ATTACHMENT 4 - PROJECT DESCRIPTION

This section includes a complete description of the proposed project and is organized as follows:

- **Background Information on Tranquillity Irrigation District**
- **Project Description**
  - Project Overview
  - Goals of the Project
  - Needed Facilities
  - Area Covered
  - Detailed Project Description
- **Public Outreach**
  - Collaboration with other Agencies
  - Information Dissemination
- **Need for the Project**
- **New Data and Knowledge**
  - Quality of Information Obtained
  - Data, Methods and Analysis to be Used
  - New Knowledge and Improvement in Groundwater Management
  - Consistency with Groundwater Management Plan
- **On-Going Use**
  - Operation and Maintenance Funding
  - Adaptive Management Strategy

4.1 - Background Information on Tranquillity Irrigation District

Below is a brief description of the origin, physiography, geology, water supplies and facilities in Tranquillity Irrigation District.

Origin

Tranquillity Irrigation District (TID or District) was formed on January 22, 1918, as a public agency designed to serve the local community with water. It is the second oldest such agency in Fresno County. A Board of Directors elected from the District at-large governs the District. The District is responsible for acquisition and delivery of surface water and groundwater for irrigation purposes. Additionally, the District, when formed, established the Community of Tranquillity. When initially established, the District was responsible for domestic water supply, energy production, recreation, streets and roads, and lighting. The District has provided domestic water to the Community since at least 1920. TID is somewhat unique for an irrigation district, in providing both agricultural water, but also drinking/domestic and municipal water throughout the entire District.

Geography

TID encompasses approximately 10,750 acres in the west central portion of Fresno County in California's Central San Joaquin Valley. The principal community is the unincorporated Community of Tranquillity, which is within the District boundary. Refer to **Figure 4.1** for a vicinity map of the District in relation to other water agencies.

Climate

The Plan area is characterized by a warm desert climate. Temperatures during summer often exceed 100 degrees F with winter temperature usually 32 degrees F or higher. Annual average precipitation is 7.4 inches. The growing season is long with most precipitation occurring during winter. The highest precipitation occurs during January with about 90 percent of the total precipitation occurring between November and April. Precipitation is rare during the summer and usually associated with infrequent tropical storms. Prevailing winds are from the northwest and usually less than 10 miles per hour.

Soils and Agronomy

Approximately 9,600 acres were irrigated in TID in 2005. TID lands are predominately used for the production of irrigated field, row and forage crops. Crops occupying 5 percent or more of the acreage included cotton, sugar beets and canning tomatoes. Other crops grown include alfalfa, almonds, wheat, vegetable seed, pasture, and corn.

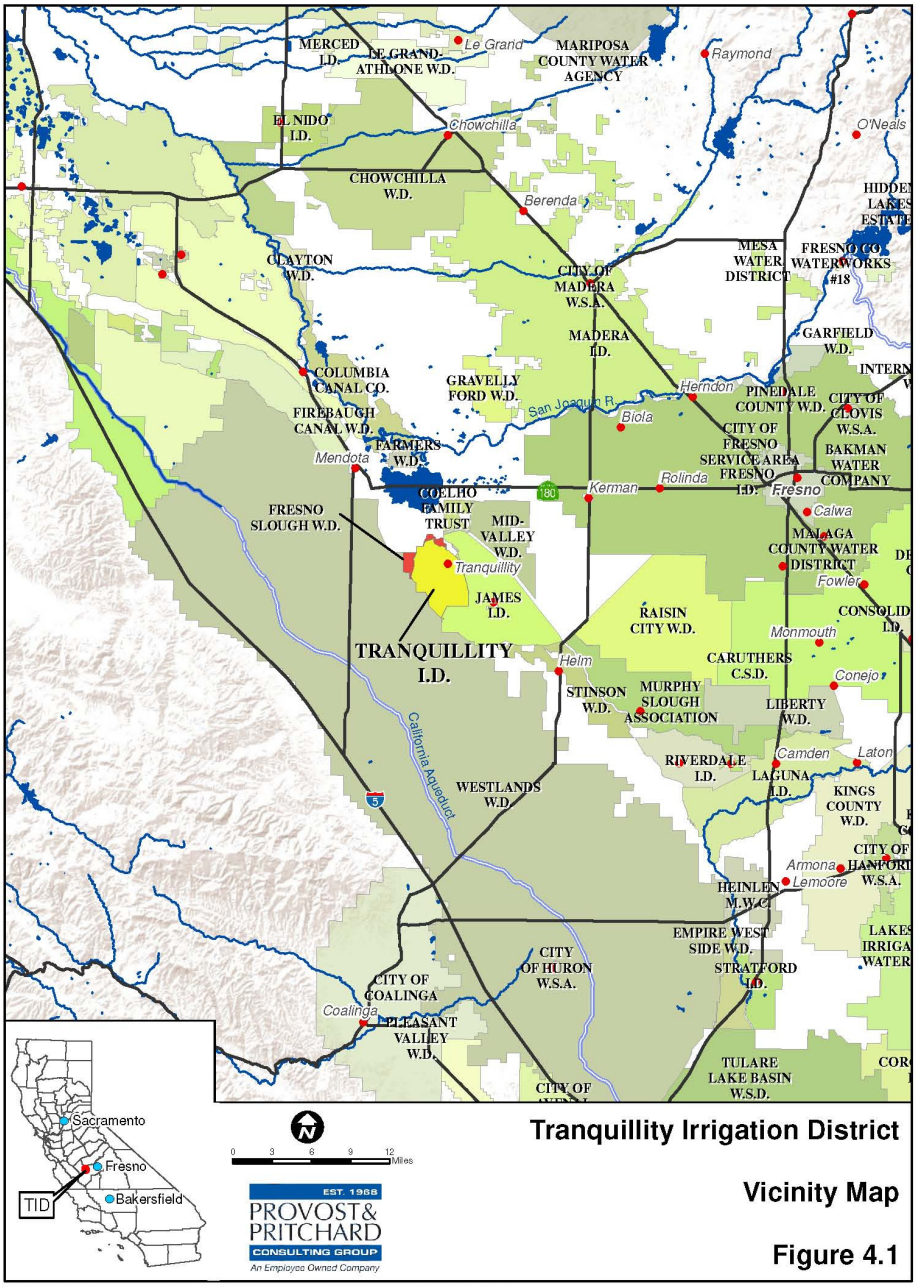

Figure 4.1 – Tranquillity Irrigation District Vicinity Map

Groundwater Basin

As defined by the Department of Water Resources, Bulletin 118, TID is located in San Joaquin River Hydrologic Region within the San Joaquin Valley Groundwater Basin. The District is the southernmost extent of the San Joaquin Valley Groundwater Basin and is within the Delta-Mendota subbasin (**Figure 4.2**). The District is bounded to the south and east by the Kings Groundwater subbasin and to the west by the Westside groundwater subbasin. The

groundwater basin boundaries are geo-political, having been determined by a combination of geological and political boundaries.

