United States Department of the Interior
United States Bureau of Land Management
and
Department of Homeland Security
U.S. Customs and Border Protection

Draft Environmental Assessment for the Paradise Cove West U.S. Customs and Border Protection Mitigation for Southwestern Willow Flycatcher

This mitigation project is required for Right-of-Way AZA 34173 under U.S. Fish and Wildlife Services Biological Assessment 22410-2007-I-0212 and Biological Opinion 22410-2008-F-0195

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1. INTRODUCTION

1.1 Project Location

The Paradise Cove West (PCW) mitigation site (project area) consists of approximately 51 acres located within Bureau of Land Management (BLM)-administered Federal lands approximately 2 miles west of downtown Yuma, Arizona, south of Interstate 8 (I-8) (Figure 1; all figures are shown in Appendix A). The project area is located between Paradise Cove East (PCE) and the Cocopah tribal land to the west, between the south bank of the Lower Colorado River (LCR) and West Levee Road at North Figueroa Avenue (Figure 2). The project area is specifically located in San Bernardino Meridian, Arizona, Township 16 South, Range 22 East, Sections 28 and 29.

The BLM-administered Federal lands along the LCR are withdrawn by the Bureau of Reclamation (BOR). Lands bordering on the LCR from Davis Dam to the international boundary have been withdrawn for reclamation purposes under reclamation laws and are managed under the Department of the Interior, Part 613 Departmental Manual, Special Programs (1984). As part of the 1993 Memorandum of Understanding between BLM and BOR, BLM is responsible for fish and wildlife, wildland fire, and law enforcement activities. BLM received a letter of concurrence from BOR for this project dated February 11, 2011. A copy is incorporated into the Final Limitrophe Mitigation/Restoration Plan located in Appendix B.

The Yuma Mesa Conduit is a BOR facility that moves water near Morales Dam north to be utilized again as part of the same system. The conduit outfall is located directly adjacent to the eastern boundary of the project area. Surrounding land use includes agriculture to the south, recreation access to the river to the east, and naturally vegetated Cocopah tribal land to the west.

1.2 Project Background

Department of Homeland Security (DHS), U.S. Customs and Border Protection (CBP) was issued a right-of-way (ROW) grant (AZA 34173) by the BLM Yuma Field Office (YFO) in 2008 to conduct vegetation treatments on up to 580 acres along the LCR near Yuma, Arizona (BLM 2008a). The grant specifically covers the Limitrophe—a 23-mile reach of the LCR that forms the international boundary with Mexico where dense vegetation can sometimes interfere with CBP's border security mission. The grant authorized the establishment of an enforcement zone created through vegetation treatments, maintenance, and mitigation for a period of 10 years. The Limitrophe treatment area is shown on Figure 1.

As authorized by the ROW grant, a total of 149.08 acres of vegetation was treated within the Limitrophe in 2008, 2012, and 2017 by CBP, triggering the need for mitigation. Mitigation in the form of revegetation is one of the conservation measures identified in the 2008 U.S. Fish and Wildlife Service (USFWS) Biological Opinion (BO) to minimize impacts resulting from the vegetation treatment in the Limitrophe. The criteria included in the BO specifies that treated habitat must be replaced with higher quality habitat outside the treatment area, either within the Limitrophe or as close to the Limitrophe as possible (USFWS 22410-2007-I-0212; USFWS 22410-2008-F-0195).

Based on the mitigation ratios prescribed in the BO, CBP calculated that 42.8 acres of mitigation would be required (Table 1). In response to this, a preferred site, PCW, located approximately 2.5 miles away from the Limitrophe site, is analyzed in this Environmental Assessment (EA) as the Proposed Action area. The Proposed Action at PCW is expected to meet the current required mitigation of 42.8 acres for vegetation treatments that have occurred within the Limitrophe ROW between 2008 and 2017. This EA outlines CBP's mitigation project proposal to create and maintain southwestern willow flycatcher (*Empidonax trailii extimus*; SWFL) migratory habitat at the PCW mitigation area for a minimum of 10 years, starting once the trees are planted.

Table 1 Current Mitigation Required						
Treated	Acres Treated 2008	Acres Treated 2012	Total Acres Treated	Proposed Replacement Vegetation Type	Mitigation Ration/ Calculation	Mitigation Acres Required
Cottonwood-willow	7.3	17.26	24.56	Cottonwood–willow	1 : 1	24.56
Saltcedar	63.8	3.69	67.49	Cottonwood–willow	(acres treated x 4) / 23	11.74
Saltcedar-mesquite	0	32.5	32.5	Mesquite III	(acres treated x 4) / 20	6.50
Arrow weed	22	0	22	None	0	0
Undetermined	0.7	1.83	2.53	None	0	0
Total	**93.8**	**55.28**	**149.08**			**42.80**
NOTE: Mitigation ratios are from Table 5 in the USFWS BO (2008).						

1.3 Purpose and Need for the Proposed Action

The primary purpose of the Proposed Action is to restore and maintain a minimum of 42.8 acres of native habitat through manual, mechanical, and chemical applications within or as close to the Limitrophe as possible. The need for the Proposed Action is to meet the mitigation requirements for impacts resulting from 149.08 acres of vegetation treatment within the Limitrophe, as outlined in the 2008 USFWS BO. The intent is to provide higher quality habitat for wildlife species than the treated vegetation. An additional need for the project is to improve public safety within the area by improving access for law enforcement and wildland fire protection.

1.4 Decision to be Made

The BLM and CBP are joint lead agencies for the development of the Draft EA and decision making regarding the alternatives analyzed. The BLM and CBP Authorized Officers would decide whether the restoration of the proposed project area complies with the 2008 USFWS BO. If it complies, they would decide which alternative would be implemented based on the National Environmental Policy Act (NEPA) analysis contained in this EA and which management actions, mitigation measures, or monitoring requirements would be prescribed to ensure management objectives are achieved.

The decision to be made by the BLM is whether to authorize restoring and maintaining native habitat through manual, mechanical, and chemical applications at PCW as mitigation for vegetation treatment within the Limitrophe. The decision to be made by CBP is whether to expend funds to restore and maintain native habitat at PCW as mitigation.

1.5 Conformance with Land Use Plan

The Proposed Action is in conformance with the YFO Resource Management Plan (RMP), which was approved on 19 January 2010, which specifically provides for the following RMP decisions:

> VM-008: Where and when practicable, develop new riparian habitat or restore damaged, degraded, and saltcedar habitats within the Colorado River and Gila River for the protection and enhancement of riparian or floodplain associated species. Install facilities to protect restoration sites as needed.
>
> WF-027: Restore degraded habitats (both upland and riparian) to ecological conditions consistent with non-game migratory bird habitat management objectives, emphasizing maintenance and/or enhancement of natural biological diversity.
>
> WF-029: Create or maintain habitat for dove and quail at suitable sites such as riparian restoration areas or retired agricultural leases.

WS-017: Floodplains and riparian areas administered by the BLM along the Colorado and Gila rivers will continue to be managed with priority consideration given to maintenance as wildlife habitat.

WS-018: Desired plant communities and suitable wildlife habitat are restored and maintained for the benefit of migratory birds, waterfowl, reptiles, big-game mammals, and other desired species within riparian areas and floodplains.

1.6 Scoping and Issues

In accordance with BLM and DHS procedures, potential issues have been identified for analysis in this EA. Scoping for this EA was conducted in accordance with BLM and DHS procedures. A stakeholder meeting was held on 30 October 2013 at the BLM YFO to discuss issues and opportunities related to mitigation restoration opportunities, challenges/constraints, and feedback concerning the PCW project area. In attendance were representatives from state (Arizona Game and Fish Department) and Federal (BLM, CBP, BOR, USFWS) agencies, as well as tribal (Cocopah Tribe) and local agricultural interested parties. Several subsequent meetings were held to discuss refinements to the proposed restoration concept. The overall main stakeholder concerns discussed regarding potential restoration at the PCW project area included: wildlife habitat, cost, preservation of important existing structures and site features, safety and access, and compatibility with the adjacent Cocopah Restoration Project.

Additionally, on 29 June 2017, an internal scoping meeting as part of monthly NEPA meetings was held by the BLM YFO to identify potential issues, concerns, and impacts that would require detailed analysis. Table 2 summarizes the resources of concern that were identified by the BLM YFO and the rationale for the determination.

Table 2
Summary of Resources and Programs Considered for Analysis

Resources and Programs Considered	Not Present	Present and Not Affected	Present and/or Potentially Affected	Rationale
Air Quality			X	See Section 3.2 for analysis.
Areas of Critical Environmental Concern (ACEC)	X			The project is not within or adjacent to an ACEC.
Cultural Resources		X		Cultural resources would not likely be impacted as any cultural resources are likely deeply buried within the project area. It is generally assumed that prehistoric sites are buried beneath the Colorado River floodplain. Given the seasonal flood cycles and the deposition associated with those cycles, it is assumed that any such sites would be deeply buried within the Proposed Action area. See Appendix C for Cultural Resources Compliance Documentation Record.
Environmental Justice			X	See Section 3.3 for analysis.
Farmlands (Prime or Unique)			X	See Section 3.4 for analysis.
Floodplains		X		Infrastructure and restoration work would not change the functionality of the floodplain of the Colorado River or interfere with potential flood flows. The Proposed Action would not result in adverse impacts to the 100-year floodplain.
Fuels/Fire Management			X	See Section 3.5 for analysis.
Grazing	X			There is no grazing within the project area.

Table 2 Summary of Resources and Programs Considered for Analysis				
Resources and Programs Considered	Not Present	Present and Not Affected	Present and/or Potentially Affected	Rationale
Human Health and Public Safety			X	See Section 3.6 for analysis.
Lands and Realty		X		The Proposed Action would be compatible with the existing land use and would be in conformance with BLM management goals; therefore, no adverse impacts to lands and realty would occur.
Migratory Birds			X	See Section 3.7 for analysis.
Minerals	X			There are no active mining claims within the project area.
Native American Religious Concerns			X	See Section 3.8 for analysis.
Paleontological Resources	X			The sedimentary geologic units in the project area are not likely to contain vertebrate fossils or scientifically significant non-vertebrate fossils. The project area is located within an area with low paleontological sensitivity.
Rangelands and Forests	X			There is no range or forest within the project area.
Recreation			X	See Section 3.9 for analysis.
Socioeconomics			X	See Section 3.10 for analysis.
Soils			X	See Section 3.11 for analysis.
Threatened and Endangered Species			X	See Section 3.12 for analysis.
Vegetation			X	See Section 3.13 for analysis.
Visual Resources			X	See Section 3.14 for analysis.
Water Quality (Drinking and Groundwater)			X	See Section 3.15 for analysis.
Weeds/Invasive Species			X	See Section 3.16 for analysis.
Wetland/Riparian Zones			X	See Section 3.17 for analysis.
Wildlife/Special Status Species			X	See Section 3.18 for analysis.

2. PROPOSED ACTION AND ALTERNATIVES

There are two alternatives carried forward for evaluation in this EA: (1) the No Action Alternative and (2) the Proposed Action Alternative, as discussed below.

2.1 No Action (Alternative 1)

Under the No Action Alternative, the BLM would not approve PCW as a mitigation site, no restoration would occur within the proposed PCW project area under this proposal, and the mitigation requirement to restore 42.8 acres of riparian habitat would not be met at this site. Large, dense stands of invasive species would remain within PCW, no improvements would be made to fire or law enforcement access, and higher quality habitat for wildlife would not be created. The No Action Alternative is shown on Figure 3.

2.2 Proposed Action (Alternative 2)

Under the Proposed Action Alternative, CBP would restore a total of 49.84 acres of habitat within the proposed PCW project area to meet the mitigation requirement of restoring and maintaining a minimum of 42.8 acres of riparian habitat. The proposed restoration would be implemented in three phases over a three-year period and each phase would be monitored and maintained for a minimum of 10 years from the date of implementation. BLM would continue monitoring and maintenance activities after CBP concludes its 10-year efforts. Restoration and infrastructure development activities would employ an excavator, bulldozer, tractor, skip loader, and passenger trucks.

Large, dense stands of invasive species would be removed within PCW, improvements would be made to fire and law enforcement access, and native riparian and marsh habitats for wildlife would be created. A detailed description of the Proposed Action is provided in the Final Limitrophe Mitigation/Restoration Plan, attached to this EA as Appendix B.

Under the Proposed Action, the existing wetland that bisects the PCW project area would be maintained. Land on the north side of the channel would include four to five discrete areas that are divided by walkable field berms that extend perpendicularly from the northern access road (near the Colorado River) to another walkable berm on the north side of the interior channel, near the willow enhanced wetland. The walkable berms would provide limited access for site maintenance, while the drivable access road would provide access for site maintenance, as well as irrigation maintenance, law enforcement (vehicle access through gates), fire prevention, and recreation (foot access only). Existing structures and access roads would be preserved, and site features would be compatible with adjacent restoration activities by the Cocopah Tribe. In addition, a green fire break would bisect the restoration area connecting the site with direct access to the existing agricultural road. Bank stability along the Colorado River will be maintained by the preservation of the dense growth of common reed, in addition to the creation of a concrete ditch.

Under the Proposed Action, site grading would be utilized to achieve mitigation goals with a balanced cut/fill approach that would require no soil export and would combine agricultural and natural approaches. Water would be supplied to the project area directly from the Colorado River via a pumping station; no groundwater well would be necessary. A pumping station located in the central portion of the project area would pump water directly from the Colorado River into a concrete irrigation channel that would extend along the entire northern extent of the project area. The pumping station would be located adjacent to the green fire break area. Diversion outlets would deliver water from the irrigation canal to the fields, which would be laser-leveled and graded to maximize water coverage.

Irrigation requirements would be dependent on root growth to reach groundwater and reduction in any salt accumulation through percolation. The depth to groundwater is estimated to be approximately 6 to 7 feet within the cottonwood–willow areas and 8 to 9 feet within the mesquite woodland.

The willow-enhanced wetland would be recontoured to better support willow and wetland plantings. There would be no changes to the elevation of the main channel (although the banks may be laid back for a smoother transition); water flow to the adjacent Cocopah tribal land restoration area may increase during peak flows, but the flow would not drop below current levels. The channel would be connected to the river by a corrugated metal culvert that would receive flow during high river water events; although water would be perennially delivered via the wastewater treatment outfall located on the southern boundary of the project area.

Excavated soil would be used to: (1) construct the walkable berms/drivable access roads; (2) construct irrigation swales along the existing road and the river edge; and (3) develop the central green fire break/access area.

Restoration components vary by each vegetation type proposed for restoration and include a mix of earthwork, irrigation and water control, container plant installation, and operations and maintenance. The restoration components for each vegetation type are described below and shown on Figure 4.

- **Willow-enhanced Wetland.** Approximately 13.9 acres of willow-enhanced wetland would be improved along the channel and its connection to the river. This area would be irrigated via the wastewater treatment outfall and via high water river events. Non-native common reed within this area would be mechanically removed and chemically treated from the channel and willow cuttings would be installed at its edge, along with a diverse suite of wetland native plant species. Plantings would consist of a mix of poles, cuttings, and plugs, and would be supplemented with seeding of native species. Herbivory cages may be installed.

- **Cottonwood–Willow.** Approximately 31.6 acres of cottonwood–willow would be supported on both sides of the willow-enhanced wetland. This area would be irrigated via the flood irrigation system. All water utilized by this method would be metered and reported as part of the BLM Colorado River Water Right. The cottonwood–willow vegetation type would include densely planted willow cuttings (minimum 24 inches x 0.5 inch) and cottonwood poles (minimum 36 inches x 1 inch) as well as supplemental 5-gallon cottonwood and willow plants in specific areas. The 5-gallon plantings would be protected from herbivory with wire cages, and the area would also be seeded with native species. In addition, herbivory cages may be installed on additional plantings.

- **Mesquite Woodland.** Approximately 4.34 acres of mesquite woodland would be supported at the southwestern, drier portion of the project area. This area would be graded as a transitional area from the channel to the access road; irrigation would occur via temporary agricultural overhead sprinklers, as needed, until the mesquite trees are surviving on their own (approximately three years). The mesquite woodland vegetation type would utilize tall pots (trees). The tall-pot plantings would be protected from herbivory with wire cages, and the area would also be seeded with native species.

Clearing and grubbing of existing vegetation would be necessary to prepare the project area. This task would be accomplished using heavy machinery, primarily a bulldozer to push material into piles and a loader to deposit material into roll-off containers for off-site disposal. Material may be chipped prior to disposal in containers to reduce the biomass to a manageable size. Restoration and infrastructure development activities would employ an excavator, bulldozer, tractor, skip loader, and passenger trucks. Restoration and infrastructure development activities would take approximately five to six weeks to complete.

Under the Proposed Action, earthwork would be necessary to prepare, excavate, grade, and level the project area to achieve appropriate surface, drainage patterns, and elevations above groundwater to support the different vegetation types. Earthwork would be accomplished using heavy machinery, including a bulldozer and an excavator. Approximately 150,000 cubic yards of cut and fill would be moved (but no export) within the project area.

A fenced pumping station would be installed in the central portion of the project area to pump water directly (via a diesel-fueled pump) from the Colorado River to support restoration plantings. Three modes of irrigation would be used:

- **Flood Irrigation via Concrete-lined Irrigation Canals.** A concrete-lined irrigation canal would span the length of the project area to serve the plantings. The ditch would be 1 to 2 feet wide at the base and 2 to 3 feet in depth, and would run along the northern edge of the project area (adjacent to the riverside berm/access road). Diversion outlets would be manually controlled to allow flood irrigation of planted areas. It is estimated that this irrigation system may utilize up to 80 acre-feet of water during Year 1, with a 20 percent decrease per year over the next three years, until the trees are established.
- **Flood Irrigation via the Improved Central Main Channel.** The willow-enhanced wetland would be connected to the river via a culvert at the upstream end of the project area, which would flush the system during high water events. In addition, the central wastewater treatment outfall would continue to provide water to the lower portion of the project area. Water use is determined by the culvert size and elevation placement (see Appendix B for details). It is estimated that this irrigation system may utilize up to 24 acre-feet of water during Year 1, with a 20 percent decrease per year over the next three years, until the vegetation is established. However, this does not account for water that would be derived from the wastewater treatment plant, which would account for a large portion of this water allocation.

- **Overhead Watering the Mesquite Woodland.** Vegetation in the southwestern portion of the project area would be served by a temporary overhead irrigation system. The system would be similar to typical agricultural practices in the Yuma area; pipes would be rented and utilized as needed. The system would be pressurized by connecting a hose to the pumping station stretched along the green fire break. The project restoration biologist would be responsible for field-fitting the system to adequately irrigate the container plantings during the maintenance period. Watering would be conducted during regular flood irrigation operations on a regular basis. It is anticipated that overhead irrigation would occur until the tree roots reach groundwater (approximately three years). It is estimated that this irrigation system may utilize up to 6 acre-feet of water during Year 1, with a 20 percent decrease per year over the next three years, until the trees are established. No water use is anticipated after Year 3.

Operations and Maintenance includes irrigation system components, gates, signage, treatment of invasive species, and remedial plantings. CBP would conduct maintenance for a minimum of 10 years or until trees are surviving on their own, as provided in the 2008 BA (BLM 2008b) and BO (USFWS 2008). Due to the design of the project area, maintenance would be required in perpetuity. BLM would be responsible for maintenance of the site after CBP has met its 10-year obligation.

The Proposed Action would be implemented in phases. The restoration components are shown on Figure 4. CBP anticipates that implementation of the phases would take place over a three-year period. Project construction and operations, including both initial treatment and subsequent maintenance, would be timed to avoid the migration, breeding, and nesting timeframe of special status species.

Phase 1 would occur in the first year and components would include construction of the following:

- Pumping station (pump, intake, generator, fence)
- Green fire break (agricultural lease) stabilization for access to pumping station. Access road stabilization to pumping station, upstream northern boundary (approximately 4,000 linear feet)
- Upstream concrete-lined irrigation swale (approximately 3,800 feet), nine diversion outlets
- Culverts (at pumping station, across central wetland, and at upstream weir)
- Three gates and signage
- Vegetation – approximately 17 acres of cottonwood–willow; three graded and leveled fields and associated berms

Phase 2 would occur in the second year and would consist of additional vegetation supported by infrastructure created in Phase 1. Components would include:

- Additional vegetation supported by infrastructure created during Phase 1
- Vegetation – Approximately 6 acres of cottonwood–willow and approximately 9 acres of willow-enhanced wetland, one graded and leveled field, associated berms, and recontoured central wetland

Phase 3 would occur in the third year and would be focused downstream of the pumping station. Components would include:

- Access road stabilization [downstream northern boundary (1,600 linear feet); four diversion outlets
- Two gates and signage
- Vegetation – Approximately 9 acres of cottonwood–willow, 6 acres of willow-enhanced wetland, and 4.34 acres of mesquite woodland; including three graded and leveled fields and associated berms, and recontoured central wetland

BLM Best Management Practices (BMPs) follow the 2010 RMP. Additional BMPs include:

- Vehicles must be washed prior to entering the site.
- All revegetation materials will be weed- and pest-free.
- Include native, drought-adapted species in the planting and seeding palettes.
- Apply seeds and install plants at the appropriate time of year.
- Rake seeds into the soil to ensure seed-to-soil contact.
- CBP would submit a Pesticide Use Proposal to BLM YFO for approval 30 days prior to initiating herbicide application activities.
- Use only herbicides included in list approved for use by BLM (BLM 2007 and BLM 2016)
- Buffer zones are required adjacent to dwellings; domestic water sources; agricultural land; and streams, lakes, and ponds (except if labeled for aquatic use):
    - 100 feet for aerial application
    - 25 feet for vehicle application
    - 10 feet for hand application
- Vehicle-mounted sprayer:
    - Use only when wind is 8 miles per hour (mph) or less (5 mph when in riparian areas).
    - Boom sprayers not to be used within 25 feet of water body (unless herbicide is labeled for aquatic use).
- Hand application:
    - Use only when wind is 8 mph or less (5 mph when in riparian areas).
    - Single nozzle application (low pressure, low volume) held 0.5 to 2.5 feet above ground level.
    - Foliar herbicide may be wiped onto plants up to the water line.
    - Granular herbicides may be applied via broadcast spreaders at 3.5 feet about the ground and at least 10 feet from the high water mark of water bodies.
- Minimize potential impacts to non-target plants and animals.
- Mechanical treatment and reseeding should be timed for maximum effect to target species and minimum impact to non-target species.

- Best treatment method(s) should be chosen by considering: species characteristics, site preparation, topography and terrain, soil characteristics, climate and seasonality, and cost-benefit analysis.
- Only herbicides approved for use in/around water are recommended for use at Paradise Cove West
- In the event of an unanticipated discovery of cultural resources, all work will cease in the area of the discovery and the BLM Authorized Officer will be notified immediately. Procedures outlined in the implementing regulations for the National Historic Preservation Act of 1966, as amended (see 36 CFR 800.13, Post Review Discoveries), will be followed. Pursuant to these regulations, all tribes consulted for this project will be notified of an unanticipated discovery within 24 hours of the discovery. Work may not resume until written authorization to proceed is issued by the BLM.
- In the event that human remains or indications that human remains may be present, such as headstones, are observed or encountered, field staff and/or contractors must immediately cease all project activity in the area and notify the BLM authorized officer. No work may proceed without the written authorization of the BLM.
- Emergency protocols for Colorado River flooding events should be established to ensure equipment, facilities, and people are protected. Protocol should also outline emergency purchasing and timeline procedures in case unforeseen damage occurs to equipment and facilities.
- In the event of an unanticipated discovery of paleontological resources, all work will cease in the area of the discovery and the BLM Authorized Officer will be notified immediately. Work may not resume until written authorization to proceed is issued by the BLM.

2.3 Alternatives Summary

Table 3 summarizes the alternatives carried forward for analysis and if they meet the purpose and need for the Proposed Action.

Table 3
Purpose and Need for the Proposed Action by Alternative

Purpose and Need	Alternative 1: No Action Alternative	Alternative 2: Proposed Action Alternative
Would the alternative meet the mitigation requirements under the 2008 USFWS BO for impacts to the Limitrophe?	No	Yes
Would the alternative restore and maintain a minimum of 42.8 acres of native habitat through manual, mechanical, and chemical applications within or as close to the Limitrophe as possible?	No	Yes

2.4 Alternatives Considered but Eliminated from Detailed Study

The BLM and CBP considered several other alternative locations for the proposed mitigation including the following sites: Mittry Lake, Confluence, and PCE. These alternatives were previously analyzed in detail during the preparation of the Final Limitrophe Mitigation/Restoration Plan (see Appendix B), but were eliminated from detailed study as discussed below.

The 2008 USFWS BO specified mitigation criteria for the revegetation site evaluation, which included: proximity to the Limitrophe; high restoration potential; cost analysis; current site conditions and need for additional preparations (soil conditioning); quality and quantity of existing native riparian habitat; current recreational uses; and U.S. Bureau of Reclamation concurrence.

Mittry Lake was eliminated due to very saline soil conditions (that would require detailed analysis to address concerns) and proximity to dense stands of invasive species that would create a constant need for maintenance. This would make it economically and technically infeasible for implementation due to the timeline in the 2008 ROW mitigation implementation requirements. Confluence was eliminated due to recreation access that would make it difficult to protect against recreation impacts and vandalism, and limited access for installation and maintenance activities. PCE was eliminated because it is encumbered by established cottonwood and willow riparian habitat, presence of migratory yellow billed cuckoo and southwestern willow flycatcher, and designation as a BLM recreation trail with fishing and hiking access. Due to these components, the USFWS does not consider these sites eligible as mitigation sites.

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 Past, Present, and Reasonably Foreseeable Future Actions

Past actions in the project area and vicinity include the following:

- Agricultural use (terminated within the project area in 1983 after a flooding event)
- Wildland fires
- Habitat/native plant restoration
- Recreational use
- Saltcedar clearing (invasive species management)
- Restoration of approximately 17 acres at Paradise Cove East and approximately 20 acres on Cocopah tribal land adjacent to the project area

Present actions in the project area and vicinity include the following:

- Recreational use
- Habitat/native plant restoration to adjacent lands to the east and west
- Invasive species management
- Herbicide and chemical fertilizer use within agricultural fields, residential and recreation areas

Reasonably foreseeable future actions in the project area and vicinity include the following:

- Recreational use
- Invasive species management
- Wildland fires
- Herbicide and chemical fertilizer use within agricultural fields, residential and recreation areas
- Restoration Area Maintenance

3.2 Air Quality

3.2.1 Affected Environment

The Proposed Action area is located in Yuma, Arizona. The Yuma area is characterized as a low-latitude arid hot desert climate with an average annual rainfall of approximately 3 inches and generally low humidity, ranging from 10 to 60 percent, except during the summer monsoon rain season. Prevailing winds are most often out of the south (Climatemps 2017).

The EPA designates Yuma County as an area that currently meets the thresholds for all criteria pollutants except for PM_{10}. Parts of the county were designated as moderate PM_{10} non-attainment areas under the 1990 Clean Air Act amendments. The Arizona Department of Environmental Quality (ADEQ) submitted the Yuma PM_{10} Maintenance Plan to the EPA and is pending approval. The Proposed Action area is within the PM_{10} non-attainment area for Yuma County (ADEQ 2017a).

3.2.2 Impacts of the Proposed Action

Restoration and infrastructure development activities would take approximately five to six weeks to complete. On-site air pollutant emissions would principally consist of exhaust emissions from the heavy-duty diesel-powered equipment as well as fugitive particulate matter from soil disturbance during infrastructure and restoration activities.

Short-term particulate emissions in the form of fugitive dust would be emitted from trucks and construction vehicles accessing the project area. A water truck would be used as needed to control dust

within the project area, especially during fall and winter months to reduce impacts to produce crop harvesting. Off-site exhaust emissions would result from workers commuting to and from the project area, as well as from truck trips for hauling material (e.g., vegetation and debris) from the project area.

A road construction emissions model was used to estimate emissions associated with the proposed work (Table 4). Emissions results were compared to the federal Clean Air Act (CAA) *de minimis* thresholds per the General Conformity Rules. The Proposed Action would not exceed CAA thresholds, as shown in Table 4 below.

Table 4
Construction Emissions (Maximum Pounds per Day)

Phase	Pollutant				
	ROG	NO_x	CO	PM_{10}	$PM_{2.5}$
Infrastructure and Restoration Activities	9.5	105.8	64.1	54.8	14.8
Maximum Daily Emissions	9.7	111.0	65.3	55.2	14.9
Annual Emissions (tons per year)	**0.73**	**8.33**	**4.92**	**3.67**	**1.01**
General Conformity: de minimis Limits (tons per year)	*100*	*100*	*100*	*100*	*100*

ROG = reactive organic compounds
NO_x = oxides of nitrogen
CO = carbon monoxide
PM_{10} = particulate matter less than 10 microns in diameter
$PM_{2.5}$ = particulate matter less than 2.5 microns in diameter

BLM-approved herbicides would be applied directly to plants when weather conditions are under 85 degrees and less than 10 mph wind speed with minimal chance for release into the atmosphere and drift to adjacent native vegetation. Potential impacts to air quality from herbicide use would be negligible and short term, dissipating almost immediately after initial application.

Under the Proposed Action, the short-term release of a small amount of regulated air pollutant emissions are expected to be well below General Conformity Rule *de minimis* levels (see Table 4). Adverse impacts to local area air quality would be reduced once infrastructure construction and restoration activities are completed. Herbicide use would not result in impacts to local air quality.

Long-term negligible beneficial air quality impacts from restoration of the project area would result from the increase in native vegetation that would reduce bare ground within the project area. Existing bare ground areas within the project area would be planted with native vegetation (approximately 1 acre of mesquite and willow-enhanced wetland) or stabilized (approximately 2 acres) for use as access to the pump station. Vegetation and stabilization of bare ground within the project area would reduce rates of wind erosion and dust generation. Overall, the Proposed Action would result in short-term negligible release of pollutant emissions without resulting in an adverse long-term impact on air quality.

3.2.3 Impacts of the No Action Alternative

Under the No Action Alternative, restoration and related infrastructure construction would not occur within the PCW project area. No impacts to air quality from these activities would occur.

3.2.4 Cumulative Impacts

The Proposed Action would result in short-term adverse negligible impacts during construction and grading activities. Long-term negligible beneficial air quality impacts from restoration of the project area would result from the increase in native vegetation and bare ground stabilization resulting in reduced rates of wind erosion and dust generation. Adjacent projects that have restored native vegetation along the LCR corridor have also contributed to reduced bare ground, resulting in reduced wind erosion and dust generation in the vicinity. Cumulative impacts of the Proposed Action would be beneficial to air quality as a result of the reduction of wind erosion and dust generation along the LCR between the Yuma East wetlands and the Cocopah tribal land restoration areas.

3.2.5 Best Management Practices, Mitigation Measures, and/or Stipulations

A water truck would be used as needed to control dust within the project area, especially during fall and winter months to reduce impacts to produce crop harvesting.

3.3 Environmental Justice

3.3.1 Affected Environment

The City of Yuma has an estimated 5.7 percent unemployment rate and 15.7 percent of families below the poverty level. Low-income and minority populations are located approximately 1 mile west of the project area (Cocopah Reservation) as well as approximately 1 mile southeast (low-income minority area) (U.S. Census 2017). Utilization of the project area vicinity by low income and minority communities is very high. Future uses are projected to be from these communities and the surrounding middle-class and visiting community.

3.3.2 Impacts of the Proposed Action

Under the Proposed Action, low-income and minority areas within 1 mile of the project area may experience short-term negligible adverse impacts from construction noise and dust emissions. Noise and dust emissions during construction activities would be minimal due to the distance between the project area and residences, which on average is approximately 1 mile. Noise and dust emissions would dissipate considerably within this distance. The Proposed Action would not disproportionately affect the minority and low-income populations in the area.

The Proposed Action would serve to create a safer and more accessible environment facilitating healthy recreation by the general public in the project area and vicinity. In addition, restoration would reduce fire risk in the project area.

Overall, implementation of the Proposed Action would not result in unfair treatment to any person with respect to race, color, national origin, or income. No disproportionately high or adverse impacts are anticipated as a result of the Proposed Action; therefore, no adverse impacts to low-income or minority populations are anticipated. Similarly, the Proposed Action would not pose a disproportionate environmental health risk or safety risk to children, as protected by Executive Order 13045.

3.3.3 Impacts of the No Action Alternative

Under the No Action Alternative, restoration and related infrastructure construction would not occur within the PCW project area; therefore, no impacts, adverse or beneficial, to low-income or minority populations from these activities would occur.

3.3.4 Cumulative Impacts

Under the Proposed Action, low-income and minority residences within 1 mile of the project area may experience short-term negligible adverse impacts from construction noise and dust emissions. Past and present actions have resulted in long-term beneficial impacts to low-income and minority through establishment of recreational use areas. Reasonably foreseeable future actions include recreational use, invasive species management, and agricultural use, which would not likely result in disproportionately high or adverse impacts to low-income and minority populations.

3.3.5 Best Management Practices, Mitigation Measures, and/or Stipulations

No measures are proposed for environmental justice.

3.4 Farmland (Prime and Unique)

3.4.1 Affected Environment

The majority of the project area is classified as soil map unit “water” and is not currently used for agriculture. Adjacent land to the south is active farmland and is classified as “prime farmland if irrigated and reclaimed of excess salts and sodium” as defined by the Farmland Protection Policy Act of 1981 (Natural Resources Conservation Service 2017). This area was farmed previous to the 1983 flooding of the Colorado River. Due to this event, the agricultural lease was modified to the current agricultural lands only and invasive species spread throughout the project area has led to invasives becoming the dominant species. Approximately 46 acres of the 51-acre project area consists of vegetation cover that is predominantly invasive species (arrowweed/saltcedar scrub and common reed scrub).

3.4.2 Impacts of the Proposed Action

The Proposed Action has been developed as required mitigation and compliance under the Endangered Species Act and a Federal Land Policy and Management Act authorized right-of-way for CBP activities. Due to the long-term requirements of the 2008 USFWS BO, these lands are no longer available for crop production under an agricultural lease and have not been used for agricultural purposes since the 1983 flood of the area.

Adjacent prime farmland would not be disturbed by activities occurring within the project area. The Proposed Action would not result in adverse impacts to prime or unique farmlands in the vicinity of the project area. Negligible beneficial impacts would occur to Food Safety Concerns at adjacent agricultural fields due to reduced dust emission when current bare ground areas are vegetated or stabilized. In addition, the removal and maintenance of invasive species would reduce the spread of these species resulting in a negligible beneficial impact.

3.4.3 Impacts of the No Action Alternative

Under the No Action Alternative, restoration and related infrastructure construction would not occur within the PCW project area. Under this alternative, saltcedar and other invasive plant species would continue to occur within the project area and have the potential to spread, resulting in adverse impacts to prime and unique farmland adjacent to the project area.

3.4.4 Cumulative Impacts

Under the Proposed Action, prime farmland in the vicinity would not be disturbed by construction, restoration, or maintenance activities.

3.4.5 Best Management Practices, Mitigation Measures and/or Stipulations

No measures are proposed for farmland.

3.5 Fuels and Fire Management

3.5.1 Affected Environment

Several human-caused fires have occurred within PCW and adjacent lands (Table 5; BLM 2014 and BLM 2017a). Vegetation within the project area consists of both native and non-native invasive species that may be susceptible to wildland fire. Riparian fires along the lower Colorado River are typically carried by high wind and low humidity. Annual growth rates range from 4 to 6 feet per year within riparian zones, resulting in potential continuous hazardous fuel growth within the project area and vicinity. The existing vegetation within the project area consists of a combination of arrowweed, saltcedar, and phragmites, which is vegetation typical of the Shrub Fuel Type model 7 (SH7). This model indicates that the shrub vegetation is prone to intense fire behavior with flame lengths up to 30 feet and rates of spread up to 200 feet per minute (Scott and Burgan 2005; Behave Plus Fire Modeling System).

Table 5 Fires in the Vicinity of the Paradise Cove West Project Area		
Fire Location	Acres	Year
Figueroa	35.0	2016
Power	0.3	2016
Paradise	2.5	2014
Lateral	13.5	2013
Johnson Place	14.0	2011
OOPS	0.5	2011
Levee Road	57	2008
Paradise Cove	0.5	2008
VP Pitt	0.3	2008
VP Pitt	0.1	2008
SOURCE: BLM 2017a.		

3.5.2 Impacts of the Proposed Action

Under the Proposed Action, proposed infrastructure would improve access for law enforcement and fire control. Creation of native riparian habitat, including high humidity microclimates, similar to southwestern willow flycatcher habitat requirements, can lead to a reduction in wildland fire size and intensity. Overall, the Proposed Action would result in long-term beneficial impacts to fuels and fire management in the project area. The vegetation structure created by the Proposed Action would be representative of fuel model TL6 (Scott and Burgan 2005). Fuel model TL6 consists of hardwood forest litter and can be used to model fire behavior in cottonwood-willow stands. Fire behavior in this fuel type is low to moderate, with spread rates up to 25 feet per minute and flame lengths up to 8 feet under the most extreme conditions (Scott and Burgan 2005; Behave Plus Fire Modeling System).

3.5.3 Impacts of the No Action Alternative

Under the No Action Alternative, restoration and related infrastructure construction would not occur within the PCW project area. Non-native invasive vegetation would continue to increase in the project area, resulting in the potential increase for wildland fire. The abundance of burnable fuels in riparian areas lends itself to high rates of fire spread and flame length greater than 11 feet (Yuma County 2010). Under this alternative, there would be a greater impact from wildland fires from public use and current site conditions (invasive species that create wildland fire fuel loads). The No Action Alternative would likely result in negligible to minor adverse impacts to fire and fuels management in the project area.

3.5.4 Cumulative Impacts

The Proposed Action would result in the reduction of hazardous fuels as well as improve access for fire control in the project area. Past and present efforts, including habitat restoration at PCE and nearby Cocopah tribal land, have reduced hazardous fuels in the project area vicinity and resulted in reduced fire danger (fewer and smaller fires). The Proposed Action, in combination with past, present, and reasonably foreseeable future actions that have reduced hazardous fuels and improved fire control access within the project area and vicinity, would result in beneficial cumulative impacts to fire management.

3.5.5 Best Management Practices, Mitigation Measures, and/or Stipulations

Irrigation maintenance and annual hazardous fuels reduction would be required to maintain green fire breaks, administrative access roads, and high humidity site conditions.

3.6 Human Health and Safety

3.6.1 Affected Environment

PCE, located east of the project area, is known to have experienced illegal activity including drugs, prostitution, and wildcat dumping that have caused human health and public safety concerns (BLM 2014).

These activities likely extend into the PCW project area. Multiple law enforcement agencies, including Federal, state, and city officers, patrol the project area vicinity for illegal activity.

Wildland fires have occurred within PCW and the project vicinity (see Table 5; BLM 2017a). All of these fires were caused by human activities. Wildland fires are managed by Federal and local fire response crews (BLM 2014).

The project area is located within breeding habitat for numerous insects and animals, such as ticks, rodents, mosquitos, and fleas that can transmit vector-borne diseases such as West Nile virus, Lyme disease, hantavirus, and the plague. West Nile virus has been reported within Yuma County (Yuma County 2017). The Yuma County Public Health District has conducted treatment of the area and continues to monitor for West Nile virus and provide vector control for the virus throughout the county.

3.6.2 Impacts of the Proposed Action

Under the Proposed Action, restoration and related infrastructure, as well as herbicide treatment of invasive species, would improve access to the project area. Improved access would assist law enforcement and fire management agencies patrol the area and provide emergency services thereby improving public safety in this area. Similar access strategies were used on the adjacent PCE site with resulting improved public safety.

During project implementation and subsequent maintenance, personnel would be exposed to safety risks from the inherent dangers of traversing the site, operating tools and equipment, and herbicide application. Personnel would be required to establish and maintain safety protocol, including appropriate handling of tools and equipment. All crew members would have appropriate personal protective equipment when handling herbicides, and be led by a certified herbicide applicator through use of an approved pesticide use proposal.

The Proposed Action would result in temporary negligible adverse impacts to human health and safety during construction and maintenance from use of heavy equipment and herbicide treatments. Long-term negligible to minor beneficial impacts to health and safety would result from improved law enforcement and access for emergency services, as well as continued maintenance of the project area to reduce invasive species fire hazards.

3.6.3 Impacts of the No Action Alternative

Under the No Action Alternative, restoration and related infrastructure construction would not occur within the PCW project area. Current public health and safety issues would continue and result in long-term adverse public health and safety impacts.

3.6.4 Cumulative Impacts

The Proposed Action would result in improved law enforcement and fire access through restoration and infrastructure of the project area (as described in Chapter 2), as well as removal and maintenance of hazardous fuels (BLM 2014). These past and present efforts to improve law enforcement, fire access, and fuels reduction in the project area vicinity, as well as improve healthy recreational opportunities within the restored project area and vicinity, would result in negligible beneficial health impacts. The Proposed Action, in combination with past, present, and reasonably foreseeable future actions within the project area and vicinity, would result in beneficial cumulative impacts to human health and safety.

3.6.5 Best Management Practices, Mitigation Measures, and/or Stipulations

Public safety concerns may result in administrative closure of the project area. This may occur during construction, breeding seasons, or as deemed necessary by the BLM Authorized Officer. Closure notices would be provided to the public as deemed appropriate by the BLM Authorized Officer.

3.7 Migratory Birds

3.7.1 Affected Environment

The emergent marsh and riparian habitats within PCW provide potential habitat for migratory birds, including foraging, cover, and nesting habitat (RECON Environmental, Inc. [RECON] 2018b). They migrate through or are seasonal (summer or winter) residents. The breeding season is when these species are most sensitive to disturbance, typically from 30 March through 30 September.

3.7.2 Impacts of the Proposed Action

Implementation of the Proposed Action would restore approximately 49.84 acres of the 51-acre project area, of which 42.8 acres is required mitigation; the remaining 1.16 acres is associated with the perimeter road and therefore eliminated from the mitigation acreage totals. Temporary, short-term negligible impacts to migratory birds would occur during implementation of restoration and construction of associated infrastructure. Short-term impacts may include loss of foraging, cover, and nesting habitat during vegetation removal and from disturbance due to noise and human activities during restoration activities.

Long-term minor to moderate beneficial impacts to migratory bird species would result from the replacement of existing invasive vegetation and dense native cover with 49.84 acres of native vegetation and riparian species. Native vegetation restoration would provide improved foraging, cover, and nesting habitat for migratory birds. Once completion of the Proposed Action has occurred and maintenance is ongoing, the number and diversity of migratory bird species are likely to increase in the project area at different times in their lifecycle.

3.7.3 Impacts of the No Action Alternative

Under the No Action Alternative, current conditions would continue and restoration of native riparian and marsh habitats within PCW would not occur. PCW would continue to experience invasive plant species infestations which would further degrade the existing migratory bird habitat. The project area would continue to provide low quality foraging, cover, and nesting habitat.

3.7.4 Cumulative Impacts

The Proposed Action would result in short-term adverse negligible impacts to migratory birds during implementation and long-term beneficial impacts as a result of riparian habitat restoration. Past and ongoing habitat restoration of adjacent areas, including restoration of the PCE and nearby Cocopah tribal land restoration area, has resulted in long-term cumulative beneficial impacts to migratory birds along the LCR corridor near the project area. These projects, along with implementation of the Proposed Action, result in several miles of native riparian vegetation along the LCR from the Yuma East Wetlands restoration area west to the Cocopah tribal land restoration area that provide essential riparian habitat for migratory birds. Additionally, implementation of flood irrigation, native tree planting, and improved green fuel breaks would increase migratory bird use of the area by improving habitat conditions. Cumulative impacts of the Proposed Action, in combination with past, present, and reasonably foreseeable future actions in the project area and vicinity, would be beneficial to migratory bird species.

3.7.5 Best Management Practices, Mitigation Measures, and/or Stipulations

The following measures would be included to minimize potential short-term impacts to migratory birds during the bird-breeding season:

- Construction activities and emergency actions would occur year-round with written permission from BLM. April through November actions may require a biological monitor to ensure no disruption to listed species. Maintenance, including mechanical vegetation treatments and retreatment should occur between 1 October and 31 March, to avoid any impacts to migratory

birds. If work is to occur during the breeding season, a qualified biologist must survey the area prior to start of construction activities for nesting and migratory birds, including threatened and endangered species. This shall include burrowing and ground-nesting species in addition to those nesting in vegetation. If any active nests (containing eggs or young) are found, an appropriately sized buffer area must be avoided until the young birds fledge.

3.8 Native American Religious Concerns

3.8.1 Affected Environment

The LCR has been a vital source of water and sustenance within a dry desert climate throughout history (BLM 2014). Indigenous peoples used to plant their crops in the river floodplain and camp on the adjacent river terraces. There are extensive remnants of these campsites at higher elevations, where past flood events have not impacted their traces. In addition, the river corridor is known for its associated intaglio features, rock art, and extensive trail networks. Many of these features are considered traditionally important or sacred to Native Americans. The Limitrophe of the Colorado River continues to be important to today's Native Americans for traditional uses, such as tribal education, gathering, hunting, and fishing; collection of mesquite wood for funerary and construction purposes; collection of willow for basket materials; possible collection of clay used for pottery making; and collection of river rocks (BLM 2014).

3.8.2 Impacts of the Proposed Action

Under the Proposed Action, restoration and related infrastructure construction, as well as herbicide treatment of invasive species, would enhance many of the characteristics that make the river corridor significant to Native American tribes, such as riparian vegetation and wildlife habitat values. Implementation of the Proposed Action would restore approximately 49.84 acres of the 51-acre project area approximately 13.9 acres of willow-enhanced wetland, approximately 31.6 acres of cottonwood-willow, and approximately 4.34 acres of mesquite would be restored. The removal or treatment of the 49.84 acres to remove invasive species would enhance the type of vegetation that is of traditional importance to the tribes, such as cottonwoods, willows, and mesquites. Similarly, habitat restoration would enhance and improve native vegetation communities of the area, returning the area to a more traditional setting. Although the berms and access road may detract from the restoration to a more native, natural setting of the area, overall, the Proposed Action would result in beneficial impacts to Native American religious concerns.

3.8.3 Impacts of the No Action Alternative

Under the No Action Alternative, restoration and related infrastructure construction would not occur within the PCW project area. Current conditions of the area would remain and the traditionally important values of vegetation and wildlife of the project area would not be enhanced or restored. The No Action Alternative would result in minor adverse impacts to Native American religious concerns.

3.8.4 Cumulative Impacts

The Proposed Action would result in long-term beneficial impacts to Native American religious concerns as a result of habitat restoration of the project area. Past and ongoing restoration of adjacent areas, along with implementation of the Proposed Action, would result in native riparian vegetation along the LCR from the East Wetlands restoration area west to the Cocopah tribal land restoration area, improving the cultural values of the area. Cumulative impacts of the Proposed Action, in combination with past, present, and reasonably foreseeable future actions in the project area and vicinity, would be beneficial to Native American religious concerns.

3.8.5 Best Management Practices, Mitigation Measures, and/or Stipulations

No BMPs or mitigation measures are proposed for Native American religious concerns.

3.9 Recreation

3.9.1 Affected Environment

The project area has no formal recreation amenities such as interpretive facilities, restrooms, trash receptacles, or formal trails. Visitors to the area likely consist of residents from adjacent residential communities as well as homeless people that regularly use the area. There are informal trails within the project area with some access to the river. Visitors to the area likely use the area for hiking, bird watching, and access to the river banks for swimming and fishing. The adjacent PCE area offers recreational opportunities at no charge to the public, including maintained roads for access, walking access to the river, and walking trails through vegetation that parallels the river.

3.9.2 Impacts of the Proposed Action

The Proposed Action would result in short-term negligible adverse impacts to recreation and long-term beneficial impacts. During implementation, wildlife viewing in the project area would be disrupted due to noise associated with grading and construction activities as well as temporary loss of habitat. Public access, including river access, would also be temporarily disrupted.

Long-term beneficial impacts to wildlife viewing would result due to the creation and enhancement of wildlife habitat and improved walking access to the project area. Under the Proposed Action, restoration and related infrastructure would enhance the riparian vegetation and wildlife habitat within PCW. The project area would likely continue to be used informally for hiking and bird watching, as well as access to the river for swimming and fishing.

3.9.3 Impacts of the No Action Alternative

Under the No Action Alternative, restoration and related infrastructure construction would not occur within the PCW project area. Current conditions of informal recreational use would likely continue.

3.9.4 Cumulative Impacts

The Proposed Action would result in short-term adverse impacts during grading and construction activities and long-term beneficial impacts from improved wildlife habitat and fire safety. In the short term, construction may disrupt the recreation activities in the adjacent PCE. Wildlife viewing may be disrupted due to construction noise and temporary habitat loss. The project area would continue to be at risk of flooding, which may result in the loss of recreational use of the area depending on severity of the flooding. In the long term, wildlife habitat increases recreational opportunities as well as safety improvements which have occurred within adjacent areas, including the PCE and Cocopah restoration projects. Cumulative impacts of the Proposed Action, in combination with past, present, and reasonably foreseeable future actions in the project area and vicinity, would be beneficial to recreational use.

