ROSEMONT COPPER PROJECT
APRIL 2014 HMMP SUPPLEMENTAL INFORMATION

Prepared for: U.S. Army Corps of Engineers

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Date: April 8, 2014

Project No.: 1049.15 0800 0800

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1. INTRODUCTION

Rosemont Copper Company (Rosemont) submitted a final Habitat Mitigation and Monitoring Plan (HMMP) on April 1, 2014 in support of the Clean Water Act Section 404 permit application for the Rosemont Copper Project (Project). Subsequent to the HMMP submittal, Rosemont's 404 permitting team met with staff from the U.S. Army Corps of Engineers (Corps) Los Angeles District office and the U.S. Environmental Protection Agency Region 9 wetlands group to review the details of the plan, first in the field (on April 2, 2014) and then in a follow up presentation (on April 3, 2014).

This memorandum has been prepared in response to questions raised during those meetings. Specifically, this memorandum provides information related to: 1) the location of the mitigation parcels relative to regional conservation efforts, including the Pima County Conservation Lands System (CLS) and the Multi-Species Conservation Plan (MSCP); 2) the Pantano Dam surface water diversion and acreage of turf and ponds at the Del Lago Golf Course supported by that diversion; and 3) the nature of the water source at Monkey Spring.

Details of this information are provided in the sections below.

2. MITIGATION PARCELS AND REGIONAL CONSERVATION EFFORTS

Federal, state and local planning agencies in southern Arizona each have mandates to manage land and natural resources responsibly and in collaboration with other entities. Many agencies regularly update regional land use and resource plans to identify and address objectives related to conservation. Often, habitat enhancement or land preservation is accomplished when a specific project is proposed. Applicable agencies consult with each another on the basis of their plans and the proposed project implications. Non-government groups and private institutions also offer studies to inform regional planning efforts and assist with development of conservation tools in collaboration with regulatory authorities.

The primary regional conservation tool used for land use in in Pima County is the Sonoran Desert Conservation Plan (SDCP) and the related CLS, which identifies specific categories of environmentally-sensitive lands. The CLS land categories are:

- **Important Riparian Areas (IRA)**: Designated for high water availability, vegetation density, connectivity to reserves and contiguity of habitat, and biological productivity.
- **Biological Core**: Designated for potential to support high value habitat for five (5) or more priority vulnerable species identified under the SDCP and provide greater biological diversity than Multiple Use Management Areas.
- **Special Species Management Areas**: Defined as crucial for the conservation of specific native floral and faunal species of special concern. Management of these areas will focus on conservation, restoration, and enhancement of habitat for these species. Much of this designation overlaps with Multiple Use Management Areas.

- **Multiple Use Management Areas**: Potential to support high value habitat for 3-4 priority vulnerable species identified under the SDCP.
- **Critical Landscape Connections**: Broadly defined areas that provide connectivity for movement of native biological resources but which also contain potential or existing barriers that tend to isolate major conservation areas.
- **Agriculture Holdings within the CLS**: Lands currently utilized for agriculture purposes and lands where agriculture uses have been abandoned.

Related conservation elements including mapped habitat models, priority conservation area, wildlife linkages, preserve areas, conservation bond areas and other relevant information is depicted and available at the SDCP Mapguide website (http://gis.pima.gov/maps/sdcp/).

Other relevant conservation efforts include:

- Santa Cruz County Comprehensive Plan (Santa Cruz 2013)
- Landscape linkages identified by Northern Arizona University (NAU), Arizona Game and Fish Department (AGFD), and the Arizona Wildlife Linkages Workgroup
- Critical Habitat designated by the U.S. Fish & Wildlife Service

2.1. FULLERTON RANCH

The 1,763-acre Fullerton Ranch is located within the Altar Valley, which is ultimately tributary to the Brawley Wash and the Santa Cruz River. The parcel is adjacent to the Marley Ranch Conservation Area, a 114,400-acre ranch that is under contract for purchase by Pima County in phases as a conservation area. The site sits at the western terminus of an identified corridor between the Santa Rita Mountains (the location of the Rosemont Project) and the Sierrita Mountains (HMMP page 7). ***Figure 1*** provides a map depicting the location of the Fullerton Ranch parcel relative to the Marley Ranch conservation acquisition parcel, as well as the designated CLS at the parcel. Fullerton Ranch is designated as primarily Biological Core with some Multiple Use lands in the northeast part of the parcel. In addition, xeroriparian habitat designated as Important Riparian Area occurs on the parcel.

