# Summation of Findings
# Natural Water Quality Committee
# 2006-2009

## DRAFT

December 31, 2009

**TABLE OF CONTENTS (to be added)**

## EXECUTIVE SUMMARY

In response to the regulatory concerns about areas of Special Biological Significance (ASBS), the State Water Resources Control Board (State Water Board) has empanelled eight experts from different scientific disciplines to help determine a functional definition of "natural water quality." It is the actions of this Natural Water Quality Committee (NWQC) that are the focus of this report.

The NWQC has a three-year mission to advise State Water Board staff regarding impacts of Scripps' Institution of Oceanography (SIO) discharges into its adjoining ASBS. While the committee focused on SIO and other relevant data in the SIO vicinity, they also recognized the importance of their work in the context of the greater ASBS, Ocean Plan, and stormwater issues. In response, the NWQC agreed that their recommendations may provide guidance for assessing impacts to water quality in any ASBS in the State. To that end, the NWQC is addressing three primary questions:

1) Are water quality objectives and permit limits being met?
2) What are impacts of waste discharges to marine species and communities?
3) What would ambient marine water quality be like without waste discharges?

In its first year, the NWQC centered its efforts on the first question by evaluating results from the SIO monitoring of ASBS discharges.

This report describes the NWQC's activities …..and include the major findings:

**[Note the following is a draft list for discussion]**

- Definition of natural water quality
- Water quality in ASBS is generally good
- There are some areas of improvement needed
- SIO has improved its effluent
- There are some issues with the COP…Table C, toxicity, etc.
- Need to have a practical approach to regulating ASBS… receiving water compliance, better characterization of waste inputs, prioritizing discharges and watershed sources…
- Need to address distant or watershed sources…etc.

## BACKGROUND

The coastal environment of California is an important ecological and economic resource. It is home to diverse and abundant marine life and has some of the richest habitats on earth including forests of the giant kelp, *Macrocystis pyrifera.* The State Water Resources Control Board (State Water Board) has created 34 Areas of Biological Significance (ASBS) in order to preserve and protect these especially valuable biological communities.

California's coasts are also a repository for waste discharges from the State's ever-increasing population. Treated municipal and industrial wastewaters, urban runoff, and power generating station discharges all represent a number of risks to aquatic life from human activities. As a result, the SWRCB, in the California Ocean Plan, has prohibited the discharge of waste to ASBS. All ASBS are State Water Quality Protection Areas that require special protection under state law.

Despite the prohibition against waste discharges to ASBS, a recent survey of ASBS has observed approximately 1,658 outfalls (SCCWRP 2003). As a result, the State Water Board has initiated regulatory actions, establishing special protections through the Ocean Plan's exception process. The intent of these regulatory actions is to achieve natural water quality of the ocean receiving water in the ASBS. One of the first regulatory actions was taken in San Diego at the ASBS adjacent to the Scripps Institution of Oceanography (SIO). The SIO, which owns and maintains the discharge outfalls to the La Jolla ASBS, was issued an Ocean Plan exception and a National Pollutant Discharge Elimination System (NPDES) Permit. As part of this regulatory action, State Water Board staff was asked to create a panel of experts from different scientific disciplines to help develop a functional definition of "natural water quality." It is the actions of the Natural Water Quality Committee (NWQC) that are the focus of this report.

The NWQC includes eight members (Table 1). The NWQC has the mission to evaluate the SIO monitoring data, and to advise the Regional Board regarding impacts of SIO's discharges to ASBS. While the committee focused on SIO and other relevant La Jolla data, they also recognized the importance of their work in the context of the greater ASBS, Ocean Plan, and stormwater issues. In response, the NWQC agreed that their work may provide guidance for assessing impacts to water quality in any ASBS in the State. To that end, the NWQC is addressing three primary questions:

1) Are water quality objectives and permit limits being met?
2) What are impacts of waste discharges to marine species and communities?
3) What would ambient marine water quality be like without waste discharges?

The NWQC has created a 3-year timeline to achieve milestones that help to answer these three questions. The first question, which is focused almost entirely on SIO permit and site specific issues, was addressed in the first year. The second question, which has both site specific and regional spatial scale issues, was addressed in the second year. The increase in spatial scale is necessary because biological impacts at the SIO ASBS can only be interpreted in response to species and communities outside of the SIO ASBS.