3.9.5 Best Management Practices, Mitigation Measures, and/or Stipulations

Vehicle gates and signage would be installed prohibiting off-leash dogs in the project area to avoid wildlife conflicts. Deterrents, such as gates and rock boulders, would be used to deter public vehicular traffic. Public safety concerns may result in administrative closure of the project area. This may occur during construction, breeding seasons, or as deemed necessary by the BLM Authorized Officer.

3.10 Socioeconomics

3.10.1 Affected Environment

Social conditions concern the human communities in the planning area, and the custom, culture, and history of the area as it relates to human use, as well current social values. Recreational vehicle parks, Native American communities, and one of the older portions of Yuma are near the project area.

The population of the city of Yuma was estimated to be 93,812 in 2015, with the majority of the population identifying as Hispanic (58.1 percent) and the remainder as white or other race (41.9). The median income in 2010 was $43,754. The top employment industries were education, health, and social services (22.5 percent), public administration (12.6 percent), and retail trade (10.8 percent). The agricultural industry was an estimated 6.1 percent of the economy (Economic Profile System 2017). The primary economic activities in the project area are related to recreation and recreation management.

3.10.2 Impacts of the Proposed Action

The Proposed Action would result in beneficial impacts to human use of the project area, as detailed in Section 3.9 (Recreation). In addition, the Proposed Action would also result in beneficial impacts to cultural values of the project area, as detailed in Section 3.8 (Native American Religious Concerns). Beneficial impacts to human use and cultural values would in turn result in beneficial impacts to social conditions in the project area vicinity.

Under the Proposed Action, restoration and related infrastructure would enhance the riparian vegetation and wildlife habitat of the area. The limited size and short-term duration of the construction work would require a minimal work force from the local community and would not result in an increase of workers from outside the local area. Therefore, the Proposed Action would not likely have an impact on city or local area demographics. Because of the limited size and short duration of the Proposed Action, the workers and equipment needs to complete the restoration are likely to come from local companies. Therefore, the Proposed Action would likely result in short-term negligible economic activity in the project area vicinity during construction from use of local area workers, as well as the purchase of supplies and meals. Overall, the Proposed Action would have negligible to no effect on employment, income, or demographics in the project area due to its small size and short-term duration.

3.10.3 Impacts of the No Action Alternative

Under the No Action Alternative, restoration and related infrastructure construction would not occur within the PCW project area; therefore, no impacts, adverse or beneficial, to social or economic conditions would occur.

3.10.4 Cumulative Impacts

The Proposed Action would result in long-term beneficial impacts to social conditions as a result of habitat restoration and improved recreational opportunities of the project area. Past and ongoing restoration of adjacent areas, along with implementation of the Proposed Action, would result in native riparian vegetation along the LCR from the Yuma East Wetlands restoration area west to the Cocopah tribal land restoration area, improving human use of the area. Cumulative impacts of the Proposed Action, in combination with past, present, and reasonably foreseeable future actions in the project area and vicinity, would be beneficial to social conditions. There would be no noticeable economic cumulative impacts from the Proposed Action in combination with past, present, and reasonably foreseeable future actions in the project area.

3.10.5 Best Management Practices, Mitigation Measures, and/or Stipulations

No socioeconomics BMPs or mitigation measures are proposed.

3.11 Soils

3.11.1 Affected Environment

Soil types within the Paradise Cove project area include Indio silt loam and Indio silt loam–saline (Natural Resources Conservation Service 2017). Both of these soils are characterized as well-drained soils of floodplains, composed of mixed alluvium, and are un-saline to moderately saline. The on-site soils are well suited to riparian restoration and currently support many desirable native plant species, including

cottonwood and willow. Soil erosion occurs due to rodent holes, beavers, and other water manipulation within the project area. Soil erosion also occurs from water flows from the existing wastewater treatment outfall located on the southern boundary of the project area (see Figure 4).

3.11.2 Impacts of the Proposed Action

Implementation of the Proposed Action would restore approximately 49.84 acres of the 51-acre project area, of which 42.8 acres is required mitigation. The Proposed Action would result in negligible to minor short-term adverse impacts to soils in the project area. Erosion may occur within cleared and grubbed areas (approximately 49.84 acres) prior to seeding and planting of native species and during maintenance operations. Compaction of soils would also occur during construction of berms. Once project implementation is complete, restoration of the project area would stabilize soils and improve soil quality. Impacts to soil resources would be expected during flood events, and from animal holes or improper site engineering, manipulation, and design features.

Implementation of the Proposed Action would have a beneficial impact on soils in the long term by reducing and/or removing the salinity added to the soils from saltcedar leaf litter, which contains concentrated salts from groundwater.

Soil erosion would likely continue from water flowing from the existing wastewater treatment outfall located on the southern boundary of the project area. The Proposed Action would not affect the amount of water flowing from the wastewater treatment outfall and would not result in increased soil erosion due to water flow.

3.11.3 Impacts of the No Action Alternative

No soil disturbance would occur under the No Action Alternative. Non-native invasive species would continue to dominate the project area, outcompeting native species and further degrading soil quality. Soil erosion would likely continue from water flowing from the existing wastewater treatment outfall. Poor soil quality and dense non-native species populations could result in an increase in fuels for wildland fire hazards in the project area as well as a reduction in habitat quality.

3.11.4 Cumulative Impacts

Restoration activities under the Proposed Action would reduce invasive plant species and improve soil quality in the long term. The minor short-term potential impacts of site preparation and construction activities would result in negligible to minor impact to soils. The Proposed Action includes restoration of native habitats and removal of non-native species, thereby improving the overall health of the soils in the project area and reducing the potential fuels for wildland fire hazards. Past and ongoing restoration of adjacent areas, such as PCE and the Cocopah tribal land restoration area, along with implementation of the Proposed Action, would result in improved soil stability and quality in the project area and vicinity. Cumulative impacts of the Proposed Action, in combination with past, present, and reasonably foreseeable future actions in the project area and vicinity, would be beneficial to soil resources.

3.11.5 Best Management Practices, Mitigation Measures, and/or Stipulations

Soil salinity would be assessed annually to determine if salinity treatments are needed to ensure native riparian plant community survivorship. Salinity treatments, administered through flood irrigation would be the responsibility of those doing maintenance.

3.12 Threatened and Endangered Species

3.12.1 Affected Environment

Based on known occurrences or presence of suitable habitat on or in the immediate vicinity of the project area, three federally listed species have the potential to occur: Yuma Ridgway's rail (*Rallus obsoletus*),

southwestern willow flycatcher (SWFL; *Empidonax traillii extimus*), and yellow-billed cuckoo (YBC; *Coccyzus americanus occidentalis*) (RECON 2018b). The Yuma Ridgeway's rail was federally listed as endangered (USFWS 1967); critical habitat has not been established for this species. The SWFL is federally listed as endangered (USFWS 1995); critical habitat was designated in 2013 (USFWS 2013). The YBC is federally listed as threatened (western distinct population segment) (USFWS 2014a). Proposed critical habitat for YBC is located within the project area (USFWS 2014b); although final critical habitat has not yet been designated.

The project area contains less than one acre of emergent marsh, scattered in five small patches along the low-flow channel. Focused surveys for the rail have been conducted annually since 2014. During the 2014 survey, Virginia rail (*Rallus limicola*) was observed; however, no rails have been observed during subsequent surveys conducted in 2015, 2016, 2017, and 2018 (Erica Stewart, Biologist BLM Yuma Field Office, personal communication with Wendy Loeffler, Biologist, RECON Environmental, August 2017 and September 2018). Vegetation treatment conducted within the project area in 2012 and 2013 allowed for the growth and expression of emergent marsh. In 2014, the extent of marsh was much larger than currently exists, allowing the Virginia rail to move into the area. Since that year, the common reed has overtaken the marsh, thus greatly reducing the suitability of the project area to support any rails, including the Yuma Ridgway's rail.

SWFL and YBC are not known to occur in the project area. There is a potential for SWFL to use existing saltcedar for nesting and foraging habitat; however, none have been observed within the project area. The current on-site habitat composition is not suitable for YBC given the lack of riparian thickets with a tall tree canopy; therefore, this species is not expected to occur within the project area boundaries.

3.12.2 Impacts of the Proposed Action

Due to the lack of existing suitable vegetation on-site, SWFL, Yuma Ridgway's rail, and YBC are unlikely to occur within the project area. However, if these species are detected on-site, temporary, short-term negligible impacts may occur during implementation of restoration and construction of associated infrastructure. Short-term impacts may include loss of foraging, cover, and nesting habitat during vegetation removal and from disturbance due to noise and human activities during restoration activities. Additional short-term impacts would result from mechanical vegetation treatment and retreatment during long-term maintenance activities. However, it is anticipated that SWFL, YBC, and rails would use nearby saltcedar and/or riparian habitats until revegetation is complete; thereby minimizing the effects from these short-term impacts. Long-term minor to moderate beneficial impacts to threatened and endangered species would result from the replacement of existing invasive vegetation and dense native cover with native vegetation and riparian species. It is the intent of the Proposed Action to restore willow-enhanced wetland, cottonwood-willow, and mesquite habitats that would support SWFL and YBC. The project includes installation of container plants (i.e., mesquite, willow species, cottonwood), direct cutting materials (i.e., willow species, cottonwood), and native seed which would provide riparian habitat suitable for SWFL and YBC. Additionally, the Proposed Action includes flood irrigation that may result in standing water and large quantity of insects, further improving YBC and SWFL foraging habitat.

The BLM initiated Section 7 consultation with the USFWS in October 2017. USFWS conducted a field visit in November 2017. As a result of comments received from USFWS, the Draft BA (RECON 2018b) was revised and resubmitted for approval. Subsequent to this submittal, 2018 rail surveys were conducted and the results have been incorporated into the BA. The Draft BA (RECON 2018b) was submitted in September 2018 for review and approval. Based on the analysis concerning the effects of the Proposed Action on threatened and endangered species, BLM and CBP propose that the project would not likely adversely affect Yuma Ridgeway's rail, SWFL, and YBC, and will not destroy or adversely affect YBC proposed critical habitat. These determinations represent the net effect of all positive and negative influences associated with the Proposed Action and therefore represent the overall finding concerning the need to consult, pursuant to Section 7 of the Federal Endangered Species Act of 1973.

3.12.3 Impacts of the No Action Alternative

Under the No Action Alternative, no direct impacts to threatened or endangered species or their habitats would occur. Due to the lack of existing suitable vegetation on-site, SWFL, Yuma Ridgway's rail, and

YBC are unlikely to occur within the project area. Without the project, long-term adverse impacts could result from increased populations of non-native species, which would continue to reduce native vegetation.

3.12.4 Cumulative Impacts

The goal of the project is to restore native riparian habitats, which are expected to support several federally listed species as well as a higher diversity of migratory birds. The Cocopah tribal land restoration areas to the west of the project area and the PCE restoration to the east would complement restoration within PCW. Cumulative impacts of the Proposed Action, in combination with past, present, and reasonably foreseeable future actions in the project area and vicinity, would be beneficial to threatened and endangered species.

3.12.5 Best Management Practices, Mitigation Measures, and/or Stipulations

The following measures would be included to minimize potential short-term impacts to Yuma Ridgway's rail, SWFL, and YBC during the bird-breeding season. Rails can start calling for mates as early as February, but nest construction begins in March and their breeding season continues through early June; SWFL breed from May through September, and YBC breed from mid-May through mid-September.

- Construction activities and emergency actions would occur year-round with written permission from BLM. April through November actions may require a biological monitor to ensure no disruption to listed species. Maintenance, including mechanical vegetation treatments and re-treatment should occur between 1 October and 31 March, to avoid any impacts to migratory birds. If work is to occur during the breeding season, a qualified biologist must survey the area prior to the start of construction activities for nesting and migratory birds, including threatened and endangered species. This shall include burrowing and ground-nesting species in addition to those nesting in vegetation. If any active nests (containing eggs or young) are found, an appropriately sized buffer area must be avoided until the young birds fledge.

- In the event that a nest is encountered or identified, field staff and/or contractors must immediately cease all project activity in the area and notify the BLM Authorized Officer. No work may proceed without the written authorization of the BLM.

- In the event the site tests positive for West Nile virus, the line manager may close the area to the public due to safety concerns.

3.13 Vegetation

3.13.1 Affected Environment

Four vegetation communities and land cover types were documented within the project area: arrowweed scrub (30.59 acres), phragmites scrub (15.50 acres), emergent marsh (0.85 acre), and bare ground/graded (3.41 acres) (RECON 2018b). Vegetation communities were classified and mapped according to the U.S. National Vegetation Classification (NatureServe 2013). Arrowweed is extensive throughout the project area, and in some areas is mixed with saltcedar. Phragmites scrub (common reed) is growing in dense stands along the southern border of the project area along the interior channel and along the LCR on the northern boundary. Emergent marsh within the project area is dominated by broadleaf cattail (*Typha latifolia*), occurring in several small patches within the low-flow channel bisecting the project area. Several desirable native plant species are present, including patches of wolfberry (*Lycium* sp.), screwbean mesquite (*Prosopis pubescens*), Goodding's willow (*Salix gooddingii*), Fremont cottonwood (*Populus fremontii* ssp. *Fremontii*), and seep willow (*Baccharis salicifolia*). All vegetation communities and/or land cover types surveyed within PCW are depicted on Figure 3.

3.13.2 Impacts of the Proposed Action

Under the Proposed Action, short-term negligible to minor impacts would occur to native vegetation during grading and construction of infrastructure within the project area. Long-term beneficial impacts to native vegetation would occur once restoration implementation is complete as a result of maintenance and monitoring.

Implementation of the Proposed Action would restore approximately 49.84 acres of the 51-acre project area, of which 42.8 acres is required mitigation; the remaining 1.16 acres is associated with the perimeter road and therefore eliminated from the mitigation acreage totals. During grading, large, dense stands of invasive species would be removed within PCW during site preparation efforts. Following site preparation, approximately 13.9 acres of willow-enhanced wetland, approximately 31.6 acres of cottonwood-willow, and approximately 4.34 acres of mesquite would be restored. A variety of native plant materials are proposed to achieve the mitigation vegetation types (i.e., willow-enhanced wetland, cottonwood-willow, and mesquite), including native species salvage, container plants, and native seed. Existing native species and pockets/stands of intact native wetland vegetation would be avoided to the extent practicable in order to minimize impacts and capitalize on these existing resources for enhanced wildlife benefits. In addition, the Proposed Action would follow the BLM BMPs for riparian revegetation, including using native, drought-adapted species in the planting and seeding palettes, applying seed and installing plant materials at the appropriate time of year, raking seeds to ensure good seed-to-soil contact, and long-term maintenance and monitoring to ensure successful establishment of targeted native vegetation.

3.13.3 Impacts of the No Action Alternative

Under the No Action Alternative, no restoration would occur. Non-native invasive species (i.e., common reed, tamarisk) would continue to dominate the project area, outcompeting native species, and further degrading wildlife habitat. The No Action Alternative would result in long-term adverse impacts to native vegetation in the project area.

3.13.4 Cumulative Impacts

Overall, the Proposed Action would result in creation and/or enhancement of approximately 49.84 acres of native vegetation and removal of vegetation dominated by non-native invasive species. Past and ongoing restoration of adjacent areas (PCE and Cocopah tribal land), along with implementation of the Proposed Action, would result in improved native vegetation in the project area and vicinity. Cumulative impacts of the Proposed Action, in combination with past, present, and reasonably foreseeable future actions in the project area and vicinity, would be beneficial to native vegetation.

3.13.5 Best Management Practices, Mitigation Measures, and/or Stipulations

All herbicide applications would follow the BLM approved Pesticide Use Proposal and associated BLM herbicide guidance (Appendix D).

3.14 Visual Resources

3.14.1 Affected Environment

The visual character of PCW includes dense stands of native (i.e., arrowweed scrub) and non-native (i.e., phragmites scrub) habitats, a 12-inch pipe and associated pumping station within the dirt access road, which bisects the site and provides water for adjacent agriculture uses, and a previously grubbed area to the southwest.

The BLM's VRM system designates lands as VRM Classes I through IV as a way to identify, evaluate, and determine the appropriate levels of protection to the public lands' scenic values. VRM Class I lands provide the most protection to scenic values and VRM Class IV lands provide the least protection (BLM

2010). The Proposed Action area is classified as VRM II. The approved RMP states that VRM Class II lands should be managed to retain the existing character of the landscape and the level of change to the characteristic landscape should be low (BLM 2010).

Contrast rating is a method of analyzing the potential visual impacts of proposed management activities and provides a comparison of existing scenic quality, sensitivity, and distance zone to the proposed activity. The degree of contrast is classified as low, moderate, or high. A Visual Contract Rating Worksheet was prepared for the PCW project area (BLM 2017b). The results of the contrast rating indicated that the project area features of land/water body, vegetation, is considered low based on the site features and landscape (BLM 2017b).

3.14.2 Impacts of the Proposed Action

Short-term temporary adverse effects to visual resources would occur during site grading and construction activities. Site grading and construction would include the presence of heavy machinery, construction materials, and 150,000 cubic yards of excavated soil. In the long term, implementation of the Proposed Action would have a beneficial visual impact. The existing dense stands of non-native species would be removed and the PCW would be restored to native riparian habitat. The Proposed Action includes restoration of native riparian habitat, which is consistent with the character of the existing landscape. The Proposed Action design meets the VRM objectives for the area (BLM 2017b). All project components would be consistent with the BLM's VRM system guidelines identified in the approved RMP (BLM 2010).

3.14.3 Impacts of the No Action Alternative

Under the No Action Alternative, visual resources would not be changed. The existing vegetation would not be removed and restoration of riparian habitat would not occur.

3.14.4 Cumulative Impacts

The Proposed Action would result in short-term adverse impacts during site grading and construction activities and long-term beneficial impacts from habitat restoration resulting in improved scenic value. Restoration of the project area along with habitat restoration of adjacent areas, including the PCE and Cocopah tribal land restoration projects, would result in improved character of the landscape and visual contrast rating. The Proposed Action, in combination with past, present, and reasonably foreseeable future actions that have restored habitat within the project area and vicinity, would result in beneficial cumulative impacts to visual resources.

3.14.5 Best Management Practices, Mitigation Measures, and/or Stipulations

No BMPs or mitigation measures are proposed for visual resources (BLM 2017b).

3.15 Water Quality (Drinking and Groundwater)

3.15.1 Affected Environment

The City of Yuma receives its water supply from two sources, the Colorado River and groundwater. Approximately 85 percent of the City's water comes from the Colorado River, with the remaining 15 percent from a seasonal blend of groundwater from three wells located at the Agua Viva Water Treatment Facility (City of Yuma 2015). All wells located within or adjacent to the project area have been retired by the BOR.

During 2016, the City of Yuma conducted all water quality testing required by Federal and state regulations. Testing revealed that the City's drinking water quality met all regulatory standards set to safeguard public health (City of Yuma 2016).

The City of Yuma Figueroa Avenue Wastewater Treatment Plant is located south of the project area. This facility has been in operation since 1970 and is the oldest and largest of Yuma's treatment facilities. This facility operates under Federal and state permits and turns over 80 percent of Yuma's wastewater into high-quality treated effluent that is discharged into the Colorado River. The Colorado River outfall from the Figueroa Avenue wastewater treatment facility is located within the southern portion of the project area. Water from this outfall is considered "waters of the United States" per the U.S. Army Corps of Engineers (USACE).

3.15.2 Impacts of the Proposed Action

Under the Proposed Action, habitat restoration would require irrigation. The primary water source for irrigation would come from the LCR via a weir along the northeastern portion of the project area boundary and a pump station in the north-central portion. The wastewater treatment outfall would provide minimal water to the willow-enhanced wetland area along the south-central portion of the project area. The proposed cottonwood–willow fields would be irrigated by flood irrigation, the proposed willow-enhanced wetland would be irrigated via an installed weir that connects with the Colorado River and the wastewater treatment outfall, and the proposed mesquite restoration area in the southwestern corner of the project area would be watered via an overhead sprinkler system, as needed, during maintenance visits. The amount of water needed for irrigation would be minimal compared to the amount of water delivered through the wastewater treatment facility outfall. Approximate water use per year would be as follows:

- Flood Irrigation via Concrete-lined Irrigation Canals: Approximately up to 80 acre-feet of water during Year 1, with a 20 percent decrease per year over the next three years (Year 2 = 64 acre-feet; Year 3 = 51 acre-feet, Year 4 = 40 acre-feet). Approximately 235 acre-feet total.

- Flood Irrigation via the Improved Central Main Channel: Approximately up to 24 acre-feet of water during Year 1, with a 20 percent decrease per year over the next three years (Year 2 = 19 acre-feet; Year 3 = 15 acre-feet, Year 4 = 12 acre-feet). Approximately 70 acre-feet total. However, this does not account for water that would be derived from the wastewater treatment plant, which would account for a large portion of this water allocation.

- Overhead Watering the Mesquite Woodland: Approximately up to 6 acre-feet of water during Year 1, with a 20 percent decrease per year over the next three years (Year 2 = 5 acre-feet; Year 3 = 4 acre-feet, Year 4 = 3 acre-feet). Approximately 18 acre-feet total. No water use is anticipated after Year 3.

The Proposed Action would include herbicide treatment of invasive plant species. Only herbicides deemed suitable by BLM for use in/around water would be applied. The BLM Best Management Practices (BMPs) for Riparian Revegetation are included as Appendix E of the 2008 BA (BLM 2008b) and the mitigation restoration plan has incorporated these applicable BMPs. Potential short-term negligible impacts to groundwater quality could result from herbicides leaching through soils into the groundwater basin. BMPs outlined in the Final Limitrophe Mitigation/Restoration Plan (see Appendix B) would limit the potential effects of groundwater resources from herbicide use within the project area.

Surface water quality could be indirectly affected by runoff, drift, spills, and leaching of herbicides from the soil. Bare ground areas could increase these impacts due to the reduction of a natural buffer and filtration capabilities provided by vegetation. Potential impacts would be minimized and avoided through proper management of herbicides to avoid overspray as well as use of BMPs.

Herbicides used at the level and intensity typical for the invasive species present within the project area do not tend to pose substantial risks of leaching into groundwater. Furthermore, the Yuma area receives low levels of precipitation annually, which would reduce leaching potential. In addition, herbicides would be applied directly to the invasive plants, limiting the potential for leaching. Overall, herbicide use would not likely result in adverse impacts to groundwater quality and aquifer conditions are likely to maintain current conditions related to recharge. Aquatic herbicide application requirements would greatly reduce potential for spills and contamination where leaching would be possible.

3.15.3 Impacts of the No Action Alternative

Under the No Action Alternative, restoration and related infrastructure construction would not occur within the PCW project area; therefore, no impacts to groundwater or water quality would occur.

3.15.4 Cumulative Impacts

Under the Proposed Action, short-term negligible impacts to groundwater may occur during herbicide treatments within the project area. Other past and present activities that may impact groundwater include application of chemical fertilizers to agricultural fields as well as herbicide application at residential and recreation areas in the vicinity of the project area. Cumulative impacts of the Proposed Action, in combination with past, present, and reasonably foreseeable future actions in the project area and vicinity, would be negligibly adverse.

3.15.5 Best Management Practices, Mitigation Measures, and/or Stipulations

The following water quality BMPs are included as part of this project.

- All irrigated water that is pumped into the project area would be metered and reported as part of the Colorado River water rights.
- Stipulations for herbicide application include an Approved Pesticide Use Proposal, use of BLM-approved herbicides, daily application reporting, and annual reporting procedures. A spill contingency plan would also be required, included as Appendix E. BLM BMPs for Riparian Revegetation are included as Appendix E of the 2008 BA and are incorporated by reference (BLM 2008b).
- BMPs, mitigation measures, and stipulations for chemical, mechanical, and manual herbicide treatment are found in Appendix D.

3.16 Weeds/Invasive Species

3.16.1 Affected Environment

The U.S. Department of Agriculture (USDA) identifies 80 state listed noxious weed species for Arizona that fall into one or more of the following categories: restricted, regulated, or prohibited (USDA 2017). Invasive species are very dense and prevalent at PCW; the dominant invasive species include saltcedar and common reed. Saltcedar within the project area boundaries has been previously cleared and treated with herbicide but has re-sprouted. Dense stands of common reed grow along the southern border of the project area and along the edge of the LCR, forming impenetrable thickets. Neither of these species is state-listed as noxious. A full list of invasive plant species that are either known to occur or that could potentially occur at PCW are described in Attachment 8 of the Final Mitigation/Restoration Plan (RECON 2018a; see Appendix B). The presence of invasive species also provides potential fuels for wildland fires within the project area.

3.16.2 Impacts of the Proposed Action

Weeds and invasive species are spread through many vectors, including vehicles and equipment. Soil disturbances and loss of native plant species also increase the spread of weeds and invasive species. Invasive weed species are a major concern due to their potential to cause permanent damage to natural plant communities.

Under the Proposed Action, construction activities would include site grading, thereby increasing the potential for introduction of noxious or invasive plants. A majority of the invasive species from within the project area boundaries would be removed using heavy machinery (i.e., excavator). Common reed removal/treatment activities would focus only on the interior channel near the outfall; dense stands along

the LCR would be left largely intact to preserve bank stability. Saltcedar populations throughout the project area would be aggressively treated during site preparation. Construction activities would follow recommended Yuma County guidelines to minimize the spread of noxious and invasive plant species. In addition, the Proposed Action would follow the BLM BMPs for Riparian Revegetation, including washing vehicles prior to entering the project area and utilizing weed and pest-free revegetation materials as detailed in the Final Mitigation/Restoration Plan (RECON 2018a) and Appendix E of the 2008 BA (BLM 2008b). The Proposed Action would result in short-term negligible impacts from the potential spread of weeds and invasive species during construction activities.

Following implementation activities, the Proposed Action includes a 10-year maintenance period to ensure the success of the restoration plantings and seeding and allow native plants to establish and become self-sustaining. Invasive species control throughout the maintenance period would follow the methodologies described in the Final Mitigation/Restoration Plan, including manual, mechanical and chemical applications (RECON 2018a). Reducing the populations of invasive species within PCW would also reduce a fuel source for potential wildland fires within the area. Therefore, implementation of the Proposed Action would result in a long-term beneficial impact from the control of weeds/invasive species.

Due to the rapid permeability of water in the project area and rapid flow of the adjacent Colorado River, mosquitos would not likely have enough time to hatch, and the spread of disease via mosquitos would be unlikely. Although West Nile virus has been reported within Yuma County, restoration and related infrastructure activities are not likely to increase the potential spread of this virus. The Proposed Action would not significantly change the characteristics of the site to increase the risk of vector-borne illnesses.

3.16.3 Impacts of the No Action Alternative

Under the No Action Alternative, current conditions would continue, and restoration of native riparian habitat within PCW would not occur. PCW would continue to experience invasive plant species infestations. Moreover, non-native invasive plant populations may continue to spread and further reduce wildlife habit quality and increase the potential for wildland fire fuels in the project area. Long-term adverse impacts from the spread of weeds and invasive plant species would occur.

3.16.4 Cumulative Impacts

The Proposed Action would result in minor short-term potential adverse impacts to the spread of weeds/invasive species during grading and implementation activities, and long-term beneficial impacts from the establishment of high-quality willow and cottonwood habitats. Restoration of the project area in combination with habitat restoration at PCE and nearby Cocopah tribal lands would result in a reduction of weed/invasive plant species in the project area and provide continuous high-quality habitat along the LCR. Therefore, the Proposed Action, in combination with past, present, and reasonably foreseeable future actions that have restored habitat within the project area and vicinity, would result in beneficial cumulative impacts to weeds/invasive species.

3.16.5 Best Management Practices, Mitigation Measures, and/or Stipulations

Best management practices, mitigations measures, and/or stipulations to minimize impacts of the Proposed Action are listed below.

- Annual mechanical, manual, and chemical application for a minimum of 10 years is recommended to control weeds/invasive species in order to establish required SWFL microclimates per the associated 2008 USFWS BO.
- The contractor will coordinate with the Yuma County Health Department, which conducts mosquito monitoring and treatment throughout the county. This survey data will be incorporated into annual reports, as available.
- BMPs, mitigation measures, and stipulations for chemical, mechanical, and manual treatment are included in Appendix D.

3.17 Wetland/Riparian Zones

3.17.1 Affected Environment

PCW is within a riparian area associated with the LCR. The USACE and ADEQ jurisdictional areas on-site total 16.55 acres, which includes 16.35 acres of wetlands and 0.20 acre of wetlands that have been disturbed for the placement and access of pumps and irrigation pipes. Wetlands within the project area include those areas dominated by common reed and broadleaf cattail. Graded areas within the floodplain were recognized to be a "problematic hydrophytic vegetation: managed plant communities" and procedures for the delineation of "Difficult Wetland Situations in the Arid West" were followed to make a jurisdictional determination (USACE 2008). These disturbed areas do not currently contain wetland vegetation. However, because of the existence of wetland hydric soils, wetland hydrology, and historical aerial photographs showing previous continuity of hydrophytic vegetation, they are considered wetland waters of the United States (USACE 2008).

3.17.2 Impacts of the Proposed Action

Short-term negligible impacts to wetlands and riparian zones would occur during construction and implementation; long-term beneficial impacts would result once implementation activities are completed and native vegetation is established. Implementation of the Proposed Action would result in the creation and/or enhancement of 49.86 acres of riparian habitat, including approximately 13.9 acres of willow-enhanced wetland, approximately 31.62 acres of cottonwood-willow, and approximately 4.34 acres of mesquite. Restoration of riparian habitat within PCW would include grading, native species planting and seeding, irrigation, and green fire breaks. Individuals and pockets/stands of intact native wetland vegetation have been identified throughout the existing willow-enhanced wetland areas. The Proposed Action was designed to minimize impacts to these areas; however, temporary negligible impacts would result during grading activities. There is a potential for sedimentation into the Colorado River during grading. Design features included as part of the Proposed Action (i.e., berms and water control diversions) and erosion control BMPs (i.e., fiber rolls, silt fencing, gravel bags) would reduce potential impacts. Long-term beneficial impacts would result once native wetland and riparian habitats are established and the maintenance and monitoring period is complete.

CBP-initiated consultation with USACE and ADEQ in October 2017 (USACE 2017; ADEQ 2017a). After review of the Clean Water Act 401 and 404 permit applications, a State 401 Water Quality Conditional Certification was issued by ADEQ pursuant to the USACE Nationwide Permit (NWP) No. 27 (ADEQ 2017b). CBP will be required to comply with all general conditions specified in the State of Arizona's Clean Water Act (CWA) 401 Water Quality Certification of the Nationwide Permit No. 27.

3.17.3 Impacts of the No Action Alternative

Under the No Action Alternative, the existing fragmented and degraded riparian habitat on-site would remain and creation and enhancement of approximately 51 acres of riparian habitat would not occur.

3.17.4 Cumulative Impacts

The Proposed Action would result in creation and/or enhancement of approximately 51 acres of native vegetation and removal of vegetation dominated by non-native invasive species. Past and ongoing restoration of adjacent areas, including PCE, Cocopah restoration to the west, and Yuma East wetlands, along with implementation of the Proposed Action, would result in improved wetland and riparian habitat in the project area and vicinity. Therefore, cumulative impacts of the Proposed Action, in combination with past, present, and reasonably foreseeable future actions in the project area and vicinity, would be beneficial to wetland and riparian habitat.

3.17.5 Best Management Practices, Mitigation Measures, and/or Stipulations

Design features have been included as part of the Proposed Action to reduce potential sedimentation into the LCR, including installation of erosion control blankets on exposed slopes and filter fencing on downstream locations of the project area boundary. Water control diversions would also be installed upstream to eliminate surges of water following grading. In addition, berms would be installed at the lower edge of the willow and cottonwood habitats to prevent sediment from leaving the project area.

Consistent with the NWP No. 27 general conditions, the following BMPs have been incorporated to minimize potential impacts to wetlands.

- Appropriate erosion control measures (i.e., fiber rolls, silt fencing, gravel bags, etc.) would be installed to prevent sedimentation into the Lower Colorado River. Any illegal dumps discovered during clearing operations would be reported to the BLM to make a determination of whether hazardous materials are present and the appropriate site-specific mitigation needed to alleviate the problem. Non-hazardous dumping removal would be the responsibility of the agency completing site maintenance.
- Refueling of machinery would be completed following accepted guidelines, and all vehicles would have drip pans during storage to contain minor spills and drips.
- Spill Contingency Plan measures are included in Appendix E.
- Prior to maintenance activities, all project areas would be demarcated in coordination with the biologist to ensure that adverse effects to biological resources are minimized, and that no work is performed outside of the designated boundaries.

3.18 Wildlife/Special Status Species

3.18.1 Affected Environment

Wildlife species within and adjacent to PCW are common and widely distributed. Small, common bird and mammal species occur with the project area, including quail, rodents, and non-game birds (RECON 2018a, 2018b). These species occur primarily within the upland and riparian portions of the project area. (federally listed species are discussed in Section 3.16, above).

3.18.2 Impacts of the Proposed Action

The Proposed Action may result in short-term adverse impacts to wildlife, but beneficial impacts in the long term. Short-term impacts to wildlife include direct mortality from vehicular traffic and disturbance of foraging, cover, and nesting habitat during vegetation removal and other restoration activities. Wildlife species that occur within PCW are common and considered to be highly mobile. The loss of some individuals and/or their habitat would have a negligible adverse impact on populations throughout the region. No special status species have been observed within the project area. However, if present, it is anticipated that special status species would utilize nearby habitat at PCE and the Cocopah restoration area to the west until higher quality willow and cottonwood habitat is established. Impacts of the Proposed Action on federally listed species are discussed in Section 3.16.2, above.

Long-term beneficial impacts of the Proposed Action include the creation and enhancement of wildlife habitat. Implementation of the Proposed Action would result in the replacement of existing invasive vegetation and dense native cover with native vegetation and riparian species. Improved vegetation conditions would provide better foraging, cover, and nesting habitat for wildlife species.

3.18.3 Impacts of the No Action Alternative

Under the No Action Alternative, current conditions would continue and restoration of native vegetation and riparian habitats would not occur. PCW would continue to experience invasive plant species

infestations further degrading wildlife habitat on-site and increasing the potential loss of habitat due to wildland fires. The No Action Alternative would result in long-term adverse impacts to native wildlife in the project area.

3.18.4 Cumulative Impacts

The Proposed Action would result in short-term adverse impacts to wildlife habitat, primarily due to vegetation removal and noise during restoration activities. Restoration under the proposed action would reduce invasive plant species and improve the riparian/wetland habitat along the LCR in the long term, thereby reducing the adverse impacts to wildlife in the long term. The Cocopah tribal land restoration areas to the west of the project area and the PCE restoration to the east would complement restoration within PCW. Cumulative impacts of the Proposed Action, in combination with past, present, and reasonably foreseeable future actions in the project area and vicinity, would be beneficial to wildlife species and habitat.

3.18.5 Best Management Practices, Mitigation Measures, and/or Stipulations

The Proposed Action would have a negligible adverse impact to wildlife populations throughout the region and, therefore, no mitigation is required.

4. SUPPORTING INFORMATION

4.1 Tribes, Individuals, Organizations, or Agencies Consulted

In preparation of the EA, information on resources within the project area was obtained from Federal and state agencies. Following is a list of the agencies contacted:

- Bureau of Land Management
- U.S. Customs and Border Protection
- Cocopah Tribe
- Ak-Chin Indian Community
- Chemehuevi Indian Tribe
- Cocopah Indian Tribe
- Colorado River Indian Tribe
- Fort Mojave Indian Tribe
- Fort Yuma-Quechan Tribe
- Gila River Indian Community
- The Hopi Tribe
- Hualapai Tribe
- Pueblo of Zuni
- Salt River Pima-Maricopa Indian Community
- Tohono O'odham Tribal Nation
- Yavapai-Apache Nation
- Yavapai-Prescott Indian Tribe
- Bureau of Reclamation
- U.S. Army Corps of Engineers
- Arizona Game & Fish Department
- Arizona State Historic Preservation Office
- Arizona Department of Environmental Quality
- U.S. Fish and Wildlife Service

4.2 List of Preparers and Reviewers

U.S. Customs and Border Protection
John Petrilla
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Adrienne Beeson
Susy Morales
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Harry Price
Stacey Higgins

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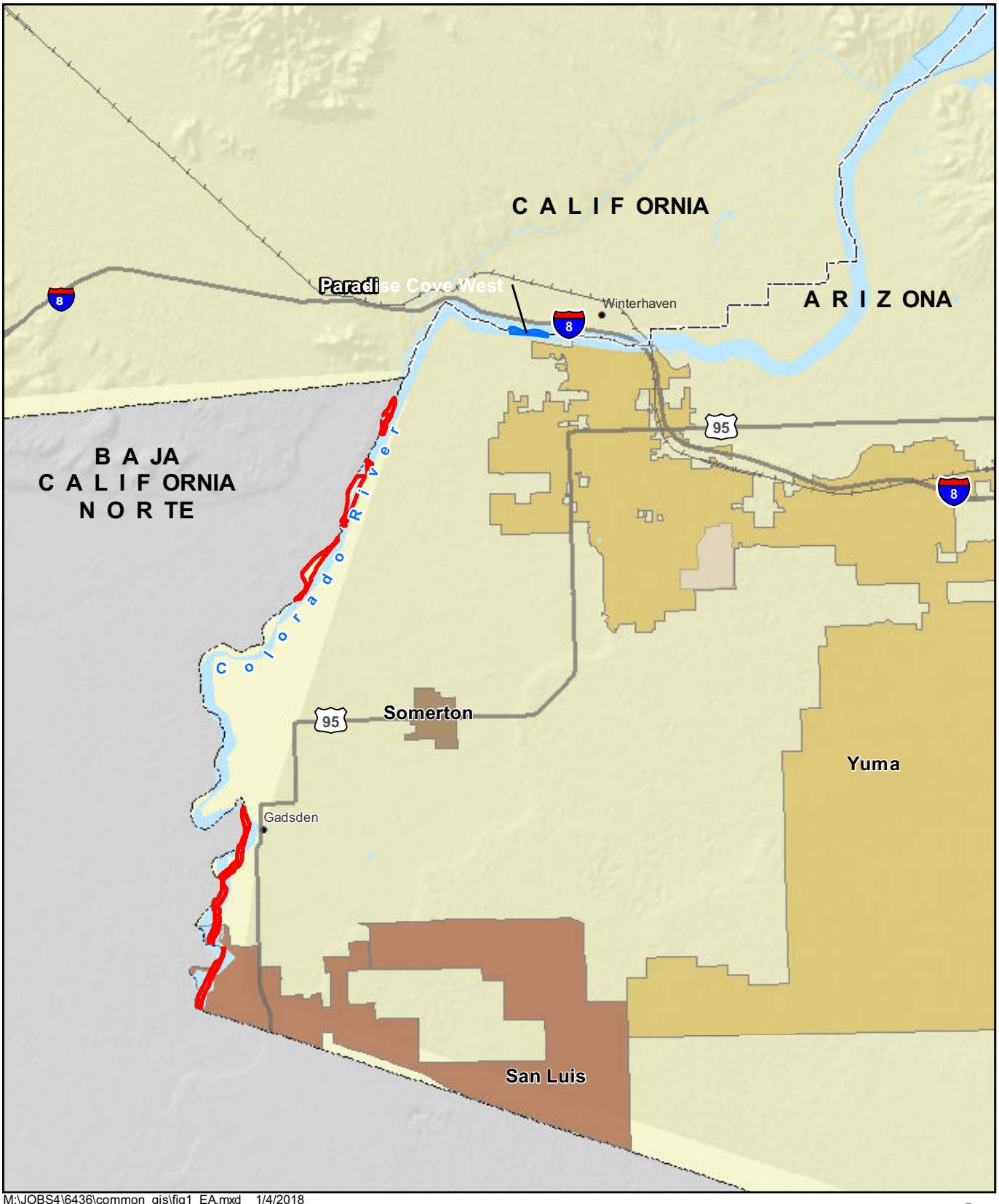
APPENDIX A - Figures



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0 Miles 4

Limitrophe Right-of-Way

Paradise Cove West

FIGURE 1

Regional Location

Image Source: NAIP (flown April 2016)

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0 Feet 400

Paradise Cove West Mitigation Area

Paradise Cove East

Cocopah Tribal Lands

FIGURE 2

Project Area

Image Source: NAIP (flown April 2016)

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Paradise Cove West Mitigation Area (50.35 ac.)

- Athel Tree
- Wolfberry
- Cottonwood
- Screwbean Mesquite
- Goodings Willow

Vegetation Communities

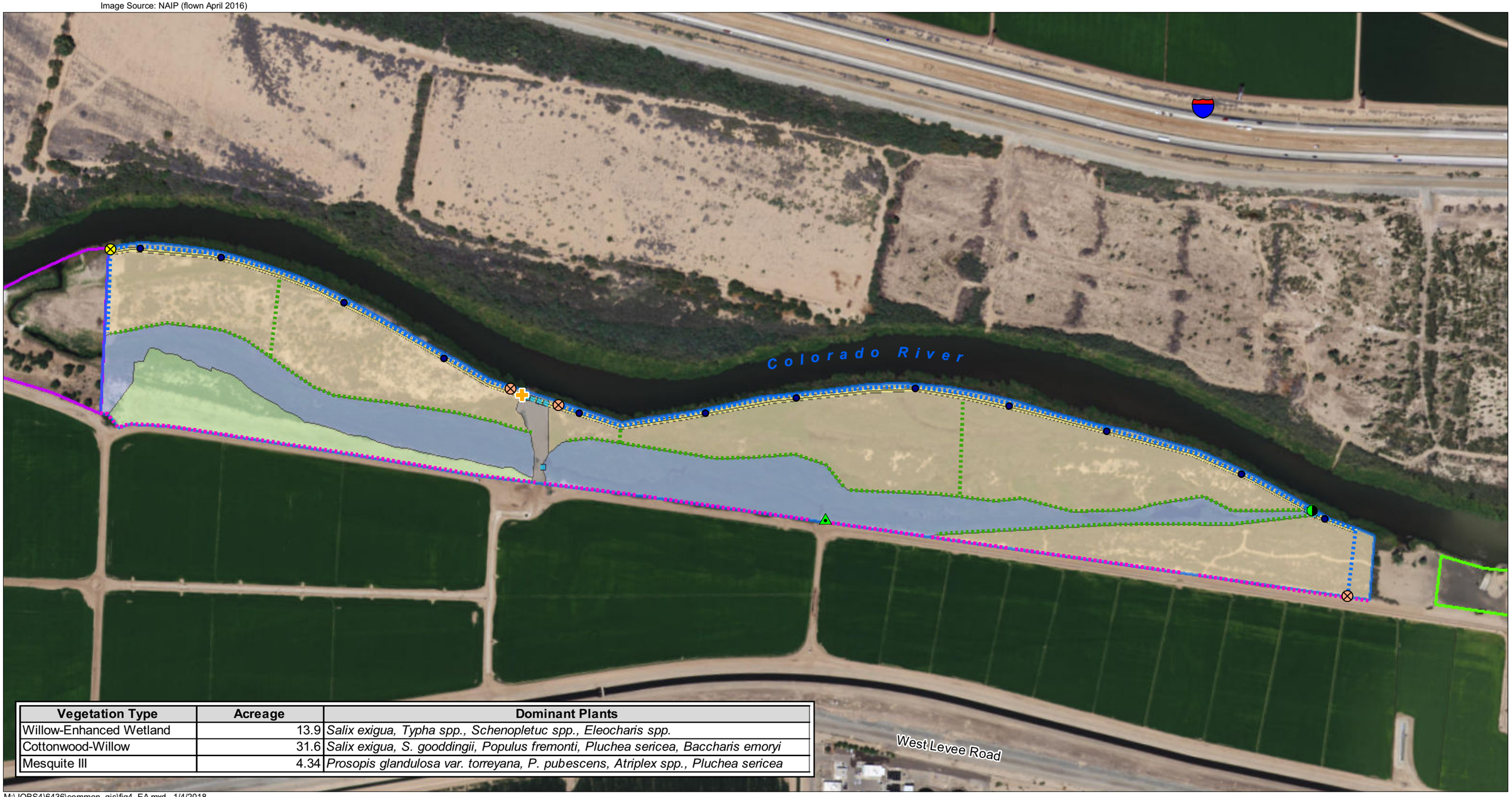
- Arrowweed Scrub (30.59 ac.)
- Bare Ground/Graded (3.41 ac)
- Emergent Marsh (0.85 ac.)
- Phragmites Scrub (15.50 ac.)

0 Feet 350

FIGURE 3

No Action Alternative

Image Source: NAIP (flown April 2016)



Vegetation Type	Acreage	Dominant Plants
Willow-Enhanced Wetland	13.9	*Salix exigua, Typha spp., Schenopletuc spp., Eleocharis spp.*
Cottonwood-Willow	31.6	*Salix exigua, S. gooddingii, Populus fremonti, Pluchea sericea, Baccharis emoryi*
Mesquite III	4.34	*Prosopis glandulosa var. torreyana, P. pubescens, Atriplex spp., Pluchea sericea*

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0 Feet 350

Project Areas
- Paradise Cove West Mitigation Area
- Paradise Cove East
- Cocopah Tribal Lands

Vegetation Type
- Green Fire Break
- Cottonwood-Willow (flood irrigated)
- Mesquite (overhead irrigation)
- Willow-Enhanced Wetland (non-irrigated)

Infrastructure
- Field Berm (2'x3'x2')
- Vehicle Berm
- Safety Berm
- Irrigation Channel (Concrete)
- Culvert (Box/Pipe)

Other Features
- Pump Station
- Weir (tbd)
- Diversion Outlet
- Gates/Signage
- Emergency Gate
- Wastewater Treatment Outfall

FIGURE 4

Proposed Action – Paradise Cove West Mitigation Area

APPENDIX B - Final Limitrophe Mitigation/Restoration Plan

Final Limitrophe Mitigation/Restoration Plan

Prepared for
Customs & Border Protection
Border Patrol and Air and Marine
Program Management Office
Environmental Branch
1301 Constitution Avenue NW, Suite B-155
Washington, DC 20004

Prepared by
RECON Environmental, Inc.
1927 Fifth Avenue
San Diego, CA 92101
P 619.308.9333

RECON Number 6436-5
14 September 2018

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ATTACHMENTS

List of Acronyms and Abbreviations

AGFD	Arizona Game and Fish Department
ASO	Arizona State Office
BA	Biological Assessment
BLM	Bureau of Land Management
BMP	Best Management Practice
BO	Biological Opinion
BOR	Bureau of Reclamation
Cal-IPC	California Invasive Plant Council
CBP	Customs and Border Protection
CY	cubic yard
DHS	Department of Homeland Security
EA	Environmental Assessment
EPA	Environmental Protection Agency
ESA	Endangered Species Act
GISD	Global Invasive Species Database
GSRM	Gila and Salt River Meridian
LCR	lower Colorado River
mmhos/cm	millimhos per centimeter
MSCP	Multi-species Conservation Plan
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NWP	Nationwide Permit
OHV	off-highway vehicle
O&M	Operations and Maintenance
PVC	polyvinyl chloride
ROW	right-of-way
SWFL	southwestern willow flycatcher
USFWS	United States Fish and Wildlife Service
YFO	Yuma Field Office
YCR	Yuma clapper rail

Executive Summary

Customs and Border Protection was issued a right-of-way grant (AZA 34173) by the Bureau of Land Management Yuma Field Office in 2008 to conduct vegetation treatments on up to 560.8 acres of vegetation along the lower Colorado River near Yuma, Arizona. The permit specifically covers the Limitrophe – a 23-mile reach of the lower Colorado River that forms the international boundary and where dense vegetation can sometimes interfere with Customs and Border Protection's border security mission. The permit authorized the establishment of an enforcement zone created through vegetation treatments, maintenance, and mitigation. In 2008 and 2012, a total of 149.08 acres of vegetation were treated, triggering a need for vegetation mitigation.

This Mitigation and Restoration Plan establishes a habitat restoration strategy for vegetation treatment activities that have already occurred under this right-of-way grant. The Bureau of Land Management has identified four mitigation site alternatives as appropriate candidates for mitigation sites: Paradise Cove West, Paradise Cove East, Mittry Lake, and the Confluence sites. This document proposes a preferred site, Paradise Cove West, and presents a specific mitigation restoration concept (Balanced Wetland) that is expected to achieve adequate mitigation credit for vegetation treatments that have occurred as of 2018.

