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PART II: AVAILABLE DATA

3.1 OBJECTIVES

The purpose of this chapter is to describe the existing data collection programs and the data available for completing the Master Water Plan and for managing water resources in the County.

3.2 DATA COLLECTION EFFORTS OR PROGRAMS

Appendix A includes the Data Summary Memorandum prepared by Wallace Group and others. This memorandum summarizes the information used to determine existing and forecast water demands and available supplies. In addition to this memorandum, excerpts from the County's Data Enhancement Plan, which describes the County's water resources data collection network, are provided below.

3.2.1 Groundwater

Groundwater data has been collected for many years in the region. Primarily the San Luis Obispo County Flood Control and Water Conservation District (District) has been the lead agency to collect this information from water providers, local agencies, and land owners.

3.2.1.1 Water levels

Water levels throughout the region have been collected in the primary groundwater basins of the region, as shown in Figure 3.1. The colored regions delineate the defined groundwater basins of the region. Red circles indicate active well sites.

3.2.1.1.1 *District Groundwater Level Measuring Program*

Groundwater levels have been measured by the District in selected wells on a semi-annual basis to provide data for planning and engineering purposes. The monitored wells are located within groundwater basins and sub-basins of the Central Coast Hydrologic Region described in Department of Water Resources Bulletin 118. Program wells are selected based on aquifer definition and uniform aerial distribution.

The District maintains a database with hundreds of wells. Readings started in the early 1950s. Water level readings are taken in April and October. The groundwater elevation data obtained from this monitoring program collected over time provide a general indication of ground water basin conditions. This information is used in determining groundwater availability and basin yield estimates, and for hydrogeologic and geotechnical impacts and assessment studies on potential projects.

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Figure 3.1 Measured Regional Groundwater Wells

The Salinas River corridor of the Paso Robles Basin, Los Osos Valley, Nipomo Mesa, San Luis Obispo Valley, and the Tri-Cities Mesa have a large number of program wells because of their high population density. The Chorro Valley, Guadalupe hydrologic area, Morro Valley, Creston area, San Juan area, and Shandon areas have a large number of program wells because of their greater agricultural land use.

The current active wells measured in the region by the District, and the regional groundwater basins are shown in Figure 3.2. The majority of well owners participate on a voluntary basis and the wells are typically production wells, which create certain challenges with maintaining an accurate, long-term record, making information available to the general public and understanding the condition of every groundwater basin in the County. The District is initiating the development of a more formal groundwater monitoring program for approval by the Board of Supervisors and with elements that can be adopted by ordinance. The program will, at a minimum, address groundwater level and usage data collection. Effort to develop the program will include town-hall meetings to ensure stakeholder involvement. Issues to be addressed during the development of the program would include, but not be limited to, gaps in the existing monitoring network, voluntary versus non-voluntary participation, distinguishing how different users (urban, agricultural, rural) would be involved/affected/not affected, education and outreach, understanding what other amendments to County Code related to groundwater data collection are being developed, and the legal authorities of the County/District.

In early 2008, Cleath & Associates evaluated the San Luis Obispo County well measuring program. Their analysis recommended that 48 wells should be eliminated, and 66 wells should be added to the program. The total number of wells in the updated monitoring program would be 485 monitoring wells. Additionally, one well should be established in each of the un-gauged groundwater basins of the region. The following basins are currently un-gauged and should have at least one centrally located well:

- Arroyo De La Cruz Valley
- Big Spring Area
- Cayucos Valley
- Huasna Valley
- Old Valley
- Rafael Valley
- Rinconada Valley
- San Capoforo Valley
- Toro Valley

3.2.1.1.2 *U.S. Geological Survey*

The USGS measures depth to groundwater in thousands of wells throughout the Nation. Their groundwater database contains records from about 850,000 wells that have been compiled during the course of ground-water hydrology studies over the past 100 years. (Figure 3.3)

The USGS is responsible for measuring the wells in Santa Barbara County's groundwater program. Locally, only a few wells are measured by the USGS, all of which are located on the southern county border in the vicinity of Santa Maria and Cuyama. Information from these wells is served via the internet through NWISWeb, the National Water Information System Web Interface. NWISWeb provides all USGS ground-water data that are approved for public release. More information can be found at: http://waterdata.usgs.gov.

3.2.1.2 Geologic Data and Well Logs

Perhaps thousands of well logs are on file for locations throughout the County, although a clear policy is lacking regarding release of the log information. The County's Environmental Health Department is responsible for the collection of well log information. Some well logs are also on file at both the County Public Works Department and the State Department of Water Resources.

Well construction data may not be available for all wells currently included in the monitoring network. Downhole surveys of some of the existing wells currently being monitored could be conducted to obtain construction details and determine which aquifers are being monitored. These downhole surveys would improve the understanding of the groundwater levels and groundwater movement in the area of the well.

For wells without construction records, video logs could be performed during pump maintenance. Recent technology developments allow down-hole investigation of wells without having to remove their pumps and can provide a video survey to determine their screen intervals; estimate the amount of flow contributed by aquifer (allowing the aquifer characteristics to be estimated) and collect water quality samples by aquifer. These video surveys do have limitations due to the pump column being in the well during the survey. The well owner could notify the District and the well logging service to coordinate these efforts with their pump maintenance.

Figure 3.2 District Groundwater Measuring Program

Figure 3.3 U.S. Geological Survey Well Measuring Program

3.2.2 Stream Flow

Water levels are typically collected in streams as part of a stream flow monitoring program. In addition, water levels are also collected in streams to support flood protection activities, and in reservoirs to assist with daily operations.

The major streams and rivers in the region include:

- Arroyo De La Cruz Creek
- Arroyo Grande Creek*
- Cayucos Creek
- Chorro Creek*
- Estrella River*
- Los Osos Creek*
- Morro Creek*
- Old Creek
- Pismo Creek
- Salinas River*
- San Capoforo Creek
- San Luis Obispo Creek*
- San Simeon Creek*
- Santa Rosa Creek*
- Toro Creek
- Villa Creek

The streams marked with an “*” indicate streams that have current gauge stations, and are shown as red circles in Figure 3.4 on the next page.

