COMPREHENSIVE GROUNDWATER QUALITY MANAGEMENT PLAN

CAWELO WATER DISTRICT COALITION
17207 Industrial Farm Road
Bakersfield, CA 93308

May 11, 2015
# Comprehensive Groundwater Quality Management Plan

Cawelo Water District Coalition

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1. INTRODUCTION AND BACKGROUND

This Comprehensive Groundwater Quality Management Plan (CGQMP) has been prepared in accordance to the requirements of the Waste Discharge Requirements General Order for Growers within the Tulare Lake Basin Area that are Members of a Third-Party Group, R5-2013-0120 (General Order). Groundwater Quality Management Plans are required for areas designated as high vulnerability areas in the Groundwater Quality Assessment Report (GAR) and for areas of confirmed water quality exceedances. The General Order provides an opportunity to develop a single CGQMP to address the noted exceedances rather than developing separate management plans for each area of concern.

A. Geographic Boundary

The Cawelo Water District Coalition (CWDC) received a Notice of Applicability dated April 25, 2014 from the Central Valley Regional Water Quality Control Board (Regional Board) authorizing CWDC to act as the third-party group or coalition representing growers of Cawelo Water District (District) for compliance under the General Order.

The CWDC coverage area is essentially the District boundary and encompasses roughly 45,000 acres. CWDC area is located in the north-central portion of Kern County, between U.S. Highway 99 on the West and State Highway 65 on the East, with the community of Oildale to the south and the community of McFarland to the north. Poso Creek crosses the CWDC coverage area bifurcating it into approximately two halves creating a northern and southern area. The CWDC also provides coverage for growers in an additional Supplemental Coverage Area (SCA) which encompasses the upstream portion of the Poso Creek watershed to the east of the CWDC area. The SCA is approximately 200,000 acres with very little irrigated agriculture. The coverage area boundaries are shown in Figure 1.

The areas to be covered by the CGQMP are all irrigated agriculture areas designated as high vulnerability by the GAR and are enrolled in the CWDC under active memberships. The high vulnerability areas are presented in Figure 2.
B. Constituent of Concern

Nitrate in the groundwater is the focus of this CGQMP. Nitrate is a naturally occurring form of nitrogen that can be formed from atmospheric nitrogen or decomposing organic matter. Nitrate can also be found in groundwater as a result of excess application of nitrogen fertilizers in irrigated agricultural and landscaped areas, percolation from feedlots or dairies, wastewater and food processing waste percolation, and leachate from septic system drain fields (Harter T., et al. 2012).

The Maximum Contaminant Level (MCL) for nitrate as N is 10mg/L or for nitrate (NO3) is 45mg/L. Over the previous 30 years a number of groundwater wells tested in the CWDC area have shown levels of NO3 that have exceeded the MCL. The source of the NO3 contamination has not been definitively determined however, irrigated agriculture has historically been present in the CWDC area and is one potential NO3 source.
Figure 2 – High Vulnerability Areas

Cawelo Water District Coalition Area
High Vulnerability Area
C. Objectives

The overall objective of a groundwater quality management plan is to determine if irrigated agriculture is known to cause or contribute to water quality degradation and if so, to reduce impacts to meet groundwater quality receiving limitations. If irrigated agriculture cannot be definitively established as a non-contributor, then approved studies or activities can be implemented to reduce any potential impacts of irrigated agricultural practices.

This CGQMP provides a strategy to investigate the potential sources of groundwater NO3 impacts and to determine if current irrigated agricultural practices can be definitively established as a non-contributor. If efforts are inconclusive then the CGQMP continues with a strategy to evaluate agricultural practices, provide education and outreach programs, and a process to implement approved management practices that are deemed protective of groundwater quality.

2. PHYSICAL SETTING AND INFORMATION

A. Land Use

Agriculture is the primary land use within the CWDC area and approximately 70% of the area was irrigated agriculture in 2014. Approximately 17% of the area was fallow and approximately 5% is used for general commercial purposes. The remaining areas are attributed to residential, roadways, reservoirs and other miscellaneous non-agricultural uses.

Citrus, vineyards, almonds and pistachios are the primary crops grown in the CWDC area and comprised 97% of all crops grown in the CWDC area in 2014. The crop acres are summarized in Figure 3.