The third question, which is almost entirely exclusive of the SIO ASBS, was addressed in the third year. The increase in spatial scale for question three is a reflection of the need to select appropriate regional or statewide reference conditions, which by definition excludes areas with discharges.

Table 1. Members of the Natural Water Quality Committee

| Members | Affiliation |
|---|---|
| Andrew Dickson | Scripps Institution of Oceanography |
| Rich Gossett | California State University Long Beach |
| Dominic Gregorio | State Water Resources Control Board |
| Burt Jones | University of Southern California |
| Steve Murray | California State University Fullerton |
| Bruce Posthumus | San Diego Regional Water Quality Control Board |
| Kenneth Schiff | Southern California Coastal Water Research Project |

## DEFINITION OF NATURAL WATER QUALITY

Natural ocean water quality: That water quality (based on selected physical chemical and biological characteristics) that is required to sustain marine ecosystems, and which is without apparent human influence, *i.e.*, an absence of significant amounts of:

a) man-made constituents (*e.g.,* DDT),
b) other chemical (*e.g.,* trace metals), physical (temperature/thermal pollution, sediment burial) and biological (*e.g.*, bacteria) constituents at concentrations that have been elevated due to man's activities above those resulting from the naturally occurring processes that affect the area in question, and
c) non-indigenous biota (*e.g.,* invasive algal bloom species) that have been introduced either deliberately or accidentally by man.

Natural ocean water would be expected to vary noticeably both from place to place, and from time to time. For example, there are significant variations in the composition of minor constituents of seawater (*e.g.,* nutrients, oxygen, trace metals) with depth in the ocean, as well as with distance from land and even between ocean basins. Furthermore, significant ocean properties such as salinity, temperature, and pH vary appreciably with location, season, and year to year due to natural oceanographic processes.

Even within California's coastal ocean, spatial differences exist as a result of regional differences in solar radiation, precipitation, and naturally occurring fresh water. Coastal seawater will differ measurably in trace element composition as a consequence of local watershed geology. Various places on the California shelf have naturally occurring hydrocarbon and groundwater seepage. In near-shore seawater, temporal and seasonal differences in suspended sediments result from variations in wave action. Naturally occurring marine life itself also alters water quality by various processes. For example, seawater near a sea lion haul-out may be high in fecal bacteria levels.

In addition, there are naturally occurring large-scale ocean cycles that dramatically influence the physical, chemical and biological components that support marine life along the California coast. For example, El Niño and La Niña oceanographic events can significantly alter the surface water temperature along the California coast thus extending or diminishing the range and abundance of cold versus warm water species. Rainfall during such El Niño events can also exert large influences on coastal water quality due to significant flood events that deliver (natural) sediments from undeveloped watersheds. Turbidity events associated with California river systems during large flood events have been observed from space.

However, the reality is that vast areas of the ocean are no longer pristine. Truly natural water quality probably does not now exist in California's coastal ocean, and may be rare throughout the world. For example, plastic debris can be found in remote areas of the ocean thousands of miles from continents, and persistent organic pollutants may be found in marine life inhabiting equally remote regions. Even if anthropogenic land-based waste discharges were to be completely eliminated from a section of coastline, there is no guarantee that natural water quality would be reestablished there. Aerial deposition,

pollutants carried by oceanic currents from distant sources, and vessel discharges may influence water quality conditions.

It is the goal of this definition to acknowledge that any definition of *natural water quality* for an ASBS must satisfy the following criteria:

- it should be possible to define *reference* areas that currently approximate *natural water quality*
- any detectable human influence on the water quality must not hinder the ability of marine life to respond to natural cycles and processes

Such criteria will ensure that the beneficial uses identified by the Ocean Plan are protected for future generations.

## SPECIFIC FINIDINGS

### Q1: Are water quality objectives and permit limits being met?

The NWQC met six times between December 2006 and September 2007 addressing the monitoring and conditions specific to the SIO NPDES permit. Both effluent and receiving waters had been sampled by SIO from [date] to [date] and some general conclusions were drawn:

