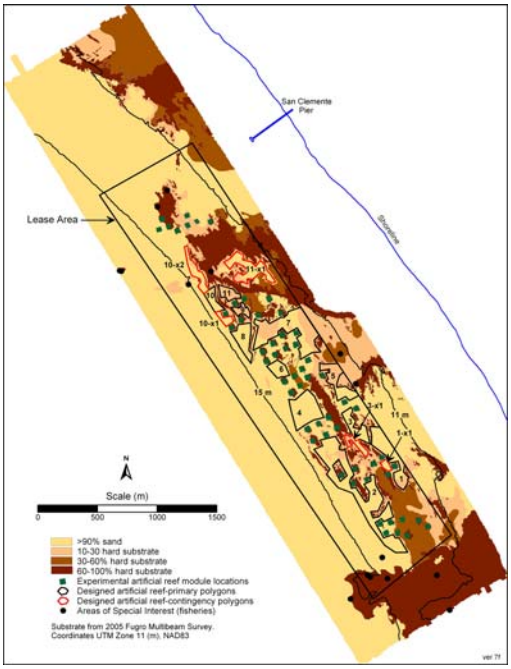
FINAL DESIGN PLAN

WHEELER NORTH REEF AT SAN CLEMENTE, CALIFORNIA
(SONGS ARTIFICIAL REEF MITIGATION PROJECT, PHASE 2 MITIGATION REEF)

COASTAL DEVELOPMENT PERMIT #E-07-010



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EXECUTIVE SUMMARY

This Final Design Plan is for the Phase 2 Mitigation Reef (the SONGS Mitigation Reef), now called the Wheeler North Reef, in San Clemente, California. On April 17, 2006, the California State Lands Commission (CSLC) adopted a resolution declaring that the SONGS Mitigation Reef would be named in honor of Dr. Wheeler North. The Executive Director of the California Coastal Commission (CCC) approved the Southern California Edison Company (SCE) Phase 2 Mitigation Reef Preliminary Design Plan (Coastal Environments, 2006) before the Commission on August 8, 2006. This Final Design Plan is intended to satisfy Section 2.1 of Condition C (Coastal Development Permit No. 6-81-330-A), which requires SCE to submit a "final mitigation plan to the Commission in the form of a coastal development permit application" for the location and design of the Phase 2 Mitigation Reef.

The Final Design Plan presented herein creates a 127.6-acre, low profile (<1 m), single-layer reef. This Phase 2 Mitigation Reef will be constructed of quarry rock, which will be distributed on the benthos in quantities similar to those of the lowest substrate density, 42% bottom coverage, used for the 22.4-acre Phase 1 Experimental Reef, constructed in September 1999. The design of the Phase 2 Mitigation Reef consists of 11 polygons, varying in area from 2.4 to 37.5 acres. A total of 8 contingency polygons (34.0 acres total) were designed as potential alternative or additional reef construction areas. These alternative sites will be used if it is determined during Phase 2 construction fieldwork that the final plan anchoring locations would directly or indirectly impact valuable biological resources without the modification of certain parts of the 11 primary polygon areas, or if surveys indicate inadequate areal coverage. The alternative sites may also be used for future remediation if the Wheeler North Reef fails to meet the established performance standards laid out in Coastal Commission Permit No. 6-81-330-A (SONGS Units 2 & 3), Section 2.4, Condition C.

The siting of the reef polygons for the Final Design Plan relied primarily on historical kelp canopy maps and the results of multi-beam and sub-bottom profiling sonar surveys (2005) conducted at the offshore lease site and subsequently verified (ground-truthed) by diver surveys (Coastal Environments and Fugro Pelagos, 2006b,c). In addition, the diver surveys evaluated the biological character of the lease area. The design also considers the historical physical and biological data collected during previous studies in the area and the results of experimental reef monitoring between 1999 and 2004 by Reed et al. (2005). In addition, the CCC and its contract scientists and Scientific Advisory Panel all contributed to the design and siting decisions for the Phase 2 Mitigation Reef.

The final reef design achieves the following: 1) it locates the Phase 2 Mitigation Reef in close proximity to the San Mateo Kelp Bed; 2) it avoids hard substrate areas; 3) it maintains the integrity of the Phase 1 Experimental Reef modules; 4) it provides for navigation channels; and 5) it avoids areas of historical kelp growth as well as areas of special interest to local fisheries.

The reef construction material will consist exclusively of quarry rock cast upon the appropriate benthic substrate in a single-layer deposition at a density of approximately 790 tons per acre (42% bottom coverage as determined by point-of-contact method developed by CCC contract scientists). This quarried construction material will conform to California Department of Fish and Game material specifications for augmentation of artificial reefs. The reef construction duration is estimated at 100 working days.

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1.0 INTRODUCTION

The objective of this report is to present the Final Design Plan for the Phase 2 Mitigation Reef of the Wheeler North Reef (the SONGS Artificial Reef Mitigation Project) at San Clemente, California[1]. The Phase 2 Final Design Plan calls for the addition of at least 127.6 acres to the existing 22.4 acres built in September 1999 for Phase 1 (the Experimental Reef). The project area is located offshore of San Clemente, California, in water depths of approximately 11.5 to 15 meters (38 to 49 ft) (Figure 1-1). The project area is an 862-acre leased parcel located 0.6 miles offshore of the San Clemente beach between the San Clemente City Pier to the north and San Mateo Point, approximately 2.5 miles to the south (Figure 1-2).

The Experimental Artificial Reef constructed during Phase 1 consists of 56 modules. Each module has a two-dimensional footprint of 40 m x 40 m (132 ft x 132 ft). The modules are grouped into seven clusters or blocks in the leased area. Phase 1 was designed to test the suitability of the primary site (San Clemente), as determined by the 1997-99 PEIR site selection process in sustaining a giant kelp forest community. In addition, construction material suitability (rock vs. concrete), density of hard substrate coverage on the bottom (17%, 34%, and 67%), and biological community assessments (including kelp community density differences as a function of distance from the adjacent existing natural kelp bed, the San Mateo Kelp Bed) were studied and evaluated.

The successful construction of the Experimental Artificial Reef in 1999 (Coastal Environments, 1999a,b) and the completion of the five-year study, "Findings and Recommendations of the Experimental Phase of the SONGS Artificial Reef Mitigation Project" (Reed et al., 2005) provided the basis for the Phase 2 plan to add at least 127.6 acres to the existing reef. The completion of Phase 2 will fulfill Coastal Commission Permit No. 6-81-330-A (SONGS Units 2 & 3), Condition C, Kelp Reef Mitigation, of April 9, 1997, which mandated the completion of a 150-acre artificial reef subject to compliance monitoring by the California Coastal Commission (CCC). This Phase 2 Mitigation Reef Final Design Plan is intended to satisfy Section 2.1 of Condition C, which requires SCE to "submit a final mitigation plan to the CCC in the form of a coastal development permit application." This plan specifies location, depth, overall hard substrate coverage, size and dispersion of reef materials, and reef relief, and it substantially conforms to the preliminary plan approved by the Executive Director.

[1] On April 17, 2006, the California State Lands Commission adopted a resolution declaring the SONGS Mitigation Reef to be hereby and in perpetuity dedicated in honor of Dr. Wheeler North. All future references to the SONGS Mitigation Reef will be succeeded by the adopted name, "Wheeler North Reef."

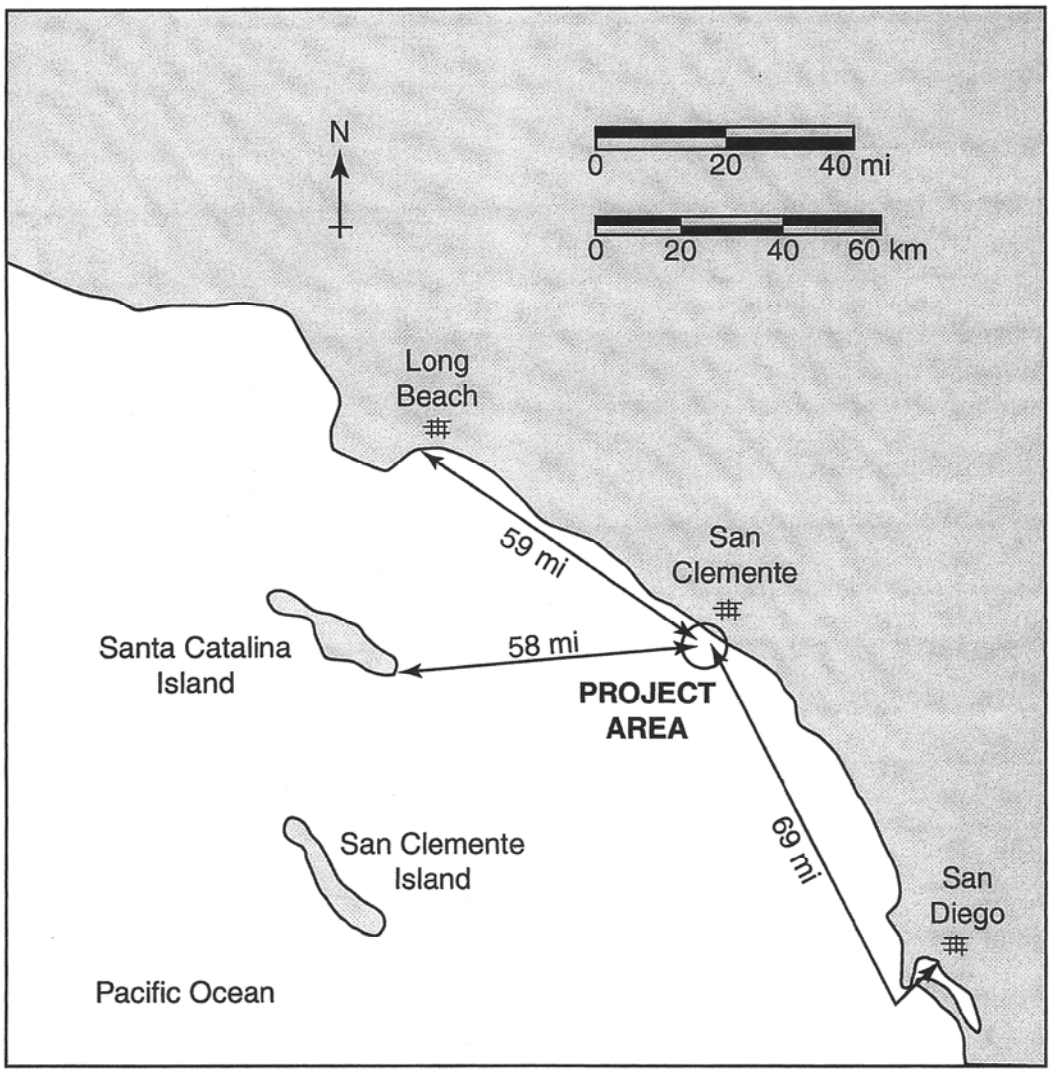

Figure 1-1. Location map of the project site.

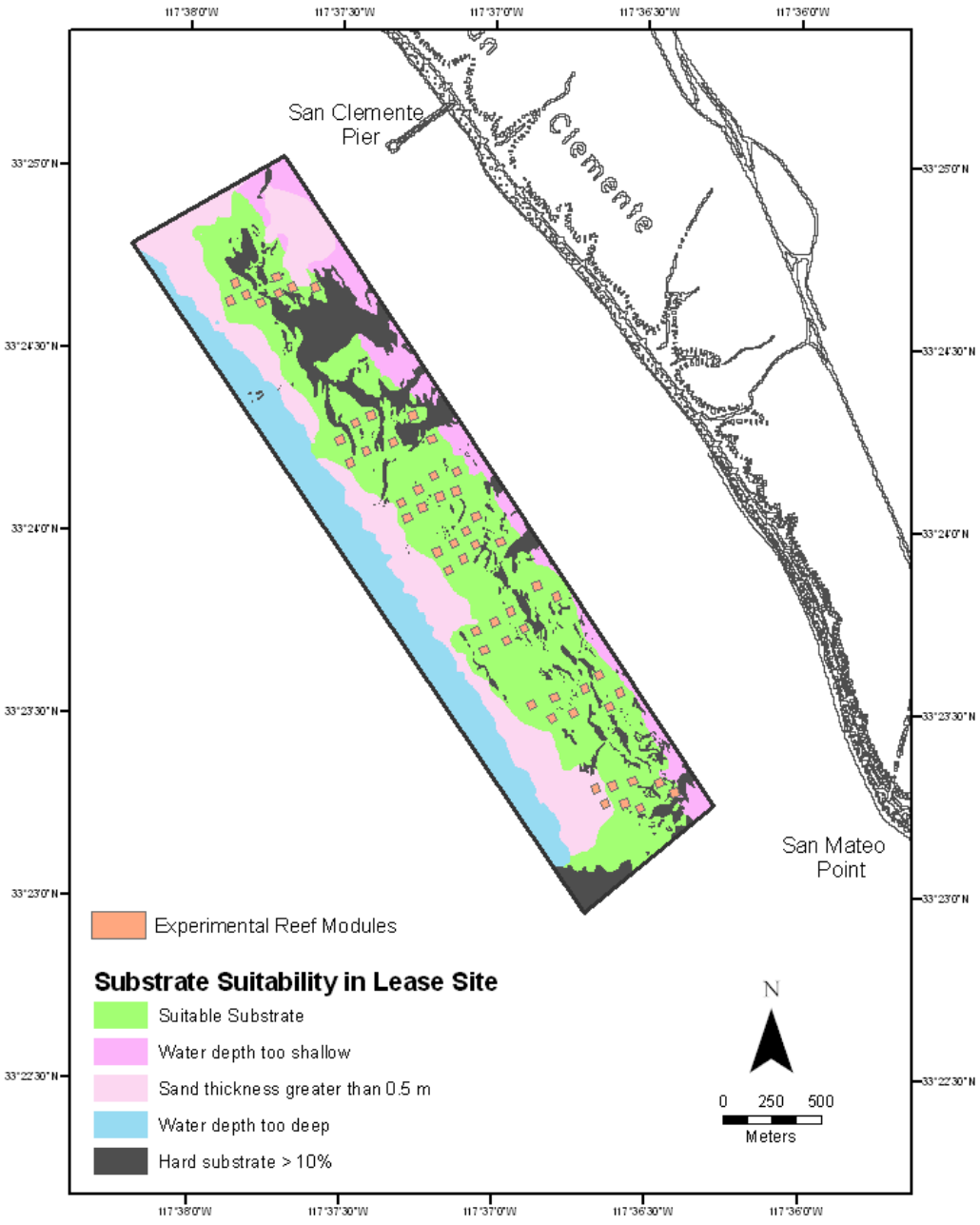

Figure 1-2. Map showing the location of the SONGS Artificial Reef Mitigation Project, including the 862-acre lease area, the 356-acre suitable reef placement area, and the 56 modules of the experimental reef (small squares) grouped into seven blocks. From Resource Insights (1999).

Reed et al. (2005) conducted the five-year monitoring study, which concluded that the experimental kelp reef shows a high probability of meeting the performance standards established by the California Coastal Commission, as stated in their Coastal Development Permit No. 6-81-330-A (CCC, 1997). The findings and recommendations of Reed et al (2005) formed the basis of the Executive Director's determination that the mitigation reef shall be built of quarry rock or rubble concrete that covers at least 42% (but no more than 86%) of the seafloor. The Commission concurred with the Executive Director's determination for the type and percent cover of hard substrate on October 12, 2005.

The design parameters specified in this Final Design Plan for the Phase 2 Mitigation Reef will create a nominal 127.6-acre reef of low relief constructed from quarry rock. These parameters are similar to those used in the construction of the lowest substrate coverage modules utilized in the Phase 1 Experimental Reef project. This Final Design Plan applies data from historical kelp canopy maps and the results of multi-beam and sub-bottom profiling sonar surveys conducted offshore of San Clemente during late October and November 2005 to determine the Phase 2 Mitigation Reef polygon locations. The electronic surveys were ground-truthed by diver surveys in February 2006 (Coastal Environments et al., 2006a,b), which included the collection of marine biological data. The design also takes into account historical physical and biological data (e.g. kelp canopy records from 1967 to 2006) collected during previous studies in the area, and the results of experimental reef monitoring between 1999 and 2004 by Reed et al. (2005). The CCC staff, CCC's contract scientists, and CCC's Scientific Advisory Panel all contributed to design and siting decisions for the Phase 2 Mitigation Reef.

The remainder of this design package is divided into the following Sections:

Section 2	Communication Plan during Phase 2 Reef Construction
Section 3	Previous Reef Studies
Section 4	Reef Design Criteria & Specifications
Section 5	Construction Material Specifications
Section 6	Construction Methods
Section 7	Density Verification Plan
Section 8	Construction Quality Control
Section 9	CEQA & NEPA Permitting
Section 10	Project Schedule

2.0 COMMUNICATION PLAN

2.1 GENERAL

Effective, comprehensive communication is fundamental to the successful completion of the construction of the Phase 2 Mitigation Reef. This plan facilitates the flow of essential information linking the various stakeholders during the construction and post-construction parts of the Phase 2 reef project. The construction phase is the period involved with the actual building of the artificial reef and involves all aspects associated with the project during construction. The post-construction phase involves the submittal of the final report and approval of the California Coastal Commission (CCC) of the construction of the reef.

Southern California Edison (SCE) is both the majority owner and operator of the San Onofre Nuclear Generating Station (SONGS), and has responsibility for the successful completion of this mitigation reef. SCE has retained Coastal Environments (CE) as the general manager and Connolly-Pacific Co. (CPC) as the construction contractor.

The plan is a matrix of communication pathways by which two-way information flows between SCE, its contractors, and the regulatory agencies. This communication network will distribute information concerning all project status issues, regulatory issues, and emergency events (Figure 2-1). Feedback comments, or requests for information and/or from the CCC staff or any responsible public agency will be considered and the proper response will be offered via the communication pathways shown in Figure 2-1. Adherence to the proposed communication model will help to assure a successful outcome of the second phase of the reef construction.

2.2 COMMUNICATION ELEMENTS

The following elements are the major components of this plan and are meant to demonstrate pathways of communication. These pathways are not exclusive and should not be construed as the only communication conduits. SCE realizes that a significant portion of communication may occur via informal pathways.

2.2.1 Pre-Construction Meeting [2]

SCE will host a preconstruction meeting, to include lead and responsible public agencies, military agencies, consultants, contractor, city and local officials, and any other interested parties. The meeting's agenda will consist of a presentation of the project scope, construction methods, schedule, public agency permitting status, and the communication process.

2.2.2 Daily Communications [3]

There will be a daily meeting at the site between an SCE representative, CPC, and CE to discuss daily tasks, progress and safety issues.

[2] Not included in flow chart
[3] Internal to SCE, CE, and CPC

2.2.3 Changes in Design, Anchoring, and Construction Methods

CE will immediately notify SCE of any significant delays or changes to the construction plan. SCE will, in turn, immediately notify the CCC of these changes. This will include notifying CCC staff of any new or altered anchor locations immediately.

2.2.4 Polygon Completion

As soon as the first two polygons are constructed, they will be surveyed by CE to verify that construction has been done according to plan; the results will be provided to the SCE project manager to forward to the CCC staff and technical advisers. After completion of each subsequent polygon, CCC staff and scientists will be immediately informed by SCE.

2.2.5 Bi-Weekly Communications

A written status report will be submitted to CCC staff consisting of all project status issues including, but not limited to, the following.

- Design Changes
- Polygon Completion Status
- Site Health & Safety Issues
- Spill Control & Counter Measures Events
- Vessel Groundings & Counter Measures Events
- Anchoring Status
- Quality Control Status
- Construction Method Changes

2.2.6 Non-Scheduled Events

SCE will immediately notify (verbally) the CCC and other responsible agencies immediately of any event that may affect public safety and/or health. SCE or CE will notify the CCC of these occurrences. Construction non-scheduled events will be recorded and submitted in the bi-weekly status report.

2.2.7 Informal Status Reporting

SCE or CE will verbally communicate any construction-related issue directly to the CCC staff. Verbal communications will be documented in the bi-weekly status report.

2.2.8 Public Issues

In addition to the public agencies identified in Figure 2-1, SCE will notify the City of San Clemente and the County of Orange of any construction events that may affect the health and/or safety of the public at large.

The construction of the Wheeler North Reef, Phase 2 Mitigation Reef, will be announced to the public through local newspapers and signs posted on San Clemente Pier and inside San Clemente City Hall. The public will be provided with a hotline phone number. Their calls will be promptly answered by SCE or its representatives.

2.2.9 Site Health and Safety

In the event of an injury or a work interruption executed upon determination of an imminent safety hazard or potentially dangerous situation, the construction manager (CE) and SCE will both be notified immediately by the Site Health and Safety Manager (SHSM).

2.2.10 Spills and Grounding

A plan for managing spills due to diesel fuel, oils, pipe leakage, and groundings is presented in Appendix E of this Final Design Plan. The spills and groundings plan includes who to contact in case of an accident and who to notify immediately at the proper agency. A list of key contact personnel will be posted at the construction barrage.

The Management of Accidental Discharge Plan (Appendix E) addresses the various types of potential spills from this project, including groundings, and the procedure to follow in each case. For operational spills, the vessel foreman will notify the local Marine Safety Officer (MSO), which is the USCG, and NRC Environmental, in order to contain and/or remove the oil from the marine environment. In case of grounding, the vessel foreman will notify the MSO, California Office of Emergency Services (OES); if there is a spill associated with the grounding, NRC Environmental will be contacted to contain and/or remove the oil from the marine environment. If a spill or grounding should occur in the vicinity of a harbor or port, then the appropriate harbor/port authority will be contacted. In either case, the construction manager (CE) and SCE will be notified by the vessel foreman or designee immediately.

2.2.11 Verification of Construction

Verification of final construction will be the responsibility of SCE. All the collected data will be processed, summarized, and plotted in graphic and tabular format as appropriate. A report will be prepared and submitted to CCC for final approval. Full cooperation between SCE and CCC's technical staff will ensure successful verification of the constructed reef.

2.2.12 Post-Construction

A final report will be prepared and submitted to CCC. This report will provide information about material used in reef construction, construction techniques, construction verification, compliance with permits, photographs, conclusions, and references.

2.2.13 Summary

A flow chart showing the communication plan is shown in Figure 2-1. Table 2-1 contains the names and contact information for the primary project management personnel, corporate office numbers, and emergency numbers and contact information.

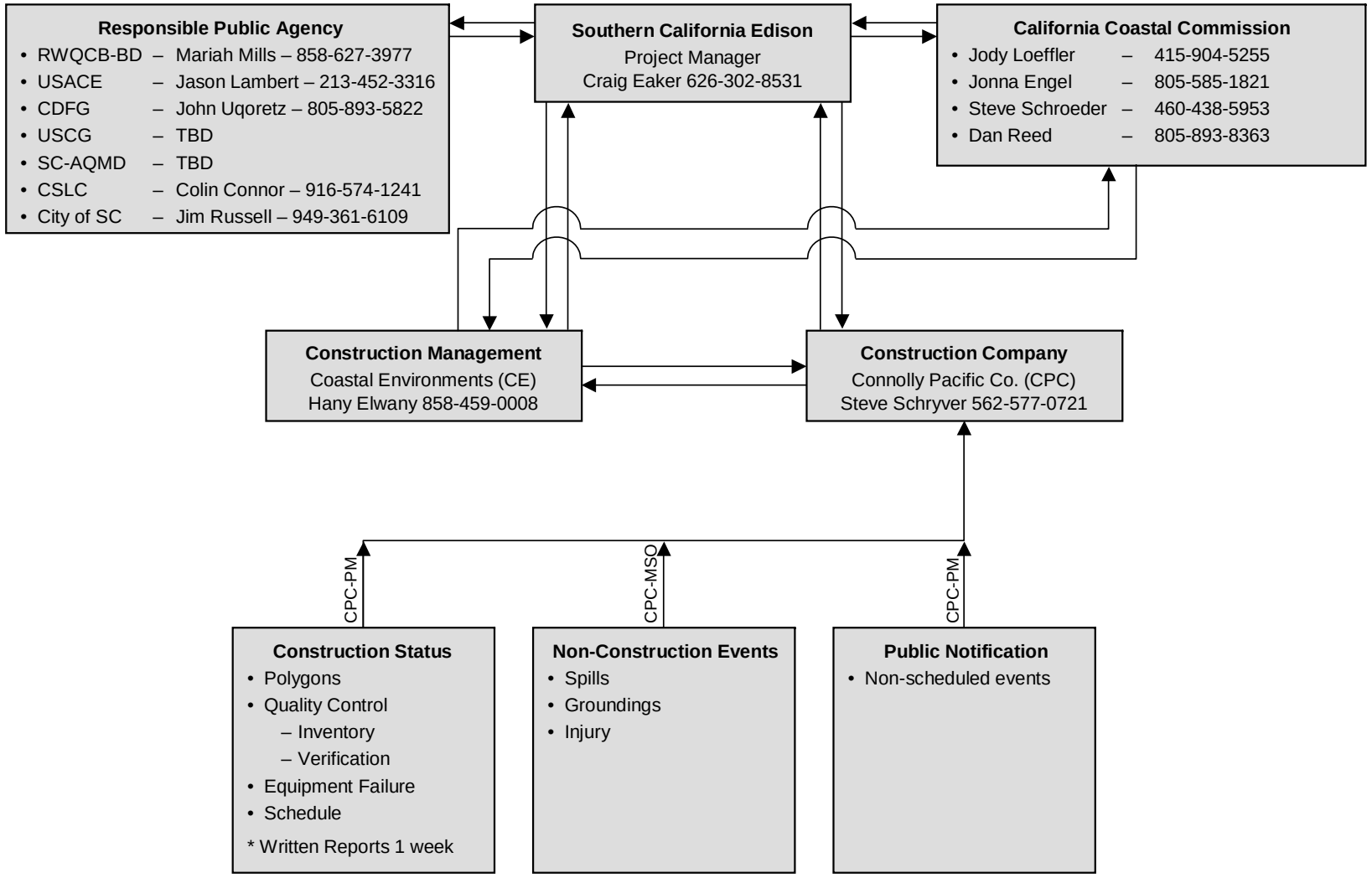

Figure 2-1. Artificial reef communications flow chart for use during construction.

Table 2-1. Key stakeholders & contact information

Title	Name	Phone #	Email/Address
Project Owner, Southern California Edison			
SCE Senior Manager	Dr. David Kay	(626) 302-2149	David.Kay@sce.com
SCE Project Manager	Mr. Craig Eaker	(626) 302-8531	Craig.Eaker@sce.com
Construction Manager, Coastal Environments			
Construction Manager	Dr. Hany Elwany	(858) 459-0008	hany@coastalenvironments.com
Construction Company, Connolly-Pacific Company			
Project Manager	Mr. Steve Schryver Mr. Dave Scott Ron Allard	(562) 437-2831 (310) 539-0568 (562) 577-0725 cell (562) 866-5877 (562) 577-0814 cell	Steve.Schryver@conpaco.com
California Coastal Commission			
Technical Adviser	Dr. Steve Schroeder	(760) 438-5953	schroete@lifesci.ucsb.edu
Technical Adviser	Dr. Dan Reed	(805) 893-7047	reed@lifesci.ucsb.edu
Spills / Grounding			
United States Coast Guard CA Office of Emergency Services Oceanside Harbor Police Long Beach Port Authority San Diego Port Authority CA Department of Fish & Game Regional Water Quality Control Board, San Diego	 Sylvia C. Rios John Uqoretz Mariah Mills	(800) 424-8802 (National) (310) 521-7380 (Long Beach) (800) 852-7550 (760) 433-9111 (562) 437-0041 (619) 686-6200 (805) 893-5822 (858) 627-3977	 srios@portofsandiego.org mmills@waterboards.ca.gov
City of San Clemente			
Emergency Office	Mr. Jim Russell	(949) 361-6109	RusselJ@san-clemente.org 100 Avenida Presidio San Clemente, CA 92672
Emergency Medical			
Dana Point Medical		(949) 240-2555	34052 La Plaza, #102 Dana Point, CA 92629
Mission Urgent Care		(760) 722-3203	616 South Coast Hwy. Oceanside, CA 92054

3.0 REEF STUDIES RELEVANT TO DESIGN CONSIDERATIONS

3.1 MONITORING OF THE EXPERIMENTAL REEF

A five-year study was carried out to monitor the 22.4-acre Experimental Artificial Reef built in September 1999. This study was a requirement of the project's CCC permit (CCC, 1997). The results of the 1999-2004 initial experimental phase study were to be used to:

1. "Assess the feasibility of using an artificial reef as mitigation for replacing the kelp forest resources lost at San Onofre, and
2. Provide insight into the artificial substrate types and configurations that will have the greatest chance of meeting the performance standards used to evaluate the success of the mitigation reef" (Reed et al., 2005).

The results of this monitoring program and the recommendations for the final build-out reef are presented in Reed et al. (2005). In summary, they found that the design aspects of the Experimental Artificial Reef were quite promising, that is, all six artificial reef designs and all seven locations (blocks) showed nearly equally high tendencies to meet the CCC permit performance standards established for the mitigation reef (CCC, 1997). They concluded that the densities of giant kelp, fish, and benthic invertebrates on the artificial reef modules were similar to or greater than those on the nearby reference reefs. Only the abundance and numbers of species of understory algae were lower on the artificial reef modules than on the natural reefs.

Reed et al. (2005) stated that the presence of understory algae is not likely to remain at low levels, but will increase over the long term due to natural disturbances. They concluded that a low-relief concrete rubble or quarry rock reef constructed off the coast of San Clemente, California had a very good chance of providing adequate in-kind compensation for the loss of kelp forest biota caused by the operation of SONGS Units 2 & 3. They warned, however, that the data they collected on recruitment, growth, and survivorship of the sea fan, *Muricea,* during the experimental phase indicated that it was reasonable to expect high densities of large *Muricea* to eventually inhabit the mitigation reef.

Reed et al. (2005) recommended that the final reef should be made of quarry rock or rubble concrete with an average vertical relief off the bottom not to exceed 1 m. Since the goal of the artificial reef is to compensate for losses to an entire kelp forest community, including giant kelp, understory algae, invertebrates, and fishes, it will be necessary for the average coverage of hard substrate to be at least as high as that of the low-coverage artificial reef design tested in the five-year experiment.

3.2 SONAR AND DIVER SURVEYS (2005-2006)

3.2.1 Sonar Surveys

Accurate maps representing bathymetry, seafloor characterization, and sub-bottom sonar surveys of sediment thickness are presented in Coastal Environments et al., 2006a,b. A multibeam system was used to obtain bathymetry data and locate sea bottom hard substrate. The bathymetry data were plotted in a 3D format to show bottom relief. The bathymetric relief, in conjunction with the backscatter data, allowed for the accurate delineation of areas of various hard substrate coverage. The use of backscatter data produces images similar to those obtained using side-scan sonar ("pseudo-side-scan sonar"). These data were used to prepare the seafloor characterization map presented in this study. The use of multibeam data was successful in characterizing the seafloor bottom, and the results were comparable to those of previous surveys that used side-scan sonar. A comparison of seafloor characterization studies conducted in 1997 (EcoSystems Management, 1997), 1999 (Coastal Environments, 1999), and 2005 (Coastal Environments, 2006a,b) shows good agreement.

Sonar surveys provided useful information about the areas that would be suitable for the SCE/SONGS Artificial Reef Mitigation Project. The bathymetry survey defined the seafloor topography within the survey area and allowed the delineation of areas suitable by depth for kelp growth (at this location, between 11-15 m). Maps of bathymetry and seafloor characterization and isopachs of sediment thickness are presented in Figures A-1 through A-3 (Appendix A). Figures A-1 and A-2 provide bathymetry and substrate information for the seafloor off San Clemente. Figure A-3 shows a 0.5 m sediment thickness isopach constructed from groundtruth probes in 1997, 1999, and 2005, in conjunction with isopach maps from 1997 and 2006.

3.2.2 Biological Observations

Biological observations were made along transects used to groundtruth the substrate characteristics mapped by the multi-beam / backscatter sonar study. The observations were made in a 1 m wide swath on either side of each 60 m long transect. The data were subdivided into 5 m increments along the transects, resulting in twelve 10 m^2 quadrants for each transect. The divers collected abundance data on epibenthic macroinvertebrates, adult and juvenile *Macrocystis*, and individuals of large algal species, such as *Laminaria*, *Pterygophora*, and *Cystoseira*. Transect locations and a summary of the biological data collected are reported in Appendix B.

The biota observed during this survey were those commonly encountered in the nearshore area along the southern California coastline and did not include sensitive or rare biotic communities, such as beds of the sand dollar *Dendraster excentricus*. There are multiple habitat types in this area, each supporting biota adapted to the particular bottom substrate and associated conditions.

Transects in areas with <10 percent hard substrate (Group A) supported species similar to those reported during past surveys in sandy areas. These Group A transects had a primarily sandy

bottom and are prime sites for placement of new areas of artificial reef if they also meet the physical requirements for reef placement. Biota associated with the sandy bottom habitat would be buried by the reef materials, but "the loss of sand bottom community biota and habitat through burial by concrete and quarry rock is considered to be a 'less-than-significant impact'," as stated in the Final Program Environmental Impact Report (Resource Insights, 1999). Additionally, many of the species found in the sandy areas are mobile and might move to avoid burial.

Areas with hard substrate coverage of 10–30 percent (Group B) supported species common to sandy bottom areas with occasional areas of hard substrate. These hard substrate areas supported additional species such as red algae, sea urchins, and the sea fan *Muricea*. The limited quantity of hard substrate in these areas consisted of small isolated patches and would not be a major impediment to reef placement. Although *Muricea* was present on two transects, it is not considered a concern, as its numbers were low. The small amount of hard substrate and isolated nature of the colonies in this substrate category are unlikely to be problems for reef placement approval. Thus, the map areas represented by the Group B transects are also acceptable sites for placement of new areas of artificial reef if they also meet the physical requirements for reef placement.

Transects representing areas with hard substrate coverage between 30 percent and 60 percent (Group C) supported understory kelps, other perennial large brown algae, and sea fans. The presence of these biota shows that at least some of the hard substrate within these areas, although surrounded by and interspersed with sand, has remained uncovered for periods long enough to support biota over several years, and these areas should be avoided when the reef is placed.

Additional information for the 30–60 percent category is available from transects that were positioned to cross boundaries of substrate categories (Group E). Transects 4 and 27B ended in this category while Transects 14 and 26 began in it. Transect 4 was entirely sand with no biota observed. Transect 27B had a substrate of 100 percent sand along the transect line, but hard substrate was observed along the sides of the transect. The substrate in the second half of the transect supported *Laminaria* kelp and the red urchin *Strongylocentrotus franciscanus*, both species associated with hard substrate. Transect 14 had a small patch of bedrock in the first 2 m, but the remainder was sand. The initial third of Transect 26 was sand with a boulder along the transect, but the presence of *Muricea* in another section indicated additional hard substrate in the area.

The results show that substrate variability in Group C is considerable, ranging from transects with no hard substrate (100 percent sand) to transects with up to 70 percent hard substrate. The areas where Transects 11 and 24 are located are not ideal for artificial reef placement. However, other transects with sections in Group C contain long expanses of primarily sand (Transects 4, 17, 26, and 27B), indicating that there may be areas appropriate for reef placement at these transects. If it is necessary to have additional areas available after those represented by Groups A and B have been determined, it may be possible to supplement with sites from the 30–60 percent hard substrate category.

Transects representing areas with hard substrate >60 percent (Group D) supported biota commonly associated with kelp such as the understory kelps *Pterygophora* and *Laminaria*, and the invertebrates *Pisaster*, *Strongylocentrotus*, and *Muricea*. As with other areas of hard substrate that support similar biota, these hard substrate areas will be avoided when the reef is placed.

For convenience, the results of the diver surveys are summarized in Table B-1, and the locations of the diver transects are shown in Figure B-1 (Appendix B).

3.3 HISTORICAL KELP ABUNDANCE

One of the primary concerns during the selection of sites for the placement of new reef material was the avoidance of any areas with significant biological resources. This was accomplished for kelp resources by using the historical records of kelp canopy that were collected by Wheeler North and MBC for the period from 1967 to 2006. The kelp canopy maps were digitized and entered into a GIS database for the region from Dana Point to Barn Kelp. The canopy locations on maps for the period from 1988 to 1993 and 1999 to 2006 were registered to substrate features found on the new substrate maps produced in 2006 (Coastal Environments and Fugro Pelagos, 2006b). This registration process is explained in detail in Appendix C.

The new canopy maps were then combined to produce a composite canopy persistence database that showed the number of years that kelp canopy was present at any location within the State Lands lease site. The boundaries of the new reef areas, including the contingency reef areas, were drawn to avoid any regions in which kelp canopy was present for more than two years in the kelp persistence database. There were a few small areas where kelp canopy with one year of presence in the persistence database were found within the new reef sites. However, in almost all cases these were found in regions where the substrate maps showed 0 to 10% hard substrate without any significant relief in the 3D bathymetry maps. We felt that these small canopy areas were likely to be drift plants or areas with residual georeferencing problems that were not corrected in the new georeferencing of the canopy maps.

3.4 CONSTRUCTION OF PHASE 1 EXPERIMENTAL ARTIFICIAL REEF

A Coastal Environments report prepared in 1999 (1999a,b) described the construction method used to build the experimental reef between August 18, 1999 and September 29, 1999. Equipment used during construction included a derrick barge with a large crane, a supply barge, a tugboat, and a support vessel. This report also described the efforts made to verify that the reef modules were constructed according to the design specifications. Verification efforts included: 1) onsite monitoring, 2) side-scan sonar surveys, 3) diver surveys, and 4) underwater video.

The average dimensions of the rock and rubble concrete used to construct the Phase 1 Experimental Reef are presented in Table 3-1. The rock/concrete weights of the various modules are presented in Table 3-2.

The minimum average amount of rock coverage on a per-acre basis for the Phase 1 Experimental Reef is approximately 790 tons. These minimum rock density modules were found to have a bottom coverage of approximately 42%, based on methods used in the CCC surveys (Reed et al., 2005).

Table 3-1. Mean and standard (Std) deviation of rock dimensions used in the Phase 1 Experimental Reef.

Sample Size	Length (inches)		Width (inches)		Height (inches)	
	Mean	Std	Mean	Std	Mean	Std
Rock	24	7	17	5	12	4
Concrete	36	15	25	11	10	4

Table 3-2. Average weight (tons) of rock/concrete for modules (40 m x 40 m) of the Phase 1 Experimental Reef.

Material	Coverage		
	Low	Medium	High
Rock	312	595	1108
Concrete	253	481	967

4.0 ARTIFICIAL REEF DESIGN

The exclusive building material for the construction of the Phase 2 Mitigation Reef will be quarry boulders. The boulder will be graded to assure a low projected profile (relief) distributed at a low-coverage density (42%, 790 tons per acre) upon the appropriate benthic substrate. The criteria used to determine and design the polygon areas for the additional reef are as follows:

- Sited within the State Lands lease area.
- Water depth between 11.5 and 15 meters.
- Sand depth 0.5 meters (± 20 %).
- Polygon areas designated as having less than 30 percent exposed hard substrate.
- Constructed in areas of no kelp presence greater than one year in the historical database from 1967 to 2004.
- Quarry rock will not be deposited within 50 meters of areas of special interest (e.g., fishing sites).
- Anchor sites will not be located in a way that would impact areas of special interest.
- Anchors will not be placed in areas that will impact hard substrate. The large areas of hard substrate at the northern edge of the San Mateo Kelp Bed will be of specific concern in anchor placement.
- Quarry rock will not be deposited within 7 meters of the existing experimental modules.
- Minimum size of reef modules will be 1600 square meters to reduce relocation of construction vessels and anchors.
- Adequate navigation channels will be provided.
- Project site is in close proximity the San Mateo Kelp Bed.

Eleven polygons were selected to construct the remaining 127.6 acres and comply with above criteria. The polygons have been overlaid onto a 3D GIS map of the seafloor bathymetry (Figure 4-1), and the calculated area of each polygon is tabulated in Table 4-1. The design achieves the following:

- Proximity to the San Mateo Kelp Bed,
- Avoids hard substrate areas of greater than 30 percent,
- Avoids areas of persistent historical kelp growth,
- Places substrate on sand with a depth of less than 0.5m to minimize subsidence of the new substrate
- Locates the reef in water depths suitable for kelp recruitment and growth
- Isolates the experimental reef modules from the new reef,
- Provides a 7 (± 1) meter margin from existing hard substrate
- Allows several navigation lanes between inshore and offshore areas, and
- Avoids areas of special interest (e.g. local fisheries).

Five additional polygons (Figure 4-2), totaling 22.4 acres, were designed as contingency areas of reef construction and potential future remediation areas. The contingency (remediation) polygons will be utilized at the discretion of the SCE Project Manager and serve as an alternate reef construction location if site specific issues dictate termination of construction at any of the primary locations (polygons). In addition, the contingency polygons may be utilized for remediation if the Wheeler North Reef fails to meet the required performance standards. Historically, SCE has estimated the amount of contingency based on experience with the project to be accomplished. 'One of a kind projects' in which SCE retains no institutional knowledge will use a 25 percent factor to estimate adders not defined in the scope of work. These one of a kind projects have been mainly in restoring environmentally damaged property. For projects where SCE holds some experience such as construction of conventional power plants, a 10 percent contingency factor has been deemed to be prudent. For projects where there is a rich experience base in design and construction, such as sub-station erection, an appropriate contingency factor would be < 5 percent.

The proposed contingency area of 22.4 acres is approximately 18 percent of the total acreage to be constructed for the Phase 2 reef. The Phase 2 reef construction will be SCE's second project of this kind and there is some experience base, but certainly, not equivalent to building power plants. The estimated contingency (18%) is about mid point between that for projects with no experience and those with some experience base. In summary, the proposed contingency area is appropriate and prudent.

Beyond this level of prudence, CE has reassessed the lease site and identified 11.6 additional acres, which meet the construction specifications. These 11.6 acres are located in the northern area of the project and constitute 9 percent bringing the total contingency or remediation potential to 27 percent or 34 acres for alternate locations of reef polygon construction.

Table 4-2 identifies the areas of the main contingency polygons as well as the secondary northern polygons, and Figure 4-3 depicts the primary and contingency (both main and secondary) polygons overlaid onto the substrate classification map (see also Figures B-2 & B-3). The preliminary and contingency polygons were also overlaid onto the areas of historical kelp growth (Figures 4-4 & 4-5). The available yearly kelp canopy maps for the project area from 1967 through the present are presented in Appendix C.

Approximately 790 (± 10%) tons of graded quarry rock distributed over one (1) acre will achieve the desired density of artificial hard substrate (~ 42% density, as estimated by CCC contract scientists in Reed et al., 2005). An estimated 100,800 (± 10%) tons of reef material mass will be deposited on 127.6 acres to accomplish the Phase 2 Mitigation Reef. Approximately 100 days of construction are estimated to be needed to complete the stated project.

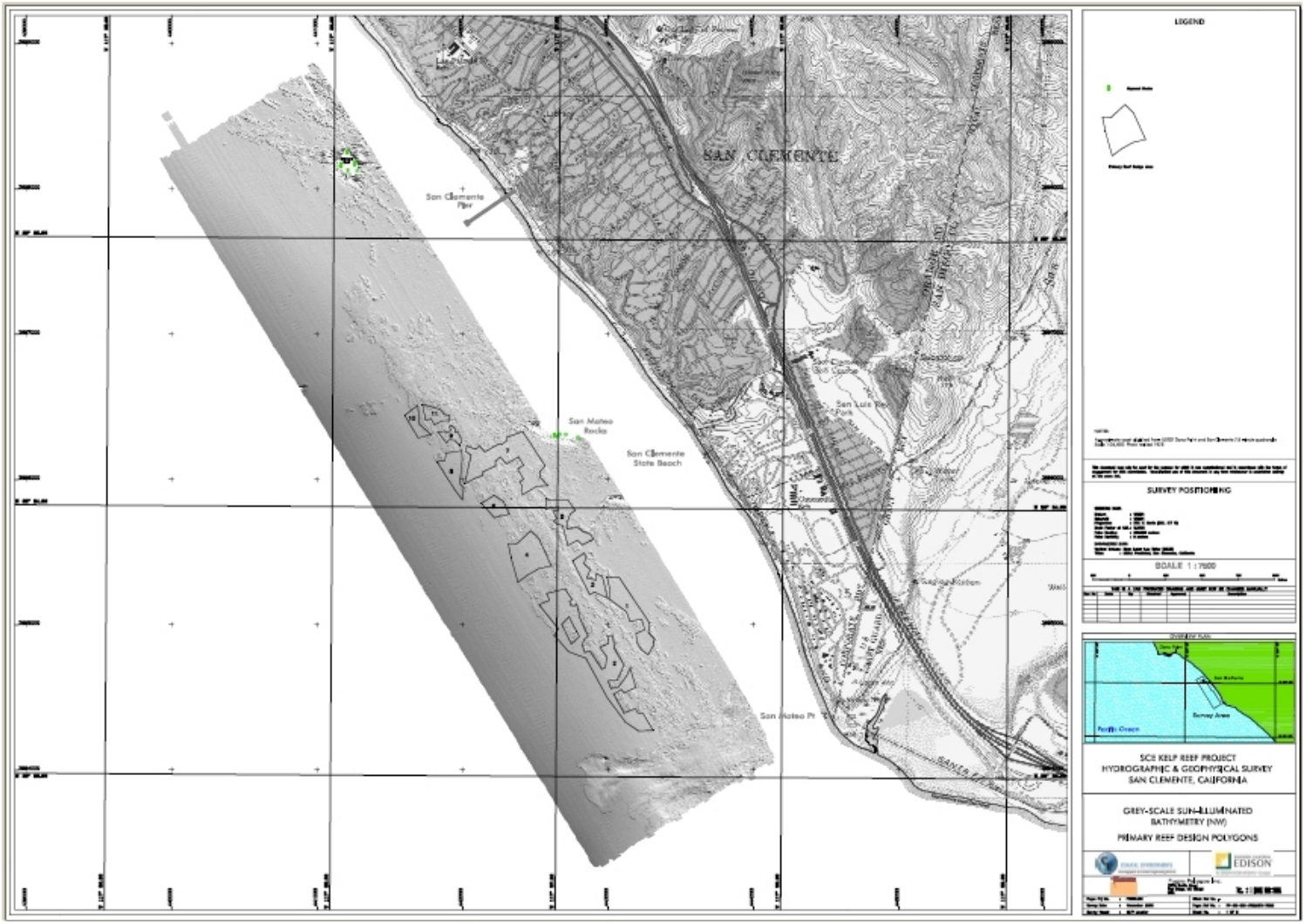

Figure 4-1. Layout of the 11 primary polygons of the Phase 2 Mitigation Reef.

Table 4-1. Areas of primary polygons 1 to 11 of the Phase 2 Mitigation Reef.

Polygon ID	Area (acres)
1	13.3
2	37.5
3	6.5
4	14.1
5	9.2
6	4.1
7	25.8
8	7.5
9	3.5
10	3.8
11	2.4
Total Primary Polygons	**127.6**

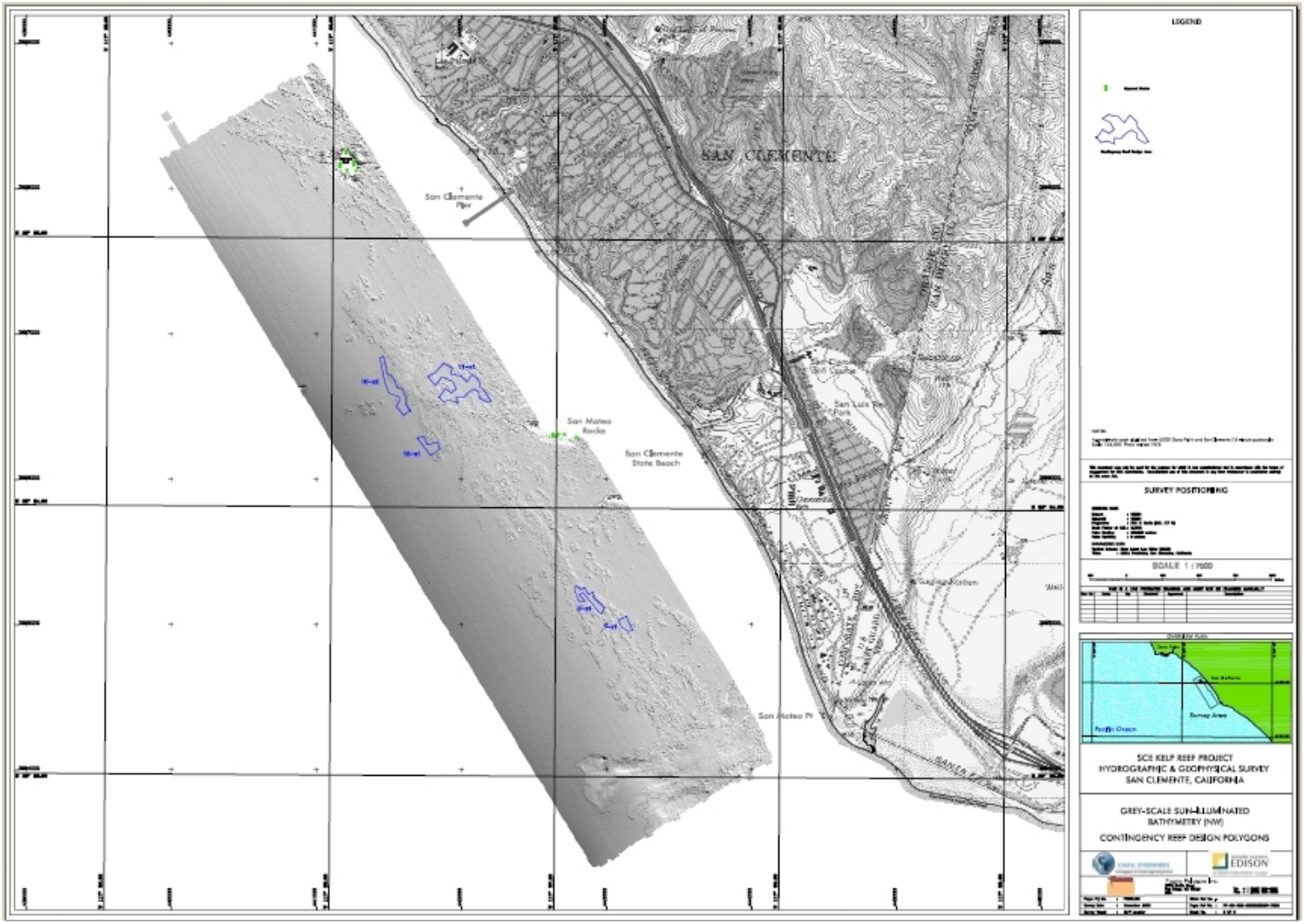

Figure 4-2. Layout of the five main Phase 2 Mitigation Reef contingency polygons.

