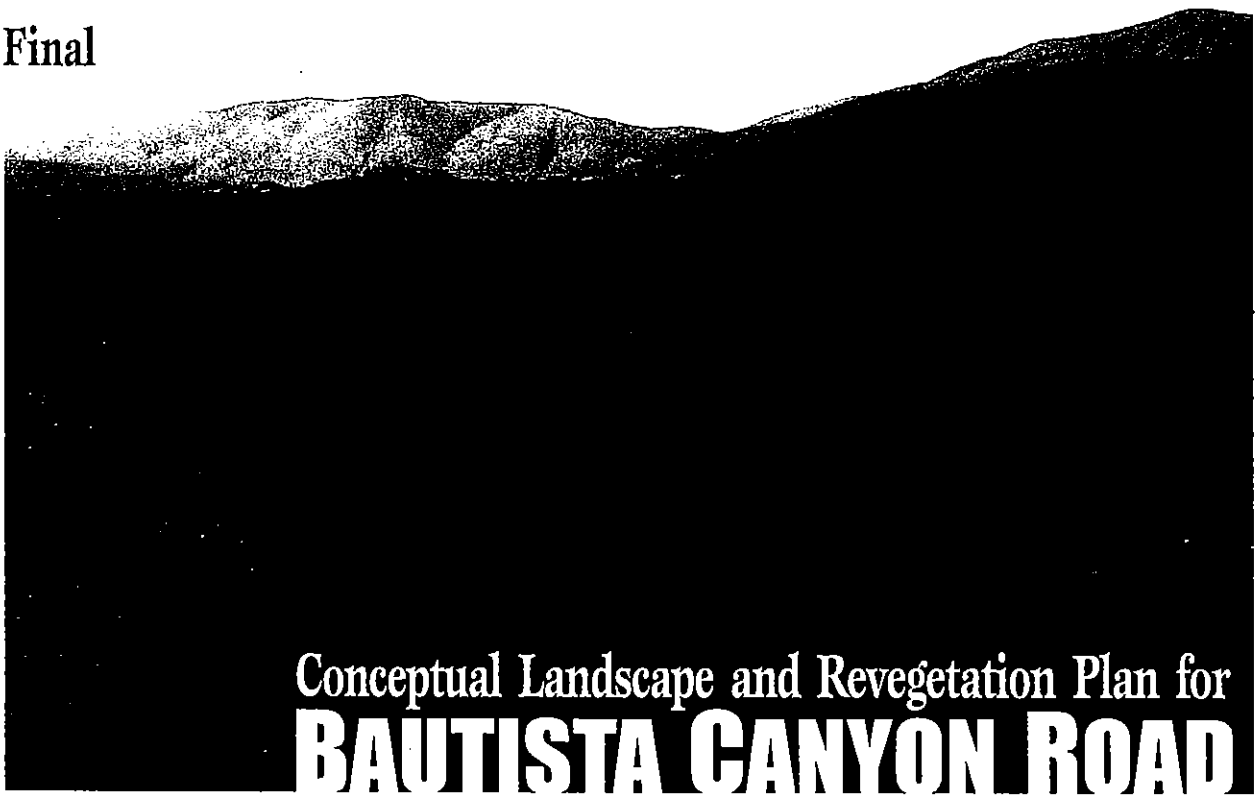
Appendix F

Conceptual Landscape and Revegetation Plan

Final



Conceptual Landscape and Revegetation Plan for BAUTISTA CANYON ROAD Riverside County, California

Submitted to:

Federal Highway Administration (FHWA)
Central Federal Lands Highway Division (CFLHD)
Contract No. DTFH68-01-D-00005
Task Order Number DTFH68-02-T-00002

February 2003

Submitted by:

Science Applications International Corporation
An Employee-Owned Company

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EXECUTIVE SUMMARY

The Federal Highway Administration (FHWA), Central Federal Lands Highway Division (CFLHD), together with the San Bernardino National Forest (SBNF), California Department of Transportation (Caltrans) and the Riverside County Transportation Department are proposing the reconstruction and paving of a 13.2 km (8.2 mile) portion of California Forest Highway 224. The reconstruction of the roadway requires considerable grading involving substantial cut and fill and straightening many of the sharp curves on the existing roadway.

This Conceptual Landscape and Revegetation Plan provides general mitigation concepts for impacts associated with habitat loss, erosion, and aesthetics due to roadway reconstruction. These mitigation measures will be included in the Environmental Impact Statement (EIS)/ Environmental Impact Report (EIR) being prepared for the project. Further refinement of the measures will be made during the design phase of the project if the project is approved.

Three alternative alignments, the 40 kilometer per hour (km/h) (~25 mph), the 55 km/h (~35 mph) alignment and the combination 55-40-55 km/h (35-25-35 mph) alignments are being considered. The combination alignment is the alternative this plan is based on because it encompasses portions of each of the other alternatives. Each alternative includes a two-span bridge over Bautista Creek.

Any alternative that reconstructs the route will result in the loss of chaparral vegetation, big sagebrush scrub, and some riparian woodlands and marsh. Habitat of federally listed wildlife species including the arroyo toad and the southwestern willow flycatcher may also be impacted. This habitat loss includes loss of formerly designated Critical Habitat for the arroyo toad in the northern portion of the alignment.

As part of the method to develop revegetation strategies appropriate for the project site, field studies were conducted to assess the existing vegetation. All areas to be revegetated occur within one of the following eight native plant communities: bigberry manzanita chaparral, chamise chaparral, coastal sage-chaparral scrub, southern mixed chaparral, redshank chaparral, big sagebrush scrub, southern cottonwood-willow riparian forest, and southern willow scrub.

General revegetation methods were outlined, including site preparation, seed and plant materials, monitoring and maintenance, irrigation, and development of performance criteria. Revegetation strategies were developed for the chaparral, big sage brush scrub, and riparian communities. It is proposed that use of container plants or cuttings requiring irrigation be limited to revegetation of riparian areas and other sensitive areas. Many of the cut slopes in the central portion of the alignment will be too steep to successfully revegetate. Methods such as rock staining will be used were appropriate to lessen any aesthetic impacts.

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1.0 INTRODUCTION

This section provides the following:

- The purpose, scope, and a brief project description of the project
- Anticipated biological impact
- A description of the organization of this plan.

1.1 PURPOSE, SCOPE AND PROJECT DESCRPTION

The Federal Highway Administration (FHWA), Central Federal Lands Highway Division (CFLHD), together with the SBNF, California Department of Transportation (Caltrans) and the Riverside County Transportation Department are proposing the reconstruction and paving of the 13.2 km (8.2 mile) portion of FH 224 (See Figure 1-1 for project location). The reconstruction of the roadway requires considerable grading involving substantial cut and fill and straightening many of the sharp curves on the existing roadway. Three alternative alignments, the 40 kilometer per hour (km/h) (25 mile per hour [mph]) alignment, the 55 km/h (35 mph) alignment, and the combination 40-55-40 km/h (35-25-35 mph) alignments are being considered. The combination alignment is the alternative this plan is based on because it encompasses portions of each of the other alternatives.

This Conceptual Landscape and Revegetation Plan provides general mitigation concepts for impacts associated with habitat loss, erosion, and aesthetics due to roadway reconstruction. These mitigation measures will be included in the Bautista Canyon Road Environmental Impact Statement (EIS)/Environmental Impact Report (EIR) being prepared for the project. Further refinement of the measures will be made during the design phase of the project if the project is approved.

The Conceptual Landscape and Revegetation Plan is limited to the cut and fill slopes created by the project, segments of the existing roadway that will be abandoned, and temporary roads required to relocate utilities. Any additional off-site revegetation is not within the scope of this plan.

1.2 ANTICIPATED IMPACT

The proposed grading will result in the loss of chaparral, big sagebrush scrub, and riparian woodlands and marsh plant communities. Habitat of listed wildlife species including the arroyo toad and the southwestern willow flycatcher will also be impacted. This habitat loss includes loss of formerly designated Critical Habitat for the arroyo toad in the northern portion of the alignment.

Cut and fill slopes will also create visual impacts. Revegetation and other measures such as rock staining of steep slopes are intended to reduce the visual impacts in the areas of high visual sensitivity.

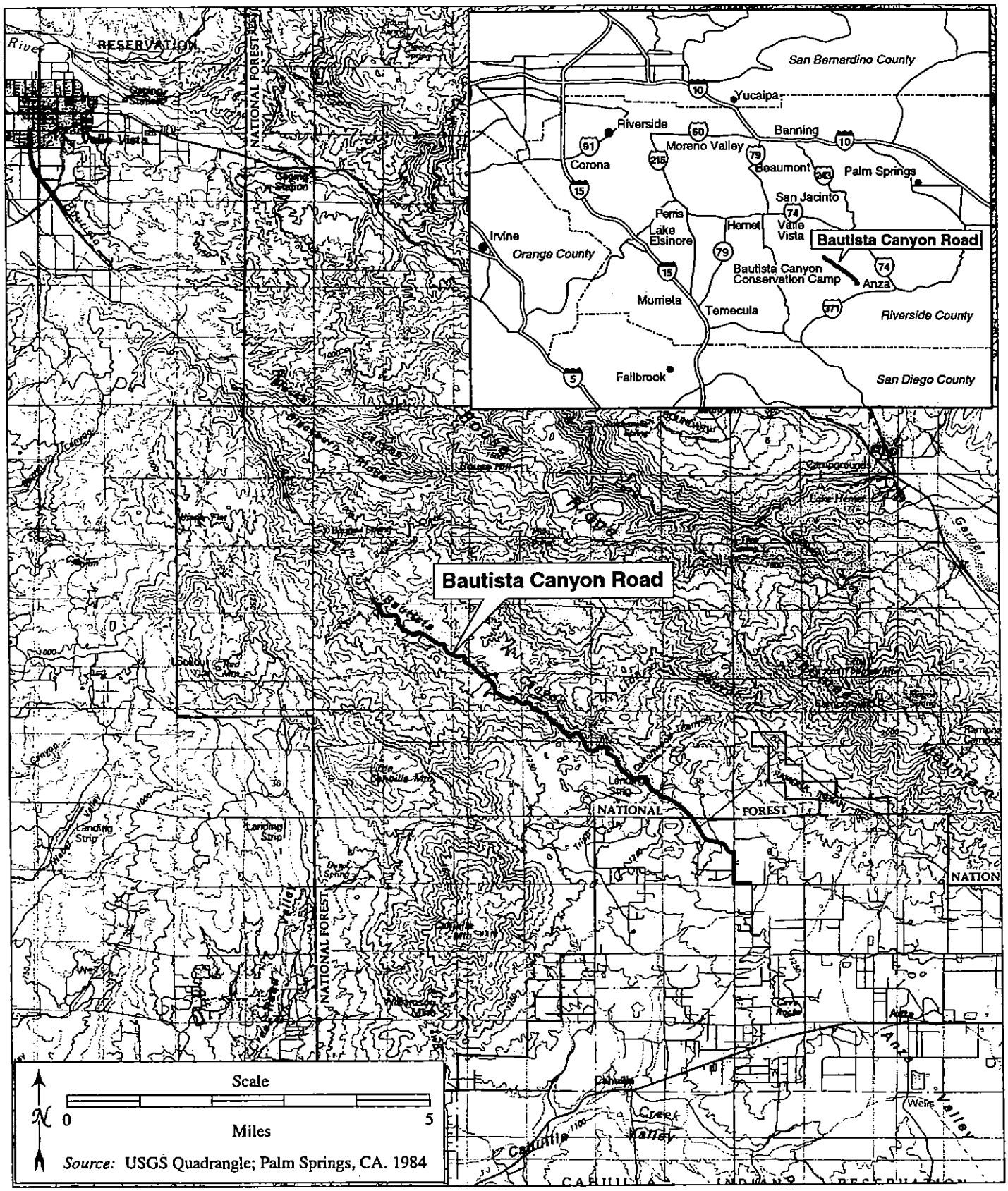

Figure 1-1. Project Location Map

1.3 PLAN ORGANIZATION

This Conceptual Landscape and Revegetation Plan consists of seven sections and two technical appendices. Section 2 describes the methods and assumptions used in developing the plan. Section 3 describes the results of the research including the review of previous revegetation plans and the vegetation analysis performed on plant communities representative of areas to be revegetated. Section 4 describes specific revegetation methods for seed application and installation of container plantings, monitoring requirements and timing, performance criteria, and reporting requirements. Revegetation areas are delineated on preliminary project plans provided under separate cover. The steps needed to implement this plan are presented in Section 5. Section 6 lists references cited in the plan. The technical appendix contains supporting and reference materials that support the results and conclusions.

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2.0 METHODS

This section describes the methods used to develop the Conceptual Landscape and Revegetation Plan for Bautista Canyon Road in the following sections:

- Research of Existing Revegetation Plans
- Plant Transects and Vegetation Analysis
- Development of Revegetation Strategies

2.1 RESEARCH OF EXISTING REVEGETATION PLANS

A number of agencies, revegetation contractors, and other persons knowledgeable about revegetation of chaparral in Southern California were contacted by SAIC biologists. The purpose of these contacts was to determine the current methods being employed and to determine the overall success of revegetation efforts conducted in the area. Organizations contacted include the following:

- San Bernardino National Forest
- California Department of Transportation
- University of California at Riverside
- Nature's Image
- S&S Seeds
- California Department of Food and Agriculture
- Habitat West
- Center for Natural Lands Management

Information for each contact is provided in Appendix A.

2.2 PLANT TRANSECTS AND VEGETATION ANALYSIS

As part of the method to develop re-vegetation strategies appropriate for the project site, field studies were conducted to assess the existing vegetation. As discussed in more detail in Chapter 4, the studies provide data for cover and density of native perennial plants. Species presence and abundance were important to document the existing vegetation, but were not particularly important in determining seed mixes for the project. All areas to be revegetated occur within one of the following eight native plant communities: bigberry manzanita chaparral, chamise chaparral, coastal sage-chaparral scrub, southern mixed chaparral, redshank chaparral, big sagebrush scrub, southern cottonwood-willow riparian forest, and southern willow scrub. In order to quantify the composition of these communities, two approaches were used, one for the upland communities and an alternate for the riparian communities.

