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**IMPACT OF SPACE SHUTTLE SUPPORT
FACILITIES CONSTRUCTION ON SPECIAL
INTEREST PLANT SPECIES
(VANDENBERG AFB, CA) .**



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**R. C. / Wooten, Jr., Dennis / Strutz
Ronald / Hudson**

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FLORIDA 32403**

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→ Fish and Wildlife Service in the June 16, 1976 Federal Register (41FR24524-24572). The surveys also included other special interest taxa designated by the California Native Plant Society as being rare, endangered, or vascular plants of limited distribution in California. Three threatened species (Castilleja mollis, Monardella crispa, and Scrophularia atrata) and two endangered species (Cirsium rhotophilum and Erigeron foliosus var blochmanae) were found in a number of the construction site areas. It was determined that construction activities would not jeopardize the continued existence of any of these species. Mitigative measures were recommended to minimize adverse plant habitat modification or removal of any of these plants. ↑

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PREFACE

This final report was prepared by Det 1 HQ ADTC Civil and Environmental Engineering Development Office (CEEDO), Tyndall AFB Florida. This work was accomplished under JON 21039P13. Maj Rutherford C. Wooten, Jr, Det 1 (CEEDO) HQ ADTC was the project officer.

The Appendix of this report was prepared by Mr R.M. Beauchamp and T.A. Oberbauer (Consultant Botanists) under contracts F046847731881 and F046847731878, respectively. Dr Paul Zedler, USAF Summer Faculty Research Associate, San Diego State University, consulted on the field studies for this report.

This report has been reviewed by the Information Office (OI) and is releasable to the National Technical Information Service (NTIS). At NTIS it will be available to the general public, including foreign nations.

This technical report has been reviewed and is approved for publication.

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SECTION I

INTRODUCTION

This report summarizes the results and conclusions of studies conducted to evaluate the impact of proposed ground support facilities construction for the Space Shuttle Program at Vandenberg AFB CA on listed and proposed threatened or endangered plant species in order to insure compliance with the Endangered Species Act of 1973. In part, Section 7 of the Endangered Species Act of 1973 requires federal agencies to take such action "to insure that actions authorized, funded, or carried out by them do not jeopardize the continued existence of such endangered or threatened species or result in the destruction or modification of habitat of such species which is determined by the Secretary of the Interior, after consultation as appropriate with the affected States, to be critical." The Space and Missile Systems Organization (SAMSO) will provide this report to the Department of the Interior Fish and Wildlife Service as part of the consultation and assistance process reflected in Section 7 of the Endangered Species Act of 1973.

The plants of special concern are those appearing in the list "Proposed Endangered Status for some 1700 US Vascular Plant Taxa" which appeared in the Federal Register, June 16, 1976 (Reference 1). Plants on this list can be granted protection by final rulemaking of the Fish and Wildlife Service effective 30 days after public notice. Because protected status could be granted to plants on this list on such short notice, and because the requirements of Section 7 have been construed to apply to federal projects ongoing and even substantially completed when final listing or critical habitat determination occurs (see Hill vs TVA, Reference 2), thorough consideration of plant species appearing on this list found on Vandenberg AFB is essential for Space Shuttle planning. To date only 4 plants, all of San Clemente Island (150 miles west of Vandenberg) have been accorded endangered status under rulemaking procedures (Reference 3).

Plant species occurring on two other lists are also of concern for this study due to their identification by the scientific community as special interest species possibly worthy of protective status considerations: An initial list of over 3100 plant taxa (Reference 4) prepared by the Smithsonian Institution for consideration under the Endangered Species Act of 1973 as candidates for endangered or threatened status; and a listing of over 1300 vascular plants by the Native Plant Society of California (Reference 5) as being rare, endangered, or of limited distribution in California. Although the list proposed by the Smithsonian Institution has been refined to include only the 1700 taxa under proposed rulemaking by the US Fish and Wildlife Service, and the list by the Native Plant Society of California has no binding effect on federal activities, we thought it prudent to consider both lists for long range environmental planning purposes.

SECTION II

STUDY AREA AND METHODS

ECOLOGICAL SETTING

Vandenberg AFB occupies most of the entire western coastal foothill region of Santa Barbara County. Its more than 150 square miles extend over some 35 miles of coastline from Point Sal on the north nearly to Point Conception on the south. The region is generally considered to be in an ecological transition zone between northern and southern California. Many plant and animal species reach their northern or southern limits in the vicinity of Vandenberg AFB. In addition, a number of plant species are restricted to rather small areas of the California coastal zone with the majority being restricted to the active and stabilized dune areas. A few Chaparral species are also restricted to this part of California occurring on the VAFB Burton Mesa.

The elevation on Vandenberg ranges from 0 to 2,170 feet. Most of the topographical relief is rolling hills except for the rugged terrain of south Vandenberg with its many small canyons and steep hillsides.

A detailed ecological survey was conducted on Vandenberg AFB in 1974-75 (References 6 and 7). The communities determined by that survey are given in Figure 1. At that time a number of vascular plant species were listed by the California Native Plant Society as being endangered, rare, or of limited distribution in California (Table 1). Several species on this list were subsequently proposed as threatened or endangered species (References 1 and 4).

Common Name	Scientific Name
Gracious Thistle	<u>Cirsium loncholepis</u>
Surf Thistle	<u>Cirsium rhotophilum</u>
Branching Beach Aster	<u>Corethrogyne leucophylla</u>
Blochman's Leafy Daisy	<u>Erigeron foliosus</u> var. <u>blochmanae</u>
Santa Ynez False Lupine	<u>Thermopsis macrophylla</u> var. <u>agrena</u>
Cream Dicentra	<u>Dicentra ochroleuca</u>
Lompoc Yerba Santa	<u>Eriodictyon capitatum</u>
Crisp Monardella	<u>Monardella crispa</u>
Club-haired Mariposa	<u>Calochortus clavatus</u> var. <u>recurvifolius</u>
Hoover's Bent Grass	<u>Agrostis hooveri</u>
Narrow-leaved Spine Flower	<u>Chorizanthe augustifolia</u>
Brewer's Spine Flower	<u>Chorizanthe breweri</u>
Nipomo Ceanothus	<u>Ceanothus impressus</u> var. <u>nipomensis</u>
Soft-leaved Indian Paint-brush	<u>Castilleja mollis</u>
Black-flowered Figwort	<u>Scrophularia atrata</u>
Arguello Wallflower	<u>Erysimum suffrutescens</u> var. <u>grandifolium</u>
Lompoc Wallflower	<u>Erysimum suffrutescens</u> var. <u>lompocense</u>
Shagbark Manzanita	<u>Arctostaphylos rudis</u>
Lompoc Manzanita	<u>Arctostaphylos pechoensis</u> var. <u>viridissima</u>
Blochman's Butterweed	<u>Senecio blochmanae</u>
	¹ <u>Chorizanthe diffusa</u>
	¹ <u>Chorizanthe rectispina</u>
Saltmarsh Bird's-beak	<u>Cordylanthus maritimus</u>
	¹ <u>Eriogonum gracile</u> var. <u>cithariforme</u>
Green Beach Primrose	<u>Camissonia cheiranthifolia</u> var. <u>nitida</u>
Surf Malacothrix	<u>Malacothrix incana</u>

Number of Species

- 1 - No common names available.
- x - expected association from literature review.
- * - observed association on Vandenberg AFB.

This Table taken from Coulombe and Cooper (Reference 6)

TABLE 1. STATUS OF RARE AND ENDANGERED PLANTS ON
VANDENBERG AFB BY VEGETATIONAL ASSOCIATION

	Bishop Pine Forest	Tanbark Oak Forest	Oak Woodland	Riparian Woodland	Chaparral	Coastal Sage Scrub (Normal)	Coastal Sage Scrub (Purple Sage)	Coastal Sage Scrub (Stabilized Dune)	Coastal Strand	Coastal Salt Marsh	Freshwater Marsh	Annual Grassland
<u>olius</u>	*			x					*			
		x			*			*				
	*				*			*				x
					x			x				x
					x							
<u>folium</u>			*	*	*			*	*			
<u>ense</u>					*	*		*				
<u>idissima</u>					*	*		*				
					*							x
<u>me</u>			x							x		
<u>itada</u>									*			
									*			
	2	1	2	2	9	1	-	8	4	1	-	3

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CONSTRUCTION ACTIVITIES

This study is concerned with those project elements proposed as part of the Space Shuttle program at Vandenberg AFB. The area under evaluation encompasses the total area of influence of all construction related activity for all project elements. These project elements are listed below and are shown in Figure 1.

(1) Modification and expansion of runway and taxiway facilities: This involves an extension of the end of the runway and erecting other buildings in the airfield vicinity.

(2) Orbiter processing facilities and tow way in the vicinity of the airfield.

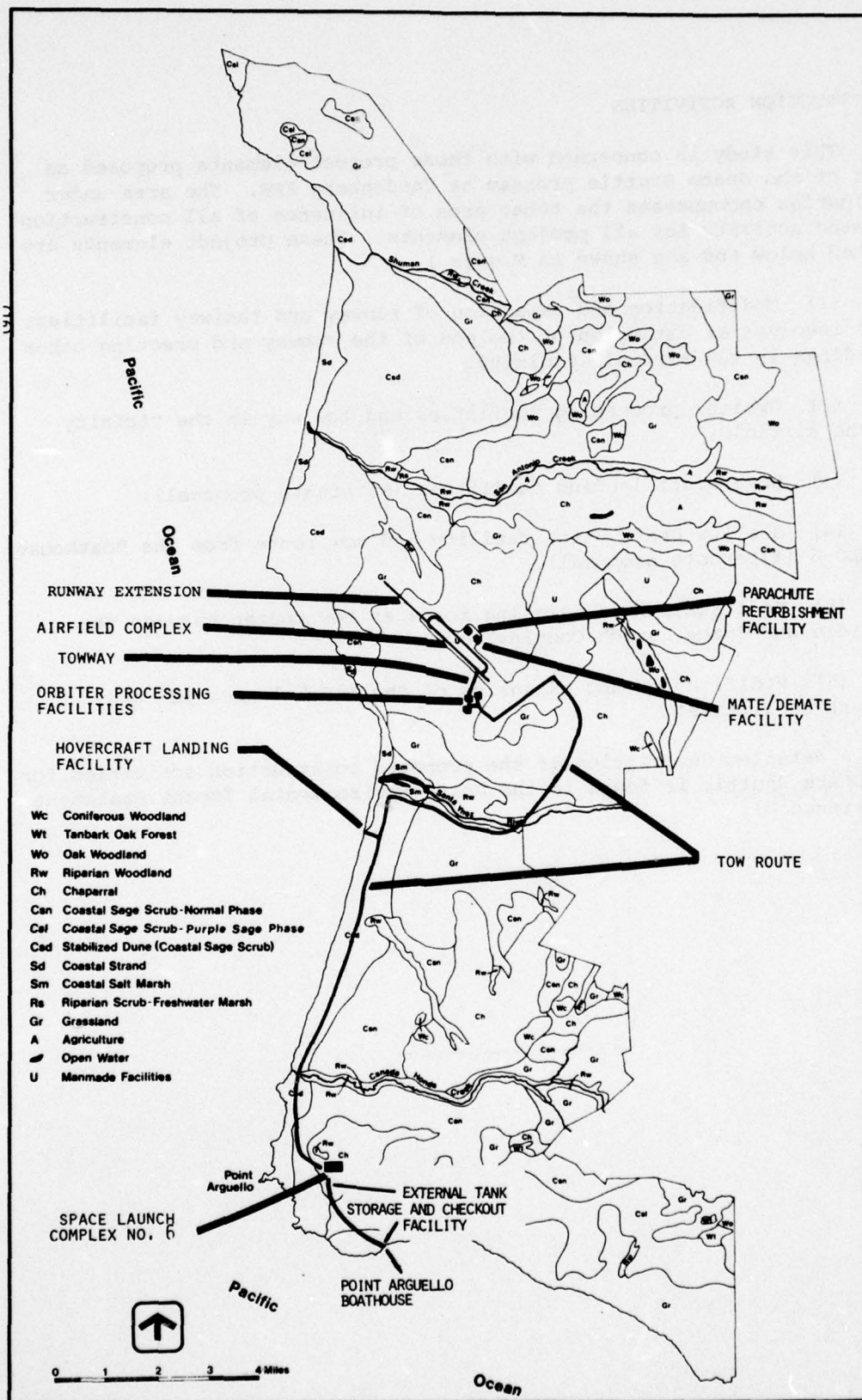
(3) Hovercraft landing facilities (alternate proposal).

(4) Shallow Draft Barge facility and tow route from the Boathouse to SLC-6 (alternate proposal).

(5) Modification of existing roads as tow routes between the airfield and Space Launch Complex No 6.

(6) Modification and expansion of the SLC-6 launch pad and support facilities.

A detailed description of the proposed construction activities for the Space Shuttle is found in the Draft Environmental Impact Statement (Reference 8).



Reference: Coulombe and Cooper, 1976 (16)

Figure 1. Distribution of Generalized Vegetation Types on Vandenberg Air Force Base

STUDY METHODS

A detailed study was made of each project site to determine the plant communities involved and their species make-up. A thorough search was made for special interest species which may not have been included by line intercept sampling techniques. The detailed results of this study are given in the Appendix of this report. Site specific information is annotated on V-80 Tow route drawings prepared by the Corps of Engineers. These maps are available through SAMSO/DE Los Angeles, California. This portion of the report with figures summarizes these results.

Our final determination as to the impact of Space Shuttle construction activities on these special interest plant taxa is based on the study mentioned above, additional field examinations made by scientists from CEEDO, SAMSO/DE and Dr Paul Zedler, San Diego State University, and information gathered from the general ecological survey conducted in 1974-75 (References 6 and 7). The additional field examinations were made to evaluate mitigative actions and to determine other locations at which threatened and endangered species might occur on Vandenberg. Photographs of the particular species and impact areas were taken and are available for examination at SAMSO/DE.

Species in this report referred to as "Threatened" are those listed in a report prepared by the Smithsonian Institution (Reference 4). Those referred to as "Endangered" are listed by the US Fish and Wildlife Service for rulemaking (Reference 1). "Special Interest Taxa" refer to species occurring on both of the above listings as well as those listed by the California Native Plant Society as vascular plants being rare, threatened or of limited distribution in California.

SECTION III

RESULTS AND DISCUSSION

PLANT SPECIES

Three threatened plant species (Castilleja mollis, Monardella crispera, and Scrophularia atrata) and two endangered species (Cirsium routhophilum) and Erigeron foliosus var. blochmanae occurring in the proposed listing of threatened and endangered plant species (Reference 1 and 4) will be impacted by Space Shuttle construction activity. The following narrative taken from Coulombe and Cooper (Reference 6) and Munz (Reference 9) provides information on the taxonomic status, distribution and occurrence of these species.

