitted cannabis sites.

# 3.6 Municipal Wastewater Effluent Infiltration or Land Application Discharge

Within the Basin's water budget, municipal wastewater effluent infiltration or land application are considered groundwater inflow and account for wastewater effluent from the City of Rio Dell, Loleta CSD, City of Ferndale, Scotia CSD, City of Fortuna (which includes the Palmer CSD), and Bear River Band of the Rohnerville Rancheria based on records provided by each municipality for 2010 through 2020. The volume of wastewater effluent is based upon a percentage of water production (70%). This value is validated by wastewater flow records from Fortuna during months with little or no precipitation, when stormwater inflow an infiltration are not factors. Groundwater inflow from municipal wastewater averaged 895 acre-feet annually for 2011 through 2020 (Table 10). Additional details for each municipality are as follows:

- Loleta CSD – annual wastewater effluent discharge based on a percentage of water production; wastewater discharge to infiltration occurs in months when there is no discharge into the river, as described in Section 2.3 of this TM
- Bear River Band of the Rohnerville Rancheria – annual wastewater effluent discharge based on a percentage of water production; all Bear River wastewater goes to septic leach fields
- City of Fortuna – municipal wastewater effluent infiltration summed from monthly records at Strongs Creek near the City of Fortuna Waste Water Treatment Plant (WWTP) from 2010 through 2020; Fortuna's annual wastewater effluent land disposal volumes also summed from monthly records available from 2010 through 2020
- City of Rio Dell – annual wastewater effluent discharge based on a percentage of water production; wastewater discharge to infiltration occurs in months when there is no discharge into the river, as described in Section 2.3 of this TM
- City of Ferndale – annual wastewater effluent discharge based on monthly WWTP records from October 2012, when the new WWTP went into operation, through 2020; discharge to surface waters (Salt River) occurs from October 1 through May 14, annually, but otherwise, wastewater disposal

occurs via land discharge; average annual usage modeled in place of unavailable wastewater data (all months in 2011 and some months in 2012) prior to contemporary record keeping available for the new WWTP

*Table 10. Total annual municipal wastewater effluent infiltration or land application discharge in acre-feet*

| 2011<br>*Wet* | 2012<br>*Below Normal* | 2013<br>*Below Normal* | 2014<br>*Critical* | 2015<br>*Dry* | 2016<br>*Above Normal* | 2017<br>*Wet* | 2018<br>*Above Normal* | 2019<br>*Below Normal* | 2020<br>*Dry* | 2011-2020 Average |
|---|---|---|---|---|---|---|---|---|---|---|
| 869 | 784 | 1,047 | 1,002 | 1,038 | 726 | 744 | 842 | 864 | 1,038 | 895 |

## 3.7 Non-Municipal Domestic and Commercial/Industrial Wastewater Effluent Infiltration

Within the Basin's water budget, non-municipal domestic, commercial, and industrial wastewater effluent (septic) are considered groundwater inflow. Non-municipal domestic, commercial, and industrial pumping is estimated for parcels outside of municipal water supply systems to be 426 acre-feet annually for 2011 through 2020. The amount of water pumped is based upon the number of dwelling units or industrial processes for given parcels. Water use for a parcel is based upon land use zoning, parcel improvements, and parcel size.

# 4. Consumptive Evapotranspiration

Within the ERVB's water budget, evapotranspiration from open water, riparian, and urban landscape land uses is considered surface water outflow, while evapotranspiration from irrigated crops and natural vegetation land uses is considered groundwater outflow. Within evapotranspiration, consumptive evapotranspiration results from irrigation via surface water and groundwater, waste water effluent returns, and the urban landscape. Evapotranspiration from urban landscape is assumed to draw water from sources of water that are accounted for in the municipal supply and not from rivers or open water. Evapotranspiration attributed to both surface water and groundwater is estimated using the California Department of Water Resources (DWR) Cal-SIMETAW model. In August 2019, DWR began operating a California Irrigation Management Information System (CIMIS) station in Ferndale which collects data that can be processed to generate site-specific estimates of evapotranspiration, which are likely to be more accurate than the Cal-SIMETAW modeling estimates. However, the CIMIS data were not used for the water budget because the water budget spans a period of ten years and the CIMIS data were available for only a small portion of this period. For additional information regarding the determination of land uses used to estimate evapotranspiration in the Cal-SIMETAW model, please see Section 2.5 of the Land Use Inventory for the Eel River Valley Basin (GHD 2021) and Agriculture Water Use Technical Memorandum for the Eel River Groundwater Basin (Humboldt County Department of Public Works, 2021).

## 4.1 Evapotranspiration from Urban Landscape

Evapotranspiration from urban landscape land uses is analyzed as surface water outflow in the ERVB's water budget, estimated using the DWRs Cal-SIMETAW model. The model produces monthly evapotranspiration rates for various crop types, native (or natural) vegetation, riparian, and open water. The land use areas are determined by combining the irrigated areas land use and remote image analysis. This produces the areas of natural vegetation, riparian, impervious surfaces, and open water, which is then used with the Cal-SIMETAW evapotranspiration rates to calculate the monthly water demand. The monthly demand is then summed for each water year to calculate the annual amount.

Evapotranspiration from surface water attributable to urban landscape ranges from a minimum of 37,837 acre-feet in 2012 (Below Normal water year) to a maximum of 42,318-acre feet in 2017 (Wet water year, Table 11). Within the water budget, surface water outflows via evapotranspiration are substantially higher (factor of ten) than the sum of surface water outflows from irrigation and municipal diversions combined.

*Table 11 Total Annual Evapotranspiration from Urban Landscape in Acre-Feet*

| 2011 *Wet* | 2012 *Below Normal* | 2013 *Below Normal* | 2014 *Critical* | 2015 *Dry* | 2016 *Above Normal* | 2017 *Wet* | 2018 *Above Normal* | 2019 *Below Normal* | 2020 *Dry* | 2011-2020 Average |
|---|---|---|---|---|---|---|---|---|---|---|
| 41,809 | 37,837 | 39,679 | 40,761 | 41,095 | 41,621 | 42,318 | 41,621 | 40,553 | 41,406 | 40,870 |

## 4.2 Evapotranspiration from Irrigated Crops

Several sources for estimating evapotranspiration for irrigated crops include DWRs Cal-SIMETAW model, DWRs California Irrigation Management Information System Ferndale Plains Station #259 (CIMIS # 259) (https://cimis.water.ca.gov/WSNReportCriteria.aspx ), and DWRs average reference evapotranspiration for Zone 1 Coastal Plains Heavy Fog Belt of 32.9” (https://cimis.water.ca.gov/Content/pdf/CimisRefEvapZones.pdf). Evapotranspiration from irrigated crops is analyzed as groundwater outflow in the ERVB’s water budget. DWRs Cal-SIMETAW model produces monthly evapotranspiration rates for various irrigated crop types, native (or natural) vegetation, riparian, and open water, land use areas determined by combining the irrigated areas, land use and remote image analysis, developed by the Humboldt County RCD and recently updated in the Land Use Technical Memorandum (GHD, 2021). These areas are used with the Cal-SIMETAW evapotranspiration rates to calculate the monthly crop evapotranspiration. The monthly demand due to evapotranspiration is summed for each water year to calculate the annual amount.

Evapotranspiration for irrigated crops sums irrigation from groundwater. Based on DWRs Cal-SIMETAW model results, evapotranspiration from groundwater averages 44,286 acre-feet and was variable over the 2011 through 2020 period, based on water year conditions. The value of the evapotranspiration of irrigated crops does not include the amount of water applied from irrigation supply wells, presented in Section 3.4. The total evapotranspiration of irrigated crops, which includes irrigation pumping (Table 9), wastewater irrigated crops, and surface water irrigated crop is presented in Table 12. Within the water budget, groundwater outflows via evapotranspiration are substantially higher than the sum of groundwater outflows from other groundwater consumptive uses, including irrigation pumping.

*Table 12. Annual evapotranspiration from irrigated crops in acre-feet*

| 2011 *Wet* | 2012 *Below Normal* | 2013 *Below Normal* | 2014 *Critical* | 2015 *Dry* | 2016 *Above Normal* | 2017 *Wet* | 2018 *Above Normal* | 2019 *Below Normal* | 2020 *Dry* | 2011-2020 Average |
|---|---|---|---|---|---|---|---|---|---|---|
| 46,287 | 39,787 | 42,349 | 43,752 | 44,290 | 45,940 | 46,289 | 45,940 | 43,474 | 44,752 | 44,286 |

There is a significant difference between the reference evapotranspiration (ETo) used in the Cal-SIMETAW model and the ETo observed at the Ferndale Plain CIMIS station. For the period 2000-2015, the average annual ETo in the Cal-SIMETAW model was 46.52” (Min – 40.94”; Max – 50.81”). These values are much greater than the ETo values observed at the Ferndale Plain CIMIS station #259 for 2020 and 2021 of 35.08” and 33.71” respectively.

While the ETo from CIMIS #259 is significantly less than the reference evapotranspiration used in the Cal-SIMETAW model, the ETo from CIMIS #259 is consistent with DWRs average reference evapotranspiration for Zone 1 Coastal Plains Heavy Fog Belt of 32.9” (https://cimis.water.ca.gov/Content/pdf/CimisRefEvapZones.pdf).

Since the evapotranspiration for each land use type (ETc) is calculated by multiplying the ETo by the relevant crop coefficient (Kc), the ETo is the determining factor for evapotranspiration estimates. Because the Cal-SIMETAW model uses an ETo that is significantly higher than that observed at the Ferndale Plain CIMIS station #259, annual evapotranspiration is likely overestimated. Through collaboration with DWR and as more CIMIS data are available, the accuracy of estimated evapotranspiration is expected to improve.

# 5. References

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USGS 2017, Estimated Use of Water in the United States in 2015, Circular 1441 Water Availability and Use Science Program.

# Appendix A

## Municipal Water Use Data

Municipal Water Provider Raw Data

Municipal Water Provider Processed Data

Municipal Water Provider Summary

| Loleta Raw Data | | | |
|---|---|---|---|
| Month | Year | Prouction in Gallons | Backwash In Gallons |
| July | 2020 | 2,623,900 | 12,300 |
| June | | 2,367,600 | 12,200 |
| May | | 2,140,900 | 5,200 |
| April | | 2,157,000 | 8,600 |
| March | | 2,110,200 | 8,600 |
| February | | 1,828,900 | 4,100 |
| Jan | | 1,865,900 | 8,000 |
| December | 2019 | 1,872,900 | 4,100 |
| November | | 1,795,000 | 8,000 |
| October | | 1,823,300 | 4,000 |
| September | | 2,144,300 | 10,300 |
| August | | 2,341,900 | 5,100 |
| July | | 2,362,400 | 10,300 |
| June | | 2,048,000 | 5,100 |
| May | | 1,851,000 | 10,200 |
| April | | 1,966,700 | 9,500 |
| March | | 2,003,300 | 9,400 |
| February | | 1,754,700 | 4,700 |
| January | | 1,939,900 | 9,500 |
| December | 2018 | 2,000,000 | 4,800 |
| November | | 1,927,000 | 4,900 |
| October | | 2,224,500 | 9,500 |
| September | | 2,873,100 | 9,500 |
| August | | 2,940,100 | 9,400 |
| July | | 3,041,100 | 4,600 |
| June | | 2,934,800 | 15,000 |
| May | | 3,119,700 | 10,100 |
| April | | 2,529,400 | 10,100 |
| March | | 2,051,200 | 8,000 |
| February | | 2,047,300 | 9,900 |
| January | | 2,411,500 | 9,900 |
| December | 2017 | 2,349,000 | 9,800 |
| November | | 2,383,300 | 9,900 |
| October | | 2,465,300 | 9,900 |
| September | | 2,420,600 | 9,800 |
| August | | 2,578,400 | 9,800 |
| July | | 2,389,500 | 10,400 |
| June | | 2,177,200 | 5,500 |
| May | | 2,108,600 | 11,200 |
| April | | 1,978,800 | 5,800 |
| March | | 2,225,900 | 5,900 |
| February | | 1,665,700 | 6,000 |
| January | | 1,930,000 | 3,700 |

| Loleta Raw Data | | | |
|---|---|---|---|
| Month | Year | Prouction in Gallons | Backwash In Gallons |
| December | 2016 | 1,789,000 | 8,700 |
| November | | 1,961,200 | 5,600 |
| October | | 1,793,700 | 5,700 |
| September | | 1,948,100 | 13,600 |
| August | | 2,088,100 | 5,900 |
| July | | 1,995,600 | 6,100 |
| June | | 1,479,200 | 6,200 |
| May | | 2,631,400 | 13,800 |

| Loleta Summary by Year | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Units | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| Water | Acre Feet / Year | 75.6 | 75.6 | 75.6 | 75.6 | 75.6 | 67.1 | 76.8 | 95.6 | 75.4 | 63.2 |
| Creek WW | Acre Feet / Year | 26.5 | 29.3 | 21.9 | 23.2 | 33.8 | 28.7 | 25.7 | 33.5 | 21.1 | 27.6 |
| Land WW | Acre Feet / Year | 26.4 | 23.6 | 31.0 | 29.7 | 15.1 | 18.3 | 28.0 | 33.4 | 31.7 | 28.0 |

| Fortuna Raw Data | | | | | | |
|---|---|---|---|---|---|---|
| Note: Palmer Pumped = Palmer CSD wastewater conveyed to Fortuna | | | | | | |
| Cal Year | Month | Water Year | Total Pumped (MG) | RKM Note | Pumped (AF) | Palmer Pumped (AF) |
| 2010 | 10 | 2011 | 32.91 | Average | 101 | 0 |
| 2010 | 11 | 2011 | 28.97 | Average | 89 | 0 |
| 2010 | 12 | 2011 | 29.21 | Average | 90 | 0 |
| 2011 | 1 | 2011 | 30 | Original script value = 7 MGD. Data different from other months; could be incomplete or format not yet standardized. Using average of remaining January values. | 93 | 0 |
| 2011 | 2 | 2011 | 27 | Original script value = 6 MGD. Data incomplete. Using average of remaining February values. | 82 | 2 |
| 2011 | 3 | 2011 | 30 | Original script printed error. no data in original file provided by City. Using average of remaining March values. | 92 | 0 |
| 2011 | 4 | 2011 | 33 | | 100 | 0 |
| 2011 | 5 | 2011 | 35 | | 109 | 0 |
| 2011 | 6 | 2011 | 39 | | 121 | 0 |
| 2011 | 7 | 2011 | 48 | | 146 | 0 |
| 2011 | 8 | 2011 | 47 | | 146 | 0 |
| 2011 | 9 | 2011 | 45 | | 138 | 3 |
| 2011 | 10 | 2012 | 36 | | 112 | 0 |
| 2011 | 11 | 2012 | 31 | | 96 | 2 |
| 2011 | 12 | 2012 | 31 | | 96 | 0 |
| 2012 | 1 | 2012 | 31 | | 97 | 2 |
| 2012 | 2 | 2012 | 30 | | 91 | 2 |
| 2012 | 3 | 2012 | 33 | | 100 | 2 |
| 2012 | 4 | 2012 | 33 | | 100 | 2 |
| 2012 | 5 | 2012 | 34 | Original script value = 999 MGD. From original file provided by City, using 34.4 | 106 | 2 |
| 2012 | 6 | 2012 | 43 | | 131 | 2 |
| 2012 | 7 | 2012 | 39 | | 120 | 2 |
| 2012 | 8 | 2012 | 35 | Original script value = 982 MGD. From original file provided by City, using 34.691 | 106 | 2 |
| 2012 | 9 | 2012 | 32 | | 97 | 3 |
| 2012 | 10 | 2013 | 33 | | 101 | 2 |
| 2012 | 11 | 2013 | 28 | | 86 | 2 |
| 2012 | 12 | 2013 | 29 | | 89 | 2 |
| 2013 | 1 | 2013 | 29 | | 90 | 2 |

| Fortuna Raw Data | | | | | | |
|---|---|---|---|---|---|---|
| Note: Palmer Pumped = Palmer CSD wastewater conveyed to Fortuna | | | | | | |
| Cal Year | Month | Water Year | Total Pumped (MG) | RKM Note | Pumped (AF) | Palmer Pumped (AF) |
| 2013 | 2 | 2013 | 27 | | 84 | 2 |
| 2013 | 3 | 2013 | 33 | | 100 | 2 |
| 2013 | 4 | 2013 | 36 | | 110 | 2 |
| 2013 | 5 | 2013 | 45 | | 138 | 2 |
| 2013 | 6 | 2013 | 35 | | 106 | 2 |
| 2013 | 7 | 2013 | 46 | Original script value printed error. Original file provided by City has comments indicating meter reading issues. Using average of remaining July values. | 141 | 3 |
| 2013 | 8 | 2013 | 38 | | 116 | 3 |
| 2013 | 9 | 2013 | 42 | | 128 | 2 |
| 2013 | 10 | 2014 | 35 | | 106 | 2 |
| 2013 | 11 | 2014 | 31 | | 96 | 2 |
| 2013 | 12 | 2014 | 33 | | 102 | 2 |
| 2014 | 1 | 2014 | 33 | | 100 | 2 |
| 2014 | 2 | 2014 | 29 | | 88 | 1 |
| 2014 | 3 | 2014 | 32 | | 100 | 1 |
| 2014 | 4 | 2014 | 33 | | 101 | 2 |
| 2014 | 5 | 2014 | 37 | | 114 | 2 |
| 2014 | 6 | 2014 | 48 | | 147 | 3 |
| 2014 | 7 | 2014 | 47 | | 145 | 2 |
| 2014 | 8 | 2014 | 42 | | 128 | 2 |
| 2014 | 9 | 2014 | 36 | | 109 | 2 |
| 2014 | 10 | 2015 | 32 | | 97 | 2 |
| 2014 | 11 | 2015 | 27 | | 84 | 1 |
| 2014 | 12 | 2015 | 27 | | 83 | 2 |
| 2015 | 1 | 2015 | 31 | | 95 | 1 |
| 2015 | 2 | 2015 | 25 | | 77 | 1 |
| 2015 | 3 | 2015 | 27 | | 84 | 1 |
| 2015 | 4 | 2015 | 27 | | 83 | 2 |
| 2015 | 5 | 2015 | 32 | | 97 | 2 |
| 2015 | 6 | 2015 | 36 | | 109 | 2 |
| 2015 | 7 | 2015 | 40 | | 123 | 2 |
| 2015 | 8 | 2015 | 38 | | 117 | 3 |
| 2015 | 9 | 2015 | 33 | | 101 | 2 |
| 2015 | 10 | 2016 | 32 | | 99 | 2 |
| 2015 | 11 | 2016 | 28 | | 86 | 2 |
| 2015 | 12 | 2016 | 29 | | 89 | 2 |
| 2016 | 1 | 2016 | 32 | | 99 | 2 |

| Fortuna Raw Data | | | | | | |
|---|---|---|---|---|---|---|
| Note: Palmer Pumped = Palmer CSD wastewater conveyed to Fortuna | | | | | | |
| Cal Year | Month | Water Year | Total Pumped (MG) | RKM Note | Pumped (AF) | Palmer Pumped (AF) |
| 2016 | 2 | 2016 | 25 | | 77 | 2 |
| 2016 | 3 | 2016 | 28 | | 84 | 2 |
| 2016 | 4 | 2016 | 28 | | 85 | 2 |
| 2016 | 5 | 2016 | 31 | | 94 | 2 |
| 2016 | 6 | 2016 | 37 | | 115 | 2 |
| 2016 | 7 | 2016 | 40 | | 123 | 2 |
| 2016 | 8 | 2016 | 43 | | 132 | 3 |
| 2016 | 9 | 2016 | 40 | | 123 | 2 |
| 2016 | 10 | 2017 | 31 | | 95 | 2 |
| 2016 | 11 | 2017 | 27 | | 84 | 2 |
| 2016 | 12 | 2017 | 28 | | 86 | 2 |
| 2017 | 1 | 2017 | 30 | | 91 | 2 |
| 2017 | 2 | 2017 | 26 | | 80 | 2 |
| 2017 | 3 | 2017 | 30 | | 93 | 2 |
| 2017 | 4 | 2017 | 27 | | 84 | 1 |
| 2017 | 5 | 2017 | 35 | | 108 | 2 |
| 2017 | 6 | 2017 | 35 | | 107 | 2 |
| 2017 | 7 | 2017 | 45 | | 137 | 3 |
| 2017 | 8 | 2017 | 45 | | 137 | 2 |
| 2017 | 9 | 2017 | 38 | | 116 | 2 |
| 2017 | 10 | 2018 | 36 | | 110 | 2 |
| 2017 | 11 | 2018 | 29 | | 89 | 2 |
| 2017 | 12 | 2018 | 29 | | 89 | 2 |
| 2018 | 1 | 2018 | 29 | | 90 | 2 |
| 2018 | 2 | 2018 | 26 | | 79 | 2 |
| 2018 | 3 | 2018 | 29 | | 89 | 1 |
| 2018 | 4 | 2018 | 27 | | 82 | 2 |
| 2018 | 5 | 2018 | 31 | | 96 | 2 |
| 2018 | 6 | 2018 | 37 | | 114 | 2 |
| 2018 | 7 | 2018 | 47 | | 144 | 2 |
| 2018 | 8 | 2018 | 43 | | 132 | 3 |
| 2018 | 9 | 2018 | 39 | | 121 | 3 |
| 2018 | 10 | 2019 | 32 | | 100 | 2 |
| 2018 | 11 | 2019 | 30 | | 91 | 2 |
| 2018 | 12 | 2019 | 29 | | 88 | 1 |
| 2019 | 1 | 2019 | 28 | | 86 | 2 |
| 2019 | 2 | 2019 | 24 | | 75 | 2 |
| 2019 | 3 | 2019 | 28 | | 86 | 1 |
| 2019 | 4 | 2019 | 28 | | 85 | 2 |
| 2019 | 5 | 2019 | 36 | | 111 | 4 |
| 2019 | 6 | 2019 | 39 | | 121 | 2 |

| Fortuna Raw Data | | | | | | |
|---|---|---|---|---|---|---|
| Note: Palmer Pumped = Palmer CSD wastewater conveyed to Fortuna | | | | | | |
| Cal Year | Month | Water Year | Total Pumped (MG) | RKM Note | Pumped (AF) | Palmer Pumped (AF) |
| 2019 | 7 | 2019 | 47 | | 143 | 3 |
| 2019 | 8 | 2019 | 48 | | 147 | 3 |
| 2019 | 9 | 2019 | 38 | | 117 | 2 |
| 2019 | 10 | 2020 | 33 | | 101 | 2 |
| 2019 | 11 | 2020 | 31 | | 96 | 2 |
| 2019 | 12 | 2020 | 30 | | 92 | 2 |
| 2020 | 1 | 2020 | 30 | | 93 | 2 |
| 2020 | 2 | 2020 | 28 | | 87 | 2 |
| 2020 | 3 | 2020 | 31 | | 94 | 2 |
| 2020 | 4 | 2020 | 33 | | 102 | 1 |
| 2020 | 5 | 2020 | 37 | | 112 | 2 |
| 2020 | 6 | 2020 | 41 | | 126 | 2 |
| 2020 | 7 | 2020 | 53 | | 163 | 3 |
| 2020 | 8 | 2020 | 52 | | 159 | 3 |
| 2020 | 9 | 2020 | 44 | | 134 | 3 |

| Fortuna Wastewater Effluent Disposal to Surface Waters and Groundwater | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Units | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| Water | Acre Feet / Year | 1,310 | 1,251 | 1,289 | 1,335 | 1,151 | 1,206 | 1,218 | 1,234 | 1,249 | 1,361 |
| Creek WW | Acre Feet / Year | 458.96 | 491.22 | 381.52 | 417.47 | 282.25 | 488.97 | 485.24 | 446.80 | 442.29 | 403.00 |
| Land WW | Acre Feet / Year | 459.67 | 398.99 | 538.16 | 533.45 | 538.52 | 371.61 | 383.52 | 433.80 | 450.71 | 567.74 |

| Rio Dell Raw Data | | | | |
|---|---|---|---|---|
| Year | MG | | AF | |
| | Surface | Wells | Surface | Wells |
| 2010 | 99.2 | 0.0 | 304.5 | 0.0 |
| 2011 | 99.1 | 0.0 | 304.1 | 0.0 |
| 2012 | 102.5 | 0.0 | 314.4 | 0.0 |
| 2013 | 114.2 | 0.0 | 350.5 | 0.0 |
| 2014 | 95.8 | 0.0 | 294.1 | 0.0 |
| 2015 | 82.9 | 0.0 | 254.4 | 0.0 |
| 2016 | 89.1 | 0.0 | 273.4 | 0.0 |
| 2017 | 85.4 | 0.0 | 262.0 | 0.0 |
| 2018 | 86.9 | 5.9 | 266.8 | 18.1 |
| 2019 | 72.4 | 13.2 | 222.2 | 40.6 |
| 2020 | 87.7 | 2.0 | 269.3 | 6.2 |

| Rio Dell Summary by Month | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Month | Cal Year | Water Year | Percent of Annual Water Used in Month | Surface Water Pumped (AF) | Groundwater Pumped (AF) | Water Pumped (AF) | Discharge to Eel (AF) | Discharge to Fields (AF) |
| 10 | 2010 | 2011 | 8% | 23.9 | 0.0 | 23.9 | 10.0 | 6.7 |
| 11 | 2010 | 2011 | 7% | 20.9 | 0.0 | 20.9 | 14.6 | 0.0 |
| 12 | 2010 | 2011 | 7% | 20.8 | 0.0 | 20.8 | 14.6 | 0.0 |
| 1 | 2011 | 2011 | 7% | 21.7 | 0.0 | 21.7 | 15.2 | 0.0 |
| 2 | 2011 | 2011 | 6% | 19.1 | 0.0 | 19.1 | 13.4 | 0.0 |
| 3 | 2011 | 2011 | 7% | 21.4 | 0.0 | 21.4 | 15.0 | 0.0 |
| 4 | 2011 | 2011 | 8% | 23.2 | 0.0 | 23.2 | 16.3 | 0.0 |
| 5 | 2011 | 2011 | 8% | 25.2 | 0.0 | 25.2 | 7.7 | 10.0 |
| 6 | 2011 | 2011 | 9% | 28.1 | 0.0 | 28.1 | 0.0 | 19.7 |
| 7 | 2011 | 2011 | 11% | 34.0 | 0.0 | 34.0 | 0.0 | 23.8 |
| 8 | 2011 | 2011 | 11% | 33.8 | 0.0 | 33.8 | 0.0 | 23.7 |
| 9 | 2011 | 2011 | 11% | 32.1 | 0.0 | 32.1 | 0.0 | 22.5 |
| 10 | 2011 | 2012 | 9% | 28.1 | 0.0 | 28.1 | 11.8 | 7.9 |
| 11 | 2011 | 2012 | 8% | 24.1 | 0.0 | 24.1 | 16.9 | 0.0 |
| 12 | 2011 | 2012 | 8% | 24.2 | 0.0 | 24.2 | 16.9 | 0.0 |
| 1 | 2012 | 2012 | 8% | 24.3 | 0.0 | 24.3 | 17.0 | 0.0 |
| 2 | 2012 | 2012 | 7% | 22.8 | 0.0 | 22.8 | 16.0 | 0.0 |
| 3 | 2012 | 2012 | 8% | 25.2 | 0.0 | 25.2 | 17.6 | 0.0 |
| 4 | 2012 | 2012 | 8% | 25.1 | 0.0 | 25.1 | 17.6 | 0.0 |
| 5 | 2012 | 2012 | 8% | 26.6 | 0.0 | 26.6 | 8.1 | 10.5 |
| 6 | 2012 | 2012 | 10% | 33.0 | 0.0 | 33.0 | 0.0 | 23.1 |
| 7 | 2012 | 2012 | 10% | 30.0 | 0.0 | 30.0 | 0.0 | 21.0 |
| 8 | 2012 | 2012 | 9% | 26.7 | 0.0 | 26.7 | 0.0 | 18.7 |
| 9 | 2012 | 2012 | 8% | 24.4 | 0.0 | 24.4 | 0.0 | 17.1 |
| 10 | 2012 | 2013 | 8% | 27.4 | 0.0 | 27.4 | 5.7 | 13.4 |
| 11 | 2012 | 2013 | 7% | 23.4 | 0.0 | 23.4 | 11.2 | 5.1 |
| 12 | 2012 | 2013 | 7% | 24.1 | 0.0 | 24.1 | 16.3 | 0.5 |
| 1 | 2013 | 2013 | 7% | 24.5 | 0.0 | 24.5 | 17.2 | 0.0 |
| 2 | 2013 | 2013 | 7% | 22.9 | 0.0 | 22.9 | 16.1 | 0.0 |
| 3 | 2013 | 2013 | 8% | 27.1 | 0.0 | 27.1 | 19.0 | 0.0 |
| 4 | 2013 | 2013 | 9% | 30.1 | 0.0 | 30.1 | 16.2 | 4.8 |
| 5 | 2013 | 2013 | 11% | 37.5 | 0.0 | 37.5 | 0.0 | 26.3 |
| 6 | 2013 | 2013 | 8% | 28.8 | 0.0 | 28.8 | 0.0 | 20.2 |
| 7 | 2013 | 2013 | 11% | 38.2 | 0.0 | 38.2 | 0.0 | 26.8 |
| 8 | 2013 | 2013 | 9% | 31.6 | 0.0 | 31.6 | 0.0 | 22.1 |
| 9 | 2013 | 2013 | 10% | 34.8 | 0.0 | 34.8 | 0.0 | 24.3 |
| 10 | 2013 | 2014 | 8% | 23.4 | 0.0 | 23.4 | 3.1 | 13.2 |
| 11 | 2013 | 2014 | 7% | 21.2 | 0.0 | 21.2 | 14.8 | 0.0 |
| 12 | 2013 | 2014 | 8% | 22.4 | 0.0 | 22.4 | 15.7 | 0.0 |
| 1 | 2014 | 2014 | 7% | 22.0 | 0.0 | 22.0 | 15.4 | 0.0 |
| 2 | 2014 | 2014 | 7% | 19.4 | 0.0 | 19.4 | 13.6 | 0.0 |

| Rio Dell Summary by Month | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Month | Cal Year | Water Year | Percent of Annual Water Used in Month | Surface Water Pumped (AF) | Groundwater Pumped (AF) | Water Pumped (AF) | Discharge to Eel (AF) | Discharge to Fields (AF) |
| 3 | 2014 | 2014 | 7% | 21.9 | 0.0 | 21.9 | 15.3 | 0.0 |
| 4 | 2014 | 2014 | 8% | 22.2 | 0.0 | 22.2 | 12.5 | 3.0 |
| 5 | 2014 | 2014 | 9% | 25.2 | 0.0 | 25.2 | 0.0 | 17.6 |
| 6 | 2014 | 2014 | 11% | 32.3 | 0.0 | 32.3 | 0.0 | 22.6 |
| 7 | 2014 | 2014 | 11% | 31.9 | 0.0 | 31.9 | 0.0 | 22.3 |
| 8 | 2014 | 2014 | 10% | 28.2 | 0.0 | 28.2 | 0.0 | 19.7 |
| 9 | 2014 | 2014 | 8% | 24.1 | 0.0 | 24.1 | 0.0 | 16.9 |
| 10 | 2014 | 2015 | 8% | 21.5 | 0.0 | 21.5 | 0.0 | 15.1 |
| 11 | 2014 | 2015 | 7% | 18.5 | 0.0 | 18.5 | 4.8 | 8.1 |
| 12 | 2014 | 2015 | 7% | 18.3 | 0.0 | 18.3 | 12.0 | 0.8 |
| 1 | 2015 | 2015 | 8% | 21.0 | 0.0 | 21.0 | 0.0 | 14.7 |
| 2 | 2015 | 2015 | 7% | 17.1 | 0.0 | 17.1 | 11.7 | 0.3 |
| 3 | 2015 | 2015 | 7% | 18.6 | 0.0 | 18.6 | 13.0 | 0.0 |
| 4 | 2015 | 2015 | 7% | 18.3 | 0.0 | 18.3 | 12.8 | 0.0 |
| 5 | 2015 | 2015 | 8% | 21.5 | 0.0 | 21.5 | 6.9 | 8.2 |
| 6 | 2015 | 2015 | 10% | 24.2 | 0.0 | 24.2 | 0.0 | 16.9 |
| 7 | 2015 | 2015 | 11% | 27.1 | 0.0 | 27.1 | 0.0 | 19.0 |
| 8 | 2015 | 2015 | 10% | 25.8 | 0.0 | 25.8 | 0.0 | 18.0 |
| 9 | 2015 | 2015 | 9% | 22.4 | 0.0 | 22.4 | 0.0 | 15.7 |
| 10 | 2015 | 2016 | 8% | 22.4 | 0.0 | 22.4 | 13.4 | 2.3 |
| 11 | 2015 | 2016 | 7% | 19.6 | 0.0 | 19.6 | 13.7 | 0.0 |
| 12 | 2015 | 2016 | 7% | 20.1 | 0.0 | 20.1 | 14.1 | 0.0 |
| 1 | 2016 | 2016 | 8% | 22.4 | 0.0 | 22.4 | 15.7 | 0.0 |
| 2 | 2016 | 2016 | 6% | 17.5 | 0.0 | 17.5 | 12.2 | 0.0 |
| 3 | 2016 | 2016 | 7% | 19.1 | 0.0 | 19.1 | 9.8 | 3.6 |
| 4 | 2016 | 2016 | 7% | 19.2 | 0.0 | 19.2 | 6.7 | 6.7 |
| 5 | 2016 | 2016 | 8% | 21.3 | 0.0 | 21.3 | 3.5 | 11.4 |
| 6 | 2016 | 2016 | 10% | 26.0 | 0.0 | 26.0 | 0.0 | 18.2 |
| 7 | 2016 | 2016 | 10% | 28.0 | 0.0 | 28.0 | 0.0 | 19.6 |
| 8 | 2016 | 2016 | 11% | 29.9 | 0.0 | 29.9 | 9.9 | 11.0 |
| 9 | 2016 | 2016 | 10% | 27.9 | 0.0 | 27.9 | 9.8 | 9.8 |
| 10 | 2016 | 2017 | 8% | 20.4 | 0.0 | 20.4 | 12.2 | 2.1 |
| 11 | 2016 | 2017 | 7% | 18.0 | 0.0 | 18.0 | 12.6 | 0.0 |
| 12 | 2016 | 2017 | 7% | 18.6 | 0.0 | 18.6 | 13.0 | 0.0 |
| 1 | 2017 | 2017 | 7% | 19.5 | 0.0 | 19.5 | 13.6 | 0.0 |
| 2 | 2017 | 2017 | 7% | 17.3 | 0.0 | 17.3 | 12.1 | 0.0 |
| 3 | 2017 | 2017 | 8% | 20.1 | 0.0 | 20.1 | 10.2 | 3.8 |
| 4 | 2017 | 2017 | 7% | 18.0 | 0.0 | 18.0 | 6.3 | 6.3 |
| 5 | 2017 | 2017 | 9% | 23.3 | 0.0 | 23.3 | 3.8 | 12.5 |
| 6 | 2017 | 2017 | 9% | 22.9 | 0.0 | 22.9 | 0.0 | 16.0 |
| 7 | 2017 | 2017 | 11% | 29.5 | 0.0 | 29.5 | 0.0 | 20.6 |

| Rio Dell Summary by Month | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Month | Cal Year | Water Year | Percent of Annual Water Used in Month | Surface Water Pumped (AF) | Groundwater Pumped (AF) | Water Pumped (AF) | Discharge to Eel (AF) | Discharge to Fields (AF) |
| 8 | 2017 | 2017 | 11% | 29.5 | 0.0 | 29.5 | 9.8 | 10.9 |
| 9 | 2017 | 2017 | 10% | 25.0 | 0.0 | 25.0 | 8.7 | 8.7 |
| 10 | 2017 | 2018 | 9% | 23.7 | 1.6 | 25.3 | 10.6 | 7.1 |
| 11 | 2017 | 2018 | 7% | 19.3 | 1.3 | 20.6 | 14.5 | 0.0 |
| 12 | 2017 | 2018 | 7% | 19.2 | 1.3 | 20.5 | 14.4 | 0.0 |
| 1 | 2018 | 2018 | 7% | 19.4 | 1.3 | 20.7 | 14.5 | 0.0 |
| 2 | 2018 | 2018 | 6% | 17.2 | 1.2 | 18.3 | 12.8 | 0.0 |
| 3 | 2018 | 2018 | 7% | 19.2 | 1.3 | 20.5 | 14.3 | 0.0 |
| 4 | 2018 | 2018 | 7% | 17.8 | 1.2 | 19.0 | 13.3 | 0.0 |
| 5 | 2018 | 2018 | 8% | 20.8 | 1.4 | 22.2 | 6.7 | 8.8 |
| 6 | 2018 | 2018 | 9% | 24.6 | 1.7 | 26.3 | 0.0 | 18.4 |
| 7 | 2018 | 2018 | 12% | 31.1 | 2.1 | 33.2 | 0.0 | 23.2 |
| 8 | 2018 | 2018 | 11% | 28.5 | 1.9 | 30.4 | 0.0 | 21.3 |
| 9 | 2018 | 2018 | 10% | 26.1 | 1.8 | 27.8 | 0.0 | 19.5 |
| 10 | 2018 | 2019 | 8% | 17.7 | 3.2 | 21.0 | 8.8 | 5.9 |
| 11 | 2018 | 2019 | 7% | 16.2 | 3.0 | 19.1 | 13.4 | 0.0 |
| 12 | 2018 | 2019 | 7% | 15.7 | 2.9 | 18.5 | 13.0 | 0.0 |
| 1 | 2019 | 2019 | 7% | 15.3 | 2.8 | 18.0 | 12.6 | 0.0 |
| 2 | 2019 | 2019 | 6% | 13.3 | 2.4 | 15.8 | 11.0 | 0.0 |
| 3 | 2019 | 2019 | 7% | 15.3 | 2.8 | 18.0 | 12.6 | 0.0 |
| 4 | 2019 | 2019 | 7% | 15.2 | 2.8 | 18.0 | 12.6 | 0.0 |
| 5 | 2019 | 2019 | 9% | 19.7 | 3.6 | 23.3 | 7.1 | 9.2 |
| 6 | 2019 | 2019 | 10% | 21.4 | 3.9 | 25.4 | 0.0 | 17.8 |
| 7 | 2019 | 2019 | 11% | 25.5 | 4.6 | 30.1 | 0.0 | 21.1 |
| 8 | 2019 | 2019 | 12% | 26.1 | 4.8 | 30.8 | 0.0 | 21.6 |
| 9 | 2019 | 2019 | 9% | 20.9 | 3.8 | 24.7 | 0.0 | 17.3 |
| 10 | 2019 | 2020 | 7% | 20.0 | 0.5 | 20.4 | 2.7 | 11.6 |
| 11 | 2019 | 2020 | 7% | 18.9 | 0.4 | 19.3 | 13.5 | 0.0 |
| 12 | 2019 | 2020 | 7% | 18.2 | 0.4 | 18.6 | 13.0 | 0.0 |
| 1 | 2020 | 2020 | 7% | 18.5 | 0.4 | 18.9 | 13.2 | 0.0 |
| 2 | 2020 | 2020 | 6% | 17.3 | 0.4 | 17.7 | 12.4 | 0.0 |
| 3 | 2020 | 2020 | 7% | 18.7 | 0.4 | 19.1 | 13.4 | 0.0 |
| 4 | 2020 | 2020 | 8% | 20.3 | 0.5 | 20.7 | 11.7 | 2.8 |
| 5 | 2020 | 2020 | 8% | 22.2 | 0.5 | 22.7 | 0.0 | 15.9 |
| 6 | 2020 | 2020 | 9% | 24.9 | 0.6 | 25.5 | 0.0 | 17.8 |
| 7 | 2020 | 2020 | 12% | 32.3 | 0.7 | 33.0 | 0.0 | 23.1 |
| 8 | 2020 | 2020 | 12% | 31.5 | 0.7 | 32.2 | 0.0 | 22.6 |
| 9 | 2020 | 2020 | 10% | 26.6 | 0.6 | 27.2 | 0.0 | 19.0 |

| Rio Dell Summary by Year | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Units | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| Surface | Acre Ft / Year | 304 | 314 | 350 | 294 | 254 | 273 | 262 | 267 | 222 | 269 |
| Groundwater | Acre Ft / Year | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 41 | 6 |
| Eel Discharge | Acre Ft / Year | 106.6 | 121.8 | 101.7 | 90.4 | 61.3 | 108.7 | 102.4 | 101.1 | 91.1 | 80.0 |
| Field Discharge | Acre Ft / Year | 106.3 | 98.3 | 143.6 | 115.4 | 116.8 | 82.6 | 81.0 | 98.3 | 92.8 | 112.9 |

| Ferndale Raw Data | | | | | |
|---|---|---|---|---|---|
| Month | Year | Water Year | Low Springs (gal) | High Springs (gal) | Van Ness Well (gal) |
| 10 | 2010 | 2011 | 2,944,100 | 1,317,100 | 0 |
| 11 | 2010 | 2011 | 2,386,600 | 1,283,900 | 0 |
| 12 | 2010 | 2011 | 2,362,700 | 1,368,800 | 0 |
| 1 | 2011 | 2011 | 2,352,300 | 1,363,600 | 0 |
| 2 | 2011 | 2011 | 2,105,900 | 1,227,400 | 0 |
| 3 | 2011 | 2011 | 2,123,200 | 1,387,400 | 0 |
| 4 | 2011 | 2011 | 2,059,400 | 1,346,300 | 0 |
| 5 | 2011 | 2011 | 2,587,900 | 1,427,300 | 0 |
| 6 | 2011 | 2011 | 2,589,300 | 1,338,300 | 0 |
| 7 | 2011 | 2011 | 2,946,600 | 1,358,500 | 1,240,000 |
| 8 | 2011 | 2011 | 2,922,000 | 1,349,800 | 1,696,000 |
| 9 | 2011 | 2011 | 2,814,900 | 1,298,000 | 858,000 |
| 10 | 2011 | 2012 | 2,918,500 | 1,330,800 | 0 |
| 11 | 2011 | 2012 | 2,523,600 | 1,266,200 | 0 |
| 12 | 2011 | 2012 | 2,559,600 | 1,319,100 | 0 |
| 1 | 2012 | 2012 | 2,765,400 | 1,347,900 | 0 |
| 2 | 2012 | 2012 | 2,567,900 | 1,267,400 | 0 |
| 3 | 2012 | 2012 | 2,797,300 | 1,321,000 | 0 |
| 4 | 2012 | 2012 | 2,888,700 | 1,326,200 | 276,000 |
| 5 | 2012 | 2012 | 2,928,900 | 1,351,700 | 1,317,000 |
| 6 | 2012 | 2012 | 2,737,000 | 1,310,000 | 1,026,000 |
| 7 | 2012 | 2012 | 2,799,900 | 1,329,000 | 903,000 |
| 8 | 2012 | 2012 | 2,737,400 | 1,299,800 | 2,543,100 |
| 9 | 2012 | 2012 | 2,630,000 | 1,236,000 | 1,844,200 |
| 10 | 2012 | 2013 | 2,743,400 | 1,277,700 | 956,400 |
| 11 | 2012 | 2013 | 2,807,800 | 1,252,400 | 455,000 |
| 12 | 2012 | 2013 | 2,893,900 | 1,337,700 | 238,400 |
| 1 | 2013 | 2013 | 2,985,100 | 1,326,200 | 264,200 |
| 2 | 2013 | 2013 | 2,617,800 | 1,202,400 | 0 |
| 3 | 2013 | 2013 | 2,670,800 | 1,341,000 | 0 |
| 4 | 2013 | 2013 | 2,765,400 | 1,285,100 | 0 |
| 5 | 2013 | 2013 | 2,762,600 | 1,274,000 | 1,227,200 |
| 6 | 2013 | 2013 | 2,613,000 | 1,208,100 | 1,713,700 |
| 7 | 2013 | 2013 | 2,735,900 | 1,232,000 | 2,823,000 |
| 8 | 2013 | 2013 | 2,922,900 | 1,172,300 | 3,013,100 |
| 9 | 2013 | 2013 | 2,854,100 | 1,141,200 | 1,254,500 |
| 10 | 2013 | 2014 | 2,948,800 | 1,215,900 | 0 |
| 11 | 2013 | 2014 | 2,846,600 | 1,180,100 | 0 |
| 12 | 2013 | 2014 | 2,931,900 | 1,213,400 | 479,800 |
| 1 | 2014 | 2014 | 2,914,700 | 1,198,600 | 465,200 |
| 2 | 2014 | 2014 | 2,661,000 | 1,064,300 | 0 |
| 3 | 2014 | 2014 | 3,020,900 | 1,180,200 | 0 |
| 4 | 2014 | 2014 | 2,893,000 | 1,124,900 | 329,400 |

| Ferndale Raw Data | | | | | |
|---|---|---|---|---|---|
| Month | Year | Water Year | Low Springs (gal) | High Springs (gal) | Van Ness Well (gal) |
| 5 | 2014 | 2014 | 2,853,300 | 1,140,000 | 1,851,400 |
| 6 | 2014 | 2014 | 2,744,900 | 1,087,700 | 2,090,000 |
| 7 | 2014 | 2014 | 2,811,800 | 1,103,700 | 2,829,100 |
| 8 | 2014 | 2014 | 2,784,100 | 1,087,300 | 2,581,200 |
| 9 | 2014 | 2014 | 2,681,200 | 1,037,900 | 1,165,200 |
| 10 | 2014 | 2015 | 2,837,800 | 1,083,600 | 924,100 |
| 11 | 2014 | 2015 | 2,801,200 | 1,044,600 | 483,400 |
| 12 | 2014 | 2015 | 2,936,900 | 1,108,100 | 712,400 |
| 1 | 2015 | 2015 | 3,048,000 | 1,104,600 | 469,400 |
| 2 | 2015 | 2015 | 2,645,800 | 1,010,400 | 260,000 |
| 3 | 2015 | 2015 | 2,967,400 | 1,086,300 | 455,800 |
| 4 | 2015 | 2015 | 2,877,500 | 1,100,600 | 634,900 |
| 5 | 2015 | 2015 | 2,727,900 | 1,094,100 | 1,410,500 |
| 6 | 2015 | 2015 | 2,695,200 | 1,024,500 | 1,618,100 |
| 7 | 2015 | 2015 | 2,731,600 | 1,026,600 | 2,501,800 |
| 8 | 2015 | 2015 | 2,662,800 | 1,009,100 | 3,113,300 |
| 9 | 2015 | 2015 | 2,581,100 | 964,800 | 1,538,600 |
| 10 | 2015 | 2016 | 2,654,600 | 970,300 | 1,036,500 |
| 11 | 2015 | 2016 | 2,594,600 | 944,700 | 682,800 |
| 12 | 2015 | 2016 | 2,768,700 | 973,300 | 1,327,100 |
| 1 | 2016 | 2016 | 3,059,600 | 1,035,500 | 70,500 |
| 2 | 2016 | 2016 | 2,924,700 | 958,800 | 0 |
| 3 | 2016 | 2016 | 3,138,900 | 1,025,900 | 0 |
| 4 | 2016 | 2016 | 3,032,300 | 962,200 | 0 |
| 5 | 2016 | 2016 | 2,994,000 | 975,100 | 1,183,900 |
| 6 | 2016 | 2016 | 2,812,000 | 897,000 | 2,240,400 |
| 7 | 2016 | 2016 | 2,837,500 | 908,900 | 3,171,700 |
| 8 | 2016 | 2016 | 2,825,300 | 997,200 | 2,634,500 |
| 9 | 2016 | 2016 | 2,707,800 | 926,300 | 2,132,900 |
| 10 | 2016 | 2017 | 2,885,100 | 968,000 | 299,600 |
| 11 | 2016 | 2017 | 2,907,100 | 945,000 | 425,400 |
| 12 | 2016 | 2017 | 3,030,100 | 1,019,200 | 0 |
| 1 | 2017 | 2017 | 3,099,600 | 1,070,400 | 0 |
| 2 | 2017 | 2017 | 2,228,100 | 1,201,200 | 0 |
| 3 | 2017 | 2017 | 2,874,300 | 1,321,000 | 0 |
| 4 | 2017 | 2017 | 2,632,600 | 1,266,400 | 0 |
| 5 | 2017 | 2017 | 3,123,000 | 1,277,800 | 0 |
| 6 | 2017 | 2017 | 3,080,600 | 1,224,800 | 687,000 |
| 7 | 2017 | 2017 | 3,126,200 | 1,247,500 | 1,719,900 |
| 8 | 2017 | 2017 | 3,064,400 | 1,249,400 | 2,876,400 |
| 9 | 2017 | 2017 | 2,940,300 | 1,198,500 | 2,664,000 |
| 10 | 2017 | 2018 | 3,025,100 | 1,252,000 | 986,100 |
| 11 | 2017 | 2018 | 2,953,000 | 1,220,000 | 0 |

| Ferndale Raw Data | | | | | |
|---|---|---|---|---|---|
| Month | Year | Water Year | Low Springs (gal) | High Springs (gal) | Van Ness Well (gal) |
| 12 | 2017 | 2018 | 2,841,100 | 1,261,900 | 0 |
| 1 | 2018 | 2018 | 2,611,700 | 1,288,000 | 0 |
| 2 | 2018 | 2018 | 2,398,900 | 1,137,700 | 0 |
| 3 | 2018 | 2018 | 2,601,000 | 1,300,100 | 0 |
| 4 | 2018 | 2018 | 2,412,100 | 1,262,600 | 0 |
| 5 | 2018 | 2018 | 2,752,800 | 1,276,900 | 0 |
| 6 | 2018 | 2018 | 2,648,000 | 1,225,900 | 1,138,000 |
| 7 | 2018 | 2018 | 2,614,400 | 1,299,800 | 2,434,900 |
| 8 | 2018 | 2018 | 2,523,100 | 1,279,600 | 2,778,200 |
| 9 | 2018 | 2018 | 2,151,600 | 1,230,500 | 1,873,600 |
| 10 | 2018 | 2019 | 2,433,200 | 1,269,500 | 955,300 |
| 11 | 2018 | 2019 | 2,479,600 | 1,233,000 | 476,900 |
| 12 | 2018 | 2019 | 2,696,500 | 1,268,800 | 736,100 |
| 1 | 2019 | 2019 | 2,744,800 | 1,277,200 | 0 |
| 2 | 2019 | 2019 | 2,413,400 | 1,194,800 | 0 |
| 3 | 2019 | 2019 | 2,689,500 | 1,348,000 | 0 |
| 4 | 2019 | 2019 | 2,695,700 | 1,244,200 | 0 |
| 5 | 2019 | 2019 | 2,801,300 | 1,337,800 | 499,200 |
| 6 | 2019 | 2019 | 2,600,900 | 1,303,700 | 1,417,600 |
| 7 | 2019 | 2019 | 2,623,400 | 1,337,100 | 2,029,400 |
| 8 | 2019 | 2019 | 2,581,600 | 1,322,800 | 3,223,100 |
| 9 | 2019 | 2019 | 2,477,000 | 1,261,600 | 1,625,500 |
| 10 | 2019 | 2020 | 2,355,500 | 1,277,200 | 1,259,400 |
| 11 | 2019 | 2020 | 2,425,700 | 1,231,300 | 898,100 |
| 12 | 2019 | 2020 | 2,603,700 | 1,278,700 | 971,200 |
| 1 | 2020 | 2020 | 2,595,100 | 1,278,800 | 1,147,600 |
| 2 | 2020 | 2020 | 2,456,300 | 1,194,000 | 1,133,100 |
| 3 | 2020 | 2020 | 2,509,400 | 1,259,300 | 1,536,700 |
| 4 | 2020 | 2020 | 2,532,500 | 1,201,800 | 1,763,900 |
| 5 | 2020 | 2020 | 2,568,000 | 1,238,800 | 2,302,900 |
| 6 | 2020 | 2020 | 2,441,900 | 1,192,600 | 883,900 |
| 7 | 2020 | 2020 | 2,503,200 | 1,218,900 | 2,187,900 |
| 8 | 2020 | 2020 | 2,482,100 | 1,202,600 | 2,009,700 |
| 9 | 2020 | 2020 | 2,388,500 | 1,156,200 | 1,586,200 |

| Ferndale Wastewater Effluent Disposal to Surface Waters and Groundwater | | | | | |
|---|---|---|---|---|---|
| Month | Year | Water Year | Total Pumped (AF) | Discharge to Salt (AF) | Discharge to Land (AF) |
| 10 | 2010 | 2011 | 13.07803 | 5.48 | 3.68 |
| 11 | 2010 | 2011 | 11.26512 | 7.89 | 0.00 |
| 12 | 2010 | 2011 | 11.45233 | 8.02 | 0.00 |
| 1 | 2011 | 2011 | 11.40446 | 7.98 | 0.00 |
| 2 | 2011 | 2011 | 10.23022 | 7.16 | 0.00 |
| 3 | 2011 | 2011 | 10.77437 | 7.54 | 0.00 |
| 4 | 2011 | 2011 | 10.45242 | 7.32 | 0.00 |
| 5 | 2011 | 2011 | 12.32304 | 3.75 | 4.88 |
| 6 | 2011 | 2011 | 12.05418 | 0.00 | 8.44 |
| 7 | 2011 | 2011 | 17.01845 | 0.00 | 11.91 |
| 8 | 2011 | 2011 | 18.31575 | 0.00 | 12.82 |
| 9 | 2011 | 2011 | 15.25617 | 0.00 | 10.68 |
| 10 | 2011 | 2012 | 13.04151 | 5.46 | 3.67 |
| 11 | 2011 | 2012 | 11.63126 | 8.14 | 0.00 |
| 12 | 2011 | 2012 | 11.9041 | 8.33 | 0.00 |
| 1 | 2012 | 2012 | 12.62411 | 8.84 | 0.00 |
| 2 | 2012 | 2012 | 11.77091 | 8.24 | 0.00 |
| 3 | 2012 | 2012 | 12.63946 | 8.85 | 0.00 |
| 4 | 2012 | 2012 | 13.78301 | 9.65 | 0.00 |
| 5 | 2012 | 2012 | 17.17957 | 5.22 | 6.80 |
| 6 | 2012 | 2012 | 15.56953 | 0.00 | 10.90 |
| 7 | 2012 | 2012 | 15.44339 | 0.00 | 10.81 |
| 8 | 2012 | 2012 | 20.19558 | 0.00 | 14.14 |
| 9 | 2012 | 2012 | 17.52515 | 0.00 | 12.27 |
| 10 | 2012 | 2013 | 15.27643 | 3.20 | 7.49 |
| 11 | 2012 | 2013 | 13.85758 | 6.65 | 3.05 |
| 12 | 2012 | 2013 | 13.71886 | 9.31 | 0.30 |
| 1 | 2013 | 2013 | 14.04265 | 9.83 | 0.00 |
| 2 | 2013 | 2013 | 11.72456 | 8.21 | 0.00 |
| 3 | 2013 | 2013 | 12.3126 | 8.62 | 0.00 |
| 4 | 2013 | 2013 | 12.43138 | 6.71 | 1.99 |
| 5 | 2013 | 2013 | 16.15511 | 0.00 | 11.31 |
| 6 | 2013 | 2013 | 16.98683 | 0.00 | 11.89 |
| 7 | 2013 | 2013 | 20.84193 | 0.00 | 14.59 |
| 8 | 2013 | 2013 | 21.81606 | 0.00 | 15.27 |
| 9 | 2013 | 2013 | 16.11214 | 0.00 | 11.28 |
| 10 | 2013 | 2014 | 12.78187 | 1.72 | 7.23 |
| 11 | 2013 | 2014 | 12.35833 | 8.65 | 0.00 |
| 12 | 2013 | 2014 | 14.19488 | 9.94 | 0.00 |
| 1 | 2014 | 2014 | 14.05186 | 9.84 | 0.00 |
| 2 | 2014 | 2014 | 11.4333 | 8.00 | 0.00 |