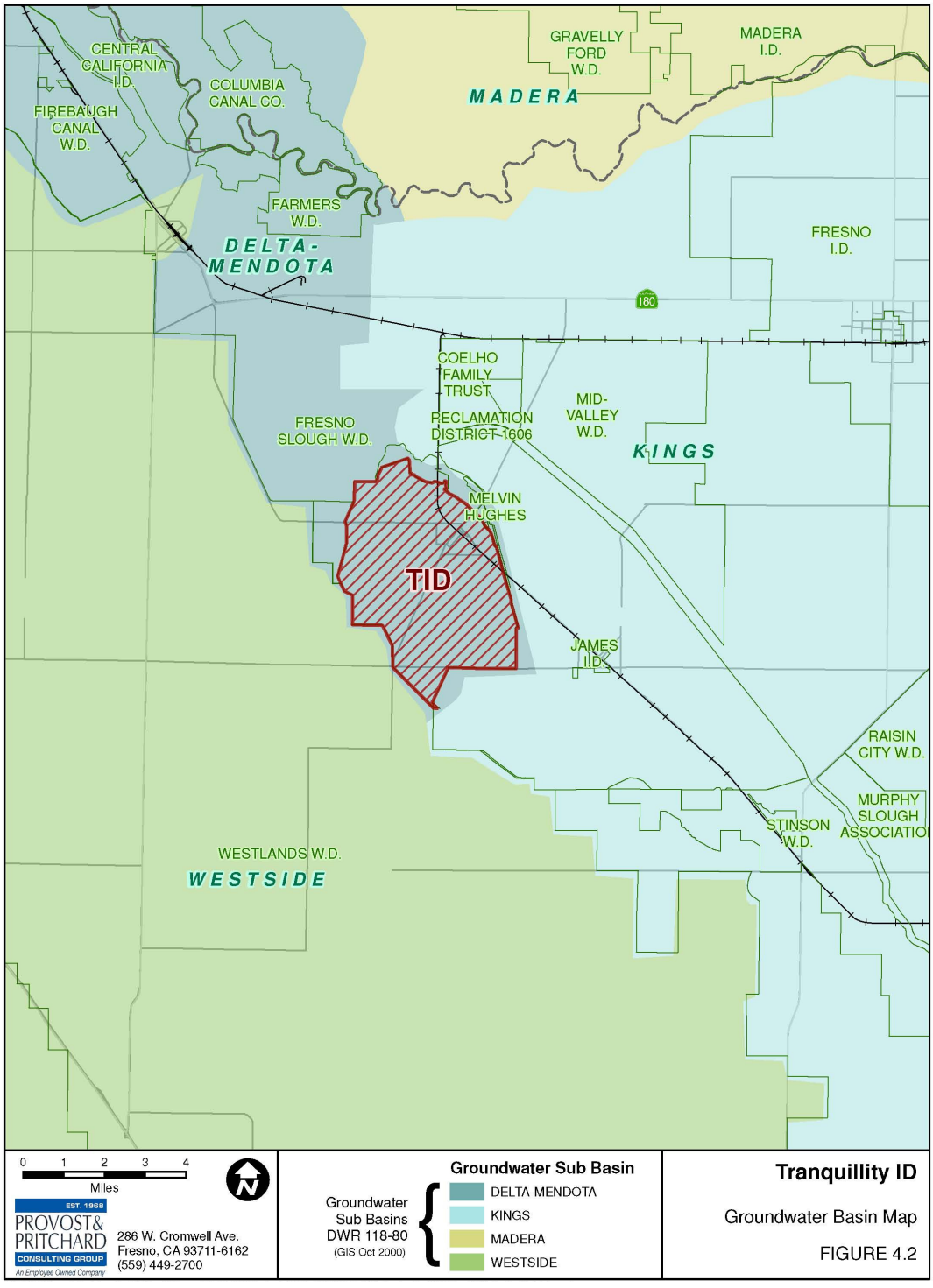

Figure 4.2 – Groundwater Basin Map

Agricultural Water Supplies

TID is geographically adjacent to the Fresno Slough, an historic northern flood outlet of the north fork of the Kings River. Fresno Slough was also a flooded backwater (swamp) of the San Joaquin River. As a result, the District has historic riparian water right claims to water from both the Kings and San Joaquin Rivers. Surface water contracts include 13,800 AF of CVP project water (Contract No. 14-06-200-701-A-LTR1) and 20,200 AF of Schedule II CVP/riparian water (Contract No. 14-06-200-701-A). The CVP water is delivered by USBR from the Shasta Division (Delta water) or Friant Division (San Joaquin River water) according to water supply availability. In addition to surface water, the TID presently owns eleven irrigation wells, and two domestic or drinking water ("city") wells. The District's surface water supplies are delivered through the Delta-Mendota Canal to Mendota Pool and then pump from the pool into the District facilities. Mendota Pool is offline for maintenance about one month every two years.

Tranquillity Drinking Water Supplies

The entire District (including the Community of Tranquillity and the surrounding area) rely on groundwater supplies for drinking water. This is partly due to the fact that surface water supplies from Mendota Pool are not always available when maintenance to Mendota Dam occurs. The current domestic groundwater sources (City Wells #4 & #5 shown on **Exhibit 4.1**) have high arsenic levels and the District has applied for grant funding to convert two irrigation wells (20-AG and 21-AG shown on **Exhibit 4.1**) that meet the arsenic standard, but need treatment for the secondary constituents of manganese and iron. The District recently completed an investigation to determine the preferred course of action to mitigate for the high arsenic levels.

Facilities

Facilities in the District or owned by the District include eleven agricultural irrigation wells, two municipal or drinking water ("city") wells, and four monitoring wells (former agricultural or municipal wells now used for monitoring). There are very few or no private agricultural and domestic wells in the District. The TID agricultural distribution system includes approximately 42 miles of unlined canals, 5 miles of pipeline, two major lift-pump stations, and a series of secondary lifts. The entire irrigation system is metered, which includes water diverted by the District and deliveries to farm turnouts. The system also is automated, which facilitates efficient operation.

The District also maintains the domestic/drinking/municipal water system for the local community, the community park, and to the rural areas in the District. The agricultural irrigation and domestic/drinking/municipal water systems are not tied together, except that both sources of supply can irrigate the community park landscaping. The demand for the domestic/drinking/municipal water uses is provided almost entirely by groundwater pumping, and has been provided by groundwater since the formation of the District. Due to the poor groundwater quality, there are little to no other private drinking water wells (only one known),

and therefore the District provides drinking and municipal water to the rural areas of the District as well as in the Community of Tranquillity. Surface water rights and CVP contract waters are used for crop irrigation, with a small amount also used for landscape irrigation at a public park. The drinking water system contains approximately 23.1 miles of pipelines (about 5.5 miles in the Community and 17.6 miles in the rural areas) from 2 to 10 inches in size, as well as tanks, booster pumps, valves and fire hydrants. **Exhibit 4.2** shows the domestic/drinking/municipal water pipeline system in the rural areas, and the "spider" distribution of the facilities required in order to service the customers, since there are no private wells.

Water Quality

Groundwater in TID is transitional in nature, reflecting a mixture of coastal derived water and Sierran derived groundwater. Being located at the "trough" of the San Joaquin Valley, TID is influenced by groundwater demands from both east and west of the District – both areas of significant groundwater pumping. Historically, wells were shallow and over time the District went deeper to find better quality water, with less iron and manganese and lower electrical conductivity. Now, groundwater is typically pumped from a confined aquifer, below the Corcoran clay, because of the unconfined aquifer water quality. The "best" groundwater supply typically has total dissolved solids of 800 to 1,000 ppm, but there is no groundwater of "good" quality. However, now in the domestic supply wells, arsenic is a principal problem in the drinking water supply for the wells pumping from the confined aquifer, and was the subject of a recent feasibility study performed by TID (see below). Sulfates, iron and manganese are also constituents of concern in the area.

The drinking water study (see Attachment 9 for additional information) included a hydro-geologic investigation to determine the best area for new groundwater wells, construct test wells to gather geologic information and zonal water quality sampling in a selected area. Based on the information obtained, it was determined that the best solution was to convert two existing agricultural wells (see **Exhibit 4.1** for location of Wells #20 and #21) to drinking water wells. These wells pump water from the unconfined aquifer, which was determined at these locations to be of better quality from an arsenic standpoint, but higher in Electrical Conductivity, iron and manganese than the current domestic supply wells (City wells #4 and #5). Therefore, treatment will be required for the iron and manganese to comply with secondary drinking water standards.

4.2 - Project Description

Project Overview

The proposed project includes the installation of five dedicated monitoring wells. These will include one nested well (with two wells perforated at different depths installed in one borehole), and three single monitoring wells to improve groundwater monitoring capabilities.

