Lower Colorado River Multi-Species Conservation Program

Balancing Resource Use and Conservation

Lower Colorado River Vegetation Monitoring 2011 Annual Report

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

August 2012

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KEY TERMS

BLCA	Beal Lake Conservation Area
BWRE	Bill Williams River East
cm	centimeters
CNU1	Cibola NWR Unit 1
COR	Contract Officer's Representative
CVCA	Cibola Valley Conservation Area
DBH	diameter at breast height
FGDC	Federal Geographic Data Committee
GPS	Global Positioning System
HCP	Habitat Conservation Plan
LCR	Lower Colorado River
m	meters
MSCP	Multi-Species Conservation Program
NWR	National Wildlife Refuge
PVC	polyvinyl chloride
PVER	Palo Verde Ecological Reserve
Reclamation	Bureau of Reclamation
SC	size class
Project Team	Parametrix, Inc., and GeoSystems Analysis, Inc.

EXECUTIVE SUMMARY

In support of habitat creation efforts for the Lower Colorado River (LCR) Multi-Species Conservation Program (MSCP), Parametrix, Inc. and GeoSystems Analysis, Inc., conducted vegetation surveys between September and December 2011. Vegetation survey protocols were developed in conjunction with the Bureau of Reclamation, which is funding and overseeing the project. Surveys were conducted at four habitat creation sites: Beal Lake Habitat Restoration Demonstration Site, Palo Verde Ecological Reserve, Cibola Valley Conservation Area, and Cibola National Wildlife Refuge Unit No. 1, and one reference site: Bill Williams River National Wildlife Refuge. Over a total of 38 field days, 366 plots were surveyed. Habitat creation sites were generally comprised of a dense overstory of native trees and shrubs, with a mix of native and non-native understory vegetation. Bill Williams River National Wildlife Refuge plots were dominated by native trees and tamarisk (a non-native invasive) with a mix of native and non-native understory vegetation. Surface water was more frequent at Bill Williams River National Wildlife Refuge compared to habitat creation sites. Data were entered in a draft database provided by the Bureau of Reclamation, and database edits were suggested. Survey methodologies appear sufficient to document data of interest. Minor protocol revisions are suggested for future surveys to ensure completeness and consistency of data. Additional database modifications are also suggested to facilitate field data entry.

1. INTRODUCTION

The LCR MSCP is a 50-year effort aimed at balancing the use of LCR water resources with the conservation of native species and habitats. To achieve these goals, the Bureau of Reclamation (Reclamation) is tasked with creating and maintaining habitat to conserve 26 MSCP "listed" species (federally- or state-protected species), while potentially benefitting five additional "evaluation" species (species that might be listed in the future). To achieve these objectives, the Habitat Conservation Plan (HCP) specifies the creation of 8,132 acres of various habitat types, including 5,940 acres of cottonwood-willow cover and 1,320 acres of honey mesquite cover (LCR MSCP 2004, LCR MSCP 2011). Key vegetation species, which are either directly planted or establish passively at these habitat creation sites, include:

- Fremont cottonwood (*Populus fremontii*)
- Goodding's willow (*Salix gooddingii*)
- Coyote willow (*Salix exigua*)
- Seep willow (*Baccharis salicina*)
- Desertbroom (*Baccharis sarothroides*)
- Honey mesquite (*Prosopis glandulosa*)
- Screwbean mesquite (*Prosopis pubescens*)
- Salt heliotrope (*Heliotropium curassavicum*)
- Quail bush (*Atriplex lentiformis*)
- Fourwing saltbush (*Atriplex canescens*)
- Cattle saltbush (*Atriplex polycarpa*)
- Tamarisk (*Tamarix* spp.)
- Arrowweed (*Pluchea sericea*)

To assist in vegetation establishment and trend monitoring at MSCP cottonwood-willow and honey mesquite habitat creation sites and reference locations, Reclamation implements recurring vegetation surveys at established locations.

Parametrix, Inc., and GeoSystems Analysis, Inc. (the Project Team) conducted vegetation surveys for Reclamation during 2011 through Contract 283-6050-001. First, the Project Team met with Reclamation to review and clarify survey methods and datasheets. Field surveys were conducted between September 14 and December 6, 2011, at four habitat creation sites on the LCR: Beal Lake Habitat Restoration Demonstration Site, Palo Verde Ecological Reserve, Cibola Valley Conservation Area, and Cibola National Wildlife Refuge (NWR) Unit No. 1 (see Figure 1). In addition, surveys were conducted on Bill Williams River NWR near the confluence with Mineral Wash, which supports a high density and diversity of avifauna and serves as a reference site. Data were entered into a development-phase version of the comprehensive MSCP database. The database was provided to the Project Team by Reclamation, and the Project Team worked with Reclamation to refine and finalize the database.

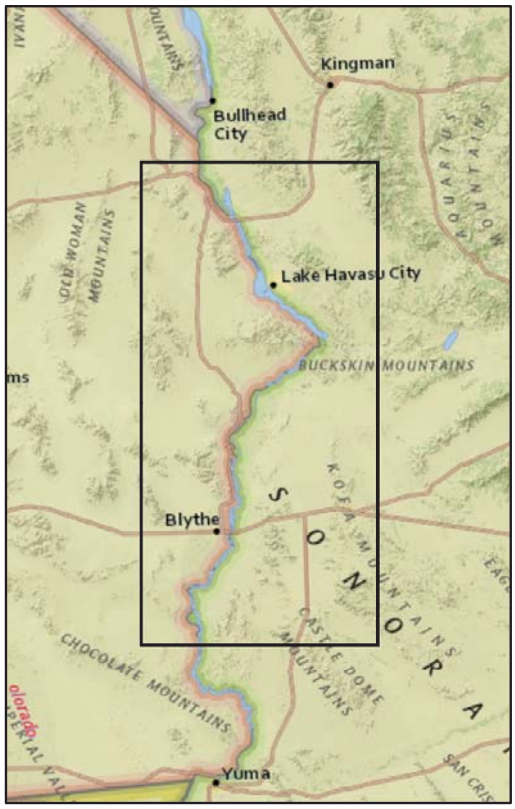
This report documents methods, summarizes survey efforts, and provides near-term recommendations for surveys conducted in subsequent years. Section 2 reviews methods; Section 3 provides a discussion; and Section 4 provides conclusions and recommendations.

Source(s): ESRI County, U.S. State, and components of the ESRI USA Base Map

2011 Vegetation Monitoring Locations: Regional Map

Source(s): Bing Maps served online via ESRI Base Map Server.
Geographic Projection of both data frames = UTM, NAD 1983, Zone 11N.
Map created by Chad McKenna, GeoSystems Analysis, Inc.
April 26, 2012.

GSA GeoSystems Analysis, Inc. Innovations in Hydrology



Source(s): National Geographic served online via ESRI Base Map Server.

2. METHODS

2.1 SURVEY OVERVIEW

Crews surveyed a total of 366 vegetation monitoring plots in 2011. The survey protocol for each plot was dependent on the vegetation present and the number of years since planting. Four types of surveys were conducted during 2011:

1. **Intensive Surveys**: Intensive surveys were implemented at Bill Williams River NWR and habitat creation sites with at least 3 years of post-planting growth that are not mowed by farm machinery for weedy plant reduction.
2. **First-Year Reduced Effort Plots**: First-year reduced effort plots were implemented in areas planted during the spring of 2011 (i.e., Palo Verde Ecological Reserve Phase 6).
3. **Second-Year Reduced Effort Plots**: Second-year reduced effort plots were implemented in areas planted during the spring of 2010 (i.e., Palo Verde Ecological Reserve Phase 5).
4. **Mesquite Reduced Effort Plots**: Mesquite reduced effort plots were implemented where weed mowing occurs between planted rows of mesquite and quail bush (Cibola Valley Conservation Area).

2.2 2011 SURVEY METHODOLOGY ADJUSTMENTS

During the project kick-off meeting and during the first week of surveys, the Project Team discussed various survey specifications with the Contract Officer's Representative (COR). The surveying method implemented is detailed in the 2011 Field Survey Protocols (Appendix I) which corresponds with the 2011 field datasheets (Appendix II). Specifications or deviations from detailed methods (and surveys conducted by previous contractors) for intensive surveys consisted of:

- Extensive datasheet revisions.
- Directional specification for densiometer measurements of canopy closure, i.e., "up" from D1 and "out" (radial) from plot center for D2, D3, D4, and D5.
- Recording secondary plot trees (i.e., Size Class (SC) 1 through 3) on one datasheet instead of having one datasheet per SC.
- Specification of which height to measure stem diameter for placement into an SC (10 centimeters [cm] above ground surface).
- Recording SC 2 and greater stems in only half of the secondary plot (Quadrant B1 and B3) as opposed to the entire secondary plot.
- Recording clonal species such as arrowweed and coyote willow by stem instead of by individual, and adjusting the tally location for arrowweed and coyote willow to the stem count area for shoots in SC 2 or larger and the E plots for SC 1 stems.

2.3 SURVEY METHODOLOGY

Because long-term vegetation monitoring for the MSCP is detailed and complex, vegetation attributes must be monitored at several different scales. To do this, the MSCP vegetation monitoring plot design utilizes nested plots for capturing data on different plant life-forms, growth habits, and SCs. The nested and sometimes overlaying (sub-) plots include one

primary plot (10 x 40 meters [m]); 1 secondary plot (5 x 15 m divided into four 2.5- x 7.5-m quadrants); four tertiary plots (0.5 x 2 m); plus five measurement points. Each of the sub-plots and the measurement points are nested within the primary plot (see plot graphic in Appendix I) and assigned a distinguishing letter (A-E) unique to the particular measurement sub-plot or point. The specific vegetation attributes captured within each sub-plot are summarized more generally below for intensive versus reduced effort plots. Detailed field instructions are included in Appendix I.

Following final protocol revisions (as discussed above in Section 2.2), intensive-level plot surveys included monitoring of:

- Total canopy closure and species-specific vegetation volume at D points.
- Distance to surface water and canopy gaps within 30 meters of plot center.
- Snags and cavities by SC within the primary (A) plot.
- Tree height and diameter at breast height (DBH) for SC 4 trees (greater than 12 cm DBH), not including mesquite and tamarisk, in the A plot.
- Tree height for mesquite and tamarisk SC 2 (greater than or equal to 3 m tall) in the A plot.
- Tree height and DBH for SC 1 through 3 trees (less than or equal to 12 cm DBH) in the secondary (B) plot.
- Tree height for tamarisk and mesquite SC 1 (less than 3 m tall) in the B plot.
- Shrub height for the B plot, not including arrowweed and coyote willow.
- Cover for trees and shrubs in the B plot.
- Stems of SC 2 and greater (greater than or equal to 2.5 cm in diameter at 10 cm above ground surface) for the first and third quadrants of the B plot (B1 and B3, respectively) to include all species.
- Coyote willow and arrowweed stem count and height in the E plots for SC 1 stems.
- Foliar and ground cover in the tertiary (C) plots.

Reduced effort first-year plots included monitoring of:

- Tree height and DBH, not divided by size class, for the A plot.
- Individual plant counts for coyote willow and arrowweed for the A plot.
- Shrub height and species for only *Atriplex* spp. and *Baccharis* spp. in the A plot.
- Cover estimates for the entire A plot (not just the secondary [B] plot).

Reduced effort second-year plots included monitoring of:

- Tree height and DBH, not divided by SC, for the A plot.
- Shrub height and species for only *Atriplex* spp. and *Baccharis* spp. for the A plot.
- Cover estimates for the entire A plot (not just the secondary [B] plot).
- Count and height for coyote willow and arrowweed stems in the E plots.

Reduced effort mesquite plots included monitoring of:

- Tree height and DBH, not divided by SC, for the entire A plot.
- Shrub height and species for only *Atriplex* spp. and *Baccharis* spp. for the A plot.
- Cover estimates for the entire A plot (not just the secondary [B] plot).

To facilitate relocation during future surveys, previously unmarked plot centers were generally marked by survey crews with a t-post, rebar, and engraved plot marker. One piece of rebar was also inserted at each corner of the primary plot to increase the probability that the same plot area is established and measured for future surveys when conditions are not favorable for Global Positioning System (GPS) reception. Exceptions to permanent marking are discussed in Section 3.0. Each section of rebar and t-post was flagged to increase visibility during future surveys.

2.4 SURVEY SUMMARY

During the 2011 season, surveys were completed at Beal Lake Habitat Restoration Demonstration Site, Bill Williams River NWR, Palo Verde Ecological Reserve, Cibola Valley Conservation Area, and Cibola NWR Unit 1 (see Table 1 below). A list of all the plots sampled is included in Appendix III.

Table 1. Total Number of Plots Sampled Within Each MSCP Area and Site By Date

Site, Phase, and Date Completed	Intensive Plots	Reduced-Effort Plots	Total Plots Measured
BEAL LAKE CONSERVATION AREA (BLCA)	**35**	**0**	**35**
BLCA Phase 01 Cell A	**3**	**0**	**3**
10/1/2011	1	0	1
10/2/2011	1	0	1
10/3/2011	1	0	1
BLCA Phase 01 Cell B	**2**	**0**	**2**
9/27/2011	2	0	2
BLCA Phase 01 Cell C	**1**	**0**	**1**
9/14/2011	1	0	1
BLCA Phase 01 Cell D	**3**	**0**	**3**
10/3/2011	1	0	1
10/4/2011	2	0	2
BLCA Phase 01 Cell F	**2**	**0**	**2**
10/2/2011	1	0	1
10/3/2011	1	0	1
BLCA Phase 01 Cell G	**2**	**0**	**2**
9/15/2011	1	0	1
10/1/2011	1	0	1

(Table Continues)

Table 1. Total Number of Plots Sampled Within Each MSCP Area and Site By Date (Continued)

Site, Phase, and Date Completed	Intensive Plots	Reduced-Effort Plots	Total Plots Measured
BEAL LAKE CONSERVATION AREA (BLCA) (Cont.)	**35**	**0**	**35**
BLCA Phase 01 Cell H	2	**0**	**2**
9/15/2011	1	0	1
10/3/2011	1	0	1
BLCA Phase 01 Cell I	3	**0**	**3**
10/3/2011	1	0	1
10/4/2011	2	0	2
BLCA Phase 01 Cell K	2	**0**	**2**
9/27/2011	2	0	2
BLCA Phase 01 Cell L	2	**0**	**2**
9/16/2011	1	0	1
9/28/2011	1	0	1
BLCA Phase 01 Cell M	1	**0**	**1**
9/30/2011	1	0	1
BLCA Phase 01 Cell N	3	**0**	**3**
10/1/2011	3	0	3
BLCA Phase 01 Cell O	1	**0**	**1**
9/30/2011	1	0	1
BLCA Phase 01 Cell P	2	**0**	**2**
9/16/2011	1	0	1
9/28/2011	1	0	1
BLCA Phase 01 Cell Q	2	**0**	**2**
10/1/2011	1	0	1
10/3/2011	1	0	1
BLCA Phase 02 Cell FF	2	**0**	**2**
9/29/2011	2	0	2
BLCA Phase 02 Cell JJ	2	**0**	**2**
9/29/2011	2	0	2
BILL WILLIAMS RIVER EAST (BWRE)	36	**0**	**36**
BWRE Cougar Point Phase 01	18	**0**	**18**
10/14/2011	8	0	8
10/15/2011	6	0	6
10/16/2011	4	0	4
BWRE Esquerra Ranch Phase 02	7	**0**	**7**
10/12/2011	1	0	1
10/13/2011	5	0	5
10/15/2011	1	0	1
BWRE Mineral Wash Phase 02	11	**0**	**11**
10/11/2011	2	0	2
10/12/2011	7	0	7
10/13/2011	2	0	2

(Table Continues)

Table 1. Total Number of Plots Sampled Within Each MSCP Area and Site By Date (Continued)

Site, Phase, and Date Completed	Intensive Plots	Reduced-Effort Plots	Total Plots Measured
CIBOLA NWR UNIT 1 (CNU1)	63	**0**	**63**
CNU1 Area 1 – Research and Demo	36	**0**	**36**
12/2/2011	11	0	11
12/3/2011	7	0	7
12/4/2011	2	0	2
12/5/2011	11	0	11
12/6/2011	5	0	5
CNU1 Area 5 – Crane Roost	27	**0**	**27**
12/3/2011	14	0	14
12/4/2011	12	0	12
12/5/2011	1	0	1
CIBOLA VALLEY CONSERVATION AREA (CVCA)	51	**45**	**96**
CVCA Phase 01	19	**0**	**19**
11/14/2011	6	0	6
11/15/2011	10	0	10
11/28/2011	1	0	1
11/29/2011	2	0	2
CVCA Phase 02	19	**0**	**19**
11/14/2011	4	0	4
11/19/2011	2	0	2
11/29/2011	12	0	12
11/30/2011	1	0	1
CVCA Phase 03	13	**0**	**13**
12/1/2011	11	0	11
12/2/2011	2	0	2
CVCA Phase 04E	0	**6*** **	**6*** **
11/15/2011	0	3***	3***
11/30/2011	0	3***	3***
CVCA Phase 04W	0	**11*** **	**11*** **
12/1/2011	0	11***	11***
CVCA Phase 05	0	**13*** **	**13*** **
11/30/2011	0	13***	13***
CVCA Phase 06	0	**15*** **	**15*** **
11/30/2011	0	15***	15***
PALO VERDE ECOLOGICAL RESERVE (PVER)	68	68	136
PVER Phase 01	8	**0**	**8**
11/9/2011	8	0	8
PVER Phase 02	18	**0**	**18**
10/18/2011	9	0	9
11/8/2011	8	0	8
11/18/2011	1	0	1

(Table Continues)

Table 1. Total Number of Plots Sampled Within Each MSCP Area and Site By Date (Continued)

Site, Phase, and Date Completed	Intensive Plots	Reduced-Effort Plots	Total Plots Measured
PALO VERDE ECOLOGICAL RESERVE (PVER) (Cont.)	68	68	136
PVER Phase 03	22	**0**	**22**
10/17/2011	8	0	8
10/18/2011	5	0	5
11/11/2011	9	0	9
PVER Phase 04	20	**0**	**20**
11/9/2011	6	0	6
11/10/2011	14	0	14
PVER Phase 05	0	**28****	**28****
11/11/2011	0	11**	11**
11/12/2011	0	17**	17**
PVER Phase 06	0	**40***	**40***
11/12/2011	0	18*	18*
11/13/2011	0	21*	21*
11/19/2011	0	1*	1*
GRAND TOTAL:	253	**113**	**366**

Note that * refers to first-year reduced effort plots, ** refers to second-year reduced effort plots, and *** refers to mesquite reduced effort plots.

As agreed upon with the COR, we eliminated the following plots from surveys during 2011:

- Palo Verde Ecological Reserve: Phase 5 Plots 132, 105, 5, 57, 277, 322, 300, 168, 200, and 185.
- Cibola Valley Conservation Area: Phase 1 Plots 93, 102, and 109; Phase 3 Plots 14, 16, 73, 95, and 131; and Phase 4E Plots 24 and 81.
- Cibola NWR Unit No. 1: Crane's Roost Plots 3, 9, 17, 20, 29, 44, 46, 52, and 54.

Two data collection omissions occurred due to datasheet revisions and miscommunications on the requirements for reduced effort plots. First, when combining SC 1 through SC 3 on one datasheet for the intensive-level plots, it was not possible to assess tree counts by size class for the secondary plot when more than 20 individuals of a species were present. Second, for first- and second-year reduced effort plots, trees were not tallied by SC. To address these data gaps for 2011 plots, the project team developed statistical methods to estimate the SC distributions. Data gaps and correctional actions are detailed in Parametrix, Inc. (2012a, 2012b).

2.5 DATA ENTRY

During the 2011 survey season, Reclamation continued development and revision of a program-wide database for organizing and relating various ongoing and future data collection projects. This database was constructed to allow field data entry for our current vegetation survey as well as future vegetation surveys. Reclamation hosted an electronic live meeting with members of the Project Team to provide background on the database purpose and structure, vegetation database entry forms, and the data entry process for our project. A draft

version of the database was also provided to the Project Team. Initially, the Project Team tested the database and the data entry process. Suggestions and clarifications were provided to Reclamation on January 30, 2012, and a revised version was then provided to the Project Team to begin data entry. Changes between the first and second draft of the database included:

- Adding a delete button to delete a record if it was entered and saved incorrectly;
- Corrections to the snag tab;
- Refinements in the collections tab;
- Adjustments to life-form and native status information for herbaceous plant species; and
- Restriction of possible data entry attributes according to the collection point. For example, hit-to-pole values are now only available for entry under Collection Point D.

