

4.7 Monitoring Plan Recommendations

The San Dieguito Watershed presents a unique opportunity for coordinated and thorough watershed assessment. Because the watershed is mostly undeveloped and there are future land-use plans to significantly increase the urbanized areas over the next twenty years, there exists a real potential for water quality and supply, habitat, social and community resources to be degraded by lack of attention and/or coordination, and by the urbanization activity itself. In addition, there may be changes in the frequency, intensity, and magnitude of use of many of the resources within the watershed. These uses and the potential changes in use should be monitored to ensure the protection of the watershed, its functions and resources. Thus, the management team should establish a long-term monitoring program that establishes baseline watershed conditions, fills-in data gaps by adapting or adding monitoring of missing key watershed indicators, and identifying trends in these key indicators; some of which may change as a result of watershed management activities. Much of the watershed is currently undeveloped, though plans included future new development. In the long term, the workgroup and watershed management team would benefit from (1) knowing the existing watershed conditions and (2) thinking well beyond existing monitoring programs to structuring overarching watershed monitoring programs around proposed and future landuse plans and watershed management activities.

Stakeholders within the watershed will be challenged with balancing economic development and the maintenance of the character, resources, and beneficial uses of the watershed. As mentioned in the previous sections, there has been significant effort to recognize and inventory existing conditions, summarize issues and concerns, and identify actions to protect, enhance, restore and rehabilitate the watershed resources. Many entities and agencies have historically monitored the streams, rivers, groundwater, and receiving waters. A new monitoring program is not necessarily desired; what is needed is a coordinated monitoring program that answers specific questions about the watershed conditions. The Management Team for the San Dieguito River Watershed would benefit from:

- A review of the objectives.
- The establishment of monitoring categories that would reflect the need to protect watershed functions and document watershed issues and proposed actions.
- Connectivity among monitoring programs to ensure coordination and identification of new monitoring opportunities to fill in watershed data and information gaps in the following areas: hydrogeomorphic, water quality, water supply, biological and habitat resources, land use, demographics, and social and economic indicators:
- Assessment of individual and group behaviors and attitudes within the watershed,
- Monitoring frequency coordination to ensure monitoring during different times of the year.
- Trend analysis to review changes in the watershed characteristics over time and to help identify data gaps.
- Integrating data and information created from monitoring activities into adaptive management and decision making.

The watershed management team will need to have a watershed plan that includes realistic actions, a comprehensive monitoring plan that documents watershed conditions and changes within the watershed as a result of implementing these actions, and establish a mechanism to update and amend the watershed management plan as needed in the future.

Monitoring suggestions, recommendations and any strategies presented herein are based upon information drawn from the *Existing Conditions section*, current municipal policies, and from stakeholders as communicated through, stakeholder meetings, public workshops and submittals of comments.

The San Dieguito WMP and monitoring plan has been developed around the following four specific watershed functions and associated goals:

- Protect and enhance water quality.
- Conserve, reuse and recharge water supply.
- Protect, enhance and restore native habitats and biological resources.
- Promote social and community resource needs.

An adaptive management approach is recommended for the coordinated assessment of the health of the watershed that involves providing greater access to monitoring data collected under existing programs, public involvement in watershed assessment, and conducting site and area-specific monitoring to determine the success of implemented projects. In addition, the coordinated assessment would include monitoring the status of existing land availability and its projected use to assist with future watershed management decisions.

There are six sequential steps in adaptive management. In water quality management, failing to verify information developed in each step can lead to actions that would misidentify issues, possibly address non-issues, and provide ineffective or only partially effective solutions that do not deliver the intended results. Following these six adaptive management steps will allow the watershed management team to effectively and efficiently deal with and address the changing situations within the watershed and the large quality and quantity of data that will be generated by the proposed coordinated monitoring programs:

- identification of the problem or management goal
- design of the management action or implementation plan
- implementation
- monitoring of management results
- evaluation of the results relative to the desired management goals
- adjustment of management actions.

A trigger for change in the management approach/actions occurs when existing management results have not achieved the desired management goals. The assumptions underlying management goals must be stated explicitly and considered as hypotheses to be tested by carefully designed and implemented monitoring programs that validate these assumptions. Ideally, management actions would be designed and implemented with experimental control sites

and adequate replication that would produce confident statistical interpretation of the results. At a minimum, careful measurement of key environmental and biological variables before and after the management action can provide insight into the effects of management at that particular site.

The recommended monitoring approach for the assessment of water quality, water supply, biological resources and habitat, and social community resources are described in the following subsections:

- 4.7.1 Water Quality
- 4.7.2 Water Supply
- 4.7.3 Native Biological Resources and Habitat
- 4.7.4 Promote Social and Community Resources

4.7.1 Water Quality

The objectives identified for this receiving water quality monitoring program include:

- 1) Identifying and evaluating existing conditions and beneficial uses
- 2) identifying pollutants and their effects on beneficial uses and
- 3) abating pollution and restoring beneficial uses

These objectives may be accomplished by performing the following actions:

- Assessing the condition of the watershed's surface and groundwater and compare it to existing and historic conditions
- Linking pollutant impacts to pollution sources
- Linking trends in pollutant loading to pollution control measures.

To ensure the waters support designated beneficial uses in the San Dieguito Watershed, the management team would require knowledge of the existing water quality conditions so that priorities may be reviewed and established in order to provide a baseline to compare future monitoring information. There are currently many groups monitoring throughout the watershed for various reasons including source water protections, urban runoff management, and irrigation suitability to name a few. However, large gaps exist spatially and temporally throughout the watershed, therefore limiting the ability to efficiently review data and establish trends. In order to establish a reliable baseline data set and begin to identify trends, identify sources of pollutants and watershed management activity effectiveness, the management team should establish a coordinated data sharing and monitoring program that takes into account the proposed land-use changes and is sub-watershed level-specific. Special working groups or subcommittees should be formed to address the multiple water quality issues affecting the reservoirs and their tributary watershed area, especially Lake Hodges. This working group should develop a plan specific to management of Lake Hodges and the tributary watershed. The Arizona State University Engineering Department published a guidance document¹ for developing a plan to address taste and odors after successfully implementing measures to reduce taste and odors in the water supplies in Arizona. The guidance document provides a framework and a scientific approach

¹<http://www4.eas.asu.edu/pwest/myweb/taste%20and%20odor%20stuff/guidance%20document%20-%20august%202002.pdf>

San Dieguito Watershed Management Plan

which may be used to develop a plan for Lake Hodges. Ultimately, a plan that is developed for Lake Hodges could be used to by other agencies to develop plans for other reservoirs in the County.