2.2. DAVIDSON CANYON PARCELS

The CLS designations within the Davidson Canyon Parcels include primarily Biological Core with some Multiple Use and Important Riparian Areas. The Davidson Canyon parcels occur within the Critical Landscape Linkage No. 3 designated as part of the CLS. In addition, the Arizona Wildlife Linkages Workgroup maps the Davidson Parcels within or in the immediate vicinity of Potential Linkage Zones 94 (Rincon – Whetstone – Santa Rita) and 95 (Santa Rita – Empire Complex) (AWLWG 2006). These parcels are also within designated critical habitat for jaguar (*Panthera onca*) (USFWS 2014), as shown in ***Figure 2***.

2.3. PANTANO DAM PARCEL

The Pantano Dam Parcel is located on land surrounded by the Cienega Creek Nature Preserve, and mapped under the CLS entirely as Important Riparian Habitat. In addition, the Pantano Dam Parcel and the associated water rights are within or directly abutting proposed critical habitat for the Northern Mexican garter snake (Cienega Creek Subbasin Unit) (USFWS 2013).

2.4. SONOITA CREEK RANCH

As noted in the HMMP, Sonoita Creek Ranch provides significant intermountain and riparian connectivity. It occurs within a portion of the Patagonia-Santa Rita Linkage Zone, identified as a critical "missing link" for connectivity that facilitates restoration and enhancement of habitat between these two mountain ranges (AWLWG 2006; Beier, et al 2008). The majority of the ranch is located within designated critical habitat for the jaguar (***Figure 2***). There are five underpasses on or directly abutting Sonoita Creek Ranch that provide safe passage for wildlife under Highway 82 (see ***Figure 3***, waypoints 36- 40; Beier, et al 2008). Of these, the principal connection with the greatest openness index would be the SR 83 crossing of Big Casa Blanca Canyon and Dark Canyon (waypoints 37-40, ***Figure 3***).

3. PANTANO DAM DIVERSION AND DEL LAGO GOLF COURSE

Surface water for Del Lago Golf Course irrigation is currently diverted at the Pantano Dam and delivered through a pipeline to the first (southernmost) golf course lake, from which the water is transferred through a series of lakes for irrigation and as water hazards at the golf course. WestLand completed a preliminary delineation of relevant features at the Del Lago Golf Course based on digitization of a recent aerial photograph and determined that the water usage at the golf course includes irrigation of approximately 74 acres of turf, and approximately 9.4 acres of water surface in 10 water features throughout the golf course. WestLand also understands that the surface water supports an indeterminate acreage of common area irrigation, which is assumed to be minor in comparison to turf and water surface usage. ***Figure 4*** shows turf and water surface areas associated with the Del Lago Golf Course.

The surface water diversion provides a base flow to the golf course year-round, with peaking demands satisfied from a groundwater well associated with the Vail Water Company system. The water delivered to the golf course from the Vail Water Company well is considered recovered Central Arizona Project (CAP) water, rather than groundwater. The Del Lago Golf Course is receiving recovered CAP water based on credits storage in a recharge project in Avra Valley under Vail Water Company's CAP allocation. (It should be noted that Vail Water Company is in the final stages of construction of new infrastructure which will provide direct delivery of this CAP allocation via a wheeling agreement with Tucson Water, allowing the physical groundwater pumping to be offset by physical deliveries of CAP water through the Tucson Water system. This system will be operational in Q3 2014.)