The Project Team initiated data entry into this revised version of the MSCP database on February 14, 2012. Electronic data entry was completed by two of our field personnel over a period of 21 entry days. During this period, the Project Team continued to correspond with Reclamation with clarifications. Most importantly, the standard naming convention for MSCP areas and sites changed between project initiation and data entry. Thus, several plot naming inconsistencies between the original plot name and the current plot name needed to be clarified and corrected. The revised version of the database also did not include sample locations for plots measured at the Palo Verde Ecological Reserve. Reclamation provided another draft of the database to the Project Team for entering PVER plots. Data entry was completed on March 31, 2012. A thorough quality control process was initiated after data entry completion. Electronic entries were compared to and corrected for 318 of the 366 plots. Tree count forms were identified as the most probable location for data entry inaccuracies during the electronic data review process. Of the 318 plots reviewed, the entire electronic dataset was reviewed on 290 of the plots, while only tree count forms were reviewed on the other 28 plots. Data were delivered to Reclamation electronically on April 5, 2012. Supporting geographic information system (GIS) shapefiles were provided to Reclamation with Federal Geographic Data Committee (FGDC)-based metadata and accompanying data dictionaries on April 16, 2012.

2.6 KUS METHOD FOR VEGETATION VOLUME

In addition to standard survey protocols, two members of the project team met with Reclamation on March 15, 2012, to review the Kus method (Kus 1998) for surveying vegetation volume. The project supervisor and a staff scientist set up a vegetation volume trial with the COR at Beal Lake Restoration site using a combination of polyvinyl chloride (PVC) and stadia rods. The attendees individually estimated the cover classes, and then compared survey estimates. Potential benefits and drawbacks of the Kus method were noted, and the project supervisor developed a list of standard protocols to be attempted at a subset of survey sites during 2012 surveys. These are presented in Section 3.3.

3. RESULTS AND DISCUSSION

3.1 SURVEY SUMMARIES

In general, MSCP restoration sites were comprised of a dense native riparian tree and shrub overstory with a mix of native and non-native understory vegetation. Sites with more than 2 years of growth were dominated by a closed canopy with few snags, and surface water was generally present only due to irrigation (i.e., there was no natural overbanking). Riparian trees were generally comprised of one age-class of Fremont cottonwood and Goodding's willow, corresponding to the year that the given phase was planted. The Bill Williams River NWR survey sites were comprised of a mixed native and non-native (tamarisk) overstory, with variably-dense understory growth of various native and non-native species. Different cohorts of riparian trees were apparent, with younger trees present nearer the active channel. Bill Williams River NWR plots were often within or immediately adjacent to surface water.

Site-specific observations are provided in the site reports (Appendix IV); survey summaries and key observations are provided below. Plot location maps for each site are provided in Appendix V.

3.1.1 Beal Lake Habitat Restoration Demonstration Site

Beal Lake was the first site surveyed by the Project Team. Between September 12 and September 16, 2011, the principal investigator, project supervisor, data manager, and the vegetation crew leaders reviewed survey methods and revised field forms in coordination with the COR. Following this initial fieldwork, two 2-person survey teams completed surveys over 8 days between September 27 and October 4, 2011. Each 2-person team completed an average of two plots per day.

Generally, fields were either dominated by Fremont cottonwood with a mixed understory of mesquite and willow, or honey and screwbean mesquite overstory with dominant understory of arrowweed and scattered willow and baccharis. Surface water in and adjacent to plots was limited to active irrigation or slowly leaking irrigation valves. Buffelgrass (*Pennisetum ciliare*) was observed in one plot (BEAL_091).

All plot corners were marked with rebar. Newly-established plots were also marked with a t-post, rebar, and engraved cap at plot center.

3.1.2 Bill Williams River NWR

Bill Williams River NWR was the second area surveyed. After an initial day with the project supervisor, to include a safety meeting and orient crews with the survey area, four 2-person survey crews completed surveys between October 11 and October 16, 2011. Each 2-person team completed an average of two intensive plots per day. No reduced effort plots were located at the site. Survey efficiency was slowed due to extensive hiking through dense vegetation to reach plots and dense vegetation and standing water within many plots.

Vegetation composition varied depending on distance from the active river and backwater channels. Communities within plots included: dominant cottonwood with a mixed understory and scattered Goodding's willow, honey mesquite with scattered tamarisk, dominant tamarisk with scattered honey mesquite, and areas with extensive herbaceous vegetation. Surface water and saturated soils were abundant within and between plots.

As specified by the Reclamation COR, no plot markers were placed at Bill Williams River NWR.

3.1.3 Palo Verde Ecological Reserve

Palo Verde Ecological Reserve was surveyed during two field trips totaling 8 days (October 17-18 and November 8-13, 2011). Four 2-person teams completed surveys of the six phases. Two-person teams completed an average of approximately 4.5 intensive plots per day or 6 reduced effort plots per day.

Vegetation across the site varied in accordance with the various planting plans implemented by Reclamation. These vegetation types included: dominant Fremont cottonwood with scattered coyote and Goodding's willow, mixture of Fremont cottonwood and willows, dominant cottonwood with little understory, dominant Goodding's and coyote willow, dense quail bush (Phase 1), dense understory of alfalfa in newly planted fields (Phase 5 and Phase 6), variable cover of Bermuda grass, and minor amounts of honey mesquite and arrowweed. A non-native plant of interest, Spanish false fleabane (*Pulicaria paludosa*) was identified in PVER6_001.

Newly-established plots in Phase 6 and Phase 1 were marked with center posts and stamped with the site phase and plot number. Most previously surveyed plots were marked with center t-posts. However, many were unmarked, and none had a stamped marker on the center post. All unmarked centers were marked during 2011 with 3/4-inch rebar and flagging. Corners of all plots were marked in Phases 3 through 6. However, because a significant amount of rebar was used to mark previously unmarked plot centers, field crews did not have enough materials to mark all corners in Phase 1 and Phase 2. Two opposite corners were marked in Phase 2, and no corners were marked in Phase 1.

3.1.4 Cibola Valley Conservation Area

Cibola Valley Conservation Area was surveyed during two field trips totaling 6 days (November 14-15 and November 29-December 2, 2011). Four 2-person teams completed surveys. Teams completed an average of approximately 3.5 intensive plots per day or 5 reduced effort plots per day.

Vegetation across the site varied in accordance with the various planting plans implemented by Reclamation. Phase 1 and 2 plots were dominated by Fremont cottonwood, Goodding's willow, and/or coyote willow. Phase 3 plots were dominated by cottonwood with one plot (CVCA3_101) dominated by honey mesquite. Phase 4W, 4E, 5, and 6 were dominated by honey mesquite and quail bush. No noxious weeds or Spanish false fleabane were observed. Tamarisk and arrowweed were present in some plots but were not prevalent. Salt heliotrope was commonly located in mesquite plots and was more abundant between trenches than within them.

Primary plot corners and previously unmarked plot centers in Phase 5, 4W, and 4E were not marked due to continued access between rows by farming equipment.

3.1.5 Cibola National Wildlife Refuge Unit No. 1

Cibola National Wildlife Refuge Unit No. 1 was surveyed during one field trip totaling 5 days (December 2-6, 2011). Four 2-person teams completed surveys. Teams completed an average of 2.5 intensive plots per day. No reduced effort plots were located at this site.

The majority of plots was previously marked with center posts and engraved caps. New plots in Area 6 were marked, but unmarked plots in the Nature Trail were not. Rebar was installed at primary plot corners of all plots, except:

- The Nature Trail.
- Plot 005 in Area 6 was only marked on two corners, as the other two fell within the adjacent alfalfa field.

Teams experienced difficulty in relocating previously marked plots. It was unclear if plots were inconsistently marked or if coordinates were incorrectly recorded during previous survey years. Although most center caps and t-posts were found, others could not be located, or sometimes t-posts were located without engraved caps. In cases where plot centers could not be re-located, teams used Archer sub-meter GPS units to re-establish plot centers and markers at the plot center.

Vegetation across the site varied due to differences in planting techniques and layouts. Area 6 was dominated by widely spaced Fremont cottonwood with little understory vegetation. The Nature Trail plot was variably dominated by Fremont cottonwood, Goodding's willow, or seep willow. Scattered honey and screwbean mesquite were also present, with Johnson grass (*Sorghum halepense* (L.) Pers.) common in the understory. The Crane's Roost was dominated by Fremont cottonwood, Goodding's willow, or mesquite, dependent on the location of plots within the planting plan. The Mass Planting Demonstration was dominated by Fremont cottonwood with little understory vegetation. Tamarisk was sometimes present in plots, but was not prevalent. No noxious weeds or Spanish false fleabane were observed.

3.2 KUS METHOD FOR VEGETATION VOLUME

The COR and two project team staff tested the Kus method at example locations within Beal Lake Habitat Restoration Demonstration Site. The team discussed the differences in scale analyzed for the Kus method compared to the "hits-to-pole" method. The Kus method, as specified for future MSCP vegetation surveys, is summarized below:

- The sampling volume consists of a 2-m long by 2-m wide by 1-m tall rectangular prism, stacked vertically.
- Within each 1-meter level, the plan view of coverage is estimated for each species and split into classes.
- Cover classes are <1%, 1–10%, 11–25%, 26–50%, 51–76%, 76–90%, and >90%.
- Overhanging branches from trees rooted outside the prism are included in cover class estimation.
- If a dead stem from a live tree is within the prism, it counts for cover.
- Cover classes should be estimated to 7 m above ground surface.
- Required materials include a 2-m-by-2-m PVC frame and two stadia rods or marked 7-m-tall PVC.

The meeting attendees estimated that this survey method would require an additional 15 minutes per plot for a team of two compared to the "hits-to-pole" method. Due to the amount of materials required, if carried out during 2012 surveys, it will likely be most efficient for a pair of observers to complete only the Kus surveys for a given day. To assist in determining cover classes, the percent cover should be converted to an area. Handouts will be provided to crew members with the amount of cover area required for each cover class to allow more efficient and consistent field estimation.

4. CONCLUSIONS AND RECOMMENDATIONS

In general, intensive surveys and reduced-effort mesquite surveys appear sufficient to collect data of interest to Reclamation. Second-year planting reduced effort plot protocols were insufficient for the characterization of the clonal species arrowweed and coyote willow (Parametrix, Inc. 2012a). We suggest future surveys be conducted for second-year plantings as they are for first-year plantings, wherein the entire primary plot area is surveyed for coyote willow individuals (Parametrix, Inc. 2012b). Year-one reduced effort protocols appear to be effective for coyote willow and arrowweed characterization. However, tree size class information should be included for future surveys (Parametrix, Inc. 2012a).

Because of additional time required for troubleshooting detailed field methods, not all planned surveys were completed. Additionally, surveys required more time than anticipated during 2011. Survey efficiency in future years will likely increase due to:

- Familiarity of project personnel with the survey protocols.
- Marking of plot centers and primary plot corners during 2011.
- Sharing of shapefiles for hiking trails on the Bill Williams River NWR as planned from MSCP contractors.
- Utilization of field protocols developed during 2011, which will be revised prior to 2012 surveys to correct for 2011 data collection issues.

To enhance efficiency and ensure that the Project Team fully understands data collection and recording needs, it is recommended that at the initiation of the 2012 field season, the Reclamation COR, the project supervisor, data manager, and all crew leaders attend a group training session. In addition, it is suggested that the 8-person crew work in groups of four for at least the first day of 2012 field data collection, with the project supervisor and/or data manager present. Prior to initiation of surveys at reduced effort plot locations, it is recommended that the project supervisor again meet with field crews to review deviations from intensive-level plot surveys.

Buffelgrass and Spanish false fleabane observations at Beal Lake Habitat Restoration Demonstration Site and Palo Verde Ecological Reserve, respectively, indicate the need for continued monitoring for non-native species of interest. It is recommended that a more thorough, buffelgrass-specific survey be conducted and followed up with manual or chemical control. It is recommended that Reclamation and contractors continue monitoring for Spanish false fleabane at all MSCP restoration sites.

During the 2012 vegetation survey, Reclamation intends to collect data electronically in the field. With adjustments, the MSCP database could be used to enter data in the field via a ruggedized tablet personal computer running a full version of Microsoft Windows® (not Windows Mobile®). If the MSCP database were to be used for field recording, we recommend modifying the data forms and incorporating a running list at the bottom of each entry form that clearly shows the data that have been entered into a collection point within the plot. Otherwise, it would be a challenge to catch data recording errors as they happen. We also recommend reorganizing tree/shrub count data entry forms by removing the "parent-child" relationship between species/size class and height/DBH. Large icon buttons at the top of the form showing the collection point would also be useful. As is the case with the current version of the database, we recommend restricting the allowable entries according to the collection point selected. In other words, only the attributes relevant for a particular collection point are displayed when that collection point is selected. For field data entry, it would also be helpful to reduce the amount of scrolling that is required through collection

points. Allowing entry of all of the attributes for D collection points for example would be more efficient, and it will also be easier to catch oversights as they occur. Additionally, a notepad in the field to note any observed data entry errors, etc., will also be required. A relatively thorough training would also need to be held prior to fieldwork to ensure that each of the field personnel is comfortable with entering data into the product.

The Kus method presents a way to survey for vegetation volume while sampling a larger area per survey location. This will likely enhance the characterization of vegetation at MSCP restoration sites. However, the amount of time required to implement this method and the usefulness of the data to Reclamation are uncertain. Therefore, it is recommended that survey crews implement these surveys at a subset of areas during 2012. Analysis of data, comparison to the "hits-to-pole" method, and calculation of the additional labor required for surveying and data entry should be determined prior to implementation of this method on the full-scale for MSCP vegetation monitoring.

5. REFERENCES

Kus, Barbara E. 1998. Use of restored riparian habitat by the endangered Least Bell's Vireo (*Vireo bellii pusillus*). Restoration Ecology 6:75-82.

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Parametrix, Inc. 2012a. Unpublished technical memorandum from Parametrix and GSA to the Bureau of Reclamation regarding omissions and proposed corrections for 2011 data collection omissions. February 2012.

Parametrix, Inc. 2012b. Unpublished technical memorandums from Parametrix and GSA to the Bureau of Reclamation with size calibration results. March 2012.

Appendix I

Field Survey Protocols

Appendix I-1

Part A – Intensive Plots

Plot Setup

General Notes:

1. Existing Plot Center markers are assumed the center of the plot. All measurements will be based off this center marker.
2. For new plots (Plot Centers to be established this year), use ArcPad to navigate to plot centers. Place re-bar in the primary plot corners and the plot center to allow repeated surveys. Place an engraved plot marker on the rebar at the plot center. DO NOT STAKE plots at Bill Williams River NWR or CVCA Phase 6.
    a. If the plot area based on this center location will result in a Primary Plot within 5 m of the habitat edge, move the plot toward the interior, which allows all survey area to be more than 5 m from the edge of the habitat. Move the center point in the direction that minimizes deviation from the mapped plot center. Note the new center point UTM on Datasheet 1.
3. For existing plots, move existing corner stakes to corners we measure. Never move existing center plot markers!

Setup Instructions:

1. Use GPS to navigate to plot center marker.
2. Use the plot attributes in ArcPad to determine the azimuth bearing ("Bearing 1") for the long plot edge (Borders 2 and 4). Note that the same bearing is used for all of the plots in a phase.
3. Subtract 90° to determine the azimuth bearing ("Bearing 2") for the short plot edge (Borders 1 and 3).
4. From the plot center, use a compass to line up the measuring tape with Bearing 2 between the plot center and Primary Plot Border 4.
5. With one person holding the coiled tape at the plot center, pull the 0 mark on the tape out 5 meters to the midpoint of Primary Plot Border 4. Check the bearing of this line with a compass. Place a pin flag at this location—the midpoint of Primary Plot Border 4.
6. With one person staying at the midpoint of Primary Plot Border 4, extend the tape to 10 m total (5 m from plot center) along the bearing line. Place a pin flag at the 10 m mark (the midpoint of Primary Plot Border 2).
7. Add pin flags at the: 1 m (point D5), 2.5 m (double flag, midpoint of Secondary Plot Border 4), 5 m (plot center/D1), 7.5 m (double flag, midpoint of Secondary Plot Border 2), 9 m (D3)and 10 m (midpoint of Primary Plot Border 2). Place two pin flags each at 0 m, 2.5 m, 7.5 m, and 10 m.
8. Reel in the tape and move to the midpoint of Primary Plot Border 2. Determine the direction of Bearing 1 from this location. Have one person stand at this location with the reeled tape and compass, and the second person extend the tape 20 m down Primary Plot Border 2 to Corner 1-2^{1}.
9. Once the tape has been extended to 20 m, backsight the tape at several locations to ensure that the azimuth remains at Bearing 1.

10. Place a piece of re-bar at Corner 1-2[1].
11. Attach the clip of the tape at 0 m to the rebar stake. Place double pin flags at the 12.5 m mark of Border 2. The double flag in this location marks the center of tertiary plot C2.
12. Continue extending tape along Bearing 1 to the 40 m mark of Border 2 (Corner 2-3[1]). Place double pin flags at the 27.5 m mark of Border 2. The double flag here marks the center of tertiary plot C1. Continue to 40m mark. Place a re-bar stake at Corner 2-3[1].
13. From Corner 2-3[1], extend the tape on Bearing 2 for 10 m along Border 3 to reach Corner 3-4[1]. Place a re-bar stake at this corner.
14. From the 27.5 m mark of Border 2, extend the tape 10 m along Bearing 2. Place pin flags at 2.5 m, 5 m (double flag), 7.5 m, and 10 m (double flag). Reel in the tape.
15. Repeat 14 for the 12.5 mark of Border 2.
16. Fill in pin flags along Primary and Secondary Plot borders.
17. From Plot Center, extend the tape 4 m in each direction along Bearing 1 (this should direct you to double flags on Border 1 and Border 3 of the Secondary Plot) and place a pin flag at these two points (D2 and D4).

Vegetation Surveys

General Notes:

1. Trees, shrubs, etc. will be considered IN a given plot if any portion of the basal cover falls on Border 1 or Border 2 of the given survey area. They will be considered OUT of a given plot if any portion of the basal cover falls on Border 3 or Border 4 of the given survey area. The exception to this rule is for the tertiary (C) quadrats—if herbaceous foliage is above the quadrat (regardless of the location of the herbaceous base), it will be included for herbaceous canopy cover; if the basal area of a plant is on the border, the portion of the vegetation inside the quadrat will be considered for basal cover.
2. Height of vegetation is measured as the distance of the maximum live foliage above ground surface in a vertical direction. We are NOT measuring stem length, so do not straighten or extend branches for height measurements.
3. Diameter is measured at a different height above ground surface depending on whether DBH or stem counts are being recorded. Diameter is always measured at 10 cm above ground surface for stem counts versus 1.4 m above ground surface for DBH. Diameter measurements are recorded without straightening the stem.
4. Size classes for mesquite and *Tamarix* are as follows: Size Class (SC) 1 is <3 m tall; SC2 is ≥3 m tall.
5. Size classes for non-mesquite or *Tamarix* trees and shrubs are designated by DBH as follows: SC 1 is ≤2.5 cm DBH; SC2 is 2.6 – 8 cm DBH; SC3 is 8.1 – 12 cm DBH; SC 4 is 12.1 to 20 cm DBH; SC5 is 20.1 – 40 cm DBH; and SC6 is >40 cm DBH. All DBH measurements will be ROUNDED UP to the next 0.5 cm interval. For example, a trunk measured as 2.1 cm would be recorded as 2.5, and would fall in SC 1; a trunk measured 11.6 cm would be recorded as 12, and would fall in SC3; and a trunk measuring exactly 12.0 cm would be recorded as 12.
6. For measuring DBH, measure the diameter of the largest LIVE stem for a given individual. The stem is considered live if there is any green foliage further along the stem.

Datasheet 1 (General Information)

1. Enter the date, site location, plot number, and observers. Plot IDs are recorded as the Site/Phase, followed by an underscore, and then the three digit plot number. For example, Plot 29 in CVCA Phase 3 would be recorded as CVCA3_029. Plots have been pre-numbered on the field maps.
2. Determine the presence of snags (ENTIRELY dead trees devoid of foliage, regardless of species) with a dbh > 2.5 cm within the primary plot. Tally by SC. If snags have cavities, count and record the number of cavities and UTMs of those trees.
3. Determine the presence of water within 30 m of **Plot Center**. If none exists, write "None" and enter a 6 in the Distance Category box. If water does exist within 30 m, determine the Distance Category and note the source or type of water.
4. Determine the presence of or open canopy space with an area of greater than or equal to $9m^2$ within 30 m of **Plot Center**. "Open canopy" is defined as without foliated vegetation greater

than 2 m off the ground surface. Number each gap, place in distance category, denote whether it is a Canopy Gap (space within the planted area) or Edge Gap (open space outside of planted area, e.g. road, edge of field), and record UTM coordinates of the center (Canopy Gap) or edge (Edge Gap). If no gaps exist within 30 m of Plot Center, write "None" and put a "6" in the distance category box.

5. Measure the canopy closure using a densiometer. Proceed to points D1 through D5. Hold the densiometer level at 1.2 m directly above the D points. Count the number of hits for either vegetation (including both live and dead branches/trees) or open sky at each line intersection AND corners. Write the number of hits in the Canopy Closure Section. The total number of hits recorded sums to 37. The orientation of the densiometer measurements is as follows: D1) face "up" the plot; D2-D5) face out from plot center.

