

Las Vegas Wash Coordination Committee

# Bostick Weir Planting Plan

July 2004



Las Vegas Wash  
Coordination  
Committee



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# I. Project Description

## A. Objective

The objective of this plan is to mitigate potential impacts to the stream channel and adjacent banks associated with the construction of the Bostick Weir. Appendix A is an aerial view of the Bostick Weir site prior to construction. This will be accomplished by the Las Vegas Wash Project Coordination Team (Wash Team) on behalf of the Southern Nevada Water Authority (SNWA) by developing long-term, self-sustaining wetlands, riparian, and upland habitat at the project site that are not dependent on further human intervention after the establishment period.

Activities will include habitat restoration and preservation through planting (i.e. restoring) native wetland, riparian, and upland plant species around the structure, removal and management of tamarisk and other invasive species on the project site, and implementing biological and water quality-monitoring programs.

Expected benefits of implementing these activities include providing habitat for wildlife, increasing the ability of the wetland vegetation to act as a polishing agent by filtering pollutants from surface flows, and adding aesthetic value to the site.

## B. Weir Description

The Bostick Weir has a permanent footprint of 7.88 acres. Appendix B is an aerial image of the Bostick Weir during construction. The structure type of the Bostick Weir is a confined rock rip-rap structure, chosen on the basis of practicality, low implementation cost, and a desire by the Clark County Parks & Community Services to implement natural looking facilities, as practical, in the Wash. The design is based upon technical criteria codified by the Clark County Regional Flood Control District, where applicable. In cases where criteria is not applicable or is not present, design procedures and criteria available from the USDA Natural Resources Conservation Service, the U.S. Bureau of Reclamation, and the U.S. Army Corps of Engineers, has been applied.

## C. Wildlife Diversity

Riparian zones sustain a greater density and diversity of bird species than nearby uplands and may offer more habitats for nesting birds in North America than any other type of vegetation (Sanders and Edge 1998). Several studies have shown that birds respond well to riparian forest restoration, showing increases in both species diversity and density (Larison, Laymon, Williams, and Smith 2000). The establishment of stands of willows in proximity to the Wash will also increase potential habitat for the endangered Southwestern Willow Flycatcher (*Empidonax traillii extimus*) (SWCA, Inc. Environmental Consultants 2000).



In addition to riparian and upland species, wetland vegetation such as bulrush and sedge will be planted. Among the most productive and varied of bird habitats, wetlands are used by approximately one-third of North America's avian species (Emergent Wetlands Habitat 1999). Restorations that succeed in establishing wetland vegetation on a site often have significant use by wetland birds (Brown and Smith 1998). Emergent marsh habitat and associated open water will increase the number of insects in the area, providing prey for insectivorous bird species (SWCA, Inc. Environmental Consultants, 2000). Marshes also provide habitat for birds that rely upon that type of habitat structure for nesting. Such birds include marsh wrens, clapper rails, and common yellowthroats (SWCA, Inc. Environmental Consultants, 2000). The creation of mesquite bosque will also benefit nesting birds, such as the Lucy's Warbler, which can nest in mesquite patches less than 1 acre in size.

Over the past three decades, tamarisk has become the dominate plant community in the Las Vegas Wash. Tamarisk excludes native vegetation, forming monocultures that provide inferior food and cover. Restoration of native plant diversity to infested areas will increase habitat quality for local birds and lead to increases in bird diversity and abundance (SWCA, Inc. Environmental Consultants 2000).

## II. Implementation Plan

### A. Mitigation Activities

The mitigation goal is to enhance habitat development and assist with bank stabilization by planting native vegetation and managing invasive species. To maximize native plant survival rates, crews from the Nevada Division of Forestry and Native Resources Nevada have been contracted and trained by the Southern Nevada Water Authority (Authority) to support mitigation efforts. Mitigation requirements for the Bostick site are 7.88 acres of land.

#### 1. Planting Program

In order to revegetate the Bostick area, the planting plan has been divided into three phases, based on project goals and funding partners. Appendix C provides the Bostick Weir Planting Plan Overview, identifying the three phases of the project as well as the estimated acreage of each site. **Phases I and III will be performed with the assistance of grant funding and will not be counted towards mitigation. The mitigation requirement (7.88 acres) will be addressed in phase II of the plan.** The phases include several planting activities as well as invasive vegetation removal. The following native species may be planted on the site based on plant availability and site suitability:

### ***Wetland Vegetation***

- Olney's three-square bulrush (*Scirpus americanus*)
- Spike rush (*Eleocharis macrostachya*)
- Torrey spikerush (*Eleocharis rostellata*)
- Alkali bulrush (*Scirpus maritimus*)
- California bulrush (*Scirpus californicus*)
- Soft-stem bulrush (*Scirpus validus*)
- Hard-stem bulrush (*Scirpus acutus*)
- Baltic rush (*Juncus balticus*)

### ***Riparian Vegetation***

- Fremont cottonwood (*Populus fremontii*)
- Sandbar willow (*Salix exigua*)
- Gooding willow (*Salix Gooddingii*)
- Yerba mansa (*Anemopsis californica*)
- Salt grass (*Distichlis spicata*)
- Alkali sacton (*Sporobolus airoides*)
- Honey mesquite (*Prosopis glandulosa*)
- Screwbean mesquite (*Prosopis pubescens*)
- Catclaw acacia (*Acacia greggii*)

### ***Upland***

- Four-wing saltbush (*Atriplex canescens*)
- Creosote bush (*Larrea tridentata*)
- Wolfberry (*Lyceum andersonii*)
- Baccharis (*Baccharis sarothroides*)
- Arrowweed (*Pluchea sericea*)
- Desert willow (*Chilopsis linearis*)

## 2. Phase I

Phase I does not count towards mitigation and was funded by Clark County Multiple Species Habitat Conservation Plan (CCMSHCP). Planting was divided into three zones based on hydrology and soils: emergent bed, riparian, and upland. Appendix D is an aerial of Phase I identifying the three planting zones.

Located on the upstream south bank portion of the Bostick Weir, this area consists of 9.7 acres. Volunteers planted 2.5 of the 9.7 acres on October 25, 2003, during our 2003 Fall Green-Up. The following vegetation was planted during the event:

### **Trees 355**

- 50 Honey mesquite (5 gal.)
- 80 Screwbean mesquite (5 gal.)
- 20 Desert willow (1 gal.)
- 75 Goodding willow (1 gal.)
- 60 Cottonwood (1 gal.)
- 70 Catclaw acacia (5 gal.)

### **Shrubs 260**

- 85 Four-wing (1 gal.)
- 30 Wolfberry (1 gal.)
- 110 Baccharis (1 gal.)
- 35 Alkali sacaton (1 gal.)

An additional 6.2 acres of emergent bed was planted during the fall months of 2003. The emergent beds are located in the impoundment immediately upstream of the weir within the Wash channel. They are inundated in the afternoon due to the diurnal fluctuations in the Wash flows. Approximately 3,000 wetland plants were planted in the emergent bed with 12-18" spacing. Roughly 300 plants of each of the following species were planted across the entire area:

- Alkali bulrush
- Olney's threesquare
- California bulrush
- Hardstem bulrush
- Softstem bulrush

The remaining 1-acre was planted at an upland site, located on the north bank upstream of the weir. The area was cleared of vegetation for construction of the weir. The site was planted spring 2004. Upland species planted at this site include:

- Four-wing saltbush
- Creosote bush
- Wolfberry
- Baccharis
- Arrowweed
- Desert willow
- Honey mesquite
- Screwbean mesquite
- Catclaw acacia

### 3. Phase II

The project goal for phase II is to mitigate the required 7.88 acres for Bostick Weir. A total of 11.25 acres will be planted at this site, exceeding

the 7.88 mitigation requirement by 3.37 acres. The additional 3.37 acres planted will be used for a future weir that will be constructed. Appendix E identifies the location and planting areas for Phase II. Due to construction of the Landfill Weir, located immediately downstream of the Bostick Weir, Phase II will be planted in several stages over different seasons. Our contractor planted the emergent/riparian zone, approximately 5.2 acres located on the weir itself. The following species were planted beginning in fall 2003:

- Alkali bulrush
- Olney's threesquare
- California bulrush
- Hardstem bulrush
- Softstem bulrush

The north bank upland area, 0.67 acres adjacent to the structure, was planted spring 2004. The north bank upland area, located downstream of the structure, was planted in spring 2004, consisting of 0.40 acres. The species selected for these sites include: Gooding willow, sandbar willow, desert willow, catclaw acacia, honey mesquite, screwbean, arrowweed, wolfberry, baccharis, four winged saltbush, alkali sacaton, and creosote.

The upland zone, 4.98 acres in size, was cleared of tamarisk to make room for dewatering ponds. This site is currently designated as a stockpile site for rock and cut plant material and will be the location for several prescribed burns. The site will be rehabilitated and planted as part of the mitigation program. Of the 4.98 acres, 1.61 acres will complete the mitigation for the Bostick weir and the remaining 3.37 acres revegetated will be used for mitigation towards a future weir.

#### 4. Phase III

The planting for phase III is sponsored by a grant from the NDEP 319 grant program and will not count towards mitigation. Appendix F shows the layout of the planting areas for phase III, approximately 5.52 acres. The planting will take place during our 2004 Fall Green-Up, with supplemental planting occurring in Spring 2005. The planting site for this phase will be along the downstream Bostick Weir southern bank and emergent/riparian zones downstream of the structure, within the channel. Species for this planting may include: Gooding willow, sandbar willow, cottonwood, desert willow, catclaw acacia, honey mesquite, screwbean, salt grass, arrowweed, wolfberry, baccharis, four winged saltbush, creosote, alkali sacaton, yerba mansa, creosote, spikerush, Torrey spikerush, alkali bulrush, Olney's threesquare, California bulrush hardstem bulrush, softstem bulrush and Baltic rush.



