

ATTACHMENT "A"

I. GENERAL MITIGATION MEASURES:

- A. Concentrated runoff from the site will not be allowed to flow over the coastal bluff, but should be intercepted before reaching the bluff and diverted to control devices.
- B. All areas of recent fill along the edge of the bluff will be planted to fast-growing grasses at the onset of the wet season to minimize first-year erosion, with native, salt-tolerant vegetation being introduced as rapidly as feasible for long-term stability.
- C. Facilities to discharge collected runoff and seawater from the tanks on the site will be constructed so that the released water does not impact on the terrace deposits, but is released onto bedrock or the gravel beach. For most locations at the site, piping will extend down the bluff to an elevation of approximately 20 feet above mean sea level.
- D. Discharge facilities will be constructed so that they can be periodically modified to accommodate changing bluff configurations. The large diameter PVC pipe now in use would appear to be ideal for this purpose.

II. MITIGATION MEASURES FOR THE EXISTING ARLONE FARM FACILITIES:

- A. Drainage control will be improved at Points A and B (Figure 5), north of the Alexander Marine Research Laboratory, so that concentrated runoff is conveyed westerly along the access road to the primary collection Point C rather than crossing the road and flowing to the bluff along uncontrolled channels.
- B. An open concrete "V" ditch, similar to that along the southerly edge of the east raceway tanks, will be installed southerly from the west raceway tanks. This ditch could be located in the center or along the southerly edge of this access road. The ditch will be designed to carry the total seawater flow to these tanks in the event of a spill, or runoff from the local area for a 100-year storm, whichever is greater. The area between this access road and the bluff (now loose fill) will be graded to direct surface flow back to the "V" ditch to the extent that this is feasible.
- C. Drainage facilities along the road to the intake pumphouse will be revised as follows:
 1. The intake to the pipe at the bottom of the road will be improved to include a concrete box configured to minimize sediment clogging (i.e., edges

raised above road level but below the level of the berm at the south edge of the road).

2. Concentrated runoff from above the steep segment of this road (easterly of Point D on Figure 5) will be intercepted and conveyed to the box inlet at the bottom of the road by a pipe buried in the roadway. (This improvement is intended to minimize runoff flowing down the steep segment of the road and consequent erosion and sedimentation at the box inlet.)
3. Runoff from the steep segment of the road will be channeled in a non-erosive device located in the center of the road or on the inland side of the road, and conveyed to the box inlet at the bottom end of the road.
4. Discharge from the pipe from the box inlet will be onto bedrock and not onto the softer terrace deposits (i.e., at or below elevation approximately 20 feet).

III. SPECIFIC MITIGATION MEASURES FOR THE ABALONE FARM EXPANSION FACILITIES:

- A. Control of excess surface runoff or a spill of seawater from the expansion facilities will be controlled by providing an open concrete ditch along the southerly perimeter of the facility.
- B. Diversion and control of runoff flowing toward the expansion facility will be governed by the General Mitigation Measures above.

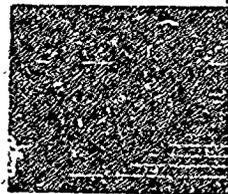
IV. SPECIFIC MITIGATION MEASURES FOR THE ALEXANDER MARINE RESEARCH LABORATORY:

- A. Within thirty (30) days of issuance of the negative declaration, a qualified geologist will visit the site and determine if the seepage from the concrete pond is still significant or whether the leak has been adequately mitigated. In the event the geologist determines the seepage is still significant, the supply of water to the pond by the applicant will be terminated.
- B. The drainage course along the southeasterly side of the concrete pond will be improved to conform to the general recommendations listed above.

Expanded Initial Study
ABALONE FARM DEVELOPMENT PLAN
ED-88-200 D870182D

Prepared for:
Office of the Environmental Coordinator
County of San Luis Obispo

Prepared by:
The Morro Group



P.O. Box 6297
Los Osos, CA 93412

November 22, 1988

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I. INTRODUCTION

The proposed project is a request to construct additional facilities for the raising of abalone at the Abalone Farm located approximately 1/2 mile southwest of Highway 1, 1/2 mile west of the mouth of Villa Creek, and approximately 6 miles west of Cayucos. The proposed facilities are additional raceway tanks which are used to raise the abalone to marketable size. The existing hatchery and nursery facilities are adequate to support the expanded raceway tanks.

The existing facilities have been operating under a lease from John Alexander, owner of the property and operator of the Alexander Marine Research Laboratory which is adjacent to the existing Abalone Farm. However, the existing facilities have not previously received a permit from the County, and the initial grading of the expansion area has precipitated permitting under the Local Coastal Plan with environmental review as required under the Plan.

Environmental issues identified in the review of this proposal include: setback for coastal bluff retreat; control of surface runoff and bluff erosion; terrestrial biological resources; marine biological resources; archaeological resources; effects on views from Highway 1; and effects on traffic on Highway 1 and air quality. This Expanded Initial Study addresses these concerns. The results of the analysis are summarized below, and the detailed analyses are included under Analysis of Environmental Issues.

II. SUMMARY

Geologic Hazards

- Analysis of rates of bluff retreat at the site indicate that the proposed expansion is located well inland of the projected 75-year edge of bluff.
- The raceway tanks at the existing facilities and the seawater pond at the Alexander Marine Research Laboratory may be affected by bluff retreat within the next 75 years. However, the value of these facilities is such that it is unlikely that expensive bluff protection measures would be proposed to protect these facilities.
- No other geologic hazards have been identified at the site and no mitigation measures are proposed.

Drainage and Erosion

- Erosion of the coastal bluff adjacent to the existing facilities appears to have occurred in the past as a result of concentrated surface runoff and/or overflow of the raceway tanks due to plugging or other failures in the seawater discharge facilities.
- Overflows due to plugging of the seawater discharge facilities have been largely eliminated by converting piping to open concrete channels with short, easily cleaned sections of pipe only where required.
- Surface runoff is a problem at some locations within the existing facilities, and measures are recommended to improve the control of concentrated runoff.
- Runoff from the access road, as it may result in erosion and sedimentation downstream in the adjacent "wetland" at the mouth of Villa Creek, has been investigated, and erosion from the road and sedimentation downstream are insignificant.
- Seepage from the bluff at the terrace bedrock contact suggests that leakage from the large concrete-lined pond at the Alexander Marine Research Lab is substantial. This condition poses a significant potential for large-scale failure of the terrace section in the bluff on the seaward side of the pond.
- Potential impacts resulting from erosion by concentrated runoff or spills of seawater from the raceway tanks can be avoided or minimized by implementing the following mitigation measures:

General Recommendations

- Concentrated runoff from the site shall not be allowed to flow over the coastal bluff, but shall be intercepted before reaching the bluff and diverted to control devices.
- All areas of recent fill along the edge of the bluff shall be planted to fast-growing grasses at the onset of the wet season to minimize first-year erosion. Native, salt-tolerant vegetation should be introduced as rapidly

as feasible for long-term stability. A list of species is included on page 6 of Appendix B.