Datasheets 2-4 (Vegetation Volume)

1. On each sheet, enter the date, site location, plot number, and observers.
2. Proceed to points D1 through D5 for vegetation volume surveys.
3. At each location, extend the stadia rod vertically to a height slightly above the canopy, or to its full extent if required.
4. From 0 to 7 m, count the number of hits per meter by species. A "hit" occurs when LIVE plant material (leaves or stem foliated at or beyond the given point) is within 10 cm of the center of the rod for a given 10 cm interval.
5. For 7 m and above, estimate if the number of hits per meter is 0, less than or equal to 5, or greater than 5.
6. A level should be rested against the side of the stadia rod to ensure it is straight.

Datasheet 5 (Primary Plot A)

1. Survey the entire Primary Plot area for mesquite trees that are greater than or equal to 3 m tall (SC2), *Tamarix* spp. greater than or equal to 3 m tall (SC2), or trees of another species with a dbh greater than 12 cm (SC4).
    a. For mesquite: Measure and record height for three trees of each mesquite species (PROGLA or PROPUB) that represent the size range observed in the plot to the nearest tenth of a meter. Estimate the heights of additional mesquite trees to the nearest half-meter. DBH columns can be dismissed.
    b. For Tamarix: Measure and record height for three *Tamarix* spp. that represent the size range observed in the plot to the nearest tenth of a meter. Estimate the height of additional plants to the nearest half-meter. DBH columns can be dismissed.
    c. For other tree species: Measure and record height (to the nearest tenth of a meter) for three trees of each species that represent the size range observed in the plot for the given species. After three trees of each species are measured and recorded, visually estimate tree height for additional individuals of each species to the nearest half meter up to 20 trees. Measure and record dbh for all trees to the nearest half centimeter up to 20 trees.

d. For all species: after 20 trees are recorded, tally TOTAL number of individuals by species **(including first 20)** that fall within the recorded height classes. Height classes are selected that best represent the range and distribution of heights observed throughout the Primary Plot.

e. **<u>For DBH, always round UP to the nearest half centimeter as discussed in the Vegetation Survey General Notes.</u>**

2. After a tree is recorded, chalk and/or flag it to prevent re-measuring during Primary Plot OR Secondary Plot surveys.
3. For each tree recorded in the Primary Plot, put a check mark in the adjacent column IF that tree is also within the Secondary Plot area. If it is not within the Secondary Plot area, record a zero in the cell.

Datasheet 6 (Secondary Plot Trees)

1. Survey the entire Secondary Plot area for additional mesquite trees or saltcedar plants that are less than 3 m tall. Collect other data as for the Primary Plot. Note that all mesquite and saltcedar plants in SC2 (greater than or equal to 3 m tall) have already been measured.
2. Survey the Secondary Plot area for other tree species with a dbh of <12 cm (SC1 through SC3). Record the Secondary Plot quadrant for each individual. Collect other data as for the Primary Plot. Note that all trees in SC 4 (dbh >12 cm) have already been measured and a check mark was recorded if the tree occurred within the Secondary Plot area. As for the primary plot, Border 1 and 2 are "in" for the secondary plot and each quadrant within.
3. For all trees: After 20 trees are recorded, tally TOTAL number of individuals (**including first 20**) by species on the bottom of the form and estimate the percentage of trees (**including the first 20**) that fall within the recorded height classes. Height classes are selected that best represent the range and distribution of heights observed throughout the Secondary Plot. SAs for the primary plot, Border 1 and 2 are "in" for the secondary plot.
4. <u>DO NOT COUNT PLUSER OR SALEXI INDIVIDUALS IN PLANT COUNTS!</u>

Datasheet 7 (Secondary Plot Shrubs, Shrub and Tree Canopy Cover)

1. Survey the entire Secondary Plot area for shrub species, <u>NOT</u> including PLUSER or SALEXI.
    a. Measure and record height (to the nearest tenth of a meter) for three individuals of each species that represent the size range observed in the plot for the given species (i.e. one short, one mid-height, and one tall individual. After three shrubs of each species are measured and recorded, visually estimate tree height for additional individuals of each species to the nearest half meter up to 20 individuals. As for the primary plot, Border 1 and 2 are "in" for the secondary plot and each quadrant within.
    b. For all shrubs: After 20 individuals are recorded, tally TOTAL number of individuals (**including first 20**) by species on the bottom of the form and estimate the percentage of trees (**including the first 20**) that fall within the recorded height classes. Height classes are selected that best represent the range and distribution of heights observed

throughout the Secondary Plot. SAs for the primary plot, Border 1 and 2 are "in" for the secondary plot.

c. Estimate the cover classes within the Secondary Plot for each woody species according to the provided cover classes. ****This should include cover estimates for SALEXI and PLUSER, even though we are not recording plant counts for these species in this secondary plot.**
    i. Remember that these are species specific, so cover classes CAN add up to greater than 100%.

Datasheet 8 (Stem Counts)

1. Survey the Stem Count Area:
    a. Dot count, by species and Secondary Plot quadrant, stems for trees or shrubs GREATER THAN OR EQUAL TO 1.5 m tall that have a DIAMETER GREATER THAN 2.5 cm AT 10 cm ABOVE GROUND SURFACE into size classes. SIZE CLASSES ARE FOR THE DIAMETER AT 10 cm ABOVE GROUND SURFACE, NOT DBH. INCLUDE ALL SPECIES, INCLUDING SALEXI WITH A DIAMETER OF >2.5 cm AT 10 cm ABOVE GROUND SURFACE. **DO NOT INCLUDE STEMS OF A LESSER DIAMETER OR STEMS ON PLANTS LESS THAN 1.5 m TALL**.
    b. For multiple stems to be counted for one plant/tree, branching must be complete at 10 above ground surface—at 10 cm above ground, daylight must be observed between branches. If branches do not separate until 10.1 cm above ground surface, it counts as one stem.
2. Survey the E plots for SALEXI and PLUSER stems with diameters **less than 2.5 cm** at 10cm above ground (stem SC 1). Include stems less than 1.5 m tall. Record the heights for the first twenty stems in each quad. Record the number of additional stems after the first 20. DO NOT COUNT STEMS IN SC2.

Datasheet 9 (Tertiary Plots C)

1. Estimate total foliar cover OF HERBACEOUS PLANTS within each tertiary plot collectively, and then by species (i.e. one cover class for total herbaceous cover, followed by one row for each species). If no herbaceous species occur in quads, write "no herbs" and enter a "0" in the cover class column.
    a. For Tertiary Plots, there are no "out" and "in" borders—if herbaceous foliage is above the open space within the quadrat, it counts for foliar cover.
2. Estimate ground cover of:
    a. Herbaceous species (basal cover);
    b. Woody species (basal cover);
    c. Litter;
    d. Bare ground;
    e. Rock/Gravel; and
    f. Water
    g. If no cover exists for one or several categories, enter a "0" in the cover class column.

h. As for foliar cover, there are no “in” or “out” borders. If a portion of a given cover is within the quadrat, it is included for basal cover.

3. Estimate the depth of litter and herbaceous vegetation to the nearest cm at three points in each quad. The measuring point will be the center point of each third of the 0.5 by 2 m quad.

Appendix I-2

Part B – Reduced Effort Plots

Reduced Effort Plot Instructions

General Notes:

1. Two levels of reduced effort are to be utilized:
    a. Mesquite plots at CVCA and first-year plantings for all vegetation types: fewer observations because of clearing between mesquite rows (CVCA) or less vegetation growth which makes some observations irrelevant.
    b. Second-year plantings for all species: Vegetation has become well-established, and clonal species have likely spread, so stem counts become relevant for these species.
2. All species within the primary plot will be noted.
3. Cover estimates will be included for salt heliotrope (HELCUR) for the PRIMARY PLOT.
4. The following details DEVIATIONS from the existing vegetation monitoring protocols.

Vegetation Surveys

CVCA Mesquite and All First-year Plantings (PVER Phase 6 for 2011):

1. Skip datasheets 1 through 5 entirely.
2. For datasheet 5, record all tree size classes, not just SC4 trees and SC2 mesquite. Do not record SALEXI or PLUSER.
    a. Measure only three individuals per species. Dot count additional individuals. You DO NOT need to break individuals into three height classes (bottom of datasheet).
3. Skip datasheet 6 (secondary trees).
4. For datasheet 7, survey the entire **primary plot area**.
    a. Record only Atriplex spp., Baccharis spp., **SALEXI, and PLUSER** for plant counts.
    b. Measure only three individuals per species. Dot count additional individuals.
    c. Cover estimates are for the entire primary plot area, not just the secondary!
    d. Estimate cover for all species above present **AND HELCUR.**
    e. **Note additional species observed in cover section. Cover estimates NOT required.**
5. **Skip datasheets 8 and 9.**

Second-year Plantings (PVER Phase 5 for 2011):

1. Same as above, EXCEPT:
    a. SALEXI and PLUSER are NOT included on Datasheet 7.
    b. Datasheet 8 ***IS*** required, but **record only SALEXI and PLUSER.**

Appendix II

Field Datasheets

LCR-MSCP Vegetation Monitoring **Datasheet 1: General Information**

Date _____ Site/Phase _____ PlotNum _____ ID _____

Observers _____ Photos _____

Canopy Closure (5 Points)

Record number of cross hairs/corners covered with vegetation and/or sky (37 total).

Orient "Up" for D1, away from center for D2-D5

	D1	D2	D3	D4	D5
Canopy					
Sky					

Distance to Gap

Estimate distance to all gaps ≥9m^2 within 30 meters of plot center; then estimate gap size, and take GPS point at gap center. **Distance from center categories: 1= <3m, 2= 3-6m, 3= 6-9m, 4= 9.1-12m, 5= 12.1-30m. If not gaps within 30 meters of plot center, enter 6 for >30 m. Gap Size estimate**: write in an estimated size, for example, 2x5m or 3X3m. **C or E:** Record if gap is canopy or edge; UTM pt at gap center or if edge, then at edge of habitat.

Gap Num	Dist Catg	Size Est	C or E	Easting	Northing

Distance to Surface Water

Estimate distance to any surface water that is within 30 meters of plot center, then record source or type of water.

Distance from center categories: 1= <3m, **2**= 3-6m, **3**= 6-9m, **4**= 9.1-12m, **5**= 12.1-30m. If no surface water within 30 meters of plot center, enter 6 for >30 m, and "none" for the "Type"

Water Num	Dist Catg	Type

Snags

Tally all snags by size class. **SC6)** >40cm; **SC5)** 20.1-40cm; **SC4)** 12.1-20cm; **SC3)** 8.1-12cm DBH; **SC2)** 2.6-8cm DBH; **SC1)** ≤2.5cm DBH.

If snag in SC 4-6 and has a cavity, record # of cavities in each snag and GPS the snag.

Tallies

SC2	SC3	SC4	SC5	SC6

#	SC	#Cavities	Easting	Northing

General Notes

_____

_____

_____

_____

_____

LCR-MSCP Vegetation Monitoring **Datasheet 2: Vegetation Volume**

Date _____

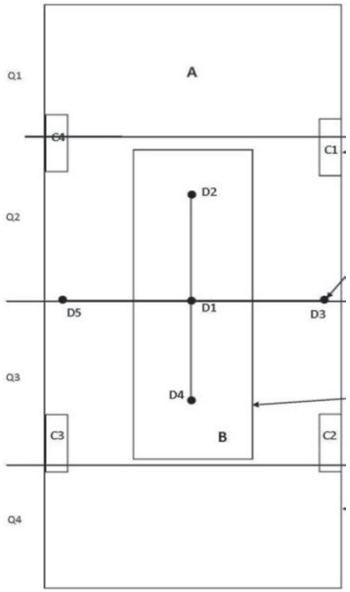
Site/Phase _____ PlotNum _____

ID _____ Observers _____

Hits to Pole (5 Points)

Record number of decimeter 'hits to pole' (within 10cm radius) for each meter layer up to 7m at collection points D1-D5 as in plot diagram. Meter layers above 7 meters will be estimated using 0, ≤5, or >5 hits per meter layer.

D1								D2							
Meter Layer	Hits by Species							Meter Layer	Hits by Species						
0_1								0_1							
1_2								1_2							
2_3								2_3							
3_4								3_4							
4_5								4_5							
5_6								5_6							
6_7								6_7							
Estimates								**Estimates**							
7_8								7_8							
8_9								8_9							
9_10								9_10							
10_11								10_11							
11_12								11_12							
12_13								12_13							
13_14								13_14							
14_15								14_15							
15_16								15_16							
16_17								16_17							
18_19								18_19							
19_20								19_20							
20_21								20_21							
21_22								21_22							
22_23								22_23							
23_24								23_24							



LCR-MSCP Vegetation Monitoring **Datasheet 3: Vegetation Volume**

Date _____

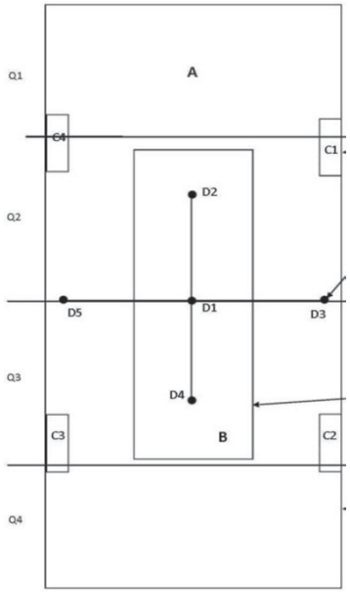
Site/Phase _____ PlotNum _____

ID _____ Observers _____

Hits to Pole (5 Points)

Record number of decimeter 'hits to pole' (within 10cm radius) for each meter layer up to 7m at collection points D1-D5 as in plot diagram. Meter layers above 7 meters will be estimated using 0, ≤5, or >5 hits per meter layer.

D3								D4							
Meter Layer	Hits by Species							Meter Layer	Hits by Species						
0_1								0_1							
1_2								1_2							
2_3								2_3							
3_4								3_4							
4_5								4_5							
5_6								5_6							
6_7								6_7							
Estimates								**Estimates**							
7_8								7_8							
8_9								8_9							
9_10								9_10							
10_11								10_11							
11_12								11_12							
12_13								12_13							
13_14								13_14							
14_15								14_15							
15_16								15_16							
16_17								16_17							
18_19								18_19							
19_20								19_20							
20_21								20_21							
21_22								21_22							
22_23								22_23							
23_24								23_24							



LCR-MSCP Vegetation Monitoring **Datasheet 4: Vegetation Volume**

Date _____

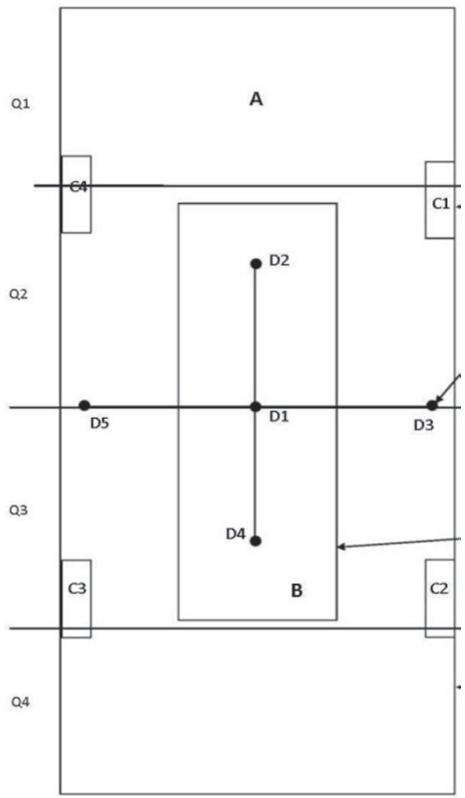
Site/Phase _____ PlotNum _____

ID _____ Observers _____

Hits to Pole (5 Points)

Record number of decimeter 'hits to pole' (within 10cm radius) for each meter layer up to 7m at collection points D1-D5 as in plot diagram. Meter layers above 7 meters will be estimated using 0, ≤5, or >5 hits per meter layer.

D5							
Meter Layer	Hits by Species						
0_1							
1_2							
2_3							
3_4							
4_5							
5_6							
6_7							
Estimates							
7_8							
8_9							
9_10							
10_11							
11_12							
12_13							
13_14							
14_15							
15_16							
16_17							
18_19							
19_20							
20_21							
21_22							
22_23							
23_24							



LCR-MSCP Vegetation Monitoring **Datasheet 5: Primary Plot**

Date _____ PlotNum _____ Area/Site _____ Observers _____ ID _____

SC4 Trees, Mesq SC2, Tamsp SC2

Page _____ of _____

Species																					
Tree # M or E	DBH	HT (m)	In 2º	DBH	HT (m)	In 2º	DBH	HT (m)	In 2º	DBH	HT (m)	In 2º	DBH	HT (m)	In 2º	DBH	HT (m)	In 2º	DBH	HT (m)	In 2º
1-M																					
2-M																					
3-M																					
4-E																					
5-E																					
6-E																					
7-E																					
8-E																					
9-E																					
10-E																					
11-E																					
12-E																					
13-E																					
14-E																					
15-E																					
16-E																					
17-E																					
18-E																					
19-E																					
20-E																					

Species																					
Dot tally # of individual plants (INCLUDE 1st 20 listed above)																					

If trees > 20, then record percent at height (up to 3 classes)	%	HT (m)	%	HT (m)	%	HT (m)	%	HT (m)	%	HT (m)	%	HT (m)	%	HT (m)

Size Class 4 trees (>12 cm DBH; exlud. mesquite); Measure DBH at 1.4m height and **round UP** to nearest 0.5 cm.

Mesquite (SC 2) ≥3m height. Mesquite are categorized by height not DBH.

Tamarix (SC 2) ≥3m height. Tamarix are categorized by height not DBH.

Place √ if tree is in secondary plot and a "0" if not.

Tree M or E = applies to tree #'s 1-20; record whether it was one of the 3 Measured trees or if it was an Estimate.

Place an X in DBH Column for TAMSP or MESQ

Record total number of individual SC 4 plants (not stems) by species INCLUDING the first 20.

If there are >20 trees for a species, then record estimates of percent of trees at each height, up to 3 categories (e.g. 100 Popfre → 30% @3m, 60% @4.5m, and 10% @6m). Height categories are chosen that best represent the distribution of heights encountered. If there are < 20 trees for a species, then ignore this section.

LCR-MSCP Vegetation Monitoring **Datasheet 6 - Secondary Trees**

Date _____ PlotNum _____ Area/Site _____ ID _____ Observers _____

Size Class 1-3 trees: **SC3)** 8.1-12 cm DBH; **SC2)** 2.6-8 cm DBH; **SC1)** ≤2.5cm DBH. Record DBH of trunk at 1.4 meters above the ground ROUNDED UP to the next 0.5 cm interval; if more than one trunk, record DBH of largest trunk. If less than 1.4 m tall, record "0" for DBH.
Mesquite and Tamsp: SC1) < 3 m height. Record heights of mesquite and Tamarix, X for DBH.

Page _____ of _____

DO NOT RECORD PLUSER OR SALEXI

SC1, 2, 3 Trees, Tamsp SC1, and Mesq SC1

sp.																		
Tree # M or E	DBH	HT (m)	DBH	HT (m)	DBH	HT (m)	DBH	HT (m)	DBH	HT (m)	DBH	HT (m)	DBH	HT (m)	DBH	HT (m)	DBH	HT (m)
1-M																		
2-M																		
3-M																		
4-E																		
5-E																		
6-E																		
7-E																		
8-E																		
9-E																		
10-E																		
11-E																		
12-E																		
13-E																		
14-E																		
15-E																		
16-E																		
17-E																		
18-E																		
19-E																		
20-E																		

Tree M or E = record whether it was one of the 3 Measured trees or if it was an Estimate.

Record number of individual trees (not stems) by species INCLUDING the first 20.

If there are >20 trees for a species, then record estimates of percent of trees at each height, up to 3 categories. If there are < 20 trees for a species, then ignore this section.

Dot tally # of individual plants (INCLUDE 1st 20 listed above)	Species															
If trees > 20, then record percent at	**%**	**HT (m)**	**%**	**HT (m)**	**%**	**HT (m)**	**%**	**HT (m)**	**%**	**HT (m)**	**%**	**HT (m)**	**%**	**HT (m)**

LCR-MSCP Vegetation Monitoring

Datasheet 7 - Secondary Shrub Count, Secondary Cover Estimates for Trees and Shrubs

Date _____ PlotNum _____ Area/Site _____ ID _____ Observers _____

Record the height for three measured (M) individuals of each species to the nearest 0.1 m. Estimate (E) height for additional individuals to the nearest 0.5 m. Record the Secondary Plot Quadrant for each individual. Borders 1 and 2 are "IN", 3 and 4 are "OUT" for each quadrant.