Each well casing is proposed to be fitted with a data logger. In addition, four former irrigation or municipal wells now used as dedicated monitoring wells will be fitted with data loggers. Water quality will also be sampled in each new casing (the 5 new well locations) at the end of the well development process. The hydrogeology and stratigraphy will be characterized using geologic logs, e-logs, and water quality results. The public will be involved through public meetings.

Goals of the Project

The broad goals of the project are to install monitoring wells and gather geologic data to strengthen the District's groundwater monitoring capabilities. The project is expected to result in significant amounts of new knowledge and an achievable improvement in groundwater management in Tranquillity Irrigation District and the neighboring Fresno Slough Water District.

Monitoring is considered critical to future management decisions, and the District's monitoring program is intended to:

1. Provide warning of potential future problems;
2. Use data gathered to generate information for water resources evaluations;
3. Develop meaningful long-term trends in groundwater characteristics; and
4. Provide data comparable from place to place in the District

The specific goals and objectives of the groundwater monitoring program are to gather public comment on the program and to plan, design and install five monitoring wells, evaluate the findings from their installation and present the findings in a report, as well as install data loggers for long term groundwater level monitoring in 9 locations. The wells will provide long-term benefits to District-wide groundwater monitoring, and localized benefit to District's "Domestic Water System Groundwater Source of Supply Area." The general, long-term goals for the monitoring wells include:

1. Establish a baseline for future monitoring
2. Fill gaps in District-wide monitoring network
3. Increase capability to measure water levels in multiple aquifers
4. Characterize geographic variability in water quality
5. Use monitoring data in part to compute groundwater stored and withdrawn
6. Provide data needed for graphical, semi-analytical or computer model analysis of groundwater conditions
7. Increase groundwater level data in an area lacking data in the statewide network

Goals specific to the Domestic Water System Groundwater Source of Supply Area include:

1. Develop long term groundwater level data above (unconfined aquifer) and below (confined aquifer) the confining layer (Corcoran clay)
2. Use monitoring data to assist in locating future recovery wells in the area.

Needed Facilities

The needed facilities for the groundwater monitoring project are five monitoring wells, with two of the wells combined into a nested well. Each casing will have a 50 foot long screened section. In addition, a data logger will be installed in each of the five new casings and four former production wells to provide continuous water-level monitoring capabilities throughout much of the District. The nested pair (MW-1 and MW-2) will be placed in the "Domestic Water System Groundwater Source of Supply Area" to monitor both the unconfined and confined aquifer in that area, since the domestic/drinking water has historically come from both aquifers. More specific details on these facilities can be found below under Detailed Project Description.

These new wells will be strategically placed to obtain a better representation of the groundwater status and fill data gaps to determine vertical as well as horizontal movement of levels and certain water quality constituents. Monitor well depths were determined by evaluating the perforated/water bearing depths of the existing production wells.

Area Covered

The area covered by the proposed project encompasses the majority of the District, as well as the TID owned land in Fresno Slough Water District as shown on **Exhibit 4.1**. Wells are located throughout the District to be able to gather data District wide. However, the new monitoring wells will provide groundwater data primarily in the northerly and central part of TID, where the majority of the existing groundwater pumping occurs. The monitoring wells in the "Domestic Water System Groundwater Source of Supply Area" are to be placed central to this dedicated area.

Detailed Project Description

The project will include construction of five monitoring wells, including one nested pair (MW-1 and MW-2), in the locations shown on **Exhibit 4.1**. Each well will have a casing extending to a depth of 600 feet below the ground surface, with the nested borehole containing a 600-foot and 400-foot well. The wells are located in areas throughout the District where the monitoring network is non-existent or has gaps, and are lacking either dedicated monitoring wells or nested monitoring wells.

The wells will be designed in two phases including a conceptual design and final design. The contractor will be required to obtain a well drilling for all the wells, and for those wells located

in Fresno County Road right-of-way, an encroachment permit will be required. A CEQA negative exemption will be filed.

The well contract will be publicly bid. The wells will be drilled using the mud rotary method by an experienced contractor. Single wells are anticipated to be drilled with a 8 ¾-inch borehole with 2 ½-inch Schedule 80 PVC casing. The nested well site is anticipated to be drilled with a 10 5/8-inch borehole and contain two 2 ½-inch Schedule 80 PVC well casings. A geologist will log the soils and a geophysical contractor will perform electric logs in each of the four boreholes. The location and elevation of each well will be surveyed. Each well casing will be fitted with a data logger to provide continuous monitoring capabilities. The water quality in each casing will also be tested for an agricultural suitability analysis and the nested well will also include testing for arsenic levels, which together test for the primary constituents of interest in the area. A detailed hydrogeologic/stratigraphic analysis will characterize the local geology and provide insight into current hydrogeologic conditions.

The project is supported by the TID & FSWD Board of Directors, who are comprised of local farmers and represent the local community. The Directors identified the need for the project on page 28 of the 2009 Groundwater Management Plan were it was said that "there are only a few wells in the District and these collectively do not provide sufficient data for generating reliable groundwater contours." There is no known opposition to the project. No letters of opposition have been received, and no opposition has been voiced during public meetings.

Public outreach will include presentations at public Board of Directors meetings, posting of information on the District's website, posting in the District office, and dissemination of project information at the TID annual grower's meetings. These all are intended to inform the public about the project and solicit their input.

4.2 – Public Outreach

Collaboration with Other Agencies

Tranquillity Irrigation District is located in the Delta-Mendota Groundwater Sub-basin, which includes numerous municipalities, irrigation districts, water districts and private water companies. TID has made many efforts to communicate and coordinate with these agencies. Below is a list of some agencies that TID has worked with in managing groundwater on a local and regional scale:

- Kings River Water Association
- Upper Kings Basin Integrated Regional Water Management Authority
- Fresno Slough Water District
- James Irrigation District
- McMullin Recharge Group
- San Luis & Delta-Mendota Water Authority

- Mendota Pool Group
- Agricultural Water Management Council
- Association of California Water Agencies

A description of each of the organizations follows:

Kings River Water Association

TID is a member of the Kings River Water Association (KRWA), a 28-member group of water agencies that was formed in 1927 to administer and manage water uses on the Kings River. The benefits of KRWA membership include conflict resolution mechanisms, and improved coordination among member agencies. The KRWA opens lines of communication so that members can work together effectively to utilize, trade, and transfer waters from the Kings River. Through their membership in KRWA, TID has rights to surface water from the Kings River and diverts high flows from the North Fork of the Kings River in wet hydrologic years.

Upper Kings Basin Integrated Regional Water Management Authority

TID is an interested party in the Upper Kings Basin Integrated Regional Water Management Authority (also known as Kings Basin Water Authority). TID attends its meetings and participates in other efforts and projects. The Authority developed an Integrated Regional Water Management Plan in 2007 and will update the plan in 2012.

Fresno Slough Water District

TID and the Fresno Slough Water District (FSWD) have tried to cooperate on groundwater management, which is best represented by the joint GMP they prepared together in 2009. The two agencies also share groundwater level data and work closely on other surface and groundwater projects. TID is a major landowner in FSWD and owns and operates multiple groundwater wells in FSWD.

James Irrigation District

James Irrigation District (JID) is located along TID's eastern border. The two Districts have collaborated on several projects. In 2007-2008 TID evaluated the feasibility of constructing interties from TID to James Irrigation District, as part of a US Bureau of Reclamation funded water conservation program. In 2010, TID allowed JID to construct a shallow monitor near their southwesterly border on TID property to evaluate potential subsurface drainage problems (see MW-James in **Exhibit 4.1**). This collaboration was important and eventually concluded that subsurface drainage is not currently a problem along their border. The construction of the well was part of a Local Groundwater Assistance grant obtained by JID. Also, JID and TID signed a Memorandum of Understanding as part of the TID's "New Well Feasibility Study" investigation (see project description in Attachment 9) and worked with JID growers to allow TID to construct Test Wells in James Irrigation District. Ultimately, JID was prepared to allow TID permission to construct new drinking water system wells within the boundaries of JID. However, when the

investigation indicated that water was similar in quality as the locations of TID 20-AG and 21-AG wells, the wells did not need to be constructed in JID.

