

Groundwater Conditions Update

Tracy Subbasin

May 2018



Prepared for

Contra Costa County Agencies:

City of Antioch, City of Brentwood, Byron-Bethany Irrigation District, Contra Costa County, Contra Costa Water District, Diablo Water District, Discovery Bay CSD, East Contra Costa Irrigation District

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1 INTRODUCTION

A proposed boundary modification to the Tracy Subbasin has been submitted to the California Department of Water Resources (DWR). The following report has been developed to provide a recent summary of groundwater conditions in the Tracy Subbasin. The basin boundary modification is based on jurisdictional grounds and involves a subdivision of the Tracy Subbasin. The jurisdictional subdivision would create a separate subbasin that comprises the portion of the Tracy Subbasin that lies within Contra Costa County. The proposed modifications are consistent with current DWR Bulletin 118 basin boundaries, involving both hydrologic surface water features and political county lines. The new hydrologic boundary would be Old River (instead of the San Joaquin River) and the new political boundary would be the Alameda County Line replacing the Stanislaus County line.

The following report includes a brief review of the hydrogeology and an update to groundwater conditions in the entire Tracy Subbasin with regards to groundwater levels and groundwater quality.

2 HYDROGEOLOGY

The Tracy Subbasin is a 539-square mile groundwater subbasin that includes the northwestern most portion of the San Joaquin Valley Groundwater Basin around the Sacramento-San Joaquin Delta and extends south into the central portion of the San Joaquin Valley. The extent of the Tracy Subbasin is defined by the areal extent of unconsolidated to semi-consolidated sedimentary deposits that are bounded by the Diablo Range on the west; the Mokelumne and San Joaquin Rivers on the north; the San Joaquin River to the east; and the San Joaquin-Stanislaus County border on the south (DWR, 2006). In the greater Tracy Subbasin area, water bearing formations include the Tulare Formation, Older Alluvium, Flood Basin Deposits, and Younger Alluvium (DWR, 2006). These continental deposits of Late Tertiary to Quaternary age have a cumulative thickness of a few hundred feet near the Coast Range foothills on the west to about 3,000 feet thick along the eastern margin of the basin. The Corcoran Clay, a laterally continuous fine-grained lacustrine deposit, occurs near the top of the Tulare Formation and confines the underlying fresh water deposits. The eastern extent of the Corcoran Clay stretches nearly as far east as the eastern basin boundary and the northern extent is near the City of Tracy.

A recent evaluation of geological conditions in East Contra Costa County (LSCE, 2016) details the various geological formations present, and discusses the groundwater hydrology in the northwestern San Joaquin Valley area. Prior to this 2016 effort, the groundwater hydrology of this area was relatively poorly known since groundwater usage is limited to eastern Contra Costa County and the Tracy area to the south and because surface water is the main source of irrigation use within the delta islands. Fresh groundwater aquifers are limited to relatively shallow depths of 500 to 700 feet in the Contra Costa County area and to 1,600 feet in the Tracy area. The 2016 report focuses on the uppermost 500 feet in which most water wells were completed in the eastern Contra Costa County study area (LSCE, 2016). A dataset of over 500 well logs was utilized to assess sand bed characteristics and their extent to develop a depositional facies model. Facies in the area include fluvial plains, delta islands, marginal delta dunes,

and alluvial plain areas. One of the main findings of this evaluation was the absence of the Corcoran Clay in the Contra Costa County area, which reflects a major distinction in the hydrogeology across the Tracy Subbasin that is recognized locally and should be reflected in the development of groundwater conceptualizations.

Four reports are provided to support the hydrogeologic conceptual model. **Attachment I-b**, referred to above, provides a detailed analysis of the geology in the Tracy Subbasin, using geophysical and stratigraphic interpretations. **Attachment I-c**, the Diablo Water District Groundwater Management Plan (2007), contains a summary of water supplies and descriptions of the geology and hydrogeology in East Contra Costa County. Further descriptions of the hydrogeology of the East Contra Costa County are provided in **Attachment I-d** and **Attachment I-e**, the Diablo Water District's Groundwater Monitoring Report (2011) and the Investigation of Ground-Water Resources in the East Contra Costa Area (1999). **Attachment I-f**.

3 GROUNDWATER LEVELS

Groundwater level data were available from the Town of Discovery Bay, Diablo Water District, DWR Water Data Library (WDL) and California Statewide Groundwater Elevation Monitoring (CASGEM), and the U.S. Geological Survey (USGS) National Water Information System (NWIS). Contour maps of equal groundwater elevation and representative long-term hydrographs are presented in this section.

3.1. Groundwater Elevation Contours

Five maps showing recent groundwater elevation contours are produced for this memorandum. DWR publishes water level contour data for the Central Valley via their Groundwater Information Center Interactive Map Application (GICIMA¹). These geospatial datasets are presented in **Figures WLC-1** through **WLC-5** for Spring 2015, Fall 2015, Spring 2016, Fall 2016, and Spring 2017. DWR contours of equal groundwater elevation cover only the southernmost portion of the Tracy Subbasin in Spring 2015. Contour data are available in the East Contra Costa County area (near Byron, Discovery Bay, Brentwood, eastern Oakley, and north toward Bethel Island) in addition to the area south of Tracy for the other four time periods. Most of the Tracy Subbasin does not have groundwater level contour coverage for the delta islands and the area to the north of Tracy.

Groundwater elevations in Spring 2015 (**Figure WLC-1**) suggest groundwater flows from the south to the northwest and northeast. A groundwater level depression exists on the southeast corner of the Tracy Subbasin during Spring 2015. In Fall 2015 (**Figure WLC-2**), the groundwater contour lines provided by DWR extend farther to the north on the west side of the city of Tracy in the southern portion of the subbasin. Groundwater in Fall 2015 also exhibits a depression in the southeast corner of the subbasin, and an additional depression appears in the southwestern corner of the city of Tracy, in which

¹ https://gis.water.ca.gov/app/gicima/#bookmark_GroundwaterElevation, accessed 2/27/2018

groundwater appears to flow southeast from the northwest of Tracy and flows northwest from south of Tracy. In the Brentwood area to the north, there appears to be a groundwater depression in the vicinity of the western edge of the Town of Discovery Bay. Groundwater flows from the northeast southward toward the depression; groundwater in the western edge of the northern portion of the subbasin (near Byron) flows to the northeast toward the depression. Groundwater levels in Spring 2016 (**Figure WLC-3**) exhibit similar trends as previous time periods. A groundwater high exists in the area of Vernalis Road in the south with groundwater flowing to the northeast and northwest; in the Brentwood area groundwater flows again toward the depression in the western Discovery Bay area. Groundwater levels in Fall 2016 (**Figure WLC-4**) follow the same trends as Fall 2015, with the high groundwater elevations existing in the Vernalis Rd area in the southern part of the subbasin. Two groundwater depressions occur in the southwestern corner of the city of Tracy and to the east; and one groundwater depression occurs in the western portion of Discovery Bay. Groundwater level contours for Spring 2017 (**Figure WLC-5**) are similar to Spring 2016 trends in the Brentwood area in the northwestern part of the subbasin, but contour data are lacking in the southern city of Tracy area, with only the high groundwater elevations at Vernalis Rd and the depression on the southeastern edge still present.

3.2. Long-Term Groundwater Level Hydrographs

Wells with groundwater level data in the Tracy Subbasin are illustrated in **Figure WL-1**. Long-term hydrographs are described in this section to provide an understanding of long-term groundwater trends throughout the Tracy Subbasin. Representative hydrographs are provided for wells that are labeled in **Figure WL-1**.

3.2.1. East Contra Costa County Area

Two monitoring wells have water level data from Diablo Water District (Creekside MW and Glen Park MW, **Figures WL-2** and **WL-3**) and are located in the northwestern portion of the Tracy Subbasin. These two wells are completed in the “Deep Aquifer”, as defined by their depth being below 200 feet. Groundwater levels, available from about 2004 to 2017 from these two wells, exhibit seasonal trends with fluctuations of around 15 to 25 feet from spring to summer. Groundwater levels in this area remain stable despite dry hydrologic conditions; notably, groundwater levels have risen by at least 7 feet since 2015.

Toward the southeastern portion of the East Contra Costa County area of the Tracy Subbasin, five wells from the Town of Discovery Bay have groundwater level data from 1988 to 2017 (**Figure WL-4**). These wells are also completed in the “Deep Aquifer”. Seasonal trends in these wells exhibit about 20 feet of seasonal fluctuation from spring to summer. Spring groundwater levels in the late 1980s and early 1990s were near to sea level despite many years of dry hydrologic conditions. Groundwater levels declined and remained stable from the late 1990s to the early 2000s. Groundwater levels dropped again in 2005, and started recovering and rising again to the mid-2010s, despite increased annual pumping during the beginning of that recovery period. Annual production (also seen in **Figure WL-4**) increased steadily from

1987 to 2008 and remained stable and slightly declined from about 2008 to 2015. Water levels remained fairly stable from 2010 to 2017.

Two additional wells with groundwater level data are located near the southwestern edge of the East Contra Costa County area of the Tracy Subbasin (USGS: 375106121372201 (001S003E15A001M) and 375228121382001 (001S003E03M001M); **Figures WL-5 and WL-6**). These two wells are completed in the “Shallow Aquifer”, occurring above 200 feet (well depths of 45 feet and 180 feet, respectively), and they have water level data from the early 1970s to 2011 and 2004, respectively. Seasonal fluctuations in these two wells are muted (+/- 2 feet of variation) compared to the deeper wells discussed above. Both wells have shallow groundwater levels consistently less than 16 feet from the land surface. The shallower well shows a long-term trend of increasing groundwater levels from 1974 to 1983, then declining until 1991 and rising again until 1998 and declining 10 feet to 2011. In contrast, the deeper well exhibits a relatively stable trend within a set range of variability between 5 to 15 feet from the land surface from 1974 to 2004.

3.2.2. Eastern and Southern Tracy Subbasin Area

Long-term representative hydrographs are available from seven wells that have data from DWR. One well is located in the delta islands area near Upper Jones Tract and Woodward Island (DWR 379163N1215157W001) and has groundwater level data from 1999 to 2014 (**Figure WL-7**). This well is completed to a well depth of 20 feet and represents the unconfined water table in the area. Seasonal fluctuations in this well are typically two feet or less, with water levels remaining relatively stable for its period of record, ranging from 3 feet to less than 7 feet below ground surface.

Two long-term hydrographs are presented for wells on the north side of the city of Tracy (DWR: 377976N1214560W001 and 377813N1214420W001) from the early 1960s to 2017 (**Figures WL-8 and WL-9**, respectively). These wells are completed at 92 and 80 feet below land surface, respectively. The northern well of this pair is located closer to surface water (Old River) and its groundwater levels reflect a relatively stable trend, with the exception of four data points since 2011² (**Figure WL-8**). This well exhibits minor seasonal fluctuations of less than 2 feet between spring and fall measurements. The southern well in this pair (DWR: 377813N1214420W001) is farther from the surface water feature and shows more seasonal fluctuation of about 4 feet from spring to fall measurements (**Figure WL-9**). This well had its highest water level measurement in 1962, followed by a period of slight decline (of about 4

² Water level data in this well changed in late 2011 from being previously monitored and reported by DWR to being measured by the San Joaquin County Flood Control and Water Conservation District. It is possible that these four recent water levels that are tens of feet lower than all other measurements in this well are questionable in status (possibly due to recent or nearby pumping), but no comments were provided with the data to confirm this assumption.

feet) through the early 1970s. Water levels in this well rose from the late 1970s to the mid-1990s, and has been showing a slight decline from 1996 to 2017 of about 6 feet.

DWR well 377538N1215138W001 is located north and west of the city of Tracy, and has a long record of water level data spanning from 1958 to 2017 (**Figure WL-10**). Although this well has an unknown well depth, it is likely another shallow well, with depths to water typically below 10 feet below ground surface. This well exhibits seasonal fluctuations typically less than 2 feet, with a long-term declining trend of about eight feet over its period of record (about 60 years).

Three wells located southeast of the city of Tracy (DWR: 377112N1213611W001, 376974N1213258W001, and 376622N1212916W001) have long-term groundwater level data from the late 1950s to 2017 (**Figures WL-11, 12, and 13**, respectively). The first two aforementioned wells have well depths from 500 feet to 775 feet below ground surface. These two wells exhibit seasonal fluctuations ranging from less than 10 feet to over 40 feet from spring to fall. Both wells show a decline of groundwater levels (around 20 feet) into the early to mid-1970s, followed by a rise in water levels until around 1986 when levels were the highest in the whole record of measurements (about 10 feet below land surface). Groundwater levels exhibited stable levels (from 10 feet to 15 feet below land surface) into 2017. The third and southernmost well in this group (DWR 376622N1212916W001, **Figure WL-13**) is likely completed in unconfined shallower sediments as indicated by its water levels remaining at relatively stable and shallow levels (above 14 feet below ground surface), and due to its seasonal fluctuations being muted compared to the deeper wells nearby (seasonal fluctuations in 376622N1212916W001 are typically less than 2 feet from spring to fall measurements). Throughout most of its historical record from 1959 to 2013, this well has exhibited stable water levels. In the last few years of drought, however, this shallow well has seen declines of over 6 feet between 2013 and 2017.

In summary, most wells show long term stable groundwater levels. The exception to this is recent declines likely due to drought.

4 GROUNDWATER QUALITY

Groundwater quality data in the Tracy Subbasin are available from four main sources: CA State Water Resources Control Board Division of Drinking Water (DDW), DWR, the State Water Board Regulated Facilities Database (Geotracker), and the USGS³. Groundwater quality data from these sources represent water quality samples from 1944 to 2017. According to the DWR Bulletin 118 description of groundwater quality in the Tracy Subbasin (DWR, 2006), areas of elevated chloride, nitrate, and boron occur in parts of the subbasin. Therefore, this groundwater quality summary focuses on the following constituents: chloride, nitrate, boron, and total dissolved solids (TDS). Groundwater quality data are presented spatially and statistically for the 1,366 wells in the Tracy Subbasin with chloride, nitrate,

³ Groundwater quality data retrieved from the online Geotracker GAMA database, <http://geotracker.waterboards.ca.gov/gama/>, accessed 2/22/2018.

boron, and/or TDS data. Maps showing the most recent post-2000 concentration of boron, chloride, nitrate, and TDS are presented and maps showing the maximum measured concentration for each well and constituent are also presented. Groundwater quality summary statistics for boron, chloride, nitrate, and TDS are provided in **Tables 1, 2, and 3** for the Tracy Subbasin, the East Contra Costa County Area, and the Eastern and Southern Tracy Subbasin Area, respectively.

4.1. Boron

Maps that show boron concentrations in wells in the Tracy Subbasin are presented in **Figures WQ-1 and WQ-2**. There are 702 wells in the Tracy Subbasin that have boron measurements; 92 of these wells are located within the East Contra Costa area. **Figure WQ-1** illustrates the most recent boron concentration for wells that have data post-2000. The agricultural water quality goal for boron, 0.7 mg/L, is exceeded in most of the wells across the subbasin with recent measurements after 2000, with the exception of the northeastern subbasin area between Union Island and Medford Island. **Figure WQ-2** shows the highest boron concentrations located along the western margin of the subbasin and around the city of Tracy. Despite the fact that the East Contra Costa area has about 20% of the number of boron measurements compared to the rest of the subbasin, **Tables 2 and 3** suggest that boron concentrations are higher in the East Contra Costa area compared to the Eastern and Southern Tracy Subbasin areas. This is mostly due to the pocket of low boron concentrations in the northwest and the many observation points that are in a northeast trending line around the Trapper Slough area between Upper Jones Tract and Roberts Island. The median and average boron concentrations throughout the Tracy Subbasin are above the agricultural water quality goal of 0.7 mg/L.

4.2. Chloride

Chloride concentrations are shown in **Figures WQ-3 and WQ-4** for the most recent post-2000 chloride concentration and the maximum measured chloride concentration for wells in the Tracy Subbasin, respectively. There are 993 wells in the Tracy Subbasin with chloride data; 217 of these wells are located in the East Contra Costa area. The California secondary maximum contaminant level (MCL) for chloride is 250 mg/L, which is exceeded mostly near the boundaries of the subbasin (along the western side of the subbasin, in the south near the city of Tracy, and along the eastern boundary of the subbasin, the San Joaquin River), but chloride also sporadically exceeds the MCL throughout the subbasin. Despite having a smaller dataset (number of wells and total measurements), the chloride concentration range, median, average, and standard deviation in the East Contra Costa area are similar to the Eastern and Southern Tracy Subbasin areas (**Tables 1 through 3**). Median values are generally below the secondary MCL, and average values are above the MCL.