Shrub Species (Do Not Include Pluser or Salexi)

Sp.								
	HT(m)	HT(m)	HT(m)	HT(m)	HT(m)	HT(m)	HT(m)	HT(m)
1-M								
2-M								
3-M								
4-E								
5-E								
6-E								
7-E								
8-E								
9-E								
10-E								
11-E								
12-E								
13-E								
14-E								
15-E								
16-E								
17-E								
18-E								
19-E								
20-E								

Additional Plants

Dot Count		**Dot Count**	
%	**HT (m)**	**%**	**HT (m)**
Dot Count		**Dot Count**	
%	**HT (m)**	**%**	**HT (m)**

Record number of individual shrubs by species INCLUDING the first 20.

If there are >20 trees for a species, then record estimates of percent of shrubs at each height, up to 3 categories.

Estimate canopy cover of all woody species in the Secondary Plot area. **Include Pluser and Salexi.**

Tree & Shrub Cover Classes	**sp.**										
Cover classes = **1)** <1%; **2)** 1-10%; **3)** 11-25%; **4)** 26-50%; **5)** 51-75%; **6)** 76-90%; **7)** >90% Include trees, SALEXI and PLUSER											

LCR-MSCP Vegetation Monitoring **Datasheet 8 - Stem Count Area**

Date_____ Plot Num _____ Area/Site_____ ID_____ Observers _____

Dot count stems by species and size class (SC 2-4). Stem counts only, no other measurements. Dot count includes tree or shrub stems that meet the minimum stem count criteria (stem >2.5 cm diameter at 10 cm above ground and height ≥ 1.5 m). **Include PLUSER and SALEXI**. Separate dot counts for secondary quads 1 and 3.

SizCls	2° Quad	Species						
2 (stems 2.5-8 cm @10cm above ground surface)	1							
3 (stems 8.1-12 cm @10cm above ground surface)	1							
4 (stems >12 cm @10cm above ground surface)	1							
2 (stems 2.5-8 cm @10cm above ground surface)	3							
3 (stems 8.1-12 cm @10cm above ground surface)	3							
4 (stems >12 cm @10cm above ground surface)	3							

Stem Counts (E Quads Nested in Secondary Plot for Tallying Coyote Willow and Arrowweed Stems)

Record SC1 (<2.5 cm diameter at 10 cm above ground surface) stems including those less than 1.5 m tall for rhizomatous spp. (Salexi, Pluser) in E quadrats. Measure first 20 stems to nearest 0.1 m to obtain average plant height. Count the number of stems over 20 (do not include first 20 in the stem count).

Quad	Salexi		Pluser	
	Height of First 20 (m)	SC1 Count (# over 1st 20)	Height of First 20 (m)	SC1 Count (# over 1st 20)
1				
2				
3				
4				

LCR-MSCP Vegetation Monitoring **Datasheet 9 - Tertiary Plots**

Date _____ PlotNum _____ ID _____

Foliar Cover (0.5x2 m)

Record foliar cover of **live herbaceous plants**. Cover classes: **1= <1%; 2= 1-10%; 3= 11-25%; 4= 26-50%; 5= 51-75%; 6= 76-90%; and 7= >90%**.

One cover class for combined herbaceuous species (0 if none), **and** one cover class for each species.

Tert. Plot (C1-C4)	Species Code	Cvr Cls

Ground Cover (0.5x2 m)

Record ground cover type-covering ground,not canopies. All sp. combined. Cover classes: **1= <1%; 2= 1-10%; 3= 11-25%; 4= 26-50%; 5= 51-75%; 6= 76-90%; and 7= >90%**. Vegetation Ht and Liter depth at 3 points (centering lengthwise at both ends and and middle of plot).

Tert. Plot (C1-C4)	Type	Cvr Cls	Height/Depth (cm)		
			1	2	3
C1	Herbaceous				
	Woody				
	Litter				
	Bare Ground				
	Rock/Gravel				
	Water				
C2	Herbaceous				
	Woody				
	Litter				
	Bare Ground				
	Rock/Gravel				
	Water				
C3	Herbaceous				
	Woody				
	Litter				
	Bare Ground				
	Rock/Gravel				
	Water				
C4	Herbaceous				
	Woody				
	Litter				
	Bare Ground				
	Rock/Gravel				
	Water				

Appendix III

Plot Locations Sampled During 2011

al Plot	Date Sampled	Date Entered	UTM Easting - Plot Center	UTM Northing - Plot Center	Bearing	Database Area	Database Area Code	Database Site	Database Site Code
	9/27/2011	2/24/2012	726189	3850826	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell B	B
	9/14/2011	2/24/2012	726099	3850765	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell C	C
	9/15/2011	2/24/2012	726014	3850809	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell H	H
	9/15/2011	2/28/2012	726049	3850849	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell G	G
	10/1/2011	2/27/2012	725905	3850755	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell Q	Q
	10/3/2011	2/28/2012	726116	3850918	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell F	F
	9/16/2011	2/28/2012	725780	3850828	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell L	L
	9/30/2011	2/27/2012	725910	3850945	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell M	M
	9/30/2011	2/27/2012	725842	3850990	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell O	O
	9/27/2011	2/24/2012	725880	3850894	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell K	K
	9/16/2011	2/28/2012	725762	3850934	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell P	P
	9/29/2011	2/27/2012	725685	3851117	315	Beal Lake Conservation Area	BLCA	BLCA Phase 02 Cell JJ	JJ
	9/29/2011	2/27/2012	725755	3851091	315	Beal Lake Conservation Area	BLCA	BLCA Phase 02 Cell FF	FF
	9/29/2011	2/27/2012	725626	3851106	315	Beal Lake Conservation Area	BLCA	BLCA Phase 02 Cell JJ	JJ
	9/29/2011	2/27/2012	725720	3851049	315	Beal Lake Conservation Area	BLCA	BLCA Phase 02 Cell FF	FF
	10/1/2011	2/28/2012	726080	3850864	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell G	G
	9/27/2011	2/24/2012	726151	3850802	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell B	B
	10/3/2011	2/28/2012	725984	3850763	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell H	H
	10/3/2011	2/28/2012	725945	3850796	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell Q	Q
	9/27/2011	2/24/2012	725896	3850873	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell K	K
	9/28/2011	2/24/2012	725766	3850866	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell L	L
	9/28/2011	2/27/2012	725806	3850935	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell P	P
	10/2/2011	2/28/2012	726075	3850923	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell F	F
	10/1/2011	2/28/2012	726021	3851016	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell N	N
	10/1/2011	2/27/2012	725922	3851027	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell N	N
	10/1/2011	2/28/2012	725997	3850991	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell N	N
	10/2/2011	2/28/2012	726091	3850990	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell A	A
	10/1/2011	2/28/2012	726128	3850995	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell A	A
	10/4/2011	2/28/2012	725891	3850577	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell D	D
	10/4/2011	2/29/2012	725805	3850659	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell I	I
	10/4/2011	2/29/2012	725846	3850699	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell I	I
	10/3/2011	2/28/2012	725890	3850689	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell I	I
	10/3/2011	2/28/2012	725962	3850649	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell D	D
	10/4/2011	2/29/2012	725958	3850573	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell D	D
	10/3/2011	2/28/2012	726213	3850925	315	Beal Lake Conservation Area	BLCA	BLCA Phase 01 Cell A	A
R1_001	10/14/2011	2/23/2012	774385	3795619	40	Bill Williams River East	BWRE	BWRE Cougar Point Phase 01	Cougar Point
R1_002	10/14/2011	2/22/2012	774510	3795627	40	Bill Williams River East	BWRE	BWRE Cougar Point Phase 01	Cougar Point
R1_003	10/14/2011	2/23/2012	774615	3795617	40	Bill Williams River East	BWRE	BWRE Cougar Point Phase 01	Cougar Point
R1_004	10/14/2011	2/22/2012	774522	3795545	40	Bill Williams River East	BWRE	BWRE Cougar Point Phase 01	Cougar Point
R1_005	10/14/2011	2/22/2012	774631	3795531	40	Bill Williams River East	BWRE	BWRE Cougar Point Phase 01	Cougar Point
R1_006	10/14/2011	2/24/2012	774541	3795453	40	Bill Williams River East	BWRE	BWRE Cougar Point Phase 01	Cougar Point
R1_007	10/15/2011	2/22/2012	774643	3795388	40	Bill Williams River East	BWRE	BWRE Cougar Point Phase 01	Cougar Point
R1_008	10/14/2011	2/23/2012	774576	3795323	40	Bill Williams River East	BWRE	BWRE Cougar Point Phase 01	Cougar Point
R1_009	10/15/2011	2/22/2012	774680	3795316	40	Bill Williams River East	BWRE	BWRE Cougar Point Phase 01	Cougar Point
R1_010	10/14/2011	2/24/2012	774642	3795273	40	Bill Williams River East	BWRE	BWRE Cougar Point Phase 01	Cougar Point
R1_011	10/15/2011	2/24/2012	774803	3795194	40	Bill Williams River East	BWRE	BWRE Cougar Point Phase 01	Cougar Point
R1_012	10/15/2011	2/22/2012	774728	3795165	40	Bill Williams River East	BWRE	BWRE Cougar Point Phase 01	Cougar Point
R1_013	10/16/2011	2/24/2012	774668	3795104	40	Bill Williams River East	BWRE	BWRE Cougar Point Phase 01	Cougar Point
R1_014	10/16/2011	2/24/2012	774760	3795109	40	Bill Williams River East	BWRE	BWRE Cougar Point Phase 01	Cougar Point
R1_015	10/15/2011	2/23/2012	774928	3795097	40	Bill Williams River East	BWRE	BWRE Cougar Point Phase 01	Cougar Point
R1_016	10/16/2011	2/24/2012	774731	3795038	40	Bill Williams River East	BWRE	BWRE Cougar Point Phase 01	Cougar Point
R1_017	10/15/2011	2/24/2012	774886	3795034	40	Bill Williams River East	BWRE	BWRE Cougar Point Phase 01	Cougar Point
R1_018	10/16/2011	2/24/2012	774790	3795000	40	Bill Williams River East	BWRE	BWRE Cougar Point Phase 01	Cougar Point
R2_019	10/13/2011	2/24/2012	775129	3794769	42	Bill Williams River East	BWRE	BWRE Esquerra Ranch Phase 02	Esquerra Ranch

al Plot	Date Sampled	Date Entered	UTM Easting - Plot Center	UTM Northing - Plot Center	Bearing	Database Area	Database Area Code	Database Site	Database Site Code
R2_020	10/13/2011	2/23/2012	775218	3794722	42	Bill Williams River East	BWRE	BWRE Esquerra Ranch Phase 02	Esquerra Ranch
R2_021	10/15/2011	2/24/2012	775067	3794684	42	Bill Williams River East	BWRE	BWRE Esquerra Ranch Phase 02	Esquerra Ranch
R2_022	10/13/2011	2/24/2012	775146	3794687	42	Bill Williams River East	BWRE	BWRE Esquerra Ranch Phase 02	Esquerra Ranch
R2_023	10/13/2011	2/23/2012	775195	3794662	42	Bill Williams River East	BWRE	BWRE Esquerra Ranch Phase 02	Esquerra Ranch
R2_024	10/13/2011	2/23/2012	775269	3794627	42	Bill Williams River East	BWRE	BWRE Esquerra Ranch Phase 02	Esquerra Ranch
R2_025	10/12/2011	2/23/2012	775379	3794560	42	Bill Williams River East	BWRE	BWRE Mineral Wash Phase 02	Mineral Wash
R2_026	10/12/2011	2/22/2012	775223	3794529	42	Bill Williams River East	BWRE	BWRE Esquerra Ranch Phase 02	Esquerra Ranch
R2_027	10/12/2011	2/23/2012	775454	3794528	42	Bill Williams River East	BWRE	BWRE Mineral Wash Phase 02	Mineral Wash
R2_028	10/12/2011	2/23/2012	775391	3794506	42	Bill Williams River East	BWRE	BWRE Mineral Wash Phase 02	Mineral Wash
R2_029	10/13/2011	2/23/2012	775614	3794483	42	Bill Williams River East	BWRE	BWRE Mineral Wash Phase 02	Mineral Wash
R2_030	10/13/2011	2/23/2012	775738	3794487	42	Bill Williams River East	BWRE	BWRE Mineral Wash Phase 02	Mineral Wash
R2_031	10/12/2011	2/22/2012	775429	3794464	40	Bill Williams River East	BWRE	BWRE Mineral Wash Phase 02	Mineral Wash
R2_032	10/11/2011	2/23/2012	775504	3794431	42	Bill Williams River East	BWRE	BWRE Mineral Wash Phase 02	Mineral Wash
R2_033	10/11/2011	2/23/2012	775445	3794412	42	Bill Williams River East	BWRE	BWRE Mineral Wash Phase 02	Mineral Wash
R2_034	10/12/2011	2/23/2012	775715	3794373	42	Bill Williams River East	BWRE	BWRE Mineral Wash Phase 02	Mineral Wash
R2_035	10/12/2011	2/23/2012	775618	3794345	42	Bill Williams River East	BWRE	BWRE Mineral Wash Phase 02	Mineral Wash
R2_036	10/12/2011	2/23/2012	775856	3794330	42	Bill Williams River East	BWRE	BWRE Mineral Wash Phase 02	Mineral Wash
ane_006	12/3/2011	3/2/2012	714677	3693854	179	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
ane_010	12/3/2011	3/2/2012	714680	3693694	179	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
ane_018	12/4/2011	3/2/2012	714754	3694057	179	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
ane_031	12/4/2011	3/2/2012	714765	3693497	179	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
ane_036	12/4/2011	3/5/2012	714811	3694016	179	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
ane_043	12/3/2011	3/2/2012	714815	3693696	179	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
ane_045	12/4/2011	3/5/2012	714816	3693576	179	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
ane_057	12/3/2011	3/2/2012	714829	3693816	179	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
ane_078	12/4/2011	3/2/2012	714937	3693741	179	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
ane_095	12/3/2011	3/2/2012	714967	3693667	179	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
ane_103	12/3/2011	3/2/2012	714970	3693379	179	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
ane_124	12/4/2011	3/2/2012	715097	3694026	179	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
ane_130	12/4/2011	3/5/2012	715100	3693786	179	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
ane_131	12/3/2011	3/2/2012	715101	3693706	179	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
ane_134	12/3/2011	3/2/2012	715103	3693586	179	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
ane_140	12/5/2011	3/6/2012	715125	3694064	179	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
ane_142	12/4/2011	3/5/2012	715126	3693944	179	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
ane_145	12/4/2011	3/2/2012	715127	3693824	179	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
ane_153	12/3/2011	Not Recorded	715131	3693424	179	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
ane_157	12/4/2011	3/5/2012	715206	3694026	180	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
ane_159	12/4/2011	3/19/2012	715206	3693914	180	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
ane_165	12/3/2011	3/2/2012	715207	3693666	180	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
ane_168	12/3/2011	3/2/2012	715207	3693506	180	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
ane_170	12/3/2011	3/2/2012	715207	3693426	180	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
ane_190	12/4/2011	3/5/2012	715361	3694071	179	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
ane_195	12/3/2011	3/2/2012	715363	3693791	179	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
ane_198	12/3/2011	3/2/2012	715365	3693671	179	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 5 - Crane Roost	Area 5
aA6_003	12/3/2011	3/31/2012	715841	3695253	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
aA6_005	12/3/2011	3/31/2012	715931	3695171	358	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
aA6_007	12/3/2011	3/31/2012	715928	3695261	358	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
aA6_011	12/3/2011	3/31/2012	715997	3695259	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
aA6_018	12/3/2011	3/31/2012	716094	3695223	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
aA6_020	12/3/2011	3/31/2012	716092	3695308	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/2/2011	2/29/2012	715558	3694290	360	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/2/2011	2/29/2012	715558	3694210	360	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/2/2011	2/29/2012	715649	3694211	360	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/2/2011	2/29/2012	715719	3694254	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1

al Plot	Date Sampled	Date Entered	UTM Easting - Plot Center	UTM Northing - Plot Center	Bearing	Database Area	Database Area Code	Database Site	Database Site Code
	12/2/2011	2/29/2012	715780	3694294	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/2/2011	2/29/2012	715799	3694215	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/2/2011	2/29/2012	715844	3694528	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/6/2011	3/6/2012	715847	3694328	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/4/2011	3/5/2012	715850	3694208	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/6/2011	3/6/2012	715893	3694530	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/2/2011	3/1/2012	715895	3694410	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/6/2011	3/6/2012	715897	3694330	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/4/2011	3/31/2012	715899	3694191	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/5/2011	3/5/2012	715967	3694413	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/5/2011	3/6/2012	715968	3694293	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/2/2011	2/29/2012	715956	3694188	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/6/2011	3/6/2012	716018	3694524	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/5/2011	3/6/2012	716019	3694414	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/5/2011	3/6/2012	716021	3694294	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/3/2011	3/1/2012	716021	3694214	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/5/2011	3/6/2012	716106	3694496	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/2/2011	3/1/2012	716107	3694416	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/5/2011	3/6/2012	716136	3694497	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/5/2011	3/5/2012	716138	3694297	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/5/2011	3/6/2012	716139	3694217	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/5/2011	3/5/2012	716075	3694251	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/5/2011	3/6/2012	716061	3694343	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/5/2011	3/6/2012	716060	3694462	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/6/2011	3/6/2012	716060	3694527	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	12/2/2011	Not Recorded	715928	3694461	359	Cibola National Wildlife Refuge Unit 1	CNU1	CNU1 Area 1 - Research & Demo	Area 1
	11/15/2011	3/6/2012	717089	3699508	89	Cibola Valley Conservation Area	CVCA	CVCA Phase 01	Phase 01
	11/15/2011	3/6/2012	717329	3699470	89	Cibola Valley Conservation Area	CVCA	CVCA Phase 01	Phase 01
	11/15/2011	3/6/2012	717130	3699424	89	Cibola Valley Conservation Area	CVCA	CVCA Phase 01	Phase 01
	11/15/2011	3/6/2012	717411	3699360	88	Cibola Valley Conservation Area	CVCA	CVCA Phase 01	Phase 01
	11/14/2011	3/6/2012	717214	3699307	88	Cibola Valley Conservation Area	CVCA	CVCA Phase 01	Phase 01
	11/15/2011	3/6/2012	717374	3699313	88	Cibola Valley Conservation Area	CVCA	CVCA Phase 01	Phase 01
	11/14/2011	3/6/2012	717614	3699322	88	Cibola Valley Conservation Area	CVCA	CVCA Phase 01	Phase 01
	11/14/2011	3/6/2012	717694	3699326	88	Cibola Valley Conservation Area	CVCA	CVCA Phase 01	Phase 01
	11/28/2011	3/2/2012	717417	3699204	87	Cibola Valley Conservation Area	CVCA	CVCA Phase 01	Phase 01
	11/15/2011	3/6/2012	717576	3699212	87	Cibola Valley Conservation Area	CVCA	CVCA Phase 01	Phase 01
	11/15/2011	3/2/2012	717736	3699220	87	Cibola Valley Conservation Area	CVCA	CVCA Phase 01	Phase 01
	11/14/2011	3/7/2012	717218	3699122	87	Cibola Valley Conservation Area	CVCA	CVCA Phase 01	Phase 01
	11/15/2011	3/7/2012	717657	3699147	87	Cibola Valley Conservation Area	CVCA	CVCA Phase 01	Phase 01
	11/15/2011	3/7/2012	717777	3699153	87	Cibola Valley Conservation Area	CVCA	CVCA Phase 01	Phase 01
	11/14/2011	3/7/2012	717101	3699068	87	Cibola Valley Conservation Area	CVCA	CVCA Phase 01	Phase 01
	11/29/2011	3/2/2012	717381	3699083	87	Cibola Valley Conservation Area	CVCA	CVCA Phase 01	Phase 01
	11/14/2011	3/7/2012	717141	3699023	87	Cibola Valley Conservation Area	CVCA	CVCA Phase 01	Phase 01
	11/29/2011	3/2/2012	717501	3699044	87	Cibola Valley Conservation Area	CVCA	CVCA Phase 01	Phase 01
	11/15/2011	3/2/2012	717700	3699056	87	Cibola Valley Conservation Area	CVCA	CVCA Phase 01	Phase 01
	11/19/2011	3/2/2012	717074	3698912	269	Cibola Valley Conservation Area	CVCA	CVCA Phase 02	Phase 02
	11/19/2011	3/2/2012	717194	3698914	269	Cibola Valley Conservation Area	CVCA	CVCA Phase 02	Phase 02
	11/14/2011	3/5/2012	717594	3698922	269	Cibola Valley Conservation Area	CVCA	CVCA Phase 02	Phase 02
	11/14/2011	3/5/2012	717674	3698924	269	Cibola Valley Conservation Area	CVCA	CVCA Phase 02	Phase 02
	11/14/2011	3/5/2012	717794	3698926	269	Cibola Valley Conservation Area	CVCA	CVCA Phase 02	Phase 02
	11/29/2011	3/2/2012	717313	3698841	269	Cibola Valley Conservation Area	CVCA	CVCA Phase 02	Phase 02
	11/29/2011	3/2/2012	717393	3698842	269	Cibola Valley Conservation Area	CVCA	CVCA Phase 02	Phase 02
	11/29/2011	3/2/2012	717473	3698843	269	Cibola Valley Conservation Area	CVCA	CVCA Phase 02	Phase 02
	11/29/2011	3/2/2012	717075	3698795	269	Cibola Valley Conservation Area	CVCA	CVCA Phase 02	Phase 02