Table 4-2. Areas of the five main contingency polygons of the Phase 2 Mitigation Reef (22.4 acres) and the three secondary contingency polygons to the north (11.6 acres).

Polygon ID	Area (acres)
Main Contingency Polygons	
1-x1	1.3
3-x1	2.8
10-x1	2.0
10-x2	5.3
11-x1	10.9
Subtotal	**22.4**
Secondary Contingency Polygons	
12-x1	7.0
13-x1	2.2
14-x1	2.4
Subtotal	**11.6**
Total Contingency Polygons	**34.0**

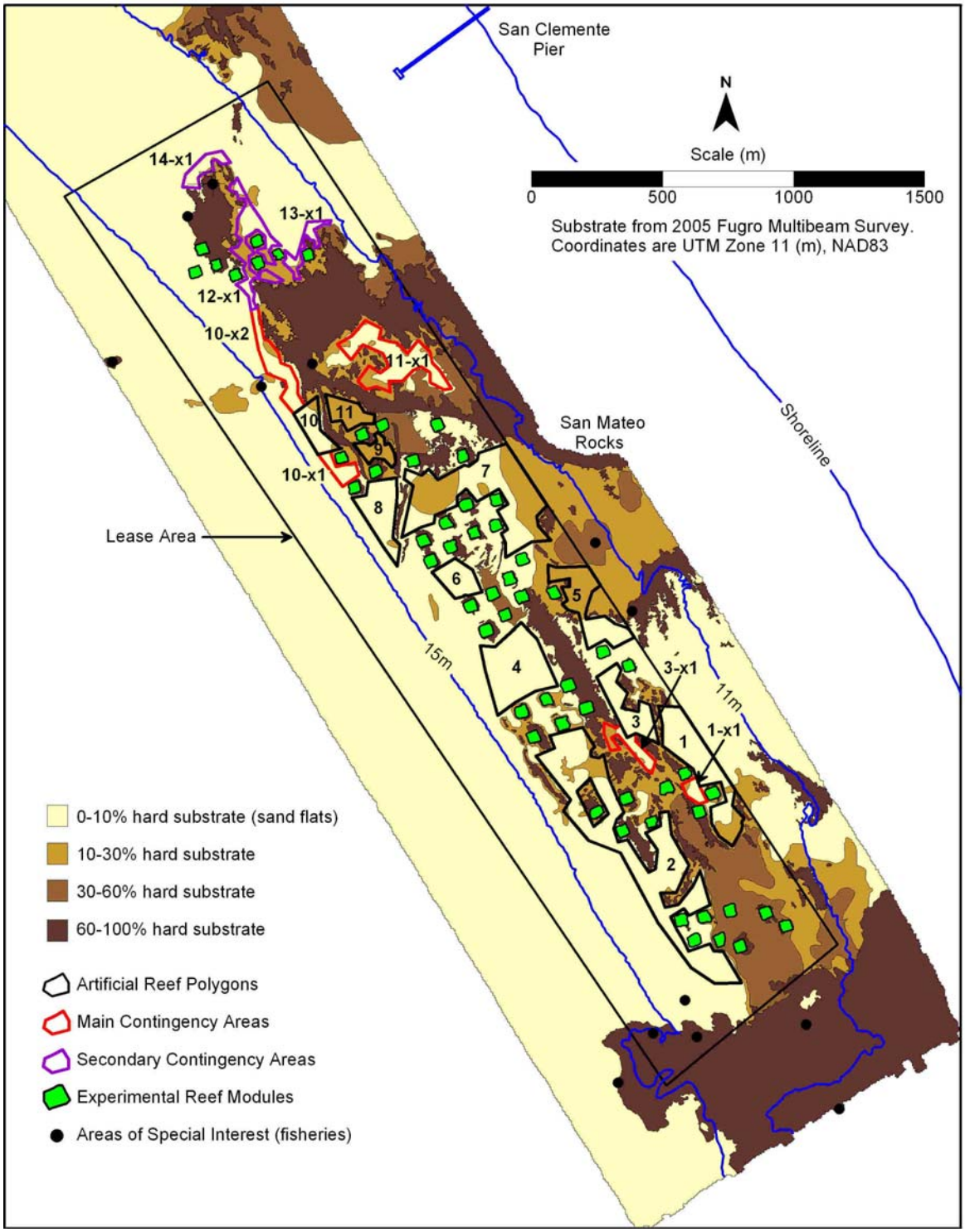

Figure 4-3. Phase 2 Mitigation Reef (127.6 acres), main contingency areas (22.4 acres), and secondary contingency areas (11.6 acres), overlaid onto a seafloor characterization map. The figure also shows areas of special interest to fisheries off San Clemente.

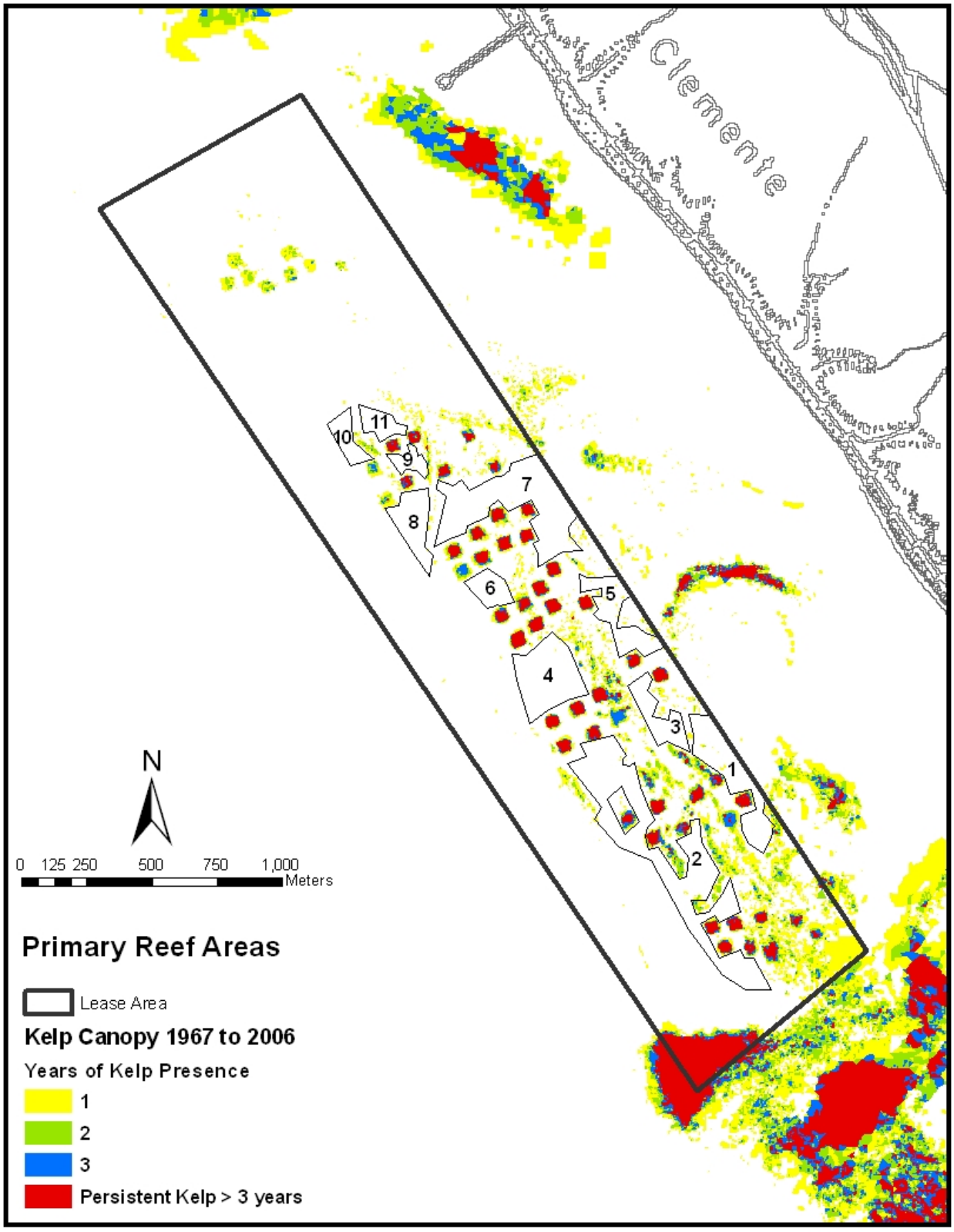

Figure 4-4. Phase 2 Mitigation Reef (127.6 acres) overlaid on top of historical kelp canopy in the region from 1967 to 2006.

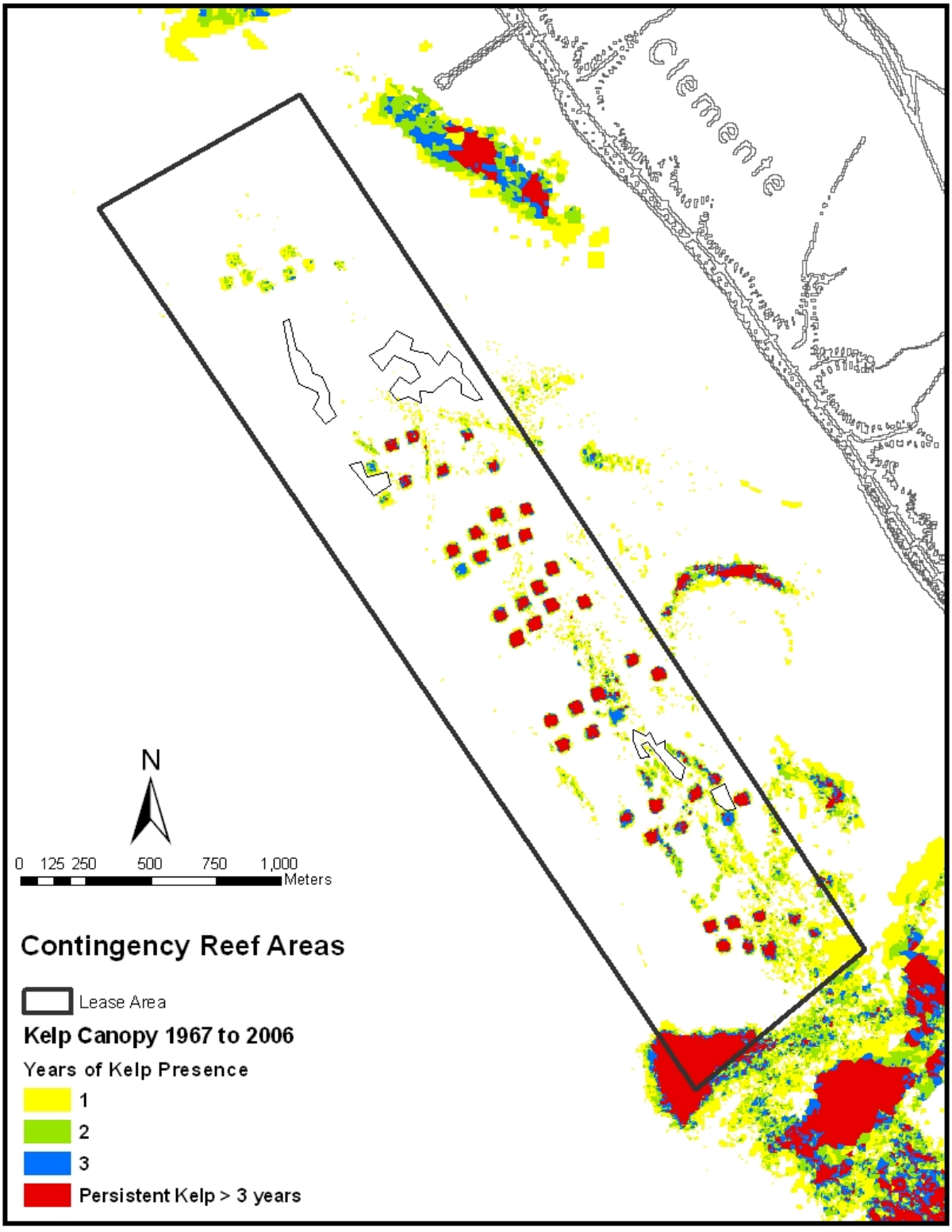

Figure 4-5. Contingency reef areas (22.4 acres) overlaid on top of historical kelp canopy in the region from 1967 to 2006.

5.0 SPECIFICATIONS, SOURCES, AND HANDLING OF REEF MATERIALS

5.1 SPECIFICATIONS FOR REEF MATERIALS

5.1.1 Physical Properties

Material availability, source locations, and minimizing air quality impacts influenced SCE and CE to select quarry boulders as the exclusive building material for constructing the reef. Quarry boulders were acceptable to CCC staff for construction of the Phase 1 reef.

All rock used for this project shall conform to the California Department of Fish and Game (CDFG) material specification guidelines for augmentation of artificial reefs with surplus materials (Appendix D; Bedford, 1997). Written approval will be obtained from CFG prior to depositing any rock. Pertinent criteria include:

1. The materials shall be clean and free of any contaminants, especially those that could dissolve in seawater (e.g., asphalt, paint, oil, or oil stains).
2. All rocks used for this project must be accepted by state and federal agencies in the following respects:
    - Purity: The materials shall be free of contamination and foreign materials.
    - Specific gravity: Shall be greater than 2.2.
    - Durability: Rocks used must remain unchanged after 30 years of submersion in seawater.

5.1.2 Boulder Dimensions and Weight

Table 5-1 shows the dimensions of the quarried boulders to be used. Boulders used in this project will have a specific gravity greater than 2.3. Table 5-2 specifies the material tests required to ensure contractor compliance with the specific weight and durability requirements for the rocks used in this project. Figure 5-1 shows the rock weight distributions by class.

REMARK:

Per California Coastal Commission's staff comments on 25 March 2008, Table 5-2 has been revised and presented on Page 26(a). Table 5-3 has been added, which gives rock weight distribution per acre and estimated number of rocks per class and is also presented on Page 26(a). Figure 5-1 has been revised and presented on Page 26(b), and a new Figure 5-2 has been added and presented on Page 26(b), which shows the data in Table 5-3, graphically.

Our previous Figure 5-2 (Page 29) has been changed to Figure 5-3.

Table 5-1. Quarried rock dimensions for the Phase 2 Mitigation Reef.

Parameter	Nominal Dimensions (ft)	Tolerance (ft)	Percent of Quarried Rock At Nominal Dimensions
Length	2	± 1	85
Width	1.5	± 0.5	85
Height	0.5 - 2	+1	85

Note: Less than 5% of the boulders shall exceed 3 feet in length.

Table 5-2. Required material tests (revised next page).

Test	California / ASTM Test	Requirement
Apparent Specific Gravity	206 / ASTM C127	2.3 minimum
Absorption	206 / ASTM C127	4.2% maximum
Durability Index	229 / ASTM C535	52 minimum / maximum 38% at 500 revolutions / maximum 50% at 1000 revolutions

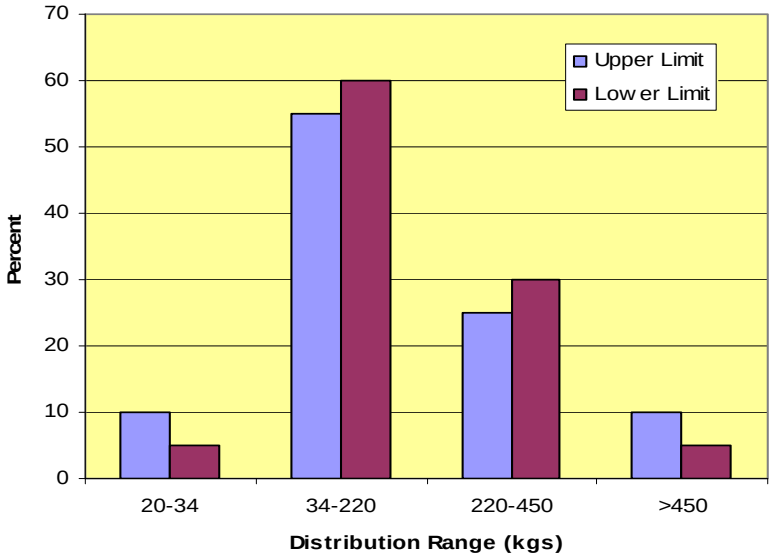

Figure 5-1. Rock weight distribution variation by class (revised next page).

Table 5-2. Required material tests (revised on 25 March 2008).

Test	California / *ASTM Test	Requirement
Apparent Specific Gravity	206 / ASTM C127	2.3 minimum
Absorption	206 / ASTM C127	4.2% maximum
Durability Index	ASTM C535	38% maximum at 500 revolutions, 50% maximum at 1000 revolutions

*** American Society of Testing and Materials**

Table 5-3. Rock weight distribution per acre and estimated number of rocks per class (new table added on 25 March 2008).

Distribution Range		Mean Rock Size		% of Rocks by Number	% of Rocks by Weight	Approximate Number of Rocks Per Acre
(kgs)	(lbs)	(kgs)	(lbs)			
20 – 34	44 – 75	27	59	24.4	5	1330
34 – 220	75 – 484	127	279	60.8	55	3109
220 – 450	484 – 990	335	737	11.8	30	643
> 450	> 990	450	990	3.0	10	160
Total				100	100	5242

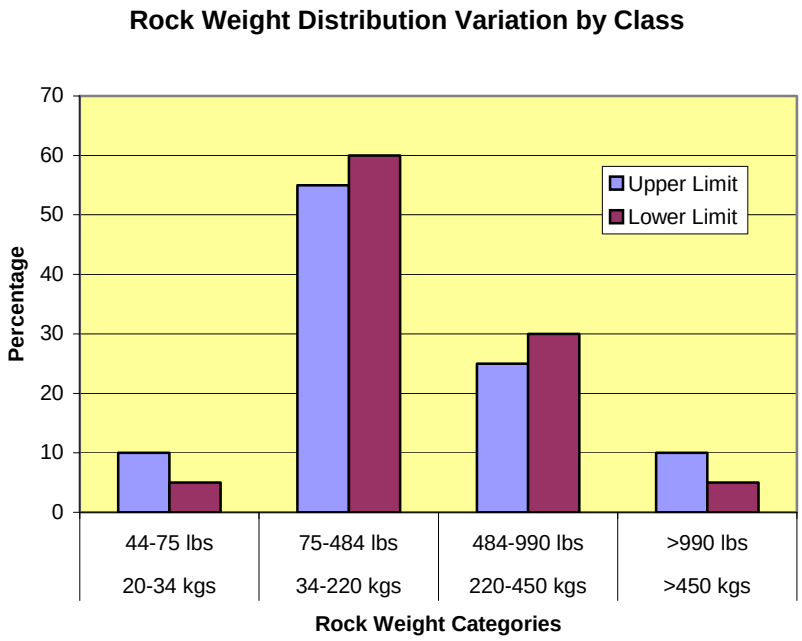

Figure 5-1. Percentage of rocks in four weight categories in two distributions, upper and lower (figure revised on 25 March 2008).

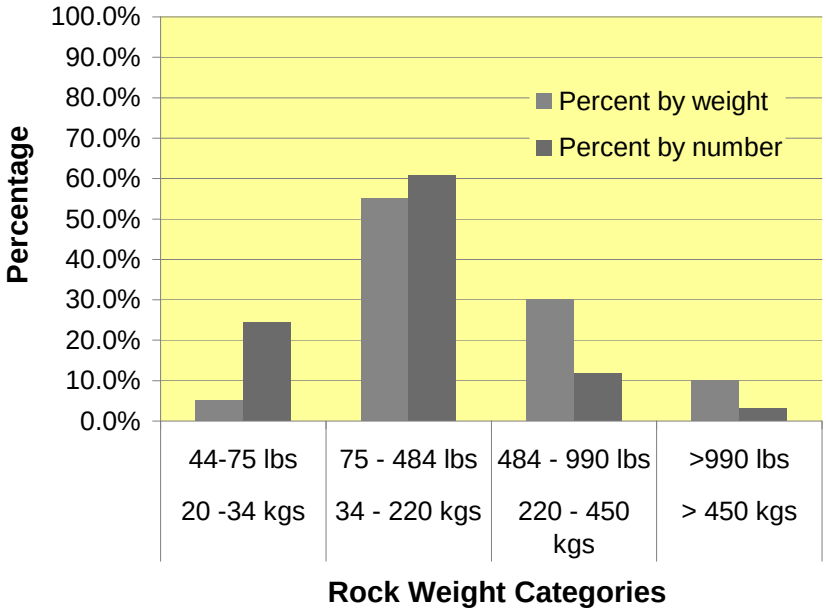

Figure 5-2. Percentage of rock by weight and number based on 5% of the lightest rock class and 10% of the heaviest rock class (new figure added on 25 March 2008).

5.1.3 Boulder Quantity and Source

Reef construction material will be supplied by the Pebbly Beach Quarry and Empire Quarry, both located on Santa Catalina Island. Catalina Island was an identified quarry material source for the erection of the Experimental Reef. The Catalina Island quarries have direct marine access for the loading of building materials, thus eliminating the need for truck hauling over public highways. Quarry boulders will be loaded directly onto flat-deck barges and towed (two in tandem) approximately 60 nautical miles to the project site. An estimated time of 8 to 10 hours is required to deliver the barges to the project site. All reef materials will conform to the specifications contained in the approved design plan for construction of the Phase 2 Mitigation Reef. The Catalina quarries will be operating at near-maximum capacity in order to produce the quantity (100,800 tons) and quality (boulder size) required and to supply the requisite mass of quarry material within a calendar year. Currently, quarry operations are on schedule for supplying the requisite mass of material in time to complete the reef build-out during one calendar year (thus avoiding re-mobilization during a second year).

SCE and CE intend to procure sufficient quarry stock from Catalina Island to complete the Phase 2 reef, and quarry production is currently proceeding as expected. Barring any work stoppage due to inclement weather or other limiting factors, the Catalina facilities are confident that they can meet production quotas. However, the estimated boulder mass (100,800 tons) does not allow for contingencies, such as interruptions in production or an additional need for quarry stock reserve. Therefore, SCE has put out a bid for a construction company to provide an additional 30,000 tons of quarry material, which would be stockpiled at Catalina Island or another quarry. This stockpile would be held in reserve to ensure a continued supply of quarry material in the event that the primary quarry cannot deliver the requisite mass or that current estimates of bottom coverage density require augmentation.

5.2 POTENTIAL AIR QUALITY EMISSION AND QUARRY SOURCE ACCEPTANCE

SCE and CE have not completed an assessment of the emission impacts from procuring building material from the Ensenada quarry. Regardless of whether the Ensenada source is ever used in the construction of the Phase 2 reef, SCE and CE will have reassessed emissions from importing building material from south of the border. SCE and CE will present and compare the estimated emissions presented in the PEIR as the ‘worst case’ vs. ‘real case’ (with 1997 emission factors) vs. ‘real case’ (with current emission factors). SCE and CE will seek all necessary air quality permitting is the necessity of procuring boulders from Ensenada comes to fruition. Additionally, should if become necessary to obtain quarry material from sources other than Santa Catalina Island, SCE will consult with CCC staff, including submitting an application to amend the CDP to sanction the procurement of boulders, if necessary. According to California State Lands Commission, the source of quarry material is not an issue that would warrant a lease modification or filing an addendum to the PEIR.

5.3 PLACEMENT OF REEF MATERIALS

Construction material (quarried boulder) deposition shall be located within specified tolerances of the boundaries of the polygons. Boundaries (acceptable tolerances in a horizontal direction on the seafloor) of actual material placement shall be located between the minimum and maximum boundaries of the polygons, as shown in Figure 5-3. These boundaries were selected taking into consideration the accuracy of the rock placement method and the navigation system DGPS.

Single-layer deposition of quarried boulder-size rock is the optimal method of constructing an acceptable reef. However, realistic construction methods will produce a certain amount of stacking or piling (overlap) of the quarry material. Overlap is defined as rock stacked on top of rock. The total amount of overlap should not exceed 15 percent in order to achieve the required hard substrate coverage. Any deviation from this degree of overlap is not acceptable for project completion and will be considered as a failure to meet construction specifications.

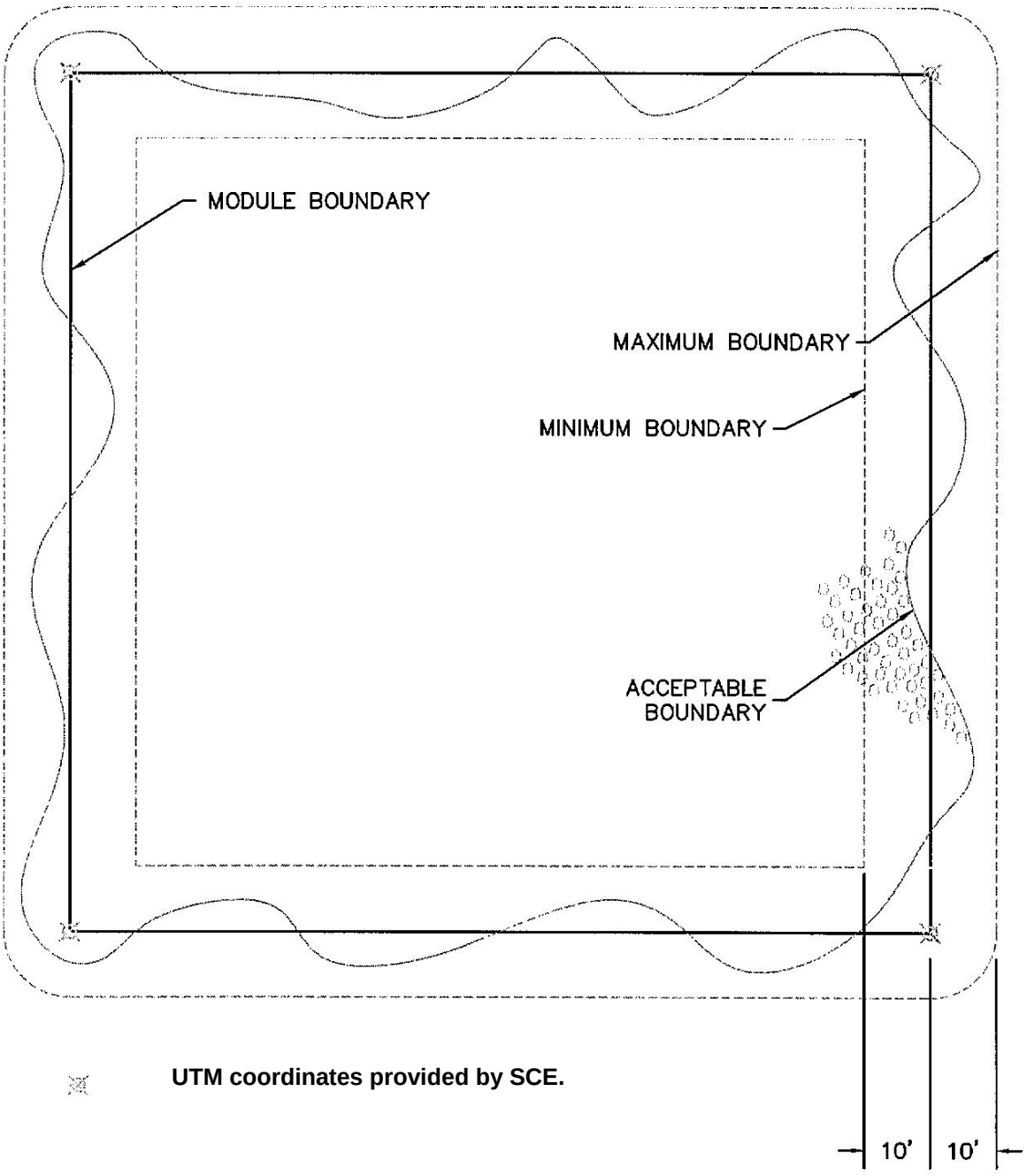

Figure 5-3. Variation of polygon shape and position showing boundary buffer tolerances.

6.0 CONSTRUCTION METHOD AND MONITORING CONSIDERATIONS

6.1 CONSTRUCTION METHOD

The Phase 2 Mitigation Reef will employ the construction method previously described in Coastal Environments (1999a,b). The described "push off" method utilized for the Experimental Reef fabrication proved to be more than adequate in building the modules to meet design specifications. The flat-deck barge(s) will be tethered to the derrick barge (Figure 6-1) equipped with GPS navigation system to guide barges to exact coordinates of any given polygon. All polygon coordinates will be programmed into the GPS Navigation System.

The front-end track loader will place quarry material at the edge of the flat-deck barge, and at a calculated distance of separation between the boulders. Once in-position, the front end track loader operator will push the boulders into the water (Figure 6-2). The calculated distance spacing the boulders and their relative size uniformity assure an approximate deposition rate of 790 tons per acre. Each polygon (Figure 6-3) will be subdivided into a series of parallel lines for boulder placement. The spacing between the lines would be 12 to 15 feet, which is the same interval spacing used in the Phase 1 Experimental Reef construction of the lowest-density "42 percent coverage" modules. The described method will be repeated until all primarily polygons are constructed.

Boulders will be placed between polygon boundaries as specified in Section 5.3. Supply barge positioning will make allowances for these tolerances in the construction of each polygon and in the avoidance of existing hard substrate areas. These tolerances should result in a buffer between existing reef and natural hard substrate areas on the seafloor of about 7 to 10 meters.

6.2 MARINE CONSTRUCTION EQUIPMENT

The equipment utilized for Phase 2 construction will be the same as that used in the erection of the Phase 1 Experimental Reef. The contractor will use the following vessels and heavy equipment: one (1) derrick barge; three (3) tugboats; one (1) crew boat (personnel transport boat); four (4) flat-deck barges; and two (2) front-end loaders. The dimensions of the derrick barge are 225 ft (length) by 76 ft (width), and the hull is 15 ft deep. The derrick barge is equipped with a six-point anchor array, with each anchor drum having a spooling capacity of 2,500 feet of 1.75-inch (diameter) spun-steel cable. The approximate maximum coverage per anchor set-up is 2,000 ft long by 800 ft wide without moving the anchors.

The derrick barge (Figure 6-2) will be accompanied (6 days/week, 24 hours/day) by three tugboats, which will also serve to pull the derrick barge into the desired working locations, both at mobilization and as needed to complete and demobilize the project. One of the tugboats will remain on site at all times. The other two will be used to tandem-haul loaded flat-deck barges from the Santa Catalina quarry to the work location and return empty barges for reloading with reef substrate materials. All personnel will be transported from Dana Point Harbor to the project site via the workboat. The workboats will remain on location for scheduled and unscheduled transportation requirements to Dana Point Harbor.

Figure 6-1. Derrick barge.

Figure 6-2. The Phase 2 Mitigation Reef rock placement method: The front-end-loader/flat-supply-barge "push off" method.

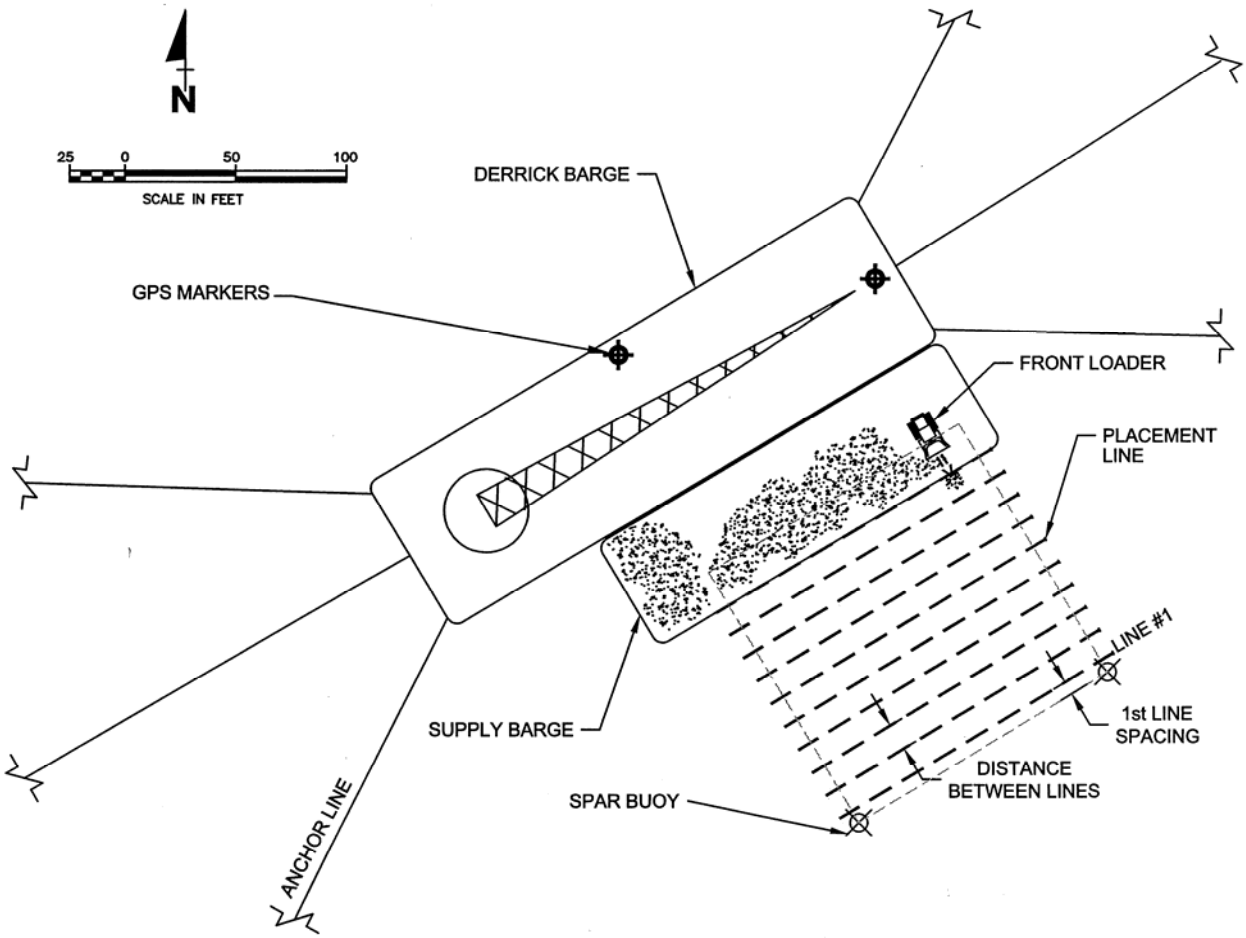

Figure 6-3. Construction method schematic showing derrick barge, supply barge, front-loader, rock placement lines, and six-anchor positioning.

6.3 CREW PLAN AND HOURS OF CONSTRUCTION OPERATION

The derrick barge crew will consist of a crane operator, foreman, crane oiler, deck engineer, and pile driver/barge hand, along with a loader operator, superintendent to direct operations, and project manager. Construction will be done during daylight hours, six days per week (Monday through Saturday) except on holidays, and during inclement weather. The crew will depart from Dana Point Harbor at 6:00 AM in order to be on site by 6:45 AM.

6.4 ANCHORING PLAN

The derrick barge will be moored by six anchor cables attached to winches on the barge (Figure 6-4). During rock placement, the barge will be located at the required position by winching on the six cables connected to the respective anchors. The anchors are designed to minimize possible drag on the bottom. This will be achieved by connecting each offshore anchor to a ten ton concrete block located on the ocean floor and by connecting the cable from the barge to each concrete block via a foam-filled can (surge-can), as shown in Figure 6-4. Anchors will be placed on sandy bottom areas or those with less than 30 percent hard substrate.

Phase 2 Mitigation Reef construction will require the deployment of the six anchors in 18 locations, as shown in Figures 6-5 and 6-6. The 89 anchor sites are designated by circles in Figure 6-5, and the sites are numbered. Seventy-nine of these anchor positions are on sand, and ten are on less-than-30 percent hard substrate. Some of the anchors will be used for more than one anchorage configuration. Each anchorage location will allow a maximum coverage of 2,000 feet by 800 feet. The exact coordinates of each anchor location will be determined before or on the day of deployment and will then be deployed under the direction of the SCE Project Manager or designee. The anchoring plan took the following into consideration: a) the ocean bottom topography; b) the existing potential for environmental harm to existing habitat as a result of the placement of anchors, chains, buoys, and/or cables; c) and the weather conditions.

All anchoring hardware moves will be conducted with ocean-capable tugboats with the capacity to pick up anchors off the ocean bottom. These tugboats are fitted with GPS navigational systems. Periodically over the construction day, the tugboat operators will check the locations of the anchors to ensure that no movement has occurred. Marker buoy movement is a sure indication of anchor movement. Appropriate action to re-seat the anchor will be done if there is significant buoy movement. It is important to note that the six-anchor design limits the movement of any one anchor in the event that the barge pulls excessively on the array. This anchoring system will limit damage to the seafloor. Table 6-1 gives the north and east coordinates for the 89 anchor locations in UTM Zone 11 (meters) format.

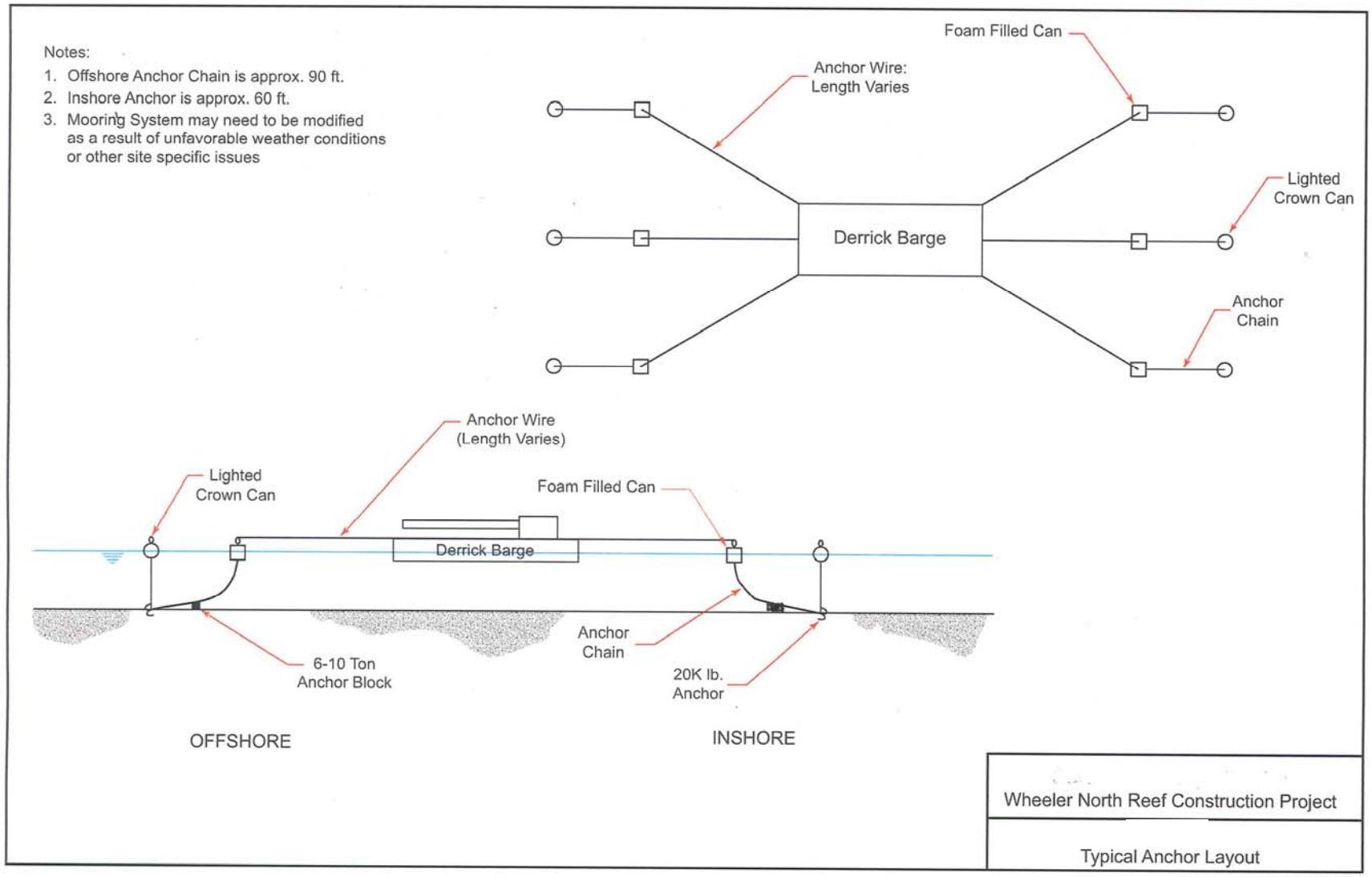

Figure 6-4. Derrick barge anchor schematic.

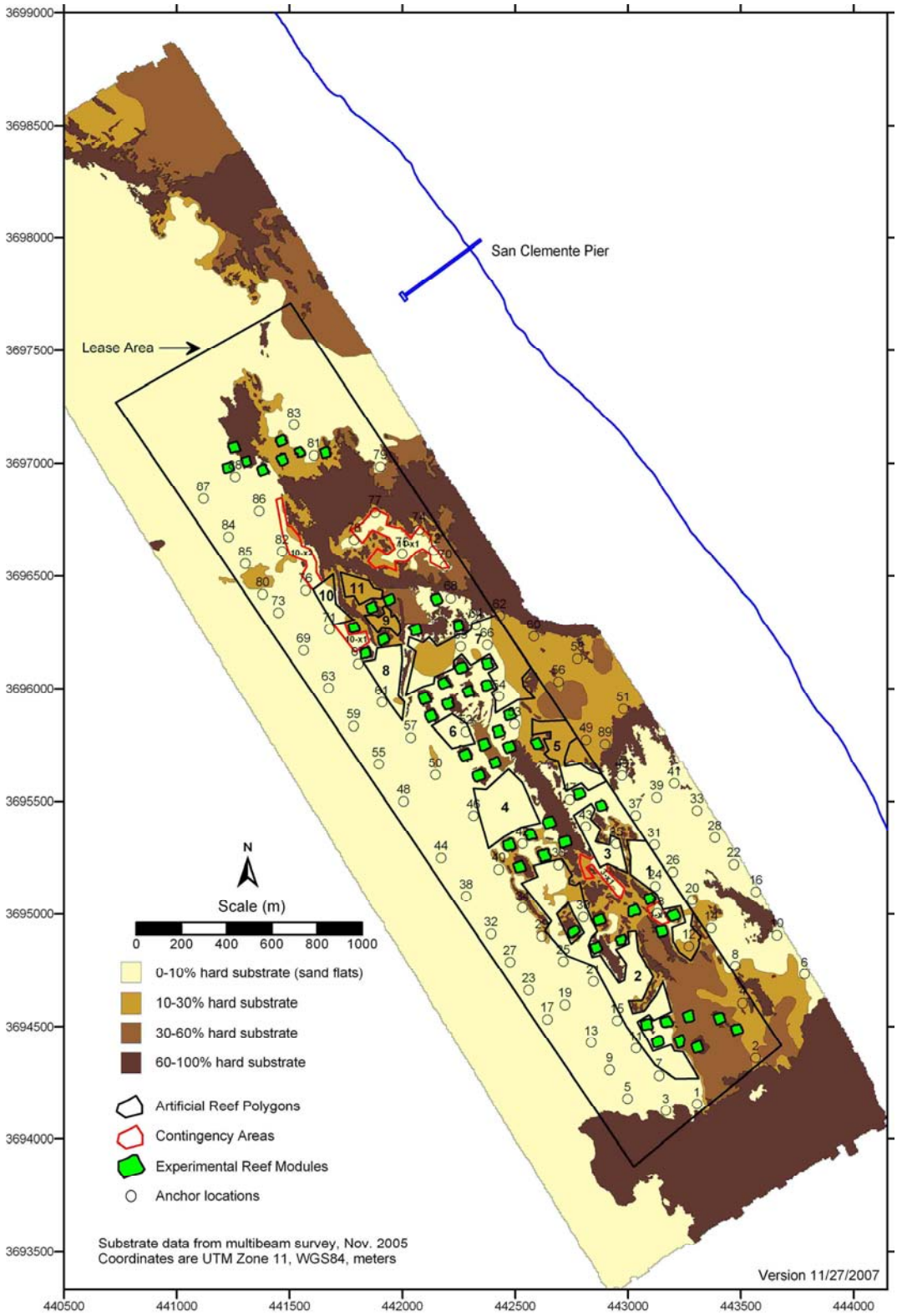

Figure 6-5. Proposed locations of derrick barge anchors shown as circles for the sixteen polygons.

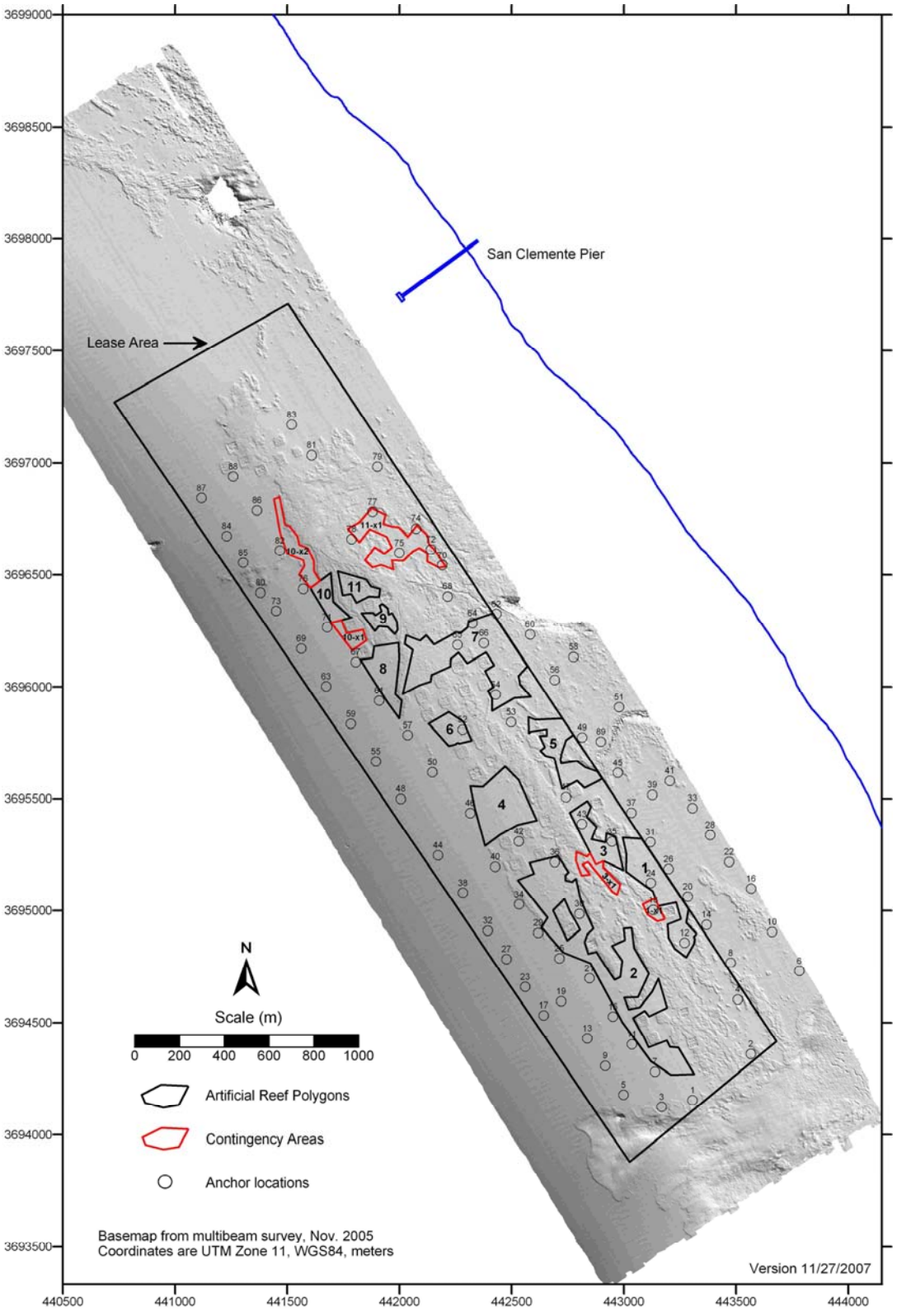

Figure 6-6. Proposed locations of the derrick barge anchors shown as circles overlaid on top of three-dimensional plot of the ocean bottom for the sixteen polygons.