The Lower, Middle, and Upper watershed areas each contain existing degraded water quality as listed on the Section 303(d) List (Table 4.7-1). It should be noted that the existing Section 303(d) listings are for exceedances of narrative and numeric water quality objectives. Managing water quality objectives includes identifying the magnitude and frequency of exceedance, and/or determining if the exceedance is actually exhibiting effects on the beneficial uses. Any sampling conducted in Section 303(d) listed waters and/or their tributaries should consider including monitoring for the listed pollutants and additional monitoring to determine if exceedances are degrading beneficial uses.

Table 4.7-1. 2002 Section 303(d) List of impaired surface waters in the San Dieguito Watershed.

Water Body Name	Hydrologic Sub Area (HSA) and HSA #	Pollutant/Stressor
Lower Watershed		
Pacific Ocean Shoreline	Solana Beach 905.11	Bacteria Indicators
Green Valley Creek	Solana Beach 905.11	Sulfates
Middle Watershed		
Hodges Reservoir	Del Dios 905.21	Color, Nitrogen, Phosphorus, TDS
Kit Carson Creek	Del Dios 905.21	TDS
Felicita Creek	Felicita 905.23	TDS
Cloverdale Creek	Highland 905.31	Phosphorus, TDS
Upper Watershed		
Sutherland Reservoir	Sutherland 905.53	Color

On January 5, 2006, the SWRCB held a public workshop to obtain public comment on “Revisions to the Federal CWA Section 303(d) List of Water Quality Limited Segments.” Any possible revisions to the Section 303(d) List should be considered and evaluated for applicability to the San Dieguito WMP. The current activities related to revisions of the Section 303(d) List can be found at the SWRCB website: http://www.waterboards.ca.gov/tmdl/303d_lists.html.

The water quality monitoring component will include 3 basic components which are:

- Public outreach
- Collection of data and general observations
- Interpretation and evaluation/assessment

Outreach Efforts

- *Goal:* Diminish and eliminate further degradation of the watershed and its resources through better management practices.

San Dieguito Watershed Management Plan

- *Mechanism: outreach to businesses, industries and residents on the stormwater pollution prevention, recycling, solid waste management, and water conservation.*

Traditional in-stream sampling done for the purpose of identifying sources of pollution in the watershed would require extensive and costly monitoring to trace each pollutant to its source. Instead, this sampling plan proposes to proactively place information into the hands of those who are unfamiliar with the impacts of their daily activities in order to effectively change their behavior and eliminate pollution sources. Informational materials that may be used for this purpose have already been produced as part of permit requirements (e.g., the MS4 stormwater permit) for San Diego County and local water purveyors. These materials are available online for anyone to use. The key to success in this endeavor is proactive outreach with a consistent and multifaceted message directed at specific or targeted areas.

Historically, outreach to the general public has been done for the most part on a reactive basis. Materials were delivered by inspectors prior to or during construction or in response to a complaint placed by an observer. With the addition of a public education model program to the MS4 stormwater permit, efforts are being made to reach the general public, corporations and small business with consistent “how to” information. This plan proposes to continue to strategically target businesses, commercial districts, industries, community groups, and school districts with a consistent message addressing stormwater pollution prevention, recycling, solid waste management and water conservation and overall environmental protection. This outreach program will communicate what the impacts of pollution are, and that people and their activities are the sources of the pollution.

The targeted pollutants of this campaign are not the current 303(d) listed pollutants for the San Dieguito Watershed, rather they are the pollutants generally associated with storm water and urban runoff. To target reductions in nutrients within the middle watershed area, the information should detail the importance of reducing the over-use of fertilizers, reducing agricultural runoff, and minimizing dry season urban runoff. This information should be directed to those within areas on listed on the existing Section 303(d) List. To target a reduction in bacteria levels at the San Dieguito River Mouth, the information should detail steps to take in order to prevent sewer line clogs or breaks, eliminate dry weather runoff, and ensure proper dog waste management at Dog Beach. Targeting TDS will be much more difficult due to the high level of TDS already in Colorado River Water imported into the region. Water purveyors are currently attempting to address this issue regionally and any recommendations suggested by the group may be considered for adoption into the WMP.

Pollutants can be categorized into 5 general categories: Toxic Substances, Sediments, Nutrients, Microbiology/Pathogens, and General Physiochemical Substances/Effects.

Each pollutant causes or exhibits direct or indirect stress on the environment and ultimately may negatively impact the beneficial uses within the watershed. A combination of water chemistry and biological monitoring should be coordinated, developed, and implemented by the multiple agencies and groups who are currently conducting activities independently to effectively identify pollutants in the watershed and to determine if the pollutants are actually causing degradation of a beneficial use. A current method of biological monitoring performed in the San Dieguito

Watershed (and other watersheds), involves sampling and assessing stream benthic macroinvertebrate communities. Benthic macroinvertebrates are living animals that reside in the sediments of streams. Their diversity, assemblage, and distribution is a reflection of past and present hydrologic regimes and water quality. When monitoring chemistry and biology, the monitoring stations where these samples are collected should be the same whenever possible. The goal of water quality monitoring is to effectively discern effects from different influencing factors such as pollutants and overall management actions.

