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**MesquitePower**

A SEMPR A ENERGY DEVELOPMENT

Steven L. Perrizo  
Plant Engineer  
Mesquite Power, LLC  
37625 W. Elliot Road  
Arlington, AZ 85322  
Tel: (623) 386-8538  
Cell: (623) 866-3183  
Fax: (623) 327-0387  
[sperrizo@mesquitepower.com](mailto:sperrizo@mesquitepower.com)

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February 11, 2010

Colleen Ryan, Supervisor  
Document Control Center  
Arizona Corporation Commission  
1200 West Washington Street  
Phoenix, Arizona 85007

Re: Mesquite Generating Station  
CEC Decision No. 63232  
Docket No. L-00000S-00-0101  
2009 Annual Report

Dear Ms. Ryan:

On behalf of Mesquite Power, LLC, I am submitting the annual report outlining the status of the Comprehensive Land Management Plan per Stipulation 12 of the Certificate of Environmental Compatibility. Also included is the status of all of the remaining stipulations as agreed to in 2003.

Attached are thirteen copies of the Annual Report for 2009. Please contact me at (623) 386-8538 should you have any questions or need additional information.

Sincerely,

Steve Perrizo  
Plant Engineer

Arizona Corporation Commission

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cc: Bob Ellis, Mesquite Power  
Marilyn Teague, Sempra Global

Certificate of Environmental Compatibility  
2009 Annual Status Report  
Mesquite Power Project  
Docket No. L-00000S-00-0101

Submitted to

Arizona Corporate Commission

by

Mesquite Power, LLC

February 2010

## **Executive Summary**

The Arizona Corporate Commission, on recommendation by the Line Siting Committee, approved a Certificate of Environmental Compatibility (CEC) for the construction of the Mesquite Generating Station, a 1,250-megawatt (MW) natural gas fired, combined cycle power plant. Stipulation 12 of the CEC requires Mesquite Power, LLC to submit an annual report outlining the implementation status of the Comprehensive Land Management Plan that was included with the application for this certificate. In June, 2003, Mesquite Power agreed to voluntarily submit a comprehensive overview of compliance to all the stipulations of the CEC.

The construction of the facility was completed in 2004. Block 1 of the facility was turned over to operations on May 20, 2003 and Block 2 of the facility was turned over to operations on November 12, 2003. Landscaping was started in November 2003 and was completed in summer 2004. Five (5) permanent production wells supply water to the plant for operations and the revegetation project at the water property.

The status of the implementation of the Comprehensive Land Management Plan is documented in the separate status report included as an attachment to this report.

## **List of Attachments**

Attachment 1..... Status Report on the Comprehensive Land Management Plan

# Certificate of Environmental Compatibility 2009 Annual Status Report

## 1.0 Introduction

The Arizona Corporate Commission, on recommendation by the Line Siting Committee, approved a Certificate of Environmental Compatibility (CEC) for the construction of the Mesquite Generating Station, a nominal 1,250-megawatt (MW) natural gas fired, combined cycle power plant. Stipulation 12 of the CEC requires Mesquite Power, LLC to submit an annual report outlining the implementation status of the Comprehensive Land Management Plan that was included with the application for this certificate. In June, 2003, Mesquite Power agreed to voluntarily submit a comprehensive overview of compliance to all the stipulations of the CEC.

## 2.0 Compliance with the Stipulations

The following is the status of the project relative to the stipulations from CEC Decision # L-00000S-00-0101.

### Stipulation 1

*The applicant and its assignees will comply with all existing applicable air and water pollution control standards and regulations, and with all existing applicable ordinances, master plans and regulations of the State of Arizona, the County of Maricopa, the United States, and any other governmental entities having jurisdiction.*

Mesquite Power is in compliance with all applicable air and water pollution control standards and regulations.

### Stipulation 2

*This authorization to construct the Mesquite Project will expire five (5) years from the date the Certificate is approved by the Arizona Corporate Commission ("Commission") unless construction of the Mesquite Project is completed to the point that the Mesquite Project is capable of operating at its rated capacity by that time; provided, however, that prior to such expiration Applicant or its assignee may request that the Arizona Corporation Commission extend this time limitation.*

Both power blocks were operating commercially as of December, 2003. The outstanding construction issues such as fencing, asphalt, and landscaping were completed in summer, 2004.

**Stipulation 3**

*Applicant shall meet all applicable requirements for groundwater use set forth in the Third Management Plan for the Phoenix Active Management Area existing as of the date Applicant first begins withdrawing groundwater in connection with the Project. Applicant shall limit its aggregate annual withdrawal of groundwater to (i) 7,500 acre feet for the Mesquite Project site, and (ii) such additional volumes available within its Type 1 Groundwater Right as may be needed to implement the portion of the Comprehensive Land Management Plan provided for at Condition 11 (ii) below.*

The five (5) permanent production wells have been supplying water to the plant for operations and irrigation. The wells were converted to non-exempt wells in an Active Management Area and all reports required by ADWR are current.

The well spacing has resulted in a limitation on the amount of water each well can pump annually as follows:

	<u>Annual Limit</u>	<u>2009 Usage</u>
Well no. 55-587025 (#1)	1,500 acre-feet	<b>1,114</b> acre-feet
Well no. 55-587026 (#2)	1,615 acre-feet	<b>1,245</b> acre-feet
Well no. 55-587021 (#3)	2,150 acre-feet	<b>1,934</b> acre-feet
Well no. 55-587022 (#4)	1,370 acre-feet	<b>1,021</b> acre-feet
Well no. 55-587023 (#5)	1,370 acre-feet	<b>1,331</b> acre-feet

A total of **6,645 acre-feet** of water was used for the plant therefore not exceeding the 7,500 acre-feet of annual withdrawal allowed. In addition to the plant use, approximately **30** acre-feet of water was used in 2009 for irrigation for the plant site, water property revegetation, and wildlife habitat projects.

In 2009 Mesquite Power met the requirements of the 3rd Management Plan of the Phoenix Active Management Area.

**Stipulation 4**

*Applicant will provide to the Commission, not more than 12 months prior to the commercial operation of the plant, a technical study regarding the sufficiency of transmission capacity from the plant to the wholesale electric market.*

Stipulation requirements met in 2003.