Table 6-1. Anchor locations (UTM Zone 11, meters).

Preliminary Anchor Plan Points								
UTM 83 Metric								
Revision "A" : Added point 89 on 11/26/07								
Anchor	X	Y	Anchor	X	Y	Anchor	X	Y
1	443,310	3,694,160	**41**	443,200	3,695,580	**81**	441,610	3,697,030
2	443,570	3,694,360	**42**	442,530	3,695,310	**82**	441,470	3,696,610
3	443,170	3,694,120	**43**	442,810	3,695,390	**83**	441,520	3,697,170
4	443,510	3,694,600	**44**	442,170	3,695,250	**84**	441,230	3,696,670
5	443,000	3,694,180	**45**	442,970	3,695,610	**85**	441,300	3,696,550
6	443,780	3,694,730	**46**	442,320	3,695,440	**86**	441,370	3,696,790
7	443,140	3,694,280	**47**	442,740	3,695,510	**87**	441,120	3,696,840
8	443,480	3,694,770	**48**	442,010	3,695,500	**88**	441,260	3,696,940
9	442,920	3,694,310	**49**	442,810	3,695,770	**89**	442,900	3,695,760
10	443,660	3,694,910	**50**	442,150	3,695,620			
11	443,040	3,694,400	**51**	442,980	3,695,910			
12	443,270	3,694,860	**52**	442,280	3,695,810			
13	442,840	3,694,430	**53**	442,500	3,695,840			
14	443,370	3,694,940	**54**	442,430	3,695,970			
15	442,950	3,694,530	**55**	441,900	3,695,670			
16	443,570	3,695,100	**56**	442,690	3,696,030			
17	442,640	3,694,530	**57**	442,040	3,695,780			
18	443,130	3,695,000	**58**	442,780	3,696,130			
19	442,720	3,694,600	**59**	441,780	3,695,830			
20	443,280	3,695,060	**60**	442,580	3,696,230			
21	442,850	3,694,700	**61**	441,910	3,695,940			
22	443,470	3,695,220	**62**	442,430	3,696,330			
23	442,560	3,694,660	**63**	441,670	3,696,000			
24	443,120	3,695,120	**64**	442,330	3,696,280			
25	442,710	3,694,790	**65**	442,260	3,696,190			
26	443,200	3,695,190	**66**	442,380	3,696,190			
27	442,480	3,694,790	**67**	441,800	3,696,110			
28	443,380	3,695,340	**68**	442,210	3,696,400			
29	442,620	3,694,900	**69**	441,560	3,696,170			
30	442,800	3,694,990	**70**	442,190	3,696,540			
31	443,120	3,695,310	**71**	441,680	3,696,270			
32	442,390	3,694,910	**72**	442,140	3,696,610			
33	443,310	3,695,460	**73**	441,450	3,696,340			
34	442,530	3,695,030	**74**	442,070	3,696,710			
35	442,950	3,695,310	**75**	442,000	3,696,600			
36	442,690	3,695,220	**76**	441,570	3,696,440			
37	443,030	3,695,440	**77**	441,880	3,696,780			
38	442,280	3,695,080	**78**	441,790	3,696,660			
39	443,130	3,695,520	**79**	441,900	3,696,980			
40	442,430	3,695,200	**80**	441,380	3,696,420			

6.5 HEALTH & SAFETY PLAN

The Health & Safety Plan is contained in Appendix E. Closely related to this plan is the plan, presented in Appendix F, for dealing with (as well as preventing) any accidental undesired discharge from equipment, spills into the ocean, or vessel problems.

6.6 CONSTRUCTION ENVIRONMENTAL IMPACT & MITIGATION PLAN

The Phase 2 Mitigation Reef will employ the same types of equipment, methods, and procedures utilized for Phase 1. All potential environmental impacts have been addressed in the Final Program Environmental Impact Report (Resource Insights, 1999), which was completed and approved by all of the vested regulatory agencies prior to the Phase 1 Experimental Reef construction. No new tasks or project aspects have been added to Phase 2 construction that could introduce new sources of environmental harm.

In the event of the release of fuel and/or lubricating oil, the construction contractor will implement the Spill Control and Countermeasure Plan (see Appendix F, Management of Accidental Discharge and Vessel Problems).

7.0 CONCEPTUAL APPROACH FOR DETERMINATION OF ROCK PLACEMENT DENSITY AND AREA FOR CONSTRUCTION VERIFICATION

Southern California Edison Company (SCE) is obligated to develop a plan to ensure the Wheeler North Reef is constructed according to the specifications of the SONGS Coastal Development permit (CDP) and the Executive Director's determination. Currently the plan is under development and will be submitted for approval by April 1, 2008. The following is a conceptual approach to developing a sonar-based method that is intended to produce a two-dimensional mapping of the boundaries and the percent coverage of the reef polygons. The methods will entail a combination of sonar and diver techniques to arrive at a reliable estimation of the boundary and density (i.e., percent cover) of the constructed reef.

7.1 CONSTRUCTION MONITORING METHODS

Condition C of California Coastal Commission (CCC) Permit, Kelp Reef Mitigation, Section 2.3, Mitigation Reef Construction, states: "The permittee shall complete a post-construction survey to demonstrate that the reef was built to specifications. If the Executive Director determines that the reef was not built to specifications, the permittee shall modify the reef to meet the approved specifications within 90 days of the post-construction survey."

The objectives of the reef construction monitoring plan are to determine:

1) The dimensions (footprint) of the constructed polygon(s),
2) The area(s) of the constructed polygon(s),
3) The density of boulder deposition,
4) That boulder deposition avoids habitat of significant biological value or areas of special status, and
5) Whether the constructed reef adheres to the design specifications defined in this plan, including reef area, material dimensions, and percent coverage and layering of reef material.

Side-scan and multi-beam sound navigation and ranging (sonar) techniques were successfully used to determine the boundaries of the experimental reef modules (EcoSystems Management Associates, 1999; Coastal Environments & Fugro, 2006b,c). SCE and Coastal Environments (CE) plan to reevaluate side-scan and multi-beam sound navigation and ranging methods (sonar) to determine the inherent advantages and disadvantages, and to subsequently select the "best method." The best sonar method will be used to determine the footprints of all constructed polygons.

In addition, the sonar methods will be evaluated for applicability for percent coverage determination. SCE and CE will develop the density estimation method primarily for internal verification of compliance with CCC construction specifications. Percent coverage determinations will be conducted on the first and second constructed polygons to verify that the construction procedures produce a product that meets the specifications. Ground-truthing diver surveys will be conducted to verify the results of the sonar surveys. SCE and CE will use

SCUBA divers to place sonar targets along the boundaries of several low-density experimental modules. These targets will be fixed points that can be used to determine the absolute accuracy of the sonar in determining the boundaries of hard substrate. The details of this calibration study will be finalized following consultation with CCC-Contract Scientist (CCC-CS) to ensure that the selected sonar method produces an acceptable estimate of deposition density. The remaining polygons will be constructed without external quality control. Upon construction completion, the "best method" sonar surveys will be conducted to determine the boundaries of the remaining polygons. Recent developments in sonar software may overcome those errors in deposition density estimations introduced by the shadows that are cast as a result of the angle of incidence of the acoustic beam. SCE and CE will use the experimental reef modules to calibrate the two sonar technologies and select the "best method."

The CCC-CS retains the responsibility for the comprehensive site-wide percent coverage estimations for all constructed polygons by using the "Point of Contact" diver survey method (Reed, 2005) developed during the post-construction activities of the Experimental Reef (1999).

All data and study results will be submitted in an acceptable format to CCC-SC and CCC staff for review, comment, and approval. A final monitoring report will be prepared by SCE and CE that will describe the equipment used, specifications, measurement methods, area sampled, results, and conclusions.

7.2 POSTCONSTRUCTION KELP WRACK & ROCK HAZARD MONITORING

The Final Program Environmental Impact Report (Resource Insights, 1999) (pages 2.5, 2.6, and Appendix H) refer to a number of project effects considered to be significant or potentially significant, including Socioeconomic, Air Quality, Transportation, Geology, Hazards, Recreation, and Public Service. Mitigation measures were recommended and a draft "Mitigation Monitoring Plan" outlining how the mitigation measures would be implemented was included as PEIR's Appendix H. The specific environmental issues, mitigation measures, and implemented monitoring are listed in this Final Design Plan's Appendix G, Summary of Environmental Issues from the PEIR (1999). The PEIR raises two issues for which it mandates a five-year monitoring program once the Phase 2 Mitigation Reef is constructed: 1) movement of reef building materials onto the shore, and 2) excess kelp on the beach. Both kelp wrack and rocks washing up onto the beach are deemed as potential significant impacts (PEIR, Table 2-1; Section 3, Geology; Section 8, Hazards; Section 10, Public Services and Utilities; and Section 13, Recreation). The proposed mitigation reef project will be substantially larger than the Experimental Reef, and issues with kelp wrack and rocks on the beach may be more significant than for the Experimental Reef.

The mandated kelp wrack and rock hazard monitoring (KW&RHMP), under the responsibility of the "Project Proponent" according to the PEIR, is essentially the same as what was done for the five-year Experimental Reef study, which specified: "Ongoing for five years, or as long as needed after construction of the mitigation reef is completed, or until a conclusion can be reached regarding the impacts of kelp and other materials washing onto the beaches or into the shallow surf zone on a biweekly basis from November through March and on a monthly basis during the other months."

The KW&RHMP will be maintained during the construction activities and for a period to be determined after construction is completed. The scope of the post-construction monitoring will be determined between SCE and the CCC-CS and CCC staff. The KW&RHMP can be found in Appendix I of this report.

7.3 PHASE 2 MITIGATION REEF PERFORMANCE MONITORING

Condition C of the CCC Permit, Kelp Reef Mitigation, Section 2.2, Mitigation Reef Goals, states: "The primary goals of the mitigation reef shall be to provide adequate conditions for a community of reef-associated biota similar in composition, diversity, and abundance to the San Onofre kelp bed that compensate for the losses incurred by SONGS operations." Section 2.4 of the CCC Permit states: "After construction of the mitigation reef is completed, the reef will be monitored, managed, and, if necessary, remediated." Section 2.4 also describes performance standards in the following areas, which are important for measuring the success of the mitigation reef and for determining whether remediation is necessary: 1) the substrate, 2) kelp beds, 3) fish, and 4) benthos.

A draft monitoring plan for the mitigation reef has been developed by the Commission staff scientists pursuant to Condition D (see Appendix H). The monitoring plan is to be completed within six months of approval of a coastal development permit for the mitigation reef. The monitoring plan describes the sampling methodology, analytical techniques, and methods for measuring performance of the mitigation reef relative to the performance standards identified in Section 2.4 of the PEIR.

SCE shall be responsible for fully implementing any remedial measures deemed necessary by the CCC Executive Director. Following completion of construction, the mitigation reef shall be monitored for a period equivalent to the operating life of SONGS.

8.0 CONSTRUCTION QUALITY CONTROL

8.1 QUALITY CONTROL FOR ROCK HANDLING AT THE QUARRY

SCE will approve representative samples of all building materials before the start date for initiating construction. SCE will ensure that the rocks satisfy all the required specifications, which are stated in Chapter 5. The construction contractor's quality control (QC) technician at the quarry will routinely monitor conformance with material specifications. In addition, periodic gradation testing will be performed for quarry materials intended to be delivered to the construction site. This testing will be performed at an independent materials testing laboratory.

8.2 QUALITY CONTROL AT THE REEF CONSTRUCTION SITE

For quantity tracking of reef material and handling of material onsite, the contractor will provide SCE with the net weight of the material delivered to the project in the form of a barge gauging ticket. Each ticket will be calculated using the industry-wide practice of barge displacement. Barge displacement tables will be generated and certified by a naval architect. All gauging tickets will indicate the date the barge was loaded, date it was emptied, source of material, net weight of material furnished and deposited, names of parties witnessing the gauging, and location where the material was placed.

The construction contractor's project manager will perform QC activities concerning the density of ocean-bottom coverage with quarried boulders per the Final Design Plan. Periodic gauging of the flat-deck barge capacity will be performed to determine the actual versus theoretical weight of boulder deposition.

To ensure that the derrick barge is positioned correctly, its location will be verified from land using accurate survey equipment (total station). This will ensure that the GPS equipment on the derrick barge is working correctly. A daily report will be prepared the following work day recording the following: a) equipment used (in list format), b) personnel, c) meteorological and oceanographic (e.g. swell height and period) conditions, d) summary of completed work, e) quarry material inventory, f) polygon completion update, and g) general and specific comments by the construction contractor and SCE representative.

In addition and specific to boulder deposition, a spreadsheet and plan view drawing will be part of the daily report that will document the quantity of quarry material deposited and the acreage covered within the reef polygon under construction.

8.3 QUALITY CONTROL AUDITS OF POLYGON CONSTRUCTION

The Contractor shall construct two polygons (half of polygon 4 and all of polygon 6) and provide sufficient schedule time (5 working days) for the implementation of the quality control audits. The selection of the other construction site (polygon) shall be at a suitable distance from the completed polygon module so as not to interfere with the implementation of the audit. SCE and/or its designee shall perform the audits of the completed polygon modules and will inform

the contractor of the inspection findings. Non-conformance with any construction and/or material specifications shall be ameliorated at the Contractor's expense and to the satisfaction of SCE or its designee. SCE and/or its designee shall issue engineering change notices, as needed, for documentation of all nonconformance audit findings.

Upon completion and acceptance of the two audit polygons, the Contractor shall complete construction of the additional nine polygons. At this juncture, SCE or its designee will complete an audit of the nine completed polygon modules. It is estimated that the post-construction QC audits will require approximately 30 working days.

8.4 CONSTRUCTION MANAGEMENT

8.4.1 Daily Oversight

SCE managers or their designated representative(s) will be on the derrick barge on a daily basis. The reef material will be inspected at the quarry site regularly before being delivered to the work site to ensure conformance with rock specifications. In addition, prior to placement of rock on the ocean floor, photographs and measurements of length, width, and height will be taken of a representative sample of the rocks. GPS measurements will be taken by our representative to ensure that the derrick barge is in the proper location. The contractor's design sheets will be checked on a daily basis prior to starting construction. The flat deck barges will be periodically gauged during the work day to evaluate actual placed vs. theoretical boulder quantity (790 tons per acre). The SCE representative will work closely with the construction company to ensure full compliance with environmental and safety conditions. Photographs will be taken regularly during construction and properly archived.

Each polygon will be surveyed immediately after construction, using sonar and diver surveys to ensure compliance with all technical specifications. The results of monitoring will be immediately discussed with the construction company, and modifications will be made as necessary. A final report detailing the construction efforts for the Phase 2 Mitigation Reef will be submitted to the CCC with all the results of the construction monitoring for their approval.

8.4.2 Compliance with Permit Conditions

SCE managers or their designated representative(s) will ensure full compliance with State and Federal agency permit conditions. Further, SCE will be in close contact with the agencies to keep them informed of the project's progress and to implement their suggestions and comments.

9.0 CEQA AND THE PERMITTING PROCESS

9.1 CEQA, THE PROGRAM EIR

The California State Lands Commission (CSLC) is the CEQA lead agency for this project. After SCE filed a lease application with the CSLC on June 26, 1997 to construct an experimental reef, it was determined that under CEQA requirements (CEQA Guidelines, Section 15168), that a Programmatic Environmental Impact Report (PEIR) should be prepared to evaluate both the experimental reef and the subsequent full mitigation reef. Hence, a "Final Program Environmental Impact Report for the Construction and Management of an Artificial Reef in the Pacific Ocean Near San Clemente, California, May 1999" (State Clearing House Number 9803127) was prepared and addresses the project impacts (Resource Insights, 1999). The PEIR is comprehensive and covers both phases of the project: Phase 1, the 22.4-acre Experimental Artificial Reef, and Phase 2, the Mitigation Reef. The PEIR addresses the following "environmental setting, impacts, and mitigation measure" subject areas: Land Use and Planning, Socioeconomics, Geology, Air Quality, Transportation, Biological Resources, Energy and Mineral Resources, Hazards, Noise, Public Services and Utilities, Aesthetics, Cultural Resources, Recreation, and Water Quality. The impacts were classified into four categories: Significant Unavoidable, Significant, Potentially Significant, and Less Than Significant. Table 8-1 summarizes these impacts.

As described in the PEIR, the construction specifications for the Mitigation Reef were to be established only after the completion of a five-year field study of the Phase 1 Experimental Artificial Reef. Therefore, to assure that the May 1999 PEIR would accurately assess a viable Phase 2 reef design, a range of possible design parameters and scenarios were evaluated, including scattered substrate coverage, substrate type (concrete or quarry rock), and a range of reef sizes (from 127.6 acres to 277.6 acres) (Resource Insights, 1999, pp. 3-12 to 3-13).

The actual Phase 2 Mitigation Reef design specifications, as discussed in the PEIR, would be determined in response to the results and recommendations (Reed et al., 2005) derived from the five-year study of the Experimental Artificial Reef. The Experimental Reef recommendations report became final in August 2005 and was acted upon and accepted by the CCC in October 2005. Based on the performance of the Experimental Artificial Reef from October 1999 through December 2004 (Reed et al., 2005), the proposed Phase 2 reef size has been determined to be 127.6 acres. This size is the minimum reef size assessed in the PEIR. The proposed coverage and substrate material is 790 tons of quarry rock per acre. This tonnage/acreage is less than 1/3 of the minimum rock coverage assessed in the PEIR. Therefore, these Phase 2 project parameters are on the conservative low-end of the PEIR-projected project size and substrate estimates.

Table 9-1. Summary of main project impacts.

Category	Type of Impact
Unavoidable Significant Impacts	Air Quality
Significant Impacts	Air Quality, Construction Material and Kelp on Beaches, Transportation, Construction Noise
Potentially Significant	Recreational and Commercial Fishing
Less Than Significant	Coastal Processes, Biological Resources, Energy and Mineral Resources, Water Quality, Land Use and Planning, Public Services, Hazardous Materials, Cultural Resources, Recreation and Aesthetics

Further, the PEIR addresses the Project Schedule, in part to describe and ensure that the projected timing of the Phase 2 component is properly considered (Resource Insights, 1999, pp. 3-26 to 3-27). The PEIR-projected schedule for the Phase 2 Mitigation Reef anticipates a Preliminary Design submittal to the CCC Executive Director six months after completion of the Phase 1 experiment. This would be approximately April 2006. The Phase 1 experiment included: 1) the five-year field monitoring study, plus 2) the time necessary for data evaluation and report preparation by the UCSB scientific team, and 3) the time necessary for the study findings and recommendations to be reviewed by the CCC staff and approved by the CCC Executive Director. The CCC design recommendations were approved in October 2005.

Based upon the CCC's approval of the CCC contract scientist's design recommendations and the submittal of a Phase 2 Preliminary Design Plan, the PEIR-projected schedule indicates that the Phase 2 Final Design Plan should be ready for submittal to the CCC and CSLC by approximately July 2007, and the start date for construction of the Mitigation Reef should be approximately Spring 2008. This is important to note here, since the May 1999 PEIR anticipates specific project timing and the actual project is still on track and within the stated scope of the PEIR (see Section 9, Project Schedule). Appendix G provides a short summary of the PEIR findings.

9.2 PERMITTING

9.2.1 CEQA Agencies

The PEIR establishes that the project proponent (SCE) is required to "come back" to CSLC [serving as the Lead Agency responsible for preparing the CEQA document in consultation with other agencies and the public] for review and approval of Phase 2 of the project at a future date, when the design and construction of the full mitigation reef have been decided upon. It may be determined at that time that additional environmental review is necessary if the final mitigation reef design is substantially different from what has been evaluated in this PEIR, or there is new information that changes the conclusions of this PEIR" (Resource Insights, 1999, pp. 2-4). SCE did submit the Preliminary Phase 2 design and construction plans to CSLC for review. In a letter dated October 29, 2007, CSLC confirmed that they amended Lease PRC 8097.1 on November 21, 2006, with the finding that the information and analyses contained in the PEIR remain valid for the Phase 2 Mitigation Reef project and that therefore no additional environmental review is necessary.

Responsible agencies under CEQA include other State and local agencies with discretionary approval over the proposed project. The PEIR will be used by these agencies in determining whether to issue permits or other approvals. Responsible agencies include the CCC and the Regional Water Quality Control Board, San Diego Region (RWQCB, SDR). Trustee agencies are other State or local agencies with resources affected by the project that will review the PEIR and comment on the findings. Trustee agencies include the California Department of Fish and Game (CDFG), California Department of Parks and Recreation (CDPR), California Public Utilities Commission (CPUC), Southern California Air Quality Management District

(SCAQMD), San Diego Air Pollution Control District (SDAPCD), City of San Clemente, and possibly the Cities of Long Beach and San Diego.

9.2.2 CEQA Action

The first step in the Phase 2 CEQA process requires that this Preliminary Plan of the Phase 2 Mitigation Reef be submitted to the Executive Director of the CCC for approval (page 3-27, Resource Insights, 1999). The Preliminary Plan was submitted to the Executive Director on May 22, 2006, and approved with specific conditions on August 8, 2006. The Preliminary Plan was sent to the CSLC with a new application for adjustment of the lease agreement, PRC 8097.1, and an environmental checklist to demonstrate that the PEIR substantially covered the plan for the final reef. On November 21, 2006, SCE obtained CSLC approval of the project and successfully negotiated a leasing agreement for the project area. Since the PEIR documented that the only "Unavoidable Significant Impact" of the project would be air quality during construction of the final reef, SCE will also initiate discussions with the SCAQMD and SDAPCD staffs.

Permits for the Phase 2 project for CEQA will include:

- A Coastal Development Permit from the CCC (This Final Design Plan is part of the CDP permit application that was submitted to CCC on December 14, 2007)
- A permit and lease agreement adjustment from the lead agency, CSLC; and (SLC signed off on the Phase 2 Mitigation Reef on Nov. 21, 2006 and SLC confirmed this in a letter to CCC on Oct. 29, 2007).
- A 401 Water Quality Certification from the RWQCB, SDR. (SCE has submitted an application to the California Regional Water Quality Board, San Diego Region and it is currently under consideration)

Meetings and informal discussions with other responsible agencies, the involved trustee agencies, and the public and interested parties will be arranged by CSLC and SCE as needed.

9.2.3 NEPA Agencies

The project will also be approved or reviewed by a number of federal agencies, including the U.S. Army Corps of Engineers, San Diego Regulatory Branch (USACOE); U.S. Fish and Wildlife Service, Marine Resources Division; National Marine Fisheries Service; and U.S. Coast Guard.

USACOE is the Lead Agency for the purposes of the National Environmental Policy Act (NEPA) review, which is being conducted independent of the CEQA review.

9.2.4 NEPA Action

The PEIR was accepted by USACOE in 1999. A separate Environmental Impact Statement (EIS) was not required as part of the NEPA review process; rather, the PEIR was determined to be adequate. USACOE will need to address both Sections 404 and 401 of the Federal Clean Water Act in evaluating this project. The Regional Water Quality Control Board, San Diego Region, will be involved with the 401 component of this evaluation (SCE has submitted a 404 application to USACOE and it is currently under consideration).

SCE and CSLC will arrange meetings with USACOE as needed to discuss the necessary steps to be taken to most efficiently coordinate the CEQA and NEPA review process as Phase 2 gets underway.

10.0 PROJECT SCHEDULE

10.1 PROJECT SCHEDULE CONSIDERATIONS

The following issues have been considered in estimating the project's duration:

1. Prior commitment of key equipment to other projects.
2. The construction company will need at least a three-month, and more likely a four-to-six-month, lead-time to secure an adequate supply of quarry rocks of the appropriate dimension.
3. Lobster season prevents construction activities between the beginning of October and mid-April.
4. Weather conditions may interfere with the construction schedule. Twenty-four hours before the advancement of weather conditions that will generate ground swells (waves) greater than 4.9 feet, all construction vessels will be withdrawn to a safe location. The estimated schedule delay for each adverse weather event is one week.
5. Air quality and cumulative construction daily emissions of PM10 and NO_x may be exceeded.
6. Possible damage to existing kelp at the experimental reef modules by anchor lines or by relocation of the construction vessels.
7. Transportation of rocks to a nearby harbor in the event that rocks from the Catalina Island quarry will not be used for this project.
8. Equipment failure and unforeseen circumstances.

10.2 SCHEDULE OUTLINE

Figure 10-1 shows the project timeline. The schedule outlines the activities between September 1, 2007 and November 30, 2008. SCE has already obtained CSLC approval of the project and successfully negotiated a leasing agreement for the project area. SCE has also submitted applications to USACOE and the California Regional Water Quality Board, San Diego Region (both are currently under consideration) and selected the construction company. The major factor affecting the project schedule is the length of time needed to complete the permitting process. It is anticipated that construction will be completed by October 2008, and the final report will be submitted to the CCC in early December 2008.

Table 10-1 shows the preliminary construction schedule, including the total weight required for each polygon and the estimated number of days required to: 1) construct each polygon; 2) move the anchors from one location to another; and 3) allow for stop-work days due to weather conditions. Construction will begin on June 2, 2008. Based on a review of the historic wave data records measured offshore of Oceanside, we estimate that we will have 1 to 2 wave storms from June through September 2008, with each storm lasting 2-3 days. Work will stop completely if wave heights exceed 1.5 m (4-9 ft). The derrick barge will move to a location where it can be anchored safely or to deep water or to Long Beach Harbor if wave heights exceed 2 m. The anchoring plan has been designed so that minimal time will be spent moving the barge from one location to another.

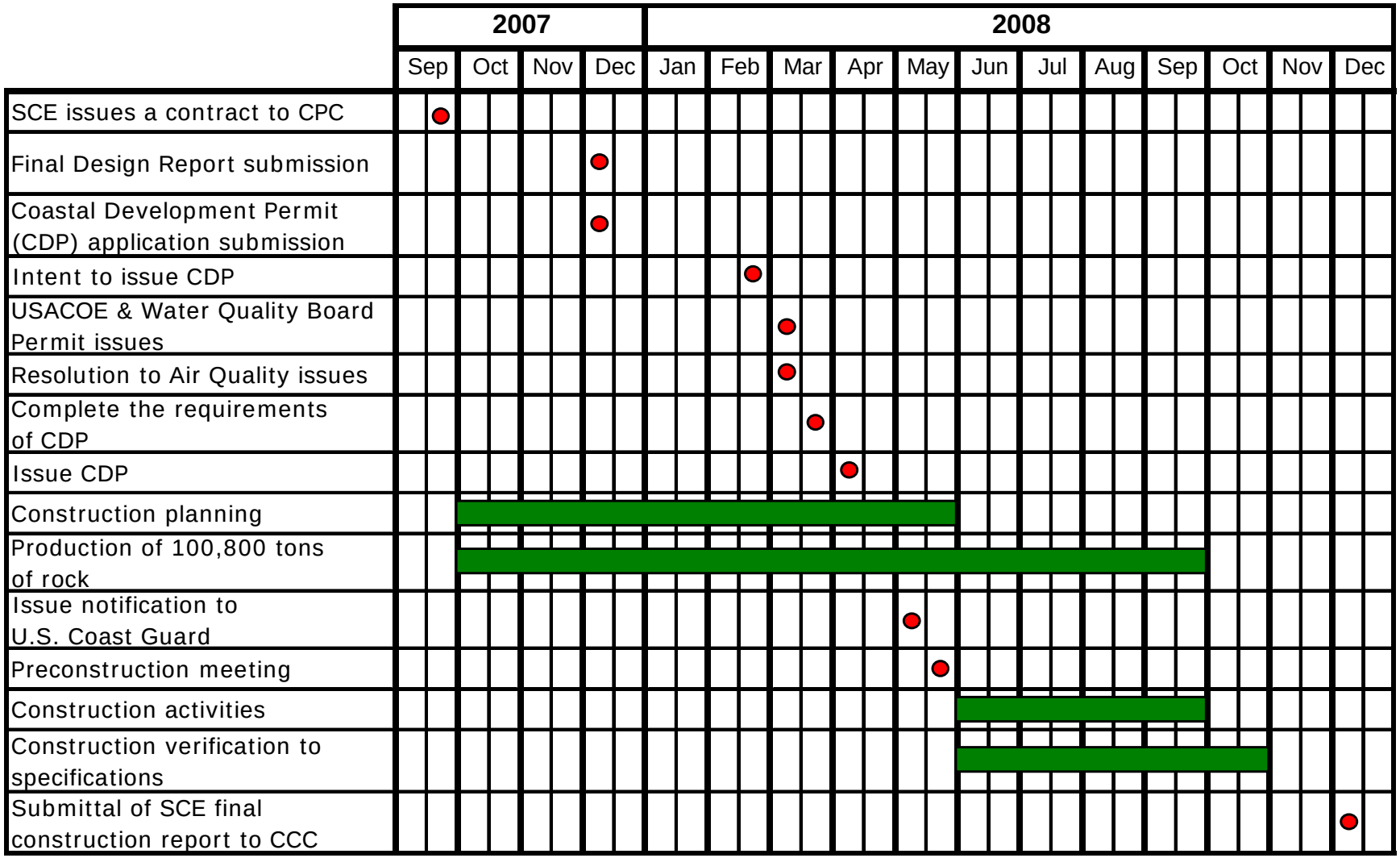

Figure 10-1. Project schedule for Wheeler North Reef at San Clemente, California, Phase 2 Mitigation Reef.

Table 10-1. Preliminary construction schedule.

Task	Polygon Number	Polygon Area (Acres)	Rock Weight (Tons)	Length of Construction (Days)
Construction of Test Polygons	6	4.1	3,239	3
	Half of 4	7	5,530	4
Construction of Other Polygons	1	13.3	10,507	8
	2	37.5	29,625	24
	3	6.5	5,135	4
	Half of 4	7.1	5,609	4
	5	9.2	7,268	6
	7	25.8	20,382	16
	8	7.5	5,925	4
	9	3.5	2,765	2
	10	3.8	3,002	3
	11	2.4	1,896	2
Anchoring, Movement, & Weather Delays				20
	TOTALS	**127.6 acres**	**100,883 tons**	**100 days**

11.0 REFERENCES

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APPENDIX A

SEAFLOOR CHARACTERISTICS OFF SAN CLEMENTE
(2005-2006 Sonar Surveys)

WHEELER NORTH REEF AT SAN CLEMENTE, CALIFORNIA
(SONGS ARTIFICIAL REEF MITIGATION PROJECT, PHASE 2 MITIGATION REEF)

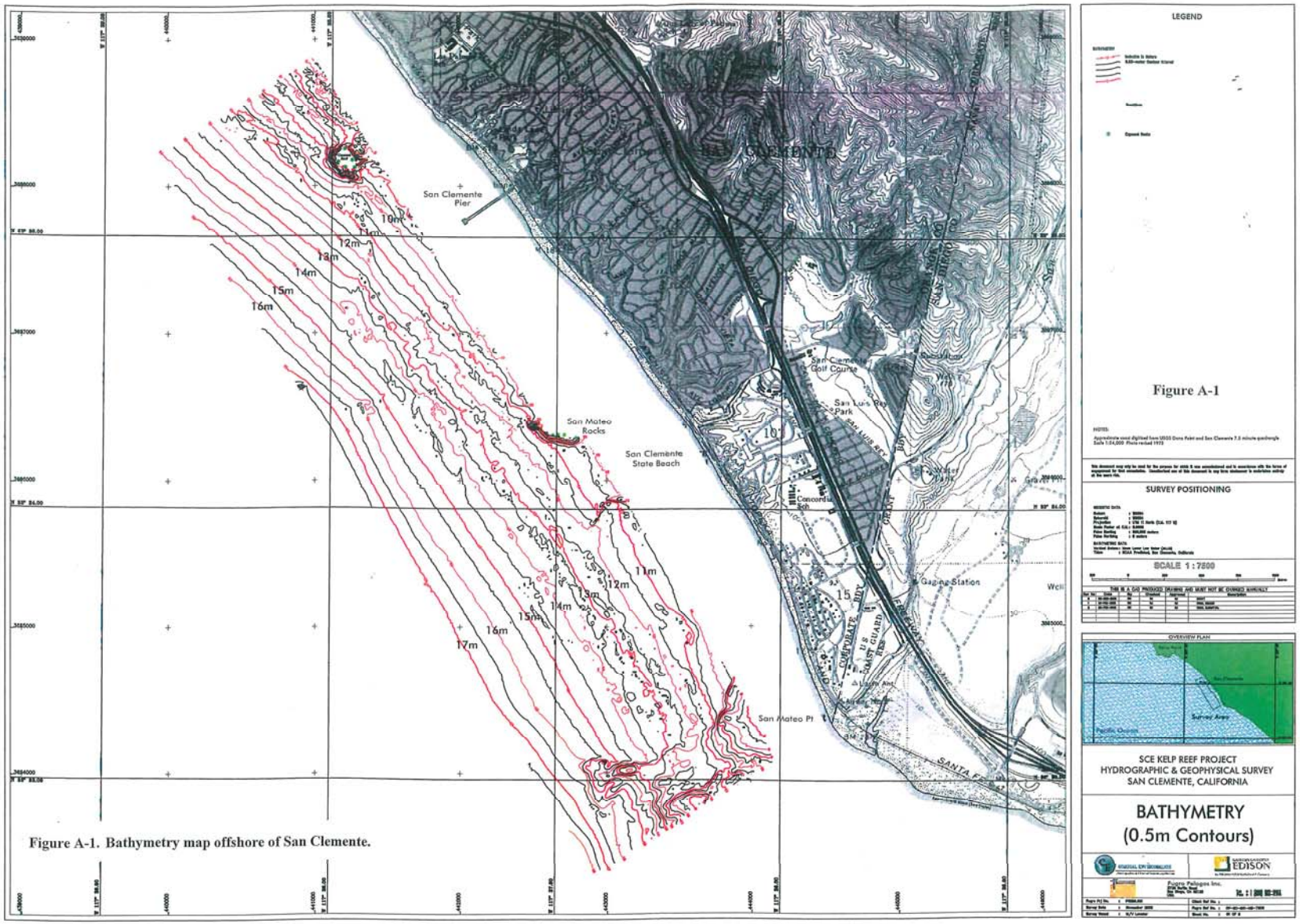

Figure A-1. Bathymetry map offshore of San Clemente.

Figure A-1. Bathymetry map offshore of San Clemente.

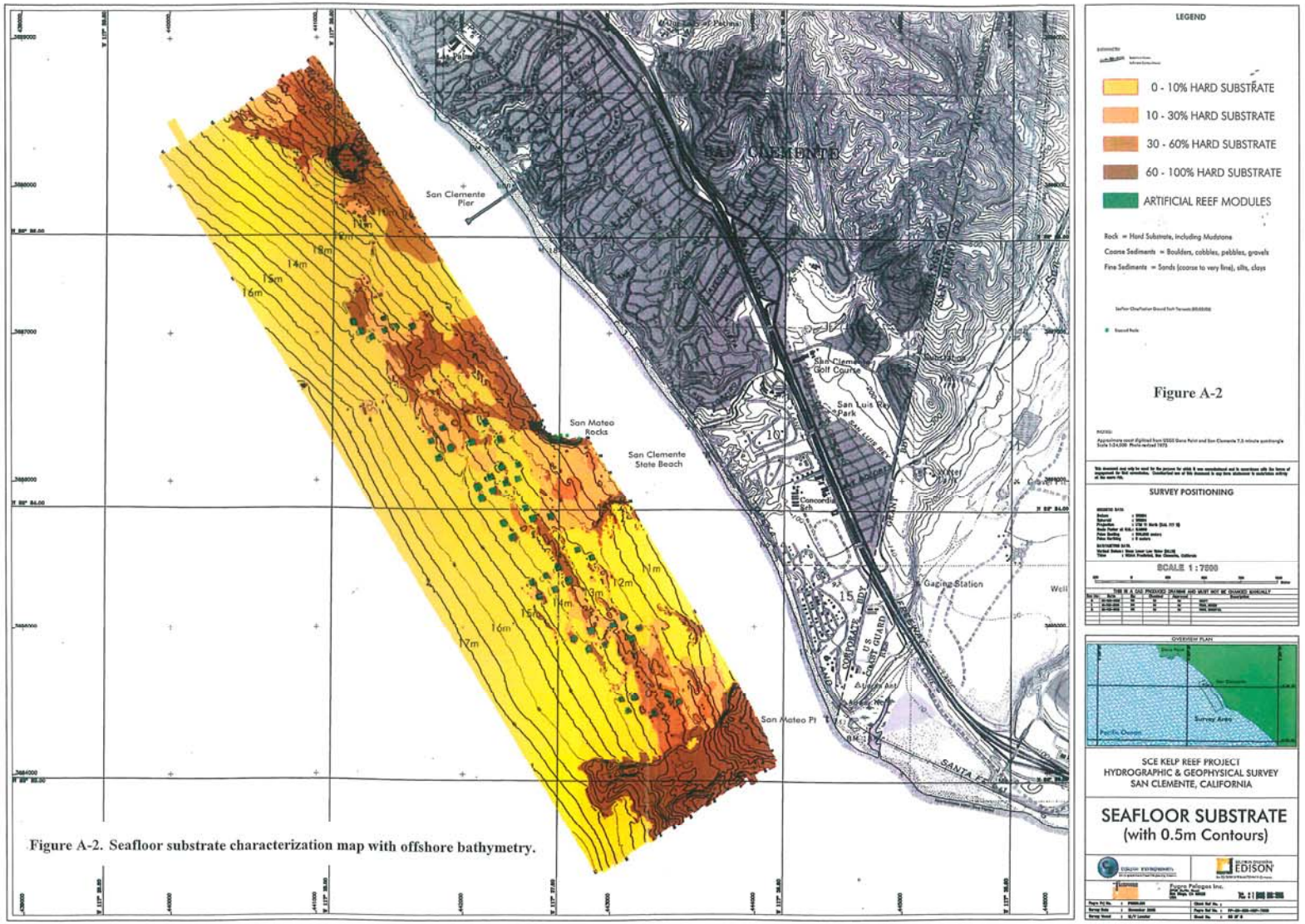

Figure A-2. Seafloor substrate characterization map with offshore bathymetry.

Figure A-2. Seafloor substrate characterization map with offshore bathymetry.

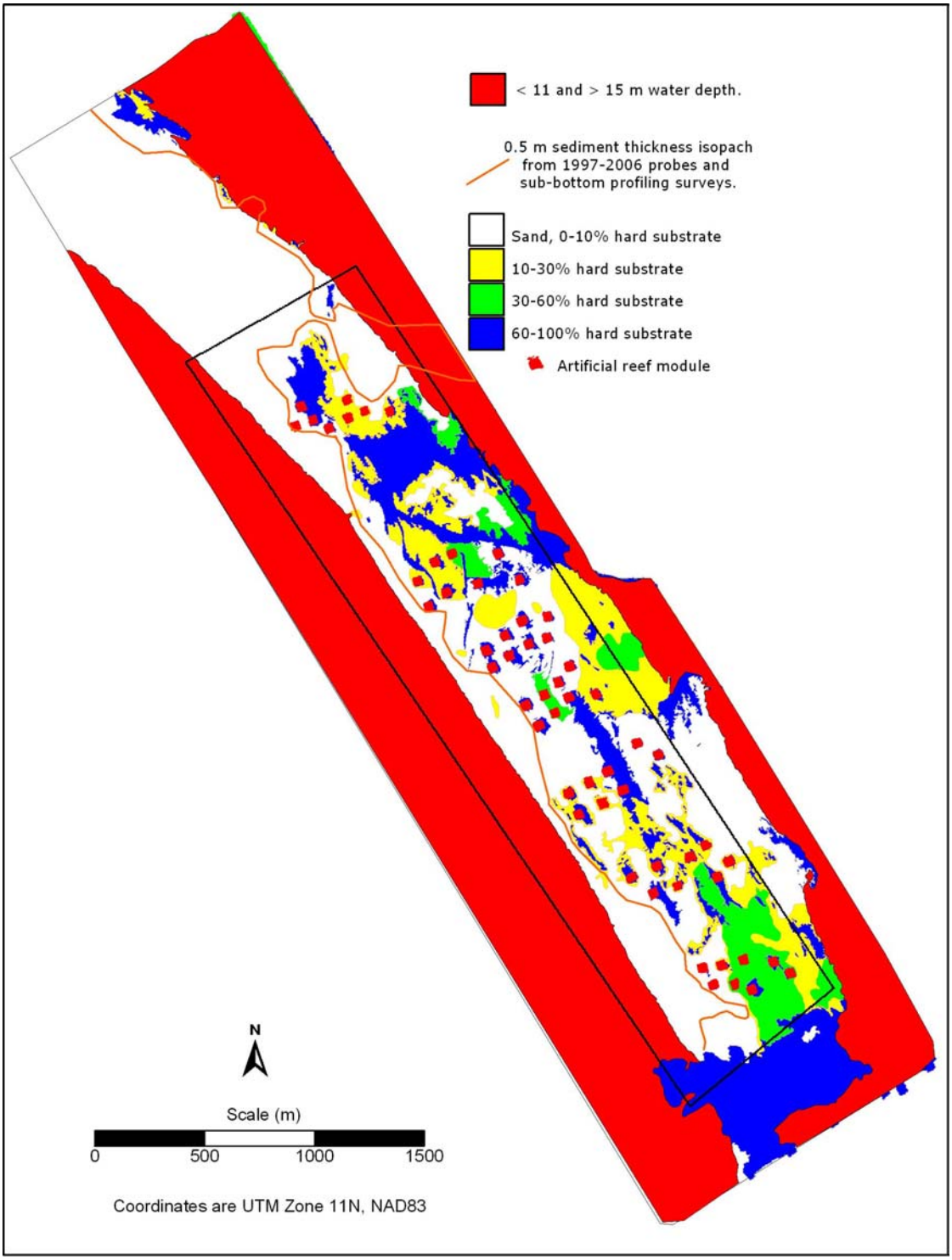

Figure A-3. Sediment thickness map with bathymetry offshore of San Clemente.

APPENDIX B

SUMMARY OF BIOLOGICAL DATA FROM DIVERS SURVEY

(February 2006)

WHEELER NORTH REEF AT SAN CLEMENTE, CALIFORNIA (SONGS ARTIFICIAL REEF MITIGATION PROJECT, PHASE 2 MITIGATION REEF)

Table B-1. Mean number of individuals per 120 m^2 for Groups A, B, C, D, and E for algae and invertebrates.

	Algae							Invertebrates										
Transect Group	*Macrocystis pyrifera* Adult	*Macrocystis pyrifera* Juveniles	***Pterygophora californica***	***Cystoseira osmundacea***	***Laminaria farlowii***	***Desmarestia ligulata***	**Other**	***Pisaster giganteus***	***Pisaster brevispinus***	***Dermasterias imbricate***	***Asterina miniata***	***Strongylocentrotus franciscanus***	***Strongylocentrotus purpuratus***	***Lytechinus anamesus***	*Muricea* spp.	***Kelletia kelletii***	**Other Gastropods**	***Dendraster excentricus***	**Other Invertebrates**
A	0	0	0	0	0	0.22	0	0.11	0	0	0	0	0	0	0	2.67	0.44	0	4.56
B	0	0	0	0	0.38	0.6	0	0	0	0	0	0	0	0	1.4	1.6	0	0	1.6
C	0	0	2	0	10	2	0	1.5	0	1.5	0	0.5	0	0	69	21	0	0	0
D	0	0	3.5	12	115.8	21.75	2.75	6	2.25	0	0.3	64.3	10	0	88.25	39.75	0.75	0	4.75
E	0	0.13	3	15	24.8	9.25	21.5	0.38	0	0.38	0.3	4	3.5	0.38	26.13	1.5	0.63	0	2.6

i. Group A (0% - 10% hard substrate) is comprised of transects 1, 3, 8, 18, 19, 21, 22, 23, and 25.
ii. Group B (10% - 30% hard substrate) is comprised of transects 9, 12, 13, 15, and 20.
iii. Group C (30% - 60% hard substrate) is comprised of transects 11 and 24.
iv. Group D (60% - 100% hard substrate) is comprised of transects 2, 5, 10, and 16.
v. Group E (mixed % hard substrate) is comprised of transects 4, 6, 7, 14,17, 26, 27a, and 27b.

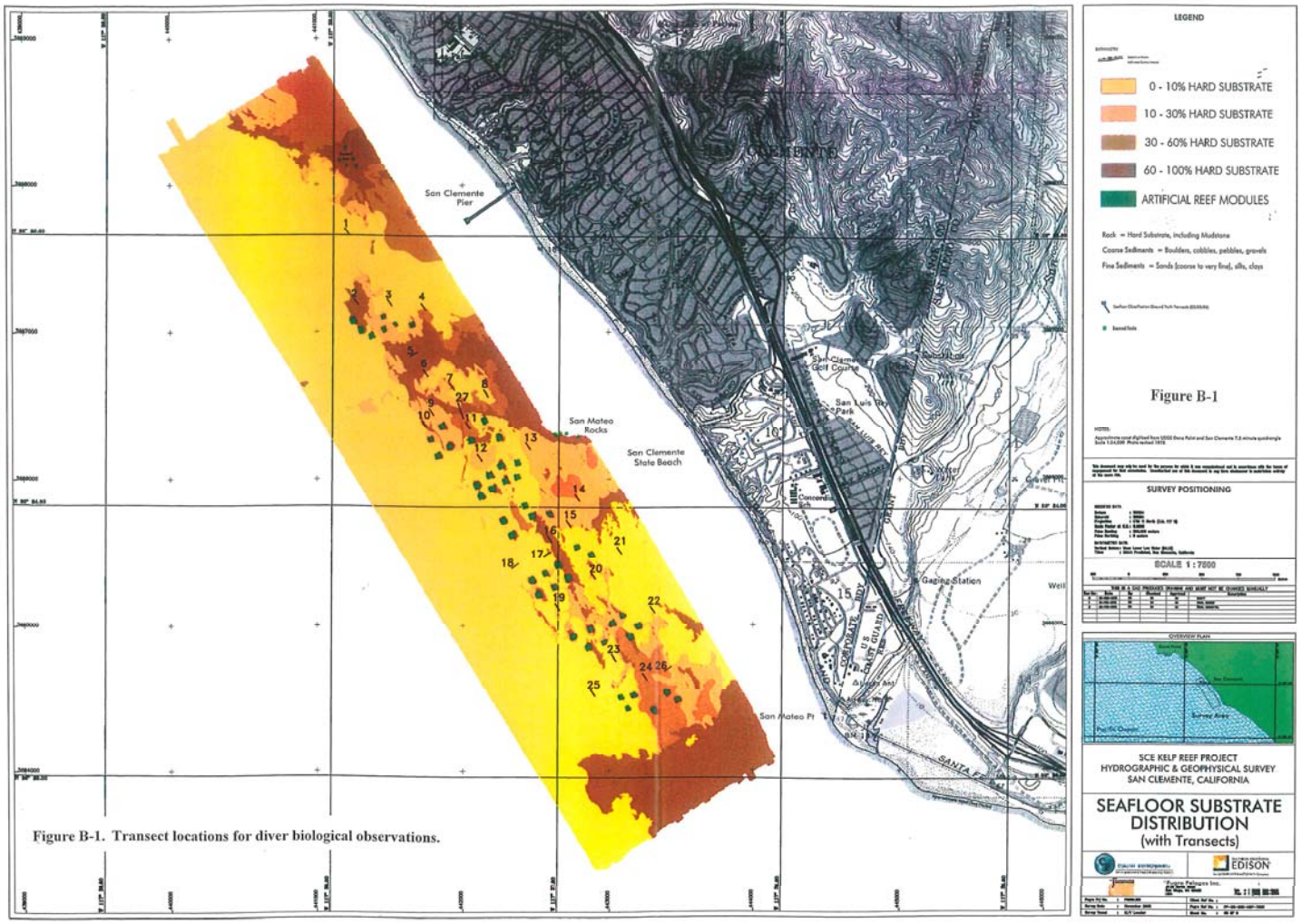

Figure B-1. Transect locations for diver biological observations.

