

**CALIFORNIA COASTAL COMMISSION**

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**W 10A**

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**STAFF RECOMMENDATION ON PERMIT APPLICATION**

**APPLICATION FILE NO.:** E-96-07

**APPLICANT:** CALIFORNIA DEPARTMENT OF FISH AND GAME

**PROJECT DESCRIPTION:** Construction of a series of artificial reefs with a total of up to 160,000 tons of quarry-rock, concrete rubble, heavy steel structures and structures of concrete, steel or other materials fabricated specifically for reef research, meeting certain minimum specifications. The reefs would cover a total sea floor area of up to approximately 10 acres.

**PROJECT LOCATION:** Reef structures would be located within the Big Sycamore Canyon Ecological Reserve with duplicate structures located outside and to the west of the reserve. Big Sycamore Canyon Ecological Reserve is located East-Southeast of Point Mugu, offshore of Ventura County. The combined area of the two sites is approximately 2,350 acres. (See Exhibits 1 & 2)

**SUBSTANTIVE FILE DOCUMENTS:** See Appendix A

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**SYNOPSIS**

The Marine Resources Protection Act (Proposition 132) created four marine ecological reserves in state waters along the mainland coast. The Act also established a fund, administered by the California Department of Fish and Game (CDFG), for the purpose of supporting marine fisheries research in these new reserves. The CDFG is seeking a coastal development permit (CDP) to construct up to ninety artificial reef "modules" within and adjacent to the Big Sycamore Canyon Ecological Reserve (BSCER). By constructing duplicate reefs both inside the reserve, where fishing is prohibited, and outside the reserve where fishing is allowed, researchers will be able to study the effects of fishing on reef populations and to help determine whether artificial reefs positively or negatively impact marine fisheries.

The applicant proposes to construct the artificial reefs using clean quarry-rock, clean, high-density concrete rubble, heavy steel structures, and structures of concrete, steel or other materials specifically designed for artificial reef research. **Special Condition 1** prohibits the use of any materials not specifically described in the application, and specifies that any materials used must conform with the CDFG's artificial reef materials specifications list (see Appendix D). Use of oil platform parts for artificial reef construction is not proposed in the permit application.

This project would represent the first marine fisheries research effort under Proposition 132. The CDFG plans to invite universities, consultants, and other public and private research entities to apply to the CDFG for proposition 132 funds to conduct fisheries research at the proposed artificial reefs. The CDFG has not proposed a specific time frame for the construction of the artificial reef modules. Construction will depend on the CDFG's future funding of proposals to conduct research at the reefs. The staff recommends in **Special Condition 2** that the reef construction activities be authorized for a period of ten years. A permit amendment would be required for any reef construction after ten years.

**Table 1** (pg. 3) summarizes project-related significant issues, potential impacts, and the mitigation measures and conditions that the applicant will implement to avoid, or reduce to insignificance, any impacts. The staff believes that the project, as proposed and conditioned, is consistent with Coastal Act policies. The staff recommends approval of the project as conditioned.

Table 1. Issue Summary: Potential Project-Related Impacts

| Potential Impact                 | Analysis  |
|----------------------------------|---|
| <p><b>Commercial Fishing</b></p> | <p>Commercial fishing at the Point Mugu site may be adversely affected. However, because the area that would be impacted is relatively small, this is not considered significant. The CDFG expects that any impacts to the commercial purse seine harvest that do occur could be offset by potentially increased commercial landings of reef associated species, particularly spiny lobsters.</p>   |
| <p><b>Marine Resources</b></p>   | <p>Extensive sand dollar beds are located near the landward boundary of the sites. The CDFG specifies in its permit application that prior to the placement of materials for any of the proposed reef modules, a diver survey will be conducted of the site and that reef materials will be placed at least 100 meters from any sand dollar beds to assure that impacts will be avoided.</p> <p>Reef construction would result in a loss by burial of existing benthic animal and plant life at the affected portion of the sea floor. At full build-out, the proposed reef modules would cover approximately 10 acres of the 2,350-acre, total area of the two sites (less than one-percent). Thus, the area of sandy bottom lost to artificial reef placement is minimal in comparison to the expanse of remaining sandy bottom habitat within the project area.</p> <p>The Commission has expressed concern in the past that some artificial reefs, particularly reefs characterized as fish attracting devices (FADs), may be detrimental to marine resources, because such reefs cause fish to be more vulnerable to commercial and sportfishing catch. Potential impacts to marine resources could subsequently result because increased harvest at FADs may impact long-term growth, production, and survival of fish populations.</p> <p>The research projects conducted at the proposed artificial reef sites will study the effects of fishing to artificial reef populations, and will attempt to identify artificial reef designs best suited to produce, as opposed to merely attract, fish. This research should serve to guide the Commission and the CDFG in future decisions concerning artificial reef projects. <b>Special Condition 2</b> clarifies that the approved reef construction is only for the purpose of the scientific research described in the CDFG's permit application and may continue only for as long as necessary to contribute further to that research.</p> <p>The CDFG includes in its list of reef materials for the proposed project "materials fabricated specifically for reef research." The Commission cannot judge whether these materials are appropriate for artificial reef construction without additional information which the CDFG is unable to provide at this time. <b>Special Condition 1</b> therefore requires that, prior to the use of such materials, the applicant obtain an amendment to this permit.</p> |

## 1.0 STAFF RECOMMENDATION

### Approval With Conditions

The staff recommends that the Commission adopt the following resolution and findings:

The Commission hereby grants permit E-96-7, subject to the conditions specified below, on the grounds that (1) as conditioned the development will conform with the provisions of Chapter 3 of the California Coastal Act and (2) will not cause any significant adverse environmental impacts within the meaning of the California Environmental Quality Act.

## 2.0 STANDARD CONDITIONS

See Appendix B.

## 3.0 SPECIAL CONDITIONS

The Commission grants this permit subject to the following special conditions:

1. In addition to the specifications provided in the applicant's project description, the materials used for the construction of the artificial reefs must conform with: (1) the CDFG materials specifications for artificial reefs (Appendix D); and (2) the following.

All materials used shall be free of contaminants and have the following characteristics:

- (a) high density (have a specific gravity at least twice that of sea water);
- (b) persistence (be relatively unaffected by prolonged immersion in sea water);
- (c) not hazardous to divers, marine mammals, or diving birds;
- (d) have a surface suitable for the growth of microorganisms, algae, and invertebrate species;
- (e) are of a size and configuration to allow for a maximum of both surface area and hiding places (i.e., have many holes and crevices);
- (f) concrete slabs must be broken into pieces not less than two feet and not greater than six feet in diameter;
- (g) concrete pilings must be broken into lengths ranging from two to ten feet; and
- (h) rebar shall not protrude more than three inches from reinforced concrete.

The use in connection with the proposed project of any materials other than clean quarry-rock, high-density concrete rubble, heavy steel structures, and structures of concrete or steel specifically designed for artificial reef research, is prohibited except in accordance with one or more amendment(s) to this permit.

2. This permit authorizes the construction of artificial reef modules for a period of ten years from the date of issuance of the permit. Pursuant to Standard Condition 2, construction must commence within two years unless the permit is extended. Any reef construction beyond ten years from the issuance of the permit will require a permit amendment. An application for an amendment shall include a project status report consisting of:
  - (a) the artificial reef experiments that have been conducted to date (including, but not limited to, the amounts and types of materials used, and the locations of the modules);
  - (b) the findings of these experiments;
  - (c) a description of the experiments/research remaining to be performed;

(d) the cumulative totals of the quantity of material deposited, and of the bottom area covered.

3. As holder of this coastal development permit, the CDFG is responsible to ensure that all work performed by the CDFG or its contractors/researchers is in full compliance with the project description and all permit conditions.

#### **4.0 FINDINGS AND DECLARATIONS**

The Commission find and declares as follows:

##### **4.1 Project Background**

###### **4.1.1 Marine Resources Protection Act**

In November 1990, California voters passed the Marine Resources Protection Act (Proposition 132) to prohibit gill netting in State waters. The measure also required the CDFG to establish four marine ecological reserves for the purpose of supporting fisheries research, and establishes a fund, administered by the CDFG, for such research.

Accordingly, section 8610.14(a) of the Fish and Game Code provides in relevant part:

*The [Fish and Game] commission shall restrict the use of these ecological reserves to scientific research relating to the management and enhancement of marine resources, including, but not limited to, scientific research as it relates to sportfishing and commercial fishing.*

###### **4.1.2 The CDFG Artificial Reef Program**

The CDFG is authorized by State law to:

*encourage the conservation, maintenance, and utilization of the living marine resources of the ocean and other waters under the jurisdiction and influence of the state for the benefit of all the citizens of the state and to promote the development of local fisheries and distant water fisheries based in California...* (Fish and Game Code §§ 1700-1701).

In 1984, the California Legislature formalized the CDFG's status as the principal agency in the State's artificial reef building process by passage of Assembly Bill 706 (Fish and Game Code, Article 2, §§ 6420-6425). This legislation authorized the CDFG to investigate efforts to enhance marine species through the placement of artificial reefs and implement a program of artificial reef research and development, including reef design, placement, and monitoring.

Since 1979, the CDFG has constructed or augmented 15 artificial reefs offshore southern California (Appendix C). The CDFG's program objectives during this time changed from building reefs that attract fish to developing reefs that enhance fish stocks. In 1986, the agency began building a series of experimental reefs designed to evaluate the importance of various reef characteristics (e.g., depth, height, and distance between modules) for fish density and production. More recently, the CDFG has shifted attention to quantitative assessments of fish productivity on artificial and natural reefs.

#### 4.1.3 Past Coastal Commission Actions on CDFG Artificial Reefs

Examples of coastal development permits (CDPs) issued for CDFG reefs in State waters, or consistency certifications concurred in for CDFG reefs in federal waters, are the following (see also Appendix C).

