

## **Appendix B**

*Laguna Restoration Wetland Investigation Report. Revised Draft.*  
November 2010

# RECLAMATION

*Managing Water in the West*

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## **LAGUNA RESTORATION WETLAND INVESTIGATION REVISED DRAFT REPORT YUMA COUNTY, ARIZONA IMPERIAL COUNTY, CALIFORNIA**

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**NOVEMBER 4, 2010**





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# DEFINITIONS

**Alluvial deposits:** Land formations at the base of mountains where fast-flowing streams meet relatively flat surfaces, such as basin floors or broad valleys. As the gradient abruptly decreases, streams deposit gravel, sand, and other sediments.

**Depth-to-soil saturation:** The depth at which the pores between soil particles are filled with water.

**Drainage patterns:** A network of intermittent or perennial channels formed by local geological and soil characteristics.

**Hydric soils:** Soils that are flooded, ponded, or saturated long enough during the growing season to develop anaerobic conditions in the upper part of the soil profile. These conditions can develop from continuous saturation during as little as 5 percent of the growing season.

**Ordinary high-water mark:** On the shoreline of a body of water, the line or marking established by the fluctuations of water and indicated by physical characteristics such as a clear and natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, and/or other indicators appropriate for the surrounding area.

**Waters of the United States:** “All waters that are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide; All interstate waters including interstate wetlands; All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation, or destruction of which could affect interstate or foreign commerce...Wetlands adjacent to waters (other than waters that are themselves wetlands) identified above.” (Definition taken from 33 CFR, Part 328.3.) “Adjacent” is defined as bordering, contiguous, or neighboring.

**Wetlands:** “Areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.” (Definition taken from 33 CFR, Part 328.3).

## Limits of jurisdiction in non-tidal waters:

1. In the absence of adjacent wetlands, the jurisdiction extends to the ordinary high-water mark, or
2. When adjacent wetlands are present, the jurisdiction extends beyond the ordinary high-water mark to the limit of the adjacent wetlands.
3. When the water of the United States consists only of wetlands the jurisdiction extends to the limit of the wetland (taken from 33 CFR, Part 328.3).

# 1.0 INTRODUCTION

The Bureau of Reclamation (Reclamation) contracted BIO-WEST, Inc. (BIO-WEST), to complete a wetland delineation of the Laguna Restoration Project Area (Project Area) as part of the application for a Section 404 permit. Reclamation plans to obtain a Nationwide Permit 27 (Aquatic Habitat Restoration, Establishment, and Enhancement) in order to complete marsh habitat and wetland restoration at the Project Area as part of the Lower Colorado River Multi-Species Conservation Program (MSCP).

The Project Area is located on Reclamation land 0.5 mile downstream of Imperial Dam on the Colorado River, approximately 4 miles west of the Yuma Proving Grounds Main Gate (Figure 1). The Project Area consists of 2,099.22 acres in Yuma County, Arizona, and Imperial County, California. In Arizona the Project Area lies within Sections 31 and 36 of Township 6 South, Range 21 West, and Sections 6, 7, 12, 13, and 14 of Township 7 South, Range 21 West. In California the Project Area lies within Sections 17, 20, 21, 28, 29, 31, and 32 of Township 15 South, Range 24 East (Figure 2). Approximate coordinates of the middle of the Project Area are 32.84635° north latitude, 114.46298° west longitude, Datum WGS 1984. A portion of The Fort Yuma Indian Reservation is located within the southwestern corner of the Project Area.

# 2.0 METHODS

A Project Area inspection was conducted November 12–18, 2009, to delineate jurisdictional wetland boundaries. At that time, access to the Fort Yuma Indian Reservation was not permissible. An additional Project Area inspection was conducted September 29–October 1, 2010, to delineate wetlands located within the Fort Yuma Indian Reservation on the Project Area. Wetland boundaries were identified in accordance with the *U.S. Army Corps of Engineers Wetlands Delineation Manual (Manual)* (Environmental Laboratory 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (Environmental Laboratory 2008). Project Area surface hydrology has been historically altered. Specifically, the Colorado River has been re-routed off site. However, the vegetation community has re-established and the Project Area is not considered significantly disturbed or atypical at this time. The Routine Determination Method for areas larger than 5 acres was used to delineate the Project Area. The three-parameter approach (hydrology, soils, and vegetation) was used to make wetland determinations at the appropriate observation points. In areas where one or more wetland parameters may have been absent or misleading, the area was mapped using mainly soil characteristics, landscape position, remnant hydrophytic vegetation, and/or persistent hydrological indicators, as specified by the manual.

Using the routine wetland delineation method, a baseline was established parallel to the eastern Project Area boundary along an irrigation canal. This baseline runs the entire length of the Project Area and is approximately 18,609 feet long from north to south (Appendix A). The Routine Delineation Section of the *Manual* requires a baseline of this length to be divided into between five and eight segments. Based on this baseline length requirement the Project Area baseline was divided into seven segments. Transect starting points were located at the midpoint of each baseline



Figure 1. Project Area location map.

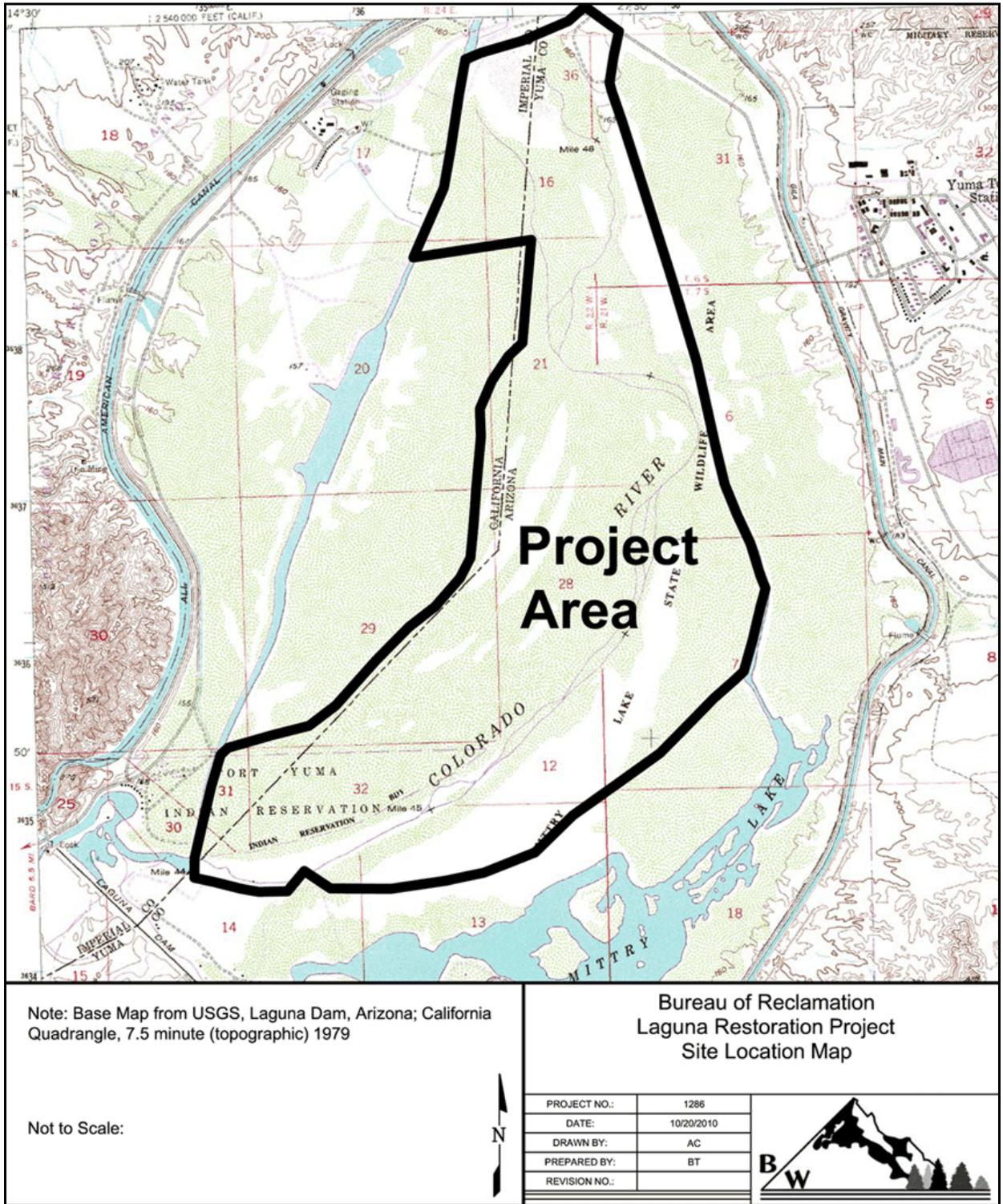


Figure 2. Project Area map.

segment and were located approximately 0.5 mile apart, positioned from the south end of the established baseline moving north (Appendix A). The transect lines were oriented in a east-to-west direction running the entire width of the Project Area and were between 2,965 feet and 6,993 feet long.