1.0 Introduction

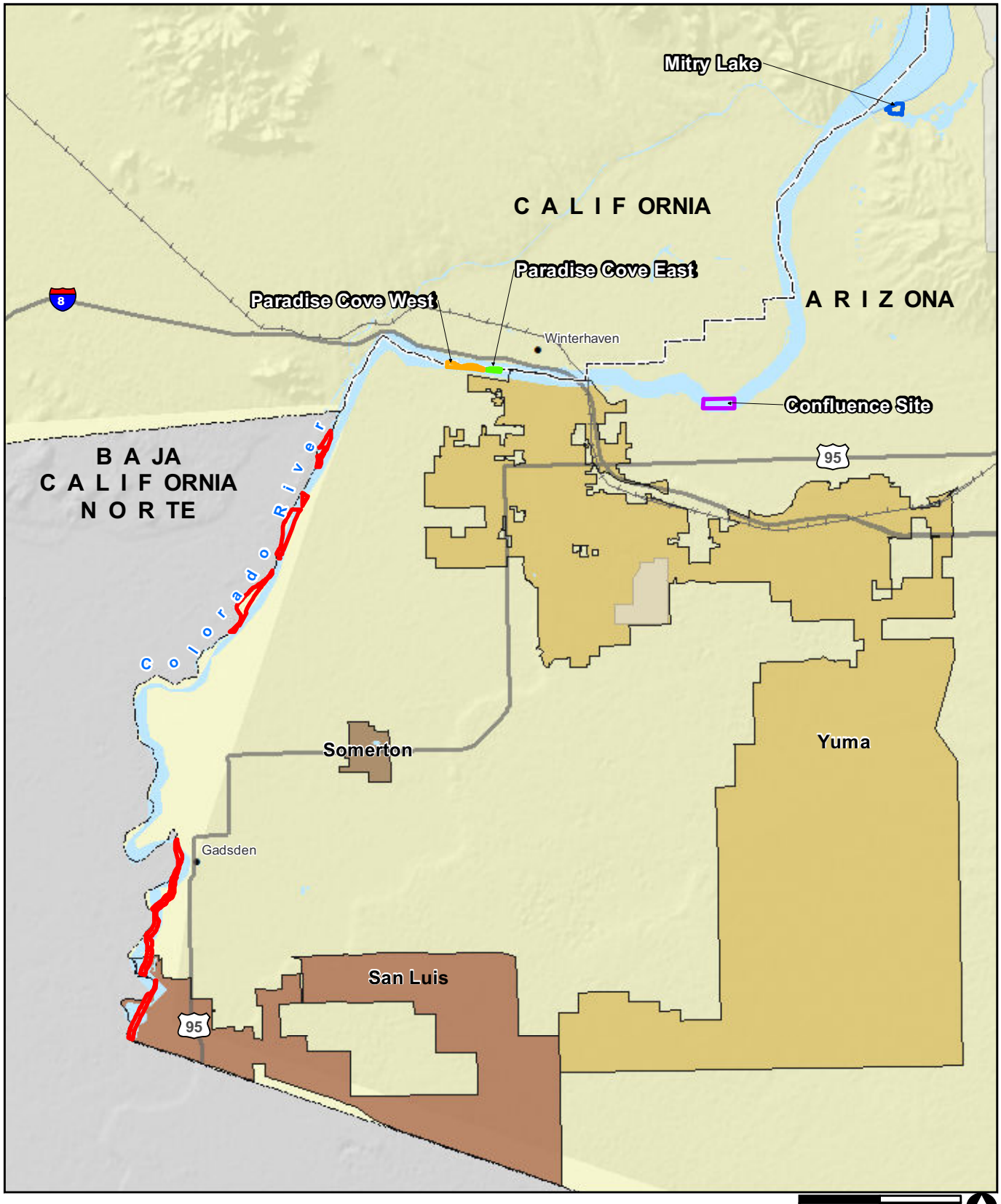
1.1 Background

Customs and Border Protection (CBP) was issued a right-of-way (ROW) grant (AZA 34173) by the Bureau of Land Management (BLM) Yuma Field Office (YFO) in 2008 to conduct vegetation treatments on up to 560.8 acres of vegetation along the lower Colorado River (LCR) near Yuma, Arizona (BLM 2008a). The ROW specifically covers the *Limitrophe*—a 23-mile reach of the LCR that forms the international boundary (Figure 1) and where dense vegetation can sometimes interfere with CBP's border security mission. The ROW authorized the establishment of an enforcement zone created through vegetation treatments, maintenance, and mitigation for a period of 10 years.

Revegetation is one of the conservation measures in the 2008 BLM Biological Assessment (BA) and the 2008 U.S. Fish and Wildlife Service (USFWS) Biological Opinion (BO) to minimize impacts resulting from the Vegetation Treatment Program in the Limitrophe Division for Safety and Law Enforcement, Lower Colorado River, Yuma County, Arizona. The criteria included in the BO (USFWS 2008) specifies that the proponent must replace treated habitat with higher quality replacement habitat outside the treatment area (600 foot wide corridor), either within the Limitrophe or as close to the Limitrophe as possible.

Over half of the vegetation in the Limitrophe project area comprises non-native saltcedar (*Tamarix* spp.), and less than 70 acres are classified as native cottonwood–willow vegetation (USFWS 2008). Vegetation treatments covered by the BA (BLM 2008b) and BO (USFWS 2008) include four different prescriptions that may be applied up to 600 feet west of the Bureau of Reclamation (BOR) levee road:

- **Prescription A.** Mechanical treatment of dense stands of saltcedar with rubber-tired or tracked vehicles (no bulldozers or other bladed equipment). Invasive vegetation is mulched, chipped, and/or shredded to ground level; desirable native vegetation such as Fremont cottonwood (*Populus fremontii*) and mesquite (*Prosopis* spp.) is preserved in place.
- **Prescription B.** Hand treatment/removal of invasives in areas where desirable natives are closely mixed in. Desirable native vegetation is preserved in place but may be pruned. Hand-cleared vegetation is mulched with a portable mulcher and spread throughout the site as directed.
- **Prescription C.** Mechanical and hand removal along levees and steep backlines. Treated vegetation to be mulched and left on-site; desirable native vegetation (cottonwood, willow, mesquite to be treated as in Prescription B) and other native shrubs would be treated as necessary.
- **Prescription D.** Mechanical treatment by bull hog in patchy areas dominated by shrubs. Standing dead material is mulched and live vegetation is thinned as necessary.



Limitrophe Permitted Treatment Areas
Mitry Lake
Confluence Site
Paradise Cove East
Paradise Cove West

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FIGURE 1
Regional Location

- Vegetation was mapped in the permit area and treatment prescriptions were assigned according to vegetation type. Nine vegetation/cover types are identified in the project area: agriculture, arrowweed (*Pluchea sericea*), cottonwood–willow, marsh, open water, saltcedar, saltcedar–mesquite, structured open water, and undetermined. Follow-up maintenance treatments can include hand and/or mechanical treatment as described above in addition to herbicide treatment (spot, cut-stump, foliar, broadcast, and/or hand-wipe application) with BLM approved herbicides.

The Yuma Resource Management Plan (BLM 2010) restates the requirement from the previous resource management plan, which was in effect at the time of the ROW grant issuance that mitigation is required for impacts to riparian vegetation, which is managed as priority wildlife habitat. To analyze the effects of vegetation removal, the BLM completed an Environmental Assessment (EA; BLM 2007a). BLM consulted with USFWS under Section 7 of the Endangered Species Act (ESA) during the preparation of this Environmental Assessment.

An index of relative wildlife habitat worth can be created by multiplying the number of acres by the wildlife value presented in Anderson and Ohmart (1984). This method was used to determine the appropriate number of mitigation acres for replacing low-value habitat with higher-value habitat (see Table 5 in USFWS 2008 for details regarding mitigation ratios). Three main mitigation guidelines have been developed for mitigation:

1. Mitigation is to occur outside of the project area (off-site);
2. Replacement vegetation must provide higher quality habitat for wildlife than the treated vegetation; and
3. Mitigation is to occur either within the Limitrophe, or as close to the Limitrophe as possible.

The EA (BLM 2007a) and BA (BLM 2008b) state that cottonwood–willow vegetation with characteristics that support southwestern willow flycatcher (*Empidonax trailii extimus*; SWFL) habitat should be prioritized in the mitigation plan. The permit covers 560.8 acres, which would result in a mitigation need of between 134 and 144 acres of replacement habitat. Since the completion of the BO (USFWS 2008), 149.08 acres have been treated to date. This activity has resulted in a current mitigation need of 42.8 acres of cottonwood–willow and mesquite vegetation (Tables 1 and 2).

This document establishes a mitigation and restoration plan for vegetation treatment activities that have already occurred under this ROW grant. Four mitigation site alternatives have been identified by BLM: Paradise Cove West, Paradise Cove East, Mittry Lake, and the Confluence site (see Figure 1). This document proposes a preferred site, Paradise Cove West, and presents a specific mitigation restoration plan.

Table 1 Summary of 2008 Biological Opinion			
Species	Endangered Species Act Status	Habitat	Effect Determination (USFWS 2008)
Southwestern willow flycatcher (*Empidonax trailii extimus*)	Listed endangered	Cottonwood–willow and saltcedar plant communities along rivers and streams	May affect, likely to adversely affect
Yuma clapper rail (*Rallus longirostris yumanensis*)	Listed endangered	Freshwater and brackish marshes	May affect, likely to adversely affect
Yellow-billed cuckoo* (*Coccyzus americanus*)	Listed Threatened	Large blocks of riparian woodlands comprising cottonwood, willow, and/or saltcedar galleries	No determination
*Listed as threatened in October 2014			

Table 2 Current Mitigation Required*						
Treated Vegetation Type	Acres Treated 2008	Acres Treated 2012	Total Acres Treated	Proposed Replacement Vegetation Type	Mitigation Ratio/ Calculation	Mitigation Acres Required
Cottonwood–willow	7.3	17.26	24.56	Cottonwood–willow	1 : 1	24.56
Saltcedar	63.8	3.69	67.49	Cottonwood–willow	(acres treated x 4) / 23	11.74
Saltcedar–mesquite	0	32.5	32.5	Mesquite III	(acres treated x 4) / 20	6.50
Arrow weed	22	0	22	None	0	0
Undetermined	0.7	1.83	2.53	None	0	0
Total	**93.8**	**55.28**	**149.08**			**42.80**
*Mitigation ratios are from Table 5 in USFWS (2008).						

1.2 Environmental Compliance

- **Biological Opinion for the Right-of-Way for Vegetation Treatment Program in the Limitrophe Division for Safety and Law Enforcement, Lower Colorado River, Yuma County, Arizona** (USFWS 2008) prepared by the USFWS in 3 March 2008.
- **Environmental Assessment (EA-AZ-320-2007-022) for Vegetation Treatments in Limitrophe for Safety and Law Enforcement** (BLM 2007a) prepared by the YFO in October 2007.
- **Biological Assessment for the Right-of-Way for Vegetation Treatments in Limitrophe for Safety and Law Enforcement, Lower Colorado Arizona** (BLM 2008b) prepared by YFO and the Arizona State Office (ASO) in October 2007 and amended in February 2008.
- **Right of Way Grant/Temporary Use Permit AZA 34173** (BLM 2008a) issued to CBP for access to the Limitrophe for vegetation treatments.
- **Feasibility Report Proposed Mitigation Site** (CBP 2010). This document presented the feasibility of a proposed mitigation site just north of the Confluence site but was ultimately dismissed due to BOR concerns.
- **Paradise Cove Restoration Plans** (Fred Phillips Consulting LLC 2009). This document was part of an Arizona Water Protection Fund Grant application.

2.0 Overview of Restoration Objectives and Desired Outcomes

2.1 Mitigation Objectives

Mitigation requirements and objectives are included in the Biological Assessment (BLM 2008b) and Biological Opinion (USFWS 2008) and referenced in the ROW grant (BLM 2008a) granted to CBP by the BLM. The objectives for replacement habitat include development of a mix of cottonwood–willow and honey mesquite (*Prosopis glandulosa* var. *torreyana*) vegetation types. Mitigation should emphasize as much cottonwood–willow as the mitigation site can support, and priority should be given to sites with wet soil. Replacement vegetation should be designed to exceed the habitat value of the acres that were treated and prioritize providing habitat to support SWFL. SWFL habitat characteristics include:

- Patch width greater than 32 feet
- Patch size greater than 10 acres
- Canopy height greater than 13 feet
- Canopy closure of more than 70 percent total from the ground to the canopy
- Greatest foliage density in the vertical layers between 3 and 13 feet above the ground
- Mean diurnal temperature between 79 and 91 degrees Fahrenheit
- Mean maximum diurnal temperature averaging between 90 and 113 degrees Fahrenheit
- Mean diurnal relative humidity greater than 33 percent
- Mean soil moisture minimum of 17 percent and average of 23 percent

Replacement vegetation should be designed to achieve habitat values greater than what is currently commonly found in the Limitrophe reach of the LCR by exhibiting:

- Greater than 10 percent density of cottonwood and willow trees that constitutes cottonwood–willow land cover under the Anderson and Ohmart classification system (1984). In the Anderson and Ohmart (1984) study, diversity and abundance of wildlife tended to increase with increasing proportions of cottonwood and willow trees (BOR 2004, 2006);
- Greater botanical diversity than is typically associated with existing stands; and
- Greater structural diversity associated with creation of multiple layers of vegetation and seral stages than existing cottonwood–willow stands on the LCR.

Priority tree species in order of decreasing importance are willow, cottonwood, and mesquite; mitigation planting should include as much willow as the site can support. A vegetation mosaic that includes patches of honey mesquite is desirable to emulate historical vegetation along the LCR prior to invasion of saltcedar. It is understood that saltcedar is

likely to become established in the mitigation area to some degree and that it is often a component of high-value wildlife habitat.

These mitigation objectives would serve as the basis of the success monitoring for the creation for the replacement habitat.

2.2 Conservation Measures

The Biological Opinion includes conservation measures to minimize the adverse effects to the SWFL and Yuma clapper rail (*Rallus longirostris yumanensis;* YCR) during the vegetation treatments. Below are excerpted conservation measures that would apply to implementation of mitigation restoration:

- Where practical, stands of arrowweed, which have traditional value for several Native American tribes, would be left on-site and avoided by project activities.
- Project operations, including both initial treatment and subsequent maintenance, would be timed to avoid the migration, breeding, and nesting timeframe of special status species.
- Mechanical vegetation treatment and re-treatment would occur between October 1 and March 31.

2.3 BLM Best Management Practices for Riparian Revegetation

BLM Best Management Practices (BMPs) for Riparian Revegetation are included as Appendix D of the BA (BLM 2008b). This mitigation restoration plan has incorporated all applicable BMPs in Chapter 4.0.

3.0 Existing Conditions and Restoration Potential

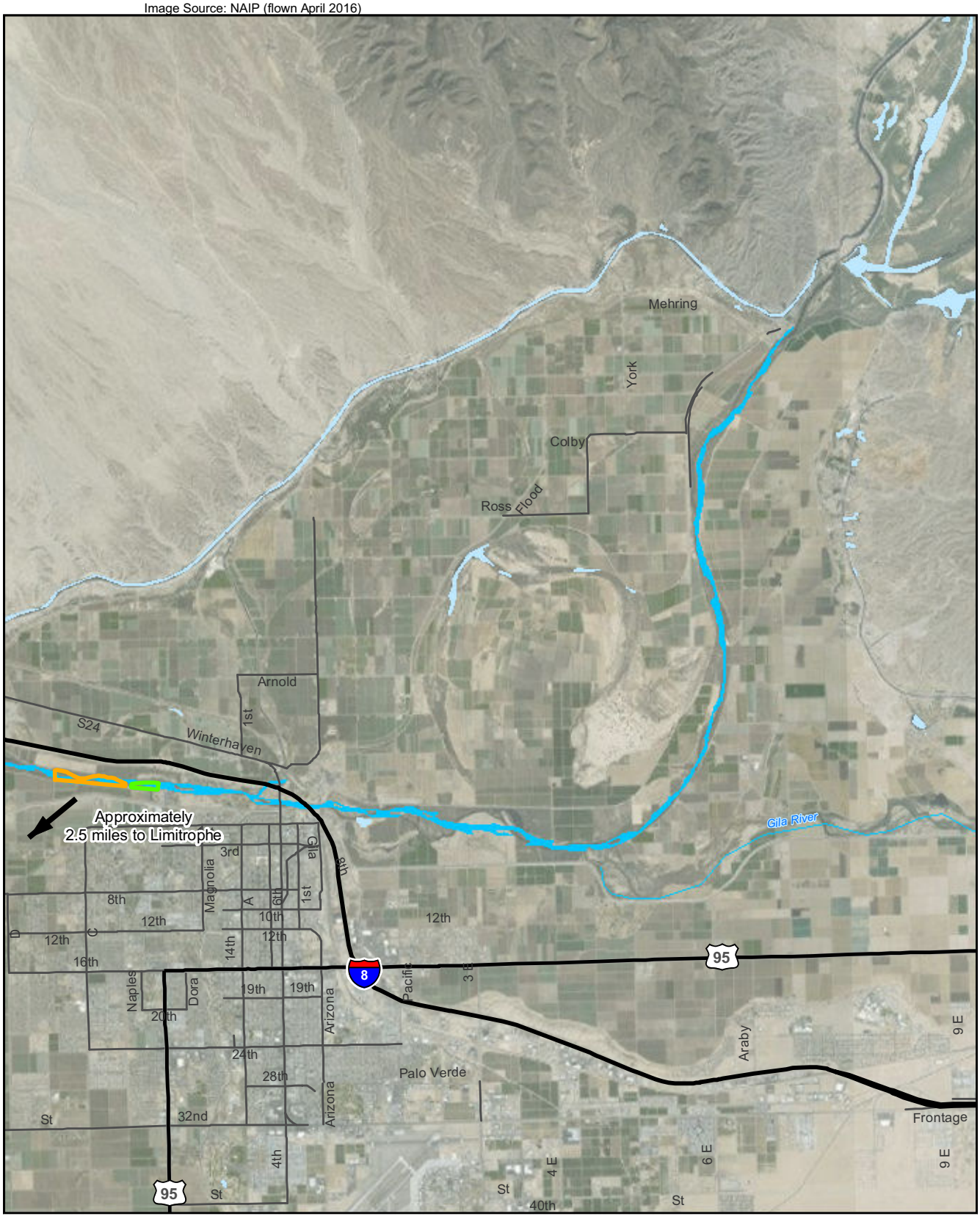
3.1 Potential Mitigation Sites

Four potential mitigation sites have been identified by the BLM with input from the BOR; these sites all meet the following minimum requirements, per Appendix B of the BA (BLM 2008b):

1. Landowner has demonstrated clear title to the land and water.
2. No deed, easement, or other legal restrictions are attached to the site that could limit the feasibility of habitat creation and management during the term of the project.
3. Sites offered for the establishment of riparian habitats must be large enough to accommodate the establishment of a minimum acreage of habitat (10 acres) and any additional area required for use as buffer land, infrastructure (e.g., roads, canals), and other features required to support the created habitat.
4. Sites are *not* located where levels of human activity are sufficiently high that it is unlikely that created land cover types can fully function as covered species habitat.
5. Sites must support conditions that would allow for the creation of habitats.
6. No hazardous materials are present on sites of a type or in quantities that would preclude the establishment, future management, or value of habitats created on the sites. Hazardous materials would need to be removed from the sites prior to implementation.

Potential mitigation sites are located outside the vegetation treatment project area, as prescribed in the EA (BLM 2007a). They are also outside of the Limitrophe reach of the LCR; however consideration was given to sites in as close proximity as possible. The four sites are Confluence, Mittry Lake, Paradise Cove East, and Paradise Cove West (Figure 2). This section presents an overview of each site, according to the site selection criteria in Appendix B of the BA (BLM 2008b).

Image Source: NAIP (flown April 2016)



Mitry Lake

Confluence Site

Paradise Cove East

Paradise Cove West

0 Miles 2

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FIGURE 2

Potential Mitigation Sites

3.1.1 Confluence Site

3.1.1.1 Location and Land Use

The Confluence site is located at the confluence of the Gila River and LCR, Sections 13 and 14 of Township 7 South, Range 22 West Gila and Salt River Meridian (GSRM), approximately 8 miles from northern portion of the Limitrophe project area (Figure 3). The site comprises approximately 150 acres, and the boundary is rectangular in shape. Surrounding land use includes intensive agriculture. The Confluence site is administered by the BLM, and recreational use includes an extensive network of off-highway vehicle (OHV) trails, shooting, and camping. This site is located directly south of the previously proposed mitigation parcel (CBP 2010).

3.1.1.2 Water Availability

Water is available by trash pump directly from the adjacent Gila and Colorado rivers.

3.1.1.3 Soil Conditions

Soil conditions described below are summarized from Natural Resources Conservation Service (NRCS) soil reports that were generated specifically for the site using the web soil survey tool (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm). The full report is included in Attachment 1.

Soils at the Confluence site include Holtville clay and Lagunita loamy sand.

- **Holtville clay** is a floodplain soil characterized as well drained and non-saline to strongly saline, with salt levels ranging from 2 to 32 millimhos per centimeter (mmhos/cm). The first 23 inches in the soil profile is clay, underlain by stratified silty clay loam.
- **Lagunita loamy sand** is considered to be "somewhat excessively drained," with a profile that is loamy sandy for up to 60 inches; this soil can be non-saline to very slightly saline (0–4 mmhos/cm).

3.1.1.4 Existing Vegetation

Vegetation throughout the Confluence site consists of a mix of saltcedar, arrowweed, and common reed (*Phragmites australis*) (Photographs 1 and 2).

3.1.1.5 Habitat Development Potential

The Confluence site contains sufficient acreage to satisfy the mitigation requirements.

3.1.1.6 Site Constraints

a. Recreational Access. The Confluence site is a popular OHV area, with existing trails throughout, including through the river (Photographs 3 and 4). During the site visit, active shooting and OHV use were observed. Trash and beer bottles were strewn across the site, indicating that the site is used extensively for social gatherings. This would be a difficult area to protect against recreation impacts and vandalism.

b. Installation and Maintenance Access. This area is fairly remote and difficult to access. Work trucks and heavy equipment would need to get permission to access the site through the agricultural fields.

3.1.1.7 Recommendation

RECON does not recommend this site for mitigation restoration due to site constraints, which may impede successfully meeting the goals and objectives of the mitigation program. In addition, BOR has not provided written concurrence for use of this location.

Image Source: NAIP (flown April 2016)

0 Feet 1,500

Confluence Site

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FIGURE 3

Confluence Site

PHOTOGRAPH 1
Confluence: Vegetation along Gila River

PHOTOGRAPH 2
Confluence: Common Reed along Gila River

PHOTOGRAPH 3
Confluence: Recreational OHV Use in Gila River

PHOTOGRAPH 4
Confluence: Recreational OHV Use Adjacent to Gila River

3.1.2 Mittry Lake

Two mitigation sites at Mittry Lake were assessed to determine the feasibility of restoration in order to meet the Limitrophe mitigation requirement. The initial site that was assessed is discussed below. Subsequently, in September 2014, a second location (Zone A) was assessed and is discussed in a separate report and attached to this document as Attachment 2.

3.1.2.1 Location and Land Use

The Mittry Lake site is located northeast of Yuma on the LCR, between Imperial Dam (upstream) and the Laguna Dam (downstream). The site is located in the Sections 13 and 14 of Township 7 South, Range 22 West GSRM and is approximately 52 acres in size. This site is the farthest potential mitigation site from the Limitrophe project area, approximately 15 miles away (Figure 4).

Mittry Lake is jointly managed by the BOR, BLM, and the Arizona Game and Fish Department (AGFD) as a wildlife management area that includes: native habitat restoration and protection, and recreational opportunities including fishing, hunting, and wildlife viewing. The parcels identified as potential mitigation sites are located in agricultural fields northwest of Mittry Lake; extensive stands of saltcedar and common reed surround the site, along with some previously restored cottonwood–willow forests to the west. The adjacent 37 acres of cottonwood–willow were restored specifically for the benefit of the threatened and endangered species.

3.1.2.2 Water Availability

Water is available from the adjacent Mittry Laker via existing agricultural aqueduct and pump, pending permission from BLM (Photograph 5). Concrete-lined irrigation canals bisect the site and would be available to deliver water to different sections of the site (Photograph 6). This site would be well suited to flood irrigation.

3.1.2.3 Soil Conditions

Soil conditions described below are summarized from NRCS soil reports that were generated specifically for the site using the web soil survey tool (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm). The full report is included in Attachment 1. Three soil types are identified in the report:

- **Salorthids** cover the majority of the site (82 percent of the project site), including the entire eastern half. Salorthids are a poorly draining soil type composed of mixed alluvium that has a salt horizon within 30 inches of the surface. At the Mittry Lake site, this soil type had visible salt deposits on the surface (Photograph 7).
- **Indio silt loam** is present in the northwest corner of the Mittry Lake site (16 percent of the project site). Indio silt loam is a well-drained floodplain soil composed of mixed alluvium. The first 6 inches in the soil profile are silty loam, underlain by

very fine sandy loam. These soils may be un-saline to slightly saline, with salt levels ranging from 1 to 4 mmhos/cm.

- **Holtville clay** is present in a sliver along the southern boundary (approximately 1 percent of the project site). Holtville clay is a floodplain soil characterized as well drained and non-saline to strongly saline, with salt levels ranging from 2 to 32 mmhos/cm. The first 23 inches in the soil profile is clay, underlain by stratified silty clay loam (Photograph 8).

This site has been cleared and graded, and is currently planted with Bermuda grass with the intention of reducing soil salinity in preparation for native riparian and floodplain tree planting. Detailed soil data should be obtained from BLM if this site is chosen for mitigation restoration; it is anticipated that leaching, deep irrigation, and soil amendments would be necessary for successful planting (BLM 2011).

3.1.2.4 Existing Vegetation

The Mittry Lake site has been cleared and graded for agriculture, and the majority of the acreage is devoid of native vegetation (Photograph 9) except for some areas of quailbush (*Atriplex lentiformis*)–saltbush (*Atriplex* sp.) scrub (Photograph 10). Bermuda grass (*Cynodon dactylon*) has been planted in the fields, and there are some areas with native sprangletop grass (*Leptochloa* sp.) as well as low-lying areas that support cattails (*Typha* sp.). Dense areas of saltcedar and common reed border the site to the north and east (Photograph 11), and there is a cottonwood–willow mitigation site to the southwest (Photograph 12).

The 751-acre Laguna Fire, which occurred on May 18, 2012, burned valuable adjacent habitat, including Betty's Kitchen, Pratt Nursery, and the Mittry Lake South Restoration area (Photograph 13). The BLM completed the Laguna Emergency Stabilization and Rehabilitation Project to address 86 acres damaged by the fire, including 9 acres of Mittry Lake South. The project included removal of hazard trees, invasive species treatment, installation of native species, replacement of lost structures and infrastructure, trail repair, and monitoring (BLM 2011).

3.1.2.5 Habitat Development Potential

The southern portion of the Mittry Lake site is adjacent to existing SWFL habitat and less dense saltcedar; mitigation on this section as a priority would have the advantage of adding to the existing SWFL patch size and providing additional connectivity. The southwestern corner is lower lying and could be easily transformed into a wetland habitat with minor recontouring.

At 52 acres in size, the Mittry Lake site is of adequate size to meet current mitigation needs, and its configuration would readily allow for phasing of revegetation.

3.1.2.6 Site Constraints

a. Soil. The soil at the site is clearly very saline and a more detailed analysis would be needed to address these concerns.

b. Invasive Species. The site is surrounded by dense stands of invasive species that would create a constant need for maintenance.

3.1.2.7 Recommendation

RECON recommends this site as a secondary choice for mitigation restoration, pending BLM's receipt of a formal concurrence memorandum from BOR that the site is available.

Additional locations within the Mittry Lake Area may also be available as mitigation acres (see Attachment 2). Upon CBP's need to move forward with a second mitigation restoration site, those options may be analyzed. BOR and AGFD have given BLM concurrence of restoring 265 additional acres of wildlife habitat within the Mittry Lake Area (see Attachment 2). Both agencies only ask to provide technical assistance and reviews of the design and environmental documents. BOR has not confirmed this site is available for CBP to use for restoration purposes.

Image Source: NAIP (flown April 2016)

0 Feet 1,500

Mitry Lake

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FIGURE 4
Mitry Lake Site

PHOTOGRAPH 5
Mittry Lake: Irrigation Pump

PHOTOGRAPH 6
Mittry Lake: Irrigation Canal System

PHOTOGRAPH 7
Mittry Lake: Salorthrid Soil with Salt Deposits

PHOTOGRAPH 8
Mittry Lake: Holtville Clay Soil with Water Pooling

PHOTOGRAPH 9
Mittry Lake: Agricultural Field

PHOTOGRAPH 10
Mittry Lake: Quailbush (*Atriplex lentiformis*) Grows in Dense Stands in Areas of High Salinity That Have Not Been Cleared

PHOTOGRAPH 11
Mittry Lake: Saltcedar (*Tamarix ramosissima*) Grows
in Dense Stands on Banks of Lower Colorado River

PHOTOGRAPH 12
Mittry Lake: Cottonwood-willow Revegetation
Site Adjacent to Site to Southwest

PHOTOGRAPH 13
Mittry Lake: Fire Recently Impacted Dense
Saltcedar (*Tamarix ramosissima*) Directly South of Site

3.1.3 Paradise Cove East Riparian Habitat Site Evaluation

3.1.3.1 Location and Land Use

The Paradise Cove East site is approximately 17 acres in size and located south of Interstate 8 (I-8), between the south bank of the LCR and West Levee Road, just east of the Paradise Cove West site. The site is located in Section 19 of Township 8 South, Range 22 West GSRM, Arizona. This site is the second closest potential mitigation site to the Limitrophe project area, approximately 3 miles away, as described in Section 3.1.4 (see Figure 5).

Surrounding land use includes agriculture to the south, the Yuma Mesa Conduit and Paradise Cove West to the west, the Hidden Cove Trailer Park to the southeast, and recreational opportunities throughout the site. Less than a mile further southeast includes the Yuma Wetlands that total approximately 1,600 acres of restored LCR habitats that are balanced with recreational opportunities.

3.1.3.2 Water Availability

Water is available by trash pump from the adjacent Colorado River. A drip irrigation system is present on-site that was installed as part of the previous revegetation effort; however, the functionality of this system is no longer working.

3.1.3.3 Soil Conditions

Soil conditions described below are summarized from NRCS soil reports that were generated specifically for the site using the web soil survey tool (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm). The full report is included in Attachment 1.

Holtville clay is the soil type present within Paradise Cove East site. This floodplain soil is characterized as well drained and can be non-saline to strongly saline, with salt levels ranging from 2 to 32 mmhos/cm. The first 23 inches in the soil profile are clay, underlain by stratified silty clay loam.

3.1.3.4 Existing Vegetation

BLM conducted a revegetation project at Paradise Cove East site after damage sustained from an 8-acre fire (the "Paradise Cove East") in 2004. Restoration activities included clearing of common reed, arrowweed, and saltcedar; planting of 1,000 trees (mesquite, Fremont cottonwood, and Goodding's willow [*Salix gooddingii*]; herbivore protection; and irrigation for the first year.

In 2013, Environmental Assessment AZ-C020-2013-027-EA and decision record was completed to incorporate hazardous fuels reduction, habitat restoration for wildlife include

threatened and endangered species, walking trail construction, Americans with Disabilities Act fishing access, upper bank flood irrigation, and vehicle access gates for emergency closures. Currently, established stands of screwbean mesquite (*Prosopis pubescens*) (Photograph 14), Goodding's willow, and cottonwood (Photograph 15) are present on-site and reach heights exceeding 20 feet. Non-natives such as saltcedar and Mexican paloverde (*Parkinsonia aculeata*) are also prevalent on-site, in some areas regenerating strongly and compromising the revegetation effort (Photograph 16). BLM continues retreatment of invasive species on a biannual basis, greatly reducing their spread.

3.1.3.5 Habitat Development Potential

At 17 acres in size, the Paradise Cove East site may not be of adequate size to meet mitigation needs. No concurrence has been obtained for this site. The BOR concurrence memorandum provided to BLM covers 17 acres at the Confluence site and 51 acres at Paradise Cove West (Attachment 3).

3.1.3.6 Site Constraints

a. Site Topography/Existing Revegetation. The topography of the site, which slopes upward from the water source, would require irrigation into perpetuity to sustain additional restoration plantings, especially willow, which is the focus of the mitigation; re-contouring of the site is not possible due to the existing revegetation project.

b. Recreational Access. In addition to the popular river access point located directly to the west of the Paradise Cove East site, there is a large established group camping area in the center of the site and extensive roads/trails (Photograph 17). This would be a difficult area to protect against recreation impacts.

3.1.3.7 Recommendation

RECON does not recommend this site for mitigation restoration due to site constraints, which may impede successfully meeting the goals and objectives of the mitigation program. This site currently provides migratory habitat for yellow-billed cuckoo (*Coccyzus americanus*) and other wildlife species, eliminating its qualification as a mitigation site per USFWS requirements.

Image Source: NAIP (flown April 2016)

0 Feet 1,500

Paradise Cove East

Paradise Cove West

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FIGURE 5

Paradise Cove East and West

PHOTOGRAPH 14
Paradise Cove East: Revegetation Area with Stand of Mature Screwbean Mesquite (*Prosopis pubescens*)

PHOTOGRAPH 15
Paradise Cove East: Revegetation Area with Cottonwood (*Populus fremontii*) and Saltcedar (*Tamarix ramosissima*)

PHOTOGRAPH 16
Paradise Cove East: Saltcedar (*Tamarix ramosissima*)
Aggressively Recruiting in Revegetation Area

PHOTOGRAPH 17
Paradise Cove East: Recreational Access Area

3.1.4 Paradise Cove West Riparian Habitat Site Evaluation

3.1.4.1 Location and Land Use

The Paradise Cove West site is located approximately 2 miles west of downtown Yuma, Arizona, south of Interstate 8 (I-8), between the south bank of the LCR and West Levee Road at North Figueroa Avenue. The site is located in Sections 28 and 29, Township 16 South, Range 22 East, San Bernardino Meridian, Arizona, and is approximately 51 acres in size. This site is the closest potential mitigation site to the Limitrophe project area, approximately 2.5 miles away, and is located directly west of the Paradise Cove East site, described above (see Figure 5).

Surrounding land use includes BLM leased agriculture to the south, BLM managed recreational access to the river to the east, and naturally vegetated Cocopah tribe-owned lands to the west.

3.1.4.2 Water Availability

There are a variety of potential restoration water sources at the Paradise Cove West site, including:

- outfall water generated by the water treatment facility;
- direct use of the Colorado River via pump/flood irrigation; and/or
- direct use of Colorado River water via culvert/channel.

According to data from BOR, depth to groundwater at Paradise Cove West is approximately 12 feet (Attachment 4), which is deeper than water levels needed to sustain willows and cottonwoods. In addition, the Yuma Mesa Conduit is a BOR facility that drains groundwater from the City of Yuma to the Colorado River in order to prevent flooding; this outfall is located directly adjacent to eastern site boundary.

3.1.4.3 Soil Conditions

Soil conditions described below are summarized from NRCS soil reports that were generated specifically for the site using the web soil survey tool (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm). The full report is included in Attachment 1.

Soil types within the Paradise Cove West site include **Indio silt loam** and **Indio silt loam –saline.** Both of these soils are characterized as well-drained soils of floodplains, composed of mixed alluvium. The first 6–12 inches in the soil profile is silty loam, underlain by up to 63 inches of very fine sandy loam. These soils may be un-saline to moderately saline, with salt levels ranging from 1 to 16 mmhos/cm. This description is consistent with the values that were obtained on-site from sampling at 18 different locations (at 1- and 5-foot depths); these values ranged from 0.72 to 19.9 mmhos/cm (Fred Phillips Consulting, LLC 2009).

These soils are well suited to riparian restoration and currently support many desirable native plant species, including cottonwood and willow.

3.1.4.4 Existing Vegetation

Vegetation at Paradise Cove West was mapped and characterized into three different cover types (Table 3, Figure 6). The most prevalent vegetation types are arrowweed/saltcedar scrub (30.59 acres), common reed scrub (15.50 acres), and emergent wetland (0.85 acre). Arrowweed is extensive throughout the site (Photographs 18 and 19), and in some areas is mixed with saltcedar that has been previously treated and that is currently re-sprouting (Photograph 20). Common reed is growing in dense stands along the southern border of the site along the interior channel (Photograph 21) and along the LCR on the northern boundary (Photograph 22). Details associated with vegetative cover can be found in the *Wetland Delineation for Paradise Cove West* (Attachment 5).

Table 3
Vegetation cover types at Paradise Cove West

Vegetation Cover Type	Acres
Arrowweed/saltcedar scrub	30.59
Common reed scrub	15.50
Emergent wetland	0.85

Several desirable native plant species are present on-site, including patches of wolfberry (*Lycium* sp.), screwbean mesquite (Photograph 23), Goodding's willow (Photograph 24), Fremont cottonwood (Photograph 25), and seep willow (*Baccharis salicifolia*; Photograph 26). Emergent wetlands support a mix of native and non-native species (Photograph 27).

3.1.4.5 Habitat Development Potential

This site has high habitat development potential and suitability for current mitigation restoration; it is easily accessible for implementation and maintenance activities, has appropriate water resources to establish and sustain riparian plantings, and would have low to moderate potential conflicts with recreationists or adjacent private land lessees. Paradise Cove West is the geographically closest potential mitigation site to the Limitrophe project area, and would provide an opportunity to return the river to a more natural pattern while providing valuable wildlife habitat. BOR has provided a concurrence memorandum to BLM stating that mitigation is an appropriate use for this site and has provided special conditions and stipulations (see Attachment 3).

Random trees of Gooding's willow and Fremont cottonwood are present in the wetland; individuals could be used as anchors for new plantings and their health improved with the drainage improvements.

Paradise Cove West is adjacent to Cocopah tribe-owned land that supports natural vegetation as well as to the Paradise Cove East site, which BLM and BOR redeveloped in

2014. Restoration at this location would amplify wildlife benefits by connecting these two areas and increasing the contiguous habitat patch size.

Estimated available habitat acreage totals 49.84 acres within Paradise Cove West; infrastructure development would occur on the remaining 1.16 acres and therefore is not included in the mitigation acreage. The Paradise Cove West site is of adequate size to meet mitigation needs per BOR memorandum to BLM approving this site as use for mitigation.

3.1.4.6 Site Constraints

a. Non-native Species. Invasive species are very dense and prevalent at the Paradise Cove West site, especially saltcedar and common reed. Although saltcedar is prevalent throughout the site, it has been previously cleared and treated with herbicide. Saltcedar is re-generating throughout the site and additional aggressive treatment would be necessary during site preparation.

Common reed grows densely along the interior channel and along the northern project boundary along the Colorado River, forming impenetrable thickets. Removal/treatment activities would need to focus only on the interior channel near the outfall; common reed would need to be left largely intact along the Colorado River to preserve bank stability.

b. Recreational Access. The adjacency to a popular river access point would necessitate signage and planting of dense vegetation at the eastern boundary to discourage recreational impacts. Vehicle gates would also be needed to control access throughout the site.

c. Safety and Maintenance Access. Firebreaks would need to be incorporated into restoration design, but could double as maintenance roads. Canopy vegetation would be allowed to grow together forming contiguous habitat from a bird's view.

d. Wastewater Treatment Outfall and Agricultural Pumping. The Paradise Cove West site receives effluent wastewater at an outfall along the southern boundary; this water forms a channel that runs parallel to the levee road and the Colorado River. In addition, there is a pumping station, which provides water for adjacent agriculture, whose access road bisects the site to the Colorado River. Preservation of and access to these features would result in site design constraints.

e. Section 404 Impacts. The Paradise Cove West site is bisected by a channel and associated wetland vegetation that would be considered jurisdictional by the U.S. Army Corps of Engineers, pursuant to Section 404 of the Clean Water Act. A formal jurisdictional delineation was performed by RECON to support an application for a Nationwide 27 permit (see Attachment 5)

3.1.4.7 Recommendation

RECON recommends that this site be considered as a priority site for mitigation restoration.

Image Source: NAIP (flown April 2016)

Paradise Cove West (50.35 ac.)

- Athel Tree
- Wolfberry
- Cottonwood
- Screwbean Mesquite
- Goodings Willow

Vegetation Communities

- Arrowweed Scrub (30.59 ac.)
- Bare Ground (graded)
- Emergent Marsh (0.85 ac.)
- Phragmites Scrub (15.50 ac.)

0 Feet 300

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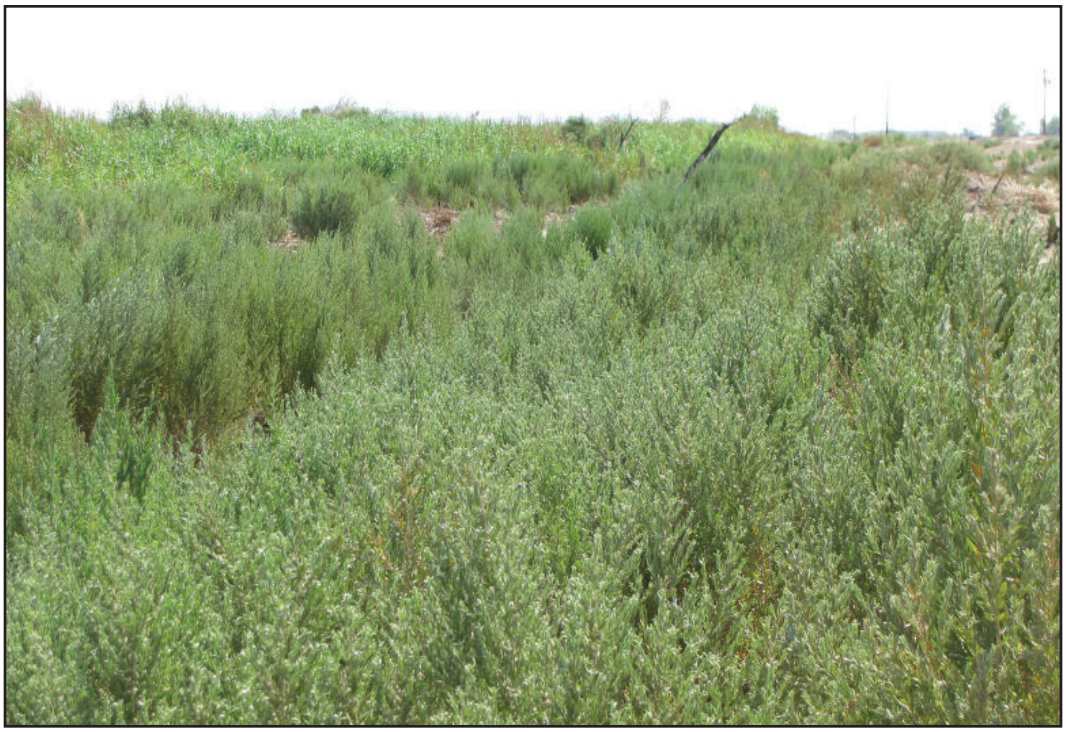
FIGURE 6

Paradise Cove West Existing Vegetation



PHOTOGRAPH 18
Paradise Cove West: Dense Stand of Arrowweed

PHOTOGRAPH 19
Paradise Cove West: Stand of Arrowweed

PHOTOGRAPH 20
Paradise Cove West: Treated Saltcedar Regenerating

PHOTOGRAPH 21
Paradise Cove West: Dense Stand of Common Reed at Southern Site Boundary

PHOTOGRAPH 22
Paradise Cove West: Dense Stand of Common Reed (*Phragmites australis*) and Saltcedar (*Tamarix ramosissima*) along Lower Colorado River

PHOTOGRAPH 23
Paradise Cove West: Stand of Screwbean Mesquite (*Prosopis pubescens*)

PHOTOGRAPH 24
Paradise Cove West: Goodding Willow
(*Salix gooddingii*) Scattered throughout Site

PHOTOGRAPH 25
Paradise Cove West: A Few Solitary Cottonwood Trees
(*Populus fremontii*) Scattered Throughout Site

PHOTOGRAPH 26
Paradise Cove West: Seep Willow/mulefat
(*Baccharis salicifolia*) Scattered throughout Site

PHOTOGRAPH 27
Paradise Cove West: Marsh Habitat with Mix of
Native and Non-native Plant Species

3.2 Comparison and Recommendation

The four potential mitigation sites have been considered and ranked according to several selection criteria (Table 4). Paradise Cove West has emerged as the primary recommended site for mitigation; several factors make it the preferred choice, including its close proximity to the Limitrophe and high restoration potential (including access to irrigation, amenable soil, ease of access, and low possibility of recreation conflicts). Mittry Lake has been identified as a suitable secondary choice; if future mitigation needs exceed credits achieved at Paradise Cove West, Mittry Lake would be an appropriate choice to achieve additional mitigation. The Paradise Cove East and Confluence sites are not recommended as suitable mitigation sites due to a variety of challenges, including access and potential recreation conflicts.

Table 4
Comparison of Potential Mitigation Sites

Selection Criteria	Potential Mitigation Sites				
	Paradise Cove West	Paradise Cove East	Mittry Lake	Mittry Lake South	Confluence
Establishment of non-native plants	high	moderate–high	moderate–high	high	high
Area (acres)	51 acres	17 acres	43 acres*	43 acres*	approx. 150 acres
Irrigation potential/ availability	high	high	high	high	high
Ease of access for installation and maintenance	high	high	moderate	high	low
Potential recreation conflicts	moderate	moderate–high	low–moderate	low-moderate	high
Recommendation	primary recommended choice	not suitable	secondary choice	third choice	not suitable

*Additional acreage available pending approval from BLM, BOR, and AGFD.

4.0 Paradise Cove West Balanced Wetland Restoration Concept

A stakeholder meeting was held on January 25, 2012, at the BLM YFO Field Office, to discuss issues and opportunities related to mitigation restoration opportunities, challenges/constraints, and feedback concerning the Paradise Cove West site. In attendance were representatives from RECON, state (AGFD) and Federal (BLM, Department of Homeland Security [DHS], BOR, USFWS agencies), as well as tribal (Cocopah Tribe) and local agricultural interested parties. Several subsequent meetings were held to discuss refinements to the concept. The overall main stakeholder concerns that have been discussed regarding potential habitat development at the Paradise Cove West site included:

1. **Wildlife Habitat.** Creation of high-quality wildlife habitat that meets mitigation requirements, especially for SWFL.
2. **Cost.** Development of a mitigation restoration plan that represents a good value for the Federal government based on cost/benefit analysis.
3. **Preservation of Important Existing Structures and Site Features.** These include: the Yuma Mesa Conduit at the eastern boundary; the bank of the Colorado River; outfall from the water treatment facility; and the access for withdrawing water for agricultural use by adjacent land leasee.
4. **Safety and Access.** Law enforcement access and firebreaks would be necessary components to the mitigation restoration plan. Limited recreational access may be permitted, but should be considered in the context of the primary goal of habitat restoration.
5. **Compatibility with Adjacent Cocopah Restoration Project.** Restoration activities at the Paradise Cove West site should take into account the need for water at the downstream Cocopah restoration site.

These concerns have been addressed in the development of several restoration concepts; the preferred concept, the Balanced Wetland Concept is described below. A detailed mitigation restoration plan is presented in Section 5.0 of this document.