- Facilities to discharge collected runoff and seawater from the tanks on the site shall be constructed so that the released water does not impact on the terrace deposits, but is released onto bedrock or the gravel beach. For most locations at the site, piping should extend down the bluff to an elevation of approximately 20 feet above mean sea level.
- Discharge facilities should be constructed so that they can be periodically modified to accommodate changing bluff configurations. The large diameter PVC pipe now in use would appear to be ideal for this purpose.

Specific Recommendations for the Existing Abalone Farm Facilities

- Drainage control shall be improved at Points A and B (Figure 8), north of the Alexander Marine Research Laboratory, so that concentrated runoff is conveyed westerly along the access road to the primary collection point C rather than crossing the road and flowing to the bluff along uncontrolled channels.
- An open concrete "V" ditch, similar to that along the southerly edge of the east raceway tanks, shall be installed southerly from the west raceway tanks. This ditch could be located in the center or along the southerly edge of this access road. The ditch shall be designed to carry the total seawater flow to these tanks in the event of a spill, or runoff from the local area for a 100-year storm, whichever is greater. The area between this access road and the bluff (now loose fill) shall be graded to direct surface flow back to the "V" ditch to the extent that this is feasible.
- Drainage facilities along the road to the intake pumphouse should be revised as follows:
 - The intake to the pipe at the bottom of the road shall be improved to include a concrete box configured to minimize sediment clogging (i.e., edges raised above road level but below the level of the berm at the south edge of the road).
 - Concentrated runoff from above the steep segment of this road (easterly of Point D on Figure 8) shall be intercepted and conveyed to the box inlet at the bottom of the road by a pipe buried in the roadway. (This improvement is intended to minimize runoff flowing down the steep segment of the road and consequent erosion and sedimentation at the box inlet.)
 - Runoff from the steep segment of the road shall be channeled in a non-erosive device located in the center of the road or on the inland side of the road, and conveyed to the box inlet at the bottom end of the road.
 - Discharge from the pipe from the box inlet shall be onto bedrock and not onto the softer terrace deposits (i.e., at or below elevation approximately 20 feet).

Specific Recommendations for the Abalone Farm Expansion Facilities

- Control of excess surface runoff or a spill of seawater from the expansion facilities shall be controlled by providing an open concrete ditch along the southerly perimeter of the facility.
- Diversion and control of runoff flowing toward the expansion facility shall be governed by the General Recommendations above.

Specific Recommendations for the Alexander Marine Research Laboratory

- Leakage from the concrete pond shall be stopped or reduced to a level of insignificance, or the use of this facility shall be terminated. Seepage at the bluff is substantial, and piping, with a major increase in the volume of flow and the possible collapse of the terrace underlying the seaward side of the pond, could develop at any time. The result could be a major scar on the coastal bluff.
- If use of this facility is to be terminated, then it shall be removed and the site returned to its original configuration to the extent that this is feasible.
- The drainage course along the southeasterly side of the concrete pond shall be improved to conform to the General Recommendations listed above.

Biological Resources

- A terrestrial botanical investigation of the site has been conducted, and no sensitive plant species are present on the site. No mitigation measures are required.
- A marine biological investigation of the intertidal and near-shore habitats adjacent to the site has been conducted, and no significant impacts to this environment have been identified.

Archaeological Resources

- A subsurface archaeological investigation of the expansion area has been conducted, and additional grading in the area southerly of the cut bank at the north edge of the graded area need not be monitored.
- Additional grading north of the cutbank in the expansion area (i.e., more than 20 feet north of elevation point 58.0 on Figure 2) shall be monitored by an archaeological team, including a Native American, to collect any archaeological materials that may be encountered.

Visual Considerations

- The expansion area is not visible from Highway 1, and no significant visual impacts are expected as a result of the proposed project.

- Some of the buildings (i.e., particularly the nursery buildings) in the existing facilities are visible from Highway 1, and the applicant has agreed to provide screening along the easterly edge of the site and in front of the nursery buildings. Cypress have been planted as proposed, and a drip irrigation system has been installed. No other mitigation measures are proposed.

Traffic

- Increased traffic on Highway 1 resulting from increased employment required to operate the expansion will be insignificant (worst-case increase of 0.5% in peak-hour traffic), and no mitigation measures are required.

Air Quality

- Effects on air quality resulting from increased traffic on Highway 1 will be insignificant, and no mitigation measures are required.

III. PROJECT DESCRIPTION

The proposed project is located on the coastal terrace approximately 1/2 mile west of the mouth of Villa Creek and 1/2 mile southwest of Highway 1 (Figure 1). The westerly portion of the site is now used for the hatching and raising of abalone, and implementation of the project would expand the area of raceway tanks in which the abalone spend the latter half of the period of growth to marketable size.

Facilities now on the site include an office, hatchery, nursery and raceway tanks (Figure 2). The primary seawater intake structure and pumphouse are located at the southwesterly corner of the site, and a secondary intake facility is located approximately 150 feet to the east. The main outfall is located near the southeasterly corner of the area of existing facilities of the Abalone Farm, near the Alexander Marine Research Laboratory. Temporary raceway tanks are located just south of the proposed expansion area, and the outfall from these tanks is located approximately 100 feet to the south. The proposed Development Plan would provide the land use permit for these uses.

Views of these facilities are shown on Figures 3 and 4 as follows:

- Figure 3, upper right, shows the office, nursery buildings, and existing raceway tanks as seen from the promontory in the south-central part of the site (Figure 2).
- Figure 3, upper left, shows the primary and secondary seawater intake facilities as seen from the promontory in the south-central part of the site (Figure 2).
- Figure 4, bottom, shows the primary seawater intake and pumphouse as seen from the access road to this facility.
- Figure 4, upper left, shows the outfall from the existing facilities. Note that discharge is onto gravel on the rocky beach below.
- Figure 4, upper right, shows the outfall from the temporary tanks. Note that discharge is onto rock within a reentrant along the bluff.

The location of the proposed expansion area as viewed from the north near the intersection of the road to the existing facilities and the road to the Alexander residence is shown on the bottom of Figure 3. The site has been partially graded. The design of the proposed expansion of the raceway tanks is shown on Figures 5 and 6. Figure 5 is a map view at the same scale as Figure 2 showing the locations of the tanks and headworks, and the grading required to implement these facilities. Figure 6 is a cross section through the headworks and the tanks showing the step-down of the tanks along existing grade and detail of the locations of the water filter and air pump in the headworks.

The existing seawater intake facilities are adequate to also supply the expansion of the raceway tanks. The outfall now used for the temporary tanks will be used for the expansion facilities, probably with the addition of more pipes.