Figure 3 – 2014 Crop Acreages
Figure 4 presents the distribution of crops, industrial areas, and other non-agricultural land uses in CWDC.

Figure 4 – 2014 Crop Survey
B. Climate

The climate of the region is semi-arid with summers that are typically hot and dry with no significant precipitation. The winters are cooler and characterized by fog and minor precipitation with an annual average rainfall of 6 inches in the CWDC area. As the elevation increases heading toward the east leaving the CEDC area and into the foothills and upper Poso Creek watershed area in the Sierra Nevada Mountains, the precipitation increases ranging from 6 to 30 inches.

During the summer months the high temperatures average in the high 90’s with the lows in the high 60’s. During the winter months the high temperatures average in the low 60’s or high 50’s with the lows averaging around 40 degrees Fahrenheit. The monthly average temperatures and precipitation are summarized in Table 1.

Table 1 - Average Monthly Temperatures and Precipitation for the CWDC Area

<table>
<thead>
<tr>
<th>Average Monthly Temperatures and Precipitation for CWDC Area</th>
<th>Jan</th>
<th>Feb</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average High (°F)</td>
<td>56.2</td>
<td>62.8</td>
<td>68.7</td>
<td>75.0</td>
<td>83.5</td>
<td>90.9</td>
<td>97.1</td>
<td>95.8</td>
<td>90.0</td>
<td>78.4</td>
<td>65.7</td>
<td>56.6</td>
<td>76.8</td>
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<tr>
<td>Average Low (°F)</td>
<td>39.3</td>
<td>42.4</td>
<td>46.5</td>
<td>50.2</td>
<td>57.5</td>
<td>64.2</td>
<td>70.3</td>
<td>69.0</td>
<td>64.0</td>
<td>55.0</td>
<td>44.6</td>
<td>39.0</td>
<td>53.5</td>
</tr>
<tr>
<td>Precipitation (Inches)</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
<td>0.5</td>
<td>0.2</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.1</td>
<td>0.3</td>
<td>0.6</td>
<td>1.0</td>
<td>6.47</td>
</tr>
</tbody>
</table>

Source: National Weather Service; Bakersfield Data

C. Geological and Soil

Within the San Joaquin Valley Groundwater Basin, the CWDC is located in the Kern County Groundwater Subbasin (Kern Subbasin). The Kern Subbasin is bounded on the north by the Kern County line and the Tule Groundwater Subbasin, in the east and southeast by granitic bedrock of the Sierra Nevada foothills and Tehachapi mountains, and on the southwest and west by the marine sediments of the San Emigdio Mountains and Coast Ranges (DWR, 2003).

The San Joaquin Valley represents the southern portion of the Great Central Valley of California. The San Joaquin Valley is a structural trough up to 200 miles long and 70 miles wide filled with up to 32,000 feet of marine and continental sediments deposited during periodic inundation by the Pacific Ocean and by erosion of the surrounding mountains, respectively. Continental deposits shed from the surrounding mountains form an alluvial wedge that thickens from the valley margins toward the axis of the structural trough. This depositional axis is below to slightly west of the series of rivers, lakes, sloughs, and marshes that mark the current and historic axis of surface drainage in the San Joaquin Valley (DWR, 2003).

Sediments that comprise the shallow to intermediate depth water-bearing deposits in the groundwater subbasin are primarily continental deposits of Tertiary and Quaternary age. From oldest to youngest, the deposits include the Olcese and Santa Margarita Formations; the Tulare Formation and Kern River Formation; older alluvium/stream deposits; and younger alluvium and coeval flood basin deposits (DWR, 2003).

Within the CWDC area, there are over 20 different soil types which are described by the Soil Survey of Kern County Northwestern Part (CA666) and the Soil Survey of Kern County, California Northeastern Part and Southeastern Part of Tulare County, California (CA668). Soil survey data
was downloaded from the USDA, NRCS Web Soil Survey to map the soil types and locations within the CWDC area and are shown in Figure 5. The Map Unit Key is provided in Figure 6.