4.1 General Description of the Balanced Wetland Concept

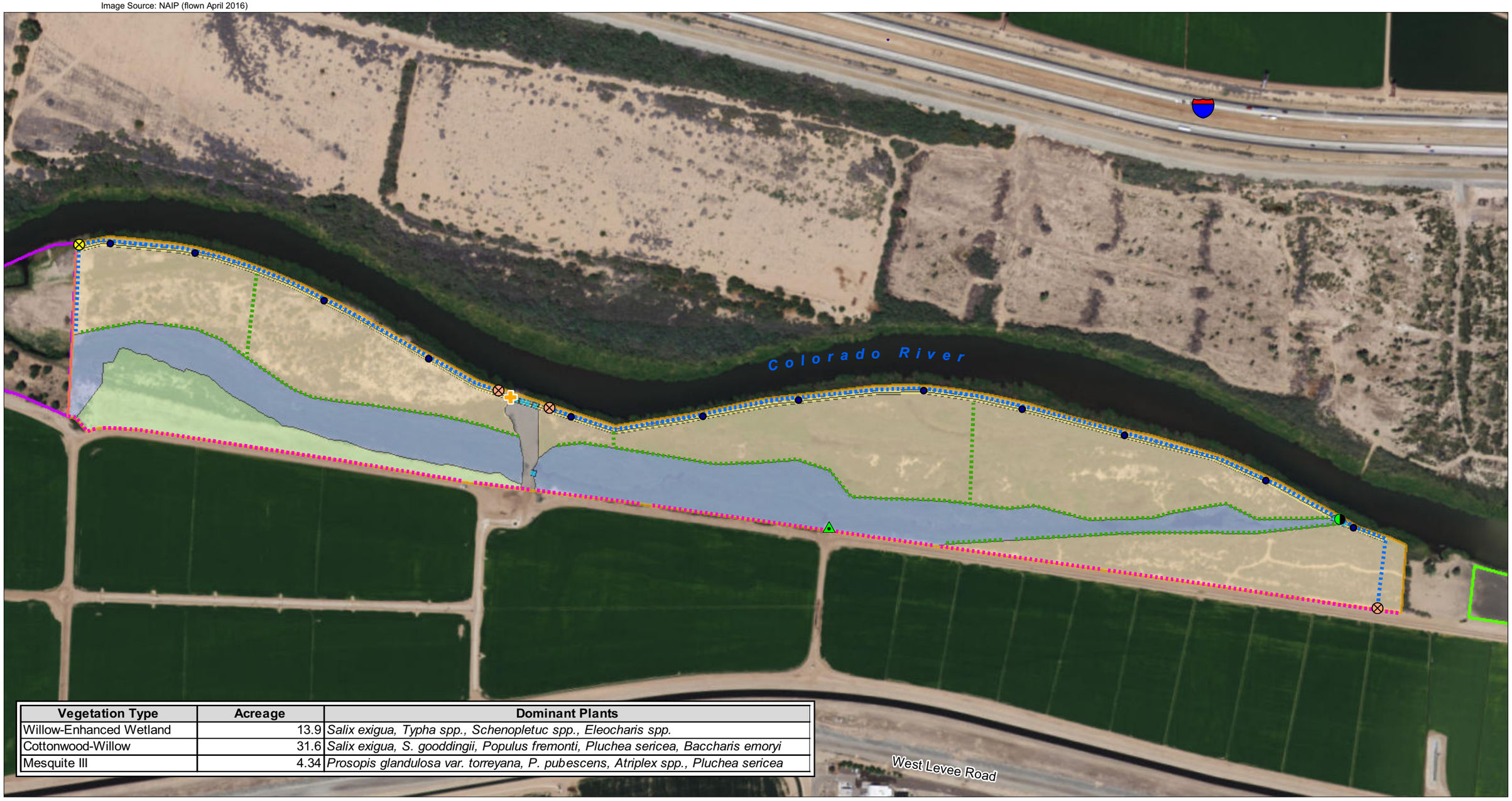
The Balanced Wetland Concept (Figure 7) maintains the existing wetland that bisects the site. Land on the north side of the channel would include four to five discrete areas that are divided by walkable field berms that extend perpendicularly from the northern drivable access road (near the Colorado River) to another walkable berm on the north side of the interior channel, near the willow-enhanced wetland. The walkable berms would provide limited access for site maintenance, while the drivable access road would provide access for site maintenance, as well as irrigation maintenance, law enforcement (vehicle access through gates), fire prevention, and recreation (foot access only).Bank stability along the Colorado River would be maintained by the preservation of the dense growth of common reed. Existing structures and access roads would be preserved, and site features would be compatible with adjacent restoration activities by the Cocopah Tribe. In addition, a green firebreak would bisect the restoration area connecting the site with direct access to the existing agricultural road.

This concept would utilize site grading to achieve mitigation goals with a balanced cut/fill approach that would require no soil export and would combine agricultural and natural approaches. By balancing material on-site, the installed container plants' root systems, depending on depth of sediment, may require significant time to reach groundwater. Irrigation requirements would be dependent on root growth to reach groundwater and reduction in any salt accumulation through percolation. The depth to groundwater is estimated to be approximately 6–7 feet within the cottonwood–willow areas and 8–9 feet within the mesquite woodland. Water would be supplied to the project directly from the Colorado River via a pumping station; no groundwater well would be necessary. This restoration concept is supported by a "border irrigation" method, commonly used by agricultural growers in the Yuma area. A pumping station located in the central portion of the site would pump water directly from the Colorado River into a concrete irrigation channel that would extend along the entire northern extent of the project area. The pumping station would be located adjacent to the green firebreak area (see Figure 7). Diversion outlets would deliver water from the irrigation canal to the fields, which would be laser-leveled and graded to maximize water coverage.

The willow-enhanced wetland would be re-contoured to better support willow and wetland plantings. There would be no changes to the elevation of the main channel (although the banks may be laid back for a smoother transition); water flow to the adjacent Cocopah restoration site may increase during peak flows, but the flow would not drop below current levels. The channel would be connected to the river by a corrugated metal culvert that would receive flow during high river water events; water would be perennially delivered via the wastewater treatment outfall located on the southern boundary of site.

Excavated soil would be used to: (1) construct the walkable berms/drivable access roads; (2) construct irrigation swales along the existing road and the river edge; and (3) develop the central fuel break/access area.

Image Source: NAIP (flown April 2016)



Vegetation Type	Acreage	Dominant Plants
Willow-Enhanced Wetland	13.9	*Salix exigua, Typha spp., Schenopletuc spp., Eleocharis spp.*
Cottonwood-Willow	31.6	*Salix exigua, S. gooddingii, Populus fremonti, Pluchea sericea, Baccharis emoryi*
Mesquite III	4.34	*Prosopis glandulosa var. torreyana, P. pubescens, Atriplex spp., Pluchea sericea*

Project Areas
- Paradise Cove West (50.35 ac.)
- Paradise Cove East
- Cocopah Tribal Lands

Vegetation Type
- Green Fire Break
- Cottonwood-Willow (flood irrigated)
- Mesquite (overhead irrigation)
- Willow-Enhanced Wetland (non-irrigated)

Infrastructure
- Field Berm (2'x3'x2')
- Vehicle Berm
- Safety Berm
- Irrigation Channel (Concrete)
- Culvert (Box/Pipe)

Other Features
- Pump Station
- Weir (tbd)
- Diversion Outlet
- Gates/Signage
- Emergency Gate
- Wastewater Treatment Outfall

0 Feet 300

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FIGURE 7

Paradise Cove West Balanced Wetland Restoration Concept

Three restoration vegetation types would be supported by this concept:

- **Willow-enhanced Wetland.** Approximately 13.9 acres of willow-enhanced wetland would be improved along the channel and its connection to the river. This area would be irrigated via the outfall and via high water river events. Non-native common reed would be removed from the channel, and willow cuttings would be installed at its edge, along with a diverse suite of wetland native plant species.

- **Cottonwood–Willow.** Approximately 31.6 acres of cottonwood–willow would be supported on both sides of the willow-enhanced wetland. This area would be irrigated via the flood irrigation system.

- **Mesquite Woodland.** Approximately 4.34 acres of mesquite woodland would be supported at the southwestern portion of the project area. This area would be graded as a transitional area from the channel to the access road; irrigation would occur via temporary agricultural overhead sprinklers, as needed, until the mesquite trees are surviving on their own (~2 years).

4.2 Evaluation Factors

CBP would conduct monitoring of the site for a 10-year period, as required in the 2008 CBP ROW grant. The monitoring program to be conducted is outlined in Section 6.0. BLM would continue monitoring of the site 10 years after full project implementation.

4.2.1 Habitat Development Potential

The Balanced Wetland Concept would provide mitigation vegetation including willow-enhanced wetland (13.9 acres), cottonwood–willow (31.6 acres) and mesquite (4.34 acres), for a total of 49.84 acres. The remaining 1.16 acres include perimeter roads and associated infrastructure development and therefore are not included in the mitigation acreage. Additionally, the area covered by the firebreak access road in the middle of Paradise Cove West site is minimal and does not warrant subtraction from the total mitigation acreage.

4.2.2 Restoration Components

4.2.2.1 Site Preparation

Clearing and grubbing of existing vegetation would be necessary to prepare the site. This task would be accomplished using heavy machinery, primarily a bulldozer, to push material into piles and a loader to deposit material into roll-off containers for off-site disposal. Material may be chipped prior to disposal in containers to reduce the biomass to a manageable size.

4.2.2.2 Earthwork

The largest component of installation would likely be earthwork necessary to prepare, excavate, and grade the site to achieve appropriate surface, drainage patterns, and elevations above groundwater to support the different vegetation types. Earthwork would be necessary to level the site and would be accomplished using heavy machinery: bulldozer and excavator. The cubic yards (CY) of cut and fill required to meet the desired site elevations have been estimated using the recent site topography data developed by NEI in March and April of 2012 (Attachment 6). Excavation quantities have been designed to meet the ideal conditions for establishment of vegetation. The Balanced Wetland Concept would require movement (but no export) of approximately 150,000 CY of material.

4.2.2.3 Irrigation and Water Control

A fenced pumping station would be installed in the central portion of the project area to pump water directly (via a diesel-fueled pump) from the Colorado River to support restoration plantings. Three modes of irrigation would be used:

- **Flood Irrigation via Concrete-lined Irrigation Canals.** A concrete-lined irrigation canal would span the length of the site to serve the plantings. The ditch would be 1–2 feet wide at the base and 2–3 feet in depth, and would run along the northern edge of the site (adjacent to the riverside berm/access road). Diversion outlets would be manually controlled to allow flood irrigation of planted areas. It is estimated that this irrigation system may utilize up to 80 acre-feet of water during Year 1, with a 20 percent decrease per year over the next three years, until the trees are established. At Years 4 through 10, CBP anticipates a maximum of 20 acre feet of water per year is needed to maintain the site and the required microclimates for the targeted SWFL.
- **Flood Irrigation via the Improved Central Main Channel.** The willow-enhanced wetland would be connected to the river via a culvert at the upstream end of the site, which would flush the system during high water events. In addition, the central wastewater treatment outfall would continue to provide water to the lower portion of the area. Water use is determined by the culvert size and elevation placement (see Section 5.6). It is estimated that this irrigation system may utilize up to 24 acre-feet of water during Year 1, with a 20 percent decrease per year over the next three years, until the vegetation is established. However, this does not account for water that would be derived from the wastewater treatment plant, which would account for a large portion of this water allocation. At Years 4 through 10, CBP anticipates a maximum of 9 acre feet of water per year is needed to maintain the site and the required microclimates for the targeted SWFL
- **Overhead Watering the Mesquite Woodland.** Vegetation in the southwestern portion of the site would be served by a temporary overhead irrigation system. The system would be similar to typical agricultural practices in the Yuma area; a secondary sprinkler pump and pipes would be rented and utilized as needed. The system would be pressurized by connecting a hose to the pumping station stretched

along the green firebreak. The project restoration biologist would be responsible for field-fitting the system to adequately irrigate the container plantings during the maintenance period. Watering would be conducted during regular flood irrigation operations on a regular basis. It is anticipated that overhead irrigation would occur until the tree roots reach groundwater (~2 years). It is estimated that this irrigation system may utilize up to 6 acre-feet of water during Year 1, with a 20 percent decrease per year over the next three years, until the trees are established. No water use is anticipated after Year 3.

4.2.2.4 Plant Material Installation

The required plant material per acre varies by vegetation type. Each vegetation type is associated with a unique planting density, species palette, and suite of planting units, as described below:

- **Willow-enhanced Wetland.** The willow-enhanced wetland would be installed along the existing and improved channel that bisects the project area. Plantings would consist of a mix of poles, cuttings, and plugs, and would be supplemented with seeding of native species. If recommended by the Project restoration biologist, herbivory cages may be installed.
- **Cottonwood–Willow.** The cottonwood–willow vegetation type would include densely planted willow cuttings (min. 24" x 0.5") and cottonwood poles (min. 36" x 1") as well supplemental 5-gallon cottonwood and willow plants in specific areas. The 5-gallon plantings would be protected from herbivory with wire cages, and the area would also be with seeded with native species. In addition, herbivory cages may be installed on additional plantings at the discretion of the Project restoration biologist.
- **Mesquite Woodland.** The mesquite woodland vegetation type would utilize tall pots (trees), which have a higher per-unit cost but would be installed at a much lower density. The tall-pot plantings would be protected from herbivory with wire cages, and the area would also be seeded with native species. As described in Section 5.5.3.3, below, herbivory cages would be installed to protect all tall-pot plantings.

4.2.2.5 Operations and Maintenance

Operations and Maintenance (O&M) includes irrigation infrastructure and maintenance needs including but not limited to: pumps, berms, canals, and roads; irrigation system components, gates, signage, treatment of invasive species, and remedial plantings. CBP would conduct maintenance for 10 years from full project implementation. Due to the design of the site, maintenance would be required in perpetuity. BLM would be responsible for maintenance of the site after CBP has met its 10-year obligation.

5.0 Proposed Restoration Plan

5.1 Vegetation Types

Existing vegetation at the Paradise Cove West site is largely a mix of arrowweed and saltcedar, dense stands of common reed along the Colorado River, and the interior channel formed by the wastewater treatment outfall (Figure 6). There are pockets of cattails, screwbean mesquite, Goodding's willow, and wolfberry (*Lycium* sp.). The current vegetation is not characteristic of habitat for any of the endangered species in the area, but has potential to become such with topographic manipulation and revegetation.

Vegetation types have been chosen and sited according to site constraints and opportunities for wildlife habitat creation at Paradise Cove West. The ultimate goal is to provide as much wildlife habitat as possible, with special emphasis on the creation of SWFL habitat. Diversity of plant species and structure is emphasized in the context of a project that will be designed to be self-sustaining at maturity. The three vegetation types in the restoration plan, from most mesic to least mesic, include:

- The **Willow-enhanced Wetland** vegetation type would comprise approximately 13.9 acres, located along the interior channel. This vegetation type is intended to provide foraging habitat for potential SWFLs, increasing the value of the adjacent cottonwood–willow vegetation. This vegetation type would include a mixture of marsh vegetation, with dense plantings of coyote willow in areas that are currently occupied by invasive common reed. A full species palette is presented in Table 5.

Table 5
Willow-enhanced Wetland Plant Palette

Species	Common Name
Baccharis salicifolia	seep willow/mulefat
Heliotropium curvassavicum	salt heliotrope
Pluchea odorata	marsh fleabane
Pluchea sericea	arrowweed
Salix exigua	coyote willow
Salix gooddingii	Goodding's willow
Schoenoplectus americanus	three-square bulrush
Schoenoplectus californicus	California bulrush
Schoenoplectus maritimus	alkali bulrush
Schoenoplectus pungens	common threesquare
Typha latifolia	common cattail

- The **Cottonwood–Willow** vegetation type would comprise approximately 31.6 acres, located adjacent to the willow-enhanced wetland and common reed along the Colorado River. This vegetation type is intended to serve as the nucleus of potential SWFL habitat and would consist of dense planting dominated by coyote willow (*Salix exigua)* and seep willow/mulefat. Cottonwood, Goodding's willow, and screwbean mesquite would be included as scattered individuals to increase diversity. A full species palette is presented in Table 6.

Table 6
Cottonwood–Willow Plant Palette

Species	Common Name
Atriplex canescens	four-wing saltbush
Baccharis salicifolia	seep willow/mulefat
Geraea canescens	desert sunflower
Lupinus arizonicus	Arizona lupine
Oenothera deltoides	birdcage evening primrose
Phacelia crenulata	scorpion weed
Pluchea sericea	arrowweed
Populus fremontii	cottonwood
Prosopis pubescens	screwbean mesquite
Salix exigua	coyote willow
Salix gooddingii	Goodding's willow

- The **Mesquite** vegetation type would comprise approximately 4.34 acres of the driest site elevations. Plantings would include honey mesquite, desert willow (*Chilopsis linearis*), four-wing saltbush (*Atriplex canescens*), and quailbush. A full species palette is presented in Table 7.

Table 7
Mesquite Plant Palette

Species	Common Name
Atriplex canescens	four-wing saltbush
Atriplex lentiformis	quail bush
Baileya multiradiata	desert marigold
Chilopsis linearis	desert willow
Lycium sp.	wolfberry
Oenothera deltoides	birdcage evening primrose
Pluchea sericea	arrowweed
Prosopis glandulosa var. torreyana	western honey mesquite
Prosopis pubescens	screwbean mesquite
Sphaeralcea ambigua	globemallow
Suaeda moquinii	desert seepweed
Verbesina encelioides	golden crownbeard

5.2 Mitigation Credit

The Balanced Wetland Concept would provide the following mitigation vegetation types:

- 31.6 acres of cottonwood–willow;
- 13.9 acres of willow-enhanced wetland; and,
- 4.34 acres of mesquite.

One of these mitigation vegetation types, willow-enhanced wetland, was not included in/or analyzed for the project; however, because this vegetation type would provide potential foraging for SWFL adjacent to cottonwood–willow vegetation as well as habitat for Yuma clapper rail, it is included in the mitigation acres presented in Table 8. The inclusion of willow-enhanced wetland within the restoration area creates a natural ecosystem structure that is present in riverine communities, in particular along braided channels outside of the thalweg of the river. By maintaining this area, the overall habitat would be more dynamic in structure and would most likely provide suitable habitat for a host of species, including two sensitive wildlife species and their varied life stages. Since willow-enhanced wetland is considered high-quality habitat, a ratio of 1 acre of treated cottonwood–willow to 1.0 acre of willow-enhanced wetland has been calculated.

The Balanced Wetland Concept will provide 42.8 acres of mitigation credit at Paradise Cove that would be used to cover the treatment of 149.08 acres. This mitigation scenario meets the mitigation requirements; restoration at Paradise Cove West would provide the necessary credits (Table 9), including approximately 7.04 acres in excess.

Table 8
Calculation of Mitigation Acres Required for Treated Vegetation

Treated Vegetation Type	Total Acres Treated and Requiring Mitigation	Mitigation Ratio / Calculation	Mitigation Acres
Cottonwood–willow	24.56	1 acre treated, 1 acre replaced	24.56
Saltcedar	67.49	(acres treated x 4) / 23	11.74
Saltcedar–mesquite	32.50	(acres treated x 4) / 20	6.50
Arrowweed/undetermined	24.53	Not required	0.00
Total	**149.08**		**42.80**

Table 9 Mitigation Credit Acres in Paradise Cove West Restoration Plan			
Mitigation Vegetation Type (ratio)	Acres Available in Balanced Wetland Design††	Mitigation Credit (acres)	Excess Acreage*
Willow-enhanced wetland† (1:1)	13.9	13.4	0.5
Cottonwood–willow (1:1)	31.6	28.0	3.6
Mesquite (1:1)	4.34	1.4	2.94
Total	**49.84**	**42.8**	**7.04**

*Excess acreage to be finalized following construction, and confirmed via USFWS and BLM formal memos.
†The willow-enhanced wetland vegetation type was not included in the mitigation table in the Biological Assessment. This ratio was utilized for this vegetation type, since it is valuable as foraging habitat for the southwestern willow flycatcher.
†† The remaining 1.16 acres associated with the Paradise Cove West site include perimeter roads and associated infrastructure development and therefore are not included in the mitigation acreage. The area covered by the firebreak access road in the middle of Paradise Cove West is minimal and does not warrant subtraction from the mitigation acreage.

5.3 Phased Approach

A phased approach for implementation has been developed due to anticipated annual financial limitations. This approach to the Balanced Wetland Concept entails implementing the project in three distinct phases. Each phase would build upon each other until the entire site is implemented. Due to the requirements of mobilization and the cost benefits in implementing certain facets in their entirety (e.g., concrete lining), each phase would not be a replicate but an extension of the preceding work.

The phases have been divided as follows; Figure 8 depicts the phasing approach.

5.3.1 Phase 1

Phase 1 is the most complex phase, since it entails the creation of the primary infrastructure that would be used through all phases. Phase 1 components include:

- Pumping station (pump, intake, generator, fence)
- Green firebreak(agricultural lease) stabilization for access to pumping station. Access road stabilization to pumping station, upstream northern boundary (~4,000 linear feet)
- Upstream concrete-lined irrigation swale (~3,800 feet), diversion outlets (9)
- Culverts (at pumping station, across central wetland, and at upstream weir)
- Gates (3) and signage
- Vegetation—17.2 acres of cottonwood–willow; three graded and leveled fields and associated berms

5.3.2 Phase 2

Phase 2 consists of additional vegetation supported by infrastructure created during Phase 1:

- Vegetation—5.6 acres of cottonwood–willow and 7.9 acres of willow-enhanced wetland, one graded and leveled field, associated berms, and re-contoured central wetland
- Retreatment of newly established invasive species

5.3.3 Phase 3

Phase 3 effort is focused downstream of the pumping station; Phase 3 components include:

- Access road stabilization [downstream northern boundary (1,600 linear feet); diversion outlets (4)]
- Gates (2) and signage
- Vegetation—8.8 acres of cottonwood–willow, 6.0 acres of willow-enhanced wetland, and 4.34 acres of mesquite woodland; including three graded and leveled fields and associated berms, and re-contoured central wetland
- Retreatment of newly established invasive species

Each phase would be monitored and maintained for a period of 10 years from date of implementation. BLM would continue monitoring and maintenance activities after CBP concludes its 10-year efforts. The phased approach is applicable only if financial resources are not available for implementation of the entire area; this approach would be approved by CBP and the BLM YFO prior to implementation. Additional details regarding phase components can be found in Attachment 7. No deviations from restoration components due to phasing are expected.

Image Source: NAIP (flown April 2016)

Paradise Cove West (50.35 ac.)
Paradise Cove East
Cocopah Tribal Lands

Phases
Phase 1 (16.41 ac.)
Phase 2 (13.86 ac.)
Phase 3 (20.08 ac.)

Vegetation Type
Green Fire Break
Cottonwood-Willow (flood irrigated)
Mesquite (overhead irrigation)
Willow-Enhanced Wetland (non-irrigated)

Infrastructure
Field Berm (2'x3'x2')
Vehicle Berm
Safety Berm
Irrigation Channel (Concrete)
Culvert (Box/Pipe)
Constructed Access Road (15-20')

Pump Station
Weir (tbd)
Diversion Outlet
Gates/Signage
Emergency Gate
Wastewater Treatment Outfall

0 Feet 300

RECON

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FIGURE 8

Paradise Cove West
Habitat Restoration Phases

5.4 Site Preparation

5.4.1 Clearing and Grubbing

BLM YFO conducted saltcedar clearing between 2010 and 2012 in the Paradise Cove West project area. All remaining saltcedar would be cleared, as well as areas of common reed along the interior channel, using heavy machinery. Common reed along the Colorado River would be retained to preserve bank stability. As areas of native vegetation are cleared, they would first be evaluated for opportunities for plant material salvage and seed collection for the revegetation. Areas of native emergent wetland vegetation would not be cleared.

5.4.2 Grading and Excavation

The project area would be graded to support the vegetation types in the restoration concept. The main channel would be smoothed and expanded in areas where non-native species are removed to create a transitional slope between the channel and the adjacent restored habitat; within the mesquite area of the project, the transitional slope would extend to the project boundary. Agricultural type fields would be constructed in the northern and southeastern portions of the project site to support cottonwood–willow planting areas; these fields will be graded and laser-leveled to promote adequate water coverage. Excess material would be used to construct field berms; the northern maintenance access road; and support for the irrigation ditches in order to separate the fields, focus irrigation, and provide maintenance/fire access.

5.4.3 Best Management Practices for Site Preparation

BLM BMPs for Riparian Revegetation are included as Appendix E of the BA (BLM 2008b). BMPs applicable to site preparation include:

- Vehicles must be washed prior to entering the site.
- All revegetation materials would be weed- and pest-free.

5.5 Native Plant Materials

A variety of native plant materials are proposed to achieve the mitigation vegetation types described in Section 4.1, including: preservation in place and enhancement of existing native wetland vegetation, installation of conventional and tall pot container plant materials, direct cutting materials, and seeding. The majority of the Paradise Cove West site is proposed to be treated with container plantings, cuttings, and seeding. Table 10 identifies appropriate plant material type by vegetation type and species; plant material types are described in the following sections.

Table 10 Native Species' Planting Techniques by Vegetation Type				
Species	Common Name	Willow-enhanced Wetland	Cottonwood–Willow	Mesquite
Anemopsis californica	yerba mansa	C		
Atriplex canescens	four-wing saltbush		S/C	S/C
Atriplex lentiformis	quail bush			S/C
Baccharis salicifolia	seep willow/mulefat	C	C	
Baileya multiradiata	desert marigold			S
Chilopsis linearis	desert willow			C
Eleocharis sp.	spikerush	C		
Eustoma exaltatum	catchfly gentian	S		
Geraea canescens	desert sunflower		S	
Lupinus arizonicus	Arizona lupine		S	
Lycium sp.	wolfberry			C
Oenothera deltoides	birdcage evening primrose		S	S
Phacelia crenulata	scorpion weed		S	
Pluchea odorata	marsh fleabane	S		
Populus fremontii	cottonwood		C/X	
Prosopis glandulosa var. torreyana	western honey mesquite			C
Prosopis pubescens	screwbean mesquite		C	C
Salix exigua	coyote willow	C/X	C/X	
Salix gooddingii	Goodding's willow	C/X	C/X	
Schoenoplectus acutus	hardstem bulrush	C		
Schoenoplectus californicus	California bulrush	C		
Schoenoplectus maritimus	alkali bulrush	C		
Sphaeralcea ambigua	globemallow			S/C
Suaeda moquinii	desert seepweed	C	C	C
Verbesina encelioides	golden crownbeard		S	S
C = container plant, S = seed mix, X = cutting				

5.5.1 Existing Native Vegetation

Individuals and pockets/stands of intact native wetland vegetation have been identified throughout the willow-enhanced wetland areas. The project is designed to not only minimize impacts to these areas but to capitalize on these existing resources for enhanced wildlife benefits.

5.5.2 Salvage Plant Material

Cuttings would be taken from the LCR and vicinity; potential collection sites include the Pratt Nursery at Mittry Lake and the Yuma East Wetlands. In addition, BOR manages two nurseries that provide plant materials for projects related to the Lower Colorado River Multi-species Conservation Plan (LCR MSCP): one in Blythe, California, and the other at Cibola National Wildlife Refuge, Arizona. These facilities allow collection of cuttings at no cost (labor must be provided); species available include coyote willow, Goodding's willow, and cottonwood. These facilities may be closed to outside agency use in the upcoming few years due to concurrent BOR projects, however small collections may be possible (Gayle Iglitz, personal communication 2012).

Following are some guidelines for using cuttings:

- Cuttings would not all be taken from one plant, but from many different plants.
- Each cutting would be a minimum of 2 feet long and ½ to 1 inch in diameter.
- Prior to installation, cuttings should be placed in water to a depth of 10 inches and soaked for a minimum of 7 days (14 days maximum).
- To ensure that the cuttings are installed in the same direction as they were obtained from the tree or shrub, they may be marked at the top end.
- Each cutting should be dipped in a root hormone immediately prior to planting.
- Cuttings should be installed to a depth of 8 to 10 inches and thoroughly watered.

5.5.3 Container Plants

Plant materials for the Paradise Cove West site should originate from seed and cutting stock local to the project area to the maximum extent possible, with preference for material collected within the LCR watershed. Material collected from this localized area would be best adapted to site conditions in the restoration area. Container plants are anticipated to be composed of a variety of sizes and types, including (but not limited to) 5 gallon, 1 gallon, grass plugs, and tall pots (30 inch), dependent on availability at time of implementation.

5.5.3.1 Conventional Plant Materials

Careful installation is critical to plant success. Conventional plant materials would be installed according to commonly accepted planting techniques for desert wetland revegetation sites, including:

- Dig a planting hole twice the size of the root ball.
- Wet planting hole thoroughly prior to plant installation.
- Backfill with clean, native soil.
- Leave the plant crown 1 to 2 inches above grade after planting in a slightly depressed basin.
- Apply vertical and horizontal mulching.
- Protect young plants from herbivory (e.g., by installing protective wire cages).

This method would be used for plants in 5-gallon containers.

5.5.3.2 Tall Pot Plant Materials

Tall pot plant materials are a very appropriate technique for restoration plantings, as demonstrated through work in Maricopa County, northern New Mexico (Fenchel et al. 2002), and in the Mojave Desert (Bainbridge 2007). Tall pots are uniquely suited for

encouraging long, well-developed root systems for successful restoration plantings, and are often used in conjunction with DriWater (Fenchel et al. 2002).

Tall pot nursery stock is grown in 6-inch-diameter polyvinyl chloride (PVC) pipes that are cut to 30-inch lengths. This growing method encourages a greater root to shoot ratio; plants with deep, well-established root systems are more likely to survive in restoration settings than traditional container plants. Tall pots are particularly appropriate for tap-rooted species, such as screwbean and honey mesquite, and desert willow. Tall pots are not appropriate for fast-growing species such as willow and cottonwood that do well with much less expensive methods.

Tall pot installation differs significantly from that of conventional container plants and should follow the following steps:

1. Construct a micro-basin.
2. Auger (8-inch-diameter) planting holes to a depth of 3 feet.
3. Pre-moisten planting holes TWICE and allow drainage prior to plant installation.
4. Slip entire plant through the bottom of the tall pot into the augered hole and remove the PVC pipe.
5. Backfill hole with native soil.
6. Soak the plant with water.

Bainbridge (2007) contains a good pictorial of the process (see page 204).

5.5.3.3 Plant Protection

Loss of newly planted restoration plant materials to herbivory can be extensive. Even plant materials that have been grown in a nursery that specializes in producing hardened, restoration-quality plant materials can be decimated by rodents, rabbits, and other herbivores if they are not protected. It is standard restoration practice to protect new plantings with hardware cloth or screen cages that are secured with rebar stakes, metal U-hooks, and/or fence posts. Cages should be at least 36 inches in height and provide ample room for the plant to grow and mature without becoming constrained; depending on the mature size of the plant, diameters of 2 feet or 4 feet are generally adequate. Removal of the cages would occur during the maintenance and establishment period, once the plants have attained adequate size and maturity to withstand herbivory pressure.

Plant protection cages would be installed on five-gallon plantings and tall pot containers, all other plantings would be protected as needed, based on recommendations by the Project restoration biologist.

5.5.4 Seed Mixes

Seeds for the Paradise Cove West site should originate from seed stock as local to the project area as possible, with preference for seed collected within the LCR watershed. These materials would be best adapted to site conditions in the restoration area. Seed collection should occur during as many seasons as possible prior to construction in order to represent the widest variety of species possible.

Seeds would be broadcast by hand across the site; ground surfaces should be roughened prior to application. This may be accomplished through various means, including raking (while seeding) or using a toothed backhoe bucket (prior to seeding to create grooves/indentations for seeds to deposit. Hand application allows for ultimate control in locating seeds and customized mixes to appropriate microhabitat conditions. As appropriate, the drill-seed method may be used to apply seeds to cottonwood-willow fields.

Different seed mixes would be applied to the cottonwood–willow and mesquite plant communities. The willow-enhanced wetland is not anticipated to require seeding for successful native plant establishment.

5.5.5 Plant Palettes and Quantities

Each of the three vegetation types would include a variety of plant material types (Tables 11 and 12). Each vegetation type would not consist of monotypic stands, but rather a mosaic of different species assemblages.

Table 11
Plant Material Types by Vegetation Type

Vegetation Type	Total Acres	Material Type	Quantity per Acre	Total Needed
Cottonwood–willow	31.6	5-gal	100	2,800
		cuttings	1,000	28,000
		poles	1,000	28,000
		plant protection	100	2,800
Mesquite	4.34	tall pots	200	380
		plant protection	200	380
Willow-enhanced wetland	13.9	poles	300	4,020
		cuttings	700	9,380
		plugs	1,000	13,400
Total	49.84			

Table 12
Total Plant Materials Needed

Material Type	Total Needed
Plugs	13,400
Cuttings	37,380
Poles	32,020
5-gal	2,800
Tall pots	380
Plant protection	2,940

5.5.6 Best Management Practices for Plant Materials

BLM BMPs for Riparian Revegetation are included as Appendix E of the BA (BLM 2008b). BMPs applicable to plant materials include:

- Include native, drought-adapted species in the planting and seeding palettes.
- Apply seeds and install plants at the appropriate time of year.
- Rake seeds into the soil to ensure seed-to-soil contact.
- Evaluate likelihood of success (See Section 5.3).

These BMPs are addressed in this mitigation restoration plan.

5.6 Irrigation

The three proposed vegetation types of the site each require a different type of an irrigation system. The cottonwood–willow fields would be irrigated by flood irrigation, the willow-enhanced wetland will be irrigated via an installed weir that connects with the Colorado River and the wastewater treatment outfall, and the mesquite in the southwestern corner would be irrigated via a temporary overhead system during maintenance visits. Table 13 details the conceptual irrigation system specifications; irrigation design would be submitted upon approval of conceptual plan.

Table 13
Specifications of Irrigation System

Parameter	Cottonwood–Willow Fields	Willow-enhanced Wetland	Mesquite Woodland
Source	Colorado River	Colorado River (24-inch weir under the maintenance road) and wastewater treatment outfall	temporary overhead system
Pump type	centrifugal water pump	n/a	centrifugal water pump
Power source	diesel fuel	n/a	diesel fuel
Output (gal/min)	1600–4200	n/a	1600–4200
Type of irrigation system	concrete-lined v-ditch	n/a	hose connection
Fields irrigated	5	n/a	n/a
Number of diversions	13	1	n/a
Drainage	none	west outlet	none

5.6.1 Cottonwood-Willow Fields

The fields located on the northern and southeastern portions of the site would be irrigated by flood irrigation. The flood irrigation would be powered by a diesel pump with an intake placed in the Colorado River in the central portion of the project area (see Figure 7). Water would be delivered via concrete lined v-ditches running along the periphery of the site and

delivering water via manually controlled diversions requiring continual management. The total numbers of diversions are anticipated to be thirteen. Irrigation water will be controlled in the field by 48-inch berms that compartmentalize the fields into distinct areas based on water coverage.

5.6.2 Willow-enhanced Wetland

The willow-enhanced wetland bisects the project site and would be the least manipulated for irrigation and have the widest range of available water sources. The primary water source would come from the outfall of the water treatment facility, which delivers water to the downstream two-thirds of the area (see Figure 7). This water source is anticipated to be perennially available to the site. To maintain and enhance the upper one-third of the wetland area, a metered 24-inch culvert, under the access road, would be installed to connect the wetland to the Colorado River. The weir opening would be set roughly at a 115-foot surface elevation, which is expected to intake water during seasonal moderate flows (regulated by discharge from the upstream dam facilities). Additionally, this elevation would allow adequate low-gradient drainage to the downstream end of the site. The current ground surface elevation is 116.23 feet.

In addition, the green fire break would need to be raised using balanced material from site in order to install an open culvert under the access road to allow flow to the western portion of the site and to avoid allowing the water to divert through the central portion of the site to the Colorado River. The culvert should have a minimum of a 9.5-square-foot opening (area) box culvert with flared ends to reduce scouring. Specific type and design of culvert will be determined by CBP in conjunction with applicable stakeholders.

5.6.3 Mesquite Woodland

The mesquite woodland is located on the southern portion of the project site and would be irrigated using a temporary overhead system, similar to the system utilized in Yuma area agricultural fields. The primary water source would come from the pumping station that feeds the concrete swales. A second pump would pull water from the concrete canals and distribute it to lateral lines via mainline pipe during irrigation events. The mainline would be installed along the green fire break through the irrigation period. The mainline would feed lateral lines that span east to west throughout the mesquite woodland. The system would be utilized until the trees have successfully reached the groundwater level and can survive without supplemental water.

5.6.4 Irrigation System Monitoring

All irrigated areas would be monitored for plant health and soil moisture on a regular basis by the project restoration biologist. Each component of all systems would be checked weekly to ensure that water is moving through all areas; the irrigation manager would ensure efficient pump operation, buildup of debris has not blocked flow paths, stagnant areas have not developed, all irrigation channels are working properly, and no field berms have rodent damage.

To establish vegetation, water rates would be adjusted to anticipated plans outlined prior to initiation. During vegetation establishment, water dispersal would be regularly maintained at the design requirements according to seasonal patterns, including flooding periods and peak water usage periods by off-site entities (i.e., low river water levels). Instructions for long-term operation of water dispersion in the fields and wetland would be prepared as necessary based on experiences during the monitoring period. Active water level management is critical to initial plant establishment; water levels and water flow rates would be controlled by manually adjusting either or both the pumping valve of the water supply intake and the diversion weir outlets. It is anticipated that irrigation for all trees will occur weekly for the first month, bi-weekly through the six-month establishment period, and monthly thereafter to meet project goals and objectives. The irrigation manager will be responsible for determining water needs of the trees and adjust as necessary to establish SWFL habitat.

Water rates would vary for management purposes (i.e., to increase plant growth, etc.). Inflow and outflow rates should be inspected and adjusted on a weekly basis. All water used must be measured and reported by the 7th of each following month to the BLM YFO. Water usage should coincide with the annually ordered water amounts for the project area.

Berms, v-ditches, and water control diversions should be inspected during each irrigation event (i.e., a minimum of weekly) and immediately after any unusual flow event (i.e., monsoons). The wetland culvert should be checked after high flows, which can scour substrates, particularly at outlets. Any damage, erosion, or blockage should be corrected as soon as possible to prevent failure and/or repairs.

Water level management is the key to determining the success of vegetation. While riparian plants can tolerate temporary changes in water depth, care should be taken not to exceed the tolerance limits of desired species for extended periods. Water rate can be increased during the hot months to increase retention time and to protect against heat stress.

5.7 Maintenance

5.7.1 Access

The maintenance road along the northern periphery of the project area would be gated at three locations (see Figure 7); the road is to provide access to irrigation facilities, as well as for the accommodation of law enforcement and fire prevention vehicular access. The berms would accommodate public foot traffic and law enforcement access.

- **Law enforcement** personnel would be able to use the maintenance road to patrol the project area in a vehicle; the field berms may be accessed by foot or OHV. The Paradise Cove East site experiences a great deal of recreational use and some illegal activity; it would be important to protect the Paradise Cove West site from such activities. Law enforcement patrol in the Paradise Cove West area has and will continue to curtail unlawful activities that could damage resources.

- **Firebreaks.** The maintenance road would accommodate a Type 6 fire engine for fire prevention actions. The green firebreak through the middle of the project site would be accessible at all times to fire personnel.

Public foot-access may be allowed along the access roads and field berms. Signage should include prohibition of off-leash dogs in the project area to avoid wildlife conflicts. Deterrents, such as gates and rock boulders, may be used to deter public vehicular traffic. The need for maintenance of the access roads, berms, firebreaks, and culvert will be determined by the on-site field manager during routine inspections. Inspections should take place at a minimum of a monthly basis. Table 14 details triggers for repair and the corrective action that may be required.

Table 14
Repair Triggers

Area of Disturbance	Type of Disturbance	Corrective Action	Schedule
Berms	holes	re-grading / rodent control	within 30 days of identification of issue
	erosion	re-grading / establishment of erosion control devices	within 90 days of identification of issue
Access roads	erosion	re-grading / establishment of erosion control devices	within 30 days of identification of issue
Culvert	excessive scouring inlet/outlet	installation of rip-rap / re-contouring	within 90 days of identification of issue/may require contract modification
	clogged by debris	hand removal	to be addressed during monthly maintenance
Project site	encroachment / fire	temporary signage / report to BLM YFO/initiate immediate conversation on how to address	immediate action to be taken in coordination with BLM YFO
Irrigation	vandalism / breakdown	report to BLM YFO / initiate immediate conversation on how to address	to be addressed during monthly maintenance/may require contract modification if damage is excessive
BLM YFO = Bureau of Land Management Yuma Field Office			

5.7.2 Invasive Plant Control

5.7.2.1 Best Management Practices

BLM BMPs for Riparian Revegetation are included as Appendix E of the BA (BLM 2008b). BMPs applicable to invasive species management include:

- Submit a Pesticide Use Proposal to BLM YFO for approval prior initiating herbicide application activities.

- Use only herbicides included in list approved for use by BLM (BLM 2007b) and in the Environmental Protection Agency's (EPA) Endangered Species Pesticide Program, as described in BLM (1991) and further limited by the Arizona Record of Decision.

- See Appendix D of the BA (BLM 2008b) for a list of herbicides and adjuvants currently approved for use on BLM lands, along with sample Pesticide Use Proposals.

- Follow BLM Standard Operating Procedures (BLM 1991).

- Buffer zones are required adjacent to dwellings; domestic water sources; agricultural land; and streams, lakes, and ponds (except if labeled for aquatic use)
    - 100 feet for aerial application
    - 25 feet for vehicle application
    - 10 feet for hand application

- Vehicle-mounted sprayer:
    - Use only when wind is 8 mph or less (5 mph when in riparian areas).
    - Boom sprayers not to be used within 25 feet of water body (unless herbicide is labeled for aquatic use).

- Hand application:
    - Use only when wind is 8 mph or less (5 mph when in riparian areas).
    - Single nozzle application (low pressure, low volume) held .5 to 2.5 feet above ground level.
    - Foliar herbicide may be wiped onto plants up to the water line.
    - Granular herbicides may be applied via broadcast spreaders at 3.5 feet about the ground and at least 10 feet from the high water mark of water bodies.

- Minimize potential impacts to non-target plants and animals.

- Mechanical treatment and re-seeding should be timed for maximum effect to target species and minimum impact to non-target species.

- Best treatment method(s) should be chosen by considering: species characteristics, site preparation, topography and terrain, soil characteristics, climate and seasonality, and cost-benefit analysis.

- Only herbicides approved for use in/around water are recommended for use at Paradise Cove West

5.7.2.2 Invasive Plant Species at Paradise Cove West

Invasive plant species that are either known to occur or that could potentially occur at the Paradise Cove West site are described in Attachment 8, along with management options. This list is not all inclusive, and invasive species management needs would be further identified during project monitoring. Treatment of invasive species would occur based on

several factors including species, density, and the potential impact to the establishment of native species; maintenance would occur on a minimum quarterly basis; and treatment timing would be recommended by the on-site field manager, approved by BLM in a pre-work conference scheduled annually in February.

5.7.3 Irrigation Maintenance

- Primary irrigation maintenance tasks would include maintaining the water levels, soil moisture, pump systems, lock boxes, weirs, and concrete swales. Tasks may include: Observation of plant materials to identify areas where plant stress may indicate failure of irrigation valve and/or system components.
- Observation of soil surface to identify areas when unusually high soil moisture, standing water, and/or soil erosion may indicate system leaks or failure of irrigation valve and system to turn off.
- Repair and/or replacement system components, if/as needed.
- Maintain the v-ditches free of vegetation; all vegetation growing within the irrigation components would be removed during routine maintenance visits.
- Repair of irrigation berms and maintenance roads, often due to insect and/or rodent damage
- Seasonal adjustment of watering period and frequency.
- Monitoring of plant materials to determine when they are sufficiently established to begin tapering off irrigation in a phased, gradually decreasing manner.
- Annual monitoring for accumulation of salts that may require periodic flushing.

Table 15 details a proposed maintenance schedule, however additional actions may be required, based on regular inspections by the irrigation manager.

Table 15
Maintenance Schedule

Task	Schedule
Oil change	annual
Irrigation check: visual inspection of all irrigation components, and vegetation for signs of irrigation failure	weekly
Repair of irrigation berms and maintenance roads	as needed
Watering period and frequency adjustments	seasonal (quarterly)
Vegetation maintenance surrounding irrigation components	as-needed/biweekly
Salt accumulation monitoring	annually
System flushing	as needed

The irrigation schedule would be adjusted as needed, as plants become established in order to conserve water and transition plantings to reduced or non-irrigated status. Suitable willow flycatcher breeding habitat characteristics are described in Table 16.

Table 16
Suitable Willow Flycatcher Breeding Habitat Characteristics along the Lower Colorado River

Variable	Value
Patch size	• >10 acres in size • >32 feet in width
Canopy height	• average greater than 13 feet
Canopy closure	• >70% from ground to canopy
Vertical foliar density	• density greatest between 3 and 13 feet above ground; this may change as additional analysis is completed
Microclimate (within restoration area)	• mean diurnal temp 79–91 degrees • mean max diurnal temp 90–113 degrees • mean diurnal relative humidity greater than 33 percent
Soil moisture	• min. 17% • average 23%
SOURCE: McLeod et al. 2005; Koronkiewicz et al. 2006	

5.7.4 Native Vegetation Maintenance

Primary maintenance tasks associated with native vegetation would include the limbing of trees within five (5) feet of either side of the access roads and removal of all vegetation that may accumulate within the irrigation swales. Maintenance of vegetation along access roads will prevent erosion and rooting within stable berms and irrigation system components, and will maintain road integrity. No vegetation should become established within the irrigation system components.

5.8 Permitting Requirements

A Clean Water Act Section 404 permit would be required by the U.S. Army Corps of Engineers Los Angeles District for this project, as there are jurisdictional waters present. It is likely that a Nationwide Permit 27 (NWP 27; Aquatic Habitat Restoration, Establishment, and Enhancement Activities) would be applicable for this project. Some of the requirements of NWP 27 include:

- an increase in the aquatic resource functions and services provided;
- use of native plants exclusively;
- vegetation type can be improved, but not converted to another type; and,
- no net loss of jurisdictional acreage.

Permit issuance requires a formal wetland delineation and permit application. No compensatory mitigation is required for a NWP 27, as it is designed to result in net aquatic habitat benefit. A formal wetland delineation was conducted in April 2013 by RECON and submitted to CBP and the BLM YFO.

5.9 Schedule

A detailed schedule would be submitted for approval prior to initiation of project. An annual kickoff meeting would occur between CBP and BLM each February to discuss the previous year's work and plan for the next year.

5.10 Cost Estimate

A detailed cost analysis has been provided in Attachment 7.

6.0 Monitoring Program

The monitoring activities for the project area are described in detail below. The monitoring activities for this project would be in compliance with the BO, BA, and ROW grant requirements (USFWS 2008; BLM 2008b; BLM 2008a, respectively). Monitoring would be accomplished by assessing a level of performance criteria based on details outlined in the BO, BA, and ROW grant (USFWS 2008; BLM 2008b; BLM 2008a, respectively). The project restoration biologist would be responsible for conducting monitoring of the effort through a 10-year period from completion of the vegetation installation. The project restoration biologist would qualitatively and quantitatively evaluate restoration success and submit reports documenting the progress on an annual basis. Table 16 details the habitat variables, which characterize suitable habitat for southwest willow flycatcher in the LCR region. Successful replacement habitat would have the characteristics of CW II, CW III, CW IV, and HM III (Anderson and Ohmart 1984; USFWS 2008).

6.1 Success Standards and Methods of Measurement

In accordance with Step 5 as outlined in the ROW grant, CBP has defined success standards that trigger changes in the implementation of this restoration plan. These standards would be used to monitor site development and to decide when to implement remedial measures to correct any deficiencies in progress. These standards are based on the BO, BA, ROW grant, previous experience, and recommendations from others involved in restoration projects along the lower Colorado River.

A series of habitat variables would be monitored on an annual basis with interim annual goals that would be used for assessing whether the habitat is trending toward suitable habitat for SWFL. A primary focus would be on establishment and survival of native trees, since trees are the basis for all aspects of the habitat. Table 17 details the success standards over the minimum 10-year monitoring period. Annual goals are to be used as indicators for triggering remedial measures. BLM would continue monitoring activities after CBP concludes its 10-year monitoring effort.

Table 17
Anticipated Changes in Southwestern Willow Flycatcher Habitat Variables

Monitoring Year	Vegetative Characteristics							Microclimatic Characteristics			
	Patch Size	Density of C/W Trees (acre)	Density of Mesquite Trees (acre)	C/W Canopy Height (foot)	C/W Canopy Closure	C/W Vertical Foliar Density	Tree Survival	Mean Diurnal Temperature	Mean Maximum Temperature	Mean Diurnal Relative Humidity	Mean Soil Moisture
1	Defined by design; no interim goals or monitoring required	1,680	160	3–7	≥35%	10%	80%	79–91° F	90–113° F	≥33%	≥23%
2		146 trees/acre & ≥10% of total trees	93 trees/acre & ≥10% of total trees		≥45%	25%	90%*				
3					≥55%	40%					
4				6–11	≥70%	≥50% of foliage 3–13 feet above ground					
5											
6											
7											
8				9–13							
9											
10											

C/W = cottonwood–willow
*relative percentage of Year 1 total
Shading indicates the attainment of suitable SWFL habitat values.

Restoration would be considered successful, when the project area is well established, invasive species have been minimized, and variable measures in Table 16 have been achieved.

6.1.1 Vegetative Characteristics

Vegetative characteristics that are to be monitored include density of cottonwood–willow trees, density of mesquite trees, canopy height, canopy closure, vertical foliar density, and tree survival. Replacement habitat would be designed with the appropriate patch size and width, density of cottonwood and willow, canopy height, canopy closure, vertical foliar density, soil moisture, temperature, and humidity to support willow flycatchers (USFWS 2008; see Table 2).

6.1.1.1 Density of Cottonwood–Willow and Mesquite

Density describes the number of individual trees in a given area within the restoration site. Density is used to assess the structure of the habitat and ensure that sufficient quantities of individual dominant trees are present for the desired habitat type (standards are derived from Anderson and Ohmart 1984). Density of cottonwood–willow trees shall be a minimum of 146 trees per acre and a minimum of 10 percent of the total trees; density of mesquite trees shall be a minimum of 93 trees per acre and a minimum of 90 percent of the total trees present. To compensate for losses during establishment and the growing period, the restoration site would be planted at a higher density than is expected of the climax state of each habitat type and far surpassing the density standards. Remedial measures would be taken if density is less than 100 percent of the goal in any site regardless of habitat type.

