Commonwealth of the Northern Mariana Islands
Nonpoint Source Pollution Monitoring Strategy

CNMI Coastal Resources Management Office
and
CNMI Division of Environmental Quality

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INTRODUCTION

Water quality in the Commonwealth of the Northern Mariana Islands has been surveyed for decades to protect public health. More recently concerns over the condition of the environment and negative effects of human activities on water quality have prompted additional assessment and monitoring activities. An assessment of the CNMI Coastal Nonpoint Pollution (NPS) Program indicated the "need to develop a plan that enables the Commonwealth to assess, over time, the extent to which implementation of management measures is reducing pollution loads and improving water quality." The CNMI Division of Environmental Quality (DEQ) and the Coastal Resources Management Office (CRM) have completed a monitoring strategy which integrates most of the CNMI environmental monitoring programs to address this condition. The monitoring strategy described below will be applied to the Coastal NPS Program by collecting and providing all data necessary to make resource management decisions and to determine the effectiveness of management measures and Best Management Practices (BMPs) in improving and maintaining water quality. The CNMI monitoring plan does not address the expansion of the Seishin Farm Piggery in Kalabera, which was specifically identified in the federal findings, because the proposal for expansion was abandoned.

Many monitoring programs that collect only water quality data are not sufficient to detect changes over time. The only way for water quality data alone to provide useful, statistically significant data would be through the use of continuous recording instruments or for samples to be collected on a daily basis for all locations, which is very expensive and difficult. A much more efficient method is to gather data on the distribution and abundances of organisms that live in the water. For all island nations with tropical marine waters these aquatic communities will shift in response to high bacteria levels, nutrient loads, and other water quality parameters (Rogers, 1990, Telesnicki and Goldberg, 1995). CNMI can then use the available water quality data, collected once per week, and combine it with benthic community data to get statistically valid results for understanding the extent and effects of upland pollution. Continued monitoring will then be used to assess mitigation measures, best management practices, etc. and ensure their effectiveness.

As noted in the 6217(g) guidance, "Water quality… is determined on the basis of the chemical, physical, and biological conditions of the water resource." It also recommends that monitoring programs provide "a description of pollutant load estimation techniques for chemical and physical parameters, plus a description of techniques to assess water quality on the basis of chemical, physical, and biological conditions." The following pages describe CNMI's current quantitative water quality monitoring programs and provide additional components being implemented to meet the recommendations of the 6217(g) guidance.

MONITORING OBJECTIVES

The CNMI NPS monitoring program:

1) Provides a quantitative assessment of ecological and water quality conditions of individual watersheds.
2) Provides quantitative data to support the recommendation of management measures and BMPs.
3) Assure implementation and maintenance of management measure and BMPs through compliance monitoring
4) Validates the effectiveness of the management measures and BMPs by providing quantitative data to support the maintenance or improvement of ambient water quality.

MONITORING APPROACH

While the Monitoring Strategy is based on two basic methodologies (physical parameters and biocriteria) the approach to utilizing the data provided by these methods is similar. First, an initial quantitative assessment (baseline monitoring) of the watershed and associated waterbodies is completed. When possible, this will include historical data as well as any new surveys needed to characterize the area (trend and baseline monitoring). The combination of physical parameter and biocriteria data are used to assess the status of the waterbody in question. If water quality impairment is detected, the source of impairment is sought out and appropriate management measures are identified to mitigate the negative effects. Monitoring is then initiated to assure compliance and maintenance of management measures and/or BMPs (compliance monitoring) and to assess the effectiveness of the management measures in maintaining and mitigating the water quality in receiving waterbodies (validation and compliance monitoring).

In the case of proposed projects that have the potential for creating NPS pollution, a similar methodology is employed. In this case, management measures are required through regulations or project permit conditions. The assessment and monitoring procedures are followed as outlined above. Monitoring assures compliance with management measure requirements and maintenance of water quality. If monitoring discovers a water quality reduction, regulatory agencies will modify management measures to mitigate for the effect. Continued water quality monitoring will then validate the effectiveness of the implemented management measures and BMPs associated with it.

