DEPARTMENT OF THE NAVY
NAVAL BASE VENTURA COUNTY
311 MAIN ROAD, SUITE 1
POINT MUGU, CA 93042-5033

IN REPLY REFER TO:
5090
Ser N46VCS/1163
September 22, 2014

Mr. Ejigu Solomon
Storm Water Compliance and Enforcement
Los Angeles Regional Water Quality Control Board
320 West 4th Street, 200
Los Angeles, CA 90013

RECEIVED
SEP 25 2014
DIVISION OF WATER QUALITY

Dear Mr. Solomon:

As required by the State Water Resources Control Board Resolution No. 2012-0031 amending the General Exception to the California Ocean Plan for Selected Discharges into Areas of Special Biological Significance, Including Special Protections for Beneficial Uses, enclosed is the Naval Base Ventura County (NBVC) San Nicolas Island (SNI) Compliance Plan.

NBVC SNI participated in the regional Areas of Special Biological Significance monitoring program in southern California.

If you have questions or need further information regarding this submittal, please contact Ms. Alicia Thompson at COMM: (805) 982-2969.

Sincerely,

Daniel T. Shide

D. T. SHIDE
Environmental Program Director
By direction of the
Commanding Officer

Enclosures: 1. Naval Base Ventura County San Nicolas Island Compliance Plan

Copy to:
Dr. Mariela Carpio-Obeso
Division of Water Quality
Ocean Standards Unit
State Water Resources Control Board
P.O. Box 100
Sacramento, CA 95812-0100

ENCLOSURE (1)

NBVC SNI
COMPLIANCE PLAN

Areas of Special Biological Significance Compliance Plan for San Nicolas Island & Begg Rock (ASBS 21)

Naval Base Ventura County
San Nicolas Island, Ventura, California

September 2014

Prepared for:

Alicia Thompson
Water Quality Program Manager
Naval Base Ventura County
Port Hueneme, California

Prepared by:

Tetra Tech
N62743-11-D-2205

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ACRONYMS AND ABBREVIATIONS

ASBS	Area of Special Biological Significance
ACSCE	Annual Comprehensive Site Compliance Evaluation
BMPs	Best management practices
CEDEN	California Environmental Data Exchange Network
DA	Drainage area
µg/L	Micrograms per liter
mg/L	Milligrams per liter
Navy	U.S. Navy
NBVC	Naval Base Ventura County
NEPA	National Environmental Policy Act
PAH	Polycyclic aromatic hydrocarbon
QAPP	Quality Assurance Project Plan
RWQCB	Regional Water Quality Control Board
SMARTS	Storm Water Multiple Application and Report Tracking System
SNI	San Nicolas Island
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	California State Water Resources Control Board
SCCWRP	Southern California Coastal Water Research Project
TBD	To be determined

1.0 INTRODUCTION

The Pacific Ocean surrounding Naval Base Ventura County (NBVC) San Nicolas Island (SNI) and Begg Rock to a distance of one nautical mile offshore, or to the 300-foot isobath, whichever is greater, has been designated by the California State Water Resources Control Board (SWRCB) as an Area of Special Biological Significance (ASBS). The ASBS designation is intended to protect fragile or valuable marine biological communities through the preservation and maintenance of natural water quality. NBVC SNI and Begg Rock, which are under the operational control of the U.S. Department of Defense, U.S. Navy (Navy), have been designated "ASBS 21." The SWRCB assigned coordination of the southern California part of the ASBS monitoring program to the Southern California Coastal Water Research Project (SCCWRP) group. SCCWRP produced the original ASBS work plan and quality assurance project plans (QAPP), compiled and performed laboratory analysis on many of the ASBS regional storm water samples, oversaw the other ASBS-contracted laboratories, and was responsible for compilation and statistical analysis of the regional stakeholder sampling results, which included 14 sites in the program.

Attachment B of SWRCB Resolution No. 2012-0031 (SWRCB 2012) details the general provisions for permitted point source discharges of storm water, and nonpoint source discharges. Site-specific regulations for nonpoint source discharges have been established for the NBVC SNI and Begg Rock ASBS, and are as follows:

- Discharges incidental to military research, development, testing, and evaluation of, and training with, guided missile and other weapons systems, fleet training exercises, small-scale amphibious warfare training, and special warfare training are allowed.
- Discharges incidental to underwater demolition and other in-water explosions are not allowed.
- Discharges must not result in a violation of the water quality objectives, including the protection of the marine aquatic life beneficial use, anywhere in the ASBS (SWRCB 2012).

Under the ASBS program, SCCWRP collected 2008 regional monitoring data for the Southern California Bight (including data from ASBS 21), and produced a summary report that addressed all 14 ASBS monitoring sites participating in the Southern Bight Regional Program (Schiff, Luk, Gregorio, and Gruber 2011). The report detailed each of the ASBS sites' sampling and monitoring programs, including statistical reference ranges for the combined chemical and water quality data results across the 14 sites. SCCWRP initiated the 2013 Southern Bight Program as described in the ASBS Bight '13 Work Plan (Bight '13, ASBS Planning Committee 2012). Due to drought conditions in Southern California during the 2012-2013 storm season, the SWRCB and SCCWRP added an additional year to the program in order to fulfill ASBS data needs for all sites where data could not be collected in the previous year due to insufficient rainfall.

SCCWRP released preliminary conclusions and results for the Bight '13 program in a regional meeting with stakeholders on August 21, 2014. On September 5, 2014, the Navy received comments from the SWRCB on the Draft 2013 ASBS Compliance Plan for NBVC. Comments have been addressed and incorporated in this version. The SWRCB letter is attached in Appendix A of this document. The sampling and monitoring discussion in this document summarizes the 2013 through 2014 ASBS 21 sampling and monitoring efforts and analytical results, evaluated against the SCCWRP 2014 preliminary reference values (SCCWRP 2014).

The Navy developed this ASBS compliance plan in accordance with the requirements of SWRCB Resolution No. 2012-0031, *Attachment B - Special Protections for Areas of Special Biological Significance, Governing Point Source Discharges of Storm Water and Nonpoint Source Waste Discharges* (SWRCB 2012). This compliance plan will be included as an attachment to the existing NBVC SNI Storm Water Pollution Prevention Plan (SWPPP) (Navy 2014).

This compliance plan contains seven sections. Section 2.0 explains the compliance plan map. Section 3.0 describes non-authorized non-storm water runoff prevention, and monitoring and reporting procedures. Section 4.0 contains a description of storm water discharges and monitoring conducted at selected sites under the ASBS monitoring program. Section 5.0 details erosion control and prevention of anthropogenic sedimentation. Section 6.0 contains a summary of currently implemented best management practices (BMPs) for storm water, and a compliance implementation schedule for BMPs. Section 7.0 is a list of references cited in the document. Appendix A contains the SWRCB letter containing comments on the 2013 Draft ASBS Compliance Plan, and Appendix B contains the updated surface water model summary for the drainages at NBVC SNI that are part of the ASBS SNI021 site program.

2.0 COMPLIANCE PLAN MAP

Figure 1 depicts surface water drainage routes including areas of possible sheet flow runoff and the priority discharge at NBVC SNI outfall SNI015. The map also shows the storm water conveyances in relation to other features such as the airport terminal and airfield, barge landing, hazardous waste storage facility, Nictown (contains service areas), power plant, waste water treatment plant, other areas prone to erosion, and areas where structural and non-structural BMPs are or will be implemented.

The Navy and SWRCB have agreed on the number and locations of ASBS core, receiving water, and visual monitoring locations at NBVC SNI. Sampling and visual monitoring locations are identified on Figure 1.

The SWPPP contains procedures for updating the ASBS compliance plan and compliance plan map when changes are made to the storm water conveyance facilities. NBVC updates the plan and map as needed.

3.0 NON-AUTHORIZED NON-STORM WATER RUNOFF PREVENTION

This section describes the measures by which all non-authorized non-storm water runoff has been eliminated, how these measures will be maintained over time, and how these measures are monitored and documented.

Under the Industrial General Permit (SWRCB 1997), NBVC SNI has developed a monitoring program. Visual observations are conducted during dry weather and wet weather conditions. Dry weather observations aid the identification of non-storm water discharges. Wet weather observations also aid in the detection of non-storm water discharges that combine with storm water; wet weather observations aid in evaluating the effectiveness of the SWPPP in minimizing storm water pollution. NBVC SNI will continue these observations to remain in compliance with the Industrial General Permit and with ASBS special protection requirements.

BMPs have been implemented at the industrial activities at NBVC SNI. The implemented BMPs are discussed in Section 6.0 of this compliance plan. Non-structural BMPs have been and will continue to be

useful in the prevention of unauthorized non-storm water discharges including conduction personnel training regarding BMPs, educational signage, and routine inspections for observed non storm water discharges, and other good housekeeping BMPs. In addition, the Navy has implemented many structural BMPs including culvert repairs, paving erosional surfaces, using catch basin safety drains, installing erosion mats, k-rails and sediment traps. NBVC SNI conducts annual inspections of all industrial areas as part of the Annual Comprehensive Site Compliance Evaluation (ACSCE) to assess BMP implementation and compliance with the Industrial General Permit. NBVC SNI will continue the implementation and evaluation of BMPs to remain in compliance with the Industrial General Permit and with ASBS special protection requirements.

NBVC SNI compliance staff and its subcontractor investigate non-storm water discharges recorded during dry weather observations or reported by facility personnel. Compliance staff document the source and circumstances of the discharge and determine if the discharge is in compliance with the Industrial General Permit. Compliance staff also document corrective actions taken if the discharge is not in compliance. Additional details are contained in the Non-Storm Water Discharge Elimination and Prevention Program Plan presented in Appendix B of the SWPPP. The Navy performs regular inspections at NBVC SNI to ensure that policies stated in the SWPPP, and Attachment B of SWRCB Resolution No. 2012-0031, are followed. Changes will be made to the SWPPP, compliance plan, and the compliance map and schedule when there are site changes or additional BMPs implemented. The SWPPP is formally revised annually and informal updates are noted in the current version of the SWPPP until the annual update is formalized.

NBVC SNI completes an annual report by July 1 of each year in the SWRCB's Storm Water Multiple Application and Report Tracking System (SMARTS). The report includes a summary and evaluation of sampling results, dry-season visual observations, wet-season visual observations, ACSCE results, and a certification that the facility is in compliance with its SWPPP and the Industrial General Permit. NBVC SNI will continue data collection and SMARTS reporting to remain in compliance.

NBVC SNI retains records of all sampling and monitoring information, copies of all reports required by the Industrial General Permit and the ASBS regulations, and records of all data used to complete the Notice of Intent for at least five years from the date of measurement, report, or application.

4.0 ASBS STORM WATER SAMPLING AND MONITORING SUMMARY

The Navy and the SWRCB identified one reference location and one receiving ocean water location for sampling during two storm events; pre-storm and post-storm sampling was conducted between the 2013 and 2014 storm seasons. In addition, three core sites were selected for sampling storm water upstream of the ocean discharges. The core sites were sampled twice. Visual monitoring was conducted at three additional sites (weather permitting). Wet weather flows that resulted in sample collections occurred on the following dates: January 25, 2013; February 19 and 20, 2013; March 6 and 7, 2013; and February 27 and 28, 2014. These four rain events met the requirements for completion of all sampling under the 2013 Southern Bight Regional program. A detailed summary of the sampling, monitoring, and results is in the following sections.

