



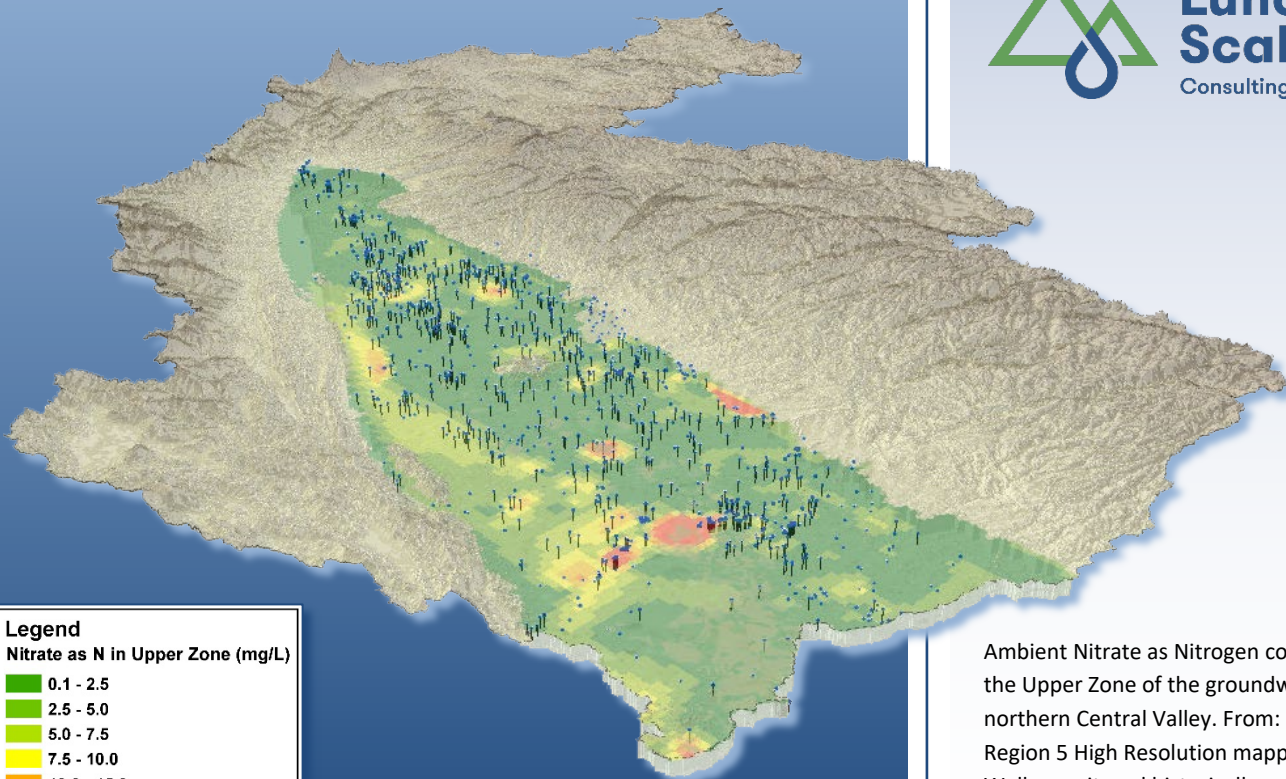
# 2021 ANNUAL GROUNDWATER QUALITY TREND MONITORING REPORT

for the Sacramento Valley Water Quality Coalition



*April 29, 2022*

*Submitted by*



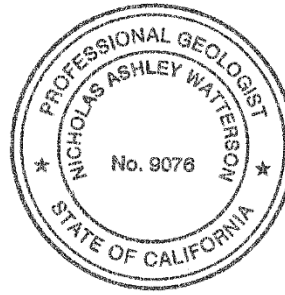
Legend	
Nitrate as N in Upper Zone (mg/L)	
0.1 - 2.5	Green
2.5 - 5.0	Light Green
5.0 - 7.5	Yellow-Green
7.5 - 10.0	Yellow
10.0 - 15.0	Orange
15.0 - 20.0	Red-Orange
> 20.0	Red

Ambient Nitrate as Nitrogen concentrations in the Upper Zone of the groundwater system in the northern Central Valley. From: LSCE et al. (2016), Region 5 High Resolution mapping for CV-SALTS. Wells monitored historically are shown. A subset of these wells is being considered for the ongoing Trend Monitoring network.

## Signature Page



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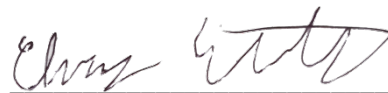


April 29, 2022

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## 1 EXECUTIVE SUMMARY

As part of compliance with the Central Valley Regional Water Quality Control Board's (Regional Board or CVRWQCB) *Order No. R5-2014-0030-R1 Waste Discharge Requirements General Order for Growers in the Sacramento River Watershed that are Members of the Third-Party Group*, hereafter referred to as the WDRs (CVRWQCB, 2014), the Sacramento Valley Water Quality Coalition (Coalition or SVWQC) must develop and implement a Groundwater Quality Trend Monitoring (GQTM) Program. This report presents results and discussion related to the SVWQC GQTM sampling activities conducted during 2021. The Coalition GQTM well network 2021 sampling event occurred during mid-August 2021 and included sampling of a total of 28 wells. The sampling plan include a total of 30 wells; however, one well could not be sampled because of withdrawal of the well owner's permission, and another well had been abandoned and destroyed in the months prior to the sample event.

No wells were added to the sampling plan for 2021, and therefore all sampled wells were sampled only for nitrate, as required by the annual monitoring schedule. All wells sampled for the GQTM were also tested for field parameters, including specific conductance, pH, temperature, dissolved oxygen, oxidation-reduction potential, and turbidity. The results from 2021 GQTM sampling, a discussion of GQTM trends and patterns, and a summary of the data quality assurance assessment are presented in this report.

The groundwater quality results from the 2021 sampling included one well with a nitrate concentration above the primary drinking water maximum contaminant level (MCL) of 10 milligrams per liter (mg/L) and three wells with nitrate concentrations at or near (but not above) the MCL. Since the one well with a nitrate exceedance had previously had an exceedance, and the well owner had been notified of that exceedance and provided a Drinking Water Notification Template in prior years, no further notification was required in 2021. In accordance with the SVWQC GQTM Workplan documents (LSCE, 2017, 2018a, 2018b, 2019, 2020), evaluation of patterns and trends in groundwater quality and any relationships with agricultural practices will be conducted at five-year intervals commencing after sufficient GQTM data have been developed for evaluating temporal trends in groundwater quality.

## 2 BACKGROUND AND GQTM OBJECTIVES

The Central Valley Regional Water Quality Control Board's (Regional Board or CVRWQCB) *Order No. R5-2014-0030-R1 Waste Discharge Requirements General Order for Growers in the Sacramento River Watershed that are Members of the Third-Party Group*, hereafter referred to as the WDRs (CVRWQCB, 2014), requires the Sacramento Valley Water Quality Coalition (Coalition or SVWQC) to develop and implement a Groundwater Quality Trend Monitoring (GQTM) Program. The WDRs Attachment B, Section IV.C. (p. 1-2) states:

*1. Objectives.* The objectives of Groundwater Quality Trend Monitoring are (1) to determine current water quality conditions of groundwater relevant to irrigated agriculture, and (2) to develop long-term groundwater quality information that can be used to evaluate the regional effects (i.e., not site-specific effects) of irrigated agriculture and its practices.

*2. Implementation.* To reach the stated objectives for the Groundwater Quality Trend Monitoring program, the third-party shall develop a groundwater quality monitoring network that will (1) be implemented over

both high and low vulnerability areas in the third-party area; and will (2) employ shallow wells, but not necessarily wells completed in the uppermost zone of first encountered groundwater. The use of existing wells is less costly than installing wells specifically designed for groundwater quality monitoring, while still yielding data which can be compared with historical and future data to evaluate long-term groundwater quality trends. The third party may also consider using existing monitoring networks such as those used by AB 3030 and SB 1938 plans.

3. *Reporting.* The results of trend monitoring are to be included in the third-party's Monitoring Report and shall include a map of the sampled wells, tabulation of the analytical data, and time concentration charts. Groundwater quality monitoring data are to be submitted electronically to the State Water Board's GeoTracker Database and to the Central Valley Water Board.

Following collection of sufficient data (sufficiency to be determined by the method of analysis proposed by the third-party or Trend Monitoring Group) from each well, the third-party is to evaluate the data for trends. The methods to be used to evaluate trends shall be proposed by the third-party or Trend Monitoring Group in the Groundwater Quality Trend Monitoring Workplan described in section IV.E below."

Between September 2017 and May 2018, the Coalition submitted two phases of the *Sacramento Valley Water Quality Coalition Groundwater Quality Trend Monitoring Workplan* (LSCE, 2017 and 2018a) to address the requirements for the GQTM Program as outlined in the WDRs Attachment B, Sections III.C and III.E. A subsequent Addendum to the Workplan was also submitted in July 2018 (LSCE, 2018b) to address comments on the Workplan provided by the Regional Board and presented an initial proposed GQTM well network. The Regional Board issued a Conditional Approval of the Addendum (CVRWQCB, 2018) and noted several additional requirements to be completed by May 1, 2019 including the submittal of a revised Workplan addressing a number of elements noted in the accompanying Regional Board staff review memorandum. Subsequently, GQTM Workplan Updates were submitted in 2019 and 2020 (LSCE, 2019, 2020) to address comments and required revisions as noted in the May 2019 Regional Board Conditional Approval letter (including the accompanying staff memorandum) and additional Regional Board staff review letter from November 9, 2019. The GQTM Workplan Updates included an increased number of wells in the GQTM network, recognizing that the GQTM well network continues to be considered an evolving network, not a static product.

In an August 6, 2020 letter, the Regional Board recommended proceeding with the Coalition's GQTM efforts as described in the 2020 Workplan Update (LSCE, 2020). This report presents the results from 2020 GQTM sampling, a discussion of GQTM trends and patterns, and a summary of the data quality assurance assessment are presented in this report.

The Coalition's boundary coincides with the boundary of the Sacramento River watershed and encompasses more than 18.2 million acres, including about 1.3 million acres of irrigated agricultural land. The Groundwater Quality Assessment Report (CH2M, 2016) prepared for the Coalition region provides an overview of hydrogeologic and groundwater quality conditions in the Coalition region.

### 3 GROUNDWATER QUALITY TREND MONITORING

The 2021 GQTM sampling event occurred in Summer 2021 and the results from this sampling event are presented in this report. The GQTM program involves groundwater quality sampling utilizing a network of wells selected to accomplish the GQTM Program objectives of monitoring regional and long-term trends in groundwater quality in relation to agricultural practices as outlined in Coalition GQTM Workplan submittals. These workplans discuss the dynamic nature of the GQTM network design,

including the expectation that the network would evolve and be expanded or otherwise modified in future years, as needed to achieve the program objectives. The GQTM network proposed for the 2021 sampling event consisted of network wells identified in the 2020 GQTM Workplan Update (LSCE, 2020) submitted in July 2020. In accordance with the annual and five-year GQTM sampling schedule, wells being sampled for the first time as part of the GQTM would have been tested for nitrate, total dissolved solids (TDS), and major cations and anions as required every five years, meanwhile wells previously sampled for the GQTM were only tested for nitrate, as required for annual monitoring. Since no new wells were sampled, only nitrate samples were collected. All wells sampled in 2021 for the GQTM were also tested for field parameters, including specific conductance, pH, temperature, dissolved oxygen, oxidation-reduction potential, and turbidity.