Figure 5 – NRCS Soil Survey
### Figure 6 – Map Unit Key

**NRCS Soil Survey, Map Unit Key, Figure 6**  
Soil Survey of Kern County, Northwestern Part (CA666)

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>128ne</td>
<td>Capay silty clay, 2 to 9 percent slopes</td>
</tr>
<tr>
<td>130</td>
<td>Chanac clay loam, 2 to 9 percent slopes</td>
</tr>
<tr>
<td>131</td>
<td>Chanac clay loam, 9 to 15 percent slopes</td>
</tr>
<tr>
<td>132</td>
<td>Chanac clay loam, 15 to 30 percent slopes</td>
</tr>
<tr>
<td>138</td>
<td>Delano sandy loam, 0 to 2 percent slopes</td>
</tr>
<tr>
<td>139</td>
<td>Delano sandy loam, 2 to 5 percent slopes</td>
</tr>
<tr>
<td>140</td>
<td>Delano sandy loam, 5 to 9 percent slopes</td>
</tr>
<tr>
<td>145</td>
<td>Driver coarse sandy loam, 0 to 2 percent slopes</td>
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<tr>
<td>146</td>
<td>Delano sandy loam, 1 to 5 percent slopes (CA668)</td>
</tr>
<tr>
<td>146ne</td>
<td>Elkhill sandy loam, 9 to 50 percent slopes, eroded</td>
</tr>
<tr>
<td>154</td>
<td>Exeter sandy loam, 0 to 2 percent slopes</td>
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<tr>
<td>174</td>
<td>Kimberlina fine sandy loam, 0 to 2 percent slopes</td>
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<td>175</td>
<td>Kimberlina fine sandy loam, 2 to 5 percent slopes</td>
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<tr>
<td>184</td>
<td>Lewkab sandy loam, 0 to 2 percent slope</td>
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<td>192</td>
<td>McFarland loam</td>
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<tr>
<td>200</td>
<td>Urban land – Delano complex, 0 to 2 percent slopes (CA668)</td>
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<tr>
<td>200ne</td>
<td>Milledom Variant-Montara complex, 15 to 30 percent slopes</td>
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<tr>
<td>222</td>
<td>Premier coarse sandy loam, 2 to 5 percent slopes</td>
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<tr>
<td>223</td>
<td>Premier coarse sandy loam, 5 to 9 percent slopes</td>
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<tr>
<td>224</td>
<td>Premier coarse sandy loam, 9 to 15 percent slopes</td>
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<tr>
<td>225</td>
<td>Premier-Durothids association, 9 to 15 percent slopes</td>
</tr>
<tr>
<td>229</td>
<td>Riverwash</td>
</tr>
<tr>
<td>243</td>
<td>Wasco sandy loam</td>
</tr>
<tr>
<td>254</td>
<td>Zerker loam, 2 to 5 percent slopes</td>
</tr>
<tr>
<td>255</td>
<td>Zerker loam, 5 to 9 percent slopes</td>
</tr>
<tr>
<td>256</td>
<td>Zerker sandy clay loam, 02 to 2 percent slopes</td>
</tr>
</tbody>
</table>
D. Hydrology

Poso Creek is an intermittent stream and the only significant natural surface water source that enters the CWDC area. The average annual flow entering the CWDC area is approximately 18,245 AF/year as presented in Figure 7.

**FIGURE 7 – Poso Creek Annual Flows**

The underlying CWDC groundwater is located in the Kern County Groundwater Subbasin (Kern Subbasin) of the Tulare Lake Basin. The Kern Subbasin is bounded on the north by the Kern County line and the Tule Groundwater Subbasin, in the east and southeast by granitic bedrock of the Sierra Nevada foothills and Tehachapi mountains, and on the southwest and west by the marine sediments of the San Emigdio Mountains and Coast Ranges (DWR, 2003).

The CWDC area is located in the eastern portion of the southern central valley floor where there are no clay layers and this area of the Kern Subbasin is an unconfined aquifer. There are no shallow groundwater tables in the CWDC area.

Extensive groundwater level data is collected from agricultural production wells and domestic wells, measured under static conditions and collected from approximately 150 to 200 wells throughout the area. The groundwater level information is provided to R.L. Schafer & Associates.
to compile the data and create groundwater depth and elevation contour maps. The 2014 groundwater depth and elevation maps are provided in Figure 8 and Figure 9.