4.1 ASBS SAMPLING AND MONITORING DESIGN

The Navy identified and delineated thirteen drainage areas with industrial activities at NBVC SNI. These are described in the SWPPP (Navy 2014). The drainage areas were delineated based on topography; some, but not all, discharge to the Pacific Ocean.

Many of the drainage channels that connect with the Pacific Ocean start atop the plateau. Because the distance from the plateau to the ocean is significant, most surface flow eventually dissipates, infiltrates into the soil, or ends up as sheet flow across vegetated areas. For those drainages that contain defined channels connecting to the Pacific Ocean, storm water runoff rarely reaches the ocean because of natural BMPs such as infiltration and vegetative filtration along the drainage route.

Surface water runoff calculations were conducted on drainage areas identified by the SWRCB as potential priority discharges. The surface water model summary is provided in Appendix B of this document. Based on soil properties, topography, vegetation, and the precipitation record for NBVC SNI, surface runoff calculations revealed that the most common type of runoff event (a 0.25 to 0.5-inch storm) occurs under initially dry soil conditions and only generates runoff from paved areas, with the exception of over-steep marine terraces in ravines and canyons, such as above the barge landing. Sparsely vegetated, oversteep ravines and canyons with exposed marine terraces are expected to contribute the majority of solids loading. Comparatively minimal erosion is expected from grassland/scrub areas due to extensive vegetative cover and gentle topography, with discharge from urban/industrial areas a minor contributor, based on the small urban/industrial acreage and location on the gently sloped grassland/scrub plateau. Watershed-wide runoff is limited to a few large storms a year, or a series of smaller storms. With the exception of oversteep ravines and canyons, storms that could generate runoff that would reach the ocean are uncommon and may occur at a frequency of every 2 to 3 years for a 1.5-inch storm, and up to every 53 years for the largest storms on record. The Navy developed a surface water runoff prediction model that was submitted to the SWRCB in fall 2013 and updated in 2014. In accordance with SWRCB requirements for storm water discharges into an ASBS, storm water samples from selected sites (as described below), are analyzed for core discharge monitoring; some sites are monitored visually and sampled if runoff is sufficient and sampling is achievable (Figure 1) (SWRCB 2012). Storm water samples from selected sites are analyzed and compared to samples collected at the selected ocean water reference site on the west side of the island, and more importantly, from the Southern Bight Regional Monitoring Program reference values derived from SCCWRP. As discussed above, the 2012-2013 storm season had insufficient storms to meet the ASBS rainfall qualifications because of an inadequate amount of flow and subsequent discharges into the ocean. Therefore, the SWRCB and SCCWRP added an additional year to the program to ensure that all sites in the program were able to obtain sufficient receiving and reference water data. As mentioned above, SCCWRP published the 2014 reference values for comparison to each sites sampling results to identify if there were sample exceedances (SCCWRP 2014).

Figure 1 shows all ASBS monitoring and visual observation sites as well as drainage area boundaries and flow directions. The SWPPP details the Navy's ongoing compliance with surface water discharges that may reach the Pacific Ocean. Since NBVC SNI is not a heavy industrial-use area, and much of the use is related to military testing and training, potential contaminant and anthropogenic discharges to the Pacific Ocean are minimal.

4.2 BARGE LANDING RECEIVING WATER SAMPLING AND MONITORING

The barge landing was identified as the primary priority ASBS discharge area, and was selected by the Navy and SWRCB as the one location where receiving ocean water would be sampled as part of the 2013-2014 ASBS monitoring program. The barge landing is located at the southern end of Beach Road and is the staging area for the transport of materials on and off the island from the pier (Figure 1). As identified in the SWPPP, the barge landing is located in Drainage Area (DA) 11 (DA-11), which is approximately 27 acres in size. DA-11 is located at the southern end of the island and is southwest of the southern end of the airport runway.

In 2004, the barge landing was re-engineered with numerous structural controls that included: paving of the staging and parking areas with an impervious concrete surface; establishing a designated vehicle parking area; and installing one permanent and three temporary storage sheds, two light poles, and two catch basins at the southern edge of the paved area. Safe drains were installed in the catch basins at SNI015A and SNI015B and are periodically maintained to prevent hydrocarbons from entering runoff to the beach.

BMPs are fully implemented, reviewed, and updated under the Industrial Permit for the barge landing. The 2013 SWPPP suggested additional BMPs including: (1) "manually clean out the end of outfall pipes as blowing sand collects in the ends of pipe openings at SNI015A and SNI015B, and may prevent flow and collection of samples for the ASBS program;" and (2) "install educational signs." The Navy has since routinely implemented the aforementioned maintenance BMPs; in the 2014 storm season, evidence of flow during storms was observed at the outfall pipes.

Under ASBS monitoring program requirements, pre-and post-storm receiving water sampling from DA-11 was conducted at the barge landing in the 2008-2009 (URS 2009), 2012-2013, and 2013-2014 storm seasons. Storm water runoff from SNI015A and SNI015B, as well as storm water runoff captured by a Vortox^R sampler at the base of the DA-11 ravine are combined into one ASBS composite sample (SNI015) for core discharge sampling. The receiving water sampling location is situated outside the tide line and the samples are collected from the pier. Pre- and post-storm receiving water samples were collected in the 2013 and 2014 storm seasons. In 2013, one post-storm sample was collected in the receiving water on January 25, under direction from SCCWRP. The rain event was not predicted so most of the sites including NBVC SNI could not collect a pre-storm sample. However, pre- and post-storm samples were collected on February 19 and 20, and March 7 and 8, 2013. In 2014, one receiving water sample was collected for pre- and post-storms on February 27 and 28. All analytical data was converted to the SWRCB California Environmental Data Exchange Network (CEDEN) format and uploaded onto their website.

4.3 BALLOON LAUNCH REFERENCE WATER SAMPLING AND MONITORING

The Navy and the SWRCB agreed to a reference location outside of areas affected by industrial activities. The reference site for ocean water is located on the northwest coast of NBVC SNI as shown on Figure 1. In 2013, one post-storm sample was collected on January 25, 2013. Pre- and post-storm samples were collected on February 19 and 20, and March 7 and 8, 2013. In 2014, one storm was sampled on February 27 and 28. Analytical data derived from the Balloon Launch sampling events were incorporated into the 2014 South Regional Bight 85th percentile reference values.

4.4 CORE MONITORING AND VISUAL MONITORING SAMPLING

Other core monitoring sites that are included in both the industrial permit program and the ASBS monitoring program are SNI019 and SNI024 (Figure 1). Storm water run-off is captured at both of these sites for core and industrial permit sampling. The Navy and the SWRCB agreed that due to the difficulty in reaching these outfalls at the point of ocean discharge, monitoring would be co-located with the industrial permitted sites, which use automatic samplers for storm water flow information and sample collection. Data collected pursuant to the Bight '13 program indicated elevated levels of some metals (copper and zinc) at both sites. The 2013 / 2014 receiving water data showed copper concentrations below the 85th percentile reference value; zinc was slightly elevated, however, the pre-storm concentration was higher than the post-storm concentration.

Surface water discharge points identified as requiring monitoring in the ASBS program include the following outfalls at their point of discharge: SNI004, SNI014, SNI015, and SNI023 (Figure 1). Each of these locations is on Beach Road or East NAVFAC Road, with nearby beach tidelines ranging from 140 to 1000 feet from the points of discharge. The outfalls are not manmade, and are natural, steeply eroded canyons that end abruptly at the beach backdunes, or drop off rocky cliffs directly into the sea. During rain events, it is nearly impossible to access these sites and potentially unsafe for personnel to observe flow. Surface water run-off modeling was performed at each of these drainages and found that due to the high permeability of the soils and sands at the points of discharge, surface water runoff makes it to the ocean most often at discharge points that are rocky cliff drainages that drop directly to the sea, or that have a short distance to flow across the beach such as at the barge landing. The Navy will attempt to observe these areas during rain events if circumstances allow.

4.5 RECEIVING WATER SAMPLING RESULTS

Table 1 displays the analytical results for all pre- and post-storm samples that exceeded the 85th percentile reference values. All other analytical results were below the 85th percentile and are not detailed in Table 1. Ammonia exceeded the 85th percentile (0.015 milligrams per liter [mg/L]) for all five 2013 sampling events for both pre- and post-storm samples, ranging from 0.04 to 0.28 mg/L. As Table 1 shows, in some cases, the pre-storm sample concentration exceeded the post-storm sample concentration. Nitrate was elevated above the 85th percentile (0.374 mg/L) in four of the five 2013 pre- and post-storm samples, ranging from 0.51 to 3 mg/L. The barge landing beach area supports large populations of sea lions and elephant seals that use the beach at the pier for haul out and breeding throughout the entire storm sampling season. Elevated levels of ammonia and nitrate are likely due to presence of these large pinniped populations.

Table 1 shows that two metals exceeded the 85th percentile including zinc and silver. As shown on Table 1, zinc exceeded the 85th percentile (19 micrograms per liter [µg/l]) that ranged from 1.1417µg/l to 29.844 µg/l. However, the pre- and post-storm results were similar; zinc concentrations tended to be higher in the pre-storm samples (Table 1). The zinc concentrations observed are likely due to their presence in native soils of SNI, which bond to sediment that is flushed down during storms in the highly erodible and steep drainage area above the barge landing. Silver also exceeded the 85th percentile (0.08 µg/l) in the 2014 storm event in the pre-storm sample (1.11 µg/l) and the post storm sample (1.0 µg/l), indicating that silver concentrations in these samples are also indicative of background conditions.

Table 1: Chemicals In Receiving Water Samples Exceeding The 85th Percentile Of The 2013/2014 Reference Data

Analyte	Barge Landing Post-storm Receiving ASBS21-REC-01-B	Barge Landing Pre-storm Receiving ASBS21-REC-02-A	Barge Landing Post-storm Receiving ASBS21-REC-02-B	Barge Landing Pre-storm Receiving ASBS21-REC-03-A	Barge Landing Post-storm Receiving ASBS21-REC-03-B	Barge Landing Pre-storm Receiving ASBS21-REC-04-A	Barge Landing Post-storm Receiving ASBS21-REC-04-B	85th Percentile of 2013/14 Reference Data
	01-25-13/09:00	02-19-13/11:30	02-20-13/05:30	03-06-13/15:30	03-08-13/05:30	02-27-14/12:00	02-28-14/08:00	
Conventionals (mg/L)								
Ammonia as N	0.04 [a]	0.05 [b, c]	0.04 J [a]	0.28 [b, c]	0.1 [a]	ND	ND	0.015
Nitrate as N	0.28	0.51 [c]	3.0 [a]	0.63 [c]	0.7 [a]	0.06	ND	0.374
Total Metals (µg/L)								
Mercury	0.0162 [a]	ND	ND	ND	ND	ND	ND	0.0006
Silver	ND	0.03	0.03	ND	ND	0.11 [b, c]	0.1 [a]	0.08
Zinc	1.621	29.4938 [b, c]	3.3343	29.8444 [b, c]	3.2269	1.4147	14.5685	19
Polynuclear Aromatic Hydrocarbons (µg/l)								
Acenaphthylene	ND	0.004 J	ND	ND	ND	ND	ND	NA
Anthracene	ND	0.0258	ND	ND	ND	ND	ND	NA
Fluoranthene	ND	0.0474	ND	ND	ND	ND	ND	NA
Fluorene	ND	0.0035 J	ND	ND	ND	ND	ND	NA
Naphthalene	0.0044 J	0.0221	ND	ND	ND	0.0014 J	0.0021 J	NA
Phenanthrene	ND	0.0682	ND	ND	ND	0.0012 J	ND	NA
Pyrene	ND	0.0971	ND	ND	ND	ND	ND	NA
Total PAHs	0.0044 J	0.2681 [b, c]	ND	ND	ND	0.0026	0.0021 J	0.0125

Notes:

a Post-storm sample concentration exceeds the 85th percentile of the 2013/2014 reference data.

b Pre-storm sample concentration exceeds the post-storm sample concentration.

c Pre-storm sample concentration exceeds the 85th percentile of the 2013/2014 reference data.