4.3. Nitrate

Maps showing the most recent nitrate value in wells with data post-2000 and the maximum measured nitrate concentration are presented in **Figures WQ-5 and WQ-6**. There are 874 wells in the Tracy

Subbasin with nitrate data; 235 of these wells are located in the East Contra Costa area. Many wells with recent data exhibit non-detectable levels of nitrate in the central portion of the Tracy Subbasin. Recent exceedances of the California primary MCL of 10 mg/L for nitrate as N concentrations exist in the city of Tracy area, and the western and southwestern portion of the East Contra Costa area. Maximum nitrate concentrations exceed the MCL in the same areas and also in the eastern portion of the subbasin. The nitrate concentrations overall are relatively similar between the East Contra Costa area and the Eastern and Southern subbasin areas (**Tables 1 through 3**), with median and average concentrations below the MCL.

4.4. Total Dissolved Solids

Maps showing the most recent post-2000 and maximum TDS concentrations are presented in **Figures WQ-7 and WQ-8**. There are 708 wells in the Tracy Subbasin with TDS measurements; 168 of these wells are located in the East Contra Costa area. Many recent post-2000 TDS measurements in the city of Tracy area and near the north and northwest borders of the Tracy Subbasin have exceeded the secondary MCL of 500 mg/L (**Figure WQ-7**). The map that shows the maximum measured TDS concentration in each well with data (**Figure WQ-8**) shows areas of high TDS occurring in the vicinity of the city of Tracy, along the western border of the Subbasin, and some wells located on the west side of the San Joaquin River on the east side of the Subbasin. The median and average TDS concentrations are similar in the East Contra Costa area and the Eastern and Southern areas, both areas have TDS concentrations that exceed the secondary MCL of 500 mg/L and reflect the overall statistics for the Tracy Subbasin (**Tables 1 through 3**).

5 SUBSIDENCE

Land subsidence is a documented issue in parts of California and the Central Valley. In particular, land subsidence due to groundwater pumping is of major concern, especially during periods of drought or dry years when the aquifers are being stressed more than usual. Land subsidence activity can be measured and monitored, usually with continuous global positioning systems (Continuous GPS, or CGPS), extensometers (which allow measurements of vertical movement of particular depths of the subsurface), and InSAR data (Interferometric Synthetic Aperture Radar compares the height of the land surface as measured from satellite imagery taken at different time snapshots). The following discussion on subsidence in the Tracy Subbasin includes data from three CGPS stations and one InSAR location, as there are no extensometers in or near the Tracy Subbasin. **Figure S-1** shows the location of three CGPS stations in or near the Tracy Subbasin, as well as time-series plots showing the vertical displacement (movement) of the land surface at those locations. One CGPS station, P256, is located in the East Contra Costa area, near the Town of Discovery Bay.

5.1. CGPS Station P256

The CGPS Station P256, station name “FallmanPropCN2005”, is located in East Contra Costa County, close to the Town of Discovery Bay. This station has data since March 2005. The time-series plot of

vertical land surface displacement shows a slight decline in the land surface elevation from 2005 to 2011, followed by a period of recovery until late 2015. From 2015 to early 2017, the land surface slightly declined and then became stable. It is difficult to depict any seasonal trends in the time-series at this site. A linear trend line fit to the station's land surface displacement values yields an approximation of the rate of ground surface change over the period of record. Over the last 13 years of available record, land subsidence occurred at a very slow rate of 0.00047 feet/year, indicating an overall total subsidence of approximately 0.00618 feet. **Table S-1** below summarizes the land surface elevation change for this station and the two other stations in or near the Tracy Subbasin.

5.2. CGPS Station P257

The CGPS Station P257, station name "TomPainSlgCN2005", is located in northwest Tracy. This station started recording in November 2005. The time-series plot of vertical land surface displacement shows mostly stable conditions. It is difficult to depict any seasonal trends in the timeseries at this site. A linear trend line fit to the station's land surface displacement values yields an approximation of the rate of ground surface change over the period of record. Over the last 12.5 years of available record, the land surface actually shows a slight rate of increase (0.000785 feet/year), resulting in an overall total change in land surface elevation of approximately 0.00984 feet.

5.3. CGPS Station 255

The CGPS Station P255, station name "ArkansaCrkCN2006", is located south of the Tracy Subbasin border, in Westley, Stanislaus County. This station started recording in April 2006. The time-series plot of vertical land surface displacement shows stable to slightly increasing conditions. Seasonal fluctuations can be detected exhibiting higher land surface elevations occurring in fall followed by lower land surface elevations in the spring. A linear trend line fit to the station's land surface displacement values yields an approximation of the rate of ground surface change over the period of record. Over the last 12.2 years of available record, the land surface shows a slight rate of increase (0.002409 feet/year), resulting in an overall total change in land surface elevation of approximately 0.0293 feet.

5.4. InSAR Near Tracy, CA

The USGS has published InSAR timeseries data for various locations within the Central Valley, including one in Tracy (**Figure S-1**)⁴. Data for this location show stable conditions with minimal elevation changes over its period of record consisting of eight measurements between December 2007 and July 2010.

⁴ https://ca.water.usgs.gov/land_subsidence/central-valley_insar-timeseries.xlsx

6 SUMMARY

Groundwater level data are available from local, statewide, and nationwide sources. Groundwater elevation contours and long-term hydrographs indicate that the East Contra Costa area of the Tracy Subbasin is a full and stable basin. Groundwater quality data from state and federal sources show that there are pockets of elevated boron, especially in the East Contra Costa area of the subbasin, relatively low chloride concentrations but some exceedances of the secondary MCL, and occurrences of elevated nitrate and TDS concentrations throughout the Tracy Subbasin. According to available CGPS data from three stations and one InSAR location, land subsidence in the East Contra Costa area as well as the Tracy Subbasin is not an issue. Time-series plots of land surface displacement indicate generally stable conditions, with minor seasonal fluctuations where detectable.

7 REFERENCES

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Tables

Table 1: Groundwater Quality Statistics, Tracy Subbasin

Chemical (units)	Date Range	Number of Wells					Number of Measurements	Concentration			
		DDW	DWR	Geotr	USGS	Total		Range	Median	Average	St Dev
Boron (mg/L)	1945- 2017	42	456	14	190	702	1,974	ND-82	1.07	1.49	2.84
Chloride (mg/L)	1944- 2017	78	483	225	207	993	4,384	ND-4,900	180	273	325
Nitrate (mg/L as N)	1944- 2017	153	289	295	137	874	6,069	ND-1,400 ⁵	2.5	5.0	19.1
TDS (mg/L)	1944- 2017	76	203	286	143	708	3,291	ND-20,400	890	1,141	1,029

Table 2: Groundwater Quality Statistics, East Contra Costa Area of the Tracy Subbasin

Chemical (units)	Date Range	Number of Wells					Number of Measurements	Concentration			
		DDW	DWR	Geotr	USGS	Total		Range	Median	Average	St Dev
Boron (mg/L)	1957- 2017	9	62	0	21	92	335	ND - 82	1.70	2.70	6.07
Chloride (mg/L)	1957- 2017	34	65	80	38	217	1,197	ND - 4,900	181.5	255.70	340.14
Nitrate (mg/L as N)	1957- 2017	68	21	125	21	235	1,864	ND - 1,400 ⁶	1.3	4.95	33.01
TDS (mg/L)	1957- 2017	34	44	69	21	168	707	ND - 20,400	891	1,129	1,529

⁵ The highest value of 1,400 mg/L as N originates from a regulated facility site (SL205032290 W-04) sampled in 2007; samples from 2005 and 2008 from the same well has nitrate concentrations of 32 and 47 mg/L as N respectively.

⁶ The highest value of 1,400 mg/L as N originates from a regulated facility site (SL205032290 W-04) sampled in 2007; samples from 2005 and 2008 from the same well has nitrate concentrations of 32 and 47 mg/L as N respectively.

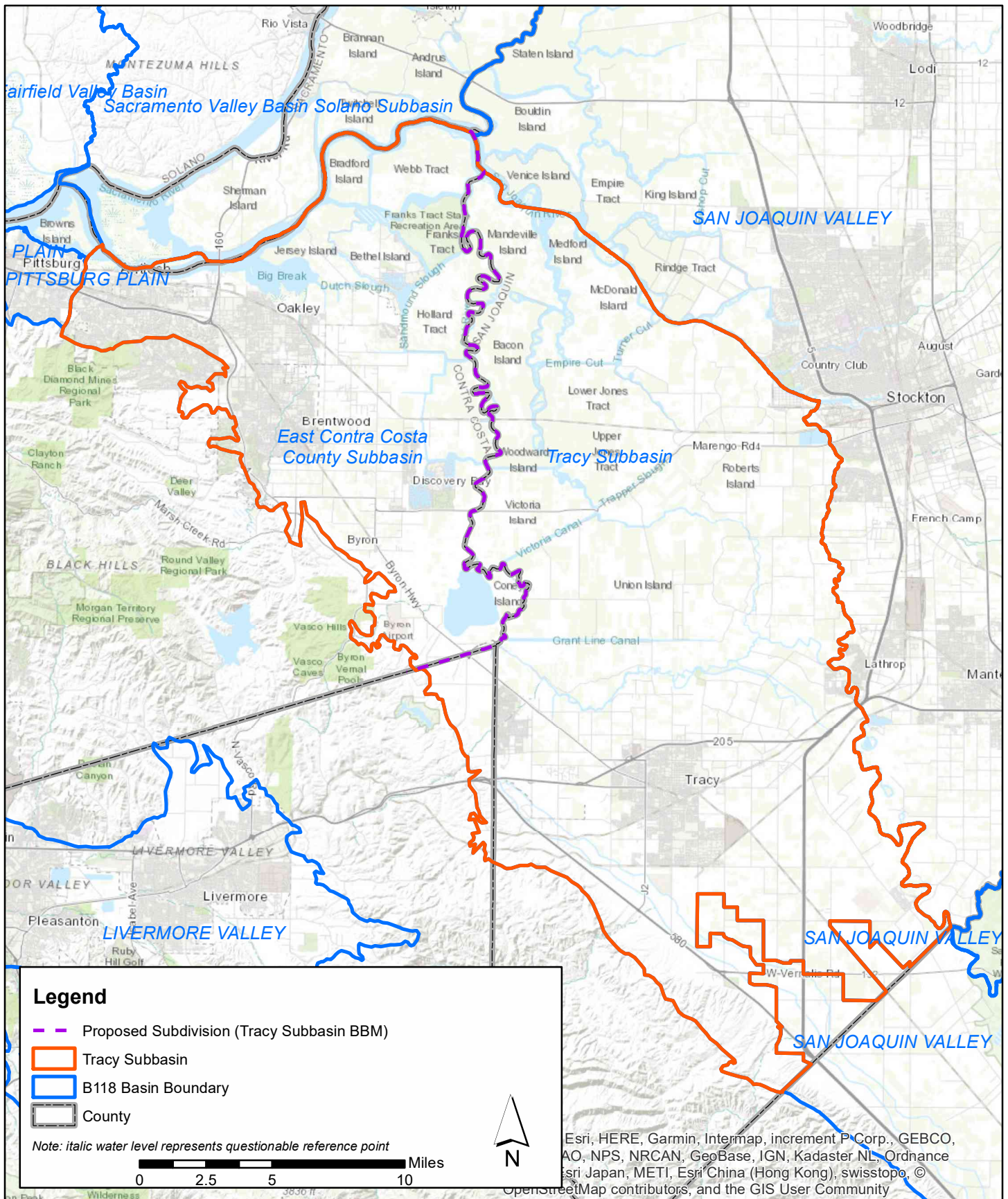
Table 3: Groundwater Quality Statistics, Eastern and Southern Tracy Subbasin Area

Chemical (units)	Date Range	Number of Wells					Number of Measurements	Concentration			
		DDW	DWR	Geotr	USGS	Total		Range	Median	Average	St Dev
Boron (mg/L)	1945- 2017	33	394	14	169	610	1,639	ND - 10	0.93	1.24	1.35
Chloride (mg/L)	1944- 2017	44	418	145	169	776	3,187	ND - 2,600	180	279.65	319.40
Nitrate (mg/L as N)	1944- 2017	85	268	170	116	639	4,205	ND - 100	3.16	5.01	6.50
TDS (mg/L)	1944- 2017	42	159	217	122	540	2,584	ND - 13,100	890	1,144	837

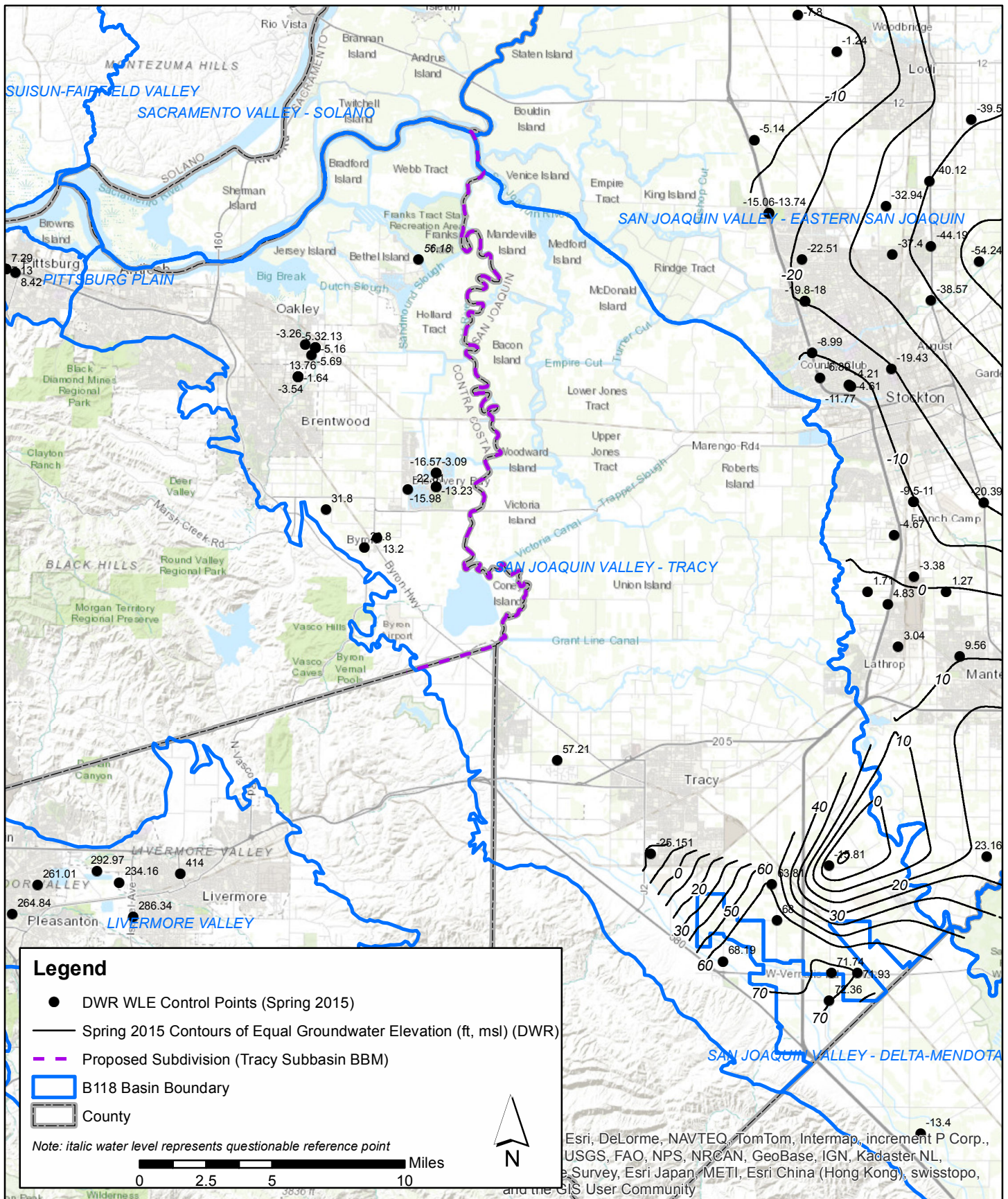
Table 4: Rates of Land Surface Elevation Change for CGPS Stations in the Vicinity of the Tracy Subbasin*

Station ID	Years of Record	Data Date Range	Rate of Land Surface Elevation Change (ft/yr)	Total Vertical Displacement on Record (ft)
P256	13.23	3/17/2005 – 6/5/2018	-0.000467	-0.00618
P257	12.54	11/22/2005 – 6/5/2018	0.000785	0.00984
P255	12.17	4/7/2006 – 6/5/2018	0.002409	0.02932
*Negative numbers indicate land subsidence, or the land surface moving downward; positive numbers indicate rebound, or the land surface moving upward.				