SAIC biologists surveyed the project corridor (proposed roadway + 50 meter (162.5 foot) buffer on either side of the proposed alternatives) searching for six patches of vegetation that

adequately represented each of the six upland community types. Upland communities include bigberry manzanita chaparral, chamise chaparral, coastal sage-chaparral scrub, southern mixed chaparral, redshank chaparral, and big sagebrush scrub. At each of the six chosen locations (Figure 2-1, Sampling Transect Locations), two vegetation sampling methods were applied: line-intercept and belt-transect. Using 50-meter (162.5-foot) transect lengths and 2-meter widths for the belt-transect, data on species presence, species cover, and open ground were recorded. Due to the time of year of the vegetation analysis coupled with the low rainfall in the winter and spring of 2001-2002, it was not possible to accurately assess annual species cover and density. The perennial vegetation is much more important in the development of revegetation plans since annual vegetation seeds will be contained in the duff (crushed native vegetation) as well as enter the project areas from undisturbed areas. Photographs taken at each transect also document the vegetation within each sampled community. Transect locations were marked in the field using rebar stakes with brightly painted PVC sleeves. Data were collected and subsequently entered into a database and analyzed.

The second approach, used in riparian communities (southern cottonwood-willow riparian forest and southern willow scrub), consisted of a more qualitative assessment based on field observations. Biologists surveyed each location where riparian restoration may occur and recorded the species composition, an estimate of species density, and the general structure of the adjacent riparian community. The general topography, apparent hydrology patterns, and overall conditions of the area proposed for revegetation were also recorded. A total of six locations were identified and assessed using this method. Photographs taken at each riparian revegetation area also document the vegetation within the vicinity. This method, as opposed to the transect sampling methods described above, was used to enable the development of a more precise, site-specific restoration methodology for smaller and more sensitive habitat types such as riparian communities.

2.3 DEVELOPMENT OF REVEGETATION STRATEGIES

Revegetation strategies, preliminary seed mixes, and planting palettes (for container and cutting stock) were developed based on species naturally occurring in the vicinity of the project. Species were selected for seed mix based on the following factors:

- Presence and abundance in the project area. This was determined by using project data (AMEC 2002) and from site visits.
- Collectability of the seed for seeded species (some species are difficult to collect, adding uncertainty and increased cost). This was determined by personal experience and by contact with a company that regularly performs seed collection in the area.
- Likelihood of germination for seeded species. Species requiring pretreatment to facilitate germination were not used. Germination rates and treatments were determined by consulting literature and experts (Emery 1988, Everett 1957, Keeley 1991, and Berlin 2002).
- Opportunity to recreate or enhance habitat for rare, threatened, and endangered animal species by providing plants for food and for cover of selected species including the Quino checkerspot butterfly.

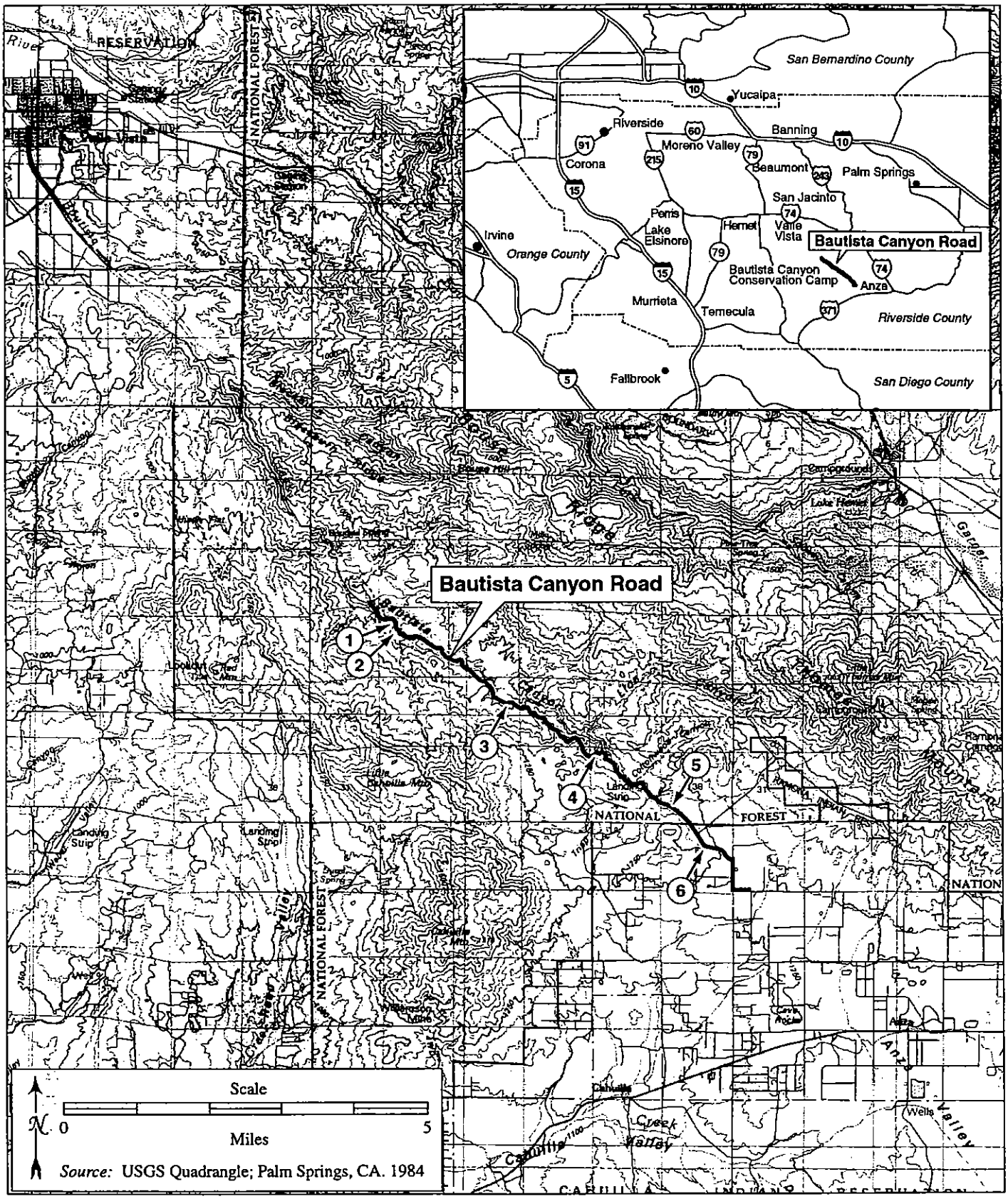

Figure 2-1. Transect Locations

- Diversity of plant types and rooting types. The goal is to plant sufficient types of species to provide cover given a variety of microhabitats present in the project area and possible annual weather regimes. It is anticipated that the cover and species diversity will vary by location even when the same seed mix is used due to microhabitat differences. Some species are expected to be more successful in some areas while other species will be more successful in other areas.

Plants were selected for revegetation that are generally early successional species that are expected to grow rapidly and provide native cover and erosion control. Longer-lived species more typical of mature plant communities (e.g., manzanitas and scrub oaks) would be expected to colonize from adjacent areas. Riparian areas are being treated differently due their limited extent on the project corridor and their importance as sensitive species habitat. In riparian areas, a combination of seeding with early successional species and planting species typical of the mature community were developed for the revegetation strategy. Some species included in the seed mix for riparian areas are more typical of uplands. These species were included to provide cover and erosion control while cuttings, transplants, and container plantings become established.

3.0 RESULTS OF RESEARCH AND FIELD STUDIES

This chapter presents the results of the research and field studies in the following sections:

- Analysis of Contacts on Revegetation
- Site Vegetation Study

3.1 ANALYSIS OF CONTACTS ON REVEGETATION

The results of the interview and other contacts with organizations and individuals concerning previous revegetation efforts are provided in detail in Appendix A. A general consensus was found that the use of slope imprinters for planting of seeds is feasible for any slope that a bulldozer can traverse. Imprinting seems to be as good or better than hydroseeding and may be more cost-effective. Imprinting of the seeds also seemed to result in better survival than hydroseeding if winter rains were not sufficient. Recent results have indicated that seeds may still grow the second year after planting if rainfall is not sufficient the first year if imprinting is used. The general consensus of those contacted indicated that use of species associated with early succession of the plants was desirable and would be more successful.

3.2 SITE VEGETATION STUDY

The results of the upland vegetation communities sampling are provided below in Table 3-1, *Percent Cover of Line Intercept Transects* and Table 3-2, *Percent Relative Abundance from Belt Transects*. In general, the namesake of each of the communities was the dominant species of that particular community with a few co-dominates and/or associate species common on the area. Vegetation cover ranged from 48.5 percent within the big sagebrush scrub to 90.5 percent within the chamise chaparral. Within all the sampled chaparral communities combined, the dominant species were chamise (*Adenostoma fasciculatum*), California buckwheat (*Eriogonum fasciculatum*), red shank (*Adenostoma sparsifolium*), buck brush (*Ceanothus cuneatus*), and bigberry manzanita (*Arctostaphylos glauca*). These five species account for 74 percent of the total vegetative cover within the sampled chaparral communities.

Results of the sampling conducted within the southern mixed chaparral community were more homogeneous than might be expected. However, these results are appropriate based on the scale of the vegetation mapping effort relative to the sampling size. Essentially, the southern mixed chaparral community is composed of a series of patches of many sub-communities. Standard sampling techniques of this community are likely to produce results indicative of the sub-community occurring at the sampling location. Although the results of the southern mixed chaparral sample were more indicative of chamise chaparral, an understanding of the vegetation mapping scale and a qualitative assessment of the project site indicate that this community is composed of a network of patches of the other four sampled chaparral communities (bigberry manzanita chaparral, chamise chaparral, coastal sage-chaparral scrub, and redshank chaparral) and scrub oak chaparral. Scrub oak chaparral was not sampled because it occupies very little area within the restoration area. However, it is likely to occur in patches throughout the mixed chaparral.

Table 3-1. Percent Cover of Line Intercept Transects

	Chamise Chaparral	*Coastal Sage/ Chaparral Scrub*	*Bigberry Manzanita Chaparral*	*Mixed Chaparral*	*Red Shank Chaparral*	*Big Sagebrush Scrub*
Adenostoma fasciculatum (chamise)	83.8	34.3	14.6	74.6	2.0	0
Artemisia tridentata (big sagebrush)	0	0	0	0	0.4	44.5
Adenostoma sparsifolium (redshank)	0	0	0	0	19.1	0
Eriogonum fasciculatum (California buckwheat)	3.9	15.9	0	0	11.5	3.8
Ceanothus cuneatus (buck brush)	0	0	0	0	35.5	0
Arctostaphylos glauca (bigberry manzanita)	0	0	68.9	0	0	0
Eriodictyon crassifolium (woolly yerba santa)	0	0	1.4	0	0	0
Rhus trilobata (skunk brush)	0	0	0	0	10.1	0
Opuntia basilaris (beavertail)	0	0	0.2	0	0	0
Salvia mellifera (black sage)	2.8	19.0	0	0	0	0
Yucca whipplei (our Lord's candle)	0	9.5	0	0.4	0	0
Trichostema lanatum (woolly bluecurls)	0	0	0	0.3	0	0
Penstemon centranthifolius (scarlet bugler)	0	0	0	0	0	0.2
Tetradymia comosa (cotton-thorn)	0	0	0	0	1.8	0
Melica imperfecta (Melic)	0	0.2	0	0	0	0
Bare Ground	7.1	19.4	8.1	20.0	15.2	43.8
Litter	2.4	1.7	6.8	4.7	4.4	7.7

Table 3-2. Percent Relative Abundance from Belt Transects

	Chamise Chaparral	*Coastal Sage/ Chaparral Scrub*	*Bigberry Manzanita Chaparral*	*Mixed Chaparral*	*Red Shank Chaparral*	*Big Sagebrush Scrub*
Adenostoma fasciculatum (chamise)	65	24	38	70	9	0
Artemisia tridentata (big sagebrush)	0	0	0	0	1	72
Eriogonum fasciculatum (California buckwheat)	9	31	0	0	9	6
Ceanothus cuneatus (buck brush)	0	0	0	0 (1 plant)	51	0
Arctostaphylos glauca (bigberry manzanita)	0	0	36	2	0	0
Eriodictyon crassifolium (woolly yerba santa)	0	0	14	0	0	0
Rhus trilobata (skunk brush)	0	0	0	0	22	0
Opuntia basilaris (beavertail)	2	0	12	0	0	0
Salvia mellifera (black sage)	25	14	0	0	0	0
Yucca whipplei (our Lord's candle)	0	31	0	0	0	0
Trichostema lanatum (woolly bluecurls)	0	0	0	23	0	0
Penstemon centranthifolius (scarlet bugler)	0	0	0	0	0	13
Tetradymia comosa (cotton-thorn)	0	0	0	0	8	0
Gutierrezia californica (California matchweed)	0	0	0	5	0	0
Lotus scoparius (deerweed)	0	0	0	0 (1 plant)	0	0
Lessingia filaginifolia (Corethrogyne)	0	0	0	0	0	4
Croton californicus (California croton)	0	0	0	0	0	5

3.2.1 Riparian Area #1

Riparian Area #1 is located approximately 3.2 km (2 miles) east of the Bautista Conservation Camp, where Bautista Canyon Road crosses Bautista Creek (Station 302+750). The area to be restored is currently a portion of the existing dirt roadway that crosses the creek at grade (no culvert). The proposed realignment of the roadway will cross the creek over a proposed bridge approximately 0.8 km (0.5 mile) upstream. The existing dirt roadway crossing and associated disturbed shoulders will be abandoned and available for restoration following construction of the new roadway.

The streambed at this location ranges from 1 to 2 meters (3 to 6 feet) wide with flood benches stretching another 6 to 12 meters (20 to 30 feet) on either side. The creek bed is composed of a series of pool and riffle complexes with medium to large boulders strewn throughout. At the time of the riparian habitat survey, early August, no surface water was present within the creek bed. Surface flows in this portion of the creek are probably only present during the winter and spring months. Riparian habitat immediately adjacent to the restoration area consists of an open cottonwood-willow riparian forest with a sparse understory dominated by annual grasses and shrubs. The canopy is comprised of scattered cottonwoods (*Populus fremontii*) with a few Western sycamore (*Platanus racemosa*) and coast live oaks (*Quercus agrifolia*) on the periphery. Associated understory species include mugwort (*Artemisia douglasiana*), mule fat (*Baccharis salicifolia*), poison oak (*Toxicodendron diversilobum*), and sandbar willow (*Salix exigua*). Annual grasses dominate the stream channel, including rabbit's foot grass (*Polypogon* sp.), oats (*Avena* sp.), and brome (*Bromus* sp.). The flood benches on both sides of the creek are occupied by a sparse assemblage of upland scrub species such as California buckwheat (*Eriogonum fasciculatum*), pinebush (*Ericameria pinifolia*), white sage (*Salvia apiana*), and big sagebrush (*Artemisia tridentata*) under a broken cottonwood canopy. Part of the bench is dominated by rush (*Juncus* sp.), which is an important basket-weaving plant for Native Americans. A dozen or so non-native tamarisk plants (*Tamarix* sp.) were also noted within adjacent riparian habitat both up and down stream from the existing road crossing.