µg/L Microgram per liter

J The associated value is an estimate.

mg/L Milligram per liter

NA Not available

ND Not detected

N Nitrogen

PAH Polynuclear aromatic hydrocarbons

The only other group of constituents that exceeded the 85th percentile reference value (0.0125 μg/l) was polycyclic aromatic hydrocarbons (PAH). The combined total PAHs that resulted in exceeding the reference value was 0.268 μg/l in the February 19, 2013 pre-storm sample at the receiving water. There were no detections of PAHs in the post-storm sample or in any of the other barge landing samples from 2013. The source of the PAHs in the pre-storm ocean water is unknown. It should be noted that at the SNI ocean water reference location in both 2013 and 2014, pre-storm ocean samples also contained PAHs (primarily naphthalene), but at concentrations below the 85th percentile.

None of the 2014 post storm receiving water sample results exceeded the 85th percentile reference data.

5.0 EROSION CONTROL AND PREVENTION OF ANTHROPOGENIC SEDIMENTATION

SNI topography is dominated by a broad plateau which gently to moderately slopes toward the northwest, and has steep dissected escarpments around most of the rest of the island. The maximum elevation of the island is 909 feet above sea level, near the southern edge of the plateau.

The plateau is comprised of alternating marine sandstone and siltstone beds that contain minor amounts of interbedded conglomerate and pebbly mudstone (Vedder and Norris 1963). Shallow alluvium covers most of the top of the plateau, while dune sands overlay the northwestern end of the island. The alternative beds of marine sediments have been deeply eroded in canyons and terraces around the island perimeter. Canyon erosion is naturally occurring, pre-dating any Navy activity. Slopes range from 3.5 to 6 percent on top of the plateau and 13 to 20 percent (steep to overstep) in the eroded canyons and terraces around the island perimeter (Figure 1). Vizcapoint and Jehemy soils are the predominant soil types. These soil types are characterized by fine textured marine silts and clays and shale terraces with internal layers of impeding vertical migration of water. The soil type corresponds to U.S. Soil Conservation Service (1972) Type D soils.

Approximately 70 to 75 percent of the island is covered with vegetation including a coastal scrub community (*Isocoma* scrub, *Baccharis* scrub, caliche scrub, and annual iceplant), grassland dominated by introduced Mediterranean grasses, and a Coreopsis scrub community (Halversen and others 1996). The deeply eroded canyons and terraces are sparsely to partially vegetated (15 to 25 percent cover).

The beaches on SNI include dune land and wide stretches of highly permeable deep sands. With the exception of the barge landing where industrial activity is situated at the beach, and several unpaved recreational parking areas with low usage, anthropogenic sedimentation from direct runoff is low. In addition, winds can be severe, causing shifting and blowing sands at the beaches as well as at the deltas of the numerous natural drainages that convey storm water to the Pacific Ocean. Natural sand accumulates at the base of the drainages, and during high rain events, increases the amount of suspended solids that may flow to the ocean. There is some evidence of anthropogenic erosion of unpaved parking areas near beaches. At Cissy Cove (SNI020) (Figure 1), runoff appears to flow in small disorganized channels onto the upper beach. Elephant seals use parts of the unpaved parking lot and the lower drainage channel at SNI020 (possibly causing some additional natural erosion). The distance from the low use parking area to the tideline is approximately 140 feet and the distance from potential contaminant source areas at Nictown are over 1,000 feet. The Navy plans to install erosion control blankets and / or rip rap around the sides of the parking area at SNI020 to eliminate undercutting of the parking area.

Access to most of these near beach parking areas are from West or East NAVFAC Roads (both unpaved and unsafe to travel on during rain events), making it difficult or impossible to observe potential erosion during rain events. Regardless, it is unlikely that eroded sediment impacts the water quality in the nearby ocean due to the permeability of the beach sand and the distance from the erosional source to the tideline.

At the barge landing area (SNI15A, SNI15B, and SNI014) (Figure 1), considered the Priority Discharge Area in this compliance plan, erosion controls are in place. The barge landing and access road (Beach Road) experience heavy equipment and vehicular traffic, however, the road and parking areas are paved with asphalt and impervious concrete, respectively. Storm water discharges to the beach either through catch basins in the parking area, or as sheet flow through drain holes in the K-rails that are in place along the beach side of the road and parking area. The concrete paving at the barge landing protects the area from potential erosion. In addition, educational signs were posted in the barge area to alert personnel to the prohibition of discharge other than storm water, to the ocean and ASBS waters.

SNI014 has been identified for visual monitoring and discharges from an open canyon on the south side of the NBVC SNI airfield. However, most of the runway run-off drains to the northwest of SNI014. The Navy and the SWRCB agreed to visually observe this site during rain events but no observations have been completed to date due to unpredictable rapid rain events. The Navy plans to perform maintenance on the K-rails near SNI014 to reduce sediment buildup behind the K-rails.

6.0 BEST MANAGEMENT PRACTICES

The Navy has identified and implemented site-specific BMPs at NBVC SNI that are designed to reduce or prevent pollutants associated with industrial activities in storm water discharges and authorized non-storm water discharges. Table 2 presents a complete list of BMPs currently implemented at NBVC SNI (as presented in Table 8-5 of the 2014 revised SWPPP) (Navy 2014). Detailed descriptions of each BMP are provided in Attachment 7 of the SWPPP. In addition to BMPs currently implemented throughout NBVC SNI, the Navy annually reevaluates the effectiveness of BMPs and the need for additional BMPs. Through storm water monitoring, periodic BMP inspections, yearly training of on-site personnel, and the annual comprehensive site compliance evaluation, current BMPS are enforced. For future activities that may impact ASBS 21 SNI, documents and review processes are in place to ensure that BMPs are developed and implemented. These include the Navy's Project Review Board process, Environmental Assessments or Environmental Impact Statements conducted under the National Environmental Policy Act (NEPA), and construction storm water management plans. All proposed construction projects and other projects that may affect the environment on NBVC SNI are required to go through the Navy's internal Project Review Board to ensure that environmental regulations are adhered to.

Future structural and non-structural BMPS will be implemented as shown in Table 2 and are summarized below. Table 3 details the BMP implementation schedule that NBVC uses to ensure that storm water runoff does not impact natural water quality conditions. Current and future construction projects that require structural and non-structural BMPs, and the documents that cite the BMPs, are listed in the table.

At the Public Works area where there were detections of PAHs at core site SNI019, the Navy will install rip-rap at the edge of the concrete parking area between Building 147 and Building 51 and just above Core Site SNI019. The rip rap will trap sediments and reduce flow into the drainage ditch where the SNI019 sample point is located. Also, the Navy will install an educational sign at this location describing prevention of spills and clean housekeeping practices for the parking area.

TABLE 2: LIST OF BMPS IMPLEMENTED AT NBVC SAN NICOLAS ISLAND

BMP No.	BMP Title
001	Label All Drums, Cans, Containers, Tanks, and Valves
002	Restrict Access to Area and Equipment
003	Perform Regular Cleaning
004	Avoid Hosing Down the Site
005	Perform Regular Pavement Sweeping
006	Control Spills
007	Place Trash Receptacles at Appropriate Locations
012	Construct Berm or Dike Around Critical Areas
013	Pave Bermed Areas
015	Recycle
016	Store Waste and Recycling Materials in Proper Containers
017	Limit Significant Materials Inventory
018	Provide Roof to Cover Source Area
020	Minimize Storm Water Run-on from adjacent facilities
021	Reduce Waste
026	Routinely Clean Catch Basins and Outfalls
028	Keep Equipment and Vehicles Clean
029	Maintain Equipment in Good Condition
033	Check Vehicles and Equipment for Leaks
036	Park Vehicles or Equipment Indoors or Under a Roof
037	Park Vehicles on an Impervious Surface
038	Designate Special Areas for Draining or Replacing Fluids
042	Discharge Wash Water to a Sanitary Sewer
044	Use Drip Pans Under Leaking Equipment
045	Perform Equipment Maintenance at Designated Areas
047	Conduct Maintenance within a Building or Covered Area
048	Reduce the Amount of Liquid Cleaning Agents Used
049	Centralize Liquid Solvent Cleaning to One Location
054	Properly Store Containers
057	Do Not Store Used Parts or Containers Directly on Ground
058	Store Batteries in a Secondary Container
059	Do Not Allow Open Flames Near Flammable Material
061	Employ Proper Handling Procedures to Transport Materials and Waste
061B	Store Liquids and Significant Materials within a Building or Covered Area
064	Monitor Major Fueling Operations
066	Eliminate Topping Off Tanks
069	Restrict Access to Tanks
070	Lock Fuel Tanks When Not in Use or on Standby
071	Keep Tanks, Piping, and Valves in Good Condition
072	Protect Tanks from Being Damaged by Vehicles
098	Construct Oil/Water Separator
110	Regularly Inspect and Maintain Storm Water Conveyance System
111	Regularly Inspect and Test Equipment
113	Conduct Personnel Training Regarding the SWPPP
115	Store Containers Inside Secondary Containment
118	Routinely Report Any Observed Non-Storm Water Discharges
D	Use Check Dams to Reduce Runoff Velocity
E	Reduce Flow Velocity at Outlet
F	Use Erosion Control Blankets

Notes:

BMP Best management practice

SWPPP Storm Water Pollution Prevention Plan

TABLE 3: BMP IMPLEMENTATION SCHEDULE

Date Implemented	BMP/Document Description
2004	Designed and built pier, impervious paved parking, and storm water conveyance system at the barge landing.
2004 to Future	Non-structural and structural BMPs currently in use at the barge landing.
March 2013	Installed signage at the barge landing as an educational BMP.
March 20, 2013	Date Attachment B Exception became effective (SWRCB 2012).
August 2013	Construction of new launch pad at Rock Crusher began; project regulated by NEPA (Overseas Environmental Impact Statement, Point Mugu Sea Range, U.S. Navy, March 2002).
September 18, 2013	Submittal of Draft ASBS 21 San Nicolas Island Compliance Plan to SWRCB.
September 2013 through Present	Wind Energy Project regulated by NEPA (Environmental Assessment for Development of Wind Energy Facilities on San Nicolas Island, August 2010) and Construction SWPPP/Erosion Plan; site at top of island on mesa, runoff to beaches is negligible. Construction project ongoing. Navy routinely oversees construction contractor to ensure BMPs are implemented.
November 2013	Manually clear outfalls SNI015A and SNI015B of sand at end of pipe and any other outfalls that impact storm water flow through outfall end of pipes.
2015 (March)	San Nicolas Island Directed Energy Test Facilities project regulated by NEPA; BMPs detailed in Draft Environmental Assessment, in regulatory review September 2014, and a Construction SWPPP/Erosion Plan will be developed.
Date TBD	San Nicolas Island Roads and Airfield Repairs project regulated under NEPA: BMPs detailed in Environmental Assessment, May 2012, project start date unknown.
2015	Install educational sign at the Public Works areas.
2015	Rebuild culverts that drain from the north side of the runway to reduce erosion.
2016	Preform maintenance on K-rails by SNI014 on Beach Road reduce sediment build up on the K-rails.
2016	Install rip rap in ditch above Core Site SNI019 to reduce flow and trap sediment.
2016	Install erosion control blankets and / or rip rap at edges of unpaved parking area at SNI020 (Cissy Cove) to reduce erosion.