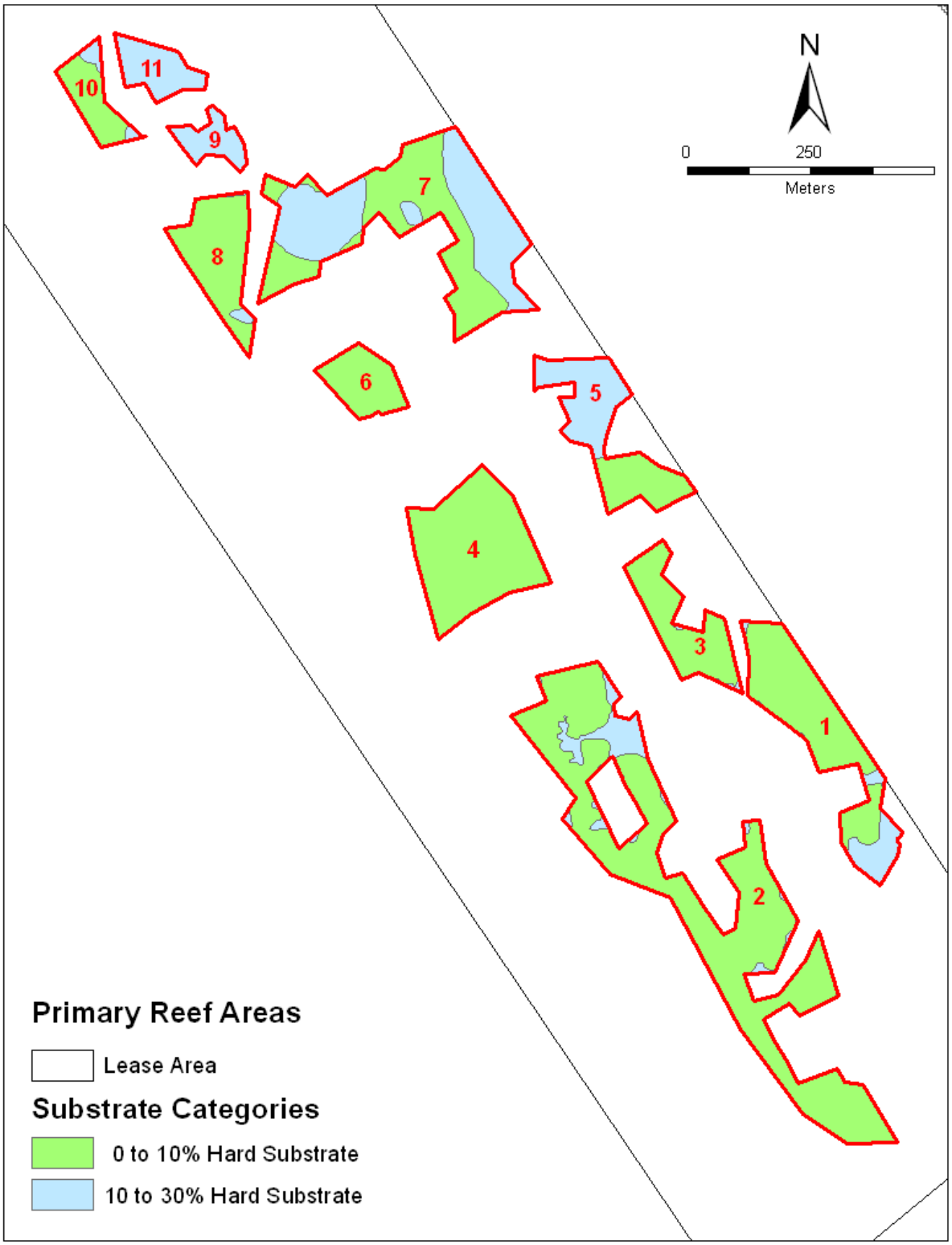

Figure B-2. Substrate coverage for the built-out reef (127.4 acres). 75% of the reef covers 0-10% hard substrate, and 25% covers 10-30% hard substrate.

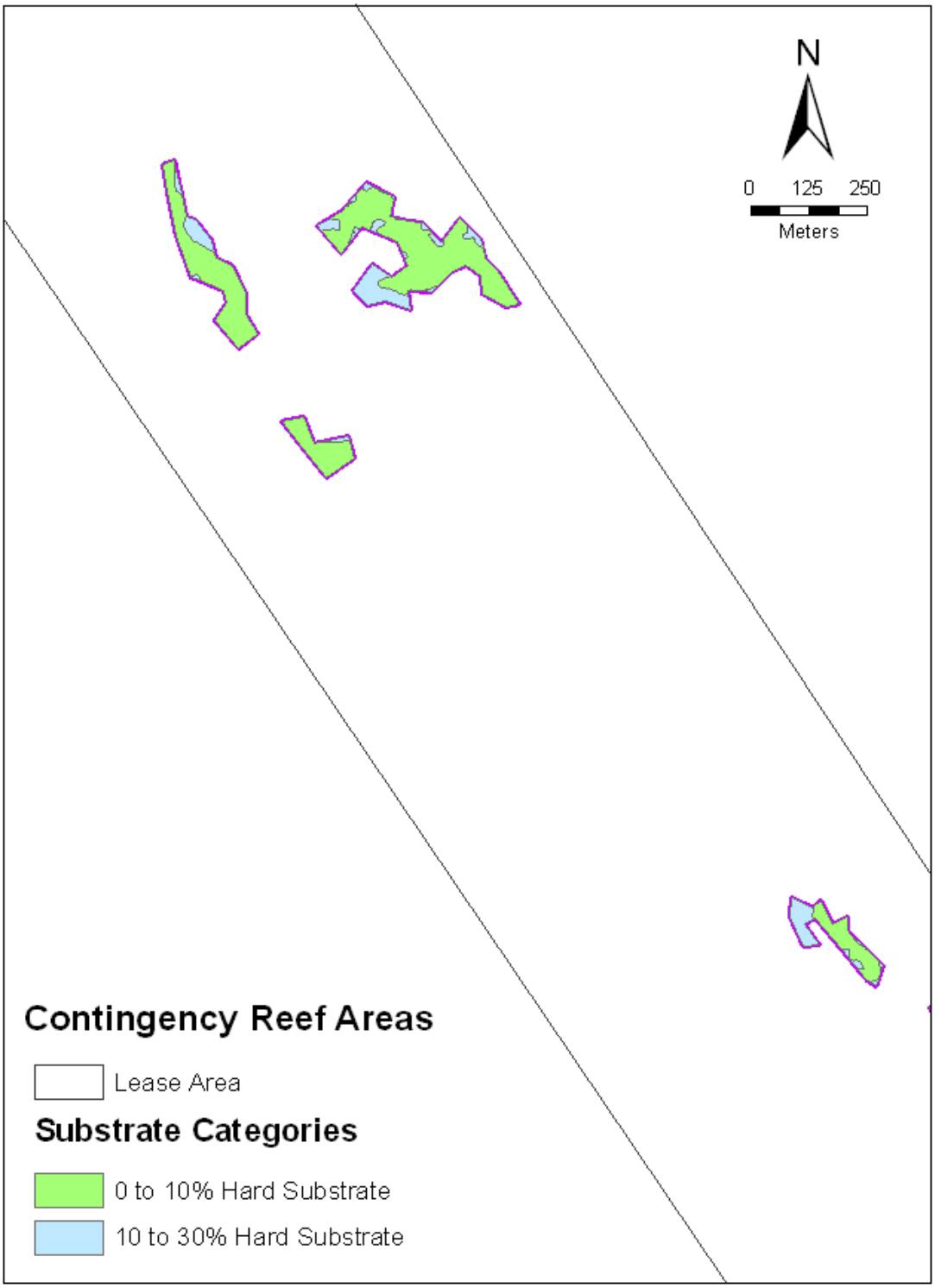

Figure B-3. Substrate coverage for contingency polygons (22.6 acres). 81% of the reef covers 0-10% hard substrate, and 19% covers 10-30% hard substrate.

APPENDIX C

KELP CANOPY COVERAGE OFF SAN CLEMENTE (1967-2004)

WHEELER NORTH REEF AT SAN CLEMENTE, CALIFORNIA (SONGS ARTIFICIAL REEF MITIGATION PROJECT, PHASE 2 MITIGATION REEF)

APPENDIX C

KELP CANOPY COVERAGE OFF SAN CLEMENTE (FROM 1967-2004)

by

Larry Deysher, Ph.D.

One of the primary concerns during the selection process was avoiding the placement of new reef material in areas with significant biological resources. The resources of concern included any kelp habitat areas and populations of species that had become rare in sandy habitats in southern California, such as *Dendraster excentricus*. Sources used to identify biological resources in the area included dive surveys conducted to site the experimental reef modules, recent dive surveys to groundtruth the multibeam sonar data, the long-term record of aerial photographs begun in 1967 by Wheeler North to identify the kelp canopy areas, and information derived from local commercial and sportfishing communities.

The historical kelp canopy maps showed that all of the kelp canopy within the lease area occurred after the La Niña events of 1988/89 and 1999/2000. However, this database suffered from the problem that the georeferencing of the canopies had been done primarily with features on land. The lack of offshore landmarks for georeferencing, coupled with the fact that a handheld 35 mm camera was used to collect the photographs, led to offsets of up to 200 meters of some kelp canopy areas from their true positions.

The construction of the experimental reef modules provided an opportunity to improve the accuracy of the georeferencing of the photographs and the maps derived from these photographs. The reefs provided a set of well-defined landmarks in the lease area to which the module canopies could be accurately matched. This allowed the entire canopy map to be warped to provide a better fit for all the canopy features in the photograph. After georeferencing, most of the canopy areas aligned to prominent substrate features within the lease area such as the features shown in Figure C-1. This substrate feature is located in the offshore portion of Block 6 of the Experimental Reef modules. This same feature could be seen to be supporting kelp in the March 1989 aerial photographs taken by Wheeler North (Figure C-2).

We georeferenced the Regional Water Quality Control Board kelp maps covering the lease site for the years 1989 to 1993 and 2000 to 2004. These were the only years when kelp was found in the lease area based on the previous kelp persistence database. A new GIS database was established that showed the number of years that kelp occurred at any location within the lease site. This data is shown with the primary reef site areas in Figure C-3.

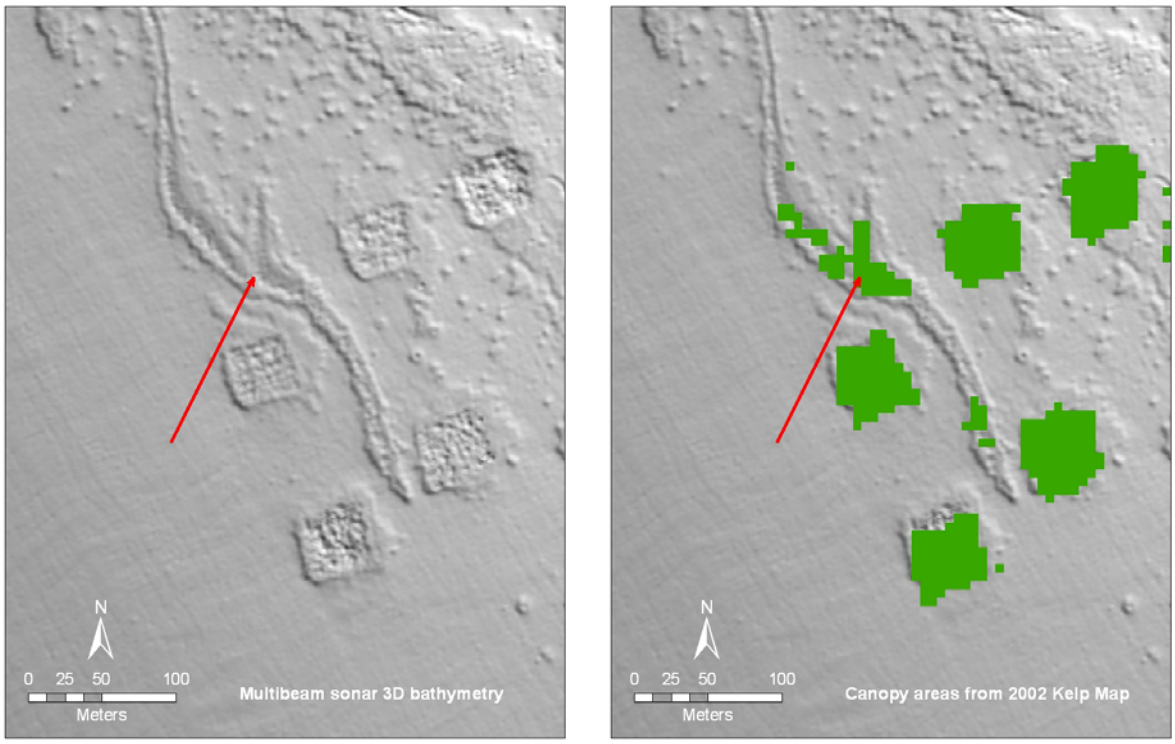

Figure C-1. Comparison of kelp canopy areas from the 2002 kelp map from the San Diego Regional Water Quality Control Board with substrate features from the multibeam sonar bathymetry map.

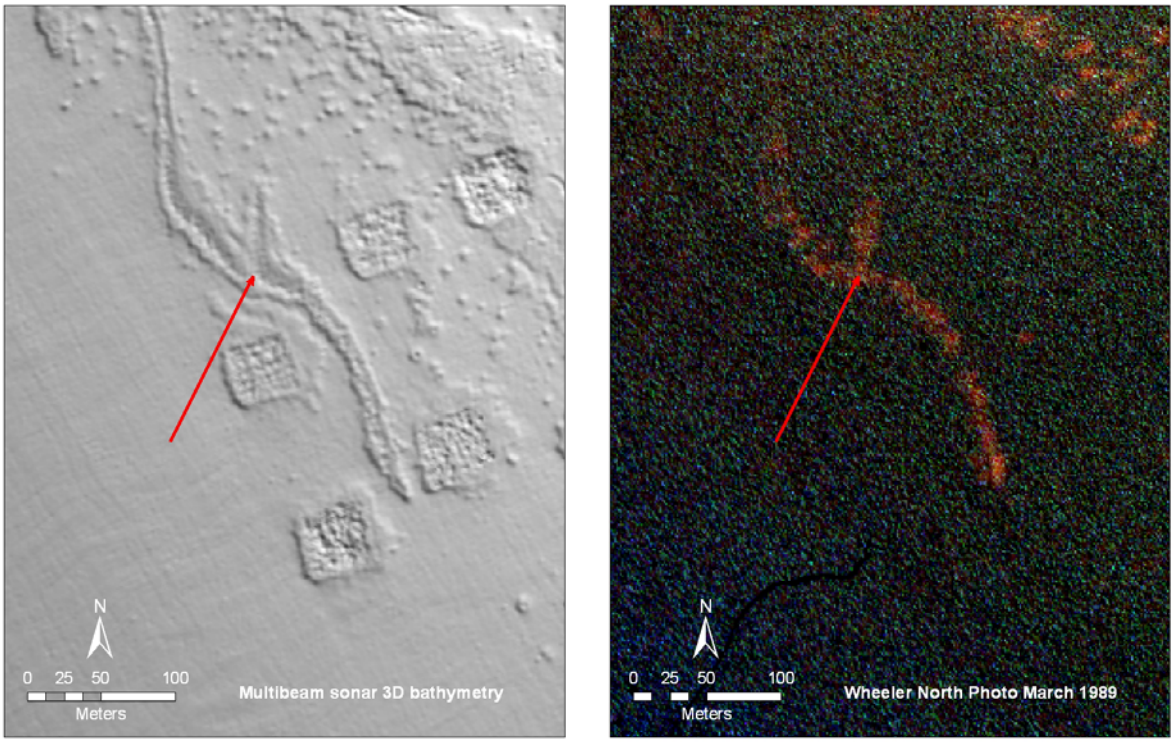

Figure C-2. Comparison of kelp canopy areas from a 1989 infrared aerial photo with the "y" shaped feature that supported kelp in 2002.

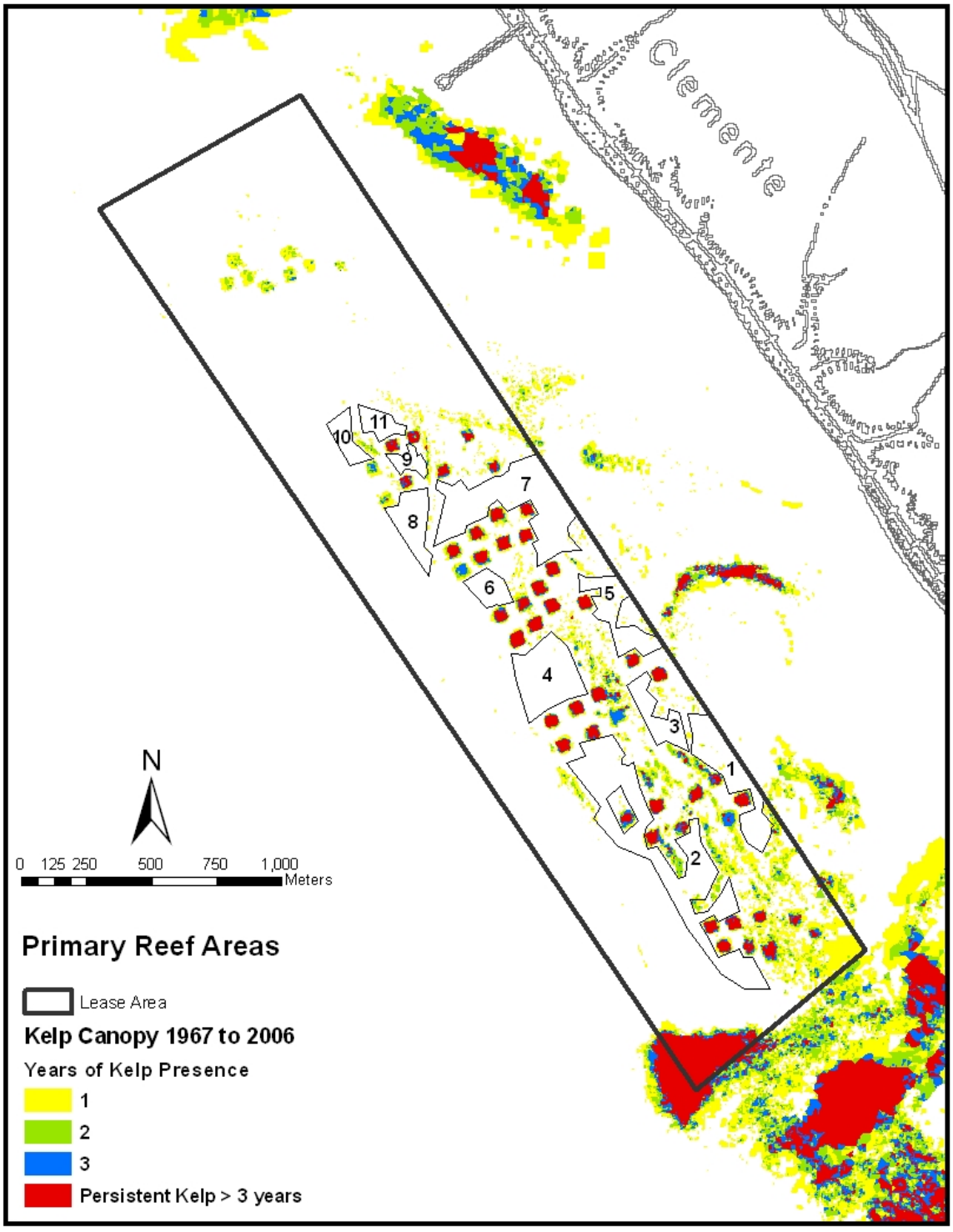

Figure C-3. Occurrence of historical kelp canopy in the region of the lease site from 1967 to 2004. The canopy areas have been georeferenced to the prominent substrate features shown in the new multibeam sonar data. YearSum is the cumulative number of years that kelp has occurred at a location.

The kelp database figured prominently in the placement of substrate for the final Mitigation Reef. New reef areas were chosen to avoid any areas with greater than one year of kelp occurrence. This criterion was selected because we found that even areas defined as 0 to 10% hard substrate showed some kelp canopy over regions without any relief in the 3D bathymetry maps. We felt that these small kelp regions were either drift plants or areas with residual georeferencing problems that could not be corrected in the new georeferencing process.

The canopy maps for the years when kelp populations were present in the State Lands Commission lease site are presented in Figures C-4 to C-43.

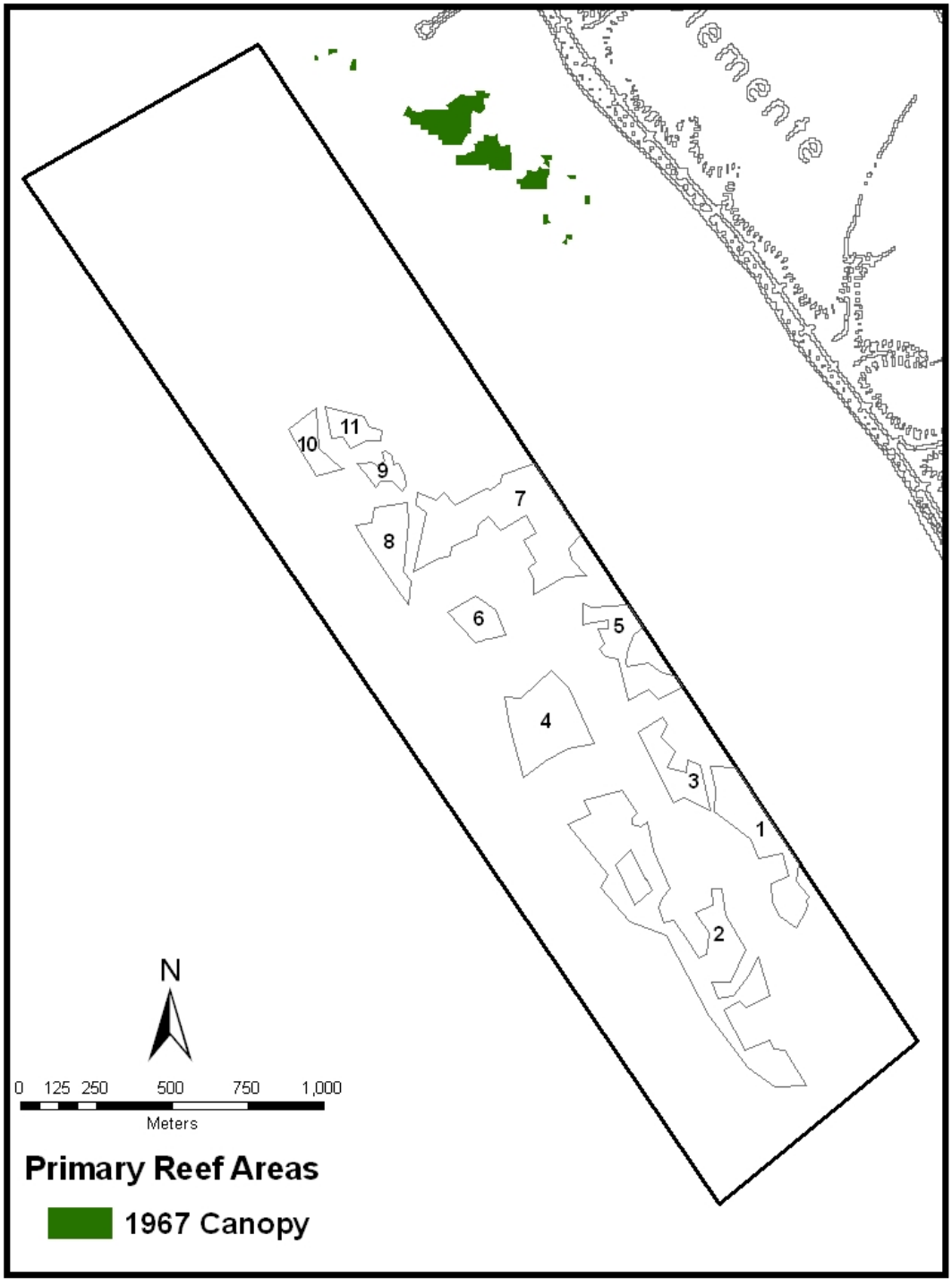

Figure C-4. 1967 kelp canopy map off San Clemente.

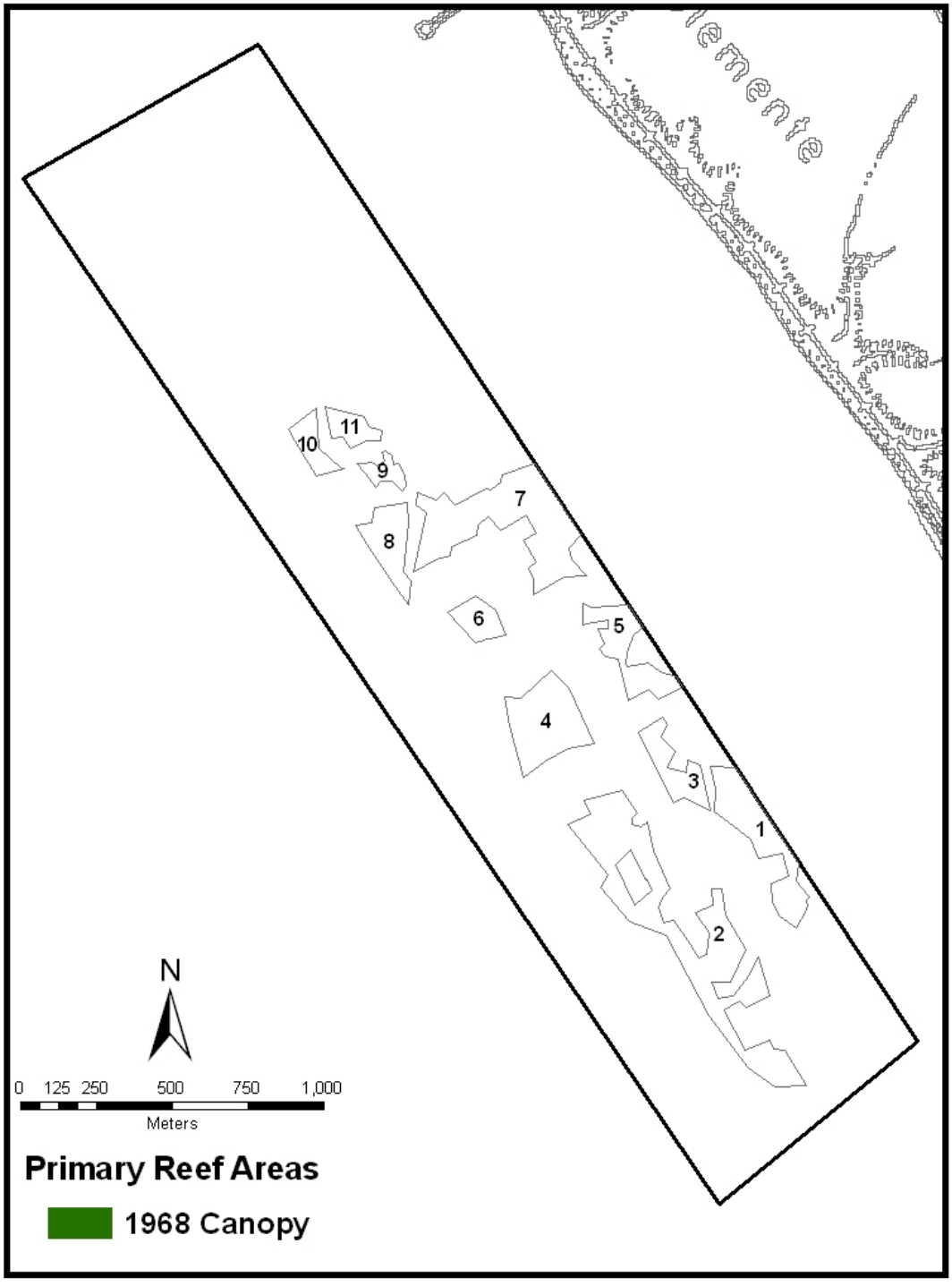

Figure C-5. 1968 kelp canopy map off San Clemente.

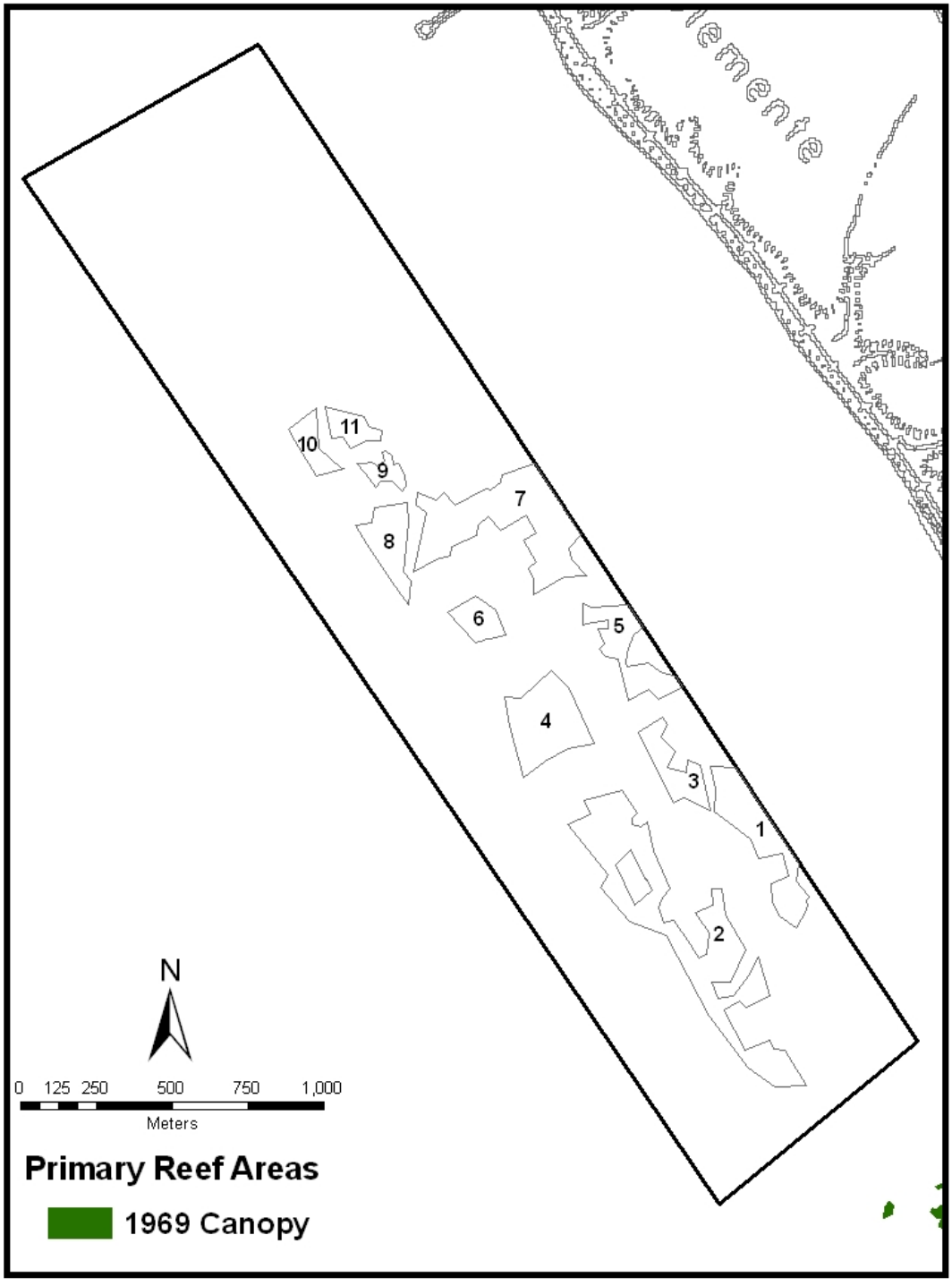

Figure C-6. 1969 kelp canopy map off San Clemente.

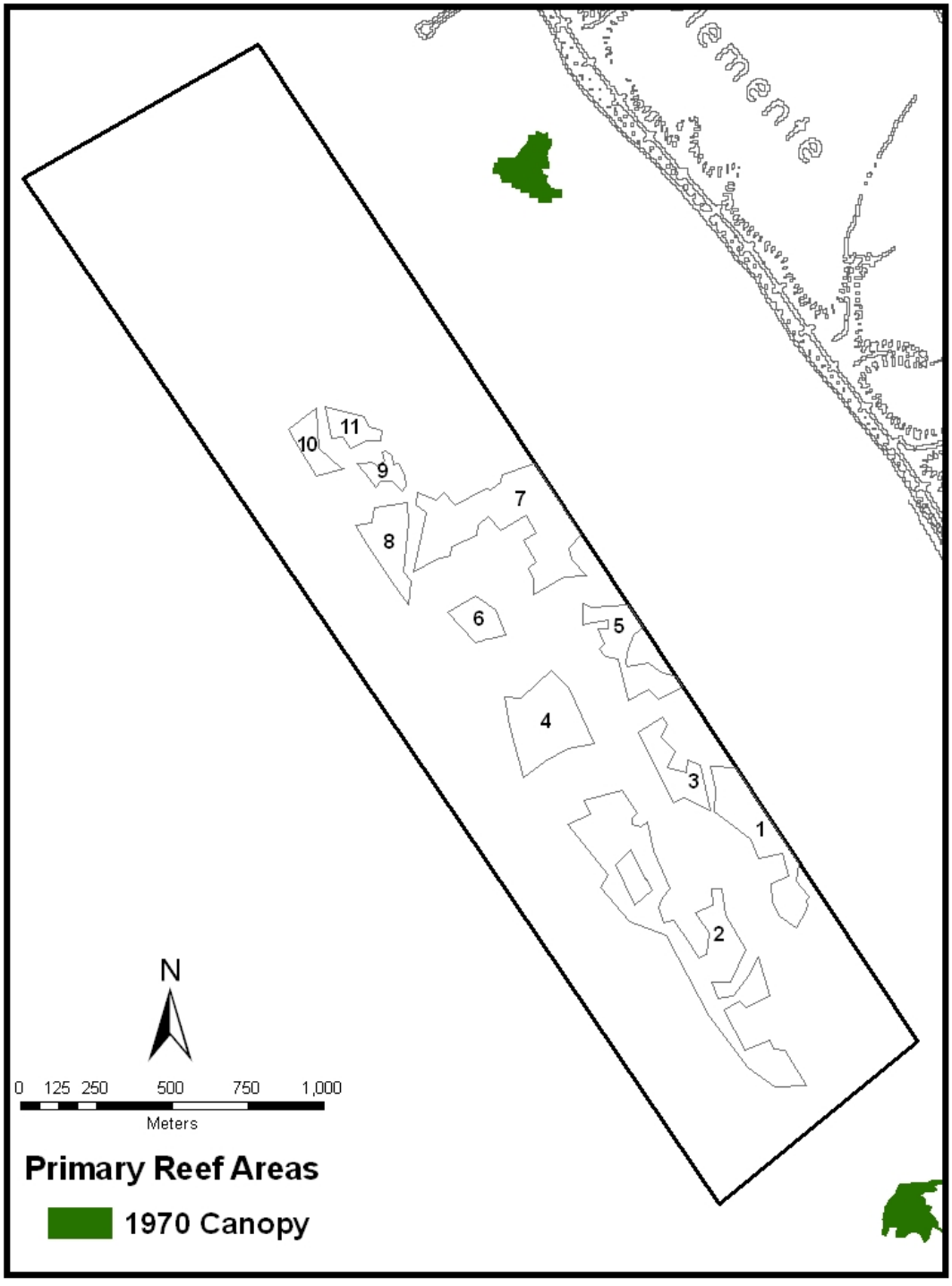

Figure C-7. 1970 kelp canopy map off San Clemente.

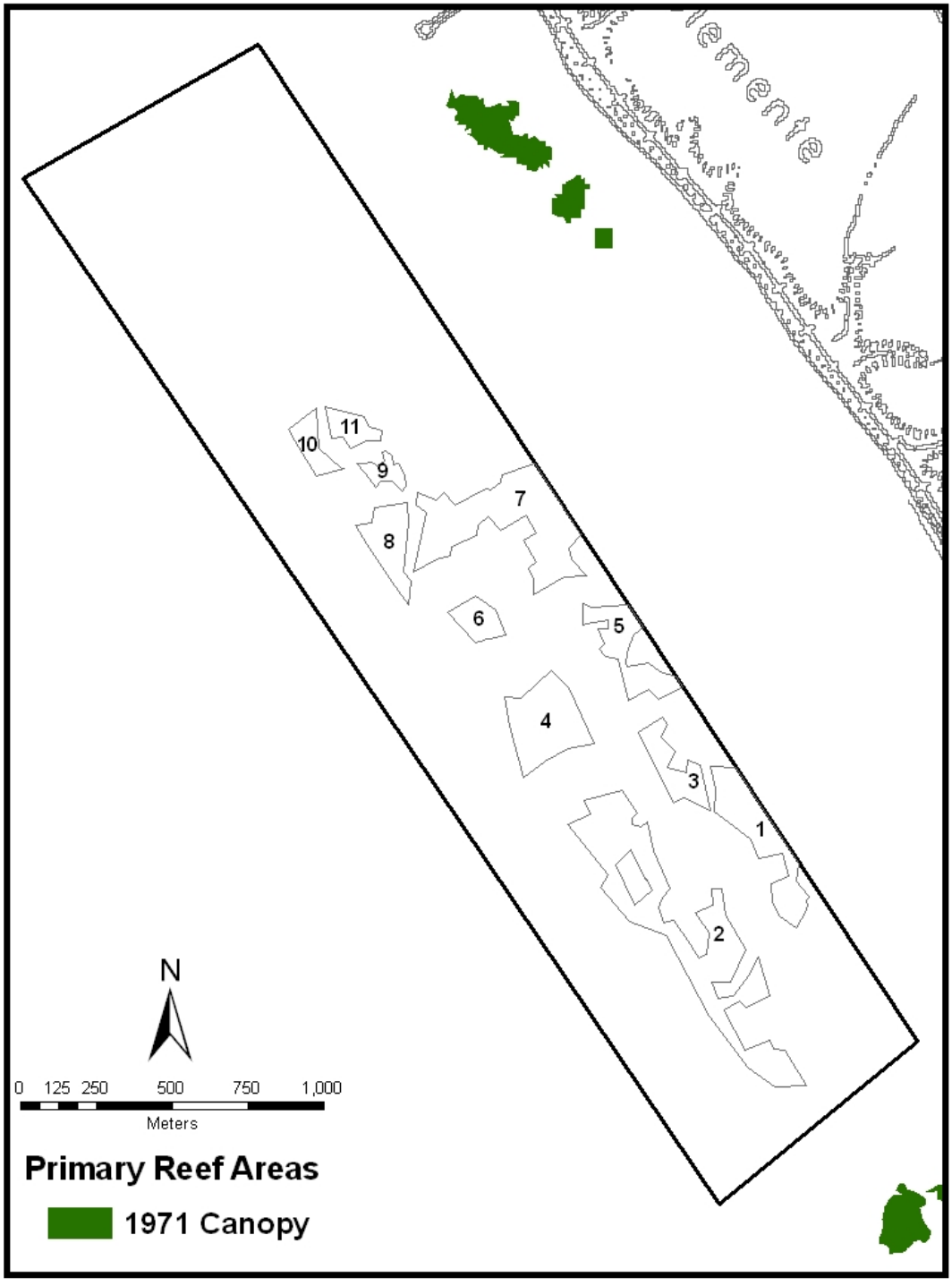

Figure C-8. 1971 kelp canopy map off San Clemente.

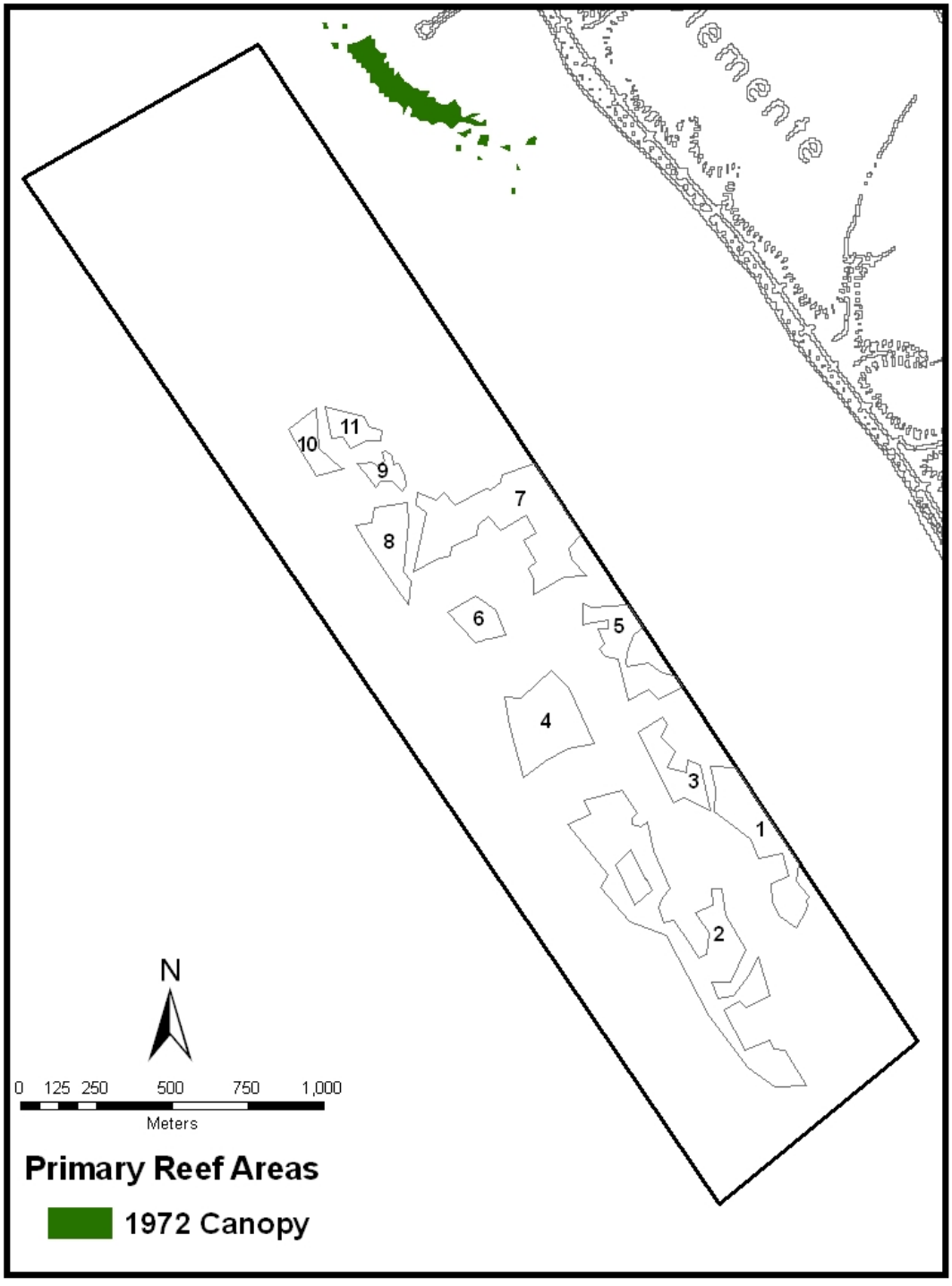

Figure C-9. 1972 kelp canopy map off San Clemente.

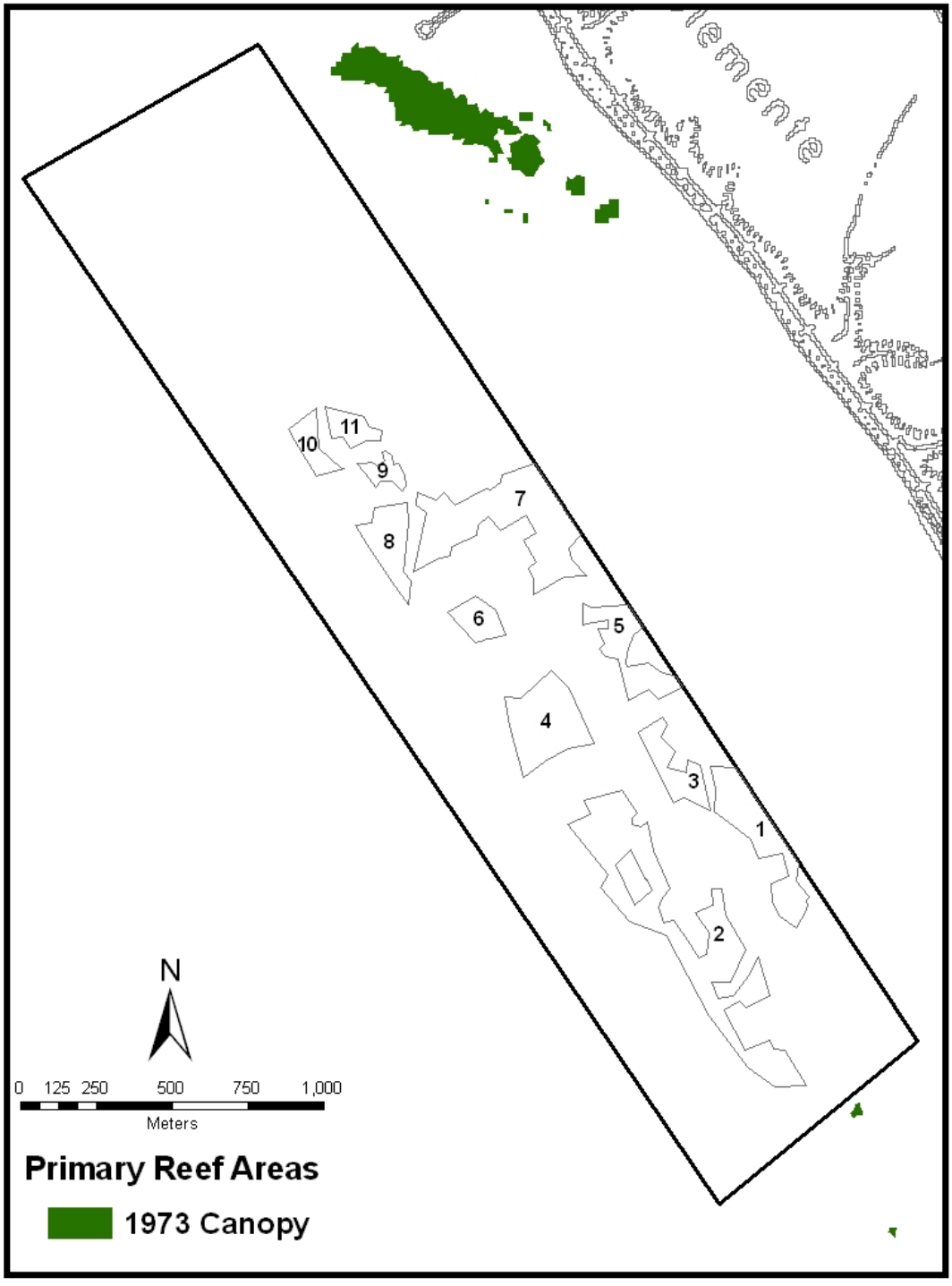

Figure C-10. 1973 kelp canopy map off San Clemente.