- In May 1986, the Commission concurred in **CC-6-86** for construction of the Bolsa Chica Artificial Reef with 10,400 tons of materials (concrete rubble, quarry-rock, clay pipe, and iron ship hulls or similar heavy iron material). In 1992, and again in 1995, the Commission concurred in **CC-9-92**, and **CC-81-95**, respectively, for augmentation of this same reef. These consistency certification authorized the placement of up to an additional 120,000 tons of clean, quarry-rock or clean, concrete rubble until October 8, 2005.
- In March 1992, the Commission concurred in **CC-67-91** to construct, and augment in the future, Pt. Loma Artificial Reef in federal waters offshore San Diego County.
- In November 1989, the Commission approved CDP No. **E-89-7** for a recreational fishing reef offshore Point Vicente, Los Angeles County (this permit expired in November 1991 before reef construction began).
- In 1986, the Commission approved, with conditions, construction of Mission Bay Park Artificial Reef (CDP No. **E-86-4**) and augmentation of Oceanside Artificial Reef No. 1 (CDP No. **E-86-6**). Special Condition 1 for both of these CDPs states that the reefs may be augmented provided the augmentation is in compliance with the following 4 criteria: (1) only clean, approved materials may be used; (2) the applicant shall allow clearance for all known and anticipated vessel traffic in the area as determined by the U.S. Coast Guard; (3) any augmentation shall be within the permitted boundaries; and (4) augmentation shall only be permitted within 10 years of granting of permit, unless a new permit is obtained.

#### 4.1.4 Project Description

The CDFG proposes the construction of up to 45 artificial reef modules at two site (total of 90 modules) offshore Ventura County. This project would represent the first marine fisheries research effort under Proposition 132. The California Department of Fish and Game (CDFG) plans to invite universities, consultants, and other public and private research entities to apply to the CDFG for proposition 132 funds to conduct fisheries research at the proposed artificial reefs. The CDFG or selected researchers would construct a series of artificial reefs within the boundaries of the Big Sycamore Canyon Ecological Reserve (BSCER) and outside of the reserve at the "Point Mugu Artificial Reef Site" to the west of the reserve. Each reef built within the reserve, where fishing is expressly prohibited, would be matched by an identical "fishing opportunity" reef outside the reserve. Comparisons of marine life at the reefs within the reserve with the corresponding structures at the Point Mugu site will enable researchers to examine the effects of fishing on populations of fish and other marine organisms at artificial reefs. The proposed project would be the first artificial reef project conducted by the CDFG to include such "replicate reefs" as experimental control sites.

The CDFG proposes to use a maximum of 160,000 tons of a variety of materials for the proposed project, including:

*quarry-rock, concrete rubble, heavy steel structures, and structures of concrete, steel or other materials fabricated specifically for reef research, meeting certain minimum specifications.*

The specifications provided in the permit application are as follows:

*Surfaces must be free of oil, anti-fouling paints and not contain any other toxic substances. All materials will not exceed any numerical or narrative receiving water quality objectives of the Water Quality Plan for Ocean Waters of California "Ocean Plan" 1994. Steel structures must have a minimum thickness of one-half inch, and must have a complex surface area and not be comprised of flat surfaces or gradually rounded surfaces greater than six feet by six feet, or 36 square feet.*

The above criteria is to exclude the use of car bodies, vessels, and oil platform legs, but would not prohibit some portions of offshore oil platforms. However, the applicant states:

*[T]he use of any oil platform parts are not requested at this time and would require future modification of the presently applied for permit.*

The CDFG seeks authorization to construct up to 45 replicated reef "modules" (90 total) configured to conduct three different experiments. The CDFG describes these experiments as: (1) "Depth Strata Experiment" for determining the depths and profiles best suited for producing and attracting different organisms; (2) "Foot Print Experiment" for determining optimum reef sizes; and (3) "High/Low Relief Comparison Experiment" for researching the effects of different reliefs on the size distribution of fishes utilizing artificial reef habitats. Exhibit 3 provides the precise design specifications, location, and purpose for each of the 90 proposed reef modules. All of the proposed modules would provide a minimum of 15 feet overhead clearance for safe vessel passage at the lowest tides.

Reef materials would be transported to the site by tug and barge, and would be pushed off the barge with a bulldozer or skip loader. The applicant states that complete build-out is anticipated to require between 50 and 100 barge loads of material (depending on size of barges available and type of material used). The CDFG has not proposed a specific time frame for the construction of the artificial reef modules. Construction will depend on the CDFG's future funding of proposals to conduct research at the reefs.

#### **4.1.5 Project Location and Environmental Setting**

The proposed artificial reefs would be located within the Big Sycamore Canyon Ecological Reserve and at the Point Mugu Artificial Reef Site adjacent to the reserve to the west, in state waters, approximately 2000 feet offshore of Big Sycamore Canyon and Point Mugu, in Ventura County (see Exhibits 1 and 2).

In October 1993, the Fish and Game Commission designated the BSCER in Ventura County (see Exhibits 1 and 2) as the only southern California, Proposition 132 marine reserve. The is bounded inshore and offshore by the 30-foot and the 120-foot (MLLW) depth contours respectively. Research activities within the reserve are subject to CDFG approval. The CDFG has identified artificial reef research as the most appropriate activity for the BSCER. The proposed reef modules would cover less than five acres within the 1,344-acre reserve.

The Point Mugu Artificial Reef Site is located immediately up coast of BSCER, and like the reserve is bounded inshore and offshore by the 30-foot and 120-foot depth contours. The proposed reef modules would cover less than five acres of the 1,007 acres of sandy bottom area within the Point Mugu site.

Both sites are entirely subtidal, and have sandy bottoms sloping gradually from the 30-foot to the 120-foot MLLW depth contours. Both sites offer essentially homogeneous, soft-bottomed habitat with virtually no hard substrates.

The north-west boundary of the project site is within approximately three nautical miles of the Mugu Naval Air Station. During missile tests, an area within one nautical mile of the Mugu Lagoon barrier beach is closed to unauthorized vessel traffic. Such closures would not preclude access to the proposed artificial reef sites.

#### **4.5 Other Agency Approvals**

##### **4.5.1 Army Corps of Engineers**

The CDFG has applied for a General Permit from the Army Corps of Engineers authorizing the proposed project under section 10 of the Rivers and Harbors Act, and section 404 of the Clean Water Act. Prior to ACOE approval, the project must receive water quality certification from the Regional Water Quality Control Board and Coastal Zone Management Program consistency review from the Commission. The action on CDP Application No. E-96-6 will comprise the Commission's consistency review for ACOE Permit No. 96-50249-TS.

#### **4.2 Coastal Act Issues**

##### **4.2.1 Marine Resources**

Coastal Act Sections 30230 and 30231 provide for the maintenance, enhancement and restoration of marine resources and biological productivity. Specifically, Section 30230 provides:

*Marine resources shall be maintained, enhanced, and where feasible, restored. Special protection shall be given to areas and species of special biological or economic significance. Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes.*

Section 30231 states:

*The biological productivity and the quality of coastal waters... appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored....*

The CDFG's proposal to construct artificial reefs inside and outside of BSCER must be examined to determine the effect on marine resources of site selection, design, and materials to be used.



#### 4.2.1.1 Site Selection

In previous actions on artificial reef projects, the Commission has expressed concern over siting artificial reefs either in areas of degraded water quality or in environmentally sensitive areas. [See, for example, Point Loma Artificial Reef (CC-67-91)].

In this artificial reef proposal, the project site is located within the Mugu Lagoon to Latigo Point Area of Special Biological Significance (ASBS). The State Water Resources Control Board designated this area an ASBS due to the relative scarcity of development in this area of the southern California coastline and the resulting high water quality. Accordingly, the SWRCB imposes strict water quality controls to minimize both point source and non-point source discharges in this area (SWRCB, *Ch. V, Section B, Water Quality Control Plan, California Ocean Plan*, 1990). Consequently, the proposed project is not expected to result in impacts to marine resources due to degraded water quality.

The soft-bottom substrate of the project site supports very few species of macroalgae, though some do grow on the exoskeletons of invertebrates. There are no kelp or eel grass beds within the project site. The project site does provide habitat for a variety of invertebrates, including extensive sand dollar beds. Numerous fishes inhabit the project site, including: California halibut, sand dabs, several species of sole, rockfishes, surfperches, white seabass, anchovies, sardines, and mackerel. Migratory species, such as yellowtail, bonito, and salmon are found seasonally within the project area (CDFG, *EIR*, 1993).

Reef construction would result in a loss by burial of existing benthic animal and plant life at the affected portion of the sea floor. At full build-out, the proposed reef modules would cover less than one-percent of the combined total area of the two sites. The impact to sandy bottom habitat within the project area is, therefore, insignificant.

Extensive sand dollar beds are located near the landward boundary of the sites. The proposed reef modules will not be constructed along the inshore boundary of the sites in order to avoid impacting the sand dollar beds. CDFG staff will perform a diver survey of every reef module site prior to the placement of any materials. The purpose of the surveys will be to determine that each module is constructed on appropriate (soft-bottom) substrate, and that no existing sand dollar beds will be affected by the reef construction.

The Commission, therefore, finds the project will be sited in a manner consistent with Coastal Act Sections 30230 and 30231, which require that uses of the marine environment be carried out in a manner that sustains the biological productivity and the quality of coastal waters.

#### 4.2.1.2 Reef Design

The Commission has expressed concern in the past that some artificial reefs, particularly reefs characterized as fish attracting devices (FADs), may be detrimental to marine resources, because such reefs cause fish to be more vulnerable to commercial and sportfishing catch. Because many fish are attracted to objects placed in the water column either at the surface or on the bottom, fish from other locations often aggregate around FADs. Potential impacts to marine resources could subsequently result because increased harvest at FADs may impact long-term growth, production, and survival of fish populations.

The CDFG believes that the design and materials used in constructing artificial reefs are important factors in determining whether or not a particular reef enhances marine resources. Beginning in the early 1980's, the CDFG has conducted research directed toward developing artificial reef designs that produce, as opposed to merely attract, desirable species. However, this research is complicated by the removal of fish from the reefs by fishing. Constructing duplicate, experimental reefs, both within and outside of the BSCER, will provide opportunities to study both the effects of fishing on artificial reef habitats, and the fish producing qualities of different artificial reef designs without the obfuscating influences of fishing on such research. The CDFG proposes to construct reef modules of various configurations in order to help determine the most biologically productive designs. The CDFG will require that the Proposition 132 funded research proposals provide for regular monitoring and reporting of project status and of the findings of the experiments that are conducted. The project research reports and reports concerning any additional research conducted by the CDFG will be submitted to the executive director.

The Commission therefore finds that the artificial reefs will be designed in a manner consistent with Coastal Act Section 30230, which requires that "Marine resources shall be... enhanced."