(1) Castilleja mollis, (Soft-leaved Indian Paint-brush), Pennell, Proc. Acad. Phila. 99:185. 1947

This bright red Castilleja demonstrates the unique relations between the flora and coastal Santa Barbara County and the northern California Channel Islands. The plant occurs on Santa Rosa Island as well as the coastal regions of San Luis Obispo and Santa Barbara Counties. On the base, the plant was observed in stabilized sand dunes along Coast Road, just north of La Honda Creek, to the mouth of Shuman Canyon, as well as along Tranquillon Ridge in Sandy soil. A population exists in primary dunes (coastal strand) at San Antonio Lagoon.

(2) Scrophularia atrata, (Black-flowered Figwort), Pennell, Proc. Acad. Phila. 99:172. 1947

This annual is rather abundant in interior canyons of the base. It ranges from San Luis Obispo County to Santa Barbara County. The type collection was made at Surf. There appears to be considerable introgression into the taxon by the more common S. californica, with which it is sympatric. Munz gives the substrate for this plant as diatomaceous shale but in the field this supposed soil preference is not evident.

(3) Cirsium routhophilum, (Surf Thistle), Blake, Journ. Wash. Acad. 21:336. 1931

This rare thistle occurs on maritime sand dunes from Pismo Beach to Point Arguello. The type locality is at Surf. The favored habitat is active sand dunes but seedling plants have been observed along the dirt road leading to the mouth of Honda Canyon. The greatest population occurs from surf to the mouth of Shuman Canyon on the sparsely vegetated dunes.

(4) Monardella crispera, (Crisp Monardella), Elmer, Bot. Gaz. 39:46. 1905

This pungent-scented shrub occurs in both active and stabilized sand dunes from Oceano, southward to Point Conception. The type collection is from Surf, where the plant is still seen, as well as along Coast Road.

(5) Erigeron foliosus var. blochmanae, (Blochman's Leafy Daisy), Greene, Pittonia 3:125. 1896

This distinctive composite occurs in stabilized sand dunes from Morro Bay southward to Canada Honda. The type specimen was taken in northern Santa Barbara Co., presumably on dunes now located within the base. The light purple flowered perennial was observed as an abundant stand on the leeward slope of stabilized dunes, 1/2 mile south of Surf.

Several other endemic taxa, based on the current local flora (Reference 8) were also included in the observations due to their local distribution on VAFB. They are: Ceanothus papillosus ssp. roweanus, Chorizanthe californica var. suksdorfii and Erysimum suffrutescens var. grandifolium.

CONSTRUCTION SITES

The general location for the sites described below are shown on Figures 1 and 2. Species distribution, community type, and general vegetation cover maps are in the Appendix.

Wade Road Hovercraft Pad

The Hovercraft Pad site lies approximately one mile south of Surf in the sand adapted vegetation zone and includes in its area of influence about 133 acres. The proposed road to access the site is located approximately 500 feet south of the Wade Road and Coast Road intersection. Cirsium rhotophilum was the only endangered or threatened species found in this area. Other special interest plants found at the site which appear in the California Native Plant Society list identified are Malacothrix incana, var. succulenta, Erysimum suffrutescens var. grandifolium, and Senecio blochmanae.

Point Arguello Boathouse Harbor

The Boathouse Harbor is located at Point Arguello which is accessed by Sudden Road off of Coast Road in the southernmost part of the base. The area of influence amounts to approximately 23 acres. No special interest plant species occur at this site. This area is heavily impacted by grazing.

Orbiter Processing Area

This area is located west of the 28th street and California Boulevard intersection and extends north to the eastern end of the runway. The area of influence for the Orbiter Processing facilities is approximately 89 acres. No endangered or threatened species were found in this area. California Native Plant Society listed species found at this site included Arctostaphylos viridissima, A. rudis, and Ceanothus impressus.

Launch Pad 1 (SLC-6)

SLC-6 is located to the east on the SLC-6 turnoff road off Coast Road in the southern end of the base. The area of influence at this site includes approximately 470 acres. Two threatened species were found in this area. These plants are Castilleja mollis and Scrophularia atrata. California Native Plant Society listed species found at this site included Arctostaphylos viridissima, A. rudis, and Ceanothus impressus.

Airfield

The area of influence for the proposed western extension of the airfield is approximately 1150 acres. The mesa top area of the western runway extension is covered with significant numbers of

Arctostaphylos viridissima, A. rudis, and Ceanothus impressus. These three plant species have been identified as special interest species by the California Native Plant Society. The canyon area of the site has minor populations of the threatened species Castilleja mollis and Scrophularia atrata. Also found in the canyon area is the plant species Erysimum suffrutescens var. lompocense, identified as a special interest species by the California Native Plant Society.

TCF/SF

The proposed External Tank Storage and Checkout Facility is located about 3800 feet south of the SLC-6 turnoff on Coast Road. The area of influence for this site is approximately 23 acres. One threatened plant species, Monardella crispera, was found at this site. No other special interest plants were identified.

OMCF Sector (Sector 1)

Sector 1 extends from the new road from the OMC, down 29th street to New Mexico Avenue and up New Mexico Avenue to 13th street. The portion of the road to be constructed from the OMC will involve several shrubs of Arctostaphylos viridissima, A. rudis, and Ceanothus impressus. The remaining portion of this tow road sector passes through disturbed areas.

13th Street Sector (Sector 2)

Sector 2 extends from the New Mexico Avenue and 13th street intersection south down 13th street to approximately 1400 feet south past Igloo Avenue. The southern portion of this sector contains moderately dense populations of Arctostaphylos viridissima, A. rudis, and Ceanothus impressus, none of which will be impacted by the tow road due to their distance from the right-of-way. The northern portion of this section extends from the 13th street intersection to about 800 feet north of Igloo Avenue. There are no special interest species of plants along this path and there is no planned excavation or road widening either.

Burton Mesa Grade Sector (Sector 3)

Sector 3 extends from 4100 feet south past Igloo Avenue to about 400 feet north of Terra Road. Excavation of the grade cut will remove several shrubs mentioned for sector 2 which now occur in the disturbed area atop the present banks adjacent to the grade. About 30 A. viridissima, 5 A. rudis, and 10 C. impressus will be removed. Two plants which appear to be Ceanothus papillosus ssp. roweanus also occur on the area of the proposed cut. No special interest plants occur in the excavation area just north of Terra Road.

Santa Ynez River Valley Sector (Sector 4)

Sector 4 extends from approximately 400 feet north of Terra Road, down 13th street and 800 feet east up Highway 246 of the 13th Street and Highway 246 intersection. No special interest plant species were observed in this sector and there is no planned excavation or road widening.

Miguelito Creek Sector

This sector extends from approximately 800 feet east on Highway 246 of the 13th street and Highway 246 intersection down Highway 246 to about 800 feet north of Spin Road. A small population of Scrophularia atrata occurs on the south side of the grade, just west of the creek underpass. About 15 plants are involved. To mitigate this impact, the road will only be widened on the north side of the grade. Also, significant populations of Dudleya caespitosa and Coreopsis gigantea may be removed if the road is widened at this point. These latter species are not listed as rare or endangered, nor are they endemic to the area.

Surf Sector (Sector 5)

Sector 5 extends south down Coast Road from about 800 feet north of Spin Road to 1500 feet south of Wade Road. The northern portion of this sector passes through stabilized dunes which contain significant populations of Senecio blochmanae, Erigeron foliosus var. blochmanae, and Erysimum suffrutescens var. grandifolium. Maintaining the present road width will preclude disturbance of these populations.

Bear Creek Road Cutoff Sector (Sector 6)

Sector 6 extends from 1500 feet south of Wade Road south on Coast Road to about 2100 feet north of Kelp Road. Excavation of stabilized dune areas immediately adjacent to the right-of-way will destroy about 25 plants of Erysimum, 10 plants of Monardella, and 3 plants of Malacothrix.

SLC-4 and SLC-5 Turnoff (Sector 7)

Sector 7 extends from 2100 feet north of Kelp Road south down Coast Road to 3100 feet south of building 748. Excavation of adjacent dune areas along this sector will destroy approximately 8 Senecio blochmanae, 25 Monardella crispa, 20 Malacothrix incana, and 10 Erysimum suffrutescens var. grandifolium.

SLC-5 Turnoff (Sector 8)

Sector 8 extends from approximately 3100 feet south of building 748 south down Coast Road to a point about 550 feet south of Honda Ridge Road. Excavation of dune areas along the tow road in this sector will remove 14 Senecio blochmanae and 3 Erysimum. More significant, however, is the

removal of about 45 plants of Castilleja mollis. The population along the road is relatively large, reflecting the large population on the adjacent dune system. To mitigate this impact, excavation will be done only on the west side of the road and only 3-5 plants of Castilleja will be destroyed. Additionally, several plants of Chorizanthe californica var. suksdorfii occur with the Castilleja.

SLC-6 Power Plant Sector (Sector 9)

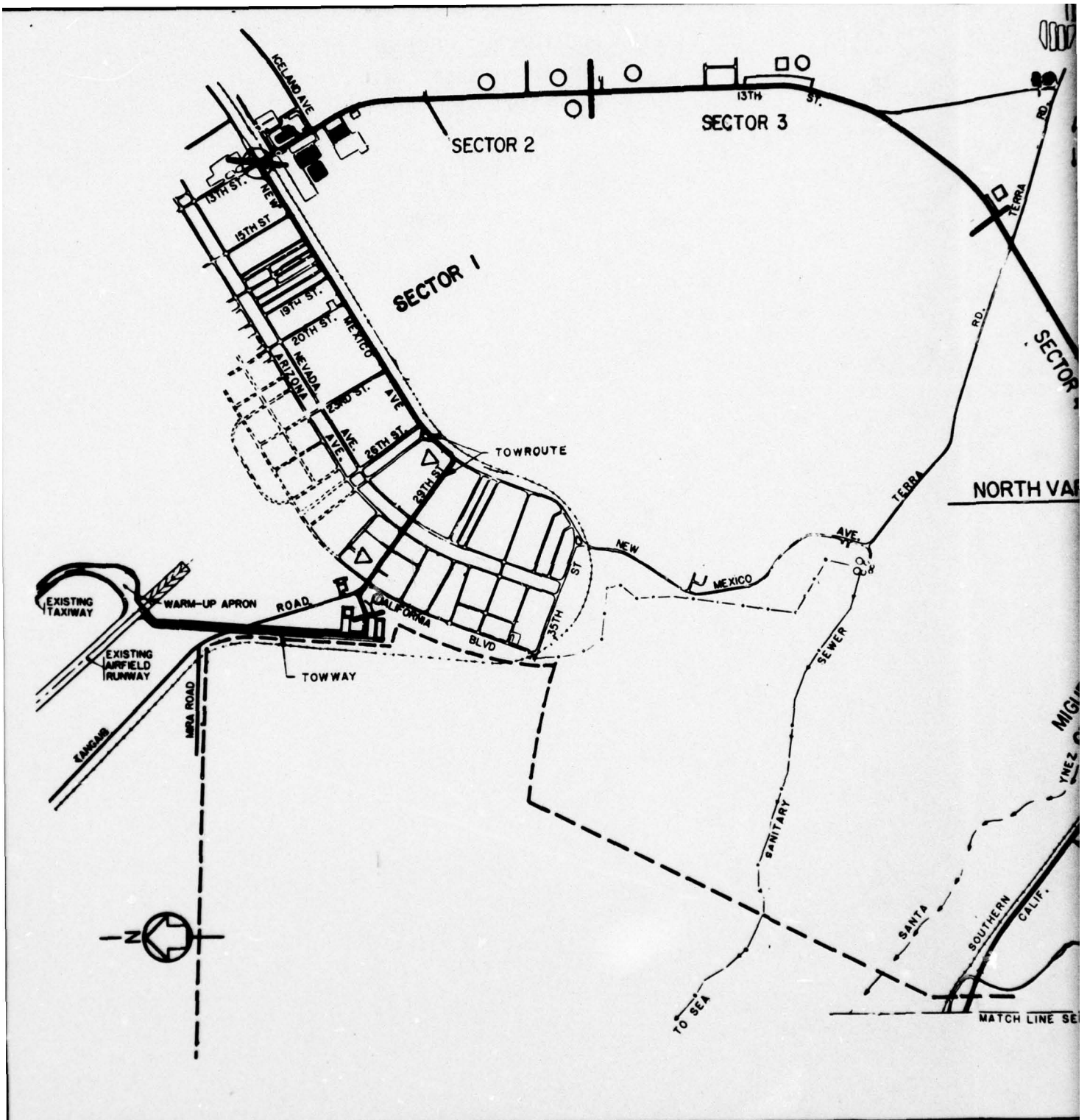
Sector 9 extends from 550 feet south of Honda Ridge Road to a point about 1300 feet north of the SLC-6 turnoff. Cirsium rhotophilum occurs in one location along this sector but will not be affected if the present road width is maintained.

SLC-6 Sector (Sector 10)

Sector 10 extends from approximately 1300 feet north of the SLC-6 turnoff south down Coast Road and east on the SLC-6 turnoff to SLC-6. Only shrubs of Ceanothus impressus occur along the right-of-way in this sector. Past disturbance associated with the present road and railroad seems to have stimulated the species. Several luxuriant Ceanothus shrubs occur on cut and fill slopes adjacent to these routes.

External Tank Tow Road

This tow road extends from the SLC-6 turnoff to the Point Arguello boathouse. A population of about 50 Monardella crispera plants lies in the path of the realignment, just south of the proposed TCF/SF facility. Also a population of several dozen Chorizanthe californica var. suksdorfii occur in the open areas with the Monardella population.