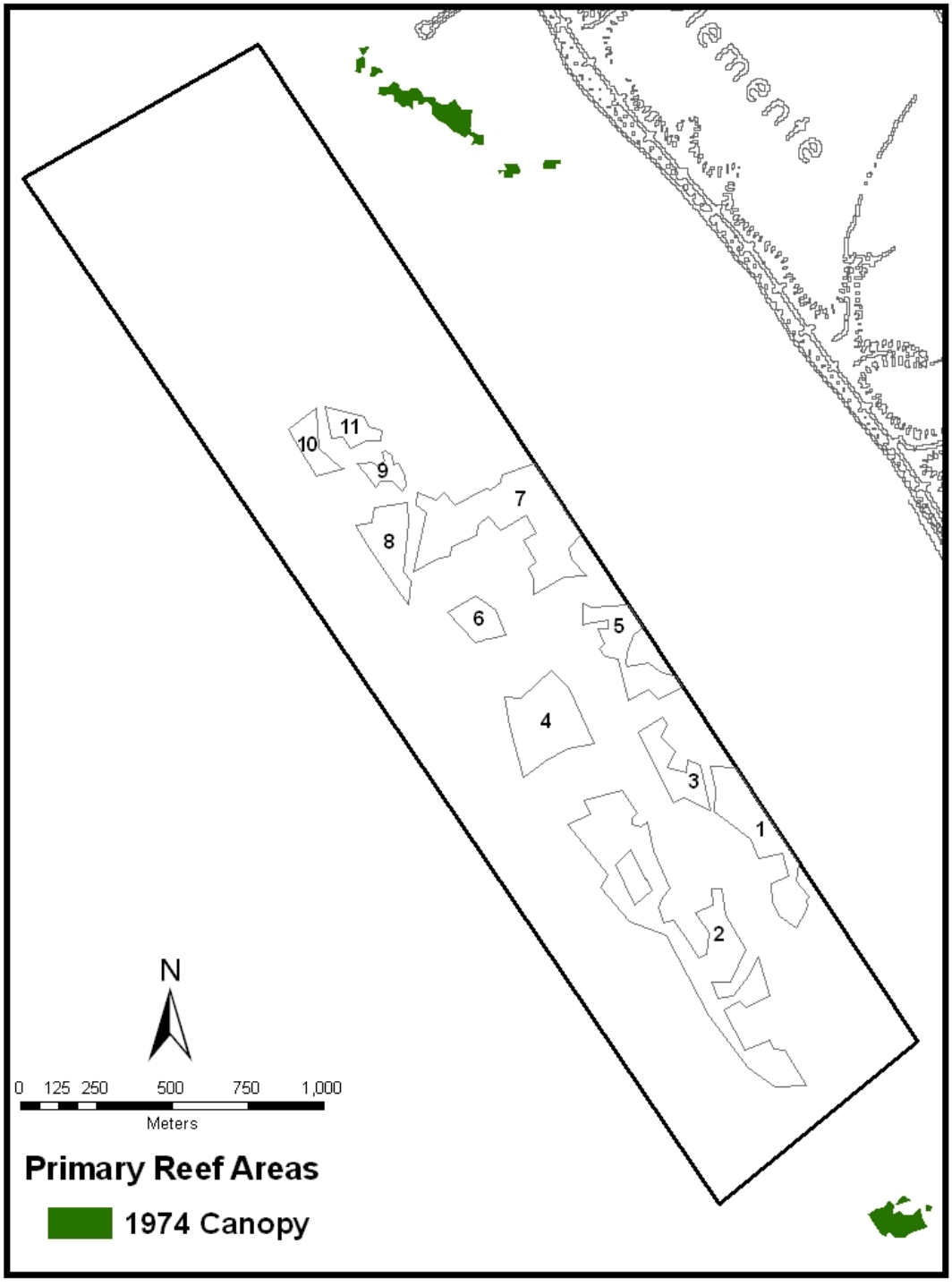

Figure C-11. 1974 kelp canopy map off San Clemente.

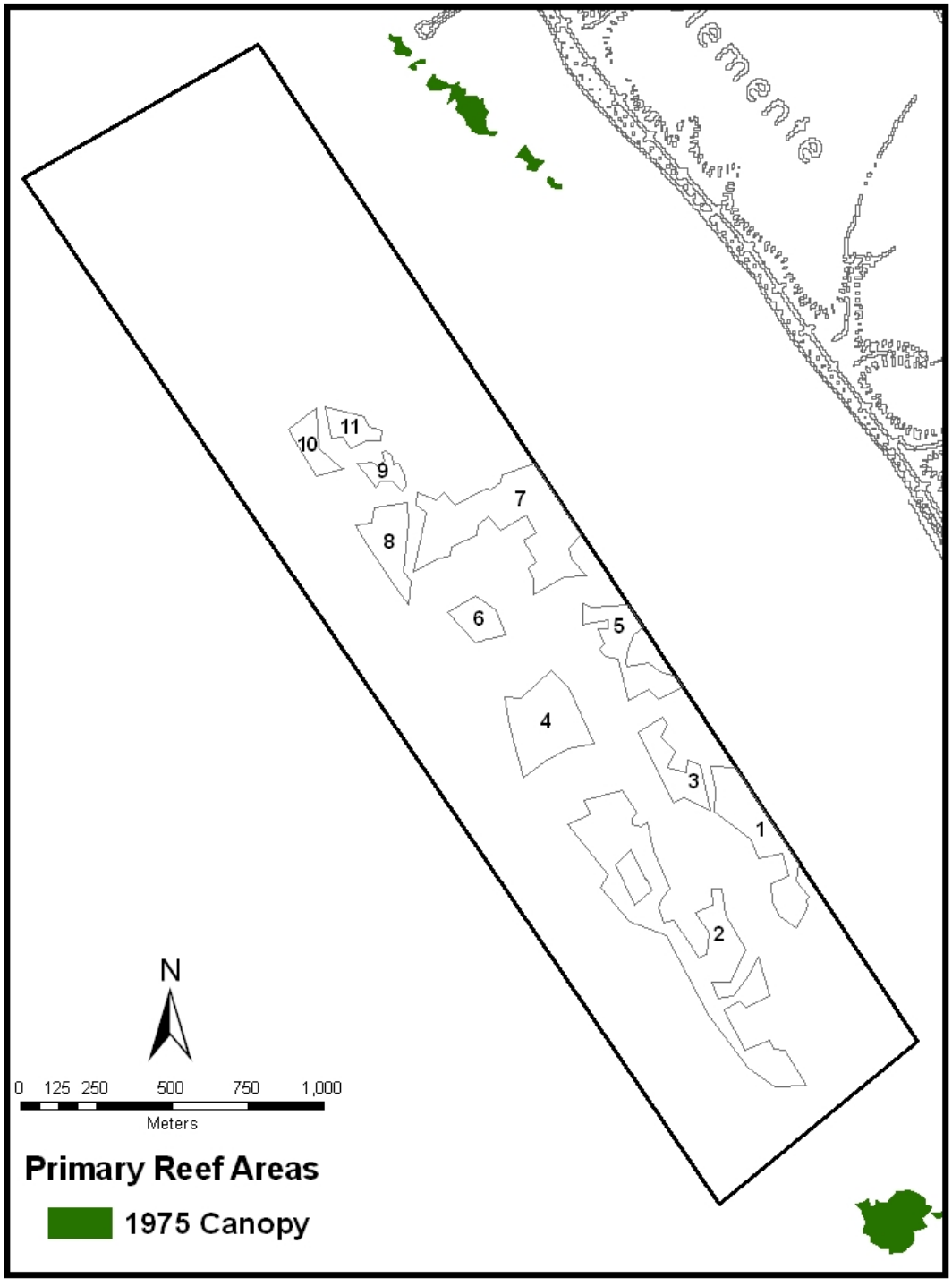

Figure C-12. 1975 kelp canopy map off San Clemente.

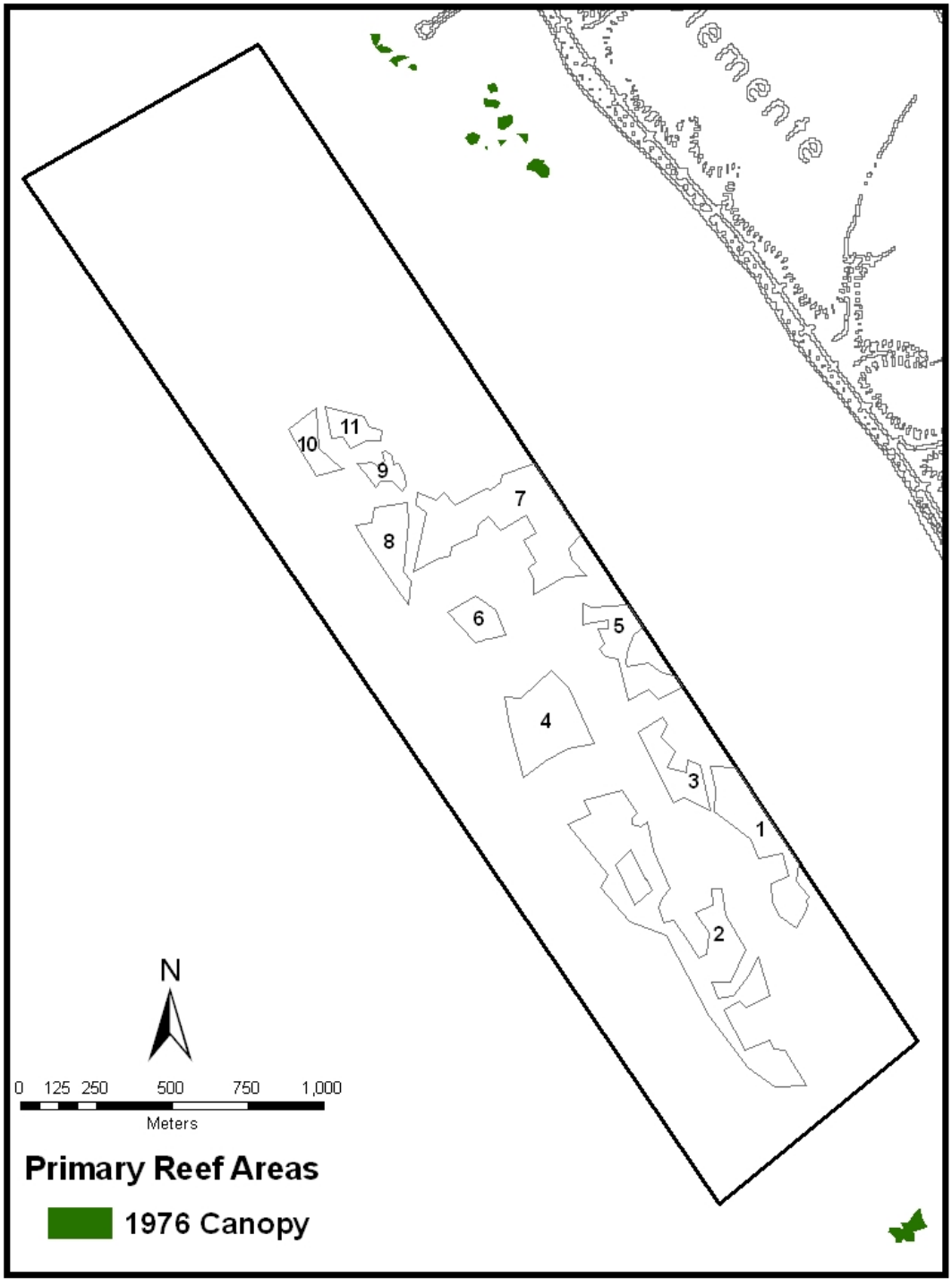

Figure C-13. 1976 kelp canopy map off San Clemente.

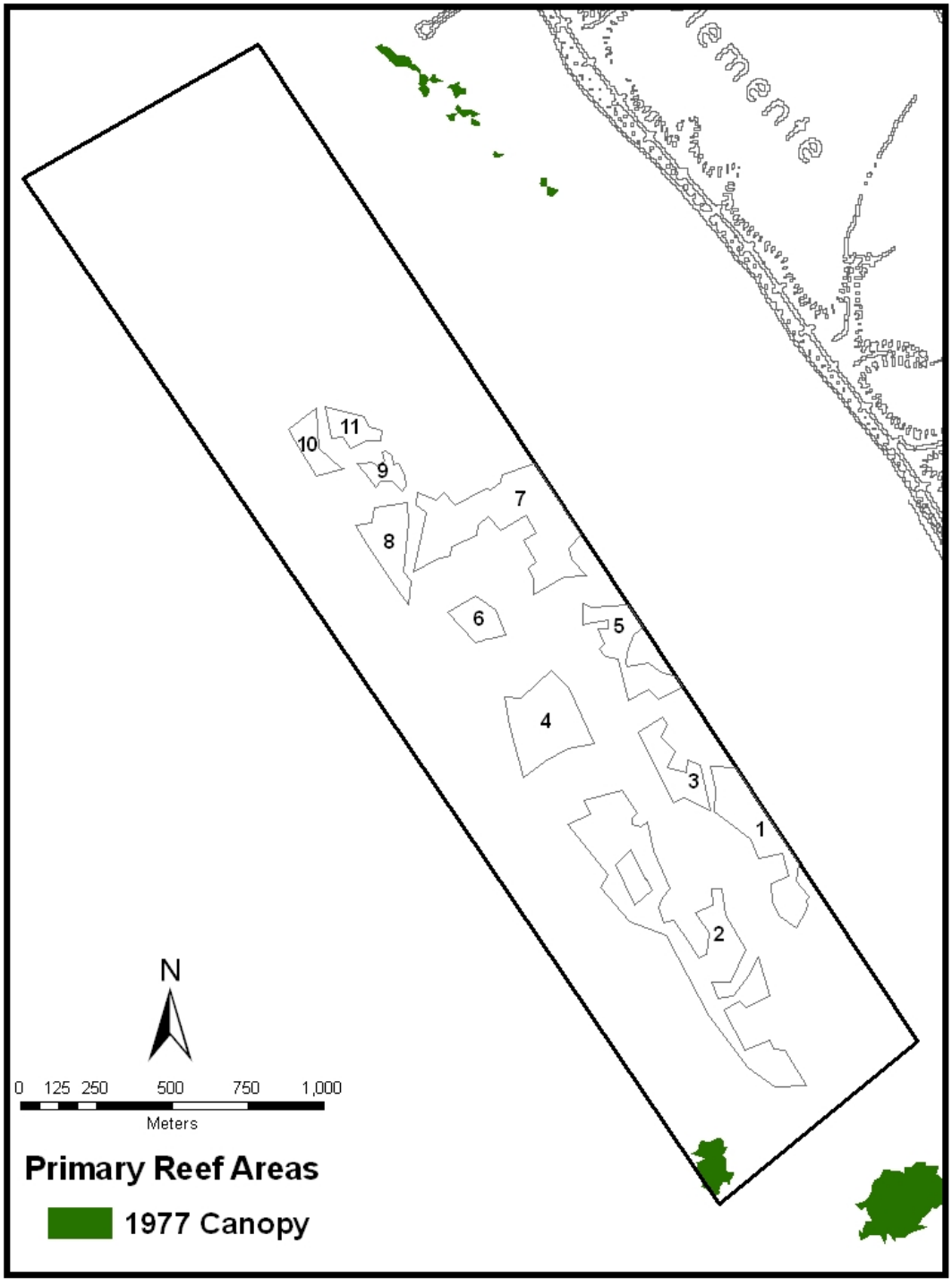

Figure C-14. 1977 kelp canopy map off San Clemente.

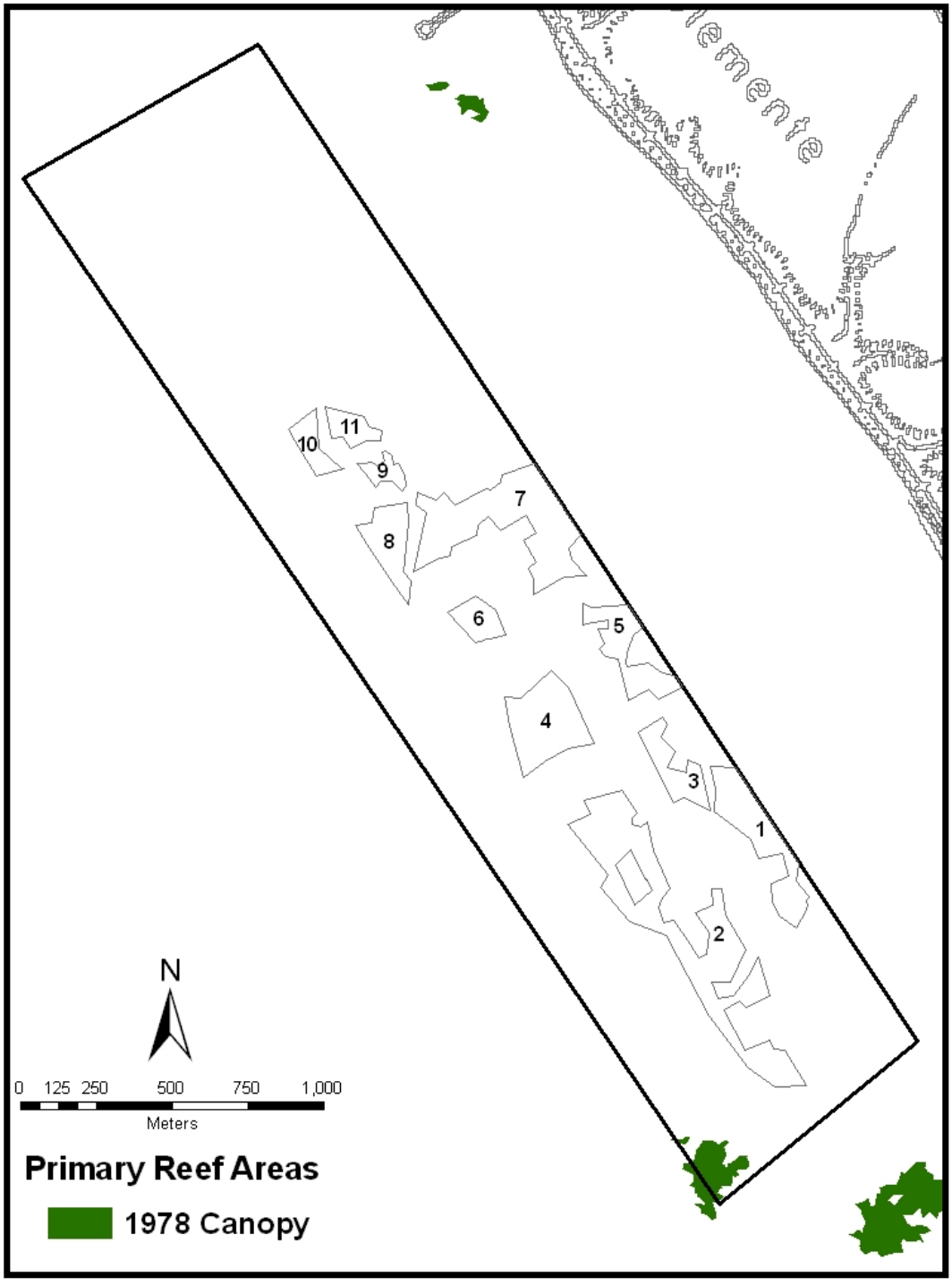

Figure C-15. 1978 kelp canopy map off San Clemente.

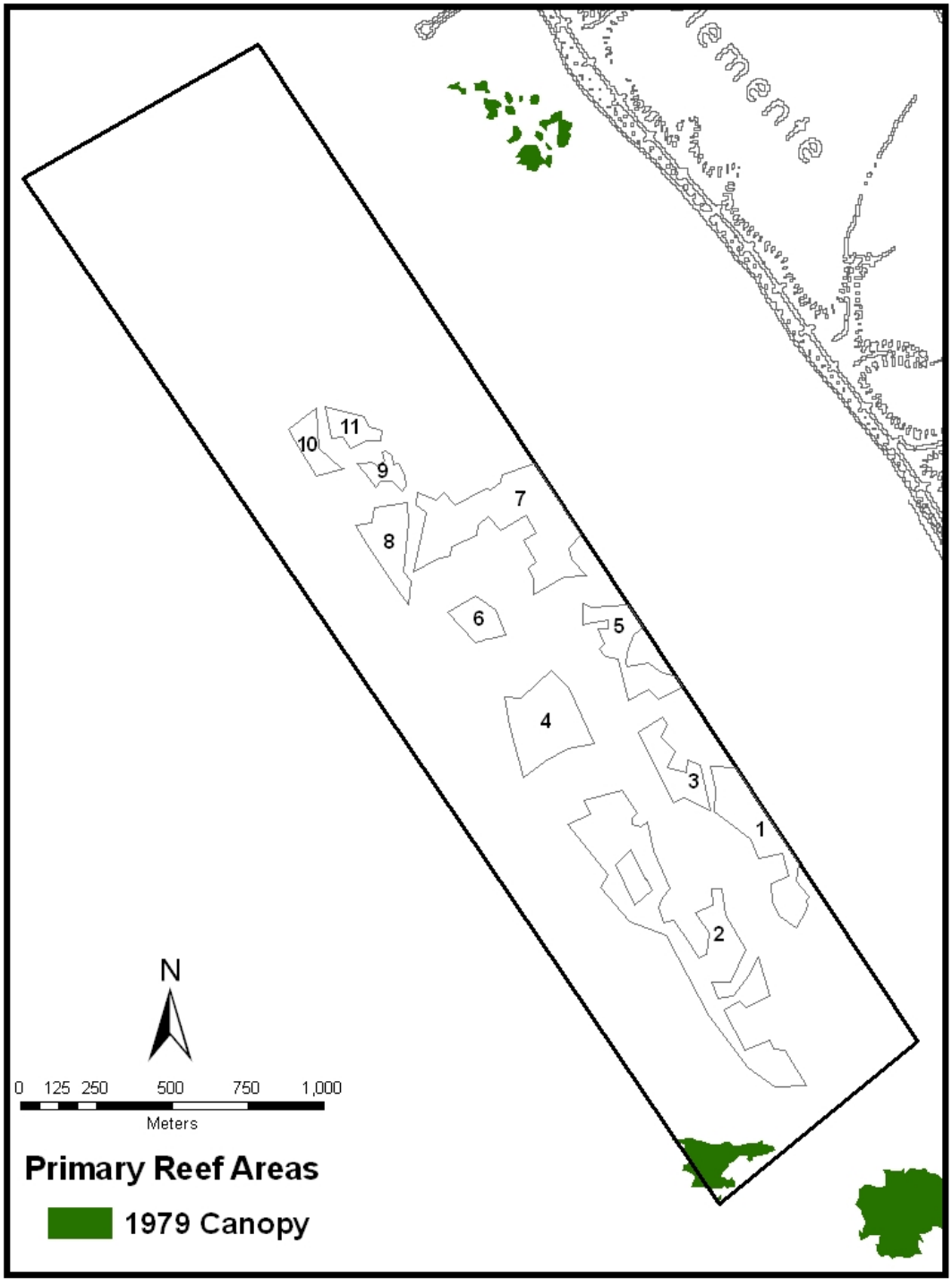

Figure C-16. 1979 kelp canopy map off San Clemente.

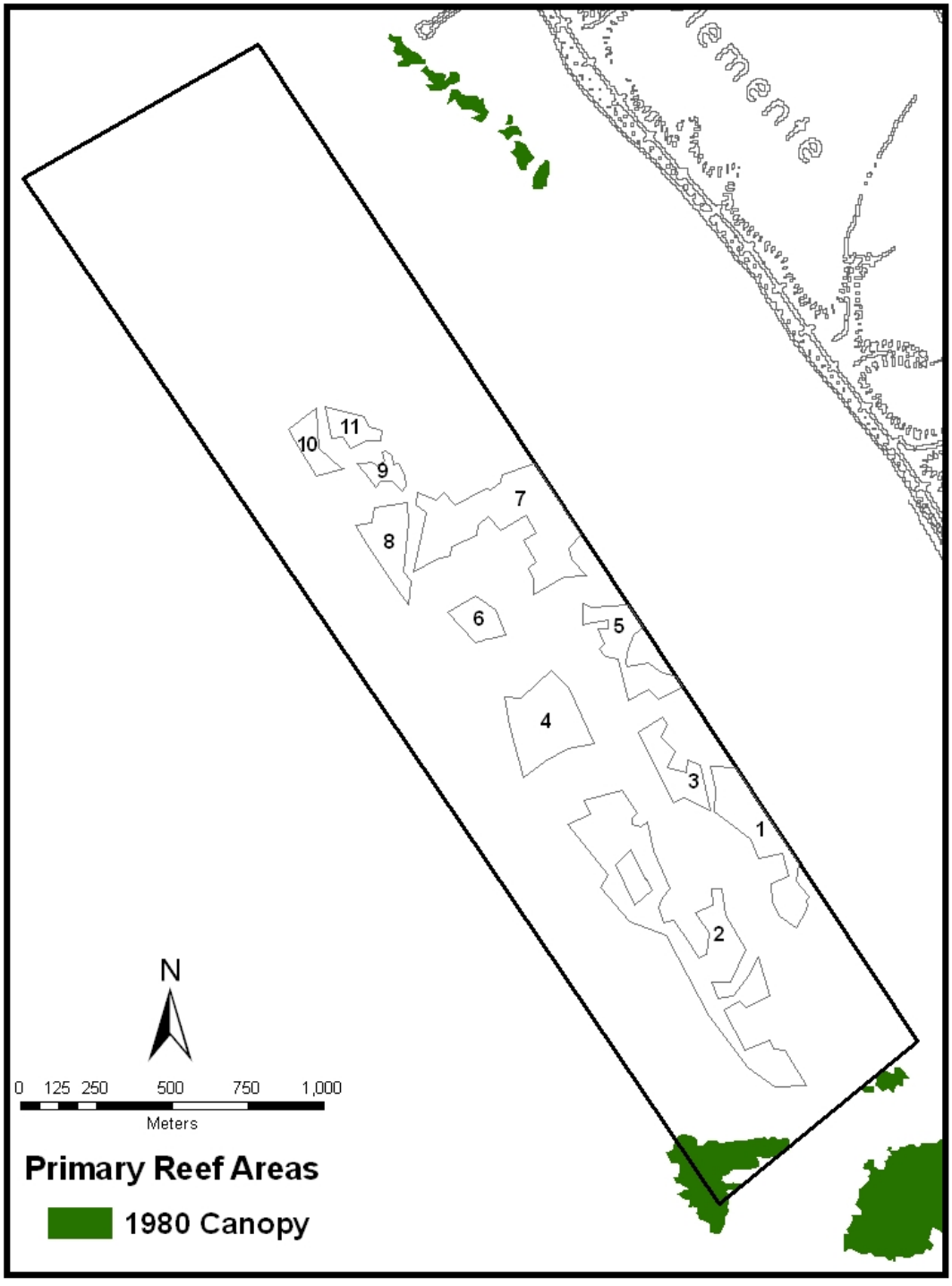

Figure C-17. 1980 kelp canopy map off San Clemente.

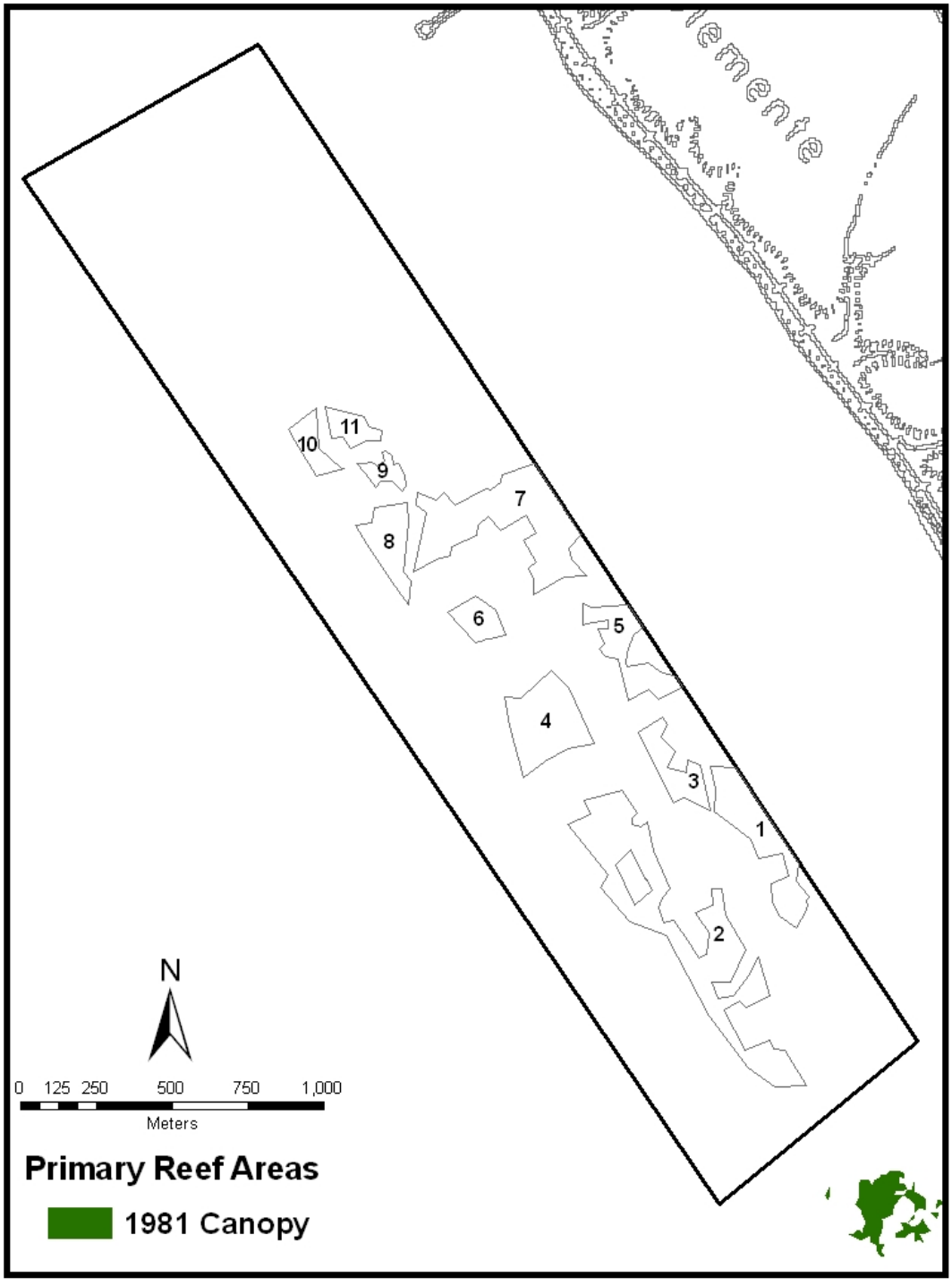

Figure C-18. 1981 kelp canopy map off San Clemente.

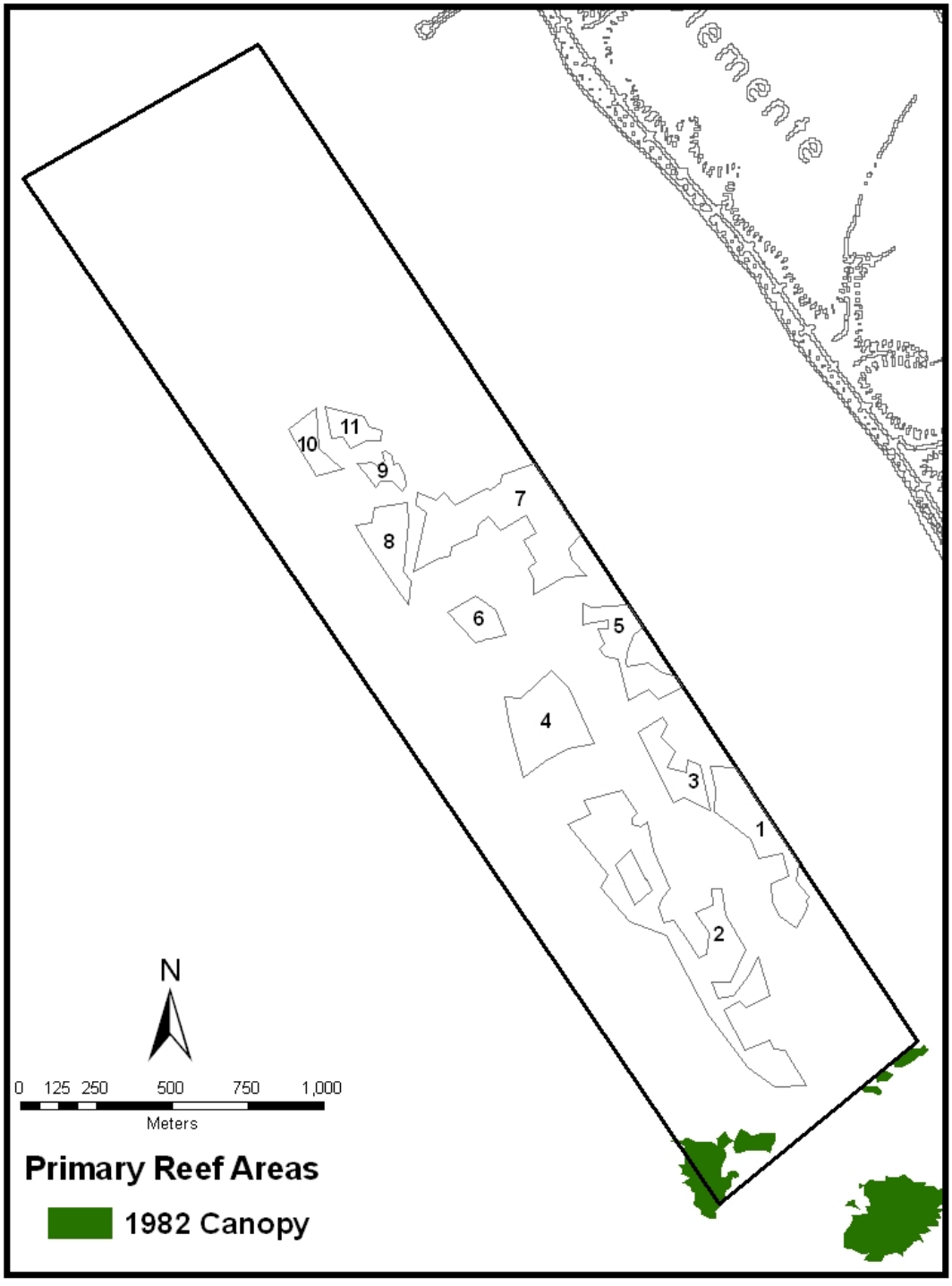

Figure C-19. 1982 kelp canopy map off San Clemente.

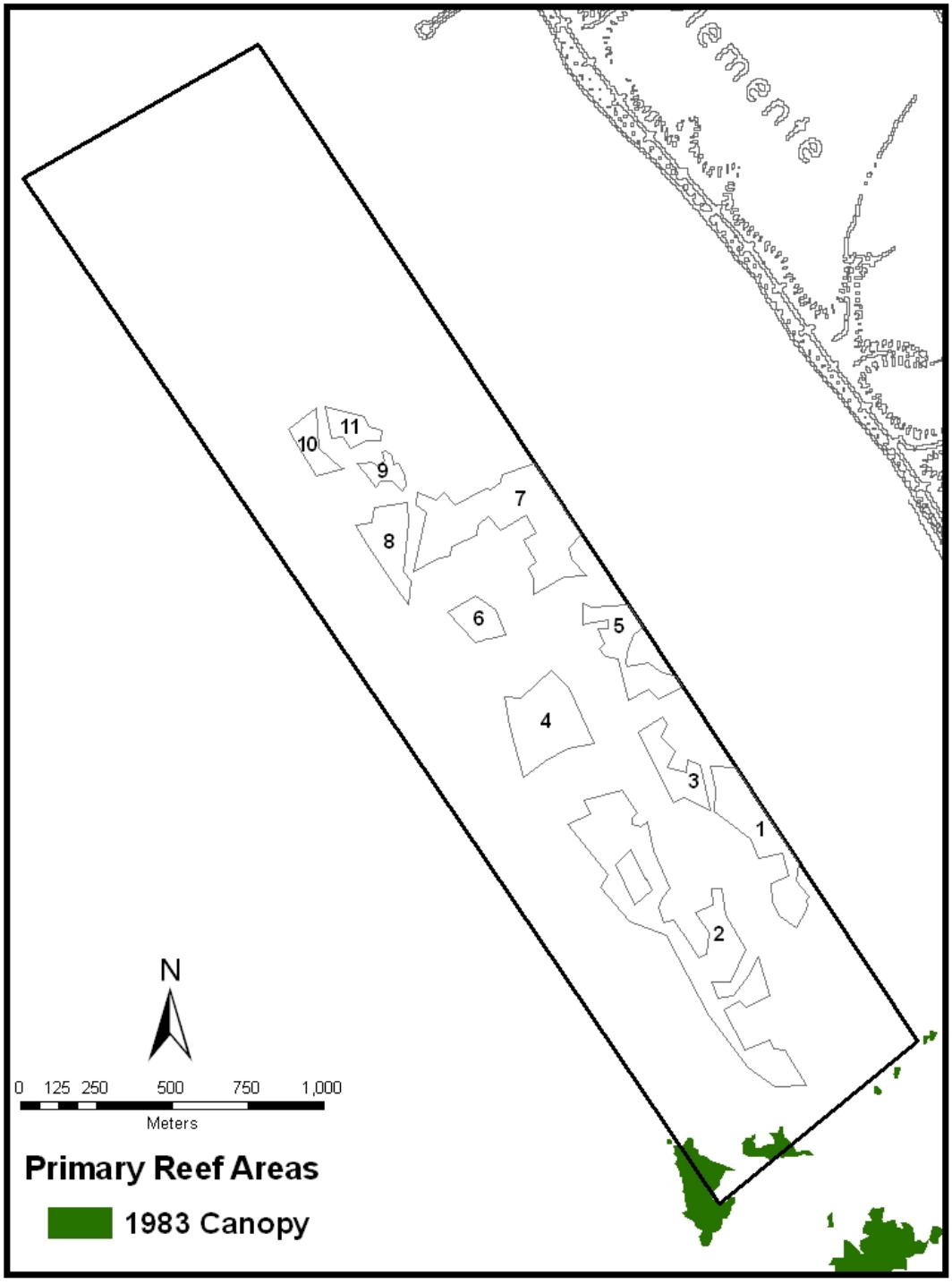

Figure C-20. 1983 kelp canopy map off San Clemente.

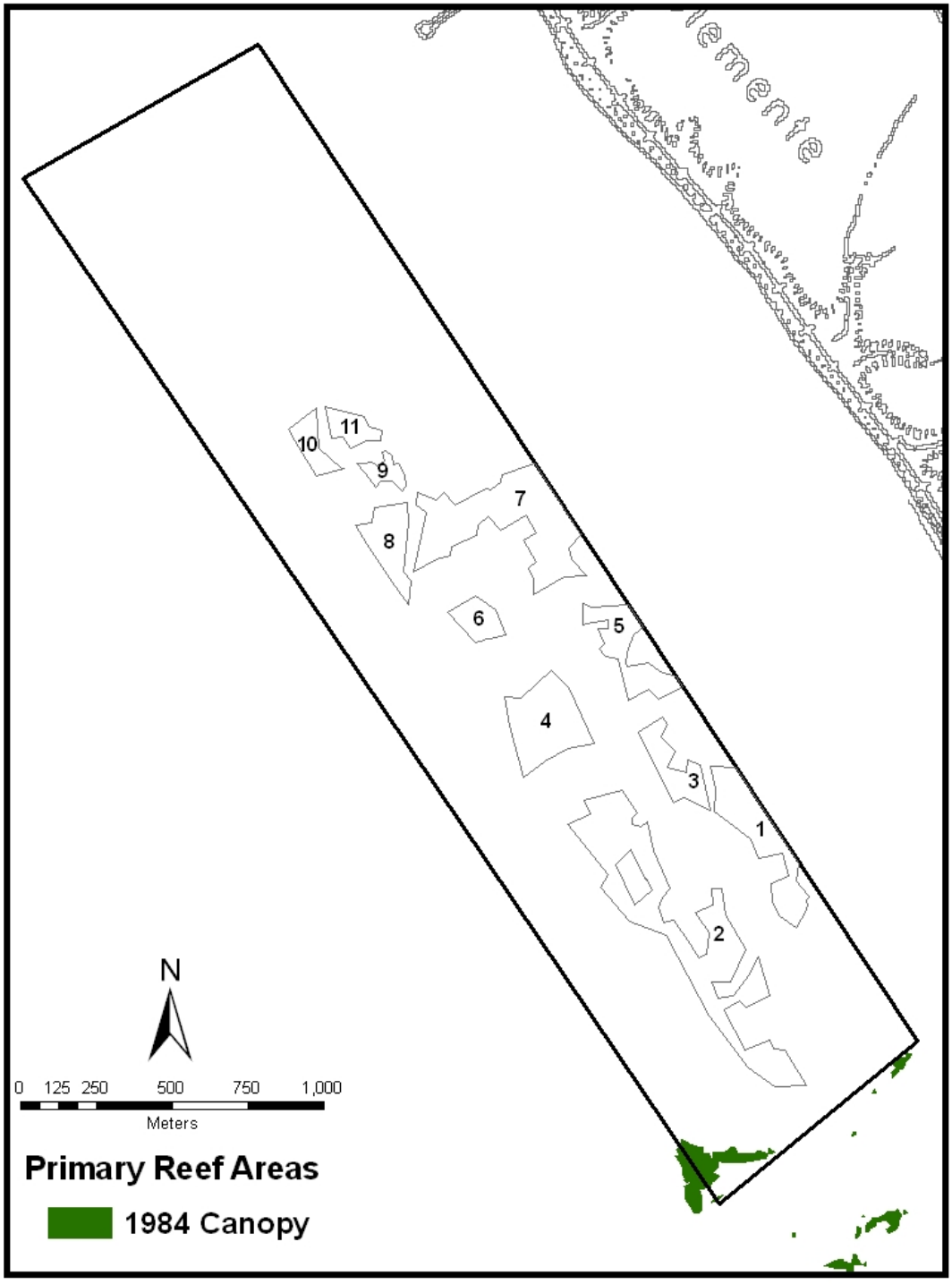

Figure C-21. 1984 kelp canopy map off San Clemente.

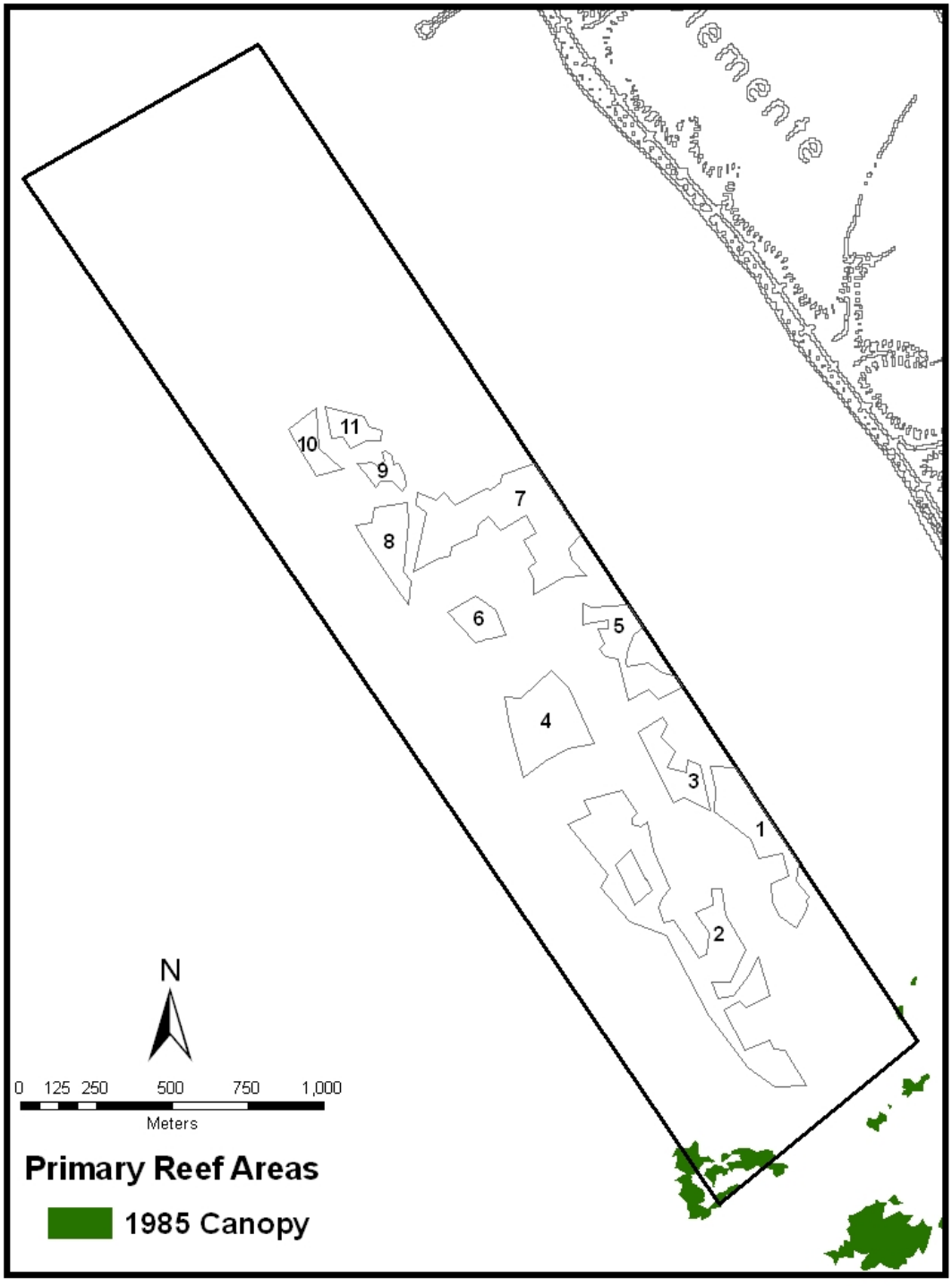

Figure C-22. 1985 kelp canopy map off San Clemente.

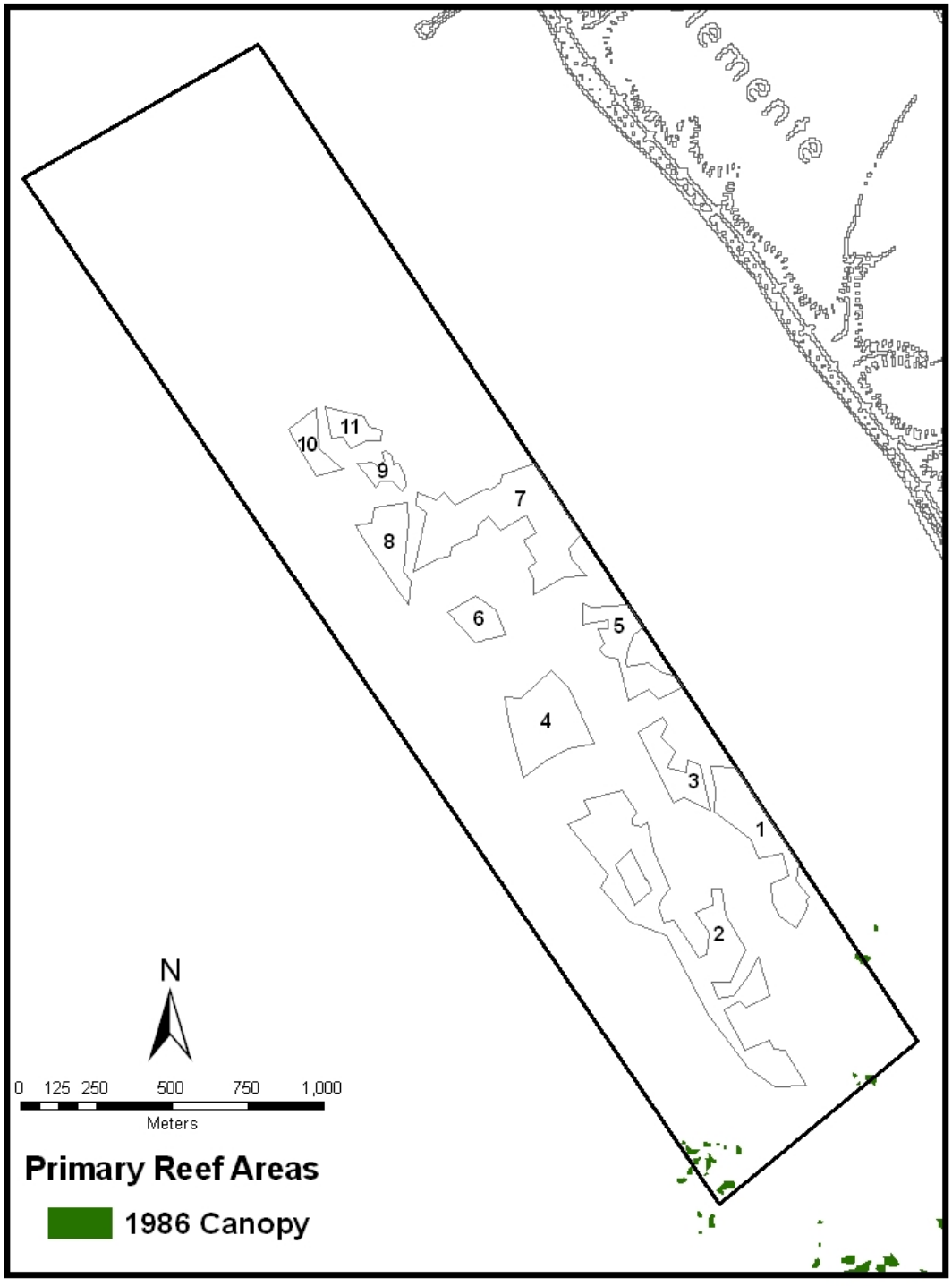

Figure C-23. 1986 kelp canopy map off San Clemente.