McMullin Recharge Group

The McMullin Recharge Group (Group) is comprised of James Irrigation District, Mid-Valley Water District, Raisin City Water District, Tranquillity Irrigation District, Terranova Management Co, LLC., and Kings River Conservation District. The Group works cooperatively to investigate groundwater recharge projects in the area of the McMullin Grade, just east of the James Irrigation District, adjacent to the James Irrigation District Eastside Wellfield. The group members share information and the TID has acquired valuable knowledge of the local geology as a consequence of their participation. The Group completed a groundwater recharge study in 2004. The study found several sites that are conducive to groundwater recharge.

San Luis & Delta-Mendota Water Authority

TID is a member agency of the San Luis & Delta-Mendota Water Authority (SLDMWA), an umbrella organization for 32 water agencies in the Central Valley. The SLDMWA was established in 1992 and represents approximately 2,100,000 acres of federal and exchange water service contractors within the western San Joaquin Valley, San Benito and Santa Clara Counties. The SLDMWA serves the information and representation needs of its members by developing, providing, and disseminating information to legislative, administrative and judicial bodies concerning a variety of water resources issues. In 2006, the SLDMWA prepared the Westside Integrated Water Resources Plan. The plan outlined a regional approach to managing water in the SLDMWA service area.

Mendota Pool Group

The Mendota Pool Group is a multi-agency group responsible for monitoring surface water quality in the Mendota Pool, and coordinating water exchanges in the Mendota Pool.

Agricultural Water Management Council

TID is a member of the Agricultural Water Management Council (AWMC or Council). The AWMC was formed in 1996, following the work of an advisory committee formed by Assembly Bill (AB) 3616, Agricultural Efficient Water Management Act of 1990. The Council consists of members of the agricultural and environmental communities and other interested parties. The members have an expressed goal to voluntarily develop Water Management Plans and implement Efficient Water Management Practices (EWMPs) to further advance water use efficiency. Members participate by signing a Memorandum of Understanding.

Association of California Water Agencies

TID is an active member of the Association of California Water Agencies (ACWA). ACWA fosters cooperation among all interest groups concerned with stewardship of the state's water resources.

Tribal Entities

No tribal entities are located in TID.

Dispute Resolution

TID has a dispute resolution policy documented on page 46 of their GMP (**Exhibit 3.2**). Since there are few private wells in the District groundwater disputes are uncommon. If they do occur they would probably involve neighboring agencies. As a result, TID has worked to develop cooperative and cordial relationships with neighboring districts. The policy will help ensure that disputes are resolved in an amicable manner.

4.3 - Information Dissemination

Information will be disseminated to the State of California, local water agencies, local growers and the general public through a variety of methods. Refer to Section 5.9, which provides a detailed discussion on information dissemination efforts.

4.4 – Need for the Project

The project is critically needed to improve groundwater monitoring, provide better data on groundwater levels and flows, and increase understanding of the subsurface conditions. The TID has recognized the need for these wells for several years, and formally documented this need in their 2009 Groundwater Management Plan (see Table 4.1 later in this section). Specific reasons the project is needed include:

1. Improve understanding of groundwater movement
2. Fill gaps in monitoring network
3. Limited dedicated monitoring wells in District
4. Lack of nested monitoring wells in District
5. Evaluate groundwater quality problems
6. Need for improved groundwater budget
7. Importance of groundwater in TID
8. Facilitate land subsidence monitoring

Each of these topics is discussed in detail below.

1 - Improve Understanding of Groundwater Movement

The proposed investigations and on-going data collection will provide a greater understanding of groundwater flows, impacts of pumping on wells, groundwater mounding, pumping depressions, transmissivity, and vertical movement of groundwater. Some specific areas of

concern are saline water intrusion from the west and groundwater movement near pumping centers. The TID GMP addresses the saline intrusion problem as follows:

> "*Groundwater is also known to be high in salts to the west of the Districts. Saline water intrusion from this area is a concern, however the Districts lack a clear understanding of the geology and how this water migrates." (pg 34)*

In addition, groundwater levels in the vicinity of productions wells are important, which is also highlighted in the GMP:

> "*As a result, future groundwater level monitoring is important so these long-term trends can also be established in and near the pumping centers*." (pg 16)

2 - Fill Gaps in Monitoring Network

TID currently has a sparse monitoring network with many spatial gaps (see **Figure 4.1**). In addition, the current lower (confined aquifer) level monitoring network consists primarily of production wells that were sited to optimize production and are not necessarily the best places for monitoring, nor are levels easily accessible when the wells are pumping or dedicated to monitoring. This has provided insufficient data for a robust monitoring program. This problem is highlighted in the TID GMP:

> "*There are only a few wells in the District and these collectively do not provide sufficient data for generating reliable groundwater contours.*" (pg 28)

The proposed wells will help to fill these gaps, have been strategically located in areas of highest need, and will provide data needed for more detailed hydrogeologic analyses.

The proposed monitoring wells and loggers will also provide data to supplement the monitoring network of wells used in groundwater mapping by the Department of Water Resources (DWR). The most recent "Lines of Equal Elevation of Water in Wells" (Spring 2007) and earlier maps prepared by DWR do not contain groundwater elevation contours in the area with TID.

3 – Limited Dedicated Monitoring Wells in District

TID monitors groundwater primarily in municipal and agricultural production wells, and three former production wells (whose casing condition and service life are unknown). The District also does maintain several shallow peizometers for monitoring drainage problems. The former production wells now used for monitoring are either in poor condition (i.e. caved in or breaks in casing) or the condition is unknown. Dedicated monitoring wells have many advantages over production wells, including the following:

- Groundwater levels cannot be measured in production wells while they are pumping, often resulting in discontinuous data with information missing in many years
- Monitoring technicians may not know how long pumps have been turned off, and if groundwater has recovered to a normal level
- One may not know which aquifer is being monitored in productions when construction details (e.g. depth, perforated interval) are missing
- Electronic pressure transducers (data loggers) are more easily damaged or lost in production wells
- Dedicated monitoring wells can provide a better picture of groundwater quality over time

Overall there is increased confidence in the quality of data produced from monitoring wells compared to production wells not designed for monitoring.

4 - Lack of Nested Monitoring Wells in District

Groundwater in the plan area is divided into three separate water bearing zones. These include the lower water-bearing zone, upper water-bearing zone and the perched or shallow zone, as discussed below.

- The **lower water-bearing zone** (confined aquifer) contains fresh water in the lower section of the Tulare Formation from the base of the E clay (Corcoran Clay) to the base of fresh water or the top of connate, saline marine water, commonly called "below the Corcoran Clay."

- The **upper water-bearing zone** (unconfined aquifer) is from the top of the Corcoran Clay to the upper sections of the Tulare Formation, often considered the bottom of the A clay.

- The **shallow or perched zone** (shallow) is from the top of the A Clay (a shallow confining layer), where it is present, to the perched groundwater table which is often within 10 feet or less of the ground surface. DWR Bulletin 118 (2003) uses 25 feet below ground surface (bgs) as a general vertical depth limit for the base of the perched zone.

The shallow or perched zone has poor groundwater quality and is not used as a water source. The Lower and Upper aquifers are both used as water supplies, but no wells are able to independently monitor each aquifer. One proposed nested well (MW-1 and MW-2 shown on **Exhibit 4.1**) will include casings that can monitor each aquifer. This is especially important in the drinking water supply area, since existing wells tap the lower aquifer, which has high arsenic levels, but the District would like to begin using the upper aquifer as a water source, which generally has lower arsenic levels, but is higher in iron and manganese.