Based on historical usage data for the past 10 years (Attachment 6 of the HMMP), the total quantity of surface water delivered to the golf course from Pantano Dam ranges from approximately 310 to 470 acre

feet per year, with total annual irrigation usage in the range of approximately 430 to 680 acre feet. Based on the quantity of supplemental water usage delivered by Vail Water Company to the golf course, and typical peak summer and overseeding usage rates, it is assumed that the surface water inflows would typically be in the range of 250 gallons per minute (gpm), or about 400 acre feet (af) per year. The quantity of water delivered by Vail Water Company (groundwater pumped from local wells treated as CAP allocation) to the golf course has historically varied from approximately 43 to 79 million gallons per year (133 to 243 af), with a peak month quantity of approximately 23 million gallons (70 af). In summary, the total annual water usage for the golf course is estimated to be approximately 570 af, and the total supply of surface water used for golf course irrigation is estimated to be approximately 400 af per year, or approximately 70 percent of the total usage.

4. MONKEY SPRING WATER

As part of a PhD thesis completed, Feth (1947) observed that Monkey Spring issues from a bank of unconsolidated gravel into a bowl-shaped basin at a rate ranging from 400 to 475 gpm (or 645 to 765 acre-feet per year). The water from Monkey Spring has been, and currently is, used either directly for irrigation or is stored in earthen reservoirs, where it is used for watering stock or can be used for irrigation.

At the time of Feth's (1947) study, the water temperature of Monkey Spring water was 81°F, which is about 20°F higher than the annual mean temperature for the area. This suggests that the spring penetrates the water table to a depth that would heat the water to this temperature (Feth 1947). Feth (1947) also considered and dismissed recent volcanic activity and recent major faulting as potential reasons for the elevated temperature of the Monkey Spring water.

Several chemical analyses of the water from Monkey Spring categorize the water as sulphate waters with calcium as the principal positive ion, and with gypsum as the probable mineralizer (Feth 1947). However, Feth (1947) failed to find a single surface expression of gypsum within the study area. It is possible that the Permian sequence prior to overthrusting held remnant amounts of gypsum and that these pockets now occur at the interface with the overthrust (Feth 1947), well below the ground surface. Another possible explanation is that magmatic gases rising along fault fissures could provide both the sulfate mineralization and the high temperatures, and the lack of any observed gypsum in the area adds weight to this possibility (Feth 1947).

The chemical analysis of Monkey Spring waters and water from wells in the Sonoita Creek basin indicate that they have different sources (Feth 1947). That is, flows from Monkey Spring act as a source for groundwater in the Sonoita Creek basin. Feth (1947) concludes that the Permian limestone to the north and east are probably the reservoir for Monkey Spring, and that fluctuations in flow and chemical analysis of waters (allowing for the introduction of concealed gypsum deposits as a mineralizer) are principal points for consideration.

Feth (1947) installed a weir at Monkey Spring and measured the flow rate and rainfall from July 15, 1946

through August 24, 1946. ***Table 1*** shows the results of Feth's measurements. Several times during the study period, Feth was unable to reach the weir at Monkey Spring, and the flowrates were interpolated by Feth (1947) and are noted in the table with an asterisk (*).

Table 1. Rainfall and Monkey Spring Flow Rates Recorded by Feth (1947)

Date	Rainfall (inches)	Spring Output (gpm)	Date	Rainfall (inches)	Spring Output (gpm)
7/15/1946	0	425	8/5/1946	0	400
7/16/1946	0.1	450	8/6/1946	0.5	425
7/17/1946	0.85	450	8/7/1946	0	413*
7/18/1946	0.2	450	8/8/1946	0	400
7/19/1946	0	475	8/9/1946	0.5	425
7/20/1946	0.8	450	8/10/1946	0	450
7/21/1946	0	450	8/11/1946	0	425
7/22/1946	0.5	450	8/12/1946	1.82	417*
7/23/1946	0.1	450*	8/13/1946	0.5	408*
7/24/1946	0	450*	8/14/1946	0	400
7/25/1946	0	450*	8/15/1946	0	425
7/26/1946	0	450*	8/16/1946	0	425
7/27/1946	0.35	450*	8/17/1946	0.25	425
7/28/1946	0	450*	8/18/1946	0.1	413*
7/29/1946	0.1	438*	8/19/1946	0.3	400*
7/30/1946	0	425	8/20/1946	1.95	400*
7/31/1946	0	425	8/21/1946	0	400
8/1/1946	0	425	8/22/1946	0	450
8/2/1946	1.35	425	8/23/1946	0	425
8/3/1946	0.35	425	8/24/1946	0	425
8/4/1946	0	400			

