Revegetation Plan for Impacts Identified in the LADWP, Inyo County EIR for Groundwater Management

Report prepared by Irene Yamashita
Inyo County Water Dept.
August 1999

INTRODUCTION

The Environmental Impact Report (EIR) pertaining to the second Los Angeles aqueduct identified land that had become barren due to changes in surface or groundwater management (City of Los Angeles Department of Water and Power and County of Inyo 1990). These lands have either remained barren for at least 20 years or the current plant cover and composition is dominated by weedy annuals. The mitigation identified in the EIR for these lands requires revegetation with native perennial plants. Because the success of revegetation on barren lands in the Owens Valley is largely unknown, the EIR provides the opportunity for Inyo and Los Angeles to conduct studies to develop effective techniques. A Memorandum of Understanding (MOU) which accompanies the EIR and long-term water agreement requires revegetation plans and implementation schedules to be completed by June 13, 1998.

The MOU states that the plans "will be prepared in accordance with the procedures set forth in ...the Green Book," the technical appendix to the Inyo-Los Angeles Agreement (City of Los Angeles Department of Water and Power and County of Inyo 1990). These procedures include: establishing a goal consistent with the goals and principles of the long-term agreement; consideration of feasible alternatives to mitigate the impact site such as cessation of pumping and use of surface water; revegetation using native plant species; and implementation of measures to control weeds and fugitive dust. The Green Book also calls for an annual written report to the Inyo/Los Angeles Standing Committee containing monitoring results and a description of the effectiveness of the mitigation program in achieving its goals.

As a first step towards understanding the research needs and existing techniques that could be employed for revegetation in the Owens Valley, a literature search was conducted in 1993 focusing on arid lands (Yamashita 1993). Currently several revegetation studies have been initiated in the Owens Valley. One study that began in 1991 consisted of planting containerized native plants in Laws and subjecting them to different planting densities, irrigation, fertilizer, and weeding regimes. Later a seeding trial was also conducted at the site (Yamashita and Manning 1997). Additional studies have tested protecting naturally occurring seedlings (Yamashita 1997) and transplants with plant shelters. Results from the Owens Valley studies, information gained from the literature search and restoration conferences, and collaboration with others working on arid land restoration were used to develop the mitigation plans included in this report.

This report describes project goals, monitoring, and general revegetation methods that will be employed at the various sites. A site description is provided for each mitigation area which includes the site location, environmental setting, soil description, quantified goals, site priority, revegetation plan, and species anticipated for use. The general site evaluation was conducted in 1993-1994 and 1997. These evaluations involved delineating the EIR-mapped sites on aerial photos and then visiting them to note areal extent and current conditions. Sites were categorized as they were in the EIR according to type of impact, either abandoned agriculture (ABAG), groundwater pumping, or into a third category of "potential" sites that "will be considered...for selective

mitigation" by the Inyo/Los Angeles Standing Committee. The latter are all within the Laws wellfield and have been impacted by a number of water and land management activities such as groundwater pumping, abandoned agriculture, water spreading, and grazing.

Four additional sites have also been included under "potential sites" in case the stated mitigation goals change to incorporate native plant revegetation. Two of these are slated for "re-greening." One is an undefined potential enhancement/mitigation (E/M) project that will become a native plant site if permanent irrigation is infeasible (East Big Pine), and another may be converted to alfalfa "if the natural vegetation does not increase"(East Shepherd Creek). These sites are briefly described here, except no on-site mapping, species list, and quantified goals were developed. It is assumed that the initial work on the ABAG and pumping impacted sites will increase the effectiveness of revegetation on these potential sites should the need arise.

It is recommended that all sites be protected as soon as possible. Other recommendations presented in this report will initially be tested in small plots to evaluate their effectiveness and to refine techniques. The most effective methods will then be applied over a larger portion of the site.

The Standing Committee may consider amending this plan if an area covered by the plan is proposed for uses other than revegetation. Proposed uses other than revegetation may include community or Indian reservation expansion or changes in land use such as conversion to irrigation. Any amendment to this plan that would result in uses other than revegetation would be subject to compliance with applicable requirements of the California Environmental Quality Act and with any provisions in the 1991 Final EIR pertaining to modification of mitigation measures adopted in the EIR.

Common names for plants were used in this report. Scientific names can be found in Appendix I, Species List.

PROJECT GOALS

Revegetation goals for mitigation in the EIR varied between "achieve[ing] as full a vegetation cover as is feasible, but at a minimum a vegetation cover sufficient to avoid blowing dust" and replacing "native vegetation of the type that has died off." However, the goals in the MOU, which supersedes the EIR, are, in order of preference, to restore the vegetation type that previously existed, to establish perennial vegetation comparable to nearby areas, or to revegetate with other native Owens Valley species. The EIR also states that "successful revegetation of these lands could take a decade or longer."

Included with each site description is a stated goal. For the majority of sites, the goal is to restore vegetation cover and composition to that of surrounding plant communities or to that which existed prior to impact. For this project, the site will be considered rehabilitated when cover is 90% and composition is 75% of the site specific stated goal with an 80% confidence limit. At least 25% of vegetation cover must include recruits at least three years old that appear to have germinated without human intervention. This would give assurance that the site has become self-sustaining. For

example, if the site goal is 15% live cover composed of 13 species, then the goal will be met when live cover reaches 13.5%, consists of at least10 species, and 3.5% of the plants are approximately 3 years old. It is expected that these are long-term goals, possibly taking over 15 to 20 years to achieve, especially if revegetation activities are ongoing. Density criteria will not be included because there are no baseline data for comparison.

After seven years, these overall goals should be reexamined to assess whether they are realistic or need revision. Assessment will include the level of effort expended on the project and a statistical evaluation of the status of the cover and composition of desirable and weedy species.

SITE PRIORITY

To assist in planning, sites were prioritized according to: (1) whether they are continuing to degrade (e.g. site continues to lose topsoil) or (2) if they impose a high degree of difficulty for revegetation (e.g. the absence of topsoil or large size). Sites that were impacted more recently or are continuing to degrade, were rated as high priority because immediate action may minimize the effort necessary to revegetate the site. Difficult sites will require experimentation and several years at a minimum to evaluate results before applying the methods on a larger scale. Therefore, they would also benefit from early implementation and were rated as high priority.

The order that sites will be fenced was based on site priority. However, because fencing crews are assigned to work in either the northern or southern portion of the valley and because the majority of sites are located in the south, some of the lower priority sites in the north will be fenced before higher priority sites in the south.

REVEGETATION METHODS

A successful revegetation program must ameliorate the environmental problems created by loss of plant cover, correct land management practices that adversely affect plant establishment, test different methods under varying conditions, and remain flexible to alter plans based on results at the site or from other sites. Time must be spent on careful planning that considers soil conditions, plant species, and past experiences.

Environmental changes caused by loss of plant cover include: increased exposure of soils to wind and solar radiation; increased soil erosion; decreases in water infiltration and organic matter; loss of soil structure, topsoil, soil microflora and faunae, and microsites for germination and seedling establishment; and invasion of non-desirable species which may exclude native plants.

The revegetation plan must address land uses that affect plant establishment. Uses such as grazing and off-road vehicles can inhibit natural recruitment and eliminate plants that have naturally established on the site. Where groundwater pumping has caused increases in depth to water from historic levels, it may be necessary to introduce different plant species from those that previously grew on the site.

Testing revegetation methods is an important part of beginning the revegetation program. For example, because soil in the Owens Valley is commonly described by the Natural Resources Conservation Service (NRCS - formerly the Soil Conservation Service) as highly susceptible to wind erosion (SCS unpublished), it will be important to determine the best methods for preparing a seedbed with minimal disturbance. Seedbed test plots will be done before implementing this practice on a large scale.

Revegetation methods range from very passive (wait and see) to very intensive (landscaping). This plan takes an intermediate approach; it is designed to protect sites from disturbance and to then intensively plant or seed small areas within the larger site. It is assumed that these planted areas will "jump start" natural recruitment by providing a constant seed source and amelioration of adverse environmental conditions in their vicinity. Monitoring will determine whether this approach is working at a particular site or needs to be revised. Thus, the following methods may be modified over time based on results of projects in the Owens Valley and in other semiarid environments.

The following is a list of methods and studies that are referred to under the site evaluations.

Eliminate disturbances

The elimination of disturbances is the primary action prescribed for all sites. It is expected that ceasing disturbance will greatly benefit some sites and, in some cases, will be the only method initially employed. However, this is expected to provide only limited success for the majority of sites because they have failed to recover for over 20 years. At these sites, a more proactive approach will be necessary to achieve the revegetation goals of the EIR and MOU.

Decreased disturbance will maintain existing plant cover, provide protection for natural recruitment, and allow for litter accumulation. These sites will be monitored biennially. Monitoring will focus on detecting and identifying populations of weedy and native species. After five years, a statistical analysis will be performed on monitoring results to determine if any detectable change has occurred. If no site improvement is observed, then additional plans will be developed and implemented.

Sites will remain protected until there is evidence that disturbance will not be detrimental to the long-term rehabilitation and stability of the site.

Characterize soil

The NRCS general soil descriptions were used to characterize soils and develop site species lists for this plan. However, site specific soil characterization will be necessary at some sites to reveal potential problems that should be addressed before revegetation work. Soil characterization may include texture, salinity, sodicity, or fertility. This information will be used to further refine species selected for sites, interpret survival results, and develop effective irrigation methods.

Use a variety of plant species for seed mixes and transplants

Transplants and seed mixes will include a large variety of plant species. Variable terrain and small differences in environmental conditions will be better utilized by a mix of species that require a variety of conditions to germinate and survive.

Locally collected plant material will be emphasized for use at all sites to reduce the probability of planting non-locally adapted stock or introducing non-local genes into the Owens Valley. However, commercial seed may need to be purchased because projects may require larger volumes of seed than can be feasibly collected by hand.

A protocol for seed collection will be developed. It will include maximizing the number of same species plants for each collection, noting location, and checking seed for maturity before collection. If seed of a species is difficult to collect, vegetative propagation will be considered. Seed will be hand collected unless other methods become available.

Transplant container plants

Container plants are more labor intensive and expensive than seeding, but may prove to be the only reliable technique to establish vegetation at some sites, as we have seen at the Laws revegetation site (Yamashita and Manning 1997). If site conditions permit, container plants can be used in combination with seeding to speed revegetation. When container plants are used, they should be planted to form a windbreak to facilitate natural recruitment and reduce wind erosion.

Size of test plots for nursery stock will vary. Plot size will depend on parameters being tested, equipment needed for site preparation, adequate number of plants for statistical analysis, and plant availability.

