Appendix A

Water Quality Trading Feasibility Assessment for San Jacinto Basin Agricultural Operators

Task 1.1 Identify Pollutants and Pollutant Forms

Technical Memo #1

October 2013 Update

Task 1.1 Description

This task will analyze and identify the appropriate pollutants for which water quality trading (WQT) among agricultural operators in the San Jacinto watershed can be environmentally sound and cost effective. Consistent with the Lake Elsinore/Canyon Lake nutrient total maximum daily loads (TMDLs). The analysis will include nitrogen, phosphorus and sediment. The analysis may also evaluate the potential for WQT to mitigate nitrate and TDS loads to groundwater to achieve Basin Plan groundwater water quality objectives. If appropriate, based on local issues of concern and the results of the agricultural operator best management practice (BMP) survey[1], other pollutants will be examined. The project team will provide a technical memo summarizing recommendations on the appropriate type and form of pollutants for potential WQT among agricultural operators in the San Jacinto River watershed. The memo will also highlight areas where future research and analysis are needed.

Drivers/Incentives for Trading

The primary driver for WQT among agricultural operators in the San Jacinto River watershed is the Lake Elsinore/Canyon Lake nutrient TMDL reflected in the Water Quality Control Plan for the Santa Ana River Basin. In addition to the TMDL, salt offset requirements for groundwater protection are another potential incentive for trading, although not the same focus as the TMDL intended to address surface water quality. Brief descriptions of each are provided below.

- **Total Maximum Daily Load (TMDL) Requirements.** The Lake Elsinore/Canyon Lake nutrient TMDL establishes phosphorus (P) and nitrogen (N) load allocations to watershed sources that contribute excessive nutrient loads to the lakes. Substantial P and N load reductions will be necessary in the San Jacinto River watershed. The focus is on wet weather driven sources, such as livestock and crop agriculture and municipal separate storm sewer systems (MS4s), because effluent from wastewater treatment plants is piped outside the watershed. According to the 2013 Agricultural Nutrient Management Plan (AgNMP) for the San Jacinto River Watershed developed by the Western Riverside County Agricultural Coalition (WRCAC), the agricultural and dairy operators will achieve compliance with the agricultural WLAs or LAs or lake water quality response targets applicable to the Lake Elsinore and Canyon Lake through a combination of watershed-based BMPs and in-lake remediation projects (WRCAC 2013).

[1] The survey was conducted by WRCAC under a separate task.

- **Basin Plan Water Quality Objectives.** The Water Quality Control Plan for the Santa Ana River Basin (Basin Plan, as amended in 2008) includes water quality objectives for inland surface waters that apply to the lakes and streams in the San Jacinto River watershed. The Basin Plan addresses sediment through narrative criteria for total suspended solids and total dissolved solids. In addition, the Basin Plan establishes numeric criteria for various forms of nitrogen. These include acute and chronic criteria for un-ionized ammonia for warm and cold water fisheries, nitrate criteria for drinking water sources (45 mg/L as nitrate or 10 mg/L as nitrogen), and criteria for total inorganic nitrogen that vary from 1 to 6 mg/L for different river reaches.

- **Salt Offset Requirements.** In addition to the nutrient TMDLs, dairies in the San Jacinto River watershed face a different set of requirements related to groundwater protection. The previous dairy discharge permit (Santa Ana Regional Water Quality Control Board [RWQCB] Order No. R8-2007-0001) required dairies to develop and implement a salt offset plan in order to apply manure, process wastewater, or stormwater from manured areas on land associated with dairies that overlie groundwater management zones (GWMZs) lacking assimilative capacity for total dissolved solids (TDS) or nitrate-nitrogen. According to the revised dairy discharge permit (Order No. R8-2013-0001), the dairies in the watershed have implemented control measures to provide the required offset for salt and nutrient loadings. The new permit includes a time schedule for specific activities required for dairies to ensure continued water resource protection:
  - By December 7, 2014: Collect and evaluate all available groundwater monitoring data, including historic data, from wells within a 5 mile radius of all dairies in the watershed to identify statistically significant changes in TDS and nitrate attributable to discharges from dairies.
  - By June 7, 2015: If the data analysis indicates hotspots or impacts from dairy discharges, quantify the salt and nutrient loads from dairies and propose additional control measures to be implemented within 6 months of approval.
  - Track waste management through a Manure Manifest System using forms provided by the Santa Ana RWQCB or through a system developed by the San Jacinto Basin Resource Conservation District (SJBRCD).[2]

  The permit also includes less specific requirements for dairies to continue salt and nutrient load reduction programs by reducing manure and process wastewater application to croplands, reducing salt content in the source water, implementing on-site wastewater treatment processes, considering implementation of regional wastewater treatment systems, and participating in local groundwater improvement projects.

Suitable Pollutants for Trading

Nitrogen and phosphorus are considered appropriate pollutants for trading under U.S. EPA's 2003 Water Quality Trading Policy and the U.S. EPA *Water Quality Trading Toolkit for National*

[2] Note that the SJBRCD has developed a process for establishing and running a Manure Manifest System; however, the system has not yet been established.

Pollutant Discharge Elimination System (NPDES) Permit Writers. Nutrients are relatively persistent in river environments and are the focus of the Lake Elsinore and Canyon Lake Nutrient TMDLs. These waterbodies are impaired for excessive nutrients as well as organic enrichment/low dissolved oxygen, sedimentation/siltation, and unknown toxicity. Therefore, phosphorus, nitrogen, and sediment are the TMDL pollutants of concern. The purpose of this task under the WQT feasibility assessment for agricultural operators in the San Jacinto River basin is to look at the most suitable forms of these pollutants for trading.

Suitable Nutrient Pollutant Forms

There are several reactive nitrogen and phosphorus forms to consider in the context of WQT. These different forms can pose a challenge when attempting to quantify nutrient loads. This is due to variability in concentrations of soluble reactive forms of nutrients across very short time periods. As a result, many water quality monitoring programs and, therefore, TMDLs rely on total nitrogen (TN) and total phosphorus (TP) when estimating loads.

It is important to consider the bioavailability of the nutrients discharged by sources rather than just default to TN and TP in the context of WQT. Considering the bioavailability of nutrients from different sources will assist in preventing localized hotspots and ensuring water quality is adequately protected. For example, if a biologically unavailable nutrient form is traded for a source's load which is substantially bioavailable, the water quality impacts may not be addressed. This is primarily the case when WQT is likely to involve both nonpoint and point sources. However, the focus of this project is on the feasibility of nonpoint source to nonpoint source trading. In the San Jacinto River watershed, nonpoint sources are more predominant than point sources, as discussed below.

In addition to bioavailability, it is important to determine at what concentration a particular nutrient form has acutely toxic properties or quickly manifests other stresses. For example, discharges of sizeable quantities of ammonia can create acute toxicity concentrations. Ammonia can also consume high levels of oxygen as the form is converted into NO_2 and then NO_3. Because of these interactions, WQT to address ammonia effluent limits is not appropriate. However, ammonia is a tradable nutrient form when it is present in concentration levels characteristic of healthy ecosystems and not causing the described impacts. In these settings, ammonia is cycling normally through the dissolved inorganic nitrogen or TN succession.

Lastly, the consideration of persistence is important. A parameter that attenuates quickly is not a viable offset for impacts further downstream. Persistence, or the fate and transport of nutrients, is an important consideration when setting eligible for trading transactions. For both TN and TP, WQT could incorporate adequate provisions to delineate appropriate boundaries and a location factor to address quicker attenuation rates in headwater streams and downstream persistence. Many of these considerations will be explored in subsequent technical memos related to the pollutant suitability assessment as part of the water quality trading feasibility analysis for the San Jacinto River watershed.

A brief discussion on the considerations related to the nutrient sources in the San Jacinto River watershed and the associated forms of nitrogen and phosphorus is provided below.

Nutrient Sources and Considerations in the San Jacinto River Watershed

Nutrient contributions to the San Jacinto River system include sediment in the lakes, as well as agricultural sources such as cropland, pastureland, and dairies. However, agricultural sources are diminishing over time as land uses change. Other potential sources of nutrient loading include discharges from failing septic systems, urban runoff, and natural background sources. At this time, the focus of the water quality trading feasibility assessment is on agricultural sources.

There are three agricultural source categories to consider when looking at pollutant forms: dairy facilities operated as animal feeding operations (AFOs) and concentrated animal feeding operations (CAFOs); and agricultural operations including crop, citrus, and other facility types. The Lake Elsinore/Canyon Lake TMDL presents total allowable nutrient loads for these sources in the San Jacinto River watershed.

Dairy facilities (operated as AFOs and CAFOs) are located in the mid-portion of the San Jacinto River watershed, in close proximity to the San Jacinto River. From the 2009 WRCAC land use data, there were approximately 1,004 acres designated as dairies-intensive (LESJWA 2010). Based on data from January 2011, there are 25,447 milking cows; 3,867 dry cows; 9,769 heifers; and 5,840 calves in the San Jacinto River basin (Tetra Tech 2011).

During large and/or frequent storm events, these facilities have the potential to overflow and contribute untreated animal waste to the San Jacinto River. These discharges would be characteristically high in nutrient concentrations, resulting in significant nutrient loading. (It is important to keep in mind that discharges from permitted CAFOs are illegal; associated nutrient load reductions from addressing discharges would not be eligible for trading because they would be the result of noncompliance.) In addition, manure and wastewater from dairies is applied as a nutrient source to cropland and other agricultural lands throughout the watershed. Runoff and irrigation return flows from agricultural lands can carry nutrient loads to local surface waters. The nutrients in dairy manure include both nitrogen and phosphorus.

Storage of solid and liquid manure at AFOs and CAFOs may also lead to increased total dissolved solids (TDS) and nitrate loads to groundwater. Infiltration of rainfall and especially irrigation water in agricultural land application areas could also increase TDS and nutrient loads to underlying groundwater.

Nitrogen Considerations

The nitrogen content of manure is represented by total Kjeldahl nitrogen (TKN), which includes the reduced forms of nitrogen, principally ammonium (NH_4^+), and amino forms of organic nitrogen both present in approximately equal parts (UMN 2000). Ammonium is directly usable by plants, while reactions in the soil can convert organic forms to NH_4^+, which in turn can be oxidized to nitrate (NO_3^-). Both ammonium and nitrate are highly soluble in water, with the related forms, ammonia (NH_3^-) and nitrite (NO_2^-) being produced in solution, based on equilibrium conditions.

The nutrient content of commercial fertilizers and considerations of the various forms of nitrogen and phosphorus are similar to those associated with manure. The main source of nitrogen in fertilizers is nitrate, but they also contain ammonia, ammonium, urea and amines (Lenntech 2011). Like nitrogen in manure, these forms are soluble in water and are transformed to related forms under aqueous equilibrium conditions.

Phosphorus Considerations

Manure contains organic phosphate and inorganic phosphate compounds, with inorganic orthophosphate (PO_4^{-3}) composing approximately 65% of total phosphorus content (ASAE 2003). The orthophosphate in fertilizers and manure is initially quite soluble. When the manure comes in contact with the soil, various reactions begin occurring that make the phosphate less soluble and less available. Phosphorus in soils is almost entirely associated with soil particles. When soil particles are carried to a river or lake, phosphorus will be contained in this sediment. When the sediment reaches a body of water it may act as a sink or a source of phosphorus in solution (UMN 2009).

Commercial fertilizers contain predominantly soluble forms of phosphate and reactions causing transformation to other forms are caused by the same processes affecting phosphates in manure.

In addition to these upland sources of phosphorus, both Canyon Lake and Lake Elsinore experience a significant phosphorus load due to recycling from sediments. Overall, watershed loads are intermittent and, as discussed, are partly in the form of organic and sorbed materials that augment the sediment source. To control phosphorus loads associated with sediment in Canyon Lake, the Lake Elsinore/Canyon Lake TMDL Task Force (Task Force) plans to add alum to achieve an interim and final chlorophyll-a response target using five applications over a two-year period (WRCAC 2013). By binding phosphorus and reducing algae growth, the continued use of alum will reduce the cycling of nutrients and associated sediment oxygen demand in the lake bottom. According to the AgNMP, if a combination of watershed BMPs and alum additions are not sufficient to meet the final DO response target, it will be necessary to implement additional in-lake solutions (e.g., aeration). For Lake Elsinore, watershed stakeholders have installed an in-lake aeration system to improve circulation so that oxygen levels are better distributed throughout the water column. In 2012, WRCAC member agricultural operators and dairies decided to contribute to the operation of the in-lake aeration system. Current lake modeling and compliance analyses demonstrate that the aeration system is likely to provide the necessary nutrient load reductions to comply with agricultural WLAs and LAs (WRCAC 2013).

Suitable Sediment Pollutant Forms

The TMDL for Lake Elsinore/Canyon Lake does not include allocations for sediment and a narrative criterion in the basin plan. Most of the sediment delivered to the lakes likely arises from erosion of the alluvial channel due to altered hydrology, possibly associated with increased imperviousness. There is no basis for establishing the level of reduction or the attribution of individual sources related to sediment. As a result, it is not likely that sediment would be included in a water quality trading program. However, sediment would be controlled by many of the same BMPs used to reduce nutrient transport. To the extent that these BMPs also reduce total dissolved solids (TDS) to groundwater, agricultural operators could possibly generate a different type of credit that could be offered to dairies that are required to offset their TDS (and nitrate) loads to underlying groundwater management zones.

Overall Watershed Considerations

This section provides a brief discussion of the watershed characteristics that could affect pollutant fate and transport and, as a result, affect the appropriate pollutant forms for WQT in the San Jacinto watershed. These factors will be discussed in more detail in a forthcoming memo on trading boundaries, but they are important to consider now when discussing pollutant forms.

The five issues in the San Jacinto watershed that could affect WQT and pollutant suitability are as follows:

1) Lakes and Reservoirs. The San Jacinto River watershed is a dynamic system with unique conditions that either enhance or restrict flows through the watershed. Normally, only low flows occur on the San Jacinto River except during and immediately after rainstorms. Flow is perennial in the headwater tributaries and intermittent in the valley reaches. Analysis of data from U.S. Geological Survey (USGS) gages has helped to characterize the river as an ephemeral system, with flow reaching Canyon Lake and Lake Elsinore only during prolonged wet periods.

   During low-flow periods, all flows in the upper reaches of the river drain to Mystic Lake, a shallow lake with a large surface area formed by subsidence. The lake is ephemeral, losing water to evaporation and infiltration during dry periods. During average and low-flow years, all flows from the upper reaches of the river are impounded in Mystic Lake. When full, Mystic Lake has been observed to maintain a substantial amount of volume for more than a year with little or no transport back to the San Jacinto River. Because of the significant loss from evaporation, infiltration, and groundwater recharge, much of the volume stored in the lake is lost from the San Jacinto River system. During very large or prolonged rainfall events, however, the storage capacity of Mystic Lake can be exceeded, resulting in overflow back to the San Jacinto River that has the potential to contribute to nitrogen and phosphorus loadings downstream. For example, modeling conducted for the TMDL shows that the overflow from Mystic Lake in the 1998 wet year contributed approximately 13 pounds of total nitrogen (TN) and 6 pounds of total phosphorus (TP) (Tetra Tech 2010). The subsidence that formed Mystic Lake is ongoing; some report that the lake’s depth increases by 8 to 10 inches each year. Because of this, increasingly large rain events will be necessary to cause overflow from Mystic Lake to the San Jacinto River.

   Downstream of Mystic Lake, the San Jacinto River forms a wide fluvial plain. When Mystic Lake does not overflow, downstream river reaches are often dry. The San Jacinto

River flows through the narrow Railroad Canyon before draining into Canyon Lake. More than 90 percent of the San Jacinto River watershed drains to Canyon Lake, which fills quickly during the wet season with the water level declining slowly over time during the normal to dry periods when little or no flow enters Canyon Lake. Salt Creek, with its headwaters in the city of Hemet and much of its main stem flowing through agricultural lands, is one of the main tributaries to Canyon Lake. (North of Canyon Lake, there is a 2 mile reach of the San Jacinto River with perennial flow. It is thought that this flow is related to the Perris storm drain, which drains urban land uses.)

Lake Elsinore is approximately 3 miles downstream of Canyon Lake at the end of the San Jacinto River watershed. Surface flow from the San Jacinto River watershed reaches Lake Elsinore only through release, overflow, or seepage from the Canyon Lake dam. Lake Elsinore acts much like a sink, with almost nonexistent outflow. In rare events, including torrential rains and extended rain periods, the lake overflows into Temescal Creek, which ultimately drains to the Santa Ana River (Tetra Tech 2009). As previously discussed, significant evaporation can cause the lake levels in Lake Elsinore to drop, triggering the need for EVMWD to supplement the lake levels using high quality recycled water that meets NPDES permit requirements.

2) Seasonality. There are wet and dry seasons in the San Jacinto watershed that have a profound effect on the watershed’s hydrology. The upper watershed is disconnected most of the time, with flows terminating in Mystic Lake. In dry seasons, many of the streams are “losing” streams. This means that pollutants discharged upstream during the dry season (possibly due to irrigation return flow) might not travel to a downstream point. It could also mean that runoff doesn’t always reach a downstream lake or reservoir. However, during wet weather events, much of the nutrient load can be flushed downstream. Seasonality, coupled with the watershed’s hydrology, will factor into future discussions on geographic scope (trading above and below Mystic Lake), as well as the development of trade ratios that take into account fate and transport during dry and wet periods.

3) Groundwater aquifer recharge zone. Runoff from sources in the San Jacinto might infiltrate in GWMZs and not arrive at downstream lakes and reservoirs. It will be important to determine how much of a pollutant form infiltrates (and in what form) and how much reaches downstream sources.

4) Irrigation return flow. Currently available data indicate that there are approximately 19,000 acres of irrigated agricultural lands in the San Jacinto River watershed (Tetra Tech 2009). Irrigation water that runs off of agricultural lands can carry nutrients and sediment from manure and commercial fertilizer application to nearby water bodies. Currently little is known about the amount of irrigation water that is returned to the San Jacinto River system, the location of the irrigated lands, and the pollutant load that can be attributed to irrigation return flows. At the time of this report, new data on agricultural land uses in the watershed are being tabulated. Those data, which result from the

agricultural BMP survey being conducted by WRCAC, will be used in future analyses to better identify the locations of potential nutrient loads from irrigation water. However, data are needed on the amount of irrigation water used by source (groundwater and recycled water) and the amount of water and associated nitrogen and phosphorus loads that are returned to the lakes and river system, as well as the type of BMPs implemented to keep irrigation return flow from running off properties.

Summary

Suitable Pollutant Forms for Trading in the San Jacinto River Watershed

In summary, nutrients and sediment (as a transport mechanism for nutrients) are suitable pollutants for water quality trading per EPA's 2003 Water Quality Trading Policy. Nutrients and sediment from agricultural sources, both nonpoint source runoff and permitted CAFOs, are the primary focus for water quality trading in the San Jacinto River watershed at this time. The pollutant forms found in the runoff from these sources are more similar in nature than if comparing nonpoint source runoff to wastewater treatment plant discharges.

The complications caused by the various forms of nitrogen and phosphorus that exist in the environment often lead to the use of TN and TP in water quality analyses. The transformations that take place on land and once in aqueous solution make it difficult to trace the forms of nutrients in surface water to the forms contributed by various sources. Thus, defining loads as TN and TP allows for a simpler comparison of nutrients in surface water and loads coming from watershed sources. As a result, TMDLs typically define allowable loads of nitrogen and phosphorus in terms of TN and TP, as is the case for the Lake Elsinore/Canyon Lake nutrient TMDLs. Therefore, from both a technical standpoint as well as a TMDL implementation stand-point, it is recommended that the water quality trading feasibility analysis for the San Jacinto watershed focus on TN and TP. Variations in nutrient forms between sources due to fate and transport, as well as type of discharge, will be further addressed through the use of trade ratios (e.g., location, delivery, and equivalency). As the water quality trading feasibility analysis progresses, the project team might revisit and adjust the findings of this technical memo as new information is established to reflect additional technical information and stakeholder input.

Future Data Needs

Because of the unique flow characteristics of the San Jacinto River system, with precipitation runoff dominating the streamflows only during a short rainy season, it will be important to characterize the influence of irrigation return flows on streamflow and pollutant loads to the lakes. The survey results recently received by WRCAC will begin to fill the gap in knowledge on the locations of irrigation return flows, but future research will be needed to characterize flow frequencies, volumes, and pollutant loads. WRCAC should consider pursuing 319 grant funding or other funding sources to address this data gap.

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Water Quality Trading Feasibility Assessment for San Jacinto Basin Agricultural Operators

Task 1.2 Recommendations on Geographic Scope and
Task 1.3 Identify Potential Participants in Sustainable Trading Program

Technical Memo #2

June 30, 2012, Updated October 24, 2013

Overview

After identifying the pollutants and pollutant forms potentially appropriate for water quality trading in the San Jacinto River watershed, the next steps in the pollutant suitability analysis for the water quality trading feasibility assessment are to consider the geographic scope of a potential trading program and identify potential agricultural trading participants. Due to the relationship between geographic scope, particularly the hydrologic considerations of the San Jacinto River watershed, and potential agricultural trading partners, these tasks have been combined into one technical memo. In addition, updated land use/land cover data for 2010 became available in January 2012. This information is necessary to help inventory potential agricultural trading participants and determine how changes in land use might affect the subwatershed zone pollutant load estimates derived for the 2010 Watershed Model Update.

The information contained in this technical memo draws upon discussions contained in Technical Memo #1 on pollutants and pollutant forms (Tetra Tech 2013), and will help to set the stage for the upcoming technical memos on supply and demand estimates, as well as trade ratios.

Task 1.2 Description: Recommendations on Geographic Scope

The goal of this task is to examine the appropriate geographic scope for water quality trading in the San Jacinto watershed to determine the appropriate boundaries for a viable, sustainable trading program. The project team analyzed pollutant sources and contributions within the watershed to determine 1) watershed characteristics that could affect implementation of water quality trading across the watershed, and 2) potential areas where water quality trading might cause “hot spots” (localized excursions of water quality criteria). This technical memorandum documents recommendations for the geographic scope of a potential water quality trading program, including identification of the most appropriate strategies for avoiding potential hot spots in the watershed. The technical memo will become part of the final pollutant suitability analysis report.

Review of the San Jacinto River Watershed Geography and Hydrologic Considerations

Technical Memo #1 provides a discussion of the geographic and hydrologic features of the San Jacinto River watershed that affect pollutant fate and transport and, as a result, will affect the technical aspects of a future trading program. The unique hydrology that characterizes the San

Jacinto River watershed was summarized in the 2007 Integrated Regional Watershed Management Plan (IRWMP) for the San Jacinto River watershed (Tetra Tech and WRIME, Inc. 2007). Figure 1 integrates the information from the IRWMP with input from technical stakeholders to depict the hydrologic features of the San Jacinto River watershed that affect pollutant fate and transport and, as a result, will affect the geographic scope of trading program boundaries.

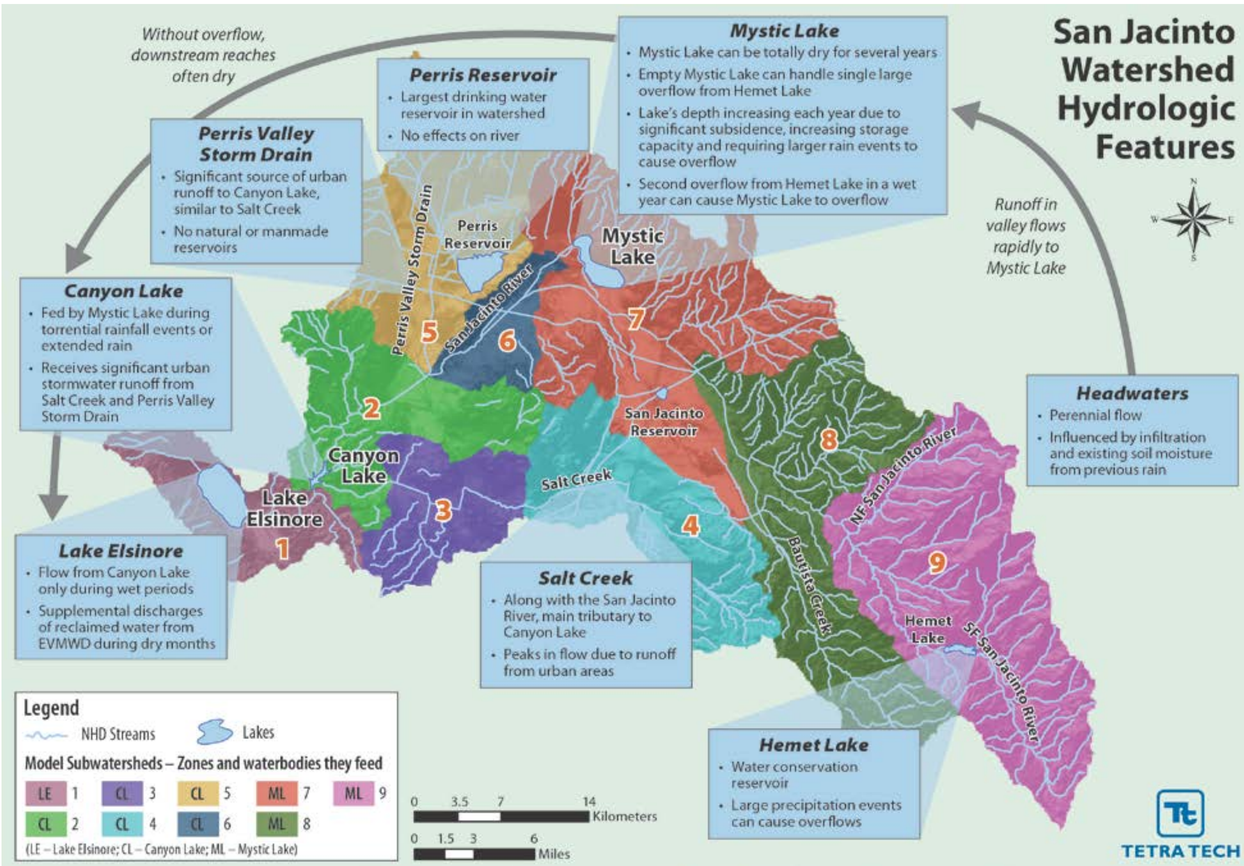

Figure 1. San Jacinto River Watershed Hydrologic Features

As shown in Figure 1, the headwaters of the San Jacinto River watershed are located in subwatershed zones 7, 8 and 9, which drain to Mystic Lake, located in subwatershed zone 7. Mystic Lake's depth is increasing annually due to significant subsidence, increasing the storage capacity of the lake. During average and low-flow years, Mystic Lake has sufficient capacity to store perennial flow from zones 7, 8 and 9—the entire flow of the San Jacinto River through these zones—without overflowing. Hemet Lake, a water conservation reservoir located in zone 9, can overflow as the result of large precipitation or snow melt events. When empty, Mystic Lake can collect and impound an overflow from Hemet Lake. According to the IRWMP, a full Mystic Lake has been observed to maintain a substantial amount of volume for more than a year with little or no transport back to the San Jacinto River. During very large or prolonged rainfall events, however, the storage capacity of Mystic Lake can be exceeded, particularly with an overflow from Hemet Lake. Data analysis by Riverside County Flood Control District indicates that, historically, Mystic Lake has overflowed on average once every 10 years. More recently, due to subsidence as discussed above, the frequency appears to have decreased. Over the past 25 years Mystic Lake has overflowed about once every 12 years as a result of two consecutive wet years (Pat Boldt, WRCAC, personal communication, April 2, 2012). It is also important to note that the San Jacinto River is often dry above and below Mystic Lake.

Downstream of Mystic Lake, the San Jacinto River forms a wide fluvial plain. When Mystic Lake does not overflow, downstream river reaches are often dry. The San Jacinto River flows through the narrow Railroad Canyon before draining into Canyon Lake. More than 90 percent of the San Jacinto River watershed (subwatershed zones 2–6) drains to Canyon Lake, which fills quickly during the wet season with the water level declining slowly over time during the normal to dry periods when little or no flow enters Canyon Lake. Salt Creek, in subwatershed zone 4, has the majority of its headwaters in the foothills and valleys south of the city of Hemet, including Cactus Valley, St. John's Canyon, and Goodhart Canyon. A significant amount of Salt Creek's headwaters and main stem flow through agricultural lands. It is one of the main tributaries to Canyon Lake. The Perris Valley Storm Drain in subwatershed zone 5 also feeds Canyon Lake. The Perris Reservoir, also located in subwatershed zone 5, does not have any effect on the watershed's hydrology. (North of Canyon Lake, there is a 2-mile reach of the San Jacinto River with perennial flow. It is thought that this flow is related to local urban stormwater runoff and rising groundwater (M. Adelson, 2012, personal communication).)

Lake Elsinore, located in subwatershed zone 1, is approximately 3 miles downstream of Canyon Lake at the bottom of the San Jacinto River watershed. Surface flow from the San Jacinto River watershed reaches Lake Elsinore primarily through release, overflow, or seepage from the Canyon Lake dam, though the river is also partially fed by perennial flow from Cottonwood Creek, which joins the river below Canyon Lake. Lake Elsinore acts much like a sink, with almost nonexistent outflow. In rare situations, including torrential rains and extended rain periods, Lake Elsinore overflows into Temescal Creek, which ultimately drains to the Santa Ana River (Tetra Tech and WRIME, Inc. 2007). As discussed in Technical Memo #1, evaporation can cause the lake levels in Lake Elsinore to drop, triggering the need for the Elsinore Valley Municipal Water District (EVMWD) to supplement the lake levels using high quality recycled water that meets National Pollutant Discharge Elimination System (NPDES) permit requirements (a source that is not within the scope of this feasibility assessment).