Figure 8- Lines of Equal Depth, Fall 2014
Figure 9 – Lines of Equal Elevation, Fall 2014
Groundwater level monitoring is conducted throughout the District area and is grouped into two areas, north of Poso Creek and South of Poso Creek. Annual average groundwater levels are computed for these two areas and for the full Cawelo Water District.

In the Fall of 2014, the average groundwater depths were 531.6 feet below ground level (BGL) for the north area and 486.5 feet BGL for the south area. The average depth to groundwater was 531.6 feet BGL for the entire district. The shallowest and deepest levels recorded for 2014 was 170 feet and 697 feet, respectively. The Cawelo Water District has been monitoring the groundwater levels in the CWDC area for over 30 years and Table 2 provides a summary of the annual average water levels for the north area, south area and for the District. Figure 10, Figure 11 and Figure 12 describes the historical groundwater level trends for the different areas of CWDC.
## Table 2 – Annual Depth to Groundwater Averages

<table>
<thead>
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<th>Year</th>
<th>North</th>
<th>South</th>
<th>District</th>
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<td>509.8</td>
<td>402.6</td>
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<td>1981</td>
<td>533.3</td>
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<td>1982</td>
<td>505.5</td>
<td>394.6</td>
<td>455.0</td>
</tr>
<tr>
<td>1983</td>
<td>499.2</td>
<td>385.1</td>
<td>447.2</td>
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<tr>
<td>1984</td>
<td>479.3</td>
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<td>1985</td>
<td>475.3</td>
<td>359.9</td>
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<tr>
<td>1986</td>
<td>464.4</td>
<td>353.3</td>
<td>413.8</td>
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<td>1987</td>
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<td>480.4</td>
<td>367.4</td>
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<tr>
<td>1989</td>
<td>468.0</td>
<td>367.7</td>
<td>422.3</td>
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<tr>
<td>1990</td>
<td>502.9</td>
<td>402.5</td>
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<td>488.6</td>
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<td>506.4</td>
<td>426.9</td>
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<td>2014</td>
<td>569.9</td>
<td>486.5</td>
<td>531.6</td>
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</table>
Figure 10 – Historical Annual Fall Average Groundwater Levels, North

Figure 11 – Historical Annual Fall Average Groundwater Levels, South
E. Irrigated Agriculture

Crop survey information for the District has been collected for 35 years and the primary crops in 1979 were cotton, citrus, vineyards and almonds. Cotton was the largest single crop accounting for almost 10,000 acres. In the following 5 to 8 years after 1979, cotton saw a sharp decline in total acreage corresponding to the rapid increase of grapes in the same general time period. Cotton completely disappeared from the District in 1997 with minor acreage showing up again in 2002 and has been absent since. During the decline of cotton, vineyards increased by over 60% and experienced minor acreage increase in the following years. Pistachios steadily increased since 1979 and maintained a consistent rate into recent years, increasing the total acreage by over 70%. Over the 35 year period, the citrus acreage has increased approximately by 20% and the almonds have remained relatively consistent.

When cotton was the largest single crop, row irrigation was the typical irrigation practice in the moderately flat areas along with flood irrigation used for other crops. Areas of the District in the northeast that are rolling hills and low level foothills required higher efficiency irrigations systems because flood and row irrigation was not feasible. An estimated 60-67% of the District was flood or row irrigated in 1979.

In the late 80’s and early 90’s, the cost of irrigation water was increasing significantly and impacting farming operations. The economics of that period drove growers away from cotton.
and other row or flood irrigated crops to high value permanent crops that warranted investments in efficient irrigation systems.

The District provides irrigation water to farmers by means of a distribution system that includes a manmade surface channel, several reservoirs, and numerous pumps to move the water throughout the district and to pressurize an underground network of pipelines that delivers water directly to farmer turnouts.

Nearly all growers in the CWDC area currently utilize a pressurized irrigation system, typically drip or micro-sprinkler, to irrigate their crops as presented in Figure 13. There are few remaining areas that use flood or row irrigation methods which total approximately 1% of all CWDC irrigation systems.

F. Existing Management Practices

Due to the location of the District, the cost to irrigate crops is relatively expensive and largely due to the need to pump surface water uphill into the CWDC area. Additionally, groundwater levels are relatively deep compared to most areas in the Kern Subbasin and therefore groundwater pumping costs are higher.