6.1.1.2 Canopy Closure

As provided in the ROW grant for this project, monitoring data would be analyzed for overall canopy closure within cottonwood–willow habitat type. An absolute cover value would be determined based on cumulative analysis. The canopy is expected to close over time as the trees continue to grow; a 35 percent canopy closure is expected after Year 1. By Year 4, the site's canopy closure is expected to 70 percent. All determinations are an absolute percentage of the cover at the time of measurement.

6.1.1.3 Canopy Height and Vertical Foliar Density

Another key component for the restoration project is to create structured habitat suitable for SWFL. The monitoring data would be analyzed separately for cover of the herbaceous understory, shrub midstory, and tree overstory, which would allow specific deficiencies to be corrected. The intent of the restoration implementation is to create the best conditional habitat within the cottonwood–willow area possible. It is anticipated that the project would be consistent with suitable SWFL habitat characteristics over the 10-year period and it is expected that trees would have a minimum 13-foot canopy, with the greatest density of foliage between 3 and 13 feet.

6.1.1.4 Tree Survival

Tree survival is the primary measurement for assessing long-term success of the restoration effort. Survival of all installed trees is anticipated to be 80 percent in Year 1. Remedial planting shall occur to account for tree mortality to ensure that 100 percent of the trees surviving after Year 1 survive through Years 2–5. Trees would be installed at sufficient numbers so that vegetative cover standards would be met. Generally, a guideline of 80 percent survival or greater in Year 1 is a good measure that the trees were installed correctly and that the hydrology is suitable; should survival be less than 80 percent, remedial plantings shall occur. If these standards are not achieved by the end of Year 2, CBP would continue to maintain the project, including replant trees, until the necessary level of tree survival is met or exceeded.

6.1.2 Microclimatic Characteristics

Microclimatic characteristics that would be monitored include mean diurnal temperature, mean maximum temperature, mean diurnal relative humidity, and mean soil moisture. Microclimate parameters would be monitored and reported by the project restoration biologist; typical parameters are detailed in Table 17. If significant deficiencies are found, remedial measures are to be taken. Measures should be taken within restoration site, under the canopy of trees. Temperature and relative humidity ranges are typical of climax communities; therefore, the restoration site may not meet ranges until trees exceed an unknown threshold.

6.1.3 Soil Salinity

Understanding soil salinity is necessary to manage alkaline soils. Soil salinity would be assessed primarily by collecting soil samples and analyzing them in the laboratory. Laboratory sampling is the most effective method when utilizing all available variables in a decision; therefore it will be the primary method used prior to implementation and will be used periodically if necessary if declining plant health and vigor is noted during monitoring.

Prior to implementation, soil samples on-site would be taken from three to four feet below the surface to reach soil levels for planting after grading. One soil sample would be collected and analyzed for every five acres of habitat. The results of the soil testing would guide any required amendments that may be utilized. During the maintenance period, the irrigation manager would maintain a consistent flushing of water to prevent salt accumulation from the restoration areas. The Project restoration biologist would monitor plant health and, if issues are noted, a soil sample may be taken from the location of declining health for testing. Salinity is not anticipated to be a significant issue at Paradise Cove West. However, if salinity does become an issue, the irrigation manager will seek methods to improve drainage and leach the soil for extended periods to move salts through the soil profile.

6.2 Monitoring Methods

The project restoration biologist would conduct the restoration monitoring. This monitoring program is intended to provide continued oversight of the restoration area after installation is completed. The restoration area would be monitored through a variety of methods to quantify each element of the success standards. Monitoring provides proactive direction and oversight of the maintenance program and measurements of overall vegetation community type development. This oversight would accomplish two objectives: (1) provide feedback for the maintenance objectives and (2) provide information to evaluate progress. Oversight would assist in developing recommendations to help meet success standards.

6.2.1 Quantitative Monitoring

Quantitative monitoring would measure the development of the vegetation within the restoration area and would provide documentation on whether the site is meeting the success standards. Quantitative monitoring would be performed once a year, per monitoring technique, to measure year-to-year changes. Quantitative monitoring would begin the second spring following implementation of restoration activities in order to allow time for the new vegetation to become established.

Monitoring would be used to evaluate habitat completeness and correct problem areas as necessary for ensuring successful restoration establishment.

6.2.1.1 Survival Sampling

The restoration area would be quantitatively monitored for tree survival and density by conducting direct counts of trees fully leafed out. Each habitat type would be sectioned into acre plots using geographic information system (GIS) software and then physically demarcating them in the field. A survey to count living, not visually declining tree stock within each habitat type would be conducted in late fall/early winter and prior to leaf drop each year. These surveys would be conducted when trees are fully leafed out. The percentage of surviving container stock would be calculated by subtracting the number of living trees from the total number of trees initially installed. Surveys would be conducted under the supervision of the Project restoration biologist.

Density of living trees per acre, by habitat type, would be calculated by totaling the number of trees present within each acre plot. To determine the percentage of high-quality trees (cottonwood, willow, and mesquite) per acre, the observer would take note of any other (non-installed) trees present during the monitoring activities and assess the percentage of high-quality trees present on-site.

6.2.1.2 Stacked-cube Transect

Suitability of vertical habitat components would be assessed using the “stacked-cube” transect method (Kus 1998) when trees are fully leafed out. Beginning in Year 3, sampling would occur at 10-meter intervals along a 50-meter transect; this would result in a total of

10 sampling points per acre. At each point, a 2 x 2 x 1-meter "cube" would be assessed for vertical foliage density and canopy closure using ocular estimates. A series of "cubes" would be assessed vertically from the ground until the observer reaches the top of the canopy. A measuring pole would be used to assist in disseminating each "cube" and assessing overall canopy height.

6.2.1.3 Microclimatic Characteristics Monitoring

Microclimatic characteristics would be monitored using either stationary devices installed on-site or mobile devices operated by the project restoration biologist. Monitoring would occur in conjunction throughout the year with maintenance operations. A detailed list of climatic data would be analyzed and summarized in the annual report. One exception would be soil moisture, which would be monitored with soil moisture probes by the irrigation specialist in conjunction with flood irrigation operations. All water deliveries would be recorded and analyzed to determine if the necessary amounts were delivered to grow the requisite habitat.

6.2.2 Photo-documentation

The restoration effort would be qualitatively documented using photographic monitoring and general observations. Several permanent viewpoints for photo-documentation would be established throughout the restoration area, including the transects. Photographs shall be taken during each monitoring period from the same vantage point and in the same direction and shall reflect information discussed in the monitoring report. These photographs and a map showing locations of the photopoints would be included in each annual report.

6.2.3 Monitoring Schedule

The monitoring period would be conducted by the project restoration biologist. Monitoring would begin at the onset of implementation and would last for a minimum of 10 years. BLM would continue monitoring activities after CBP concludes its 10-year monitoring effort. Stacked cube transects would be established in the late spring/early summer annually beginning in Year 3, and tree survival monitoring would be conducted annually in late fall/early winter beginning in Year 1. Microclimatic characteristics would be recorded during maintenance operations. Photographic documentation would be taken during both monitoring periods. A monitoring schedule is presented in Table 18.

Table 18
Quantitative Monitoring Schedule

Description	Year 1	Year 2	Year 3	Year 4-10
Spring/summer stacked cube sampling	–	–	annually	annually
Fall/winter tree survival sampling	annually	annually	annually	annually
Photographic documentation	annually	annually	annually	annually

7.0 Reporting and Adaptive Management

7.1 Annual Reports

Annual monitoring reports would be produced for a period of 10 years, beginning approximately one year after installation. Reports filed at the end of each year would include a summary and analysis of monitoring data collected and an evaluation of restoration progress. Reports would be submitted to the CBP and BLM YFO by January of the subsequent year following monitoring. An annual in-person meeting to discuss these reports and the next year's program of work would occur.

Annual reports would include the following:

- Summary and maps of all maintenance activities including clearing, herbicide, etc.
- An evaluation of habitat monitoring data based on thresholds and performance criteria. Raw data would be submitted to the BLM annually.
- An analysis of all qualitative and quantitative monitoring data.
- Monitoring photographs.
- Maps identifying monitoring areas, planting zones, etc., as appropriate.
- Remedial actions taken during the year, as appropriate.
- Maintenance actions completed during the previous year.
- Summary of herbicide application
- Spreadsheet of the previous year's water actual usage and anticipated water needs for the next year.

7.2 Progress Reports

Progress reports will be submitted on a monthly basis to CBP and BLM YFO for the duration of the project. These reports will summarize the activities that occurred in the preceding month, including; a summary of maintenance tasks performed, dates and types of work conducted, ocular estimates of native and non-native plant growth, other observations made, work to be conducted during the next reporting period, and any outstanding issues and/or recommendations. Additional information will include a summary of herbicides used on-site and monthly water usage.

Additional reporting requirements include the submittal of daily herbicide use reports to BLM YFO. These reports will be drafted each day when herbicides are used and submitted on a weekly basis to BLM YFO. Information to be provided includes herbicide type, EPA number, location of application, quantity used, temperature, time of day, wind speed, and any reportable surfactants used.

Monitoring and maintenance of the site will be completed to ensure successful establishment of vegetation within the restored area. Should immediate response be required to address any project issues, roadblocks, or anything threatening project success, an open discussion will take place in order to determine the best course of action.

8.0 Final Restoration Success

If monitoring data are trending toward successful establishment of SWFL habitat and thereby long-term sustainability at the end of the 10-year monitoring period and if the tree survival performance standards have been met, the restoration would be considered a success. When the monitoring period is complete, CBP would notify the stakeholders when submitting the Annual Status Report that documents this completion.

CBP would continue all maintenance and operations for the full 10 years to ensure continued success until BLM YFO takes over at Year 11. If during continued monitoring site conditions change and they no longer meet the requirements, CBP will perform remedial actions to ensure the project's success.

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ATTACHMENTS

ATTACHMENT 1
NRCS Soil Survey Reports

United States Department of Agriculture

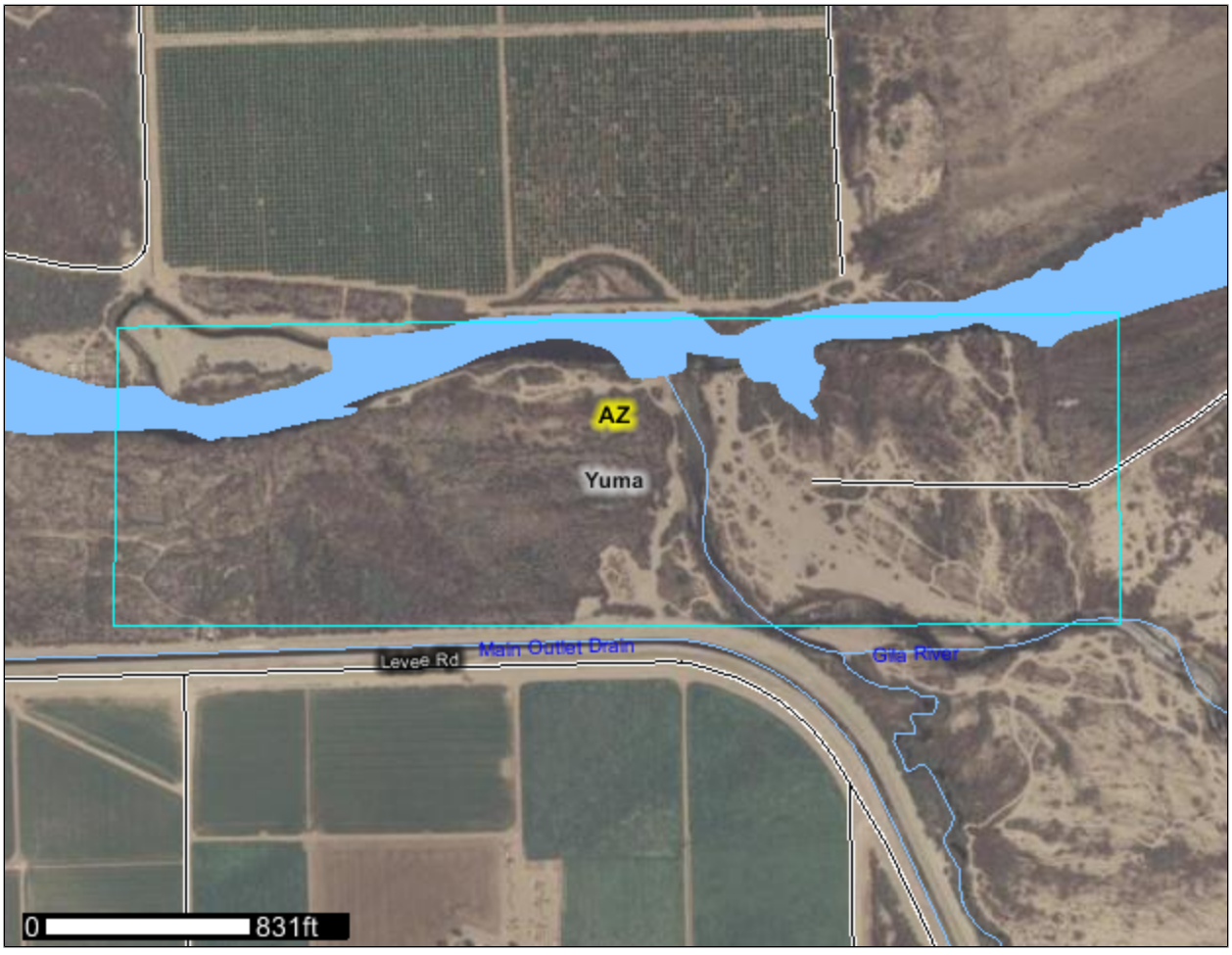
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Yuma-Wellton Area, Parts of Yuma County, Arizona and Imperial County, California

Confluence Site



December 8, 2011

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://soils.usda.gov/sqi/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:6,750 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 11N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Yuma-Wellton Area, Parts of Yuma County, Arizona and Imperial County, California
Survey Area Data: Version 8, Aug 4, 2009

Date(s) aerial images were photographed: 6/23/2007; 6/30/2007

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Yuma-Wellton Area, Parts of Yuma County, Arizona and Imperial County, California (AZ649)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
12	Holtville clay	0.9	0.8%
18	Lagunita loamy sand	0.0	0.0%
35	Water	111.8	99.2%
Totals for Area of Interest		**112.7**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If

intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Yuma-Wellton Area, Parts of Yuma County, Arizona and Imperial County, California

12—Holtville clay

Map Unit Setting

Elevation: 80 to 600 feet
Mean annual precipitation: 0 to 0 inches
Mean annual air temperature: 72 to 76 degrees F
Frost-free period: 250 to 325 days

Map Unit Composition

Holtville and similar soils: 100 percent

Description of Holtville

Setting

Landform: Flood plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to strongly saline (2.0 to 32.0 mmhos/cm)
Sodium adsorption ratio, maximum: 13.0
Available water capacity: Very high (about 12.2 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability (nonirrigated): 7s

Typical profile

0 to 13 inches: Clay
13 to 23 inches: Clay
23 to 75 inches: Stratified silty clay loam

18—Lagunita loamy sand

Map Unit Setting

Elevation: 80 to 600 feet

Mean annual precipitation: 0 to 0 inches
Mean annual air temperature: 72 to 76 degrees F
Frost-free period: 250 to 325 days

Map Unit Composition
Lagunita and similar soils: 100 percent

Description of Lagunita

Setting
Landform: Flood plains, alluvial fans, terraces, drainageways
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread, dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Recent mixed alluvium

Properties and qualities
Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 30.0
Available water capacity: Low (about 3.9 inches)

Interpretive groups
Land capability classification (irrigated): 4s
Land capability (nonirrigated): 7s

Typical profile
0 to 8 inches: Loamy sand
8 to 60 inches: Loamy sand

35—Water

Map Unit Composition
Water: 100 percent

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United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Yuma-Wellton Area, Parts of Yuma County, Arizona and Imperial County, California

December 9, 2011

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://soils.usda.gov/sqi/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

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Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map (Mitry Lake)

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

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Map Unit Legend (Mitry Lake)

Yuma-Wellton Area, Parts of Yuma County, Arizona and Imperial County, California (AZ649)			
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Totals for Area of Interest		**48.6**	**100.0%**

Map Unit Descriptions (Mitry Lake)

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Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Yuma-Wellton Area, Parts of Yuma County, Arizona and Imperial County, California

12—Holtville clay

Map Unit Setting

Elevation: 80 to 600 feet
Mean annual precipitation: 0 to 0 inches
Mean annual air temperature: 72 to 76 degrees F
Frost-free period: 250 to 325 days

Map Unit Composition

Holtville and similar soils: 100 percent

Description of Holtville

Setting

Landform: Flood plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to strongly saline (2.0 to 32.0 mmhos/cm)
Sodium adsorption ratio, maximum: 13.0
Available water capacity: Very high (about 12.2 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability (nonirrigated): 7s

Typical profile

0 to 13 inches: Clay
13 to 23 inches: Clay
23 to 75 inches: Stratified silty clay loam

13—Indio silt loam

Map Unit Setting

Elevation: 80 to 600 feet

Mean annual precipitation: 0 to 0 inches
Mean annual air temperature: 72 to 76 degrees F
Frost-free period: 250 to 325 days

Map Unit Composition
Indio and similar soils: 100 percent

Description of Indio

Setting
Landform: Flood plains, alluvial fans
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread, dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Properties and qualities
Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 13.0
Available water capacity: High (about 10.8 inches)

Interpretive groups
Land capability classification (irrigated): 1
Land capability (nonirrigated): 7c

Typical profile
0 to 6 inches: Silt loam
6 to 63 inches: Stratified very fine sandy loam

27—Salorthids, nearly level

Map Unit Setting
Elevation: 100 to 600 feet
Mean annual precipitation: 0 to 0 inches
Mean annual air temperature: 72 to 76 degrees F
Frost-free period: 250 to 325 days

Map Unit Composition
Salorthids and similar soils: 100 percent

Description of Salorthids

Setting

Landform: Flood plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None

Interpretive groups

Land capability (nonirrigated): 7w
Ecological site: Saline Subirrigated 3-7" p.z. (R040XD413AZ)

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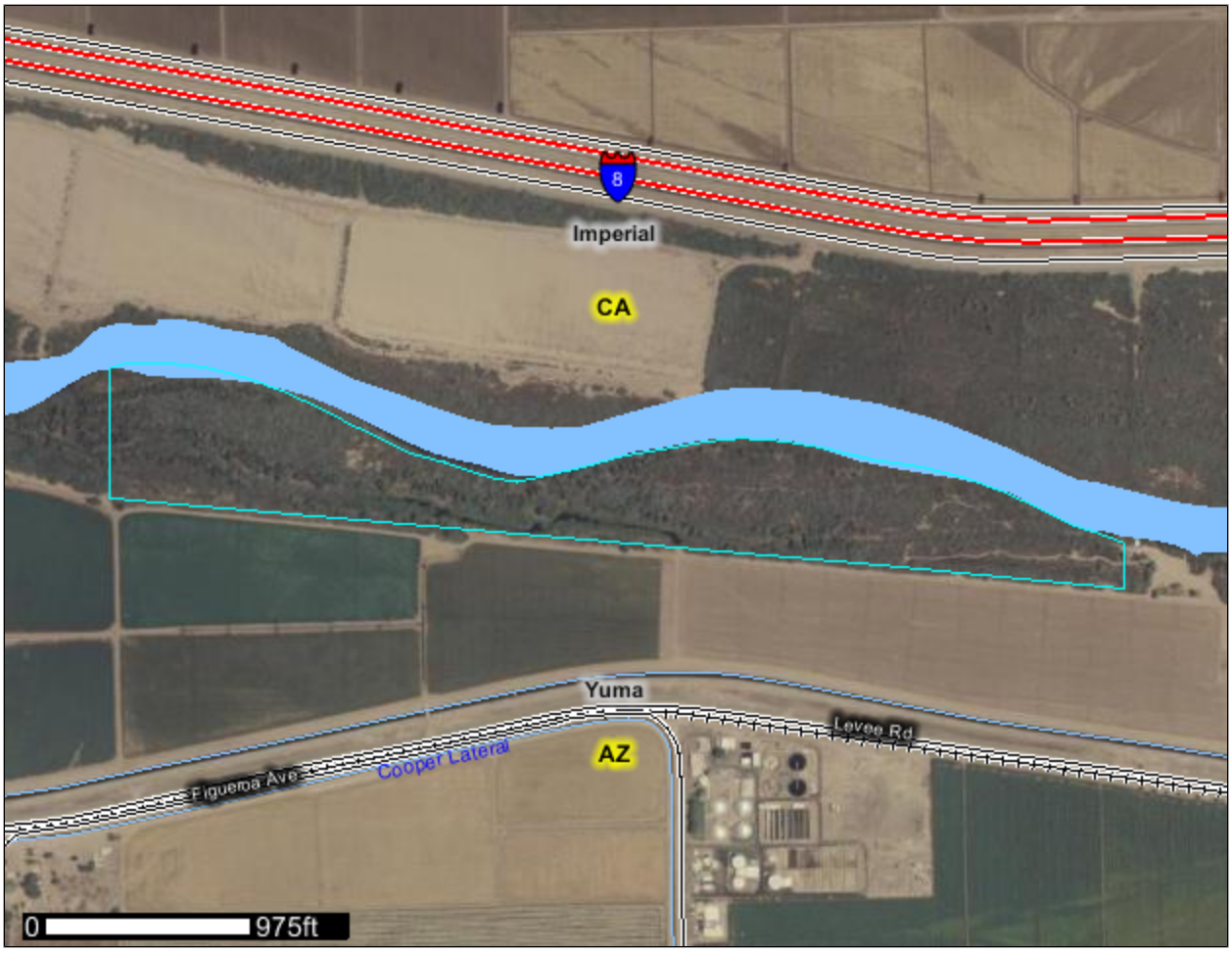
United States Department of Agriculture

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Yuma-Wellton Area, Parts of Yuma County, Arizona and Imperial County, California



December 9, 2011

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://soils.usda.gov/sqi/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

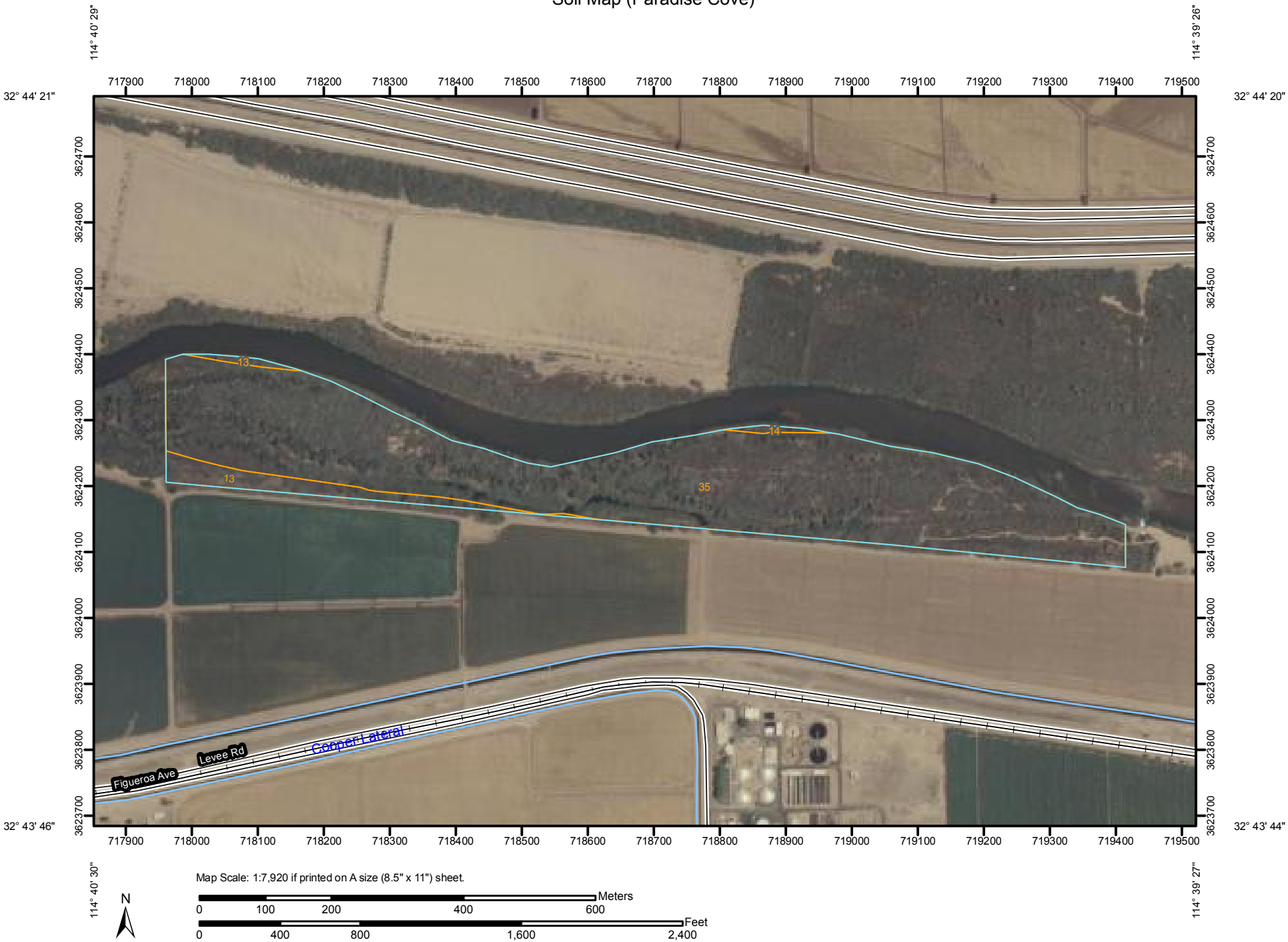
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map (Paradise Cove)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:7,920 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 11N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Yuma-Wellton Area, Parts of Yuma County, Arizona and Imperial County, California
Survey Area Data: Version 8, Aug 4, 2009

Date(s) aerial images were photographed: 6/23/2007

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (Paradise Cove)

Yuma-Wellton Area, Parts of Yuma County, Arizona and Imperial County, California (AZ649)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
13	Indio silt loam	3.2	6.5%
14	Indio silt loam, saline	0.3	0.5%
35	Water	45.7	93.0%
Totals for Area of Interest		**49.1**	**100.0%**

Map Unit Descriptions (Paradise Cove)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If

intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

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Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Yuma-Wellton Area, Parts of Yuma County, Arizona and Imperial County, California

13—Indio silt loam

Map Unit Setting

Elevation: 80 to 600 feet
Mean annual precipitation: 0 to 0 inches
Mean annual air temperature: 72 to 76 degrees F
Frost-free period: 250 to 325 days

Map Unit Composition

Indio and similar soils: 100 percent

Description of Indio

Setting

Landform: Flood plains, alluvial fans
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread, dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 13.0
Available water capacity: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability (nonirrigated): 7c

Typical profile

0 to 6 inches: Silt loam
6 to 63 inches: Stratified very fine sandy loam

14—Indio silt loam, saline

Map Unit Setting

Elevation: 80 to 600 feet
Mean annual precipitation: 0 to 0 inches

Mean annual air temperature: 72 to 76 degrees F
Frost-free period: 250 to 325 days

Map Unit Composition
Indio and similar soils: 100 percent

Description of Indio

Setting
Landform: Flood plains, alluvial fans
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread, dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Properties and qualities
Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Very slightly saline to moderately saline (4.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum: 45.0
Available water capacity: Low (about 6.0 inches)

Interpretive groups
Land capability classification (irrigated): 3s
Land capability (nonirrigated): 7s

Typical profile
0 to 12 inches: Silt loam
12 to 60 inches: Stratified very fine sandy loam

35—Water

Map Unit Composition
Water: 100 percent

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United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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December 9, 2011

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Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://soils.usda.gov/sqi/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map (Transient Fire)

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:3,060 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 11N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Yuma-Wellton Area, Parts of Yuma County, Arizona and Imperial County, California
Survey Area Data: Version 8, Aug 4, 2009

Date(s) aerial images were photographed: 6/23/2007

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (Transient Fire)

Yuma-Wellton Area, Parts of Yuma County, Arizona and Imperial County, California (AZ649)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
12	Holtville clay	0.9	5.5%
35	Water	14.9	94.5%
Totals for Area of Interest		**15.8**	**100.0%**

Map Unit Descriptions (Transient Fire)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Yuma-Wellton Area, Parts of Yuma County, Arizona and Imperial County, California

12—Holtville clay

Map Unit Setting

Elevation: 80 to 600 feet
Mean annual precipitation: 0 to 0 inches
Mean annual air temperature: 72 to 76 degrees F
Frost-free period: 250 to 325 days

Map Unit Composition

Holtville and similar soils: 100 percent

Description of Holtville

Setting

Landform: Flood plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to strongly saline (2.0 to 32.0 mmhos/cm)
Sodium adsorption ratio, maximum: 13.0
Available water capacity: Very high (about 12.2 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability (nonirrigated): 7s

Typical profile

0 to 13 inches: Clay
13 to 23 inches: Clay
23 to 75 inches: Stratified silty clay loam

35—Water

Map Unit Composition

Water: 100 percent

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ATTACHMENT 2

Mittry Lake Reconnaissance Study

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September 9, 2014

Mr. Steve Hodapp
LMI
Environmental Planning Branch
Border Patrol Facilities and Tactical Infrastructure Branch
Program Management Office
Facilities Management and Engineering
1301 Constitution Ave NW, Suite B-155
Washington, DC 20004

Reference: Mittry Lake Reconnaissance Study – Work Order No. 4 (HSBP1013F00401)
(RECON 6436-3)

Dear Mr. Hodapp:

RECON Environmental, Inc. (RECON) conducted a reconnaissance survey on April 22, 2014, of the Mittry Lake South Expansion area (Figure 1), as delineated by U.S. Bureau of Land Management (BLM) Yuma Field Office (YFO) and Bureau of Reclamation (BOR), to evaluate the potential of this site to meet the replacement habitat criteria as specified in the BLM YFO right-of-way (ROW) permit (AZA 34173). The purpose of the survey was to assist the U.S. Customs and Border Protection (CBP) in determining an appropriate mitigation restoration area that addresses the acreage requirements for compensation to impacts within the Limitrophe project area (Table 1).

Background

CBP was issued a ROW permit (AZA 34173) by the BLM YFO in 2008 to conduct vegetation treatments on up to 560 acres of vegetation along the lower Colorado River (LCR) near Yuma, Arizona (BLM 2008a). The ROW permit specifically covers the Limitrophe, a 23-mile reach of the LCR that forms the international boundary with Mexico and where dense vegetation can sometimes interfere with CBP's border security mission. To analyze the effects of this ROW grant, the BLM completed an environmental assessment (BLM 2008b). BLM consulted with U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act during the preparation of this environmental assessment. The permit authorized the establishment of an enforcement zone created through vegetation treatments, maintenance, and mitigation for a period of 10 years or until the habitat is sustaining.

TABLE 1
CURRENT MITIGATION REQUIRED[1]

Treated Vegetation Type	Acres Treated 2008	Acres Treated 2012	Total Acres Treated	Proposed Replacement Vegetation Type	Mitigation Ratio / Calculation	Mitigation Acres Required
Cottonwood–willow	7.3	17.26	24.56	Cottonwood–willow	1 : 1	24.56
Saltcedar	63.8	3.69	67.49	Cottonwood–willow	(acres treated x 4) / 23	11.74
Saltcedar–mesquite	0	32.5	32.5	Cottonwood-Willow	(acres treated x 4) / 20	6.50
Arrow weed	22	0	22	None	0	0
Undetermined	0.7	1.83	2.53	None	0	0
Total	**93.8**	**55.28**	**149.08**			**42.80**

[1]Mitigation ratios are from Table 5 in USFWS (2008b).

The BLM YFO Resource Management Plan (BLM 2010) restates the requirement from the previous resource management plan, which was in effect at the time of the ROW grant issuance that mitigation is required for impacts to riparian vegetation, which is managed as priority wildlife habitat. This reconnaissance survey was to assess the restoration potential of land within the Mittry Lake South Expansion area for vegetation treatment activities that have already occurred under this ROW permit, and to identify a preferred revegetation site.

This reconnaissance study assessed an approximately 200-acre parcel within the Mittry Lake South Expansion area to determine the feasibility of restoring approximately 50 acres of the site to meet the mitigation requirement of 42.8 acres (see Table 1) and allow for installation of infrastructure. This site is under the management of BLM and Arizona Game and Fish, with BOR maintaining withdrawal rights. After the site was assessed, a potential site for restoration was identified, denoted as Zone A (Figure 2). This does not preclude the remainder of the area, denoted as Zone B, from the potential for restoration, but the identified site was chosen due to several site factors that the other areas do not possess.

General Description of Mittry Lake Restoration Concept (Zone A)

Restoration of vegetation within Zone A would focus on the creation of dense cottonwood-willow habitat, which would potentially benefit southwestern willow flycatcher (*Empidonax traillii extimus*) habitat in the Mittry Lake Wildlife Area. Zone A is approximately 50 acres in size to account for the habitat mitigation requirements and required infrastructure. The parcel would be divided into six cells that would each be flood irrigated via a concrete- lined irrigation channel running centrally through the parcel with manually operated outlet structures delivering water to each cell. The vegetation restoration area would be divided into two primary cells by the construction of the access road/irrigation canal that would divide the site horizontally (east–west) (Figure 3). These primary cells would be further divided into subsections by the installation of field berms running vertically (north–south). The berms will function as divides to efficiently flood irrigate the site and to allow foot traffic to the interior of the site. Additionally, an access road would be constructed around the perimeter of the site to allow vehicular access along the edges of the parcel; this road will provide access for site maintenance, law enforcement, and passive recreation.

Prior to site grading, the site would be cleared of non-native vegetation, primarily saltcedar (*Tamarix* spp.). All biomass would be removed from site and disposed of at an off-site facility.

The vegetation restoration concept would utilize laser-leveled site grading to achieve a level flood irrigated field to install appropriate vegetation and achieve maximum coverage. By using a flood irrigation system, all cut/fill material can be balanced on-site, requiring no soil export. In addition, by flooding the cells, a uniform density of desirable species can be installed, thereby meeting the mitigation goals in the least amount of area. However, by using this type of irrigation system, the

time required for installed plants' root systems to reach groundwater may be significantly increased depending on the depth to groundwater (i.e., extended maintenance period).

Water would be supplied to the project from Mittry Lake by way of a pumping station and concrete irrigation channel (see Figure 3). A similar system is being used in the adjacent "moist soil unit" parcels. A pumping station located on the bank of Mittry Lake, in the southwest corner of the South Expansion area, would pump water directly from Mittry Lake into an existing concrete irrigation channel that runs along the western perimeter of the vegetation restoration areas to a culvert box/pipe (Photographs 1-2). It is anticipated that a new pumping station would be installed as part of the effort. The culvert would connect the existing irrigation channel to the new irrigation channel running centrally through the restoration area (Photograph 3). Ten diversion outlets would deliver water from the irrigation channel to each cell; an example can be seen in Photograph 4 (see Figure 3). Due to the high salt content of the soil, the cells would be flushed multiple times prior to installation of plant material. Additional soil amendments may be required to condition the soil and bind salts throughout the implementation and maintenance periods.

Plants, primarily cottonwood-willow poles and cuttings, would be installed at a density to meet the mitigation goals and create southwestern willow flycatcher habitat. Poles and cuttings would be irrigated until they are self-sustaining. Maintenance within the restoration area would focus on the eradication of non-native plant species, irrigation management, remedial plantings, and infrastructure maintenance.

Site Factors

The following factors were required to be met prior to a mitigation location being chosen (BLM 2008b):

- Clear title to land and water. BLM has demonstrated that the Mittry Lake South Expansion area has a clear title to the land and water. However, the site is managed by multiple entities, including Arizona Game and Fish and BOR; concurrence would be required from all stakeholders prior to initiation of the project.

- No deed, easement, or legal restrictions. No known legal restrictions are attached to the Mittry Lake South Expansion that could limit the feasibility of habitat creation and management during the term of the project. However, concurrence from all legal stakeholders would be required prior to initiation of the project.

- Minimum acreage for the establishment of riparian of habitat (10 acres). The Mittry Lake South Expansion, Zone A site offered for the establishment of riparian habitat is large enough to accommodate the minimum acreage of habitat (10 acres) and any additional area required for use as buffer land, infrastructure (e.g., roads, canals), and other features required to support the created habitat.

- Human activity low enough to ensure success of site. The level of human activity at the proposed site is low and it is likely that created land cover types can fully function as covered species habitat.

- Site supports the conditions that would allow for the creation of habitats. The proposed site can support conditions that would allow for the creation of desired habitat with the use of flood irrigation channels.

- No hazardous materials present. No known hazardous materials are present on the Mittry Lake South Expansion site of a type or in quantities that would preclude the establishment, future management, or value of habitat created on the site.

In addition, several other factors were assessed, including current land use, water availability, soil conditions, existing conditions, the potential for successfully installing cottonwood-willow riparian habitat, and any other site constraints. This data was used to determine the preferred site (i.e., Zone A).

Existing Conditions and Restoration Potential

Location and Land Use

The Mittry Lake South Expansion site is located northeast of Yuma on the LCR, between Imperial Dam (upstream) and the Laguna Dam (downstream). The site is located in the Sections 13 and 14 of Township 7 South, Range 22 West GSRM.

Mittry Lake is jointly managed by the BLM and the Arizona Game and Fish Department for recreation, including fishing, hunting, and wildlife viewing. Additionally BOR has overarching withdrawal rights for the entirety of the project site,

Water Availability

Written approval from the BLM for the procurement of 252 acre feet per year of water from Mittry Lake during the first two years in order to maintain the restoration site will be required. The water needs will reduce as the plants become established and/or reach the groundwater table. Initially, each acre would be flooded to a depth of three inches, twice per month. Proposed irrigation would consist of constructing a concrete irrigation channel that connects to the existing system running from the lake to the "Moist Soil Units." The constructed system would convey water to the restoration area using a pump at the source (provided by CBP) and via manually controlled flood irrigation gates along the central channel. Specific irrigation construction designs will be determined upon approval of the area, but other irrigation techniques, such as overhead emitters, could be utilized depending on the situation. However, flood irrigation would be the most suitable for the locale and to meet the mitigation requirements for habitat.

Soil Conditions

Soil conditions described below are summarized from Natural Resource Conservation Service soil reports that were generated specifically for the site using the Web Soil Survey tool (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm).

One soil type, salorthids, is identified at the Mittry Lake site. Salorthids is a poorly draining soil type composed of mixed alluvium that has a salt horizon within 30 inches of the surface. There are visible salt deposits on the soil surface.

To improve soil conditions, a series of controlled flood events would be required prior to restoration to flush salts from the soil. In addition, it may be beneficial to remove the top 2 inches of soil prior to site grading. Excess material may be utilized for berm and access road creation. Dependent upon salt accumulation in the soil, the soil may require amendments to condition the soil for restoration of desired habitat type; this action would entail incorporating soil amendments that bind salts and allow for flushing during flood events. The soil would need to be monitored for salt levels throughout the maintenance period; additional amendments may be required through the project duration.

Existing Vegetation

Vegetation throughout the Mittry Lake South Expansion is dominated by saltcedar, with a minor presence of saltbush (*Atriplex* sp.) in the sandy areas. Along the water's edge, common reed (*Phragmites australis*) dominates, and cattail (*Typha* sp.) is present. A stand of burned cottonwoods (*Populus* sp.) exists on site; no other large native trees were noted.

Zone A and the adjacent area consist primarily of saltcedar; therefore, a persistent long-term maintenance regiment will be required.

Habitat Development Potential

The Mittry Lake South Expansion has sufficient acreage for habitat development. By using a flood irrigation technique, the majority of the site is open for development of habitat. This technique would allow for creating and sustaining the desired cottonwood-willow habitat structure. Any restoration would require long-term maintenance to suppress the recruitment of saltcedar. Areas directly adjacent to Mittry Lake (<100 feet) are considered too close to the ground water table to effectively grade and transition into the desired habitat due to the possible encroachment of open water and associated native wetland vegetation (i.e., cattail) and persistent encroachment of saltcedar and common reed.

Zone A was chosen due to its central location within the Mittry Lake South Expansion area, ease of access for implementation and maintenance activities, appropriate water resources to establish and sustain riparian plantings, and would have low to moderate potential conflicts with recreationists or adjacent private land leases. Moreover, the mitigation acreage requirements can be met within one contiguous parcel.

Earthwork

The largest component of installation would likely be the earthwork necessary to prepare, excavate, and grade the site to achieve appropriate surface, drainage patterns and elevations to support the plantings. Clearing and grubbing will be necessary to prepare the site and remove the saltcedar. Each cell would be surveyed and leveled to meet irrigation requirements for complete coverage. All removed soil would be balanced on-site and/or utilized in the construction of the access road or berms.

Irrigation and Water Control

A concrete-lined irrigation channel would span the length of the site (bisecting it horizontally) to serve the plantings. The ditch would be 1-2 feet wide at the base and 2-3 feet in depth. Diversion outlets would be manually controlled to allow flood irrigation of the planted areas.

Plant Material Installation

The cottonwood-willow vegetation type will comprise approximately 50 acres, located in the Mittry Lake South Expansion area. This vegetation type has been chosen according to the site constraints and opportunities for wildlife habitat creation in the Mittry Lake South Expansion area. It is intended to serve as the nucleus of potential southwestern willow flycatcher habitat and will consist of dense plantings dominated by coyote willow (*Salix exigua*) cuttings (min. 24 inches by 0.5 inch), seep willow/mule fat (*Baccharis salicifolia*), cottonwood poles (min. 36 inches x 1 inch), and Gooding's willow (*Salix gooddingii*). The area would also be seeded with native herbaceous species to preclude encroachment from non-native plant species. See Tables 2 and 3 for proposed specifications.

TABLE 2
PROPOSED PLANT MATERIAL TYPES BY VEGETATION TYPE

Vegetation Type	Total Acres	Material Type	Quantity per Acre	Total Needed
Cottonwood–Willow	43	cuttings	1,500	64,500
		poles	950	40,850

TABLE 3
NATIVE SPECIES' PLANTING TECHNIQUES BY VEGETATION TYPE

Species	Common Name	Cottonwood–Willow
Baccharis salicifolia	seep willow/mule fat	X
Geraea canescens	desert sunflower	S
Lupinus arizonicus	Arizona lupine	S
Oenothera deltoides	birdcage evening primrose	S
Phacelia crenulata	scorpion weed	S
Pluchea sericea	arrow weed	P
Populus fremontii	cottonwood	X
Salix exigua	coyote willow	X
Salix gooddingii	Goodding's willow	X
Verbesina encelioides	golden crownbeard	S

P = passive establishment, S = seed mix, X = cutting/pole

Cost Estimate

Earthwork

The largest component of installation cost would likely be the earthwork necessary to prepare, excavate, and grade the site to achieve appropriate surface and drainage patterns to support the vegetation. Clearing and grubbing will be necessary to prepare the site. The cut and fill required to meet the site specifications is estimated to be approximately 150,000 cubic yards. Excavation quantities have been designed to meet the ideal conditions for establishment of vegetation. The proposed concept would require no export of material. A cost of $5 per cubic yard has been used for this estimate, although this may vary at the time of contracting. Clearing and grubbing is presented as a lump sum and will include the preliminary clearing of all invasive species (e.g., saltcedar). Earthwork will include the construction of the concrete-lined irrigation channels, roads, and graded and leveled fields.

Irrigation and Water Control

A fenced pumping station would be installed at the lakeshore, southwest corner of the project area to pump water directly (via a diesel-fueled pump) from Mittry Lake to support restoration plantings. Irrigation would be via a concrete-lined irrigation channel that would span the length of the site to serve the plantings. The ditch would be 1–2 feet wide at the base and 2–3 feet in depth, and would run centrally through the site. Diversion outlets would be manually controlled and allow flood irrigation of planted areas.

Costs associated with the irrigation systems include installation of a pump station, including fencing and a diesel-powered pump; concrete-lined irrigation channels and diversion outlets; culverts; weirs; and road stabilization.

Plant Material Installation

The cottonwood–willow vegetation type would include densely planted willow cuttings and cottonwood poles. In addition, the area would also be with seeded with native species.

Cost for plant material is based on a per-acre basis.

Maintenance and Monitoring

CBP will conduct monitoring of the site for a 10-year period, as provided in the CBP ROW grant. Due to the design of the site, site maintenance will be required in perpetuity. CBP will provide maintenance of the site for a period of 10 years or until the plants become self-sufficient. The maintenance and monitoring period will begin at the conclusion of the implementation period. Overall cost of maintenance and monitoring will decrease as the plants become established and preclude the encroachment of non-native species; however, cost for infrastructure (i.e., concrete channels and roads) maintenance will be required in perpetuity.

Overall Installation Cost

The total estimated cost for installation of vegetation restoration components (including site preparation, irrigation, and planting) at Zone A at Mittry Lake is approximately $1.8 million (Table 4). The per-acre cost for installation would be approximately $43,000.

TABLE 4
TOTAL ESTIMATED INSTALLATION COSTS

	Unit	Unit Cost	Quantity	Total
Management				
Project Construction Management	LS	$60,000	1	$60,000
Subtotal				**$60,000**
Site Preparation				
Clearing and Grubbing	LS	$98,000	1	$98,000
Grading	CY	$5	150,000	$750,000
Gates / Signs	LS	$10,000	3	$30,000
Soil Amendments	LS	$25,000	1	$25,000
Subtotal				**$903,000**
Irrigation Installation				
Field-leveling	AC	$2,500	43	$107,500
Irrigation canal	LF	$45	1,400	$63,000
Division Outlets	EA	$1,500	10	$15,000
Pump / Fittings	EA	$25,000	1	$25,000
Pump / Lock box	EA	$20,000	1	$20,000
Pump Station Fencing	LS	$20,000	1	$20,000
Access Road Stabilization	LS	$105,000	1	$105,000
Culvert	EA	$9,500	1	$9,500
Subtotal				**$365,000**
Planting				
Poles	EA	$8	40,850	$326,800
Cuttings	EA	$2	64,500	$129,000
Seeding	AC	$1,500	43	$64,500
Subtotal				**$520,300**
	TOTAL			**$1,848,300**

AC = acre; EA = each; CY = cubic yard; LF = linear feet; LS = lump sum

Overall Operations and Maintenance Cost

The total estimated cost for 10 years of operation and maintenance of the vegetation restoration project at Zone A of the Mittry Lake South Expansion is approximately $1.9 million (Table 5).

Operation and maintenance includes operation/maintenance of irrigation system components, treatment of invasive species, road maintenance, and monitoring and reporting.

TABLE 5
TOTAL ESTIMATED OPERATIONS AND MAINTENANCE COSTS

	Yrs 1–2	Yrs 3–5	Yrs 6–10	Total
Operations & Maintenance				
Pump Station (inc. fuel)	$46,800	$70,200	$117,000	$234,000
Gates/Signage Repair	$3,000	$4,000	$10,000	$17,000
Irrigation and Infrastructure (inc. operator)	$180,000	$225,000	$300,000	$705,000
Invasive Species Treatment	$150,000	$215,000	$285,000	$650,000
Soil Conditioning	$30,000	$30,000	$50,000	$110,000
Road Maintenance	$30,000	$20,000	$15,000	$65,000
Monitoring & Reporting	$45,000	$67,500	$112,500	$225,000
Sub-total	**$484,800**	**$631,700**	**$889,500**	
Average Annual Cost	**$242,200**	**$210,567**	**$177,900**	
10-year Operation and Maintenance Total Cost				**$2,006,000**

Recommendation

In order to address the needs of the ROW permit, a preferred locale, Zone A, within the Mittry Lake South Expansion survey site was chosen as the preferred site based on the assessed factors and a limited number of site constraints (see Figure 3). Constraints that are present within Zone A, but do not preclude the area from consideration, include the following:

a. **Soil.** The soil is alkaline with a high concentration of salt; these conditions can make establishment of desirable plant species difficult. Salt deposition and desiccation is present at the soil surface (Photograph 5). The grading/turning of the soil and potential removal of a portion of the soil may be required; in addition, controlled flood events and soil conditioning would be required prior to installation of plants material.

b. **Invasive species.** The site is dominated by dense stands of saltcedar, initially the site would need to be cleared of this vegetation, in addition natural recruitment from seed on-site and seed dispersed from stands on adjacent properties would require extensive maintenance for an extended period of time. (Photograph 6)

c. **Grading/site recontouring.** To meet the irrigation requirements, the site would need to be surveyed, laser-leveled, and graded to address irrigation needs, and would require an access road, raised berms, and irrigation infrastructure. It is anticipated that all material would be balanced on-site. An example of proposed concept can be found on the adjacent property (Photograph 7).

d. **Installation and maintenance access.** The site is accessible along the western edge along existing road (Photograph 8). The addition of similar maintenance roads would be required along the northern, eastern, and southern edges of the site to provide access to installed irrigation infrastructure. It is anticipated that gates would be required to prevent unauthorized access in two locations.

e. **Water availability.** By conveying water via concrete-lined irrigation channels from Mittry Lake, irrigation should be efficient and effective. Pending approval from BLM, water can

be available. The site was chosen due to its distance to the proposed pumping station and existing irrigation channel, which will reduce infrastructure requirements.