Seeding

Seeding is the least expensive method of revegetation, and possibly, the least likely to succeed. Seeding will be performed by broadcasting or with a drill seeder. Broadcasting is the simplest method, however, it may not be the most effective because seeds are not planted at optimal depths and it requires large quantities of seed. Drill seeding uses seed more efficiently, plants them at optimal depths, and may or may not be used on prepared seedbeds; however, it requires cleaned seeds. Seeding will be performed in autumn to take advantage of winter precipitation and natural stratification.

Seeding will also be attempted on areas used for water spreading. These areas will be difficult to rehabilitate because of continued disturbance. Plants must survive soil ripping or scarification, water saturation, and desiccation. Seeding grasses onto ripped moist soil may provide a mulch cover during spreading and non-spreading years and thereby prevent blowing dust. Having a vegetative cover on these barren soils may potentially reduce the likelihood of weed invasions. Alkali sacaton will be used for this project because it is native, can germinate under saturated conditions and can withstand some flooding during growth. Other species that can meet these specification will also be considered.

Seeding was primarily chosen for experimentation at sites that already have been leveled (ABAG) because most seedbed preparation methods alter soil horizons and reduce microtopography. However, the drill seeder may be an option for areas of undisturbed topography.

Wind erosion potential and the ability to ameliorate blowing dust will be a factor in choosing sites for ripping. Ripping will be the preferred seedbed option because soil disturbance can be minimized by limiting the number of furrows. The deep narrow furrows created by ripping increase water infiltration, root penetration, and drainage. This technique will have limited application if the furrows fill in quickly or cause dust problems.

Seedbed furrows should be designed to lie perpendicular to prevailing winds. Shrubs grown with this technique have effectively reduced wind-borne dust problems on ABAG fields in Southern Arizona by forming a windbreak (SCS 1985). Once plants in furrows become established, calmer conditions at the soil surface may encourage natural recruitment by allowing accumulation of litter and organic matter, and thus providing additional microsites for seed germination.

Test plots for seedbeds and seeding will be, at a minimum, 50m x 50m unless equipment restrictions or data analysis requires a change of plot size.

Protect natural recruitment, seedlings, and transplants

Protection of transplants is a commonly used technique to increase plant establishment. Plant shelters could also be used for new recruits to protect them from wind and solar radiation. There is an indication that protection can aid growth and establishment of some species of seedlings in the Owens Valley (Yamashita 1997).

Use wood chip mulch to assist plant establishment

Wood chip mulch is being recommended because it is inexpensive, it degrades slowly, and it is too heavy to blow away. Wood chip mulch can be used as windrows to catch windblown soil, seed and microorganisms, or spread lightly over the soil surface to lower soil temperatures for enhanced germination. It also protects the soil surface from sun and wind, reduces weeds, slows moisture loss, and increases water infiltration.

Incorporate soil amendments into the soil

Loss of topsoil and disturbance of soil horizons may be ameliorated by the use of soil amendments. This may involve organic sources such as topsoil from areas that will be disturbed by construction, composted material, or other products. Inorganic sources such as gypsum may also be considered if their application can be limited to one to two years.

Wood chips may also be incorporated into the soil as an organic amendment. It will be tested for its effects on seed germination and seedling survival. The potential negative effect of mulch binding with available nitrogen can be circumvented by the addition of a slow release fertilizer. However, because native plants may better compete with weeds in low nitrogen soils, fertilization may not be beneficial.

Inoculate the soil with microorganisms

If both seeding and transplants continue to fail at a site, then soil inoculum will be tested. Inoculum could be obtained from undisturbed sites or can be purchased from commercial sources.

Site maintenance

Site maintenance includes irrigation, weed control, and maintaining plant shelters. These periodic visits will also provide a visual check on any necessary management changes, such as fence repair, increased irrigation regimes, or the need for replacement plantings.

The EIR states that short-term irrigation may be necessary for establishing plants, but long-term survival should be independent of supplemental water. This revegetation plan requires that all sites receiving seeds and transplants be irrigated for a minimum of two years during the spring and summer months.

Heavy summer precipitation may obviate the need for irrigation; however, winter precipitation does not appear to increase survival through the summer (Yamashita and Manning 1997). Irrigation needs for germinated seedlings have not been investigated, thus it is not known how long seedlings may require irrigation. It is possible that irrigation will be necessary for more than two years for optimal survival. However, irrigation is extremely labor intensive and alternative methods to deliver water should be investigated.

Weeds will be controlled around seedlings and transplanted container plants if visual or quantitative monitoring demonstrates they are suppressing survival and growth of favored species. Results from a revegetation study indicate that weeding transplanted shrubs can increase growth and survival for at least 2 years, especially if unirrigated (Yamashita and Manning 1997). Removal of Russian thistle around plants is necessary only once a year and can be accomplished when weeds are still small.

Monitoring

Monitoring will be used to assess whether sites are proceeding towards the stated goals, to observe whether management changes are necessary, and to allow comparisons between projects to enhance learning from documented successes and failures.

Cover and composition will be measured using permanent line-point transects (see Appendix III for protocol). Photos will be taken during transects at permanently established photopoints. To assess rehabilitation progress, line-point transects will be run prior to revegetation activities to document baseline conditions.

Areas that are seeded or planted with containerized plants will have two phases of monitoring. Initially sites will be checked for germination and survival of seeded species or survival of transplanted material. This monitoring will alert planners if there is a need for remedial action, for example, additional plantings, wind protection, and/or weed control. This monitoring will occur annually for five years.

After the initial annual survival and maintenance monitoring, sites will be monitored once every five years for vegetation cover and composition. Data collection will attempt to track planted versus naturally occurring individuals to determine whether mitigation is proceeding towards the site goals.

An annual written report describing the work completed and monitoring results will be presented to the Inyo/Los Angeles Technical Group and Standing Committee.

IMPLEMENTATION SCHEDULE

The revegetation site plans include an implementation schedule. It is LADWP's intent to commence the projects as stated in the schedule. In the event of unforeseen circumstances, the schedule may be subject to delay. This situation will not change LADWP's obligation to mitigate the impacts described in the EIR. Schedule changes will be addressed in the annual report.

SPECIES LISTS

Lists of species that will be considered for seed mixes or grown for transplanting are included with each site. As many species as possible from the lists will be tested for survival at a site before any large scale planting or seeding occurs. Each species has a superscript number to reference its source for inclusion. These sources are as follows: 1a) 1984-87 LADWP on-site vegetation parcel inventory, 1b) 1984-87 LADWP vegetation parcel inventory from parcels within 5 mi. of the site, 2) NRCS soil description/plant associations, and 3) personal observations.

Species lists and goals were derived either by using vegetation cover and composition data from the site if it was mapped prior to impact or from plant communities within a five mile radius of the site. For sites mapped prior to impact, site goals and mapped species, cover, and composition are the same. When communities within a 5 mile radius were used, they were narrowed down to those that were similar in elevation and habitat (i.e. soil type and depth to water) and averaged for live cover. Composition goals were determined to be half of the combined number of perennial species from the selected communities. Plant communities that had high occurrences of weedy native or non-native species were used for species lists but not live cover or composition goals. Native perennial species that are opportunistic were not included in any species list because it is assumed they will occur without assistance. Examples of these species include: Nevada saltbush, rubber rabbitbrush, and big sagebrush.

Trace species that were not included in the 1984-87 vegetation map summary database will be added to species lists prior to beginning the revegetation work. This research may increase composition numbers and species added to mixes or grown for transplanting.

SITE DESCRIPTIONS BY IMPACT TYPE

In the following site descriptions, maps of numbered vegetation parcels were copied from and refer to the vegetation inventory conducted by the Los Angeles Department of Water and Power (LADWP) between the years 1984 to 1987. Figures accompanying site descriptions can be found on page 35.

Abandoned Agriculture (ABAG)

ABAG sites mapped in the EIR have similar features: the boundaries are well defined, the topography is level, soil horizons have been mixed, topsoil has likely blown away, and they have a sparse cover of weedy species. Most of the sites are large and surrounded by disturbed lands which further isolate the area from native seed sources. All the sites also have old irrigation canals, which will be investigated as a possible method to irrigate the revegetation projects. The three impact areas of this type described in the EIR are:

EIR Impact #	Site Location	Acres
10-18	Laws	139
10-16	South Bishop	124
10-19	Big Pine	209

Laws

This site is approximately 1 mi. SE of the town of Laws (Fig. 1). It was mapped by LADWP as parcel no. 118 consisting of 139 acres of ABAG on the Laws 7.5' USGS quad (T6S R33E, SE1/4 Sec. 27,SW1/4SW1/4 Sec. 26, & NW1/4NW1/4 Sec.35) and is divided by Laws-Poleta Rd. Access is at the Upper McNally canal road which runs along the northeastern edge of the site.

Currently the site is seasonally grazed by livestock. The sparse vegetation cover is predominantly Russian thistle, and some rabbitbrush is encroaching from the boundaries, especially down slope from the canals. Cottonwoods, tree and shrub willows, and fivehook bassia grow along the McNally canals and the Laws return ditch.

Soils at the site were mapped as a complex of Seaman (coarse-loamy, mixed (calcareous), thermic Typic Torriorthents) and Yellowrock (sandy, mixed, thermic Typic Torriorthents) soils with 2-5% slopes. Seaman soils occupy 70% of this map unit. Water permeability for both soils is similar (moderately rapid and rapid) and both are subject to severe wind erosion. Available water capacity is moderate for Seaman soil and low for Yellowrock soil. Management considerations listed by NRCS include limiting off-road vehicles, maintaining uniform plant cover, and they suggest using minimal tillage.

Current impediments to natural recruitment include wind erosion, potential rodent herbivory, livestock grazing, wind scouring, and weed infestation.

Goal: Revegetate the site with plant species found in the surrounding area. Because it is unknown what species existed on the site prior to agriculture, it is assumed the surrounding parcels represent the best estimate of those species that were present or could be used to successfully revegetate the site.

Quantifiable goals were based on 31 Great Basin Mixed Scrub and 25 Shadscale Scrub communities. Thus, the goals for native perennial plant species live cover is 11.5% composed of at least 11 different species. (See "Species List" above for descriptions of how communities were chosen for goal development.)

Priority: High - The site will be difficult because of its size, weedy cover, and severe wind erosion problems. Because rehabilitation may be slow, it would be prudent to begin work as soon as fencing can be accomplished.

Revegetation plan:

Although this parcel is listed as a high priority site, the implementation schedule is complicated by unresolved litigation and possible future adjustments or changes in lease boundaries. As a result the following target dates may not be feasible.

- Eliminate disturbances (1998)

The site west of Laws-Poleta Rd. will be fenced along the lower McNally canal and along the irrigated pasture to the north. The east side requires fencing along both McNally canals and along the eastern edge.