Estimated Pollutant Loads by Subwatershed Zone

The hydrology of the San Jacinto River watershed affects how nutrients from nonpoint and point sources move through the various subwatershed zones from Mystic Lake to Canyon Lake and, eventually, to Lake Elsinore. The watershed modeling conducted to support the Lake Elsinore and Canyon Lake Nutrient Total Maximum Daily Loads (TMDL) effort provides estimates of relative pollutant loads from each of the subwatershed zones under three different scenarios. A review of the 2010 land use/land cover data (AIS 2012) compared to the 2008 land use/land cover data used in the 2010 Watershed Model Update indicates that there is not a significant change in agricultural land use/land cover. For purposes of discussing relative subwatershed zone pollutant loads, the analysis contained in the 2010 Watershed Model Update is considered relevant for this water quality trading feasibility assessment[1]. Tables 1 and 2 provide a summary of total nitrogen and total phosphorus loads for each subwatershed zone for the three scenarios used in the TMDL modeling analysis. These scenarios represented conditions when (1) Mystic Lake and Canyon Lake overflowed, (2) Canyon Lake overflowed but Mystic Lake did not, and (3) neither Mystic Lake nor Canyon Lake overflowed.

Key assumptions from the 2010 Watershed Model Update that are necessary to understand the pollutant loads presented in Tables 1 and 2 are as follows:

- The load for zone 7 is summarized as the load exported from Mystic Lake. As a result, if the load stated for zone 7 is zero, then Mystic Lake did not overflow and no nutrient load could be transported to the bottom portion of the watershed.
- The load for zone 2 is summarized as the load to Canyon Lake, instead of *from* the lake (as with Mystic Lake and zone 7) due to the complexities of Canyon Lake. Zone 2 includes the total load from zones 3 through 9 (subject to losses through delivery), combined with local loads from the area within the zone 2 boundary, and summarized as input into Canyon Lake.
- The load for zone 1 represents the nutrient loads contributed by local land areas within zone 1. Exported loads are not shown for zone 1 because nutrient processes within Lake Elsinore and Canyon Lake would need to be considered in estimating the loads exported from this zone.

Tables 1 and 2 illustrate how little of the nutrient load entering Mystic Lake from zones 7, 8 and 9 leaves Mystic Lake (zone 7) during the overflow scenario, showing that pollutant loads above Mystic Lake do not have much effect on the downstream water quality of Canyon Lake and Lake Elsinore. In Table 1, zone 7 for Scenario 1 contributes an estimated 13 pounds of total nitrogen. In Table 2, zone 7 for Scenario 1 contributes 6 pounds of total phosphorus. The assumptions used in the TMDL modeling do not allow for estimates of the pollutant loads contributed by Canyon Lake to Lake Elsinore in an overflow scenario. The pollutant loadings estimated through the TMDL modeling do illustrate a hydrology-driven grouping in subwatershed zones that could influence the geographic scope of trading in the San Jacinto River watershed.

[1] If the watershed model is updated in the future, the most recent land use/land cover data should be re-evaluated against the subsequent model update.

Table 1. Total Nitrogen Loads (lbs) for Three TMDL Scenarios by Subwatershed Zones (Tetra Tech 2010)

Scenario	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9
1: ML and CL Overflowed	36,769	206,755	25,152	13,717	82,692	27,692	13	143,626	69,612
2: CL overflowed, ML no overflow	5,788	36,255	8,675	4,491	20,402	1,045	0	14,458	5,575
3: No overflow from ML or CL	3,797	29,304	6,825	3,902	15,516	961	0	6,913	2,385

Table 2. Total Phosphorus Loads (lbs) for Three TMDL Scenarios by Subwatershed Zones (Tetra Tech 2010)

Scenario	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9
1: ML and CL Overflowed	11,559	78,723	5,720	2,975	27,369	15,212	6	58,045	27,292
2: CL overflowed, ML no overflow	874	6,416	1,436	747	3,281	336	0	5,130	2,044
3: No overflow from ML or CL	522	5,061	1,015	573	2,322	285	0	1,991	745

Avoiding Hot Spots

The issue of potential hot spots, or localized water quality standard exceedances, is critical to consider during water quality trading program design. During the feasibility assessment phase, considering potential hot spots can influence geographic boundaries of the trading program.

For the San Jacinto River watershed, the natural hydrology plays an important role in avoiding hot spots through the function of Mystic Lake to retain contributions of pollutants from zones 7, 8, and 9. As a result, the potential for hot spots need to be considered in zones 1–6. Use of trade ratios to account for pollutant fate and transport serve as a critical mechanism in avoiding localized exceedances of water quality. The subsequent technical memo will focus on trade ratios and address how ratios can help to avoid hot spots in subwatershed zones 1–6 with a focus on protecting water quality in Canyon Lake and Lake Elsinore.

Options for Geographic Scope of Water Quality Trading in the San Jacinto River Watershed

A number of factors influence the appropriate geographic scope for a water quality trading program. The primary factor to consider is avoidance of hot spots, as previously discussed. But beyond water quality considerations, the geographic scope of the trading program can also influence economic feasibility. While it might be possible to trade pollutants within a watershed and avoid hotspots, the geography of a watershed could make trading cost-prohibitive. This is likely to be the case in watersheds where trade ratios will be needed to equalize pollutant fate and transport among different areas of the watershed. For example, a pound of phosphorus reduction in zone 9 above Mystic Lake will not produce the same positive water quality effect for Canyon Lake as a pound of phosphorus reduction in zone 3, therefore a trade ratio is necessary to make these reductions equivalent in the watershed. Trade ratios can increase the cost of credits for trading and can have a negative effect on the economic feasibility of trading between partners. Trade ratios are the topic of the next technical memo, but it is important to consider how this element of water quality trading could affect options for geographic scope.

Based on the current understanding of the San Jacinto River watershed's hydrology and the estimated pollutant load contributions to the Canyon Lake and Lake Elsinore from each subwatershed zone, there are three geographic options to consider for water quality trading.

1) **Watershed-wide trading.** This option would allow trading among all agricultural operators throughout the boundary of the San Jacinto River watershed.

    - ✓ *Pros:* Would allow any agricultural operator eligible for trading in the San Jacinto River watershed to trade with any other eligible agricultural operator regardless of location. Allows regulatory drivers and economics to guide potential trading partners' decisions to trade.

    - ✓ *Cons:* Would rely heavily on trade ratios to equalize trading credits for nitrogen and phosphorus, particularly for agricultural operators above Mystic Lake that have little effect on the downstream water quality of Canyon Lake or Lake Elsinore.

2) **Three trading zones.** This option would divide the San Jacinto River watershed into three trading zones: above Mystic Lake, between Mystic Lake and Canyon Lake, and below Canyon Lake to Lake Elsinore. Trading could only take place among eligible agricultural operators located within a specified trading zone.

    - ✓ *Pros:* Trading zones would take hydrologic and water quality influences into account and would limit the type of trade ratios necessary to apply to a trade. Would improve economic and pollutant suitability of trades without the need for complex and time-consuming calculations to derive multiple trade ratios.

    - ✓ *Cons:* Could prevent trading among agricultural operators that might be willing to pay for nutrient credits generated by agricultural operators outside of a particular trading zone due to ancillary benefits, not just water quality benefits for Canyon Lake and Lake Elsinore.

3) **Two trading zones.** This option is similar to Option #2, but would focus on above Mystic Lake and below Mystic Lake as the two trading zones.

    - ✓ *Pros*: Allows for more potential trading opportunities among agricultural operators below Mystic Lake than restricting trading to three smaller zones.

    - ✓ *Cons*: Would potentially require more complex modeling to better understand how Canyon Lake overflows and associated nutrient loads influence Lake

Elsinore's water quality to determine an appropriate trade ratio for agricultural sources located zones 2–6 interested in trading with sources located in zone 1 (note: there are no agricultural operators located in zone 1).

The hydrology of the San Jacinto River watershed, and the focus on reducing nutrient loads to Canyon Lake and Lake Elsinore, would seem to make Options 2 and 3 the more viable options for water quality trading in the San Jacinto River watershed. Additional work on trading elements such as supply and demand and trade ratios, the topics of subsequent technical memos under the water quality trading feasibility assessment, will help to further clarify the most appropriate option for the geographic scope of a future water quality trading program.

The next step in the water quality trading feasibility assessment is to develop an initial understanding of the potential agricultural operators that might participate as water quality trading partners in the San Jacinto River watershed.

Task 1.3 Description: Identify Potential Participants in Sustainable Trading Program

The goal of this task is to compile an inventory of potential nonpoint and point source buyers and sellers in the San Jacinto River watershed based on current and future regulatory drivers that will influence sources' interest in purchasing or selling pollutant reduction credits. The first step is to take a closer look at regulatory drivers related to nutrient load reductions in the San Jacinto River watershed and how these drivers will serve as a possible incentive for participating in water quality trading. This information will help to generate a preliminary inventory of potential buyers and sellers, providing the foundation for determining credit supply and demand in the San Jacinto River watershed.

Regulatory Drivers and Trading Incentives for Potential Water Quality Trading Buyers and Sellers

As discussed in Technical Memo #1, the nutrient TMDLs for Lake Elsinore and Canyon Lake establish load allocations (LAs) for agricultural and urban nonpoint sources and wasteload allocations (WLAs) for point sources, including concentrated animal feeding operations (CAFOs). Although CAFOs are, in a regulatory context, point sources with WLAs. These allocations represent the annual nitrogen and phosphorus load that can be contributed by each group of sources without contributing to water quality impairments in the lakes. Tables 3 and 4 show the LAs and WLAs for Canyon Lake and Lake Elsinore from the TMDL (SARWQCB 2011).

Table 3. Canyon Lake Nitrogen and Phosphorus Wasteload and Load Allocations (SARWQCB 2011)

Canyon Lake Nutrient TMDL	Final Load Allocation (kg/yr)[a]	
	TP	TN
Total TMDL	**8,691**	**37,735**
Total WLA	***487***	***6,248***
Supplemental water	48	366
Urban	306	3,974
CAFO	132	1,908
Total LA	***8,204***	***31,487***
Internal sediment	4,625	13,549
Atmospheric deposition	221	1,918
Agriculture	1,183	7,583
Open/forest	2,037	3,587
Septic systems	139	4,850

a. TMDL and allocations specified as a 10-year running average

Table 4. Lake Elsinore Nitrogen and Phosphorus Wasteload and Load Allocations (SARWQCB 2011)

Lake Elsinore Nutrient TMDL	Final Load Allocation (kg/yr)[a]	
	TP	TN
Total TMDL	**28,584**	**239,025**
Total WLA	3,845	7,791
Supplemental water	3,721	7,442
Urban	124	349
CAFO	0	0
Total LA	***21,969***	***210,461***
Internal sediment	21,554	197,370
Atmospheric deposition	108	11,702
Agriculture	60	213
Open/forest	178	567
Septic systems	69	608
Canyon Lake Watershed[b]	2,770	20,774

a. TMDL and allocations specified as a 10-year running average
b. Allocation for Canyon Lake overflows

The TMDL LAs and WLAs shown in red in Tables 3 and 4 are the primary focus of the water quality trading feasibility assessment. A TMDL provides the driver for trading in many water quality trading programs through the regulatory mechanisms used to implement the TMDL, most often a permit. The WLAs assigned to point sources establish the basis for water quality-based effluent limits in waste discharge permits (usually under the NPDES program) and often create incentive for those sources to purchase credits to meet the more stringent limits. Since nonpoint sources generally are not subject to waste discharge permit requirements, TMDL LAs for these sources usually establish a baseline level of water quality used to measure generation of credits (i.e., for water quality improvements that go beyond the baseline requirement). For purposes of this water quality trading feasibility analysis, agricultural sources are the primary focus and have the potential to be both credit buyers and credit sellers through a trading program.

The nutrient TMDL for Lake Elsinore and Canyon Lake was incorporated into the Water Quality Control Plan for the Santa Ana River Basin on December 20, 2004 (SARWQCB 2011). The nutrient TMDL included a detailed TMDL Implementation Plan that identifies actions intended to achieve the assigned WLAs and LAs. The actions identified under the TMDL Implementation Plan as part of the enforceable Water Quality Control Plan for the Santa Ana River Basin also provide potential drivers for water quality trading.

A discussion of each of the regulatory drivers or voluntary incentives related to each agricultural source with a WLA or LA is provided below. The information on trading drivers will help to not only identify the potential universe of trading partners, but also to help determine which sources are likely buyers or sellers.

- **CAFOs.**[2] CAFOs may be compelled to meet WLAs through numeric effluent limits established in NPDES permits. An existing NPDES permit applies to dairies and related facilities (heifer ranches and calf nurseries) of all sizes (i.e., not limited to facilities that meet the size thresholds in the federal CAFO definition) in the San Jacinto River watershed (Order No. R8-2007-0001) (SARWQCB 2007). The permit establishes technology-based effluent limits, which typically constitute the baseline for trading for sellers, or the minimum control level that a discharger must attain in order to participate in trading as a buyer. Dairies and related facilities in the San Jacinto River Basin are allowed to discharge from the production area only as the result of a precipitation event and only if the production area is designed, constructed, operated, and maintained to contain all manure, litter, and process wastewater including the runoff and direct precipitation from a 25-year, 24-hour rainfall event. For land application areas, the permit includes a special provision that requires dischargers to develop and implement a site specific nutrient management plan that is subject to the review and approval of the Executive Officer. Together, these requirements constitute the trading baseline (sellers) and minimum control level (buyers) for dairies covered under Order No. R8-2007-0001.

[2] Note: Order No. R8-2007-0001 has been revised since this memo was initially developed. The revisions reflected in the revised Order No. R8-2013-0001 do not change how the permit affects CAFOs' potential participation in trading. Refer to Technical Memo #3 on supply and demand for a description of the revised permit and how its conditions affect potential nutrient credit supply for a WQT program.

For dairies and related facilities in the San Jacinto River watershed that are permitted under Order No. R8-2007-0001, the water quality-based effluent limitations are based on the TMDL. The permit includes a compliance schedule for dairies in the Lake Elsinore and Canyon Lake watershed to develop and implement a number of monitoring and nutrient reduction plans to meet TMDL requirements. Specifically, dairies are required to develop and implement a plan to offset the impacts of the discharge of process wastewater and land application of manure within the basin. Under a traditional trading program, a dairy could meet this requirement by purchasing offset credits. In addition, a dairy could also generate credits, at least theoretically, if it could implement practices that exceed its individual offset requirement. Numeric effluent limits for dairies or other types of CAFOs in the watershed have not been established in NPDES permits. Therefore, for dairies to participate as credit buyers from agricultural operators or credit sellers to agricultural operators, it would be necessary to calculate facility-specific numeric trading baselines and TMDL targets to support quantification of the credit supply or demand.

Other permit requirements also may provide incentives for dairies to participate in trading. For example, Order No. R8-2007-0001 includes a compliance schedule for dairies in the San Jacinto River watershed to develop and implement a Work Plan to offset the impacts of process wastewater discharge and land application of manure or cease process wastewater discharges and land application of manure by September 6, 2012. This is a ground water protection requirement based on the permit's Land Discharge Specifications, which prohibit "[t]he discharge of waste containing TDS and/or nitrogen concentrations in excess of the underlying groundwater management zone objectives for those constituents…, unless adequately offset to the satisfaction of the Executive Officer." If approved by the Regional Board, this offset requirement could create an additional demand for dairies to purchase nitrogen reduction credits from agricultural operators provided the BMPs used to generate the credits can demonstrate no nitrate loading to ground water.

- **Agriculture.** As discussed above, TMDLs also typically do not establish regulatory drivers for non-point sources (e.g., agricultural operators) to meet established LAs. However, the Western Riverside County Agriculture Coalition's (WRCAC) goal is to work with dairy CAFOs and agricultural operators in the watershed to meet the TMDL targets (WLAs and LAs). All dairies and nearly all private agricultural landowners in the watershed have joined WRCAC to voluntarily comply with the TMDL. Thus, even absent numeric limits for dairies and a regulatory driver for agricultural operators, the TMDL still provides a *de facto* driver for trading.

  The Conditional Waiver [of WDRs] for Agricultural Discharges (CWAD) will apply to agricultural lands in the San Jacinto River watershed and is currently being developed by the Santa Ana Regional Water Quality Control Board. Although the exact requirements of the CWAD are not yet known, it is anticipated that it will require agricultural land owners to implement structural and non-structural BMPs that are either specified for certain land uses or presented as a menu of BMP options (or a combination of the two). Once adopted, the CWAD will provide a regulatory driver for agricultural sources to implement nutrient reduction practices. An individual agricultural operator may wish to purchase or sell credits depending on his or her ability or willingness to implement site-specific BMPs to meet the requirements.

WRCAC's Agricultural Nutrient Management Plan (AgNMP) for the San Jacinto Watershed (currently in draft[3]) is one of the plans required under Order No. R8-2007-0001. The draft AgNMP establishes current status and 2015 and 2020 projections for meeting the TMDL allocations (WRCAC 2011). These projections will be explored in more detail in the upcoming memorandum on supply and demand, but it is important to this discussion to understand that the draft AgNMP views load reductions resulting from CWAD implementation as a component of achieving the TMDL targets. Thus, even though the CWAD itself will not establish numeric load reduction targets, the CWAD will reinforce the TMDL LAs and provide a regulatory mechanism that compels agricultural operators to achieve them. The TMDL LAs, therefore, would establish the baselines and water quality goals needed to quantify agricultural operators' credit supply and demand with the CWAD serving as the regulatory driver for trading.

Other nonpoint sources identified in the TMDL and assigned LAs (e.g., in-stream sediment, atmospheric deposition, open/forestry) are not likely participants in a water quality trading program, unless the concept of offsetting is introduced into the water quality trading program design.

Potential Water Quality Trading Credit Buyers and Sellers and Other Potential Partners

Using the trading driver information discussed above, the next step is to create a general inventory of potential credit buyers and sellers. At this point in the assessment, the inventory is general and the assumptions about buyers versus sellers are broad. In subsequent steps of the assessment, the goal will be to look at potential credit supply and demand. This will provide a clearer picture of how the drivers can affect trading decisions among potential partners.

Because the primary focus of the water quality feasibility assessment is to determine the feasibility of agricultural-to-agricultural source trading, the assessment will only focus on agricultural sources (both nonpoint and point sources) contributing to the nutrient loads of Canyon Lake and Lake Elsinore, as identified in the TMDL. The presence and participation of other regulated point sources could impact trading feasibility for agricultural operators, but are not the focus of the analysis at this point in time.

An overview of agricultural sources (both nonpoint sources and point sources) in the San Jacinto River watershed is provided below.

[3] The AgNMP was finalized after this memo was originally drafted. Revisions between the draft and final AgNMP do not affect the concepts presented in this memo. Subsequent technical memos are based on the final version of the AgNMP.

- **Agricultural sources.** Table 5 presents the 2010 land use acres and estimated nutrient loads for each of the agricultural nonpoint sources to illustrate generally which land uses may be more likely to participate in trading as buyers or sellers. Please note that the estimated nutrient loads in Table 5 are only provided to give an idea of the relative nutrient contribution from each land use; more accurate estimates of nutrient loads based on the 2010 land use data could not be developed without additional modeling analysis, which is beyond the scope of this project. Table 5 also shows the percent change in agricultural land uses between 2005 and 2010 to provide a general idea of how the nutrient loads from these land uses might be changing over time. Figure 2 shows the type and location of agricultural land uses within each subwatershed zone throughout the San Jacinto River watershed based on 2010 land use data. Table 6 provides a break-down of agricultural land use acreage by subwatershed zone represented in Figure 2. Note that Tables 5 and 6 represent all agricultural acreage in the watershed. Although WRCAC's TMDL compliance efforts focus on agricultural parcels greater than 20 acres and generally do not include parcels owned by federal, tribal, or state government, or animal operations other than dairies (i.e., poultry), this memo includes these other stakeholders because they might have incentive to participate in trading with WRCAC in the future.

Table 5. Relative Acreages and Nutrient Loads for Agricultural Land Uses

Land Use Code	Land Use Description	2010 Area (acres)[a]	Estimated Nutrient Loads (lbs/yr)[b]		2005 to 2010 Change (%)
			TN	TP	
2110	Irrigated Agriculture	18,938	14,281	9,073	-24%
2120	Non-Irrigated Agriculture	14,537	10,543	6,761	-35%
2121	Vacant - Zoned Agriculture	12,132	994	373	6%
2200	Orchards/Vineyards, Undifferentiated	232	128	97	-18%
2210	Citrus	3,255	2,774	2,102	-1%
2300	Nurseries, Undifferentiated	884	422	322	5%
2310	Turf Farms	1,142	139	75	9%
2320	Christmas Tree Farm	19	5	4	39%
2411	Dairies - Intensive	983	3,902	886	-16%
2412	Dairies - Non-Intensive	1,250	4,494	1,011	3%
2413	Abandoned Dairies	57	88	19	-38%
2420	Other Livestock	152	523	117	-32%
2500	Poultry	268	858	198	-25%
2600	Other Agriculture, Undifferentiated	414	338	214	-15%
2610	Compost/Manure Piles	184	833	191	248%
2620	Backyard Livestock	1,542	8,133	1,988	7%
2700	Horses	2,744	12,777	2,870	-2%
1851	San Jacinto Wildlife Area - Davis Unit[c]	10,081	857	321	0%
1852	San Jacinto Wildlife Area - Potrero Unit[c]	9,123	881	330	0%
	Totals	77,934	62,969	26,951	-15%

a. Reflects all agricultural acreage, including parcels <20 acres and those under federal, state, or tribal ownership.
b. Estimated by calculating a per-acre load from the 2010 model update agricultural land use loading estimates (based on 2007 land use data) and applying the per-acre loads to the 2010 land use acreages.
c. Portions of the San Jacinto Wildlife Area are leased for agricultural use.

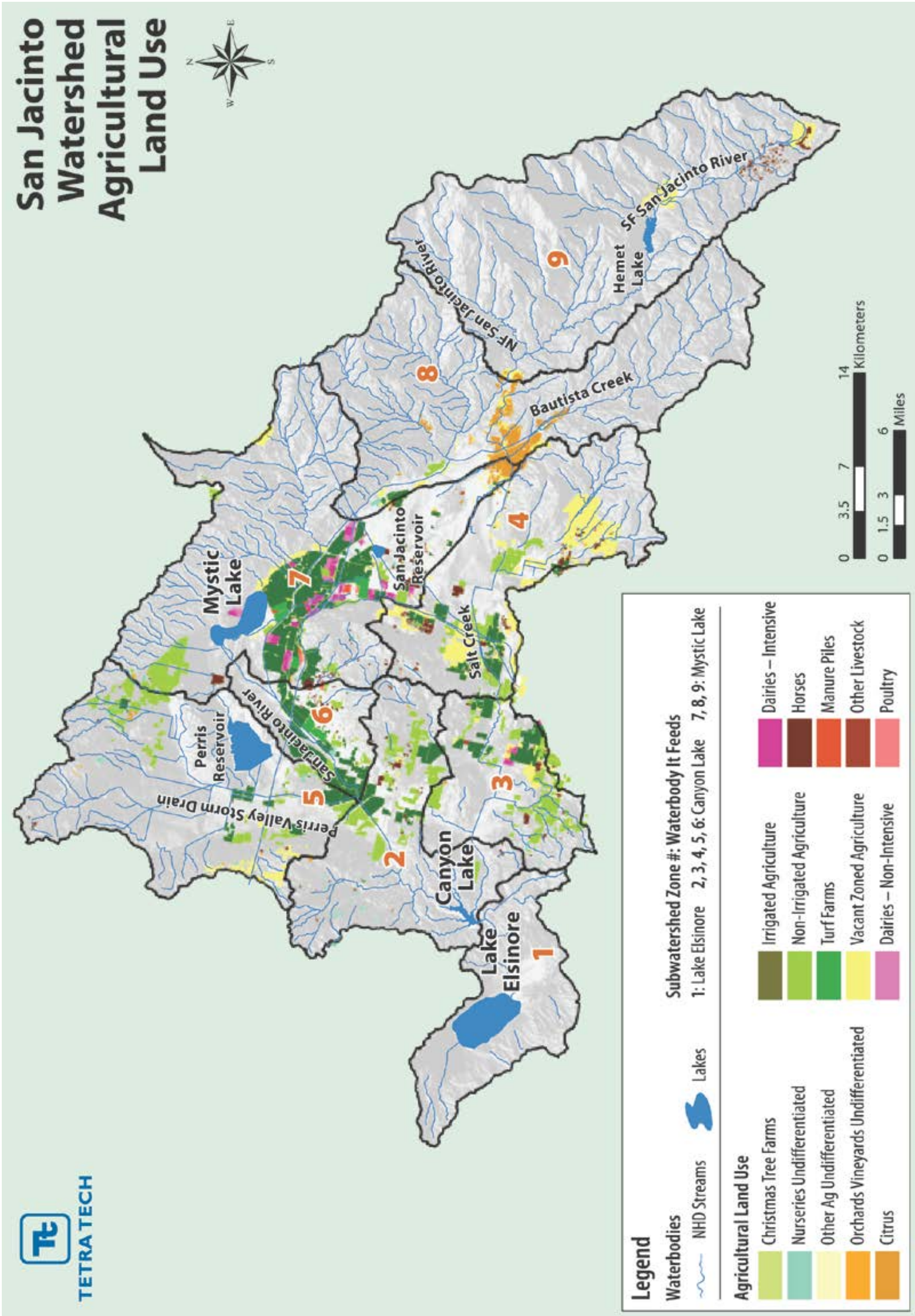

Figure 2. Agricultural land uses by subwatershed zone in the San Jacinto River watershed[4]

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[4] Note: Figure 1 does not reflect September 2013 revisions to the boundaries of subwatersheds 4, 6, and 7 in the area south of Mystic Lake. See Tech Memo #3.

Table 6. Agricultural Land Use Acreage by Subwatershed Zone (AIS 2012)

	Subwatershed Zone Area (acres)									
Agricultural Land Use	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
San Jacinto Wildlife Area - Davis Unit					670	2,585	6,826			10,081
San Jacinto Wildlife Area - Potrero Unit							9,000	122		9,123
Irrigated Agriculture		1,545	1,968	1,895	1,485	3,534	8,295	217		18,938
Non-Irrigated Agriculture		2,993	2,918	2,202	2,799	625	2,814	187		14,537
Vacant - Zoned Agriculture		111	703	6,340	1,034	38	1,450	735	1,720	12,132
Orchards/Vineyards, Undifferentiated		39	11	27	46	8	61	40		232
Citrus		4	20	119	63		593	2,374	82	3,255
Nurseries, Undifferentiated		216	116	59	204	88	108	92		884
Turf Farms						390	752			1,142
Christmas Tree Farm			6	3	2	8				19
Dairies - Intensive			57				926			983
Dairies - Non-Intensive			73	15			1,162			1,250
Abandoned Dairies			29				29			57
Other Livestock		8	30	24	9	1	66		13	152
Poultry		1	40	38		40	148			268
Other Agriculture, Undifferentiated		10	19	56	17	70	223	19		414
Compost/Manure Piles		1					182			184
Backyard Livestock		510	179	254	190	225	154	22	10	1,542
Horses		308	221	793	85	189	675		473	2,744
Total	**0**	**5,746**	**6,389**	**11,824**	**6,605**	**7,799**	**33,464**	**3,808**	**2,298**	**77,934**

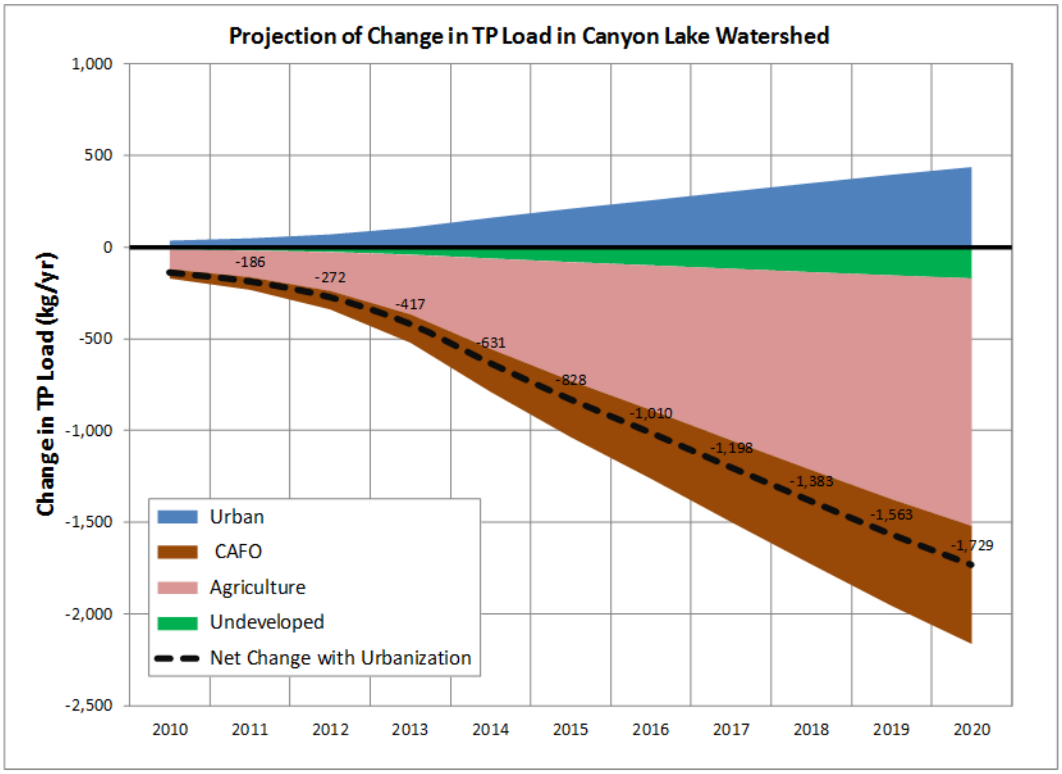
Table 7 shows the number of individual agricultural operators in each subwatershed zone. This is the total universe of agricultural operators potentially available to participate in trading as credit buyers or sellers.