**Stipulation 5**

*The plant interconnection must satisfy the Western Systems Coordinating Council's ("WSCC") single contingency outage criteria (N-1) without reliance on remedial action such as generator unit tripping or load shedding.*

Stipulation requirements met in 2003.

**Stipulation 6**

*Applicant will within fifteen (15) days of reaching such an agreement, submit to the Commission an interconnection agreement with the transmission provider with whom it will be interconnecting.*

Stipulation requirements met in 2003.

**Stipulation 7**

*Applicant or one of its affiliates will become a member of WSCC, or its successor, and file a copy of its WSCC Reliability Criteria Agreement or Reliability Management System (RMS) Generator Agreement with the Commission.*

Stipulation requirements met in 2003.

**Stipulation 8**

*Applicant will use commercially reasonable efforts to become a member of the Southwest Reserve Sharing Group, or its successor, thereby making its units available for reserve sharing purposes, subject to competitive pricing.*

This was provided to the ACC in a letter dated July 11, 2003.

**Stipulation 9**

*Applicant will use low profile structures, moderate stacks, neutral colors, compatible landscaping, and low intensity directed lighting for the plant.*

The plant was designed and constructed using low profile structures, moderate stacks, and neutral colors. The landscaping involved the replanting of many mesquite trees removed from the site during construction. The outdoor lighting was designed and constructed by the engineering, procurement, and construction (EPC) contractor in accordance with Maricopa County and International Dark-Sky Association recommendations. The plant construction is complete and no other lighting is to be installed.

**Stipulation 10**

*Applicant will operate the Project so that during normal operations the Project will not exceed (i) HUD residential noise guidelines or (ii) OSHA worker safety noise standards.*

Noise emissions performance testing was performed on June 27-28, 2007 by GEC, Inc. To support compliance with OSHA worker noise exposure limits, in-plant sound pressure level measurements were conducted throughout the facility and those areas that experienced sound levels above 85 dBA during normal peak load operation were identified. In addition, A-weighted (L90) sound level measurements were taken at six property boundary locations during simultaneous base load operation of both power blocks.

**Stipulation 11**

*Applicant will implement its Comprehensive Land Management Plan as presented to the Committee in hearing Exhibit A-13 for the plant site and the 3,000 acre Water Property that includes:*

- (i) Installation of a professionally designed landscape plan for the entrance of the facility and along Elliot Road.*
- (ii) Implementation of a comprehensive revegetation program designed to restore portions of the water property with plant communities similar to the adjacent desert lands.*
- (iii) Where feasible, the development of ongoing working relationships with the Phoenix Zoo, Southwest Wildlife Rehabilitation and Educational Foundation, Inc. and Arizona Game and Fish Department to develop alternative land uses for the water property that can be beneficial to the community and consistent with an "open space" land use designation; and*

Stipulation 11(i) - Was completed in 2004.

Stipulation 11(ii) - The revegetation will be completed in Spring, 2009. The watering continues on the last two year's plantings.

Stipulation 11(iii) - An enhanced wildlife habitat was completed in December, 2007 and is currently in operation.

**Stipulation 12**

*Applicant will submit annual reports (for 10 years) to the Commission setting forth the status of implementation of the Comprehensive Land Management Plan and any feasible alternative land uses which may have been identified and agreed upon by Applicant and the aforesaid organizations. The first annual report shall be filed one year from the date this Certificate is approved by the Commission.*

The status of the implementation of the Comprehensive Land Management Plan is documented in the Status Report on the Comprehensive Land Management Plan provided in **Attachment 1**.

This annual report also voluntarily provides the status of all the stipulations.

# ATTACHMENT 1

## Status Report on the Comprehensive Land Management Plan

# Report to the Arizona Corporation Commission on the Mesquite Power/University of Arizona Desert Revegetation Experimental Planting

Prepared by T.M. Bean and M.M. Karpiscak  
30 November 2009

## Executive Summary

Beginning with a small test planting March 2002, over 2,000 acres of degraded former agricultural lands have since been successfully planted to native Sonoran Desert species on the Mesquite Power water properties in the last 7 years. The last scheduled planting, located on the property north of Elliot Road, was completed in early 2009. Ironically, just as the revegetation plantings have been completed, most of these fields are now likely to be cleared of vegetation in preparation for the development of a solar energy generation facility. At present, no solar arrays are planned for the area north of Elliot Road, hence, this is the only planting expected to survive construction of the new solar facility. This report is an updated version of the 2008 report, modified to reflect changes in plans for future construction on the site and to include the most recent plant survey data for fields planted in 2006 and 2007. A final summary report and assessment of the revegetation program will be completed by the end of 2010.

## Introduction

As part of the land management plan for the Mesquite Power Project, in 2001 the University of Arizona began to study the implementation of a comprehensive revegetation program to restore a large portion of the Mesquite Power water property with self-sustaining native plant communities similar to the adjacent, unfarmed desert lands. The primary purpose of the revegetation program is to return these former agricultural lands to beneficial use as open space that will attract wildlife and enhance the surrounding environment. The scope of the project is large: approximately 3,000 acres of retired agricultural land exists on the site, having lain fallow for a period of 10-20 years. These properties were acquired for their water rights and are located about 2 miles west of the Mesquite Power generating facility. The project site is situated within the lower Colorado subdivision of the Sonoran Desert, the most arid and therefore the most difficult to revegetate. Revegetation of such harsh environments is a difficult and slow process, but by studying our successes and failures in this project we have an opportunity to improve our success in additional plantings at this location and to establish a sound scientific and practical basis for future revegetation plantings in low desert environments in Arizona and the southwest. An aerial photograph showing an outline of the overall site is presented in Figure 1. Additional acreage was recently purchased as part of the plans for the proposed solar facility. These areas are not shown in Figure 1.

## Background

An estimated 850 square miles of abandoned farmland exists in the Gila and Santa Cruz River Valleys of Arizona (Jackson *et al.*, 1991). Much of this barren land is dominated by exotic annuals such as *Salsola kali* (Russian thistle, aka "tumbleweed") and *Sisymbrium irio* (London rocket) (Karpiscak, 1980), existing in stark contrast to native desert lands dominated by *Larrea tridentata* (creosote bush) and *Atriplex* spp. (saltbush). This land is often associated with environmental problems such as dust pollution, a loss of wildlife habitat, accelerated soil erosion and downstream flooding caused by rapid runoff from barren surfaces, *Salsola kali* (Russian

thistle or “tumbleweed”) blowing onto roadways and adjacent properties, and auto accidents during dust storms. A typical retired farm field in the Sonoran Desert is shown in Figure 2. Until recently, there has been little interest in restoring the lowland scrub that is native to this part of the Sonoran Desert, likely due to a general lack of knowledge about its ecology. Few studies have been made of the lowland desert vegetation, that of Shantz and Piemeisel (1924) to evaluate the soils and vegetation for their agronomic potential and that of Karpiscak (1980) to study the process of secondary succession on abandoned farmland, are some of the most well known.