- Use container plants (start in 2000, transplant out 2001)

Container plants will be used because of the hazard of wind erosion on seedbeds and unsuccessful attempts at seeding previously (Yamashita and Manning 1997). However, additional studies may demonstrate that seeds can be used to establish plants successfully. Transplants will be installed in rows perpendicular to the wind to reduce wind erosion. Unless other studies indicate otherwise, plant protectors will be installed over selected species.

- Site maintenance (2001 - ongoing)
- Monitor (1999 – ongoing)

Species list:

The list for seed mixes and container plants included species from the following plant communities: Great Basin Mixed Scrub, Shadscale Scrub, Rabbitbush Scrub, Desert Sink Scrub, Nevada Saltbush Scrub, Desert Greasewood Scrub, and Desert Saltbush Scrub.

Shrubs/Forbs:

allscale saltbush[1b]	fourwing saltbush[1b]	Parry saltbush[1b]
Anderson wolfberry[1b,4]	indigo bush[1b,2]	rose four-o'clock[1b]
black greasewood[1b]	little horsebush[1b]	shadscale[1b,2]
bud sagebrush[1b,2]	longspine horsebush[1b]	spiny hopsage[1b,2]

button encelia[3]	needleleaf rabbitbrush[1b]	spiny menodora[1b]
desert alysum[1b,3]	Nevada dalea[1b]	winterfat[1b,2]
desert aster[1b]	Nevada ephedra[1b]	

Grasses:

bottlebrush squirreltail[1b]	Indian ricegrass[1b,2]	saltgrass[1b]

South Bishop

This site is approximately 2 miles south of the town of Bishop (Fig. 2). It was mapped by LADWP as vegetation parcel no. 97, consisting of 124 acres of ABAG on the Bishop 7.5' USGS quad (T7S R33E, SE1/4 Sec. 18 & NE1/4 Sec. 19). Historically, the site was planted in alfalfa until 1968 when it was abandoned. The site can be easily accessed from a canal road on the northern and eastern edge of the parcel.

Currently the site is used for seasonal livestock grazing. Although vegetation cover is minimal, in most years wind erosion appears minimized by the very sparse cover of weedy annuals and rabbitbrush which is encroaching from the edges, especially on the western portion.

Soils were mapped as Lucerne loamy fine sand, 0-2% slopes. The Lucerne soils are coarse-loamy, mixed, thermic Xeralfic Haplargids. Water permeability is moderately rapid with a low available water capacity. NRCS management concerns relevant to revegetation include minimizing soil tillage due to the wind erosion hazard and limiting off-road vehicle use.

Current impediments to natural recruitment include grazing, presence of weeds, and off-road vehicle use.

Goal: Revegetate the site with plant species found in surrounding areas. Because it is unknown what species existed on the site before impact, it is assumed the surrounding parcels represent the best estimate of those species that were present or could be used to successfully revegetate the site.

Great Basin Mixed Scrub was chosen as an appropriate target community for revegetating this site. Thus, the target for native perennial plant species live cover is 15% composed of at least 12 different species. Live cover was derived from the average live cover of 52 Great Basin Mixed Scrub parcels and by taking approximately half the combined number of perennial species from these parcels.

Priority: Low – This site was given low priority because it has a sparse but uniform cover of annuals which help stabilize the soil, it does not have aggressive weedy plant species, and it has natural recruitment occurring along the periphery.

Revegetation plan:

- Eliminate disturbances (1999).

A fence runs parallel to Hwy. 395 and on the northern edge parallel to the A1 drain. To create an exclosure, a fence will be constructed on the eastern border parallel to the Bishop Creek Canal and along the south. This will require approximately one mile of fencing.

This site will provide an opportunity to observe the results of using site protection as a revegetation method.

- Create test plots if vegetation does not naturally increase after 5 years of site protection (2004).

If no progress towards rehabilitation is occurring, test plots will be used to determine the best method of revegetation. These studies are expected to emphasize seeding if it has proven successful at other sites. Minimizing wind erosion will be emphasized in seedbed preparation.

Study plots will be irrigated although the method is not yet determined. Potential water sources are the A1 drain, well 141, or transporting water to the site.

After five years (2009) of testing, the most successful species and planting method will be used to revegetate the entire site.

- Site maintenance (as needed)
- Monitor (2000 – ongoing)

Species list:

This list for seed mixes and container plants includes species from the following plant communities located within 5 miles of the parcel: Great Basin Mixed Scrub, Big Sagebrush Scrub, Rabbitbrush Scrub, Desert Saltbush Scrub, Desert Sink Scrub, Greasewood Scrub, Shadscale Scrub and Nevada Saltbush Scrub. All species except two were found in the Great Basin Mixed Scrub communities.

Shrubs/Forbs:

allscale saltbush[1b]	desert aster[1b]	Nevada dalea[1b]
black greasewood[1b]	fourwing saltbush[1b,2,3]	Nevada ephedra[1b]
bud sagebrush[1b]	indigo bush[1b]	shadscale[1b]
burrobush[1b]	little horsebush[1b]	spiny hopsage[1b]
Calif. buckwheat[1b]	longspine horsebush[1b]	spiny menodora[1b]
Cooper's goldenbush[1b]	needleleaf rabbitbrush[1b]	winterfat[1b]

Grasses:

bottlebrush squirreltail[1b]	Great Basin wildrye[2]	saltgrass[1b]
desert needlegrass[1b]	Indian ricegrass[1b]	

Big Pine

This site is located directly east of the Big Pine Indian Reservation on the eastern edge of the town of Big Pine and is easily accessed from the Big Pine canal road (Fig. 3). The EIR describes two revegetation sites within the same vegetation parcel no. 160, 211 acres of ABAG on the Big Pine 7.5' USGS quad (T9S R34E, SE1/4 Sec.17, SW1/4 Sec.16). The area was planted with alfalfa in 1924 prior to purchase by LADWP; more recent agricultural history is unknown. A site visit to determine the boundaries for mitigation and fence perimeter resulted in a 209 acre area that will be protected for revegetation activities.

The eastern portion of the parcel, "East Big Pine," is intended to be "evaluated as a potential E/M project, however, if permanent irrigation is deemed infeasible, it will be revegetated with native plants" according to the EIR. Because it is within the same parcel as the revegetation area, mitigation would be same for both sites. East Big Pine is listed in the "potential mitigation" section because of its E/M status.

Currently the site is grazed by livestock. There is usually a fairly uniform cover of native and exotic annuals. The density and vigor of native shrubs on the perimeter of the site is poor and Russian thistle, locust, elm, and saltcedar are present. Big sagebrush, Nevada saltbush, fourwing saltbush, and black greasewood, are becoming established in parts of the impact area.

Soils at the site were mapped as a complex of Hesperia (coarse-loamy, mixed, thermic, nonacid Xeric Torriorthents) and Cartago (sandy, mixed, thermic Xeric Torriorthents) soils with 0-5% slopes. Hesperia soil comprises 65% of this map unit. Soil characteristics are fairly similar with moderately rapid to rapid permeability, moderate to low available water capacity, and moderate to severe wind erosion hazard, on Hesperia and Cartago, respectively. Management concerns relevant to revegetation are potential wind erosion if tilled and low available water capacity, especially on Cartago soils.

Current impediments to natural recruitment include grazing, invasion of weedy plant species, and some off-road vehicle use. Because the perimeter shrubs are sparse and mixed with annual weeds, there will be a constant source of weed seeds from the bordering communities.

Goal: Revegetate the site with plant species found in the surrounding area. Because it is unknown what species existed on the site prior to agricultural use, it is assumed the surrounding parcels represent the best estimate of those species that were present or could be used to successfully revegetate the site.

The live cover goal of 17.7% for this site was averaged between Great Basin Mixed Scrub, Desert Sink Scrub, and Shadscale Scrub communities. The composition goal for the site is ten perennial species.

Priority: Medium - Because of its large size, experimentation on seeding with minimal soil disturbance may be appropriate here. Because of the time required to evaluate a new technique, the test project should be started soon.

Revegetation plan:

- Eliminate disturbances (1998).

The site will be fenced along the eastern border and partially along the northern borders.

- Conduct more specific soil characterization (1999).

Evaluate the potential for wind erosion if preparing seedbeds.

- Create test plots (grow plants in 2000, plant in 2001).

If wind erosion potential appears low to moderate, test plots may include seeding. Disturbed soil may be covered with wood chips, if necessary, to reduce wind erosion.

Containerized shrubs may be tested for effectiveness as windrows. Shrubs and grasses may be planted between seeded rows and be protected with wind fences or individual shelters. If wind erosion hazard is severe then transplants will be used in lieu of seeding. Plant material will be irrigated.

After 5 years (2006) these methods will be expanded over a larger area based on the results of the test plots.

- Use soil amendments (2001)

If plant establishment remains difficult, or soil characterization demonstrates a need, soil amendments will be tested. Products and their use would need to be investigated.

- Site maintenance (2001 - ongoing)
- Monitor (1999 - ongoing)

Species list:

This list for seed mixes and container plants includes species for the following plant communities located within 5 miles of the parcel: Great Basin Mixed Scrub, Shadscale Scrub, Desert Sink Scrub, Nevada Saltbush Scrub, and Rabbitbrush Scrub.

Shrubs/Forbs:

allscale saltbush[1b]	indigo bush[1b,2]	Parry saltbush[1b]
black greasewood[1b]	little horsebush[1b]	shadscale[1b,2]
bud sagebrush[1b,2]	longspine horsebush[1b]	spiny hopsage[1b,2]
burrobush[1b]	Nevada dalea[1b]	spiny menodora[1b]
Cooper's goldenbush[1b]	Nevada ephedra[1b,2]	winterfat[1b,2]
fourwing saltbush[1b,2]		

Grasses:

alkali sacaton[1b]	desert needlegrass[1b,2]	saltgrass[1b]
bottlebrush squirreltail[1b,2]	Indian ricegrass[1b,2]	

Groundwater pumping

The four sites listed below are identified in the EIR as being degraded due to groundwater pumping. They were the most variable of the sites visited. All of these sites still have remnant scattered patches of native shrubs.

EIR Impact #	Site Location	Acres
10-12	Five Bridges	~60
10-14	Hines Spring	1-2
10-11	Tinemaha/Blackrock	
	Charlie's Butte	.4
	Hines Spring S	--
	Blackrock 16E	7.5
10-13	Independence	
	Independence 105	13.4
	Independence 131	74.6
	Independence 123	28.5

Five Bridges

The Five Bridges Impact Area is located approximately 3.5 miles north of Bishop (Fig. 4) and is easily accessed from Five Bridges Rd. (T6S R33E, Sec.24). Before the combined impact of groundwater pumping, fire, and drought, this site was mapped as a complex of riparian, meadow, and upland plant communities. The original impact area encompassed approximately 300 acres, including all or portions of the following vegetation parcels located on the Fish Slough 7.5' USGS quad: 42, 53, 54, 124, 125, 126, 129, and 130 (primarily in T6S R32E, Sec. 24). Since the impact was identified, remedial measures have mitigated approximately 80% of the area. This mitigated area is seasonally grazed, however a fence prevents livestock from grazing on the unmitigated portion. The site also provides access to the Owens River for recreational use.