Observation points along each transect were located in areas where a change in vegetation communities was noted (Appendix B). In areas determined to represent wetland upland interfaces, paired observation points were taken to document conditions on either side of the wetland-upland boundary. For practical reasons observation points were not taken in areas containing significant standing water, but standing water and marsh areas were included within the wetland polygon. In addition, some of the observation points could not be located exactly on the transect line due to impenetrable stands of dense vegetation. In these cases the observation point was located as close to the transect as possible. Observation point data was recorded on standard Arid West Supplement data sheets (Appendix C).

For each observation point, the presence or absence of hydrological indicators was noted. The determination of wetland hydrology was based on the presence of at least one positive primary indicator or two positive secondary indicators of a prolonged period of saturation. Primary indicators include observation of surface water, soil inundation or saturation, watermarks, drift deposits, surface soil cracks, salt crust, and aquatic invertebrates. Secondary indicators include drainage patterns, muck surface, saturation visible on aerial imagery, and the facultative-neutral test. Environmental changes and the topographic position of the sample points relative to observed water tables were also noted.

Soil pits were dug at each sample point to a depth of at least 18 inches to characterize soil profiles and soil/water conditions. At least one positive hydric soil indicator was required at each sample point to classify a soil as hydric. For example, soils in prolonged anaerobic conditions undergo chemical reduction, thereby producing lighter soil colors. During the field survey, the colors of the soil profile matrix and mottles were identified using Munsell® soil color charts (Kollmorgen Instruments 1990). Soil horizonation, texture, moisture content, and depth to saturation and/or standing water were noted. The presence or absence of particulate organic matter, organic matter staining, concretions, mottling, and gleying also were noted. Selected soils samples were collected for laboratory analysis. These samples consisted of a mixture of the upper 18 inches of soil within a sample pit. The samples were labeled, iced, and shipped to a certified laboratory for analysis.

For consistency, soil profiles observed in the field were compared with the soil descriptions referenced on the Natural Resources Conservation Service (NRCS) Web Soil Survey website (NRCS 2009) (Appendix D). The soil survey reference and the field sampling were not consistent within wetland areas. Significant portions of the Project Area contain a surface salt crust and salt concretions within the soil. “In the Arid West, salt content is a common cause of high soil pH” (Environmental Laboratory 2008). In areas containing a salt crust and or salt concretions within the soil, determination of hydric soils followed guidance provided in the Final Arid West Regional Supplement, specifically, Problematic Hydric Soils, Section 1, Moderately to Very Strongly Alkaline Soils (Environmental Laboratory 2008). According to this guidance redoxomorphic features may not form in alkaline wetland soils. The most common example of this noted on the

Project Area is the lack of a sufficiently reduced soil matrix. Specifically, Project Area wetland soils commonly form distinct or prominent soil mottling, however, the matrix chroma of these soils is not low enough to meet the F3 reduced matrix hydric soil indicator. In these situations the presence of soil mottling, wetland vegetation, wetland hydrology, and landscape position were used to determine the status of a particular observation point.

For a site to be classified as having hydrophytic vegetation, dominant plant species must have certain characteristics. On the data forms in Appendix C, BIO-WEST recorded the tree species that occurred within a 30-foot radius of each sample point, sapling and shrubs that occurred within a 5-foot radius of each sample point, and herbaceous species located within a 5-foot radius of each sample point. The relative occurrence of species was estimated visually. Species comprising 20 percent or more of the total areal cover per stratum were considered dominant, following the guidelines of the U.S. Army Corps of Engineers's (Corps's) 50/20 rule (Environmental Laboratory 1987). The wetland indicator status of dominant plants was noted. Plant species recorded were assigned an indicator status according to the *National List of Plant Species That Occur in Wetlands: 1996 National Summary* (USFWS 1997). When woody burned plants had resprouted and were identifiable, they were included in the recorded data.

Of the dominant plant species recorded, greater than 50 percent must have an indicator status of facultative (34–66 percent probability of occurring in wetlands), facultative wetland (67–99 percent probability of occurring in wetlands), or obligate wetland (greater than 99 percent probability of occurring in wetlands) for a site to be classified as having hydrophytic vegetation for wetland delineation purposes.

One hundred and seventeen sample points were established to characterize existing hydrological, soil, and vegetative conditions of the Project Area. The sample points were marked in the field by pink pin flags marked "WETLAND DELINEATION" with the sample point number written on the flag. Photographs of sample points and representative site conditions were taken during the Project Area inspection (Appendix E).

Based on the sample point data, wetland boundaries were determined. The approximate locations of delineated wetland boundaries and sample points were surveyed using a global positioning system with sub-meter accuracy. The survey data were downloaded into a computer-aided drafting and design program to produce a map showing the delineated wetland boundaries, sample point locations, and estimated wetland acreage as illustrated in Appendix B.

### **3.0 GENERAL CONDITIONS**

The Project Area was inspected during November 2009 and September/October 2010. Vegetation on the Project Area had not entered dormant winter stage at the time of the Project Area visits. The Project Area contains riparian-wetland and open-water marsh habitats associated with the historic Colorado River Channel, in addition to recently disturbed wetland and upland areas. The Project Area has been historically altered due to the construction of Imperial Dam, irrigation canals, berms, and roadways. However, conditions within the Project Area have normalized to a degree that a

routine wetland delineation was appropriate. Hydrologic indicators were generally present despite dry season conditions. Soils textures generally ranged from clay to sand depending on their position in the landscape. The Project Area contains large areas that are covered with a salt crust and site soils commonly contain salt concentrations.

## 4.0 WETLAND INVESTIGATION FINDINGS

### 4.1 Vegetation

Plant communities found on the Project Area included upland scrub/shrub, riparian-wetland scrub/shrub, emergent wetland areas with open water, disturbed wetlands and disturbed uplands. Overall, vegetation diversity was low due to the presence of highly competitive or invasive species. The dominant plant species observed on the Project Area are included in Table 1.

**Table 1. List of dominant plant species observed within the Project Area.**

| COMMON NAME    | SCIENTIFIC NAME             | INDICATOR STATUS <sup>a</sup> |
|----------------|-----------------------------|-------------------------------|
| arrow weed     | <i>Pluchea sericea</i>      | FAC                           |
| cattail        | <i>Typha latifolia</i>      | OBL                           |
| common reed    | <i>Phragmites australis</i> | FACW+                         |
| giant reed     | <i>Arundo donax</i>         | FACW                          |
| honey mesquite | <i>Prosopis glandulosa</i>  | FACU                          |
| quail bush     | <i>Atriplex lentiformes</i> | FACW                          |
| salt cedar     | <i>Tamarix ramosissima</i>  | FACW                          |

<sup>a</sup> Indicator status: OBL = obligate wetland species, FAC = facultative species, FACW = facultative wetland species, FACW + = greater probability of occurring in wetlands than FACW species, FAC + = greater probability of occurring in wetlands than FAC species, FACU = facultative upland species.