1) waste seawater system effluent measurements had identified some constituents of concern (outside of permit limits) such as copper, suspended solids, settleable solids, acute toxicity (topsmelt), chronic toxicity (kelp) and dioxins;
2) runoff generally had more constituents with concentrations greater than those specified in Ocean Plan Tables A and B compared with the waste seawater system. These constituents included copper, turbidity, oil and grease, settleable solids, PAHs, indicator bacteria, chronic toxicity (topsmelt and kelp) and dioxins;
3) chromium, lead, and zinc in the runoff were also elevated above the Ocean Plan Table B six month median levels on more than one occasion during wet weather;
4) receiving water in the ASBS was elevated above water quality objectives on at least one occasion for chronic toxicity (kelp) and/or dioxin during wet and dry weather sampling;
5) dioxins appear to be ubiquitous in the environment and are likely not a direct result of SIO activities (see white paper below);
6) one sampling period coincided with a red tide event (June 2005) that may have had a confounding or synergistic effect with regard to the toxicity tests;
7) water quality measurements also revealed some technical shortcomings of EPA and State approved test methods, such as elevated total residual chlorine measurements in seawater matrix (see white paper below), and acute toxicity interpretations when control variability is extremely small; and
8) most other Table B constituents were not detected, or were present in small amounts that represented no reasonable potential (RP) to cause impacts based on RP analysis using State Water Board developed software.

More recently, SIO monitoring data show improvements in effluent quality …..? (**include a brief summary of recent results**).

A receiving water study for bacterial contamination was conducted by SIO examining more than 10 sites plus outfall discharges at multiple time intervals during dry weather. The results indicated that bacterial concentrations were routinely low and below water quality standards. In general, the NWQC determined that bacterial monitoring was an inappropriate indicator for assessing potential impacts to aquatic life for this ASBS than other water quality measures. Given that SIO and the County Health Department routinely monitors this beach for the protection of human health, the NWQC recommended against future non-routine bacterial monitoring and reinvest their effort into other monitoring elements.

Finally, SIO had developed a dilution and dispersion computer model for their discharges into the nearshore coastal zone of the ASBS. The model had been previously calibrated and validated at the mouth of the Santa Margarita River that discharges into the littoral zone near Oceanside. Based on model runs at La Jolla conducted by SIO, results indicated that dilution of SIO discharges could be very large due to turbulent mixing and advection by wave action and longshore currents. The lowest dilution simulated was 7:1. While the model input parameters (i.e., tide, wave height and direction, etc.) were some of the best available, the NWQC was concerned that little model validation at the La Jolla ASBS had been conducted.

## Q2: What are impacts of waste discharges to marine species and communities?

Quantifying the chemical components of an effluent only partially assesses the potential of waste discharge to ASBS. Ultimately, one needs to also assess the biological integrity of marine communities residing in ASBS to determine if the human influence on water quality is hindering the ability of marine life to respond to natural cycles and processes. To this end, several ASBS stakeholders and the State Water Board utilized scientists at the University of California Santa Cruz to compile existing intertidal biological monitoring programs from ASBS statewide to assess if historical data were sufficient to make statements about the integrity of ASBS intertidal marine communities (Raimondi 2009).

Raimondi (2009) evaluated 12 ASBS intertidal monitoring programs and summarized five features that hindered an independent, integrated assessment of biological impacts in ASBS. First, the methods used in the monitoring programs differed dramatically ranging from careful designs leading from specific questions to almost a naturalist perspective on a site. Second, all of the monitoring programs were done either by the discharger or consultants to the discharger. Third, the basis for determining if a discharge is causing an impact differed dramatically among monitoring programs. Fourth and most important; most monitoring programs were not clear about what the basis for determination of

impact was. One strong recommendation for an integrated assessment was that there should be a general basis for determination of impact that is consistently applied. There should also be a general assessment design that would produce information sufficient to produce a rigorous determination of impact. Finally, the reporting requirements for assessments should be standardized including data and metadata reporting, transfer, and storage.

Eight of the monitoring programs provided datasets that were insufficient to make an independent assessment of impacts to biological integrity as a result of ASBS discharge. Of the four remaining monitoring programs, independent analysis by Raimondi (2009) concluded that three of the monitoring programs provided data that detected a difference in either community composition, abundance, and/or percent cover in the rocky intertidal zone between the program's reference site and discharge site. While the strength of the conclusion about discharge impact to biota must be tempered due to numerous factors (i.e., differences in monitoring methods, sampling design, site selection, etc.), it is clear that biological monitoring in the rocky intertidal zone may be used for assessing the impact of ASBS discharges.