| Ferndale Wastewater Effluent Disposal to Surface Waters and Groundwater | | | | | |
|---|---|---|---|---|---|
| Month | Year | Water Year | Total Pumped (AF) | Discharge to Salt (AF) | Discharge to Land (AF) |
| 3 | 2014 | 2014 | 12.89358 | 9.03 | 0.00 |
| 4 | 2014 | 2014 | 13.34228 | 7.51 | 1.83 |
| 5 | 2014 | 2014 | 17.93795 | 0.00 | 12.56 |
| 6 | 2014 | 2014 | 18.17703 | 0.00 | 12.72 |
| 7 | 2014 | 2014 | 20.69983 | 0.00 | 14.49 |
| 8 | 2014 | 2014 | 19.80365 | 0.00 | 13.86 |
| 9 | 2014 | 2014 | 14.99039 | 0.00 | 10.49 |
| 10 | 2014 | 2015 | 14.87131 | 0.00 | 10.41 |
| 11 | 2014 | 2015 | 13.28673 | 3.46 | 5.84 |
| 12 | 2014 | 2015 | 14.60092 | 9.59 | 0.63 |
| 1 | 2015 | 2015 | 14.18536 | 0.00 | 9.93 |
| 2 | 2015 | 2015 | 12.0192 | 8.23 | 0.18 |
| 3 | 2015 | 2015 | 13.84009 | 9.69 | 0.00 |
| 4 | 2015 | 2015 | 14.15774 | 9.91 | 0.00 |
| 5 | 2015 | 2015 | 16.05905 | 5.15 | 6.09 |
| 6 | 2015 | 2015 | 16.38222 | 0.00 | 11.47 |
| 7 | 2015 | 2015 | 19.21254 | 0.00 | 13.45 |
| 8 | 2015 | 2015 | 20.82443 | 0.00 | 14.58 |
| 9 | 2015 | 2015 | 15.60482 | 0.00 | 10.92 |
| 10 | 2015 | 2016 | 14.30629 | 8.56 | 1.46 |
| 11 | 2015 | 2016 | 12.95803 | 9.07 | 0.00 |
| 12 | 2015 | 2016 | 15.55756 | 10.89 | 0.00 |
| 1 | 2016 | 2016 | 12.78463 | 8.95 | 0.00 |
| 2 | 2016 | 2016 | 11.91884 | 8.34 | 0.00 |
| 3 | 2016 | 2016 | 12.78217 | 6.52 | 2.42 |
| 4 | 2016 | 2016 | 12.25951 | 4.29 | 4.29 |
| 5 | 2016 | 2016 | 15.81505 | 2.59 | 8.48 |
| 6 | 2016 | 2016 | 18.25928 | 0.00 | 12.78 |
| 7 | 2016 | 2016 | 21.23232 | 0.00 | 14.86 |
| 8 | 2016 | 2016 | 19.81716 | 6.55 | 7.32 |
| 9 | 2016 | 2016 | 17.69948 | 6.19 | 6.19 |
| 10 | 2016 | 2017 | 12.74504 | 7.62 | 1.30 |
| 11 | 2016 | 2017 | 13.12806 | 9.19 | 0.00 |
| 12 | 2016 | 2017 | 12.42769 | 8.70 | 0.00 |
| 1 | 2017 | 2017 | 12.79813 | 8.96 | 0.00 |
| 2 | 2017 | 2017 | 10.52485 | 7.37 | 0.00 |
| 3 | 2017 | 2017 | 12.87578 | 6.57 | 2.44 |
| 4 | 2017 | 2017 | 11.96641 | 4.19 | 4.19 |
| 5 | 2017 | 2017 | 13.50648 | 2.22 | 7.24 |
| 6 | 2017 | 2017 | 15.32216 | 0.00 | 10.73 |
| 7 | 2017 | 2017 | 18.70185 | 0.00 | 13.09 |

| Ferndale Wastewater Effluent Disposal to Surface Waters and Groundwater | | | | | |
|---|---|---|---|---|---|
| Month | Year | Water Year | Total Pumped (AF) | Discharge to Salt (AF) | Discharge to Land (AF) |
| 8 | 2017 | 2017 | 22.06742 | 7.29 | 8.16 |
| 9 | 2017 | 2017 | 20.87845 | 7.31 | 7.31 |
| 10 | 2017 | 2018 | 16.15327 | 6.77 | 4.54 |
| 11 | 2017 | 2018 | 12.80734 | 8.97 | 0.00 |
| 12 | 2017 | 2018 | 12.5925 | 8.81 | 0.00 |
| 1 | 2018 | 2018 | 11.96856 | 8.38 | 0.00 |
| 2 | 2018 | 2018 | 10.85417 | 7.60 | 0.00 |
| 3 | 2018 | 2018 | 11.97285 | 8.38 | 0.00 |
| 4 | 2018 | 2018 | 11.27801 | 7.89 | 0.00 |
| 5 | 2018 | 2018 | 12.36754 | 3.76 | 4.90 |
| 6 | 2018 | 2018 | 15.382 | 0.00 | 10.77 |
| 7 | 2018 | 2018 | 19.486 | 0.00 | 13.64 |
| 8 | 2018 | 2018 | 20.19742 | 0.00 | 14.14 |
| 9 | 2018 | 2018 | 16.13025 | 0.00 | 11.29 |
| 10 | 2018 | 2019 | 14.29585 | 5.99 | 4.02 |
| 11 | 2018 | 2019 | 12.85798 | 9.00 | 0.00 |
| 12 | 2018 | 2019 | 14.42905 | 10.10 | 0.00 |
| 1 | 2019 | 2019 | 12.34391 | 8.64 | 0.00 |
| 2 | 2019 | 2019 | 11.07391 | 7.75 | 0.00 |
| 3 | 2019 | 2019 | 12.39148 | 8.67 | 0.00 |
| 4 | 2019 | 2019 | 12.09193 | 8.46 | 0.00 |
| 5 | 2019 | 2019 | 14.23539 | 4.33 | 5.64 |
| 6 | 2019 | 2019 | 16.33434 | 0.00 | 11.43 |
| 7 | 2019 | 2019 | 18.38358 | 0.00 | 12.87 |
| 8 | 2019 | 2019 | 21.87498 | 0.00 | 15.31 |
| 9 | 2019 | 2019 | 16.46294 | 0.00 | 11.52 |
| 10 | 2019 | 2020 | 15.01433 | 2.02 | 8.49 |
| 11 | 2019 | 2020 | 13.98004 | 9.79 | 0.00 |
| 12 | 2019 | 2020 | 14.89617 | 10.43 | 0.00 |
| 1 | 2020 | 2020 | 15.41147 | 10.79 | 0.00 |
| 2 | 2020 | 2020 | 14.68072 | 10.28 | 0.00 |
| 3 | 2020 | 2020 | 16.28278 | 11.40 | 0.00 |
| 4 | 2020 | 2020 | 16.87451 | 9.50 | 2.31 |
| 5 | 2020 | 2020 | 18.75126 | 0.00 | 13.13 |
| 6 | 2020 | 2020 | 13.86741 | 0.00 | 9.71 |
| 7 | 2020 | 2020 | 18.13836 | 0.00 | 12.70 |
| 8 | 2020 | 2020 | 17.47666 | 0.00 | 12.23 |
| 9 | 2020 | 2020 | 15.74723 | 0.00 | 11.02 |

| Ferndale Summary by Year | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Units | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| Water | Acre Ft / Year | 160.2 | 153.6 | 173.3 | 185.3 | 182.7 | 185.0 | 185.4 | 176.9 | 171.2 | 176.8 |
| To Salt | Acre Ft / Year | 55.1 | 62.7 | 52.5 | 54.7 | 46.0 | 72.0 | 69.4 | 60.6 | 62.9 | 64.2 |
| To Land | Acre Ft / Year | 52.4 | 58.6 | 77.2 | 73.2 | 83.5 | 57.8 | 54.4 | 59.3 | 60.8 | 69.6 |

| Scotia Summary by Month | | | | | | |
|---|---|---|---|---|---|---|
| Month | Cal Year | Water Year | Percent of Annual Water Used in Month | Water Pumped (AF) | Discharge to Eel (AF) | Discharge to Log Pond (AF) |
| 10 | 2010 | 2011 | 8% | 42.68 | 17.9 | 12.0 |
| 11 | 2010 | 2011 | 7% | 37.20 | 26.0 | 0.0 |
| 12 | 2010 | 2011 | 7% | 37.08 | 26.0 | 0.0 |
| 1 | 2011 | 2011 | 7% | 38.65 | 27.1 | 0.0 |
| 2 | 2011 | 2011 | 6% | 34.04 | 23.8 | 0.0 |
| 3 | 2011 | 2011 | 7% | 38.21 | 26.7 | 0.0 |
| 4 | 2011 | 2011 | 8% | 41.44 | 29.0 | 0.0 |
| 5 | 2011 | 2011 | 8% | 45.01 | 13.7 | 17.8 |
| 6 | 2011 | 2011 | 9% | 50.13 | 0.0 | 35.1 |
| 7 | 2011 | 2011 | 11% | 60.65 | 0.0 | 42.5 |
| 8 | 2011 | 2011 | 11% | 60.33 | 0.0 | 42.2 |
| 9 | 2011 | 2011 | 11% | 57.23 | 0.0 | 40.1 |
| 10 | 2011 | 2012 | 9% | 48.48 | 20.3 | 13.6 |
| 11 | 2011 | 2012 | 8% | 41.60 | 29.1 | 0.0 |
| 12 | 2011 | 2012 | 8% | 41.68 | 29.2 | 0.0 |
| 1 | 2012 | 2012 | 8% | 41.88 | 29.3 | 0.0 |
| 2 | 2012 | 2012 | 7% | 39.34 | 27.5 | 0.0 |
| 3 | 2012 | 2012 | 8% | 43.50 | 30.5 | 0.0 |
| 4 | 2012 | 2012 | 8% | 43.27 | 30.3 | 0.0 |
| 5 | 2012 | 2012 | 8% | 45.84 | 13.9 | 18.2 |
| 6 | 2012 | 2012 | 10% | 56.86 | 0.0 | 39.8 |
| 7 | 2012 | 2012 | 10% | 51.84 | 0.0 | 36.3 |
| 8 | 2012 | 2012 | 9% | 46.16 | 0.0 | 32.3 |
| 9 | 2012 | 2012 | 8% | 42.18 | 0.0 | 29.5 |
| 10 | 2012 | 2013 | 8% | 42.40 | 8.9 | 20.8 |
| 11 | 2012 | 2013 | 7% | 36.20 | 17.4 | 8.0 |
| 12 | 2012 | 2013 | 7% | 37.30 | 25.3 | 0.8 |
| 1 | 2013 | 2013 | 7% | 37.94 | 26.6 | 0.0 |
| 2 | 2013 | 2013 | 7% | 35.52 | 24.9 | 0.0 |
| 3 | 2013 | 2013 | 8% | 42.01 | 29.4 | 0.0 |
| 4 | 2013 | 2013 | 9% | 46.52 | 25.1 | 7.5 |
| 5 | 2013 | 2013 | 11% | 58.12 | 0.0 | 40.7 |
| 6 | 2013 | 2013 | 8% | 44.65 | 0.0 | 31.3 |
| 7 | 2013 | 2013 | 11% | 59.17 | 0.0 | 41.4 |
| 8 | 2013 | 2013 | 9% | 48.98 | 0.0 | 34.3 |
| 9 | 2013 | 2013 | 10% | 53.84 | 0.0 | 37.7 |
| 10 | 2013 | 2014 | 8% | 43.14 | 5.8 | 24.4 |
| 11 | 2013 | 2014 | 7% | 39.04 | 27.3 | 0.0 |
| 12 | 2013 | 2014 | 8% | 41.33 | 28.9 | 0.0 |
| 1 | 2014 | 2014 | 7% | 40.55 | 28.4 | 0.0 |
| 2 | 2014 | 2014 | 7% | 35.74 | 25.0 | 0.0 |
| 3 | 2014 | 2014 | 7% | 40.45 | 28.3 | 0.0 |

| Scotia Summary by Month | | | | | | |
|---|---|---|---|---|---|---|
| Month | Cal Year | Water Year | Percent of Annual Water Used in Month | Water Pumped (AF) | Discharge to Eel (AF) | Discharge to Log Pond (AF) |
| 4 | 2014 | 2014 | 8% | 41.01 | 23.1 | 5.6 |
| 5 | 2014 | 2014 | 9% | 46.50 | 0.0 | 32.6 |
| 6 | 2014 | 2014 | 11% | 59.64 | 0.0 | 41.7 |
| 7 | 2014 | 2014 | 11% | 58.79 | 0.0 | 41.2 |
| 8 | 2014 | 2014 | 10% | 52.03 | 0.0 | 36.4 |
| 9 | 2014 | 2014 | 8% | 44.42 | 0.0 | 31.1 |
| 10 | 2014 | 2015 | 8% | 45.96 | 0.0 | 32.2 |
| 11 | 2014 | 2015 | 7% | 39.42 | 10.3 | 17.3 |
| 12 | 2014 | 2015 | 7% | 39.04 | 25.6 | 1.7 |
| 1 | 2015 | 2015 | 8% | 44.87 | 0.0 | 31.4 |
| 2 | 2015 | 2015 | 7% | 36.49 | 25.0 | 0.6 |
| 3 | 2015 | 2015 | 7% | 39.59 | 27.7 | 0.0 |
| 4 | 2015 | 2015 | 7% | 39.06 | 27.3 | 0.0 |
| 5 | 2015 | 2015 | 8% | 45.96 | 14.7 | 17.4 |
| 6 | 2015 | 2015 | 10% | 51.55 | 0.0 | 36.1 |
| 7 | 2015 | 2015 | 11% | 57.84 | 0.0 | 40.5 |
| 8 | 2015 | 2015 | 10% | 54.99 | 0.0 | 38.5 |
| 9 | 2015 | 2015 | 9% | 47.85 | 0.0 | 33.5 |
| 10 | 2015 | 2016 | 8% | 44.36 | 26.5 | 4.5 |
| 11 | 2015 | 2016 | 7% | 38.87 | 27.2 | 0.0 |
| 12 | 2015 | 2016 | 7% | 39.98 | 28.0 | 0.0 |
| 1 | 2016 | 2016 | 8% | 44.48 | 31.1 | 0.0 |
| 2 | 2016 | 2016 | 6% | 34.70 | 24.3 | 0.0 |
| 3 | 2016 | 2016 | 7% | 38.01 | 19.4 | 7.2 |
| 4 | 2016 | 2016 | 7% | 38.16 | 13.4 | 13.4 |
| 5 | 2016 | 2016 | 8% | 42.33 | 6.9 | 22.7 |
| 6 | 2016 | 2016 | 10% | 51.59 | 0.0 | 36.1 |
| 7 | 2016 | 2016 | 10% | 55.52 | 0.0 | 38.9 |
| 8 | 2016 | 2016 | 11% | 59.31 | 19.6 | 21.9 |
| 9 | 2016 | 2016 | 10% | 55.34 | 19.4 | 19.4 |
| 10 | 2016 | 2017 | 8% | 42.28 | 25.3 | 4.3 |
| 11 | 2016 | 2017 | 7% | 37.20 | 26.0 | 0.0 |
| 12 | 2016 | 2017 | 7% | 38.45 | 26.9 | 0.0 |
| 1 | 2017 | 2017 | 7% | 40.36 | 28.3 | 0.0 |
| 2 | 2017 | 2017 | 7% | 35.83 | 25.1 | 0.0 |
| 3 | 2017 | 2017 | 8% | 41.59 | 21.2 | 7.9 |
| 4 | 2017 | 2017 | 7% | 37.34 | 13.1 | 13.1 |
| 5 | 2017 | 2017 | 9% | 48.29 | 7.9 | 25.9 |
| 6 | 2017 | 2017 | 9% | 47.45 | 0.0 | 33.2 |
| 7 | 2017 | 2017 | 11% | 61.02 | 0.0 | 42.7 |
| 8 | 2017 | 2017 | 11% | 61.13 | 20.2 | 22.6 |
| 9 | 2017 | 2017 | 10% | 51.69 | 18.1 | 18.1 |

| Scotia Summary by Month | | | | | | |
|---|---|---|---|---|---|---|
| Month | Cal Year | Water Year | Percent of Annual Water Used in Month | Water Pumped (AF) | Discharge to Eel (AF) | Discharge to Log Pond (AF) |
| 10 | 2017 | 2018 | 9% | 48.24 | 20.2 | 13.6 |
| 11 | 2017 | 2018 | 7% | 39.33 | 27.5 | 0.0 |
| 12 | 2017 | 2018 | 7% | 39.08 | 27.4 | 0.0 |
| 1 | 2018 | 2018 | 7% | 39.40 | 27.6 | 0.0 |
| 2 | 2018 | 2018 | 6% | 34.91 | 24.4 | 0.0 |
| 3 | 2018 | 2018 | 7% | 39.00 | 27.3 | 0.0 |
| 4 | 2018 | 2018 | 7% | 36.21 | 25.3 | 0.0 |
| 5 | 2018 | 2018 | 8% | 42.27 | 12.9 | 16.7 |
| 6 | 2018 | 2018 | 9% | 50.03 | 0.0 | 35.0 |
| 7 | 2018 | 2018 | 12% | 63.20 | 0.0 | 44.2 |
| 8 | 2018 | 2018 | 11% | 57.94 | 0.0 | 40.6 |
| 9 | 2018 | 2018 | 10% | 53.01 | 0.0 | 37.1 |
| 10 | 2018 | 2019 | 8% | 43.33 | 18.1 | 12.2 |
| 11 | 2018 | 2019 | 7% | 39.51 | 27.7 | 0.0 |
| 12 | 2018 | 2019 | 7% | 38.25 | 26.8 | 0.0 |
| 1 | 2019 | 2019 | 7% | 37.25 | 26.1 | 0.0 |
| 2 | 2019 | 2019 | 6% | 32.57 | 22.8 | 0.0 |
| 3 | 2019 | 2019 | 7% | 37.25 | 26.1 | 0.0 |
| 4 | 2019 | 2019 | 7% | 37.14 | 26.0 | 0.0 |
| 5 | 2019 | 2019 | 9% | 48.15 | 14.6 | 19.1 |
| 6 | 2019 | 2019 | 10% | 52.37 | 0.0 | 36.7 |
| 7 | 2019 | 2019 | 11% | 62.17 | 0.0 | 43.5 |
| 8 | 2019 | 2019 | 12% | 63.65 | 0.0 | 44.6 |
| 9 | 2019 | 2019 | 9% | 51.00 | 0.0 | 35.7 |
| 10 | 2019 | 2020 | 7% | 40.23 | 5.4 | 22.8 |
| 11 | 2019 | 2020 | 7% | 38.09 | 26.7 | 0.0 |
| 12 | 2019 | 2020 | 7% | 36.69 | 25.7 | 0.0 |
| 1 | 2020 | 2020 | 7% | 37.23 | 26.1 | 0.0 |
| 2 | 2020 | 2020 | 6% | 34.81 | 24.4 | 0.0 |
| 3 | 2020 | 2020 | 7% | 37.67 | 26.4 | 0.0 |
| 4 | 2020 | 2020 | 8% | 40.85 | 23.0 | 5.6 |
| 5 | 2020 | 2020 | 8% | 44.76 | 0.0 | 31.3 |
| 6 | 2020 | 2020 | 9% | 50.21 | 0.0 | 35.1 |
| 7 | 2020 | 2020 | 12% | 65.09 | 0.0 | 45.6 |
| 8 | 2020 | 2020 | 12% | 63.48 | 0.0 | 44.4 |
| 9 | 2020 | 2020 | 10% | 53.53 | 0.0 | 37.5 |

| Scotia Summary by Year | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Units | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| Eel | Acre Ft / Year | 190.2 | 210.1 | 157.5 | 166.9 | 130.7 | 215.8 | 212.1 | 192.6 | 188.2 | 157.5 |
| Log Ponds | Acre Ft / Year | 189.7 | 169.7 | 222.3 | 213.0 | 249.2 | 164.0 | 167.8 | 187.2 | 191.7 | 222.3 |

| Bear River Raw Data | | | | |
|---|---|---|---|---|
| Month | Cal Year | Water Year | Water Pumped (gal) | Water Pumped (AF) |
| 1 | 2014 | 2014 | 1,429,335 | 4.4 |
| 2 | 2014 | 2014 | 1,334,935 | 4.1 |
| 3 | 2014 | 2014 | 1,426,000 | 4.4 |
| 4 | 2014 | 2014 | 1,475,214 | 4.5 |
| 5 | 2014 | 2014 | 1,643,461 | 5.0 |
| 6 | 2014 | 2014 | 1,751,782 | 5.4 |
| 7 | 2014 | 2014 | 1,777,157 | 5.5 |
| 8 | 2014 | 2014 | 1,681,744 | 5.2 |
| 9 | 2014 | 2014 | 1,409,166 | 4.3 |
| 10 | 2014 | 2015 | 1,348,850 | 4.1 |
| 11 | 2014 | 2015 | 1,125,100 | 3.5 |
| 12 | 2014 | 2015 | 1,066,160 | 3.3 |
| 1 | 2015 | 2015 | 1,136,990 | 3.5 |
| 2 | 2015 | 2015 | 1,034,960 | 3.2 |
| 3 | 2015 | 2015 | 1,394,470 | 4.3 |
| 4 | 2015 | 2015 | 1,217,200 | 3.7 |
| 5 | 2015 | 2015 | 2,056,460 | 6.3 |
| 6 | 2015 | 2015 | 1,296,230 | 4.0 |
| 7 | 2015 | 2015 | 1,680,220 | 5.2 |
| 8 | 2015 | 2015 | 1,590,370 | 4.9 |
| 9 | 2015 | 2015 | 1,488,550 | 4.6 |
| 10 | 2015 | 2016 | 1,467,890 | 4.5 |
| 11 | 2015 | 2016 | 1,327,590 | 4.1 |
| 12 | 2015 | 2016 | 1,390,080 | 4.3 |
| 1 | 2016 | 2016 | 1,400,930 | 4.3 |
| 2 | 2016 | 2016 | 1,120,510 | 3.4 |
| 3 | 2016 | 2016 | 1,196,310 | 3.7 |
| 4 | 2016 | 2016 | 1,215,140 | 3.7 |
| 5 | 2016 | 2016 | 1,065,880 | 3.3 |
| 6 | 2016 | 2016 | 1,274,870 | 3.9 |
| 7 | 2016 | 2016 | 1,147,960 | 3.5 |
| 8 | 2016 | 2016 | 1,272,930 | 3.9 |
| 9 | 2016 | 2016 | 1,048,420 | 3.2 |
| 10 | 2016 | 2017 | 1,273,420 | 3.9 |
| 11 | 2016 | 2017 | 1,116,820 | 3.4 |
| 12 | 2016 | 2017 | 1,183,540 | 3.6 |
| 1 | 2017 | 2017 | 995,910 | 3.1 |
| 2 | 2017 | 2017 | 850,900 | 2.6 |
| 3 | 2017 | 2017 | 901,350 | 2.8 |
| 4 | 2017 | 2017 | 967,110 | 3.0 |
| 5 | 2017 | 2017 | 995,010 | 3.1 |
| 6 | 2017 | 2017 | 1,133,650 | 3.5 |

| Bear River Raw Data | | | | |
|---|---|---|---|---|
| Month | Cal Year | Water Year | Water Pumped (gal) | Water Pumped (AF) |
| 7 | 2017 | 2017 | 1,401,840 | 4.3 |
| 8 | 2017 | 2017 | 1,365,080 | 4.2 |
| 9 | 2017 | 2017 | 1,328,370 | 4.1 |
| 10 | 2017 | 2018 | 988,280 | 3.0 |
| 11 | 2017 | 2018 | 886,610 | 2.7 |
| 12 | 2017 | 2018 | 811,280 | 2.5 |
| 1 | 2018 | 2018 | 1,263,691 | 3.9 |
| 2 | 2018 | 2018 | 1,263,691 | 3.9 |
| 3 | 2018 | 2018 | 1,263,691 | 3.9 |
| 4 | 2018 | 2018 | 1,263,691 | 3.9 |
| 5 | 2018 | 2018 | 1,263,691 | 3.9 |
| 6 | 2018 | 2018 | 1,263,691 | 3.9 |
| 7 | 2018 | 2018 | 1,263,691 | 3.9 |
| 8 | 2018 | 2018 | 1,263,691 | 3.9 |
| 9 | 2018 | 2018 | 1,263,691 | 3.9 |
| 10 | 2018 | 2019 | 1,263,691 | 3.9 |
| 11 | 2018 | 2019 | 1,263,691 | 3.9 |
| 12 | 2018 | 2019 | 1,263,691 | 3.9 |
| 1 | 2019 | 2019 | 1,298,960 | 4.0 |
| 2 | 2019 | 2019 | 1,190,020 | 3.7 |
| 3 | 2019 | 2019 | 1,079,600 | 3.3 |
| 4 | 2019 | 2019 | 1,075,730 | 3.3 |
| 5 | 2019 | 2019 | 1,287,570 | 4.0 |
| 6 | 2019 | 2019 | 1,704,410 | 5.2 |
| 7 | 2019 | 2019 | 1,762,840 | 5.4 |
| 8 | 2019 | 2019 | 1,981,270 | 6.1 |
| 9 | 2019 | 2019 | 1,601,320 | 4.9 |
| 10 | 2019 | 2020 | 1,659,740 | 5.1 |
| 11 | 2019 | 2020 | 1,444,900 | 4.4 |
| 12 | 2019 | 2020 | 1,284,400 | 3.9 |
| 1 | 2020 | 2020 | 1,324,400 | 4.1 |
| 2 | 2020 | 2020 | 1,726,340 | 5.3 |
| 3 | 2020 | 2020 | 1,073,290 | 3.3 |
| 4 | 2020 | 2020 | 828,300 | 2.5 |
| 5 | 2020 | 2020 | 1,268,600 | 3.9 |
| 6 | 2020 | 2020 | 1,511,980 | 4.6 |
| 7 | 2020 | 2020 | 2,001,210 | 6.1 |
| 8 | 2020 | 2020 | 1,859,460 | 5.7 |
| 9 | 2020 | 2020 | 1,670,800 | 5.1 |

| Bear River Summary by Year | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Units | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| Water Pumped | Acre Ft / Year | 49.0 | 49.0 | 49.0 | 53.9 | 50.4 | 45.8 | 41.5 | 43.1 | 51.5 | 54.2 |
| Land Application | Acre Ft / Year | 34.3 | 34.3 | 34.3 | 37.7 | 35.3 | 32.1 | 29.0 | 30.2 | 36.0 | 37.9 |

| Hydesville Raw Data | | | | | |
|---|---|---|---|---|---|
| Month/Year | Month | Calendar Year | Water Year | Monthly Total Pumped (gal) | Water Pumped (AF) |
| Oct-09 | 10 | 2009 | 2010 | 3,042,415 | 9.3 |
| Nov-09 | 11 | 2009 | 2010 | 2,855,939 | 8.8 |
| Dec-09 | 12 | 2009 | 2010 | 2,965,670 | 9.1 |
| Jan-10 | 1 | 2010 | 2010 | 2,692,950 | 8.3 |
| Feb-10 | 2 | 2010 | 2010 | 2,712,772 | 8.3 |
| Mar-10 | 3 | 2010 | 2010 | 3,780,242 | 11.6 |
| Apr-10 | 4 | 2010 | 2010 | 3,088,567 | 9.5 |
| May-10 | 5 | 2010 | 2010 | 2,923,558 | 9.0 |
| Jun-10 | 6 | 2010 | 2010 | 4,212,212 | 12.9 |
| Jul-10 | 7 | 2010 | 2010 | 5,201,666 | 16.0 |
| Aug-10 | 8 | 2010 | 2010 | 4,582,770 | 14.1 |
| Sep-10 | 9 | 2010 | 2010 | 4,136,963 | 12.7 |
| Oct-10 | 10 | 2010 | 2011 | 804,900 | 2.5 |
| Nov-10 | 11 | 2010 | 2011 | 3,942,708 | 12.1 |
| Dec-10 | 12 | 2010 | 2011 | 3,185,507 | 9.8 |
| Jan-11 | 1 | 2011 | 2011 | 3,200,841 | 9.8 |
| Feb-11 | 2 | 2011 | 2011 | 3,060,068 | 9.4 |
| Mar-11 | 3 | 2011 | 2011 | 3,390,384 | 10.4 |
| Apr-11 | 4 | 2011 | 2011 | 3,368,917 | 10.3 |
| May-11 | 5 | 2011 | 2011 | 3,691,005 | 11.3 |
| Jun-11 | 6 | 2011 | 2011 | 4,275,343 | 13.1 |
| Jul-11 | 7 | 2011 | 2011 | 4,986,467 | 15.3 |
| Aug-11 | 8 | 2011 | 2011 | 5,904,263 | 18.1 |
| Sep-11 | 9 | 2011 | 2011 | 5,724,219 | 17.6 |
| Oct-11 | 10 | 2011 | 2012 | 5,094,254 | 15.6 |
| Nov-11 | 11 | 2011 | 2012 | 4,896,108 | 15.0 |
| Dec-11 | 12 | 2011 | 2012 | 4,539,612 | 13.9 |
| Jan-12 | 1 | 2012 | 2012 | 4,608,054 | 14.1 |
| Feb-12 | 2 | 2012 | 2012 | 4,480,146 | 13.8 |
| Mar-12 | 3 | 2012 | 2012 | 3,083,704 | 9.5 |
| Apr-12 | 4 | 2012 | 2012 | 3,013,467 | 9.2 |
| May-12 | 5 | 2012 | 2012 | 3,152,745 | 9.7 |
| Jun-12 | 6 | 2012 | 2012 | 3,264,795 | 10.0 |
| Jul-12 | 7 | 2012 | 2012 | 3,350,815 | 10.3 |
| Aug-12 | 8 | 2012 | 2012 | 3,968,663 | 12.2 |
| Sep-12 | 9 | 2012 | 2012 | 3,635,504 | 11.2 |
| Oct-12 | 10 | 2012 | 2013 | 3,125,069 | 9.6 |
| Nov-12 | 11 | 2012 | 2013 | 2,340,866 | 7.2 |
| Dec-12 | 12 | 2012 | 2013 | 2,277,360 | 7.0 |
| Jan-13 | 1 | 2013 | 2013 | 2,496,076 | 7.7 |
| Feb-13 | 2 | 2013 | 2013 | 2,309,375 | 7.1 |

| Hydesville Raw Data | | | | | |
|---|---|---|---|---|---|
| Month/Year | Month | Calendar Year | Water Year | Monthly Total Pumped (gal) | Water Pumped (AF) |
| Mar-13 | 3 | 2013 | 2013 | 2,457,254 | 7.5 |
| Apr-13 | 4 | 2013 | 2013 | 2,579,852 | 7.9 |
| May-13 | 5 | 2013 | 2013 | 3,660,263 | 11.2 |
| Jun-13 | 6 | 2013 | 2013 | 4,052,215 | 12.4 |
| Jul-13 | 7 | 2013 | 2013 | 5,004,195 | 15.4 |
| Aug-13 | 8 | 2013 | 2013 | 4,560,648 | 14.0 |
| Sep-13 | 9 | 2013 | 2013 | 3,381,334 | 10.4 |
| Oct-13 | 10 | 2013 | 2014 | 2,719,802 | 8.3 |
| Nov-13 | 11 | 2013 | 2014 | 2,433,244 | 7.5 |
| Dec-13 | 12 | 2013 | 2014 | 2,644,554 | 8.1 |
| Jan-14 | 1 | 2014 | 2014 | 2,655,474 | 8.1 |
| Feb-14 | 2 | 2014 | 2014 | 2,128,583 | 6.5 |
| Mar-14 | 3 | 2014 | 2014 | 2,189,171 | 6.7 |
| Apr-14 | 4 | 2014 | 2014 | 2,428,980 | 7.5 |
| May-14 | 5 | 2014 | 2014 | 3,358,445 | 10.3 |
| Jun-14 | 6 | 2014 | 2014 | 4,460,698 | 13.7 |
| Jul-14 | 7 | 2014 | 2014 | 4,310,649 | 13.2 |
| Aug-14 | 8 | 2014 | 2014 | 3,552,626 | 10.9 |
| Sep-14 | 9 | 2014 | 2014 | 3,074,728 | 9.4 |
| Oct-14 | 10 | 2014 | 2015 | 2,493,981 | 7.7 |
| Nov-14 | 11 | 2014 | 2015 | 1,819,734 | 5.6 |
| Dec-14 | 12 | 2014 | 2015 | 2,331,590 | 7.2 |
| Jan-15 | 1 | 2015 | 2015 | 2,217,745 | 6.8 |
| Feb-15 | 2 | 2015 | 2015 | 1,784,354 | 5.5 |
| Mar-15 | 3 | 2015 | 2015 | 2,184,758 | 6.7 |
| Apr-15 | 4 | 2015 | 2015 | 2,275,640 | 7.0 |
| May-15 | 5 | 2015 | 2015 | 2,433,094 | 7.5 |
| Jun-15 | 6 | 2015 | 2015 | 3,211,462 | 9.9 |
| Jul-15 | 7 | 2015 | 2015 | 3,548,886 | 10.9 |
| Aug-15 | 8 | 2015 | 2015 | 3,161,272 | 9.7 |
| Sep-15 | 9 | 2015 | 2015 | 3,216,998 | 9.9 |
| Oct-15 | 10 | 2015 | 2016 | 2,577,609 | 7.9 |
| Nov-15 | 11 | 2015 | 2016 | 2,153,118 | 6.6 |
| Dec-15 | 12 | 2015 | 2016 | 2,809,338 | 8.6 |
| Jan-16 | 1 | 2016 | 2016 | 2,307,280 | 7.1 |
| Feb-16 | 2 | 2016 | 2016 | 1,894,085 | 5.8 |
| Mar-16 | 3 | 2016 | 2016 | 2,064,180 | 6.3 |
| Apr-16 | 4 | 2016 | 2016 | 2,285,446 | 7.0 |
| May-16 | 5 | 2016 | 2016 | 2,591,396 | 8.0 |
| Jun-16 | 6 | 2016 | 2016 | 3,496,951 | 10.7 |
| Jul-16 | 7 | 2016 | 2016 | 3,656,747 | 11.2 |

| Hydesville Raw Data | | | | | |
|---|---|---|---|---|---|
| Month/Year | Month | Calendar Year | Water Year | Monthly Total Pumped (gal) | Water Pumped (AF) |
| Aug-16 | 8 | 2016 | 2016 | 3,882,344 | 11.9 |
| Sep-16 | 9 | 2016 | 2016 | 3,366,448 | 10.3 |
| Oct-16 | 10 | 2016 | 2017 | 2,301,895 | 7.1 |
| Nov-16 | 11 | 2016 | 2017 | 2,234,212 | 6.9 |
| Dec-16 | 12 | 2016 | 2017 | 2,377,592 | 7.3 |
| Jan-17 | 1 | 2017 | 2017 | 2,442,145 | 7.5 |
| Feb-17 | 2 | 2017 | 2017 | 1,980,479 | 6.1 |
| Mar-17 | 3 | 2017 | 2017 | 2,200,017 | 6.8 |
| Apr-17 | 4 | 2017 | 2017 | 1,901,490 | 5.8 |
| May-17 | 5 | 2017 | 2017 | 2,426,063 | 7.4 |
| Jun-17 | 6 | 2017 | 2017 | 2,970,682 | 9.1 |
| Jul-17 | 7 | 2017 | 2017 | 3,495,179 | 10.7 |
| Aug-17 | 8 | 2017 | 2017 | 3,770,443 | 11.6 |
| Sep-17 | 9 | 2017 | 2017 | 3,635,354 | 11.2 |
| Oct-17 | 10 | 2017 | 2018 | 2,872,320 | 8.8 |
| Nov-17 | 11 | 2017 | 2018 | 2,407,064 | 7.4 |
| Dec-17 | 12 | 2017 | 2018 | 2,151,996 | 6.6 |
| Jan-18 | 1 | 2018 | 2018 | 2,419,929 | 7.4 |
| Feb-18 | 2 | 2018 | 2018 | 2,048,572 | 6.3 |
| Mar-18 | 3 | 2018 | 2018 | 2,282,372 | 7.0 |
| Apr-18 | 4 | 2018 | 2018 | 2,290,000 | 7.0 |
| May-18 | 5 | 2018 | 2018 | 2,471,000 | 7.6 |
| Jun-18 | 6 | 2018 | 2018 | 3,372,058 | 10.3 |
| Jul-18 | 7 | 2018 | 2018 | 4,610,061 | 14.1 |
| Aug-18 | 8 | 2018 | 2018 | 4,110,000 | 12.6 |
| Sep-18 | 9 | 2018 | 2018 | 3,763,861 | 11.6 |
| Oct-18 | 10 | 2018 | 2019 | 2,712,024 | 8.3 |
| Nov-18 | 11 | 2018 | 2019 | 2,446,184 | 7.5 |
| Dec-18 | 12 | 2018 | 2019 | 2,463,613 | 7.6 |
| Jan-19 | 1 | 2019 | 2019 | 2,691,977 | 8.3 |
| Feb-19 | 2 | 2019 | 2019 | 2,220,588 | 6.8 |
| Mar-19 | 3 | 2019 | 2019 | 2,580,407 | 7.9 |
| Apr-19 | 4 | 2019 | 2019 | 2,508,044 | 7.7 |
| May-19 | 5 | 2019 | 2019 | 2,878,753 | 8.8 |
| Jun-19 | 6 | 2019 | 2019 | 3,629,703 | 11.1 |
| Jul-19 | 7 | 2019 | 2019 | 4,578,280 | 14.1 |
| Aug-19 | 8 | 2019 | 2019 | 4,476,780 | 13.7 |
| Sep-19 | 9 | 2019 | 2019 | 3,561,452 | 10.9 |
| Oct-19 | 10 | 2019 | 2020 | 2,607,902 | 8.0 |
| Nov-19 | 11 | 2019 | 2020 | 2,448,578 | 7.5 |
| Dec-19 | 12 | 2019 | 2020 | 3,224,553 | 9.9 |

| Hydesville Raw Data | | | | | |
|---|---|---|---|---|---|
| Month/Year | Month | Calendar Year | Water Year | Monthly Total Pumped (gal) | Water Pumped (AF) |
| Jan-20 | 1 | 2020 | 2020 | 2,895,284 | 8.9 |
| Feb-20 | 2 | 2020 | 2020 | 2,154,390 | 6.6 |
| Mar-20 | 3 | 2020 | 2020 | 2,414,394 | 7.4 |
| Apr-20 | 4 | 2020 | 2020 | 2,668,116 | 8.2 |
| May-20 | 5 | 2020 | 2020 | 2,771,041 | 8.5 |
| Jun-20 | 6 | 2020 | 2020 | 3,520,387 | 10.8 |
| Jul-20 | 7 | 2020 | 2020 | 4,598,704 | 14.1 |
| Aug-20 | 8 | 2020 | 2020 | 4,235,176 | 13.0 |
| Sep-20 | 9 | 2020 | 2020 | 3,644,256 | 11.2 |
| Oct-20 | 10 | 2020 | 2021 | 3,052,588 | 9.4 |
| Nov-20 | 11 | 2020 | 2021 | 2,676,344 | 8.2 |
| Dec-20 | 12 | 2020 | 2021 | 2,555,168 | 7.8 |

| Hydesville Summary by Year | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Units | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| Water | Acre Ft / Year | 139.8 | 144.5 | 117.4 | 110.4 | 94.2 | 101.5 | 97.4 | 106.8 | 112.8 | 114.1 |

| Riverside Raw Data | |
|---|---|
| Water Source : Upland Well | |
| Year | Water Use (AF/Y) |
| 2005 | 38.15 |
| 2006 | 26.29 |
| 2007 | 26.05 |
| 2008 | NA |
| 2009 | 31.53 |
| 2010 | 33.2 |
| 2011 | 31.88 |
| 2012 | 32.36 |
| 2013 | 34.8 |
| 2014 | NA |
| 2015 | 23.51 |

| Riverside Summary by Year | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Units | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| Water | Acre Ft / Year | 31.9 | 32.4 | 34.8 | 30.9 | 23.5 | 30.9 | 30.9 | 30.9 | 30.9 | 30.9 |

| Palmer CSD Raw Data | | | | |
|---|---|---|---|---|
| Month | Cal Year | Water Year | Water Pumped (CF) | Water Pumped (AF) |
| 10 | 2010 | 2011 | 0 | 0 |
| 11 | 2010 | 2011 | 0 | 0 |
| 12 | 2010 | 2011 | 0 | 0 |
| 1 | 2011 | 2011 | 0 | 0 |
| 2 | 2011 | 2011 | 73,797 | 2 |
| 3 | 2011 | 2011 | 0 | 0 |
| 4 | 2011 | 2011 | 0 | 0 |
| 5 | 2011 | 2011 | 0 | 0 |
| 6 | 2011 | 2011 | 0 | 0 |
| 7 | 2011 | 2011 | 0 | 0 |
| 8 | 2011 | 2011 | 0 | 0 |
| 9 | 2011 | 2011 | 145,855 | 3 |
| 10 | 2011 | 2012 | 0 | 0 |
| 11 | 2011 | 2012 | 78,074 | 2 |
| 12 | 2011 | 2012 | 0 | 0 |
| 1 | 2012 | 2012 | 76,336 | 2 |
| 2 | 2012 | 2012 | 74,470 | 2 |
| 3 | 2012 | 2012 | 71,791 | 2 |
| 4 | 2012 | 2012 | 72,590 | 2 |
| 5 | 2012 | 2012 | 85,027 | 2 |
| 6 | 2012 | 2012 | 92,250 | 2 |
| 7 | 2012 | 2012 | 93,716 | 2 |
| 8 | 2012 | 2012 | 102,040 | 2 |
| 9 | 2012 | 2012 | 135,027 | 3 |
| 10 | 2012 | 2013 | 98,128 | 2 |
| 11 | 2012 | 2013 | 108,288 | 2 |
| 12 | 2012 | 2013 | 90,508 | 2 |
| 1 | 2013 | 2013 | 81,551 | 2 |
| 2 | 2013 | 2013 | 65,642 | 2 |
| 3 | 2013 | 2013 | 67,781 | 2 |
| 4 | 2013 | 2013 | 80,481 | 2 |
| 5 | 2013 | 2013 | 90,642 | 2 |
| 6 | 2013 | 2013 | 88,235 | 2 |
| 7 | 2013 | 2013 | 122,995 | 3 |
| 8 | 2013 | 2013 | 118,182 | 3 |
| 9 | 2013 | 2013 | 88,770 | 2 |
| 10 | 2013 | 2014 | 89,705 | 2 |
| 11 | 2013 | 2014 | 66,845 | 2 |
| 12 | 2013 | 2014 | 75,936 | 2 |
| 1 | 2014 | 2014 | 90,241 | 2 |

| Palmer CSD Raw Data | | | | |
|---|---|---|---|---|
| Month | Cal Year | Water Year | Water Pumped (CF) | Water Pumped (AF) |
| 2 | 2014 | 2014 | 62,165 | 1 |
| 3 | 2014 | 2014 | 56,952 | 1 |
| 4 | 2014 | 2014 | 79,813 | 2 |
| 5 | 2014 | 2014 | 87,433 | 2 |
| 6 | 2014 | 2014 | 109,224 | 3 |
| 7 | 2014 | 2014 | 104,545 | 2 |
| 8 | 2014 | 2014 | 103,074 | 2 |
| 9 | 2014 | 2014 | 94,652 | 2 |
| 10 | 2014 | 2015 | 75,401 | 2 |
| 11 | 2014 | 2015 | 61,764 | 1 |
| 12 | 2014 | 2015 | 77,139 | 2 |
| 1 | 2015 | 2015 | 65,107 | 1 |
| 2 | 2015 | 2015 | 51,737 | 1 |
| 3 | 2015 | 2015 | 64,405 | 1 |
| 4 | 2015 | 2015 | 72,995 | 2 |
| 5 | 2015 | 2015 | 72,727 | 2 |
| 6 | 2015 | 2015 | 80,882 | 2 |
| 7 | 2015 | 2015 | 105,080 | 2 |
| 8 | 2015 | 2015 | 112,968 | 3 |
| 9 | 2015 | 2015 | 103,075 | 2 |
| 10 | 2015 | 2016 | 85,160 | 2 |
| 11 | 2015 | 2016 | 67,914 | 2 |
| 12 | 2015 | 2016 | 75,936 | 2 |
| 1 | 2016 | 2016 | 68,048 | 2 |
| 2 | 2016 | 2016 | 76,871 | 2 |
| 3 | 2016 | 2016 | 67,914 | 2 |
| 4 | 2016 | 2016 | 75,000 | 2 |
| 5 | 2016 | 2016 | 75,267 | 2 |
| 6 | 2016 | 2016 | 102,540 | 2 |
| 7 | 2016 | 2016 | 87,116 | 2 |
| 8 | 2016 | 2016 | 132,085 | 3 |
| 9 | 2016 | 2016 | 104,812 | 2 |
| 10 | 2016 | 2017 | 98,262 | 2 |
| 11 | 2016 | 2017 | 78,743 | 2 |
| 12 | 2016 | 2017 | 68,582 | 2 |
| 1 | 2017 | 2017 | 66,444 | 2 |
| 2 | 2017 | 2017 | 75,530 | 2 |
| 3 | 2017 | 2017 | 71,930 | 2 |
| 4 | 2017 | 2017 | 45,720 | 1 |
| 5 | 2017 | 2017 | 77,670 | 2 |

| Palmer CSD Raw Data | | | | |
|---|---|---|---|---|
| Month | Cal Year | Water Year | Water Pumped (CF) | Water Pumped (AF) |
| 6 | 2017 | 2017 | 89,050 | 2 |
| 7 | 2017 | 2017 | 118,180 | 3 |
| 8 | 2017 | 2017 | 107,880 | 2 |
| 9 | 2017 | 2017 | 91,850 | 2 |
| 10 | 2017 | 2018 | 81,280 | 2 |
| 11 | 2017 | 2018 | 84,500 | 2 |
| 12 | 2017 | 2018 | 84,890 | 2 |
| 1 | 2018 | 2018 | 87,170 | 2 |
| 2 | 2018 | 2018 | 72,720 | 2 |
| 3 | 2018 | 2018 | 62,030 | 1 |
| 4 | 2018 | 2018 | 78,070 | 2 |
| 5 | 2018 | 2018 | 81,290 | 2 |
| 6 | 2018 | 2018 | 86,630 | 2 |
| 7 | 2018 | 2018 | 106,420 | 2 |
| 8 | 2018 | 2018 | 120,320 | 3 |
| 9 | 2018 | 2018 | 113,230 | 3 |
| 10 | 2018 | 2019 | 89,310 | 2 |
| 11 | 2018 | 2019 | 82,620 | 2 |
| 12 | 2018 | 2019 | 61,040 | 1 |
| 1 | 2019 | 2019 | 89,230 | 2 |
| 2 | 2019 | 2019 | 68,980 | 2 |
| 3 | 2019 | 2019 | 59,090 | 1 |
| 4 | 2019 | 2019 | 87,430 | 2 |
| 5 | 2019 | 2019 | 164,170 | 4 |
| 6 | 2019 | 2019 | 107,487 | 2 |
| 7 | 2019 | 2019 | 124,600 | 3 |
| 8 | 2019 | 2019 | 133,690 | 3 |
| 9 | 2019 | 2019 | 99,470 | 2 |
| 10 | 2019 | 2020 | 83,960 | 2 |
| 11 | 2019 | 2020 | 85,290 | 2 |
| 12 | 2019 | 2020 | 89,170 | 2 |
| 1 | 2020 | 2020 | 75,410 | 2 |
| 2 | 2020 | 2020 | 80,340 | 2 |
| 3 | 2020 | 2020 | 100,000 | 2 |
| 4 | 2020 | 2020 | 64,300 | 1 |
| 5 | 2020 | 2020 | 87,710 | 2 |
| 6 | 2020 | 2020 | 94,380 | 2 |
| 7 | 2020 | 2020 | 134,500 | 3 |
| 8 | 2020 | 2020 | 136,890 | 3 |
| 9 | 2020 | 2020 | 110,700 | 3 |

| Palmer CSD Summary by Year | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Units | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| Water | Acre Ft / Year | 5.0 | 20.2 | 25.3 | 23.4 | 21.7 | 23.4 | 22.7 | 24.3 | 26.8 | 26.2 |

# Humboldt County Board of Supervisors Resolution 20-39
# (Appendix A)

**RESOLUTION NO. 20-39**

**RESOLUTION OF THE HUMBOLDT COUNTY BOARD OF SUPERVISORS AUTHORIZING FORMATION OF THE HUMBOLDT COUNTY GROUNDWATER SUSTAINABILITY AGENCY FOR THE EEL RIVER VALLEY GROUNDWATER BASIN**

**WHEREAS,** the California Legislature adopted, and the Governor signed into law, the Sustainable Groundwater Management Act of 2014 ("SGMA"); and

**WHEREAS,** the legislative intent of SGMA includes providing for sustainable management of groundwater basins, enhancing local management of groundwater consistent with rights to use or store groundwater, establishing minimum standards for sustainable groundwater management and providing local groundwater agencies with the authority and technical and financial assistance necessary to sustainably manage groundwater; and

**WHEREAS,** in order to exercise the authority granted in SGMA, a local agency, or a combination of local agencies, overlying a groundwater basin may decide to form a Groundwater Sustainability Agency ("GSA") for the local management of groundwater; and

**WHEREAS,** the County of Humboldt ("County") is a local agency, as that term is defined under SGMA, which overlies the Eel River Valley groundwater basin (basin number 1-10); and

**WHEREAS,** on January 1, 2015, the California Department of Water Resources ("DWR") designated the Eel River Valley groundwater basin as a medium-priority basin; and

**WHEREAS,** on October 6, 2015, the Humboldt County Board of Supervisors ("Board") approved the formation of an Eel River Valley Groundwater Working Group consisting of stakeholders representing agricultural, municipal and environmental interests to provide input regarding the local response to DWR's designation of the Eel River Valley groundwater basin as a medium-priority basin; and

**WHEREAS,** DWR authorized local agencies to submit a Groundwater Sustainability Plan ("GSP") Alternative by January 1, 2017, if the GSP Alternative demonstrates that the basin has operated within its sustainable yield over a period of ten (10) years and contains the functional equivalent of a GSP; and

**WHEREAS,** on December 13, 2016, the Board approved Resolution No. 16-142 authorizing the Humboldt County Department of Public Works ("Public Works") to submit a GSP Alternative for the Eel River Valley groundwater basin; and

**WHEREAS,** County deferred on formation of a GSA in 2016 because a GSP Alternative could be submitted by a local agency without forming a GSA; and

**WHEREAS,** on December 31, 2016, Public Works submitted a GSP Alternative for the Eel River Valley groundwater basin to DWR for review and approval; and

**WHEREAS,** Public Works performed annual monitoring and reporting activities for the Eel River Valley groundwater basin following submittal of the GSP Alternative; and

**WHEREAS,** in 2018 SGMA Basin Prioritization process, DWR renewed its designation of the Eel River Valley groundwater basin as a medium-priority basin; and

**WHEREAS**, on July 17, 2019, DWR issued a notification letter and staff report stating that DWR intended to disapprove the GSP Alternative for the Eel River Valley groundwater basin because the GSP Alternative did not contain all the required elements and did not provide sufficient evidence that the requirements for sustainable groundwater management had been performed for a ten (10) year period; and

**WHEREAS**, on September 30, 2019, the County submitted a comment letter regarding DWR's review of the GSP Alternative for the Eel River Valley groundwater basin; and

**WHEREAS**, SGMA requires that all medium-priority basins have an adopted GSP no later than January 31, 2022, if a GSP Alternative has not been approved; and

**WHEREAS**, on November 12, 2019, the Board approved Resolution No. 19-111 which committed the County to work collaboratively with water uses and stakeholders to form a GSA for the Eel River Valley groundwater basin and authorized Public Works to apply for a Sustainable Groundwater Management Planning Grant for the development of a GSP; and

**WHEREAS**, on November 13, 2019, DWR issued a notification letter and staff report stating that the GSP Alternative for the Eel River Valley groundwater basin was disapproved for the reasons stated in its notification letter dated July 17, 2019; and

**WHEREAS**, on March 5, 2020, there was unanimous consent among attendees of the Eel River Valley Groundwater Working Group for the County to become the GSA for the Eel River Valley groundwater basin, and for the Board to form a Groundwater Resources Advisory Committee that would advise the Board on groundwater matters in the Eel River Valley and provide guidance and assistance to Public Works in developing the GSP; and

**WHEREAS**, on March 13, 2020, DWR issued an award notification to Humboldt County for the aforementioned grant application for funds to develop a GSP; and

**WHEREAS**, Sections 10723.8 and 10724 of SGMA require that a local agency deciding to be a GSA must notify DWR of its decision and intention to undertake sustainable groundwater management within the agency's jurisdictional boundary; and

**WHEREAS**, Section 10724 of SGMA provides that in the event that there is an area within a high- or medium-priority basin that is not within the management area of a GSA, the county within which that unmanaged area lies will be presumed to be the GSA for that area, unless the county declines its presumptive role as the GSA; and

**WHEREAS**, as of the time of consideration of this resolution, no other local agency has provided notice to DWR of the formation, or intent to form, a GSA for the Eel River Valley groundwater basin; and

**WHEREAS**, on May 5, 2020, after publication of notice as required by California Government Code Section 6066, the County held a public hearing regarding formation of the Humboldt County Groundwater Sustainability Agency for the Eel River Valley groundwater basin; and

**WHEREAS**, pursuant to Sections 15306, 15307 and 15308 of Title 14 of the California Code of Regulations, adoption of this resolution is exempt from the California Environmental Quality Act as information collection actions which do not result in a serious or major disturbance to an environmental resource, actions taken by regulatory agencies for protection of natural resources and actions taken by regulatory agencies for protection of the environment.