It would be difficult to interpret data collected for chemistry and biology at monitoring stations separated by great distances or those influenced by different environmental factors. Using existing stream gauging stations make a good place to conduct monitoring due to the availability of accurate flow measurement and accessibility, so long as the stream conditions in the immediate vicinity meets stream bioassessment monitoring requirements and recommendations. Or another example would be to coordinate chemical and biological monitoring around watershed activities such as a wetland restoration project that would document the effectiveness of the restoration project. These two methods would provide information to help understand the conditions of specific areas or influence of specific actions.

Yet another way to conduct monitoring is to randomly select sites across the watershed using a stratified random approach. This is a common method used to establish a data set that would help in determining baseline conditions. The stratified random approach and the targeted monitoring both have benefits and shortfalls. Using these two monitoring approaches together would yield general watershed or subwatershed conditions and specific information about stream reaches or pesticide effects, for example. It is suggested that the random stratified monitoring approach be considered on a less frequent basis and in response to implementing watershed-wide actions and a targeted approach be considered when monitoring watershed actions that target specific stream segments or investigative pollution tracking.

It is assumed that each agency and/or group is conducting water monitoring activities in order to answer specific conditions in the San Dieguito Watershed. These water monitoring programs may share many of the same analytes and monitoring locations. Data comparison and analysis may still be incompatible due to difference in analytical methods, detection limits or collection methods. The suggested list of analytes and detection limits are based upon the Section 303(d) List, existing municipal storm water monitoring requirements, and local municipal water supply monitoring requirements. The goal of a unified approach to water monitoring is to improve the reliability, comparability, and usability of data to draw reliable conclusions. For example, the ability to discern the relative contribution of groundwater versus urban runoff in a creek for a specific analyte may lead to very different management strategies. Water quality monitoring conducted in the watershed should include visual observations, flow, and water sample analysis whenever feasible as shown in Table 4.7-2.

Table 4.7-2. Water quality field observations and analytical samples

Visual Observations	Flow Measurements	Water Samples
Odor Color Clarity Floatables Deposits Vegetation Biology	Volume	Toxic Substances: Metals, Pesticides Sediments: TSS, Turbidity Nutrients: Total Phosphorus, Orthophosphate, TKN, Nitrate, Nitrite. Microbiology: Total and Fecal Coliform, Enterococcus pH, Temperature, Conductivity

Two suggested field monitoring sheets that are widely used throughout the region include the field sheet from the municipal storm water ‘Dry Weather Monitoring’ and ‘Benthic Community Bioassessment’ programs. These field sheets provide standards for recording information and standardized guidance in determining qualitative monitoring components. In addition, workgroups that meet on a regular basis should review the field sheets and make amendments as necessary to ensure information is recorded consistently for comparability and compliance purposes. These field forms can be found at the following websites:

- http://www.projectcleanwater.org/html/wg_monitoring.html.
- http://www.dfg.ca.gov/cabw/csbp_2003.pdf

Goal:

- Promote science-based methods for water quality and environmental assessment of the watershed.
- Protect, enhance and restore beneficial uses of watershed.

Mechanism: Coordinated compliance monitoring that reduces and eliminates redundancies.

As new regulations are established for receiving water quality, there is a growing need for an accurate and consistent assessment of water quality in the San Dieguito Watershed. Such a monitoring program would be used to verify the pollutants of concern, levels of exceedance, and measured improvements in water quality from implemented management actions.

No TMDLs have been established for the San Dieguito Watershed to date, and it would be important to accurately establish baseline conditions for the watershed and track improvement. The “TMDL for Indicator Bacteria Project 1-Beaches and Creeks” in the San Dieguito region is currently proposed by the San Dieguito Lagoon mouth is listed as part of this TMDL. Performing coordinated sampling prior to the planning and implementation of TMDLs will assure that they are developed based upon sound data and address actual problems. Though currently a lower priority for TMDL development, it should be expected that Section 303(d) listed water bodies within the San Dieguito Watershed will eventually have TMDLs developed and implemented by the SDRWQCB. Samples taken of the water columns in the following water bodies should be analyzed at a minimum for the listed pollutants and indicator bacteria, metals, nutrients, and general physiochemical analytes.

Surface water quality is monitored regularly by industries and municipalities at or near many of these locations under their respective discharge or stormwater permit requirements. Summaries of these programs are available online at <http://www.waterboards.ca.gov/sandiego/programs/programs.html>. These programs include analysis for a full range of physiochemical analytes, toxic substances, microbiology, toxicity, and benthic macroinvertebrate bioassessment. Recent efforts by the California SWRCB to compile comprehensive databases for permit program compliance monitoring should soon be available.

Rather than proposing additional sampling, what is needed is an electronic, GIS-based (preferably accessible via the World Wide Web) data system where data can be easily submitted and accessed. With this program, each discharger could submit an electronic report of the receiving water data (as they have always done to the appropriate enforcement agency), and in turn other San Dieguito Watershed servers could access the given databases and pull the data together as needed. Although not a substantial burden for dischargers, an additional requirement to submit information to this database could be viewed as such by the SDRWQCB and qualify a discharger to some type of credit. In addition, a database that centralizes information will provide dischargers with a basis to request modifications to their monitoring requirements when redundancies are identified. When the database has been fully developed, it can also be used as a tool to identify data gaps and additional programs can be recommended to fill these gaps. Suggesting additional baseline water quality monitoring without first knowing where water quality monitoring is occurring would likely lead to additional redundancies. An example of a data gap that might potentially warrant further sampling would be additional sampling to help complete water quality/pollutant transport identification for Section 303(d) listed water bodies.