Notes:

BMP Best management practice
NEPA National Environmental Policy Act
SWPPP Storm Water Pollution Prevention Plan
SWRCB State Water Resources Control Board
TBD To be determined

The Navy has a project to repair and rebuild many of the culverts that drain storm water off the runway, thereby reducing erosional sediments from entering the drainages above ASBS sites SNI024, SNI004, SNI005 and SNI006.

At SNI014, the Navy plans perform maintenance on the K-rail to prevent sediments from piling up on the road behind the K-rail on Beach Road during storm events.

At SNI020, which is a popular unpaved parking area for recreational activities, the Navy will install erosion control blankets and / or rip rap to reduce erosion of the sides of the parking areas and drainage ditches.

In summary, the Southern California Bight 2013 Regional Monitoring Program was extended through the 2013-2014 storm season by the SRWRCB because of insufficient rainfall that resulted in an inability to collect from enough storms in 2012-2013. The storm event captured on February 27 and 28, 2014 filled data gaps from 2013. The 2014 sample results show that the exceedances identified in 2013 were eliminated or reduced to below the 85th percentile reference data, or were below the pre-storm result in the 2014 storm sampling event. This provides solid evidence that the current BMPs described above are effectively reducing or eliminating contaminant discharges at the ocean at SNI. The Navy will continue to implement current BMPs, ensure adequate training of all personnel and contractors that conduct activities on NBVC SNI, and will add new BMPs as needed that will be documented in the annual SWPPP update.

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FIGURE 1

ASBS 21 SAN NICOLAS ISLAND COMPLIANCE PLAN MAP

APPENDIX A

SRWCB SEPTEMBER 5, 2014 LETTER

CALIFORNIA
Water Boards

EDMUND G. BROWN JR.
GOVERNOR

MATTHEW RODRIQUEZ
SECRETARY FOR
ENVIRONMENTAL PROTECTION

State Water Resources Control Board

September 5, 2014

Ms. Alicia Thompson
Water Quality Program Manager
Naval Base Ventura County
Port Hueneme, CA

COMMENTS ON DRAFT COMPLIANCE PLAN FOR SAN NICOLAS ISLAND AND BEGG ROCK (NO. 21) AREA OF SPECIAL BIOLOGICAL SIGNIFICANCE FROM THE U.S. NAVY AT VENTURA COUNTY

Dear Ms. Thompson,

The State Water Resources Control Board (State Water Board) received the Areas of Special Biological Significance (ASBS) draft Compliance Plan from the U.S. Navy at Ventura County dated September 20, 2013. A draft compliance plan is required under section I.A.3.b of Attachment B of the State Water Board's Resolution No. 2012-0012 *Approving Exceptions to the California Ocean Plan for Selected Discharges into ASBS, Including Special Protections for Beneficial Uses, and Certifying a Program Environmental Impact Report* (General Exception). Attachment B in the General Exception contains the *Special Protections for ASBS, Governing Point Source Discharges of Storm Water and Nonpoint Source Waste Discharges* (Special Protections), which describes special conditions required of the discharger.

State Water Board staff has reviewed the draft Compliance Plan and provides the following comments:

1. **Map of storm water runoff**: Section I.A.2.a of the Special Protections requires a map of surface drainage of storm water runoff showing areas of sheet runoff, prioritized discharges, and a description of any structural Best Management Practices (BMPs) already employed or to be employed. Priority discharges are those that pose the greatest water quality threat and which are identified to require installation of structural BMPs.

   Figure 1 in the draft Compliance Plan includes a map that presumably includes the above requirements. However, staff is not able to read or discern whether all required items have been included due to the small font and resolution of the map. In the final Compliance Plan, please make the symbols and writing on the map larger and legible.

2. **Erosion controls**: Section I.A.2.e of the Special Protections requires the ASBS Compliance Plan to address erosion control and prevention of anthropogenic

sedimentation in ASBS. The natural habitat conditions in the ASBS shall not be altered as a result of anthropogenic sedimentation.

The draft Compliance Plan states there is evidence of anthropogenic erosion of unpaved parking areas near beaches. If there is evidence of anthropogenic sedimentation reaching the ASBS, please incorporate structural BMPs to address anthropogenic erosion in the final Compliance Plan.

3. **Compliance and implementation schedule**: Section I.A.3.b requires the final Compliance Plan to include a schedule for structural controls based on results of the runoff and receiving water monitoring to be submitted within 30 months from the effective date of the General Exception. Section I.A.3.d stipulates that any structural controls identified in the final Compliance Plan be operational within six years of the effective date.

   Staff understands the Department of the Navy at San Nicolas Island and Begg Rock has not yet received results from receiving water and core discharge monitoring, and these results may change which structural controls are determined to be necessary to comply with the Special Protections. In the final Compliance Plan, please include a description and schedule for any additional projects to be implemented and operational by the compliance deadline of March 20, 2018. If this compliance deadline cannot be met, additional information is required to support an extension.

Staff appreciates the efforts of the U.S. Navy on the draft Compliance Plan and will continue to collaborate to resolve the comments mentioned in this letter as needed. Within 30 days from the date of this letter, please submit the final Compliance Plan addressing these comments for approval by the State Water Board Executive Director.

For further questions pertaining to this subject matter, please contact Dr. Maria de la Paz Carpio-Obeso, Ocean Unit Chief, at (916) 341-5858 or MarielaPaz.Carpio-Obeso@waterboards.ca.gov.

Sincerely,

FOR

Victoria A. Whitney, Deputy Director
Division of Water Quality

Cc:

Mr. Jonathan Bishop, Chief Deputy Director
State Water Resources Control Board
1001 I Street
Sacramento, CA 95814

Ms. Marleigh Wood, Office of Chief Counsel
State Water Resources Control Board
1001 I Street
Sacramento, CA 95814

Mr. Samuel Unger, Executive Officer II
Los Angeles Regional Water Quality Control Board
320 W. Fourth Street, Suite 200
Los Angeles, CA 90013

APPENDIX B

SURFACE WATER RUNOFF MODELING FOR SAN NICOLAS ISLAND ASBS SNI 21 OUTFALLS

APPENDIX B
SURFACE WATER RUNOFF MODELING
FOR SAN NICOLAS ISLAND ASBS SNI 21 OUTFALLS

Contents

ACRONYMS AND ABBREVIATIONS

ABC	Aquatic Bioassay and Consulting Laboratories, Inc.
AMC	Antecedent moisture condition
ASBS	Areas of Special Biological Significance
Bight'13	Southern California Bight 2013
CFS	cubic feet per second
CN	Curve Number
DA	Drainage Areas
Mg/L	Milligrams per liter
MG	Million gallons
Navy	U.S. Department of the Navy
NBVC	Naval Base Ventura County
NRCS	Natural Resources Conservation Service
RWQCB	California Regional Water Quality Control Board
SNI	San Nicolas Island
SWRCB	California State Water Resources Control Board
USCS	U.S. Soil Conservation Service
WRCC	Western Regional Climate Center

1.0 INTRODUCTION

The California State Water Resourced Control Board (SWRCB), under its Areas of Special Biological Significance (ASBS) special protections program, mandated surface water runoff modeling at the ASBS sites, one of which is San Nicolas Island (SNI) ASBS 21. The SWRCB and Naval Base Ventura County (NBVC) identified the following seven SNI outfalls of 18 inches or greater diameter to conduct NBVC modeling. Outfalls modeled include: SNI004, SNI014, SNI015A, SNI015B, SNI019, SNI023, and SNI024 as shown on Figure B-1. The modeling effort applied data from historical and winter 2013–2014 precipitation records, and is described below; surface water runoff model results are listed in Tables B-1 through B-3.

1.1 PREDICTION OF STORM WATER RUNOFF

During a given storm event, only a portion of the total volume of precipitation results in storm water runoff. The amount of storm-related discharge for a given watershed is a factor of soil type, slope, soil permeability, and percent and type of cover. The U.S. Soil Conservation Service (USCS) Curve Number (CN) Method (USCS 1972, Natural Resources Conservation Service [NRCS] 1986) is widely accepted for predicting storm-related runoff (W_{eff}), via the following equations:

$$W_{eff} = \frac{(P - 0.2S_{max})^2}{(P + 0.8S_{max})}$$

$$S_{max} = \frac{1000}{CN} - 10$$

Where:

W_{eff} = storm-related runoff (inches)
P = precipitation (inches)
S_{max} = watershed storage capacity (inches)
CN = USCS curve number

The USCS CN is assigned based on land use, percent and type of cover, and hydrologic soil group. Three antecedent moisture condition (AMC) classes (I, II, III) are used to adjust a CN to account for dry, moist, and saturated soil conditions in each watershed for the 5 days prior to the storm event. If the 5-day antecedent rainfall is less than 0.5 inch, the AMC class is I (CN I). If the 5-day antecedent rainfall exceeds 0.5 inch, but is less than 1.1 inches, the AMC class is II (CN II). If the 5-day antecedent rainfall exceeds 1.1 inches, the AMC class is III (CN III).

1.2 PHYSICAL CONDITIONS AT NBVC SNI CONTRIBUTING TO RUNOFF

Runoff from the six drainage areas (DA) that drain into the seven outfalls requiring modeling are shown on Figure B-1. Outfalls SNI015A and SNI015B both receive runoff from the same DA. Runoff from these DAs was evaluated based on soil type, slope, permeability, and percent and type of cover. Watershed hydrologic boundaries were delineated within a geographic information system layer by reviewing topographic lines and aerial photographs of NBVC SNI. CN values were then predicted for each watershed (Table B-1) based on a review of aerial and ground level photographs, observation of soil type and precipitation response, topography, predominant soil types obtained from the USCS (USCS 1985), and vegetative cover data obtained from *Plant Communities of San Nicolas Island* (Halvorson and others 1996).

NBVC SNI is an oval-shaped island about 9.6 miles long and 3.4 miles wide, encompassing approximately 22.4 square miles. The island topography is dominated by a broad plateau, which gently to moderately slopes to the northeast (Figure B-1). The maximum elevation on the island is 909 feet above mean sea level, near the southern edge of the plateau.