**NOW, THEREFORE, THE HUMBOLDT COUNTY BOARD OF SUPERVISORS HEREBY RESOLVES AS FOLLOWS:**

1. The Humboldt County Board of Supervisors hereby finds that the facts set forth in the recitals to this resolution are true and correct and establish the factual basis for adoption of this resolution.

2. The Humboldt County Board of Supervisors hereby authorizes formation of the Humboldt County Groundwater Sustainability Agency for the Eel River Valley groundwater basin.

3. The Humboldt County Board of Supervisors hereby directs the Humboldt County Department of Public Works to notify the California Department of Water Resources of its intent to manage groundwater within the boundaries of the Humboldt County Groundwater Sustainability Agency for the Eel River Valley groundwater basin as shown in the attached Exhibit A.

4. The Humboldt County Board of Supervisors hereby directs the Humboldt County Department of Public Works to inform the California Department of Water Resources of its decision to form the Humboldt County Groundwater Sustainability Agency for the Eel River Valley groundwater basin and to take such other and further steps as necessary to comply with the Sustainable Groundwater Management Act of 2014.

5. The Humboldt County Board of Supervisors hereby directs the Humboldt County Department of Public Works to return with proposed bylaws for the Humboldt County Groundwater Sustainability Agency for the Eel River Valley groundwater basin, including the structure for a Groundwater Resources Advisory Committee.

6. This resolution shall take effect immediately upon its adoption.

**BOARD OF SUPERVISORS, COUNTY OF HUMBOLDT, STATE OF CALIFORNIA**
Certified copy of portion of proceedings, Meeting of May 5, 2020

Dated: May 5, 2020

Estelle Fennell, Chair
Humboldt County Board of Supervisors

Adopted on motion by Supervisor Wilson, seconded by Supervisor Madrone, and the following vote:

| | | |
|---|---|---|
| AYES: | Supervisors | Bohn, Fennell, Madrone, Wilson, Bass |
| NAYS: | Supervisors | -- |
| ABSENT: | Supervisors | -- |
| ABSTAIN: | Supervisors | -- |

STATE OF CALIFORNIA )
County of Humboldt )

I, KATHY HAYES, Clerk of the Board of Supervisors, County of Humboldt, State of California, do hereby certify the foregoing to be an original made in the above-entitled matter by said Board of Supervisors at a meeting held in Eureka, California.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the Seal of said Board of Supervisors.

Ryan Sharp
Deputy Clerk of the Board of Supervisors of the County of Humboldt, State of California

# Groundwater Sustainability Plan Elements Guide
(Appendix B)

| Article 5. | | | Plan Contents for Eel River Valley Groundwater Basin | GSP Document References | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Page Numbers of Plan | Or Section Numbers | Or Figure Numbers | Or Table Numbers | Notes |
| § 354. | | | **Introduction to Plan Contents** | | | | | |
| | | | This Article describes the required contents of Plans submitted to the Department for evaluation, including administrative information, a description of the basin setting, sustainable management criteria, description of the monitoring network, and projects and management actions. | | | | | |
| | | | Note: Authority cited: Section 10733.2, Water Code. | | | | | |
| | | | Reference: Section 10733.2, Water Code. | | | | | |
| **SubArticle 1.** | | | **Administrative Information** | | | | | |
| § 354.2. | | | **Introduction to Administrative Information** | | | | | |
| | | | This Subarticle describes information in the Plan relating to administrative and other general information about the Agency that has adopted the Plan and the area covered by the Plan. | | | | | |
| | | | Note: Authority cited: Section 10733.2, Water Code. | | | | | |
| | | | Reference: Section 10733.2, Water Code. | | | | | |
| § 354.4. | | | **General Information** | | | | | |
| | | | Each Plan shall include the following general information: | | | | | |
| (a) | | | An executive summary written in plain language that provides an overview of the Plan and description of groundwater conditions in the basin. | 1:5 | | | | |
| (b) | | | A list of references and technical studies relied upon by the Agency in developing the Plan. Each Agency shall provide to the Department electronic copies of reports and other documents and materials cited as references that are not generally available to the public. | 10,154:158 | 10, 12 | | | |
| | | | Note: Authority cited: Section 10733.2, Water Code. | | | | | |
| | | | Reference: Sections 10733.2 and 10733.4, Water Code. | | | | | |
| § 354.6. | | | **Agency Information** | | | | | |
| | | | When submitting an adopted Plan to the Department, the Agency shall include a copy of the information provided pursuant to Water Code Section 10723.8, with any updates, if necessary, along with the following information: | | | | | |
| (a) | | | The name and mailing address of the Agency. | 20 | 1.6.1 | | | |
| (b) | | | The organization and management structure of the Agency, identifying persons with management authority for implementation of the Plan. | 20 | 1.6.2 | | | |
| (c) | | | The name and contact information, including the phone number, mailing address and electronic mail address, of the plan manager. | 20 | 1.6.2 | | | |
| (d) | | | The legal authority of the Agency, with specific reference to citations setting forth the duties, powers, and responsibilities of the Agency, demonstrating that the Agency has the legal authority to implement the Plan. | 20 | 1.6.3 | | | |
| (e) | | | An estimate of the cost of implementing the Plan and a general description of how the Agency plans to meet those costs. | 159:160 | 9.5 | | | |
| | | | Note: Authority cited: Section 10733.2, Water Code. | | | | | |
| | | | Reference: Sections 10723.8, 10727.2, and 10733.2, Water Code. | | | | | |
| § 354.8. | | | **Description of Plan Area** | | | | | |
| | | | Each Plan shall include a description of the geographic areas covered, including the following information: | | | | | |

| Article 5. | | | Plan Contents for Eel River Valley Groundwater Basin | GSP Document References | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Page Numbers of Plan | Or Section Numbers | Or Figure Numbers | Or Table Numbers | Notes |
| (a) | | | One or more maps of the basin that depict the following, as applicable: | | | | | |
| | (1) | | The area covered by the Plan, delineating areas managed by the Agency as an exclusive Agency and any areas for which the Agency is not an exclusive Agency, and the name and location of any adjacent basins. | 23 | 2.1 | 1 | | |
| | (2) | | Adjudicated areas, other Agencies within the basin, and areas covered by an Alternative. | 18 | 1.4 | | | The Basin does not contain areas with adjudicated groundwater rights or Alternative plans. |
| | (3) | | Jurisdictional boundaries of federal or state land (including the identity of the agency with jurisdiction over that land), tribal land, cities, counties, agencies with water management responsibilities, and areas covered by relevant general plans. | 17:18, 30:32 | 1.4, 2.5:2.6 | 2 | | |
| | (4) | | Existing land use designations and the identification of water use sector and water source type. | 30 | 2.5 | 5 | 7 | See Land Use Inventory Technical Memorandum (GHD, 2022) and Water Use Technical Memorandum (GHD, 2022). |
| | (5) | | The density of wells per square mile, by dasymetric or similar mapping techniques, showing the general distribution of agricultural, industrial, and domestic water supply wells in the basin, including de minimis extractors, and the location and extent of communities dependent upon groundwater, utilizing data provided by the Department, as specified in Section 353.2, or the best available information. | 47:49 | 3.6.5 | 4, 13 | | See primarily Figure 13. |
| (b) | | | A written description of the Plan area, including a summary of the jurisdictional areas and other features depicted on the map. | 17:18, 23:30 | 1.4, 2.1:2.5 | | | |
| (c) | | | Identification of existing water resource monitoring and management programs, and description of any such programs the Agency plans to incorporate in its monitoring network or in development of its Plan. The Agency may coordinate with existing water resource monitoring and management programs to incorporate and adopt that program as part of the Plan. | 33:34, 37:39 | 2.7, 2.9 | | | See Surface Water Flow Technical Memorandum |
| (d) | | | A description of how existing water resource monitoring or management programs may limit operational flexibility in the basin, and how the Plan has been developed to adapt to those limits. | N/A | | | | No existing water resource monitoring or management programs are expected to limit operational flexiblilty in the Basin. |
| (e) | | | A description of conjunctive use programs in the basin. | N/A | | | | No cojunctive use in the Basin. |
| (f) | | | A plain language description of the land use elements or topic categories of applicable general plans that includes the following: | | | | | |
| | (1) | | A summary of general plans and other land use plans governing the basin. | 31:32 | 2.6 | | | |
| | (2) | | A general description of how implementation of existing land use plans may change water demands within the basin or affect the ability of the Agency to achieve sustainable groundwater management over the planning and implementation horizon, and how the Plan addresses those potential effects | 105:109 | 5.7 | | | |
| | (3) | | A general description of how implementation of the Plan may affect the water supply assumptions of relevant land use plans over the planning and implementation horizon. | 160 | 9.7 | | | |
| | (4) | | A summary of the process for permitting new or replacement wells in the basin, including adopted standards in local well ordinances, zoning codes, and policies contained in adopted land use plans. | 40 | 2.11 | | | |

| Article 5. | | | Plan Contents for Eel River Valley Groundwater Basin | GSP Document References | | | | |
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| | | | | Page Numbers of Plan | Or Section Numbers | Or Figure Numbers | Or Table Numbers | Notes |
| | (5) | | To the extent known, the Agency may include information regarding the implementation of land use plans outside the basin that could affect the ability of the Agency to achieve sustainable groundwater management. | N/A | | | | Land use plans outside the Basin are not expected to affect GSP implentation. |
| (g) | | | A description of any of the additional Plan elements included in Water Code Section 10727.4 that the Agency determines to be appropriate. | 73:79 | 4.7 | | | See Groundwater Dependent Ecosystem Assessment, Revised January 2022 (Stillwater Sciences, Revised January 2022). |
| | | | Note: Authority cited: Section 10733.2, Water Code. | | | | | |
| | | | Reference: Sections 10720.3, 10727.2, 10727.4, 10733, and 10733.2, Water Code. | | | | | |
| **§ 354.10.** | | | **Notice and Communication** | | | | | |
| | | | Each Plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following: | | | | | |
| (a) | | | A description of the beneficial uses and users of groundwater in the basin, including the land uses and property interests potentially affected by the use of groundwater in the basin, the types of parties representing those interests, and the nature of consultation with those parties. | 22, 24:30 | 1.10, 2.4 | | | See Appendix B |
| (b) | | | A list of public meetings at which the Plan was discussed or considered by the Agency. | N/A | | | | See Appendix C |
| (c) | | | Comments regarding the Plan received by the Agency and a summary of any responses by the Agency. | 22 | | | | See Appendix G |
| (d) | | | A communication section of the Plan that includes the following: | | | | | |
| | (1) | | An explanation of the Agency's decision-making process. | 20 | 1.6.2 | | | |
| | (2) | | Identification of opportunities for public engagement and a discussion of how public input and response will be used. | 22, 157:158 | 1.10, 9.2.2 | | | See Appendix C |
| | (3) | | A description of how the Agency encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin. | 22, 157:158 | 1.10, 9.2.2 | | | See Appendix C |
| | (4) | | The method the Agency shall follow to inform the public about progress implementing the Plan, including the status of projects and actions. | 22, 157:158 | 1.10, 9.2.2 | | | See Appendix C |
| | | | Note: Authority cited: Section 10733.2, Water Code. | | | | | |
| | | | Reference: Sections 10723.2, 10727.8, 10728.4, and 10733.2, Water Code | | | | | |
| **SubArticle 2.** | | | **Basin Setting** | | | | | |
| **§ 354.12.** | | | **Introduction to Basin Setting** | | | | | |
| | | | This Subarticle describes the information about the physical setting and characteristics of the basin and current conditions of the basin that shall be part of each Plan, including the identification of data gaps and levels of uncertainty, which comprise the basin setting that serves as the basis for defining and assessing reasonable sustainable management criteria and projects and management actions. Information provided pursuant to this Subarticle shall be prepared by or under the direction of a professional geologist or professional engineer. | | | | | |
| | | | Note: Authority cited: Section 10733.2, Water Code. | | | | | |
| | | | Reference: Section 10733.2, Water Code. | | | | | |

| Article 5. | | | Plan Contents for Eel River Valley Groundwater Basin | GSP Document References | | | | |
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| | | | | Page Numbers of Plan | Or Section Numbers | Or Figure Numbers | Or Table Numbers | Notes |
| **§ 354.14.** | | | **Hydrogeologic Conceptual Model** | | | | | |
| (a) | | | Each Plan shall include a descriptive hydrogeologic conceptual model of the basin based on technical studies and qualified maps that characterizes the physical components and interaction of the surface water and groundwater systems in the basin. | 41:50 | 3 | 8:15 | | See Hydrogeologic Conceptual Model Report (GHD, August 2021). |
| (b) | | | The hydrogeologic conceptual model shall be summarized in a written description that includes the following: | | | | | |
| | (1) | | The regional geologic and structural setting of the basin including the immediate surrounding area, as necessary for geologic consistency. | 41:44 | 3.2:3.4 | 9 | | |
| | (2) | | Lateral basin boundaries, including major geologic features that significantly affect groundwater flow. | 23, 45:50 | 2.1, 3.6 | 3 | | See Aquifer Parameters Technical Memorandum (GHD, December 2021). |
| | (3) | | The definable bottom of the basin. | 58:59, 88 | 4.2, 5.4 | | | See Aquifer Parameters Technical Memorandum (GHD, December 2021). |
| | (4) | | Principal aquifers and aquitards, including the following information: | | | | | |
| | | (A) | Formation names, if defined. | 45:46 | 3.6.1, 3.6.2 | | | See Aquifer Parameters Technical Memorandum (GHD, December 2021). |
| | | (B) | Physical properties of aquifers and aquitards, including the vertical and lateral extent, hydraulic conductivity, and storativity, which may be based on existing technical studies or other best available information. | 46:47 | 3.6.3 | | | See Aquifer Parameters Technical Memorandum (GHD, December 2021). |
| | | (C) | Structural properties of the basin that restrict groundwater flow within the principal aquifers, including information regarding stratigraphic changes, truncation of units, or other features. | 43:50 | 3.4, 3.6 | | | See Aquifer Parameters Technical Memorandum (GHD, December 2021). |
| | | (D) | General water quality of the principal aquifers, which may be based on information derived from existing technical studies or regulatory programs. | 63:66 | 4.4 | | | See Saltwater Intrusion Technical Memorandum (SHN, September 2021), Water Quality Technical Memorandum. (SHN, September 2021), Water Quality Sampling and Analysis Plan. (SHN, June 2021), Hydrogeologic Conceptual Model Report (GHD, August 2021). |
| | | (E) | Identification of the primary use or uses of each aquifer, such as domestic, irrigation, or municipal water supply. | 47:49 | 3.6.5 | | 9 | |
| | (5) | | Identification of data gaps and uncertainty within the hydrogeologic conceptual model | 50 | 3.8 | | | |
| (c) | | | The hydrogeologic conceptual model shall be represented graphically by at least two scaled cross-sections that display the information required by this section and are sufficient to depict major stratigraphic and structural features in the basin. | N/A | | 10:11 | | See Hydrogeologic Conceptual Model Report (GHD, August 2021) Figures 3:7. |
| (d) | | | Physical characteristics of the basin shall be represented on one or more maps that depict the following: | | | | | |
| | (1) | | Topographic information derived from the U.S. Geological Survey or another reliable source. | 41:43 | 3.2 | 1 | | See Figure 1 and Terrain Data and Imagery Technical Memorandum (GHD, July 30, 2021). |
| | (2) | | Surficial geology derived from a qualified map including the locations of cross-sections required by this Section. | 43:44 | 3.4 | 9, 10, 11 | | See Figures 9, 10, 11 |

| Article 5. | | | Plan Contents for Eel River Valley Groundwater Basin | GSP Document References | | | | |
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| | | | | Page Numbers of Plan | Or Section Numbers | Or Figure Numbers | Or Table Numbers | Notes |
| | (3) | | Soil characteristics as described by the appropriate Natural Resources Conservation Service soil survey or other applicable studies. | 44:45 | 3.5 | 12 | | See Figure 12 |
| | (4) | | Delineation of existing recharge areas that substantially contribute to the replenishment of the basin, potential recharge areas, and discharge areas, including significant active springs, seeps, and wetlands within or adjacent to the basin. | 49:50 | 3.6.6 | 14 | | See Figure 14 |
| | (5) | | Surface water bodies that are significant to the management of the basin. | 43 | 3.3 | 8 | | See Figure 8 |
| | (6) | | The source and point of delivery for imported water supplies. | N/A | | | | The basin does not import water. See section 1.4 |
| | | | Note: Authority cited: Section 10733.2, Water Code. | | | | | |
| | | | Reference: Sections 10727.2, 10733, and 10733.2, Water Code. | | | | | |
| **§ 354.16.** | | | **Groundwater Conditions** | | | | | |
| | | | Each Plan shall provide a description of current and historical groundwater conditions in the basin, including data from January 1, 2015, to current conditions, based on the best available information that includes the following: | | | | | |
| (a) | | | Groundwater elevation data demonstrating flow directions, lateral and vertical gradients, and regional pumping patterns, including: | | | | | |
| | (1) | | Groundwater elevation contour maps depicting the groundwater table or potentiometric surface associated with the current seasonal high and seasonal low for each principal aquifer within the basin. | N/A | | 18:21 | | Contour maps are found in Figures 18:21 of the separate GSP_Figures1-39.pdf file. (Subsequent references to Figures refer to this file) Also see Water Levels Technical Memorandum. (SHN, September 2021) |
| | (2) | | Hydrographs depicting long-term groundwater elevations, historical highs and lows, and hydraulic gradients between principal aquifers. | N/A | | 17 | | Hydrographs are found in Figure 17. Also see Water Levels Technical Memorandum. (SHN, September 2021) |
| (b) | | | A graph depicting estimates of the change in groundwater in storage, based on data, demonstrating the annual and cumulative change in the volume of groundwater in storage between seasonal high groundwater conditions, including the annual groundwater use and water year type. | 59 | 4.2 | | | See Chart 2. |
| (c) | | | Seawater intrusion conditions in the basin, including maps and cross-sections of the seawater intrusion front for each principal aquifer. | 59:62 | 4.3 | 22:29 | | See Saltwater Intrusion Technical Memorandum (SHN, September 2021) |
| (d) | | | Groundwater quality issues that may affect the supply and beneficial uses of groundwater, including a description and map of the location of known groundwater contamination sites and plumes. | 62:65 | 4.4 | 30, 31 | | See Water Quality Technical Memorandum. (SHN, September 2021) |
| (e) | | | The extent, cumulative total, and annual rate of land subsidence, including maps depicting total subsidence, utilizing data available from the Department, as specified in Section 353.2, or the best available information. | 65 | 4.5 | 15 | | |
| (f) | | | Identification of interconnected surface water systems within the basin and an estimate of the quantity and timing of depletions of those systems, utilizing data available from the Department, as specified in Section 353.2, or the best available information. | 65:71, 129:136 | 4.6, 6.11 | 8, 39 | | See Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022). General information on interconnected surface waters is in Section 4.6 with information on stream depletion in Section 6.11. See also Chart 15 on p. 140. |

| Article 5. | | | Plan Contents for Eel River Valley Groundwater Basin | GSP Document References | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Page Numbers of Plan | Or Section Numbers | Or Figure Numbers | Or Table Numbers | Notes |
| (g) | | | Identification of groundwater dependent ecosystems within the basin, utilizing data available from the Department, as specified in Section 353.2, or the best available information. | 72:78 | 4.7 | 33:36 | 10, 11 | See Groundwater Dependent Ecosystem Assessment, Revised January 2022 (Stillwater Sciences, Revised January 2022) |
| | | | Note: Authority cited: Section 10733.2, Water Code. | | | | | |
| | | | Reference: Sections 10723.2, 10727.2, 10727.4, and 10733.2, Water Code. | | | | | |
| **§ 354.18.** | | | **Water Budget** | | | | | |
| (a) | | | Each Plan shall include a water budget for the basin that provides an accounting and assessment of the total annual volume of groundwater and surface water entering and leaving the basin, including historical, current and projected water budget conditions, and the change in the volume of water stored. Water budget information shall be reported in tabular and graphical form. | 79:108 | 5 | | 11, 13:19 | See Diagrams 1, 2, and Charts 3:14. See Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022). |
| (b) | | | The water budget shall quantify the following, either through direct measurements or estimates based on data: | | | | | |
| | (1) | | Total surface water entering and leaving a basin by water source type. | 87:89, 91:93 | 5.4.1, 5.4.3 | | 15,17 | See Chart 4, 6 See Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022). |
| | (2) | | Inflow to the groundwater system by water source type, including subsurface groundwater inflow and infiltration of precipitation, applied water, and surface water systems, such as lakes, streams, rivers, canals, springs and conveyance systems. | 89:91 | 5.4.2 | | 16 | See Chart 5. See Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022). |
| | (3) | | Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow. | 93:96 | 5.4.4 | | 18 | See Chart 7.See Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022). |
| | (4) | | The change in the annual volume of groundwater in storage between seasonal high conditions. | 57:59, 97 | 4.2, 5.4.5 | | | See Chart 2. See Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022). |
| | (5) | | If overdraft conditions occur, as defined in Bulletin 118, the water budget shall include a quantification of overdraft over a period of years during which water year and water supply conditions approximate average conditions. | N/A | | | | Overdraft coditions do not exist in the Basin. See Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022). |
| | (6) | | The water year type associated with the annual supply, demand, and change in groundwater stored. | 80:83 | 5.2 | | 14 | See Charts 3, 9:14. See Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022). |
| | (7) | | An estimate of sustainable yield for the basin. | 138 | 6.13 | | | See Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022). |
| (c) | | | Each Plan shall quantify the current, historical, and projected water budget for the basin as follows: | | | | | |
| | (1) | | Current water budget information shall quantify current inflows and outflows for the basin using the most recent hydrology, water supply, water demand, and land use information. | 87:97, 99:103 | 5.4, 5.5.2 | | 14:17 | See Charts 10:14. See Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022). |

| Article 5. | | | Plan Contents for Eel River Valley Groundwater Basin | GSP Document References | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Page Numbers of Plan | Or Section Numbers | Or Figure Numbers | Or Table Numbers | Notes |
| | (2) | | Historical water budget information shall be used to evaluate availability or reliability of past surface water supply deliveries and aquifer response to water supply and demand trends relative to water year type. The historical water budget shall include the following: | | | | | |
| | | (A) | A quantitative evaluation of the availability or reliability of historical surface water supply deliveries as a function of the historical planned versus actual annual surface water deliveries, by surface water source and water year type, and based on the most recent ten years of surface water supply information. | N/A | | | | Surface water deliveries, as part of Federal or State water supply projects, are not present in the basin. Surface water use is minimal and is not expected to vary. |
| | | (B) | A quantitative assessment of the historical water budget, starting with the most recently available information and extending back a minimum of 10 years, or as is sufficient to calibrate and reduce the uncertainty of the tools and methods used to estimate and project future water budget information and future aquifer response to proposed sustainable groundwater management practices over the planning and implementation horizon. | 79, 83:109 | 5.1, 5.3:5.7 | | | See Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022). |
| | | (C) | A description of how historical conditions concerning hydrology, water demand, and surface water supply availability or reliability have impacted the ability of the Agency to operate the basin within sustainable yield. Basin hydrology may be characterized and evaluated using water year type. | 80:81, 84:103 | 5.1, 5.3:5.5 | | | Because the basin has historically been managed sustainably, historic conditions have not impacted the ability to continue sustainable management. See Chart 9:14. See Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022). |
| | (3) | | Projected water budgets shall be used to estimate future baseline conditions of supply, demand, and aquifer response to Plan implementation, and to identify the uncertainties of these projected water budget components. The projected water budget shall utilize the following methodologies and assumptions to estimate future baseline conditions concerning hydrology, water demand and surface water supply availability or reliability over the planning and implementation horizon: | | | | | |
| | | (A) | Projected hydrology shall utilize 50 years of historical precipitation, evapotranspiration, and streamflow information as the baseline condition for estimating future hydrology. The projected hydrology information shall also be applied as the baseline condition used to evaluate future scenarios of hydrologic uncertainty associated with projections of climate change and sea level rise. | 104:108 | 5.7 | | | See Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022). |
| | | (B) | Projected water demand shall utilize the most recent land use, evapotranspiration, and crop coefficient information as the baseline condition for estimating future water demand. The projected water demand information shall also be applied as the baseline condition used to evaluate future scenarios of water demand uncertainty associated with projected changes in local land use planning, population growth, and climate. | 104:108 | 5.7 | | | See Water Use Technical Memorandum (GHD, 2022), Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022), Land Use Inventory Technical Memorandum (GHD, 2022) |

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| | | (C) | Projected surface water supply shall utilize the most recent water supply information as the baseline condition for estimating future surface water supply. The projected surface water supply shall also be applied as the baseline condition used to evaluate future scenarios of surface water supply availability and reliability as a function of the historical surface water supply identified in Section 354.18(c)(2)(A), and the projected changes in local land use planning, population growth, and climate. | N/A | 5.7 | | | There are not stored or exported surface water supplies to the basin. Information on projected surface water flows, which contribute to the water budget, are same as above. See Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022). |
| (d) | | | The Agency shall utilize the following information provided, as available, by the Department pursuant to Section 353.2, or other data of comparable quality, to develop the water budget: | | | | | |
| | (1) | | Historical water budget information for mean annual temperature, mean annual precipitation, water year type, and land use. | 98 | 5.4, 5.5.1 | | | See Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022). |
| | (2) | | Current water budget information for temperature, water year type, evapotranspiration, and land use. | 83:87 | 5.3 | | | See Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022). |
| | (3) | | Projected water budget information for population, population growth, climate change, and sea level rise. | 83:87, 104:108 | 5.3, 5.7 | | | See Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022). |
| (e) | | | Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow. If a numerical groundwater and surface water model is not used to quantify and evaluate the projected water budget conditions and the potential impacts to beneficial uses and users of groundwater, the Plan shall identify and describe an equally effective method, tool, or analytical model to evaluate projected water budget conditions. | 80:109 | 5 | | | See Agricultural Groundwater Use Technical Memorandum (HCDPW, HCRCD, WRS, October 2021), Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022), Land Use Inventory Technical Memorandum (GHD, 2022), Preliminary Analysis of 2020/2021 Surface Water and Groundwater Interaction Studies–Eel River Valley Groundwater Basin, (SHN, January 2022), Surface Water Flows Technical Memorandum 2021 (Thomas Gast and Associates, January 2022), Surface Water Flows Technical Memorandum 2020 (Thomas Gast and Associates, January 2022). |
| (f) | | | The Department shall provide the California Central Valley Groundwater-Surface Water Simulation Model (C2VSIM) and the Integrated Water Flow Model (IWFM) for use by Agencies in developing the water budget. Each Agency may choose to use a different groundwater and surface water model, pursuant to Section 352.4. | 83:87 | 5.3 | | | See Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022). |
| | | | Note: Authority cited: Section 10733.2, Water Code. | | | | | |
| | | | Reference: Sections 10721, 10723.2, 10727.2, 10727.6, 10729, and 10733.2, Water Code. | | | | | |
| **§ 354.20.** | | | **Management Areas** | | | | | |

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| (a) | | | Each Agency may define one or more management areas within a basin if the Agency has determined that creation of management areas will facilitate implementation of the Plan. Management areas may define different minimum thresholds and be operated to different measurable objectives than the basin at large, provided that undesirable results are defined consistently throughout the basin. | 110 | 6.2 | | | |
| (b) | | | A basin that includes one or more management areas shall describe the following in the Plan: | | | | | |
| | (1) | | The reason for the creation of each management area. | N/A | | | | No management acreas established. See Section 6.2 |
| | (2) | | The minimum thresholds and measurable objectives established for each management area, and an explanation of the rationale for selecting those values, if different from the basin at large. | N/A | | | | No management acreas established. See Section 6.2 |
| | (3) | | The level of monitoring and analysis appropriate for each management area. | N/A | | | | No management acreas established. See Section 6.2 |
| | (4) | | An explanation of how the management area can operate under different minimum thresholds and measurable objectives without causing undesirable results outside the management area, if applicable. | N/A | | | | No management acreas established. See Section 6.2 |
| (c) | | | If a Plan includes one or more management areas, the Plan shall include descriptions, maps, and other information required by this Subarticle sufficient to describe conditions in those areas. | N/A | | | | No management acreas established. See Section 6.2 |
| | | | Note: Authority cited: Section 10733.2, Water Code. | | | | | |
| | | | Reference: Sections 10733.2 and 10733.4, Water Code. | | | | | |
| **SubArticle 3.** | | | **Sustainable Management Criteria** | | | | | |
| **§ 354.22.** | | | **Introduction to Sustainable Management Criteria** | | | | | |
| | | | This Subarticle describes criteria by which an Agency defines conditions in its Plan that constitute sustainable groundwater management for the basin, including the process by which the Agency shall characterize undesirable results, and establish minimum thresholds and measurable objectives for each applicable sustainability indicator. | | | | | |
| | | | Note: Authority cited: Section 10733.2, Water Code. | | | | | |
| | | | Reference: Section 10733.2, Water Code. | | | | | |
| **§ 354.24.** | | | **Sustainability Goal** | | | | | |
| | | | Each Agency shall establish in its Plan a sustainability goal for the basin that culminates in the absence of undesirable results within 20 years of the applicable statutory deadline. The Plan shall include a description of the sustainability goal, including information from the basin setting used to establish the sustainability goal, a discussion of the measures that will be implemented to ensure that the basin will be operated within its sustainable yield, and an explanation of how the sustainability goal is likely to be achieved within 20 years of Plan implementation and is likely to be maintained through the planning and implementation horizon. | 110 | 6.3 | | | |
| | | | Note: Authority cited: Section 10733.2, Water Code. | | | | | |

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| | | | Reference: Sections 10721, 10727, 10727.2, 10733.2, and 10733.8, Water Code. | | | | | |
| **§ 354.26.** | | | **Undesirable Results** | | | | | |
| (a) | | | Each Agency shall describe in its Plan the processes and criteria relied upon to define undesirable results applicable to the basin. Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin. | 109:139 | 6 | | | |
| (b) | | | The description of undesirable results shall include the following: | | | | | |
| | (1) | | The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate. | 114, 119, 120, 126:127, 129 | 6.6.1, 6.7.1, 6.8.1. 6.9.1, 6.11.1 | | 21 | |
| | (2) | | The criteria used to define when and where the effects of the groundwater conditions cause undesirable results for each applicable sustainability indicator. The criteria shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin. | 114:136 | 6.6.2:6.6.5, 6.7.2:6.7.5, 6.8.2:6.8.5, 6.9.2:6.9.5, 6.11.2:6.11.5 | | 21:26 | |
| | (3) | | Potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results. | 118, 125, 127, 135 | 6.6.3, 6.7.3, 6.8.3. 6.9.3, 6.11.3 | | | |
| (c) | | | The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site. | 118:119, 120, 126, 128, 136 | 6.6.5, 6.7.5, 6.8.5, 6.9.5, 6.11.5 | | 21:25 | |
| (d) | | | An Agency that is able to demonstrate that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin shall not be required to establish criteria for undesirable results related to those sustainability indicators. | 128 | 6.10 | | | |
| | | | Note: Authority cited: Section 10733.2, Water Code. | | | | | |
| | | | Reference: Sections 10721, 10723.2, 10727.2, 10733.2, and 10733.8, Water Code. | | | | | |
| **§ 354.28.** | | | **Minimum Thresholds** | | | | | |

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| (a) | | | Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26. | 114:118, 119, 121:125, 127, 129:135, 136:137 | 6.6.3, 6.8.3. 6.9.3, 6.11.3, 6.12 | | 26 | Numeric values summarized in Table 26. |
| (b) | | | The description of minimum thresholds shall include the following: | | | | | |
| | (1) | | The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by uncertainty in the understanding of the basin setting. | N/A | 4, 6 | | | Information is described in Sections 4 and 6, as well as Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022). |
| | (2) | | The relationship between the minimum thresholds for each sustainability indicator, including an explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators. | 117, 124, 127, 135, 136:138 | 6.6.3, 6.8.3. 6.9.3, 6.11.3, 6.12 | | 26 | |
| | (3) | | How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals. | N/A | N/A | | N/A | The Basin is not adjacent to another groundwater basin subject to SGMA. See section 1.4 on page 20 of the plan. |
| | (4) | | How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests. | 118, 125, 127, 135 | 6.6.3, 6.8.3. 6.9.3, 6.11.3 | | 20:24 | Groundwater Storage (Section 6.7.3) is not expected to occur. The MT is set at Sustainable Yield, but the effects of Groundwater Levels and other SMCs also describe the effects of reduction in storage. Subsidence (6.10) is not present in the basin. |
| | (5) | | How state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference. | 118, 125, 127, 135 | 6.6.3, 6.7.3, 6.8.3. 6.9.3, 6.11.3 | | 20:24 | Groundwater Storage (Section 6.7.3) is not expected to occur. The MT is set at Sustainable Yield, but the effects of Groundwater Levels and other SMCs also describe the effects of reduction in storage. Subsidence (6.10) is not present in the basin. |
| | (6) | | How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in Subarticle 4. | 118, 125, 127, 135 | 6.6.3, 6.7.3, 6.8.3. 6.9.3, 6.11.3 | | 20:24 | Groundwater Storage (Section 6.7.3) is not expected to occur. The MT is set at Sustainable Yield, but the effects of Groundwater Levels and other SMCs also describe the effects of reduction in storage. Subsidence (6.10) is not present in the basin. |
| (c) | | | Minimum thresholds for each sustainability indicator shall be defined as follows: | | | | | |

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| | (1) | | Chronic Lowering of Groundwater Levels. The minimum threshold for chronic lowering of groundwater levels shall be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results. Minimum thresholds for chronic lowering of groundwater levels shall be supported by the following: | | | | | |
| | | (A) | The rate of groundwater elevation decline based on historical trends, water year type, and projected water use in the basin. | 51:57, 114:119 | 4.1, 6.6 | 17 | 21 | |
| | | (B) | Potential effects on other sustainability indicators. | 114 | 6.6.1:6.6.3 | | | |
| | (2) | | Reduction of Groundwater Storage. The minimum threshold for reduction of groundwater storage shall be a total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results. Minimum thresholds for reduction of groundwater storage shall be supported by the sustainable yield of the basin, calculated based on historical trends, water year type, and projected water use in the basin. | 119 | 6.7.3 | | | |
| | (3) | | Seawater Intrusion. The minimum threshold for seawater intrusion shall be defined by a chloride concentration isocontour for each principal aquifer where seawater intrusion may lead to undesirable results. Minimum thresholds for seawater intrusion shall be supported by the following: | | | | | |
| | | (A) | Maps and cross-sections of the chloride concentration isocontour that defines the minimum threshold and measurable objective for each principal aquifer. | N/A | | 22:29 | | See Figures 22:29 |
| | | (B) | A description of how the seawater intrusion minimum threshold considers the effects of current and projected sea levels. | 86:87 | 5.3 | | | |
| | (4) | | Degraded Water Quality. The minimum threshold for degraded water quality shall be the degradation of water quality, including the migration of contaminant plumes that impair water supplies or other indicator of water quality as determined by the Agency that may lead to undesirable results. The minimum threshold shall be based on the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the Agency to be of concern for the basin. In setting minimum thresholds for degraded water quality, the Agency shall consider local, state, and federal water quality standards applicable to the basin. | 127 | 6.9.3 | | | |
| | (5) | | Land Subsidence. The minimum threshold for land subsidence shall be the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results. Minimum thresholds for land subsidence shall be supported by the following: | | | | | |
| | | (A) | Identification of land uses and property interests that have been affected or are likely to be affected by land subsidence in the basin, including an explanation of how the Agency has determined and considered those uses and interests, and the Agency's rationale for establishing minimum thresholds in light of those effects. | N/A | 6.10 | 15 | | Subsidence is not present in the basin. |
| | | (B) | Maps and graphs showing the extent and rate of land subsidence in the basin that defines the minimum threshold and measurable objectives. | N/A | | 15 | | See Figure 15 |

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| | (6) | | Depletions of Interconnected Surface Water. The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results. The minimum threshold established for depletions of interconnected surface water shall be supported by the following: | | | | | |
| | | (A) | The location, quantity, and timing of depletions of interconnected surface water. | 129 | 6.11.1 | 8 | | See Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022) and Preliminary Analysis of 2020/2021 Surface Water and Groundwater Interaction Studies–Eel River Valley Groundwater Basin, (SHN, January 2022). |
| | | (B) | A description of the groundwater and surface water model used to quantify surface water depletion. If a numerical groundwater and surface water model is not used to quantify surface water depletion, the Plan shall identify and describe an equally effective method, tool, or analytical model to accomplish the requirements of this Paragraph. | 129:136 | 6.11 | | | See Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022). |
| (d) | | | An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence. | 114, 119, 123:125, 133:135 | 6.6.1, 6.7.3, 6.8.3.2, 6.11.3.2 | | 25, 26 | |
| (e) | | | An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish minimum thresholds related to those sustainability indicators. | 128 | 6.10 | | | |
| | | | Note: Authority cited: Section 10733.2, Water Code. | | | | | |
| | | | Reference: Sections 10723.2, 10727.2, 10733, 10733.2, and 10733.8, Water Code. | | | | | |
| **§ 354.30.** | | | **Measurable Objectives** | | | | | |
| (a) | | | Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin within 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon. | 118:119, 125, 128, 136 | 6.6.4, 6.7.4, 6.8.4, 6.9.4, 6.11.4 | | 22:26 | |
| (b) | | | Measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metrics and monitoring sites as are used to define the minimum thresholds. | 118:119, 125, 128, 136 | 6.6.4, 6.7.4, 6.8.4, 6.9.4, 6.11.4 . | | 22 | |

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| (c) | | | Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty. | 118, 125, 136 | 6.6.4, 6.8.4.1, 6.11.4.2 | | 26 | |
| (d) | | | An Agency may establish a representative measurable objective for groundwater elevation to serve as the value for multiple sustainability indicators where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual measurable objectives as supported by adequate evidence. | 118, 125, 136 | 6.6.4, 6.8.4.1, 6.11.4.2 | | 26 | |
| (e) | | | Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin within 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon. | 138, 151 | 6.1,8.1, 8.2 | | | The basin is currently being sustianably managed and conditions are not expected to change that condition. |
| (f) | | | Each Plan may include measurable objectives and interim milestones for additional Plan elements described in Water Code Section 10727.4 where the Agency determines such measures are appropriate for sustainable groundwater management in the basin. | N/A | | | | Interim milestones were not established because the Basin is being managed within its sustainability goal. |
| (g) | | | An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for a finding of inadequacy of the Plan. | 118:119, 125, 128, 136 | 6.6.4, 6.7.4, 6.8.4, 6.9.4, 6.11.4 | | 22:26 | |
| | | | Note: Authority cited: Section 10733.2, Water Code. | | | | | |
| | | | Reference: Sections 10727.2, 10727.4, and 10733.2, Water Code. | | | | | |
| **SubArticle 4.** | | | **Monitoring Networks** | | | | | |
| **§ 354.32.** | | | **Introduction to Monitoring Networks** | | | | | |
| | | | This Subarticle describes the monitoring network that shall be developed for each basin, including monitoring objectives, monitoring protocols, and data reporting requirements. The monitoring network shall promote the collection of data of sufficient quality, frequency, and distribution to characterize groundwater and related surface water conditions in the basin and evaluate changing conditions that occur through implementation of the Plan. | | | | | |
| | | | Note: Authority cited: Section 10733.2, Water Code. | | | | | |
| | | | Reference: Section 10733.2, Water Code. | | | | | |
| **§ 354.34.** | | | **Monitoring Network** | | | | | |
| (a) | | | Each Agency shall develop a monitoring network capable of collecting sufficient data to demonstrate short-term, seasonal, and long-term trends in groundwater and related surface conditions, and yield representative information about groundwater conditions as necessary to evaluate Plan implementation. | 140:149 | 7 | 38:41 | | |

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| (b) | | | Each Plan shall include a description of the monitoring network objectives for the basin, including an explanation of how the network will be developed and implemented to monitor groundwater and related surface conditions, and the interconnection of surface water and groundwater, with sufficient temporal frequency and spatial density to evaluate the affects and effectiveness of Plan implementation. The monitoring network objectives shall be implemented to accomplish the following: | | | | | |
| | (1) | | Demonstrate progress toward achieving measurable objectives described in the Plan. | 140:144 | 7.1:7.2 | | | |
| | (2) | | Monitor impacts to the beneficial uses or users of groundwater. | 140:144 | 7.1:7.2 | | | |
| | (3) | | Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds. | 140:144 | 7.1:7.2 | | | |
| | (4) | | Quantify annual changes in water budget components. | 140:144 | 7.1:7.2 | | | |
| (c) | | | Each monitoring network shall be designed to accomplish the following for each sustainability indicator: | | | | | |
| | (1) | | Chronic Lowering of Groundwater Levels. Demonstrate groundwater occurrence, flow directions, and hydraulic gradients between principal aquifers and surface water features by the following methods: | | | | | |
| | | (A) | A sufficient density of monitoring wells to collect representative measurements through depth-discrete perforated intervals to characterize the groundwater table or potentiometric surface for each principal aquifer. | 141:142, 145:149 | 7.2.2 | 40-41 | 27 | |
| | | (B) | Static groundwater elevation measurements shall be collected at least two times per year, to represent seasonal low and seasonal high groundwater conditions. | 141:142, 145:149 | 7.2.2 | 40-41 | 27 | |
| | (2) | | Reduction of Groundwater Storage. Provide an estimate of the change in annual groundwater in storage. | 141:142 | 7.2.2 | 40-41 | 27 | Groundwater levels are used to estimate changes in storage. |
| | (3) | | Seawater Intrusion. Monitor seawater intrusion using chloride concentrations, or other measurements convertible to chloride concentrations, so that the current and projected rate and extent of seawater intrusion for each applicable principal aquifer may be calculated. | 142:143 | 7.2.3 | 40-41 | 27 | |
| | (4) | | Degraded Water Quality. Collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues. | 143 | 7.2.4 | 40-41 | 27 | |
| | (5) | | Land Subsidence. Identify the rate and extent of land subsidence, which may be measured by extensometers, surveying, remote sensing technology, or other appropriate method. | 144 | 7.2.7 | | | |
| | (6) | | Depletions of Interconnected Surface Water. Monitor surface water and groundwater, where interconnected surface water conditions exist, to characterize the spatial and temporal exchanges between surface water and groundwater, and to calibrate and apply the tools and methods necessary to calculate depletions of surface water caused by groundwater extractions. The monitoring network shall be able to characterize the following: | | | | | |

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| | | (A) | Flow conditions including surface water discharge, surface water head, and baseflow contribution. | 143:144 | 7.2.5:7.2.6 | | | |
| | | (B) | Identifying the approximate date and location where ephemeral or intermittent flowing streams and rivers cease to flow, if applicable. | 143:144 | 7.2.5 | | | See Surface Water Flows Technical Memorandum 2021 (Thomas Gast and Associates, January 26, 2022), Surface Water Flows Technical Memorandum 2020 (Thomas Gast and Associates, January 26, 2022), and Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022) . |
| | | (C) | Temporal change in conditions due to variations in stream discharge and regional groundwater extraction. | 143:144 | 7.2.5 | | | See Surface Water Flows Technical Memorandum 2021 (Thomas Gast and Associates, January 26, 2022), Surface Water Flows Technical Memorandum 2020 (Thomas Gast and Associates, January 26, 2022), and Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022) . |
| | | (D) | Other factors that may be necessary to identify adverse impacts on beneficial uses of the surface water. | 143:144 | 7.2.5 | | | See Surface Water Flows Technical Memorandum 2021 (Thomas Gast and Associates, January 26, 2022), Surface Water Flows Technical Memorandum 2020 (Thomas Gast and Associates, January 26, 2022), and Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022) . |
| (d) | | | The monitoring network shall be designed to ensure adequate coverage of sustainability indicators. If management areas are established, the quantity and density of monitoring sites in those areas shall be sufficient to evaluate conditions of the basin setting and sustainable management criteria specific to that area. | 140:149 | 7 | 40-41 | | See Surface Water Flows Technical Memorandum 2021 (Thomas Gast and Associates, January 26, 2022), Surface Water Flows Technical Memorandum 2020 (Thomas Gast and Associates, January 26, 2022), and Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022) . |
| (e) | | | A Plan may utilize site information and monitoring data from existing sources as part of the monitoring network. | 140:149 | 7 | 40-41 | | |
| (f) | | | The Agency shall determine the density of monitoring sites and frequency of measurements required to demonstrate short-term, seasonal, and long-term trends based upon the following factors: | | | | | |
| | (1) | | Amount of current and projected groundwater use. | 140:141 | 7.1, 7.2.1 | | | Agricultural Groundwater Use Technical Memorandum (HCDPW, HCRCD, WRS, October 2021). |
| | (2) | | Aquifer characteristics, including confined or unconfined aquifer conditions, or other physical characteristics that affect groundwater flow. | 140 | 7.1 | | | |

| | | | | GSP Document References | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Page Numbers of Plan | Or Section Numbers | Or Figure Numbers | Or Table Numbers | Notes |
| | (3) | | Impacts to beneficial uses and users of groundwater and land uses and property interests affected by groundwater production, and adjacent basins that could affect the ability of that basin to meet the sustainability goal. | 140 | 7.1 | | | |
| | (4) | | Whether the Agency has adequate long-term existing monitoring results or other technical information to demonstrate an understanding of aquifer response. | 140 | 7.1 | | | |
| (g) | | | Each Plan shall describe the following information about the monitoring network: | | | | | |
| | (1) | | Scientific rationale for the monitoring site selection process. | 140 | 7.1 | | | |
| | (2) | | Consistency with data and reporting standards described in Section 352.4. If a site is not consistent with those standards, the Plan shall explain the necessity of the site to the monitoring network, and how any variation from the standards will not affect the usefulness of the results obtained. | 144 | 7.4 | | | See also Data Collection and Analysis Work Plan (County, 2022). |
| | (3) | | For each sustainability indicator, the quantitative values for the minimum threshold, measurable objective, and interim milestones that will be measured at each monitoring site or representative monitoring sites established pursuant to Section 354.36. | 137 | 6 | | 26 | |
| (h) | | | The location and type of each monitoring site within the basin displayed on a map, and reported in tabular format, including information regarding the monitoring site type, frequency of measurement, and the purposes for which the monitoring site is being used. | 137, 145:150 | | 40:41 | 26, 27 | |
| (i) | | | The monitoring protocols developed by each Agency shall include a description of technical standards, data collection methods, and other procedures or protocols pursuant to Water Code Section 10727.2(f) for monitoring sites or other data collection facilities to ensure that the monitoring network utilizes comparable data and methodologies. | 140:143 | 7.2.1:7.2.3 | | | See also Data Collection and Analysis Work Plan (County, 2022). |
| (j) | | | An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish a monitoring network related to those sustainability indicators. | 144 | 7.2.7 | | | No monitoring network established for subsidence. Relying on InSAR. |
| | | | Note: Authority cited: Section 10733.2, Water Code. | | | | | |
| | | | Reference: Sections 10723.2, 10727.2, 10727.4, 10728, 10733, 10733.2, and 10733.8, Water Code | | | | | |
| **§ 354.36.** | | | **Representative Monitoring** | | | | | |
| | | | Each Agency may designate a subset of monitoring sites as representative of conditions in the basin or an area of the basin, as follows: | | | | | |
| (a) | | | Representative monitoring sites may be designated by the Agency as the point at which sustainability indicators are monitored, and for which quantitative values for minimum thresholds, measurable objectives, and interim milestones are defined. | 137, 145:150 | 6, 7 | 38:41 | 26, 27 | Representative monitoring sites are designated in Tables 26 and 27 and more fully explained in Sections 6 and 7. |
| (b) | | | (b) Groundwater elevations may be used as a proxy for monitoring other sustainability indicators if the Agency demonstrates the following: | | | | | |
| | (1) | | Significant correlation exists between groundwater elevations and the sustainability indicators for which groundwater elevation measurements serve as a proxy. | 119, 123, 132:134 | 6.7, 6.8. 6.11 | | | See Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022). |

| Article 5. | | | Plan Contents for Eel River Valley Groundwater Basin | GSP Document References | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Page Numbers of Plan | Or Section Numbers | Or Figure Numbers | Or Table Numbers | Notes |
| | (2) | | Measurable objectives established for groundwater elevation shall include a reasonable margin of operational flexibility taking into consideration the basin setting to avoid undesirable results for the sustainability indicators for which groundwater elevation measurements serve as a proxy. | 118, 125, 136 | 6.6.4, 6.8.4.1, 6.11.4.2 | | 26 | Table 26 reflects the margin of safety. |
| (c) | | | The designation of a representative monitoring site shall be supported by adequate evidence demonstrating that the site reflects general conditions in the area. | 114, 119, 123:125, 133:135 | 6.6.1, 6.7.1, 6.8.3.2, 6.11.3.2 | 38:41 | 26,27 | See Hydrologic Model Technical Memorandum, Revised January 2022 (GHD, Revised January 2022) and Water Levels Technical Memorandum (SHN, September 2021). |
| | | | Note: Authority cited: Section 10733.2, Water Code. | | | | | |
| | | | Reference: Sections 10727.2 and 10733.2, Water Code | | | | | |
| **§ 354.38.** | | | **Assessment and Improvement of Monitoring Network** | | | | | |
| (a) | | | Each Agency shall review the monitoring network and include an evaluation in the Plan and each five-year assessment, including a determination of uncertainty and whether there are data gaps that could affect the ability of the Plan to achieve the sustainability goal for the basin. | 154:155 | 8.3.2 | | | |
| (b) | | | Each Agency shall identify data gaps wherever the basin does not contain a sufficient number of monitoring sites, does not monitor sites at a sufficient frequency, or utilizes monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the Agency. | 159 | 3.8, 8.2.2, 9.3 | | | No additional monitoring sites were identified in the GSP to fill data gaps. Existing data gaps will be filled with data collected from newly installed monitoring locations. |
| (c) | | | If the monitoring network contains data gaps, the Plan shall include a description of the following: | | | | | |
| | (1) | | The location and reason for data gaps in the monitoring network. | 159 | 9.3 | | | The additional data gaps will be filled with data collected from newly installed monitoring locations. |
| | (2) | | Local issues and circumstances that limit or prevent monitoring. | N/A | | | | No issues or circumstances were identified that prevent necessary monitoring. |
| (d) | | | Each Agency shall describe steps that will be taken to fill data gaps before the next five-year assessment, including the location and purpose of newly added or installed monitoring sites. | 159 | 7.5, 8.2, 9.3 | | | Data Collection and Analysis Work Plan (County, 2022) |
| (e) | | | Each Agency shall adjust the monitoring frequency and density of monitoring sites to provide an adequate level of detail about site-specific surface water and groundwater conditions and to assess the effectiveness of management actions under circumstances that include the following: | | | | | |
| | (1) | | Minimum threshold exceedances. | 159 | 9.3 | | | No additional monitoring sites were identified in the GSP to fill data gaps. Existing data gaps will be filled with data collected from newly installed monitoring locations. |

| Article 5. | | | Plan Contents for Eel River Valley Groundwater Basin | GSP Document References | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Page Numbers of Plan | Or Section Numbers | Or Figure Numbers | Or Table Numbers | Notes |
| | (2) | | Highly variable spatial or temporal conditions. | 159 | 9.3 | | | No additional monitoring sites were identified in the GSP to fill data gaps. Existing data gaps will be filled with data collected from newly installed monitoring locations. |
| | (3) | | Adverse impacts to beneficial uses and users of groundwater. | 159 | 9.3 | | | No additional monitoring sites were identified in the GSP to fill data gaps. Existing data gaps will be filled with data collected from newly installed monitoring locations. |
| | (4) | | The potential to adversely affect the ability of an adjacent basin to implement its Plan or impede achievement of sustainability goals in an adjacent basin. | N/A | | | | No adjacent basins. |
| | | | Note: Authority cited: Section 10733.2, Water Code. | | | | | |
| | | | Reference: Sections 10723.2, 10727.2, 10728.2, 10733, 10733.2, and 10733.8, Water Code | | | | | |
| **§ 354.40.** | | | **Reporting Monitoring Data to the Department** | | | | | |
| | | | Monitoring data shall be stored in the data management system developed pursuant to Section 352.6. A copy of the monitoring data shall be included in the Annual Report and submitted electronically on forms provided by the Department. | | | | | |
| | | | Note: Authority cited: Section 10733.2, Water Code. | | | | | |
| | | | Reference: Sections 10728, 10728.2, 10733.2, and 10733.8, Water Code. | | | | | |
| **SubArticle 5.** | | | **Projects and Management Actions** | | | | | |
| **§ 354.42.** | | | **Introduction to Projects and Management Actions** | | | | | |
| | | | This Subarticle describes the criteria for projects and management actions to be included in a Plan to meet the sustainability goal for the basin in a manner that can be maintained over the planning and implementation horizon. | | | | | |
| | | | Note: Authority cited: Section 10733.2, Water Code. | | | | | |
| | | | Reference: Section 10733.2, Water Code. | | | | | |
| **§ 354.44.** | | | **Projects and Management Actions** | | | | | |
| (a) | | | Each Plan shall include a description of the projects and management actions the Agency has determined will achieve the sustainability goal for the basin, including projects and management actions to respond to changing conditions in the basin. | 150:156 | 8 | | | |
| (b) | | | Each Plan shall include a description of the projects and management actions that include the following: | | | | | |
| | (1) | | A list of projects and management actions proposed in the Plan with a description of the measurable objective that is expected to benefit from the project or management action. The list shall include projects and management actions that may be utilized to meet interim milestones, the exceedance of minimum thresholds, or where undesirable results have occurred or are imminent. The Plan shall include the following: | | | | | |

| Article 5. | | | Plan Contents for Eel River Valley Groundwater Basin | GSP Document References | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Page Numbers of Plan | Or Section Numbers | Or Figure Numbers | Or Table Numbers | Notes |
| | | (A) | A description of the circumstances under which projects or management actions shall be implemented, the criteria that would trigger implementation and termination of projects or management actions, and the process by which the Agency shall determine that conditions requiring the implementation of particular projects or management actions have occurred. | 150 | 8.2 | | | |
| | | (B) | The process by which the Agency shall provide notice to the public and other agencies that the implementation of projects or management actions is being considered or has been implemented, including a description of the actions to be taken. | 155, 157:158 | 8.6, 9.2.2 | | | |
| | (2) | | If overdraft conditions are identified through the analysis required by Section 354.18, the Plan shall describe projects or management actions, including a quantification of demand reduction or other methods, for the mitigation of overdraft. | N/A | | | | Overdraft conditions are not identified in the Basin. |
| | (3) | | A summary of the permitting and regulatory process required for each project and management action. | 155:156 | 8.6 | | | |
| | (4) | | The status of each project and management action, including a time-table for expected initiation and completion, and the accrual of expected benefits. | 156 | 8.6 | | 27 | |
| | (5) | | An explanation of the benefits that are expected to be realized from the project or management action, and how those benefits will be evaluated. | 156 | 8.6 | | | |
| | (6) | | An explanation of how the project or management action will be accomplished. If the projects or management actions rely on water from outside the jurisdiction of the Agency, an explanation of the source and reliability of that water shall be included. | 156 | 8.6 | | | |
| | (7) | | A description of the legal authority required for each project and management action, and the basis for that authority within the Agency. | 156 | 8.6 | | | |
| | (8) | | A description of the estimated cost for each project and management action and a description of how the Agency plans to meet those costs. | 156 | 8.6 | | | |
| | (9) | | A description of the management of groundwater extractions and recharge to ensure that chronic lowering of groundwater levels or depletion of supply during periods of drought is offset by increases in groundwater levels or storage during other periods. | 156 | 8.6 | | | |
| (c) | | | Projects and management actions shall be supported by best available information and best available science. | 150:156 | 8 | | | |
| (d) | | | An Agency shall take into account the level of uncertainty associated with the basin setting when developing projects or management actions. | 150:156 | 8 | | | |
| | | | Note: Authority cited: Section 10733.2, Water Code. | | | | | |
| | | | Reference: Sections 10727.2, 10727.4, and 10733.2, Water Code. | | | | | |

# Stakeholder Communications and Engagement Plan and Stakeholder Outreach Summary (2015-2021) (Appendix C)

# Stakeholder Communications and Engagement Plan

## Eel River Valley Groundwater Basin

Humboldt County, California

December 2020

Humboldt County Groundwater Sustainability Agency

1106 Second Street, Eureka, CA 95501

707.445.7741

# Contents



**LIST OF FIGURES**



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**ACRONYMS AND ABBREVIATIONS**

| | |
|---|---|
| BOS | Humboldt County Board of Supervisors |
| DAC | Disadvantaged Community |
| DWR | California Department of Water Resources |
| EDAs | Economically Distressed Areas |
| ERGWG | Eel River Groundwater Working Group |
| GRAC | Groundwater Resources Advisory Committee |
| GSA | Groundwater Sustainability Agency |
| GSP | Groundwater Sustainability Plan |
| HCDPW | Humboldt County Department of Public Works |
| Humboldt County GSA | Humboldt County Groundwater Sustainability Agency |
| SGMA | Sustainable Groundwater Management Act |

## SGMA Overview

**The Sustainable Groundwater Management Act (SGMA)** was signed into law by California Governor Jerry Brown in 2014 (Water Code 10720 through 10737.8). SGMA provides local agencies with the framework to manage groundwater basins in a sustainable manner. The legislation recognizes that groundwater is most effectively managed at the local level and requires local agencies to achieve groundwater sustainability within 20 years of submitting a **Groundwater Sustainability Plan (GSP)**. GSP's are required for groundwater basins designated as medium- or high-priority.