*Values interpolated by Feth (1947) from surrounding observations.

The Monkey Spring flowrates measured during this period varied from 400 gpm to 475 gpm. Feth (1947) concluded based on the information in ***Table 1*** that flows from Monkey Spring were subject to local precipitation (within the watershed), with a 36- to 48-hour time lag. However, Feth (1947) provided no statistical analysis to support this conclusion.

To see if there is a relationship between rainfall and the flowrate from Monkey Spring, WestLand ran linear regressions on the data in ***Table 1***. It was assumed for this analysis that there might be some lag from a rain event and an effect on Monkey Spring; therefore, the regression was performed for a zero lag up to a lag of 6 days. No relationship was found in this data (***Table 2***). In no case was the relationship between precipitation and Monkey Spring flow rate statistically significant ($p<0.05$).

Table 2. Regression of Rainfall and Flow Rate Based on Lagged Data

Lag (days)	Coefficient of Determination (□)□	Probability (*p*)
0	0.02	0.35
1	0.05	0.19
2	0.004	0.71
3	0.001	0.85
4	0.006	0.65
5	0.002	0.82
6	0.007	0.63

Given the results of WestLand's statistical analysis, it is reasonable to conclude that the flow from Monkey Spring is not, in fact, subject to short-term fluctuations due to localized precipitation.