The area still requiring mitigation is predominately mapped as Alkali Meadow and encompasses vegetation parcel nos. 53, 123, 124, 125, and one narrow strip of Riparian Scrub along the river and meanders, parcel no. 54. Currently the unmitigated area has been severely infested by native and non-native weeds which will be an obstacle to future revegetation efforts.

Soils at the site were mapped as a complex of Torrifluvents-Fluvaquentic Endoaquolls, two stream terrace soils with 0-2% slopes. Both soils have moderate to moderately rapid permeability and are saline with potentially high ECs and SARs which may limit species available for revegetation. Torrifluvent soils comprise 60% of this map unit and are hummocky, ranging from loamy sand to silt loam below the surface layer, are well to poorly drained, and have moderate available water capacity and moderate wind erosion hazard. The Fluvaquentic Endoaquolls are oxbow and river meanders with

coarse sand to silt loam with low to moderate available water capacity. Both wind and water erosion hazard is slight. Management considerations for this soil complex are to limit off-road vehicles to maintain soil depth and reduce soil erosion and graze only after soils have adequately drained.

In late 1995, Dr. Bill Platts of Ecosystem Sciences visited the site and produced a mitigation plan for LADWP in 1996 (Platts 1996) which Los Angeles has agreed to implement. Parts of the revegetation plan from Ecosystem Sciences are presented in italics.

Goal: R*estore the area to a complex of vegetation communities with similar species composition and cover as exists at local similar sites. The goal will be attained when the desired vegetation conditions are achieved and are sustainable.*

Live cover and composition numbers are from on-site mapping during the 1984-87 vegetation inventory. For Alkali Meadows, live cover goals are 60% composed of four different perennial species. Riparian Scrub live cover goals are 90% composed of four different perennial species. Composition numbers are 75% of the previously mapped number of species.

Priority: High - This site is currently receiving remedial action to control weeds. This process must continue before any additional rehabilitation work can occur.

Revegetation plan:

- Map the site (1998).

Using a global positioning system (GPS), delineate areas that still require mitigation.

- *Eliminate all artificial irrigation of the project area (1998 – 2002).*

Necessary irrigation will be supplied through planned high flows of the Owens River that will flood the area three times a year. This flooding regime should allow recovering vegetation to respond to more natural processes and assist natural recruitment rather than relying on artificial flows from irrigation ditches. The duration of the flows will be for a sufficient period of time to allow water to flow through the area for 24 hours. These pulse flows should be evaluated after 5 years to determine their effectiveness towards accomplishing the rehabilitation goals. The river flows should occur as follows:

May/June – This 24hr 700 cfs flow is intended to distribute willow and cottonwood seeds and plant parts along the riparian areas. This pulse will be timed to coincide with maximum seed set.
July 1 and August 1 – These two 660 cfs flows will recharge the banks and waterways during seedling growth.

- *Seed small areas of the burn with native species (2000 - 2002).*

Site preparation will include fertilizing and controlling weedy plants by potentially burning or spraying with herbicide. Seeding will be done with a range drill.

- *Allow the water table to remain at its natural level (1998 - ongoing)*

Permanently shut down pumping wells E/M #385 and E/M#386 .

- *Develop and implement a 10-year grazing plan (1998 - 2007).*

This plan will exclude grazing from riparian zones and exclude grazing in upland areas during the growing season. Cattle guards will be installed at major use areas instead of gates. (Fencing and installation of cattle guards has been completed.)

- *Dead willows will not be removed or burned*
- *Monitoring (1998 - ongoing)*

Monitoring will consist of annual photopoints and annual reading of the two previously established vegetation transects. Line-point transects will be used to determine whether the site has met the goals stated above.

Species list:

This list for seed mixes includes species from Alkali Meadow and Riparian Scrub communities that existed on the site prior to impact.

Shrubs/Forbs/Trees:

cluster goldenweed[1a]	salix[1a] (tree and shrub)	Woods rose[1a]
Fremont's cottonwood[1a]		

Grasses/Grasslike:

alkali sacaton[1a]	beardless wildrye[1a]	saltgrass[1a]
Baltic rush[1a]	clustered field sedge[1a]	spikerush[1a]

Hines Spring

The mitigation for Hines Spring, as stated in the EIR, is to provide pumped groundwater to the currently dry spring area. The water supply will be part of 1600 acre feet of "additional mitigation" defined in the MOU. The Hines Spring area (Fig. 6) will encompass approximately one to two acres and will be developed and implemented by Ecosystem Sciences and LADWP in accordance with the MOU. Therefore no revegetation plan is presented for this area in this report.

Tinemaha/Blackrock

This impact description is broken into three areas, the first area referred to as Charlie's Butte is approximately 0.25 mile south of Charlie's Butte (Fig. 5), Hines Spring S is located in the drainage of Hines Spring, and Blackrock 16E is approximately one mile SE of Hines Spring (Fig. 6).

Tinemaha 54

The Charlie's Butte site was incorrectly mapped in the EIR according to D. Groeneveld (pers. com.). The actual impact site is near the mapped site and is easily accessed by roads to Charlie's Butte (Fig. 5). Recent GPS mapping placed the site in parcel 54 but the vegetation demonstrated that it should have been in vegetation parcel 64. Parcel 64 is designated as Alkali Meadow with 33% live cover on the Tinemaha Reservoir 7.5' USGS quad (T11S R34E, SE1/4NW1/4 Sec.11). Currently the 0.4 acre mitigation site has recovering alkali sacaton and juvenile Nevada saltbush which appear to be invading the area.

Soil at the site was mapped as Shondow loam with 0-2% slopes. The Shondow soils are fine-loamy, mixed, thermic Aquic Argixerolls. Water permeability is moderately slow with moderate available water capacity and subsoil salinity and sodicity is high. Susceptibility to wind erosion is moderate. Management suggestions include limiting off-road vehicles and careful grazing management.

Current impediments to natural recovery include off-road vehicle use, wind erosion, herbivory, groundwater pumping, and soil disturbance from rodents, livestock, and elk.

Goal: Restore vegetation conditions to that which existed prior to impact. The live cover goal is 33% and composition will be composed of at least three species, predominantly alkali sacaton. Other species that were mapped on this site include rubber rabbitbrush, Nevada saltbush, black greasewood, and Indian paintbrush.

Priority: High – Immediate protection may greatly simplify restoration and may be the only necessary action. Delaying action may greatly increase the difficulty due to weed infestation and further loss of plant cover and topsoil.

Revegetation plan:

- Eliminate disturbances (1998).

  Plant protection rather than fencing will be implemented because of the small size of the site (approximately 1/3 of an acre) and because a road runs through the middle. Alkali sacaton that are recovering will be protected. If only a few alkali sacaton are present, then transplants will be installed, watered, and protected (1999).

- Site maintenance (1998 – ongoing)

  Because the site has invading juvenile Nevada saltbush, maintenance may include their removal when they are within 0.5 m of a protected alkali sacaton. Removal of plants will take into consideration the potential for wind erosion.

- Monitor (1999 - ongoing)

  Initially monitoring will focus on the success of plant protection and the need for weed control. Additional plans for seeding, transplanting, and weed control will be developed if rehabilitation appears stalled or failing after three years (2001).

This site will require long-term monitoring after it has been revegetated to protect the site from changing community type and detecting weed invasions.

Hines Spring S

This site is located in the old drainage of Hines Spring (Fig. 6) and is located in vegetation parcels 11 and 16 on the Blackrock 7.5' quad (T11S R34E, SE1/4NW1/4 and NE1/4SW1/4 (contiguous) Sec. 23). Because this area will likely be affected by the Hines Spring on-site mitigation, the site goal and revegetation plan for this area will be developed within three years after the work at Hines Spring is completed. Plans for the spring area will be completed by mid-2001.

Blackrock 16E

This site is accessible from the Intake Rd. off Hwy. 395 approximately 2.25 mi. east of the community of Aberdeen (Fig. 6) on the Blackrock 7.5' quad (T11S R34E, NE1/4SE1/4 Sec. 23). The EIR reported that this once included marsh, meadow, upland, and riparian plants, but it is now dominated by a sparse cover of shrubs. Wind erosion and grazing have further impacted the area in combination with groundwater pumping.

The site is currently used to graze packstock. The parcel was mapped as 297 acres of Alkali Meadow with 35% live cover. Fivehook bassia and Russian thistle made up 17% and 11% of the cover, respectively. The 7.5 acre mitigation portion of this parcel has little to no native vegetation. There is some natural recruitment of sagebrush and Nevada saltbush juvenile shrubs. Weeds are scattered throughout the area and fivehook bassia and tamarisk are mainly concentrated in the moister swales.

Soils at the site were mapped as Winnedumah silt loam, saline-sodic with 0-2% slopes. The Winnedumah soils are fine-loamy, mixed, thermic Xerollic Haplargids. The soil is calcareous in the top 41 inches, permeability is moderately slow, available water capacity is moderate to high and both salinity and sodicity are high in surface soil. The hazard of wind erosion is moderate. Management considerations include limiting off-road vehicles, grazing management, and planting only salt tolerant plants.

Current impediments to natural recruitment include packstock grazing, weed infestation, and difficult soils.

Goal: Rehabilitate the site to an Alkali Meadow similar to those within a 5 mi. radius of the site. The goal for live cover is 34%, composed of six species. Alkali sacaton and saltgrass should be the dominant species. The live cover goal was derived from the average live cover of the previously mentioned Alkali Meadows and composition was derived from the number of most commonly found species (excluding weeds) in those parcels.

Priority: High - Protection may begin the process of recovering the vegetation on the site. Delaying action may greatly increase the difficulty due to weed infestation and loss of topsoil.

Revegetation plan:

- Eliminate disturbances (1998).
  Fence the site to protect it from grazing.

- Site maintenance (1998 – ongoing)
  Site maintenance may include the removal of aggressive juvenile plants and weeds if they appear to compete with the recovery of desired species. Removal of plants will take into consideration the potential for wind erosion.

- Monitor (1999 – ongoing)
  Initially, monitoring will focus on recruitment and the need for weed control. Additional plans for seeding, transplanting, and weed control will be developed if rehabilitation appears stalled or failing during the first three years (2001).

Species list:

This species list for potential seed mixes and container plants only includes species from Alkali Meadows within a 5 mi. radius of the site. Aggressive native plants, such as Nevada saltbush, rubber rabbitbrush, and big sagebrush, were not included because they already exist on the parcel, and it is assumed they will spread without assistance. If monitoring demonstrates a paucity of species diversity then additional species will be added to this list.