The majority of the Project Area is composed of wetland scrub/shrub and upland dominated by salt cedar (*Tamarix ramosissima*) and arrowweed (*Pluchea sericea*). Upland areas were dominated by salt cedar, arrowweed, and honey mesquite (*Prosopis glandulosa*). The Project Area appears to have burned at some point in the past. However, vegetation has recovered and grown back. An open water/emergent marsh wetland containing cattail (*Typha latifolia*), giant reed (*Arundo donax*), and common reed (*Phragmites australis*) is located in the center of the Project Area. This emergent marsh and open water is associated with the historic channel of the Colorado river. Small barrow pit areas also contain common reed and cattail marsh. Vegetation located along the wetland/upland interface typically included arrowweed, quail bush (*Atriplex lentiformes*), and salt cedar.

Vegetation communities within the Project Area generally fall within six categories which are shown in Appendix B.

- ***Seasonally Flooded Shrub/Scrub Wetland***  
This vegetation community is the most common within the Project Area. These areas are dominated by dense salt cedar and contain highly saline soils. Some of the shrub scrub wetlands contain areas of arrowweed and quail bush. The salinity and alkalinity of the soils in these wetlands often prevents the formation of normal hydric soil characteristics. There are 1,271.01 acres of seasonally flooded shrub/scrub wetland within the Project Area.
- ***Permanently Flooded Marsh Wetland***  
These wetlands are found within the historic channel of the Colorado River that runs through the center of the Project Area. Additional marsh areas include small barrow pit areas on the northwestern portion of the Project Area. Project Area marshes are dominated by common reed, cattail, and giant reed. The salinity and alkalinity of the soils in these wetlands often prevents the formation of normal hydric soil characteristics. There are 213.47 acres of permanently flooded marsh wetland on the Project Area.
- ***Seasonally Flooded Disturbed Non-vegetated Wetland***  
These wetlands are located on the southern portion of the Project Area and were recently salt cedar shrub/scrub wetland. These wetlands have been mechanically cleared of vegetation but exhibit wetland hydrology and soils. Salt cedar is beginning to re-establish here. There are 13.59 acres of seasonally flooded disturbed non-vegetated wetlands on the Project Area.
- ***Arrowweed Sandbar Upland***  
These linear vegetation features are dominated by arrowweed and exhibit upland hydrology and soil characteristics. There are 133.71 acres of arrowweed sandbar uplands on the Project Area.
- ***Salt Cedar/Mesquite Upland***  
This vegetation community contains a mixture of upland and wetland vegetation and exhibits upland hydrology and soil characteristics. This community has been disturbed in some parts of the Project Area. In these disturbed areas arrowweed has become established and in some cases is dominant; however, salt cedar is still the dominant plant overall within the community. There are 430.57 acres of salt cedar/mesquite uplands on the Project Area.
- ***Disturbed Non-vegetated Upland***  
The majority of this community is currently used by BLM to dispose of off-site dredge material. The dredge pile is composed of large mounds of un-vegetated sand. One small area of upland agricultural field is located within the southwestern corner of the Project Area. An upland fill road is located north of the Fort Yuma Indian Reservation portion of the Project Area. There are 36.87 acres of disturbed non-vegetated upland on the Project Area.

## 4.2 Soils

Significant portions of the Project Area contain a surface salt crust and salt concretions within the soil. “In the Arid West, salt content is a common cause of high soil pH” (Environmental Laboratory 2008). In areas containing a salt crust and/or salt concretions within the soil, determination of hydric soils followed guidance provided in the Final Arid West Regional Supplement, specifically, Problematic Hydric Soils, Section 1, Moderately to Very Strongly Alkaline Soils (Environmental Laboratory 2008). According to this guidance, redoxomorphic features may not form in alkaline wetland soils. The most common example of this noted on the Project Area is the lack of a sufficiently reduced soil matrix. Specifically, Project Area wetland soils commonly form distinct or prominent soil mottling, however, the matrix chroma of these soils is not low enough to meet the F3 reduced matrix hydric soil indicator. In these situations the presence of soil mottling, wetland vegetation, wetland hydrology, and landscape position were used to determine the status of a particular observation point.

Soils located within the California portion of the Project Area and western portions of the Project Area within Arizona are not mapped by NRCS. The Arizona portion of the Project Area that is mapped contains Salorthids and Indio Silt Loam. The majority of the mapped soils are Salorthids. These soils are located on nearly level sites with a frost-free period of 250–325 days. They are located on floodplains with a parent material of mixed alluvium. They are poorly drained with a depth to water table of more than 80 inches and are rarely flooded. The Project Area is located within a floodplain. However, the depth to the water table and the frequency of flooding in the official Salorthid soil description do not match the majority of soils observed within the Project Area. A small portion of the Project Area is mapped as Indio-Silt Loam. These soils are located on 0-2 percent slopes with a frost-free period of 250–325 days. They are located on floodplains with a parent material of mixed alluvium. They are well drained with a depth to water table of more than 80 inches and are never flooded or ponded. Conditions observed in portions of the Project Area mapped as Indio-Silt loam do not match soils of this description.

## 4.3 Hydrology

The Project Area is located approximately 0.5 mile downstream of the Imperial Reservoir, within the historic channel and floodplain of the Colorado River. Two canals that provide outflow from Imperial Reservoir form the northern boundary and portions of the western and eastern Project Area boundaries. Groundwater, seepage from the Imperial Reservoir, and surface-water runoff provide hydrologic connection to the Project Area. A large, open-water and marsh community is located within a historic channel of the Colorado River, which runs through the center of the Project Area. Project Area wetlands exhibit numerous hydrologic indicators including surface soil cracks, salt crust, sediment deposits, water marks, surface water, saturation, drift deposits, inundation on aerial images, aquatic invertebrates (specifically freshwater mussels), and drainage patterns.

## 4.4 Wetlands

The Project Area contains seasonally flooded shrub/scrub wetland, permanently flooded marsh, and seasonally flooded recently disturbed non-vegetated wetland (Table 2). Project Area wetlands are further described as individual polygons in Appendix B. The majority of the Project Area wetlands are dominated by dense salt cedar. Marsh/open water habitats are dominated by cattails, common reed, and giant reed. The investigation revealed a total of 1,498.07 acres of wetlands within the Project Area.

**Table 2. Wetland Types within the Project Area.**

| WETLAND POLYGON IDENTIFIER <sup>a</sup> | WETLAND TYPE                                       | ACREAGE  |
|---|--|----------|
| A, B, C, F, K                           | Permanently Flooded Marsh                          | 213.47   |
| D, E, G, H, I, J, L                     | Seasonally Flooded Shrub/Scrub Wetland             | 1,271.01 |
| M, N, O                                 | Seasonally Flooded Disturbed Non-vegetated Wetland | 13.59    |
| TOTAL WETLAND ACREAGE                   |  | 1,498.07 |

<sup>a</sup> See Appendix B.

## 5.0 SOIL SAMPLING RESULTS

Eighty-three soil samples were collected during the wetland investigations, as required by the Reclamation Statement of Work (Sheet 1, Appendix F). Sixty-eight of these samples were collected from Project Area wetlands and fifteen of the samples were collected from Project Area uplands. The samples were placed on ice and shipped to the University of Idaho Analytical Sciences Laboratory for analysis. Analysis included the following: an extended fertility test measuring pH, P, K, NO<sub>3</sub>, NH<sub>4</sub>, SO<sub>4</sub>, organic matter, and Boron; a conductivity measurement; and a micronutrient screening including DTPA - Fe, Mn, Cu, and Zn. The soil sampling report is included in Appendix F.

