APPENDIX D

PROGRAM SUMMARIES

1. Surface Water Ambient Monitoring Program (SWAMP)

2. Groundwater Ambient Monitoring and Assessment (GAMA)

APPENDIX D - 1

Surface Water Ambient Monitoring Program

Role of Science and Engineering in Decision-Making at the Water Boards

The Surface Water Ambient Monitoring Program (SWAMP) was established under Water Code Sec. 13192 (AB 982) as a statewide effort administered by the SWRCB to assess the conditions of surface waters throughout the state. "Ambient monitoring" collects information about the status of the physical, chemical, and biological characteristics of water quality that can be used to measure overall quality of water resources, temporal trends (degradation or improvement), and overall effectiveness of prevention, regulatory, and remedial actions. Responsibility for implementation of monitoring activities resides with the nine RWQCBs. Monitoring conducted by SWAMP is done through contracts with the California Department of Fish and Game and the U.S. Geological Survey.

SWAMP integrates the existing water quality monitoring of the SWRCB and the RWQCBs and coordinates with monitoring programs of other agencies, dischargers, and citizen groups. SWAMP creates an ambient monitoring program that addresses all 190 hydrologic units of the State using consistent and objective monitoring, sampling and analytical methods; consistent data quality assurance protocols; and centralized and integrated data management. Monitoring "waters of the state" includes 11,000 miles of rivers and streams, over 10,000 lakes, over 1,300,000 acres of bays and estuaries, and 1,609 miles of coastline. The data collected includes: chemical pollutants; toxicity; bacterial indicators; contaminants in fish/shellfish tissue; biological assessment (living organisms); habitat (ecological) assessment; and other field data. Evaluating, processing, formatting, and assuring the quality of these data for input into a database that can be integrated into statewide database (California Environmental Data Exchange Network [CEDEN]) has been a major effort of SWAMP in the absence of a fully funded water quality monitoring program. Some of the regional monitoring data is incorporated into the Environmental Protection Indicators for California (EPIC) report on the status of the environment. Regional monitoring data also helps to assess program performance and support federal CWA Sec. 305(b) reporting requirements on the area or percentages of the State's surface waters that fully or partially support their beneficial uses (e.g., are they safe to swim, drink, or eat the fish?).

Where, what, and how are science and engineering used in the SWAMP?

Where: Adequate and accurate monitoring and assessment are the cornerstones to preserving, enhancing and restoring water quality. The information gathered from monitoring activities is critical to protect the beneficial uses of water, to develop water quality standards, conduct federal Clean Water Act assessments and to determine the effects of pollution and of pollution prevention programs. Surface water monitoring and assessment activities are conducted as part of the Surface Water Ambient Monitoring Program (SWAMP). SWAMP is a somewhat unique program in that it provides the water quality data and information needed for many of the other programs at the Water Boards. Therefore the technical and scientific defensibility of SWAMP contributes to the credibility and scientific rigor of other programs.

To meet Clean Water Act objectives, SWAMP should answer the following questions:

- What is the overall quality of California's surface waters? § 305(b)
- To what extent is surface water quality changing over time? § 305(b)
- What are the problem areas and areas worthy of protection? § 305(b), § 303(d)
- What level of protection is needed? § 303(c)
- How effective are clean water projects and programs? § 303, § 314 § 319, § 402

But SWAMP is envisioned to do more than fulfill statutory requirements. The program is designed to coordinate a statewide framework of high quality, consistent and scientifically defensible methods and strategies to improve the monitoring, assessment and reporting of California's water quality. Each element of the SWAMP framework integrates several scientific and technological disciplines.

What: The SWAMP science and management framework is comprehensive in scope, covering monitoring objectives, monitoring design, water quality indicators, quality assurance, data management, data analysis/assessment, reporting, programmatic evaluation general support and infrastructure planning. The framework is implemented by State and Regional Board Environmental Scientists with extensive expertise in biology, chemistry, biochemistry, toxicology, ecology, microbiology, hydrology, monitoring design, experimental design, quality assurance and statistics.

How: Each study or monitoring program objective is defined in specific qualitative and quantitative terms and linked to an environmental management decision or reporting requirement of the Clean Water Act. Several monitoring designs (for example, fixed station, intensive and screening-level monitoring, rotating basin, targeted and probability design) are being integrated to meet the full range of

decision-making needs. Sampling designs yield data that are representative of the environmental attributes under study, with consideration of statistical probabilities associated with sampling. The uncertainty associated with estimates and conclusions drawn from each component of the monitoring program are understood, quantified, and limited to a reasonable extent, commensurate with the potential costs (both monetary and environmental) of decision errors. The quality of the data is assessed and validated to ensure that the data quality objectives of the program are met. SWAMP currently uses core indicators to characterize the health of different waterbody types and the status of different beneficial uses. Core indicators for each type of waterbody include physical/habitat, chemical/toxicological and biological/ecological endpoints as appropriate, and can assess attainment with water quality standards throughout the state. All data is stored in an Internet accessible electronic data system for water quality, fish tissue, toxicity, sediment chemistry, microbiology, habitat and biological data, with appropriate metadata and geo-locational standards.