5 – Evaluate Groundwater Quality Problems

Groundwater quality in TID is generally fair but is poor in some places. The groundwater is high in several constituents and is marginal for some crops. For instance, total dissolved solids (TDS) in the groundwater is typically 800 to 1,000 ppm. TID is also addressing high arsenic levels in the drinking water supply. This was the subject of a recent study by Provost & Pritchard Consulting Group (2011) which was funded by the California Department of Public Health (see **Exhibit 4.3** for a table of contents from the investigation – the full report is available by request). As a result of this investigation, the project geologist determined the best water quality (from an arsenic standpoint) for the drinking water system is located above the Corcoran clay in an area generally encompassing the Community of Tranquillity and an area southeast of the Community. As such, the District Board of Directors has dedicated an area as the "Domestic Water System Groundwater Source of Supply Area" (see **Exhibit 4.4** for the District resolution and map of the area, as well as **Exhibit 4.1** for the area) so to better manage this groundwater resource area. Other constituents of concern include iron, manganese and sulfate. The project includes water sampling at the new wells to provide important baseline data. The monitoring wells will continue to be sampled, at least annually, and will provide additional sampling points to better characterize and observe trends in the local groundwater quality.

6 - Need for Improved Groundwater Budget

TID is located in the Delta-Mendota subbasin of the San Joaquin Valley Basin (see **Figure 4.2**). DWR (2003) has assigned a groundwater budget type 'B' to the Delta-Mendota subbasin, which means that enough data is available to estimate groundwater extraction to meet water needs, but insufficient data is available to characterize the groundwater budget. The proposed wells will provide information in an area historically lacking data. This is a small step towards improving our understanding of the groundwater budget.

7 - Importance of Groundwater in Tranquillity Irrigation District

Groundwater is an important resource in TID. In dry years, surface water is insufficient to meet crop demands, plus the reliability of Delta supplies is uncertain, and groundwater provides an important supplemental supply. More importantly, the Community of Tranquillity relies entirely on groundwater due to a lack of facilities to treat surface water. Therefore, preserving the sustainability of groundwater is essential for the economic well being and livelihood of the growers and Community of Tranquillity.

Regional groundwater pumping to the west of TID, in Westlands Water District, and to the northeast of TID, in Mid-Valley Water District are expected to increase over time. Westlands Water District has faced serious reductions in surface water supplies and the growers are increasingly relying on groundwater. Large parcels in Mid-Valley Water District that were historically planted in annual crops have been converted to permanent crops, and as a result,

these lands will require a reliable supply every year, and there is little potential for fallowing the land in dry years. These two situations will place further strain on the regional groundwater supplies. Curtailments to the major surface water supplies are occurring in the San Joaquin River and Sacrament-Bay Delta. These will both impact surface water supplies for the District and other regional agencies.

8 – Facilitate Land Subsidence Monitoring

Land subsidence has been a large problem in the western San Joaquin Valley, particularly north of TID. Land subsidence has been monitored in the area for many years, but monitoring efforts have declined in recent times. However, a benchmark on TID Lift Station No. 1 is periodically resurveyed to check for land subsidence. It is likely that some land subsidence has been arrested with the importation of large volumes of surface water since TID established their surface water contracts. However, there is often a time delay in subsidence after groundwater withdrawals, so the District may still be experiencing subsidence. In addition, regional overdraft may worsen due to population growth, increase in permanent plantings, and loss of surface waters to environmental flows. The proposed wells will provide useful data on groundwater levels in the confined aquifer, which are essential to predicting future land subsidence. TID's goals related to land subsidence and groundwater monitoring are found in their GMP:

> "*Further study is needed to identify historical low groundwater levels, and determine the effect that increased pumpage would have on water levels and the possible non-elastic permanent subsidence*." (pg 16)

Benchmarks are proposed to be installed at the base of each new monitor well concrete slab and surveyed by GPS methods, to facilitate future subsidence monitoring.

4.5 – New Data and Knowledge

Quality of Information Obtained

Several measures are in place to help ensure that high quality information will be obtained. These measures are described in other sections of this application and are referenced below:

- Work will be performed using standard and accepted methods and analysis, as described below under 'Data, Methods and Analysis to be Used'.

- The project will be performed according to a detailed and focused Work Plan (**Section 5.4**).

- The quality assurance measures described in **Section 8** will help to ensure that information gathered is of high quality.

- The public outreach/information dissemination efforts described in **Section 5.9** will help ensure that the project is proceeding in the right direction and that the project provides information that is needed, useful, and understood. Comments, suggestions and criticisms from the stakeholders will be used to improve the project.

Data, Methods and Analysis to be Used

The TID will use methods and analysis that are accepted in the engineering and hydrogeologic community, and have proven effective on similar projects. These methods are briefly described below, and well be expanded in considerable detail in the project plans and specifications.

Monitoring Well Designs

The monitoring wells will be based on a similar design performed by the District's consulting engineer in the neighboring James Irrigation District, but will be modified as needed for site specific conditions. Those wells were also funded through a Local Groundwater Assistance Grant and have performed as expected. The well design will follow wellhead protection and well construction standards documented in the TID Groundwater Management Plan (page 32 and 42 in **Exhibit 3.2**).

Well Drilling

Wells will be drilled by an experienced well driller with a C-57 well driller's license. The wells will be drilled by the mud rotary method using standard procedures. The contractor shall perform preliminary development by swabbing and airlifting followed by development by pumping.

Electric Logs

An electric log will be performed in each borehole using an experienced geophysical contractor. The entire borehole will be logged. The contractor shall maintain borehole integrity and circulate fluid to stabilize the borehole until the geophysical contractor is on site. The logging company shall obtain a sample of circulating fluid for calibration of the logs.

Water Quality Sampling

Water quality samples will be collected from each casing by an experienced technician, geologist or engineer after well development has occurred. The samples will be collected according to TID's Monitoring Protocols documented in the Groundwater Management Plan (Appendix C in **Exhibit 3.2** of this application). Water quality testing will be performed by accredited, experienced, state-certified testing laboratories to ensure appropriate testing

methods and chain of custodies. Field blank and duplicate samples will be collected to validate the results of the laboratory.

Hydrogeologic/Stratigraphic Analysis

The hydrogeologic/stratigraphic analysis will be the culminating task for the project, and will gather all new data to develop a detailed interpretation of the local hydrogeology. A professional geologist will perform the analysis using geologic logs, e-logs, water quality test results, and other new information. The hydrogeology and stratigraphy will be characterized and compared to published reports and data on other nearby wells.

New Knowledge and Improvement in Groundwater Management

The proposed project will help improve knowledge of the local groundwater and result in a significant improvement in groundwater management.

New Knowledge

The following is a list of new data that will be collected as part of the project, and on-going monitoring:

- Local stratigraphy (from geologic logs)
- Water quality from different locations and separate aquifers
- Groundwater levels from new locations and from separate aquifers
- Continuous water level measurements from data loggers

Improvement in Groundwater Management

The aforementioned data will allow for improved groundwater management in many ways, as described below:

- Sufficient data will be available for the first time to prepare reliable groundwater contour maps
- Additional groundwater level data will be available and submitted to three levels of groundwater monitoring:
  - Local/District – TID groundwater monitoring program;
  - Regional – Kings River Conservation District Regional monitoring program; and
  - Statewide – California Statewide Groundwater Elevation Monitoring Program (CASGEM), as well as DWR developed groundwater basin contour maps. Historically, the contour maps have stopped short of TID, and the information provided from these new wells could facilitate better mapping. The Department's website http://www.water.ca.gov/groundwater/data_and_monitoring/south_central_region/GroundwaterLevel/gw_level_monitoring.cfm contains the historic and current groundwater mapping prepared by DWR. The groundwater basin contour maps (both depth to water and groundwater elevation) and the hydrologic region contour

maps do not include any mapping in the area covered by Tranquillity Irrigation District.