In SGMA, sustainable groundwater management is defined as management of groundwater supplies in a manner that can be maintained in planning and implementation phases without causing undesirable results. Undesirable results are significant and unreasonable effects from the following six conditions: chronic lowering of groundwater levels, reduction of groundwater storage, seawater intrusion, degraded water quality, land subsidence, and depletion of interconnected surface waters.

SGMA and its GSP Emergency Regulations (California Code of Regulations, Title 23, Sections 350 through 358.6) established requirements related to stakeholder engagement during GSP preparation and of documentation requirements within the GSP. These requirements include:

- *SGMA (Section 10723.2) mandates all interests of all beneficial uses and users of groundwater be considered: The groundwater sustainability agency shall consider the interests of all beneficial uses and users of groundwater, as well as those responsible for implementing groundwater sustainability plans. The interests are represented by Agriculture Users; Domestic Well Owners; Municipal Well Operators; Public Water Systems; Local Land Use Planning Agencies; Environmental Users of Groundwater; Surface Water Users; Federal Government; California Native American Tribes; Disadvantaged Communities; Entities monitoring and reporting groundwater elevations in all or part of a groundwater basin.*
- *SGMA (Section 10723.4) requires the maintenance of an interested persons list: The groundwater sustainability agency shall establish and maintain a list of persons interested in receiving notices regarding plan preparation, meeting announcements, and availability of draft plans, maps, and other relevant documents. Any person may request, in writing, to be placed on the list of interested persons.*
- *SGMA GSP Emergency Regulations (Section 354.10) set forth notification requirements as follows: Each Plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties. DWR has prepared a Guidance Document for Groundwater Sustainability Plan Stakeholder Communication and Engagement (DWR Guidance Document, January 2018. https://water.ca.gov/Programs/Groundwater-Management/Assistance-and-Engagement)*

A summary of SGMA engagement and notification requirements for all phases of SGMA as presented in the Guidance Document for Groundwater Sustainability Plans are shown in **Appendix A**. To assist **Groundwater Sustainability Agencies (GSA)** in identifying stakeholders that reflect diverse social, cultural and economic elements of the population, the **California Department of Water Resources (DWR)** Guidance Document provides a Stakeholder Engagement Chart that lists various interest and examples of stakeholder groups within each of these categories. This chart is shown below as **Table 1**. For purposes of this Stakeholder Communications and Engagement Plan, Beneficial Users and interested parties are collectively referred to as stakeholders. The **Humboldt County Groundwater Sustainability Agency (Humboldt County GSA)** developed an initial stakeholder list and distributes meeting notices and relevant information to the stakeholders who have requested to be notified. This list is presented in **Appendix B** (omitting contact and confidential personal information). It includes Beneficial Users, people who have signed up for the Agency's email list, and other potentially interested parties including local businesses, government agencies, associations, and service organizations. The list will evolve during GSP development as additional stakeholders are identified. As of June 2020, 147 interested parties are included on the list. Visit the Humboldt County Groundwater website for a link to be added to the email list.

Implementation of SGMA and outreach requirements are broken down into four phases. Communication objectives and goals are discussed throughout this document and specifically discussed in Section III: Communication Objectives to Support the GSP and Section VI: Implementation Timeline.

**Table 1:** Consideration of various interests and examples of stakeholder groups within each of these categories.

| Category of Interest | Examples of Stakeholder Groups |
|---|---|
| General Public | Citizens groups, Community leaders |
| Land Use | Municipalities (City, County planning departments)<br>Regional land use agencies |
| Private users | Private pumpers, Domestic users, School systems, Hospitals |
| Urban/ Agriculture users | Water agencies, Irrigation districts, Mutual water companies, Resource Conservation Districts, Farmers/Farm Bureaus |
| Industrial users | Commercial and industrial self-supplier<br>Local trade association or group |
| Environmental and Ecosystem | Federal and State agencies, Wetland managers, Environmental groups |
| Economic Development | Chambers of commerce, Business groups/associations,<br>Elected officials (Board of Supervisors, City Council),<br>State Assembly Members, State Senators, State Congress representative |
| Human right to water | Disadvantaged Communities, Small community systems,<br>Environmental Justice Groups |
| Tribes | Tribal Government |
| Federal lands | Military bases, Department of Defense, Forest Service,<br>National Park Service, Bureau of Land Management |
| Integrated Water Management | Regional water management groups (IRWM regions),<br>Flood agencies, Recycled water coalition |
| Other | Businesses, Environmental consulting firms, Ag financing groups,<br>Educational institutions |

# I. Description and Background of the Eel River Valley Basin

## Basin Description and Boundary

The Eel River Valley groundwater basin is adjacent to the Pacific Ocean in Humboldt County, California, and experiences a cool maritime climate and substantial winter precipitation. The basin boundary encompasses approximately 72,957 acres and 21,558 residents, with nearly half of this population residing within the City of Fortuna. In addition to agriculture and timber resources, the City of Fortuna, the City of Ferndale, the City of Rio Dell, and the unincorporated communities of Loleta, Carlotta, Hydesville, and Scotia occupy the basin. The Eel River Valley Groundwater Basin contains five (5) census designated places which are recognized by DWR as Economically Distressed Areas: Ferndale, Loleta, Fortuna, Scotia, and Rio Dell.

Groundwater is supplied for general household use, agriculture production, and industrial or business use. Groundwater suppliers in the basin include: private domestic and agricultural wells, municipal wells, and public water systems. The basin is bisected by the main stem Eel River and its tributary, the Van Duzen River, both of which provide habitat for anadromous salmonids and other fish and aquatic species. The coastal basin discharges to the Pacific Ocean near Loleta, California. Tidal influences have been recorded in Eel River water studies up to five miles upstream of the river mouth (SHN, 2019). A study performed in 2016 by the Humboldt County Resource Conservation District, and included in the Eel River Valley Basin GSP Alternative Submittal, estimated that approximately 13,558 acres of agricultural lands were irrigated with groundwater, of which more than 85% was applied to grazed pasture or hay crop production for livestock. Other common basin crop types include corn, quinoa, and cannabis. The basin provides for multi-use opportunities for outdoor recreational enthusiasts. The Eel River Valley basin and Eel River watershed and are shown in **Figures 1** and **2.**


**Figure 1**. Image showing the Eel River Valley groundwater basin located entirely within Humboldt County, highlighted in cyan, Eel River watershed boundary (purple), and main stem of the Eel and Van Duzen Rivers is shown by the blue lines.


**Figure 2**. Image showing the Eel River watershed boundary (purple) across Humboldt, Trinity, Mendocino, Glen, and Lake Counties. The branches of the Eel River and its tributaries are shown by the blue lines. The Eel – Russian River basin divide is shown by the red line. The Eel River Valley basin is located entirely within Humboldt County, highlighted in cyan.

**Disadvantaged Areas (DAs)**

The term Disadvantaged Area (DA) refers to the collective group of Severely Disadvantaged Communities (SDACs), **Disadvantaged Communities (DAC)**, and **Economically Distressed Areas (EDAs)** (SGM Grant Program 2019 Guidelines). The term EDA is defined as "a municipality with a population of 20,000 persons or less, a rural county, or a reasonably isolated and divisible segment of a larger municipality where the segment of the population is 20,000 persons or less, with an annual median household income that is less than 85% of the Statewide median household income, and with one or more of the following conditions as determined by the department: (1) financial hardship, (2) Unemployment rate at least 2% higher than the Statewide average, or (3) low population density (Water Code §79702(k))."

The Eel River Valley Groundwater Basin contains five (5) census designated places which are EDAs, based on DWR's EDA Mapping Tool (https://gis.water.ca.gov/app/edas/). The percentage of the basin population situated within an EDA is 77% (18,066 divided by 23,384). A map depicting the five EDAs is provided in **Figure 3** and a table summarizing the median household income (MHI) and population for each place is provided below in **Table 2**.

**Table 2.** Median household income (MHI) and population for each EDA.

| Place | GEOID | MHI | Population |
|---|---|---|---|
| Loleta | 0642328 | $38,542 | 624 |
| Ferndale | 0623910 | $41,042 | 1,419 |
| Fortuna | 0625296 | $44,904 | 11,917 |
| Rio Dell | 0660900 | $39,981 | 3,372 |
| Scotia | 0670518 | $44,063 | 734 |
| | | Total: | 18,066 |

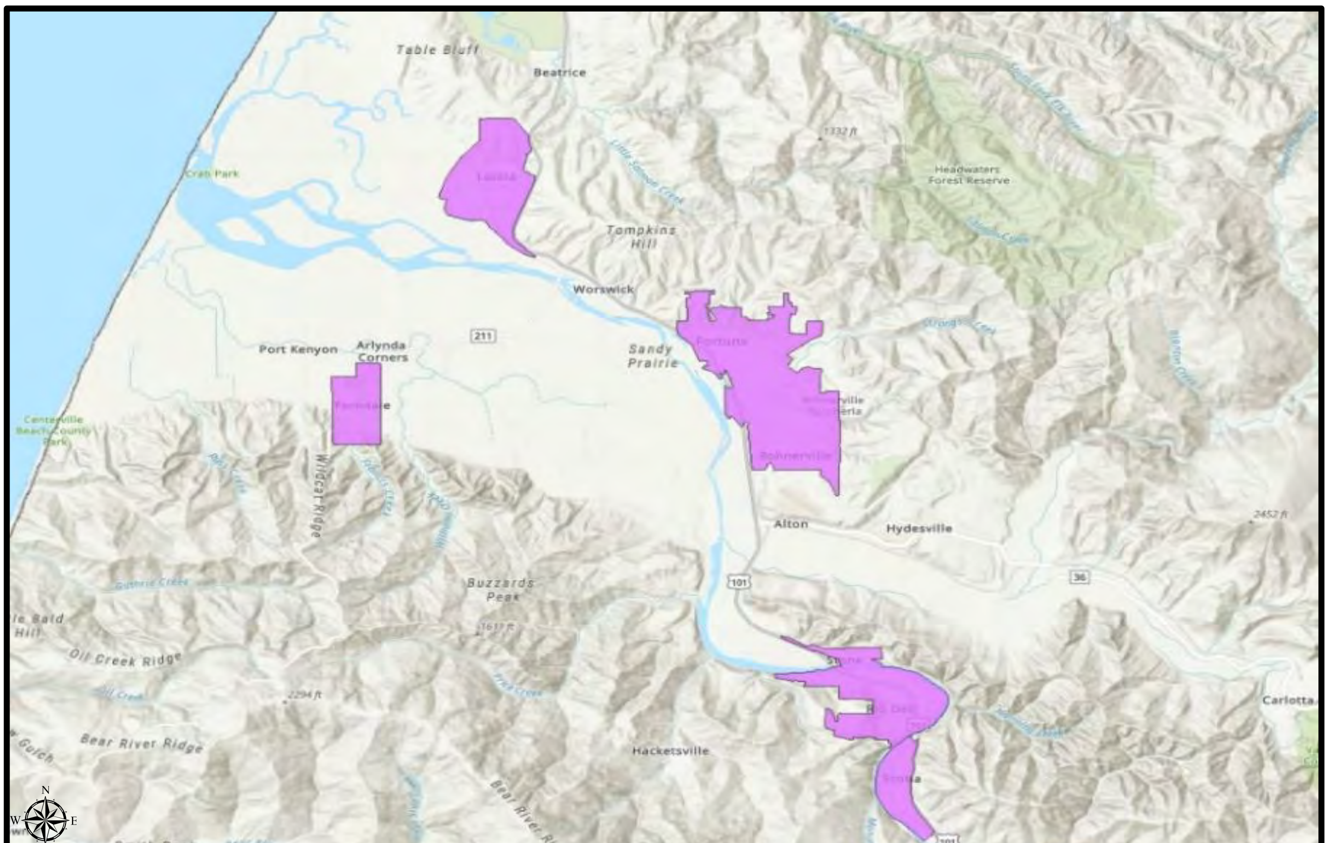



**Figure 3.** Image showing the five EDAs (magenta) in the Eel River Valley basin, February 14, 2020.

## Basin Background

DWR designated the Eel River Valley groundwater basin as a medium-priority basin January 1, 2015. During the 2018 SGMA Basin Prioritization process, DWR renewed its designation of the Eel River Valley groundwater basin as a medium-priority basin. **Humboldt County Department of Public Works (HCDPW)**, at the direction of the **Humboldt County Board of Supervisors (BOS)**, began the process of coming into compliance with SGMA following the 2015 medium-priority basin designation. Below spells out the steps taken for this process:

- October 6, 2015, the BOS approved the formation of the **Eel River Valley Groundwater Working Group (ERGWG)** consisting of stakeholders representing agricultural, municipal and environmental interests to provide input regarding the local response to DWR's designation of the Eel River Valley groundwater basin as a medium-priority basin.
- DWR authorized local agencies to submit a GSP Alternative by January 1, 2017, if the GSP Alternative demonstrates that the basin has operated within its sustainable yield over a period of ten (10) years and contains the functional equivalent of a GSP.
- December 13, 2016, the BOS approved Resolution No. 16-142 authorizing the HCDPW to submit a GSP Alternative for the Eel River Valley groundwater basin.
- BOS deferred on formation of a GSA in 2016 because a GSP Alternative could be submitted by a local agency without forming a GSA.
- December 31, 2016, HCDPW submitted a GSP Alternative for the Eel River Valley groundwater basin to DWR for review and approval.
- HCDPW performed annual monitoring and reporting activities for the Eel River Valley groundwater basin following submittal of the GSP Alternative.
- July 17, 2019, DWR issued a notification letter and staff report stating that DWR intended to disapprove the GSP Alternative for the Eel River Valley groundwater basin because the GSP Alternative did not contain all the required elements and did not provide sufficient evidence that the requirements for sustainable groundwater management had been performed for a ten (10) year period.
- September 30, 2019, HCDPW submitted a comment letter regarding DWR's review of the GSP Alternative for the Eel River Valley groundwater basin.
- SGMA requires that all medium-priority basins have an adopted GSP no later than January 31, 2022, if a GSP Alternative has not been approved.
- November 12, 2019, the BOS approved Resolution No. 19-111 which committed the County to work collaboratively with water uses and stakeholders to form a GSA for the Eel River Valley groundwater basin and authorized HCDPW to apply for a Sustainable Groundwater Management Planning Grant for the development of a GSP.
- November 13, 2019, DWR issued a notification letter and staff report stating that the GSP Alternative for the Eel River Valley groundwater basin was disapproved for the reasons stated in its notification letter dated July 17, 2019.
- March 5, 2020, there was unanimous consent among attendees of the ERGWG for the County BOS to become the **Humboldt County Groundwater Sustainability Agency (Humboldt County GSA)** for the Eel River Valley groundwater basin.
- March 13, 2020, DWR issued an award notification to Humboldt County for the aforementioned grant application for funds to develop a GSP for the Eel River Valley groundwater basin.
- May 5, 2020, after publication of notice as required by California Government Code Section 6066, the County held a public hearing regarding formation of the Humboldt County GSA for the Eel River Valley

groundwater basin. Pursuant to Sections 15306, 15307 and 15308 of Title 14 of the California Code of Regulations, adoption of Resolution No. 20-39 is exempt from the California Environmental Quality Act as information collection actions which do not result in a serious or major disturbance to an environmental resource, actions taken by regulatory agencies for protection of natural resources and actions taken by regulatory agencies for protection of the environment.

BOS authorized the formation of the Humboldt County GSA for the Eel River Valley groundwater basin.

BOS directed the HCDPW to return with proposed bylaws for the Humboldt County GSA for the Eel River Valley groundwater basin, including the structure for a **Groundwater Resources Advisory Committee (GRAC)**.

Request for Qualifications for Professional Consulting Services for the Eel River Valley Groundwater Sustainability Plan and Monitoring Well Installation Project was issued.

- May 7, 2020, HCDPW notified DWR of its intent to manage groundwater within the boundary of the Humboldt County GSA for the Eel River Valley groundwater basin.

  HCDPW informed DWR of its decision to form the Humboldt County GSA for the Eel River Valley groundwater basin and to take such other and further steps as necessary to comply with the Sustainable Groundwater Management Act of 2014.
- July 22, 2020, HCDPW completed the review and selection process of the 2 proposals submitted. GHD, Inc. was selected as the Eel River Valley Groundwater Sustainability Plan and Monitoring Well Installation Project consultant. The County and Consultant are working together to develop the GSP.

## Basin Governance and Decision-Making Process

The Humboldt County GSA is governed by the Humboldt County Board of Supervisors. The agency was formed under authority established by California's SGMA of 2014 and Humboldt County Board of Supervisors Resolution 20-39 (May 5, 2020). The GSA's decision-making process is broken down by the roles of the Board of Directors, staff, Eel River Groundwater Working Group, and Groundwater Resources Advisory Committee (if formed).

### Role of Humboldt County GSA

The Humboldt County GSA is governed by the Humboldt County Board of Supervisors and is responsible for making final policy decisions relative to the Humboldt County GSA and adopting and implementing the Eel River Valley GSP.

The Humboldt County GSA will be staffed through the Humboldt County Department of Public Works. Public Works staff will perform the day-today administrative duties and technical work and make recommendations for policy decisions. During GSP development, staff will provide presentations and hold open forums on various aspects of GSP development.  Information presented at GSA Board Meetings will also be presented and expanded upon at working group meetings.

Due to the State's orders regarding COVID-19, Humboldt County GSA Board meetings may be held via a web-based platform until otherwise noticed. The GSA Board operates and provides notice for these meetings consistent with the Brown Act (California Government Code 54950 et seq.). As described below regarding the GSA Website, all meeting materials are available to the public on the GSA website.  Public comments are accepted at each meeting.

### Role of Eel River Groundwater Working Group

On October 6, 2015, the BOS approved the formation of the ERGWG to provide input regarding the local response to DWR's designation of the Eel River Valley groundwater basin as a medium-priority basin. Through this working group, the Humboldt County GSA is able to encourage the active involvement of diverse social, cultural, and economic elements of the population within the groundwater basin prior to and during the development and implementation of the GSP.

The ERGWG is an informal organization of stakeholders that serves to provide a forum for sharing information and viewpoints and provide input to the HCDPW staff on matters dealing with GSA and GSP development, GSP implementation, and other GSA/GSP matters; open to all interested stakeholders who wish to participate. **Appendix C** provides a preliminary schedule and list of meeting topics based on the current project schedule. The list and schedule are preliminary and subject to change based on the project schedule, stakeholder feedback, and at the discretion of the HCGSA. At each of these meetings, staff and/or consultant (as directed by the HCGSA) will provide a presentation to be followed by ample time for public discussion, questions and answers, and stakeholder input.

### Role of Groundwater Resources Advisory Committee

In Section 10727.8 "Public Notification and Participation; Advisory Committee" of the SGMA, GSAs may appoint and consult with an advisory committee for the purpose of developing and implementing a GSP. BOS Resolution No. 20-39 directed the HCDPW to present a proposed structure for an advisory committee. At that time, the Humboldt County GSA may choose to form the GRAC. If formed, the GRAC would support and advise HCDPW staff in the GSP development and advise the Humboldt County GSA in the development and implementation of the GSP.

## II. Communication Objectives to Support the GSP

The communication objectives during GSP development, public review, and implementation phases of the SGMA compliance is to encourage active involvement of diverse, social, cultural, and economic elements of the population within the Eel River Valley basin. The Humboldt County GSA will give beneficial users and users of groundwater opportunities to engage in the GSP process by providing educational outreach opportunities for stakeholders while reaching out through various communication avenues. ERGWG members are direct representatives of their communities and industries, and it is important for them to continually gather feedback/input, and concerns/needs of their constituents and report back to HCDPW staff and ERGWG meetings. Any stakeholder input received will be reviewed and taken into consideration during GSP development.

**Phase 1: GSA Formation and Coordination**

GSA formation and coordination has been completed. This phase spans 2019 through November 2020 and consists of the Humboldt County Board of Supervisors adopting Resolution 20-39 authorizing formation of the Humboldt County Groundwater Sustainability Agency for the Eel River Valley groundwater basin, establishing and maintaining the List of Interested Parties, and creating the Communication and Engagement Plan to outline communication efforts for the GSP development, public engagement and implementation phases. Stakeholder input was utilized during the GSA formation phase through publicly noticed meetings of the Eel River Groundwater Working Group, made up of stakeholders in the Eel River Valley basin.

**Phase 2: GSP Preparation and Submission**

The Humboldt County GSA will focus on the development of the GSP while working with stakeholders for feedback and input from November 2020 through December 2021. The Humboldt County GSA will hold stakeholder meetings with the purpose of educating and informing stakeholders about SGMA and the GSP process, while also soliciting feedback and input to mitigate the negative impacts to beneficial users of groundwater as much as possible. Opportunities for stakeholder feedback and input are discussed in the following sections. The GSP is anticipated to be adopted by the Humboldt County GSA between December 2021 and January 2022. The adopted GSP will be submitted to DWR on or before January 31, 2022.

**Phase 3: GSP Review and Evaluation**

Phase 3 will begin following submission of the GSP to DWR in January 2022. Phase 3 focuses on GSP review and evaluation. DWR will hold a 60-day review and comment period for stakeholders. DWR will begin review of the GSP and provide an evaluation to Humboldt County GSA within 2 years.

**Phase 4: Implementation and Reporting**

Phase 4 will begin immediately after submitting the plan in January 2022. During the implementation phase, communication and engagement efforts will be focused on educational and informational awareness of the requirements and processes of achieving or maintaining groundwater sustainability by 2042. This will be an ongoing phase, as the GSP has a fifty-year planning horizon with measurable objectives, interim milestones in increments of five years that would achieve sustainability twenty years from the start of implementing the plan (SGMA Section 10727.2(b)(1)) in 2042.

**Time Period**: The Plan is intended to cover stakeholder communication and engagement from November 2020 -January 2022, from when the GSP is due to be submitted to California Department of Water Resources through the 20-year sustainability goal.

***Note: This Plan presents a set of potential outreach methods and a preliminary plan for stakeholder engagement by the Humboldt County Groundwater Sustainability Agency during preparation and implementation of the Groundwater Sustainability Plan for the Eel River Valley groundwater basin. The Humboldt County Groundwater Sustainability Agency will select appropriate outreach tools for each stakeholder event. In order to ensure an adaptive, responsive approach to stakeholder outreach and engagement, this plan may be updated and amended during its implementation.***

# III. Eel River Groundwater Basin Stakeholders

SGMA Section 10723.2 "Consideration of All Beneficial Uses and Users of Groundwater" states: *The groundwater sustainability agency shall consider the interests of all beneficial uses and users of the groundwater, as well as those responsible for implementing groundwater sustainability plans.*

SGMA Section 10723.4 "Maintenance of Interested Persons List" states: *The groundwater sustainability agency shall establish and maintain a list of persons interested in receiving notices regarding plan preparation, meeting announcements, and availability of draft plans, maps, and other relevant documents. Any person may request, in writing, to be placed on the list of interested persons.* In compliance with the SGMA requirement, Humboldt County GSA maintains a list of interested persons, and distributes meeting notices and relevant information to the stakeholders who have requested to be included. A list of identified stakeholders representing the interests of beneficial users is included in Attachment A.

## Beneficial Users of Groundwater

- **Agricultural Users** – Approximately 20% of the basin area is utilized by agricultural users who are solely reliant on groundwater for their irrigation needs. Agricultural users include livestock or crop producers. Organizations representing the interests of agricultural users include the Humboldt County Farm Bureau.
- **Domestic well owners** – Domestic well owners are located within the Humboldt County GSA boundary on rural residential and agricultural properties.
- **Municipal well operators** – The City of Fortuna and City of Rio Dell are municipal well operators within the Humboldt County GSA boundary.
- **Public water systems** – Public water system operators within the Humboldt County GSA boundary not included in the municipal well operator category above include the Del Oro Water Company (Ferndale area), Loleta Community Services District, Hydesville Community Services District, Palmer Creek Community Services District, Riverside Community Services District, and Bear River Band of the Rohnerville Rancheria.
- **Local land use planning agencies** – Local land use planning agencies include County of Humboldt, City of Fortuna, City of Rio Dell, and City of Ferndale.
- **Environmental users of groundwater** – Groundwater serves to replenish surface waters such as the Eel and Van Duzen Rivers which have multiple beneficial uses including cold freshwater habitat, water recreation, and sport fishing. Humboldt County will consult with interested non-profit organizations active within the basin, along with the California Department of Fish & Wildlife, U.S. Fish & Wildlife Service, and National Marine Fisheries Service.
- **Surface water users** – Surface water users include the City of Rio Dell and Scotia Community Services District. In addition, Humboldt County will review the State Water Resources Control Board's Electronic Water Rights Information Management System (eWRIMS) to review information on surface water rights within the Humboldt County GSA boundary.
- **Federal government, including but not limited to military and managers of federal lands** – Humboldt County is not aware of any federally managed lands within the Humboldt County GSA boundary. The Humboldt County GSA will consult with U.S. Fish & Wildlife Service, National Marine Fisheries Service, and the U.S. Geological Survey.
- **California Native American Tribes** – Native American Tribes located within the Humboldt County GSA boundary include the Bear River Band of the Rohnerville Rancheria. In addition, the Wiyot Tribe has a

close cultural connection to the lower Eel River.

- **Disadvantaged communities, including, but not limited to, those served by private domestic wells or small community water systems** – The basin contains five census designated places (Loleta, Fortuna, Ferndale, Rio Dell, and Scotia) which are Economically Distressed Areas (EDAs), based on DWR's EDA Mapping Tool (https://gis.water.ca.gov/app/edas/). The percentage of the basin population situated within an EDA is 77%.
- **Entities listed in Water Code section 10927 that are monitoring and reporting groundwater elevations in all or part of the groundwater basin managed by the groundwater sustainability agency-** Humboldt County and DWR collaborate on the monitoring and reporting of groundwater elevations within the basin under the California Statewide Groundwater Elevation Monitoring (CASGEM) program.

## Identification of Stakeholder Issues and Interests

Through discussions with the Eel River Groundwater stakeholder working group, overriding concerns, major concerns or challenges are centralized around the economic impacts to agricultural industries, which also have direct impacts on DACs, salt water intrusion in the aquifer(s), and impacts to surface water habitat.

The Humboldt County GSA will continue to provide opportunities for stakeholders to identify and discuss concerns, interests, and anticipated challenges. Humboldt County GSA and ERGWG members represent the interests of the stakeholders identified for the Eel River Valley basin. Stakeholder concerns and input, resulting from these discussions, will be summarized in written format and presented to the Humboldt County GSA, ERGWG, and GRAC (if formed) for consideration during the GSP development and may also be used for any communications and public meeting presentations held for DACs and other stakeholder groups.

Methods for stakeholders to identify concerns, interests, or anticipated challenges include:

- Attend Humboldt County GSA Board meetings and participate in the public comment
- Attend the ERGWG meetings and participate in discussions
- Have a direct conversation with a Humboldt County GSA Board member or staff
- Provide a written/typed letter or email to the Humboldt County GSA Board (Humboldt County GSA, Hank Seemann, 1106 Second St, Eureka, CA 95501. Email: hseemann@co.humboldt.ca.us)
- Complete and submit the DWR Stakeholder Survey Form to Humboldt County GSA, Hank Seemann, 1106 Second St, Eureka, CA 95501, email: hseemann@co.humboldt.ca.us (**Appendix D**)

## IV. Methods for Public Notification, Education, and Engagement

The Humboldt County GSA seeks to provide multiple opportunities and formats to notify the public about upcoming meetings, provide GSP status updates, educate Beneficial Users, and obtain public input about various GSP components. These opportunities include Humboldt County GSA Board meetings, ERGWG or GRAC meetings, the Humboldt County Groundwater website, Board Director or staff updates and discussions at meetings held by other agencies and organizations, emails and mailings, informational posters and flyers, video presentations, social media postings, and local media advertisements and articles. Informational material may also be offered in Spanish. The Humboldt County GSA may use DWR's Written Translation Service to communicate the groundwater planning activities with their non-English speaking constituents. The anticipated functions of these meetings and media are summarized on **Table 3**. The outreach methods listed in Table 3 and described below are intended to present a range of options available to the Humboldt County GSA as it conducts stakeholder engagement. The Humboldt County GSA will choose the appropriate and most effective methods from among these options (likely using a combination of some but not necessarily all of the listed options) as well as additional methods that may become available. The outreach approach may change during the course of developing the GSP based on insights gained and feedback from stakeholders. Due to COVID-19, it is not anticipated that large gatherings will be held, rather meetings will be held via video conferencing or one-on-one in person when appropriate. **Appendix E** provides an example evaluation form that the Agency may use to obtain meeting participant feedback. **Appendix F** provides a means for tracking stakeholder outreach efforts completed by the Humboldt County GSA.

**Table 3**: Notification, Education, and Engagement Meetings and Media.

| Meetings/Media | Notify and Inform about Upcoming Meetings and Project Status | Educate (SGMA and GSP Topics) | Obtain Public Input |
|---|---|---|---|
| Humboldt County GSA Board | √ | √ | √ |
| Eel River Groundwater Working Group or Groundwater Resources Advisory Committee | √ | √ | √ |
| Humboldt County Groundwater Website | √ | √ | |
| Humboldt County GSA Board Director, staff, or consultants outreach at meetings held by other agencies and organizations | √ | √ | √ |
| Emails, mailings, posters, and flyers | √ | √ | |
| Video presentations | √ | √ | |
| Social media (Facebook) | √ | √ | |
| Local media | √ | √ | |
| Other agency and organization communications (websites, newsletters, etc.) | √ | √ | |
| Posters or Flyers | √ | √ | |

**A. Humboldt County Groundwater Website**

The Humboldt County Groundwater website will be a tool for distributing and archiving meeting and communication materials, a repository for any studies, a resource for information about SGMA and groundwater, a means for providing updates on milestone progress to the public and to support public awareness. Staff anticipates updating the website on a quarterly basis or more often if needed. The website includes:

- Information about the Humboldt County GSA
- Meeting calendar
- Meeting materials, including agendas, Board packets, minutes, and presentations
- SGMA information and resource documents or links
- Technical reports and public drafts of SGMA required documents
- Progress updates, either written or through short pre-recorded videos
- Agency contact information

**B. Outreach at Meetings Held by Other Agencies and Organizations**

In addition to the Stakeholder meetings provided by the Humboldt County GSA for the purpose of GSP engagement, meetings held by other agencies and organizations provide opportunities for outreach. Humboldt County GSA Board Directors, staff, or consultants will provide periodic GSP updates and information at meetings held by other agencies and organizations. Such meetings include but may not be limited to:

- Bear River Band of the Rohnerville Rancheria Tribal Council
- City of Ferndale Council
- City of Fortuna Council
- City of Rio Dell Council
- Eel River Groundwater Working Group
- Groundwater Resources Advisory Committee (if formed)
- Humboldt County Board of Supervisors
- Humboldt County Farm Bureau
- Humboldt County Resource Conservation District
- Salt River Watershed Council
- Buckeye Conservancy
- Humboldt Del Norte Cattlemen Association/Cattlewomen
- North Coast Grower's Association

**C. Emails, Mailings, Posters, and Flyers**

The Humboldt County GSA will send emails and/or mailings to stakeholders on the stakeholder interest list (Appendix B) about upcoming Board and GRAC meetings, and general GSP updates. Posters and flyers may be used as additional outreach material to disseminate information to the public and be posted or made available at local feed stores, coffee shops, or frequently trafficked locations.

**D. Video Presentations**

Due to the State's orders regarding COVID-19, and to avoid large gatherings, pre-recorded video presentations may be used to provide progress updates to the public. Humboldt County GSA, ERGWG, and GRAC meetings may be held via a web-based platform and recorded for later viewing.

**E. Social Media**

The Humboldt County GSA will leverage social media technologies (ie. Facebook) to disseminate information only, such as provide project information and progress updates, and educational materials to stakeholders. Social media will not be used as a discussion platform nor as a means for gathering feedback and input from the public.

- Look us up on Facebook: Humboldt County Groundwater Sustainability Agency

**F. Local Media**

The Humboldt County GSA may choose to advertise upcoming meetings in local newspapers, radio and TV stations, and may also prepare press releases. The press releases may be distributed to local and regional media and Legislative and Congressional representatives.

**G. Other Agencies' and Organizations' Communication Channels**

The Humboldt County GSA may request that other organizations include information about the GSP and upcoming meetings in their newsletters and/or on their websites, including but not limited to:

- Humboldt County Farm Bureau *(*https://www.humboldtcountyfarmbureau.com//*)*
- Humboldt County Resource Conservation District (http://humboldtrcd.org/)
- University of California Cooperative Extension-Humboldt County (https://humboldtgov.org/614/UC-Cooperative-Extension)
- Buckeye Conservancy (http://buckeyeconservancy.org/)

## Stakeholder Survey and Mapping

Through ongoing communications, public education, and outreach efforts, stakeholders will have the opportunity to have a voice in the GSP development process. Stakeholder surveys and discussions are a valuable source in collecting feedback from the beneficial users who have vested interests in how the implementation of the GSP will affect their interests. Because the Humboldt County GSA established efficient avenues of direct communication with stakeholders, a traditional stakeholder survey will not be conducted. Feedback and concerns will be solicited through direct correspondence and discussions with stakeholders. However, a survey form will be made available upon request for any stakeholder who wishes to provide feedback (Appendix D).

# V. Implementation Timeline

Milestones and stakeholder engagement opportunities throughout the GSP development process are shown in Figure 1: SGMA Notification and Engagement Requirements. Supporting tactics or tools that may be used to communicate information and resources available to stakeholders during each phase is described below:

**Phase 1: GSA Formation and Coordination**

This phase spans 2019 through November 2020 and consists of:

- ERGWG unanimously approved of the County becoming the GSA for the Eel River Valley groundwater basin
- Humboldt County Board of Supervisors adopted Resolution 20-39 authorizing formation of Humboldt County GSA for the Eel River Valley groundwater basin
- Stakeholder input was utilized during the GSA formation phase through publicly noticed meetings of the Eel River Groundwater Working Group, made up of stakeholders in the Eel River Valley basin
- Execution of the grant agreement from DWR to support the GSP development
- Establish and maintain the List of Interested Parties
- Solicit requests for proposals and selected GHD, Inc. as a consultant to conduct basin studies and develop the GSP
- Maintain communication channels with the Eel River Groundwater Working Group
- Develop the Stakeholder Communications and Engagement Plan to outline communication efforts for the GSP development and implementation phases
- Develop and launch a user-friendly website and provide periodic updates
- Provide periodic email updates to those on the interested persons list (Appendix B)

**Phase 2: GSP Preparation and Submission**

This phase spans November 2020 through January 2022 and consists of:

- Development of the GSP while working with stakeholders for feedback and input.
- Work with GHD, Inc. to prepare the GSP following the steps described in the DWR grant agreement scope of work.
- Hold stakeholder meetings with the purpose of educating and informing stakeholders about SGMA and the GSP process, while also soliciting feedback and input to mitigate the negative impacts to beneficial users of groundwater as much as possible. Opportunities for stakeholder feedback and input are discussed in the previous sections.
- When it is not feasible to hold in-person meetings, provide email or website updates on progress either written or pre-recorded short videos.

**Phase 3: GSP Review and Evaluation**

This phase begins following submission of GSP to DWR, spanning from February 2022 through 2024 and consists of:

- DWR will hold a 60-day review and comment period for stakeholders.
- Public comment can be submitted via SGMA Portal for 60-days.
- GSP will be posted on the Humboldt County Groundwater website for the public and stakeholders to

conveniently download and review.

- DWR will begin review of the GSP and provide an evaluation to Humboldt County GSA within 2 years.

**Phase 4: Implementation and Reporting**

Phase 4 will begin immediately after submitting the plan in January 2022. During the implementation phase, communication and engagement efforts will be focused on educational and informational awareness of the requirements and processes of reaching or maintaining groundwater sustainability by 2042. This will be an ongoing phase, as the GSP has a fifty-year planning horizon with measurable objectives, interim milestones in increments of five years that would achieve or maintain sustainability twenty years from the start of implementing the plan (SGMA Section 10727.2(b)(1)) in 2042.

**Key Messages**

As the Humboldt County GSA begins the process of reaching out to stakeholders to inform and engage them in groundwater management issues and items, it is critical that it share clear and consistent key messages to avoid confusion and misunderstanding. Key messages include the following:

- Preparing a GSP is **required** by SGMA.
- SGMA allows for **local control** if the GSP is prepared within the specified timeline (by January 31, 2022).
- Information obtained during GSP development will allow for a determination of basin sustainable yield and will **empower** local stakeholders to effectively manage the groundwater basin.
- The intent of SGMA is for groundwater resources to be managed sustainably for long-term reliability and multiple economic, social, and environmental benefits.
- The GSP will increase **confidence** and reduce uncertainty about the future sustainability of our ground water supply.
- The GSA is committed to an **open and transparent** GSP preparation process.

# VI. Evaluation and Assessment

## Milestone Review

The Humboldt County GSA staff evaluate the effectiveness of its outreach and engagement methods throughout the process and, in particular, following each Stakeholder meeting. Appendix E provides an example evaluation form that the Agency may use to obtain meeting participant feedback. Among the factors to be considered are:

- How well was the meeting attended?
- How did attendees find out about the meeting?
- What topics were attendees most interested in during the meeting?
- Were the presentations clear and effective in conveying the information needed by stakeholders to understand and take part in GSP development?
- Was there ample time for discussion, questions, and answers?
- Did attendees have an opportunity to provide meaningful input?

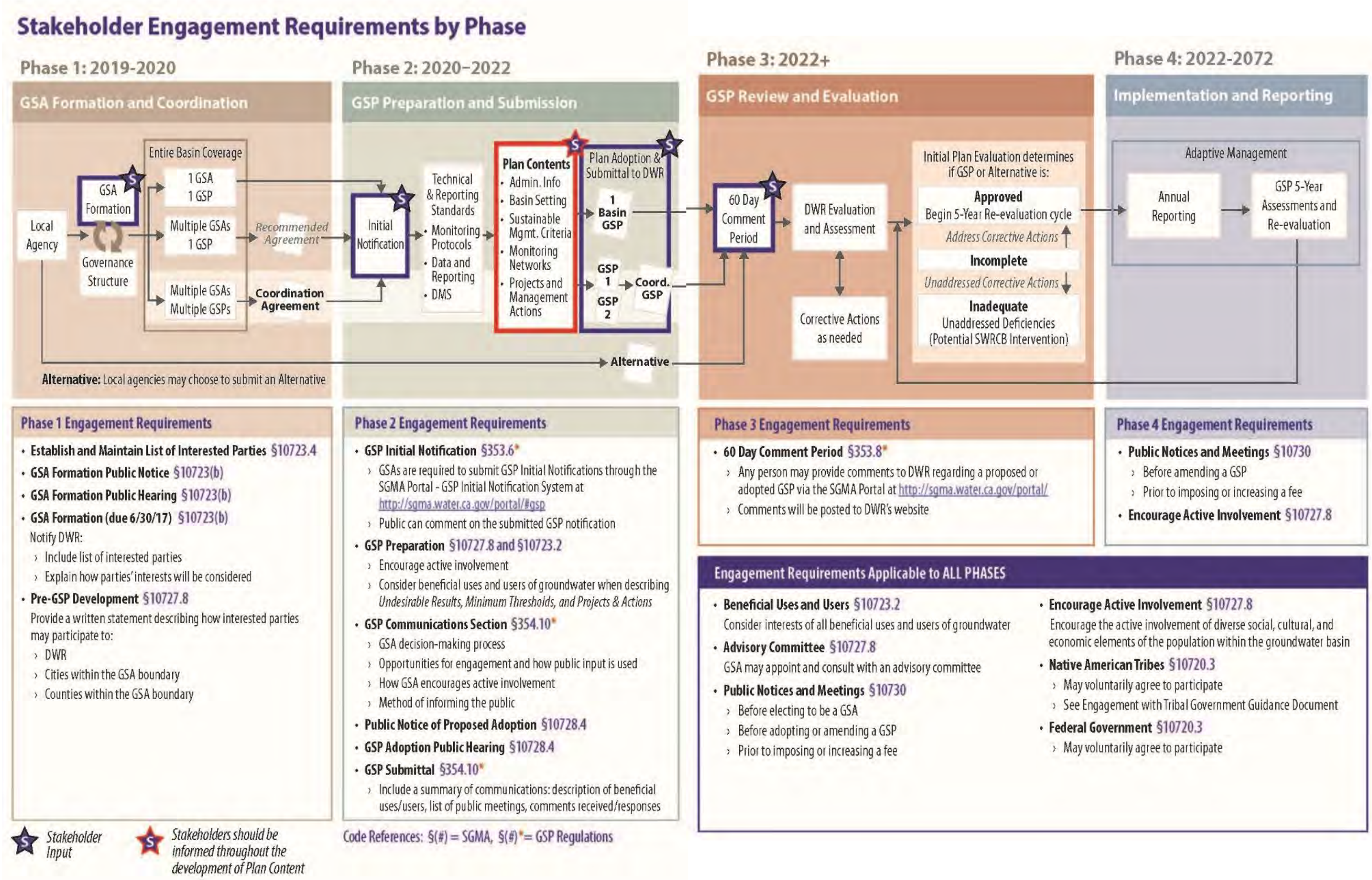
Humboldt County GSA staff will facilitate an in-depth discussion with the Board for feedback regarding communication and engagement efforts for the stakeholder groups. Discussion topics include:

- Successful outreach and what worked well
- What has not worked well or needs adjusting for more effective results
- Additional outreach methods to consider or adopt
- Lessons learned
- Next steps

# Appendices

## Appendix A: Stakeholder Engagement Requirements by Phase

SGMA Notification and Engagement Requirements as described in the DWR guidance document for groundwater sustainability plans (https://groundwaterexchange.org/wp-content/uploads/2020/02/DWR-Stakeholder-Communication-and-Engagement.pdf).



## Appendix B: Interested Persons List

The following table provides a list of Beneficial Users and potentially interested parties identified to date. This list will evolve during the GSP preparation process.

| Beneficial User/Groundwater Interest Category | Stakeholder Name | Organization/Affiliation |
|---|---|---|
| Agricultural user | Andy & Sarah Albin | Albin Dairy |
| Agricultural user | Andy Titus | Fern Vallee Farms |
| Agricultural user | Blake Alexandre | Alexandre Family Farms |
| Agricultural user | Bobby Dolcini | Riverside Dairy |
| Agricultural user | Chad Lake | Sequoia Orchids |
| Agricultural user | Chris Cahill | Cahill Dairy |
| Agricultural user | Chris Howard | Alexandre Family Farms |
| Agricultural user | Cliff Clendenen | Clendenen's Cider Works |
| Agricultural user | Cody & Thomas Nicholson-Stratton | Foggy Bottoms Dairy |
| Agricultural user | Colton Brodt | Brodt Dairies |
| Agricultural user | Daniel & Jordon DelBiaggio | Del Biaggio Dairies |
| Agricultural user | Daren & Karen Hansen | D.Hansen Dairy |
| Agricultural user | Dave Renner | Diamond Point Dairy |
| Agricultural user | Dennis Leonardi | Evening Star Holsteins |
| Agricultural user | Denver Nelson | |
| Agricultural user | Eric Bess | Bess Dairy |
| Agricultural user | Frank Boldrini | Boldrini Dairy |
| Agricultural user | Frank Leonardo | Grizzly Bluff Holsteins |
| Agricultural user | Gene Sarvinski | Sarvinski Dairy |
| Agricultural user | George Toste | Toste Dairy |
| Agricultural user | Jay Russ | Russ Ranches |
| Agricultural user | Jeremy Weaver | NorthCoast Pump House |
| Agricultural user | Jim and Susan Regli | Regli Jerseys and Reas Creek Jerseys |
| Agricultural user | Jim Renner | Renner Ranches |
| Agricultural user | Jim Walker | Walker Dairy |
| Agricultural user | Johanna Rodoni | |
| Agricultural user | John Vevoda | Vevoda Dairy |
| Agricultural user | Joseph Alexandre | Alexandre Family Farms |
| Agricultural user | Katherine Ziemer | Humboldt County Farm Bureau |
| Agricultural user | Lee Mora | Humboldt Grassfed Beef |
| Agricultural user | Leslie O'Neil | O'Neil Dairy |
| Agricultural user | Lucas McCanless | McCanless Dairy |
| Agricultural user | Mario Avelar | Avelar Brothers Dairy |
| Agricultural user | Mark & Nikki Miranda | M & N Miranda Dairy |

| | | |
|---|---|---|
| Agricultural user | Matt Boynton | Riverside Ranch |
| Agricultural user | Melissa Lema | Western United Dairymen |
| Agricultural user | Mike Boynton | Mike Boynton Dairy |
| Agricultural user | Mike Griffith | Griffith Dairy |
| Agricultural user | Pete & Mary Bansen | Bancrest Dairy Inc. |
| Agricultural user | Ray Shinn | Shinn Dairy |
| Agricultural user | Robert Hansen | Hansen Dairy |
| Agricultural user | Robin Renner | Diamond R Ranch |
| Agricultural user | Rusty Rocha | Rocha Dairy |
| Agricultural user | Ryan Rice | RP Rice Construction |
| Agricultural user | Sharon Lutz | Green Acres Dairy |
| Agricultural user | Steve Scilacci | Scilacci Dairy |
| Agricultural user | Tim & Dorice Miranda | Miranda Dairy |
| Agricultural user | Tim Phillis | |
| Agricultural user | Tom Ghidinelli | Pleasant Point Dairy |
| Agricultural user | Tom Losa | Losa Dairy |
| Agricultural user | Tom Rayl | Rayl Dairy |
| Agricultural user | Tracy Coppini | Coppini Lane Jerseys |
| Agricultural user | Zach Cahill | Cahill Dairy |
| Business-environmental consulting | Ben Gettleman | Kearns & West |
| Business-environmental consulting | Brad Job | Pacific Watershed Associates |
| Business-environmental consulting | Brianne Kolson | NRM |
| Business-environmental consulting | Christine Manhart | LACO Associates |
| Business-environmental consulting | Dave Fisch | Fisch Drilling |
| Business-environmental consulting | Frank Bickner | Jacobson James & Associates |
| Business-environmental consulting | Gary Simpson | SHN Consulting Engineers |
| Business-environmental consulting | Jason Buck | SHN Consulting Engineers |
| Business-environmental consulting | Kelly Morris | LACO Associates |
| Business-environmental consulting | Mark McGowan | Jacobson James & Associates |
| Business-environmental consulting | Mark Nichols | Jacobson James & Associates |
| Business-environmental consulting | Michael Bombard | GHD, Inc. |
| Business-environmental consulting | Orrin Plocher | Freshwater Environmental Services |
| Business-environmental consulting | Patrick Sullivan | GHD, Inc. |
| Business-environmental consulting | Rob Frizzell | Professional Engineers in California Government |
| Business-environmental consulting | Ryan Crawford | GHD, Inc. |
| Business-environmental consulting | Tom Gast | Thomas Gast and Associates |

| | | |
|---|---|---|
| California Native American tribes | Eddie Kock | Wiyot Tribe |
| Domestic well owner | Cheryl Laffranchi | |
| Domestic well owner | David Sopjes | |
| Environmental users of groundwater | Darren Mierau | CalTrout |
| Environmental users of groundwater | Pat Higgins | Friends of the Eel River |
| Environmental users of groundwater | Scott Greason | Friends of the Eel River |
| Federal government | Jon Shultz | USDA-NRCS |
| Local land use planning agencies | Adam Weinberg | RWQCB |
| Local land use planning agencies | Ben Dolf | County of Humboldt |
| Local land use planning agencies | Brianna Seapy | CDFW |
| Local land use planning agencies | David Manthorne | CDFW |
| Local land use planning agencies | Estelle Fennell | County of Humboldt |
| Local land use planning agencies | Hank Seemann | County of Humboldt |
| Local land use planning agencies | Jane Arnold | CDFW |
| Local land use planning agencies | Jeff Dolf | County of Humboldt |
| Local land use planning agencies | Jeff Jahn | NOAA |
| Local land use planning agencies | Jennifer Curtis | USGS |
| Local land use planning agencies | Jeremiah Puget | RWQCB |
| Local land use planning agencies | John Miller | County of Humboldt |
| Local land use planning agencies | John Wellik | County of Humboldt |
| Local land use planning agencies | Kristal Davis-Fadtke | CDFW |
| Local land use planning agencies | Mark Smelser | CDFW |
| Local land use planning agencies | Mary Jane Ashton | County of Humboldt |
| Local land use planning agencies | Matt Goldsworthy | NOAA |
| Local land use planning agencies | Merritt Perry | City of Fortuna |
| Local land use planning agencies | Michael Wheeler | County of Humboldt |
| Local land use planning agencies | Michelle Dooley | DWR |
| Local land use planning agencies | Norm Crawford | County of Humboldt |
| Local land use planning agencies | Randy Hooper | County of Del Norte |
| Local land use planning agencies | Rex Bohn | County of Humboldt |
| Local land use planning agencies | Robert Vogt | County of Humboldt |
| Local land use planning agencies | Stephen Umbertis | County of Humboldt |
| Local land use planning agencies | Summer Daugherty | County of Humboldt |
| Local land use planning agencies | Zachary Stanko | USGS |
| Local land use planning agencies | Rick Rogers | NOAA Fisheries West Coast Region |
| Local land use planning agencies | Ian Espinoza | DWR |
| Local land use planning agencies | Patricia Vellines | DWR |
| Local land use planning agencies | Monty Larson | CDFW |
| Local land use planning agencies | Claudia Faunt | USGS |
| Municipal well operator | Kevin Farmer | Palmer Creek Community Services District |

| | | |
|---|---|---|
| Municipal well operator | Cameron Yaple (General Manager) | Hydesville Community Water District |
| Municipal well operator | Christopher Christianson (Chief Treatment Plant Operator) | City of Fortuna |
| Municipal well operator | Marcus Drumm (General Manager) | Loleta Community Services District |
| Municipal well operator | Mary Burke | Mckinleyville Community Service District |
| Municipal well operator | Paul Skofield (Operator) | Riverside Community Services District |
| Municipal well operator/California Native American tribes | Hank Brenard (Environmental and Natural Resources Director) | Bear River Band of the Rohnerville Rancheria |
| Municipal well operator/Surface water user | Cameron Yaple (General Manager) | City of Rio Dell |
| Municipal well operator/Surface water user | Kyle Knopp | City of Rio Dell |
| Other-interested individual | Alex Blessing | The Wildlands Conservancy |
| Other-interested individual | Ethan Amezcua | |
| Other-interested individual | Hollie Hall | |
| Other-interested individual | Jack Rice | Consultant |
| Other-interested individual | John Corbett | |
| Other-interested individual | Julie Houtby | Farm Ag Credit |
| Other-interested individual | NCH | |
| Other-interested individual | Nick Angeloff | |
| Other-interested individual | Renee Abrams | |
| Other-interested individual | Russ Forsburg | Farm Ag Credit |
| Other-interested individual | Stuart Dickey | |
| Other-interested individual | Tracy Boobar | |
| Other-interested individual | Vivian Helliwell | Medocino Community Network |
| Other-interested individual | Annje Dodd | |
| Public water system | Troy Hubner (Asst. Field Superintendent) | Del Oro Water Company |
| State agency | Bob McPherson | Humboldt State University |
| State agency | Christopher Watt | RWQCB |
| State agency | Doreen Hansen | Humboldt County RCD |
| State agency | Frances Tjarnstrom | Humboldt County RCD |
| State agency | Gary Markegard | Humboldt County RCD |
| State agency | Jacob Taulbee | Humboldt County RCD |
| State agency | Jasper Oshun | Humboldt State University |
| State agency | Jeff Stackhouse | UCCE |

| | | |
|---|---|---|
| State agency | Jill Demers | Humboldt County RCD |
| State agency | Justin Ebrahemi | Humboldt State University |
| State agency | Yana Valachovic | UCCE |
| State agency | Senator Mike McGuire | State Government |
| Surface water users | Leslie Marshall (General Manager) | Scotia Community Services District |

## Appendix C: Preliminary Groundwater Working Group/Groundwater Resources Advisory Committee Meeting Schedule

The following meeting topic and frequency list is preliminary and subject to change based on the project schedule, stakeholder feedback, and the Board's discretion.