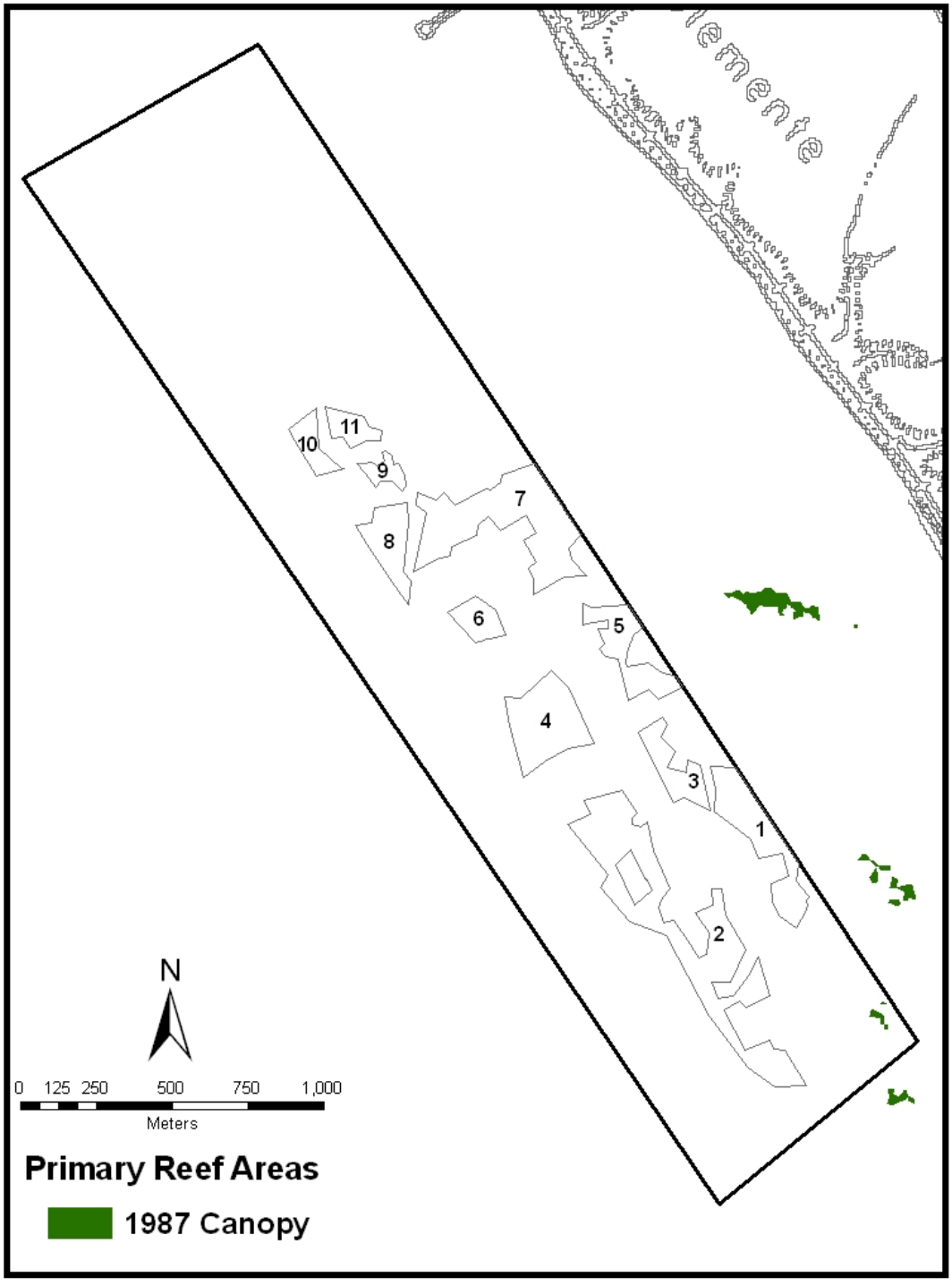

Figure C-24. 1987 kelp canopy map off San Clemente.

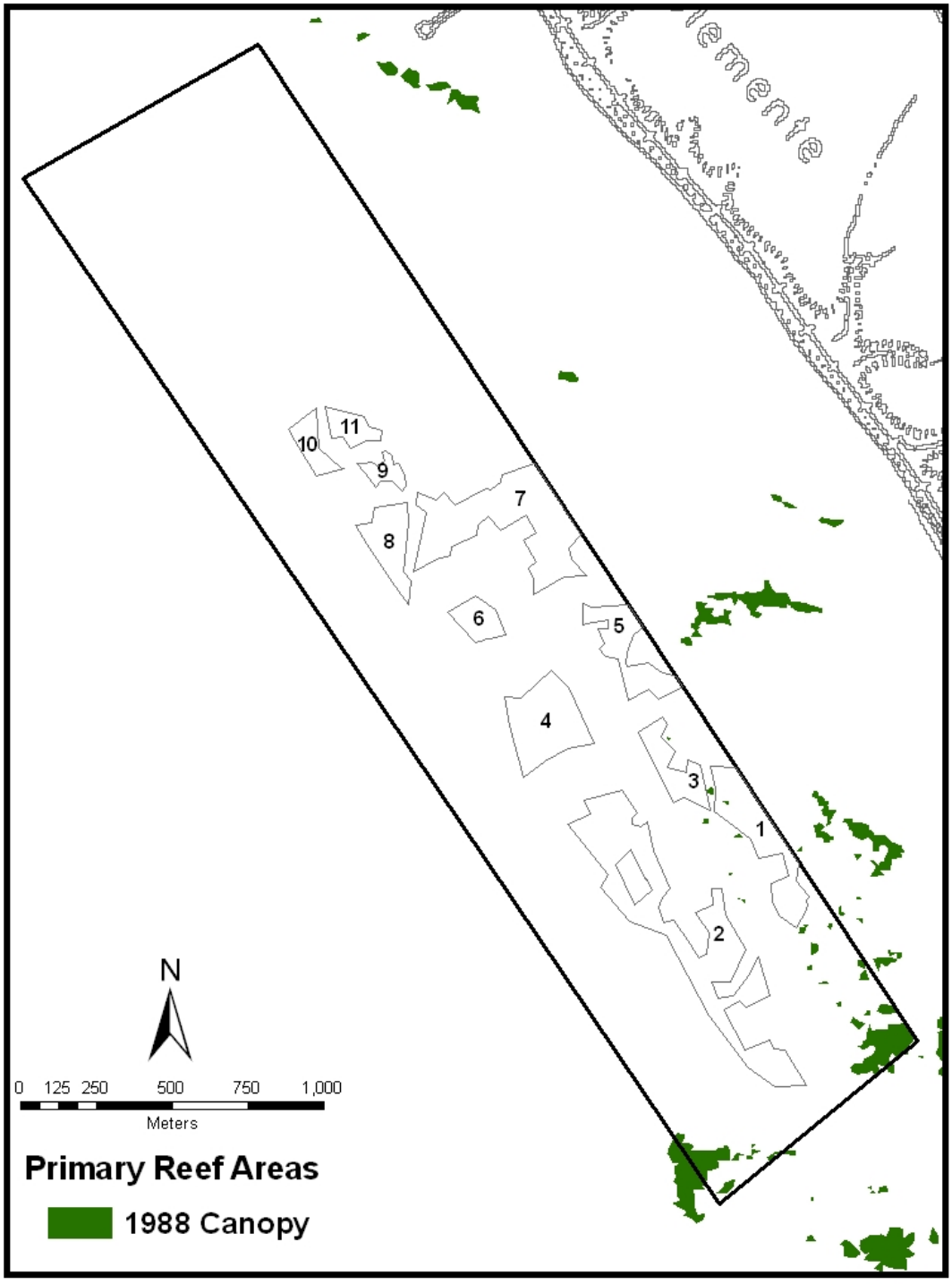

Figure C-25. 1988 kelp canopy map off San Clemente.

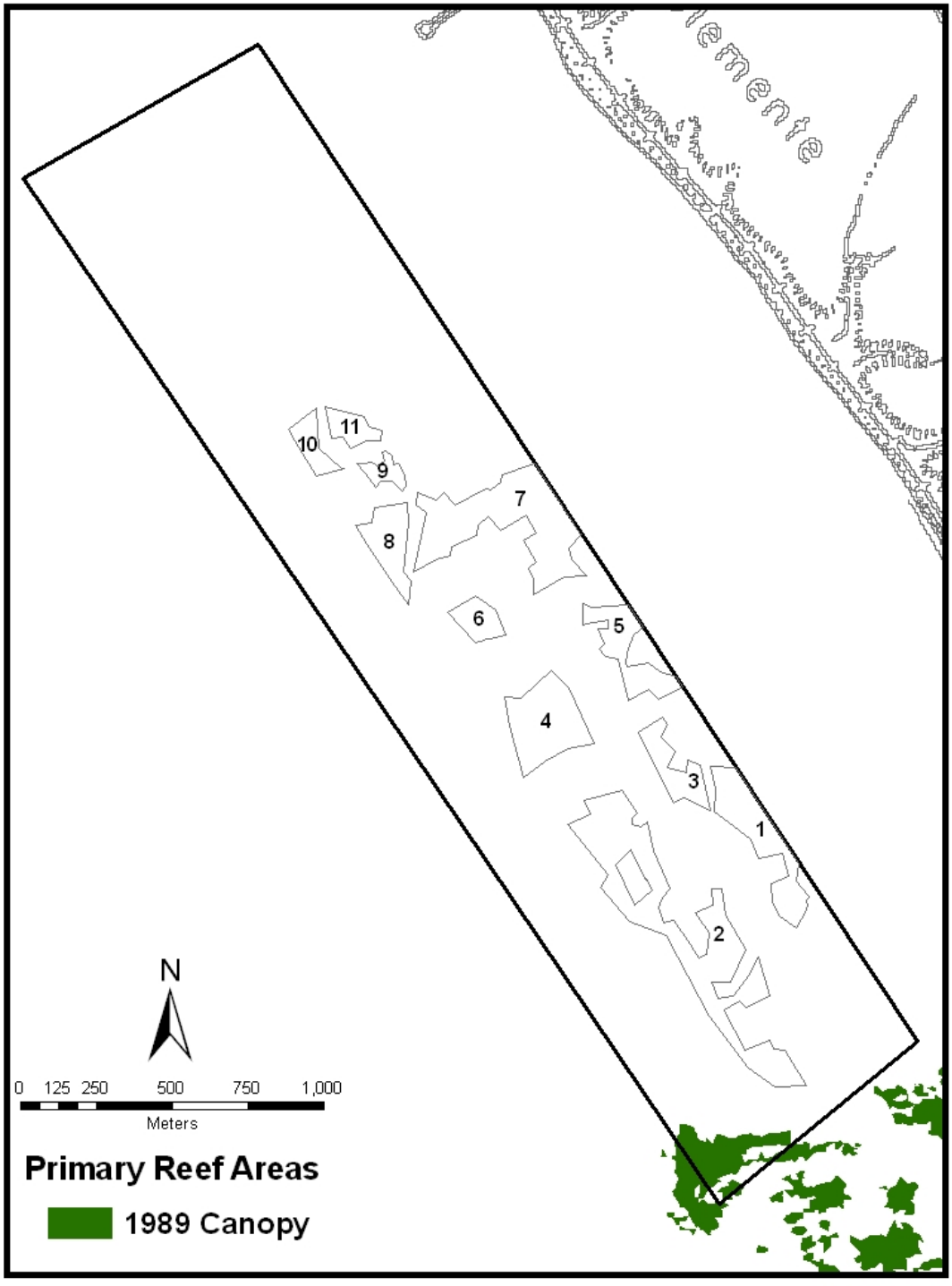

Figure C-26. 1989 kelp canopy map off San Clemente.

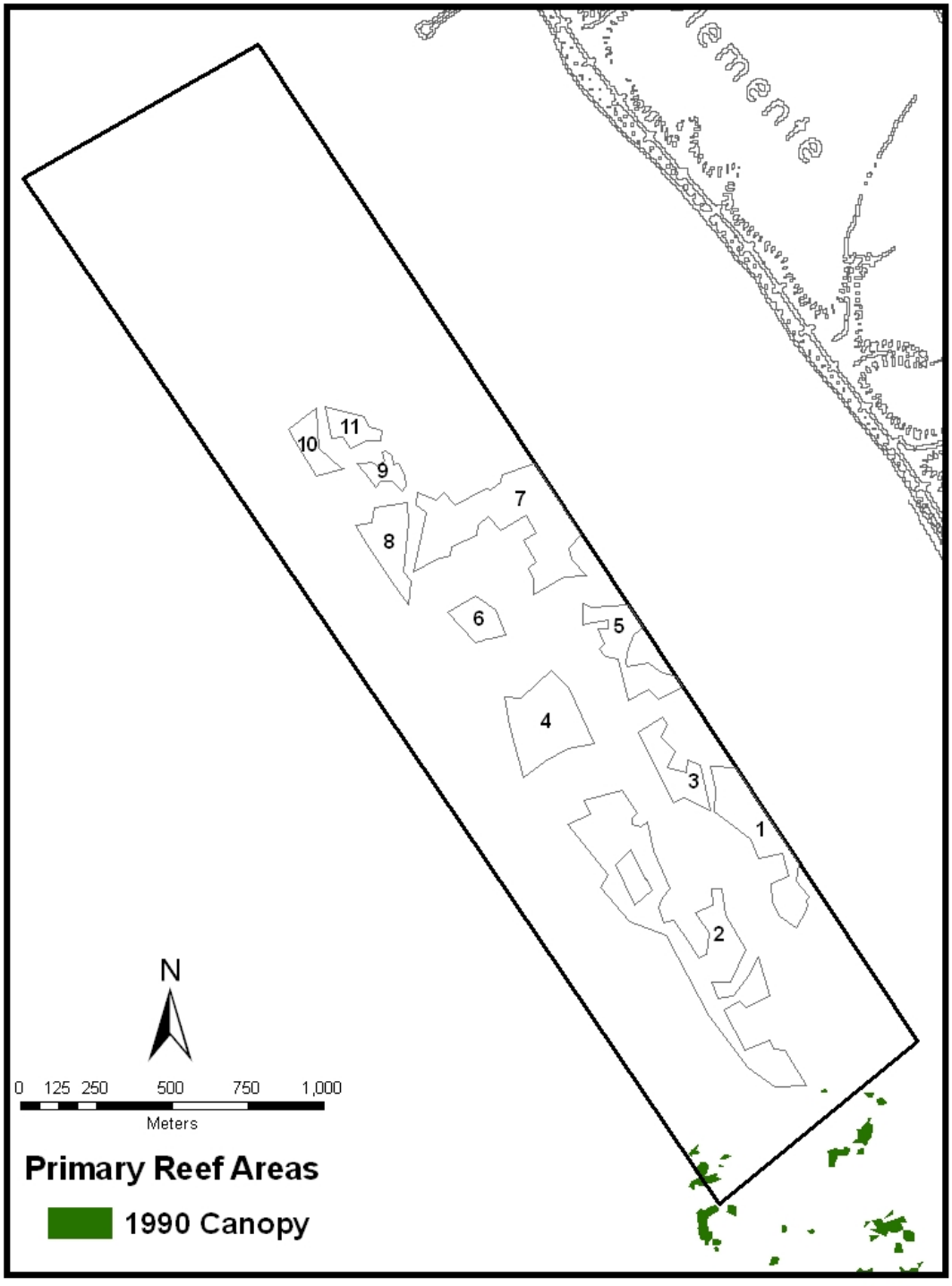

Figure C-27. 1990 kelp canopy map off San Clemente.

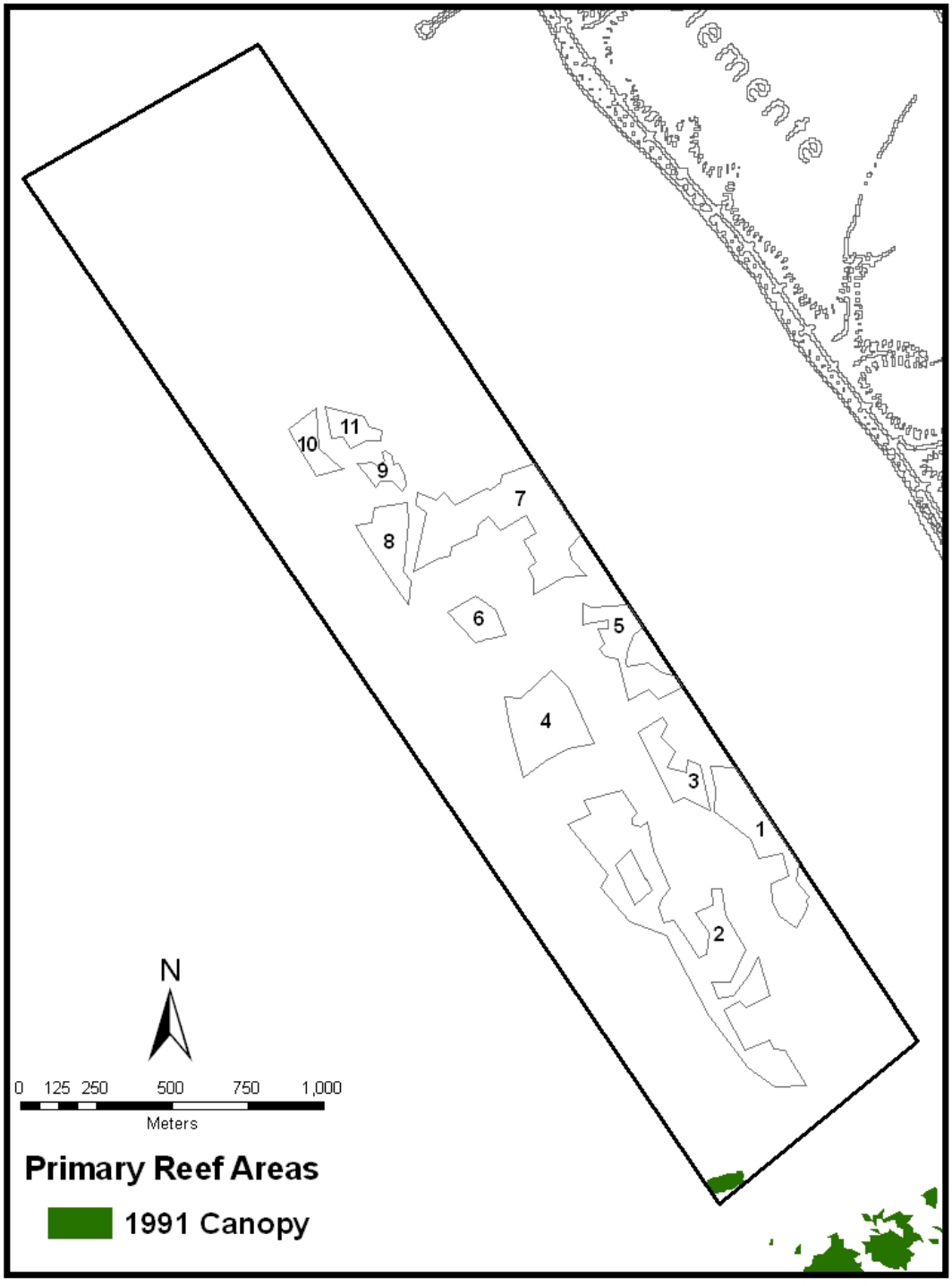

Figure C-28. 1991 kelp canopy map off San Clemente.

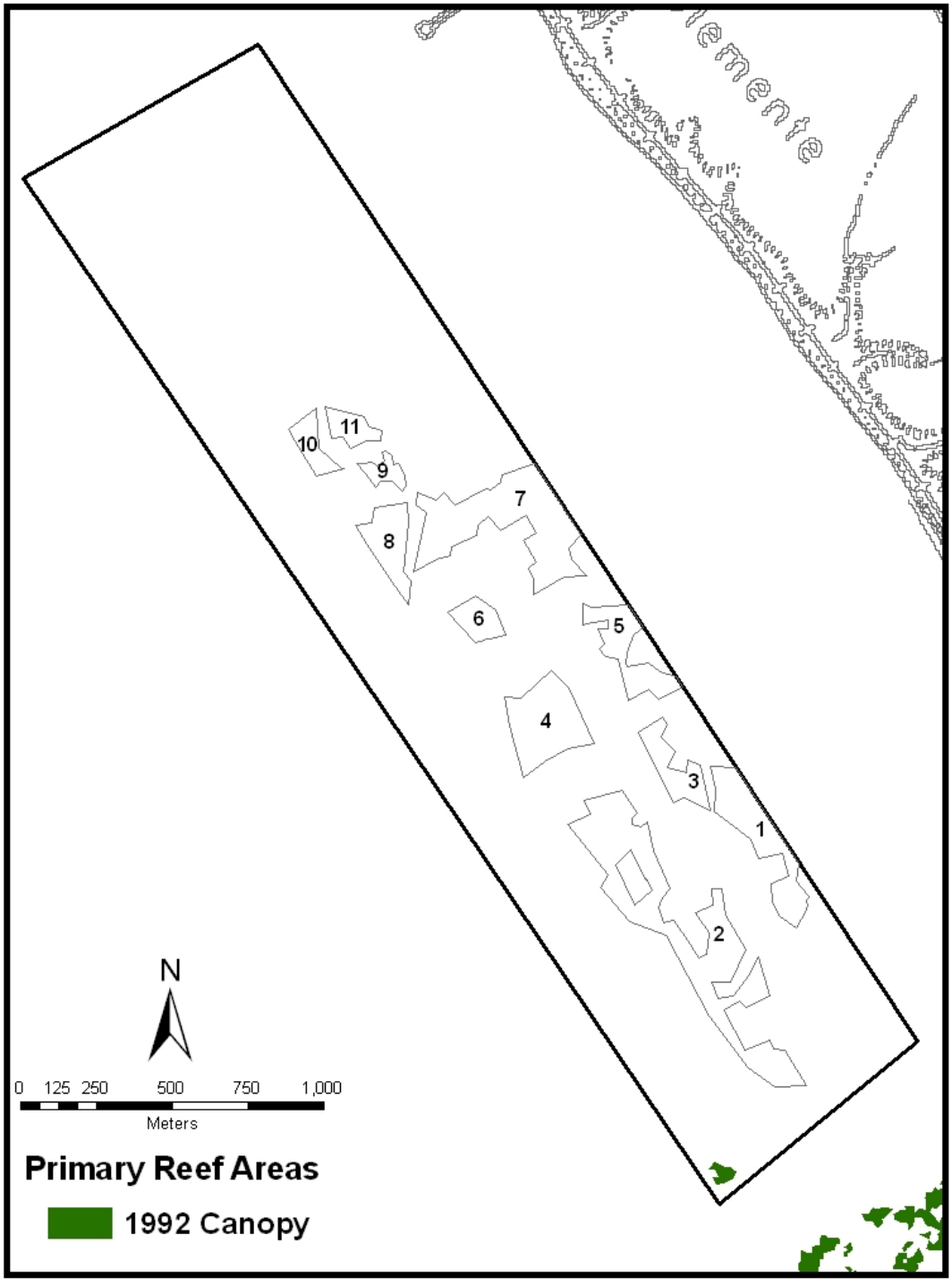

Figure C-29. 1992 kelp canopy map off San Clemente.

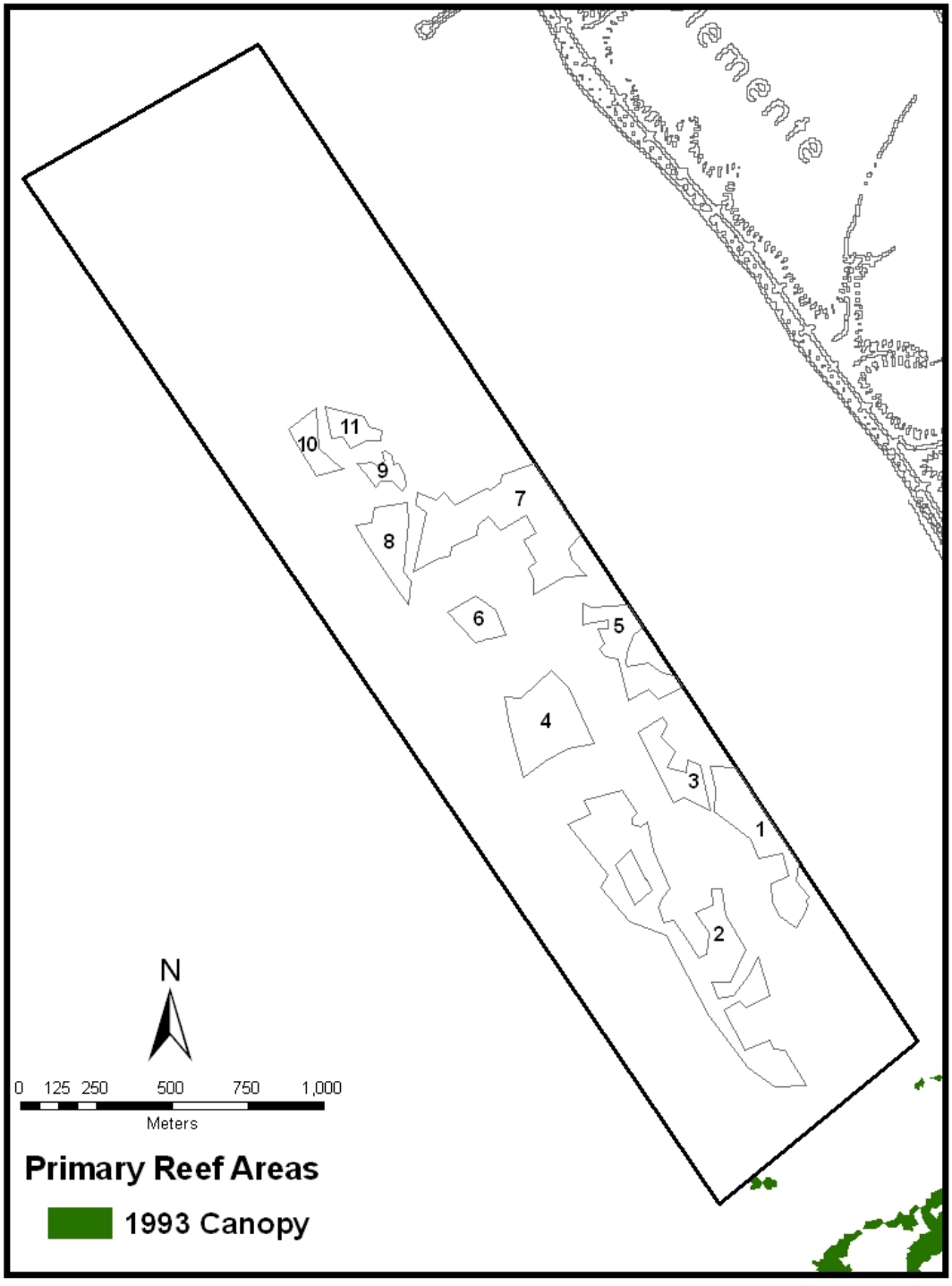

Figure C-30. 1993 kelp canopy map off San Clemente.

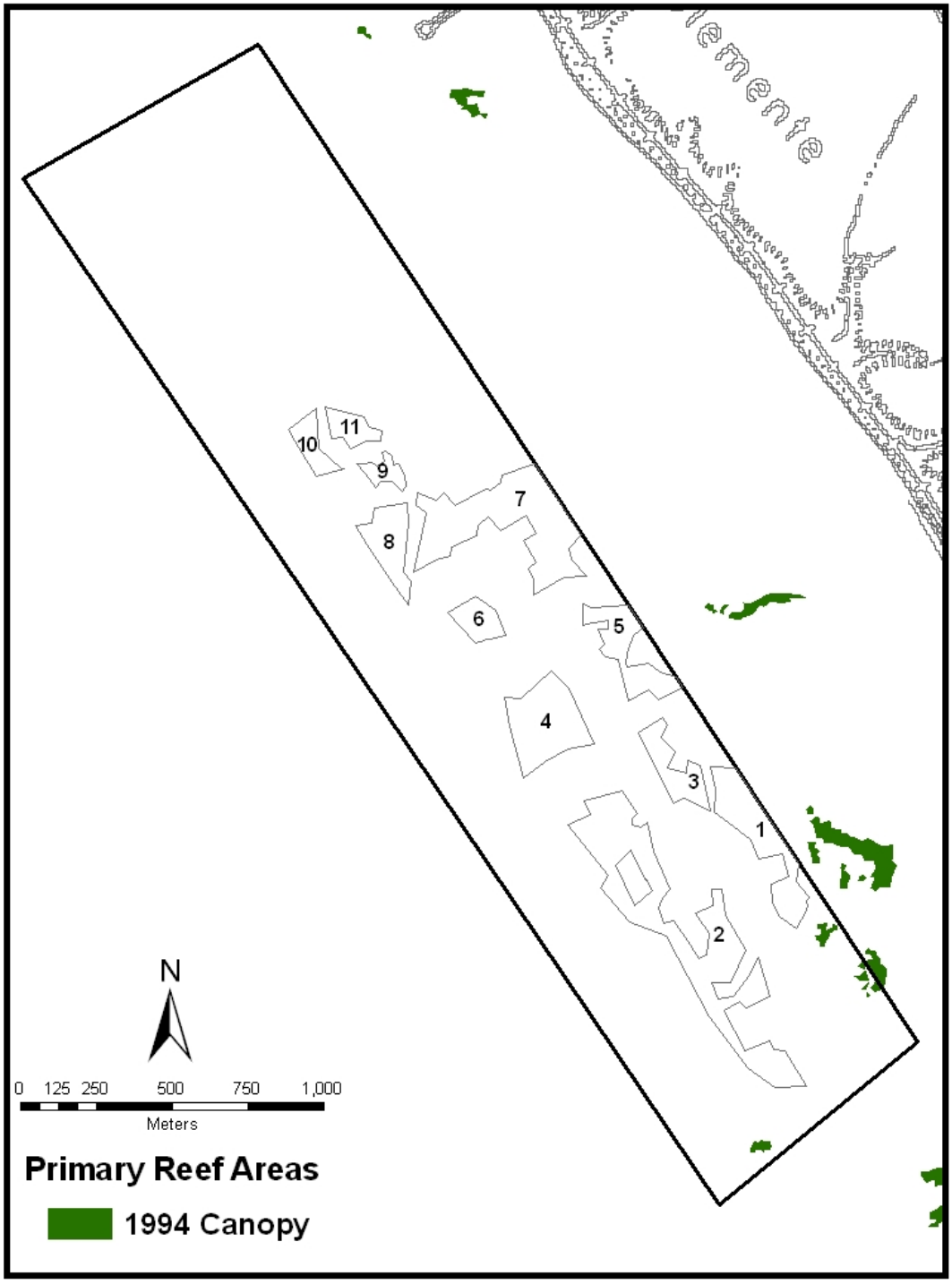

Figure C-31. 1994 kelp canopy map off San Clemente.

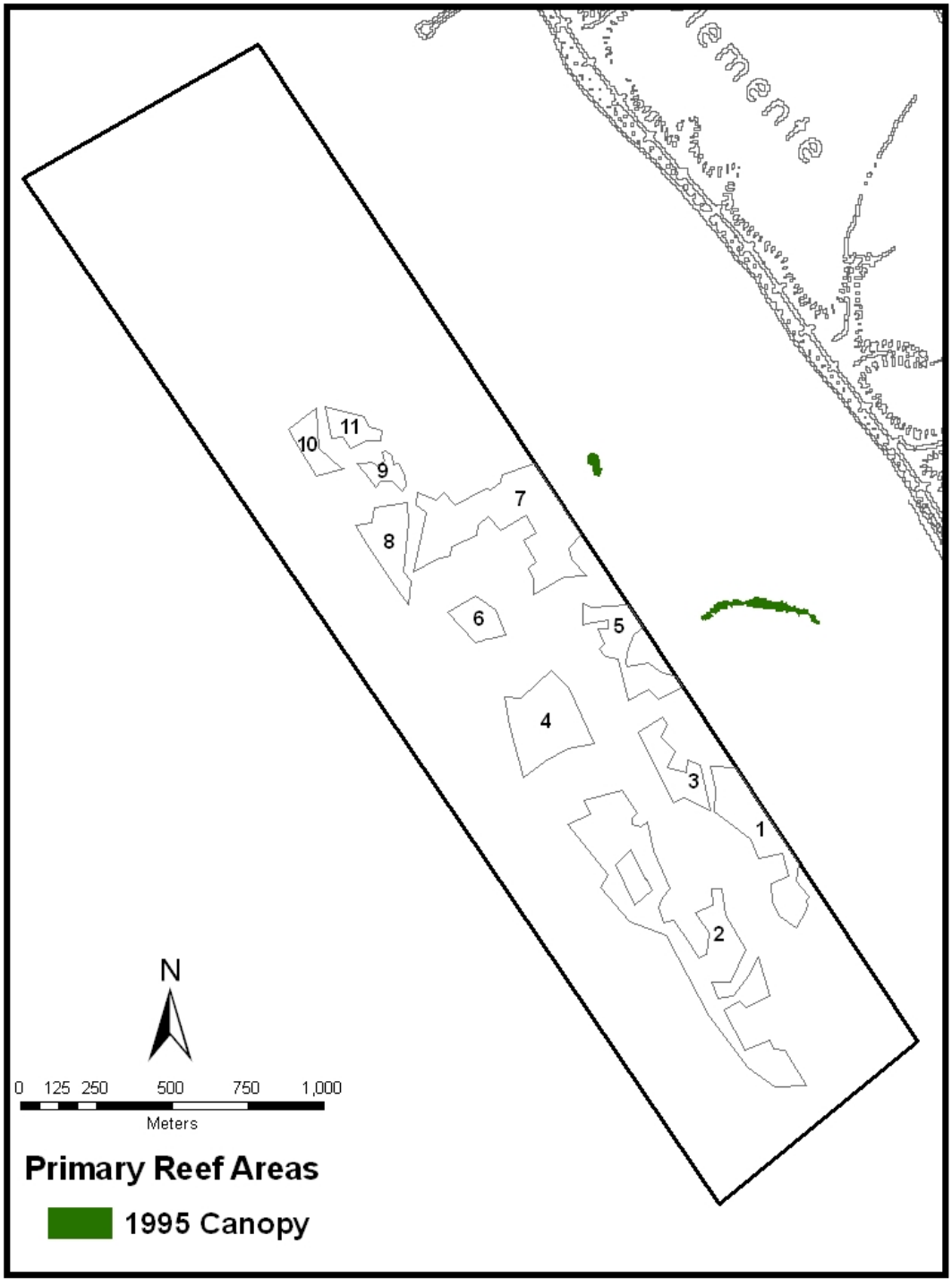

Figure C-32. 1995 kelp canopy map off San Clemente.

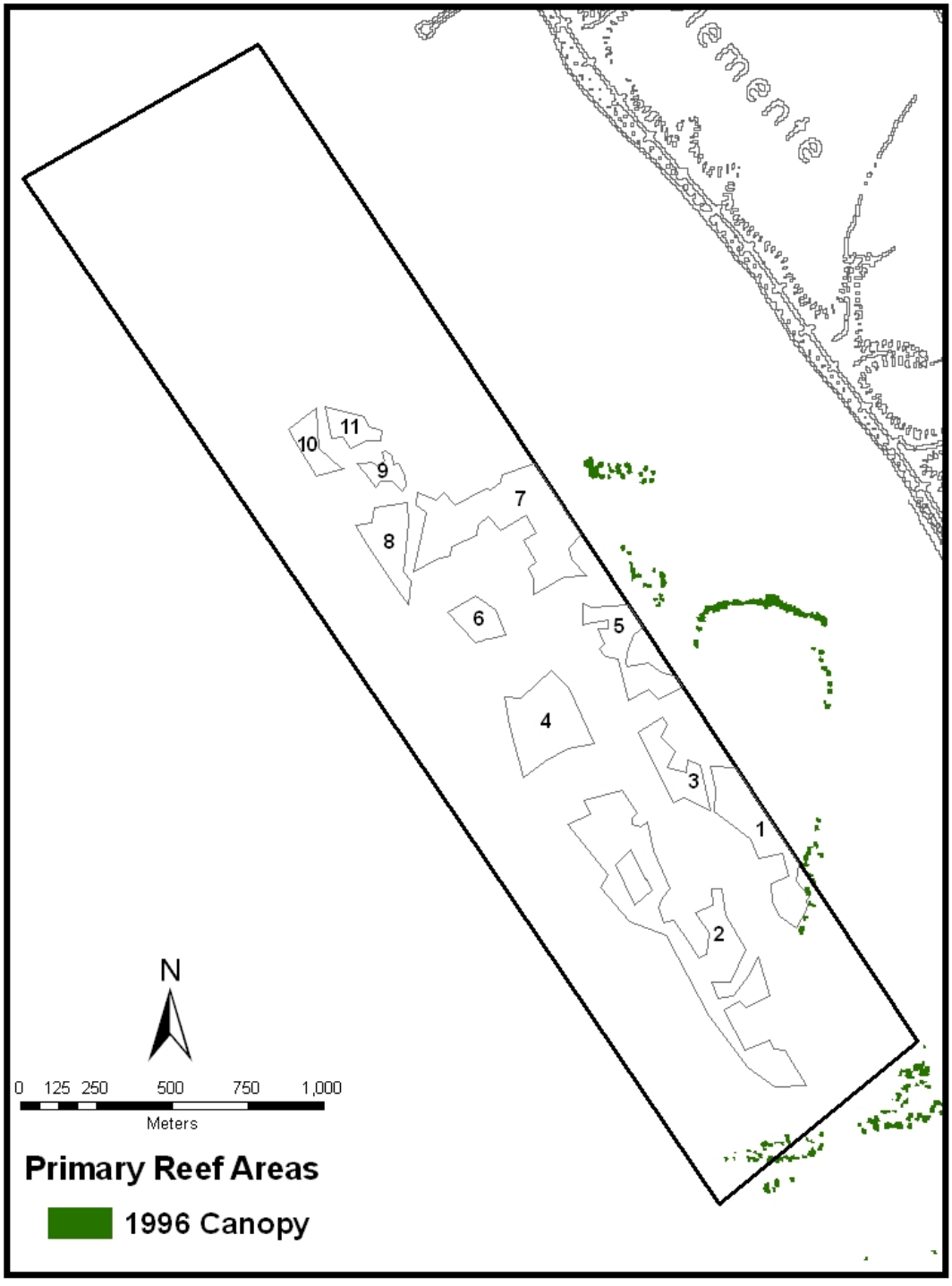

Figure C-33. 1996 kelp canopy map off San Clemente.

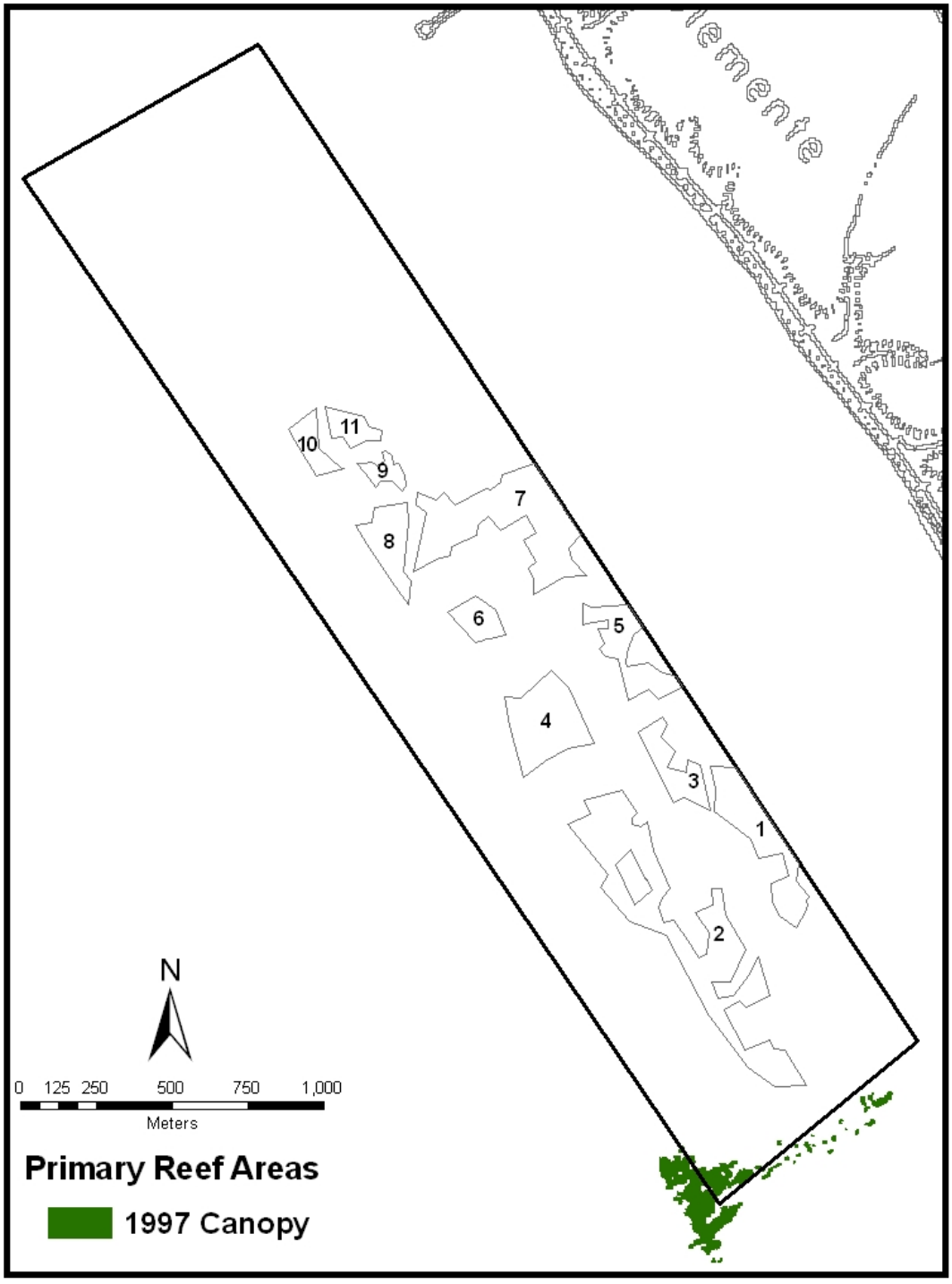

Figure C-34. 1997 kelp canopy map off San Clemente.

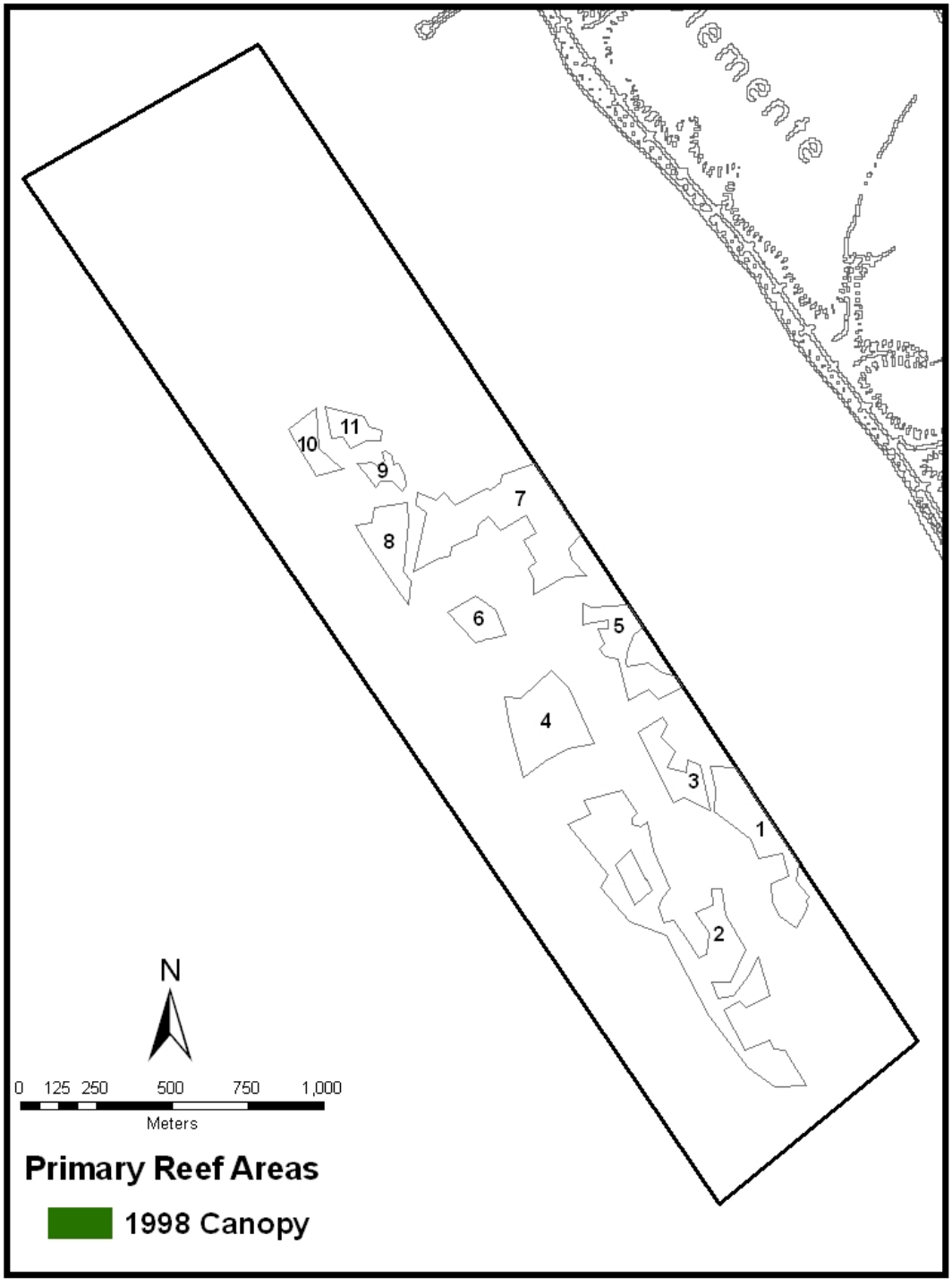

Figure C-35. 1998 kelp canopy map off San Clemente.

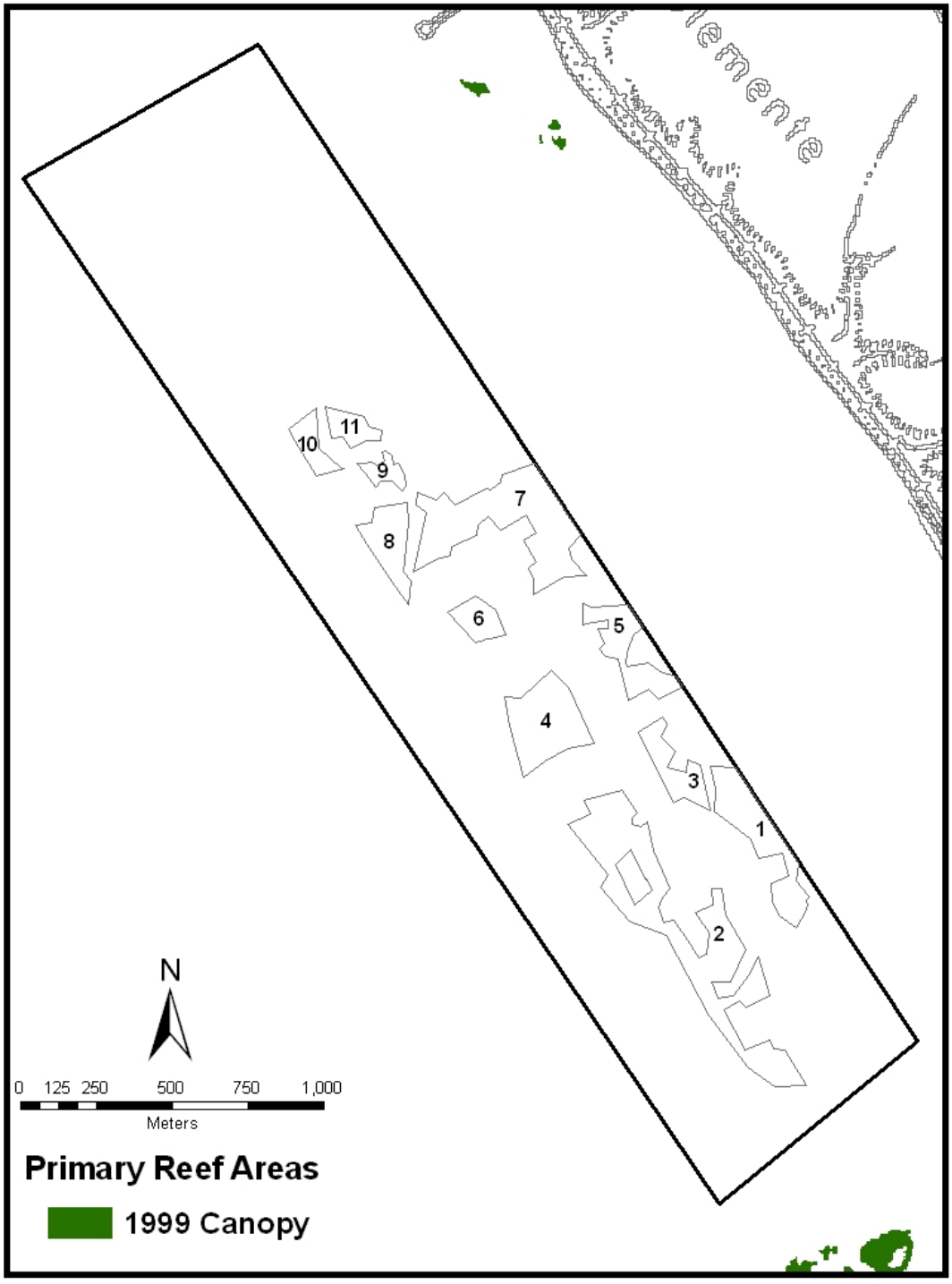

Figure C-36. 1999 kelp canopy map off San Clemente.

