

CASGEM Monitoring Plan for the Stanislaus County Portion of Eastern San Joaquin Groundwater Subbasin

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Stanislaus County
Department of Environmental Resources

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Table of Contents

1.0	Introduction.....	1
1.1	Scope and Purpose	1
2.0	Groundwater Basin Descriptions and Hydrogeology	1
2.1	Overall Setting.....	2
2.2	Water Bearing Formations	2
3.0	Groundwater Level Monitoring.....	3
3.1	Monitoring History	3
3.2	Monitoring Network Rationale	3
3.3	CASGEM Monitoring Network and Data Gaps.....	3
4.0	Monitoring Procedures	4
4.1	Monitoring Frequency and Timing.....	4
4.2	Well Locations.....	4
4.3	Reference Points.....	4
4.4	Field Methods	5
4.4.1	Graduated Steel Tape	5
4.4.2	Electric Water Level Meter	5
4.4.3	Sonic Water Level Meter	6
4.4.4	Pressure Transducer	6
4.5	Data Collection, Processing, and Reporting	6
5.0	References	7

List of Figures

Figure 1 – Stanislaus County and Adjoining Groundwater Subbasins of the San Joaquin Groundwater Basin

Figure 2 – Aerial Image of the Portion of the Eastern San Joaquin Subbasin in Stanislaus County

Figure 3 – Groundwater Monitoring Plan Wells in the Eastern San Joaquin Subbasin in Stanislaus County

Figure 4 – Potential Groundwater Monitoring Wells in the East San Joaquin Subbasin in Stanislaus County

List of Tables

Table 1 – Summary of Groundwater Monitoring Well Information

List of Acronyms and Abbreviations

CASGEM	California Statewide Groundwater Elevation
DWR	Department of Water Resources (California)
SCDER	Stanislaus County Department of Environmental Resources

CASGEM Monitoring Plan
For the Stanislaus County Portion of the
Eastern San Joaquin Groundwater Basin

1.0 INTRODUCTION

This monitoring plan for a portion of Eastern San Joaquin Subbasin groundwater has been developed by the Stanislaus County Department of Environmental Resources (SCDER) to meet requirements of the California Department of Water Resources (DWR) California Statewide Groundwater Elevation Monitoring (CASGEM) program. The plan covers monitoring of groundwater elevations within the Stanislaus County portion of the Eastern San Joaquin alluvial subbasin identified in DWR Bulletin 118, and for which a Monitoring Entity has not yet been designated. This area is defined by the County political boundary on the western side, the Stanislaus River on the south, and consolidate rocks of the Sierra Nevada Batholith on the east. The total area of the Eastern San Joaquin Subbasin is 1,105 square miles, and the area within Stanislaus County is 170 square mile or 15 percent of the total subbasin area (Figure 1), and is commonly referred to as the Northern Triangle. This monitoring plan provides information on the groundwater basin, the wells to be sampled, and the monitoring schedule and methods.

1.1 Scope and Purpose

The monitoring plan presents a description of the groundwater subbasin; monitoring schedule and well network distribution; procedures for collecting and reporting the groundwater elevation data; and a description of the monitoring plan rationale.

This groundwater monitoring plan can be revised as necessary when refinements are made to the monitoring network to address program needs and data gaps. Revisions will be submitted to DWR when additions or removal of wells from the monitoring network occur.

2.0 GROUNDWATER BASIN DESCRIPTIONS AND HYDROGEOLOGY

Stanislaus County is located in the San Joaquin Valley which is the southernmost portion of the Great Valley Geomorphic Province of California. Four alluvial subbasins are identified in DWR Bulletin 118 as being partially or fully located within Stanislaus County (Figure 1). This monitoring plan addresses the Stanislaus County portion of the Eastern San Joaquin Subbasin.