The plateau is composed of alternating marine sandstone and siltstone beds that contain minor amounts of interbedded conglomerate and pebbly mudstone (Vedder and Norris 1963). Shallow alluvium covers most of the top of the plateau, while dune sands overlay the northwestern end of the island. The alternating beds of marine sediments have been deeply eroded in canyons and terraces around the island perimeter. Canyon erosion is naturally occurring, pre-dating any U.S. Department of the Navy (Navy) activity. Slopes range from 3.5 to 6 percent on top of the plateau, and 13 to 20 percent (steep to over-steep) in the eroded canyons and terraces around the island perimeter. Vizcapoint and Jehemy Soils, the predominant soil types, are characterized by fine-textured marine silts and clays and shale terraces, with internal layers impeding vertical migration of water. The soil type corresponds to USCS Type D soils (USCS 1972).

Approximately 70 to 75 percent of the island is covered with vegetation that includes coastal scrub (*Isocoma* scrub, *Baccharis* scrub, caliche scrub, and annual iceplant), grassland dominated by introduced Mediterranean grasses, and a Coreopsis scrub community (Halvorson and others 1996). The deeply eroded canyons and terraces are sparsely to partially vegetated (15 to 25 percent cover).

1.3 EVALUATION OF PRECIPITATION RECORD

Daily precipitation data applied during the modeling effort were obtained from Navy (acquired at the Navy-operated SNI weather station), from storm water sampling network stations, and from the Western Region Climatic Center (WRCC) website (http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca7870). These data were used to assess frequencies and types of soil antecedent moisture conditions prior to modeled storms, return frequencies of storms of different intensity, and the maximum storm intensity based on the precipitation record from 1933–1952, 1963–1989, and 2004–2010.

The climate of the island is characterized by a Mediterranean pattern of relatively cool, wet winters and warm, dry summers. Based on the precipitation record, the annual precipitation at NBVC SNI has ranged from 2.96 inches (2009) to 23.29 inches (1983), and an average of 9.15 inches, with about 75 percent falling between November and March. The summer months average less than 0.1 inch, and most of what falls is drizzle from stratus clouds. The current 2013–2014 water year (June 1 to May 31) appears to be the driest on record, with only 1.98 inches of precipitation.

The maximum intensity 24-hour storm occurred on December 27, 1984, generating 3.25 inches of precipitation. Recurrence intervals of different intensity 24-hour duration storms in the precipitation record were determined by plotting frequency on extreme value distribution paper after Dunne and Leopold (Dunne and Leopold 1978). The 2-year return (recurrence) storm intensity is 1.15 inches, which means that every 2 years a storm with an intensity of 1.15 inches is likely to occur. The return frequencies for other storms include: 10-year storm intensity of 2.2 inches, 25-year storm intensity of 2.8 inches, 50-year storm intensity of 3.15 inches, and estimated 100-year storm intensity of 3.6 inches. The 100-year return storm was not observed in the precipitation record.

In addition, 70.7 percent of the storms began under dry soil conditions (AMC I), 17.1 percent of the storms began under moist soil conditions (AMC II), and 12.1 percent of the storms began under wet soil conditions (AMC III). Intensity of a storm and amount of soil moisture determine the amount of runoff generated.

Three storm events during winter 2013–2014 were also identified for evaluation of potential storm water runoff. These storm events occurred on November 29, 2013, February 6, 2014, and February 27-28, 2014, resulting in accumulation of 0.70, 0.19, and 0.54 inch of precipitation, respectively. Daily precipitation data for the winter 2013–2014 events were obtained from the Mesowest Real Time Observation Monitor and Analysis Network website —

(http://raws.wrh.noaa.gov/cgi-bin/roman/past.cgi?stn=KNSI&day1=9&month1=10&year1=2013).

Precipitation was not recorded or did not exceed 0.5 inch during the 5-day period prior to each of these storm events; therefore, dry soil moisture conditions (AMC I) were modeled for each event.

1.4 EVALUATION OF SNI STORM WATER RUNOFF

Differences in physical conditions (soil type, slope, permeability, and percent and type of cover) and initial soil moisture within six of the DAs on NBVC SNI were referenced to predict the runoff CN values required to calculate storm water runoff; Table B-1 indicates the minimum precipitation required to generate runoff under different soil moisture conditions for each DA. Calculated runoff volumes for each of the six DAs under conditions of different storm sizes and soil moisture are listed in Table B-2. Runoff volumes were also calculated for DAs 1, 3, 6, 8, 10b, and 11 (Figure B-1) during the three winter 2013–2014 storm events, and are listed in Table B-3. Runoff from each DA under different initial soil moisture conditions, different historical storm sizes, and during winter 2013–2014 storm events are summarized below.

During most storms, runoff occurs only from partially paved urban/industrial areas, requiring only 0.1 to 0.5 inch of precipitation dry initial soil conditions (AMC I). The range in required precipitation to induce runoff is due to differences in the physical conditions of each DA. As storms grow larger, runoff occurs from the partially vegetated, over-steep ravine and canyon walls, requiring 0.65 to 1 inch of precipitation under dry initial soil conditions. Runoff from the well-vegetated, gently sloped grassland/scrub areas occurs only after 1.4 to 1.7 inches of precipitation has fallen. Runoff from urban/industrial areas (small percentage of land area) becomes less important as the amount of precipitation increases. Dry initial soil moisture conditions (AMC I) occurred prior to each winter 2013–2014 storm event, and precipitation was less than 0.65 inch during two of those storms (the threshold for runoff from ravine and canyon walls); therefore, runoff occurred only within partially paved urban/industrial areas during two of the three storms.

Approximately 71 percent of the time that precipitation occurs, the soil is initially dry (AMC I), requiring more precipitation to wet the soil to field capacity before runoff can occur. Therefore, watershed-wide runoff is limited to a few large storms a year or a series of smaller storms, closely spaced over a few days (AMC II or III). Regular erosional events can occur within the ravines/canyons with just 0.65 inch of precipitation, even with dry initial soil conditions (AMC I). The threshold for canyon erosion drops to approximately 0.25 inch of precipitation when the soil is initially moist (AMC II) and just 0.1 inch when the soil is initially saturated (AMC III). The soil was initially dry (AMC I) prior to each winter 2013-2014 storm event, and precipitation was less than 0.65 inch during two of the storms (the threshold for

runoff from ravine and canyon walls), so runoff occurred in the ravines/canyons during only one of the three storms (the event on November 29, 2013).

While hourly precipitation data during each storm were not available, Navy storm water sampler flow data show almost immediate runoff from urban/industrial areas. No storm water sampler flow data were available at the bottoms of the ravines and canyons to document beginning of runoff and time to peak flow from a watershed. The runoff data listed in Tables B-2 and B-3 represent total runoff volume rather than peak flow during a typical 6-hour storm.

Erosion and discharge of total and suspended soils are generally expected in the sparsely vegetated and over-steep ravines and canyons with exposed marine terraces. Comparatively minimal erosion is expected from grassland/scrub areas due to extensive vegetative cover and gentle slopes. Discharge from urban/industrial areas of total dissolved solids (detections range from about 100 to 310 milligrams per liter [mg/L]) and total suspended solids (detections range from about 20 to 68 mg/L) has been documented by Navy storm water samplers, and is a minor contributor to overall eroded solids based on small urban/industrial acreage and position on the gently sloped grassland/scrub plateau.

1.4.1 Runoff Model Results for Historical Storm Events Between 1933 and 2010

The following is a discussion of runoff model results, based on the 1933 through 2010 precipitation record (see Section 1.3) for the seven Outfalls SNI004, SNI014, SNI015A, SNI015B, SNI019, SNI023, and SNI024, and their associated DAs:

<u>DA-1 Watershed (Outfall SNI019)</u>

- Runoff volume from DA-1—a large, predominantly grassland/scrub-covered watershed—during a 0.5 inch, 6-hour storm, ranged from 0.005 million gallons (MG) (0.03 cubic feet per second [CFS]) under dry initial soil conditions (AMC I), to 0.17 MG (1.05 CFS) under moist initial soil conditions (AMC II). Generally, a 0.25 inch storm under dry initial soil conditions generates runoff only from paved areas in DA-1. Runoff from the over-steep marine terraces in the ravines and canyon begins to occur at approximately 0.65 inch of precipitation in DA-1. A 0.25 to 0.5 inch storm under dry initial soil conditions (AMC I) represents the most common type of runoff event.

- Runoff volume from DA-1 during a 1.5 inch, 6-hour storm ranged from 0.63 MG (3.9 CFS) under dry initial soil conditions (AMC I), to 3.5 MG (21.7 CFS) under moist initial soil conditions (AMC II). Most of the runoff from DA-1, even during moist initial soil conditions, is from the ravines/canyons and urban/industrial area. A 1.5 inch storm typically occurs every 2 to 3 years, and is not very common where annual precipitation averages 9.15 inches.

- Maximum runoff volume from DA-1 during the three largest storms on record ranged from 6.5 to 26.8 MG (40.3 to 166 CFS) for dry (AMC I) to wet (AMC III) initial soil conditions. The storms generating these volumes of runoff occur every 7, 27, and 53 years.

- While runoff from the ravine/canyon walls represents a decreasing contribution to overall runoff with increased precipitation, the erosive, sparsely vegetated, over-steep marine terraces are expected to contribute most of the solids loading from DA-1. In addition, the high flow rates from the upper watershed that discharge into the canyon during large storms likely contribute to high solids loading from erosional mass wasting and headward cutting of the canyon.

- While runoff volume provides the cumulative amount of runoff, flow rate is of more interest for movement of eroded materials to the base of the canyon. Most storms do not exceed 6-hour duration; however, the precipitation record provides only daily data. Therefore, an average flow rate over a 6-hour storm period yields a flow rate of 2,778 gallons per minute or 6.2 CFS for each 1 MG of storm water runoff. Flow rates for the preceding DA-1 and following DAs assume a storm of 6-hour duration, and represent an average rather than peak flow.

DA-3 Watershed (Outfall SNI023)

- Runoff volume from DA-3—a large, predominantly grassland/scrub-covered watershed—during a 0.5 inch, 6-hour storm ranged from 0.016 MG (0.1 CFS) under dry initial soil conditions (AMC I), to 0.12 MG (0.72 CFS) under moist initial soil conditions (AMC II). Generally, a 0.25 inch storm under dry initial soil conditions generates runoff only from urbanized areas in DA-3. Runoff from the over-steep marine terraces in the ravines and canyons begins to occur at approximately 1 inch of precipitation in DA-3. A 0.25 to 0.5 inch storm under dry initial soil conditions (AMC I) represents the most common type of runoff event.

- Runoff volume from DA-3 during a 1.5 inch, 6-hour storm ranged from 0.39 MG (2.4 CFS) under dry initial soil conditions (AMC I) to 3.1 MG (19.2 CFS) under moist initial soil conditions (AMC II). Most of the runoff from DA-3 during dry initial soil conditions is from the ravines/canyons and urban/industrial areas. Most of the runoff from DA-3, even during moist initial soil conditions, is from the urban/industrial area. A 1.5 inch storm typically occurs every 2 to 3 years, and is not very common where annual precipitation averages 9.15 inches.