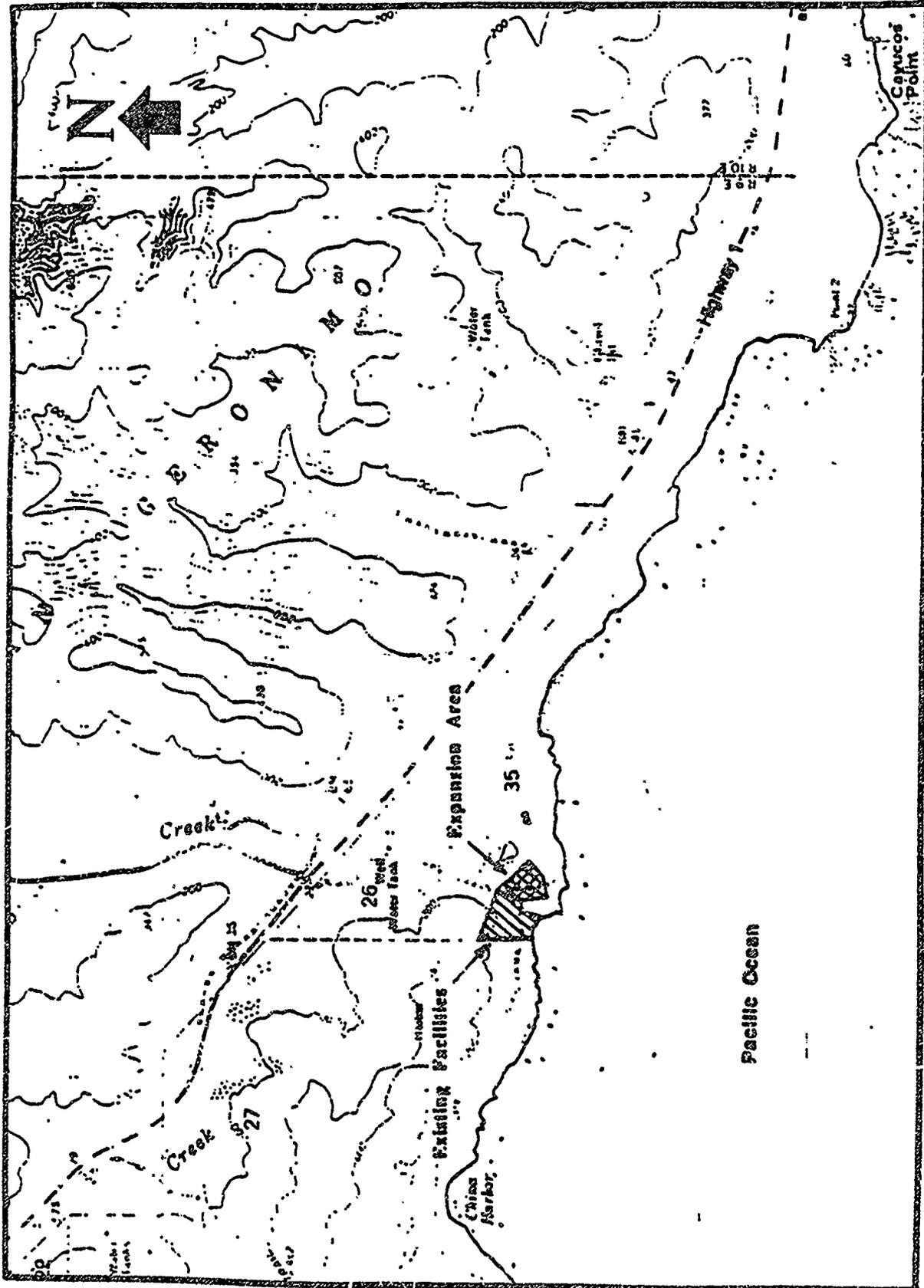
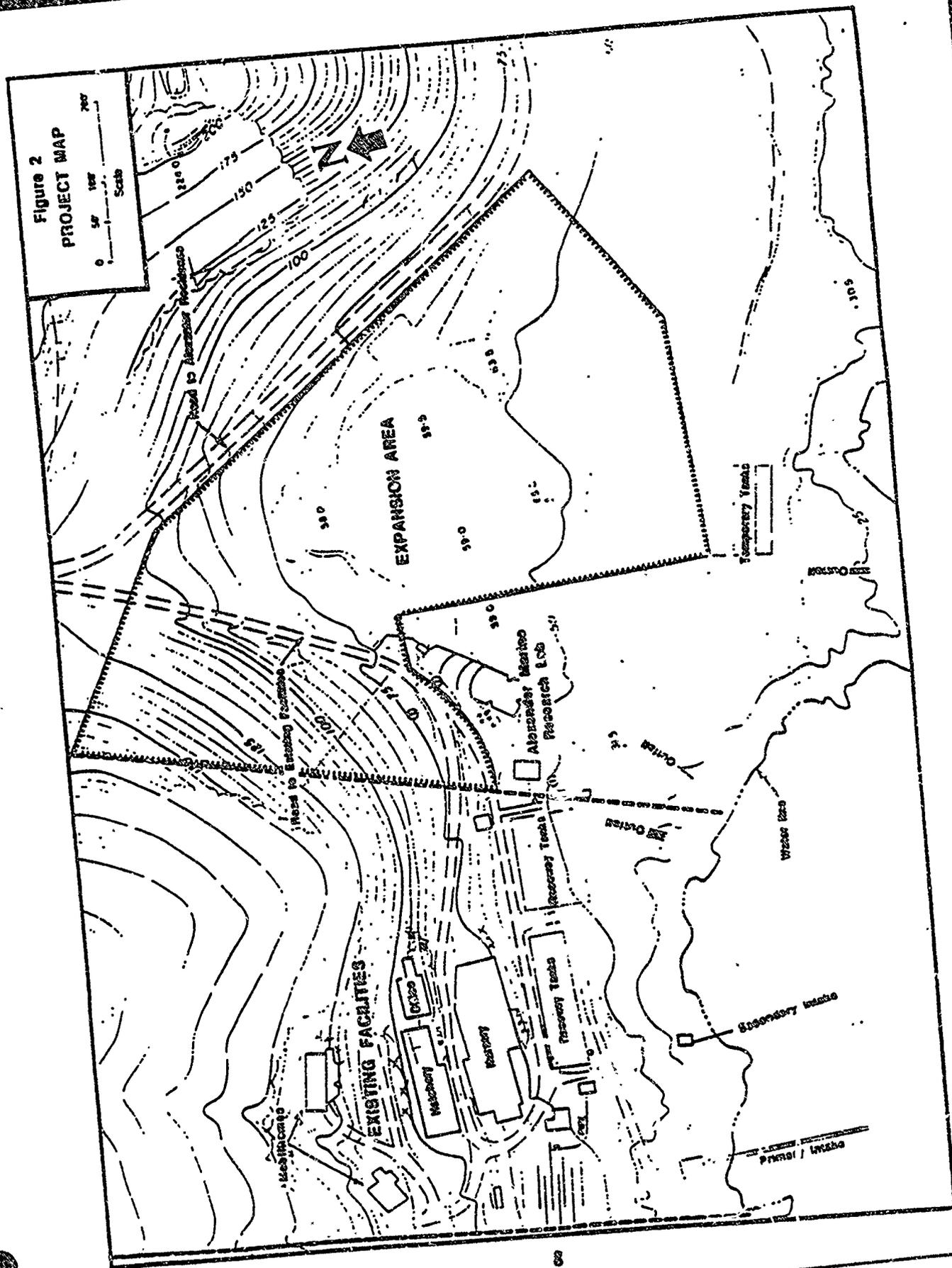


Figure 1. Location Map. Base from USGS Cayucos Quadrangle, culture current to 1965. Scale: 1" = 2,000'