#### 4.2.1.3 Reef Materials

According to the CDFG, during the time since construction of its first artificial reefs in 1958, the agency has gained a clear understanding of which materials are most (and least) suited to build artificial reefs. For example, the CDFG found that automobiles and streetcars are not satisfactory materials for long-term habitat enhancement because they deteriorate rapidly, while automobile tires tend to be carried from their original placement site by the force of heavy seas. In contrast, the CDFG states that while thin steel materials, such as car bodies, deteriorate rapidly in the marine environment, heavy gauge steel structures are more persistent, lasting 50 years or longer. On the basis of this experience, the CDFG has produced a set of criteria for materials suitable for the construction of artificial reefs (see Appendix D).

Diver surveys at the Pendleton Artificial Reef (PAR) in northern San Diego County indicate that quarry-rock reefs enhance biological resources by creating holes and crevices which provide favorable habitat for lobsters and other marine life. By providing refuge areas from predators, these reefs potentially increase survivorship and production of congregating fishes (Coastal Commission Adopted Findings on CDP E-89-2 (Carlsbad Artificial Reef), 10/11/89). In 1985, the CDFG observed an increase in densities of resident and certain semi-resident fish species at PAR, particularly rock wrasse, garibaldi, senorita, and sheephead.

In a survey of the Bolsa Chica artificial reef conducted in 1992 (6 years after original construction), the CDFG observed that "the concrete rubble appears to be performing as well as the quarry-rock used in all of CDFG's experimental reefs" (Bedford, et al., *Observations of the Biological Communities at Bolsa Chica Artificial Reef*, 1992). However, rebar protruding from concrete rubble can be hazardous to divers, and is not persistent in sea water (pers. comm. with Greg Walls and Jerry Kashiwada, CDFG).<sup>1</sup> Rebar may also be hazardous to marine mammals and diving birds. To maximize surface area and hiding places, concrete rubble must be broken into appropriately sized pieces.

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<sup>1</sup> Also see paragraph 4.2.3 concerning impacts of rebar to water-oriented recreational activities.

Therefore, the Commission is requiring in **Special Condition 1** that, in order to conform with Coastal Act Sections 30230 and 30231, the materials used in the construction of the proposed artificial reefs must conform with the CDFG's artificial reef materials specifications list, which provides that the materials possess certain characteristics, including:

- are non-toxic in the marine environment;
- sufficient density to remain permanently in place (have a specific gravity at least twice that of sea water);
- persistence (be relatively unaffected by prolonged immersion in sea water);
- not hazardous to marine mammals, or diving birds;
- have a surface suitable for the growth of microorganisms, algae, and invertebrate species; and
- are of a size and configuration to allow for a maximum of both surface area and hiding places (i.e., have many holes and crevices).

Clean quarry-rock and correctly sized pieces of clean, high density concrete rubble, with no rebar protruding more than three inches, as well as heavy steel structures and structures of steel or concrete specifically designed for artificial reef research meet the above specified criteria.

In addition to the materials described above, the CDFG proposes to use "other materials fabricated specifically for reef research." The Commission cannot judge whether these materials meet the criteria specified above without additional, specific information concerning the size, shape, density, and constituents of such materials. The CDFG is unable to provide such information at this time, as no particular materials have been identified for the proposed project. Rather, the CDFG is seeking Commission authorization to use such materials if available at a future date. Thus, the Commission requires in **Special Condition 1** that, prior to the use of any materials other than those specifically approved for use herein, the applicant obtain an amendment to this permit.

The Commission therefore finds that the use of the proposed artificial reef materials, in combination with **Special Condition 1**, is consistent with Coastal Act Sections 30230 and 30231, which require that uses of the marine environment be carried out in a manner that sustains the biological productivity and the quality of coastal waters.

#### 4.2.1.4 Conclusion

The CDFG has designed the proposed artificial reef project in a manner that, in combination with **Special Condition 1**, will protect the biological productivity and quality of coastal waters. The Commission therefore finds the project consistent with Coastal Act Sections 30230 and 30231.

#### **4.2.2 Filling of Coastal Waters**

The proposed artificial reef construction constitutes "fill" as defined by Coastal Act Section 30108.2, which states:

*"Fill" means earth or any other substance or material, including pilings placed for the purposes of erecting structures thereon, placed in a submerged area.*

The Commission examined the proposed reef project for its consistency with Coastal Act Section 30233 which provides in relevant part:

*(a) The diking, filling, or dredging of open coastal waters, shall be permitted in accordance with other applicable provisions of this division, where there is no feasible less environmentally damaging alternative, and where feasible mitigation measures have been provided to minimize adverse environmental effects, and shall be limited to the following:*

*...(8) Nature study, aquaculture, or similar resource dependent activities.*

"Nature study" is not defined in the Coastal Act, however Coastal Act Section 30100.2 defines aquaculture as follows:

*"Aquaculture" means a form of agriculture as defined in Section 17 of the Fish and Game Code. Aquaculture products are agricultural products, and aquaculture facilities and land uses shall be treated as agricultural facilities and land uses in all planning and permit-issuing decisions governed by this division.*

Fish and Game Code Section 17 states:

*"Aquaculture" means that form of agriculture devoted to the propagation, cultivation, maintenance, and harvesting of aquatic plants and animals in marine, brackish, and fresh water....*

The proposed project is intended to enhance the biological productivity of coastal waters and to contribute to scientific knowledge concerning the management of marine fisheries. Thus, the Commission finds it is an allowable activity under Coastal Act Section 30233(a)(8) as both nature study and a resource dependent activity similar to aquaculture.

Coastal Act Section 30233 also requires the Commission to find that there is no feasible less environmentally damaging alternative to the proposed project, and that feasible mitigation measures are provided to minimize adverse environmental effects.

The proposal constitutes the first artificial reef project within one of the four Marine Ecological Reserves under the Marine Resources Protection Act. These reserves were created for the purpose of supporting marine fisheries research. The location of each of the four reserves was carefully considered by the Fish and Game Commission with input from the scientific community, commercial and sport fishing groups, and interested public. The CDFG identifies artificial reef research as the most productive and useful research activity for the BSCER.

The proposed reef sites, both in and out of the BSCER, contain no kelp beds and no eel grass beds. The CDFG selected the Point Mugu site for its proximity to the BSCER. The proposed replicate reef experiment requires that reef modules be constructed both inside and immediately outside of the reserve, either up coast or down coast. The Commission does not find that constructing the replicate reefs downshore of the BSCER would be any less environmentally damaging than constructing them upshore at the Point Mugu site. The project sites are also well suited for artificial reef research due to the high water quality in this area of the coast.

To minimize adverse environmental effects, the CDFG proposes to avoid the sand dollar beds located along the nearshore boundaries of the project sites. **Special Condition 1** assures that the materials used for the proposed reefs will protect and enhance the long-term biological productivity and quality of coastal waters and marine resources. Therefore, the Commission finds that the proposed project, as conditioned, is consistent with Coastal Act Section 30233

#### 4.2.3 Recreational and Commercial Fishing

Coastal Act Section 30220 states:

*Coastal areas suited for water-oriented recreational activities that cannot readily be provided at inland water areas shall be protected for such uses.*

Coastal Act Section 30234 states in part:

*Facilities serving the commercial fishing and recreational boating industries shall be protected and, where feasible, upgraded....*

Coastal Act Section 30234.5 states:

*The economic, commercial, and recreational importance of fishing activities shall be recognized and protected.*

Pursuant to the Marine Resources Protection Act and the CDFG's Administrative Regulations, both commercial fishing and recreational uses (e.g., fishing, boating, diving) are prohibited within the BSCER (see Appendix E). Therefore, constructing artificial reef modules within the BSCER will not adversely affect recreational or commercial fishing, or other water-oriented recreational activities. If the project is successful in providing new information concerning the optimum artificial reef designs as intended, it will serve to enhance marine fisheries in the future.

In addition to possible future benefits resulting from scientific research, the Commercial Passenger Fishing Vessel ("party boat") and other sportfishing industries are expected to be served by the construction of the reef modules at the Point Mugu site. Currently, there is minimal recreational fishing activity within this sandy bottomed area. Thus, the construction of the artificial reef modules at the Point Mugu site will benefit the recreational fishing community by providing new reef modules for sportfishing vessel operators to visit.

Similarly, the proposed reef modules at the Point Mugu site will also provide new recreational diving opportunities. **Special Condition 1** specifies that the proposed reefs will not include materials that may be hazardous or otherwise unsuitable to divers.

The commercial purse seine harvest of anchovy, sardine, and squid may be adversely affected by reef modules located at the Point Mugu site in waters shallower than 80 feet. However, because the area that would be affected is relatively small, any potential adverse impacts would be insignificant. The CDFG expects that any impacts to the commercial purse seine harvest that do occur will be offset by potentially increased commercial landings of reef associated species, particularly spiny lobsters.

Pursuant to the CDFG's artificial reef notification procedures (see Appendix D), the U.S. Coast Guard will be notified at least two weeks prior to any barge operations for the proposed reef construction, and such notice will be included in the Coast Guard's Aids to Navigation and Notice to Mariners. These measures should provide sufficient advance notification to commercial and recreational fishermen of the construction activities.

The Commission finds, therefore, that the proposed reef augmentation project is consistent with Coastal Act Sections 30220, 30234 and 30234.5.

#### **4.2.4 Cumulative Impacts**

Coastal Act Section 30250 requires that:

*New...development,.. shall be located...where it will not have significant adverse effects, either individually or cumulatively on coastal resources....*

Section 30105.5 defines cumulative impacts as:

*"Cumulatively" or "cumulative effect" means the incremental effects of an individual project shall be reviewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.*

If total build-out is achieved, approximately one percent of the soft-bottom habitat in the project area would potentially be converted to more biologically productive reef habitat. The proposed project incorporates measures to avoid adverse environmental impacts, and will serve to benefit the environment both by potentially increasing the biological productivity of coastal waters and by providing information that will improve the management of marine resources in the future.

Pursuant to **Special Condition 2**, the reef construction activities are subject to re-authorization after ten years from the date that reef construction begins. Re-authorization will be subject to an analysis of the project to date, and will allow evaluation of the project in the context of other artificial reef projects undertaken or permitted during the preceding ten-year period. The construction period may be extended by the executive director upon the determination that continuation of the project will contribute further to scientific knowledge concerning the management and enhancement of marine resources. The results of the research conducted under this project will provide the Commission with information that will help guide future decisions regarding artificial reef proposals.

The Commission finds, therefore, that there will be no significant negative cumulative impacts to marine resources from the proposed artificial reefs, and since the project will contribute to a cumulative enhancement of recreational fishing opportunities, the Commission finds the project consistent with Section 30250.