## 6.0 CONCLUSIONS AND RECOMMENDATIONS

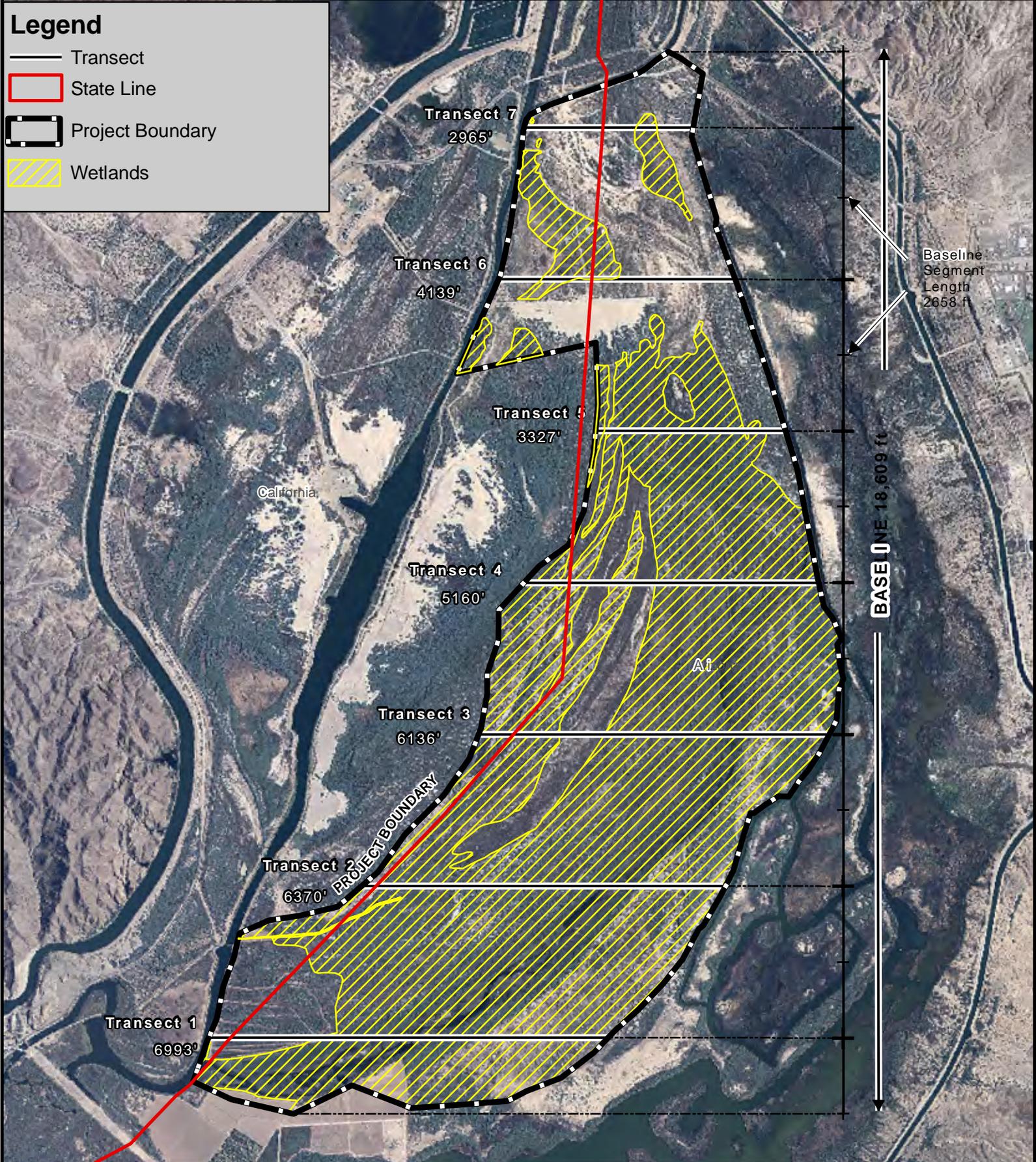
The investigation of the 2,099.22-acre Project Area revealed a total of 1,498.07 acres of wetlands and 601.15 acres of uplands. Of these, 1,271.01 acres were seasonally flooded scrub/shrub wetlands, 213.47 acres were permanently flooded marsh wetlands, and 13.58 acres were seasonally flooded disturbed non-vegetated wetlands. The wetlands within the Project Area have the necessary characteristics to be considered jurisdictional water bodies that can be regulated by the Corps. However, the Corps has final jurisdiction over determining whether an isolated water body or wetland is subject to interstate commerce and is, therefore, a “water of the United States.”

## 7.0 REFERENCES CITED

- Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Vicksburg (MS): U.S. Army Waterways Experiment Station. Technical Report Y-87-1.
- Environmental Laboratory. 2008. Final Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region. U.S. Army Corps of Engineers Engineer Research and Development Center. Technical Report ERDC/EL TR-08-28.
- Kollmorgen Instruments. 1990. Munsell Soil Color Charts. Baltimore (MD): Kollmorgen Instruments Corporation.
- [NRCS] Natural Resources Conservation Service. 11/15/2009. Web Soil Survey 2.0. Location: [www.nrcs.gov](http://www.nrcs.gov).
- [USFWS] U.S. Fish and Wildlife Service. 1997. National list of plant species that occur in wetlands: 1996 National Summary. Washington (D.C.): U.S. Fish and Wildlife Service. 209 p.

# Legend

- Transect
- State Line
- Project Boundary
- Wetlands



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## Bureau of Reclamation Laguna Restoration Project Transect & Wetland Location Map



Note: Base Map from GEO/Graphix Inc. & Bohannon Huston Inc.  
Color infrared, orthophoto mosaic, 1-foot pixel, August 2004