**Modeling, Water Budget, Basin Setting, and Sustainable Management Criteria – Fall 2020 and Winter 2021** (Location to be determined)

- Data collection - landowner participation, and timing
- Technical discussion of the model
- Well monitoring
- Water budget

**Data Gaps and Sustainability Goals – Spring and Summer 2021** (Location to be determined)

- Identify data gaps, additional data collection as needed
- Sustainability goals
  - Undesirable results
  - Minimum thresholds
  - Measurable objectives

**Proposed Projects, Management Actions, and Monitoring– Fall 2021** (Location to be determined)

- Proposed Projects and Management Actions to be considered in the GSP
- Monitoring network and data management system

## Appendix D: DWR Stakeholder Survey Form

*Stakeholder Survey Template* *Page **1** of **1***

**Stakeholder Survey Template**

Date:

Organization or Business Name:

Name of Primary Contact or Individual Stakeholder Name:

Contact Information for primary contact or individual stakeholder:

Email: Twitter:

Cell: Website:

| ***Question*** | ***Response*** | ***Notes*** |
|---|---|---|
| Are you familiar with SGMA regulations? | | |
| Are you currently engaged in activity or discussions regarding groundwater management in this region? | | |
| Do you own or manage operate land in this region? | | |
| Do you manage water resources? If yes, what is your role? | | |
| What is your primary interest in land or water resources management? | | |
| Do you have concerns about groundwater management? If so, what are they? | | |
| Do you have recommendations regarding groundwater management?<br>If so, what are they? | | |
| What else do you want me to know? | | |
| Who else should we listen to? | | |

*California Department of Water Resources*
*SGMA Stakeholder Communication and Engagement Digital Toolkit*

## Appendix E: Stakeholder Meeting Evaluation Form

### Humboldt County Groundwater Sustainability Agency

### Eel River Valley Basin Groundwater Sustainability Plan

### Stakeholder Meeting Evaluation

Meeting Date: ______________________

Please answer the following questions about today's meeting by circling the appropriate number.

| | Excellent | Good | Average | Poor | Very Poor | N/A No Opinion |
|---|---|---|---|---|---|---|
| | **(5)** | **(4)** | **(3)** | **(2)** | **(1)** | **(0)** |
| What is your overall rating of today's meeting? | 5 | 4 | 3 | 2 | 1 | 0 |
| Rate the usefulness to you of the information in today's meeting | 5 | 4 | 3 | 2 | 1 | 0 |
| Rate how clearly the material was presented | 5 | 4 | 3 | 2 | 1 | 0 |
| Rate the opportunity provided to ask questions, discuss concerns, and provide input to the GSP | 5 | 4 | 3 | 2 | 1 | 0 |
| Rate the location accessibility of today's meeting | 5 | 4 | 3 | 2 | 1 | 0 |
| Rate the length of today's meeting | 5 | 4 | 3 | 2 | 1 | 0 |

HCGSA Eel River Valley Basin Stakeholder Meeting Evaluation Form (7.2020)
1

**ADDITIONAL QUESTIONS AND SPACE FOR COMMENTS ON REVERSE SIDE**

*Contact Information (Optional)*

*Name:*________________________________________

*Email address:*____________________________________

*Phone number:*____________________________________

How did you hear about this meeting?

What information did you find most useful?

What additional information or presentations would be useful and interesting to you?

What suggestions do you have to improve these meetings?

Please include any additional comments that you have regarding the meeting:

HCGSA Eel River Valley Basin Stakeholder Meeting Evaluation Form (7.2020)
2

## Appendix F: Stakeholder Outreach Tracking and Documentation Tool

**Stakeholder Outreach Tracking and Documentation Tool**

| Meeting Date/Location | Agency/ Organization | Email-blast to Stakeholder List? when? | Mailings? When? | Flyer distributed at other meetings/events? Where and when? | Additional outreach and publicity (press release, ads, posting on other websites, notice in other newsletters) | Topics discussed at meeting | # of participants, interests represented | Evaluation, additional comments |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

# Eel River Valley Groundwater Basin Stakeholder Outreach Tracking and Documentation Tool, 2015-2019

| Meeting Date | Meeting Location | Agency/ Organization/ Group | Topics discussed at meeting | # of participants |
|---|---|---|---|---|
| February 24, 2015 | Board of Supervisors chambers, Eureka | Humboldt County Board of Supervisors | Provide guidance on County response to SGMA, Direct Public Works to convene a workshop for stakeholders on SGMA, Authorize staff to apply for grant funding | Video available on Access Humboldt. |
| April 27, 2015 | Humboldt County Agricultural Center, Eureka | Workshop on groundwater in the Eel River Valley | Overview of groundwater legislation, Overview of hydrogeology in the Eel River Basin, Invited Statements, Facilitated discussion | 42 |
| May 20, 2015 | Riverwalk Lodge, Fortuna | Eel River Forum- hosted by Friends of the Eel River and CDFW | Key aspects of SGMA, State Water Policy Water Code 113, Basin Ranking, Powers of Authority, Beneficial Uses and Users, Legislation Summary, Timeline, Outreach, Initial data review, Understanding the basin and its' functions | - |
| October 6, 2015 | Board of Supervisors chambers, Eureka | Humboldt County Board of Supervisors | Update on Eel River Forum workshop, approves formation of Eel River Valley Groundwater Working Group | Video available on Access Humboldt. |
| October 21, 2015 | Humboldt County Agricultural Center, Eureka | Eel River Valley Groundwater Working Group | SGMA overview, Eel River Valley groundwater basin overview, Role of the working group, Proposition 1 grant program proposition | 27 |
| December 14, 2015 | Humboldt County Agricultural Center, Eureka | Eel River Valley Groundwater Working Group | Proposition 1 grant program, DWR medium-priority ranking for Eel River Valley groundwater basin, working group membership, Irrigation Water and Fertigation Management Planning Project | 28 |
| February 22, 2016 | Humboldt County Agricultural Center, Eureka | Eel River Valley Groundwater Working Group | Update on DWR Guidelines, Compliance Timeline, and Alternative Submittals, Proposition 1 Grant Program update, Summary of Water Supplier Information, Presentation of monitoring data from Cheryl Laffranchi (Northcoast Pumphouse), HCRCD Irrigation/Fertigation Study update | 35 |
| April 25, 2016 | Humboldt County Agricultural Center, Eureka | Eel River Valley Groundwater Working Group | Brief updates, Proposition 1 grant for technical study and planning, GSA formation and governance, Update on Humboldt County RCD's Irrigation Water/Fertigation Management Planning Project | 34 |

| | | | | |
|---|---|---|---|---|
| September 12, 2016 | Humboldt County Agricultural Center, Eureka | Eel River Valley Groundwater Working Group | Review current compliance approach for SGMA and purpose/membership of Working Group, Review previous meeting materials, Update on groundwater basin assessment, Update on HCRCD's Irrigation Water and Fertigation Management Planning Project | 31 |
| November 7, 2016 | Humboldt County Agricultural Center, Eureka | Eel River Valley Groundwater Working Group | Review previous meeting materials, Update of technical study, Project timeline and Submittals | 30 |
| December 2, 2016 | Humboldt County Agricultural Center, Eureka | Eel River Valley Groundwater Working Group | Irrigation water use, DWR basin priority ranking, DWR alternative submittal, Initial results from groundwater basin assessment data collection, Review timeline and next steps | 27 |
| December 13, 2016 | Board of Supervisors chambers, Eureka | Humboldt County Board of Supervisors | Adopt a resolution authorizing Public Works to submit a Groundwater Sustainability Plan Alternative | Video available on Access Humboldt. |
| December 20, 2016 | Humboldt County Agricultural Center, Eureka | Eel River Valley Groundwater Working Group | Irrigation water use, Alternatives to GSP | 24 |
| March 22, 2017 | Riverwalk Lodge, Fortuna | Eel River Forum- hosted by Friends of the Eel River and CDFW | Alternative Plan submittal, Basin ranking process, SGMA, Sustainability Indicators, Concerns, Timeline, Working group purpose and scope, SGMA paths to compliance, Review of existing data | - |
| May 3, 2018 | Humboldt County Farm Bureau, Eureka | Humboldt County Farm Bureau | SGMA legislation review, Sustainability Indicators, SGMA paths to compliance, Basin ranking process, Working group structure, Ag water use summary, Review of existing data | - |
| June 21, 2018 | Humboldt County Agricultural Center, Eureka | Eel River Valley Groundwater Working Group | GSP alternative submittal, Annual report for 2017 water year, DWR's draft 2018 basin prioritization results, Working group purpose review | 19 |
| September 30, 2019 | Humboldt County Agricultural Center, Eureka | Eel River Valley Groundwater Working Group | DWR's assessment of the Groundwater Sustainability Plan Alternative submittal, Basis for DWR's assessment, Review of monitoring data, Discuss formation of GSA, Prop 68 Grant funding opportunity | 26 |

Interests represented at each meeting include: agriculture, environmental, water service districts, municipalities, residents, disadvantaged community members, and beneficial users.

# Eel River Valley GSP Stakeholder Outreach Tracking and Documentation Tool, 2020-2022

| Meeting Date/Location | Agency/ Organization | Email-blast to Stakeholder List? when? | Additional outreach and publicity (press release, ads, posting on other websites, notice in other newsletters) | Topics discussed at meeting | # of participants, interests represented | Evaluation, additionalcomments |
|---|---|---|---|---|---|---|
| 3/5/2020 Humboldt County Agriculture Commissioners Building, Eureka, CA | Eel River Groundwater Working Group | Yes, 2 weeks prior and week of meeting | Meeting notice posted on County Groundwater website. | Presentation and discussion on SGMA Compliance, the steps to completing a Groundwater Sustainability Plan (GSP) by January 2022, the proposed options for creating a Groundwater Sustainability Agency by April 2020, and timeline of project. | 40- agriculture, environmental, water service districts, municipalities, residents, disadvantaged community members, beneficial users. | |
| 6/11/2020 Farm Bureau office, Eureka, CA | Humboldt County Farm Bureau Board Meeting | No | Farm Bureau staff provided notice to members and public. | Explained the SGMA process, provided an update on Eel River GSP project progress, received comments, and answered questions. | 17- agriculture producers, small businesses, beneficial users | |
| 9/13/2020, Zoom meeting | Humboldt County Resource Conservation District | No | District staff provided notice to board members and public via email and District website (humboldtrcd.org) | Presented Eel River GSP project to Board members and public, and an update on progress. | 13- agriculture, environmental, beneficial users | |
| 11/5/2020 Farm Bureau office, Eureka, CA | Humboldt County Farm Bureau Board Meeting | No | Farm Bureau staff provided notice to members and public. | Provided an update on Eel River GSP project progress, received comments, and answered questions. | 15- agriculture producers, small businesses, beneficial users | |
| 11/4/2020 Agriculture Commissioners meeting room, Eureka, CA | Humboldt/Del Norte County Cattlemen's Association | No | Association staff provided notice to members and public. | Provided an update on Eel River GSP project progress, received comments, solicited participation for water balance work, and answered questions. | 10- agriculture producers, beneficial users | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 11/30/2020, Zoom meeting with option to meet at Humboldt County Agriculture Commissioners Building, Eureka, CA | Eel River Groundwater Working Group | Yes, 2 weeks prior and week of meeting | Meeting notice posted on County Groundwater website. | County staff explained the SGMA process, provided an update on project process, an introduction the project team, and answered questions. | 30- agriculture, environmental, water service districts, municipalities, residents, disadvantaged community members, beneficial users. | Web-based platform not as effective as in person meetings. Explore additional options for stakeholder engagement. |
| 12/10/2020, Zoom meeting | Humboldt County Resource Conservation District | No | District staff provided notice to board members and public via email and District website (humboldtrcd.org) | Provided an update on Eel River GSP project progress, received comments, and answered questions. | 22- agriculture, environmental, beneficial users | |
| 12/16/2020 Zoom meeting | NOAA and NMFS | No | Individual outreach to NOAA and NMFS biologists and engineers who expressed interest in participating in the Eel River GSP development. | Provided an update on Eel River GSP project progress, received comments, and answered questions. | 7- GSA staff and NOAA/NMFS biologists and engineers | Gained an understanding of NOAA/NMFS concerns in the basin and how they may contribute to the GSP development. |
| March 8-12, 2021, Ferndale and Fortuna | Seven (7) Small in person group meetings with different agriculture producers | Individual outreach via email and/or phone call | No | Explained the SGMA process, provided an update on Eel River GSP project progress, solicited participation in data collection, received comments, and answered questions. | 41- agriculture, Western United Dairymen, Humboldt County RCD, County Supervisors | Effective group meetings where participants could speak freely and have an authentic conversation. Gained understanding of concerns. |
| 3/15/2021 Zoom Meeting | Fortuna City Council | No | City staff provided public notice on their website. | Explained the SGMA process, provided an update on Eel River GSP project progress, received comments, and answered questions. | 19- city government, disadvantaged community members, beneficial users | |
| 4/1/2021 Farm Bureau office, Eureka, CA | Humboldt County Farm Bureau Board Meeting | No | Farm Bureau staff provided notice to members and public. | Provided an update on Eel River GSP project progress, received comments, and answered questions. | 15- agriculture, State Veterinarian, small businesses | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 4/8/2021<br>Zoom meeting | Humboldt County Resource Conservation District | No | District staff provided notice to board members and public via email and District website (humboldtrcd.org) | Provided an update on Eel River GSP project progress, received comments, and answered questions. | 17-board members, agriculture producers, agency personnel, beneficial users | |
| 4/20/2021<br>Zoom meeting | The Buckeye Board meeting | No | Buckeye Executive Director provided notice to members and public. | Explained the SGMA process, provided an update on Eel River GSP project progress, received comments, and answered questions. | 13- Agriculture, timber production, small business, environmental | |
| 4/20/2021<br>Zoom meeting | Cal Trout and Trout Unlimited | Individual outreach via email and/or phone call | Individual outreach to biologists and engineers who expressed interest in participating in the Eel River GSP development. | Explained the SGMA process, provided an update on Eel River GSP project progress, received comments, and answered questions. | 6- GSA staff and CalTrout and Trout Unlimited biologist, engineer, and hydrologist. | Gained an understanding of CalTrout/Trout Unlimited concerns in the basin and how they may contribute to the GSP development. |
| 4/21/2021<br>Zoom meeting | The Nature Conservancy | Individual outreach via email and/or phone call | Individual outreach to those who expressed interest in participating in the Eel River GSP development. | Explained the SGMA process, provided an update on Eel River GSP project progress, received comments, and answered questions. Focus of discussion was on GDEs. | 6- GSA staff, TNC geologist, County consulting modeling team members | Gained an understanding of TNC concerns in the basin and how they may contribute to the GSP development. |
| 4/29/2021<br>Zoom meeting | Friends of the Eel River | Individual outreach via email and/or phone call | Individual outreach to those who expressed interest in participating in the Eel River GSP development. | Explained the SGMA process, provided an update on Eel River GSP project progress, received comments, and answered questions. | 5- GSA staff, FER Executive Director and Board member | Gained an understanding of FER concerns in the basin and how they may contribute to the GSP development. |

| | | | | | | |
|---|---|---|---|---|---|---|
| 5/25/2021 Zoom meeting | Humboldt County Board of Supervisors meeting | Yes, 5/21/2021 | Notice posted on County Groundwater website under News Flash. Email or text was sent to 444 people signed up to receive notices. Notice published on County Board of Supervisors meeting calendar and publicly noticed per Brown Act Rules. | Drought Conditions and Implications for Wildfire Risk and Water Availability, SGMA and Eel River GSP project status. A recording of the meeting can be found on Access Humboldt's Board of Supervisor's video archives. | Meeting is broad cast live through Access Humboldt and participants who wish to speak call in. Unknown how many people actually viewed the webcast. | |
| 5/27/2021 Zoom meeting | California Department of Fish and Wildlife and NOAA | Individual outreach via email and/or phone call | Individual outreach to those who expressed interest in participating in the Eel River GSP development. | Explained the SGMA process, provided an update on Eel River GSP project progress, received comments, and answered questions. | 6-GSA staff, CDFW and NOAA wildlife biologists | Gained an understanding of CDFW concerns in the basin and how they may contribute to the GSP development. |
| 6/16/2021 Zoom meeting | Ferndale City Council | No | City staff provided public notice on their website. | Explained the SGMA process, provided an update on Eel River GSP project progress, received comments, and answered questions. | 16- city government, disadvantaged community members, beneficial users, agricultural producers | |
| 7/20/2021 Zoom meeting | Humboldt County Board of Supervisors | Yes, one week before | Notice posted on County Groundwater website under News Flash. Email or text was sent to 444 people signed up to receive notices. Notice published on County Board of Supervisors meeting calendar and publicly noticed per Brown Act Rules. | Provided an update on Eel River GSP project progress, drought impacts to basin, and received comments and answered questions. A recording of the meeting can be found on Access Humboldt's Board of Supervisor's video archives. | Meeting is broad cast live through Access Humboldt and participants who wish to speak call in. Unknown how many people actually viewed the webcast. | |
| 11/5/2021 Eel River basin, Ferndale, CA | Hydrogeology class, Humboldt State University | No | No | Eel River Valley basin geology, water rights, SMCs, modeling results, stakeholder engagement. | 13-students, professor, outreach consultant Jack Rice, County staff | |
| 12/14/2021 Zoom meeting | Rio Dell City Council | No | City staff provided public notice on their website. | GSP briefing, answered questions, and received comments | 15-City council and staff, and stakeholders | Received public comment |
| 12/15/2021 Zoom meeting | Ferndale City Council | No | City staff provided public notice on their website. | GSP briefing, answered questions, and received comments | 18- City council and staff, and stakeholders | Received public comment |

| | | | | | | |
|---|---|---|---|---|---|---|
| 12/15/2021 Zoom meeting | CDFW, NOAA, and RWQCB | No | No | GSP briefing, answered questions, and received comments | 8-County staff and agency representatives | Received comments |
| 12/16/2021 Ferndale Fairgrounds Turf Room | Agriculture producers and partners | No | Specific outreach to agriculture stakeholders and partners | GSP briefing, answered questions, and received comments | 6-agriculture producers | Received comments |
| 12/16/2021 Event barn by the bridge | Agriculture producers and partners | No | Specific outreach to agriculture stakeholders and partners | GSP briefing, answered questions, and received comments | 11-agriculture producers, UC Cooperative Extension Livestock Advisor, HCRCD, WUD representatives. | Received comments |
| 12/17/2021 Zoom meeting | Friends of the Eel River | No | Specific outreach to FOER | GSP briefing, answered questions, and received comments | 4- County staff and FOER representative. | Received comments |
| 12/20/2021 Zoom | Fortuna City Council | No | City staff provided public notice on their website. | GSP briefing, answered questions, and received comments | 20-City Council members, City staff, stakeholders | Received public comment |
| 1/4/2022 Zoom meeting | Humboldt County Board of Supervisors/ GSA | Yes, 12/11/2021 and 12/30/2021 | Notice published on County Board of Supervisors meeting calendar and publicly noticed per Brown Act Rules. | Provided GSP briefing, answered questions, and received public comments. A recording of the meeting can be found on Access Humboldt's Board of Supervisor's video archives. | Meeting is broad cast live through Access Humboldt and participants who wish to speak call in. Unknown how many people actually viewed the webcast. | Received public comment |
| 1/6/2022 Farm Bureau office, Eureka, CA | Humboldt County Farm Bureau Board Meeting | No | Farm Bureau staff provided notice to members and public. | Provided an update on the SGMA County program and review report given to County Board of Supervisors on 1/4/2022. | 10- agriculture, small businesses, beneficial users | Received public comment |
| 1/13/2022 Zoom meeting | Humboldt County Resource Conservation District | No | District staff provided notice to board members and public via email and District website (humboldtrcd.org) | Provided an update on the SGMA County program and review report given to County Board of Supervisors on 1/4/2022. | Board members, agriculture producers, agency personnel, beneficial users | Received public comment |
| 1/25/2022 Zoom meeting | Humboldt County Board of Supervisors/ GSA | Yes 12/11/2021, 12/30/2021 | Notice published on County Board of Supervisors meeting calendar and publicly noticed per Brown Act Rules. | Present Final Eel River GSP for Board adoption, public hearing. A recording of the meeting can be found on Access Humboldt's Board of Supervisor's video archives. | Meeting is broad cast live through Access Humboldt and participants who wish to speak call in. Unknown how many people actually viewed the webcast. | |

# Summary of NRCS Irrigation Enhancement Projects (Appendix D)

United States Department of Agriculture

Natural Resources Conservation Service
5630 South Broadway
Eureka, CA 95503
(707) 832-5585

June 17, 2021

Ms. Summer Daugherty
Senior Environmental Analyst
Humboldt County Department of Public Works
1106 Second Street
Eureka, CA 95501

RE: USDA-NRCS Irrigation enhancements for Eel River Groundwater Basin

Summer,

As requested in previous correspondence, this office has compiled water saving enhancement projects that the United States Department of Agriculture, Natural Resources Conservation Service (USDA-NRCS) has assisted groundwater irrigators with in the Eel River Groundwater Basin through the Environmental Quality Incentives Program (EQIP). EQIP is a conservation incentives program that assists eligible farmers and ranchers with technical and financial assistance. This information has been compiled for the period of the last ten years, from 2011 through current year 2021.

Over the ten-year period USDA-NRCS has assisted 25 irrigators in the groundwater basin on irrigation enhancement projects on 40 distinct farms. These farms are distinct from an irrigation standpoint in that they all have irrigation infrastructure in place that is not shared or connected with another farm. Projects selected for assistance in the EQIP program are ranked on irrigation water savings calculated by an NRCS conservationist. Projects with the most water savings are selected for funding. Existing irrigation systems are often aged hand move sprinkler systems that are inefficient in use as well as labor intensive. These systems are difficult to manage to get the timing and amount of water needed to the field to meet the crop water demand. It is important to note, that it is NRCS policy to not assist producers who wish to irrigate land that is currently not irrigated.

USDA-NRCS has assisted in installing 22 irrigation pipeline systems. Irrigation pipelines in the basin are critical infrastructure that covey's irrigation water from the well to the fields so water can be applied at the correct time and amount. Pipelines are sized based on crop demand for precise water application and match the well pump output with the sprinkler system. Often NRCS funded pipelines are replacements for leaking existing pipelines which can have significant water savings, or they are supporting a complete irrigation system that collectively has a large irrigation water savings.

There have been 30 sprinkler systems implemented in the basin with USDA-NRCS support. Sprinkler system upgrades significantly reduce the amount of water applied and increases the ability for the irrigator to apply precise water applications based on crop need. In the basin three different sprinkler systems have been used successfully. Hard hose traveling irrigation guns have been used for over ten years, initially to apply dairy manure to fields. These guns with the correct nozzle are efficient at applying water over large areas very quickly. Wheel line sprinklers have become adopted by irrigators in the last five years. These systems also can be moved fast but will place water more precisely than existing irrigation systems, and have a significant water savings, especially when used on windy days. Finally, the most efficient systems installed in the last three years are center pivot irrigation systems. These systems will provide the most flexibility in speed and application rate.

The third piece in an efficient irrigation system is the well pump itself. The pump not only can lead to great water savings as part of a system but can also address excessive energy use of aged inefficient pumps. Most pumps installed using the EQIP program have also had flow meters installed at the well head to track and record water use. 16 well pump upgrades have been completed in the last ten years.

Management of a new system is critical. All irrigation systems installed with the EQIP program require extensive follow up between the participant and the NRCS conservationist to ensure the system is operating properly, and the system is delivering water to the crop at the correct amount at the correct time. Frequent use of moisture sensors and other data gathering tools are used to inform participants and the NRCS conservationist that the system is operating as designed.

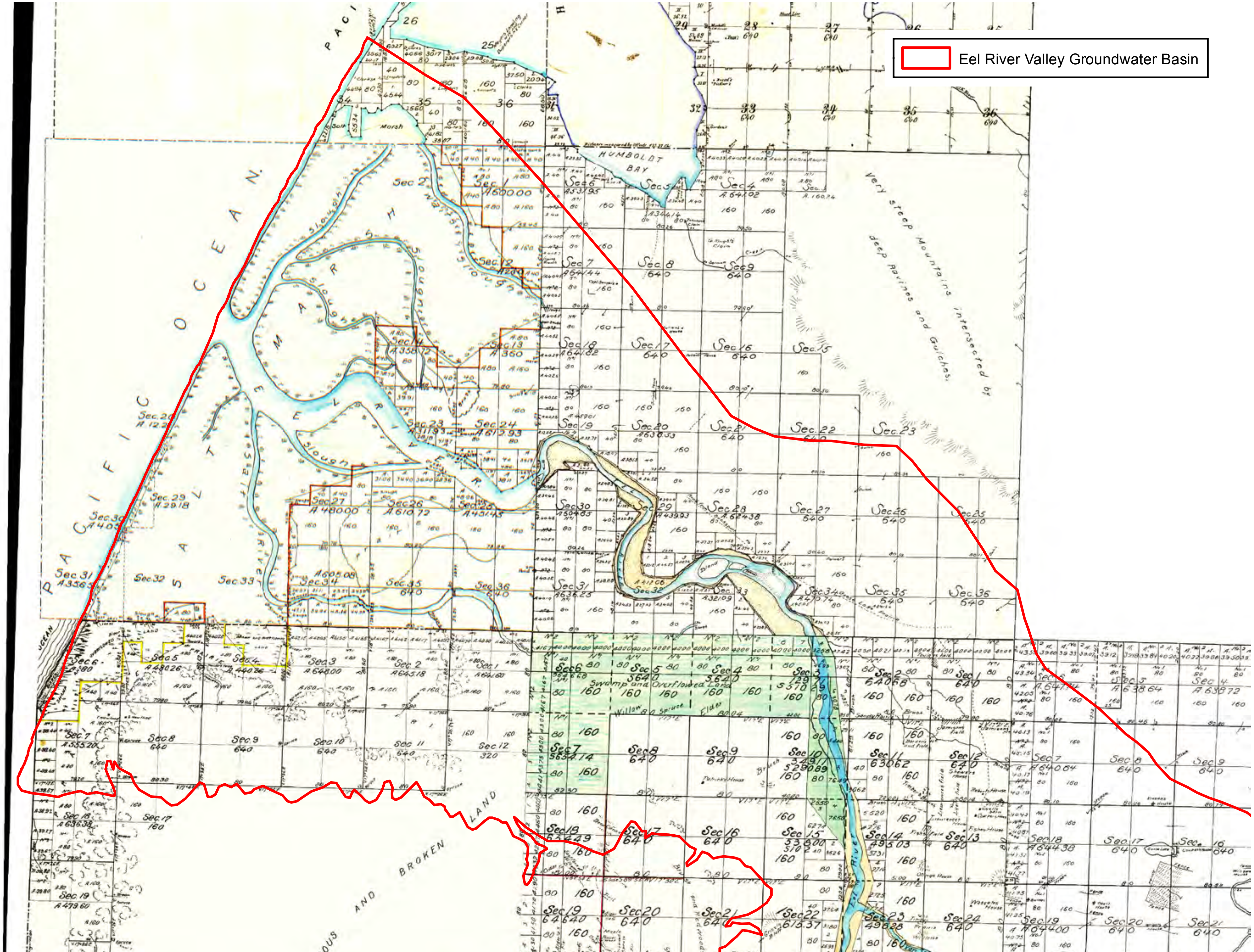
If you have additional questions or comments on the work that NRCS has done in the Eel River Groundwater basin to address irrigation water enhancements, please reach out directly.