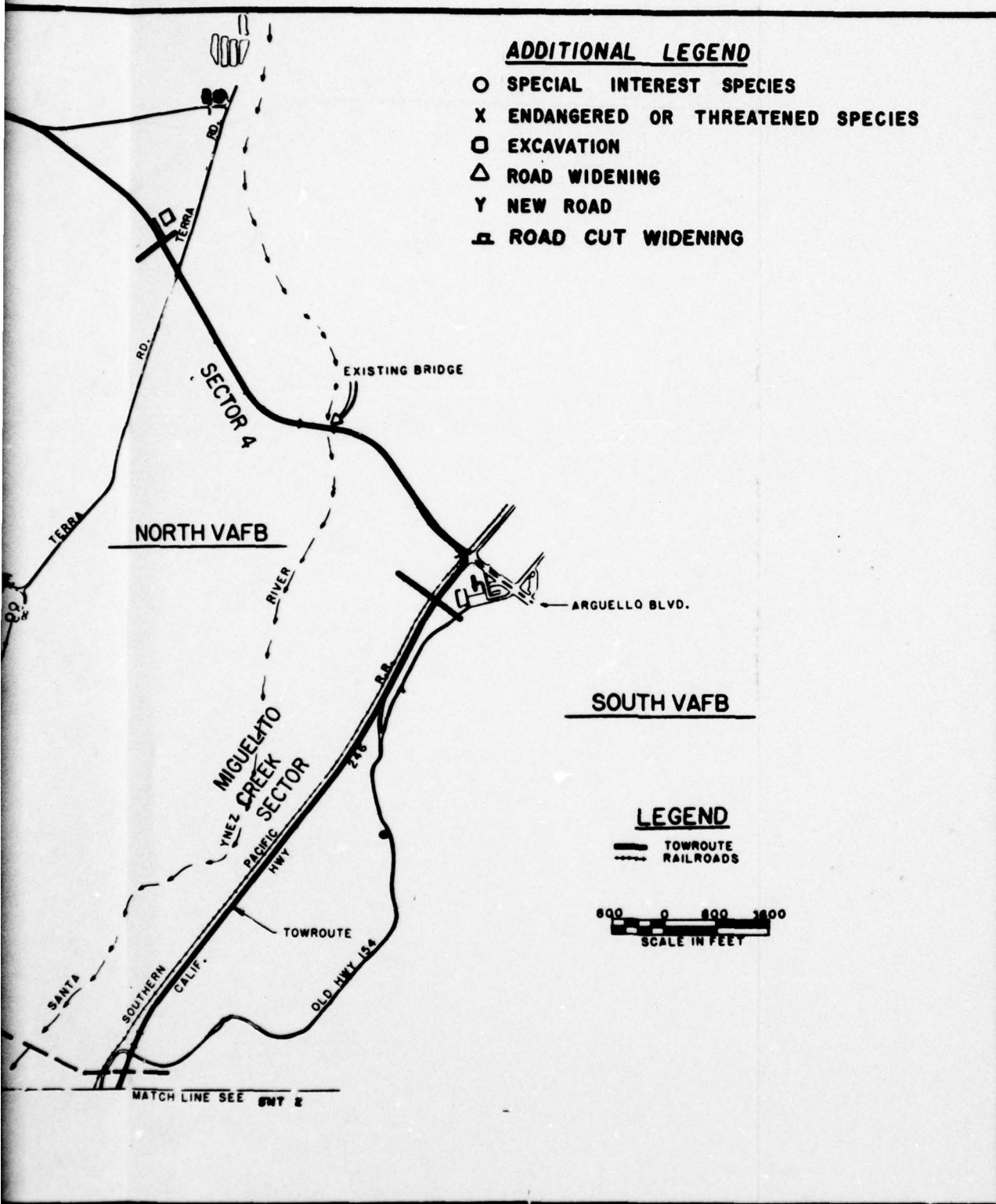
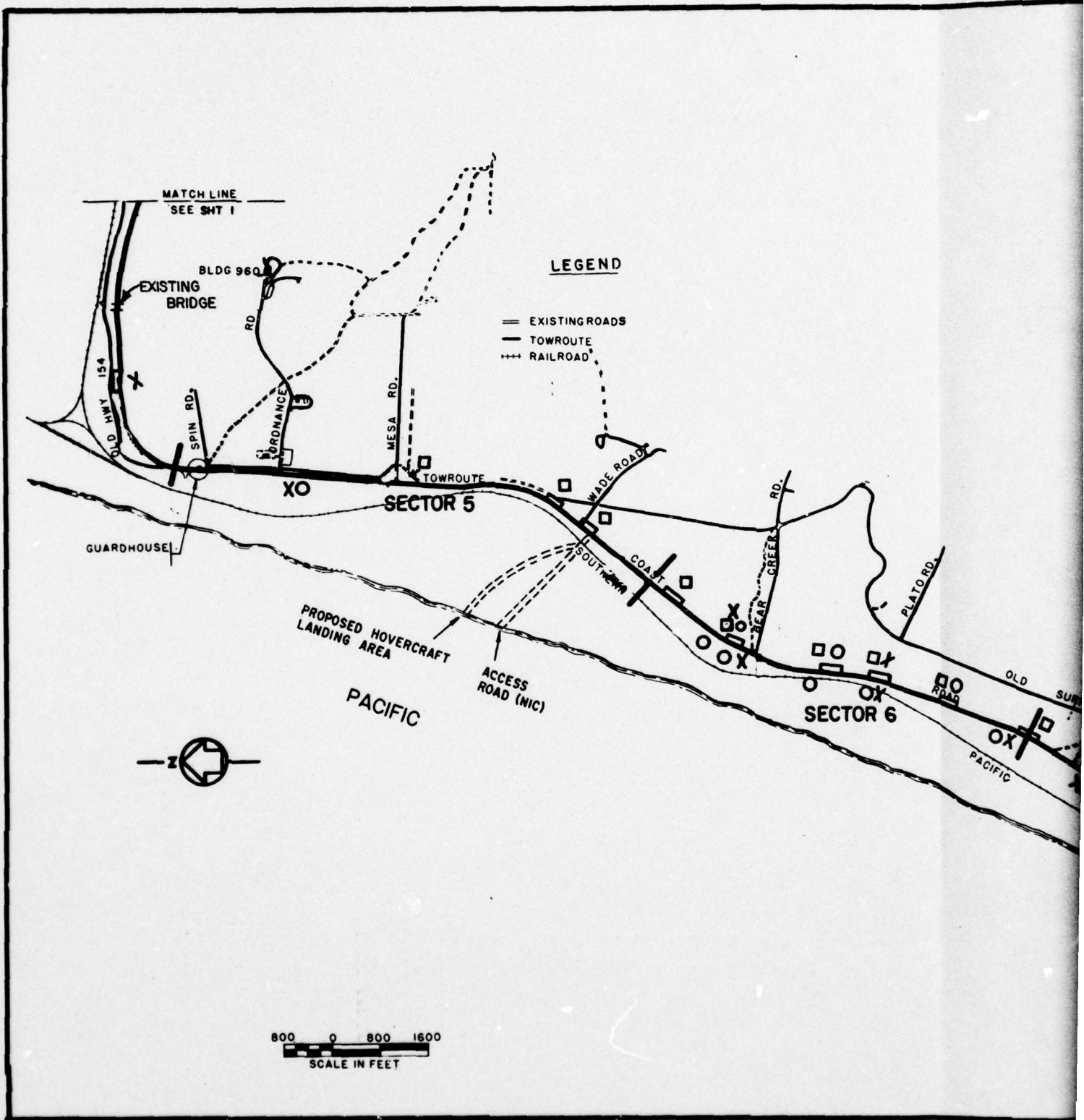
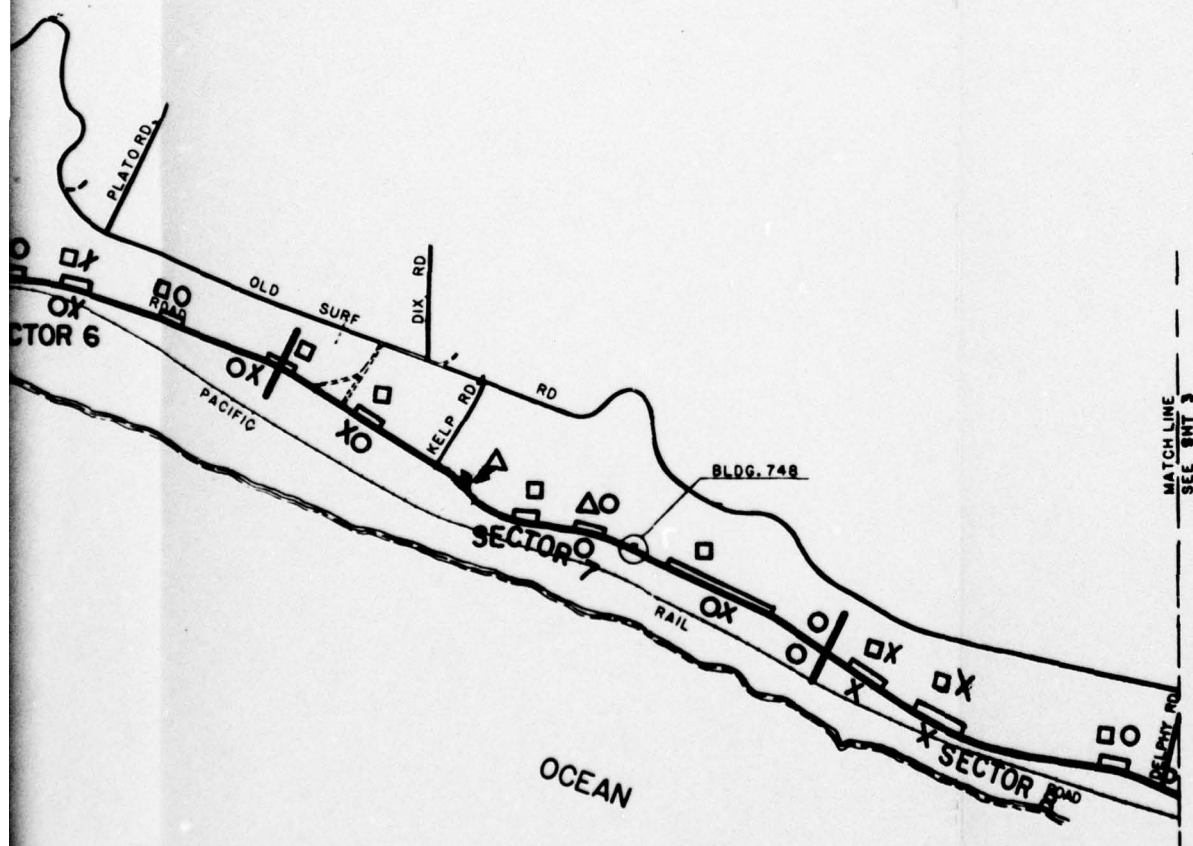
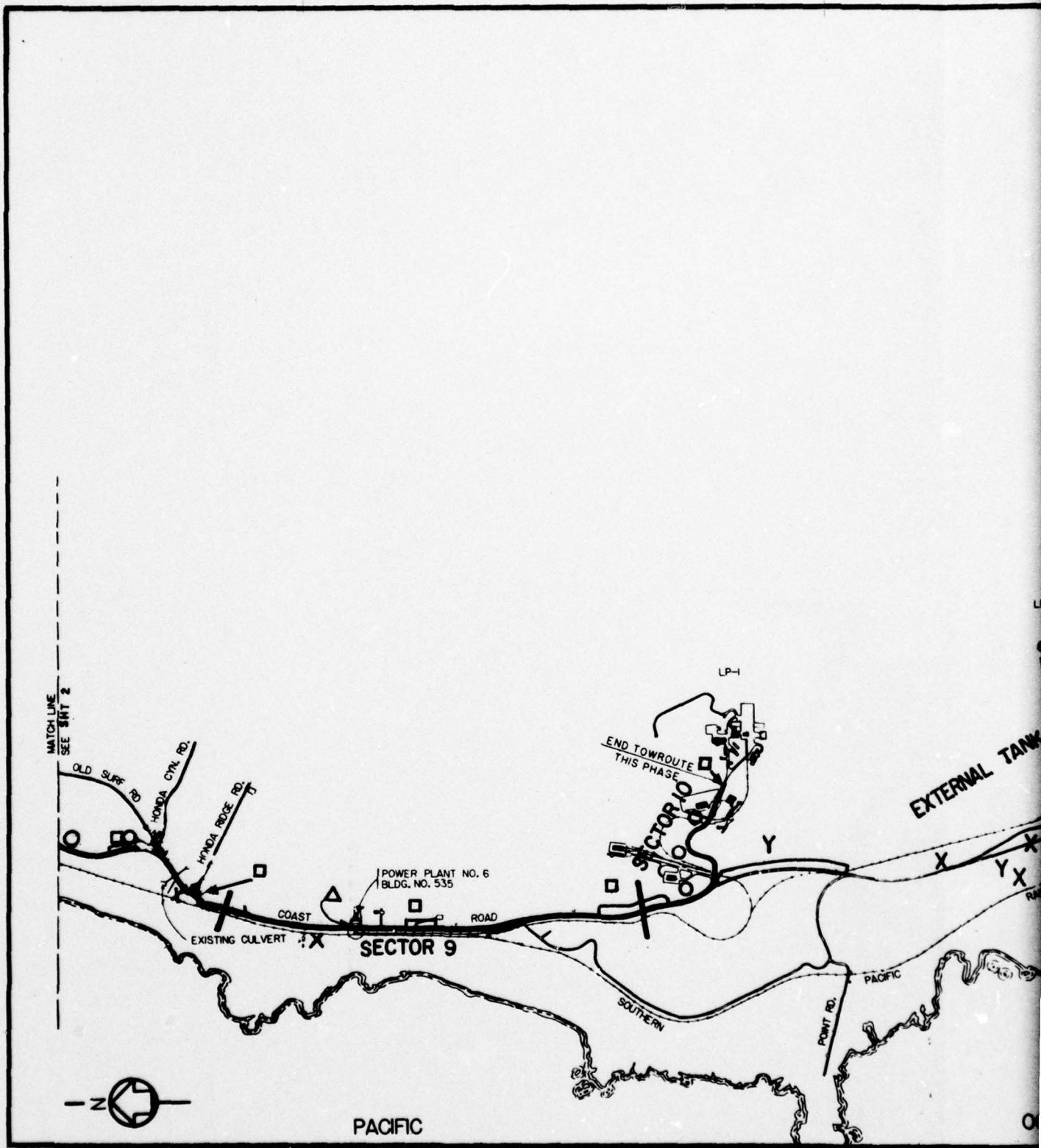


Figure 2. Location of Special Interest Plant Species on or Adjacent to Orbiter Tow Route

2







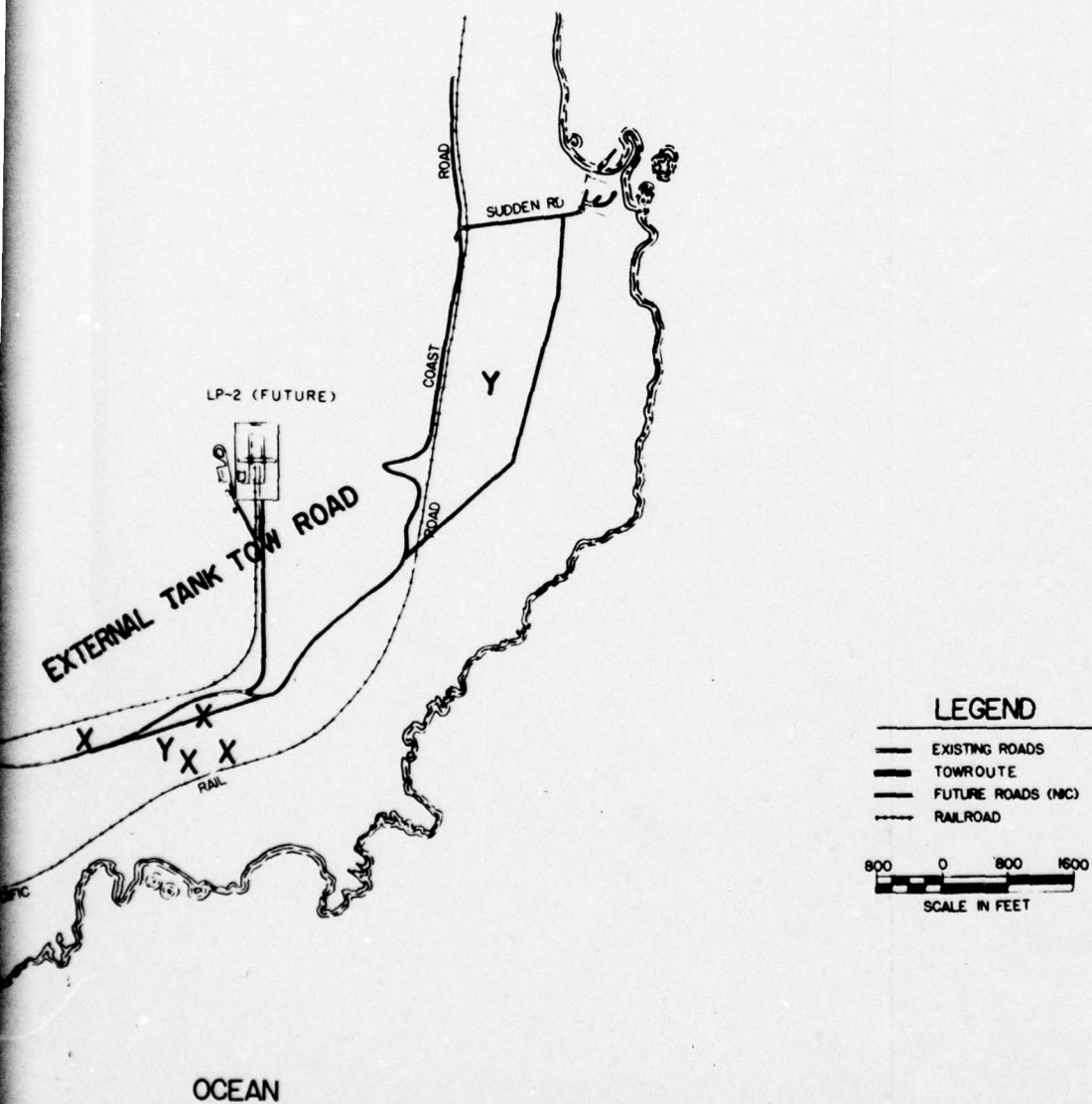


Figure 2. Location of Special Interest Plant Species on or Adjacent to Orbiter Tow Route (Concluded)

SECTION IV

SUMMARY AND CONCLUSIONS

Construction activities in support of the Space Shuttle program will not have an unacceptable impact on Vandenberg AFB plant species that are proposed as threatened or endangered. This action does not jeopardize the continued existence of any of the species in question.