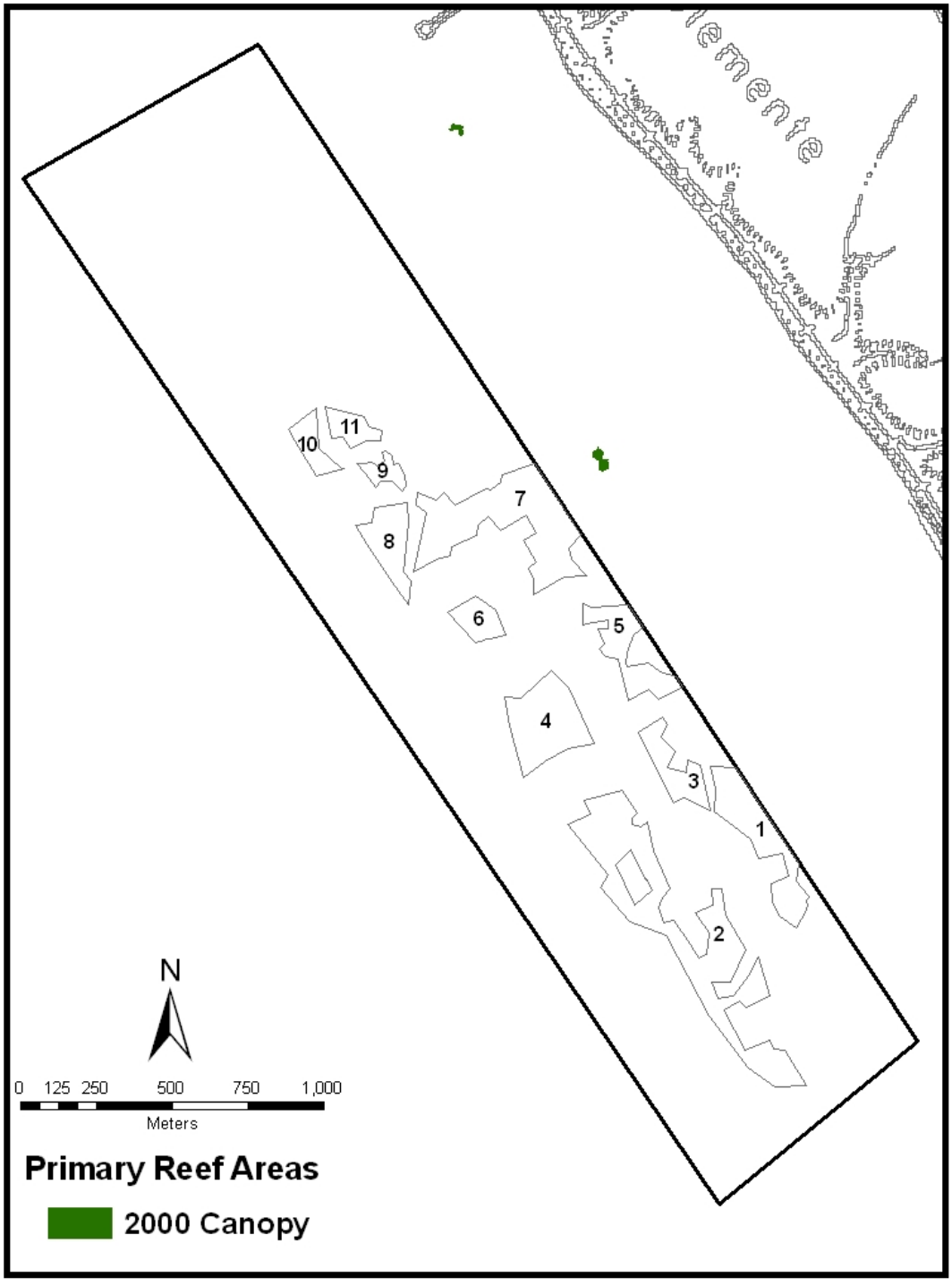

Figure C-37. 2000 kelp canopy map off San Clemente.

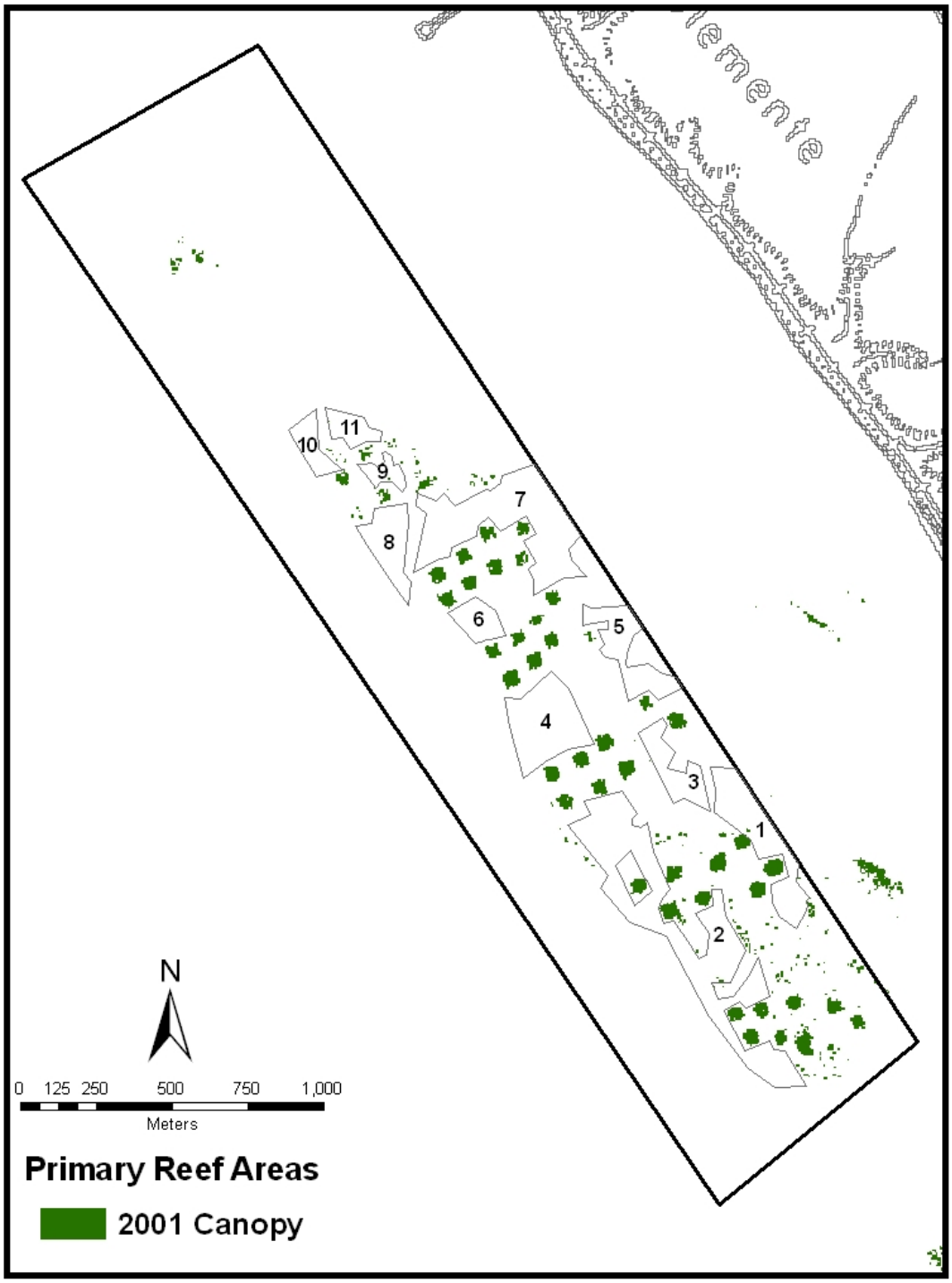

Figure C-38. 2001 kelp canopy map off San Clemente.

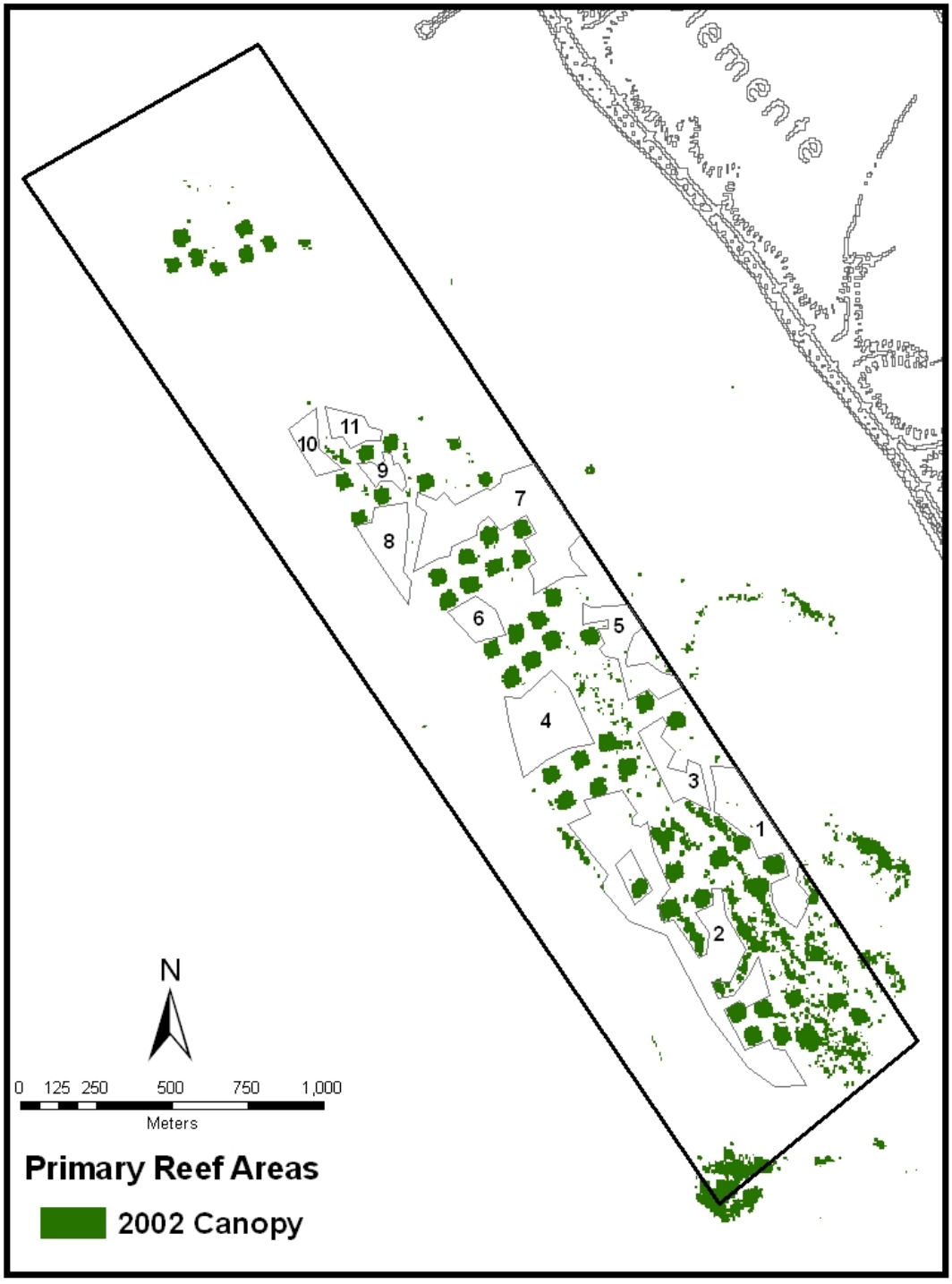

Figure C-39. 2002 kelp canopy map off San Clemente.

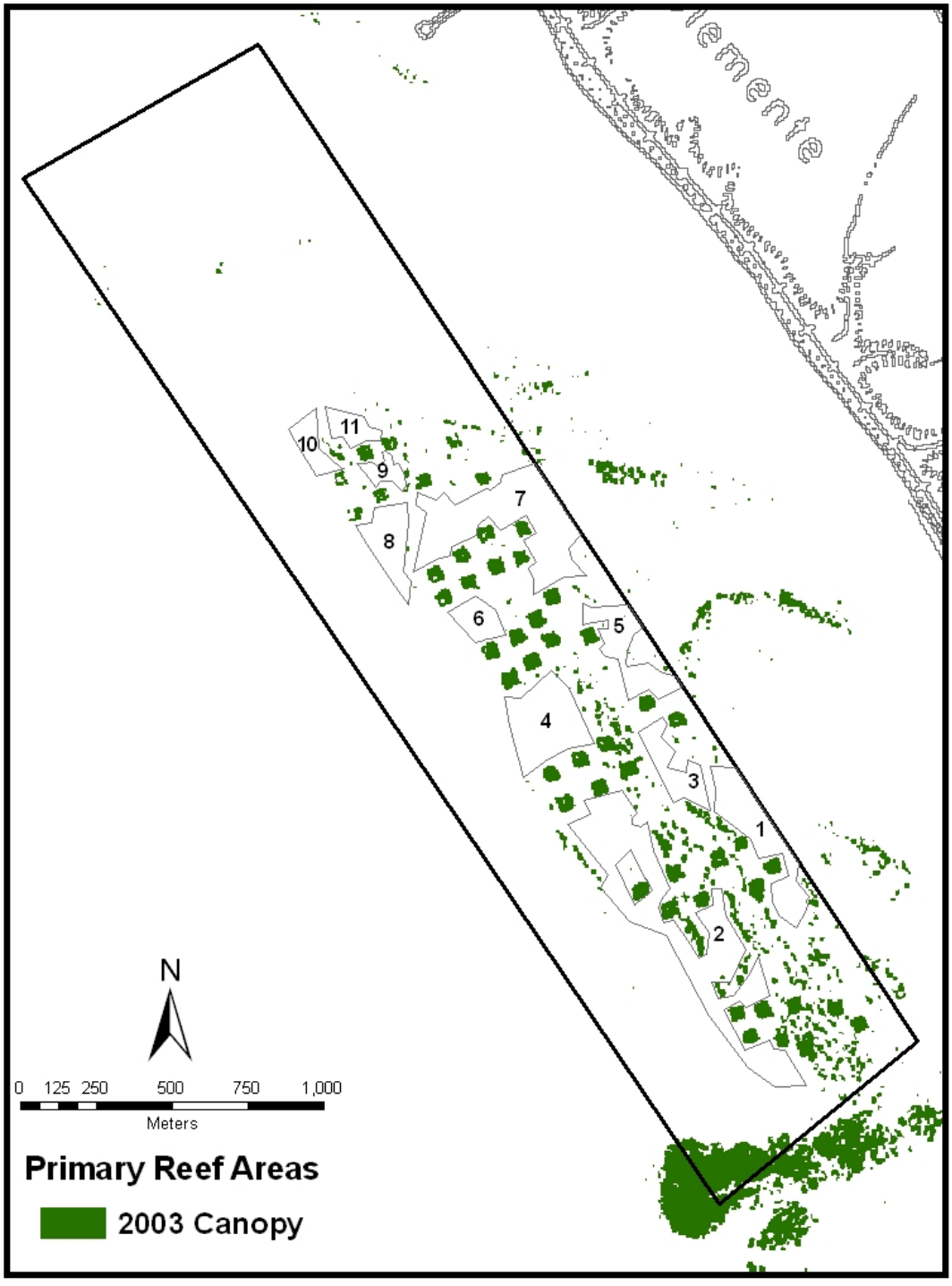

Figure C-40. 2003 kelp canopy map off San Clemente.

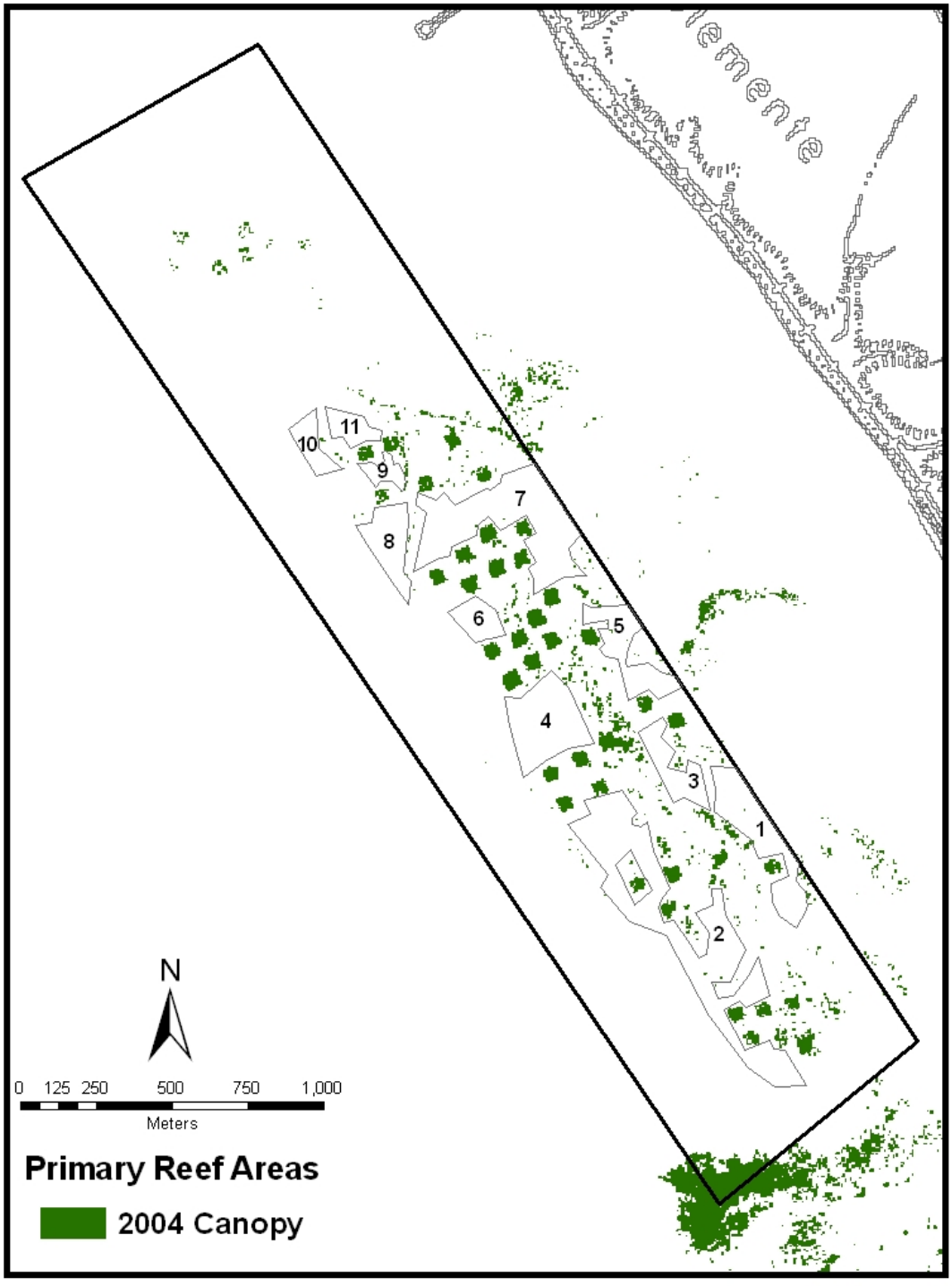

Figure C-41. 2004 kelp canopy map off San Clemente.

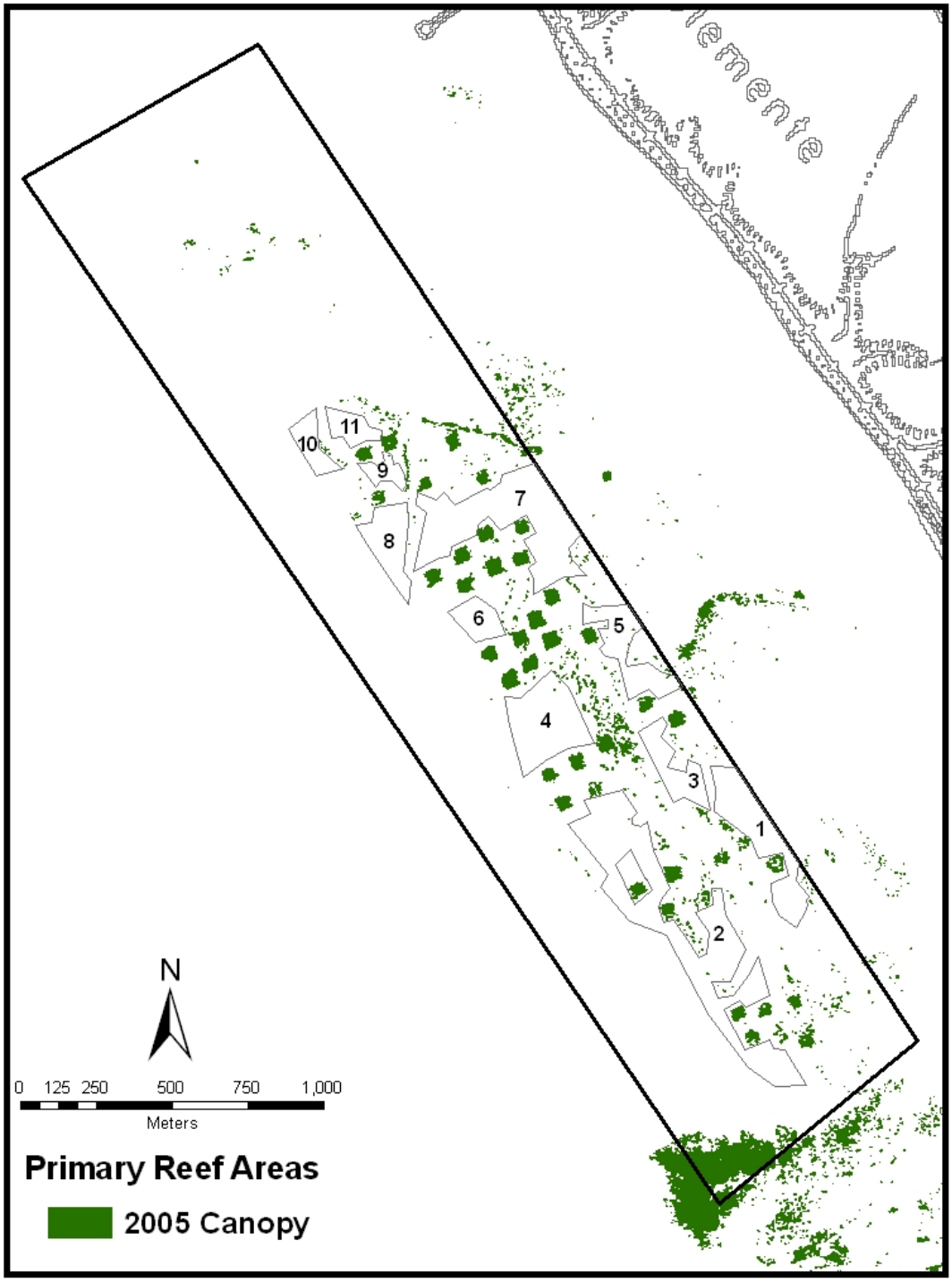

Figure C-42. 2005 kelp canopy map off San Clemente.

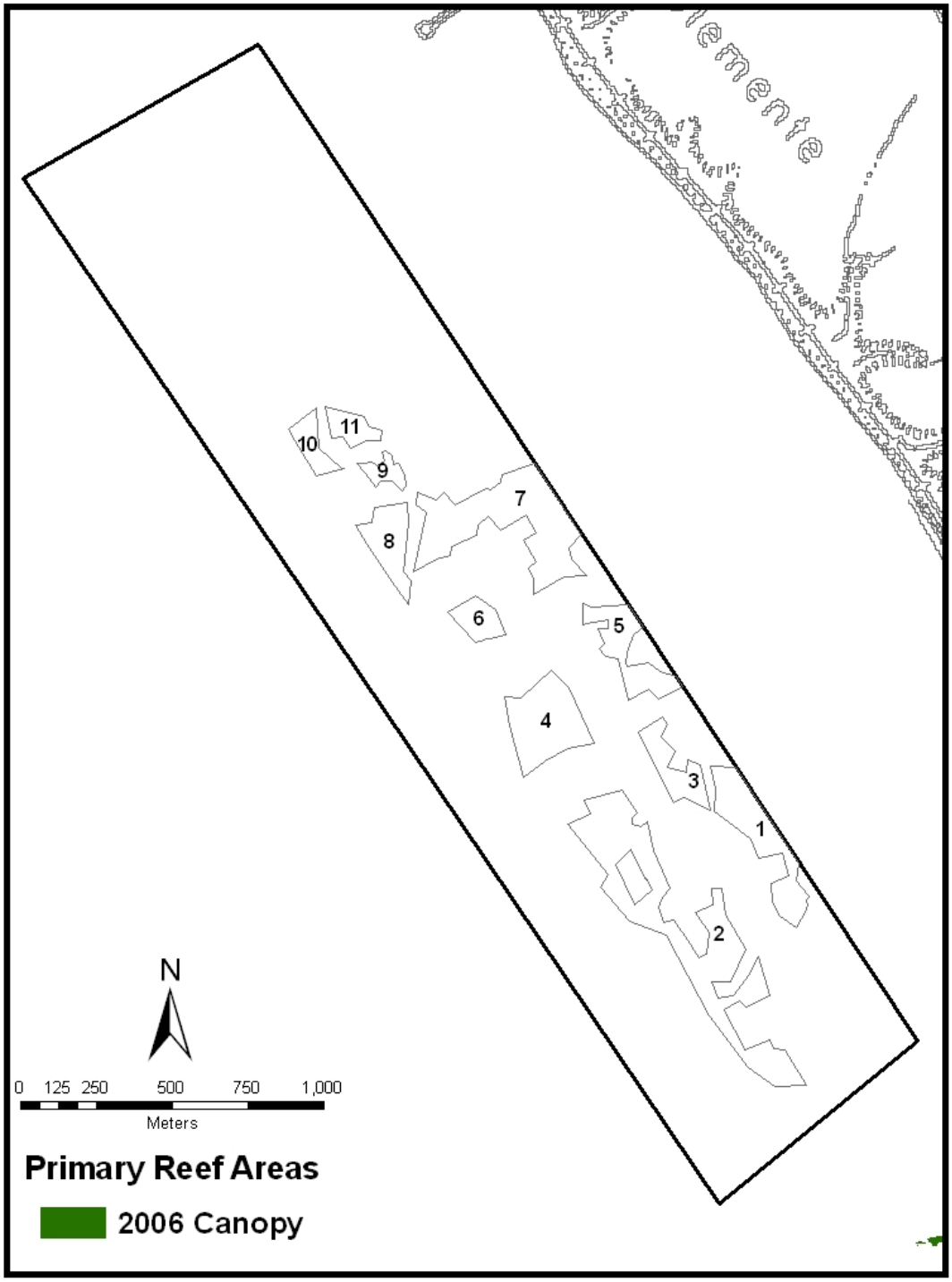

Figure C-43. 2006 kelp canopy map off San Clemente.

APPENDIX D

CALIFORNIA DEPARTMENT OF FISH AND GAME GUIDELINES

APPENDIX D

CALIFORNIA DEPARTMENT OF FISH AND GAME GUIDELINES

MATERIAL SPECIFICATION GUIDELINES AND NOTIFICATION PROCEDURE FOR AUGMENTATION OF ARTIFICIAL REEFS WITH SURPLUS MATERIALS

The California Department of Fish and Game (CDFG) coordinates the state program for research and construction of artificial reefs off the coast of California. Department biologists have been involved in the planning and construction of over 35 artificial reefs off our coastline. Some of these reefs, in Orange and San Diego Counties, are permitted for future expansion through the use of surplus materials of opportunity. Cities, counties, public agencies and private organizations or businesses are invited to submit proposals to CDFG for disposal of certain categories of surplus materials for use in the construction of artificial reefs.

Acceptable Materials

Materials suitable for construction of artificial reefs must meet the following criteria:

(1) The material must be persistent. It must be hard, but may not be so brittle that collisions with other similar materials or boat anchors would tend to shatter it. It must remain unchanged after years of submersion in seawater.

(2) The material must have a specific gravity at least twice that of seawater. The material must be dense enough to remain in position during strong winter storms, even in water depths as shallow as 30 feet.

(3) The material must not contain potentially toxic substances. Petroleum products, including tires, are not acceptable reef material.

(4) Acceptable materials include, but may not be limited to, quarry rock and high density concrete. Other materials may be considered on a case-by-case basis.

Procedure for Placement of Materials

Placement of material at any reef site requires prior written approval from the California Department of Fish and Game. Specific off-loading sites and actual configuration of material placement will be determined by CDFG, in writing, and will be strictly adhered to.

Responsibilities of Principal Party to Agreement (City, Port District, etc.)

NOTIFICATION: The Principal party to the agreement must notify CDFG a minimum of one full month prior to moving any material to the specified reef site.

Responsibilities of Barge Contractor

NOTIFICATION: The barge contractor must notify the U.S. Coast Guard two weeks prior to moving any material to the reef site. The Coast Guard must be given a minimum of two weeks lead time to include this job in their Aids to Navigation and Notice to Mariners (Los Angeles area, 562-499-5410; San Diego area, 619-557-5877).

This notification must include:

(1) Location of work site.

(2) Size and type of equipment that will be performing the work.

(3) Name and radio call sign for working vessels, if applicable.

(4) Telephone numbers for on-site contact with project engineers.

(5) Schedule for completing the project.

PLACEMENT OF MATERIALS:

The contractor must arrange for inspection of loaded barge materials immediately prior to movement of any barge to the reef site.

CDFG shall place temporary buoys at the off loading site. The barge loads of materials must not be allowed to drift off-site during material augmentation.

Prepared by:

Dennis W. Bedford
Marine Resources Region – Long Beach
October 30, 1997

APPENDIX E

HEALTH AND SAFETY PLAN

WHEELER NORTH REEF AT SAN CLEMENTE, CALIFORNIA (SONGS ARTIFICIAL REEF MITIGATION PROJECT, PHASE 2 MITIGATION REEF)

APPENDIX E

HEALTH AND SAFETY PLAN

WHEELER NORTH REEF AT SAN CLEMENTE, CALIFORNIA (SONGS ARTIFICIAL REEF MITIGATION PROJECT, PHASE 2 MITIGATION REEF)

E.1 INTRODUCTION

This Health and Safety Plan Manual meets the requirements of applicable State and Federal requirements. It addresses the activities associated with the placement of A-500 stone at the Wheeler North Reef construction project. The Site Health and Safety Officer (SHSO) will be responsible for implementing this SHSP during all site work, and compliance with this plan is required of all individuals and third parties who enter controlled areas at the site.

E.1.1 PROPOSED FIELD ACTIVITIES

The scope of work includes placement and transport of A-500 stone for Wheeler North Reef construction.

The services provided by Contractor will consist of the following:

- Transportation of A-500 stone
- Placement of A-500 stone

E.1.2 EMERGENCY INFORMATION

The following personnel are critical to the planned activities at the Wheeler North Reef Construction Project.

1. SCE Project Manager
2. SCE On-Site Representative
3. Construction Company's Project Superintendent
4. Construction Company's Project Manager
5. Construction Company's Health and Safety Manager
6. Construction Company's General Manager/V.P.

A list of the work, home, and cell phone numbers for the above-named personnel will be prepared prior to the start of construction and will be available in the derrick barge control room. A list showing contact information (names, phone numbers, and addresses) for the agencies will also be displayed in the derrick barge control room.

E.1.3 INDUSTRIAL CLINIC INFORMATION

Dana Point Medical Center:
34052 La Plaza, #102
Dana Point, CA 92629
(949) 240-2555

Mission Urgent Care
616 South Coast Hwy
Oceanside, CA
(760) 722-3203

E.2 PERSONNEL RESPONSIBILITIES AND AUTHORITY

The following section briefly describes the health and safety personnel designations and associated responsibilities, which will be employed for field activities associated with this health and safety plan.

E.2.1 PROJECT MANAGER

The project manager (PM) has the overall responsibility for the health and safety of site personnel. The PM will ensure that adequate resources are provided to the field health and safety staff to carry out their responsibilities as outlined below. The PM will also ensure that the fieldwork is scheduled with adequate personnel and equipment to complete the job safely.

E.2.2 PROJECT SUPERINTENDENT

The project superintendent (PS) will be responsible for ensuring that all work is performed in accordance with the contract requirements in a safe and healthful manner. The PS shall ensure that work crews have adequate resources to effectively conduct field activities and (in conjunction with the SHSM) that proper protective equipment is being utilized by all personnel, enforce appropriate disciplinary actions when health and requirements are not being followed or unsafe practices occur, and oversee work practices to verify that they are in accordance with the SHSP. The project foreman (PF) has the authority to suspend field activities if the health and safety of personnel are in danger.

E.2.3 SITE HEALTH AND SAFETY MANAGER

The SHSM or designee will be present on site during the conduct of potentially hazardous field operations and will coordinate all health and safety activities. The SHSM or designee will be responsible for implementation of the SHSP, overseeing that appropriate personal protective equipment (PPE) is used relative to the hazard which may be encountered, verifying that communication systems are in place, monitoring conformance

with safety and emergency response procedures, giving safety briefings, seeing that safety equipment is maintained, and conducting safety audits. The SHSM or designee, in conjunction with the PS, will conduct at least weekly safety and health inspections of all work areas for compliance with SHSP requirements and implement timely corrective actions to inspection findings. The SHSM or designee has stop work authorization, which will be executed upon determination of an imminent safety hazard or potentially dangerous situation. Work cannot restart until clearance has been authorized by the SHSM or designee.

The SHSM shall possess the knowledge and experience necessary to ensure that all elements of the approved SHSP are implemented and enforced on site.

E.2.4 SUBCONTRACTED PERSONNEL AND THIRD PARTIES

All subcontracted and third party personnel shall be responsible for compliance with this SHSP and other applicable regulations. Subcontractor personnel shall not be permitted unescorted access to the project site prior to the fulfillment of requirements established by this plan and the receipt and acknowledgment of a hazard communication briefing provided by the CPC SHSM or designee. The onsite subcontractors will be responsible for providing their personnel with appropriate personal protective equipment. Subcontracted and third party supervisory personnel have the authority to request a work area hazard assessment by the CPC SHSM prior to commencement or continuation of work activities.

E.2.5 GENERAL SITE WORKERS

It is the responsibility of all site workers, including subcontractors and visitors, to report any unsafe or potentially hazardous conditions to the SHSM or the PF. They should maintain knowledge of the information, instructions, and emergency response actions contained in this SHSP. Additionally, they shall comply with rules, regulations and procedures as set forth in this SHSP and any revisions, which may be implemented.

E.2.6 PERSONNEL PROTECTION REQUIREMENTS

All personnel that are required to enter the work areas shall have the following PPE:

- Hard hat
- Life jacket
- Safety glasses/goggles
- Sturdy leather work boots
- Gloves

E.2.7 TRAINING

Prior to commencement of stone placement activities, all personnel who will be required to enter the work area or handle rock barges shall be adequately trained in barge handling and proper working conditions. Prior to commencement of crane operations, all operators must have

current crane certification with adequate training.

Special on-site training with equipment and procedures unique to this jobsite shall be performed as required. Training in emergency response and evacuation procedures shall be provided as well.

E.3 HAZARD ASSESSMENT

The potential hazards associated with the placement of the rock include both chemical and physical hazards. The potential for encountering chemical hazards will depend on the characteristics of the site. The potential for encountering physical hazards, such as heat stress, noise, slipping, tripping, falling, and other hazards will be present depending on the equipment used and type of work being performed.

E.3.1 CHEMICAL HAZARDS

Site activities may expose operations personnel to chemical hazards. Every effort will be made to identify the potential chemical hazards to which personnel may be exposed and to minimize the risk by utilizing such measures as engineering controls, work practice design, administrative measures, and personnel protective equipment. Personnel may be exposed to chemical hazards from rock dust through inhalation, ingestion, and/or skin/mucous membrane absorption or contact.

The probability of significant exposure to chemical hazards during rock placement is expected to be moderate to high. The highest potential for exposure will be through inhalation of dust that could enter the worker's breathing zone during placement and handling of rock barges. In order to minimize the probability of significant exposure to chemical hazards during those tasks, the following measures will be implemented.

- The use of dust suppressants to reduce fugitive dust emissions from work areas.
- Monitoring of air-borne contaminants using real time dust monitoring.
- Material handling activities will cease during high wind episodes.

E.3.2 FIRE HAZARDS

There may be potential for fire at the site. In the event of a fire, hazardous materials could be abruptly released into the air. The risk of fire increases with the presence of energized electrical circuits and improperly grounded electrical equipment.

The overall probability for an injury due to fire during work activities is unlikely due to the following:

- Power tools will be bonded and grounded, spark-proof and explosion-resistant where appropriate to prevent ignition of flammable material in the workplace.
- Smoking and/or open flames will only be allowed in designated areas at the worksite.

E.3.3 INDUSTRIAL HAZARDS

Field activities associated with this project have the potential of causing injury to operating personnel. The types of accidents that could occur include, but are not limited to: falling or slipping from walking on wet decks, tools or equipment falling on personnel, hand injuries, tripping over tools or equipment, fire and electrical hazards. The safety measures and management controls in place to prevent or mitigate other hazards associated with these activities can be expected to reduce the likelihood of an industrial injury. The frequency and severity of accidents is inversely proportional to the training and safety awareness of personnel and their level of compliance with federal and state safety regulations.

E.3.4 HEAT STRESS/COLD STRESS/WORK STRESS

During work activities, workers may be required to wear protective clothing, which may adversely impact the normal heat exchange mechanisms the body needs to operate efficiently. High ambient temperatures can result in various heat-related stress symptoms. The Site Health and Safety Officer and all other site personnel must be alert for signs and symptoms of heat stress. The project foreman (PF) must be certain that work practices for each operation take into account the risks of heat stress. Radiant heat will be sufficiently high to create more of a hazard during the summer than during the winter.

Symptoms of heat stress include dizziness, profuse sweating, skin color change, vision problems, confusion, nausea, slurred speech, fatigue, fainting, and clammy skin. Personnel who exhibit any of these symptoms must immediately be removed from the work site and be allowed to rest in a shaded location.

Heat stroke is a medical emergency, and medical attention must be provided immediately. Preventive measures for heat stress and heat stroke include monitoring temperature indexes, following appropriate work/rest schedules, and compensation for electrolyte loss. The work schedule may be changed to take advantage of cooler ambient temperatures, which occur in the early morning portion of the day.

The recommended Threshold Limit Values (TLV) for work/rest schedules for light, moderate, and heavy workloads for acclimatized workers are presented below:

Work-Rest Regimen	Light Work °C [F]	Moderate Work °C [F]	Heavy Work °C [F]
Continuous work	30.0 [86]	26.7 [80]	25.0 [77]
75% work, 25% rest ea. hr.	30.6 [87]	28.0 [82]	25.9 [78]
50% work, 50% rest ea. hr.	31.4 [89]	29.4 [85]	27.9 [82]
25% work, 75% rest ea. hr.	32.2 [90]	31.1 [88]	30.0 [86]

As the workload increases, the heat stress impact on an unacclimatized worker is exacerbated. For unacclimatized workers, the permissible heat exposure TLV should be reduced by approximately 2.5°C.

The values above are valid for light summer clothing such as that customarily worn by acclimatized workers when working under hot environmental conditions. Where there is a requirement for protection against harmful substances in the work environment, and additional personal protective clothing and equipment must be worn, a correction of the above-mentioned TLV values is warranted, as outlined in the American Conference of Governmental Industrial Hygienists 1993-1994 booklet.

The SHSO may adjust the schedule after it is determined that the rest breaks are effective and the workers are adequately acclimatized to a different work schedule. Workers will be interviewed by the SHSO periodically to ensure that the controls are effective and excessive heat exposure is not occurring. Workers will be instructed on how to monitor their own body symptoms and to take a break before a negative effect is observed.

In order to reduce the potential for heat stress-related injuries during field activities, the following measures will be implemented and enforced by the SHSO and project foreman.

- Establish a cool, shaded, and weather-protected rest area in the support zone after decontamination. Protective clothing should be removed or opened following decontamination to allow evaporative cooling.
- Avoid overtime, extended hours, and double shifts.
- Implement the most strenuous tasks during non-peak hours such as early morning.
- Workers should drink enough water and mineral-supplemented beverages (such as Gatorade or equivalent) during field activities. For an 8-hour workday, a minimum of 50 ounces of salted fluids should be ingested. The PF will see that plenty of liquids are provided, which must only be consumed at an approved eating/drinking area in the Support Zone.
- Workers should not be allowed to perform any strenuous work during rest breaks.

Hazardous work activities that rely on a high degree of personal alertness may increase the risk of accidents when performed by individuals experiencing excessive psychological and possibly physiological stress. The PF assumes the responsibility for using good judgment in the assignment of personnel fatigued by excessive hours of work in these stressful environments.

E.3.5 NOISE

Suitable hearing protection (ear plugs) may be required by the SHSO based on the work schedule for heavy equipment. Excessive noise may be encountered during abatement activities. Any employee whose work exposes him/her to more than 85 dBA on an 8-hour time-weighted average shall be placed in a hearing conservation program and required to wear hearing protection while working.

E.3.6 CONFINED SPACE OPERATIONS

The nature of work during this project does not have the potential to create conditions of confined space for on-site personnel. If confined space work becomes necessary due to changed site conditions or emergencies on the derrick barge, the latest version of the CPC Confined Space Program procedure will be implemented. This will require provision for confined space monitoring, permitting, training, rescue provisions, and additional PPE. All confined space operations must be supervised by the SHSC or other competent person.

E.3.7 FALL PROTECTION

- Fall protection systems must be used to eliminate fall hazards when performing construction activities at a height of 6 feet or greater and when performing general industry activities at a height of 4 feet or greater.
- Do not use fall protection systems with which you have not been trained.
- Remain within the guardrail system when provided. Leaning over or stepping across a guardrail system is not permitted.
- Do not stand on objects (boxes, buckets, bricks, blocks, etc.) or ladders to increase working height on top of platforms protected by guardrails.
- Inspect personal fall arrest systems prior to each use. Do not use damaged fall protection systems at any time or for any reason.
- Set up personal fall arrest systems so that one can neither free-fall more than 6 feet nor contact any lower level.
- Only attach personal fall arrest systems to anchorage points capable of supporting at least 5,000 pounds.
- Use fall protection equipment for fall protection only, not to hoist materials. Do not use personal fall arrest systems that have been subjected to impact loading.

E.3.8 OPERATIONAL HAZARDS

The following precautions will be implemented to minimize the possibility of accidents and/or incidents:

- Field personnel will stay clear of equipment when lifting or in motion.
- Workers should familiarize themselves with proper usage of equipment/tools. In addition, safety shields and other safety attachments will be enforced.
- Use of proper personnel protective equipment while handling rock barges.
- Noise monitoring will be conducted during work activities. If levels exceed 85 dBA, hearing protection will be used.
- Ergonomic training will be provided to all site personnel during the preconstruction and safety meeting.
- Caution will be exercised during work activities and when working around equipment.

The following hazards may be encountered during work operations:

- Possibility of on-site injury resulting from being struck by falling stones and tools.
- Slipping on wet decks.
- Exposure to dust or other hazards.
- Excessive noise.
- Unsafe ground conditions.

The following precautions will be implemented to minimize the possibility of accidents and/or incidents.

- Personnel will stay clear of equipment when it is lifting or in movement.
- To reduce dust emissions, several measures will be implemented during site activities. These include but are not limited to the following: use of dust suppressant, real-time monitoring for airborne emissions and upgrade if established action levels are exceeded.
- A noise monitoring program will be implemented throughout field activities, and proper hearing protection will be used if noise levels exceed 85 dBA.

E.4 EMERGENCY RESPONSE

E.4.1 PRE-EMERGENCY PLANNING

The project foreman performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with onsite parties, the facility, and local emergency-service providers as appropriate.

- Review the site emergency and contingency plans where applicable.
- Determine what onsite communication equipment is available (e.g., two-way radio, air horn).
- Determine what offsite communication equipment is needed (e.g., nearest telephone, cell phone).
- Confirm and post emergency telephone numbers, evacuation routes, assembly areas, and route to hospital, communicate the information to onsite personnel.
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, and releases.
- Designate one vehicle as the emergency vehicle. Place hospital directions and map inside. Keep keys in the ignition during field activities.
- Inventory and check site emergency equipment, supplies, and potable water.

E.4.2 EMERGENCY EQUIPMENT AND SUPPLIES

The PF shall verify that these supplies are available, as needed, and in proper working order:

- 20-lb. fire extinguisher (A, B, and C classes)
- First aid kits

- Personal eye wash
- Potable water
- Hand wash stations

E.4.3 INCIDENT RESPONSE

In the event of fire, explosion, or chemical release, actions to be taken include:

- Shut down operations and evacuate the immediate area.
- Notify appropriate response personnel.
- Account for personnel at the designated assembly area(s).
- Assess the need for site evacuation and evacuate the site as warranted.

Instead of implementing a work-area evacuation, small fires or spills posing minimal safety or health hazards may be controlled.

E.4.4 EVACUATION PROCEDURES

- Evacuation routes and assembly areas will be designated by the PF before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The PF and a "buddy" will remain on the site after it has been evacuated (if safe) to inform local responders of the nature and location of the incident.
- The PF will account for all personnel at the assembly area.
- The PF will write up the incident as soon as possible after it occurs and submit a report to the Health and Safety Manager.

E.4.5 EMERGENCY MEDICAL TREATMENT

The procedures listed below may also be applied to non-emergency incidents. Injuries and illnesses (including overexposure to contaminants) must be reported to the supervisor. During non-emergencies, follow these procedures as appropriate.

- Notify appropriate emergency response authorities, e.g., call 911.
- The PF will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury.
- Initiate first aid and CPR where feasible.
- Get medical attention immediately.
- Make certain that the injured person is accompanied to the emergency room.
- Report the incident.

APPENDIX F

MANAGEMENT OF ACCIDENTAL DISCHARGE AND VESSEL PROBLEMS

WHEELER NORTH REEF AT SAN CLEMENTE, CALIFORNIA (SONGS ARTIFICIAL REEF MITIGATION PROJECT, PHASE 2 MITIGATION REEF)

APPENDIX F

MANAGEMENT OF ACCIDENTAL DISCHARGE AND VESSEL PROBLEMS

WHEELER NORTH REEF AT SAN CLEMENTE, CALIFORNIA (SONGS ARTIFICIAL REEF MITIGATION PROJECT, PHASE 2 MITIGATION REEF)

F.1 OPERATIONAL SPILLS

Operational spills might involve one or more of the following substances carried on board the vessel: (i) diesel fuel; (ii) lube oil; (iii) hydraulic oil; or (iv) waste oil. None of these substances is carried as cargo, as defined by 33 C.F.R. Section 155.1020. Rather, they are carried on board for the sole use of the crane barge and its appurtenances.

(i) Diesel fuel:

To avert operational spills while fueling the loader or winches, the vessel pilebutt shall stand by the hose shut-off switch located at the hose reel, and the vessel oiler shall operate the quick-release valve at the discharge end of the rubber fuel hose. A spill kit shall be available for use in the event of a spill. In the event of spillage, the pilebutt shall engage the shut-off switch and the oiler shall engage the quick-release valve. If the fuel is spilled on the deck, it shall be immediately removed, bagged and disposed of at an appropriate hazardous waste reception facility. Operational spills not involving use of the hose reel would result in fuel being discharged into internal areas of the crane barge. Fuel spilled in internal areas shall be treated similarly. In the event of spillage in the water, the vessel foreman shall notify the local MSO and the construction company and remain available by VHF radio. NRC Environmental shall be called out to contain and/or remove the fuel from the marine environment.

(ii) Lube oil:

Lube oil is drawn off the tank into a pail on an as-needed basis. A spill kit shall be available for use in the event of a spill. If the oil is spilled on deck or in the machinery space, it shall be immediately removed, bagged and disposed of at an appropriate hazardous waste reception facility. In the event of spillage in the water, the vessel foreman shall notify the local MSO and the construction company and remain available by VHF radio. NRC Environmental shall be called out to contain and/or remove the oil from the marine environment.

(iii) Hydraulic oil:

Hydraulic oil is drawn from the tank into a pile on as-needed basis. A spill kit shall be available for use in the event of a spill. If the oil is spilled on deck or in the machinery space, it shall be immediately removed, bagged and disposed of at an appropriate hazardous waste reception facility. In the event of spillage in the water, the vessel foreman shall notify the local

MSO and the construction company and remain available by VHF radio. NRC Environmental shall be called out to contain and/or remove the hydraulic oil from the marine environment.