Sincerely,

Jonathan Shultz
District Conservationist
USDA-NRCS Eureka, CA

c.c.: Jack Rice

# Historical Maps and Aerial Photographs (1854-2020)
# (Appendix E)

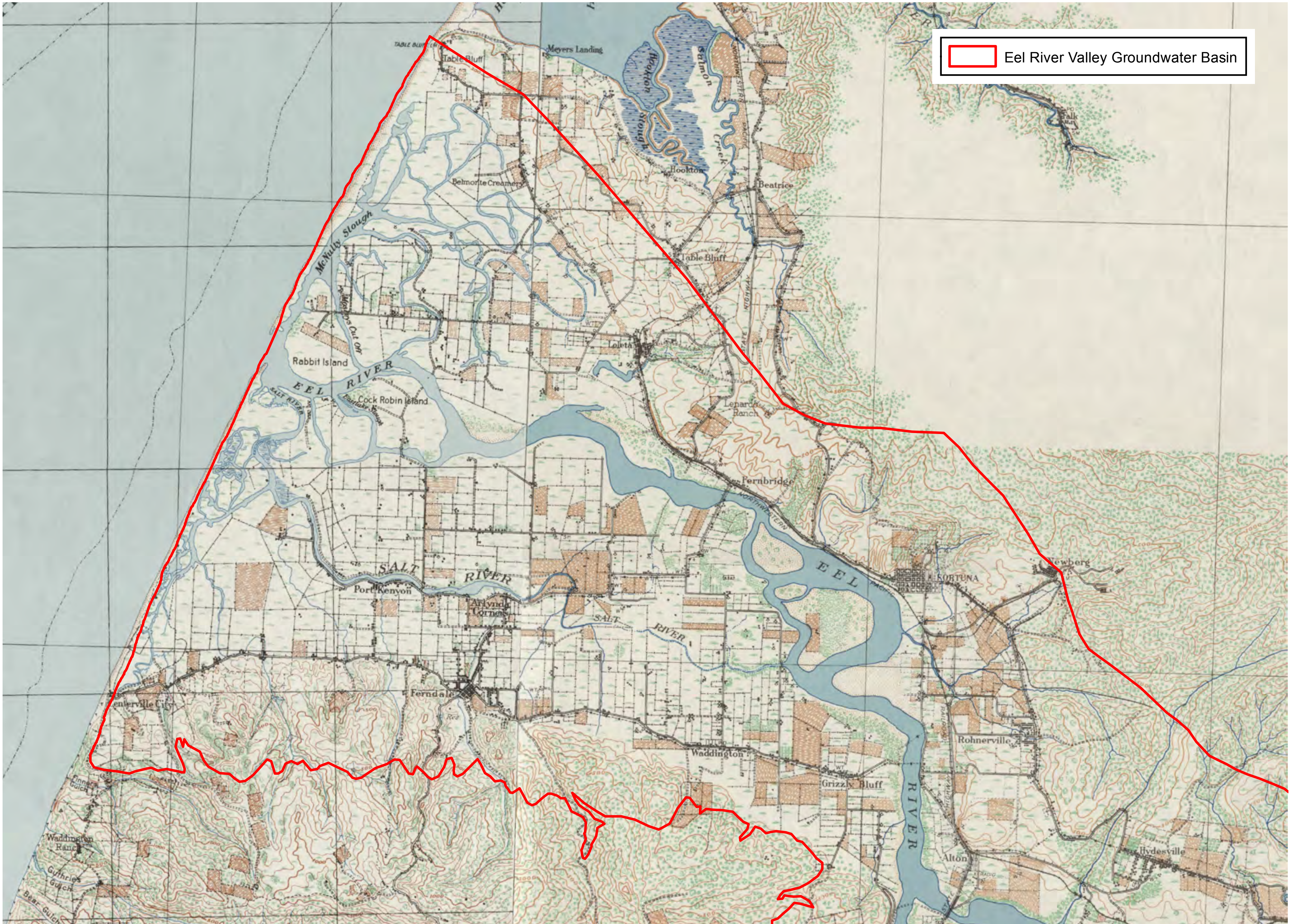



Sources:
Humboldt Historical Atlas (2007)
U.S. Department of Agriculture

**Historical Maps and Photographs**

1:100,000

**1854 US Survey General Township Plat Maps**

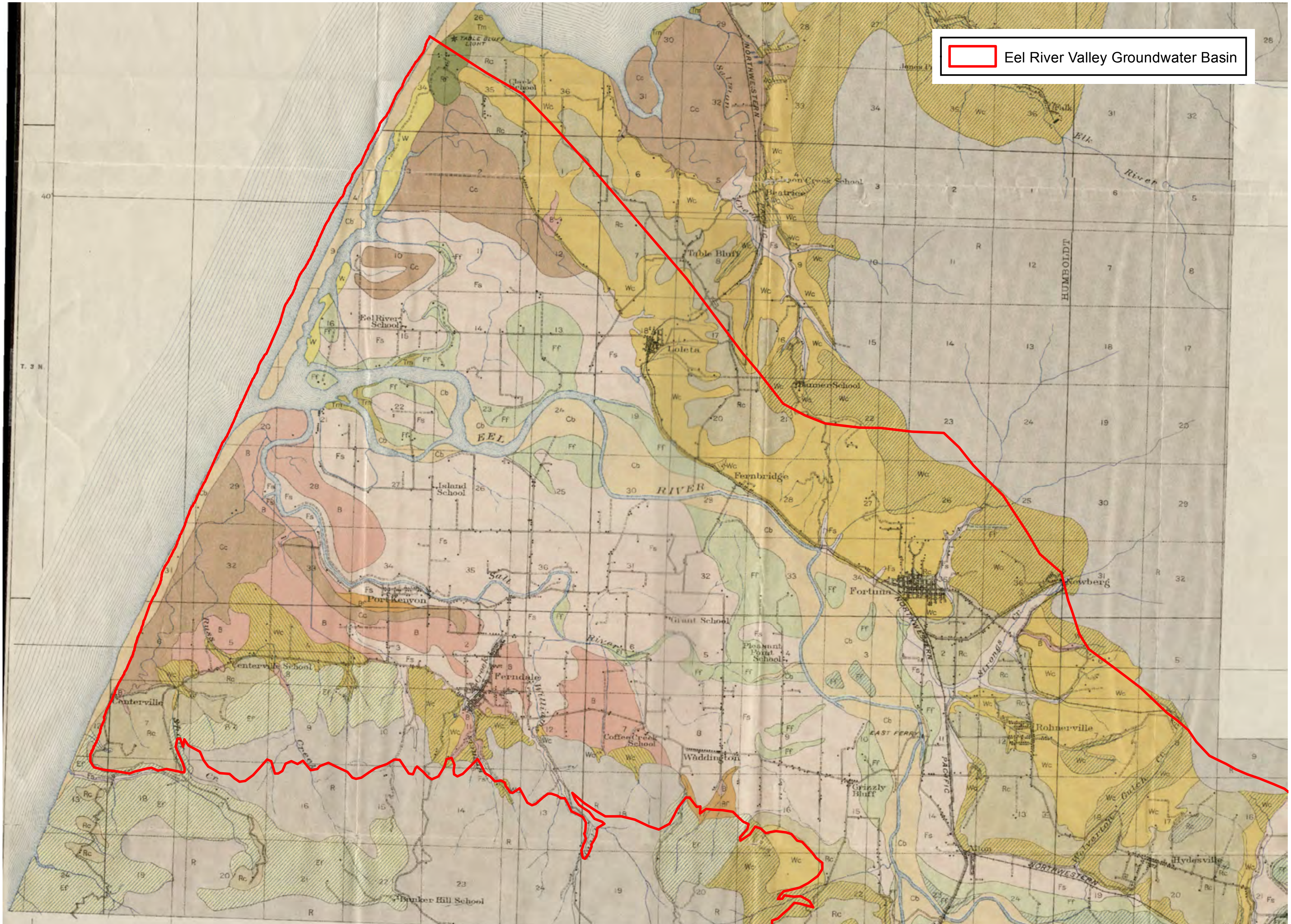



Sources:
Humboldt Historical Atlas (2007)
U.S. Department of Agriculture

**Historical Maps and Photographs**

1:100,000

**1916 U.S. Army Corps of Engineers Tactical**

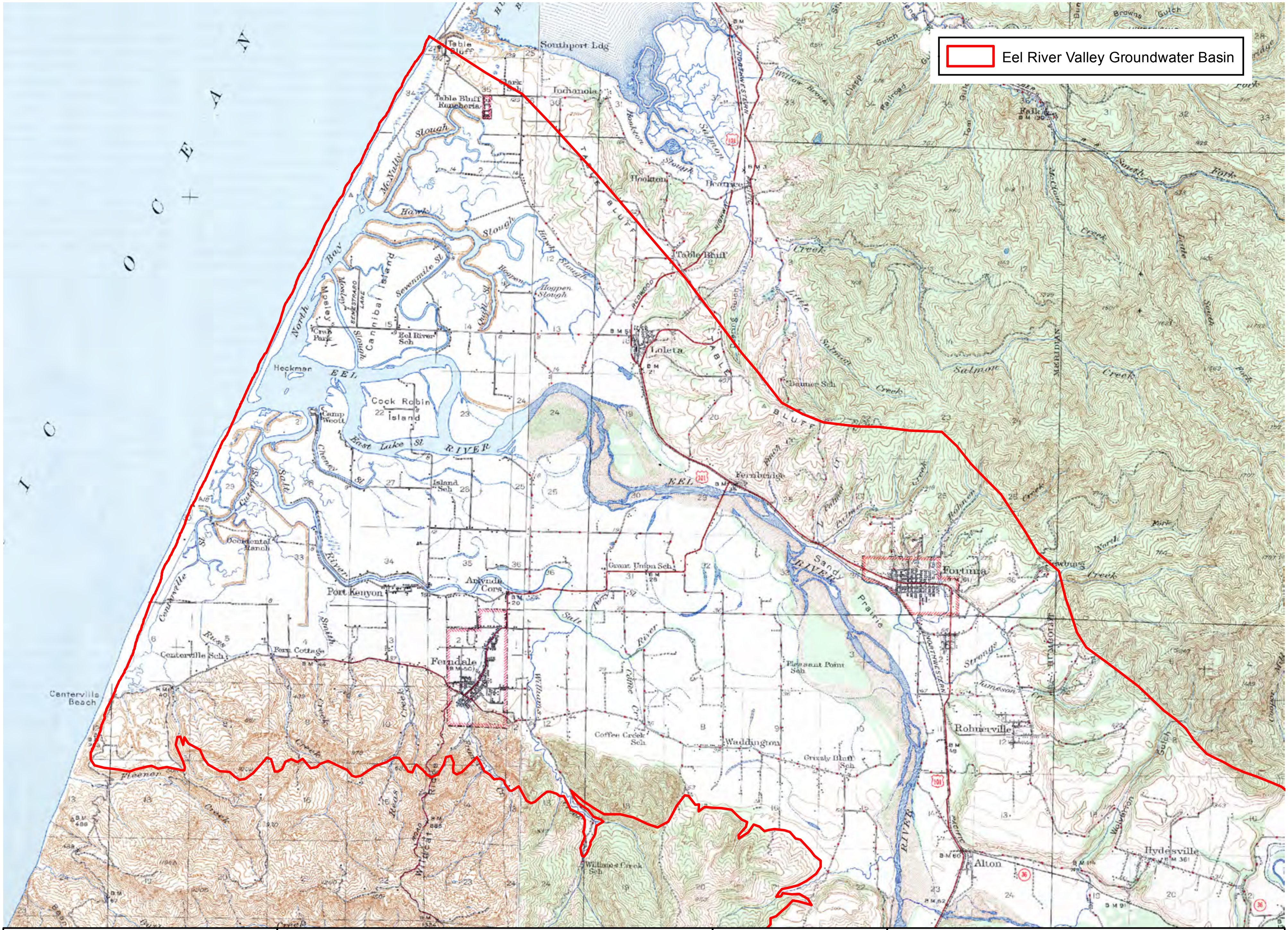



Sources:
Humboldt Historical Atlas (2007)
U.S. Department of Agriculture

**Historical Maps and Photographs**

1:100,000

**1921 US Department of Agriculture Soils**




Sources:
Humboldt Historical Atlas (2007)
U.S. Department of Agriculture

**Historical Maps and Photographs**

1:100,000

**1942 US Geological Survey Quadrangle**


Sources:
Humboldt Historical Atlas (2007)
U.S. Department of Agriculture

**Historical Maps and Photographs**

1:100,000

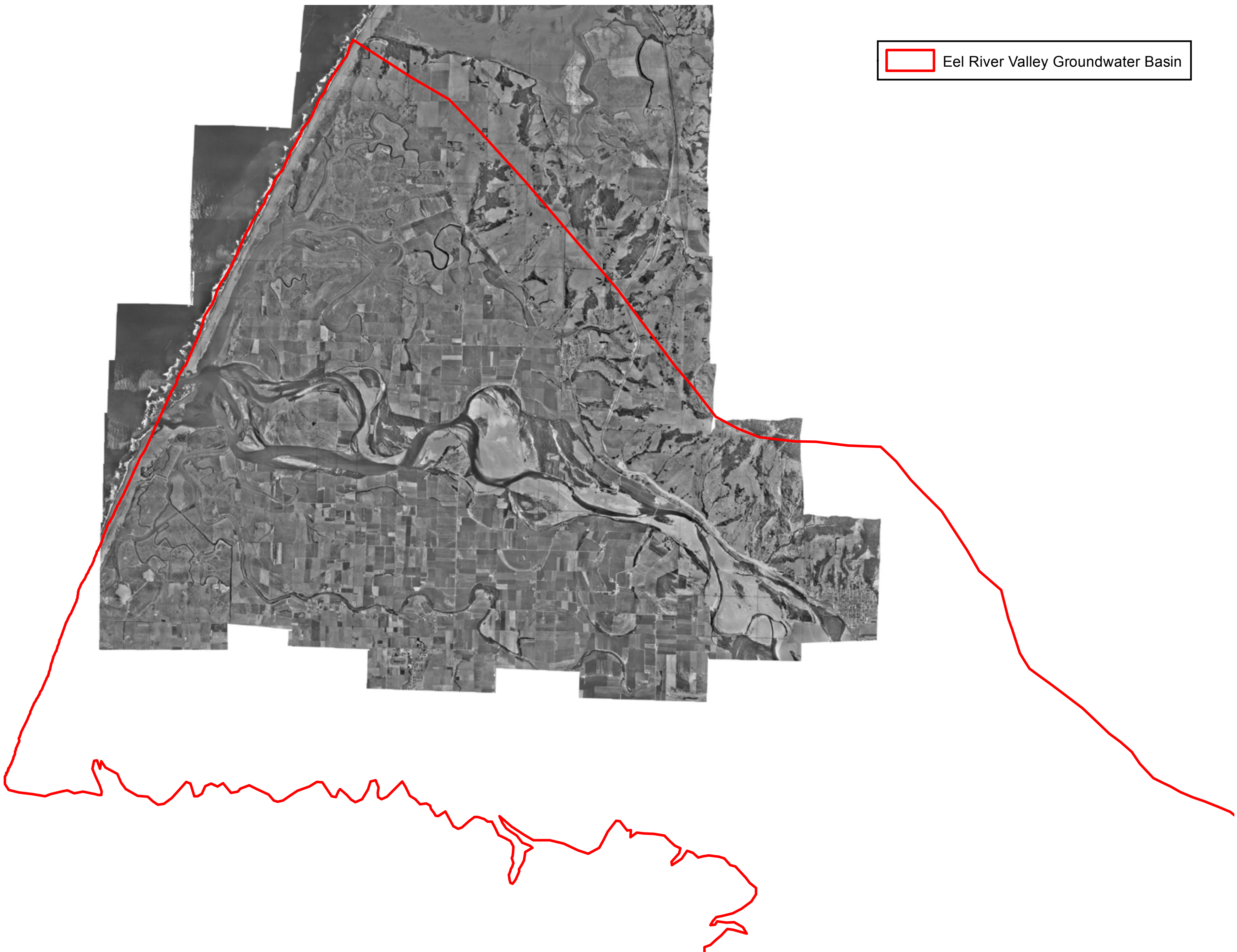
**1948 Aerial Photograph Mosaic**


Sources:
Humboldt Historical Atlas (2007)
U.S. Department of Agriculture

**Historical Maps and Photographs**

1:100,000

**1954 Aerial Photograph Mosaic**

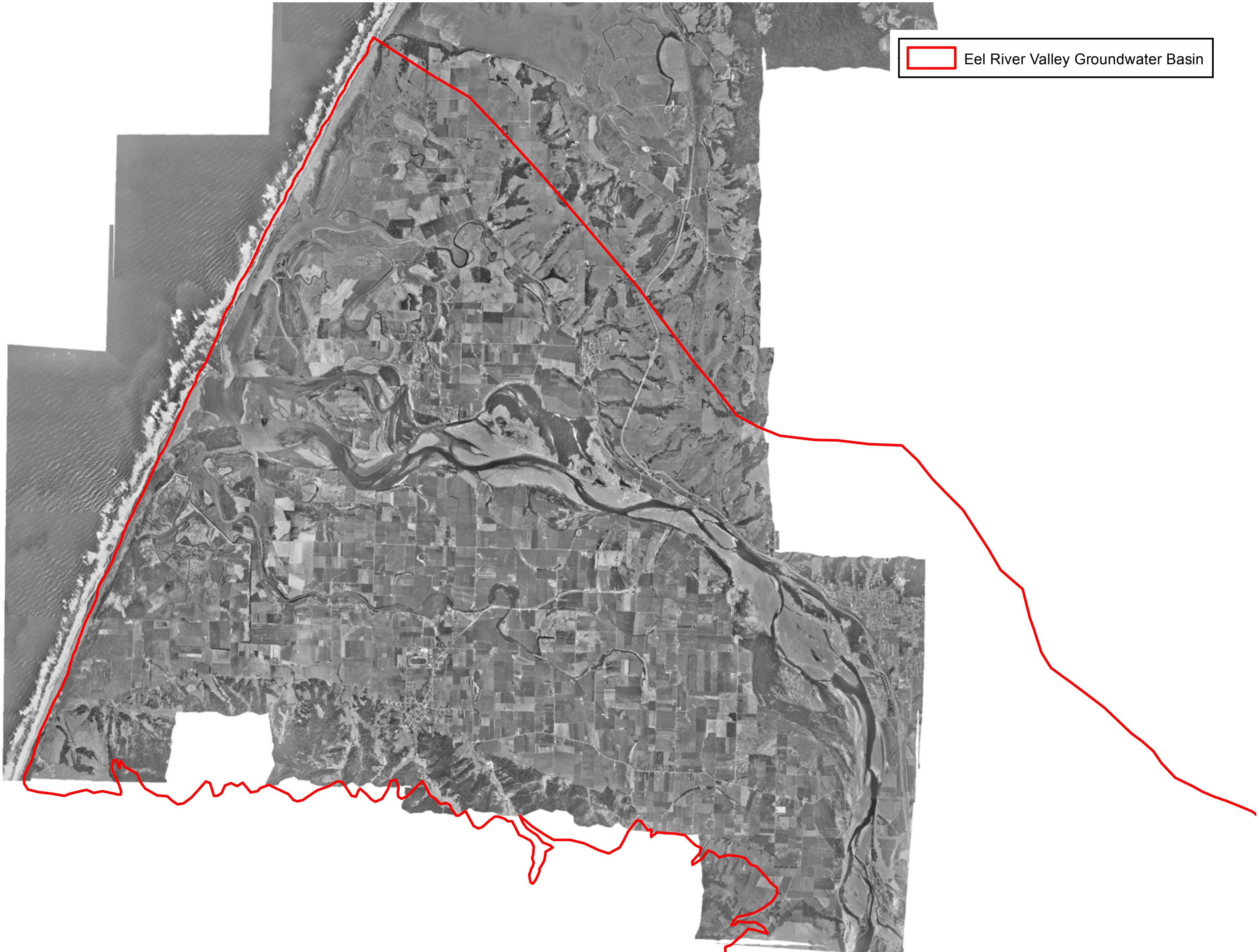



Sources:
Humboldt Historical Atlas (2007)
U.S. Department of Agriculture

**Historical Maps and Photographs**

1:100,000

**1958 Aerial Photograph Mosaic**

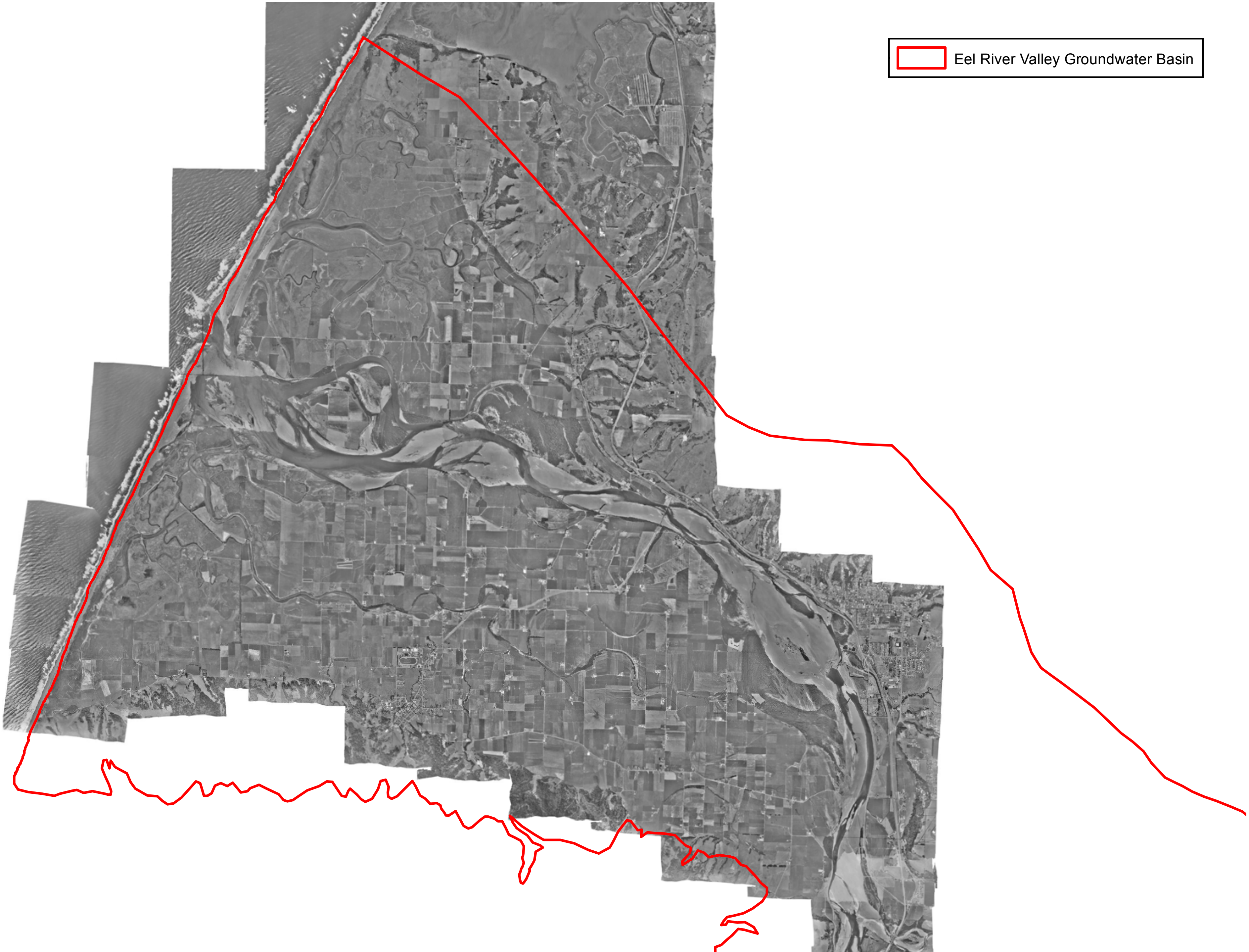



Sources:
Humboldt Historical Atlas (2007)
U.S. Department of Agriculture

**Historical Maps and Photographs**

N W E S 1:100,000

**1965 Aerial Photograph Mosaic**




Sources:
Humboldt Historical Atlas (2007)
U.S. Department of Agriculture

**Historical Maps and Photographs**

N
W E
S
1:100,000

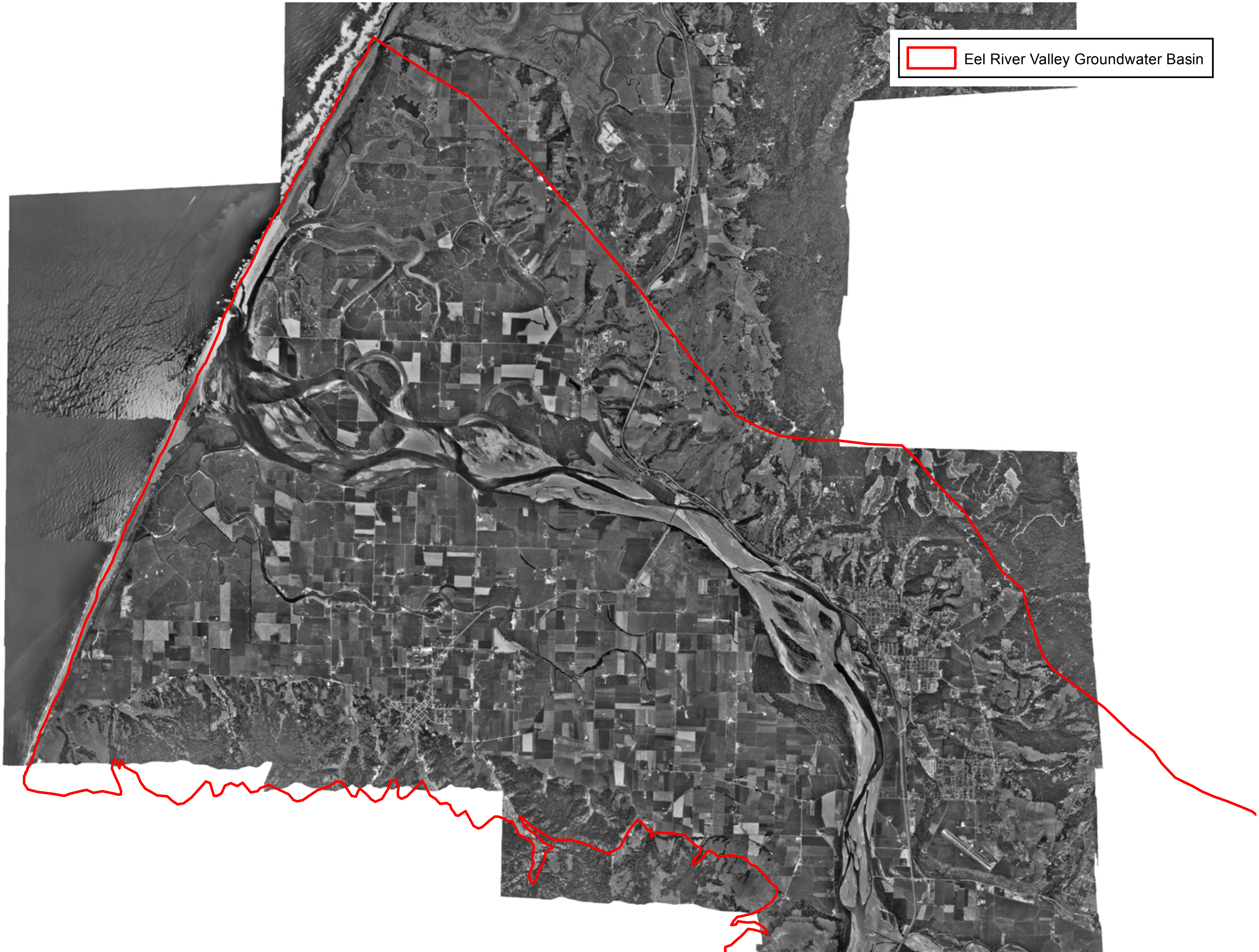
**1970 Aerial Photograph Mosaic**


Sources:
Humboldt Historical Atlas (2007)
U.S. Department of Agriculture

**Historical Maps and Photographs**

1:100,000

**1981 Aerial Photograph Mosaic**




Sources:
Humboldt Historical Atlas (2007)
U.S. Department of Agriculture

**Historical Maps and Photographs**

1:100,000

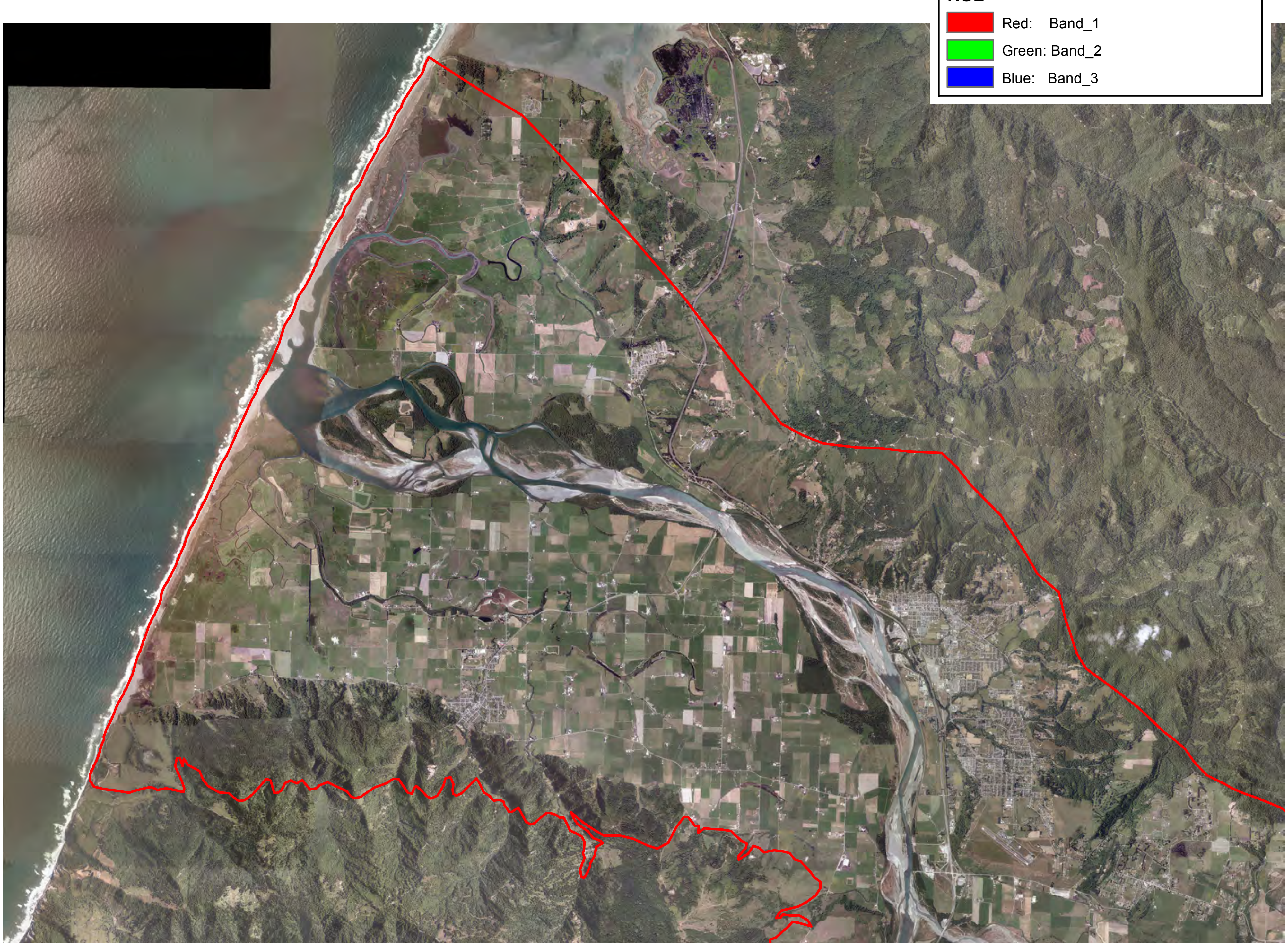
**1988 Aerial Photograph Mosaic**


Sources:
Humboldt Historical Atlas (2007)
U.S. Department of Agriculture

**Historical Maps and Photographs**

1:100,000

**1998 Aerial Photograph Mosaic**




Sources:
Humboldt Historical Atlas (2007)
U.S. Department of Agriculture

**Historical Maps and Photographs**

N W E S 1:100,000

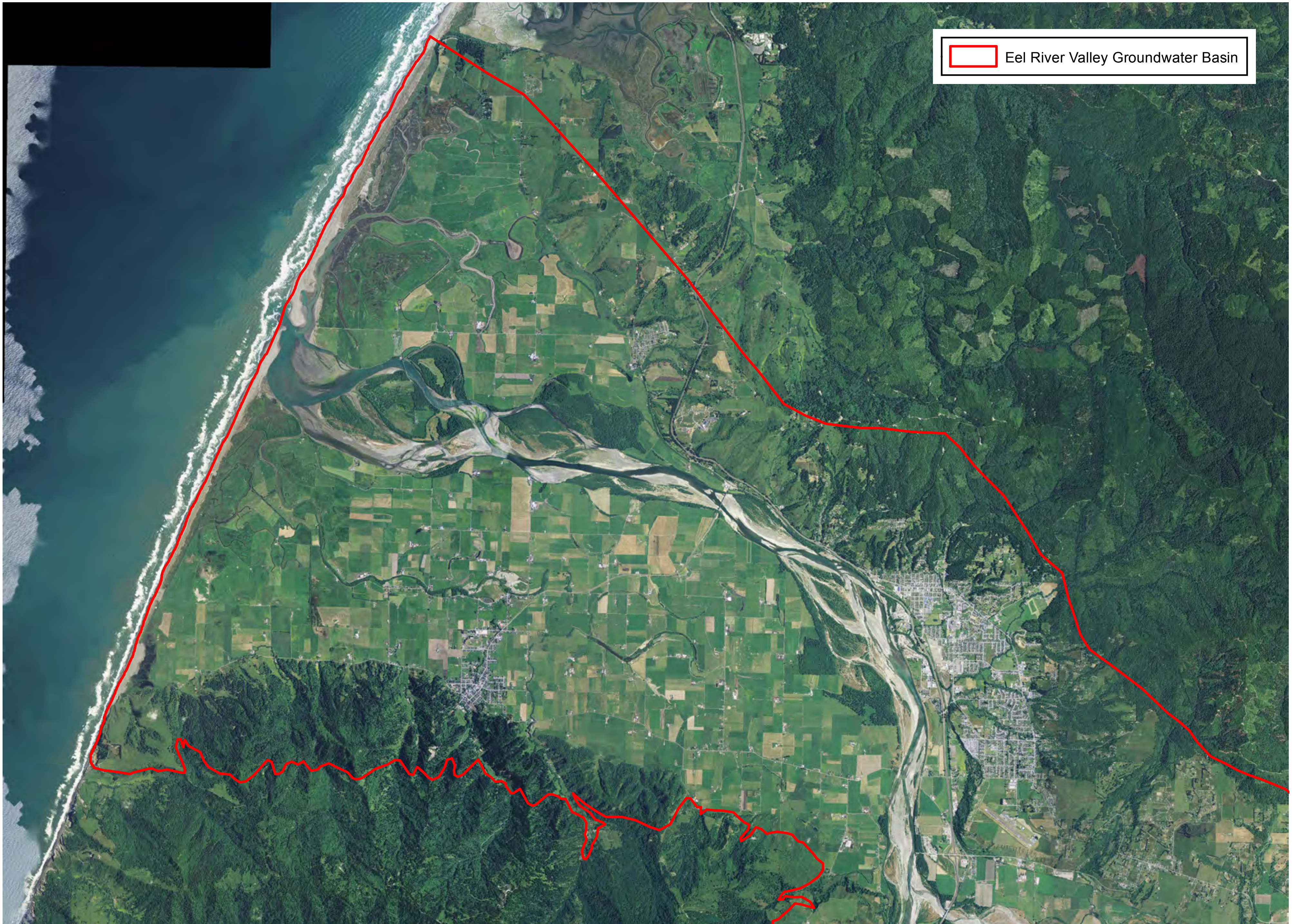
**2010 USDA NAIP Imagery**


Sources:
Humboldt Historical Atlas (2007)
U.S. Department of Agriculture

**Historical Maps and Photographs**

1:100,000

**2005 USDA NAIP Imagery**




Sources:
Humboldt Historical Atlas (2007)
U.S. Department of Agriculture

**Historical Maps and Photographs**

N
W E
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1:100,000

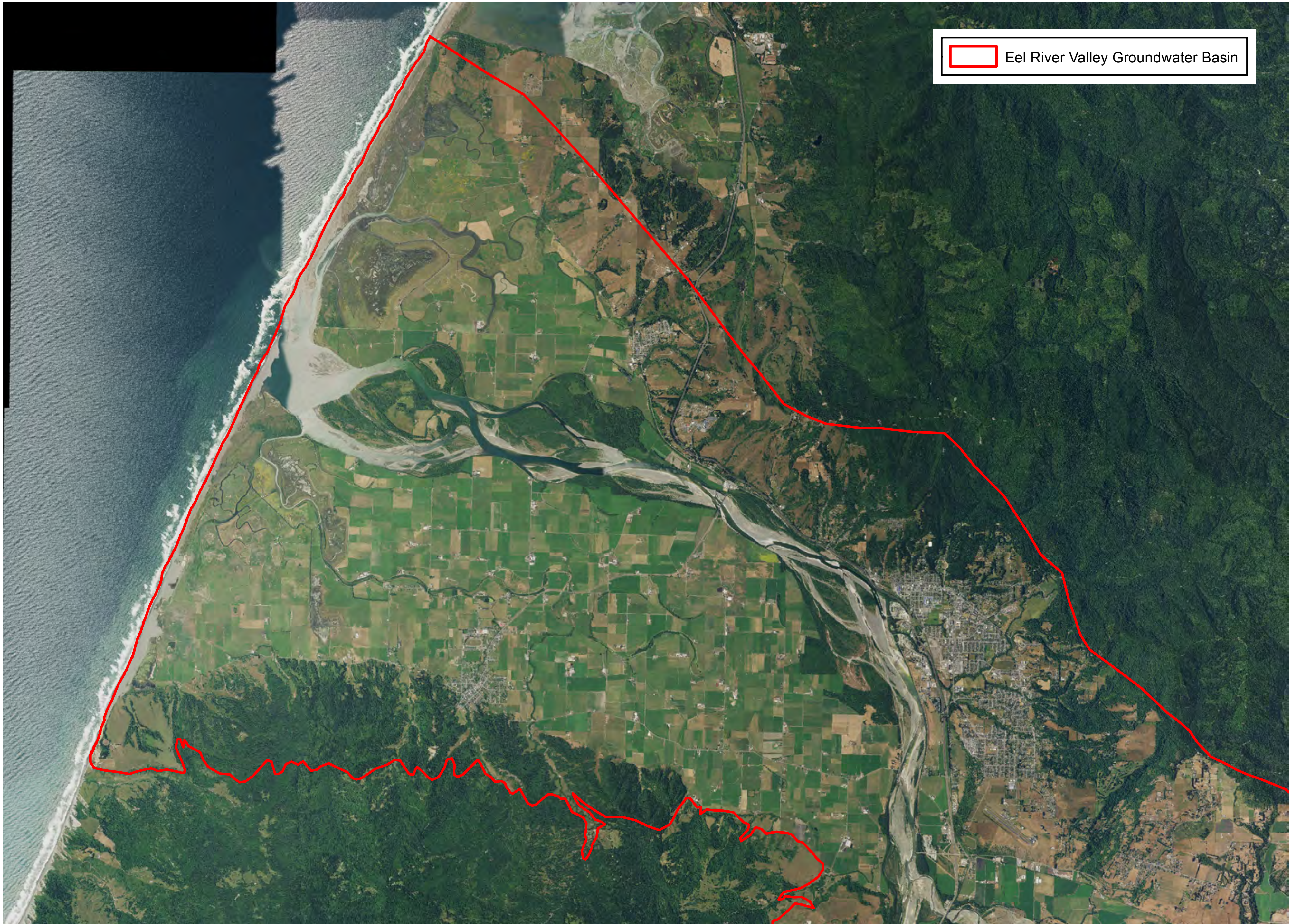
**2012 USDA NAIP Imagery**


Sources:
Humboldt Historical Atlas (2007)
U.S. Department of Agriculture

**Historical Maps and Photographs**

1:100,000

**2016 USDA NAIP Imagery**




Sources:
Humboldt Historical Atlas (2007)
U.S. Department of Agriculture

**Historical Maps and Photographs**

1:100,000

**2020 USDA NAIP Imagery**

**Ferndale Monthly Rainfall Totals**
**(October 1963 – September 2021)**
**(Appendix F)**

| Water Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | June | Jul | Aug | Sep | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1964 | 4.20 | 7.12 | 3.44 | 10.72 | 1.18 | 5.25 | 0.43 | 1.42 | 0.54 | 0.23 | 0.22 | 0.07 | 34.82 |
| 1965 | 2.59 | 11.50 | 18.55 | 7.26 | 1.61 | 1.06 | 6.01 | 0.29 | 0.51 | 0.07 | 0.35 | 0.06 | 49.86 |
| 1966 | 0.74 | 7.01 | 6.58 | 9.88 | 3.85 | 6.37 | 1.39 | 0.03 | 0.36 | 0.22 | 0.44 | 1.25 | 38.12 |
| 1967 | 0.71 | 9.87 | 7.48 | 8.49 | 0.97 | 8.51 | 4.73 | 1.16 | 0.58 | 0.02 | 0.06 | 1.84 | 44.42 |
| 1968 | 2.29 | 4.77 | 4.66 | 9.32 | 2.98 | 4.10 | 0.62 | 0.81 | 0.17 | 0.22 | 2.11 | 0.35 | 32.40 |
| 1969 | 2.56 | 5.81 | 11.55 | 13.88 | 11.1 | 1.45 | 3.57 | 1.10 | 0.53 | 0.16 | 0.01 | 0.38 | 52.10 |
| 1970 | 1.85 | 3.96 | 9.72 | 12.4 | 3.77 | 2.88 | 1.62 | 0.80 | 0.21 | 0.00 | 0.00 | 0.00 | 37.21 |
| 1971 | 1.57 | 10.91 | 10.75 | 6.32 | 3.49 | 7.93 | 2.73 | 0.77 | 1.25 | 0.13 | 0.45 | 1.03 | 47.33 |
| 1972 | 1.36 | 7.20 | 8.21 | 6.61 | 6.89 | 4.30 | 3.29 | 0.71 | 0.47 | 0.02 | 0.07 | 0.48 | 39.61 |
| 1973 | 4.77 | 5.23 | 7.12 | 8.13 | 4.48 | 7.25 | 0.77 | 0.00 | 0.49 | 0.01 | 0.11 | 1.88 | 40.24 |
| 1974 | 3.45 | 19.67 | 7.89 | 9.66 | 6.78 | 8.24 | 4.08 | 0.38 | 0.49 | 0.35 | 0.37 | 0.00 | 61.36 |
| 1975 | 1.18 | 2.14 | 8.71 | 5.45 | 9.30 | 11.92 | 3.07 | 0.56 | 0.29 | 0.15 | 0.31 | 0.00 | 43.08 |
| 1976 | 6.91 | 5.51 | 5.95 | 2.19 | 7.66 | 3.00 | 3.50 | 0.28 | 0.16 | 0.00 | 0.17 | 3.37 | 38.70 |
| 1977 | 2.14 | 5.32 | 7.38 | 10.35 | 8.59 | 3.88 | 4.80 | 0.94 | 0.19 | 0.14 | 1.58 | 0.06 | 45.37 |
| 1978 | 0.16 | 3.65 | 0.62 | 1.93 | 3.20 | 4.72 | 1.13 | 2.44 | 0.32 | 0.06 | 0.41 | 2.71 | 21.35 |
| 1979 | 0.04 | 0.99 | 2.80 | 4.63 | 6.97 | 3.31 | 3.20 | 1.81 | 0.03 | 0.28 | 0.67 | 0.55 | 25.28 |
| 1980 | 7.66 | 5.86 | 4.19 | 3.51 | 7.21 | 5.58 | 4.45 | 1.27 | 0.14 | 0.01 | 0.08 | 0.25 | 40.21 |
| 1981 | 1.05 | 2.07 | 6.83 | 11.55 | 4.40 | 5.32 | 0.72 | 1.46 | 0.24 | 0.05 | 0.06 | 0.93 | 34.68 |
| 1982 | 3.57 | 10.91 | 7.57 | 5.47 | 4.68 | 8.42 | 7.61 | 0.06 | 0.56 | 0.18 | 0.14 | 0.48 | 49.65 |
| 1983 | 5.91 | 7.89 | 11.64 | 9.26 | 11.40 | 10.97 | 6.23 | 1.32 | 0.71 | 0.90 | 3.78 | 0.18 | 70.19 |
| 1984 | 1.04 | 12.69 | 14.46 | 0.66 | 4.97 | 4.35 | 2.77 | 1.60 | 1.00 | 0.02 | 0.05 | 0.13 | 43.74 |
| 1985 | 3.68 | 16.34 | 4.47 | 0.76 | 4.18 | 4.94 | 0.27 | 0.70 | 0.96 | 0.05 | 0.32 | 1.10 | 37.77 |
| 1986 | 3.97 | 3.42 | 2.66 | 8.50 | 11.65 | 6.31 | 1.58 | 1.88 | 0.14 | 0.02 | 0.02 | 2.92 | 43.07 |
| 1987 | 1.53 | 1.90 | 4.80 | 6.76 | 4.43 | 10.03 | 0.90 | 0.31 | 0.17 | 0.24 | 0.08 | 0.05 | 31.20 |
| 1988 | 0.75 | 3.87 | 12.55 | 6.78 | 0.18 | 1.21 | 2.14 | 1.89 | 2.68 | 0.09 | 0.03 | 0.05 | 32.22 |
| 1989 | 0.56 | 9.93 | 7.67 | 5.08 | 3.11 | 7.98 | 1.66 | 1.16 | 0.25 | 0.02 | 0.37 | 0.95 | 38.74 |
| 1990 | 3.25 | 2.01 | 0.71 | 7.46 | 5.77 | 3.18 | 1.45 | 3.65 | 0.23 | 0.43 | 0.51 | 0.12 | 28.77 |
| 1991 | 2.07 | 2.89 | 2.63 | 0.91 | 3.36 | 7.84 | 1.43 | 1.88 | 0.31 | 0.43 | 0.93 | 0.08 | 24.76 |

| Water Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | June | Jul | Aug | Sep | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1992 | 1.24 | 2.33 | 2.10 | 3.18 | 6.70 | 4.41 | 1.87 | 0.22 | 0.72 | 0.19 | 0.15 | 0.17 | 23.28 |
| 1993 | 1.98 | 2.57 | 10.44 | 8.20 | 6.20 | 4.36 | 4.60 | 3.70 | 1.71 | 0.49 | 0.64 | 0.27 | 45.16 |
| 1994 | 0.47 | 1.77 | 7.61 | 5.54 | 8.59 | 2.86 | 3.12 | 1.49 | 0.57 | 0.13 | 0.04 | 0.20 | 32.39 |
| 1995 | 0.50 | 7.21 | 7.69 | 16.22 | 2.17 | 12.52 | 6.72 | 1.38 | 1.11 | 0.26 | 0.19 | 0.46 | 56.43 |
| 1996 | 0.58 | 1.32 | 11.97 | 9.70 | 8.53 | 3.33 | 5.02 | 1.90 | 0.03 | 0.07 | 0.11 | 0.75 | 43.31 |
| 1997 | 2.43 | 5.19 | 23.13 | 9.71 | 2.50 | 2.65 | 2.76 | 0.44 | 1.13 | 0.07 | 0.63 | 0.85 | 51.49 |
| 1998 | 2.68 | 8.36 | 5.95 | 14.76 | 17.08 | 8.79 | 3.51 | 3.48 | 0.76 | 0.53 | 0.14 | 0.17 | 66.21 |
| 1999 | 2.26 | 11.80 | 6.05 | 4.95 | 12.13 | 10.43 | 3.00 | 1.40 | 0.30 | 0.17 | 0.65 | 0.15 | 53.29 |
| 2000 | 1.79 | 7.97 | 4.93 | 10.70 | 9.71 | 3.00 | 3.38 | 2.22 | 0.56 | 0.26 | 0.14 | 0.44 | 45.10 |
| 2001 | 3.13 | 3.41 | 2.29 | 5.18 | 5.61 | 2.96 | 3.04 | 0.46 | 0.77 | 0.33 | 0.54 | 0.24 | 27.96 |
| 2002 | 0.95 | 7.66 | 11.50 | 6.36 | 5.58 | 4.87 | 2.45 | 0.80 | 0.22 | 0.11 | 0.05 | 0.18 | 40.73 |
| 2003 | 0.26 | 3.93 | 26.71 | 4.98 | 3.63 | 6.55 | 12.98 | 1.45 | 0.09 | 0.06 | 0.47 | 0.45 | 61.56 |
| 2004 | 0.72 | 6.39 | 11.08 | 7.65 | 11.01 | 2.36 | 1.35 | 1.36 | 0.23 | 0.19 | 0.43 | 0.31 | 43.08 |
| 2005 | 6.29 | 2.34 | 8.79 | 7.25 | 3.07 | 6.88 | 4.86 | 3.27 | 3.03 | 0.10 | 0.14 | 0.08 | 46.10 |
| 2006 | 1.83 | 6.17 | 14.52 | 9.89 | 6.42 | 13.04 | 4.69 | 0.89 | 0.27 | 0.14 | 0.02 | 0.16 | 58.04 |
| 2007 | 0.54 | 7.36 | 7.78 | 1.96 | 12.04 | 3.01 | 2.66 | 1.23 | 0.29 | 0.84 | 0.05 | 0.23 | 37.99 |
| 2008 | 3.15 | 2.28 | 7.85 | 10.70 | 4.12 | 2.59 | 1.84 | 0.11 | 0.43 | 0.15 | 0.44 | 0.06 | 33.72 |
| 2009 | 1.25 | 3.87 | 6.37 | 1.43 | 7.91 | 5.44 | 1.11 | 1.99 | 0.24 | 0.21 | 0.16 | 0.56 | 30.54 |
| 2010 | 2.86 | 3.80 | 4.41 | 11.29 | 5.57 | 5.85 | 7.94 | 3.28 | 1.81 | 0.08 | 0.35 | 0.62 | 47.86 |
| 2011 | 4.29 | 5.41 | 11.19 | 1.71 | 5.08 | 12.30 | 4.22 | 1.37 | 1.62 | 0.20 | 0.17 | 0.27 | 47.83 |
| 2012 | 3.25 | 4.53 | 1.67 | 5.81 | 3.42 | 12.10 | 5.09 | 0.66 | 1.78 | 1.16 | 0.11 | 0.10 | 39.68 |
| 2013 | 2.41 | 8.90 | 11.11 | 2.88 | 1.73 | 3.64 | 1.87 | 0.85 | 0.46 | 0.06 | 0.23 | 2.07 | 36.21 |
| 2014 | 0.14 | 1.32 | 0.61 | 0.89 | 6.06 | 5.74 | 1.50 | 0.72 | 0.16 | 0.14 | 0.17 | 2.45 | 19.90 |
| 2015 | 5.56 | 4.15 | 10.72 | 1.13 | 7.82 | 2.20 | 4.06 | 0.25 | 0.13 | 0.19 | 0.57 | 0.68 | 37.46 |
| 2016 | 1.01 | 4.34 | 13.16 | 13.29 | 3.33 | 10.05 | 3.24 | 0.59 | 0.05 | 0.16 | 0.14 | 0.23 | 49.59 |
| 2017 | 9.9 | 7.7 | 7.55 | 13.05 | 13.21 | 7.35 | 5.92 | 1.03 | 0.52 | 0.17 | 0.11 | 0.66 | 67.17 |
| 2018 | 1.11 | 6.54 | 1.87 | 7.07 | 2.03 | 9.79 | 4.37 | 0.99 | 0.53 | 0.09 | 0.14 | 0.25 | 34.78 |
| 2019 | 0.7 | 4.89 | 5.69 | 8.31 | 15.63 | 5.5 | 2.09 | 3.14 | 0.07 | 0.09 | 0.61 | 1.16 | 47.88 |
| 2020 | 0.96 | 1.35 | 9.82 | 7.32 | 0.96 | 3.3 | 2.33 | 4.28 | 0.62 | 0.14 | 0.13 | 0.46 | 31.67 |
| 2021 | 0.34 | 3.34 | 3.51 | 8.41 | 6.06 | 5.09 | 0.9 | 0.35 | 0.47 | 0.68 | 0.18 | 0.99 | 30.32 |

Notes:

Data provided by J. Lema, Ferndale CA. Gauge located at 515 Shaw Ave. since October 1994, and at 1345 Main Street from October 1970 to October 1994.

Location prior to October 1970 was not determined.

# Comment Letters on Draft Groundwater Sustainability Plan and Response to Comments (Appendix G)

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1655 Heindon Road
Arcata, California 95521-4573

December 20, 2021 **Refer to NMFS #:** 10012WCR2021AR00040

Mr. Hank Seeman
Humboldt County Groundwater Sustainability Agency
Humboldt County Department of Public Works
1106 Second Street
Eureka, California 95501

Re: National Marine Fisheries Service's Comments and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Recommendations for Humboldt County Groundwater Sustainability Agency regarding the Eel River Valley Groundwater Sustainability Plan

Dear Mr. Seeman,

This letter communicates the National Marine Fisheries Service's (NMFS) comments and essential fish habitat (EFH) conservation recommendations regarding the Humboldt County Groundwater Sustainability Agency's (GSA) proposed Eel River Valley Groundwater Sustainability Plan (GSP) to satisfy the requirements of the Sustainable Groundwater Management Act (SGMA). NMFS is the lead federal agency responsible for the stewardship of the nation's offshore living marine resources and their habitats, and implements the Endangered Species Act (ESA) and the Magnuson Stevens Fishery Conservation and Management Act (MSA) to fulfill its mission of promoting healthy ecosystems. Federally-managed living marine resources provide an important source of food and recreation for the nation, as well as thousands of jobs and a traditional way of life for many coastal communities. For the purposes of the MSA, EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the associated physical, chemical, and biological properties that are used by fish (50 CFR 600.10).

EFH has been designated within the GSP area by the Pacific Fishery Management Council (PFMC) for three Federal Fishery Management Plans or FMP's: Pacific Coast Salmon FMP (PFMC 2016); Pacific Coast Groundfish FMP (PFMC 2019b); and Coastal Pelagic Species FMP (PFMC 2019a). The Eel River estuary is EFH for all three FMP's, while the freshwater portion of the Eel River (and Van Duzen River) is EFH for the Pacific Coast Salmon FMP. The Eel River Valley GSP also overlaps with the critical habitat of three species of Pacific salmon listed under the ESA: Southern Oregon/Northern California coho salmon, California Coastal Chinook salmon, and Northern California steelhead.

The GSP contains great detail and has provided insight into how the Eel River Valley aquifer functions and provides for crucial cold water inputs during the warm and low flow summer and early fall season. The GSP suggests that the "sustainability goal is currently being met", which appears to be unfounded, and directly contradicts the California Department of Water Resources (DWR) groundwater evaluation process that assigned a “medium” priority to the Eel River Valley sub-basin. Per DWR guidance, if the GSP intends to claim that the basin is currently being sustainably managed, then it must demonstrate and provide evidence that the effect of each undesirable result “does not exist and cannot occur” (DWR 2017). Regarding the effect streamflow depletion has on migration, spawning and rearing habitat within the basin, the draft GSP fails this requirement by not addressing streamflow depletion impacts during summer. If the draft GSP continues with this assertion, it should fully explain, in detail, why the historically high streamflow depletion rates that correspond to their proposed sustainable management criteria will avoid significant and unreasonable impacts to surface water beneficial uses.

The GSP has criteria (Sustainability Management Criteria, or SMC) for ‘Depletion of Interconnected Surface Water’ (SMC-6), in which the GSP has focused on adult passage or migration as the most sensitive life stage. The assertion that “fish passage is considered one of the most sensitive of surface water beneficial uses” should be justified; as variations in summer base-flow representing less than a tenth of one cubic foot per second have been shown to influence juvenile coho salmon survival (Obedzinski et al. 2018). The GSP relies on 130 cubic feet per second (cfs) as an adequate passage flow and then identified a pumping scenario that might cause a 0.1 foot reduction (while flows are at or above 130 cfs during September or October). The results indicate that pumping could occur at 150% over the baseline rate of usage before causing a 0.1 foot reduction during these high flows (130 cfs). This approach discounts the timing of critical flow conditions in the Eel River, which generally occur during the summer months (when flows are well below 130 cfs). The GSP fails to identify any thresholds to ensure that groundwater usage does not significantly affect summer and fall surface water flows and degrade the viability of listed species and their habitat.

Undesirable results are already occurring in the GSP area during the summer months. As noted in the draft GSP, the Van Duzen River is often dry at its confluence with the Eel River, preventing migration of all life stages. This is an undesirable result that is having significant and unreasonable impacts on surface waters and their beneficial uses, occasionally leading to stranding and mortality of adult Chinook salmon. The GSP evaluated the reductions in surface flows that result from groundwater pumping using models, which indicated that the Eel River near monitoring location ME-7 likely experiences reductions in flow of up to 14 cfs in the summer months. The historical record at the Scotia gage indicates that minimum flows range from 15-27cfs in August. This modelled reduction in flow near ME-7 is attributed to groundwater use and may be removing a majority of the flow in the Eel River during the summer and early fall, leading to disconnected and dry reaches, like what occurred in September of 2014 when a large stretch of the Eel River went dry (Press Democrat 2014). Restricting or precluding upstream migration of adult salmon and steelhead should be considered a significant and unreasonable condition in and of itself

Ensuring that a proportion of the surface waters remain in all GSP waterways throughout the entire year is vital to support water quality, ameliorate disease, and ensure pool and riffle sequences remain wetted and connected to each other to accommodate passage of all life stages of listed species. The GSP fails to reconcile the historic impacts of groundwater use within the Van Duzen and Eel Rivers, which the GSP indicate are already experiencing unreasonable conditions and contributing to reductions in the viability of sensitive species listed under the ESA or managed under the MSA.

**Essential Fish Habitat Conservation Recommendations**

NMFS believes that the proposed GSP may cause significant adverse effects to EFH for the Pacific Coast Salmon FMP, and have adverse effects to the function of designated critical habitat for Coastal Chinook salmon. It does not appear that the draft GSP will achieve sustainable groundwater management in the Eel River Valley within the next 20 years, and groundwater use will continue to have negative effects on the viability of listed species and the greater ecosystem in general, as evidenced by all of the unreasonable conditions occurring already (the Van Duzen River confluence being dry, the Eel River going dry, disease outbreaks and stranding mortality events for Chinook salmon). Implementing these conservation recommendations would minimize the adverse and unreasonable effects to EFH and fulfill the obligations under Section 305(b) of the MSA.

1. The GSP should address the already significant and unreasonable reductions in surface flow in the Eel and Van Duzen Rivers during the most sensitive summer and fall months. The GSA should refocus the approach for SMC-6 and develop criteria that would not significantly degrade interconnected surface waters, or have negative effects on the viability of listed or managed species during the critical summer period.

2. The GSP should limit groundwater use to no more than 100% of baseline usage during the summer and fall months of June, July, August, September, and October, and ensure that there is no more than a 0.1 foot reduction in surface waters at any point during the water year, and most importantly, during the summer and fall months where low flows have been impacting listed adult Chinook salmon for many years.

Please let us know how we can assist the GSA, as well as fulfill our obligations to provide EFH conservation recommendations to the State as required by MSA Section 305(b)(4)(A). Please contact Matt Goldsworthy at Matt.Goldsworthy@noaa.gov.

Sincerely,

Jeffrey Jahn
South Coast Branch Chief
Northern California Office

Ccs: Ian Espinoza- California Department of Water Resources
Kerry Griffen- Staff Officer, Pacific Fishery Management Council
Monty Larson- Water Rights Coordinator, California Department of Fish and Wildlife
Bryan McFadin- North Coast Regional Water Quality Control Board
Christopher Watt- North Coast Regional Water Quality Control Board

## REFERENCES

California Department of Water Resources (DWR). 2017. Sustainable Management Criteria BMP. Available at https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-6-Sustainable-Management-Criteria-DRAFT_ay_19.pdf

PFMC (Pacific Management Fishery Council). 2016. The Fishery Management Plan for U.S. West Coast Commercial and Recreational Salmon Fisheries off the Coast of Washington, Oregon, and California. PFMC, Portland, OR. As Amended through Amendment 19, March 2016.

PFMC. 2019a. Coastal Pelagic Species Fishery Management Plan. Portland, OR. As Amended through Amendment 17, June.

PFMC. 2019b. Pacific Coast Ground Fish Fishery Management Plan For California, Oregon, and Washington Groundfish Fishery. Portland, OR. As Amended through Amendment 28, December.

Obedzinski, M., Nossaman Pierce, S., Horton, G.E., and Deitch, M.J., 2018. Effects of Flow-Related Variables on Oversummer Survival of Juvenile Coho Salmon in Intermittent Streams, Transactions of the American Fisheries Society, v. 147, 3, pp 588-605.

Press Democrat. 2014. Water Starved Eel River Goes to Ground. September 11, 2014. Santa Rosa, California. Available at: https://www.pressdemocrat.com/article/news/water-starved-eel-river-goes-to-ground-near-fortuna/?artslide=0

December 20, 2021

Humboldt County GSA
c/o Humboldt County Department of Public Works
1106 Second Street
Eureka, CA 95501-0579

*Submitted via email: hseemann@co.humboldt.ca.us*

**Re: Public Comment Letter for Eel River Valley Draft GSP**

Dear Hank Seemann,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Eel River Valley Basin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.

    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Eel River Valley Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

| | |
|---|---|
| **Attachment A** | GSP Specific Comments |
| **Attachment B** | SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users |
| **Attachment C** | Freshwater species located in the basin |
| **Attachment D** | The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset" |

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

# Attachment A

**Specific Comments on the Eel River Valley Draft Groundwater Sustainability Plan**

## 1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

### A. Identification of Key Beneficial Uses and Users

**Disadvantaged Communities, Drinking Water Users, and Tribes**

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **insufficient**. The GSP identifies and maps the locations of Economically Distressed Areas (EDAs) (Figure 3 of the Stakeholder Engagement Plan) and provides the population of each EDA within the basin. The plan also provides a map of domestic well locations and the depths of these wells within the basin. However, we note the following deficiencies with the identification of these key beneficial users:

- The GSP identifies tribal communities that have cultural and traditional ties within the basin. However, the plan fails to map the locations of tribal lands or tribal interests in the basin.
- The GSP fails to identify the DAC population dependent on groundwater as their source of drinking water in the basin. Specifics should be provided on how much each DAC community relies on a particular water supply (e.g., what percentage is supplied by groundwater).

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

| RECOMMENDATIONS |
| --- |
| • Provide a map of tribal lands for the Bear River Band of the Rohnerville Rancheria and the Wiyot Tribe in the basin.<br>• Provide maps of DACs and SDACs within the basin and clarify if the definition of DACs and EDAs within the basin are the same. |

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

- Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).

**Interconnected Surface Waters**

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. The GSP primarily uses groundwater elevation data from 2020 and 2021 (both dry years) in the ISW analysis. However, using seasonal groundwater elevation data over multiple water year types is an essential component of identifying ISWs. In California's Mediterranean climate, groundwater interconnections with surface water can vary seasonally and interannually, and that natural variability needs to be considered when identifying ISWs. Furthermore, we recommend that the GSP discuss the screening depths of wells used in ISW analysis to illustrate the connectivity between the shallow principal aquifer and stream reaches in the basin.

We recommend the GSP discuss the gaps in data needed to adequately characterize the interaction between groundwater and surface water within the basin. The GSP should consider any segments with data gaps as potential ISWs and clearly marked as such on maps provided in the GSP.

**RECOMMENDATIONS**

- Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015.

- Overlay the basin's stream reaches on depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells used in the analysis and discuss the screening depths of the wells.

- For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.

- Describe data gaps for the ISW analysis. We recommend that the GSP considers any segments with data gaps as potential ISWs and clearly marks them as such on maps provided in the GSP.

**Groundwater Dependent Ecosystems**

The identification of Groundwater Dependent Ecosystems (GDEs) is **incomplete**. The GSP mapped GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset) and other sources, including Classification and Assessment with Landsat of Visible Ecology Groupings (CalVeg) data and National Agriculture Imagery Program (NAIP) imagery. However, we found that some mapped vegetation features were improperly disregarded. Vegetation polygons were incorrectly removed in areas with direct precipitation inputs or very local shallow subsurface flows. However, this removal criteria is flawed since GDEs, in addition to groundwater, can rely on multiple water sources simultaneously and at different temporal/spatial scales. Vegetation receiving precipitation inputs or very local shallow subsurface flows can still potentially be reliant on shallow groundwater aquifers, and therefore should not be removed from consideration as a GDE solely based on their proximity to these additional water supplies.

We commend the GSA for the comprehensive and detailed description of vegetation communities, critical habitat, and special-status species specific to each GDE subarea in the basin. The GSP could be further improved by confirming that depth-to-groundwater measurements under GDEs are corrected for land surface elevations.

**RECOMMENDATIONS**

- Re-evaluate the vegetation polygons with direct precipitation inputs or very local shallow subsurface flows. Refer to Attachment C of this letter for best practices for using local groundwater data to verify whether vegetation polygons are supported by groundwater in an aquifer.
- For the depth-to-groundwater contour maps, note the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth-to-groundwater contours across the landscape.

**Native Vegetation and Managed Wetlands**

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[2,3] The integration of native vegetation into the water budget is **insufficient**. The GSP text discusses evapotranspiration from riparian habitats, but it is grouped into a category with all evapotranspiration in the water budget tables. The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the basin.

**RECOMMENDATIONS**

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation.
- State whether or not there are managed wetlands in the basin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

[2] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]
[3] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

## B. Engaging Stakeholders

**Stakeholder Engagement During GSP Development**

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Stakeholder Communications and Engagement Plan.[4]

We note the following deficiencies with the overall stakeholder engagement process:

- The GSP documents opportunities for public involvement and engagement in general terms for listed stakeholders. Public notice and engagement activities include attendance at Humboldt County GSA Board meetings, Eel River Groundwater Working Group meetings and discussions, direct conversations with Humboldt County GSA Board members and staff, providing written comments to the Humboldt County GSP, and DWR Stakeholder Surveys. The GSP does not state whether there was direct engagement with DACs, tribal stakeholders, or environmental stakeholders.

- The GSP notes that the Eel River Groundwater Working Group is meant to encourage the active involvement of the population during GSP development and implementation and is open for all interested stakeholders. However, the GSP does not include a list of current members.

- The GSP mentions potentially developing a Groundwater Resource Advisory Committee but fails to clearly state if it has already been created or provide a description of its members.

- The plan does not include documentation on how stakeholder input from the above-mentioned outreach and engagement was solicited, considered, and incorporated into the GSP development process.

- Section 9 of the GSP (Implementation), including a section entitled 'Communication and Stakeholder Engagement,' states that the section will be developed for the final plan. As this section of the GSP is finalized, include a detailed plan for continual opportunities for engagement through the implementation phase of the GSP that is specifically directed to DACs, domestic well owners, tribes, and environmental stakeholders within the basin.

| RECOMMENDATIONS |
| --- |
| ● In the Stakeholder Communications and Engagement Plan, describe active and targeted outreach to engage DACs, drinking water users, tribes, and environmental stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process. |

[4] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

- Provide information on whether the GSA has initiated contact with tribal stakeholders in the basin during GSP development, and how tribal concerns were considered during the GSP development process.
- Provide documentation on how stakeholder input was incorporated into the GSP development process.
- Clearly describe the membership of the Eel River Groundwater Working Group and the Groundwater Resource Advisory Committee.
- Utilize DWR's tribal engagement guidance to comprehensively identify, involve, and address all tribes and tribal interests that may be present in the basin.[5]

## C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[6,7,8]

**Disadvantaged Communities and Drinking Water Users**

For chronic lowering of groundwater levels, the GSP presents an analysis of the impacts of groundwater levels on wells in the basin. The GSP states (p. 102): *"The total number of wells in the initial well inventory was 221 and included all water supply wells (domestic, agricultural, industrial, public). Of these, wells that had total completed depths of less than 30 feet (14 wells) and/or wells that were constructed prior to 1965 (67 wells) were filtered out to establish the final well dataset for analysis, herein referred to as the 'study wells' (140 total)."* Minimum thresholds were established at groundwater levels at which 10% of the wells within each of two regions would have less than ten feet of water above the bottom of the well. The resulting minimum thresholds are as follows (p. 103): *"For the West Threshold Region, the minimum threshold in each well was set at 13 feet below the average Fall groundwater elevation for that well. For the East Threshold Region, the minimum threshold in each was set at four feet below the average Fall groundwater elevation for that well."* By grouping all water supply wells together, the true impacts to domestic wells have not been determined. Therefore, the GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users, especially given the absence of a domestic well mitigation plan in the GSP. In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs, drinking water users, or tribes when defining undesirable results, nor does it describe

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[5] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[6] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

[7] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[8] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

how the groundwater level minimum thresholds are consistent with Human Right to Water policy and will avoid significant and unreasonable impacts on these beneficial users.[9]

The GSP states (p. 105): *"An undesirable result would exist if one of the following scenarios occurs: 1. Groundwater levels in four or more representative monitoring sites fall below their minimum thresholds over the course of any one year. 2. Groundwater levels in two or more representative monitoring sites fall below their minimum thresholds for two sequential years."* Using this definition of undesirable results for groundwater levels, significant and unreasonable impacts to beneficial users experienced during single dry years will not result in an undesirable result. This is problematic since the GSP is failing to manage the basin in such a way that strives to minimize significant adverse impacts to beneficial users, which are often felt greatest in below-average, dry, and drought years. Furthermore, the requirement that four monitoring wells exceed the minimum threshold before triggering an undesirable result means that areas with high concentrations of domestic wells may experience impacts significantly greater than the established minimum threshold because the four-well threshold isn't triggered.

For degraded water quality, the GSP only establishes SMC for arsenic. The GSP states (p. 113): *"For this GSP, one constituent of concern, arsenic, was selected as a precautionary measure. The level of concern is the drinking water MCL. The minimum threshold for degraded water quality is set as follows: Two supply wells exceeding the arsenic MCL of 10 ug/L."* According to the state's anti-degradation policy,[10] high water quality should be protected and is only allowed to worsen to the MCL if a finding is made that it is in the best interest of the people of the State of California. No analysis has been done and no such finding has been made. Furthermore, the GSP's Water Quality Technical Memorandum discusses other constituents of concern (COCs), both naturally occurring and those associated with industrial activities. Significantly, nitrate is an acute contaminant which, at levels above the maximum contaminant level, can affect public health. This is a particular concern for domestic wells, as nitrate exceedances do not affect the taste or smell of the water. All COCs in the basin that may be impacted or exacerbated by groundwater use and/or management should be included in the SMC, in addition to coordinating with water quality regulatory programs.

**RECOMMENDATIONS**

**Chronic Lowering of Groundwater Levels**

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels. Include information on the impacts during prolonged periods of below average water years.

- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on drinking water users, DACs, and tribes within the basin. Further describe the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be fully or partially de-watered at the minimum threshold.

- Consider minimum threshold exceedances during single dry years when defining the groundwater level undesirable result across the basin.

[9] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3
[10] Anti-degradation Policy https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/1968/rs68_016.pdf

**Degraded Water Quality**

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when defining undesirable results for degraded water quality.[11] For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[12]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users, DACs, and tribes.

- Set minimum thresholds and measurable objectives for all water quality constituents within the basin that can be impacted and/or exacerbated as a result of groundwater use or groundwater management.

- Set minimum thresholds that do not allow water quality to degrade to levels at or above the MCL trigger level.

**Groundwater Dependent Ecosystems and Interconnected Surface Waters**

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts on GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. Since GDEs are present in the basin, they must be considered when developing SMC for chronic lowering of groundwater levels.

For depletion of interconnected surface water, the GSP describes impacts to fish passage when establishing SMC. The GSP states (p. 116): *"Because fish passage is considered one of the most sensitive indicators of surface water beneficial uses and a quantitative framework for riffle depth is available, the potential change in river stage relative to minimum fish passage depth was selected as the basis for setting minimum thresholds for surface water depletions."* The GSP continues (p. 118): *"A reduction in stage of 0.1 feet was set as a conservative benchmark for potential impact on riffle depth and fish passage. Exceedance of this benchmark does not mean that beneficial uses of the interconnected surface water are degraded or the viability of special-status species are threatened but provides a starting point for analysis. Simulation modeling using a number of conservative assumptions indicated that groundwater pumping could increase by 150% above current conditions before the stage of the Eel River would be reduced by 0.1 feet at the downstream end of the study reach (sub-region ME-7) when fish passage conditions exist."* The GSP also establishes seven wells as representative monitoring sites for monitoring protective water levels associated with potential impacts to interconnected surface waters. We recommend that as the SMC for depletion of interconnected surface water are refined in the future, the GSA further describes what significant and unreasonable effects are for ISWs. We also recommend that the GSP provide discussion that adaptive changes in SMC for ISWs will be made, if groundwater, streamflow, or biological monitoring reveals that existing SMC are not protective of surface water beneficial users.

[11] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

[12] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

**RECOMMENDATIONS**

- When establishing SMC for the basin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems."

- Evaluate impacts on GDEs when establishing SMC for chronic lowering of groundwater levels. When defining undesirable results, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the basin.[13] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[14]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the basin are reached.[15] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[8,16]

- Provide discussion that adaptive changes in SMC for ISWs will be made, if groundwater, streamflow, or biological monitoring reveals that existing SMC are not protective of surface water beneficial users.

## 2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[17] The effects of climate change will intensify the impacts

[13] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[14] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[15] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[16] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[17] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[18] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP would benefit from clearly and transparently incorporating the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the basin. While these extreme scenarios may have a lower likelihood of occurring and their consideration is not required (only suggested) by DWR, their consequences could be significant and their inclusion can help identify important vulnerabilities in the basin's approach to groundwater management.

The GSP fails to clearly illustrate how climate change impacts key inputs (e.g., changes in precipitation, evapotranspiration, and surface water flows) of the projected water budget. While precipitation inputs are stated to be adjusted for climate change in Section 5.7 of the GSP, the plan does not quantify these changes in precipitation in text or in tables for the projected water budget. The plan also fails to provide a sustainable yield for the basin. The sustainable yield should be calculated based on the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of extremely wet and dry scenarios, omission of projected climate change effects on key inputs, and omission of sustainable yield calculated based on the projected water budget with climate change incorporated, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, tribes, and domestic well owners.

**RECOMMENDATIONS**

- Integrate climate change, including extreme climate scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Illustrate how climate change is projected to modify precipitation, evapotranspiration, and surface water flow inputs and include the values in projected water budget tables.
- Calculate sustainable yield based on the projected water budget with climate change incorporated.
- Incorporate climate change scenarios into projects and management actions.

[18] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

## 3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around GDEs, tribes, domestic wells, and DACs in the basin. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[19]

Figure 39 (Representative Monitoring Sites for Well Impacts) shows sufficient spatial representation for DACs and drinking water users for groundwater elevation monitoring, however depth representation cannot be verified with information provided in the GSP. The GSP does not provide a figure of the water quality monitoring network, therefore we cannot verify the representation of DACs, drinking water users, and tribes for water quality monitoring within the basin.

The GSP does not discuss data gaps for GDEs and ISWs in the Monitoring Network or Project and Management Actions sections of the GSP, despite recognition of sparse groundwater elevation data for some GDE units (e.g., Upper Eel GDE Unit) in the GDE Technical Memorandum. We recommend that the GSP further discuss these data gaps and provide specific plans, such as locations and a timeline, to fill them.

**RECOMMENDATIONS**

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, tribes, and GDEs to clearly identify monitored areas.

- Increase the number of RMSs in the shallow aquifer across the basin as needed to map ISWs and adequately monitor all groundwater condition indicators across the basin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, tribes, GDEs, and ISWs when identifying new RMSs.

- Ensure groundwater elevation and water quality RMSs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, tribes, and GDEs.

- Describe biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the basin.

[19] "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

## 4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, tribes, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

We note that the plan does not include a domestic well mitigation program to avoid significant and unreasonable loss of drinking water. We strongly recommend inclusion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation.