Table 7. Number of WRCAC Agricultural Operators Potentially Available to Participate in Trading, by Subwatershed Zone (2010) (AIS 2012)

Subwatershed Zone	Total Number of Agricultural Operators[a]	# of Agricultural Operators with > 20 Acres[b]			
		Including Vacant Zoned Ag[c] and Dairies[d]	Including Vacant Zoned Ag, Excluding Dairies[d]	Excluding Vacant Zoned Ag[c] and Dairies[d]	
				Private	Agency[e]
1	1	0	0	0	0
2	1,040	37	37	36	1
3	490	64	62	53	1
4	680	102	102	47	1
5	777	62	62	50	1
6	528	36	36	34	1
7	574	118	105	89	1
8	100	35	35	22	2
9	154	14	14	4	0
Total	4,344	468	453	343	8

a. The total number of individuals owning parcels of any size under any of the agricultural land use codes
b. Operators with parcels < 20 acres are exempted from TMDL compliance under WRCAC's voluntary compliance program and thus are unlikely to participate as credit buyers, though they may participate in trading as credit sellers.
c. Participation by operators with land in the category Vacant Zoned Ag is difficult to predict; these are areas that may be more likely to be developed under normal conditions but that may be returned to agricultural production during an economic downturn when there is less development pressure.
d. The agricultural land use data include some dairy cropland; although these areas are considered part of the CAFO point source from a regulatory standpoint.
e. The number that are federal, state, or tribal land owners. These are listed separately as the trading drivers may apply differently to agency landowners, either increasing or decreasing the likelihood that they may participate (this will be explored further in the upcoming memo on credit supply and demand). Although small in number, in some subwatershed zones these may account for a substantial portion of the agriculture acreage.

The agricultural acreage estimates are projected to decrease over time as the amount of urban land uses increase. As stated in the AgNMP, the rate of attrition for agriculture and CAFO land uses corresponds to projected land use change included in the urban CNRP. The CNRP used ultimate build out for the general plan land use projections for each city and the County of Riverside and a Caltrans growth rate forecast to develop the land use projections for years between 2010 and build out, assumed to occur in 2035. Figure 3 illustrates the corresponding changes in TN and TP loads associated with land use conversions over time (WRCAC 2013).



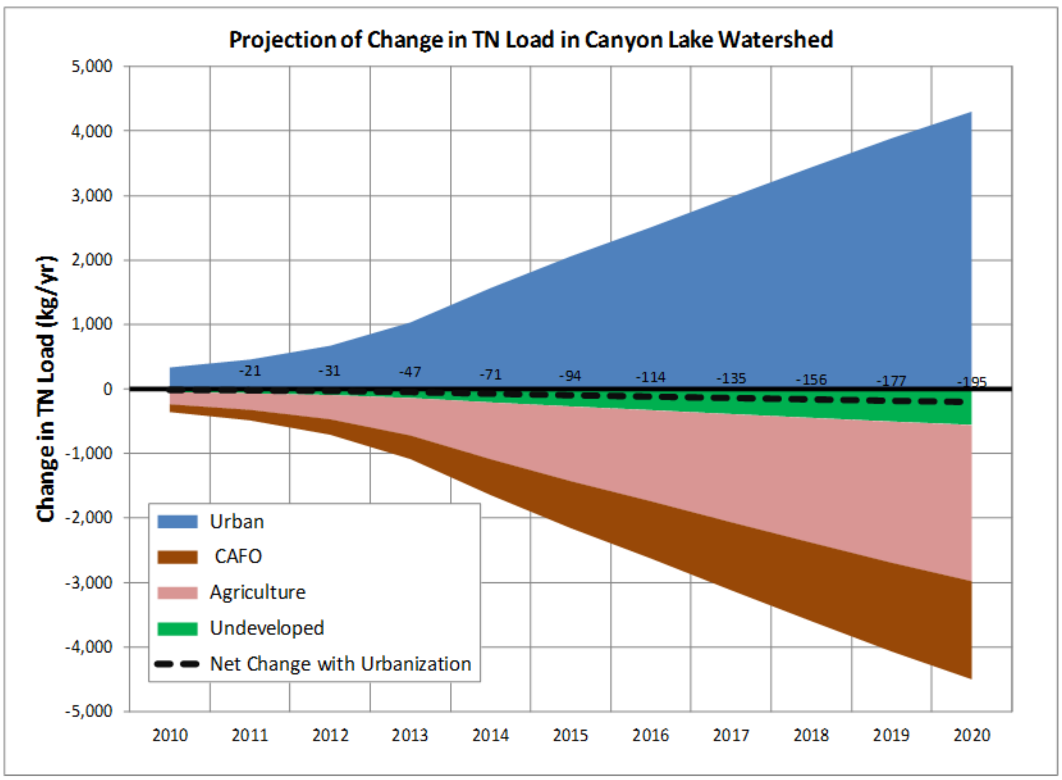


Figure 3. Changes in TN and TP loads associated with land use conversions over time

As discussed under the drivers section above, point source discharges are discharges that require NPDES permit coverage. For purposes of this water quality trading feasibility assessment, CAFOs are the only NPDES permitted agricultural source with a WLA.

As of January 2011, 23 dairies were operating under the waste discharge permit (Order No. R8-2007-0001) in the San Jacinto River watershed[5]. Annual report data from 2010, available for 22 of those dairies, indicated that those dairies had a combined total of 29,314 mature dairy cows and 15,609 heifers and calves. It is estimated that these animals generate a combined total of approximately 128,000 tons of solid manure (as excreted) and more than 1.4 million gallons of wastewater per year (Tetra Tech 2011). Using assumptions consistent with the draft AgNMP[6] (WRCAC 2011), the nutrient content of the solid manure generated at dairies is estimated at 768 tons of nitrogen and 128 tons of phosphorus (as excreted). Using the average nutrient content of wastewater at San Jacinto dairies sampled in 2009[7] (Tetra Tech 2009), the nutrient content of the wastewater generated at the 23 dairies operating as of January 2011 is 2.4 tons of nitrogen and 0.3 tons of phosphorus per year. This includes the nutrient content of the source water used. (It is important to note that the number of dairies and animals at dairies changes over time and such changes directly affect the amount of nutrients generated in wastewater from dairies.) Most of the dairies, however, are located in subwatershed zone 7 and therefore contribute nutrient loads under most scenarios only to Mystic Lake. According to the AgNMP, three dairies are located downstream of Mystic Lake (in subwatershed zone 3), all of which have implemented an Engineered Waste Management Plan (EWMP) to comply with the CAFO Permit. The 2010 Watershed Model Update estimated nutrient losses from dairies at 3,792 lbs TN/year and 859 lbs TP/year. However, the AgNMP states:

> *The Permit requires retention of the 25-year storm event on-site and therefore no loading of nutrients from these areas will occur, except during extreme storm events, when loads are likely to pass through both Canyon Lake and Lake Elsinore. The CAFO Permit includes ongoing inspection of these properties to ensure compliance with the Permit and hence the TMDL. Thus, there is no additional watershed load reduction required from CAFO sources in the Canyon Lake watershed (WRCAC 2013).*

Therefore, dairies could participate in trading as credit sellers to meet TMDL WLAs for CAFOs or even as credit sellers if programs, practices, or technologies are identified that will help dairies in eligible areas reduce nutrient loads beyond what is required under the TMDL. As discussed above, all of the nutrients discharged from dairies under Order No. R8-2007-0001.

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[5] Note: Order No. R8-2007-0001 has been revised since this memo was initially developed. The revisions reflected in the revised Order No. R8-2013-0001 do not change how the permit affects CAFOs' potential participation in trading. Refer to Technical Memo #3 on supply and demand for a description of the revised permit and how its conditions affect potential nutrient credit supply for a WQT program.

[6] Assumed nutrient concentrations in wet manure of 1,000 mg TP/kg (2 lb/ton) and 6,000 mg TN/kg (12 lb/ton). Note that the results of dairy corral manure sampling conducted at 10 San Jacinto dairies in 2009 yielded mean concentrations of 5,367 mg TP/kg (11 lb/ton) and 25,059 mg TN/kg (50 lb/ton).

[7] Mean nutrient concentration in dairy wastewater of 51 mg TP/L (4.26×10^{-4} lb/gallon) and 399 mg TN/L (3.33×10^{-3} lb/gallon). Samples were collected from 10 dairies and represent wastewater as discharged from the milk barn.

The proportion that is covered by the technology-based requirement and that which is subject to water quality-based requirements would need to be quantified as part of program development to determine an individual dairy's credit supply (seller) or demand (buyer).

As indicated above, currently all dairies in the San Jacinto River watershed are covered under the waste discharge permit, regardless of their size or status as a discharging CAFO. Future iterations of Order No. R8-2007-0001, which expires in 2012, could include revisions that reflect the results of recent litigation on federal CAFO rules (refer to footnote 5 on page A-28). The courts in two cases (*Waterkeeper Alliance et al. v. EPA* and *National Pork Producers Council v. EPA*) have ruled that facilities cannot be required to apply for permits based on the potential to discharge or because the facility proposes to discharge. California statutes permit state agencies to issue permits that are more stringent or broader in scope than federal regulations but some states have not required all CAFOs to obtain permit coverage pursuant to these court decisions. A change in the San Jacinto dairies' status as permitted CAFOs could impact whether and how those facilities participate in water quality trading.

In addition to dairies a number of horse and poultry operations exist in the watershed, some of which may be CAFOs. Because these operations are currently not covered under CAFO permits, and therefore there is no mechanism for establishing effluent limits based on TMDL WLAs, these operations are treated as nonpoint sources for this assessment. Regional Board staff anticipates that these and other non-dairy livestock operations would be subject to the CWAD. Requirements under the CWAD, or future development of NPDES permits for these facilities, could impact their status and participation as credit buyers or sellers under a trading program.

Based on the information about water quality trading drivers and the inventory of potential participants, Table 8 provides a preliminary assessment of sources and their associated drivers that might make them better suited as potential buyers or sellers in a water quality trading program. The subsequent technical memo under the water quality trading feasibility assessment will use Table 8 as a foundation for estimating potential credit supply and demand in the San Jacinto River watershed.

Table 8. Preliminary Assessment of Potential Credit Buyers and Sellers Based on Applicable Regulatory Driver for the San Jacinto River Watershed

Type of Source	Applicable Zones	Regulatory Driver	Pollutant-specific Potential Buyer/Seller Status	
			TN[a]	TP
Agricultural Nonpoint Sources				
Non-state/federal/tribal (WRCAC) Agricultural Operators with irrigated or livestock (other than dairy) agricultural land uses over 20 aggregated acres	2-9	CWAD requirements	Seller	Buyer/Seller
Non-state/federal/tribal (WRCAC) Agricultural Operators with irrigated or livestock (other than dairy) agricultural land uses under 20 aggregated acres or non-irrigated land use	2-9	No regulatory requirements[b]	Seller	Seller
Federal/state Agricultural Operators with irrigated or livestock agricultural land uses over 20 aggregated acres	4, 7-9	CWAD requirements	Seller	Buyer/Seller
Federal/state Agricultural Operators with irrigated or livestock agricultural land uses less than 20 aggregated acres	4, 7-9	No regulatory requirements[b]	Seller	Seller
Tribal Agricultural Operators	8	No regulatory driver	Seller	Seller
Agricultural Point Sources				
WRCAC Dairies	3, 7	Order No. R8-2013-0001 (dairy permit)	Buyer/Seller	Buyer/Seller

a. 2010 model update shows existing TN load is lower than TMDL LA (WRCAC 2013).
b. Irrigated or livestock (other than dairy) agricultural land uses under 20 aggregated acres may be subject to the CWAD if found to cause or contribute to water quality problems.

Summary Recommendations on Geographic Scope and Inventory of Potential Trading Partners in the San Jacinto River Watershed

There are three potential options for the geographic boundaries of trading based on the hydrologic features of the San Jacinto River watershed. These options are 1) watershed-wide; 2) three trading zones based on subwatershed zones above Mystic Lake, between Mystic Lake and Canyon Lake, and below Canyon Lake; and 3) two trading zones based on above and below Mystic Lake. The use of trade ratios would make the first option possible, but would likely render trading above Mystic Lake infeasible based on both economic and water quality considerations. Given the hydrology of the watershed, trading is most likely to occur below Mystic Lake, making Options 2 and 3 the potential best options for trading. The geographic scope should not exclude sources above Mystic Lake from participating; there could be other incentives outside of TMDL implementation that could drive these upstream sources to participate in trading. However, the geographic scope of the trading program should promote trading in areas where it is most likely to be feasible and sustainable.

From the analysis of agricultural sources and associated drivers, it appears that there will be more interest in total phosphorus trading in the watershed, due to the existing surplus reductions of total nitrogen beyond TMDL LA for agricultural nonpoint and point sources (WRCAC 2013). The next step in the feasibility assessment is to take the information about potential buyers and sellers to estimate the potential credit supply and demand based on regulatory drivers in the watershed and possible nutrient control options. This will be the focus of the next technical memo for the San Jacinto River Watershed Water Quality Trading Feasibility Assessment.

Future Data Needs

As described in Technical Memo #1, it will be important to characterize the influence of irrigation return flows on stream flow and pollutant loads to the lakes to characterize flow frequencies, volumes, and pollutant loads. Further analysis on nutrient loadings from Canyon Lake to Lake Elsinore also will be necessary to develop trade ratios if there is a need to trade between zone 1 and other subwatershed zones. WRCAC should consider pursuing CWA Section 319 grant funding or other funding sources to address these data gap.

In addition, complete and comprehensive analysis of the CWAD as a driver for trading will not be possible until the final requirements of the CWAD are known. For purposes of this water quality trading feasibility assessment, the focus will be on hypothetical CWAD scenarios using information from the WRCAC AgNMP (see the supplemental memo to Technical Memo #3).

Although the estimate of potential agricultural buyers and sellers is based on current data, stakeholders involved in water quality trading program development should account for agricultural land attrition and growth of urban land as these agricultural lands transition. This will lower the load for agricultural sources, potentially to the point where these sources can meet their required load reduction through changes in land use.

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Water Quality Trading Feasibility Assessment for San Jacinto Basin Agricultural Operators

Task 1.4 Estimate Supply and Demand

Technical Memo #3

October 25, 2013

Contents

Tables

1. Overview

The discussion in Technical Memo #2 focused on geographic scope considerations and identification of potential nonpoint source (NPS) participants in a water quality trading program for the San Jacinto River watershed. This technical memo builds on that information to estimate the potential water quality credit supply and demand associated with potential trading program participants. This information begins to establish a foundation for the discussion of trade ratios to be presented in Technical Memo #4 and the economic feasibility components of the overall water quality trading feasibility assessment. Ultimately, an initial estimate of supply and demand at the subwatershed zone scale, coupled with the information in Technical Memo #4 and a supplemental discussion on the Conditional Waiver of Agricultural Discharge (CWAD) requirements' effect on trading, will provide a better understanding of which sources are likely to have financial incentives to participate in trading and which sources might find it economically infeasible.

This phase of the water quality trading market feasibility analysis relies heavily on existing information about specific trading drivers (e.g., total maximum daily load [TMDL] allocations, permit requirements, and the CWAD that is still under development) that will serve as the baselines for each type of source and estimates of current nutrient loads from each source category based on the assumptions and estimates from the Agricultural Nutrient Management Plan (AgNMP)[1]. Discussions among stakeholders in the San Jacinto River watershed about potential changes to the Canyon Lake/Lake Elsinore TMDL, different approaches to reducing in-lake nutrient loads, TMDL implementation participation, modifications to the AgNMP, and other watershed-related data and information, will affect the assumptions used to estimate supply and demand for the San Jacinto River watershed water quality trading market feasibility assessment. Over time, it will be necessary to revisit and update this analysis using new assumptions, data, and information related to achieving water quality standards through TMDL implementation in the San Jacinto River watershed.

It is important to note that a new subwatershed zone boundary analysis was prepared for WRCAC during the finalization of this technical memo. This resulted in subwatershed zone boundary shifts for agricultural acreage in subwatershed zones 4, 6, and 7, resulting in increased acreage for some land uses in zone 6 and decreased acreage in zones 4 and 7. Where possible, this technical memo integrates the changes in the agricultural acreage among these subwatershed zones. However, the AgNMP does not reflect this latest shift in subwatershed zone boundaries; therefore, information from the AgNMP used for this technical memo does not reflect the new boundary change either. Appendix A to this technical memo provides more details on the subwatershed zone boundary changes, including a map and a table of shifted acreage. In addition, the AgNMP makes certain assumptions about applicability of the CWAD requirements that are inconsistent with current information provided after development of the AgNMP. Specifically, the AgNMP calculates CWAD-based BMP load reductions for some non-irrigated agricultural lands. In July 2013, the Santa Ana Regional Water

[1] Agricultural Nutrient Management Plan for the San Jacinto Watershed, submitted by WRCAC to the Santa Ana Regional Water Quality Control Board on April 30, 2013

Quality Control Board (SAWRQCB) indicated that the CWAD will apply only to irrigated agriculture. Again, analyses conducted for this technical memorandum accounts for the current understanding of CWAD applicability to the extent possible, whereas information derived from the AgNMP does not.

1.1 Task 1.4 Description: Estimate Supply and Demand

The goal of this task is to estimate water quality trading credit supply and demand from agricultural sources using the inventory generated under Task 1.3 and discussed in Technical Memo #2. The project team estimated pollutant credit supply and demand based on the inventory of potential buyers and sellers, the assumed current performance, and the future regulatory drivers associated with these sources. To estimate demand, the project team examined regulatory drivers including but not limited to the nutrient TMDL wasteload allocations (WLAs) and load allocations (LAs) and the requirements of the future CWAD program. Using the baseline estimated supply and demand, Technical Memo #4 will examine changes in the estimate due to the application of trade ratios.

1.2 Summary of Potential Water Quality Trading Participants

As discussed in Technical Memo #2, a variety of agricultural nonpoint and point sources could potentially participate in a water quality trading program. Table 1 identifies those sources, along with the applicable subwatershed zones and regulatory drivers and the potential buyer or seller status for each pollutant, as identified in Technical Memo #2. It is important to keep in mind that this project focuses on nonpoint sources. Agricultural point sources (concentrated animal feeding operations [CAFOs]) are included in this analysis because the regulatory drivers associated with point sources could create a demand for nutrient credits from other members of the agricultural community. Therefore, it is important to include point sources in the analysis as potential credit buyers for agricultural nutrient credits. The inclusion of point sources in this analysis is in no way intended to assist point sources in meeting regulatory requirements and it is intended to only show the potential benefits to the agricultural community through water quality trading.[2]

[2] In some limited circumstances agricultural encroachment has occurred on parcels that are not normally agricultural. Some of those parcels are owned by entities that operate municipal separate storm sewer systems (MS4s) and are therefore regulated as point sources. If such an entity has joined WRCAC and paid appropriate TMDL allocation fees for agricultural parcels, they will be allowed to participate in WRCAC trading programs.

Table 1. Preliminary Assessment of Potential Agriculture-Based Credit Buyers and Sellers Based on Applicable Regulatory Driver for the San Jacinto River Watershed

Type of Source	Applicable Zones[a]	Regulatory Driver	Pollutant-specific Potential Buyer/Seller Status	
			TN	TP
Nonpoint Sources[b]				
Non-state/federal/tribal Agricultural Operators	2 – 9	TMDL LA/CWAD[c]	Seller [2010 model update shows existing TN load is lower than TMDL LA (WRCAC 2013)]	Buyer/Seller
State/federal/tribal Agricultural Operators	2 – 8	TMDL LA/CWAD[d]	Participation in trading dependent on participation in TMDL implementation process with WRCAC	
Point Sources				
WRCAC CAFOs (Dairies)	3, 7	Order No. R8-2013-0001 (CAFO permit)	Buyer/Seller	Buyer/Seller

a. Limitations on trading among sources in different zones are discussed below and are explored further in Technical Memo #4 on trade ratios.
b. Excluding internal sediment, atmospheric deposition, and open/forest categories from the TMDL.
c. Based on information currently available, CWAD requirements will only apply to irrigated agricultural land and agricultural operations with 20 acres or more. Agricultural operators with less than 20 acres in aggregate will not be subject to CWAD requirements.
d. Based on information currently available, CWAD requirements will only apply to federal and state irrigated agricultural land in this category of nonpoint sources; non-irrigated agriculture and tribal lands will not be subject to CWAD requirements. To estimate credit supply and demand, this analysis assumes that the CWAD will apply to federal and state agricultural operators but will not apply to tribal operators.

1.3 Key Terms and Concepts for Estimating Credit Supply and Demand

Before undertaking an analysis to estimate credit supply and demand, it is important to understand a few key terms related to the process. For purposes of this water quality trading feasibility analysis, the key terms and associated definitions are as follows:

Baseline: 1.) Baseline is the pollutant control requirements that apply to buyers and sellers in the absence of trading. Sellers must first achieve their applicable baselines before they can enter the trading market and sell credits. Buyers can purchase credits to achieve their applicable baselines once they have met their minimum control levels. 2.) Some programs use baseline to define loads in a specific year, which usually represents the starting point of the program.

Credit, or Pollutant Reduction Credit: A credit is a measured or estimated unit of pollutant reduction per unit of time at the discharge location of the buyer or user of the credit. A seller generates excess load reductions by controlling their discharge beyond what is needed to meet the baseline. A buyer compensates a seller for creating the excess load reductions that are then converted into credits by using trade ratios. Where appropriate, the buyer can use the credits to meet a regulatory obligation.

Credit demand: Credit demand is the amount of pollutant reduction credits that a buyer or a group of buyers would need to purchase to achieve the applicable baseline (i.e., pollutant control requirement in the absence of trading) after achieving the applicable minimum control level. Estimates of credit demand will shift due to trade ratios that account for environmental factors, pollutant fate and transport, and uncertainty associated with best management practice performance.

Credit supply: Credit supply is the amount of pollutant credits that a seller or a group of sellers can generate after achieving the applicable baseline (i.e., pollutant control requirement in the absence of trading). Estimates of credit supply will shift due to trade ratios that account for environmental factors, pollutant fate and transport, and uncertainty associated with best management practice performance.

Minimum control level: The minimum control level is the pollutant load that a credit buyer must first meet before purchasing credits to meet the baseline. This pollutant load could be a technology-based effluent limit (TBEL) specified in a permit or an operation’s current discharge level.

Using these definitions, the following sections provide the analysis of credit supply and demand for the potential water quality trading participants in the San Jacinto River watershed.

1.4 Overview of Process to Estimate Supply and Demand

Estimating the potential credit supply and demand for water quality trading in the San Jacinto River watershed requires a more detailed look at each source’s current pollutant loads, the applicable baselines for credit sellers and buyers, and the minimum control level for credit buyers. A basic equation to determine credit supply or demand is as follows:

(Total estimated pollutant load) – (baseline load) = credit supply or demand

If (total estimated pollutant load) > (baseline load) = credit demand

If (total estimated pollutant load) < (baseline load) = credit supply

It is important to note that the baseline requirements will have a significant influence on credit supply and credit demand and, as a result, the success of a water quality trading program. While the U.S. Environmental Protection Agency’s 2007 *Water Quality Trading Toolkit* uses the definition of baseline as presented above, there are a variety of ways to craft baselines to support a successful water quality trading program. For example, the definition of a baseline for a nonpoint source seller is often the LA set under an approved TMDL or, if no LA exists, the existing pollutant load or implementation of a set of best management practice (BMP) requirements. However, where an LA exists, it might be necessary to have the same type of flexibility in establishing the baseline that exists when an LA isn’t in place. The goal should be to establish a baseline that is protective of water quality but also promotes water quality trading. This memo identifies the potential baseline considerations for each type of pollutant source and describes the effect of varying baseline requirements on potential credit supply and demand for each source category.

The detailed process to estimate credit supply and demand will vary by source type because information on current pollutant loads and associated baselines isn't readily available for each source type at the watershed, subwatershed zone, and individual source levels. Also, it is difficult to ascertain if a source would be likely to invest in upgrading pollutant control technologies or best management practice installation to achieve their baselines. Decisions to upgrade pollutant control treatment technologies will ultimately affect credit supply and demand. The information presented here represents rough estimates for the overall source category with different baseline considerations at the watershed level and by zone. The discussion also addresses considerations at the individual source level, where possible.

2. Supply and Demand Estimates by Sector

The estimated credit supply and demand by agricultural source type is presented in Section 2 as follows:

1. Description of the overall source category
2. Estimated existing loads from the source category
3. Discussion of baseline options
4. Estimates of supply and demand

Section 3 presents an overall analysis of supply and demand among all categories by watershed and by zone.

This section provides the supply and demand estimates for the agricultural nonpoint source categories identified in the inventory of potential buyers and seller (Technical Memo #2). These nonpoint sources are 1) non-state/federal/tribal (i.e., WRCAC) agricultural operators and 2) state/federal/tribal agricultural operators. This section also provides supply and demand estimates for WRCAC CAFOs (dairies).

2.1 Non-State/Federal/Tribal Agricultural Operators

2.1.1 Description of the overall source category

Approximately 4,336 non-state/federal/tribal agricultural operators, also referred to as WRCAC agricultural operators based on membership or eligibility to participate in WRCAC, throughout the San Jacinto River watershed could potentially participate in water quality trading. Table 2 presents a breakdown of the number of agricultural operators by subwatershed zone.

Table 2. Number of Agricultural Operators Potentially Available to Participate in Trading, by Subwatershed Zone (2010) (AIS 2012)

Subwatershed Zone	Total Number of Agricultural Operators[c]	# of Agricultural Operators with > 20 Acres[a,b]			
		Including Vacant Zoned Ag[d] and Dairies[e]	Including Vacant Zoned Ag, Excluding Dairies[e]	Excluding Vacant Zoned Ag[d] and Dairies[e]	
				Private	Agency[f]
1	1	0	0	0	0
2	1,040	37	37	36	1
3	490	64	62	53	1
4	680	102	102	47	1
5	777	62	62	50	1
6	528	36	36	34	1
7	574	118	105	89	1
8	100	35	35	22	2
9	154	14	14	4	0
Total	4,344	468	453	335	8

a. These data do not reflect recent revisions to the subwatershed zone boundaries.
b. Operators with total parcels < 20 acres are exempted from TMDL compliance under WRCAC's voluntary compliance program, but will have the option to participate in trading as sellers.
c. The total number of individuals owning parcels of any size under any of the agricultural land use codes.
d. Participation by operators with land in the category Vacant Zoned Ag is difficult to predict; these areas may be more likely to be developed under normal conditions but may be returned to agricultural production during an economic downturn when there is less development pressure.
e. The agricultural land use data include some dairy cropland; although these areas are considered part of the CAFO point source from a regulatory standpoint.
f. The number that are federal, state, or tribal land owners. These are listed separately as the trading drivers may apply differently to agency landowners, either increasing or decreasing the likelihood that they may participate. Although small in number, in some subwatershed zones these may account for a substantial portion of the agriculture acreage.

Tables 3 and 4 provide a summary of the 2010 land use data for agricultural land uses in the San Jacinto River watershed that corresponds to the 4,344 agricultural operators in the watershed (i.e., including state/federal/tribal; note that this figure also includes 15 dairy operators as dairies have both point source and nonpoint source agricultural discharges). Approximately 58,888 acres fall under an agricultural land use category (excluding "Dairies – Intensive"). Of that total, 56,520 acres are operated by non-state/federal/tribal (i.e., WRCAC) agricultural operators. Most of the agricultural land use acreage is located in zone 7 (14,694 acres) and zone 4 (11,539 acres).

Table 3. Summary of 2010 Land Use Data for Ag Land Uses, All Acreage, by Zone

Land Use Code	Description	Area (acres)[a,b]									
		Total[c]	Subwatershed Zone								
			1	2	3	4	5	6	7	8	9
2110	Irrigated Agriculture	18,938	-	1,545	1,968	1,887	1,485	5,783	6,054	217	-
2120	Non-Irrigated Agriculture	15,537	-	2,993	2,918	2,174	2,799	813	3,654	187	-
2121	Vacant - Zoned Agriculture	12,132	-	111	703	6,147	1,034	100	1,581	735	1,720
2200	Orchards/Vineyards, Undifferentiated	232	-	39	11	27	46	32	37	40	-
2210	Citrus	3,255	-	4	20	119	63	-	593	2,374	82
2300	Nurseries, Undifferentiated	884	-	216	116	59	204	134	62	92	-
2310	Turf Farms	1,142	-	-	-	-	-	508	634	-	-
2320	Christmas Tree Farm	19	-	-	6	3	2	8	-	-	-
2412	Dairies - Non-Intensive[d]	1,250	-	-	73	-	-	179	997	-	-
2413	Abandoned Dairies	57	-	-	29	-	-	-	29	-	-
2420	Other Livestock	293	-	8	30	20	9	14	57	-	154
2500	Poultry	268	-	1	40	38	-	131	57	-	-
2600	Other Agriculture, Undifferentiated	414	-	10	19	45	17	129	175	19	-
2610	Compost/Manure Piles	183	-	1	-	-	-	37	145	-	-
2620	Backyard Livestock	1,543	-	510	179	253	190	291	89	22	10
2700	Horses	2,744	-	308	221	767	85	360	530	-	473
Totals		58,888	-	5,746	6,333	11,539	5,935	8,518	14,694	3,686	2,439

a. Data reflect recent revisions to subwatershed zone boundaries.
b. Data include all agricultural acres, except the "Dairies-Intensive" land use (code 2441) including state/federa/tribal acres, non-state/federal/tribal acres, and parcels that, when aggregated by ownership are less than 20 acres.
c. Subwatershed zone subtotals may not add to watershed totals due to rounding.
d. After application of technology-based requirements under Order No. R8-2013-0001, these acres contribute nonpoint source agricultural stormwater discharges.