### 3.1 2021 GQTM Network Sampling Activities

Information related to the GQTM network wells sampled in 2021 are summarized in **Table 1** and their locations are displayed on **Figure 1**. The 2021 groundwater quality sampling for the SVWQC GQTM Program took place between August 16 and August 21, 2021. A total of 30 wells were planned for sampling in 2021 as outlined in the 2020 GQTM Workplan Update and 2020 Annual GQTM Report. The well owner for one well (SVWQC00027, Nord School), who is not a Coalition member, replaced their well with a deeper well not suitable for meeting the objectives of the GQTM. The owner of another well (SVWQC00018, Curry Road) elected to withdraw from participation in the program. As a result, a total of 28 GQTM network wells were sampled in 2021.

The 2021 GQTM network well sampling event was conducted without notable problems other than the loss of two wells. Wells were measured for depth to water (if access to water level measurements was available) upon arrival at each site and prior to conducting any well purging unless the well was running upon arrival. All wells were purged and sampled in accordance with the standard operation procedures (SOP) for sampling activities using existing pumping equipment. All sampled wells were monitored for field parameters including pH, temperature, electrical conductivity (EC), dissolved oxygen (DO), oxidation-reduction potential (ORP), and turbidity during the well purging and sampling event. In all wells sampled, the pumped water had achieved stabilization of field parameters prior to sample collection and no remarkable occurrences during the sampling process were noted. All water samples were stored on ice after collection and delivered to California Laboratory Services in Sacramento for analysis of nitrate and major cations and anions, in accordance with the GQTM requirements. Field forms from the sampling activities are provided as part of the electronic data submittal package submitted together with this document.

**Table 1: 2021 GQTM Network Wells**

GQTM Well ID	State Well Number	WCR Number	Well Use	Well Construction Information					Latitude (NAD83)	Longitude (NAD83)	Depth Bottom of Upper Zone (feet) <sup>3</sup>	Percent Screen in Upper Zone	Explanation of Monitored Depth
				Seal Depth (feet)	Seal Mat.	Total Well Depth (feet) <sup>1,2</sup>	Depth Top of Screen (feet) <sup>2</sup>	Depth Bottom of Screen (feet) <sup>1</sup>					
SVWQC00001	17N/03E-18		PWS		Cem				39.32262	-121.67860	113	N/A	The well depth is not known. WCRs indicate that all wells in vicinity are of similar depths, generally less than the bottom of the Upper Zone. Therefore, well is likely screened in the Upper Zone.
SVWQC00003	18N/02E-35		Irrig		Bent	105		105	39.36562	-121.70920	136	100%	Screens entirely in Upper Zone
SVWQC00004	18N/01W-16		PWS	50	Cem	120		120	39.41960	-121.96697	137	100%	Screens entirely in Upper Zone
SVWQC00005	22N/02W-32	369971	PWS	80	Bent	225	145	225	39.71070	-122.10609	139	0%	Older very shallow domestic wells skew delineated Upper Zone depth; recent wells are typically deeper. The well is screened at typical depth (from 145 to 225 feet) for domestic wells in the nearby sections (32 to 330 feet).
SVWQC00006	13N/01W-19	702875	PWS	60	Cem	260	180	260	38.96060	-122.01811	234	68%	Mostly in Upper Zone; well depth is less than the average domestic well depth in area (264 feet).
SVWQC00007	13N/09W-10	916600	PWS	50	Cem	121	55	105	38.98349	-122.84658	Not Mapped	N/A	Screens entirely above average domestic well depth in area (100 feet).
SVWQC00008	13N/05E-13		Dom		Cem	111		111	38.97403	-121.36062	98	N/A	Upper Zone is very shallow. Well screens are likely mostly in Upper Zone and entirely above average domestic well depth in area (127 feet).
SVWQC00009	42N/09E-25	138832	PWS	120	Cem	400	120	400	41.44681	-120.87935	Not Mapped	N/A	Outside Central Valley - Upper Zone not defined. Well intake depth is partially above average domestic well depth in area (215 feet). Well depths range from 75 to 640 feet in the area.
SVWQC00010	21N/15E-12		Dom			159		159	39.69027	-120.25014	Not Mapped	100%	Relatively shallow well; outside Central Valley Floor area - Upper Zone not defined. Likely screened mostly or entirely above average depth of nearby domestic wells (145 feet).

GQTM Well ID	State Well Number	WCR Number	Well Use	Well Construction Information					Latitude (NAD83)	Longitude (NAD83)	Depth Bottom of Upper Zone (feet) <sup>3</sup>	Percent Screen in Upper Zone	Explanation of Monitored Depth
				Seal Depth (feet)	Seal Mat.	Total Well Depth (feet) <sup>1,2</sup>	Depth Top of Screen (feet) <sup>2</sup>	Depth Bottom of Screen (feet) <sup>1</sup>					
SVWQC00011	06N/01E-17	116111	Other	20	Cem	120	70	80	38.36561	-121.89659	207	100%	Screens entirely in Upper Zone
SVWQC00012	07N/02E-17	51591	Dom		Cem	165	115	165	38.45108	-121.77325	260	100%	Screens entirely in Upper Zone
SVWQC00013	23N/15E-30	1089364	Stock	23	Cem	203	23	203	39.80460	-120.34511	Not Mapped	N/A	Relatively shallow well; outside Central Valley - Upper Zone not defined. Screened mostly above average depth of nearby domestic wells (152 feet).
SVWQC00015	10N/02E-08		PWS		Cem	226	203	226	38.72674	-121.76936	226	100%	Screens entirely in Upper Zone
SVWQC00016	09N/02E-09	72206	PWS	80	Cem	157	134	157	38.64049	-121.76376	273	100%	Screens entirely in Upper Zone
SVWQC00017	10N/01W-18	428830	Irrig	60	Cem	210	80	210	38.70895	-122.01271	185	80%	Screens mostly in Upper Zone
<del>SVWQC00018</del>	<del>20N/02E-26</del>	<del>141495</del>	<del>Dom</del>	<del>20</del>	<del>-</del>	<del>80</del>	<del>60</del>	<del>80</del>	<del>39.56190</del>	<del>-121.70782</del>	<del>142</del>	<del>100%</del>	<del>Screens entirely in Upper Zone</del>
SVWQC00019	13N/02W-03	2734	Dom		Cem	<b>140</b>		<b>140</b>	39.01184	-122.06906	228	100%	Screens entirely in Upper Zone
SVWQC00020	24N/03W-08	77262	Dom		Cem	152	144	152	39.94890	-122.22980	163	100%	Screens entirely in Upper Zone
SVWQC00021	18N/01W-30	E0113243	Dom	28	Bent	120	90	120	39.37719	-122.01334	142	100%	Screens entirely in Upper Zone
SVWQC00022	12N/01E-13	E067697	Dom	80	Bent	160	110	150	38.88302	-121.81911	247	100%	Screens entirely in Upper Zone
SVWQC00023	21N/02E-29		Dom			<b>121</b>		<b>121</b>	39.64656	-121.77023	141	100%	Screens entirely in Upper Zone
SVWQC00024	26N/02W-17		PWS		Cem	<b>120</b>		<b>120</b>	40.10719	-122.10759	131	100%	Screens entirely in Upper Zone
SVWQC00026	15N/09W-07		PWS	40	Cem	130	80	130	39.16774	-122.91139	Not Mapped	N/A	Shallow well; outside Central Valley - Upper Zone not defined. Screens sampling primarily above the local average domestic well depth (106 ft).
SVWQC00027	<del>22N/01W-11</del>	<del>70806</del>	<del>PWS</del>	<del>50</del>	<del>Bent</del>	<del>200</del>	<del>140</del>	<del>200</del>	<del>39.78040</del>	<del>-121.95486</del>	<del>134</del>	<del>0%</del>	<del>Relatively shallow well; represents water quality within the depth range for typical local domestic wells, which range from 35 to 520 feet deep. Zone of wells screens not hydraulically distinct from delineated Upper Zone.</del>



GQTM Well ID	State Well Number	WCR Number	Well Use	Well Construction Information					Latitude (NAD83)	Longitude (NAD83)	Depth Bottom of Upper Zone (feet) <sup>3</sup>	Percent Screen in Upper Zone	Explanation of Monitored Depth
				Seal Depth (feet)	Seal Mat.	Total Well Depth (feet) <sup>1,2</sup>	Depth Top of Screen (feet) <sup>2</sup>	Depth Bottom of Screen (feet) <sup>1</sup>					
SVWQC00028	11N/03W-10	555247	Dom	20	Cem	110	90	110	38.81890	-122.18366	136	100%	Screens entirely in Upper Zone
SVWQC00031	37N/04E-04		Dom			<b>98</b>		<b>98</b>	41.07892	-121.51902	Not Mapped	N/A	Very shallow well; outside Central Valley Floor area - Upper Zone not defined. Much shallower than average depth of nearby domestic wells (230 feet).
SVWQC00032	14N/03E-22	053306	Dom			139	100	120	39.04675	-121.62959	114	68%	Screens mostly in Upper Zone, depth typical for local domestic wells.
SVWQC00033	06N/05E-24	583117	Dom	50	Cem	220	169	220	38.35233	-121.37830	200	62%	Screens mostly in Upper Zone, entirely above average local domestic well depth.
SVWQC00034	29N/03W-04	091561	Dom	20	Bent	100	75	100	40.39615	-122.20709	156	100%	Screens entirely in Upper Zone
SVWQC00035	11N/02E-13		Dom			<b>100</b>		<b>100</b>	38.80289	-121.69580	198	100%	Screens entirely in Upper Zone

Note: Table includes all GQTM network wells planned for sampling in 2021. Strikeout of SVWQC00018 and SVWQC00027 indicates wells that could not be sampled in 2021.

<sup>1</sup> **Bold** values for total depth and bottom of screens are based on a tag of the well bottom conducted in the field; in such cases the total well depth is assumed to also be the bottom of the screen.

<sup>2</sup> In open-completion wells (open hole) the depth to top of screens is represented as the bottom of the casing and the total depth is the depth of the well borehole.

<sup>3</sup> The Upper Zone is defined by CV-SALTS (LSCE and LWA, 2016) based on typical domestic well depths and other hydrogeologic characteristics. The depth of bottom of Upper Zone from CV-SALTS ranges from less than 100 feet to about 300 feet in the Coalition region. Average domestic well depth in the vicinity is presented where Upper Zone depth was not determined by CV-SALTS.

PWS = public water supply; Dom = domestic; Irrig = irrigation; Bent = bentonite; Cem = cement

### 3.2 2021 GQTM Network Sampling Results

The results from the 2021 GQTM sampling event are presented in **Table 2**. Water quality results exceeding applicable drinking water standards are highlighted in bold in **Table 2**. For the purpose of comparing results with water quality objectives, the results are discussed below relative to drinking water standards. Some of the more notable water quality results from the sampling are discussed below.

In the 2021 sampling, analytical water quality results for one of the sampled wells, SVWQC00016, exceeded the primary drinking water MCL of 10 mg/L for nitrate (as nitrogen) and three wells (SVWQC00012, SVWQC00015, SVWQC00020) had nitrate concentrations that did not exceed the MCL, but were near or at the MCL. Samples from four wells, SVWQC00011, SVWQC00019, SVWQC00023, and SVWQC00028, were between 5 and 7.5 mg/L for nitrate. The remaining 20 network wells had nitrate concentrations of 5 mg/L or less, with 14 of these wells having nitrate concentration of 2.5 mg/L or less.

SVWQC00016 had previously tested above the MCL nitrate concentration in 2018, 2019, and 2020 and the well owner had previously been provided a Drinking Water Notification Template. Since this was the only well with a result over the MCL, and it had previously tested above the MCL, no Drinking Water Notifications were required for this year. SVWQC00012 had nitrate results above the MCL in 2018 and 2019 and near the MCL in 2020. SVWQC00020 had results above the MCL in 2018, 2019, and 2020.