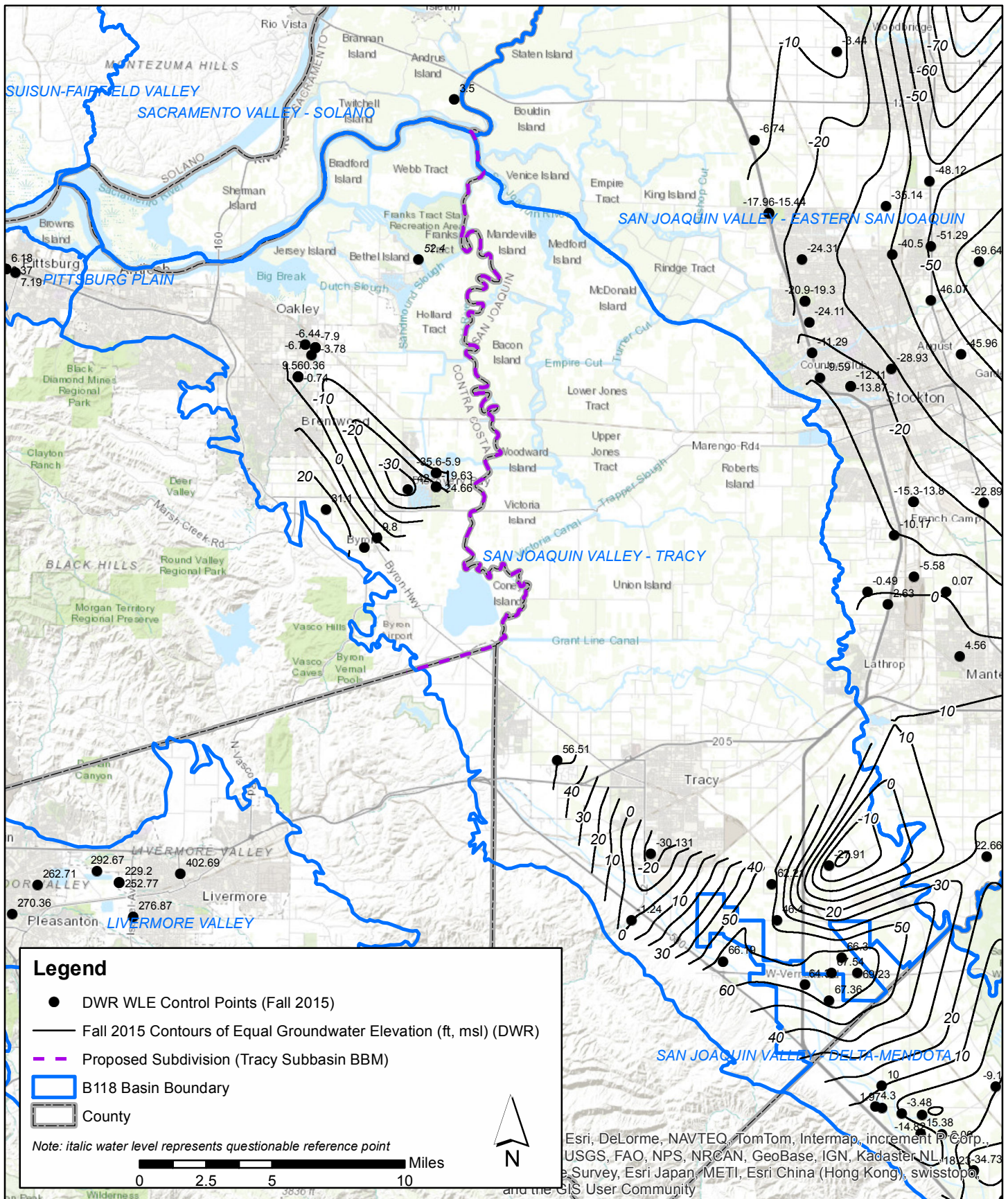
Figures



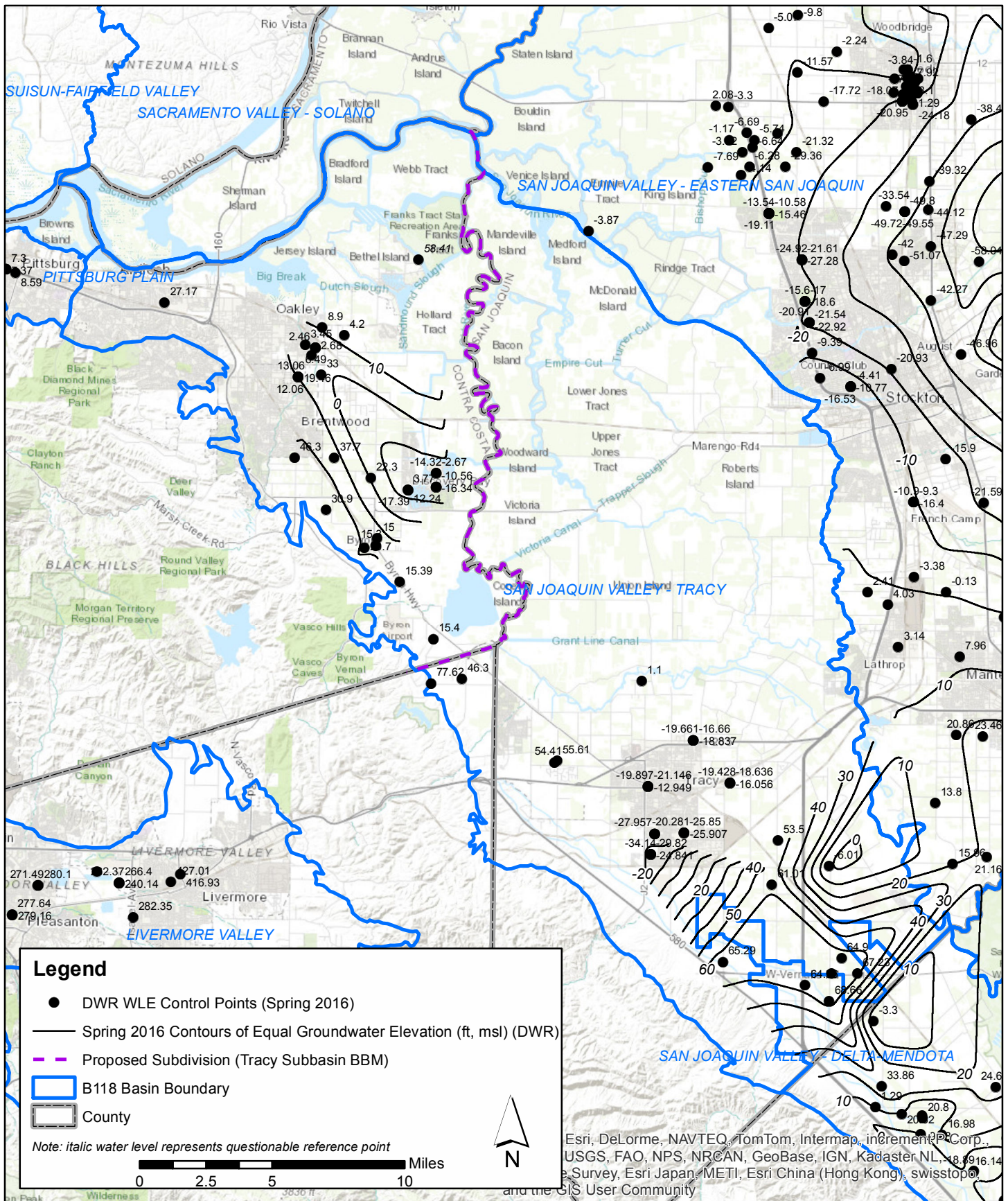
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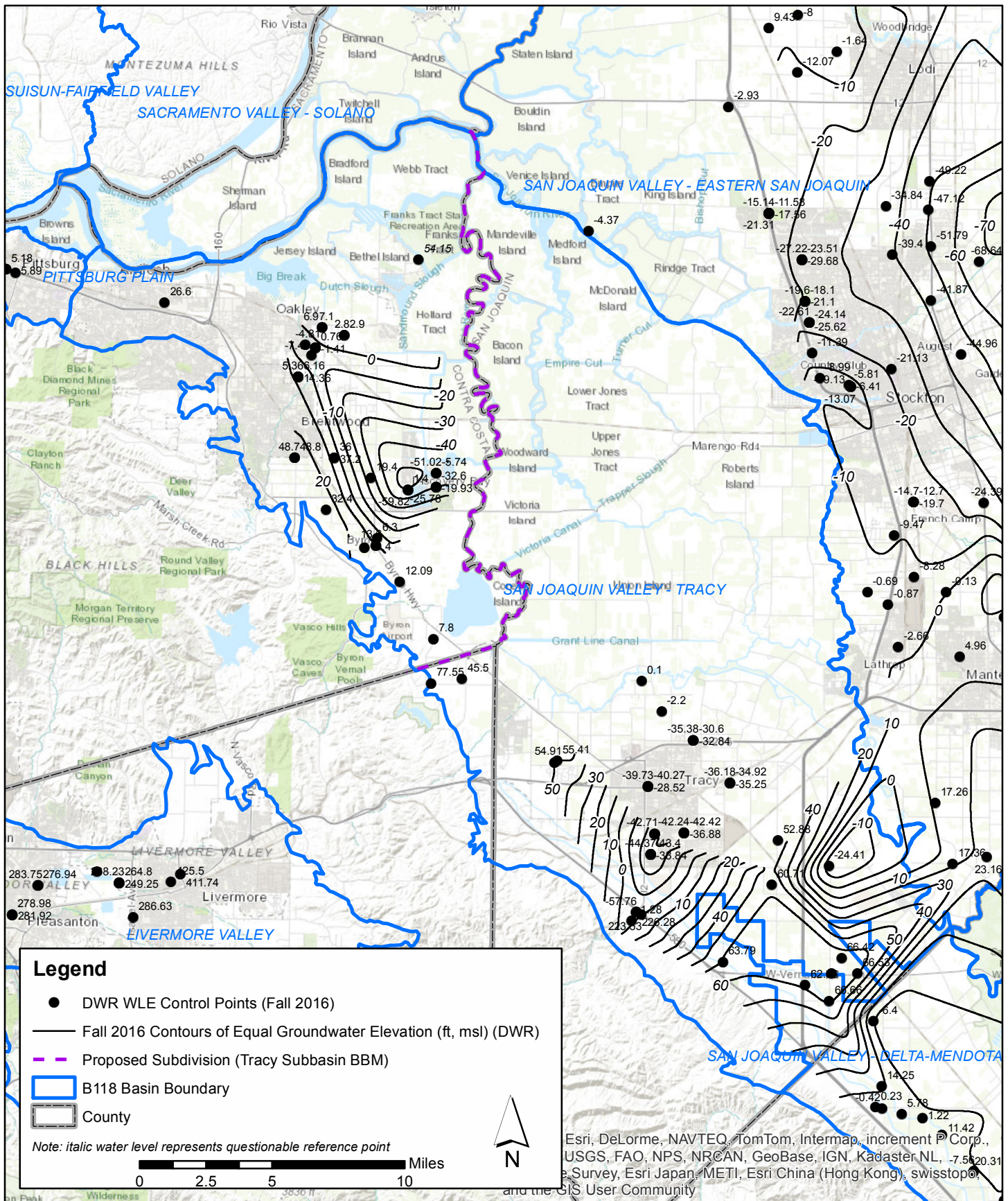
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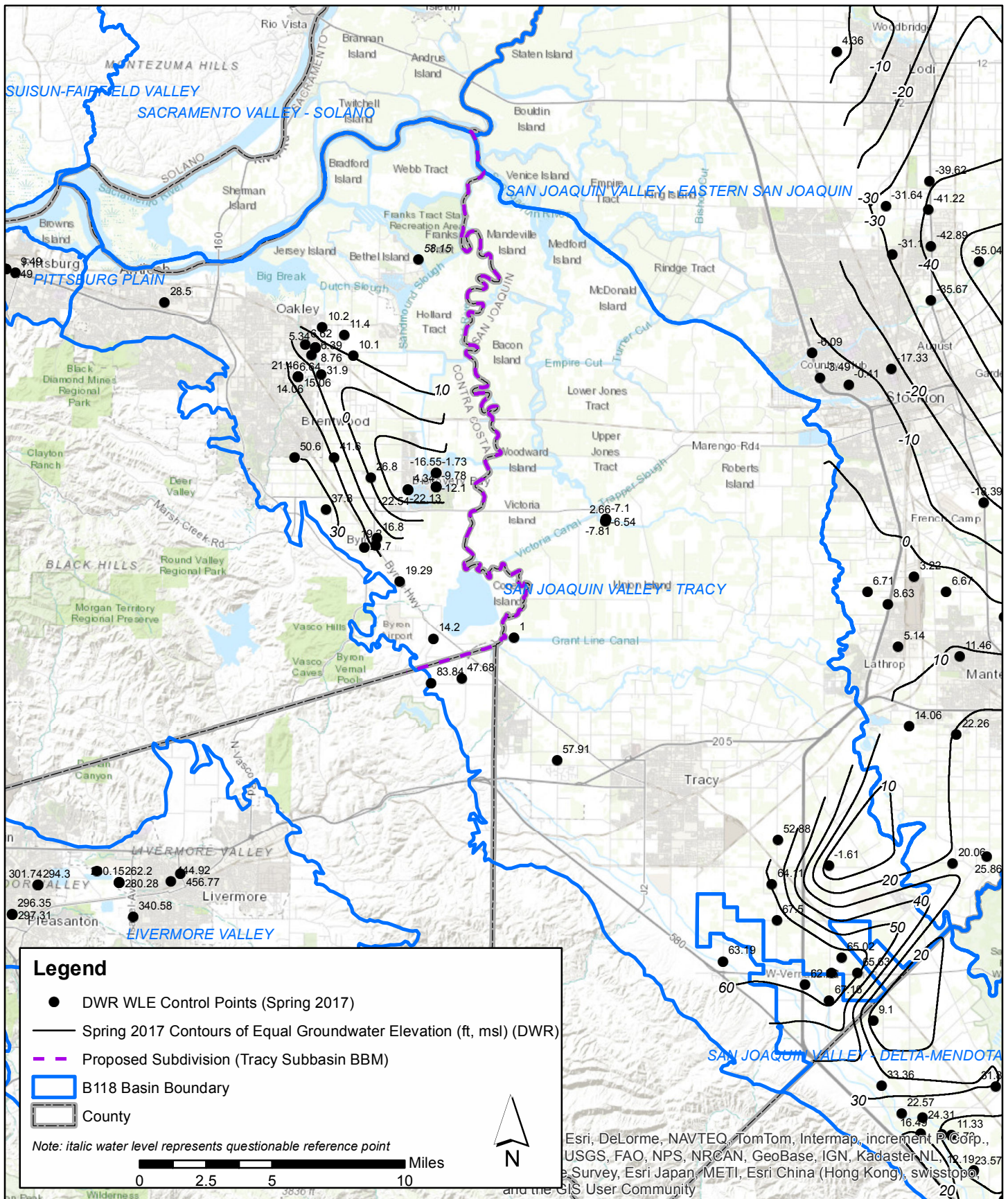
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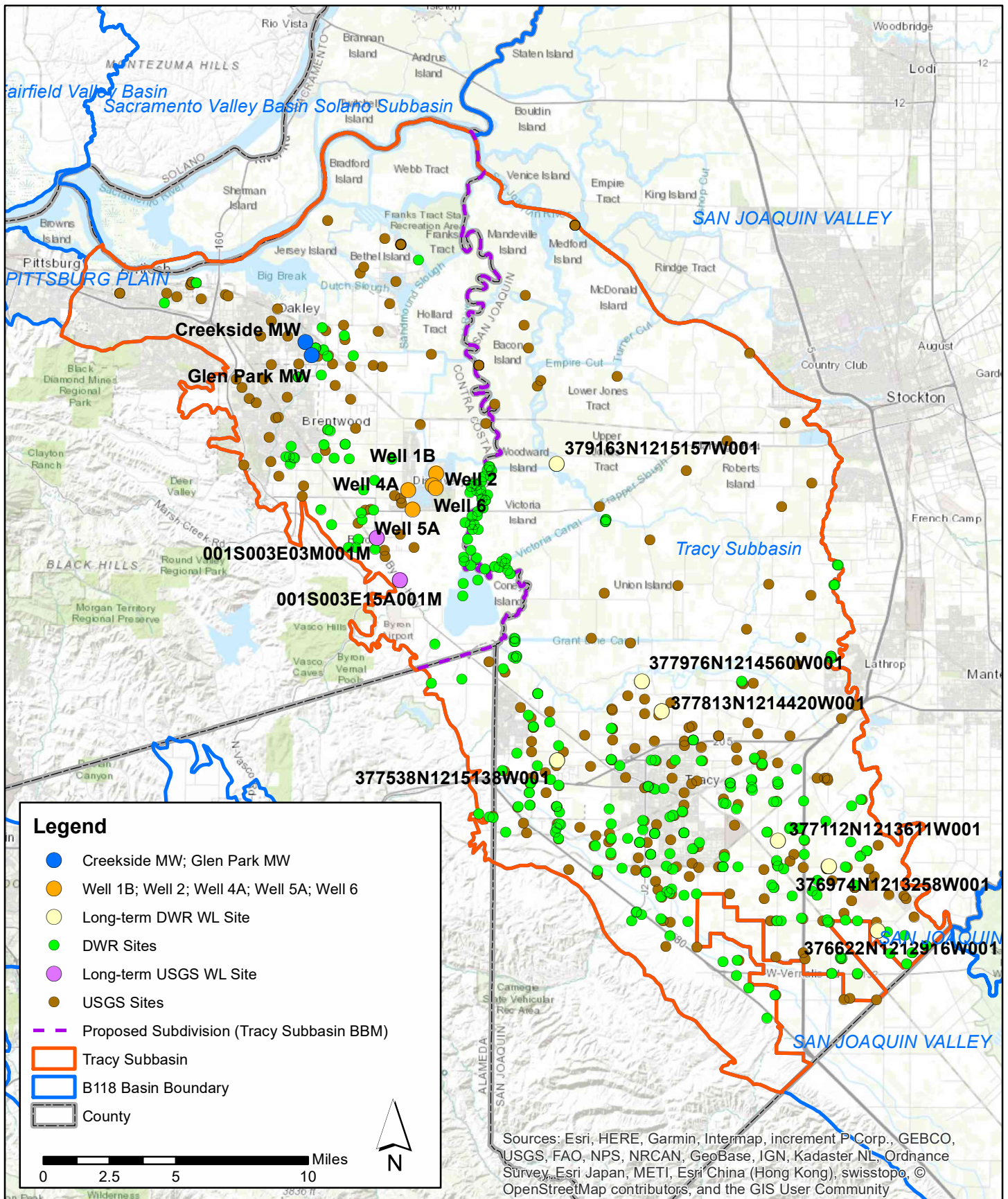
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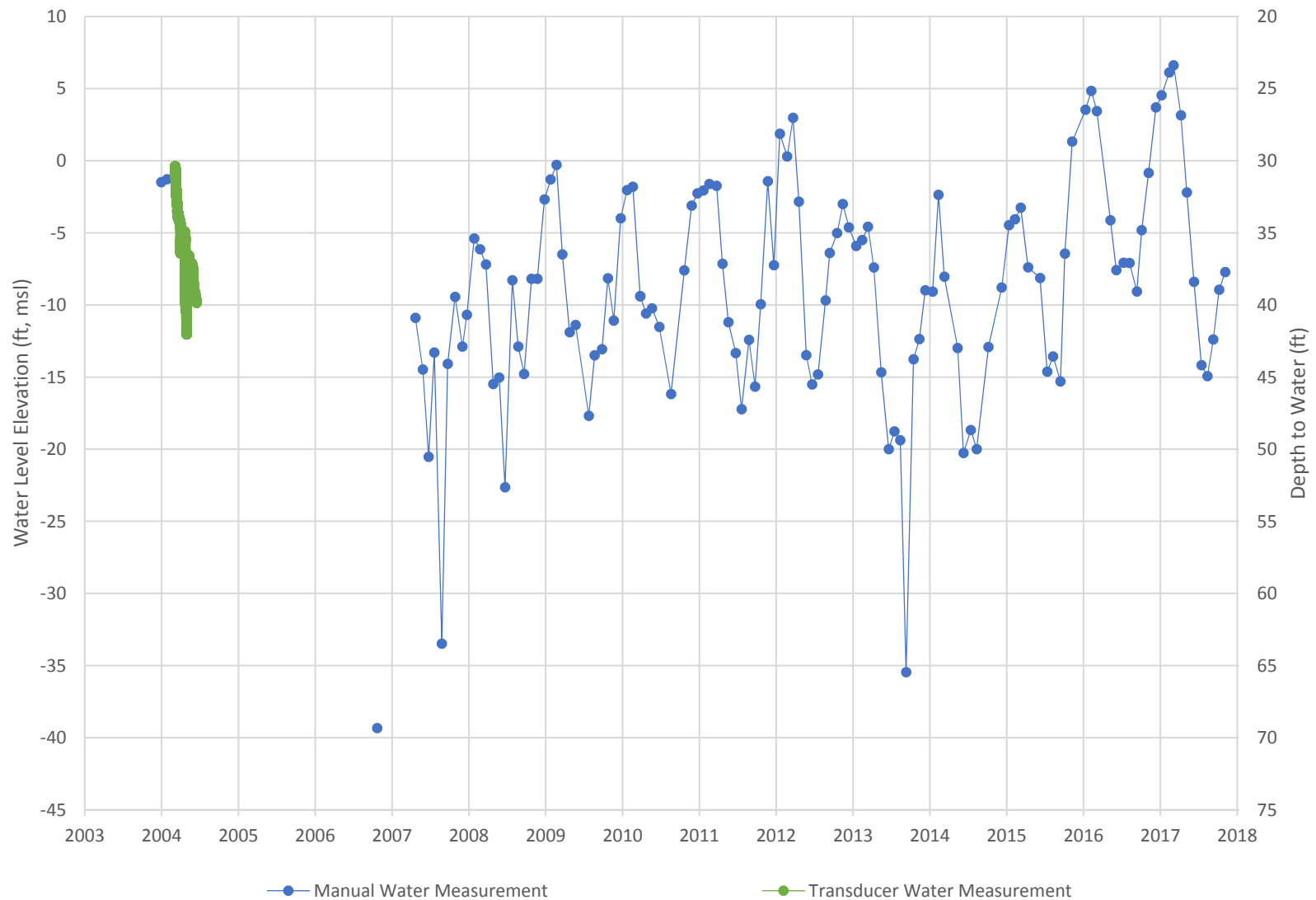
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Water Level in DWD Creekside MW