Figure 3.4 Streams With Current Gauge Stations

There are seven major streams in the region that do not currently have stream gauges, as suggested in the above figure. Those streams are marked by a red cross ("+") on the map above. (Existing streams are marked by a red circle.) Those streams include:

- Arroyo De La Cruz Creek
- Cayucos Creek
- Old Creek
- Pismo Creek
- San Capoforo Creek
- Toro Creek
- Villa Creek

In order to measure stream flow at the outlet of each Hydrologic Catalog Unit within the region, stream gauges should be placed at the outlet of each of the above creeks. The Salinas River, Santa Maria River, and Estrella River watersheds all have USGS stream gauges that measure streamflow from their respective accounting units. When adding new sites to the stream network, using past, inactive gauges, which may have a period of record that will complement any new data collected, should be considered.

Once each major stream in the region has a stream gauge, it would be worthwhile to gauge some of the smaller tributaries and creeks in the region. County basins that would significantly benefit from enhanced stream flow monitoring conducted for land use and water resources planning include the Paso Robles Basin, San Simeon Basin, Santa Rosa Basin, Los Osos Basin, San Luis Obispo/Edna Valley Basin, Arroyo Grande Basin, Nipomo Mesa Basin, and the Santa Maria Basin. When enhancing the monitoring in these regions, placing gauges on major creeks near the confluence with significant tributaries, on some smaller streams and tributaries, and at major cities along the major creeks should be considered.

To manage water resources for "in-stream" values and functions such as recreation, aesthetic enjoyment, and habitat for aquatic ecosystems, it is important to measure the stages of streams in the region. The recommendations above meet this data requirement. To understand the regional natural flow regime, there should be a number of stream gauges in natural watersheds. The recommendations above meet this need.

An enhanced flood warning system may be used to some extent in many communities of the region. With adequate warning, property owners may have time to install flood gates or move valuable objects to higher ground. Unfortunately, times of concentration of creeks and rivers in the county are relatively short – only a few hours or less. A flood warning system would only allow enough time for the most basic preparations. Communities with historic flooding that may benefit from a flood warning system include Cambria and other

north coast communities, San Luis Obispo to Avila Beach, Five Cities/Arroyo Grande Watershed, Los Osos, Shandon, and old town Nipomo.

In particular, the following roads are consistently flooded in storm events and would benefit from the installation of a real-time stage gauge:

- Airport Road at the Estrella River in Paso Robles
- Buena Vista Drive at Huerohuero Creek in Paso Robles
- San Luis Bay Drive at San Luis Obispo Creek (near Monte Road towards Avila)
- Shell Creek Crossing near Shandon (flash floods potential)
- Turri Road in Los Osos (roughly 1.5 miles upstream of South Bay Drive)
- Upper Santa Rosa Creek Road in Cambria

There are two agencies that collect stream flow information in the region: District and the United States Geological Survey, as discussed below. Stream flow data is also collected on occasion through the Central Coast Ambient Monitoring Program (CCAMP), but only when water quality samples are collected. The CCAMP does not use permanent stream flow gauges.

3.2.2.1 District Stream Measuring Program

The District has records of various length from over 30 stream gauging stations, including six stations that were acquired from the USGS. Currently, 18 stream gauge stations located throughout San Luis Obispo County are maintained the County Public Works Department. Each of the gauge stations measure the depth of flow or “stage” of the stream which can be used to estimate the stream discharge at the gauge location.

These sites are maintained to support District reservoir operations, flood control, and other water resources purposes. Most of the District gauges are on coastal creeks and rivers, with the exception of one gauge on the Salinas River, just downstream of the Salinas Dam, as shown in Figure 3.5.

For more information of the District’s Stream Gauges, go to: http://www.slocountywater.org/site/Water%20Resources/Data/maps/stream-flow.htm.

3.2.2.2 U.S. Geological Survey Stream Gauging Program

The U.S. Geological Survey (USGS) stream gauging program provides streamflow data for a variety of purposes that range from current needs, such as flood forecasting, to future or long-term needs, such as detection of changes in streamflow due to human activities or global warming. The development of data on the flow of the Nation's rivers mirrors the development of the country. From the establishment of the first stream gauging station operated by the USGS in 1889, this program has grown to include 7,292 stations in operation as of 1994. Data from the active stations, as well as from discontinued stations,

are stored in a computer data base that currently holds mean daily-discharge data for about 18,500 locations and more than 400,000 station-years of record. The stream-discharge data base is an ever-growing resource for water resources planning and design, hydrologic research, and operation of water resources projects.

The U.S. Geological Survey's National Streamflow Information Program (NSIP) operates and maintains approximately 7,500 stream gauges which provide long-term, accurate, and unbiased information on streamflow to meet the needs of many diverse users. The mission of NSIP is to provide the streamflow information and understanding required to meet local, State, regional, and national needs.

Streams maintained by the USGS tend to be on inland streams and rivers, and are typically funded, at least in part, at a local level. Most stream gauges in the region, if not all, support local reservoir operations (Figure 3.6).

3.2.3 Precipitation

Many agencies collect precipitation data in the region. The major rain gauge networks are shown on Figure 3.7 and discussed below.

3.2.3.1 District Recording Rain Gauge Program

There are a number of recording rain gauges in operation in the County. These gauges provide a record of accumulated precipitation versus time. The District Recording Rain Gauge network consists of 13 recording gauges located throughout the region. The distribution and density of recording rain gauges in the region is fairly limited, and noticeably lacking in the northern and eastern part of the region (Figure 3.8).

Figure 3.5 San Luis Obispo County Stream Measuring Program

Figure 3.6 USGS Stream Gauge Sites

Figure 3.7 Regional Rain Gauge Network

Figure 3.8 County Recording Rain Gauge Distribution

It is recommended that recording rain gauges be installed in the following areas:

- Avila Beach
- Baywood/Los Osos
- California Valley (rural area and community area)
- Cholame
- Grover Beach
- Halcyon
- Harmony
- Pismo Beach
- San Simeon
- Santa Margarita
- Shandon (rural area and community area)
- Templeton

Another three (3) standard rain gauges in Pismo Beach, and one each in Paso Robles, Atascadero, Los Osos and Nipomo are recommended to improve the density of information.