The surf thistle (Cirsium rhotophilum) appears to be quite abundant on Vandenberg in coastal strand. A maximum of five acres of coastal strand would be destroyed if the Wade Road Hovercraft Pad was constructed. This loss of habitat would amount to one-third of one percent of the 1700 acres of coastal strand on Vandenberg AFB. An examination of coastal strand on Vandenberg showed a patchy distribution of Cirsium mostly on the back side of dunes on south Vandenberg. Cirsium, however, on north Vandenberg in the vicinity of Purisima point was very dense and occurred all over the dunes. At least eight stands of over one hundred plants were observed in the limited survey compared with stands of 5-20 plants on south Vandenberg in the coastal strand north of the proposed hovercraft landing area.

Monardella crispera plants will be destroyed in several areas along the tow route and in the proposed External Tank Storage and Checkout Facility area. This species is very abundant on south Vandenberg in the coastal sage scrub-normal phase community. A spot check showed that patches of Monardella crispera were in the area nearby the proposed road realignment in the External Tank Tow Road sector. This is the last sector on the tow road maps. Several hundred plants were seen in stands of 30-40 plants that seem to correspond with previously disturbed areas. This species was also especially abundant along Coast Road south of Honda Ridge Road to Bear Creek Road (Figure 2). Four to 500 plants were observed in separate populations in one dune system adjacent to the road. Monardella crispera was found in many other adjacent dunes with populations of 20-30 plants. We estimate that about 100 plants and their associated areas will be destroyed by construction activity. This will have minimal impact on the total number of plants on the base or their associated habitat. Furthermore, it is likely that the Monardella will re-invade the new road cuts. This means that the reduction in population size stated here may well be a maximum number.

Several construction sites will have impact on Scrophularia atrata. It is rather abundant in a semi-disturbed gulley that will be partially filled by westward extension of the runway. The population occurring on highway 246 east of Miguelito Creek will be protected by cutting only on the north side of the grade to provide proper clearance for the towed orbiter vehicle. It is estimated that only about 14 Scrophularia at the SLC-6 launch pad will be destroyed by construction activity. In relation to its total population on Vandenberg AFB, the impact on this species will be minimal. This species has been found to be abundant in interior canyons on the base (References 6 and 7) and in drainage ways along the Southern Pacific right-of-way.

Castilleja mollis occurs along with Scrophularia atrata in the disturbed gulley to be filled by the westward extension of the runway and also at the SLC-6 Launch Pad. An undetermined number of plants will be destroyed due to construction at both of these locations. A significant number of Castilleja mollis also occur along the tow route on coast road just south of the Honda Ridge road. In this area the road will be cut on the west to give proper orbiter clearance thus saving most of the plants. Only 3-5 plants will be destroyed by this action. There will be very little overall impact on this species since it is abundant in the adjacent dunes in this area. It also occurs along the road in Honda Canyon at many locations.

The endangered species Erigeron foliosus var. blochmanae occurs along the tow route in sector five but will not be impacted by planned tow route construction activity. It has been recorded in this area before as an abundant stand (Reference 6).

All of the above species are associated with communities that are widespread on Vandenberg and are for the most part relatively undisturbed. With the exception of Cirsium rhotophilum and Erigeron foliosus var. blochmanae, however, the other three species tend to flourish in moderately disturbed areas of their habitat. Previous studies conducted by Coulombe and Cooper (Reference 6) indicated observed community associations for these species and calculated the extent of the various communities on Vandenberg. Monardella crispera occurs in coastal sage scrub (stabilized dune phase). This phase comprises about 9,000 acres on Vandenberg. Construction for the space shuttle will impact 46 acres or 0.5% of available habitat. Castilleja mollis is found associated with coastal sage scrub (stabilized dune phase) and to some extent in the coastal strand. Again less than 1.0% of available habitat will be affected.

Scrophularia atrata was observed to be associated with several communities: Oak Woodland, Riparian Woodland, Chaparral, Coastal Sage Scrub (Stabilized Dune). This perennial has been identified as being rather abundant in interior canyons on the base. Numerous small and large canyons exist on Vandenberg, providing an undetermined amount of suitable habitat for this species. Construction activities will impact far less than 1.0% of the suitable habitat for this species also.

As stated before, less than 1/3 of 1.0% of suitable habitat for Cirsium rhotophilum would be affected; therefore, no appreciable impact will occur in this species from removal of suitable habitat for its existence.

In the field survey for special interest species, equal attention was devoted to the 26 species listed in Table 1. However, in the conclusions and mitigative measures, attention is focused on those species that have appeared on federal lists (References 1 and 4). Of these, prime attention is directed, because of their potential legal significance, to the two endangered

species, Cirsium rhotophlium and Erigeron foliosus var. blochmanae (Reference 1). Nevertheless, none of the special interest species not appearing on the federal lists will be significantly impacted. They are generally abundant on Vandenberg and very little of their available habitat will be destroyed by proposed Space Shuttle construction activities.

Mitigative measures will be taken to decrease the impact on endangered and threatened species and plant communities in general. The following mitigative alternatives were established for those situations where impacts were unavoidable.

1. The topsoil for all stationary construction sites will be removed, stockpiled, and put back in place after the construction activity is terminated. This action should allow revegetation of the area to include those threatened species that seem to thrive in disturbed areas of suitable habitat.

2. Areas adjacent to construction sites will be protected by clearly marking the limits of the allowable construction zones and construction light fencing around known locations of endangered or threatened species.

3. Disturbed areas will be reseeded with non-competitive native plant species.

4. No action will be taken where low importance is given to loss of species or habitat.

5. An Environmental Protection Plan (EPP) will be developed and incorporated as part of architectural and engineering specifications. Policies of grading and reseeded with non-competitive native plant species to restore to natural conditions will be incorporated into the EPP.

APPENDIX

SURVEY OF THE BOTANICAL RESOURCES
IN THE SPACE SHUTTLE CONSTRUCTION
ZONE, VANDENBERG AIR FORCE BASE,
CALIFORNIA

by

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SECTION I

STUDY METHODS

Personnel and Survey Methods

A plant survey of proposed Space Shuttle project sites on Vandenberg Air Force Base was conducted during June 6-9 and June 13-16, 1977. R. Mitchel Beauchamp served as the consulting plant taxonomist and Thomas A. Oberbauer acted as vegetation analyst. Both previously gained experience with the special interest plants of the Vandenberg region during the Summer of 1974 and Spring of 1975. This plant survey was coordinated by Dr Paul Zedler of San Diego State University.

Base maps of the project sites were provided by SAMSO/DEV, Los Angeles AFS, Los Angeles CA. Survey results are delimited at the scale of the original SAMSO/DEV maps due to the limitations of the scale of the reduced copies provided by SAMTEC. Both the areas designated on the maps to be studied intensively and those to be studied less intensively were investigated equally.

All sites were surveyed on foot and the tow road was surveyed by car and on foot at specific locations. In each of the major study areas, the vegetation was sampled by means of line intercept, using 30 meter transects. The percent relative cover for each species was then determined from these transect data. The vegetation maps were drawn using 1974 IR photographs at a scale of 1:12000.

Description of Special Interest Areas

The majority of rare and endangered species occur in Chaparral and the Coastal Dune systems.

The Chaparral association on Burton Mesa is composed of several endemic shrubs. This situation is significant in that not only are the species composing the vegetation type endemic and/or rare, but the association of these plants is likewise endemic and unique to this small region of extreme western Santa Barbara County. To simply call the association Chaparral does not adequately expound the unique floristic nature of the vegetation.

The Coastal Dune systems of extreme western Santa Barbara County and San Luis Obispo County are also vegetated by a floristically unique plant cover. Several species in this vegetation association are rather ubiquitous, while some are restricted to the general coastline of Southern California, and others are strictly endemic to the coastline from Point Arguello to Morro Bay.

SECTION II

SPECIAL INTEREST PLANT TAXA

Two listings were used to determine the special interest plant taxa to be evaluated. The proposed listing of Threatened and Endangered plant species by the Smithsonian Institution (Schreiner Reference 3) and proposed listing by the US Fish and Wildlife Service of Endangered plant species (Greenwalt Reference 1) gave those species for which federal agencies will provide protection once enacted under the Endangered Species Act. The listing of the California Native Plant Society (CNPS), which includes species additional to the federal listing also served as a source of plant taxa to be evaluated (Powell Reference 5). The taxa, appearing on one or both listings, were encountered along the proposed tow road or on proposed sites and are given in Table A-1.

***TABLE A-1. SPECIAL INTEREST SPECIES ENCOUNTERED ALONG PROPOSED CONSTRUCTION SITES AND TOW ROAD**

SPECIES	CNPS Listing	CNPS Status	Federal Status	Map Code
<u>Arctostaphylos rudis</u>	R	1 - - -		Ar
<u>Arctostaphylos viridissima</u>	R	1-1-1-3		Av
<u>Castilleja mollis</u>	E	2-2-1-3	T	Cm
<u>Ceanothus impressus</u>	L	0- - -3		Ci
<u>Cirsium rhotophilum</u>	E	2-2-1-3	E	Cr
<u>Erigeron foliosus</u> var. <u>blochmanae</u>	E	1-2-1-3	E	Eb
<u>Erysimum suffrutescens</u> var. <u>lompocense</u>	R	1-1-1-3		Es
<u>Malacothrix incana</u>	R	1- - -		Ms
<u>Monardella crispa</u>	E	1-2-1-3	T	Mc
<u>Scrophularia atrata</u>	E	2-2-1-3	T	Sa
<u>Senecio blochmanae</u>	R	1-1-1-3		Sb

***Explanation:**

CNPS listing:

E = Taxa on "Very Rare and Endangered Plants" List.

R = Taxa on "Rare and Not Endangered Plants (including some of uncertain status)" List.

L = Taxa on "Plants not Rare but Mostly of Limited Distribution" List.

CNPS Status:

Rarity (R)

0. Formerly a rare plant candidate. Not rare but of limited distribution.
1. Rare, of limited distribution, but distributed widely enough that potential for extinction or extirpation is apparently low at present.
2. Occurrence confined to several populations or one extended population.
3. Occurs in such small numbers that it is seldom reported; or occurs in one of very few highly restricted populations.

P.E. Possibly extinct or extirpated.

Endangerment (E)

1. Not endangered.
2. Endangered in part.
3. Totally endangered.

Vigor (V)

1. Stable or increasing.
2. Declining.
3. Approaching extinction or extirpation.

General Distribution (D)

1. Not rare outside California.
2. Rare outside California.
3. Endemic to California.

Federal Proposed Status:

T = Threatened (Reference 4).

E = Endangered (Reference 1).

Additionally several endemic taxa, based upon the current local flora (Smith Reference 10) were included in the monitored listing due to their local distribution on VAFB. These included:

<u>Ceanothus papillosus</u> ssp. <u>roweanus</u>	Cw
<u>Chorizanthe californica</u> var. <u>suksdorfii</u>	Ck
<u>Erysimum suffrutescens</u> var. <u>grandifolium</u>	Eg

Several other rare, threatened, endangered or endemic plant taxa occur in the vicinity of the proposed facilities but were not encountered during the survey. These taxa include:

<u>Argostis hooveri</u>	<u>Cordylanthus maritimus</u> var. <u>maritimus</u>
<u>Amsinckia spectabilis</u> var. <u>microcarpa</u>	<u>Corethrogyne leucophylla</u>
<u>Chorizanthe angustifolia</u>	<u>Dicentra ochroleuca</u>
<u>Cirsium loncholepis</u>	<u>Dichondra donnelliana</u>
<u>Dudleya blochmanae</u> ssp. <u>blochmanae</u>	<u>Juncus falcatus</u>
<u>Eriodictyon capitatum</u>	<u>Monardella undulata</u> ssp. <u>frutescens</u>
<u>Erysimum insulare</u>	<u>Monardella undulata</u> ssp. <u>undulata</u>
<u>Fritillaria biflora</u>	<u>Solanum xantii</u> ssp. <u>hoffmannii</u>

Proposed Facilities

Western Runway Extension - The mesa top area is covered with Chaparral containing significant numbers of Arctostaphylos viridissima, Arctostaphylos rudis and Ceanothus impressus. Several hundred plants of each species are involved. The canyon area of the site has moderate populations of Castilleja mollis, Erysimum suffrutescens var. lompocense and Scrophularia atrata. The Castilleja had a population of about 20 plants; the Erysimum, about 17 plants; and the Scrophularia, over a hundred large plants. All of the populations appeared to be in good health and there were several small plants or seedlings of the Erysimum. See Figure A-1.

Orbiter Processing Area - The vegetation at this proposed facility is the same as that of the mesa portion of the western runway extension, with similar densities of the two Arctostaphylos and the Ceanothus. Involved in the site are about 400 A. viridissima, 80 A. rudis, and 150 C. impressus.