The CASGEM Monitoring Entity (CM Entity) for the remaining 85 percent the Eastern San Joaquin Subbasin is the Eastern San Joaquin Groundwater Basin Authority. The remaining three alluvial basins in Stanislaus County - Modesto (5-22.02), Turlock (5-22.03), and Delta-Mendota (5-22.07) are addressed in the groundwater level monitoring plans submitted by the respective CM Entities established for each subbasin. The Stanislaus & Tuolumne Rivers Groundwater Basin Association is the CM Entity for the Modesto Subbasin; the Turlock Groundwater Basin Association is the CM Entity for the Turlock Subbasin and the San Luis & Delta Mendota Water Authority is the CM Entity for the Delta-Mendota Subbasin.

Much of the background data included in this report was obtained from DWR Bulletin 118. The Bulletin 118 section on the Eastern San Joaquin Subbasin was updated January 20, 2006.

2.1 Overall Setting

The Great Valley is a broad structural trough bounded by the tilted block of the Sierra Nevada on the east and the complexly folded and faulted Coast Ranges on the west. The Eastern San Joaquin Subbasin is defined by the areal extent of unconsolidated to semi-consolidated sedimentary deposits that are bounded by the Mokelumne River on the north and northwest; San Joaquin River on the west; Stanislaus River on the south; and consolidated bedrock on the east. This monitoring plan covers only the Stanislaus County portion of the Eastern San Joaquin Subbasin, and therefore the western boundary covered in this monitoring plan is the County political boundary, and the northern boundary is approximately the Calaveras River.

The Eastern San Joaquin Subbasin is drained by the San Joaquin River and several of its major tributaries namely, the Tuolumne, Stanislaus, and Calaveras Rivers. The San Joaquin River flows northward into the Sacramento and San Joaquin Delta and discharges into the San Francisco Bay. Annual precipitation within the subbasin ranges from about 11 inches in the southwest to about 25 inches in the northeast.

2.2 Water Bearing Formations

Water bearing formations of significance in the Eastern San Joaquin Subbasin consist of the Modesto Formation, Riverbank Formation, Laguna Formation, and Mehrten Formation.

Modesto and Riverbank Formations. These units are exposed in the southwestern corner of the County boundary and Stanislaus River. These units are Recent to Late Pleistocene in age and consist primarily of sand and gravel in the fan areas while clay, silt, and sand are dominant in the interfan areas. These units range in thickness from a thin veneer on the east side of the basin to over 150 feet near the center of the basin. Groundwater occurs unconfined within these units. Well yields to 650 +/- gallons per minute (gpm) are reported.

Laguna Formation. This unit is exposed in a northwest trending band from Oakdale north. The Laguna Formation is Plio-Pleistocene in age and consists of discontinuous lenses of stream laid sand and silt with lesser amounts of clay and gravel. There are no regionally significant fine-grained intervals that could cause water pressure conditions, although the heterogeneous nature of the sediments causes local confinement. Regionally, yields of 1,500 gpm have been reported from highly permeable beds, but average yields are about 900 +/- gpm. Groundwater occurs under unconfined to locally semiconfined conditions within this unit.

Mehrten Formation. This formation is exposed in the easternmost part of the subbasin where it forms readily identifiable, nearly flat-topped hills. The formation is late Miocene to Pliocene in age and is composed of moderately to well indurated andesitic sand to sandstone interbedded with conglomerate, tuffaceous siltstone, and claystone. The Mehrten Formation is approximately 400 feet thick in eastern surface outcrops. Regional studies indicate that Mehrten Formation sands commonly yield on the order of 1,000 gpm from wells. The formation appears to be semiconfined at least locally in the Stockton area, due to the inferred extensive fine-grained beds in its upper part.

3.0 GROUNDWATER LEVEL MONITORING

The following sections discuss the history of groundwater level monitoring in the Eastern San Joaquin Valley groundwater basin; current monitoring activities in the basin; and the proposed network of CASGEM monitoring wells. Data gaps in the monitoring network are also identified and discussed.