Current sampling programs, which could be included in this database, are performed by:

Coastline

City of Del Mar

City of Solana Beach

County of San Diego Department of Environmental Health

San Dieguito Lagoon

City of Del Mar

San Dieguito Lagoon Restoration Project

San Dieguito River Park Main Channel and Tributaries

County of San Diego Department of Public Works, Clean Water Program

City of Del Mar

City of San Diego

City of Escondido

City of San Diego, Water Department

City of San Diego, Metropolitan Wastewater Department

Reservoirs

City of San Diego, Water Department

San Dieguito Watershed Management PlanGroundwater

County of San Diego Department of Environmental Health
San Diego County Water Authority
Olivenhain Municipal Water District

The key to success of this program is a single point of contact that is well familiar with the watershed, WSIG and the database. This entity would maintain the database, provide quality assurance and quality control (QA/QC) for the data received, and provide regular reports on the data generated. Current agencies and institutions capable of performing this data management would include SANDAG, local Universities and Colleges. There is current effort by the lead copermittee of the Municipal Storm Water Management Program, the County of San Diego, to obtain funding for such a project on behalf of all municipal storm water copermittees under the Integrated Regional Watershed Management Program Proposition 50 Funding. By proactively staying informed of the various efforts in the watershed, and with support from the regulating community, trends and improvements in the overall assessment of the San Dieguito Watershed will be readily available utilizing a unified network of existing monitoring programs.

- *Goal: link pollution impacts to pollution sources*
- *Mechanism: outreach to businesses, industries and residents on stormwater pollution prevention, recycling, solid waste management, and water conservation*

The targeted pollutants of this campaign are those pollutants that would contribute to degradation of source water quality including surface water and groundwater.

In regard to nutrients, the consistent messages presented should be (1) to minimize the use of fertilizers through the preservation and planting of native plants which require little to no fertilizer; (2) encourage organic farming; (3) reduce sewer overflows through regular proactive system maintenance and reduce petroleum and food grease blockages of the sewers by educating users about proper oil and grease recycling and disposal; (4) proper septic system care and management and reporting of alleged system failures. These activities can be easily and efficiently completed using existing educational resources. Other than education, the establishment of buffers between development and surface waters provides opportunities to reduce pollutants through treatment. Installation or creation of structural BMPs such as wetlands to treat runoff from developed areas provides water purification functions as well as habitat, interpretational opportunities, and the desire to incorporate ‘green development’ and ‘green belts.’

Observation Stations

- Develop an effective approach to meeting water quality regulations for the watershed.
- Obtain grant funds to implement watershed improvement projects.



Mechanism: visitors to the receiving water bodies in the watershed record visual and olfactory observations that agency personnel regularly respond to.

A regular and ongoing visual and olfactory survey of the receiving water bodies in the watershed should be initiated. It is recognized that observational information is inherently subjective and, therefore, cannot be used to demonstrate water quality improvements in a regulatory context (e.g., to provide adequate justification to de-list a 303(d) listed impaired water body). However, visual and olfactory observations of a water body by its users, is a good indicator of how those users perceive the beneficial use and/or impairment of the water body and could initiate a more thorough sampling investigation in the event of an observed infraction.

This sampling program will establish observation stations along the water bodies and in the natural areas of the watershed. These stations will include informational kiosks with instructions on type of information desired, how the information will be used, and will provide data forms for properly recording the needed information. A covered lock box will be provided to collect completed data forms. The collected information will assist local agency representatives in identifying pollution sources and the public's perception of the given area. As sources are identified and control measures put in place, these observation stations can continue to be used to document the improvements to the area and assure that visual and olfactory aspects of the water are acceptable to its users. This provides an opportunity for public involvement and participation in stewardship of the watershed and will allow for a focused response by agency representatives. It also will provide additional information aside from discrete quantitative sampling for the information provided in the observation books would we collected and reviewed by the same people who take on the proactive public outreach program component described above.

In order to minimize the subjectivity of this type of survey, the data forms should clearly define the type of information requested and provide for concrete analysis by observers. For example, rather than indicating there were lots of birds in the channel, an observer could be asked to indicate the number of different species and approximate count. If algae or foul odors are observed in the area, the observer could be requested to indicate the approximate size of the bloom or radius in which odors can be detected. By providing a set parameter of answers for the observer to use, a standardized monitoring program can be implemented that will guide the layperson in collecting usable pertinent data. This approach is currently being used by such entities as the Audubon Society (<http://www.audubon.org>) and Reef Check in the marine realm (<http://www.reefcheck.org>).

4.7.2 Water Supply

The objectives identified for this water supply monitoring program include:

- Identifying and evaluating existing water supply
- Identifying potential future water supplies
- Ensuring source water protection

San Dieguito Watershed Management Plan

These objectives may be accomplished by performing the following actions:

- Assessing the condition of the watershed's existing and future surface and groundwater supplies
- Monitoring source water protection efforts

Current inventories of ground water and surface water are regularly monitored by the local water purveyors. Volumes of available surface water and surface water storage capacity are more closely tracked than that of ground water. While there is information on groundwater quality available from the San Diego County Department of Environmental Health, there are no broad scope studies or sources of information linking ground water recharge and extraction to water quality and ultimate usability. Utilizing the existing information, it is suggested that ground water monitoring be incorporated in conjunction with a reclaimed water injection feasibility study.

Municipal, industrial, and agricultural beneficial uses depend upon water that is of good quality and in adequate supply. Protecting source water supplies and preventing contamination has long been the chosen method. Surface and groundwater supplies are sensitive to nutrient loading by local sources. In the San Dieguito River Middle and Upper watersheds, rural residential areas on septic systems, areas with intensive agriculture and farming, and urbanized areas with extensive impervious surfaces have the potential to impact volume and nutrient loading on surface storage reservoirs and groundwaters. The Lower watershed has similar land uses in addition to being impacted by salt water intrusion from the ocean. Thus, water supply monitoring programs and protection efforts will vary greatly depending on the given region.

Extensive studies and monitoring currently conducted by the City of San Diego Water Department provide a model for source water protection in the San Dieguito Watershed for the Sutherland and Hodges Reservoirs. In addition, The City of San Diego Water Department and other water purveyors monitor for source water protection purposes in other watersheds with both similar and different land use characteristics. These different monitoring programs take into consideration how land use has changed through the years and how the quality of the source water has been affected. As the San Dieguito Watershed land uses change and additional development occurs within source watersheds, the San Dieguito Watershed monitoring program should reflect these land use changes. Referencing other source water monitoring programs with similar land use activities may prove insightful in establishing an efficient program for the San Dieguito Watershed.