Perforation: 230-240 ft

Well Depth: 380ft

Reference Point Elevation: 29.54 ft msl

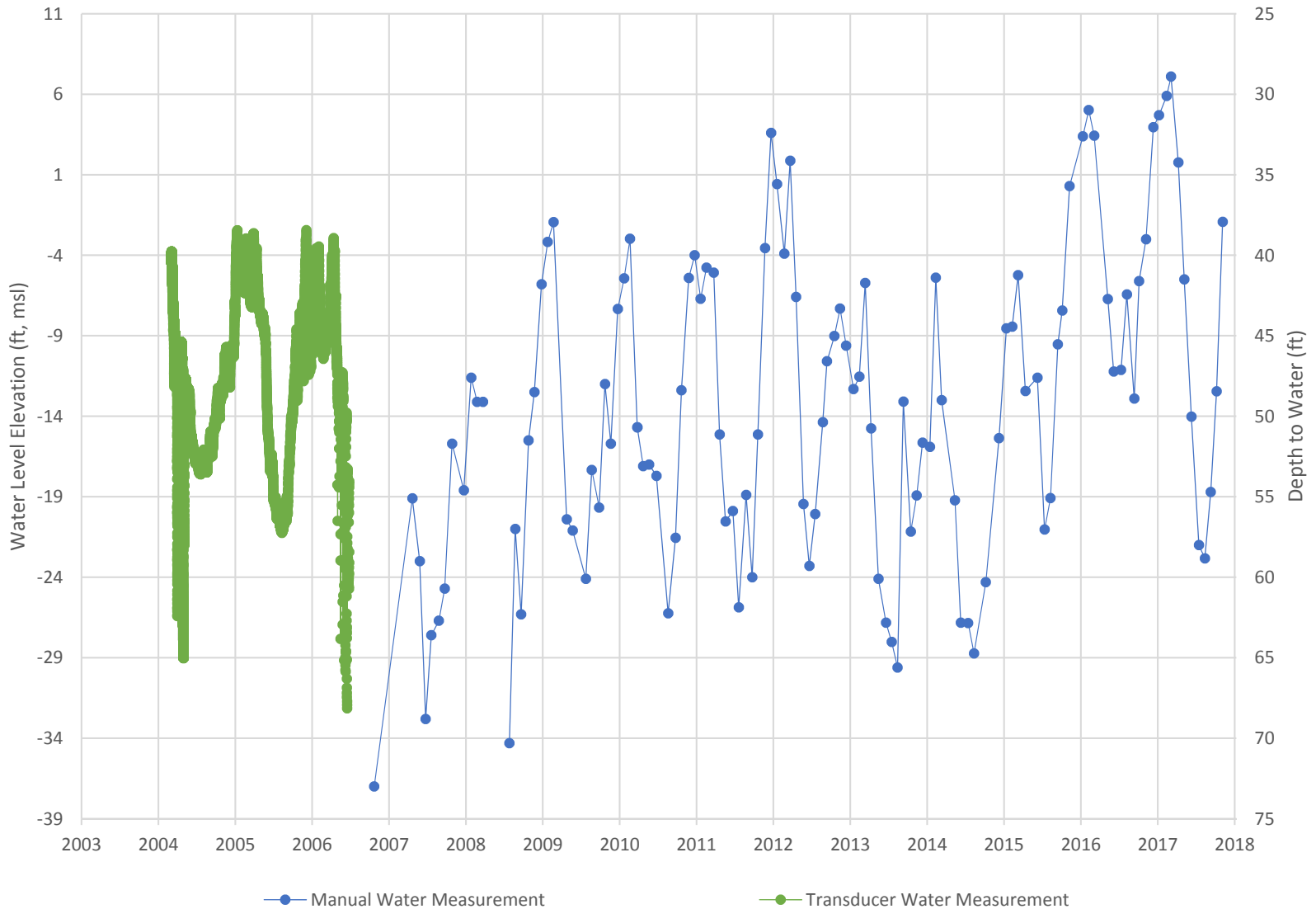


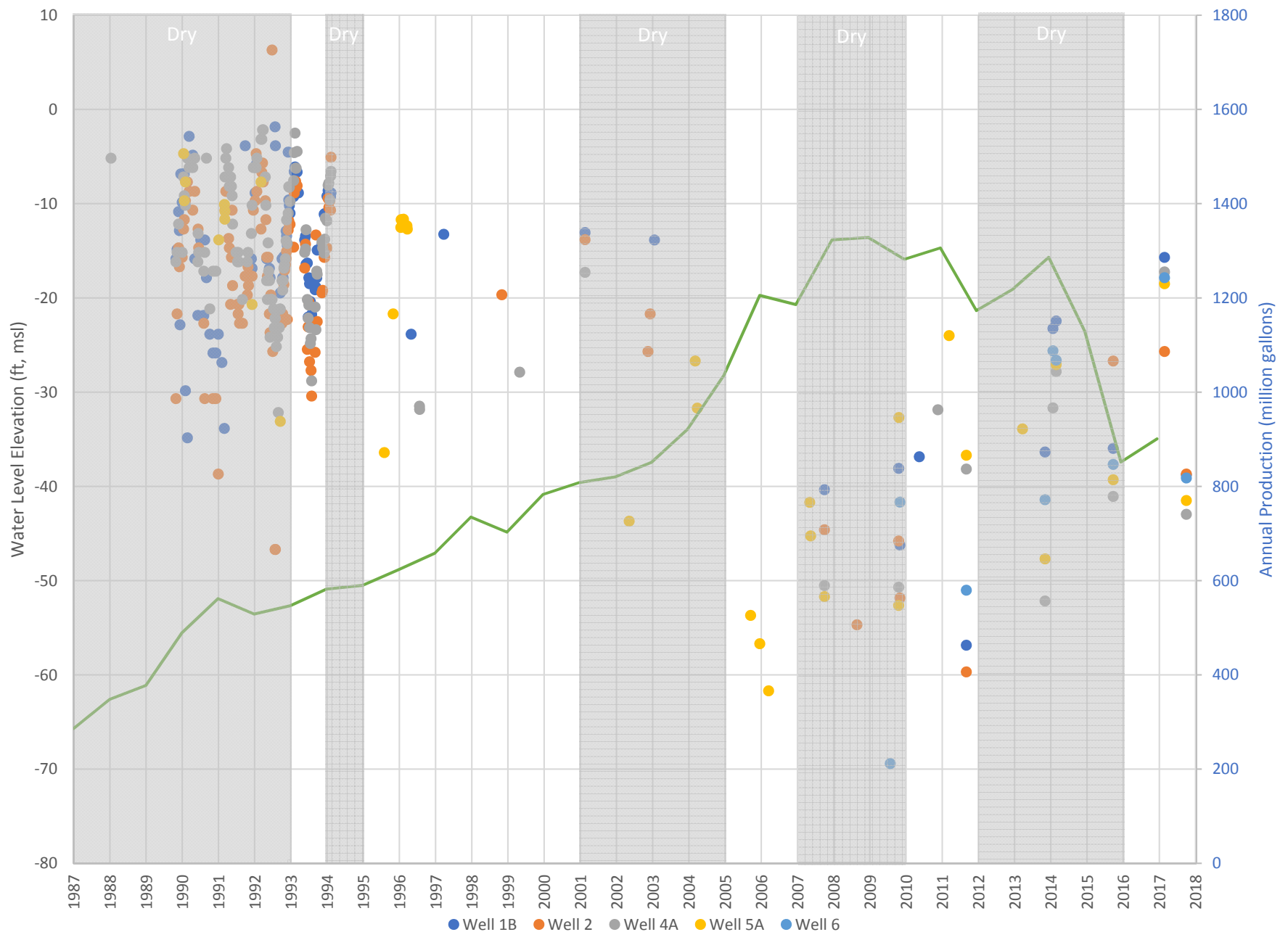
Water Level in DWD Glen Park MW

Perforation: 220-230, 260-290 ft

Well Depth: 300ft

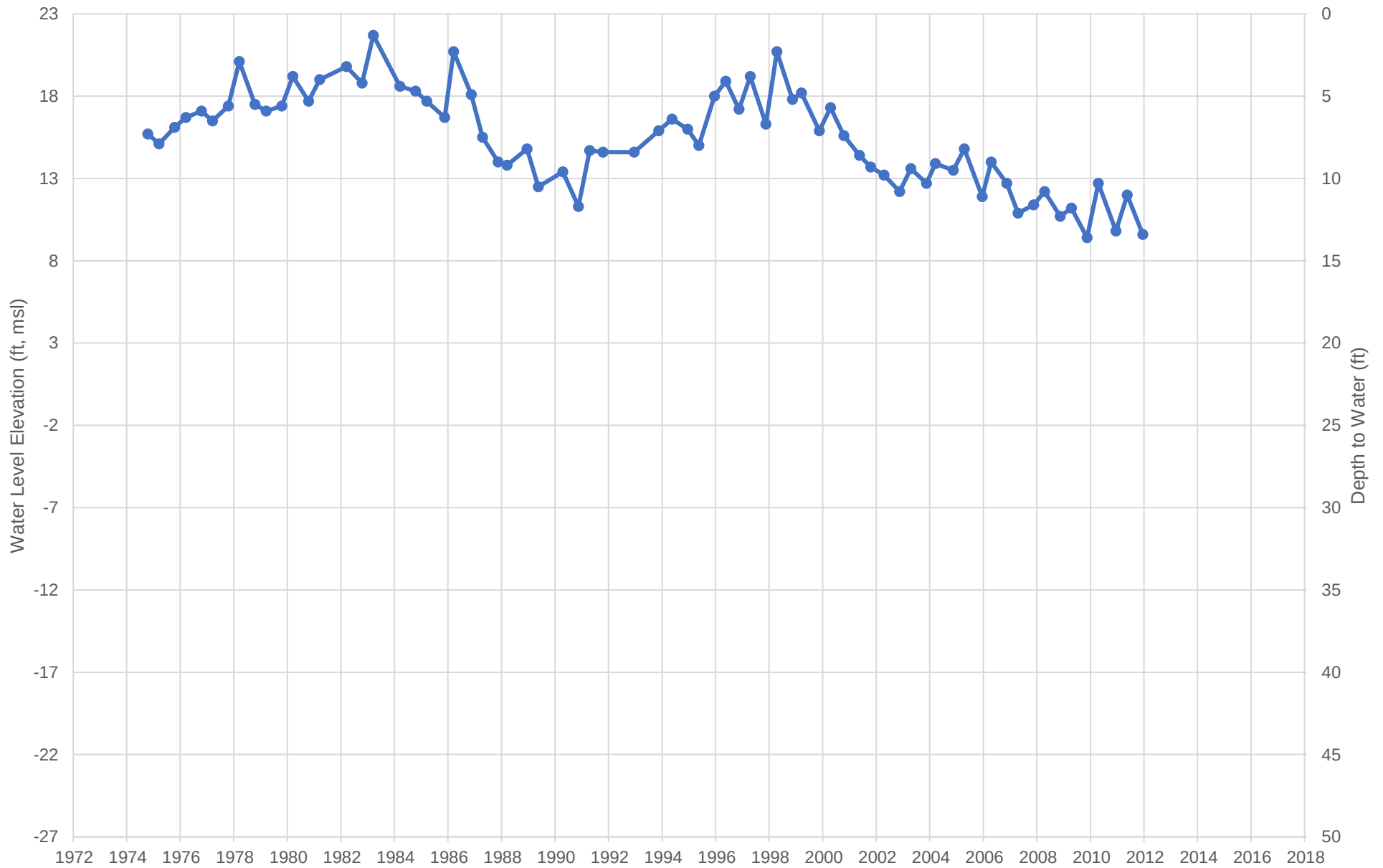
Reference Point Elevation: 35.54 ft msl





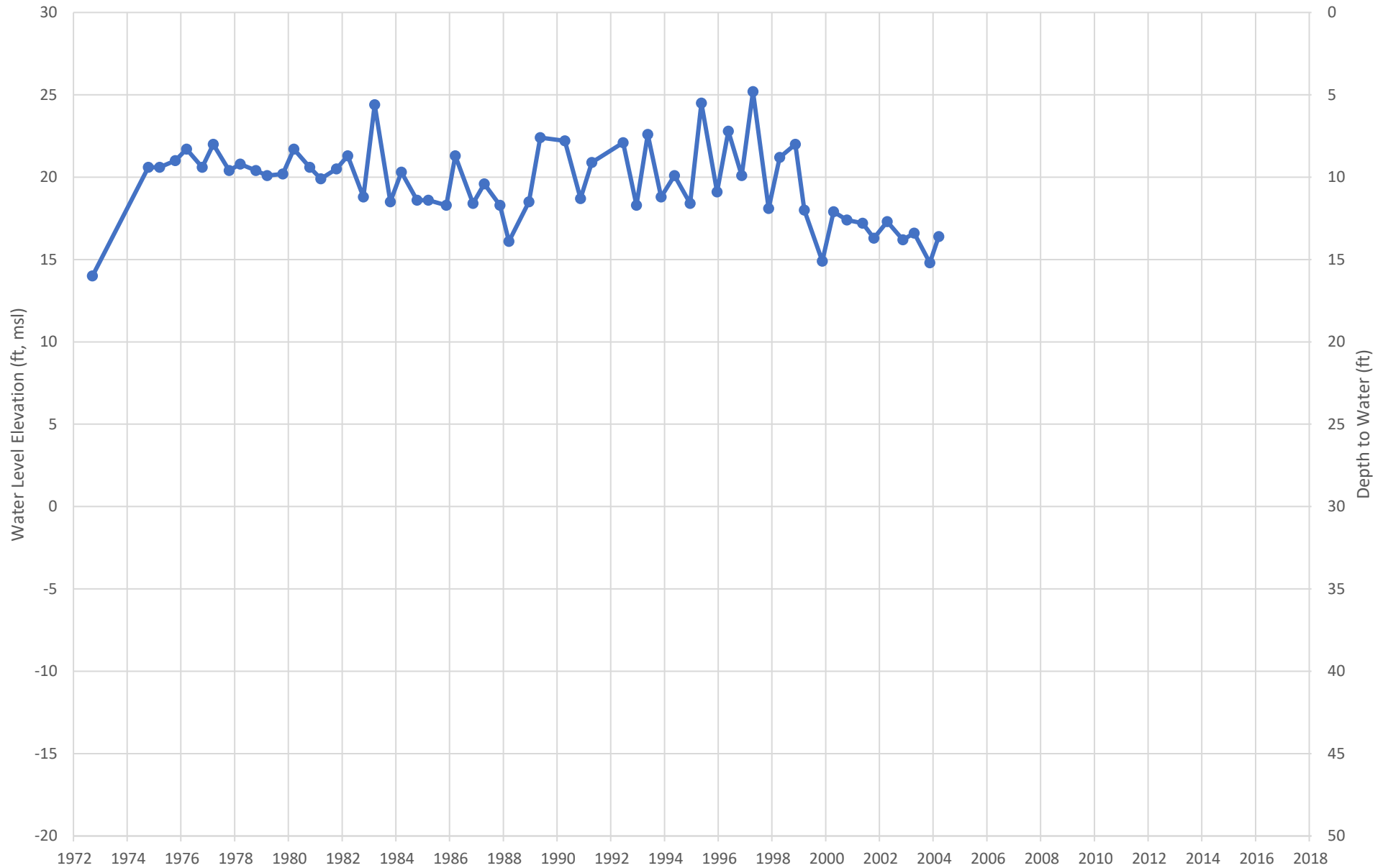
USGS: 375106121372201 (001S003E15A001M)

Well Depth: 45ft
Reference Point Elevation: 23 ft msl