During this assessment, the primary concern was access to water and the ability to convey water to the proposed mitigation site. The assumption for irrigation followed a similar approach to the approved approach at the previously considered site (Paradise Cove), which involved a flood or agricultural style irrigation system. This style of irrigation can be obtained within Zone A. Zone A meets or exceeds all the requirements for the potential of restoration. While the site has considerable constraints, as detailed above, the overall potential is outweighed by the benefits. Zone A would meet the mitigation requirements set forth in the ROW Permit for compensation to impacts within the Limitrophe.

Please review this information, call me with any questions, and let me know if you concur with this approach or have other direction for us. Once we receive confirmation, we will move forward with preparing the Mitigation Restoration Plan for Mittry Lake. We will provide all GIS layers to you (per the specifications in our project scope) once these maps are finalized.

Sincerely,

Robert Hobbs
Senior Restoration Ecologist

Attachment

References Cited

Bureau of Land Management

2008a Biological Assessment. Right-Of-Way for Vegetation Treatments in Limitrophe for Safety and Law Enforcement. Lower Colorado River, Yuma County, Arizona. Yuma Field Office and Arizona State Office. October 2007, Amended February 2008.

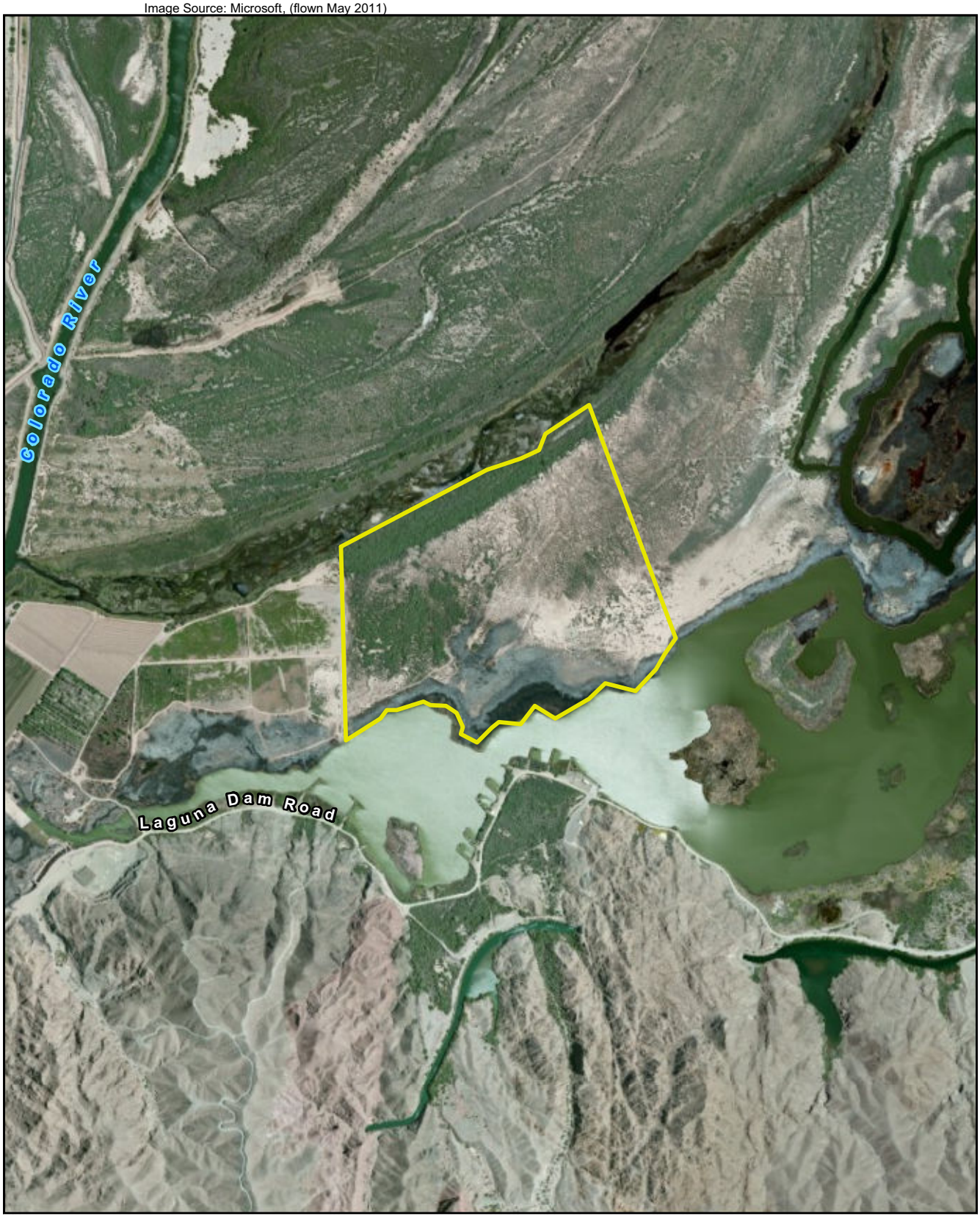
2008b Biological Assessment. Right-Of-Way for Vegetation Treatments in Limitrophe for Safety and Law Enforcement. Lower Colorado River, Yuma County, Arizona. Yuma Field Office and Arizona State Office. October 2007, Amended February 2008.

2010 Yuma Field Office Record of Decision and Approved Resource Management Plan. January.

ATTACHMENT A

Figures and Photographs

Image Source: Microsoft, (flown May 2011)



0 Feet 1,500

Survey Area

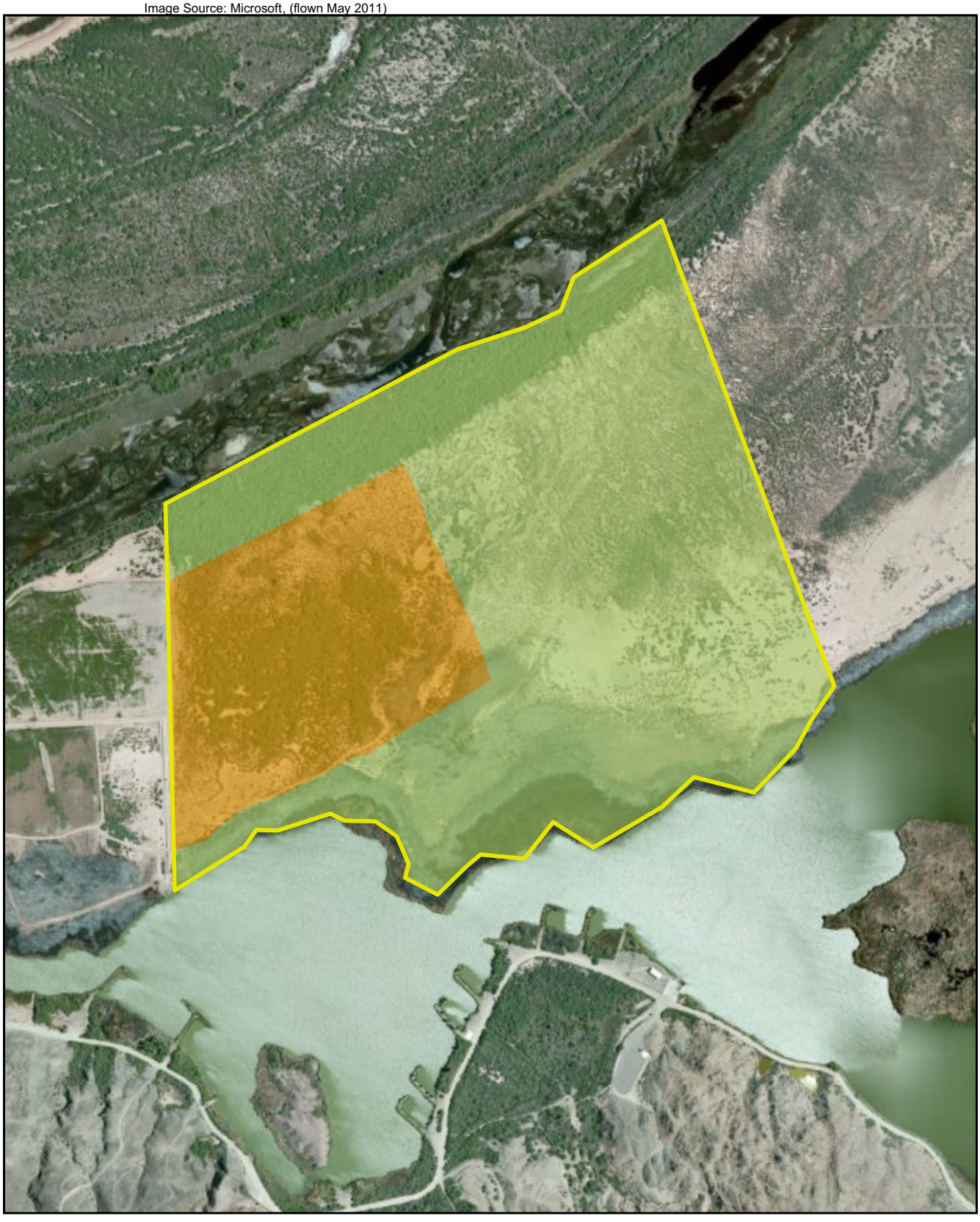
FIGURE 1

Mittry Lake South Expansion Area

RECON

\\serverfs01\gis\JOBS4\6436\common_gis\fig1_Mitigation_Assessment.mxd

Image Source: Microsoft, (flown May 2011)



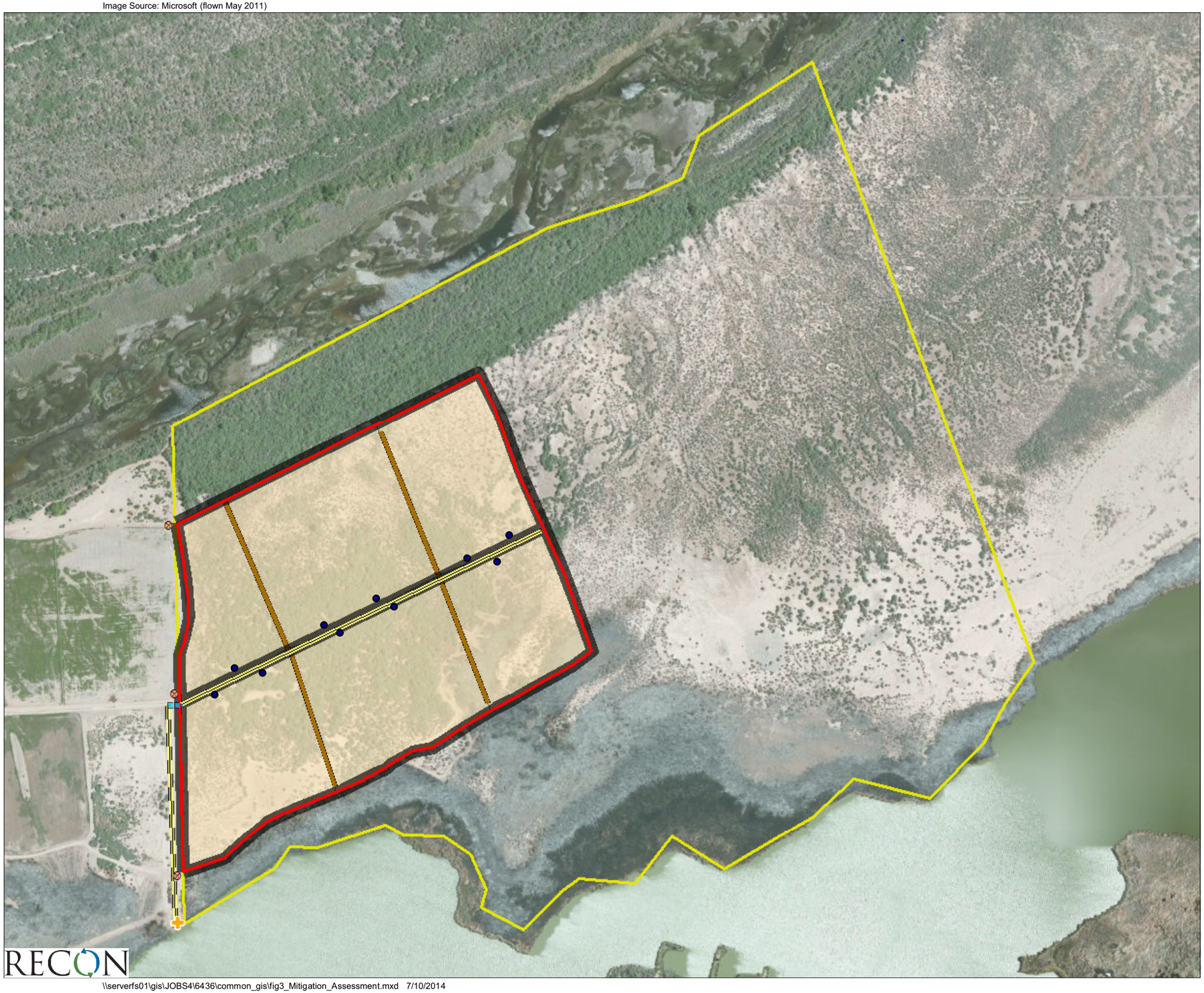
RECON

\\serverfs01\gis\JOBS4\6436\common_gis\fig2_Mitigation_Assessment.mxd 7/10/2014

FIGURE 2

Restoration Zones

Image Source: Microsoft (flown May 2011)



- Survey Area
- Proposed Restoration Parcel (50 acres)
- Vegetation Type: Cottonwood-Willow
- Field Berm (2'x3'x2')
- Irrigation Channel (Concrete)
- Culvert (Box/Pipe)
- Constructed Access Road (15-20')
- Pump Station
- Diversion Outlet
- Gates/Signage

0 Feet 400

RECON

\\serverfs01\gis\JOBS4\6436\common_gis\fig3_Mitigation_Assessment.mxd 7/10/2014

FIGURE 3

Mittry Lake Mitigation Restoration Concept

PHOTOGRAPH 1
Pumping Station Inlet at Mittry Lake

PHOTOGRAPH 2
Pumping Station Outlet Flows into eExisting Irrigation Channel

RECON

PHOTOGRAPH 3
Proposed Irrigation Channel; Tie-in Location

PHOTOGRAPH 4
Manually Operated Diversion Outlet

PHOTOGRAPH 5
Salt Deposition on Soil Surface

PHOTOGRAPH 6
Dense Saltcedar Stands Present On-site

PHOTOGRAPH 7
Example of Proposed Grading Concept

PHOTOGRAPH 8
Western Maintenance Access Road

RECON

In Reply Refer To:
6840 (C020)

JAN 07 2013

Memorandum

To: Jennifer McCloskey- Area Manager, Bureau of Reclamation

From: John MacDonald- Field Manager John MacDonald

Subject: Mittry South Expansion

The Bureau of Land Management (BLM) Yuma Field Office (YFO) proposes to create improved wildlife habitat within the Mittry Lake Wildlife Area. These activities total 256 acres and would be located within the Gila and Salt River Meridian at T6S, R22W, Sec 12 and 13. A map of the project area is attached.

The BLM YFO would like to work in partnership with your agency and the Arizona Game and Fish Department (AGFD) in the design and implementation of this project. AGFD has requested between five and ten acres of the proposed 256 acres be set aside for an annual youth dove hunt. These acres would be planted with the grain and left for the dove during the bi-annual hunting season. The other 246 acres would be occupied by a centrally located irrigation channel to provide flood irrigation for waterfowl ponds, cottonwood-willow habitat, and mesquite habitat. The new irrigation channel would connect to an existing channel and pump located on the southwest side of the proposed project that pumps water from Mittry Lake. The YFO would be using its Colorado River water allocation to irrigate the site.

The YFO is requesting Bureau of Reclamation's (BR) concurrence with this project proposal. Upon receipt of concurrence, a team of specialists from BLM, BR, and AGFD would lead in the design and National Environmental Policy Act compliance of the project.

For further information concerning this project please contact Wildlife Biologist Erica Stewart: 928-317-3295 or estewart@blm.gov.

ESTEWART:mz:1/4/2013:U\correspondence\Mittry.South.Expansion

United States Department of the Interior

BUREAU OF RECLAMATION
Lower Colorado Region
Yuma Area Office
7301 Calle Agua Salada
Yuma, AZ 85364

IN REPLY REFER TO:

YAO-7210
ENV-4.00
LND-6.00

FEB 1 3 2013

MEMORANDUM

To: Field Manager, Bureau of Land Manager, Yuma Field Office, 2555 East Gila Ridge Road, Yuma AZ 85365
Attention: Erica Stewart

From: Jennifer McCloskey
Area Manager

Subject: Bureau of Land Management (BLM) – Concurrence Memorandum Regarding the Proposed Mittry South Expansion Project (Project) – Contract No. 14-06-300-2883 – Yuma Project, Laguna Division, Arizona.

The Bureau of Reclamation Yuma Area Office is in receipt of your letter dated January 7, 2013, where you are requesting our concurrence for the Project. The plan is to improve approximately 256 acres for wildlife habitat within the existing boundaries of the Mittry Lake Wildlife Area on Reclamation Withdrawn land and in accordance with the referenced contract.

We concur with BLM's intent to create habitat on the proposed acreage and to provide technical assistance and reviews of the design and environmental compliance documents. Additionally, we request a meeting with you to better understand the water use requirements for the project and to work with our office on water schedule and delivery procedures. Any outflow from the project area will return to the Colorado River and will make up a portion of the overall water delivery to Mexico.

We look forward to working with you on this Project. Please contact Mr. Christopher Wallis, Resources Management Office Chief, at telephone No. 928-343-8215 or via electronic mail at cwallis@usbr.gov to schedule further discussions regarding water requirements for the project site.

JAN 07 2013

In Reply Refer To:
6840 (C020)

To: Pat Barber-Regional Supervisor, Arizona Game and Fish Department

From: John MacDonald-Field Manager

Subject: Mittry South Expansion

The Bureau of Land Management (BLM) Yuma Field Office (YFO) proposes to create improved wildlife habitat within the Mittry Lake Wildlife Area. These activities total 256 acres and would be located within the Gila and Salt River Meridian at T6S, R22W, Sec 12 and 13. A map of the project area is attached.

The BLM YFO would like to work in partnership with your agency and the U.S. Bureau of Reclamation (BR) in the design and implementation of this project. Your agency has requested between five and ten acres of the proposed 256 acres be set aside for an annual youth dove hunt. These acres would be planted with grain and left for the dove during the bi-annual hunting season. The other 246 acres would be occupied by a centrally located irrigation channel to provide flood irrigation for waterfowl ponds, cottonwood-willow habitat, and mesquite habitat. The new irrigation channel would connect to an existing channel and pump located on the southwest side of the proposed project that pumps water from Mittry Lake. The YFO would be using its Colorado River water allocation to irrigate the site.

The YFO is requesting Arizona Game and Fish Department's (AGFD) concurrence with this project proposal. Upon receipt of concurrence, a team of specialists from BLM, BR, and AGFD would lead in the design and National Environmental Policy Act compliance for the project.

For further information or any questions concerning this project please contact Wildlife Biologist Erica Stewart: 928-317-3295 or estewart@blm.gov.

Sincerely,

John MacDonald

Field Manager

ESTEWART:mz:1/4/2013:U\correspondence\AGFD.Mittry.MacD

THE STATE OF ARIZONA
GAME AND FISH DEPARTMENT
5000 W. CAREFREE HIGHWAY
PHOENIX, AZ 85086-5000
(602) 942-3000 • WWW.AZGFD.GOV
REGION IV, 9140 E. 28TH ST., YUMA, AZ 85365

February 1, 2013

Erica Stewart
Bureau of Land Management
2555 E Gila Ridge Road
Yuma, Arizona 85365

Re: Mittry South Expansion

Mrs. Stewart:

The Arizona Game and Fish Department (Department) has reviewed the Bureau of Land Management (BLM) January 7, 2013 proposal to improve wildlife habitat within the Mittry Lake Wildlife Area (MLWA). The proposed activities would set aside 5-10 acres for an annual youth dove hunt while the remaining 246 acres would be used to create waterfowl ponds, cottonwood-willow habitat, and mesquite habitat. A new irrigation channel would connect to an existing channel and pump located on the southwest side of the proposed project that pumps water from Mittry Lake using the BLM Yuma field office Colorado River water allocation.

The Department strongly supports the restoration of wildlife habitat located within MLWA. We believe this restoration is important because it will provide much needed habitat for the southwestern willow flycatcher (*Empidonax traillii extimus*), Yellow-billed cuckoo (*Coccyzus americanus occidentalis*), Yuma clapper rail (*Rallus longirostris yumanensis*), and other migratory species.

Thank you for the opportunity to provide comments on this habitat restoration plan. We look forward to continued coordination and cooperation toward the restoration of wildlife habitat. If you have any questions, please contact me at 928-341-4069 or tbommarito@azgfd.gov.

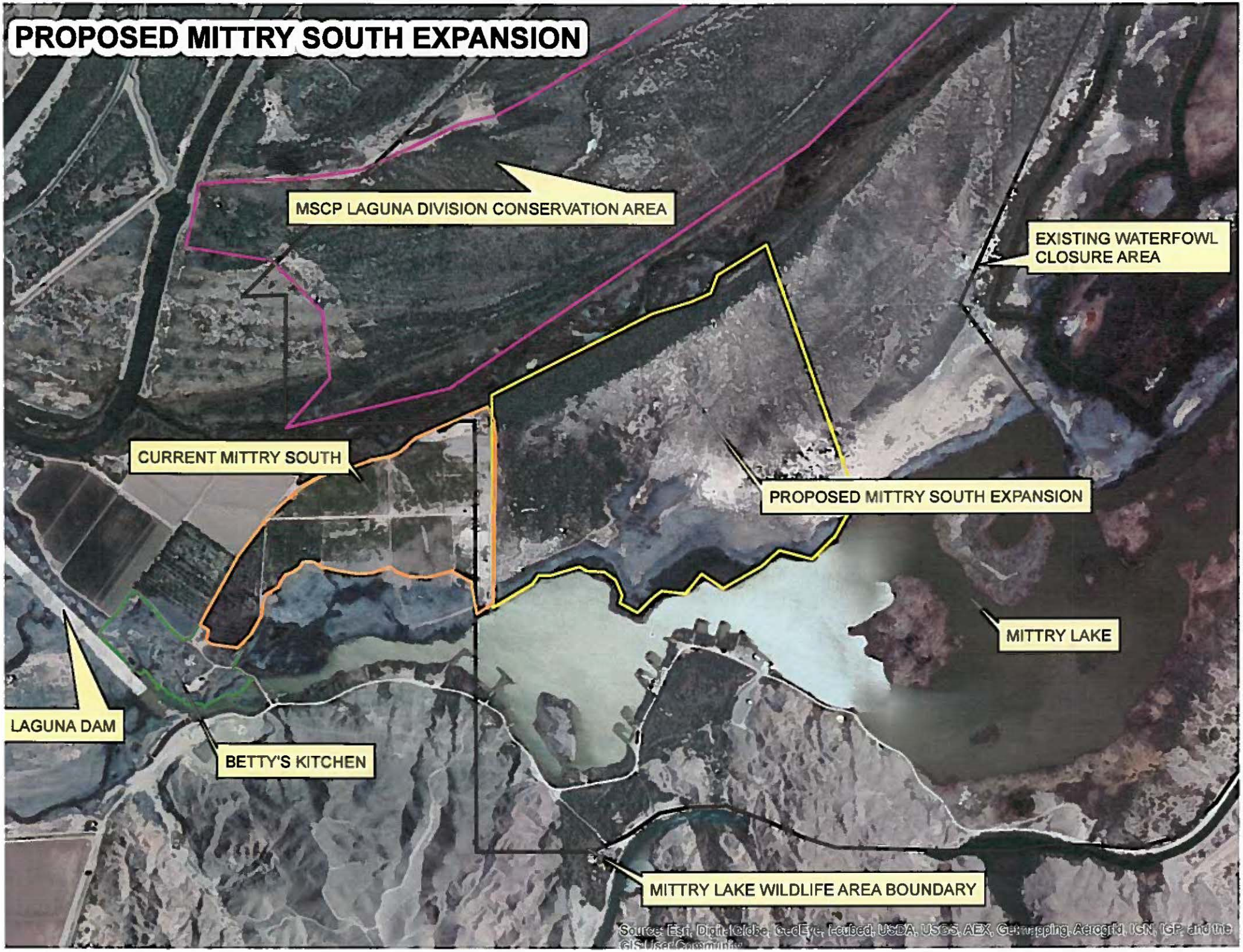
Sincerely,

Tab Bommarito

Tab Bommarito
Habitat Specialist
Region IV, Yuma

cc: Pat Barber, Regional Supervisor, Region IV
Bill Knowles, Habitat Program Manager, Region IV
Laura Canaca, PEP Supervisor, Habitat Branch
Leonard Ordway, Assistant Director, Field Operations

AGFD # M13-02014850


PROPOSED MITTRY SOUTH EXPANSION
MSCP LAGUNA DIVISION CONSERVATION AREA
EXISTING WATERFOWL CLOSURE AREA
CURRENT MITTRY SOUTH
PROPOSED MITTRY SOUTH EXPANSION
MITTRY LAKE
LAGUNA DAM
BETTY'S KITCHEN
MITTRY LAKE WILDLIFE AREA BOUNDARY
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

ATTACHMENT 3

BOR Concurrence Memorandum for Paradise Cove West and Paradise Cove East

United States Department of the Interior

BUREAU OF RECLAMATION
Yuma Area Office
7301 Calle Agua Salada
Yuma, Arizona 85364

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:

YAO-7210
LND-6.00
ENV-7.00

FEB 11 2011

MEMORANDUM

To: Field Manager, Bureau of Land Management, Yuma Field Office,
2555 East Gila Ridge Road, Yuma, Arizona 85365
Attention: Mr. David Daniels

From: Christopher M. Wallis
Chief, Resource Management Office

Subject: Bureau of Land Management (BLM) – Consultation and Concurrence Memorandum Regarding the Department of Homeland Security Vegetation Clearing Project (Project) – Colorado River Front Work and Levee System, Yuma Division, Arizona (Your Memorandum Dated January 25, 2011)

The Bureau of Reclamation, Yuma Area Office (YAO), is in receipt of your subject Memorandum in which you are requesting concurrence to use certain Reclamation withdrawn lands for mitigation purposes for the subject Project. After thorough research and review by both Reclamation and BLM, and following the agency partnership meeting held at YAO on January 18, 2011, it has been determined the following two (2) locations will be utilized as mitigation sites.

Description of Use Area:

Site No. 1 is located within portions of lot 8, sec. 19, T. 8 S., R. 22 W., Gila and Salt River Meridian, Yuma County, Arizona. The parcel consists of approximately 17.7 acres, more or less.

Site No. 2 is located within portions of lots 1, 2, 5, and 6, section 28, and within portions of lots 22 and 23, section 29 all within T. 16 S., R. 22 E., San Bernardino Meridian, Arizona. The parcels consist of approximately 51.0 acres, more or less.

Please note, that Site No. 2 is located within portions of the terminus of the Reclamation facility formally identified as the Yuma Mesa Conduit (YMC), to which Reclamation must maintain access for operation and maintenance activities.

Reclamation has determined that the use of the above-noted mitigation sites are acceptable to us, and will not preclude us from fulfilling our Reclamation project needs for dredging and bankline protection. Please be advised that the following special conditions and stipulations are included with our concurrence.

Special Conditions and Stipulations

1. BLM may not allow contamination or pollution of the project lands, waters or project works of Reclamation, and for which BLM shall take reasonable precautions to prevent such contamination or pollution by third parties. BLM shall comply with all applicable Federal, State, and local law and regulations, and Reclamation policies and instructions, existing or hereafter enacted or promulgated, concerning any hazardous material that will be used, produced, transported, stored, or disposed of on or in project lands, waters or project works of Reclamation. Upon discovery of any event which may or does result in contamination or pollution of project lands, waters or project works of Reclamation, the BLM shall initiate emergency measures to protect human health and safety, and the environment if necessary, and shall provide notice of such discovery with full details of the actions to Reclamation. In the case of any hazardous materials emergency involving the withdrawn lands and/or the YMC, BLM will immediately notify Reclamation's Environmental Planning and Compliance Group Manager at telephone No. 928-343-8100.

2. BLM will maintain and ensure a sanitary work site (clear of debris and physical hazards) during mitigation operation in and around the YMC.

3. Reclamation retains all rights reserved and the authority to enter upon the above-described lands, and in particular to perform any improvements or repairs to the YMC.

4. BLM will be solely liable for any damages incurred to the YMC, resulting from mitigation operations and maintenance of Site No. 2.

5. BLM will notify Reclamation of any proposed changes to the subject request and obtain Reclamation approval prior to implementation of said changes.

6. BLM shall not construct any groundwater wells in the lands described herein.

7. After completion of all mitigation work, BLM is required to furnish Reclamation with final mitigation plans, photos and reports for Site Nos. 1 and 2.

8. Reclamation requires immediate notification to YAO's Operations and Maintenance Office at telephone No. 928-343-8100, in the event of any emergency involving the YMC.

We thank you for the opportunity to review and provide consultation. Please contact me at telephone No. 928-343-8215 or via electronic mail at cwallis@usbr.gov for future coordination efforts regarding this matter.

Attachment 4
BOR Yuma Area Groundwater Map

RECLAMATION
Managing Water in the West

U.S. Department of the Interior
Bureau of Reclamtion

705000 710000 715000 720000
362 5000 / 362 0000 / 361 5000 / 361 0000 / 360 5000 / 360 0000

Depth To Groundwater (ft.)
Dashed where approximate.

Observation Well
Reading (ft.)

Drainage Well

Public Lands Survey Section Line

Irrigation District Border

Levee

Canal

Drain

Major Road

Minor Road

River

Depth To Groundwater

0' - 6'

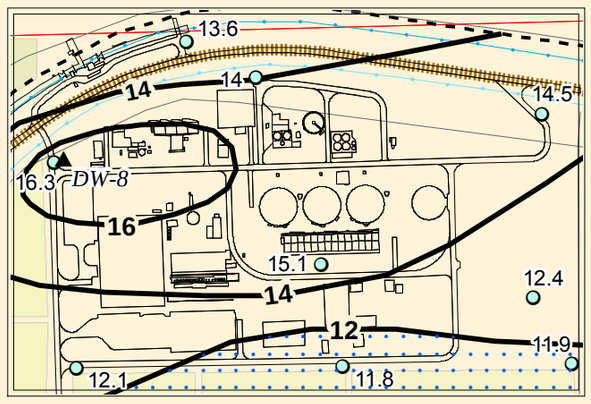
6' - 12'

No color over 12'

Depth To Groundwater Acreage:

0' to 4' = 291 Acres
0' to 6' = 5,754 Acres
0' to 8' = 23,011 Acres

Groundwater Readings Taken:
November 1 to 8, 2011



Inset

See Inset

Yuma

Somerton

San Luis

ARIZONA

Map Area

Morelos Dam

COLORADO RIVER

All American Canal

Gila Gravity Main Canal

West Main Canal

Lateral

Cloud Lateral

Green Lateral

Central Drain

Main Drain Extension

Northwest Drain

Central Drain Stub #2

Sioux Canal

Yuma Main Canal

Cocopah Canal

Drain No.4

Main Drain

Southeast Drain

West Drain

Central Canal

East Drain

River to YM-2

YM-2 to YM-3

YM-3 to YM-4

YM-4 Collector

YM-2 Collector

YM-3 Collector

YM-6 to YM-7

YM-7 to YM-8

YM-8 to YM-9

YM-9 to YM-10

YM-10 to YM-11

B Main Lateral

A Canal

B Canal

DW-1 DW-2 DW-4 DW-5 DW-7 DW-8 DW-8R DW-9 DW-10 DW-11 DW-12 DW-14 DW-15 DW-16 DW-17 DW-18 DW-19

YC-1 YC-2 YC-3 YC-4

YV-7R YV-8 YV-13R2

YM-1 YM-2R2 YM-3R YM-4 YM-5R YM-6R YM-7 YM-8 YM-9 YM-10 YM-11 YM-12 YM-13

10 3/4St.R 11 3/4 St 12 St 12 1/4 St.R2 13 St. R2 13 7/8 St 14 1/4 St. 14 1/2 St. 16th St 16 1/2 St 17 1/2 St 9 3/4 St.

1 0.5 0 1 2
Miles

N

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

YUMA PROJECT
VALLEY DIVISION

DEPTH TO GROUNDWATER
November 2011

DATA: T. FOX
DRAWN: T. STAGGS
CHECKED: W. GREER
APPROVED: J. HUMBLE

T.Staggs - YAOGIS2011-0108, Completed November 29, 2011

Grid: UTM. NAD 27. Zone 11. Meter

ATTACHMENT 5

Wetland Delineation for Paradise Cove West

Wetland Delineation for Paradise Cove West Yuma, Arizona

Prepared for

U.S. Customs and Border Protection
Environmental Planning
Program Management Office
1301 Pennsylvania Ave. NW, Suite B-155
Washington, DC 20229

Prepared by

RECON Environmental, Inc.
1927 Fifth Avenue
San Diego, CA 92101-2358
P 619.308.9333 F 619.308.9334
RECON Number 6436-1

Michael Nieto, Biologist

2 January 2018

TABLE OF CONTENTS

FIGURES

TABLES

ATTACHMENTS

1.0 Summary of Findings

A RECON wetland specialist performed a routine wetland delineation on the approximately 50.35-acre Paradise Cove project area near Yuma, Arizona. Methods for delineating wetlands followed guidelines set forth by the U.S. Army Corps of Engineers (ACOE; 1987), including the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region* (ACOE 2008).

ACOE and Arizona Department of Environmental Quality (AZDEQ) jurisdictional waters were delineated within the Paradise Cove project area, located on the southern bank of the Colorado River. ACOE and AZDEQ jurisdictional waters total 16 acres on-site.

Impacts to jurisdictional waters on-site would require a Section 404 Clean Water Act (CWA) Permit from ACOE and a Section 401 water quality certification from the AZDEQ.

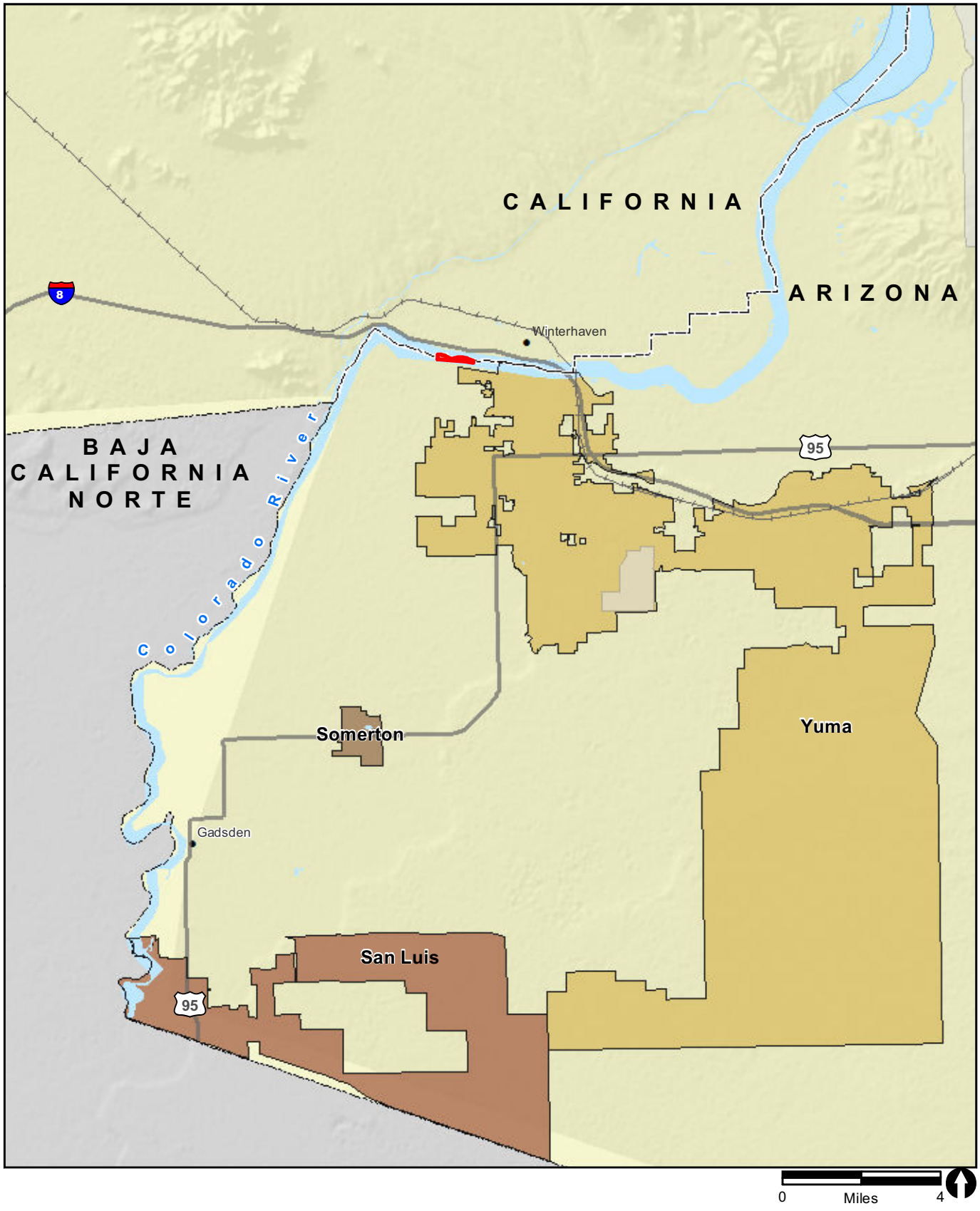
2.0 Introduction

This report describes the results of a wetland delineation conducted within the approximately 50.35-acre Paradise Cove project area. The site is located on the southern bank of the Colorado River in the city of Yuma in the State of Arizona. The project area is located on a vegetated terrace within the active flood plain of the Colorado River near the intersection of West Levee Road and North Figueroa Avenue in Yuma, Arizona (Figures 1 and 2). The project area is located in the U.S. Geological Survey (USGS) 7.5-minute topographical map Yuma West, 1979 quadrangle, Sections 28 and 29, T16SR22E (see Figure 2; USGS 1996). The project area is located on the southern bank of the Colorado River and runs parallel to the West Levee Road and is bounded by open water to the north and agricultural uses to the south (Figures 3).

The elevation for this project area ranges from approximately 119 to 122 feet above mean sea level. The lowest elevation contour is located at the Colorado River bank on the northern border of the project area. The highest elevation contour is located at the access road along the southern boundary of the project area.

3.0 Methods

RECON wetland specialist Michael Nieto performed a routine wetland delineation within the Paradise Cove project area on March 19, 2013. The wetland delineation was performed according to the guidelines set forth by ACOE (1987, 2008). Prior to conducting the delineation, an aerial photograph and the USGS Yuma West, 1979 quadrangle were examined to aid in the



Project Location

FIGURE 1

Regional Location

RECON

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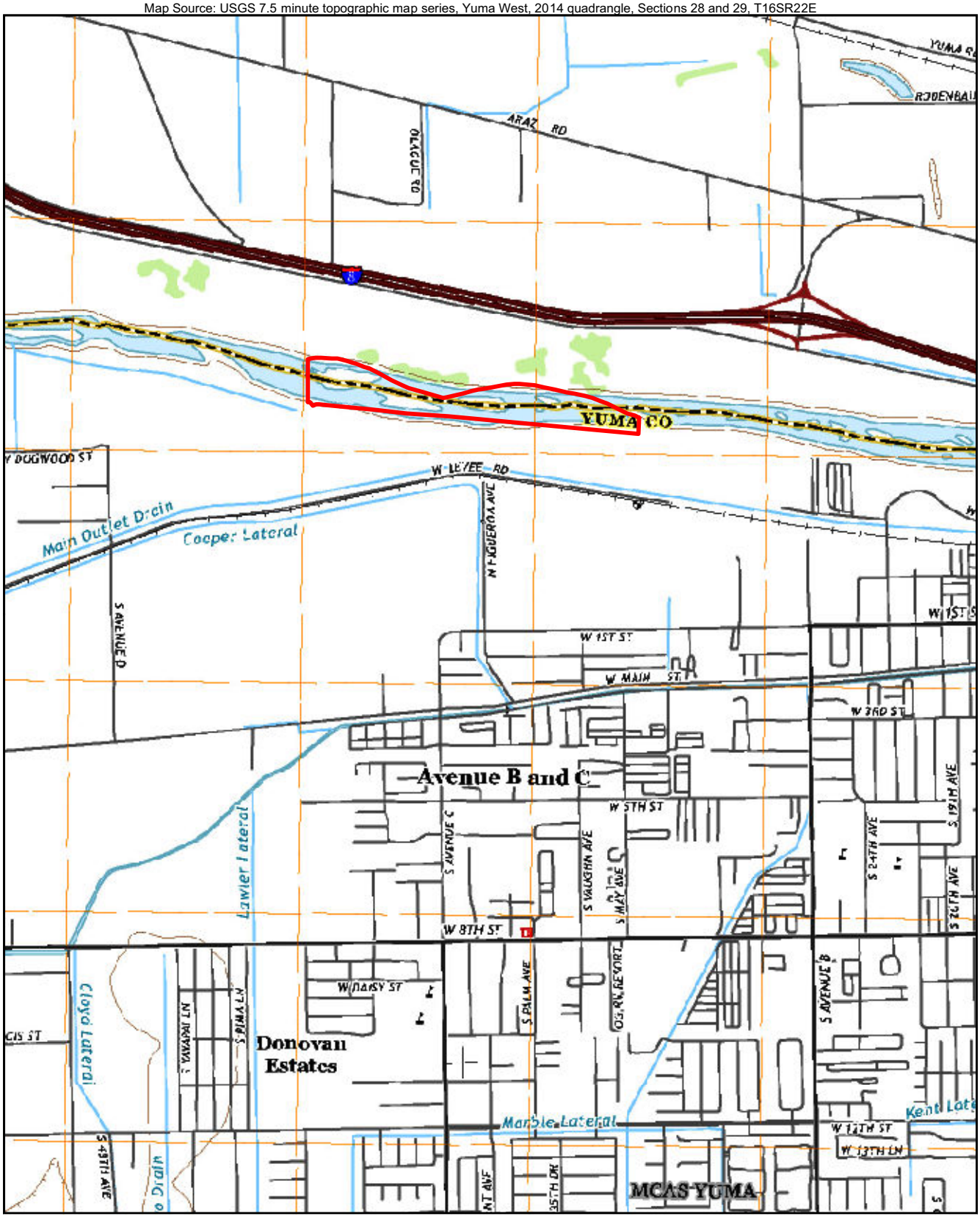
Map Source: USGS 7.5 minute topographic map series, Yuma West, 2014 quadrangle, Sections 28 and 29, T16SR22E



Project Location

FIGURE 2

Project Location on USGS Map

RECON

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determination of potential waters of the U.S. on-site. Once on-site, the parcel of land was examined to determine the presence of any indicators of wetlands, including wetland vegetation, hydric soils, and hydrology. Soil test pits were located: (1) within potential wetland areas and (2) in or adjacent to the spot where the boundary between wetland and upland was inferred (based on changes in the topography, hydrology, and composition of the vegetation).

The project area was traversed on foot, by walking meandering transects to attain complete coverage of the project area. Aerial photographs and Trimble sub-meter global positioning system (GPS) field verification were used to map vegetation boundaries, jurisdiction boundaries, soil pit locations, and prominent wetland indicators. Field data were later digitized into ArcGIS. Mapped jurisdictional waters were analyzed in ArcGIS to provide approximate acreage. ACOE wetland delineation forms are included as Attachment 1. Photographs of the Project Area are provided in Attachment 2.

3.1 ACOE Wetlands/Waters

According to the ACOE manual (ACOE 1987), wetlands are defined as “those areas that are inundated or saturated by surface or groundwater 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.”

Wetlands are delineated using three parameters: hydrophytic vegetation, wetland hydrology, and hydric soils. According to ACOE, indicators for all three parameters must be present to qualify a wetland. The definition of a wetland includes the phrase “under normal circumstances,” because there are situations in which the vegetation of a wetland has been removed or altered as a result of a recent natural event or human activities (ACOE 1987).

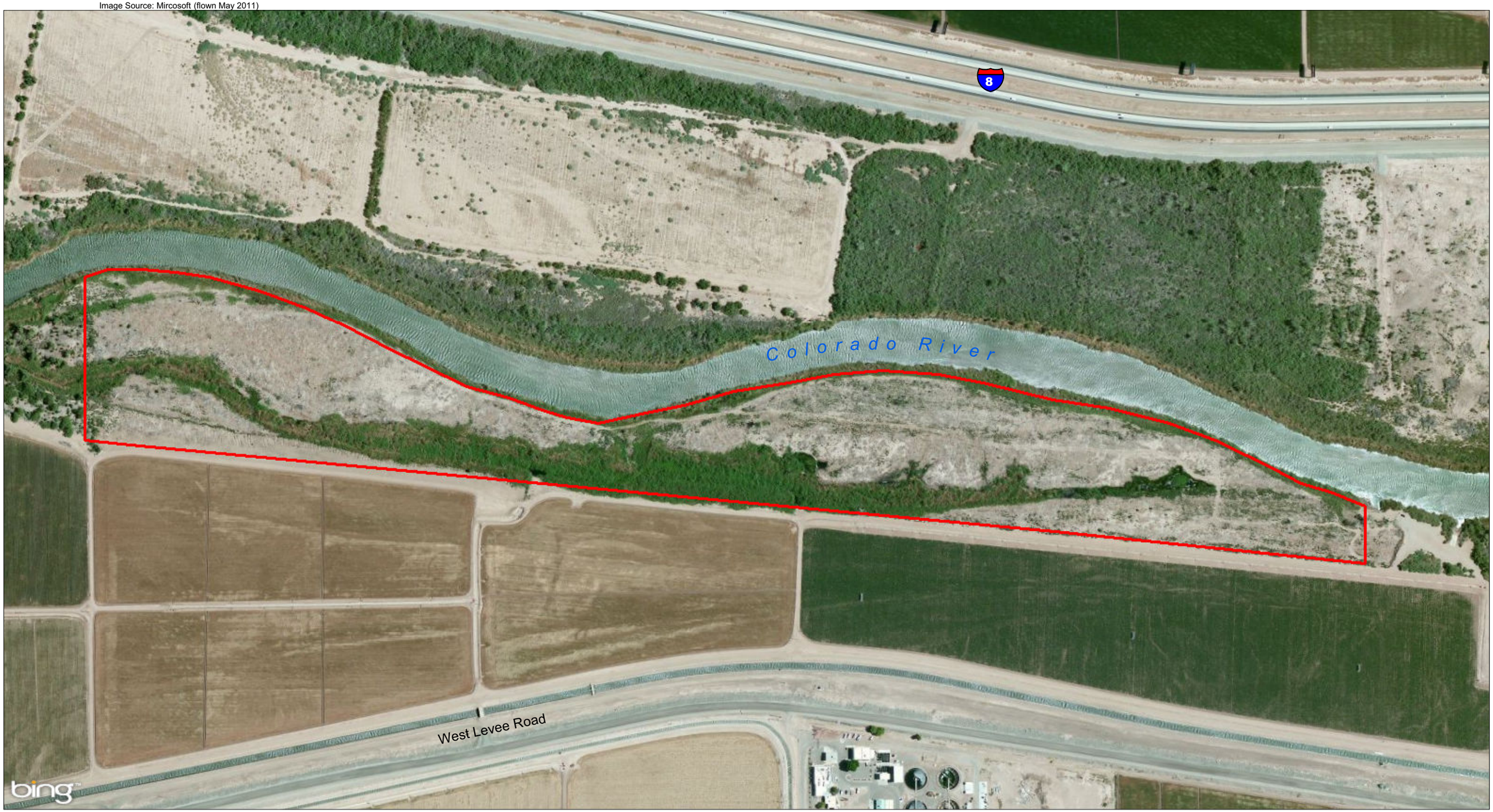
Atypical situations and problem areas may lack one or more of the three criteria and still be considered wetlands. Background information on the previous condition of the area and/or field observations may indicate that a site meets the wetland criteria prior to disturbance. Additional delineation procedures would be employed if normal circumstances did not occur on a site.

3.1.1 Regulatory Definition

In accordance with Section 404 of the Clean Water Act (CWA), ACOE regulates the discharge of dredged or fill material into waters of the United States. The term “waters of the United States” is defined as:

- All waters currently used, or used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters subject to the ebb and flow of the tide;

Image Source: Mircosoft (flown May 2011)



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Project Boundary

FIGURE 3

Project Location on Aerial Photograph

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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 foreign commerce including any such waters, (1) which could be used by interstate or foreign travelers for recreational or other purposes; or (2) from which fish or shellfish are, or could be, taken and sold in interstate or foreign commerce; or (3) which are used or could be used for industries in interstate commerce.