## B. Planting Methods

A combination of container plants, pole plantings and local cuttings will be used. Success of the plantings will depend on correct timing, location, techniques, sufficient monitoring, effective tamarisk control, and favorable weather conditions. (SWCA, 1995) The data gathered from past and current monitoring activities at other sites, have led to the identification of planting seasons that optimize survival rates and development of a native species plant list that can be used at future planting sites. Through these efforts, the appropriate planting seasons have been identified as October through November and February through April. The following is a brief description of planting methods that will be implemented at the project site:

### 1. Container Plants

One and five-gallon container plants are planted on 5 to 10 and 10 to 15 foot centers (feet apart) throughout the planting sites. In order to establish these container plants, two watering methods are implemented. Both systems will be used approximately 2 years, allowing vegetation to become acclimated to the soil conditions found in the Wash.

#### *DriWater*

DriWater is composed of 98% water and 2% food grade that slowly releases moisture to the root ball of the plant and will last 30-60 days depending on soil activity. DriWater was chosen to help the plants become acclimated to the Wash conditions.

#### *Hand-watering*

In addition to DriWater, plants at this site will be hand-watered once a week during the growing season. An overhead spray is used, mocking a flood irrigation technique. This watering system will be used in conjunction with DriWater during the growing season. This system was chosen because of the higher elevation and the depth to the shallow ground water table. Hand-watering system will keep the soil moist by watering at a slower rate, over a longer period of time. Watering occurs in the early morning and late afternoon to reduce the rate of evaporation.

### 2. Pole Planting

Pole planting is an inexpensive and successful method of tree establishment for Fremont cottonwood and Goodding willow trees. These trees are easily established in high ground water conditions from pole plantings six feet or more in length. Pole planting of Fremont cottonwood trees was conducted this winter for the third year in the mitigation sites.

These trees were harvested from a local tributary to the Wash and transplanted to six planting sites on the Wash: Pabco South Upper Plateau, Pabco South Lower Plateau, Pabco South Upstream, Pabco North, Historic Lateral South and Bostick South. The cottonwoods at this site will be utilized as a harvesting site for future pole planting activities in the Wash. The poles were six feet in length and transplanted into the ground water table.

### 3. Local Nurseries

Two local nurseries, the National Park Service at the Lake Mead National Recreational Area and the Nevada Division of Forestry at the Floyd Lamb State Park, were developed to supply locally derived native species. The Wash Team provided seeds and cuttings to both nurseries from throughout the Lower Colorado River. The establishment of local nurseries is an essential step in the restoration effort for several reasons:

- Propagation of locally derived species will increase planting survival rates based on current plant acclimation to the local environment such as climate, soil and water quality conditions.
- The local genetic population of plant species will be maintained, further strengthening the resilience of the local stock by enhancing the natural system.

Both nurseries have supplied more than 7000 plants to the restoration efforts. Trees and shrubs are grown to 1 gallon and 5 gallon sizes to increase the planting success rate. Funding continues to be provided through grants from the Bureau of Reclamation. The grant funding was provided to both nurseries that supply plant stock, for the enhancement efforts in the Wash and make improvement to their nurseries. Through the harvesting efforts of the Wash Team, both nurseries will be able to provide the majority of the plants for planting activities.

## C. **Soil Analysis**

Soils data is important to investigate prior to developing site revegetation strategies. Soil composition and profile are important indicators for determining the potential success of a revegetation project as it can detail the subsurface conditions plants will be exposed to. Soil texture (i.e., the partitioning of sands, silts, and clays) and below ground moisture gradients can often be the limiting factors for plant survival and growth. Along the Wash, soil descriptions and analyses can be helpful to determine their suitability, limitations, and management for specific uses. Project Team staff conducted soils investigations at potential planting sites adjacent to the structure on July 3 on the south side and December 3, 2003 on the north side. A map of the soil pit locations and results is listed in Appendix G. A contractor supplied a backhoe and an operator to excavate the soil

pits used in the investigation. These pits were dug to help develop conceptual models of the soil profile across each of the individual sites. Landscape features, as well as historical information, about the sites were used to determine locations for each of the test pits. The soil samples were submitted to the Utah State University, Soil Testing Lab.

1. Soil Results

A total of 7 soil samples were collected from the Upstream Bostick South (UBS) site. Samples were analyzed for texture, pH, EC, OM, and micro- and macronutrients. Soils at the UBS site are predominately loamy sands and sandy loams. These textural classes are relatively coarse grained and will provide suitable drainage for many plants, however, suitable irrigation will need to be applied to maintain moist conditions. Organic matter in these soils is limited, however, this is typical for our area. Salinity (reported here as conductivity) values varied across the site with measurements ranging from 3.8 to 17 dS/m. The high values observed are consistent with the chemical signature of the shallow groundwater table found adjacent to the Wash. Prolonged salinity at this level would be detrimental for plants on the site. Plants growing under these conditions will require irrigation sufficient enough to flush salts from the soil. Nutrient concentrations on the site are adequate for root development and should not be a limiting factor in survival.

A total of 8 soil pits at 5 sites were dug at Bostick North. Soil texture ranged from loamy sand to sandy loam to silt loam. Coarse-grained soils (loamy sands) were found primarily adjacent to the bank stabilization rock walls on the upstream and downstream side, North of the weir. This suggests that these sites will have greater drainage and will require more watering than other sites, in order to replace the water that is lost to gravitational forces. Texture, however, should not be a factor limiting plant growth on any of the sites since loamy sands, sandy loams, and silt loams generally provide suitable substrate conditions. Soil salinity is within the tolerant range for all of the plants that we use. Salinity values for sites 4, 5, 6, and 8 were higher than the other sites. This may result in higher osmotic potentials at these sites and therefore watering may need to be done more often to reverse this effect. Macronutrients do not appear to be a limiting growth factor on any of the sites. For sites 1, 3, and 7 water content should stay above 11% and for the rest of the sites it should stay above 16%. Field capacity values range from 15-30%. Sites farther away from the bank can have more water added to them, and consequently it will remain in the soil profile, than closer sites. Information gathered from this soils investigation suggests that soils are not a factor limiting plant growth.

## D. Invasive Species Removal & Management

Phase I of this revegetation plan was to manage the invasive species: tamarisk and tall whitetop, which had invaded the planting site. Control and management of invasive species at this site will foster re-establishment of native species. The weed management effort is based on the Las Vegas Wash Integrated Weed Management Plan developed by the interagency group, the Las Vegas Wash Weed Partnership.

### 1. Tamarisk Management

Tamarisk (*Tamarix ramosissima*), which is a highly invasive non-native species, has been present in the Wash for more than 40 years and represents more than 80% of the existing Wash plant community, has been partially removed from the project site to foster reestablishment of native species. With more than 1,500 acres in the Wash, the level of control for Tamarisk in the Wash is containment. Tamarisk is cleared in conjunction with the development of weirs and bank stabilization features, as well as in mitigation sites. However, the level of tamarisk control in the revegetation sites is suppression. The two methods used to control tamarisk are discussed below:

#### ***Herbicide Treatment***

Herbicide was applied to tamarisk trees via the cut stump method with Garlon4 herbicide. This method entails cutting the tree down at ground level with a chain saw, and then immediately spraying the remaining stump with an herbicide. The material was moved to a stockpile site for a controlled burn at later time.

#### ***Mechanical Removal***

With the assistance from the Bureau of Reclamation, mechanical clearing was achieved by removing the root crown from the soil by root plowing. Follow-up application of Garlon4 was required to remove re-sprouting tamarisk. Additionally, where appropriate at the mitigation sites, tamarisk sprouts are hand pulled by crews on a quarterly basis during the growing season.

Approximately 30 acres of tamarisk were mechanically removed from the soil by root plowing to provide construction and maintenance access to the site. Site clearing occurred in stages. Seven acres were cleared by May 2001. An additional 16.5 acres were cleared by June 2002. The debris was stockpiled and later removed from the site. Approximately 5 acres of tamarisk was cleared to create two dewatering ponds during construction. The material was stockpiled at the site. Since June 2002, an additional 1.5



acres of tamarisk growing along the south bank was mechanically cleared from the soil by root plowing. The debris (approximately 2,089 cubic yards) was placed in one slash pile near the Demonstration Weir at a site designated for a prescribed burn.



### **Prescribed Burns**

The Nevada Division of Forestry conducted a prescribed burn December 9, 2003, of cut tamarisk and other weed slash. A portion of the material originated from the Bostick Weir and the remainder was from additional tamarisk clearing at the Demonstration Weir site. This was the second burn conducted over a one-year period in an effort to reduce the costs of disposal fees for the weed management program.