No wells were sampled for the broader suite of analytes required for the GQTM for first-time sampled wells and at five-year intervals.

Letters summarizing the 2021 sampling results for individual wells and noting any identified water quality exceedances have been transmitted to all GQTM network well owners. Additional communication with owners of network wells exhibiting nitrate exceedances who are Coalition members is also in process to make well owners aware of management practices contained in the Coalition's Groundwater Quality Management Plan or other management practices intended to protect groundwater quality. These practices may include actions related to wellhead protection as well as agricultural management practices.

A spreadsheet with tabulated results for the 2021 sampling is included with the accompanying electronic data submittal package. All laboratory analytical report files and chain of custody forms associated with the sampling and analytical testing are also provided in the electronic data submittal package.

**Table 2: 2021 GQTM Sampling Results**

Site ID	Sample Date	ANALYTE	Nitrate + nitrite (as nitrogen)	Total Dissolved Solids (TDS)	Boron	Calcium	Magnesium	Potassium	Sodium	Chloride	Sulfate	Bicarbonate (as HCO3)	Carbonate (as CO3)	Hydroxide (as CaCO3)	Total Alkalinity (as CaCO3)	Temperature	pH	Specific Conductance (EC)	Turbidity	Oxidation-Reduction Potential (ORP)	Dissolved Oxygen (DO)	Depth to Water
		UNITS	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	°C	pH units	uS/cm	NTU	mV	mg/L	ft, bgs
		MCL	10 <sup>1</sup>	500/1,000 <sup>2</sup>	1.0 <sup>4</sup>						250/500 <sup>2</sup>	250/500 <sup>2</sup>						6.5/8.5 <sup>3</sup>	900/1,600 <sup>2</sup>			
SVWQC00001	8/18/2021		4.5													18.11	7.48	522	0	235.7	4.13	N/A
SVWQC00003	8/18/2021		1.3													17.07	7.5	392	0	372.5	2.39	13.58
SVWQC00004	8/18/2021		2.5													17.52	7.07	912	0	284	5.76	N/A
SVWQC00005	8/19/2021		4.2													20.6	7.04	579	0	250	7.4	N/A
SVWQC00006	8/17/2021		4.2													20.65	6.78	478	3.2	320	4.65	N/A
SVWQC00007	8/17/2021		4.6													16.71	6.81	295	0	259	2.11	61.87
SVWQC00008	8/18/2021		1.4													20.27	<b>6.36</b>	302	0	297	5.42	69.8
SVWQC00009	8/20/2021		ND													29.96	7.47	501	33	-28	2.3	N/A
SVWQC00010	8/21/2021		ND													16.37	7.35	243	0	197	6.78	98.56
SVWQC00011	8/16/2021		6													18.85	6.54	1,210	4.6	264	1.5	10.6
SVWQC00012	8/16/2021		10													18.41	6.6	975	0.8	278	4.11	54.77
SVWQC00013	8/21/2021		ND													13.8	7.26	1,200	0	-122	3.6	10.52
SVWQC00015	8/16/2021		10													18.66	6.82	904	0	304	4.79	71.98
SVWQC00016	8/16/2021		<b>13</b>													18.71	6.39	1,220	0.4	324	2.28	67.02
SVWQC00017	8/17/2021		0.6													18.77	6.8	564	0.3	264	4.9	61.03
SVWQC00019	8/17/2021		6.3													19.77	<b>6.48</b>	587	0	312	9.48	65.8
SVWQC00020	8/19/2021		8.9													20.92	7.07	412	0	243	7.93	112
SVWQC00021	8/18/2021		ND													17.92	7.45	601	0	-12.1	3.21	N/A
SVWQC00022	8/16/2021		ND													17.13	6.92	578	0	141	2.26	N/A
SVWQC00023	8/19/2021		5.6													18.93	6.58	655	7	238	6.51	58.1

Site ID	Sample Date	ANALYTE	Nitrate + nitrite (as nitrogen)	Total Dissolved Solids (TDS)	Boron	Calcium	Magnesium	Potassium	Sodium	Chloride	Sulfate	Bicarbonate (as HCO3)	Carbonate (as CO3)	Hydroxide (as CaCO3)	Total Alkalinity (as CaCO3)	Temperature	pH	Specific Conductance (Ec)	Turbidity	Oxidation-Reduction Potential (ORP)	Dissolved Oxygen (DO)	Depth to Water
		UNITS	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	°C	pH units	uS/cm	NTU	mV	mg/L	ft, bgs
		MCL	10 <sup>1</sup>	500/1,000 <sup>2</sup>	1.0 <sup>4</sup>						250/500 <sup>2</sup>	250/500 <sup>2</sup>						6.5/8.5 <sup>3</sup>	900/1,600 <sup>2</sup>			
SVWQC00024	8/19/2021		3.4													20.03	6.74	508	0	235	3.76	N/A
SVWQC00026	8/19/2021		0.56													20.03	6.74	508	0	235	3.76	N/A
SVWQC00028	8/17/2021		5.8													15.44	<b>6.36</b>	248	0	187	2.12	44.2
SVWQC00031	8/17/2021		ND													19.14	<b>6.08</b>	980	0	308	5.56	N/A
SVWQC00032	8/20/2021		0.12													13.92	6.79	214	0	168	6.63	N/A
SVWQC00033	8/18/2021		2.9													18.88	6.66	<b>1,700</b>	0.6	-1	1.17	N/A
SVWQC00034	8/16/2021		1.3													18.36	6.93	323	4.2	287	9.95	71.92
SVWQC00035	8/19/2021		ND													18.62	6.66	285	0	250	7.9	46.65

<sup>1</sup> Primary Maximum Contaminant Level (MCL) for drinking water. <sup>2</sup> Secondary MCL (recommended/upper range) for drinking water. <sup>3</sup> Suggested lower/upper acceptable range for drinking water.

<sup>4</sup> State Notification (Action) level - A health-based level established by the State of California for some constituents lacking MCLs; if a public water system detects a constituent at concentrations above the action level, local governing bodies must be notified.

ND = Not detected above laboratory minimum detection level or reporting limit (MDL) shown; N/A = no access to water level reading.

**Bold values indicate results above an MCL or action level.**

All wells were previously sampled for broader set of constituents in accordance with five-year schedule and were only sampled for nitrate and field parameters in accordance with annual requirement.

### 3.3 Groundwater Quality Trends and Patterns

A map of locations and concentrations of nitrate in GQTM network wells in 2021 is presented as **Figure 2**. Land uses mapped in 2018 based on Department of Water Resources (DWR)<sup>1</sup> data are also shown in **Figure 2** in relation to the GQTM network wells and 2021 nitrate concentrations. As discussed above and illustrated in **Figure 2**, nitrate concentrations in wells sampled in 2021 were generally low, although one nitrate MCL exceedance did occur and three additional wells had concentration at or near (but not above) the MCL. The well exceeding the nitrate MCL is symbolized in red in **Figure 2**; wells with nitrate concentrations between 7.5 and 10 mg/L are displayed in orange in **Figure 2**. The one nitrate exceedance occurred in a well located within the Central Valley Floor area of the Coalition region, in the more southern part of the Coalition in the Yolo Subwatershed area. Of the three wells with nitrate concentrations between 7.5 and 10 mg/L, one is located in the Yolo Subwatershed area, one is in the Solano Subwatershed area and one is located in the Shasta-Tehama Subwatershed area. Nearly half of the wells sampled in 2021 had nitrate concentrations of less than 2.5 mg/L, including less than detectable nitrate concentrations in samples collected from wells located in the groundwater basins outside of the Central Valley. Otherwise, no notable spatial patterns in nitrate concentrations are apparent from the 2021 GQTM sampling results.

The primary objective of the GQTM Program is to evaluate regional temporal trends in groundwater quality as they relate to agricultural practices. As discussed in the GQTM Workplan, more extensive evaluation of groundwater quality data and identification of any trends and associated relationships with agricultural practices will be conducted and summarized at five-year intervals and once a sufficient period of record of groundwater quality data has been developed for assessing such trends. The first five-year review and reporting of the GQTM results is planned to occur in 2023.

The groundwater quality results from the 2021 sampling event represent the second, third, or fourth groundwater quality datapoint for the Sacramento Valley Water Quality Coalition GQTM network wells. Charts of time-series nitrate concentration data for all network wells are presented in **Appendix A**. Most of the charts with sufficient historical data show relatively stable to decreasing trends in nitrate concentrations based on available historical groundwater quality data for GQTM network wells. One well (SVWQC00016) appears to exhibit a trend of increased nitrate concentrations since the mid-2000s based on historical data records, but no data on nitrate concentrations in the well exist between about 2009 and the commencement of GQTM monitoring in 2018. The samples collected from the well since 2018 suggest a shorter-term trend of decreasing concentrations. A longer-term record of recent nitrate concentrations will be important in understanding current trends in groundwater quality. The period of available data record for most wells remains relatively limited. As network wells develop a longer-term time-series record of datapoints, more in-depth analysis and evaluation of groundwater quality trends in GQTM network wells will be conducted as part of the broader GQTM program summary and analysis completed every five years.

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<sup>1</sup> <https://data.cnra.ca.gov/dataset/statewide-crop-mapping>

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### 3.4 Summary of Quality Assurance Evaluation for 2021 Sampling Event

Consistent with the QAPP, field measurements of electrical conductivity (EC) at 25°C, pH, dissolved oxygen (DO) and temperature (T) were obtained during the sample retrieval and the laboratory performed analysis for nitrate + nitrite as nitrogen (NO<sub>3</sub> as N). Additional field parameters of turbidity and oxidation-reduction potential (ORP) were also recorded during sampling.

As all network wells had previously been sampled and the 2021 sample event is the 4<sup>th</sup> year of the monitoring program, no analyses for boron (B), sodium (Na), potassium (K), calcium (Ca), magnesium (Mg), chloride (Cl), sulfate (SO<sub>4</sub>), carbonate and bicarbonate alkalinity, or total dissolved solids (TDS) were required in 2021, in accordance with the annual and five-year sampling schedule in the GQTM Workplan and QAPP.

#### 3.4.1 Purging, sample handling, and custody

Wells were purged according to the SOP. Samples were retrieved upon stabilization of indicator parameters (i.e., EC and pH) and after the turbidity of the discharging water dropped below 10 NTUs. Purging and sampling activities were documented on field sheets provided in the QAPP. Samples were collected in laboratory-supplied bottles and transported under prescribed chain of custody to the laboratory according to the QAPP.

#### 3.4.2 Field and analytical completeness

A total of 30 wells were planned for sampling, and 28 wells were able to be sampled in 2021 resulting in an overall 93 percent completeness for well sampling and field parameters (**Table 3**). Two well originally planned for sampling in 2021 could not be sampled because the well owners notified the sampler that the wells could no longer be used for the GQTM network. All well samples collected were analyzed at the laboratory resulting in 100 percent analytical completeness (**Table 3**). For the purpose of field quality control (QC), the QAPP prescribes the collection of one duplicate sample and one blank sample for every 20 samples retrieved (each must be at least 5 percent of total samples). In accordance with the QAPP, four duplicate samples were retrieved representing 14 percent of the wells sampled. Two field blank samples were submitted to the laboratory representing approximately 7 percent of the wells sampled. The assessment of completeness for field QC sampling is summarized in **Table 4**. A summary of the hold times specified in the QAPP for the laboratory analyses is presented in **Table 5**. All analyses were conducted within the specified hold time.