- All other impoundments of waters otherwise defined as waters of the United States under the definition;

- Tributaries of waters identified above;

- The territorial seas; and

- Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in the paragraphs above (33 Code of Federal Regulations [CFR] Part 328.3(a)).

3.1.2 Hydrophytic Vegetation

Hydrophytic vegetation is defined as "the sum total of macrophytic plant life growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content" (ACOE 1987). The potential wetland areas within the project area were surveyed by walking through the project area and making observations of those areas exhibiting characteristics of jurisdictional waters or wetlands. Vegetation units with potential wetland areas were examined, and data for each vegetation stratum (i.e., tree, shrub, herb, and vine) were recorded on the datasheet provided in the 2008 *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region*[1] (ACOE 2008). The percent absolute cover of each species present was visually estimated and recorded.

The wetland indicator status of each species recorded was determined by using the list of wetland plants for Arizona provided by the ACOE (ACOE 2012). An obligate (OBL) indicator status refers to plants that have a 99-percent probability of occurring in wetlands under natural conditions. A facultative wet (FACW) indicator status refers to plants that occur in wetlands (67–99 percent probability), but are occasionally found in non-wetlands. A facultative (FAC) indicator status refers to plants that are equally likely to occur in wetlands or non-wetlands (estimated probability 34–66 percent). Facultative upland (FACU) species are more often found in upland sites. Upland (UPL) species have a high probability to occur in upland sites. A not indicated (NI)

[1] Hereafter referred to as *Arid Supplement*

status refers to species that have insufficient data available to determine an indicator status at this time, for the local region.

Plant species nomenclature follows that contained in *Biotic communities of the American Southwest-United States and Mexico* (Brown 1982). Dominant species with an indicator status of NI or not listed in the 2012 list, if any, were evaluated as either wetland or upland indicator species based on local professional knowledge of where the species are most often observed in habitats characteristic of the Colorado River in Southern Arizona.

Vegetation communities observed on-site were classified and mapped according to the United States National Vegetation Classification (USNVC) (NatureServe 2013).

3.1.3 Hydric Soils

A hydric soil is a soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic vegetation (ACOE 1987). Hydric soil indicators are formed predominantly by the accumulation or loss of iron, manganese, sulfur, or carbon compounds (ACOE 2008). The hydric soil criterion is considered fulfilled at a location; if soils in the area can be inferred to have a high groundwater table, evidence of prolonged soil saturation, or any indicators suggesting a long-term reducing environment in the upper 18 inches of the soil profile.

3.1.4 Wetland Hydrology

The presence of wetland hydrology indicators confirm that inundation or saturation has occurred on a site, but may not provide information about the timing, duration, or frequency of the event. Hydrology features are generally the most ephemeral of the three wetland parameters (ACOE 2008).

Hydrologic information for the site was obtained by reviewing USGS topographic maps and by directly observing hydrology indicators in the field. The wetland hydrology criterion is considered fulfilled at a location if, based upon the conclusions inferred from the field observations, an area has a high probability of being periodically inundated or has soils saturated to the surface at some time during the growing season to develop anaerobic conditions in the surface soil environment, especially the root zone (ACOE 1987). If at least one primary indicator or at least two secondary indicators are found at a sample point, the wetland hydrology criterion is considered fulfilled.

3.2 AZDEQ Jurisdictional Waters

The Arizona Department of Environmental Quality (AZDEQ) is the regional agency responsible for protecting water quality in Arizona and administers the CWA 401 certification program. The

jurisdiction of this agency includes waters of the state as mandated by the federal CWA Section 401.

4.0 Results of Field Data

Four vegetation communities/land cover types were documented within the project area including areas with and without hydrophytic vegetation. The hydrology within the project area is provided by the Colorado River, its associated floodplain and high and low flow channels. The soil types mapped on-site include Indio silt loam and Indio silt loam saline. Additionally, the data collected at the soil test pits were recorded onto a *Wetland Determination Data Form–Arid West Region*. The wetland data forms are provided in Attachment 1.

4.1 Vegetation

Four USNVC vegetation communities/land cover types occur on-site including arrowweed seasonally flooded shrubland, common reed western North America temperate semi-natural herbaceous vegetation, broadleaf cattail western herbaceous vegetation, and bare ground (graded) (Figure 4). All vegetation communities and/or land cover types surveyed within the Paradise Cove project boundary, along with their associated Cowardin classification, are listed in Table 1.

TABLE 1
VEGETATION COMMUNITIES / LAND COVER TYPES WITHIN THE PROJECT AREA

Type or Community	Cowardin class	Acres
Arrowweed seasonally flooded shrubland	Palustrine shrub-scrub wetland	30.59
Common reed western North America temperate semi-natural herbaceous vegetation	Palustrine persistent emergent wetland	15.50
Broadleaf cattail western herbaceous vegetation	Palustrine persistent emergent wetland	0.85
Bare ground (graded)	n/a	3.41

Areas with and without hydrophytic vegetation were observed on-site. Areas with hydrophytic vegetation, in general, were considered potential jurisdictional areas. Locations on-site without hydrophytic vegetation were considered upland unless additional evidence suggested that a wetland or other non-wetland jurisdictional water might occur.

4.1.1 Areas with Hydrophytic Vegetation

Areas dominated by obligate and facultative hydrophytic plant species satisfy the hydrophytic vegetation criterion, one of the three criteria necessary to be identified as an ACOE wetland.

Areas with hydrophytic vegetation communities, totaling 46.39 acres, were observed within the project area, including: arrowweed seasonally flooded shrubland, common reed western North America temperate semi-natural herbaceous vegetation, and broadleaf cattail western herbaceous vegetation.

4.1.1.1 Arrowweed Seasonally Flooded Shrubland

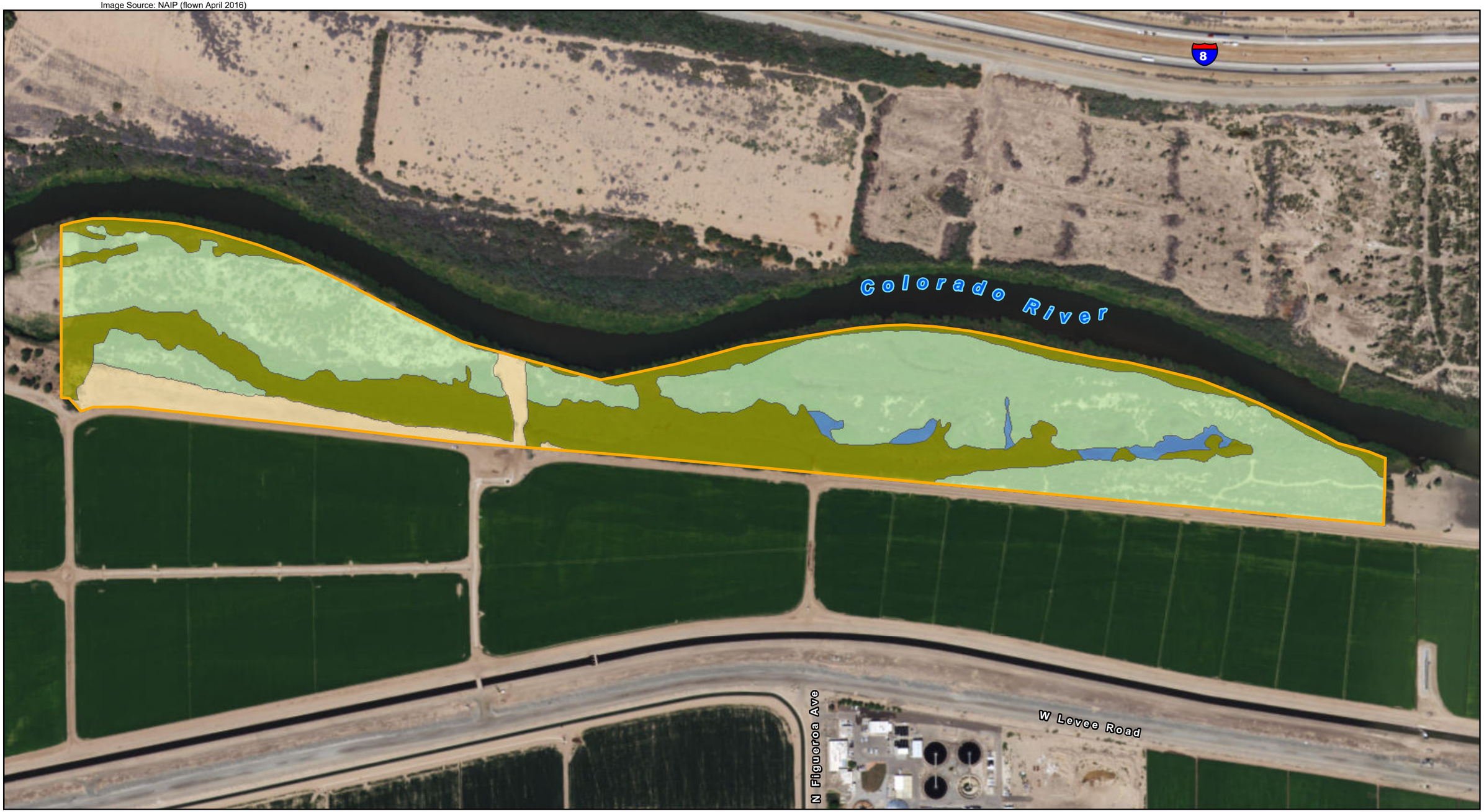
Arrowweed seasonally flooded shrubland is a vegetation community found within riverine systems throughout the Sonoran Desert in southwestern United States and Mexico. It is typically composed of dense stands of arrowweed with varying levels of invasion by tamarisk (an exotic tree) and is found on relatively xeric portions of active floodplains.

Arrowweed seasonally flooded shrubland, totaling 30.59 acres, occurs within the project area (Photograph 1). This vegetation community was observed growing in dense stands on relatively xeric terraces within the Colorado River floodplain within the project area. This community was dominated by arrowweed (*Pluchea sericea* – FACW) with significant densities of tamarisk (*Tamarix ramosissima* – FACW). Occasional native Fremont cottonweed trees (*Populus fremontii* – FACW) were observed within this vegetation community.

4.1.1.2 Common Reed Western North America Temperate Semi-Natural Herbaceous Vegetation

Common reed western North America temperate semi-natural herbaceous vegetation is widespread in both estuarine intertidal and palustrine persistent emergent wetlands (Cowardin et al. 1979). This vegetation community is dominated by common reed (*Phragmities australis* – FACW) and often found in dense, monotypic stands (Hansen et al. 1988). Along the southern reaches of the Colorado River common reed scrub is known to grow alongside native clonal wet marsh species such as cattail (*Typha* sp.) (Stevens et al. 1995).

Image Source: NAIP (flown April 2016)



Paradise Cove West

Vegetation Communities

- Arrowweed Seasonally Flooded Shrubland Vegetation
- Bare Ground (graded)
- Broadleaf Cattail Western Herbaceous Vegetation
- Common Reed Western North America Temperate Semi-natural Herbaceous Vegetation

0 Feet 300

RECON

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FIGURE 4

Vegetation Communities within Project Area

Common reed western North America temperate semi-natural herbaceous vegetation, totaling 15.50 acres, occurs within the project area (Photograph 2). This vegetation community was observed growing in dense monocultures in two areas within the project area: 1) the vegetated fringe directly bordering the Colorado River to the north and 2) within a low-flow channel that bisects the property. Common reed scrub within the project was found to be dominated exclusively by common reed).

4.1.1.3 Broadleaf Cattail Western Herbaceous Vegetation

Broadleaf cattail western herbaceous vegetation comprises perennial emergent monocots typically forming a closed canopy. This vegetation community occurs in open bodies of fresh water with little current flow, such as ponds, and to a lesser extent around seeps and springs. Broadleaf cattail western herbaceous vegetation occurs in areas of permanent inundation by freshwater.

Broadleaf cattail western herbaceous vegetation, totaling 0.85 acre, occurs within the project area (Photograph 3). Broadleaf cattail western herbaceous vegetation was observed to be dominated by broadleaf cattail (*Typha latifolia* – OBL) in a patchy distribution within the low-flow channel bisecting the project area.

4.1.2 Areas Lacking Hydrophytic Vegetation

Areas lacking hydrophytic vegetation include all bare ground. Bare ground within the project area is a result of recent grubbing with heavy machinery. Grubbing has occurred in two locations within the project area: 1) in the southwestern corner of the project area adjacent to an access road and 2) in the central portion of the project area connecting an access road to the main channel of the Colorado River. Based on a review of historical aerial imagery, the vegetation grubbing occurred within the last 2 years (grubbing in southwestern corner of the project appears to have occurred between 2010 and 2011, grubbing in center of project area appears to have occurred between 2011 and the present). The southwestern grubbed area forms a small berm and triangular-shaped terrace near an access road (Photograph 4). The central grubbed area contains two large water pumps and approximately 390 feet of an aboveground 12-inch-diameter pipe (Photograph 5–7). The pipe leads to large spigot and (based on observed tire tracks) is likely used to fill vehicle-towed water tanks (Photograph 8). In addition, an improvised culvert and has been built to facilitate heavy equipment crossing the low flow channel (Photograph 9). Resprouting wetland vegetation and plant debris within the grubbed areas indicate that the areas were previously vegetated with arrowweed scrub and common reed scrub (Photograph 10). Some of these grubbed areas were likely federal wetlands and will still be considered wetland waters of the U.S. (see Section 5.1).

4.2 Soils

Soils in the Indio Series occur throughout the project area. Indio Series (Indio silt loam and Indio silt loam saline) consists of well drained and moderately well drained, very deep silt loams that formed in alluvium derived from acid and igneous and micaceous rocks. Runoff is very slow, and the erosion hazard is none to slight. Although Indio soils have been identified as hydric by Natural Resource Conservation Service (NRCS) in California, a condition of this rating is that the soils must occur in depressional wetlands. As the wetlands on this project are riverine, Indio soils are assumed to be hydric only if they fulfill ACOE hydric soil criterion.

4.3 Hydrology

The Paradise Cove project area is located along the southern bank of the active floodplain of the Colorado River. The river floodplain is bounded by two levees, one approximately 700 feet south of the project area and the second approximately 1,000 feet north of the project boundary. The total width of the floodplain (levee to levee) at the project area is approximately 2,000 feet. Approximately 700 feet of available floodplain land area to the south are currently occupied by agricultural uses. The Colorado River is approximately 1,450 miles in length terminating at the Pacific Ocean (a Traditional Navigable Waterway) 104 miles downstream in the Gulf of California. It has a watershed that encompasses approximately 246,000 square miles and contains 29 major dams. The two dams, which regulate flow along this reach of the river, are Laguna Diversion Dam (15 miles upstream) and Imperial Dam (19 miles upstream).

The Paradise cove is located on a terrace on the southern bank of the river and is bisected by a vegetated low flow channel. ACOE wetland primary hydrology indicators including surface water and thin muck surfaces were observed within the low flow channel and fringing vegetation adjacent to the river. Although salt deposits were observed throughout the area, they appeared to be efflorescent in nature and not acceptable as an ACOE primary hydrology indicator.

5.0 Wetland Delineation

ACOE jurisdictional areas on-site total 16.55 acres, all of which are considered ACOE wetlands (Table 2). This acreage consists of common reed western North America temperate semi-natural herbaceous vegetation and broadleaf cattail western herbaceous vegetation associated with the Colorado River. Jurisdictional waters on-site are shown on Figure 5.

Image Source: NAIP (flown April 2016)

Paradise Cove West

Jurisdictional Waters

ACOE Wetland

ACOE Wetland (Disturbed)

Upland

0 Feet 300

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FIGURE 5

Jurisdictional Waters within Project Area

TABLE 2
EXISTING JURISDICTIONAL WATERS (acres)

Jurisdictional Waters	Acres
ACOE Waters of the US	
Wetlands	16.35
Wetlands (disturbed)	0.20
Total ACOE	16.55
AZDEQ Waters of the State	16.55

5.1 ACOE Jurisdictional Waters

ACOE jurisdiction area on-site totals 16.55 acres, which includes 16.35 acres of ACOE wetlands and 0.20 acre of ACOE wetlands that have been disturbed for the placement and access of pumps and irrigation pipes. Wetlands within the project area include those areas dominated by common reed and broadleaf cattail. Graded areas within the floodplain were recognized to be a "problematic hydrophytic vegetation: *managed plant communities*" and procedures for the delineation of "Difficult Wetland Situations in the Arid West" were followed to make a jurisdictional determination (ACOE 2008). These disturbed areas do not currently contain wetland vegetation. However, because of the existence of wetland hydric soils, wetland hydrology, and historical aerial photographs showing previous continuity of hydrophytic vegetation, they are considered wetland waters of the United States (ACOE 2008). It is unknown whether the observed disturbance of jurisdictional wetlands was authorized.

5.2 AZDEQ Jurisdictional Waters

The AZDEQ takes jurisdiction over all waters of the state and all waters of the United States as mandated by the federal CWA. A total of 16.55 acres is within the AZDEQ jurisdiction. Impacts to jurisdictional waters would require 401 water quality certification.

6.0 Regulatory Issues

ACOE and AZDEQ jurisdictional waters are regulated by the federal and state governments under a no-net-loss policy, and all impacts are considered significant. Unavoidable and authorized impacts would require mitigation through habitat creation, enhancement, or preservation as determined by a qualified restoration biologist in consultation with the regulatory agencies during the permitting process. Impacts to ACOE and AZDEQ jurisdictional waters would require a Section 404 permit authorization from ACOE and 401 State Water Quality Certification from AZDEQ.

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1996 Yuma, West, 7.5-minute Topographical Map.

.

Attachments

Attachment 1

Wetland Delineation Data Sheets

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Paradise Cove | City/County: Yuma, Arizona | Sampling Date: 3/19/2013

Applicant/Owner: U.S. Border Patrol | State: AZ | Sampling Point: SP-1

Investigator(s): Michael Nieto | Section, Township, Range: Sections 28 and 29, T16S, R22E

Landform (hillslope, terrace, etc.): terrace | Local relief (concave, convex, none): none | Slope (%): 0-2

Subregion (LRR): D | Lat: 32.7331 | Long: -114.66255 | Datum:

Soil Map Unit Name: Indio silt loam | NWI classification: Freshwater Forested/ Shrub

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation , Soil , or Hydrology significantly disturbed? N Are "Normal Circumstances" present? Yes X No

Are Vegetation , Soil , or Hydrology naturally problematic? N (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?**	**Yes** **No** X
Hydric Soil Present?	Yes	No X		
Wetland Hydrology Present?	Yes	No X		

Remarks: Sampling point taken within arrowweed/saltcedar scrub on floodplain terraces.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot size:)			
1. *Pluchea sericea*	60	Y	FACW
2. *Tamarix ramosissima*	10	N	NI
3. *Prosopis glandulosa var. torreyana*	3	N	UPL
4.			
5.			
	63	= Total Cover	
Herb Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	0	= Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
	0	= Total Cover	

% Bare Ground in Herb Stratum 37 | % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks: Vegetation at this sampling is hydric.

SOIL

Sampling Point: SP-1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10 YR 3/3	100					clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5) (**LRR C**)
___ 1 cm Muck (A9) (**LRR D**)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) (**LRR C**)
___ 2 cm Muck (A10) (**LRR B**)
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: -

Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks: No hydric soil indicators were observed at this sampling location. Soil at this location is within a stable floodplain and does not appear to be problematic.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1) (**Nonriverine**)
___ Sediment Deposits (B2) (**Nonriverine**)
___ Drift Deposits (B3) (**Nonriverine**)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-Stained Leaves (B9)
___ Salt Crust (B11)
___ Biotic Crust (B12)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water Marks (B1) (**Riverine**)
___ Sediment Deposits (B2) (**Riverine**)
___ Drift Deposits (B3) (**Riverine**)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Thin Muck Surface (C7)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No X Depth (inches): _____

Water Table Present? Yes _____ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No X Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Although salt deposits were obsered throughout the area, they appeared to be efflorescent in nature and not acceptable as an ACOE primary hydrology indicator.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Paradise Cove | City/County: Yuma, Arizona | Sampling Date: 3/19/2013

Applicant/Owner: U.S. Border Patrol | State: AZ | Sampling Point: SP-2

Investigator(s): Michael Nieto | Section, Township, Range: Sections 28 and 29, T16S, R22E

Landform (hillslope, terrace, etc.): terrace | Local relief (concave, convex, none): none | Slope (%): 0-2

Subregion (LRR): D | Lat: 32.7339 | Long: -114.66314 | Datum:

Soil Map Unit Name: Indio silt loam | NWI classification: Freshwater Forested/ Shrub

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation , Soil , or Hydrology significantly disturbed? N Are "Normal Circumstances" present? Yes X No

Are Vegetation , Soil , or Hydrology naturally problematic? N (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	X	No	
Hydric Soil Present?	Yes	X	No	
Wetland Hydrology Present?	Yes	X	No	

Is the Sampled Area within a Wetland? **Yes** X **No**

Remarks: Sampling point taken within emergent marsh vegetation in an inundated high-flow channel within the floodplain of the Colorado River.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot size:)			
1. *Typha latifolia*	65	Y	OBL
2.			
3.			
4.			
5.			
	65	= Total Cover	
Herb Stratum (Plot size:)			
1. *Heliotropum curassavicum*	2	Y	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	2	= Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
	0	= Total Cover	

% Bare Ground in Herb Stratum 33 % Cover of Biotic Crust

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	65	x 1 =	65
FACW species		x 2 =	
FAC species		x 3 =	
FACU species	2	x 4 =	8
UPL species		x 5 =	
Column Totals:	67 (A)		73 (B)

Prevalence Index = B/A = 1.1

Hydrophytic Vegetation Indicators:

- Dominance Test is >50%
- X Prevalence Index is ≤3.0[1]
- Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks: The emergent marsh vegetation at this sampling point is hydrophytic.

SOIL

Sampling Point: SP-2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-4	10 YR 2/1	100					muck	
4-16	10 YR 4/3	100					clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- X 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: -

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks: The soil at this sampling point is hydric.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- X Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes X No ___ Depth (inches): 0

Water Table Present? Yes X No ___ Depth (inches): 0

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): 0

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Strong hydrology indicators are present at this sampling point.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Paradise Cove City/County: Yuma, Arizona Sampling Date: 3/19/2013

Applicant/Owner: U.S. Border Patrol State: AZ Sampling Point: SP-3

Investigator(s): Michael Nieto Section, Township, Range: Sections 28 and 29, T16S, R22E

Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): none Slope (%): 0-2

Subregion (LRR): D Lat: 32.73425 Long: -114.66161 Datum:

Soil Map Unit Name: ndio silt loam NWI classification: Freshwater Forested/ Shrub

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation , Soil , or Hydrology significantly disturbed? N Are "Normal Circumstances" present? Yes X No

Are Vegetation , Soil , or Hydrology naturally problematic? N (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	X	No	
Hydric Soil Present?	Yes	X	No	
Wetland Hydrology Present?	Yes	X	No	

Is the Sampled Area within a Wetland? **Yes** X **No**

Remarks: Sampling Point taken within dense common reed scrub directly adjacent to the active, low-flow channel of the Colorado River.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot size:)			
1. *Phragmities australis*	80		FACW
2.			
3.			
4.			
5.			
	80	= Total Cover	
Herb Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	0	= Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
		= Total Cover	

% Bare Ground in Herb Stratum 20 % Cover of Biotic Crust

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks: Vegetation at this sampling point is strongly hydrophytic

SOIL

Sampling Point: SP-3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6.5	7.5 YR 5/1		2.5 YR 4/6	7	C	M	loamy sand	
6.5-18	7.5 YR 5/3		7.5 YR 5/8	10	C	M	loamy sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- X Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: -

Depth (inches): -

Hydric Soil Present? Yes X No ___

Remarks: Soil at this sampling point is strongly hydric.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- X Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): -

Water Table Present? Yes ___ No X Depth (inches): -

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): -

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available: n/a

Remarks: The sampling point shows evidence of hydrology.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Paradise Cove | City/County: Yuma, Arizona | Sampling Date: 3/19/2013

Applicant/Owner: U.S. Border Patrol | State: AZ | Sampling Point: SP-4

Investigator(s): Michael Nieto | Section, Township, Range: Sections 28 and 29, T16S, R22E

Landform (hillslope, terrace, etc.): terrace | Local relief (concave, convex, none): none | Slope (%): 0-2

Subregion (LRR): D | Lat: 32.73339 | Long: -114.66805 | Datum:

Soil Map Unit Name: ndio silt loam | NWI classification: Freshwater Forested/ Shrub

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation , Soil , or Hydrology significantly disturbed? N Are "Normal Circumstances" present? Yes X No

Are Vegetation , Soil , or Hydrology naturally problematic? N (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	X	No	
Hydric Soil Present?	Yes	X	No	
Wetland Hydrology Present?	Yes	X	No	

Is the Sampled Area within a Wetland? **Yes** X **No**

Remarks: Sampling Point taken within phragmities scrub associated with high-flow channel within project area.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot size:)			
1. *Phragmities australis*	85	Y	FACW
2.			
3.			
4.			
5.			
	85	= Total Cover	
Herb Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
		= Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
		= Total Cover	

% Bare Ground in Herb Stratum 15 % Cover of Biotic Crust

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks: The vegetation at this sampling point is strongly hydrophytic

SOIL

Sampling Point: SP-4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10 YR 2/1	100	5 YR 6/3	2	C	M	clay	
4-18	10 YR 6/3	98	5 YR 6/3	1	C	M	loamy sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: -

Depth (inches): -

Hydric Soil Present? Yes X No ___

Remarks: Soil at sampling point is considered hydric.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- x Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- x FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): -

Water Table Present? Yes ___ No X Depth (inches): -

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): -

Wetland Hydrology Present? Yes x No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available: n/a

Remarks: Hydrology indicators are present at this sampling point.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Paradise Cove | City/County: Yuma, Arizona | Sampling Date: 3/19/2013

Applicant/Owner: U.S. Border Patrol | State: AZ | Sampling Point: SP-5

Investigator(s): Michael Nieto | Section, Township, Range: Sections 28 and 29, T16S, R22E

Landform (hillslope, terrace, etc.): terrace | Local relief (concave, convex, none): none | Slope (%): 0-2

Subregion (LRR): D | Lat: 32.73494 | Long: -114.67111 | Datum:

Soil Map Unit Name: Indio silt loam | NWI classification: Freshwater Forested/ Shrub

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation , Soil , or Hydrology significantly disturbed? N Are "Normal Circumstances" present? Yes X No

Are Vegetation , Soil , or Hydrology naturally problematic? N (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?**	**Yes** **No** X
Hydric Soil Present?	Yes	No X		
Wetland Hydrology Present?	Yes	No X		

Remarks: Sampling point taken within arrowweed/saltcedar scrub on floodplain terraces.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot size:)			
1. *Pluchea sericea*	60	Y	FACW
2. *Tamarix ramosissima*	15	N	NI
3. *Prosopis glandulosa var. torreyana*	7	N	UPL
4.			
5.			
	82	= Total Cover	
Herb Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	0	= Total Cover	
Woody Vine Stratum (Plot size:)			
1.			
2.			
	0	= Total Cover	

% Bare Ground in Herb Stratum 18 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

Prevalence Index is ≤3.0[1]

Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks: Vegetation at this sampling is hydric.

SOIL

Sampling Point: SP-5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10 YR 3/3	100					clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5) (**LRR C**)
___ 1 cm Muck (A9) (**LRR D**)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) (**LRR C**)
___ 2 cm Muck (A10) (**LRR B**)
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: -

Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks: No hydric soil indicators were observed at this sampling location. Soil at this location is within a stablized floodplain and does not appear to be problematic.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1) (**Nonriverine**)
___ Sediment Deposits (B2) (**Nonriverine**)
___ Drift Deposits (B3) (**Nonriverine**)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-Stained Leaves (B9)
___ Salt Crust (B11)
___ Biotic Crust (B12)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water Marks (B1) (**Riverine**)
___ Sediment Deposits (B2) (**Riverine**)
___ Drift Deposits (B3) (**Riverine**)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Thin Muck Surface (C7)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No X Depth (inches): _____

Water Table Present? Yes _____ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No X Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Although salt deposits were obsered throughout the area, they appeared to be efflorescent in nature and not acceptable as an ACOE primary hydrology indicator.

Attachment 2
Photographs

PHOTOGRAPH 1: Arrowweed seasonally flooded shrubland vegetation on a relatively xeric terrace within the project area.

PHOTOGRAPH 2: Common reed western North America temperate semi-natural herbaceous vegetation near a low-flow channel within the project area.

PHOTOGRAPH 3: Broadleaf cattail western herbaceous vegetation in a low-flow channel within the project area.

PHOTOGRAPH 4: Grubbed area adjacent to access road in southwestern corner of the project area.

PHOTOGRAPH 5: Central grubbed area across jurisdictional wetlands. Two water pumps and 12-inch-diameter water pipe were observed.

PHOTOGRAPH 6: Central grubbed area across jurisdictional wetlands.

PHOTOGRAPH 7: Detail of pump drawing water from main channel of the Colorado River in central grubbed area.

PHOTOGRAPH 8: Detail of spigot at southern terminus of water pipe in central grubbed area.

PHOTOGRAPH 9: Detail of a makeshift culvert crossing jurisdictional wetlands in central grubbed area.

PHOTOGRAPH 10: Resprouting common reed near water pipe in central grubbed area.

ATTACHMENT 6
Paradise Cove West Topographic Survey

Image source: NAIP (flown April 2016

0 Feet 450

Project Boundary

Paradise Cove West Topographic Survey

APPENDIX F

Paradise Cove West Topographic Survey

RECON

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ATTACHMENT 7
Cost Breakdown

Cost Estimate

Earthwork

The largest component of installation cost would likely be earthwork necessary to prepare, excavate, and grade the site to achieve appropriate surface, drainage patterns, and elevations above groundwater to support the different vegetation types. Clearing and grubbing would be necessary to prepare the site. The CY of cut and fill required to meet the desired site elevations is estimated to be approximately 150,000 cubic yards. Excavation quantities have been designed to meet the ideal conditions for establishment of vegetation. The Balanced Wetland Concept would require movement, but no export of material. A cost of $5 per CY has been used for this estimate, although this may vary at the time of contracting. Clearing and grubbing is presented as a lump sum and would include the preliminary clearing of all invasive species (e.g., common reed and saltcedar).Clearing would be accomplished through the use of heavy equipment removing material and depositing biomass in containers for off-site disposal.

Earthwork would be significantly higher cost during Phase 1 due to the construction of the central area including the pumping station, culverts, road stabilization, and graded and leveled fields. Earthwork in subsequent phases would primarily be focused on field establishment and transitional slopes. Cost for mobilization would be assumed during each phase.

Irrigation and Water Control

A fenced pumping station would be installed in the central area of the project area to pump water directly (via a diesel-fueled pump) from the Colorado River to support restoration plantings. Two modes of irrigation would be used:

- **Flood Irrigation via Concrete-lined Irrigation Canals.** A concrete-lined irrigation canal would span the length of the site to serve the plantings. The ditch would be 1–2 feet wide at the base and 2–3 feet in depth, and would run along the northern edge of the site (adjacent to the riverside berm/access road. Diversion outlets would be manually controlled and allow flood irrigation of planted areas.
- **Flood Irrigation via the Improved Main Channel.** The willow-enhanced wetland would be connected to the river via a culvert that would flush the system during high water events.
- **Temporary Overhead System**. The mesquite woodland would require the purchase/rental of irrigation equipment for a minimum of two years. The system would include a second pumping system, a temporary mainline and a series lateral sprinkler pipes/heads.

Costs associated with the irrigation systems include installation of a pump station, including fencing and diesel powered pump; concrete-lined irrigation canals and diversion outlets; culverts; weirs; and road stabilization.

Additional costs associated with water control would be the installation of a culvert under the green firebreak access road through the central portion of the project area. This culvert would have a minimum opening of 9.5 square feet (area) box design with a flared inlet and outlet.

Cost for irrigation would be highest during Phase 1 due to the installation of the pumping station, upstream concrete swale, and culverts. Phase 3 would entail the completion of the concrete swale downstream of the pumping station. No irrigation construction cost is assumed in Phase 2

Plant Material Installation

The estimated cost for installation of plant materials per acre varies by vegetation type. Each vegetation type is associated with a unique planting density, species palette, and suite of planting units, as described below:

- **Willow-enhanced Wetland.** The willow-enhanced wetland would be installed along the existing and improved channel that bisects the project area.
- **Cottonwood–Willow.** The cottonwood–willow vegetation type would include densely planted willow cuttings, and cottonwood poles, and 5-gallon cottonwood and willow plants. The 5-gallon plantings would be protected from herbivory with wire cages, and the area would also be with seeded with native species.
- **Mesquite Woodland.** The mesquite woodland vegetation type would utilize tall pot container plants. The tall-pot plantings would be protected from herbivory with wire cages, and the area would also be with seeded with native species.

Cost for plant material is based on a per acre basis regardless of phase.

Maintenance and Monitoring

CBP would conduct maintenance and monitoring of the site for a 10-year period, as provided in the CBP ROW grant. Due to the design of the site, site maintenance would be required in perpetuity. CBP would provide maintenance of the site for a period of 10 years. Each maintenance and monitoring period would begin at the conclusion of each phased implementation. Overall cost of maintenance and monitoring would increase, as the size of area treated increases. However, cost for treatment of invasive species would decrease over time, as native plants would dominate the area.

Overall Installation Cost

The total estimated cost for installation of revegetation components (including site preparation, irrigation, and planting) at Paradise Cove West is approximately $2.4 million (Table A). The per-acre cost for installation would be approximately $46,000.

Table A Total Estimated Installation Costs				
	Unit	Unit Cost	Quantity	Total
Management				
Project construction management	LS	$70,000	1	$70,000
Subtotal				**$70,000**
Site Preparation				
Clearing and excavation	LS	$148,000	1	$148,000
Grading and field leveling	CY	$5	150,000	$750,000
Culvert (green fuel break)	LS	$18,000	1	$18,000
Gates / signs	LS	$10,000	5	$50,000
Subtotal				**$966,000**
Irrigation Installation				
Cottonwood–willow	AC	$3,500	28	$98,000
Irrigation canal	LF	$45	6000	$270,000
Divisions / outlets	EA	$2,500	13	$32,500
Pump / fittings	EA	$45,000	1	$45,000
Pump / lock box	EA	$20,000	1	$20,000
Pump station fencing	LS	$20,000	1	$20,000
Overhead irrigation system	LS	$150,000	1	$150,000
Road stabilization	LS	$145,000	1	$145,000
Culvert	EA	$15,500	3	$46,500
Subtotal				**$826,000**
Planting				
5-gal	EA	$20	2,800	$56,000
Poles	EA	$8	32,020	$256,160
Cuttings	EA	$2	37,380	$74,760
Tall pots	EA	$40	380	$15,200
Plugs	EA	$4	13,400	$53,600
Plant protection	EA	$10	3,180	$31,800
Seeding	AC	$1,500	29.2	$43,800
Subtotal				**$531,320**
	TOTAL			**$2,393,320**
AC = acre; EA = each; CY = cubic yard; LF = linear feet; LS = lump sum				

Overall Operations and Maintenance Cost

The total estimated cost for 10 years of O&M of the revegetation project at Paradise Cove West is approximately $1,800,000 (Table B). O&M includes maintenance of irrigation system components, treatment of invasive species, road maintenance, and monitoring and reporting.

Table B Total Estimated Operations and Maintenance Costs				
	Yrs 1–2	Yrs 3–5	Yrs 6–10	Total
Operations & Maintenance				
Pump station (including fuel)	$66,800	$70,200	$117,000	$254,000
Gates/signage repair	$10,000	$12,000	$35,000	$57,000
Irrigation and infrastructure	$250,000	$180,000	$125,000	$555,000
Invasive species treatment	$180,000	$225,000	$125,000	$530,000
Road maintenance	$60,000	$60,000	$45,000	$165,000
Monitoring & reporting	$65,000	$97,500	$112,500	$275,000
Sub-total	**$631,800**	**$644,700**	**$559,500**	
Average annual cost	**$315,900**	**$214,900**	**$111,900**	
			10-year Total Cost	**$1,836,000**

Phased Approach Cost

A phased approach for implementation has been developed due to anticipated annual financial limitations. This approach to the Balanced Wetland Concept entails implementing the project in three distinct phases. Each phase would build upon each other until the entire site is implemented. Due to the requirements of mobilization and the cost benefits in implementing certain facets in their entirety (e.g., concrete lining), each phase would not be a replicate but an extension of the preceding work.

The phases have been divided as follows (Figure 8 depicts the phasing approach):

Phase 1 is the most complex phase, since it entails the creation of the primary infrastructure that would be used through all phases. Phase 1 components include;

- Pumping station (pump, intake, generator, fence)
- "Bareground" (agricultural lease) stabilization for access to pumping station
- Access road stabilization [to pumping station, upstream northern boundary (~4,000 linear feet)
- Upstream concrete lined irrigation swale (~3,800 feet); diversion outlets (9)
- Culverts (at pumping station, across central wetland, and at upstream weir)
- Box culvert under green fuel break
- Gates (3) and signage
- Vegetation – 17.2 acres of cottonwood–willow; three graded and leveled fields and associated berms

Phase 2 consists of additional vegetation supported by infrastructure created during Phase 1:

- Vegetation—5.6 acres of cottonwood–willow and 7.9 acres of willow-enhanced wetland One graded and leveled field, associated berms, and re-contoured central wetland

Phase 3 effort is focused downstream of the pumping station; Phase 3 components include;

- Access road stabilization [downstream northern boundary (1,600 linear feet); diversion outlets (4)]
- Gates (2) and signage
- Vegetation—8.8 acres of cottonwood–willow, 6.0 acres of willow-enhanced wetland, and 4.34 acres of mesquite woodland; including three graded and leveled fields and associated berms, and re-contoured central wetland
- Temporary overhead irrigation for mesquite woodland

Table C details the anticipated cost for implementation for each phase.

Table C Phased Approach Implementation Costs								
	Unit	Unit Cost	Phase 1 Quantity	Total	Phase 2 Quantity	Total	Phase 3 Quantity	Total
Management								
Project construction management	EA	$20,000	2	$40,000	1	$20,000	1	$20,000
Subtotal				**$40,000**		**$20,000**		**$20,000**
Site Preparation								
Clearing and excavation	AC	$4,150	16	$66,400	7	$29,050	13	$53,950
Grading and field leveling	CY	$5	65,000	$325,000	35,000	$175,000	50,000	$250,000
Culvert (green fuel break)	LS	$18,000	1	$18,000	-	-	-	-
Gates / signs	EA	$10,000	4	$40,000	-	-	1	$10,000
Subtotal				**$449,400**		**$204,050**		**$313,950**
Irrigation Installation								
Cottonwood–willow	AC	$3,500	13.6	$47,600	5.6	$19, 600	8.8	$30,8000
Irrigation canal	LF	$45	4000	$180,000	-	-	2000	$90,000
Divisions / outlets	EA	$2,500	9	$22,500	-	-	4	$10,000
Pump / fittings	EA	$45,000	1	$45,000	-	-	-	-
Pump / lock box	EA	$20,000	1	$20,000	-	-	-	-
Pump station fencing	LS	$20,000	1	$20,000	-	-	-	-
Overhead irrigation system	LS	$150,000	-	-	-	-	1	$150,000
Road stabilization (inc. addtl. mobs)	LF	$33	3,825	$126,225	-	-	2,138	$70,554
Culvert	EA	$15,500	3	$46,500	-	-	-	-
Subtotal				**$507,825**		**$19,600**		**$351,354**
Planting								
5-gal	EA	$20	1,340	$26,800	560	$11,200	880	$11,600
Poles	EA	$8	13,400	$107,200	7,910	$63,280	11,910	$95,280
Cuttings	EA	$2	13,400	$26,800	10,990	$21,980	15,590	$31,180
Tall pots	EA	$40	-	-	-	-	380	$15,200
Plugs	EA	$4	-	-	7,700	$30,800	5,700	$22,800
Plant pProtection	EA	$10	1,340	$13,400	560	$5,600	1,260	$12,600
Seeding	AC	$1,500	13.4	$20,400	5.6	$8,400	10.2	$15,300
Subtotal				**$194,600**		**$141,260**		**$203,960**
PHASE IMPLEMENTATION TOTAL				**$1,191,825**		**$384,910**		**$889,264**
OVERALL TOTAL								**$2,465,999**

Each phase would be maintained and monitored for a period of 10 years; the cost presented in Table D anticipates implementation taken place over a three-year period. Additional cost may be applicable if implementation is delayed over a longer period.

Table D
Phased Approach Operations and Maintenance Cost

	Unit	Year 1 (Phase 1) Quantity	Total	Year 2 (Phases 1–2) Quantity	Total	Year 3 (Phases 1–3) Quantity	Total	Years 4–5 (Phases 1–3) Quantity	Two-year Total	Years 6–10 (Phases 1-3) Quantity	Five-year Total
O&M											
Gates / signs	EA	4	$8,000	4	$8,000	5	$10,000	5	$20,000	5	$50,000
Pump station (including fuel)	EA	1	$33,400	1.25	$41,750	1.5	$50,100	2	$66,800	2	$66,800
Irrigation and infrastructure	EA	1	$80,000	1.25	$100,000	1.5	$140,000	1.5	$140,000	1.5	$140,000
Invasive species	AC	13.6	$39,440	26.9	$78,010	42.8	$124,120	42.8	$179,760	42.8	$449,400
Monitoring & reporting	YR	1	$25,400	1	$25,400	2	$50,800	2	$50,800	3	$76,200
Total			**$186,240**		**$253,160**		**$375,020**		**$457,360**		**$782,400**
Average annual cost			**$186,240**		**$253,160**		**$375,020**		**$228,680**		**$156,480**

O&M = operations and maintenance; EA= each; AC= acre; YR = year

Attachment 8
Species Treatment

Invasive plant species that are either known to occur or that could potentially occur at the Paradise Cove West site are described below, along with management options. This list is not all-inclusive, and invasive species management needs would be further identified during project monitoring.

A. Athel Tree (*Tamarix aphylla*)

- Nativity: North Africa, Middle East, and India.
- Plant type: Athel tree is a large growing (up to 40 feet tall), arborescent, evergreen to semi-evergreen tamarisk. The bark is reddish brown to gray in color on large, distinctive trunks.
- Leaves: Foliage is gray in color, twigs look jointed, and scale-like leaves are typically *not* overlapping.
- Flowers: Flowering occurs from May to July. The flowers are white to pale pink born on mostly compound racemes.
- Mechanical Control: During site preparation and clearing, athel trees can be cut, bulldozed, and stumps removed. It is important that the entire root mass is removed, and that follow-up control of resprouts and new plants is scheduled.
- Chemical Control: Triclopyr is the herbicide most commonly cited as effective in controlling athel tree. There are several chemical methods of treatment for athel tree:
    - The National Park Service (NPS) uses the **hack-and-squirt** method at Lake Mead National Recreation Area. This method allows trees to remain in place as they are killed and involves cutting through the bark/cambium layers and immediately applying herbicide to the wound.
    - In the **cut-stump** method, trees are cut down, and herbicide is immediately applied directly to the cut stump.
    - **Foliar spray** is a method that is useful in controlling young athel trees; herbicide is applied directly to the leaves.
- Treatment Schedule: Mechanical removal of trees can occur in conjunction with grubbing and clearing activities associated with project implementation. Foliar herbicide application should occur during the summer monsoon active growing period; hack and squirt and cut-stump treatments should be conducted in the fall.

B. Bermuda Grass (*Cynodon dactylon*)

- Nativity: East Africa.

- Plant type: Bermuda grass is a turf-forming grass that spreads by seeds, stolons, and rhizomes.

- Prevention: New infestations of Bermuda grass can be greatly reduced or prevented by minimizing soil disturbance and maintaining plant cover that shades soil surfaces (Chambers and Hawkins 2002). BMPs that limit ground disturbance should be encouraged; only weed-free materials should be used in the project area.

- Mechanical Control: Bermuda grass may be controlled with mulches of black polyethylene plastic or geotextile landscape fabric that block out all light in monotypic stands. The grass should be mowed and irrigated, plastic placed over the plants, and plastic left intact (without any holes) for at least six to eight weeks in summer. Placing plastic over Bermuda grass in winter will not control it. It is important to make sure that the plastic remains intact without holes, or Bermuda grass will grow through the holes and survive.

  Clear plastic mulching (solarization) is effective for eradication of Bermuda grass plants and seed if it is applied during periods of high solar radiation. Before applying the plastic, closely mow the Bermuda grass, remove the clippings, and water the area well. It is not necessary to cultivate before solarization, but a shallow cultivation may improve control. Place clear, ultraviolet-protected polyethylene over the area. The plastic should extend roughly two feet beyond the Bermuda grass stolons to make sure that the infested area is covered; it must be maintained intact for four to six weeks. Shade will reduce the effectiveness of solarization, because it limits the amount of radiation. After solarization, do not cultivate the area deeper than three inches to avoid bringing invasive species seed into the upper soil layer. Solarization is the only effective way to kill seeds in the soil.

- Chemical Control: Post-emergent herbicides can be used when Bermuda grass is actively growing (late spring–summer). Selective herbicides should be applied in early spring, when new Bermuda grass growth is less than six inches in height, then reapplied before the regrowth reaches six inches in height. Additional applications may be needed as new growth occurs. Follow label directions to ensure that any annual limits of application are not exceeded. Control will be increased if the plant is growing well with plenty of leaf area. Plants that are drought stressed, insect damaged, or have dust on their leaves will not be controlled.

  Glyphosate is a non-selective herbicide that kills both the tops of the plant and the roots. For it to be most effective, it must be applied to vigorously growing Bermuda grass that is not water stressed. Do not mow the Bermuda grass for two to three weeks before applying it, and withhold water for two to three days after an application. For even more effective control, spray the area with glyphosate, leave it for up to seven days, then cultivate the area to cut surface stolons, and bring

rhizomes to the surface to dry out. If the area is not cultivated, another application of glyphosate may be necessary when this invasive species begins to grow again.

- Treatment Schedule: If using the mulching method is used to control Bermuda grass, application must occur during the hot summer months. Herbicide application should occur during vigorous, active growth (late spring–summer). Follow-up control should occur at least twice per year. A monsoon treatment regime could include herbicide application during the last week of August with two additional treatments, 10 days apart (three treatments total for end of season eradication).

C. Buffelgrass (*Pennisetum ciliare*)

- Nativity: Africa.

- Plant type: Perennial bunchgrass. Plants quickly respond to moisture by turning bright green; during dry periods, the plants become a golden brown. Previous season's growth remains on the plant and fades to a light gray.

- Leaves: Buffelgrass has a hairy ligule (area where the leaf blade diverges from the stem); when the leaf blade is pulled slightly away from the stem, delicate hairs are obvious. The leaf blade contains small stiff hairs so if you run your fingers gently along the blade from the stem to the tip of the leaf, it will feel 'rough.'

- Flowers: The seeds develop on the end of a stalk, which has a slightly fuzzy appearance that looks like a bottlebrush. The central stem that used to contain the inflorescence seeds is extremely rough if you run your fingers from the bottom to the top.

- Prevention: BMPs that limit ground disturbance should be encouraged; only weed-free materials should be used in the project area.

- Mechanical Control: Small populations (≤ 25 plants) can be removed manually. Individual plants should be removed completely—including the root crown in its entirety (as this plant will resprout)—by shovel or digging bar. Dug plants should be bagged and removed from the project area. Infestations need to be monitored and retreated for at least two years following initial treatment.

- Chemical Control: Buffelgrass should be treated with glyphosate or triclopyr while it is actively growing, generally during the summer rain season. Chemical control works best when treating a solid stand of buffelgrass. A special glyphosate product will be used near riparian areas or other open water.

- Treatment Schedule: Mechanical removal of buffelgrass can be scheduled any time of year. Herbicide should be applied while the plants are green and actively growing, usually during the summer monsoon season. Follow-up control is critical no matter which treatment option is chosen and should occur at least twice per year.

D. Common Reed (*Phragmites australis*)

- Nativity: Cosmopolitan. Common reed has been present in North America for at least 40,000 years, according to the fossil record, but has increased dramatically in North America in the last 150 years. Scientists hypothesize that non-native genotypes of this species have "cryptically invaded" native populations, contributing to its increased dominance (Saltonstall 2002; Swearingen and Saltonstall 2010).

- Plant type: Common reed is a stout and erect perennial grass that can reach 20 feet in height. Dense stands are created along water courses and seeps by an extensive rhizome and stolon network.

- Leaves: The stems are hollow, leafy, and branchless, with leaves measuring 4 to 20 inches in length and 0.4 to 2 inches in width.

- Flowers: Flowering occurs from July through October, but new plants are rarely produced by seed.