al Plot	Date Sampled	Date Entered	UTM Easting - Plot Center	UTM Northing - Plot Center	Bearing	Database Area	Database Area Code	Database Site	Database Site Code
	11/29/2011	3/2/2012	717275	3698798	269	Cibola Valley Conservation Area	CVCA	CVCA Phase 02	Phase 02
	11/29/2011	3/1/2012	717595	3698803	269	Cibola Valley Conservation Area	CVCA	CVCA Phase 02	Phase 02
	11/29/2011	3/2/2012	717675	3698804	269	Cibola Valley Conservation Area	CVCA	CVCA Phase 02	Phase 02
	11/29/2011	Not Recorded	717117	3698734	269	Cibola Valley Conservation Area	CVCA	CVCA Phase 02	Phase 02
	11/30/2011	3/1/2012	717477	3698741	269	Cibola Valley Conservation Area	CVCA	CVCA Phase 02	Phase 02
	11/29/2011	3/1/2012	717677	3698745	269	Cibola Valley Conservation Area	CVCA	CVCA Phase 02	Phase 02
	11/14/2011	3/5/2012	717797	3698747	269	Cibola Valley Conservation Area	CVCA	CVCA Phase 02	Phase 02
	11/29/2011	3/1/2012	717319	3698677	269	Cibola Valley Conservation Area	CVCA	CVCA Phase 02	Phase 02
	11/29/2011	3/2/2012	717639	3698684	269	Cibola Valley Conservation Area	CVCA	CVCA Phase 02	Phase 02
	11/29/2011	3/2/2012	717719	3698686	269	Cibola Valley Conservation Area	CVCA	CVCA Phase 02	Phase 02
	12/1/2011	3/1/2012	714138	3698409	178	Cibola Valley Conservation Area	CVCA	CVCA Phase 03	Phase 03
	12/1/2011	2/29/2012	714211	3698127	178	Cibola Valley Conservation Area	CVCA	CVCA Phase 03	Phase 03
	12/1/2011	3/1/2012	714217	3697967	178	Cibola Valley Conservation Area	CVCA	CVCA Phase 03	Phase 03
	12/2/2011	3/1/2012	714301	3697771	178	Cibola Valley Conservation Area	CVCA	CVCA Phase 03	Phase 03
	12/1/2011	3/1/2012	714318	3698452	178	Cibola Valley Conservation Area	CVCA	CVCA Phase 03	Phase 03
	12/1/2011	3/7/2012	714404	3697654	179	Cibola Valley Conservation Area	CVCA	CVCA Phase 03	Phase 03
	12/1/2011	3/1/2012	714439	3698374	179	Cibola Valley Conservation Area	CVCA	CVCA Phase 03	Phase 03
	12/1/2011	3/1/2012	714445	3698134	179	Cibola Valley Conservation Area	CVCA	CVCA Phase 03	Phase 03
	12/1/2011	3/1/2012	714449	3697934	179	Cibola Valley Conservation Area	CVCA	CVCA Phase 03	Phase 03
	12/1/2011	3/7/2012	714454	3697734	179	Cibola Valley Conservation Area	CVCA	CVCA Phase 03	Phase 03
	12/1/2011	3/7/2012	714512	3698178	179	Cibola Valley Conservation Area	CVCA	CVCA Phase 03	Phase 03
	12/1/2011	3/7/2012	714560	3698335	179	Cibola Valley Conservation Area	CVCA	CVCA Phase 03	Phase 03
	12/2/2011	3/1/2012	714571	3697856	179	Cibola Valley Conservation Area	CVCA	CVCA Phase 03	Phase 03
CVCA4E_045	11/15/2011	3/15/2012	716792	3699450	89	Cibola Valley Conservation Area	CVCA	CVCA Phase 04E	Phase 04E
CVCA4E_117	11/15/2011	3/15/2012	716639	3699197	89	Cibola Valley Conservation Area	CVCA	CVCA Phase 04E	Phase 04E
CVCA4E_125	11/30/2011	3/15/2012	716959	3699205	89	Cibola Valley Conservation Area	CVCA	CVCA Phase 04E	Phase 04E
CVCA4E_177	11/15/2011	3/15/2012	716765	3699039	89	Cibola Valley Conservation Area	CVCA	CVCA Phase 04E	Phase 04E
CVCA4E_232	11/30/2011	3/15/2012	716691	3698823	88	Cibola Valley Conservation Area	CVCA	CVCA Phase 04E	Phase 04E
CVCA4E_274	11/30/2011	3/15/2012	716854	3698736	89	Cibola Valley Conservation Area	CVCA	CVCA Phase 04E	Phase 04E
_002	12/1/2011	3/15/2012	714074	3698656	358	Cibola Valley Conservation Area	CVCA	CVCA Phase 04W	Phase 04W
_021	12/1/2011	3/15/2012	714189	3698580	358	Cibola Valley Conservation Area	CVCA	CVCA Phase 04W	Phase 04W
_024	12/1/2011	3/15/2012	714254	3698900	358	Cibola Valley Conservation Area	CVCA	CVCA Phase 04W	Phase 04W
_040	12/1/2011	3/15/2012	714320	3698701	358	Cibola Valley Conservation Area	CVCA	CVCA Phase 04W	Phase 04W
_045	12/1/2011	3/15/2012	714363	3698943	358	Cibola Valley Conservation Area	CVCA	CVCA Phase 04W	Phase 04W
_053	12/1/2011	3/15/2012	714375	3698623	358	Cibola Valley Conservation Area	CVCA	CVCA Phase 04W	Phase 04W
_058	12/1/2011	3/15/2012	714404	3698905	358	Cibola Valley Conservation Area	CVCA	CVCA Phase 04W	Phase 04W
_060	12/1/2011	3/15/2012	714407	3698825	358	Cibola Valley Conservation Area	CVCA	CVCA Phase 04W	Phase 04W
_065	12/1/2011	3/15/2012	714415	3698625	358	Cibola Valley Conservation Area	CVCA	CVCA Phase 04W	Phase 04W
_084	12/1/2011	3/15/2012	714538	3698868	358	Cibola Valley Conservation Area	CVCA	CVCA Phase 04W	Phase 04W
_088	12/1/2011	3/15/2012	714543	3698708	358	Cibola Valley Conservation Area	CVCA	CVCA Phase 04W	Phase 04W
	11/30/2011	3/15/2012	714660	3698811	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 05	Phase 05
	11/30/2011	3/15/2012	714689	3698892	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 05	Phase 05
	11/30/2011	3/15/2012	714747	3699094	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 05	Phase 05
	11/30/2011	3/15/2012	714749	3699014	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 05	Phase 05
	11/30/2011	3/15/2012	714753	3698774	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 05	Phase 05
	11/30/2011	3/15/2012	714755	3698694	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 05	Phase 05
	11/30/2011	3/15/2012	714814	3698656	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 05	Phase 05
	11/30/2011	3/15/2012	714876	3699217	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 05	Phase 05
	11/30/2011	3/15/2012	714878	3699097	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 05	Phase 05
	11/30/2011	3/15/2012	714882	3698857	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 05	Phase 05
	11/30/2011	3/15/2012	714941	3699295	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 05	Phase 05
	11/30/2011	3/15/2012	714944	3699135	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 05	Phase 05
	11/30/2011	3/15/2012	714954	3698696	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 05	Phase 05
	11/30/2011	3/15/2012	715066	3698621	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 06	Phase 06

al Plot	Date Sampled	Date Entered	UTM Easting - Plot Center	UTM Northing - Plot Center	Bearing	Database Area	Database Area Code	Database Site	Database Site Code
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	11/30/2011	3/15/2012	715060	3699156	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 06	Phase 06
	11/30/2011	3/15/2012	715133	3698823	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 06	Phase 06
	11/30/2011	3/15/2012	715126	3699304	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 06	Phase 06
	11/30/2011	3/15/2012	715129	3699063	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 06	Phase 06
	11/30/2011	3/15/2012	715164	3699397	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 06	Phase 06
	11/30/2011	3/15/2012	715257	3698665	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 06	Phase 06
	11/30/2011	3/15/2012	715318	3698796	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 06	Phase 06
	11/30/2011	3/15/2012	715317	3698878	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 06	Phase 06
	11/30/2011	3/15/2012	715312	3699364	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 06	Phase 06
	11/30/2011	3/15/2012	715311	3699445	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 06	Phase 06
	11/30/2011	3/15/2012	715368	3699007	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 06	Phase 06
	11/30/2011	3/15/2012	715366	3699128	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 06	Phase 06
	11/30/2011	3/15/2012	715363	3699292	359	Cibola Valley Conservation Area	CVCA	CVCA Phase 06	Phase 06
	11/9/2011	2/15/2012	729410	3730659	268	Palo Verde Ecological Reserve	PVER	PVER Phase 01	Phase 01
	11/9/2011	2/15/2012	729287	3730654	268	Palo Verde Ecological Reserve	PVER	PVER Phase 01	Phase 01
	11/9/2011	3/14/2012	729083	3730645	268	Palo Verde Ecological Reserve	PVER	PVER Phase 01	Phase 01
	11/9/2011	2/15/2012	729370	3730602	268	Palo Verde Ecological Reserve	PVER	PVER Phase 01	Phase 01
	11/9/2011	3/14/2012	729164	3730594	268	Palo Verde Ecological Reserve	PVER	PVER Phase 01	Phase 01
	11/9/2011	3/14/2012	728922	3730584	268	Palo Verde Ecological Reserve	PVER	PVER Phase 01	Phase 01
	11/9/2011	3/14/2012	729131	3730516	268	Palo Verde Ecological Reserve	PVER	PVER Phase 01	Phase 01
	11/9/2011	3/14/2012	728847	3730508	268	Palo Verde Ecological Reserve	PVER	PVER Phase 01	Phase 01
	10/18/2011	2/17/2012	728399	3730413	88	Palo Verde Ecological Reserve	PVER	PVER Phase 02	Phase 02
	11/18/2011	2/16/2012	728719	3730427	88	Palo Verde Ecological Reserve	PVER	PVER Phase 02	Phase 02
	11/8/2011	2/15/2012	728839	3730432	88	Palo Verde Ecological Reserve	PVER	PVER Phase 02	Phase 02
	11/8/2011	2/16/2012	728320	3730374	88	Palo Verde Ecological Reserve	PVER	PVER Phase 02	Phase 02
	11/8/2011	2/16/2012	728520	3730383	88	Palo Verde Ecological Reserve	PVER	PVER Phase 02	Phase 02
	11/8/2011	2/15/2012	728322	3730313	87	Palo Verde Ecological Reserve	PVER	PVER Phase 02	Phase 02
	11/8/2011	2/15/2012	728442	3730319	87	Palo Verde Ecological Reserve	PVER	PVER Phase 02	Phase 02
	11/8/2011	2/16/2012	728522	3730322	87	Palo Verde Ecological Reserve	PVER	PVER Phase 02	Phase 02
	11/8/2011	2/16/2012	728841	3730337	87	Palo Verde Ecological Reserve	PVER	PVER Phase 02	Phase 02
	10/18/2011	2/21/2012	728367	3730236	88	Palo Verde Ecological Reserve	PVER	PVER Phase 02	Phase 02
	10/18/2011	2/21/2012	728446	3730240	88	Palo Verde Ecological Reserve	PVER	PVER Phase 02	Phase 02
	10/18/2011	2/17/2012	728646	3730248	88	Palo Verde Ecological Reserve	PVER	PVER Phase 02	Phase 02
	10/18/2011	2/21/2012	728850	3730186	88	Palo Verde Ecological Reserve	PVER	PVER Phase 02	Phase 02
	10/18/2011	2/21/2012	728930	3730189	88	Palo Verde Ecological Reserve	PVER	PVER Phase 02	Phase 02
	10/18/2011	2/21/2012	728411	3730134	88	Palo Verde Ecological Reserve	PVER	PVER Phase 02	Phase 02
	10/18/2011	2/22/2012	728491	3730138	88	Palo Verde Ecological Reserve	PVER	PVER Phase 02	Phase 02
	10/18/2011	2/17/2012	728811	3730151	88	Palo Verde Ecological Reserve	PVER	PVER Phase 02	Phase 02
	11/8/2011	2/16/2012	728491	3730138	88	Palo Verde Ecological Reserve	PVER	PVER Phase 02	Phase 02
	11/11/2011	2/21/2012	728655	3730050	87	Palo Verde Ecological Reserve	PVER	PVER Phase 03	Phase 03
	11/11/2011	2/21/2012	728735	3730053	87	Palo Verde Ecological Reserve	PVER	PVER Phase 03	Phase 03
	10/18/2011	2/17/2012	728339	3729949	88	Palo Verde Ecological Reserve	PVER	PVER Phase 03	Phase 03
	11/11/2011	2/21/2012	728538	3729958	88	Palo Verde Ecological Reserve	PVER	PVER Phase 03	Phase 03
	11/11/2011	2/21/2012	728778	3729968	88	Palo Verde Ecological Reserve	PVER	PVER Phase 03	Phase 03
	11/11/2011	2/14/2012	728580	3729915	88	Palo Verde Ecological Reserve	PVER	PVER Phase 03	Phase 03
	11/11/2011	2/21/2012	728820	3729926	88	Palo Verde Ecological Reserve	PVER	PVER Phase 03	Phase 03
	11/11/2011	2/21/2012	728900	3729929	88	Palo Verde Ecological Reserve	PVER	PVER Phase 03	Phase 03
	11/11/2011	2/21/2012	728543	3729836	88	Palo Verde Ecological Reserve	PVER	PVER Phase 03	Phase 03
	11/11/2011	2/21/2012	728623	3729839	88	Palo Verde Ecological Reserve	PVER	PVER Phase 03	Phase 03
	10/17/2011	2/21/2012	728743	3729844	88	Palo Verde Ecological Reserve	PVER	PVER Phase 03	Phase 03
	10/18/2011	2/17/2012	728347	3729758	87	Palo Verde Ecological Reserve	PVER	PVER Phase 03	Phase 03
	10/17/2011	2/21/2012	728626	3729770	87	Palo Verde Ecological Reserve	PVER	PVER Phase 03	Phase 03
	10/17/2011	2/21/2012	728826	3729779	87	Palo Verde Ecological Reserve	PVER	PVER Phase 03	Phase 03

al Plot	Date Sampled	Date Entered	UTM Easting - Plot Center	UTM Northing - Plot Center	Bearing	Database Area	Database Area Code	Database Site	Database Site Code
	10/18/2011	2/17/2012	728467	3729731	88	Palo Verde Ecological Reserve	PVER	PVER Phase 03	Phase 03
	10/17/2011	2/20/2012	728987	3729754	88	Palo Verde Ecological Reserve	PVER	PVER Phase 03	Phase 03
	10/18/2011	2/17/2012	728352	3729655	87	Palo Verde Ecological Reserve	PVER	PVER Phase 03	Phase 03
	10/18/2011	2/17/2012	728471	3729660	87	Palo Verde Ecological Reserve	PVER	PVER Phase 03	Phase 03
	10/17/2011	Not Recorded	728591	3729666	87	Palo Verde Ecological Reserve	PVER	PVER Phase 03	Phase 03
	10/17/2011	2/17/2012	728671	3729669	87	Palo Verde Ecological Reserve	PVER	PVER Phase 03	Phase 03
	10/17/2011	2/20/2012	728831	3729676	87	Palo Verde Ecological Reserve	PVER	PVER Phase 03	Phase 03
	10/17/2011	2/21/2012	728911	3729680	87	Palo Verde Ecological Reserve	PVER	PVER Phase 03	Phase 03
	11/10/2011	2/22/2012	729958	3731115	87	Palo Verde Ecological Reserve	PVER	PVER Phase 04	Phase 04
	11/10/2011	Not Recorded	729884	3731017	87	Palo Verde Ecological Reserve	PVER	PVER Phase 04	Phase 04
	11/10/2011	2/21/2012	730164	3731029	87	Palo Verde Ecological Reserve	PVER	PVER Phase 04	Phase 04
	11/10/2011	2/21/2012	730443	3731042	87	Palo Verde Ecological Reserve	PVER	PVER Phase 04	Phase 04
	11/10/2011	2/22/2012	729926	3730978	88	Palo Verde Ecological Reserve	PVER	PVER Phase 04	Phase 04
	11/10/2011	2/22/2012	730046	3730983	88	Palo Verde Ecological Reserve	PVER	PVER Phase 04	Phase 04
	11/10/2011	2/21/2012	730526	3731004	88	Palo Verde Ecological Reserve	PVER	PVER Phase 04	Phase 04
	11/10/2011	2/22/2012	730569	3730928	87	Palo Verde Ecological Reserve	PVER	PVER Phase 04	Phase 04
	11/10/2011	2/22/2012	729930	3730840	87	Palo Verde Ecological Reserve	PVER	PVER Phase 04	Phase 04
	11/10/2011	2/22/2012	730090	3730847	87	Palo Verde Ecological Reserve	PVER	PVER Phase 04	Phase 04
	11/10/2011	2/22/2012	730330	3730858	87	Palo Verde Ecological Reserve	PVER	PVER Phase 04	Phase 04
	11/10/2011	2/22/2012	730213	3730803	87	Palo Verde Ecological Reserve	PVER	PVER Phase 04	Phase 04
	11/10/2011	2/22/2012	730313	3730808	87	Palo Verde Ecological Reserve	PVER	PVER Phase 04	Phase 04
	11/10/2011	2/22/2012	730010	3730704	87	Palo Verde Ecological Reserve	PVER	PVER Phase 04	Phase 04
	11/9/2011	2/15/2012	729896	3730599	86	Palo Verde Ecological Reserve	PVER	PVER Phase 04	Phase 04
	11/9/2011	2/14/2012	729616	3730694	87	Palo Verde Ecological Reserve	PVER	PVER Phase 04	Phase 04
	11/9/2011	2/15/2012	729500	3730628	87	Palo Verde Ecological Reserve	PVER	PVER Phase 04	Phase 04
	11/9/2011	2/16/2012	729580	3730632	87	Palo Verde Ecological Reserve	PVER	PVER Phase 04	Phase 04
	11/9/2011	2/16/2012	729779	3730643	87	Palo Verde Ecological Reserve	PVER	PVER Phase 04	Phase 04
	11/9/2011	Not Recorded	729625	3730546	87	Palo Verde Ecological Reserve	PVER	PVER Phase 04	Phase 04
	11/12/2011	2/16/2012	731124	3731929	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/12/2011	2/16/2012	731246	3731876	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/12/2011	2/16/2012	731406	3731883	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/12/2011	2/16/2012	731765	3731898	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/12/2011	2/16/2012	731810	3731831	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/12/2011	2/16/2012	731331	3731758	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/12/2011	2/16/2012	731491	3731765	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/12/2011	2/16/2012	731611	3731770	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/12/2011	2/16/2012	731813	3731759	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/12/2011	2/16/2012	731258	3731636	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/12/2011	2/16/2012	731323	3731536	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/12/2011	2/15/2012	731402	3731540	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/11/2011	2/17/2012	730806	3731442	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/12/2011	2/16/2012	731445	3731472	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/12/2011	2/16/2012	731565	3731478	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/11/2011	2/16/2012	731089	3731406	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/12/2011	2/16/2012	731288	3731415	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/11/2011	2/17/2012	730728	3731367	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/11/2011	2/16/2012	730973	3731294	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/11/2011	2/17/2012	730735	3731237	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/11/2011	2/16/2012	731214	3731259	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/11/2011	2/15/2012	731374	3731267	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/11/2011	2/16/2012	730977	3731155	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/11/2011	2/16/2012	731297	3731172	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/11/2011	2/17/2012	730860	3731087	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/11/2011	2/16/2012	731140	3731102	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05

al Plot	Date Sampled	Date Entered	UTM Easting - Plot Center	UTM Northing - Plot Center	Bearing	Database Area	Database Area Code	Database Site	Database Site Code
	11/12/2011	2/16/2012	730744	3731020	87	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/12/2011	2/14/2012	730868	3730970	86	Palo Verde Ecological Reserve	PVER	PVER Phase 05	Phase 05
	11/13/2011	2/16/2012	731007	3732760	87	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/13/2011	2/17/2012	731128	3732765	87	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/12/2011	2/17/2012	731783	3732794	87	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/13/2011	3/15/2012	731864	3732797	87	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/13/2011	2/17/2012	731988	3732803	87	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/13/2011	Not Recorded	731132	3732715	88	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/13/2011	3/15/2012	731420	3732727	88	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/13/2011	2/17/2012	732032	3732754	88	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/13/2011	2/16/2012	731054	3732634	87	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/12/2011	2/17/2012	731339	3732647	87	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/13/2011	Not Recorded	731503	3732654	87	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/12/2011	Not Recorded	731912	3732672	87	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/13/2011	3/15/2012	731102	3732600	88	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/13/2011	3/31/2012	731264	3732606	88	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/12/2011	2/16/2012	731992	3732636	88	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/13/2011	3/15/2012	731345	3732518	88	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/13/2011	3/15/2012	731585	3732528	88	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/13/2011	3/15/2012	731706	3732533	88	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/13/2011	3/15/2012	731866	3732539	88	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/12/2011	2/16/2012	732027	3732545	88	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/13/2011	Not Recorded	731505	3732492	88	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/13/2011	3/15/2012	731908	3732508	88	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/13/2011	2/17/2012	731989	3732511	88	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/19/2011	2/17/2012	731196	3732340	87	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/13/2011	3/15/2012	731648	3732360	87	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/13/2011	2/16/2012	731729	3732364	87	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/12/2011	2/16/2012	732015	3732377	87	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/12/2011	Not Recorded	731077	3732295	88	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/12/2011	2/17/2012	731319	3732306	88	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/13/2011	3/15/2012	731601	3732318	88	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/12/2011	2/17/2012	731241	3732213	87	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/12/2011	2/17/2012	731376	3732164	88	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/12/2011	2/17/2012	731786	3732180	88	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/12/2011	2/17/2012	731089	3732065	88	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/12/2011	2/17/2012	731370	3732076	88	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/12/2011	2/17/2012	731530	3732082	88	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/12/2011	2/17/2012	731651	3732087	88	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/12/2011	2/17/2012	731974	3732100	88	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/12/2011	2/17/2012	731299	3732029	88	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06
	11/12/2011	2/17/2012	731836	3732051	88	Palo Verde Ecological Reserve	PVER	PVER Phase 06	Phase 06