- Maximum runoff volume from DA-3 during the largest storms on record (1.98, 2.72, 3.25 inches) ranged from 5.8 to 28.1 MG (35.9 to 174 CFS) for dry (AMC I) to wet (AMC III) initial soil conditions. The storms generating these volumes of runoff occur every 7, 27, and 53 years.

- The urban/industrialized area is on the plateau of the upper watershed. While runoff from the ravine/canyon walls represents a decreasing contribution to overall runoff with increasing precipitation, the erosive, partially vegetated, over-steep marine terraces are expected to contribute most of the solids loading from DA-3. In addition, the high flow rates from the upper watershed that discharge into the canyons during large storms likely contribute to high solids loading from erosional mass wasting and headward cutting of the canyons.

DA-6 Watershed (Outfall SNI024)

- Runoff volume from DA-6—a large, predominantly grassland/scrub-covered watershed—during a 0.5 inch, 6-hour storm ranged from no flow under dry initial soil conditions (AMC I), to 0.23 MG (1.4 CFS) under moist initial soil conditions (AMC II). Generally, a 0.5 inch storm under dry initial soil conditions is required to begin generating runoff from paved areas in DA-6. Runoff from the over-steep marine terraces in the ravines and canyons begins to occur at approximately 0.67 inch of precipitation in DA-6. A 0.25 to 0.5 inch storm under dry initial conditions (AMC I) represents the most common type of runoff event.

- Runoff volume from DA-6 during a 1.5 inch, 6-hour storm ranged from 0.99 MG (6.1 CFS) under dry initial soil conditions (AMC I), to 7.7 MG (47.7 CFS) under moist initial soil conditions (AMC II). Most of the runoff from DA-6 under dry initial soil conditions is from the ravines/canyons and urban/industrial areas. However, during moist initial soil conditions, all areas of the watershed contribute flow. A 1.5 inch storm typically occurs every 2 to 3 years, and is not very common where annual precipitation averages 9.15 inches.

- Maximum runoff volume from DA-6 during the largest storms on record (1.98, 2.72, 3.25 inches) ranged from 14.6 to 48.9 MG (90.6 to 303 CFS) for dry (AMC I) to wet (AMC III) initial soil conditions. The storms generating these volumes of runoff occur every 7, 27, and 53 years.

- The urban/industrialized area is on the plateau of the upper watershed and is mostly vegetated within the runway area. While runoff from the ravine/canyon walls represents a decreasing contribution to overall runoff with increasing precipitation, the erosive, sparsely vegetated, over-steep marine terraces are expected to contribute most of the solids loading from DA-6. In addition, the high flow rates from the upper watershed that discharge into canyons during large storms likely contribute to high solids loading from erosional mass wasting and headward cutting of the canyons.

DA-8 Watershed (Outfall SNI004)

- Runoff volume from DA-8—a small, sparsely vegetated watershed composed of over-steep marine terrace canyons—during a 0.5 inch, 6-hour storm ranged from 0.0005 MG (0.003 CFS) under dry initial soil conditions (AMC I), to 0.034 MG (0.21 CFS) under moist initial soil conditions (AMC II). Generally, a 0.25 inch storm under dry initial soil conditions generates runoff only from paved areas in DA-8. Runoff from the over-steep marine terraces in the ravines and canyons begins to occur at approximately 0.65 inch of precipitation in DA-8. A 0.25 to 0.5 inch storm under dry initial soil conditions (AMC I) represents the most common type of runoff event.

- Runoff volume from DA-8 during a 1.5 inch, 6-hour storm ranged from 0.15 MG (0.93 CFS) under dry initial soil conditions (AMC I) to 0.59 MG (3.6 CFS) under moist initial soil conditions (AMC II). Most of the runoff from DA-8, even during moist initial soil conditions, is from the ravines/canyons and urban/industrial areas. A 1.5 inch storm typically occurs every 2 to 3 years, and is not very common where annual precipitation averages 9.15 inches.

- Maximum runoff volume from DA-8 during the largest storms on record (1.98, 2.72, 3.25 inches) ranged from 1.1 to 2.9 MG (7 to 18.1 CFS) for dry (AMC I) to wet (AMC III) initial soil conditions. The storms generating these volumes of runoff occur every 7, 27, and 53 years.

- Because the industrialized area is mostly paved, most of the solids loading from DA-8 are expected to originate from the sparsely vegetated, over-steep marine terraces and canyon above the industrialized area. In addition, the high flow rates from the upper watershed that discharge into canyons during large storms likely contribute to high solids loading from erosional mass wasting and headward cutting of the canyons.

<u>DA-10B Watershed (Outfall SNI014)</u>

- Runoff volume from DA-10B—a small, sparsely vegetated watershed composed of over-steep marine terrace canyons—during a 0.5 inch, 6-hour storm ranged from no flow under dry initial soil conditions (AMC I), to 0.07 MG (0.42 CFS) under moist initial soil conditions (AMC II). Runoff from the over-steep marine terraces in the ravines and canyons begins at approximately 0.67 inch of precipitation in DA-10B. A 0.25 to 0.5 inch storm under dry initial soil conditions (AMC I) represents the most common type of runoff event.

- Runoff volume from DA-10B during a 1.5 inch, 6- hour storm ranged from 0.35 MG (2.2 CFS) under dry initial soil conditions (AMC I) to 1.4 MG (8.5 CFS) under moist initial soil conditions (AMC II). Most of the runoff from DA-10B, even during moist initial soil conditions, is from the ravines/canyons. A 1.5 inch storm typically occurs every 2 to 3 years, and is not very common where annual precipitation averages 9.15 inches.

- Maximum runoff volume from DA-10B during the largest storms on record (1.98, 2.72, 3.25 inches) ranged from 2.6 to 5.7 MG (16.4 to 35.2 CFS) for dry (AMC I) to wet (AMC III) initial soil conditions. The storms generating these volumes of runoff occur every 7, 27, and 53 years.

- Because the range/scrubland is mostly vegetated and runoff is from the sparsely vegetated, over-steep marine terraces, most of the solids loading from DA-10B is expected to originate in the over-steep marine terraces and canyon. In addition, the high flow rates from the upper watershed that discharge into canyons during large storms likely contribute to high solids loading from erosional mass wasting and headward cutting of the canyons.

<u>DA-11 Watershed (Two Outfalls SNI015A and SNI015B)</u>

- Runoff volume from DA-11—a small, sparsely vegetated watershed composed of over-steep marine terrace canyons—during a 0.5 inch, 6-hour storm ranged from 0.01 MG (0.06 CFS) under dry initial soil conditions (AMC I), to 0.04 MG (0.25 CFS) under moist initial soil conditions (AMC II). Most of the runoff during small storms occurs from the paved barge landing area at the base of the canyon. Runoff from the over-steep marine terraces in the canyons above the barge landing area begins to occur at approximately 0.67 inch of precipitation in DA-11. A 0.25 to 0.5 inch storm under dry initial soil conditions (AMC I) represents the most common type of runoff event.

- Runoff volume from DA-11 during a 1.5 inch, 6-hour storm ranged from 0.16 MG (0.99 CFS) under dry initial soil conditions (AMC I), to 0.45 MG (2.8 CFS) under moist initial soil conditions (AMC II). Most of the runoff from DA-11 is from the canyon above the barge landing area. A 1.5 inch storm typically occurs every 2 to 3 years, and is not very common.

- Maximum runoff volume from DA-11 during the largest storms on record (1.98, 2.72, 3.25 inches) ranged from 0.8 to 1.6 MG (5 to 9.9 CFS) for dry (AMC I) to wet (AMC III) initial soil conditions. The storms generating these volumes of runoff occur every 7, 27, and 53 years.

- Because most of the runoff is from the sparsely vegetated, over-steep marine terraces above the barge landing, most of the solids loading from DA-11 is expected to originate in the canyon. In addition, the high flow rates from the upper watershed that discharge into canyons during large storms likely contribute to high solids loading from erosional mass wasting and headward cutting of the canyons. RU.

1.4.2 Runoff Model Results for Winter 2013-2014 Storm Events

The following is a discussion of runoff model results, based on the winter 2013–2014 precipitation record (see Section 1.3) for the seven outfalls (SNI004, SNI014, SNI015A, SNI015B, SNI019, SNI023, and SNI024), and their associated DAs.

<u>DA-1 Watershed (Outfall SNI019)</u>

- Runoff did not occur from DA-1—a large, predominantly grassland/scrub-covered watershed—during the storm on February6, 2014 (0.19 inch) under dry initial soil conditions (AMC I).

- Runoff volume from DA-1 during the storm on November 29, 2013 (0.70 inch, 6-hour), was 0.0099 MG (0.061 CFS) under dry initial soil conditions (AMC I). Approximately 0.6 percent of the runoff occurred within 33 acres of ravines and canyons, and 99.4 percent occurred within the 47 acres of urban/industrialized areas of DA-1. Runoff did not occur within the remaining 536 acres of range/scrubland and beaches, as approximately 1.4 and 1.7 inches of precipitation is required to generate runoff from these portions of DA-1.

- Runoff volume from DA-1 during the storm on February 27-28, 2014 (0.54 inch, 6-hour), was 0.0463 MG (0.287 CFS) under dry initial soil conditions (AMC I). All of the runoff occurred within the 47 acres of urban/industrialized areas of DA-1. Runoff did not occur within 33 acres of ravines and canyons as approximately 0.65 inch of precipitation is required to generate runoff from this portion of DA-1. Runoff did not occur within the remaining 536 acres of range/scrubland and beaches, as approximately 1.4 and 1.7 inches of precipitation is required to generate runoff from these portions of DA-1.

- The urban/industrialized area is on the plateau and is mostly vegetated within the runway area. While runoff from the ravine/canyon walls represents a small contribution to overall runoff, runoff from the plateau in the upper watershed passes through ravines and the canyon, and is

expected to erode the sparsely vegetated, over-steep marine terraces. The erosive runoff from the canyon is expected to contribute most of the solids loading from DA-1.

- Based upon a review of Outfall SNI019 information presented in "San Nicolas Island Area of Special Biological Significance Industrial Storm Water Discharge Survey" (Navy 2012), the outfall is 1,400 feet from the tideline along Beach Road. The drainage reach between the outfall and tideline is a canyon vegetated for approximately 600 feet and overrun by a dune field over the last 750 feet. Approximately 50 feet of active beach is present beyond the dune field. Sediment appears to be accumulating in the drainage due to the change in energy slope as a result of dune field incursion.

- Given the long reach of sand-filled channel, dune field incursion, and the amount of water retained by such a large volume of sand, it is unlikely that water discharged to the ocean during the observed winter 2013–2014 storm events. If water reached the tideline, the energy of the water would not likely have been great enough to transport sediment to the tideline.

<u>DA-3 Watershed (Outfall SNI023)</u>

- Minimal runoff occurred from DA-3—a large, predominantly grassland/scrub-covered watershed—during the storm on February 27-28, 2014 (0.54 inch, 6-hour), under dry initial soil conditions (AMC I). Runoff was limited to the approximately 25-acre, partially paved, urban/industrial area, and amounted to 0.0227 MG (0.141 CFS). No runoff occurred during the storm on February 6, 2014 (0.19 inch) under dry initial soil conditions (AMC I).