## **APPENDIX B: WETLAND DELINEATION MAPS**



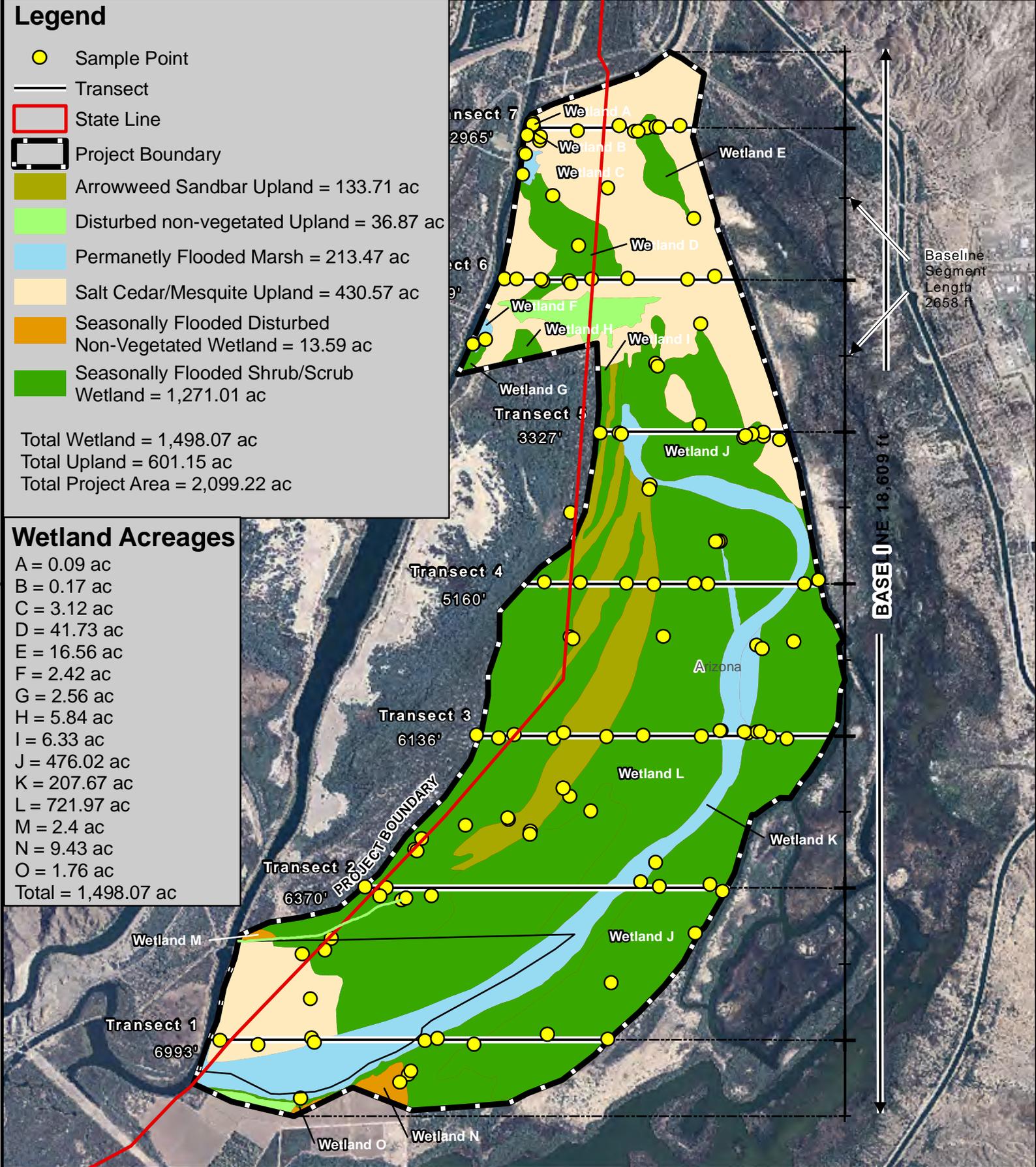
# Legend

- Sample Point
- Transect
- State Line
- Project Boundary
- Arrowweed Sandbar Upland = 133.71 ac
- Disturbed non-vegetated Upland = 36.87 ac
- Permanently Flooded Marsh = 213.47 ac
- Salt Cedar/Mesquite Upland = 430.57 ac
- Seasonally Flooded Disturbed Non-Vegetated Wetland = 13.59 ac
- Seasonally Flooded Shrub/Scrub Wetland = 1,271.01 ac

Total Wetland = 1,498.07 ac  
 Total Upland = 601.15 ac  
 Total Project Area = 2,099.22 ac

## Wetland Acreages

- A = 0.09 ac
- B = 0.17 ac
- C = 3.12 ac
- D = 41.73 ac
- E = 16.56 ac
- F = 2.42 ac
- G = 2.56 ac
- H = 5.84 ac
- I = 6.33 ac
- J = 476.02 ac
- K = 207.67 ac
- L = 721.97 ac
- M = 2.4 ac
- N = 9.43 ac
- O = 1.76 ac
- Total = 1,498.07 ac



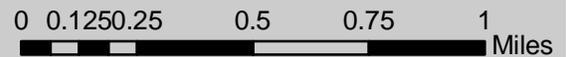
**BIO-WEST, Inc.**

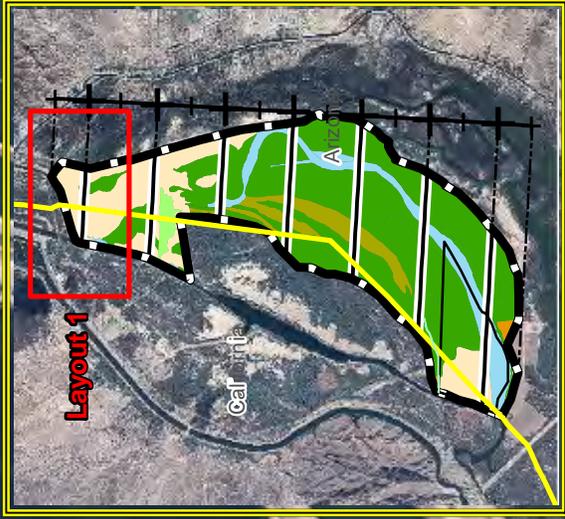
1063 West 1400 North  
 Logan, Utah, 84321  
 www.bio-west.com  
 435-752-4202

# Bureau of Reclamation Laguna Restoration Project Wetland Map



Note: Base Map from GEO/Graphix Inc. & Bohannon Huston Inc.  
 Color infrared, orthophoto mosaic, 1-foot pixel, August 2004





# Transect 7 2965'

Wetland A  
0.09 ac

Wetland B  
0.17 ac

Wetland C  
3.12 ac

Wetland E  
16.56 ac

Wetland D  
41.73 ac

a1  
a2  
a3  
a4  
a5  
a6  
a7  
a8

b46

b40

b47

b41



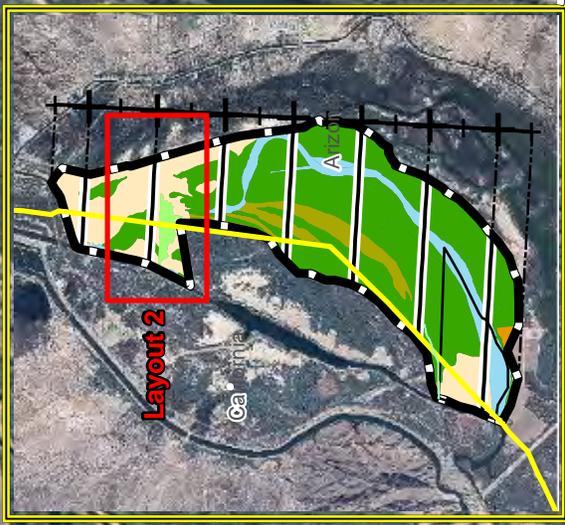
## Bureau of Reclamation Laguna Restoration Project Wetland Map



- Legend**
- Sample Point
  - Transect
  - State Line
  - Project Boundary

- Arrowweed Sandbar Upland
- Disturbed non-vegetated Upland
- Permanently Flooded Marsh
- Salt Cedar/Mesquite Upland
- Seasonally Flooded Disturbed Non-Vegetated Wetland
- Seasonally Flooded Shrub/Scrub Wetland

Note: Base Map from GEO/Graphics Inc. & Bohannan Huston Inc. Color infrared, orthophoto mosaic, one-foot pixel, August 2004



**Transect 6  
4139'**

**Wetland E  
16.56 ac**

**Wetland C  
3.12 ac**

**Wetland D  
41.73 ac**

**Wetland F  
2.42 ac**

**Wetland G  
2.56 ac**

**Wetland H  
5.84 ac**

**Wetland I  
6.33 ac**

**Wetland J  
476.02 ac**

a49

a48

b29

b47

b30

b31

b46

b40

b41

a47

a46

a44

a45

a43

a42

a40

a41

a51

a52

Note: Base Map from GEO/Graphics Inc. & Bohannan Huston Inc. Color infrared, orthophoto mosaic, one-foot pixel, August 2004