Water supply demands can be expected to change with increases in development and local water supply conditions thereby providing two metrics for tracking over time. Land use updates are frequently made available by the SANDAG in a GIS format thereby graphically tracking changes in the land use over time. In addition, numerical statistics that support the GIS are readily available and annually reported by SANDAG. The current water supply models, which help with planning of future water infrastructure projects and source water protection plans, rely on projected land use changes and these reports from SANDAG.

San Dieguito Watershed Management Plan

4.7.3 Native Biological Resources and Habitat

The goal identified by the WSIG for monitoring the habitat of the San Dieguito Watershed is to assure that the stream, riparian, and upland habitat communities are successfully supporting a diverse and rich community of organisms.

The objectives identified for this native biological resource and habitat monitoring program include.

- 1) Ensuring the preservation of existing habitats,
- 2) Enhancing and restoring present habitats, and
- 3) Minimizing impact of urban development (and fire) by monitoring the existing, enhanced, and restored habitats and the organisms that inhabit them.

The future land development plan for the San Dieguito Watershed includes significant increases in residential, commercial, industrial, and park land use therefore open space will be reduced by approximately 50%. With the proposed land use changes, there will need to be a coordinated and integrated approach to land development to maintain the functionality of stream, riparian, and upland habitats and their connectivity. Development of land as residential, commercial, and industrial uses increase the imperviousness of the watershed which is contrary to proposed actions to increase pervious surfaces. Thus monitoring and documenting existing stream geomorphology before changes in land use will provide a baseline to compare modifications in stream configuration, sediment deposition, erosion, and habitat. It is suggested that annual monitoring of the riparian corridor during the months of May-July when stream dynamics have settled to a minimum after the winter rains, thereby providing a good representation of biological resource and habitat conditions. During the same months, upland habitat and biological resource surveys should also be conducted.

The California Stream Bioassessment Procedure (CSBP) is a standardized protocol for assessing biological and physical/habitat conditions of streams in California. The CSBP is a regional adaptation of the national Rapid Bioassessment Protocols outlined by the U.S. EPA in "Rapid Bioassessment Protocols for use in Streams and Rivers" (EPA/841-B-99-002).

The CSBP is a cost-effective tool that utilizes measures of the stream's benthic macroinvertebrate community and physical/habitat characteristics to determine the stream's biological and physical integrity. The CDFG has developed a protocol brief to assist resource professionals implement a benthic macroinvertebrate stream bioassessment program, though the brief provides only a summary of the information. Additional information and updates on bioassessment can be obtained by visiting the CDFG Aquatic Bioassessment Laboratory website at www.dfg.ca.gov/cabw/cabwhome.html.

When conducting bioassessment it is important to collect samples at the same location over many years in order to truly document temporal changes. Current bioassessment recommendations suggest monitoring twice per year, once in the spring and once in the fall. Stream benthic community bioassessment stations should be established where there is a

San Dieguito Watershed Management Plan

perennial flow and where the bioassessment would be likely to identify effects from watershed activities whether good (reduced erosion from farming activities) or bad (urban pollutant runoff).

Due of the limited development of the San Dieguito Watershed, there is vast potential for preserving, restoring, and enhancing habitat areas. Maintaining records of simple habitat surveys by citizens and making the surveys readily available for review, no matter how specific or broad in scope, will lead to increased appreciation for these natural areas, and ultimately increased participation in watershed stewardship. Several stakeholders within the watershed take interest to individual species such as red tailed hawks or arroyo toads. Individuals or small groups independently conducting monitoring of sensitive species should have their data recorded and stored in a manner to facilitate later use.

The natural and potential habitat areas in the watershed are regularly monitored by various groups and are listed below:

San Dieguito River Valley

San Dieguito River Valley Conservancy
Friends of the San Dieguito River Valley

Volcan Mountain

Volcan Mountain Preserve Foundation

Guejito Park

Ramona Grasslands

San Pasqual Valley Agricultural Preserve

The information collected by these various groups could also be posted to the web based database in order to provide biological information to those interested. In addition, the observation stations recommended as part of the water quality program could include observations regarding the wildlife and habitat found in the area.

Because of the proposed development within the San Dieguito Watershed, the existing conditions of habitats, creeks, riparian areas, and special watershed resources must be monitored in order to improve the value of these resources to the community. Using existing efforts and tools currently available, this assessment could be easily done on a yearly or biennial basis. Municipalities, conservancies, universities, and SANDAG house a current and expanding electronic inventory of resources. Using current GIS inventories, existing aerial photographs, governmental databases, monitoring programs, and citizen volunteers, the watershed functions can be assessed by examining and collectively interpreting changes through the years of: vacant land, property ownership, zoning, demographics, open space, monitoring data, and current preservation plans.

Very high resolution aerial imagery is currently available from SANDAG and web resources such as Google Earth and TerraServer. Using available aerial images in conjunction with parcel ownership GIS coverages, the existing habitat and open space areas can be tracked, classified,

and prioritized. The parcel ownership GIS coverage includes information on the property size and value which may be helpful in identifying key areas for possible acquisition so that they may be preserved or utilized to enhance the habitat functions of the watershed. An initial site assessment should be scheduled to estimate the “quality” of the property of interest. Consideration could then be given to acquiring the parcels that are privately owned with grant funds to be converted to or protected as natural open areas for habitat restoration/enhancement. Additional factors that would possibly make a parcel more valuable would be the habitat value of adjacent parcels, the presence of sensitive species, and accessibility which could support interpretation opportunities. Those parcels that are publicly owned and satisfactory for protection as open space should be noted as such and cataloged.

These land parcels could be listed on a central database so that when funds become available for land acquisition in the San Dieguito Watershed, those with interest and the means to do so, will be able to easily identify potential areas for future acquisition. Any acquisition of land or alteration for watershed management purposes in the watershed for open space will require appropriate jurisdictional approval. Such approval would come from departments of public works, recreation and parks, transportation, and planning, as well as from city managers and land use authorities.