USGS: 375228121382001 (001S003E03M001M)

Well Depth: 180ft
Reference Point Elevation: 30 ft msl

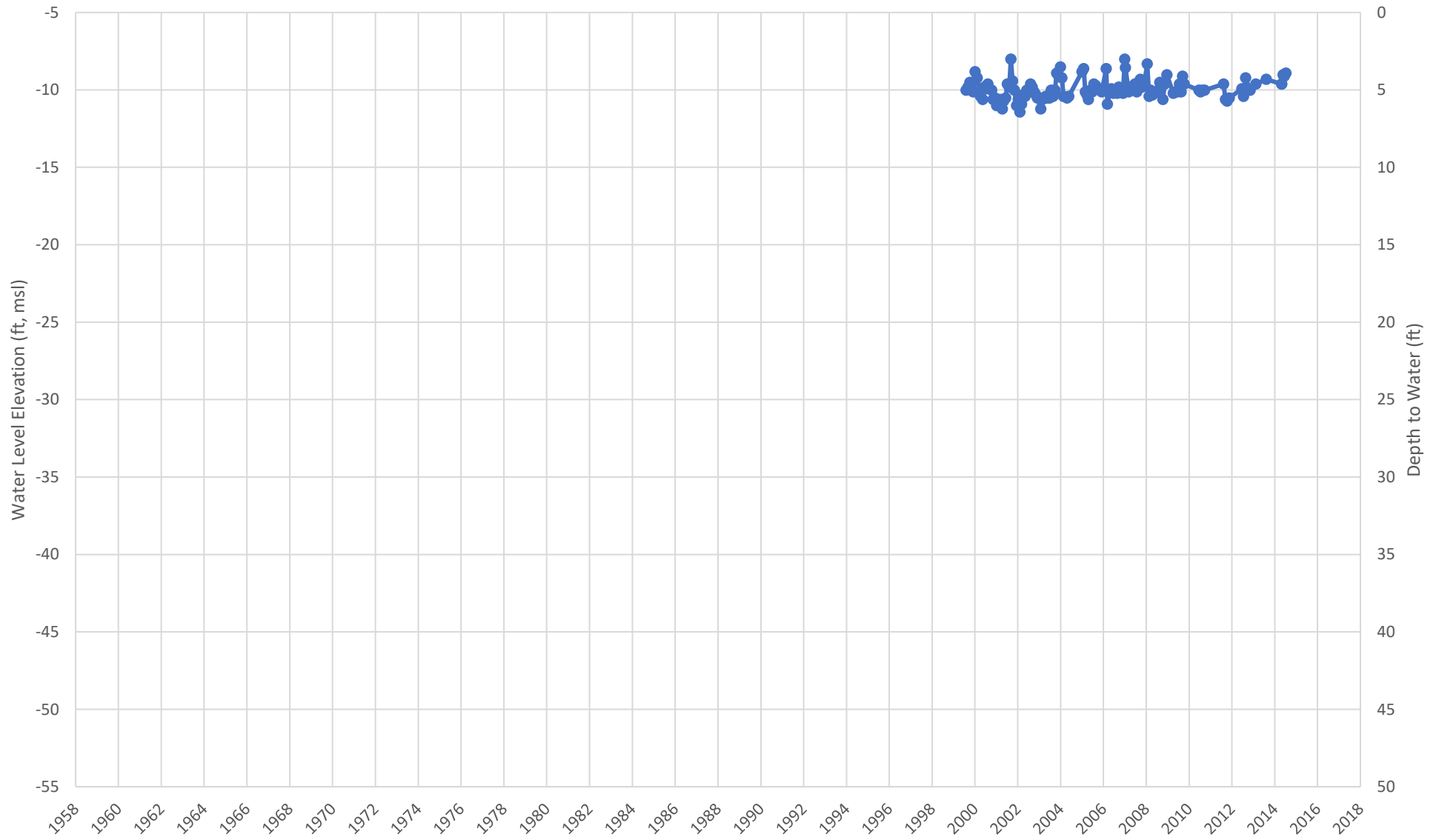


DWR: 379163N1215157W001 (01N04E22K001M)

Perforation: unknown

Well Depth: 20 ft

Reference Point Elevation: -4.62 ft msl

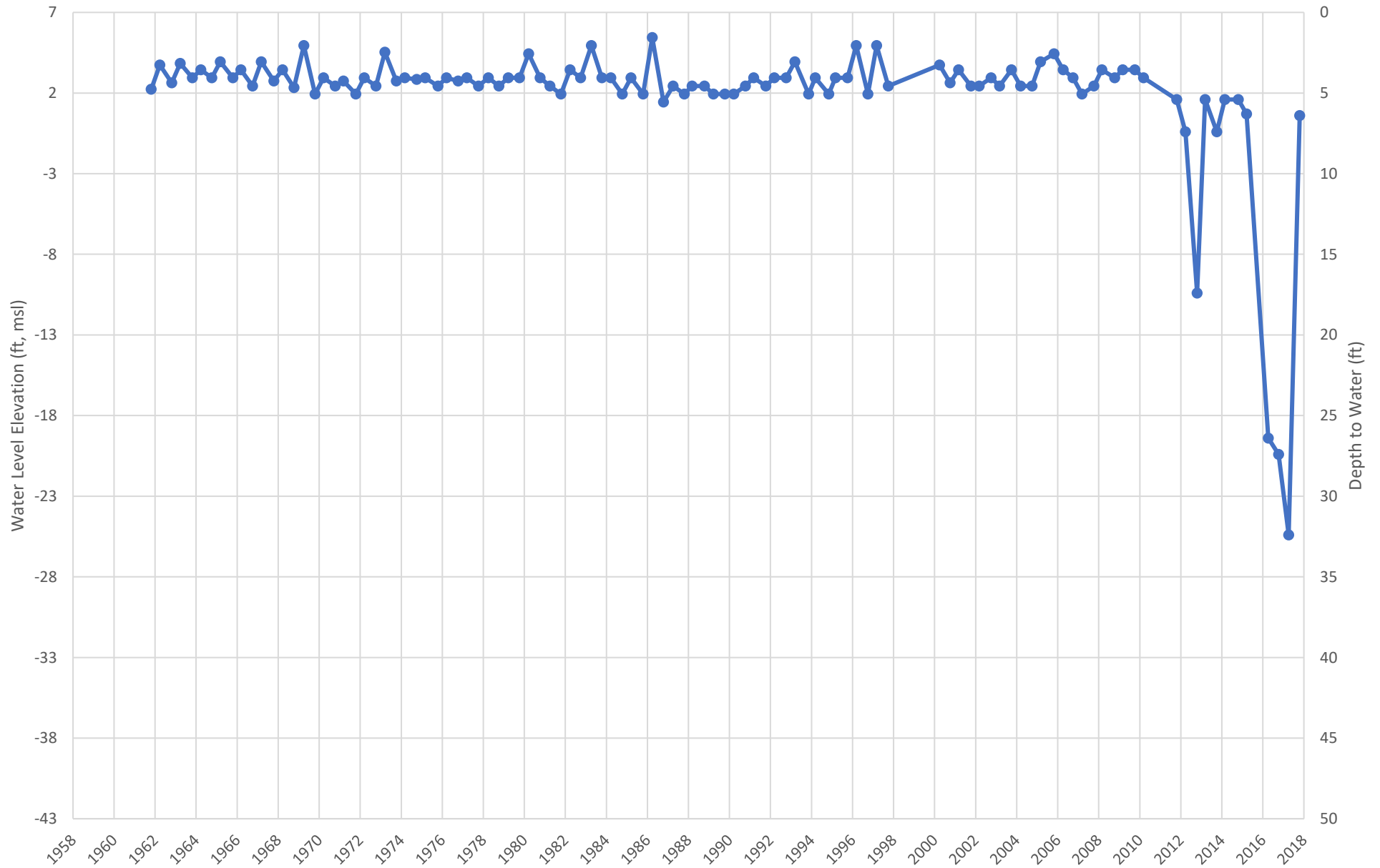


DWR: 377976N1214560W001 (01S05E31R002M)

Perforation: unknown

Well Depth: 92 ft

Reference Point Elevation: 6.94 ft msl

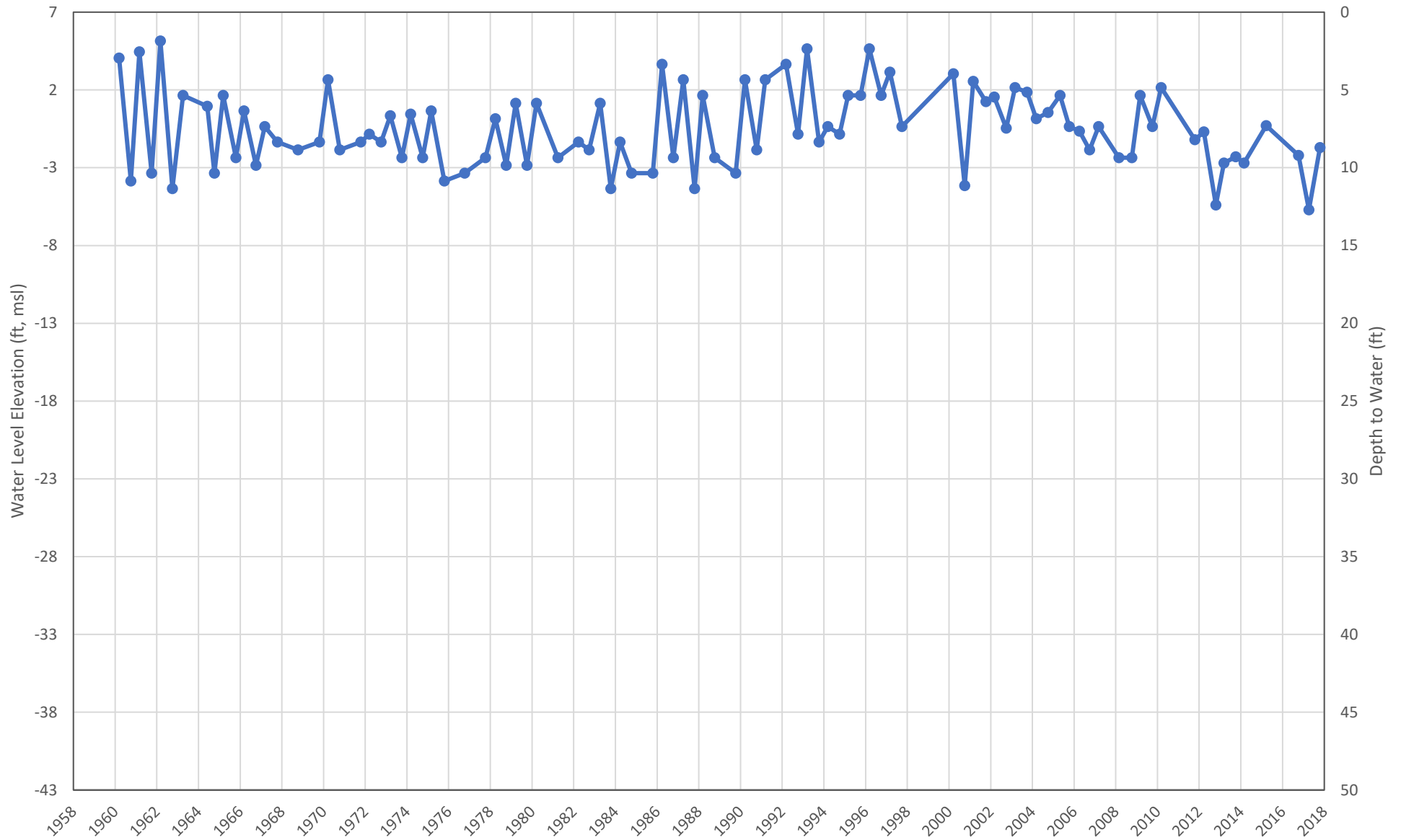


DWR: 377813N1214420W001 (02S05E08B001M)