3.2.2 Riparian Area #2

Riparian Area #2 is located near Station 303+850, where Bautista Canyon Road crosses an ephemeral tributary drainage to Bautista Creek. The creek passes under the existing road in an easterly direction through a large culvert and onward towards Bautista Creek. The proposed realignment of the roadway will occur in nearly the same location but the proposed roadway will occupy an additional 15 meters (50 feet) to the west. Following construction of the roadway, riparian revegetation opportunities may exist at the west end of the newly extended culvert.

The width of the tributary creek ranges from 0.3 to 0.6 meters (1 to 2 feet) on either side of the culvert. Before entering the culvert on the west side of the road, water is detained in a small debris basin until spilling over the basin and into the culvert. On the east side of the culvert, the drainage drops abruptly for approximately 4.5 meters (15 feet) then resumes a more moderate slope towards Bautista Creek. Riparian vegetation at this location is limited to a small patch of mule fat scrub and mugwort, a few scattered cottonwoods, and a single coast live oak tree within the basin. Upland species scattered throughout the creek bed and basin periphery

include yerba santa *(Eriodictyon crassifolium)*, big sagebrush, California buckwheat, deer weed *(Lotus scoparius)*, and pinebush. Habitat approximately 100 feet further down stream is more consistent with a cottonwood-sycamore riparian forest.

3.2.3 Riparian Area #3

Riparian Area #3 occurs along a stretch of roadway where Bautista Creek runs parallel and immediately adjacent (Station 307+350 to 308+750). The riparian canopy along most of this portion of the creek stretches to the northern edge of the roadway and occasionally overlaps it. The proposed realignment of the roadway will occasionally occur on the existing dirt roadway but more frequently is located further upslope to the south and away from the creek. Consequently, many segments of the existing roadway will be abandoned and available for restoration following construction of the new roadway.

Riparian habitat adjacent to the portions of roadway to be abandoned consists of mature southern willow scrub and mixed willow riparian woodland. A series of seeps along the creek and the slow grade through the area account for the year-round saturated soils and lush riparian habitat within this area. The canopy often stretches over the Bautista Road with widths ranging from approximately 30 to 60 meters (100 to 200 hundred feet). Dominant species of the canopy are red willow (*Salix laevigata*) and arroyo willow (*Salix lasiolepis*) with occasional western sycamores. Understory vegetation is dense with dominants such as sandbar willow, tarragon (*Artemisia dracunculus*), virgin's bower (*Clematis ligusticifolia*), California rose (*Rosa californica*), and honeysuckle. Dominant understory species located within the creek bed include rushes (*Juncus* sp.), mugwort, stinging nettle (*Urtica dioica*), watercress (*Rorippa nasturtium-aquaticum*), and duckweed (*Lemna* sp.). While riparian habitat lines the northern side of the road, upland chaparral communities occupy the slopes to the south. The historical location of the transition from upland to riparian is likely to have occurred in the location of the existing roadway in several areas.

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4.0 REVEGETATION METHODS

This section provides the methods proposed for revegetation along Bautista Canyon Road.

4.1 SITE PREPARATION

This section addresses topsoil salvage and storage, soil decompaction and contouring, cut and fill slopes, and pre-planting weed control.

4.1.1 Topsoil Salvage and Storage

Topsoil and crushed native vegetation (duff) will be salvaged and stored on site. Prior to stripping, the vegetation will be crushed by driving heavy machinery over it. Crushing the vegetation will be done as necessary to break it into a duff that can be collected with the topsoil. Ideally the duff material will be no larger than 3 to 6 inches in size. Topsoil and duff will be collected and stored for reapplication following final grading in areas to be seeded. Topsoil and duff will be stored in disturbed areas away from the majority of construction activity, and storage locations will be recommended by the project biologist[1].

Topsoil/duff piles will be arranged in rows not typically exceeding 6 feet in height to preserve soil microfauna and seed viability. Topsoil and duff should be labeled to avoid confusing it with subsoil and will be kept in separate piles for each area of the road realignment. If topsoil is stored over the winter or spring and weeds are present, weeds should be cut to reduce seed set and to lessen the need for weed control later in the project.

Every effort will be made to replace topsoil in the same general area and habitat from which it was removed. Salvaging and replacing topsoil and duff is a commonly used procedure to aid in native revegetation efforts. Purposes for using this method include the following:

- The topsoil will contain important nutrients, soil microorganisms, and medium providing a more favorable environment for establishing new plants.
- The topsoil and duff will contain some seeds that may germinate following replacement of topsoil. Some seeds, especially from plants that grow in a fire-prone habitat, remain viable in the soil for many years. Those seeds may germinate soon after replacement of the topsoil or may remain dormant and then sprout following fire.
- The duff will contain fiber that will make the soils less erosion-prone and reduce the loss of seeds, nutrients, and moisture.
- Nutrients stored in plant material will become available to establishing plants as decomposition of the organic matter progresses over many years.
- Reusing duff material will eliminate disposal issues associated with clearing and grubbing.

1 The project biologist should be identified at the outset of the program. He/she should be familiar with the local environment and revegetation techniques.

4.1.2 Soil Decompaction and Contouring.

In areas were the existing road will be abandoned, the existing soil surface will be ripped to uncompact the soil. Abandoned roadways areas will be obliterated and either restored to the approximate original ground contour or shaped to blend with the existing terrain. Topsoil and duff salvaged, as described above, will be placed over the fill and the site will be seeded.

4.1.3 Cut and Fill Slopes

Fill Slopes. Fill slopes that are not steeper than 1:1.5 will be smoothed and topsoil reapplied as feasible. The surface will be seeded with a seed mix. Fill slopes that are steeper than 1:1.5 may not be revegetated because revegetation is less likely to be successful and revegetation equipment cannot be used on very steep slopes. However, steeper (greater than 1:1.5) slopes may be hydroseeded. Steep fill slopes may be contained through the use of wireframe (gabion) retaining walls using native rock material.

Cut Slopes. Treatment of cut slopes will depend on steepness, composition, and size. This information will not be available until the geology report is complete. However, cut slopes that are gentle enough (less than 1:1.5) should have the topsoil replaced and be seeded. Areas that are very steep will probably not be seeded. In highly visible areas, options such as rock staining will be explored to reduce visual impact of recently exposed rock faces.

4.1.4 Pre-planting Weed Control

Prior to seeding and installation of cuttings and container plantings, perennial non-native invasive exotic species will be removed. Removal methods will be as described in section 4.4, Weed Control. Weeds that are particularly problematic (e.g. tamarisk) will be targeted.

4.2 SEED AND OTHER PLANT MATERIAL

This section describes considerations for seed collection, timing, storage, and application. Methods, timing, and storage of other native plant material such as cuttings and container plants are also presented. It is anticipated that all seed for the project will be obtained, tested, stored, mixed, bagged, and delivered to the revegetation contractor. Propagation materials (other than seed) would be collected and container plantings. Seeding and installation of the container plantings would be conducted.

Inoculation of container plants and of seed mixes with mycorrhizal fungi is recommended. Mycorrhizal fungi are abundant in undisturbed natural areas and form symbiotic relationships with plants. The fungi serve the plant similarly to the plants own roots (to which the fungi are attached) but transporting water and minerals to the plant. In turn, the plant provides the fungi with sugars. The relationship aides in survival of plants, especially in situations where the ground has been disturbed or where topsoil has been stored in excess of several weeks to several months.

4.2.1 Seed and Plant Material Collection.

Ideally, seed and other plant materials collected or originating from the project area are considered superior to commercial sources for the following reasons:

- The integrity of local gene pools is preserved.
- Adaptation to site-specific conditions is ensured.
- Inadvertent introduction of inappropriate species or pathogens is avoided.

It is therefore recommended that all seed and plant materials of native species to be used for revegetation will be collected from the local area. If a specified seed is not available, other similar species may be substituted as discussed in section 4.2.4. Any substitutions should be collected from the same local area. Appropriate areas for seed collection within the collection limits should be defined in the field, taking into account the following considerations:

- Ecological similarity to the area to be reseeded
- Proximity to the project site
- Land ownership
- Accessibility
- Abundance and availability of target species
- Ensuring of genetic diversity of source material by collecting seeds from a diverse sample of the parent plants within the collection area
- Avoiding collecting Quino checkerspot butterfly (*Euphydryas editha quino*) host plant seed within 1 mile of known occupied habitat

However, commercial seed sources may be used for more common native species, particularly where the original source location is from upland areas in the vicinity of the San Jacinto Mountains. Species that may be available commercially include California sagebrush (*Artemisia californica*), deerweed (*Lotus scoparius*), and black sage (*Salvia mellifera*). Dwarf plantain (*Plantago erecta*) may also be available commercially. However, the dwarf plantain is a Quino checkerspot butterfly host plant, and therefore it may be more desirable to collect it locally. Any use of commercial seed sources would be subject to approval of SBNF.

If local native plants are used for revegetation, commercial seed from the project vicinity may not be available. In general, custom collection from the project area by a qualified seed collection contractor would be required. It is possible to grow plants that are produced from local material and then collect seed from those grown plants. However, growing plants for seed collection is not expected to be an economically feasible option.

Seed collection should be initiated 2 years prior to timing of seed application. This should allow sufficient time to collect the seed but not have a reduction in viability of seed. Because some species do not produce seed well during some years, it is possible that some of the seed will not be available in the year it is needed. For this reason, the seed mix may be adjusted slightly, if necessary (see section 4.2.4 for limitations in seed mix adjustment).

All seed collected, grown, or purchased for the project should be tested to determine if it meets the minimum standards established in the industry. Specifically, the minimum pure live seeds per pound must be met. If the contractor is unable to meet those standards, the amount of seed will be adjusted upward to result in the same overall number of pure live seeds by species.

4.2.2 Seed Storage and Mixing

Seed will be stored to ensure maximum viability by the seed collection contractor including refrigeration (if necessary).

Seed should be mixed in quantities as preferred by the seed application contractor (probably 0.5 acre lots). All bagged seed should be labeled with the size of area it will cover and amount of each species listed. The source location of all native species would be provided on the label (e.g., Hemet/Anza area).

4.2.3 Container Plant Material, Cuttings, and Transplants

For container material, a nursery will be selected that has specific knowledge and experience in native plant propagation, specifically of species used or species similar to those used in this project. Plants that can readily be started from cuttings (such as willows and cottonwoods) will be most likely started from cuttings. Other species, particularly rushes and mugwort, may be started more easily from plugs. Plants should be grown in facilities with an environment similar to the project area and inoculated with mycorrhizal fungi. For example, growing plants in a cool, coastal environment would not be appropriate. The nursery selected to grow container material should be selected and under contract a minimum of 2 years in advance of scheduled planting to ensure that plants are available when needed.

For plantings directly from cuttings (willows only), material will be collected from the immediate project area on the same day as planting. Generally, cuttings will be collected near to the areas to be planted to ensure species are adapted to site-specific conditions and for convenience. More information on cutting installation is provided in section 4.2.6.

For direct transplants such as mugwort and mulefat (*Artemisia douglasiana* and *Baccharis salicifolia*), plants will be collected from the immediate vicinity where they will be planted. If feasible, plants from the cleared construction corridor will be used preferentially to those in adjacent, undisturbed areas. Care will be taken in transplanting plants from adjacent, undisturbed areas to avoid degrading the habitat. If possible, only a portion of individual plants will be removed, allowing the remaining portions to continue growing. See section 4.2.6 for instructions for collection and planting transplanted species.

4.2.4 Plant Palettes

For the purpose of revegetation seeding and planting, plant communities are divided into the following categories: chaparral, big sagebrush scrub, and riparian forest/scrub. Most plantings in riparian areas will be from containers, transplants, and cuttings. The species to be included in seed mixes for each plant community are in Tables 4-1 through 4-3. The plant palettes may be adjusted to include more plants of ethnobotanical importance in consultation with local Native Americans. The area disturbed for roadway construction (including cut and fill slopes),

Table 4-1. Preliminary Chaparral Seed Mix

Scientific Name (Common Name)
Adenostoma fasciculatum (Chamise)
Adenostoma sparsifolium (Redshank)
Antirrhinum couterianum[1] (Coulter's snapdragon)
Artemisia californica (California sagebrush)
Cordylanthus rigidus[1] (Bird's beak)
Eriogonum fasciculatum (California buckwheat)
Eriophyllum confertiflorum (Golden yarrow)
Lotus scoparius (Deerweed)
Malacothamnus fasciculatus (Chaparral mallow)
Melica imperfecta (Melic)
Plantago erecta[1] (Dwarf plantain)
Salvia mellifera (Black sage)
Yucca whipplei (Our Lord's Candle)
1. Annual species included in seed mix because it is a primary host plant for Quino checkerspot butterfly. Use of plants that serve as a host to the Quino checkerspot butterfly in close proximity to the roadway will be reexamined based on consultation with the USFWS and the Biological Opinion.

Table 4-2. Preliminary Big Sagebrush Seed Mix

Scientific Name (Common Name)
Artemisia tridentata (Big sagebrush)
Castilleja exserta1 (Purple owl's clover)
Cordylanthus rigidus1 (Bird's beak)
Croton californica (California croton)
Encelia farinosa (Brittle bush)
Eriogonum fasciculatum (California buckwheat)
Lessingia filaginifolia (Corethrogyne)
1. Annual species included in seed mix because it is a primary host plant for Quino checkerspot butterfly. Use of plants that serve as a host to the Quino checkerspot butterfly in close proximity to the roadway will be reexamined based on consultation with the USFWS and the Biological Opinion.