Exotic Species

The presence of non-native/exotic species poses a threat to the quality of natural habitats. In the San Dieguito Watershed, the exotic plant *Arundo donax* has established expansive stands within several reaches of riparian areas, displacing native plants and the organisms that depend upon the native habitats. Many other watersheds in the San Diego region are plagued with invasive stands of *Arundo donax* and have had to undertake extensive removal programs in order to keep water flowing through the stream channels and to restore habitat. Ultimate removal of *Arundo donax* would help improve the water supply and habitat quality in the San Dieguito Watershed along with flood control by restoring the water flow. Before that can happen, an inventory of *Arundo donax* should be created and frequently updated as this invasive plant can rapidly establish large stands within 1-2 years under optimal conditions. This inventory can be compiled using existing monitoring programs for water quality monitoring and habitat surveys by training individuals conducting the monitoring to document and report the presence and densities of *Arundo donax* within the watershed. A simple reporting tool could be to call into a future interpretation center representative who has a computer or map resource to document sightings. Tracking exotic species is an important exercise, as the dataset can be used to apply for exotic species removal grant funds and also as a tool to document the trends of invasive species over time.

The Middle watershed areas above the Hodges Reservoir and into the San Pasqual Valley currently contain extensive stands of *Arundo donax* and would be an ideal place to start maintaining such a database. Much of the area above Hodges Reservoir and into the San Pasqual Valley is publicly owned which would facilitate access for field surveys in order to validate aerial photograph interpretation.

4.7.4 Promote Social and Community Resources and Watershed Stewardship

The goal identified by the WSIG for monitoring the social and community resources of the San Dieguito Watershed is to assure that existing land use plans are compatible with efforts to maintain water quality, water supply, and biological resources.

The objectives identified for this social and community resources monitoring program include:

- 1) Ensuring compatible land uses,
- 2) Maintaining the agricultural character,
- 3) Monitoring the effectiveness of stewardship enhancement efforts.

Environmental stewardship is an important element to the success of watershed management. One way to achieve a reversal in environmental degradation is to change the behaviors of those in the watershed that have led to the initial or ongoing degradations.

In order to be truly effective, stakeholder involvement must be woven throughout the watershed management process. The first step is to increase public awareness of watershed problems at all ages, across all land uses, and all professions. The awareness in turn cultivates personal stewardship, which can be further encouraged with organized public involvement activities and reinforced through routine outreach actions.

These objectives may be accomplished by performing the following actions

- Eliminate land use related conflicts.
- Maintain the agricultural and open space character of the watershed by preserving lands suitable for agriculture.
- Tracking public awareness and stewardship behaviors.
- Tracking public participation and participation in watershed conservancy activities and membership

Compatible Land Uses

Analysis of the compatibility of land uses involves many factors which include several categories: aesthetics, noise, odor, pollution, and lighting to name a few. There can exist conflicts at the interface of two different human-derived land uses just as there can be conflicts at the edge of human and biological or habitat land uses. Human-human and human-biological edge effects exist in the San Dieguito Watershed and additional conflicts may occur with future development. For example, in the human-human interface there is potential for loud mechanical fans used to circulate warm air around citrus groves to keep people awake at night during frost events. Another example would be the possibility of a mulching operation to produce undesirable odors at a near-by school. In either of the aforementioned situations, it would not have been wise to locate a residential area or school adjacently to such operations in order to ensure that existing land uses can be compatible with future land uses.

The human-biological interface is more delicate and often times not fully understood. For example, research studies of sensitive organisms such as the California gnatcatcher and the Arroyo toad have yield information about suitable habitat and the impact of encroachment into their habitat. However, the edge effect is not linear and varies for these two organisms. Developments that border or protrude into a biological or habitat community in reality extend far beyond the physical property boundary. For example, domesticated cats and dogs that explore throughout habitats and open space often disturb or prey upon native species of birds and rabbits. Depending upon the width, an open space habitat bound on two or three sides may appear lush while bird inhabitation and reproduction may be negligible. This is a commonly understood fact near several San Diego County estuaries and lagoons where feral cats and dogs often disturb nesting shore birds. These changes are difficult to quantify because the changes may occur slowly over a long period of time or a baseline biological survey has not yet been completed so there is no ability to compare pre and post development data.

Examples of disturbances that cause edge effects associated with residential development include noise and lighting impacts, increased erosion or sedimentation and siltation, increased human intrusion, exotic species invasion (plants and animals), and the disruption of the natural composition of native species (i.e., increasing human-adapted species at the expense of rarer and more sensitive native species). The construction of access roads and utilities to serve residential development can also cause edge effects. Edge effects can affect vegetation communities, thus altering wildlife habitat and affect sensitive species. They are more difficult to quantify because they often are not manifested in a change in the visual landscape, and often result in gradual change over a longer period of time.

Furthermore, the types of edge effects are diverse and their effects are highly variable. Animals venturing in the opposite direction may be a conflict as well:: wild animals from open space areas such as hawks, rattlesnakes, coyotes, and bobcats may disturb residents by injuring or killing pets in the developed areas. Rabbits have been known to eat valuable landscaping.

A few simple principles when reviewing edge effects are:

- Edge effects affect biological resources and habitats as well as humans.
- Smaller open space areas bound by development on one or more sides may exhibit edge effects all throughout the open space.
- Edge effects vary for different organisms.
- Edge effects can extend for thousands of feet.

A suggested way of approaching edge effects metrics include applying the general principles listed above to categorized edge effects. For example: studying edge effects along residential, commercial, agricultural, and municipal parks can present general findings about which edge effects are prevalent or if multiple edge effects are affecting an open space. Such metrics provide valuable information which can be used to help support watershed management decisions. Although current models suggest lineal distances for the general minimum setbacks, there should not be an effort to define a specific lineal distance which will protect all organisms in all settings.

Specific socioeconomic variables for a region, along with characteristics of the area's existing and planned land uses, can be used as indicators to evaluate and project the health of a watershed. These variables and characteristics can be used to estimate the impervious surface cover in an area, which has been shown to affect the quality of receiving waters, such as streams, lakes, and bays (Center for Watershed Protection, 1999). Unfortunately, due to the arid, Mediterranean conditions of the San Diego region, many traditional water quality monitoring and modeling techniques using the socioeconomic and land use characteristics fail to achieve the same results as those used in wetter climates. Nonetheless, impervious surface cover in the San Dieguito Watershed plays a large role in the health of the watershed and its water quality.