Of the seven types of monitoring listed in the 6217(g) guidance, the CNMI uses a less dissected set which still comprises all types: **Assessment** (= Baseline), **Trend** (= Trend, Validation and Effectiveness), and **Compliance** (= Compliance, Implementation, and Project). The application of these monitoring types to NPS issues is identical to five points of Meals (1991) listed in the 6217(g) guidance.

METHODS

I. ASSESSMENT AND TREND MONITORING

As the methods for assessment and trend monitoring used in the CNMI are identical, except for the purpose for which the surveys carried out, the methodology below does not distinguish between the two. Water quality monitoring in the CNMI has

been historically divided into two major components: physical parameter monitoring (including chemical parameters) and biocriteria monitoring. Although the data from these components are now integrated for the purpose of analysis, the focus of the separate programs

A. PHYSICAL and CHEMICAL PARAMETER METHODS

The Division of Environmental Quality Environmental Surveillance Laboratory (DEQESL) was established by the Commonwealth of the Northern Mariana Islands to provide monitoring data required under the Safe Drinking Water Act (P.L. 93-523) and other environmental programs. The data generated by the laboratory are used to evaluate the quality of drinking water and recreational waters in the Commonwealth. The microbiological and chemical parameters that DEQESL currently monitors include: Salinity (ppt.), Dissolved Oxygen (% D.O.), Temperature (°C), pH, Turbidity (NTU), Nitrate (NO_3) and Fecal coliform (cfu/100ml). The DEQESL Quality Assurance Manual includes Standard Operating Procedures (SOPs) for sampling, testing, reporting, and providing quality assurance for traditional water quality parameters.

These parameters are monitored on a weekly basis for Saipan West Beaches, bi-weekly for Susupe Lake, monthly for Tinian, Rota and Managaha Beaches (Table 1, Table 2). Saipan's eastern beaches are monitored on a quarterly basis.

The CNMI has implemented three physical parameter monitoring programs.

1. Surface Water Quality Monitoring Program

On a weekly basis, DEQ monitors 39 fixed stations along Saipan's most used West coast beaches (Table 1) for the microbiological and chemical parameters listed above. Six beaches on the Northeast coast and six beaches on the Southeast coast are monitored only on a quarterly basis because the quality of the water is consistently in compliance with CNMI water quality standards and a smaller population uses these less developed areas. Eleven sites around Managaha Island are monitored on a monthly basis due to its importance as a recreational site for both residents and tourists. For an example of the application of this program, see Appendix 1 and 2.

Table 1. Saipan microbiological and chemical monitoring sites (n = 59).

Name	Watershed ID #	Region ID#	Site ID#	Test Freq.
Wing Beach	2	1	01	W
PauPau Beach	2	1	02	W
Nikko Hotel	4	1	03	W
San Roque School	4	1	04	W
Plumeria Hotel	4	1	05	W
Aqua Resort Hotel	4	1	06	W
Tanapag Meeting Hall	4	1	07	W
Central Repair Shop	4	1	08	W
Sea Plane Ramp	4	1	09	W
DPW Channel Bridge	6	1	10	W
N.Puerto Rico Dump	6	1	11.1	W
S. Puerto Rico Dump	6	1	11.2	W
Smiling Cove Marina	6	1	12	W
American Memorial Park Drainage	6	1	12.1	W
Outer Cove Marina	6	1	13	W
Micro Beach	6	1	14	W
Hyatt Hotel	6	1	15	W
Dai-Ichi Hotel	6	1	16	W
Garapan Drainage #1	6	1	17	W
Samoan Housing	6	1	18	W
Hafa-Adai Hotel	6	1	19	W
Garapan Drainage #2	6	1	20	W
Garapan Fishing Dock	6	1	21	W
Garapan Beach	6	1	22	W
Garapan Drainage #3	6	1	23	W
Chalan LauLau Beach	9	1	24	W