Table 4-3. Preliminary Riparian Forest/Scrub Seed Mix[1]

Scientific Name (Common Name)
Antirrhinum couterianum[2] (Coulter's snapdragon)
Baccharis salicifolia (Mulefat)
Leymus condensatus (Giant wild rye)
Cordylanthus rigidus[2] (Bird's beak)
Eriogonum fasciculatum
Ericameria pinifolia
Lotus scoparius
Artemisia tridentata
1. Most planting in riparian areas will be from containers, transplants, and cuttings. 2. Annual species included in seed mix because it is a primary host plant for Quino checkerspot butterfly. Use of plants that serve as a host to the Quino checkerspot butterfly in close proximity to the roadway will be reexamined based on consultation with the USFWS and the Biological Opinion.

except paved areas and areas with slopes steeper than 1:1.5, will be seeded and some areas will have container plantings, transplants, and cuttings as well. Slopes grater than 1:1.5 may be hydroseeded if feasible. Plant communities were grouped for the following reasons:

- An early successional seed mix is prescribed for each plant community. Similar plant community types would have similar assemblages of successional species because the distinguishing species (e.g., scrub oaks and manzanita) would not generally be present. The distinguishing species were not generally included in the mix because those species generally require pretreatment of seed prior to application or do not establish well from seed.
- With fewer seed mixes, it is cost-effective to include more species in each mix. The per-unit cost of custom-collected seed is high if only a small amount is collected. Having a more diverse seed mix increases the likelihood of successful establishment of some species in different microhabitats. Diversity of species within one site increases the erosion control potential and the likelihood of recovery after fire.
- It is less expensive to apply fewer seed mixes because the seeding contractor does not have to change mixes frequently, saving time and material. It will also be easier to monitor because most of the disturbed roadway corridor will have similar treatments making it easier to isolate problem areas.

Areas currently vegetated as bigberry manzanita chaparral, chamise chaparral, coastal sage-chaparral scrub, southern mixed chaparral, red shank chaparral, and scrub oak chaparral will be seeded with the chaparral mix. The big sagebrush scrub mix will be representative of this community alone. Small amounts of chaparral surrounded by big sagebrush scrub will be treated as big sagebrush scrub for continuity and because the post-construction attributes of the soil are expected to be very similar in adjacent areas. Areas currently supporting white alder-live oak riparian forest, southern cottonwood-willow riparian forest, open cottonwood-willow riparian forest, and southern willow scrub will be seeded with the riparian mix and container plantings will be installed that were selected specifically for each site. The riparian seed mix will include upland and transitional species because they are present in adjacent areas and will provide cover while cuttings, transplants, and container plantings are establishing. Ruderal and old road areas will be seeded with a mix based on adjacent vegetation. For example, ruderal areas in bigberry manzanita chaparral will be seeded with the chaparral mix.

Seed mixes may be adjusted depending on the availably of seed of a specific species during the year when seed is collected with approval of the project biologist. If a species will be eliminated from the mix, one should be added to maintain diversity. If adding a species is not feasible, quantities of the remaining species will be increased.

In addition to seeding, container plantings, transplants, and cuttings will be installed in sensitive riparian habitat areas and at other key areas (e.g., the entrance to closed roadway sections). Redshank and other attractive shrubs will be transplanted from areas of the road corridor, grown in a nursery until construction is complete, and planted. Precise number of shrubs to be transplanted has not been determined.

The riparian seed mix will be applied as described in section 4.2.5 to all riparian areas to be revegetated. The seed mix is intended to create a low density of native shrubs and grass among

which container plantings will be installed. Container plantings, cuttings, and transplants in riparian areas will be specific to the preexisting and/or adjacent vegetation. Numbers of plants of a particular type are not specified as part of this plan. That will be determined during formulation of the detailed revegetation plan for the project. Plantings for each riparian area are listed in Table 4-4.

Table 4-4. Plantings for Riparian Areas

Location Description	*Plantings To Be Installed and Approximate Density*
Riparian Area #1 (Station 302.750)	• *Salix lasiolepis* (C) • *Populus fremontii* (CP) • *Platanus racemosa* (CP) • *Baccharis salicifolia* (T or CP) • *Artemisia douglasiana* (T or CP) • *Juncus* sp. (T)
Riparian Area #2 (Station 303.850)	• *Populus fremontii* (CP) • *Baccharis salicifolia* (T or CP) • *Artemisia douglasiana* (T or CP)
Riparian Area #3 (Station 307.350 to 3.8.750)	• *Salix lasiolepis* (C) • *Salix laevigata* (C) • *Platanus racemosa* (CP) • *Juncus* sp. (T) • *Artemisia douglasiana* (T or CP)
1. CP= container planting; T= Transplant; C= cutting	

4.2.5 Seed Application

Seeding. All areas to be restored will be seeded with a mix prescribed for the habitat in the surrounding area (See Tables 4-1 through 4-3 for seed mixes). Seed mix application areas are delineated on project plans and shown generally in Figure 4-1. Total area to be revegetated by plant community is given in Table 4-5. Seed will be applied with 60 lbs/acre of mycorrhizal innoculum. The benefits of seeding combined with mycorrhizal inoculum are well documented and are expected to increase establishment, size, and survival of seeded species.

Table 4-5. Revegetation Area by Plant Community

Plant Community	*Total Acreage*
Chaparral	54.9
Big sagebrush scrub	5.5
Riparian	0.6
Areas too steep to revegetate	5.6
Total	66.6
Total acreage is based on plans dated 08/08/2002 Acreage does not include temporary utility access road	

Seeds will be applied with an imprinter. An imprinter works by inserting mycorrhizal inoculum below the soil surface. Then it presses the seed into the ground in mini-watershed divots. The imprinter will be of the type that is mounted to the blade of a bulldozer so seed and inoculum can be applied on steep slopes. See Figure 4-2 for photographs of an imprinter. Seed application will take place in the fall or early winter after the first rains. The intention of waiting is to ensure the soil is moist and that the imprinter can make indentations to the desired depth.

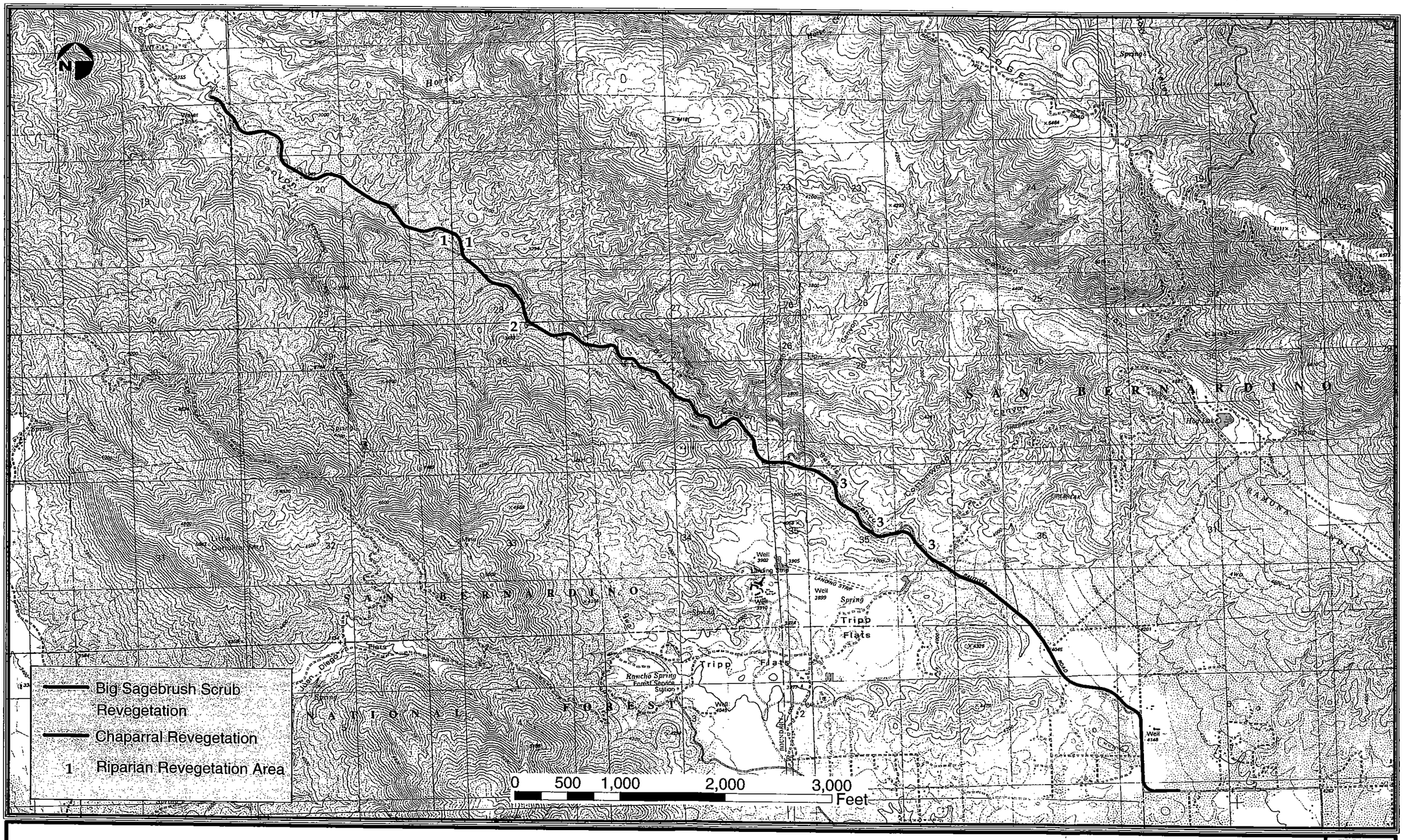
An imprinter was chosen for seed application for the following reasons:

- Recommendation of experts.
- Seed is dry when it is applied and capable of "waiting" until the ground is appropriately wet before sprouting. Hydroseeding is the other typical method used on steep slopes and in such a dry environment, seeds often die before there is sufficient rainfall.
- The indentations cause water to collect and percolate instead of running off. This results in increased water availability for establishing vegetation.
- The imprinter allows mycorrhizal inoculum to be applied with the seed. Mycorrhizal inoculum aides in establishment, growth, and survival of many native plants.
- The imprinter aides in erosion control by making indentations in the ground that are better than track-walking because the indentations are not in even rows.
- The imprinter is an ideal way to apply seed on steep slopes. If a bulldozer can work on the slope, it can be seeded. The only other way to apply seeds to steep slopes is by hydroseeding or hand-sowing. Hand sowing is less effective and drill seeding can only be done on relatively flat surfaces.

4.2.6 Installation of Plantings

Container Plantings. Precise locations for installation of container plantings will be determined in detailed revegetation plans for this project. Instructions for installation of container plantings at locations specified are as follows:

1. Excavate a planting hole twice as large as the rootball of the plant to be installed.
2. Partially backfill the planting hole with friable native soil.
3. With the palm of the hand covering the open end, upend the plant container.
4. Carefully tap the container so the plant rests upside down on the hand, leaving the rootball completely intact.
5. Examine the plant for a healthy root system. If there are signs of being rootbound or girdling, break up the roots to allow proper growth.
6. Insert the rootball into the planting hole so the top of rootball is approximately 1 inch above the finished grade.
7. Firm the soil around the plant and add more backfill if necessary to bring soil to the root crown at finished grade.
8. Construct a 4-inch-high, hand-compacted earthen berm 30 inches in diameter around the plant unless otherwise directed by the project biologist.
9. Irrigate immediately after installation to settle the soil.



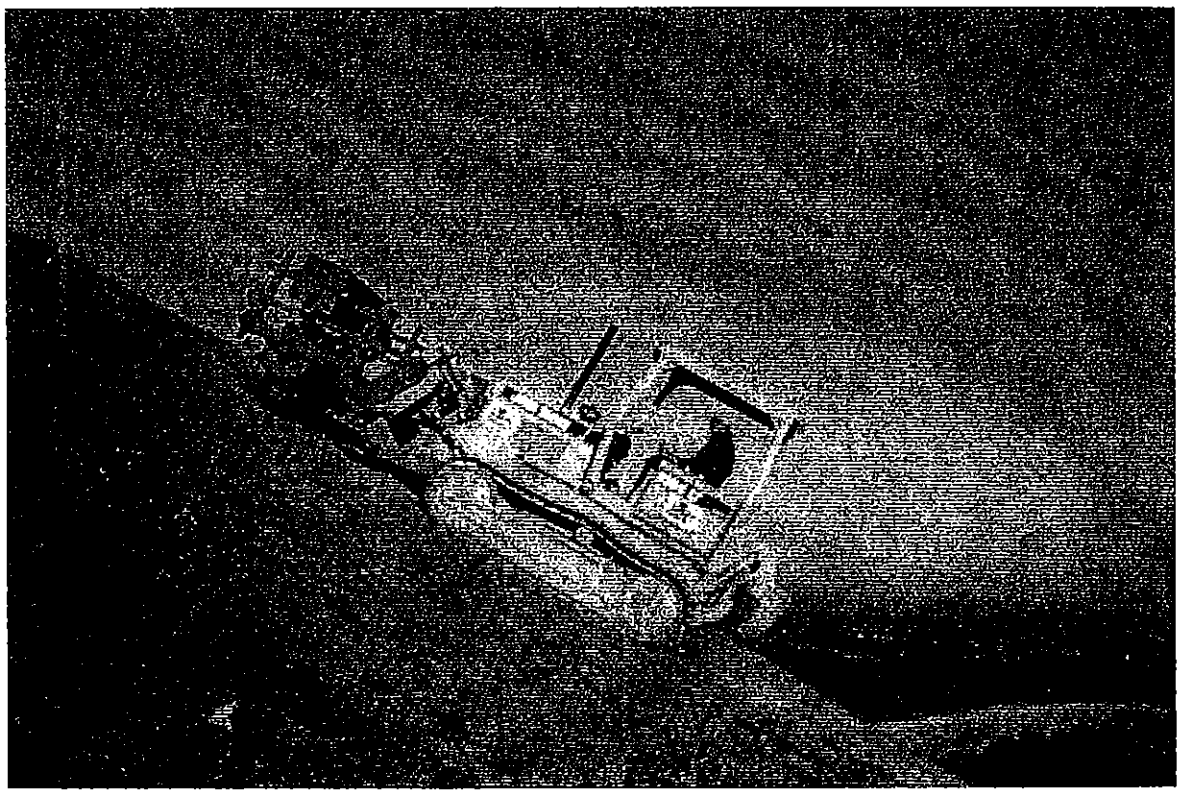
Seed Mix Application Areas

FIGURE

4-1

Imprinter

Soil surface following imprinting



Imprinter on a steep slope

Photographs provided by Nature's Image Inc.

Figure 4-2. Land Imprinting

10. If roots become exposed, place additional soil around the root crown.

11. Evenly apply 3 inches of organic mulch within the planting basin. Alternatively, a porous weed mat may be used to prevent the watering basin around the tree from being colonized by non-native grasses.

Transplants. This method will be used for direct transplant of rootstock for plants such as roses, rushes, and mugwort. Instructions for collecting and installing transplants follow.