- Prevention: Early detection and extraction by hand tools of small clumps. It is critical to remove all subsurface rhizomes and stolons to avoid re-infestation. All debris produced from manual cutting or digging should be bagged and removed from site.

- Mechanical Control: Mechanical removal can be done with shovels and pry bars if the clumps are less than 6.5 feet tall, but large clumps require large machinery such as a backhoe. Plants should first be exposed/isolated from surrounding plants and other obstacles, removed by digging, and then material should be bagged and removed from the site. It is imperative that all of the roots and leaves are removed, as this plant can become re-established from any material left on-site. Mechanical removal can result in excessive ground disturbance, leaving a site vulnerable to re-infestation by common reed or another invasive species.

- Chemical Control: The key to common reed removal is killing of the root mass. This requires treatment of the plant with a systemic herbicide at appropriate times of the year to ensure translocation to the roots. Currently, Rodeo® and Aquamaster® are the only glyphosate-based herbicides that are approved for use in wetlands and that have proven very effective against common reed. The herbicide treatment should include a foliar application of a 2–5 percent solution (or at the manufacturer's recommendation) applied post-flowering and pre-dormancy at a rate of 0.5 liter to 1 hectare (0.2 to 0.6 liter/acre; Bell 1996). During this time, usually mid-August to early November, the plants are actively translocating nutrients to the root mass in preparation for winter dormancy, which results in effective movement of herbicide to the roots. Two to three weeks after foliar herbicide application, the leaves and stems should begin to brown and soften.

- Treatment Schedule: Mechanical removal can occur any time of year; herbicide application should occur between mid-August and early November.

E. Giant Reed (*Arundo donax*)

- Nativity: Mediterranean Basin or warmer regions of the Old World.

- Plant type: Giant reed is a robust perennial grass 9 to 30 feet tall, growing in many-stemmed, cane-like clumps, spreading from horizontal rootstocks below the soil, and often forming large colonies many meters across.

- Leaves: The light green leaves diverge from the stem in a distinctive herringbone pattern. This species can be distinguished from common reed by inspecting the leaf nodes, which do not have hairs.

- Reproduction: This species reproduces vegetatively, either from underground rhizome extension or from plant fragments carried downstream, primarily during floods, to become rooted and form new clones. These fragments can develop new shoots when buried under one to three meters of silt/debris. Arundo is also capable of spreading and expanding clumps through "layering"—the adventitious sprouting of leaves when they contract soil (Boland 2006). Large colonies of this species typically occur in low-gradient riparian areas and floodplains of medium to large streams. Scattered colonies occur in moist areas or springs and on steeper slopes of dry riverbanks.

- Prevention: Boland (2006) found that clumps of arundo within the flood zone spread faster than those outside of the flood zone on the Tijuana River in California. It may be a good strategy to prioritize treatment of plants in the flood zones. All debris produced from manual cutting or digging should be bagged and removed from site.

- Mechanical Control: Mechanical removal can be done with shovels and pry bars if the clumps are less than 6.5 feet tall, but large clumps require large machinery such as a backhoe. Plants should first be exposed/isolated from surrounding plants and other obstacles, removed by digging, and then material should be bagged and removed from the site. It is imperative that all of the roots and leaves are removed, as this plant can become reestablished from any material left on-site. Mechanical removal can result in excessive ground disturbance, leaving a site vulnerable to re-infestation by arundo or another invasive species.

  An effective practice is to cut or mow an infested area, allow resprouting, and returning three weeks to three months later when plants are three to six feet (1–2 m) tall and treat the new growth by foliar spraying of glyphosate (Dudley 2000).

- Chemical Control: The key to all giant reed removal is killing of the root mass. This requires treatment of the plant with a systemic herbicide at appropriate times of the year to ensure translocation to the roots. The herbicide treatment should include a foliar application of a 2–5 percent solution (or at the manufacturer's recommendation) applied post-flowering and pre-dormancy at a rate of 0.5 liter to 1 hectare (0.2 to 0.6 liter/acre; Bell 1996). During this time, usually mid-August to early November, the plants are actively translocating nutrients to the root mass in

preparation for winter dormancy that results in effective movement of herbicide to the roots. Two to three weeks after foliar herbicide application, the leaves and stems should begin to brown and soften.

Imazapyr has been shown to be more effective than glyphosate in treating giant reed in southern California restoration projects, requiring only one treatment as opposed to five or more years of re-treatment. There is, however, some concern regarding impacts to adjacent deep-rooted vegetation (e.g., willows; Pete Tomsovic, personal communication 2009).

- Treatment Schedule: Giant reed should be removed as soon as it is detected; seasonality is not important for mechanical removal, but herbicide application should occur once flowering is complete (late summer) and before winter dormancy. Follow-up control should occur at least twice per year. Treatment of regrowth is most effective from March through July.

F. Johnson Grass (*Sorghum halepense*)

- Nativity: Mediterranean.

- Plant type: Large perennial bunchgrass that can easily reach heights over 6 feet tall.

- Leaves: Bright green leaves.

- Reproduction: It spreads both by seeds and by rhizomes, and can be dispersed by wind, water, and wildlife. Dormant seed can survive for at least six years under field conditions, and it has been estimated that some seed may remain viable for up to 15 years.

- Prevention: BMPs that limit ground disturbance should be encouraged; only weed-free materials should be used in the project area. Johnson grass is very difficult to control. The best strategy is to keep it from invading and remove any individuals that begin to establish (Chambers and Hawkins 2002).

- Mechanical Control: For small infestations, the entire plant should be removed manually. It is critical to remove the deep rhizomes. This species should be bagged and hauled off-site, because leaf fragments as small as 2.5 centimeters can produce new plants from depths to about 10 centimeters. Plants cannot tolerate repeated, close mowing (UNLV 2010).

- Chemical Control: Glyphosate and dalapon are recommended herbicides for control, and can be more effective if rhizomes are fragmented prior to treatment, as this breaks their dormancy and allows the herbicide to translocate (Mau-Crimmins et al. 2005). The University of Las Vegas recommends the use of sethoxydim, fluazifop, or fenoxaprop prior to the development of the flower stalk and imazapic or glyphosate if the flower stalk is present (UNLV 2010).

Some biotypes are resistant to herbicides; rotation of herbicides used may prevent development of herbicide resistance.

- Treatment Schedule: Plants may be removed at any time of the year but is preferable before flowering. Herbicide is most effective if applied in the fall (NPS 2004). This species is actively growing during the summer monsoon season.

G. Little Mallow / Cheeseweed (*Malva parviflora*)

- Nativity: Mediterranean.

- Plant type: Little mallow is an annual or biennial herbaceous plant that can grow up to four feet tall. Plants do not survive temperatures below freezing.

- Leaves: Leaves of seedlings are heart-shaped with smooth edges, and the first true leaves are nearly circular or heart-shaped with a notch where the petiole attaches to the leaf. Mature leaves have five to seven lobes and are crinkly in appearance.

- Flowers: Flowers are inconspicuous. Reproduction is by seed, although under favorable conditions stem fragments with nodes can develop adventitious roots and new shoots. The hard seed coat allows this plant's seed to remain dormant for 100 years.

- Prevention: BMPs that limit ground disturbance should be encouraged; only weed-free materials should be used in the project area.

- Mechanical Control: Hand-remove young plants before long, tough taproot develops. Cut taproot below crown to remove older plants.

- Chemical Control: Young plants can be treated with 2,4-D, glyphosate, or various other herbicides. Seeds can germinate at soil depths of one to two inches, allowing them to escape many pre-emergent herbicides.

- Treatment Schedule: Little mallow should be removed or treated with herbicide during the spring.

H. London Rocket (*Sisymbrium irio*)

- Nativity: Eurasia.

- Plant type: London rocket is a highly competitive winter annual that usually grows to about two feet tall.

- Leaves: The edges of the first true leaves of seedlings are often somewhat indented, and most or all of the early leaves are deeply indented.

- Flowers: The stems of mature plants bear long, tubular seedpods and have a small cluster of yellow flowers at the tip.

- Prevention: BMPs that limit ground disturbance should be encouraged; only weed-free materials should be used in the project area.

- Mechanical Control: Small infestations can be removed by hand prior to seed set.

- Chemical Control: NPS (2004) identifies glyphosate as an appropriate herbicide. London rocket is resistant to Group B/2 herbicides, known as acetolactate synthase inhibitors; this group includes the commonly used active ingredient imazapyr.

- Treatment Schedule: London rocket should be removed or treated with herbicide during the spring, prior to flowering and fruit set.

I. Malta Starthistle (*Centaurea melitensis*)

- Nativity: Europe, Mediterranean region.

- Plant type: Malta starthistle is an erect winter annual.

- Leaves: Gray–green foliage starts as a basal rosette with deeply lobed leaves.

- Flowers: Yellow spiny flower heads bloom in May and June. The flower head stems are distinctively winged, and the flower head spines are branched at the base.

- Prevention: BMPs that limit ground disturbance should be encouraged; only weed-free materials should be used in the project area. Early detection via monitoring is critical to preventing infestations of this plant.

- Mechanical Control: There are several mechanical methods for treating Malta starthistle, including:

    - **Hand-digging.** Small infestations can be hand-dug. This is especially effective on new introductions. Care should be taken not to spread seeds when hand-pulling. Placing the pulled plants in a garbage bag is a good measure to prevent seed spread.

    - **Tilling.** For large-scale infestations, tilling so that the roots are separated below the soil surface should provide complete control of these plants.

    - **Weed whipping or mowing** can be used effectively. Mowing is best when conducted at a stage where 2 to 5 percent of the seed heads are flowering and only when the lowest branches of plants are above the height of the mower blades (Cal-IPC 2009).

- Chemical Control: Mature plants are harder to control than immature plants in the rosette stage. During the rosette stage and prior to bolting, aminopyralid, 2,4-D, clopyralid, or dicamba can be used; picloram can be applied anytime from rosette to flower bud stage (UNLV 2010). NPS notes that clopyralid is very selective and

effective, with low rates of application needed and that glyphosate is effective at 1 percent solution (Mau-Crimmins et al. 2005).

- Treatment Schedule: Early detection and treatment is critical, because once the plants flower, they can produce viable seeds within eight days (Chambers and Hawkins 2002). Herbicides should be applied in the spring, prior to seed set. Tilling and/or mowing should be done when soil is dry and rainfall is not expected. Repeated treatment should be expected (DiTomaso and Gerlach 2000).

J. Mexican Paloverde (*Parkinsonia aculeata*)

- Nativity: Mexico and tropical America. Felger et al. (2001) noted that this tree has become naturalized throughout the arid sub-tropics and tropical regions of the world, and that its original distribution is difficult to discern due to its weedy nature and extensive naturalization. That said, it is estimated that its original range included Central America and southern Mexico.

- Plant type: Mexican paloverde is a small multi-trunked tree or shrub that grows 15–30 feet tall. Bark is yellowish green, sometimes with gray scars.

- Leaves: It is distinguished from the native paloverde (*Parkinsonia florida* and *P. microphylla*) by its long leaf rachises and generally weeping appearance. Leaves are bipinnately compound with up to 30 leaflets.

- Flowers: Bright yellow flowers have a distinctive reddish–brown banner petal (sometimes only a few red spots/marks).

- Mechanical Control: There are several mechanical methods of treatment for Mexican paloverde. Small individuals of Mexican paloverde trees should be removed by bulldozer or pulling with a tractor to effectively remove all roots. Larger trees can be cut down, and the stumps immediately treated with herbicide as described below. Seedlings should be pulled by hand or machine, as appropriate. Follow-up removal will be necessary as ground disturbance will encourage additional seedling germination and establishment.

- Chemical Control: Immediately (within 15 seconds) after Mexican paloverde trees are cut as close to the ground as possible, the stumps should be treated with herbicide (picloram or triclopyr have been successfully used) to prevent resprouting. In some cases, it may be preferable to leave mature trees in place due to habitat value for perching birds, reduction of ground disturbance, or expense. It is possible to kill these trees *in situ* by drilling holes in the trunk (near the base) and immediately injecting picloram or triclopyr into the holes. Trees should be monitored to ensure the herbicide's effectiveness.

- Treatment Schedule: During implementation; seasonality is not important for mechanical removal. Herbicide should be applied while the trees are actively growing in the summer. Follow-up control should occur at least twice per year.

K. Oleander (*Nerium oleander L.*)

- Nativity: Mediterranean.
- Plant type: Oleander is a perennial shrub or small tree up to 12 feet tall.
- Leaves: The leaves are simple, linear, 3–12 inches long, whorled around stem, glossy dark green on top, and lighter underneath.
- Flowers: Terminal clusters may be yellow, white, pink, or red and are produced in late spring.
- Prevention: BMPs that limit ground disturbance should be encouraged; only weed-free materials should be used in the project area.
- Mechanical Control: Small infestations of young individuals can be hand-dug with care to remove the entire root crown. Plant materials should be bagged, carried off-site, and properly disposed of.
- Chemical Control: Glyphosate can be used as either a foliar spray, drizzle, or cut stump application.
- Treatment Schedule: Removal or treatment can occur at any time and should be implemented as soon as this plant is detected

L. Puncture Vine (*Tribulus terrestris*)

- Nativity: Mediterranean.
- Plant type: Puncture vine is a mat-forming summer annual known for its woody, five-lobed bur, which breaks apart into nutlets with stout thorns that can puncture bicycle tires and injure humans and animals.
- Leaves: The hairy, pinnately compound green leaves are distinctive for a weed with a prostrate growth habit.
- Flowers: Flowers are yellow with five petals.
- Reproduction: Reproduction is by seed, which may remain viable for up to five years. Seedlings can produce flowers in three weeks and burs in six weeks.
- Prevention: BMPs that limit ground disturbance should be encouraged; only weed-free materials should be used in the project area.
- Mechanical Control: Manual removal must include the taproot.

- Chemical Control: Glyphosate, imazapyr, dicamba, chlorsulfuron, and 2,4-D can effectively reduce infestations; herbicides should be applied when the plants are young and actively growing – before fruiting stage.

- Treatment Schedule: Puncture vine should be removed or treated with herbicide during the summer monsoon active growing season.

M. Rabbitsfoot Grass (*Polypogon monspeliensis*)

- Nativity: Southern and western Europe.

- Plant type: Rabbitsfoot grass is an upright winter annual grass that grows up to three feet tall. Plants can occasionally spread by stolons.

- Leaves: Leaves are flat and up to 12 inches long, rolled in the bud.

- Flowers: Dense panicles are up to seven inches long and fuzzy in appearance, pale green to yellowish tan in color.

- Prevention: BMPs that limit ground disturbance should be encouraged; only weed-free materials should be used in the project area.

- Mechanical Control: Small populations should be removed by hand (NPS 2004).

- Chemical Control: Undocumented, however glyphosate is likely to be effective.

- Treatment Schedule: Rabbitsfoot grass should be removed or treated with herbicide during the spring active growing season.

N. Ravenna Grass (*Saccharum ravennae*)

- Nativity: Southern and western Europe.

- Plant type: Ravenna grass is a perennial bunchgrass that grows up to nine feet tall with large plumes

- Leaves: Leaves are weakly serrated with hair bases (curled around the other leaves, below the blade joint).

- Flowers: Dense plumes are up to 12 inches long and fuzzy in appearance, pale green to yellowish tan in color.

- Prevention: BMPs that limit ground disturbance should be encouraged; only weed-free materials should be used in the project area.

- Mechanical Control: Small populations should be mowed, followed by chemical control.

- Chemical Control: Undocumented, however glyphosate is likely to be effective.

- Treatment Schedule: Ravenna grass should be removed or treated with herbicide during the spring active growing season.

O. Red Brome (*Bromus rubens*)

- Nativity: Europe, Mediterranean region.

- Plant type: Winter/spring annual grass, similar to cheatgrass, and usually less than 8 inches tall. Plants growing in arid regions, such as this project site, are generally less robust than those growing in wetter regions. This species reproduces by seed only; it emerges in early winter following rainfall, but remains inactive until spring, when rainfall combined with higher temperatures stimulate growth. Typically, plants continue to grow through May.

- Flowers: Red brome has a brush-like inflorescence that becomes reddish–purplish in color as plants mature. The seed-bearing spikelets are very sharp and stiff and can become lodged in the fur, feet, ears, and eyes of native and domestic animals.

- Prevention: BMPs that limit ground disturbance should be encouraged; only weed-free materials should be used in the project area.

- Mechanical Control: Manual removal of plants through pulling and hoeing can be effective if done before seeds mature, but is usually feasible only with small infestations as it is labor intensive. In small infestations, covering the ground with mulch or black plastic (solarization) will reduce plant growth (Chambers and Hawkins 2002).

- Chemical Control: The NPS recommends the use of pre-emergent herbicides (such as soil-active atrazine at 11.2 kg/hectare) with one or two applications before seed set is usually sufficient (Mau-Crimmins et al. 2005). Use of pre-emergent herbicide should be considered carefully however, as the impacts to native vegetation can last for many years after treatment.

- Treatment Schedule: Plants should be treated in the early spring, immediately upon identification and prior to seed set.

P. Redstem Filaree / Storksbill (*Erodium cicutarium*)

- Nativity: Eurasia

- Leaves: Plants develop as a basal rosette with hairy leaves that are divided into three to nine individual leaflets arranged oppositely from one another. Leaflets are lanceolate in form and range from 1.25 to 8 inches long.

- Flowers: Pink–purple flowers with five petals. Reproduction is by seed. The fruit coils tighten under dry conditions and loosen under humid conditions to help drill seeds into the soil.

- Prevention: BMPs that limit ground disturbance should be encouraged; only weed-free materials should be used in the project area.

- Mechanical Control: Manual removal prior to seed set. Germination decreases when temperatures increase above 80 degrees Fahrenheit.

- Chemical Control: Plants can be treated with 2,4-D, dicamba, or glyphosate.

- Treatment Schedule: Foliar herbicide application in fall, winter, or early spring (germination stage) prior to seed set (NPS 2004).

Q. Russian Thistle / Tumbleweed (Salsola sp.)

- Nativity: Eurasia.

- Plant type: Russian thistle is a common annual that grows one to four feet tall and is common in disturbed areas. It forms a tumbleweed.

- Flowers: Inconspicuous flowers bloom from July to October.

- Reproduction: In the fall, the plant often breaks off at the ground and tumbles around dropping its seeds along the way. Russian thistle has high reproductive potential, with each plant capable of producing up to 250,000 seeds (Young et al. 1992). However, seed germination from soil seed bank drops off sharply after the first year and was not found to occur after year three in a four-year study in Canada (Crompton and Bassett 1985).

- Prevention: BMPs that limit ground disturbance should be encouraged; only weed-free materials should be used in the project area. Russian thistle can be suppressed if native vegetation can be established first.

- Mechanical Control: Russian thistle should be pulled by hand or hoed below ground level to remove the plant before the seed heads have formed. This species may need to be removed more than once in a growing season.

- Chemical Control: Russian thistle should be sprayed with the herbicide glyphosate when the plant is actively growing but prior to flowering. Herbicide application rates should wet the plant thoroughly; it is best to apply herbicide when the plants are seedlings, as it will require much less volume and may be more effective. Chemical control may be preferred in some situations to limit ground disturbance.

  2,4-D should not be used, as it can cause the plant to become tough and leathery, actually increasing its resistance to management (Mau-Crimmins et al. 2005).

- Treatment Schedule: Control methods should be applied before the plants set seed and while the plants are actively growing. Seeds are produced during the summer; by fall, the plant dries out, breaks off, and rolls away. Therefore, the optimal time to control Russian thistle is in the spring during active growth. Follow-up control should occur at least twice per year.

R. Sahara Mustard (*Brassica tournefortii*)

- Nativity: North Africa, the Middle East, and southern Europe.

- Plant type: Robust, fast-growing winter annual. The erect stem can be 4–40 inches in height, is branched extensively, and forms a tumbleweed once the plant dries up and the stem breaks.

- Leaves: A basal rosette of leaves with stinging hairs that can be up to three feet across under favorable conditions. The leaves smell like cabbage when they are crushed.

- Flowers: Flowers are small (less than ¼ inch) and pale yellow, with four petals that are arranged in an "X". Fruits are long, narrow seed capsules with a beaked tip; each plant can produce between 750 and 9,000 tiny seeds each (University of Nevada Cooperative Extension 2002).

- Prevention: BMPs that limit ground disturbance should be encouraged; only weed-free materials should be used in the project area.

  Control of Sahara mustard along roadsides will help prevent its spread to other areas. Do not drive vehicles or walk through infested areas once this plant has gone to seed, especially following a rain event, as the mucilaginous coating on the seeds allow them to stick onto objects and travel to new places. Repeated treatments and monitoring on small areas are preferable to diffuse treatments over wide areas, which may inadvertently increase the density of this plant (Trader et al. 2006).

  Early detection via monitoring is critical to preventing infestations of this plant.

- Mechanical Control: If an infestation is small, it is possible to remove the plants by digging them out of the ground or hand-hoeing. This is especially effective if the invasion is new and there is not a seed bank existing in the soil. It is important to do this prior to seed set and also to bag and remove the plants from the site. A site should be re-visited weekly in order to catch later-germinating plants, especially if there have been multiple rainfall events.

  Line-trimming or mowing are not effective means of control for this species, as the flowering stalks will regrow.

- Chemical Control: Sahara mustard is often the first winter annual to germinate in an area, making effective herbicide treatment possible while minimizing impacts to

non-target species. Triclopyr at 2 percent concentration has been effective at killing young rosette/early flowering plants at Lake Mead National Recreation Area (University of Nevada Cooperative Extension 2002). According to the NPS, Sahara mustard can also be controlled with 2,4-D or dicamba (1 pound/acre), or glyphosate (1.5 pound/acre; Mau-Crimmins et al. 2005). Application of post-emergent herbicides should be done prior development of seed pods and prior to the germination of desirable native species if possible.

- Treatment Schedule: Sahara mustard should be treated in the spring as soon as it is identified, preferably while it is in the rosette stage and absolutely before it flowers. Populations of this species must be vigilantly re-treated.

S. Saltcedar (*Tamarix* spp.)

- Nativity: Eurasia and Africa.

- Plant type: Saltcedar is a rhizomatous shrub that may occur as spotty to heavy infestations along drainages and shores of water bodies. Saltcedar is drought-tolerant and withstands lowered water tables as well as flooding (Carpenter 1998).

- Leaves: The scale-like leaves have salt glands. The bark is reddish–brown with smooth stems less than one inch in diameter.

- Flowers: Small, white to deep pink, and densely packed on racemes.

- Reproduction: Saltcedar is a prolific seeder, with as many as 50,000 seeds per plant per year, produced over a long period (April to October; Horton et al. 1960). Seeds are easily dispersed by wind, or as water moves through the watercourses that they occupy. The seeds remain viable only for a few weeks, but they germinate easily in saturated soil. Saltcedar can also reproduce vegetatively, if stems are buried in damp soil, as in a flooding situation ("layering").

- Prevention: Like many other invasive species, saltcedar is easily spread and difficult to eradicate. Therefore, early detection and control are critical to the successful control of this species. Most critical, however, is the reestablishment of natural hydrologic regimes if possible. Post-treatment monitoring is also essential, since saltcedar is capable of resprouting following treatment. Potential efficacy of large scale eradication efforts should be carefully considered prior to treatment.

- Mechanical Control: Cutting alone is not an effective means of controlling saltcedar, since it tends to resprout vigorously from roots and stumps. However, cutting to the stump and then immediately applying herbicide has been effective (see below).

  Seedlings and small plants may be successfully uprooted by hand if the entire root system can be removed.

- Chemical Control: Cut an individual saltcedar shrub as close to the ground as possible and immediately (in less than 30 seconds) apply a triclopyr or imazapyr herbicide to the perimeter of the cut stems. This method is most effective during fall months when the plants are actively translocating materials to their roots (Carpenter 1998). Foliar treatment of any resprouts is necessary.

  This method allows plants to be treated selectively, which especially important if there are also native species present.

- Treatment Schedule: Saltcedar should be immediately eradicated upon detection. All cut vegetative material should be bagged and carried off-site. Follow-up control should occur at least twice per year. It the cut-stump herbicide method is used, fall is the optimal time for treatment.

T. Southern Sandbur (*Cenchrus echinatus*)

- Nativity: Southern U.S., Mexico, Central and South America.

- Plant type: Southern sandbur is an erect summer annual grass up to two feet tall. The stems are slightly flattened in cross section and take on maroon coloration on the lower portions at maturity.

- Leaves: The eight-inch-long leaves can be smooth or have a sparse covering of long, soft hairs.

- Flowers: Flowers are produced in the fall with racemes up to three inches long. Flexible spines on the green fruit are arranged in a whorl.

- Prevention: BMPs that limit ground disturbance should be encouraged; only weed-free materials should be used in the project area.

- Mechanical Control: Hand removal is appropriate for small populations (NPS 2004).

- Chemical Control: Treat with glyphosate if soil disturbance is undesirable or hand removal is ineffective (NPS 2004).

- Treatment Schedule: Southern sandbur should be treated during the summer monsoon growing season.

U. Tree Tobacco (*Nicotiana glauca*)

- Nativity: Argentina.
- Plant type: Tree tobacco is an herbaceous perennial that grows into a shrub or small tree up to 20 feet tall.
- Leaves: The leaves are alternate, oval, two to eight inches long, grayish green, and somewhat succulent.

- Flowers: Yellow tubular flowers are produced from March to November.
- Prevention: BMPs that limit ground disturbance should be encouraged; only weed-free materials should be used in the project area.
- Mechanical Control: Small infestations of young individuals can be hand-dug with care to remove the entire root crown (GISD 2010). Plant materials should be bagged, carried off-site, and properly disposed of.
- Chemical Control: Oneto et al. (2004) found the following in field trials in California:
  - Glyphosate can be used either as a foliar spray, drizzle, or cut stump application.
  - Triclopyr provides excellent control when used in basal bark and cut stump treatments.
  - Herbicide application is only appropriate for individuals that have attained a very large size and/or for which mechanical removal would cause excessive damage or soil disturbance.
- Treatment Schedule: Removal or treatment can occur at any time and should be implemented as soon as this plant is detected to avoid seed spread.

V. Yellow Nutsedge (*Cyperus esculentus*)

- Nativity: Eurasia, West Africa.
- Plant type: Yellow nutsedge is a grass-like warm season perennial that grows in wet areas. Plants develop an extensive system of rhizomes, tubers, and roots. Under favorable conditions, one plant can produce hundreds to thousands of tubers in one season. One plant can develop into a dense colony three meters or more in diameter. Colony boundaries can increase more than one meter per year.
- Leaves: Foliage dies back with cool temperatures in fall, but tubers survive and sprout the following spring.
- Reproduction: Reproduction is by seeds and tubers.
- Prevention: BMPs that limit ground disturbance should be encouraged; only weed-free materials should be used in the project area.
- Mechanical Control: Limiting tuber production and draining tuber energy reserves by repeatedly removing small plants before the six-leaf stage (every two to three weeks in summer) can eventually control populations. Mature tubers can resprout up to 12 times.

  Shading or solarization can help to limit populations by weakening shoots and decreasing tuber formation, but matured tubers may not be eliminated.
- Chemical Control: Glyphosate can be used to kill yellow nutsedge. Mature nutsedge tubers are unaffected by systemic herbicides.
- Treatment Schedule: Apply herbicide during the summer monsoon active growing season.

APPENDIX C – Cultural Resource Compliance Documentation Record

Form AZ-8110-5 UNITED STATES DEPARTMENT OF THE INTERIOR
(January 2001) BUREAU OF LAND MANAGEMENT
ARIZONA STATE OFFICE

CULTURAL RESOURCE COMPLIANCE DOCUMENTATION RECORD

Project No:DOI-BLM-AZ-C020-2017-0028
Project Name: Paradise Cove West U.S. Customs and Border Protection Mitigation for Southwestern Willow Flycatcher
Special Recreation Permit/Case File No: N/A
Proponent/Institution: Bureau of Land Management, United States Department of Homeland Security, U.S. Customs and Border Protection
Cultural Resource Use Permit No: N/A
Project Manager: Erica Stewart, Biologist

Inventory Method: ☒Existing Data Review ☐Class II ☐ Class III ☐Waived

Eligibility Recommendation:

Not-eligible sites (list site numbers):
Eligible sites (list site numbers):

Effect Recommendation (only on eligible sites from above):

☒ No Historic Properties Affected ☐ Adverse Effect

☐ No Adverse Effect

Treatment Recommendations: (check and attach full description and map(s) as needed)

☐ Avoidance (by project redesign/cancellation, etc.)

☐ Physical or administrative protection measures

☒ Standard stipulations

☐ Special stipulations

☐ Data recovery (collection, excavation, detailed recording, etc.)

Consultation:

☒ Covered under PA, no further consultation required with SHPO or ACHP

Consultation required: ☐ SHPO ☐ Advisory Council ☒ Native Americans

Comments: Pursuant to Section 106 and 36 CFR 800, BLM has determined that this undertaking would have no effect on historic properties. This determination was made on the following rationale: The undertaking is the revegetation as part of a mitigation conservation measure as outlined in the Environmental Assessment. The project will include ground

Form AZ-8110-5 UNITED STATES DEPARTMENT OF THE INTERIOR
(January 2001) BUREAU OF LAND MANAGEMENT
ARIZONA STATE OFFICE

CULTURAL RESOURCE COMPLIANCE DOCUMENTATION RECORD

disturbance however cultural resources would not likely be impacted as any cultural resources are likely deeply buried within the project area. In addition, the proposed action would not affect the previously documented historic canals in the area as they are well outside the project boundaries.

Proposed Undertaking: The primary purpose of the proposed action is to restore and maintain approximately 42.8 acres of native habitat through manual, mechanical, and chemical applications, to include a mix of cottonwood willow and honey mesquite, with an emphasis on providing habitat to support the southwestern willow flycatcher.

Project Location: Yuma County, Arizona. T.16 S., R.22 E., Sections 28 & 29

No further Section 106 consideration is required.

Signed: _____ Date: 11/2/2017
Archaeologist

Signed: _____ Date: 11/2/17
Assistant Field Manager

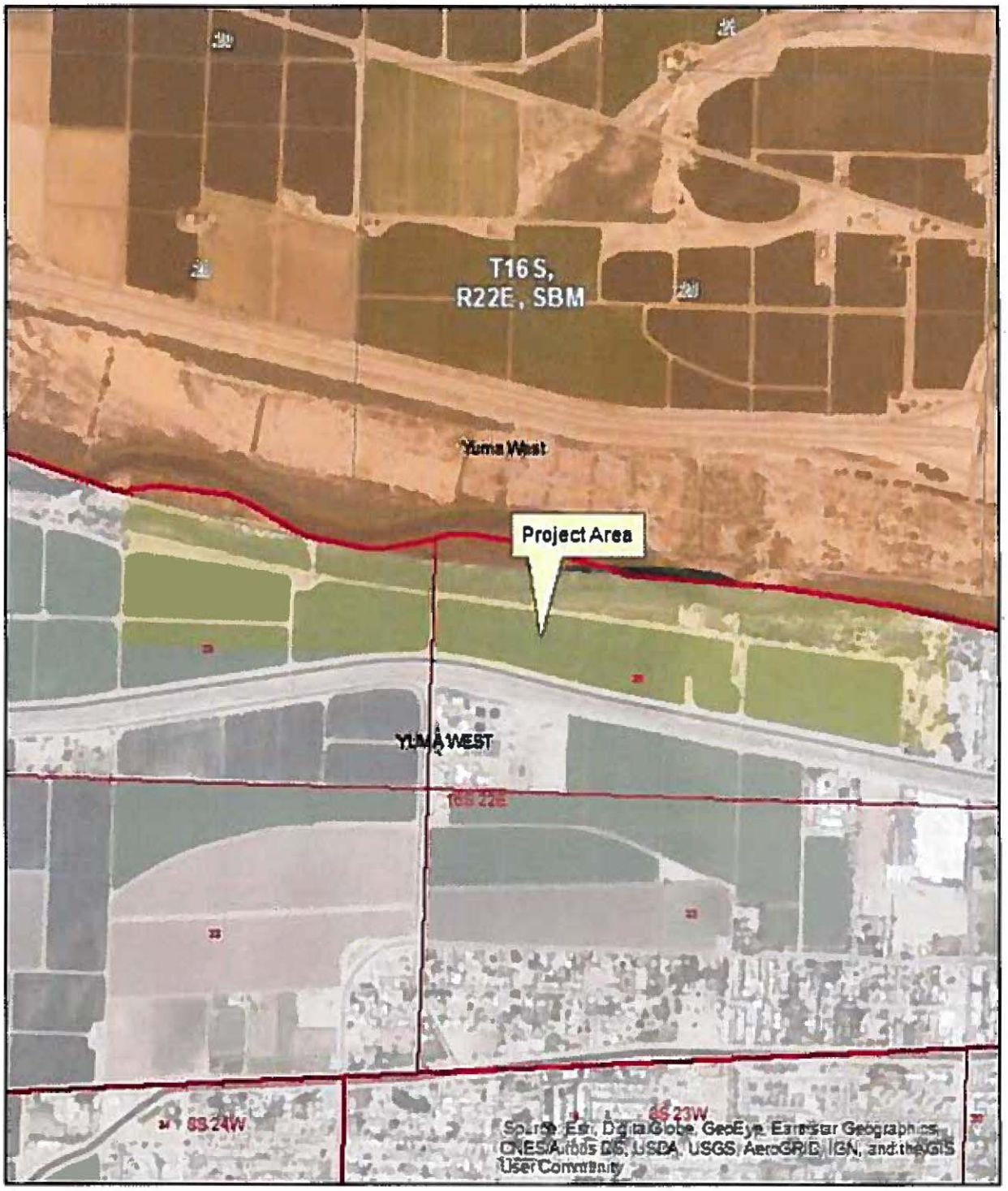
Signed: _____ Date: 11.2.17
Field Manager

Attachment: Standard Stipulations

- Actions which result in impacts to archaeological or historical resources shall be subject to the provisions of the Archaeological Resources Protection Act of 1979 as amended and the Federal Land Policy and Management Act of 1976. These statutes protect cultural resources for the benefit of all Americans. No person may excavate, remove, damage, or otherwise alter or deface any historic or prehistoric site, artifact or object of antiquity located on public lands without authorization.

- The holder shall immediately bring to the attention of the Lake Havasu Field Manager (or designated representative) any cultural resources (prehistoric/historic sites or objects) and/or paleontological resources (fossils) encountered during permitted operations and maintain the integrity of such resources pending subsequent investigation. All permitted operations within 30 meters (100 feet) of the cultural resources shall cease until written authorization to proceed is received from the Authorized Officer.

Paradise Cove West



Legend

- CadNSDI Townships
- CadNSDI Sections

AZSite Resources

NRHP Eligibility Status

- Eligible
- Ineligible
- Undetermined
- Unknown

Yuma West
T.16 S., R.22 E., Sects. 28 & 29

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APPENDIX D – Best Management Practices for Vegetation Treatment

BEST MANAGEMENT PRACTICES FOR VEGETATION TREATMENTS

The following chemical, mechanical, and manual treatment methods will be used to achieve vegetation management objectives in the PCE project area.

A. Chemical Treatment

YFO will use Environmental Protection Agency-approved herbicides in accordance with the Endangered Species Pesticide Program covered in the BLM's Vegetation Treatment on BLM Lands in Thirteen Western States FEIS (USDOI BLM 1991) and further limited to those approved for use by this document's ROD. These herbicides are Atrazine; Bromacil; Bromacil + Diuron; Chlorsulfuron; Clopyralid; 2,4-D, Diacamba; Dicamba +2,4-D; Diuon; Glyphosate; Glyphosate + 2,4-D;Hexazinone; Imazapyr; Mefluidide; Metsulfuron Methyl; Picloram; Picloram + 2,4-D; Simazine; Sulfometuron Methyl; Tebuthiuron; and Triclopyr. This list may be amended to accommodate subsequent updates to the herbicide EIS. Treatments will follow Standard Operating Procedures on pages 1-19 through 1-32 and project design features on pages 1-33 through 1-37 of the *Environmental Impact Statement for Vegetation Treatments, Watersheds and Wildlife Habitats on Public Lands Administered by the BLM in the Western United States, including Alaska* (USDOI BLM 1991). Additionally, project design features, including buffer strips described on page 10 of the above mentioned ROD, as follows: Buffer zones will be used adjacent to dwellings, domestic water sources, agriculture land, streams, lakes and ponds. A minimum buffer zone of 100 feet wide will be provided for aerial application, 25 feet for vehicle application and 10 feet for hand application (USDOI BLM 1991). Any deviations must be in accordance with the label for the herbicide. Herbicides will be hand wiped on individual plants within 10 feet of water where application is critical. Additionally, in order to protect listed, proposed, and candidate species, these buffer strips will be used.

YFO will work closely with the USFWS to ensure that herbicide applications will not affect listed or proposed, threatened, and endangered species on a project-level basis. If adverse effects are anticipated during informal consultation, YFO will formally consult on these projects. If USFWS develops herbicide guidance for particular species that improves protection beyond the current BLM design features, YFO will consider and incorporate that guidance as it consults with USFWS on a project-level basis. The chemicals can be applied by many different methods, and the selected technique depends on a number of variables. Some of these are (1) the treatment objective (removal or reduction); (2) the accessibility, topography, and size of the treatment area; (3) the characteristics of the target species and the desired vegetation; (4) the location of sensitive areas in the immediate vicinity (potential environmental impacts); (5) the anticipated costs and equipment limitations; and (6) the meteorological and vegetative conditions of the treatment area at the time of treatment.

Herbicides are applied in several ways, depending upon the treatment objective, topography of the treatment area, target species, expected costs, equipment limitations, and potential environmental impacts. Herbicide applications will be timed to have the least impact on non-target plants and animals consistent with the objectives of the vegetation management program.

The chemicals will be applied aerially with helicopters or fixed-wing aircraft, or on the ground using vehicles or manual application devices. Helicopters are more expensive to use than fixed-wing aircraft, but they are more maneuverable and effective in areas with irregular terrain and in treating specific target vegetation in areas with many vegetation types. Manual applications are used only for treating small areas, areas with sensitive cultural resources, or those inaccessible by vehicle.

Rates of herbicide application will depend on the target species, other vegetation present, soil type, depth of the ground water table, and presence of other water sources. When target species occur in riparian areas, the application rate will be reduced to reduce injury to non-target species.

The size of areas that will be treated may vary from 10 feet in diameter to 100 acres, but, most such areas will vary from 10 feet in diameter to less than five acres. The normal area of treatment by helicopter will be less than 100 acres.

During aerial applications, nozzles to reduce drift will be used for all liquid applications. Liquid herbicides will not be applied when wind speeds exceed five miles per hour (mph), and granular herbicides will not be applied when wind speeds exceed 10 mph. Herbicides will not be applied when conditions stated on the herbicide label cannot be met and when air turbulence significantly affects the desired spray pattern. Buffer zones (see Glossary) to protect water resources will be provided according to individual State regulations and guidelines and herbicide labels.

Vehicle-mounted sprayer (hand gun or boom) applications will be mainly used in open areas that are readily accessible by vehicle. The boom will be used only where feasible to treat concentrated weed infestations. The hand gun will be used for spot treatment of weeds and only up to the high water line near water bodies. Neither hand guns nor booms will be used in riparian areas where weeds are closely intermingled with shrubs and trees. Under both hand gun and boom methods, sprays will be applied in a manner that gives the best possible coverage with the least amount of drift, and only when wind velocity is below eight mph, except in riparian areas where treatment will be applied only at wind velocities below five mph. Boom sprayers will not be used within 25 feet of water bodies.

Hand applications could involve backpack spraying, hand wiping application, and cyclone broadcast spreading (granular formulations). Backpack sprayers are operated at low pressure and low volume and release herbicide through a single nozzle held from 0.5 to 2.5 feet above the ground when wind velocities do not exceed eight mph. Near water, wind velocities cannot exceed five mph. Contact systemic herbicides (see Glossary), such as glyphosate, wiped on individual plants, will be used up to the existing high water line. Granular formulations will be applied through broadcast spreaders at about 3.5 feet above the ground and no closer than 10 feet from the high water line of streams and other water bodies.

Herbicide applications are scheduled and designed to minimize potential impacts on non-target plants and animals, while remaining consistent with the objective of the vegetation treatment program. The rates of application depend on the target species, presence, and condition of non-target vegetation, soil type, depth to the water table, presence of other water sources, and the requirements of the label.

In many circumstances, the herbicide chosen, time of treatment, and rate of application of the herbicide are different than the most ideal herbicide application for maximum control of the target plant species in order to minimize damage to the non-target plant species and to ensure minimum risk to human health and safety.

B. Mechanical Treatment

Mechanical methods of vegetation treatment employ several different types of equipment to suppress, inhibit, or control herbaceous and woody vegetation. The goal of mechanical treatments is to kill or reduce the cover of undesirable vegetation and thus encourage the growth of desirable plants. YFO uses wheel tractors, crawler-type tractors, mowers, or specially designed vehicles with attached implements for mechanical vegetation treatments. The use of mechanical equipment to reduce fuel hazards will be conducted in accordance with BLM established procedures. Re-seeding after a mechanical treatment has been applied and is important to help ensure that desirable plants will become established on the site and not invasive species. The mechanical treatment and re-seeding should occur at a time to best control the undesirable vegetation and encourage the establishment of desirable vegetation. The best mechanical method for treating undesired plants in a particular location depends on the following factors:

- Characteristics of the undesired species present such as plant density, stem size, woodiness, brittleness, and re-sprouting ability
- Need for seedbed preparation, re-vegetation, and improve water infiltration rates

- Topography and terrain
- Soil characteristics such as type, depth, amount and size of rocks, erosion potential, and susceptibility to compaction
- Climatic and seasonal conditions
- Potential cost of improvement as compared to expected results

Bulldozing is conducted with a wheeled or crawler tractor with a heavy hydraulic controlled blade. Vegetation is pushed over and uprooted, and then left in windrows or piles. Bulldozing is best adapted to removing scattered stands of large brushes or trees. There are several different kinds of blades available depending on the type of vegetation and goals of the project. The disadvantage of bulldozing is soil disturbance and damage to non-target plant species.

Disk plowing in its various forms can be used for removing shallow-rooted herbaceous and woody plants. Disk plows should only be used where all of the vegetation is intended to be killed. There are several different kinds of root plows that are specific for certain types of vegetation. In addition to killing vegetation, disk plowing is effective in loosening the soil surface to prepare it for seeding and to improve the rate of water infiltration. The disadvantage of disk plowing is that it may be expensive and usually kills all species. Also, plowing is usually not practicable on steep slopes (greater than a 35 to 45 percent slope) or rocky soil. Plant species that sprout from roots may survive.

Chaining and cabling is accomplished by dragging heavy anchor chains or steel cables hooked behind tractors in a U-shape, half circle of J-shaped manner. Chaining and cabling is effective on rocky soils and steep slopes. Chaining and cabling is best used to control non-sprouting woody vegetation such as small trees and shrubs. However, desirable shrubs may be damaged in the process. Herbaceous vegetation is normally not injured by this control method. This control method is cost effective, as large areas can be readily treated. The chains or cables also scarify the soil surface in anticipation of seeding desirable species. The disadvantage is that weedy herbaceous vegetation can survive this treatment.

There are various tractor attachments that are used for mowing, beating, crushing, chopping, or shredding vegetation depending on the nature of the plant stand and goals of the project. The advantage in using this type of equipment is that selective plants may be targeted to achieve specific goals. For example, mowing is effective in reducing plant height to a desirable condition and it usually does not kill vegetation. Mowing is more effective on herbaceous than woody vegetation. On the other hand, a rolling cutter can kill woody non-sprouting vegetation by breaking stems at ground level but leave herbaceous vegetation. Mowing, beating, crushing, chopping, or shredding usually does not disturb the soil. Rocky soil and steep slopes may limit this use of equipment.

Debris management after a mechanical control treatment application is critical in fuel reduction projects. Vegetation material that is left onsite will dry and become more hazardous than before the treatment. Herbaceous material is usually not a problem, because it will decompose relatively fast depending on soil moisture, ambient humidity, and temperature. Woody vegetation should be piled and burned under acceptable fire management practices.

Efforts repeated every 21 days during the growing season can deplete the underground food supply of some perennials. This method will be required for at least a three-year period to attain satisfactory control and will be considered only in areas where slope is less than 10 percent and where a small percentage of the vegetation consists of shrubs. This method will also weaken non-target species in treated areas.

C. Manual Treatment

Hand-operated power tools and hand tools are used in manual vegetation treatment to cut, clear, or prune herbaceous and woody species. In manual treatments, workers will cut plants above ground level; pull, grub, or dig out plant root systems to prevent subsequent sprouting and re-growth; scalp at ground level or remove competing plants around desired vegetation; or place mulch around desired vegetation to

limit the growth of competing vegetation. Hand tools such as the handsaw, axe, shovel, rake, machete, grubbing hoe, mattock (combination of axe and grubbing hoe), brush hook, and hand clippers are used in manual treatments. Axes, shovels, grubbing hoes, and mattocks can dig up and cut below the surface to remove the main root of plants such as prickly pear and mesquite that have roots that can quickly resprout in response to surface cutting or clearing. Workers also may use power tools such as chain saws and power brush saws.

Manual methods are highly labor intensive, requiring periodic retreatment, ranging from every three weeks during the growing season to annually, depending on the target species. These methods have been successful in controlling annuals and biennials, but are ineffective in controlling creeping perennials.

APPENDIX E – Spill Prevention Plan Measures

SPILL PREVENTION PLAN

The following describes spill prevention measures that shall be implemented to reduce the potential for a spill to occur. In case of a spill, measures to contain and clean the spill are also included.

Spill Prevention Measures

- The Contractor must, at all times, maintain appropriate types and sufficient quantities of materials on-site to contain any spill or inadvertent release of materials that may cause a condition of pollution or nuisance if the materials reached Waters of the United States.
- Best management practices (BMPs) will be implemented to control the erosion of sediments into the water, prevent or contain spills from storage locations or equipment used within or adjacent to the river channel and other actions that may affect water quality.
- The Contractor shall ensure that adequate management practices are planned for, implemented, and assessed to address discharges of waste associated with, and not limited to, the following:
    - Erosion and discharge of sediments to water during clearing activities;
    - Erosion and discharge of sediments to water during excavation activities;
    - Spill prevention and containment from fuels and equipment fluids;
    - Equipment storage and maintenance;
    - Material staging and stockpiling;
    - Personnel trash; and
    - Wastewater.
- No water containing mud, silt, or other pollutants from grading or other activities shall be allowed to enter the river of and Waters of the United States or be placed in locations that may be subjected to high storm flows.
- Spoil sites shall not be located in areas with flowing water or locations that may be subjected to high storm flows, where spoil shall be washed back into the river or area of flowing water where it will impact aquatic or riparian vegetation.
- No broken concrete, cement, debris, soil, silt, sand, bark, slash, sawdust, rubbish, or washings thereof, oil or petroleum products, or other organic or earthen material from construction or associated activity shall be allowed to enter into or be placed where it may be washed by rainfall or runoff into Waters of the United States. At the close of each working day, the Contractor shall sweep up any materials laying uncontained in the construction areas, and dispose of any trash accumulated in construction areas. When all operations are completed, any excess materials or debris shall be removed from the work area. No rubbish shall be deposited within 150 feet of the high water mark of the river.
- The Contractor shall develop and implement a Spill Prevention and Remediation Plan and workers shall be instructed as to it requirements. Construction supervisors and personnel shall be instructed to (1) be alert for indications of equipment related contamination, such as stains and odors, and (2) respond immediately with appropriate actions as detailed in the spill prevention and remediation plan if indications of equipment-related contamination are noted.
- The Contractor shall immediately report spills or leaks to the BLM Authorized Officer. All spills shall be immediately controlled, contained, and cleaned up. The cleanup of all spills shall begin immediately upon observation of the spill. The Contractor shall keep spill kits containing absorbent materials at the construction site readily available during all refueling and replenishment of equipment fluid activities.
- The Contractor shall ensure that all equipment maintenance, staging, and dispensing of fuel, oil, coolant, or any other such activities occurs in designated areas outside Waters of the United States. The Contractor shall prohibit the storage of fuels and other hazardous materials and

refueling and maintenance of equipment and vehicles near the river channel. Refueling and maintenance of equipment and vehicles shall be prohibited within 100 feet of the river.

- Hazardous materials shall not be stored on the project site, and any unused or leftover hazardous products shall properly be disposed of off-site.
- During construction activities, equipment shall be in proper working condition and inspected for leaks and drips on a daily basis prior to commencement of work near Waters of the United States.
- During construction activities, fuels, solvents, and lubricants shall be stored such that potential spills and/or leaks will be contained. Soil contamination resulting from spills and/or leaks would be remediated as required by Federal and/or state law. Storage areas would be constructed so that containers would not be subjected to damage by construction equipment.
- The Contractor shall implement appropriate BMPs to minimize soil erosion and transport of pollutants.