- Additional data will be available to more accurately assess long-term changes in groundwater storage
- Baseline groundwater quality will be collected for comparison to future data
- Groundwater quality can be monitored better in a dedicated drinking water supply area that has high arsenic levels
- More data will be available to evaluate groundwater gradients, groundwater inflow and outflow, and most importantly, the inflow of lower quality groundwater from the west
- Groundwater level data from the confined aquifer may be useful in evaluating the potential for future land subsidence
- A nested well will allow, for the first time, groundwater levels to be measured at one point in two separate aquifers
- More accurate data will be available that is not subject to restrictions or limitations imposed by production wells.

Consistency with Groundwater Management Plan

The proposed project is consistent with several goals and objectives listed in the TID Groundwater Management Plan (Attachment 3, **Exhibit 3.2**) as shown in **Table 4.1**.

Table 4.1 – Consistency of Project with Groundwater Management Plan

Tranquillity Irrigation District Groundwater Management Plan	
pg 4-5	*"6. Implement a groundwater-monitoring program to provide an "early warning" system to future problems.* *7. Stabilize groundwater levels in order to minimize pumping costs and energy use, and provide groundwater reserves for use in droughts."*
pg 21	***"Increase Knowledge of Local Geology and Hydrogeology.*** *Increase knowledge of the local geology and hydrogeology through technical studies, subsurface investigations, water quality testing, water level monitoring, and land subsidence monitoring. Gain a better understanding of regional groundwater quality and flow conditions, and potential impacts to the Districts from surrounding water sources with poor water quality. Seek funding for these investigations through State and Federal grant programs."*
pg 28	*"Periodically review the monitoring network to determine if it provides sufficient areal coverage to evaluate groundwater levels"*
pg 31	*"Increased water level monitoring, especially in known pumping centers"*
pg 34	*"Seek grant funding to study the geology and hydrogeology of the Districts western border, gain a better understanding of groundwater flow conditions into the Districts, and install monitoring wells and perform water quality testing."*

4.6 – On-going Use

Operation and Maintenance Funding

The TID has adequate funding to continue monitoring the new wells in the long-term, and has adequate funding to address well maintenance. After completion of the project, on-going monitoring and maintenance will be added to the duties of the existing District staff. Extra staff will not be needed to cover these additional work requirements. The requested funding will provide fully functioning facilities, and they are not dependent on additional funds to be used.

Groundwater Monitoring and Maintenance Funds

Exhibit 4.5 includes the 2011-2012 annual budget for TID. This budget is typical of past years and future years are expected to have similar budget categories and amounts. The budget

includes three categories that are currently used for groundwater management and monitoring, as shown in **Table 4.2**.

Table 4.2 – Groundwater Management Budget

Description	Budget
Repair/Maintain (R/M) Pumps & Wells	$30,000
Water Sampling	$3,500
Outside Engineering	$30,000

On-going Monitoring

Groundwater levels will be monitored continuously using the data loggers, and the data will be retrieved on a bi-annual basis from the proposed monitor wells. Groundwater quality will be monitored approximately once per year from the District's production wells. However, on-going monitoring will require minimal effort and only a few hundred dollars of salary and laboratory costs per year. The costs to monitor the new wells can easily be accommodated with the available budgets listed under 'Water Sampling' in **Table 4.2**.

Monitoring Well Maintenance

The monitoring wells will be constructed according to standard practices to ensure quality and lasting construction. Thus, it is anticipated that the wells will have a significant design life and maintenance costs will be minimal. Annual maintenance costs for wells range from 0.5% to 1.5% of the construction cost per year[1]. Assuming maintenance costs of 1% per year, and a construction cost of $170,000, the annual maintenance costs would be $1,700/year. These costs can also be easily accommodated with the budgets listed in for 'Repair/Maintain Pumps & Wells'. If engineering services are needed they would likely be small and could be paid for with the 'Outside Engineering' budget in **Table 4.2**.

Cost share

The proposed project does not include any cost share.

Adaptive Management Strategy

The District has developed an adaptive management strategy to help ensure that groundwater monitoring can evolve due to changing conditions, stakeholder disputes, or changes in priorities.

[1]Jensen, M. E. '*Design and Construction of Farm Irrigation Systems*", 1980, pg 58.

Recognition of Need for Adaptive Management

The first step in developing an adaptive management is recognizing the need to adapt. The TID monitoring system is growing and improving. The proposed wells will significantly improve the monitoring system by filling spatial gaps, and providing dedicated monitoring wells, nested wells and data loggers. In fact, the new wells are needed to provide data for improving and adapting the districts operations.

Groundwater Management Plan Amendments

Groundwater monitoring protocols are documented in the TID Groundwater Management Plan (Appendix C in **Exhibit 3.2**). Groundwater monitoring data will be evaluated continuously, and, when deemed appropriate, the GMP will be amended to include new monitoring procedures.

Adapt in Cooperation with Neighboring Agencies

TID is working closely with neighboring agencies, such as Fresno Slough Water District (FSWD) and James Irrigation District (JID), to monitor groundwater. FSWD and TID jointly prepared their GMP, share groundwater level data, and frequently collaborate on projects. JID and TID are both interested in each other's groundwater levels, and TID allowed JID to construct a monitoring well on their border, just inside TID. Adaptive management may build upon these cooperative relationships, and develop groundwater policies that are amenable to surrounding areas.

Dispute Resolution Policy

TID has a documented dispute resolution process that can be used to adapt groundwater operations, if necessary. This process is found on page 46 of their GMP (**Exhibit 3.2**). If disputes arise then this policy will be followed to adapt and improve groundwater management.

MENDOTA POOL
FRESNO SLOUGH BYPASS
R15E
R16E
CENTRAL
MALAGA
AMERICAN
JEFFERSON
LINCOLN
CLAYTON
ADAMS
SUMNER
SOUTH
PARLIER
MANNING
DINUBA
FLORAL
ALPINE
SJVRR
FRESNO SLOUGH
JAMES
MARTIN
MASTERS
MARIN
CONTRA COSTA
SACRAMENTO
LEVEE
COLORADO
TUOLUMNE
CALAVERAS
AMADOR
SONOMA
NAPA
SAN LUIS DRAIN
T14S
T15S
COMMUNITY OF TRANQUILLITY
MORTON
25-AG (C)
26-AG (C)
FS1-AG (C)
22-AG (C)
MW-5 (C)
24-AG (C)
23-AG (C)
MW-4 (C)
MW-TW#1 (U)
27-AG (C)
16-AG (C)
28-AG (C)
MW-TW#2 (U)
MW-19B (U)
19-AG (C)
City Well 5 (C)
MW-1 (U)
MW-2 (C)
City Well 4 (C)
21-AG (U)
20-AG (U)
30-AG (C)
29-AG (C)
MW-3 (C)
MW-TW#3 (C)
MW-JAMES (S)
MW-1 & MW-2 comprise of one nested well with 2 casings
26 25 30 29 28
35 36 31 32 33
02 01 06 05 04
11 12 07 08 09 10
14 13 18 17 16 15
23 24 19 20 21 22
26 25 30 29 28 27
35 36 31 32

0 0.25 0.5 Miles

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Production Wells
- Irrigation Well (##-AG)
- Drinking Water Well (#)