The revegetation of former agricultural lands is a complex process involving many challenges and often resulting in limited success. This is in part because the establishment of arid adapted vegetation on former agricultural lands is an evolving science and there is a general lack of an established proven methodology. Few documented examples exist of attempted revegetation efforts on retired farmland (Jackson *et al.*, 1991; Munda, 1986) and even fewer on a site as large as the project area (Thacker and Cox, 1992). Other concerns include the management of dust and invasive weeds, *Tamarix chinensis* (salt cedar), in particular.

Undisturbed or long-fallowed agricultural soils can develop a physical soil crust that limits the amount of dust that is capable of becoming airborne. Any soil-disturbing event breaks this crust and can increase the potential for dust problems and also provides an establishment site for invasive weeds. If not managed carefully, any irrigation used to establish native species can further aid in the establishment of undesired species. Additionally, new seedlings or container stock of native species can be particularly attractive to wildlife and losses to herbivory should be expected.

### **Inventory of Adjacent Unfarmed Areas**

The unfarmed areas to the east and west of the site were inventoried by the University of Arizona to provide an estimate of local vegetation parameters, once in 2001 and again in 2007 (Table 1). Vegetation densities on these areas were highly variable and were estimated at 102 and 375 plants per acre, respectively, and vegetative cover was estimated at 5% and 28%, respectively using line transects and the nearest individual distance method as described by Barbour *et al.* (1998). Average plant spacings were estimated at 7-13 feet from any random point to the nearest individual plant. The most abundant species on the adjacent unfarmed lands is *Larrea tridentata* (creosote bush), which comprises about 60 – 80% of all plants on the inventoried areas. *Ambrosia dumosa* (white bursage) is the second most abundant species, comprising about 10 – 25% of all plants on the inventoried areas. Other common species occurring on the adjacent lands include *Prosopis velutina* (velvet mesquite), *Lycium exsertum* (wolfberry), *Atriplex polycarpa* (desert saltbush), *Opuntia ramosissima* (diamond cholla), *Acacia greggii* (catclaw acacia), *Krameria grayii* (white ratany), *Pleuraphis rigida* (big galleta), and *Dasyochloa pulchella* (fluffgrass), among others. Plant species were identified according to Kearney and Peebles (1960).

### **The “Target” Plant Community**

One challenge in revegetation of retired croplands in this region is determining the pre-disturbance (target) plant community. Reliable personal accounts are rare since much of the land was cleared more than 30 years ago, and any aerial photographs are of an inappropriate scale to accurately determine the plant species present. Often, the only clues that remain are the plant

communities on lands adjacent to the cropland, although croplands in the Southwest typically are located adjacent to ephemeral watercourses (washes) and are lower in elevation and probably of a slightly different soil type than the areas that remain unfarmed. Early research by Shantz and Piemiesel (1924) in central Arizona supports this observation, stating that the best lands for agriculture were the desert saltbush-dominated shrub communities adjacent to washes, which transitioned into creosote bush-dominated communities as distance from a wash and elevation increased. Although the two communities sampled were creosote bush-dominated, as a bet-hedging strategy, we decided to select common species from both communities in composing the species list for our revegetation project efforts. In retrospect, this has proved to be a wise choice, as saltbush species have performed particularly well in the revegetation plantings.

### **Plant Material Sources**

Unfortunately, not all of the native species found during the inventory are commercially available. Of those that are, some are not readily available in sufficient quantities for a project of this scale. Special arrangements have been made with large nurseries specializing in desert plants, but orders must be made up to a year in advance. None of the available plant materials are source identified. Some researchers suggest that most desirable plant materials for use in restoration efforts would come from the primary restoration gene pool (Booth and Jones, 2001), which includes those populations that are genetically connected to local populations. Custom seed collection is very expensive, can be an unreliable source of seed during dry years, and can be a significant source of introduction for noxious and invasive weed species depending on where the target species are collected. Others have argued that locally collected plant materials may no longer have an evolutionary advantage for revegetation of highly disturbed sites because current conditions are quite different from those found prior to its being brought into agriculture. In this effort the same plant species as those growing naturally on adjoining sites or in some instances on the revegetation site itself were used in the planting, their origins, however, are from various Arizona locals. Appropriate cacti species were unavailable in seed or container stock in sufficient quantities, thus this functional group was left out of the planting palette. Similarly, *Krameria*, a common species on adjacent undisturbed lands, is thought to be a root parasite and both seed and container stock are extremely rare.

### **Initial Plantings 2002**

On March 6, 2002, approximately 50 acres of retired farmland was hand-planted using a mixture of 15 species of native shrubs, forbs, and grasses using Rose Pot container stock (Table 2). Rose Pot container stock (sometimes sold as "liners"), measuring 2 x 2 x 3 inches, are commonly sold by wholesale nurseries to retail outlets, where they are then planted into larger size containers and sold to the consumer after a short period of growth. A seed mixture of 12 native species was hand-seeded (Table 2). The entire field was drip irrigated using a system designed after vegetable production in the Yuma area. Planting rates for container stock were 200 plants per acre, or double the vegetation density found on the adjacent undisturbed and unfarmed areas. This was to compensate for the higher mortality of the smaller container stock size. Seed was applied at a rate of 15 lbs per acre to selected areas (a two foot radius around each drip emitter) within a portion of the field. Seed was applied in known amounts and proportions to selected emitters, and this should allow us to estimate germination, establishment, and survival rates by species. With this information, we will be better able to predict the expected species composition of a given seed mix under similar field conditions. Some species

have much higher survival rates than others, probably reflecting their higher tolerance to being transplanted from such a small container, which may be related to their specific root physiology. Top performers for the container stock included all *Atriplex* spp., *Prosopis velutina*, *Lycium exsertum*, and *Pleuraphis rigida* (Table 2). Initial germination and establishment of the seeded portions of the field was high, making it difficult to properly inventory the resulting stands. *Atriplex lentiformis* (quail brush), has performed consistently well across all treatments. There was poor establishment of *Larrea tridentata* from seed and container stock, which is a dominant species in surrounding unfarmed areas.