#### 3.4.3 Analytical precision and accuracy

The laboratory performed all QA/QC for laboratory precision and accuracy in accordance with the QAPP including lab blanks, lab duplicates, matrix spikes, and lab control spikes. Results of the assessment of precision and accuracy are summarized in **Tables 6 and 7** and include evaluation of chemistry QC with field and laboratory blank samples; laboratory control and matrix spikes to evaluate accuracy; and field, laboratory, and matrix spike duplicates to evaluate precision. Analytical precision and accuracy met all acceptability requirements for most analytes tested. One of the four field duplicates was outside of the range of acceptability. In the one instance where the field duplicate was outside of acceptability range, both the original and duplicate samples had low concentrations of nitrate (<3 mg/L) and the variability in

results between the original and duplicate sample does not suggest any concerns with precision and accuracy of the results. The laboratory blanks, control spikes, matrix spikes, and analytical duplicates were all within the acceptability criteria. The analytical precision and accuracy were deemed acceptable for all constituents based on the combined results from laboratory controls, including laboratory blanks.

#### 3.4.4 Quality assurance evaluation conclusions

All groundwater quality data are considered acceptable based on the review of QA/QC procedures and results in accordance with the requirements in the QAPP. All of the data obtained as part of the 2021 sampling event were accepted and are considered useable.

**Table 3: Completeness of Field and Analytical Testing**

Constituent	Test Type	Analytical Method	Matrix	Wells Planned for Sampling	Wells Sampled	Field and Transport Completeness	Total Samples Analyzed	Analytical Completeness
Dissolved Oxygen (DO)	Field parameter	SM4500-O G-2001	Groundwater	30	28	93%	28	100%
Electrical Conductivity (EC) at 25 °C	Field parameter	SM2510-B 1997	Groundwater	30	28	93%	28	100%
pH	Field parameter	SM4500-H+ B-2000	Groundwater	30	28	93%	28	100%
Temperature	Field parameter	SM2550-B 2000	Groundwater	30	28	93%	28	100%
*Oxidation-reduction potential (ORP)	Field parameter	-	Groundwater	30	28	93%	28	100%
*Turbidity	Field parameter	EPA180.1	Groundwater	30	28	93%	28	100%
Nitrate + Nitrite as N	Laboratory	SM4500-NO3 E	Groundwater	30	28	93%	28	100%
Total Dissolved Solids (TDS)	Laboratory	SM2540C	Groundwater	n/a	n/a	n/a	n/a	n/a
Carbonate	Laboratory	SM 2330B	Groundwater	n/a	n/a	n/a	n/a	n/a
Bicarbonate	Laboratory	SM 2330B	Groundwater	n/a	n/a	n/a	n/a	n/a
Alkalinity as CaCO <sub>3</sub>	Laboratory	SM 2320B	Groundwater	n/a	n/a	n/a	n/a	n/a
Chloride	Laboratory	EPA 300.0	Groundwater	n/a	n/a	n/a	n/a	n/a
Sulfate	Laboratory	EPA 300.0	Groundwater	n/a	n/a	n/a	n/a	n/a
Boron	Laboratory	EPA 200.7	Groundwater	n/a	n/a	n/a	n/a	n/a
Calcium	Laboratory	EPA 200.7	Groundwater	n/a	n/a	n/a	n/a	n/a
Magnesium	Laboratory	EPA 200.7	Groundwater	n/a	n/a	n/a	n/a	n/a
Potassium	Laboratory	EPA 200.7	Groundwater	n/a	n/a	n/a	n/a	n/a
Sodium	Laboratory	EPA 200.7	Groundwater	n/a	n/a	n/a	n/a	n/a
<b>Total</b>				<b>210</b>	<b>196</b>	<b>93%</b>	<b>196</b>	<b>100%</b>

\* ORP and turbidity are optional field parameters.

n/a = not applicable because analytes were not tested during 2021 event.



**Table 4: Completeness of Field QC**

Constituent	Analytical Method	Matrix	Total Well Samples Analyzed	Field Duplicate Samples Analyzed	Field Blank Samples Analyzed	Total Samples Analyzed (well and duplicates)	Field Duplicate Completeness	Field Blank Completeness
Nitrate + Nitrite as N	SM4500-NO3 E	Groundwater	28	4	2	34	14.3%	7.14%
Total Dissolved Solids (TDS)	SM2540C	Groundwater	n/a	n/a	n/a	n/a	n/a	n/a
Carbonate	SM 2330B	Groundwater	n/a	n/a	n/a	n/a	n/a	n/a
Bicarbonate	SM 2330B	Groundwater	n/a	n/a	n/a	n/a	n/a	n/a
Alkalinity as CaCO <sub>3</sub>	SM 2320B	Groundwater	n/a	n/a	n/a	n/a	n/a	n/a
Chloride	EPA 300.0	Groundwater	n/a	n/a	n/a	n/a	n/a	n/a
Sulfate	EPA 300.0	Groundwater	n/a	n/a	n/a	n/a	n/a	n/a
Boron	EPA 200.7	Groundwater	n/a	n/a	n/a	n/a	n/a	n/a
Calcium	EPA 200.7	Groundwater	n/a	n/a	n/a	n/a	n/a	n/a
Magnesium	EPA 200.7	Groundwater	n/a	n/a	n/a	n/a	n/a	n/a
Potassium	EPA 200.7	Groundwater	n/a	n/a	n/a	n/a	n/a	n/a
Sodium	EPA 200.7	Groundwater	n/a	n/a	n/a	n/a	n/a	n/a
<b>Total</b>			<b>28</b>	<b>4</b>	<b>2</b>	<b>34</b>	<b>14.3%</b>	<b>7.14%</b>

Completeness values below the acceptability requirement of 5 percent are presented in **bold**. n/a = not applicable because analytes were not tested during 2021 event.

**Table 5: Evaluation of Sample Hold Times**

Constituent	Analytical Method	Matrix	Hold Time	Total Samples Analyzed (well, duplicates, and blanks)	Samples Analyzed within Hold Time	Acceptability
Nitrate + Nitrite as N	SM4500-NO3 E	Groundwater	7 days	34	34	100%
Total Dissolved Solids (TDS)	SM2540C	Groundwater	7 days	n/a	n/a	n/a
Carbonate	SM 2330B	Groundwater	14 days	n/a	n/a	n/a
Bicarbonate	SM 2330B	Groundwater	14 days	n/a	n/a	n/a
Alkalinity as CaCO3	SM 2320B	Groundwater	14 days	n/a	n/a	n/a
Chloride	EPA 300.0	Groundwater	28 days	n/a	n/a	n/a
Sulfate	EPA 300.0	Groundwater	28 days	n/a	n/a	n/a
Boron	EPA 200.7	Groundwater	6 months	n/a	n/a	n/a
Calcium	EPA 200.7	Groundwater	6 months	n/a	n/a	n/a
Magnesium	EPA 200.7	Groundwater	6 months	n/a	n/a	n/a
Potassium	EPA 200.7	Groundwater	6 months	n/a	n/a	n/a
Sodium	EPA 200.7	Groundwater	6 months	n/a	n/a	n/a
<b>Total</b>				<b>34</b>	<b>34</b>	<b>100%</b>

Acceptability values below 90 percent are presented in **bold**. n/a = not applicable because analytes were not tested during 2021 event.

**Table 6: Evaluation of Field Duplicates and Blanks**

Constituent	Analytical Method	Matrix	Sample Type	Acceptability Requirement	Total Samples	Samples within Acceptability	Acceptability
Nitrate + Nitrite as N	SM4500-NO3 E	Groundwater	Field duplicate	RPD≤25%	4	3	<b>75%</b>
<b>Field Duplicate Total</b>					<b>4</b>	<b>3</b>	<b>75%</b>

Acceptability values below 90 percent are presented in **bold**. n/a = not applicable because analytes were not tested during 2021 event.

Constituent	Analytical Method	Matrix	Sample Type	Acceptability Requirement	Total Samples	Samples within Acceptability	Acceptability
Nitrate + Nitrite as N	EPA 300.0	Groundwater	Field blank	<RL or < sample/5	2	2	<b>100%</b>
<b>Field Blank Total</b>					<b>2</b>	<b>2</b>	<b>100%</b>

Acceptability values below 90 percent are presented in **bold**. n/a = not applicable because analytes were not tested during 2021 event.

**Table 7: Evaluation of Lab Controls and Spikes**

Constituent	Analytical Method	Matrix	Sample Type	Acceptability Requirement	Total Samples	Samples within Acceptability	Acceptability
<b>Lab Blanks</b>							
Nitrate + Nitrite as N	SM4500-NO3	Water	Blank	< RL	3	3	100%
<b>Lab Blank Total</b>					<b>3</b>	<b>3</b>	<b>100%</b>
<b>Lab Control Spikes</b>							
Nitrate + Nitrite as N	SM4500-NO3	Water	LCS	PR 90-110	3	3	100%
<b>Lab Control Total</b>					<b>3</b>	<b>3</b>	<b>100%</b>
<b>Matrix Spikes</b>							
Nitrate + Nitrite as N	SM4500-NO3 E	Water	Matrix Spike	PR 80-120	3	3	100%
<b>Matrix Spike Total</b>					<b>3</b>	<b>3</b>	<b>100%</b>
<b>Analytical Duplicates</b>							
Total Dissolved Solids	SM2540C	Water	MSD/LCSD	RPD ≤ 25%	6	6	100%
<b>Analytical Duplicate Total</b>					<b>6</b>	<b>6</b>	<b>100%</b>

Acceptability values below 90 percent are presented in **bold**. n/a = not applicable because analytes were not tested during 2021 event.

LCS=lab control spike; MS=matrix spike; MSD=matrix spike duplicate; LCSD=lab control spike duplicate

### 3.5 GQTM Network Discussion

An initial network of wells was selected for the GQTM and presented in the Workplan (LSCE, 2017, 2018a, 2018b) based on evaluation of candidate wells and their individual well characteristics in combination with locational considerations identified in the Workplan and Addendum. The Workplan presented the prioritization of areas for monitoring derived through a quantitative evaluation using factors based on required GQTM considerations indicated in the WDRs, including historical water quality, high vulnerability areas delineated in the GAR, proximity and flow direction relative to any communities, and land use and agricultural areas. Identified Monitoring Areas (MAs) delineate general areas of higher monitoring priority. Unlike a random design approach, this focuses monitoring efforts in areas where impacts from agricultural activities are more likely to manifest in the groundwater. As described in the Workplan, the target depth zone for the GQTM network is the Upper Zone as delineated by CV-SALTS (LSCE and LWA, 2016). The depth of the Upper Zone is defined based on hydrogeologic considerations and the typical depth of domestic wells. The bottom of the Upper Zone within the SVWQC is typically not defined by any distinct hydrogeologic feature(s).

The Workplan discusses the dynamic nature of the GQTM network design, including the expectation that the network would evolve and be expanded or otherwise modified in future years, as needed to achieve the program objectives. The Coalition submitted GQTM Workplan Updates in 2019 and 2020 (LSCE, 2019, 2020) in May 2019 and July 2020, including discussion of modifications and additions to the GQTM network and additional rationale for the network design. The Regional Board provided a review of the 2020 GQTM Workplan Update in a August 6, 2020 letter (CVRWQCB, 2020) including recommending proceeding with the GQTM efforts as described in the 2020 Workplan Update. If any changes to the GQTM network occur, an update is to be submitted 60 days prior to sampling. Two network wells are being removed from the GQTM program for the 2022 sampling event because one well has been replaced with a deeper well not suitable for the GQTM and one well is being removed at the request of the well owners. The owners of the two wells being removed from the GQTM network are not Coalition members. A separate submittal will be provided at least 60 days prior to the 2022 sampling event presenting the planned GQTM well network for 2022.

## 4 OTHER ANNUAL REPORTING REQUIREMENTS

In accordance with the WDRs, this Annual Groundwater Quality Trend Monitoring Report provides information on the Coalition monitoring activities and results related to the GQTM program. Additional required annual reporting elements identified in the Monitoring and Reporting Program (MRP) are addressed in the Annual Monitoring Report, or other submittal documents, as appropriate.