CALENDAR PAGE
MINUTE PAGE

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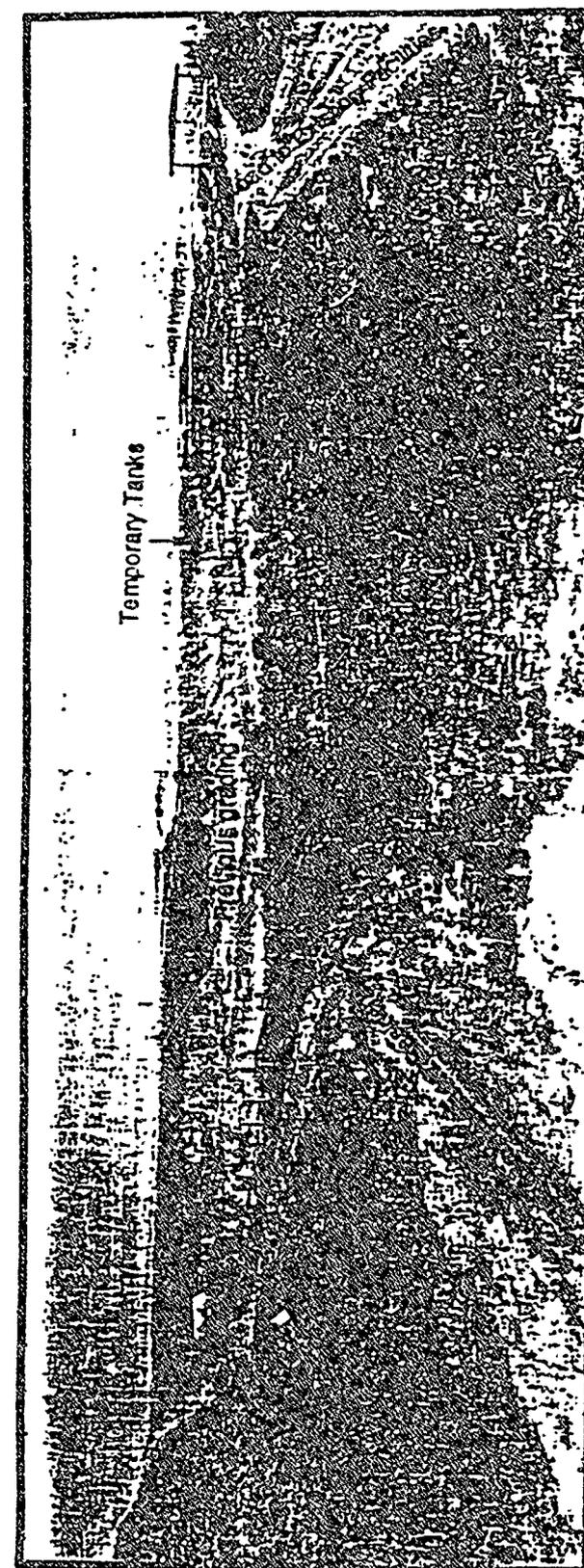
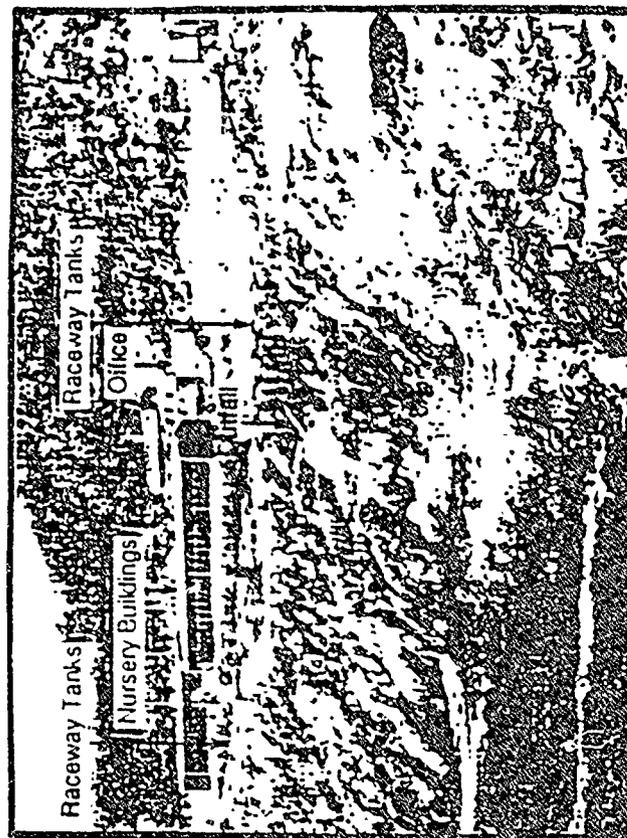
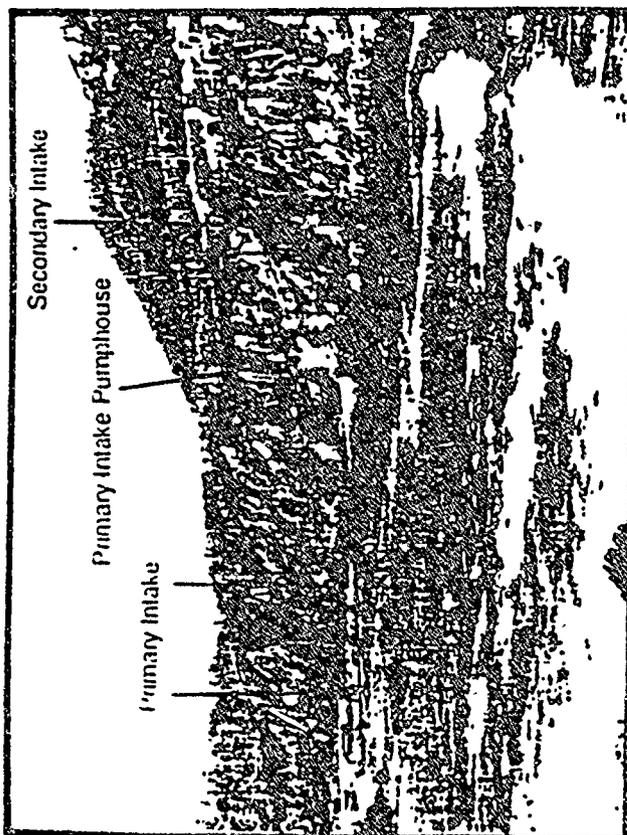


Figure 3. Views of existing facilities (top) and the expansion area (bottom).

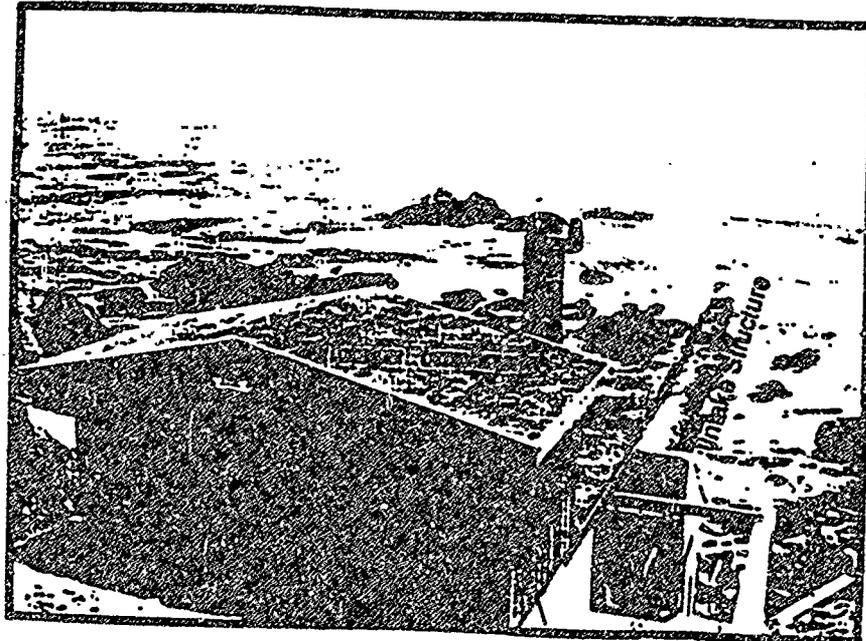


Figure 4. Views of the outfall structures (top) and the intake facilities (bottom).