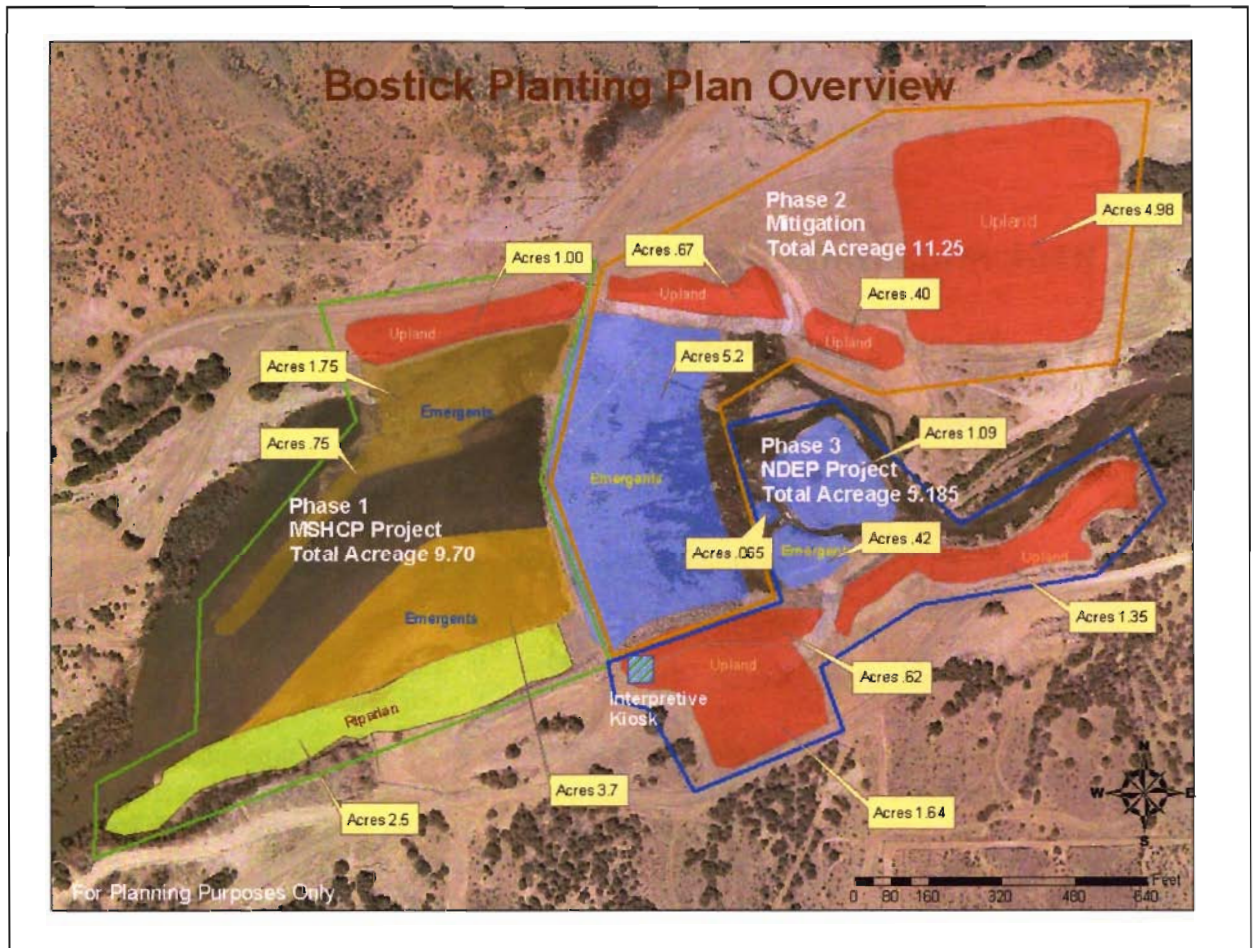
## 2. Tall Whitetop and Giant Reed Management

Tall whitetop is in the early stage of infestation in the Wash, and as such the population may be brought under control in the Wash system. An aggressive control program is under way to manage tall whitetop, giant reed, and other invasive weeds in the Wash. Approximately 680 gross infested areas of tall white top have been mapped and treated since the fall of 2002. Glyphosate (aquatically approved Rodeo) and metsulfuron methyl (Escort) is applied biannually to gain control of the infestation. The goal of the tall whitetop control program is containment, and is expected to last three to five years. Tall whitetop has been found in small patches at the Bostick planting site prior to construction. All plants were treated as part of the biannual weed control program that began in fall 2002. A map of the tall whitetop locations at the Bostick site is in Appendix H.

Giant Reed has been found in the wash in small patches. In total, forty-two stands have been found, and thirty eight of them have been treated and removed from the Wash. Four new patches have been discovered and treated in fall of 2003. The goal for giant reed is eradication from the Wash, but will require frequent monitoring. Like tall whitetop, Rodeo and Escort are used to treat the giant reed. To date, no giant reed has been found at the Bostick planting site.

### III. Site Design

The map below is an aerial photograph showing the final planting design -- discussed above and detailed by location below -- that incorporates all three phases of planting activities and tamarisk management. Images of the progression of activities are in Appendix I that include site preparation and clearing, construction, and volunteer planting activities.



#### A. Final Planting Plan Design

- Phase I Description
  - Consists of upstream Bostick weir north bank, upstream Bostick weir south bank, and upstream Bostick weir emergent bed.
  - Remove tamarisk by using cut stump method with herbicide.
  - Remove tamarisk using mechanical removal.
  - Plant shrubs, trees, and emergent vegetation.
- Phase II Description



- Covers downstream Bostick weir south bank and downstream Bostick riparian area.
  - Remove tamarisk by using cut stump method with herbicide.
  - Remove tamarisk using mechanical removal.
  - Plant shrubs, trees, and emergent vegetation.
3. Phase III Description
- Contains Bostick Weir north and downstream north bank. The weir itself, which also serves as an emergent bed/riparian area.
  - Remove tamarisk by using cut stump method with herbicide.
  - Remove tamarisk using mechanical removal.
  - Plant shrubs, trees, and emergent vegetation.

## **IV. Bank Stabilization**

### **A. Current Conditions**

Situated approximately 1,800 feet downstream of the existing Historical Lateral Weir, which is located near SNWA's water line crossing of the Wash, the 5.4N-830E and 5.4S-840E bank stabilization projects are intended to stabilize the channel bed in the reach of the wash between the Bostick Weir site and Historic Lateral Weir. The Bostick Weir is one of the three largest structures planned for installation in the Wash.

### **B. Stabilization Methods**

The structure is designed as a two-stage weir, using a confined rock rip-rap type, modified chevron weir configuration. The upstream slope is set at 3:1, and the weir section has a minimum width of 16 feet and a length of 760 feet. The downstream chute section is set at a grade of 20:1 with side slopes at 4:1 maximum. The apron section is a minimum of 25 feet wide. A single stage counter-weir, set at an elevation of 1,493.0 feet, has a top width of 20 feet and serves as a secondary roadway access across the structure. The structure has a low flow weir elevation of 1,508.5 feet. The existing channel bed immediately below the weir section lies at approximately 1,498.0 feet. To meet expected future channel bed scour conditions, the structure's apron floor is set at an elevation of 1,490.0 feet.

Channel bank protection at the Bostick is intended to stop or slow the process of bank erosion caused by meandering Wash flow. Bank protection includes the use of rock or broken concrete riprap, revegetation and other means to provide stability. The North bank protection is upstream 455 feet and downstream 200 feet. The bank slopes are 2:1. The South bank protection is upstream 375 feet and downstream 200 feet with bank slopes are 4:1 & 2:1 respectively.

Two dewatering ponds were created during construction. Pond one was 1.38 acres with a capacity of 16.56 acre-feet and was used October 2003 through February 2003. Pond two was 4.76 acres in size with a capacity of 76.16 acre-feet and was in use from February 2003 through June 2003. After construction was complete, this site was backfilled and is designated as a stockpile area. This area will be used for a dual purpose, serving as a stockpile area for rock riprap, as well as plant debris. The plant debris will consist of tamarisk and other weeds that will be burned at this site, as part of the prescribed burn program in the Wash, as discussed previously in Phase II of this plan.

## **V. Monitoring**

By monitoring the success of vegetation planting efforts at the project site, information will be collected that will then be used to improve the success of subsequent bioengineering activities at this site and other erosion controls structure sites along the Las Vegas Wash. The following four monitoring plans: vegetation, water quality, macroinvertebrates, and bird census, have been implemented in the Wash. Appendix J is for Biological Monitoring: Species Identified through January 2004.

### **A. Vegetation**

Vegetation monitoring will be conducted for two years to track the success and mortality rates of plantings, as well as overall changes in species composition and abundance within plant communities. A vegetation-monitoring plan was developed by the SNWA and adopted by the U.S. Army Corp of Engineers in December 2001. These vegetation surveys along with photograph documentation at permanently established photo-points will assist in tracking changes in the vegetation community. Avian species observations will also be noted, and used as indicators to changes in vegetation communities (SWCA, 1995). Similar data will be recorded on the results of all vegetation plantings and tamarisk management techniques. In addition to the Las Vegas Wash Vegetation Monitoring Plan, a botanical inventory of the Wash is underway to identify and map the various plant species found in the Wash. To date approximately 189 different species of plants have been identified. Appendix K is a Botanical Inventory List for the Las Vegas Wash.

### **B. Water Quality**

Water quality in the Las Vegas Wash is typical of most urban waterways and each flow component -- sediment, urban chemicals, and stormwater -- has unique characteristics that contribute to the wash's overall water quality.

In order to ensure that construction of erosion control structures planned for the Wash will help establish wetlands and facilitate the polishing of flows, it will be important to evaluate the relationship between wetlands and water quality. A

Mainstream Las Vegas Wash Monitoring Program was developed in October of 2000. The data collected on a monthly basis include water temperature, dissolved oxygen, pH and specific conductance. In addition, major cations, anions and heavy metals were evaluated. These data provide a baseline assessment of water quality parameters in the Wash for use in evaluating how stabilization and revegetation activities are affecting water quality in the Wash and is available online.

### **C. Macroinvertebrates**

Erosion control structures constructed in Las Vegas Wash will significantly reduce further erosion, as well as reduce the velocity of water flowing into Las Vegas Bay. Once erosion control structures are completed, sedimentation will occur above each structure, and both lentic and lotic aquatic habitat will increase. Macroinvertebrates study was implemented in July of 2002 at eight sites along the Wash; this monthly monitoring program has identified 148 total taxa, including 11 sensitive taxa.