### 4.1 Electronic Data Submittal and Data Uploaded to GeoTracker

In accordance with the requirements for reporting of annual groundwater monitoring results, an electronic data submittal with information related to the Coalition's GQTM activities is being provided to accompany this report (**Appendix B**). Included in the electronic data submittal are the following items:

- Excel worksheet containing export of data uploaded to GeoTracker
- Excel worksheet containing:
  - Summary table of information on 2021 GQTM network wells, including latitude and longitude information
  - Summary table of results from 2021 GQTM sampling event in tabular form
  - Summary sheet of laboratory analytical methods
- GIS shapefile dataset with locations of 2021 GQTM network wells
- Field forms for 2021 GQTM sampling event
- Laboratory analytical report files including chain of custody forms and laboratory narrative of QC failures and identification of any analytical problems and anomalies

All other electronic data and information relating to the Coalition's other monitoring activities is addressed in the Annual Monitoring Report submittal, or other associated submittals, as appropriate.

## 5 SUMMARY AND CONCLUSIONS

The 2021 GQTM sampling event was successfully completed with 28 GQTM wells being sampled. Water quality results from the 2021 sampling indicates one well with nitrate concentration above the MCL and three additional wells with nitrate concentrations equal to, or very close to, the MCL. About half of the wells sampled had nitrate concentrations below 2.5 mg/L. Limited data are available for evaluating long-term trends and patterns in groundwater quality at this point in the GQTM program implementation; however, review of time-series charts of nitrate concentrations in GQTM wells suggests that most or all wells have stable or declining trends in nitrate concentrations. In accordance with the GQTM Workplan, an evaluation of trends will be conducted at five-year intervals starting in reporting on the first five years of GQTM data in 2023.

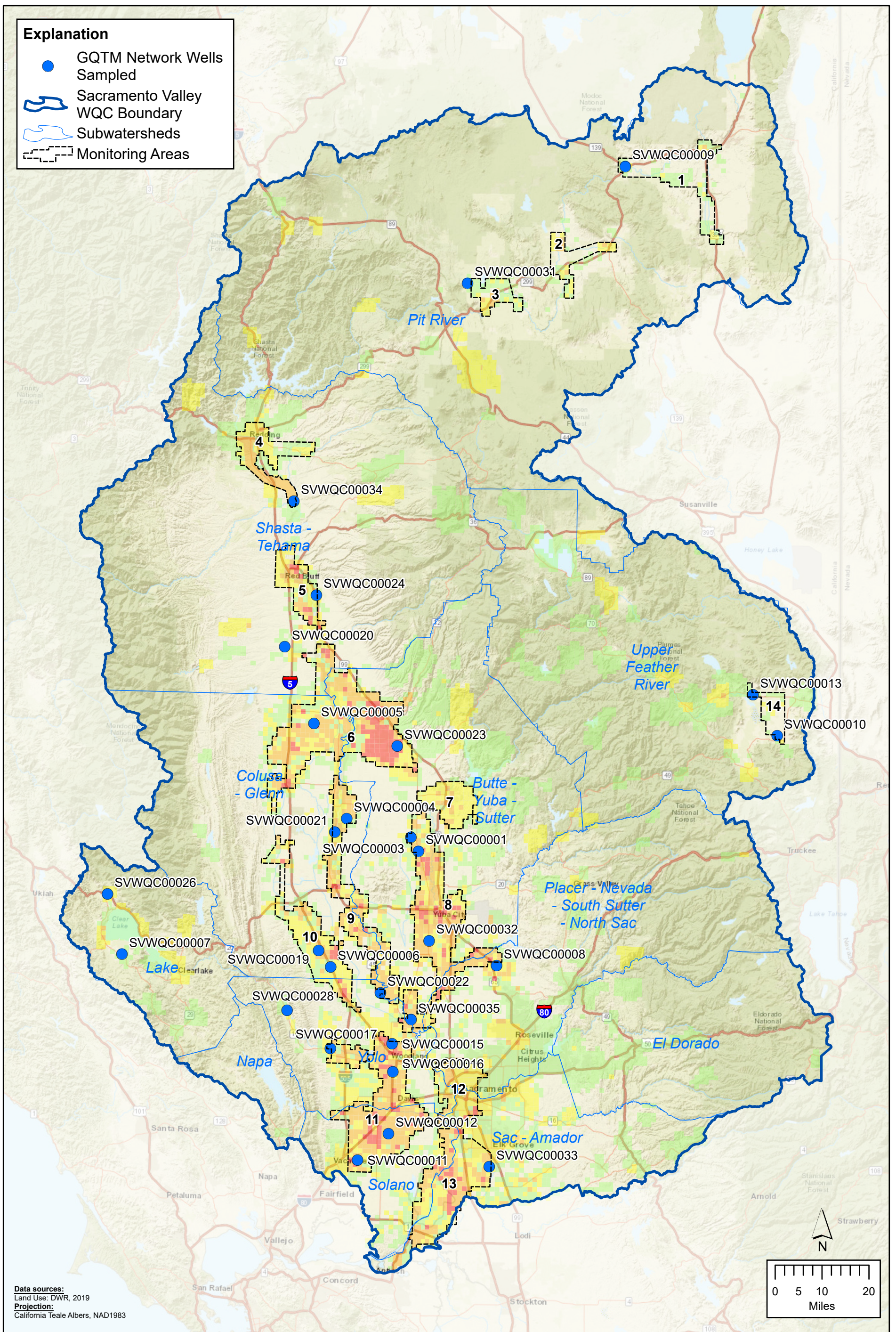
The owner of GQTM network well SVWQC00016, which was the only well with a nitrate exceedance in 2021, was previously notified and provided a Drinking Water Notification Template in 2019. Well SVWQC00016 is a transient non-community public water system well. Letters summarizing the 2021 sampling results for individual wells and noting any identified water quality exceedances were prepared and transmitted to all GQTM network well owners. Additional communication by the Coalition with owners of network wells exhibiting nitrate exceedances will continue to make well owners aware of

management practices contained in the Coalition's Groundwater Quality Management Plan or other management practices intended to protect groundwater quality.

## 6 REFERENCES

- Central Valley Regional Water Quality Control Board (CVRWQCB). 2020. Review of the 2020 Groundwater Quality Trend Monitoring Workplan: Sacramento Valley Water Quality Coalition. August 6, 2020.
- Central Valley Regional Water Quality Control Board (CVRWQCB). 2019. Review of the 2019 Groundwater Quality Trend Monitoring Workplan: Sacramento Valley Water Quality Coalition. November 5, 2019.
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- Central Valley Regional Water Quality Control Board (CVRWQCB). 2015. Order R5-2014-0030-R1, Waste Discharge Requirements General Order for Growers within the Sacramento River Watershed that are Members of the Third-Party Group. Adopted March 12, 2014; revised June 5, 2015 (including all applicable revisions).
- CH2M. 2016. Groundwater Quality Assessment Report, Prepared for Central Valley Regional Water Quality Control Board On Behalf Of Northern California Water Association & Sacramento Valley Water Quality Coalition. Final. January 2016.
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- Luhdorff & Scalmanini (LSCE). 2019. Sacramento Valley Water Quality Coalition Groundwater Quality Trend Monitoring Workplan: 2019 Revisions and Update. May 1, 2019.
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- Luhdorff and Scalmanini (LSCE). 2018b. Sacramento Valley Water Quality Coalition Groundwater Quality Trend Monitoring Workplan: Addendum. July 31, 2018.
- Luhdorff & Scalmanini (LSCE). 2017. Groundwater Quality Trend Monitoring Workplan, Phase 1 – Monitoring Design Approach, for the Sacramento Valley Water Quality Coalition. September 18, 2017.

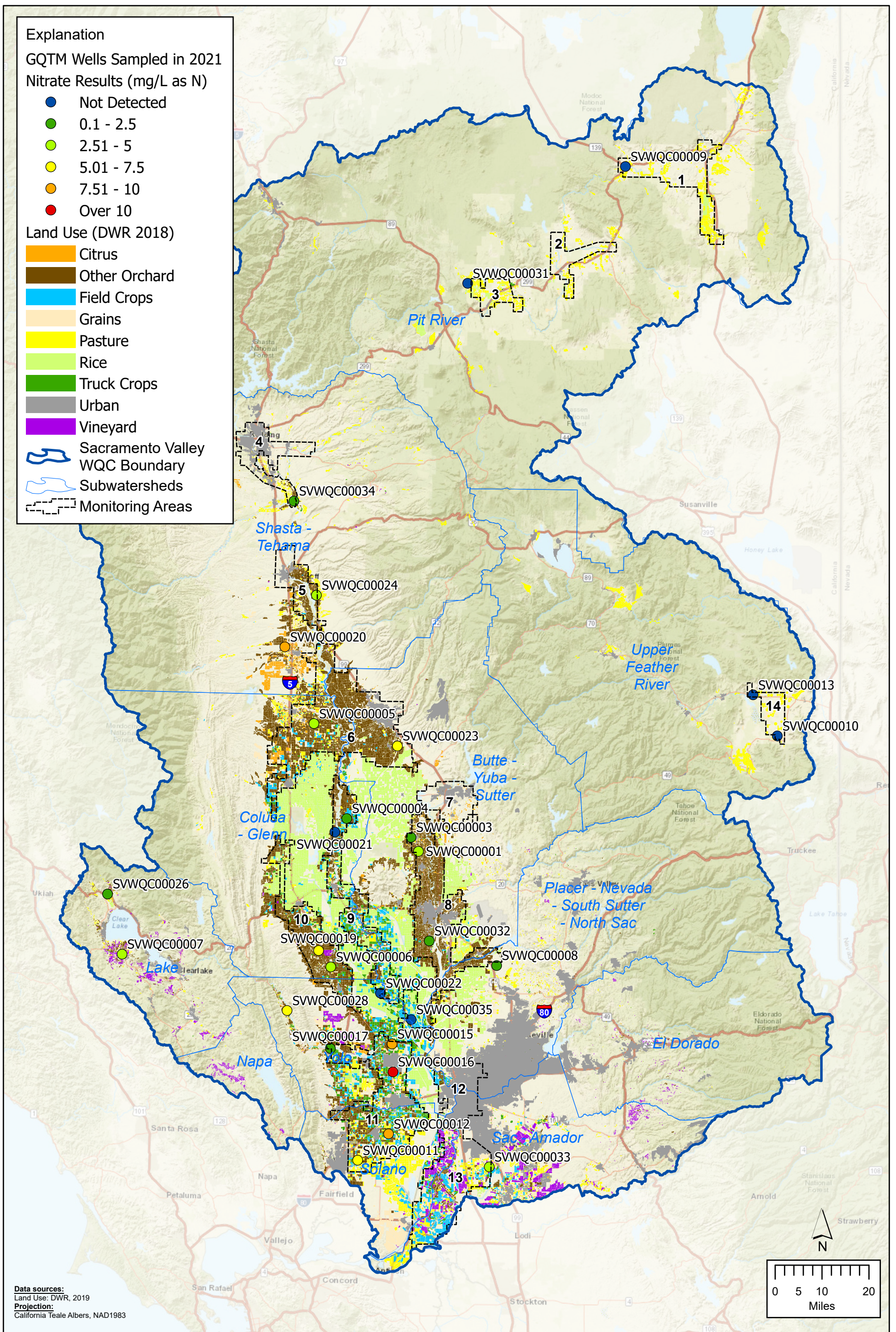
## Map Figures



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**FIGURE 1**  
 2021 GQTM Network Wells