3.2.3.2 District Volunteer Precipitation Program

Precipitation data from approximately 50 stations throughout San Luis Obispo County are collected by the County Public Works Department. These records are usually in the form of daily entries of the precipitation occurring during the preceding 24-hour periods. These daily records are summarized in monthly totals.

Volunteer rain gauges are generally operated at-will, by regional residents, business owners, or local agencies. The volunteers independently collect precipitation data and provide it to the District or other agency on an annual basis.

There are a significant amount of volunteer rain gauges in the region, particularly in urban and suburban areas. As with the District recording rain program, the east portion of the region is particularly under represented (Figure 3.9).

3.2.3.3 District ALERT Rain Gauge Program

ALERT is an acronym for Automated Local Evaluation in Real Time, which is a method of using remote sensors in the field to transmit environmental data to a central computer in real time. This standard was developed in the 1970's by the National Weather Service and

Figure 3.9 County Volunteer Rain Gauge Distribution

has been used by the National Weather Service, Army Corps of Engineers, Bureau of Reclamation, as well as numerous state and local agencies, and international organizations (footnote 1).

The District ALERT System was developed in cooperation with the National Oceanic and Atmospheric Administration (NOAA) which is a primary user of the information. The District ALERT System consists of one computer base station located at the County Courthouse and radio repeaters that receive and retransmit telemetry from remote sensors located at various locations throughout the County.

Data from these gauges serves to provide real-time information to flood forecasters and engineers during storm events. Due to the inconsistency of ALERT data transmissions, historic data for these gauges is typically unreliable and/or unavailable. For key sites, the District has converted some ALERT gauges to recording rain gauges that will provide accurate time-series precipitation data. (Figure 3.10). Additional ALERT gauges would be beneficial in the extreme northwest corner of the County, the Hearst Castle area, the Cayucos area and the Templeton area.

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3.2.3.4 California Irrigation Management Information System (CIMIS) Stations

In 1982, through a joint research and development effort between UC Davis and DWR a computerized weather station system was established as a more cost effective method for estimating crop water use. This program was given the name "California Irrigation Management Information System" or CIMIS. In 1985, the administration and implementation of the program, and its further development, were turned over to DWR.

The California Irrigation Management Information System (CIMIS) is a program of the Office of Water Use Efficiency, California Department of Water Resources (DWR) that manages a network of over 120 automated weather stations in the state of California. CIMIS was developed to assist irrigators in managing their water resources efficiently. Efficient use of water resources benefits Californians by saving water, energy, and money.

The CIMIS stations gather climatic data (precipitation, temperature, humidity, solar radiation, etc.), which is used to calculate the evapotranspiration (ET). ET is the loss of water to the atmosphere by the combined processes of evaporation (from soil and plant surfaces) and transpiration (from plant tissues). It is an indicator of how much irrigation water is needed (or used) for healthy growth and productivity.

CIMIS stations are maintained by local agencies that use standard equipment and maintenance procedures. The data seems to be reliable, particularly for hourly rainfall information during storms.

[1] Descriptions of the ALERT system are based on information provided in the websites for Orange County and the World Meteorological Organization

Figure 3.10 District Real-Time Rain Gauge Network

As shown on the Figure 3.11, there are four (4) CIMIS stations currently in operation throughout the region. Those stations are located in southeast Atascadero, west of Nipomo, 6.5 miles northwest of San Luis Obispo, and on the Cal Poly Campus. To help estimate agricultural water use in each climatic region and to supplement evaporation data collected at reservoirs and by weather stations, it is recommended that two additional evaporation pans (or weather stations) are established around Cambria (or further north) and east of Paso Robles.

3.2.3.5 National Oceanic and Atmospheric Administration / National Weather Service Cooperative Observer Network

The National Weather Service Cooperative Observer Program (COOP) was formally created in 1890 under the Organic Act. Its mission is to provide observational meteorological data (usually consisting of daily maximum and minimum temperatures, snowfall, and 24-hour precipitation totals) and to provide observational meteorological data in near real-time to support forecast, warning and other public service programs of the NWS.

More than 11,000 volunteers take observations on farms, in urban and suburban areas, National Parks, seashores, and mountaintops. A cooperative station is a site where observations are taken or other services rendered by volunteers or contractors. A cooperative station may be collocated with other types of observing stations such as standard observations stations, Flight Service Stations, etc.

This network was established to provide near real-time data. Unfortunately, the historic dataset for many of these gauges is not complete. It is recommended that data from these gauges not be used for water resources planning. It should be noted that this is a generalization regarding gauges in this network, primarily since these gauges are maintained by different sorts of volunteers and there does not appear to be consistent data maintenance or reporting.

There are twelve active COOP stations in the region, as shown in Figure 3.12. More information about the COOP can be found at: http://www.ncdc.noaa.gov/oa/ncdc.html and at: http://www.nws.noaa.gov/om/coop/.

3.2.3.6 Citizen Weather Observer Program (CWOP)

The Citizen Weather Observer Program (CWOP) allows users with computerized weather stations to send their information via a website to be included into the United States Mesonet. This data is then used by the Rapid Update Cycle (RUC) forecast model to produce short term forecasts (3 to 12 hours into the future) of conditions across the United States' lower 48 states.

Figure 3.11 Regional CIMIS Gauges

Figure 3.12 Regional COOP Stations

The CWOP is a private-public partnership with three main goals: 1) to collect weather data contributed by citizens; 2) to make these data available for weather services and homeland security; and 3) to provide feedback to the data contributors so that they have the tools to check and improve their data quality. In fact, the web address, www.wxqa.com, stands for weather quality assurance. There are over 6,000 registered CWOP members worldwide and roughly eight in the region.

CWOP is a group of ham radio operators and other private citizens around the country that have volunteered the use of their weather data for education, research and use by interested parties. The APRS-IS collects weather data transmitted from individual stations and communicates these data to the amateur radio findU server where the data are organized and made available to the MADIS Program at 15-minute intervals. The CWOP data also go to the MADIS Quality Control and Monitoring System (QCMS) which checks data quality using a variety of techniques. Based on these checks, data may be declared questionable. Occasional questionable data is normal. However, a high percentage of questionable data may indicate instrument or siting problems.