3.1 Monitoring History

Groundwater level measurements in the Stanislaus County portion of Eastern San Joaquin Valley groundwater basin have been ongoing, in some form, since the 1940s. Presently, the DWR conducts semi-annual surveys of groundwater levels to monitor fluctuations in water level and determine relative changes in storage over time. During the October 2014 CASGEM documented semi-annual round of water level survey there were 25 wells included in the DWR data collection program. In October 2015 there were nine wells included in the DWR data collection program. All monitored wells are “voluntary wells” in the CASGEM system, therefore, there is limited information about the well construction details.

3.2 Monitoring Network Rationale

The Stanislaus County portion of the Eastern San Joaquin Subbasin (Northern Triangle) covers 170 square miles, the area is relatively rural and does not contain significant population centers (Figure 2). Guidance in the DWR Groundwater Elevation Monitoring Guidelines “Density of monitoring wells”, suggests well network densities ranging from 0.7 to 10 wells per square mile. Using the maximum value of 10 wells per 100 square miles, 17 wells should meet the CASGEM monitoring requirement.

3.3 CASGEM Monitoring Network and Data Gaps

This section describes the number and distribution of wells in the CASGEM monitoring network of each subbasin, identifies data gaps in some of the monitored subbasins, and outlines the approach for addressing data gaps where applicable. As stated above the subbasin is 170 square miles, therefore, 17 wells should meet the needs of the CASGEM program.

Beyond general guidance for monitoring well density, review of the aerial photograph shown on Figure 2 indicates most development is present south of the Woodward Reservoir, and from the Woodward Reservoir to the area where the County boundary crosses CA State Highway 4. There is limited development north of Highway 4 along Rock Creek. There is essentially no developed farm land from where Milton Road crosses Rock Creek, until in the vicinity of the Calaveras River, a distance of about six miles.

The existing documented October 2015 CASGEM network consists of six wells that are owned by private individuals who elected to participate in the CASGEM program. All are considered “voluntary wells” and therefore there is no information available on well construction including well depth or screen interval.

In addition to the six 2015 CASGEM network wells, Stanislaus County has agreements with eleven well owners within the Northern Triangle for groundwater monitoring. The eleven wells are listed in Table 1 along with the six existing October 2015 monitoring wells: all seventeen wells are shown on Figure 3. There is one domestic well, ten irrigation wells, and six wells of unknown type in the monitoring well network. The

horizontal distribution of monitoring wells along the Stanislaus River up to the Woodward Reservoir is adequate. Well depth is reported for ten of the seventeen wells listed in Table 1 and the wells range in depth from 155 feet to 720 feet. The screen interval is reported for nine of the ten wells. Due to the lack of well depth and screen interval additional wells will be needed to address the Monitoring Plan data gap.

With regards to the horizontal distribution of wells, there is a data gap of monitoring wells north of Woodward Reservoir. To address the data gap, Stanislaus County is in negotiations with ten land owners to obtain access to stock pond wells and agricultural wells (Figure 4). The ten locations are widely spaced, however, eight are located north and east of the Woodward Reservoir extending to the northern tip of the county. Four potential wells are in the vicinity of or north of Highway 4. If the ten landowners join the program, then the Northern Triangle monitoring network would include a total of 27 wells with broad coverage. At this time it is unknown if the “ten landowner wells” have information on well depth and screen interval. As the wells are added into the groundwater monitoring well network, the horizontal and vertical distribution will be reevaluated to determine additional wells are needed.

4.0 MONITORING PROCEDURES

This section addresses the various procedures and protocols involved in collecting, processing, and reporting data from wells in the CASGEM network.

4.1 Monitoring Frequency and Timing

Six of the CASGEM wells are currently, and will continue to be, measured on a semi-annual basis in March and October. The additional eleven wells will also be measured on a semi-annual basis in March and October. All seventeen wells will be measured over one week (five consecutive work days) during March and October.