A regional ASBS biological monitoring program has been implemented in southern California. More than 20 rocky intertidal sites are being quantitatively sampled for habitat quality, invertebrate and algal abundance and composition by the UC Santa Cruz Raimondi research team. Half of the sample sites are at reference locations with the specific intent of deriving a regional reference condition for comparing intertidal sites near regulated ASBS discharges. Results of this regional intertidal monitoring program is expected no later than the summer of 2010.

In addition, more than 60 subtidal rocky reef sites have been quantitatively sampled for habitat quality, vertebrate, invertebrate and algal abundance and composition. This monitoring, led by researchers at Occidental College, UC Santa Barbara, and San Diego State University also includes 30 reference locations as well as at least one site in each ASBS in southern California. While being performed for multiple reasons within the framework of the Southern California Bight 2008 regional monitoring effort, this program has a specific monitoring question that directly addresses biological integrity in ASBS. Results of this regional subtidal monitoring program is expected no later than 2011.

Bioaccumulation in receiving waters had also been conducted using both mussels and sand crabs. SIO results indicated that:

1) most organic constituents were present at statistically nonsignificant levels relative to a reference site during the study period;
2) certain pollutants were elevated in transplanted mussels near the SIO pier (Cr, Ni, Fe, and Mn) and at the south end of the adjoining La Jolla ASBS (As) where the City of San Diego storm outfalls are located relative to other sites within the study area;
3) Certain pollutants were elevated in transplanted mussels near the SIO pier (Cr and Ni) relative to historical statewide Mussel Watch results; and

4) large relative variability in tissue concentrations from sand crabs due to age/reproductive status precluded an assessment of spatial scale gradients and an evaluation of potential effects.

## Q3: What would ambient marine water quality be like without waste discharges?

The State Water Board funded a statewide monitoring program during the winter of 2008-09 specifically to assess the water quality in ASBS near and far from regulated discharges. More than 100 chemical constituents and toxicity were measured from 62 sites using a probabilistic study design; roughly half of sites were sampled in the ocean directly in front of a regulated discharge and the other half were located in the ocean > 500 m from a regulated discharge. It is important to point out that the sample sites > 500 m from direct discharges may be influenced by watershed drainages either into or outside of the ASBS, and therefore may represent background but not necessarily natural conditions. Samples at each site were collected < 24 hr prior to rainfall and again < 24 hr following rainfall. At least one ocean sample near a discharge and another distant from a discharge was selected for each mainland ASBS in California.

The statewide survey illustrated generally good chemical water quality in ASBS (Table 2). None of the constituents measured exceeded the instantaneous maximum objective listed in the California Ocean Plan (SWRCB 2003). Seven out of 15 constituents did not exceed the Ocean Plan's most stringent objectives (six month median or 30 day average, depending on the specific constituent) including strictly anthropogenic chemicals such as DDTs or PCBs. Of the eight parameters that did exceed the most stringent Ocean Plan objectives, six (arsenic, cadmium, copper, lead, nickel and zinc) exceeded the objective for relatively small (< 7%) portions of ASBS shoreline (those ASBS exceeding the standards are: …….. ). Many of these constituents are common in urban stormwater but have natural sources as well. Of these six constituents, copper and lead exceeded the objectives for larger portions of coastline away from direct discharges.

The constituents two that exceeded the objectives over large percentages of ASBS coastline were chromium (50%) and polycyclic aromatic hydrocarbons (PAH)(87%), both of which have both natural and anthropogenic potential sources. Upon closer inspection, it appears that roughly equal portions of ASBS ocean waters exceeded Ocean Plan objectives for PAH both near and far from discharges. For chromium, the extent of shoreline that exceeded 6-month median objectives was similar between pre-storm and post-storm conditions (data not shown). It is important to note that the chromium standard is based on the more toxic hexavalent chromium isotope, but that the analysis was for total chromium. The lack of excessive chemical contamination in ASBS receiving waters was supported by toxicity studies that showed little (< 5%) ASBS shoreline exhibited chronic toxicity to one endemic species (the purple sea urchin, *Strongylocentrotus purpuratus*).