CWOP members send their weather data by internet alone and internet-wireless combination to the findU server and then every 15 minutes, the entire data set is sent from the findU server to the NOAA MADIS server. The data are checked for quality and then redistributed to users. There are over 500 different user organizations of mesonet data, including the National Weather Service (Figure 3.13).

For more information on the Citizen Weather Observer Program, go to: www.wxqa.com.

3.2.3.7 Remote Automated Weather Station (RAWS) Gauges

There are nearly 2,200 interagency Remote Automated Weather Stations (RAWS) strategically located throughout the United States. These stations monitor the weather and provide weather data that assists land management agencies with a variety of projects such as monitoring air quality, rating fire danger, and providing information for research applications.

Most of the stations owned by the wildland fire agencies are placed in locations where they can monitor fire danger. RAWS units collect, store, and forward data to a computer system at the National Interagency Fire Center (NIFC) in Boise, Idaho, via the Geostationary Operational Environmental Satellite (GOES). The GOES is operated by the National Oceanic and Atmospheric Administration (NOAA). These data are automatically forwarded to several other computer systems including the Weather Information Management System (WIMS) and the Western Regional Climate Center (WRCC) in Reno, Nevada.

Fire managers use these data to predict fire behavior and monitor fuels; resource managers use the data to monitor environmental conditions. Locations of RAWS stations can be searched online courtesy of the Western Regional Climate Center.

Figure 3.13 Citizen Weather Observer Program Gauges

The United States Forest Service and National Park Service use RAWS gauges for vegetation mapping, fire fuel mapping, fire risk estimates and fire detection, post-fire severity mapping, insect-infestation mapping, and relative water stress monitoring (Figure 3.14).

3.2.3.8 NWS Automated Surface Observing System (ASOS) Stations

Federally funded, ASOS is a joint program of the National Weather Service, the Federal Aviation Administration, and the Department of Defense. The ASOS systems serve as the Nation's primary surface weather observing network. ASOS works non-stop, 24 hours a day, every day of the year. ASOS is installed at more than 900 airports across the country, where they make observations.

ASOS's constant stream of data benefits the forecast and research communities and promotes more accurate forecasts of all kinds.

ASOS reports the following basic weather elements:

- Sky conditions such as cloud height and cloud amount up to 12,000 feet,
- Surface visibility up to at least 10 statute miles,
- Basic present weather information such as the type and intensity for rain, snow, and freezing rain,
- Obstructions to vision like fog, haze, and/or dust,
- Sea-level pressure and altimeter settings,
- Air and dew point temperatures,
- Wind direction, speed and character (gusts, squalls),
- Precipitation accumulation, and
- Selected significant remarks including- variable cloud height, variable visibility, precipitation beginning/ending times, rapid pressure changes, pressure change tendency, wind shift, peak wind.

Besides serving aviation needs, ASOS serves as a primary climatological observing network in the United States, making up the first-order network of climate stations. Because of this, not every ASOS is located at an airport; for example, one of these units is located at Central Park in New York City and another is located on Cabbage Hill near Pendleton, Oregon, for the sole purpose of providing climatological observations.

Figure 3.14 Remote Automated Weather Station (RAWS) Gauges

Regionally, there are three ASOS systems. These stations are located at the Paso Robles, San Luis Obispo, and Santa Maria airports, as shown on Figure 3.15. For more information on FAA ASOS Stations, go to: http://www.faa.gov/airports_airtraffic/weather/asos/?state=CA.

3.2.3.9 National Weather Service Precipitation Forecasts (QPF)

The generation of increasingly accurate quantitative precipitation forecasts (QPFs) has been identified as a top priority of the National Weather Service and United States Weather Research Program. The primary applications of QPFs are:

- Flood forecasting,
- Water resource management, and
- Prediction of significant snowfall.

In light of the devastating socioeconomic impacts of flash and river flooding and significant snowfall, QPFs have emerged as a critical facet of the end-to-end forecast process. Timely and accurate flood and winter storm forecasts are essential for the preservation of life and property. In an average year, the number of fatalities and property damage owing to flash and river flooding exceeds that for all weather-related natural phenomena. Although the death toll associated with heavy snow events is typically small, heavy snow can cripple transportation and often has a prolonged economic impact.

Improving QPF and its effect on flood forecasting and water resource management is being recognized as an immense challenge, and will require that the academic and research communities be engaged through the Collaborative Science, Technology, and Applied Research Program and the United States Weather Research Program. Progress in QPF, especially in flash-flood forecasting, will require better understanding of cloud microphysical processes and of land-surface-atmospheric interactions, improved measurements of atmospheric water vapor, better understanding of the dynamics of mesoscale convective systems, better parameterizations of cloud turbulent and microphysical processes, and further development of mesoscale numerical models.

In addition to the many scientific issues relating to QPF, there are also issues in provision of improved, real-time service to users, not the least of which involves the interaction of the important components of the modernized National Weather Service, including the National Centers for Environmental Prediction (NCEP), the Weather Forecast Offices (WFOs), and the River Forecast Centers (RFCs) that constitute an end-to-end forecast process. Several years ago, an operations concept was developed for the production and use of quantitative precipitation information in the modernized NWS. The next task is to develop a QPF implementation plan based on these concepts which accounts for the role of NCEP Service Centers, the WFOs and RFCs, and the implementation of Advanced Weather Interactive Processing System (AWIPS) (Figure 3.16).

Figure 3.15 FAA ASOS Stations

Figure 3.16 Local National Weather Service QPFs

There are three National Weather Service QPF points in the region and one in the City of Santa Maria, as shown below. For more information on Local National Weather Service QPFs, go to: www.wrh.noaa.gov/lox/main.php?suite=hydrologyandpage=observations.