- Runoff volume from DA-3 during the storm on November 29, 2013 (0.70 inch, 6-hour), was 0.0576 MG (0.357 CFS) under dry initial soil conditions (AMC I). All runoff occurred within 25 acres of urban/industrialized areas of DA-3. Runoff did not occur within the remaining 643 acres of range/scrubland and partially-vegetated marine terrace canyons, as approximately 1.04 and 1.7 inches of precipitation is required to generate runoff from these portions of DA-3.

- The urban/industrialized area is on the plateau of the upper watershed. Runoff from the plateau passes through ravines and the canyon, and is expected to erode the sparsely vegetated, over-steep marine terraces. The erosive runoff from the canyon is expected to contribute most of the solids loading from DA-3.

- Based upon a review of Outfall SNI023 information presented in "San Nicolas Island Area of Special Biological Significance Industrial Storm Water Discharge Survey" (Navy 2012), the outfall is 1,100 feet from the ocean along Beach Road. The drainage reach between the outfall and ocean is a vegetated canyon, which eventually discharges to the ocean from a rock shelf. No sediment appears to be accumulating in the drainage channel.

- Given the lack of sediment accumulation in the channel, incision of the channel in marine terraces, and lack of a beach, any water draining from the canyon during the observed winter 2013–2014 storm events would discharge to the ocean. Sediment eroded from the steep canyons may accumulate upstream of Beach Road due to the change in slope and impoundment.

DA-6 Watershed (Outfall SNI024)

- Runoff did not occur from DA-6—a large, predominantly grassland/scrub-covered watershed—during the storm on February 6, 2014 (0.19 inch), under dry initial soil conditions (AMC I).

- Runoff volume from DA-6 during the storm on February 27-28, 2014 (0.54 inch, 6-hour), was 0.0017 MG (0.011 CFS) under dry initial soil conditions (AMC I). All of the runoff occurred within the 102 acres of urban/industrialized areas of DA-6. Runoff did not occur within 34 acres of ravines and canyons, as approximately 0.67 inch of precipitation is required to generate runoff from this portion of DA-6. Runoff did not occur within the remaining 901 acres of range/scrubland, as approximately 1.39 inches of precipitation is required to generate runoff from this portion of DA-6.

- Runoff volume from DA-6 during the storm on November 29, 2013 (0.70 inch, 6-hour), was 0.0413 MG (0.256 CFS) under dry initial soil conditions (AMC I). Approximately 0.7 percent of the runoff occurred within 34 acres of ravines and canyons, and 99.3 percent occurred within the 102 acres of urban/industrialized areas of DA-6. Runoff did not occur within the remaining 901 acres of range/scrubland, as approximately 1.39 inches of precipitation is required to generate runoff from this portion of DA-6.

- The urban/industrialized area is on the plateau of the upper watershed and is mostly vegetated within the runway area. While runoff from the ravine/canyon walls represents a small contribution to overall runoff, runoff from the plateau passes through ravines and canyons and is expected to erode the sparsely vegetated, over-steep marine terraces. The erosive runoff from the canyon is expected to contribute most of the solids loading from DA-6.

- Based upon a review of Outfall SNI024 information presented in "San Nicolas Island Area of Special Biological Significance Industrial Storm Water Discharge Survey" (Navy 2012), the outfall is 1,100 feet from the ocean along Beach Road. The drainage reach between the outfall and ocean is a vegetated canyon, which eventually discharges to the ocean from a rock shelf. No sediment appears to be accumulating in the drainage channel.

- Given the lack of sediment accumulation in the channel, incision of the channel in marine terraces, and lack of a beach, any water draining from the canyon during the observed winter 2013–2014 storm events would discharge to the ocean. Sediment eroded from the steep canyons may accumulate upstream of Beach Road due to the change in slope and impoundment.

DA-8 Watershed (Outfall SNI004)

- Runoff did not occur from DA-8—a small, sparsely vegetated watershed composed of over-steep marine terrace canyons—during the storm on February 6, 2014 (0.19 inch), under dry initial soil conditions (AMC I).

- Runoff volume from DA-8 during the storm on February 27-28, 2014 (0.54 inch, 6-hour), was 0.0011 MG (0.007 CFS) under dry initial soil conditions (AMC I). All of the runoff occurred

within the 5-acre industrialized area of DA-8. Runoff did not occur within 21 acres of over-steep ravines and canyons, as approximately 0.65 inch of precipitation is required to generate runoff from this portion of DA-8. Runoff did not occur within the remaining 32 acres of range/scrubland and beaches, as approximately 1.4 and 1.7 inches of precipitation is required to generate runoff from these portions of DA-8.

- Runoff volume from DA-8 during the storm on November 29, 2013 (0.70 inch, 6-hour), was 0.0054 MG (0.033 CFS) under dry initial soil conditions (AMC I). Approximately 3.5 percent of the runoff occurred within 21 acres of over-steep ravines and canyons, and 96.5 percent occurred within the 5-acre industrialized area of DA-8. Runoff did not occur within the remaining 32 acres of range/scrubland and beaches, as approximately 1.4 and 1.7 inches of precipitation is required to generate runoff from these portions of DA-8.

- Because the industrialized area is mostly paved, most of the solids loading are expected to originate in the sparsely vegetated, over-steep marine terraces, and the canyon above the industrialized area.

- Based upon a review of Outfall SNI004 information presented in "San Nicolas Island Area of Special Biological Significance Industrial Storm Water Discharge Survey" (Navy 2012), the drainage outfall is approximately 200 feet from the tideline at the Coast Guard Jetty below Beach Road. A discharge pipe is not present at this location; instead, the drainage discharges into an impoundment area on the beach, which is associated with the Reverse Osmosis Plant.

- Given the discharge to an impoundment area on the beach and the amount of water retained by such a large volume of sand, it is unlikely that water discharged during the observed winter 2013-2014 storm events.

<u>DA-10B Watershed (Outfall SNI014)</u>

- Runoff did not occur from DA-10B—a small, sparsely vegetated watershed composed of over-steep marine terrace canyons—during the storms on February 6, 2014 and February 27-28, 2014 (0.19 and 0.54 inch, respectively), under dry initial soil conditions (AMC I).

- Runoff volume from DA-10B during the storm on November 29, 2013 (0.74 inch, 6-hour), was 0.0007 MG (0.004 CFS) under dry initial soil conditions (AMC I). All runoff occurred within 78 acres of over-steep ravines and canyons of DA-10B. Runoff did not occur within the remaining 24 acres of range/scrubland and beaches, as approximately 1.4 inches of precipitation is required to generate runoff from this portion of DA-10B.

- Because the range/scrubland is mostly vegetated and runoff is from the sparsely vegetated, over-steep marine terraces, most of the solids loading from DA-10B are expected to originate in the over-steep marine terraces and canyon.

- Based upon a review of Outfall SNI014 information presented in "San Nicolas Island Area of Special Biological Significance Industrial Storm Water Discharge Survey" (Navy 2012), the

outfall is 190 feet from the tideline along Beach Road. The area between the outfall and tideline is a sandy active beach. The drainage channel crosses Beach Road and passes through notches in the base of K-Rail placed along the downstream side of the road. Sediment appears to be accumulating in the drainage channel up to 300 feet upstream of the road, and on the road. Sediment is periodically removed from the road or displaced by aeolian transport.

- Given the long reach of the sand-filled channel upstream of the road, width of the beach, and amount of water retained by such a large volume of channel sediment and beach sand, it is unlikely that water reached the tideline during the observed winter 2013–2014 storm events. If water reached the tideline, the energy of the water would not likely have been great enough to transport sediment to the tideline, given the energy loss upstream of the K-Rail.

DA-11 Watershed (Outfall SNI015A and Outfall SNI015B)

- Minimal runoff occurred from DA-11—a small, sparsely vegetated watershed composed of over-steep marine terrace canyons—during the storm on February 6, 2014 (0.19 inch), under dry initial soil conditions (AMC I). The runoff was limited to the approximately 2-acre paved barge landing area, and amounted to 0.0007 MG (0.004 CFS).

- Runoff volume from DA-11 during the storm on February 27-28, 2014 (0.54 inch, 6-hour), was 0.0123 MG (0.076 CFS) under dry initial soil conditions (AMC I). The runoff was limited to the approximately 2-acre paved barge landing area. Runoff did not occur within the 3 acres of beaches or the 22 acres of ravines and canyons, as approximately 0.67 and 1.4 inches of precipitation is required to generate runoff from these portions of DA-11.

- Runoff volume from DA-11during the storm on November 29, 2013 (0.70 inch, 6-hour) was 0.0199 MG (0.123 CFS) under dry initial soil conditions (AMC I). Approximately 1 percent of the runoff occurred within 22 acres of ravines and canyons, and 99 percent occurred within the 2-acre barge landing area of DA-11. Runoff did not occur within the remaining 3 acres of beaches, as approximately 1.4 inches of precipitation is required to generate runoff from this portion of DA-11.

- Because the barge landing area is mostly paved, most of the solids loading from DA-11 are expected to originate in the sparsely vegetated, over-steep marine terraces and canyon above the landing area. Runoff from the canyon appears to be diverted around the barge landing area.

- Outfalls SNI015A and SNI015B are below the barge landing area and approximately 80 feet above the tideline. The drainage area between the outfall pipes and tideline is a sandy active beach. The outfall pipes appear to collect drainage only from the concrete barge landing area and the upslope DA 11 drainage. The beach slope immediately below the outfall pipes is partially covered in riprap rock. A slight drainage swale is apparent on the beach between Outfall SNI015A and the tideline.

- Given the limited distance between the two outfalls and the tideline, and observation of a slight drainage swale on the beach, it is likely that water reached the tideline during at least the largest of the observed winter 2013–2014 storm events.