San Jose Beach	9	1	25	W
Civic Center Beach	9	1	26	W
Diamond Hotel	9	1	27	W
Grand Hotel	9	1	28	W
Community School	9	1	29	W
Sugar Dock	9	1	30	W
CK Dist #2 Drainage	9	1	31	W
CK Dist #4 Lally Beach	9	1	32	W
Chalan Piao Beach	9	1	33	W
Hopwood School	9	1	34	W
San Antonio Beach	9	1	35	W
PIC Beach	9	1	36	W
San Antonio Lift Station	9	1	37	W
Grotto Cave	3	22	01	Q
Bird Island Beach	3	2	02	Q
Jeffrey's Beach	5	2	03	Q
Old Man By the Sea	5	2	04	Q
Marine Beach	7	2	05	Q
Tank Beach	7	2	06	Q
Forbidden Island	7	64	09	Q
North Laulau Beach	8	6	10	Q
South Laulau Beach	8	6	11	Q
Obyan Beach	11	6	12	Q
Ladder Beach	11	6	13	Q
Unai Dangkulo Beach	11	6	14	Q
Managaha Beaches	NA	3	01-11	M

Table 2. Tinian (N=10) and Rota (n=12) microbiological and chemical monitoring sites .

Name	Watershed ID #	Region ID#	Site ID#	Test Freqency
TINIAN				
Unai Masalok Beach	20005	04	01	M
Unai Dangkolo Beach	20005	04	02	M
Unai Babui	20005	04	03	M
Unai Chulu	20005	04	04	M
Leprosarium Beach I	20005	04	05	M
Leprosarium Beach II	20005	04	06	M
Tachogna Beach	20005	04	07	M
Taga Beach	20005	04	08	M
Harbor	20005	04	09	M
Kammer Beach	20005	04	10	M
ROTA				
Coral Garden Beach	100005	05	01	M
Kokomo Beach Club	100005	05	02	M
Mobile Station Storm Drainage	100001	05	03	M
East Harbor Dock	100001	05	04	M
Tweksberry Beach	100001	05	05	M
West Harbor Marina	100001	05	06	M
District #2 Storm Drainage	100001	05	07	M
District #1 Storm Drainage	100001	05	08	M
Veterans Memorial Beach	100002	05	09	M
Teteto Beach	100002	05	10	M
Guata Beach	100002	05	11	M
Swimming Hole	100003	05	12	M

2. Saipan Lagoon Water Quality Sampling Program

This recently implemented program collects water quality data on a weekly basis from within the southern sections of the Saipan Lagoon. The selected sites correspond to the surface water quality monitoring program stations along the southern lagoon. Samples are taken at the surface from mid and outer lagoon sites. Salinity, dissolved oxygen and temperature are measured in the field. The remaining parameters, pH, turbidity , nitrate, and fecal coliform, are measured in the laboratory.

3. Nearshore Coral Reef Water Quality Sampling

This program collects water quality data at MMT biocriteria monitoring sites at haphazard intervals. Samples are collected at the surface and at 8m (15 ft.) depths at these sites. Selected sites are sampled at 24 m (60 ft.) annually. Temperature, salinity and dissolved oxygen are measured in the field with portable instruments. Nutrients, pH, and turbidity are analyzed with benchtop instruments by the DEQESL.

4. Ground Water Monitoring Program

The CNMI Groundwater Protection and Management Act was enacted into law in 1988. The first set of Well Drilling regulations were adopted in 1992 and later amended in 1994. The well drilling regulations set standard requirements and criteria for licensed well drillers, well construction, setback distances, and requirements for operating of new and renewed wells. As part of operations, annual monitoring of chlorides, conductivity, total dissolve solids, pH, total coliform and monthly withdrawal rate of water are required for all wells. Well monitoring is conducted each year on 224 wells during June, July, August, and September by the DEQESL.

With the new GIS program and hand held GPS units, DEQ will continue to develop a database of all private wells with information on operation date, location, and monitoring data. The database is its early infantile stages with much need for improvement on quality control of missing or inaccurate data. It is envisioned that the data will be integrated into the CNMI GIS system. DEQ will be able to use the fully developed GIS system to identify existing sources of contamination and potential problems for proposed new and existing wells.