Perforation: 50-80 ft

Well Depth: 80 ft

Reference Point Elevation: 6.65 ft msl



DWR: 377538N1215138W001 (02S04E15R002M)

Perforation: unknown

Well Depth: unknown

Reference Point Elevation: 65.11 ft msl

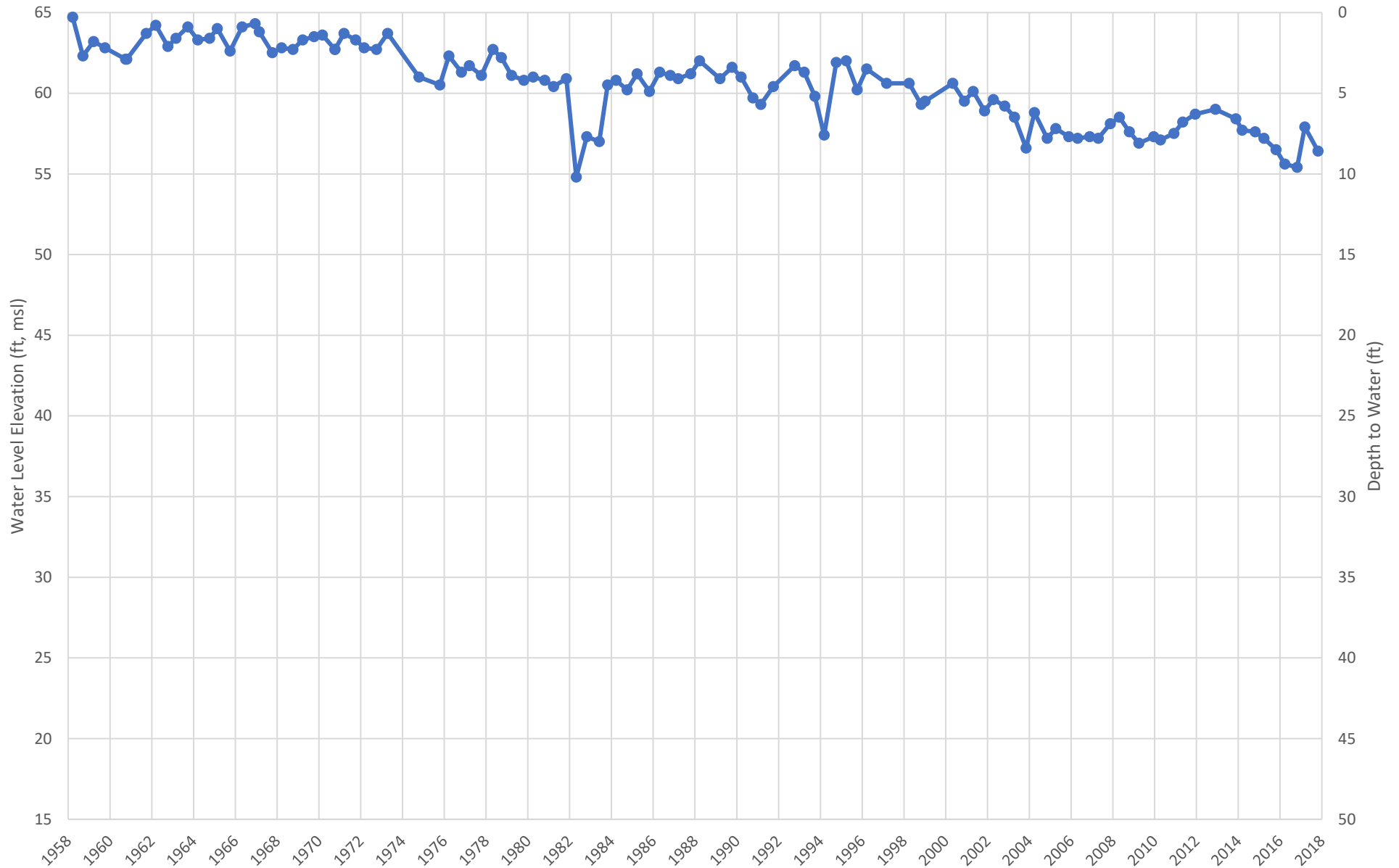


Figure WL-10

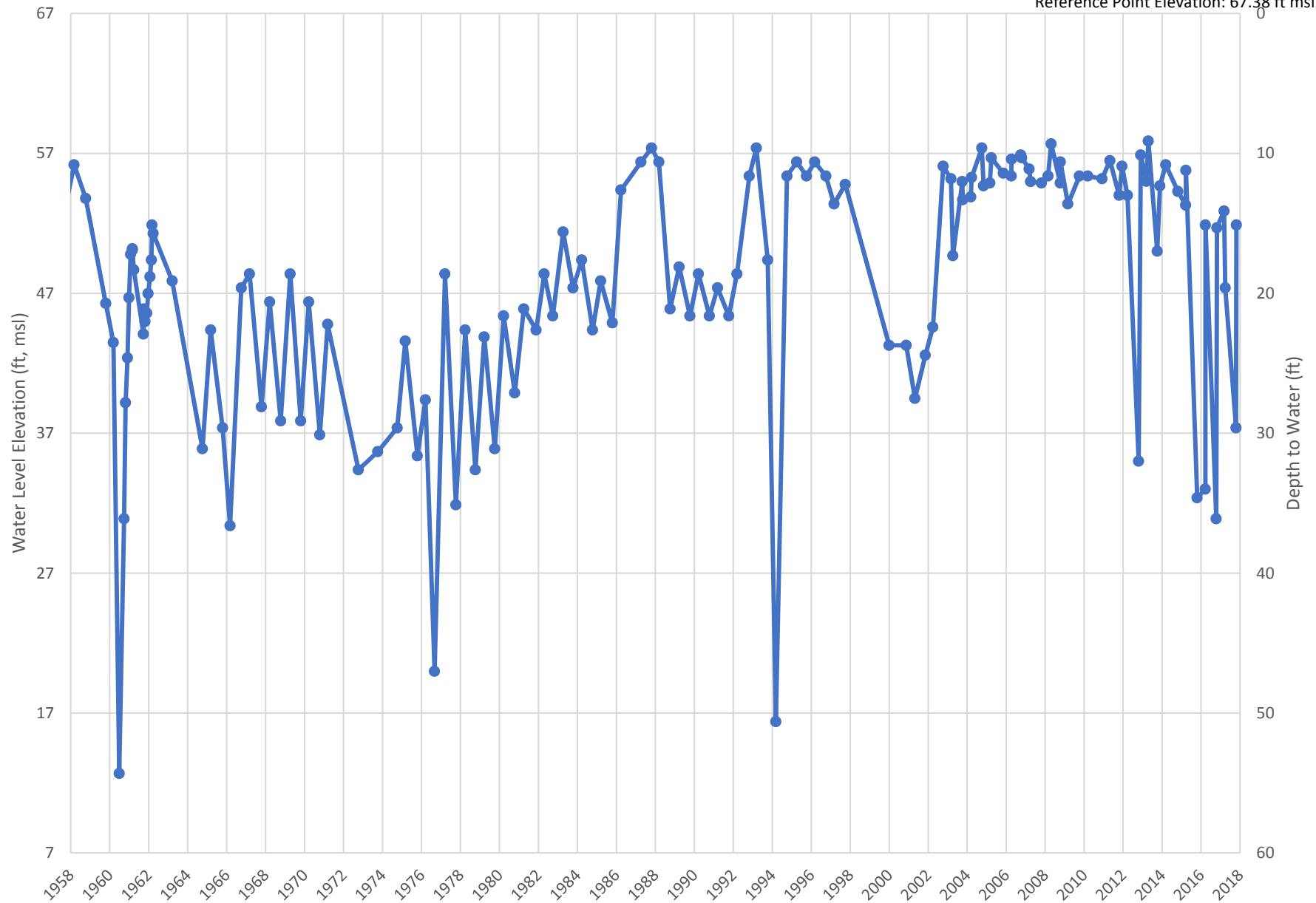
Hydrograph for DWR: 377538N1215138W001 (02S04E15R002M)

DWR: 377112N1213611W001 (02S06E31N001M)

Perforation: 50-500 ft

Well Depth: 500 ft

Reference Point Elevation: 67.38 ft msl

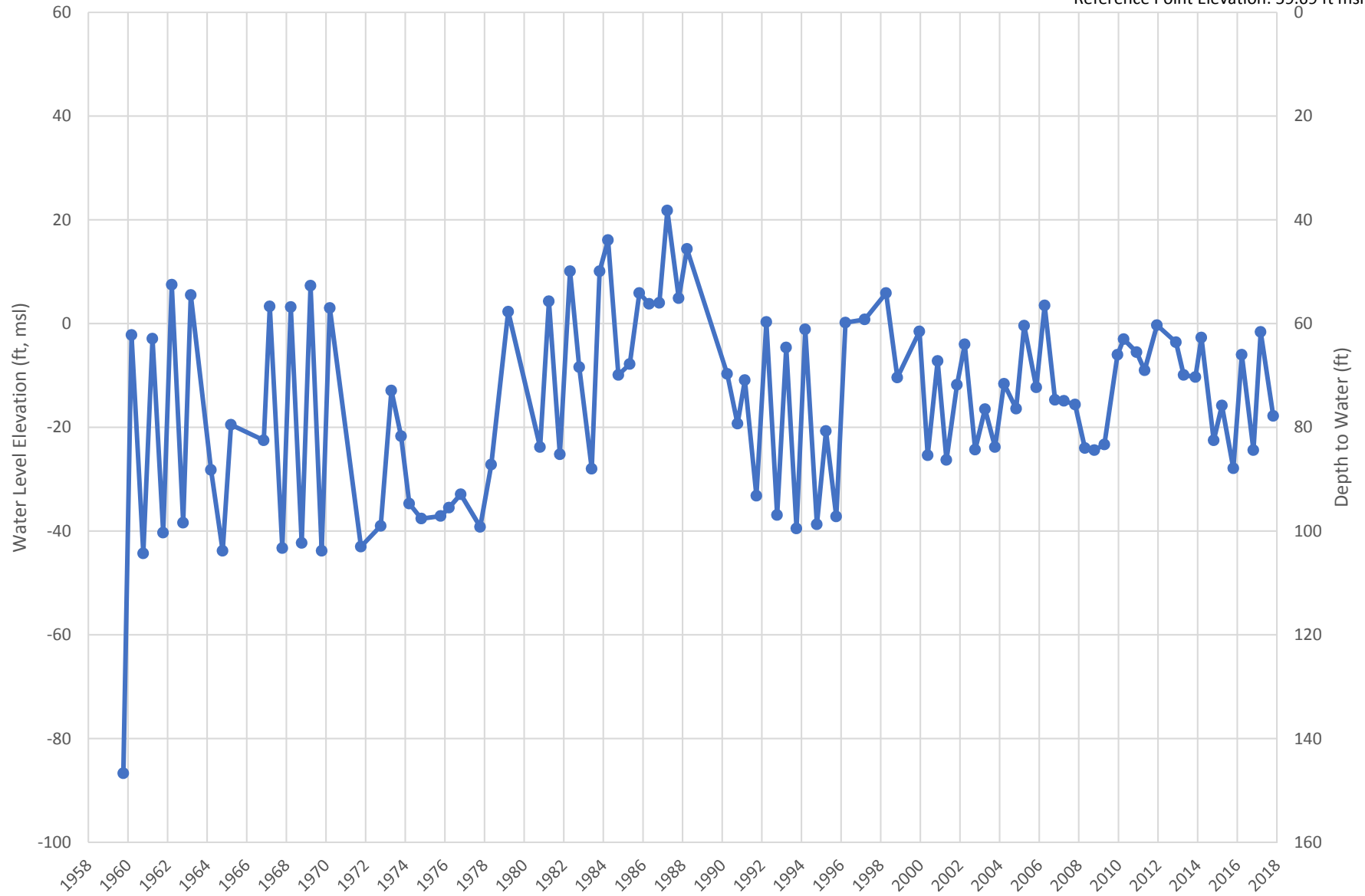


DWR: 376974N1213258W001 (03S06E05R001M)