Table 3 is a summary of all agricultural land uses in the San Jacinto watershed, with the exception of the "Dairies – Intensive" land use, which represents dairy production areas. It includes agricultural parcels that, when aggregated by ownership, total less than 20 acres, although they are not included in the WRCAC TMDL program. Operators with total parcels < 20 acres are exempted from TMDL compliance under WRCAC's voluntary compliance program, but will have the option to participate in trading as sellers. Acres that are included in the WRCAC TMDL program (i.e., those that, when aggregated by ownership total 20 acres or more), total 42,691 acres, which includes 1,000 acres of farmable land from the San Jacinto Wildlife area in subwatershed zone 7 and 141 acres that is cattle grazing land used by the Bureau of Land Management (BLM) in subwatershed zone 9. Additionally, 6,227 acres fall into the land use category of vacant land zoned agriculture (code 2121) that has not been farmed in the past three years. However, those parcels could potentially be farmed in the future and therefore are included in the trading analysis. Finally, since the land use data shown in Table 3 were originally mapped, the SARWQCB in its process to identify parcels exempt from inclusion in the WRCAC TMDL program, has determined that 2,722 acres across all of the agricultural land use categories are not used for agricultural purposes and will not be returned to agricultural use. All subsequent table data is based on Table 3 data, unless otherwise noted.

Table 4. Summary of 2010 Land Use Data for Ag Land Uses, All Acreage, by Ownership

Land Use Code	Description	Area (acres)		
		Total[a]	State, Federal, Tribal	WRCAC
2110	Irrigated Agriculture	18,938	1	18,937
2120	Non-Irrigated Agriculture	15,537	1,187	14,351
2121	Vacant - Zoned Agriculture	12,132	916	11,215
2200	Orchards/Vineyards, Undifferentiated	232	-	232
2210	Citrus	3,255	119	3,137
2300	Nurseries, Undifferentiated	884		884
2310	Turf Farms	1,142	2	1,140
2320	Christmas Tree Farm	19		19
2412	Dairies - Non-Intensive[b]	1,250		1,250
2413	Abandoned Dairies	57		57
2420	Other Livestock	293	141	152
2500	Poultry	268		268
2600	Other Agriculture, Undifferentiated	414	-	414
2610	Compost/Manure Piles	183		183
2620	Backyard Livestock	1,543	3	1,539
2700	Horses	2,744		2,744
Totals		58,888	2,368	56,520

a. Area subtotals may not add to watershed totals due to rounding.
b. After application of technology-based requirements under Order No. R8-2013-0001, these acres contribute nonpoint source agricultural stormwater discharges.

2.1.2 Estimated existing loads from the source category

The estimated existing pollutant loads from non-state/federal/tribal agricultural operators are derived by calculating a per-acre load for each land use from the 2010 TMDL model update and applying the per-acre load to the 2010 acres for each land use developed by WRCAC. This is the best approach for estimating a total load for each land use in the absence of additional modeling, which is outside the scope of the water quality trading feasibility analysis. It is important to note that the estimated loads do not include estimates for *outside watershed* acres defined as portions of in-watershed parcels that extend beyond the watershed boundary and are not eligible for trading.

Estimated total nitrogen loads

Table 5 presents the estimated total nitrogen (TN) loads by agricultural land use owner type for the entire San Jacinto River watershed for both non-state/federal/tribal agricultural operators (i.e., WRCAC loads) and state/federal/tribal agricultural operators. Although state/federal/tribal operators are discussed in the next section, it is helpful to see a comparison of the two categories. Across the San Jacinto River watershed, non-state/federal/tribal agricultural operators (i.e., WRCAC member agricultural operators), are estimated to contribute 25,854 kilograms per year (kg/yr) of TN. State/federal/tribal agricultural land owners contribute an estimated 700 kg/yr of TN. These per-acre estimates across the watershed do not account for TN attenuation because the AgNMP provided loading rates specific to zones. A more refined estimate of loads by zone is presented in Table 6.

Table 5. San Jacinto River Watershed Estimated TN Loads (kg/yr) by Agricultural Land Use and Owner Type

Land Use Code	Description	State, Federal, and Tribal Loads (kg/yr)	WRCAC Loads (kg/yr)
2110	Irrigated Agriculture	0.3	6,478
2120	Non-Irrigated Agriculture	390.4	4,721
2121	Vacant - Zoned Agriculture	34.1	417
2200	Orchards/Vineyards, Undifferentiated	-	58
2210	Citrus	45.8	1,212
2300	Nurseries, Undifferentiated	-	192
2310	Turf Farms	0.1	63
2320	Christmas Tree Farm	-	2
2412	Dairies - Non-Intensive[a]	-	2,039
2413	Abandoned Dairies	-	40
2420	Other Livestock	220.7	238
2500	Poultry	-	389
2600	Other Agriculture, Undifferentiated	-	153
2610	Compost/Manure Piles	-	378
2620	Backyard Livestock	8.1	3,681
2700	Horses	-	5,795
Totals		700	25,854

a. After application of technology-based requirements under Order No. R8-2013-0001, these acres contribute nonpoint source agricultural stormwater discharges.

Tables 6a and 6b provide a breakdown of the estimated nitrogen load from all agricultural operators by zone, with Table 6a focusing on TN loads entering Canyon Lake from all zones and Table 6b focusing on TN loads entering Mystic Lake from zones 7–9.

Table 6a applies the loading factors (i.e., ratios of lake loading to watershed washoff) presented in the AgNMP specific to agricultural sources upstream of Mystic Lake (zones 7–9) and downstream of Mystic Lake to Canyon Lake (zones 2–6). According to the AgNMP, approximately 65 percent of TN washoff from agricultural sources downstream of Mystic Lake to

Canyon Lake (zones 2–6) is delivered to Canyon Lake. Less than 0.01 percent of TN washoff from agricultural sources above Mystic Lake (zones 7–9) makes it to Canyon Lake.

Table 6a. Estimated TN Loads to Canyon Lake with AgNMP TN Load Factors by Zone (All Ag Land Uses and Owner Types)

Land Use Code	Description	Estimated TN Load with TN Load Factors Applied (kg/yr)[a]									
		Total[b]	Subwatershed Zone								
			1	2	3	4	5	6	7	8	9
2110	Irrigated Agriculture	2,817	-	343	438	419	330	1,286	0.2	0.01	-
2120	Non-Irrigated Agriculture	2,501	-	640	624	465	598	174	0.1	0.01	-
2121	Vacant - Zoned Agriculture	196	-	3	17	149	25	2.4	0.01	0.003	0.01
2200	Orchards/Vineyards, Undifferentiated	25	-	6	2	4	8	5	0.001	0.001	-
2210	Citrus	52	-	1	5	30	16	-	0.02	0.1	0.003
2300	Nurseries, Undifferentiated	103	-	30	16	8	29	19	0.001	0.002	-
2310	Turf Farms	18	-	-	-	-	-	18	0.003	-	-
2320	Christmas Tree Farm	1.5	-	-	0.5	0.2	0.2	0.6	-	-	-
2412	Dairies - Non-Intensive[c]	268	-	-	78	-	-	190	0.2	-	-
2413	Abandoned Dairies	13	-	-	13	-	-	-	0.002	-	-
2420	Other Livestock	83	-	8	31	21	9	15	0.01	-	0.02
2500	Poultry	199	-	1	38	36	-	124	0.01	-	-
2600	Other Agriculture, Undifferentiated	53	-	2	5	11	4	31	0.01	0.001	-
2610	Compost/Manure Piles	51	-	2	-	-	-	50	0.03	-	-
2620	Backyard Livestock	2,211	-	793	278	393	295	452	0.02	0.01	0.002
2700	Horses	2,390	-	423	303	1,053	117	494	0.1	-	0.1
Totals		10,981	-	2,253	1,847	2,589	1,431	2,859	0.7	0.1	0.1

a. Data reflect recent revisions to subwatershed zone boundaries.
b. Subwatershed zone subtotals may not add to watershed totals due to rounding.
c. After application of technology-based requirements under Order No. R8-2013-0001, these acres contribute nonpoint source agricultural stormwater discharges.

In looking at Table 6a, it is helpful to keep in mind how the zones affect the different waterbodies in the San Jacinto River watershed. Zones 7–9 drain to Mystic Lake. Zones 2–6 drain to Canyon Lake, influenced by overflows from Mystic Lake.[3] Zone 1, which contains no agricultural acreage, drains to Lake Elsinore, which is also influenced by overflows from Canyon Lake. It is important to note that the TN loads for zones 2–6 presented above do not exactly

[3] Accounting for nutrient contributions from Mystic Lake to Canyon Lake during overflow years is a subject for further analysis in the WQT program development phase. Trade ratios developed for the WQT program would account for nutrient retention time in Mystic Lake, fate and transport from Mystic Lake to Canyon Lake, and the anticipated amount and frequency of overflows.

match the TN loads for zones 2–6 presented in the AgNMP (Table 3-2) due to variations in estimation methodology. The purpose of estimating the TN loads by zone is to show relative zone contributions for considering zone-specific supply and demand within this water quality trading feasibility assessment.

According to Table 6a, agricultural sources located in zone 4 contribute the greatest nitrogen load (2,589 kg/yr) of any zone, this is approximately 24 percent of the total estimated nitrogen load from agricultural sources in the San Jacinto River watershed. The agricultural land use category with the largest estimated nitrogen contribution in zone 4 is Horses (1,053 kg/yr). zones 7–9 contribute less than 0.01 percent of TN to Canyon Lake and have the potential to affect the San Jacinto watershed downstream of Mystic Lake in overflow years. According to Technical Memo #2, Mystic Lake overflows are estimated to occur every 10–12 years according to the 2007 TMDL model, which could significantly impact the TMDL allocation for agricultural operators in those zones during overflow years and, therefore, their credit supply or demand. This issue is also addressed in Technical Memo #4 on trade ratios.

Agricultural operators located in zones 2–6 contribute an estimated nitrogen load of 10,979 kg/yr, almost 100 percent of the total estimated nitrogen load from agricultural sources in the San Jacinto River watershed to Canyon Lake. Proportionally, this is in line with the relative load contributions estimated by the AgNMP when comparing zones 2–6 and zones 7–9.

Zone 1 has no estimated TN load because there are no agricultural sources located in this zone. The TN load from zones 2–6 that drain to Canyon Lake have the potential to affect Lake Elsinore during overflow events. Loading factors, similar to the ones calculated in the AgNMP to determine the effect of zones 2–9 on Canyon Lake, are necessary to estimate the effect of zones 2–9 on Lake Elsinore. However, determining loading factors for zones 2–9 to determine the influence on Lake Elsinore would require an analysis of past TMDL modeling, which is outside the scope of this effort. According to the AgNMP, the nutrient loads in Lake Elsinore have the potential to be addressed through aeration and other in-lake projects. Therefore, while trading might be possible in zone 1, it would not involve agricultural sources.

While nutrient loads from subwatershed zones 7–9 have minimal contributions to Canyon Lake, except in overflow years, the agricultural activities found in these subwatershed zones do contribute nutrient loads to Mystic Lake. Table 6b shows the estimated TN loads from agricultural land uses in zones 7–9. The load factors are estimated using information from the 2010 TMDL model and are based on an average of the wet, moderate, and dry years included in the model. Therefore, the actual load delivered to Mystic Lake could be higher than the Table 6b estimates in a wet year or lower in a dry year. The TN load factor for zone 7 is 79.3 percent, meaning that approximately 79.3 percent of the TN from this subwatershed zone enters Mystic Lake. The TN load factor for zone 8 is 76.9 percent and is 76.7 percent for zone 9.

Table 6b. Estimated TN Loads to Mystic Lake with TMDL model TN Load Factors by Zone (All Ag Land Uses and Owner Types)

Land Use Code	Description	Estimated TN Load with TN Load Factors Applied (kg/yr)[a]			
		Total[b]	Subwatershed Zone		
			7	8	9
2110	Irrigated Agriculture	1,699	1,642	57	-
2120	Non-Irrigated Agriculture	1,000	953	47	-
2121	Vacant-Zoned Agriculture	117	47	21	49
2200	Orchards/Vineyards, Undifferentiated	15	7	8	-
2210	Citrus	912	182	706	24
2300	Nurseries, Undifferentiated	26	11	15	-
2310	Turf Farms	28	28	-	-
2320	Christmas Tree Farm	-	-	-	-
2412	Dairies-Non-Intensive	1,290	1,290	-	-
2413	Abandoned Dairies	16	16	-	-
2420	Other Livestock	256	71	-	185
2500	Poultry	66	66	-	-
2600	Other Agriculture, Undifferentiated	57	52	5	-
2610	Compost/Manure Piles	237	237	-	-
2620	Backyard Livestock	227	169	40	18
2700	Horses	1,654	887	-	767
Totals		7,599	5,657	900	1,042

a. Data reflect recent revisions to subwatershed zone boundaries.
b. Subwatershed zone subtotals may not add to watershed totals due to rounding.

According to Table 6b, agricultural land uses in subwatershed zones 7–9 contribute approximately 7,599 kg/yr of TN to Mystic Lake (this represents an average of wet, moderate, and dry years, as described above). Zone 7 contributes the highest (74 percent) TN load to Mystic Lake, followed by zone 9 (14 percent) and zone 8 (12 percent). Within zone 7, irrigated agriculture and dairies (non-intensive) contribute the highest TN load. Within zone 8, citrus contributes the most TN to Mystic Lake. Within zone 9, horses and other livestock contribute the most TN to Mystic Lake.

It is important to keep in mind that the nutrient loads from agricultural sources in all the subwatershed zones will change over time due to changes in land use (i.e., agricultural land transitioning to urban land), as mentioned in Technical Memo #2 and the AgNMP.

Estimated phosphorus loads

Table 7 presents the total phosphorus (TP) loads by agricultural land use owner type for the entire San Jacinto River watershed for both non-state/federal/tribal agricultural operators (i.e., WRCAC loads) and state/federal/tribal agricultural operators. As stated above, it is helpful to see a comparison of the two categories although state/federal/tribal operators are discussed in the next section. Across the San Jacinto River watershed, non-state/federal/tribal agricultural operators (i.e., WRCAC member agricultural operators) are estimated to contribute 11,439 kg/yr of TP. State/federal/tribal agricultural operators contribute an estimated 350 kg/yr of TP. These estimates across the watershed do not account for TP attenuation because the AgNMP provided loading rates specific to zones. A more refined estimate of loads by zone is presented in Table 8.

Table 7. Watershed TP Loads by Owner Type

Land Use Code	Description	State, Federal, Tribal Loads (kg/year)	WRCAC Loads (kg/year)
2110	Irrigated Agriculture	0.2	4,115
2120	Non-Irrigated Agriculture	250.4	3,027
2121	Vacant - Zoned Agriculture	12.8	156
2200	Orchards/Vineyards, Undifferentiated	-	44
2210	Citrus	34.7	919
2300	Nurseries, Undifferentiated	-	146
2310	Turf Farms	0.0	34
2320	Christmas Tree Farm	-	2
2412	Dairies - Non-Intensive[a]	-	458
2413	Abandoned Dairies	-	8
2420	Other Livestock	49.6	53
2500	Poultry	-	90
2600	Other Agriculture, Undifferentiated	-	97
2610	Compost/Manure Piles	-	86
2620	Backyard Livestock	2.0	900
2700	Horses	-	1,302
Totals		350	11,439

a. After application of technology-based requirements under Order No. R8-2013-0001, these acres contribute nonpoint source agricultural stormwater discharges.

Tables 8a and 8b provide a breakdown of the estimated phosphorus load from all agricultural operators by zone, with Table 8a focusing on TP loads entering Canyon Lake from all zones and Table 8b focusing on TP loads entering Mystic Lake from zones 7–9.

Table 8a provides a breakdown of the estimated TP load from agricultural operators by zone. As stated above, a zone-by-zone break out of non-state/federal/tribal loads from state/federal/tribal loads is not available. Therefore, Table 8a presents a TP load estimate by zone for all agricultural operators. In addition, Table 8a applies the loading factors (i.e., ratios of lake loading to watershed washoff) presented in the AgNMP specific to agricultural sources upstream of Mystic Lake (zones 7–9) and downstream of Mystic Lake to Canyon Lake (zones 2–6). According to the AgNMP, approximately 63 percent of TP washoff from agricultural sources downstream of Mystic Lake to Canyon Lake (zones 2–6) make it to Canyon Lake. Less than 0.01 percent of TP washoff from agricultural sources above Mystic Lake (zones 7–9) make it to Canyon Lake.

Table 8a. Estimated TP Loads to Canyon Lake with AgNMP TP Load Factors by Zone (All Ag Land Uses and Owner Types)

Land Use Code	Description	Estimated TP Load with TP Load Factors Applied (kg/yr)[a]									
		Total[b]	Subwatershed Zone								
			1	2	3	4	5	6	7	8	9
2110	Irrigated Agriculture	1,734	-	211	269	258	203	792	0.1	0.005	-
2120	Non-Irrigated Agriculture	1,555	-	398	388	289	372	108	0.1	0.004	-
2121	Vacant - Zoned Agriculture	71	-	1	6	54	9	0.9	0.002	0.001	0.002
2200	Orchards/Vineyards, Undifferentiated	19	-	5	1	3	6	4	0.001	0.001	-
2210	Citrus	38	-	1	4	22	12	-	0.02	0.1	0.002
2300	Nurseries, Undifferentiated	76	-	22	12	6	21	14	0.001	0.002	-
2310	Turf Farms	10	-	-	-	-	-	10	0.002	-	-
2320	Christmas Tree Farm	1	-	-	0.4	0.2	0.1	0.5	-	-	-
2412	Dairies - Non-Intensive[c]	58	-	-	17	-	-	41	0.04	-	-
2413	Abandoned Dairies	3	-	-	3	-	-	-	0.0004	-	-
2420	Other Livestock	18	-	2	7	4	2	3.2	0.002	-	0.01
2500	Poultry	45	-	0.2	9	8	-	28	0.002	-	-
2600	Other Agriculture, Undifferentiated	32	-	1	3	7	3	19	0.00	0.0004	-
2610	Compost/Manure Piles	11.4	-	0.4	-	-	-	11	0.01	-	-
2620	Backyard Livestock	524	-	188	66	93	70	107	0.01	0.001	0.001
2700	Horses	520	-	92	66	229	25	107	0.03	-	0.02
Totals		4,715	-	922	850	974	723	1,245	0.3	0.1	0.03

a. Data reflect recent revisions to subwatershed zone boundaries.
b. Subwatershed zone subtotals may not add to watershed totals due to rounding.
c. After application of technology-based requirements under Order No. R8-2013-0001, these acres contribute nonpoint source agricultural stormwater discharges.

As stated above, it is helpful to keep in mind how the zones affect the different waterbodies in the San Jacinto River watershed. Zones 7–9 drain to Mystic Lake. Zones 2–6 drain to Canyon Lake, influenced by overflows from Mystic Lake. Zone 1, which has no agricultural acreage, drains to Lake Elsinore, which is also influenced by overflows from Canyon Lake. It is important to note that the TP loads for zones 2–6 presented above do not exactly match the TN loads for zones 2–6 presented in the AgNMP (Table 3-2) due to variations in estimation methodology. The purpose of estimating the TP loads by zone is to show relative zone contributions for considering zone-specific supply and demand within this water quality trading feasibility assessment.

According to Table 8a, agricultural sources located in zone 6 contribute the greatest phosphorus load (1,245 kg/yr) of any zone, this is approximately 26 percent of the total estimated phosphorus load from agricultural sources in the San Jacinto River watershed. The agricultural land use category with the largest estimated TP contribution in zone 6 is irrigated agriculture (792 kg/yr). According to Table 8a, most of the estimated phosphorus load to Canyon Lake is from irrigated agriculture (1,734 kg/yr). Zones 7–9 contribute less than 0.01 percent of TP to Canyon Lake and have the potential to affect the San Jacinto watershed downstream of Mystic Lake in overflow years. According to the 2007 TMDL model, Mystic Lake overflows are estimated to occur every 10–12 years. The overflows could significantly impact the TMDL allocation for agricultural operators in those zones during overflow years and, therefore, impact their credit supply or demand. This issue is discussed in Technical Memo #4 on trade ratios.

Agricultural operators located in zones 2–6 contribute an estimated phosphorus load of 4,714 kg/yr, or nearly 100 percent of the total estimated TP load from agricultural sources in the San Jacinto River watershed.

Zone 1 has no estimated TP load because there are no agricultural sources located in this zone. The TP load from zones 2–6 that drain to Canyon Lake have the potential to affect Lake Elsinore during overflow events. Loading factors, similar to the ones calculated in the AgNMP to determine the effect of zones 2–9 on Canyon Lake, are necessary to estimate the effect of zones 2–9 on Lake Elsinore. However, determining loading factors for zones 2–9 to determine the influence on Lake Elsinore would require an analysis of past TMDL modeling, which is outside the scope of this effort. According to the AgNMP, the nutrient loads in Lake Elsinore have the potential to be addressed through aeration and other in-lake projects. Therefore, while trading might be possible in zone 1, it would not involve agricultural sources.

While the nutrient loads from subwatershed zones 7–9 have minimal contributions to Canyon Lake, except in overflow years, the agricultural activities found in these subwatershed zones do contribute nutrient loads to Mystic Lake. Table 8b shows the estimated TP loads from agricultural land uses in zones 7–9. The load factors are estimated using information from the 2010 TMDL model and are based on an average of the wet, moderate, and dry years included in the model. Therefore, the actual load delivered to Mystic Lake could be higher than the Table 6b estimates in a wet year or lower in a dry year. The TP load factor for zone 7 is 80.3 percent, meaning that approximately 80.3 percent of the TP from this subwatershed zone enters Mystic Lake. The TP load factor for zone 8 is 76.8 percent and is 76.4 percent for zone 9.

Table 8b. Estimated TP Loads to Mystic Lake with TMDL model TP Load Factors by Zone (All Ag Land Uses and Owner Types)

Land Use Code	Description	Estimated TP Load with TP Load Factors Applied (kg/yr)[a]			
		Total[b]	Subwatershed Zone		
			7	8	9
2110	Irrigated Agriculture	1,093	1,056	36	-
2120	Non-Irrigated Agriculture	649	619	30	-
2121	Vacant-Zoned Agriculture	44	18	8	18
2200	Orchards/Vineyards, Undifferentiated	11	6	6	-
2210	Citrus	692	140	534	18
2300	Nurseries, Undifferentiated	20	8	12	-
2310	Turf Farms	15	15	-	-
2320	Christmas Tree Farm	-	-	-	-
2412	Dairies-Non-Intensive	294	294	-	-
2413	Abandoned Dairies	3	3	-	-
2420	Other Livestock	58	16	-	41
2500	Poultry	15	15	-	-
2600	Other Agriculture, Undifferentiated	37	33	3	-
2610	Compost/Manure Piles	54.9	55	-	-
2620	Backyard Livestock	56	42	10	4
2700	Horses	373	202	-	172
Totals		3,415	2,522	639	254

a. Data reflect recent revisions to subwatershed zone boundaries.
b. Subwatershed zone subtotals may not add to watershed totals due to rounding.

According to Table 8b, subwatershed zones 7–9 contribute approximately 3,415 kg/yr of TP to Mystic Lake (this represents an average of wet, moderate, and dry years, as described above). Zone 7 contributes the highest (74 percent) TP load to Mystic Lake, followed by zone 8 (19 percent) and zone 9 (7 percent). Within zone 7, irrigated agriculture contributes the highest TP load. Within zone 8, citrus contributes the most TP to Mystic Lake. Within zone 9, horses and other livestock contribute the most TP to Mystic Lake.

It is also important to keep in mind that the nutrient loads from agricultural sources will change over time due to changes in land use (i.e., agricultural land transitioning to urban land), as mentioned in Technical Memo #2 and the AgNMP.

2.1.3 Discussion of baseline options

With an understanding of estimated existing loads from agricultural sources, the next element in estimating supply and demand is to consider potential baseline options. The baseline establishes the quantifiable load reduction or requirements that a source must achieve to be eligible to participate in trading as a seller. For buyers, the baseline is the quantifiable load reduction that a source needs to meet to achieve compliance, upon first meeting a minimum control level.

There are two possible baselines to consider for agricultural operators that would like to participate in water quality trading related to 1) the load allocation set under the TMDL and 2) the CWAD requirements. Under each of these broad categories, there are different factors to consider that could affect how the baseline is designed to facilitate effective water quality trading.

TMDL load allocations

The first potential baseline for agricultural operators interested in generating and selling water quality trading credits is the nutrient TMDLs for Canyon Lake and Lake Elsinore. Tables 9 and 10 present the load allocations for agriculture set for Canyon Lake and Lake Elsinore under the TMDL.

Table 9. Canyon Lake Nitrogen and Phosphorus Load Allocations (SARWQCB 2011)

Canyon Lake Nutrient TMDL	Final Load Allocation (kg/yr)[a]	
	TP	TN
Total LA	***8,204***	***31,487***
Internal sediment	4,625	13,549
Atmospheric deposition	221	1,918
Agriculture	1,183	7,583
Open/forest	2,037	3,587
Septic systems	139	4,850

a. TMDL and allocations specified as a 10-year running average

Table 10. Lake Elsinore Nitrogen and Phosphorus Load Allocations (SARWQCB 2011)

Lake Elsinore Nutrient TMDL	Final Load Allocation (kg/yr)[a]	
	TP	TN
Total LA	***21,969***	***210,461***
Internal sediment	21,554	197,370
Atmospheric deposition	108	11,702
Agriculture	60	213
Open/forest	178	567
Septic systems	69	608
Canyon Lake Watershed[b]	2,770	20,774

a. TMDL and allocations specified as a 10-year running average
b. Allocation for Canyon Lake overflows

The AgNMP uses the agricultural load allocations to derive an allowable load. The allowable load is expressed as a per-acre loading rate based on land use acreage at the time of TMDL development. Allowable loads in subsequent years are determined as the product of the allocated load per acre and the number of acres of agriculture land use. Table 11 presents the allowable loads for TN and TP derived for the AgNMP. It is important to note that the allowable loads in Table 11 do not reflect the recent shift in subwatershed boundaries and, therefore, the allowable loads might actually be higher than those contained in Table 11 due to additional acreage in subwatershed zone 6.

Table 11. Allowable TP and TN Loads for WRCAC member agriculture sources in the Canyon Lake Watershed below Mystic Lake Calculated through the AgNMP (WRCAC 2013)

Nutrient	Loading (kg/yr)	2003 [a]	2007 [b]	2015 [b]	2020 [b]
TP	Allowable Load [c]	1,183	229	192	152
TN	Allowable Load [c]	7,583	1,471	1,233	974

a. Based on TMDL LA for agriculture
b. Loads shown represent WRCAC members only
c. Allowable load is equal to the TMDL per acre LAs and current and projected WRCAC member agriculture land uses

The allowable loads from the AgNMP based on the TMDL LA could potentially serve as a baseline for agricultural operators who wish to participate in water quality trading as sellers. It would be necessary to translate the allowable load to an appropriate percent reduction for individual agricultural operators to apply to their individual existing nutrient loads. For example, the AgNMP has calculated an estimated TP load of 484 kg/yr in 2015 for WRCAC member agricultural operators and an allowable load of 192 kg/yr, which equals a 40 percent phosphorus load reduction for those sources. The 40 percent load reduction could serve as the baseline for participating in trading as a seller. This would require individual agricultural operators to estimate the TP loads at the time of trading participation using a per-acre TP loading rate for the type of agricultural land use. Agricultural operators would then document how the 40 percent TP reduction baseline has been met by quantifying BMP efficiencies, and then quantify credits generated through additional BMP implementation beyond the 40 percent TP baseline that would be eligible for sale.

Potential CWAD requirements

Another option for an agricultural operator baseline is the impending CWAD Program requirements. Under the CWAD Program, the SAWRQCB will require agricultural operators to implement their choice of appropriate structural or non-structural BMPs. Although the CWAD Program is not yet final, the SAWRQCB has indicated that the CWAD will likely apply to irrigated agricultural operations and horse, poultry, and other livestock operations with agricultural lands that, when aggregated, are 20 acres or greater. Table 12 provides a list of non-state/federal/tribal agricultural acreage by subwatershed zone that would be subject to CWAD requirements.

Table 12. Non-State/Federal/Tribal Agricultural Lands (Aggregated 20 Acres or More) that are Subject to CWAD Requirements, by Subwatershed Zone

Land Use Code	Description	Area (acres)[a]								
		Total[b]	Subwatershed Zone							
			2	3	4	5	6	7	8	9
2110	Irrigated Agriculture	17,276	1,361	1,826	1,620	1,224	5,176	5,860	209	-
2200	Orchards/Vineyards, Undifferentiated	85	21	0.1	0.1	11	13	24	17	-
2210	Citrus	2,799	-	3	98	54	-	472	2,111	61
2300	Nurseries, Undifferentiated	305	10	26	20	81	55	30	84	-
2420	Other Livestock	34	-	26	1	1	-	-	-	7
2500	Poultry	237	-	40	12	-	131	54	-	-
2700	Horses	1,043	122	74	272	4	75	327	-	170
Totals		21,780	1,514	1,995	2,022	1,374	5,449	6,767	2,420	237

a. Data reflect recent revisions to subwatershed zone boundaries.
b. Subwatershed zone subtotals may not add to watershed totals due to rounding.

Based on the acreage in Table 12, 21,780 acres are subject to CWAD requirements, (2010 land use update). When compared to the total non-state/federal/tribal acreage in Table 4, 39 percent of the total non-state/federal/tribal agricultural acreage is subject to the CWAD requirements. That translates to 32 percent of the non-state/federal/tribal agricultural acreage in zones 2–6 and 51 percent of the non-state/federal/tribal acreage in zones 7–9. This means that the CWAD requirements will serve as a driver for trading (e.g., create a demand) on more than one-third of the total non-state/federal/tribal acreage. BMP implementation on the remaining non-state/federal/tribal agricultural acreage is voluntary.

Recent discussions on CWAD development indicate that a filter strip or field border requirement will be included in the CWAD, in addition to having the option to implement other structural and non-structural BMPs. The AgNMP included a discussion of eight BMPs that agricultural operators may also develop for nutrient reduction effectiveness. The filter strip/field border requirement under the CWAD could serve as a baseline for agricultural operators who want to participate in water quality trading as sellers. For example, the CWAD requirements could state that operators wishing to participate in trading must first implement a 30-foot filter strip to manage or use mitigate water quality concerns (e.g., phosphorus loads). Once agricultural operators implement the 30-foot filter strip, the trading baseline would be met and they could implement additional BMPs to generate additional nutrient load reductions that would be eligible for trading.