5. REFERENCES

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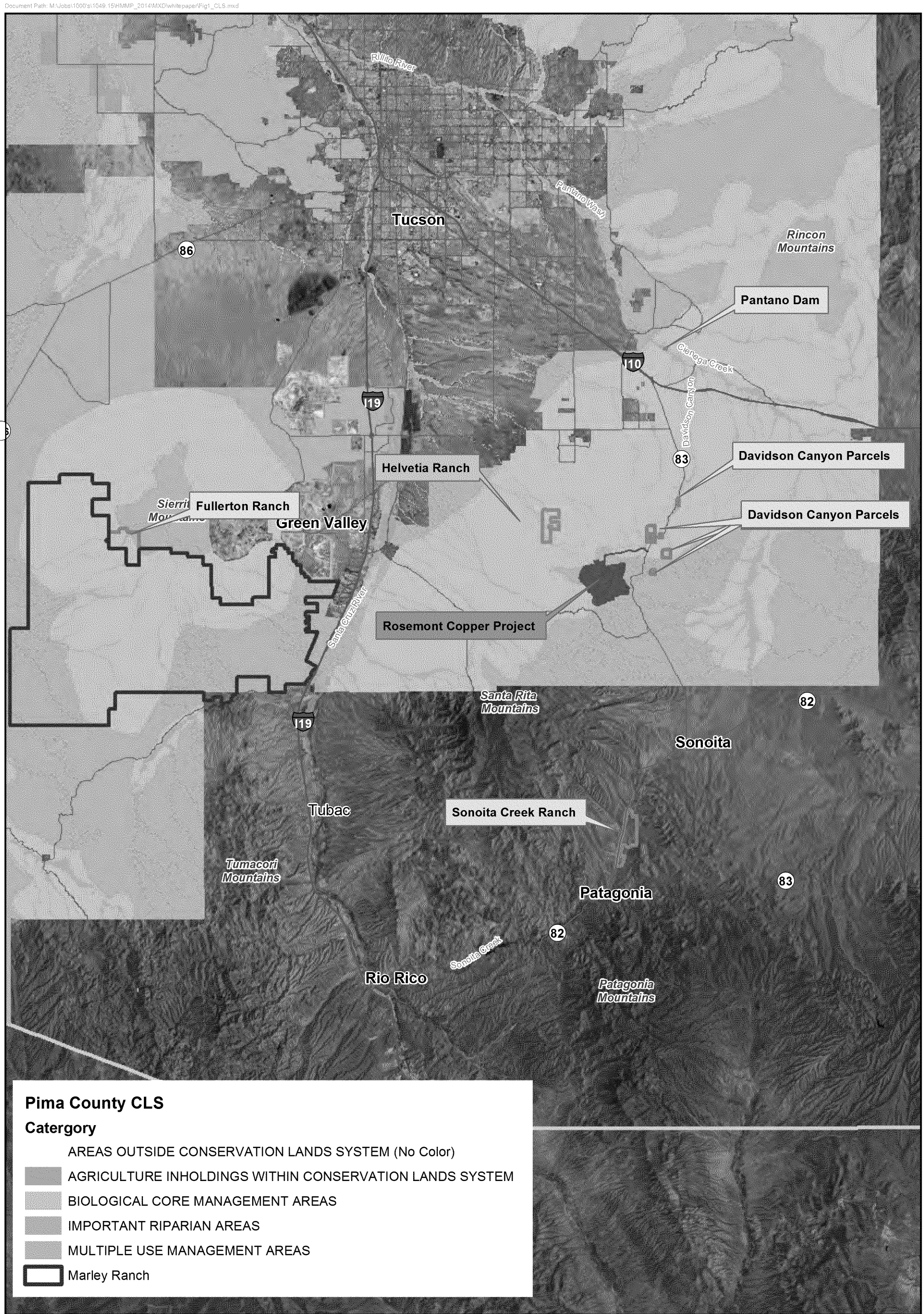
_____. 2014. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Jaguar; Final Rule. Federal Register 79: 12572-12654.

FIGURES



Pima & Santa Cruz Counties, Arizona
Data Source: Pima County Conservation Land Management System (http://www.pima.gov/cmo/admin/Reports/ConservationReport/PDF/Chapters/Reserves/Marley%20Ranch%20Conservation%20Area.pdf)
Photo Source: ESRI World Imagery
Microsoft, November 8, 2010