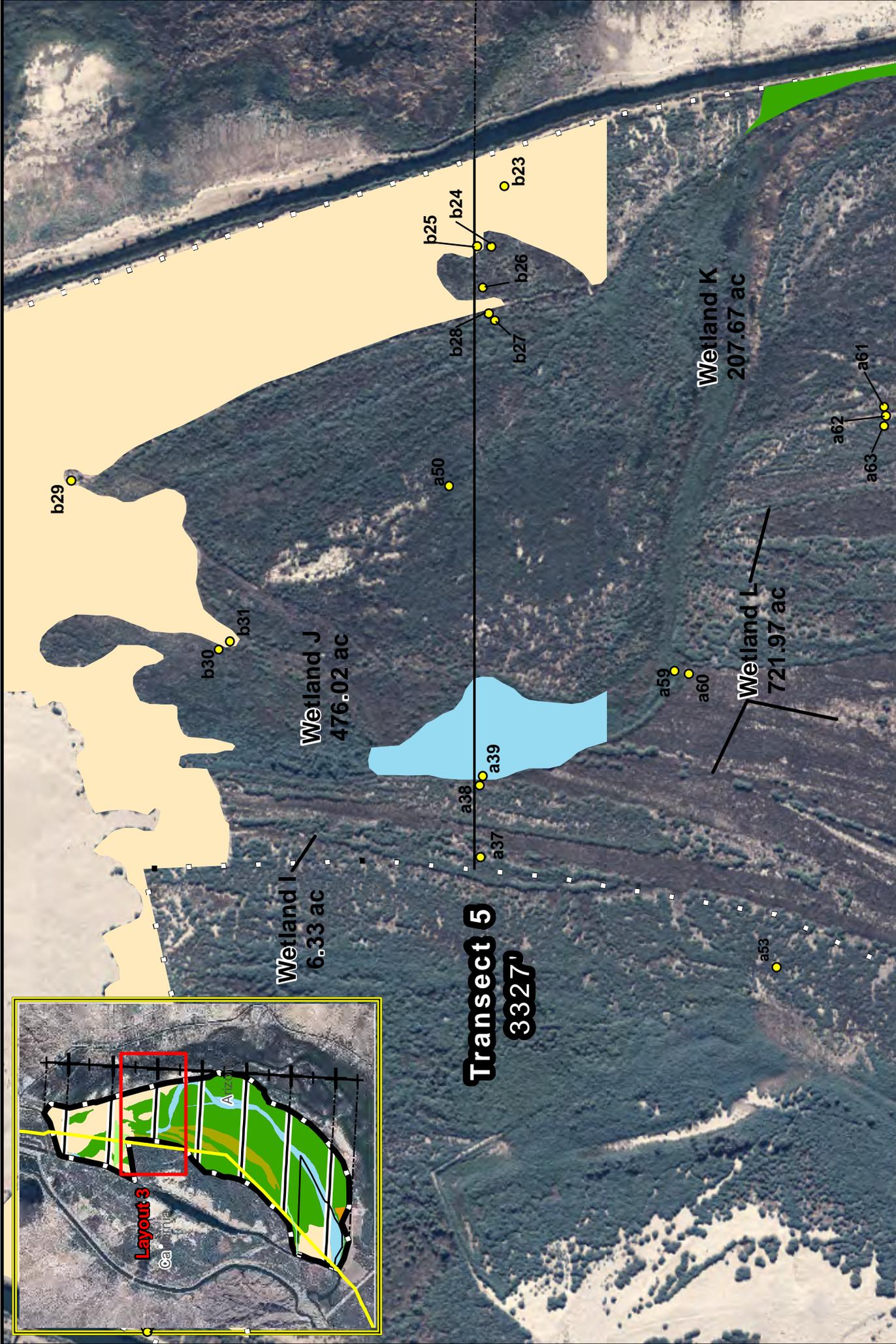
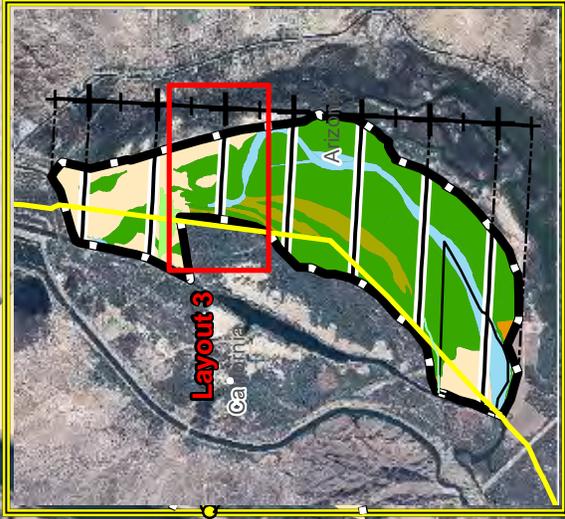
**Legend**

- Sample Point
- Transect
- State Line
- Project Boundary
- Seasonally Flooded Disturbed Non-Vegetated Wetland
- Seasonally Flooded Shrub/Scrub Wetland
- Arrowweed Sandbar Upland
- Disturbed non-vegetated Upland
- Permanently Flooded Marsh
- Salt Cedar/Mesquite Upland

**Bureau of Reclamation  
Laguna Restoration Project  
Wetland Map**

0 125 250 500 750 1,000 Feet

**BIO-WEST, Inc.**  
1063 West 1400 North  
Logan, Utah, 84321  
www.bio-west.com  
435-752-4202



Note: Base Map from GEO/Graphics Inc. & Bohannan Huston Inc. Color infrared, orthophoto mosaic, one-foot pixel, August 2004

**Legend**

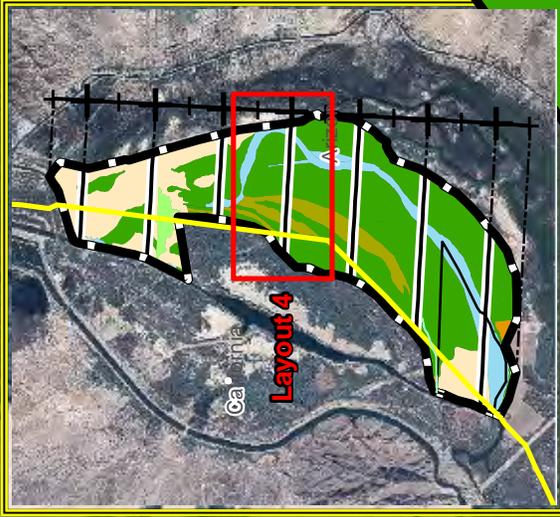
- Sample Point
- Transect
- State Line
- Project Boundary
- Seasonally Flooded Disturbed Non-Vegetated Wetland
- Seasonally Flooded Shrub/Scrub Wetland
- Arrowweed Sandbar Upland
- Disturbed non-vegetated Upland
- Permanently Flooded Marsh
- Salt Cedar/Mesquite Upland