1. Conduct direct transplant of root stock in winter to early spring for better success.

2. Collect a mass of root structures at least 6 x 6 x 8 inches (approximately) deep and adherent soil from healthy populations in adjacent areas or in roadway areas to be disturbed.

3. Collect the root structures from different areas to avoid excessive disturbance to existing populations when collecting in areas that will not be disturbed by road construction. For transplants from within the road disturbance area, all plants of specified species should be salvaged (as feasible). For mugwort, the mass of root structure can be only 3 to 4 inches deep and will generally consist of a rooting section of a branch.

4. Keep root sections moist and protected from wind and sunlight from time of collection to time of installation on the same day as collected. If transplants cannot be planted on the same day they are removed, transfer to a nursery for care and plant as described for container plantings above.

5. Select a planting location based on elevation and proximity to existing plants and other transplants.

6. Excavate a planting hole slightly bigger than the size of the rootball.

7. Plant and compact rootball thoroughly into soil.

8. Backfill with suitable native soil as required. Water immediately after planting.

9. Cut stems to approximately 6 inches above root structure.

Cuttings. The following method will be used to obtain and install willow cuttings:

1. Obtain cuttings from adjacent areas during the winter while plants are dormant (generally December through March 15th, depending on species).

2. Take cuttings from several different plants to maintain the species and genetic diversity within the creek.

3. Use sharp pruning shears or saw to take cuttings without causing injury to the bark.

4. Cut the bottom at a slant. Cutting should be from 1.5 to 3 feet long, and from 0.5 inch to 1.5 inches in diameter at the bottom.

5. Trim side branches with sharp pruning shears, flush with the main branch without causing injury to buds.

6. Keep cuttings moist by wrapping them with wet fabric during transport, if conditions are dry or windy, or if transport takes more than 30 minutes.

7. If possible, install cuttings on the same day as cut, or store overnight fully immersed in water.

8. Auger or dig a planting hole 8 to 12 inches in diameter to a minimum depth of 2 feet.

9. Place the cutting right side up, approximately 75 percent of cutting into the hole with slanted end pointing down (buds pointed up).

10. Backfill with friable native soil and compact the planting hole to finish grade or drive cuttings into soil using a mallet or by pushing.

11. Irrigate immediately to settle the soil.

12. Adjust soil level as necessary to finished grade.

4.2.7 Erosion Control

This section addresses surface erosion control to reduce loss of topsoil and sedimentation into creeks and drainages. A plan to maintain stabilized soil through use of proper soil compaction and techniques such as terracing will be developed by design engineers at the 70 percent plan stage and are beyond the scope of this plan. Short-term erosion control (during construction and before seeding) is not addressed here and should be addressed during project planning and engineering as timing will play an important role in the need for temporary erosion control.

The most effective long-term erosion control will be established vegetation. Above ground, it will slow the energy of rainfall and allow infiltration of that rainfall into the soil. The presence of variable rooting types and microorganisms that make up the soil environment will hold the soil together, making erosion less likely. However, before the native vegetation is well established, the potential for erosion is high. Measures will be needed to ensure that topsoil is not washed away before plants are well established.

Except where slopes are too steep to accommodate a land imprinter (used for seeding), all erosion control will be applied subsequent to seeding. Erosion control installed prior to seeding would likely be destroyed during seeding (if done by an imprinter). Slopes that are too steep to be seeded by an imprinter may be hydroseeded or have seed applied with a binder to help prevent erosion.

The depressions made by the imprinter will aid in erosion control by increasing percolation of rainfall into the soil and slowing run-off. Any water draining beyond the depressions left by the imprinter will have to be slowed and directed off the project. For that reason, water should

be directed off the disturbed area by logs made of coconut fiber, rice straw, or certified weed-free straw (see Figure 4-3 for a diagram of installation of logs) or similar devices. Typically, the logs consist of biodegradable fibers stuffed into tubes of photodegradable plastic netting. They work by decreasing the amount of vertical slope subject to erosion (by breaking it into smaller pieces). The individual logs are installed in a trench that is 50 to 100 mm deep (2 to 4 inches) and staked into place. The stakes should be driven approximately 400 mm into the ground and staked every 150 mm (6 inches). Adjacent rolls should be abutted securely, but not over lapped.

Additional methods of surface (topsoil) erosion control will be addressed later in project development, but may include techniques such as the following:

- Erosion control fabric. There are a variety of types of erosion control fabric that can be used under different conditions. The purpose of the erosion control fabric is to dissipate the energy of rainfall, but allow plants to germinate through the fabric. There may be some limitations to using this method in combination with imprinting as good soil to fabric contact may be difficult to obtain with the divots created by the imprinter.

- Hydroseeding/Hydromulching. This technique involves spraying the seed on the slope with a slurry of much. The mulch acts to dissipate the energy of raindrops and runoff. There are binders available as well that are more effective than hydromulch in holding together and thus preventing erosion.

- Waterbars. Similar in function to fiber logs described above, but made of soil and cannot be used in conjunction with imprinting.

- Willow cuttings installed at steep creek banks to facilitate rapid willow growth and bank stabilization.

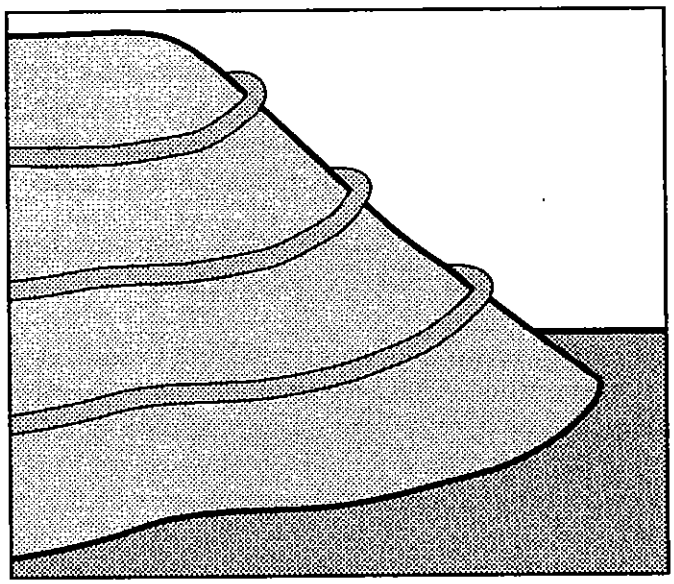
- Willow wattling. Sections of willow stems are tied in bundles and partially buried. They are held in place by willow stakes.

Erosion control logs and other devices (if applicable) should be inspected frequently during the first rainy season following installation. Installation and maintenance could be part of the revegetation contract or tied to the revegetation monitoring effort.

4.3 IRRIGATION

Irrigation is recommended for container, cutting, and transplanted plants in riparian and other areas because seeded species are expected to establish without additional irrigation. Selection of appropriate irrigation methods will be made during development of a detailed revegetation plan. The following irrigation methods will be considered:

- Drip irrigation to individual plantings. This option would consist of water storage (e.g., storage tank beside the road and above the restoration area) with water lines running from the storage device to the plantings. The water tank could be filled periodically with a water truck. Drip emitters would have to be inspected frequently to ensure they were working properly and that rodents had not damaged the irrigation lines.



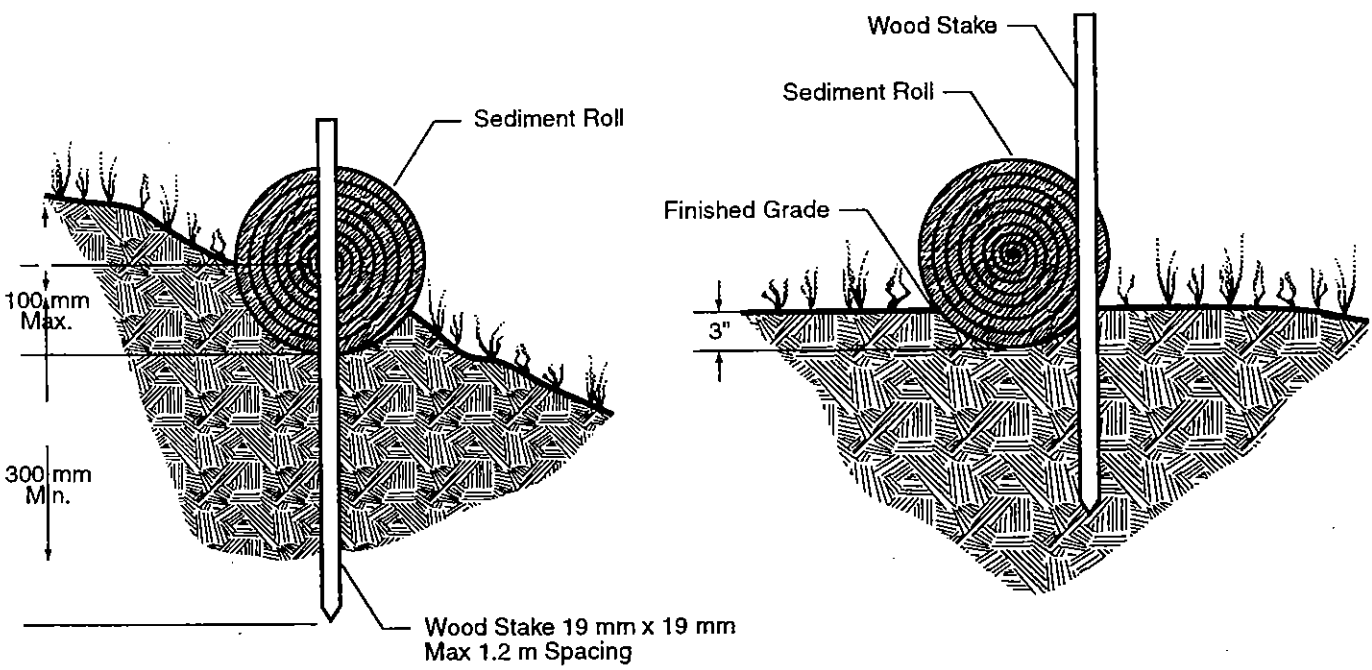


Figure 4-3. Installation of Fiber Rolls

- Using hoses and laborers to water individual plantings. Water would be contained in a water truck parked on the road with hoses running from the truck to plantings. Water could be applied to basins around individual plants or to tubes that would transfer the water to the root zone of individual plants. In some locations, the hoses would have to be extended long distances over steep terrain. Some minor damage to existing vegetation and plantings would be expected due to hoses being dragged. This method involves cost and safety considerations, both for having the truck parked on the road for extended periods and for having laborers working in the heat and steep terrain.

Frequency of irrigation will be determined during the development of a detailed revegetation plan, but will generally be conducted during the first 1 to 3 growing seasons after planting, depending on rainfall.

4.4 WEED CONTROL

Weed control will focus on the following species:

- Those with the potential to interfere with the reestablishment of native vegetation in the restoration area (as used here road corridor is synonymous with construction corridor and includes all areas disturbed by construction)
- Those that are not already so prevalent in areas immediately adjacent to the restoration area as to reduce reestablishment of plantings

Weeds will be removed manually where practical. Herbicides will be used to control weeds or infestations. A qualified biologist will monitor all herbicide use and appropriate precautions will be taken to prevent incidental damage to natives. These precautions include directional spraying to avoid natives and stopping spraying when wind speeds exceed 5 mph, potentially causing drift.

In shrub communities, weed control will focus on the following highly invasive species: yellow star thistle (*Centaurea solstitialis*), Russian thistle (*Salsola tragus*), and tocalote (*Centaurea melitensis*). Surveys and treatment will be timed to prevent or minimize seed set of these species. Other weed species such as mustards and wild radish will be removed as recommended by the project biologist to ensure successful revegetation.

In riparian areas, persistent perennial weeds such as tamarisk, castor bean, and poison-hemlock that would interfere with revegetation goals will be the focus of weed control efforts. Individual tamarisk and castor bean will be removed annually; poison-hemlock will be treated at least annually by herbicidal or manual means to minimize its competitive effect on reestablishing vegetation, if it observed. Annual and non-persistent perennial weeds, such as sweetclovers (*Melilotus* spp.) and rabbitsfoot grass (*Polypogon monspeliensis*), may be cut back as judged necessary by the project biologist to minimize competition with plantings.

4.5 MONITORING

4.5.1 Monitoring Tasks and Schedule

An intensive monitoring program is recommended to ensure that revegetation goals are met. The revegetation areas will be monitored for a minimum of 3 years, extending until performance criteria are met. It may take 5 years to meet the performance criteria. Weeds and other problems need to be identified early to ensure that they are properly addressed before they worsen.

The objectives of monitoring will be to document germination, establishment, and growth of natives and to identify the need for maintenance such as erosion control, weed eradication, or replanting

Prior to planting, the revegetation contractor will ensure the integrity of the soil surface, that all temporary devices installed during construction (other than for erosion control) are removed, and the soil surface is prepared (as necessary) for seeding. In addition, in areas of fill or where soil does not appear conducive to plant growth, soil should be sampled for presence of chemicals that may reduce revegetation success. Areas with less than 2 inches of salvaged topsoil should be tested as well. This sampling may detect concentrations of boron, salts or other naturally occurring substances in the fill or cut soils that may impede plant growth. If localized areas are found, then remedial action can take place before revegetation. Subsequent to planting, the road corridor should be inspected for completeness of work by the seeding contractor, and to ensure that all erosion control measures are in place and functional. After planting, the objectives of monitoring will be to document establishment and growth of planted species and to identify the need for maintenance including erosion and/or weed control. Incipient weed problems are defined as establishment on the treatment area of weedy species not abundant in adjacent areas that might, by establishment on the treatment areas, interfere with revegetation by native species or threaten to invade adjacent undisturbed habitats. Specific requirements for cover and density etc. are discussed in section 4.5.2, Performance Criteria.

Table 4-6 depicts the recommended monitoring schedule for each monitoring visit. The entire road corridor and abandoned road segments should be monitored according to this schedule. Monitoring of specific areas will cease, however, when performance criteria are met. Seed planting will generally be done during the fall or early winter following construction and monitoring would begin during that growing season. For this reason, the year subsequent to completion of construction is generally assumed to be the first year of the revegetation monitoring effort. This schedule may be modified, as necessary, depending on site-specific conditions. Substantive changes in the schedule, such as a recommendation to omit a particular activity because it appears unnecessary, will be submitted to SBNF for approval prior to implementation. While minor maintenance can be accomplished during monitoring, major maintenance efforts such as erosion and weed control, supplemental irrigation, reseeding, or replanting, etc., will be scheduled, as necessary.