Appendix IV

Long Term Vegetation Monitoring of MSCP Restoration Sites

Appendix IV-1

Beal Lake Habitat Restoration Demonstration Site

LONG TERM VEGETATION MONITORING OF MSCP RESTORATION SITES
Individual Site Reports
10/20/11

Project: Lower Colorado River Multi-Species Conservation Program (LCR MSCP)
Site: Beal Lake Habitat Restoration Demonstration Site
Dates of Survey: September 12, 2011 – September 16, 2011 and October 27, 2011 – November 4, 2011
Observers: Todd Caplan (Principal Investigator), Matt Grabau (Project Supervisor), Chad McKenna (Data Manager), Will Widener (Field Lead), Daniel Bunting, Talise Dow, Cyrus Bullock

I Summary of Field Activities

During an initial training session (September 12-16, 2011), the project Principal Investigator, Supervisor, and Data Manager refined field data collection methods and trained crew leaders at the Beal Lake Habitat Restoration Demonstration Site (Beal) at Havasu National Wildlife Refuge. During an eight day field session starting September 27, 2011 and ending October 4, two teams of two field personnel completed vegetation data collection at Beal. An average of approximately 2 plots by each team was completed per day; all the plots within the site were surveyed. Average time of arrival to the site was 0730 hours and average time of departure was 1700 hours. Weather conditions ranged from abundant sunshine and 105 degrees Fahrenheit heat for a majority of the survey to thunderstorms and rain during three days of the survey. No major obstacles or unusual observations occurred during the survey. Corners of each primary plot were marked with ½" re-bar and flagged to facilitate future plot setup. Centers of newly-established plots were marked with a center fence post and 5/8" re-bar with a stamped aluminum post-cap.

II Obstacles

Minor obstacles encountered at the site which may have affected the project schedule and/or should be considered for future survey efforts include:

- Initially, many clarifications and revisions were required for the field methods and field forms.
- Numerous plots mapped as having the center marked were not marked and/or center posts were not located. In such instances, the centers and corners of the primary plots were marked as described above.
- Plot BEAL_085 was shifted to the southwest to eliminate overlap with BEAL_056.
- One large Western Diamondback Rattlesnake (*Crotalus atrox*) was spotted in the roadway during the field surveys.
- Plots dominated by thick mesquite (*Prosopis pubescens* and *Prosopis glandulosa*) and arrowweed (*Pluchea sericea*) slowed down plot set-up and data collection. As a result, the average number of plots per team per day was reduced to 2 from the initially-estimated 4.
- Incidental leaks (incompletely-closed alfalfa valves) in the irrigation outlets partially flooded two plots.
- Initially the team received the wrong key for the refuge entry gate. A second trip was required to the refuge headquarters in Needles, California to obtain the correct key.

III Habitat

Habitat types encountered and surveyed at the site include:

- Plots with a dominant cottonwood (*Populous fremontii*) overstory with mixed mesquite understory and scattered willows (*Salix* sp.).
- Plots with dominant mesquite overstory with dominant arrowweed understory with scattered willows and baccharis (*Baccharis* sp.).
- Very few plots within the site contain herbaceous species or tamarix (*Tamarix* sp.).
- Excluding active irrigation and irrigation leaks, no water features within the plots.

IV Other Considerations

Other considerations for the field site which may require swift management action include:

- One plot (BEAL_091) contained small areas of buffelgrass (*Pennisetum ciliare*), considered a prohibited, regulated and restricted noxious weed in Arizona.
- Leaking irrigation outlets partially flooded a few sample plots.
- Abundant sign (prints, scat, odor) of feral pigs was observed throughout the project area, with extensive soil and vegetation disturbance apparent in some areas (e.g. Field K).
- Plots BEAL_048 and BEAL_056 overlap with areas cleared of vegetation for mist net placement.

Appendix IV-2

Bill Williams River National Wildlife Refuge; Reference Site

LONG TERM VEGETATION MONITORING OF MSCP RESTORATION SITES
Individual Site Reports
10/20/11

Project: Lower Colorado River Multi-Species Conservation Program (LCR MSCP)
Site: Bill Williams River National Wildlife Refuge; Reference Site
Dates of Survey: October 11, 2011 – October 16, 2011
Observers: Will Widener (Field Lead), Daniel Bunting, Talise Dow, Cyrus Bullock, Zsuzsi Kovacs, Andrew Alderete, Lauren Cmiel , Claire Nash

I Summary of Field Activities

During a six day field session starting October 1, 2011 and ending October 6, four teams of two field personnel completed vegetation data collection at the Bill Williams River National Wildlife Refuge (BWRNWR) near the confluence with Mineral Wash. An average of approximately 2 plots by each team was completed per day; all the plots within the site were surveyed. The team camped just outside the boundary of the refuge within Bureau of Land Management (BLM) property and hiked to the monitoring plots within the refuge. Time of arrival to the plots varied depending on hiking distance and ability to locate the center of the plots within dense vegetation. An average work day, including hiking to and from the plots and data collection, lasted approximately 10 hours. Weather conditions consisted of sunshine and temperatures in the 90's (degrees Fahrenheit) for the duration of the survey. The primary constraints for completion of more plots per day were 1) hiking distance required to arrive at some plots, 2) dense vegetation encountered while hiking (i.e. no established trails), and 3) dense mid and understory live and dead vegetation layers which caused difficulty regarding traveling to, setting up, and surveying plots. No other major obstacles or unusual observations occurred during the survey. Upon BWRNWR request, the plots were not permanently marked and flagging was collected after each plot was surveyed.

II Obstacles

Minor obstacles encountered at the site which may have affected the project schedule and/or should be considered for future survey efforts include:

- Preparation required for dry camping in Mineral Wash.
- Difficulty in passage within the refuge due to areas dominated by salt cedar (*Tamarix* sp.), usually containing a lot of dead and down woody debris.
- Limited access to plots.
- Numerous water crossings.
- A few plots dominated by thick mesquite (*Prosopis glandulosa*).
- Difficult hiking conditions at times.

However, all the above mentioned conditions were addressed in the Tool Box Safety Meeting with the entire survey team prior to the start of the survey.

III Habitat

Habitat types encountered and surveyed at the site include:

- Plots with a dominant cottonwood (*Populous fremontii*) overstory with mixed mesquite understory and scattered willows (*Salix gooddingii*).
- Plots dominated by honey mesquite (*Prosopis glandulosa*) with scattered tamarix. No screwbean mesquite captured in any plots, though a few scattered individuals were observed between plots.
- Plots dominated by tamarix with scattered mesquite.
- Some plots containing herbaceous species.

- Numerous plots including water features such as the Bill Williams River, backwater channels, pools created behind beaver dams, and other pools of open water, which make for excellent habitat for various species of MSCP interest.
- More herbaceous vegetation was observed at the site compared to Beal Lake.
- No plots contained coyote willow, but a few scattered individuals were observed between plots.

IV Other Considerations

Other considerations for the field site which may require swift management action include:

- Extensive live tamarix and accumulation of much dead and down woody debris may pose a fire risk within the refuge.
- Spanish false fleabane (*Pulicaria paludosa*), a non-native and potentially invasive species was observed at Bill Williams River. This species was recorded in plots 002, 026, and 031. It was abundant where present, but only present in some canopy openings.

Appendix IV-3

Cibola National Wildlife Refuge Unit #1

LONG TERM VEGETATION MONITORING OF MSCP RESTORATION SITES
Individual Site Reports
12/6/11

Project: Lower Colorado River Multi-Species Conservation Program (LCR MSCP)
Site: Cibola National Wildlife Refuge Unit #1
Dates of Survey: December 2 – December 6, 2011
Observers: Will Widener (Field Lead), Matt Koons, Talise Dow, Cyrus Bullock, Zsuzsi Kovacs, Andrew Alderete, Lauren Cmiel , Claire Nash

I Summary of Field Activities

During a five day field session (December 2 through December 6, 2001), four teams of two field personnel completed vegetation data collection at the Cibola National Wildlife Refuge (NWR) Unit #1. Vegetation surveys within the refuge consisted entirely of "intensive plots" (i.e. full vegetation monitoring protocol); the survey did not include any "reduced effort plots". The project site consists of 4 distinct units:

- Cibola Area 6
- Cibola Nature Trail (CNT)
- Cibola Mass Planting Demonstration (CMP)
- Cibola Cranes Roost (CCrane)

Two additional riparian areas exist within Cibola NWR Unit #1, but were not included in survey efforts—"Seed Feasibility Study" and "Cottonwood Genetics Study."

A total of 54 intensive plots were surveyed during the 2011 sampling period within the 4 units. Plots not monitored during 2011 were:

- CCrane plots 3, 9, 17, 20, 29, 44, 46, 52, and 54.

A majority of the plots were previously staked with a center T- post and two corners with ½ inch rebar. During this 2011 field session, we installed ½ inch rebar and flagging at all four plot corners of most plots. **Exceptions to this plot staking included**:

- Plots within the CNT were not permanently marked.
- Plots within Area 6 had not been previously marked. We marked center points of all the plots with T-posts and engraved caps and the corners marked with ½ inch rebar and flagging. Only 2 corners of plot 005 were marked because two corners fell within an alfalfa field.

Weather consisted of mostly sunny conditions with wind and low temperatures in the 30's and high temperatures in the 60's (degrees Fahrenheit). No major obstacles or unusual observations occurred during the survey.

II Obstacles

Minor obstacles encountered at the site which may have affected the project schedule and/or should be considered for future survey efforts include:

- Plots dominated by thick seep willow (*Baccharis salicifolia*) and/or screwbean and honey mesquite (*Prosopis pubescens* and *Prosopis glandulosa*) within the Nature Trail.
- Difficulty in finding previous plots. It is unclear if they were inconsistently marked or if coordinates were incorrectly recorded during previous survey years. Although most center caps and t-posts were found, others could not be located, or sometimes t-posts were located without center caps. .

III Habitat

Habitat types encountered and surveyed at the site include:

- Area 6 is dominated by cottonwood (*Populous fremontii*) overstory with little understory vegetation.
- Plots within the CNT are dominated by cottonwood, Gooding's willow (*Salix gooddingii*), and/or seep willow with scattered mesquite (honey and screwbean) and Johnson grass (*Sorghum halepense*).
- Plots within CCrane are dominated by cottonwood, Gooding's willow, and/or mesquite (honey and screwbean).
- Plots within CMP are dominated by cottonwood.
- No noxious weeds or Spanish false fleabane (*Pulicaria paludosa*) were identified within any of the plots.
- Tamarix (*Tamarix* sp.) was identified within a few plots, but was not prevalent within the site.

IV Other Considerations

Other considerations for the field site which may require swift management action include:

- None

Appendix IV-4

Cibola Valley Conservation Area (CVCA)

LONG TERM VEGETATION MONITORING OF MSCP RESTORATION SITES
Individual Site Reports
12/2/11

Project: Lower Colorado River Multi-Species Conservation Program (LCR MSCP)
Site: Cibola Valley Conservation Area (CVCA)
Dates of Survey: November 14-15; November 29 – December 2, 2011
Observers: Will Widener (Field Lead), Matt Koons, Talise Dow, Cyrus Bullock, Zsuzsi Kovacs, Andrew Alderete, Lauren Cmiel , Claire Nash

I Summary of Field Activities

During two field sessions totaling six days (November 14-15 and November 29 through December 2, 2001), four teams of two field personnel completed vegetation data collection at the Cibola Valley Conservation Area (CVCA). Vegetation surveys included "intensive plots" (i.e. full vegetation monitoring protocol) for areas which were planted prior to 2010 and "reduced effort plots" for areas planted with mesquite. A total of 51 intensive plots and 45 reduced effort plots were surveyed during this CY 2011 monitoring effort.

Plots not monitored during 2011 monitoring included:

- CVCA phase 1 plots 93, 102, and 109.
- CVCA phase 3 plots 14, 16, 73, 95, and 131.
- CVCA phase 4E plots 24 and 81.

A majority of the plots were previously staked with a center T- post and two corners with ½ inch rebar. During this CY 2011 field session, we installed ½ inch rebar and flagging at all four plot corners of most plots. **Exceptions to this plot staking included**:

- The center points or corners of Phase 6 plots are not marked and it was requested that they not be marked because of threat to plowing equipment.
- The center points of a majority of phase 4W, 4E, and 5 plots were previously marked with T-posts and engraved caps. Plots with center points within plow rows are not marked and by request were not marked because of threat to plowing equipment. None of the corners were previously marked or were marked during the 2011 survey by request.

Weather consisted of mostly sunny conditions and temperatures in the 70's and 80's (degrees Fahrenheit) during the first four days of the survey. The last two days of the survey consisted of overcast skies and gusty winds. No major obstacles or unusual observations occurred during the survey.

II Obstacles

Minor obstacles encountered at the site which may have affected the project schedule and/or should be considered for future survey efforts include:

- The irrigation season continued into the first field monitoring effort. This was an issue for the first two days of field work, when plots within flooded irrigation checks had to be avoided. The irrigation season ended after those first two days. In future monitoring years, the irrigation contractor should be contacted in advance to ensure access to all plots.

III Habitat

Habitat types encountered and surveyed at the site include:

- Phase 1 and 2 plots are dominated by cottonwood (*Populous fremontii*), Gooding's willow (*Salix gooddingii*), and/or coyote willow *(Salix exigua*).
- Phase 3 plots are dominated by cottonwood with one plot (CVCA3_101) dominated by honey mesquite (*Prosopis glandulosa*).
- Phase 4W, 4E, 5, and 6 plots are dominated by honey mesquite and quail bush (*Atriplex lentiformis*). Numerous quail bush seedlings were observed.
- No noxious weeds or Spanish false fleabane (*Pulicaria paludosa*) were identified within any of the plots.
- Tamarix (*Tamarix* sp.) and arrowweed (*Pluchea sericea)* was identified within a few plots, but was not prevalent within the site.
- Salt heliotrope (*Heliotropium curassavicum*) was commonly found scattered in the mesquite plots, but never with high densities.

IV Other Considerations

Other considerations for the field site which may require swift management action include:

- Mowing of rows in between the trenches at the mesquite plots (Phase 4W, 4E, 5 and 6) create habitat fragmentation and possibly disturbs some of the target species for the MSCP. Additionally, salt heliotrope appears to prefer these flat sandy rows in between the trenches and does not grow as well in the trenches. When salt heliotrope is mowed, the food source for adult MacNeill's Sootywing (*Hesperopsis gracielae*), a MSCP target species, might be reduced.

Appendix IV-5

Palo Verde Ecological Reserve

LONG TERM VEGETATION MONITORING OF MSCP RESTORATION SITES
Individual Site Reports
11/23/11

Project: Lower Colorado River Multi-Species Conservation Program (LCR MSCP)
Site: Palo Verde Ecological Reserve
Dates of Survey: October 17-18 and November 8-13, 2011
Observers: Will Widener (Field Lead), Matt Koons, Talise Dow, Cyrus Bullock, Zsuzsi Kovacs, Andrew Alderete, Lauren Cmiel , Claire Nash

I Summary of Field Activities

During two field sessions totaling eight days (October 17 - 18, 2001; November 8 - 13, 2001), four teams of two field personnel completed vegetation data collection at the Palo Verde Ecological Reserve (PVER). Vegetation surveys included "intensive plots" (i.e. full vegetation monitoring protocol) for areas which were planted prior to 2010 and "reduced effort plots" for areas planted in 2010 or 2011. A total of 95 intensive plots and 67 reduced effort plots were surveyed during this CY 2011 monitoring effort. Plots eliminated from 2011 monitoring included PVER Phase 5 plots 132, 105, 5, 57, 277, 322, 306, 146, 222, 300, 168, 200, and 185.

A majority of the plots were previously staked with a center T- post and two corners with ½ inch rebar. During this CY 2011 field session, we installed ½ inch rebar and flagging at all four plot corners of most plots. Center points that were not previously staked were marked either with T-post or with ¾ inch rebar and flagging. **Exceptions to this plot staking included**:

- Corners of the primary plots in PVER Phase 1 plots 009, 020, 004, 015, 024, 039 and 001 were not marked because we ran out of rebar. Corners for these plots will be staked with rebar during CY 2012 field monitoring.
- Only 2 corners of PVER Phase 2 plot 012 were marked because we ran out of rebar. The two remaining corners will be marked during the CY 2012 field monitoring.
- Center points and the primary corners within the PVER 5 plots were not previously marked. Thus, we marked the center of the plots with fence posts or ¾" rebar and flagging.
- None of the plots within the PVER site were previously marked with stamped aluminum post-caps. Engraved caps will be installed at plots within PVER Phase 1 and PVER Phase 6 in December 2011. However, marking of Phase 2 through Phase 5 was not included in the SOW, so we will not place engraved caps at these plots during this CY 2011 monitoring session.

Weather consisted of mostly sunny conditions and temperatures in the 80's (degrees Fahrenheit) during the first session and 70's during the second session. No major obstacles or unusual observations occurred during the survey.

II Obstacles

Minor obstacles encountered at the site which may have affected the project schedule and/or should be considered for future survey efforts include:

- Flood irrigation management of several plots was occurring during this vegetation monitoring effort. Those plots were under water and could not be surveyed until the water levels receded.
- Monitoring was implemented during bird hunting season, so we were instructed to avoid certain access roads in navigating to certain plots.

III Habitat

Habitat types encountered and surveyed at the site include:

- Plots with a dominant cottonwood (*Populous fremontii*) overstory with scattered coyote and Gooding's willow (*Salix exigua* and *S. gooddingii*, respectively).
- Plots with a mix of cottonwoods and willows (Gooding's and coyote willow).
- Plots dominated by cottonwoods.
- Plots dominated by willows (both species).
- Plots dominated by quailbush (*Atriplex lentiformis*), especially within some plots in PVER 1.
- Plots with an understory dominated by alfalfa (*Medicago sativa*), especially within PVER 5 and PVER 6.
- Plots with variable cover of Bermuda grass (*Cynodon dactylon*).
- A non-native plant of interest, Spanish false fleabane (*Pulicaria paludosa*), was identified within plot PVER6_001.
- Mesquite (*Prosopis glandulosa*) and arrowweed (*Pluchea sericea)* was identified within a few plots, but was not prevalent within the site.

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IV Other Considerations

Other considerations for the field site which may require swift management action include:

- Monitoring population trends of non-native Spanish false fleabane (*Pulicaria paludosa*).