A general review of the sample data for the private wells shows that chlorides and conductivity gradually increase over time in many of the wells. In some wells, a reduction in the operating pressure has resulted in a decrease in conductivity and chlorides. (Note: Conductivity was believed to be a better indicator of increasing saltwater intrusion due to potential laboratory error associated with testing equipment for chlorides). It is the current unofficial policy to limit all new wells to under a pumping rate of 20 gallons per minute unless there are unusual circumstances with high quality aquifer and special needs.

As DEQ laboratory capabilities increase, DEQ will continue requiring the testing of nitrates in private and municipal water wells used for drinking and other human consumptions. To be assured that the quality of ground water being used by the local community is not contaminated from old military or current activities, testing for metals, volatile organic compounds, and synthetic organic compounds, pesticide and herbicide, radionuclides and other inorganic compounds were required as part of a source water

assessment. In May 2000, DEQ and EPA region IX conducted an island wide sampling of all private wells for VOC's, metals, pesticides and herbicides on several wells. In 1999, DEQ started enforcing the Phase II/V chemical monitoring and is currently underway. Several private well were found to have exceeded the EPA Maximum Contaminant Level (MCL) for drinking water.

Although the data for drinking water wells have not yet been used to assess sources of NPS pollutants, the presence of contaminants in some wells suggests that there is underground transport of pollutants occurring in the CNMI.

5. Intermittent and Perennial Stream Sampling

As the CNMI has very few perennial stream, the focus of this methodology is on intermittent streams which primarily flow only during storm events. The Nonpoint Source Branch has recently begun watershed inspections in Priority 1 – Category I watersheds, (i.e., West Takpochau, Kagman, Lau Lau, Achugao). The goal of the watershed inspections is to gather data during storm events regarding non-point source pollutant loads based on water quality criteria. This is done by marking GPS points at the bottom of a major drainage region, and working upward. All GPS points will be integrated onto a GIS map to be created for long-term storage. Water sampling along all GPS points for dissolved oxygen, temperature, pH, conductivity, turbidity, nitrates and phosphates will occur during storm events for a given drainage. This will identify where the major sources of non-point source pollution are coming from and allow for proper best management practices (BMP) placement.

This monitoring methodology provides data on NPS pollutant load estimation as recommended by the 6217(g) guidance. Initial characterization of pollution load is estimated with data provided by pressure transducers placed in selected drainages to provide records of flow volumes in stream channels and haphazard stream sampling during storm events for analysis of runoff water quality. Following mitigation through implementation of BMPs, continued monitoring will validate the effectiveness of the implemented BMPs. See Appendix 2 for a case study.

B. BIOCRITERIA MONITORING METHODS

Although several attempts have been made to establish biocriteria monitoring programs to address NPS issues in the CNMI, the current programs evolved from the efforts of the Marine Monitoring Team (MMT) created by DEQ in 1997. A Long-Term Marine Monitoring Plan for the Commonwealth of the Northern Marianas (Burr 1996) was developed, however this plan is currently under revision and the overview below reflects the programs' current methods.

1. Long-Term Marine Monitoring Program

The goal of this data collection program is to monitor regions that are associated with identified or potential water quality disturbances (runoff, sewage outfalls, urban development, etc.). Selected sites of low water quality disturbances have been surveyed to provide qualitative control sites; however, the primary standard of evaluation is initial assessment surveys. For each site three to five 50 m transect lines are laid parallel to the shoreline in an end-to-end manner. The beginning and end of all transect lines are

permanently marked with an iron reinforcing bar driven into the reef. Once finished setting up each site, a GPS reading is recorded for the beginning of the first transect. Sites are resurveyed annually after the initial assessment. Presently, there are eleven sites on Saipan (with three additional proposed), seven sites on Rota (with three additional proposed), seven on Tinian (with three additional proposed) and one on Aguijan (with one additional proposed).