(iv) Waste oil:

Waste lube oil is stored in 55-gallon barrels on the weather deck under the crane house. No more than two barrels are used on the vessel at any one time to store waste oil. A spill kit shall be available for use. If the oil is spilled on deck or in the machinery space, it shall be immediately removed, bagged and disposed of at an appropriate hazardous waste reception facility. Once filled with oil, the barrels are removed from the vessel by crane to a shoreside facility for disposal at an appropriate facility. In the event of spillage on the water, the vessel foreman shall notify the local MSO and the construction company and remain available by VHF radio. NRC Environmental shall be called out to contain and/or remove the oil from the marine environment.

(v) Pipe leakage:

The vessel oiler shall check the piping and rubber hose daily for leakage. Where leakage is found, it shall be repaired immediately. In the event of leakage, the vessel deck engineer shall secure valve(s) at the appropriate tank before repairing the leak. Spilled fuel on the vessel shall be immediately removed, bagged and disposed of at an appropriate hazardous waste reception facility. In the event of spillage on the water, the vessel foreman shall notify the local MSO and the construction company and remain available by VHF radio. NRC Environmental shall be called out to contain and/or remove the fuel from the marine environment.

F.2 SPILLS RESULTING FROM CASUALTIES AND VESSEL PROBLEMS

In the event of a casualty, the vessel foreman's first priority is to ensure the safety of the vessel's personnel and to initiate actions that may prevent escalation of the incident and marine pollution.

(i) Grounding:

The likelihood of grounding, although remote, could occur when the vessel is under tow or when the vessel is working. In either instance, because the vessel's hull walls do not comprise any part of the tank wall in which diesel fuel, lube oil or waste oil is stored, hull damage would cause no damage to the subject tanks. Accordingly, risk of spillage as a result of hull damage is not existent. Should an unforeseeable grounding event occur that causes a spill, the vessel foreman shall immediately report the accident to the MSO and the construction company. It is mandatory that the construction company immediately report the incident to the California Office of Emergency Services ("OES"). The foreman's report shall include information requested in the foregoing report form in paragraph III.B. That information will be used by the construction company's representatives when notifying the OES and, if necessary, provided to NRC Environmental if deployment of spill containment/cleanup equipment is required. While the foreman assesses and reports the incident, the crane operator shall shut down the crane's

operating engines. The oiler shall shut down all non-essential power-generating equipment and secure all fuel and oil lube lines on the weather deck. The deck engineer shall secure all fuel and oil lube lines on the weather deck. The pilebutt shall see that all open flames are extinguished. The foreman shall remain in radio contact with the local MSO and the construction company until the discharge is stopped, and thereafter maintain contact as needed. The foreman shall apprise the construction company's office if the oil containment/cleanup services of NRC Environmental are required. Finally, the vessel's tug will stand by and render any necessary assistance.

(ii) Fire or explosion:

If a fire or explosion occurs, the local MSO will be notified immediately by the vessel foreman. While awaiting a response from the USCG or local fireboat agencies, all crewmen shall report to the galley for a head count. In the event that one or more crewmen are missing, the vessel foreman shall so notify the MSO and direct a search for the missing crew where practical. If one or more crewmen are injured, the foreman shall render first aid with the assistance of available crewmen. The foreman shall also notify the MSO of any injuries sustained as a result of the fire or explosion.

The crew will fight the fire with portable fire extinguishers and/or fire hoses if essential power-generating equipment and fire pumps are operational. The oiler shall determine if the equipment and fire pumps are operational. The pilebutt and crane operator shall man the fire-fighting equipment at the direction of the deck engineer. The vessel's standby tug shall render any assistance requested by the vessel foreman. The foreman shall remain in constant contact with the MSO and apprise them of the status of the incident. The foreman shall determine if the fire or explosion warrants abandoning the vessel. If it is determined that the vessel is to be abandoned, the crew shall board the tug assigned to the vessel. In the event the tug is unavailable, the crew shall board the vessel's life raft.

If there is a spill as a result of the fire or explosion, the vessel foreman shall immediately report the incident to the local MSO and to the construction company's office. It is mandatory that the construction company immediately report the incident to the OES. The foreman's report shall include information requested in the foregoing report form in paragraph III.B. The construction company's representatives will make that information available to the OES and, if necessary, to NRC Environmental when they are requested to deploy spill containment/cleanup equipment. While the foreman assesses and reports the incident, the crane operator shall shut down the crane's operating engines. The oiler shall shut down all non-essential power-generating equipment and secure all fuel and oil lube lines on the weather deck. The deck engineer shall secure all fuel and oil lube lines on the weather deck. The pilebutt shall ensure that all open flames are extinguished. The foreman shall remain in radio contact with the local MSO and the construction company's office until the discharge is stopped, and thereafter maintain contact as needed. The foreman shall apprise the construction company's office if the oil containment/cleanup services of NRC Environmental are required. Finally, the vessel's tug will stand by and render any necessary assistance.

(iii) Containment system failure:

First, a visual inspection should be carried out.

All ballast/bunker tanks to be sounded (Ullage) and all other compartments that may have contact with the sea should be sounded to ensure that they are intact.

Soundings of ballast tanks/bunkers are to be compared with last sounding to check for possible leaks.

Soundings are to be taken around the vessel to establish the vessel's position on the grounding area.

When the vessel is aground, due regard should be given to the indiscriminate opening of ullage plugs, sighting ports, etc., as loss of buoyancy could be the result of such actions.

(iv) Collision:

A collision is unlikely to cause a spill unless the vessel sinks or one or more of the holding tanks is "holed." If the vessel sinks, the crew shall board the standby tug and the vessel foreman shall notify the MSO of the sinking. The foreman shall furnish the information requested by the form shown at paragraph III.B. to the MSO and the construction company's office. It is mandatory that the construction company immediately report the incident to the OES. NRC Environmental shall be dispatched to undertake spill control and/or cleanup.

If the collision causes a spill from one or more of the holding tanks, the crane barge foreman shall immediately report the incident to the local MSO and to the construction company's office. It is mandatory that the construction company immediately report the incident to the OES. The foreman's report shall include information requested in the report form designated in paragraph III.B. That information will be used by the construction company's representatives when notifying the OES. While the foreman assesses and reports the incident, the crane operator shall shut down the crane's operating engines. The oiler shall shut down all non-essential power-generating equipment and secure all fuel and oil lube lines below the weather deck. The deck engineer shall secure all fuel and oil lube lines on the weather deck. The pilebutt shall ensure that all open flames are extinguished. The foreman shall remain in radio contact with the MSO and the construction company's office until the discharge is stopped, and thereafter maintain contact as needed. NRC Environmental shall be called out to contain and/or remove the oil from the marine environment.

(v) Hull failure:

Hull failure to the vessel is unforeseeable absent a collision. In the event a collision causes hull failure, the foregoing collision procedures shall be followed.

(vi) Excessive list:

Excessive list of the vessel is also unforeseeable absent a collision causing flooding of one or more wing tanks. Damage to a wing tank causing flooding would not likely cause one or more of the holding tanks amid vessels to spill diesel fuel, lube oil or waste oil. Should a spill occur, the foregoing collision procedures shall be followed.

(vii) Vessel submerged/foundered:

If the vessel is submerged or foundered to the extent that it, or parts of it, are submerged, all measures shall be taken to evacuate all persons on board. Avoid contact with any spilled oil. Alert other vessels/vessels and/or the nearest coastal state for assistance in rescuing lives and the vessel as far as possible.

(viii) Vessel wreck/stranded:

The likelihood of being wrecked or stranded, although remote, could occur when the vessel is under tow or when the vessel is working. In either instance, because the vessel's hull walls do not comprise any part of a tank wall in which diesel fuel, lube oil or waste oil is stored, hull damage would cause no damage to the subject tanks. Accordingly, risk of spillage as a result of hull damage is non-existent. Should an unforeseeable wrecking event occur that causes a spill, the vessel foreman shall immediately report the incident to the MSO and to the construction company's office. It is mandatory that the construction company immediately report the incident to the California Office of Emergency Services ("OES"). The foreman's report shall include information requested in the foregoing report form in paragraph III.B. That information will be used by the construction company's representatives when notifying the OES and, if necessary, provided to NRC Environmental if deployment of spill containment/cleanup equipment is required. While the foreman assesses and reports the incident, the crane operator shall shut down the crane's operating engines. The oiler shall shut down all non-essential power-generating equipment and secure all fuel and oil lube lines on the weather deck. The pilebutt shall see that all open flames are extinguished. The foreman shall remain in radio contact with the local MSO and the construction company's office until the discharge is stopped, and thereafter maintain contact as needed. The foreman shall apprise the construction company's office if the oil containment/cleanup services of NRC Environmental are required. Finally, the vessel's tug will stand by and render any necessary assistance.

(ix) Hazardous Vapor Release

In case of any vapor release out of the containment system, precautions have to be taken to protect the persons onboard against contamination. The vessel should be brought with the accommodation upward to the spill area as far as possible. The crew should be evacuated from any area of risk. All possible sources of ignition should be eliminated, and non-essential air intakes shut down to prevent intake of vapor into accommodation and engine spaces.

If unavoidable work has to be carried out within risk areas, the involved persons have to wear protective clothing and breathing apparatus.

F.3 PRIORITY ACTIONS TO ENSURE THE SAFETY OF PERSONNEL AND THE VESSEL

Safety of vessel personnel and the vessel are paramount.

In the event that a crewman's injuries require outside emergency assistance, the MSO shall be contacted immediately. While awaiting emergency assistance, the construction company's vessel personnel will render first aid and/or CPR[4]. The vessel's tug shall stand by in the event its services are required in aiding an injured crewman. If the vessel requires evacuation, the standby tug shall provide evacuation services and notify the MSO of the circumstances in the event that the vessel foreman cannot do so. In the event that the tug is unavailable, the crew shall use the emergency life raft stowed on the vessel for evacuation. The vessel foreman shall be responsible for evacuation of the vessel, and the vessel crane operator shall fulfill the foreman's duties in the event he is disabled.

In the event that the safety of the vessel is threatened, the standby tug shall act at the direction of the vessel foreman in rendering assistance. If the vessel sustains damage threatening its integrity, the vessel foreman shall immediately notify the MSO and the construction company's office, and remain available by VHF radio. The construction company's operations manager will act as liaison with the MSO and other agencies.

F.4 MITIGATING ACTIVITIES

If safety of both the vessel and the personnel has been addressed, the vessel foreman shall care for the following issues:

- Assessment of the situation and monitoring of all activities as documented evidence.
- Care for further protection of the personnel, use of protective gear, assessment of further risk to health and safety.
- Containment of the spilled material by absorption and safe disposal within leakproof containers of all used material onboard until proper delivery ashore, with due consideration to possible fire risk.
- Decontamination of personnel after finishing the cleanup process.

All personnel shall refer to the MSDS's on board for additional information.

[4] Many of the construction company's personnel have training certifying them as givers of first aid and CPR.

F.5 ASSESSING DAMAGE TO THE VESSEL, INCLUDING MAKING DAMAGE STABILITY AND LONGITUDINAL STRENGTH ASSESSMENTS

In the event that vessel damage assessment is required, it shall be conducted by a qualified marine surveyor.

F.6 LIGHTENING PROCEDURES TO BE FOLLOWED IN CASES OF EXTENSIVE STRUCTURAL DAMAGE

The vessel does not carry cargo, as defined in 33 C.F.R. Section 155.1020. Accordingly, 33.C.F.R. Section 151.26 is not applicable to the extent that it calls for lightening procedures for ship-to-ship transfer of cargo.

Should the vessel sustain extensive structural damage requiring transfer of diesel fuel, the following lightening procedures will apply:

(1) Diesel fuel: Where extensive structural damage causes a spill, the collision procedures set forth above shall be observed. Where structural damage creates a need to lighten the vessel of diesel fuel, the vessel foreman shall so notify the construction company.

Prior to lightening operations, the vessel oiler and pilebutts shall open a tank hatch cover designated by the deck engineer for fuel transfer. A spill kit shall be readily available during the operations. The barge operator will have a licensed tankerman in charge of lightening operations. Before beginning the operations, the crane operator shall shut down the crane's operating engines. The deck engineer shall shut down all non-essential power-generating equipment and secure all fuel and oil lube lines below the weather deck. The oiler shall secure all fuel and oil lube lines on the weather deck. The pilebutt shall ensure that all open flames are extinguished. During lightening operations, the deck engineer shall remain in constant radio contact with the barge tankerman. The pilebutt, oiler and crane operator shall monitor lines securing the barge to the crane barge during the operations. The foreman shall remain available by radio with the local MSO and the construction company's office until lightening operations are completed. If the fuel is spilled on deck, it shall be immediately removed, bagged and disposed of at an appropriate hazardous waste reception facility. In the event of spillage in the water, the vessel foreman shall notify the local MSO and the construction company's corporate office. NRC Environmental shall be called out to contain and/or remove the fuel from the marine environment. The vessel's tug will stand by and render any necessary assistance.

(2) Lube oil, hydraulic oil and waste oil: The crane barge carries small quantities of these three products, or a maximum of 800 gallons, 800 gallons, and 100 gallons, respectively. Accordingly, removing one or more of these substances to lighten the vessel is unforeseeable and not addressed herein.

F.7 MEASURES TO BE TAKEN IN THE EVENT OF CASUALTY

(i) Response to oil spills

The vessel foreman and crew shall muster and ensure the following actions to be taken.

- The foreman is to command the crew to go to oil spillage prevention stations.
- In order to prevent additional outflow, take the following measures:
- (1) Secure oil spill area,
- (2) Reduce internal pressure in oil spill tank,
- (3) Close or cut off related piping.
- Create optimum condition for prevention of additional outflow of oil by adjusting ballast or by using other methods.
- Transfer oil internally from damaged tanks to intact tanks to prevent additional outflow of oil.
- A contract with a salvage and oil pollution cleanup company should be entered into promptly, while maintaining contact with the representative of the vessel owner.
- When necessary, transfer oil from the damaged tank to another vessel to prevent additional outflow of oil.

(ii) Response to fire/explosions

The vessel foreman and crew shall muster and ensure that the following actions are taken.

- The foreman is to order the crew to go to their fire-fighting stations.
- Conduct effective and appropriate initial fire-fighting operations, check condition of lifeboats, and prepare to abandon vessel for the preservation of life. Take care not to give the order to abandon vessel either prematurely or too late.
- Promptly shift paint cans, oily waste, fixtures including ropes, and other inflammables and explosives in the vicinity of the fire.
- When the fire is becoming more intense due to the wind, anchor vessel or maneuver vessel to leeward.
- Close openings, including doors, scuttles, skylights and ventilation ducts, stop mechanical ventilation, and cool around them when necessary.
- Position vessel so that the fire and smoke do not hamper fire-fighting activities.
- Cut off electric power supply leading to fire site.
- When fire-fighting activities of the barge are judged inadequate, request assistance from vessels sailing in the vicinity before it is too late.
- With respect to flammable vapour,
  (1) If there is an escape or jettison of flammable cargo or fuel oil, care should be taken to prevent flammable vapour from the cargo or fuel oil from reaching sources of ignition on board the vessel or other vessels. If this is impossible, measures should be taken to eliminate any sources of ignition as far as practicable.

(iii) Response to collision

The vessel foreman and crew shall muster and ensure that the following actions are taken.

- The foreman is to order the crew to go to their designated stations.
- When there is no immediate danger to their own vessel and crew, rescue crew of the other vessel.
- Investigate the damaged area of the vessel and the ingress of water and take emergency measures to prevent the damage from becoming worse.
- When an ingress of water is found as a result of damage investigation, take necessary measures to prevent water from coming in, or pump out the water already taken in, according to the position and amount of water taken in. Such measures include the closing of water-tight doors, inserting wooden plugs, use of collision mats, cement box, strengthening of bulkhead, and use of water discharge pumps.
- When water penetration is severe even after countermeasures are taken and there is a danger of the vessel sinking, consider intended grounding on an appropriate shore.

(iv) Response to grounding

If the vessel runs aground, the vessel foreman and crew shall muster and the following steps should be taken immediately.

(1) Sound the emergency alarm and initiate emergency response procedures.
(2) Eliminate all avoidable sources of ignition and ban all smoking on board.
(3) Consider whether to shut off air intake of accommodation and engine room.

Further actions:

(1) Carry out a visual inspection of the vessel to determine the severity of the situation.
(2) Take soundings around the vessel to determine the nature and gradient of the seabed.
(3) Check difference in the tidal ranges at the grounding site.
(4) Evaluate tidal current in the grounding area.
(5) Take soundings of all cargo, ballast and bunker tanks, and check all other compartments adjacent to the hull. Ullage plugs should not be opened indiscriminately, as loss of buoyancy could result.
(6) Compare present tank soundings against departure soundings.
(7) Evaluate the probability of additional release of oil.

Having assessed the damage that the vessel has sustained, and taking into account the effects of hull stress and stability, the foreman should decide whether any action can be taken to avoid further spillage, such as:

(1) Transfer of cargo and bunkers internally. If the damage is limited—for example, to one or two tanks—consideration should be given to transfer of liquid from damaged to intact tanks.

(2) Isolate all cargo and bunker tanks to reduce further loss due to hydrostatic pressure during tidal changes.
(3) Review existing and forecasted weather conditions to see if they will adversely affect the vessel.
(4) Evaluate the possibility of transferring cargo to barges or other vessels, and request such assistance accordingly.
(5) Trim or lighten the vessel sufficiently to avoid damage to intact tanks, thereby avoiding additional pollution from spillage of oil or noxious liquid substance.

If the risk of additional damage to the vessel from attempting to refloat it by its own means is assessed to be greater than from remaining aground until assistance has been obtained, the foreman should try to prevent the vessel from moving from its present position by:

(1) Using anchors
(2) Taking in ballast in empty tanks (if possible)
(3) Reducing longitudinal stress on the hull by transferring cargo internally. Attention should be given to hull stress and damage stability information. Care must be taken with the compatibility of noxious liquid substances with tank type, material of construction and tank coating.

The foreman should obtain information about the situation, including the following.

(1) Tides and currents
(2) Weather, including wind, state of sea and swell.
(3) Any weather forecast changes.
(4) Nature of the bottom.
(5) Depth of water around the vessel, the calculated buoyancy needed to refloat, draught, and trim after refloating.
(6) Condition of the vessel, including stresses on the hull.

Strict safety precautions should be taken before entering any empty space, in order to avoid any risks from toxic fumes or oxygen deficiency.

Soundings should be taken around the vessel to determine the extent of the grounding/stranding as accurately as possible. If the sea is too rough for accurate sounding, it may be possible to measure the distance from the seabed to the main deck. By marking this on a longitudinal section from the general arrangement drawings, the extent of grounding can be determined.

If the vessel is structurally intact, an immediate attempt may be made to refloat her with or without assistance. In deciding whether to make an immediate attempt to refloat, the foreman should consider the use of the tugs and ground tackle as well as the possible damage that might be caused to the vessel.

Immediate refloating may be the best course to adopt even if the vessel has sustained bottom damage. However, if there are signs of excessive hogging, sagging or of undulations in the sides of the hull, more careful consideration is required before attempting to refloat the vessel. In these circumstances, lightening of the vessel may reduce the risk of further damage and pollution.

When judged to be impossible to refloat without aid, promptly arrange salvage interests.

When water ingresses into the vessel due to grounding, take preventive measures, i.e., close water-tight doors in order to minimize ingress of water.

If there is minor damage to a full cargo tank or fuel oil tanks, internal transfer of cargo or fuel oil may reduce or eliminate any outflow of cargo or fuel oil and pollution that may be caused. However, a substantial transfer of cargo or fuel oil when the vessel is aground may produce unacceptable stresses on the hull.

(v) Response to hull/containment system failure

The vessel foreman and crew shall muster and ensure that the following actions are taken.

- The foreman is to order the crew to go to designated stations.
- In the event of leakage from an area above sea level, promptly transfer cargo oil and/or fuel oil in problem tank and reduce level in tank to below sea level.
- Should it be impossible to transfer oil internally, consider transfer to another vessel or an onshore tank.
- Should it be suspected that leakage has occurred from an area below sea level, immediately close openings of upper deck, including vent valve of damaged tank
- Should it be impossible to identify the specific tank from which leakage is occurring, reduce levels of all tanks in the vicinity, taking account the effect on hull stress and stability.

(vi) Response to excessive list

If excessive list occurs rapidly and unexpectedly, it may be due to:

(1) Failure of the hull plating
(2) Failure between an internal bulkhead and compartments
(3) Shift of cargo
(4) Damage through grounding or collision
(5) Incorrect operational procedures

The vessel foreman and crew shall muster and ensure that the following actions are taken immediately.

(1) The foreman is to sound the emergency alarm and order the crew to go to designated stations.
(2) Stop any rock tubing or ballast operation in progress.
(3) If under way, reduce speed or stop.
(4) Investigate reason for the list.

Further measures:

(1) Take soundings of all tanks and compare with departure condition.
(2) Investigate the damaged area of the vessel and ingress of water, and take emergency measures according to degree of the list to prevent the damage from becoming worse.
(3) When ingress of water is found as a result of damage investigation, take necessary measures to prevent water coming in or being discharged overboard, according to the position and amount of water taken in.

(vii) Response to submerged/foundered

The vessel foreman and crew shall muster and ensure that the following actions are taken immediately.

- If the vessel is wrecked to the extent that it or parts of it are submerged, take all measures to evacuate all persons on board.
- Avoid contact with any spilled oil.
- Alert other vessels and/or the nearest coastal state for assistance in rescuing lives.
- All openings in hull and superstructures are to be checked for watertight integrity. Ensure that all water doors, sewage and other relevant damage control valves are closed.
- Fill bottom tanks with ballast low side first.
- Should the situation appear to be deteriorating, urgency or distress messages should be dispatched as appropriate.

(vii) Response to hazardous vapour release

The vessel foreman and crew shall muster and ensure that the following actions are taken immediately.

- In case of any vapour release out of the containment system, a gas analyzer should identify the properties of the vapor and precautions should be taken to protect the persons onboard against contamination.
- Cargo and bunkering operations are to be shut down if such operations are taking place in the meantime.
- The vessel should be brought up-wind to the spill area as far as possible.
- The crew should be evacuated from any area of risk.
- If the situation takes place in or near a port, Port/Harbor Authorities should be notified, and if needed, assistance should be requested.

- All possible sources of ignition should be eliminated and non-essential air intakes shut down to prevent intake of vapour into accommodation and engine spaces.
- If unavoidable work has to be carried out within risk areas, the involved persons have to wear protective clothing and breathing apparatus.

(viii) Response to wrecked/stranded

If the vessel is wrecked or stranded, the vessel foreman and crew shall muster and the following steps should be taken immediately.

(1) Sound the emergency alarm, and initiate emergency response procedures.
(2) Take soundings around the vessel to determine the nature and gradient of the seabed.
(3) Check difference in the tidal ranges at the stranding site.
(4) Evaluate tidal current in the stranding area.
(5) Take soundings of all cargo, ballast and bunker tanks and check all other compartments adjacent to the hull. Ullage plugs should not be opened indiscriminately as loss of buoyancy could result.
(6) Compare present tank soundings against departure soundings.
(7) Evaluate the probability of additional release of oil.

Having assessed the damage that the vessel has sustained, and taking into account the effects of hull stress and stability, the foreman should decide whether any action can be taken to avoid further spillage, such as:

(1) Transfer of cargo and bunkers internally. If the damage is limited, for example, to one or two tanks, consideration should be given to transfer of liquid form damaged to intact tanks.
(2) Isolate all cargo and bunker tanks to reduce further loss due to hydrostatic pressure during tidal changes.
(3) Review existing and forecasted weather conditions to see if they will adversely affect the vessel.
(4) Evaluate the possibility of transferring cargo to barges or other vessels, and request such assistance accordingly.
(5) Trim or lighten the vessel sufficiently to avoid damage to intact tanks, thereby avoiding additional pollution from spillage of oil or noxious liquid substance.

If the risk of additional damage to the vessel by attempting to refloat it by its own means is assessed to be greater than by remaining stranded until assistance has been obtained, the foreman should try to prevent the vessel from moving from its present position by:

(1) Using anchors
(2) Taking in ballast in empty tanks (if possible)
(3) Reducing longitudinal stress on the hull by transferring cargo internally. Attention should be given to hull stress and damage stability information. Care must be taken

with the compatibility of noxious liquid substances with tank type, material of construction and tank coating.

The foreman should obtain information about the situation, including the following.

(1) Tides and currents
(2) Weather, including wind, state of sea and swell.
(3) Any weather forecast changes.
(4) Nature of the bottom.
(5) Depth of water around the vessel, the calculated buoyancy needed to refloat, draught, and trim after refloating.
(6) Condition of the vessel, including stresses on the hull.

Strict safety precautions should be taken before entering any empty space, in order to avoid any risks from toxic fumes or oxygen deficiency.

Soundings should be taken around the vessel to determine the extent of the wreck/stranding as accurately as possible. If the sea is too rough for accurate sounding, it may be possible to measure the distance from the seabed to the main deck. By marking this on a longitudinal section from the general arrangement drawings, the extent of wreck/stranding can be determined.

If the vessel is structurally intact, an immediate attempt may be made to refloat her, with or without assistance. In deciding whether to make an immediate attempt to refloat, the foreman should consider the use of the tugs and ground tackle, as well as having regard for the possible damage that might be caused to the vessel.

Immediate refloating may be the best course to adopt even if the vessel has sustained bottom damage. However, if there are signs of excessive hogging, sagging or undulations in the sides of the hull, more careful consideration is required before attempting to refloat the vessel. In these circumstances, lightening of the vessel may reduce the risk of further damage and of pollution.

When judged impossible to refloat without aid, promptly arrange salvage interests.

When water ingresses into the vessel due to wrecking/stranding, take preventive measures, i.e., close watertight doors in order to minimize ingress of water.

If there is minor damage to a full cargo tank or fuel oil tanks, internal transfer of cargo or fuel oil may reduce or eliminate any outflow of cargo or fuel oil and pollution that may be caused. However, a substantial transfer of cargo or fuel oil when the vessel is stranded may produce unacceptable stresses on the hull.

APPENDIX G

SUMMARY OF ENVIRONMENTAL ISSUES FROM THE PROGRAM EIR (1999)

APPENDIX G

SUMMARY OF ENVIRONMENTAL ISSUES FROM THE PROGRAM EIR (1999)

G.1 SOCIOECONOMICS

- The interference of construction with the recreational fishing business is considered a potentially significant impact, both for the experimental reef and for the mitigation reef.
- Recreational fishing businesses that conduct operations in the project area shall be notified of project-related activities two weeks before the onset of construction.
- Construction activities will be limited to the period between May 1 and Sept 30 in order not to impact commercial lobster fishing.
- Commercial fishermen who conduct operations in the project area shall be notified of project-related activities two weeks before the onset of construction. This will allow them to select alternative urchin and crab fishing sites and to collect any fishing equipment from the project area before construction.

G.2 GEOLOGY

- The study of the related North Carlsbad Kelp Forest concluded that the presence of a kelp forest would likely result in the attenuation of short-period, local wind-driven waves, such as surface chop, but would not have a substantial effect upon long-period, low-frequency swell waves. These findings indicate that artificial and mitigation reefs would not result in indirect effects on beach development and coastal landforms.
- While the mitigation reef could affect coastal currents in its immediate vicinity, studies have shown that potential changes in currents would not cause an increase in nearshore sedimentation.
- Smaller rocks and pieces of concrete associated with the experimental and mitigation reefs could be washed up onto the beaches adjacent to the lease area and into the surf zone during typical storm events.
- The mitigation reef will be monitored for the movement of construction material during storm events. This monitoring will be on a biweekly basis from the months of November through March and on a monthly basis for the rest of the year, consistent with the program outlined in the mitigation measures of this project.

G.3 AIR QUALITY

- The proposed project is expected to have primary effects on air quality during construction and is not expected to result in indirect impacts. The mitigation reef would only generate potentially significant emissions during reef construction. As a result, only the construction-related emissions and significance thresholds are considered.
- The daily emissions for the mitigation reef would be the same as those for the experimental

reef for all activities occurring in one day. Both reefs would involve the same level of construction activity and hours of equipment operation on a daily basis.

- Quarterly emissions for the mitigation reef are very different than for the experimental reef due to the much longer duration of construction activities. All of the mitigation reef build-out scenarios span more than one quarter. As a result, the estimated quarterly emissions represent a full quarter of construction activities.
- Mitigation is required for daily and quarterly emissions of PM10 and NO_x. The breakdown of emissions by construction elements shows that the PM10 emissions are primarily related to truck hauling, and NO_x emissions are primarily related to tugboat towing and off-loading.
- There are three different mitigation strategies for reducing these emissions to less-than-significant levels: 1) standard mitigation measures for construction-related emissions recommended by the air districts, which apply to local emissions; 2) purchasing or leasing emissions offsets; and 3) changes in construction activities that reduce emissions.
- Virtually all PM10 emissions would be generated by fugitive road dust from trucks hauling reef materials from inland quarry rock and recycled concrete suppliers to the port. The problem of exceeding daily thresholds of significance is largely a function of transport distance and number of truck trips per day. As a result, the mitigation measures focus on adjusting these factors.
- Standard Mitigation Measures are:
  1. Apply water sprays to the concrete piles and graveled areas at least twice daily. Water down quarry rock and conveyer belts if soil is visible. Increase the frequency of watering when wind speeds exceed 15 miles per hour.
  2. Extend pavement from roads or access ways to concrete piles to remove at least three-quarters of the gap. Apply quality gravel to the remaining unpaved area so that vehicles and mobile equipment never maneuver on dirt.
  3. Sweep streets manually or with water sweepers at the end of the workday if visible soil material is carried onto private or public paved roads. Reclaimed water shall be used, if available, with the water sweepers.
  4. Retard injection timing on diesel engines to two degrees Before Top Center.
  5. Use high pressure injectors on diesel engines to reduce NO_x emissions by approximately 40 percent.

G.4 TRANSPORTATION

If an inland quarry is to be used, traffic issues must be addressed as follows:

- The construction traffic impacts of the mitigation reef would occur over 141 to 306 days if the mitigation reef is built of concrete, over 177 to 389 days if it is built of quarry rock. These days would occur over several years during the May to September construction season.
- During the PM peak hour, the Level of Service (LOS) would be reduced at two intersections, Ocean Boulevard and Atlantic Avenue, and Ocean Boulevard and Cherry Avenue, to unacceptable levels. This is considered a significant impact. To mitigate for this impact, the project proponent and all project contractors shall restrict truck trips to off-peak travel hours

(9:00 AM to 4:00 PM).

- The addition of mitigation reef construction traffic would alter the level of service during the AM peak hour on southbound I-710 between Pacific Coast Highway and Willow Street from LOS D to LOS E. This is considered a significant impact. To mitigate for this impact, the project proponent and all project contractors shall restrict truck trips to off-peak travel hours (9:00 AM to 4:00 PM).
- The addition of mitigation reef construction traffic would alter the level of service during the AM peak hour on northbound I-5 between L and J Streets from LOS E to LOS F. This exacerbation of an existing deficiency on I-5 is considered a significant impact. To mitigate for this impact, the project proponent and all project contractors shall restrict truck trips to off-peak travel hours (9:00 AM to 4:00 PM).

G.5 BIOLOGICAL RESOURCES

- The effects of anchors and chains on the sand-bottom community would primarily be limited to the immediate construction areas. None of the species at the project site is federally or state listed as threatened or endangered. Additionally, the sand-bottom habitat at the project site is mostly unproductive, and the affected area very small compared to the area of similar habitat occurring elsewhere in the SCB. Therefore, the impact of the derrick barge on the sand-bottom community is considered less than significant for the mitigation reef. Recommended mitigation includes buoys to keep the amount of chain length dragging on the ocean bottom to a minimum.
- The placement of mitigation reef materials would disturb bottom sediments and increase water turbidity near the construction site. The predominantly sand-sized bottom sediments in the project site are expected to settle out quickly and to travel only short distances from the construction site. There may be fine materials mixed in with the reef materials, and these may take longer to settle out and therefore travel farther, but their quantity is expected to be small. Sand-bottom habitat similar to the project site is extensive in the SCB, and the species identified at the project site are abundant and widely distributed elsewhere. No mitigation is therefore required.

G.6 HAZARDS

- The mitigation reef will be monitored for the movement of construction materials during storm events. Monitoring will be done on a biweekly basis for the months of November through March and on a monthly basis during the rest of the year. Any reef material found on the beach or in the shallow surf area would be removed by the project proponent.

G.7 NOISE

- The use of truck routes within residential and commercial zones would create noise levels in conflict with the County of Los Angeles, County of San Diego, and City of San Diego noise control ordinances. The conflict would be particularly substantial during the nighttime, when more restrictive thresholds apply. This is considered a significant impact. To reduce this

impact to a less-than-significant level, contractors will be directed to avoid the use of routes within areas zoned for residential and commercial uses. In the event that such routes cannot be avoided, the contractor will be directed to avoid use of these routes during the weekday hours of 7 PM to 7 AM and all day on Sunday.

G.8 PUBLIC SERVICES AND UTILITIES

- The need for offshore emergency response services could occur during construction of the mitigation reef. It is recommended that the Harbor Patrol be notified when any construction plans/schedules for the artificial reef are finalized. The Harbor Patrol should be given notification two weeks prior to the start of construction activities.
- The possibility of rocks and kelp wrack washing onshore or into the shallow surf zone is considered a significant impact because it may require additional public services for cleanup. To reduce the impact to a less-than-significant level, monitoring will be done on a biweekly basis throughout the months of November through March and on a monthly basis during the other months. The monitoring will be conducted for five years or for as long as needed after construction is completed. The monitoring visits would be coordinated to occur immediately after any large storm events (by the next day). The monitoring would include: 1) observations of the amount of kelp wrack on the beach and of potential rocks/concrete; 2) tracking beach cleanup schedules and costs (including disposal); and 3) tracking the number of complaints from beach-users or nearby residents and businesses due to kelp and/or rocks/concrete on the beaches.

G.9 AESTHETICS

- The presence of several barges and a crane 0.6 miles and farther offshore at the project site would not substantially alter the area's visual integrity as seen from any designated scenic routes or view corridors. Although this is considered a less-than-significant impact, the following mitigation is recommended: Conduct an educational outreach program to inform the public about the project and the construction activities.

G.10 RECREATION

- Construction activities in the project lease area would make portions of the site unavailable for recreation for short periods. Because this area would be small in relation to other opportunities for boating and diving in close proximity, this is considered a less-than-significant impact. However, recommended mitigation includes a notice to mariners published with the U.S. Coast Guard Waterways Branch and a similar notice posted at several locations at the Dana Point Harbor, including the Sheriff's Harbor Patrol, charter boat businesses, and dive shops. Temporary signs should also be posted at recreation sites, such as the San Clemente Pier and the mouth of San Mateo Creek.
- Reef material on the shoreline would potentially affect the safety of the beach environment and large amounts of kelp could reduce recreation. To mitigate for reef material or kelp wrack on the beaches or in the shallow surf zone, a monitoring program will be conducted as described above in D.8, Public Services and Utilities.

G.11 WATER QUALITY

- The placement of reef material at the project site would temporarily disturb the fine sand and silt of the ocean floor and resuspend these particles, causing a local increase in turbidity. However, the potential for adverse effects is low because the reef materials must meet the CDFG guidelines, and sands predominate in the lease area. Because the particles will settle out quickly, this is considered a less-than-significant impact.

Other issues discussed in the EIR are: 1) energy and mineral resources; and 2) land use and planning. The impacts of these two issues were less than significant.

APPENDIX H

MONITORING PLAN FOR THE SONGS MITIGATION REEF PREPARED BY THE CALIFORNIA COASTAL COMISSION

APPENDIX I

KELP WRACK & ROCK HAZARD MONITORING PLAN

APPENDIX I

KELP WRACK & ROCK HAZARD MONITORING PLAN

by

Robert S. Grove

I.1 BACKGROUND AND NEED FOR MONITORING

The Final Program Environmental Impact Report (PEIR) (Resource Insights, 1999) (pages 2.5–2.6 and Appendix H) refers to a number of project effects considered to be significant or potentially significant, including Socioeconomic, Air Quality, Transportation, Geology, Hazards, Recreation, and Public Service. Mitigation measures were recommended, and a draft "Mitigation Monitoring Plan" outlining how the mitigation measures would be implemented was included as PEIR's Appendix H.

The PEIR raises two issues for which it mandates a five-year monitoring program of both the Phase 1 Experimental Reef and the Phase 2 Mitigation Reef: 1) movement of reef building materials onto the shore, and 2) excess kelp on the beach. Both kelp wrack and rocks washing up onto the beach are deemed as potential significant impacts (PEIR, Table 2-1; Section 3, Geology; Section 8, Hazards; Section 10, Public Services and Utilities; and Section 13, Recreation). The proposed mitigation reef project will be substantially larger than the Experimental Reef, and issues with kelp wrack and rocks on the beach may be more significant than for the Experimental Reef.

The mandated kelp wrack and rock hazard monitoring plan (KW&RHMP), which falls under the responsibility of the "Project Proponent," according to the PEIR, has been herein modified and reduced for this Phase 2 study from what was done for the five-year Phase 1 study. The Phase 1 study was performed over a six-year period from November 1999 through October 2005 per the requirements specified in the 1999 CCC Coastal Development Permit. Monthly beach monitoring was required for April through October, with twice-a-month monitoring required between November through March, as well as monitoring within 24 hours of storm conditions throughout the year. The Phase 1 study concluded that impacts on the beach of the Phase 1 kelp mitigation artificial reef modules were minimal: that is, no reef substrate material was observed to have washed up or migrated onto the beach, and no significant amounts of kelp wrack had washed ashore such that the City of San Clemente had to perform beach maintenance beyond what they considered normal in the context of past practices.

I.2 PHASE 2 KELP WRACK AND ROCK HAZARD MONITORING PROGRAM

The KW & RHMP will start at the conclusion of the construction of the Phase 2 Mitigation Reef. The monitoring program will continue for 5 years. The beach will be assessed using nearly the exact procedures used for the Phase 1 study between 1999 and 2005. One

change will be that beach surveys will be performed within 48 hours following a significant period of large wave heights passing through the San Clemente area. The procedures to be used are described in detail on pages 15-18 of the "Sixth Annual Beach Monitoring Report, November 2004 through October 2005," prepared by SCE for the CCC, January 31, 2006.

The following are the excerpted methods from the above document, as modified for the Phase 2 study.

I.3 STUDY METHODS

I.3.1 MONITORING OBLIGATIONS AND SCHEDULE

The beach monitoring program is being conducted by SCE. The field effort consists of beach surveys performed monthly during the summer months, bimonthly during the winter months, and within 48 hours following significant periods of large wave heights. SCE monitors the "beach adjacent to the project site, from 1 km upcoast to 1 km downcoast from the project boundaries" (Coastal Development Permit, Condition 9, Phase 1 CDP). This area extends from 1 km north of the San Clemente Pier and south for approximately 3.2 miles to the mouth of San Mateo Creek at the "Trestles" wooden railroad bridge (Figure I-1). Monitoring includes:

"1) quantitative estimates of the amount of kelp (percent of beach covered and volume) on the beach [5 five-hundred-foot stations are surveyed quantitatively];
2) a count of rocks and concrete pieces present, in the unlikely event of artificial reef material washing ashore [5 five-hundred-foot stations are surveyed quantitatively], and;
3) documentation of beach clean-up activities by state or municipal agencies" (Coastal Development Permit, Condition 9, Phase 1 CDP).

This project is also responsible for removing any rocks or concrete washed ashore from the experimental reef (Coastal Development Permit, Condition 9, Phase 1 CDP; EIR, Vol. II, Appendix H, page 3).

Monitoring began in October 1999 with the assessment of aerial photography that is performed routinely for the SONGS NPDES (National Pollutant Discharge Elimination System) permit and with a preliminary beach survey. By November 1999, the quantitative/qualitative routine beach surveys were established for this program, and these surveys continued through October 2005 ("for a period of 6 years or until the beginning of construction of the mitigation reef, whichever is earlier" - Coastal Development Permit, Condition 9, Phase 1 CDP). The surveys will start up again after the completion of the Phase 2 reef.

Annual reports shall be submitted to the Executive Director within 3 months of completion of each 12-month monitoring period, per the Coastal Development Permit, Condition 9. The routine field effort will result in field notes of conditions as noted above, as well as a pictorial representation of conditions on the survey days, taken at reasonable low-tide conditions. The critical time for these assessments, according to the Program EIR [p. 4.10-7], is "immediately

after any large storm events (by the next day – now defined as within 48 hours following a significant period of large wave heights)".

A major goal of this effort, according to the EIR, is to collect data on the amount of kelp washing onto the beaches currently and establish a baseline because the City of San Clemente and the California Department of Parks and Recreation do not collect this information.

I.3.2 DATA COLLECTION AND MANAGEMENT

Surveys are performed as close to the lower-low-tide as practical on each survey day, and the survey days are scheduled for the more extreme lower-low-tides during the month, as much as possible (surveying during daylight hours is one of the limiting parameters, for example).

Qualitative observations of kelp wrack, hard substrate along the sandy beach, and general beach conditions are recorded during each beach survey.

Five permanent transects (see Figure I-1 for locations, and Table I-1 for the coordinates of the survey stations) and standard data collection procedures were established during the November 1999 surveys to record estimates of the amount of kelp in cubic feet; the percent of beach covered by kelp; and the count of reef substrate material present. For this quantitative analysis of kelp wrack in the study area, five 500-foot stations were established in accordance with past kelp wrack assessment in the area (ZoBell, 1959). The amount of seaweed, in cubic feet, on the 500-foot length of beach was estimated so that the results could be comparable over time.

All information is recorded on standard data sheets. A handheld global positioning system (GPS) instrument was used to initially record the exact positions (Table I-1) of the north and south ends of these transects. The five transects are each 500 feet long, parallel to the water's edge, and located (from south to north) at:

1. **San Mateo Point**: The south end of this transect is at the very northernmost edge of the permanent natural cobble field that is exposed at low tide. This point on the beach is directly below a red-and-white navigation marker (circular sign on post) positioned on the bluff above the beach. The north end of this Station 1 transect is at a point along the beach in front of the bluff where a grid of horizontal/vertical concrete retaining revetment is visible in the bluff face behind and above the railroad tracks and riprap.

2. **State Beach**: The San Clemente State Beach (off of Avenida Calafia) Camping Access Trail: The north end of this transect is out on the beach directly in front of the railroad track underpass at the State Beach camping grounds trail. The south end of the transect is directly in front of the next drainage culvert that also goes under the railroad tracks.

3. **Calafia**: The Calafia Park State Beach (this parking lot is operated by the City of San Clemente, but it is a State Beach) at the end of Avenida Calafia: The south end of the transect is directly out from the beach access point along the railroad track riprap. There

is a railroad flashing light signpost at this position and a wooden staircase (installed in 2004) down to the beach. The north end of the transect is adjacent to a railroad sign on the riprap that is small and white with black numbering that says "206."

4. **San Clemente Pier**: The City of San Clemente Municipal Pier: The south end of the transect is adjacent to a set of permanent picnic tables up on the beach, about 200 feet south of the pier. The north end is 250 feet north of the pier opposite a children's area permanent swing set.

5. **Buena Vista**: El Portal Street beach access point along Avenue Buena Vista, 1 km north of the Municipal Pier: The north end of the transect is directly out on the beach from the small bridge that supports the railroad tracks and is a beach access point from a long steep stairway down from Avenue Buena Vista near the cross street of El Portal. This bridge was originally built of wood, as evidenced in the first-year pictures, but was re-built out of concrete in mid-2001.

Data from these 500-foot transects are recorded at 50-foot intervals, from both below the berm/scarp (wet beach area) and above the berm/scarp (dry beach area).

Photographs of the beach are also taken during each survey. Marine Advisors (1964) first took these types of photographic surveys in the San Onofre area in 1963. Photographs are taken at low tide looking back up the beach toward the railroad tracks and north and south along the beach at each of the transect locations. Any perceived unusual disturbances of the beach, materials on the beach, or algal wrack are also photographed and the location is noted during each 3.7-mile beach survey.

I.3.3 TRACKING PROJECT-RELATED BEACH CLEANUP ACTIVITIES BY STATE OR MUNICIPAL AGENCIES

Any beach cleanup activity that could be construed as being connected with or involving material or kelp from the Wheeler North Reef will be recorded and reported as part of this project. Typically, the State Beach is not cleaned, but the City Beach is routinely cleaned. The City does not keep historical or detailed records of their beach cleaning activities (Resource Insights, 1999).

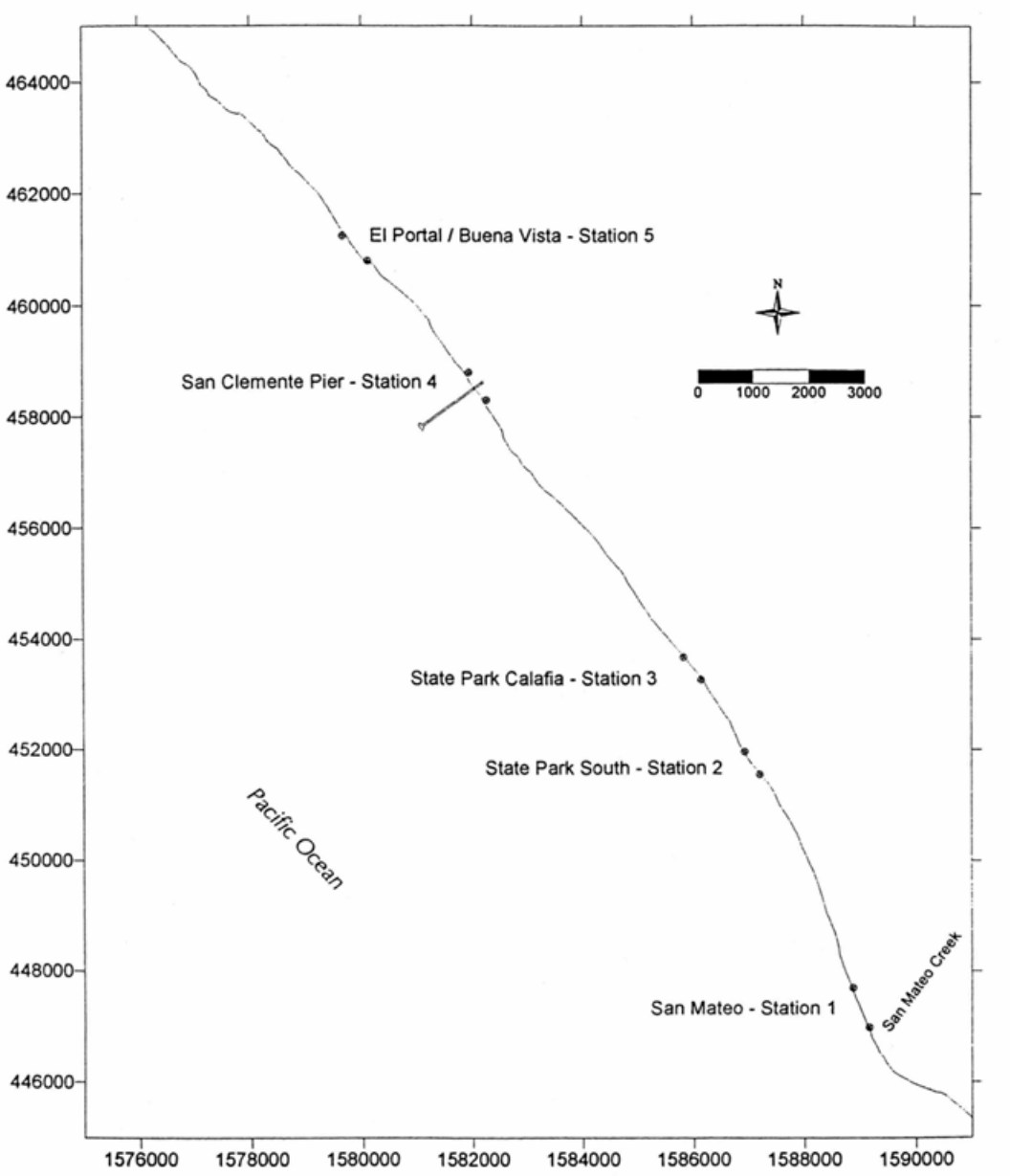

Figure I-1. Locations of the five permanent 500-ft transects for the quantitative assessment of kelp in the San Clemente study area.

Table I-1. Kelp Wrack & Rock Hazard Monitoring Program, locations of the five 500-ft quantitative survey stations, GPS-designated positions (north and south endpoints) .

Survey Station #	Station Location	North End of Survey Station		South End of Survey Station	
		Latitude	Longitude	Latitude	Longitude
1	San Mateo Point	33 23 392	117 35 870	33 23 275	117 35 811
2	State Park Beach, Camping Access	33 24 091	117 36 260	33 24 024	117 36 205
3	State Beach, Calafia Parking Lot	33 24 370	117 36 483	33 24 304	117 36 420
4	San Clemente City Pier	33 25 209	117 37 260	33 25 127	117 37 196
5	Buena Vista/El Portal Avenues	33 25 606	117 37 714	33 25 533	117 37 625