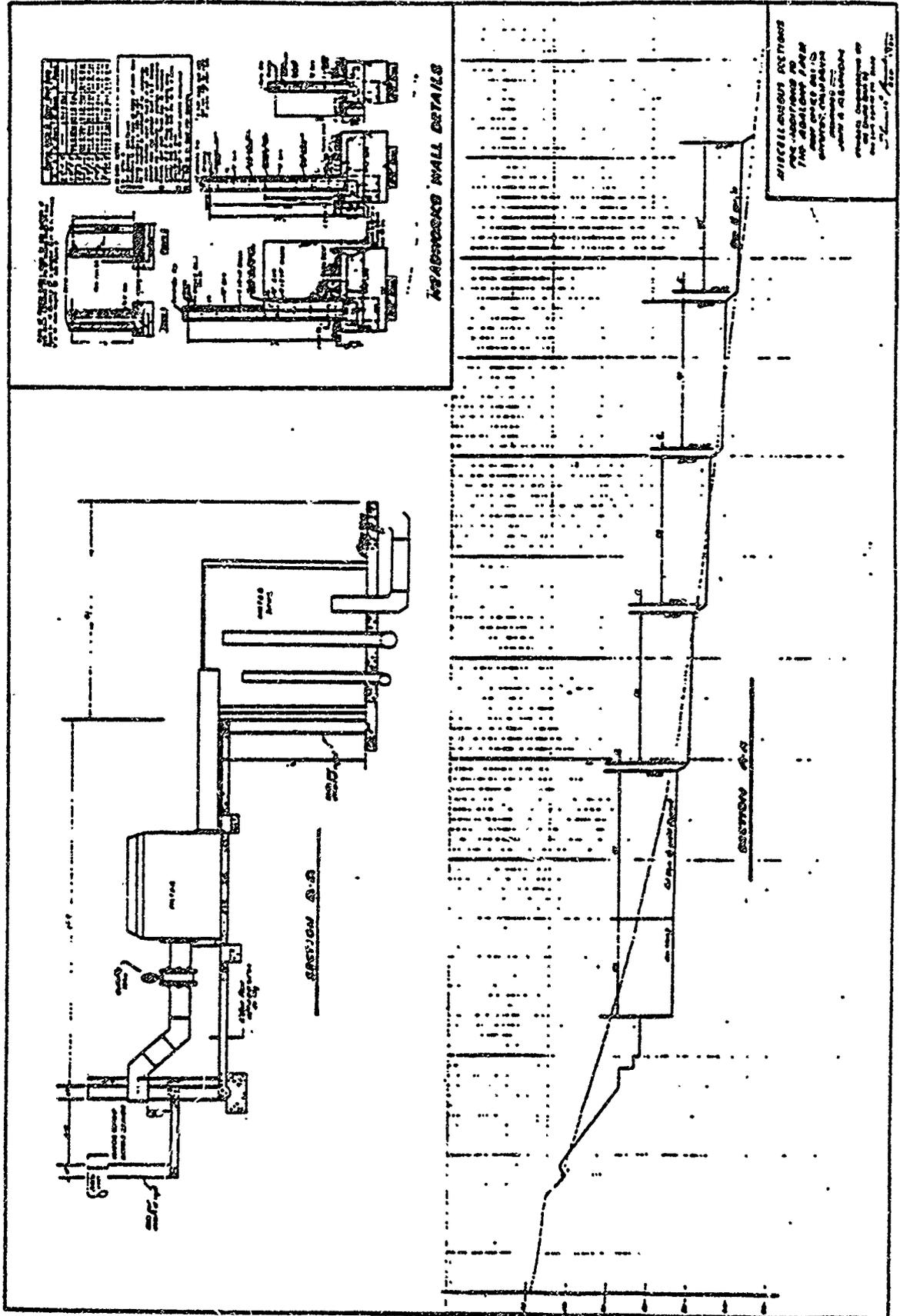


Figure 6. Cross sections through raceway tanks (bottom) and headworks (top).

IV. ENVIRONMENTAL SETTING

A. PHYSICAL SETTING

The proposed project is located on the coastal terrace at a location where slopes are in the range of 5-20%. Some existing facilities have been located on slopes up to approximately 35%, but the area of new development is relatively flat. The site is underlain by terrace deposits composed primarily of silty fine sands that support vegetation consisting primarily of introduced grasses. Bedrock, composed primarily of resistant sandstone, underlies the terrace deposits at depths ranging from about 5 feet at the edge of the bluff in the easterly part of the site to 35 feet or more at the bluff in the westerly part of the site. The bedrock rises to a height of 20-25 feet in the coastal bluff, which provides good resistance to wave erosion. Water depths offshore are shallow, and numerous rocks and small islands are exposed in the near offshore area.

The site is now used for raising abalone for market, and the project is to expand the area of raceway tanks where the abalone spend the latter half of their period of growth.

Pictures of various parts of the site are included as Figures 3 and 4 in the Project Description above. Access to the site is by dirt road from Highway 1 just north of the Villa Creek bridge.

B. CONSISTENCY WITH APPLICABLE PLANS AND POLICIES

The project site is located in the Coastal Zone in the Escondido Planning Area, and is subject to the Local Coastal Zone Land Use Element (CZLUE) and Coastal Zone Land Use Ordinance (CZLUO).

1. Land Use

The CPLUE designates the site as Agriculture. Coastal Table 'O' designates aquaculture as an allowable use in such designations provided the soils are non-prime. The Soil Survey of San Luis Obispo County, Coastal Part (Ernstrom, 1984), classifies the soils on the coastal terrace portion of the site as Still gravelly sandy clay loam, 2 to 9% slopes (map unit 210) which is in capability unit IIe-4 (prime) when irrigated and IIIe-4 when not irrigated.

Comment: The site itself does not have a reliable source of irrigation water, but it may be technically feasible to pump water from the underflow of Villa Creek to the north, and pump it over the ridge to the site. It is unlikely that a project of this extent would be economically feasible on such a small area. Also, while the soils on the terrace portion of the site may be prime when irrigated, areas adjacent to the ocean in this part of the County are not used for intensive agriculture probably because of the severe climatic conditions during most of the year. Based on these considerations, the site is probably not suitable for intensive agriculture, and the proposed use would appear to be allowable within the Agriculture designation.