The sites are evaluated by a set of five surveys: benthic cover, coral communities, fish abundance, invertebrate abundance and biodiversity. Benthic cover is evaluated using the photo point-quadrat method or the equivalent video belt transect method (Randall and Birkeland, 1978, and Aronson et al., 1994). The benthic categories chosen for analysis are corals (to generic level), turf algae (less than 2cm), macro-algae (greater than 2 cm, genus level if abundant), coralline algae, branching coralline algae, all other inverts (grouped together due to lack of abundances), and sand/bare substrate. Coral communities are further examined using the point-quarter method (Randall and Birkeland, 1978). This yielded data regarding population densities, species coverage, relative abundances, size distributions, and total coral coverage for any given site. Fish are surveyed along 10m wide belt transects and grouped at the family level. All macro-invertebrates are counted within 2 meters of each side of the transect lines. The macro-invertebrates are identified to the generic level. Finally a general checklist of all fishes, algae and macro-invertebrates at each site is created.

This set of surveys, combined with chemical and physical water quality parameter sampling, provide an overview of water quality and environmental health at each site. At present, most of the sites in this program are at the third year of trend monitoring. This should provide sufficient data to evaluate the effectiveness of the implementation of watershed wide management measures and BMPs through detection of improvement of water quality.

2. Saipan Lagoon Habitat Assessment Program

This program is currently in the initial assessment phase. All habitats within the Saipan lagoon are being delineated and surveyed. In-water surveys first identify each of the habitats that exist along a series of transect lines perpendicular to shore which extend out to the barrier reef. The exact number of these transect lines required to survey the Saipan Lagoon has not yet been identified. Each habitat transition along the transect lines is marked with a hand held global positioning system (GPS) receiver for creation of a geographic information system (GIS) based habitat map.

Within each visually identified habitat, benthic cover and invertebrates are surveyed with methods identical to the LTMMP (above); however, only two 50m transects are surveyed. In areas of dense of seagrass growth, $0.5m^2$ quadrats for root counts are used in place of benthic video. Checklists of all marine organisms found in each habitat are complied.

Benthic coverage data are being analyzed using Cluster Analysis Similarity Testing to statistically test the habitat delineations. Aerial imagery is visually interpreted to create a final habitat map based on the statistically differentiable habitats. This will serve as the baseline for future comparison purposes, and to assess future effects of BMPs. See Case Study 3 in Appendix 3, below.

3. Reef Flat Monitoring

Reef flat monitoring is another recently initiated program in the CNMI. As reef flats are often the first water bodies to receive NPS pollution, the MMT began to assess the effects of this pollution on a number of reef flats. Initial surveys have been completed for Saipan (Wing Beach, Lau Lau Bay) and Rota (Talakaya, Sasanhaya Bay, West Harbor). Additional sites on Saipan (Tank Beach, Ladder Beach, Coral Ocean Point) and Tinian (Unai Babui, Long Beach) and Rota (Teteto Beach) are proposed.

Again, the basic methodology is similar to that of the Long-Term Marine Monitoring Program. In this case, surveys are based on six 15m transects laid parallel to shore. Benthic cover is surveyed using either video transects or point-quadrat surveys, depending on water depth. Invertebrate belt transects and biodiversity checklists are also completed. If the area between the shore and reef crest is divided into multiple habitat types, each habitat is surveyed.

C. COMPLIANCE MONITORING METHODS

1. Permit Enforcement

Two CNMI agencies, CRM and DEQ, assure the use of management measures and BMPs through project permits. Permits are tracked through GIS integrated database in order to understand the implemented management scheme of individual watersheds. Earth moving, erosion control, wastewater systems and confined animal facility operations (CAFOs) are permitted by DEQ and the agency has personnel specifically assigned to monitor permit compliance. CRM regulates activities ranging from hotel construction to marine sports in coastal "Areas of Particular Concern" and also regulates any development that meets "Major Siting" requirements, such as hotels and golf courses. Permit conditions that address NPS concerns are monitored for compliance by CRM Enforcement Officers on a weekly basis. Non-compliance with permit conditions may result in monetary fines or permit suspension.

2. Regulation Enforcement

Enforcement Officers from CRM and DEQ are able to enforce the agencies' general NPS related regulations at all times. Anyone violating these agencies regulations may be subject to monetary fines. Both agencies regularly patrol the island to identify illegal activities. Recent changes to regulations have increased the ability of enforcement officers to fine law breakers, notably in the areas of littering and illegal dumping. During the course of these routine monitoring activities, unpermitted projects are often identified and brought into compliance. Monitoring activities are entered into the GIS to update tracking events.