During the first year after planting, monitoring will be conducted in February/March, May/June, and October (as listed in Table 4-6). Additional visits may be required to detect and correct erosion following significant rainstorms. Subsequently, scheduled monitoring will be

Table 4-6. General Revegetation Monitoring Schedule

Timing	*Task*
Year 1, Post Seeding	• General inspections seeding coverage, presence and proper placement of erosion control devices, weeds, and other problems (all plant communities) • Minor maintenance • Establish photo reference points
Year 1, 2 months after seeding	• General inspections for vegetation establishment, vigor, weeds, and other potential problems (all plant communities) • Minor maintenance
Year 1, October	• General inspections for vegetation establishment, weeds, and other problems (all plant communities) • Minor maintenance • Photographic reference points • Aerial or overview photographic monitoring (anytime from August through October)
Years 2- remainder of monitoring period, March or April	• General inspections for vegetation establishment, weeds, and other problems (chaparral and big sagebrush scrub) • Inspect planted trees and shrubs for survival and vigor and possible need for replanting (chaparral and big sagebrush scrub) • Minor maintenance
Years 2- remainder of the monitoring period, June	• General inspections for vegetation establishment, weeds, and other problems (riparian forest and scrub) • Inspect planted trees and shrubs for survival and vigor and possible need for replanting (riparian forest and scrub) • Minor maintenance
Even-numbered years, October	• General inspections for vegetation establishment, weeds, and other problems (all plant communities) • Inspect planted trees and shrubs for survival and vigor and possible need for replanting (all plant communities) • Minor maintenance • Photographic reference points
Odd numbered years, October	• General inspections for vegetation establishment, weeds, and other problems (all plant communities) • Inspect planted trees and shrubs for survival and vigor and possible need for replanting (all plant communities) • Minor maintenance • Photographic reference points • Aerial or overview photographic monitoring (anytime from August through October)
At completion of monitoring, October	• Vegetation surveys to verify that performance criteria are met (all plant communities) • Inspect planted trees and shrubs for survival and vigor and possible need for replanting (all plant communities) • Photographic reference points • Aerial or overview photographic monitoring (anytime from August through October)

Notes:

This schedule is subject to change depending upon a number of factors including: timing of project completion, seasonal climate conditions, survival rate of planted species, and rate and level of effort of maintenance activities.

Maintenance activities associated with the revegetation effort such as erosion and weed control, protective devices, supplemental irrigation, replanting or reseeding, etc. will be scheduled and performed apart from this monitoring schedule.

conducted generally in March or April, June, and October. This schedule is preliminary and may be modified.

Trees and other plantings will be evaluated in the fall, prior to the dormant season, for a minimum of 3 years, in conjunction with the normal monitoring and maintenance. Plantings, seedlings, and resprouting from cut plants will be specifically inspected and evaluated for size and vigor, condition of protective devices (if any) and irrigation system (if any), presence of competitive weeds or other factors such as gophers or insect infestations, that might affect their survival. Remedial action can be taken as recommended by the project biologist. The riparian sites and other key areas will be photographed annually.

Aerial photographic surveys or overview photos taken from the road across the canyon are recommended and can be used to evaluate the progress of revegetation. Overview photographs taken from across the canyon may be superior to aerial photography because the angle of the photographs would be more perpendicular to the angle of the slopes being photographed. Photography could be recommended at the completion of construction and in the late summer or fall of the first and third years after commencing restoration. Photography should continue every other year until performance criteria are met. Scale of aerial photographs, if used, would be 1:2400 (1 inch equals 200 feet) to allow for easy interpretation. Results from these surveys may be evaluated and information on progress extrapolated using "ground truth" information from terrestrial monitoring activities. Copies of photographs with area of disturbance highlighted (as necessary) would be included in annual monitoring reports for the years that the photos are taken.

A minimum of 10 photographic reference points should be established at points providing an overview or a close up of revegetation areas. Points would be marked either by placing a stake or using an existing marker, such as a telephone pole or road sign. Points will be revisited annually and photographed. Every effort would be made to duplicate the area photographed in previous years as precisely as possible. Annual photographs from reference points should continue until areas that are the subject of photographs meet the performance criteria. A subset of the photographs would be provided in the annual monitoring report.

A minimum of 10 50-meter permanent transects are recommended in restoration locations in chaparral and three transects in big sagebrush scrub. Transect locations would be marked on a set of alignment sheets. All transects would be sampled for cover (line-intercept transect) and for density (1 meter belt transect on both sides of the tape) annually in the spring. All shrubs and Quino checkerspot nectar plants within each transect will be recorded, and cover by each species determined. Results of transect sampling would be provided in the annual monitoring reports.

Weed control will be integrated with the monitoring effort. Small individual weeds could be removed by hand where practical. Herbicide use would be necessary to control larger weeds or infestations. All herbicide use will be consistent with label directions and conducted under the supervision of a qualified applicator. Type and amount of herbicide to apply will be determined based on recommendations of a licensed pest control advisor. Timing of surveys and removal and/or spraying will be slightly before flowering of target species.

Whenever the performance criteria are not met or when monitoring indicates that additional erosion control or weed control actions are necessary, the project biologist will recommend measures in consultation with FHWA, SBNF, and Riverside County required to meet performance criteria and monitor the implementation of the measures.

4.5.2 Performance Criteria

Performance criteria are designed to ensure that a self-regenerating ecosystem is re-established in the area of disturbance that is effective in erosion control and does not pose a threat to adjoining plant communities as a source of weeds or non-local genotypes of native species. The ultimate (long-term, beyond performance criteria) goal in areas of predominantly native plant communities is to return the disturbed area to a native plant community characteristic of the site prior to disturbance.

Field monitors will record key revegetation information such as species present, cover of individual species, overall cover, and presence and abundance of weeds. The data collected will be entered into a database and then compared to the performance criteria to determine if attainment has been reached and, if not, to estimate the additional time required to meet the criteria.

The locations of all plantings will be marked on a copy of the project plans. These sites will be periodically revisited by vegetation monitors during the regular revegetation monitoring to determine success of plantings.

Chaparral and Big Sage Brush Scrub

Goal: Establish self-regenerating chaparral ecosystem that is effective in long-term slope stabilization and erosion control and that does not pose a threat to adjoining plant communities as a source of weeds. The vegetation should gradually develop the characteristics of the adjacent undisturbed chaparral communities.

General Objectives: At acceptance the following objectives must have been met in chaparral and big sagebrush scrub:

- Topsoil is stable and not being lost to wind and water erosion to an extent that exceeds similar adjacent areas that were not disturbed for a minimum of 3 years.
- Native shrub density should generally be about 1 per square meter. The minimum density requirement was determined based on ranges in density of mature vegetation sampled for this project as described in Chapter 2. Generally, a higher density would be desired in recovering areas than in undisturbed areas because recovering shrubs would be young and expected to thin. Density values will be estimated using an objective technique such as transects on representative sample areas.
- No concentrations of weeds are present that would threaten to invade adjoining native habitats. Examples of weeds that would pose a threat to adjoining habitats include yellow star thistle and fennel (*Foeniculum vulgare*). The abundance of these species in the restoration area must be no greater than in adjacent areas of scrub and chaparral not disturbed by construction and should not threaten continued recovery of native

vegetation, after year 3, toward equivalency with adjoining vegetation not disturbed by the project.

Objectives Specific to Chaparral: At acceptance the following objectives must have been met in chaparral only:

- The percent ground cover by native perennial vegetation has increased over the monitoring period and is at least 40 percent at the end of monitoring. Alternatively, native vegetative cover must equal that on a nearby ecologically equivalent reference area identified at the outset of the project.
- A minimum of five native perennial plant species can be found in a representative 2-meter wide belt transect conducted in the restored area, except where adjacent areas of undisturbed vegetation have fewer native perennial species in a comparable area, and native shrub density meets the previous objective.

These criteria will be evaluated during monitoring and may be revised to take into account any unusual conditions, such as drought, and to incorporate the latest standards generally acceptable to the local scientific community.

Riparian Forest/Scrub

General

Goal: Restore suitable areas previously disturbed by construction to riparian habitat having species composition and habitat value equivalent to adjacent riparian areas of similar channel elevation.

Objectives: At the end of monitoring the revegetated site will have the following characteristics:

- Well-established ground cover that is appropriate for the site. This may consist of native riparian understory species, such as mugwort, mulefat, etc., and freshwater marsh species. The understory and marsh species should cover all habitat that would normally support understory. Ground cover must be in vigorous condition and be stable or increasing in trend.
- Established saplings of tree species from adjacent areas will be vigorous and in positions as to eventually form (without additional protection or maintenance) a canopy over the stream equivalent to that of adjacent undisturbed areas. At acceptance, trees must meet objectives stated below under "Trees."
- Cover by weedy species should be at a minimum. The site must be completely free of perennial exotic species such as tamarisk, except as outline below. At acceptance, the total ground cover by weeds must meet one or more of the following conditions: (1) be less than 10 percent of the habitat area; (2) be of equivalent (or lower) density to that in adjoining habitat areas not disturbed by construction; or (3) be composed of species that are typical of early successional riparian habitats but that are gradually eliminated as the

riparian habitat develops. Weeds must be in a decreasing or stable condition based upon a year-to-year comparison.

- Have survived (meeting other defined criteria) for a minimum of 2 years without supplemental irrigation.

Acceptance would require a demonstration that these objectives have been met.

Trees

Goal: Planted trees (cottonwoods and sycamores) should be able to survive under normal circumstances without further protection or maintenance. Young trees must be readily able to withstand normal seasonal droughts and pressure from herbivores. Riparian trees should be situated in such a way as to be able to survive normal seasonal flooding.

Objectives: At the end of monitoring, planted trees should meet the following criteria:

- Have a vigorous appearance.
- Be a minimum of 2 inches in diameter at the base.

If substantial replanting is necessary during the project, monitoring may be extended.

4.5.4 Reporting Requirements

Annual progress reports should be prepared by February 1 of each year during active monitoring of restoration. The annual report would cover restoration activities and results of monitoring for the preceding year. Reports would provide a narrative description of the progress of the revegetation and qualitative and quantitative results of the monitoring. The report would include an analysis of the monitoring data, and recommendations or remedial actions, if necessary. Transect data and tree growth data would be summarized in graphical and/or tabular form. Photographs of stream crossings and photographic reference points would be included in the reports.

Any substantive deviations from the approved plan proposed by the FHWA will be submitted to SBNF for approval prior to implementation.

FHWA may institute emergency changes of a substantive nature under exigent conditions. No changes will be made which could substantially affect threatened, endangered, or rare species, or species of special concern without prior notification to and written approval from permitting agencies.

erosion control) should be identified prior to seeding or planting and the treatment implemented at the appropriate time. It is further recommended that chemical soil testing be performed in areas to assure that exposed soils have the chemical constituents necessary to support the vegetation type identified in the plan. High levels of boron, salinity, nitrate, or alkalinity are especially important to identify and correct.

5.2.2 Plan Implementation

The detailed landscape and revegetation plan will be implemented as defined by the detailed plans and specifications.

5.2.3 Monitoring

A detailed monitoring plan should be prepared and implemented. It should incorporate the final success criteria and the methods for analyzing the vegetation to determine success. The monitoring plan should specify a schedule for monitoring and methods and frequency of removal of noxious weeds. Additionally the plan should identify the methods and timing of any reseeding should the revegetation program not meet the expected success criteria.

6.0 REFERENCES

AMEC Earth & Environmental, Inc. 2002. *Biological Assessment/Biological Evaluation for the Bautista Canyon Road Project*. Prepared for County of Riverside. Internal Draft. April.

Emery, D.E. 1988. *Seed Propagation of Native California Plants*. Santa Barbara Botanic Garden. Santa Barbara, California

Everett, P.C. 1957. *A Summary of the Culture of California Plants at the Rancho Santa Ana Botanic Garden 1927-1950*. Abbey Garden Press.

FHWA. 2002. Federal Highways Administration, Draft Engineering Plans, 8/8/02.

Keeley, J.E. 1991. "Seed Germination and Life History Syndromes in the California Chaparral." *Bot.Rev.* 57:81-116.

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APPENDIX A
Contact Forms

Personal Contact Report

Name of Contact/Title: **Edith Allen**						
Organization and Address of Contact: **University of California at Riverside**						
Telephone No.: **909-787-2123**			**Ext.:**			
Resource/Discipline/Topic: **University Professor**						
Contacted by: **Tamara Klug**		**Date:** **7/23/02**		**Time:**		
Contact Type: (Circle one)	Phone **X**		Meeting		Meeting Location	

Included in reference list: Yes _____ No: _____

Prepared by:

SUMMARY OF DISCUSSION, DATA COLLECTED AND RECOMMENDED CONTACT

Ms Allen has conducted research in revegetation in Riverside County for several years. She conducted a study of germination and establishment of different species using different seeding methods. She found that the success by different methods depending on the size of the seed. Smaller-seeded species were more successful when hydroseeded and larger-seeded species where more successful when they were drill seeded.

She sent me several papers she had written and gave me references for some others. She recommends imprinting on slopes if possible. If imprinting is not possible, soil should be scarified.

Personal Contact Report

Name of Contact/Title: **Grady Banister**						
Organization and Address of Contact: **Nature's Image** **20381 Lake Forest Drive, Suite B-19** **Lake Forest, CA 92630**						
Telephone No.: **949-454-1215**			**Ext.:**			
Resource/Discipline/Topic: **Revegetation Contractor**						
Contacted by: **Tamara Klug**		**Date:** **7/23/02**		**Time:**		
Contact Type: (Circle one)	Phone **X**		Meeting		Meeting Location	

Included in reference list: Yes _____ No: _____

Prepared by:

SUMMARY OF DISCUSSION, DATA COLLECTED AND RECOMMENDED CONTACT

Discussed feasibility of different seeding techniques in dry habitats and in on steep slopes. Types and approximate cost of each method is listed below:

- Imprinting. There are two types tow behind and slope imprinters. Tow behind imprinters can be used in similar areas as drill seeding (limited to almost level areas). Slope imprinters can handle any slope that a bulldozer can drive on. Very approximate cost is $500/ acre, for application only (does not include cost of seed or mycorrhizal inoculum). I did not request details on the pros and cons of success with imprinting because I have other literature sources on the subject.
- Hydroseeding. Hydroseed can be applied on any steepness of slope; it is only limited by the length of hose required to apply it and the strength of the pump to get it p a hill. Mortality of the seed is generally higher and riskier with this method as it is dependent on rainfall shortly after application and too much rainfall can cause it wash away prior to seedling establishment. Binders to improve erosion control are possible, at substantial increase in cost. Feasibility is difficult in areas without a good water source. Cost is about $1000/acre without a binder.
- Drill Seeding. Drill seeding is not commonly used. It can only be used in relatively flat areas. Cost is about $500/acre.