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FIGURE

TABLES

Table B-1. Physical Conditions, Prediction of Curve Numbers, and Minimum Rainfall Required to Generate Runoff

Watershed Subbasin	Outfall	Area Type	Soil Type	Vegetation Cover	Hydrologic Condition	CN AMC I	CN AMC II	CN AMC III	% Area	Area (acres)	Minimum Rainfall to Generate AMC I Runoff (in)	Minimum Rainfall to Generate AMC II Runoff (in)	Minimum Rainfall to Generate AMC III Runoff (in)
DA-1	**SNI019**	Range/Scrub	D	Undisturbed, >75% cover	Good, moderate slopes	54	73	87	86.7	534	1.70	0.74	0.30
616 Acres	(ASBS	Erosional	D	Average of 25% veg cover	Poor, oversteep	75	88	95	5.4	33	0.65	0.27	0.10
	Biomonitoring)	Beach	A	No cover	Poor	59	77	89	0.3	2	1.40	0.60	0.25
		Urban/Ind	D	Average of 55% impervious	Fair	83	93	97	7.6	47	0.40	0.15	0.06
DA-3	**SNI023**	Range/Scrub	D	Undisturbed, >75% cover	Good, moderate slopes	54	73	87	92.4	617	1.70	0.74	0.30
668 Acres		Erosional	D	Average of 50% veg cover	Fair, oversteep	66	82	92	3.9	26	1.04	0.44	0.17
		Urban/Ind	D	Average of 83% impervious	Poor	87	95	98	3.7	25	0.30	0.10	0.04
DA-6	**SNI024**	Range/Scrub	D	Undisturbed, 50-75% cover	Fair, moderate slopes	59	77	89	86.9	901	1.39	0.60	0.25
1037 Acres		Erosional	D	Average of 25% veg cover	Poor, oversteep	75	88	95	3.3	34	0.67	0.27	0.10
		Urban	D	Average of 43% impervious	Good	80	91	97	9.8	102	0.50	0.20	0.06
DA-8	**SNI004**	Range/Scrub	D	Undisturbed, >75% cover	Good, moderate slopes	54	73	87	36.7	21.4	1.70	0.74	0.30
58.3 Acres		Erosional	D	Average of 15% veg cover	Poor, oversteep	75	88	95	35.9	20.9	0.65	0.27	0.10
		Beach	A	No cover	Poor	59	77	89	18.4	10.7	1.40	0.60	0.25
		Urban	D	Average of 65% impervious	Fair	83	93	97	9	5.3	0.40	0.15	0.06
DA-10B	**SNI014**	Range/Scrub	D	Undisturbed, 50-75% cover	Fair, moderate slopes	59	77	89	21.9	22.4	1.39	0.60	0.25
102 Acres		Erosional	D	Average of 25% veg cover	Poor, oversteep	75	88	95	76.7	78.2	0.67	0.27	0.11
		Beach	A	No cover	Poor	59	77	89	1.4	1.4	1.39	0.60	0.25
DA-11	**SNI015A and 015B**	Erosional	D	Average of 25% veg cover	Poor, oversteep	75	88	95	81.7	22.4	0.67	0.27	0.11
27.4 Acres	(ASBS	Beach	A	No cover	Poor	59	77	89	9.9	2.7	1.39	0.60	0.25
	Discharge)	Urban	D	Average of 95% impervious	Poor	95	98	99	8.4	2.3	0.11	0.04	0.02

Notes:

% = Percent
\> = Greater than
AMC = Antecedent moisture condition
CN = Curve number
in = Inch

CN AMC I = Curve number used when 5-day cumulative precipitation prior to the storm event is less than 0.5 inch
CN AMC II = Curve number used when 5-day cumulative precipitation prior to the storm event ranges from 0.5 inch to 1.1 inches
CN AMC III = Curve number used when 5-day cumulative precipitation prior to the storm event exceeds 1.1 inches

AMC I Conditions occur 1176/1663 or 70.7 % of the time in the precipitation record
AMC II Conditions occur 285/1663 or 17.1 % of the time in the precipitation record
AMC III Conditions occur 201/1663 or 12.1 % of the time in the precipitation record

A = Soil Type A has high infiltration rates and is well drained, typical of beach sands and channel sediments.
D = Soil Type D has very slow infiltration rates with fine textures and layers impeding vertical migration, typical of marine silts and clays and shale terraces. At SNI, these include Vizcapoint and Jehemy Soils.

Table B-2. Storm Water Runoff Under Various Soil Moisture Conditions and for Storm Sizes

Watershed Subbasin	Outfall	Area Type	CN AMC I	CN AMC II	CN AMC III	% Area	AMC II **0.25 inch** Storm Runoff Volume (gal)	AMC I **0.5 inch Storm** Runoff Volume (gal)	AMC II **0.5 inch Storm** Runoff Volume (gal)	AMC I **1.0 inch Storm** Runoff Volume (gal)	AMC II **1.0 inch Storm** Runoff Volume (gal)	AMC I **1.5 inch Storm** Runoff Volume (gal)	AMC II **1.5 inch Storm** Runoff Volume (gal)	AMC I Max Historic **(3.25 inch)** Storm Runoff Volume (gal)	AMC II Max Historic **(1.98 inch)** Storm Runoff Volume (gal)	AMC III Max Historic **(2.72 inch)** Storm Runoff Volume (gal)
DA-1	**SNI019**	Range/Scrub	54	73	87	86.7	0	0	0	0	248,105	0	1,879,583	3,444,523	4,516,002	21,707,823
616 Acres	(ASBS	Erosional	75	88	95	5.4	0	0	29,092	27,152	226,664	149,338	520,897	1,010,662	850,474	1,950,307
	Biomonitoring)	Beach	59	77	89	0.3	2,483	0	0	0	2,597	93	11,374	21,330	23,757	89,534
		Urban/Ind	83	93	97	7.6	0	4,873	141,405	168,568	574,766	483,412	1,105,513	2,106,070	1,654,137	3,038,672
							2,483	**4,873**	**170,497**	**195,721**	**1,052,131**	**632,844**	**3,517,368**	**6,582,586**	**7,044,370**	**26,786,336**
DA-3	**SNI023**	Range/Scrub	54	73	87	92.4	0	0	0	0	286,668	0	2,171,728	3,979,908	5,217,928	25,081,886
668 Acres		Erosional	66	82	92	3.9	0	0	1,163	0	80,607	27,707	244,059	471,878	448,699	1,339,844
		Urban/Ind	87	95	98	3.7	21,191	16,200	114,836	152,004	382,410	363,345	687,375	1,329,902	993,636	1,689,930
							21,191	**16,200**	**116,000**	**152,004**	**749,685**	**391,051**	**3,103,162**	**5,781,688**	**6,660,262**	**28,111,660**
DA-6	**SNI024**	Range/Scrub	59	77	89	86.9	0	0	0	0	1,169,837	42,062	5,124,070	9,609,384	10,702,415	40,335,268
1037 Acres		Erosional	75	88	95	3.3	0	0	29,973	27,975	233,532	153,864	536,682	1,041,288	876,246	2,009,407
		Urban	80	91	97	9.8	7,247	0	195,882	230,795	995,005	791,299	2,049,735	3,989,463	3,174,322	6,594,564
							7,247	**0**	**225,855**	**258,771**	**2,398,373**	**987,224**	**7,710,487**	**14,640,136**	**14,752,982**	**48,939,240**
DA-8	**SNI004**	Range/Scrub	54	73	87	36.7	0	0	0	0	9,943	0	75,324	138,039	180,978	869,939
58.3 Acres		Erosional	75	88	95	35.9	0	0	18,425	17,197	143,554	94,581	329,902	640,086	538,633	1,235,194
		Beach	59	77	89	18.4	0	0	0	0	13,893	500	60,852	114,118	127,099	479,009
		Urban	83	93	97	9	1,671	549	15,946	19,009	64,814	54,512	124,664	237,493	186,530	342,659
							1,671	**549**	**34,371**	**36,205**	**232,203**	**149,593**	**590,742**	**1,129,736**	**1,033,241**	**2,926,801**
DA-10B	**SNI014**	Range/Scrub	59	77	89	21.9	0	0	0	0	29,084	1,046	127,391	238,901	266,076	1,002,786
102 Acres		Erosional	75	88	95	76.7	0	0	68,939	64,343	537,124	353,886	1,234,369	2,394,963	2,015,366	4,621,636
		Beach	59	77	89	1.4	0	0	0	0	1,818	65	7,962	14,931	16,630	62,674
							0	**0**	**68,939**	**64,343**	**568,025**	**354,997**	**1,369,722**	**2,648,796**	**2,298,071**	**5,687,096**
DA-11	**SNI015A and 015B**	Erosional	75	88	95	81.7	0	0	19,747	18,431	153,856	101,369	353,579	686,025	577,291	1,323,845
27.4 Acres	(ASBS	Beach	59	77	89	9.9	0	0	0	0	3,506	126	15,355	28,796	32,072	120,872
	Discharge)	Urban	95	98	99	8.4	6,612	10,565	19,853	35,182	49,392	63,238	79,946	168,234	109,572	162,523
							6,612	**10,565**	**39,600**	**53,612**	**206,755**	**164,733**	**448,880**	**883,055**	**718,935**	**1,607,239**

Notes:

% = Percent

Storm sizes based on 1933 to 2010 precipitation record from Western Region Climatic Center (WRCC) website, http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca7870

AMC = Antecedent moisture condition

ASBS = Areas of Special Biological Significance

CN = Curve number

gal = Gallon

CN AMC I = Curve number used when 5-day cumulative precipitation prior to the storm event is less than 0.5 inch

CN AMC II = Curve number used when 5-day cumulative precipitation prior to the storm event ranges from 0.5 inch to 1.1 inches

CN AMC III = Curve number used when 5-day cumulative precipitation prior to the storm event exceeds 1.1 inches

AMC I Conditions occur 1176/1663 or 70.7 % of the time in the precipitation record

AMC II Conditions occur 285/1663 or 17.1 % of the time in the precipitation record

AMC III Conditions occur 201/1663 or 12.1 % of the time in the precipitation record

Table B-3. Storm Water Runoff During Winter 2013-2014 Storm Events

Watershed Subbasin	Outfall	Area Type	CN AMC I	CN AMC II	CN AMC III	% Area	AMC I 2/6/14 (0.19 inch) Storm Runoff Volume (gal)	AMC I 2/27 - 2/28/14 (0.54 inch) Storm Runoff Volume (gal)	AMC I 11/29/13 (0.70 inch) Storm Runoff Volume (gal)
DA-1	**SNI019**	Range/Scrub	54	73	87	86.7	0	0	0
616 Acres	(ASBS	Erosional	75	88	95	5.4	0	0	296
	Biomonitoring)	Beach	59	77	89	0.3	0	0	0
		Urban/Ind	83	93	97	7.6	0	9,955	46,008
							0	**9,955**	**46,304**
DA-3	**SNI023**	Range/Scrub	54	73	87	92.4	0	0	0
668 Acres		Erosional	66	82	92	3.9	0	0	0
		Urban/Ind	87	95	98	3.7	0	22,747	57,631
							0	**22,747**	**57,631**
DA-6	**SNI024**	Range/Scrub	59	77	89	86.9	0	0	0
1037 Acres		Erosional	75	88	95	3.3	0	0	305
		Urban	80	91	97	9.8	0	1,745	41,030
							0	**1,745**	**41,335**
DA-8	**SNI004**	Range/Scrub	54	73	87	36.7	0	0	0
58.3 Acres		Erosional	75	88	95	35.9	0	0	187
		Beach	59	77	89	18.4	0	0	0
		Urban	83	93	97	9	0	1,123	5,188
							0	**1,123**	**5,375**
DA-10B	**SNI014**	Range/Scrub	59	77	89	21.9	0	0	0
102 Acres		Erosional	75	88	95	76.7	0	0	701
		Beach	59	77	89	1.4	0	0	0
							0	**0**	**701**
DA-11	**SNI015A and 015B**	Erosional	75	88	95	81.7	0	0	201
27.4 Acres	(ASBS	Beach	59	77	89	9.9	0	0	0
	Discharge)	Urban	95	98	99	8.4	734	12,281	19,704
							734	**12,281**	**19,905**

Notes:

% = Percent
AMC = Antecedent moisture condition
ASBS = Areas of Special Biological Significance
CN = Curve number
gal = Gallon

Precipitation record from Mesowest Real Time Observation Monitor and Analysis Network website
http://raws.wrh.noaa.gov/cgi-bin/roman/past.cgi?stn=KNSI&day1=9&month1=10&year1=2013

CN AMC I = Curve number used when 5-day cumulative precipitation is less than 0.5 inch