#### **4.2.5 The California Environmental Quality Act (CEQA)**

The CDFG approved a final Negative Declaration determining that the project will not result in any significant adverse environmental impacts within the meaning of the California Environmental Quality Act (CEQA). The project as conditioned herein incorporates measures necessary to avoid any significant environmental effects under the Coastal Act. Therefore, the Commission finds that the proposed project is consistent with the resource protection policies of the Coastal Act and with the CEQA.

APPENDIX A

SUBSTANTIVE FILE DOCUMENTS

Bedford, D. W. 1996. Proposal to the California Coastal Commission to Permit Experimental Artificial Reefs Inside and Outside the Big Sycamore Canyon Ecological Reserve (March 1996).

California Coastal Commission. 1995. Adopted Findings on Consistency Certification No. CC-81-95 (Bolsa Chica Artificial Reef), including substantive file documents.

\_\_\_\_\_. 1992. Adopted Findings on Consistency Certification No. CC-9-92 (Bolsa Chica Artificial Reef), including substantive file documents.

\_\_\_\_\_. 1991. Adopted Findings on Consistency Certification No. CC-67-91 (Pt. Loma Artificial Reef), including substantive file documents.

\_\_\_\_\_. 1989. Adopted Findings on CDP E-89-7 (Palos Verdes Artificial Reef), including substantive file documents.

\_\_\_\_\_. 1987. Adopted Findings on CDP E-87-3 (Santa Monica Bay Artificial Reef), including substantive file documents.

\_\_\_\_\_. 1987. Adopted Findings on CDP E-87-5 (Topanga Artificial Reef), including substantive file documents.

\_\_\_\_\_. 1986. Adopted Findings on Consistency Certification No. CC-6-86 (Bolsa Chica Artificial Reef), including substantive file documents.

\_\_\_\_\_. 1986. Adopted Findings on CDP E-86-3 (Pacific Beach Artificial Reef), including substantive file documents.

\_\_\_\_\_. 1986. Adopted Findings on CDP E-86-4 (Mission Bay Park Artificial Reef), including substantive file documents.

\_\_\_\_\_. 1986. Adopted Findings on CDP E-86-5 (Oceanside Artificial Reef No. 2), including substantive file documents.

\_\_\_\_\_. 1986. Adopted Findings on CDP E-86-6 (Oceanside Artificial Reef No. 1), including substantive file documents.

California Code of Regulations, Title 14, Section 630.5

California Constitution. Article 3, Section 3.5, (Administrative Agencies).

\_\_\_\_\_. Article 10B, (Marine Resource Protection Act).

California Department of Fish and Game. 1996. Negative Declaration for the Experimental Artificial Reefs Inside and Outside the Big Sycamore Canyon Ecological Reserve (March 1996).

\_\_\_\_\_. 1993. Final Environmental Impact Report for the Marine Resources Protection Act of 1990, Ecological Reserves.

Fish and Game Code, Sections 17, 1700-1701, 6420-6425, & 8610.14.

State Water Resources Control Board. 1990. California Ocean Plan. Water Quality Control Plan. Ch. V, Section B.



**APPENDIX B**  
**STANDARD CONDITIONS**

1. **Notice of Receipt and Acknowledgment.** The permit is not valid and development shall not commence until a copy of the permit, signed by the permittee or authorized agent, acknowledging receipt of the permit and acceptance of the terms and conditions, is returned to the Commission office.
2. **Expiration.** If development has not commenced, the permit will expire two years from the date on which the Commission voted on the application. Development shall be pursued in a diligent manner and completed in a reasonable period of time. Application for extension of the permit must be made prior to the expiration date.
3. **Compliance.** All development must occur in strict compliance with the proposal as set forth in the application for permit, subject to any special conditions set forth below. Any deviation from the approved plans must be reviewed and approved by the staff and may require Commission approval.
4. **Interpretation.** Any questions of intent of interpretation of any condition will be resolved by the Executive Director or the Commission.
5. **Inspections.** The Commission staff shall be allowed to inspect the site and the development during construction, subject to 24-hour advance notice.
6. **Assignment.** The permit may be assigned to any qualified person, provided assignee files with the Commission an affidavit accepting all terms and conditions of the permit.
7. **Terms and Conditions Run with the Land.** These terms and conditions shall be perpetual, and it is the intention of the Commission and the permittee to bind all future owners and possessors of the subject property to the terms and conditions.

**APPENDIX C****California Department of Fish and Game (CDFG) Artificial Reefs  
Approved (if CDP) or Concurred in (if CC) by the Coastal Commission**

| CDP # or<br>CC #               | Name of Artificial Reef  | County      | Year<br>CCC<br>Action | Built/<br>Aug-<br>mented | Depth<br>(MLL<br>W)   | Site<br>Area<br>(acres) |
|--------------------------------|--|-------------|-----------------------|--------------------------|-----------------------|-------------------------|
| CC-81-95<br>CC-9-92<br>CC-6-86 | Bolsa Chica (BCAR) Augmentation<br>Bolsa Chica (BCAR) Augmentation<br><i>Original reef constructed</i>         | Orange      | 1995<br>1992<br>1986  | ongoing<br><br>1986      | 85-100<br><br>"       | 220<br><br>"            |
| CC-67-91                       | Pt. Loma (PLAR)  | San Diego   | 1992                  | 1992                     | 160-165               | 92                      |
| E-89-7                         | Palos Verdes (PVAR) <sup>2</sup>   | Los Angeles | 1989                  | --                       | --                    | --                      |
| E-89-2                         | Carlsbad (CAR)   | San Diego   | 1989                  | 1989                     | 37-57                 | n/d                     |
| E-87-5                         | Topanga (TAR)  | Los Angeles | 1987                  | 1987                     | 28                    | 13                      |
| E-87-3                         | Santa Monica Bay (SMBAR)   | Los Angeles | 1987                  | 1987                     | 42-72                 | 256                     |
| E-86-6<br>F5257<br>--          | Oceanside # 1 (OAR1) Augmentation<br><i>OAR1 Augmentation</i> <sup>3</sup><br><i>Original reef constructed</i> | San Diego   | 1986<br>1977<br>--    | 1987<br>--<br>1964       | 45-90<br>--<br>82-120 | 64<br>--<br>4           |
| E-86-5                         | Oceanside # 2 (OAR2)   | San Diego   | 1986                  | 1987                     | 42-72                 | 256                     |
| E-86-4                         | Mission Bay Park (MBPAR)   | San Diego   | 1986                  | 1987                     | 80-90                 | 173                     |
| E-86-3                         | Pacific Beach (PBAR)   | San Diego   | 1986                  | 1987                     | 42-72                 | 109                     |
| 5-84-699                       | Marina Del Rey # 2 (MDRAR2)  | Los Angeles | 1984                  | 1985                     | 65                    | 6.9                     |
| 4-84-189                       | San Luis Obispo County (SLOCAR)  | San Luis O. | 1984                  | 1985                     | 42-52                 | 13                      |
| 4-84-29                        | Atascadero (AAR) <sup>4</sup>  | San Luis O. | 1984                  | 1985                     | 55                    | 0.4                     |
| 4-83-<br>196A                  | Pitas Point (PPAR)   | Ventura     | 1983                  | 1984                     | 28                    | 1.1                     |
| F8985                          | Pendleton (PAR)  | San Diego   | 1980                  | 1980                     | 43                    | 3.5                     |
| A-79-<br>5037<br>--            | Redondo Beach (RBAR)<br>Augmentation<br><i>Original reef constructed</i>                                       | Los Angeles | 1979<br><br>--        | 1979<br><br>1962         | 72<br><br>72          | n/d<br><br>1.6          |

n/d = no data.

<sup>2</sup> Construction of PVAR pursuant to CDP No. E-89-7 was never started; CDP expired after 2 years.<sup>3</sup> Augmentation of OAR1 pursuant to CDP No. F5257 was not conducted; CDP expired after 2 years.<sup>4</sup> The applicant for AAR (CDP No. 4-84-196A) was Texaco; however, CDFG built and maintains AAR.

## APPENDIX D

### **California Department of Fish and Game Material Specifications and Notification Procedure Surplus Materials for Augmentation to Artificial Reefs**

The California Department of Fish and Game (CDFG) is designated as the "lead agency" in the construction of artificial reefs off the coast of California. Department biologists have been involved in the planning and construction of over 30 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 the disposal of certain categories of surplus material, for use in the construction of artificial reefs. **ONLY THOSE PROPOSALS WHICH WILL INCUR NO COST TO THE STATE FOR TRANSPORTATION OF MATERIALS TO THE REEF SITE WILL BE CONSIDERED.**

#### Acceptable Materials

Materials suitable for construction of artificial reefs must meet the following general 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 essentially unchanged after years of submersion in salt water.
- (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.

Acceptable materials include, but may not be limited to **QUARRIED ROCK** and **HIGH DENSITY CONCRETE**. Other materials may be considered on a case to case basis.

#### Preparation of Surplus Concrete Materials

**SIZE:** Concrete slabs must be broken into chunks; 2 ft. minimum diameter; 4-6 ft. optimum size.  
Concrete pilings must be broken into lengths, ranging from 2-10 ft.

**REBAR:** Reinforced concrete is allowable, but no rebar may protrude more than 3 inches.

### PROCEDURE

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 one full month prior to moving any material to the specified reef site.

#### **REEF AUGMENTATION REPORT:**

As part of the record keeping on all reef construction off the California coast, the principal party to this agreement must submit a Report of Augmentation to CDFG no later than 10 working days after completion of off-loading of materials. This report will include:

- (1) Verification of inspection by the principal party that each barge load of materials is in compliance with the above specifications.
- (2) Estimated quantity of material actually placed on the site.
- (3) A sketch of the completed augmentation, accompanied by LORAN coordinates for each load of material placed.

#### 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 week lead time to include this job in their Aids to Navigation and Notice to Mariners. Los Angeles area: (310) 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.