Monitoring Wells
- Existing
- Proposed

Note: Loggers to be installed in all proposed and existing Monitoring Wells

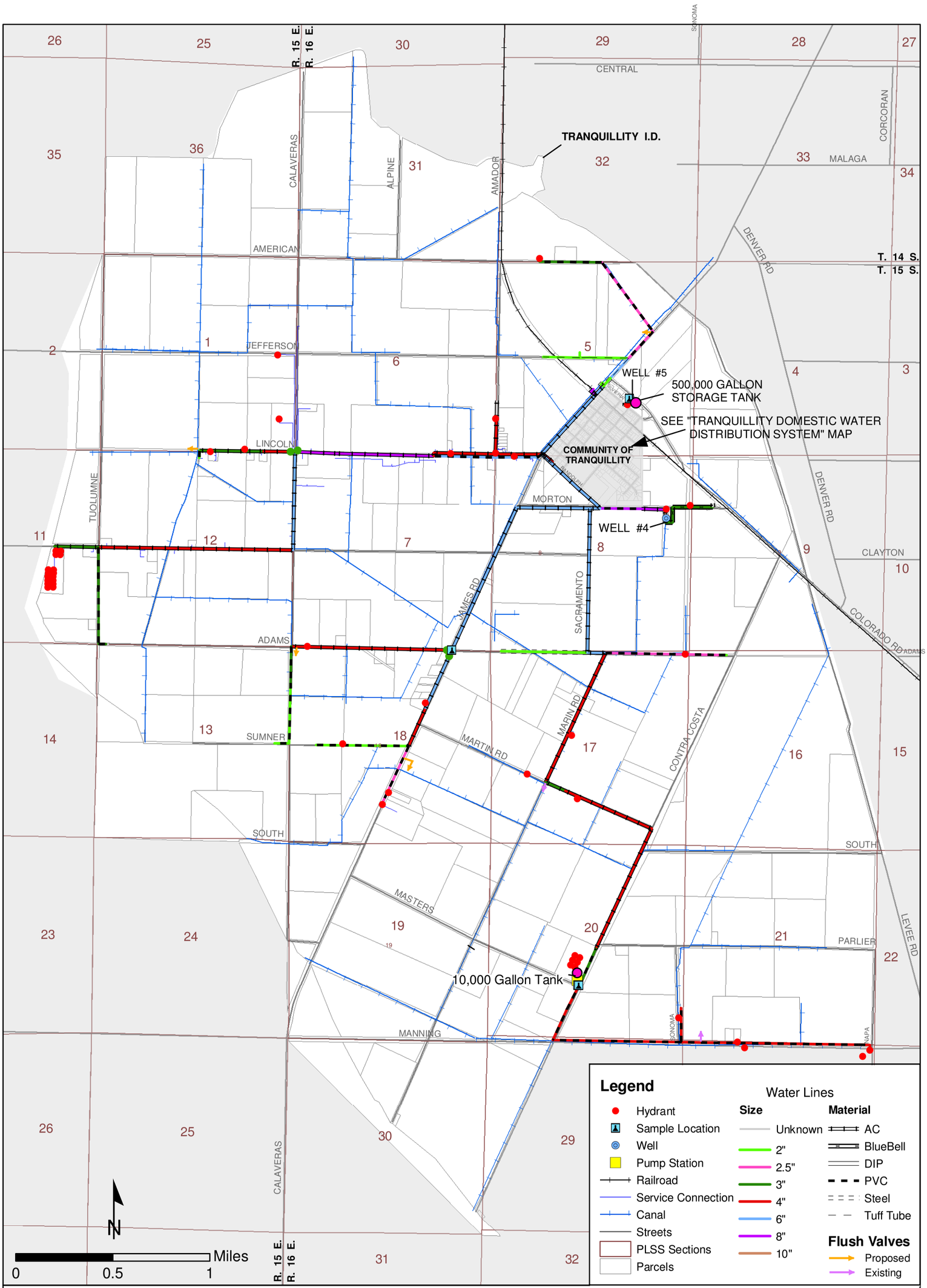
- Fresno Slough WD
- James ID
- Tranquillity ID
- Reclamation District 1606
- Township Range Line
- Section Line
- *Domestic Water System Groundwater Source of Supply Area*
- Agricultural Canals/Pipelines
- ( ) **Groundwater Aquifer**
  - **S = Shallow**
  - **U = Unconfined**
  - **C = Confined**

EXISTING AND PROPOSED GROUNDWATER FACILITIES MAP

TRANQUILLITY IRRIGATION DISTRICT

EXHIBIT 4.1

7/06/2012 \\evolution\clv_clients\Clients\TranquillityID-1075\Projects\1075-12C2 2012 LGA Application\GIS\Groundwater_Facilities_Map.mxd



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TRANQUILLITY IRRIGATION DISTRICT
FOUNDED 1918
Tranquillity, CA

Tranquillity Irrigation District Rural Domestic Water Distribution System

1 inch equals 2,500 feet

EXHIBIT 4.2

z:\clients\tranquilityid_1075\feature\Report_Figure_District_11x17.mxd

6/05/2006

EXHIBIT 4.3

Name of Water System: Tranquillity Irrigation District
System ID 1010030
Project Number: 1010030-002
Funding Agreement No. 84-10C09

New Well Feasibility Study Report
March 2011

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Tables

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RESOLUTION NO. 2011-06

ADOPTION OF DEDICATED GROUNDWATER SOURCE OF SUPPLY AREA POLICY FOR THE BENEFIT OF THE TRANQUILLITY IRRIGATION DISTRICT DOMESTIC WATER SYSTEM

WHEREAS, as of January 22, 2001, the U.S. Environmental Protection Agency under the Safe Drinking Water Act adopted a revised Maximum Contaminant Level (MCL) of 10 parts per billion (ppb) for arsenic for all suppliers of domestic water to the public, with effective date for implementing the MCL of January 23, 2006 ; and

WHEREAS, as of November 28, 2008 the State of California adopted regulations to conform to the federal MCL of 10 ppb; and

WHEREAS, the water quality of both Tranquillity Irrigation District well #4 and #5 being the sole source of supply to the domestic water distribution system tested routinely between approximately 12 and 16 ppb and not in compliance with the standard; and

WHEREAS, the District has entered into a contract with the California Department of Public Health (DPH) to fund a feasibility/planning study that has resulted in the definition of an area southeast of the Community of Tranquillity as having the best quality of water for human consumption and meeting the water quality requirements of the DPH; and

WHEREAS, the District proposes adoption of the Drinking Water Improvement Project ("Project") for the purpose of providing drinking water to District customers that is in compliance with drinking water standards. The Project involves the modification of up to two existing agricultural irrigation wells for use as drinking water wells or the construction of up to two new drinking water wells along the proposed pipeline alignment, along with pumping plants, electrical service, backup generator, controls, associated pipeline and appurtenances. In addition, a coagulation/filtration and treatment plant with evaporation ponds would be constructed to remove iron and manganese from the water to secondary standard requirements; and

WHEREAS, the District intends to execute a contract with the DPH for grant funding to cover the construction cost of the project facilities;

NOW, THEREFORE, THE BOARD OF DIRECTORS OF THE TRANQUILLITY IRRIGATION DISTRICT resolves as follows:

1. That the groundwater aquifer above the Corcoran Clay bounded by the description included as Attachment "A" and as shown approximately in Attachment "B" within the Tranquillity Irrigation District be dedicated as the source of supply to the Tranquillity domestic water system and that no irrigation wells be constructed or water supply developed from this area.
2. Upon the execution of a contract for construction funding for the Drinking Water Improvement Project from the California Department of Public Health that this resolution will be binding upon the District.
3. That the Board of Directors hereby directs the General Manager to carry out the conditions of this policy in managing both the Tranquillity Irrigation District facilities as well as the facilities of the domestic water system.
4. That the Board of Directors hereby directs the General Manager to file and/or transmit this resolution to agencies with jurisdiction regarding the regulation of the domestic water system.