Table 2. Percent of ASBS shoreline that exceeded State Water Board Ocean Plan objectives following storm events.

| | | % Shoreline Greater Than OP Objective | | |
|---|---|---|---|---|
| | **Ocean Plan Objective** | **All ASBS** | **Near Discharge** | **>500 m from Discharge** |
| Ammonia-N[1] | 2.4 mg/L | -- | -- | -- |
| Arsenic[1] | 32 ug/L | 1.6 | 2.7 | -- |
| Cadmium[1] | 4 ug/L | 2.1 | 3.6 | -- |
| Chromium[1] | 8 ug/L | 50 | 61 | 35 |
| Copper[1] | 12 ug/L | 6.9 | 4.8 | 9.8 |
| Lead[1] | 8 ug/L | 4.8 | -- | 11.5 |
| Nickel[1] | 20 ug/L | 15 | 24 | 3 |
| Silver[1] | 2.8 ug/L | -- | -- | -- |
| Zinc[1] | 80 ug/L | 3.8 | 6.5 | -- |
| HCH-lindanes[2] | 8.0 ng/L | -- | -- | -- |
| Chlordane[2] | 0.023 ng/L | -- | -- | -- |
| DDTs[2] | 0.17 ng/L | -- | -- | -- |
| Dieldrin[2] | 0.04 ng/L | -- | -- | -- |
| PAHs[2] | 8.8 ng/L | 87 | 85 | 89 |
| PCBs[2] | 0.019 ng/L | -- | -- | -- |

[1] 6-month median
[2] 30-day average

Pilot Reference Area Study:

A pilot study at reference areas with minimal anthropogenic inputs investigated the study design elements and sampling techniques for wet weather sampling of receiving waters in ASBS. The lessons learned as part of this pilot were used when regional programs were implemented beginning in the winter of 2008-09. In general, the regional program identified three monitoring questions including: 1) what is the range of natural water quality at reference locations? 2) how does the range of concentrations at ASBS compare to this range of natural water quality? 3) How do ASBS with discharges compare to ASBS without discharges?

The pilot study targeted eight sites. Four are located in southern California and four in Central California. These sites represent beaches that receive discharges from reference watershed catchments defined as >95% space, contains no 303d listed waterbodies, and discharge to open beaches with breaking waves. Samples were collected in the receiving waters, immediately in front of discharges from the reference watershed. All sites were collected during at least one storm event. Samples were collected in less than 24 hr from the cessation of rainfall.

Samples were collected and analyzed for total suspended solids (TSS), trace metals, polynuclear aromatic hydrocarbons (PAHs), and chlorinated hydrocarbons.

The results of this were **(to be added)**

Add a section on the targeted results in Southern CA. **(to be added)**

Discuss a comparison of reference data to COP objectives and Table C…for example does Table C adequately represent background? Should there be amendments to the COP? **(to be added)**

## THE NEED FOR ADDITIONAL GUIDANCE

### White Paper on ASBS Grant Monitoring

The voters of California have approved Bond measures for Proposition 84 that provides funding to assist responsible parties to comply with the discharges prohibition into ASBS. The State Water Board is planning on distributing approximately $32,000,000 from Proposition 84 specifically to remove waste from discharges that drain directly to ASBS. Approximately $1,000,000 from Proposition 84 may be set aside to provide for coordinated effectiveness monitoring for the suite of projects recommended for funding. As a result, the NWQC was encouraged by State Water Board staff to address monitoring issues related to Proposition 84 grant funded projects. The NWQC addressed this issue in three steps: 1) determine the success (or failure) of monitoring programs associated with other grant programs; 2) assess what factors would be important for grant funded monitoring for ASBS; and 3) provide recommendations to the Proposition 84 Task Force, the body that evaluates Proposition 84 Grant proposals, including monitoring.

Ultimately, the NWQC made three recommendations to the Proposition 84 Task Force to enhance the grant program monitoring components (Attachment A). These recommendations included: 1) a cohesive, question-driven monitoring program; 2) a unified monitoring design that ensures comparability in sampling, data analysis, and information management; and 3) a single person or group responsible for coordinating, collating, assessing and reporting on the Proposition 84 monitoring effort.

### White Paper on Suggested Goals and Approaches for Protection of ASBS

<u>Recommendation</u>
The State Water Board should consider a different goal for protection of Areas of Special Biological Significance (ASBS) and different approaches for achieving that goal.

<u>Background</u>
The Ocean Plan establishes requirements that apply to discharges of waste to California ocean waters in general, with the intent of protecting the beneficial uses of those waters.

The Ocean Plan also establishes a higher level of protection for ASBS by prohibiting discharges of waste to ASBS (with certain exceptions). The Ocean Plan specifies that discharges are to be located a sufficient distance from ASBS "to assure maintenance of natural water quality conditions" in ASBS.