Socioeconomic characteristics, including population density and housing density, can be used to identify areas contributing substantial quantities of urban runoff due to correlations between these characteristics and impervious surface cover (Center for Watershed Protection, 1999). While this is appropriate for residential areas, commercial or industrial areas with low population and housing stock, but high impervious cover, are underrepresented for their contribution to urban runoff. Therefore, in areas with substantial amounts of commercial or industrial land uses, population and housing density should be used in conjunction with other indicators to evaluate an area's contribution to regional water quality (Center for Watershed Protection, 1999).

Land use characteristics used as indicators for watershed health take into better account all of the different land uses in an area, instead of being biased towards residential areas, as is the case with socioeconomic indicators. Land use characteristics can also identify sources of non-urban runoff, such as agricultural and recreational areas. With differentiations able to be made between land use types, generalizations can also be made about the potential contaminants that may come from these land uses. The trade-off, however, is the greater level of effort required to use land use characteristics for water quality indicators. Maps and aerial photography must be obtained, digitized, and analyzed using a GIS where areas of different land use types can be identified and calculated.

Land cover information can be used to provide a baseline against which future planned uses can be compared. Land cover can be inferred from existing land use information. The land cover types of existing uses are broken into a variety of categories describing their general use. Although the volume and constituents of runoff from these land cover types cannot be determined from their identification, the following generalizations can be made from the cover types that can assist in the watershed evaluation (SWRCB, 2004):

- Multiple-family residential areas – high proportion of impervious surfaces contributing to runoff; contaminants likely to consist of litter, motor oil, or other car fluids
- Single-family residential areas – with lawns, have moderate proportion of impervious surfaces contributing to runoff; contaminants likely to consist of litter, motor oil or other car fluids, animal waste, and pesticides, herbicides, and fertilizers from yards
- Recreational areas – low proportion of impervious surfaces contributing to runoff; contaminants differ widely depending on type of facility but likely to contain fecal coliform from pets, herbicides, pesticides, and fertilizers from landscaped areas

San Dieguito Watershed Management Plan

- Agricultural and Ranching areas – low proportion of impervious surfaces contributing to runoff; contaminants likely to contain fine sediment, fecal bacteria, herbicides, pesticides, and fertilizers
- Roads and freeways, shopping centers, commercial, and light industrial areas – high proportion of impervious surfaces contributing to runoff; contaminants likely to consist of litter, rubber, motor oil, grease, or other car fluids.

Assumptions regarding the runoff and contaminants likely to originate from other cover types can also be made at this level of analysis. Because these generalizations are assumptions, they should be used to assist in the identification of areas that deserve closer scrutiny in an analysis of watershed health, but would not provide any categorical conclusions.

Neither socioeconomic data nor land-use characteristics provide precise, quantitative indicators for existing water quality and watershed health or for future conditions. Both socioeconomic and land use indicators can, however, provide important information on where particular stressors are likely to occur and where quantitative studies should be focused in the watershed. Therefore, they are generally more useful in evaluating large-scale trends in the watershed as opposed to the effectiveness of specific management actions or strategies. It is recommended that assessment and calculation of these socioeconomic and land use indicators occur following the release of new population or growth forecasts or adoption of general plan updates.

It is also important to assess public awareness and attitudes about problems in the watershed and means of solving them. Societal attitudes and behaviors, after all, are what ultimately contribute to or cause many environmental problems. Changes in these attitudes and behaviors can lessen if not eliminate these problems. Public surveys can provide a useful social indicator of the effectiveness of education programs and the progress being made in changing societal sentiment and actions for the better. They can target specific groups of people or focus on specific management actions to evaluate the group's awareness and likelihood of implementing specific actions or practices.

Agricultural Character

The goal identified by the WSIG is to protect the agricultural character and viable pastureland in the area even as pressure for development increases. Agricultural uses and the rural landscape define the character of the San Dieguito Watershed. As new residential homes, commercial and industrial areas, and associated infrastructure such as roads and park are designed and constructed, it will be important to preserve this rural and agricultural character.

The area's natural beauty is enhanced through the preservation of large contiguous open spaces within and between individual developments and the maintenance of scenic views and other unique features.

Land planning committees and conservation commissions need to work together in order to prevent the implementation of land use policies that convert agricultural character into unchecked continuous development. The mis-allocation of land and haphazard building of school sites, public buildings, roads, sewers, etc, can all have unintended negative consequences in retaining the wanted agricultural setting of the area.

Many landowners have indicated an interest in preserving their land in an open or agricultural state but are unsure of their options. The following items can be monitored and tracked to assist in the decision making in order to preserve the agricultural character and heritage of the San Dieguito Watershed:

- Actively define agricultural activities and agricultural land use in the San Dieguito Watershed in order to better adapt to changing market needs.
- Create a watershed-wide agricultural profile in order to understand the present status and overall trends. This would include an inventory of present and past agricultural activities, location of active and inactive farm lands and possible locations of future agricultural land.
- Review a soils-map of the watershed as defined by the USDA Natural Resources Conservation Service (NRCS). Once the locations of the best agricultural soils are defined, a priority should be given to agricultural use preservation over other pending development activities. Tracking changes in municipal general plan amendments would identify any suggested changes for land use.
- Seek private and public funding to purchase development rights on key agricultural land as part of an open-space protection plan. Tracking the acquisition of the parcels would show continued effort and effort toward completing the goal.
- Differentiate zoning and site-review requirements for agricultural development from commercial, industrial and residential development. Evaluating and monitoring differences or changes in municipal ordinances and how each would affect the different parts of the watershed and watershed functions.
- Promote and encourage agricultural-based businesses to locate in the community in order to support the existing agricultural activities. Such businesses would include agricultural feed, supply and equipment retailers. Monitor trends toward a community supported agriculture such as presence of feed stores, interpretive centers, farmers markets, and other supportive indicators such as fliers, signage, and website listings.
- Promote and support local farmer's markets in commercially attractive locations and registered farm stands in order to promote locally grown agricultural products. Identifying and tracking food stand health permits by the County of San Diego.
- Promote and support local academic programs training farmers (present and future) in the most current agricultural practices. This should emphasize the need to recruit and stimulate future farmers in order to maintain the agricultural legacy of the community. This may be tracked by the growing number of participants in farm bureau meetings, establishment of classes at local community colleges, and possible structured and accredited courses.
- Continuing to educate landowners of legal and land use tools that can be utilized to protect their land, such as conservation easements for tax credits, will be important to preserving the character of the area (NHOSP, 2000). Utilizing the County of San Diego Tax Assessor's Office would provide information on recording of tax credits, easements, and other parcel information.