4.2 Well Locations

CASGEM has provided the latitude and longitude of the six wells in the 2015 CASGEM program. Locations of the seven OID have been surveyed with horizontal accuracy of 1 foot and vertical accuracy of 0.1 foot. Hand held GPS was used to location the four remaining wells and the accuracy is +/- 10 feet. New wells will be established using a handheld GPS unit, which has accuracy to within 10 feet.

4.3 Reference Points

CASGEM provide the ground surface elevation (GS) and water level measurement reference point (RP) elevation data for the six wells in the 2015 CASGEM program. The ground surface and reference point elevation data are provided in Table 1.

The seven OID well reference point was surveyed with an accuracy of 0.1 feet. For the remaining four monitoring wells, the ground surface elevation was established using Google Earth Pro, and the accuracy is approximately +/- 5 feet. A steel tape was used to establish the height of the reference point above ground surface. Future reference point elevations will be established using the Google Earth Pro software combined with a steel tape.

4.4 Field Methods

Groundwater elevation data collected from wells in the CASGEM network are intended to reflect static conditions. Best efforts will be made to ensure that wells have not recently been pumped prior to collecting a data point. Depth to water measurements will be made using one or more of the methods discussed in the following sections. Measurement methods described in the following sections are based on the Department of Water Resources document *Groundwater Elevation Monitoring Guidelines* (December 2010) with some alterations specific to wells in the monitored basins/subbasins described in this Monitoring Plan.

4.4.1 Graduated Steel Tape

Prior to measurement:

- Ensure that the reference point on the well can be clearly determined. Check notes in the field data collection notebook.
- Review the notes and comments for previous measurements in the field data collection notebook to determine if there are any unique circumstances at this well.
- Take note of whether oil has previously been present at this well; this will be recorded in the comments section of the data form.

Making a measurement:

- Use the previous depth to water measurement to estimate a length of tape that will be needed.
- Lower the tape into the well, feeling for a change in the weight of the tape, which typically indicates that either (a) the tape has reached the water surface or (b) the tape is sticking to the side of the well casing.
- Continue lowering the tape into the well until the next whole foot mark is at the reference point. This value on the tape should be recorded in the field data collection notebook.
- Bring the tape to the surface and record the number of the wetted interval to the nearest foot.
- If an oil layer is present, read the tape at the top of the oil mark to the nearest foot. Note in the comments section of the data form that oil was present.
- Repeat this procedure a second time and note any differences in measurement in the field data collection notebook.

4.4.2 Electric Water Level Meter

This method of measurement employs a battery-powered water level meter and a small probe attached to a ruled length of cable. Depth to water measurements collected using this equipment are recorded to the nearest tenth of an inch. This instrument is sometimes referred to as a “sounder”.

Prior to measurement:

- Review the field data sheet for the well and note whether oil has been present at this well in the past. The electric water level meter should not be used in wells where oil is present.
- Ensure that the reference point on the well can be clearly determined. Check notes in the field data collection notebook.
- Confirm that the water level meter is functioning and is turned on so that the beeping indicator will operate properly.

Making a measurement:

- Review previous depth to water measurements for the well to estimate the length of tape that will be needed.
- Lower the electrode into the well until the indicator sounds, showing the probe is in contact with the water surface.
- Place the tape against the reference point and read the depth to water to the nearest foot. Record this value on the field data sheet.
- Make a second measurement and note any differences in measurement in the field data collection notebook.

4.4.3 Sonic Water Level Meter

This meter uses sound waves to measure the depth to water in a well. The meter must be adjusted to the air temperature outside the well; there is a card with reference temperatures in the case with the sonic meter.

Making a measurement:

- Insert the meter probe into the access port and push the power-on switch. Record the depth from the readout.
- Record the depth to water measurement in the field data collection notebook.