Shrubs/Forbs:

black greasewood[1a,1b,2]	fourwing saltbush[1b]	shadscale[2]

Grasses:

alkali sacaton[1a,1b,2]	Great Basin wildrye[2]	saltgrass[1a,1b,2]
beardless wildrye[1b]		

Independence

This mitigation area consists of three sites referred to as Independence 105, Independence 131, and Independence 123 (Fig. 7). Independence 105 is accessed from Mazourka Cyn. Rd. and is approximately 1 mi. SE of the town of Independence. The other two are easily accessed from a dirt road off of Mazourka Cyn. Rd. and are approximately 2.25 (Independence 131) and 2.5 miles (Independence 123) SE of the town of Independence. All sites are located on the Independence 7.5' USGS quad.

The soil at all the sites was mapped as complex of Morey family-Winnedumah, drained-Rindge family with 0-2% slopes. Morey family soils with similar inclusions comprise 40% of this map unit and are fine-silty, mixed, thermic Typic Argiaquolls. Winnedumah soils are fine-loamy, mixed, thermic Xerollic Haplargids. and with similar inclusions comprise 25% of this map unit. Rindge family soils are euic, thermic Typic

Medisaprists and with similar inclusions comprise 20% of this map unit. All have moderately slow to slow permeability, high available water capacity, moderate to high shrink-swell capacity, and potentially high ECs and SARs. Management factors for revegetation include potential for wind erosion, inadequate drainage, salinity, and sodicity. Off-road vehicles should be limited and careful grazing management should be instituted on these soils.

The most northern site is in parcel no. 105 and is divided into north and south sections by Mazourka Canyon Rd.(T13S R35E, NE1/4NE1/4 Sec. 21). It was mapped as Nevada Saltbush Scrub with 5% plant cover, with Russian thistle and fivehook bassia making up 20% of the plant composition. After a site visit, it appeared that only the southern portion of the parcel, consisting of 13.4 acres, requires mitigation. Currently, there is recruitment of Nevada saltbush, fourwing saltbush, and allscale saltbush.

The middle site was mapped as parcel no. 131 (T13S R35E, SW1/4SW1/4 Sec. 22) consisting of 33 acres of Nevada Saltbush Scrub with 5% live cover. Fifty percent of the cover composition was annual forbs and 18% was Russian thistle. The boundaries of the revegetation area also include approximately half of vegetation parcel 125 (T13S R35E, NW1/4 Sec. 27) totaling 74.6 acres. This parcel was mapped as 129 acres of Desert Saltbush Scrub with 10% live cover consisting of 50% fourwing saltbush and 25% Russian thistle. This area was disturbed during the installation of a pipeline for a replacement well. The furrows from this disturbance are still visible and could be seeded with native seeds.

The most southern area was mapped as parcel no. 123 (T13S R35E, SW1/4 Sec. 27), 16 acres of Nevada Saltbush Scrub with 5% cover, 95% of the cover is Nevada saltbush. The impact extends to the west into parcel 231, 38.5 acres mapped as 8% live cover of Nevada Saltbush Scrub. In some areas, the wind has deposited sands on the leeward side of vegetation, however, the majority of the site has a hard soil surface with few “safe sites” for seed germination and seedling survival. Some natural recruitment is occurring along the southern boundary where wind erosion appears less severe. Remnant native plants are now confined to “shrub islands” or low-lying wetter areas.

Currently the sites are used for seasonal livestock grazing. Ongoing disturbances inhibiting natural revegetation include groundwater pumping, wind erosion, grazing, and invasion by weedy plants.

Goal: For Independence 105, 131, and 123. To revegetate with species mapped in surrounding communities. Historically the site supported species adapted to a shallow water table. Because current management no longer supports a high water table, it is assumed surrounding parcels represent the best estimate of those species that could be used to successfully revegetate the site.

Quantifiable goals were based on the five plant communities included in the species list below. The goal for live cover is 17% composed of four perennial plant species. These numbers were derived from the average live cover of the five plant communities and composition from half the number of species that will be tested on the sites.

Priority: Independence 105 - High - Because this site is showing natural recruitment, immediate protection may be the only action necessary. This site is slated for fencing in 1998. Independence 131 and 123 - High - These sites present the most difficult soil conditions and may require several years of experimentation to develop effective techniques. Thus, it would be beneficial to begin work as soon as feasible. These two sites are slated to be fenced in 1999.

Revegetation plan:

Independence 105

- Eliminate disturbances (1998)

  Fencing will be the main revegetation activity unless monitoring after three years indicates that further action is necessary (2001). Additional plans would likely include weed control, transplanting, and/or seeding.

- Monitor (1999 - ongoing)

Independence 131

- Eliminate disturbances (1999)

  The site will be fenced.

- Conduct more site specific soil characterization (1999).

  On-site soil characterization and fertility tests will be conducted if they have proven useful at other sites.

- Use container plants in test plots (start in 2001, transplant out 2002).

  Containerized plants will be installed in windrows to reduce wind erosion. Plant protection will be provided for transplants.

- Seed areas that have been previously ripped (2000) and test plots (2002).

  Seeds will be broadcast and raked or drill seeded into soil that was ripped for pipeline installation and in test plots.

- Mulch (2002)

  Mulch will be spread in rows to catch soil, seeds, and litter, and to protect transplants if it has proven useful at other sites.

- Test soil inoculation and/or soil amendments (2007).

  Soil inoculation and/or soil amendments will be tested if seed and transplants continue to fail at the site. Sources and method for inoculation and amendments to be determined.

- Site maintenance (2003 - ongoing)

  Seeds in previously ripped soils will not be irrigated.

- Monitor (2000 - ongoing)

- Expand revegetation work (2007)

  Based on results from test plots, plans for the entire site will be developed (2007) and implemented (2008).

Independence 123

- Eliminate disturbances (1999).
  This site will be fenced.
- Use container plants in test plots (start in 2001, transplant out 2002).
  Containerized plants will be installed in windrows to reduce wind erosion. Plant protection will be provided for transplants.
- Seed (2002)
  The site will be seeded in test plots if it has been used successfully at other sites with natural topography.
- Mulch (2002)
  Mulch will be spread in rows to catch soil, seeds, and litter, and to protect transplants if it has proven useful at other sites.
- Expand revegetation work (2007)
  Based on results from test plots, plans for the entire site will be developed (2007) and implemented (2008).
- Site maintenance (2003 - ongoing)
- Test soil inoculation (2007)
  Soil inoculation will be tested if seed and transplants continue to fail at the site. Sources and method for inoculation to be determined.
- Monitor (2000 - ongoing)

Independence 105, 131, and 123

Species list:

This list for seed mixes and container plants includes species from the following plant communities: Nevada Saltbush Scrub, Desert Sink Scrub, Desert Greasewood Scrub, Desert Saltbush Scrub, and Shadscale Scrub.

Shrubs/Forbs

allscale saltbush[1a]	desert olive[4]	inkweed[1b]
black greasewood[1b,2]	fourwing saltbush[1a]	

Grasses:

alkali sacaton[1b,2]	saltgrass[1b,2]

Potential Mitigation Sites

Six sites in the Laws wellfield were identified in the EIR as candidates for "selective mitigation" that would not interfere with water management activities and would require approval from the Inyo/Los Angeles Standing Committee. Past, and in some cases, current impacts to these sites include a combination of groundwater pumping, abandoned agriculture, water spreading, fires, and "other factors."

Another group of four sites were slated to be mitigated by re-greening projects (three sites) or converted to alfalfa (E. Shepherd Creek). However, at the East Big Pine site, if re-greening is deemed infeasible, then the secondary goal is to revegetate with native plants. These four sites are addressed in this plan as potential mitigation sites if circumstances lead to a change in the mitigation goal.

Because of the potential nature of these sites, they were not addressed as thoroughly as those in the previous sections. Half of the six sites in the Laws wellfield are low priority because the existing vegetation cover appears to keep wind erosion and weed invasion low. The other three show signs of wind erosion and will be addressed after mitigation has begun on high priority ABAG and groundwater impacted sites. Site goals are only qualitative and boundaries were not delineated from field visits; maps presented in this report are from the EIR. Also, the E/M sites were not given a priority designation or species list.

Impact #	Site Location	Acres
10-18	Laws 33	93
	36	99
	88	136
	82	36
	Jean Blanc Rd.	258
	Laws return ditch (124)	62
10-19	Northeast Big Pine	30*
10-19	East Big Pine	20*
10-11	E. Independence	30*
10-11	E. Shepherd Creek	60*

* denotes acreage given in the EIR

There are six distinct Laws sites, the first four are named by their vegetation parcel number and are easily accessed from Hwy. 6 (Fig. 8). All the sites, with the exception of a portion of the Jean Blanc Rd. site are located on the Laws USGS 7.5' quad.

Laws 33

This site was mapped by LADWP as a 93 acre Nevada Saltbush Scrub, parcel no. 33 (T6S R33E, NW1/4NW1/4 and SW1/4NW1/4, Sec. 23) with 19% live cover. However, 50% of the plant composition consisted of Russian thistle and fivehook bassia,

45% and 5% respectively. The site can be accessed from a canal road off Hwy. 6. The site has sparse to dense native vegetation scattered throughout the parcel but there are areas that remain barren. Revegetation efforts will be limited to identifiable barren areas.

This site is split between two soil map units, a complex of Sabies (fine-loamy, mixed (calcareous), thermic Xeric Torriorthents) and Yaney (coarse-loamy, ashy (calcareous), thermic Vitrandic Torrifluvents) soils and an association of Yaney and Yaney soils. (The two Yaney soils vary in surface textures, one is sandy and the other is loamy.) All have moderate to moderately rapid water permeability, high available water capacity, and moderate (Sabies-Yaney) or severe (Yaney-Yaney) wind erosion. Limiting off-road vehicles and careful grazing management to preserve plant cover and prevent soil erosion were recommended for both soil units.

The high cover of weedy species and grazing are constraints to revegetating the site.

Goal: Assist expansion of native plant species that already exist on the site onto barren areas .

Priority: Low – Wind erosion doesn't appear to be a problem at this site. There is also an adequate seed source on site. This site is slated for protection in 2001 if approved by the Standing Committee, however, unresolved litigation may complicate revegetation plans.

Revegetation plan:

- Eliminate disturbances

  Site protection will be the main revegetation activity until monitoring indicates the need for further action.

- Monitor

  If protection produces no apparent positive changes then additional plans will include weed control, protecting natural recruitment if helpful in other areas, and possibly planting or seeding native plants.

Species list for Laws 33, 36, 88, and 82 sites:

This list for seed mixes and container plants includes species from the following plant communities: Great Basin Mixed Scrub, Shadscale Scrub, Desert Sink Scrub, Rabbitbrush Scrub, Rabbitbrush Meadow, Nevada Saltbush Scrub, and Desert Greasewood Scrub.