Based on current AIS data, 61 percent of total WRCAC acres are exempt from CWAD requirements because the agricultural operators have less than 20 acres in aggregate or because the agricultural land uses are not those subject to the CWAD (irrigated agriculture and livestock). Of this 64 percent, 68 percent of total WRCAC acres below Mystic Lake (zones 2–6) are exempt from CWAD requirements and 49 percent of total WRCAC acres above Mystic Lake (zones 7–9) are exempt from CWAD requirements. The CWAD could require agricultural operators with regulated land uses and aggregated agricultural lands less than 20 acres to comply if those operations are causing or contributing to water quality problems.

For the agricultural operators who have, in aggregate, less than 20 acres of agricultural land and therefore are not subject to the CWAD but would like to participate in trading, the filter strip/field border requirement or other agricultural BMPs like those used to comply with CWAD requirements could be implemented to establish eligibility to participate in trading. Nutrient reductions generated by the implementation of additional BMPs installed after meeting eligibility requirements could then be considered tradeable credits.

2.1.4 Estimates of supply and demand

Determining potential supply and demand for the non-state/federal/tribal agricultural operators is challenging without baselines in place. The TMDL load allocations are currently the most quantifiable potential baseline for agricultural operators, but it is clear that the CWAD Program requirements will eventually become the regulatory mechanism for achieving the TMDL load allocations. Ideally, the CWAD Program will establish the requirements to be used as the baseline in the analysis to determine the potential supply and demand in the San Jacinto River watershed and within the zones to identify where the most potential for water quality trading exists.

The AgNMP has provided a foundation for the supply and demand analysis for the non-state/federal/tribal agricultural operators with a total of more than 20 acres. However, a potential water quality trading program will go beyond WRCAC members to include state/federal/tribal agricultural operators and CAFO (dairies).

The analysis in the AgNMP focuses on WRCAC members only and zones 2–6 only (below Mystic Lake to Canyon Lake). The information provided by the AgNMP is helpful in understanding potential supply and demand in this portion of the watershed for this subset of agricultural operators. Table 13 presents the analysis provided by the AgNMP that identifies existing nutrient loads, allowable loads, and required reductions or, where applicable, credits. This table does not reflect the shift in subwatershed zone boundaries; therefore, these numbers could be higher with the shift of agricultural acreage into subwatershed zone 6.

Table 13. Estimation of Load Reduction Requirements for WRCAC Member Agriculture Sources in the Canyon Lake Watershed below Mystic Lake (Zones 2–6) Calculated for the AgNMP

Land Use	Nutrient	Loading (kg/yr)	2003 [a]	2007 [b]	2015 [b]	2020 [b]
Agriculture	TP	Existing / Estimated Load	4,413	578	484	383
		Allowable Load [c]	1,183	229	192	152
		Required Reduction / (Credit)	3,230	348	292	231
	TN	Existing / Estimated Load	11,057	971	241	47
		Allowable Load [c]	7,583	1,471	1,233	974
		Required Reduction / (Credit)	3,474	(499)	(993)	(927)

a. Based on TMDL LA and WLA for agriculture and CAFO sources
b. Loads shown represent WRCAC members only
c. Allowable load is equal to the TMDL per acre LAs and WLAs and current and projected WRCAC member agriculture and CAFO land uses

According to Table 13, WRCAC member agricultural sources will need additional TP reductions to meet their allowable loads by 2020, which decrease over time due to a change in total acreage as agricultural acreage experiences attrition. However, TN load reductions will exceed the allowable load, generating a credit for agricultural sources in zones 2–6. As a result, there will not be a demand for TN credits from WRCAC member agricultural sources to achieve the TMDL TN load allocations. If other subsets of agricultural operators, specifically state/federal agricultural operators, need TN load reduction credits, these operators could turn to WRCAC member agricultural sources to purchase TN credits. In addition, point sources such as stormwater permittees and CAFOs could also turn to WRCAC member agricultural sources to purchase credits depending on their TN load reduction needs.

The AgNMP estimates in Table 13 show that WRCAC member agricultural sources as a group will need to reduce TP loads in zones 2–6. According to the AgNMP, WRCAC member agricultural sources will achieve the additional TP load reduction requirements through a combination of watershed BMPs required under the CWAD and in-lake remediation projects. This approach to achieving the TMDL LA is estimated to generate a TP reduction surplus for non-state/federal/tribal agricultural sources (WRCAC 2013). Table 14 reflects the difference between the total load reduction requirements for non-state/federal/tribal agricultural sources and the expected load reductions from watershed BMP implementation (CWAD BMP implementation as well as reduction of manure spreading, with the applicable TP and TN loading factors) to demonstrate the remaining TP load and addition TN surplus. It is important to note that Table 14 does not reflect the shift in subwatershed zone boundaries and, therefore, these numbers could be higher. The remaining TP load after watershed BMP implementation will potentially be addressed by in-lake remediation project implementation in Canyon Lake (i.e., alum treatments). These treatments, if they occur, are projected to result in an annual total reduction of 3,609 kg/yr of TP (WRCAC 2013). When looking at the in-lake BMP load reduction requirement column of Table 14, the annual load of TP will generate an annual TP supply of 3,345 kg/yr (2010), 3,553 kg/yr (2015) and 3,684 kg/yr (2020).

Table 14. Calculation of Load Reduction Requirements to be Achieved with In-Lake Remediation Projects by WRCAC Member Agriculture Operators (WRCAC 2013)

Year	Total Load Reduction Requirement (kg/yr) [a]		Watershed Load Reduction / (Debit) [b] kg/yr)		In-Lake BMP Load Reduction Requirement (kg/yr)	
	TP	TN	TP	TN	TP	TN
2010	348	-499	-84	-144	264	-643
2015	292	-993	-236	-862	56	-1,855
2020	231	-927	-306	-1,216	-75	-2,143

a. Negative values indicate no reduction requirement, and presence of a credit relative to the WRCAC agriculture load allocation

b. Washoff reduction benefits reduced by a loading factor of 63 percent for TP and 65 percent for TN to account for losses in nutrients from watershed wash off to loads into Canyon Lake

Table 15. Summary of Supply and Demand Estimate for Non-State/Federal/Tribal Agricultural Operators (WRCAC 2013)

Type of Source	Applicable Zones[a]	Driver/Implementation Approach	Estimate of (Supply) and Demand (kg/yr)[a]							
			TN				TP			
			2003	2007	2015	2020	2003	2007	2015	2020
Non-state/federal/tribal (WRCAC member) Agricultural Operators	2–6 (below Mystic Lake to Canyon Lake)	TMDL LA allowable load	3,474	(499)	(993)	(927)	3,230	348	292	231
		Remaining load or surplus achieved through CWAD (BMP-based)[b] and reduction of manure spreading	3,474	(643)	(1,855)	(2,143)	NA	264	56	(75)
		Surplus achieved through CWAD (BMP-based)[b] and reduction of manure spreading with in-lake remediation projects	3,474	(643)	(1,855)	(2,143)	NA	(3,345)	(3,553)	(3,684)
	7–9 (above Mystic Lake)	CWAD (BMP-based implementation)	Estimated TN load to Mystic Lake: 7,599 kg/yr Estimated TP load to Mystic Lake: 3,415 kg/yr Trading above Mystic Lake would be triggered by CWAD requirements if WRCAC determined a need for a quantifiable load reduction from these sources to help with TMDL implementation. No subwatershed zone demand for nutrient reductions from sources above Mystic Lake at this time; could possibly exist at agricultural operator level to meet CWAD BMP requirements.							
	1 (Lake Elsinore): no WRCAC properties	NA	NA							

a. Data do not reflect recent revisions to subwatershed zone boundaries, which are anticipated to increase estimated allowable loads and load reductions in subwatershed zones 2–6 (net increase including a decrease in zone 4 acreage) and decrease allowable loads and load reductions in zones 7–9 (net decrease in zone 7 after shifting acres from zone 4 and into zone 6).
b. Supply and demand estimates shown here are from the AgNMP, which anticipated CWAD applicability to irrigated and non-irrigated agricultural land uses. If the CWAD applies only to irrigated agricultural land, nutrient reductions from implementation of CWAD BMPs will be lower than the estimates shown.

Based on the findings in Table 15, WRCAC member agricultural operators located in zones 2–6 (without adjustments for subwatershed zone boundary changes and CWAD applicability) will have a supply of TN credits and a demand for TP credits to achieve the TMDL allowable load, with TP demand diminishing over time and TN supply increasing over time. When considering two implementation approaches to achieve the TMDL allowable load for WRCAC member agricultural operators, the TP demand transforms into a TP supply sometime approaching 2020, recognizing this number might shift due to changes to subwatershed zone boundaries and CWAD applicability.

The first implementation approach (i.e.,existing and planned BMP implementation under the CWAD), coupled with agricultural acreage attrition and reductions in manure spreading, results in less demand and, by 2020, a projected TP surplus. This implementation scenario could generate feasibility for agricultural operator-to-agricultural operator trading within zones 2–6 to meet CWAD BMP requirements until 2020. The agricultural operator-level supply and demand depends on economic factors that would drive an agricultural operator's decision to implement a particular structural or non-structural BMP to comply with CWAD requirements, purchase TP credits, or install additional BMPs to generate credits. Economic factors include the cost of BMP installation and maintenance, trading transaction costs, as well as costs related to achieving the trading baseline prior to generating credits or meeting a minimum control level prior to purchasing credits. The CWAD will be BMP-based and will not require a specific load or percent reduction for TN and TP. During the initial phase of the CWAD Program, WRCAC intends to work with agricultural operators to quantify the estimated TN and TP load reductions from the BMPs implemented by land use type to comply with the CWAD. If the estimated TN and TP load reductions do not demonstrate adequate progress toward TMDL LAs and WLAs for agricultural sources, WRCAC will determine a TN and TP load reduction target that agricultural operators must achieve through BMP implementation when complying with the CWAD. A specific TN and TP load reduction target associated with BMP implementation under the CWAD will serve as a stronger driver for participation in trading than a general BMP implementation requirement. In the absence of a specific TN and TP load reduction target associated with CWAD requirements, it is challenging to assess how economic factors related to CWAD compliance would affect trading participation decisions and, by extension, operator-level supply and demand. A broader discussion of potential CWAD scenarios (discussed in a separate supplemental memo) explores how different baselines and approaches to the CWAD might affect supply and demand at the individual operator level.

Under the second implementation approach (i.e., existing and planned BMPs under the CWAD with in-lake remediation projects), the TP demand becomes a significant TP surplus in all years. The AgNMP states that if in-lake remediation projects are used, this approach would include an effectiveness assessment to determine if the projects are performing as anticipated or if additional BMP implementation is necessary. While the non-state/federal/tribal agricultural operators with aggregated agricultural land of 20 acres or greater would likely still be required to comply with CWAD requirements, it seems unlikely that water quality trading to meet CWAD requirements would be a necessity given the surplus of TP credits generated through the in-lake remediation projects. Agricultural operators would be less likely to incur the transaction costs of trading if the CWAD doesn't generate an economic incentive to do so.

The AgNMP doesn't calculate an allowable load for WRCAC member agricultural operators above Mystic Lake due to <1 percent of nutrient loads from these agricultural acres contributing to nutrient loads in Canyon Lake. There is no TMDL-based driver for nutrient trading above Mystic Lake. At this time, any trading above Mystic Lake would possibly be BMP-based driven by CWAD requirements at the individual agricultural operator level. Separate CWAD scenarios explore how different baselines and approaches to the CWAD might affect supply and demand at the individual operator level.

While not reflected in Table 15, non-state/federal/tribal agricultural operators with aggregated agricultural lands equaling less than 20 acres or operators with non-irrigated acres not used for livestock production (i.e., those not required to comply with CWAD requirements) could be eligible to participate in trading if they first met a baseline. Therefore, any tradeable credits generated by this particular group could serve as a reserve pool of credits.

2.2 State/Federal/Tribal Agricultural Operators

2.2.1 Description of the overall source category

Eight of the 4,344 agricultural operators presented in Table 2 are state/federal/tribal agricultural operators. Table 3 provides a summary of the 2010 land use data for agricultural land uses in the San Jacinto River watershed. Table 16 provides a condensed version of that table, presenting the acreage associated with state/federal/tribal agricultural operators for each land use.

Table 16. Summary of 2010 Land Use Data for Ag Land Uses (acres)

Land Use Code	Description	Watershed-Wide Total Acres[a]	State/Fed/Tribal (acres)	Non-State/Federal/Tribal (acres)
2110	Irrigated Agriculture	18,938	1	18,937
2120	Non-Irrigated Agriculture	15,537	1,187	14,351
2121	Vacant - Zoned Agriculture	12,132	916	11,215
2200	Orchards/Vineyards, Undifferentiated	232	-	232
2210	Citrus	3,255	119	3,137
2300	Nurseries, Undifferentiated	884		884
2310	Turf Farms	1,142	2	1,140
2320	Christmas Tree Farm	19		19
2412	Dairies - Non-Intensive	1,250		1,250
2413	Abandoned Dairies	57		57
2420	Other Livestock	293	141	152
2500	Poultry	268		268
2600	Other Agriculture, Undifferentiated	414	-	414
2610	Compost/Manure Piles	183		183
2620	Backyard Livestock	1,543	3	1,539
2700	Horses	2,744		2,744
Totals		58,888	2,368	56,520

a. Subtotals may not add to watershed totals due to rounding.

According to Table 16, state/federal/tribal agricultural operators cover approximately 2,368 acres in the San Jacinto River watershed or four percent of the total agricultural land use in the watershed. The majority of the state/federal/tribal acreage is vacant-zoned agriculture. Of the 2,368 state/federal/tribal acres summarized in table 15, 1,295 acres (55 percent) are federally-operated, 1,039 acres (44 percent) are state-operated, and 35 acres (1.5 percent) are tribe-operated. The major land use (858 acres) for federal land is vacant-zoned agriculture. For state-owned land, the major land use (1,000 acres) is non-irrigated agriculture (these are San Jacinto Wildlife Area acres leased for farming). For tribal land, the major land use (22 acres) is vacant-zoned agriculture.

2.2.2 Estimated existing loads from the source category

The estimated existing pollutant loads from state/federal/tribal agricultural operators are derived by calculating a per-acre load for each land use from the 2010 TMDL model update and applying the per-acre load to the 2010 acres for each land use developed by WRCAC. This is the same approach described above for non-state/federal/tribal agricultural operators.

Estimated total nitrogen loads

Table 6 presented the estimated TN loads by agricultural land use owner type and subwatershed zone for both non-state/federal/tribal agricultural operators (i.e., WRCAC loads) and state/federal/tribal agricultural operators.

Tables 17a and 17b provide a breakdown of the estimated TN load from state/federal/tribal agricultural operators by zone, with Table 17a focusing on TN loads entering Canyon Lake from all zones and Table 17b focusing on TN loads entering Mystic Lake from zones 7–9.

Table 17a. Estimated State/Federal/Tribal TN Loads (kg/yr) to Canyon Lake with AgNMP TN Load Factors by Zone (All Ag Land Uses)

Land Use Code	Description	Estimated TN Load with TN Load Factors Applied (kg/yr)									
		Total[a]	Subwatershed Zone								
			1	2	3	4	5	6	7	8	9
2110	Irrigated Agriculture	0.00003	-	-	-	-	-	-	0.00003	-	-
2120	Non-Irrigated Agriculture	0.04	-	-	-	-	-	-	0.03	0.01	-
2121	Vacant - Zoned Agriculture	1	-	-	-	1	-	-	0.0001	0.0001	0.003
2200	Orchards/Vineyards, Undifferentiated	-	-	-	-	-	-	-	-	-	-
2210	Citrus	0.005	-	-	-	-	-	-	-	0.005	-
2300	Nurseries, Undifferentiated	-	-	-	-	-	-	-	-	-	-
2310	Turf Farms	0.00001	-	-	-	-	-	-	0.00001	-	-
2320	Christmas Tree Farm	-	-	-	-	-	-	-	-	-	-
2412	Dairies - Non-Intensive	-	-	-	-	-	-	-	-	-	-
2413	Abandoned Dairies	-	-	-	-	-	-	-	-	-	-
2420	Other Livestock	0.02	-	-	-	-	-	-	-	-	0.02
2500	Poultry	-	-	-	-	-	-	-	-	-	-
2600	Other Agriculture, Undifferentiated	-	-	-	-	-	-	-	-	-	-
2610	Compost/Manure Piles	-	-	-	-	-	-	-	-	-	-
2620	Backyard Livestock	0.001	-	-	-	-	-	-	-	0.001	-
2700	Horses	-	-	-	-	-	-	-	-	-	-
Totals		1	-	-	-	1	-	-	0.03	0.01	0.03

a. Subwatershed zone subtotals may not add to watershed totals due to rounding.

According to Table 17a, state/federal/tribal agricultural sources located in zone 4 contribute the greatest nitrogen load (1 kg/yr) of any zone from vacant-zoned agriculture. Zones 7–9 contribute less than 0.01 percent of TN to Canyon Lake, but have the potential to affect the San Jacinto watershed downstream of Mystic Lake in overflow years.

While the nutrient loads from subwatershed zones 7–9 have minimal contributions to Canyon Lake, except in overflow years, the agricultural activities found in these subwatershed zones do contribute nutrient loads to Mystic Lake. Table 16b shows the estimated TN loads from state/federal/tribal agricultural land uses in zones 7–9. The load factors are estimated using information from the 2010 TMDL model. The TN load factor for zone 7 is 79.3 percent, meaning that approximately 79.3 percent of the TN from this subwatershed zone enters Mystic Lake. The TN load factor for zone 8 is 76.9 percent and is 76.7 percent for zone 9.

Table 17b. Estimated State/Federal/Tribal TN Loads (kg/yr) to Mystic Lake with TMDL Model TN Load Factors by Zone (All Ag Land Uses)

Land Use Code	Description	Estimated TN Load with TN Load Factors Applied (kg/yr)			
		Total[a]	Subwatershed Zone		
			7	8	9
2110	Irrigated Agriculture	0.2	0.2	-	-
2120	Non-Irrigated Agriculture	308	261	47	-
2121	Vacant - Zoned Agriculture	25	1	0.6	23
2200	Orchards/Vineyards, Undifferentiated	-	-	-	-
2210	Citrus	35	-	35	-
2300	Nurseries, Undifferentiated	-	-	-	-
2310	Turf Farms	0.07	0.07	-	-
2320	Christmas Tree Farm	-	-	-	-
2412	Dairies - Non-Intensive	-	-	-	-
2413	Abandoned Dairies	-	-	-	-
2420	Other Livestock	169	-	-	169
2500	Poultry	-	-	-	-
2600	Other Agriculture, Undifferentiated	-	-	-	-
2610	Compost/Manure Piles	-	-	-	-
2620	Backyard Livestock	6	-	6	-
2700	Horses	-	-	-	-
Totals		544	262	89	192

a. Subwatershed zone subtotals may not add to watershed totals due to rounding.

According to Table 17b, subwatershed zones 7–9 contribute approximately 544 kg/yr of TN to Mystic Lake. Zone 7 contributes the highest (48 percent) TN load to Mystic Lake, followed by zone 9 (35 percent) and zone 8 (16 percent). Within zones 7 and 8, non-irrigated agriculture contributes the highest TN load. Within zone 9, Other Livestock contributes the most TN to Mystic Lake. It is unlikely that state/federal/tribal land will transition to urban as non-state/federal/tribal agricultural land is expected to do.

Estimated phosphorus loads

Table 8 presented the TP loads by agricultural land use owner type and subwatershed zone for both non-state/federal/tribal agricultural operators (i.e., WRCAC loads) and state/federal/tribal agricultural operators.

Tables 18a and 18b provide a breakdown of the estimated TP load from all state/federal/tribal agricultural operators by zone, with Table 18a focusing on TP loads entering Canyon Lake from all zones and Table 18b focusing on TP loads from entering Mystic Lake from zones 7–9.

Table 18a provides a breakdown of the estimated TP load to Canyon Lake from state/federal/tribal agricultural operators by zone. Table 18a applies the loading factors (i.e., ratios of lake loading to watershed washoff) presented in the AgNMP specific to agricultural sources upstream of Mystic Lake (zones 7–9) and downstream of Mystic Lake to Canyon Lake (zones 2–6). According to the AgNMP, approximately 63 percent of TP washoff from agricultural sources downstream of Mystic Lake (zones 2–6) make it to Canyon Lake. Less than 0.01 percent of TP washoff from agricultural sources above Mystic Lake (zones 7–9) make it to Canyon Lake.

Table 18a. Estimated State/Federal/Tribal TP Loads (kg/yr) to Canyon Lake with AgNMP TP Load Factors by Zone (All Ag Land Uses)

Land Use Code	Description	Estimated TP Load to Canyon Lake with TP Load Factors Applied (kg/yr)									
		Total[a]	Subwatershed Zone								
			1	2	3	4	5	6	7	8	9
2110	Irrigated Agriculture	0.00002	-	-	-	-	-	-	0.00002	-	-
2120	Non-Irrigated Agriculture	0.03	-	-	-	-	-	-	0.02	0.004	-
2121	Vacant - Zoned Agriculture	0.5	-	-	-	0.5	-	-	0.0001	0.00003	0.001
2200	Orchards/Vineyards, Undifferentiated	-	-	-	-	-	-	-	-	-	-
2210	Citrus	0.003	-	-	-	-	-	-	-	0.003	-
2300	Nurseries, Undifferentiated	-	-	-	-	-	-	-	-	-	-
2310	Turf Farms	0.000004	-	-	-	-	-	-	0.000004	-	-
2320	Christmas Tree Farm	-	-	-	-	-	-	-	-	-	-
2412	Dairies - Non-Intensive	-	-	-	-	-	-	-	-	-	-
2413	Abandoned Dairies	-	-	-	-	-	-	-	-	-	-
2420	Other Livestock	0.005	-	-	-	-	-	-	-	-	0.005
2500	Poultry	-	-	-	-	-	-	-	-	-	-
2600	Other Agriculture, Undifferentiated	-	-	-	-	-	-	-	-	-	-
2610	Compost/Manure Piles	-	-	-	-	-	-	-	-	-	-
2620	Backyard Livestock	0.0002	-	-	-	-	-	-	-	0.0002	-
2700	Horses	-	-	-	-	-	-	-	-	-	-
Totals		0.5	-	-	-	0.5	-	-	0.02	0.01	0.01

a. Subwatershed zone subtotals may not add to watershed totals due to rounding.

According to Table 18a, the total TP to Canyon Lake from state/federal/tribal sources is minimal since the majority of the acres are in zones 7–9. State/federal/tribal agricultural sources located in zone 4 contribute the greatest TP load (.5 kg/yr) of any zone from vacant-zoned agriculture. Zones 7–9 contribute less than 0.01 percent of TP wash-off to Canyon Lake and have the potential to affect the San Jacinto watershed downstream of Mystic Lake in overflow years.

While the nutrient loads from subwatershed zones 7–9 have minimal contributions to Canyon Lake, except in overflow years, the agricultural activities found in these subwatershed zones contribute nutrient loads to Mystic Lake. Table 18b shows the estimated TP loads from state/federal/tribal agricultural land uses in zones 7–9. The load factors are estimated using information from the 2010 TMDL model. The TP load factor for zone 7 is 80.3 percent, meaning that approximately 80.3 percent of the TP from this subwatershed zone enters Mystic Lake. The TP load factor for zone 8 is 76.8 percent and is 76.4 percent for zone 9.

Table 18b. Estimated State/Federal/Tribal TP Loads to Mystic Lake with TMDL Model TP Load Factors by Zone (All Ag Land Uses)

Land Use Code	Description	Estimated TP Load with TP Load Factors Applied (kg/yr)			
		Total[a]	Subwatershed Zone		
			7	8	9
2110	Irrigated Agriculture	0.2	0.2	-	-
2120	Non-Irrigated Agriculture	200	169	30	-
2121	Vacant - Zoned Agriculture	9	0.4	0.2	9
2200	Orchards/Vineyards, Undifferentiated	-	-	-	-
2210	Citrus	27	-	27	-
2300	Nurseries, Undifferentiated	-	-	-	-
2310	Turf Farms	0.04	0.04	-	-
2320	Christmas Tree Farm	-	-	-	-
2412	Dairies - Non-Intensive	-	-	-	-
2413	Abandoned Dairies	-	-	-	-
2420	Other Livestock	38	-	-	38
2500	Poultry	-	-	-	-
2600	Other Agriculture, Undifferentiated	-	-	-	-
2610	Compost/Manure Piles	-	-	-	-
2620	Backyard Livestock	2	-	2	-
2700	Horses	-	-	-	-
Totals		275	170	59	46

a. Subwatershed zone subtotals may not add to watershed totals due to rounding.

According to Table 18b, subwatershed zones 7–9 contribute approximately 275 kg/yr of TP to Mystic Lake. Zone 7 contributes the highest (62 percent) TP load to Mystic Lake, followed by zone 8 (22 percent) and zone 9 (17 percent). Within zones 7 and 8, non-irrigated agriculture contributes the highest TP load. Within zone 9, Other Livestock contributes the most TP to Mystic Lake. It is unlikely that state/federal/tribal land will transition to urban as non-state/federal/tribal agricultural land is expected to do.

2.2.3 Discussion of baseline options

The assumption is that TMDL allocations and CWAD requirements apply to federal and state agricultural operators with aggregated agricultural land equaling 20 acres or more, but not tribal agricultural operators or federal and state agricultural operators with aggregated agricultural lands equaling less than 20 acres. Based on the land use data provided, it appears that no state, federal, or tribal entity owns, in aggregate, less than 20 acres of agricultural land. Table 19 presents the federal and state agricultural acreage that is subject to CWAD requirements.

Table 19. Federal and State Irrigated Agricultural Acreage (Aggregated 20 Acres or More) Subject to CWAD Requirements

Land Use Code	Description	Area (acres)								
		Total[a]	Subwatershed Zone							
			2	3	4	5	6	7	8	9
2110	Irrigated Agriculture	0.9	-	-	-	-	-	0.9	-	-
2200	Orchards/Vineyards, Undifferentiated	0	-	-	-	-	-	-	-	-
2210	Citrus	105	-	-	-	-	-	-	105	-
2300	Nurseries, Undifferentiated	0	-	-	-	-	-	-	-	-
2420	Other Livestock	141	-	-	-	-	-	-	-	141
2500	Poultry	0	-	-	-	-	-	-	-	-
2700	Horses	0	-	-	-	-	-	-	-	-
Totals		247	0	0	0	0	0	0.9	105	141

a. Subwatershed zone subtotals may not add to watershed totals due to rounding.

According to Table 19, most of the acreage subject to CWAD requirements is other livestock located in subwatershed zone 9 and citrus located in subwatershed zone 8. The livestock acres are cattle grazing land owned by the BLM. The citrus acres are assumed to be federally-owned acres leased to the Soboba Indian Reservation for citrus production and are assumed to be subject to CWAD requirements.

It is also assumed that baseline options for federal and state agricultural operators are the same as those for non-state/federal/tribal agricultural operators discussed in the previous section. Potential baselines are 1) the load allocation set for agricultural sources under the TMDL (see Tables 9 and 10) and 2) the CWAD Program requirements. Agricultural operators interested in purchasing water quality credits to meet the baseline would have to first meet a minimum control level. Agricultural operators interested in selling water quality credits would first have to meet the baseline.

The tribal agricultural lands owned by the Soboba Band of Luiseño Indians are not subject to the CWAD; however, if the tribe would like to participate in trading, agricultural BMPs like those used to comply with CWAD requirements could be implemented to establish eligibility in trading.

Nutrient reductions generated by the implementation of additional BMPs installed after meeting eligibility requirements could then be considered tradeable credits.

2.2.4 Estimates of supply and demand

Using some of the assumptions made in the AgNMP for non-state/federal/tribal agricultural operators in zones 2–6, it is possible to get a general sense of the supply and demand at a watershed level for state/federal/tribal agricultural operators.

To determine the existing/estimated load, the total acreage for state/federal/tribal agricultural sources (2,368 acres) is taken from Table 16. Using this acreage, it is possible to apply the TP and TN per acre load allocations provided in Table 3-1 of the AgNMP, which is presented below as Table 20.

Table 20. Load and Wasteload Allocations for Agriculture and CAFO Nutrient Sources in Canyon Lake Watershed (WRCAC 2013)

Source	Nutrient	Allocation (kg/yr)	Unit	Allocation (kg/ac/yr)
Agriculture	TP	1,183	per acre[a]	0.021
	TN	7,583	per acre[a]	0.136
CAFO	TP	132	per cow[b]	0.002
	TN	1,908	per cow[b]	0.026

a. TMDL developed based on land use estimate of ~56,000 acres of agricultural land in Canyon Lake watershed
b. TMDL developed when cow population in the Canyon Lake watershed was ~72,000
Note: Lake Elsinore nutrient TMDL includes a load allocation for overflows from Canyon Lake to Lake Elsinore, which is partially from agriculture and CAFO sources within the Canyon Lake watershed.

For 2,368 acres, the estimated allowable load for state/federal/tribal agricultural operators would be 50 kg/yr TP and 322 kg/yr TN.

Table 21 provides an estimate of supply and demand relative to Canyon Lake for state/federal/tribal agricultural operators using the same allowable loads calculation approach used in the AgNMP. It is assumed that state/federal/tribal agricultural acreage will remain constant over time and will not experience the attrition that is expected for WRCAC agricultural lands. If anything, it is possible that federal agricultural acreage could increase slightly over time (by up to approximately 5 percent). It is also assumed that the recent revision to subwatershed boundaries does not impact state/federal/tribal lands.