Personal Contact Report

Name of Contact/Title: **Bruce Berlin**						
Organization and Address of Contact: **S & S Seeds**						
Telephone No.: **805-684-0436**			**Ext.:**			
Resource/Discipline/Topic: **Seed Contractor**						
Contacted by: **Tamara Klug**		**Date:** **7/24/02**		**Time:**		
Contact Type: (Circle one)	Phone **X**		Meeting		Meeting Location	

Included in reference list: **Yes** _____ **No:** _____

Prepared by:

SUMMARY OF DISCUSSION, DATA COLLECTED AND RECOMMENDED CONTACT

Mr. Berlin gave me data on germination and purity rates for seeds of species we were considering for the project. Of the species we are interested in, *Plantago erecta* is grown commercially from stock in the Moreno Valley. The growing area is their ranch in Los Alamos.

His experience has been that imprinting is an effective method of seed application, especially in dry habitats. He knows of one arid project where seed was imprinted one year. The rainy season was substantially below normal and nothing came up. The project was considered a failure. The following year (with normal rainfall and no additional inputs) the seeded species came up and established well.

Personal Contact Report

Name of Contact/Title: **Baldo Villegas**						
Organization and Address of Contact: **3288 Meadow View Road** **Sacramento, CA 95832**						
Telephone No.: **916-262-2051**			**Ext.:**			
Resource/Discipline/Topic: **Implementation Coordinator for Yellow Star Thistle Biological Control Program**						
Contacted by: **Tamara Klug**		**Date:** **8/12/02**		**Time:**		
Contact Type: (Circle one)	Phone **X**		Meeting		Meeting Location	

Included in reference list: **Yes** _____ **No:** _____

Prepared by:

SUMMARY OF DISCUSSION, DATA COLLECTED AND RECOMMENDED CONTACT

I called Mr. Villegas to learn more about yellow star thistle infestation in Riverside County. He is involved in a project using biological control agents (e.g. beetles) to control or reduce seed set of yellow star thistle. The project has been going on for more than a decade and they have used several control agents. The problem in Riverside County is less than some areas northward. Yellow star thistle is more prevalent along roadsides than other areas.

Personal Contact Report

Name of Contact/Title: **Melody Lardner**						
Organization **San Bernardino National Forest** **San Bernardino, CA**						
Telephone No.:			**Ext.:**			
Resource/Discipline/Topic: **Botany/Revegetation**						
Contacted by: **Westermeier/Klug**		**Date:** **May 8, 2002**		**Time:**		
Contact Type: (Circle one)	Phone		Meeting	X	Meeting Location	**Riverside, CA**

Included in reference list: Yes ___X__ No: _____

Prepared by: Westermeier

SUMMARY OF DISCUSSION, DATA COLLECTED AND RECOMMENDED CONTACTS:

This information was provided during a SEE meeting.

The SBNF has no specific revegetation guidelines, but offered a number of suggestions. Native seeds should be used whenever possible and the use of noxious weeds should be avoided. Seeds and propagation materials should be collected within the same mountain range and within 1,000 feet of the elevation to be revegetated. It may not be necessary to revegetate everything especially steep road cuts. Major factors associated with revegetation include seeding, weed control and compaction. The SBNF may allow temporary seeding with non-natives such as sterile grasses. Transplanting of vegetation is not typically successful, but it would be appropriate for riparian species. Hydroseeding has not seemed to work well, especially when there is a dry year.

The California Department of Transportation (Caltrans) may be a good source of revegetation plans and information. They developed the Highway 138 revegetation plan. That highway looked good after only a couple of years. It was recommended that Caltrans be contacted.

The SBNF wants abandoned roadways regraded to natural topography and those areas and critical habitat intensively revegetated. Any use of herbicides for noxious weed control should be addressed in the EIS/EIR. Mitigation in the form of removal of noxious weeds such as tamarisk should also be considered.. The Forest Service Weed Prevention Guide may have

useful information. Noxious weed surveys would also be required.

More intensive revegetation should be conducted near roadways and vertical mulching should also be considered. The outlook should also be more intensively vegetation. This area should also be considered for interpretation of native plants. Use of container plants may be appropriate for this area. Revegetation should be at a successional stage and not a climax stage.

Rock coloring should be considered for major visual areas. Coloring may not be necessary throughout the alignment.

Criteria for revegetation success are needed. There is no Forest Service standard for success criteria for revegetation. Criteria are developed on a project specific basis. Top soil should be removed and stored where possible. The crushed brush, also known as duff, should also be removed and stored.

Personal Contact Report

Name of Contact/Title: **Lydia White, Technician**						
Organization **California Department of Transportation** **District 8** **San Bernardino, CA**						
Telephone No.: **909-494-0349**			**Ext.:**			
Resource/Discipline/Topic: **Botany/Revegetation**						
Contacted by: **Westermeier**			**Date:** **July 17,2002**		**Time:**	
Contact Type: (Circle one)	Phone	X	Meeting		Meeting Location	

Included in reference list: Yes ___X__ No: _____

Prepared by: Westermeier

SAIC inquired as to the existence of revegetation plans for the Highway 138 widening projects and any additional projects they may have. They were not able to locate any separate plans or specifications for these projects. Revegetation plans were incorporated into the engineering specifications and not separate documents. Caltrans is currently preparing standards for revegetation plants, but they are not available yet.

Belt Transect Form

Transect number: #1
Observers: C.E. & MB
Date: 7/31/22

Species	Tally
Artr	80
Erfa	7
Lefi	4
Crca	5
Pece	14

Species	Abbreviation
Adenostoma fasciculatum	Adfa
Adenostoma sparsifolium	Adsp
Arctostaphylos glauca	Argl
Artemisia californica	Arca
Artemisia douglasiana	Ardo
Artemisia tridentata	Artr
Baccharis salicifolia	BaSa
Ceanothus cuneatus	Cecu
Ceanothus leucodermis	Cele
Cercocarpus betuloides	Cebe
Encelia farinosa	Enfa
Eriodictyon crassifolium	Ercr
Eriogonum fasciculatum	Erfa
Heteromeles arbutifolia	Hear
Keckiella antirrhiniodes	Kean
Keckiella ternata	Kete
Lessingia filaginifolia	Lefi
Lotus scoparius	Losc
Malacothamnus fasciculatus	Mafa
Mimulus aurantiacus	Miau
Plantago racemosa	Plra
Populus fremontii	Pofr
Prosopus glandulosa	Prgl
Prunus ilicifolia	Pril
Quercus agrifolia	Quag
Quercus berberidifolia	Qube
Rhamnus ilicifolia	Rhil
Rhus ovata	Rhov
Salix exigua	Saex
Salix laevigata	Sala1
Salix lasiolepis	Sala2
Salvia mellifera	Same1
Sambucus mexicana	Same2
Lessingia filaginifolia	Lefi
Croton californicus	Crca
Penstemon centranthifolius	Pece

Belt Transect Form

Transect number: 2 (Red Shank Chaparral)
Observers: CE : MB Date: 7/31/02

Species	Tally
Cecu	63
Adfa	11
Rhtr	27
Erfa	11
Teco	10
Artr	1

Species	Abbreviation
Adenostoma fasciculatum	Adfa
Adenostoma sparsifolium	Adsp
Arctostaphylos glauca	Argl
Artemisia californica	Arca
Artemisia douglasiana	Ardo
Artemisia tridentata	Artr
Baccharis salicifolia	BaSa
Ceanothus cuneatus	Cecu
Ceanothus leucodermis	Cele
Cercocarpus betuloides	Cebe
Encelia farinosa	Enfa
Eriodictyon crassifolium	Ercr
Eriogonum fasciculatum	Erfa
Heteromeles arbutifolia	Hear
Keckiella antirrhiniodes	Kean
Keckiella ternata	Kete
Lessingia filaginifolia	Lefi
Lotus scoparius	Losc
Malacothamnus fasciculatus	Mafa
Mimulus aurantiacus	Miau
Plantago racemosa	Plra
Populus fremontii	Pofr
Prosopus glandulosa	Prgl
Prunus ilicifolia	Pril
Quercus agrifolia	Quag
Quercus berberidifolia	Qube
Rhamnus ilicifolia	Rhil
Rhus ovata	Rhov
Salix exigua	Saex
Salix laevigata	Sala1
Salix lasiolepis	Sala2
Salvia mellifera	Same1
Sambucus mexicana	Same2
Rhus trilobata	Rhtr
Tetradymia comosa	Teco

Belt Transect Form

Transect number: 3 (mixed CH)
Observers: MB & CE. Date: 8/1/02

Species	Tally
Adfa	161
Argl	5
Trla	52
Guca	12
Losp	1
Cecu	1

soils: rocky clay
slope: flat/slightly N facing

Species	Abbreviation
Adenostoma fasciculatum	Adfa
Adenostoma sparsifolium	Adsp
Arctostaphylos glauca	Argl
Artemisia californica	Arca
Artemisia douglasiana	Ardo
Artemisia tridentata	Artr
Baccharis salicifolia	BaSa
Ceanothus cuneatus	Cecu
Ceanothus leucodermis	Cele
Cercocarpus betuloides	Cebe
Encelia farinosa	Enfa
Eriodictyon crassifolium	Ercr
Eriogonum fasciculatum	Erfa
Heteromeles arbutifolia	Hear
Keckiella antirrhiniodes	Kean
Keckiella ternata	Kete
Lessingia filaginifolia	Lefi
Lotus scoparius	Losc
Malacothamnus fasciculatus	Mafa
Mimulus aurantiacus	Miau
Plantago racemosa	Pira
Populus fremontii	Pofr
Prosopus glandulosa	Prgl
Prunus ilicifolia	Pril
Quercus agrifolia	Quag
Quercus berberidifolia	Qube
Rhamnus ilicifolia	Rhil
Rhus ovata	Rhov
Salix exigua	Saex
Salix laevigata	Sala1
Salix lasiolepis	Sala2
Salvia mellifera	Same1
Sambucus mexicana	Same2

Yucca whipplei = Yuwh
Lonicera spicata = Losp
Gutierrezia californica = Guca
Trichostemia lanatum. Trla

This area burned ~10-12 yrs ago by chance transect hit few sp. other than Adfa. Historicly, prefire, probably included red shank as dominant. Communities mapped as mixed actually are composed of large patches of single species dominated areas. A mosaic of the other CH types mapped. Too small to map out at this scale of project. No red shank recruitment is visible.

Belt Transect Form

Transect number: 4 - Big open plain to
Observers: CE · MB Date: 8/1/02

Species	Tally
Argl	28
Opba	9
Adfa	30
Ercr	11

Species	Abbreviation
Adenostoma fasciculatum	Adfa
Adenostoma sparsifolium	Adsp
Arctostaphylos glauca	Argl
Artemisia californica	Arca
Artemisia douglasiana	Ardo
Artemisia tridentata	Artr
Baccharis salicifolia	BaSa
Ceanothus cuneatus	Cecu
Ceanothus leucodermis	Cele
Cercocarpus betuloides	Cebe
Encelia farinosa	Enfa
Eriodictyon crassifolium	Ercr
Eriogonum fasciculatum	Erfa
Heteromeles arbutifolia	Hear
Keckiella antirrhiniodes	Kean
Keckiella ternata	Kete
Lessingia filaginifolia	Lefi
Lotus scoparius	Losc
Malacothamnus fasciculatus	Mafa
Mimulus aurantiacus	Miau
Plantago racemosa	Plra
Populus fremontii	Pofr
Prosopus glandulosa	Prgl
Prunus ilicifolia	Pril
Quercus agrifolia	Quag
Quercus berberidifolia	Qube
Rhamnus ilicifolia	Rhil
Rhus ovata	Rhov
Salix exigua	Saex
Salix laevigata	Sala1
Salix lasiolepis	Sala2
Salvia mellifera	Same1
Sambucus mexicana	Same2
Opuntia basilaris	Opba

Belt Transect Form

Transect number: 5 (Coastal Sage / Chaparral Scrub)
Observers: CE & MB Date: 8/1/02

Species	Tally
Erfa	23
Yucch	22
Adfa	17
Same1	10

Species	Abbreviation
Adenostoma fasciculatum	Adfa
Adenostoma sparsifolium	Adsp
Arctostaphylos glauca	Argl
Artemisia californica	Arca
Artemisia douglasiana	Ardo
Artemisia tridentata	Artr
Baccharis salicifolia	BaSa
Ceanothus cuneatus	Cecu
Ceanothus leucodermis	Cele
Cercocarpus betuloides	Cebe
Encelia farinosa	Enfa
Eriodictyon crassifolium	Ercr
Eriogonum fasciculatum	Erfa
Heteromeles arbutifolia	Hear
Keckiella antirrhiniodes	Kean
Keckiella ternata	Kete
Lessingia filaginifolia	Lefi
Lotus scoparius	Losc
Malacothamnus fasciculatus	Mafa
Mimulus aurantiacus	Miau
Plantago racemosa	Plra
Populus fremontii	Pofr
Prosopus glandulosa	Prgl
Prunus ilicifolia	Pril
Quercus agrifolia	Quag
Quercus berberidifolia	Qube
Rhamnus ilicifolia	Rhil
Rhus ovata	Rhov
Salix exigua	Saex
Salix laevigata	Sala1
Salix lasiolepis	Sala2
Salvia mellifera	Same1
Sambucus mexicana	Same2

Belt Transect Form

Transect number: 6 (Chaparral)
Observers: CE & MB Date: 8/1/02

Species	Tally
Adfa	43
Same1	116
Opba	1
Erfa	6

Species	Abbreviation
Adenostoma fasciculatum	Adfa
Adenostoma sparsifolium	Adsp
Arctostaphylos glauca	Argl
Artemisia californica	Arca
Artemisia douglasiana	Ardo
Artemisia tridentata	Artr
Baccharis salicifolia	BaSa
Ceanothus cuneatus	Cecu
Ceanothus leucodermis	Cele
Cercocarpus betuloides	Cebe
Encelia farinosa	Enfa
Eriodictyon crassifolium	Ercr
Eriogonum fasciculatum	Erfa
Heteromeles arbutifolia	Hear
Keckiella antirrhiniodes	Kean
Keckiella ternata	Kete
Lessingia filaginifolia	Lefi
Lotus scoparius	Losc
Malacothamnus fasciculatus	Mafa
Mimulus aurantiacus	Miau
Plantago racemosa	Plra
Populus fremontii	Pofr
Prosopus glandulosa	Prgl
Prunus ilicifolia	Pril
Quercus agrifolia	Quag
Quercus berberidifolia	Qube
Rhamnus ilicifolia	Rhil
Rhus ovata	Rhov
Salix exigua	Saex
Salix laevigata	Sala1
Salix lasiolepis	Sala2
Salvia mellifera	Same1
Sambucus mexicana	Same2
Opuntia basilaris	Opba