A late frost was experienced by the plants just prior to planting, and may have increased mortality of certain species, especially *Baileya multiradiata* and *Ambrosia dumosa*. Irrigation was ceased in this field in early spring of 2003, due to the spread of the invasive exotic tree *Tamarix chinensis*, which had become established at more than 30 percent of the emitters in the field. Once irrigation was ceased, no further establishment of *Tamarix chinensis* was witnessed, and some of the smaller trees died. Most of the native species planted in this field have not exhibited any signs of drought stress, with the exception of *Atriplex lentiformis*, which was observed to drop leaves during the summer months but later recovered with the onset of cooler temperatures. Many “volunteer” (not intentionally planted) seedlings have been observed—these are most likely the progeny of the container stock. Species that have been particularly successful at reproducing include *Prosopis velutina*, *Atriplex* spp., *Aristida purpurea*, *Pleuraphis rigida*, *Lycium exsertum*, and *Sphaeralcea ambigua*. We found an average of at least one volunteer for every 4 emitters surveyed.

Cover and density, as of 2008, of planted species in this field (“2002 RP”) can be seen in Tables 3 and 4. Eleven species of perennial plants occur in this field, 10 of those being native. This planting experienced unusually high levels of encroachment of a native shrub, *Isocoma acradensis* (burroweed) and the invasive and federally listed noxious weed *Tamarix chinensis* (see discussion above). However, survival and establishment of desired species such as *Prosopis velutina*, *Atriplex lentiformis*, *A. polycarpa*, *Lycium exsertum*, and *Pleuraphis rigida* was high and did not appear to be impacted by *Isocoma* or *Tamarix*—minus these two species, overall native plant density in this field is 246.3 plants  $\text{ac}^{-1}$  and cover is 18.8%, well within the parameters in the undisturbed areas.

## February 2003 Plantings

Approximately 283 acres were planted with some 60,000 container stock near the end of February 2003. The same methods were employed (drip irrigation, hand planting, Rose Pot container stock). The species composition remained the same. No seed was used in this planting. The results from an associated study indicated that larger container stock may be more effective for revegetation than the small Rose Pot container stock (Bean *et al.* 2004), but data was unavailable until after the order for the smaller container stock had been made. To accommodate the higher mortality of the smaller container stock this field was planted at double density. Some 1-gallon container stock of *Larrea tridentata*, became available at the last minute, however, and was planted in selected parts of the field. This planting was completely covered by a rank growth of annual weeds that occurred in 2004 through 2006 (Figure 3). Visual results of the planting are quite satisfactory with creosote bush doing particularly well in this planting (Figure 4).

Cover and density of planted species in this field (“2003 RP” and “2003 1-GAL”), measured in March 2008, can be seen in Tables 3 and 4. Thirteen species of perennial plants

occur in the portion of this field planted with Rose Pot container stock, 7 in the 1-gallon portion of the field, all native. Encroachment of *Isocoma* was also high in this field, especially in the portion planted with Rose Pot container stock. This species is often symptomatic of heavy livestock grazing and its abundance here is likely as a function of the proximity to the heavily overgrazed state land to the south. Fortunately no *Tamarix* was found in the planted area in either portion of this field. The Rose Pot portion is dominated by *Prosopis velutina*, *Lycium exsertum*, *Atriplex lentiformis* and *A. polycarpa*. Minus the *Isocoma*, density of native species in this portion of the field is 313 plants ac<sup>-1</sup> and cover is 12.2%. The 1-gallon portion of the field is heavily dominated by *Larrea tridentata*. Similarly to the Rose Pot portion, other dominant species include *Prosopis velutina*, *Lycium exsertum*, *Atriplex lentiformis* and *A. polycarpa*, suggesting that these species are highly suited to revegetation in these areas. Minus the *Isocoma*, density of native species in this portion of the field is 336.8 plants ac<sup>-1</sup> and cover is 14%. Both portions of the field are within the normal parameters of the undisturbed adjacent areas. Curiously, *Nicotiana trigonophylla* (native tobacco), a perennial native species not planted, was also found in this field.

### **Spring and Fall 2004 Plantings**

A total of 425 acres was scheduled for planting in 2004 using the same mixture of fifteen native species that were transplanted in 2002 (Table 1). The 2004 planting utilized one-gallon size container stock, which was designed to allow us to compare survival between container stock of different sizes (Rose Pot vs. one-gallon) on the Mesquite Power property. The planting was split between the spring (72 ac) and fall (353 ac) months to compare the differential survival of species planted in different seasons. Seasonal differences in temperatures, soil moisture, and animal activity are hypothesized to have significant effects on the survival of the container stock.

We also expected the fall planting to have less germination and establishment of salt cedar because of cooler temperatures, the 2004 planting scheme was designed to allow us to make this comparison. The fall 2004 plantings, however, were impacted by the very wet fall and winter of 2004/2005 and were not completed until the spring of 2005. Qualitatively speaking, this was a successful planting with apparent high survival and establishment of planted species (Figure5). In addition, a small area of about 40 acres was not planted due to the failure of the irrigation tape that collapsed under the compaction of the soil resulting from the persistent rains that started in October of 2004.

Cover and density of planted species in this field ("2004/5 1-GAL"), measured in March 2008, can be seen in Tables 3 and 4. Thirteen species of perennial plants occur in this field, all native. Like the previous fields, this planting also experienced encroachment of *Isocoma*, but in much lower levels. Dominant species in this field include *Atriplex lentiformis*, *A. polycarpa*, *A. canescens*, *Ambrosia dumosa*, and *Larrea tridentata*. Minus the *Isocoma*, overall native plant density in this field is 320.1 plants ac<sup>-1</sup> and cover is 15.7%, well within the parameters in the undisturbed areas.