Table 21. Estimated Supply and Demand (Relative to Canyon Lake) for State/Federal/Tribal Agricultural Sources with TMDL-Derived Baseline

Nutrient	Loading (kg/yr)	2010	2015	2020
TP	Existing / Estimated Load (from Table 17a)	.5	Analysis of changing acreage for these time steps not available and outside the scope of this effort, although federal/state/tribal agricultural acreage is not expected to change significantly.	
	Baseline (Allowable Load derived from TMDL LA)	50		
	Required Reduction (Demand) / (Supply)	49.5		
TN	Existing / Estimated Load (from Table 16a)	1		
	Baseline (Allowable Load derived from TMDL LA)	322		
	Required Reduction (Demand) / (Supply)	321		

According to Table 21, using the TMDL derived baseline calculated in a manner similar to the allowable load for WRCAC member agricultural operators in the AgNMP, state/federal/tribal agricultural sources have a supply of both TP and TN. Table 22 presents a summary of the supply and demand estimates for state/federal/tribal agricultural operators.

Table 22. Summary of Supply and Demand Estimate for State/Federal/Tribal Agricultural Operators

Type of Source	Applicable Zones[a]	Driver/ Implementation Approach	Estimate of (Supply) and Demand (kg/yr)							
			TN				TP			
			2003	2010	2015	2020	2003	2010	2015	2020
State/ federal/ tribal Agricultural Operators	2–6 (below Mystic Lake to Canyon Lake)	LA achieved through CWAD (BMP-based)	NA	321	NA	NA	NA	49.5	NA	NA
	7–9 (above Mystic Lake)	CWAD (BMP-based)	Estimated TN load to Mystic Lake: 544 kg/yr Estimated TP load to Mystic Lake: 275 kg/yr Trading above Mystic Lake would be triggered by CWAD requirements if WRCAC determined a need for a quantifiable load reduction from these sources to help with TMDL implementation. No subwatershed zone demand for nutrient reductions from sources above Mystic Lake at this time; could possibly exist at agricultural operator level to meet CWAD BMP requirements.							

Based on the findings in Table 22, state/federal/tribal agricultural operators located in zones 2–6 have a supply of TN and TP credits. The assumption is that, over time, supply would either remain the same or increase over time due to possible addition of federal agricultural acreage. The surplus TN reductions are not needed by other agricultural operators in the San Jacinto River watershed, but other types of sources might need this surplus reduction to meet their TMDL TN allocations. The surplus TP reductions are needed by other agricultural operators at the subwatershed level and could be tradeable after meeting a baseline requirement.

2.3 WRCAC CAFOs (Dairies)

2.3.1 Description of the overall source category

Dairies in the San Jacinto River watershed are subject to permit requirements that restrict discharges from dairy production areas and require nutrient management plans and specific BMPs for dairy land application areas. The San Jacinto dairies are point source dischargers as defined under the Clean Water Act; however, the Act exempts certain agricultural stormwater discharges from their land application areas from permit requirements. Those discharges of agricultural stormwater, therefore, are treated as nonpoint sources for purposes of this analysis.

The dairies are treated as point sources under the TMDL and their discharge permit includes specific requirements for dairies to meet the TMDL wasteload allocations for the watershed. The TMDL allows for adaptive management and ongoing evaluation of control measures that can be developed to implement the TMDL required targets. This approach would appear to allow for dairies to participate in a trading program to meet water quality-based TMDL requirements in their permits. However, the AgNMP indicates that no additional load reduction is required from CAFO sources based on implementation of Engineered Waste Management Plans that prevent production area discharges to the watershed under most circumstances. For land application areas, a dairy that meets its permit requirements and implements additional BMPs to further reduce the nutrient load in its nonpoint source agricultural stormwater discharges could participate in trading as a credit seller.

As of January 2011, 23 dairies were operating under the waste discharge permit (then Order No. R8-2007-0001) in the San Jacinto River watershed. Annual report data from 2010, available for 22 of those dairies, indicated that the dairies had a combined total of 29,314 mature dairy cows and 15,609 heifers and calves. Most of the dairies and their associated land application areas (designated as “Dairies – Non-Intensive”) are located in zone 7 and therefore contribute nutrient loads under most scenarios only to Mystic Lake. This analysis does not anticipate a scenario under which trading among dairies and agricultural operators above Mystic Lake would be beneficial. According to the AgNMP, three dairies are located downstream of Mystic Lake in zone 3. Those three dairies account for 73 acres of “non-intensive” dairy land use in zone 3. All of the dairies are privately owned (i.e., none are state/federal/tribal).

2.3.2 Estimated existing loads from the source category

In 2010, there were 1,250 acres of “Dairies – Non-Intensive” land use (generally dairy land application sites). Since the majority of dairies are located in subwatershed zone 7, the majority of the nutrient load from dairies is from zone 7. But, as stated in the AgNMP, <1 percent of TN and TP wash-off from agricultural sources affect Canyon Lake. Therefore, those loads will not have a significant impact on Canyon Lake, with the exception of Mystic Lake overflow years. Table 23 presents estimated loads for dairies in zones 2–6 to Canyon Lake. Note that the estimated CAFO nonpoint source loads in Table 23 do not account for recent revisions to the subwatershed zone boundaries so that they can be compared to the total dairy load calculated in the AgNMP.

Table 23. Estimated Annual Load from Dairies in Zones 2–6 to Canyon Lake

Nutrient Source	Nutrient Load (kg/year)	
	TN	TP
Dairies (Intensive and non-intensive land uses), total load[a]	183	70
Dairies(Intensive and non-intensive land uses), load delivered to Canyon Lake[b]	119	44
Dairies – non-intensive land use, load delivered to Canyon Lake[c]	93	20
Percent of total dairy load to Canyon Lake from dairies – non-intensive	78%	45%

a. From Table 3-3 of the AgNMP

b. Calculated by applying Canyon Lake wash off rates: 65 percent for TN and 63 percent for TP

c. Represents the dairy nonpoint source load, calculated using the per-acre load-based estimation methodology described above for other agricultural land uses

2.3.3 Discussion of baseline options

The baseline options for CAFOs include the TMDL WLA assigned to CAFOs and the NPDES permit (Order No. R8-2013-0001) that applies to dairies and related facilities.

TMDL baseline considerations

Tables 24 and 25 present the TMDL WLAs assigned to CAFOs for Canyon Lake and Lake Elsinore.

Table 24. Canyon Lake Nitrogen and Phosphorus Wasteload and Load Allocations (SARWQCB 2011)

Canyon Lake Nutrient TMDL	Final Load Allocation (kg/yr)[a]	
	TP	TN
Total TMDL	**8,691**	**37,735**
Total WLA	***487***	***6,248***
Supplemental water	48	366
Urban	306	3,974
CAFO	132	1,908

a. TMDL and allocations specified as a 10-year running average

Table 25. Lake Elsinore Nitrogen and Phosphorus Wasteload and Load Allocations (SARWQCB 2011)

Lake Elsinore Nutrient TMDL	Final Load Allocation (kg/yr)[a]	
	TP	TN
Total TMDL	**28,584**	**239,025**
Total WLA	3,845	7,791
Supplemental water	3,721	7,442
Urban	124	349
CAFO	0	0

a. TMDL and allocations specified as a 10-year running average

All San Jacinto dairies are enrolled under a discharge permit that includes requirements to meet the TMDL WLA for CAFOs. According to the permit, "The Regional Board recognizes that the goal of the TMDL is to achieve the numeric targets in the two lakes even if the numeric wasteload allocations… are not met. If this goal is achieved through in-lake control measures or other means, then the beneficial uses of the lakes will be restored." Accordingly, the water quality-based requirements in the permit are largely BMP-based and do not establish firm numeric effluent limitations that could be used to set trading baselines. Consistent with the AgNMP, this analysis assumes that compliance with the permit, which is required of all dairies, constitutes compliance with the TMDL.

NPDES permit baseline considerations

An existing NPDES permit applies to dairies and related facilities (heifer ranches and calf nurseries) of all sizes (i.e., not limited to facilities that meet the size thresholds in the federal CAFO definition) in the San Jacinto River watershed (Order No. R8-2013-0001) (SARWQCB 2013). The permit establishes TBELs, which typically constitute the minimum control level that a discharger must attain in order to participate in trading as a buyer.

The TBELs for CAFOs under Order No. R8-2013-0001 are design standards and BMPs that apply to the production areas and land application areas. For CAFO production areas, the permit requires implementation of an Engineered Waste Management Plan (EWMP) that describes how the CAFO is designed, constructed, operated, and maintained to contain manure and all wastewater generated as a part of normal operations, as runoff from manured areas resulting from normal precipitation events, and as the result of runoff from a 25-year, 24-hour storm event. Implementation of the EWMP and several specific operation and maintenance requirements constitutes compliance with the TBELs for production areas. The permit allows the discharge of pollutants resulting from precipitation from a production area that is in compliance with these requirements. According to the AgNMP, implementation of the EWMPs will ensure that the dairies below Mystic Lake will not discharge except during extreme storm events, when loads are likely to pass through both Canyon Lake and Lake Elsinore.

For land application sites at permitted CAFOs, the permit requires implementation of a nutrient management plan (NMP) that is designed to minimize nutrient losses from the field and that must be approved by the SARWQCB. Federal NPDES regulations (40 CFR 122.23(e)) clarifies that precipitation-related runoff from land application sites where such an nutrient management practices have been implemented is considered agricultural stormwater, which is a nonpoint source, exempt from NPDES permit requirements under the Clean Water Act. As described above, dairies could generate credits by meeting their permit requirements and implementing additional BMPs to further reduce their allowable nonpoint source nutrient loads.

2.3.4 Estimates of supply and demand

The AgNMP has provided a gap analysis of CAFO sources below Mystic Lake to Canyon Lake (zones 2–6). The information provided by the AgNMP is helpful in understanding potential supply and demand in this portion of the watershed for this subset of CAFOs.

The AgNMP gap analysis for CAFOs states:

> *For CAFOs in zones 2–6, there are only three existing WRCAC member CAFO operators, all of which have implemented an Engineered Waste Management Plan (EWMP) to comply with the CAFO Permit. The Permit requires retention of the 25-year storm event on-site and therefore no loading of nutrients from these areas will occur, except during extreme storm events, when loads are likely to pass through both Canyon Lake and Lake Elsinore. The CAFO Permit includes ongoing inspection of these properties to ensure compliance with the Permit and hence the TMDL. Thus, there is no additional watershed load reduction required from CAFO sources in the Canyon Lake watershed.*

Based on the AgNMP analysis, CAFOs located in zones 2–6 will not have a watershed-wide demand for TP or TN credits.

Therefore, any implementation activity that CAFOs might undertake at land application sites above and beyond permit requirements could generate nutrient reduction credits that, if quantified, could be eligible for trading with other sources.

A continued supply and demand analysis is necessary to consider the estimated loads and allowable loads from CAFOs located in zone 7. While less than 0.01 percent of the nutrient contributions from zone 7 reach Canyon Lake, there are contributions associated with the overflow from Mystic Lake that occurs every 10–12 years. Therefore, it could be feasible to consider their overflow contributions to provide them with the opportunity to participate in trading. This is an issue that will require further analysis in the WQT program development phase, specific to trade ratios, as well as credit generation and timing issues.

Supply and demand estimates at the individual CAFO level are dependent on the TBEL requirements under the NPDES permit as well as whether the SARWQCB will allow dairies to use their groundwater nitrate and TDS offset requirements to generate credits. The permit does not include numeric water quality-based effluent limits that apply to the allowable production area discharges from CAFOs since the compliance dates for the TMDL WLAs are after the permit expiration date. However, it is anticipated that the WLAs will be reflected as water quality-based effluent limits in future iterations of the permit.

An individual dairy might generate credits by installing technologies to reduce its nutrient load beyond that required to meet the water quality-based effluent limits. However, there are several regulatory and permit elements that complicate identification of supply and demand at permitted dairies in the San Jacinto River watershed. First, as discussed above, agricultural stormwater discharges – in this case precipitation-related runoff from land application sites where an NMP has been implemented – are exempt from NPDES permitting requirements under the Clean Water Act. This means that water quality-based effluent limits (e.g., to implement TMDL WLAs) cannot be applied to those discharges. Essentially, land application sites at dairies are both point sources (relative to discharges subject to the permit's technology-based requirements) and non-point sources (relative to exempt agricultural stormwater discharges). Therefore, after application of the approved NMP, these areas might be treated as agricultural (non-dairy) sources for purposes of trading. Quantification of the available supply of credits requires estimating an individual dairy's nutrient load after implementation of its NMP as well as the expected nutrient load reductions from implementation of further BMPs. This could raise regulatory questions about the adequacy of the NMP since the applicable effluent limitation guidelines referenced in the permit (40 CFR 412.4) require development of NMPs that minimize nitrogen and phosphorus movement to surface waters.

Second, the permit also includes land discharge specifications that require dairies to offset their entire discharged nitrate and TDS load if they overlie groundwater management zones that lack assimilative capacity for these constituents. This is a state (non-NPDES) requirement for protection of groundwater. All dairies in the San Jacinto River watershed overlie groundwater management zones lacking assimilative capacity. This requirement applies to allowable discharges from the production area as well as agricultural stormwater from land application areas. The interaction between this offset requirement and the TMDL allocations that apply to dairies is unclear. For example, if a dairy implements practices to offset the nonpoint source portion of its TDS or nitrate load for its land application areas, can those practices generate credits to meet TMDL agricultural load allocations? What portion of nitrate and TDS applied under an approved NMP must be offset and could a dairy purchase credits to satisfy that requirement? These questions must be resolved in order to quantify an individual dairy's credit supply or demand.

3. Summary of Supply and Demand by Source Type

As discussed in previous sections, estimates of TN and TP supply and demand vary among agricultural sources, due to factors such as regulatory driver and associated baselines, geographic location, and implementation approaches. Table 26 provides a summary of supply and demand estimates and considerations for each type of source.

According to Table 26, demand exists for WRCAC member agricultural sources in zones 2–6 for TP during 2015-2020, before attrition of agricultural acreage creates a surplus of TP load for these sources. Implementation of watershed BMPs through the CWAD and reduction in manure application reduce the TP demand until 2020. Implementation of in-lake remediation projects in Canyon Lake create a significant surplus of TP that would be available for trading with other sources. In addition, state/federal/tribal agricultural sources are estimated to have a supply of both TN and TP, because the estimated existing load is significantly smaller than the estimated allowable load calculated using a similar approach to the AgNMP.

In zones 7–9, the TMDL LA isn't a driving factor for trading due to the 0.01 percent loading factors for TP and TN for sources above Mystic Lake. CWAD requirements, however, might generate an interest in a form of trading above Mystic Lake that focuses on BMP offsets in the form of implementation credits and not trading to achieve a water quality-based goal.

Table 26. Summary of Supply and Demand Estimates for all Potential Agricultural Sources in the San Jacinto River Watershed

Type of Source	Applicable Zones[a]	Potential Baseline	Driver/Implementation Approach	Estimate of (Supply) and Demand (kg/yr)[a]							
				TN				TP			
				2003	2007	2015	2020	2003	2007	2015	2020
Non-state/federal/tribal (WRCAC member) Agricultural Operators	2 – 6 (below Mystic Lake to Canyon Lake)	% reduction based on TMDL LA allowable load (analyzed in AgBMP) or BMPs specified by CWAD	TMDL LA allowable load	3,474	(499)	(993)	(927)	3,230	348	292	231
			Remaining load or surplus achieved through CWAD (BMP-based)[b] and reduction of manure spreading	3,474	(643)	(1,855)	(2,143)	NA	264	56	(75)
			Surplus achieved through CWAD (BMP-based)[b] and reduction of manure spreading with in-lake remediation projects	3,474	(643)	(1,855)	(2,143)	NA	(3,345)	(3,553)	(3,684)
	7-9 (above Mystic Lake)	% reduction based on TMDL LA allowable load (not analyzed in AgNMP) or BMPs specified by CWAD	CWAD (BMP-based)	Estimated TN load to Mystic Lake: 7,599 kg/yr Estimated TP load to Mystic Lake: 3,415 kg/yr Trading above Mystic Lake would be triggered by CWAD requirements if WRCAC determined a need for a quantifiable load reduction from these sources to help with TMDL implementation. There is no subwatershed zone demand for nutrient reductions from sources above Mystic Lake at this time; demand could possibly exist at agricultural operator level to meet CWAD BMP requirements.							
State/ federal/tribal Agricultural Operators	2 – 6 (below Mystic Lake to Canyon Lake)	% reduction based on TMDL LA allowable load (not analyzed in AgNMP) or BMPs specified by CWAD	Surplus achieved through CWAD (BMP-based)[b]		(321)	(321)	(321)		(49.5)	(49.5)	(49.5)
	7-9 (above Mystic Lake)		CWAD (BMP-based)	Estimated TN load to Mystic Lake: 544 kg/yr Estimated TP load to Mystic Lake: 275 kg/yr Trading above Mystic Lake would be triggered by CWAD requirements if WRCAC determined a need for a quantifiable load reduction from these sources to help with TMDL implementation. There is no subwatershed zone demand for nutrient reductions from sources above Mystic Lake at this time; demand could possibly exist at agricultural operator level to meet CWAD BMP requirements.							

Type of Source	Applicable Zones[a]	Potential Baseline	Driver/Implementation Approach	Estimate of (Supply) and Demand (kg/yr)[a]							
				TN				TP			
				2003	2007	2015	2020	2003	2007	2015	2020
WRCAC CAFOs (Dairies)	3, 4	Order No. R8-2013-0001 (CAFO permit)		No additional TN/TP reduction required; TN/TP supply could be generated by individual dairies that choose to implement controls above and beyond permit requirements. Could potentially supply up to 93 kg/yr TN and 20 kg/yr TP (estimated existing nonpoint source load that could be controlled through implementation of additional BMPs).							

a. Data do not reflect recent revisions to subwatershed zone boundaries, which are anticipated to increase estimated allowable loads and load reductions in subwatershed zones 2–6 (net increase including a decrease in zone 4 acreage) and decrease allowable loads and load reductions in zones 7–9 (net decrease in zone 7 after shifting acres from zone 4 and into zone 6).

b. Supply and demand estimates shown here are from the AgNMP, which anticipated CWAD applicability to irrigated and non-irrigated agricultural land uses. If the CWAD applies only to irrigated agricultural land, nutrient reductions from implementation of CWAD BMPs will be lower than the estimates shown.

4. Conclusions

There is limited potential for agricultural source-to-agricultural source water quality trading in the San Jacinto River watershed, based on estimates of supply and demand linked to the 2013 AgNMP analysis. The greatest demand for this type of trading would exist for WRCAC member agricultural sources to obtain TP reduction credits within zones 2–6 to meet the TMDL allowable load before 2020 in the absence of in-lake remediation projects in Canyon Lake. Estimates show that state/federal/tribal agricultural sources could supply a portion of the WRCAC agricultural operator TP demand. Whether the dairies in zone 3 could meet the remaining demand depends on SARWQCB determinations of whether BMPs would be considered to go beyond permit requirements and whether salt offset measures could be used to generate credits. The surplus TN load reductions available now and the eventual TP load surplus generated by WRCAC member agricultural sources in zones 2–6 could be available to other non-agricultural sources within the San Jacinto River watershed that might have a TMDL WLA-driven demand (e.g., urban stormwater sources).

Other factors at the individual operator-level can affect supply and demand estimates, such as BMP costs and transaction costs. The application of other trade ratios, the subject of Technical Memo #4, can also affect supply and demand, as well as baseline requirements. The separate CWAD scenario analysis looks more closely at how these factors might influence individual operator-level supply and demand estimates based on current understanding of the potential CWAD requirements.

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Appendix A to Technical Memo #3

September 2013 Revised Subwatershed Zone Boundaries

In September 2013, WRCAC undertook an effort to correct the subwatershed zone boundaries for the San Jacinto River watershed to account for a better understanding of the hydrology of subwatershed zones and the associated drainage of the basins to either Mystic Lake or Canyon Lake. During the TMDL development process, the assumption was made that the areas then identified as subwatershed zones 7–9 all drained to Mystic Lake. However, the recent analysis demonstrates that portions of those areas drain to Canyon Lake. The updated analysis provided boundary revisions which modified some of the acreage and associated nutrient loads associated with subwatershed zones.

As described throughout Technical Memo #3, the boundary revisions, and associated changes to subwatershed agricultural acreages and nutrient loads were incorporated to the extent possible into the supply and demand analysis. However, much of the work depended on previous analyses reported in WRCAC's AgNMP, which was completed before the revision of the subwatershed zone boundaries. The maps and table below are provided to assist the reader in visualizing the effect of the subwatershed boundary revisions and the two different sets of acreage data that support the supply and demand and AgNMP analyses.

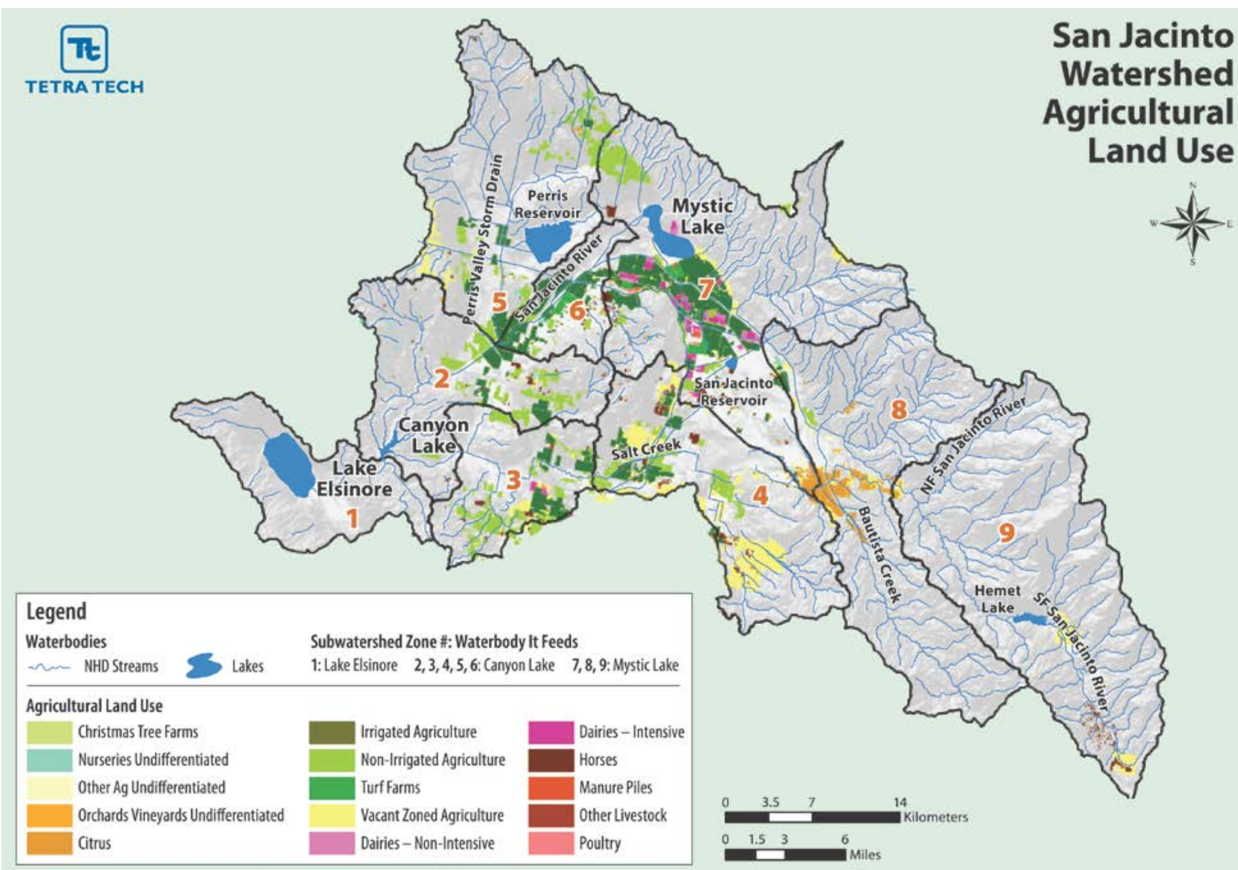

Figure 1. Map of agricultural land uses and original (2010) subwatershed boundaries used for the AgNMP analyses

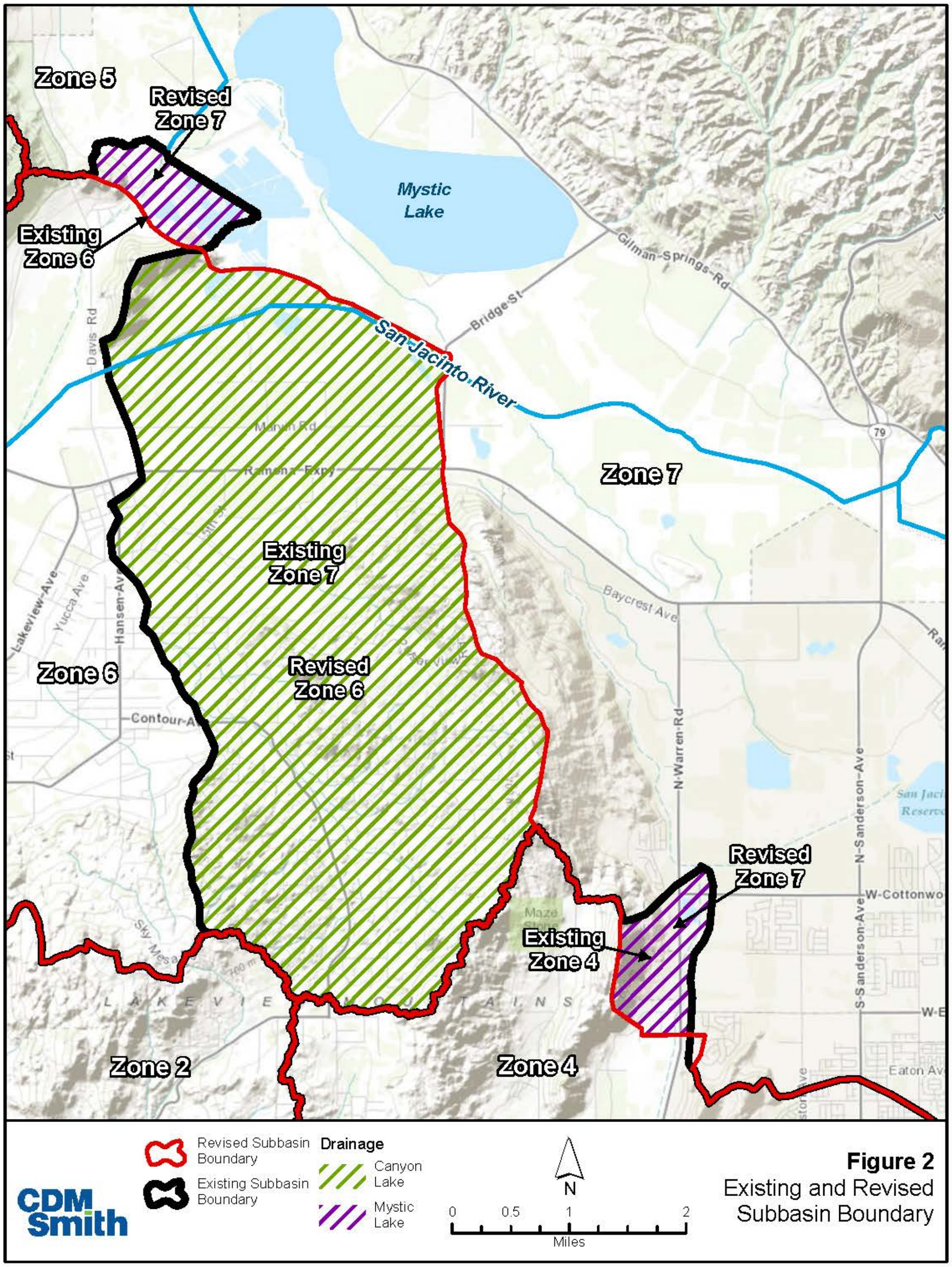

Figure 2. Detail map showing 2013 revised boundaries for Subwatershed Zones 4, 6, and 7 in the area south of Mystic Lake

Table 1. Agricultural acres affected by 2013 subwatershed boundary revisions

WRCAC Land Use Code	Corrected acreage[a]		
	Zone 7 to Zone 6 (Mystic Lake to San Jacinto River/ Canyon Lake)	Zone 4 to Zone 7 (Salt Creek to Mystic Lake)	Net Change in Ag Acreage Moved to Canyon Lake Watershed
2110	2,249	8	2,241
2120	188	28	161
2121	62	193	-131
2200	24	0	24
2300	46	0	46
2310	118	0	118
2412	179	15	164
2420	13	4	9
2500	91	0	91
2600	59	11	48
2610	37	0	37
2620	66	1	66
2700	171	26	145
Total	3,303	286	3,019

a. No agricultural acreage moved from Zone 6 to Zone 7 as a result of the subwatershed boundary revisions.

CWAD Scenarios: Potential Effects of the CWAD Requirements on Supply and Demand

Supplemental Analysis to Technical Memorandum #3

October 24, 2013

The analysis of total nitrogen (TN) and total phosphorus (TP) supply and demand presented in Technical Memo #3 focuses on the subwatershed zone scale within the San Jacinto River watershed. As discussed in Technical Memo #3, requirements of the Conditional Waiver for Agricultural Discharges (CWAD) for individual agricultural operators will influence supply and demand within and among subwatershed zones. As a result, it is important to consider how the CWAD requirements will potentially influence individual agricultural operators' decisions to participate in trading as a means to achieve the Canyon Lake/Lake Elsinore TMDL allocations. This analysis is intended to supplement the discussion of supply and demand in Technical Memo #3.

Summary of Agricultural Acreage Subject to CWAD Requirements

Based upon the best information currently available, Technical Memo #3 and the CWAD Scenarios assume that the CWAD will apply to:

- Subwatershed zones 2–9 (no agricultural acreage found in zone 1);
- Irrigated agriculture (includes irrigated row crops as well as orchards/vineyards, citrus, and nurseries);
- Poultry, horse, and other livestock operations (does not include dairies, which are regulated under waste discharge permits);
- Parcels owned by persons with, in aggregate, 20 or more acres of agricultural land use;
- Private, state, or federally-owned land (i.e., no tribal lands), and;
- Irrigated agriculture and livestock parcels owned by persons with, in aggregate, less than 20 acres of agricultural land use, if determined to cause or contribute to water quality impairment.