4.4.4 Pressure Transducer

Automated water-level measurements are made with a pressure transducer attached to a data logger. Pressure transducers are lowered to a depth below the water level in the well and fastened to the well head at a reference point. Data points are logged on an hourly basis. During the data collection process, data loggers are stopped, and the data are downloaded onto a laptop, and then the data logger is reactivated and scheduled to begin collecting data again on the next hour. Upon return from the field, data is processed and reviewed for errors.

4.5 Data Collection, Processing, and Reporting

Following completion of all fieldwork, data are transcribed from field data sheets and checked for errors before being loaded into SCDER's database. All data will be stored in the SCDER database before being uploaded to the CASGEM website. Submittal of data to the CASGEM website will occur at a minimum of twice per year, no later than January 1 and July 1, per DWR CASGEM program guidelines.

Bi-annual submittal of data to the CASGEM website will include the following for well in the CASGEM network, as described in the DWR document *CASGEM Procedures for Monitoring Entity Reporting*:

- Well identification number
- Measurement date
- Reference point and land surface elevation, in feet, using NAVD88 vertical datum
- Depth to water, in feet
- Method of measuring water depth
- Measurement quality codes
- Measuring agency identification
- Comments about measurement, if applicable

The following information will also be submitted to the CASGEM online system, as it is required by DWR unless otherwise noted:

- Monitoring Entity name, address, telephone number, contact person name and email address, and any other relevant contact information
- Groundwater basins being monitored (both entire and partial basins)
- State Well Identification number (if available)
- Decimal latitude/longitude coordinates of well (NAD83)
- Groundwater basin or subbasin
- Reference point elevation of the well, in feet, using NAVD88 vertical datum
- Elevation of land surface datum at the well, in feet, using NAVD88 vertical datum
- Use of well
- Well completion type (e.g. single well, nested well, or multi-completion well)
- Depth of screened interval(s) and total depth of well, in feet, if available
- Well Completion Report number (DWR Form 188), if available.

5.0 REFERENCES

Department of Water Resources, 2010. California Statewide Groundwater Elevation Monitoring (CASGEM) Program Procedures for Monitoring Entity Reporting.

Department of Water Resources, 2010. Groundwater Elevation Monitoring Guidelines.

Department of Water Resources, 2003, California's Groundwater, Updated 2003

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TABLE

Table 1
Summary of Groundwater Well Monitoring Information
Stanislaus County Portion of the
Eastern San Joaquin Subbasin
Groundwater Monitoring Plan
November 2015