SWAMP is evaluated as part of a continuous improvement feedback loop. All elements of the program are reviewed to determine its scientific validity, whether it is being implemented as designed and how well it serves the water quality decision needs of the state. This may include, for example, undertaking audits focused on implementation of the monitoring program objectives, quality assurance protocols, laboratory procedures and data analysis/assessment procedures. All monitoring plans and technical reports are peer reviewed as part of this process. Every three years the program undergoes a complete external peer review by a panel of eight members from nationally recognized federal, state and academic monitoring and research programs.

Recommendations:

(1) Increase the resources allocated to monitoring and assessment. When the SWAMP program was originally designed it was envisioned to provide information for all the Water Boards' decision-making needs. In a report to the legislature, it was estimated that the program would cost between $59 and $115 million per year and include 87 to 132 staff positions. The current program is funded at $3.4 million and 17 staff positions or approximately 7 percent of what is needed.

(2) Promote the coordination of monitoring activities and comparability of data among other agencies and monitoring entities. Hundreds of agencies and entities collect water quality information, but differences in design, analysis,

quality assurance and data management make it difficult to use data collected by different groups. At the staff level, many agencies are beginning to work toward data comparability and data integration through the California Environmental Data Exchange Network hosted by the Department of Water Resources. This type of collaboration is supported at the Water Boards, but needs to be supported by other agencies interested in water quality.

APPENDIX D – 2

Groundwater Ambient Monitoring and Assessment Program

Role of Science and Engineering in Decision-Making at the Water Boards

The California Water Code requires the State Water Board to develop a statewide groundwater quality monitoring program with input from specified stakeholders. The State Water Board developed the Groundwater Ambient Monitoring and Assessment Program (GAMA) to assess the water quality of the groundwater in all basins of the state. The water quality assessment methodology for GAMA was developed by the U.S. Geological Survey (USGS). It employs state-of-the-science age-dating analysis using resources and expertise at Lawrence Livermore National Laboratory (LLNL) and low-level (trace) detection of contaminants using the analytical laboratories of both USGS and LLNL. Water wells to be sampled are identified based on a statistical analysis that best represents groundwater quality in each hydrogeologic basin. USGS prepared and published a scientific report outlining the approach used by the GAMA Program.

The data collected for the GAMA program are not normally available. There are approximately 334 GAMA analytes compared to the 101 Title 22 analytes required by the California Department of Health Services (CDHS) in monitoring public water supplies. Many of the GAMA analytes will be monitored at trace levels. These data will be especially useful for providing an early indication of potential water-quality problems. The data also will be used to identify the natural environmental factors (e.g., hydrogeology) and human activities (e.g., waste discharges) affecting groundwater quality. An understanding of these factors is important for the long-term management and protection of California's groundwater resources.

The more substantive work products and findings of the GAMA Program, prior to AB 599, have been published by USGS and LLNL.

<u>Legal mandates and requirements:</u>

In July 1999, supplemental language to the Budget Act of 1999 required the State Water Board to provide the Legislature with a plan for monitoring ambient groundwater quality. In January 2002, Assembly Bill 599 (AB 599 - Water Code Sections 10780-10782.3) established the Groundwater Quality Monitoring Act of 2001. AB 599 required that the State Water Board, in coordination with an Interagency Task Force (ITF) and Public Advisory Committee (PAC), integrate existing groundwater quality monitoring programs and design new program elements,

as necessary, to establish a statewide comprehensive groundwater quality monitoring program described in a March 2002 report to the Legislature. The State Water Board developed a plan for implementing a program to comprehensively monitor and assess the quality of all groundwater basins/sub-basins in the state. As required by AB 599, the groundwater quality monitoring program builds on State Water Board's GAMA program developed in 2000.

The GAMA program has three aspects:

- Prioritized Basin Assessment specified in AB 599;
- Voluntary Domestic Well Assessment Project; and
- Associated Studies.

The *Prioritized Basin Assessment* is the primary activity and is funded by $50 million from Proposition 50. The key elements of the Prioritized Basin Assessment include:

1. Accelerating implementation of the GAMA Program established pursuant to the Budget Act of 1999. The program assesses each groundwater basin through direct and other statistically reliable sampling approaches and enhances the water quality information currently collected from public water supply wells through additional testing of those wells for groundwater age-dating and trace-level constituents (including volatile organic compounds). This information is then used as the basis for developing consistent hydrogeologic assessments for each basin/sub-basin or basin groups. The hydrogeologic assessments focus on susceptibility/vulnerability of the groundwater to surface contamination.