Shrubs/Forbs:

allscale saltbush[1b]	indigo bush[1b]	Nevada ephedra[1b]
black greasewood[1b]	little horsebush[1b]	Parry saltbush[1b]
bud sagebrush[1b]	longspine horsebush[1b]	shadscale[1b]
desert alysum[1b]	Nevada dalea[1b]	

Grasses:

alkali sacaton[1b] Indian ricegrass[2] saltgrass[1b]

Laws 36

This site was mapped as parcel no. 36 (T6S R33E, NE1/4 and SE1/4 Sec. 9), 99 acres of Desert Sink Scrub with 19% live cover, 58% of the cover is Russian thistle. This site is accessible from Hwy. 6. Much of the area is used for surface water spreading, and in anticipation of water spreading in 1993, the soil was ripped, although no water was spread on the site.

The soil at this site was mapped as a Yaney-Yaney association that was described in the previous description, Laws 33.

Currently, there is perennial native vegetation between the ripped areas which could provide a seed source but occasional ripping as well as wind erosion is likely a serious obstacle to recruitment.

Goal: Develop a procedure that allows for continued surface water spreading without leaving barren ground. This procedure needs to accommodate both spreading and non-spreading years as in 1993, when high runoff is anticipated but ripped areas are not subsequently wetted.

Priority: High – This site has high wind erosion when ripped and not wetted. This site is slated for fencing in 2000 if approved by the Standing Committee, however, unresolved litigation may change revegetation plans.

Revegetation plan:

- Remove disturbances on water spreading areas

  Fence water spreading areas to keep soil erosion to a minimum and potentially allow vegetation to cover the soil after water is evaporated.

- Seed

  Develop a mix of plants species to be spread on ripped soil both during spreading and after water has begun to evaporate. Initially no additional irrigation will be used.

- Monitor

  This site will be carefully monitored for the presence of tamarisk and perennial pepperweed. If these weed species are found, weed control will be implemented immediately.

Laws 88

This area was mapped as parcel no. 88 (T6S R33E, SW1/4, Sec. 15), 136 acres of Desert Sink Scrub with 14% live cover. Russian thistle was the dominant species and tamarisk composed 1% of the plant cover. Approximately 1/3 of the parcel has been

leveled for agriculture, but the remaining section has retained a natural topography. Some of the shrubs and grasses near the northern border receive tailwater from irrigation. Two irrigation canals on the site have cottonwoods and willows growing on the edges. Natural recruitment of native grasses and shrubs is occurring. Weeds include Russian thistle, tamarisk, annual *Atriplex*, and fivehook bassia. Much of the site has an acceptable cover of vegetation, although there are spots that remain barren. Revegetation efforts should assist natural recruitment and only be necessary in the barren areas.

The soil at this site was mapped as a Sabies-Yaney complex that was described in the previous description, Laws 33.

Goal, Priority, Revegetation plan and Species list: Same as Laws 33 with the addition of:

- Conduct more site specific soil characterization.

On-site soil characterization and/or fertility tests will be conducted because of mineral toxicity reported by lessee.

Laws 82

This site was mapped as parcel no. 82 (T6S R33E, SE1/4NE1/4, Sec. 16), 36 acres of Rabbitbrush Meadow with 18% live cover. Russian thistle made up 13% of the plant composition when mapped. The site has many shrub islands between barren areas and the vegetation parcel boundaries are indistinct on the ground. Although the site has not been leveled, historically the area was disturbed by tracks for the narrow gauge railroad which is still visible on aerial photos.

The soil at this site was mapped as a Sabies-Yaney complex that was described in the previous description, Laws 33.

On-going disturbances include heavy equipment, wind erosion, groundwater pumping, and grazing. Extending west beyond this mapped site into parcel 81, there are similar barren areas which could also benefit from rehabilitation.

Goal, Priority, Revegetation plan, and Species list: Same as Laws 33

Jean Blanc Rd.

This site contains areas impacted by both abandoned agriculture and groundwater pumping (Fig. 8). Parcels in this area include - on the Laws 7.5' USGS quad: vegetation parcel no. 75 (T6S R33E, SW1/4SE1/4, Sec. 17), mapped as 30 acres of ABAG; no. 76 (T6S R33E, SE1/4SE1/4 Sec. 17), 10 acres of 7% live cover of Desert Greasewood Scrub; and no. 77 (T6S R33E, SW1/4SW1/4, Sec. 16), 31 acres of ABAG. The Fish Slough quad includes vegetation parcel no. 34 (T6S R33E, SW1/4, Sec. 17, NW1/4 Sec. 20), with 153 acres of ABAG and parcel 33 (T6S R33E, NE1/4SW1/4 Sec. 17), 34 acres that were formerly the Laws treelot.

The impacts at these vegetation parcels appear to have been exacerbated by drought, groundwater pumping, and grazing. A nearby exclosure demonstrates higher plant cover and mulch inside the fenced plot compared to surrounding areas.

Soils were mapped as a complex of Goodale (sandy-skeletal, mixed, thermic Xeric Torriorthents) and Yaney (coarse-loamy, ashy (calcareous), thermic Vitrandic Torrifluvent) soils. Sixty five percent of the map unit is composed of Goodale soils and similar inclusions and 20% is Yaney soils and similar inclusions. Although both soils have moderately rapid to moderate permeability and high salinity and sodicity, they differ in available water capacity and hazard of wind erosion. The Goodale soils have low available water capacity and severe hazard of wind erosion, in contrast to the Yaney soils with high available water capacity and slight wind erosion hazard. Management recommendations include limiting off-road vehicles and careful grazing management.

Goal: Revegetate the site with plant species found on site and in the surrounding areas.

Priority: High – This site will require several years of experimentation to develop effective techniques because of its large size and saline soils. It is anticipated that this site will be fenced in 2000 if approved by the Standing Committee.

Revegetation plan:

- Eliminate disturbances.

  Fencing will be critical to revegetation success and should be constructed as soon as feasible.

- Conduct more site specific soil characterization

  On-site soil characterization and fertility tests will be conducted if they have proven useful at other sites.

- Use container plants in test plots

  Plant protectors or mulch will be used to protect transplants.

- Use mulch

  Mulch will be spread in rows to catch soil, seeds, and litter and to protect transplants.

- Seed

  A variety of species will be seeded in the autumn using the drill seeder if successful at previous revegetation sites. Mulch may be used to spread over the seeded area to reduce wind erosion.

- Site maintenance

- Monitor

  If seeding and transplants fail, soil inoculation and/or soil amendments will be tested.

Species list:

This species list for seed mixes and container plants includes species from the following plant communities: Alkali Meadow, Rabbitbrush Meadow, Nevada Saltbush Meadow, Rabbitbrush Scrub, Nevada Saltbush Scrub, Desert Sink Scrub, Shadscale Scrub, and Desert Greasewood Scrub.

Shrubs/Forbs:

allscale saltbush[1b]	inkweed[1b]	shadscale[1b]
black greasewood[1b]	Nevada dalea[1b]	shrubby alkali aster[1b]
fourwing saltbush[1b]	Parry saltbush[1b]	

Grasses/Grasslike:

alkali muhly	beardless wildrye[1b]	Great Basin wildrye[1b]
alkali sacaton[1b]	carex[1b]	saltgrass[1b]

Laws Return Ditch

This site is in vegetation parcel no 124 on the Laws 7.5'USGS quad (T6S R33E, NW1/4NW1/4 Sec. 35 & NE1/4NE1/4 Sec. 34), mapped as 62 acres of ABAG (Fig. 1). It is accessible from the Laws-Poleta Rd. The site topography varies between areas with hummocks and areas that have been leveled. The vegetation is mainly weedy native and non-native species. Current impediments to recruitment include groundwater pumping and grazing.

The soil at this site was mapped as a Sabies-Yaney complex that was described in the previous description, Laws 33.

Goal: Revegetate the site with species found in surrounding parcels. This site probably had a higher water table supporting plant communities that can no longer be maintained with the current conditions.

Priority: Medium – This site doesn't appear to have severe wind erosion problems, but because it has weedy species and shows no signs of natural recruitment, it may be a difficult site to revegetate. It is anticipated that this site will be fenced in 2000 if approved by the Standing Committee.

Revegetation plan:

- Eliminate disturbances
  The site will be fenced.
- Test transplants and seeding
  Plant container plants in windbreak rows if it has been successful at previous sites. Use the seeding method that has proven the most successful at other mitigation sites.
- Site Maintenance
- Monitor
  If seeding and transplants fail, soil inoculation and/or soil amendments will be tested.

Species list:

The species list for this site is the same as for the Laws Jean Blanc Rd. above with the addition of the following shrubs:

desert alysum[1b] longspine horsebush[1b]

Enhancement/Mitigation projects

Northeast Big Pine

This site is slated to be a re-greening project described as 30 acres of irrigated pasture (Fig. 3). The 30 acres are contained within the 167 acre Rabbitbrush Scrub parcel no. 153 on the Big Pine 7.5' USGS quad (T9S R34E, SE1/4NW1/4 Sec.17). It was planted in alfalfa in 1924 but there are no records of when it was taken out of production (furrows are still visible). Live cover was mapped at 25% with Russian thistle comprising 30%. The EIR delineates only the area with the sparsest cover within the vegetation parcel. Near the Big Pine canal, vegetation is the most dense with willow, Nevada saltbush, saltgrass and weedy annuals. Current impediments to natural recruitment include off-road vehicle traffic and invasion of weedy plants.

This site spans two soil map units; one is a complex of Hesperia-Cartago soils that was described for the Big Pine ABAG site and the other is a Shondow-drained Hessica, sandy substratum association with 0-2% slopes. The Shondow soils are fine-loamy, mixed, thermic Aquic Argixerolls and the Hessica soils are fine-loamy, mixed, thermic Xerollic Natrargids. This map unit is located in the northern portion of the site. These soils have moderate to moderately slow permeability and high available water capacity. Management considerations include moderate to severe wind erosion hazard and potentially high salinity and sodicity. Off-road vehicles should be limited and grazing should be carefully managed to preserve soil and vegetation cover.

Goal: Revegetate the site with plant species found in the surrounding area. Near the canal, species with higher water requirements could be used.

Revegetation plan:

- Eliminate disturbances

  The site will need to be fenced, and this would be the initial revegetation method.

- Monitor

  If recruitment of desirable species is observed, then protection without additional input will be continued. If protection produces no apparent positive changes then additional plans will be developed. These will include weed control, protecting natural recruitment if helpful in other areas, and possibly planting or seeding native plants.

East Big Pine

This 20 acre site (Fig. 3) was discussed earlier in the Big Pine ABAG section. The revegetation plan for the two sites would be the same.