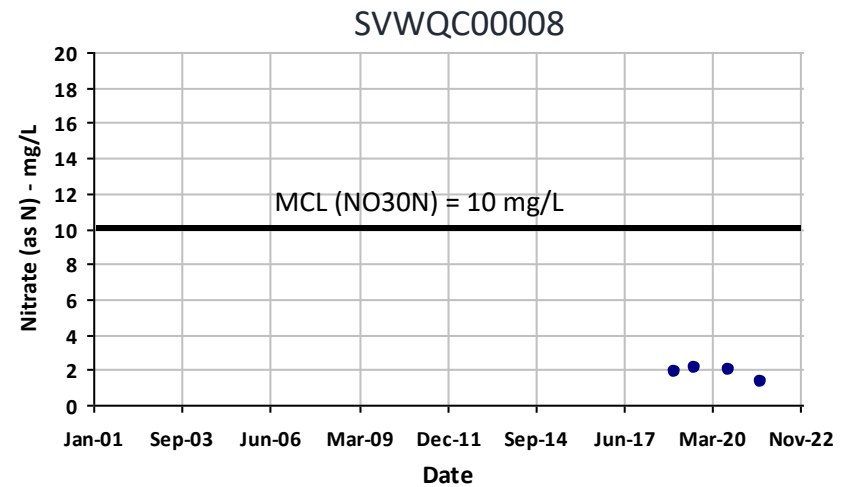
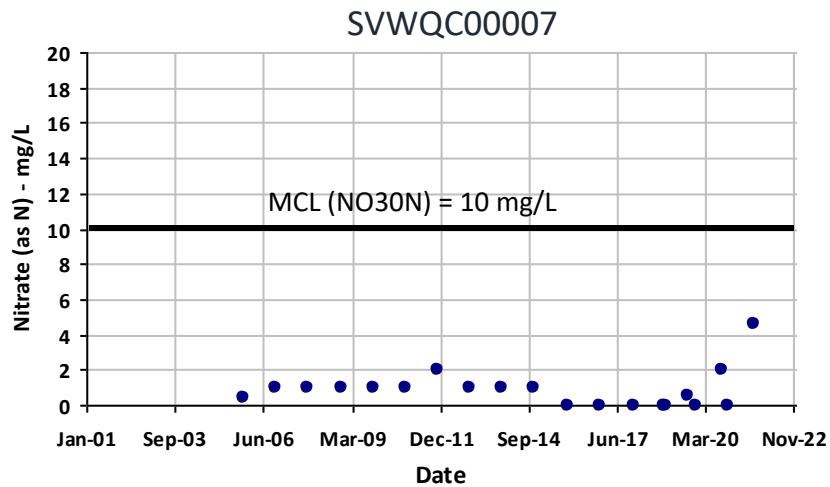
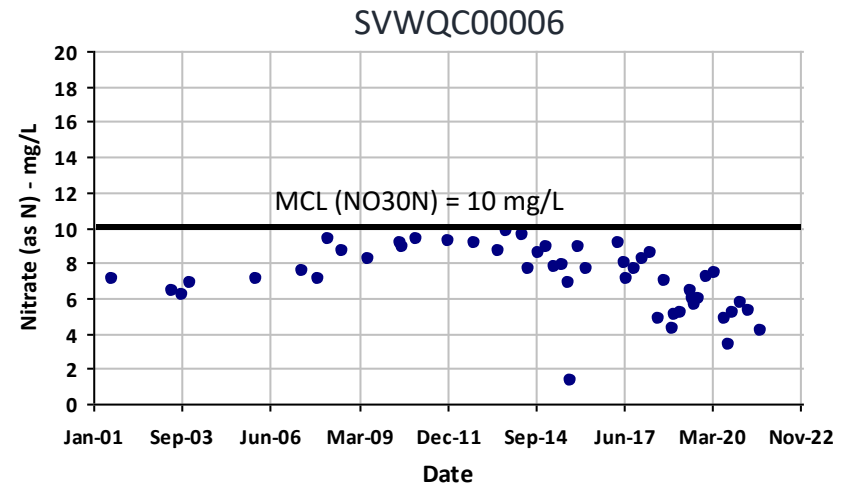
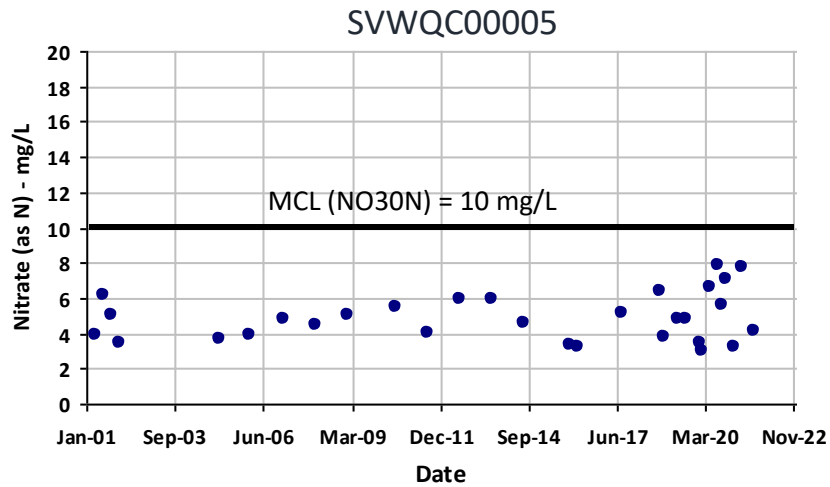
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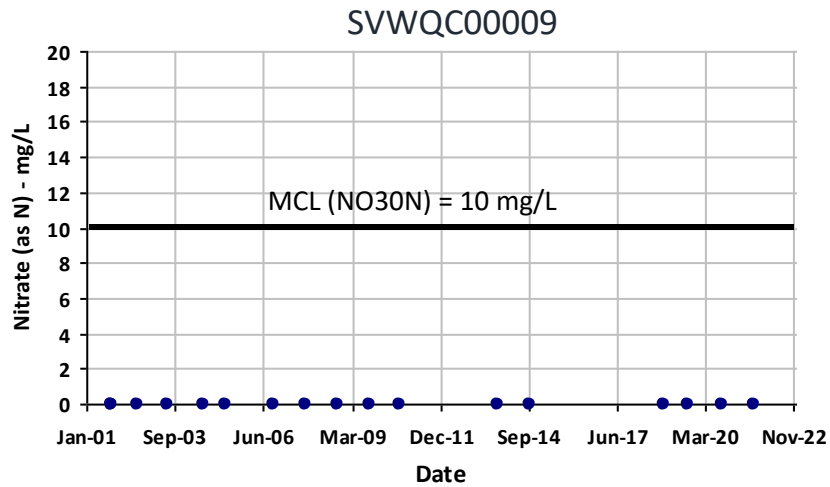
**FIGURE 2**  
 2021 GQTM Nitrate Results with Land Uses

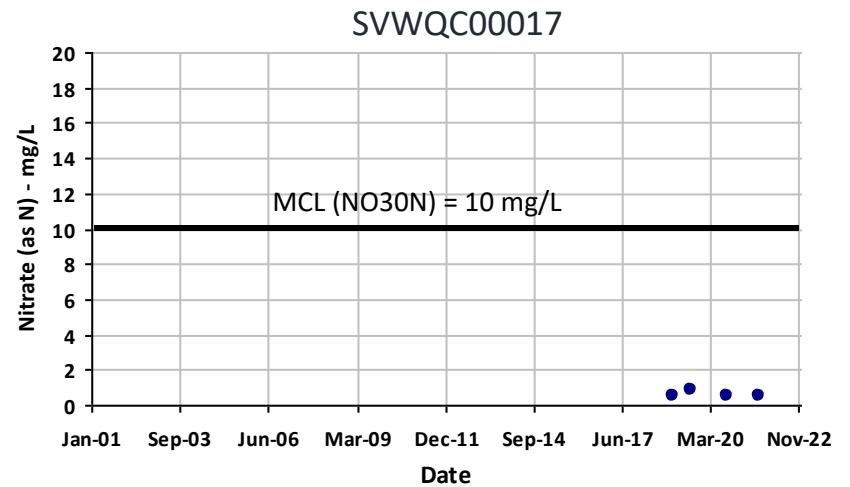
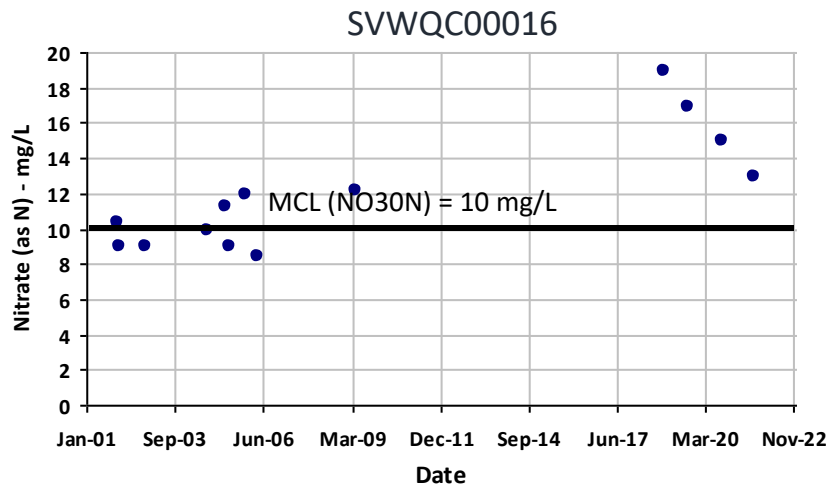
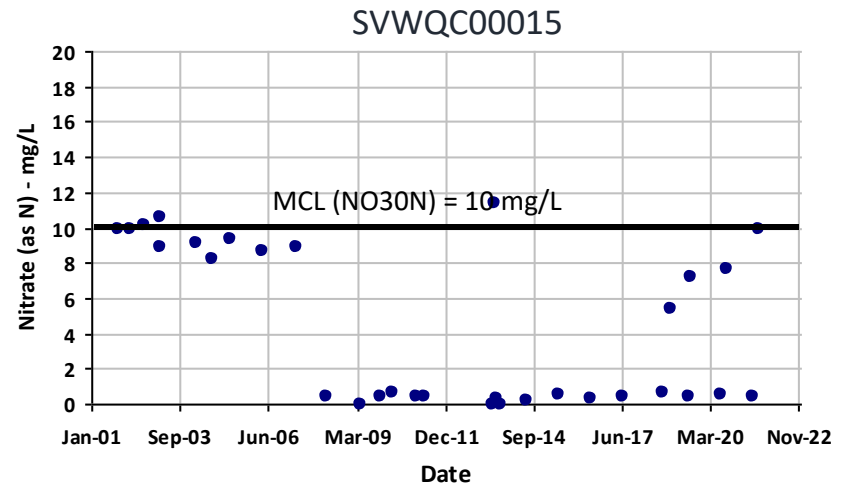
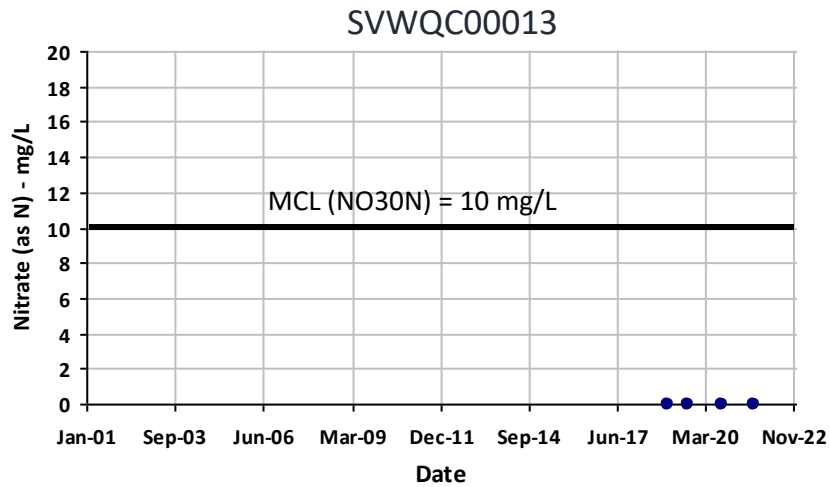
## **Appendix A: GQTM Network Well Nitrate Concentration Time-Series Plots**