**RECOMMENDATIONS**

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[20]

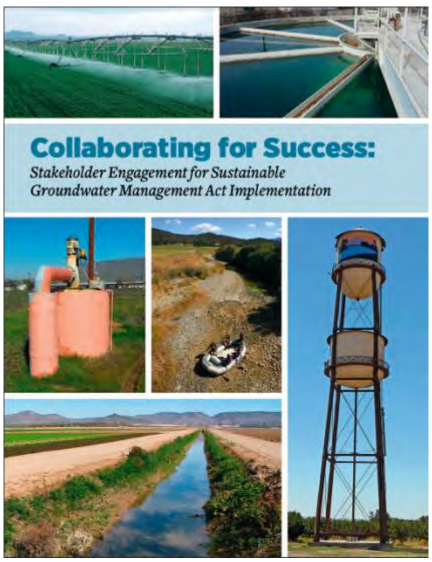
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[20] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

# Attachment B

## SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

## Stakeholder Engagement and Outreach




Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

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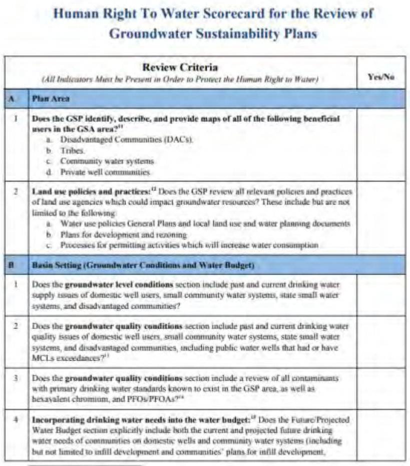
## The Human Right to Water

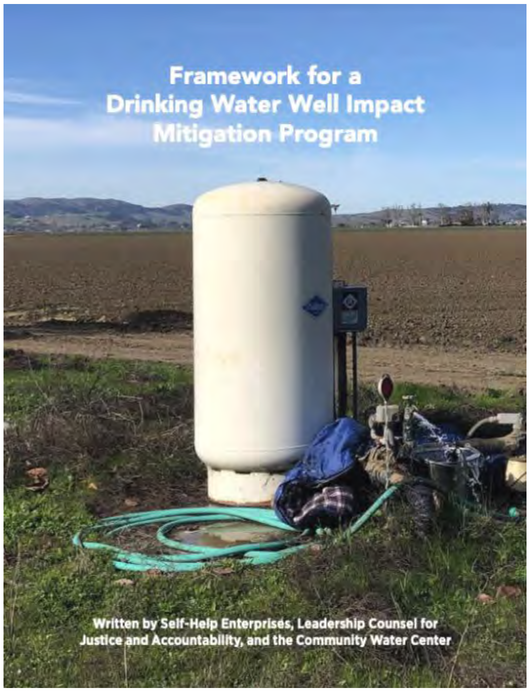


**Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans**

| | Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)* | Yes/No |
|---|---|---|
| A | **Plan Area** | |
| 1 | **Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11]<br>a. Disadvantaged Communities (DACs).<br>b. Tribes.<br>c. Community water systems<br>d. Private well communities | |
| 2 | **Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following:<br>a. Water use policies General Plans and local land use and water planning documents<br>b. Plans for development and rezoning<br>c. Processes for permitting activities which will increase water consumption | |
| B | **Basin Setting (Groundwater Conditions and Water Budget)** | |
| 1 | Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities? | |
| 2 | Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13] | |
| 3 | Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14] | |
| 4 | **Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development, | |

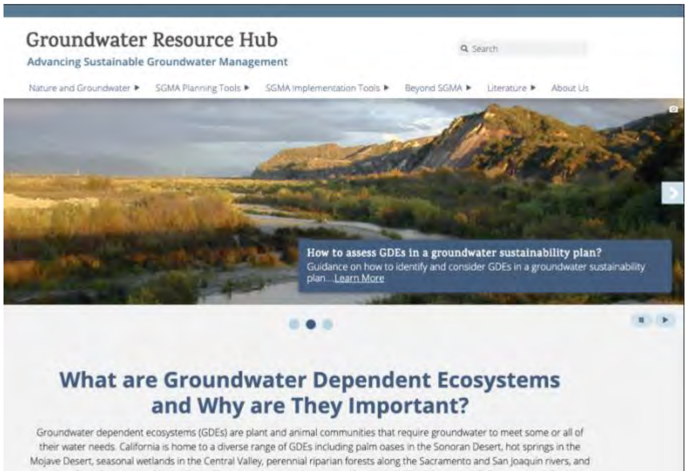
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

## Drinking Water Well Impact Mitigation Framework




The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

## Groundwater Resource Hub




The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

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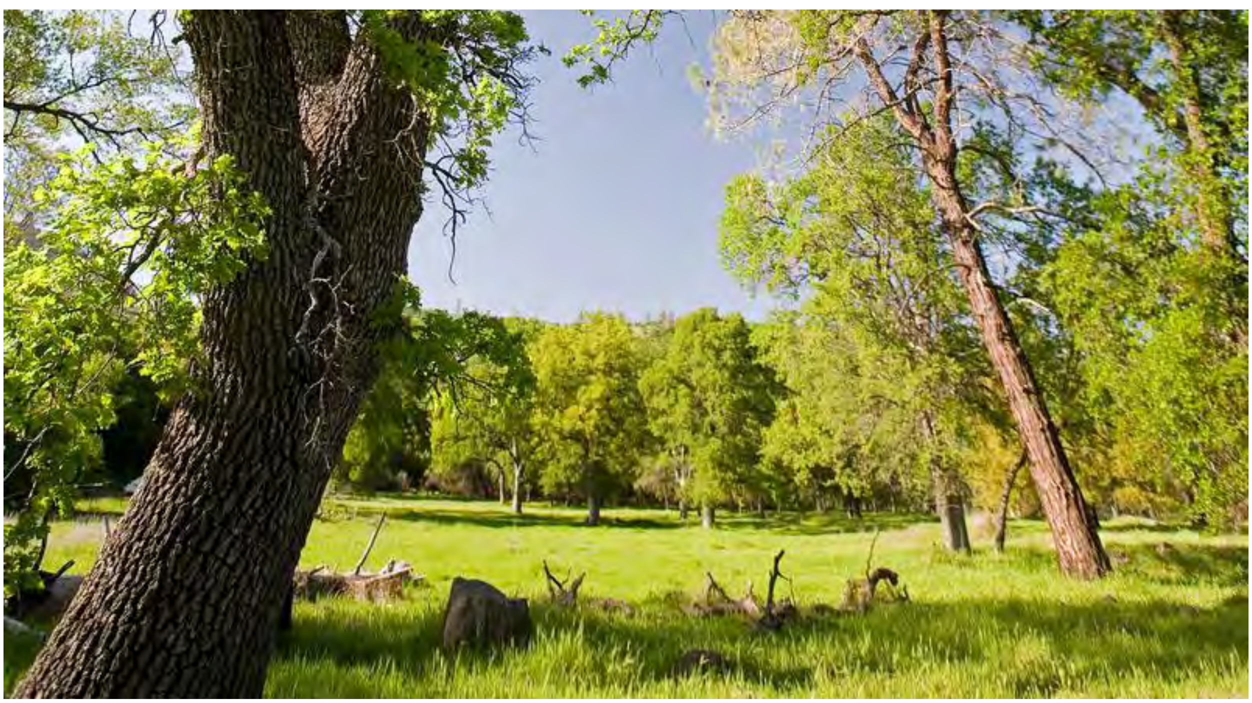
## Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

## How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

## How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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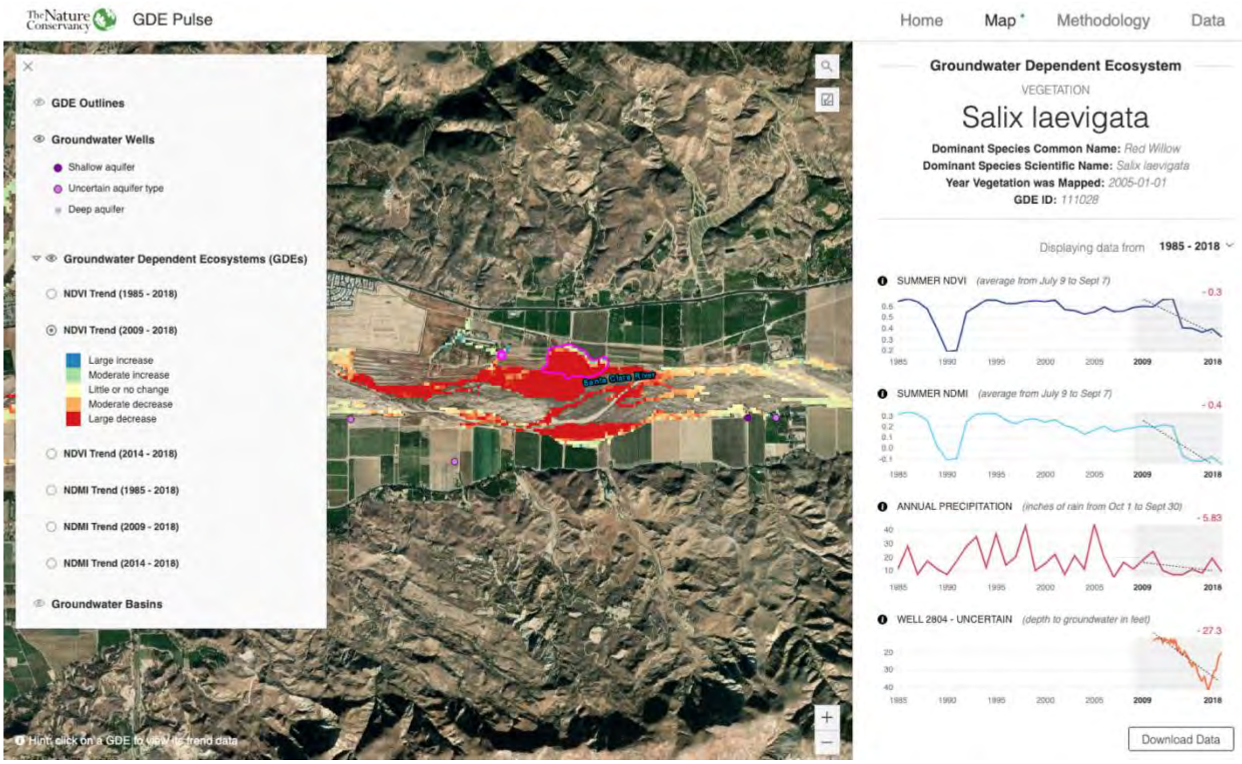
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

# GDE Pulse




GDE Pulse is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset.  The following datasets are available for downloading:

**Normalized Difference Vegetation Index (NDVI)** is a satellite-derived index that represents the greenness of vegetation.  Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI.  We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

**Normalized Difference Moisture Index (NDMI)** is a satellite-derived index that represents water content in vegetation.  NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels.  Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI.  We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

**Annual Precipitation** is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

**Depth to Groundwater** measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

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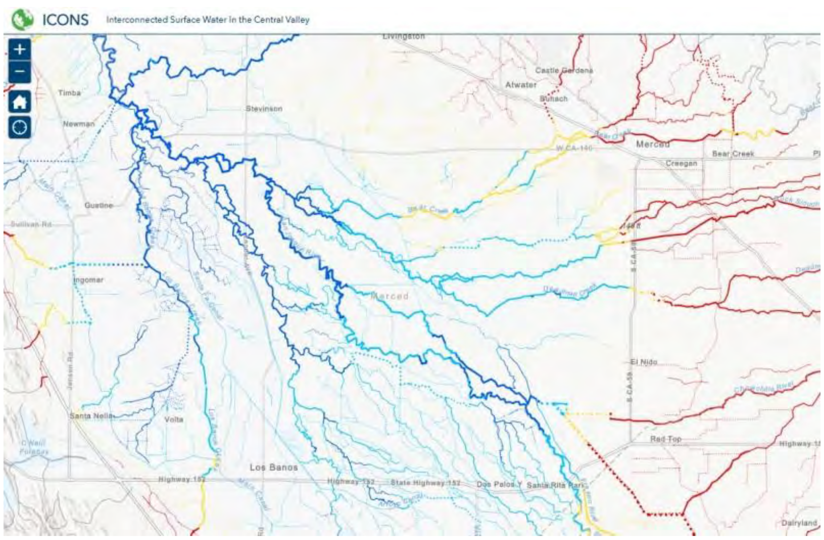
# ICONOS Mapper

## Interconnected Surface Water in the Central Valley




ICONS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

# Attachment C

## Freshwater Species Located in the Eel River Valley Subbasin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Eel River Valley Subbasin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

| Scientific Name | Common Name | Legal Protected Status | | |
|---|---|---|---|---|
| | | Federal | State | Other |
| **BIRDS** | | | | |
| Coccyzus americanus occidentalis | Western Yellow-billed Cuckoo | Candidate - Threatened | Endangered | |
| Riparia riparia | Bank Swallow | | Threatened | |
| Actitis macularius | Spotted Sandpiper | | | |
| Aechmophorus clarkii | Clark's Grebe | | | |
| Aechmophorus occidentalis | Western Grebe | | | |
| Agelaius tricolor | Tricolored Blackbird | Bird of Conservation Concern | Special Concern | BSSC - First priority |
| Aix sponsa | Wood Duck | | | |
| Anas acuta | Northern Pintail | | | |
| Anas americana | American Wigeon | | | |
| Anas clypeata | Northern Shoveler | | | |
| Anas crecca | Green-winged Teal | | | |
| Anas cyanoptera | Cinnamon Teal | | | |
| Anas discors | Blue-winged Teal | | | |
| Anas platyrhynchos | Mallard | | | |
| Anas strepera | Gadwall | | | |
| Anser albifrons | Greater White-fronted Goose | | | |
| Ardea alba | Great Egret | | | |
| Ardea herodias | Great Blue Heron | | | |
| Aythya affinis | Lesser Scaup | | | |

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

| | | | | |
|---|---|---|---|---|
| Aythya americana | Redhead | | Special Concern | BSSC - Third priority |
| Aythya collaris | Ring-necked Duck | | | |
| Aythya marila | Greater Scaup | | | |
| Aythya valisineria | Canvasback | | Special | |
| Botaurus lentiginosus | American Bittern | | | |
| Bucephala albeola | Bufflehead | | | |
| Bucephala clangula | Common Goldeneye | | | |
| Butorides virescens | Green Heron | | | |
| Calidris alpina | Dunlin | | | |
| Calidris mauri | Western Sandpiper | | | |
| Calidris minutilla | Least Sandpiper | | | |
| Chen caerulescens | Snow Goose | | | |
| Chen rossii | Ross's Goose | | | |
| Chlidonias niger | Black Tern | | Special Concern | BSSC - Second priority |
| Chroicocephalus philadelphia | Bonaparte's Gull | | | |
| Cinclus mexicanus | American Dipper | | | |
| Cistothorus palustris palustris | Marsh Wren | | | |
| Cygnus buccinator | Trumpeter Swan | | | |
| Cygnus columbianus | Tundra Swan | | | |
| Cypseloides niger | Black Swift | Bird of Conservation Concern | Special Concern | BSSC - Third priority |
| Egretta thula | Snowy Egret | | | |
| Empidonax traillii | Willow Flycatcher | Bird of Conservation Concern | Endangered | |
| Fulica americana | American Coot | | | |
| Gallinago delicata | Wilson's Snipe | | | |
| Grus canadensis | Sandhill Crane | | | |
| Haliaeetus leucocephalus | Bald Eagle | Bird of Conservation Concern | Endangered | |
| Himantopus mexicanus | Black-necked Stilt | | | |
| Icteria virens | Yellow-breasted Chat | | Special Concern | BSSC - Third priority |
| Limnodromus scolopaceus | Long-billed Dowitcher | | | |
| Lophodytes cucullatus | Hooded Merganser | | | |
| Megaceryle alcyon | Belted Kingfisher | | | |
| Mergus merganser | Common Merganser | | | |
| Mergus serrator | Red-breasted Merganser | | | |
| Numenius americanus | Long-billed Curlew | | | |

| | | | | |
|---|---|---|---|---|
| Numenius phaeopus | Whimbrel | | | |
| Nycticorax nycticorax | Black-crowned Night-Heron | | | |
| Oreothlypis luciae | Lucy's Warbler | | Special Concern | BSSC - Third priority |
| Oxyura jamaicensis | Ruddy Duck | | | |
| Pelecanus erythrorhynchos | American White Pelican | | Special Concern | BSSC - First priority |
| Phalacrocorax auritus | Double-crested Cormorant | | | |
| Phalaropus tricolor | Wilson's Phalarope | | | |
| Piranga rubra | Summer Tanager | | Special Concern | BSSC - First priority |
| Plegadis chihi | White-faced Ibis | | Watch list | |
| Pluvialis squatarola | Black-bellied Plover | | | |
| Podiceps nigricollis | Eared Grebe | | | |
| Podilymbus podiceps | Pied-billed Grebe | | | |
| Porzana carolina | Sora | | | |
| Rallus limicola | Virginia Rail | | | |
| Recurvirostra americana | American Avocet | | | |
| Setophaga petechia | Yellow Warbler | | | BSSC - Second priority |
| Tachycineta bicolor | Tree Swallow | | | |
| Tringa melanoleuca | Greater Yellowlegs | | | |
| Tringa semipalmata | Willet | | | |
| Tringa solitaria | Solitary Sandpiper | | | |
| Xanthocephalus xanthocephalus | Yellow-headed Blackbird | | Special Concern | BSSC - Third priority |
| **CRUSTACEANS** | | | | |
| Americorophium salmonis | | | | Not on any status lists |
| Americorophium spinicorne | | | | Not on any status lists |
| **FISH** | | | | |
| Eucyclogobius newberryi | Tidewater goby | Endangered | Special Concern | Vulnerable - Moyle 2013 |
| Spirinchus thaleichthys | Longfin smelt | Candidate | Threatened | Vulnerable - Moyle 2013 |
| Oncorhynchus mykiss - NC summer | Northern California coast summer steelhead | Threatened | Special Concern | Endangered - Moyle 2013 |
| Oncorhynchus mykiss - NC winter | Northern California coast winter steelhead | Threatened | | Near-Threatened - Moyle 2013 |
| Oncorhynchus tshawytscha - CCC fall | California Coast fall Chinook salmon | Threatened | Special | Vulnerable - Moyle 2013 |
| **HERPS** | | | | |
| Actinemys marmorata marmorata | Western Pond Turtle | | Special Concern | ARSSC |

| | | | | |
|---|---|---|---|---|
| Ambystoma gracile | Northwestern Salamander | | | |
| Anaxyrus boreas boreas | Boreal Toad | | | |
| Ascaphus truei | Coastal Tailed Frog | | | |
| Dicamptodon tenebrosus | Pacific Giant Salamander | | | |
| Rana aurora | Northern Red-legged Frog | | Special Concern | ARSSC |
| Rana boylii | Foothill Yellow-legged Frog | Under Review in the Candidate or Petition Process | Special Concern | ARSSC |
| Rhyacotriton variegatus | Southern Torrent Salamander | | Special Concern | ARSSC |
| Taricha granulosa | Rough-skinned Newt | | | |
| Thamnophis sirtalis sirtalis | Common Gartersnake | | | |
| Dicamptodon ensatus | California Giant Salamander | | | ARSSC |
| Thamnophis atratus atratus | Santa Cruz Gartersnake | | | Not on any status lists |
| Thamnophis elegans terrestris | Coast Gartersnake | | | Not on any status lists |
| **INSECTS & OTHER INVERTS** | | | | |
| Amiocentrus aspilus | A Caddisfly | | | |
| Anax junius | Common Green Darner | | | |
| Antocha monticola | | | | Not on any status lists |
| Antocha spp. | Antocha spp. | | | |
| Archilestes californica | California Spreadwing | | | |
| Argia agrioides | California Dancer | | | |
| Argia emma | Emma's Dancer | | | |
| Argia lugens | Sooty Dancer | | | |
| Baetis adonis | A Mayfly | | | |
| Baetis spp. | Baetis spp. | | | |
| Baetis tricaudatus | A Mayfly | | | |
| Brillia flavifrons | | | | Not on any status lists |
| Brillia spp. | Brillia spp. | | | |
| Calineuria californica | Western Stone | | | |
| Centroptilum album | A Mayfly | | | |
| Centroptilum spp. | Centroptilum spp. | | | |
| Chaetocladius spp. | Chaetocladius spp. | | | |
| Cheumatopsyche spp. | Cheumatopsyche spp. | | | |
| Chironomidae fam. | Chironomidae fam. | | | |
| Chironomus anonymus | | | | Not on any status lists |
| Chironomus spp. | Chironomus spp. | | | |

| | | | | |
|---|---|---|---|---|
| Cladotanytarsus marki | | | | Not on any status lists |
| Cladotanytarsus spp. | Cladotanytarsus spp. | | | |
| Corixidae fam. | Corixidae fam. | | | |
| Cricotopus annulator | | | | Not on any status lists |
| Cricotopus spp. | Cricotopus spp. | | | |
| Dicosmoecus gilvipes | A Caddisfly | | | |
| Diphetor hageni | Hagen's Small Minnow Mayfly | | | |
| Dixidae fam. | Dixidae fam. | | | |
| Eukiefferiella claripennis | | | | Not on any status lists |
| Eukiefferiella spp. | Eukiefferiella spp. | | | |
| Glossosoma alascense | A Caddisfly | | | |
| Glossosoma spp. | Glossosoma spp. | | | |
| Gomphus kurilis | Pacific Clubtail | | | |
| Gumaga griseola | A Bushtailed Caddisfly | | | |
| Gumaga spp. | Gumaga spp. | | | |
| Hesperoperla pacifica | Golden Stone | | | |
| Hetaerina americana | American Rubyspot | | | |
| Heterotrissocladius oliveri | | | | Not on any status lists |
| Heterotrissocladius spp. | Heterotrissocladius spp. | | | |
| Hydropsyche alternans | | | | Not on any status lists |
| Hydropsyche spp. | Hydropsyche spp. | | | |
| Hydroptila ajax | A Caddisfly | | | |
| Hydroptila spp. | Hydroptila spp. | | | |
| Hydroptilidae fam. | Hydroptilidae fam. | | | |
| Laccobius acutipenis | | | | Not on any status lists |
| Laccobius spp. | Laccobius spp. | | | |
| Lepidostoma spp. | Lepidostoma spp. | | | |
| Lestes dryas | Emerald Spreadwing | | | |
| Lestes stultus | Black Spreadwing | | | |
| Libellula luctuosa | Widow Skimmer | | | |
| Libellula saturata | Flame Skimmer | | | |
| Macromia magnifica | Western River Cruiser | | | |
| Malenka bifurcata | | | | Not on any status lists |
| Malenka spp. | Malenka spp. | | | |

| | | | | |
|---|---|---|---|---|
| Micropsectra nigripila | | | | Not on any status lists |
| Micropsectra spp. | Micropsectra spp. | | | |
| Microtendipes caducus | | | | Not on any status lists |
| Microtendipes spp. | Microtendipes spp. | | | |
| Nanocladius anderseni | | | | Not on any status lists |
| Nanocladius spp. | Nanocladius spp. | | | |
| Nemouridae fam. | Nemouridae fam. | | | |
| Ophiogomphus bison | Bison Snaketail | | | |
| Optioservus canus | Pinnacles Optioservus Riffle Beetle | | Special | |
| Optioservus spp. | Optioservus spp. | | | |
| Oreodytes abbreviatus | | | | Not on any status lists |
| Oreodytes spp. | Oreodytes spp. | | | |
| Orthocladius appersoni | | | | Not on any status lists |
| Orthocladius spp. | Orthocladius spp. | | | |
| Paltothemis lineatipes | Red Rock Skimmer | | | |
| Paracladopelma alphaeus | | | | Not on any status lists |
| Paracladopelma spp. | Paracladopelma spp. | | | |
| Paratanytarsus grimmii | | | | Not on any status lists |
| Paratanytarsus spp. | Paratanytarsus spp. | | | |
| Pentaneura spp. | Pentaneura spp. | | | |
| Phaenopsectra dyari | | | | Not on any status lists |
| Phaenopsectra spp. | Phaenopsectra spp. | | | |
| Polycentropus spp. | Polycentropus spp. | | | |
| Polypedilum albicorne | | | | Not on any status lists |
| Polypedilum spp. | Polypedilum spp. | | | |
| Procladius barbatulus | | | | Not on any status lists |
| Procladius spp. | Procladius spp. | | | |
| Progomphus borealis | Gray Sanddragon | | | |
| Pseudochironomus richardsoni | | | | Not on any status lists |
| Pseudochironomus spp. | Pseudochironomus spp. | | | |
| Radotanypus spp. | Radotanypus spp. | | | |
| Rheotanytarsus hamatus | | | | Not on any status lists |
| Rheotanytarsus spp. | Rheotanytarsus spp. | | | |

| | | | | |
|---|---|---|---|---|
| Rhionaeschna californica | California Darner | | | |
| Rhyacophila spp. | Rhyacophila spp. | | | |
| Sialis arvalis | | | | Not on any status lists |
| Sialis spp. | Sialis spp. | | | |
| Simulium anduzei | | | | Not on any status lists |
| Simulium spp. | Simulium spp. | | | |
| Sperchon spp. | Sperchon spp. | | | |
| Sperchon stellata | | | | Not on any status lists |
| Stictotarsus aequinoctialis | | | | Not on any status lists |
| Stictotarsus spp. | Stictotarsus spp. | | | |
| Sublettea spp. | Sublettea spp. | | | |
| Sympetrum corruptum | Variegated Meadowhawk | | | |
| Tanytarsus angulatus | | | | Not on any status lists |
| Tanytarsus spp. | Tanytarsus spp. | | | |
| Tricorythodes explicatus | A Mayfly | | | |
| Tricorythodes spp. | Tricorythodes spp. | | | |
| Tropisternus californicus | | | | Not on any status lists |
| Tropisternus spp. | Tropisternus spp. | | | |
| Tvetenia spp. | Tvetenia spp. | | | |
| Tvetenia vitracies | | | | Not on any status lists |
| Wormaldia anilla | A Caddisfly | | | |
| Wormaldia spp. | Wormaldia spp. | | | |
| Zaitzevia parvula | | | | Not on any status lists |
| Zaitzevia spp. | Zaitzevia spp. | | | |
| Ameletus majusculus | A Mayfly | | | |
| **MAMMALS** | | | | |
| Lontra canadensis canadensis | North American River Otter | | | Not on any status lists |
| Neovison vison | American Mink | | | Not on any status lists |
| **MOLLUSKS** | | | | |
| Anodonta californiensis | California Floater | | Special | |
| Ferrissia fragilis | Fragile Ancylid | | | CS |
| Ferrissia spp. | Ferrissia spp. | | | |
| Margaritifera falcata | Western Pearlshell | | Special | |
| Physa acuta | Pewter Physa | | | Not on any status lists |
| Physa spp. | Physa spp. | | | |

| | | | | |
|---|---|---|---|---|
| Pisidium casertanum | | | | Not on any status lists |
| Pisidium spp. | Pisidium spp. | | | |
| **PLANTS** | | | | |
| Carex lyngbyei | Lyngbye's Sedge | | Special | CRPR - 2B.2 |
| Montia howellii | Howell's Miner's-lettuce | | Special | CRPR - 2B.2 |
| Alnus rubra | Red Alder | | | |
| Alopecurus saccatus | Pacific Foxtail | | | |
| Carex arcta | Northern Clustered Sedge | | Special | CRPR - 2B.2 |
| Carex nudata | Torrent Sedge | | | |
| Cotula coronopifolia | NA | | | |
| Crypsis vaginiflora | NA | | | |
| Eryngium aristulatum aristulatum | California Eryngo | | | |
| Euthamia occidentalis | Western Fragrant Goldenrod | | | |
| Glyceria elata | Tall Mannagrass | | | |
| Jaumea carnosa | Fleshy Jaumea | | | |
| Populus trichocarpa | NA | | | Not on any status lists |
| Ranunculus repens | NA | | | |
| Ranunculus sardous | NA | | | |
| Salix exigua exigua | Narrowleaf Willow | | | |
| Salix lasiolepis lasiolepis | Arroyo Willow | | | |
| Sequoia sempervirens | | | | |
| Spartina foliosa | California Cordgrass | | | |
| Stachys ajugoides | Bugle Hedge-nettle | | | |
| Stachys rigida quercetorum | | | | Not on any status lists |
| Typha latifolia | Broadleaf Cattail | | | |

# Attachment D

July 2019

## IDENTIFYING GDEs UNDER SGMA

### Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

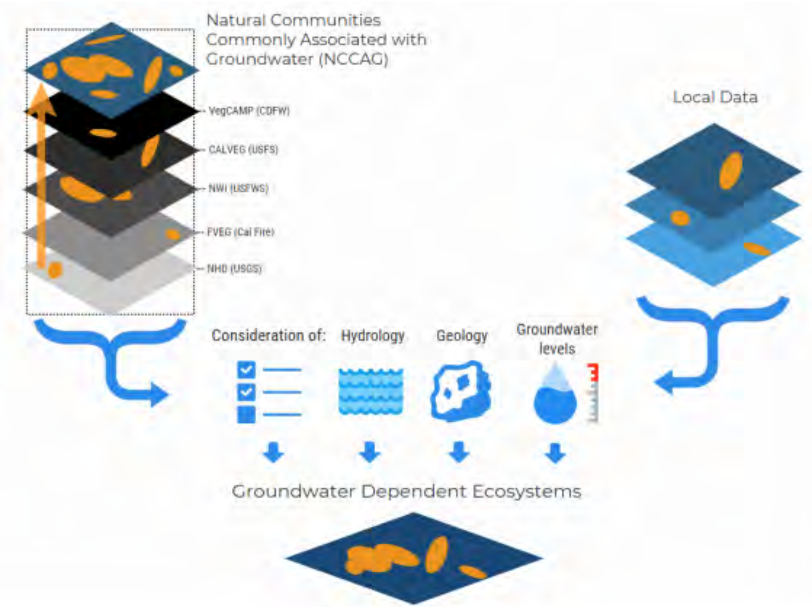



**Figure 1. Considerations for GDE identification.**
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

### BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

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[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/

[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

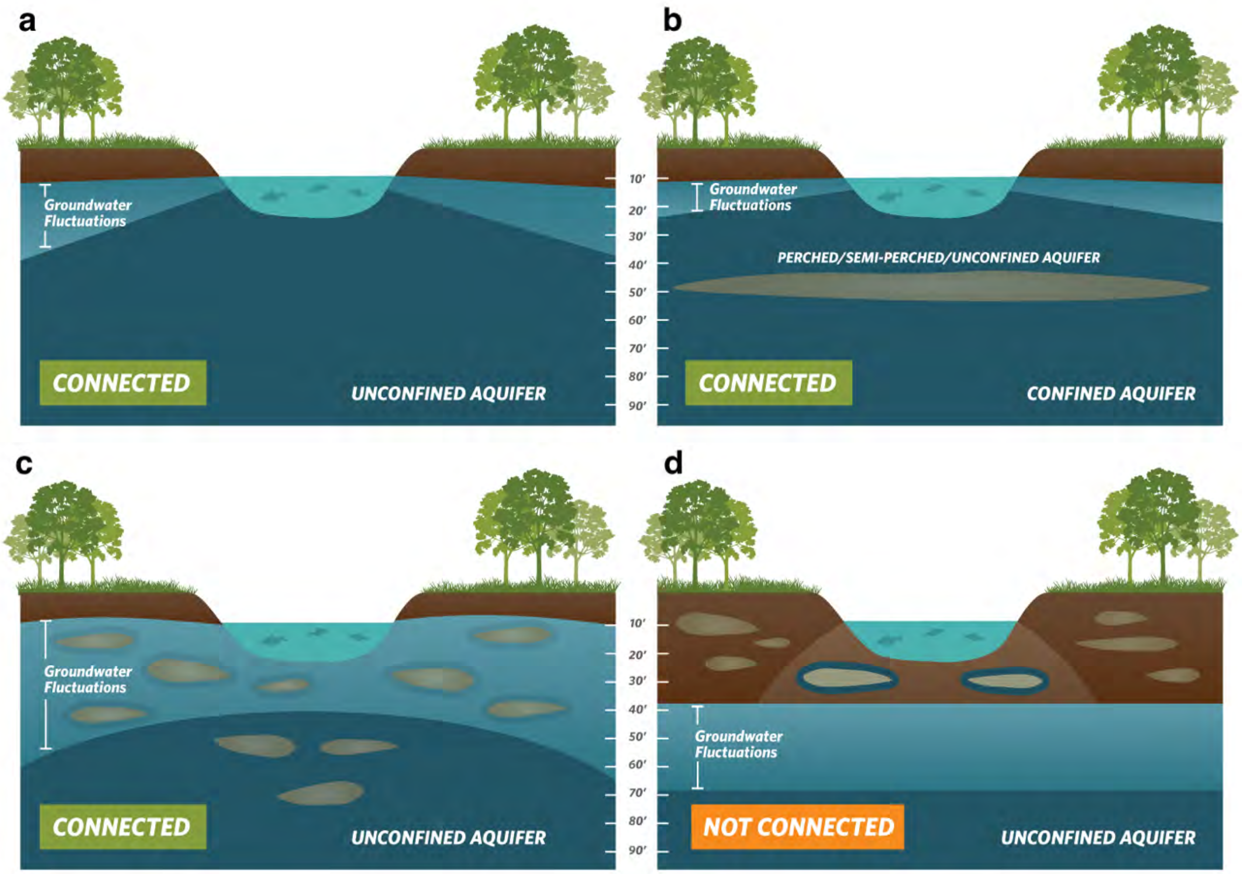


**Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a)** Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

## BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

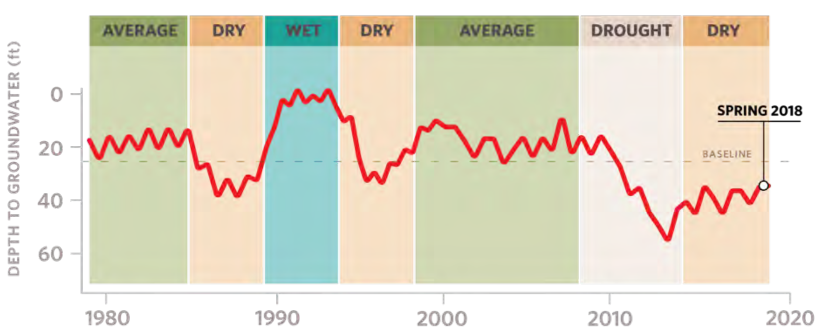


**Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time.** Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

## BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

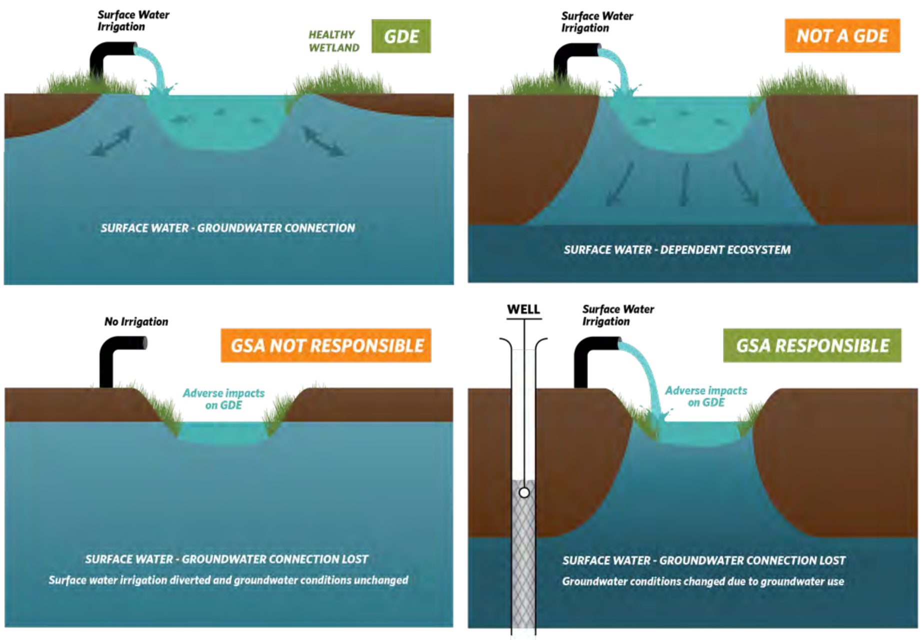


**Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left)** Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

## BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

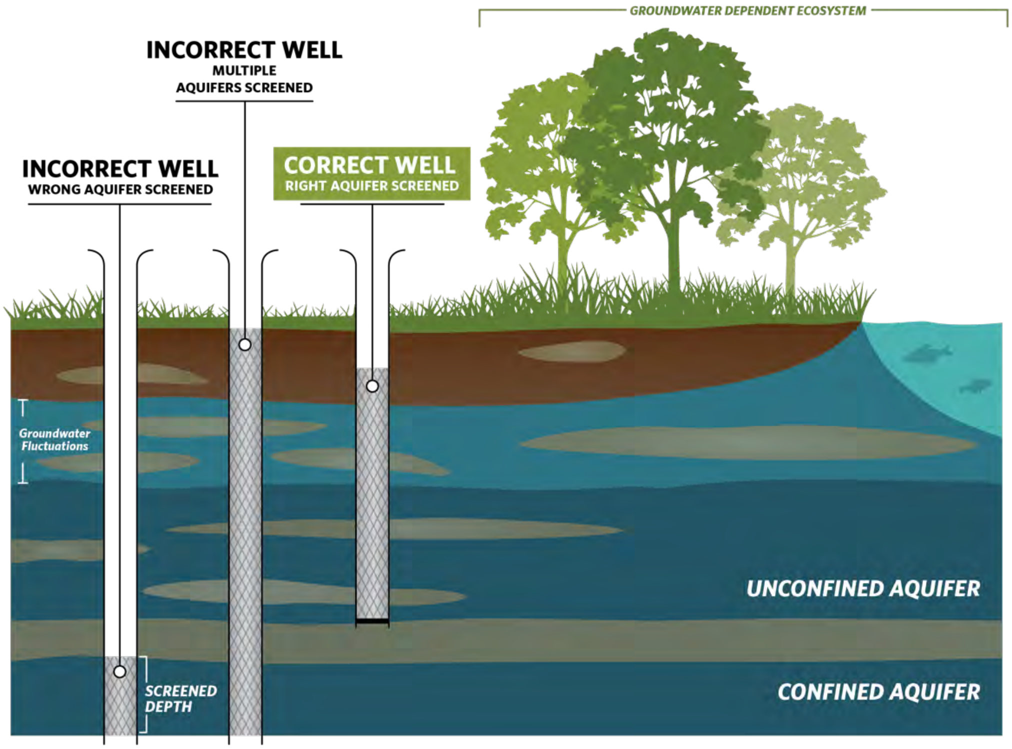


**Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.**

## BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

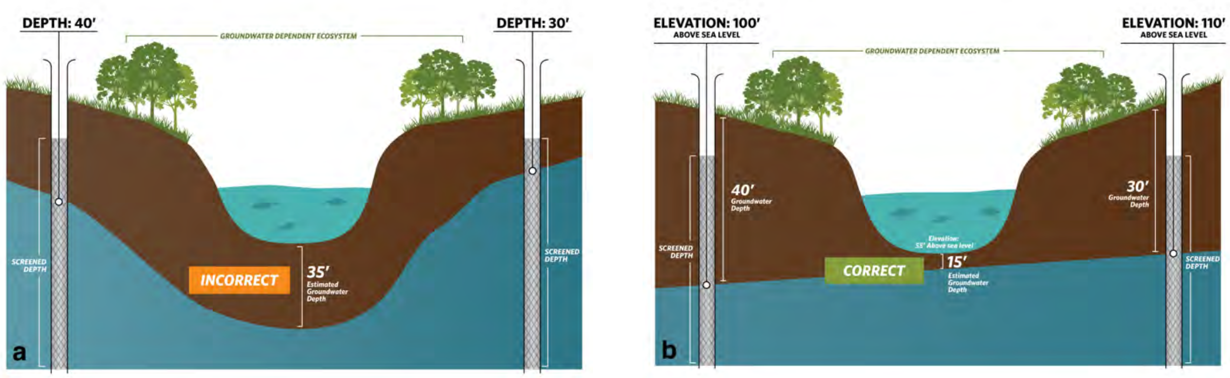


**Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a)** Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

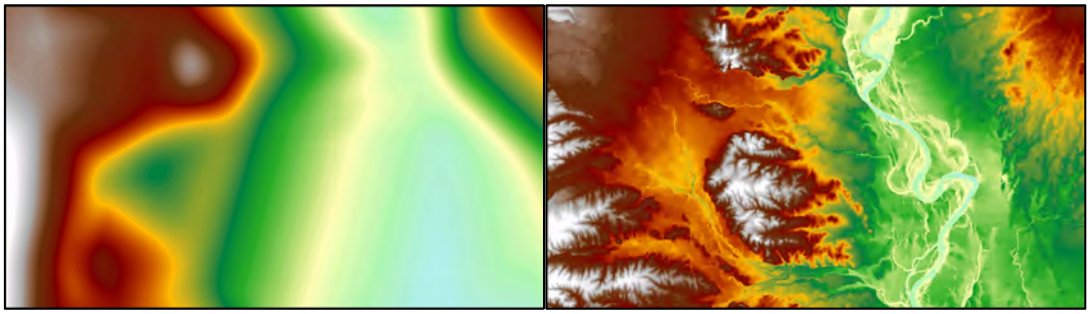

**Figure 7. Depth-to-groundwater contours in Northern California. (Left)** Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

## BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

### KEY DEFINITIONS

**Groundwater basin** is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

**Groundwater dependent ecosystem (GDE)** are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

**Interconnected surface water (ISW)** surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

**Principal aquifers** are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

### ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

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December 22, 2021

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**SUBJECT: CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE COMMENTS ON THE EEL RIVER VALLEY BASIN DRAFT GROUNDWATER SUSTAINABILITY PLAN**

Dear Hank Seeman:

The California Department of Fish and Wildlife (Department) appreciates the opportunity to provide comments on the Humboldt County Groundwater Sustainability Agency (GSA) Eel River Valley (Basin) Draft Groundwater Sustainability Plan (GSP) prepared pursuant to the Sustainable Groundwater Management Act (SGMA). The Basin is designated as medium priority under SGMA and must be managed under a GSP by January 31, 2022.

The Department is writing to support ecosystem preservation and enhancement in compliance with SGMA and its implementing regulations based on Department expertise and best available information and science. As trustee agency for the State's fish and wildlife resources, the Department has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and the habitat necessary for biologically sustainable populations of such species (Fish & Game Code §§ 711.7 and 1802).

Development and implementation of GSPs under SGMA represents a new era of California groundwater management. The Department has an interest in the sustainable management of groundwater, as many sensitive ecosystems, species, and public trust resources depend on groundwater and interconnected surface waters (ISWs), including ecosystems on Department-owned and managed lands within SGMA-regulated basins.

SGMA and its implementing regulations afford ecosystems and species specific statutory and regulatory consideration, including the following as pertinent to GSPs:

- GSPs must **consider impacts to groundwater dependent ecosystems** (GDEs) (Water Code § 10727.4(l); see also 23 CCR § 354.16(g));

- GSPs must consider the interests of all beneficial uses and users of groundwater, including environmental users of groundwater (Water Code § 10723.2) and GSPs must **identify and consider potential effects on all beneficial uses and users of groundwater** (23 CCR §§ 354.10(a), 354.26(b)(3), 354.28(b)(4), 354.34(b)(2), and 354.34(f)(3));
- GSPs must **establish sustainable management criteria that avoid undesirable results** within 20 years of the applicable statutory deadline, including **depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water** (23 CCR § 354.22 *et seq*. and Water Code §§ 10721(x)(6) and 10727.2(b)) and describe monitoring networks that can identify adverse impacts to beneficial uses of interconnected surface waters (23 CCR § 354.34(c)(6)(D)); and
- GSPs must **account for groundwater extraction for all water use sectors,** including managed wetlands, managed recharge, and native vegetation (23 CCR §§ 351(al) and 354.18(b)(3)).

Furthermore, the Public Trust Doctrine imposes a related but distinct obligation to consider how groundwater management affects public trust resources, including navigable surface waters and fisheries. Groundwater hydrologically connected to surface waters is also subject to the Public Trust Doctrine to the extent that groundwater extractions or diversions affect or may affect public trust uses. (*Environmental Law Foundation v. State Water Resources Control Board* (2018), 26 Cal. App. 5th 844; *National Audubon Society v. Superior Court* (1983), 33 Cal. 3d 419.) The GSA has “an affirmative duty to take the public trust into account in the planning and allocation of water resources, and to protect public trust uses whenever feasible.” (*National Audubon Society*, *supra*, 33 Cal. 3d at 446.) Accordingly, groundwater plans should consider potential impacts to and appropriate protections for ISWs and their tributaries, and ISWs that support fisheries, including the level of groundwater contribution to those waters.

In the context of SGMA statutes and regulations, and Public Trust Doctrine considerations, groundwater planning should carefully consider and protect environmental beneficial uses and users of groundwater, including fish and wildlife and their habitats, GDEs, and ISWs.

The Department recommends the GSP Sustainable Management Criteria include consideration of environmental beneficial uses and users of groundwater, better quantify groundwater extraction, and better characterize surface water-groundwater connectivity. The Department is providing additional comments and recommendations as notated in Attachment A.

If have any questions related to the Departments comments and/or recommendations on the Eel River Valley Basin GSP please contact Senior Environmental Scientist Specialist Monty Larson at monty.larson@wildlife.ca.gov or (707) 496-2292.

Sincerely,

DocuSigned by:
Robert Hawkins
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Tina Bartlett, Regional Manager
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Enclosures (Attachment A)

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## Attachment A

*CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE COMMENTS ON THE EEL RIVER VALLEY BASIN (BASIN) GROUNDWATER SUSTAINABILITY PLAN (GSP)*

**COMMENTS AND RECOMMENDATIONS**

The Department's comments are as follows:

1. Comment #1- Agricultural groundwater use is largely unknown (GSP section 2.4.1, pages 21-24).
    a. Issue: The GSP states that agricultural groundwater use was estimated from just 4% of the irrigated land with most metered groundwater irrigators located in the western portion of the basin. Water use was highly variable with nearly an order of magnitude difference between the largest and smallest application on a per acre basis.
    b. Recommendation: The Department recommends the GSA extend the agricultural groundwater use monitoring network to include 25% of the groundwater irrigated acres representative of all groundwater irrigated portions of the Eel River Valley Basin (ERVB), soil types, and irrigation methods to provide greater accuracy in estimated agricultural groundwater use.
2. Comment #2- Groundwater use estimates in the Hydrogeologic Conceptual Model may not represent actual use (GSP section 3.6.5, pages 42 and 43).
    a. Issue: The Hydrogeologic Conceptual Model may not accurately represent groundwater flow without more accurate groundwater extraction information (see Comment #1).
    b. Recommendation: The Department recommends the GSP include additional agricultural and irrigation use data in the Hydrogeologic Conceptual Model to more precisely represent total groundwater use.
3. Comment #3- Hydrogeologic Conceptual Model Technical Memorandum (GHD 2021).
    a. Issue: The Department finds the Hydrogeologic Technical Memorandum cited in Section 3 of the GSP provides incomplete well construction information. Some of the wells used to characterize water surface elevations within the alluvial system and underlying Carlotta Formation have incomplete well construction information. The GSP provides multiple figures and tables indicating the wells used to characterize water levels, but does not include pertinent well construction information (well depth and screen intervals) associated with the observation points. Some of the

wells used to characterize water levels have deeper well completions and well screen intervals below the alluvial aquifer system. In addition, to calculate a result for groundwater levels and storage within the alluvial aquifer system, the modeling should be parameterized on observed groundwater elevations (i.e. 2003 spring water levels). The GSP utilizes wells that have well perforation completion depths within different aquifer systems or wells that have well screen perforations over multiple aquifer systems (i.e. alluvium and Carlotta Formation). The Department finds that such wells are poor candidates for calculations of water levels or storage within an individual aquifer. Independent of historic water level observations, if well data are not exclusively completed within the alluvial aquifer system, the best result to be expected is a general or composite water level elevation within the basin.

b. Recommendation: The Department recommends the Hydrogeologic Conceptual Model clarifies or adds the necessary well construction information for the observation points to provide a more accurate depiction of groundwater occurrence within the basin and specifically within the identified aquifer systems within the basin.

4. Comment #4- Hydrogeologic Conceptual Model Technical Memorandum (GHD 2021).
    a. Issue: The Department finds the Hydrogeologic Conceptual Model Technical Memorandum and GSP does not characterize the subbasin geologic and hydrogeologic framework within the basin (23 CCR 354.14). The Department finds the GSP lacks specific information regarding the extent (lateral and vertical) of confinement within the basin. The location and the extent of confining units will have an impact regarding aquifer specific parameters (i.e., storability, transmissivity, hydraulic connectivity) and water level occurrence. The GSA has installed several paired monitoring wells that indicate the presence of depth specific monitoring well completions (shallow and deep) and associated water levels. The water level observations from these points indicate different hydraulic heads and provides a brief discussion on vertical gradients associated with these points. The significance of these observations is that water may move vertically (up or down) within the aquifer systems within the basin.
    b. Recommendation: The Department recommends the GSP identify the lateral and vertical extent of confinement within the basin (i.e., to include additional characterizations of locations and associated parameters), as these occurrences have the potential to influence water level surface in the basin where wells are connected through construction or where semi-confined to unconfined conditions exist. The Department recommends the

GSP provides additional characterization of these locations and associated parameters.

5. Comment #5- The proposed water budget does not rely on the best available data to provide an estimate of sustainable yield per 23 CCR 354.18 (GSP Section 5.2, pages 70-72).
    a. Issue: The Department finds the water year type is based on rainfall in Ferndale and not does not include rainfall gages representative of the entire Eel River watershed. The Department finds that reliance on a single rainfall gauge/ location may not accurately reflect recharge to groundwater and availability for extraction or lack thereof.
    b. Recommendation: The Department recommends the water year type for the purpose of water budgeting should be based on an index of rainfall gages throughout the Eel River watershed to provide an estimate of sustainable yield.
6. Comment #6- Groundwater-Surface Water Model predictions (5.3, pages 75).
    a. Issue: The Department is concerned the hydrologic model of groundwater levels as interpreted in the GSP appears to suggest that water is not being drawn from the Eel River into the alluvial aquifer. In addition, the model does not consider the impact of surface water withdrawal on beneficial users of groundwater. Analysis from several reports associated with the GSP indicate there are significant groundwater-surface water interactions and the Eel River is losing surface flow to the groundwater system every year under all water year types analyzed during the irrigation season (SHN 2019, SHN 2021, Thomas Gast and Associates 2021).
    b. Recommendation: The Department recommends the hydrologic model is reconfigured to accurately reflect groundwater surface water interactions. These modifications should be completed before the model is used to predict future groundwater extraction scenarios or is used to evaluate potential significant and unreasonable results (23 CCR 354.26).
7. Comment #7- The sustainability goal does not account for Interconnected Surface Water (ISW) and may not sufficiently protect Groundwater Dependent Ecosystems (GDEs) and species (Section 6.3, page 97).
    a. Issue: The Department is concerned the basin is not being managed sustainably, as stated in the GSP. The Department finds that groundwater extraction in the basin is depleting ISW in the Eel River near Fortuna (SHN 2019, Thomas Gast and Associates 2021) and impacting adjacent GDEs. The Department finds that groundwater extraction of ISW has resulted in lowering and maintaining groundwater levels that are below the rooting depth for several species of trees dependent on groundwater

including Black Cottonwood (*Populus trichocarpa)* and Red Alder (*Alnus rubra*) (SHN 2021).

b. Recommendation: The Department recommends the GSP revises the sustainability goal to include undesirable results that occur due to groundwater extraction and include how groundwater will be managed to prevent significant and unreasonable results including depletion of ISW. In addition, the Department recommends the sustainability goal is revised to specify the reasons behind the goal and a realistic path to achieving the goal, including specific consideration of GDEs, species and habitats (23 CCR § 354.24). Minimum thresholds for the sustainability goal should be established that are protective of ISW flows that will maintain juvenile salmonid passage depths (0.4 feet) through all critical riffles.

8. Comment #8- The sustainable management criteria for chronic lowering of groundwater levels defines significant and unreasonable results and minimum thresholds that only consider impacts to groundwater wells and the ability to continue extraction and excludes GDEs (Section 6.6, pages 101-106).
   a. Issue: The Department is concerned the significant and unreasonable results for groundwater lowering excludes potential impacts to GDEs. The Department is further concerned the identified minimum thresholds are not likely to maintain existing GDEs. Water level data collected in Fall 2020 and Spring 2021 at the City of Fortuna disposal monitoring well site west of the Eel River indicate that groundwater levels were below the rooting depth of all GDE plant species. It is likely that groundwater levels in the adjacent GDEs have remained below the rooting zone of representative GDE plant communities for more than a year. Groundwater depths comparatively greater than the rooting depth will likely cause progressively adverse impacts to this GDE, such as reduced growth, reduced reproduction, or increased mortality (Rohde 2018). GDEs consisting mostly of mature trees with low rates of reproduction and recruitment are at risk of future ecosystem if baseline groundwater levels are at depths greater than seedlings and saplings can access to take root and replace mature trees.
   b. Recommendation: The Department recommends the minimum thresholds for groundwater reflect levels that are protective of GDEs and species, as well as maintain groundwater levels that are accessible to groundwater dependent species within GDEs in the basin.
9. Comment #9- As the sustainable management criteria for reduction in groundwater storage does not define minimum thresholds or measurable objectives, the Department cannot evaluate whether these criteria will avoid

undesirable results or avoid significant or unreasonable conditions (23 CCR 354.28) (Section 6.7, page 106).

   a. Issue: The Department is concerned the GSP fails to consider undesirable results resulting from the minimum thresholds given the highly interconnected groundwater/surface water system.
   b. Recommendation: The Department recommends minimum thresholds and measurable objectives be developed to include a description of each minimum threshold and how they were established for each of the six sustainability indicators; inclusive of how they will prevent adverse impacts to GDEs and aquatic ecosystems dependent on interconnected surface waters.

10. Comment #10- The sustainable management criteria for depletion of interconnected surface water minimum thresholds are insufficient to ensure avoidance of significant and unreasonable adverse impacts (undesirable results) to fish and wildlife and beneficial users of groundwater (Section 6.11, pages 115-120).
    a. Issue: The Department finds the description of potential impacts to groundwater-dependent ecosystems does not adequately describe the range of effects of groundwater pumping on streamflow depletion. The GSPs consideration of 130 cubic feet per second as suitable for upstream migration does not adequately protect fisheries.
    b. Recommendation: The Department recommends the GSA conducts data driven analyses on fish passage, habitat connectivity, and optimum flows for all life stages of anadromous fish in the basin.
11. Comment #11- The sustainable management criteria for depletion of interconnected surface water minimum thresholds using groundwater levels as a proxy for surface water depletion (Section 6.11.3.2, pages 118-120).
    a. Issue: The Department is concerned that average fall groundwater elevation data derived from a single point in time may not accurately represent the minimum fall groundwater level and may obscure impacts of groundwater extraction on interconnected surface waters. The Department also finds the GSP has not developed criteria to evaluate the proposed minimum threshold which includes documentation on how the minimum threshold may affect environmental beneficial uses and users of groundwater or valid methods for quantitatively measuring minimum thresholds (23 CCR 354.28).
    b. Recommendation: The Department recommends that groundwater wells used to define the minimum threshold for surface water depletion (GSP Table 24. page 120) install continuous monitoring devices to accurately define groundwater levels and minimum thresholds. Installation of

continuous monitoring devices will provide the GSA with data to assess impacts, manage minimum thresholds, and help ensure regional groundwater extractions do not lead to significant and adverse impacts on fish or wildlife resources.