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N

0 15,000 30,000 Feet

Legend

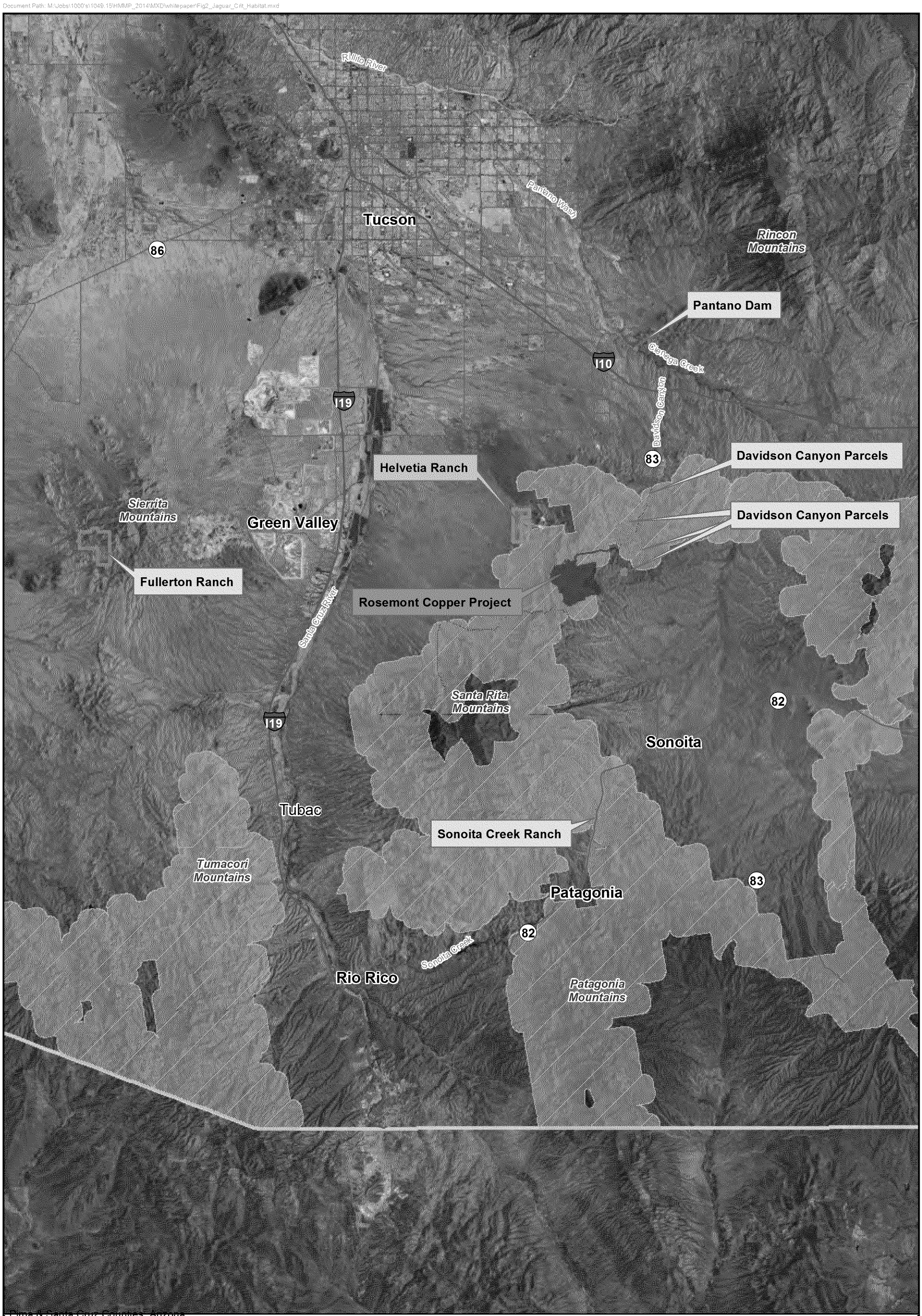
- Rosemont Copper Project
- Non 404 Aquatic Mitigation
- 404 Mitigation Parcel
- International Border

ROSEMONT COPPER

HMMP Supplemental Information
April 8, 2014

PIMA COUNTY CONSERVATION LAND SYSTEM
Figure 1

PERMIT NO. SPL-2008-00816-MB



Pima & Santa Cruz Counties, Arizona,
Data Source: USFWS Critical Habitat Portal
Photo Source: ESRI World Imagery
Microsoft, November 8, 2010

Legend

- Rosemont Copper Project
- Non 404 Aquatic
- 404 Mitigation Parcel
- International Border
- Jaguar Critical Habitat