### **Fall 2005 and Fall 2006/Winter 2007 Plantings**

Plantings for Fall 2005 were originally scheduled to start in late October 2005 using the same plant palette as was previously used in the Fall 2004/Spring 2005 plantings. All the plants were one-gallon sized container stock. The area selected for planting covers some 400 acres just south of Elliot Road and adjoining the Mesquite Wildlife Oasis development. However, the planting

was delayed by a regional shortage of essential irrigation infrastructure components caused by Hurricane Katrina, which hit the New Orleans region and disables certain sectors of the oil industry and the resin manufacturing facilities. These components were finally obtained and were installed in early 2006 in preparation for the planting. The planting was completed in the spring of 2006 and last inventoried in spring 2009. This field was disked prior to planting, resulting in excessive growth of *Salsola* and preventing the U of A team from sampling in 2008.

Current cover and density of planted species in this field ("2006 1-GAL") can be seen in Tables 3 and 4. Eleven species of perennial plants occur in this field, ten native. This planting has not experienced high encroachment of *Isocoma*, though it is present and is expected to increase if livestock are not excluded from the site. Dominant species in this field include *Atriplex canescens*, *A. polycarpa*, *Larrea*, and *Lycium*. Overall native plant density in this field is 146.0 plants ac<sup>-1</sup> and cover is 8.6%. Excessive growth of *Salsola* is thought to have hindered initial establishment and resulted in lower density and cover of planted species in this field compared to other plantings.

Plantings for Fall 2006 were scheduled to start in late October 2006 using the same plant palette as was previously used in the Fall 2004/Spring 2005 and Fall 2005/Spring 2006 plantings. A delay was encountered because of administrative changes at the power company. The actual placement of the plants took place in early 2007. All the plants were 1-gallon sized container stock. The area planted covers some 300 acres south of Elliot Road and the Fall 2005/Spring 2006 planting.

Current cover and density of planted species in this field ("2007 1-GAL") can be seen in Tables 3 and 4. Eight species of perennial plants occur in this field, seven native. This planting has not experienced high encroachment of *Isocoma*, though it is present and is expected to increase if livestock are not excluded from the site. This field has been significantly invaded by *Tamarix*, however, which is not surprising given the close proximity of this field to a natural drainage that harbors a large infestation of salt cedar. Dominant species in this field include *Atriplex canescens*, *A. polycarpa*, *Larrea*, and *Prosopis*. Overall native plant density in this field is 308.1 plants ac<sup>-1</sup> and cover is 5.7%.

### **Fall 2007/Winter 2008 Plantings**

Plantings for Fall 2007 were scheduled to start in late October 2007 using the same plant palette as was previously used in the Fall 2004/Spring 2005 and Fall 2005/Spring 2006 plantings. A delay was encountered because of the construction and planting of the Mesquite Wildlife Oasis trail and weather conditions at the site. The actual placement of the plants occurred in early 2008. All the plants were one-gallon sized container stock. The species composition is the same as used for the fall 2005 planting that took place in early 2006 and the fall 2006 planting that took place in early 2007. The areas selected to be planted covers some 200 acres south of Elliot Road and near the completed Mesquite Wildlife Oasis. Some of the plants were used in and around the Mesquite Wildlife Oasis. Current cover and density of planted species in this field ("2008 1-GALx4") can be seen in Tables 3 and 4. Fourteen species of perennial plants occur in this field, thirteen native. Unlike the previous fields, this planting did not experience encroachment of *Isocoma*, but *Cynodon dactylon* (bermudagrass), an invasive sod-forming grass common to former agricultural areas is present. Dominant species in this field include *Atriplex lentiformis*, *A. polycarpa*, *A. canescens*, *Ambrosia dumosa*, *Acacia greggii* and *Prosopis velutina*. Minus the *Cynodon*, overall native plant density in this field is 1,834.5 plants ac<sup>-1</sup> and cover is 13.2%. Densities are much higher in this field because it was planted at quadruple densities to

create a visual effect for the Mesquite Wildlife Oasis and because of its close proximity to Elliot Road.

### **Fall 2008/Winter 2009 Plantings**

Plantings for fall 2008 were scheduled to start in late October 2008 using the same plant palette used in previous plantings. The permitting process to install an irrigation line across Elliot Road delayed the planting, and the actual placement of the plants occurred in December 2008 and early 2009. All the plants were 1-gallon sized container stock. This area covers some 250 acres north of Elliot Road and west of the completed Mesquite Wildlife Oasis. Figure 6 shows the plants some 10 months after they were outplanted. The field north of Elliot Road was surveyed in late 2009 and data analyses are underway. Results will be included in the 2010 report.

### **Current Status of the Mesquite Property Revegetation Program**

A total of approximately 2,050 acres has been revegetated as of the end of 2009. The first small experimental planting of 50 acres was made in March 2002, followed by a scaled-up planting of 283 acres in February 2003, a small Spring 2004 planting of some 72 acres and a large, full-scale implementation planting of 353 acres for Fall 2004/Spring 2005. This in turn was followed an additional 400 acres planted in early 2006, 500 acres in 2007 and 2008, and 250 acres in early 2009, bringing the total planted area to 2,050 acres. A map showing the locations of individual field plantings, planting dates and the types of plant materials used is presented in Figure 7.

During 2005, the U of A team was able to work with Dr. Raymond M. Turner, a retired Botanist from United States Geological Survey (USGS) in Tucson to establish permanent photography stations on the site to document the long-term vegetation changes. Dr. Turner established 3 photo stations on the property and these were added to the photo collection of the USGS in 2006. This collection contains over 2,000 photographs of the Sonoran Desert some of which have been published in "The Changing Mile," a photographic study that uses matched photographs to evaluate long-term vegetation changes. These sites are in addition to those established by the U of A team specifically for the project.

Excessive growth of annual agricultural weeds is a normal phenomenon of recently retired or disturbed fields, as weed seed banks especially of species such as *Salsola kali* can persist for several years and thrive on newly disturbed soil. This should be less of a problem in future years as time since last disturbance increases, the soil surface forms a crust and the selected desired plants become fully established. However, the surge in annual plant growth during 2005 delayed and prevented the completion of some of scheduled revegetation activities. The debris from this rank growth continued to make it impossible to survey most sites in 2006, but comprehensive surveys were completed in 2007 and 2008. Another surge in annual plant growth occurred in early 2008, though a greater abundance of desirable native annuals was noted. Also during 2008 the Mesquite Wildlife Oasis was completed and became operational.