CASGEM Well ID	Local Well Name	Location		G.S. Elevation (feet, NAVD 88)	R.P. Stick-Up (feet above ground surface)	R.P. Elevation (feet, NAVD 88)	Total Depth (feet)	Screen Interval(s) (feet below ground surface)	Well Type	Well Completion Report	Notes
		Longitude	Latitude								
377952N1207505W001	Olive #2*	-120.75055	37.79522	285	0.83	285.83	575	five screens from 292 to 557	Irrigation	NA	
378164N1206958W001	Searway Dom*	-120.69576	37.81638	240	0.54	240.54	unknown	unknown	Domestic	NA	
378521N1207663W001	Sonora #5*	-120.76630	37.85210	225	0	225.00	220	60 to 220	Irrigation	948043	
378589N1207522W001	Sonora #8*	-120.75216	37.85886	240	1.21	241.21	155	90 to 155	Irrigation	NA	
378402N1208710W001	1S10E21A1-23†	-120.8710	37.8402	222.46	0	222.46	400	unknown	Irrigation	NA	
377909N1208675W001	OID - 04**	-120.86752	37.79090	188.91	0.48	189.39	501	168 to 249	Irrigation	NA - drilled in 1940	Cable Tool / Open Bottom, Well Depth 501 feet / Cased to 255 feet
378130N1209240W001	OID - 05**	-120.92401	37.81304	152.08	0.325	152.41	502	120 to 245	Irrigation	NA - drilled in 1940	Cable Tool / Open Bottom, Well Depth 502 feet / Cased to 254 feet
377860N1209016W001	OID - 09†	-120.9016	37.7860	167.08	0.25	167.33	475	98†† to 232	Irrigation	NA - drilled in 1943	Cable Tool / Open Bottom, Well Depth 475 feet / Cased to 232.5 feet
378112N1208251W001	OID-17**	-120.82508	37.81124	223.42	0.45	223.87	720	190 to 310 330 to 410 430 to 720	Irrigation	E0297030	
378332N1209185W001	OID - 14†	-120.9185	37.8332	149.87	0.53	150.40	390	60 to 66 83 to 87	Irrigation	NA - drilled in 1944	Cable Tool / Open Bottom, Well Depth 390 feet / Cased to 237 feet
378088N1208895W001	OID - 16**	-120.88945	37.80877	171.67	0.45	172.12	280	55 to 72	Irrigation	NA - drilled in 1944	Cable Tool / Open Bottom, Well Depth 280 feet / Cased to 115 feet
378874N1208954W001	01N10E32Q001M***	-120.8954	37.8874	153.42	0	153.42	Confidential	Confidential	Unknown	NA	
378163N1208321W001	1S10E26J1-25***	-120.8321	37.8163	212.5	0	212.50	Confidential	Confidential	Unknown	NA	
378138N1208591W001	1S10E27Q1-122***	-120.8591	37.8138	202.48	0	202.48	Confidential	Confidential	Irrigation	NA	
377985N1208524W001	1S10E34R1-124***	-120.8524	37.7985	219.49	0	219.49	Confidential	Confidential	Unknown	NA	
377843N1208435W001	02S10E02P001M***	-120.8435	37.7843	192.5	1	193.50	Confidential	Confidential	Unknown	NA	
377766N1208657W001	02S10E10M002M***	-120.8657	37.7766	112.48	1.5	113.98	Confidential	Confidential	Unknown	NA	

CASGEM = California Statewide Groundwater Elevation Monitoring

G.S. = Ground Surface

R.P = Reference Point

NA = Not Available

* Latitude and Longitude by GPS, stickup by steel tape, ground surface from Google Earth Pro