In addition to the high cost of irrigation water, nutrient applications are conducted at a high level of management to improve effectiveness and to reduce cost. Operating drip or micro-sprinkler irrigation systems allow the growers to use fertigation and deliver liquid fertilizer to the crop in the irrigation water. This provides a precise method to deliver nutrients and to provide it at a schedule that can maximize the crop up-take of the nutrients. High efficiency nutrient applications can be achieved using row or flood irrigation methods with prudent planning and scheduling however, this method of irrigation and associated nutrient applications are generally considered less efficient than management practices associated with drip or micro-sprinkler.

The economic factors affecting farming in the CWDC area has forced farmers to employ a high level of agricultural management practices that include fertilizer and irrigation practices. The economic impacts are the primary reason the CWDC area has experienced a shift from row crops and flood irrigation to permanent crops with drip or micro-sprinkler systems.

Nonetheless, management practices can vary from grower to grower within a single commodity and can be dependent on target yields, individual irrigations systems and operational schedules. General descriptions for nutrient management practices are similar for each of the primary crops in the CWDC area and include soil broadcast, fertigation and foliar applications employing post and pre-harvest application schedules. Further information is necessary to determine the current baseline of management practices and will be obtained from the completed Farm Evaluation forms to be submitted by coalition members.
Figure 13 – 2014 Grower Irrigation Systems
G. Applicable Groundwater Data

The analysis of the groundwater data for the CWDC area was presented in the GAR. The areas with applicable data indicating NO3 levels exceeding the MCL are within designated high vulnerability areas and established the baseline for this CGQMP, Groundwater Quality Trend Monitoring program and the Management Practices Evaluation Program.

Groundwater data was obtained from the State Water Resources Control Board’s Groundwater Ambient Monitoring and Assessment Program (GAMA). The GAMA database includes data from the California Department of Public Health, California Department of Pesticides Regulation, USGS GAMA Priority Basin and GAMA Domestic Wells. Additional data sources included the Kern County Water Agency and the District’s groundwater monitoring programs.

3. Management Plan Strategy

A. Approach

The approach to the management plan strategy is to determine the sources of NO3 in the high vulnerability areas and employ the appropriate actions as described in this CGQMP. The potential sources will be classified as one of two sources; non-irrigated agriculture or irrigated agriculture. It is recognized there are large knowledge gaps regarding nitrate in the groundwater, transportation to the groundwater and the potential nitrate impacts of agricultural practices and therefore a conclusive determination of nitrate sources may be infeasible or unlikely for most of the high vulnerability areas. This CGQMP will address both areas of determined sources and undetermined sources.

Sources of NO3 identified as non-irrigated agriculture will be documented and reported to the Regional Board. CWDC will work with the Regional Board to determine the next steps to address these specific areas.

If irrigated agriculture is determined to be a potential contributor to groundwater nitrate impacts, or should it be found inconclusive, then the associated coalition members in high vulnerability areas will be required to participate in education and outreach programs. These programs will focus on providing resources to help growers improve irrigation and nutrient practices. Additionally, intent of the MPEP is to determine which management practices are protective of the groundwater and any new applicable information generated from the MPEP will be evaluated and provided to the appropriate members. **Figure 14** is a flow diagram presenting the approach to the CGQMP.
Figure 14 – CGQMP Approach Flow Diagram

1. High Vulnerability Areas
   → Comprehensive Groundwater Quality Management Plan

2. Determine Nitrate Source
   - Non-Irrigated Ag
   - Irrigated Ag
   - Undetermined

3. Outreach & Education
   - YES
     → Current Practices Protective of Groundwater?
   - NO
     → Education on MPEP Practices

4. MPEP
   → CGQMP Status Report

5. Report
   → Regional Board
B. Prioritization

The GAR set the prioritization for the high vulnerability areas regarding implementation of the CGQMP, Groundwater Quality Trend Monitoring program and the MPEP as presented in Figure 15.

Figure 15 – Prioritization of High Vulnerability Areas
C. Actions Taken

Early in the CWDC area, cotton was the largest single crop and row irrigation was the typical irrigation practice in the moderately flat areas along with flood irrigation used for other crops. The areas of CWDC in the northeast that are rolling hills and low level foothills required higher efficiency irrigation systems because flood and row irrigation was not feasible. An estimated 60-67% of the District was flood or row irrigated.