Prepared by:

Dennis W. Bedford  
Marine Resources Division - Long Beach  
California Department of Fish and Game

November 15, 1991

## APPENDIX E

Proposition 132, enacted by the California electorate on November 6, 1990, added The Marine Resources Protection Act (MRPA) to the California Constitution providing:

*Prior to January 1, 1994, the Fish and Game Commission shall establish four new ecological reserves in ocean waters along the mainland coast.... The Commission shall restrict the use of these ecological reserves to scientific research relating to the management and enhancement of marine resources. (§14, Art. 10B, Cal. Const.)*

Accordingly, in 1992, the legislature added Section 8610.14 to the Fish and Game Code which also states:

*Prior to January 1, 1994, the Commission shall establish four new ecological reserves in ocean waters along the mainland coast.... The Commission shall restrict the use of these ecological reserves to scientific research relating to the management and enhancement of marine resources.*

On July 22, 1992, at the request of the Fish and Game Commission, the State Attorney General issued Opinion No. 92-302, concerning the Marine Resources Protection Act, concluding:

*The ocean ecological reserves established under article X B of the Constitution are to be limited to scientific research to the exclusion of all other human activities.*

However, effective October 1, 1993, the legislature amended Section 8610.14, adding subsection (b) which specifies:

*Recreational uses, including, but not limited to, hiking, walking, viewing, swimming, diving, surfing, and transient boating are not in conflict with this section.*

Finally, on January 1, 1994, the Fish and Game Commission added Section 630.5 to Title 14 of the California Code of Regulations, designating the four new marine reserves pursuant to the MRPA and the Fish and Game Code. Section 630.5 prohibits fishing, swimming, diving, and boating within the reserves except as specifically authorized by the CDFG for scientific research purposes. The staff of the CDFG believes that Fish and Game Code Section 8610.14(b) lacks force of law as it is in conflict with the California Constitution.

However, Article 3, Section 3.5 of the California Constitution prohibits the CDFG from refusing to give effect to Section 8610.14(b) on the basis of its alleged unconstitutionality. Article 3, Section 3.5 states in relevant part:

*An administrative agency... has no power:*

*(a) To declare a statute unenforceable, or refuse to enforce a statute, on the basis of it being unconstitutional unless an appellate court has made a determination that such statute is unconstitutional;*

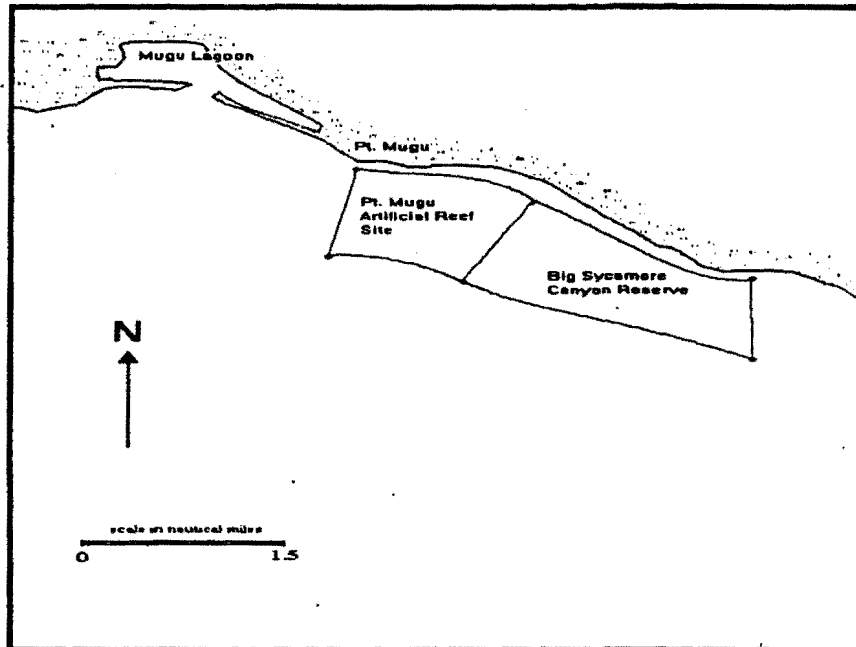
*(b) To declare a statute unconstitutional;*

**Big Sycamore Canyon Reserve Corner Coordinates:**

|    |               |                |                                    |
|----|---------------|----------------|------------------------------------|
| NE | 34° 03' 52" N | 119° 00' 00" W | (Area = 1,344 acres)               |
|    |               |                | Inshore boundary length = 2.20 nm  |
| SE | 34° 03' 00" N | 119° 00' 00" W | Offshore boundary length = 2.70 nm |
|    |               |                | West boundary length = 1.10 nm     |
| SW | 34° 03' 50" N | 119° 02' 40" W | East boundary length = 1.00 nm     |
| NW | 34° 04' 41" N | 119° 02' 02" W |                                    |

**Pt. Mugu Artificial Reef Site Corner Coordinates:**

|    |               |                |                                    |
|----|---------------|----------------|------------------------------------|
| NE | 34° 04' 41" N | 119° 02' 02" W | (Area = 1,007 acres)               |
|    |               |                | Inshore boundary length = 1.38 nm  |
| SE | 34° 03' 50" N | 119° 02' 40" W | Offshore boundary length = 1.06 nm |
|    |               |                | West boundary length = 0.96 nm     |
| SW | 34° 04' 06" N | 119° 03' 54" W | East boundary length = 1.10 nm     |
| NW | 34° 05' 02" N | 119° 03' 39" W |                                    |



|                        |
|------------------------|
| <b>EXHIBIT NO.</b> 1   |
| <b>APPLICATION NO.</b> |
| E-96-7 Fish & Game     |
|                        |

Figure 1.

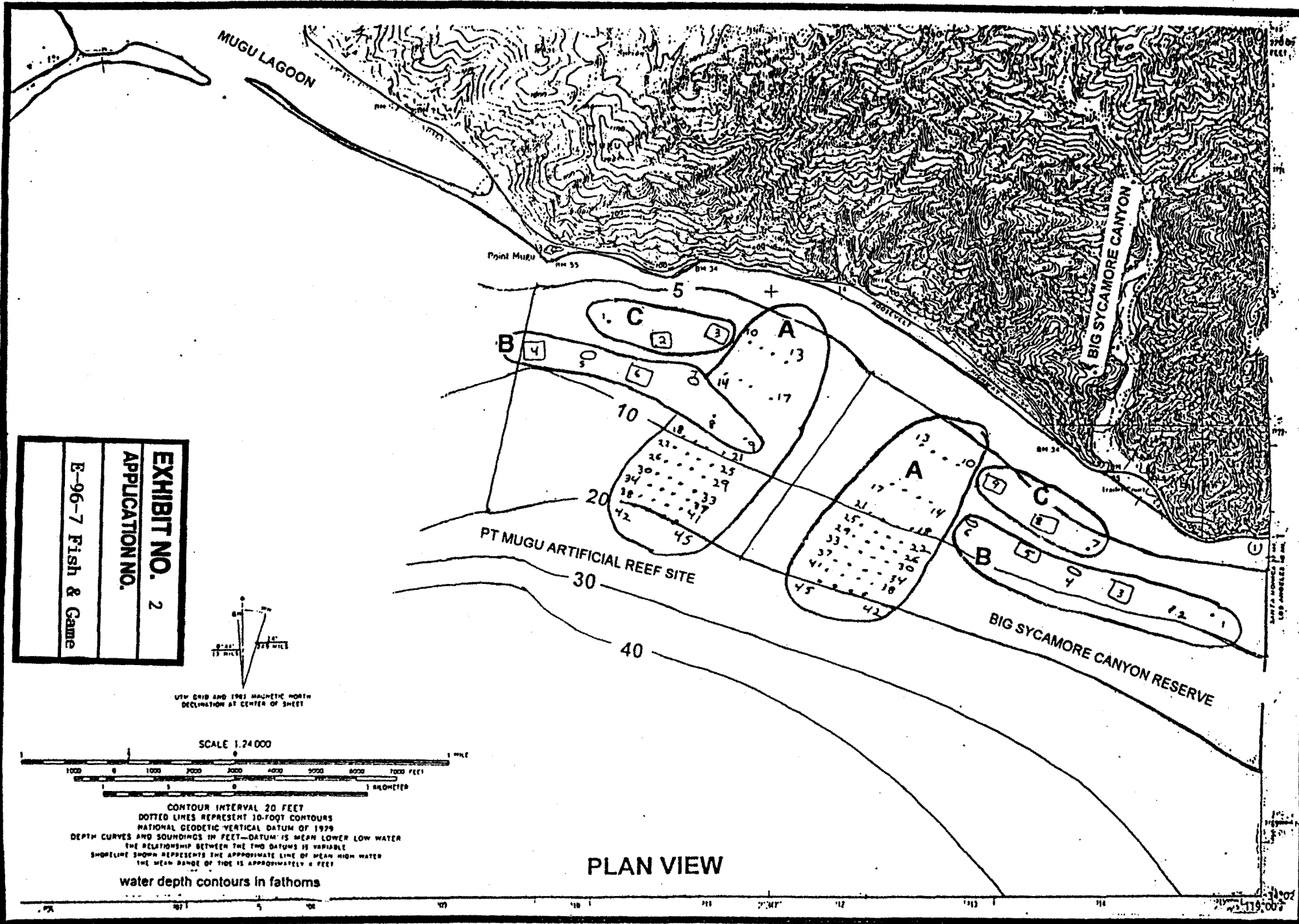
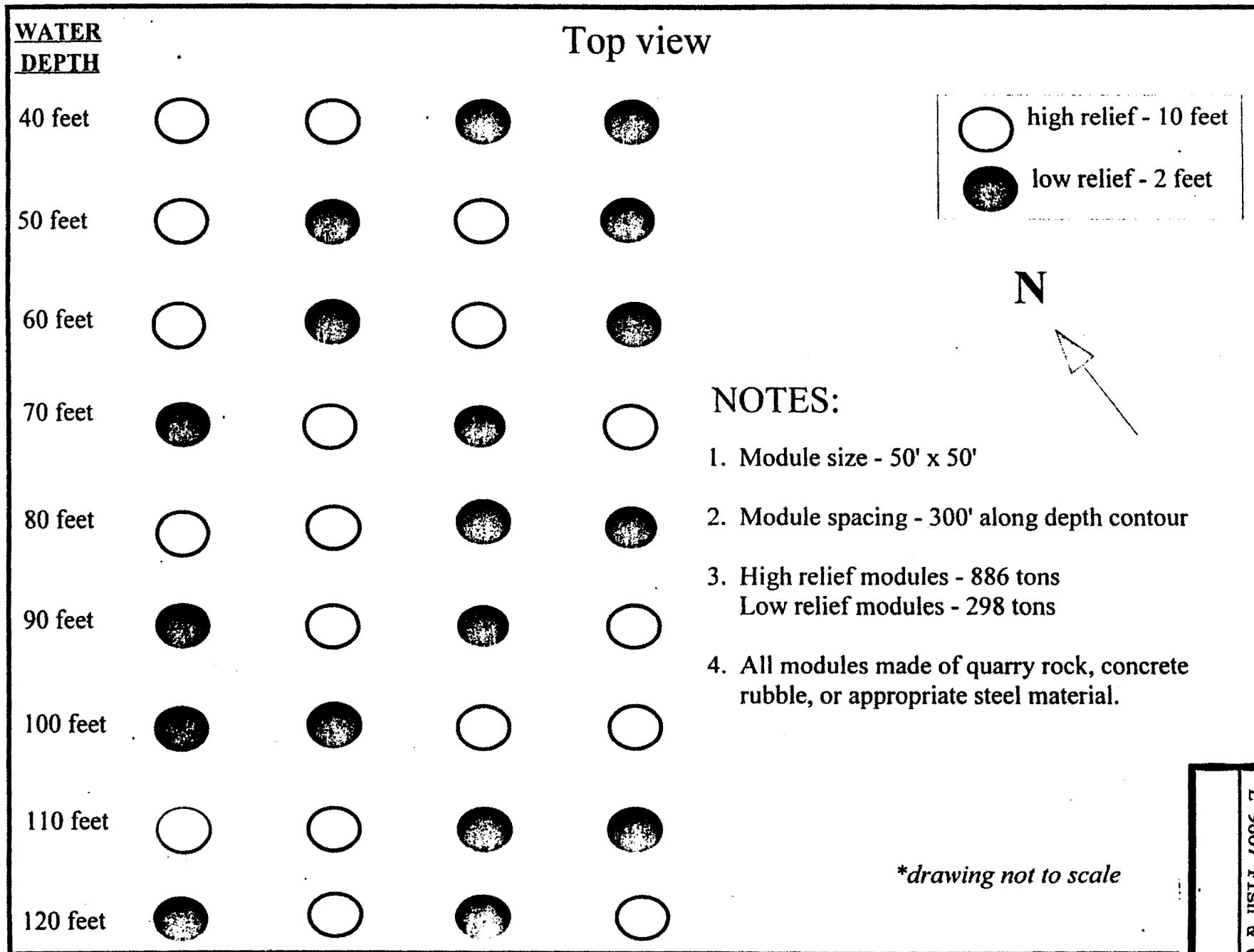