MEASURING PROGRAM EFFECTIVENESS

Detection, through this monitoring program, of the maintenance or improvement of water quality conditions resulting from the implementation of management measures and BMPs is the primary measure of effectiveness of this program.

As noted by Meals (1991) in the 6217(g) guidance, a "feedback loop", or means assessment of one's data collection program is essential. The goal of this form of review is to be certain that one is able to detect change in the parameters which are of interest. Preliminary analysis of our monitoring programs' data have showed the ability to detect statistically significant variation in both chemical/physical and biocriteria water quality parameters (Appendix 3). The majority of the listed environmental monitoring programs have collected sufficient data to provide baselines, initial trends and some statistically significant relationships among pollution sources and environmental effects. All of these factors are needed for the assessment of management measure and BMP effectiveness. Recent and proposed improvements in compliance monitoring will also support the effective evaluation of the success of management measures and BMPs in mitigating NPS pollution. In addition, Permits are tracked through GIS integrated database in order to understand the implemented management scheme of individual watersheds.

The ultimate measure of success of this monitoring program will be its ability to statistically correlate water quality maintenance or improvement with the implementation of management measures and BMPs intended to mitigate for existing or anticipated effects that impair water quality.

CONCLUSION

In the conditions for approval of the Commonwealth of the Northern Mariana Islands (CNMI) Coastal Nonpoint Pollution Control Program, the inclusion of management measure for inspections of OSDS in conformity with the (g) Guidance is required. The CNMI Division of Environmental Quality (DEQ) and the CNMI Coastal Resources Management Office (CRM) have completed an assessment of this management measure in the Commonwealth. The federal findings are provided (Appendix 4), and the Monitoring Strategy above supports that the management measure is being adequately addressed by existing practices and should have the conditional approval in this category changed to fully approved status.

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APPENDIX 1- Case Study 1: Rainfall and NPS Pollution Correlations

Non-point source pollution is a major concern for CNMI's surface and marine waters. In order for CNMI to plan infrastructure development projects, data are necessary for watershed assessments on a regional basis. In order to suggest Best Management Practices to mitigate for pollution, the sources of pollution must first be identitified. Presented below are discussions regarding the relationship between bacteria levels and rainfall events. Nutrient data from this time period were not continuous and not able to be analyzed or discussed.

Discussion will be limited to nine (out of 59) sites on Saipan that results have shown five or more violations for high fecal bacterial counts (and beach closures). The goal of the present analysis was to understand what may be causing the various violations and beach closures. Specifically, there are two types of pollution that we are concerned with 1) point source and 2) non-point source pollution. Violations may be occurring as a result of sewer overflows, faulty septic systems, or other point sources. Violations may also be occurring as a result of runoff and non-point source pollution. The assumption, or hypotheses, that are tested here are; 1) if non-point source pollution is the cause of high bacteria levels than bacteria levels should be related to rainfall events, and 2) if point source pollution is the cause of high bacteria levels than bacteria levels should not be dependant on rainfall events.

Rainfall data was supplied by USGS and was entered into the DEQESL water quality results spreadsheet. Weekly rainfall levels were used to test for relationships with weekly bacteria count data. As stated above, nine (9) sample locations were tested based upon five (5) or more bacteria violations and beach closures. Regressions between rainfall and bacteria levels for all nine locations showed only two statistically significant relationships, Dai-Ichi Drainage and Hafa Adai Drainage (Table 3, Red Colors). Other locations showed relationships that were close to, but not significant (Table 3, Yellow Colors). The remaining sample locations showed no relationship between bacteria levels and rainfall events (Table 3, Green Colors). Further analysis of the Dai-Ichi Drainage results indicates that large storm events and associated bacterial violations may be resultant from non-point source pollution in the watershed. Further analysis of the San Roque drainage samples indicates that rainfall events are not associated with bacterial violations. In this case, there may be a periodic release of a pollutant source that is responsible for the bacteria violations noted.

Table 3. Results from statistical regression analysis for nine sample locations. Red colors indicate a strong relationship between bacteria violations and rainfall events, Yellow colors indicate small relationship between bacteria violations and rainfall events, Green colors indicate no relationship between bacteria violations and rainfall events.