Appendix V

Plot Location Maps

Appendix V-1

Beal Lake Conservation Area Map

2011 Vegetation Monitoring Plots:
Beal Lake Conservation Area

Legend

Field Name **2011 Vegetation Plot** Reduced

Intensive

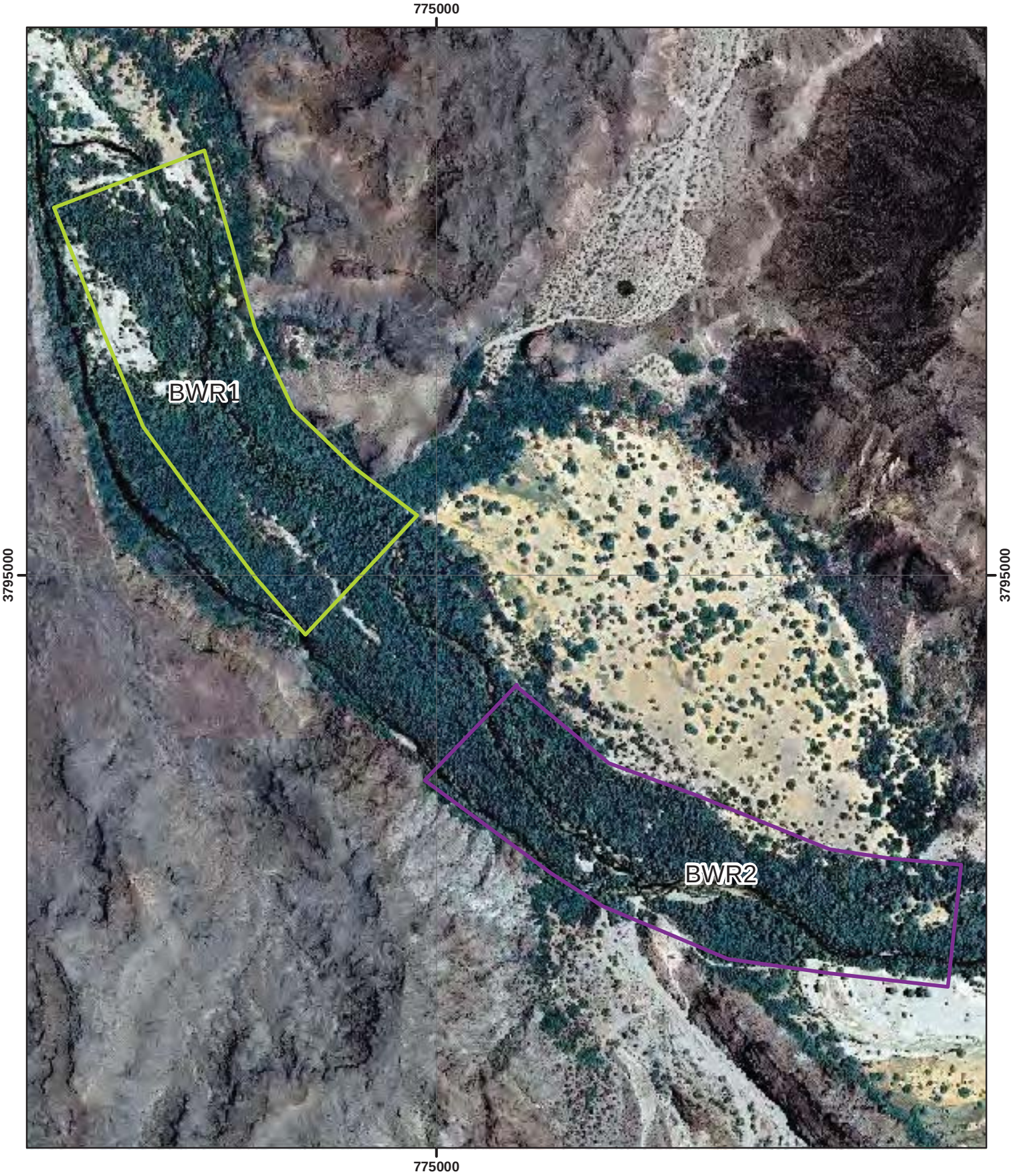
0 250 500 Feet

Map created by Chad McKenna of GeoSystems Analysis, Inc. on April 30, 2012. Grid projection = UTM, NAD 1983, Zone 11N, meters.

Appendix V-2

Bill Williams River East Maps

2011 Vegetation Monitoring Plots:
Bill Williams River East Phases



Legend

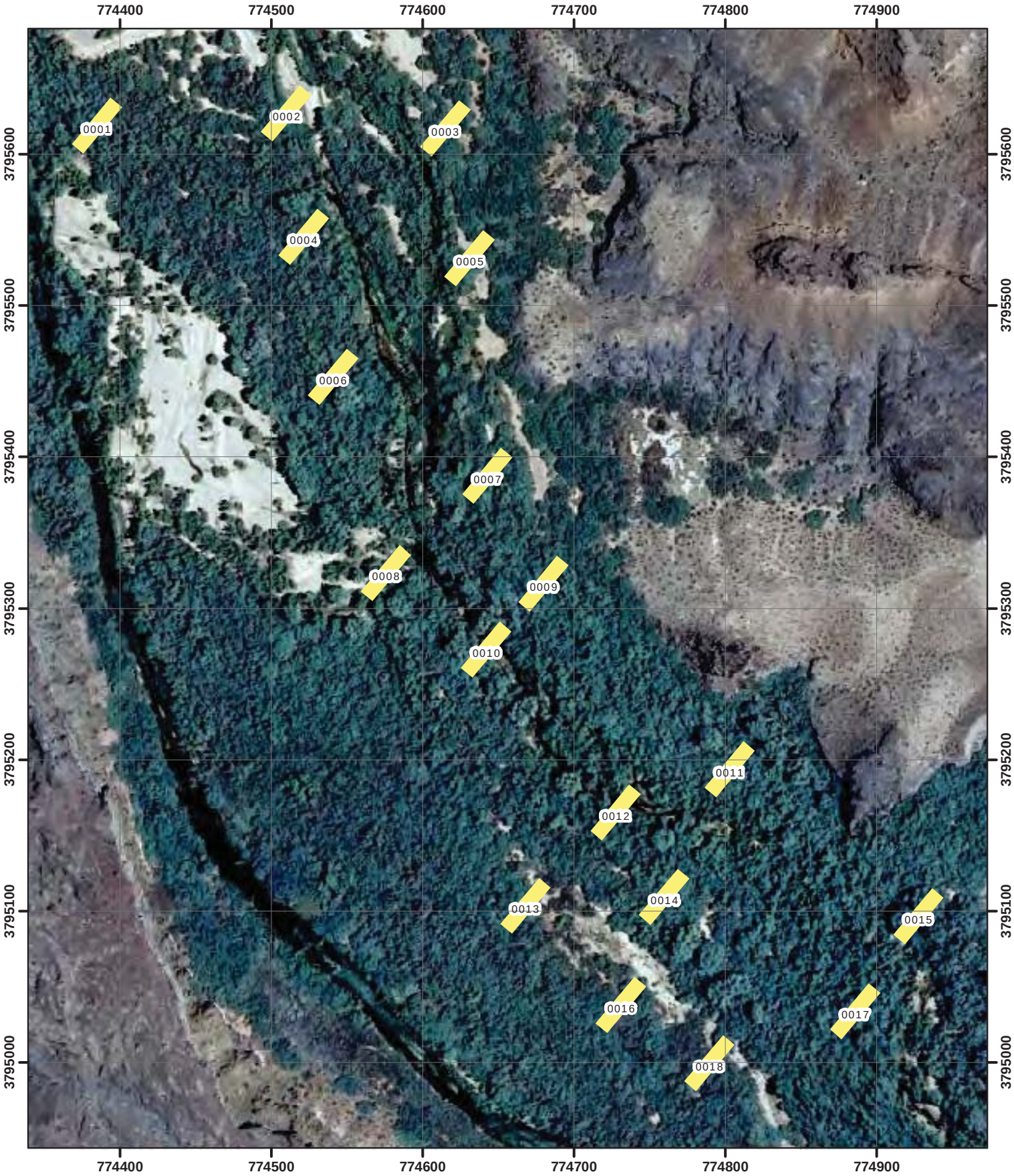
Phase Boundaries 2

1

0 1,250 2,500 Feet

Source: Based on site delineations provided by Reclamation during August 2011.
Map created by Chad McKenna of GeoSystems Analysis, Inc. on
April 30, 2012. Grid projection = UTM, NAD 1983, Zone 11N, meters.

2011 Vegetation Monitoring Plots:
Bill Williams River, Cougar Point, Phase 01



Legend

2011 Vegetation Plot Reduced

Intensive

0 250 500 Feet

Map created by Chad McKenna of GeoSystems Analysis, Inc. on April 30, 2012. Grid projection = UTM, NAD 1983, Zone 11N, meters.

2011 Vegetation Monitoring Plots:
Bill Williams River, Esquerra Ranch, Phase 02

Legend

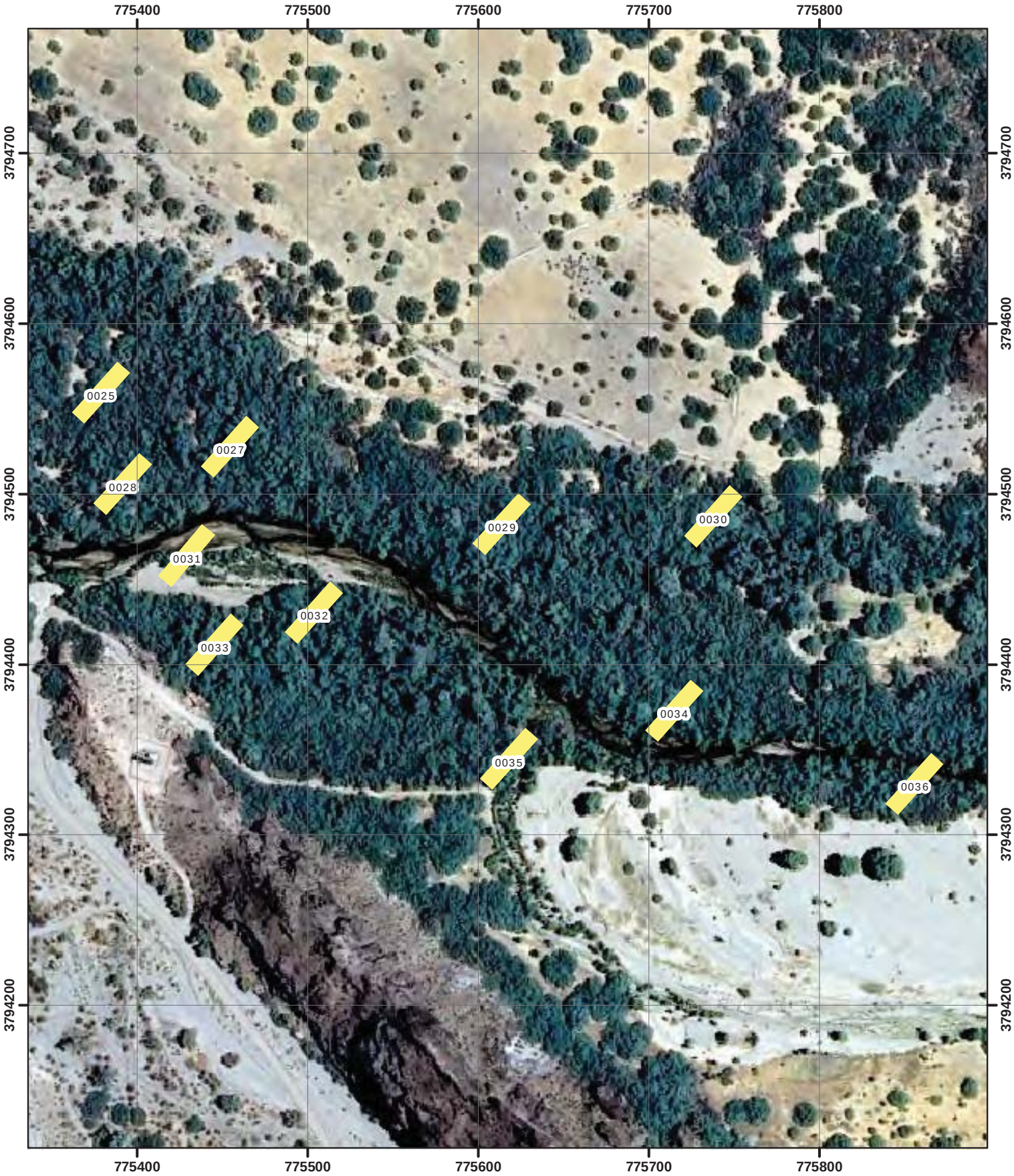
2011 Vegetation Plot Reduced

Intensive

0 250 500 Feet

Map created by Chad McKenna of GeoSystems Analysis, Inc. on April 30, 2012. Grid projection = UTM, NAD 1983, Zone 11N, meters.

2011 Vegetation Monitoring Plots:
Bill Williams River, Mineral Wash, Phase 02



Legend

2011 Vegetation Plot Reduced

Intensive

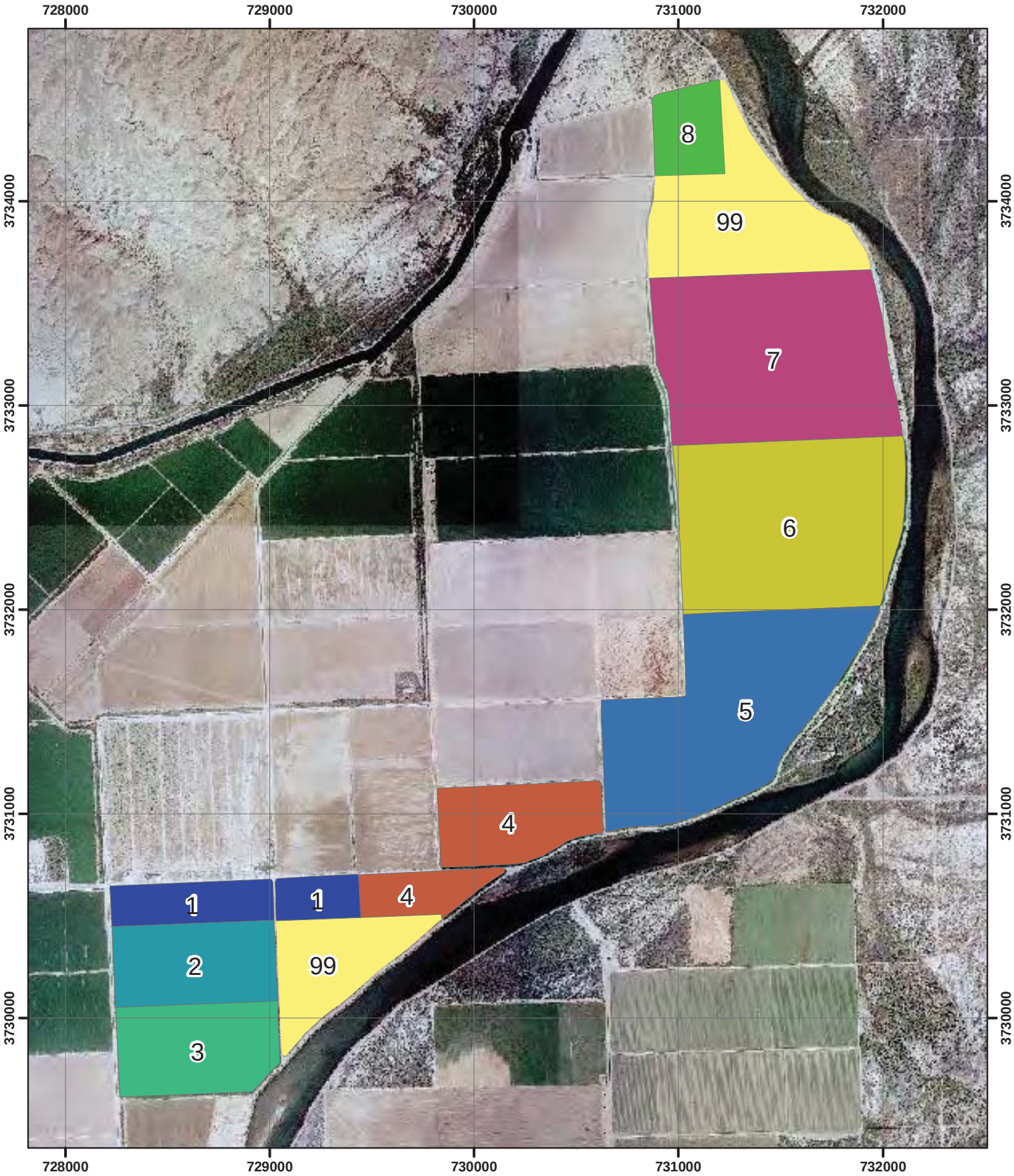
0 250 500 Feet

Map created by Chad McKenna of GeoSystems Analysis, Inc. on April 30, 2012. Grid projection = UTM, NAD 1983, Zone 11N, meters.

Appendix V-3

Palo Verde Ecological Reserve Maps

2011 Vegetation Monitoring Plots:
Palo Verde Ecological Reserve Management Phases



Legend

Phase 1 2 3 4 5 6 7 8 N/A

0 1,250 2,500 5,000 Feet

Source: Based on site delineations provided by Reclamation during September 2011.
Map created by Chad McKenna of GeoSystems Analysis, Inc. on
April 30, 2012. Grid projection = UTM, NAD 1983, Zone 11N, meters.

2011 Vegetation Monitoring Plots:
Palo Verde Ecological Reserve, Phase 01

Legend

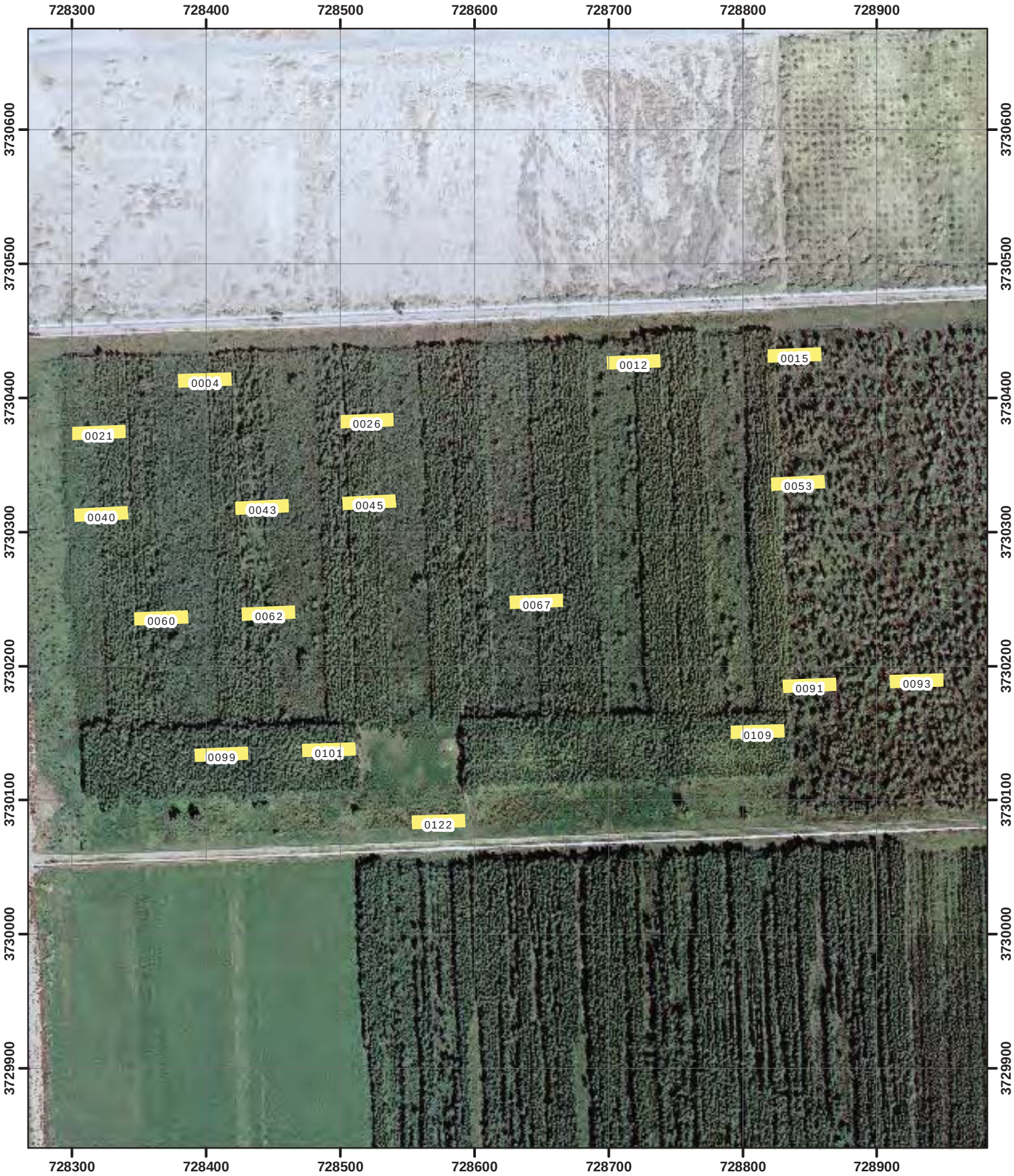
2011 Vegetation Plot Reduced

Intensive

0 250 500 Feet

Map created by Chad McKenna of GeoSystems Analysis, Inc. on April 30, 2012. Grid projection = UTM, NAD 1983, Zone 11N, meters.