In the late 80’s and early 90’s, the cost of irrigation water was significantly increasing and impacting farming operations. The economics of that period drove growers away from cotton and row or flood irrigation systems to high value permanent crops that warranted investments in more efficient irrigation systems. Nearly all growers in the CWDC area currently utilize a pressurized irrigation system, typically drip or micro-sprinkler, to irrigate their crops as presented in Figure 13. There are few remaining areas that use flood or row irrigation methods which total approximately 1% of all CWDC irrigation systems.

In addition to the high cost of irrigation water, nutrient applications are conducted at a high level of management to improve effectiveness and to reduce cost. Operating drip or micro-sprinkler irrigation systems allow the growers to use fertigation and deliver liquid fertilizer to the crop in the irrigation water. This provides a precise method to deliver nutrients and provide them at a schedule that can maximize the crop up-take of the nutrients. High efficiency nutrient applications can be achieved using row or flood irrigation methods with prudent planning and scheduling however, this method of irrigation and associated nutrient applications are generally considered less efficient than management practices associated with drip or micro-sprinkler.

The economic factors affecting farming in the CWDC area has forced farmers to employ a high level of agricultural management practices that include fertilizer and irrigation practices. These practices are some of the most efficient in Kern County and the Tulare Lake Basin area.

D. Outreach and Education

Outreach and Education programs for members with operations in high vulnerability areas will focus on providing resources to help growers improve irrigation and nutrient practices. These programs will be provided at a minimum of 2 times a year and focus on practices appropriate for the priority being addressed. Programs will be organized by CWDC and enlist the assistance of other appropriate groups such as commodity groups, California Department of Food and Agriculture, University of California Cooperative Extension and other suitable groups or experts.

Additionally, as information and studies become available from the MPEP, applicable materials will be incorporated into the education and outreach programs or MPEP specific outreach will be provided.

E. Management Practices and Validation

A better understanding of agricultural management practices will be developed from the information provided on Farm Evaluation forms submitted by members. As noted earlier,
growers in the CWDC area currently employ high efficiency irrigations systems and management practices but the additional information will help to provide details to further evaluate those practices.

Evaluation of the management practices and how they may potentially impact groundwater quality is a tremendously difficult and problematic effort. The discharge of irrigation water and transport of nitrates to the groundwater can be impacted by many different factors such as preexisting conditions, soil type, depth to groundwater, crop type, management practices and many other factors. There are large data gaps in understanding the nitrate impacts and interaction with the various crops and conditions along with large variations in the temporal delay between activities at the surface and their direct impacts on the groundwater.

The general objective of the MPEP is to establish this direct relationship between the management practices for various crops and the impact they have on the groundwater quality. This process is intended to determine which practices are protective of the groundwater quality however, for the reasons stated, this will prove to be a difficult task and applicable studies and information generated by the MPEP may not be available to CWDC for many years. CWDC is currently participating in the group development of the MPEP with other Tulare Lake Basin coalitions and will endeavor to help develop a program that initially addresses the high priority areas in CWDC.

F. Identification of Administration and Duties

The CWDC Irrigated Lands Regulatory Program coordinator is David Hampton and will be responsible for administering the CGQMP. The CWDC Board of Directors have assigned this duty to Mr. Hampton and authorized him delegate general tasks as necessary and require him to obtain Board approval for consultants and partnerships. See Figure 16 for organization chart.
Figure 21 – On-Farm Irrigation Systems

CAWELO WATER DISTRICT
Organizational Chart
(CGQMP Administration)

Cawelo Water District
Board of Directors
Scott Hamilton – President
Keith Watkins – Vice President
Brian Blackwell
David Fenn
Mark Smith

General Manager
David Ansolabehere

Assistant General Manager
David Hampton
(CWDC ILRP Coordinator)

Controller
LeeAnn Giles

Administrative Staff

Cooperating Partners

Consultants
4. Implementation Strategy

The GAR identifies three different priority areas within the high vulnerability areas and is presented in Figure 15 as High, Medium and Low Priority areas. The implementation approach of the CGQMP is to use a staggered schedule to address the different commodities within the priority classifications in the CWDC area. Almonds and vineyards are the primary crops within the High Priority areas and therefore will be the initial focus (Phase 1) of the CGQMP. The CGQMP will address citrus and pistachios (Phase 2) in the high priority areas on a staggered schedule that provides an opportunity for the initial stages of the plan to develop and be established for the almonds and vineyards. Subsequently, information and data disseminated and obtained from Phases 1 and 2 will be applied to the corresponding commodities in the medium priority areas along with efforts initiated for the remaining crops in the high priority areas (Phase 3). The information and data compiled from the previous phases will be applied to the low priority areas (Phase 4).