East Independence

This 30 acre site is slated as a re-greening project in the EIR (Fig. 9), however, the site was mapped as 20 acres, parcel no. 188 on the Independence 7.5' USGS quad (T13S R35E, SE1/4NW1/4 Sec17). It is easily accessible by town roads and adjacent to the Little League field which contributes to heavy vehicle disturbance. The presence of weedy plant species (fivehook bassia and Russian thistle) are also a potential revegetation problem. Native perennial plant species (fourwing saltbush, saltgrass, and alkali sacaton) are present and recruitment was apparent, although the previously mentioned disturbances will likely prevent site rehabilitation from occurring without intervention. If the site is turned into an irrigated pasture, Los Angeles will be the lead party responsible for implementing the project. But, plans for a native plant site have been developed.

Soil at the site was mapped as Shabbell sandy loam with 0-2% slopes. Shabbell soils are coarse-loamy, mixed thermic Aridic Argixerolls. This soil has moderately rapid permeability and moderate available water capacity. Wind erosion hazard is moderate. Soil management recommendation include revegetating disturbed areas as soon as possible as well as careful grazing management that takes soil temperature and wetness into consideration.

Goal: Rehabilitate the site with native plants similar to communities at the same elevation north and south of town.

Revegetation plan:

- Eliminate disturbances
  The site will need to be fenced, and this would be the initial revegetation method.
- Contact local organizations that may be interested in the project
  Volunteers may be willing to volunteer for planting and site maintenance.
- Monitor
  If recruitment of desirable species is observed, then protection without additional input will be continued. If protection produces no apparent positive changes then additional plans will be developed. These will include weed control, protecting natural recruitment if helpful in other areas, and possibly planting or seeding native plants.

East Shepherd Creek

This site was described in the EIR as 60 acres that are "poorly vegetated." The area is easily accessible from Hwy. 395 . The northern portion of the impact site was mapped as vegetation parcel 142 (Fig. 10) on the Independence 7.5' USGS quad (T13S R35E, NW1/4SW1/4 Sec. 34). Parcel 142 is described as having 18 acres of Nevada Saltbush Scrub with 80% live cover. This cover, when mapped was composed of 75% Russian thistle, 21% fivehook bassia, and 1% Nevada saltbush. If perennial vegetation does not naturally increase, it is planned to become an expansion of the E/M alfalfa field on the west side of the highway. If the site is turned into an alfalfa field, Los Angeles will be the lead party responsible for implementing the project.

Soil at the site was mapped as complex of Morey family-Winnedumah, drained-Rindge family with 0-2% slopes that was described for the Independence sites.

Goals: Revegetate the site with plant species found in the surrounding area on the same soil type.

Revegetation plan:

- Eliminate disturbances

  The site will need to be fenced, and this would be the initial revegetation method.

- Monitor

  If recruitment of desirable species is observed, then protection without additional input will be continued. If protection produces no apparent positive changes then additional plans will be developed. These will include weed control, protecting natural recruitment if helpful in other areas, and possibly planting or seeding native plants.

IMPLEMENTATION SCHEDULE

Tasks	Agency	1998	1999	2000	2001	2002	2003+
Finalize mitigation plans	ICWD/DWP						
Research trace species for species lists	ICWD/DWP						
Run baseline transects at mitigation sites	ICWD/DWP						
Develop protocol and data sheets for monitoring sites	ICWD/DWP						
Develop protocol and data sheets for collecting plant materials	ICWD/DWP						
Collect seeds/cuttings	ICWD/DWP						
Research seeding rates for desired species	ICWD/DWP						
Research irrigation methods	ICWD/DWP						
Investigate facilities for cleaning seeds and determining PLS	ICWD/DWP						
Investigate sources and costs of purchasing plants	ICWD/DWP						
Investigate use and costs of soil amendments	ICWD/DWP						
Collect mulch	ICWD/DWP						
Prepare annual status report	ICWD/DWP						
Link precip gauges to mitigation sites	ICWD/DWP						
Link piezometers to mitigation sites	ICWD/DWP						
Develop protocol for gauging wind erosion	ICWD/DWP						
Develop cost estimates for growing in-house	ICWD/DWP						
Research and test methods of weed control	ICWD/DWP						
Research various plant protection devices	ICWD/DWP						
Determine which sites need additional soil characterization	ICWD/DWP						
Laws (high)							
fence site	DWP						
grow (2000) and transplant (2001) container plants	ICWD/DWP						
site maintenance	ICWD/DWP						
monitor	ICWD/DWP						
Bishop 97 (low)							
fence site	DWP						
test plots if necessary	ICWD/DWP						2004
expand seeding or use transplants	ICWD/DWP						2009
monitor	ICWD/DWP						
Big Pine area (medium)							
fence site	DWP						
conduct soil characterization & analysis if necessary	ICWD/DWP						
grow (2000) and transplant (2001) container plants	ICWD/DWP						
seed and mulch	ICWD/DWP						
site maintenance	ICWD/DWP						
expand revegetation work	ICWD/DWP						2006
monitor	ICWD/DWP						

Tasks	Agency	1998	1999	2000	2001	2002	2003+
Five Bridges (high)							
map site	ICWD/DWP						
weed control (herbicide application)	DWP						
wells 385 & 386 off	DWP						
pulse irrigation from river (min. 5 yrs.)	DWP						
drill seed	DWP						
prepare and implement 10 yr grazing plan	DWP						+
monitor (run transects and take photos)	DWP						
Tinemaha 54 (high)							
protect plants	ICWD/DWP						
monitor	ICWD/DWP						
additional remedial action if necessary (after 3 yrs)	ICWD/DWP						
Hines Spring So							
develop mitigation plan	ICWD/DWP						
Blackrock 16E							
fence site	DWP						
monitor	ICWD/DWP						
additional remedial action if necessary (after 3 years)	ICWD/DWP						
Independence 105							
fence site	DWP						
monitor	ICWD/DWP						
additional remedial action if necessary	ICWD/DWP						
Independence 131							
fence site	DWP						
conduct soil characterization & analysis if necessary	ICWD/DWP						
grow (2001) and transplant (2002) container plants	ICWD/DWP						
seed ripped areas	ICWD/DWP						
site maintenance	ICWD/DWP						
expand revegetation work	ICWD/DWP						2007
monitor	ICWD/DWP						
Independence 123							
fence site	DWP						
grow (2001) and transplant (2002) container plants	ICWD/DWP						
mulch	ICWD/DWP						
drill seed	ICWD/DWP						
site maintenance	ICWD/DWP						
monitor	ICWD/DWP						
expand revegetation work	ICWD/DWP						2007

FIGURES

Fig. 1 Laws ABAG mitigation site (hatched) and potential mitigation site, Laws return ditch (stippled), parcel 124.

Fig. 2 South Bishop ABAG site (hatched).

Fig. 3 Big Pine ABAG site (hatched), East Big Pine potential E/M site (stippled portion of parcel 160), and NE Big Pine regreening (stippled portion of parcel 153).

Fig. 4 Five Bridges mitigation site showing original impact area as stippled (including area of concern) and area still in need of mitigation shown as hatched.

Fig. 5 The Tinemaha site (hatched) is shown in the scrub parcel 54, but site visits confirmed that the plant community type should be the same as the alkali meadow parcel, 64.

Fig. 6 This map shows the location of Hines Spring, Blackrock 16E (hatched) and the potential area of Hines Spring S. (stippled).

Fig. 7 Mitigation sites in the Symmes/Shepherd wellfield (hatched), Independence 105, 131 (two areas), and 123.

Fig. 8 Potential mitigation sites (stippled), Laws 36, 33, 82, and 88, along Hwy. 6 and the area adjacent to Jean Blanc Rd.

Fig. 9 Regreening site, E. Independence (stippled).

Fig. 10 Potential E/M alfalfa fields, E. Shepherd Creek (stippled).

LITERATURE CITED

City of Los Angeles Department of Water and Power and County of Inyo. 1990. Water from the Owens Valley to supply the second Los Angeles aqueduct. SCH #89080705. Draft Environmental Impact Report Vol. I. Sept. 1990.

City of Los Angeles Department of Water and Power and County of Inyo. 1990. Green Book for the long-term groundwater management plan for the Owens Valley and Inyo Co. June 1990.

Hickman, James C. (ed.). 1993. The Jepson manual: Higher plants of California. University of California Press.

Platts, William. (1996). Final recommendations based on the goal to reestablish native grasses and willow. Five Bridges Mitigation Project. Letter to Lloyd Anderson, LADWP. December 8, 1996

SCS. 1985. Vegetative treatment of abandoned cropland in the Sonoran Desert to reduce soil erosion. Tech. Notes. USDA, Soil Con. Ser. Plant Materials No. 4 - Arizona. April 1985.

SCS. (unpublished). 1994 Draft - Benton/Owens Valley Soil Survey Manuscript

Yamashita, I.S. 1993. Revegetation on arid lands: The effects of adverse impacts and techniques for revegetation. Report prepared for the Inyo/Los Angeles Tech Group. February 18, 1993.

Yamashita, Irene. 1997. Using plant shelters to increase plant establishment: 2nd annual report. Report to the Inyo/Los Angeles Tech. Group. May 1997

Yamashita, Irene S. and Sara J. Manning. 1997. Monitoring results of four revegetation treatments on barren farmland in the Owens Valley, Calif. – 1996 progress report. 1997. Report to the Inyo/Los Angeles Tech. Group. May 1997.

APPENDICES

I. SPECIES LIST

The following list uses the Jepson manual (Hickman 1993) for scientific names, however, if name changes occurred in Jepson, the second line refers to its previous name.

The "sites" column lists those sites where the plant species will be used. LawsII refers to Laws 33, 36, 88, and 82, and Symmes/Shepherd refers to Independence 105, 131, and 123.