2. Combining Designations

The site is part of a Sensitive Resource Area (SRA) that extends along the coast from Villa Creek westward to the limit of the Planning Area. This SRA is apparently the Ocean Shoreline. Concerns include "maintaining open views of the shoreline and ocean from

Highway 1 and the long term option for additional public recreation areas, and, if privately developed in the future, maintaining maximum public access to the immediate shoreline.

Comment: Views from Highway 1 are addressed in this Expanded Initial Study, and no significant impacts have been identified. Vertical access from Highway 1 is designated on the Circulation map at the mouth of Villa Creek to the east of the site, but not at the site itself. The project would, therefore, appear to avoid concerns related to this SRA.

The site is not designated a Geologic Study Area (GSA) for Bluff Erosion, but probably should be.

Comment: Bluff retreat is addressed in this Expanded Initial Study, and the proposed project is not within areas subject to retreat within 75 years. Parts of the existing facility may encounter problems within the 75-year period. However, removing and replacing these facilities elsewhere on the site will be much less costly than a shoreline protection structure. The project would, therefore, appear to be consistent with the GSA.

The area north of the existing facilities and expansion area which includes the access road to the site is designated "wetlands" on Map 2 of the Estero Combining Designations Map.

Comment: Hydrologic mapping of the area along the access road draining to the "wetlands" is included in the Drainage and Erosion section of this Expanded Initial Study.

3. Planning Area Standards

a. Sensitive Resource Area

3. *Location Criteria. Locate all new development (excluding utility corridors where it is demonstrated that the alternative will be visually less obtrusive and environmentally less damaging) so that preferably no new structures extend above the highest horizon line of knolls, hilltops, and ridgelines such that the structure is silhouetted against the sky when viewed from nearby collector or arterial roads. When such siting is infeasible or environmentally more damaging, the structures shall require Development Plan review and shall be designed and be of such materials and colors to be harmonious and unobtrusive as feasible.*

Comment: Since no new structures extend above the highest horizon line of knolls, hilltops, and ridgelines such that the structure is silhouetted against the sky when viewed from nearby collector or arterial roads, the project would appear to be consistent with this standard.

4. *Location Criteria - Sloping Sites. New building sites and driveways are limited to locations where site slopes are less than 30%.*

Comment: No new building sites or driveways are proposed on slopes exceeding 30%, and the project would appear to be consistent with this standard.

6. Site Planning - Development Plan Projects. Projects requiring Development Plan approval are to concentrate proposed uses in the least sensitive portions of properties. Native vegetation is to be retained as much as possible.

Comment: A biological survey of the site has been conducted and no sensitive plant species have been identified on the site. The project would appear to be consistent with this standard.

b. Agriculture

1. Site Selection. New development is to concentrate residential and agricultural structural structures in the non-prime areas where terrain, access and agricultural operations would permit.

Comment: The proposed project will not interfere with any existing or planned agricultural operations, and the project would appear to be consistent with this standard.

4. Land Use Ordinance Section 23.07.160, Sensitive Resource Area (SRA)

The proposed project is located within the Ocean Shoreline SRA, and provisions of Section 23.07.160 of the Coastal Zone Land Use Ordinance are applicable. This section establishes detailed procedures and standards for the processing of development applications within SRAs, and identifies specific investigations that must be conducted prior to the making of an environmental determination and the subsequent processing of the project. Standards applicable to the project and investigations required by this section are discussed below.

23.07.166 - Minimum Site Design and Development Standards: All uses within a Sensitive Resource Area shall conform to the following standards:

- b. Shoreline areas shall not be altered by grading, paving, or other development of impervious surfaces for a distance of 100 feet from the mean high tide line, 75 feet from any lakeshore, or 50 feet from any streambank, except where authorized through Development Plan approval. Where the requirements of

Comment: The proposed project will not alter shoreline areas for a distance of 100 feet or more from the mean high tide line, except for the intake and outfall structures, and lakeshores or streambanks are not present. The outfall and intake structures do not increase runoff. The project would appear to be consistent with this requirement.

- c. Construction and landscaping activities shall be conducted to not degrade lakes, ponds, wetlands, or perennial watercourses within an SRA through filling, sedimentation, erosion, increased turbidity, or other contamination.

Comment: The project as proposed will not affect any of the sensitive features included above. However, the existing access to the site does cross a "wetland", and potential erosion and sedimentation related to this access route is an issue related to the project. Hydrologic mapping of the area along the access route and comment on erosion and sedimentation in the adjacent "wetland" are

included in the Drainage and Erosion section of this Expanded Initial Study. No adverse effects have been identified, and the project would appear to be consistent with this requirement.

23.07.170 - Environmentally Sensitive Habitats: The provisions of this section apply to developments proposed within or adjacent to (within 100 feet of the boundary of) an Environmentally Sensitive Habitat as defined by Chapter 23.11 of this title, and as mapped by the Land Use Element combining designation maps.

Comment: No development is proposed within or adjacent to the environmentally sensitive habitat at the mouth of Villa Creek, but access to the site is along an existing road across the upper end of this "wetland" and along its westerly side. Hydrologic mapping of the area along the access route and comment on erosion and sedimentation in the adjacent "wetland" are included in the Drainage and Erosion section of this Expanded Initial Study. No adverse effects have been identified, and the project would appear to be consistent with this requirement.

23.07.176 - Terrestrial Habitat Protection: The provisions of this section are intended to preserve and protect rare and endangered species of terrestrial plants and animals by preserving their habitats. Emphasis for protection is on the entire ecological community rather than only the identified plant or animal.

Comment: A botanical investigation of the site has been conducted, and no sensitive plant species are present.

23.07.178 - Marine Habitats: The provisions of this section are intended to preserve and protect habitats for marine fish, mammals and birds. Development within or adjacent to marine habitats is subject to the provisions of this section.

- a. Protection of kelp beds, offshore rocks, reefs and intertidal areas. Development shall be sited and designed to mitigate impacts that may have adverse effects upon the habitat, or that would be incompatible with the continuance of such habitat areas.*
- b. Siting of shoreline structures. Shoreline structures, including piers, groins, breakwaters, seawalls and pipelines shall be designed or sited to avoid and to minimize impacts on marine habitats.*
- c. Coastal access. Coastal access shall be monitored and regulated to minimize impacts on marine resources. If negative impacts are demonstrated, then the appropriate agency shall take steps to mitigate these impacts, including limitations on the use of the coastal access.*

Comment. The project would appear to be subject to this section. The existing operations and the sites of proposed operations affecting marine resources have been investigated by a marine biologist, and no significant adverse effects on marine resources have been identified.

V. ANALYSIS OF ENVIRONMENTAL ISSUES

A. GEOLOGIC HAZARDS

1. Existing Conditions

An engineering geologic report has been prepared for the project to conform with the requirements of Section 23.04.118b of the Coastal Zone Land Use Ordinance. That report is attached as Appendix A, and its content related to geologic hazards is summarized below. Information related to bluff erosion is addressed in the next section.

a. Geologic Units

The area of the project site has been mapped by Hall (1974) at a scale of 1"=2,000, and the bedrock in the area is Cretaceous sandstone which is the dominant unit underlying the coastal bluffs from the area of the site north to the community of Cambria. This unit is composed primarily of medium grained, arkosic sandstone that is hard, resistant to erosion, and stable under most geologic conditions. However, thin beds of siltstone and claystone are present in some areas between the massive to thick bedded sandstones, and overall resistance to erosion is primarily related to the distribution of these weaker units.