Site Name	Significant Relationship Between Bacteria Counts and Rainfall	P Value (Level of Significance)	
San Roque School Beach	No	0.55704	
Tanapag Meeting Hall Beach	No	0.57369	
DPW Channel Bridge Beach	No	0.12773	
Smiling Cove Marina	No	0.87737	
Outer Cove Marina	No	0.41227	
Dai-Ichi Drainage Beach	Yes	0.00003	***
Hafa-Adai Drainage Beach	Yes	0.00487	**
Garapan Fishing Dock Marina	No	0.97486	
Sugar Dock Marina	No	0.45614	

Although sufficient nutrient data were not available for statistical analysis, results from the Saipan Lagoon Habitat Assessment Program corroborate high nutrient inputs into this system. The nearshore habitats typical of the Saipan Lagoon are seagrass dominated (MMT, unpubl. data). Both Dai-Ichi and Hafa-Adai drainages are dominated by fleshy macroalgae, an indication of excessive nutrient levels. The follow up task is now to intensively survey all watersheds associated with bacteria violations and rainfall for point and non-point source pollution sources to allow for identification and implementation of BMPs. Again, the assessment data from the Saipan Lagoon Habitat Assessment Program can provide validation for any implemented BMPs by documenting biocriteria-based water qualtiy improvement in the nearshore environment. The number of bacterial violations detected by the Surface Water Monitoring Program should also indicate the effectiveness of any implemented BMPs.

APPENDIX 2-Case Study 2: West Takpochau Watershed NPS Pollution Assessment Strategy Pilot Project

This proposed project was recently funded and will test a strategy to address NPS pollution in Category 1 Watersheds by tracing, pinpointing, and recommending measures to address NPS pollution. The West Takpochau Watershed lies in the middle of Saipan Island and encompasses the highest peak. The West Takpochau watershed is a Category I watershed, meaning, *"a watershed which is in need of restoration because it does not meet or is faced with imminent threats of not meeting clean water and other natural resource goals"*. The only two (2) waterbodies on the CNMI's 303(d) list are located in the West Takpochau watershed. Those are the waters around the Puerto Rico Dump, and the waters next to the Garapan Stormwater Drainage. These are listed as impaired waters.

The villages in the West Takpochau Watershed include Garapan, Gualo Rai, Capital Hill and Navy Hill. Garapan has many small and large business establishments, including the tourist district area. Gualo Rai, Capital Hill and Navy Hill consist of a large number of residential homes, a few schools, several garment factories, and the only health center (hospital) on the island. Also present in the watershed are eight (8) DEQ Laboratory Beach Monitoring Sites located on the west side of the island. These coastal sites have five or more violations of the CNMI's microbiological standards, as reported in the CNMI's 305(b) report (Houk, 2002). Two of these sites violated these microbiological standards ten or more times per year.

The Puerto Rico dump, Saipan's only waste disposal area, is located on the shoreline of the Saipan lagoon within the West Takpochau watershed. Because the dump is in violation of the Clean Water Act (pursuant to an Administrative Order issued by the EPA) and because leachate entering the lagoon contains numerous low level contaminants (WERI Technical Report No. 93, 2001) the area surrounding Puerto Rico dump does not support its designated use (Class A). Class A waters are defined in the CNMI's Water Quality Standards to mean that their use for recreational purposes and aesthetic enjoyment must be protected. DEQ's water quality database (containing data from 1993 – 2001) shows that the waters of the Saipan lagoon surrounding Takpochau watershed have poorer water quality than the other Saipan watersheds with data for the following three parameters: turbidity, dissolved oxygen, and fecal coliform.

Land uses, improper sewage delivery systems, septic tanks, urban runoff, and reverse osmosis discharges are all major additions to pollution in the watershed. An estimated 1,000 or more septic systems are within in the Takpochau watershed (CNMI's Unified Watershed Assessment). Only an estimated 25 percent of the watershed's area is served by the municipal sewer system. Urban runoff is remarkably high, since a large portion of this watershed has become developed over the years. Many of Saipan's major roads traverse the Takpochau watershed. Little consideration was/is being given to planning for control of urban runoff on impervious surfaces. Thus far, stormwater treatment and runoff control measures have not been used with the majority of development in this watershed.