3.2.4 Reservoirs

3.2.4.1 Local Reservoir Operations

Daily surface water levels are measured for most major reservoirs in the region as part of daily reservoir operations. The County maintains reservoir operational records for two reservoirs – Lopez and Salinas. Other agencies collect and maintain reservoir operation data for the other major reservoirs, shown on Figure 3.17.

Data for each reservoir is available from the agency that operates the reservoir. As part of regular reservoir operations, daily lake elevation values are recorded at the following reservoirs:

- Chorro
- Salinas
- Lopez (includes Terminal Reservoir)
- Whale Rock
- Nacimiento
- Twitchell

Daily stage and storage values for these reservoirs are reported to the District on a daily basis.

3.2.5 Water Quality

Numerous federal, state, and local agencies and organizations have conducted water quality monitoring in the region over the past several decades. Non-profit organizations and other agencies in San Luis Obispo County are currently monitoring water quality in the County and the Central Coast region. These groups have relatively well-developed programs. Continued monitoring at the County level will provide a better overall picture of water quality in the County and will make the most efficient use of County resources[2]. Some regional water quality monitoring efforts are described below.

3.2.5.1 Sampling Surface Water

3.2.5.1.1 *Water Use Monitoring*

Operators of public water systems (any system that serves drinking water to at least 24 persons for at least 60 days out of the year, or who serves domestic water to 15 or more service connections, is a public water system and must have a domestic water supply permit) conduct routine monitoring to ensure that the water they produce complies with Safe Drinking Water Act standards. Results are reported to the State of California

[2] San Luis Obispo County Stormwater Management Plan, June 2006.

Figure 3.17 Reservoir Locations

Department of Public Health (CDPH). Monitoring broadly encompasses several categories of constituents: microorganisms, disinfectants, disinfection byproducts, inorganic chemicals, organic chemicals, and radionuclides.

Sampling is conducted at treatment plants, within distribution systems, and at the tap, and monitoring results are evaluated to ensure that applicable drinking water quality standards are met. For regulated constituents, results are compared to Primary and Secondary MCLs, and unregulated contaminants are evaluated against CDPH Detection Limits for Purposes of Reporting (e.g., color, corrosivity, and odor).

Small water systems[3] are also required to conduct routine monitoring and report to the Environmental Health Services Division of the San Luis Obispo County Public Health Department.

3.2.5.1.2 *Surface Water Ambient Monitoring Program (SWAMP)*

The Surface Water Ambient Monitoring Program (SWAMP) is intended to integrate existing water quality monitoring activities of the State Water Resources Control Board and the Regional Water Quality Control Boards, and to coordinate with other monitoring programs.

Ambient monitoring refers to any activity in which information about the status of the physical, chemical, and biological characteristics of the environment is collected to answer specific questions about the status and trends in those characteristics. For the purposes of SWAMP, ambient monitoring refers to these activities as they relate to the characteristics of water quality. Only a small portion of SWAMP can be implemented at its current funding level. As a result, resources are focused where monitoring information is most needed to support regional program priorities, such as maintaining high quality waters, such as Lake Tahoe, or supporting the restoration of priority watersheds.

SWAMP is a statewide monitoring effort designed to assess the conditions of surface waters throughout the state of California. The program is administered by the State Water Resources Control Board. Responsibility for implementation of monitoring activities resides with the nine Regional Water Quality Control Boards that have jurisdiction over their specific geographical areas of the state. Monitoring is conducted in SWAMP through the Department of Fish and Game and U.S. Geological Survey master contracts and local Regional Boards monitoring contracts.

SWAMP is also intended to capture monitoring information collected under other State and Regional Board Programs such as the State's TMDL (Total Maximum Daily Load), Nonpoint Source, and Watershed Project Support programs. SWAMP does not conduct effluent or

[3] Systems having between 15 - 199 service connections and regularly serving 25 or more individuals daily at least 60 days out of the year, or systems that have 5-14 service connections and not regularly serving more than an average of 25 individuals daily for more than 60 days out of the year

discharge monitoring, which is covered under National Pollutant Discharge Elimination System permits and Waste Discharge Requirements.

Data from sites that are a part of the SWAMP can be obtained online at: http://bdat.ca.gov.

3.2.5.1.3 *303(d) Clean Water Act*

Under section 303(d) of the Clean Water Act, states, territories, and authorized tribes are required to develop lists of impaired waters. These are waters that are too polluted or otherwise degraded to meet the water quality standards set by states, territories, or authorized tribes. The law requires that these jurisdictions establish priority rankings for waters on the lists and develop total maximum daily loads (TMDLs) for these waters. A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still safely meet water quality standards.

3.2.5.1.4 *National Pollutant Discharge Elimination System Compliance Monitoring*

As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or man-made ditches. Industrial, municipal and other facilities must obtain permits if their discharges go directly to surface waters.

EPA conducts inspections of facilities subject to the regulations to determine compliance. EPA inspections involve:

- Reviewing discharge monitoring reports
- Interviewing facility personnel knowledgeable of the facility
- Inspecting the processes that generate and treat wastewater
- Sampling wastewater discharges to navigable waterways and other points in the generation or treatment process
- Reviewing how samples are collected and analyzed by the laboratory

3.2.5.2 Streams, Lakes & Reservoirs

3.2.5.2.1 *Central Coast Ambient Monitoring Program (CCAMP)*

The Central Coast Regional Water Quality Control Board (Regional Board) is responsible for maintaining and enhancing water quality throughout central coastal California, including 370 miles of coastline in San Mateo, Santa Cruz, Monterey, San Luis Obispo, and Santa Barbara counties. In 1998, the Regional Board initiated the Central Coast Ambient Monitoring Program (CCAMP), with a broad mandate to gather water quality data in groundwater, rivers, streams, estuaries, and the ocean, throughout the Regional Board's jurisdiction. It is the Regional Board's goal to "collect, assess, and disseminate water quality information to aid decision-makers and the public in maintaining, restoring, and

enhancing water quality and associated beneficial uses". Currently there are 23 river/stream sites in the region. (Figure 3.18). Flow data is also collected at some but not all of these sites when the water quality samples are collected. These are not permanent stream flow gauges. Some monitoring within the Morro Bay watershed is also completed by the Morro Bay National Estuary Program (MBNEP). MBNEP data is compatible with CCAMP data management systems.