Figure 2.



# DEPTH STRATA EXPERIMENT PLAN



2 x 1000 2

Figure 3.

|                        |
|------------------------|
| <b>EXHIBIT NO.</b> 3   |
| <b>APPLICATION NO.</b> |
| E-9607 Fish & Game     |

# DEPTH STRATA EXPERIMENT PLAN

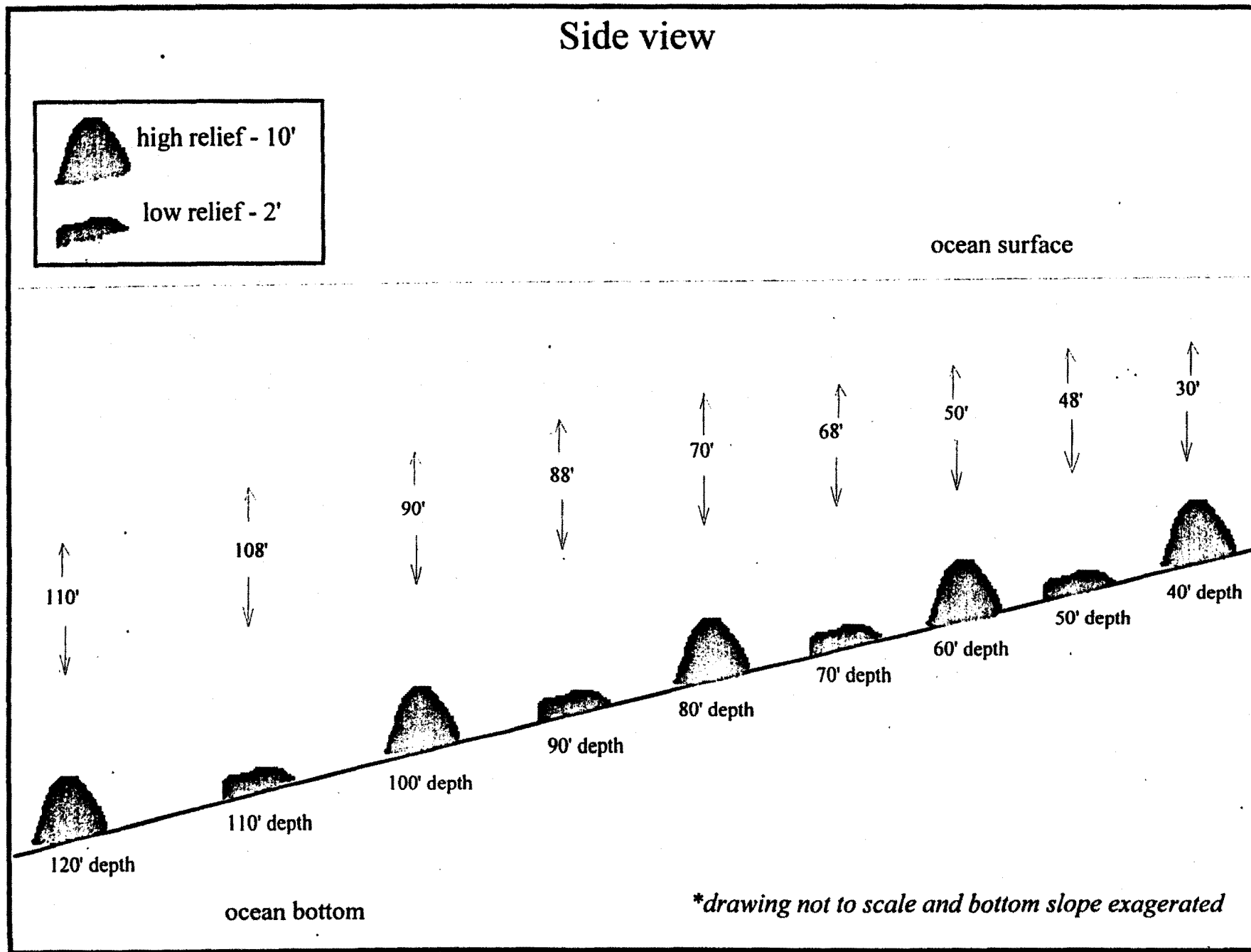


Figure 4.

# FOOTPRINT EXPERIMENT PLAN

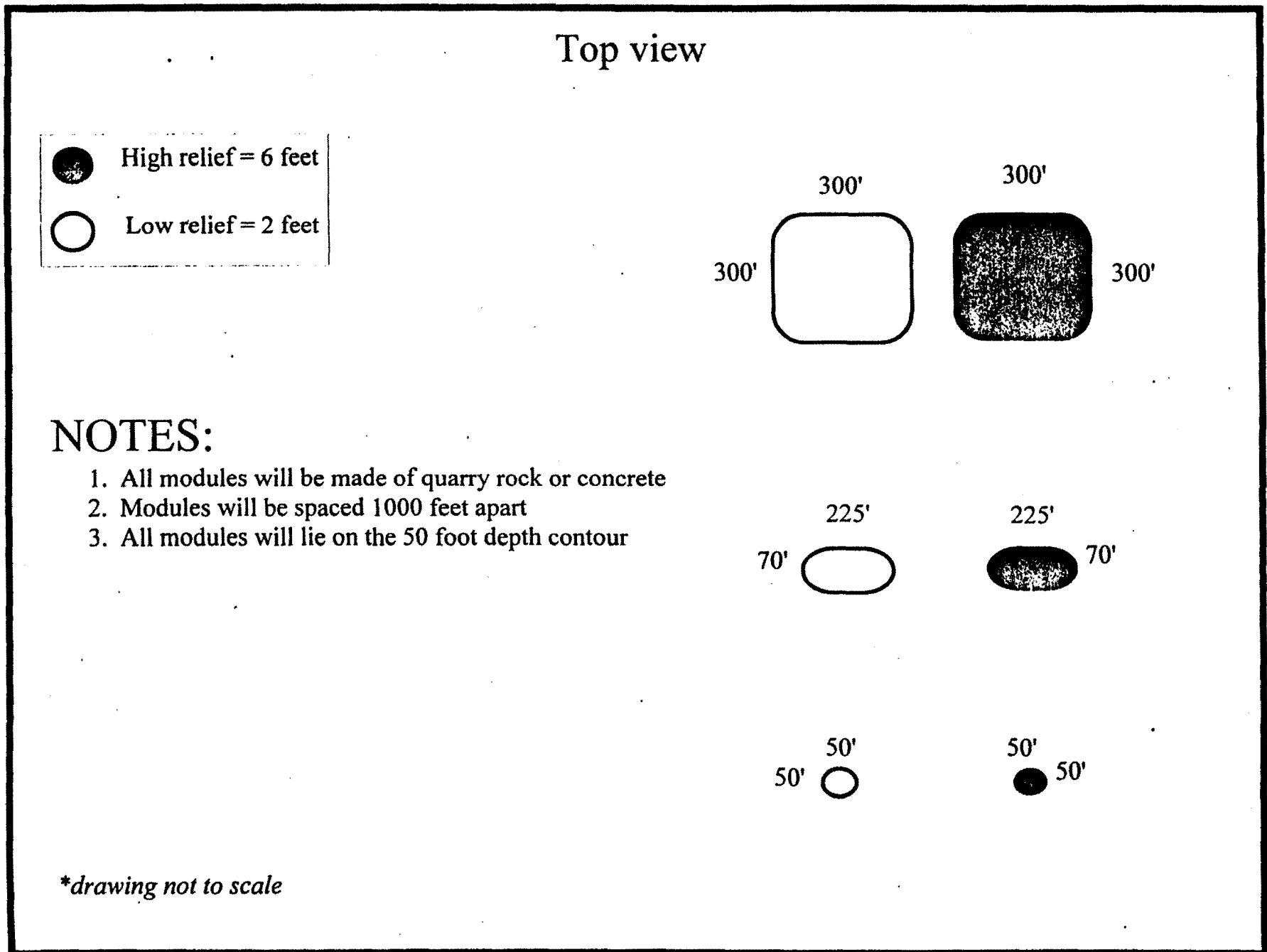


Figure 5.