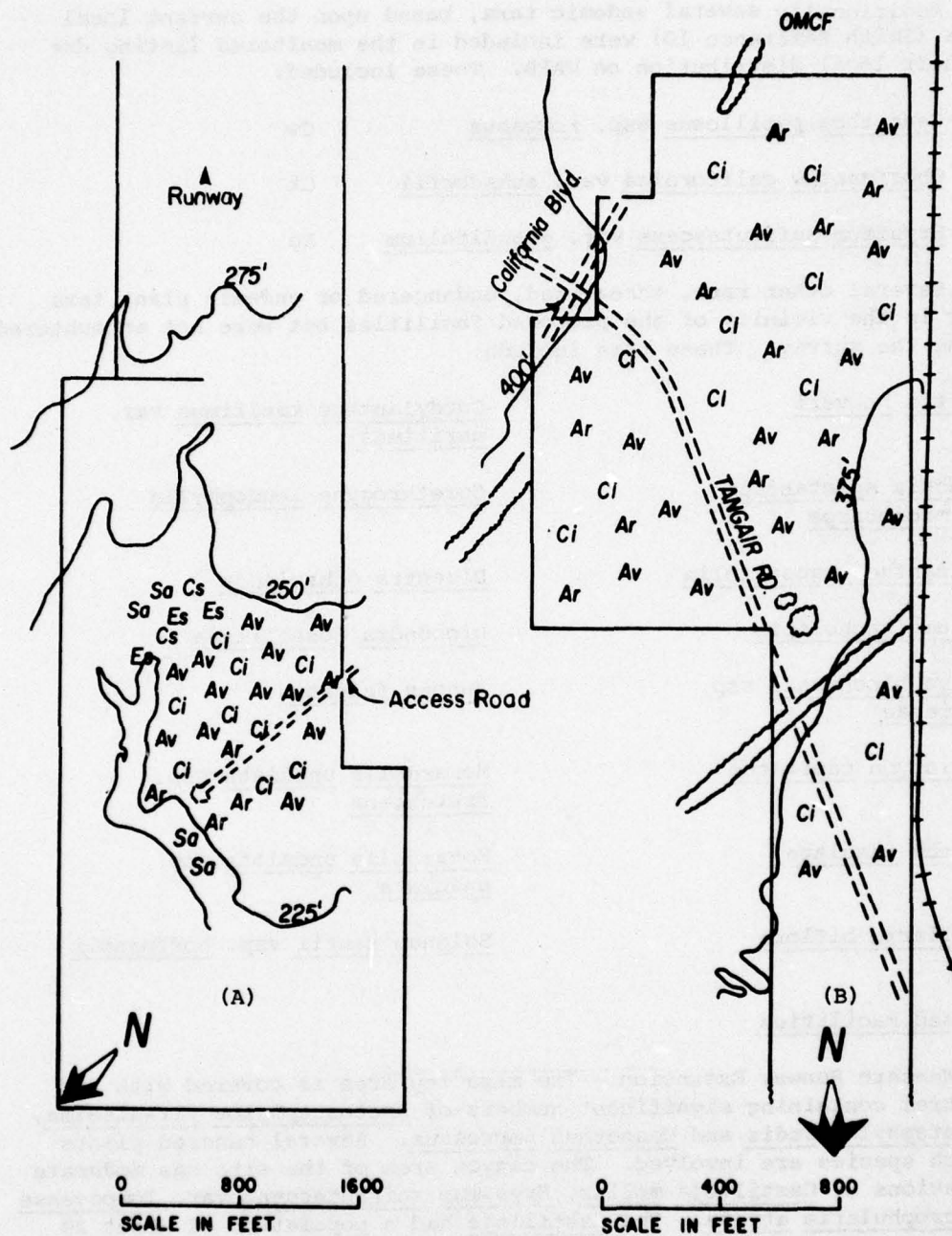


Figure A-1. (A) Western Runway Extension Showing Location of Special Interest Plant Species. (This map is taken from the runway centerline profile map). (B) Orbiter Maintenance and Checkout Facility Showing Location of Special Interest Plant Species.

Hovercraft Pad - The Coastal Dunes of this site have four special interest plant species. Cirsium rhotophilum occurs in the more seaward portion of the dunes. Twelve plants were observed, grouped as two major populations. Several seedling plants occurred in the populations. Malacothrix incana var. succulenta is very infrequent in the more seaward portion of the dunes, with only five plants seen. Erysimum suffrutescens var. grandifolium is abundant in the leeward portion of the stabilized dunes. Over 250 plants occur on the site. Senecio blochmanae occurs in the same habitat as E. suffrutescens var. grandifolium but is less dense. A total of 200 plants of the Senecio were counted. See Figure A-2.

Launch Pad I (SLC-6) - The upper portion of this site has significant numbers of Ceanothus impressus, Arctostaphylos viridissima, A. rudis, Castilleja mollis and Scrophularia atrata. These latter two species occur particularly close to the launch pad and will probably be eliminated. About 14 Castilleja and 14 Scrophularia plants are involved. The rather remote location of the Arctostaphylos and Ceanothus may preclude their elimination. Good stands of Scrophularia occur along the Southern Pacific right-of-way and in the drainage to the west. The herbaceous perennial appears to prefer weedy habitats such as railroad embankments and creek bottoms. See Figures A-3 and A-4.

TCF/SF - This otherwise overgrazed site has a noteworthy population of Monardella crispera in the southwestern portion. About 15 plants occur on the site, per se, however many more occur to the south, along the tow road. See Figure A-5.

Boathouse - No special interest plant species occur at this facility. See Figure A-5.

Tow Road Alignment

OMCF Sector (Sheet 1^a) - The portion of the road to be constructed at the facility will involve several shrubs of Arctostaphylos viridissima, A. rudis, and Ceanothus impressus. The remaining portion of this tow road sector passes through disturbed areas.

13th Street Sector (Sheet 2) - The southern portion of this sector contains moderately dense populations of Arctostaphylos viridissima, A. rudis and Ceanothus impressus, none of which will be impacted by the tow road due to their distance from the right-of-way.

Burton Mesa Grade Sector (Sheet 3) - Excavation of the grade cut will remove several shrubs mentioned for Sheet 2, which now occur in the disturbed area atop the present banks adjacent to the grade. About 30 A. viridissima, 5 A. rudis and 10 C. impressus will be removed. Two plants which appear to be Ceanothus papillosus ssp. roweanus also occur on the area of the proposed cut.

^a Sheet numbers refer to Corps of Engineers transportation tow route maps. These sheet numbers also correspond to the sector numbers on Figure 2.

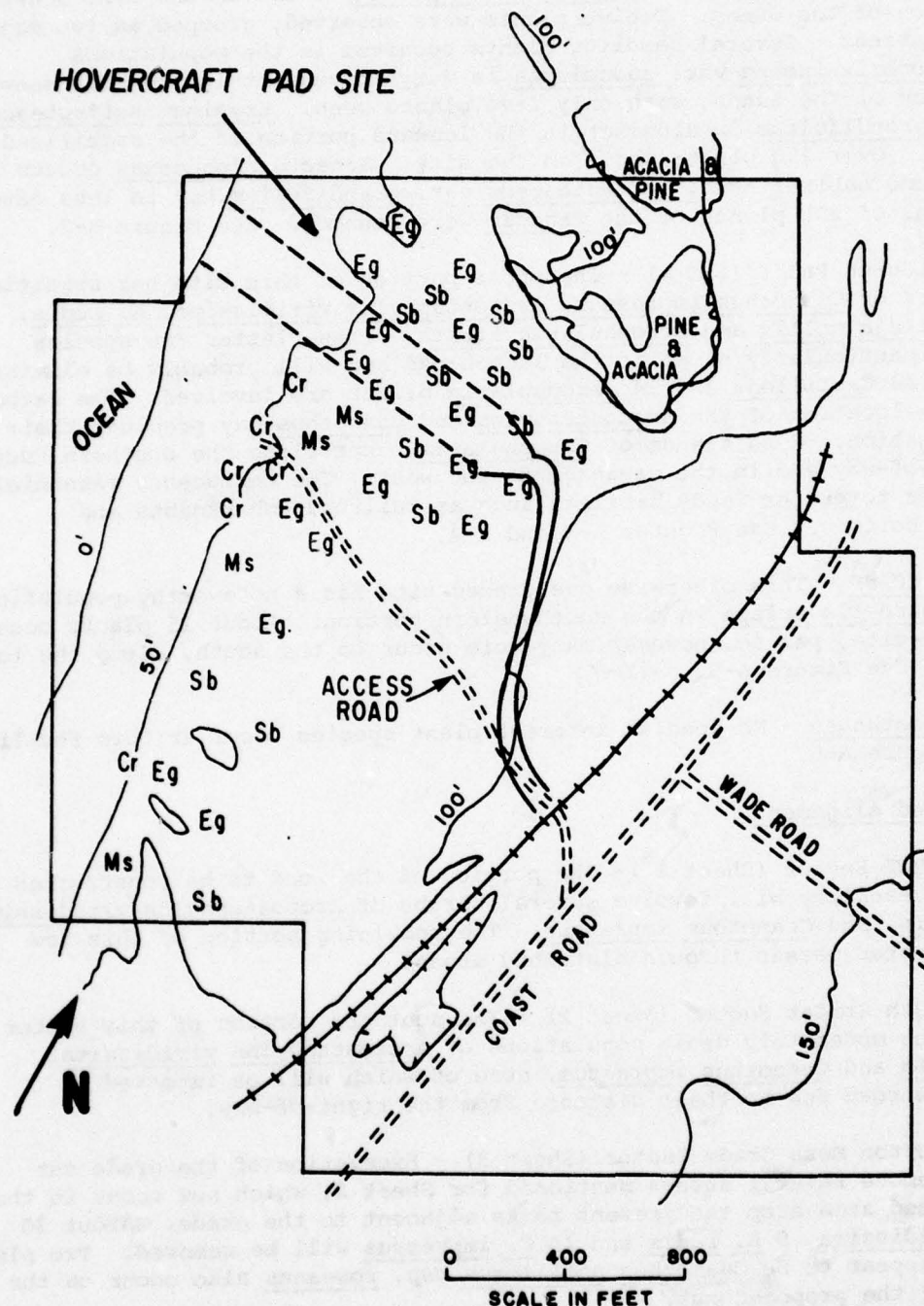


Figure A-2. Hovercraft Site, South of Surf Showing the Location of Special Interest Plant Species. (This map was taken from sheet 44 of the 1974 C-1 series of the Vandenberg AFB Master Plan).

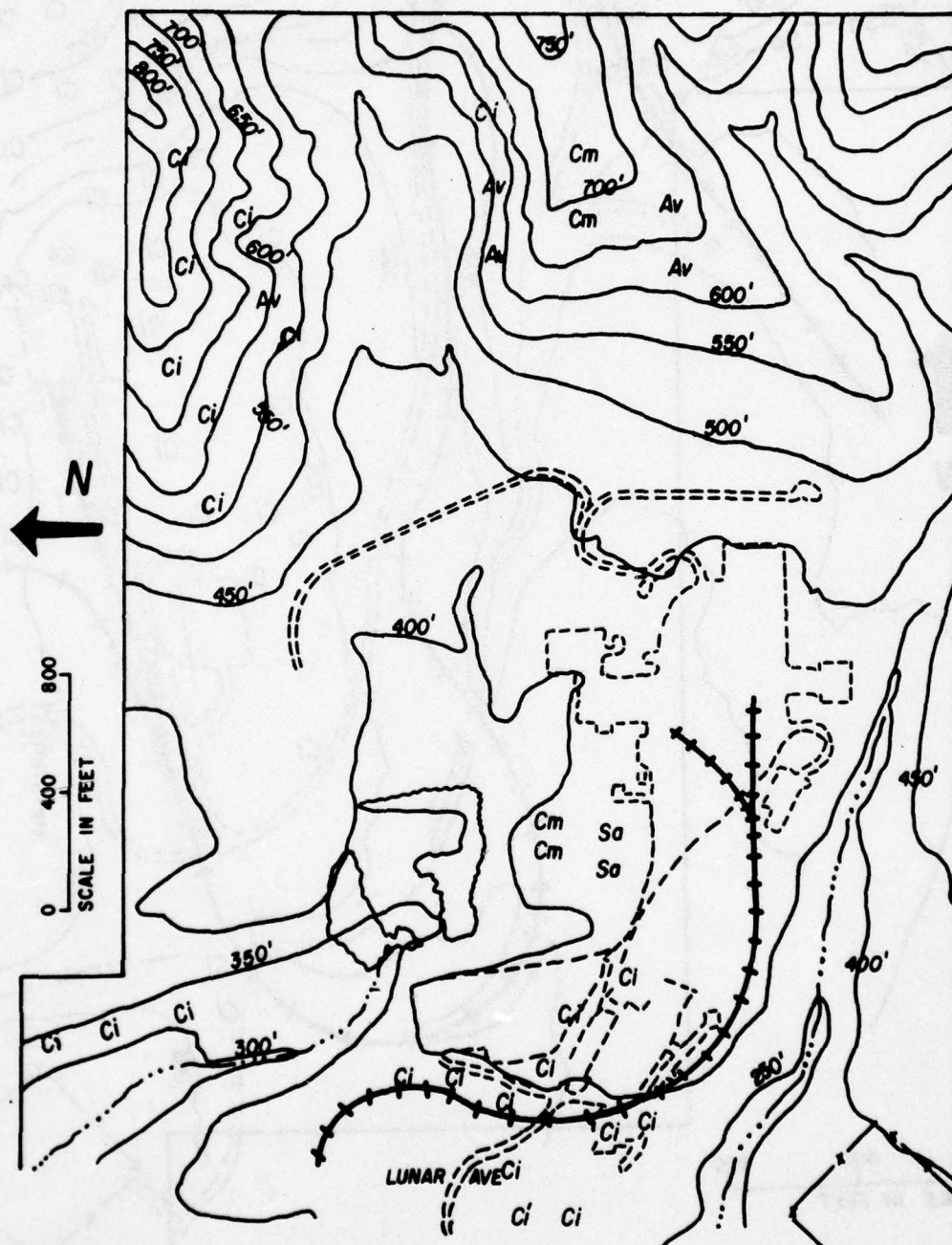


Figure A-3. SLC-6 East Area Showing the Location of Special Interest Plant Species. (This map was taken from sheet 57 of the 1974 C-1 series of the Vandenberg AFB Master Plan).