Common name	**Family**	**Scientific Name**	**Sites**
alkali muhly	Poaceae	*Muhlenbergia asperifolia*	Jean Blanc Rd., Laws 124
alkali sacaton	Poaceae	*Sporobolus airoides*	Big Pine, Five Bridges, Tinemaha 54, Blackrock 16E, Symmes/Shepherd, LawsII, Jean Blanc Rd., Laws 124
allscale saltbush	Chenopodiaceae	*Atriplex polycarpa*	Bishop 97, Laws, Big Pine, Symmes/Shepherd, LawsII, Jean Blanc Rd., Laws 124
Anderson wolfberry	Solanaceae	*Lycium andersonii*	Laws
annual atriplex	Chenopodiaceae	*Atriplex* spp.	
Baltic rush	Juncaceae	*Juncus balticus*	Five Bridges
beardless wildrye	Poaceae	*Leymus triticoides*	Bishop 97, Five Bridges, Blackrock 16E, Jean Blanc Rd., Laws 124
big sagebrush	Asteraceae	*Artemisia tridentata*	
black greasewood	Chenopodiaceae	*Sarcobatus vermiculatus*	Bishop 97, Laws, Big Pine, Tinemaha 54, Blackrock16E, Symmes/Shepherd, LawsII, Jean Blanc Rd., Laws 124
bottlebrush squirreltail	Poaceae	*Elymus elymoides* *Sitanion hystrix*	Bishop 97, Laws, Big Pine
bud sagebrush	Asteraceae	*Artemisia spinescens*	Bishop 97, Laws, Big Pine, LawsII, Laws 124
burrobush	Asteraceae	*Hymenoclea salsola*	Bishop 97, Big Pine
button encelia	Asteraceae	*Encelia frutescens*	Laws
Calif. buckwheat	Polygonaceae	*Eriogonum fasciculatum*	Bishop 97
carex	Cyperaceae	*Carex* spp.	Jean Blanc Rd.
cluster goldenweed	Asteraceae	*Pyrrocoma racemosus* *Happlopappus racemosus*	Five Bridges
clustered field sedge	Cyperaceae	*Carex praegracilis*	Five Bridges
Cooper's goldenbush	Asteraceae	*Happlopappus cooperi* *Ericameria cooperi*	Bishop 97, Big Pine
desert alysum	Brassicaceae	*Lepidium fremontii*	Laws, LawsII, Laws 124
desert aster	Asteraceae	*Xylorhiza tortifolia*	Bishop 97, Laws
desert needlegrass	Poaceae	*Achnatherum speciosum* *Stipa speciosa*	Bishop 97, Big Pine
desert olive	Oleaceae	*Forestiera pubescens* *F. neomexicana*	Symmes/Shepherd
fivehook bassia	Chenopodiaceae	*Bassia hyssopifolia*	
fourwing saltbush	Chenopodiaceae	*Atriplex canescens*	Bishop 97, Laws, Big Pine, Blackrock

Common name	Family	Scientific Name	Sites
			16E, Symmes/Shepherd, Jean Blanc Rd.
Fremont's cottonwood	Salicaceae	*Populus fremontii*	Five Bridges
Great Basin wildrye	Poaceae	*Leymus cinereus*	Bishop 97, Blackrock 16E, Jean Blanc Rd., Laws 124
Indian paintbrush.	Scrophulariaceae	*Castilleja* spp.	Tinemaha 54
Indian ricegrass	Poaceae	*Achnatherum hymenoides* *Oryzopsis hymenoides*	Bishop 97, Laws, Big Pine
indigo bush	Fabaceae	*Psorothamnus arborescens* var *minutifolius*	Bishop 97, Laws, Big Pine, LawsII, Laws 124
inkweed	Chenopodiaceae	*Suaeda moquinii* *Suaeda torreyana*	Symmes/Shepherd, Jean Blanc Rd., Laws 124
little horsebush	Asteraceae	*Tetradymia glabrata*	Bishop 97, Laws, Big Pine, LawsII
longspine horsebush	Asteraceae	*Tetradymia axillaris*	Bishop 124, Laws, Big Pine, LawsII, Laws 124
needleleaf rabbitbrush	Asteraaceae	*Chrysothamnus teretifolius*	Bishop 97, Laws
Nevada dalea	Fabaceae	*Psorothamnus polydenius*	Bishop 97, Laws, Big Pine, LawsII, Jean Blanc Rd., Laws 124
Nevada ephedra	Ephedraceae	*Ephedra nevadensis*	Bishop 97, Laws, Big Pine, LawsII
Nevada saltbush	Chenopodiaceae	*Atriplex lentiformis* ssp. *torreyi* *Atriplex torreyi*	
Parry saltbush	Chenopodiaceae	*Atriplex parryi*	Laws, Big Pine, LawsII, Jean Blanc Rd., Laws ret. ditch
perennial pepperweed	Brassicaceae	*Lepidium latifolium*	
rose four-o'clock	Nyctaginaceae	*Mirabilis alipes*	Laws
rubber rabbitbrush	Asteraceae	*Chrysothamnus nauseosus*	
Russian thistle	Chenopodiaceae	*Salsola tragus* *Salsola kali* var *tenuifolia*	
Salix (tree and shrub)	Salicaceae	*Salix* spp.	Five Bridges
saltgrass	Poaceae	*Distichlis spicata*	Bishop 97, Laws, Big Pine, Five Bridges, Blackrock 16E, Symmes/Shepherd, LawsII, Jean Blanc Rd., Laws 124
shadscale	Chenopodiaceae	*Atriplex confertifolia*	Bishop 97, Laws, Big Pine, Blackrock 16E, LawsII, Jean Blanc Rd., Laws 124
shrubby alkali aster	Asteraceae	*Machaeranthera carnosa* *Aster intricatus*	Jean Blanc Rd., Laws ret. ditch
spikerush	Cyperaceae	*Eleocharis* spp.	Five Bridges
spiny hopsage	Chenopodiaceae	*Grayia spinosa*	Bishop 97, Laws, Big Pine, Laws 124
spiny menodora	Oleaceae	*Menodora spinescens*	Bishop 97, Laws, Big Pine
Tamarisk	Tamaricaceae	*Tamarix ramosissima*	
winterfat	Chenopodiaceae	*Krascheninnikovia lanata* *Ceratoides lanata*	Bishop 97, Laws, Big Pine
Woods rose	Rosaceae	*Rosa woodsii* var *ultramontana* *Rosa woodsii*	Five Bridges

II. LIST OF MITIGATION SITES

Abandoned Agriculture (ABAG)

Impact #	Site Location	Acres	Priority
10-18	Laws	139	high
10-16	Bishop 97	124	low
10-19	Big Pine	209	medium

Groundwater pumping

Impact #	Site Location	Acres	Priority
10-12	Five Bridges	~60	high
10-14	Hines Spring	1-2	na
10-11	Tinemaha/Blackrock		
	Tinemaha 54	.4	high
	Hines Spring S	--	--
	Blackrock 16E	7.5	high
10-13	Independence		
	Independence 105	13.4	high
	Independence 131	74.6	high
	Independence 123	28.5	high

Potential Mitigation Sites

Impact #	Site Location	Acres	Priority
10-18	Laws 33	93	low
	36	99	high
	88	136	low
	82	36	low
	Jean Blanc Rd.	258	high
	Laws return ditch (124)	62	med
10-19	Northeast Big Pine	30	na
10-19	East Big Pine	20	na
10-11	E Independence	30	na
10-11	E. Shepherd Creek	60	na

III. FIELD PROTOCOL FOR LINE-POINT TRANSECTS

Equipment List

- 100 m tape
- pencil, clipboard, and data sheets
- camera
- plastic bags for plant collection

Methods

All sites will be outfitted with permanent transect posts for measuring vegetation cover and composition. Readings will require stretching a 100 m tape between permanent posts and recording live hits every 0.5 m "point". A live hit will be recorded when any living portion of a plant is intercepted under a point. Point intervals may vary between sites or may change as a result of data analysis. The plant will be identified to species and whether it was planted as part of the revegetation project. All plant species that are observed on the site but not encountered along the transects will also be noted on data sheets. Unknown species will be collected for identification.

In addition to data collection, observers will also note any need for management activities such as fence repair, weed control, or replanting.

Permanent photo points will be located at each site and pictures will be taken when transects are run.

IV. SUMMARY OF TWO REVEGETATION STUDIES IN THE OWENS VALLEY

Results of four revegetation treatments on barren farmland in the Owens Valley, Calif. – 1996 progress report, May 1996, by Irene S. Yamashita and Sara J. Manning.

In December 1991, 400, 3-4 year old, fourwing saltbush shrubs were transplanted onto barren abandoned farmland in Laws. The transplants were subjected to four treatments: irrigation, density, fertilizer, and weed control, and their growth and survival were monitored annually for five years.

The four treatments were applied as follows. Irrigation consisted of 2 liters of water once a month April through September for the first three years. Density consisted of planting shrubs either in rows spaced 2 m apart for low density or 1 m apart for the high density treatment; plants within rows were spaced 2 m apart. The high density spacing, when combined with no irrigation, has not been maintained due to low survival. Fertilized shrubs received 10 g of a 9-month release formula (Osmocote 18-6-12) in the bottom of the planting holes prior to transplanting. No additional fertilizer has been applied since planting. Weed control consisted of removing weedy species once a year within 0.5 m of the shrubs for the first three years.

Results from five years of monitoring demonstrated that irrigation was the most important treatment for increasing survival. Survival rates of at least 84% were maintained in combinations that included irrigation with one exception that also combined high density, no fertilizer, and no weed removal. For irrigated shrubs, applying fertilizer appeared to be the next most important treatment for increasing survival followed by low density planting. In unirrigated treatment combinations, weed control, followed by low density planting, enhanced survival while the presence of fertilizer generally had a negative effect. Based on survival rates, irrigation appeared beneficial for three years at the high density planting and two years at the lower density.

There have been no significant within-year or overall differences in growth among the 16 treatment combinations during the five growing seasons.

In 1996, 91% of the shrubs were reproductively mature. Data from this site shows that monoecious shrubs can change sex and that reproductively mature shrubs may not flower annually. In general, higher growth enhances reproductive maturity. No statistics were performed on sexual expression and treatments.

This site is not yet considered permanently revegetated because after six growing seasons, during which the last four have had high seed production and precipitation, there has been only one naturally occurring seedling that has survived for more than a year.

In 1994, 30 plants representing, five additional species were transplanted on the site. These species included rubber rabbitbush, greasewood, winterfat, desert needlegrass, and budsage. No treatments were applied and only 1 winterfat survived. In 1996, 88 additional plants were installed and the dead plants from 1994 were replaced.

These plants are currently being irrigated with 2 liters of water. This planting included Nevada ephedra, winterfat, allscale, shadscale, and budsage.

Seeding basins were tried in 1993 and 1995. In 1993, 112 hand-dug basins were seeded with 6 species with 16 basins serving as controls. In 1995, four additional species were used to replace some of the 1993 plantings and during spring some germination was observed but none of these seedlings survived the summer. It was interesting to find that an unusually wet winter and cool moist spring still resulted in 100% seedling mortality.

Using plant shelters to increase plant establishment: 2nd annual report, May 1997, by Irene S. Yamashita

This study began in 1995 to investigate using plant shelters on naturally occurring seedlings as a method of revegetation. Five sites were selected and 100, 7.5 in. TUBEX brand shelters were used. The study was concluded because of high mortality, loss of shelters, and the difficulty of relocating test and control seedlings. Only minimal data were collected in 1996 precluding statistical analyses. However, with the few plants remaining, shelters appeared to improve survival in both 1995 and 1996.

It was apparent that shelters need to be stabilized more securely than in this study. Physical disturbances such as wind, herbivores, and possibly vandalism appeared to contribute to loss of the shelters and tags on control seedlings because the one fenced site, had a high recovery of sheltered and control seedlings.