Line-Intercept Tansect Form

Transect number: * 1 Great Basin Shrub
Page 1 of 1
Observers: C. E. Date 7/31/02

From	To	Species
0	2.5	BG
2.5	5.05	Artr
	5.65	BG
	6.35	Erfa
	6.85	Artr, Erfa
	7.45	Artr
	8.15	dead Artr
	8.55	Erfa
	11.2	Artr
	11.65	BG
	12.45	Erfa
	13.70	Artr
	15.45	BG
	16.8	Artr
	17.05	BG
	17.1	Artr
	18.4	BG
	18.8	Artr
	21.3	dead material
	22.3	Artr
	25.0	BG
	25.1	Pece
	25.9	BG
	26.1	Artr
	27.2	BG
	31.0	Artr
	32.8	BG
	33.5	Artr
	35.4	BG
	36.3	Artr
	36.6	Artr, Pece
	37.95	Artr
	38.3	BG
	40.	Artr
	43.55	BG
	44.15	Artr
	44.8	dead material
	45.	Artr
	46	BG
	46.3	Artr
	46.7	BG
	47.3	Artr
	47.6	BG
	47.8	Artr
	48.45	BG
	48.9	Artr
	49.4	BG
	50.0	Artr

Species	Abbreviation
Adenostoma fasciculatum	Adfa
Adenostoma sparsifolium	Adsp
Arctostaphylos glauca	Argl
Artemisia californica	Arca
Artemisia douglasiana	Ardo
Artemisia tridentata	Artr
Baccharis salicifolia	BaSa
Ceanothus cuneatus	Cecu
Ceanothus leucodermis	Cele
Cercocarpus betuloides	Cebe
Encelia farinosa	Enfa
Eriodictyon crassifolium	Ercr
Eriogonum fasciculatum	Erfa
Heteromeles arbutifolia	Hear
Keckiella antirrhiniodes	Kean
Keckiella ternata	Kete
Lessingia filaginifolia	Lefi
Lotus scoparius	Losc
Malacothamnus fasciculatus	Mafa
Mimulus aurantiacus	Miau
Plantago racemosa	Plra
Populus fremontii	Pofr
Prosopus glandulosa	Prgl
Prunus ilicifolia	Pril
Quercus agrifolia	Quag
Quercus berberidifolia	Qube
Rhamnus ilicifolia	Rhil
Rhus ovata	Rhov
Salix exigua	Saex
Salix laevigata	Sala1
Salix lasiolepis	Sala2
Salvia mellifera	Same1
Sambucus mexicana	Same2

Bare Ground = BG
Penstemon centranthifolius = Pece

Annuals occ. in all litter
Lessingia glandulifera
Eriastrum sapphirinum
Penstemon centranthifolius

Soils = sandy / soft / friable
Topo = Flat

Note: Appears to be an area which was disdurbed/grazed converting Red Shank CH to Great Basin Scrub after disturbance stopped. No sign of red shank colonization after approx 15-20 yrs

Line-Intercept Transect Form

Transect number: 3 (mixed CH) Page 2 of 2

Observers: M.B. & C.E. Date 8/1/02

From	To	Species
	45.5	Adfa
	46.15	BG
	46.4	Adfa
	46.7	dead material
	46.85	Adfa
	47.5	dead material
	48.9	Adfa
	50.0	dead material

Species	Abbreviation
Adenostoma fasciculatum	Adfa
Adenostoma sparsifolium	Adsp
Arctostaphylos glauca	Argl
Artemisia californica	Arca
Artemisia douglasiana	Ardo
Artemisia tridentata	Artr
Baccharis salicifolia	BaSa
Ceanothus cuneatus	Cecu
Ceanothus leucodermis	Cele
Cercocarpus betuloides	Cebe
Encelia farinosa	Enfa
Eriodictyon crassifolium	Ercr
Eriogonum fasciculatum	Erfa
Heteromeles arbutifolia	Hear
Keckiella antirrhiniodes	Kean
Keckiella ternata	Kete
Lessingia filaginifolia	Lefi
Lotus scoparius	Losc
Malacothamnus fasciculatus	Mafa
Mimulus aurantiacus	Miau
Plantago racemosa	Plra
Populus fremontii	Pofr
Prosopus glandulosa	Prgl
Prunus ilicifolia	Pril
Quercus agrifolia	Quag
Quercus berberidifolia	Qube
Rhamnus ilicifolia	Rhil
Rhus ovata	Rhov
Salix exigua	Saex
Salix laevigata	Sala1
Salix lasiolepis	Sala2
Salvia mellifera	Same1
Sambucus mexicana	Same2

Line-Intercept Tansect Form

Transect number: 4 (3-point / manzanita) Page 1 of 1.

Observers: CE : MB Date 8-1-02

From	To	Species
0	.9	Argl
	1.0	Ercr, Argl
	1.3	Argl
	1.95	BG
	2.7	Adfa, Argl
	4.0	BG
	5.7	Adfa
	5.85	Adfa, Argl
	7.5	Argl
	8.4	Argl, Adfa
	8.9	Argl
	11.4	Argl, Adfa
	12.7	B.G. / litter
	14.0	dead material
	15.2	Argl
	15.4	litter
	15.5	Ercr
	16.1	dead wood
	19.9	Argl
	21.3	Argl, Adfa
	22.8	Argl
	23.0	Argl, Adfa
	23.4	Argl, Adfa, Ercr
	23.7	Adfa
	26.0	Argl
	26.5	Ercr, Argl
	28.0	Argl
	28.4	Argl, Adfa
	29.8	Argl, Ercr
	31.2	Adfa, Argl
	31.7	Adfa
	31.8	Opba, Adfa
	32.5	Adfa, Argl
	38.1	Argl
	38.7	Argl, Adfa
	39.7	Argl
	40.2	Argl, Adfa
	41.2	Adfa
	42.6	B.G.
	43.4	Adfa
	44.3	Argl
	45.0	B.G.
	46.0	Argl
	47.35	Argl, Adfa
	47.45	Argl, Adfa, Opba
	50.0	Argl, Adfa

Species	Abbreviation
Adenostoma fasciculatum	Adfa
Adenostoma sparsifolium	Adsp
Arctostaphylos glauca	Argl
Artemisia californica	Arca
Artemisia douglasiana	Ardo
Artemisia tridentata	Artr
Baccharis salicifolia	BaSa
Ceanothus cuneatus	Cecu
Ceanothus leucodermis	Cele
Cercocarpus betuloides	Cebe
Encelia farinosa	Enfa
Eriodictyon crassifolium	Ercr
Eriogonum fasciculatum	Erfa
Heteromeles arbutifolia	Hear
Keckiella antirrhiniodes	Kean
Keckiella ternata	Kete
Lessingia filaginifolia	Lefi
Lotus scoparius	Losc
Malacothamnus fasciculatus	Mafa
Mimulus aurantiacus	Miau
Plantago racemosa	Plra
Populus fremontii	Pofr
Prosopus glandulosa	Prgl
Prunus ilicifolia	Pril
Quercus agrifolia	Quag
Quercus berberidifolia	Qube
Rhamnus ilicifolia	Rhil
Rhus ovata	Rhov
Salix exigua	Saex
Salix laevigata	Sala1
Salix lasiolepis	Sala2
Salvia mellifera	Same1
Sambucus mexicana	Same2
Opuntia basilaris	Opba

BG = Baregrand

Line-Intercept Tansect Form

Transect number: 5 (Arctostaphylos glauca / Bare ground / Same) Page 1 of 2

Observers: OE : MB Date 8/1/02

From	To	Species
0	0.3	Erfa
	0.9	Same 1
	2.1	Same 1, Erfa
	6.3	Same 1
	6.8	Dead wood
	8.4	Erfa
	9.0	Erfa, Adfa
	10.5	Adfa
	10.8	BG
	10.9	same 1
	11.25	Dead wood
	12.75	Same 1
	13.4	Same 1, Adfa
	16.0	Adfa
	16.6	Adfa Same 1
	16.7	Meim
	17.95	Same 1
	18.3	Erfa
	18.9	BG
	19.7	Yuwh
	21.8	BG
	26.8	Adfa Meim
	28.0	Adfa, Yuwh
	28.8	Adfa
	29.1	Adfa Yuwh
	29.65	Adfa
	29.95	Adfa, Yuwh
	30.1	Adfa, Same 1
	31.0	BG
	32.7	Adfa
	34.1	Adfa Yuwh
	34.5	Yuwh
	34.8	Adfa
	35.4	BG
	35.8	Yuwh
	36.2	Yuwh, Erfa
	36.5	Erfa
	37.25	Erfa, Yuwh
	37.7	Erfa
	38.3	BG
	38.95	Yuwh
	39.15	Erfa, Yuwh
	39.3	BG
	40.0	Erfa
	41.5	BG
	41.8	Yuwh
	42.5	Erfa, Yuwh

Species	Abbreviation
Adenostoma fasciculatum	Adfa
Adenostoma sparsifolium	Adsp
Arctostaphylos glauca	Argl
Artemisia californica	Arca
Artemisia douglasiana	Ardo
Artemisia tridentata	Artr
Baccharis salicifolia	BaSa
Ceanothus cuneatus	Cecu
Ceanothus leucodermis	Cele
Cercocarpus betuloides	Cebe
Encelia farinosa	Enfa
Eriodictyon crassifolium	Ercr
Eriogonum fasciculatum	Erfa
Heteromeles arbutifolia	Hear
Keckiella antirrhiniodes	Kean
Keckiella ternata	Kete
Lessingia filaginifolia	Lefi
Lotus scoparius	Losc
Malacothamnus fasciculatus	Mafa
Mimulus aurantiacus	Miau
Plantago racemosa	Plra
Populus fremontii	Pofr
Prosopus glandulosa	Prgl
Prunus ilicifolia	Pril
Quercus agrifolia	Quag
Quercus berberidifolia	Qube
Rhamnus ilicifolia	Rhil
Rhus ovata	Rhov
Salix exigua	Saex
Salix laevigata	Sala1
Salix lasiolepis	Sala2
Salvia mellifera	Same1
Sambucus mexicana	Same2
Yucca whipplei	Yuwh
Melica imperfecta	Meim

BG = Bare ground

Line-Intercept Tansect Form

Transect number: 5 (Coastal Sage/Riparian Ecotone) Page 2 of 2

Observers: CE & MB Date 8/1/02

From	To	Species
	43.2	Erfa
	46.9	BG
	48.1	Erfa
	48.5	Yuwh, Erfa
	49.3	Yuwh
	56.0	Yuwh, Erfa

Species	Abbreviation
Adenostoma fasciculatum	Adfa
Adenostoma sparsifolium	Adsp
Arctostaphylos glauca	Argl
Artemisia californica	Arca
Artemisia douglasiana	Ardo
Artemisia tridentata	Artr
Baccharis salicifolia	BaSa
Ceanothus cuneatus	Cecu
Ceanothus leucodermis	Cele
Cercocarpus betuloides	Cebe
Encelia farinosa	Enfa
Eriodictyon crassifolium	Ercr
Eriogonum fasciculatum	Erfa
Heteromeles arbutifolia	Hear
Keckiella antirrhiniodes	Kean
Keckiella ternata	Kete
Lessingia filaginifolia	Lefi
Lotus scoparius	Losc
Malacothamnus fasciculatus	Mafa
Mimulus aurantiacus	Miau
Plantago racemosa	Plra
Populus fremontii	Pofr
Prosopus glandulosa	Prgl
Prunus ilicifolia	Pril
Quercus agrifolia	Quag
Quercus berberidifolia	Qube
Rhamnus ilicifolia	Rhil
Rhus ovata	Rhov
Salix exigua	Saex
Salix laevigata	Sala1
Salix lasiolepis	Sala2
Salvia mellifera	Same1
Sambucus mexicana	Same2

Line-Intercept Tansect Form

Transect number: 6 (Transect diagonal) Page 1 of 1

Observers: CE, MB Date 8/1/07

From	To	Species
0	0.7	Dead veg
	0.85	Erfa
	0.95	Dead veg
	2.2	Erfa
	2.35	BG
	2.55	Erfa
	2.9	Erfa, Adfa
	9.5	Adfa
	9.8	Adfa, Same1
	10.2	Adfa
	10.7	Adfa, Same1
	10.9	Adfa
	12.3	BG, Dead veg
	16.5	Adfa
	17.1	Adfa, same1
	18.9	Adfa
	19.6	BG
	23.8	Adfa
	24.3	BG
	30.6	Adfa
	31.2	Adfa, same1
	33.3	Adfa
	35.7	Adfa, same1
	38.0	Adfa
	41.6	Adfa, Same1
	42.5	Same1
	43.3	Adfa, same1
	44.2	Adfa
	45.0	BG - Dead veg
	45.6	Adfa
	46.0	Dead veg
	46.2	Adfa
	48.7	Same1
	49.5	Adfa, same1
	50.0	Adfa

Species	Abbreviation
Adenostoma fasciculatum	Adfa
Adenostoma sparsifolium	Adsp
Arctostaphylos glauca	Argl
Artemisia californica	Arca
Artemisia douglasiana	Ardo
Artemisia tridentata	Artr
Baccharis salicifolia	BaSa
Ceanothus cuneatus	Cecu
Ceanothus leucodermis	Cele
Cercocarpus betuloides	Cebe
Encelia farinosa	Enfa
Eriodictyon crassifolium	Ercr
Eriogonum fasciculatum	Erfa
Heteromeles arbutifolia	Hear
Keckiella antirrhiniodes	Kean
Keckiella ternata	Kete
Lessingia filaginifolia	Lefi
Lotus scoparius	Losc
Malacothamnus fasciculatus	Mafa
Mimulus aurantiacus	Miau
Plantago racemosa	Plra
Populus fremontii	Pofr
Prosopus glandulosa	Prgl
Prunus ilicifolia	Pril
Quercus agrifolia	Quag
Quercus berberidifolia	Qube
Rhamnus ilicifolia	Rhil
Rhus ovata	Rhov
Salix exigua	Saex
Salix laevigata	Sala1
Salix lasiolepis	Sala2
Salvia mellifera	Same1
Sambucus mexicana	Same2

BG = Bare ground