Existing and Suggested Goals

Although "maintenance of natural water quality conditions" in ASBS would be desirable, such a goal does not appear to be realistic. Considering the definition of "natural water quality" (see *NWQC Definition* above), and considering the nature, extent, and magnitude of anthropogenic influences on California coastal waters (and their ecosystems) and on the watersheds and stream systems that drain to the coast, it seems unlikely that "natural water quality conditions" (or, for that matter, natural biological conditions) are or can be consistently achieved and maintained in all ASBS at all times.

Although "maintenance of natural water quality conditions" in ASBS is probably not an achievable goal, a goal "to minimize anthropogenic influence on water quality" in ASBS would be realistic and would also provide impetus?? an incentive?? for continuing improvement.

Existing and Suggested Approaches

Everything else being equal, stopping existing waste discharges directly into ASBS would be expected to result in improved, more nearly natural, less anthropogenically influenced water quality conditions in ASBS. In some cases, however, such improvements may be insignificant, although the cost of terminating such discharges may be substantial.

Furthermore, stopping discharges directly into ASBS cannot not ensure protection of water quality in ASBS, if only because other discharges (including aerial deposition) can influence water quality conditions in ASBS. The degree to which a discharge might influence an ASBS is a function of a number of factors, including but not limited to the proximity of the discharge to the ASBS and the characteristics of the discharge. Consequently, larger, "dirtier" discharges outside of or further away from an ASBS could have a greater influence on that ASBS than smaller, "cleaner" discharges directly into or closer to the same ASBS. Although the Ocean Plan calls for discharge locations to be kept away from ASBS, in many cases the locations where anthropogenically influenced land runoff (e.g., via streams and rivers) enters the ocean cannot readily be changed. Even if such locations could be changed, doing so could have significant adverse effects on beneficial uses of waters outside of ASBS (e.g., in estuaries).

In order to avoid significant expenditures that do little to protect ASBS, an assessment of existing and potential anthropogenic influences on each ASBS should be conducted. Those influences should be ranked as posing a high, medium, or low threat to the ASBS. Priority should be given to reducing and minimizing the anthropogenic influences that pose greater threats, regardless of their proximity to the ASBS.

In order to provide a higher level of protection to ASBS, a higher level of protection should be provided to California coastal waters as a whole. ASBS exist within the larger context of California coastal waters as a whole. ASBS are not separate from or isolated from those waters. Water, biota, and substances move between ASBS and surrounding coastal waters. Therefore, providing a higher level of protection to California coastal waters as a whole would also provide a higher level of protection to ASBS. This might be accomplished using various combinations of requirements, including requirements that would limit the total mass of specified pollutants that can be discharged into California coastal waters or segments thereof.

### White Paper on Total Residual Chlorine (to be added)

### White Paper on Dioxins (to be added)

### Interactions with the Coastal Ocean Observing System (to be added)

**CONCLUSIONS (to be added)**

**RECOMMENDATIONS (to be added)**

# ATTACHMENT A

**Natural Water Quality Committee**
**Initial Recommendations for Monitoring ASBS Implementation Projects**

The Natural Water Quality Committee (NWQC) was formed at the direction of the State Water Resources Control Board (SWRCB, resolution 2004-052, Section 3.a.). The charge of the NWQC was to define natural water quality based on a review of monitoring data and to advise the Water Boards regarding the attainment of natural water quality relative to waste discharges in Areas of Special Biological Significance (ASBS). Some of these recommendations have focused on monitoring as one approach to assessing the attainment of natural water quality.

The voters of California have approved Bond measures for Proposition 84 that provides funding to assist responsible parties to comply with the discharge prohibition into ASBS. The SWRCB is planning on distributing approximately $32,000,000 from Proposition 84 specifically to remove waste from discharges to ASBS. Approximately $1,000,000 from Proposition 84 may be set aside to provide for coordinated effectiveness monitoring for the suite of projects recommended for funding. As a result, the NWQC was encouraged by State Water Board staff to address monitoring issues related to Proposition 84 funded projects. The NWQC addressed this issue in three steps: 1) determine the success (or failure) of monitoring programs associated with other grant programs; 2) assess what factors would be important for grant funded monitoring for ASBS; and 3) provide recommendations to the Proposition 84 Task Force, the body that evaluates Proposition 84 Grant proposals, including monitoring.