The revegetation program has been an overwhelming success to date, with the goal of establishing self-sustaining populations of native vegetation being largely accomplished. Thought quantitative measurements have not been taken, avian, mammal, and reptile usage of this new habitat appears to have increased dramatically in the planted areas. During 2008 a mountain lion was reported on the site. These areas stand in stark contrast to the surrounding unplanted abandoned agricultural lands that contain little or no vegetation or animal life.

Diversity of native perennials is high in the planted fields (7-13 species), with the dominant species being *Atriplex* spp., *Larrea tridentata*, *Lycium exsertum*, *Prosopis velutina*, *Ambrosia dumosa*, *Acacia greggii*, and *Pleuraphis rigida*, representing a wide variety of life forms including trees, shrubs, sub-shrubs, and grasses. Not including the anomalous “2008 1-GALx4” field, densities of desirable species range from 146.0 to 336.8 plants ac<sup>-1</sup> and cover ranges from 5.7 to 18.8%. The majority of these fields have not received any irrigation for the past 5 to 7 years and have shown their ability to not only persist but reproduce and expand. This project has been a rare success in the very difficult field of arid land restoration, and provides an extremely unique opportunity to evaluate the long-term trajectories of this artificially established ecosystem.

The Fall 2008/Winter 2009 plantings completes the revegetation planting activities on the Mesquite Power water property. The areas identified in previous reports as “to be re-evaluated/planted” have been re-classified as having adequate plant recovery during an on-site inventory in 2009 (Figure 7). There are no plans for additional plantings, especially given the current plans to remove existing plantings and vegetation for development of a solar power electrical generation facility. A new stipulation “W” was issued in December 2008 by the Maricopa County Planning and Development Department for modification of the existing Special Use Permit for the operation of the Mesquite Power electrical generating facility. This modification was issued for the possible development of a solar power electrical generation facilities on most of the Mesquite Power water property south of Elliott Road. This stipulation states the following in regard to revegetation:

*All re-vegetated areas within the given portion of the water property are permitted to undergo vegetation removal as necessary for construction and operation of the solar energy generation facilities.*

The University of Arizona team will provide assistance to Mesquite Power in developing plans for these solar facilities to ensure that the integrity of the restored plant community is maintained as much as possible consistent with the construction and operational needs of the solar facilities. At present, it appears that all vegetation in the revegetation plantings south of Elliot will be removed. Only the most recent planting north of Elliot Road and the area planted around the education center are expected to survive. The UA team will focus on inventorying the fields to be destroyed in early 2010, and will compile that data as part of the final report due in December, 2010.

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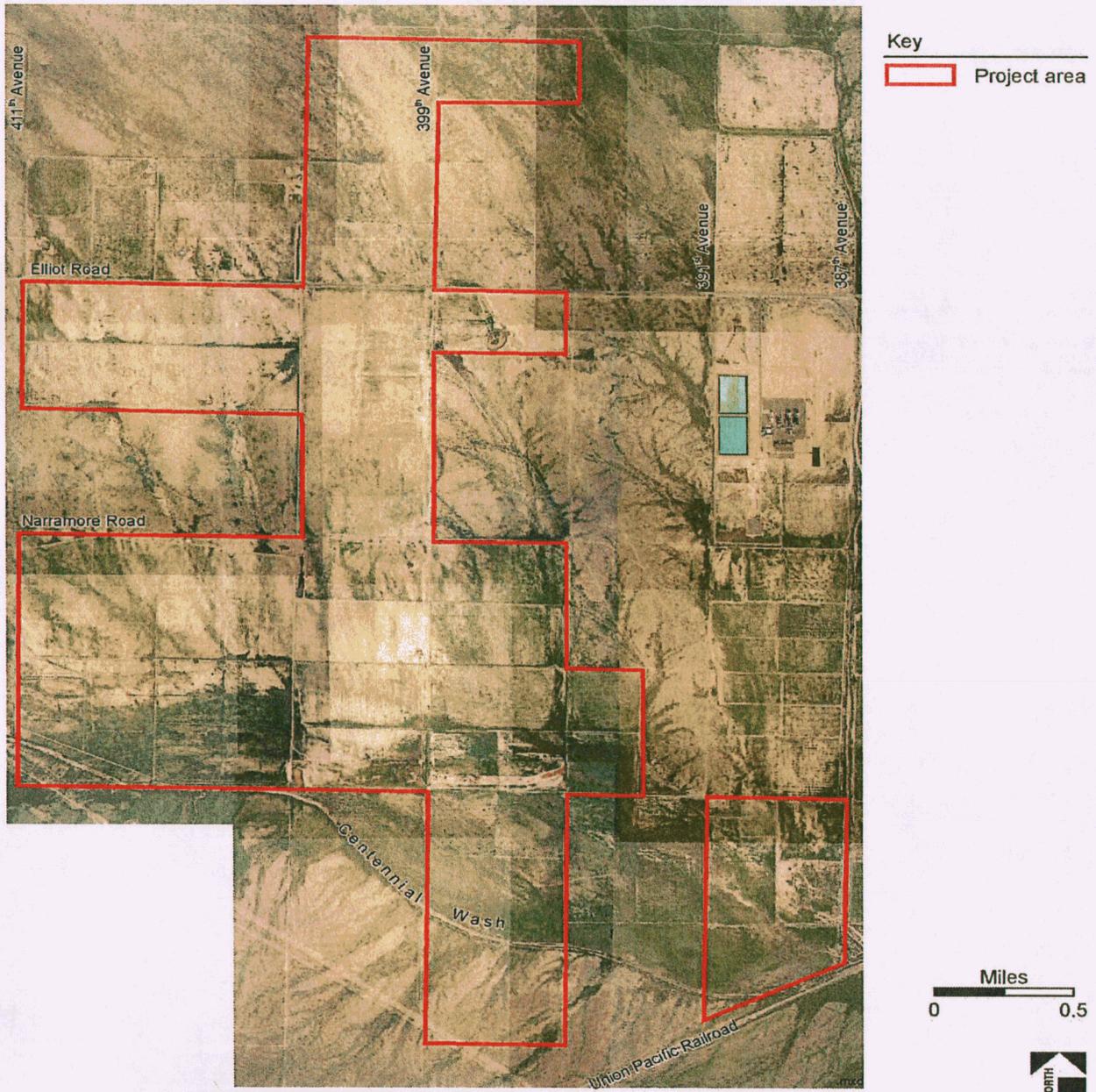


Figure 1. Aerial Photograph of the Mesquite Power Water Property (Logan Simpson Design Inc.).