### **D. Bird Census**

Located on the Pacific Migratory Flyway, the Wash provides critical avian habitat in the Mojave Desert. On November 14, 2000 the Wash Team partnered with the Red Rock Audubon Society (RRAS) to conduct a bird census to collect baseline data and to document changes in diversity and abundance, as weir construction and habitat restoration progressed. The bird census completed its third study year on October 7, 2003. A total of 128 species and 43 families were recorded during the three-year period. Census findings led to the addition of 12 new species to Carolyn Titus's, "The Birds of the Las Vegas Wash", compiled over thirty years for the RRAS. Beginning summer 2004, a point count survey will be conducted to collect additional data on the avian populations in the Wash.

## **VI. Contingency**

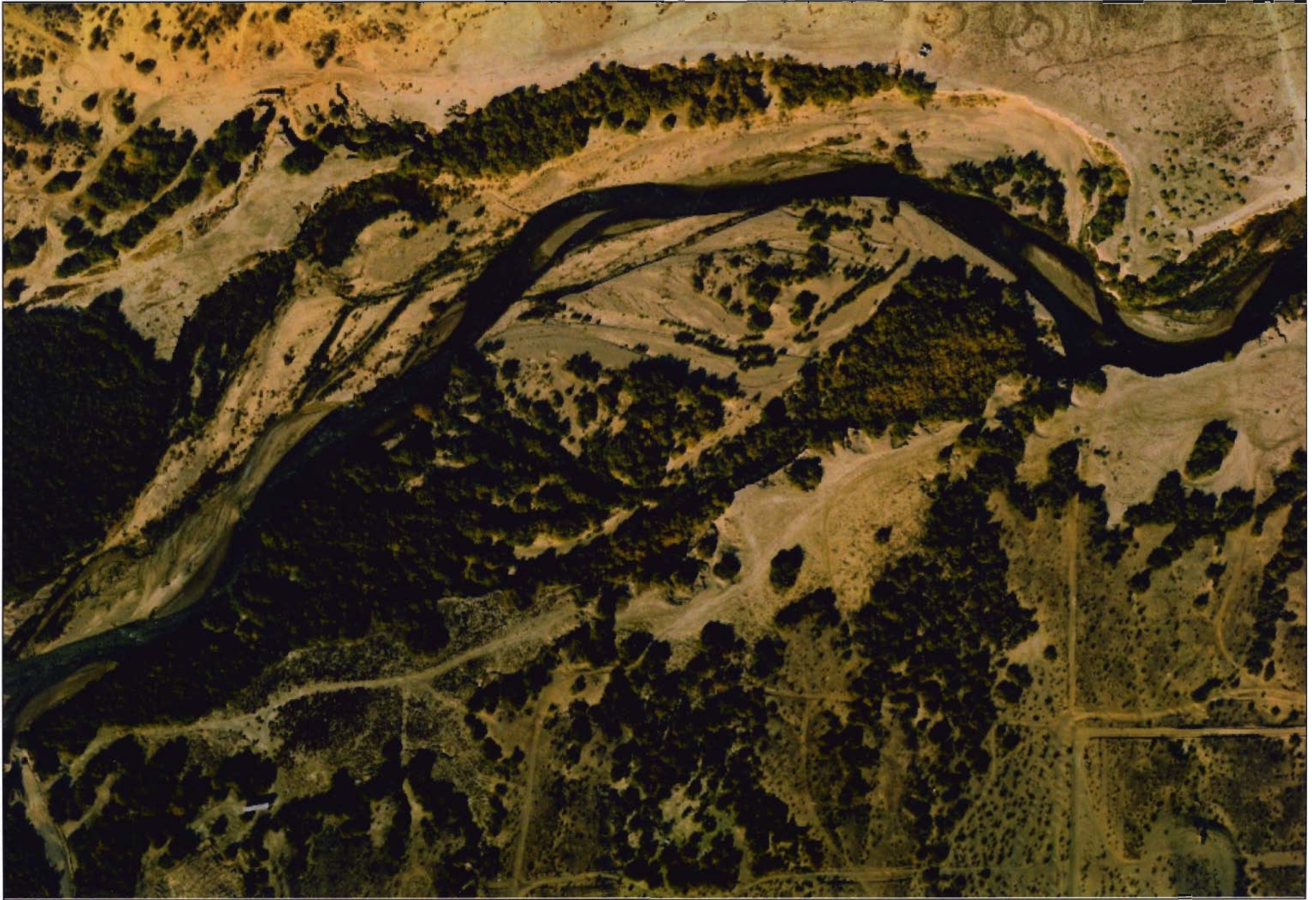
The Las Vegas Wash is a dynamic system, and as Bostick Weir begins to stabilize this reach of the wash, it is anticipated that mitigation efforts outlined herein may need to be re-evaluated and adaptively addressed.

If permit requirements of 80 % survival of native species planted with less than 20% encroachment of invasive species is not reached, within the 2 year monitoring period, further mitigation activities will be developed and implemented at the project site to ensure the objective of developing long-term, self-sustaining wetlands that are not dependent on further human intervention after the establishment period is reached.

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## Bostick Prior to Construction 2000