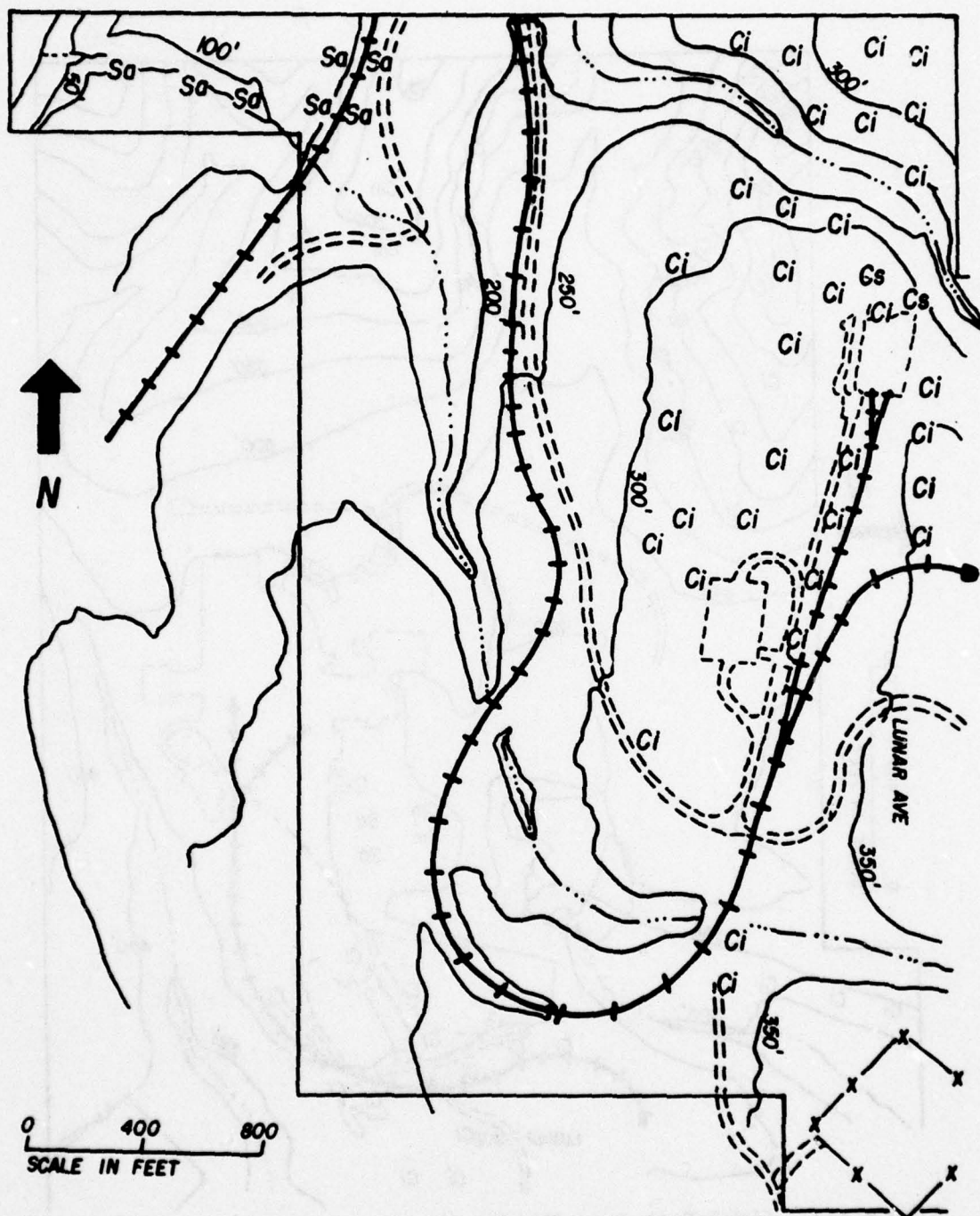


Figure A-4. SLC-6 West Area Showing the Location of Special Interest Plant Species. (This map was taken from sheet 57 of the C-1 series of the Vandenberg AFB Master Plan).

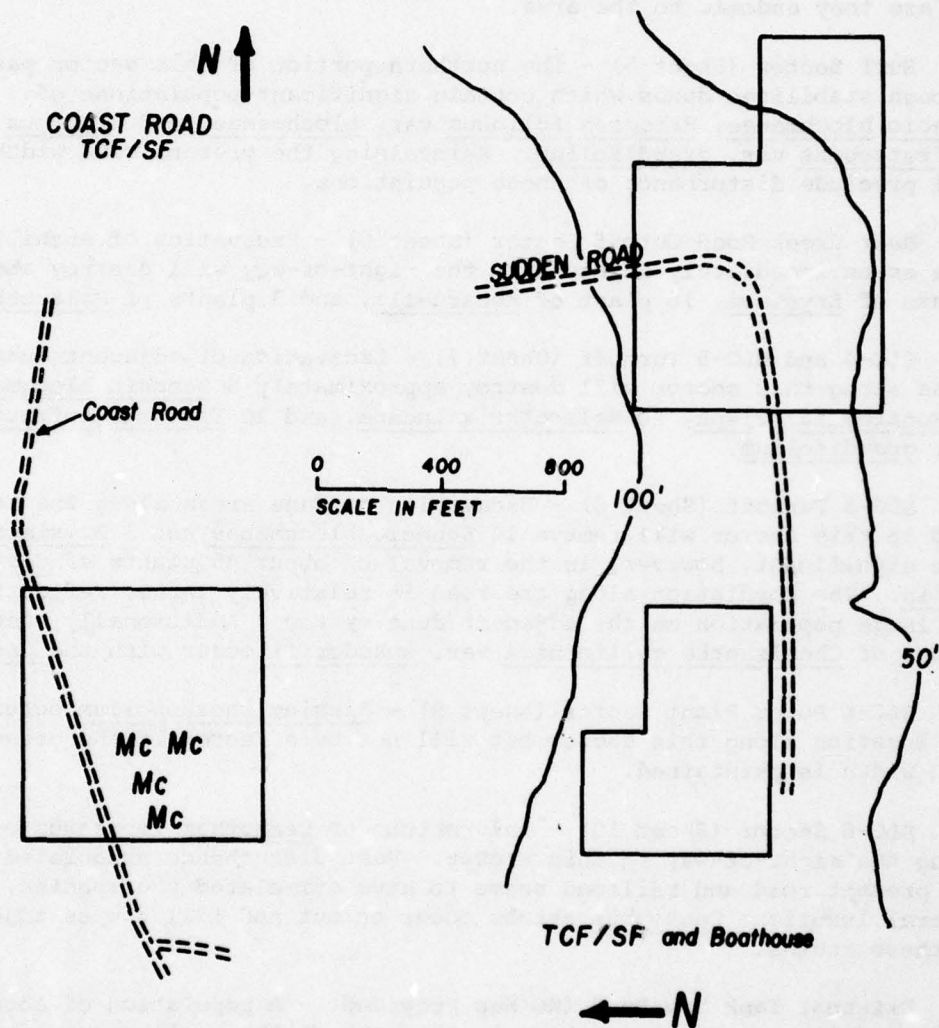


Figure A-5. TCF/SF Alternatives and Boathouse Showing Location of Special Interest Plant Species.

Santa Ynez River Valley Sector (Sheet 4) - No special interest plant species were observed in this sector.

Miguelito Creek Sector - A small population of Scrophularia atrata occurs on the south side of the grade, just west of the creek underpass. About 15 plants are involved. Also significant populations of Dudleya caespitosa and Coreopsis gigantea may be removed if the road is widened at this point. These latter species are not listed as rare or endangered, nor are they endemic to the area.

Surf Sector (Sheet 5) - The northern portion of this sector passes through stabilized dunes which contain significant populations of Senecio blochmanae, Erigeron foliosus var. blochmanae, and Erysimum suffrutescens var. grandifolium. Maintaining the present road width will preclude disturbance of these populations.

Bear Creek Road Cutoff Sector (Sheet 6) - Excavation of stabilized dune areas immediately adjacent to the right-of-way will destroy about 25 plants of Erysimum, 10 plant of Monardella, and 3 plants of Malacothrix.

SLC-4 and SLC-5 Turnoff (Sheet 7) - Excavation of adjacent dune areas along this sector will destroy approximately 8 Senecio blochmanae, 25 Monardella crispera, 20 Malacothrix incana, and 10 Erysimum suffrutescens var. grandifolium.

SLC-5 Turnoff (Sheet 8) - Excavation of dune areas along the tow road in this sector will remove 14 Senecio blochmanae and 3 Erysimum. More significant, however, is the removal of about 45 plants of Castilleja mollis. The population along the road is relatively large, reflecting the large population on the adjacent dune system. Additionally, several plants of Chorizanthe californica var. suksdorfii occur with the Castilleja.

SLC-6 Power Plant Sector (Sheet 9) - Cirsium rhothophilum occurs in one location along this sector but will not be affected if the present road width is maintained.

SLC-6 Sector (Sheet 10) - Only shrubs of Ceanothus impressus occur along the right-of-way in this sector. Past disturbance associated with the present road and railroad seems to have stimulated the species. Several luxuriant Ceanothus shrubs occur on cut and fill slopes adjacent to these routes.

External Tank Tow Road (No Map Provided) - A population of about 50 Monardella crispera plants lies in the path of the realignment, just south of the TCF/SF facility. Use of the present roadway or realignment of the route 75 feet to the west would avoid destruction of the population. Also a population of several dozen Chorizanthe californica var. suksdorfii occurs in the open areas with the Monardella population.

SECTION III

VEGETATION

Hovercraft Pad Site

The Hovercraft Pad site lies approximately 1 mile south of Surf in the sand adapted vegetation zone. Within the Hovercraft Pad site, three vegetation community types, Coastal strand, Coastal sage scrub-stabilized dune phase, and Coastal sage scrub-normal phase, have been identified and mapped (See Figure A-6). Of these three community types, Coastal strand and the Coastal sage scrub-stabilized dune phase contain the most significant plant species. The major part of the site is, however, covered with Coastal sage scrub-normal phase (See table A-2).

TABLE A-2. PERCENTAGE OF THE HOVERCRAFT PAD SITE COVERED BY THE VEGETATION COMMUNITIES

Community Type	Percent of site covered by each
Coastal strand	2.5
Coastal sage scrub-stabilized dune phase	19.5
Coastal sage scrub-normal phase	46.3
Disturbed grassland	28.0
Acacia and Pine plantings	3.2

The Disturbed grassland refers to areas that were originally covered with Coastal sage scrub-normal phase but have been altered to a grassy, weedy state through past disturbance. The most common species present are introductions of Mediterranean origin including Erodium cicutarium, Avena fatua, Bromus diandrus, Bromus rubens and Medicago polymorpha.

The results of the transect data are presented in Table A-3. The transect through Coastal strand encompasses a stand of Cirsium rathophilum. Because the transect is entirely contained within a Cirsium rathophilum stand, the 14.3 percent cover represents a maximum amount of relative cover for this species. The Cirsium rathophilum was confined to only the back side of the first row of dunes and does not represent the entire Coastal strand community.

The calculated density for Cirsium rathophilum is between 1 and 1.8 individuals per square meter.

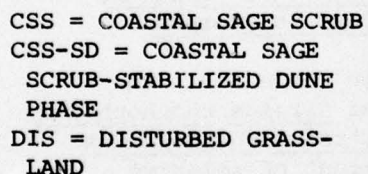


Figure A-6. Hovercraft Landing Area Showing the Vegetation Community Types. (This map was taken from sheet 44 of the 1974 C-1 series of the Vandenberg AFB Master Plan).

TABLE A-3. PERCENT RELATIVE COVER FOR SPECIES IN
THE HOVERCRAFT PAD AREA

Coastal sage scrub-normal phase

Species	Relative Percent Cover
<u>Haplopappus ericoides</u>	75.7
<u>Artemisia californica</u>	15.7
<u>Lotus scoparius</u>	3.7
<u>Cuscuta</u> ssp.	4.2
Unvegetated soil	11.5

Coastal sage scrub-stabilized dune phase

Species	Relative Percent Cover
<u>Herrea elongata</u>	17.7
<u>Carpobrotus edulis</u>	13.5
<u>Astragalus nuttallii</u>	11.5
<u>Haplopappus venetus</u> var. <u>sedoides</u>	3.6
<u>Dudleya caespitosa</u>	3.4
<u>Croton californicus</u>	3.3
<u>Coreopsis gigantea</u>	2.8
<u>Eschscholzia californica</u> var. <u>maritima</u>	2.2
<u>Corethrogyne filaginifolia</u> var. <u>robusta</u>	2.0
<u>Camissonia cheiranthifolia</u>	2.0
<u>Haplopappus ericoides</u>	1.7
<u>Abronia latifolia</u>	1.3
<u>Calystegia macrostegia</u> ssp. <u>cyclostegia</u>	0.6
Unvegetated soil	42.6

Coastal strand

Species	Relative Percent Cover
<u>Carpobrotus edulis</u>	25.4
<u>Calystegia soldonella</u>	16.0
<u>Cirsium rathophilum</u>	14.3
<u>Ambrosia chamissonis</u> ssp. <u>bipinnatisecta</u>	12.9
<u>Cakile maritima</u>	6.3
<u>Abronia maritima</u>	6.3
<u>Abronia latifolia</u>	4.7
<u>Eriogonum parvifolium</u>	3.8
<u>Eriophyllum staechadifolium</u> var. <u>artemisiaefolium</u>	3.2
<u>Astragalus nuttallii</u>	2.1
<u>Cuscuta</u> ssp.	2.0
<u>Dudleya caespitosa</u>	0.5
<u>Malacothrix incana</u> var. <u>succulenta</u>	0.3
Unvegetated soil	27.2

Orbiter Processing Site

The vegetation of the Orbiter processing area is predominantly a broad leaf form of Chaparral. This Chaparral is particularly of interest because some of the dominant species are plants that are rare or of limited distribution. These include such plants as Arctostaphylos viridissima, Arctostaphylos rudis, and Ceanothus impressus. In addition, in some portions of this site, the presence of Eryngium armatum and Carex pansa indicate that the area contains vernal formations. However, due to the time of year, no other vernal pool associated species were found.

Part of the Orbiter processing area has been cleared of woody vegetation, leaving mostly non-native herbaceous species. There have also been Eucalyptus and Monterey pine trees planted in the area, with the pines regenerating adventively. Table A-4 lists the percentages of the study site covered by each of the vegetation community types; Figure A-7 illustrates the distribution of the vegetation.

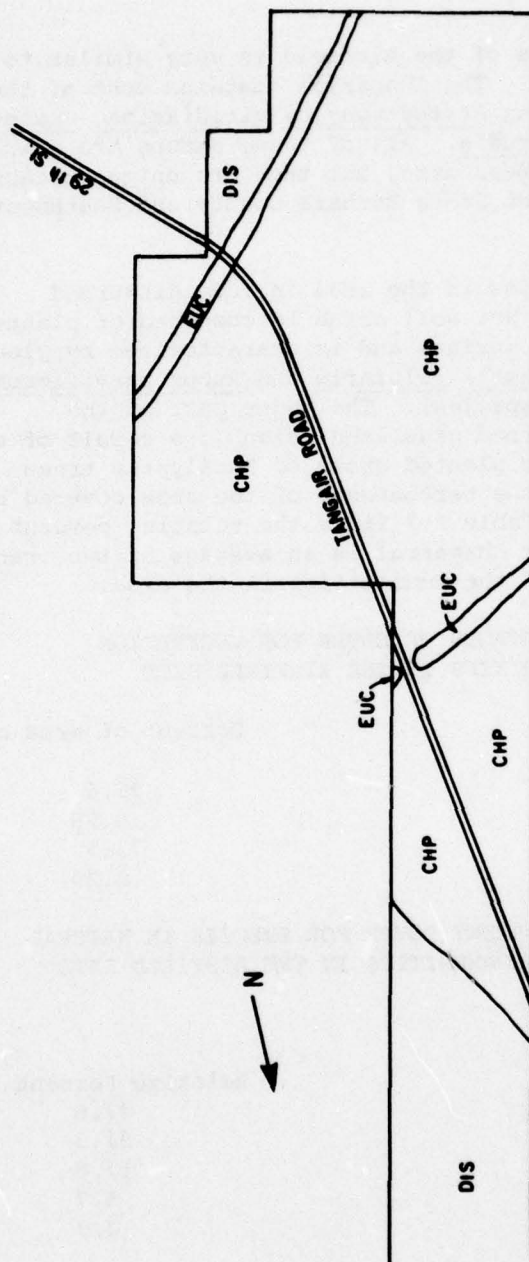
TABLE A-4. PERCENTAGES OF THE ORBITER PROCESSING AREA COVERED BY VEGETATION COMMUNITIES

Community Type	Percent of site covered
Chaparral	73.5
Eucalyptus trees	3.2
Disturbed grassland	23.2

Table A-5 presents the average percent cover for species from two transects in the relatively undisturbed Chaparral of the Orbiter site.