**Figure 2. A typical un-revegetated field prior to planting. This small part of one field was left un-planted to use as a control site to compare to fields that were to be planted. Note the lack of any perennial plant cover in foreground. The March 2002 planting is visible in the background.**

**Table 1: Density (plants ac<sup>-1</sup>) and cover (%) of vegetation in adjacent unfarmed areas. Surveyed in 2001 and 2007.**

Species	NATURAL W		NATURAL E	
	density	cover	density	cover
<i>Acacia greggii</i>			0.5	0.2%
<i>Ambrosia dumosa</i>	41.6	0.4%	25.5	0.3%
<i>Atriplex polycarpa</i>			1.0	0.0%
<i>Dasyochloa pulchella</i>			2.0	0.0%
<i>Krameria erecta</i>			0.5	0.1%
<i>Larrea tridentata</i>	291.5	25.9%	61.3	4.1%
<i>Lycium exsertum</i>			5.6	0.2%
<i>Opuntia ramosissima</i>	36.4	0.6%	4.1	0.0%
<i>Pleuraphis rigida</i>	5.2	0.8%	0.5	0.0%
<i>Prosopis velutina</i>			1.0	0.4%
TOTAL	374.84	27.6%	102.11	5.4%

**Table 2: Species seeded or transplanted from container stock in the Mesquite Power March 2002 planting. Container stock survival data is listed for the year 2005. Seeded species frequency (percentage of seeded emitters where that species is present) is listed for the year 2009.**

Species	Common name	Container stock # planted	2005 Survival (%)	Seed: grams seeded	2009 Frequency
<i>Acacia greggii</i>	catclaw acacia	611	14.3	151	2.0%
<i>Ambrosia dumosa</i>	white bursage	611	0	234	2.0%
<i>Aristida purpurea</i>	purple threeawn	917	12.7	378	0
<i>Atriplex canescens</i>	fourwing saltbush	611	74.4	272	48.5%
<i>Atriplex lentiformis</i>	quailbush	611	60.3	224	69.7%
<i>Atriplex polycarpa</i>	desert saltbush	611	69.8	237	24.2%
<i>Baileya multiradiata</i>	desert marigold	917	3.1	350	0
<i>Cassia covesii</i>	desert senna	917	0	316	0
<i>Larrea tridentata</i>	creosotebush	611	2.9	148	0
<i>Lycium exsertum</i>	wolfberry	917	50.0	Not seeded	
<i>Muhlenbergia porteri</i>	bush muhly	611	4.4	224	0
<i>Parkinsonia microphylla</i>	littleleaf paloverde	611	2.6	Not seeded	
<i>Pleuraphis rigida</i>	big galleta	917	35.2	Not seeded	
<i>Prosopis velutina</i>	velvet mesquite	611	71.8	154	35.4%
<i>Sphaeralcea ambigua</i>	globemallow	617	11.7	409	7.1%
TOTAL		11,000	27.4	3,097	

**Table 3: Cover (%) of planted and invading (marked with an asterisk\*) species occurring on selected plantings at the Mesquite Power property in 2008, except "2006 1-GAL" and "2007 1-GAL," which were surveyed in 2009. Column headings indicate planting dates and original plant container size (RP = Rose Pot, 1-GAL = One Gallon). Species that were present but at less than 0.1% cover are reported as 0.0%.**

	2002 RP		2003 RP		2003 1-GAL		2004/5 1-GAL		2006 1-GAL		2007 1-GAL		2008 1-GALx4	
<i>Acacia greggii</i>	0.1%	0.4%		0.2%										0.1%
<i>Ambrosia dumosa</i>		0.2%		1.0%					0.0%					0.1%
<i>Aristida purpurea</i>		0.0%		0.1%										0.0%
<i>Atriplex canescens</i>	0.6%	1.1%		2.6%					3.0%					1.0%
<i>Atriplex lentiformis</i>	8.4%	5.0%		3.6%	2.0%				1.0%					0.6%
<i>Atriplex polycarpa</i>	2.8%	1.8%		4.9%	1.9%				3.8%					1.7%
<i>Cynodon dactylon*</i>														0.2%
<i>Isocoma tenuisecta*</i>	1.0%	1.0%		0.3%	0.2%				0.0%					0.1%
<i>Larrea tridentata</i>		0.6%		1.4%	8.5%				0.1%					0.1%
<i>Lycium exsertum</i>	0.8%	1.2%		0.2%	0.5%				0.24%					0.3%
<i>Muhlenbergia porteri</i>	0.0%	0.1%		0.1%										0.1%
<i>Nicotiana trigonophylla*</i>		0.0%							0.0%					0.0%
<i>Parkinsonia microphylla</i>														0.2%
<i>Pleuraphis rigida</i>	0.3%	0.2%		0.1%	0.1%									8.9%
<i>Prosopis velutina</i>	5.7%	1.7%		1.0%	1.0%				0.1%					0.6%
<i>Senna covesii</i>														0.0%
<i>Sphaeralcea ambigua</i>	0.1%			0.1%					0.0%					0.0%
<i>Tamarix chinensis*</i>	1.8%								0.4%					0.6%
<b>TOTAL</b>	<b>21.6%</b>	<b>13.2%</b>	<b>14.2%</b>	<b>16.0%</b>	<b>16.0%</b>	<b>8.6%</b>	<b>5.9%</b>	<b>13.4%</b>						

**Table 4: Density (plants ac<sup>-1</sup>) of planted and invading (marked with an asterisk\*) species occurring on selected plantings at the Mesquite Power property in 2008, except "2006 1-GAL" and "2007 1-GAL," which were surveyed in 2009. Column headings indicate planting dates and original plant container size (RP = Rose Pot, 1-GAL = One Gallon).**