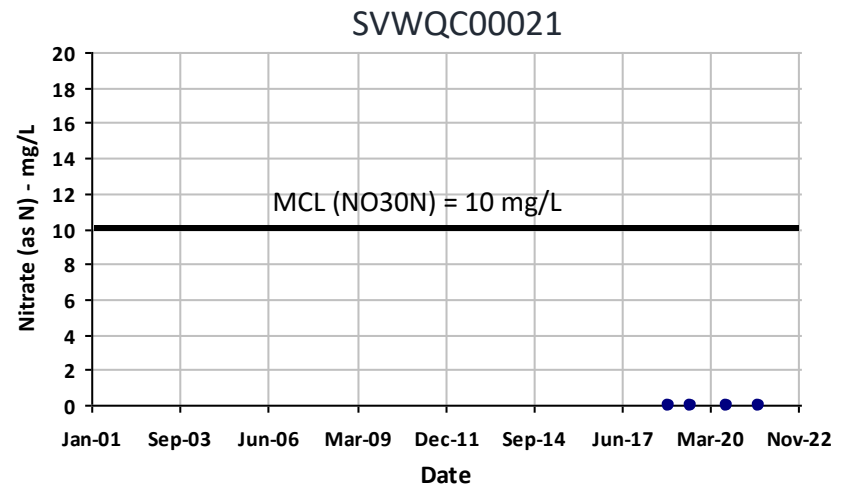
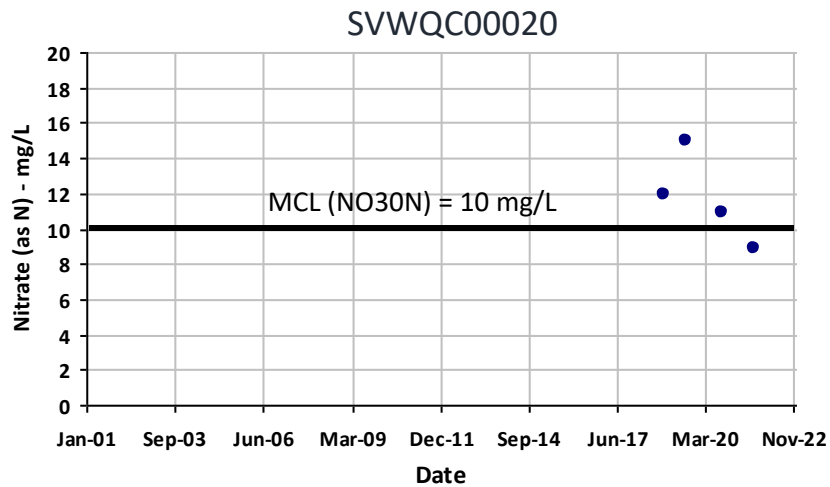
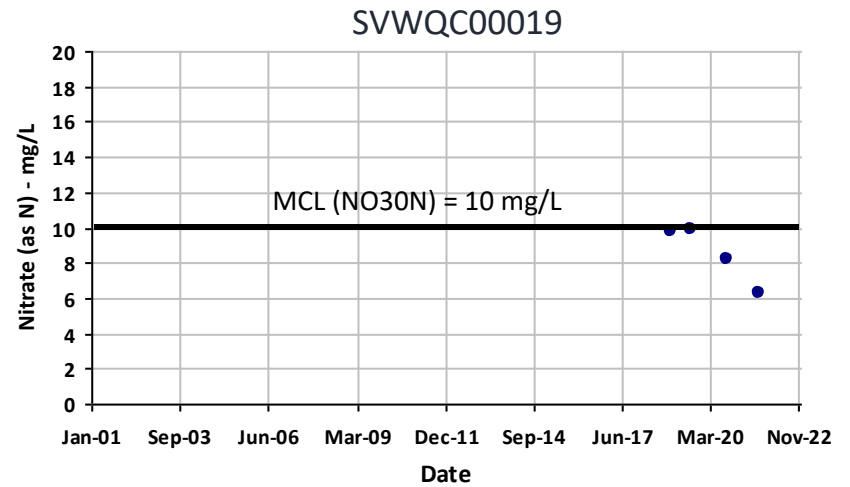
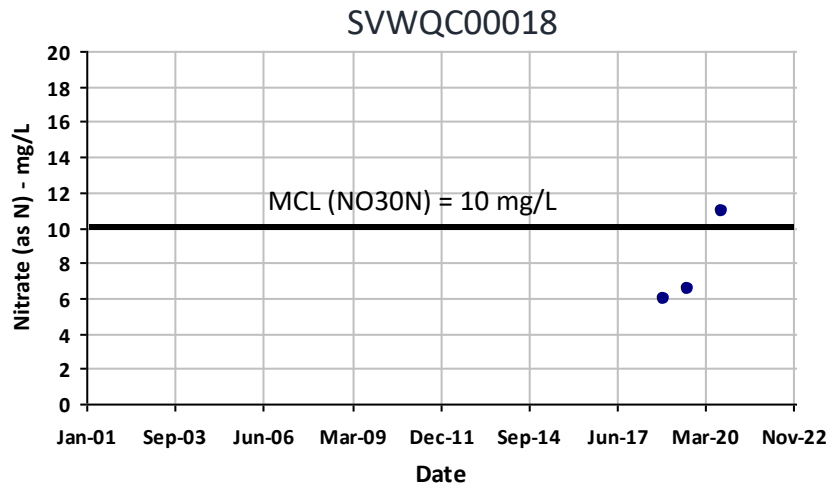
This appendix presents time-series nitrate concentration plots for GQTM network wells for which sufficient data are available. Concentrations relative to the primary drinking water MCL of 10 mg/L are presented on the plots.

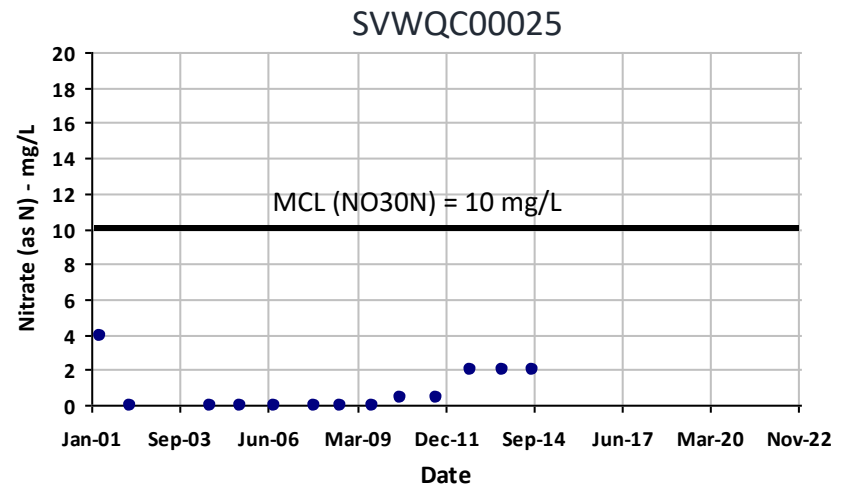
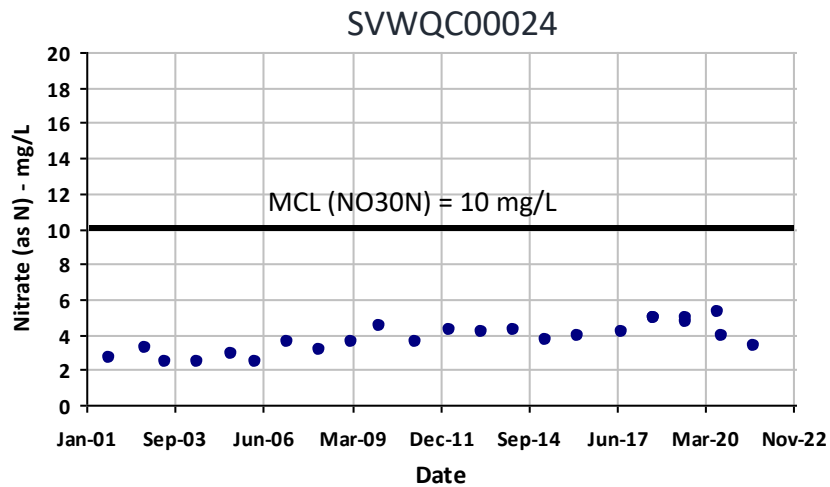
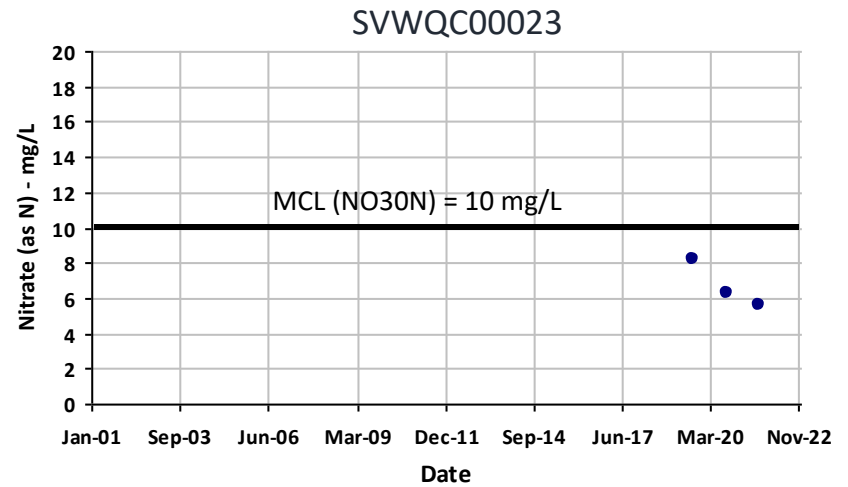
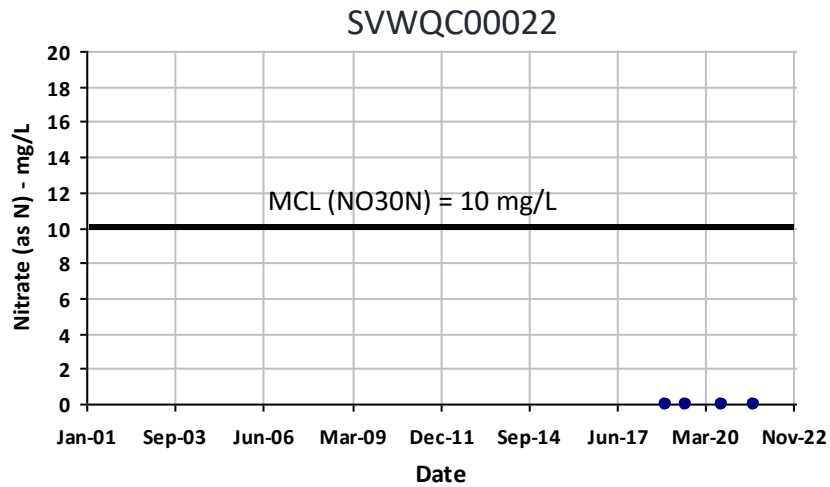