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3.2.5.2.2 *SLO County Water Quality Lab*

Water sampling and analysis for District-provided water supplies are performed by the San Luis Obispo County Water Quality Laboratory. This lab is certified by the DHS as an environmental testing laboratory for bacteriological and chemical analyses. The lab performs analyses on water and wastewater for all County Special Districts, including:

- Cayucos
- Nipomo
- San Luis Obispo Country Club
- County Airport
- Oak Shores
- Santa Margarita

- Lopez Recreation Area
- Operations Center
- Shandon
- Lopez WTP
- Salinas Project
- State Water

3.2.5.2.3 *Waste Discharge Compliance Monitoring*

Under Federal Clean Water Act Section 401, every applicant for a federal permit or license for any activity that may result in a discharge to a water body must obtain state water quality certification that the proposed activity will comply with state water quality standards.

The Regional Board regulates point source discharge of wastewater to land and surface waters of the region so that the highest quality and beneficial uses of these waters are protected and enhanced. Regulation is by issuance of either Waste Discharge Requirements (WDRs) or National Pollutant Discharge Elimination System (NPDES) permits. Both WDRs and NPDES permits contain monitoring requirements to verify compliance with applicable conditions. These requirements vary according to those specific conditions.

All persons or agencies discharging (or proposing to discharge) pollutants from a point source into any waters of the state are required to apply for and have a permit under the NPDES program and/or WDRs (issued by the Regional Board) to discharge. Typically publicly owned treatment works are regulated, through NPDES permits and/or WDRs, to monitor water quality for all points of water discharge.

Figure 3.18 Central Coast Ambient Monitoring Program

Key permit conditions applicable to all NPDES permits or WDRs include those for monitoring. These conditions apply to both stormwater and non-stormwater discharges. Although the state, local authority, or EPA's general permits can impose additional requirements, the permit holder must typically monitor discharges within the following parameters:

- Flow
- Pollutants listed in the terms of the permit conditions
- Pollutants that could have a significant impact on the quality of the receiving streams
- Pollutants specified as subject to monitoring by EPA regulations
- Other pollutants for which the EPA requests monitoring in writing

Each of these monitoring parameters must be measured at the frequency specified in the NPDES permit, WDR, or at intervals sufficiently frequent to yield data that would characterize the nature of the discharge. Examples of cities and agencies that are currently operating wastewater collection, treatment and disposal systems under a NPDES permit include:

- City of Paso Robles
- City of Atascadero
- Atascadero State Hospital
- Templeton CSD
- San Miguel CSD
- South San Luis Obispo County Sanitation District
- City of Pismo Beach

3.2.5.3 Estuaries and Wetlands

Current monitoring in estuaries and wetlands is summarized below. Note that there is significant estuarine monitoring that is conducted by other federal agencies, state and local agencies, and the academic community that may not be discussed here.

3.2.5.3.1 *San Luis Obispo Science and Ecosystem Alliance (SLOSEA)*

As mentioned above, SLOSEA monitors water quality in the Morro Bay Estuary at the following sites and hopes to map spatial and temporal changes in the physical and chemical characteristics of water quality in the Morro Bay ecosystem.

Conductivity (and salinity), temperature, dissolved oxygen, oxygen saturation, fluorescence (a proxy for chlorophyll-a), turbidity, nitrate, current/current profile, and depth of water are

measured at these sites (Figure 3.19). More information on the sites maintained by SLOSEA can be found here: http://www.slosea.org.

3.2.5.3.2 *EPA's National Coastal Assessment*

The US EPA's National Coastal Assessment surveys the condition of the Nation's coastal resources by creating an integrated, comprehensive monitoring program among the coastal states.

To answer broad-scale questions on environmental conditions, EMAP and its partners have collected estuarine and coastal data from thousands of stations along the coasts of the continental United States. EMAP's National Coastal Assessment comprises all the estuarine and coastal sampling done by EMAP beginning in 1990. This includes the sampling done in the biogeographic provinces as well as data from the Regional EMAP (REMAP) studies done by EPA Regional Offices. Locally there are five stations in the region, see Figure 3.20, several of which are off-shore, coastal sampling sites. This data can be retrieved and stations mapped online at: http://oaspub.epa.gov/coastal/coast.search.

3.2.5.4 Oceans and Beaches

3.2.5.4.1 *California Clean Beaches Program*

The Beaches Environmental Assessment and Coastal Health (BEACH) Act of 2000 requires that coastal and Great Lakes states and territories report to United States Environmental Protection Agency (US EPA) on beach monitoring and notification data for their coast recreation waters. The BEACH Act defines coastal recreation waters as the Great Lakes and coastal waters (including coastal estuaries) that states, territories, and authorized tribes officially recognize or designate for swimming, bathing, surfing, or similar activities in the water.

The BEACH Program focuses on the following five areas to meet the goals of improving public health and environmental protection for beach goers and providing the public with information about the quality of their beach water:

- Strengthening beach standards and testing
- Providing faster laboratory test methods
- Predicting pollution
- Investing in health and methods research
- Informing the public

Figure 3.19 SLOSEA Sites

Figure 3.20 EPA's National Coastal Assessment

The County's Environmental Health Services Division monitors beach water quality for recreational use through a California State grant between April 1 and October 31 of each year. Monitoring includes ocean water samples collected from the County's most visited beaches on a weekly basis. Shoreline samples are analyzed for bacterial indicators.

Locally, the County's Environmental Health Services Division conducts the public health beach monitoring and regulatory program. In 2010, nineteen (19) locations were analyzed for three indicator bacteria: enterococcus, total coliform, and fecal coliform. Beaches monitored included (Figure 3.21):

- Pismo State Beach, Oceano
- Pismo Beach
- Shell Beach
- Avila Beach
- Olde Port Beach
- Hazard Canyon
- Morro Bay City Beach
- Cayucos Beach
- Pico Ave., San Simeon

3.2.5.4.2 *National Data Buoy Center*

The National Oceanic and Atmospheric Administration (NOAA) National Data Buoy Center (NDBC), a part of the National Weather Service, designs, develops, operates, and maintains a network of data collecting buoys and coastal stations.