Table 1 shows the total amount of non-state/federal/tribal agricultural acreage subject to CWAD requirements by subwatershed zone.

Table 1. Non-federal/state/tribal agricultural acreage in the San Jacinto River watershed subject to CWAD requirements as defined in July 2013 by subwatershed zone

Land Use Code	Description	Area (acres)								
		Total	Subwatershed Zone							
			2	3	4	5	6	7	8	9
2110	Irrigated Agriculture	17,276	1,361	1,826	1,620	1,224	5,176	5,860	209	-
2200	Orchards/Vineyards, Undifferentiated	85	21	0.1	0.1	11	13	24	17	-
2210	Citrus	2,799	-	3	98	54	-	472	2,111	61
2300	Nurseries, Undifferentiated	305	10	26	20	81	55	30	84	-
2420	Other Livestock	34	-	26	1	1	-	0	-	7
2500	Poultry	237	-	40	12	-	131	54	-	-
2700	Horses	1,043	122	74	272	4	75	327	-	170
Totals		21,780	1,514	1,995	2,022	1,374	5,449	6,767	2,420	237

According to Table 1, subwatershed zones 6 and 7 contain the most acreage subject to CWAD requirements. The two most significant categories of agricultural activity subject to CWAD requirements are irrigated agriculture and citrus. Among the livestock land uses, the horses category has the most acreage subject to CWAD requirements. Zones 2–6 (below Mystic Lake) have approximately 12,355 acres subject to CWAD requirements and zones 7–9 (above Mystic Lake) have approximately 9,425 acres subject to CWAD requirements.

When compared to the total non-state/federal/tribal acreage in Table 4 of Technical Memo #3, 39 percent of the total non-state/federal/tribal agricultural acreage is subject to CWAD requirements. That translates to 32 percent of the non-state/federal/tribal agricultural acreage in subwatershed zones 2–6 and 51 percent of the non-state/federal/tribal acreage in zones 7–9. This means that the CWAD requirements will serve as a driver for trading (e.g., create a demand for water quality credits) for more than one-third of the total non-state/federal/tribal acreage. Best management practice (BMP) implementation on the remaining non-state/federal/tribal agricultural acreage is voluntary.

Table 2 presents the federal and state agricultural acreage that is subject to CWAD requirements.

Table 2. Federal and state irrigated agricultural acreage (more than 20 aggregated acres) subject to CWAD requirements

Land Use Code	Description	Area (acres)								
		Total	Subwatershed Zone							
			2	3	4	5	6	7	8	9
2110	Irrigated Agriculture	0.9	-	-	-	-	-	0.9	-	-
2200	Orchards/Vineyards, Undifferentiated	0	-	-	-	-	-	-	-	-
2210	Citrus	105	-	-	-	-	-	-	105	-
2300	Nurseries, Undifferentiated	0	-	-	-	-	-	-	-	-
2420	Other Livestock	141	-	-	-	-	-	-	-	141
2500	Poultry	0	-	-	-	-	-	-	-	-
2700	Horses	0	-	-	-	-	-	-	-	-
Totals		247	0	0	0	0	0	0.9	105	141

According to Table 2, all of the state and federal agricultural lands subject to the CWAD are in zones 7–9 (above Mystic Lake). Most of the acreage subject to CWAD requirements is other livestock located in zone 9; this is cattle grazing land operated by the BLM. The citrus acres in subwatershed zone 8 are assumed to be federally-owned acres leased to the Soboba Indian Reservation for citrus production and are assumed to be subject to CWAD requirements. This acreage translates to 10 percent of the total federal/state/tribal acreage and 11 percent of the federal/state/tribal acreage in zones 7–9 (above Mystic Lake).

Summary of Potential CWAD Requirements

As of the time of this document, the CWAD requirements are still under development. However, several conversations with the Regional Board, as well as WRCAC, have provided insights as to the potential CWAD requirements. Based on these conversations, the CWAD will potentially include the following requirements:

- Implementation of filter strip/field border along waterways and associated easements to address water quality concerns
- Implementation of other accepted structural and non-structural agricultural BMPs to address nitrogen and phosphorus loads.
    - ✓ The CWAD will not specify these BMPs, but may include a menu of BMPs from which operators may select.
    - ✓ Recognition of BMPs that are in place at the time of TMDL approval are eligible to count toward CWAD compliance.

While the CWAD will not prescribe BMPs, other than potentially filter strips/field borders where applicable, the AgNMP identifies several potential BMPs that agricultural operators might use to comply with CWAD requirements and provides the nutrient reduction efficiencies associated with those BMPs. Note, however, that it is not assumed that the CWAD will limit agricultural operators to the BMPs identified in the AgNMP. The BMPs included in the AgNMP are:

- Incorporated manure
- Vegetated buffers
- Polyacrylamide (PAM) application
- Sudan Grass (S. Grass) and Disc Plow (D. Plow)
- Spread Manure
- Cover Crop
- Mulch
- D. Plow

Figure 1 (shown as Figure 3-6 in the AgNMP) provides the percent change from control due to BMP for TN and TP for each of the BMPs listed above.

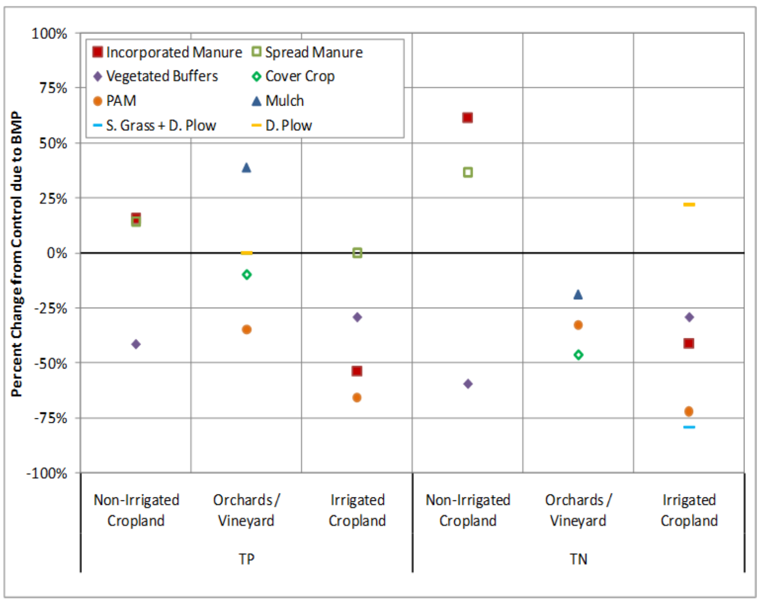

Figure 1 Effectiveness of Agricultural BMPs for TP and TN Loading Rate Reduction (data from UCR, 2011) (Figure 3-6 from the AgNMP).

Figure 1 shows non-irrigated cropland; this category of agriculture will not be subject to CWAD requirements based on eligibility discussions with the Regional Board in July 2013. It is assumed that agricultural operators required to comply with the CWAD will be able to select from the BMPs presented in Figure 1, although they may not be limited to implementing this list of BMPs.

Overview of CWAD Scenarios

With an understanding of the agricultural acreage subject to CWAD requirements and the potential nature of the requirements, it is possible to examine how the CWAD might influence water quality trading through supply and demand by considering different CWAD scenarios.

The CWAD scenarios are intended to serve as the basis for discussion and illuminate the effects of the CWAD as a driver for trading. Because insufficient real-world data exist at the individual agricultural operator level for the purposes of this analysis, the scenarios are based on available information coupled with specific assumptions and caveats. The actual numbers used in each scenario are intended to highlight the potential effects of the CWAD on trading and should not be used to drive any management decisions at this point in time. However, with improved data in the future and permit language to use as a foundation, WRCAC could use a similar approach to help refine trading considerations and water quality trading program development.

The three CWAD scenarios presented in this document are as follows:

- Scenario 1: Compliance with initial CWAD requirements.
- Scenario 2: Compliance with CWAD requirements to meet a quantified nutrient load reduction target based on initial CWAD compliance analysis.
- Scenario 3: BMP Implementation on CWAD-Exempt Non-State/Federal/Tribal Agricultural Acreage

Each of these scenarios and the potential effect on supply and demand are presented in more detail below. It is important to note that the analyses and examples provided for Scenarios 2 and 3 are based on data provided by the AgNMP, which did not project BMPs for CWAD compliance on the livestock land uses that are now anticipated to be subject to CWAD requirements. In addition, while some of the BMPs identified in the AgNMP may be applicable to grazing and other land uses at livestock facilities (e.g., vegetated buffers), the nutrient reduction efficiencies for those land uses are likely to differ from those identified in the AgNMP. Therefore, the scenarios are limited to the irrigated agriculture land uses (including orchards/vineyards) addressed in the AgNMP.

Scenario 1: Compliance with initial CWAD requirements

Scenario 1 assumes that the initial CWAD requirements apply to only the agricultural acreage in subwatershed zones 2–9 subject to CWAD requirements (see Tables 1 and 2). This scenario also assumes that all agricultural operations subject to CWAD requirements must implement a structural or non-structural BMP and, where agricultural operations are adjacent to waterways, a 30-foot filter strips/field borders to address water quality concerns.

As discussed, the CWAD would not prescribe the structural or non-structural BMP that agricultural operators must use to comply with the CWAD and if BMPs have been implemented after the TMDL approval date (September 30, 2005), they can count toward CWAD compliance.

<u>Effects on Scenario 1 on Trading Supply and Demand</u>

Under Scenario 1, the CWAD imposes only BMP implementation requirements on acreage subject to the CWAD. There is no quantifiable load reduction target to accompany the BMP-based requirements. As a result, the goal is not to reduce TN or TP by a specific amount, but rather to implement a structural or non-structural practice.

- **Scenario 1 Supply Considerations.** For acres that are subject to the CWAD, implementation of BMPs beyond the CWAD minimum requirements can generate nutrient load credits. These nutrient load reductions would count toward the TMDL allowable load (discussed in Technical Memo #3). At the individual agricultural operator level, BMP implementation to comply with the CWAD would generate a tradeable credit supply, if the operator first met a trading baseline. For example, where filter strips/field borders are applicable on a parcel not subject to the CWAD, implementation of this practice could serve as a trading baseline. Any BMPs implemented beyond the filter strip/field border would generate nutrient load reductions eligible for trading with the application of the necessary trade ratios (see Technical Memorandum #4). Note, however, that if the CWAD does not establish any specific required practices, the baseline can be set as part of the program design. One option could be to allow credits to be generated for all practices implemented after a certain date, such as the date of TMDL adoption. Options for establish trading baselines are detailed in Technical Memo #3 and below under Scenario 2.

- **Scenario 1 Demand Considerations.** Without a quantifiable load reduction target to accompany the BMP-based requirements, the initial CWAD requirements do not drive a demand for TN or TP credits for the purposes of trading. Instead, agricultural operators might have a demand for a BMP offset from other agricultural operators. For example, if an agricultural operator does not feel it is economically viable or technically feasible to implement a structural or non-structural BMP on a particular field, the agricultural operator could pay another operator to implement additional BMPs. This type of offset would be subject to equivalency determinations to ensure that the BMP actually implemented would achieve nutrient reductions in the target waterbody that are equivalent to those that otherwise would have been achieved by implementing BMPs on the parcel subject to the CWAD.

The initial BMP-focused CWAD requirements do not result in a demand for TN or TP credits through trading. The initial BMP-focused CWAD requirements could result in off-site BMP offset projects. Any BMPs implemented under the initial CWAD requirements by non-state/federal/tribal agricultural operators would count toward the overall TMDL allowable load requirements for WRCAC.

Scenario 2: Compliance with CWAD requirements to meet a quantified nutrient load reduction target based on initial CWAD compliance analysis.

Under this scenario, the assumption is that WRCAC will estimate the nutrient load reductions generated under Scenario 1 to determine progress toward the TMDL allowable load (see Technical Memo #3). Based on the analysis of nutrient load reductions achieved through initial

CWAD compliance[1], WRCAC would then quantify the additional nutrient load reductions necessary to ensure the TMDL allowable loads are met and assign WRCAC members either a required nutrient load reduction or a percent reduction that must be achieved through the next year of CWAD compliance. At this point, the CWAD would have a quantifiable nutrient load reduction target that would influence water quality trading credit supply and demand.

A hypothetical example is presented below to illustrate how Scenario 2 might influence water quality trading supply and demand. The hypothetical example focuses on TP in subwatershed zones 2–6 (below Mystic Lake and above Canyon Lake) because, according to Technical Memorandum #3, that is where a subwatershed zone demand exists between now and 2020.[2] In addition, the example focuses on non-state/federal/tribal (i.e., WRCAC acreage) irrigated crop land and orchards/vineyards, consistent with the AgNMP estimates on which it is based.

Step 1: Determine nutrient load reductions achieved through compliance with initial CWAD requirements (Scenario 1).

According to the AgNMP (Table 3-5), 25 percent of WRCAC acreage has qualifying BMP implementation that results in TP washoff reductions (2010) of 70 kg/yr for irrigated cropland and 1 kg/year for orchards/vineyards. (Note that these are reductions calculated only for the 17,361 acres of irrigated agriculture and orchards/vineyards included in the AgNMP analysis. The AgNMP analysis does not include estimates for nutrient reductions from existing BMPs on the 2,799 acres of citrus land, 305 acres of nurseries, or the 1,314 acres of livestock land uses that are subject to the CWAD. It should be assumed that additional nutrient reductions would be realized from existing and future developed BMPs on those acres.)

[1] As described in *Task 4.4 Ongoing Outreach for Long Term Use of WeBMP and Protocols for Verification of Data Obtained Through WeBMP* (see Appendix B of the *Water Quality Trading Feasibility Assessment for San Jacinto Basin Agricultural Operators*), WRCAC will quantify load reductions for all BMPs implemented since TMDL adoption through the initial period of CWAD compliance. This process is anticipated to last approximately two years from the time the CWAD is adopted. The adoption of baselines under the WQT program will determine what portion of the reductions achieved through those BMPs are eligible to generate credits during each phase of CWAD implementation.

[2] Although subwatersheds 7, 8 and 9 contribute very little nutrient load to Canyon Lake, except in wet weather scenarios, agricultural acres in these subwatersheds do affect Mystic Lake. As such, load reductions from existing BMPs and new BMPs implemented for CWAD compliance will positively impact water quality in Mystic Lake on an annual basis and will have a positive impact on Canyon Lake and Lake Elsinore in overflow years. The washoff rates and trade ratios discussed in Technical Memos #3 and #4 that account for the impact of agricultural land above Mystic Lake on water quality in Canyon Lake annualize the contributions in overflows from Mystic Lake to Canyon Lake that occur approximately once every 10 to 12 years. In reality, although nutrient reductions from agricultural acres above Mystic Lake have virtually no impact on Canyon Lake and Lake Elsinore in dry and moderate years, the beneficial effect of those reductions on Canyon Lake and Lake Elsinore lakes in wet years is much greater than indicated by the washoff rates and trade ratios used in this analysis. Development of trade ratios during the WQT program development phase could include calculation of a ratio to be used for above Mystic-below Mystic trading only in wet weather years.

Step 2: Compare nutrient load reductions achieved through compliance with initial CWAD requirements in Scenario 1 to TMDL allowable load to determine the needed nutrient load reduction to stay on target with the TMDL.

The 71 kg/yr TP reduction from CWAD compliance on WRCAC irrigated row crop and orchards/vineyards acreage would be coupled with the 103 kg/yr TP reduction associated with the reduction of manure spreading as reported in the AgNMP, for an assumed TP reduction of 174 kg/yr. The allowable TP load for 2015, as reported in the AgNMP and Table 25 of Technical Memo #3, is 292 kg/yr. Assuming that the total TP load is 580 kg/yr for 2015, this would translate to an additional reduction of 114 kg/yr , or a 20 percent reduction[3] in TP beyond initial CWAD compliance, to achieve the TP allowable load of 292 kg/yr. WRCAC would then state that WRCAC agricultural acreage must implement BMPs that will achieve an additional 20 percent reduction in TP beyond the BMPs implemented during the initial year of CWAD compliance.

Effects on Scenario 2 on Trading Supply and Demand

Under Scenario 2, WRCAC will state that non-state/federal/tribal agricultural operators subject to the CWAD and participating in WRCAC must achieve a specified percent reduction in nutrients, likely with a focus on TP, to achieve the necessary progress toward the TMDL allowable load.

> **Scenario 2 Supply Considerations.** Under this scenario, it is assumed that generating a supply can only occur after the specified percent reduction is achieved through BMP implementation (e.g., achieving the trading baseline). Therefore, the specified percent reduction serves as the trading baseline under Scenario 2. It is assumed that any BMPs put in place during the initial year of CWAD compliance would not be eligible to count toward the baseline[4]. If the agricultural operator can demonstrate that new BMPs implemented beyond the initial year of CWAD compliance exceed the specified percent reduction requirement (i.e., the baseline), the additional nutrient load reductions would be considered an eligible trading supply. Keep in mind that agricultural operators would then need to apply the applicable trade ratios to the additional nutrient load reductions to determine the actual number of available credits. For example, an agricultural operator demonstrates that PAM application will reduce TP loss from a parcel located in subwatershed zone 6 by 60 percent, or 40 percent more than the required baseline. For this particular parcel, that extra 40 percent amounts to 1 kg/year TP reduction from that parcel. Application of a 2:1 uncertainty ratio and a TP loading factor of 0.63 (location ratio) results in 0.315 kg/yr TP credits available for trading. This amount would be further discounted by application of a delivery ratio once a trading partner was identified.

[3] It is important to bear in mind that the example is hypothetical. The 20 percent value and supporting calculations are provided as an example of how the analysis will be performed. Actual addition reductions needed will not be known until existing BMPs under the initial period of CWAD compliance are quantified.

[4] As discussed previously, it is assumed that all BMPs implemented since TMDL adoption will have been quantified during the initial phase of CWAD compliance and that the additional percent reduction required under scenario 2 would reflect additional reductions needed after accounting for all existing BMPs.

It is important to note that establishing a trading baseline is done during the WQT program development phase and is subject to discussion among WRCAC and SARWQCB. The baseline could be established in the manner described above for purposes of this hypothetical scenario, but there are other options to consider. The range of options to consider include:

- Install additional BMPs beyond those quantified under first two years of CWAD compliance to achieve that needed additional 20 percent reduction and then trade anything in excess.
- Demonstrate that existing BMPs reduce the pollutant by the full needed percent reduction (in the hypothetical, it is 50 percent) and anything in excess of the 50 percent reduction from the field's estimated load is considered eligible for trading.
- Require implementation of one specified BMP (e.g., 30-foot filter strip along waterways and easements) and anything implemented above and beyond that particular BMP is considered to generate tradeable credits.
- Maintain BMPs implemented under first two years of CWAD compliance, anything additional implemented in third year of CWAD compliance is considered to generate reductions eligible for trading.

- **Scenario 2 Demand Considerations.** With a quantifiable load reduction target to accompany the BMP-based requirements, the second year of CWAD requirements could drive a demand for TN or TP credits. Agricultural operators subject to the percent reduction target to be achieved through the second year of CWAD compliance would need to evaluate the potential BMPs that could achieve the percent reduction and the associated cost of BMP implementation. It is assumed that BMPs implemented during the first year of CWAD compliance would not be eligible for achieving the percent reduction target specified by WRCAC under this scenario. Agricultural operators might determine that it makes economic sense to implement BMPs that will achieve a portion of the specified percent reduction target and pay for credits to achieve the rest, or to purchase credits to entirely achieve the percent reduction. Ultimately what will drive the demand are individual agricultural operators' decisions about the willingness to pay for 1) additional BMPs beyond what was implemented in the initial year of CWAD compliance to achieve the specified percent reduction or 2) nutrient credits generated by other agricultural operators to achieve some or all of the specified percent reduction through the second year of CWAD implementation. Applicable trade ratios will affect the actual number of credits that an agricultural operator will need to achieve the specified percent reduction.

The percent reduction requirement that WRCAC could impose on WRCAC members subject to CWAD requirements could serve as a more significant driver for trading by generating a stronger demand for tradeable credits.

Scenario 3: BMP Implementation on CWAD-Exempt Non-State/Federal/Tribal Agricultural Acreage

Agricultural acreage not subject to the CWAD would also be eligible to participate in trading. Although these CWAD exempt operations (e.g., non-irrigated agricultural lands and producers with less than 20 acres of aggregated agricultural land) would still first be required to meet a baseline, either BMP-based or quantitative, before generating nutrient load reductions eligible for trading.

This scenario explores the potential nutrient load reductions that could be achieved by CWAD-exempt non-state/federal/tribal agricultural acreage within zones 2–6. All assumed BMPs and associated efficiencies are taken from the AgNMP. Note that the examples below do not differentiate between existing and new BMPs; they simply provide example load reductions that might be achieved from CWAD-exempt acreage. Actual existing and new BMPs on those acres would need to be quantified as part of CWAD compliance, likely through the weBMP system discussed in Appendix B.

Irrigated Cropland (land use 2110 not subject to CWAD):

- Selected BMPs for CWAD-exempt acreage: Combination of vegetated buffers and PAM application, for combined efficiency of 47% TP reduction
    - CWAD-exempt acreage (all irrigated cropland for aggregated parcels <20 acres) = 1,460 acres irrigated cropland
    - TP load (with Canyon Lake Washoff Rate) for 1,460 acres irrigated cropland = 200 kg/yr
    - Load reduction for application of new BMPs to 1,460 acres (47% of 200 kg/yr) = 94 kg/yr
- Total estimated load reduction for Irrigated Cropland not subject to CWAD = 94 kg/yr

Orchards/Vineyards (land use 2200 not subject to CWAD)

- Selected BMPs for CWAD-exempt acreage: PAM application, 37% TP reduction
    - CWAD-exempt acreage (all orchards/vineyards for aggregated parcels <20 acres) = 110 acres orchards/vineyards
    - TP load (with Canyon Lake Washoff Rate) for 110 acres orchards/vineyards = 13 kg/yr
    - Load reduction for application of new BMPs to 110 acres (37% of 10 kg/yr) = 5 kg/yr
- Total estimated load reduction for Orchards/Vineyards not subject to CWAD = 5 kg/yr

Non-irrigated Cropland (land use 2120; assuming that the AgNMP only looks at the non-irrigated cropland land use)

- Selected BMPs for CWAD-exempt acreage: Vegetated buffer, 41% TP reduction (this practice is applied only to 25% of acres, as vegetated buffers will not be appropriate for all fields; 50% is arbitrary, could adjust)
    - Acreage for BMP application (25% of all WRCAC non-irrigated agricultural acreage) = 2,924 acres non-irrigated agricultural land
        - Note: 540 of these (18%) are exempt (owners with <20 aggregated acres)
    - TP load (with Canyon Lake Washoff Rate) for 2,924 acres non-irrigated agricultural acres = 389 kg/yr
    - Load reduction for application of new BMPs to 2,924 acres (41% of 389 kg/yr) = 159 kg/yr
- Total estimated load reduction for non-irrigated agriculture = 159 kg/yr

Effects of Scenario 3 on Trading Supply and Demand

Under Scenario 3, CWAD-exempt WRCAC agricultural operators have the potential to participate in trading if they choose to first achieve a specified baseline, such as BMP implementation or a percent nutrient load reduction.

Scenario 3 Supply Considerations. Under this scenario, generating a supply could only occur after the achieving the baseline, to be determined by WRCAC during trading program development. Keep in mind that agricultural operators would then need to apply the applicable trade ratios (e.g., 2:1 uncertainty ratio) to additional nutrient load reductions achieved beyond the baseline to determine the actual number of available credits. WRCAC could consider using credits generated by CWAD-exempt WRCAC agricultural operators as reserve pool credits used as insurance for trades among other WRCAC agricultural operators engaged in trading with other agricultural operators. According to the analysis above, a potential reserve pool would include the 258 kg/yr of TP reduced on CWAD-exempt WRCAC agricultural acreage in subwatershed zones 2–6. This TP load already reflects the associated TP load factor, but would still need an uncertainty ratio of 2:1 that would translate to approximately 129 kg/yr of TP credits. Assume that 5 percent of those credits (6 kg/yr) would account for reductions associated with meeting a baseline, leaving approximately 123 kg/yr of TP credits available for trading. These credits could satisfy the TP reductions needed under Scenario 2 (114 kg/yr) and still provide a reserve pool of credits (9 kg/yr).

- **Scenario 3 Demand Considerations.** Because these agricultural operators are not subject to CWAD requirements, there is likely to be no trading credit demand from this group. Any agricultural operators under this group that would be deemed subject to the CWAD requirements due to causing or contributing to water quality impairments would likely not be eligible for trading to meet CWAD requirements.

The analysis for Scenario 3 only includes WRCAC agricultural acreage. Therefore, an additional surplus is possible from state/fed/tribal CWAD-exempt acres involved in voluntary BMP implementation.

Conclusions

The CWAD scenarios illustrate that CWAD eligibility and CWAD requirements are likely to affect the supply and demand for nutrient credits at the individual agricultural operator level. In particular, demand is most likely to be driven by potential quantifiable nutrient load reductions that might result from the assessment of nutrient load reductions associated with CWAD compliance during year one of the CWAD. Without this quantifiable nutrient load reduction, overarching subwatershed zone demand for TP exists (see Technical Memo #3), but individual agricultural operators would not have this driver translated to the field-scale. For this reason, it is critical that a system be identified or developed to track field-scale BMPs and quantify associated load reductions, as described in *Task 4.4 Ongoing Outreach for Long Term Use of WeBMP and Protocols for Verification of Data Obtained Through WeBMP* (see Appendix B of the *Water Quality Trading Feasibility Assessment for San Jacinto Basin Agricultural Operators*). Such a system will need to be operational by the time the CWAD is adopted to ensure timely quantification of existing BMP load reductions that will serve to define the demand for additional TP reductions at the individual operator level.

Water Quality Trading Feasibility Assessment for San Jacinto Basin Agricultural Operators

Task 1.5 Define Trade Ratio Considerations

Technical Memo #4

October 24, 2013

Contents

1.0 Overview

The discussion in Technical Memo #4 focused on estimating the supply and demand of nutrient credits for a potential water quality trading program for the San Jacinto River watershed. This technical memo discusses trade ratios—a component of water quality trading that affects supply and demand estimates at the subwatershed scale and the individual landowner scale. The estimates of supply and demand currently reflect one type of trade ratio that accounts for pollutant fate and transport to Canyon Lake and Mystic Lake, but there are others that a water quality trading program could consider to reflect watershed characteristics such as hydrology, pollutant fate and transport between potential trading partners, and water quality goals.

1.1 Task 1.5 Description: Define Trade Ratio Considerations

The goal of this task is to define the various types of trade ratios that a water quality trading program for the San Jacinto River watershed might want to incorporate and the considerations associated with each type of trade ratio. Ultimately, the type and value of trade ratios will affect the overall supply and demand estimate. However, the actual selection of trade ratios is dependent on the trading program development process, including stakeholder involvement. As a result, this memo does not make recommendations on possible values of potential trade ratios, with the exception of the actual trade ratios based on nutrient fate and transport used in the TMDL and incorporated in the supply and demand memo.

1.2 Overview of Trade Ratios and Relationship to Supply and Demand

A major challenge for water quality trading programs is quantifying the link between pollution reduction activities and water quality benefits. One pound of pollution reduced through a pollution reduction project does not necessarily equate to a one pound reduction at the receiving water or waterbody of concern. Many factors may influence the effectiveness of an action to improve water quality improvement, and must be accounted for in a water quality trading program. Trade ratios adjust for these factors and enable trades to produce net water quality benefits to the waterbody of concern. The functions trade ratios can perform include:

- Accounting for the effects of nutrient transport (on land and in water)
- Accounting for watershed hydrology
- Ensuring equivalency among multiple pollutants

Key Terms

Waterbody of Concern (WOC): Receiving water that is the focus of restoration and ultimately the point where pollutant load reductions are needed. For this analysis, the WOCs are Lake Elsinore and Canyon Lake, with an emphasis on Canyon Lake.

Edge-of-Field Load Reduction: The boundary of a water quality improvement project. The point at which water quality benefits associated with an improvement project are estimated.

Ratio Factor: Adjust water quality trading credit values to accommodate for environmental and spatial factors that influence pollution loads.

Accounting Factor: Programmatic adjustments to water quality credit trades that aim to ensure water quality benefits and account for uncertainty.

- Accounting for the relative uncertainty between different types of load reduction estimates
- Ensuring additional water quality benefits from trades

Some trading programs might need to account for several of these factors and, therefore, might include more than one type of trade ratio. Higher trade ratios, either single trade ratios with high values or several trade ratios that aggregate to a large value, can reduce the viability of water quality trading by limiting potential cost savings from trading. That's because trade ratios essentially discount the value of a credit. This has implications for credit supply and demand. Trade ratios reduce the number of credits available in the market and increase the number of credits needed by credit buyers. While this helps to provide for net reductions in expected nutrient loads, it also effectively increases the costs of load reduction project implementation and ultimately increases credit costs for potential buyers. Market participation by credit buyers is largely determined by cost. If water quality trading does not provide a more cost effective avenue for credit buyers to achieve water quality load reduction requirements, then these sources will invest in best management practice (BMP) implementation as opposed to purchasing credits.

1.3 San Jacinto River Watershed Characteristics Affecting Trade Ratios

The information in previous technical memos all contain information on characteristics of the San Jacinto River watershed and agricultural sources that are pertinent to the discussion of trade ratios, including geography, hydrology, pollutant type, source types, and subwatershed zones. Information from these previous technical memos were used to generate critical assumptions about the context of water quality trading in the San Jacinto River watershed that relate to trade ratio considerations.