2. Conducting the monitoring and assessment program in accordance with the prioritization of basins/sub-basins set forth in the AB 599 Report to the Governor and Legislature. A water use criterion places those basins most heavily used for drinking water in first priority.

3. Expanding Geotracker as the State Water Board's principle database for storing, managing, and assessing groundwater information. Geotracker will be a comprehensive statewide database that provides useful access to water quality monitoring and assessment information to the public.

Voluntary Domestic Well Assessment Project

Nearly 600,000 private domestic water supply wells provide drinking water to rural residents. Most owners assume their wells will produce a dependable supply of safe

drinking water. The quality of the water, however, is not guaranteed. No federal or state law ensures the quality of drinking water drawn from a domestic well, and as a result, the quality of domestic well water in California is largely unknown. The Voluntary Project is part of an effort to assess water quality and relative susceptibility of groundwater resources to contamination from surface sources, as well as to provide the public with specific information regarding domestic well water quality. The project's technical approach is modeled after the Santa Clara Valley Water District's (SCVWD) report on its private well water testing program (SCVWD, 1998).

The Project identifies specific focus areas based upon existing knowledge of water quality and land use, in coordination with local environmental agencies and the Regional Water Boards. State Water Board staff conducts the field sampling and a contract laboratory conducts the trace analyses. Domestic wells are sampled for various constituents commonly found in domestic well water, including the Title 22 public drinking water supply analytes. In some cases, age-dating (tritium/helium3) and trace analyses are conducted. Results of sampling and analysis are provided to domestic well owners as quickly as possible, as well as to local environmental agencies and Regional Water Boards. The data are posted and managed on the Geotracker Web site that also includes a geographic information system (GIS) allowing online access to additional environmental data.

In addition to providing the public with specific information regarding domestic well water quality, the Voluntary Project data will be used collectively with existing groundwater information including data collected as part of the Prioritized Basin Assessment to help assess the water quality of the more shallow aquifers providing water supply.

Special Studies

Nitrates: Nitrate is the most common anthropogenic contaminant in public drinking water supply wells. LLNL is performing a variety of nitrate studies some of which are funded by the State Water Board.

Endocrine disruptors: Endocrine disruptors are constituents from a variety of sources that have the ability to modulate the endocrine system of both humans and wildlife. Endocrine disrupting compounds (EDCs) alter endocrine homeostasis by interfering with the biologic action, production, or pharmacokinetics of endogenous hormones. EDCs are of growing concern for water quality. Exposures to EDCs can result in alterations in patterns of gene expression. These changes in gene expression can be detected using a highly sensitive, characteristic, and informative screening tool

called a microarray gene chip. LLNL and UC Davis are testing a microarray gene chip to identify chemicals in water that can induce shared, prototypic gene-expression profiles. This cutting-edge technology is based on molecular biology.

What science is used?

A statistical and scientific approach was used to determine the criteria used to prioritize basins for monitoring and assessment as described in the USGS report to the State Water Board and Public Advisory Committee.

Analytical procedures use DHS-approved procedures from Title 22, and use a more extensive USGS protocol to analyze over 400 constituents (over 300 more than DHS). Many of the USGS analyses have much lower detection limits than DHS requires.

Noble gas age-dating of groundwater is performed by LLNL, the top of the five laboratories worldwide.

Well selection for sampling is based on a peer-reviewed statistical approach developed over the last few decades at the USGS.

Assessments of the groundwater quality in basins, spatial (vertical and horizontal) relationships, inter-basin comparisons, trend analyses, and possible future problems are made based on statistical comparisons of analytical results.

Prior to publication, experimental results and analyses are peer-reviewed internally by the rigorous USGS process as well as by State and Regional Water Board staff and LLNL collaborators.

Determination of the endocrine-disrupting attributes of some samples. Determination of whether the groundwater contains endocrine-disrupting chemicals followed by their identification where possible.

Identifying conditions where de-nitrification occurs naturally and for which sources of nitrate.

How science is used in the planning (decision-making) process

Scientific approaches are used:

- To prioritize groundwater basins to be assessed

- To select number of and the specific wells to be sampled in a study area
- To select analytes to be sampled
- To analyze samples, including determination of whether the groundwater contains endocrine-disrupting chemicals.
- To interpret data collected, for example determining how recently groundwater was in contact with the Earth's surface by age-dating the water
- To determine the timeframe over which the nitrate problem has developed, including historic sources from agriculture vs urban. To delineate areas where denitrification occurs to assist in groundwater management. To identify possible treatment remedies as alternatives to blending, which is only available where low-nitrate concentration water is available.