0 55 110 220 330 440 Feet

For Planning Purposes Only



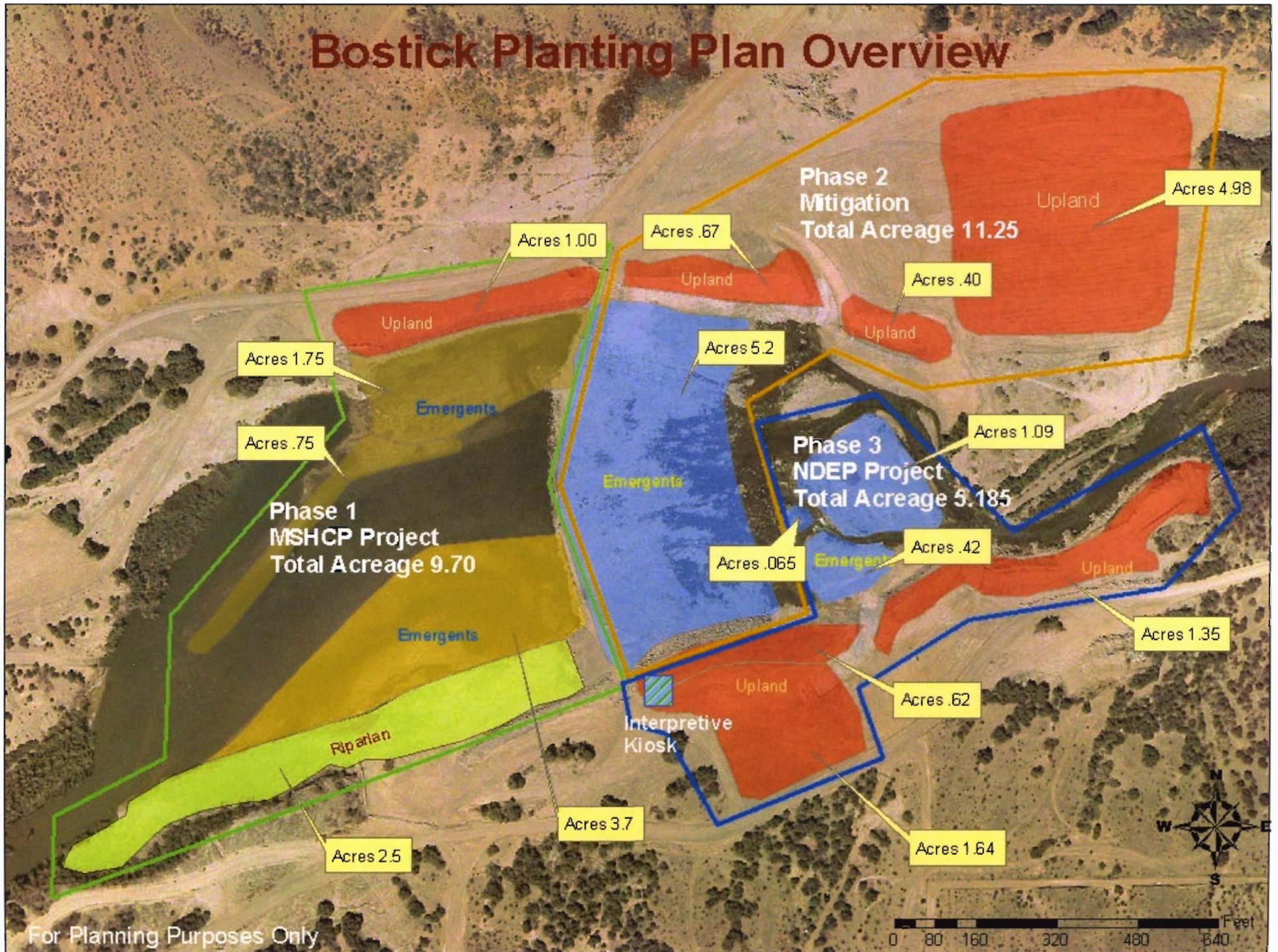


# Bostick During Construction



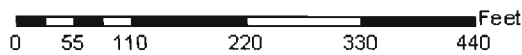


# Bostick Planting Plan Overview



For Planning Purposes Only



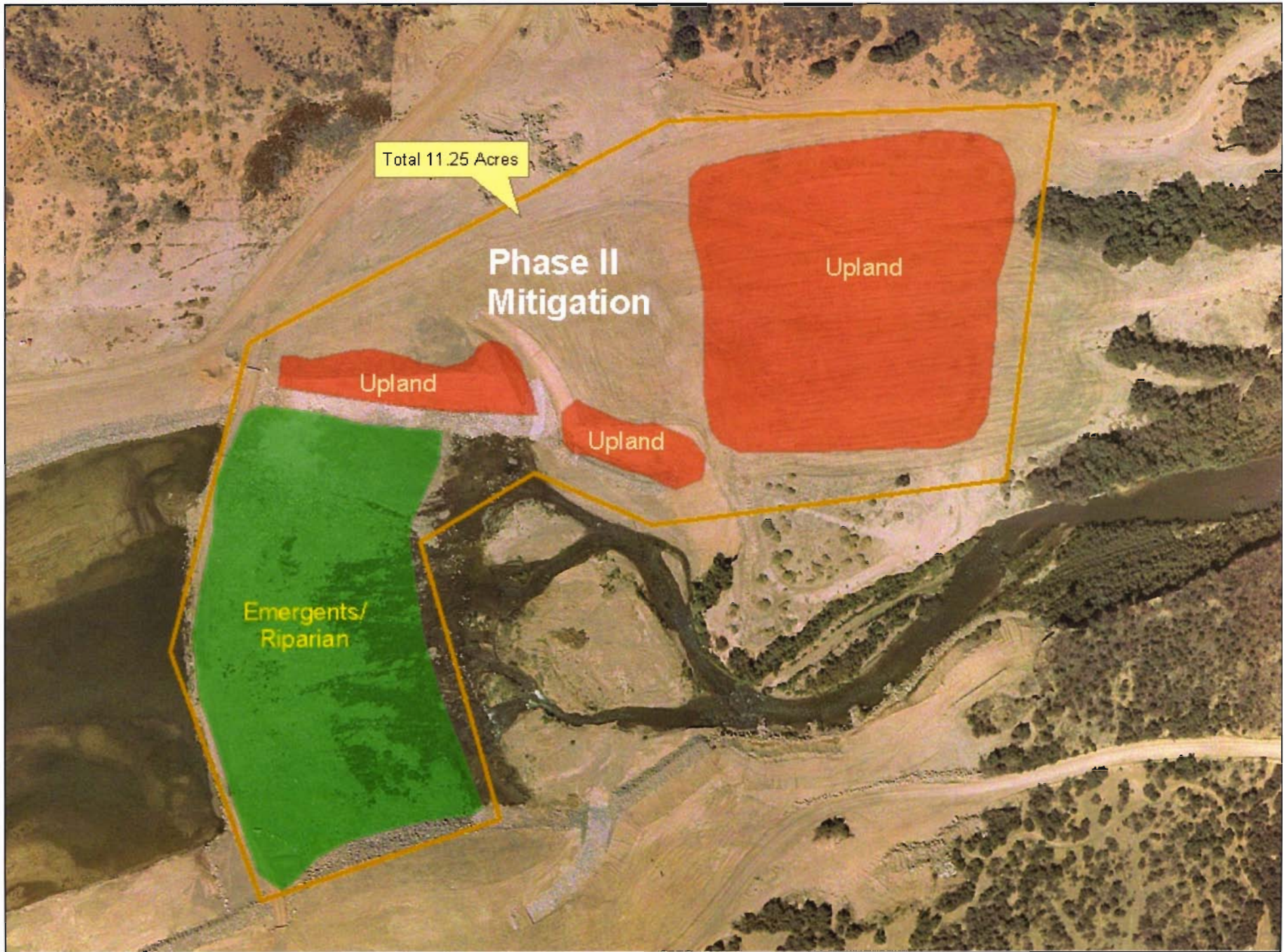


# **Bostick Planting Plan Phase I**

For Planning Purposes Only







Total 11.25 Acres

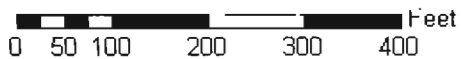
### Phase II Mitigation

Upland

Upland

Upland

Emergents/  
Riparian

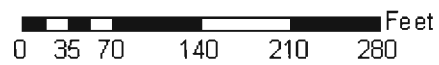
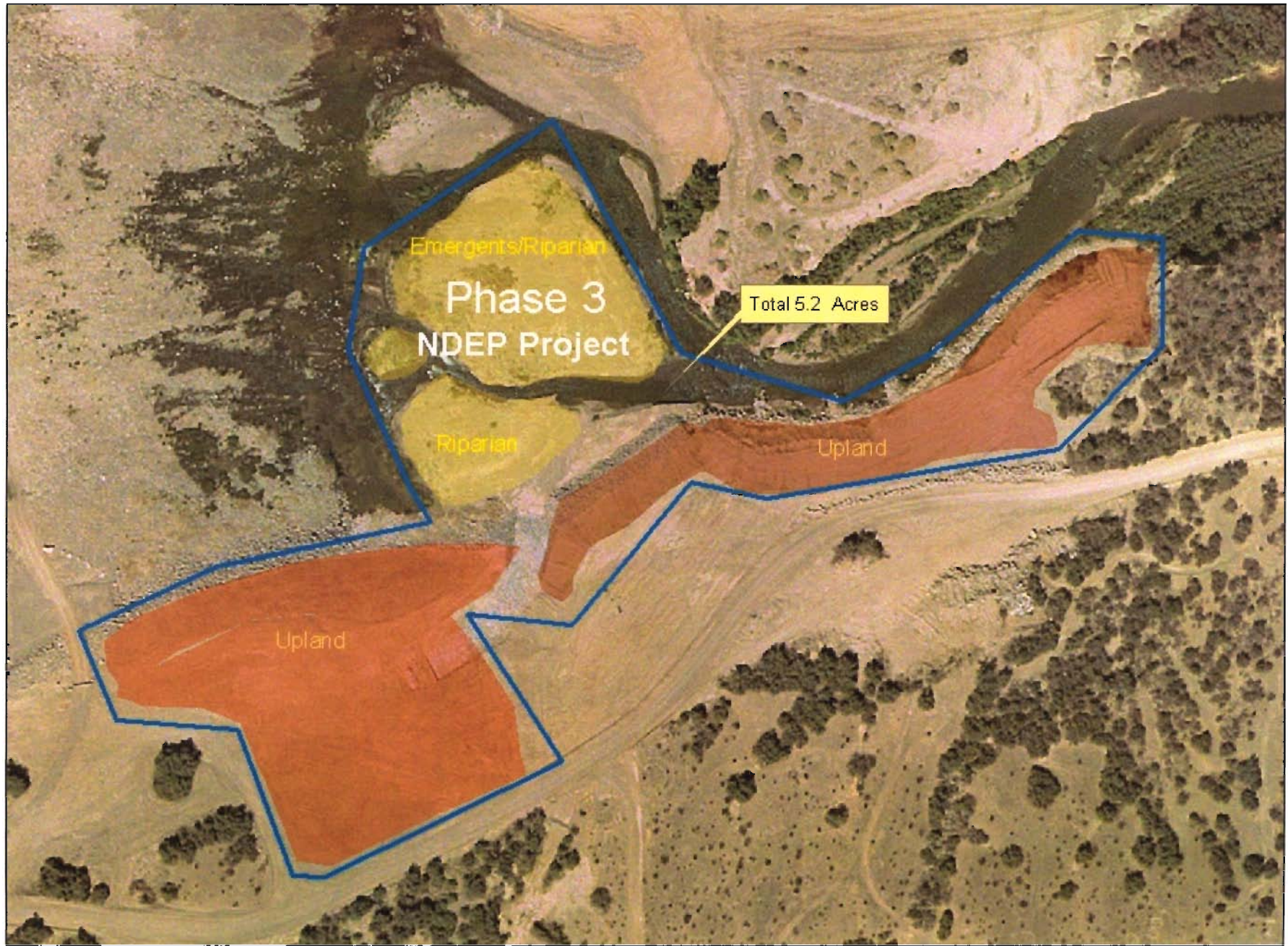