**Bureau of Reclamation  
Laguna Restoration Project  
Wetland Map**

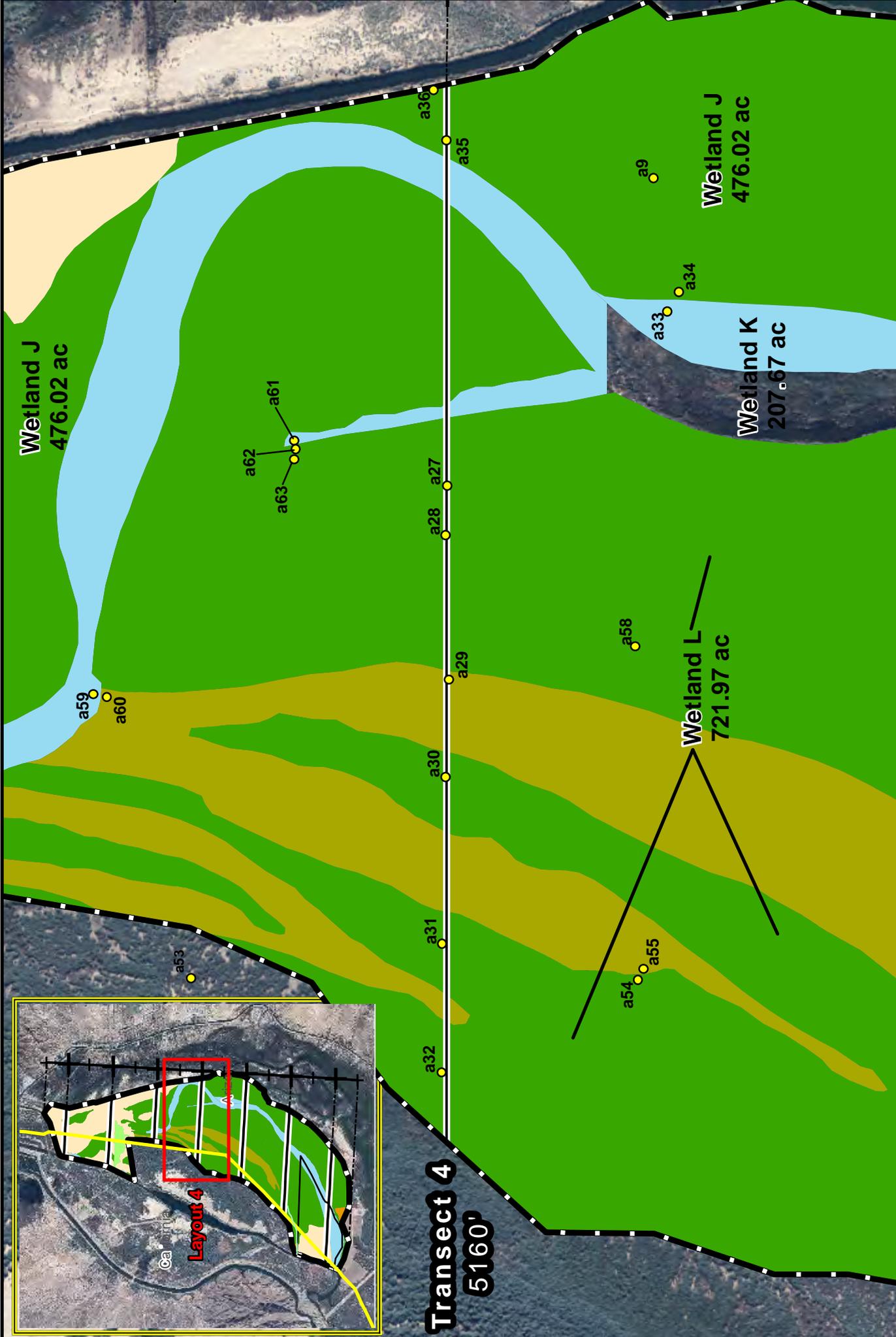
0 125 250 500 750 1,000 Feet

N

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**Transect 4**  
5160'



**Bureau of Reclamation**  
**Laguna Restoration Project**  
**Wetland Map**

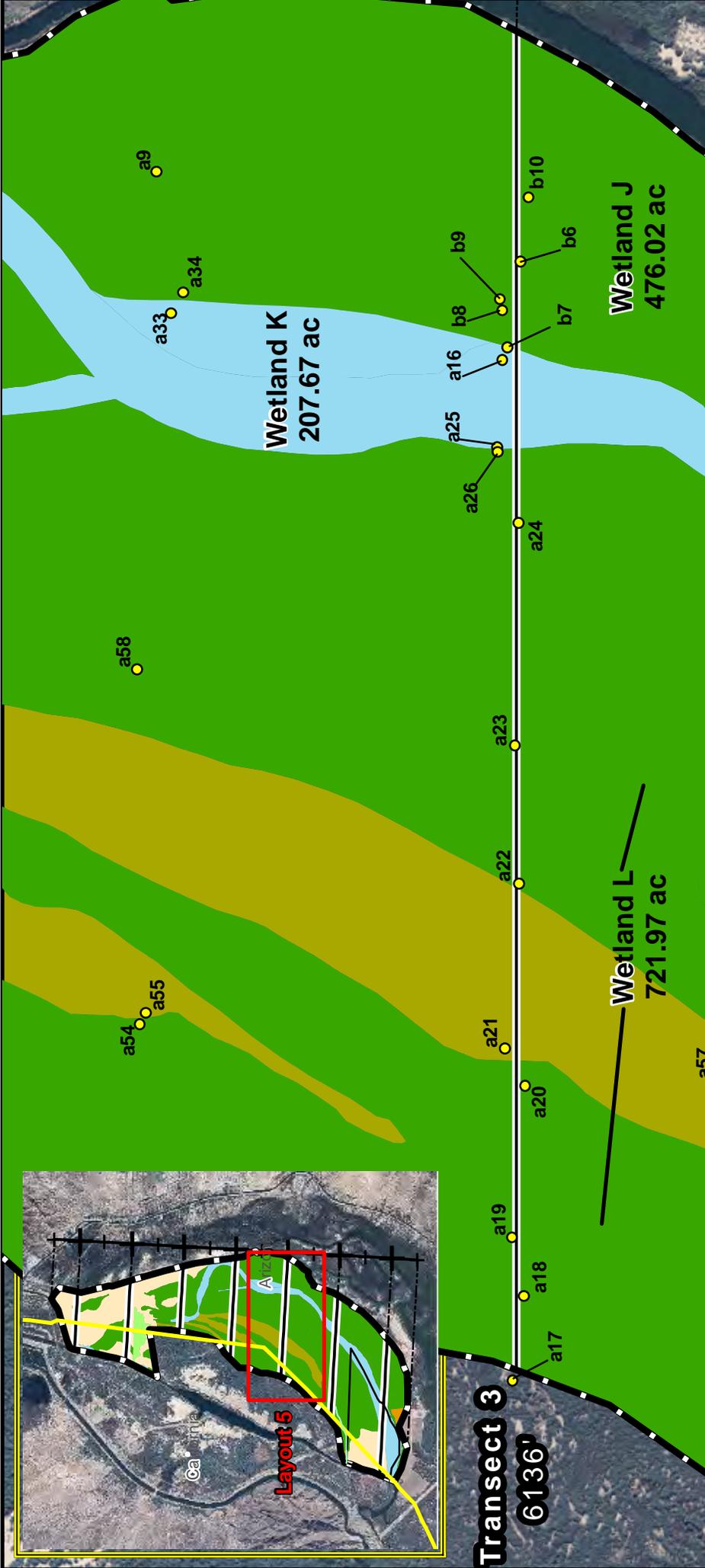
0 150 300 600 900 1,200 Feet

N

- Legend**
- Sample Point
  - Transect
  - State Line
  - ▭ Project Boundary

- Arrowweed Sandbar Upland
- Disturbed non-vegetated Upland
- Permanently Flooded Marsh
- Salt Cedar/Mesquite Upland
- Seasonally Flooded Disturbed Non-Vegetated Wetland
- Seasonally Flooded Shrub/Scrub Wetland

Note: Base Map from GEO/Graphics Inc. & Bohannan Huston Inc.  
Color infrared, orthophoto mosaic, one-foot pixel, August 2004



Note: Base Map from GEO/Graphics Inc. & Bohannon Huston Inc. Color infrared, orthophoto mosaic, one-foot pixel, August 2004