# FOOTPRINT EXPERIMENT PLAN

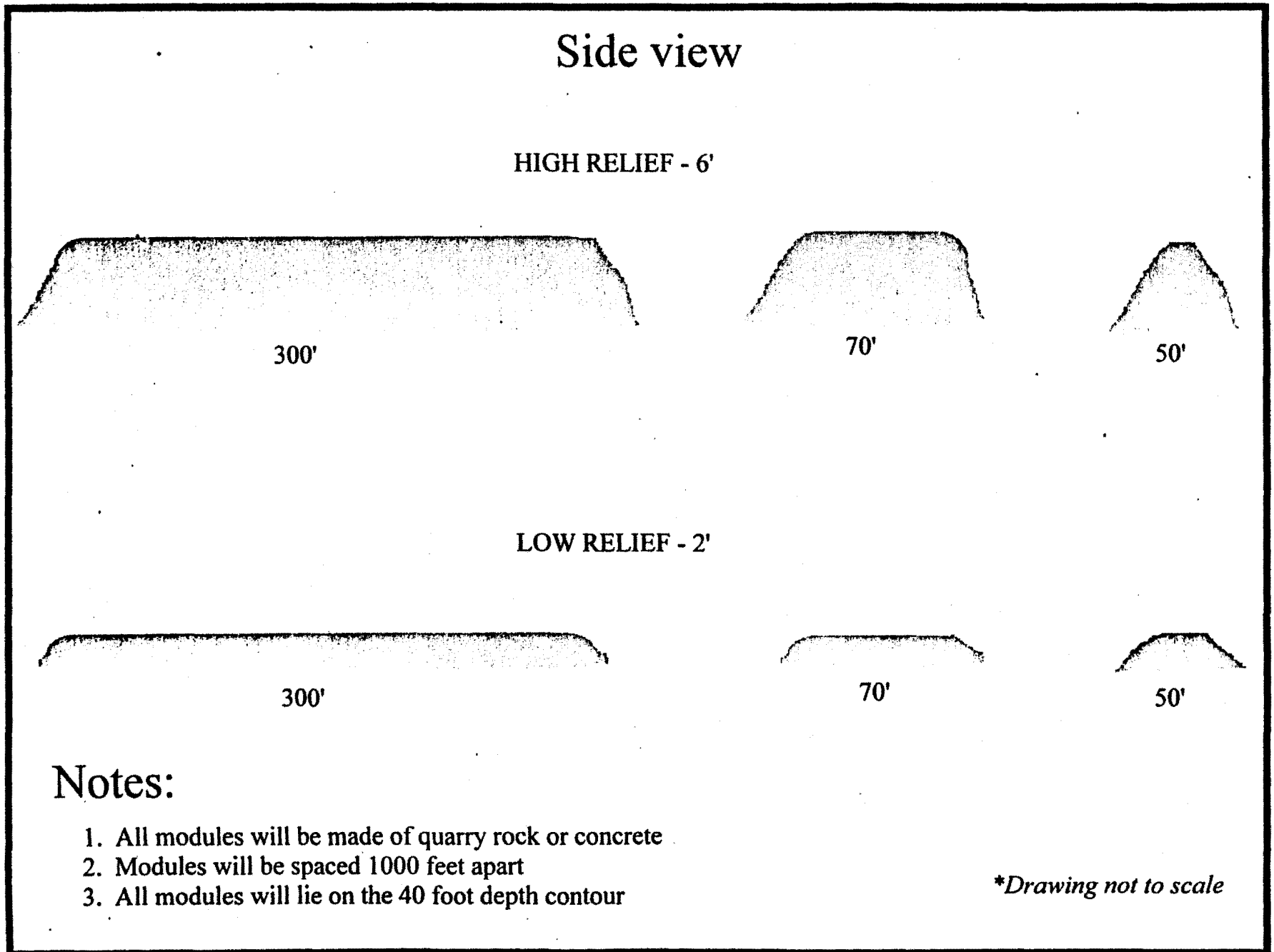


Figure 6.

# RELIEF COMPARISON EXPERIMENT PLAN

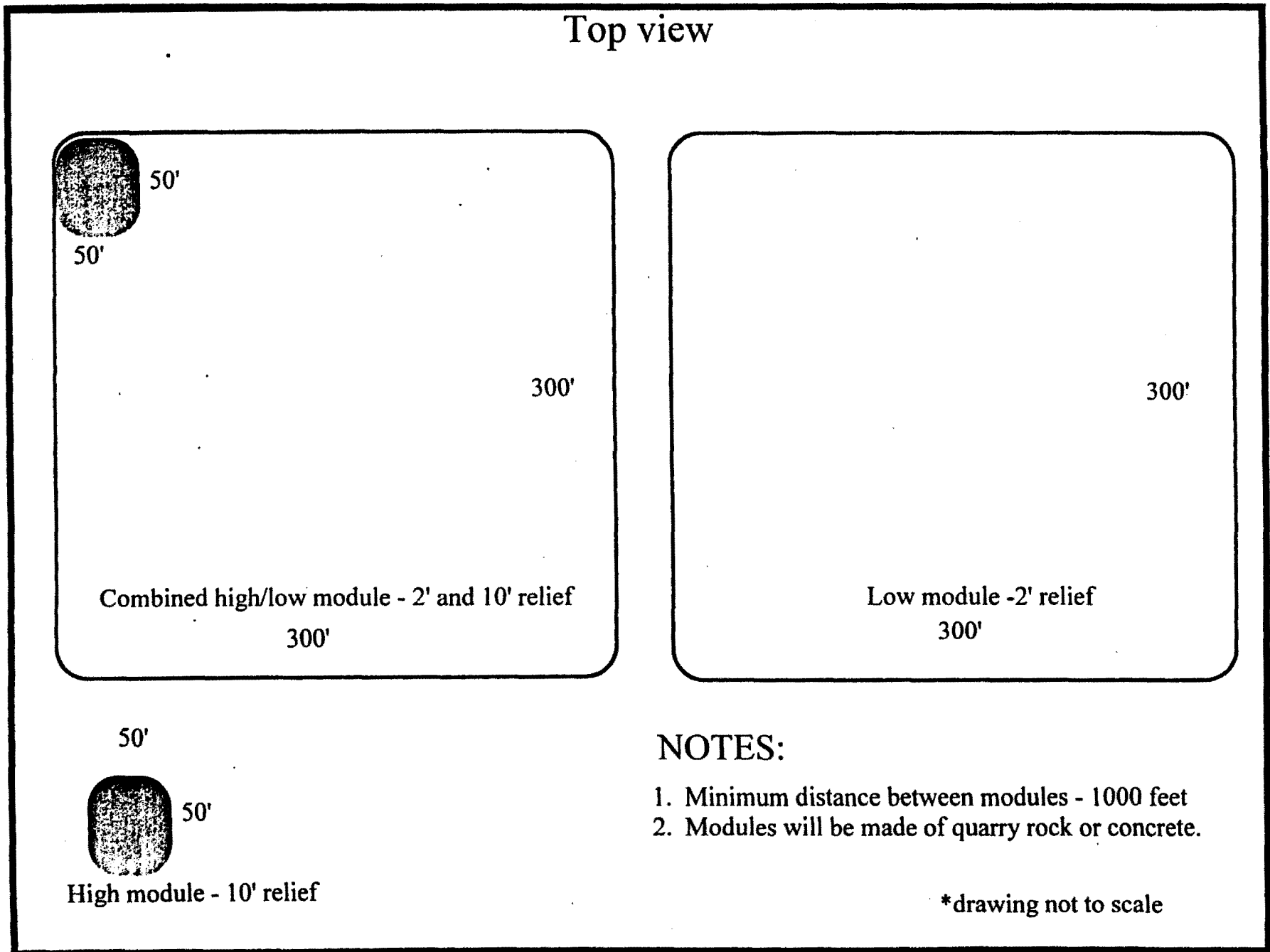


Figure 7.

# RELIEF COMPARISON EXPERIMENT PLAN

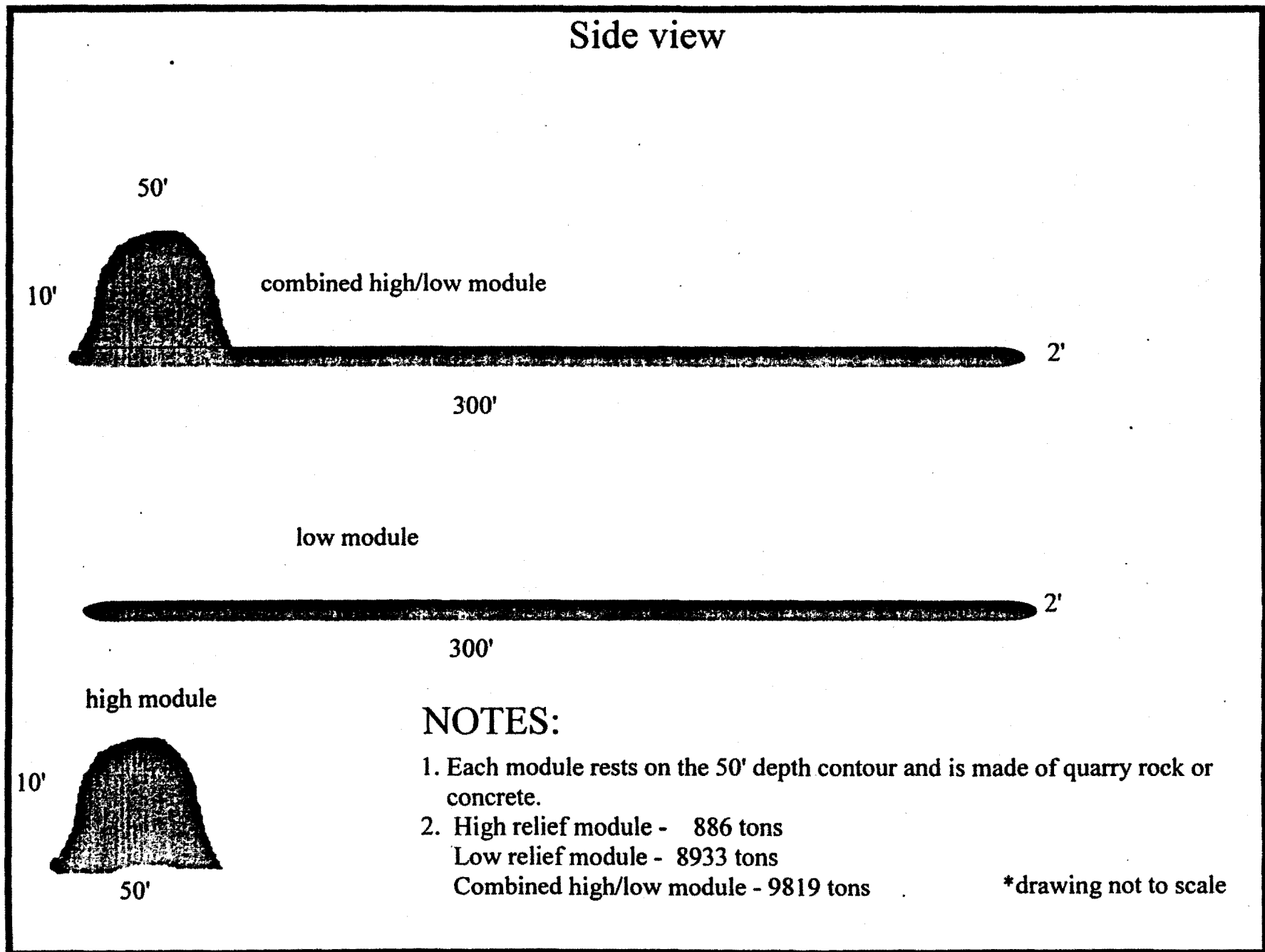


Figure 8.