## **Bostick Planting Plan Phase II**

For Planning Purposes Only







### **Bostick Planting Plan Phase III**

For Planning Purposes Only





# Bostick Weir South Soil Sampling Site Locations and Results

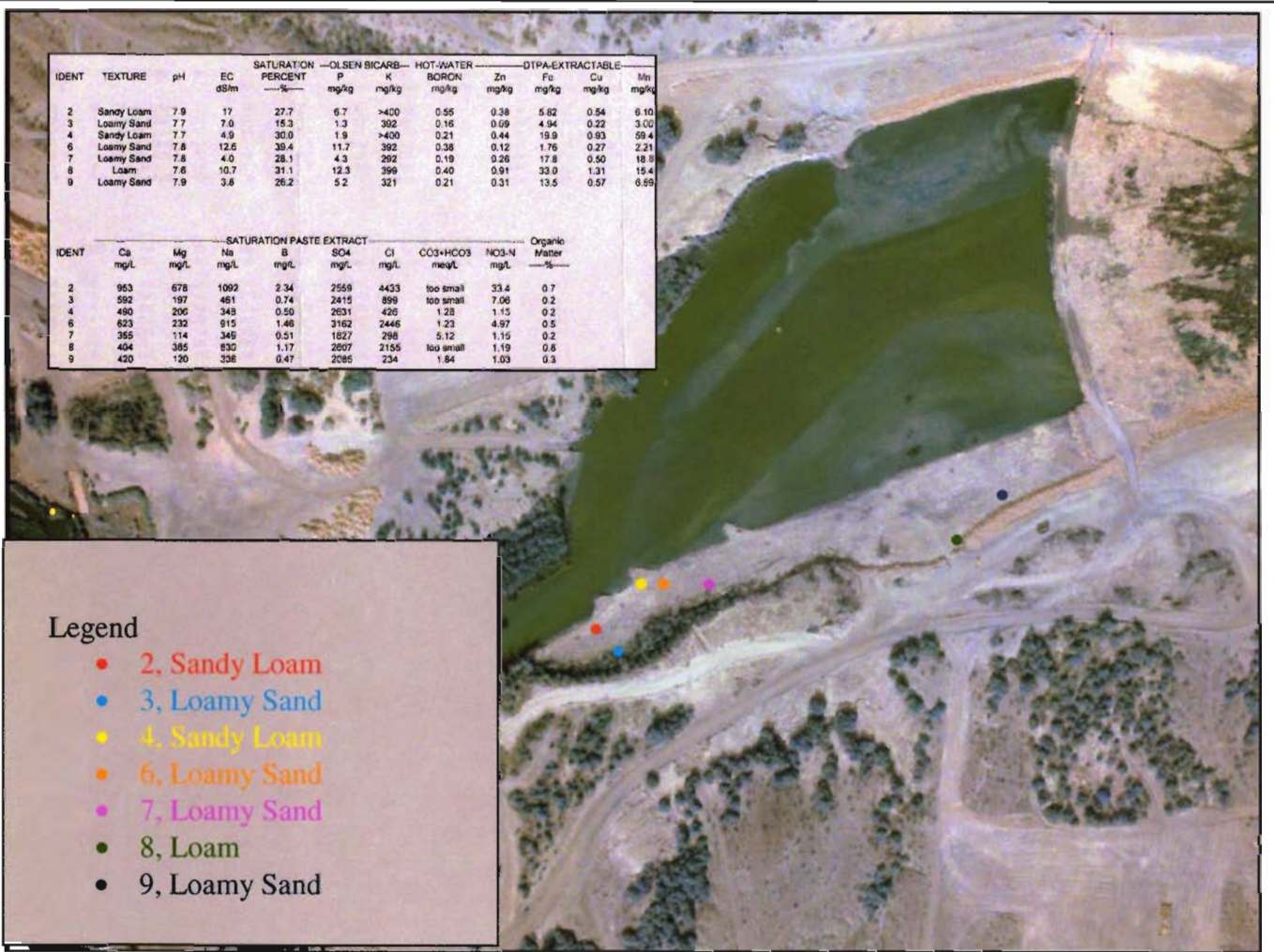
IDENT	TEXTURE	pH	EC dS/m	SATURATION PERCENT		--OLSEN BICARB--		HOT-WATER		DTPA-EXTRACTABLE			
				B	PERCENT	P mg/kg	K mg/kg	BORON mg/kg	Zn mg/kg	Fe mg/kg	Cu mg/kg	Mn mg/kg	
2	Sandy Loam	7.9	17	27.7	6.7	>400	0.55	0.38	5.82	0.54	6.10		
3	Loamy Sand	7.7	7.0	15.3	1.3	302	0.16	0.09	4.94	0.22	3.00		
4	Sandy Loam	7.7	4.9	30.0	1.9	>400	0.21	0.44	19.9	0.93	59.4		
6	Loamy Sand	7.8	12.6	39.4	11.7	392	0.38	0.12	1.76	0.27	2.21		
7	Loamy Sand	7.8	4.0	28.1	4.3	292	0.19	0.26	17.8	0.50	18.8		
8	Loam	7.6	10.7	31.1	12.3	399	0.40	0.91	33.0	1.31	15.4		
9	Loamy Sand	7.9	3.8	26.2	5.2	321	0.21	0.31	13.5	0.57	6.89		

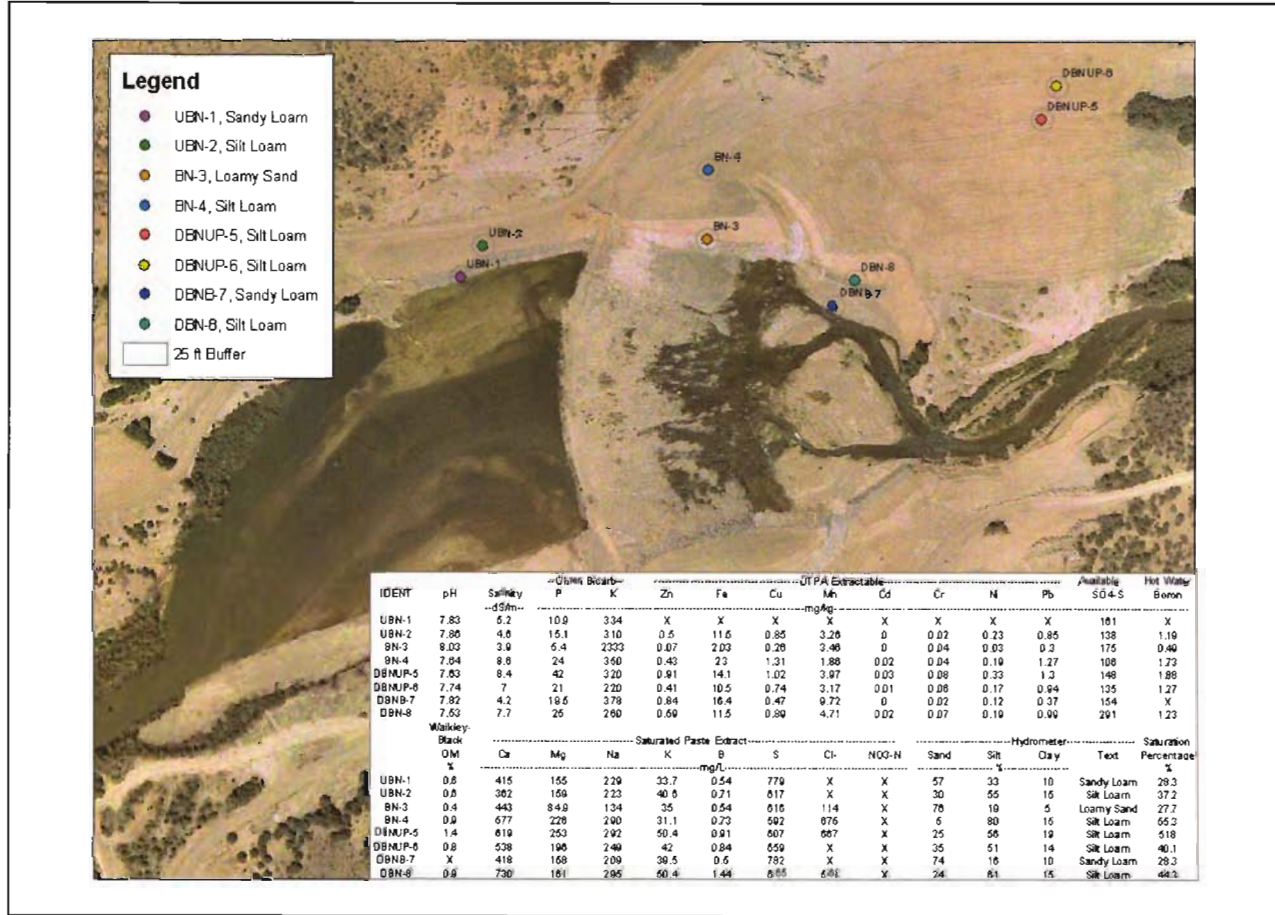
IDENT	SATURATION PASTE EXTRACT								Organic Matter --%--
	Ca mg/L	Mg mg/L	Na mg/L	B mg/L	SO4 mg/L	Cl mg/L	CO3+HCO3 meq/L	NO3-N mg/L	
2	963	678	1092	2.34	2559	4433	too small	33.4	0.7
3	592	197	461	0.74	2415	899	too small	7.06	0.2
4	490	206	343	0.50	2031	426	1.28	1.15	0.2
6	623	232	915	1.46	3162	2446	1.23	4.97	0.5
7	365	114	346	0.51	1827	298	5.12	1.15	0.2
8	404	385	830	1.17	2007	2155	too small	1.19	0.6
9	420	120	338	0.47	2085	234	1.84	1.03	0.3

### Legend

- 2, Sandy Loam
- 3, Loamy Sand
- 4, Sandy Loam
- 6, Loamy Sand
- 7, Loamy Sand
- 8, Loam
- 9, Loamy Sand



# Bostick Weir North Soil Sampling Site Locations and Results





# Tall Whitetop Infestation in the Proximity of the Bostick Weir Site



# Clearing the Site

## Clearing before construction



**Removal of Invasive Species (Tamarisk)**





# Construction in Progress



# Construction Complete



Completed August 6, 2003



# Site Ready for Planting

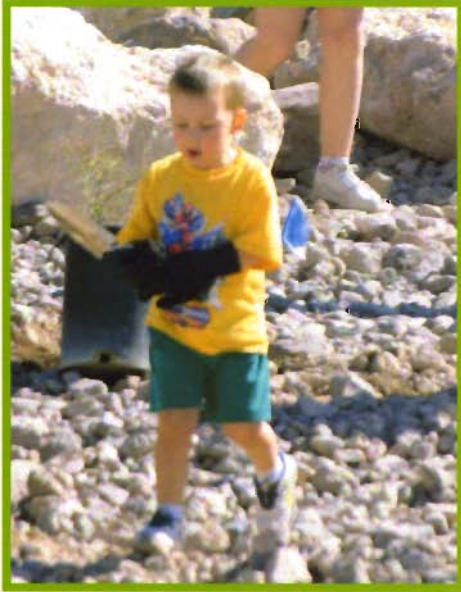


**October 2003**



# Volunteers Come to Plant

Green - Up Fall 2003



October 25, 2003





# Planting Complete



Baccharis



Rabbit fencing  
protecting  
Four-wing saltbush



## Las Vegas Wash Coordination Committee Biological Monitoring Programs: Species Identified through January 2004

### Fish Survey

Green sunfish (*Lepomis cyanellus*)  
Mosquitofish (*Gambusia affinis*)  
Common carp (*Cyprinus carpio*)  
Black bullhead (*Ameiurus melas*)  
Red shiner (*Cyprinella lutrensis*)  
Suckermouth catfish (Family Loricariidae: *Hypostomus plecostomus*)  
Fathead minnow (*Pimephales promelas*)