The major marine observing systems that form the US national marine observations backbone are:

- NOAA's National Weather Service's NDBC Ocean Observing System (NWS NOOS),
- NOAA's National Ocean Service's (NOS) National Water Level Observation Network (NWLON) and their Physical Oceanographic Real-Time System (PORTS)
- NOAA's Tropical Moored Buoy (TMB) projects
- NOAA's OAR drifting buoy programs.

Figure 3.21 County Public Health Beach Monitoring 2010

NWS forecasters need frequent, high-quality marine observations to examine conditions for forecast preparation and to verify their forecasts after they are produced. Other users rely on the observations and forecasts for commercial and recreational activities. NDBC provides hourly observations from a network of about 90 buoys and 60 Coastal Marine Automated Network (C-MAN) stations to help meet these needs. All stations measure wind speed, direction, and gust; barometric pressure; and air temperature. In addition, all buoy stations, and some C-MAN stations, measure sea surface temperature and wave height and period. Conductivity and water current are measured at selected stations.

There are a few stations in the region, as shown on Figure 3.22. More information on stations that are a part of the National Data Buoy Center can be found at: http://www.ndbc.noaa.gov.

3.2.5.5 Sampling Groundwater

Groundwater is often sampled to determine the chemistry of the groundwater for purposes of utilizing the water for human consumption. Public water supply systems are subject to regulation by the California Department of Public Health, which specifies minimum guidelines for sampling frequency and sampling procedures that must be followed by any water system operator.

3.2.5.5.1 *United States Geological Survey (USGS)*

The USGS has conducted water quality sampling at more than 150 sites in the County since the 1920s. (Figure 3.23) Analytical parameters vary, but can include physical measures (e.g., pH and temperature) nutrients, major inorganics (e.g., chloride, potassium, and sulfate), and minor inorganics (e.g., boron and manganese). The USGS also conducts research and special studies to further the development of scientific knowledge and its application to real world management problems.

3.2.5.5.2 *Waste Discharge Compliance Monitoring*

The Regional Board regulates discharges of wastewater to groundwater or surface water so that the highest quality and beneficial uses of these waters are protected and enhanced. Regulation is by issuance of either Waste Discharge Requirements (WDR) or NPDES permit. WDRs contain monitoring requirements to verify compliance with applicable conditions. These requirements vary according to those specific conditions.

WDR permit requirements often include groundwater monitoring. For example, the Regional Board has established monitoring programs for recycled water and wastewater operations that discharge to groundwater. Dischargers must periodically collect and analyze groundwater quality samples from wells representative of the receiving groundwater.

Figure 3.22 National Data Buoy Center

Figure 3.23 Historic United States Geological Survey (USGS) Water Quality Monitoring Sites

For a list of adopted orders, permits, resolutions, and settlements issued by the Central Coast Regional Water Quality Control Board, go to:
http://www.waterboards.ca.gov/centralcoast/board_decisions/adopted_orders/

3.2.5.5.3 *State Water Resources Control Board Ground-Water Ambient Monitoring and Assessment Program (GAMA)*

The Ground-Water Ambient Monitoring and Assessment Program (GAMA) program is a comprehensive assessment of statewide groundwater quality. The program is designed to help better understand and identify risks to groundwater resources. Ground water will be sampled at many locations across California in order to characterize its constituents and identify trends in groundwater quality. The results of these tests will provide information for water agencies to address a variety of issues ranging in scale from local water supply to statewide resource management.

The GAMA program was developed in response to the Ground-Water Quality Monitoring Act of 2001 (Sections 10780-10782.3 of the Water Code): a public mandate to assess and monitor the quality of groundwater used as public supply for municipalities in California. The goal of the act was to improve statewide groundwater monitoring and facilitate the availability of information about groundwater quality to the public. The State Water Resources Control Board is implementing the GAMA Program in coordination with the U.S. Geological Survey and Lawrence Livermore National Laboratory.

3.2.5.5.4 *Other Groundwater Management Efforts*

Various groundwater management efforts in the County also include groundwater quality sampling. These include efforts in basins under adjudication that are required to monitor and report annually and/or develop Groundwater Management Plans, where a Groundwater Management Plan is voluntarily being developed, where an entity is implementing a project with monitoring requirements, where individual entities or groups are developing Salt and Nutrient Management Plans in accordance with the State Water Board's Basin Plan, where seawater intrusion is of concern to agencies that rely on coastal groundwater basins for their water supply, and where individual property owners check the quality of their drinking and/or irrigation water supply. The availability of the information varies with each effort, making it challenging to fully understand the condition of all groundwater basins. Sharing of this data with governmental agencies or regional groups conducting groundwater basin studies and, when appropriate, the public at-large, should be encouraged.

3.2.6 Unimpaired Runoff

As part of the Environmental Water Demand analysis, annual unimpaired (i.e., unregulated by impoundments or dams and not substantially effected by the diversion or pumping of water) flow statistics (e.g., mean, median, FMF) were calculated for select locations throughout San Luis Obispo County. The record/flow statistic(s) at long-term gaging

stations were used to extend the record/flow statistic(s) of short-term gaging stations, and these in turn were used to estimate the flow statistic(s) at ungaged locations.

The environmental water demands were quantified for areas where data were available and unimpaired runoff data could be obtained, calculated, or estimated. Unimpaired runoff estimates were calculated by developing regional, multiple regression relationships that predict runoff at an ungaged, or partially gaged, location as a function of runoff at a gaged location. Once the estimated unimpaired runoff has been established, the environmental water demand was calculated by using the median annual discharge methodology (Hatfield and Bruce, 2000).

The eastern portion of the County (i.e., WPAs 9, 10, 11, 14, and 15) was ultimately excluded from the environmental water demand analysis due to the lack of unimpaired data and regional physiographic differences. The District should consider installing stream gages in these WPAs to collect flow statistics, which would aid in determining environmental water demands for the eastern portion of the County.