Approval: Ayes 2; Noes 0; Absent 1; Abstained ____

Signed _____
President; Jerome Salvador

Attested _____
Secretary; Elizabeth Reeves

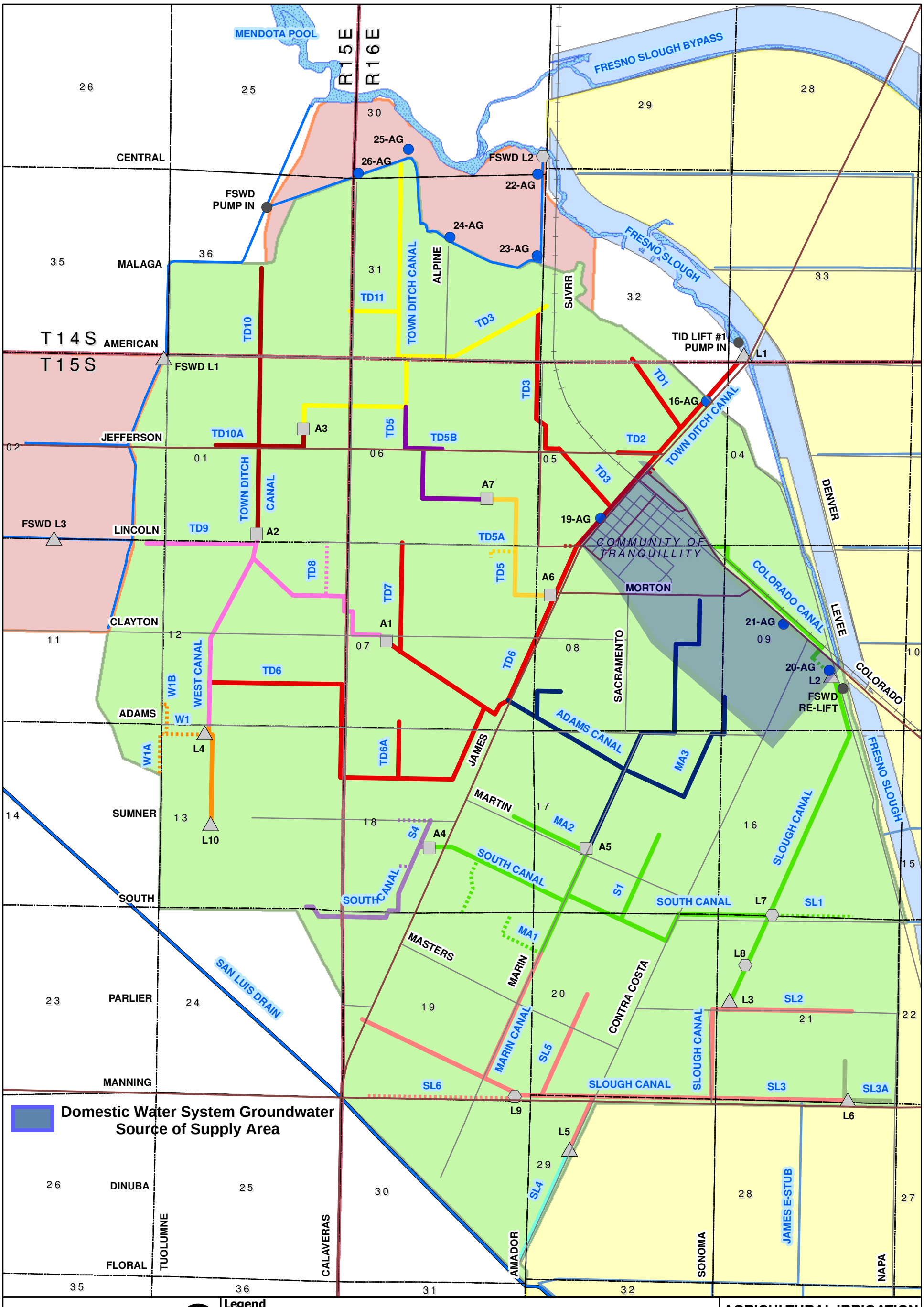
Attachment "A"

Description of Groundwater Source of Supply to the Domestic Water System of the Tranquillity Irrigation District

A one-half mile in width strip of land, with northeasterly boundary coincident with the southwesterly right-of-way of Colorado Avenue, starting at the intersection of the easterly boundary of Tranquillity Irrigation District and Colorado Avenue and extending in a northwesterly direction to and coincident with the southeasterly right-of-way of James Road.

District Seal

Attachment "B"



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TRANQUILLITY IRRIGATION DISTRICT
2012 ANNUAL BUDGET

Budget

		2012 Proposed
Income:		
Well Water Sales from prior yr & carryover funds		$1,000,000.00
Contract Water Sales		
City Water		$222,160.00
Deposits On Hand (returnable income)		$12,000.00
Irrigation Water		$1,000,000.00
Well Water for F&S		$10,000.00
Assessments		$78,500.00
Property Lease		$145,625.00
Grant $$$		
Rental house, Misc, Labor Income		$15,000.00
Manning Avenue loans		$0.00
KWRA - Rights Water		$181,224.00
Interest		$20,000.00
	Totals	**$2,684,509.00**
Expenditures:		
New Purchase/Major Upgrades		
Possible Matching Grant USBR		
City Water System Upgrades inc grant projects		
Reservoir		$400,000.00
Field & Shop Equipment		
Canal System Upgrades (2009 - SCADA)		
Vehicle/Heavy Equipment		$20,000.00
Wells & Pumps (19B = 2010)		
Lift Pumps		
	Totals	**$420,000.00**
Long Term Debts:		
Westamerica (Fresno Slough Prop)		$0.00
DWR meter project		$83,376.33
City National (Irrigation improvements)		$0.00
DHCCP (peripheral canal project)		$16,786.00
Westlands Intertie		$0.00
	Totals	**$100,162.33**
General Expenses:		
Wages		$539,737.00
Payroll Taxes & UI		$15,000.00
Medical, Dental, Vision Insurance		$290,000.00
Pension Expense (TID cont)		$85,000.00
R/M Irrigation System		$12,000.00
Weed Control		$25,000.00
➔ R/M Pumps & Wells		$30,000.00
R/M Vehicles		$10,000.00
R/M Equipment		$15,000.00
R/M City Water System		$5,000.00
R/M Office Equipment		$5,000.00
R/M Building		$5,000.00
R/M Park		$1,000.00

TRANQUILLITY IRRIGATION DISTRICT
2012 ANNUAL BUDGET

Budget

		2012 Proposed
	Equipment Rental (excavator)	$0.00
	Equipment Rental (diesel engines - wells) TID use	$0.00
	Equipment Rental (diesel engines - wells) sale use	$0.00
	Equipment Lease (backhoe, tractor, forklift)	$0.00
	Contract Water Costs/SLDMWA pu fees	$185,000.00
	Irrigation Power - Electrical & Diesel (TID use)	$250,000.00
	Irrigation Power - Electrical & Diesel (sale use)	$0.00
	Utilities - Office, Shop, Park	$20,000.00
	City Water Power	$40,000.00
	Telephone & Broadband	$15,000.00
	Office Supplies	$5,000.00
	Outside Supplies	$25,000.00
	Misc Operating/Office Expenses	$7,000.00
	Copier Lease	$3,000.00
	Loan Interest	$12,000.00
	Legal	$15,000.00
	Audit Fees	$25,000.00
	Gen & Liab Insurance	$25,000.00
	Workers Comp Insurance	$16,000.00
	Uniforms	$4,000.00
	Employee Training	$2,000.00
	Employee Conferences/Meetings	$15,000.00
	Fuel & Oil	$45,000.00
	City Water Treatment	$10,000.00
➔	Water Sampling	$3,500.00
➔	Outside Engineering	$30,000.00
	KRWA Expenses (incl. dues)	$10,000.00
	SLDMWA	$65,000.00
	Dues (all other dues)	$40,000.00
	Taxes & Permits (prop., Rights Water)	$22,000.00
	Totals	**$1,927,237.00**

Total Income	**$2,684,509.00**
Total Expenditures	**$2,447,399.33**
Carry over cash for expenses	**$237,109.67**
Savings (backup funds)	$500,000.00
Well water sales from current year	$560,000.00
New carry over cash total	***$1,060,000.00***