**Latitude, Longitude, and Rerence Point by surveyed by OID: stickup by steel tape, ground surface calculated.

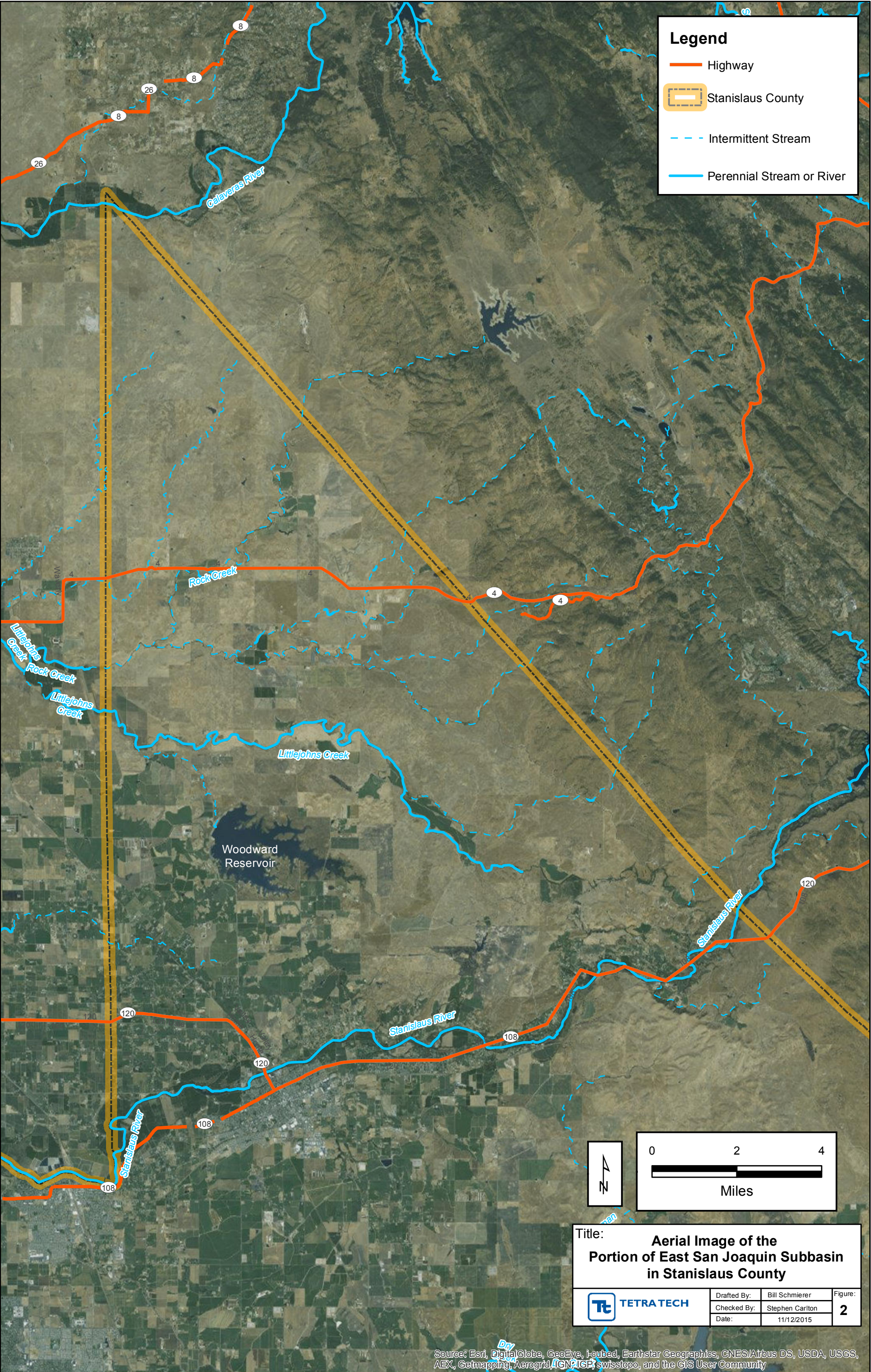
***Latitude, Longitude, and Rerence Point reported by CASGEM.

† Location appearently in CASGEM: Latitude, Longitude, and Reference Point not the same as reported by OID. Latitude difference ranges from 0.00016 to 0.00045 degrees, Longitude difference ranges from 0.00006 to 0.00064 degrees.

Reference Point difference ranges from 0.9 to 4.6 feet (NAD 88)

†† Well detail lists top of perforations as "below water level" rather than depth in feet.

FIGURES



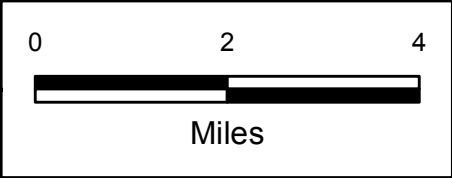
Legend

Highway

Stanislaus County

Intermittent Stream

Perennial Stream or River



Title: Aerial Image of the Portion of East San Joaquin Subbasin in Stanislaus County