The DWR has identified over 1,000 water rights applications and permits for San Luis Obispo County (DWR 2009b). For purposes of this analysis, the unimpaired mean annual discharge and environmental water demand is presented without including an analysis of the 1,000 diversion rights in the County. However, some of the established instream flow requirements are included. In order to obtain a better understanding of how much surface water is available for aquatic life, the District would need to identify and quantify all diversion rights and instream flow requirements in the watershed.

3.2.7 Land Use

3.2.7.1 Urban Land Uses

Urban land uses refer to the unincorporated communities and incorporated cities in the County, and include residential, commercial, industrial, parks, institutions, and golf courses. Primary sources of water demand data for urban centers came from water system master plans (WSMP) and urban water management plans (UWMP) prepared by water purveyors, incorporated cities, and unincorporated communities. Additionally, the County's Annual Resource Summary Report 2008 (ARS) provides projected water demand and population data for these areas.

Since existing water demands and future water demand projections are based on information from WSMPs and UWMPs, land use information was not used to calculate water demand. The urban water demand for individual areas in the County was associated with a GIS layer that included the existing and future urban demand for each unincorporated community and incorporated city.

More information on the summary of urban water demands is provided later in this chapter.

3.2.7.2 Rural Land Uses

Rural water demands for unincorporated areas of the County that are outside population centers discussed above were calculated using the County's Land Use ArcGIS® layer, which includes land use and potential dwelling units (DUs) per acre for all unincorporated areas of the County. Vacant and developed properties and potential subdivisions and units in the unincorporated areas of the County were used to calculate a rural water demand. Additional sources include information from purveyors, water management plans, and the County's ARS.

See Appendix D for a description on the methods that the County used to prepare the land use data and for a detailed discussion of how the study utilized the County Land Use ArcGIS® database. For the rural demand analysis, all areas in the County that were accounted for with urban or agricultural water demand were excluded. However, rural homesites on agricultural lands were included in the rural land use demand analysis. Existing and projected future nurseries and vineyards present in the Land Use ArcGIS® layer were merged into the agriculture ArcGIS® layer and included in the agricultural demand analysis.

More information on the approach to calculating rural water demands is provided later in this chapter.

3.2.7.3 Agricultural Land Uses

The Agriculture/Crop GIS layer for the County from August 2008 was used, as well as other information provided by the Agricultural Commissioner's office. This land use layer is updated yearly with information from the pesticide use permits obtained through the San Luis Obispo County Department of Agriculture. The pesticide use permits provide the most accurate information available regarding the location of planned commercial agricultural production during the year, but in some instances may not be entirely accurate. Occasionally sites that obtain permits are not planted for a variety of reasons, and many vegetable crop sites may be planted with more than one crop rotation during a year (Isensee, 2009). The project team estimated agricultural production based on available information. The records do capture most organic operations usage. Use of water for ranching and pasture irrigation, among other uses not captured in pesticide permits, are not included. In Water Planning Areas where the majority of land is used for these purposes, the agricultural water demand may be significantly underestimated. Analysis of diversion rights records would help to address this issue in future updates to the Master Water Plan.

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The agricultural crop GIS data was used to determine crop acreages throughout the County. Additional information from the Agricultural Commissioner's office, UC Farm Advisors, and Cachuma Resource Conservation District (CRCD) Irrigation Specialist was utilized to estimate existing and future agricultural water demand. More information on the approach to calculating agricultural water demands is provided later in this chapter.

3.2.8 Population

Population information was taken from WSMPs, UWMPs, and the County's *Annual Resource Summary* Report.

3.2.9 Water System Production and Consumption

3.2.9.1 Water Quantity/Quality

A thorough understanding of the quantity of water required for various uses is critical for developing sustained use of the region's water resources. Sufficient quantities of fresh water are necessary, not only for economic development, agriculture, and recreation, but also for supporting ecosystems. Many programs in government agencies and other organizations use water quantity data and information.

Improving water quantity data and characterization, strengthening cooperation between water management programs, and preparing now for future water quantity concerns have been identified as key issues that require water quantity data.

Water quantity is also linked to water quality with regards to issues such as pollutant concentration levels, wastewater discharge requirements, and anthropogenic impacts associated with rainfall/recharge events. Environmental and climatic conditions play a major role in the demands for and the availability of water supplies. Effective decision making relies on water quantity data and information from both naturally occurring events and human activities. Tracking data and information on droughts, floods, storm water runoff, instream flows, ground water recharge, water withdrawals, development related storm drainage, and water diversions is critical. Managing the region's water resources for sustained use cannot be successful without the knowledge and understanding of the hydrologic cycle, the myriad of demands on the resource and fluctuation in ground and surface water supplies.

3.2.9.2 Water Use Data

Water use is not monitored by a regional authority. It is the responsibility of each water provider to monitor their customers' water use. Fortunately, most water providers in the region meter their customers' water use and, therefore, have information on their customers' water use. Annually, water use data is requested by the County from these water providers.

Water users that own or use private wells and individuals that live outside of established city limits are typically not required to monitor or report their water use to any agency. One of the largest groups of water users that do not have their water use monitored are agricultural water users, who use a relatively large amount of water.

Recommendations adopted by the County Board of Supervisors in the 2009 Annual Resource Summary Report, listed below, serve to address this issue, which will improve data availability for use in future updates to the Master Water Plan.

- Installation of flow meters on all new non-agricultural wells, record water use and other information monthly and report semi annually
- Require all water purveyors (including mutual water companies) with over 10 connections to record water use and other information monthly and report semi-annually
- Encourage voluntary well metering, monitoring and reporting

3.2.10 Agriculture

Since agricultural water predominately comes from groundwater sources, and is generally not provided – or metered – by a water supply system, a representative percentage of agricultural water users could meter and report their water use. Ideally, all meter readings would be recorded every month and reported to a central agency on an annual basis.

3.2.10.1.1 *Agriculture and Irrigation Water Uses*

The County should consider sponsoring a voluntary pilot program that would track actual applied water per acre for various agricultural users throughout the County. The vineyard community in the North County is participating in a program led by the University of California, Davis, Cooperative Extension to estimate applied water per acre that may serve as a model for implementation throughout the County.