Perforation: 252-275, 295-340, 395-436, 487-537, 589-597, 623-698, 724-749

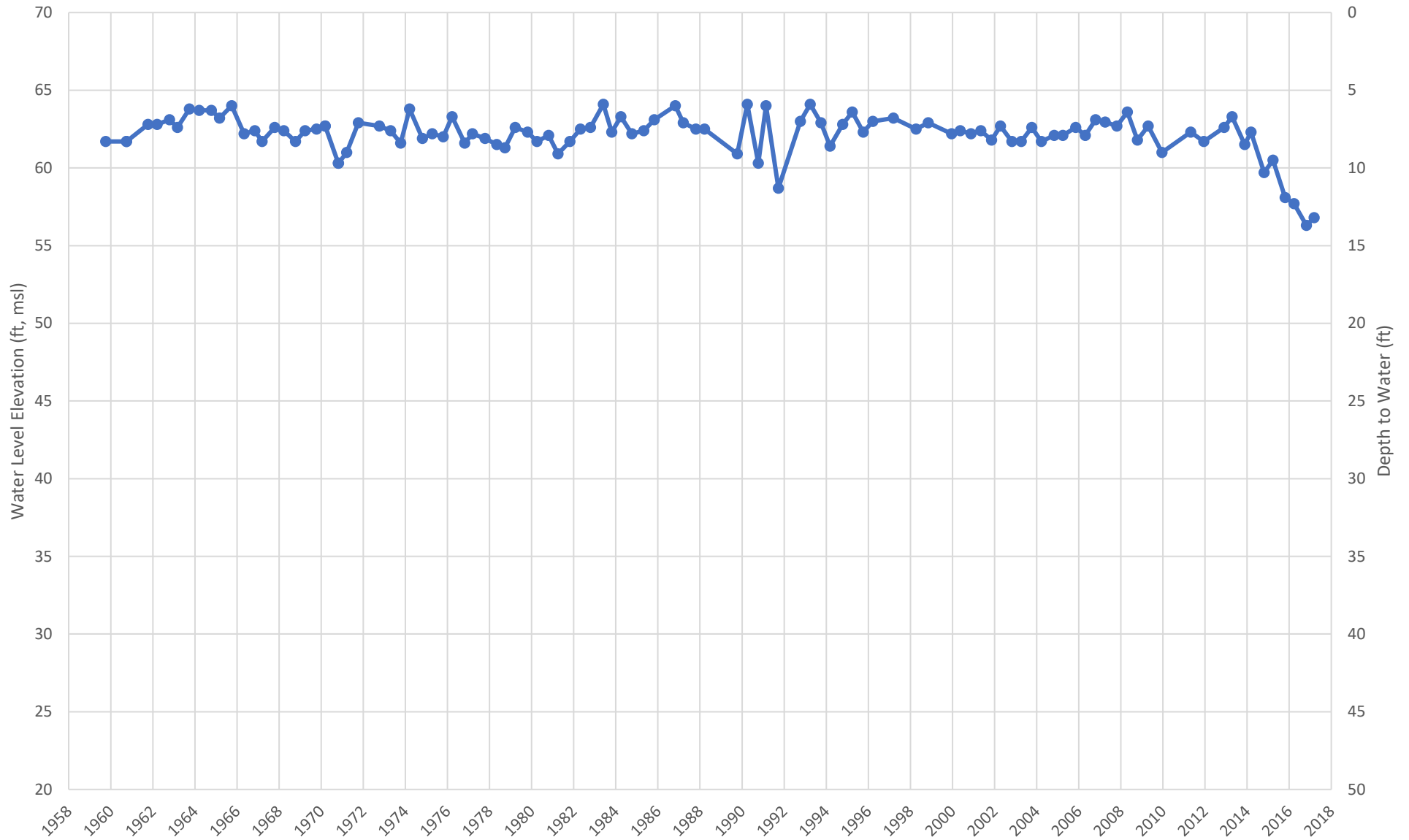
Well Depth: 775 ft

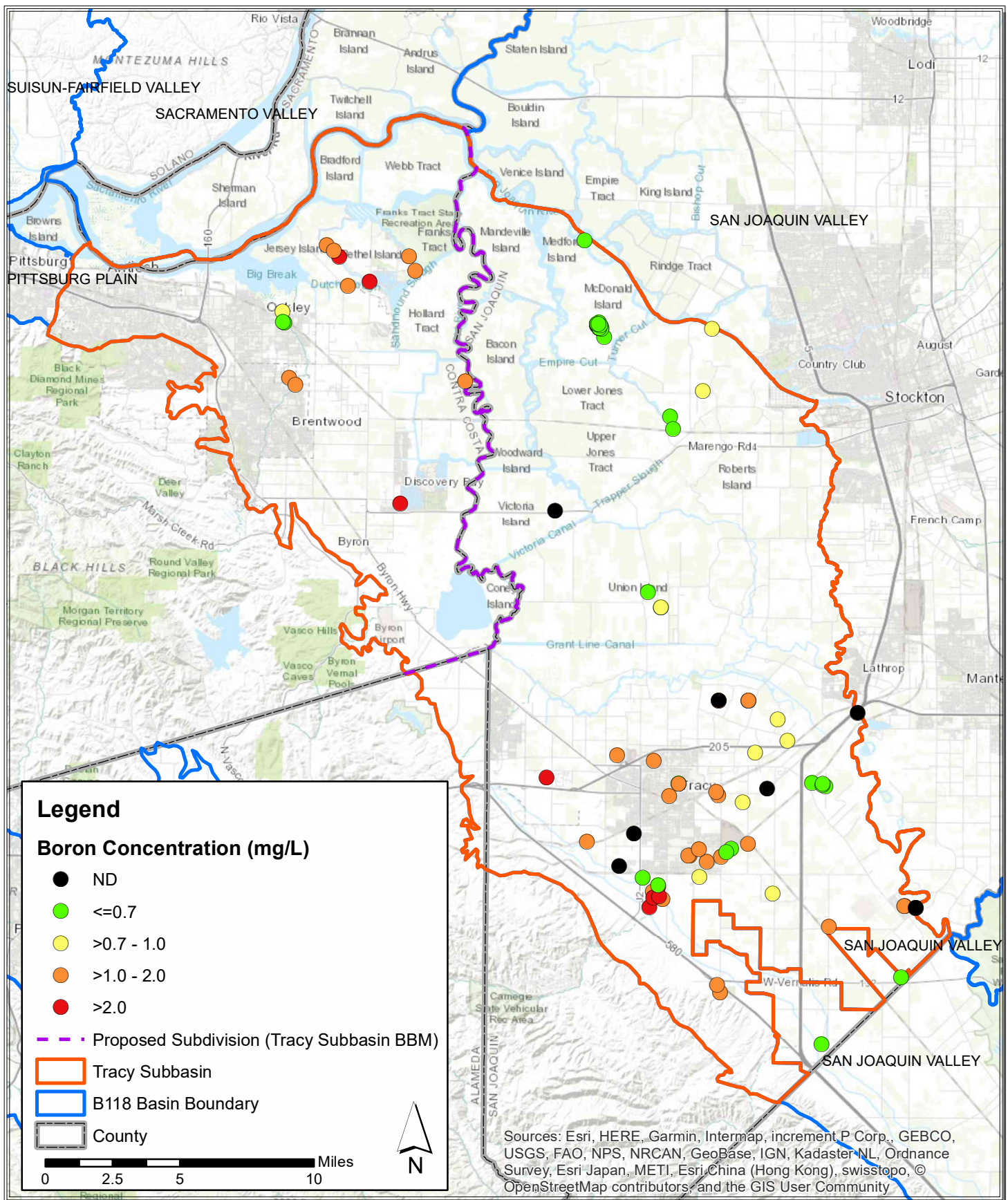
Reference Point Elevation: 59.69 ft msl



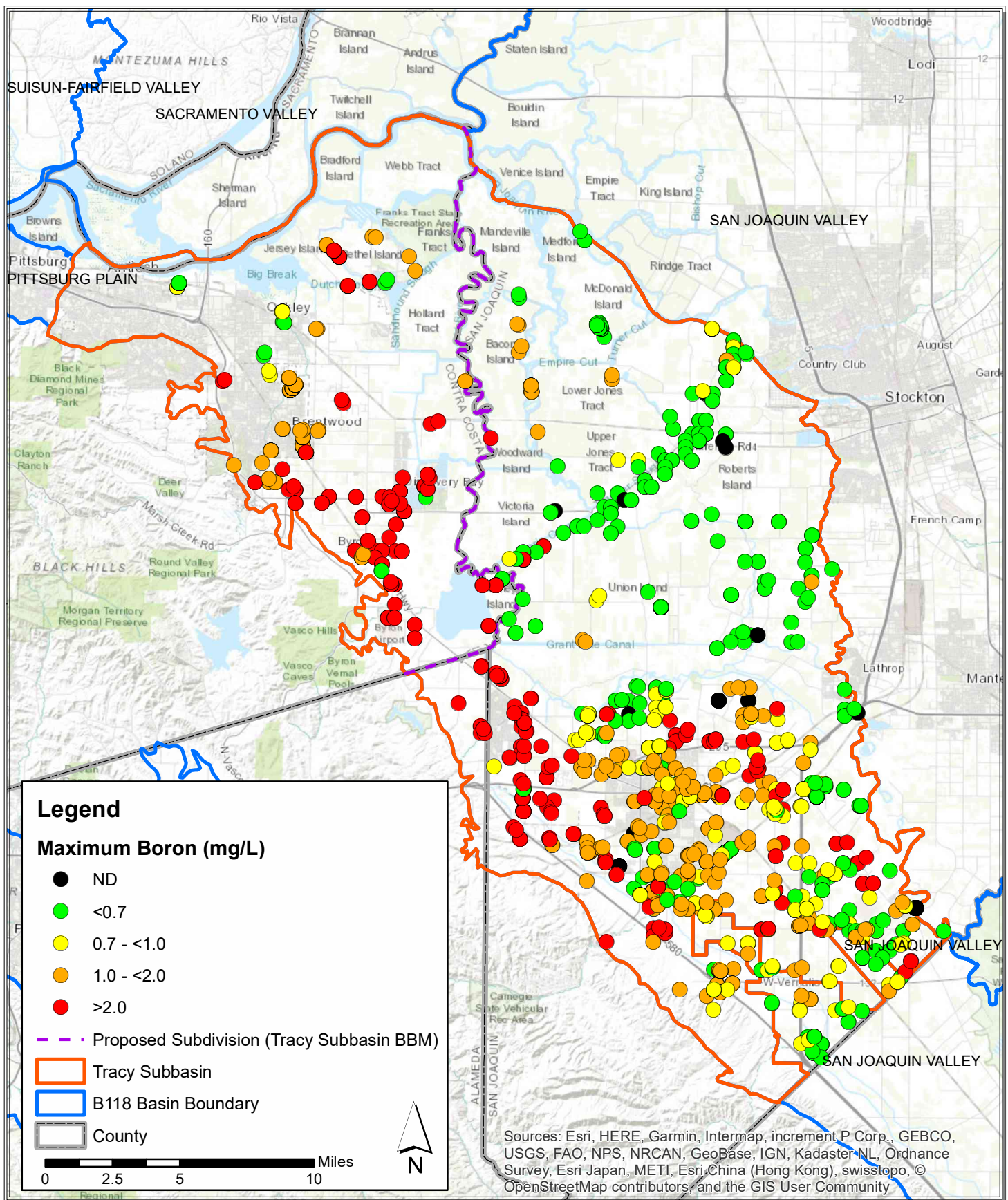
DWR: 376622N1212916W001 (03S06E22H001M)