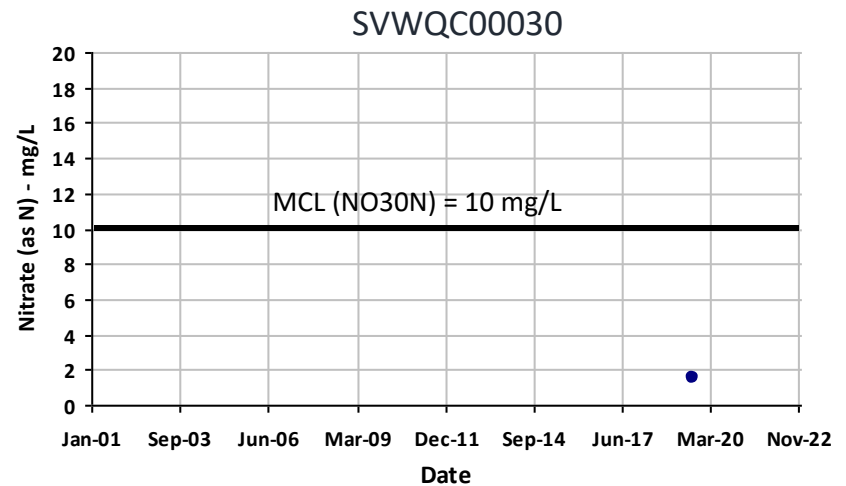
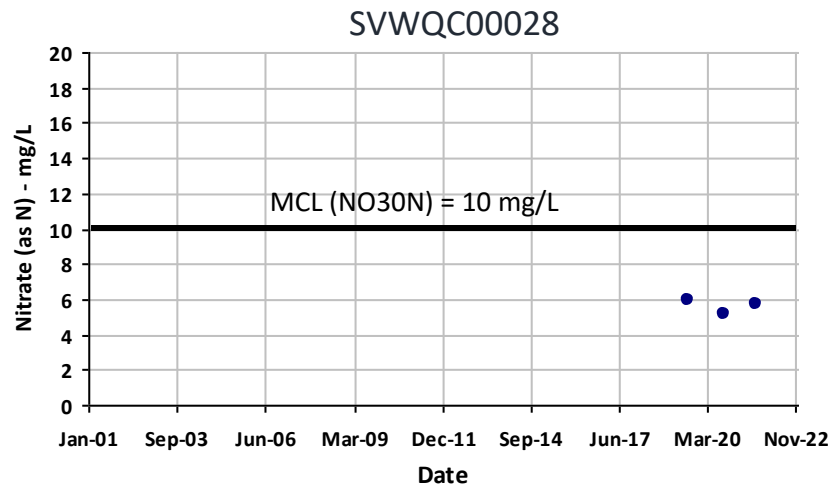
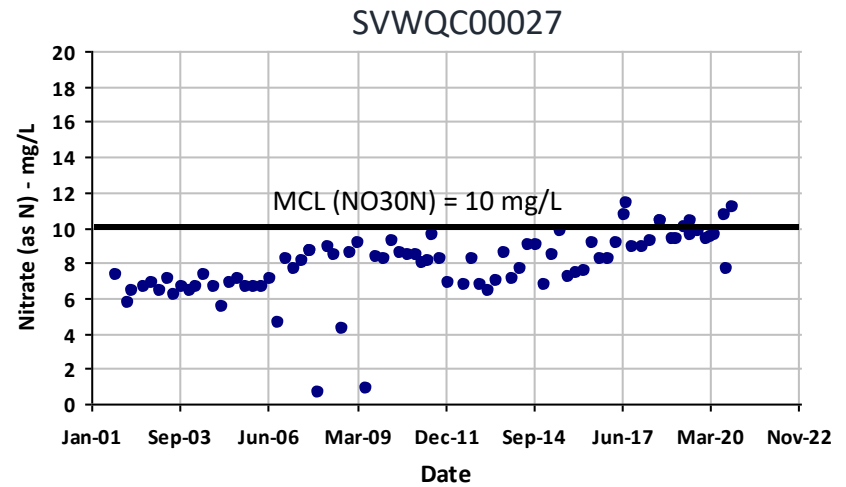
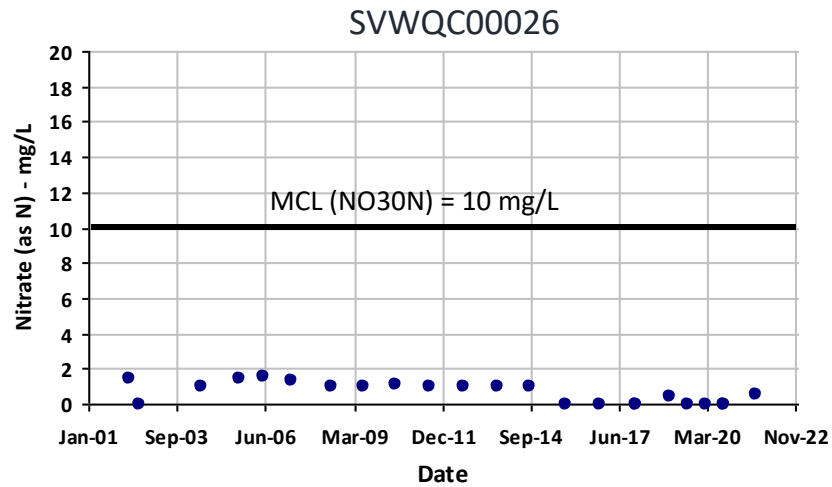




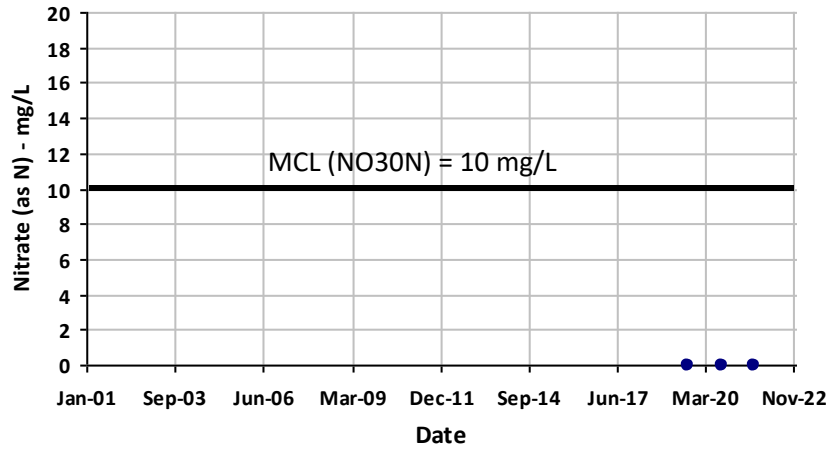




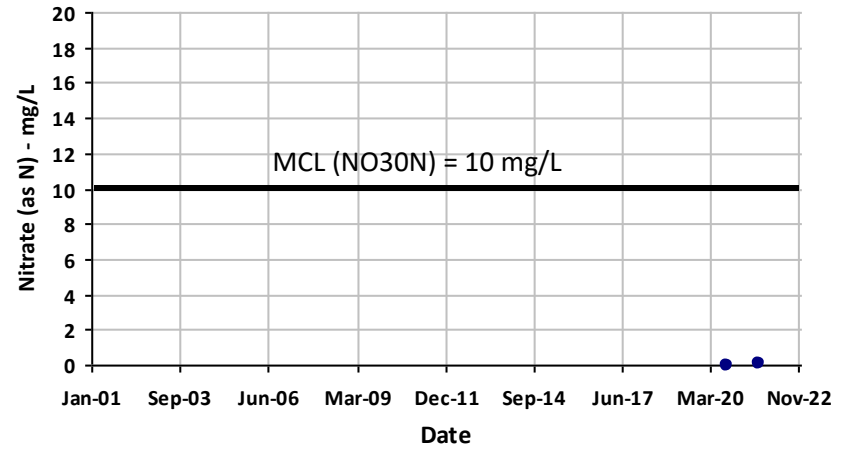




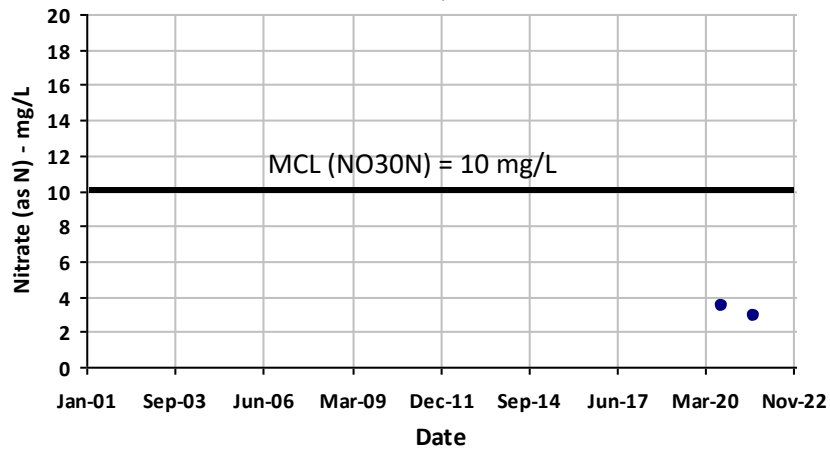
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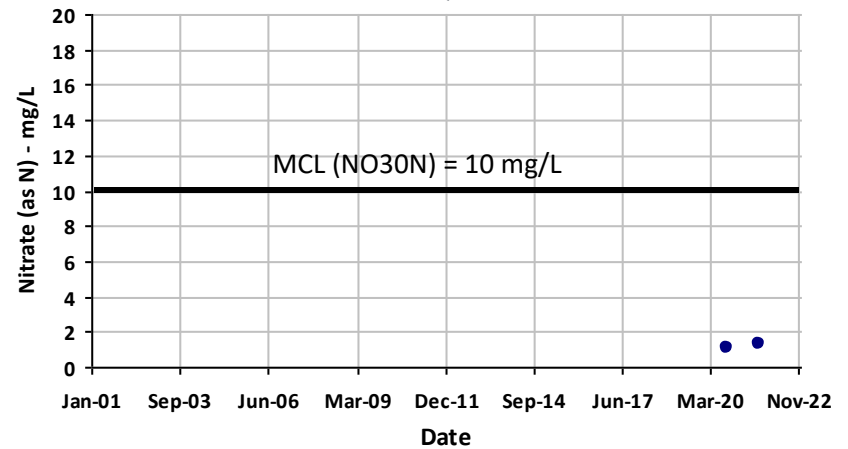
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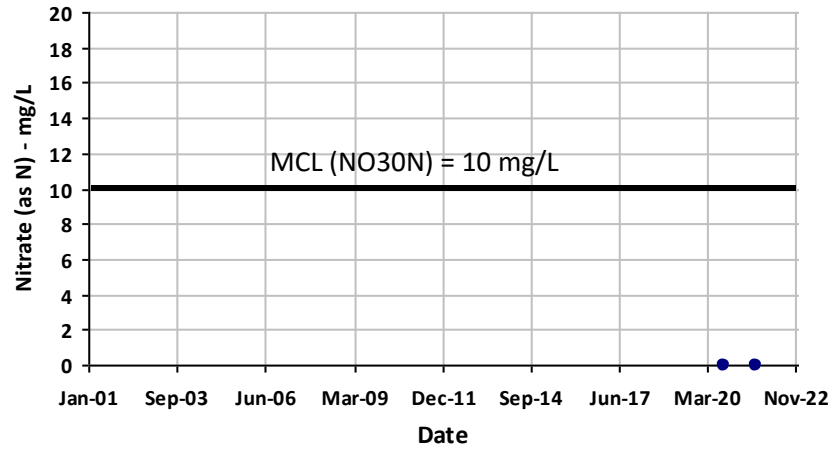
SVWQC00033



SVWQC00034



SVWQC00035



## **Appendix B: Electronic Data Submittal**

This appendix is submitted separately as an electronic data submittal containing data submittal requirements including tabular summary data sheets of sampling results, original laboratory analytical report files, field forms, analytical methods, and GIS files