- Trading in the San Jacinto River watershed involves only Total Nitrogen (TN) and Total Phosphorus (TP), as these are the nutrients of concern in the Lake Elsinore and Canyon Lake TMDL.
- Three potential trading areas exist, as shown in Figure 1: below Lake Elsinore (subwatershed zone 1), below Mystic Lake and above Canyon Lake (subwatershed zones 2–6), and above Mystic Lake (subwatershed zones 7–9).
- Water quality trading in the San Jacinto River watershed is based around Lake Elsinore and Canyon Lake, and not their tributaries, based on the TMDL. Therefore, Lake Elsinore and Canyon Lake are the waterbodies of concern (WOC) for purposes of trading. This means that water quality benefits and impacts focus on the estimated load reduction upon entry to one of the lakes, will not be determined at the point of entry to a stream. For the purposes of nonpoint source trading, the primary emphasis is on TP loads to Canyon Lake based on the discussion in Technical Memo #3 on Supply and Demand because demand is likely to be greatest for TP in zones 2–6.
- Mystic Lake could be considered a WOC for purposes of trading in subwatershed zones 7–9 (Trading Area 3). This would take into account TN and TP loading factors to Mystic Lake, not Canyon Lake.

- Existing loads for WRCAC operators were derived by using an average per-acre load for each land use from the 2010 TMDL model update and applying the per-acre load to the number of acres for each land use. Actual loading from each field is a distribution around this average which is determined considering site-specific conditions. WRCAC is currently developing a program to address site-specific data through the weBNMP and an agricultural nutrient database program, expected to be operational within the next 2-3 years.

TRADING AREA	SUBWATERSHED ZONES	HYDROLOGIC FEATURES	DRAINAGE AREA
1	Zone 1	Lake Elsinore	Lake Elsinore watershed below Canyon Lake
2	Zones 2, 3, 4, 5, 6	Canyon Lake Perris Reservoir Salt Creek	Canyon Lake watershed below Mystic Lake
3	Zones 7, 8, 9	Mystic lake Hemet Lake	Complete Mystic Lake watershed

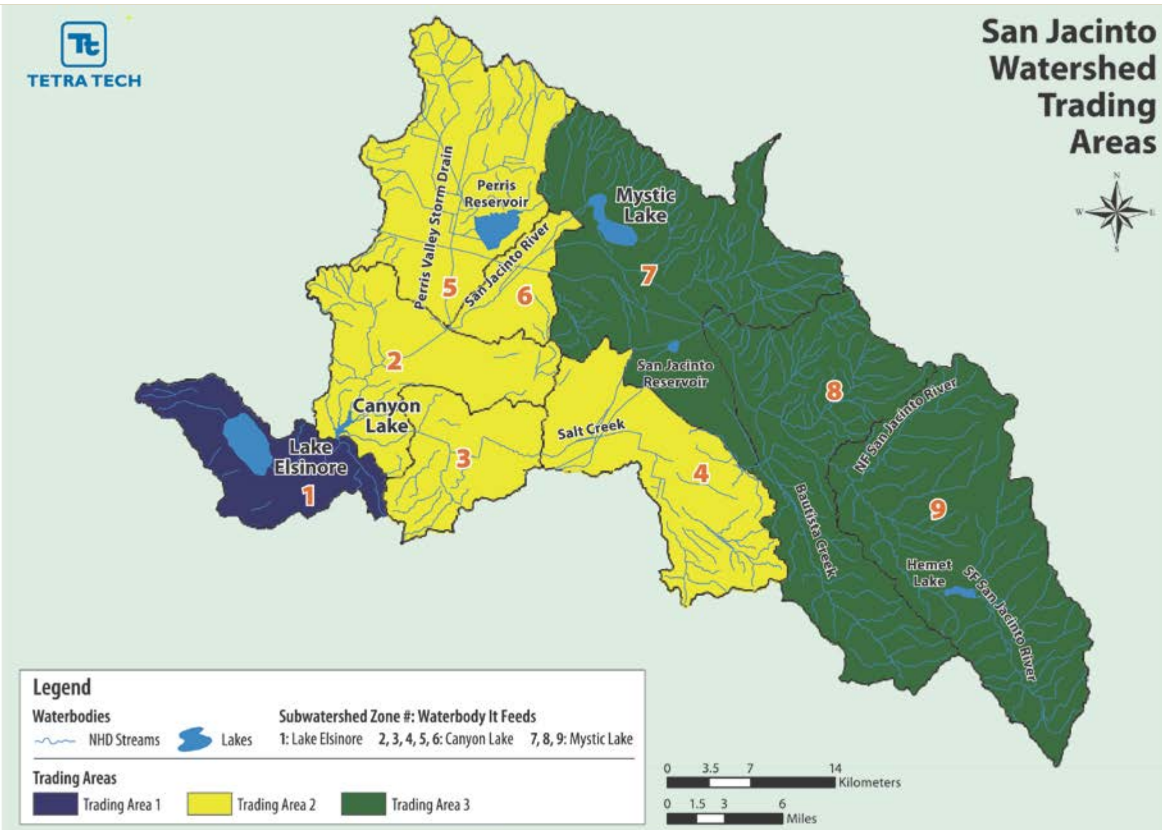

Figure 1. San Jacinto River Watershed Trading Areas and Associated Subwatershed Zones

2.0 Trade Ratio Types and Applicability to the San Jacinto River Watershed

This section provides an introduction to the types of trade ratios and how they function in water quality trading, as well as the applicability of each trade ratio to potential water quality trading in the San Jacinto River watershed. The discussion of trade ratios will point out the potential use for each trade ratio, but will not provide specific values unless these factors have been established through the TMDL or the AgNMP. Additional analysis, coupled with stakeholder discussion, will be necessary to determine the appropriate value for trade ratios that don't currently have calculated factors to be used in the San Jacinto River watershed. The information contained in this document will help to inform future analysis related to trade ratio development for the San Jacinto River watershed.

2.1 Overview of Trade Ratio Types and Definitions

There are six types of trade ratios that are often used in water quality trading programs to account for watershed characteristics and programmatic or performance concerns. This section introduces the basic definition for each type of trade ratio. A trade ratio can be one or a combination of these ratios.

Delivery. The delivery ratio accounts for the fate and transport of pollutants between two trading partners. This factor takes into account unique watershed features, such as hydrology, soils and vegetation. It is assumed that discharged nutrient loads reduce in quantity and potency as they travel over land or through subsurface flows. The closer two trading partners are in proximity to each other, and the fewer intervening hydrological factors that exist, the lower the delivery ratio will be for trading (EPA 2007). Delivery factors can account for distance by estimating the river miles between two potential trading partners and assigning a factor based on a range of distances.

Location. Like the delivery ratio, the location ratio addresses the fate and transport of nutrients, watershed characteristics, time and distance between the source of discharge and the WOC. The location factor accounts for the fact that a pound of a pollutant discharged upstream will not necessarily arrive as a pound of a pollutant at the WOC. Each source has a unique location ratio that reflects a source's relative impact of pollutant loading or reduction on the WOC (EPA 2007). Sources in closer proximity to the WOC will have lower location ratios than sources farther upstream. Lower location factors indicate that the mass of a pollutant load (e.g., one pound of nitrogen) from a source nearer the receiving waters has a greater impact. Location factors can account for this distance in three ways:

- Modeling Option: A unique location factor is applied to each discharge source that reflects a source's relative impact of pollutant loading or reduction on the receiving waters. A continuous fate and transport simulation model can be used to estimate the portion of loads reaching the receiving waters. This can be a costly approach as it requires ratio analysis at every source location.
- Zone Option: The location factor is applied to a management zone, giving any discharge source within that zone the same ratio. The same rules would apply as in the

previous scenario, but the overall cost to determine unique location ratios for each source would be eliminated.

- Distance Option: A simple equation is developed that defines the fraction of pollutants reaching the receiving water given the distance from the receiving water.

Equivalency. The equivalency ratio adjusts credit availability to account for different forms of the same pollutant or cross-pollutant trading. Pollutants, such as nitrogen and phosphorus can exist in different forms, depending on the source, which may impact water quality in different ways. This is particularly true for point source to nonpoint source trading. Different forms of the same pollutant can only be traded if they have the same effect on water quality or if they are made equivalent by use of the equivalency factor. Equivalency factors are typically established by defining a single ratio that translates a pollutant to the form that is being traded. For example, a ratio may be assigned that accounts for the relatively greater bio availability of ammonia than organic nitrogen. The equivalency factor can also be applied to cross-pollutant trading under the same principal. As long as calculations are made to determine the effects on water quality, the pollutant type does not matter.

Uncertainty . The uncertainty ratio is typically employed for trades involving nonpoint sources as the credit producer and point sources as the credit buyer. The uncertainty factor compensates for the relatively greater uncertainty of the load reduction from nonpoint source BMPs when compared to well-defined and monitored point source discharges reductions. The uncertainty factor can be applied to buyer or seller credit determinations. Uncertainty factors are set to account for this difference in one of the following ways:

- BMP Option: Assesses the range of measurement and performance variability of BMPs by statistically analyzing the variability of monitoring data for different types of BMPs. This can often be an expensive and time intensive process, and requires more monitoring data than is typically available.
- Watershed-Wide Option: Sets a single, conservative uncertainty factor for all nonpoint source load reductions. The majority of water quality trading programs use this method as it is cost effective and can often capture all levels of variability.

Retirement . The retirement ratio can be applied to accelerate achievement of water quality standards. This accounting factor retires a percentage of all credits generated, meaning that those credits are no longer available for sale. The retirement ratio allows for a reduction in the overall loading to the receiving waters with each trade. The retirement factor is often used in waterbodies that have not established a TMDL, as it accounts for uncertainty in the exact reductions needed from individual sources to improve water quality. The retirement ratio is uniform across all source categories and applies to all trades throughout the watershed.

Reserve. The reserve ratio serves as a pool of credits or insurance fund should any purchased credits default, meaning they do not enter the market as legitimate credits. Credits may default through a lack of water quality benefits as anticipated or other project failures. As with the retirement ratio, the reserve ratio is applied to all trades and is uniform throughout the watershed. Reserve ratios set aside a portion of all generated credits into a reserve pool, which operates as an insurance fund. When a project failure is identified, the reserve credits can be used to replace the shortfall for the buyer. This provides an insurance mechanism for buyers to insulate them from regulatory liability when sellers fail to produce expected load reductions. Reserve pool credits remaining at the end of a year can be retired to accelerate water quality improvement. In some cases reserve credits are valid in perpetuity, however, it is likely inappropriate given the assumed annual accounting for local reductions.

Key Terms

Reserve Ratio: the percentage of credits set aside to account for project implementation risk and unknown natural events.

Reserve Pool: the accounting structure that functions as a credit reserve. Similar to an insurance fund.

2.2 Applicability of Trade Ratios to the San Jacinto River Watershed

With an understanding of each type of trade ratio, it is possible to better understand how each trade ratio might function within the context of the San Jacinto River watershed. Table 1 provides a brief summary of each trade ratio, with applicability and technical considerations for use in the San Jacinto River watershed. This section also provides a discussion of the applicability and analysis needed to determine a value for each trade ratio.

Table 1: Summary of Trade Ratios and Applicability to San Jacinto River Watershed with Considerations

Type of Trade Ratio	Description	Applicability to San Jacinto	San Jacinto Considerations
Delivery	Accounts for the fate and transport of nutrients between two trading partners.	Yes	Consider river mile distances between potential trading partners. Use of zones for delivery ratios might not account for varying distances within larger zones.
Location	Addresses the fate and transport of nutrients, watershed characteristics, time and distance between the point of entry to a surface waterbody and the waterbody of concern.	Yes	Necessary for discharges entering surface waters upstream of Canyon Lake & Lake Elsinore. Referred to as loading factors in AgNMP and Technical Memo #3. Calculated through AgNMP for zones 2–6 and 7-9 for Canyon Lake. TMDL modeling estimates derived for Mystic Lake.
Equivalency	Adjusts for the relative impact of different pollutants or different forms of the same pollutant.	No	Not necessary with a focus on non-point to non-point source trading (agricultural and potentially urban runoff) using TN and TP at this point in time. Might need revisiting if program expands to include permitted wastewater treatment facilities or other point source dischargers such as MS4s.

Type of Trade Ratio	Description	Applicability to San Jacinto	San Jacinto Considerations
Uncertainty	Accounts for the relative increase in uncertainty of load reduction estimates and variability in the performance of nonpoint source best management practices when compared to other load reduction estimates.	Yes	Necessary for any trade involving nonpoint sources, particularly when effectiveness will be estimated and not measured. Recommend watershed-wide option for simplicity and assuming there is insufficient data to rigorously determine variability by direct BMPs.
Reserve	Percentage of credits placed in reserve to cover shortfalls from natural occurrences and project failure.	Yes	Recommended to act as a programmatic insurance against shortfalls created by individual BMPs not being maintained. Also serves to accelerate improvement, as with a retirement factor, if excess credits remain at the end of the year.
Retirement	Indicates the proportion of credits that must be purchased in addition to the credits needed to meet regulatory obligations. These excess credits are taken out of circulation (retired) to accelerate water quality improvement.	No	Not recommended, especially if reserve factor is used, as it is likely to create an unnecessary economic impediment to trading

Each subsection below provides specific information on applicability and analysis needs for each trade ratio, with the exception of equivalency and retirement.

2.2.1 Delivery Ratio

The delivery ratio is highly applicable to water quality trades in the San Jacinto Watershed. The extent of agricultural operators and varying distances between them, coupled with the unique hydrologic conditions throughout the watershed, makes the delivery factor important in all trades in the San Jacinto Watershed.

Analysis Needed

The trade ratio requires either a receiving model analysis to determine contributions from individual sources to specific river mile locations or a less refined GIS-based approach with assumptions about individuals' contributions to a particular river mile.

Potential Range

Delivery factors can fall within a wide range that can vary greatly depending on distance between potential trading partners and environmental conditions. Trading partners within very close proximity are likely to contribute loads at the same river mile and would likely have a 1:1 ratio. The greater the distance between river miles associated with two potential trading partners, the greater the delivery ratio.

2.2.2 Location Ratio

The location ratio is applicable to a San Jacinto River watershed trading program. This type of ratio essentially exists for the San Jacinto River watershed through the analysis conducted to develop the AgNMP and the TMDL, reflected as loading factors in Technical Memo #3 on Supply and Demand. Table 2 provides the loading factors developed for the AgNMP and derived from the TMDL modeling data for both Canyon Lake and Mystic Lake.

Table 2. TN and TP Loading Factors for Subwatershed Zones by WOC

<table>
<tr><th rowspan="2">Subwatershed Zone(s)</th><th colspan="2">Canyon Lake Loading Factors</th><th colspan="2">Mystic Lake Loading Factors</th></tr>
<tr><th>TN</th><th>TP</th><th>TN</th><th>TP</th></tr>
<tr><td>2 – 6</td><td>0.65</td><td>0.63</td><td>-</td><td>-</td></tr>
<tr><td>7</td><td rowspan="3">0.0001</td><td rowspan="3">0.0001</td><td>0.793</td><td>0.803</td></tr>
<tr><td>8</td><td>0.769</td><td>0.768</td></tr>
<tr><td>9</td><td>0.767</td><td>0.764</td></tr>
</table>

Analysis Needed

Refinement of the zone option might be needed to determine a loading factor for each specific zone below Mystic Lake and above Canyon Lake (subwatershed zones 2–6, or Trading Area 2). Per the analysis conducted in the AgNMP, zones 2–6 are assigned the same loading factors for TN and the same loading factors for TP. While this approach worked to support the analysis for the AgNMP, a trading program focused on delivered loads to the WOC might be better served by loading factors (or location ratios) tailored to the specific hydrologic characteristics of each subwatershed zone. While programmatically more complex, this approach would provide more refinement in accounting for inter-zone trades. Technical Memo #3 uses this approach by estimating distinct loading factors for subwatershed zone 7, 8, and 9 above Mystic Lake in Trading Area 3.

Another potential type of loading factor to consider is one that accounts for Mystic Lake overflow years. During overflow events, TN and TP contributions to Canyon Lake from Mystic Lake would be more significant than the 0.0001 loading factors calculated through the AgNMP.

2.2.3 Uncertainty Ratio

Uncertainty factors are applicable to any trades in the San Jacinto River watershed involving a nonpoint source. Nonpoint source BMPs are expected to be the primary means of generating load reduction credits in the San Jacinto River watershed. In the AgNMP, WRCAC identifies several voluntary BMPs that agricultural producers can undertake to reduce pollutant loading to Lake Elsinore and Canyon Lake. While these BMPs are estimated to reduce pollutant loading, the accuracy of the actual load reduction estimates is largely unknown. Even with extensive modeling and monitoring efforts, there is still a level of uncertainty of load reductions achieved through BMP measures due to factors such as proper installation and operation and maintenance issues or, for cover crops, an establishment time lag.

Analysis Needed

The BMP Option applies the uncertainty factor to individual BMPs. To set uncertainty factors for each BMP, extensive monitoring and data analysis efforts must be conducted on pilot projects. This will reduce the level of uncertainty about the benefits achieved by different BMPs. Once effectiveness is determined, ratios can be applied in an Order of Uncertainty table such as the example presented below.

The Watershed-Wide Option applies the uncertainty ratio to the watershed as a whole. This method requires little to no ongoing monitoring efforts and would be the same for all nonpoint source credit producers and their implemented BMPs. This approach aims to capture all levels of uncertainty with a conservative estimate.

Potential Range

Uncertainty factors generally fall within a 1.1:1 – 2:1 range. A 2:1 ratio is a generally used uncertainty ratio to include all levels of BMP uncertainty throughout a watershed. In most programs used, a 2:1 ratio was set for uncertainty with little or no scientific or modeling data used. In cases where a 2:1 ratio is used. Relative uncertainty for nonpoint source loads may be assumed equivalent, or the ratio may apply when the loading from nonpoint source without BMPs are assumed to have relatively greater certainty. Table 3 provides some potential range options for various BMPs.

Table 3: Example Order of Uncertainty Table for BMPs

1.5:1 Ratio	2:1 Ratio	3:1 Ratio
Companion Crops	Buffer with upland practices	Tillage practices
	Fall cover crops	Buffer without supporting practices

Source: Wisconsin Department of Natural Resources. "A Water Quality Trading Framework for Wisconsin." 01 July 2011. Pg. 18. http://fyi.uwex.edu/wqtrading/files/2011/05/WQ-Trading-Framework-5-20-11-Draft.pdf

2.2.4 Reserve Ratio

The reserve ratio can provide insurance for credit buyers in the San Jacinto River watershed and would help to encourage water quality trading in the early stages of the trading program. While several BMPs have been planned for in documents such as the AgNMP, there is still risk and uncertainty about how each BMP will be implemented. Therefore the primary purpose of the reserve factor is to account for BMP implementation risk. The reserve factor helps to reduce this risk, benefiting water quality and encouraging trading activity.

Analysis Needed

Reserve pools are established as an accounting factor that affects credit generation throughout the watershed. The percentage of credits that enter into the reserve pool should be informed by the expectation of BMP implementation risk, the expected percent of BMPs that will not be implemented to the expected level of quality committed to when initially developing load reduction estimates. There is also a need to determine when reserve pool credits should be retired. This will be determined by the length of credit effectiveness, meaning the length of time in which water quality benefits are realized from credit generation activities. Annual retirement of reserve pool credits is simple and eliminates the need for complex analysis of the nutrient cycle.

<u>Potential Range</u>

The reserve ratio can be set at any appropriate range so long as it does not affect trade activity. Most programs reviewed set a reserve factor of 10%. As with retirement factors the reserve factor is flexible and can be adjusted once trading begins and an accurate understanding of implementation risk is gained.

As with most insurance mechanisms, the higher activity volume level, the lower the influence any one project failure will have to the overall system. Thus the reserve factor may be lowered with greater trading activity if significant amounts of credits are being retired on an annual basis.

3.0 Trade Ratios and Influence on Credit Supply and Demand

Water quality credit buyers and sellers in the San Jacinto Watershed go through separate, yet similar processes to determine their credit numbers. Utilizing a six step process and associated *Factor Criteria Checklist* described in sections 3.1 and 3.2, agricultural operators can determine the effects ratio and accounting factors have on their potential credit supply and demand. Agricultural operators determine their need to purchase credits (whether or not they are discharging beyond their allowable limit) and the number of credits they need to purchase to meet the required baseline. Credit sellers determine the anticipated load reductions from one or more BMPs, apply trade ratios to this additional load reduction and determine the total number of credits available for sale.

As a rule of thumb, trade ratios will take a nutrient load demand and increase it; therefore, the number of credits an agricultural operator needs to meet the baseline will exceed the actual nutrient load reduction needed. The opposite is true for a nutrient load supply. Trade ratios will take the excess load reduction and decrease it; therefore, the number of credits an agricultural operator has available for sale will be less than the actual nutrient load reduction achieved beyond the baseline. Therefore, looking at load demand or surplus before the application of trade ratios provides a false sense of the nutrient commodity. Nutrient loads don't become an actual credit until after the application of trade ratios. And because trade ratios are so dependent on site-specific factors, it's difficult to truly gauge supply and demand at the watershed or subwatershed zone scale. Hypothetical examples at the individual agricultural operator level sheds light on how trade ratios actually affect supply and demand estimates.

The calculations presented below address the recommended options for each trade ratio and utilize the *Factor Criteria Checklist*. Both buyers and sellers are responsible for calculating credit needs and availability. The location and delivery ratios described in this memo have the same application for buyers and sellers, however the uncertainty and reserve ratios are applied differently.

The following trade ratios are suggested for use in the San Jacinto River watershed to determine water quality credit value based on applicability, feasibility and cost.

- Delivery Ratio: Distance Option
- Location Ratio: Load factors estimated through the AgNMP
- Uncertainty Ratio: Watershed-Wide Option
- Reserve Pool: Percentage

3.1 Determining Credit Needs with Trade Ratios (Hypothetical Example)

As shown in the CWAD scenarios developed to support Technical Memo #3 on Supply and Demand, individual credit needs is dependent upon CWAD requirements. For the purposes of describing the effect of trade ratios on credit needs, Scenario 2 of the CWAD scenarios will be used. Using that scenario as a basis, an example illustrating how an agricultural operator located in subwatershed zone 2 would determine credit needs. As in Scenario 2, assume that WRCAC quantifies a percent reduction needed during year 2 of CWAD implementation to achieve the TMDL allowable loads. For purposes of this memo, there is an assumed 10 percent reduction in TP from all agricultural operators based on an analysis of initial CWAD implementation effectiveness by WRCAC. This process is described below, and shown in Figure 2, with an example illustrating how an entity with an excessive TP discharge in subwatershed zone 6 calculates their credit demand relative to Canyon Lake as the WOC.

Step 1: Determine agricultural operator's load amount. Determine amount of nutrient load reduction needed to comply with CWAD requirements.

Step 2: Determine appropriate site characteristics and associated ratio factor. Determine which criteria apply to the site using the *Factor Criteria Checklist*.

Step 3: Calculate the integrated site-specific trade ratio utilizing the *Factor Criteria Checklist*. For agricultural operators with a need to purchase credits, place each factor in the following equation: ($a\!:b = a/b$). Convert each fraction to a decimal and multiply.

$$\boldsymbol{Integrated\ Site\ Specific\ Ratio} = Delivery\ (x)\ Location$$

Step 4: Calculate credit needs. Apply the integrated site-specific trade ratio to the remaining load amount. This will give you the number of credits needed prior to the application of the accounting factor.

$$\boldsymbol{Credit\ Needs} = Remaining\ Load\ (x)\ Integrated\ Site\ Specific\ Trade\ Ratio$$

Step 5: Apply the Uncertainty Ratio. Credit buyers apply the Uncertainty Ratio to credit needs to accommodate for any uncertainty in BMP effectiveness.

$$\boldsymbol{Uncertainty\ Application} = Credits\ Needed\ (x)\ Uncertainty$$

Total Credit Needs is the amount of credit needs with the Uncertainty Ratio applied.

Step 1: Total Load		Allowable Load	Remaining Load	
150 lbs/TP		135 lbs/TP	15 lbs/TP	
Site-Specific Trade Ratios (choose most representative for each site)		**TP Ratio Factors**	**Step 2: Site Characteristic**	**Multiplier**
Delivery	Partners >10 river miles apart (zones 2–6 only)	5:1		
	Partners 5-10 river miles apart (zones 2–6 only)	3:1		
	Partners 1-5 river miles apart (zones 2–6 only)	1.5:1	X	1.5
	Partners <1 river mile apart	1:1		
Location	Trading Area 3 (Zones 7,8,9)	10,000:1		
	Trading Area 2 (Zones 2,3,4,5,6)	1.6:1	X	1.6
	Trading Area 1 (Zone 1)	1:1		
			Step 3: Integrated Site-Specific Trade Ratio (x)	2.4
			Step 4: Credit Needs	36
Performance-Specific Trade Ratio (applied to all transactions)		**Ratio Factor**	**Multiplier**	**Step 5: Uncertainty Application**
Uncertainty	Watershed-Wide Option	2:1	2	72
			Total Credit Needs	72

Figure 2: Example use of the Factor Criteria Checklist to determine credit needs

3.2 Determining Credit Supply with Trade Ratios (Hypothetical Example)

Agricultural operators in the San Jacinto River watershed generate credits through load reductions achieved beyond an established baseline, such as a percent reduction as discussed in Scenario 2 of the CWAD Scenarios memo. For purposes of this example, a hypothetical 10 percent TP reduction beyond initial year of BMP implementation is used. Credit producers determine their edge-of-field load reductions beyond this baseline achieved through additional BMP implementation and apply the relevant trade ratios to determine the credit supply available for sale. This process is described below, and shown in Figure 3, with an example illustrating how an entity reducing TP discharge in subwatershed zone 6 calculates their credit supply relative to Canyon Lake as the WOC.

Step 1: Determine edge-of-field load reductions. Estimate load reductions beyond the established baseline achieved through the implementation of BMPs. Estimates will be based on specific monitoring or through BMP expectation models.

Step 2: Determine appropriate site characteristics and associated ratio factor. Determine which criteria apply to the site using the *Factor Criteria Checklist*.

Step 3: Calculate the integrated site-specific trade ratio utilizing the *Factor Criteria Checklist*. For agricultural operators with a nutrient load reduction surplus, place each factor in the following equation: $(a{:}b = b/a)$. Convert each fraction to a decimal and multiply.

$$\boldsymbol{Integrated\ Site\ Specific\ Trade\ Ratio} = Delivery\ (\times)\ Location$$

Step 4: Calculate total load reduction credits. Apply the integrated site-specific trade ratio to the surplus load reduction amount. This will give you the total number of credits created as a result of the BMP.

$$\boldsymbol{Credit\ Supply} = Load\ Reduction\ (\times) Integrated\ Site\ Specific\ Trade\ Ratio$$

Step 5: Apply the Reserve Ratio. Credit suppliers apply the reserve ratio to the credit supply.

$$\boldsymbol{Reserve\ Pool\ Credits} = \boldsymbol{Credit\ Supply} - (\boldsymbol{Credit\ Supply}\ (\times)\ \boldsymbol{Reserve\ Factor})$$

Step 6: Calculate the total credits available for sale. Add the uncertainty factor output to the credit needs to determine the total number of credits needed by the buyer.

$$\boldsymbol{Total\ Credits\ Available} = Load\ Reduction\ Credits\ (-)\ Reserve\ Pool\ Credits$$

Load Reduction to Meet Baseline	Step 1: Estimated Edge-of-Field Load Reduction	Load Reduction Surplus
10 lbs/TP/yr	110 lbs/TP/yr	100 lbs/TP/yr

Site-Specific Trade Ratios (choose most representative for each site)		Ratio Factors	Step 2: Site Characteristic	Multiplier
Delivery	Partners >10 river miles apart (zones 2–6 only)	5:1		
	Partners 5-10 river miles apart (zones 2–6 only)	3:1	X	0.33
	Partners 1-5 river miles apart (zones 2–6 only)	1.5:1		
	Partners <1 river mile apart	1:1		
Location	Trading Area 3 (Zones 7,8,9)	10,000:1		
	Trading Area 2 (Zones 2,3,4,5,6)	1.6:1	X	0.63
	Trading Area 1 (Zone 1)	1:1		
			Step 3: Integrated Site-Specific Trade Ratio (x)	0.21
			Step 4: Credit Supply	21 lbs/TP

Performance-Based Trade Ratio (applied to all transactions)	Ratio Factor	Multiplier	Step 5: Reserve Pool Credits
Reserve Pool	10%	0.10	2.1
		Step 6: Total Credits Available to Sell	18.9 lbs/TP

Figure 3: Example use of the Factor Criteria Checklist to determine credit supply

4.0 Conclusions and Next Steps

The hypothetical examples provided above demonstrate the profound effect that trade ratios can have on credit supply and demand for nonpoint to nonpoint source trading in the San Jacinto River watershed. Site-specific trade ratios coupled with performance-based trade ratios can increase an individual agricultural operator's demand and decrease an individual operator's supply. This consideration, coupled with economic factors and the transaction costs associated with water quality trading can impede the feasibility of trading in the San Jacinto River watershed. Elements of trading program design intended to reduce transaction costs, such as a third-party credit aggregator, could help to make trading more viable.

In terms of next steps for trade ratio development, determining the appropriate delivery ratio approach to account for fate and transport between two trading partners should be a primary priority, followed by stakeholder discussions to determine an acceptable uncertainty ratio to account for BMP performance uncertainties. These trade ratios, in addition to the delivery ratio, are key to a credible water quality trading program.

Resources

US EPA. "Water Quality Trading Toolkit for Permit Writers." June 2009. http://www.epa.gov/npdes/pubs/wqtradingtoolkit_fundamentals.pdf

Western Riverside County Agricultural Coalition. " Agricultural Nutrient Management Plan for the San Jacinto Watershed." April 2013.

Wisconsin Department of Natural Resources. "A Water Quality Trading Framework for Wisconsin." 01 July 2011. http://fyi.uwex.edu/wqtrading/files/2011/05/WQ-Trading-Framework-5-20-11-Draft.pdf