A. Implementation Schedule

Upon Regional Board approval of the CGQMP and GAR, the initial phase or Phase 1 will begin immediately with the process of identifying potential sources of nitrates that impact the groundwater quality. Information and data compiled from the Farm Evaluation forms is critical to the CGQMP implementation and the determination of potential sources. Also, additional field surveys or inquiries may be necessary and can require a significant amount of time to complete. After receiving Farm Evaluations it is estimated that it will take 6 to 12 months to evaluate the information and make a determination on potential nitrate sources. Once determinations are completed or deemed inconclusive, outreach and education programs can be developed and provided within a year to address the management practices for the almond and vineyard commodities in the high priority areas. Members with operations in these areas will be required to attend a minimum of 2 outreach and education workshops per year.

During Phase 1, the MPEP will continue to be developed and studies and evaluations of management practices potentially will not be completed for several years after initial implementation of the CGQMP. As MPEP information becomes available it will be incorporated into the process as appropriate.

Once outreach and education programs have been developed for Phase 1 then the same process will begin for Phase 2 and the subsequent phases. As the implementation of the CGQMP continues, much of the efforts and information of the earlier phases will potentially be common to the different phases and therefore developed programs may apply to the different phases. It is expected the staggered schedules will share common tasks and eventually merge into a single governing schedule.

B. Partners and Participating Members

CWDC will draw on many different resources to develop effective outreach and education programs. The programs will be organized by CWDC and enlist the assistance of various groups such as commodity groups, California Department of Food and Agriculture, University of California Cooperative Extension, other coalitions and other appropriate groups or experts.
Members in the high vulnerability areas will be required to attend a minimum of two outreach and education programs and will be provided with additional information on available resources. Members will be required to evaluate the information provided and report to the CWDC any plans to incorporate or the implementation of new management practices.

5. Monitoring Methods

The evaluation of management practices and how they may potentially impact groundwater quality is a tremendously difficult and problematic effort. The discharge of irrigation water and transport of nitrates to the groundwater can be impacted by many different factors such as preexisting conditions, soil type, depth to groundwater, crop type, management practices and many other factors. The depth to groundwater in the CWDC area is approximately between 400 to 600 feet and the GAR roughly estimates the transportation of nitrates from the root zone to the groundwater can be over 20 to 30 years. The General Order requires groundwater quality trend monitoring however, the current or future agricultural activities cannot be evaluated based on water quality data acquired within 5 or 10 years or potentially even a larger period. CWDC will develop a groundwater quality trend monitoring plan with the understanding that the monitoring plan is a long-term plan taking into consideration the activities occurring over a 10 year period or more.

CWDC will review and evaluate other potential methods to monitor the effectiveness of the outreach and education programs and applicable MPEP studies and information.

A. Data Evaluation

Data will be collected per an approved GQTMP and analyzed for long-term nitrate impacts. The temporal delay of potential water quality impacts from surface activities prevents any direct evaluation of current or newly employed management practices and any evaluations will have to be based on representative studies or information provided by the outreach and education programs or the MPEP.

B. Reporting

The status and progress of the CGQMP, along with data and information collected, will be reported to the Regional Board as required and submitted May 1 of each year.
6. References

DWR, 2003, Department of Water Resources, Groundwater Basins in California, DWR Bulletin 118, Update 2003, Sacramento, CA


USDA, 1988, United States Department of Agriculture Soil Conservation Service, Soil Survey of Kern County, Northwestern Part

USDA, 2007, United States Department of Agriculture Natural Resources Conservation Service, Soil Survey of Kern County, Northeastern Part, and Southeastern Part of Tulare County, California