TETRA TECH

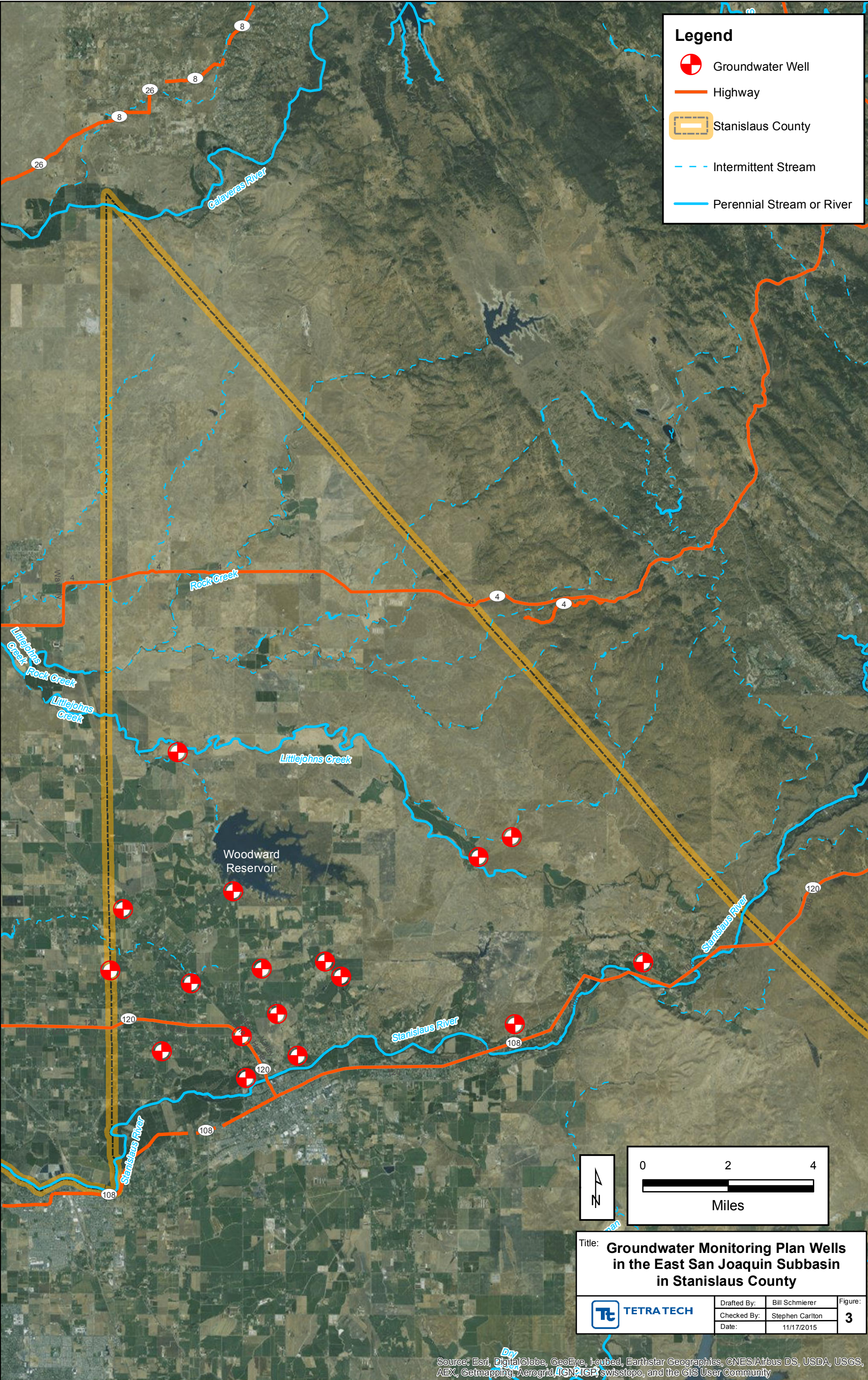
Drafted By: Bill Schmierer

Checked By: Stephen Carlton

Date: 11/12/2015

Figure: 2

Source: Esri, DigitalGlobe, GeoEye, I-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Legend

Groundwater Well

Highway

Stanislaus County

Intermittent Stream

Perennial Stream or River

024

Miles

Title:Groundwater Monitoring Plan Wells in the East San Joaquin Subbasin in Stanislaus County

TETRA TECH

Drafted By:Bill Schmierer

Checked By:Stephen Carlton

Date:11/17/2015

Figure:3

Source: Esri, DigitalGlobe, GeoEye, I-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