N

0 15,000 30,000 Feet

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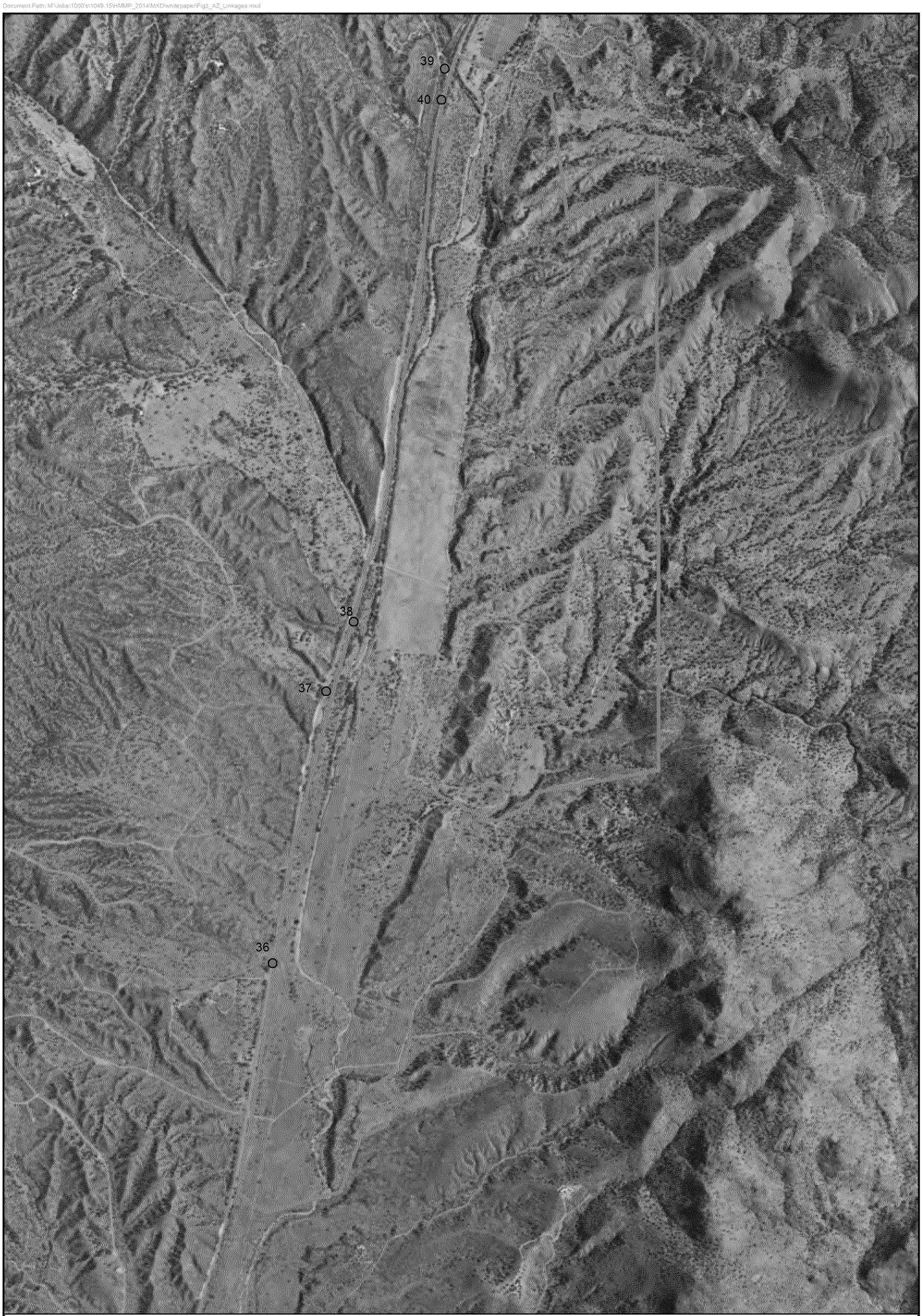
JAGUAR CRITICAL HABITAT
Figure 2

PERMIT NO. SPL-2008-00816-MB



Pima & Santa Cruz Counties, Arizona,
Data Source: Arizona Missing Linkages-Patagonia - santa Rita Linkage Design 2008
Photo Source: ESRI World Imagery
Microsoft, November 8, 2010

Legend

Sonoita Creek Ranch

Field Waypoints

N

0 750 1,500 Feet

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ARIZONA LINKAGES
Figure 3

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Path: M:\Jobs\1000's\1049.15\HMMP_2014\MXD\whitepaper\Fig4_DelLago_Golf Course.mxd

Date: 4/8/2014 User: chuckp

Legend

Turf (74.02 Acres)

Lake/Pond (9.42 Acres)

Pima County, Arizona,
Photo Source: Pima Association of Governments 2011

N

0 250 500 Feet

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DEL LAGO GOLF COURSE
Figure 4

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