### Reptile Survey

Western whiptail lizard (*Cnemidophorus tigris*)  
Desert horned lizard (*Phrynosoma platyrhinos*)  
Western banded gecko (*Coleonyx variegatus*)  
Desert common night lizard (*Xantusia vigilis*)  
Desert spiny lizard (*Sceloporus magister*)  
Long-nosed leopard lizard (*Gambelia wislizenii*)  
Desert iguana (*Dipsosaurus dorsalis*)  
Side-blotched lizard (*Uta stansburiana*)  
Zebra-tailed lizard (*Callisaurus draconoides*)  
Great Basin gopher snake (*Pituophis melanoleucus*)  
Western blind snake (*Leptotyphlops humilis*)  
Common kingsnake (*Lampropeltis getulus*)  
Sidewinder (*Crotalus cerastes*)  
Red coachwip (*Masticophis flagellum*)  
Great Basin collared lizard (*Crotaphytus bicinctores*)

### Small Mammal Survey

Long-tailed pocket mouse (*Chaetodipus formosus*)  
Desert pocket mouse (*Chaetodipus penicillatus*)  
Little pocket mouse (*Perognathus longimembris*)  
Cactus mouse (*Peromyscus eremicus*)  
Merriam's kangaroo rat (*Dipodomys merriami*)  
Desert woodrat (*Neotoma lepida*)  
House mouse (*Mus musculus*)  
White-tailed antelope squirrel (*Ammospermophilus leucurus*)  
Desert shrew (*Notiosorex crawfordi*)  
Round-tailed ground squirrel (*Spermophilus tereticaudus*)

**Las Veags Wash Coordination Committee**

**Bird Census Results**

**November 2000 - October 2003**

**WATERFOWL**

Canada Goose  
Wood Duck  
Gadwall  
Mallard  
Cinnamon Teal  
Northern Shoveler  
Northern Pintail  
Green-winged Teal  
Common Goldeneye  
Common Merganser

**NEW WORLD QUAIL**

Gambel's Quail

**GREBES**

Pied-billed Grebe  
Eared Grebe  
Western Grebe  
Clark's Grebe

**CORMORANTS**

Double-crested Cormorant

**BITTERN & HERONS**

Great Blue Heron  
Great Egret  
Snowy Egret  
Green Heron  
Black-crowned Night-Heron

**IBISES**

White-faced Ibis

**NEW WORLD VULTURES**

Turkey Vulture

**HAWKS**

Osprey  
Northern Harrier  
Sharp-shinned Hawk  
Cooper's Hawk  
Red-shouldered Hawk  
Red-tailed Hawk

**FALCONS**

American Kestrel  
Peregrine Falcon  
Prairie Falcon

Las Veags Wash Coordination Commitee

Bird Census Results

November 2000 - October 2003

<b>RAILS, GALLINULES &amp; COOTS</b>	Virginia Rail Common Moorhen American Coot
<b>PLOVERS</b>	Killdeer
<b>STILTS &amp; AVOCETS</b>	Black-necked Stilt American Avocet
<b>SANDPIPERS &amp; PHALAROPES</b>	Greater Yellowlegs Lesser Yellowlegs Spotted Sandpiper Least Sandpiper Long-billed Dowitcher Common Snipe
<b>GULLS &amp; TERNS</b>	Ring-billed Gull
<b>DOVES</b>	Rock Pigeon White-winged Dove Mourning Dove
<b>ROADRUNNERS</b>	Greater Roadrunner
<b>TYPICAL OWLS</b>	Northern Saw-whet Owl
<b>SWIFTS</b>	Vaux's Swift White-throated Swift
<b>HUMMINGBIRDS</b>	Black-chinned Hummingbird Anna's Hummingbird Broad-tailed Hummingbird
<b>KINGFISHERS</b>	Belted Kingfisher
<b>WOODPECKERS</b>	Northern Flicker
<b>TYRANT FLYCATCHERS</b>	Western Wood-Pewee Black Phoebe Say's Phoebe Ash-throated Flycatcher Cassin's Kingbird Western Kingbird



Las Veags Wash Coordination Committee

Bird Census Results

November 2000 - October 2003

<b>SHRIKES</b>	Loggerhead Shrike
<b>VIREOS</b>	Warbling Vireo
<b>CROWS &amp; JAYS</b>	Western Scrub-Jay Pinyon Jay Common Raven
<b>SWALLOWS</b>	Tree Swallow Violet-green Swallow Northern Rough-winged Swallow Bank Swallow Cliff Swallow Barn Swallow
<b>VERDINS</b>	Verdin
<b>BUSHTITS</b>	Bushtit
<b>WRENS</b>	Rock Wren Bewick's Wren Marsh Wren
<b>KINGLETS</b>	Golden-crowned Kinglet Ruby-crowned Kinglet
<b>GNATCATCHERS</b>	Blue-gray Gnatcatcher Black-tailed Gnatcatcher
<b>THRUSHES</b>	Hermit Thrush American Robin
<b>MOCKINGBIRDS &amp; THRASHERS</b>	Northern Mockingbird Crissal Thrasher
<b>STARLINGS</b>	European Starling
<b>PIPITS</b>	American Pipit
<b>WAXWINGS</b>	Cedar Waxwing
<b>SILKY FLYCATCHERS</b>	Phainopepla

**Las Veags Wash Coordination Commitee**

**Bird Census Results**

**November 2000 - October 2003**

**WOOD-WARBLERS**

Orange-crowned Warbler  
Lucy's Warbler  
Yellow Warbler  
Yellow-rumped Warbler  
Palm Warbler  
MacGillivray's Warbler  
Common Yellowthroat  
Wilson's Warbler  
Yellow-breasted Chat

**TANAGERS**

Western Tanager

**EMBERIZIDS**

Spotted Towhee  
Abert's Towhee  
Chipping Sparrow  
Brewer's Sparrow  
Vesper Sparrow  
Lark Sparrow  
Black-throated Sparrow  
Savannah Sparrow  
Fox Sparrow  
Song Sparrow  
Lincoln's Sparrow  
White-crowned Sparrow  
Dark-eyed Junco

**CARDINALS, GROSBEAKS & BUNTINGS**

Black-headed Grosbeak  
Blue Grosbeak  
Lazuli Bunting  
Indigo Bunting

**BLACKBIRDS**

Red-winged Blackbird  
Western Meadowlark  
Yellow-headed Blackbird  
Brewer's Blackbird  
Great-tailed Grackle  
Brown-headed Cowbird  
Bullock's Oriole

**FINCHES**

House Finch  
Lesser Goldfinch

**Las Veags Wash Coordination Commitee**

**Bird Census Results**

**November 2000 - October 2003**

**OLD WORLD SPARROWS**

House Sparrow



**Vascular Plant List for the Las Vegas Wash Project**  
**Botanical Survey as of April 1, 2004**

Family (Scientific Name)	Family (Common Name)	Species (Scientific Name)	Species (Common Name)
AMARANTHACEAE	Amaranth Family	<i>Amaranthus albus</i>	Tumbleweed
		<i>Amaranthus ca. powellii</i>	Amaranth
		<i>Tidestromia oblongifolia</i>	Honey sweet
ASTERACEAE	Aster Family	<i>Acroptilon repens</i>	Russian Knapweed
		<i>Ambrosia dumosa</i>	Burro bush
		<i>Amphipappus fremontii</i>	Chaff bush
		<i>Aster subulatus</i> var. <i>ligulatus</i>	Alkali aster
		<i>Atrichoseris platyphylla</i>	Gravel ghost
		<i>Baccharis emoryi</i>	Emory waterweed
		<i>Baileya multiradiata</i>	Desert marigold
		<i>Chaenactis carphoclinia</i>	Pebble pincushion
		<i>Cirsium vulgare</i>	Bull thistle
		<i>Conyza bonariensis</i>	Horseweed
		<i>Conyza canadensis</i>	Horseweed
		<i>Conyza coulteri</i>	Horseweed
		<i>Cotula coronopifolia</i>	Brass buttons
		<i>Eclipta prostrata</i>	False daisy
		<i>Encelia farinosa</i>	Brittle bush
		<i>Encelia virginensis</i>	Brittle bush
		<i>Enceliopsis nudicaulis</i>	Naked-stem daisy
		<i>Erigeron divergens</i>	Fleabane
		<i>Eriophyllum ambiguum</i>	wooly daisy
		<i>Gnaphalium luteo-album</i>	Cudweed
		<i>Helianthus annuus</i>	Sunflower
		<i>Heterotheca</i> cf. <i>psammophila</i>	Camphorweed
		<i>Hymenoclea salsola</i> var. <i>salsola</i>	Cheesebush
		<i>Isocoma acradenia</i> var. <i>eremophila</i>	Goldenbush
		<i>Lactuca</i> cf. <i>biennis</i>	Prickly lettuce
		<i>Lactuca serriola</i>	Prickly lettuce
		<i>Machaeranthera pinnatifida</i> var. <i>goodingii</i>	Gooding aster
		<i>Malacothrix glabrata</i>	Desert dandelion
		<i>Peucephyllum schottii</i>	Pygmy cedar
		<i>Pluchea odorata</i>	Salt marsh fleabane
		<i>Pluchea sericea</i>	Arrow weed
		<i>Psathyrotes ramosissima</i>	Turtle plant
		<i>Psilostrophe cooperi</i>	Paper flower
		<i>Senecio flaccidus</i> var. <i>monoensis</i>	Wash groundsel
		<i>Sonchus asper</i>	Prickly sow thistle
		<i>Sonchus oleraceus</i>	Sow thistle
		<i>Stephanomeria pauciflora</i> var. <i>pauciflora</i>	Wire lettuce
		<i>Stylocline micropoides</i>	Desert nest straw
		<i>Xanthium strumarium</i>	Cocklebur
AZOLLACEAE	Mosquito Fern Family	<i>Azolla</i> sp.	Mosquito fern
BIGNONIACEAE	Aster Family	<i>Chilopsis linearis</i> ssp. <i>arcuata</i>	Desert willow
BORAGINACEAE	Borage Family	<i>Amsinckia tessellata</i> var. <i>tessellata</i>	Devil's lettuce
		<i>Cryptantha angustifolia</i>	Narrow-leaved cryptantha
		<i>Cryptantha barbiger</i>	Bearded cryptantha
		<i>Cryptantha maritima</i>	cryptantha
		<i>Cryptantha nevadensis</i>	Cryptantha
		<i>Cryptantha pterocarya</i>	Wing-nut cryptantha
		<i>Cryptantha recurvata</i>	Cryptantha
		<i>Heliotropium curassavicum</i>	Salt heliotrope
		<i>Pectocarya heterocarpa</i>	Comb-bur
		<i>Pectocarya platycarpa</i>	Comb-bur