The terrace deposits are composed of silty and clayey sands that are only partially consolidated and much more susceptible to erosion than the underlying bedrock. In the easterly half of the study area, the thickness of the terrace deposits at the edge of the bluff varies in the range of 3-5 feet, and the top of the bedrock is consistently at an elevation of approximately 20-25 feet. However, beginning at a point westerly of the Temporary Tanks, the thickness of terrace deposits increases northwesterly to approximately 35-40 feet near the westerly boundary of the existing abalone facilities. In these areas where the terrace at the bluff is much thicker, the elevation of the top of the bedrock is at an elevation of 20-25 feet as it is to the east where the terrace deposits are much thinner.

b. Geologic Structure

The orientation of bedding planes in the Cretaceous sandstone sequence at the site is primarily northerly with dip to the east at medium to steep angles. This alignment is consistent with those of physical features along the bluff and the rocks offshore. The bedrock in the area is highly fractured and jointed, but the alignments of these rock features do not appear to control to any significant extent variations in the rates of retreat of the bluff. That the bedrock is fractured contributes to its erodability, but fracture and joint patterns are not significantly affecting the locations of retreat.

c. Bluff Retreat

Coastal bluffs on the Central Coast normally include a lower section composed of bedrock with a relatively high but variable degree of resistance to wave erosion, and an upper section composed of terrace deposits that have a relatively low degree of resistance to wave erosion. Where bedrock extends significantly (i.e., 10-15 feet or more) above the zone of effective wave attack (i.e., above the shore-line angle), bluff retreat is controlled almost totally by the characteristics of the bedrock units. However, where the bedrock is low in the coastal bluff (less than 5 feet), erosion at the edge of the bluff is controlled primarily by the resistance of the overlying terrace deposits, and the degree to which the beach seaward

of the bluff is erodible. This condition is relatively limited on the Central Coast, but where it is present relatively high rates of retreat are common. Examples include the bluff in north Morro Bay and southern Cayucos, Pismo Beach near the pier, and Montana de Oro just north of the mouth of Hazard Canyon where 30-50 feet of bluff was lost in the 1983 storms alone.

At the project site, bedrock is high in the bluff (20-25 feet), and retreat from wave erosion is controlled primarily by the resistance of the bedrock units. Also, the wave-cut platform is shallow for several hundred feet offshore, and numerous rocks are exposed at mid- to low-tide for distances of 300 to 400 feet offshore. This condition extends offshore for at least 1/2 mile as shown by the seaward protrusion of the depth contours on Figure 1 and the presence of kelp beds offshore. There are gravel deposits on some of the beaches along the bluff at the site. However, these are thin (a foot or so), and the sea bottom offshore can be considered as being bedrock and not easily erodible.

Rates of the retreat of coastal bluffs can be determined from historical evidence such as photographs (aerial or ground locations) of the same area taken at different times, or survey maps of the bluff edge or survey points that have been referenced to the bluff edge. This type of evidence is normally available for areas urbanized several tens of years ago (i.e., Los Angeles-San Diego region), but it is not generally available for rural regions which include most of San Luis Obispo County. Exceptions include the Dinosaur Caves-Shelter Cove area of Pismo Beach where large-scale Caltrans aerial photographs were utilized to establish rates of retreat over the last 30 years (Asquith, 1983), the South Palisades area of Pismo Beach where a pipeline near the bluff provides a long-term line of reference, and the Pirate's Cove area of Avila Beach where near-bluff physiographic features have not been significantly altered and where rates of retreat are locally high.

These studies establish rates of retreat in rock for the Central Coast generally as follows:

<u>Geologic Condition</u>	<u>Average Rate of Retreat (ft/yr)</u>
Hard, resistant rocks (e.g., Obispo tuffs and older hard rocks)	<0.2
Medium resistant rocks (e.g., Miocene shales and siltstones)	0.2-0.4
Low resistant rocks (e.g., folded and fractures shales and siltstones)	0.4-0.8
Very low resistant rocks (e.g., landslide debris)	1.0-2.0 or higher

Aerial photographs available in the County files and past surveys of the site have been reviewed, and no information has been identified that would further refine local rates of bluff retreat beyond those that can be assigned on a general basis. That is, available aerial photographs are at scales in the range of 1,000-2,000 ft/in, and threshold measurements of approximately 0.02 inches equate to distances of 20 to 40 feet, or the retreat that would be expected with the normal range of conditions in 50 to 100 years. These photographs, therefore do not provide useful information unless rates of retreat are substantially above normal levels.

Land surveys are sometimes of help, particularly if the site involved is in an urban area where detailed surveys have been routine. However, the project site has been a cattle ranch until recently, and detailed data from old surveys are not available.

Based on our past experience in the analysis of bluff retreat in coastal areas of San Luis Obispo County and the characteristics of the bedrock section at the site, rates of bluff retreat should be in the range of <0.02 to 0.4 ft/yr. Higher rates cannot be totally ruled out, but there are no significant data that would suggest that abnormally high rates should be applied to the site. This range of rates of bluff retreat is distributed to the coastal bluffs at and adjacent to the site as shown on Figure 7 with one exception. The zones of relatively high shale and siltstone content located south of the existing raceway tanks and near the southeast corner of the study area are assigned a slightly higher rate of 0.5 ft/yr because of the low resistance of these units to erosion. These beds are only about 10-15 feet thick, so the period of more rapid erosion is not applicable to the entire 75-year projection interval.

The projected 75-year edge of bluff is shown on Figure 7 based on these estimated rates of retreat. This projection indicates that the project (proposed expansion area) will not be adversely affected by bluff retreat in the next 75 years. The seawater pond constructed at the Alexander Marine Research Laboratory ("Artificial fill" on map) and the existing Raceway Tanks may, however, be affected by future bluff retreat.

Effects of surface runoff on bluff erosion are addressed in the Drainage and Erosion section of this report.

d. Slope Stability

No evidence of past landslide conditions were observed at the site either in the bluff or on the slopes above the site. One small area of out-of-slope dip is present to the south of the westerly of the two existing raceways. This condition has been taken into account in assigning the rate of retreat in this area.

e. Seismic Considerations

No active or potentially active faults are known or suspected at or in the near vicinity of the site, and fault rupture hazards are insignificant.

Earthquakes generated by movement on major active faults in the region consist primarily of the expected magnitude 8.0-8.5 event on the San Andreas fault located approximately 43 miles to the northeast, and an event of considerable question on the Hosgri fault located approximately 5 miles offshore (PG&E, 1988). The maximum credible earthquake magnitude (M_w) for the Hosgri fault is approximately 7.2 (PG&E, 1988), but a much smaller magnitude is more likely. The expected large magnitude event on the San Andreas fault would likely generate maximum ground accelerations at the site in the range of 0.1g, and the questionable magnitude 7.2 event could generate ground accelerations of approximately 0.5g (Campbell, 1981). Lesser events are more likely, but a magnitude 6.0-6.5 earthquake on this fault would still generate accelerations up to approximately 0.3g.