To date, DEQ's Surface Water Monitoring Program has identified this watershed as a major contributor to water quality degradation in the CNMI. The Saipan Lagoon Habitat Assessment Program has nearly completed initial surveys needed for baseline

characterization of the watershed's receiving waters. The pilot project will now intiate with watershed sampling during storm events from the shoreline up through its tributaries so the areas and activities that contribute most to NPS pollution can be identified.

Best Management Practices will be developed to address sources of pollution. Following the implementation of the developed BMPs, compliance monitoring and continued trend monitoring in the Saipan Lagoon will be used to validate the results of the BMPs. A major part of this plan is to aggressively research contributors of NPS pollution in CNMI's priority watersheds and recommend best management practices (BMPs) that will alleviate or mitigate the degrading water quality problems.

APPENDIX 3-Case Study 3: Saipan Lagoon Aquatic Ecosystem Restoration Project

The Saipan Lagoon Aquatic Ecosystem Restoration Project (SLAERP) is an ongoing collaborative project funded by the US ACOE and being carried out by CRM, DEQ and an ACOE contractor since 2001. The program has nearly completed an initial assessment of the environmental, physical and hydrological aspects of a section of the Saipan Lagoon from the Fishing Base area in Garapan to Quartermaster Road and encompassing the watersheds that drain into this section of the lagoon. In addition to the standard surveys used by the Saipan Lagoon Habitat Assessment Program, this project included analysis of currents and sediment contaminants.

Sediment and pollutant loads from storm water flow, potential sources of NPS pollutants and rainfall data were collected within each watershed. BMPs (Ponding Basins) are currently being designed for potential implementation sites and will be constructed following the land acquisition process. CRM and DEQ will continue to monitor the lagoon environment and watershed runoff water quality and quantity after the construction of BMPs to validate the effectiveness of the mitigation measures in improving water quality.

APPENDIX 4- CNMI Coastal Nonpoint Pollution Program Federal Findings

The following are the original finding, condition, and rationale as described in the letter from USEPA and NOAA, dated October 3, 1997, that transmitted the Findings for the Commonwealth of The Northern Mariana Islands Coastal Nonpoint Pollution Program.

FINDING: The CNMI's program does not include a plan to assess overtime the success of the management measures in reducing pollution loads and improving water quality.

CONDITION: Within one year, the CNMI will develop a plan that enables the Commonwealth to assess overtime the extent to which implementation of management measures is reducing pollution loads and improving the water quality.

RATIONALE: The CNMI included on page 68 of its program submittal a statement that a methodology to determine if water quality degradation still occurs after management measures are implemented is "to be developed." The CNMI has, however, added biological monitoring, sediment monitoring, research into alternative bacterial indicators, and analysis of nutrients to its existing monitoring program. The Commonwealth also proposes to hold monthly meetings between CRM and DEQ to discuss monitoring findings and to determine future program directions (LCRAG), including the need to implement additional management measures.

The CNMI has described a fairly extensive beach sampling program that should help determine whether the management measures are improving the water quality, particularly with regard to fecal coliform, sediment, and nutrients. With weekly sampling at 37 beaches, there should considerable opportunity to focus on the impacts of management measures in selected watersheds or watershed sub-areas. The land use and other maps provided in the submittal indicated that the CNMI has the capability to closely track management measure implementation in concert with water quality monitoring.

While the Commonwealth provides some detail regarding its monitoring program and expectations for section 6217, it does not describe how these efforts will be applied to the coastal nonpoint program. In its monitoring plan, the CNMI should include information regarding the number and location of monitoring stations, the types and frequency of water quality data being collected, methods for tracking management measure implementation, and the analytic approaches that will be employed in conjunction with existing monitoring efforts to assess the success of management measures in achieving water quality objectives. The monitoring plan will also specifically target the proposed expansion of the Seishin Farm piggery in Kalabera and the Puerto Rico Dump Critical Coastal Area.