TABLE A-5. SPECIES COVER IN CHAPARRAL OF THE ORBITER PROCESSING SITE

Species	Relative Percent Cover
<u>Arctostaphylos viridissima</u>	57.4
<u>Adenostoma fasciculatum</u>	21.9
<u>Arctostaphylos rudis</u>	7.6
<u>Salvia mellifera</u>	7.2
<u>Toxicodendron diversilobum</u>	6.1
<u>Ceanothus ramulosus</u>	3.5
<u>Stipa pulchra</u>	2.0
<u>Ceanothus impressus</u>	1.1
<u>Juncus patens</u>	0.6
<u>Rhamnus californicus</u>	0.5
<u>Diplacus lompocensis</u>	0.4
<u>Eriophyllum confertiflorum</u>	0.11
<u>Baccharis pilularis</u>	0.03



CHP = CHAPARRAL
 EUC = EUCALYPTUS TREES
 DIS = DISTURBED GRASSLAND

0 400 800
 SCALE IN FEET

Figure A-7. Orbiter Processing Area Showing the Vegetational Communities.

It should also be mentioned that Eriodictyon capitatum occurs about a quarter mile south of this site, on slightly disturbed soil. Eriodictyon capitatum is proposed as endangered by the US Department of Interior.

Airfield

The vegetation in the area of the Airfield is very similar to that of the Orbiter processing area. The Chaparral contains most of the same species of shrubs including Arctostaphylos viridissima, Ceanothus impressus, and Arctostaphylos rudis. All of these shrubs are fairly common over the entire Burton Mesa area, but they are unique because they are restricted to Northwest Santa Barbara County and Southwestern San Luis Obispo County.

Other vegetation communities in the area include disturbed grassland and wet soil scrub. Wet soil scrub is composed of plants requiring water below the soil surface and is characterized by plants such as Rosa californica, Baccharis pilularis and Rubus parviflorus (See table A-7 for additional species). The major part of the Airfield is covered with Disturbed grassland which is a result of shrub removal. There is also a large planted grove of Eucalyptus trees in the area. Table A-6 lists the percentages of the area covered by each of the vegetation groupings. Table A-7 lists the relative percent cover for each species. The data for Chaparral is an average of two transects. See Figure A-8 for locations of the communities in the area.

TABLE A-6. PERCENTAGES OF COVER FOR VEGETATION COMMUNITIES IN THE AIRFIELD SITE

Community Type	Percent of area covered
Chaparral	25.6
Wet soil scrub	0.55
Disturbed grassland	73.5
Eucalyptus	0.29

TABLE A-7. RELATIVE PERCENT COVER FOR SPECIES IN NATURAL VEGETATION COMMUNITIES IN THE AIRFIELD SITE

Chaparral

Species	Relative Percent Cover
<u>Arctostaphylos viridissima</u>	47.6
<u>Arctostaphylos rudis</u>	21.3
<u>Ceanothus ramulosus</u>	17.8
<u>Haplopappus ericoides</u>	5.7
<u>Ceanothus impressus</u>	3.9

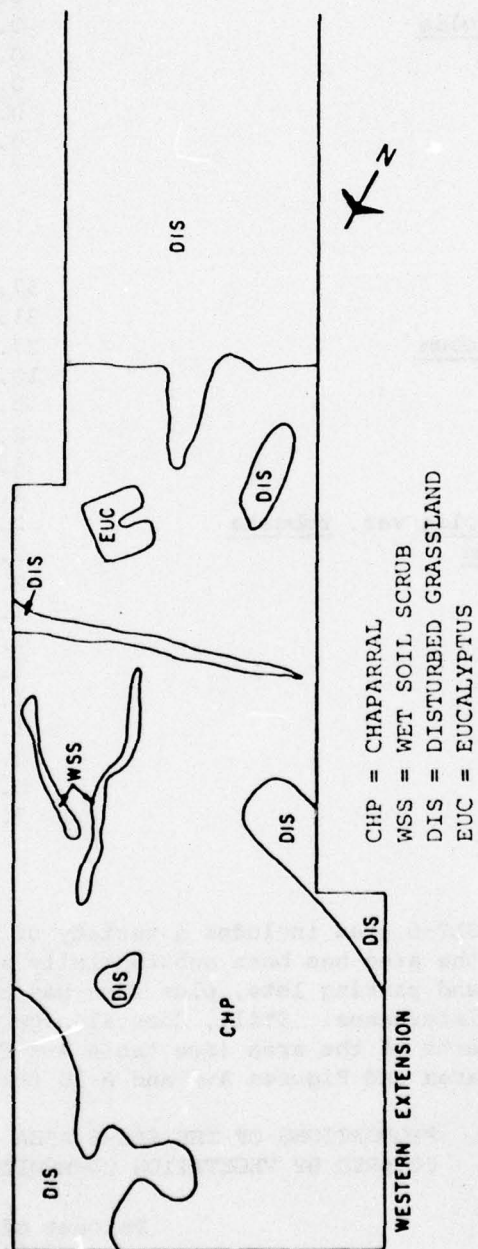


Figure A-8. Airfield Area Showing Vegetational Communities. (This map was taken from the runway centerline profile map).

Species	Relative Percent Cover
<u>Eriophyllum confertiflorum</u>	2.4
<u>Adenostoma fasciculatum</u>	1.3
<u>Solidago</u> ssp.	0.6
<u>Corethrogyne filaginifolia</u>	0.25
<u>Helianthemum scoparium</u>	0.2
<u>Baccharis pilularis</u>	0.2
<u>Lotus scoparius</u>	0.16
<u>Carex</u> ssp.	0.05

Wet soil scrub

Species	
<u>Baccharis pilularis</u>	57.1
<u>Rosa californica</u>	31.4
<u>Toxicodendron diversilobum</u>	27.0
<u>Horkelia cuneata</u>	10.7
<u>Rubus ursinus</u>	9.0
<u>Sonchus asper</u>	8.3
<u>Astragalus nuttallii</u>	6.5
<u>Eriogonum</u> ssp.	3.7
<u>Corethrogyne filaginifolia</u> var. <u>robusta</u>	2.9
<u>Gnaphalium ramosissimum</u>	2.8
<u>Erodium cicutarium</u>	2.5
<u>Conyza canadensis</u>	1.8
<u>Eriogonum parvifolium</u>	1.2
<u>Haplopappus ericoides</u>	1.2
<u>Artemisia californica</u>	1.0
<u>Anagallis arvensis</u>	1.0
<u>Bromus diandrus</u>	0.5
<u>Avena fatua</u>	0.4
Unvegetated soil	7.6

SLC-6 Area

The vegetation of the SLC-6 area includes a variety of community types. A large portion of the area has been substantially altered through the placement of buildings and parking lots, plus some has been altered to grassland through past disturbance. Still, Coastal sage scrub-normal phase and Chaparral cover parts of the area (See table A-8 for proportions of vegetation cover in the area and Figures A-9 and A-10 for a map of the area).

TABLE A-8. PROPORTIONS OF THE SLC-6 AREA
COVERED BY VEGETATION COMMUNITIES

Community Type	Percent of area covered
Chaparral	19.2
Coastal sage scrub	41.3
Disturbed grassland	27.2
Manmade facilities	11.7
Eucalyptus	0.6

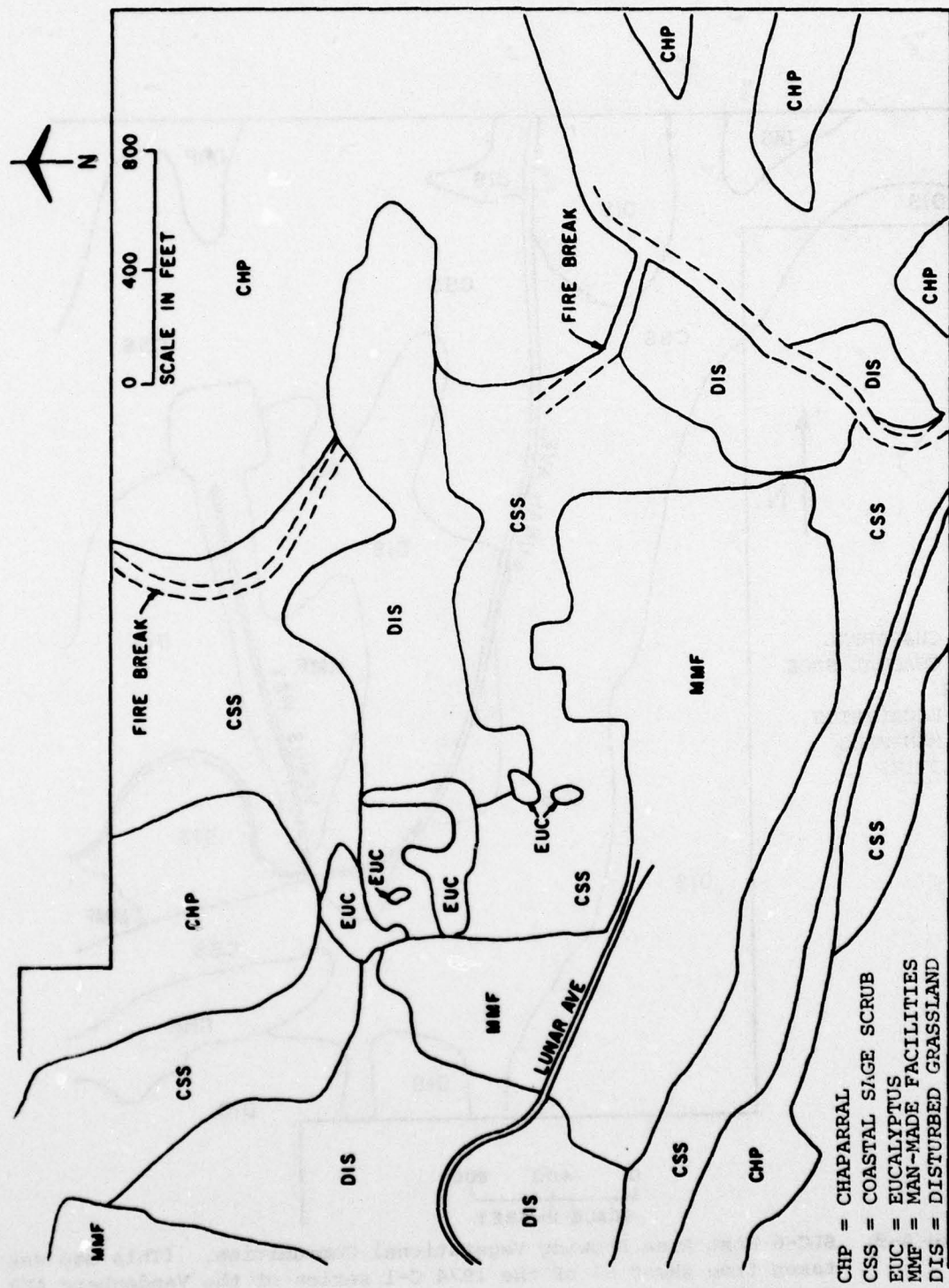


Figure A-10. SLC-6 East Area Showing Vegetational Communities. (This map was taken from sheet 57 of the 1974 C-1 series of the Vandenberg AFB Master Plan).

Table A-9 presents relative cover for plant species in the SLC-6 area. The first transect was taken through a Coastal sage scrub area while the second was taken in an area that was disturbed but is apparently being recovered with a mixture of Coastal sage scrub and Ceanothus impressus.

TABLE A-9. RELATIVE PERCENT COVER FOR SPECIES IN A
TRANSECT FROM THE AREA AROUND SLC-6

Coastal sage scrub

Species	Relative Percent Cover
<u>Artemisia californica</u>	84.0
<u>Baccharis pilularis</u>	73.3
<u>Salvia spathacea</u>	27.0
<u>Gnaphalium ramosissimum</u>	3.3
<u>Anagallis arvensis</u>	3.0
<u>Sanicula crassicaulis</u>	1.3
<u>Scrophularia atrata</u>	0.3

Transect near Venus Way in disturbed area

Species	
<u>Artemisia californica</u>	30.3
<u>Erodium botrys</u>	30.2
<u>Ceanothus impressus</u>	23.2
<u>Baccharis pilularis</u>	16.3
<u>Haplopappus venetus</u> var. <u>sedoides</u>	14.2
<u>Haplopappus ericoides</u>	6.2
<u>Lotus scoparius</u>	3.3
<u>Cardionema ramosissimum</u>	2.0
<u>Atriplex semibaccata</u>	0.5
Unvegetated soil	4.8

The Chaparral on the lower slopes northwest of Venus Way contains species such as Ceanothus impressus, Rhamnus californicus, and Diplacus lompocensis while the Chaparral on the higher slopes in the lower portion of Red-roof Canyon, east of SLC-6 is composed of Adenostoma fasciculatum, Quercus wislezenii, Vaccinium ovatum, Arctostaphylos viridissima, Arctostaphylos rudis and Dudleya farinosa.

Castilleja mollis was found near the top of the ridge to the east of the complex and in small numbers near the Eucalyptus groves. The Scrophularia atrata in the transect was the only one found outside of the gully to the south of the SLC facility.