### Big Sycamore Canyon Reserve Artificial Reef Coordinates

| Module Number | 34° N Latitude |           | 119° W Longitude |           | Length (feet) | Width (feet) | Height (feet) | Foot print (square feet) | Foot print (acres) | Volume (cubic yards) | Mass (tons) | Experiment   |
|---------------|----------------|-----------|------------------|-----------|---------------|--------------|---------------|--------------------------|--------------------|----------------------|-------------|--------------|
|               | (minutes)      | (seconds) | (minutes)        | (seconds) |               |              |               |                          |                    |                      |             |              |
| 1             | 03             | 36        | 00               | 20        | 50            | 50           | 6             | 1964                     | 0.05               | 333                  | 443         | Foot print   |
| 2             | 03             | 38        | 00               | 30        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298         | Foot print   |
| 3             | 03             | 40        | 00               | 45        | 300           | 300          | 6             | 90000                    | 2.07               | 20000                | 23600       | Foot print   |
| 4             | 03             | 52        | 00               | 58        | 225           | 70           | 6             | 15750                    | 0.36               | 3500                 | 4655        | Foot print   |
| 5             | 03             | 54        | 01               | 11        | 300           | 300          | 2             | 90000                    | 2.07               | 6667                 | 8933        | Foot print   |
| 6             | 03             | 55        | 00               | 56        | 225           | 70           | 2             | 15750                    | 0.36               | 1167                 | 1563        | Foot print   |
| 7             | 03             | 55        | 00               | 56        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886         | High/low     |
| 8             | 04             | 02        | 01               | 08        | 300           | 300          | 2-10          | 90000                    | 2.07               | 7333                 | 9819        | High/low     |
| 9             | 04             | 10        | 01               | 22        | 300           | 300          | 2             | 90000                    | 2.07               | 6667                 | 8933        | High/low     |
| 10            | 04             | 18        | 01               | 34        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298         | Depth strata |
| 11            | 04             | 19        | 01               | 36        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298         | Depth strata |
| 12            | 04             | 20        | 01               | 38        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886         | Depth strata |
| 13            | 04             | 22        | 01               | 41        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886         | Depth strata |
| 14            | 04             | 07        | 01               | 38        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298         | Depth strata |
| 15            | 04             | 09        | 01               | 39        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886         | Depth strata |
| 16            | 04             | 11        | 01               | 44        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298         | Depth strata |
| 17            | 04             | 11        | 01               | 54        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886         | Depth strata |
| 18            | 04             | 00        | 01               | 45        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298         | Depth strata |
| 19            | 04             | 02        | 01               | 51        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886         | Depth strata |
| 20            | 04             | 04        | 01               | 55        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298         | Depth strata |
| 21            | 04             | 06        | 02               | 02        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886         | Depth strata |
| 22            | 03             | 58        | 01               | 48        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886         | Depth strata |
| 23            | 04             | 00        | 01               | 57        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298         | Depth strata |
| 24            | 04             | 00        | 02               | 00        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886         | Depth strata |
| 25            | 04             | 02        | 02               | 03        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298         | Depth strata |
| 26            | 03             | 54        | 01               | 51        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298         | Depth strata |
| 27            | 04             | 56        | 01               | 55        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298         | Depth strata |
| 28            | 03             | 58        | 02               | 02        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886         | Depth strata |
| 29            | 04             | 00        | 02               | 06        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886         | Depth strata |
| 30            | 03             | 54        | 01               | 55        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886         | Depth strata |
| 31            | 03             | 56        | 02               | 00        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298         | Depth strata |
| 32            | 03             | 58        | 02               | 03        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886         | Depth strata |
| 33            | 03             | 59        | 02               | 08        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298         | Depth strata |
| 34            | 03             | 52        | 01               | 55        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886         | Depth strata |
| 35            | 03             | 52        | 02               | 02        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 397         | Depth strata |
| 36            | 03             | 53        | 02               | 03        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298         | Depth strata |
| 37            | 03             | 53        | 02               | 13        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298         | Depth strata |
| 38            | 03             | 49        | 02               | 00        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298         | Depth strata |
| 39            | 03             | 50        | 02               | 03        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298         | Depth strata |
| 40            | 03             | 51        | 02               | 08        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886         | Depth strata |
| 41            | 03             | 52        | 02               | 15        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886         | Depth strata |
| 42            | 03             | 48        | 02               | 03        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886         | Depth strata |
| 43            | 03             | 48        | 02               | 08        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298         | Depth strata |
| 44            | 03             | 49        | 02               | 13        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886         | Depth strata |
| 45            | 03             | 49        | 02               | 17        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298         | Depth strata |
|               |                |           |                  |           |               |              |               | 468107                   | 10.75              | 62577                | 79953       |              |

Table 1.

### Point Mugu Artificial Reef Coordinates

| Module Number | 34° N Latitude |           | 119° W Longitude |           | Length (feet) | Width (feet) | Height (feet) | Foot print (square feet) | Foot print (acres) | Volume (cubic yards) | Mass (tons)  | Experiment   |
|---------------|----------------|-----------|------------------|-----------|---------------|--------------|---------------|--------------------------|--------------------|----------------------|--------------|--------------|
|               | (minutes)      | (seconds) | (minutes)        | (seconds) |               |              |               |                          |                    |                      |              |              |
| 1             | 04             | 53        | 03               | 18        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886          | High/low     |
| 2             | 04             | 50        | 03               | 03        | 300           | 300          | 2             | 90000                    | 2.07               | 6667                 | 8933         | High/low     |
| 3             | 04             | 50        | 02               | 45        | 300           | 300          | 2-10          | 90000                    | 2.07               | 7333                 | 9330         | High/low     |
| 4             | 04             | 46        | 03               | 39        | 300           | 300          | 6             | 90000                    | 2.07               | 20000                | 23600        | Foot print   |
| 5             | 04             | 46        | 03               | 26        | 225           | 70           | 2             | 15750                    | 0.36               | 1167                 | 1563         | Foot print   |
| 6             | 04             | 41        | 03               | 07        | 300           | 300          | 2             | 90000                    | 2.07               | 6667                 | 8933         | Foot print   |
| 7             | 04             | 40        | 02               | 55        | 225           | 70           | 6             | 15750                    | 0.36               | 3500                 | 4655         | Foot print   |
| 8             | 04             | 30        | 02               | 50        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298          | Foot print   |
| 9             | 04             | 28        | 02               | 35        | 50            | 50           | 6             | 1964                     | 0.05               | 333                  | 443          | Foot print   |
| 10            | 04             | 50        | 02               | 36        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298          | Depth strata |
| 11            | 04             | 49        | 02               | 33        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298          | Depth strata |
| 12            | 04             | 47        | 02               | 30        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886          | Depth strata |
| 13            | 04             | 46        | 02               | 26        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886          | Depth strata |
| 14            | 04             | 40        | 02               | 45        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298          | Depth strata |
| 15            | 04             | 38        | 02               | 42        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886          | Depth strata |
| 16            | 04             | 36        | 02               | 38        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298          | Depth strata |
| 17            | 04             | 33        | 02               | 34        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886          | Depth strata |
| 18            | 04             | 26        | 02               | 58        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298          | Depth strata |
| 19            | 04             | 24        | 02               | 52        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886          | Depth strata |
| 20            | 04             | 24        | 02               | 51        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298          | Depth strata |
| 21            | 04             | 22        | 02               | 45        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886          | Depth strata |
| 22            | 04             | 22        | 03               | 00        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886          | Depth strata |
| 23            | 04             | 20        | 02               | 55        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298          | Depth strata |
| 24            | 04             | 19        | 02               | 52        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886          | Depth strata |
| 25            | 04             | 18        | 02               | 45        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298          | Depth strata |
| 26            | 04             | 18        | 03               | 01        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298          | Depth strata |
| 27            | 04             | 16        | 02               | 58        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298          | Depth strata |
| 28            | 04             | 14        | 02               | 52        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886          | Depth strata |
| 29            | 04             | 14        | 02               | 51        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886          | Depth strata |
| 30            | 04             | 14        | 03               | 03        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886          | Depth strata |
| 31            | 04             | 16        | 03               | 00        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298          | Depth strata |
| 32            | 04             | 15        | 02               | 58        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886          | Depth strata |
| 33            | 04             | 14        | 02               | 52        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298          | Depth strata |
| 34            | 04             | 14        | 03               | 08        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886          | Depth strata |
| 35            | 04             | 13        | 03               | 04        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886          | Depth strata |
| 36            | 04             | 12        | 03               | 00        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298          | Depth strata |
| 37            | 04             | 10        | 02               | 52        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298          | Depth strata |
| 38            | 04             | 12        | 03               | 12        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298          | Depth strata |
| 39            | 04             | 10        | 03               | 04        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298          | Depth strata |
| 40            | 04             | 10        | 03               | 01        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886          | Depth strata |
| 41            | 04             | 07        | 02               | 57        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886          | Depth strata |
| 42            | 04             | 07        | 03               | 14        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886          | Depth strata |
| 43            | 04             | 06        | 03               | 08        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298          | Depth strata |
| 44            | 04             | 05        | 03               | 04        | 50            | 50           | 10            | 1964                     | 0.05               | 666                  | 886          | Depth strata |
| 45            | 04             | 04        | 03               | 00        | 50            | 50           | 2             | 1964                     | 0.05               | 224                  | 298          | Depth strata |
| <b>TOTAL</b>  |                |           |                  |           |               |              |               | <b>468107</b>            | <b>10.75</b>       | <b>62577</b>         | <b>79953</b> |              |

Table 2.