BRASSICACEAE	Mustard Family	Descuriana pinnata ssp. glabra Guillenia lasiophylla Lepidium fremontii var. fremontii Lepidium lasiocarpum Lepidium latifolium Lesquerella tenella Rorippa nasturium-aquatica Sisymbrium irio Streptanthella longirostris	Tansy mustard California mustard Desert alyssum peppergrass Broad-leaved peppergrass Bead pod Water Cress London rocket Streptanthella
CACTACEAE	Cactus Family	Cylindropuntia echinocarpa Cylindropuntia ramosissima Opuntia basilaris	Golden cholla Diamond cholla Beavertail
CAMPANULACEAE	Bellflower Family	Nemacladus glanduliferus var. orientalis	Thread plant
CHENOPODIACEAE	Goosefoot Family	Allenrolfea occidentalis Atriplex canescens ssp. canescens Atriplex confertifolia Atriplex elegans var. fasciculata Atriplex hymenelytra Atriplex lentiformis var. lentiformis Atriplex polycarpa Bassia hyssopifolia Chenopodium album Chenopodium ambrosioides Chenopodium sp. Salsola paulsenii Salsola tragus Suaeda moquinii	Iodine bush Four-wing saltbush Shadscale Wheelscale Desert holly Quail bush Allscale Bassia Lamb's quarters Mexican tea Lamb's quarters Russian thistle Russian thistle Bush seepweed
CONVOLVULACEAE	Morning Glory Family	Convolvulus arvensis	Bind weed
CYPERACE	Sedge Family	Cyperus erythrorhizos Eleocharis cf. macrostachya Eleocharis cf. montevidensis Scirpus acutus var. occidentalis Scirpus americanus Scirpus californicus Scirpus cf. pungens Scirpus maritimus	Nut-sedge Spike-rush Spike-rush Tule Olney three-square California tule Common three-square Bulrush
EPHEDRACEAE	Joint-Fir Family	Ephedra torreyana	Torrey joint-fir
EUPHORBIACEAE	Spurge Family	Euphorbia micromeria Euphorbia prostrata	Sonoran sand-mat spurge
FABACEAE	Legume Family	Acacia greggii Medicago sativa Melilotus cf. Indica Prosopis glandulosa var. torreyana Prosopis pubescens Prosopis sp. (alba) Prosopis velutina Psoralea fremontii var. fremontii Senna armata	Catclaw Alfalfa Yellow sweet-clover Honey mesquite Screw-bean mesquite White mesquite Velvet mesquite Indigo Bush Desert senna
GERANIACEAE	Geranium Family	Erodium cicutarium Erodium texanum	Red-leaf filaree Texas filaree
HYDROPHYLLACEAE	Waterleaf Family	Eucrypta micrantha Phacelia crenulata var. crenulata Phacelia ivesiana Phacelia pulchella var. goodingii	Eucrypta Purple phacelia phacelia Gooding phacelia

JUNCACEAE	Rush Family		
		<i>Juncus balticus</i>	Wire rush
KRAMERIACEAE	Krameria Family		
		<i>Krameria erecta</i>	Range rhatany
LAMIACEAE	Mint Family		
		<i>Marrubium vulgare</i>	Horehound
LEMNACEAE	Duckweed Family		
		<i>Lemna sp. (ca. minor)</i>	Duckweed
LOASACEAE	Loasa Family		
		<i>Mentzelia sp. (ca. albicaulis)</i>	Stick-leaf
		<i>Mentzelia tricuspis</i>	Stick-leaf
		<i>Petalonyx nitidus</i>	Shining sandpaper plant
MALVACEAE	Mallow Family		
		<i>Malva parviflora</i>	Cheeseweed
		<i>Sphaeralcea ambigua var. rugosa</i>	Desert mallow
		<i>Sphaeralcea emoryi</i>	Emory mallow
MORACEAE	Mulberry Family		
		<i>Morus alba</i>	White mulberry!!
NYCTAGINACEAE	Four O'Clock Family		
		<i>Allionia incarnata</i>	Pink windmills
		<i>Mirabilis bigelovii var. bigelovii</i>	Four o'clock
OLEACEAE	Olive Family		
		<i>Fraxinus velutina</i>	Velvet ash
ONAGRACEAE	Evening Primrose Family		
		<i>Camissonia boothii ssp. condensata</i>	Woody bottle washer
		<i>Camissonia brevipes var. brevipes</i>	Sun cup
		<i>Camissonia refracta</i>	evening primrose
PAPAVERACEAE	Poppy Family		
		<i>Arctomecon californica</i>	Bear poppy
		<i>Eschscholzia californica</i>	California poppy
		<i>Eschscholzia glyptosperma</i>	Desert poppy
PLANTAGINACEAE	Plantain Family		
		<i>Plantago major</i>	Common plantain
		<i>Plantago ovata</i>	Desert plantain
PLUMBAGINACEAE	Plumbago Family		
		<i>Limonium californicum</i>	Sea lavender
POACEAE	Grass Family		
		<i>Agrostis viridis</i>	Bent grass
		<i>Aristida purpurea var.</i>	Purple three-awn
		<i>Arrundo donax</i>	Giant reed
		<i>Bromus madritensis ssp. Rubens</i>	Foxtail chess
		<i>Cynodon dactylon</i>	Bermuda grass
		<i>Distichlis spicata</i>	Saltgrass
		<i>Echinochloa crus-gallii</i>	Barnyard grass
		<i>Leptochloa uninerva</i>	Mexican sprangletop
		<i>Panicum capillare</i>	Witchgrass
		<i>Phragmites australis</i>	Common reed
		<i>Pleuraphis rigida</i>	Galleta grass
		<i>Polypogon monspeliensis</i>	Rabbit's foot grass
		<i>Schismus barbatus</i>	Splitgrass
		<i>Setaria pumila</i>	Bristlegrass
		<i>Sorghum halapense</i>	Johnsongrass
		<i>Sporobolus airoides</i>	Alkali sacaton
		<i>Vulpia octoflora var. hirtella</i>	Six weeks fescue
POLEMONIACEAE	Phlox Family		
		<i>Aliciella leptomeria</i>	Gilia
		<i>Gilia cf. inconspicua</i>	Gilia
		<i>Gilia scopulorum</i>	Rock gilia
		<i>Gilia stellata</i>	Gilia



POLYGONACEAE	Buckwheat Family	Chorizanthe brevicornu Chorizanthe rigida Eriogonum deflexum var. deflexum Eriogonum inflatum var. inflatum Eriogonum thomasii Eriogonum trichopes var. trichopes Polygonum lapathifolium Rumex stenophyllus	Brittle spineplant Rigid spineplant Buckwheat Desert trumpet Thomas buckwheat Little trumpet Willow weed Dock
RESEDACEAE	Reseda Family		
SALICACEAE	Willow Family	Oligomeris linifolia	Mignonette
		Populus fremontii Salix exigua Salix goodingii Salix laevigata	Fremont cottonwood Narrow-leaved willow Gooding willow Red willow
SAURURACEAE	Lizard's-tail Family		
SCROPHULARIACEAE	Figwort Family	Anemopsis californica	Yerba Mansa
SOLANACEAE	Nightshade Family	Veronica anagallis-aquatica	Water speedwell
		Datura wrightii Lycium andersonii var. andersonii Nicotiana glauca Nicotiana obtusifolia Physalis crassifolia Solanum americanum Solanum elaeagnifolium	Sacred datura Anderson thornbush Tree tobacco Desert tobacco ground cherry Nightshade Silver-leaf nightshade
TAMARACACEAE	Tamarisk Family		
TYPHACACEAE	Cattail Family	Tamarix cf. ramosissima	Salt cedar
		Typha domingensis	Southern cattail
ULMACEAE	Elm Family	Ulmus sp.	Elm
VISCACEAE	Mistletoe Family	Phorodendron californicum	Desert mistletoe
ZYGOPHYLLACEAE	Caltrop Family	Larrea tridentata	Creosote bush