The trend across the nation is to preserve the agricultural communities and rural agricultural character, by promoting and fostering active and productive family farms. Through the preservation of existing farm lands, historical agricultural land marks and ensuring that farmers

can financially support their agricultural activities and families, the community's agricultural character and heritage is protected for future generations. The stakeholders hope to see an increasing trend of large and small scale farmers who sell their goods through local community supported agricultural programs.

Stewardship

Efforts to educate and increase stewardship and the behaviors we wish to change with these efforts can and should be tracked quantitatively. Surveys can be sent to residents, students, or any other group to gauge their awareness of certain problems and their support for remedying them. Reviewing trends in complaints reported to municipalities and other enforcement agencies can indirectly measure changes in behavior. An increasing number of complaints may indicate that more people are aware of an issue, that they care enough to take the time out of their day to report it, and that there is an appropriate place to report it. Residents and businesses need to know that taking the time to do the right thing benefits them. So, providing feedback to complainant or respondents of questionnaires and surveys reinforces the behaviors that should be seen with increasing stewardship.

It should be a goal to measure stewardship over a longer period of time primarily through indirect measures which may include tracking of participants at watershed events, frequency and scope of articles in local publications, and growth in affiliation or membership with non-profit organizations that support watershed stewardship to just name a few. Direct methods of stewardship can be accomplished through infrequent and targeted surveys though this type of survey can have its limitations. Some individuals do not want to take the time to participate in a survey or may provide intentional misinformation. Local water purveyors and municipalities utilize educational consultants to help develop and convey important messages and track the effectiveness of the outreach. It is suggested that the stakeholders collaborate with the existing educational efforts currently underway from water purveyors, municipal storm water programs, and refuse and recycling management companies, while retaining an educational consultant, to develop a survey method that would incorporate all known avenues to monitor and track stewardship.

4.7.5 Assessment of Implemented Programs and Projects

Program and project actions recommended in this WMP include recommendations for assessment and/or monitoring to determine the success of the implemented actions. These recommendations are included in the description of actions in Section 4.3 through 4.7 of this Action Plan. In many cases, a recommendation is made to coordinate the assessment of the implemented action with existing assessment and/or monitoring programs. For site specific projects, recommendations are made to either compare environmental conditions upstream and downstream of the implemented project, or to measure environmental conditions prior to and then after the project to document changes in environmental quality over time. Data collected from the site specific monitoring also would be input into the centralized database to support the overall assessment of watershed health.

Table 4.7-3. Monitoring plan overview

Objective	Monitoring	Frequency	Metrics and Trends
<ul style="list-style-type: none"> • Diminish and eliminate further degradation of the watershed and its resources through better management practices. 	Impervious Cover	Consistent with GIS updates, annually	Reduction in impervious cover
	Changes in Section 303(d) listings	Triennially, consistent with SWRCB Section 303(d) updates	Decreasing trend in the number of listings on the Section 303(d) List
<ul style="list-style-type: none"> • Protect, enhance and restore beneficial uses of watershed. 	Best Management Practices	Annually	Increasing inventory of implemented structural best management practices and reduction in BMP targeted pollutants
	Erosion and Sedimentation	Annually	Stable trails, Stable Creek banks, and minimal sedimentation in creeks and rivers, Bioassessment
<ul style="list-style-type: none"> • Develop an effective approach to meeting water quality regulations for the watershed. 	Trash	Annually	Reduction in visible trash within surface waters and buffers.
	Potable water use	Annually	Stable or decreasing use of potable water supply per capita
<ul style="list-style-type: none"> • Promote science-based methods for water quality and environmental assessment of the watershed. 			

Objective	Monitoring	Frequency	Metrics and Trends
<ul style="list-style-type: none"> Obtain grant funds to implement watershed improvement projects. 	Reclaimed water use	Annually	Increasing production, availability, and use of reclaimed water.
<ul style="list-style-type: none"> Involve and encourage public participation in management and protection of watershed resources. 	Raw water inventory	Annually	Maximization of usability, while supporting existing biological communities.
<ul style="list-style-type: none"> Increase the viability, diversity, health and function of ecological systems of the watershed. 	Existing High Quality Habitats	Ongoing	Increasing protection and interpretation.
<ul style="list-style-type: none"> Raise public awareness and increase personal stewardship of the watershed. 	Degraded Habitats	Ongoing	Increasing exotic removal and native reestablishment
<ul style="list-style-type: none"> Increase the viability, diversity, health and function of ecological systems of the watershed. 	Habitat / Development Interface	Ongoing	Reduction in post development encroachment
<ul style="list-style-type: none"> Increase the viability, diversity, health and function of ecological systems of the watershed. 	Land Use Compatibility	2-5 years	Increasing use of buffers for habitat protection and agricultural land uses
<ul style="list-style-type: none"> Increase the viability, diversity, health and function of ecological systems of the watershed. 	Agricultural Lands	2-5 years	Increasing designation of land as agricultural preserves.
<ul style="list-style-type: none"> Raise public awareness and increase personal stewardship of the watershed. 	Stewardship Efforts	2-5 years	Increasing collaborative outreach and efforts across all watershed functions