TCF/SF and Boathouse Area

The vegetation along the Coast Road from the Sudden Ranch gate to the Boathouse is mostly Coastal sage scrub-normal phase with various levels of disturbance. The three proposed facility pad areas are all in areas that consist mostly of weedy, non-native plants (See Figures A-11 and

DIS = DISTURBED
GRASSLAND
CHP = CHAPARRAL
CSS = COASTAL
SAGE SCRUB

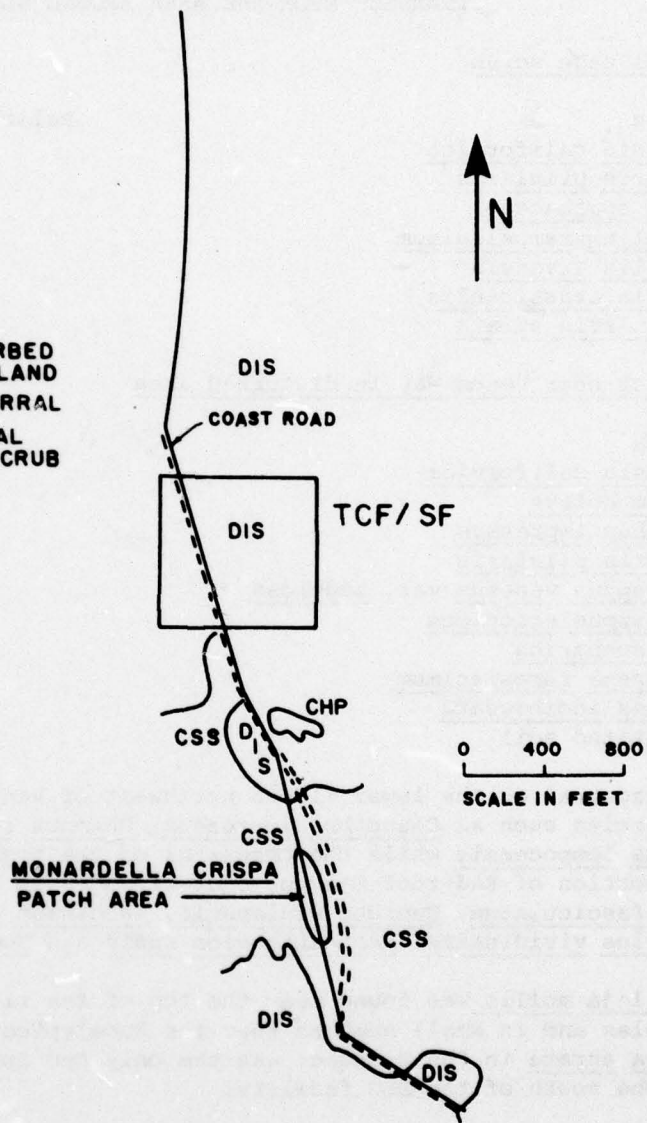


Figure A-11. TCF/SF and External Tank Tow Road Showing Vegetational Communities.

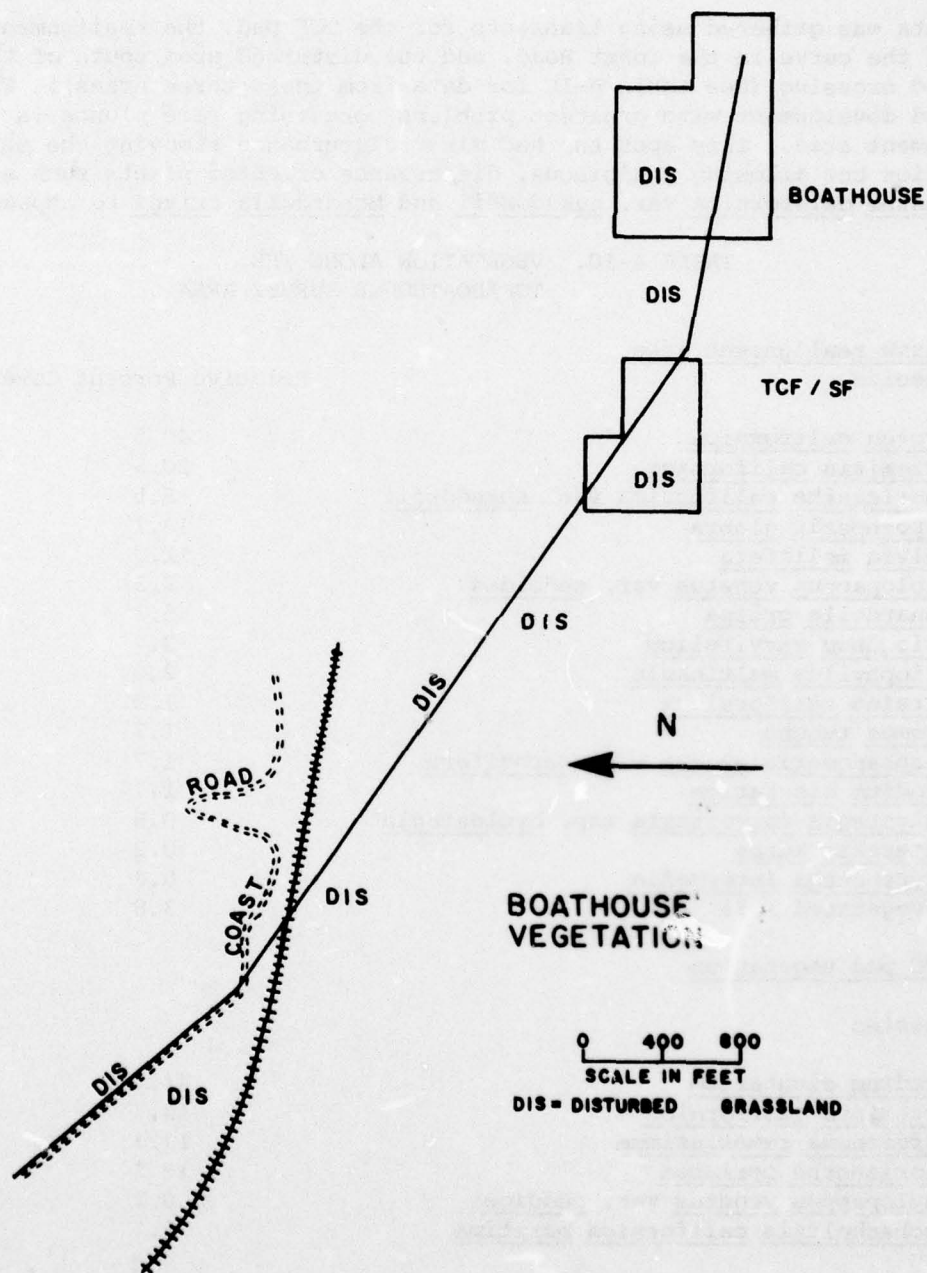


Figure A-12. Boathouse Area Showing Vegetational Communities.

A-12). However, some native herbaceous plants produce showy displays in the less heavily grazed areas here. Also, Monardella crispera occurs in some of the more lightly disturbed areas, particularly the TCF pad and the curve realignment of the Coast Road.

Data was gathered using transects for the TCF pad, the realignment area of the curve in the Coast Road, and the disturbed area south of the railroad crossing (See table A-10 for data from these three areas). The proposed development with greatest problems concerning rare plants is the realignment area. This spot has had minor disturbance removing the shrub vegetation but allowing indigenous, disturbance oriented plants such as Chorizanthe californica var. suksdorfii and Monardella crispera to appear.

TABLE A-10. VEGETATION ALONG THE
TCF/BOATHOUSE SURVEY AREA

<u>Curve realignment area</u>	
Species	Relative Percent Cover
<u>Croton californica</u>	40.5
<u>Artemisia californica</u>	20.5
<u>Chorizanthe californica</u> var. <u>suksdorfii</u>	18.5
<u>Hypochoeris glabra</u>	13.1
<u>Salvia mellifera</u>	11.0
<u>Haplopappus venetus</u> var. <u>sedoides</u>	8.3
<u>Monardella crispera</u>	5.3
<u>Eriogonum parvifolium</u>	3.7
<u>Eriophyllum multicaule</u>	2.0
<u>Cirsium californicum</u>	1.8
<u>Bromus rubens</u>	1.7
<u>Stephanomeria exigua</u> ssp. <u>carotifera</u>	1.7
<u>Erodium cicutarium</u>	1.2
<u>Calystegia macrostegia</u> ssp. <u>cyclostegia</u>	0.8
<u>Lamarckia aurea</u>	0.2
<u>Cryptantha intermedia</u>	0.2
Unvegetated soil	3.8
 <u>TFC pad vegetation</u>	
Species	
<u>Erodium cicutarium</u>	44.2
<u>Artemisia californica</u>	13.7
<u>Cardionema ramosissimum</u>	12.3
<u>Chorizanthe coriacea</u>	10.3
<u>Haplopappus venetus</u> var. <u>sedoides</u>	8.2
<u>Eschscholtzia californica</u> <u>maritima</u>	5.5

Species	Relative Percent Cover
<u>Hypochoeris glabra</u>	4.2
<u>Croton californica</u>	3.0
<u>Erodium botrys</u>	2.2
<u>Bromus diandrus</u>	0.67
<u>Carex ssp.</u>	0.67
<u>Bromus mollis</u>	0.5
<u>Vulpia octoflora</u>	0.33
<u>Cirsium californicum</u>	0.3
Unvegetated soil	6.3

Boathouse area vegetation

Species	Relative Percent Cover
<u>Centaurea melitensis</u>	69.5
<u>Bromus diandrus</u>	63.5
<u>Brassica geniculata</u>	14.5
<u>Erodium cicutarium</u>	5.2
<u>Sonchus asper</u>	3.8
<u>Medicago polymorpha</u>	2.7
<u>Hordeum leporinum</u>	1.3
<u>Bromus rubens</u>	0.5
<u>Chenopodium murale</u>	0.3
<u>Capsella bursa pastoris</u>	0.3
Unvegetated soil	6.2

As can be seen from the data in table A-10, the Boathouse area contains few native plants. The transect data presented for this area demonstrates an extreme condition of grazing. The TCF pad, however, has not been disturbed to this condition yet.

Tow Road Alterations

The major modifications to occur on the tow road path from the cantonment area to SLC-6 will involve widening existing road cuts. Several of these cuts do contain rare and endangered plant species. But, it should be understood that these plants are inhabiting areas that were disturbed when producing the current cut areas.

One excavation site to widen a road cut that would affect rare and endangered plants occurs north of Honda Canyon and south of the SLC-4 turnoff. The data presented in the first part of Table A-11 was collected from the top of the ridge west of the road. In the area, Castilleja mollis makes up 1.3% of the vegetative cover. The percent cover for this species may be higher on the actual face of the road cut. Other than the high concentration of Castilleja mollis, this transect is representative of many of the other areas to be disturbed along the Coast Road Tow way.

TABLE A-11

TOW ROAD EXCAVATION VEGETATION DATA

Castilleja mollis road cut

Species	Relative Percent Cover
<u>Corethrogyne filaginifolia robusta</u>	23.5
<u>Haplopappus ericoides</u>	19.5
<u>Carpobrotus edulis</u>	14.3
<u>Lotus scoparius</u>	5.6
<u>Eriogonum parvifolium</u>	4.9
<u>Dudleya caespitosa</u>	4.7
<u>Lupinus chamissonis</u>	3.2
<u>Croton californicum</u>	3.0
<u>Coreopsis gigantea</u>	2.2
<u>Castilleja mollis</u>	1.3
<u>Cuscuta ssp.</u>	1.2
<u>Gnaphalium ramosissimum</u>	1.0
<u>Cardionema ramosissimum</u>	0.83
<u>Ammophila</u>	0.33

Santa Ynez Valley Burton Mesa road cut on 13th st

Species	
<u>Arctostaphylos viridissima</u>	40.9
<u>Adenostoma fasciculatum</u>	17.7
<u>Ceanothus spp. (See text)</u>	2.7
<u>Helianthemum scoparius</u>	2.5
<u>Artemisia californicus</u>	1.7
<u>Lotus junceus</u>	0.77
<u>Ceanothus ramulosus</u>	0.3
Unvegetated soil	35.0

Apparently roadcuts through dune vegetation does not seriously harm the populations of rare dune-adapted plants. This is probably due to the adaptations to survive on a changing substrate. Planting of non-native dune stabilants may prevent these rare plants from reinvading the clear surface.

Table A-11 also represents data collected from the upper mesa portion along the road cut on Burton Mesa grade. Though this area has been somewhat disturbed, the vegetation, like most of that on Burton Mesa, contains species unique to the area. One Ceanothus type that was found here represents what appears to be a form of the Tranquillon Mountain ceanothus, Ceanothus papillosus var. roweanus. It apparently represents a relict population of this shrub.

The tow road passes through Chaparral and disturbed areas in the region around the cantonment portion of the base. In the southern part of the base, the major vegetation type along the entire length of the tow road is Coastal sage scrub-stabilized dune phase plus Coastal sage scrub-normal

phase in a few locations. For a vegetation map of the tow road, please refer to the vegetation map overlays of Vandenberg Air Force Base Master Plan Maps, drawn in 1974-75 by Thomas Oberbauer. Copies of these vegetation maps should be available at Vandenberg AFB and at SAMSO.

General Biological Impacts

A compilation of the numbers of the various species expected to be destroyed by the proposed facilities is given on Table A-12. At the various sites, however, a general prediction of impacts can be made. Destruction of native vegetation in the western runway extension and OMCf site will allow the invasion of non-native, weedy species. Already the entire runway perimeter is covered by Veldt Grass, Ehrharta calycina, which will further invade the western area once it is modified.

Destruction of dune habitat may allow wind erosion of the unprotected features, such as at the Hovercraft Pads. Widening roads in the stabilized dunes will expose these cuts to wind erosion. Because of their adaptation to unstable conditions, several of the endemic species such as Monardella crispera, Malacothrix incana, and Senecio blochmanae will reinvade the cuts eventually. The immediate stabilization of the cuts and fills in the dune areas should avoid the planting of species which would compete with the reinvansion by adapted native species.

TABLE A-12. COMPILATION OF INDIVIDUALS TO BE
DESTROYED BY PROPOSED FACILITIES

Facility	Plant Taxa												
	Ar	Av	Ci	Ck	Cm	Cr	Cw	Eg	Es	Mc	Ms	Sa	Sb
W Rwy Ext	500	2000	800		20				17			100	
OMCF	80	400	200										
Hvrcft						12		250			5		200
SLC-6			100		14							14	
TCF/SF										15			
Boat Hse													
Sheet 1 cf OMCf													
Sheet 2													
Sheet 3	5	30	5				2						
Sheet 4													
Miglito												15	
Sheet 5													
Sheet 6								25	10	3			
Sheet 7								10	25	20			8
Sheet 8				12	45			3					14
Sheet 9													
Sheet 10			10										
	Ar	Av	Ci	Ck	Cm	Cr	Cw	Eg	Es	Mc	Ms	Sa	Sb
	585	2430	1115	12	79	12	2	288	17	50	28	129	222

Recommendations to Reduce Biological Impacts

In general, to reduce biological impacts of the various construction projects for the Space Shuttle implementation, we recommend the following actions.

1. The Boathouse area should be chosen over the Surf site for the Hovercraft facility.
2. All heavy equipment should be restricted to areas of alignment widening, especially in the Chaparral and Dune areas.
3. Fresh dune cuts should be stabilized, if necessary, with a burlap blanket and with planting of Acacia trees. Avoid planting *Ammophila* grass or other exotic species. Indigenous species could be hydroseeded onto the areas if necessary.
4. Wherever possible remove topsoil (4-6 inches) and stockpile to be placed back into the disturbed areas.
5. Considerations should be given to making special interest species available for botanical preserves or collectors if such groups are interested.

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