**Legend**

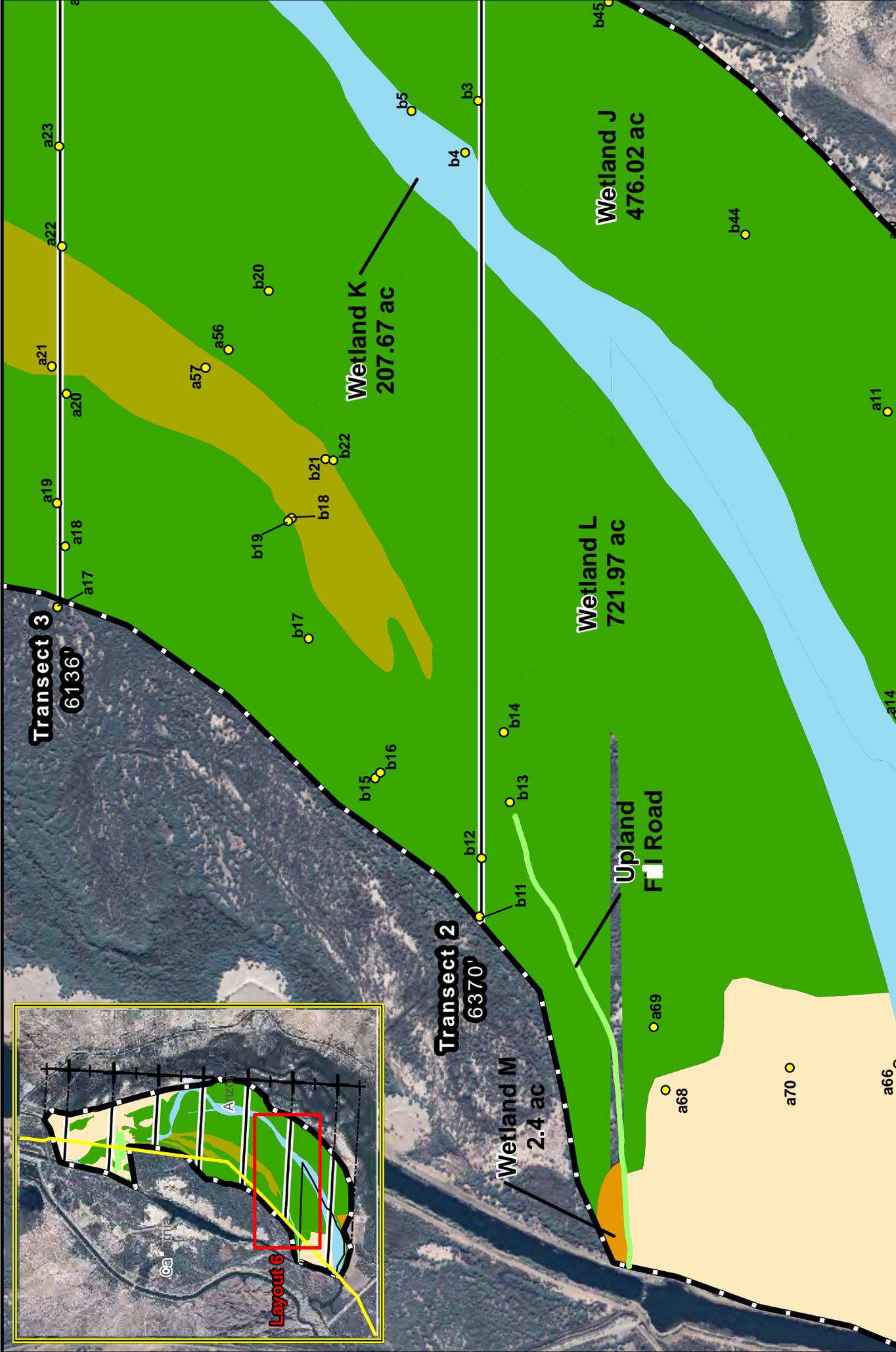
- Sample Point
- Transect
- State Line
- Project Boundary
- Arrowweed Sandbar Upland
- Disturbed non-vegetated Upland
- Permanently Flooded Marsh
- Salt Cedar/Mesquite Upland
- Seasonally Flooded Disturbed Non-Vegetated Wetland
- Seasonally Flooded Shrub/Scrub Wetland

**Bureau of Reclamation  
Laguna Restoration Project  
Wetland Map**

0 190 380 760 1,140 1,520 Feet

N

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Note: Base Map from GEO/Graphics Inc. & Bohannon Huston Inc. Color infrared, orthophoto mosaic, one-foot pixel, August 2004

**Legend**

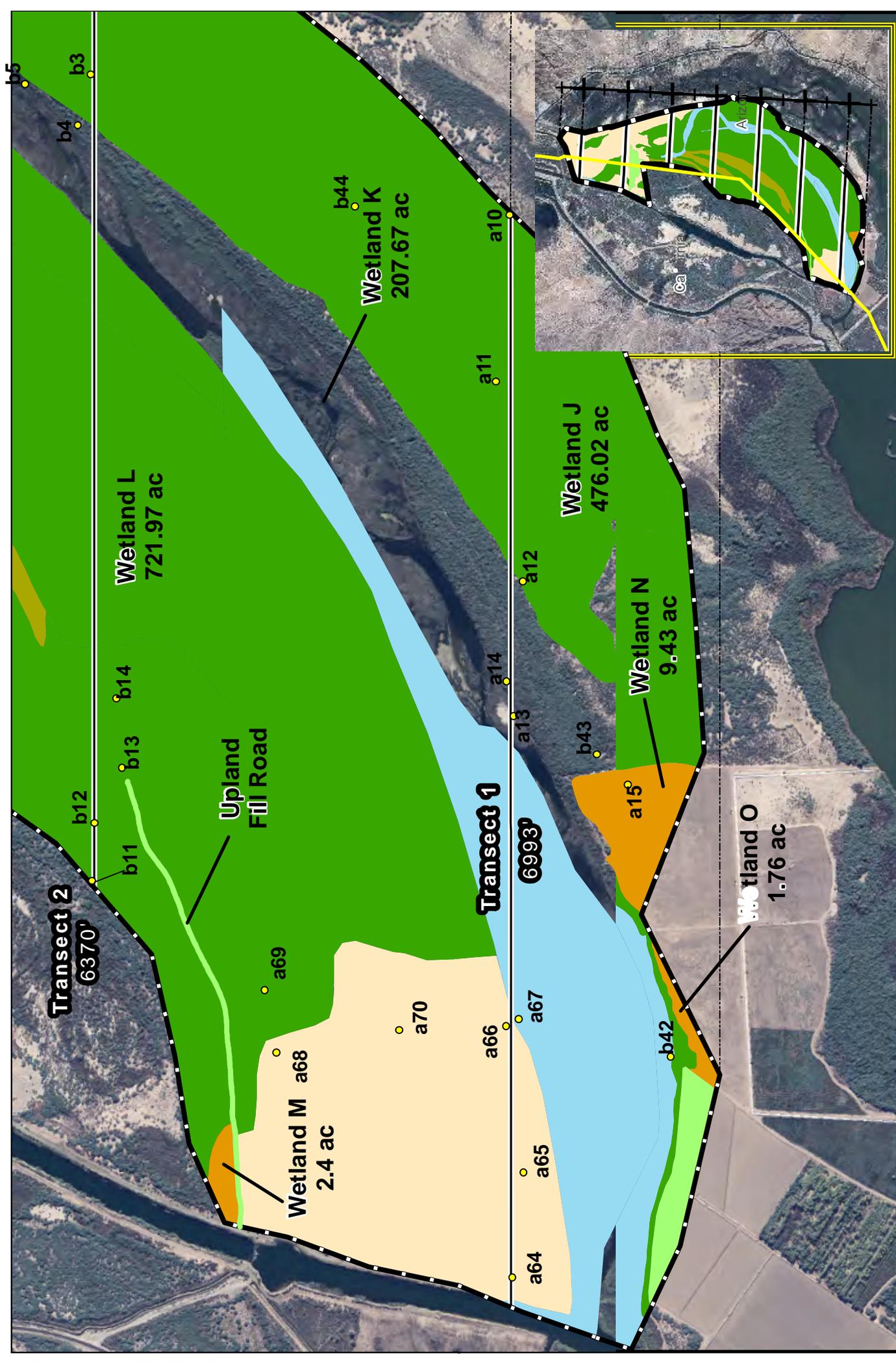
- Sample Point
- Transect
- State Line
- Project Boundary
- Arrowweed Sandbar Upland
- Disturbed non-vegetated Upland
- Permanently Flooded Marsh
- Salt Cedar/Mesquite Upland
- Seasonally Flooded Disturbed Non-Vegetated Wetland
- Seasonally Flooded Shrub/Scrub Wetland

**Bureau of Reclamation  
Laguna Restoration Project  
Wetland Map**

Scale: 0 262.5 525 1,050 1,575 2,100 Feet

North Arrow

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**Legend**

- Sample Point
- Transect
- State Line
- Project Boundary
- Arrowweed Sandbar Upland
- Disturbed non-vegetated Upland
- Permanently Flooded Marsh
- Salt Cedar/Mesquite Upland
- Seasonally Flooded Disturbed Non-Vegetated Wetland
- Seasonally Flooded Shrub/Scrub Wetland

**Bureau of Reclamation  
Laguna Restoration Project  
Wetland Map**

0 270 540 1,080 1,620 2,160 Feet

N

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