Perforation: unknown
Well Depth: unknown
Reference Point Elevation: 69.69 ft msl

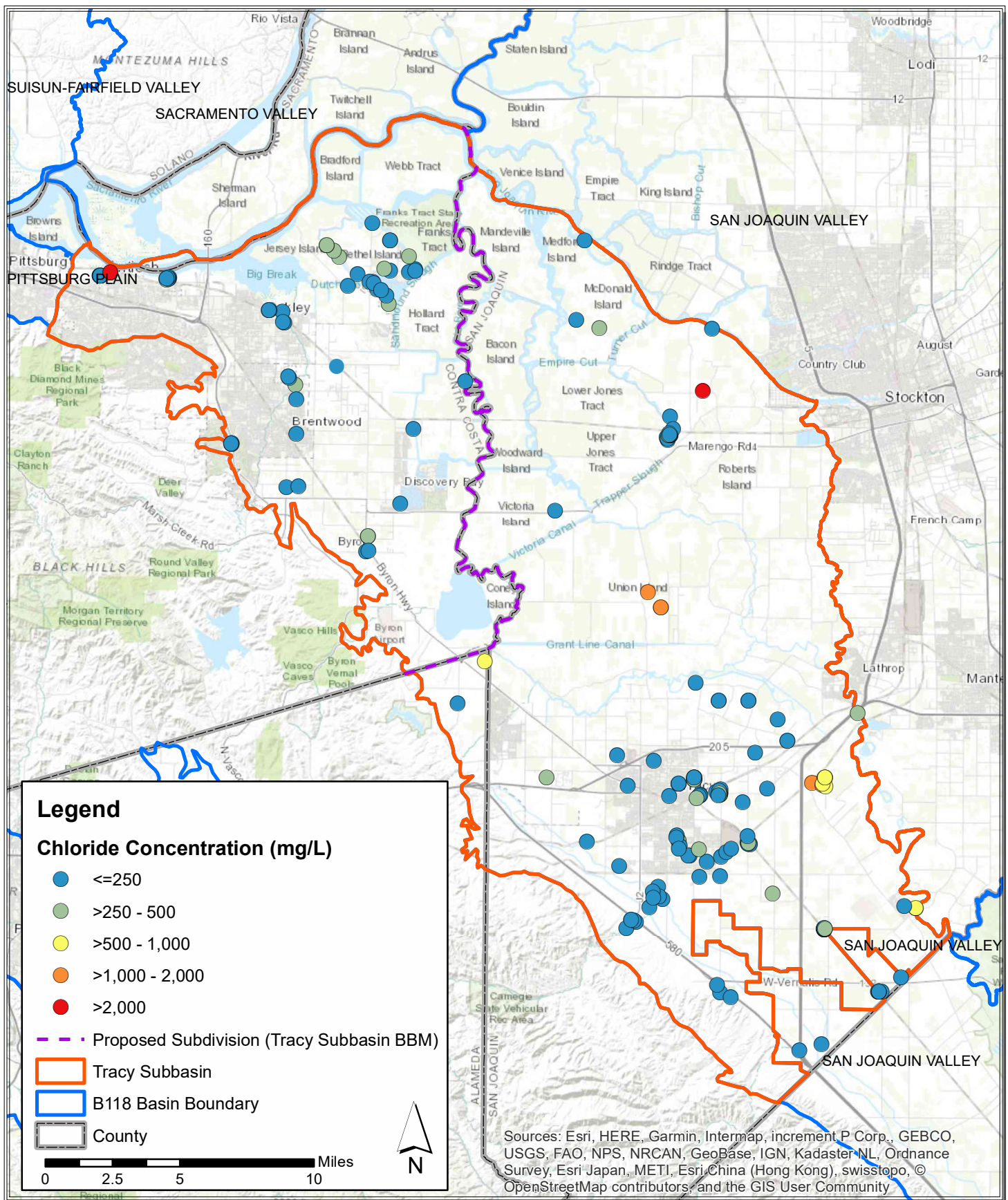




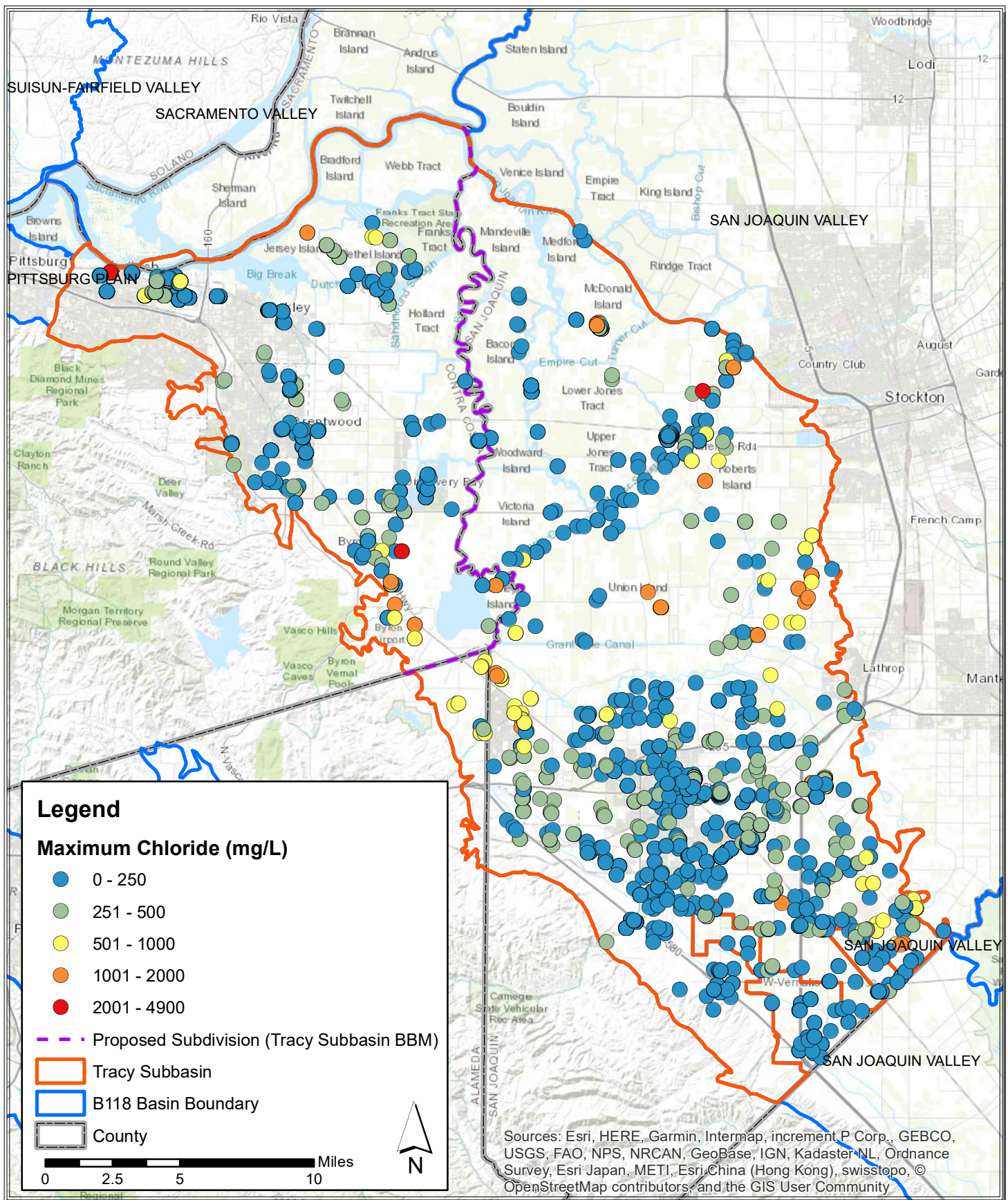
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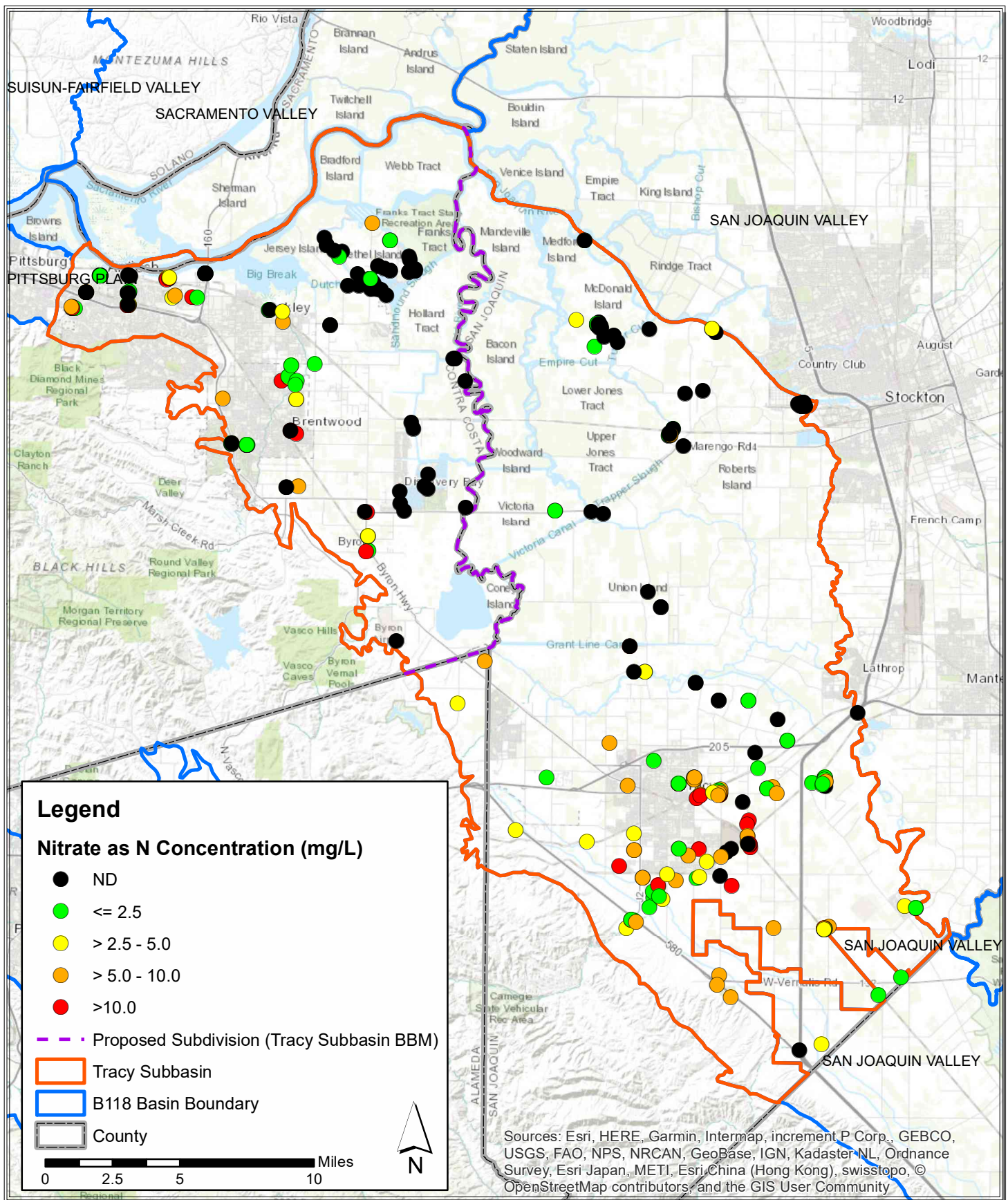
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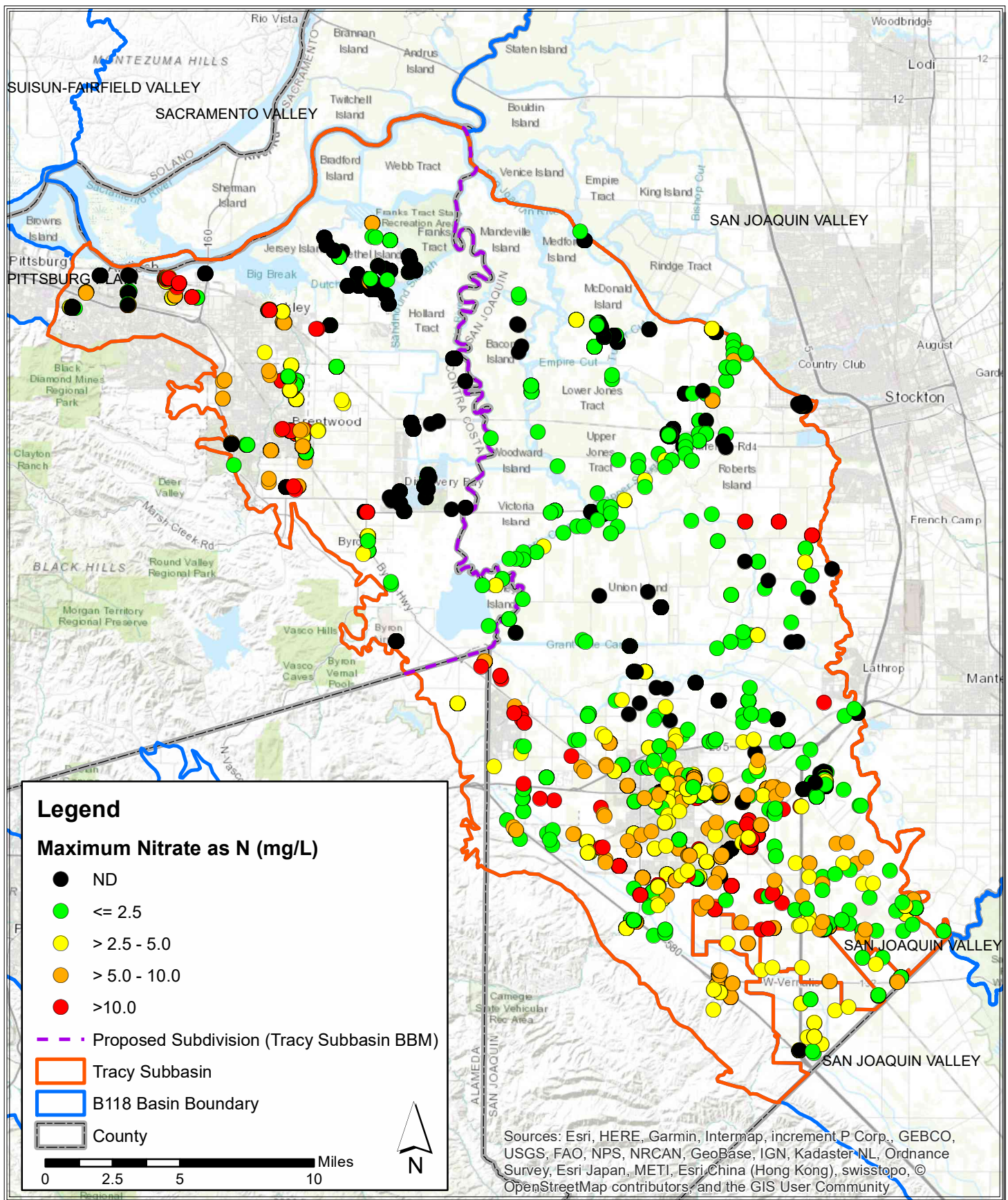
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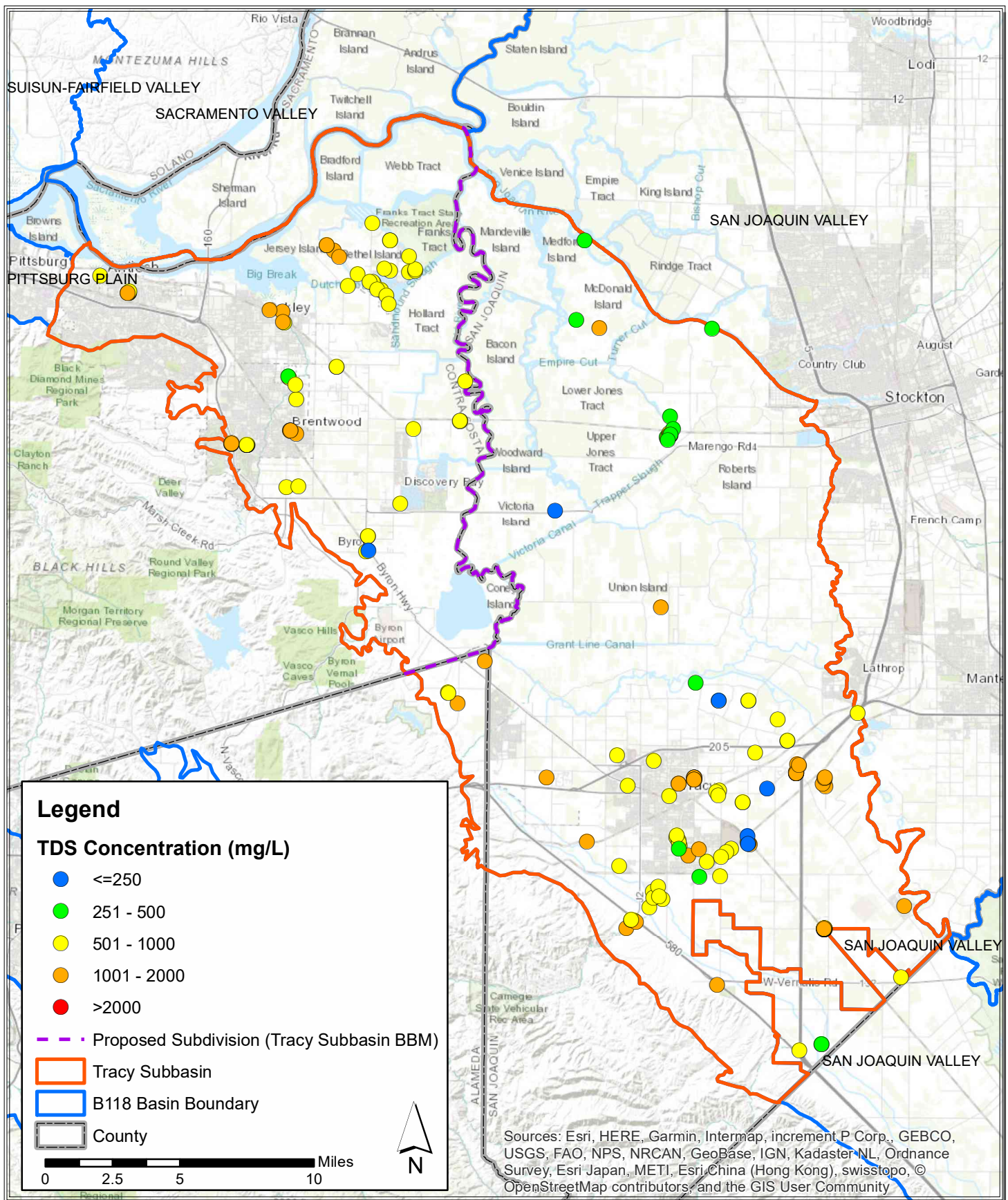
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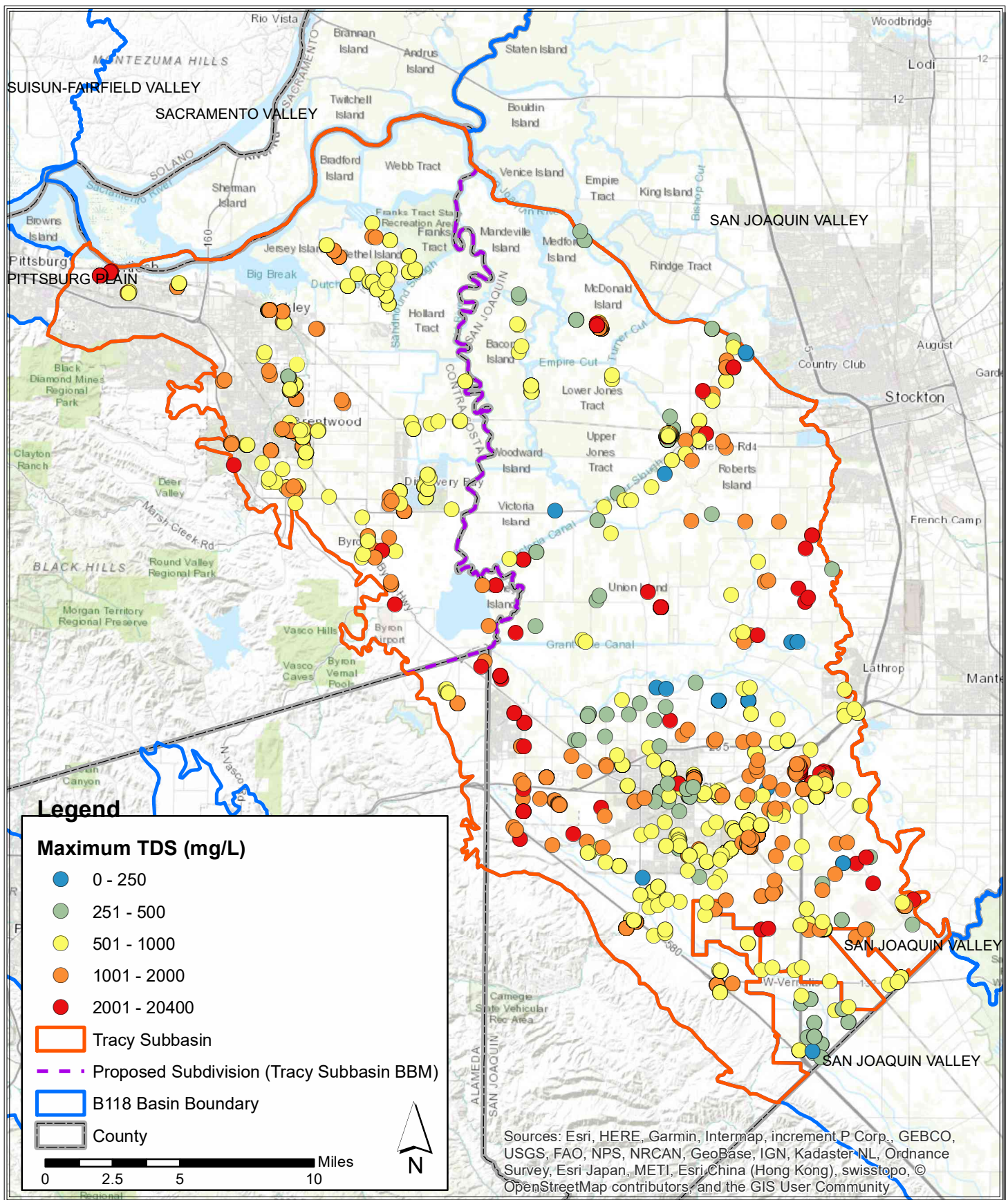
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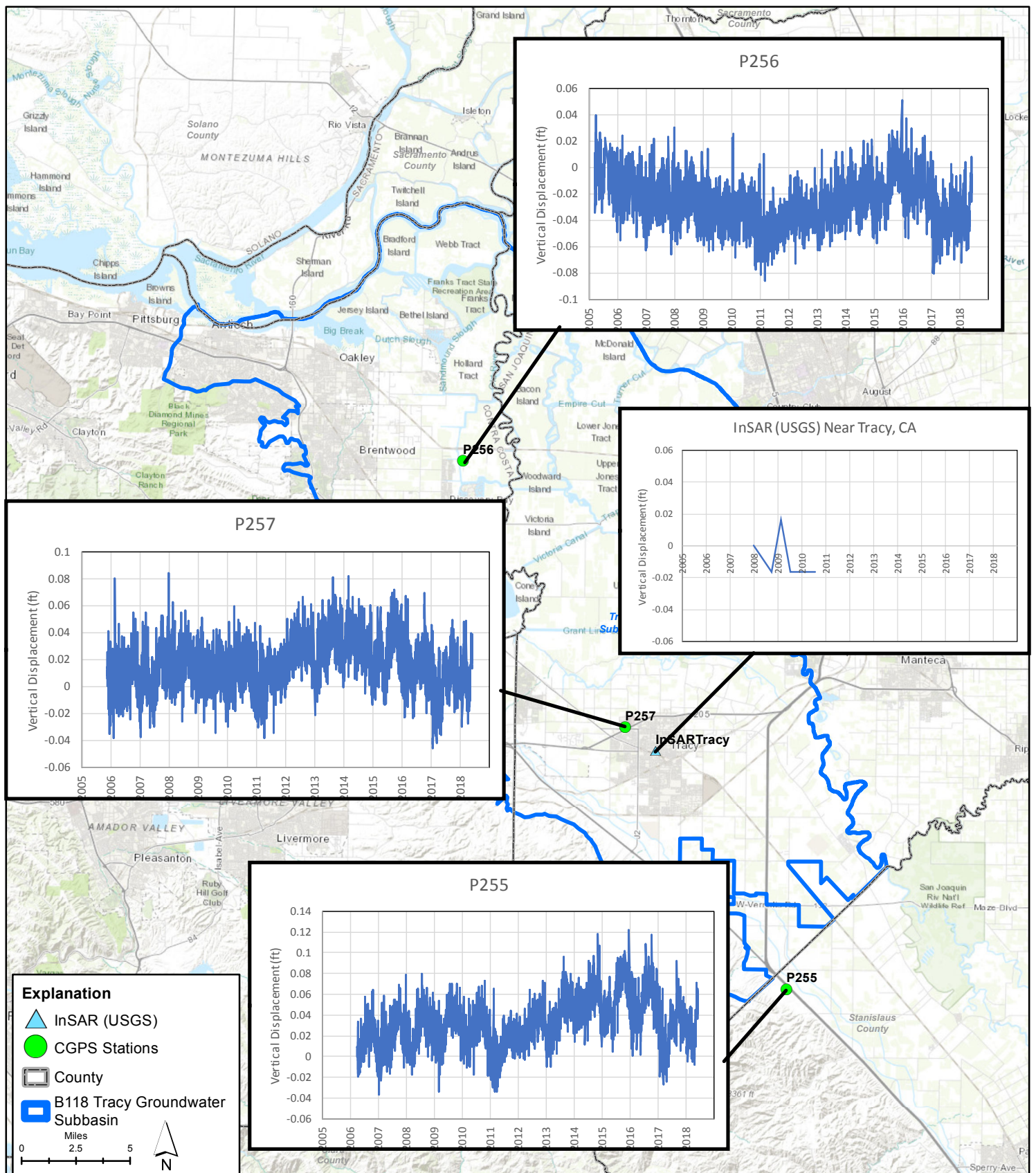
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