After discussions with RWQCB and SWRCB staff, task force members from other grant programs (i.e., Proposition 50), and the grantees themselves, the NWQC came to three conclusions regarding the successes and failures of previous grant programs. Frequently in the past, grant programs were incapable of assessing the success/failure of their program for either removal of pollutants or improvements to receiving waters. Inadequate guidance was provided to the grantees on the specific goals of the monitoring programs employed, especially to those grantees that lacked capabilities and experience with monitoring. Specifically, grantees rarely had a vision of the State's monitoring objectives such as cumulative pollutant removal. Even for those grantees with experience and capability, the timeline of the grant programs (typically two to three years) were inconsistent with adequately quantifying the goal of measuring pollutant reductions.

The NWQC discussed several important elements to enhance the Proposition 84 grant program monitoring components. These elements included: 1) a cohesive, question-driven monitoring program; 2) a unified monitoring design that ensures comparability in sampling, data analysis, and information management; and 3) a person or group responsible for coordinating, collating, assessing and reporting on the Proposition 84

monitoring effort. A clear statement of objectives needs to be composed so as to provide a vision for the Proposition 84 monitoring program. Monitoring experts universally agree that this is best achieved through the use of a well-formed and unambiguous monitoring question, much akin to a hypothesis for testing. This question should be crafted with care and agreed to by the Proposition 84 Task Force or other governing body.

A centralized monitoring design should be created with sufficient scientific rigor that the monitoring question can be answered with a specified level of confidence. It is impossible to describe what this design may look like until the monitoring question is created, but there are certain elements that must be included. The first element should be some level of standardized sampling. Standardized sampling approaches ensure representativeness and reduce bias in data collection. For example, flow weighted composite sampling during wet weather runoff can produce very different results than grab sampling, even during the same storm event at the same site. Comparing data from different sampling approaches is inappropriate and could lead to faulty conclusions. Similarly, standardized quality assurance should be achieved through the laboratory analysis portion of a large-scale monitoring program. Comparability is paramount and several large-scale monitoring programs use performance-based quality assurance guidelines to ensure comparability for laboratory analysis. Finally, a centralized data management system is necessary for collating the reams of information generated by multiple monitoring programs. Grantees will focus on the monitoring data associated with the management actions specific to their project and these individual data sets will be, for the most part, relatively small and easy to manage. Combining data sets from numerous individual grant projects *post hoc*, however, would be daunting to impossible and could cost hundreds of thousands of dollars unless a well-conceived information management system is implemented before data collection. Thankfully, several systems exist within the state that could be used as a vehicle for data management.

Finally, a person or group must be tasked from the beginning with the responsibility for coordinating the Proposition 84 ASBS monitoring program. Deriving monitoring questions, ensuring comparability, and quality assurance/training cannot be done as a sideline to one's daily activities. It is a full-time job. The larger the program, the more likely it will require additional personnel to accomplish all of the integration necessary to address the monitoring question. It will be this entity that shall be responsible for communicating with grantees on monitoring and eventually for writing a summary report of the program's success at reducing pollutant loads and/or concentrations.

The NWQC had four recommendations to the ASBS Task Force on a structure for the statewide grant monitoring program to achieve the three goals of monitoring question(s), comparability, and organization. The first recommendation stated the singular monitoring question of utmost importance, "How much pollutant (i.e., in kg) was removed as a result of the grant-funded BMP?" Several additional questions are feasible and perhaps warranted, but this single question must be answered. The second recommendation addressed who should coordinate the Proposition 84 monitoring. The NWQC felt that the SWRCB should coordinate this monitoring, perhaps through one of

their statewide programs such as the Surface Water Ambient Monitoring Program (SWAMP). Third, the NWQC felt that at least 10% of each grant should be allocated to monitoring activities. Each grantee can conduct this coordinated monitoring themselves or, if they prefer, return 10% of the grant back to the SWRCB to arrange for the coordinator to conduct this monitoring. Regardless of who implements the monitoring, the SWRCB must use the $1 million set aside from Proposition 84 to conduct the coordination, quality assurance, and data management to ensure comparability. Finally, the NWQC recommended that grantees be allowed a 1-year, no-cost extension to conduct post-construction monitoring. The extra time will provide invaluable monitoring information, particularly in the drier parts of the state where rainfall is limited to a short window of time during the year.