2. Project Impacts

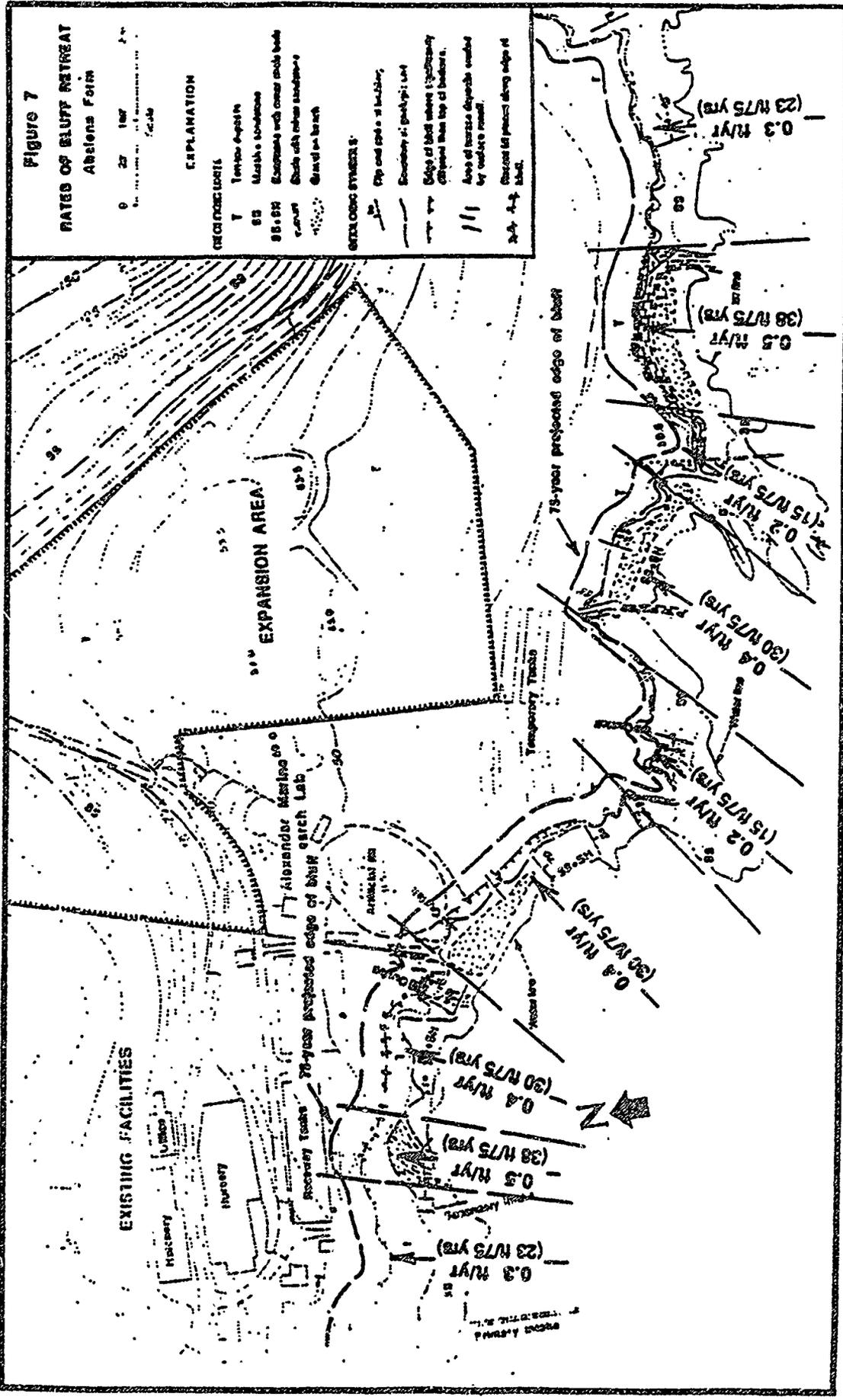
a. Bluff Retreat

Estimated rates of bluff retreat based on geologic characteristics of the bluff and experience in other parts of San Luis Obispo County indicate that the project (proposed expansion area) will not be adversely affected by bluff retreat in the next 75 years. The seawater pond constructed at the Alexander Marine Research Laboratory ("Artificial fill" on Figure 7) and

Figure 7
RATES OF BLUFF RETREAT
Abslons Point

0 27 187 277
 377 477 577 677 777 877 977 1077 1177 1277 1377 1477 1577 1677 1777 1877 1977 2077 2177 2277 2377 2477 2577 2677 2777 2877 2977 3077 3177 3277 3377 3477 3577 3677 3777 3877 3977 4077 4177 4277 4377 4477 4577 4677 4777 4877 4977 5077 5177 5277 5377 5477 5577 5677 5777 5877 5977 6077 6177 6277 6377 6477 6577 6677 6777 6877 6977 7077 7177 7277 7377 7477 7577 7677 7777 7877 7977 8077 8177 8277 8377 8477 8577 8677 8777 8877 8977 9077 9177 9277 9377 9477 9577 9677 9777 9877 9977 10077 10177 10277 10377 10477 10577 10677 10777 10877 10977 11077 11177 11277 11377 11477 11577 11677 11777 11877 11977 12077 12177 12277 12377 12477 12577 12677 12777 12877 12977 13077 13177 13277 13377 13477 13577 13677 13777 13877 13977 14077 14177 14277 14377 14477 14577 14677 14777 14877 14977 15077 15177 15277 15377 15477 15577 15677 15777 15877 15977 16077 16177 16277 16377 16477 16577 16677 16777 16877 16977 17077 17177 17277 17377 17477 17577 17677 17777 17877 17977 18077 18177 18277 18377 18477 18577 18677 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- EXPLANATION**
- RETREAT RATES**
- T Terrace deposit
 - SB Marsh & lowland
 - SB+SH Estuaries with coarse silt and sand
 - SH+SH Estuaries with medium sand & silt
 - SH+SH+SB Estuaries with fine sand & silt
 - SH+SH+SB+SH Estuaries with silt & clay
- OTHER SYMBOLS**
- Top and edge of bluff
 - Boundary of property lot
 - Edge of bluff where topography changes from top of bluff
 - Area of terrace deposits marked by terrace walls
 - Contour interval along edge of bluff



the existing Raceway Tanks, however, may be affected by future bluff retreat. These facilities can be removed at such time as bluff retreat becomes a problem as the value of these facilities would not warrant preventive measures.

b. Slope Stability

No slope stability problems have been identified at the site and no impacts resulting from this hazard are expected.

c. Seismic Considerations

The expected large magnitude earthquake on the San Andreas fault 43 miles to the northeast will result in relatively minor groundshaking at the project site, and no significant impacts to the proposed project are expected. Some minor damage to existing structures should be expected, and there may be sloshing of water out of the tanks in the nursery and raceway facilities. These effects should not be significant.

Occurrence of a large (magnitude 6.0-6.5) or major (magnitude 7) earthquake on the Hosgri fault located about 5 miles offshore could cause significant damage to the existing and proposed facilities. However, the actual occurrence of such an event during the life of the project is unlikely, and damage that may occur is not expected to result in significant secondary effects.

3. Mitigation Measures

No significant adverse impacts related to geologic hazards have been identified at the site and no mitigation measures are required.