	2002 RP	2003 RP	2003 1-GAL	2004/5 1-GAL	2006 1-GAL	2007 1-GAL	2008 1-GALx4
<i>Acacia greggii</i>	6.7	29.0		11.6			189.8
<i>Ambrosia dumosa</i>		7.3		46.6	2.0		189.8
<i>Aristida purpurea</i>		7.3		17.5			63.3
<i>Atriplex canescens</i>	13.3	29.0		23.3	23.7	104.2	189.8
<i>Atriplex lentiformis</i>	59.9	43.6	6.6	34.9	4.0		158.1
<i>Atriplex polycarpa</i>	33.3	7.3	26.4	69.9	55.3	90.6	411.2
<i>Cynodon dactylon</i> *							31.6
<i>Isocoma tenuisecta</i> *	79.8	79.9	13.2	17.5	4.0	9.1	
<i>Larrea tridentata</i>		14.5	198.1	34.9	19.7	13.6	126.5
<i>Lycium exsertum</i>	26.6	43.6	26.4	5.8	17.8	9.1	94.9
<i>Muhlenbergia porteri</i>	0.0	7.3		11.6			94.9
<i>Nicotiana trigonophylla</i> *		7.3					
<i>Parkinsonia microphylla</i>				23.3	2.0		31.6
<i>Pleuraphis rigida</i>	26.6	21.8	6.6				94.9
<i>Prosopis velutina</i>	66.5	94.4	72.6	23.3	5.9	36.2	158.1
<i>Senna covesii</i>							31.6
<i>Sphaeralcea ambigua</i>	13.3			17.5	9.9	4.5	
<i>Tamarix chinensis</i> *	26.6				2.0	40.8	
<b>TOTAL</b>	<b>352.7</b>	<b>392.1</b>	<b>350.0</b>	<b>337.6</b>	<b>146.0</b>	<b>308.1</b>	<b>1866.1</b>



**Figure 3: Photograph Showing Rank Growth of Winter Annual Weeds in 2005 that Prevented Plant Field Counts. This view is of one of the fields planted in 2003.**



Figure 4: March 2008 view of successful planting made in February 2003. The rank growth shown in the previous Figure is no longer present. Species like *Atriplex* spp. have done very well from small container stock, but *Larrea tridentata* was planted using larger container stock to ensure sufficient survival, mimicking the plant composition found in nearby undisturbed areas. The growth of the planted species as well as the presence of desirable native annuals illustrate that the planted perennials and annuals that have moved into the area on their own are well established on this revegetated field.

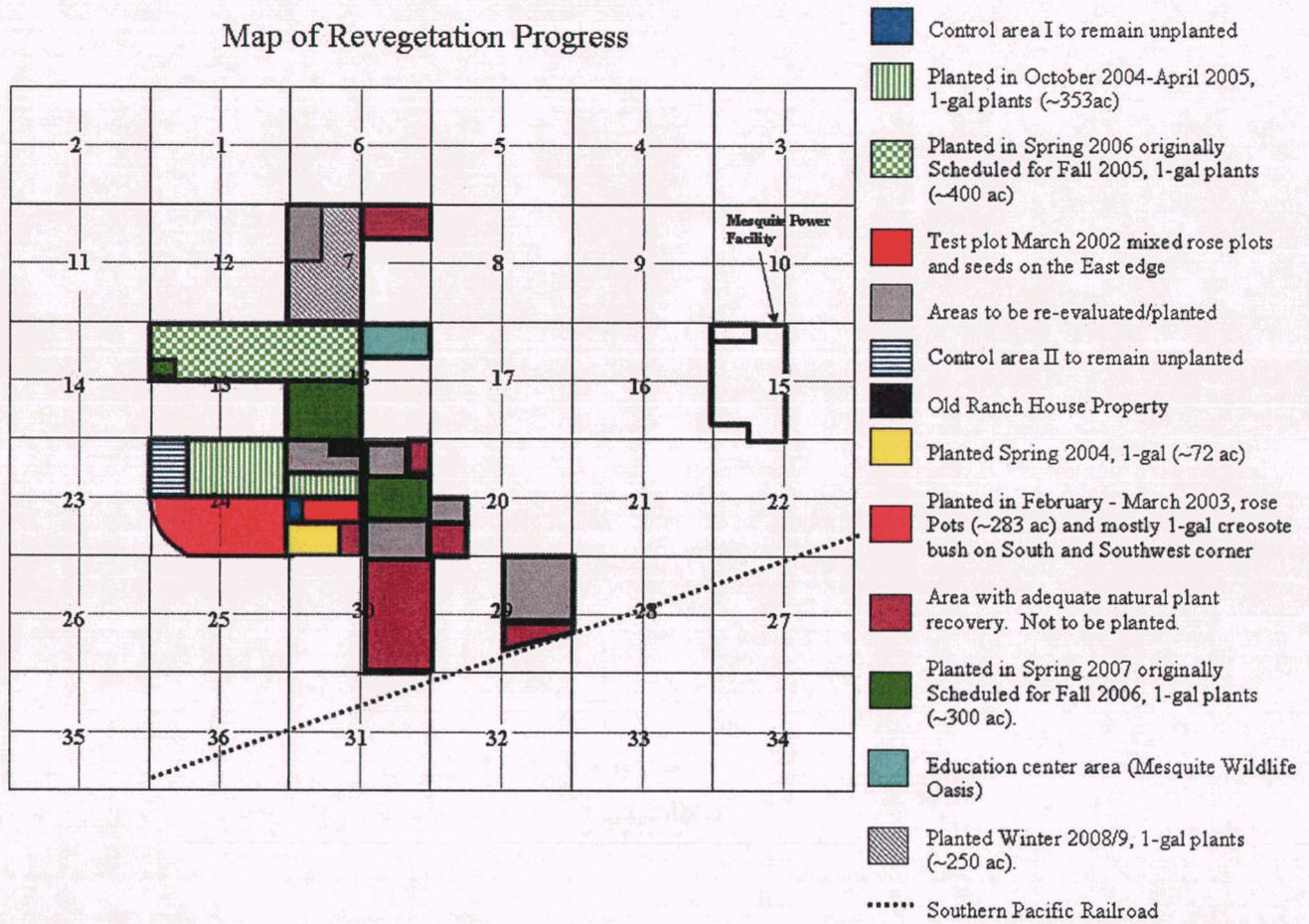


**Figure 5: March 2008 view of the planting done in late 2004 and early 2005. This photograph illustrates the growth of the planted species as well as the greater presence of desirable native annuals that have established on their own. The plant growth at this location mimics that shown in the previous Figure from the 2003 planting.**



**Figure 6: View of the recently planted field north of Elliott Road. This field planted in late 2008 and early 2009 is not included in the area to be cleared for the construction of the proposed solar facility.**

### Map of Revegetation Progress



**Figure 7: Map of revegetation plantings at the Mesquite Power property.**