12. Comment #12- The sustainable management criteria for depletion of interconnected surface water measurable objectives have not been developed (Section 6.11.4, page 120).
    a. Issue: The Department finds the GSP is unclear on whether the measurable objective will or will not result in undesirable results.
    b. Recommendation: The Department requests clarification of how the GSP will establish attainable measurable objectives for each sustainability indicator that reflect fish and wildlife needs with a reasonable margin of operational flexibility and safety for each measurable objective (not risking undesirable results) that considers dynamic hydrology, climate, etc.
13. Comment #13- The Department finds that many sections of the Draft GSP are yet to be developed. Due to the incomplete nature of the GSP the Department cannot comment on these sections. The lack of a complete Draft GSP may result in additional comments on the Final GSP.
14. Comment #14– The GSP does not adequately account for state jurisdictional boundaries within Section 2 (Description of Planning Area) or its associated maps (Description of Planning Area, General Land Use Characteristics and Jurisdictional Areas [Section 2.5, pg. 25-26]).
    a. Issue: The Department finds that CDFW lands including the Eel River Wildlife Area and Table Bluff Ecological Reserve are not explicitly included in the planning area description or figures as required by 23 CCR § 354.8(a).
    b. Recommendation: The Department recommends the GSP includes and accounts for all state lands, including CDFW lands, in the jurisdictional boundaries described in Section 2 of the GSP and relevant figures.

## CONCLUSION

In conclusion, though the Eel River Valley Basin GSP does provide an initial assessment of groundwater use and potential impacts of that use, it does not comply with all aspects of SGMA statutes and regulations. Given this, the Department deems the GSP insufficient in its consideration of fish and wildlife beneficial uses and for the users of groundwater and interconnected surface waters. The Department recommends the Humboldt County GSA address the above comments to avoid a potential ‘incomplete’ or ‘inadequate’ GSP determination per 23 CCR § 355.4(b)(1), (2), and (4), as assessed by the Department of Water Resources, for the following reasons derived from regulatory criteria for GSP evaluation:

1. The assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are not reasonable and/or not supported by the best available information and best available science (23 CCR § 355.4(b)(1)). (See Comments #1, 2, 3, 4, 5, 6).
2. The sustainable management criteria and projects and management actions are not commensurate with the level of understanding of the basin setting, based on the level of uncertainty, as reflected in the GSP (23 CCR § 355.4(b)(3)) (See Comment #1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12).
3. The interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have not been considered (23 CCR § 355.4(b)(4)) (See Comment #7, 8, 9, 10, 14).

## *LITERATURE CITED*

Rohde, M. M., S. Matsumoto, J. Howard, S. Liu, L. Riege, and E. J. Remson. 2018. Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans. The Nature Conservancy, San Francisco, CA.

SHN. 2019. Technical Memorandum: Preliminary Analysis of Surface Water/Groundwater Interaction Monitoring: Eel River Valley Basin. Eureka, California.

SHN. 2019. Technical Memorandum: Water Levels. Eureka, California.

Thomas Gast and Associates Environmental Consultants. 2021. Technical Memorandum: Surface Water Monitoring in the Eel River Valley Basin. Arcata, California.

December 23, 2021

Hank Seemann
Humboldt County Department of Public Works
1106 Second Street
Eureka, CA 95501

**Re: Eel River Valley Sustainability Plan (administrative draft)**

Ha'wa'lou (Greetings) Hank Seemann

The Eel River Valley Groundwater Basin is within the ancestral territory of the Wiyot Tribe and protecting the groundwater supply and groundwater-dependent ecosystems is a priority for the Wiyot Natural Resources Department (WNRD). The WNRD applauds the Humboldt County Groundwater Sustainability Agency (HCGSA) for completing the administrative draft of Eel River Valley Groundwater Sustainability Plan but has concerns regarding inputs to the minimum thresholds, criteria of an Undesirable Result, and the reaction if an Undesirable Result occurs.

The WNRD believes that the minimum thresholds developed should consider the importance of groundwater seepage to cold-water fishes (Ebersole et al. 2003). Groundwater seepage into rivers, tributaries, and estuaries create persistent discontinuous patches of cool water providing thermal refuge for trout and salmon. Minimum thresholds for groundwater pumping need to consider the impact to available habitat with suitable temperatures, often referred to as thermal refugia, for culturally important fishes, including steelhead trout, Chinook salmon, and Coho salmon.

Furthermore, the WNRD has concerns regarding criteria for an event to be classified an "Undesirable Result". More specifically, the second scenario for an Undesirable Result to occur requires minimum thresholds to be broken for two sequential years despite negative impacts to groundwater-dependent ecosystems possibly occurring immediately. The WNRD recommends that the temporal component for this scenario be removed with an immediate response to be enacted.

Moreover, the WNRD would like the HCGSA to clarify the response if an Undesirable Result occurs. The plans current response (below) does not include the type of further analysis, any type of time frame, or if any tangible actions will be taken.

> "If one of these two scenarios occurs, then further analysis would determine if beneficial uses of the interconnected surface water are degraded or the viability of special status species are threatened, and whether reasonable reductions or limitations in groundwater pumping could avoid these effects without jeopardizing other beneficial uses of groundwater." (6.11.5-pg. 121)

1000 Wiyot Drive • Loleta, California 95551 • (707) 733-5055 • (800) 388-7633 • FAX (707) 733-5601

Additionally, without any baseline monitoring of the "interconnected surface waters" or the "special status species", it would be challenging to determine if/how they are "degraded" or what caused degradation. Also, the phrase "could avoid these effects without jeopardizing other beneficial uses of groundwater" implies that reduction measures will only be considered if there are no economic consequences and takes priority away from resources that are culturally important to the Wiyot Tribe.

Thank you for taking the time to consider these concerns for public review.

Rra'dutwas (with kindness),

Adam N. Canter
Natural Resources Director
Wiyot Natural Resources Department
1000 Wiyot Dr. Loleta, CA 95551
707-733-5055x105
adam@wiyot.us

# FRIENDS OF THE EEL RIVER

*Working for the recovery of our Wild & Scenic River, its fisheries and communities.*

Friday, December 24, 2021

Hank Seeman
Humboldt County
via email

**Re: Comments on Draft Groundwater Sustainability Plan**

Dear Hank and Groundwater Team:

Thank you for the informative presentation on the draft GSP last Friday. The following brief notes and comments may help to improve the final plan.

At this writing, several technical memos remain outstanding. We may comment on them when they are posted.

The draft GSP taught me Townsend's big-eared bats drink water.

The final GSP should note that Northern California summer steelhead were listed by the California Fish and Game Commission this summer as Endangered under the California Endangered Species Act.

As we noted Friday, one of our key concerns is the way the sustainable management criteria for depletion of interconnected surface water is stated. Any action that "… threatens the viability of a special-status species…" would, for species like Chinook salmon and steelhead listed under the federal Endangered Species Act, be an action that jeopardize those species. The threshold for impacts to listed species should be lower than jeopardy or, for that matter, take.

If the threshold for impacts to listed species were take, then the county would need to be prepared to immediately curtail pumping that could affect surface flows. Instead, the rest of the Significant and Unreasonable use statement says "… and reasonable reductions or limitations in groundwater pumping could avoid these effects without jeopardizing other beneficial uses of groundwater." That looks like a rule that says groundwater pumpers never have to stop pumping if they don't want to.

We would suggest that the undesirable result that should trigger analysis is depletion of surface flows such that beneficial uses are impaired. If restricting groundwater extraction could help diminish impacts to public trust resources, the county has a duty to consider how such restrictions can be imposed.

The draft GSP estimates evapotranspiration from natural vegetation and from irrigated agriculture, but then presents those results as part of the same category. What proportion of evapotranspiration is from irrigated agriculture alone?

In its analysis of salt intrusion and sea level rise, the draft GSP uses a figure of 0.5 feet of sea level rise by 2030 and 1.48 by 2070. These estimates seem improbably conservative. How would the analysis change if you doubled those figures? Note for example that recent reports suggest the Thwaites Ice Shelf is likely to collapse in the next three to five years, entraining several feet of sea level rise from the resulting speedup in the Thwaites Glacier behind the ice shelf:

> *The failure of the shelf would not immediately accelerate global sea level rise. The shelf already floats on the ocean surface, taking up the same amount of space whether it is solid or liquid.*
>
> *But when the shelf fails, the eastern third of Thwaites Glacier will triple in speed, spitting formerly landlocked ice into the sea. Total collapse of Thwaites could result in several feet of sea level rise, scientists say, endangering millions of people in coastal areas.* (See washingtonpost.com/climate-environment/2021/12/13/thwaites-glacier-melt-antarctica/)

Similar reports from Greenland suggest Humboldt is likely to see at least three feet of sea level rise well before 2070. The GSP should note that the lower Eel and Humboldt Bay is now seeing sea level rise at the highest rate in coastal California, because the land at the coastal margin is sinking due to tectonic forces at about the same rate that saltwater is presently rising.

The draft GSP notes in several areas the relative proportion of wells in various categories without ever revealing the actual numbers behind those proportions, e.g. agricultural uses account for 86.4% of groundwater use. How many agricultural wells are we talking about? What are their capacities? Where are they located? How much water have they been pumping? The county has that information or has the power to require that information be disclosed.

It would be much easier to understand the economics and impacts of groundwater pumping if we had a clearer picture of who is using how much water, when, and why. Maps showing densities of wells per square mile are harder to prepare than maps of the actual wells. Why obscure the details of water use in the lower Eel? How has pumped groundwater been used, ie at what rates on what crops? Similarly, the final GSP should detail the history of well drilling in the lower Eel over the last several decades, or at a minimum the last 10 years. How many new wells have been drilled, where, and to what depths?

The draft GSP notes that CASGEM well readings are ‘generally stable.’ Please report the outlier numbers as well as the broader trends. The draft GSP notes that the flows of the Eel River are key to maintaining groundwater levels in the Lower Eel. At what point would diminishing flows in the Eel begin to reduce groundwater levels in the basin?

With respect to the county’s well permitting process, the draft GSP is not clear how or by what standards the county evaluates proposed wells. How does the county insure that wells are not improperly sited, for example not sunk in areas where they would tap subsurface flows? And how does the county consider the potential effects, including cumulative effects, of approving well permits and operations?

The Water Year Type chart on page 72 of the draft GSP presents the last 30 years of water year data at Ferndale as a color-coded bar chart, with annual precipitation varying from a low of just over 20 inches in 2014 to a high of about 65 inches in 1998 and 2017. Five of the first fifteen years were below average water years. Ten of the second fifteen years were below average. This trend shows that even on the coast we are not immune from the effects of climate change, including the collapse of the assumptions of hydrological stationarity that have been the premise of water management over the last century.

Of course, given the relationship between flows in the Eel River and the lower Eel groundwater basin documented in the draft GSP, precipitation in Ferndale should be considered together with related data, including the even steeper decline in precipitation and increase in temperatures in the inland portions of the Eel River basin. As well, given the increase in groundwater demand associated with higher temperatures, the GSP should present data regarding temperature changes both in the lower Eel basin and the interior which affect not only crop demands but snow melt, vegetation uptake and transpiration, and impacts on salmonid populations.

We are heading into a future where the lack of precipitation alone is likely to continue to create hostile conditions in our rivers and streams for native fish. As the draft GSP documents at page 24, groundwater diversions are higher in drier and warmer years. Those are of course the years in which potential impacts to fisheries and other beneficial uses of surface water can be critical, not to mention significant.

The draft GSP explains that parts of Humboldt county and indeed parts of the lower Eel Groundwater basin are disadvantaged communities such that the California Department of Water Resources judged it appropriate to grant the county funds to support this planning effort without a cost-matching requirement. It would be difficult to support that argument on the basis that the people who own the land and run the irrigation pumps are disadvantaged.

It seems clear the draft GSP is written to insure the irrigating community is in no way inconvenienced by any requirement that it change, or even report, its groundwater use. Treating the uses of the lower Eel River valley's land and water that have become entrenched over the last century as entitlements does not make them sustainable. Practices which ensure native species can continue to thrive are those which can be sustained.

Thank you for all of your work on this plan and the technical material supporting it.

Sincerely yours,

/s/
Scott Greacen
Conservation Director

# Humboldt County Farm Bureau

5601 So. Broadway, Eureka, CA 95503
Serving Agriculture Since 1913


County of Humboldt
Groundwater Sustainability Agency
1106 Second Street
Eureka, Ca 95501

December 24, 2021

Attn: Hank Seemann

Re: Comments on Administrative Draft Groundwater Sustainability Plan, Eel River Valley

Dear Mr. Seemann:

The Humboldt County Farm Bureau would like to maintain the integrity of the Eel River Basin for the beneficial use of all those who dependent on it. Aligned with the Sustainable Groundwater Management Act's (SGMA) intention of informed, researched, and thoughtful local oversight by a Groundwater Sustainability Agency (GSA), we support the public discovery, debate, and implementation of the sustainability indicators and development of thresholds of undesirable results.

Humboldt County's Board of Supervisors and Staff, working as our GSA has determined the Eel River Groundwater Basin to be displaying characteristics of a basin interacting with its users and the year-to-year changes in precipitation. Based on this research, the basin fluctuates and continues to return to prior levels indicative of a system that is able to support its use by all benefactors in the past, now, and into the future.

In the agricultural community, we have continued to seek more efficient methods of water use. Today, we are more efficient than ever before and strive to conserve water and not use more water than is necessary to grow and provide for our livestock and forages. With the assistance of many water-efficient grants and programs, farmers are continuing to improve their water use and conservation. We hope to avoid undue burdens to all community members by any actions that do more harm than good in the correction of a potential undesirable result in the future.

We continue to be interested in supporting research and data collection and look forward to working with you in the future.

Sincerely,

*Joseph Alexandre*

Joseph Alexandre
Farm Bureau President


Phone (707) 443-4844 • Fax (707) 443-0926 • email: humboldtfb@sbcglobal.net

County of Humboldt December 24, 2021
Groundwater Sustainability Agency
1106 Second Street
Eureka, CA 95501

Attn: Hank Seemann

RE: Comments on Administrative Draft Groundwater Sustainability Plan, Eel River Valley

Dear Mr. Seemann,

My name is Ronald Vevoda and I am member of the Humboldt County Farm Bureau as well as a dairy farmer in Ferndale, California. After reading the draft of the Groundwater Sustainability Plan of the Eel River Valley, it is my opinion that plan would be beneficial to all affected members of the valley. I believe that the county has done a thorough job with their research and findings and I support the plan at this time.

Dairies across the Eel River Valley strive to become more efficient every year with our water use. As advances continue to be made in the area of water conservation, we (dairy farmers) have adapted our water usage so that we are using what only what we need. As research and programs continue to provide information, we plan on using that information to help inform our decisions with water usage. Water is vital to our livelihood and it only makes sense for us to be conservative as we continue to grow. We hope other members of the Eel River Valley feel the same way and are planning to work together to save this precious commodity.

I look forward to the further research, data and findings that the Sustainability Plan of the Eel River Valley finds in the upcoming years.

Sincerely,

Ronald Vevoda

Jan. 4, 2022
Agenda Item I, Eel River Valley Draft Groundwater Sustainability Plan

Good morning, Chair Bass, Supervisors, and Staff
My name is Vivian Helliwell, with PCFFA and the Institute for Fisheries Resources, a non-profit organization whose mission is to protect and restore fish populations and the human economies that depend on them.
Salmon fishing, mostly shut down for 30 years now, has provided local, high quality food, tourism, and many jobs.
Eel river native salmon and steelhead are at a bare remnant of historic and viable populations and are listed under state and federal ESA's or managed under the Magnuson-Stevens fishery conservation and management act.

At Humboldt County's first SGMA meeting, several years ago at the Ag Center, a Representative from the Department of Environmental Health stated that the number of well permits was increasing exponentially. How many wells are there, what is their capacity? How many wells can the aquifer support?

I commend the Planning Department, their consultants and water users on the work that has been done so far and the efficiency measures irrigators are using.
The Draft Plan shows how the Eel River Valley aquifer contributes cold water to the river's interconnected surface flows during summer and early fall. National Marine Fisheries Service is responsible for the fish. Their view is that the thresholds for undesirable results is already being exceeded, that the basin is not currently being managed sustainably, according to the effects on surface flows in Eel and Van Duzen confluence in the late summer and fall--that it "degrades the viability of listed species and their habitat"—more flow needs to be left for all the life stages of fish, not just adult migration, for the GSP to be considered adequate.

Additionally, as Supervisor Madrone and others said, a whole watershed approach is appropriate.
As the climate inland trends toward warmer and less rain, and as agricultural use increases during warm, dry years, a conservative approach is needed to account for the warmer dryer climate trends.

The surface waters need thresholds of carrying capacity as the Watershed Planning Areas firmly established in Humboldt County's General Plan for each watershed in the Cannabis 2 regulations at the Board of Supervisors.

The agencies recommend a wider area covered by monitoring wells, monitoring throughout the year, and a 100% of baseline usage in summer and fall, not 150%. It is bad enough that the baseline year for SGMA was a very dry year, and could ensure failure of sustainable water use.

Two years of undesirable results should not be allowed to pass before analysis for actions are taken. Our Eel River wild salmon stocks are at risk as we speak here today!

I encourage you to follow the agency and tribal recommendations for more conservative watershed management to protect your use of groundwater, as well as the other beneficial uses of interconnected surface water. If the Plan is deemed inadequate, DWR will take over from local management of our water.
Thanks for hearing our comments.

Salmon Returning!

Vivian Helliwell
Watershed Conservation Director
Pacific Coast Federation of Fishermen's Associations (PCFFA) and
Institute for Fisheries Resources (IFR)
North Coast Salmon Rivers Project
(707) 953-0095
vhelliwell@mcn.org

**Response to Comments**
**on the**
**Draft Eel River Valley Groundwater Sustainability Plan**

Prepared by: Humboldt County Groundwater Sustainability Agency
Date: January 29, 2022

**California Department of Fish and Wildlife (Letter dated December 22, 2021)**

Comment #1 (page 6): The commenter recommended extending the agricultural groundwater use monitoring network to include 25% of the land irrigated with groundwater.

Response: The estimate of agricultural irrigation water use (Humboldt County et al, 2021) is sufficiently robust for preparation of the GSP. Additional water meters would be beneficial for ensuring representative data but are not considered essential. Section 8 of the GSP was modified to include the goal of securing grant funding to double the number of flow meters on agricultural irrigation systems within five years.

Comment #2 (page 6): The commenter recommended including additional agricultural and irrigation use data.

Response: The GSP uses all available data regarding groundwater use. The commenter did not provide any data or identify any sources of data that are not already considered in the development of the GSP.

Comment #3 (page 6): The commenter requested additional discussion regarding well depths in the hydrogeologic conceptual model.

Response: Section 4 in the GSP was revised with consideration for the comments provided.

Comment #4 (page 7): The commenter requested additional discussion regarding lateral and vertical confinement within the Basin.

Response: Section 4 was revised with consideration for the comments provided.

Comment #5 (page 8): The commenter recommended basing water year types on rainfall gages located throughout the Eel River watershed and not solely on a gage located in Ferndale.

Response: The approach for classifying water year types in the GSP is consistent with DWR's Water Year Type Dataset Development Report (2021). The Humboldt County GSA does not agree that the methodology for designating water year types should be changed. The rainfall gage located in Ferndale, within the Basin, is sufficiently representative of conditions within the Basin to determine water year type. Even if additional rainfall gages were used, the results would not be consequential for the content of the GSP because the methodology for assigning water years is based on a fixed distribution among the five water year types. In other words, no matter what gage or set of gages are considered, there will be four critical water years, five dry water years, six below normal water years, etc. The GSA will contact the commenter and offer further discussion on this topic.

Comment #6 (page 8): The commenter stated a concern that the hydrologic model suggests that water is not being drawn from the Eel River into the alluvial aquifer.

Response: This comment appears to be based on a misunderstanding regarding the construction of the hydrologic model and its output. The GSA will contact the commenter and offer further discussion on this topic.

Comment #7a (page 8): The commenter stated that groundwater extraction of interconnected surface waters has resulted in lowering and maintaining groundwater levels that are below the rooting depth of several species of trees dependent on groundwater.

Response: The technical memorandum entitled Assessment of Groundwater Dependent Ecosystems for the Eel River Valley Basin Groundwater Sustainability Plan (Stillwater Sciences, 2022), which is an attachment to the GSP, discusses how potential groundwater dependent ecosystems were identified based on the type of vegetation (i.e., phreatophytes) and their proximity to groundwater. It was assumed that GDEs would be present where groundwater levels are less than 30 feet below ground surface. Vegetation located where groundwater is deeper than the rooting depth during part of the year is likely sustained by other sources of water when groundwater is below the rooting zone. Other water sources include surface water infiltration into the subsurface, precipitation (including rainfall and fog drip), and irrigation runoff. One result of the moderate summer-time temperatures and frequent fog in the Basin is that soil moisture lasts longer into the dry season than would be observed in hot and arid climates. The commenter makes general claims about depletion of interconnected surface water and impacts to GDEs that are not supported with data and information. Therefore, revisions to the GSP are not warranted at this time. The GSA will contact the commenter and offer further discussion on these topics.

Comment #7b (page 9): The commenter stated that a minimum threshold should be established that is protective of interconnected surface water flows that will maintain juvenile salmonid passage depths (0.4 feet) through all critical riffles.

Response: Juvenile salmonids have very limited presence in the lower Eel River during the summer due in part to high water temperatures (Stillwater Sciences, 2021a; Stillwater Sciences 2022). The commenter does not provide evidence to support the need for setting minimum thresholds based on passage of juvenile salmonids.

Comment #8 (page 9): The commenter stated that the development of sustainable management criteria for chronic lowering of groundwater levels excludes GDEs. The commenter further stated that groundwater levels on a specified parcel near the Eel River are below the rooting depth of groundwater-dependent plant species. The commenter concluded that the plant species are at risk for adverse impacts from lowering of groundwater levels.

Response: The GSP does not exclude consideration of GDEs. The biological response to change in groundwater was assessed based on changes in Normalized Difference Vegetation Index (NDVI) data. This analysis is presented in more detail in Stillwater Sciences (January 2022). NDVI, an estimate of vegetation greenness, is a commonly used proxy for vegetation health in analyses of temporal trends in the health of groundwater-dependent vegetation. NDVI data is relatively stable for all identified GDEs.

The parcel identified by the commenter likely depends on multiple sources of water throughout the year, as described above. Vegetation may use groundwater during wetter water years and during wetter times of the year, while relying more on surface water infiltration into the subsurface, precipitation (rainfall and fog drip), and agricultural irrigation runoff when groundwater levels are lower. The parcel has had a steady NDVI over the last four years, suggesting that other sources of water may sustain the vegetation during the summer (see Figures 1-5, below). The commenter did not provide evidence that the plant species are, in fact, under stress or being impacted, nor did the commenter provide evidence that groundwater pumping is causing the groundwater levels to be lower than the rooting depths. Revisions to the GSP are not warranted.

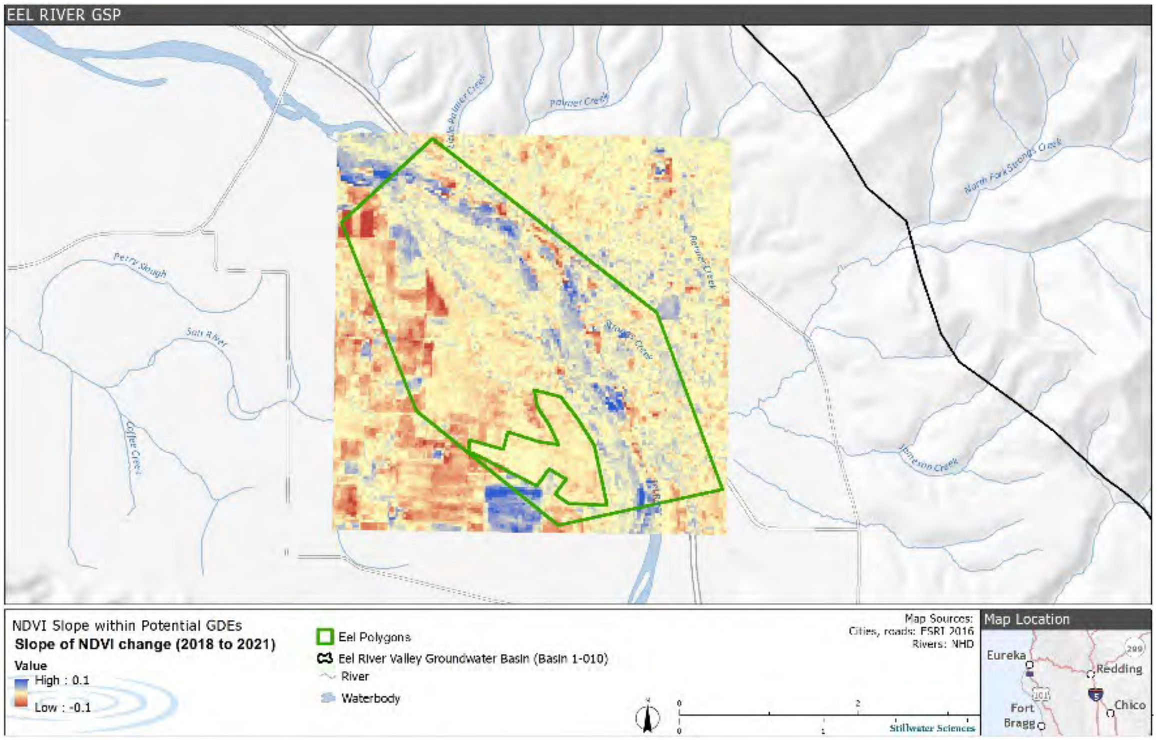


*Figure 1. Slope change of NDVI from 2018-2021 near Fortuna. The smaller polygon outlines the potential GDE discussed in the CDFW comments*

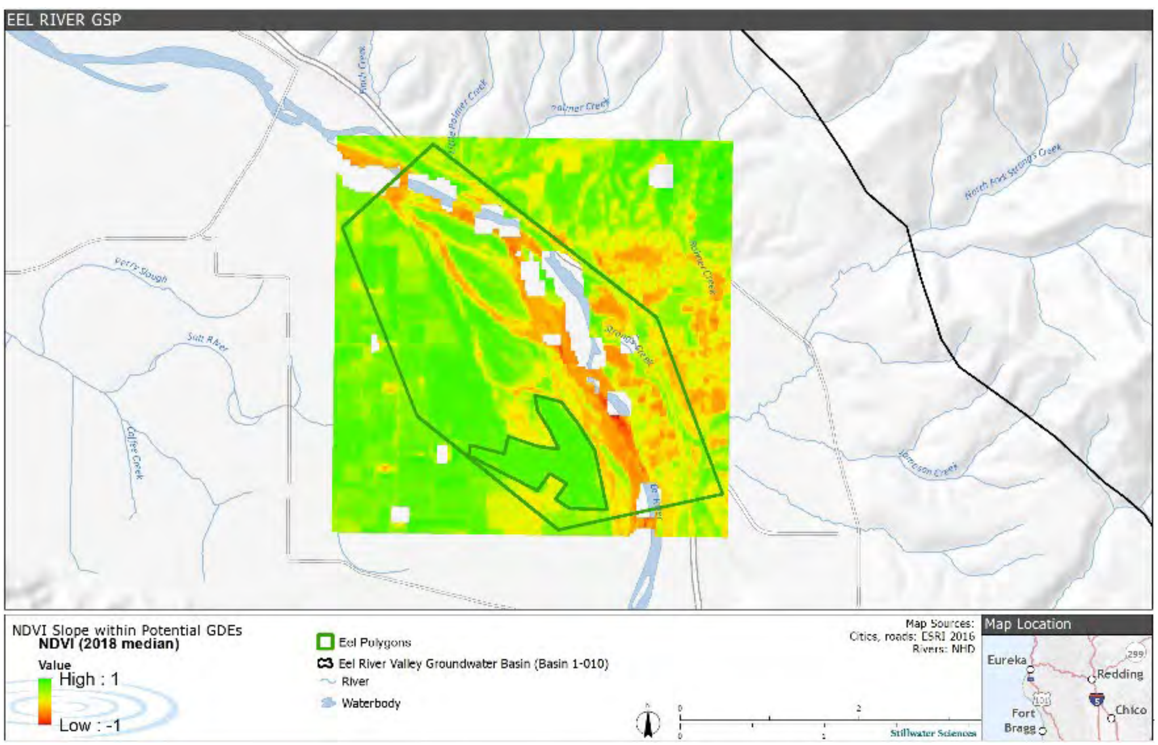


*Figure 2. Median summer 2018 NDVI near Fortuna, CA. The smaller polygon outlines the potential GDE discussed in the CDFW comments.*

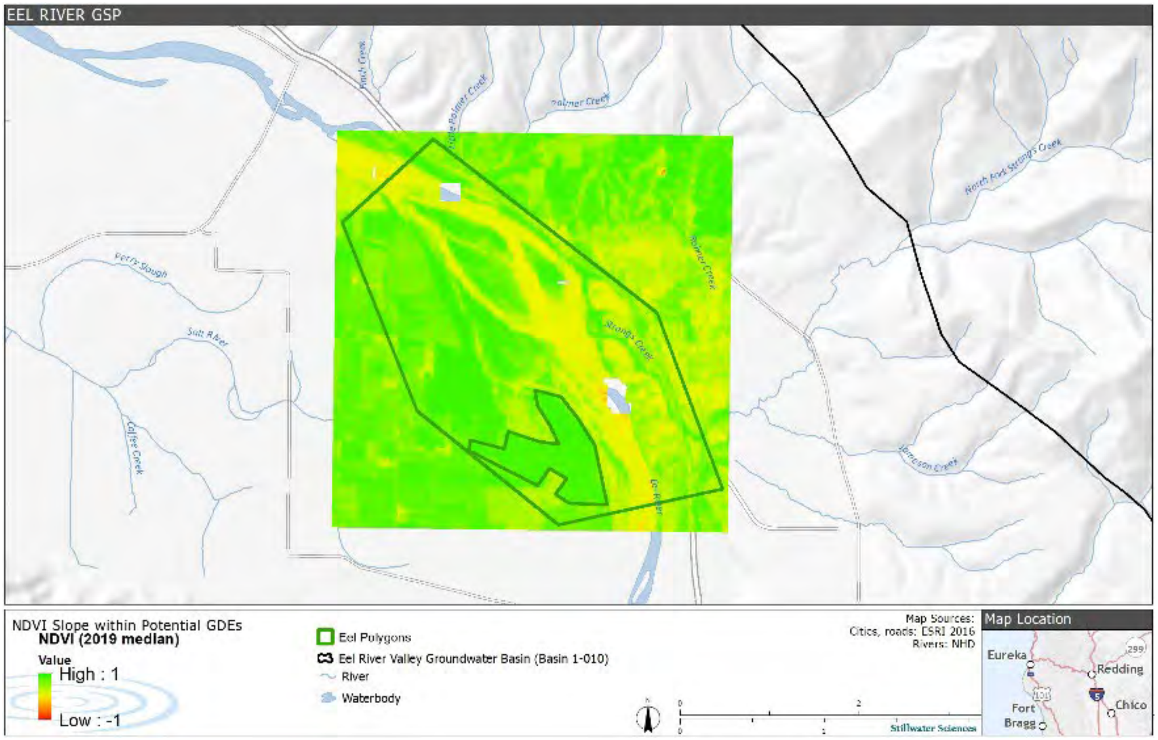


*Figure 3. Median summer 2019 NDVI near Fortuna, CA. The smaller polygon outlines the potential GDE discussed in the CDFW comments.*

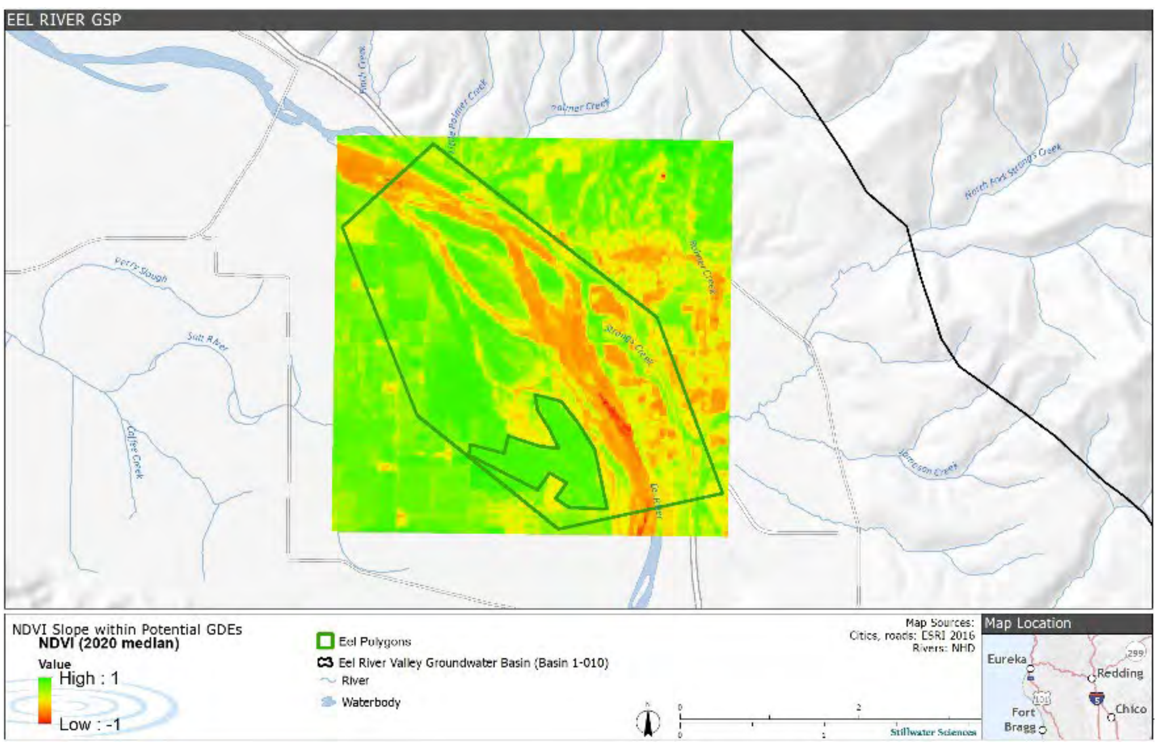


*Figure 4. Median summer 2020 NDVI near Fortuna, CA. The smaller polygon outlines the potential GDE discussed in the CDFW comments.*

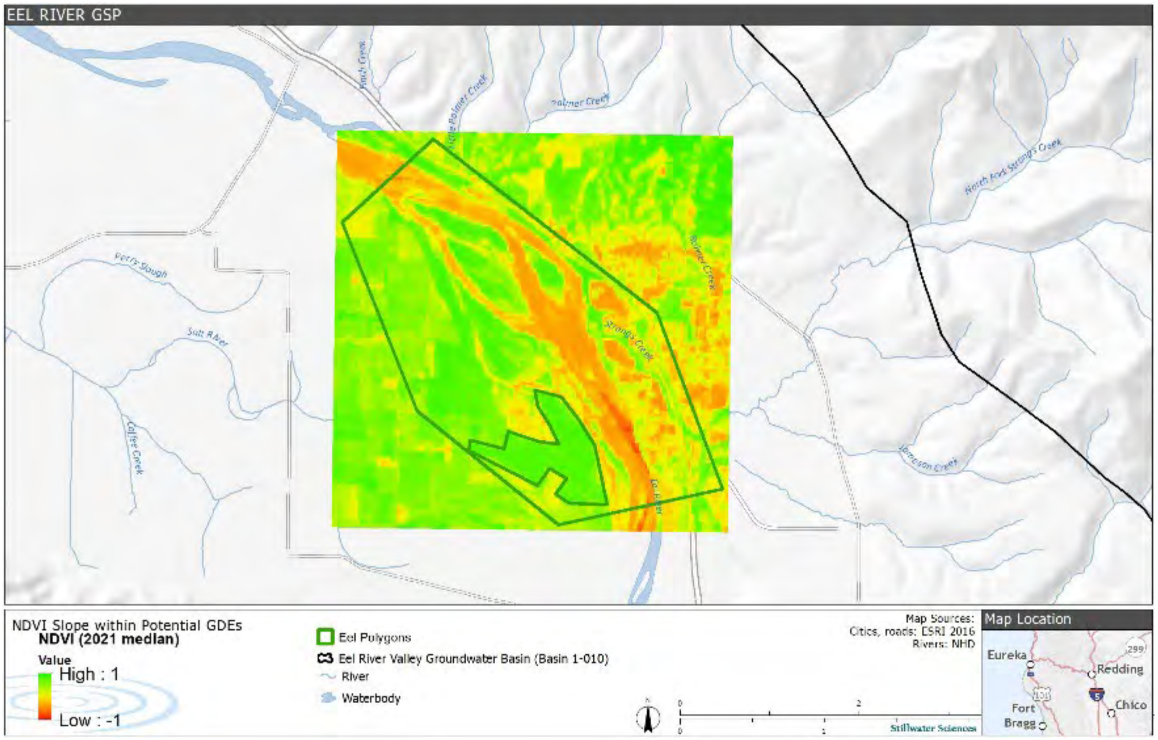


*Figure 5. Median summer 2021 NDVI near Fortuna, CA. The smaller polygon outlines the potential GDE discussed in the CDFW comments.*

<u>Comment #9 (page 9)</u>: The commenter noted that the draft GSP did not include discussion of minimum thresholds and measurable objectives for groundwater storage (SMC #2).

Response: The GSP was revised to include a discussion of the minimum thresholds and measurable objectives for this SMC.

<u>Comment #10 (page 10)</u>: The commenter requested more expansive studies regarding fish passage, habitat connectivity, and optimum flows for all life stages of anadromous fish in the basin.

Response: The requested studies are outside the scope of the GSA's responsibilities under SGMA. The commenter did not present evidence that groundwater pumping is causing adverse impacts to fisheries.

<u>Comment #11 (page 10)</u>: The commenter recommended that minimum thresholds should be based on the minimum groundwater levels measured in continuous monitoring devices rather than point-in-time measurements.

Response: The GSA plans to operate continuous monitoring devices within the County monitoring wells (Section 7 in the GSP).

<u>Comment #12 (page 11)</u>: The commenter noted that the draft GSP did not contain a measurable objective for interconnected surface waters (SMC #6).

Response: The GSP was revised to include a measurable objective for interconnected surface waters.
<u>Comment #13 (page 11)</u>: The commenter noted that certain sections in the draft GSP were incomplete.

Response: These sections have been completed in the final GSP.

Comment #14 (page 11): The commenter noted that the GSP did not include a map identifying state jurisdictional boundaries within the Basin.

Response: Figure 2 in the GSP was revised to depict state jurisdictional boundaries.

**Humboldt County Farm Bureau (Letter dated December 24, 2021)**

Comment #1 (page 1): The commenter stated that farmers within the basin will continue to improve their water use and conservation with the assistance of water-efficient grants and programs. The commenter expressed support for research and data collection and continued interest in working with the Humboldt County GSA.

Response: Comment noted.

**Friends of the Eel River (Letter dated December 24, 2021)**

Comment #1 (page 1): The commenter recommended that the GSP should note that Northern California summer steelhead were listed as endangered under the California Endangered Species Act by the California Fish and Game Commission in 2021.

Response: Technical memorandum TM-3 (Stillwater Sciences, January 2022) was revised to note this fact.

Comment #2 (page 1): The commenter took issue with the significant and unreasonable statement for SMC #6 (depletion of interconnected surface water). The commenter suggested that undesirable results for SMC #6 should be defined as depletion of surface flows such that beneficial uses are impaired.

Response: The GSP provides specific criteria for determining when groundwater conditions cause significant and unreasonable adverse impacts on beneficial uses of the surface water. Revisions to the GSP are not warranted.

Comment #3 (page 1): The commenter requested clarification regarding the components of evapotranspiration.

Response: Section 5 of the GSP and technical memorandum TM-15 (GHD, January 11, 2022) were revised to provide more clarity on evapotranspiration.

Comment #4 (page 2): The commenter recommended considering a scenario of three feet of sea level rise before 2070.

Response: Technical memorandum TM-5 (GHD, January 25, 2022) was revised to evaluate seawater intrusion under a modeling scenario with three feet of sea level rise.

Comment #5 (page 2): The commenter requested additional information regarding agricultural wells.

Response: Technical memorandum TM-1 (Humboldt County, Oct. 19, 2021) provides sufficient information regarding agricultural wells to estimate agricultural groundwater use.

Comment #6 (page 2): The commenter requested that discussion of historical groundwater levels in CASGEM wells should include description of outlier numbers as well as broader trends.

Response: Figure 17 of the GSP provides graphs of the historical CASGEM data for readers to observe both outliers and broader trends.

Comment #7 (page 2): The commenter requested further information on Humboldt County's well permitting process.

Response: The existing well permitting process is described in Section 2.11 of the GSP. Studies to support development of new criteria for permitting new wells are currently in progress by the Humboldt County Building and Planning Department and Environmental Health Division.

Comment #8 (page 2-3): The commenter noted that over the last 30 years, the last 15-year period had more dry water years than the first 15-year period.

Response: Section 5.2 of the GSP was revised to include a statement regarding this observation.

Comment #9 (page 3): The commenter requested data and analysis regarding precipitation and temperature changes in the inland portions of the Eel River watershed.

Response: No changes were determined to be warranted.

**Ronald Vevoda (Letter dated December 24, 2021)**

Comment #1 (page 1): The commenter stated that dairy farmers in the Eel River Valley strive to become more efficient every year with water use and use available information and research to inform decisions with water usage. The commenter expressed interest in further research, data, and findings through implementation of the GSP.

Response: Comment noted.

**Wiyot Tribe (Letter dated December 23, 2021)**

Comment #1 (page 1): The commenter stated that minimum thresholds should consider the importance of groundwater seepage for thermal refugia (patches of cool water) for culturally important fishes.

Response: Thermal refugia are important for cold-water fisheries and groundwater seepage is likely important for helping to maintain cooler water temperatures in certain reaches of interconnected surface waters within the Basin. The Humboldt County GSA is not aware of any data or evidence suggesting that groundwater pumping is causing adverse impacts on the temperature of interconnected surface waters. The GSA created a hydrologic model to simulate the flow of water between the aquifer and the Eel and Van Duzen River and support development of the GSP. Hydrologic modeling (Tables 8-14 in GHD, 2022a) indicated that groundwater pumping under current conditions would reduce flows in the Eel River an average of 1-2% and maximum of 9-12% during September through November. The modeled percent difference in flows with and without pumping during July and August had a comparable magnitude to the September through November period (Attachment A in GHD, 2022a). Based on these relatively small magnitudes, the effects of pumping on water temperature within the Eel River are not expected to be significant.

Comment #2 (page 1): The commenter expressed concern that the description of some undesirable results requires exceedance of minimum thresholds for two sequential years.

Response: Short-term fluctuations in groundwater levels are possible even while average or long-term conditions are stable. Some of the definitions of undesirable results include a provision for minimum thresholds to be exceeded for two sequential years to avoid premature response to temporary fluctuations (or a "false positive" if one data point is flagged based on data quality standards). This provision triggers action at the point when it's more likely that a real trend may be developing.

Comment #3 (page 1): The commenter requested clarification regarding the Humboldt County GSA's response if one of the scenarios for undesirable results under SMC #6 occurs.

Response: The sustainability indicator for SMC #6 involves beneficial uses of interconnected surface waters. If minimum thresholds are exceeded as defined in the GSP, one response would be to evaluate if there is additional evidence of significant and unreasonable impacts to the beneficial uses. The results of this evaluation would assist in planning for effective actions to mitigate any impacts where groundwater pumping is a contributing factor. Another response would be to evaluate whether reasonable reductions or limitations in groundwater pumping could avoid these effects without jeopardizing other beneficial uses of groundwater. This evaluation is important because the intent of SGMA and the mandate for the GSA is to manage groundwater resources for multiple benefits. The likelihood of being effective in avoiding significant unreasonable impacts to the beneficial uses of interconnected surface water by reducing groundwater pumping would need to be weighed along with the likelihood and severity of adverse impacts on other groundwater users.

**National Marine Fisheries Service (Letter dated December 20, 2021)**

Comment #1 (page1-2): The commenter stated that the suggestion in the GSP that the sustainability goal is currently being met is unfounded because it contradicts DWR's assignment of a medium priority to the Basin.

Response: A basin's priority level is independent from whether the basin is being managed sustainably. DWR designates four priority levels (high, medium, low, and very-low) for groundwater basins based on eight criteria (Water Code Section 10933) addressing the relative importance of groundwater as a water supply source and the potential for adverse effects from groundwater use. Designation as a high- or medium-priority basin does not imply or signify that groundwater resources are being managed unsustainably. Rather, these designations signify that the basins warrant a formal level of assessment and management based on DWR's scoring system. Sustainability is determined separately, based on the presence or absence of undesirable results associated with the six sustainability indicators defined in SGMA. The GSP was revised (Section 1.1) to further explain this distinction.

Comment #2 (page 2): The commenter cites DWR's Sustainable Management Criteria Best Management Practice (DWR, 2017) and asserts that a GSP must demonstrate and provide evidence that the effect of each undesirable result does not exist and cannot occur if the GSP claims that the basin is currently being managed sustainably.

Response: The commenter's assertion is not consistent with DWR (2017), which states (page 5):

> "The default position for GSAs should be that all six sustainability indicators apply to their basin. If a GSA believes a sustainability indicator is not applicable for their basin, they must provide evidence that the indicator does not exist and could not occur. For example, GSAs in basins not adjacent to the Pacific Ocean, bays, deltas, or inlets may determine that seawater intrusion is not an applicable sustainability indicator, because seawater intrusion does not exist and could not occur."

As evident by the quote in its entirety, this provision guides a GSA's consideration whether a sustainability indicator is applicable within a basin, not whether the basin is being managed sustainably.

Comment #3 (page 2): The commenter requests justification for focusing on fish passage as one of the most sensitive indicators of surface water beneficial uses. The commenter cites a published study (Obedzinski et al, 2018) to support the statement that variations in summer base-flow representing less than a tenth of one cubic foot per second have been shown to influence juvenile coho salmon survival.

The commenter states that the GSP discounts the timing of critical flow conditions in the Eel River, which generally occur during the summer months.

Response: The lower Eel River reaches stressful water temperature levels during the late summer and early fall (Stillwater Sciences, 2021b; Stillwater Sciences, 2022). The potential for juvenile rearing downstream of the Van Duzen mouth is limited. Based on over 20 years of underwater observations conducted in compliance with gravel mining permits, no juvenile coho salmon have ever been observed rearing in the lower Eel or Van Duzen Rivers during the summer and fall (Dennis Halligan, pers. comm.), indicating that the lower Eel is not juvenile coho salmon rearing habitat. The Obedzinski et al. (2018) paper refers to small intermittent streams in the Russian River basin, which provide juvenile coho rearing habitat, and analyzes the amount of flow that might be able to keep pools connected. The findings of this study are not transferrable to the lower Eel River.

Comment #4 (page 2): The commenter states that the Van Duzen River is often dry at its confluence with the Eel River, preventing migration of all life stages and occasionally leading to stranding and mortality of adult Chinook salmon, and identifies this condition as an undesirable result.

Response: SGMA defines undesirable results as effects caused by groundwater conditions occurring throughout the basin. The commenter does not provide data or evidence indicating that groundwater pumping is causing the mouth of the Van Duzen River to go dry. The Van Duzen River delta has been experiencing dry conditions and stranding issues for decades. Results from hydrologic modeling (page 32 in GHD, 2022a) indicated minimal changes in stream flow within the Van Duzen River due to groundwater extraction. Stream flow reductions due to groundwater pumping likely have some effect, as considered in the GSP, but the morphology and sediment dynamics of the delta are likely the major contributing factors to the situation. The National Marine Fisheries Service and California Department of Fish and Wildlife have tried to work with the commercial gravel miners to alleviate this condition in recent years by conducting narrow trench excavations, but the water table appears to be too low to allow for connectivity during most years even after these operations (Dennis Halligan, pers. comm).

Comment #5 (page 2): The commenter noted that the hydrologic model indicated that groundwater pumping could cause in-stream flow reductions up to 14 cfs at location ME-7 in the Eel River during the summer months. The commenter compared this result to the historic minimum flows in the Eel River at the Scotia gage such as September 2014 and concluded that groundwater pumping may be removing a majority of the flow in the Eel River during the summer and early fall, leading to disconnected and dry reaches.

Response: Hydrologic modeling requires careful application and interpretation of results. The hydrologic model was calibrated for a 20-year period (2000-2020) and generates output as a monthly average. The model is appropriately used to characterize the range of interactions between the aquifer and the Eel River over a range of water year types, but interpretation of model outputs for a specific month and year and comparison with gage measurements should be made with caution due to the inherent uncertainty and limitations of the model. Tables 8 through 14 in GHD (2022a) report the maximum, average, and minimum change in flow associated with pumping for September, October, and November during the 20-year model period. These modeling results indicate that groundwater pumping under current conditions would reduce flows in the Eel River an average of 1-2% and maximum of 9-12% during September through November. These results indicate that groundwater pumping is not removing a majority of the flow in the Eel River, including during dry and critical water years.

The GSP uses an integrated approach of considering modeling results in conjunction with empirical data and other technical analysis to understand the effects of groundwater conditions and evaluate whether undesirable results are present. Modeling provides insight based on a simplified conceptualization of the natural system and should be complemented with geologic and hydrologic interpretation of geomorphic conditions. SHN (2022) analyzes surface flow and water level measurements to assess the patterns of water flow in the Eel River corridor between the confluence with the Van Duzen River and the tidal reach. SHN (2022) notes that channel morphology plays an important role in groundwater/surface water interactions. Underflow (shallow water flowing within the porous sediment below the channel) is a significant component of the flow system, especially due to the step-like longitudinal profile of the channel. Natural groundwater elevations and the dominant flow pattern from east to west are a primary factor for the Eel River having losing stream conditions on the left bank during the summer.

Based on the technical analysis in GHD (2022a) and consideration of all the study results, the GSP (Section 6.11) utilizes the modeling results in conjunction with empirical data (rating curves) to develop appropriate minimum thresholds for SMC #6.

Comment #6 (pages 2-3): The commenter asserted that "unreasonable conditions" are already occurring within the Eel River and Van Duzen River and linked these conditions with "the historic impacts of groundwater use."

Response: The technical studies commissioned for this GSP do not support the conclusion that groundwater use is causing significant and unreasonable impacts on beneficial uses of interconnected surface waters. The commenter appears to be referring to general habitat conditions not caused by groundwater conditions or making predetermined conclusions without full consideration of the evidence.

Comment #7 (page 3): The commenter makes two conservation recommendations to minimize adverse and unreasonable effects to essential fish habitat pursuant to Section 305(b) of the Magnuson Stevens Fishery Conservation and Management Act (MSA). The first recommendation is for the GSP to address "the already significant and unreasonable reductions in surface flow in the Eel and Van Duzen Rivers during the most sensitive summer and fall months." The second recommendation is for the GSP to limit groundwater use to no more than 100% of baseline usage and ensure that there is no more than a 0.1-foot reduction in surface waters at any point during the water year.

Response: Section 305(b) of the MSA authorizes the National Marine Fisheries Service to make recommendations to state agencies. As discussed in previous responses, the best available science and information do not support the commenter's presumption that groundwater pumping is directly causing, or is even a primary contributing factor, in the conditions cited in the commenter's letter (i.e., the Van Duzen River confluence being dry, the Eel River going dry, disease outbreaks, stranding mortality events for Chinook salmon). The commenter's claims and recommendations are not supported by compelling evidence.

**The Nature Conservancy, Audubon California, Local Government Commission, Union of Concerned Scientists, Clean Water Action/Clean Water Fund (Letter dated December 20, 2021)**

Comment #1: The commenter transmitted documents with information regarding the availability of databases, references, and mapping tools.

Response: Comment noted.

Comment #2 (pages 3-4): The commenter made comments about the depiction of tribes, disadvantaged communities, and interconnected surface waters on maps in the GSP.

Response: The figures of the GSP were revised based on these comments.

Comment #3 (pages 4-5): The commenter made specific critiques about the analysis of GDEs.

Response: None of the vegetation polygons were removed because they received precipitation inputs or shallow subsurface flows. Rather, polygons that were semi-permanently inundated were reclassified as river, stream, or canal but still maintained as GDEs. Some areas mapped as Typha by Calveg were reclassified based on aerial photographic review (coupled with the consultant's knowledge of the sites) indicating that the areas are actually intertidal mudflat. Tidally connected vegetated polygons were removed mostly in areas where the GDE classification differed based on the data source (NWI versus Calveg), particularly for areas where aerial photographs suggested the vegetation was pickleweed. Pickleweed is not a phreatophyte and does not indicate a connection to groundwater. The GSA is aware that GDEs can rely on a variety of water sources and used this knowledge as the basis for our analysis. Redwood vegetation types were removed based on landform, particularly for areas where investigation suggested the landform (e.g., hillslope, strath terrace) was elevated above the channel and likely leads to a disconnect between the groundwater table and the shallow-rooted trees. Stillwater Sciences revised their technical memorandum (Assessment of Groundwater Dependent Ecosystems for the Eel River Valley Basin Groundwater Sustainability Plan) to clarify their methods.

<u>Additional Comments (pages 6-13)</u>: The commenter critiqued stakeholder engagement during GSP development; consideration of beneficial uses and users when establishing sustainable management criteria and analyzing impacts on beneficial uses and users; integration of climate change; and addressing beneficial users in projects and management actions.

Response: The comments were reviewed and considered as the draft GSP was revised and finalized.

**Pacific Coast Federation of Fishermen's Associations (Letter dated January 4, 2022)**

<u>Comments</u>: The commenter expressed support for the recommendations in the commenter letters from National Marine Fisheries Service and the Wiyot Tribe, and for a watershed-based conservation approach.

Response: Section 8 of the GSP was revised to identify the benefits of a watershed-based approach for actions to enhance surface water flows entering the Basin.