2011 Vegetation Monitoring Plots:
Palo Verde Ecological Reserve, Phase 02



Legend

2011 Vegetation Plot Reduced

Intensive

0 250 500 Feet

Map created by Chad McKenna of GeoSystems Analysis, Inc. on April 30, 2012. Grid projection = UTM, NAD 1983, Zone 11N, meters.

2011 Vegetation Monitoring Plots:
Palo Verde Ecological Reserve, Phase 03

Legend

2011 Vegetation Plot Reduced

Intensive

0 250 500 Feet

Map created by Chad McKenna of GeoSystems Analysis, Inc. on April 30, 2012. Grid projection = UTM, NAD 1983, Zone 11N, meters.

2011 Vegetation Monitoring Plots:
Palo Verde Ecological Reserve, Phase 04

Legend

2011 Vegetation Plot Reduced

Intensive

0 250 500 1,000 Feet

Map created by Chad McKenna of GeoSystems Analysis, Inc. on April 30, 2012. Grid projection = UTM, NAD 1983, Zone 11N, meters.

2011 Vegetation Monitoring Plots:
Palo Verde Ecological Reserve, Phase 05

Legend

2011 Vegetation Plot Reduced

Intensive

0 250 500 1,000 Feet

Map created by Chad McKenna of GeoSystems Analysis, Inc. on April 30, 2012. Grid projection = UTM, NAD 1983, Zone 11N, meters.

2011 Vegetation Monitoring Plots:
Palo Verde Ecological Reserve, Phase 06

Legend

2011 Vegetation Plot Reduced

Intensive

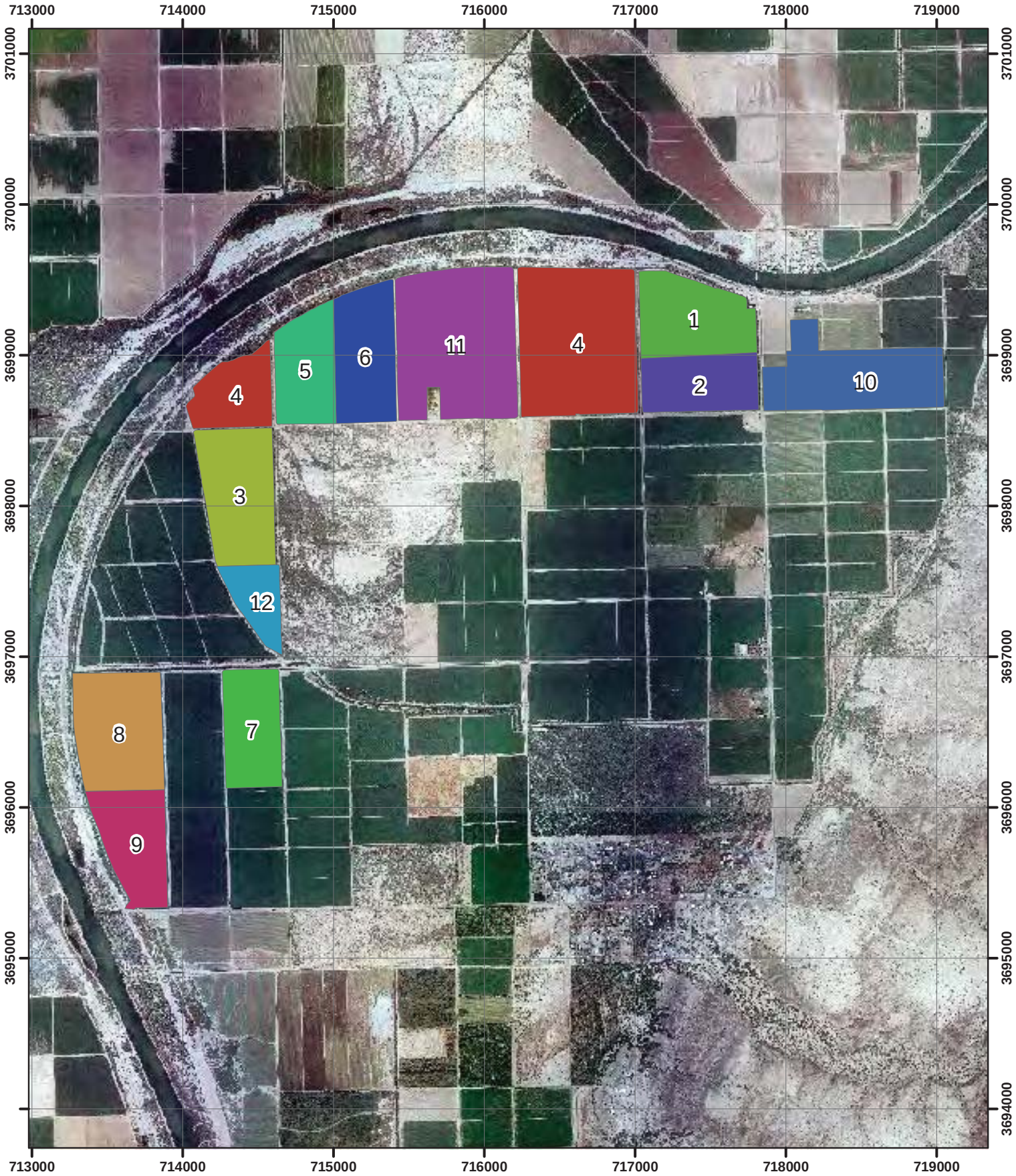
0 250 500 1,000 Feet

Map created by Chad McKenna of GeoSystems Analysis, Inc. on April 30, 2012. Grid projection = UTM, NAD 1983, Zone 11N, meters.

Appendix V-4

Cibola Valley Conservation Area Maps

2011 Vegetation Monitoring Plots:
Cibola Valley Conservation Area Management Phases



Legend

Phase 2 4 6 8 10 12

1 3 5 7 9 11

0 1,250 2,500 5,000 Feet

Source: Based on site delineations provided by Reclamation during September 2011.
Map created by Chad McKenna of GeoSystems Analysis, Inc. on
April 30, 2012. Grid projection = UTM, NAD 1983, Zone 11N, meters.

2011 Vegetation Monitoring Plots:
Cibola Valley Conservation Area, Phase 01

Legend

2011 Vegetation Plot Reduced

Intensive

0 250 500 Feet

Map created by Chad McKenna of GeoSystems Analysis, Inc. on April 30, 2012. Grid projection = UTM, NAD 1983, Zone 11N, meters.

2011 Vegetation Monitoring Plots:
Cibola Valley Conservation Area, Phase 02

Legend

2011 Vegetation Plot Reduced

Intensive

0 250 500 Feet

Map created by Chad McKenna of GeoSystems Analysis, Inc. on April 30, 2012. Grid projection = UTM, NAD 1983, Zone 11N, meters.

2011 Vegetation Monitoring Plots:
Cibola Valley Conservation Area, Phase 03

Legend

2011 Vegetation Plot Reduced

Intensive

0 250 500 Feet

Map created by Chad McKenna of GeoSystems Analysis, Inc. on April 30, 2012. Grid projection = UTM, NAD 1983, Zone 11N, meters.

2011 Vegetation Monitoring Plots:
Cibola Valley Conservation Area, Phase 04E

Legend

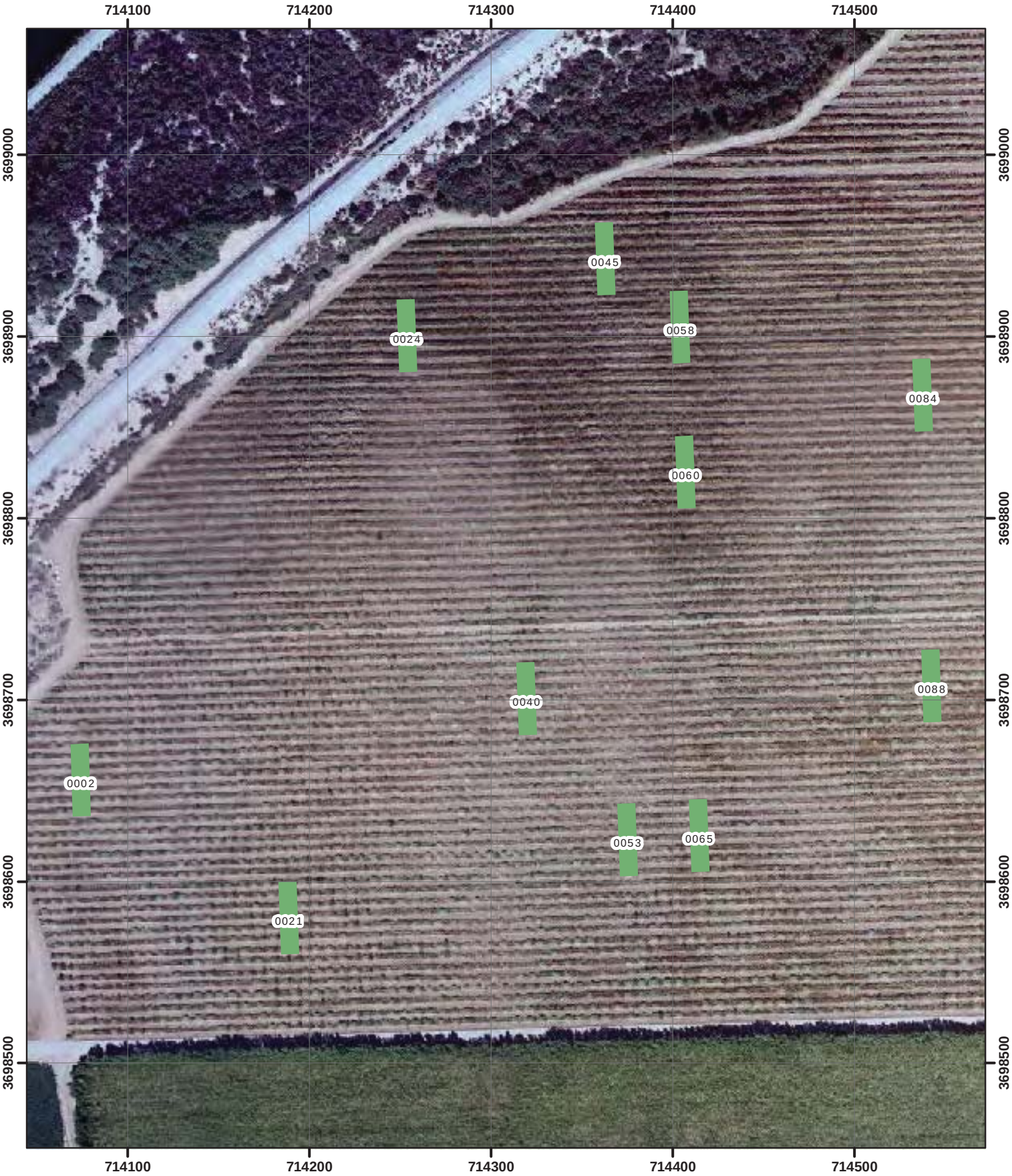
2011 Vegetation Plot Reduced

Intensive

0 250 500 Feet

Map created by Chad McKenna of GeoSystems Analysis, Inc. on April 30, 2012. Grid projection = UTM, NAD 1983, Zone 11N, meters.

2011 Vegetation Monitoring Plots:
Cibola Valley Conservation Area, Phase 04W



Legend

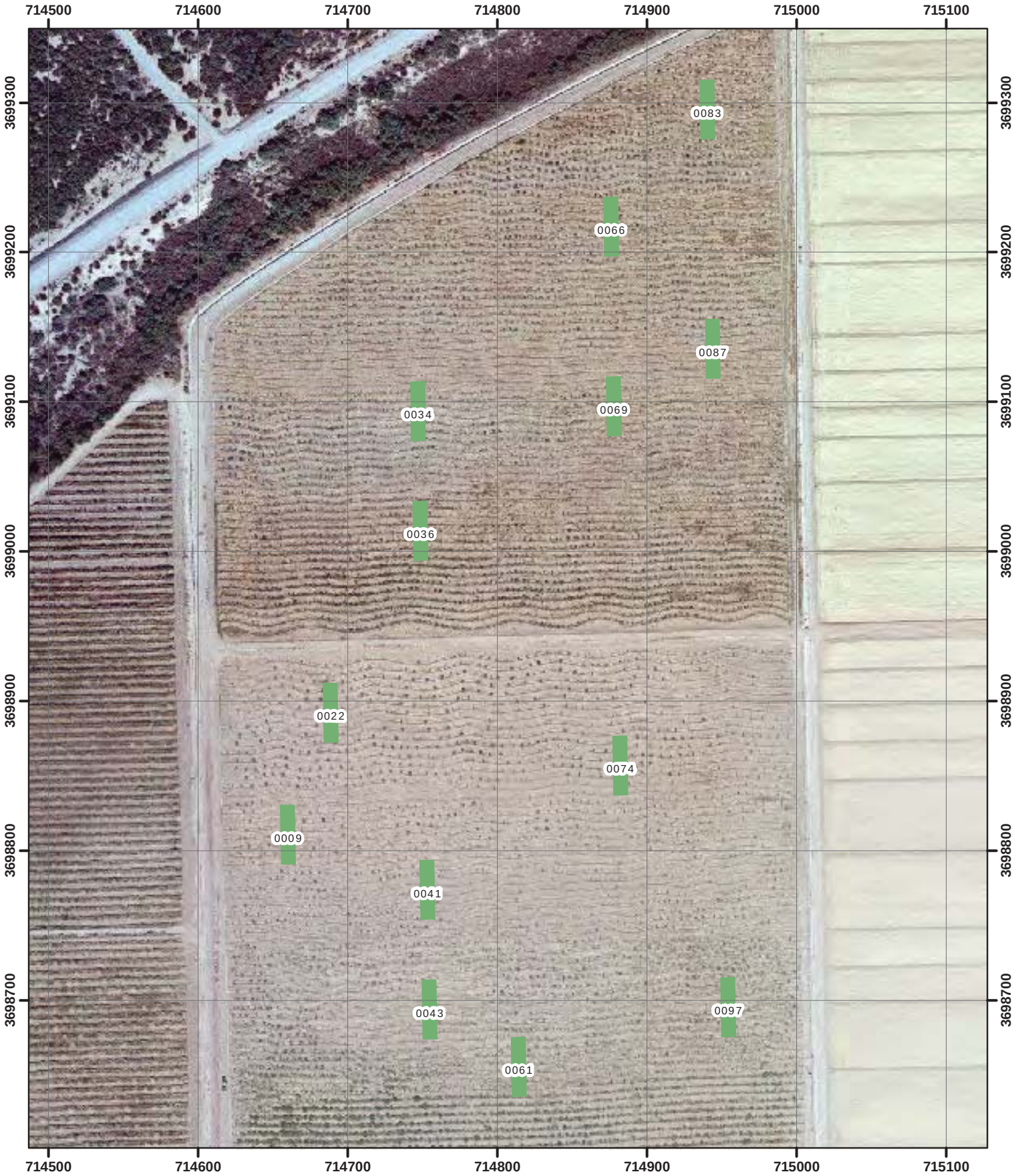
2011 Vegetation Plot Reduced

Intensive

0 250 500 Feet

Map created by Chad McKenna of GeoSystems Analysis, Inc. on April 30, 2012. Grid projection = UTM, NAD 1983, Zone 11N, meters.

2011 Vegetation Monitoring Plots:
Cibola Valley Conservation Area, Phase 05



Legend

2011 Vegetation Plot Reduced

Intensive

0 250 500 Feet

Map created by Chad McKenna of GeoSystems Analysis, Inc. on April 30, 2012. Grid projection = UTM, NAD 1983, Zone 11N, meters.

2011 Vegetation Monitoring Plots:
Cibola Valley Conservation Area, Phase 06

Legend

2011 Vegetation Plot Reduced

Intensive

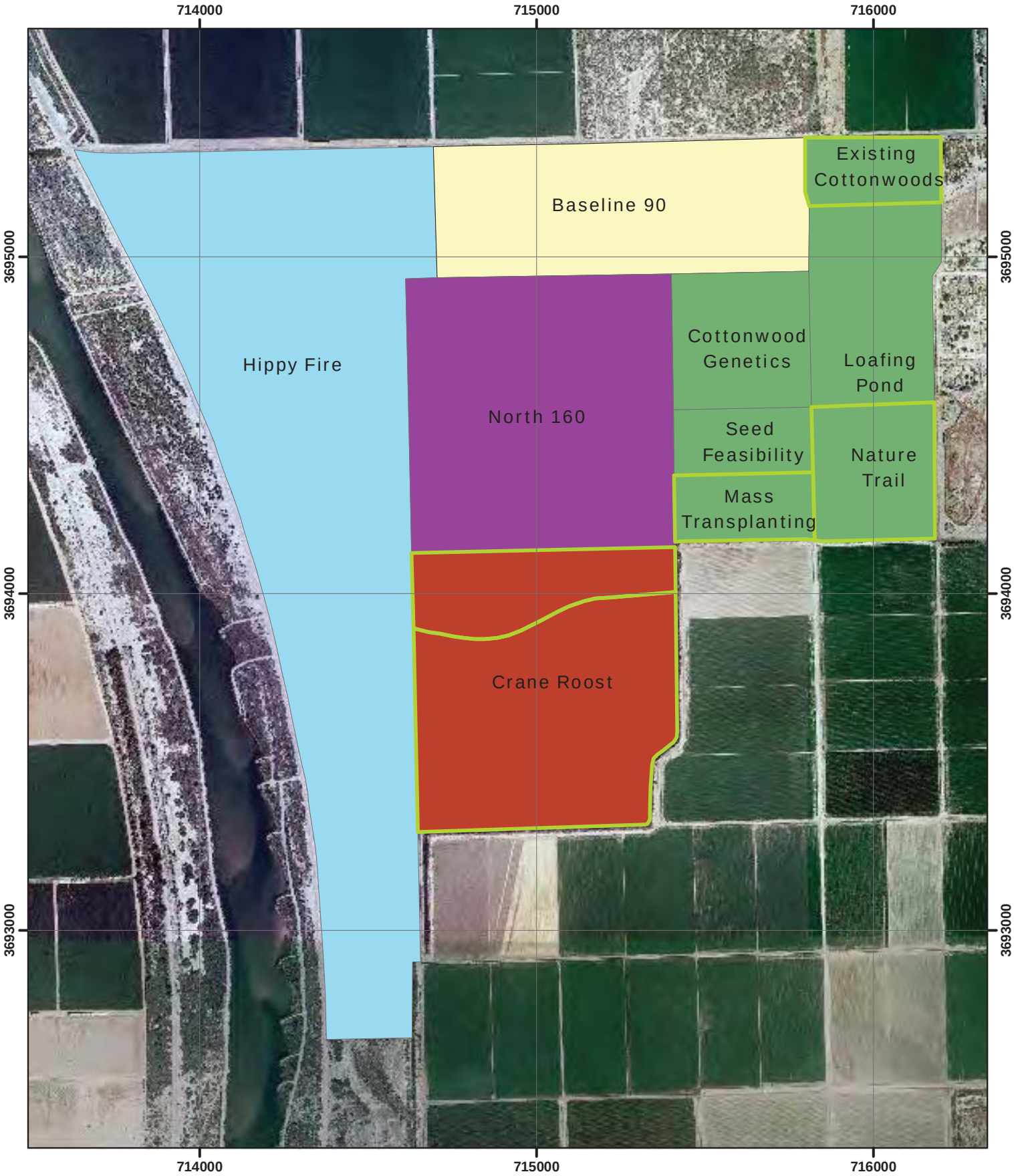
0 250 500 Feet

Map created by Chad McKenna of GeoSystems Analysis, Inc. on April 30, 2012. Grid projection = UTM, NAD 1983, Zone 11N, meters.

Appendix V-5

Cibola National Wildlife Refuge Maps

2011 Vegetation Monitoring Plots:
Cibola National Wildlife Area Management Areas



Legend

Portions Sampled in 2011

Management Areas

1, 2, 3, 4, 5

0 1,250 2,500 Feet

Source: Based on site delineations provided by Reclamation during September 2011. Map created by Chad McKenna of GeoSystems Analysis, Inc. on April 30, 2012. Grid projection = UTM, NAD 1983, Zone 11N, meters.

2011 Vegetation Monitoring Plots:
Cibola National Wildlife Refuge, Unit 1 - Research & Demo

Legend

2011 Vegetation Plot Reduced

Intensive

0 250 500 1,000 Feet

Map created by Chad McKenna of GeoSystems Analysis, Inc. on April 30, 2012. Grid projection = UTM, NAD 1983, Zone 11N, meters.

2011 Vegetation Monitoring Plots:
Cibola National Wildlife Refuge, Unit 5 - Crane Roost

Legend

2011 Vegetation Plot Reduced

Intensive

0 250 500 Feet

Map created by Chad McKenna of GeoSystems Analysis, Inc. on April 30, 2012. Grid projection = UTM, NAD 1983, Zone 11N, meters.